



**STOCKHOLM AGREEMENT  
WATER ON DECK MODEL EXPERIMENTS  
FOR PASSENGER/RO-RO VESSEL**

**“EMSA 1”**

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<b>Title:</b>	<b><i>Stockholm Agreement Water On Deck Model Experiments for the Passenger/Ro-Ro Vessel “EMSA 1”</i></b>		
<b>Summary:</b>	<p>This report details the model experiments carried out on behalf of “Safety At Sea Ltd.” at Vienna Model Basin. The purpose of the model experiments was to investigate the damage survivability of the passenger/Ro-Ro vessel “EMSA 1”. The model experiments were performed in accordance with the Model Test Method prescribed in the consolidated edition of EC DIRECTIVE 2003/25/EC which includes the amendments detailed in Directive 2005.12.EC.</p> <p>The report includes general particulars of the vessel, details of the damage case selection and a description of the experimental procedure. Finally, the results of the experiments are presented.</p> <p>Measurements were carried out without the model at three different locations within the drift range to ensure the correct wave realisation is used.</p> <p>The model experiments were carried out in waves characterised by significant wave heights between 2.50 m and 4.25 m. “EMSA 1” did not survive all damage cases, but the survival boundary has been found.</p>		
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## GENERAL PARTICULARS

The passenger/Ro-Ro vessel “EMSA 1” is operating in an area, where the significant wave height ( $H_S$ ) is between 2.50 m and 4.25 m. The general particulars of the vessel, both full scale and model scale, are shown in Table 1 (Damage Case 1, R7\_S7-9.1.2-1) and Table 1a (Damage Case 2, R7\_P6-7.4.0), Table 1b (Damage Case, R7M2\_P5-7.4.0-1), Table 1c, (Damage Case, R7M2\_P4-6.1.0-1)

The model was constructed in the scale of 1:25.

Dimension	Full Scale	Model Scale
$L_{MOD}$	111.900 m	4476.0 mm
$L_{BP}$	104.400 m	4176.0 mm
B	18.600 m	744.0 mm
$T_F / T_M / T_Q / T_A$	4.500/4.500/4.500/4.500 m	180.0/180.0/180.0/180.0 mm
D, Depth to Car Deck	6.30 m	252.0 mm
Displacement in fresh water	5383.10 tonnes	344.5 kg

Table 1: General Particulars of the intact vessel (Damage Case 1, R7\_S7-9.1.2-1)

Dimension	Full Scale	Model Scale
$L_{MOD}$	111.900 m	4476.0 mm
$L_{BP}$	104.400 m	4176.0 mm
B	18.600 m	744.0 mm
$T_F / T_M / T_Q / T_A$	4.500/4.500/4.500/4.500 m	180.0/180.0/180.0/180.0 mm
D, Depth to Car Deck	6.30 m	252.0 mm
Displacement in fresh water	5383.10 tonnes	344.5 kg

Table 1a: General Particulars of the intact vessel (Damage Case 2, R7\_P6-7.4.0)

Dimension	Full Scale	Model Scale
$L_{MOD}$	111.900 m	4476.0 mm
$L_{BP}$	104.400 m	4176.0 mm
B	18.600 m	744.0 mm
$T_F / T_M / T_A$	4.500/4.500/4.500/4.500 m	180.0/180.0/180.0/180.0 mm
D, Depth to Car Deck	6.30 m	252.0 mm
Displacement in fresh water	5383.10 tonnes	344.5 kg

Table 1b: General Particulars of the intact vessel 2446A (Damage Case, R7M2\_P5-7.4.0-1)



## GENERAL PARTICULARS

Dimension	Full Scale	Model Scale
$L_{MOD}$	111.900 m	4476.0 mm
$L_{BP}$	104.400 m	4176.0 mm
B	18.600 m	744.0 mm
$T_F / T_M / T_Q / T_A$	4.500/4.500/4.500/4.500 m	180.0/180.0/180.0/180.0 mm
D, Depth to Car Deck	6.30 m	252.0 mm
Displacement in fresh water	5383.10 tonnes	344.5 kg

Table 1c: General Particulars of the intact vessel 2446B (Damage Case, R7M2\_P4-6.1.0-1)



## DAMAGE CASE SELECTION

The damage conditions to be model tested have been selected according to EC DIRECTIVE 2003/25/EC (including amendments) and are defined as follows:

- The worst SOLAS damage is selected from those damages where the centerline of the damage opening lies within the range  $\pm 35\% L_{BP}$  from midships and is taken to be that which gives the least total area under the residual stability curve (Appendix to Annex I Paragraph 3.1).
- If the worst SOLAS damage location is outside the range  $\pm 10\% L_{BP}$  from midship, a second MIDSHP damage condition is to be selected within  $\pm 10\% L_{BP}$  range and is taken to be that which gives the least total area under the residual stability curve. (Appendix to Annex I Paragraph 3.1).

### Worst (SOLAS) Damage Case

The worst SOLAS damage was selected over the trim range of the vessel from 0.00 m stern trim to 0.00 m bow trim. The overall worst damage case and associated initial condition is shown below.

Damage: R7\_S7-9.1.0-1  
Draught: 4.50 m  
Trim: 0.0 m trim by Stern  
KG: 8.809 m  
GM: 1.385 m

The damage opening is centered on frame 63.

Damage: R7\_P6-7.4.0  
Draught: 4.50 m  
Trim: 0.0 m trim by Stern  
KG: 8.809 m  
GM: 1.385 m

The damage opening is centered on frame 51.

Damage: R7M2\_P5-7.4.0-1  
Draught: 4.50 m  
Trim: 0.0 m trim by Stern  
KG: 8.594 m  
GM: 1.600 m

The damage opening is centered on frame 36 to 84.

Damage: R7M2\_P4-6.1.0-1  
Draught: 4.50 m  
Trim: 0.0 m trim by Stern  
KG: 8.591 m  
GM: 1.600 m

The damage opening is centered on frame 36.



## **DAMAGE CASE SELECTION**

### **Model Test Damage Case Hydrostatics**

Model test damage case hydrostatics can be found in Appendix A.

It should be noted that these hydrostatics are calculated for the hull without appendages, in line with the hull to be used in the model test, floating in water with a density of  $1.025 \text{ t/m}^3$ .

Furthermore, the displacements shown in Appendix C, differ to those shown in Appendix A as they have been calculated with a fluid density of  $1.000 \text{ t/m}^3$  as is the case during the model experiments.





## CONSTRUCTION OF THE MODEL

The model was constructed by plywood, Plexiglas and foam. The shell of the hull is made of 5 mm which plywood, covered with fiberglass. The skeg was modeled, but other appendages such as rudders, thrusters, fin stabilizers are not modeled.

Transverse watertight bulkheads below the car deck were constructed using plywood covered with fiberglass. The intact tanks below the car deck were constructed using foam. The car deck was constructed using 3 mm clear Plexiglas to aid observation, especially with regards leakage.

Two vertical bars were fixed aft and forward of the model with a horizontal bar attached in between these two. The horizontal bar supports the ballast weights and can be adjusted vertically in order to alter the vertical centre of gravity of the model.

Wooden bars are attached along the top edges of the model, both longitudinally and transversally, in order to improve the stiffness of the model.

Model test information and damage drawings for the model are given in Appendix A and photographs of the model are given in Appendix B.



## LOADING CONDITION AND BALLASTING

Safety At Sea Ltd provided the loading conditions for the damage cases; (Damage Case 1 R7\_S7-9.1.0-1), (Damage Case 2 R7\_P6-7.4.0), (Damage Case R7M2\_P5-7.4.0-1) and (Damage Case R7M2\_P5-7.4.4.0-1)

Both the full scale and model scale values are summarized in Table 2, 2a, 2b, 2c along with the values that were measured at the time of the experiments.

Item	Full Scale	Model Scale	
		Calculated	Measured
Displacement/ Weight	5383.10 t	344.5 kg (Fresh water)	345.0 kg (Fresh water)
Draught AP, Port	4.500 m	180.0 mm	--- mm
Draught AP, Starboard	4.500 m	180.0 mm	Not accessible
Draught 0.25LBP, Port	4.500 m	180.0 mm	180 mm
Draught 0.25LBP, Starboard	4.500 m	180.0 mm	180 mm
Draught Amidship, Port	4.500 m	180.0 mm	180 mm
Draught Amidship, Starboard	4.500 m	180.0 mm	180 mm
Draught FP	4.500 m	180.0 mm	180 mm
Trim by Stern	0.0 m	0.0 mm	0.0 mm

Table 2: Intact Vessel Particulars, worst SOLAS damage R7\_S7-9.1.0

Item	Full Scale	Model Scale	
		Calculated	Measured
Displacement/ Weight	5383.10 t	344.5 kg (Fresh water)	345.0 kg (Fresh water)
Draught AP, Port	4.500 m	180.0 mm	--- mm
Draught AP, Starboard	4.500 m	180.0 mm	Not accessible
Draught 0.25LBP, Port	4.500 m	180.0 mm	180 mm
Draught 0.25LBP, Starboard	4.500 m	180.0 mm	180 mm
Draught Amidship, Port	4.500 m	180.0 mm	180 mm
Draught Amidship, Starboard	4.500 m	180.0 mm	180 mm
Draught FP	4.500 m	180.0 mm	180 mm
Trim by Bow	0.0 m	0.0 mm	0.0 mm

Table 2a: Intact Vessel Particulars, SOLAS damage R7\_P6-7.4.0



## LOADING CONDITION AND BALLASTING

Item	Full Scale	Model Scale	
		Calculated	Measured
Displacement/ Weight	5383.10 t	344.5 kg (Fresh water)	345.0 kg (Fresh water)
Draught AP, Port	4.500 m	180.0 mm	--- mm
Draught AP, Starboard	4.500 m	180.0 mm	not accessible
Draught 0.25LBP, Port	4.500 m	180.0 mm	180 mm
Draught 0.25LBP, Starboard	4.500 m	180.0 mm	180 mm
Draught Amidship, Port	4.500 m	180.0 mm	180 mm
Draught Amidship, Starboard	4.500 m	180.0 mm	180 mm
Draught FP	4.500 m	180.0 mm	180 mm
Trim by Bow	0.0 m	0.0 mm	0.0 mm

Table 2b: Intact Vessel (2446A) Particulars, SOLAS damage R7M2\_P5-7.4.0-1

Item	Full Scale	Model Scale	
		Calculated	Measured
Displacement/ Weight	5383.10 t	344.5 kg (Fresh water)	345.0 kg (Fresh water)
Draught AP, Port	4.500 m	180.0 mm	--- mm
Draught AP, Starboard	4.500 m	180.0 mm	not accessible
Draught 0.25LBP, Port	4.500 m	180.0 mm	180 mm
Draught 0.25LBP, Starboard	4.500 m	180.0 mm	180 mm
Draught Amidship, Port	4.500 m	180.0 mm	180 mm
Draught Amidship, Starboard	4.500 m	180.0 mm	180 mm
Draught FP	4.500 m	180.0 mm	180 mm
Trim by Bow	0.0 m	0.0 mm	0.0 mm

Table 2c: Intact Vessel (2446B) Particulars, SOLAS damage R7M2\_P4-6.1.0-1



## INCLINING EXPERIMENT

### PROCEDURE

The inclining test was performed following standard practice. One weight belonging to the ballast weight was transferred to a known distance first to the port side and then to the starboard side, measuring each time the ensuing angle of inclination using an inclinometer. The average inclination was used to find the GM using the following equations:

$$\Phi_{AV} = \frac{\Phi_P + \Phi_{ST}}{2}$$

$$GM = \frac{wd}{\Delta \cdot \tan(\Phi_{AV})}$$

$$KG = KM - GM$$

Where:

w	one weight (kg)
d	horizontal distance between weights (m or mm)
$\Phi_{AV}$	average angle of inclination (deg)
$\Delta$	model weight (incl. w)

A test was conducted for each damage case using the intact loading condition as described previously and the results are shown in Table 3, Table 3a Table 3b and Table 3c.

### WORST SOLAS DAMAGE (DAMAGE CASE 1 R7\_S7-9.1.0-1)

Item	Full Scale	Model Scale (1:25)
Weight $\Delta$	5390.6 tonnes	345.0 kg
KM <sub>T</sub>	10.194 m	407.8 mm
d	6.250 m	250.0 mm
w	77734.375 kg	4.975 kg
<b>Target GM<sub>T</sub></b>	<b>1.385 m</b>	<b>55.21 mm</b>
Measured angle of inclination $\Phi$	3.723 deg	3.723 deg
<b>Measured GM<sub>T</sub></b>	<b>1.385 m</b>	<b>55.21 mm</b>

Table 3: Inclining test results for the intact model

Item	Full Scale	Model Scale (1:25)
Weight $\Delta$	5390.6 tonnes	345.0 kg
KM <sub>T</sub>	10.194	407.8 mm
d	6.250 m	250.0 mm
w	77734.375 kg	4.975 kg
<b>Target GM<sub>T</sub></b>	<b>1.385 m</b>	<b>55.21 mm</b>
Measured angle of inclination $\Phi$	3.729 deg	3.729 deg
<b>Measured GM<sub>T</sub></b>	<b>1.385 m</b>	<b>55.21 mm</b>

Table 3a: Inclining test results for the intact model



## INCLINING EXPERIMENT

### WORST SOLAS DAMAGE (DAMAGE CASE 2 1 R7\_P6-7.4.0)

Item	Full Scale	Model Scale (1:25)
Weight $\Delta$	5390.6 tonnes	345.0 kg
$KM_T$	10.194	407.8 mm
d	6.250 m	250.0 mm
w	77734.375 kg	4.975 kg
<b>Target <math>GM_T</math></b>	<b>1.385 m</b>	<b>55.21 mm</b>
Measured angle of inclination $\Phi$	3.729 deg	3.729 deg
<b>Measured <math>GM_T</math></b>	<b>1.3802 m</b>	<b>55.20 mm</b>

Table 3b: Inclining test results for the intact model

### WORST SOLAS DAMAGE (DAMAGE CASE R7M2\_P4-6.1.0-1)

Item	Full Scale	Model Scale (1:25)
Weight $\Delta$	5390.6 tonnes	345.0 kg
$KM_T$	10.191 m	407.6 mm
d	6.250 m	250 mm
w	77734.375 kg	4.975 kg
<b>Target <math>GM_T</math></b>	<b>1.6 m</b>	<b>64,0 mm</b>
Measured angle of inclination $\Phi$	3.251 deg	3.251 deg
<b>Measured <math>GM_T</math></b>	<b>1.5797 m</b>	<b>6.319 mm</b>

Table 3c: Inclining test results for the intact model



## ROLL RADIUS OF GYRATION

According to the Model Test Method, the roll radius of gyration ( $K_{XX}$ ) of the intact model should be in the range **0.35B** to **0.40B**, where B refers to the beam of vessel. It is also important to ensure an accurate modelling of the vessel's dynamic characteristics so that an essential departure from 0.4B must be avoided. Free rolling tests in air were carried out in order to estimate the natural roll period ( $T_n$ ). The roll radius of gyration can then be determined using the following expression:

$$K_{xx} = \sqrt{\frac{gh}{(2\pi/T_n)^2} - h^2}$$

Where:  $h$  = distance between centre of rotation and centre of gravity (m)  
 $T_n$  = natural roll period in air of model system (sec)

A summary of the intact free rolling tests is given in the tables 4 a, 4a and 4b while the time histories of the tests are given in Appendix E and E1 and E3

### Worst Solas Damage (DAMAGE CASE 1 R7\_S7-9.1.0-1)

Item	Full Scale	Model Scale (1:25)
h	3.988 m	159.5 mm
Measured natural roll period	7.800 sec	1.5600 sec
Roll radius of gyration ( $K_{XX}$ )	6.66 m	266.4 mm
B	18.60 m	744.0 mm
<b><math>K_{XX}/B</math></b>	<b>0.3581</b>	<b>0.3581</b>

Table 4: Free Roll Tes in Air

### Worst Solas Damage (DAMAGE CASE 2 R7\_P6-7.4.0)

Item	Full Scale	Model Scale (1:25)
h	3.988 m	159.5 mm
Measured natural roll period	7.7530 sec	1.5506 sec
Roll radius of gyration ( $K_{XX}$ )	6.61 m	264.2 mm
B	18.60 m	744.0 mm
<b><math>K_{XX}/B</math></b>	<b>0.3552</b>	<b>0.3552</b>

Table 4a: Free Roll Test in Air



## ROLL RADIUS OF GYRATION

### Worst Solas Damage (DAMAGE CASE R7M2\_P4-6.1.0-1)

Item	Full Scale	Model Scale (1:25)
h	4.263 m	170.5 mm
Measured natural roll period	7.7760 sec	1.5552 sec
Roll radius of gyration ( $K_{XX}$ )	6.77 m	270.9 mm
B	18.60 m	744.0 mm
$K_{XX}/B$	<b>0.3892</b>	<b>0.3892</b>

Table 4b: Free Roll Test in Air



## PITCH RADIUS OF GYRATION

According to the Model Test Method, the pitch radius of gyration of the model ( $K_{YY}$ ) should be in the range 0.2LOA to 0.25LOA. In order to determine the pitch radius of gyration the model was suspended from the horizontal ballast bar, which is above the vertical centre of gravity (KG). The longitudinal position of the suspension point is located so that an even keel of the model in the air is achieved. The model was pushed down and then let free to pitch around the rotation point. The total time for a certain number of pitching periods is measured and the natural pitch period of the model in the air is determined by taking the average pitching period. The pitch mass moment of inertia is determined by using the following equations:

$$I_{YY} = M_s K_{YY}^2 + M_s h^2$$

$$I_{YY} = \frac{M_s g h T_p^2}{(2\pi)^2}$$

and the pitch radius of gyration is:

$$K_{YY} = \sqrt{\frac{I_{YY}}{M_s} - h^2}$$

Where:

- h = distance between centre of rotation and centre of gravity (m)
- $T_p$  = natural pitch period of model system (sec)
- $M_s$  = mass of the model system (kg)
- $I_{YY}$  = pitch mass moment of inertia of the model system (kg m<sup>2</sup>)
- $K_{YY}$  = pitch radius of gyration (m)

The results of the test are summarized in Table 5, 5a, 5b and 5c.

Item	Model Scale
$M_s$	345.00 kg
h	395.5 mm
$T_p$	3.52 sec
$I_{YY}$	421.03 kg m <sup>2</sup>
LOA	4476 mm
<b><math>K_{YY}</math></b>	<b>10311 mm</b>
<b><math>K_{YY}/LOA</math></b>	<b>0.2304</b>

Table 5: Pitch radius of gyration, Damage Case 1 R7\_S7-9.1.0-1

Item	Model Scale
$M_s$	345.00 kg
h	379.5 mm
$T_p$	3.600 sec
$I_{YY}$	421.50 kg m <sup>2</sup>
LOA	4476.0 mm
<b><math>K_{YY}</math></b>	<b>10381 mm</b>
<b><math>K_{YY}/LOA</math></b>	<b>0.2319</b>

Table 5a: Pitch radius of gyration, Damage Case 2 P6-7.1.0





## PITCH RADIUS OF GYRATION

Item	Model Scale
$M_s$	345.00 kg
h	384.5 mm
$T_p$	3.6467 sec
$I_{YY}$	438.20 kg m <sup>2</sup>
LOA	4476.0 mm
<b><math>K_{YY}</math></b>	<b>1059.4 mm</b>
<b><math>K_{YY}/LOA</math></b>	<b>0.2367</b>

Table 5b: Pitch radius of gyration, Damage Case 2 P6-7.1.0

Item	Model Scale
$M_s$	345.00 kg
h	367.0 mm
$T_p$	3.8971 sec
$I_{YY}$	477.67 kg m <sup>2</sup>
LOA	4834 mm
<b><math>K_{YY}</math></b>	<b>1118.0 mm</b>
<b><math>K_{YY}/LOA</math></b>	<b>0.2498</b>

Table 5c: Pitch radius of gyration, Damage Case R7M2\_P4-6.1.0-1



## ENVIRONMENTAL CONDITIONS

In accordance with the Model Test Method, an irregular wave environment was modeled using JONSWAP spectra as specified below. Waves are assumed to be coming from beam into the damage opening.

### SHORT WAVES

For short waves the peakness parameter,  $\gamma$ , is 3.3. The peak period is calculated as:

$$T_p = 4\sqrt{H_s}$$

And the zero crossing period is:

$$T_z = \frac{T_p}{1.285}$$

Where,  $T_p$ : Peak Period (sec)

$T_z$ : Zero Crossing Period (sec)

$H_s$ : Significant wave height (m)

$\gamma$ : Peakness parameter

Wave	$\gamma$	$H_s$ (m)	$T_p$ (sec)	$T_z$ (sec)
Short	3.3	4.25	8.246	6.417
Short	3.3	4.00	8.000	6.226
Short	3.3	3.90	7.899	6.147
Short	3.3	3.75	7.746	6.028
Short	3.3	3.50	7.483	5.824
Short	3.3	3.35	7.321	5.697
Short	3.3	3.25	7.211	5.612
Short	3.3	3.00	6.928	5.392
Short	3.3	2.50	6.325	4.922

Table 7 Summary of wave characteristics (JONSWAP)



## EXPERIMENTS

### EXPERIMENTAL SET UP

The test section of the sea-keeping tank is 180 m long, 10.0 m wide and 5.0 m deep with a wave maker at one end and a beach at the other. The wave maker has 2 flaps capable of generating regular and irregular waves using in-house software.

Wave realizations are generated in the presence of authorities and for each record the spectral characteristics are automatically checked to ensure adherence to the pre-specified sea states.

For a representative wave realization, measurements were performed prior to the test at three different locations within the drift range.

The model was free to drift and placed in beam seas ( $90^\circ$  heading) with the damage hole facing the oncoming waves, with no mooring system permanently attached to the model. To maintain a beam sea heading of approximately  $90^\circ$  during the model test the following requirements were satisfied:

- Heading control lines, intended for minor adjustment, were located at the centre line of the stem and stern, in a symmetrical fashion and at a level between the position of KG and the damaged waterline
- The carriage speed was equal to the actual drift speed of the model with speed adjustment made when necessary

Ten experiments were carried out. The test period for each experiment was of a duration such that a stationary state was reached, but not less than 30 min in full scale. A different wave realization train was used for each experiment.

Roll and pitch motions are also measured using Qualisys motion capture system to readily provide motion records during the experiments.

### EXPERIMENTAL PROCEDURE

The model is initially positioned 50 m away from the wave maker. When the set-up is ready, random wave realizations are produced in the computer. These wave signals are then sent to the wave maker.

During the experiments, instantaneous measurements of the wave realizations from the fixed wave probe, as well as roll and pitch motions of the model can be observed on the available monitors. All this information was recorded. (See DVD 2458)

The total test time of each test was around 582 seconds, which corresponds to approximately 30.0 minutes in full scale. After the completion of each test the measured wave and roll statistics are examined to ensure compliance with the Model Test Method.



## RESULTS

The tested damage is damage case 1 (R7\_S7-9.1.0-1) in a random wave environment, exposed to different significant wave heights. . The summary of the results is given in table 7a, 7b and 7c. The wave and roll motion statistics are given in Appendix D, while the wave and the roll motion time histories are given in Appendix E.

Test No*	Wave No	Wave Height HS (m)		Result
		Target	Fixed	
(Damage Case 1, R7_S7-9.1.0-1), Short Waves ( $\gamma = 3.3$ )				
29678-01	29678-01	4.00	4.0026	Survived
29678-02	29678-02	4.00	4.0369	Capsized
29678-03	29678-03	4.00	4.0386	Capsized
29678-04	29678-04	4.00	4.0598	Capsized
29678-05	29678-05	4.00	4.0534	Capsized
29678-06	29678-06	4.00	4.0294	Capsized
29678-07	29678-078	4.00	4.0462	Capsized
29678-08	29678-08	4.00	4.0501	Capsized
29678-09	29678-09	4.00	4.0307	Capsized
29678-10	29678-10	4.00	3.9964	Capsized
29680-01	29680-01	3.00	3.0236	Survived
29680-02	29680-02	3.00	3.0510	Survived
29680-03	29680-03	3.00	3.0586	Survived
29680-04	29680-04	3.00	3.0546	Survived
29680-05	29680-05	3.00	3.0493	Survived
29681-01	29681-01	3.50	3.5638	Capsized
29681-02	29681-02	3.50	3.5439	Survived
29681-03	29681-03	3.50	3.5656	Survived
29681-04	29681-04	3.50	3.5345	Survived
29681-05	29681-05	3.50	3.5263	Survived
29681-06	29681-06	3.50	3.5489	Capsized
29681-07	29681-07	3.50	3.5260	Survived
29681-08	29681-08	3.50	3.5223	Survived
29681-09	29681-09	3.50	3.5450	Survived
29681-10	29681-10	3.50	3.5522	Capsized
29682-01	29682-01	3.25	3.2839	Survived
29682-02	29682-02	3.25	3.2909	Survived
29682-03	29682-03	3.25	3.3095	Survived
29682-04	29682-04	3.25	3.2967	Survived
29682-05	29682-05	3.25	3.3113	Survived
29682-06	29682-06	3.25	3.2531	Survived
29682-07	29682-07	3.25	3.2681	Survived
29682-08	29682-08	3.25	3.2932	Survived
29682-09	29682-09	3.25	3.2980	Survived
29682-10	29682-10	3.25	3.2742	Survived

Table 7a: Summary of the experimental results - \*This number corresponds with the number referenced on the video



## RESULTS

Test No*	Wave No	Wave Height HS (m)		Result
		Target	Fixed	
(Damage Case 1, R7_S7-9.1.0-1), Short Waves ( $\gamma = 3.3$ )				
29683-01	29683-01	4.00	4.0350	Capsized
29683-02	29683-02	4.00	4.0562	Capsized
29683-03	29683-03	4.00	4.0870	Survived
29683-04	29683-04	4.00	4.0427	Survived
29683-05	29683-05	4.00	4.0304	Survived
29683-06	29683-06	4.00	4.0496	Capsized
29683-07	29683-07	4.00	4.0449	Capsized
29683-08	29683-08	4.00	4.0421	Capsized
29683-09	29683-09	4.00	4.0594	Capsized
29683-10	29683-10	4.00	4.0364	Capsized
29687-01	29687-01	3.75	3.8129	Survived
29687-02	29687-02	3.75	3.7828	Survived
29687-03	29687-03	3.75	3.7968	Survived
29687-04	29687-04	3.75	3.7947	Survived
29687-05	29687-05	3.75	3.8021	Survived
29687-06	29687-06	3.75	3.8078	Survived
29687-07	29687-07	3.75	3.8038	Survived
29687-08	29687-08	3.75	3.8143	Survived
29687-09	29687-09	3.75	3.8141	Survived
29687-10	29687-10	3.75	3.8063	Survived
29688-01	29688-01	3.50	3.5505	Survived
29688-02	29688-02	3.50	3.5531	Survived
29688-03	29688-03	3.50	3.5752	Survived
29688-04	29688-04	3.50	3.5630	Survived
29688-05	29688-05	3.50	3.5564	Survived
29688-06	29688-06	3.50	3.5524	Survived
29688-07	29688-07	3.50	3.5593	Survived
29688-08	29688-08	3.50	3.5557	Survived
29688-09	29688-09	3.50	3.5697	Survived
29688-10	29688-10	3.50	3.5510	Survived
29689-01	29689-01	4.25	4.2873	Survived
29689-02	29689-02	4.25	4.3034	Survived
29689-03	29689-03	4.25	4.3042	Survived
29689-04	29689-04	4.25	4.2605	Survived
29689-05	29689-05	4.25	4.2771	Survived
29689-06	29689-06	4.25	4.2930	Capsized
29689-07	29689-07	4.25	4.2586	Capsized
29689-08	29689-08	4.25	4.3301	Capsized
29689-09	29689-09	4.25	4.3100	Survived
29689-10	29689-10	4.25	4.2878	Capsized

Table 7b: Summary of the experimental results - \*This number corresponds with the number referenced on the video



## RESULTS

Test No*	Wave No	Wave Height HS (m)		Results
		Target	Fixed	
(Damage Case 1, R7_S7-9.1.0-1), Short Waves ( $\gamma = 3.3$ )				
29690-01	29690-01	3.35	3.3962	Survived
29690-02	29690-02	3.35	3.3988	Survived
29690-03	29690-03	3.35	3.3902	Survived
29690-04	29690-04	3.35	3.4133	Survived
29690-05	29690-05	3.35	3.4041	Survived
29690-06	29690-06	3.35	3.3953	Survived
29690-07	29690-07	3.35	3.4075	Survived
29690-08	29690-08	3.35	3.3906	Survived
29690-09	29690-09	3.35	3.3935	Survived
29690-10	29690-10	3.35	3.3843	Survived
29691-01	29691-01	3.90	3.9437	Survived
29691-02	29691-02	3.90	3.9415	Survived
29691-03	29691-03	3.90	3.9513	Survived
29691-04	29691-04	3.90	3.9611	Survived
29691-05	29691-05	3.90	3.9542	Survived
29691-06	29691-06	3.90	3.9536	Survived
29691-07	29691-07	3.90	3.9630	Survived
29691-08	29691-08	3.90	3.9719	Survived
29691-09	29691-09	3.90	3.9496	Survived
29691-10	29691-10	3.90	3.9363	Survived

Table 7c: Summary of the experimental results - \*This number corresponds with the number referenced on the video



## RESULTS

The tested damage is damage case 2 (R7\_P6-7.4.0) in a random wave environment, exposed to different significant wave heights. . The summary of the results is given in table 7d and 7e. The wave and roll motion statistics are given in Appendix D1, while the wave and the roll motion time histories are given in Appendix E1.

Test No*	Wave No	Wave Height HS (m)		Results
		Target	Fixed	
(Damage Case 1, R7_S7-9.1.0-1), Short Waves ( $\gamma = 3.3$ )				
29663-01	29663-01	4.00	4.0996	Survived
29663-02	29663-02	4.00	4.0170	Survived
29663-03	29663-03	4.00	4.0249	Survived
29663-04	29663-04	4.00	4.0350	Survived
29663-05	29663-05	4.00	4.0532	Survived
29663-06	29663-06	4.00	4.0480	Survived
29663-07	29663-07	4.00	4.0388	Survived
29663-08	29663-08	4.00	4.0340	Survived
29663-09	29663-09	4.00	4.0704	Capsized
29663-09.1	29663-09.1	4.00	4.0682	Capsized
29663-10	29663-10	4.00	4.0481	Survived
29665-01	29664-01	3.75	3.7983	Capsized
29664-02	29664-02	3.75	3.8038	Survived
29664-03	29664-03	3.75	3.7892	Survived
29664-04	29664-04	3.75	3.7745	Survived
29664-05	29664-05	3.75	3.7850	Capsized
29664-06	29664-06	3.75	3.7687	Capsized
29664-07	29664-07	3.75	3.7994	Capsized
29664-08	29664-08	3.75	3.7882	Capsized
29664-09	29664-09	3.75	3.7959	Capsized
29664-10	29664-10	3.75	3.7442	Capsized
29665-02	29665-02	3.25	3.2918	Survived
29665-03	29665-03	3.25	3.2867	Survived
29665-04	29665-04	3.25	3.2849	Survived
29665-05	29665-05	3.25	3.2921	Capsized
29665-06	29665-06	3.25	3.3015	Capsized
29666-01	29666-01	3.50	3.5212	Survived
29666-02	29666-02	3.50	3.5698	Survived
29666-03	29666-03	3.50	3.5554	Survived
29666-04	29666-04	3.50	3.5297	Capsized
29666-05	29666-05	3.50	3.5082	Capsized

Table 7d: Summary of the experimental results - \*This number corresponds with the number referenced on the video



## RESULTS

Test No*	Wave No	Wave Height HS (m)		Results
		Target	Fixed	
(Damage Case 2, R7__ P6-7.4.0), Short Waves ( $\gamma = 3.3$ )				
29675-01	29675-01	2.50	2.5009	Survived
29675-02	29675-02	2.50	2.5224	Survived
29675-03	29675-03	2.50	2.5386	Survived
29675-04	29675-04	2.50	2.5375	Survived
29675-05	29675-05	2.50	2.5527	Survived
29676-01	29676-01	4.25	4.3079	Survived
29676-02	29676-02	4.25	4.2906	Survived
29676-03	29676-03	4.25	4.2974	Survived
29676-04	29676-04	4.25	4.2993	Survived
29676-05	29676-05	4.25	4.2922	Survived

Table 7e: Summary of the experimental results - \*This number corresponds with the number referenced on the video





## RESULTS

The tested damage is damage case R7M2\_P4-6.1.0-1 in a random wave environment, exposed to a significant wave height of 4.00 m. . The summary of the results is given in table 7f. The wave and roll motion statistics are given in Appendix D3, while the wave and the roll motion time histories are given in Appendix E3

Test No*	Wave No	Wave Height HS (m)		Results
		Target	Fixed	
(Damage Case , R7M2_P4-6.1.0-1), Short Waves ( $\gamma = 3.3$ )				
30000-01	30000-01	4.00	4.0329	Survived
30000-02	30000-02	4.00	4.0385	Survived
30000-03	30000-03	4.00	4.0373	Survived
30000-04	30000-04	4.00	4.0420	Survived
30000-05	30000-05	4.00	4.0426	Survived
30000-06	30000-06	4.00	4.0305	Survived
30000-07	30000-07	4.00	4.0360	Survived
30000-08	30000-08	4.00	4.0473	Survived
30000-09	30000-09	4.00	4.0510	Survived
30000-10	30000-10	4.00	4.0339	Survived

Table 7f: Summary of the experimental results - \*This number corresponds with the number referenced on the video



## CONCLUSIONS

Model experiments were carried out in a sea state characterised by a significant wave heights of between 2.50 m and 4.25 m to investigate the survivability of the passenger /Ro-Ro vessel. The experiments were conducted according to the Model Test Method specified by IMO. Based on the results of these tests, the following conclusions may be drawn:

- For the worst SOLAS damage (damage case R7\_S7-9.1.0-1) the vessel was tested for significant wave heights between 3.35 m and 4.00 m and she did not survive all the tests.
- For the worst SOLAS damage (damage case R7\_P6-7.4.0) the vessel was tested for significant wave heights between 2.50 m and 4.25 m and she did not survive all the tests.
- For the worst SOLAS damage (damage case R7M2\_P4-6.1.0-1) the vessel was tested for a significant wave height of 4.00 m and she survived the tests.



## **APPENDIX A**

### **DAMAGE INFORMATION & DRAWINGS OF THE MODEL**

**Model No. 2446, 2446A, 2446B**

**Project: "EMSA 1"**

Intact Hydrostatics and Stability Information for Single Damage Case

-----  
Damage Case : R7\_S7-9.1.0-1  
Damage Side : STARBOARD  
Initial Condition : SOLAS\_DAM

Intact Hydrostatics

Intact Stability

-----  
Midship Draught : 4.500 m  
Trim : 0.000 m (Between Perps)  
Trim Angle : 0.000 deg  
Heel Angle : 0.000 deg  
Displacement : 5540.5 Tonnes  
Moulded Volume : 5383.1 m3  
LCB : 49.14 m (From AP)

KMT : 10.194 m  
KG : 8.809 m  
GM : 1.385 m

MAIN CHARACTERISTICS OF THE VESSEL:

-----  
Length betw. perpendiculars 104.40 m  
Breadth, moulded 18.60 m  
Design draught 4.50 m  
X-coord. of after perpendicular 0.00 m  
X-coord. of reference point 52.20 m  
X-coord. of midship section 42.00 m  
X-coord. of building frame 0 0.00 m  
Thickness of keelplate 0.010 m  
Mean thickness of shell plating 0.010 m  
Density of water 1.0250 ton/m3

Sign Conventions

-----  
Trim by Bow : -  
Heel to Port : -

Calculations are based on MODELHULL date 2010-05-04 time 13:34

Shell thickness used in the calculation 10.0 mm  
X-coord. of aft end of DWL 0.30 m  
X-coord. of fore end of DWL 108.21 m

Calc. sections 208

Intact GZ Curve

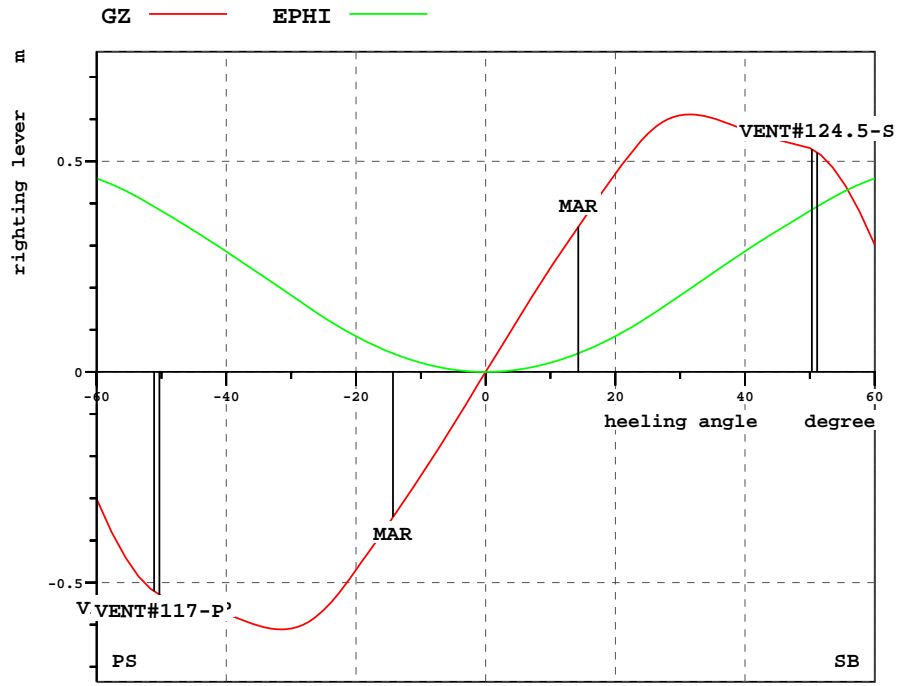
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Initial condition : SOLAS\_DAM  
 Damage case : R7\_S7-9.1.0-1, Zones Z07-Z09 Starboard, b1, l.ext1  
 Stage of damage : INTACT  
 Phase of stage : EQ

HEEL degree	GZ m	EPHI rad*m	T m	TR m	OPNAME	IMRES m	RESMRG m
-60.0	-0.302	0.459	0.020	-1.805	VENT#117.	-1.75	-4.98
-50.0	-0.532	0.382	1.315	-1.366	VENT#117.	0.05	-4.29
-45.0	-0.551	0.335	1.942	-1.208	VENT#117.	0.93	-3.91
-40.0	-0.574	0.286	2.515	-1.066	VENT#117.	1.83	-3.45
-35.0	-0.603	0.235	3.015	-0.909	VENT#117.	2.78	-2.92
-30.0	-0.609	0.182	3.439	-0.747	VENT#117.	3.76	-2.31
-27.0	-0.590	0.150	3.654	-0.653	VENT#117.	4.35	-1.91
-24.0	-0.549	0.120	3.839	-0.565	VENT#117.	4.96	-1.49
-21.0	-0.492	0.093	3.997	-0.481	VENT#117.	5.56	-1.04
-18.0	-0.427	0.069	4.130	-0.400	VENT#117.	6.16	-0.58
-15.0	-0.360	0.048	4.242	-0.320	VENT#117.	6.75	-0.11
-12.0	-0.293	0.031	4.333	-0.241	VENT#117.	7.34	0.37
-9.0	-0.223	0.018	4.404	-0.163	VENT#117.	7.91	0.85
-7.0	-0.175	0.011	4.441	-0.114	VENT#117.	8.28	1.18
-5.0	-0.126	0.005	4.469	-0.068	VENT#117.	8.64	1.51
-4.0	-0.101	0.003	4.480	-0.047	VENT#117.	8.82	1.67
-3.0	-0.075	0.002	4.489	-0.028	VENT#117.	8.99	1.83
-2.0	-0.049	0.001	4.495	-0.012	VENT#117.	9.17	2.00
-1.0	-0.024	0.000	4.499	-0.003	VENT#117.	9.34	2.16
0.0	0.000	0.000	4.500	0.000	VENT#117.	9.50	2.32
1.0	0.024	0.000	4.499	-0.003	VENT#117.	9.34	2.16
2.0	0.049	0.001	4.495	-0.012	VENT#117.	9.17	2.00
3.0	0.075	0.002	4.489	-0.028	VENT#117.	8.99	1.83
4.0	0.101	0.003	4.480	-0.047	VENT#117.	8.82	1.67
5.0	0.126	0.005	4.469	-0.068	VENT#117.	8.64	1.51
7.0	0.175	0.011	4.441	-0.114	VENT#117.	8.28	1.18
9.0	0.223	0.018	4.404	-0.163	VENT#117.	7.91	0.85
12.0	0.293	0.031	4.333	-0.241	VENT#117.	7.34	0.37
15.0	0.360	0.048	4.242	-0.320	VENT#117.	6.75	-0.11
18.0	0.427	0.069	4.130	-0.400	VENT#117.	6.16	-0.58
21.0	0.492	0.093	3.997	-0.481	VENT#117.	5.56	-1.04
24.0	0.549	0.120	3.839	-0.565	VENT#117.	4.96	-1.49
27.0	0.590	0.150	3.654	-0.653	VENT#117.	4.35	-1.91
30.0	0.609	0.182	3.439	-0.747	VENT#117.	3.76	-2.31
35.0	0.603	0.235	3.015	-0.909	VENT#117.	2.78	-2.92
40.0	0.574	0.286	2.515	-1.066	VENT#117.	1.83	-3.45
45.0	0.551	0.335	1.942	-1.208	VENT#117.	0.93	-3.91
50.0	0.532	0.382	1.315	-1.366	VENT#117.	0.05	-4.29
60.0	0.302	0.459	0.020	-1.805	VENT#117.	-1.75	-4.98

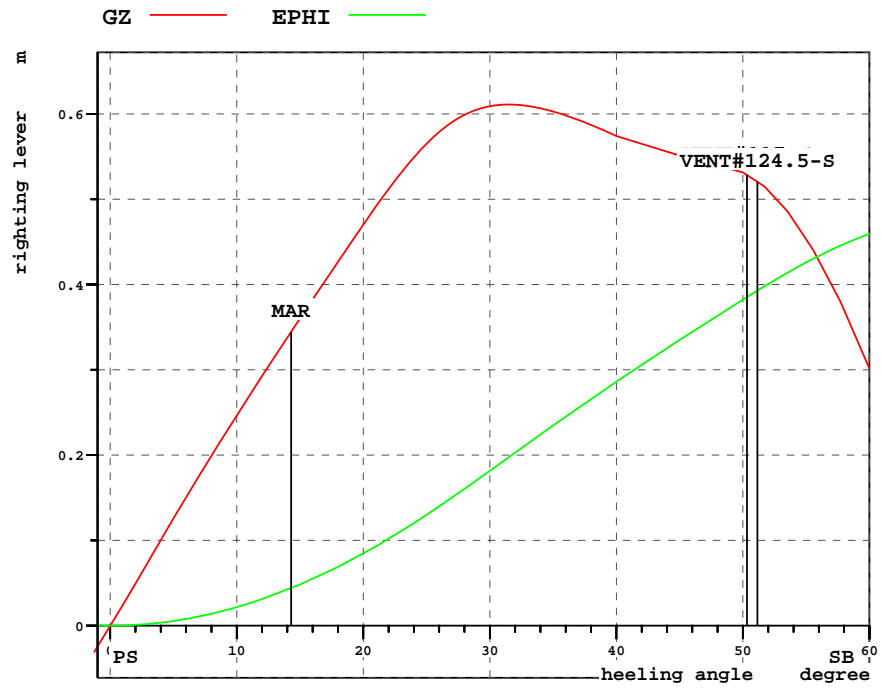
Intact GZ Plot (Whole Range)

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Intact GZ Plot (Heeling To Starboard)

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Damage Hydrostatics and Stability Information for Single Damage Case

-----  
 Damage Case : R7\_S7-9.1.0-1  
 Damage Side : STARBOARD  
 Initial Condition : SOLAS\_DAM  
 Flooding Stage : \*LAST  
 Phase of Stage : EQ

Damaged Compartments

-----

Room	Permeability	Volume	XCG	YCG	ZCG	Moulded Volume
HOLD1	0.90	0.0	-	-	-	0.0
T631	0.95	0.0	-	-	-	0.0
T610_MT	0.95	647.4	43.20	0.11	3.21	681.5
T633	0.95	0.0	-	-	-	0.0
T731	0.95	391.0	51.94	0.05	3.01	411.6
T711	0.95	15.1	54.02	7.10	5.00	15.9

-----

Floating Position

-----  
 (Draughts given on centreline and perpendicular to waterline)

Draught Forward TF	5.233 m	Heel Angle	0.848 Deg (To Stbd)
Draught T	5.133 m	Trim	-0.200 m
Draught Aft TA	5.033 m	Trim Angle	0.110 Deg

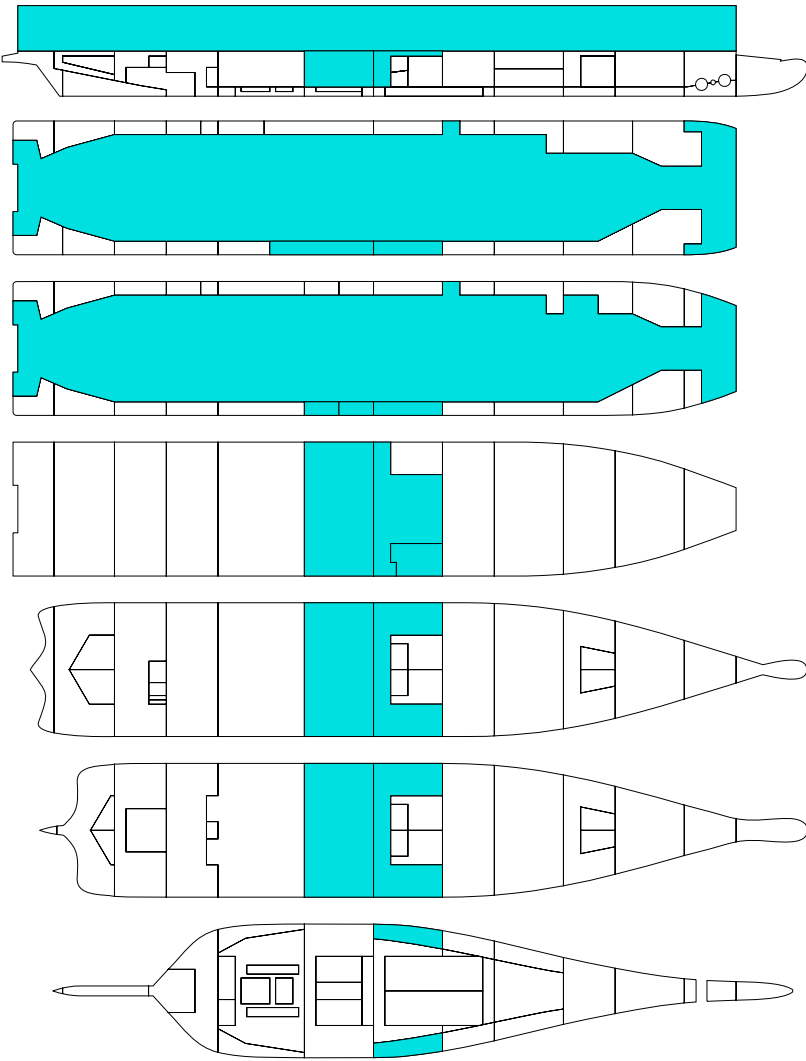
Damage GZ Particulars

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Range	19.860 Deg (Stbd)
GZ Max	0.097 m
Angle at GZ Max	10.502 Deg (Stbd)
Area Under GZ Curve	0.021 m.rad

Damage Case Drawing

-----





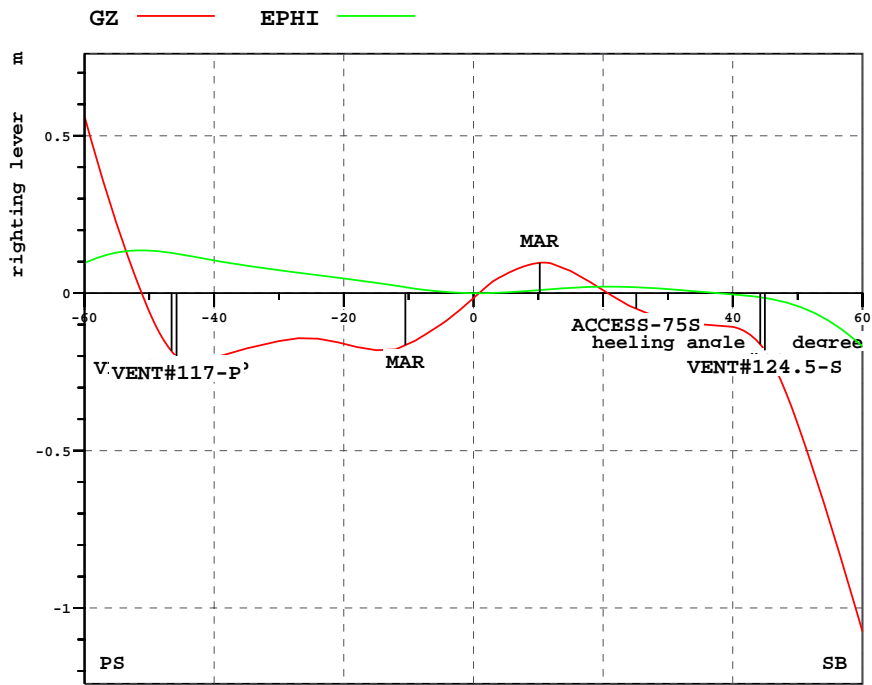
Damaged GZ Curve

-----  
 Initial condition : SOLAS\_DAM  
 Damage case : R7\_S7-9.1.0-1, Zones Z07-Z09 Starboard, b1, l.ext1  
 Stage of damage : 1  
 Phase of stage : EQ

HEEL degree	GZ m	EPHI rad*m	T m	TR m	OPNAME	IMRES m	RESMRG m
-60.0	0.561	0.095	1.653	-0.552	VENT#117.	-2.91	-6.39
-50.0	-0.058	0.135	2.458	-0.715	VENT#117.	-0.85	-5.32
-45.0	-0.210	0.122	2.916	-0.650	VENT#117.	0.17	-4.78
-40.0	-0.205	0.104	3.404	-0.519	VENT#117.	1.15	-4.24
-35.0	-0.175	0.087	3.829	-0.432	VENT#117.	2.14	-3.65
-30.0	-0.152	0.073	4.171	-0.375	VENT#117.	3.16	-2.98
-27.0	-0.143	0.065	4.343	-0.355	VENT#117.	3.78	-2.55
-24.0	-0.145	0.058	4.494	-0.338	VENT#117.	4.39	-2.10
-21.0	-0.156	0.050	4.628	-0.321	VENT#117.	4.99	-1.65
-18.0	-0.171	0.041	4.744	-0.302	VENT#117.	5.58	-1.18
-15.0	-0.181	0.032	4.843	-0.279	ACCESS-7.	6.16	-0.71
-12.0	-0.179	0.023	4.930	-0.250	ACCESS-7.	5.75	-0.23
-9.0	-0.151	0.014	5.010	-0.216	ACCESS-7.	5.31	0.24
-7.0	-0.126	0.009	5.054	-0.201	ACCESS-7.	5.02	0.55
-5.0	-0.099	0.005	5.088	-0.191	ACCESS-7.	4.72	0.86
-4.0	-0.085	0.004	5.102	-0.189	ACCESS-7.	4.57	1.02
-3.0	-0.069	0.002	5.113	-0.189	ACCESS-7.	4.42	1.18
-2.0	-0.051	0.001	5.121	-0.191	ACCESS-7.	4.26	1.34
-1.0	-0.034	0.000	5.128	-0.194	ACCESS-7.	4.11	1.49
0.0	-0.015	0.000	5.131	-0.197	ACCESS-7.	3.96	1.59
0.8	0.000	-0.000	5.133	-0.200	ACCESS-7.	3.83	1.51
1.0	0.003	-0.000	5.133	-0.200	ACCESS-7.	3.81	1.49
2.0	0.021	0.000	5.133	-0.204	ACCESS-7.	3.65	1.32
3.0	0.037	0.001	5.129	-0.207	ACCESS-7.	3.50	1.16
4.0	0.050	0.001	5.122	-0.211	ACCESS-7.	3.35	1.00
5.0	0.060	0.002	5.111	-0.216	ACCESS-7.	3.19	0.84
7.0	0.078	0.005	5.082	-0.231	ACCESS-7.	2.89	0.52
9.0	0.093	0.008	5.045	-0.250	ACCESS-7.	2.58	0.20
12.0	0.094	0.013	4.981	-0.292	ACCESS-7.	2.12	-0.29
15.0	0.071	0.017	4.911	-0.329	ACCESS-7.	1.64	-0.78
18.0	0.036	0.020	4.830	-0.359	ACCESS-7.	1.15	-1.28
21.0	-0.004	0.021	4.732	-0.384	ACCESS-7.	0.66	-1.76
24.0	-0.040	0.020	4.618	-0.406	ACCESS-7.	0.18	-2.24
27.0	-0.065	0.017	4.485	-0.425	ACCESS-7.	-0.30	-2.70
30.0	-0.081	0.013	4.334	-0.442	ACCESS-7.	-0.78	-3.15
35.0	-0.099	0.005	4.033	-0.479	ACCESS-7.	-1.54	-3.86
40.0	-0.107	-0.004	3.655	-0.542	ACCESS-7.	-2.24	-4.50
45.0	-0.183	-0.016	3.242	-0.651	ACCESS-7.	-2.92	-5.11
50.0	-0.415	-0.041	2.868	-0.669	ACCESS-7.	-3.64	-5.72
60.0	-1.074	-0.169	2.152	-0.473	ACCESS-7.	-5.07	-6.87

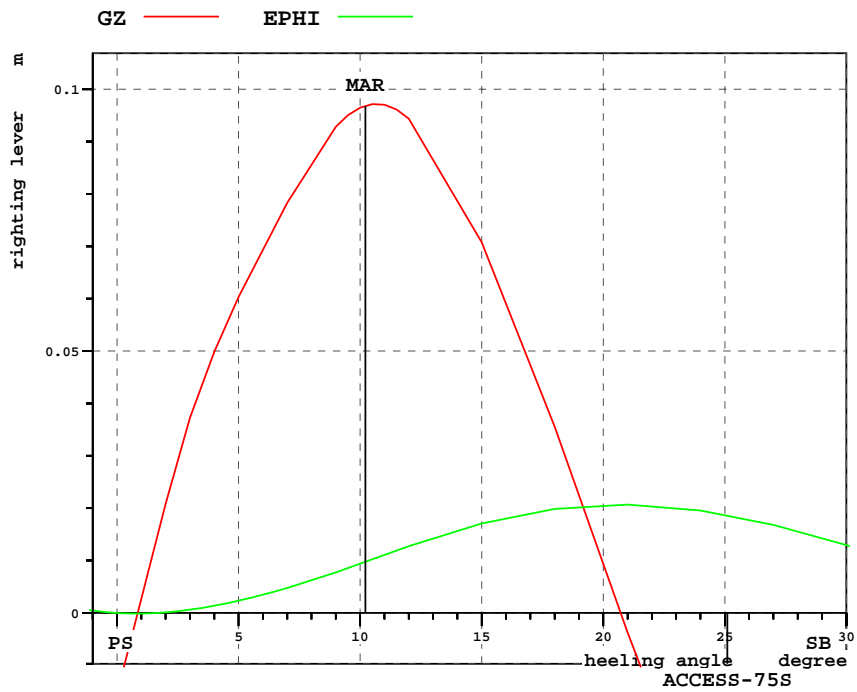
Damaged GZ Plot (Whole Range)

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Damage GZ Plot (Heeling To Starboard)

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Model Test Draught Marks

(Draughts given on centreline and perpendicular to baseline)

Damage Case : R7\_S7-9.1.0-1  
 Damage Side : STARBOARD  
 Equilibrium Heel Angle: 0.848 Degrees

Locations of Draught Marks and Breadths at Draught Mark locations

Draught Mark	X Location	Full Breadth At Mean Damage Draught
AP	0.000 m	18.019 m
AFT QUARTER	26.100 m	18.600 m
MIDSHIP	52.200 m	18.600 m
FP	104.400 m	0.191 m

Draughts in Intact, Damage Equilibrium and at 1 degree of Heel

Draught Marks at AP	Intact	Equilibrium	1 Degree Heel
Port	4.500 m	4.900 m	4.876 m
Mean	4.500 m	5.034 m	5.034 m
Starboard	4.500 m	5.167 m	5.191 m

Draught Marks at Aft Quarter	Intact	Equilibrium	1 Degree Heel
Port	4.500 m	4.946 m	4.921 m
Mean	4.500 m	5.084 m	5.084 m
Starboard	4.500 m	5.221 m	5.246 m

Draught Marks at Midship	Intact	Equilibrium	1 Degree Heel
Port	4.500 m	4.996 m	4.971 m
Mean	4.500 m	5.134 m	5.134 m
Starboard	4.500 m	5.271 m	5.296 m

Draught Marks at FP	Intact	Equilibrium	1 Degree Heel
Port	4.500 m	5.232 m	5.232 m
Mean	4.500 m	5.233 m	5.233 m
Starboard	4.500 m	5.235 m	5.235 m

Intact Hydrostatics and Stability Information for Single Damage Case

Damage Case : P6-7.1.0  
Damage Side : PORT  
Initial Condition : SOLAS\_DAM

Intact Hydrostatics

Intact Stability

Midship Draught	: 4.500 m	KMT	: 10.194 m
Trim	: 0.000 m (Between Perps)		
Trim Angle	: 0.000 deg	KG	: 8.809 m
Heel Angle	: 0.000 deg	GM	: 1.385 m
Displacement	: 5540.5 Tonnes		
Moulded Volume	: 5383.1 m3		
LCB	: 49.14 m (From AP)		

MAIN CHARACTERISTICS OF THE VESSEL:

Length betw. perpendiculars	104.40 m
Breadth, moulded	18.60 m
Design draught	4.50 m
X-coord. of after perpendicular	0.00 m
X-coord. of reference point	52.20 m
X-coord. of midship section	42.00 m
X-coord. of building frame 0	0.00 m
Thickness of keelplate	0.010 m
Mean thickness of shell plating	0.010 m
Density of water	1.0250 ton/m3

Sign Conventions

Trim by Bow : +  
Heel to Port : -

Calculations are based on MODELHULL date 2010-04-19 time 16:27

Shell thickness used in the calculation	10.0 mm
X-coord. of aft end of DWL	0.30 m
X-coord. of fore end of DWL	108.21 m

Calc. sections 208

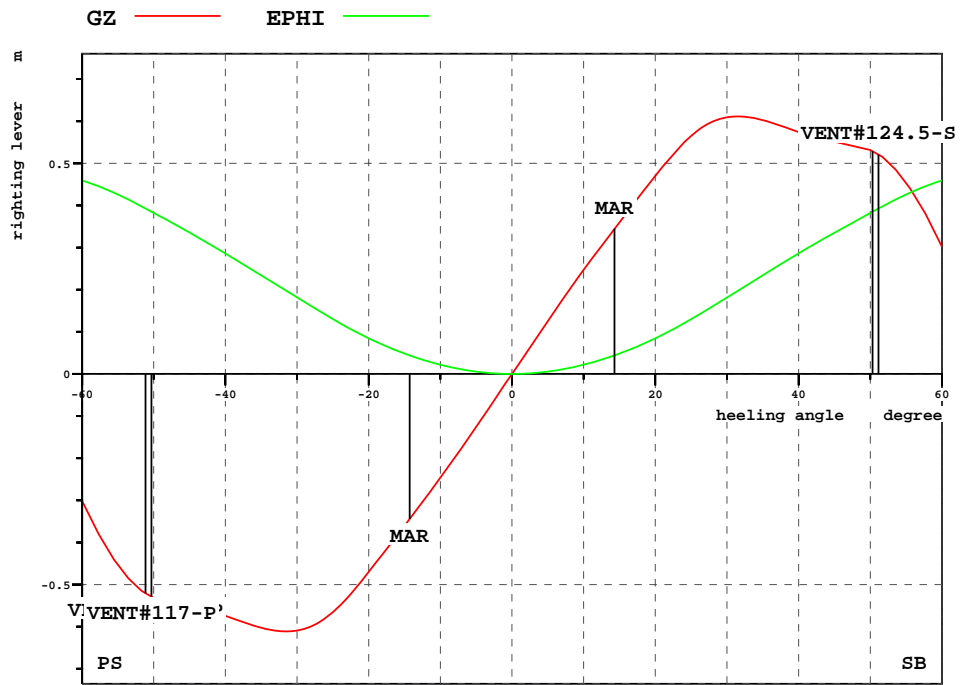
Intact GZ Curve

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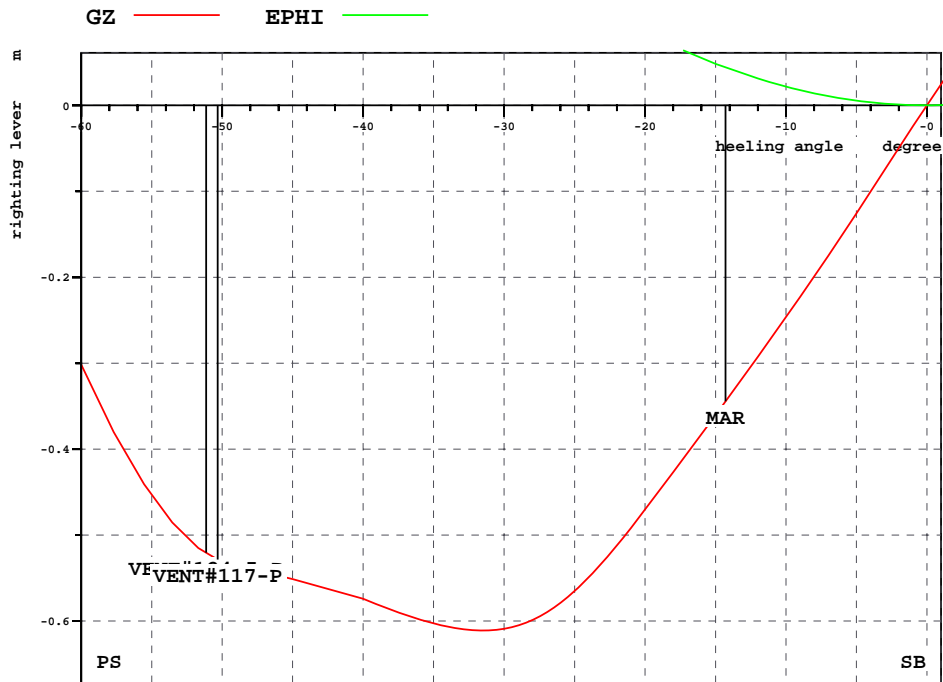
Initial condition : SOLAS\_DAM  
 Damage case : P6-7.1.0, Zones Z6-Z7 Port, b1  
 Stage of damage : INTACT  
 Phase of stage : EQ

HEEL degree	GZ m	EPHI rad*m	T m	TR m	OPNAME	IMRES m	RESMRG m
-60.0	-0.302	0.459	0.020	1.805	VENT#117.	-1.75	-4.98
-50.0	-0.532	0.382	1.315	1.366	VENT#117.	0.05	-4.29
-45.0	-0.551	0.335	1.942	1.208	VENT#117.	0.93	-3.91
-40.0	-0.574	0.286	2.515	1.066	VENT#117.	1.83	-3.45
-35.0	-0.603	0.235	3.015	0.909	VENT#117.	2.78	-2.92
-30.0	-0.609	0.182	3.439	0.747	VENT#117.	3.76	-2.31
-27.0	-0.590	0.150	3.654	0.653	VENT#117.	4.35	-1.91
-24.0	-0.549	0.120	3.839	0.565	VENT#117.	4.96	-1.49
-21.0	-0.492	0.093	3.997	0.481	VENT#117.	5.56	-1.04
-18.0	-0.427	0.069	4.130	0.400	VENT#117.	6.16	-0.58
-15.0	-0.360	0.048	4.242	0.320	VENT#117.	6.75	-0.11
-12.0	-0.293	0.031	4.333	0.241	VENT#117.	7.34	0.37
-9.0	-0.223	0.018	4.404	0.163	VENT#117.	7.91	0.85
-7.0	-0.175	0.011	4.441	0.114	VENT#117.	8.28	1.18
-5.0	-0.126	0.005	4.469	0.068	VENT#117.	8.64	1.51
-4.0	-0.101	0.003	4.480	0.047	VENT#117.	8.82	1.67
-3.0	-0.075	0.002	4.489	0.028	VENT#117.	8.99	1.83
-2.0	-0.049	0.001	4.495	0.012	VENT#117.	9.17	2.00
-1.0	-0.024	0.000	4.499	0.003	VENT#117.	9.34	2.16
0.0	0.000	0.000	4.500	0.000	VENT#117.	9.50	2.32
1.0	0.024	0.000	4.499	0.003	VENT#117.	9.34	2.16
2.0	0.049	0.001	4.495	0.012	VENT#117.	9.17	2.00
3.0	0.075	0.002	4.489	0.028	VENT#117.	8.99	1.83
4.0	0.101	0.003	4.480	0.047	VENT#117.	8.82	1.67
5.0	0.126	0.005	4.469	0.068	VENT#117.	8.64	1.51
7.0	0.175	0.011	4.441	0.114	VENT#117.	8.28	1.18
9.0	0.223	0.018	4.404	0.163	VENT#117.	7.91	0.85
12.0	0.293	0.031	4.333	0.241	VENT#117.	7.34	0.37
15.0	0.360	0.048	4.242	0.320	VENT#117.	6.75	-0.11
18.0	0.427	0.069	4.130	0.400	VENT#117.	6.16	-0.58
21.0	0.492	0.093	3.997	0.481	VENT#117.	5.56	-1.04
24.0	0.549	0.120	3.839	0.565	VENT#117.	4.96	-1.49
27.0	0.590	0.150	3.654	0.653	VENT#117.	4.35	-1.91
30.0	0.609	0.182	3.439	0.747	VENT#117.	3.76	-2.31
35.0	0.603	0.235	3.015	0.909	VENT#117.	2.78	-2.92
40.0	0.574	0.286	2.515	1.066	VENT#117.	1.83	-3.45
45.0	0.551	0.335	1.942	1.208	VENT#117.	0.93	-3.91
50.0	0.532	0.382	1.315	1.366	VENT#117.	0.05	-4.29
60.0	0.302	0.459	0.020	1.805	VENT#117.	-1.75	-4.98

Intact GZ Plot (Whole Range)



Intact GZ Plot (Heeling To Port)



Damage Hydrostatics and Stability Information for Single Damage Case

-----  
 Damage Case : P6-7.1.0  
 Damage Side : PORT  
 Initial Condition : SOLAS\_DAM  
 Flooding Stage : \*LAST  
 Phase of Stage : EQ

Damaged Compartments

-----

Room	Permeability	Volume	XCG	YCG	ZCG	Moulded Volume
HOLD1	0.90	0.0	-	-	-	0.0
T510	0.85	884.5	32.15	-0.14	3.46	1040.5
T500	0.95	150.2	33.90	-0.00	0.66	158.1
T502	0.95	14.4	27.63	-1.57	0.76	15.2
T503	0.95	8.9	31.60	-0.00	0.98	9.4
T506	0.95	5.3	35.60	-0.00	0.97	5.6
T504	0.95	6.9	34.00	-2.95	1.09	7.3
T632	0.95	0.0	-	-	-	0.0
T600	0.95	133.6	42.52	-0.32	0.59	140.6
T610	0.95	721.6	43.14	-0.15	3.50	759.6
T634	0.95	0.0	-	-	-	0.0
T603	0.95	9.5	43.20	0.00	0.98	10.0
T602	0.95	14.2	43.20	-3.00	0.98	15.0

-----

Floating Position

-----  
 (Draughts given on centreline and perpendicular to waterline)

Draught Forward TF	5.018 m	Heel Angle	-1.297 Deg (To Port)
Draught T	5.545 m	Trim	-1.053 m
Draught Aft TA	6.071 m	Trim Angle	0.578 Deg

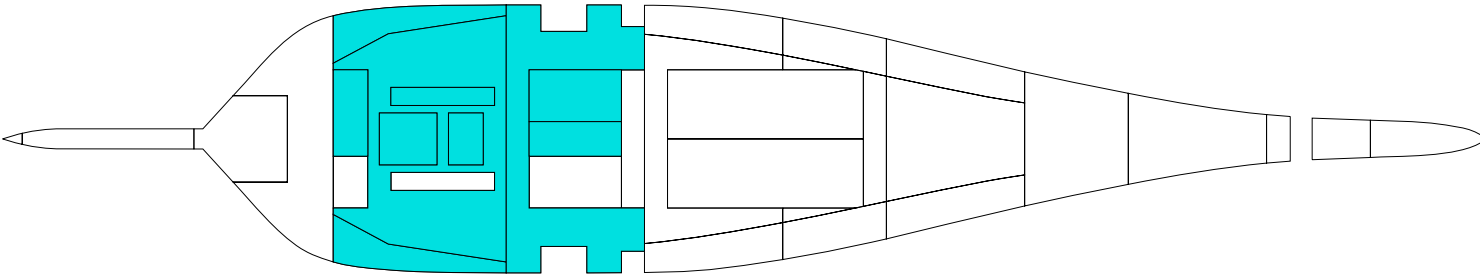
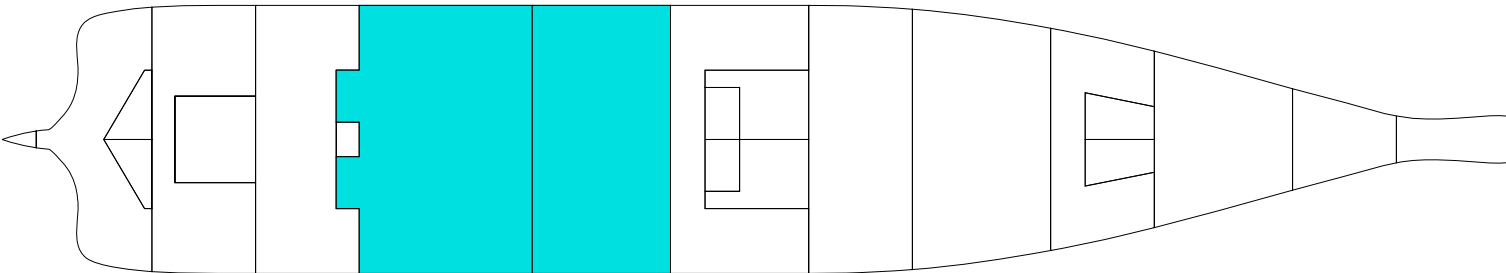
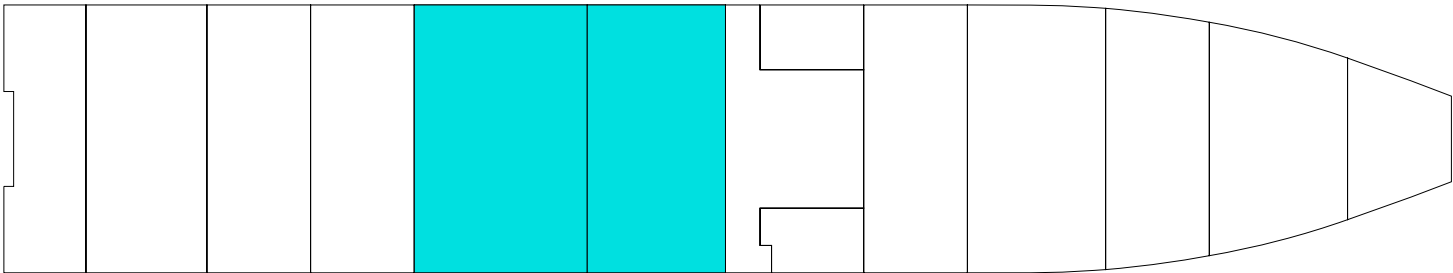
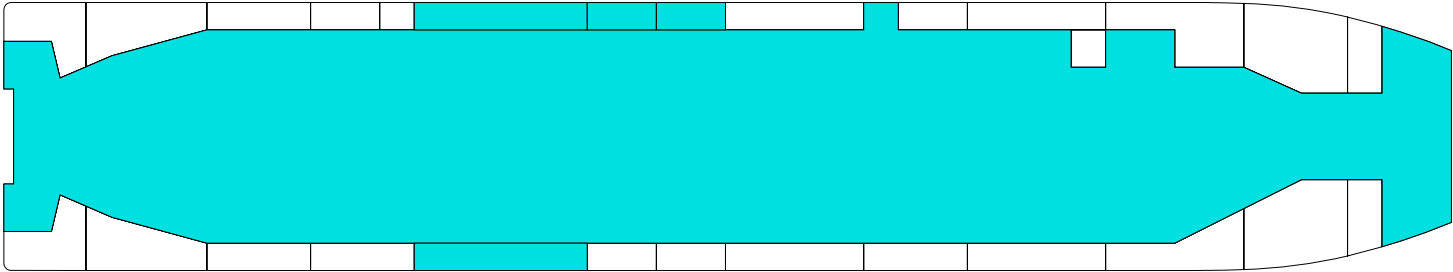
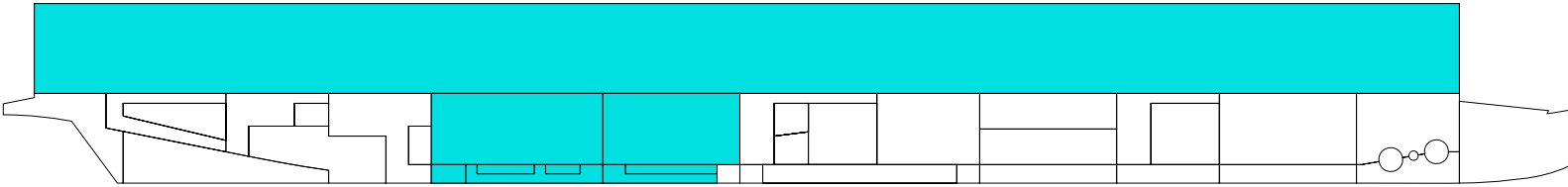
Damage GZ Particulars

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Range	42.129 Deg (Port)
GZ Max	0.143 m
Angle at GZ Max	35.881 Deg (Port)
Area Under GZ Curve	0.057 m.rad

Damage Case Drawing

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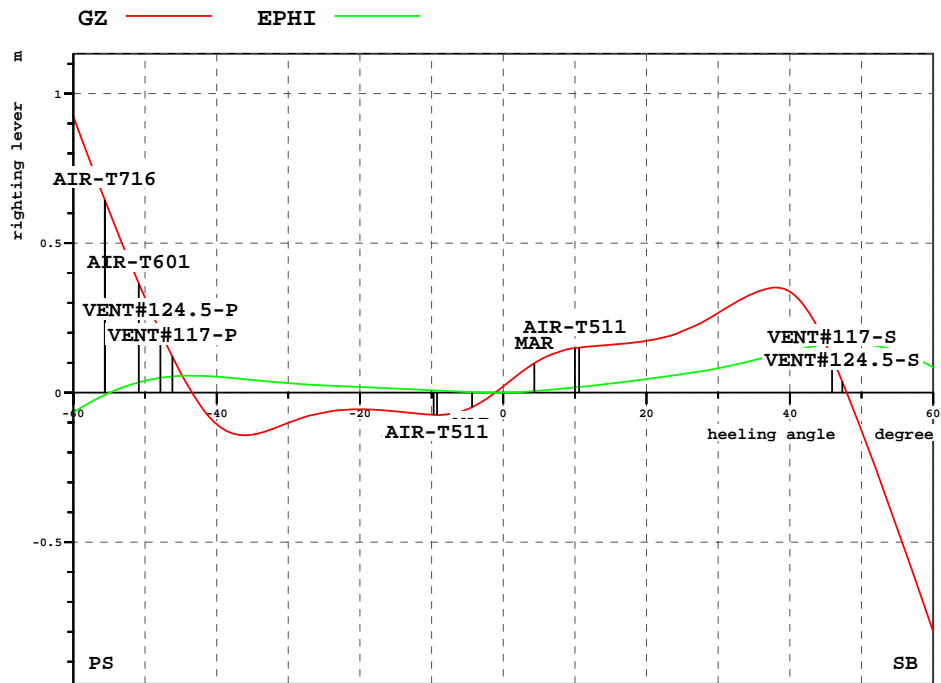
Damaged GZ Curve

-----  
 Initial condition : SOLAS\_DAM  
 Damage case : P6-7.1.0, Zones Z6-Z7 Port, b1  
 Stage of damage : 1  
 Phase of stage : EQ

HEEL degree	GZ m	EPHI rad*m	T m	TR m	OPNAME	IMRES m	RESMRG m
-60.0	0.923	-0.067	2.961	-3.114	VENT#117.	-2.85	-9.22
-50.0	0.317	0.040	3.616	-2.599	VENT#117.	-0.77	-7.70
-45.0	0.067	0.056	3.937	-2.277	AIR-T511	-0.34	-6.87
-40.0	-0.106	0.054	4.268	-1.966	AIR-T511	-0.24	-6.04
-35.0	-0.141	0.042	4.626	-1.806	AIR-T511	-0.25	-5.31
-30.0	-0.101	0.031	4.944	-1.804	AIR-T511	-0.29	-4.62
-27.0	-0.076	0.027	5.092	-1.781	AIR-T511	-0.28	-4.16
-24.0	-0.062	0.023	5.215	-1.739	AIR-T511	-0.26	-3.67
-21.0	-0.056	0.020	5.313	-1.678	AIR-T511	-0.23	-3.15
-18.0	-0.057	0.017	5.388	-1.599	AIR-T511	-0.18	-2.60
-15.0	-0.062	0.014	5.442	-1.503	AIR-T511	-0.12	-2.04
-12.0	-0.071	0.010	5.479	-1.392	AIR-T511	-0.06	-1.46
-9.0	-0.075	0.006	5.503	-1.273	AIR-T511	0.00	-0.88
-7.0	-0.071	0.004	5.516	-1.190	AIR-T511	0.04	-0.49
-5.0	-0.056	0.002	5.528	-1.114	AIR-T511	0.07	-0.12
-4.0	-0.045	0.001	5.533	-1.085	AIR-T511	0.08	0.06
-3.0	-0.030	0.000	5.538	-1.066	AIR-T511	0.09	0.24
-2.0	-0.013	-0.000	5.543	-1.057	AIR-T511	0.09	0.40
-1.3	0.000	-0.000	5.545	-1.053	AIR-T511	0.09	0.52
-1.0	0.005	-0.000	5.546	-1.051	AIR-T511	0.09	0.57
0.0	0.024	0.000	5.546	-1.049	AIR-T511	0.09	0.73
1.0	0.042	0.001	5.546	-1.051	AIR-T511	0.09	0.57
2.0	0.060	0.001	5.543	-1.057	AIR-T511	0.09	0.40
3.0	0.078	0.003	5.538	-1.066	AIR-T511	0.09	0.24
4.0	0.092	0.004	5.533	-1.085	AIR-T511	0.08	0.06
5.0	0.105	0.006	5.527	-1.114	AIR-T511	0.07	-0.12
7.0	0.130	0.010	5.510	-1.187	AIR-T511	0.05	-0.49
9.0	0.146	0.015	5.492	-1.267	AIR-T511	0.02	-0.87
12.0	0.155	0.023	5.461	-1.375	AIR-T511	-0.03	-1.43
15.0	0.160	0.031	5.417	-1.468	AIR-T511	-0.09	-2.00
18.0	0.167	0.039	5.356	-1.544	AIR-T511	-0.13	-2.54
21.0	0.178	0.048	5.274	-1.601	AIR-T511	-0.17	-3.07
24.0	0.195	0.058	5.167	-1.638	AIR-T511	-0.19	-3.57
27.0	0.226	0.069	5.034	-1.649	AIR-T511	-0.19	-4.03
30.0	0.267	0.082	4.871	-1.634	AIR-T511	-0.17	-4.46
35.0	0.332	0.108	4.525	-1.551	AIR-T511	-0.08	-5.08
40.0	0.338	0.138	4.126	-1.547	AIR-T511	0.01	-5.68
45.0	0.164	0.162	3.776	-1.716	AIR-T511	-0.03	-6.42
50.0	-0.126	0.164	3.458	-1.925	VENT#117.	-0.86	-7.20
60.0	-0.798	0.084	2.785	-2.287	VENT#117.	-2.98	-8.61

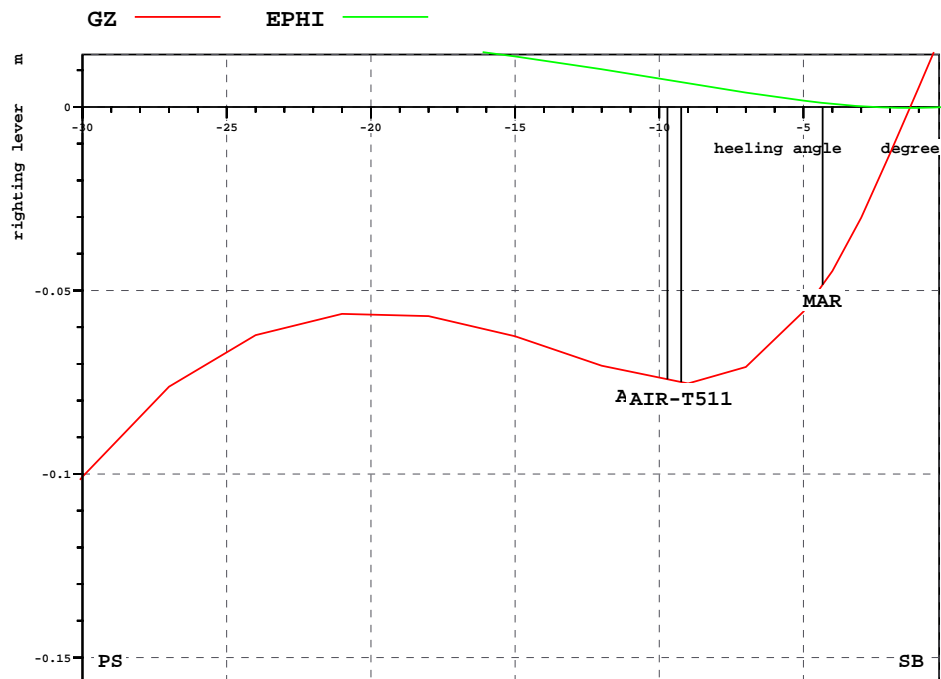
Damaged GZ Plot (Whole Range)

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Damage GZ Plot (Heeling To Port)

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Model Test Draught Marks

-----

(Draughts given on centreline and perpendicular to baseline)

Damage Case : P6-7.1.0  
 Damage Side : PORT  
 Equilibrium Heel Angle: -1.30 Degrees

Locations of Draught Marks and Breadths at Draught Mark locations

-----

Draught Mark	X Location	Full Breadth At Mean Damage Draught
AP	0.000 m	18.600 m
AFT QUARTER	26.100 m	18.600 m
MIDSHIP	52.200 m	18.600 m
FP	104.400 m	0.139 m

Draughts in Intact, Damage Equilibrium

-----

Draught Marks at AP	Intact	Equilibrium
Port	4.500 m	6.283 m
Mean	4.500 m	6.073 m
Starboard	4.500 m	5.862 m

Draught Marks at Aft Quarter	Intact	Equilibrium
Port	4.500 m	6.020 m
Mean	4.500 m	5.810 m
Starboard	4.500 m	5.599 m

Draught Marks at Midship	Intact	Equilibrium
Port	4.500 m	5.757 m
Mean	4.500 m	5.546 m
Starboard	4.500 m	5.336 m

Draught Marks at FP	Intact	Equilibrium
Port	4.500 m	5.021 m
Mean	4.500 m	5.020 m
Starboard	4.500 m	5.018 m

Draught Mark Explanation

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Damage floating position draught marks calculation shown in red  
Modlel Draught marks calculation method shown in green

FIGURE 1

FIGURE 2

Intact Hydrostatics and Stability Information for Single Damage Case

Damage Case : R7M2\_P5-7.4.0-1  
Damage Side : PORT  
Initial Condition : DSM2

Intact Hydrostatics

Midship Draught : 4.500 m  
Trim : 0.000 m (Between Perps)  
Trim Angle : 0.000 deg  
Heel Angle : 0.000 deg  
Displacement : 5540.5 Tonnes

Intact Stability

KMT : 10.194 m  
KG : 8.594 m  
GM : 1.600 m

Moulded Volume : 5383.1 m3 (Actual Floating Position)  
LCB : 49.14 m (From AP - Level Trim Floating Position)

MAIN CHARACTERISTICS OF THE VESSEL:

Length betw. perpendiculars 104.40 m  
Breadth, moulded 18.60 m  
Design draught 4.50 m  
  
X-coord. of after perpendicular 0.00 m  
X-coord. of reference point 52.20 m  
X-coord. of midship section 42.00 m  
X-coord. of building frame 0 0.00 m  
  
Thickness of keelplate 0.010 m  
Mean thickness of shell plating 0.010 m  
Density of water 1.0250 ton/m3

Sign Conventions

Trim by Bow : -  
Heel to Port : -

Calculations are based on MODELHULL date 2010-05-04 time 12:34

Shell thickness used in the calculation 10.0 mm  
X-coord. of aft end of DWL 0.30 m  
X-coord. of fore end of DWL 108.21 m

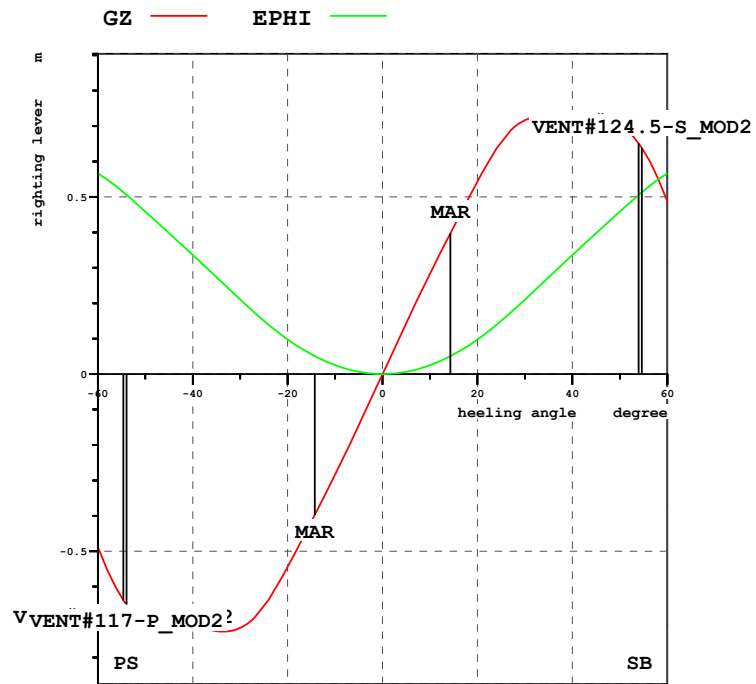
Calc. sections 208  
Plate thickness: 10.0mm

Intact GZ Curve

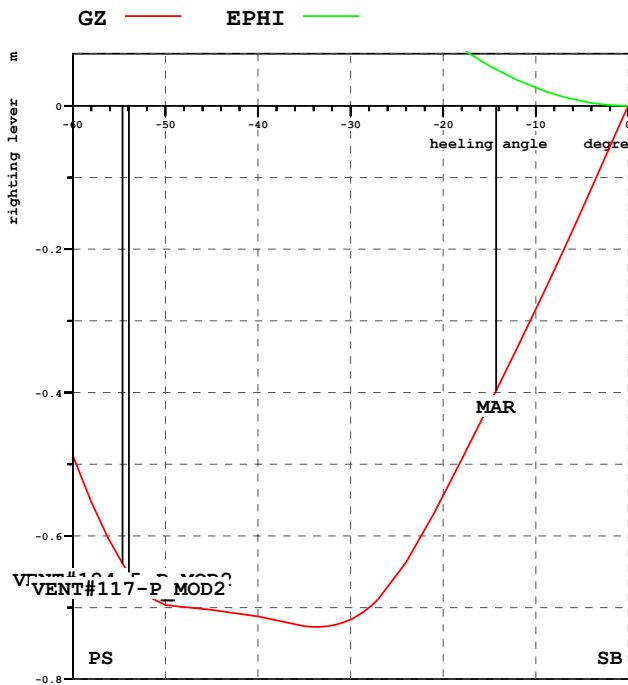
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 Initial condition : DSM2, Deepest subd. load line  
 Damage case : R7M2\_P5-7.4.0-1, Zones Z05-Z07 Port, b4, l.ext1  
 Stage of damage : INTACT  
 Phase of stage : EQ

HEEL degree	GZ m	EPHI rad*m	T m	TR m	OPNAME	IMRES m	RESMRG m
-60.0	-0.488	0.567	0.020	-1.804	VENT#117.	-1.25	-4.98
-50.0	-0.696	0.459	1.315	-1.365	VENT#117.	0.69	-4.29
-45.0	-0.703	0.398	1.942	-1.207	VENT#117.	1.64	-3.91
-40.0	-0.712	0.336	2.515	-1.065	VENT#117.	2.60	-3.45
-35.0	-0.726	0.273	3.015	-0.908	VENT#117.	3.60	-2.92
-30.0	-0.717	0.210	3.439	-0.747	VENT#117.	4.62	-2.31
-27.0	-0.688	0.173	3.654	-0.653	VENT#117.	5.24	-1.91
-24.0	-0.637	0.139	3.839	-0.564	VENT#117.	5.87	-1.49
-21.0	-0.569	0.107	3.997	-0.480	VENT#117.	6.49	-1.04
-18.0	-0.493	0.079	4.130	-0.399	VENT#117.	7.11	-0.58
-15.0	-0.416	0.056	4.242	-0.320	VENT#117.	7.72	-0.11
-12.0	-0.337	0.036	4.333	-0.241	VENT#117.	8.32	0.37
-9.0	-0.257	0.020	4.404	-0.163	VENT#117.	8.90	0.85
-7.0	-0.201	0.012	4.441	-0.113	VENT#117.	9.27	1.18
-5.0	-0.145	0.006	4.469	-0.067	VENT#117.	9.64	1.51
-4.0	-0.116	0.004	4.480	-0.047	VENT#117.	9.82	1.67
-3.0	-0.086	0.002	4.489	-0.028	VENT#117.	9.99	1.83
-2.0	-0.057	0.001	4.495	-0.012	VENT#117.	10.17	2.00
-1.0	-0.028	0.000	4.499	-0.003	VENT#117.	10.34	2.16
0.0	0.000	0.000	4.500	0.000	VENT#117.	10.50	2.32
1.0	0.028	0.000	4.499	-0.003	VENT#117.	10.34	2.16
2.0	0.057	0.001	4.495	-0.012	VENT#117.	10.17	2.00
3.0	0.086	0.002	4.489	-0.028	VENT#117.	9.99	1.83
4.0	0.116	0.004	4.480	-0.047	VENT#117.	9.82	1.67
5.0	0.145	0.006	4.469	-0.067	VENT#117.	9.64	1.51
7.0	0.201	0.012	4.441	-0.113	VENT#117.	9.27	1.18
9.0	0.257	0.020	4.404	-0.163	VENT#117.	8.90	0.85
12.0	0.337	0.036	4.333	-0.241	VENT#117.	8.32	0.37
15.0	0.416	0.056	4.242	-0.320	VENT#117.	7.72	-0.11
18.0	0.493	0.079	4.130	-0.399	VENT#117.	7.11	-0.58
21.0	0.569	0.107	3.997	-0.480	VENT#117.	6.49	-1.04
24.0	0.637	0.139	3.839	-0.564	VENT#117.	5.87	-1.49
27.0	0.688	0.173	3.654	-0.653	VENT#117.	5.24	-1.91
30.0	0.717	0.210	3.439	-0.747	VENT#117.	4.62	-2.31
35.0	0.726	0.273	3.015	-0.908	VENT#117.	3.60	-2.92
40.0	0.712	0.336	2.515	-1.065	VENT#117.	2.60	-3.45
45.0	0.703	0.398	1.942	-1.207	VENT#117.	1.64	-3.91
50.0	0.696	0.459	1.315	-1.365	VENT#117.	0.69	-4.29
60.0	0.488	0.567	0.020	-1.804	VENT#117.	-1.25	-4.98

Intact GZ Plot (Whole Range)



Intact GZ Plot (Heeling To Port)



Damage Hydrostatics and Stability Information for Single Damage Case

---

Damage Case : R7M2\_P5-7.4.0-1  
 Damage Side : PORT  
 Initial Condition : DSM2  
 Flooding Stage : 1  
 Phase of Stage : EQ

Damaged Compartments

---

Room	Moulded Vol m3	PERM	Net Vol m3	XCG m	YCG m	ZCG m
HOLD1_MOD2	2388.5	0.90	2149.66	13.13	-0.00	9.45
T410	711.2	0.95	675.69	22.97	0.67	4.80
T511	10.4	0.95	9.85	25.60	0.00	2.65
T510	1395.1	0.85	1185.86	32.10	0.03	4.60
T504	7.3	0.95	6.89	34.00	-2.95	1.09
HOLD2_MOD2	3609.1	0.90	3248.23	45.71	-0.07	9.45
T632	113.8	0.95	108.09	40.51	-8.35	10.30
T610_MT	892.9	0.95	848.25	43.20	0.00	3.80
T634	31.5	0.95	29.94	45.60	-8.35	8.03

---



Damage Hydrostatics and Stability Information for Single Damage Case Continued

---

Flooded Water Volume in Damaged Compartments

---

Room	Permeability	Flooded Vol m3	XCG m	YCG m	ZCG m
HOLD1_MO.	0.90	379.6	12.40	-4.02	7.49
T410	0.95	483.4	22.97	-1.63	3.80
T511	0.95	9.8	25.60	0.00	2.65
T510	0.85	883.8	32.13	-1.89	3.80
T504	0.95	6.9	34.00	-2.95	1.08
HOLD2_MO.	0.90	340.9	43.54	-5.21	7.28
T632	0.95	30.4	40.57	-8.41	8.07
T610_MT	0.95	664.6	43.17	-1.66	3.49
T634	0.95	27.6	45.59	-8.39	7.90

---

Damage Hydrostatics and Stability Information for Single Damage Case Continued

---

Floating Position

---

(Draughts given on centreline and perpendicular to waterline)

Draught Forward TF	3.919 m	Heel Angle	-22.66 Deg (To Port)
Draught T	5.365 m	Trim	2.892 m
Draught Aft TA	6.811 m	Trim Angle	1.587 Deg

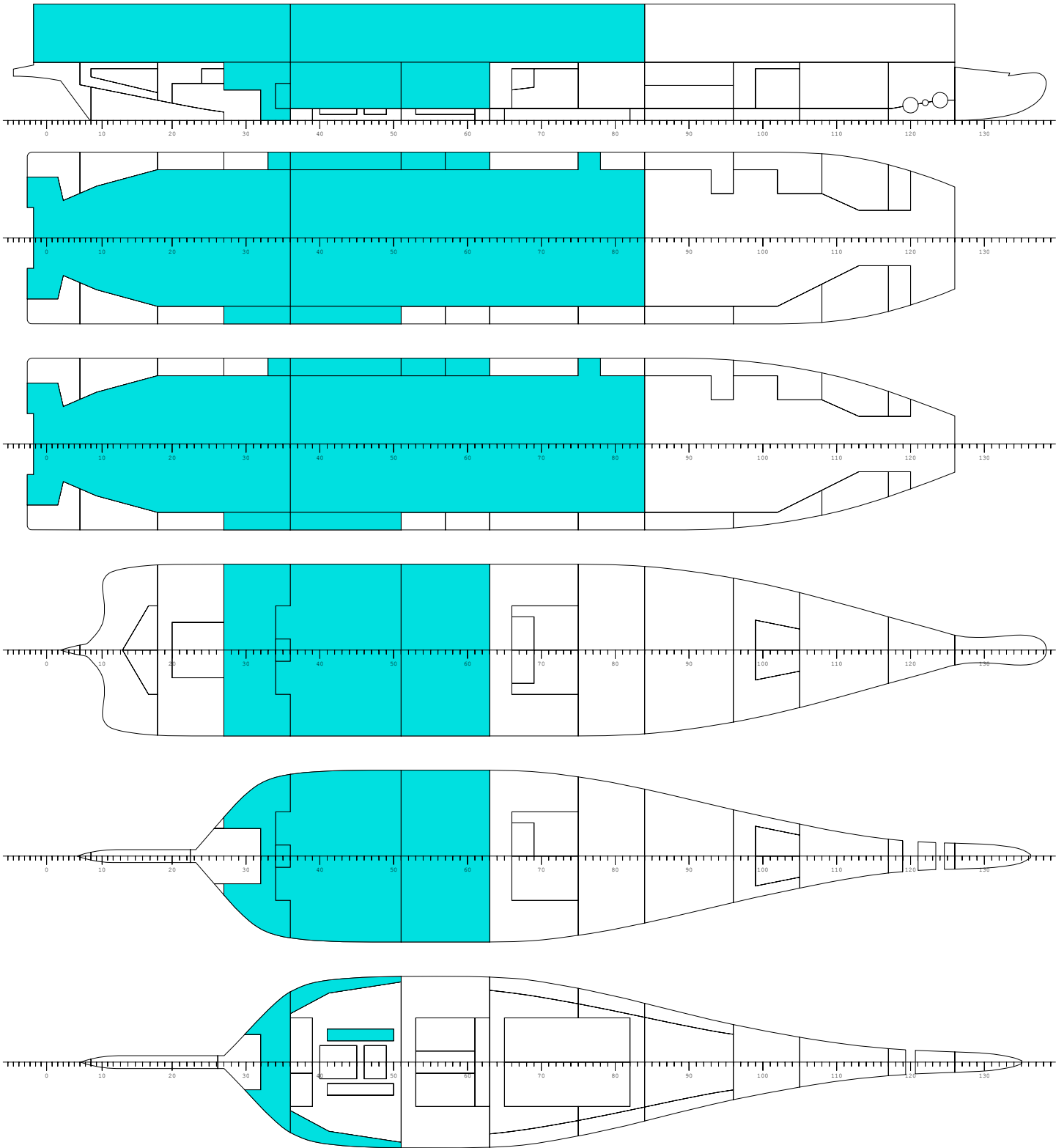
Damage GZ Particulars

---

Range	21.916 Deg (Port)
GZ Max	0.114 m
Angle at GZ Max	35.828 Deg (Port)
Area Under GZ Curve	0.025 m.rad

Damage Case Drawing

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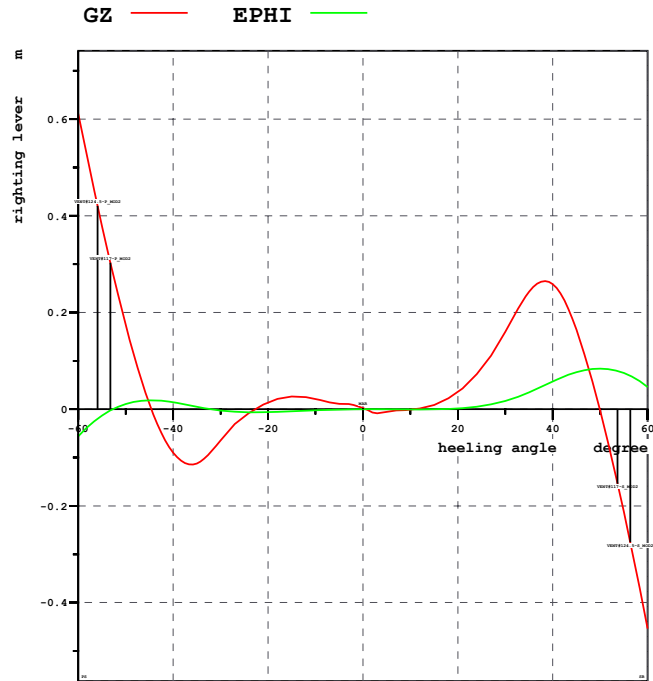
Damaged GZ Curve

-----  
 Initial condition : DSM2, Deepest subd. load line  
 Damage case : R7M2\_P5-7.4.0-1, Zones Z05-Z07 Port, b4, l.ext1  
 Stage of damage : 1  
 Phase of stage : EQ

HEEL degree	GZ m	EPHI rad*m	T m	TR m	OPNAME	IMRES m	RESMRG m
-60.0	0.612	-0.056	2.895	5.700	VENT#117.	-1.32	-10.49
-50.0	0.174	0.011	3.653	4.716	VENT#117.	0.63	-8.84
-45.0	0.011	0.018	4.002	4.161	VENT#117.	1.58	-7.91
-40.0	-0.090	0.015	4.335	3.600	VENT#117.	2.52	-6.95
-35.0	-0.112	0.005	4.659	3.168	VENT#117.	3.48	-6.05
-30.0	-0.064	-0.003	4.982	3.016	VENT#117.	4.48	-5.29
-27.0	-0.031	-0.005	5.159	2.984	VENT#117.	5.10	-4.85
-24.0	-0.008	-0.006	5.309	2.928	VENT#117.	5.70	-4.38
-22.7	0.000	-0.006	5.365	2.892	VENT#117.	5.97	-4.15
-21.0	0.010	-0.006	5.431	2.846	VENT#117.	6.30	-3.87
-18.0	0.021	-0.006	5.527	2.744	VENT#117.	6.89	-3.34
-15.0	0.026	-0.004	5.599	2.630	VENT#117.	7.46	-2.78
-12.0	0.025	-0.003	5.651	2.511	VENT#117.	8.02	-2.22
-9.0	0.019	-0.002	5.685	2.395	VENT#117.	8.57	-1.64
-7.0	0.014	-0.001	5.699	2.325	VENT#117.	8.92	-1.27
-5.0	0.011	-0.001	5.712	2.268	VENT#117.	9.27	-0.90
-4.0	0.011	-0.001	5.718	2.248	VENT#117.	9.43	-0.73
-3.0	0.011	-0.000	5.724	2.234	VENT#117.	9.60	-0.56
-2.0	0.009	-0.000	5.728	2.228	VENT#117.	9.77	-0.39
-1.0	0.006	-0.000	5.733	2.232	VENT#117.	9.93	-0.23
0.0	0.003	0.000	5.736	2.239	VENT#117.	10.10	-0.08
1.0	-0.002	0.000	5.735	2.243	VENT#117.	9.94	-0.24
2.0	-0.007	-0.000	5.733	2.246	VENT#117.	9.77	-0.41
3.0	-0.008	-0.000	5.728	2.255	VENT#117.	9.60	-0.57
4.0	-0.007	-0.000	5.721	2.269	VENT#117.	9.44	-0.74
5.0	-0.005	-0.000	5.713	2.290	VENT#117.	9.27	-0.92
7.0	-0.003	-0.001	5.697	2.350	VENT#117.	8.93	-1.28
9.0	-0.002	-0.001	5.679	2.424	VENT#117.	8.58	-1.65
12.0	0.001	-0.001	5.640	2.546	VENT#117.	8.05	-2.22
15.0	0.009	-0.000	5.583	2.671	VENT#117.	7.49	-2.79
18.0	0.023	0.000	5.504	2.792	VENT#117.	6.93	-3.34
21.0	0.043	0.002	5.402	2.900	VENT#117.	6.35	-3.87
24.0	0.073	0.005	5.273	2.981	VENT#117.	5.76	-4.37
27.0	0.111	0.010	5.113	3.030	VENT#117.	5.16	-4.83
30.0	0.160	0.017	4.925	3.052	VENT#117.	4.55	-5.25
35.0	0.243	0.035	4.578	3.159	VENT#117.	3.55	-5.96
40.0	0.259	0.057	4.220	3.503	VENT#117.	2.60	-6.79
45.0	0.164	0.077	3.871	4.027	VENT#117.	1.66	-7.71
50.0	-0.003	0.084	3.515	4.566	VENT#117.	0.71	-8.62
60.0	-0.454	0.046	2.742	5.525	VENT#117.	-1.23	-10.24

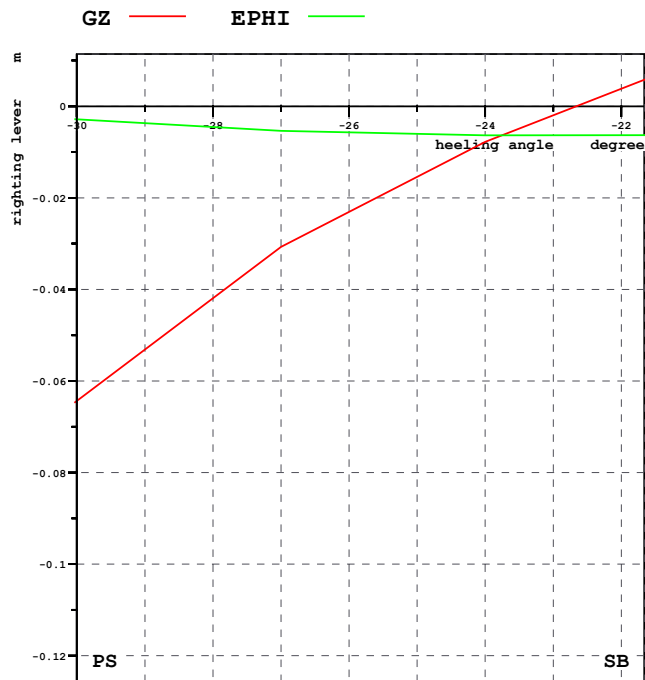
Damaged GZ Plot (Whole Range)

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Damage GZ Plot (Heeling To Port)

---



Model Test Draught Marks

(Draughts given on centreline and perpendicular to baseline)

Damage Case : R7M2\_P5-7.4.0-1  
 Damage Side : PORT  
 Equilibrium Heel Angle: -22.7 Degrees

Locations of Draught Marks and Breadths at Draught Mark locations

Draught Mark	X Location	Full Breadth At Mean Damage Draught
AP	0.000 m	18.598 m
AFT QUARTER	26.100 m	18.600 m
MIDSHIP	52.200 m	18.600 m
FP	104.400 m	2.772 m

Draughts in Intact, Damage Equilibrium

Draught Marks at AP	Intact	Equilibrium
Port	4.500 m	11.263 m
Mean	4.500 m	7.380 m
Starboard	4.500 m	3.498 m

Draught Marks at Aft Quarter	Intact	Equilibrium
Port	4.500 m	10.480 m
Mean	4.500 m	6.597 m
Starboard	4.500 m	2.714 m

Draught Marks at Midship	Intact	Equilibrium
Port	4.500 m	9.697 m
Mean	4.500 m	5.814 m
Starboard	4.500 m	1.930 m

Draught Marks at FP	Intact	Equilibrium
Port	4.500 m	4.826 m
Mean	4.500 m	4.247 m
Starboard	4.500 m	3.668 m

# Draught Mark Explanation

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Damage floating position draught marks calculation shown in red  
Model Draught marks calculation method shown in green

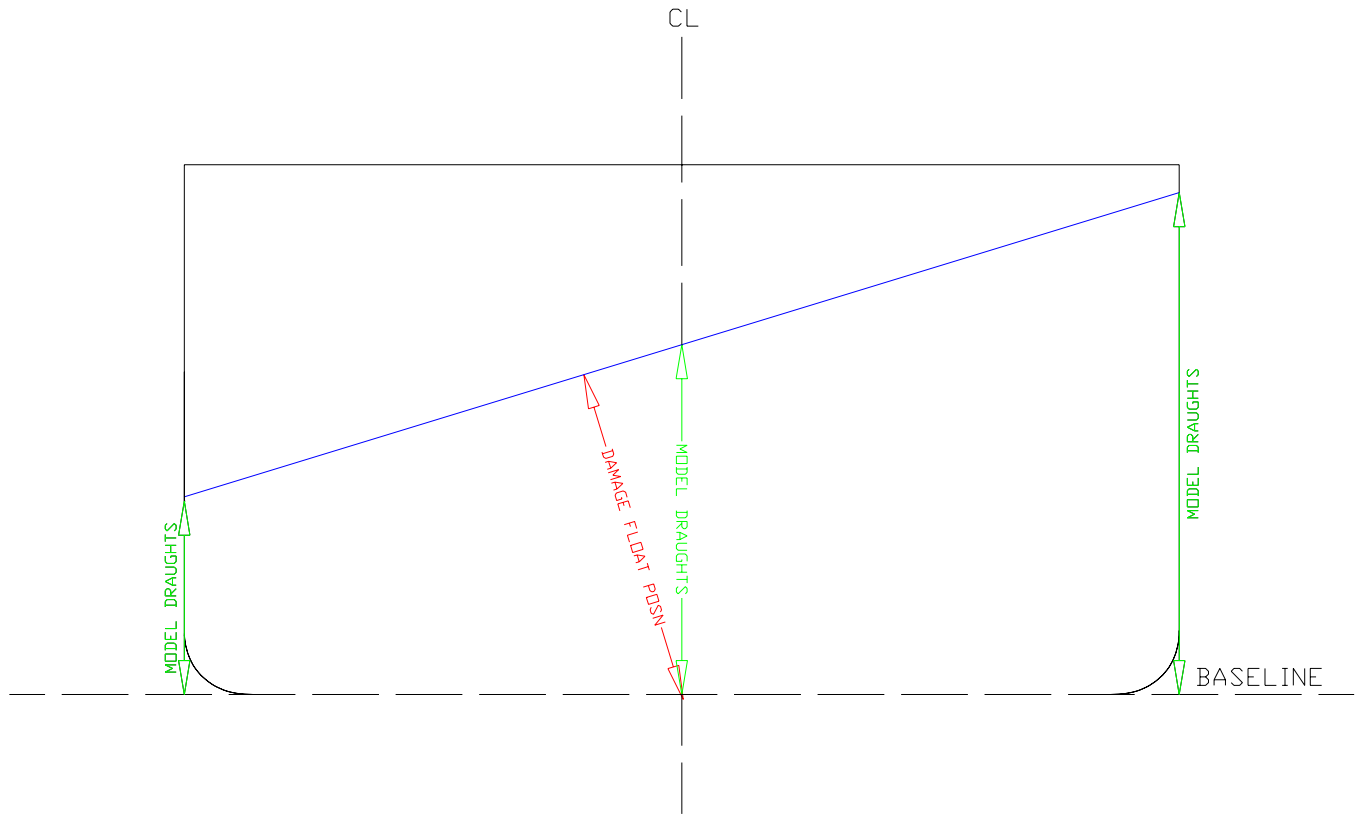


FIGURE 1

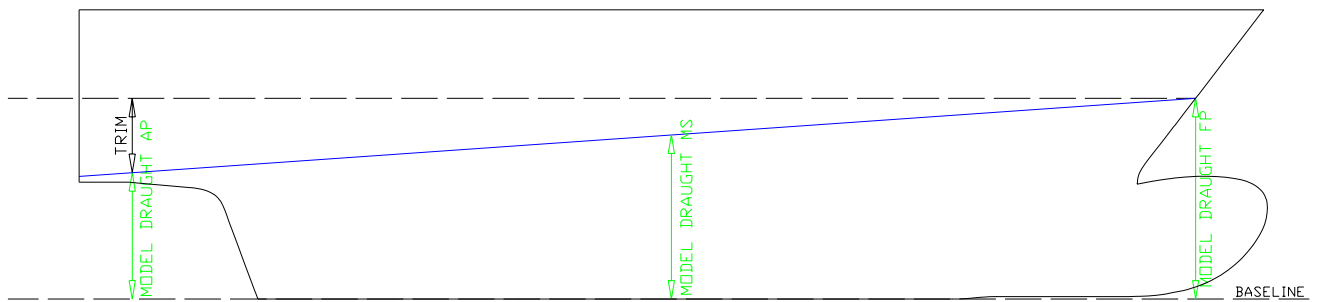


FIGURE 2

Intact Hydrostatics and Stability Information for Single Damage Case

Damage Case : R7M2\_P5-7.4.0-1  
Damage Side : PORT  
Initial Condition : DSM2

Intact Hydrostatics

Midship Draught : 4.500 m  
Trim : 0.000 m (Between Perps)  
Trim Angle : 0.000 deg  
Heel Angle : 0.000 deg  
Displacement : 5540.5 Tonnes

Intact Stability

KMT : 10.194 m  
KG : 8.361 m  
GM : 1.833 m

Moulded Volume : 5383.1 m3 (Actual Floating Position)  
LCB : 49.14 m (From AP - Level Trim Floating Position)

MAIN CHARACTERISTICS OF THE VESSEL:

Length betw. perpendiculars 104.40 m  
Breadth, moulded 18.60 m  
Design draught 4.50 m  
  
X-coord. of after perpendicular 0.00 m  
X-coord. of reference point 52.20 m  
X-coord. of midship section 42.00 m  
X-coord. of building frame 0 0.00 m  
  
Thickness of keelplate 0.010 m  
Mean thickness of shell plating 0.010 m  
Density of water 1.0250 ton/m3

Sign Conventions

Trim by Bow : -  
Heel to Port : -

Calculations are based on MODELHULL date 2010-05-04 time 12:34

Shell thickness used in the calculation 10.0 mm  
X-coord. of aft end of DWL 0.30 m  
X-coord. of fore end of DWL 108.21 m

Calc. sections 208  
Plate thickness: 10.0mm

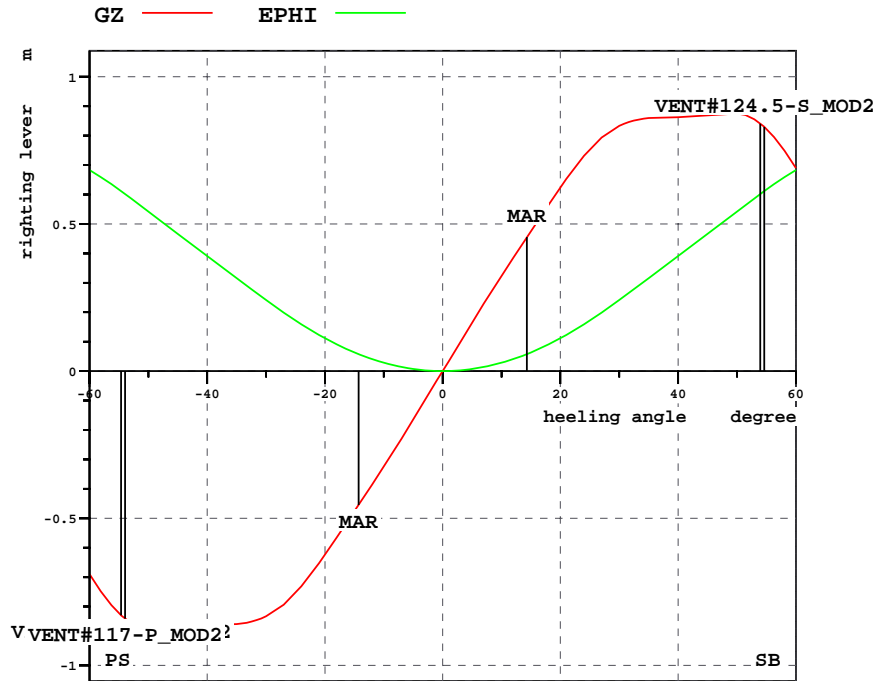


Intact GZ Curve

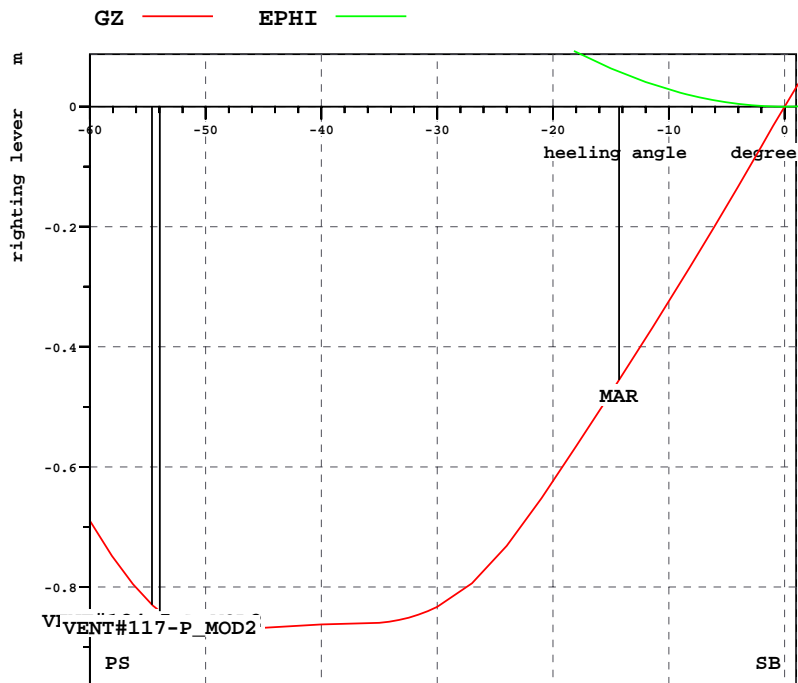
-----  
 Initial condition : DSM2, Deepest subd. load line  
 Damage case : R7M2\_P5-7.4.0-1, Zones Z05-Z07 Port, b4, l.ext1  
 Stage of damage : INTACT  
 Phase of stage : EQ

HEEL degree	GZ m	EPHI rad*m	T m	TR m	OPNAME	IMRES m	RESMRG m
-60.0	-0.690	0.683	0.020	-1.803	VENT#117.	-1.25	-4.98
-50.0	-0.875	0.542	1.315	-1.364	VENT#117.	0.69	-4.29
-45.0	-0.868	0.466	1.942	-1.206	VENT#117.	1.64	-3.91
-40.0	-0.862	0.391	2.515	-1.064	VENT#117.	2.60	-3.45
-35.0	-0.860	0.316	3.015	-0.907	VENT#117.	3.60	-2.92
-30.0	-0.833	0.241	3.439	-0.746	VENT#117.	4.62	-2.31
-27.0	-0.794	0.199	3.654	-0.652	VENT#117.	5.24	-1.91
-24.0	-0.731	0.159	3.839	-0.564	VENT#117.	5.87	-1.49
-21.0	-0.652	0.123	3.997	-0.480	VENT#117.	6.49	-1.04
-18.0	-0.565	0.091	4.130	-0.399	VENT#117.	7.11	-0.58
-15.0	-0.476	0.064	4.242	-0.319	VENT#117.	7.72	-0.11
-12.0	-0.386	0.041	4.333	-0.240	VENT#117.	8.32	0.37
-9.0	-0.293	0.023	4.404	-0.162	VENT#117.	8.90	0.85
-7.0	-0.230	0.014	4.441	-0.113	VENT#117.	9.27	1.18
-5.0	-0.165	0.007	4.469	-0.067	VENT#117.	9.64	1.51
-4.0	-0.132	0.005	4.480	-0.047	VENT#117.	9.82	1.67
-3.0	-0.098	0.003	4.489	-0.028	VENT#117.	9.99	1.83
-2.0	-0.065	0.001	4.495	-0.012	VENT#117.	10.17	2.00
-1.0	-0.032	0.000	4.499	-0.003	VENT#117.	10.34	2.16
0.0	0.000	0.000	4.500	0.000	VENT#117.	10.50	2.32
1.0	0.032	0.000	4.499	-0.003	VENT#117.	10.34	2.16
2.0	0.065	0.001	4.495	-0.012	VENT#117.	10.17	2.00
3.0	0.098	0.003	4.489	-0.028	VENT#117.	9.99	1.83
4.0	0.132	0.005	4.480	-0.047	VENT#117.	9.82	1.67
5.0	0.165	0.007	4.469	-0.067	VENT#117.	9.64	1.51
7.0	0.230	0.014	4.441	-0.113	VENT#117.	9.27	1.18
9.0	0.293	0.023	4.404	-0.162	VENT#117.	8.90	0.85
12.0	0.386	0.041	4.333	-0.240	VENT#117.	8.32	0.37
15.0	0.476	0.064	4.242	-0.319	VENT#117.	7.72	-0.11
18.0	0.565	0.091	4.130	-0.399	VENT#117.	7.11	-0.58
21.0	0.652	0.123	3.997	-0.480	VENT#117.	6.49	-1.04
24.0	0.731	0.159	3.839	-0.564	VENT#117.	5.87	-1.49
27.0	0.794	0.199	3.654	-0.652	VENT#117.	5.24	-1.91
30.0	0.833	0.241	3.439	-0.746	VENT#117.	4.62	-2.31
35.0	0.860	0.316	3.015	-0.907	VENT#117.	3.60	-2.92
40.0	0.862	0.391	2.515	-1.064	VENT#117.	2.60	-3.45
45.0	0.868	0.466	1.942	-1.206	VENT#117.	1.64	-3.91
50.0	0.875	0.542	1.315	-1.364	VENT#117.	0.69	-4.29
60.0	0.690	0.683	0.020	-1.803	VENT#117.	-1.25	-4.98

Intact GZ Plot (Whole Range)



Intact GZ Plot (Heeling To Port)



Damage Hydrostatics and Stability Information for Single Damage Case

-----  
 Damage Case : R7M2\_P5-7.4.0-1  
 Damage Side : PORT  
 Initial Condition : DSM2  
 Flooding Stage : 1  
 Phase of Stage : EQ

Damaged Compartments

-----

Room	Moulded Vol m3	PERM	Net Vol m3	XCG m	YCG m	ZCG m
HOLD1_MOD2	2388.5	0.99	2352.69	13.13	-0.00	9.45
T410	711.2	0.95	675.69	22.97	0.67	4.80
T511	10.4	0.95	9.85	25.60	0.00	2.65
T510	1395.1	0.85	1185.86	32.10	0.03	4.60
T504	7.3	0.95	6.89	34.00	-2.95	1.09
HOLD2_MOD2	3609.1	0.99	3555.01	45.71	-0.07	9.45
T632	113.8	0.95	108.09	40.51	-8.35	10.30
T610_MT	892.9	0.95	848.25	43.20	0.00	3.80
T634	31.5	0.95	29.94	45.60	-8.35	8.03

-----

Damage Hydrostatics and Stability Information for Single Damage Case Continued

---

Flooded Water Volume in Damaged Compartments

---

Room	Permeability	Flooded Vol m3	XCG m	YCG m	ZCG m
HOLD1_MO.	0.99	393.4	12.19	-3.81	7.36
T410	0.95	505.8	22.95	-1.22	3.80
T511	0.95	9.8	25.60	-0.00	2.65
T510	0.85	912.6	32.14	-1.50	3.76
T504	0.95	6.9	34.00	-2.95	1.09
HOLD2_MO.	0.99	318.1	43.03	-5.16	7.13
T632	0.95	24.5	40.78	-8.39	7.72
T610_MT	0.95	698.5	43.17	-1.30	3.51
T634	0.95	23.3	45.58	-8.39	7.65

---

Damage Hydrostatics and Stability Information for Single Damage Case Continued

---

Floating Position

---

(Draughts given on centreline and perpendicular to waterline)

Draught Forward TF	4.064 m	Heel Angle	-19.17 Deg (To Port)
Draught T	5.557 m	Trim	2.985 m
Draught Aft TA	7.049 m	Trim Angle	1.638 Deg

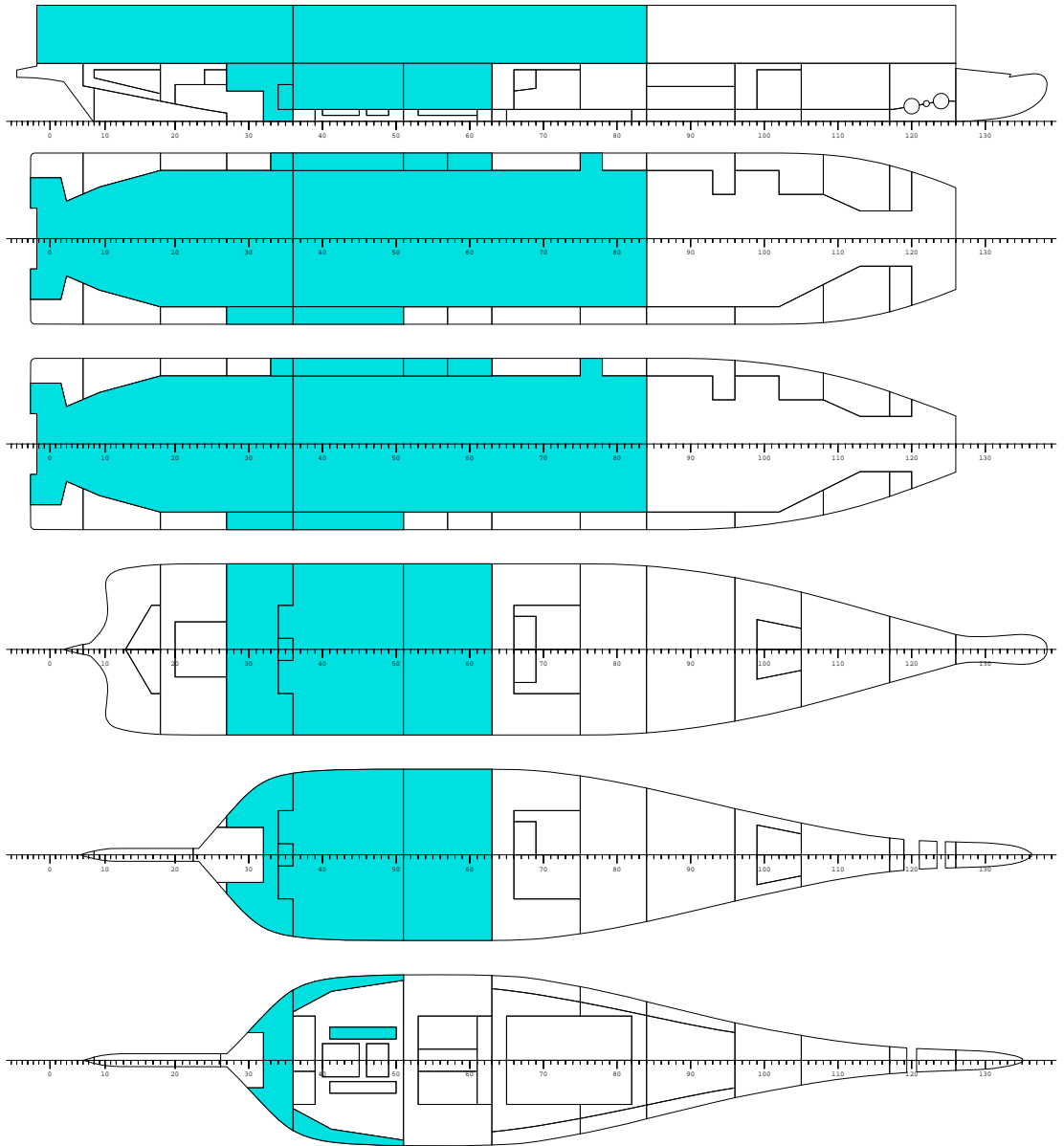
Damage GZ Particulars

---

Range	22.622 Deg (Port)
GZ Max	0.114 m
Angle at GZ Max	33.360 Deg (Port)
Area Under GZ Curve	0.025 m.rad

# Damage Case Drawing

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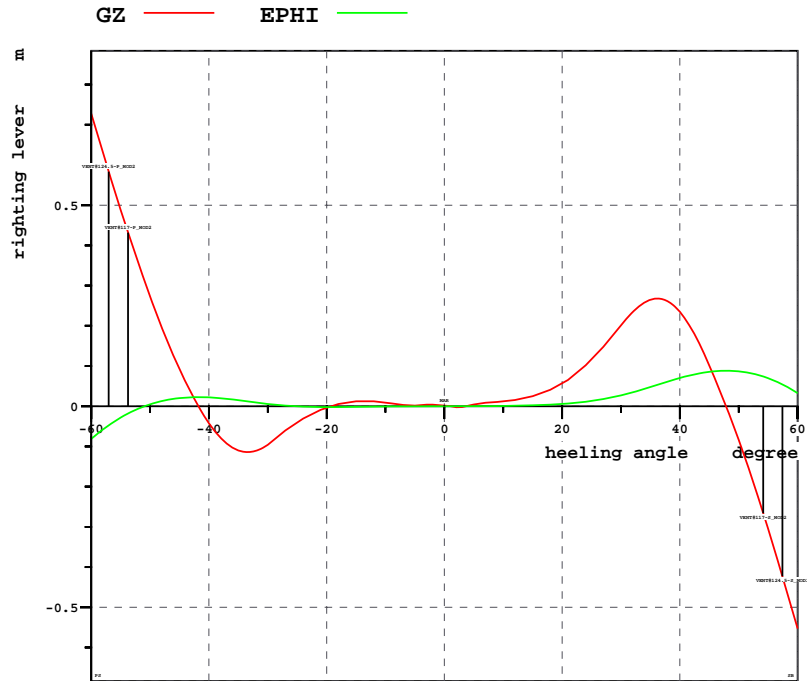


Damaged GZ Curve

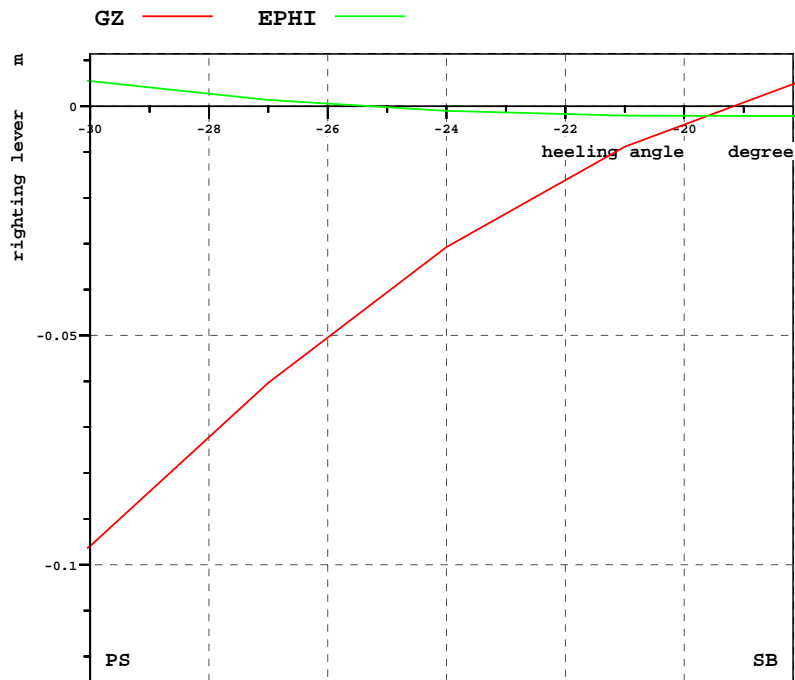
-----  
 Initial condition : DSM2, Deepest subd. load line  
 Damage case : R7M2\_P5-7.4.0-1, Zones Z05-Z07 Port, b4, l.ext1  
 Stage of damage : 1  
 Phase of stage : EQ

HEEL degree	GZ m	EPHI rad*m	T m	TR m	OPNAME	IMRES m	RESMRG m
-60.0	0.728	-0.081	3.461	7.537	VENT#117.	-1.20	-11.99
-50.0	0.274	0.005	4.069	6.060	VENT#117.	0.71	-9.94
-45.0	0.092	0.020	4.339	5.262	VENT#117.	1.66	-8.82
-40.0	-0.042	0.022	4.587	4.445	VENT#117.	2.58	-7.64
-35.0	-0.110	0.015	4.830	3.732	VENT#117.	3.51	-6.51
-30.0	-0.096	0.005	5.097	3.365	VENT#117.	4.50	-5.58
-27.0	-0.060	0.001	5.258	3.282	VENT#117.	5.11	-5.10
-24.0	-0.031	-0.001	5.395	3.187	VENT#117.	5.71	-4.60
-21.0	-0.009	-0.002	5.503	3.067	VENT#117.	6.31	-4.06
-19.2	0.000	-0.002	5.557	2.985	VENT#117.	6.67	-3.71
-18.0	0.006	-0.002	5.587	2.932	VENT#117.	6.90	-3.49
-15.0	0.012	-0.002	5.649	2.788	VENT#117.	7.47	-2.91
-12.0	0.012	-0.001	5.689	2.642	VENT#117.	8.03	-2.32
-9.0	0.007	-0.001	5.713	2.501	VENT#117.	8.58	-1.73
-7.0	0.003	-0.000	5.721	2.416	VENT#117.	8.93	-1.34
-5.0	0.001	-0.000	5.729	2.348	VENT#117.	9.28	-0.96
-4.0	0.003	-0.000	5.734	2.324	VENT#117.	9.45	-0.78
-3.0	0.004	-0.000	5.739	2.307	VENT#117.	9.61	-0.61
-2.0	0.004	-0.000	5.743	2.300	VENT#117.	9.78	-0.44
-1.0	0.003	-0.000	5.747	2.303	VENT#117.	9.95	-0.28
0.0	0.002	0.000	5.750	2.310	VENT#117.	10.11	-0.13
1.0	0.001	0.000	5.751	2.318	VENT#117.	9.95	-0.30
2.0	-0.002	0.000	5.748	2.323	VENT#117.	9.78	-0.46
3.0	-0.002	-0.000	5.744	2.332	VENT#117.	9.62	-0.63
4.0	0.001	-0.000	5.738	2.349	VENT#117.	9.45	-0.80
5.0	0.004	0.000	5.732	2.374	VENT#117.	9.29	-0.98
7.0	0.009	0.000	5.720	2.444	VENT#117.	8.95	-1.35
9.0	0.011	0.001	5.707	2.532	VENT#117.	8.60	-1.74
12.0	0.016	0.001	5.677	2.679	VENT#117.	8.06	-2.33
15.0	0.025	0.002	5.630	2.831	VENT#117.	7.51	-2.92
18.0	0.041	0.004	5.563	2.981	VENT#117.	6.94	-3.50
21.0	0.065	0.007	5.473	3.121	VENT#117.	6.36	-4.06
24.0	0.102	0.011	5.354	3.237	VENT#117.	5.77	-4.58
27.0	0.148	0.018	5.206	3.322	VENT#117.	5.18	-5.07
30.0	0.201	0.027	5.032	3.391	VENT#117.	4.57	-5.53
35.0	0.265	0.048	4.729	3.671	VENT#117.	3.59	-6.38
40.0	0.235	0.070	4.450	4.286	VENT#117.	2.66	-7.42
45.0	0.102	0.086	4.187	5.070	VENT#117.	1.73	-8.56
50.0	-0.084	0.087	3.908	5.846	VENT#117.	0.79	-9.67
60.0	-0.553	0.033	3.282	7.294	VENT#117.	-1.11	-11.69

Damaged GZ Plot (Whole Range)



Damage GZ Plot (Heeling To Port)





Model Test Draught Marks

-----

(Draughts given on centreline and perpendicular to baseline)

Damage Case : R7M2\_P5-7.4.0-1  
 Damage Side : PORT  
 Equilibrium Heel Angle: -19.2 Degrees

Locations of Draught Marks and Breadths at Draught Mark locations

-----

Draught Mark	X Location	Full Breadth At Mean Damage Draught
AP	0.000 m	18.598 m
AFT QUARTER	26.100 m	18.600 m
MIDSHIP	52.200 m	18.600 m
FP	104.400 m	2.683 m

Draughts in Intact, Damage Equilibrium

-----

Draught Marks at AP	Intact	Equilibrium
Port	4.500 m	10.695 m
Mean	4.500 m	7.463 m
Starboard	4.500 m	4.230 m

Draught Marks at Aft Quarter	Intact	Equilibrium
Port	4.500 m	9.905 m
Mean	4.500 m	6.673 m
Starboard	4.500 m	3.440 m

Draught Marks at Midship	Intact	Equilibrium
Port	4.500 m	9.115 m
Mean	4.500 m	5.883 m
Starboard	4.500 m	2.650 m

Draught Marks at FP	Intact	Equilibrium
Port	4.500 m	4.769 m
Mean	4.500 m	4.303 m
Starboard	4.500 m	3.837 m

# Draught Mark Explanation

-----  
Damage floating position draught marks calculation shown in red  
Model Draught marks calculation method shown in green

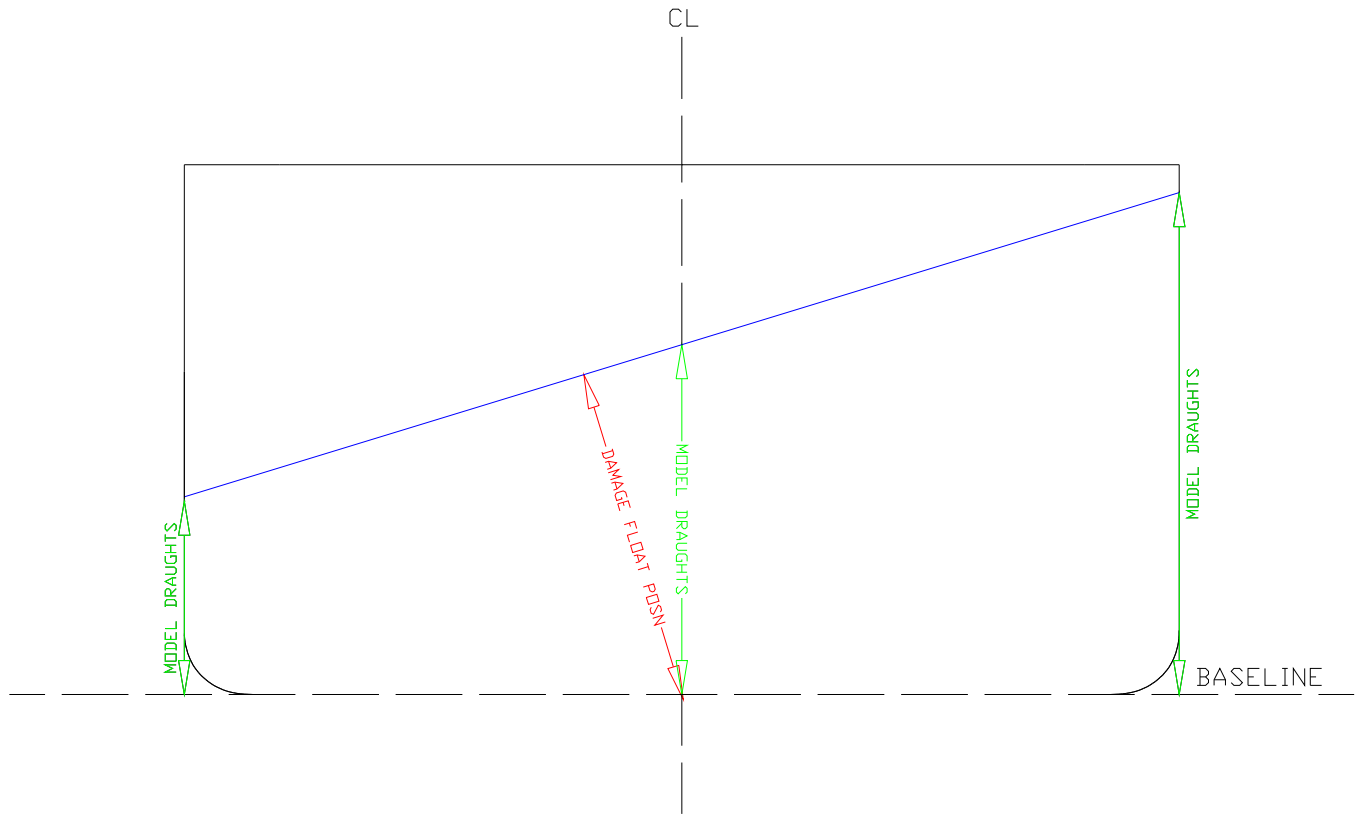


FIGURE 1

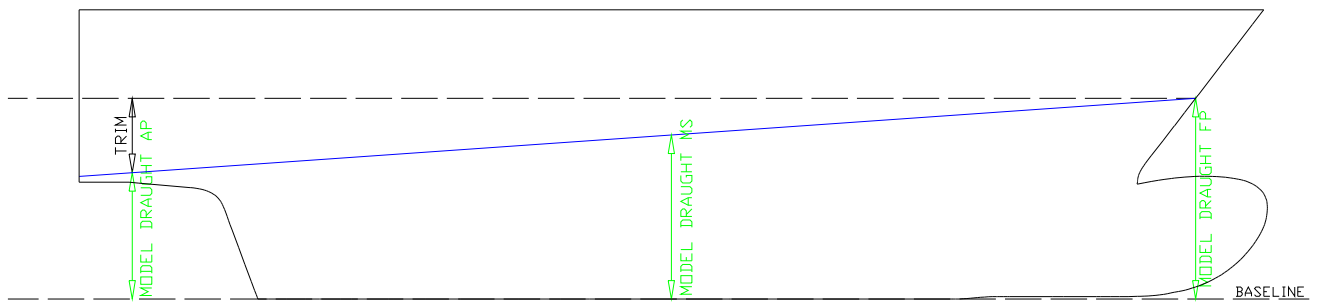


FIGURE 2

Intact Hydrostatics and Stability Information for Single Damage Case

Damage Case : R7M2\_P5-7.4.0-1  
Damage Side : PORT  
Initial Condition : DSM2

Intact Hydrostatics

Intact Stability

-----  
Midship Draught : 4.500 m  
Trim : 0.000 m (Between Perps)  
Trim Angle : 0.000 deg  
Heel Angle : 0.000 deg  
Displacement : 5540.5 Tonnes  
-----  
Moulded Volume : 5383.1 m3 (Actual Floating Position)  
LCB : 49.14 m (From AP - Level Trim Floating Position)

MAIN CHARACTERISTICS OF THE VESSEL:

-----  
Length betw. perpendiculars 104.40 m  
Breadth, moulded 18.60 m  
Design draught 4.50 m  
  
X-coord. of after perpendicular 0.00 m  
X-coord. of reference point 52.20 m  
X-coord. of midship section 42.00 m  
X-coord. of building frame 0 0.00 m  
  
Thickness of keelplate 0.010 m  
Mean thickness of shell plating 0.010 m  
Density of water 1.0250 ton/m3

Sign Conventions

-----  
Trim by Bow : -  
Heel to Port : -

Calculations are based on MODELHULL date 2010-05-04 time 12:34

Shell thickness used in the calculation 10.0 mm  
X-coord. of aft end of DWL 0.30 m  
X-coord. of fore end of DWL 108.21 m

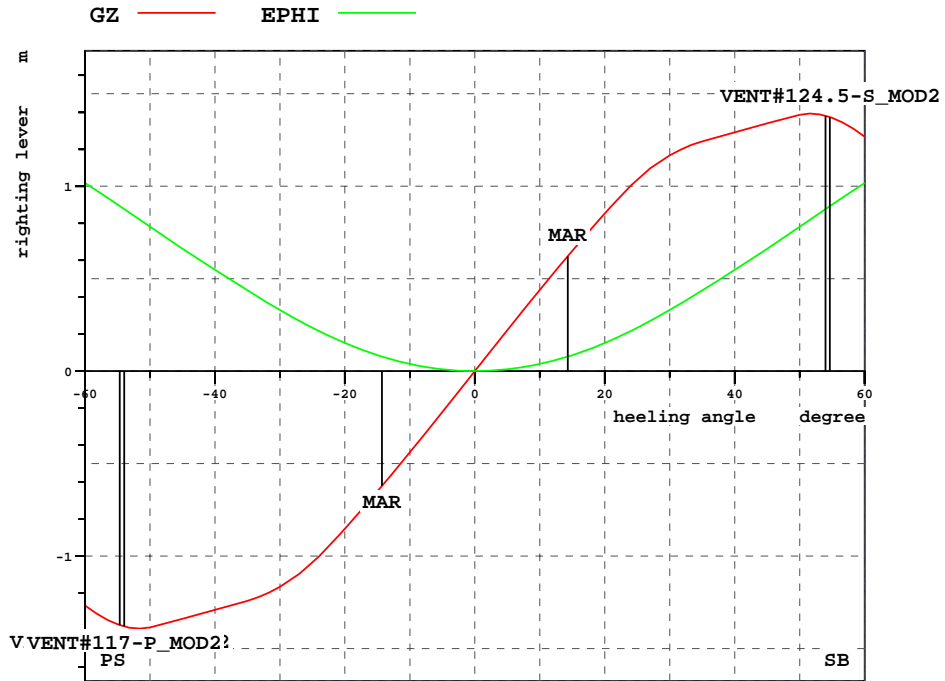
Calc. sections 208  
Plate thickness: 10.0mm

Intact GZ Curve

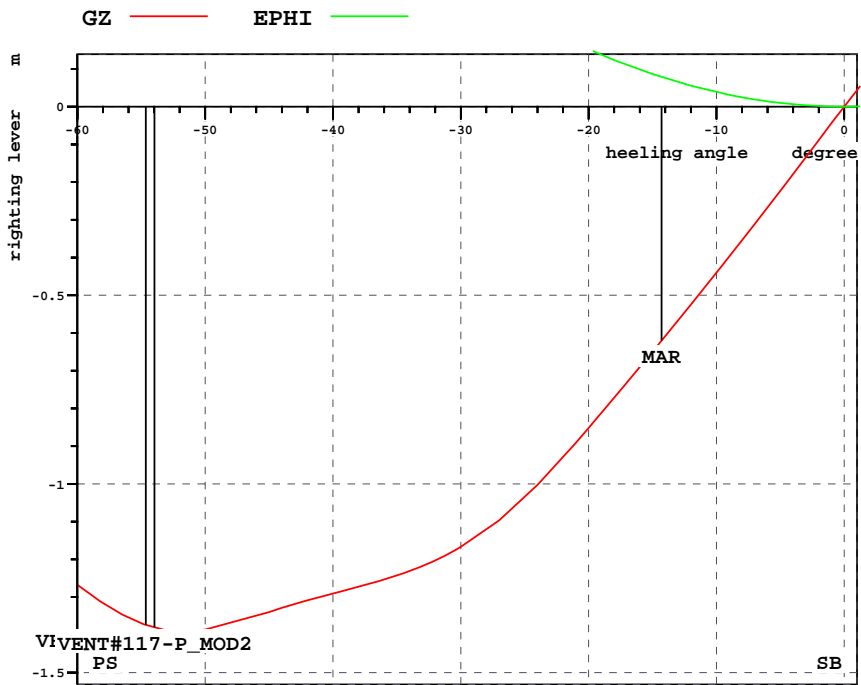
-----  
 Initial condition : DSM2, Deepest subd. load line  
 Damage case : R7M2\_P5-7.4.0-1, Zones Z05-Z07 Port, b4, l.ext1  
 Stage of damage : INTACT  
 Phase of stage : EQ

HEEL degree	GZ m	EPHI rad*m	T m	TR m	OPNAME	IMRES m	RESMRG m
-60.0	-1.267	1.017	0.020	-1.800	VENT#117.	-1.25	-4.98
-50.0	-1.386	0.780	1.315	-1.362	VENT#117.	0.69	-4.29
-45.0	-1.340	0.662	1.942	-1.204	VENT#117.	1.64	-3.90
-40.0	-1.291	0.547	2.514	-1.062	VENT#117.	2.60	-3.45
-35.0	-1.242	0.436	3.015	-0.905	VENT#117.	3.60	-2.92
-30.0	-1.167	0.331	3.439	-0.744	VENT#117.	4.62	-2.31
-27.0	-1.097	0.272	3.654	-0.650	VENT#117.	5.25	-1.91
-24.0	-1.003	0.217	3.839	-0.562	VENT#117.	5.87	-1.49
-21.0	-0.891	0.167	3.997	-0.478	VENT#117.	6.50	-1.04
-18.0	-0.772	0.123	4.130	-0.398	VENT#117.	7.11	-0.58
-15.0	-0.649	0.086	4.242	-0.318	VENT#117.	7.72	-0.11
-12.0	-0.525	0.056	4.333	-0.240	VENT#117.	8.32	0.37
-9.0	-0.397	0.031	4.404	-0.162	VENT#117.	8.90	0.85
-7.0	-0.311	0.019	4.441	-0.113	VENT#117.	9.27	1.18
-5.0	-0.223	0.010	4.469	-0.067	VENT#117.	9.64	1.51
-4.0	-0.178	0.006	4.480	-0.046	VENT#117.	9.82	1.67
-3.0	-0.133	0.003	4.489	-0.028	VENT#117.	9.99	1.83
-2.0	-0.088	0.002	4.495	-0.012	VENT#117.	10.17	2.00
-1.0	-0.044	0.000	4.499	-0.003	VENT#117.	10.34	2.16
0.0	0.000	0.000	4.500	0.000	VENT#117.	10.50	2.32
1.0	0.044	0.000	4.499	-0.003	VENT#117.	10.34	2.16
2.0	0.088	0.002	4.495	-0.012	VENT#117.	10.17	2.00
3.0	0.133	0.003	4.489	-0.028	VENT#117.	9.99	1.83
4.0	0.178	0.006	4.480	-0.046	VENT#117.	9.82	1.67
5.0	0.223	0.010	4.469	-0.067	VENT#117.	9.64	1.51
7.0	0.311	0.019	4.441	-0.113	VENT#117.	9.27	1.18
9.0	0.397	0.031	4.404	-0.162	VENT#117.	8.90	0.85
12.0	0.525	0.056	4.333	-0.240	VENT#117.	8.32	0.37
15.0	0.649	0.086	4.242	-0.318	VENT#117.	7.72	-0.11
18.0	0.772	0.123	4.130	-0.398	VENT#117.	7.11	-0.58
21.0	0.891	0.167	3.997	-0.478	VENT#117.	6.50	-1.04
24.0	1.003	0.217	3.839	-0.562	VENT#117.	5.87	-1.49
27.0	1.097	0.272	3.654	-0.650	VENT#117.	5.25	-1.91
30.0	1.167	0.331	3.439	-0.744	VENT#117.	4.62	-2.31
35.0	1.242	0.436	3.015	-0.905	VENT#117.	3.60	-2.92
40.0	1.291	0.547	2.514	-1.062	VENT#117.	2.60	-3.45
45.0	1.340	0.662	1.942	-1.204	VENT#117.	1.64	-3.90
50.0	1.386	0.780	1.315	-1.362	VENT#117.	0.69	-4.29
60.0	1.267	1.017	0.020	-1.800	VENT#117.	-1.25	-4.98

Intact GZ Plot (Whole Range)



Intact GZ Plot (Heeling To Port)



Damage Hydrostatics and Stability Information for Single Damage Case

---

Damage Case : R7M2\_P5-7.4.0-1  
 Damage Side : PORT  
 Initial Condition : DSM2  
 Flooding Stage : 1  
 Phase of Stage : EQ

Damaged Compartments

---

Room	Moulded Vol m3	PERM	Net Vol m3	XCG m	YCG m	ZCG m
HOLD1_MOD2	2388.5	1.00	2388.51	13.13	-0.00	9.45
T410	711.2	0.95	675.69	22.97	0.67	4.80
T511	10.4	0.95	9.85	25.60	0.00	2.65
T510	1395.1	0.85	1185.86	32.10	0.03	4.60
T504	7.3	0.95	6.89	34.00	-2.95	1.09
HOLD2_MOD2	3609.1	1.00	3609.14	45.71	-0.07	9.45
T632	113.8	0.95	108.09	40.51	-8.35	10.30
T610_MT	892.9	0.95	848.25	43.20	0.00	3.80
T634	31.5	0.95	29.94	45.60	-8.35	8.03

---

Flooded Water Volume in Damaged Compartments

---

Room	Permeability	Flooded Vol m3	XCG m	YCG m	ZCG m
HOLD1_MO.	1.00	119.8	8.61	-0.18	6.51
T410	0.95	567.8	22.89	0.01	3.91
T511	0.95	9.8	25.60	0.00	2.65
T510	0.85	968.4	32.14	-0.02	3.67
T504	0.95	6.9	34.00	-2.95	1.09
HOLD2_MO.	1.00	0.3	27.07	-2.80	6.32
T632	0.95	0.0	-	-	-
T610_MT	0.95	789.0	43.16	-0.02	3.63
T634	0.95	0.0	-	-	-

---

Damage Hydrostatics and Stability Information for Single Damage Case Continued

---

Floating Position

---

(Draughts given on centreline and perpendicular to waterline)

Draught Forward TF	4.596 m	Heel Angle	-0.198 Deg (To Port)
Draught T	5.751 m	Trim	2.311 m
Draught Aft TA	6.907 m	Trim Angle	1.268 Deg

Damage GZ Particulars

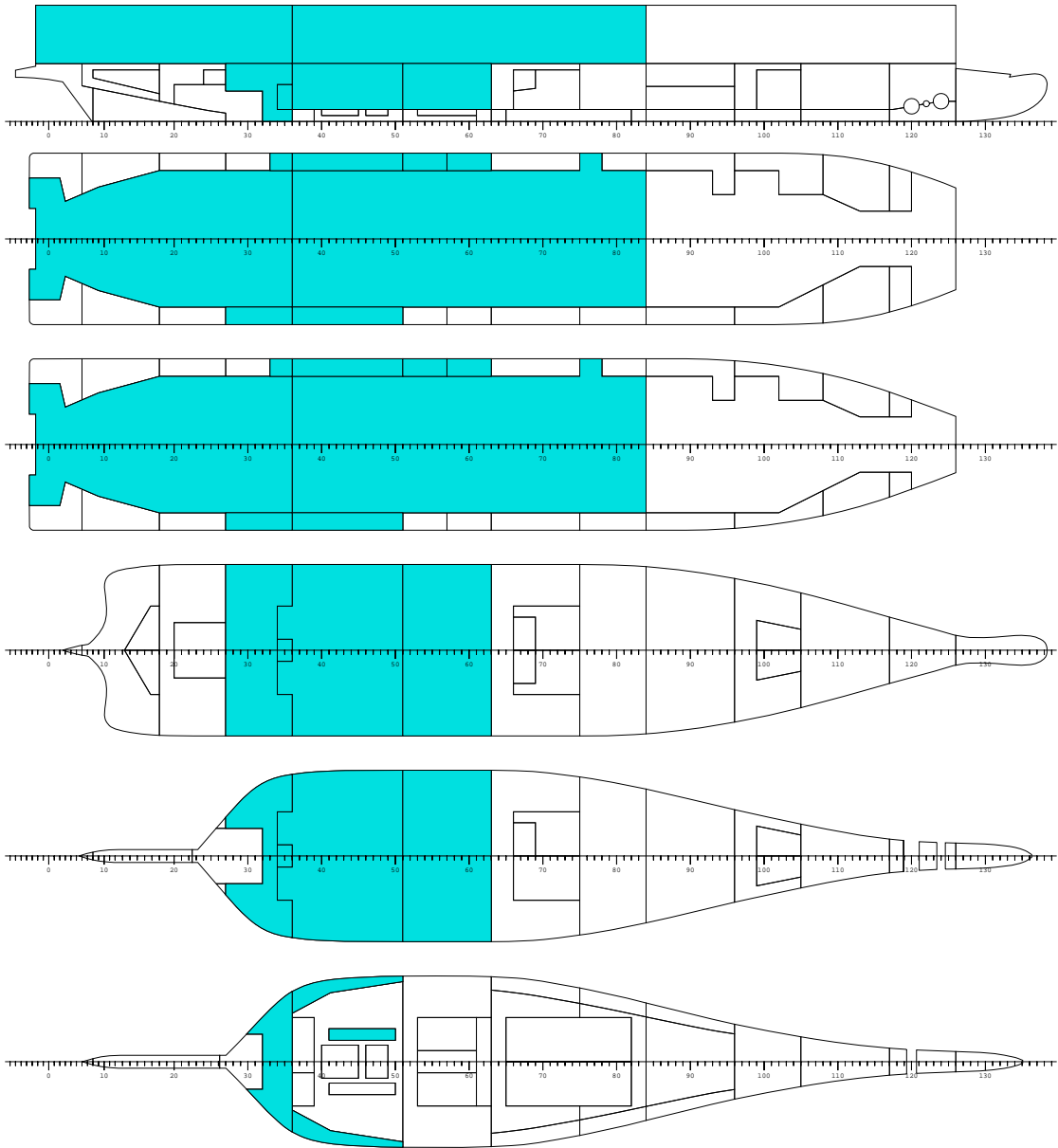
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Range	54.662 Deg (Port)
GZ Max	0.464 m
Angle at GZ Max	35.000 Deg (Port)
Area Under GZ Curve	0.233 m.rad



# Damage Case Drawing

-----



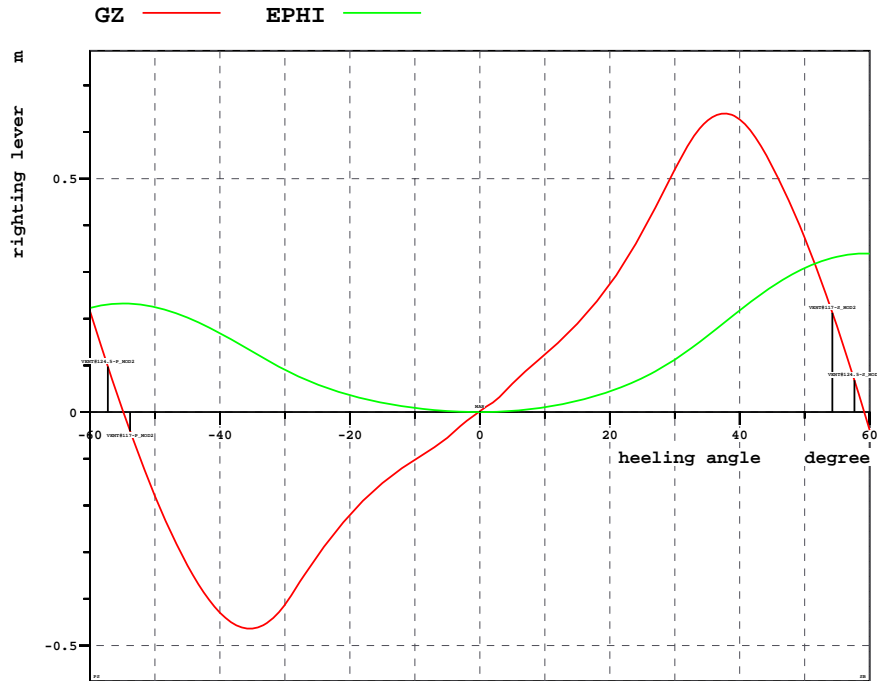
Damaged GZ Curve

-----  
 Initial condition : DSM2, Deepest subd. load line  
 Damage case : R7M2\_P5-7.4.0-1, Zones Z05-Z07 Port, b4, l.ext1  
 Stage of damage : 1  
 Phase of stage : EQ

HEEL degree	GZ m	EPHI rad*m	T m	TR m	OPNAME	IMRES m	RESMRG m
-60.0	0.217	0.223	3.580	7.915	VENT#117.	-1.17	-12.30
-50.0	-0.180	0.225	4.156	6.333	VENT#117.	0.73	-10.17
-45.0	-0.328	0.202	4.409	5.481	VENT#117.	1.67	-9.00
-40.0	-0.430	0.169	4.640	4.612	VENT#117.	2.59	-7.78
-35.0	-0.464	0.129	4.866	3.842	VENT#117.	3.52	-6.60
-30.0	-0.412	0.091	5.120	3.426	VENT#117.	4.50	-5.64
-27.0	-0.349	0.071	5.277	3.329	VENT#117.	5.11	-5.15
-24.0	-0.289	0.054	5.411	3.227	VENT#117.	5.71	-4.64
-21.0	-0.236	0.040	5.517	3.100	VENT#117.	6.31	-4.09
-18.0	-0.190	0.029	5.599	2.958	VENT#117.	6.90	-3.52
-15.0	-0.152	0.020	5.658	2.809	VENT#117.	7.47	-2.93
-12.0	-0.120	0.013	5.697	2.657	VENT#117.	8.03	-2.34
-9.0	-0.093	0.007	5.718	2.511	VENT#117.	8.58	-1.74
-7.0	-0.075	0.004	5.725	2.423	VENT#117.	8.93	-1.35
-5.0	-0.055	0.002	5.732	2.353	VENT#117.	9.28	-0.97
-4.0	-0.042	0.001	5.737	2.328	VENT#117.	9.45	-0.79
-3.0	-0.030	0.001	5.741	2.310	VENT#117.	9.61	-0.61
-2.0	-0.019	0.000	5.745	2.303	VENT#117.	9.78	-0.45
-1.0	-0.008	0.000	5.749	2.305	VENT#117.	9.95	-0.29
-0.2	0.000	-0.000	5.751	2.311	VENT#117.	10.08	-0.16
0.0	0.002	0.000	5.752	2.312	VENT#117.	10.11	-0.13
1.0	0.012	0.000	5.753	2.321	VENT#117.	9.95	-0.30
2.0	0.020	0.000	5.750	2.326	VENT#117.	9.78	-0.47
3.0	0.032	0.001	5.746	2.336	VENT#117.	9.62	-0.63
4.0	0.046	0.002	5.740	2.354	VENT#117.	9.45	-0.81
5.0	0.061	0.002	5.735	2.380	VENT#117.	9.28	-0.98
7.0	0.087	0.005	5.724	2.452	VENT#117.	8.94	-1.36
9.0	0.111	0.009	5.712	2.543	VENT#117.	8.60	-1.75
12.0	0.148	0.015	5.684	2.694	VENT#117.	8.06	-2.34
15.0	0.190	0.024	5.639	2.852	VENT#117.	7.50	-2.94
18.0	0.237	0.035	5.574	3.007	VENT#117.	6.94	-3.52
21.0	0.293	0.049	5.486	3.154	VENT#117.	6.36	-4.09
24.0	0.361	0.066	5.370	3.276	VENT#117.	5.77	-4.62
27.0	0.438	0.087	5.224	3.369	VENT#117.	5.17	-5.12
30.0	0.520	0.112	5.053	3.448	VENT#117.	4.57	-5.58
35.0	0.624	0.163	4.760	3.768	VENT#117.	3.60	-6.46
40.0	0.627	0.218	4.498	4.440	VENT#117.	2.67	-7.55
45.0	0.526	0.269	4.253	5.276	VENT#117.	1.75	-8.74
50.0	0.373	0.308	3.989	6.104	VENT#117.	0.81	-9.88
60.0	-0.039	0.339	3.396	7.658	VENT#117.	-1.09	-11.99

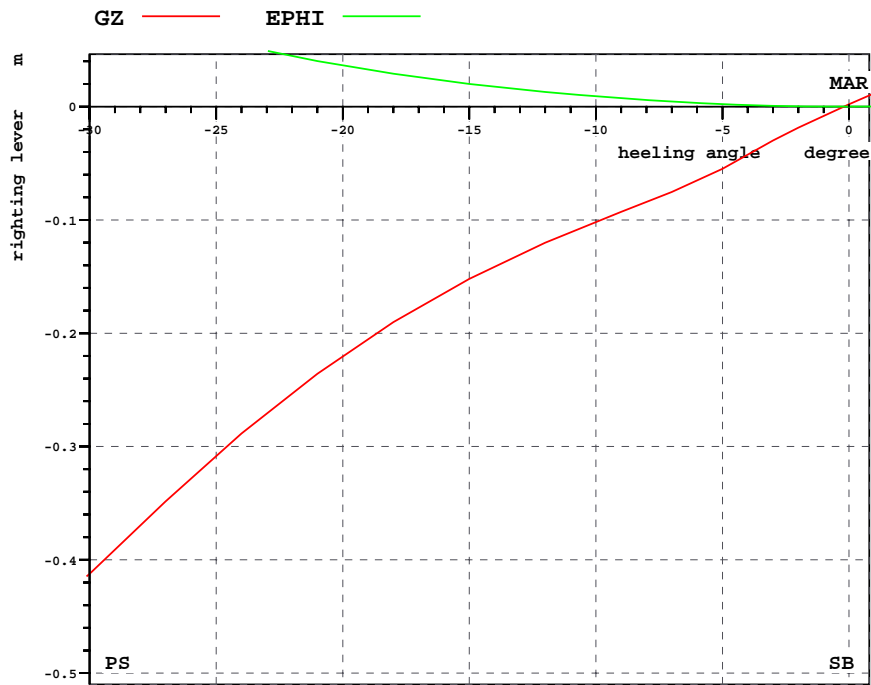
Damaged GZ Plot (Whole Range)

---



Damage GZ Plot (Heeling To Port)

---



Model Test Draught Marks

(Draughts given on centreline and perpendicular to baseline)

Damage Case : R7M2\_P5-7.4.0-1  
 Damage Side : PORT  
 Equilibrium Heel Angle: -0.20 Degrees

Locations of Draught Marks and Breadths at Draught Mark locations

Draught Mark	X Location	Full Breadth At Mean Damage Draught
AP	0.000 m	18.598 m
AFT QUARTER	26.100 m	18.600 m
MIDSHIP	52.200 m	18.600 m
FP	104.400 m	2.027 m

Draughts in Intact, Damage Equilibrium and at 1 degree of Heel

Draught Marks at AP	Intact	Equilibrium	1 Degree Heel
Port	4.500 m	6.939 m	7.069 m
Mean	4.500 m	6.907 m	6.907 m
Starboard	4.500 m	6.875 m	6.744 m
Draught Marks at Aft Quarter	Intact	Equilibrium	1 Degree Heel
Port	4.500 m	6.361 m	6.491 m
Mean	4.500 m	6.329 m	6.329 m
Starboard	4.500 m	6.297 m	6.167 m
Draught Marks at Midship	Intact	Equilibrium	1 Degree Heel
Port	4.500 m	5.784 m	5.914 m
Mean	4.500 m	5.751 m	5.751 m
Starboard	4.500 m	5.719 m	5.589 m
Draught Marks at FP	Intact	Equilibrium	1 Degree Heel
Port	4.500 m	4.600 m	4.614 m
Mean	4.500 m	4.596 m	4.596 m
Starboard	4.500 m	4.593 m	4.578 m

# Draught Mark Explanation

-----  
Damage floating position draught marks calculation shown in red  
Model Draught marks calculation method shown in green

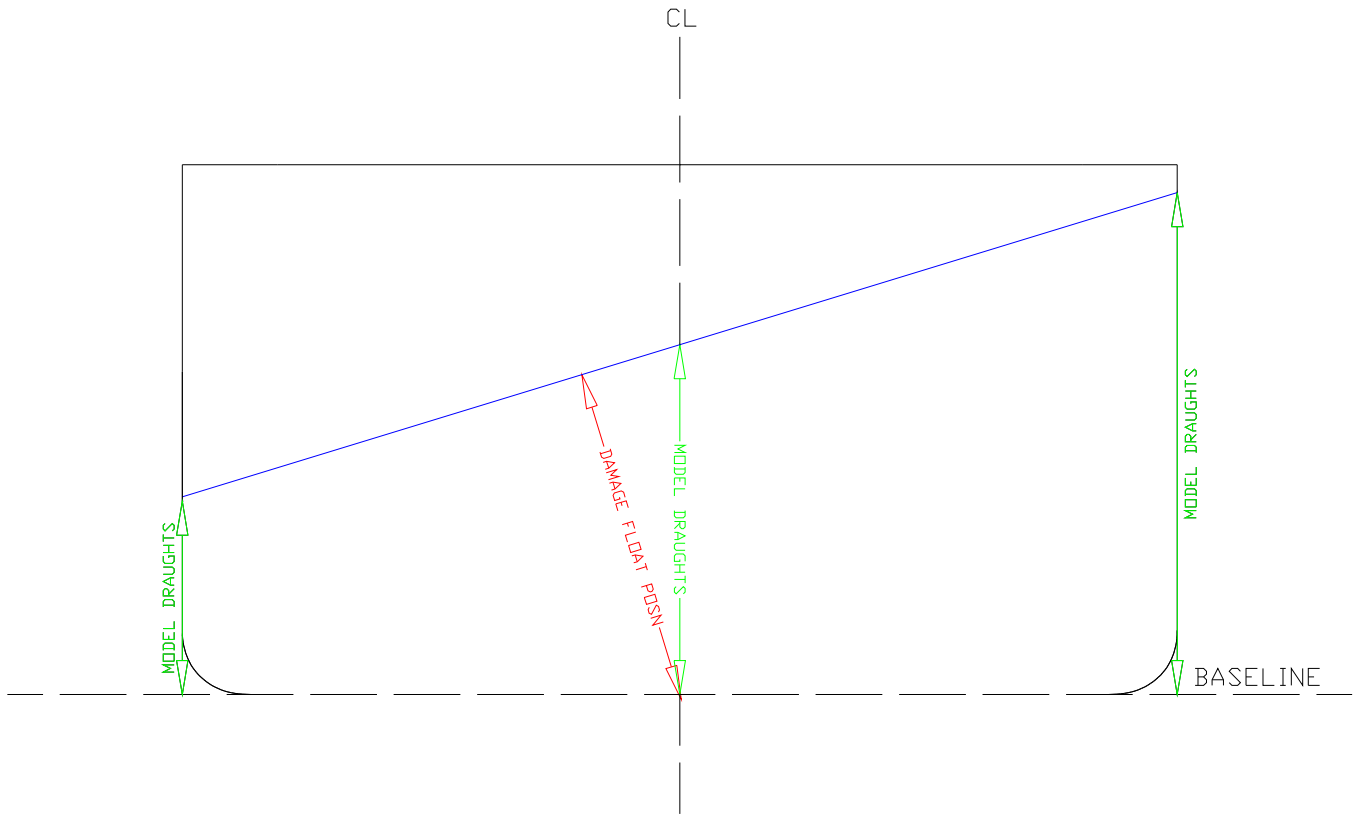


FIGURE 1

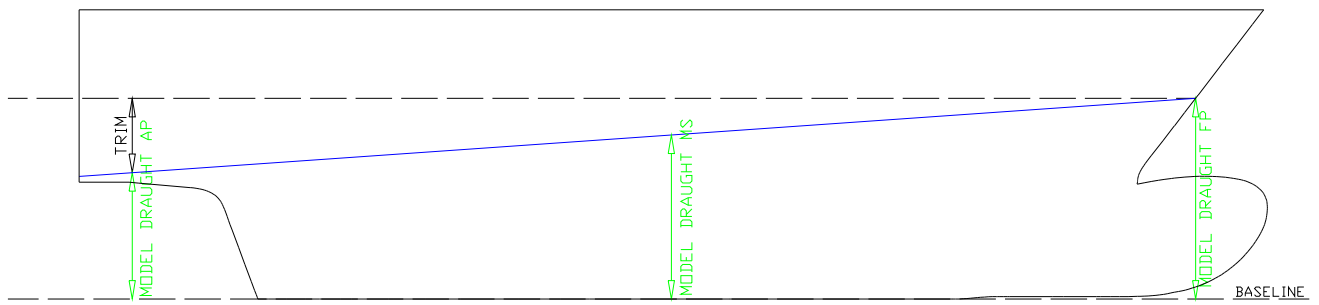


FIGURE 2

Intact Hydrostatics and Stability Information for Single Damage Case

Damage Case : R7M2\_P4-6.1.0-1  
Damage Side : PORT  
Initial Condition : DSM2

Intact Hydrostatics

Intact Stability

-----  
Midship Draught : 4.500 m  
Trim : 0.000 m (Between Perps)  
Trim Angle : 0.000 deg  
Heel Angle : 0.000 deg  
Displacement : 5542.0 Tonnes  
-----  
Moulded Volume : 5384.6 m3 (Actual Floating Position)  
LCB : 49.15 m (From AP - Level Trim Floating Position)

MAIN CHARACTERISTICS OF THE VESSEL:

-----  
Length betw. perpendiculars 104.40 m  
Breadth, moulded 18.60 m  
Design draught 4.50 m  
  
X-coord. of after perpendicular 0.00 m  
X-coord. of reference point 52.20 m  
X-coord. of midship section 42.00 m  
X-coord. of building frame 0 0.00 m  
  
Thickness of keelplate 0.010 m  
Mean thickness of shell plating 0.010 m  
Density of water 1.0250 ton/m3

Sign Conventions

-----  
Trim by Bow : -  
Heel to Port : -

Calculations are based on MODELHULL date 2010-05-04 time 12:34

Shell thickness used in the calculation 10.0 mm  
X-coord. of aft end of DWL 0.30 m  
X-coord. of fore end of DWL 108.21 m

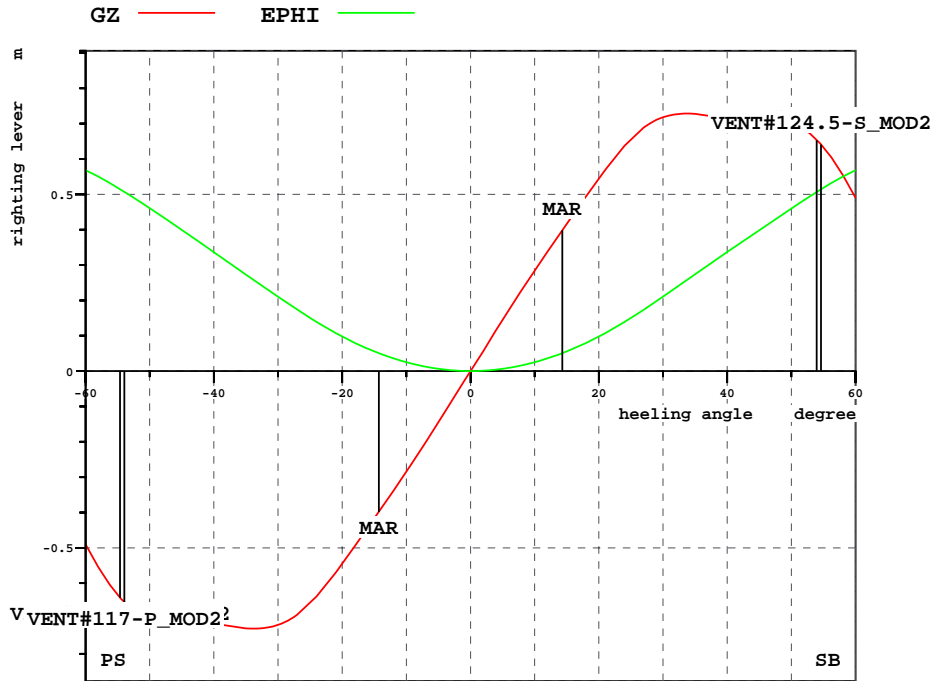
Calc. sections 220  
Plate thickness: 10.0mm

Intact GZ Curve

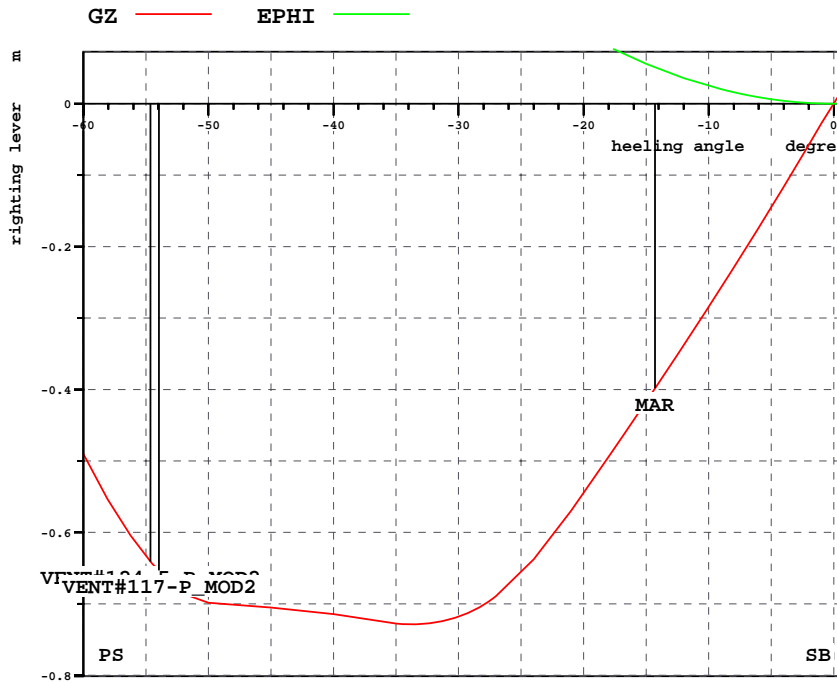
-----  
 Initial condition : DSM2, Deepest subd. load line  
 Damage case : R7M2\_P4-6.1.0-1, Zones Z04-Z06 Port, b1, l.ext1  
 Stage of damage : INTACT  
 Phase of stage : EQ

HEEL degree	GZ m	EPHI rad*m	T m	TR m	OPNAME	IMRES m	RESMRG m
-60.0	-0.490	0.568	0.020	-1.805	VENT#117.	-1.25	-4.98
-50.0	-0.699	0.460	1.315	-1.365	VENT#117.	0.69	-4.29
-45.0	-0.705	0.399	1.942	-1.207	VENT#117.	1.64	-3.91
-40.0	-0.714	0.337	2.515	-1.066	VENT#117.	2.60	-3.45
-35.0	-0.728	0.274	3.016	-0.908	VENT#117.	3.60	-2.92
-30.0	-0.718	0.211	3.439	-0.747	VENT#117.	4.62	-2.31
-27.0	-0.689	0.174	3.655	-0.653	VENT#117.	5.24	-1.91
-24.0	-0.638	0.139	3.839	-0.564	VENT#117.	5.87	-1.49
-21.0	-0.570	0.107	3.997	-0.481	VENT#117.	6.49	-1.04
-18.0	-0.494	0.080	4.130	-0.400	VENT#117.	7.11	-0.58
-15.0	-0.417	0.056	4.242	-0.320	VENT#117.	7.72	-0.11
-12.0	-0.338	0.036	4.333	-0.241	VENT#117.	8.32	0.37
-9.0	-0.257	0.020	4.404	-0.163	VENT#117.	8.90	0.85
-7.0	-0.202	0.012	4.441	-0.113	VENT#117.	9.27	1.18
-5.0	-0.145	0.006	4.469	-0.068	VENT#117.	9.64	1.51
-4.0	-0.116	0.004	4.480	-0.047	VENT#117.	9.82	1.67
-3.0	-0.086	0.002	4.489	-0.028	VENT#117.	9.99	1.83
-2.0	-0.057	0.001	4.495	-0.012	VENT#117.	10.17	2.00
-1.0	-0.028	0.000	4.499	-0.003	VENT#117.	10.34	2.16
0.0	0.000	0.000	4.500	0.000	VENT#117.	10.50	2.32
1.0	0.028	0.000	4.499	-0.003	VENT#117.	10.34	2.16
2.0	0.057	0.001	4.495	-0.012	VENT#117.	10.17	2.00
3.0	0.086	0.002	4.489	-0.028	VENT#117.	9.99	1.83
4.0	0.116	0.004	4.480	-0.047	VENT#117.	9.82	1.67
5.0	0.145	0.006	4.469	-0.068	VENT#117.	9.64	1.51
7.0	0.202	0.012	4.441	-0.113	VENT#117.	9.27	1.18
9.0	0.257	0.020	4.404	-0.163	VENT#117.	8.90	0.85
12.0	0.338	0.036	4.333	-0.241	VENT#117.	8.32	0.37
15.0	0.417	0.056	4.242	-0.320	VENT#117.	7.72	-0.11
18.0	0.494	0.080	4.130	-0.400	VENT#117.	7.11	-0.58
21.0	0.570	0.107	3.997	-0.481	VENT#117.	6.49	-1.04
24.0	0.638	0.139	3.839	-0.564	VENT#117.	5.87	-1.49
27.0	0.689	0.174	3.655	-0.653	VENT#117.	5.24	-1.91
30.0	0.718	0.211	3.439	-0.747	VENT#117.	4.62	-2.31
35.0	0.728	0.274	3.016	-0.908	VENT#117.	3.60	-2.92
40.0	0.714	0.337	2.515	-1.066	VENT#117.	2.60	-3.45
45.0	0.705	0.399	1.942	-1.207	VENT#117.	1.64	-3.91
50.0	0.699	0.460	1.315	-1.365	VENT#117.	0.69	-4.29
60.0	0.490	0.568	0.020	-1.805	VENT#117.	-1.25	-4.98

Intact GZ Plot (Whole Range)



Intact GZ Plot (Heeling To Port)





Damage Hydrostatics and Stability Information for Single Damage Case

-----  
 Damage Case : R7M2\_P4-6.1.0-1  
 Damage Side : PORT  
 Initial Condition : DSM2  
 Flooding Stage : 1  
 Phase of Stage : EQ

Damaged Compartments

-----

Room	Moulded Vol m3	PERM	Net Vol m3	XCG m	YCG m	ZCG m
HOLD1_MOD2	2388.5	0.90	2149.66	13.13	-0.00	9.45
T432	57.5	0.95	54.58	21.60	-8.35	9.45
T410	710.1	0.95	674.59	22.97	0.68	4.80
T510	1395.2	0.85	1185.89	32.10	0.03	4.60
HOLD2_MOD2	3609.1	0.90	3248.23	45.71	-0.07	9.45
T632	113.8	0.95	108.08	40.51	-8.35	10.30

-----

Damage Hydrostatics and Stability Information for Single Damage Case Continued

---

Flooded Water Volume in Damaged Compartments

---

Room	Permeability	Flooded Vol m3	XCG m	YCG m	ZCG m
HOLD1_MO.	0.90	0.0	-	-	-
T432	0.95	0.0	-	-	-
T410	0.95	472.8	22.89	0.00	3.51
T510	0.85	824.0	32.12	-0.00	3.30
HOLD2_MO.	0.90	0.0	-	-	-
T632	0.95	0.0	-	-	-

---

Damage Hydrostatics and Stability Information for Single Damage Case Continued

---

Floating Position

---

(Draughts given on centreline and perpendicular to waterline)

Draught Forward TF	4.342 m	Heel Angle	0.000 Deg
Draught T	5.129 m	Trim	1.574 m
Draught Aft TA	5.916 m	Trim Angle	0.864 Deg

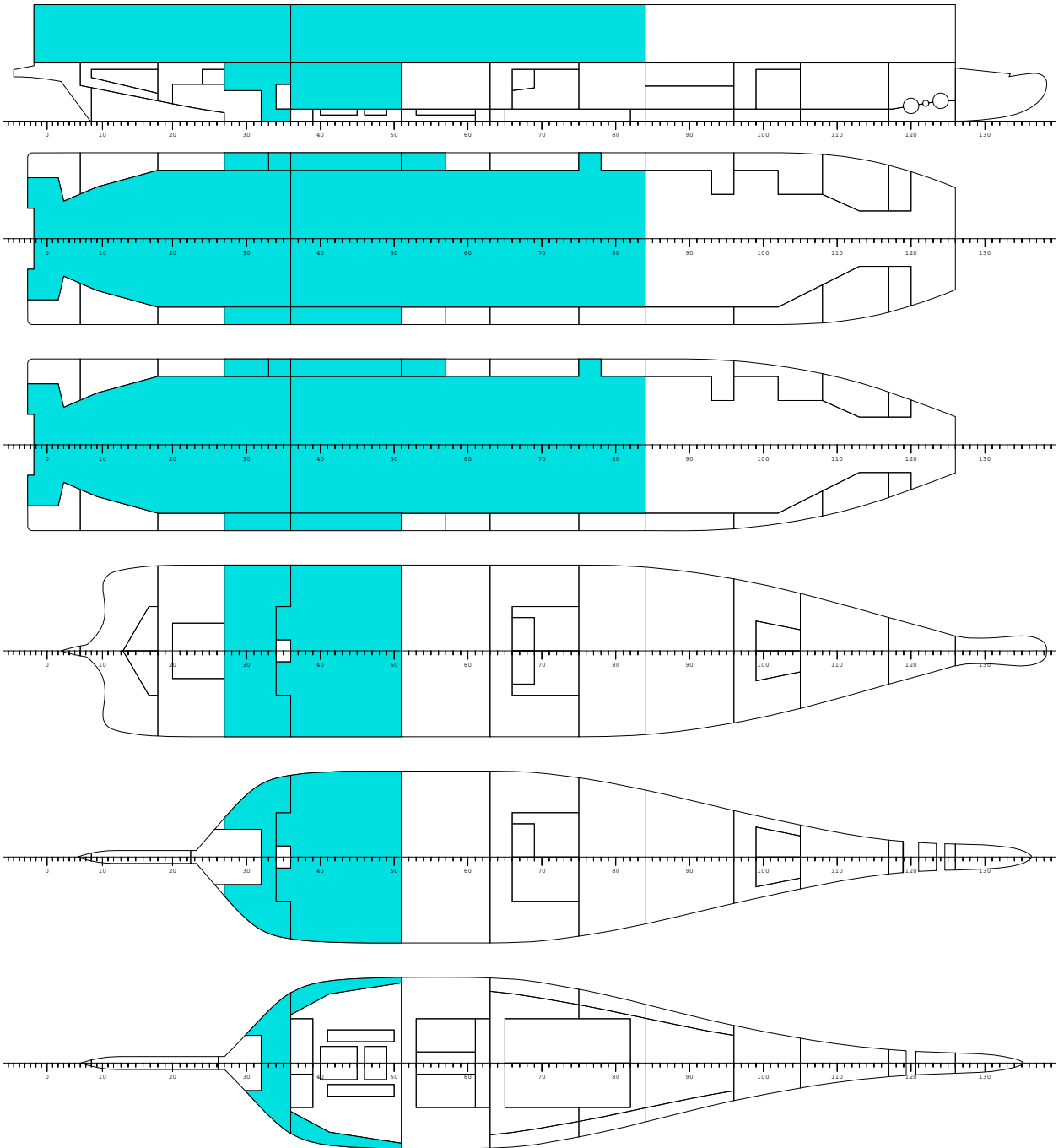
Damage GZ Particulars

---

Range	47.333 Deg (Port)
GZ Max	0.161 m
Angle at GZ Max	37.572 Deg (Port)
Area Under GZ Curve	0.093 m.rad

# Damage Case Drawing

-----

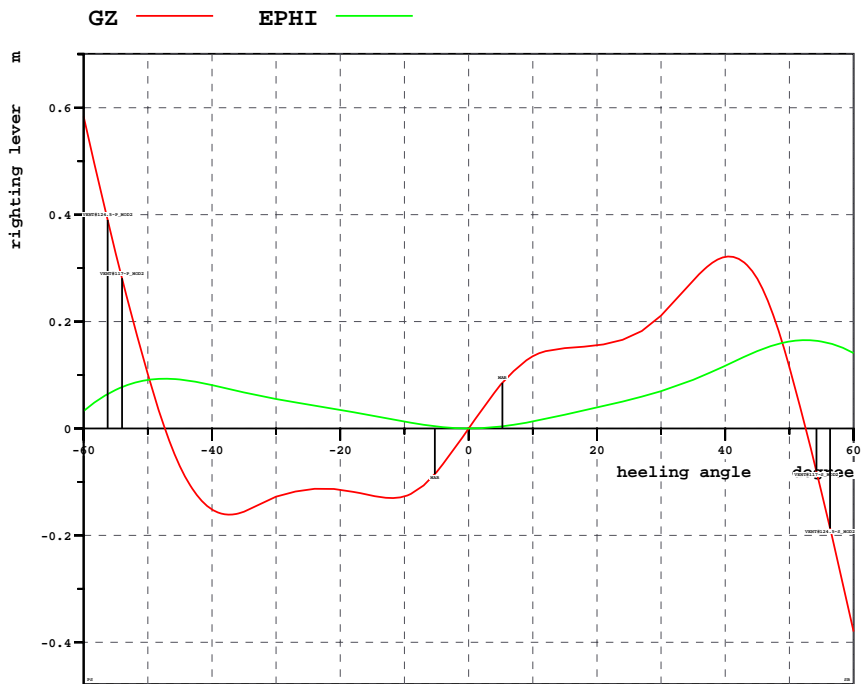


Damaged GZ Curve

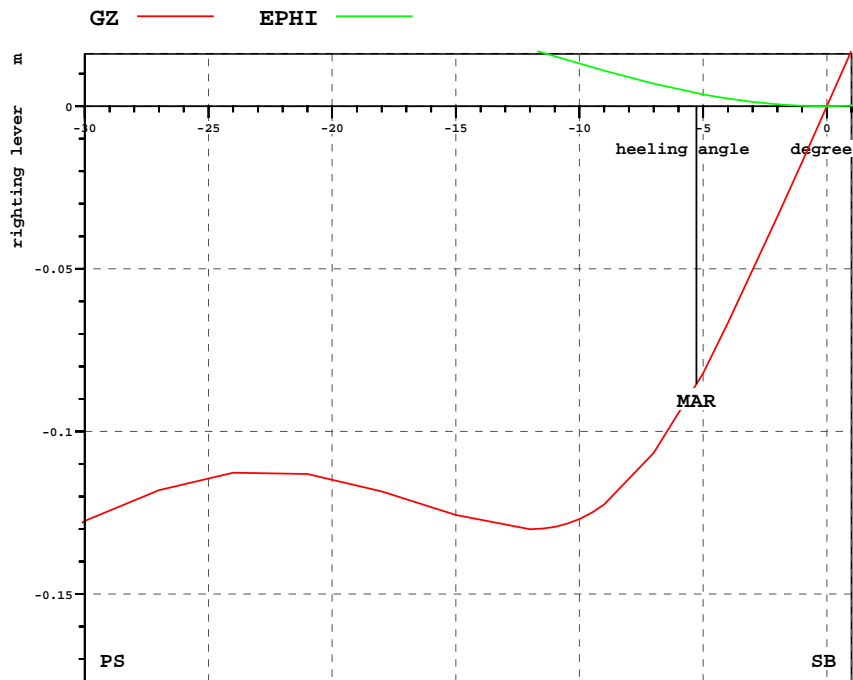
-----  
 Initial condition : DSM2, Deepest subd. load line  
 Damage case : R7M2\_P4-6.1.0-1, Zones Z04-Z06 Port, b1, l.ext1  
 Stage of damage : 1  
 Phase of stage : EQ

HEEL degree	GZ m	EPHI rad*m	T m	TR m	OPNAME	IMRES m	RESMRG m
-60.0	0.584	0.033	2.142	4.086	VENT#117.	-1.17	-8.90
-50.0	0.102	0.091	2.946	3.213	VENT#117.	0.77	-7.35
-45.0	-0.071	0.092	3.332	2.755	VENT#117.	1.73	-6.51
-40.0	-0.151	0.081	3.723	2.393	VENT#117.	2.68	-5.72
-35.0	-0.156	0.068	4.100	2.253	VENT#117.	3.69	-5.01
-30.0	-0.128	0.055	4.416	2.205	VENT#117.	4.75	-4.30
-27.0	-0.118	0.049	4.572	2.168	VENT#117.	5.38	-3.84
-24.0	-0.113	0.043	4.706	2.123	VENT#117.	6.01	-3.36
-21.0	-0.113	0.037	4.816	2.065	VENT#117.	6.63	-2.85
-18.0	-0.118	0.031	4.904	1.993	VENT#117.	7.23	-2.32
-15.0	-0.126	0.024	4.972	1.907	VENT#117.	7.82	-1.78
-12.0	-0.130	0.018	5.023	1.809	VENT#117.	8.39	-1.22
-9.0	-0.122	0.011	5.064	1.708	VENT#117.	8.93	-0.67
-7.0	-0.107	0.007	5.086	1.647	VENT#117.	9.28	-0.30
-5.0	-0.082	0.004	5.106	1.604	VENT#117.	9.62	0.05
-4.0	-0.067	0.002	5.114	1.593	VENT#117.	9.79	0.22
-3.0	-0.050	0.001	5.120	1.584	VENT#117.	9.96	0.38
-2.0	-0.034	0.001	5.125	1.578	VENT#117.	10.13	0.55
-1.0	-0.017	0.000	5.128	1.575	VENT#117.	10.29	0.71
0.0	0.000	0.000	5.129	1.574	VENT#117.	10.46	0.88
1.0	0.017	0.000	5.128	1.575	VENT#117.	10.29	0.71
2.0	0.034	0.001	5.125	1.578	VENT#117.	10.13	0.55
3.0	0.050	0.001	5.120	1.584	VENT#117.	9.96	0.38
4.0	0.067	0.002	5.114	1.593	VENT#117.	9.79	0.22
5.0	0.082	0.004	5.106	1.604	VENT#117.	9.62	0.05
7.0	0.107	0.007	5.086	1.647	VENT#117.	9.28	-0.30
9.0	0.128	0.011	5.061	1.705	VENT#117.	8.94	-0.66
12.0	0.145	0.018	5.016	1.804	VENT#117.	8.39	-1.21
15.0	0.150	0.026	4.960	1.896	VENT#117.	7.83	-1.76
18.0	0.153	0.034	4.886	1.976	VENT#117.	7.24	-2.30
21.0	0.157	0.042	4.792	2.041	VENT#117.	6.64	-2.82
24.0	0.166	0.051	4.675	2.090	VENT#117.	6.02	-3.31
27.0	0.183	0.060	4.534	2.122	VENT#117.	5.40	-3.78
30.0	0.211	0.070	4.366	2.137	VENT#117.	4.77	-4.22
35.0	0.277	0.091	4.022	2.135	VENT#117.	3.73	-4.88
40.0	0.321	0.118	3.606	2.170	VENT#117.	2.72	-5.48
45.0	0.280	0.145	3.175	2.421	VENT#117.	1.76	-6.18
50.0	0.115	0.163	2.770	2.832	VENT#117.	0.81	-6.98
60.0	-0.380	0.141	1.947	3.664	VENT#117.	-1.13	-8.49

Damaged GZ Plot (Whole Range)



Damage GZ Plot (Heeling To Port)



Model Test Draught Marks

-----

(Draughts given on centreline and perpendicular to baseline)

Damage Case : R7M2\_P4-6.1.0-1  
 Damage Side : PORT  
 Equilibrium Heel Angle: 0.000 Degrees

Locations of Draught Marks and Breadths at Draught Mark locations

-----

Draught Mark	X Location	Full Breadth At Mean Damage Draught
AP	0.000 m	18.600 m
AFT QUARTER	26.100 m	18.600 m
MIDSHIP	52.200 m	18.600 m
FP	104.400 m	2.617 m

Draughts in Intact, Damage Equilibrium and at 1 degree of Heel

-----

Draught Marks at AP	Intact	Equilibrium	1 Degree Heel
Port	4.500 m	5.916 m	6.078 m
Mean	4.500 m	5.916 m	5.916 m
Starboard	4.500 m	5.916 m	5.753 m

Draught Marks at Aft Quarter	Intact	Equilibrium	1 Degree Heel
Port	4.500 m	5.522 m	5.684 m
Mean	4.500 m	5.522 m	5.522 m
Starboard	4.500 m	5.522 m	5.360 m

Draught Marks at Midship	Intact	Equilibrium	1 Degree Heel
Port	4.500 m	5.129 m	5.291 m
Mean	4.500 m	5.129 m	5.129 m
Starboard	4.500 m	5.129 m	4.966 m

Draught Marks at FP	Intact	Equilibrium	1 Degree Heel
Port	4.500 m	4.342 m	4.364 m
Mean	4.500 m	4.342 m	4.342 m
Starboard	4.500 m	4.342 m	4.319 m

# Draught Mark Explanation

-----  
Damage floating position draught marks calculation shown in red  
Model Draught marks calculation method shown in green

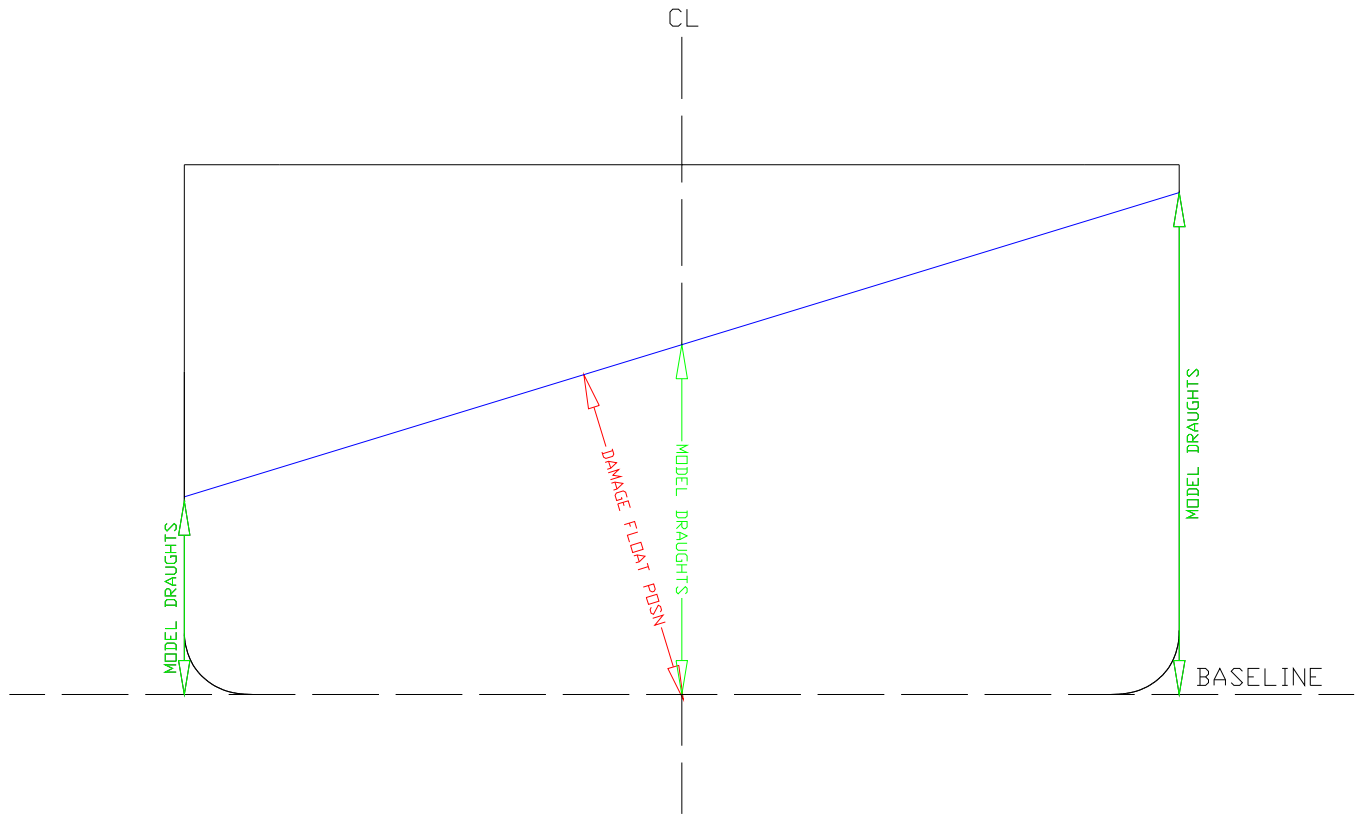


FIGURE 1

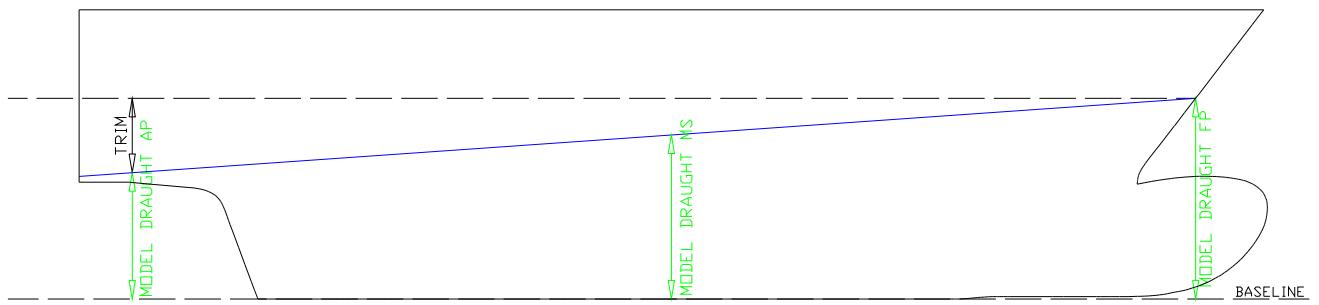


FIGURE 2





## **PHOTOGRAPHS OF THE MODEL**

**Model No. 2446**

**Project: "EMSA 1"**

**Test No. 29665**

**Damage Case 2 R7\_P6-7.4.0**



## **APPENDIX B**

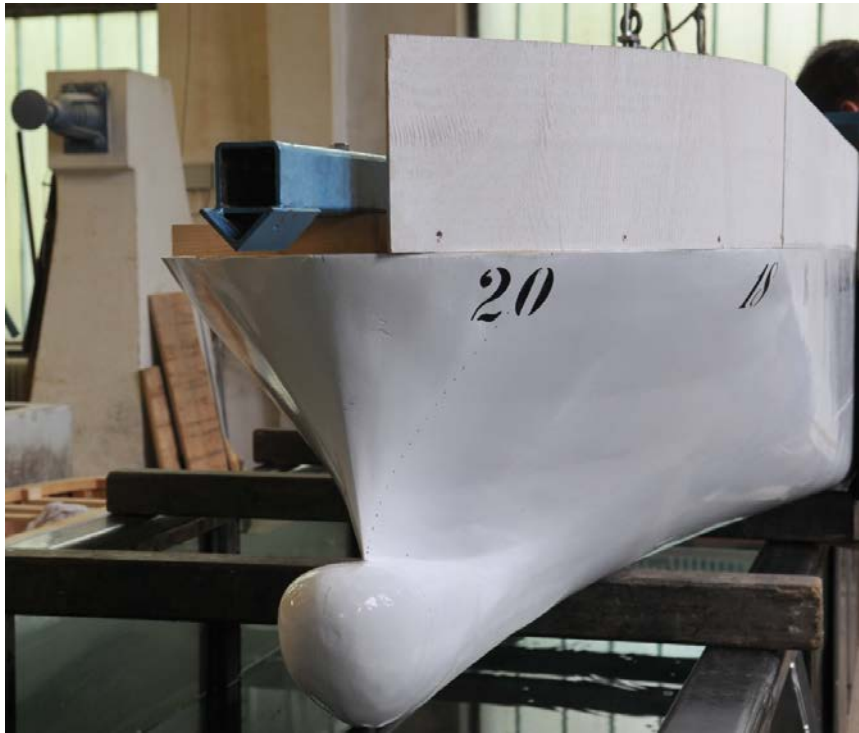
### **PHOTOGRAPHS OF THE MODEL**

**Model No. 2446, 2446B - intact vessel**

**Project: "EMSA 1"**



Model No. 2446 intact vessel





Model No. 2446 intact vessel





Model No. 2446 intact vessel



Model No. 2446 intact vessel





Model No. 2446 intact vessel





Model No. 2446B





Model No. 2446B



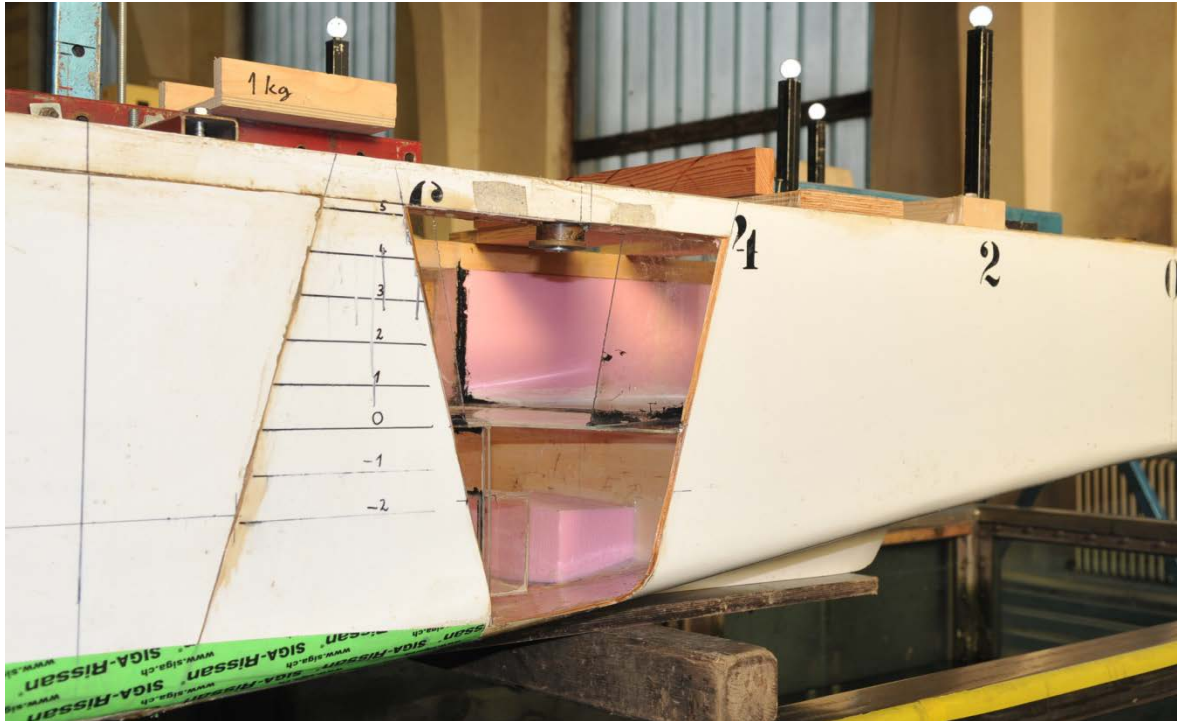
Model No. 2446B



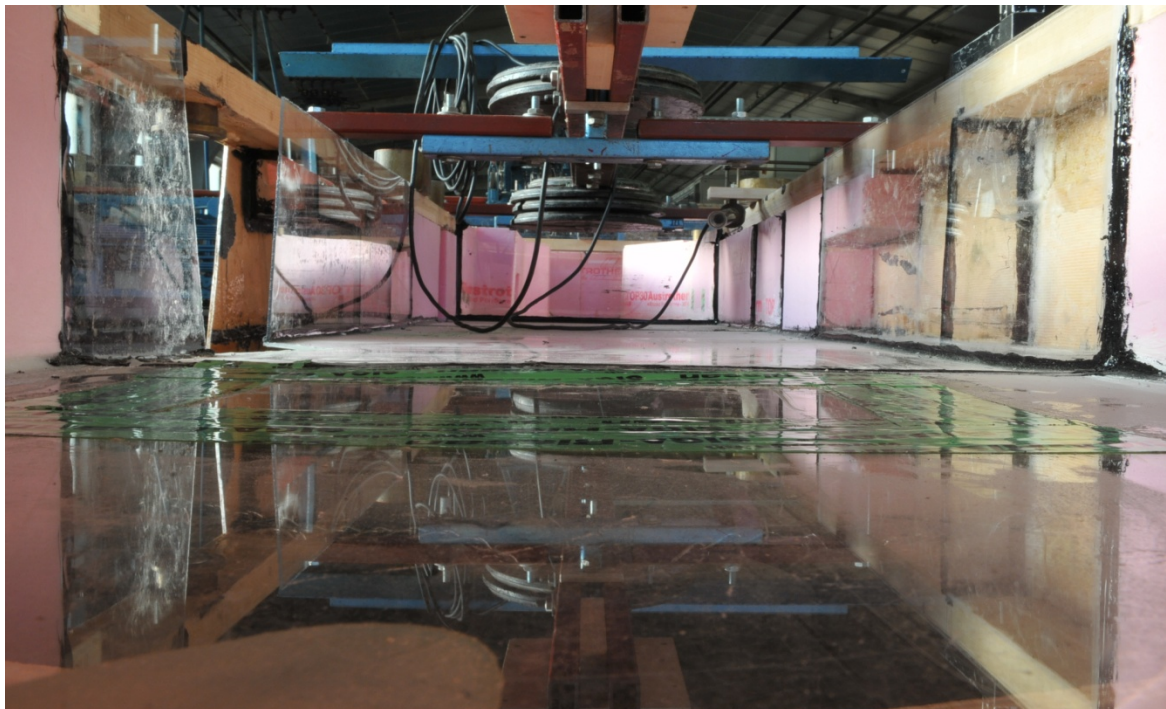




Model No. 2446B



Model No. 2446B



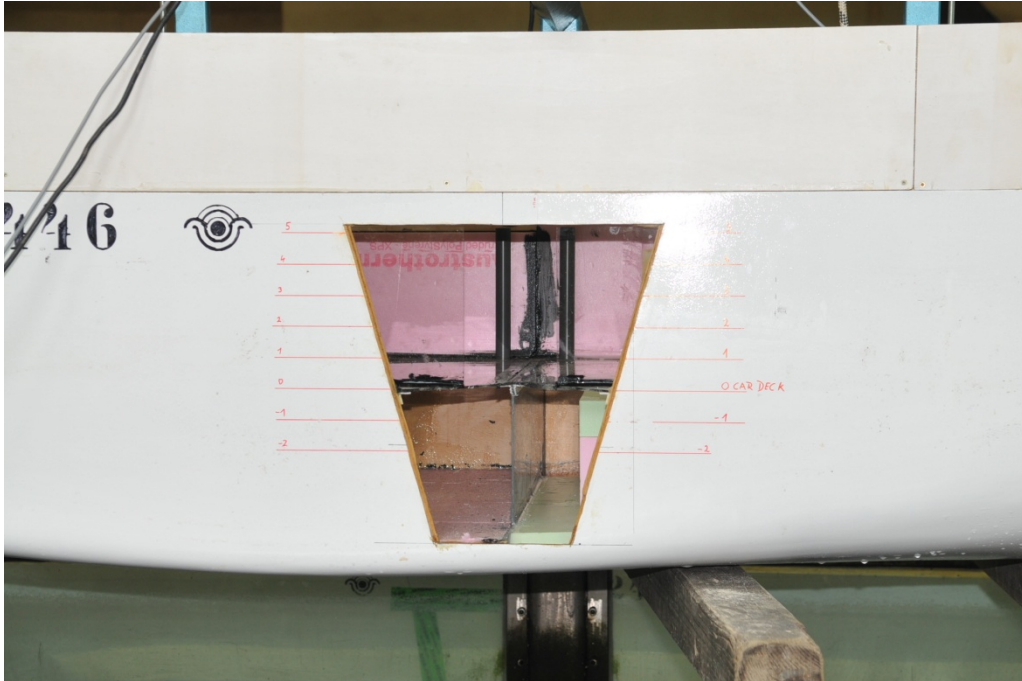


## **PHOTOGRAPHS OF THE MODEL**

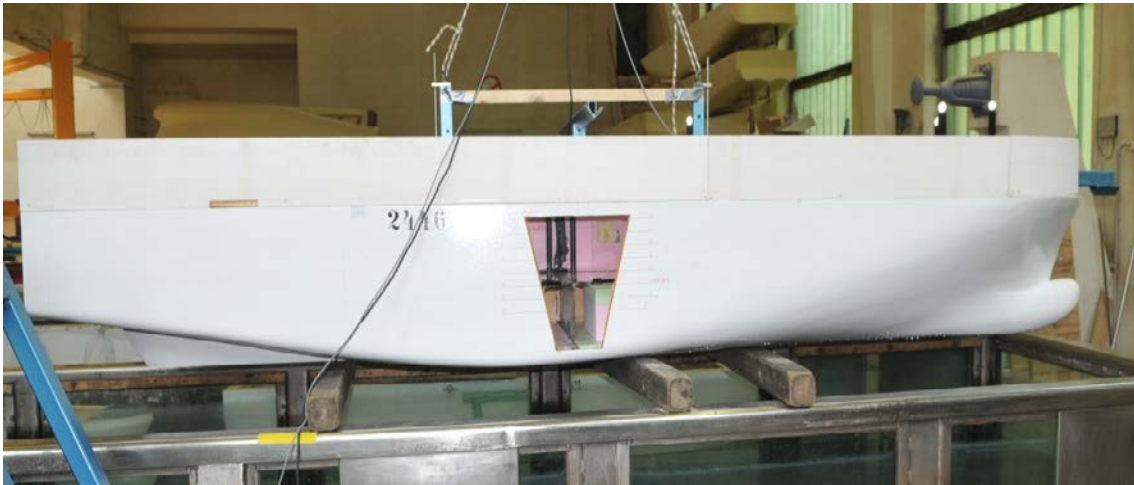
**Model No. 2446**

**Project: "EMSA 1"**

**Damage Case 1 R7\_S7-9.1.0-7**









## **PHOTOGRAPHS OF THE MODEL**

**Model No. 2446**

**Project: "EMSA 1"**

**Damage Case 2 R7\_P6-7.4.0**









## **PHOTOGRAPHS OF THE MODEL**

**Model No. 2446**

**Project: "EMSA 1"**

**Test No. 29665**

**Damage Case 2 R7\_P6-7.4.0**



Model No. 2446, Test No.29665





Model No. 2446, Test No. 29665





Model No. 2446, Test No. 29665





Model No. 2446, Test No. 29665





Model No. 2446, Test No. 29665





## **APPENDIX C**

### **MODEL TEST PROTOCOL**

**Model No. 2446**

**Project: "EMSA 1"**

**Damage Case-1 R7\_S7-9.1.0-1**

Details of the dimensions and the damage conditions

## GENERAL PARTICULARS

Model Scale = 1: 25

	SHIP (m)	MODEL (mm)	NOTES	CHECKED
<b>MAIN DIMENSIONS</b>				
LMOD	111.900	4476.0		-
LBP	104.400	4176.0		<b>4175</b>
BMLD	18.600	744.0		<b>741</b>

<b>LONGITUDINAL POSITION OF DAMAGE 1 R7_S7-9.1.0-1</b>				
Aft Bulkhead	38.400	1536.0	From AP (#0)	
Fwd Bulkhead	57.600	2304.0	From AP (#0)	

<b>LONGITUDINAL POSITION OF DAMAGE 2 R7_P6-7.4.0</b>				
Aft Bulkhead	26.400	1056.0	From AP (#0)	<b>1056.0</b>
Fwd Bulkhead	48.000	1920.0	From AP (#0)	<b>1920.0</b>

Shell Plate Thickness      5      mm

*Alistair Murphy (Sas)*  
*Boyer (Trafi)*



R7-S7-9.1.0-1

10-14 May

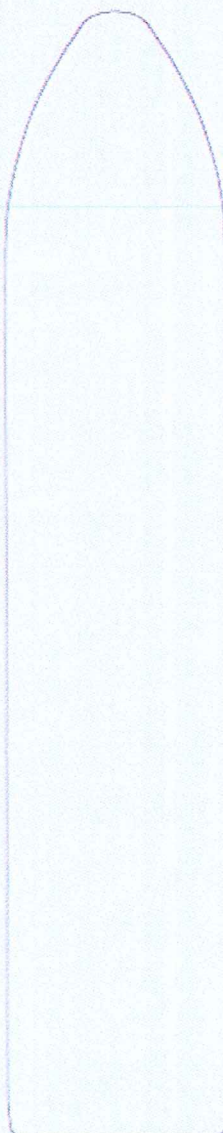
INTACT DRAUGHTS - DAMAGE 1

Alister Murphy (SAS)  
Zoff (Trafi)

FP	
Full Size	4.500 m
Model	180.0 mm
Check	180 mm

Port

Starboard



Midship	
Full Size	4.500 m
Model	180.0 mm
Check	180 mm

Midship	
Full Size	4.500 m
Model	180.0 mm
Check	180 mm

Quarter	
Full Size	4.500 m
Model	180.0 mm
Check	180 mm

Quarter	
Full Size	4.500 m
Model	180.0 mm
Check	180 mm

AP	
Full Size	4.500 m
Model	180.0 mm
Check	X mm

AP	
Full Size	4.500 m
Model	180.0 mm
Check	X mm

10-14 May

DAMAGE DRAUGHTS - DAMAGE 1

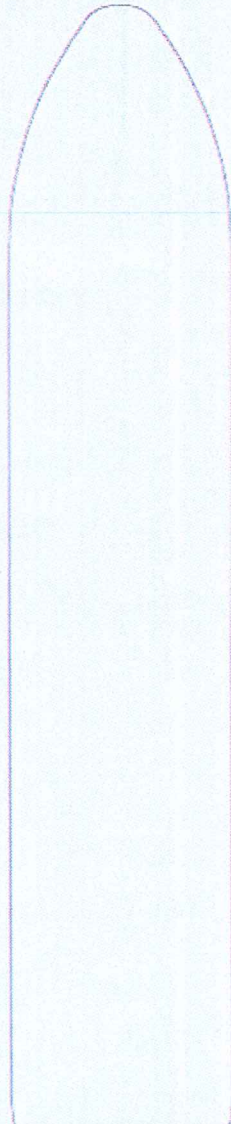
Alistair Murphy (SAS)  
Zfg (Trafalgar)

FP	
Full Size	5.233 m
Model	209.3 mm
Check	✓ mm

Static Heel	
1.000	degree(s)

Port

Starboard



Midship	
Full Size	4.971 m
Model	198.8 mm
Check	✓ mm

Midship	
Full Size	5.296 m
Model	211.6 mm
Check	✓ mm

Quarter	
Full Size	4.921 m
Model	196.8 mm
Check	✓ mm

Quarter	
Full Size	5.246 m
Model	209.8 mm
Check	✓ mm

AP	
Full Size	4.876 m
Model	195.0 mm
Check	✓ mm

AP	
Full Size	5.191 m
Model	207.6 mm
Check	✓ mm

10-14 May

DAMAGE OPENING - DAMAGE 1

	SHIP (m)	MODEL (mm)	NOTES	CHECKED
DAMAGE OPENING				
DMLD	6.30	252.0	Cardeck at V	✓
Length	6.240	249.6	3%Ls + 3.0m	250
Dist from AP (#10)	48.00	1920.0		1917.0
B/5	5.58	223.2	from CL	223
	3.72	148.8	from BEXT	✓

Alistair Murphy (SAS)  
Zff (Trafo)

**INTACT STABILITY CHARACTERISTICS - DAMAGE 1**

	SHIP (m)	MODEL (mm)	NOTES	CHECKED
<b>VESSEL WEIGHT</b>				
Displacement (fresh water)	5383.10 tonnes	344.5 kg	345	✓

<b>INTACT STABILITY CHARACTERISTICS</b>				
GMT	1.385	55.4		1.383 ✓
KG	8.809	352.4		—
KM	10.194	407.8		—
LCB	49.140	1965.6	From AP (#10)	—

Incline Weight Lever 4.975 Kg.  
0.25m.

Intact Roll (in water) T 16.918 sec

Intact Roll (in Air) T 10.0414 sec  
K/B 0.3667 (0.35 → 0.4)

Intact Pitch (in Air) T 3.46 sec  
K/L 0.2285 (0.2 → 0.25)

Damage Roll (in water) T 21.8830 sec.

Alistair Murphy (Safety At Sea)

*[Signature]* (Finnish Transport Safety Agency)

*[Signature]* (Schiffbau technische Versuchsanstalt in Wien)



Wednesday 12 May 2010

**Plan for Friday 14 May 2010**

On Thursday 12 May, the survival boundary, in terms of Significant Wave Height, was sought for Ship 1 with damage case R7\_S7-9.1.0-1. Five runs for each wave height were performed with the following results.

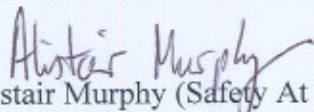
Run	Hs 3.00m	Hs 3.25m	Hs 3.50m
1	Survive	Survive	CAPSIZE
2	Survive	Survive	Survive
3	Survive	Survive	Survive
4	Survive	Survive	Survive
5	Survive	Survive	Survive


Based on these results it can be estimated that the maximum survivable Hs is between 3.00m and 3.50m Hs.


The plan for Friday 14 May is therefore to complete the 10 runs per Hs required by the Stockholm Agreement by performing an additional 5 runs at the wave heights bordering the survival boundary.

If time allows, additional runs shall be performed at 4.00m Hs and 2.50m Hs to ensure that nothing unexpected occurs at Hs values significantly greater than or less than the estimated survival boundary.

At the end of the day, as has been done at the end of each other day, the floating position will be checked to ensure no changes have occurred during testing.

  
Alistair Murphy (Safety At Sea)

  
Bo Fagerholm (Finnish Transport Safety Agency)

  
Clemens Strasser (SVA)

14-05-2010

MODEL TEST EXPERIMENTS - DAMAGE 1

RUN	Hs TARGET	Hs FIX	Hs TRAV	COMMENTS
29682.06	3.25	3.2531	—	Survive
29682.07	3.25	3.2681	—	Survive (max HEEL ≈ 12°)
29682.08	3.25	3.2932	—	Survive
29682.09	3.25	3.2980	—	Survive
29682.10	3.25	3.2742	—	Survive
<hr/>				
29681.06	3.50	3.5489	—	Capsize (300-320sec, HEEL ≈ 20°)
29681.07	3.50	3.5260	—	Survive
29681.08	3.50	3.5223	—	Survive (120sec → HEEL ≈ 16°)
29681.09	3.50	3.5450	—	Survive (150sec → HEEL ≈ 15°)
29681.10	3.50	3.5522	—	Capsize (70sec, HEEL ≈ 40°)
<hr/>				
29683.01	4.00	4.035	—	Capsize (~200sec)
29683.02	4.00	4.0562	—	Capsize (~75-90sec)
29683.03	4.00	4.087	—	Survive
29683.04	4.00	4.0427	—	Survive
29683.05	4.00	4.0304	—	Survive
29683.06	4.00	4.0496	—	Capsize (~180 ÷ 200sec)
29683.07	4.00	4.0449	—	Capsize (~100 ÷ 115sec)
29683.08	4.00	4.0421	—	Capsize (~120 ÷ 150sec)
29683.09	4.00	4.0594	—	Capsize (~130 ÷ 150sec)
29683.10	4.00	4.0364	—	Capsize (~60 ÷ 70sec)
<hr/>				
/				

*[Signature]* (SVA)

SHIP1 - MODEL TEST PROTOCOL.xls

Piotr Dobyński Safety at Sea  
*[Signature]*



## **APPENDIX D**

### **STATISTICS OF WAVES AND ROLL MOTIONS**

**Model No. 2446**

**Project: “EMSA 1”**

**Damage Case-1 R7\_S7-9.1.0-1**

**Roll Test in Air Measurements**

**Pitch Test in Air Measurements**

**Spectral Characteristics of the Target and Measured Waves**

**Summary of the Measured Wave and Roll Time Realisations**





**Roll in Air Measurements**

**Model No. 2446**

**Project: "EMSA 1"**

**Damage Case-1 R7\_S7-9.1.0-1**

**Vienna Model Basin Ltd.**

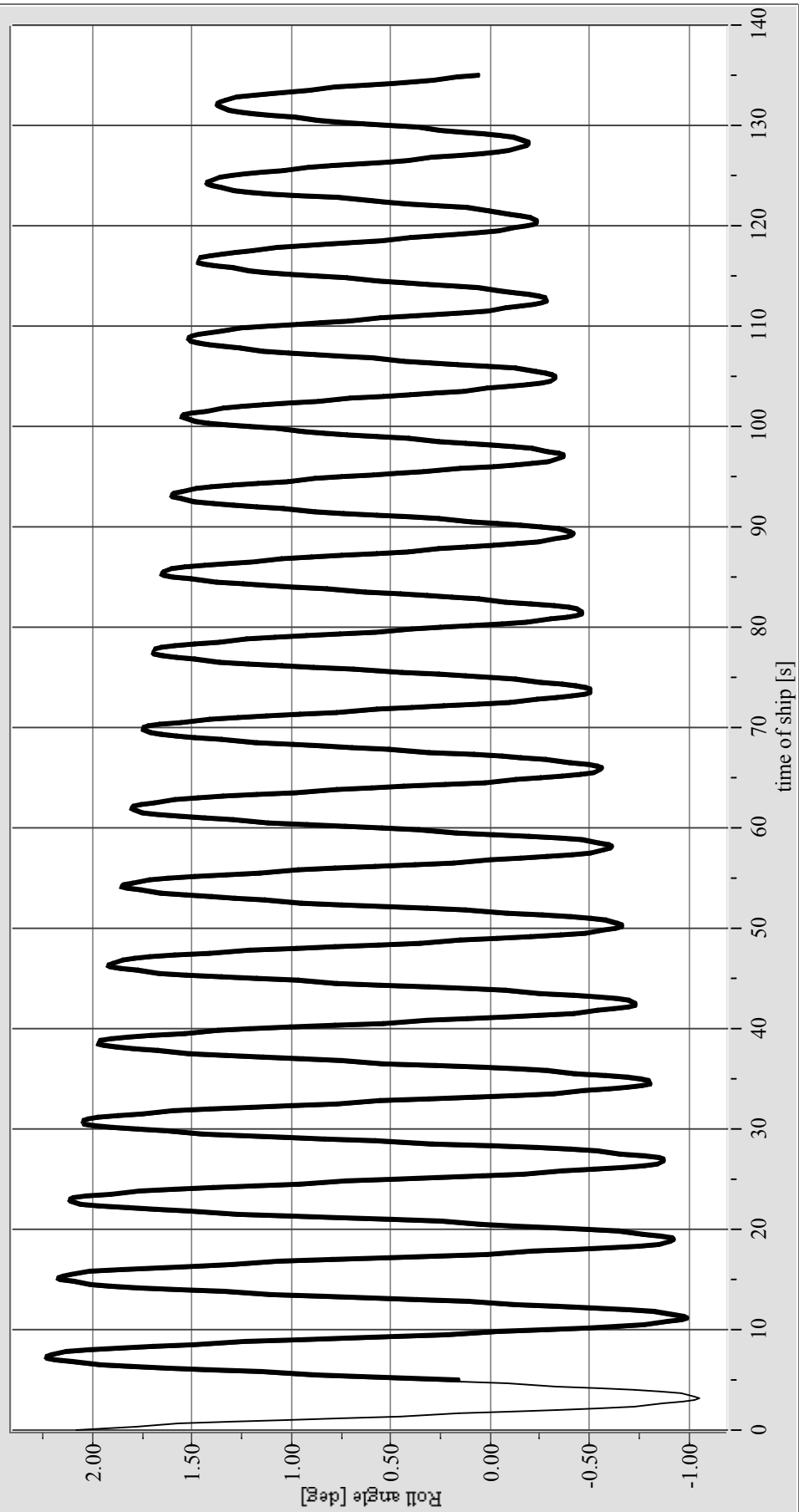
**Roll Test in Air**

**Model No. 2446**

**Test No. 29677-03**

**No bilge keels**

PLOT\_1



**Period (Model / Ship) = 1.5600 s / 7.8000 s**

**Project: EMSA 1**



## **Pitch in Air Measurements**

**Model No. 2446**

**Project: "EMSA 1"**

**Damage Case-1 R7\_S7-9.1.0-1**

Vienna Model Basin Ltd.

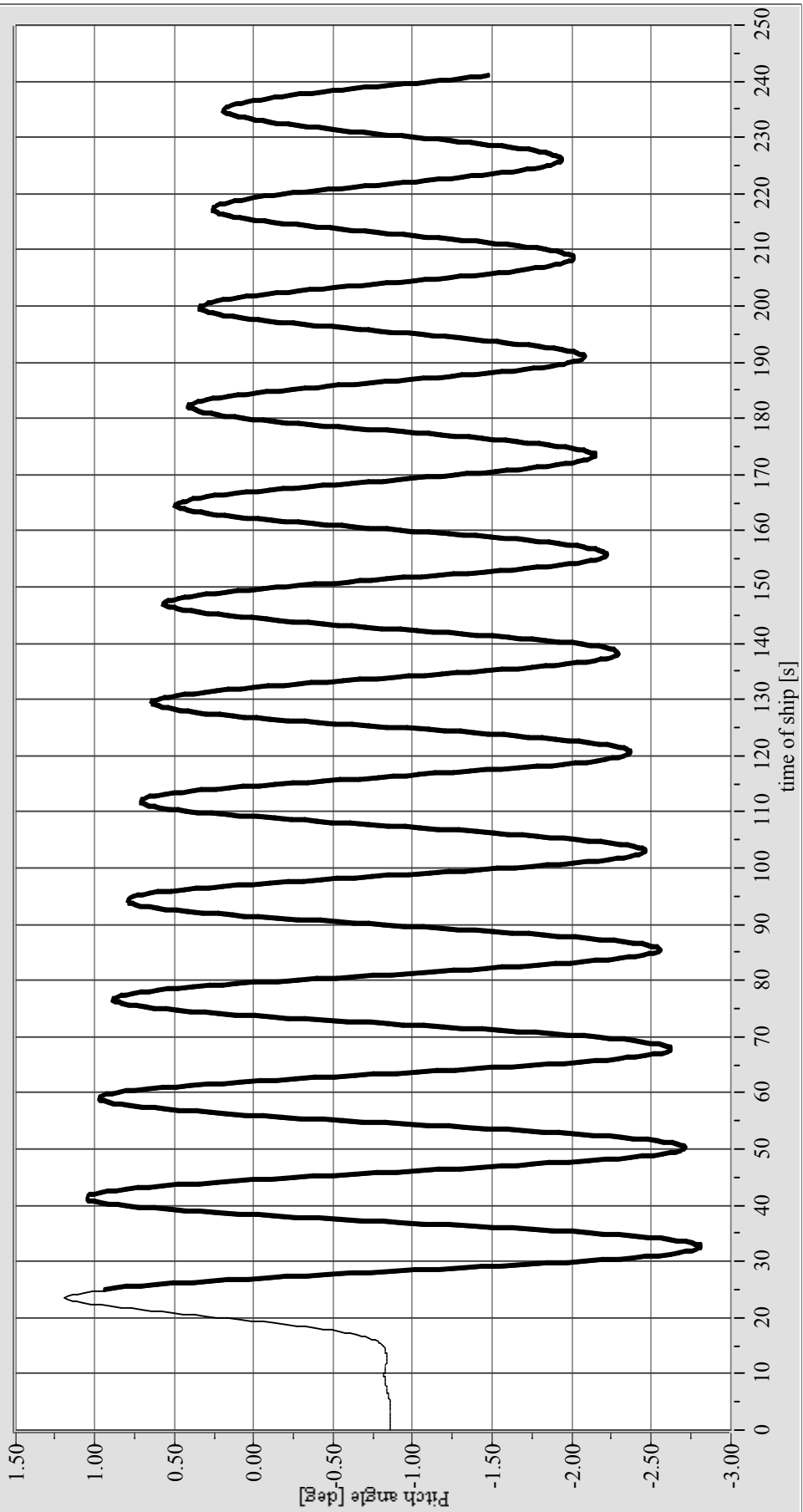
Pitch Test in Air

Model No. 2446

Test No. 29677-04

No bilge keels

PLOT\_1



Period (Model / Ship) = 3.5200 s / 17.6000 s

Project: EMSA 1



## **Spectral Characteristics of the Target and Measured Waves**

**Model No. 2446**

**Project: “EMSA 1”**

**Damage Case-1 R7\_S7-9.1.0-1**

**Hs = 4.00 m**



## WAVE MEASUREMENT DURING THE TESTS

### Location 1 (Arc 29) Wave Probe-1 DHI-834

**Model No.:** 2446

**Test No.:** 29678-01 to 10

**Project:** EMSA 1

**Damage 1:** R7\_S7-9.1.0-1

**Wave Type:** Jonswap

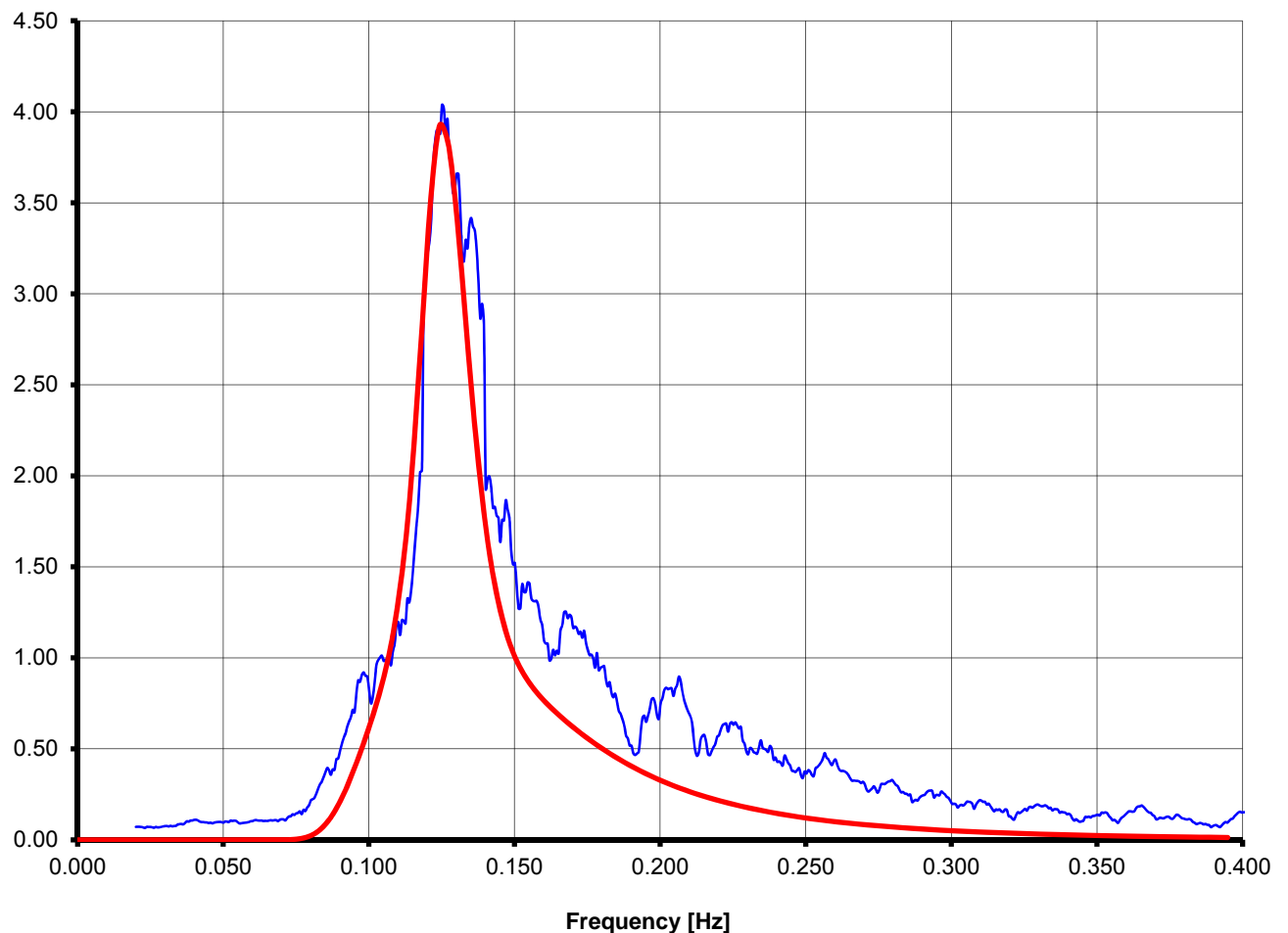
**Scale:** 25.00

### Short Waves

Parameter	Value	Units
$H_s$	<b>4.000</b>	m
gamma	3.300	
$T_p$	8.000	s
$T_z$	6.226	s

## Spectral Characteristics

**Spectral Density  $S(\omega)$  [m<sup>2</sup>.s]**



— Measured Wave Spectrum      — Target Wave Spectrum

# WAVE MEASUREMENT DURING THE TESTS (FIXED WAVE PROBE)

**Model No.:** 2446

**Test No.:** 29678-01 to 10

**Project:** EMSA 1

**Damage 1:** R7\_S7-9.1.0-1

**Wave Type:** Jonswap,  $\gamma = 3.3$

**Scale:** 25.00

Target of the Waves			Variation of the Waves		
H <sub>s</sub>	T <sub>P</sub>	T <sub>Z</sub>	H <sub>s</sub>	T <sub>P</sub>	T <sub>Z</sub>
[m]	[s]	[s]	[m]	[s]	[s]
<b>4.000</b>	8.000	6.226	4.000 - 4.100	7.800 - 8.200	5.914 - 6.537

No. of the Test	Wave No.	Location 1 (Wave Probe-1 DHI-834)			Location 2 (Wave Probe-2 DHI-835)			Location 3 (Wave Probe-3 DHI-836)		
		Hs	Tp	Tz	Hs	Tp	Tz	Hs	Tp	Tz
[ ]		[m]	[s]	[s]	[m]	[s]	[s]	[m]	[s]	[s]
29678-01	29678-01	4.0026	8.007	6.236						
-02	-02	4.0369	8.167	6.486						
-03	-03	4.0386	7.828	5.959						
-04	-04	4.0598	8.048	6.301						
-05	-05	4.0534	7.810	5.929						
-06	-06	4.0294	7.906	6.079						
-07	-07	4.0462	7.864	6.013						
-08	-08	4.0501	8.023	6.261						
-09	-09	4.0307	7.837	5.972						
-10	-10	3.9964	8.182	6.509						



## **Spectral Characteristics of the Target and Measured Waves**

**Model No. 2446**

**Project: “EMSA 1”**

**Damage Case-1 R7\_S7-9.1.0-1**

**Hs = 3.00 m**





## WAVE MEASUREMENT DURING THE TESTS

### Location 1 (Arc 29) Wave Probe-1 DHI-834

**Model No.:** 2446

**Test No.:** 29680-01 to 05

**Project:** EMSA 1

**Damage 1:** R7\_S7-9.1.0-1

**Wave Type:** Jonswap

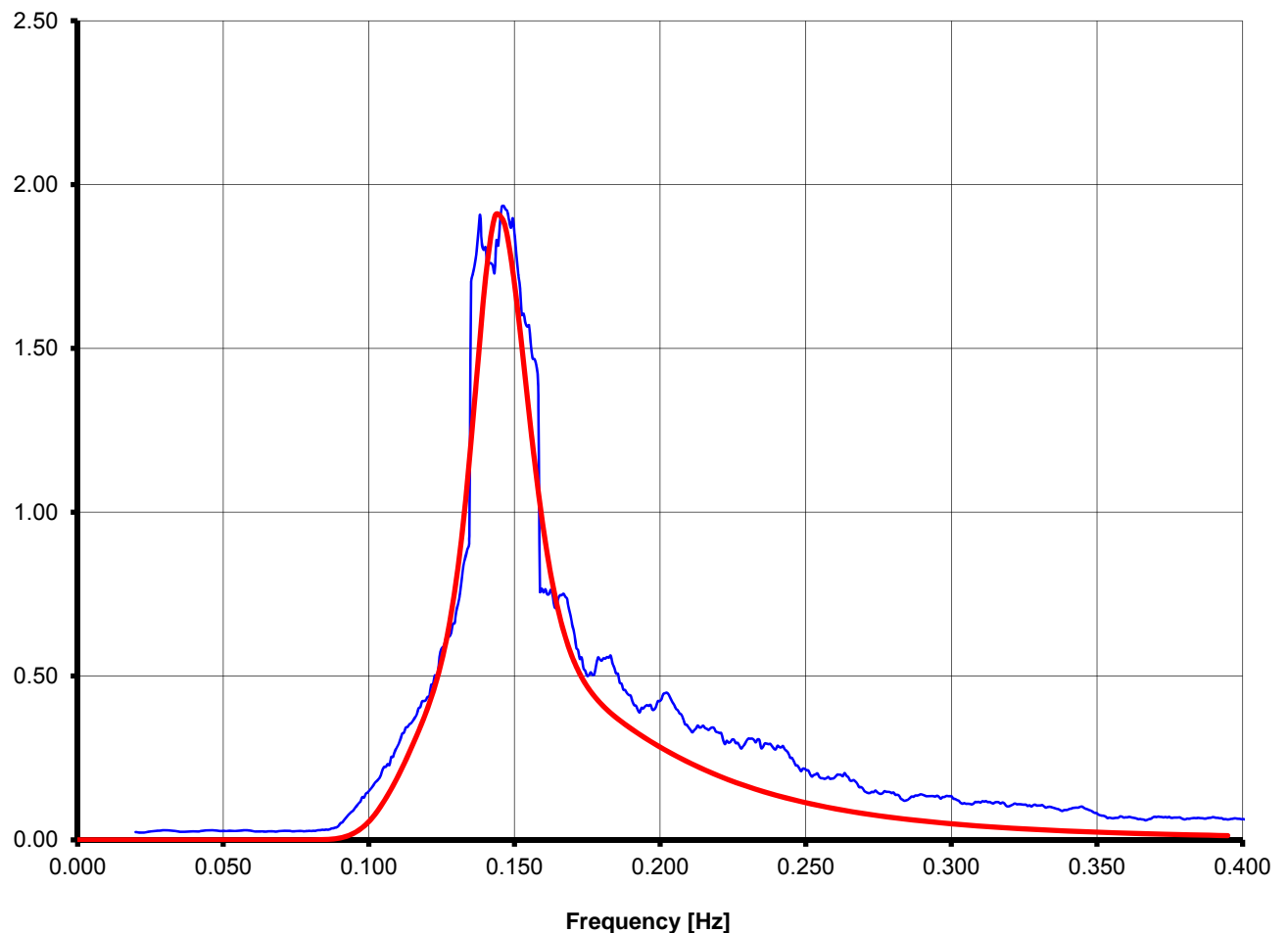
**Scale:** 25.00

#### Short Waves

Parameter	Value	Units
$H_s$	<b>3.000</b>	m
gamma	3.300	
$T_p$	6.928	s
$T_z$	5.392	s

### Spectral Characteristics

**Spectral Density  $S(\omega)$  [m<sup>2</sup>.s]**



— Measured Wave Spectrum      — Target Wave Spectrum

# WAVE MEASUREMENT DURING THE TESTS (FIXED WAVE PROBE)

**Model No.:** 2446

**Test No.:** 29680-01 to 05

**Project:** EMSA 1

**Damage 1:** R7\_S7-9.1.0-1

**Wave Type:** Jonswap,  $\gamma = 3.3$

**Scale:** 25.00

Target of the Waves			Variation of the Waves		
H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>
[m]	[s]	[s]	[m]	[s]	[s]
<b>3.000</b>	6.928	5.392	3.000 - 3.075	6.755 - 7.101	5.122 - 5.661

No. of the Test	Wave No.	Location 1 (Wave Probe-1 DHI-834)			Location 2 (Wave Probe-2 DHI-835)			Location 3 (Wave Probe-3 DHI-836)		
		Hs	Tp	Tz	Hs	Tp	Tz	Hs	Tp	Tz
[ ]		[m]	[s]	[s]	[m]	[s]	[s]	[m]	[s]	[s]
29680-01	29680-01	3.0236	6.792	5.180						
-02	-02	3.0510	7.040	5.566						
-03	-03	3.0586	6.955	5.434						
-04	-04	3.0546	6.999	5.502						
-05	-05	3.0493	6.850	5.270						



## **Spectral Characteristics of the Target and Measured Waves**

**Model No. 2446**

**Project: "EMSA 1"**

**Damage Case-1 R7\_S7-9.1.0-1**

**Hs = 3.50 m**



## WAVE MEASUREMENT DURING THE TESTS

### Location 1 (Arc 29) Wave Probe-1 DHI-834

**Model No.:** 2446

**Test No.:** 29681-01 to 10

**Project:** EMSA 1

**Damage 1:** R7\_S7-9.1.0-1

**Wave Type:** Jonswap

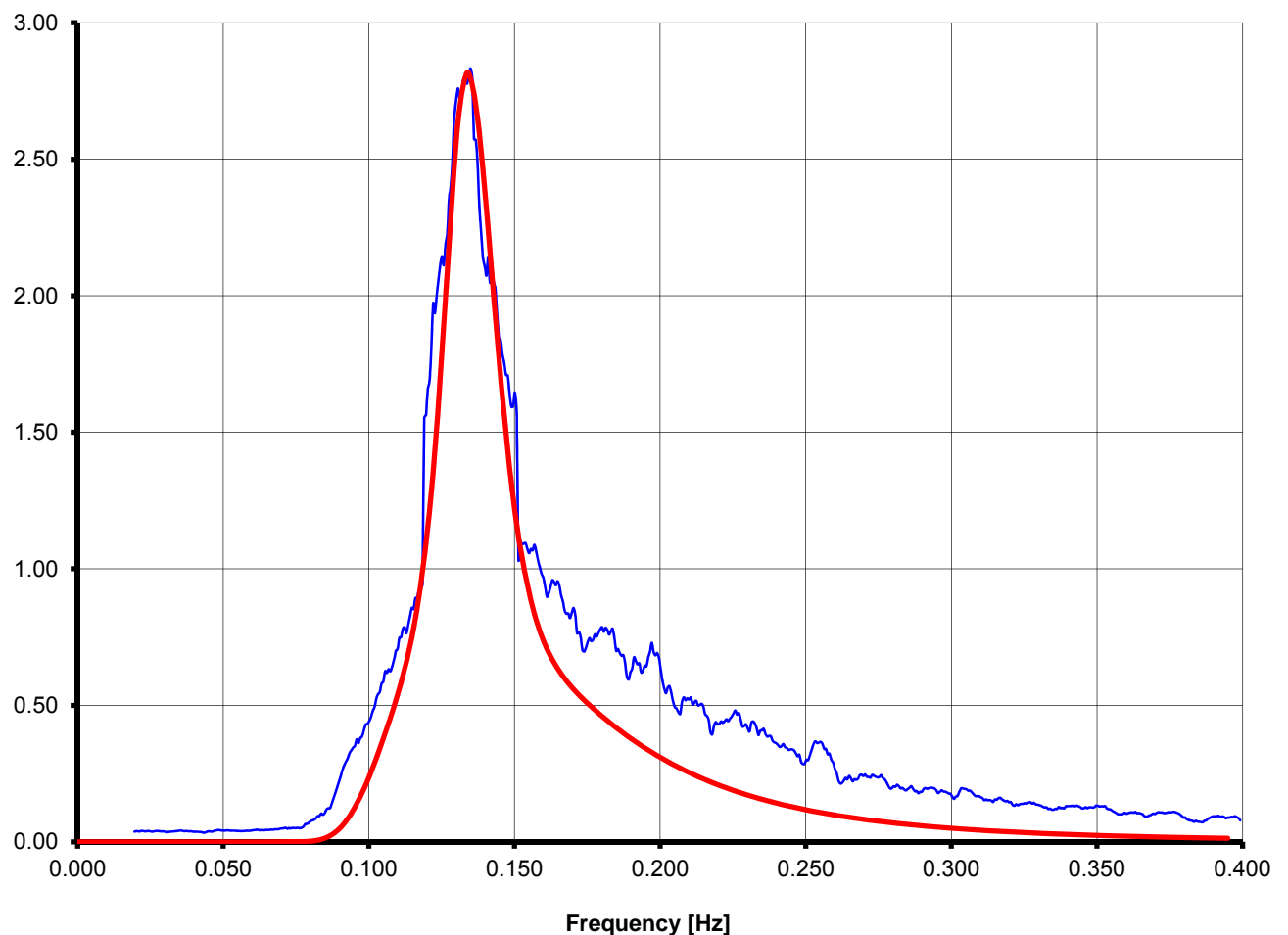
**Scale:** 25.00

### Short Waves

Parameter	Value	Units
$H_s$	<b>3.500</b>	m
gamma	3.300	
$T_p$	7.483	s
$T_z$	5.824	s

## Spectral Characteristics

**Spectral Density  $S(\omega)$  [m<sup>2</sup>.s]**



# WAVE MEASUREMENT DURING THE TESTS (FIXED WAVE PROBE)

**Model No.:** 2446

**Test No.:** 29681-01 to 10

**Project:** EMSA 1

**Damage 1:** R7\_S7-9.1.0-1

**Wave Type:** Jonswap,  $\gamma = 3.3$

**Scale:** 25.00

Target of the Waves			Variation of the Waves		
H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>
[m]	[s]	[s]	[m]	[s]	[s]
<b>3.500</b>	7.483	5.824	3.500 - 3.588	7.296 - 7.670	5.532 - 6.115

No. of the Test	Wave No.	Location 1 (Wave Probe-1 DHI-834)			Location 2 (Wave Probe-2 DHI-835)			Location 3 (Wave Probe-3 DHI-836)		
		H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>
[ ]		[m]	[s]	[s]	[m]	[s]	[s]	[m]	[s]	[s]
29681-01	29681-01	3.5638	7.437	5.751						
-02	-02	3.5439	7.596	5.999						
-03	-03	3.5656	7.588	5.986						
-04	-04	3.5345	7.498	5.847						
-05	-05	3.5263	7.446	5.766						
-06	-06	3.5489	7.633	6.056						
-07	-07	3.5260	7.435	5.749						
-08	-08	3.5223	7.589	5.988						
-09	-09	3.5450	7.490	5.834						
-10	-10	3.5522	7.560	5.942						



## **Spectral Characteristics of the Target and Measured Waves**

**Model No. 2446**

**Project: "EMSA 1"**

**Damage Case-1 R7\_S7-9.1.0-1**

**Hs = 3.25 m**



## WAVE MEASUREMENT DURING THE TESTS

### Location 1 (Arc 29) Wave Probe-1 DHI-834

**Model No.:** 2446

**Test No.:** 29682-01 to 10

**Project:** EMSA 1

**Damage 1:** R7\_S7-9.1.0-1

**Wave Type:** Jonswap

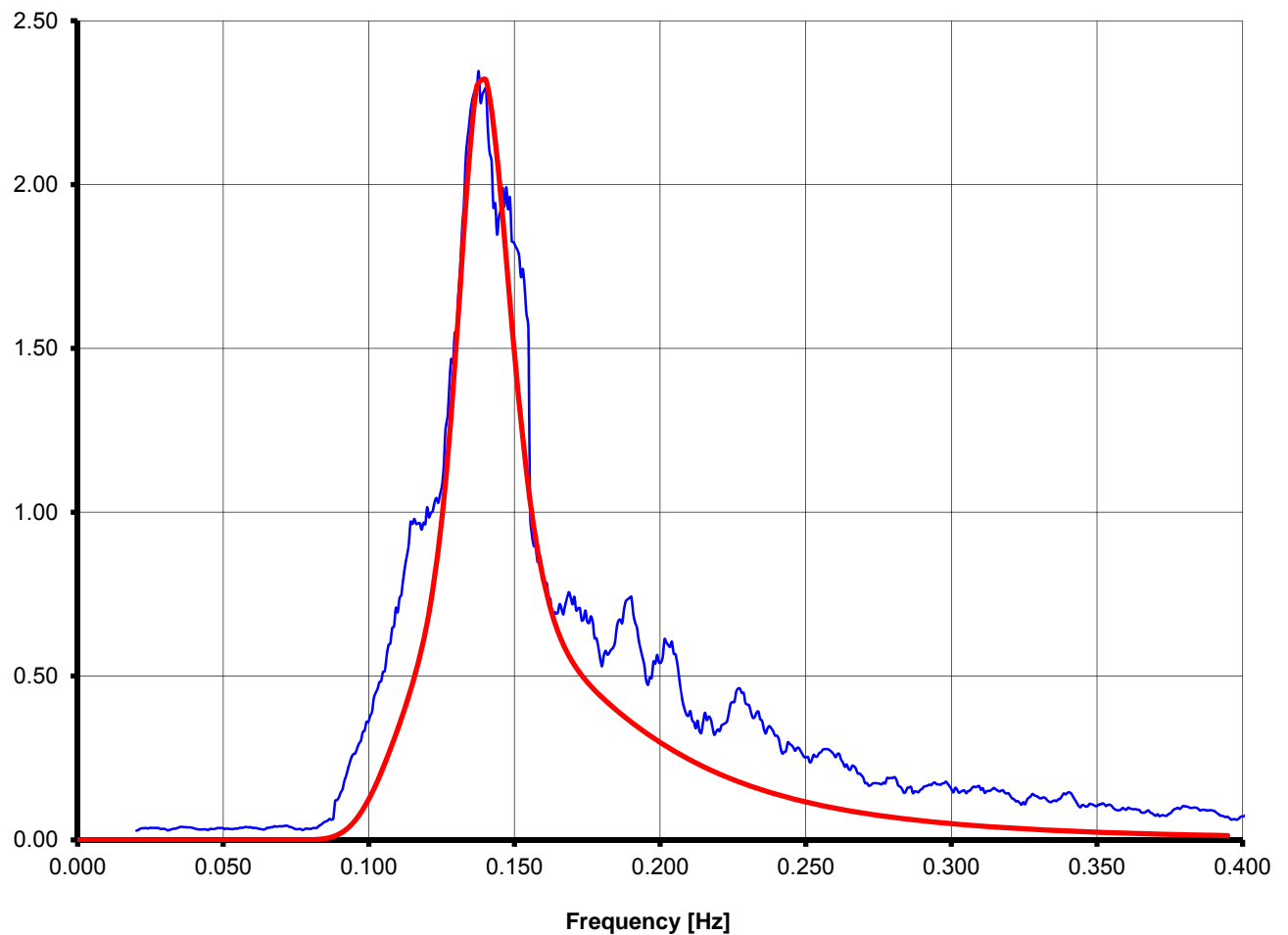
**Scale:** 25.00

#### Short Waves

Parameter	Value	Units
$H_s$	<b>3.250</b>	m
gamma	3.300	
$T_p$	7.211	s
$T_z$	5.612	s

### Spectral Characteristics

**Spectral Density  $S(\omega)$  [m<sup>2</sup>.s]**



— Measured Wave Spectrum      — Target Wave Spectrum

# WAVE MEASUREMENT DURING THE TESTS (FIXED WAVE PROBE)

**Model No.:** 2446

**Test No.:** 29682-01 to 10

**Project:** EMSA 1

**Damage 1:** R7\_S7-9.1.0-1

**Wave Type:** Jonswap,  $\gamma = 3.3$

**Scale:** 25.00

Target of the Waves			Variation of the Waves		
H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>
[m]	[s]	[s]	[m]	[s]	[s]
<b>3.250</b>	7.211	5.612	3.250 - 3.331	7.031 - 7.391	5.331 - 5.892

No. of the Test	Wave No.	Location 1 (Wave Probe-1 DHI-834)			Location 2 (Wave Probe-2 DHI-835)			Location 3 (Wave Probe-3 DHI-836)		
		H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>
[ ]		[m]	[s]	[s]	[m]	[s]	[s]	[m]	[s]	[s]
29682-01	29682-01	3.2839	7.354	5.834						
-02	-02	3.2909	7.036	5.339						
-03	-03	3.3095	7.250	5.672						
-04	-04	3.2967	7.316	5.775						
-05	-05	3.3113	7.050	5.361						
-06	-06	3.2531	7.333	5.802						
-07	-07	3.2681	7.037	5.340						
-08	-08	3.2932	7.245	5.665						
-09	-09	3.2980	7.078	5.405						
-10	-10	3.2742	7.173	5.553						





## **Spectral Characteristics of the Target and Measured Waves**

**Model No. 2446**

**Project: “EMSA 1”**

**Damage Case-1 R7\_S7-9.1.0-1**

**Hs = 4.00 m**



## WAVE MEASUREMENT DURING THE TESTS

### Location 1 (Arc 29) Wave Probe-1 DHI-834

**Model No.:** 2446

**Test No.:** 29683-01 to 10

**Project:** EMSA 1

**Damage 1:** R7\_S7-9.1.0-1

**Wave Type:** Jonswap

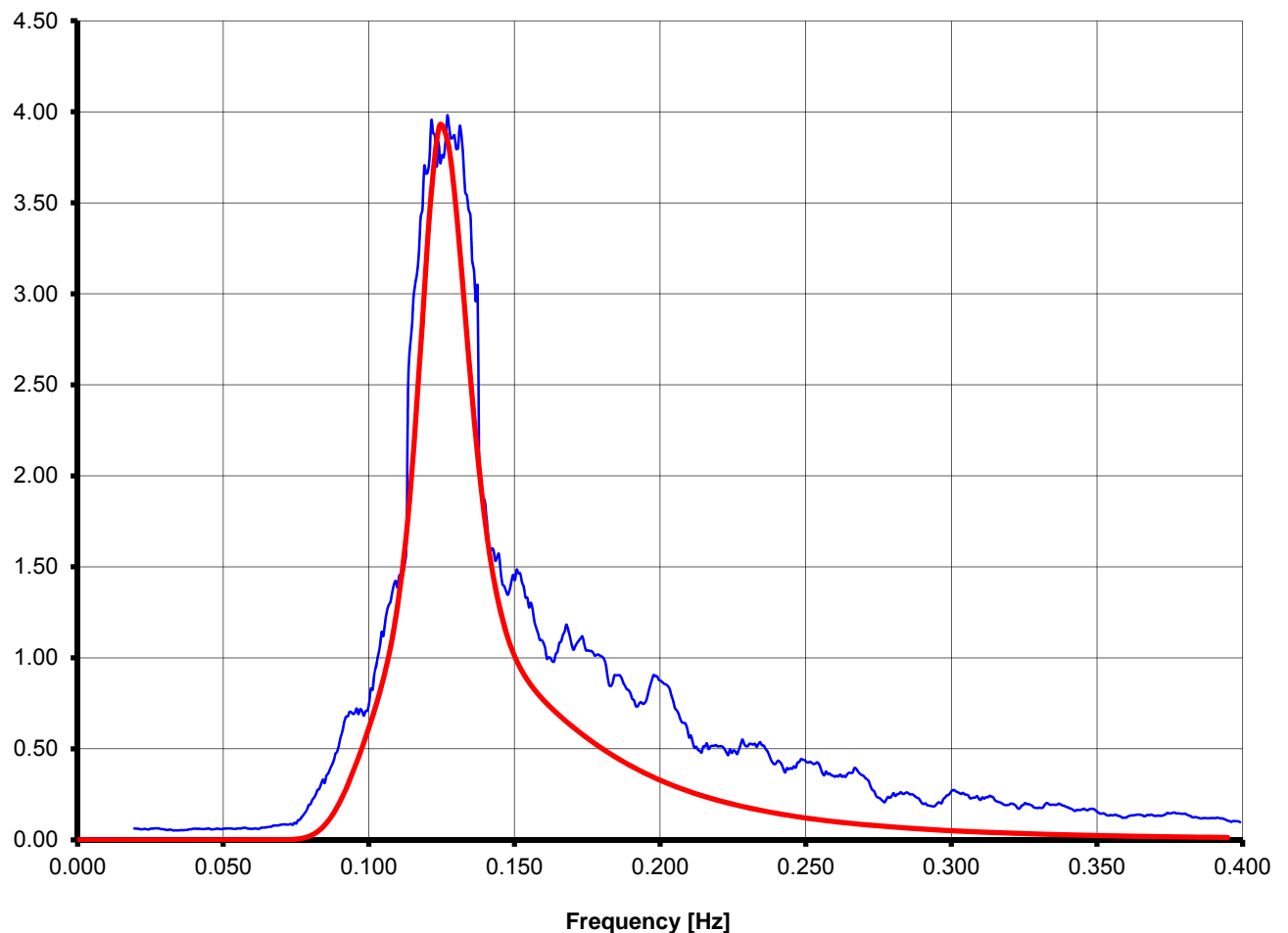
**Scale:** 25.00

### Short Waves

Parameter	Value	Units
$H_s$	<b>4.000</b>	m
gamma	3.300	
$T_p$	8.000	s
$T_z$	6.226	s

## Spectral Characteristics

**Spectral Density  $S(\omega)$  [ $m^2 \cdot s$ ]**



— Measured Wave Spectrum      — Target Wave Spectrum

# WAVE MEASUREMENT DURING THE TESTS (FIXED WAVE PROBE)

**Model No.:** 2446

**Test No.:** 29683-01 to 10

**Project:** EMSA 1

**Damage 1:** R7\_S7-9.1.0-1

**Wave Type:** Jonswap,  $\gamma = 3.3$

**Scale:** 25.00

Target of the Waves			Variation of the Waves		
H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>
[m]	[s]	[s]	[m]	[s]	[s]
<b>4.000</b>	8.000	6.226	4.000 - 4.100	7.800 - 8.200	5.914 - 6.537

No. of the Test	Wave No.	Location 1 (Wave Probe-1 DHI-834)			Location 2 (Wave Probe-2 DHI-835)			Location 3 (Wave Probe-3 DHI-836)		
		H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>
[ ]		[m]	[s]	[s]	[m]	[s]	[s]	[m]	[s]	[s]
29683-01	29683-01	4.0350	8.088	6.362						
-02	-02	4.0562	8.187	6.516						
-03	-03	4.0870	8.023	6.261						
-04	-04	4.0427	8.149	6.457						
-05	-05	4.0304	7.933	6.121						
-06	-06	4.0496	8.110	6.396						
-07	-07	4.0449	7.894	6.061						
-08	-08	4.0421	7.840	5.977						
-09	-09	4.0594	8.194	6.527						
-10	-10	4.0364	8.032	6.275						



## **Spectral Characteristics of the Target and Measured Waves**

**Model No. 2446**

**Project: “EMSA 1”**

**Damage Case-1 R7\_S7-9.1.0-1**

**Hs = 3.75 m**



## WAVE MEASUREMENT DURING THE TESTS

### Location 1 (Arc 29) Wave Probe-1 DHI-834

**Model No.:** 2446

**Test No.:** 29687-01 to 10

**Project:** EMSA 1

**Damage 1:** R7\_S7-9.1.0-1

**Wave Type:** Jonswap

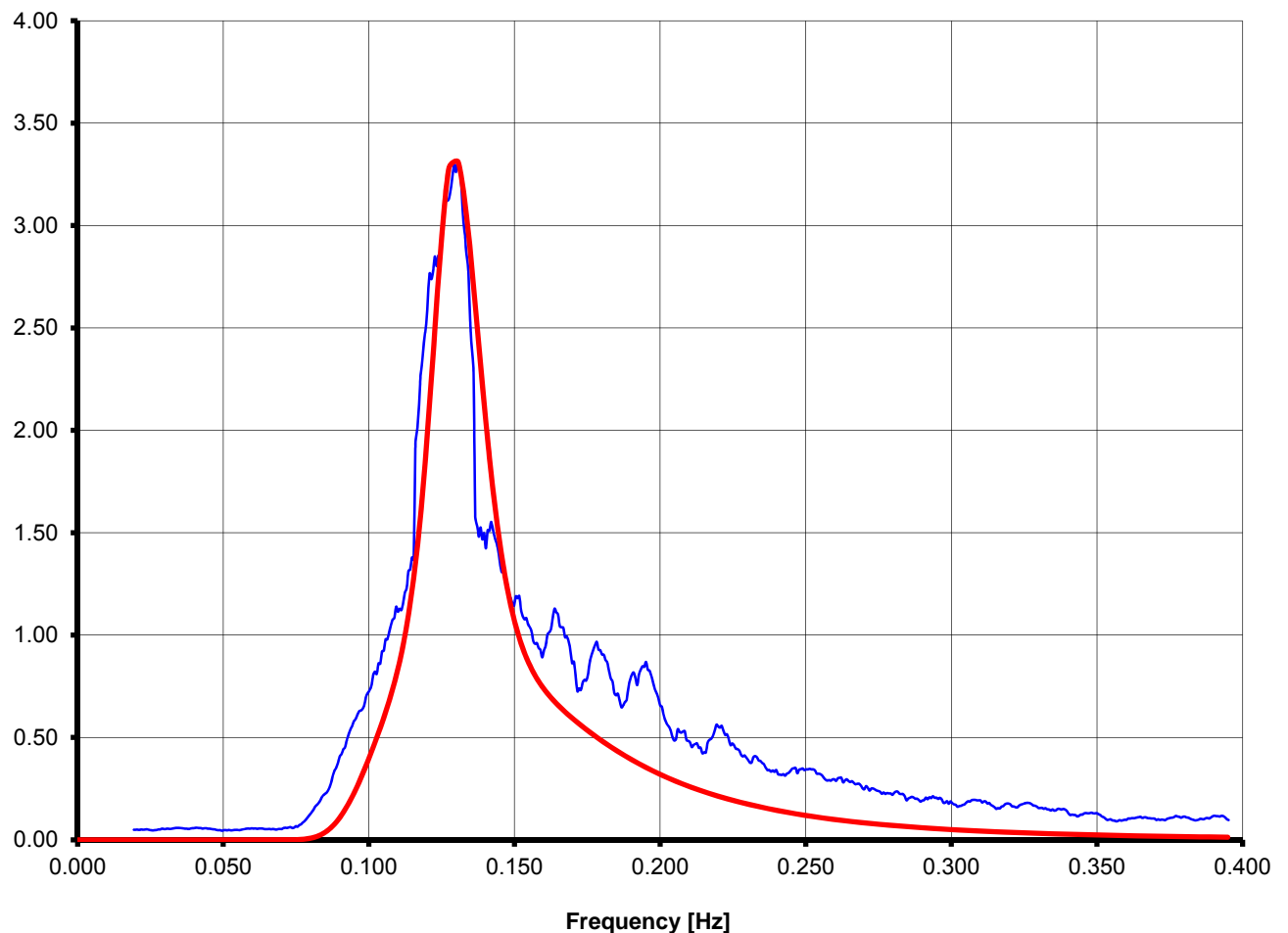
**Scale:** 25.00

### Short Waves

Parameter	Value	Units
$H_s$	<b>3.750</b>	m
gamma	3.300	
$T_p$	7.746	s
$T_z$	6.028	s

## Spectral Characteristics

**Spectral Density  $S(\omega)$  [ $m^2 \cdot s$ ]**



— Measured Wave Spectrum

— Target Wave Spectrum

# WAVE MEASUREMENT DURING THE TESTS (FIXED WAVE PROBE)

**Model No.:** 2446

**Test No.:** 29687-01 to 10

**Project:** EMSA 1

**Damage 1:** R7\_S7-9.1.0-1

**Wave Type:** Jonswap,  $\gamma = 3.3$

**Scale:** 25.00

Target of the Waves			Variation of the Waves		
H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>
[m]	[s]	[s]	[m]	[s]	[s]
<b>3.750</b>	7.746	6.028	3.750 - 3.844	7.552 - 7.940	5.727 - 6.329

No. of the Test	Wave No.	Location 1 (Wave Probe-1 DHI-834)			Location 2 (Wave Probe-2 DHI-835)			Location 3 (Wave Probe-3 DHI-836)		
		H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>
[ ]		[m]	[s]	[s]	[m]	[s]	[s]	[m]	[s]	[s]
29687-01	29687-01	3.8129	7.572	5.757						
-02	-02	3.7828	7.604	5.806						
-03	-03	3.7968	7.673	5.914						
-04	-04	3.7947	7.777	6.076						
-05	-05	3.8021	7.862	6.209						
-06	-06	3.8078	7.930	6.314						
-07	-07	3.8039	7.715	5.979						
-08	-08	3.8143	7.617	5.827						
-09	-09	3.8141	7.931	6.316						
-10	-10	3.8063	7.637	5.859						



## **Spectral Characteristics of the Target and Measured Waves**

**Model No. 2446**

**Project: “EMSA 1”**

**Damage Case-1 R7\_S7-9.1.0-1**

**Hs = 3.50 m**



## WAVE MEASUREMENT DURING THE TESTS

### Location 1 (Arc 29) Wave Probe-1 DHI-834

**Model No.:** 2446

**Test No.:** 29688-01 to 10

**Project:** EMSA 1

**Damage 1:** R7\_S7-9.1.0-1

**Wave Type:** Jonswap

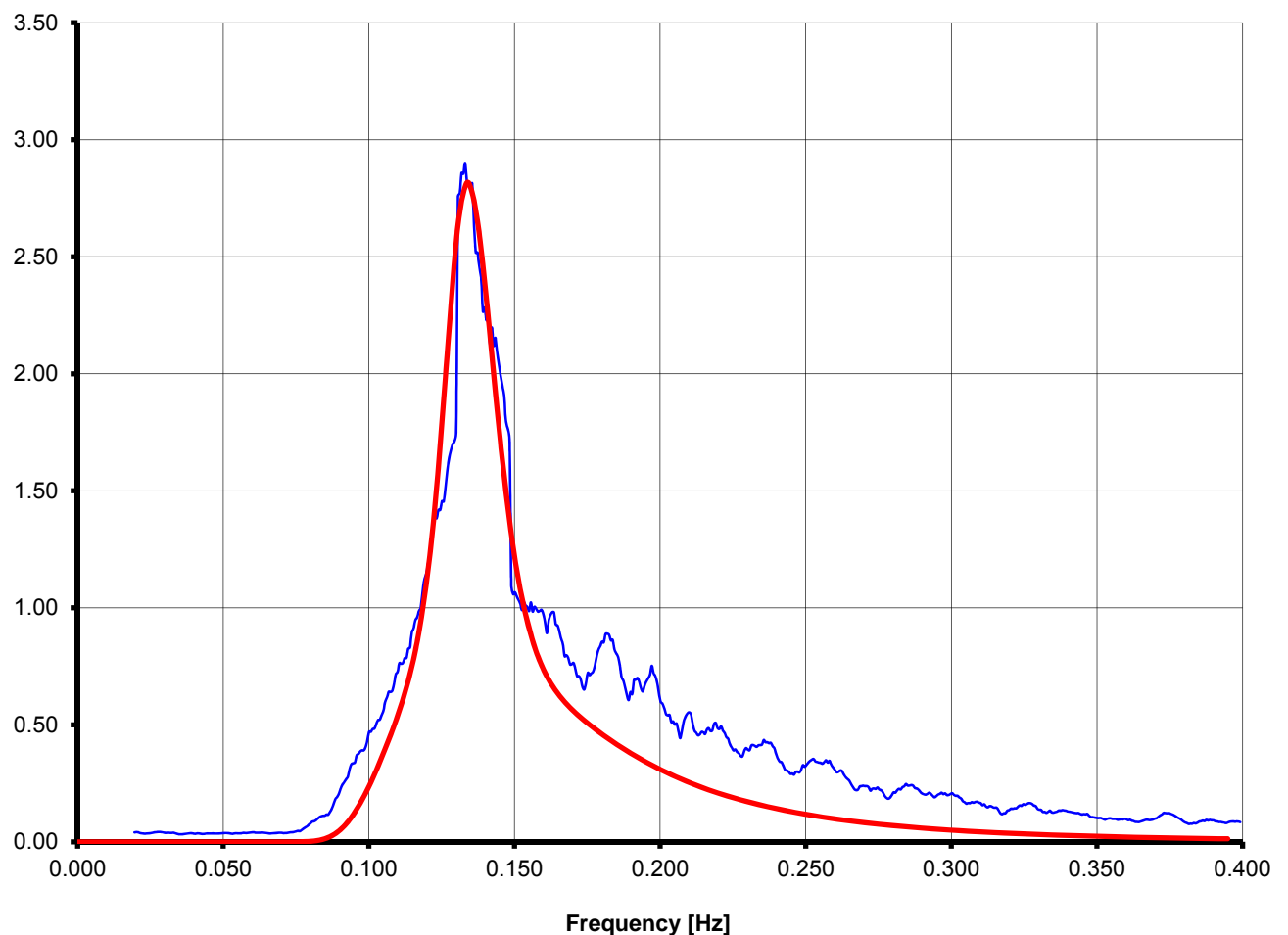
**Scale:** 25.00

### Short Waves

Parameter	Value	Units
$H_s$	<b>3.500</b>	m
gamma	3.300	
$T_p$	7.483	s
$T_z$	5.824	s

## Spectral Characteristics

**Spectral Density  $S(\omega)$  [ $m^2 \cdot s$ ]**



— Measured Wave Spectrum      — Target Wave Spectrum



# WAVE MEASUREMENT DURING THE TESTS (FIXED WAVE PROBE)

**Model No.:** 2446

**Test No.:** 29688-01 to 10

**Project:** EMSA 1

**Damage 1:** R7\_S7-9.1.0-1

**Wave Type:** Jonswap,  $\gamma = 3.3$

**Scale:** 25.00

Target of the Waves			Variation of the Waves		
H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>
[m]	[s]	[s]	[m]	[s]	[s]
<b>3.500</b>	7.483	5.824	3.500 - 3.588	7.296 - 7.670	5.532 - 6.115

No. of the Test	Wave No.	Location 1 (Wave Probe-1 DHI-834)			Location 2 (Wave Probe-2 DHI-835)			Location 3 (Wave Probe-3 DHI-836)		
		H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>
[ ]		[m]	[s]	[s]	[m]	[s]	[s]	[m]	[s]	[s]
29688-01	29688-01	3.5505	7.498	5.847						
-02	-02	3.5531	7.623	6.040						
-03	-03	3.5752	7.618	6.033						
-04	-04	3.5630	7.502	5.852						
-05	-05	3.5564	7.555	5.935						
-06	-06	3.5524	7.491	5.836						
-07	-07	3.5593	7.523	5.885						
-08	-08	3.5557	7.399	5.692						
-09	-09	3.5697	7.574	5.965						
-10	-10	3.5510	7.584	5.980						



## **Spectral Characteristics of the Target and Measured Waves**

**Model No. 2446**

**Project: "EMSA 1"**

**Damage Case-1 R7\_S7-9.1.0-1**

**Hs = 4.25 m**



## WAVE MEASUREMENT DURING THE TESTS

### Location 1 (Arc 29) Wave Probe-1 DHI-834

**Model No.:** 2446

**Test No.:** 29689-01 to 10

**Project:** EMSA 1

**Damage 1:** R7\_S7-9.1.0-1

**Wave Type:** Jonswap

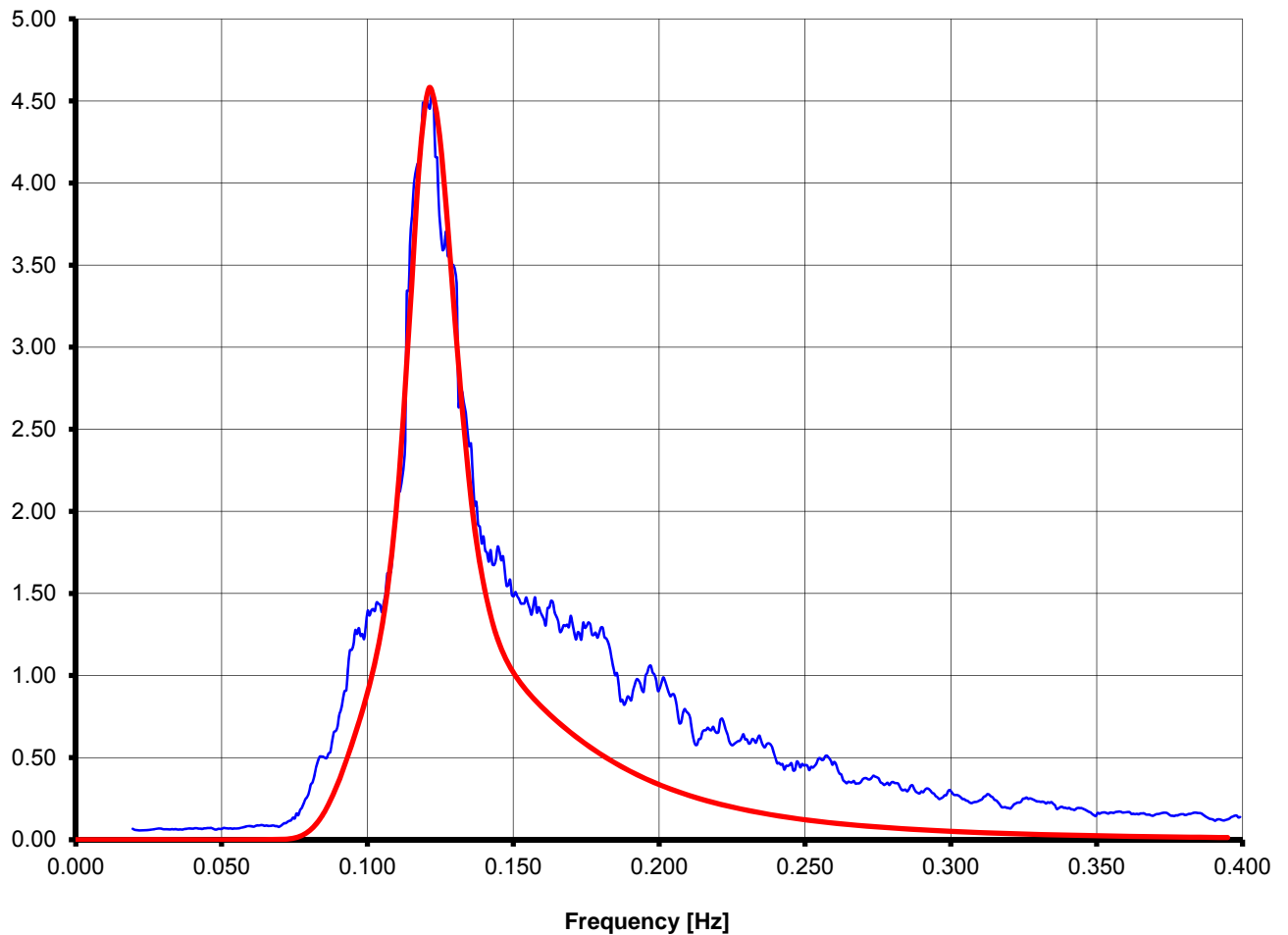
**Scale:** 25.00

#### Short Waves

Parameter	Value	Units
$H_s$	<b>4.250</b>	m
gamma	3.300	
$T_p$	8.246	s
$T_z$	6.417	s

### Spectral Characteristics

**Spectral Density  $S(\omega)$  [m<sup>2</sup>.s]**



— Measured Wave Spectrum      — Target Wave Spectrum

# WAVE MEASUREMENT DURING THE TESTS (FIXED WAVE PROPE)

**Model No.:** 2446

**Test No.:** 29689-01 to 10

**Project:** EMSA 1

**Damage 1:** R7\_S7-9.1.0-1

**Wave Type:** Jonswap,  $\gamma = 3.3$

**Scale:** 25.00

Target of the Waves			Variation of the Waves		
H <sub>s</sub>	T <sub>P</sub>	T <sub>Z</sub>	H <sub>s</sub>	T <sub>P</sub>	T <sub>Z</sub>
[m]	[s]	[s]	[m]	[s]	[s]
<b>4.250</b>	8.246	6.417	4.250 - 4.356	8.040 - 8.452	6.096 - 6.738

No. of the Test	Wave No.	Location 1 (Wave Probe-1 DHI-834)			Location 2 (Wave Probe-2 DHI-835)			Location 3 (Wave Probe-3 DHI-836)		
		Hs	Tp	Tz	Hs	Tp	Tz	Hs	Tp	Tz
[ ]		[m]	[s]	[s]	[m]	[s]	[s]	[m]	[s]	[s]
29689-01	29689-01	4.2873	8.192	6.332						
-02	-02	4.3034	8.183	6.319						
-03	-03	4.3042	8.433	6.708						
-04	-04	4.2608	8.186	6.323						
-05	-05	4.2771	8.227	6.387						
-06	-06	4.2930	8.074	6.149						
-07	-07	4.2586	8.319	6.531						
-08	-08	4.3301	8.054	6.118						
-09	-09	4.3100	8.223	6.381						
-10	-10	4.2878	8.095	6.181						



## **Spectral Characteristics of the Target and Measured Waves**

**Model No. 2446**

**Project: "EMSA 1"**

**Damage Case-1 R7\_S7-9.1.0-1**

**Hs = 3.35 m**



## WAVE MEASUREMENT DURING THE TESTS

### Location 1 (Arc 29) Wave Probe-1 DHI-834

**Model No.:** 2446

**Test No.:** 29690-01 to 10

**Project:** EMSA 1

**Damage 1:** R7\_S7-9.1.0-1

**Wave Type:** Jonswap

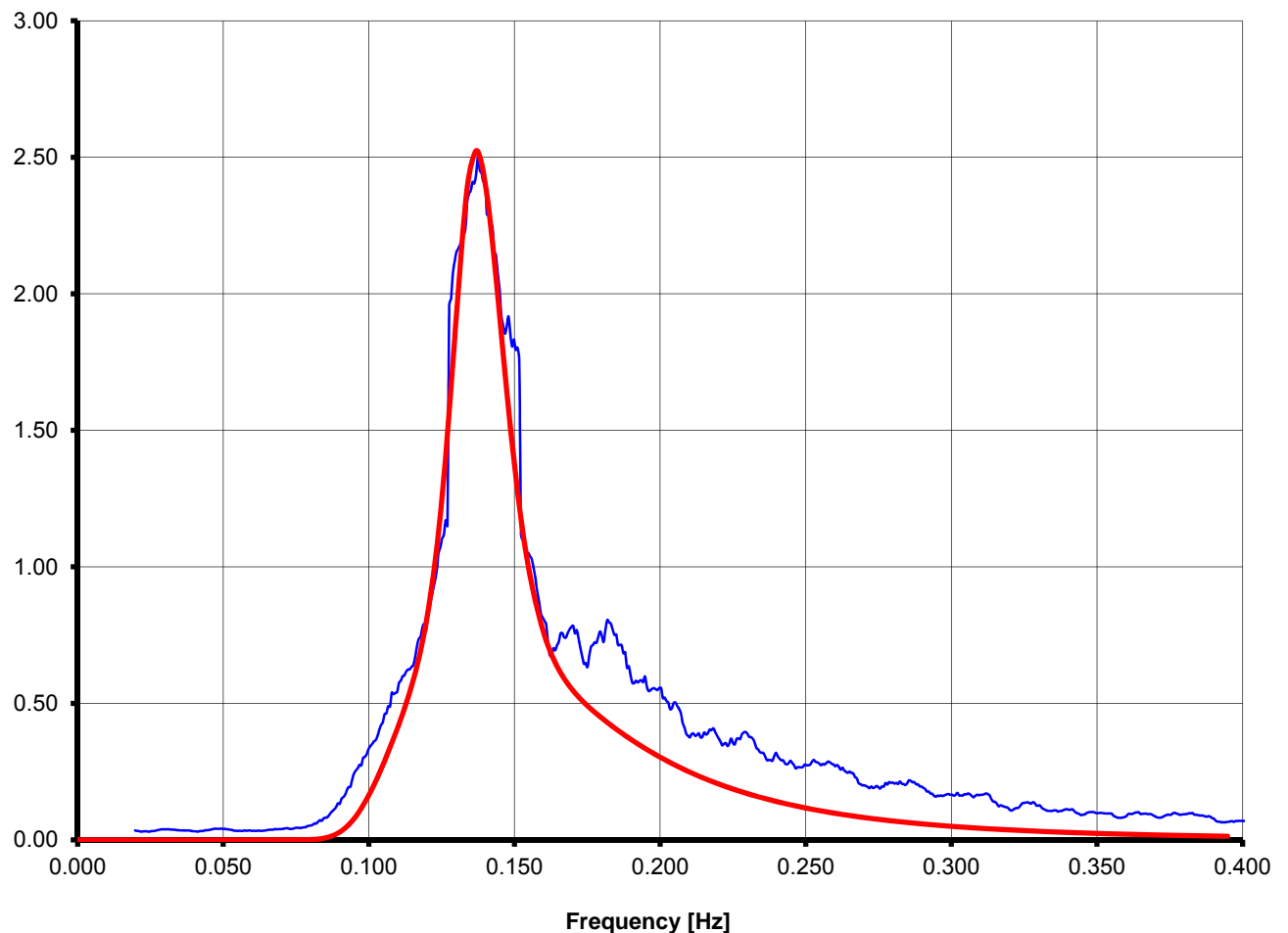
**Scale:** 25.00

#### Short Waves

Parameter	Value	Units
$H_s$	<b>3.350</b>	m
gamma	3.300	
$T_p$	7.321	s
$T_z$	5.697	s

### Spectral Characteristics

**Spectral Density  $S(\omega)$  [ $m^2 \cdot s$ ]**



— Measured Wave Spectrum      — Target Wave Spectrum

# WAVE MEASUREMENT DURING THE TESTS (FIXED WAVE PROPE)

**Model No.:** 2446

**Test No.:** 29690-01 to 10

**Project:** EMSA 1

**Damage 1:** R7\_S7-9.1.0-1

**Wave Type:** Jonswap,  $\gamma = 3.3$

**Scale:** 25.00

Target of the Waves			Variation of the Waves		
H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>
[m]	[s]	[s]	[m]	[s]	[s]
<b>3.350</b>	7.321	5.697	3.350 - 3.434	7.138 - 7.504	5.413 - 5.982

No. of the Test	Wave No.	Location 1 (Wave Probe-1 DHI-834)			Location 2 (Wave Probe-2 DHI-835)			Location 3 (Wave Probe-3 DHI-836)		
		H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>
[ ]		[m]	[s]	[s]	[m]	[s]	[s]	[m]	[s]	[s]
29690-01	29690-01	3.3962	7.393	5.809						
-02	-02	3.3988	7.202	5.512						
-03	-03	3.3902	7.246	5.581						
-04	-04	3.4133	7.330	5.711						
-05	-05	3.4041	7.276	5.627						
-06	-06	3.3953	7.406	5.829						
-07	-07	3.4075	7.212	5.527						
-08	-08	3.3906	7.416	5.845						
-09	-09	3.3935	7.392	5.808						
-10	-10	3.3843	7.502	5.979						



# **Spectral Characteristics of the Target and Measured Waves**

**Model No. 2446**

**Project: "EMSA 1"**

**Damage Case-1 R7\_S7-9.1.0-1**

**Hs = 3.90 m**





## WAVE MEASUREMENT DURING THE TESTS

### Location 1 (Arc 29) Wave Probe-1 DHI-834

**Model No.:** 2446

**Test No.:** 29691-01 to 10

**Project:** EMSA 1

**Damage 1:** R7\_S7-9.1.0-1

**Wave Type:** Jonswap

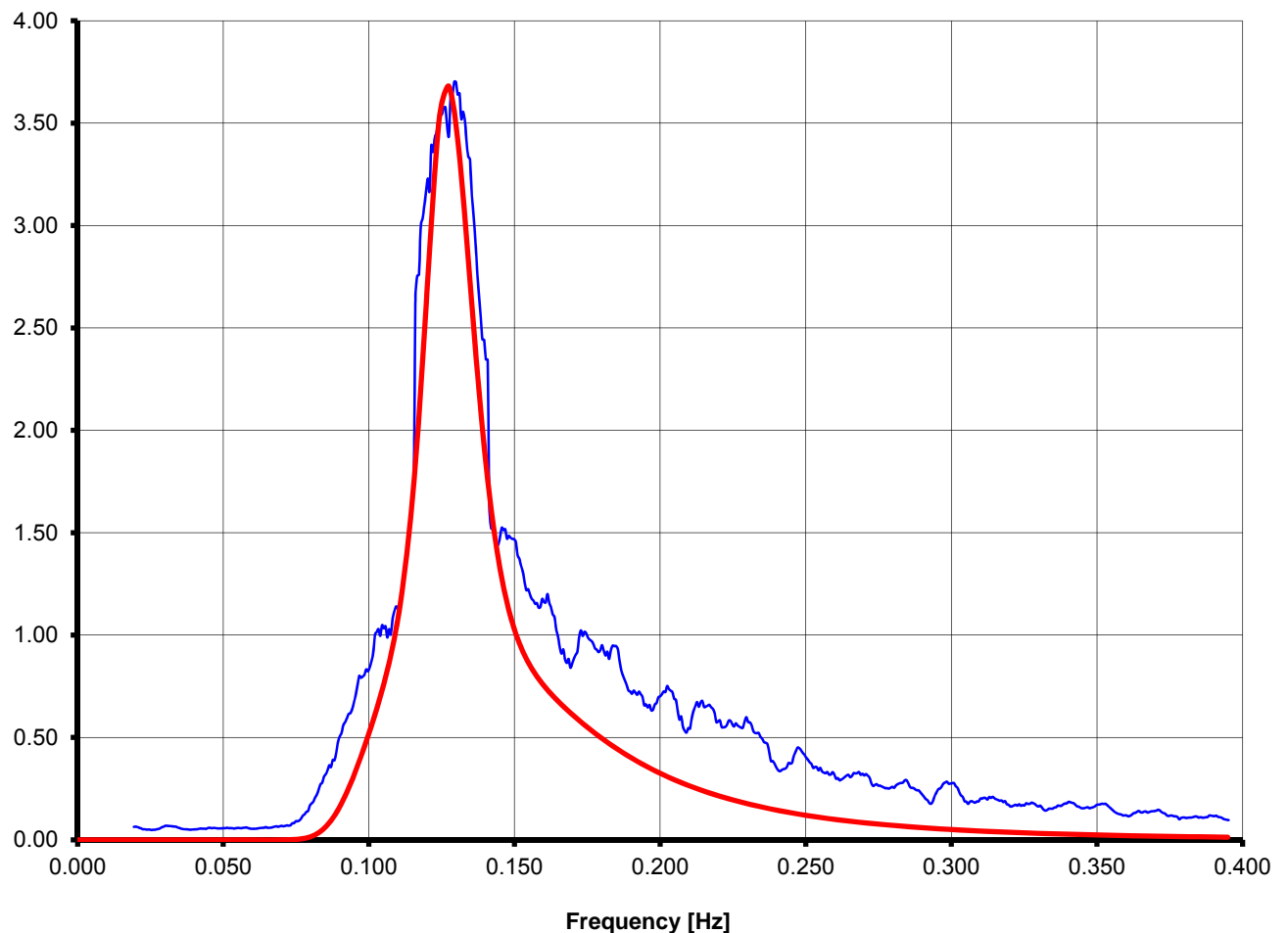
**Scale:** 25.00

#### Short Waves

Parameter	Value	Units
$H_s$	<b>3.900</b>	m
gamma	3.300	
$T_p$	7.899	s
$T_z$	6.147	s

### Spectral Characteristics

**Spectral Density  $S(\omega)$  [ $m^2 \cdot s$ ]**



— Measured Wave Spectrum      — Target Wave Spectrum

# WAVE MEASUREMENT DURING THE TESTS (FIXED WAVE PROPE)

**Model No.:** 2446

**Test No.:** 29691-01 to 10

**Project:** EMSA 1

**Damage 1:** R7\_S7-9.1.0-1

**Wave Type:** Jonswap,  $\gamma = 3.3$

**Scale:** 25.00

Target of the Waves			Variation of the Waves		
H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>
[m]	[s]	[s]	[m]	[s]	[s]
<b>3.900</b>	7.899	6.147	3.900 - 3.998	7.702 - 8.097	5.840 - 6.455

No. of the Test	Wave No.	Location 1 (Wave Probe-1 DHI-834)			Location 2 (Wave Probe-2 DHI-835)			Location 3 (Wave Probe-3 DHI-836)		
		Hs	Tp	Tz	Hs	Tp	Tz	Hs	Tp	Tz
[ ]		[m]	[s]	[s]	[m]	[s]	[s]	[m]	[s]	[s]
29691-01	29691-01	3.9437	7.803	5.998						
-02	-02	3.9415	7.752	5.918						
-03	-03	3.9513	7.891	6.135						
-04	-04	3.9611	7.744	5.906						
-05	-05	3.9542	8.037	6.362						
-06	-06	3.9536	7.926	6.189						
-07	-07	3.9630	7.725	5.876						
-08	-08	3.9719	8.007	6.314						
-09	-09	3.9496	8.025	6.342						
-10	-10	3.9363	8.066	6.407						



**Summary of the Measured Wave and Roll Time  
Realisations**

**Model No. 2446**

**Project: “EMSA 1”**

**Damage Case-1 R7\_S7-9.1.0-1**



# Sea Keeping Test in Irregular Seas (Statistics)

Evaluation of Damage (Ship Values)

Model No.: 2446

Test No.: 29678-01 - 10

Project: EMSA

Hs [m] = 4.00

Damage 1: R7\_S7-9.1.0-1

Scale = 25.00

Test No.	Description	RMS (SD) Value	Significant Value	max	min	mean	Drift [m]	Duration of the Tests [min]
29678-01	Roll Angle [deg]*	2.509	10.036	12.982	-0.817	4.814	823.6	30
	Pitch Angle [deg]**	0.290	1.161	1.948	-0.785	0.412		
	Heave	0.640	2.562	2.553	-2.257	0.017		
	Wave Elevation (fix) [m]			4.508	-3.135	-0.113		
-02	Roll Angle [deg]*	5.032	20.127	34.294	-8.669	5.491	640.5	30
	Pitch Angle [deg]**	0.323	1.294	1.512	-0.659	0.397		
	Heave	0.693	2.771	2.199	-2.131	0.014		
	Wave Elevation (fix) [m]			3.418	-3.522	-0.137		
-03	Roll Angle [deg]*	6.154	24.618	35.356	-15.689	6.184	408.2	30
	Pitch Angle [deg]**	0.326	1.304	1.732	-1.098	0.393		
	Heave	0.719	2.875	2.408	-2.108	0.064		
	Wave Elevation (fix) [m]			3.761	-3.269	-0.101		
-04	Roll Angle [deg]*	7.033	28.131	43.823	-6.577	8.634	492.8	30
	Pitch Angle [deg]**	0.322	1.288	1.804	-0.961	0.380		
	Heave	0.732	2.927	2.855	-2.541	0.015		
	Wave Elevation (fix) [m]			4.046	-2.778	-0.029		
-05	Roll Angle [deg]*	5.124	20.497	29.448	0.922	7.923	214.6	30
	Pitch Angle [deg]**	0.295	1.178	1.278	-0.461	0.393		
	Heave	0.745	2.981	2.150	-2.504	0.014		
	Wave Elevation (fix) [m]			3.555	-2.421	-0.225		
-06	Roll Angle [deg]*	5.951	23.803	41.940	-0.223	8.517	640.4	30
	Pitch Angle [deg]**	0.302	1.209	1.508	-0.720	0.393		
	Heave	0.718	2.871	2.032	-2.106	-0.083		
	Wave Elevation (fix) [m]			3.832	-3.027	-0.210		
-07	Roll Angle [deg]*	8.261	33.043	40.435	1.264	10.210	279.6	30
	Pitch Angle [deg]**	0.360	1.440	1.375	-0.605	0.388		
	Heave	0.753	3.012	1.761	-1.969	-0.053		
	Wave Elevation (fix) [m]			3.425	-2.769	-0.021		
-08	Roll Angle [deg]*	8.205	32.820	42.973	1.926	11.778	292.3	30
	Pitch Angle [deg]**	0.349	1.397	1.397	-0.583	0.394		
	Heave	0.698	2.790	2.233	-2.363	-0.010		
	Wave Elevation (fix) [m]			3.464	-2.670	-0.186		
-09	Roll Angle [deg]*	9.462	37.847	40.896	3.434	15.756	164.7	30
	Pitch Angle [deg]**	0.353	1.413	1.303	-0.526	0.392		
	Heave	0.744	2.975	1.954	-2.286	-0.059		
	Wave Elevation (fix) [m]			3.350	-2.844	-0.096		
-10	Roll Angle [deg]*	10.227	40.910	43.232	2.124	16.013	225.2	30
	Pitch Angle [deg]**	0.259	1.035	1.213	-0.360	0.389		
	Heave	0.656	2.624	1.453	-1.759	-0.125		
	Wave Elevation (fix) [m]			2.779	-2.501	-0.103		



## Sea Keeping Test in Irregular Seas (Statistics)

Evaluation of Damage (Ship Values)

**Model No.: 2446**

**Test No.: 29680-01 - 05**

**Project: EMSA**

**Hs [m] = 3.00**

**Damage 1: R7\_S7-9.1.0-1**

**Scale = 25.00**

Test No.	Description	RMS (SD) Value	Significant Value	max	min	mean	Drift [m]	Duration of the Tests [min]
29680-01	Roll Angle [deg]*	2.353	9.413	12.431	-0.504	4.943	903.7	30
	Pitch Angle [deg]**	0.258	1.030	1.397	-0.720	0.401		
	Heave	0.518	2.070	1.861	-1.693	0.027		
	Wave Elevation (fix) [m]			3.297	-2.427	-0.015		
-02	Roll Angle [deg]*	1.397	5.590	9.331	-0.439	4.531	995.3	30
	Pitch Angle [deg]**	0.281	1.123	1.357	0.533	0.404		
	Heave	0.479	1.915	1.649	-1.717	-0.008		
	Wave Elevation (fix) [m]			2.755	-2.459	-0.147		
-03	Roll Angle [deg]*	1.317	5.268	8.467	-0.133	3.746	1031.0	30
	Pitch Angle [deg]**	0.346	1.384	1.469	-0.779	0.411		
	Heave	0.484	1.937	2.442	-2.204	-0.006		
	Wave Elevation (fix) [m]			3.354	-2.202	-0.057		
-04	Roll Angle [deg]*	2.510	10.038	14.123	-0.047	4.350	1014.4	30
	Pitch Angle [deg]**	0.322	1.287	1.415	-0.749	0.404		
	Heave	0.471	1.883	2.557	-2.193	0.005		
	Wave Elevation (fix) [m]			3.021	-2.539	-0.049		
-05	Roll Angle [deg]*	1.506	6.024	9.266	0.043	3.995	1020.1	30
	Pitch Angle [deg]**	0.356	1.426	2.045	-0.979	0.414		
	Heave	0.460	1.842	1.977	-1.987	-0.019		
	Wave Elevation (fix) [m]			3.092	-2.491	-0.059		



# Sea Keeping Test in Irregular Seas (Statistics)

Evaluation of Damage (Ship Values)

Model No.: 2446

Test No.: 29681-01 - 10

Project: EMSA

Hs [m] = 3.50

Damage 1: R7\_S7-9.1.0-1

Scale = 25.00

Test No.	Description	RMS (SD) Value	Significant Value	max	min	mean	Drift [m]	Duration of the Tests [min]
29681-01	Roll Angle [deg]*	6.725	26.899	41.612	-8.449	6.007	760.0	30
	Pitch Angle [deg]**	0.286	1.143	1.343	-0.565	0.393		
	Heave	0.580	2.320	1.973	-1.967	-0.057		
	Wave Elevation (fix) [m]			3.407	-2.948	-0.144		
-02	Roll Angle [deg]*	2.082	8.329	12.060	0.454	5.209	1054.3	30
	Pitch Angle [deg]**	0.325	1.302	1.570	-0.839	0.408		
	Heave	0.579	2.317	1.861	-1.737	0.028		
	Wave Elevation (fix) [m]			3.432	-3.082	0.064		
-03	Roll Angle [deg]*	2.454	9.814	11.473	-0.043	5.046	1075.2	30
	Pitch Angle [deg]**	0.344	1.378	1.678	-0.828	0.409		
	Heave	0.588	2.352	2.031	-2.259	-0.015		
	Wave Elevation (fix) [m]			3.406	-2.928	-0.110		
-04	Roll Angle [deg]*	2.086	8.343	14.418	0.248	5.021	1100.3	30
	Pitch Angle [deg]**	0.320	1.282	1.483	-0.770	0.409		
	Heave	0.571	2.283	2.586	-2.710	-0.054		
	Wave Elevation (fix) [m]			3.529	-2.969	-0.160		
-05	Roll Angle [deg]*	2.996	11.985	14.605	0.346	6.072	1113.4	30
	Pitch Angle [deg]**	0.364	1.458	1.912	-0.950	0.408		
	Heave	0.586	2.344	2.251	-2.095	0.019		
	Wave Elevation (fix) [m]			3.323	-3.170	-0.093		
-06	Roll Angle [deg]*	6.061	24.243	40.230	-1.793	7.303	1211.8	30
	Pitch Angle [deg]**	0.329	1.314	1.631	-0.871	0.389		
	Heave	0.575	2.301	1.909	-2.277	-0.063		
	Wave Elevation (fix) [m]			4.167	-2.673	-0.044		
-07	Roll Angle [deg]*	1.971	7.882	12.456	0.425	5.050	1192.5	30
	Pitch Angle [deg]**	0.321	1.642	-0.781	0.417	0.000		
	Heave	0.559	2.234	1.764	-1.880	-0.007		
	Wave Elevation (fix) [m]			3.328	-3.109	-0.075		
-08	Roll Angle [deg]*	2.281	9.125	15.570	0.922	5.240	1210.1	30
	Pitch Angle [deg]**	0.327	1.310	1.674	-0.932	0.411		
	Heave	0.589	2.356	2.509	-0.769	-0.050		
	Wave Elevation (fix) [m]			4.034	-2.768	-0.050		
-09	Roll Angle [deg]*	2.547	10.187	14.479	0.490	5.977	1141.7	30
	Pitch Angle [deg]**	0.331	1.325	1.710	-0.893	0.399		
	Heave	0.598	2.391	2.341	-2.275	-0.013		
	Wave Elevation (fix) [m]			3.464	-3.001	-0.117		
-10	Roll Angle [deg]*	10.929	43.718	43.081	0.173	11.556	296.8	30
	Pitch Angle [deg]**	0.697	2.790	1.552	-2.812	-0.415		
	Heave	0.697	2.790	1.552	-2.812	-0.415		
	Wave Elevation (fix) [m]			2.855	-2.608	-0.024		



# Sea Keeping Test in Irregular Seas (Statistics)

Evaluation of Damage (Ship Values)

Model No.: 2446

Test No.: 29682-01 - 10

Project: EMSA

Hs [m] = 3.25

Damage 1: R7\_S7-9.1.0-1

Scale = 25.00

Test No.	Description	RMS (SD) Value	Significant Value	max	min	mean	Drift [m]	Duration of the Tests [min]
29682-01	Roll Angle [deg]*	2.082	8.329	12.060	0.454	5.209	1054.3	30
	Pitch Angle [deg]**	0.325	1.302	1.570	-0.839	0.408		
	Heave	0.579	2.317	1.836	-1.762	0.003		
	Wave Elevation (fix) [m]			3.303	-2.451	-0.002		
-02	Roll Angle [deg]*	2.237	8.947	13.770	1.588	5.432	1086.2	30
	Pitch Angle [deg]**	0.342	1.370	1.732	-0.900	0.411		
	Heave	0.517	2.069	1.838	-1.798	0.001		
	Wave Elevation (fix) [m]			3.327	-2.803	-0.017		
-03	Roll Angle [deg]*	1.821	7.286	10.584	0.133	4.647	1118.1	30
	Pitch Angle [deg]**	0.512	2.050	2.331	-2.057	-0.028		
	Heave	0.827	3.308	3.423	-2.813	-0.043		
	Wave Elevation (fix) [m]			0.301	0.000	0.074		
-04	Roll Angle [deg]*	1.733	6.931	13.392	0.450	4.212	1053.7	30
	Pitch Angle [deg]**	0.360	1.441	1.865	-1.051	0.419		
	Heave	0.487	1.947	2.265	-2.505	-0.018		
	Wave Elevation (fix) [m]			3.225	-2.823	-0.116		
-05	Roll Angle [deg]*	1.564	6.256	9.518	0.256	4.391	1117.8	30
	Pitch Angle [deg]**	0.369	1.475	1.706	-0.886	0.419		
	Heave	0.501	2.005	1.674	-2.080	-0.255		
	Wave Elevation (fix) [m]			2.938	-2.858	-0.320		
-06	Roll Angle [deg]*	1.236	4.945	9.076	0.155	3.960	974.7	30
	Pitch Angle [deg]**	0.261	1.043	1.327	-0.608	0.399		
	Heave	0.532	2.129	1.830	-1.874	-0.024		
	Wave Elevation (fix) [m]			3.352	-2.588	-0.009		
-07	Roll Angle [deg]*	2.767	11.066	13.194	-0.439	5.739	1046.4	30
	Pitch Angle [deg]**	0.284	1.137	1.350	-0.601	0.395		
	Heave	0.563	2.251	2.100	-1.872	-0.024		
	Wave Elevation (fix) [m]			3.512	-2.888	-0.038		
-08	Roll Angle [deg]*	1.919	7.677	11.804	0.533	4.992	1187.9	30
	Pitch Angle [deg]**	0.318	1.272	1.836	-0.922	0.409		
	Heave	0.542	2.170	1.757	-1.881	-0.038		
	Wave Elevation (fix) [m]			3.396	-2.642	-0.024		
-09	Roll Angle [deg]*	1.785	7.139	9.925	-0.014	4.547	1162.1	30
	Pitch Angle [deg]**	0.303	1.213	1.415	-0.562	0.417		
	Heave	0.547	2.189	2.383	-2.021	-0.015		
	Wave Elevation (fix) [m]			3.600	-2.846	-0.250		
-10	Roll Angle [deg]*	1.685	6.738	12.949	0.234	4.622	1225.3	30
	Pitch Angle [deg]**	0.313	1.250	1.462	-0.670	0.410		
	Heave	-0.522	2.087	2.352	-2.392	0.022		
	Wave Elevation (fix) [m]			3.770	-2.576	-0.011		



# Sea Keeping Test in Irregular Seas (Statistics)

Evaluation of Damage (Ship Values)

**Model No.: 2446**

**Test No.: 29683-01 - 10**

**Project: EMSA**

**Hs [m] = 4.00**

**Damage 1: R7\_S7-9.1.0-1**

**Scale = 25.00**

Test No.	Description	RMS (SD) Value	Significant Value	max	min	mean	Drift [m]	Duration of the Tests [min]
29683-01	Roll Angle [deg]*	7.777	31.107	46.393	0.324	9.290	638.9	30
	Pitch Angle [deg]**	0.315	1.259	1.570	-0.547	0.379		
	Heave	0.678	2.711	2.075	-2.201	-0.019		
	Wave Elevation (fix) [m]			3.805	-2.810	-0.046		
-02	Roll Angle [deg]*	10.474	41.896	46.724	1.062	12.111	348.9	30
	Pitch Angle [deg]**	0.362	1.447	1.472	-1.026	0.366		
	Heave	0.690	2.759	1.835	-1.847	-0.008		
	Wave Elevation (fix) [m]			3.912	-2.861	-0.113		
-03	Roll Angle [deg]*	2.626	10.503	14.310	-0.914	3.863	1169.1	30
	Pitch Angle [deg]**	0.333	1.331	1.926	-0.986	0.426		
	Heave	0.676	2.705	2.114	-2.432	-0.110		
	Wave Elevation (fix) [m]			4.007	-3.173	0.014		
-04	Roll Angle [deg]*	1.965	7.859	10.992	-1.270	3.694	1214.2	30
	Pitch Angle [deg]**	0.325	1.300	1.451	-0.713	0.423		
	Heave	0.677	2.706	2.542	-2.204	0.099		
	Wave Elevation (fix) [m]			4.043	-3.213	-0.127		
-05	Roll Angle [deg]*	2.132	8.528	12.676	-0.482	5.359	1217.6	30
	Pitch Angle [deg]**	0.345	1.379	1.627	-0.778	0.407		
	Heave	0.664	2.658	2.522	-2.380	-0.014		
	Wave Elevation (fix) [m]			3.914	-4.047	-0.231		
-06	Roll Angle [deg]*	9.326	37.305	51.415	0.641	9.727	654.3	30
	Pitch Angle [deg]**	0.344	1.374	1.444	-0.738	0.380		
	Heave	0.675	2.700	2.020	-2.688	-0.118		
	Wave Elevation (fix) [m]			4.534	-3.347	-0.111		
-07	Roll Angle [deg]*	7.745	30.980	40.165	1.940	10.835	406.9	30
	Pitch Angle [deg]**	0.318	1.273	1.735	-0.752	0.366		
	Heave	0.697	2.789	2.426	-2.010	0.094		
	Wave Elevation (fix) [m]			3.470	-3.138	0.008		
-08	Roll Angle [deg]*	9.387	37.547	47.560	0.443	9.791	550.6	30
	Pitch Angle [deg]**	0.311	1.245	1.408	-0.547	0.384		
	Heave	0.692	2.769	2.278	-2.104	-0.013		
	Wave Elevation (fix) [m]			3.720	-3.393	-0.172		
-09	Roll Angle [deg]*	6.645	26.579	38.383	1.573	8.717	525.7	30
	Pitch Angle [deg]**	0.352	1.407	1.465	-0.716	0.386		
	Heave	0.699	2.794	2.571	-2.871	-0.012		
	Wave Elevation (fix) [m]			4.299	-2.640	-0.011		
-10	Roll Angle [deg]*	13.279	53.114	46.732	-16.495	11.383	356.2	30
	Pitch Angle [deg]**	0.368	1.472	1.523	-0.706	0.366		
	Heave	0.755	3.021	2.348	-2.514	-0.099		
	Wave Elevation (fix) [m]			3.477	-2.591	-0.014		





# Sea Keeping Test in Irregular Seas (Statistics)

Evaluation of Damage (Ship Values)

Model No.: 2446

Test No.: 29687-01 - 10

Project: EMSA

Hs [m] = 3.75

Damage 1: R7\_S7-9.1.0-1

Scale = 25.00

Test No.	Description	RMS (SD) Value	Significant Value	max	min	mean	Drift [m]	Duration of the Tests [min]
29687-01	Roll Angle [deg]*	2.544	10.177	14.519	-0.698	4.914	929.6	30
	Pitch Angle [deg]**	0.310	1.238	1.638	-0.796	0.377		
	Heave	0.652	2.607	2.254	-2.368	-0.075		
	Wave Elevation (fix) [m]			4.418	-2.996	-0.135		
-02	Roll Angle [deg]*	2.052	8.209	11.455	0.202	4.804	996.0	30
	Pitch Angle [deg]**	0.311	1.244	1.523	-0.655	0.378		
	Heave	0.626	2.506	1.898	-1.778	-0.006		
	Wave Elevation (fix) [m]			3.970	-3.209	-0.083		
-03	Roll Angle [deg]*	2.149	8.596	12.078	-0.799	4.686	1016.0	30
	Pitch Angle [deg]**	0.330	1.319	1.620	-0.688	0.376		
	Heave	0.643	2.573	2.121	-2.577	-0.076		
	Wave Elevation (fix) [m]			3.729	-3.059	-0.088		
-04	Roll Angle [deg]*	1.978	7.911	13.925	-0.090	4.307	991.9	30
	Pitch Angle [deg]**	0.341	1.364	1.548	-0.760	0.375		
	Heave	0.636	2.543	2.590	-2.366	0.026		
	Wave Elevation (fix) [m]			4.101	-2.895	-0.036		
-05	Roll Angle [deg]*	2.473	9.893	13.838	0.122	5.135	1006.1	30
	Pitch Angle [deg]**	0.328	1.313	1.613	-0.832	0.373		
	Heave	0.611	2.445	1.906	-2.042	-0.016		
	Wave Elevation (fix) [m]			4.162	-3.572	-0.202		
-06	Roll Angle [deg]*	1.505	6.019	8.935	0.277	4.106	974.6	30
	Pitch Angle [deg]**	0.348	1.392	1.566	-0.821	0.379		
	Heave	0.603	2.410	2.251	-2.201	-0.004		
	Wave Elevation (fix) [m]			3.277	-3.087	-0.086		
-07	Roll Angle [deg]*	1.920	7.681	11.196	-0.817	4.249	973.7	30
	Pitch Angle [deg]**	0.343	1.370	1.692	-0.954	0.373		
	Heave	0.599	2.398	2.547	-2.291	-0.032		
	Wave Elevation (fix) [m]			4.450	-2.853	-0.020		
-08	Roll Angle [deg]*	1.760	7.039	10.667	-0.173	3.813	864.3	30
	Pitch Angle [deg]**	0.377	1.509	1.742	-1.022	0.376		
	Heave	0.597	2.388	2.008	-2.112	-0.098		
	Wave Elevation (fix) [m]			3.842	-2.803	-0.010		
-09	Roll Angle [deg]*	1.697	6.789	9.407	-0.659	3.903	974.8	30
	Pitch Angle [deg]**	0.608	2.432	1.928	-2.200	-0.064		
	Heave	0.608	2.432	1.928	-2.200	-0.064		
	Wave Elevation (fix) [m]			3.776	-2.898	0.016		
-10	Roll Angle [deg]*	1.665	6.658	10.404	-0.252	3.515	900.3	30
	Pitch Angle [deg]**	3.490	1.394	1.613	-0.738	0.381		
	Heave	0.570	2.281	2.458	-2.220	0.026		
	Wave Elevation (fix) [m]			4.114	-3.016	0.001		



# Sea Keeping Test in Irregular Seas (Statistics)

Evaluation of Damage (Ship Values)

Model No.: 2446

Test No.: 29688-01 - 10

Project: EMSA

Hs [m] = 3.50

Damage 1: R7\_S7-9.1.0-1

Scale = 25.00

Test No.	Description	RMS (SD) Value	Significant Value	max	min	mean	Drift [m]	Duration of the Tests [min]
29688-01	Roll Angle [deg]*	1.523	6.093	7.502	-0.227	3.047	853.8	30
	Pitch Angle [deg]**	0.377	1.507	1.656	-0.947	0.379		
	Heave	0.515	2.060	2.102	-1.696	0.087		
	Wave Elevation (fix) [m]			4.277	-2.455	-0.011		
-02	Roll Angle [deg]*	1.447	5.786	80.320	0.018	2.954	959.9	30
	Pitch Angle [deg]**	0.379	1.517	1.886	-1.109	0.379		
	Heave	0.491	1.963	1.778	-1.738	-0.016		
	Wave Elevation (fix) [m]			3.329	-2.562	0.001		
-03	Roll Angle [deg]*	1.522	6.089	8.518	-0.288	2.615	740.1	30
	Pitch Angle [deg]**	0.340	1.360	1.552	-0.871	0.382		
	Heave	0.508	2.033	2.056	-1.678	0.124		
	Wave Elevation (fix) [m]			3.512	-2.641	0.093		
-04	Roll Angle [deg]*	1.314	5.254	7.438	-0.979	2.719	805.5	30
	Pitch Angle [deg]**	0.419	1.678	1.976	-1.127	0.379		
	Heave	0.499	1.996	2.323	-2.139	0.018		
	Wave Elevation (fix) [m]			3.783	-2.882	-0.008		
-05	Roll Angle [deg]*	1.142	4.570	7.268	0.043	3.091	892.9	30
	Pitch Angle [deg]**	0.400	1.599	1.692	-0.878	0.379		
	Heave	0.505	2.019	1.791	-1.721	0.026		
	Wave Elevation (fix) [m]			3.352	-2.700	-0.117		
-06	Roll Angle [deg]*	1.400	5.599	9.526	-0.018	3.117	962.8	30
	Pitch Angle [deg]**	0.387	1.546	1.858	-0.907	0.377		
	Heave	0.506	2.024	2.147	-2.093	0.021		
	Wave Elevation (fix) [m]			3.302	-2.509	-0.013		
-07	Roll Angle [deg]*	1.058	4.233	7.661	0.050	2.633	936.2	30
	Pitch Angle [deg]**	0.412	1.647	1.901	-0.857	0.379		
	Heave	0.457	1.830	1.866	-1.560	0.052		
	Wave Elevation (fix) [m]			3.592	-2.684	0.006		
-08	Roll Angle [deg]*	1.108	4.432	6.368	-0.104	2.517	772.3	30
	Pitch Angle [deg]**	0.419	1.676	1.818	-1.091	0.380		
	Heave	0.468	1.872	1.886	-1.854	-0.006		
	Wave Elevation (fix) [m]			3.743	-2.846	-0.025		
-09	Roll Angle [deg]*	1.113	4.450	8.204	-0.994	2.532	832.4	30
	Pitch Angle [deg]**	0.385	1.540	1.602	-0.853	0.383		
	Heave	0.443	1.773	2.434	-2.098	0.091		
	Wave Elevation (fix) [m]			4.277	-2.679	-0.004		
-10	Roll Angle [deg]*	0.854	3.415	6.041	0.054	2.438	882.6	30
	Pitch Angle [deg]**	0.423	1.694	2.048	-1.109	0.396		
	Heave	0.404	1.618	1.495	-1.497	0.011		
	Wave Elevation (fix) [m]			3.542	-2.446	-0.014		



# Sea Keeping Test in Irregular Seas (Statistics)

Evaluation of Damage (Ship Values)

Model No.: 2446

Test No.: 29689-01 - 10

Project: EMSA

Hs [m] = 4.25

Damage 1: R7\_S7-9.1.0-1

Scale = 25.00

Test No.	Description	RMS (SD) Value	Significant Value	max	min	mean	Drift [m]	Duration of the Tests [min]
29689-01	Roll Angle [deg]*	0.000	0.000	9.349	-0.500	2.667	0.0	30
	Pitch Angle [deg]**	0.000	0.000	1.886	-1.181	0.383		
	Heave	0.000	0.000	0.000	0.000	0.000		
	Wave Elevation (fix) [m]			0.000	0.000	0.000		
-02	Roll Angle [deg]*	2.136	8.545	10.598	0.014	3.586	951.3	30
	Pitch Angle [deg]**	0.427	1.708	1.775	-1.048	0.370		
	Heave	0.637	2.546	2.775	-2.797	-0.003		
	Wave Elevation (fix) [m]			4.394	-2.948	-0.012		
-03	Roll Angle [deg]*	1.554	6.217	9.094	0.655	3.879	1081.4	30
	Pitch Angle [deg]**	0.392	1.569	1.555	-0.738	0.376		
	Heave	0.615	2.462	1.966	-1.872	-0.044		
	Wave Elevation (fix) [m]			4.053	-3.075	-0.040		
-04	Roll Angle [deg]*	2.082	8.327	11.473	-0.360	5.182	874.4	30
	Pitch Angle [deg]**	0.313	1.250	1.796	-0.914	0.237		
	Heave	0.736	2.944	3.183	-2.573	-0.009		
	Wave Elevation (fix) [m]			4.257	-3.599	-0.015		
-05	Roll Angle [deg]*	2.498	9.992	14.364	0.482	5.988	794.9	30
	Pitch Angle [deg]**	0.366	1.466	1.904	-1.274	0.328		
	Heave	0.763	3.051	2.349	-2.799	-0.103		
	Wave Elevation (fix) [m]			4.504	-3.216	-0.013		
-06	Roll Angle [deg]*	4.076	16.306	21.686	-7.060	6.935	725.0	30
	Pitch Angle [deg]**	0.330	1.320	1.526	-0.684	0.318		
	Heave	0.738	2.950	2.477	-2.479	-0.003		
	Wave Elevation (fix) [m]			5.092	-2.922	-0.045		
-07	Roll Angle [deg]*	4.552	18.207	23.731	-0.623	7.893	608.7	30
	Pitch Angle [deg]**	0.356	1.424	1.613	-0.770	0.321		
	Heave	0.754	3.015	3.452	-2.994	-0.035		
	Wave Elevation (fix) [m]			4.025	-3.449	-0.002		
-08	Roll Angle [deg]*	8.803	35.210	35.881	-12.532	11.142	184.7	30
	Pitch Angle [deg]**	0.348	1.393	1.386	-0.727	0.319		
	Heave	0.905	3.619	2.426	-2.514	-0.025		
	Wave Elevation (fix) [m]			3.174	-2.712	-0.008		
-09	Roll Angle [deg]*	2.324	9.294	12.247	0.410	5.519	792.6	30
	Pitch Angle [deg]**	0.366	1.465	1.624	-0.828	0.335		
	Heave	0.672	2.686	2.473	-2.495	-0.016		
	Wave Elevation (fix) [m]			4.493	-3.682	-0.057		
-10	Roll Angle [deg]*	4.693	18.772	32.008	-0.079	6.036	377.7	30
	Pitch Angle [deg]**	0.331	1.323	1.501	-0.990	0.333		
	Heave	0.698	2.792	2.181	-2.525	-0.029		
	Wave Elevation (fix) [m]			4.726	-3.839	0.002		



# Sea Keeping Test in Irregular Seas (Statistics)

Evaluation of Damage (Ship Values)

Model No.: 2446

Test No.: 29690-01 - 10

Project: EMSA

Hs [m] = 3.35

Damage 1: R7\_S7-9.1.0-1

Scale = 25.00

Test No.	Description	RMS (SD) Value	Significant Value	max	min	mean	Drift [m]	Duration of the Tests [min]
29690-01	Roll Angle [deg]*	1.724	6.895	9.529	-0.612	4.138	639.9	30
	Pitch Angle [deg]**	0.313	1.251	1.433	-0.781	0.339		
	Heave	0.540	2.161	2.411	-2.245	0.001		
	Wave Elevation (fix) [m]			3.456	-2.985	-0.020		
-02	Roll Angle [deg]*	1.976	7.906	11.149	-0.068	4.422	713.5	30
	Pitch Angle [deg]**	0.351	1.402	1.681	-0.886	0.337		
	Heave	0.521	2.085	1.893	-2.097	0.001		
	Wave Elevation (fix) [m]			3.776	-2.693	-0.016		
-03	Roll Angle [deg]*	1.735	6.938	9.691	0.266	4.032	690.4	30
	Pitch Angle [deg]**	0.337	1.347	1.382	-0.925	0.338		
	Heave	0.549	2.194	2.435	-2.053	0.034		
	Wave Elevation (fix) [m]			3.340	-2.848	-0.014		
-04	Roll Angle [deg]*	2.090	8.360	15.070	0.353	4.681	715.6	30
	Pitch Angle [deg]**	0.328	1.312	1.454	-0.799	0.337		
	Heave	0.535	2.141	2.824	-2.528	0.001		
	Wave Elevation (fix) [m]			3.996	-2.638	0.005		
-05	Roll Angle [deg]*	2.316	9.263	14.530	0.220	4.401	684.8	30
	Pitch Angle [deg]**	0.379	1.516	1.692	-1.012	0.335		
	Heave	0.556	2.223	2.357	-2.125	0.049		
	Wave Elevation (fix) [m]			3.602	-2.494	-0.010		
-06	Roll Angle [deg]*	1.206	4.823	7.816	0.079	2.928	576.2	30
	Pitch Angle [deg]**	0.359	1.436	1.462	-0.695	0.345		
	Heave	0.440	1.759	1.842	-1.740	0.048		
	Wave Elevation (fix) [m]			4.103	-2.717	-0.009		
-07	Roll Angle [deg]*	1.398	5.592	8.316	0.551	3.453	618.3	30
	Pitch Angle [deg]**	0.337	1.347	1.595	-0.871	0.336		
	Heave	0.485	1.938	2.127	-2.161	0.014		
	Wave Elevation (fix) [m]			3.422	-2.603	0.005		
-08	Roll Angle [deg]*	1.298	5.192	7.751	0.191	3.211	561.9	30
	Pitch Angle [deg]**	0.355	1.418	1.620	-0.936	0.337		
	Heave	0.472	1.889	1.935	-1.859	0.016		
	Wave Elevation (fix) [m]			3.155	-2.438	-0.013		
-09	Roll Angle [deg]*	1.372	5.490	8.860	-0.205	3.145	620.9	30
	Pitch Angle [deg]**	0.357	1.429	1.793	-0.907	0.344		
	Heave	0.473	1.892	1.804	-1.578	0.056		
	Wave Elevation (fix) [m]			3.505	-2.514	-0.014		
-10	Roll Angle [deg]*	1.145	4.582	7.225	-0.043	2.950	619.1	30
	Pitch Angle [deg]**	0.382	1.526	1.757	-1.145	0.345		
	Heave	0.479	1.917	2.124	-1.830	0.050		
	Wave Elevation (fix) [m]			3.484	-2.516	0.000		



# Sea Keeping Test in Irregular Seas (Statistics)

Evaluation of Damage (Ship Values)

Model No.: 2446

Test No.: 29691-01 - 10

Project: EMSA

Hs [m] = 3.90

Damage 1: R7\_S7-9.1.0-1

Scale = 25.00

Test No.	Description	RMS (SD) Value	Significant Value	max	min	mean	Drift [m]	Duration of the Tests [min]
29691-01	Roll Angle [deg]*	1.300	5.201	9.972	0.486	3.079	581.4	30
	Pitch Angle [deg]**	0.359	1.436	1.656	-0.774	0.347		
	Heave	0.566	2.265	2.326	-2.252	0.017		
	Wave Elevation (fix) [m]			3.724	-3.347	-0.015		
-02	Roll Angle [deg]*	2.242	8.969	13.842	0.144	3.867	632.4	30
	Pitch Angle [deg]**	0.415	1.659	1.793	-0.950	0.345		
	Heave	0.556	2.223	1.970	-1.698	0.056		
	Wave Elevation (fix) [m]			3.590	-3.010	-0.003		
-03	Roll Angle [deg]*	2.126	8.503	12.848	0.284	4.042	654.5	30
	Pitch Angle [deg]**	0.386	1.546	1.811	-1.116	0.340		
	Heave	0.592	2.369	2.377	-2.229	0.000		
	Wave Elevation (fix) [m]			3.695	-3.024	-0.005		
-04	Roll Angle [deg]*	2.107	8.427	10.789	-1.051	3.778	616.1	30
	Pitch Angle [deg]**	0.408	1.630	1.710	-1.177	0.338		
	Heave	0.588	2.352	2.140	-2.300	-0.006		
	Wave Elevation (fix) [m]			3.555	-3.268	-0.004		
-05	Roll Angle [deg]*	1.416	5.664	8.284	0.482	3.944	684.2	30
	Pitch Angle [deg]**	0.374	1.497	1.721	-1.080	0.339		
	Heave	0.607	2.427	1.958	-2.128	-0.008		
	Wave Elevation (fix) [m]			4.489	-2.857	0.010		
-06	Roll Angle [deg]*	1.360	5.439	7.200	-0.468	3.721	655.6	30
	Pitch Angle [deg]**	0.402	1.607	1.624	-0.947	0.341		
	Heave	0.585	2.340	2.369	-2.481	-0.006		
	Wave Elevation (fix) [m]			4.315	-3.173	-0.011		
-07	Roll Angle [deg]*	1.351	5.406	8.269	0.454	3.547	646.7	30
	Pitch Angle [deg]**	0.383	1.533	1.696	-1.098	0.343		
	Heave	0.576	2.305	2.449	-2.439	0.310		
	Wave Elevation (fix) [m]			3.754	-3.358	0.003		
-08	Roll Angle [deg]*	1.835	7.339	11.585	0.047	3.727	588.6	30
	Pitch Angle [deg]**	0.396	1.584	1.966	-1.300	0.343		
	Heave	0.582	2.327	2.793	-2.685	0.008		
	Wave Elevation (fix) [m]			4.334	-3.448	-0.010		
-09	Roll Angle [deg]*	1.773	7.093	9.868	0.050	4.047	699.0	30
	Pitch Angle [deg]**	0.426	1.702	1.768	-1.152	0.342		
	Heave	0.573	2.292	2.025	-1.827	0.009		
	Wave Elevation (fix) [m]			4.073	-3.223	-0.011		
-10	Roll Angle [deg]*	1.706	6.822	11.077	-0.032	3.932	730.2	30
	Pitch Angle [deg]**	0.426	1.703	2.171	-1.069	0.340		
	Heave	0.571	2.285	2.144	-2.114	0.010		
	Wave Elevation (fix) [m]			4.389	-2.791	-0.012		



## **APPENDIX E**

### **TIME HISTORIES OF THE EXPERIMENTS WAVE AND ROLL TIME HISTORIES**

**Model No. 2446**

**Project: "EMSA 1"**

**Damage Case-1 R7\_S7-9.1.0-1**

Irregular Beam Seas

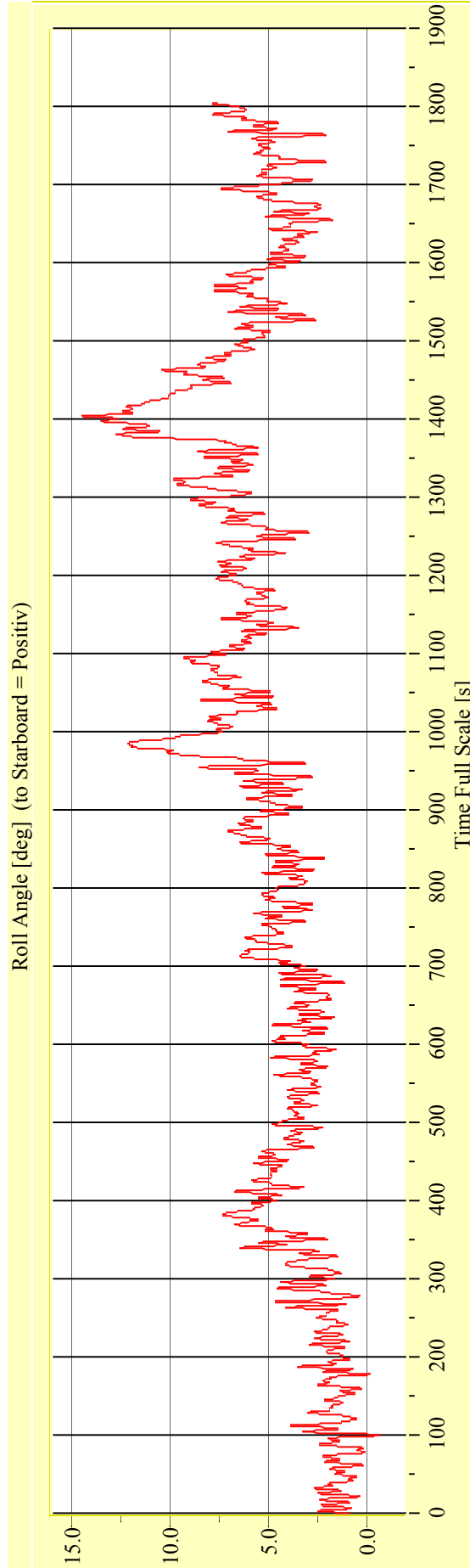
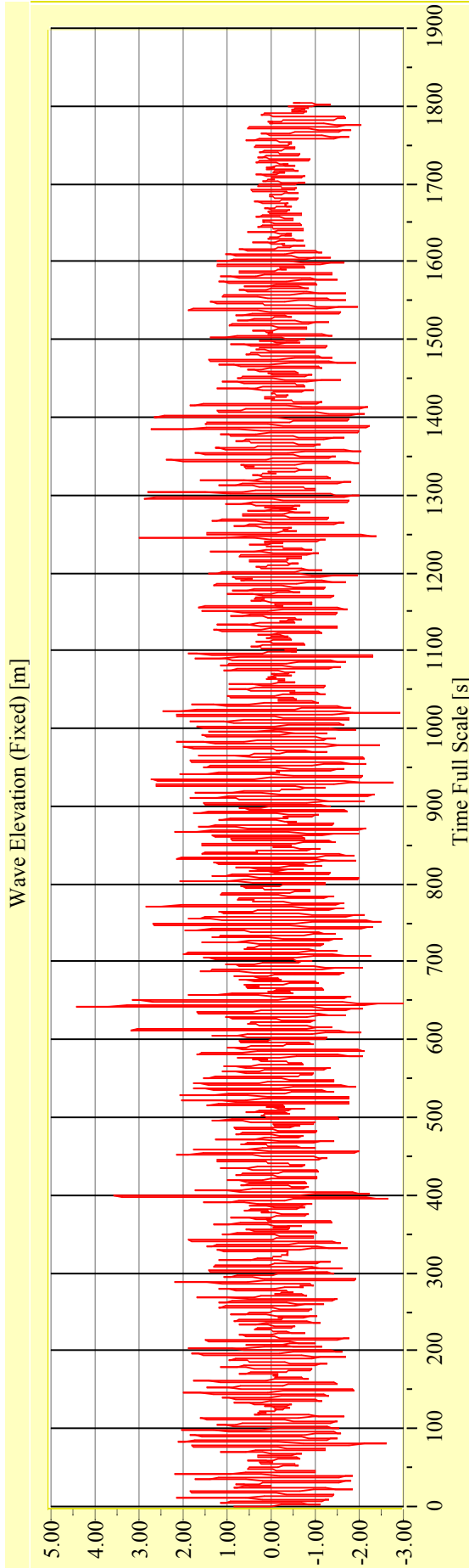
Vienna Model Basin

Model No. 2446

Test No. 29687-01

Target Waves:  $H_s = 3,75$  m  $T_p = 7,746$  s

$\gamma = 3,3$



Date: 20.05.2010

Project: EMSA 1

Damage 1: R7\_S7-9.1.0-1

Irregular Beam Seas

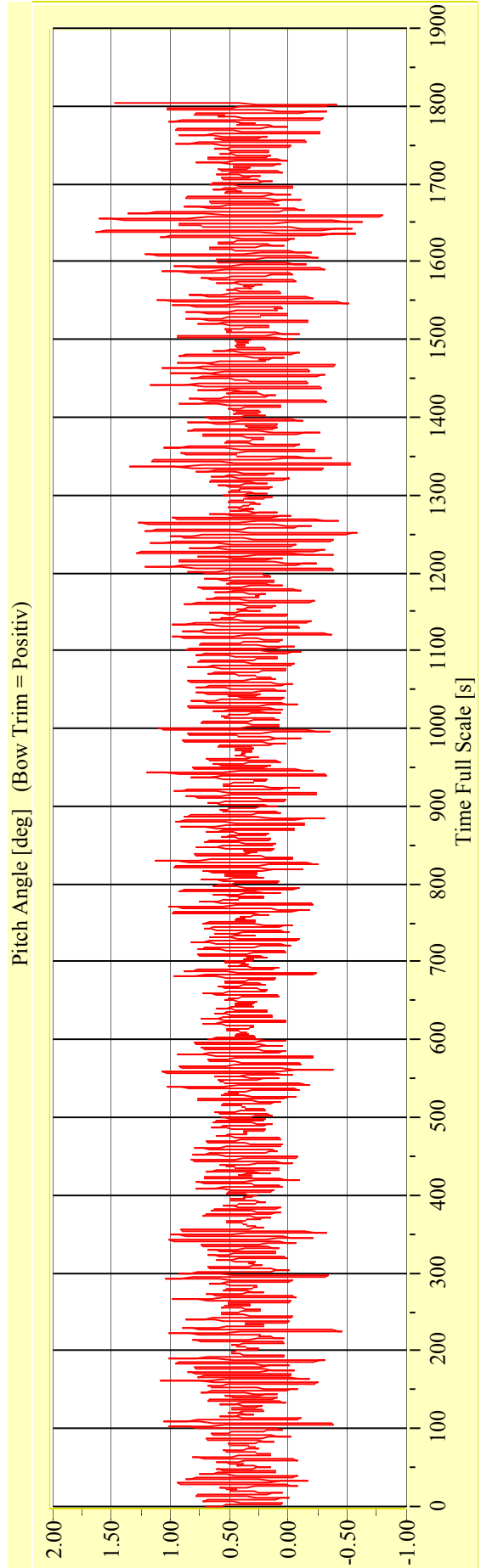
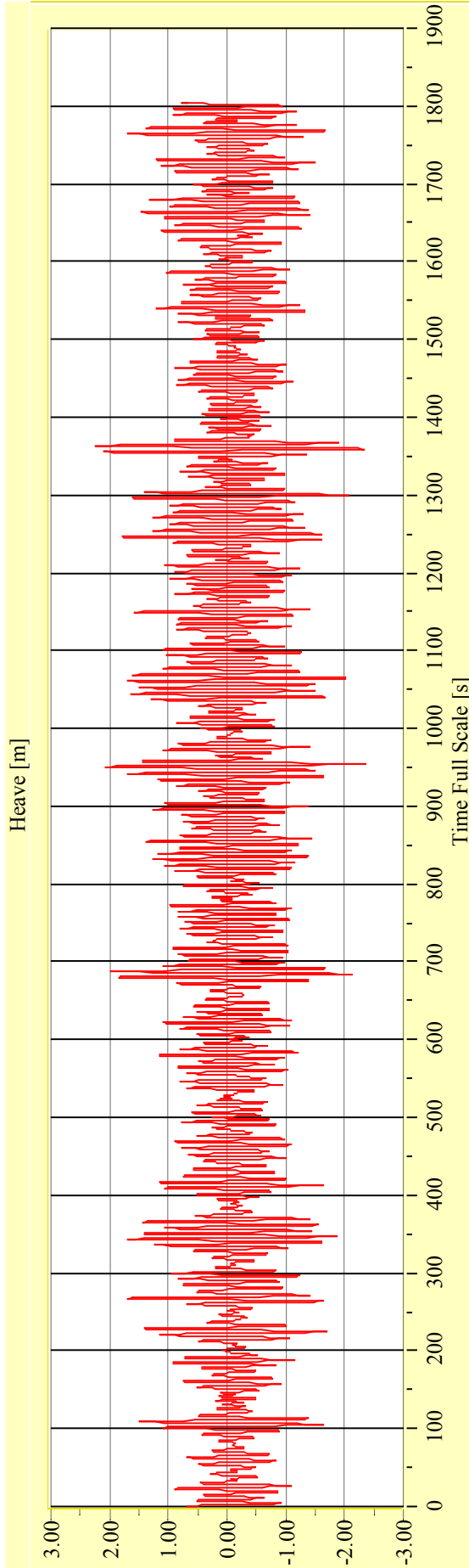
Vienna Model Basin

Model No. 2446

Test No. 29687-01

Target Waves: Hs = 3,75 m Tp = 7,746 s

gamma = 3,3





**Irregular Beam Seas**

**Vienna Model Basin**

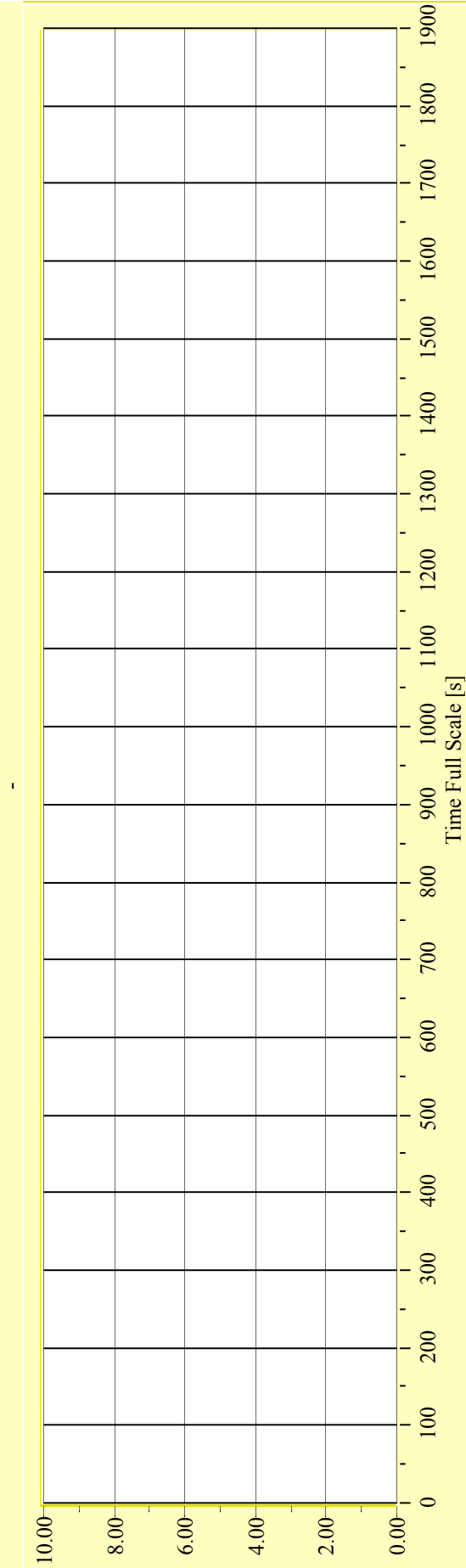
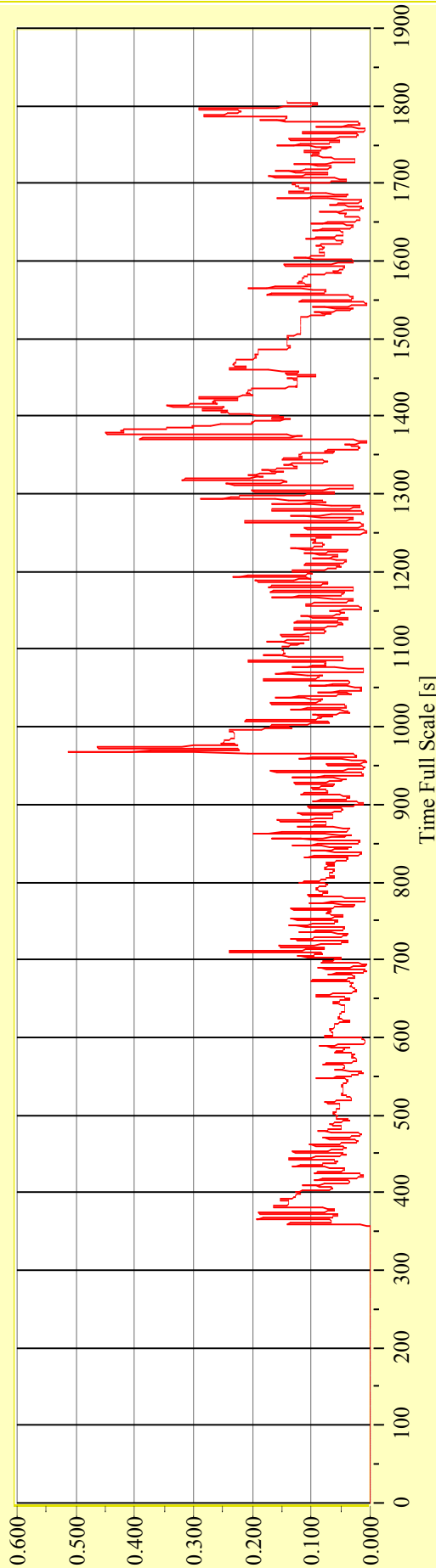
**Model No. 2446**

**Test No. 29687-01**

**Target Waves: Hs = 3,75 m Tp = 7,746 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



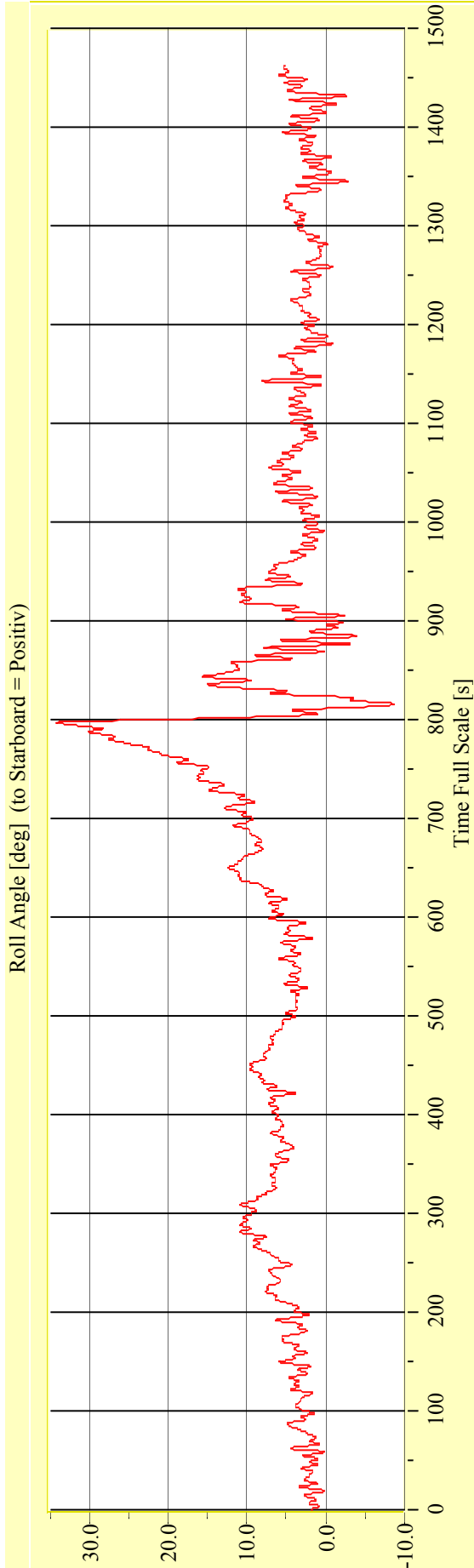
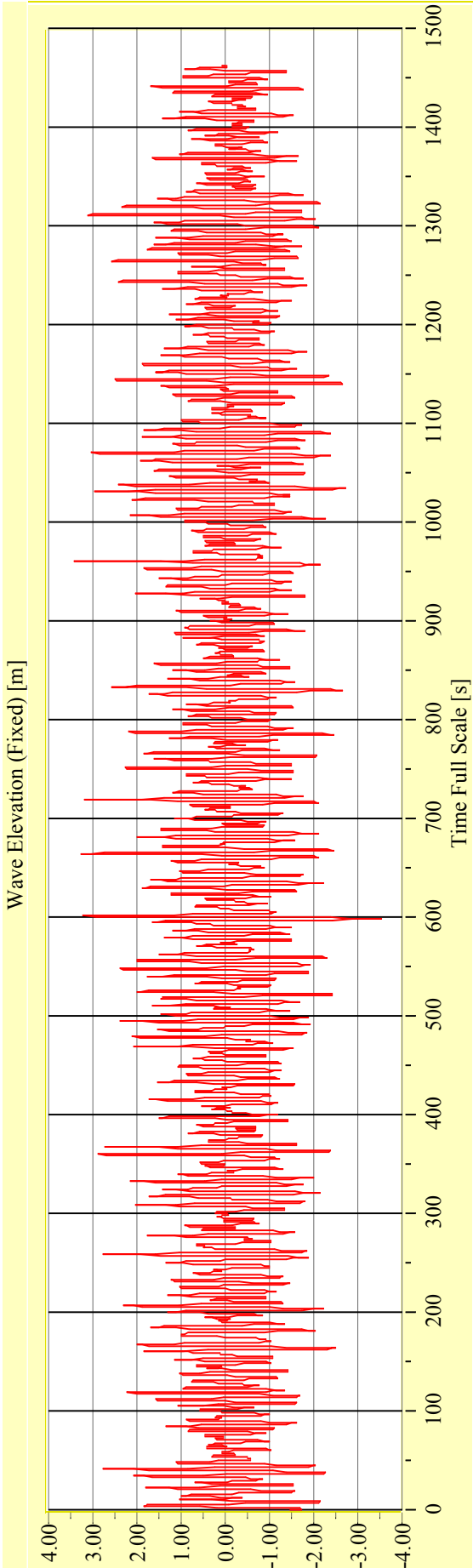
**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

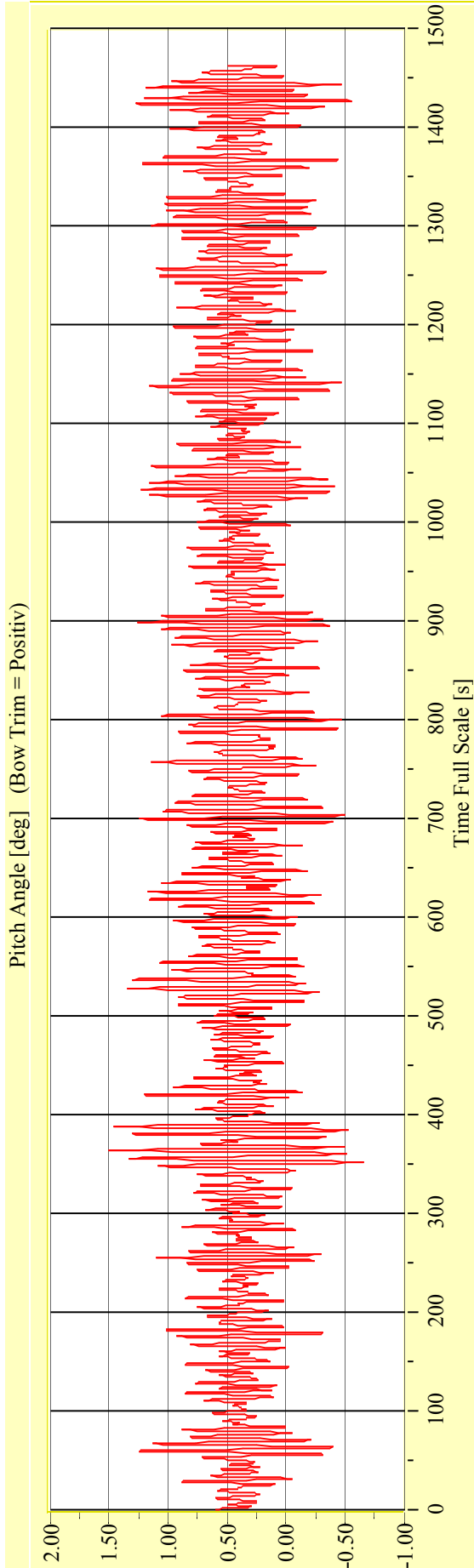
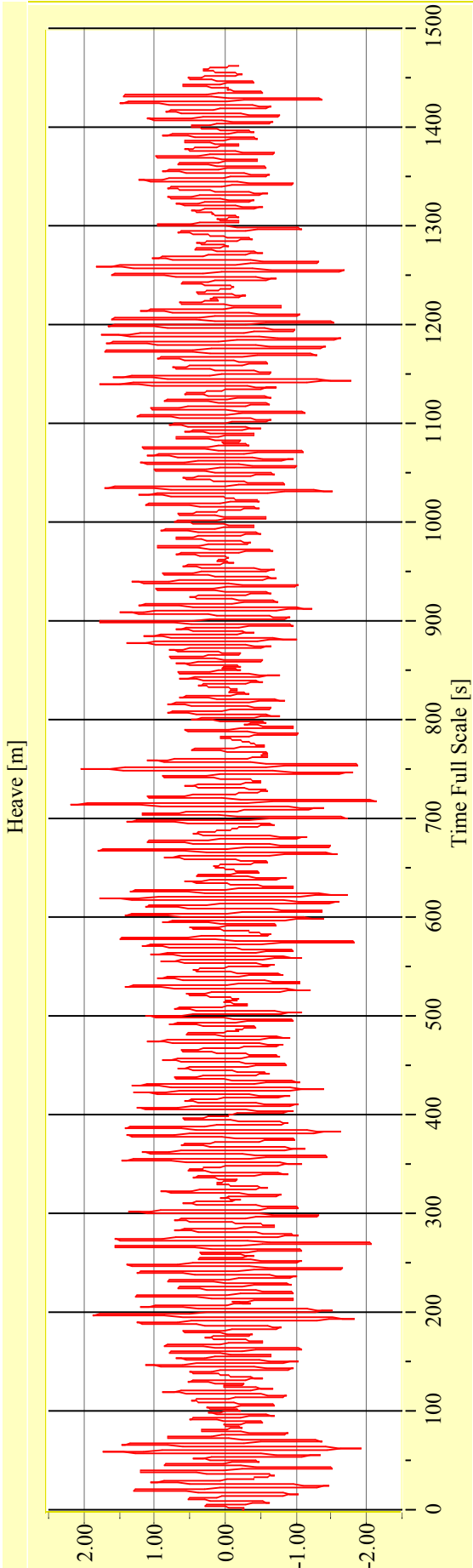
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29678-02**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**



**Date: 11.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29678-02**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**



**Date: 11.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**

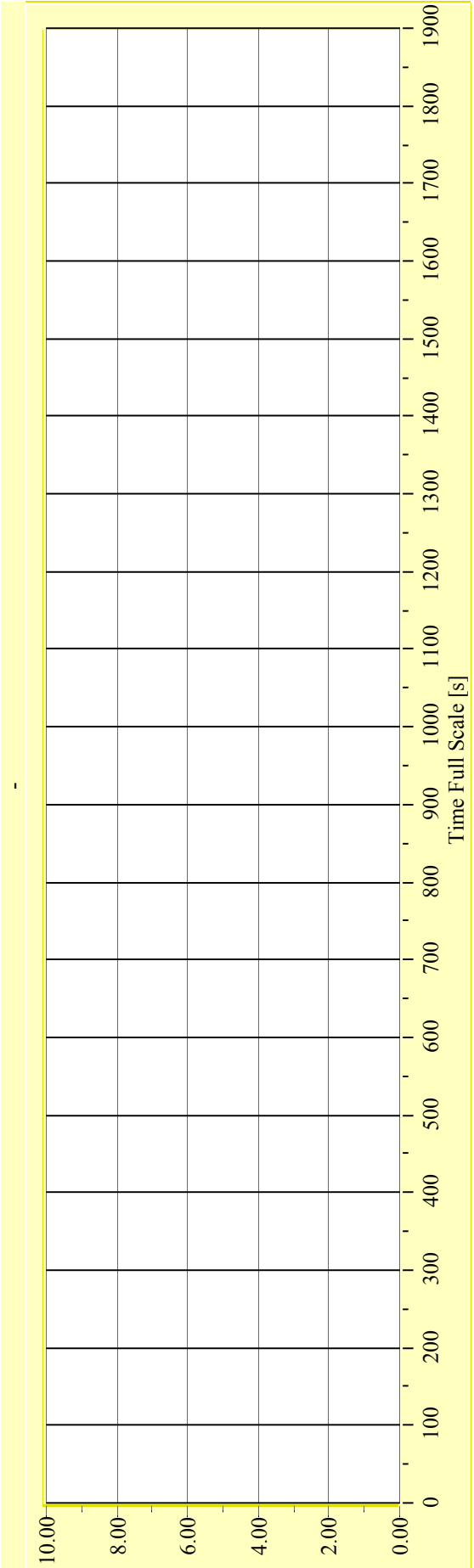
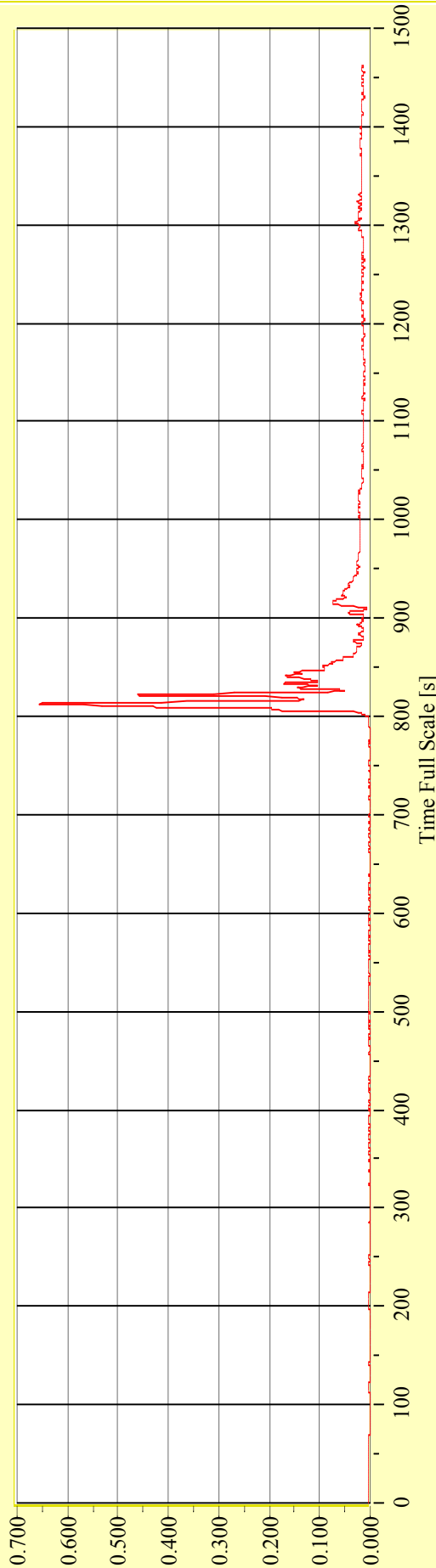
**Model No. 2446**

**Test No. 29678-02**

**Target Waves: Hs = 4,0 m Tp = 8,0 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Date: 11.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

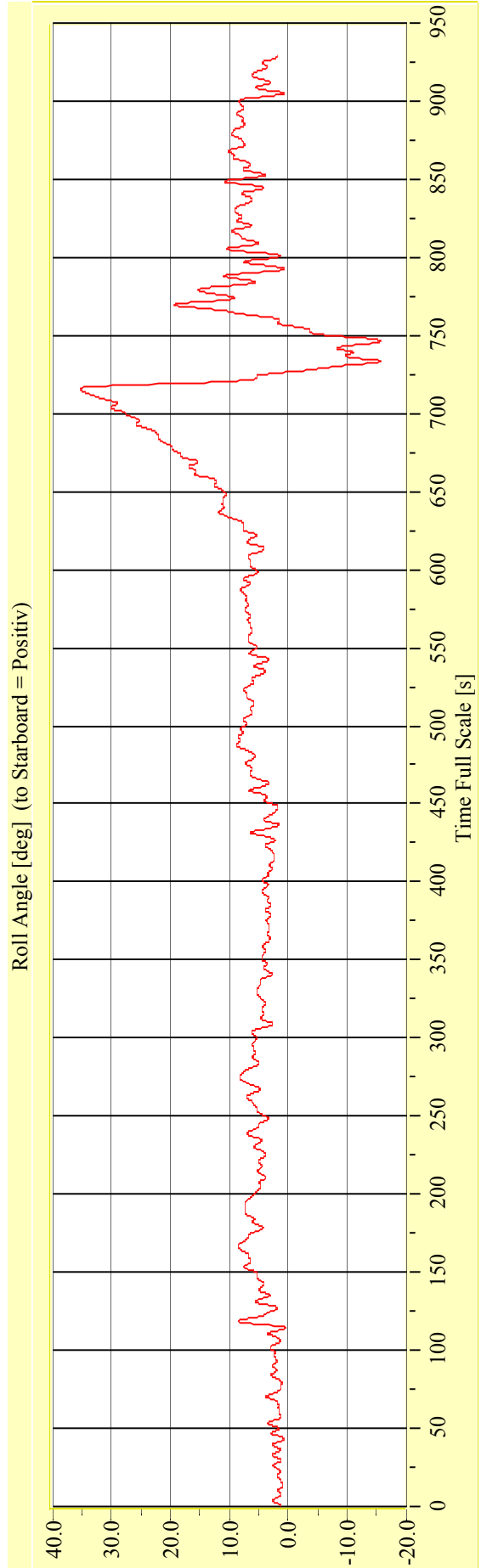
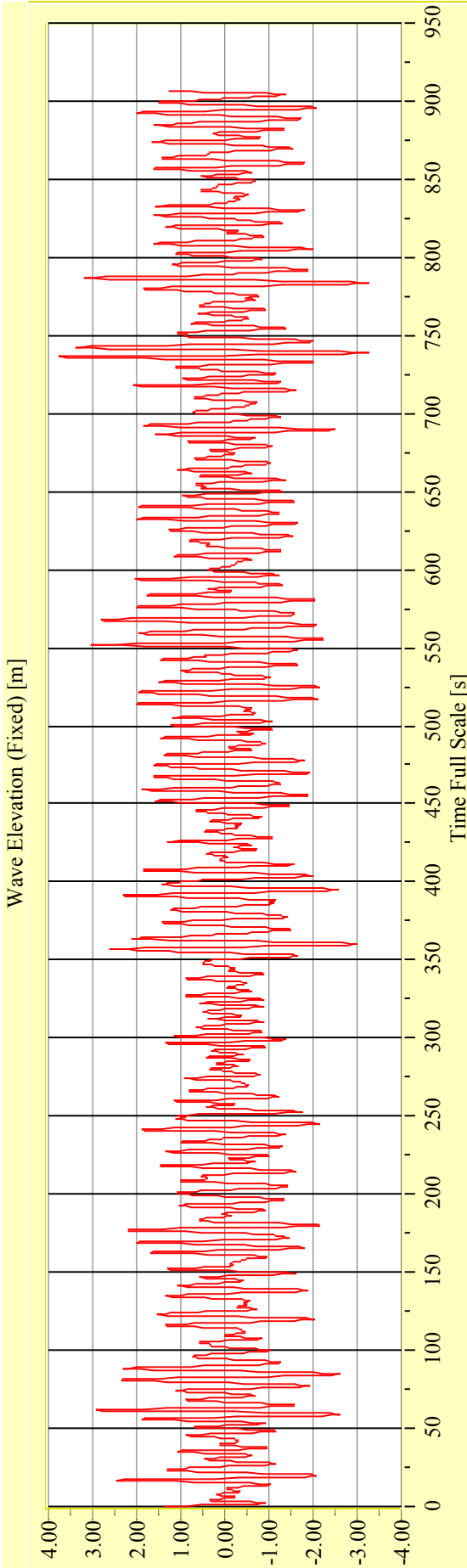
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29678-03**

**Target Waves: Hs = 4.0 m Tp = 8.0 s**

**gamma = 3,3**



Irregular Beam Seas

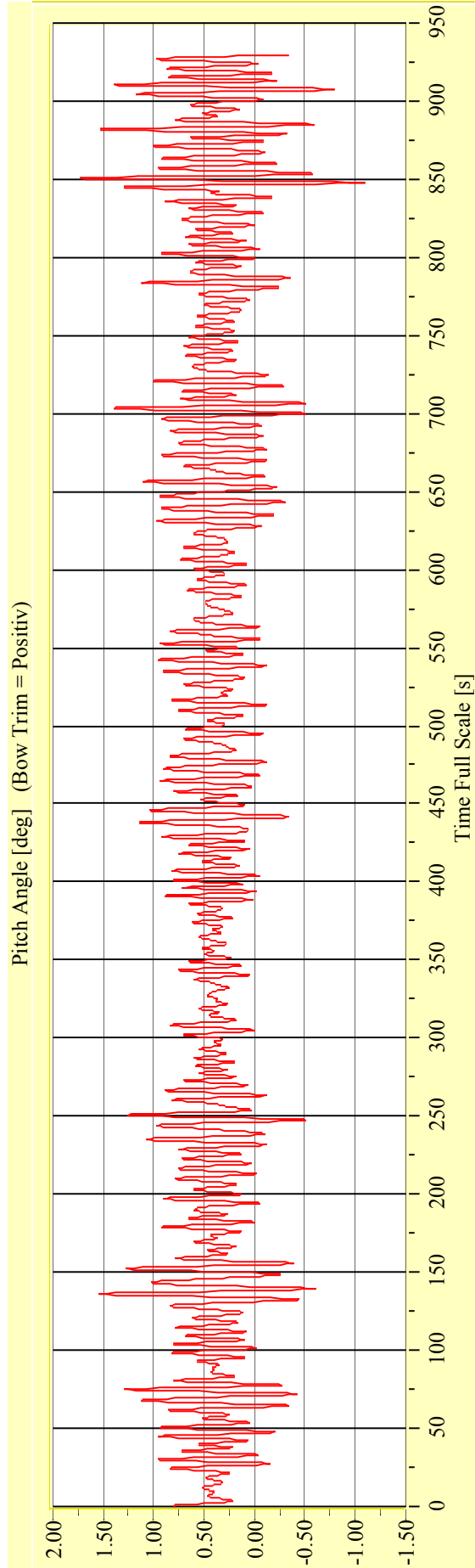
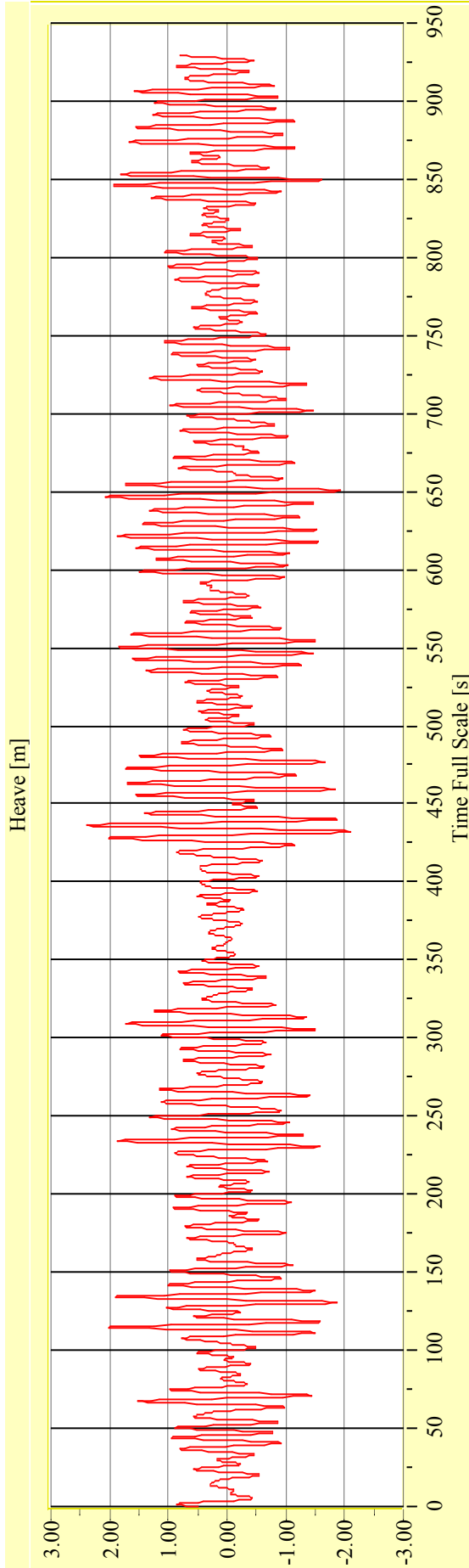
Vienna Model Basin

Model No. 2446

Test No. 29678-03

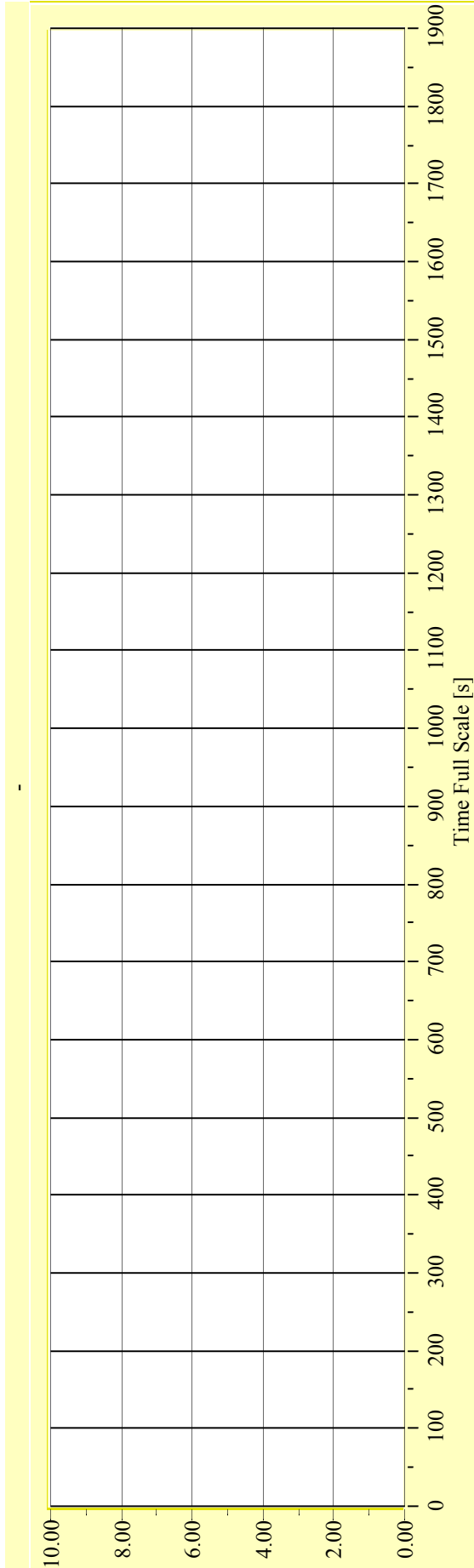
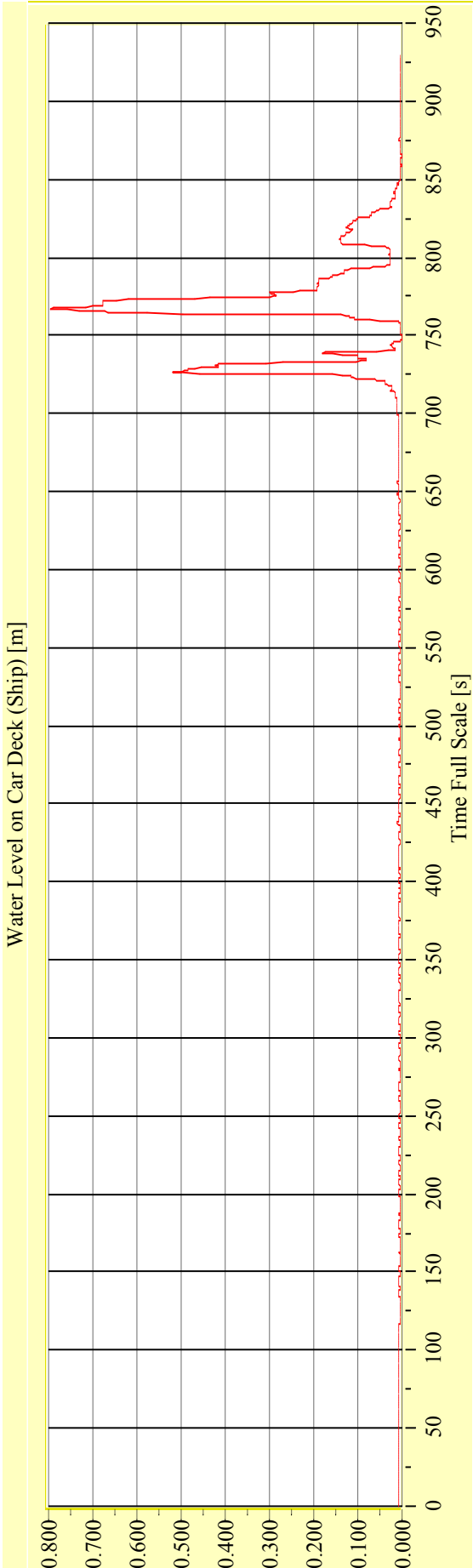
Target Waves: Hs = 4.0 m Tp = 8.0 s

gamma = 3,3



**Irregular Beam Seas**

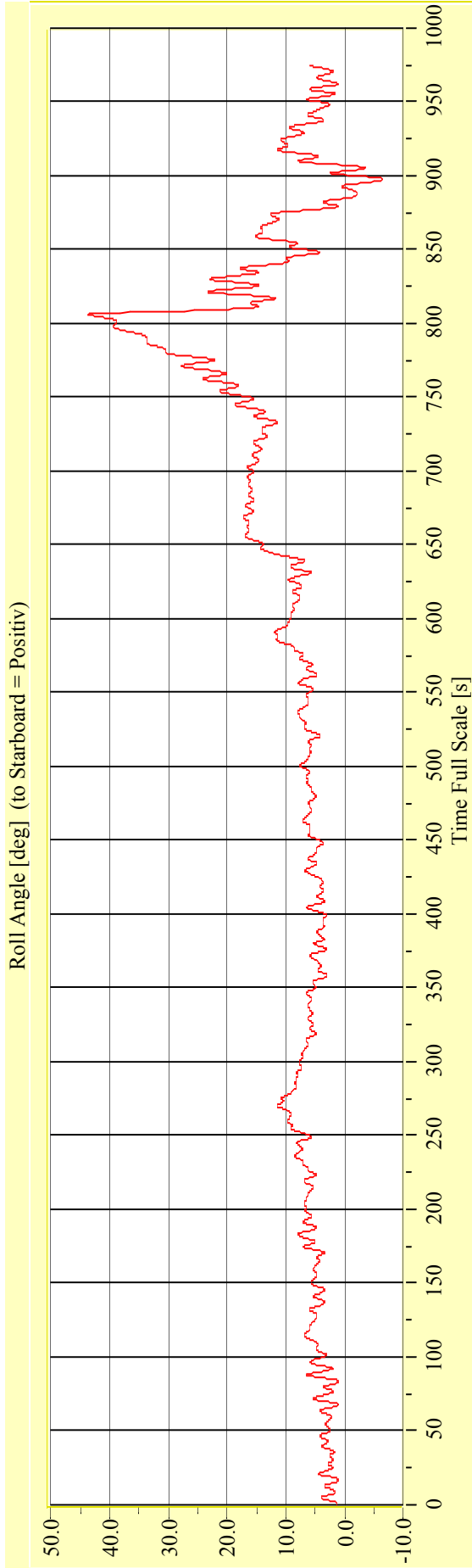
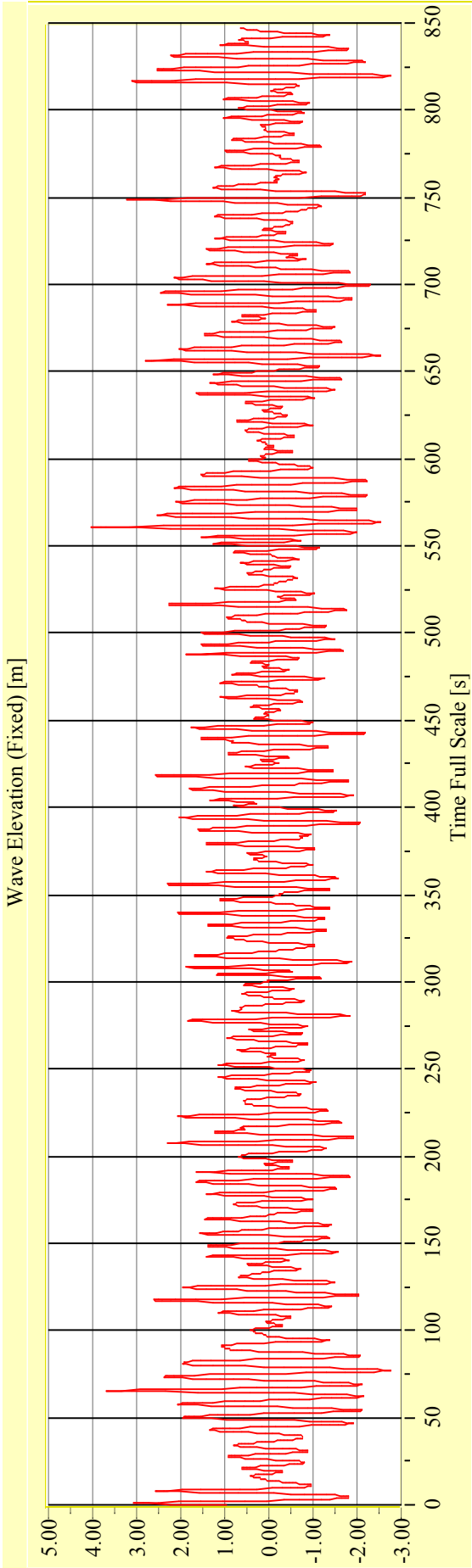
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29678-03**      **Target Waves: Hs = 4,0 m Tp = 8,0 s**      **gamma = 3,3**



**Date: 11.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29678-04**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**



**Date: 11.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**



Irregular Beam Seas

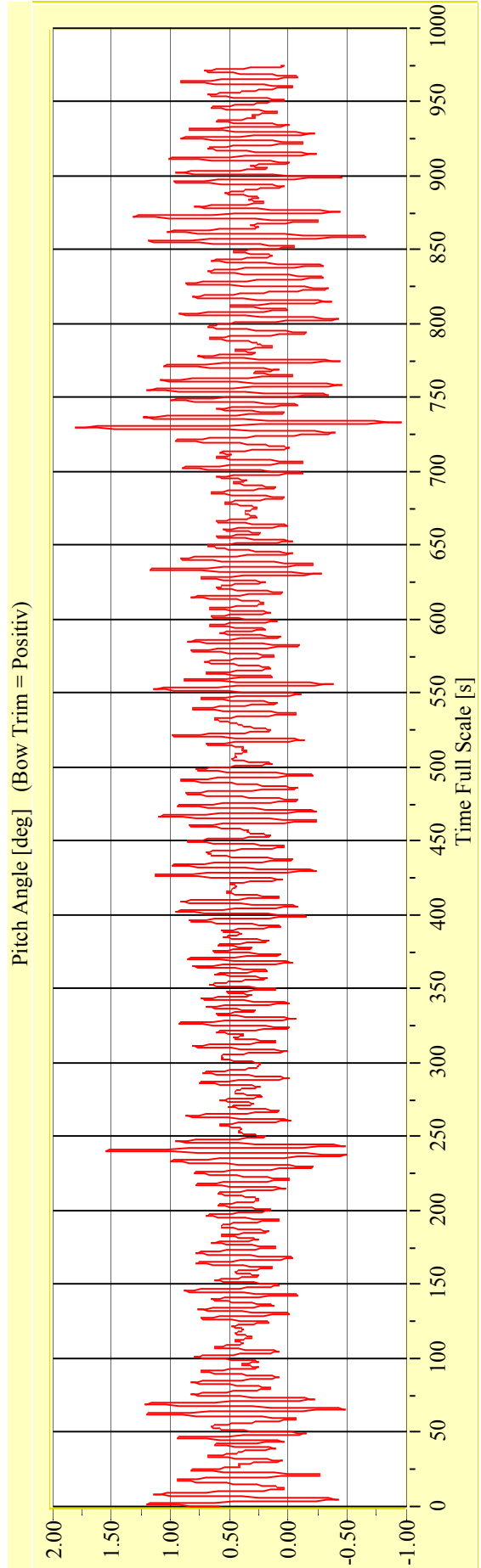
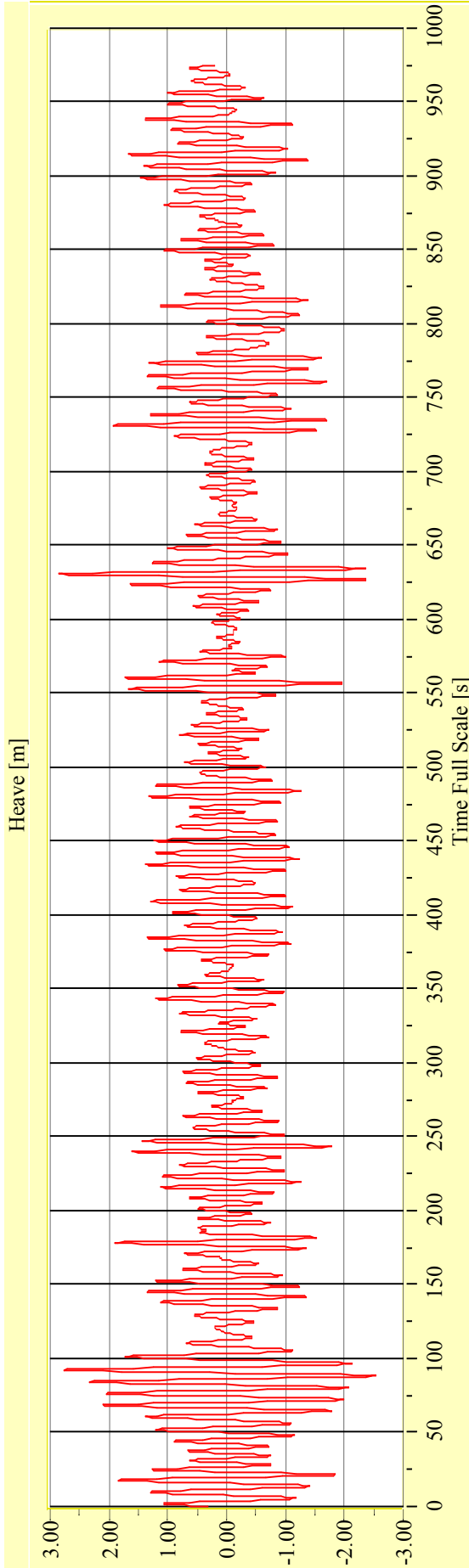
Vienna Model Basin

Model No. 2446

Test No. 29678-04

Target Waves: Hs = 4.0 m Tp = 8.0 s

gamma = 3,3



**Irregular Beam Seas**

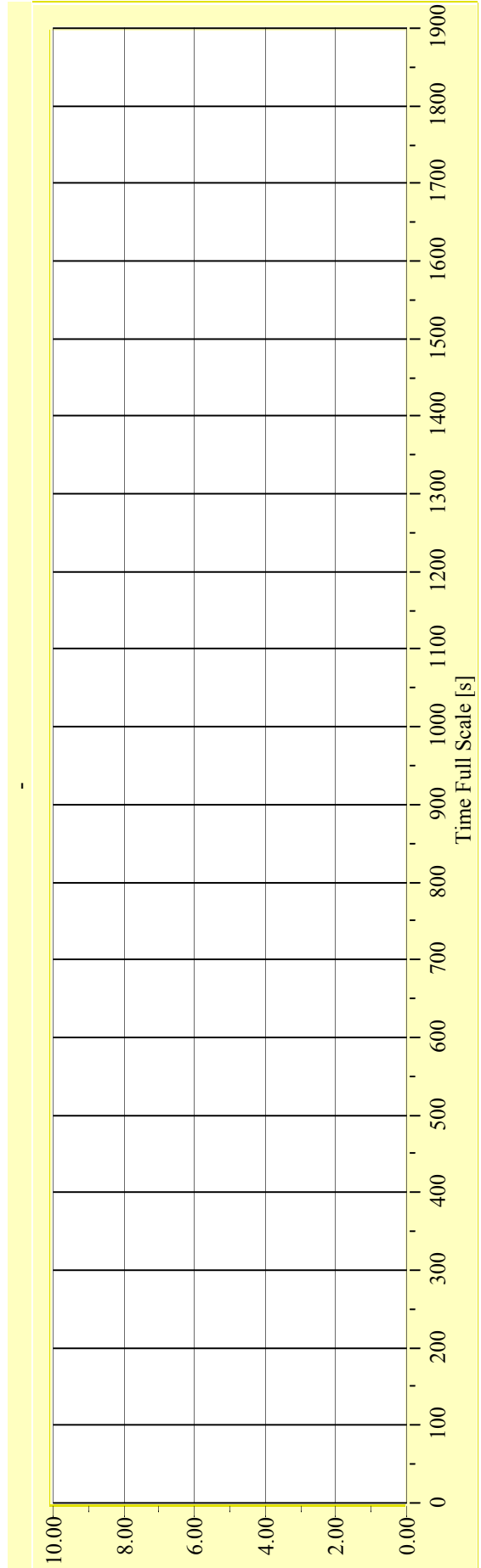
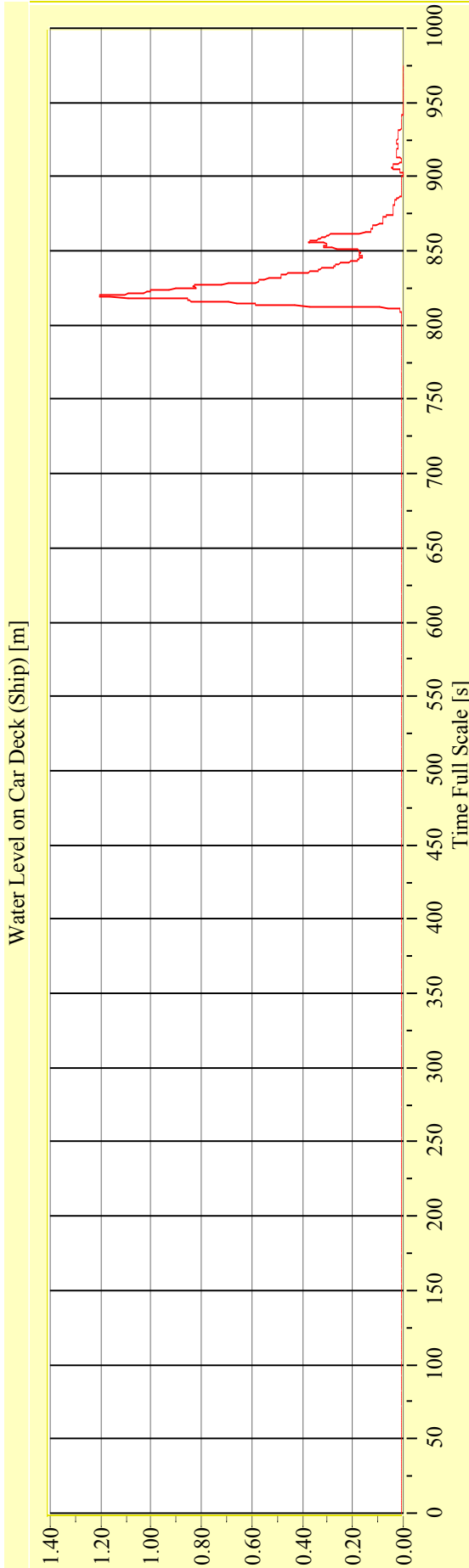
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29678-04**

**Target Waves: Hs = 4.0 m Tp = 8.0 s**

**gamma = 3,3**



**Date: 11.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

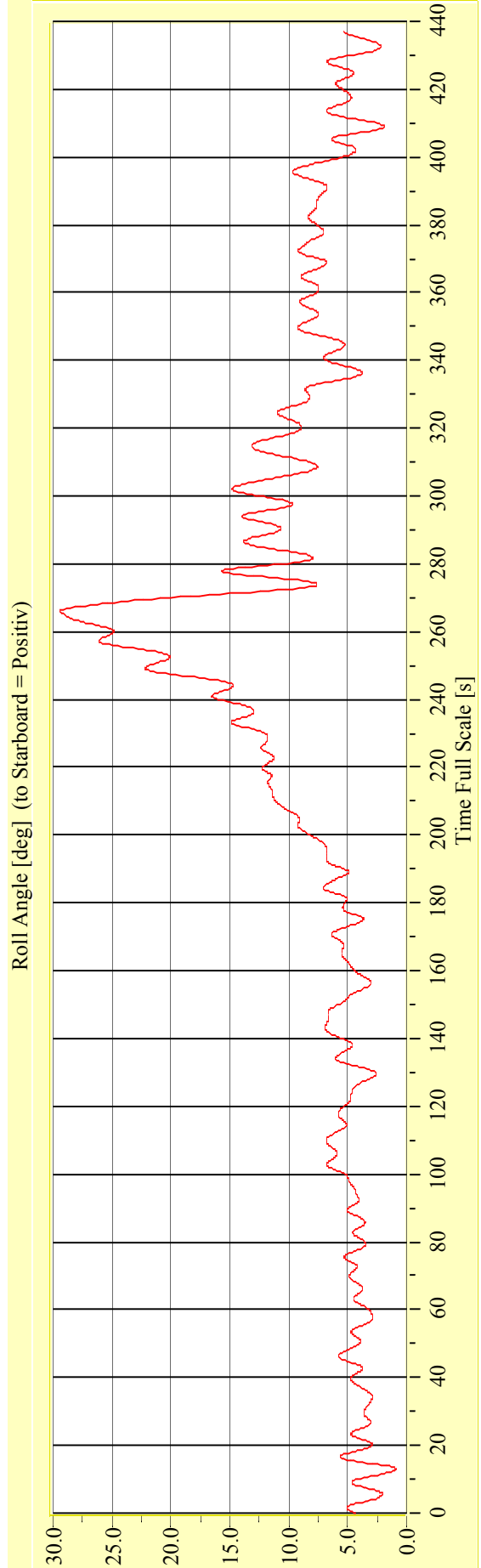
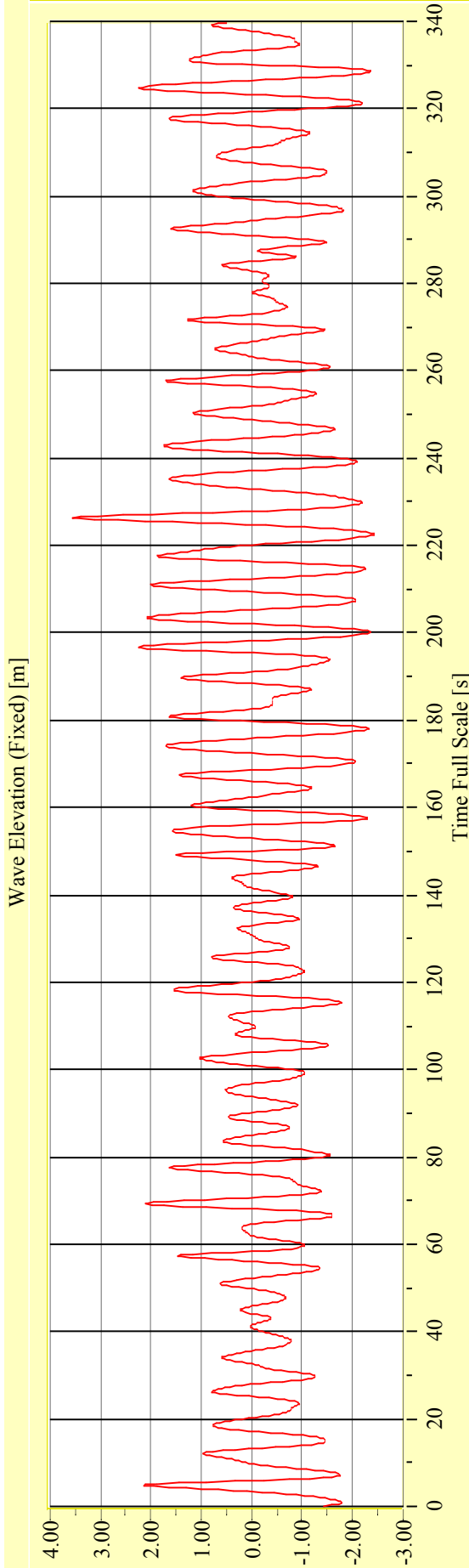
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29678-05**

**Target Waves: Hs = 4.0 m Tp = 8.0 s**

**gamma = 3,3**



**Irregular Beam Seas**

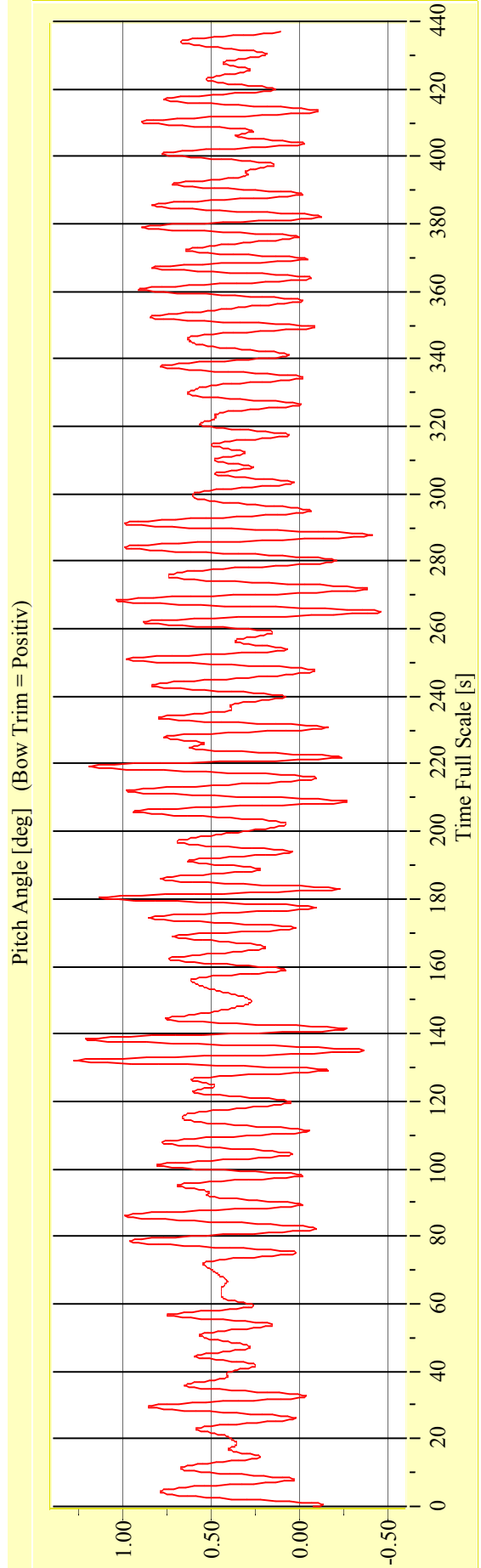
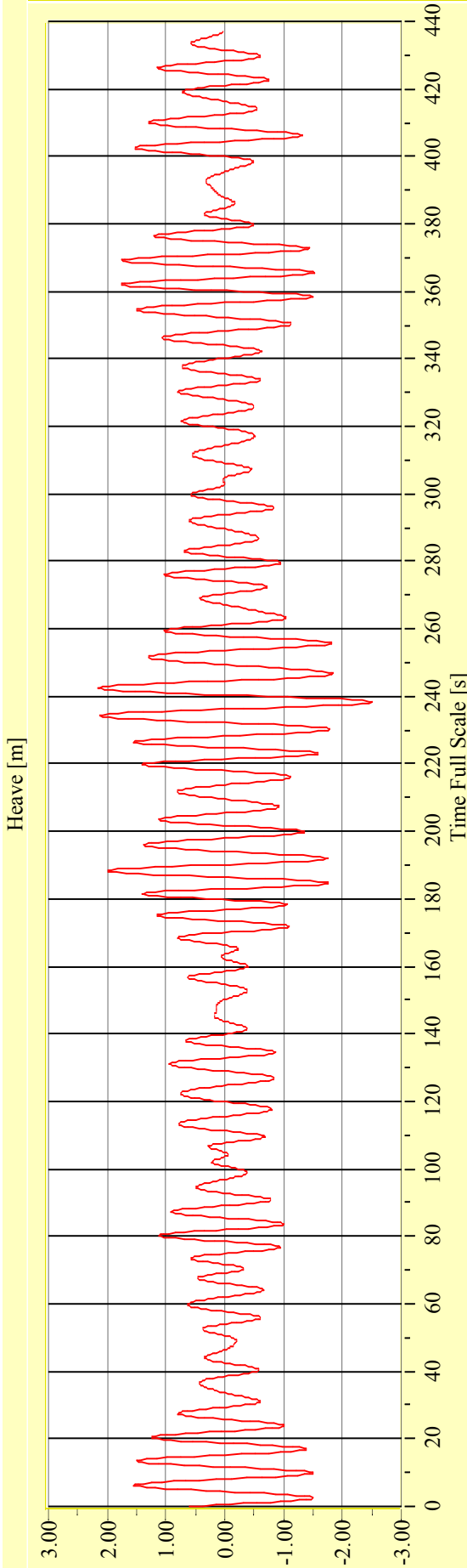
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29678-05**

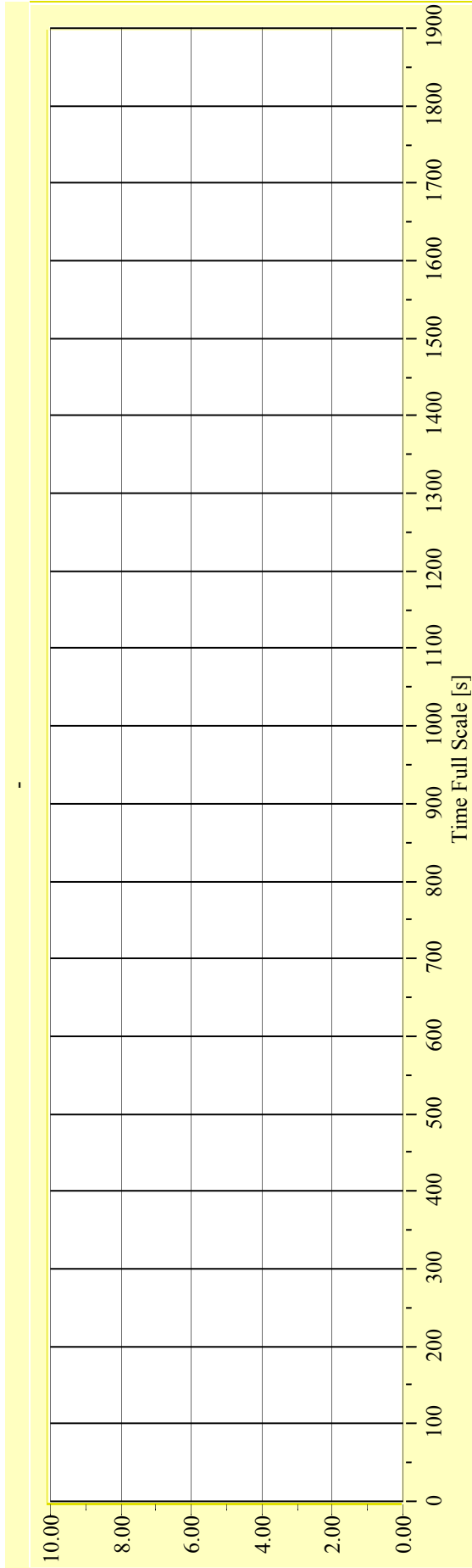
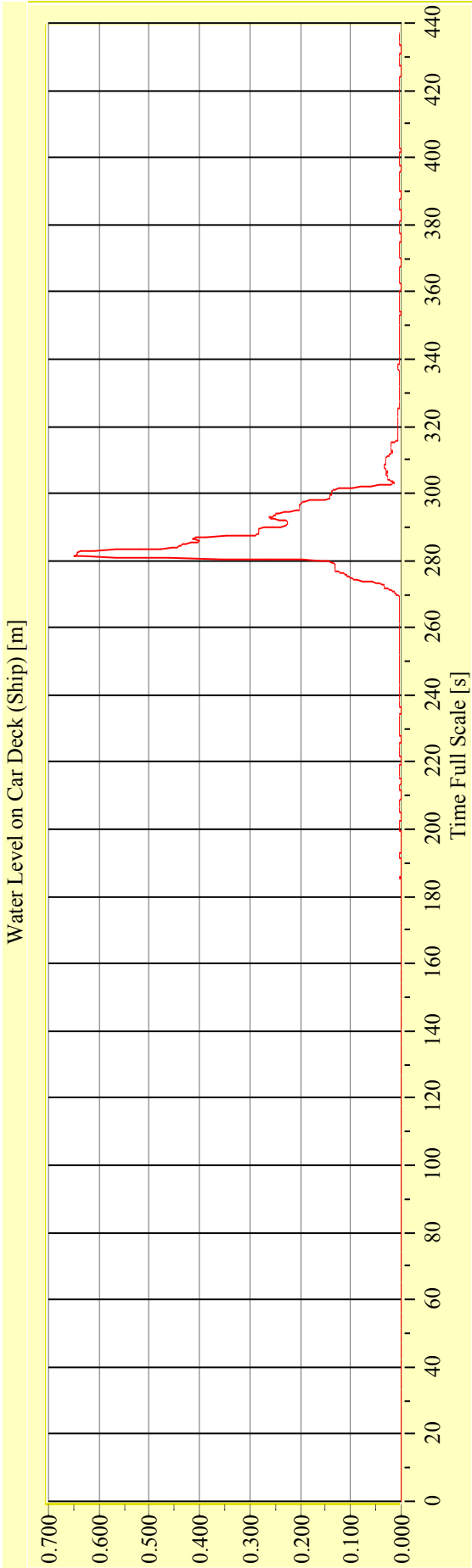
**Target Waves: Hs = 4.0 m Tp = 8.0 s**

**gamma = 3,3**



**Irregular Beam Seas**

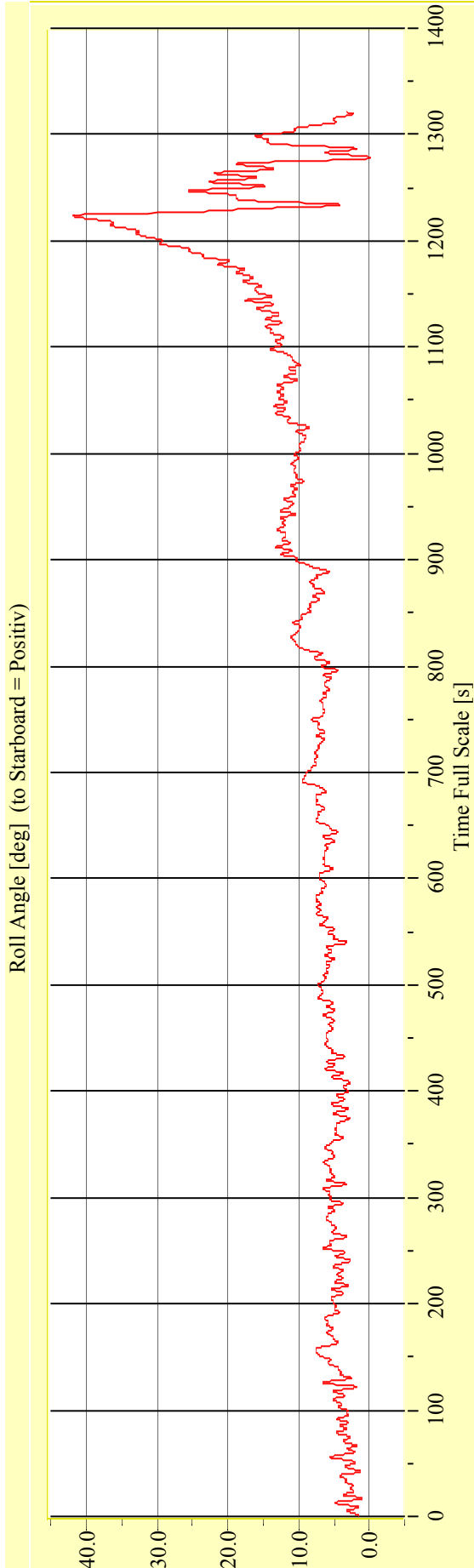
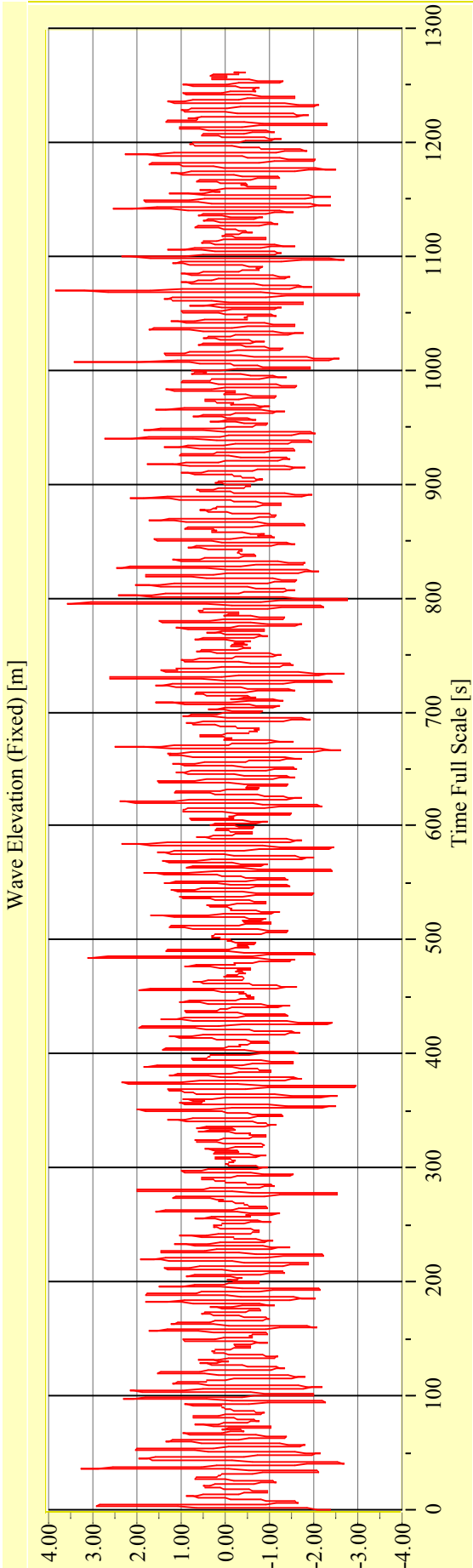
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29678-05**      **Target Waves: Hs = 4,0 m Tp = 8,0 s**      **gamma = 3,3**



**Date: 11.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

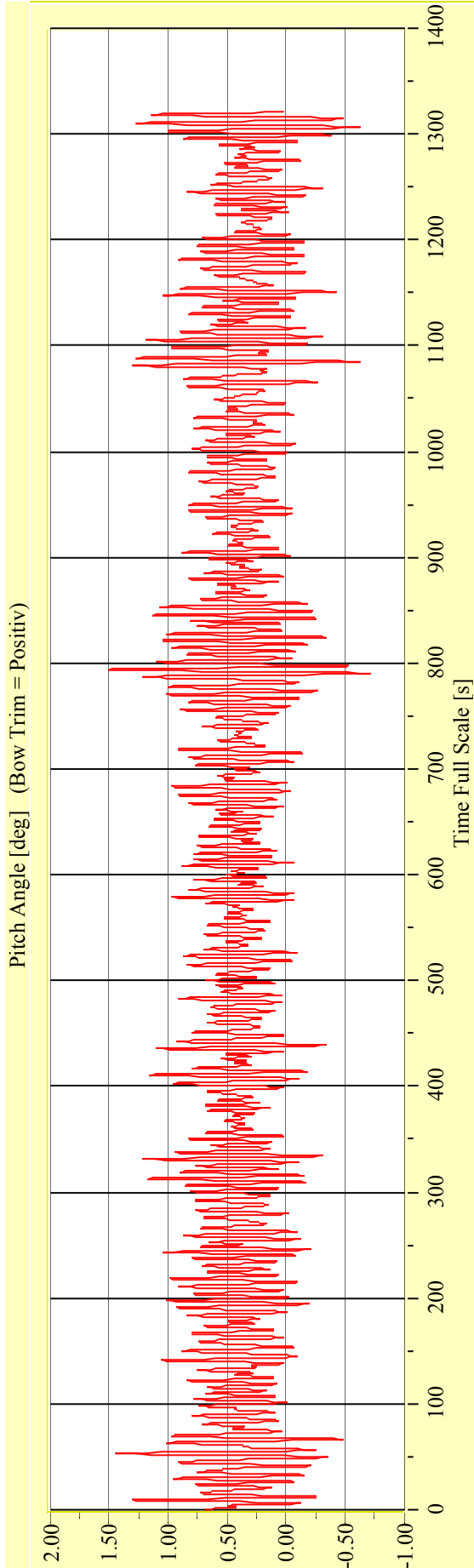
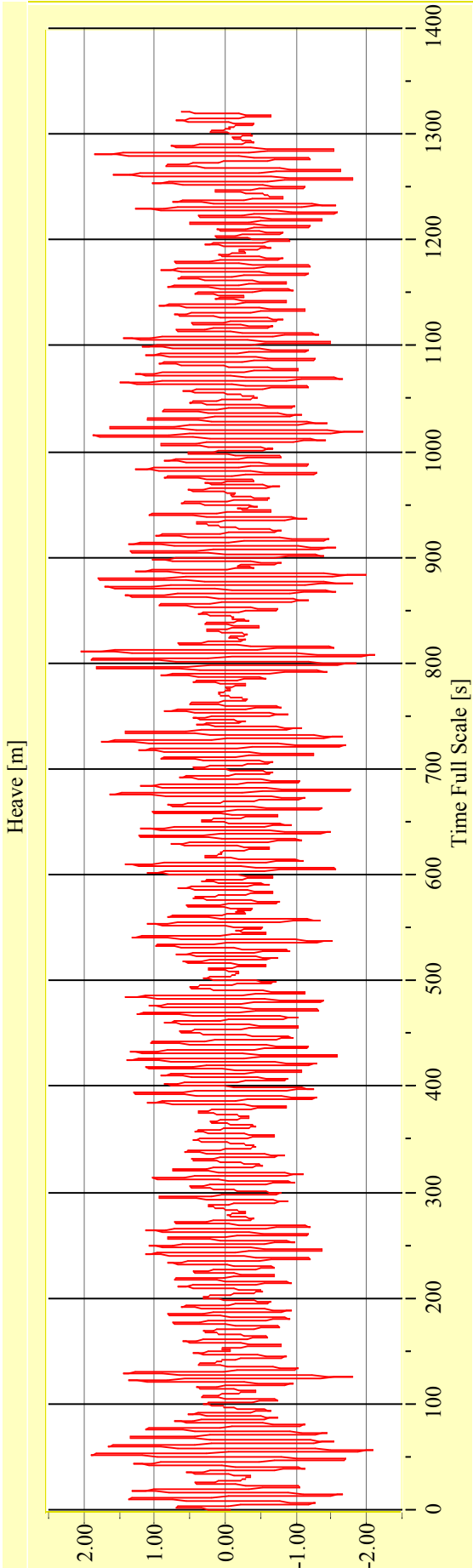
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29678-06**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**



**Date: 11.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

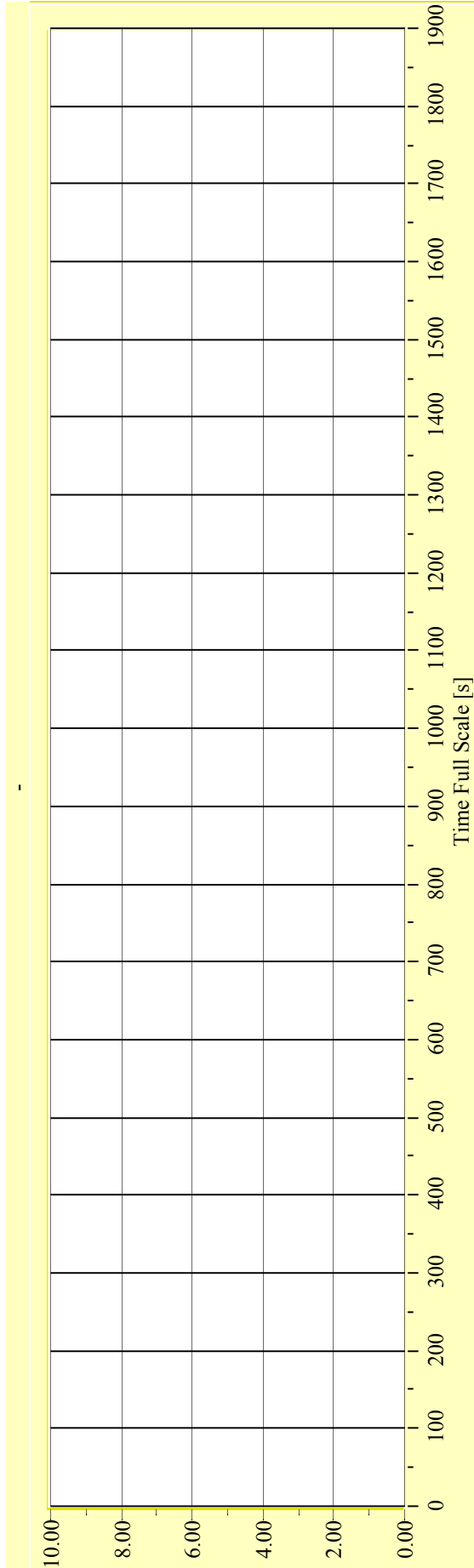
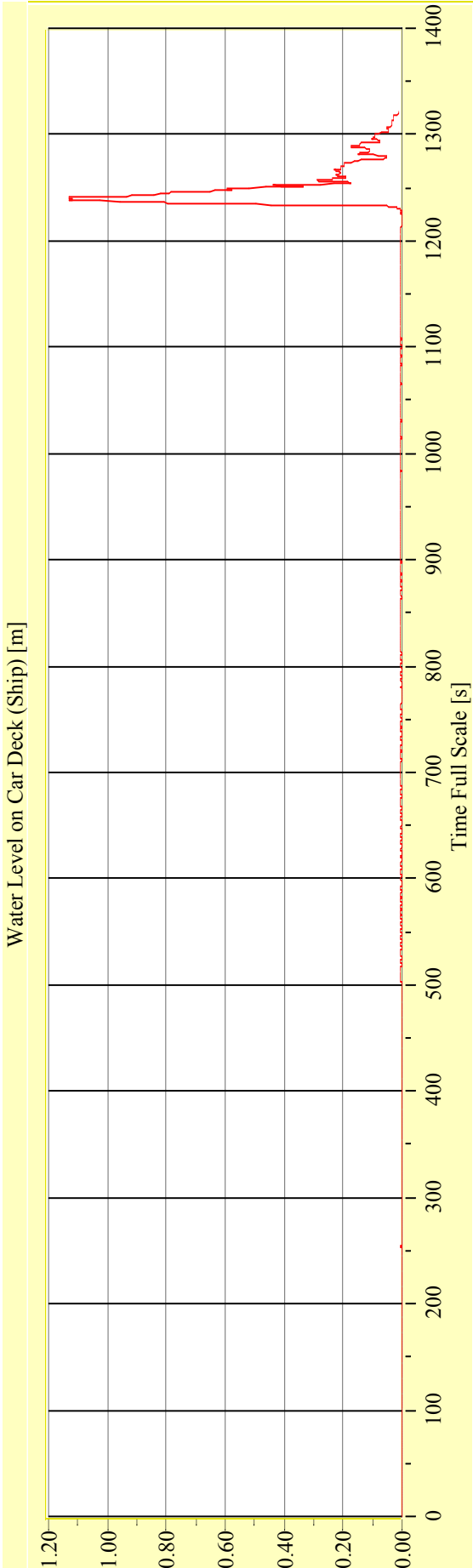
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29678-06**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**



**Date: 11.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29678-06**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**



**Date: 11.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**



**Irregular Beam Seas**

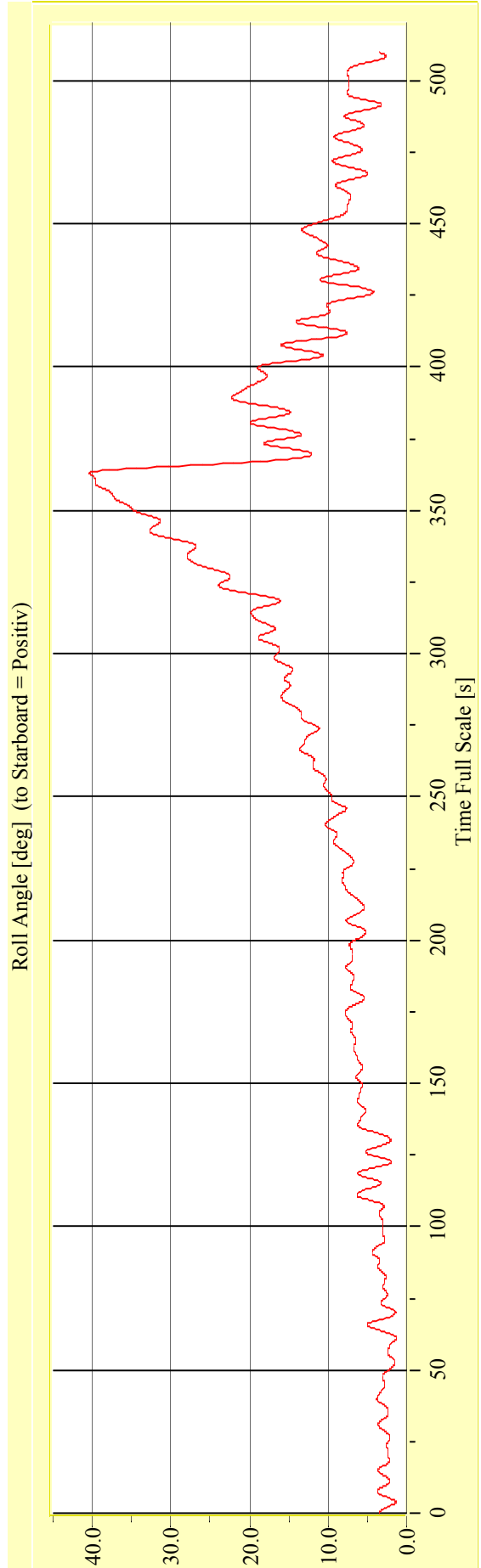
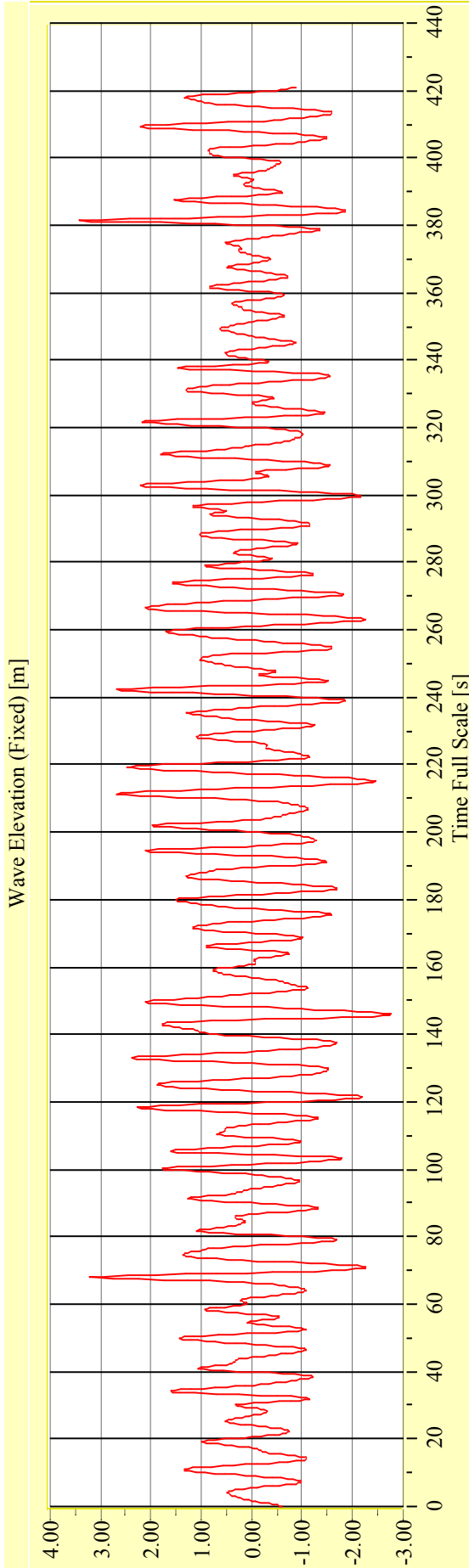
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29678-07**

**Target Waves: Hs = 4.0 m Tp = 8.0 s**

**gamma = 3,3**



**Irregular Beam Seas**

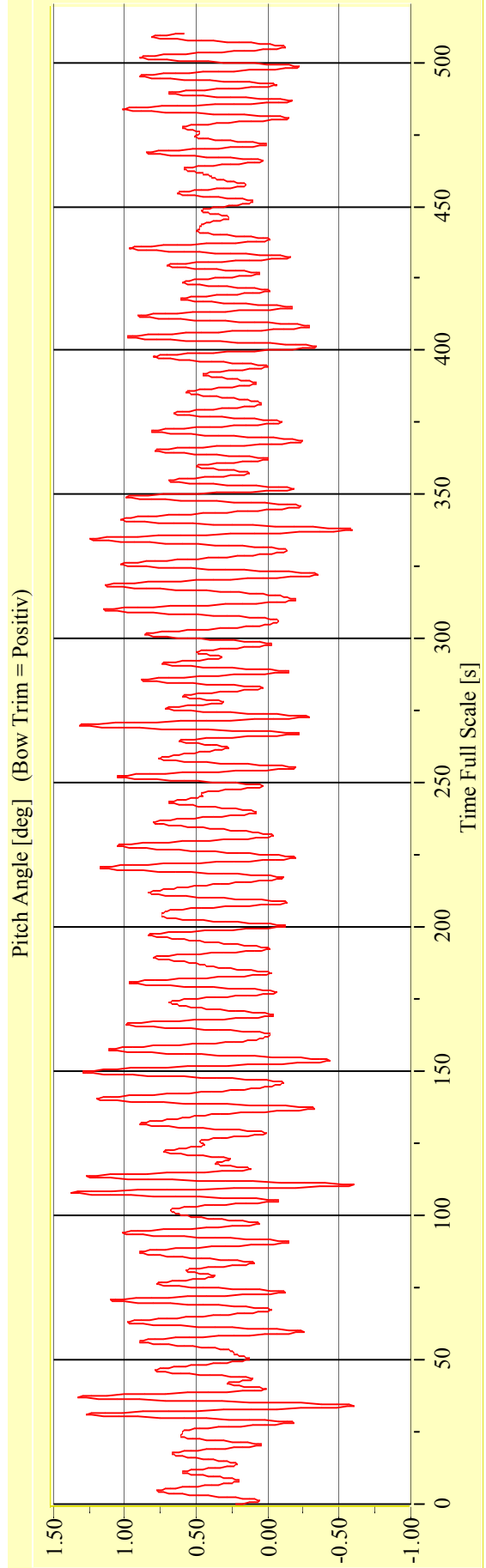
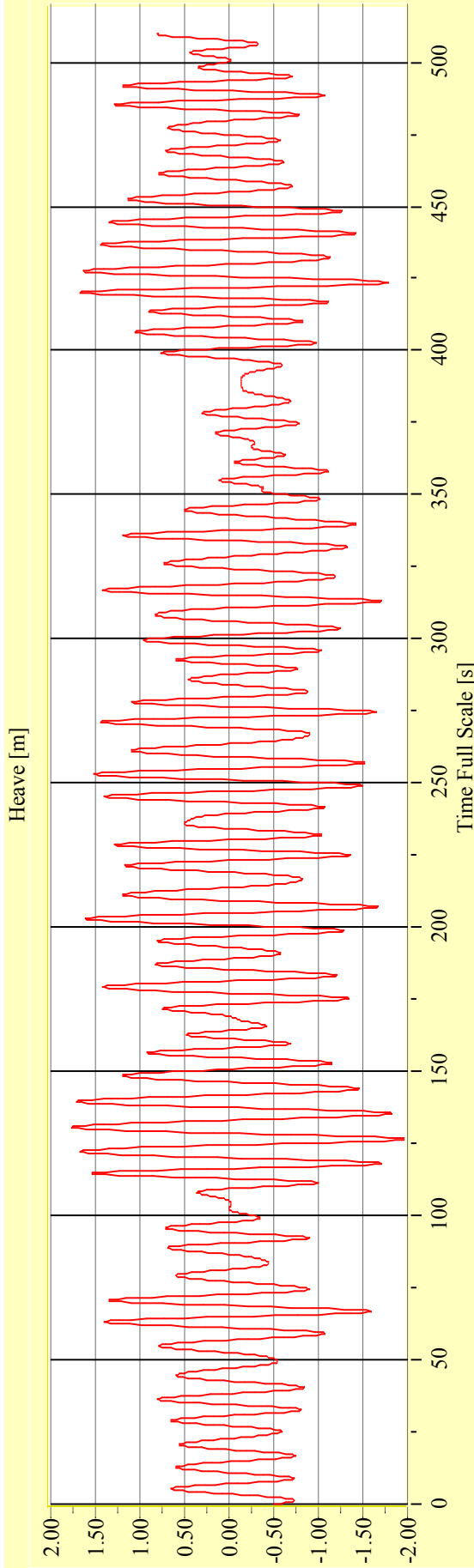
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29678-07**

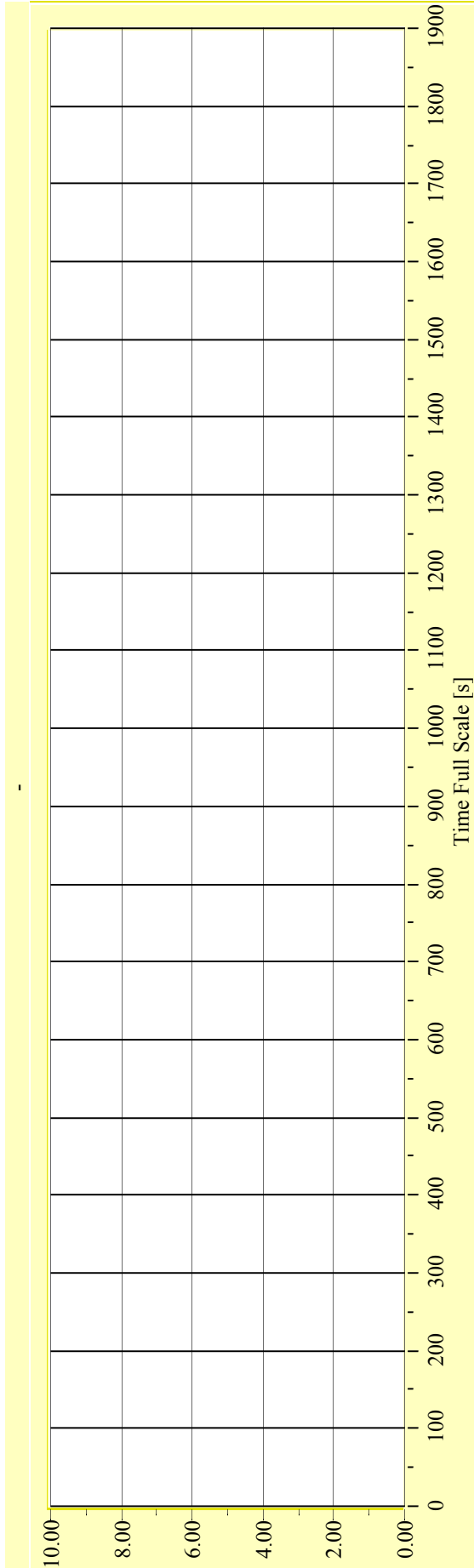
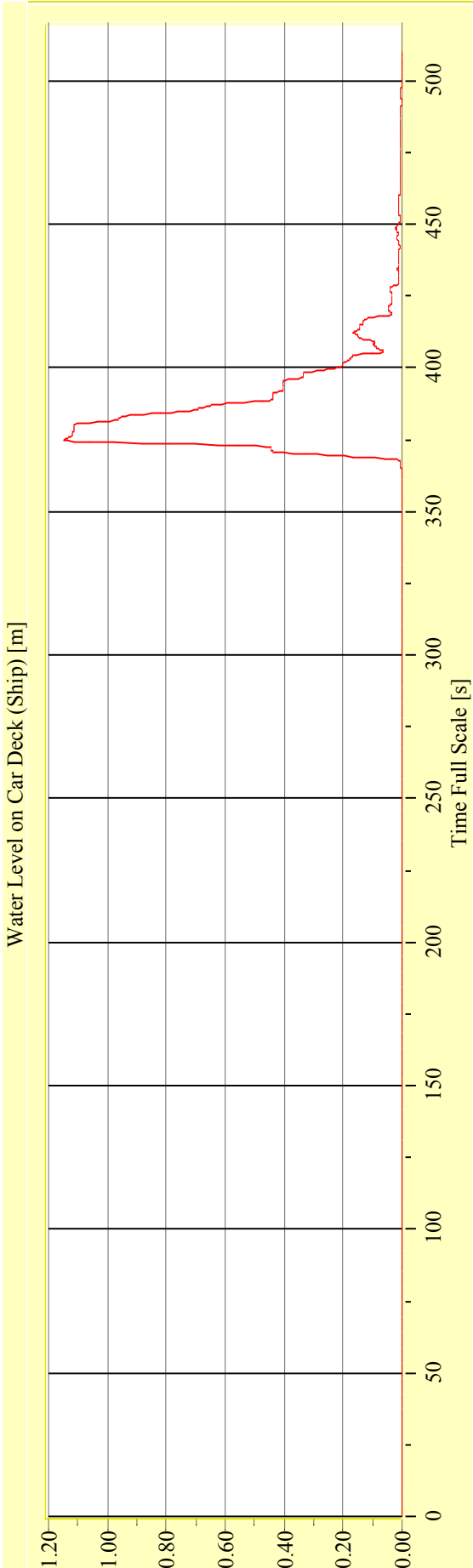
**Target Waves: Hs = 4.0 m Tp = 8.0 s**

**gamma = 3,3**



**Irregular Beam Seas**

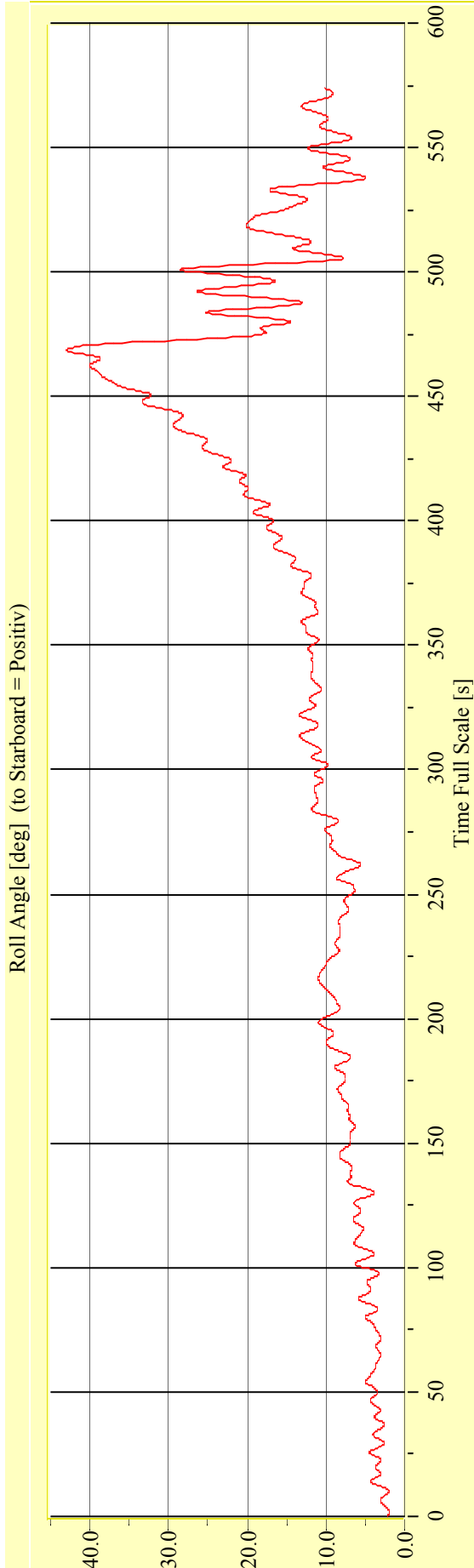
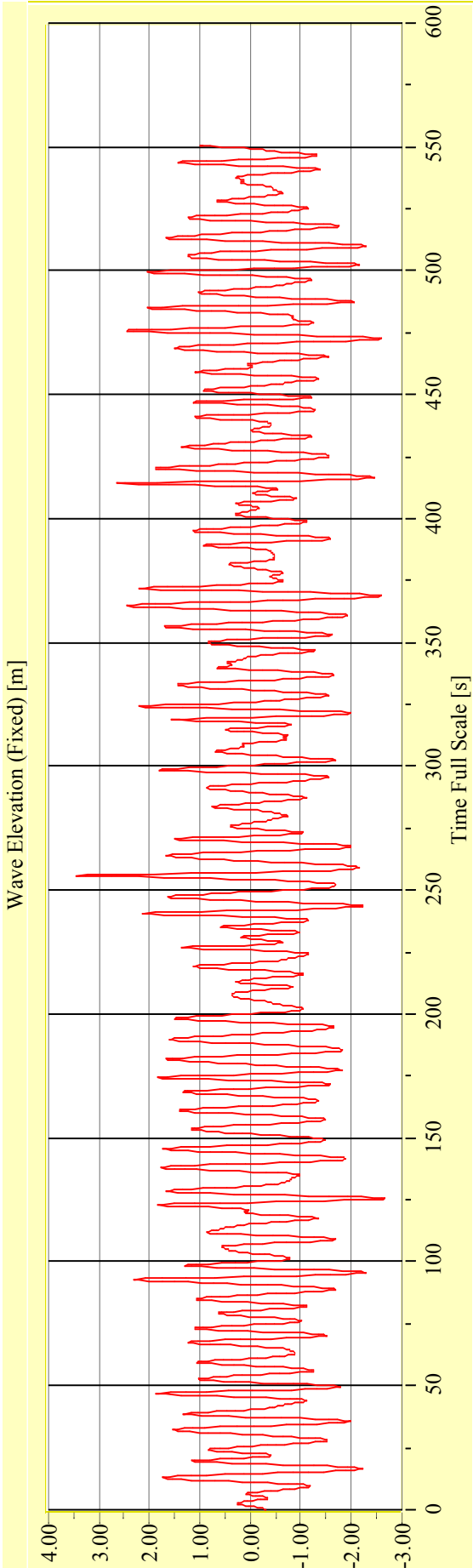
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29678-07**      **Target Waves: Hs = 4,0 m Tp = 8,0 s**      **gamma = 3,3**



**Date: 11.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

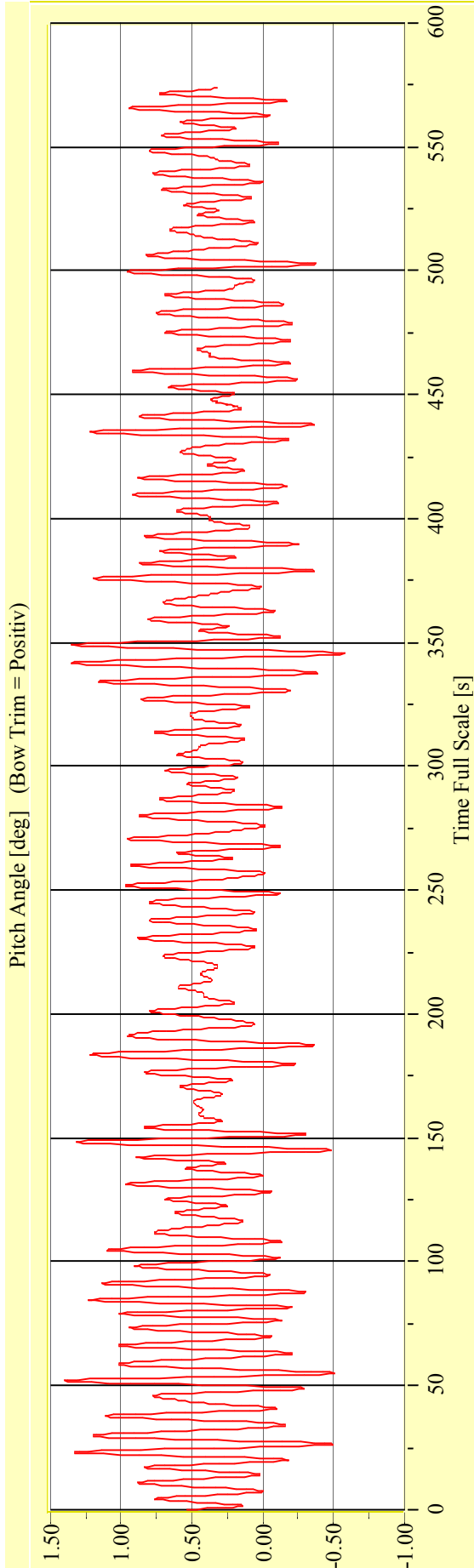
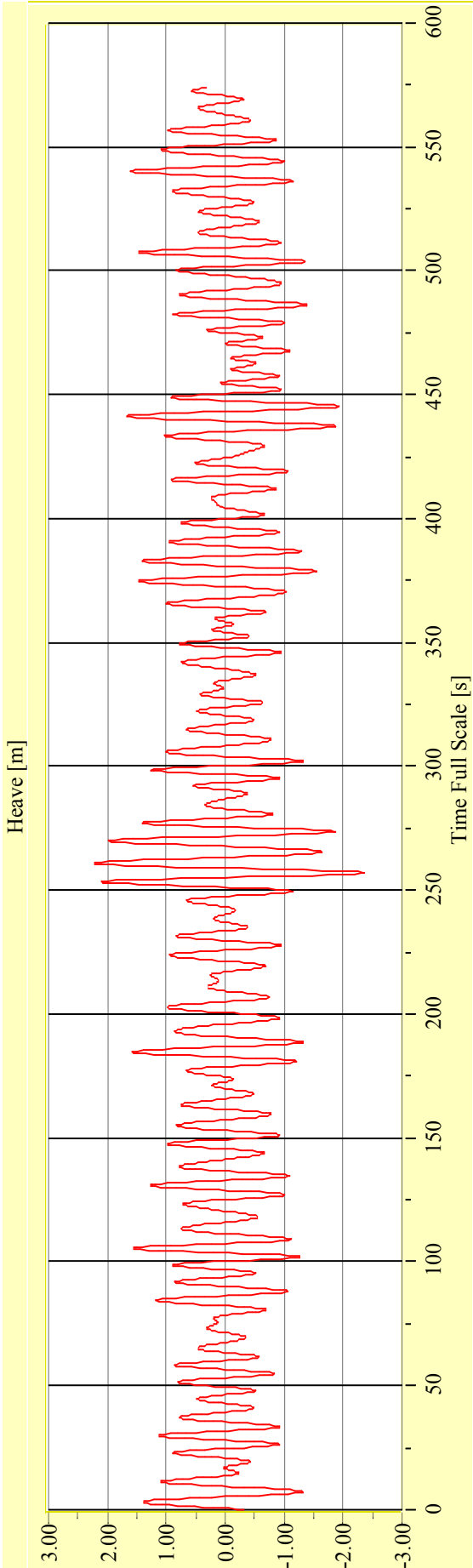
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29678-08**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**



**Date: 11.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29678-08**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**



**Date: 11.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**

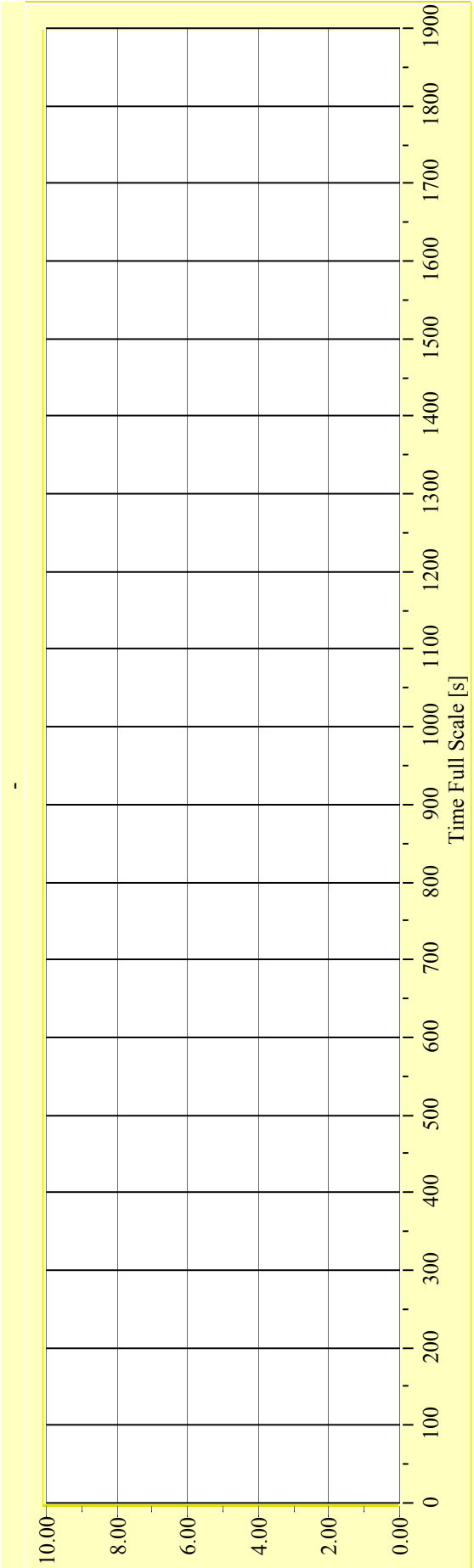
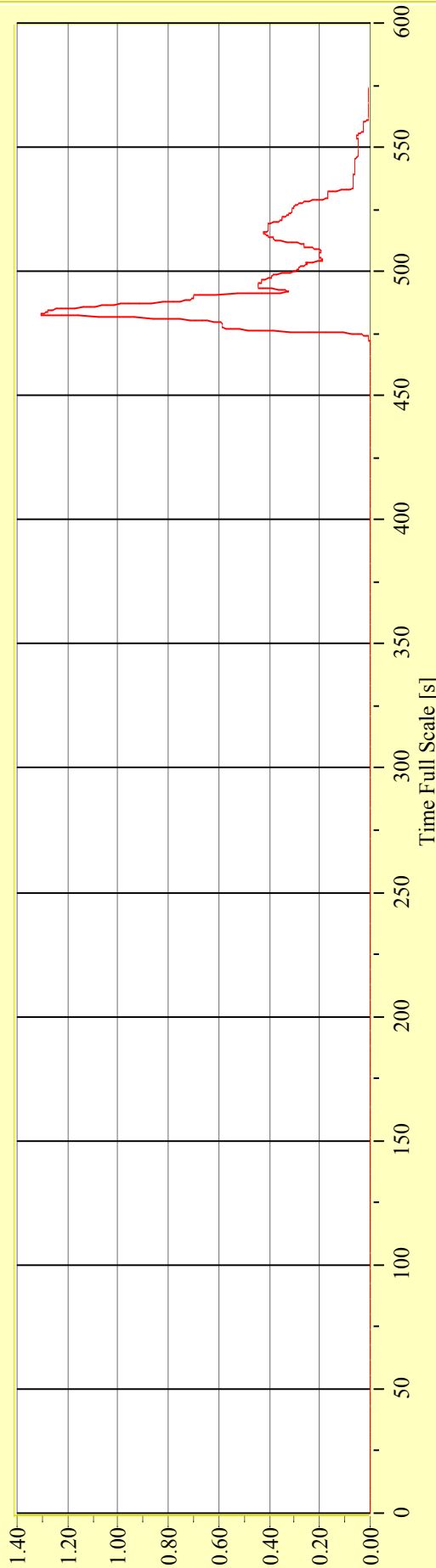
**Model No. 2446**

**Test No. 29678-08**

**Target Waves: Hs = 4,0 m Tp = 8,0 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



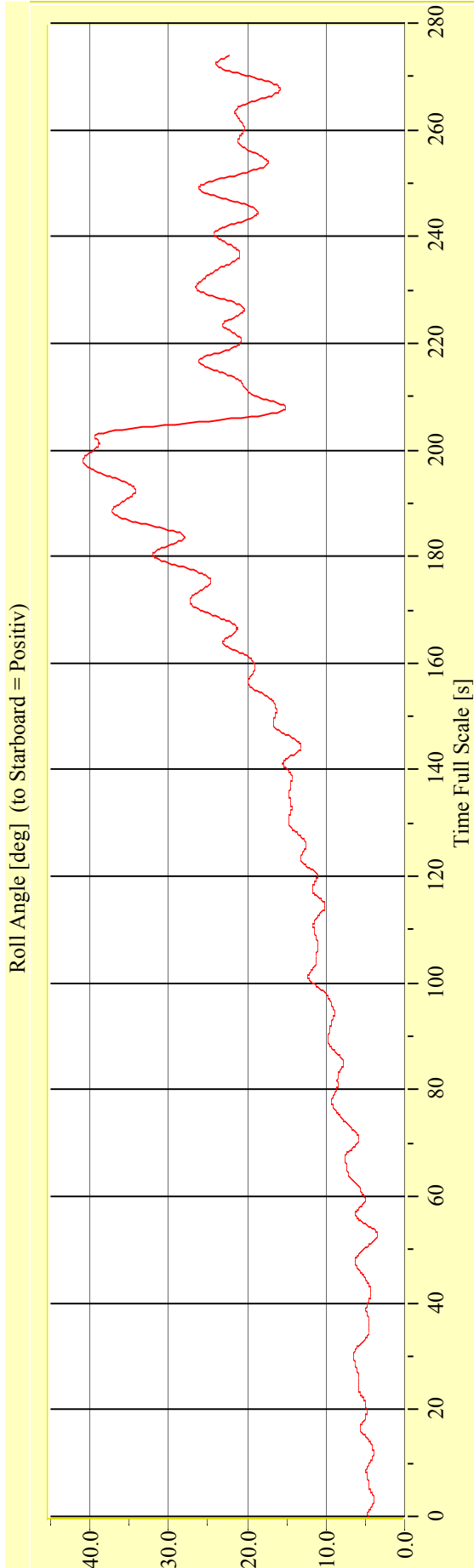
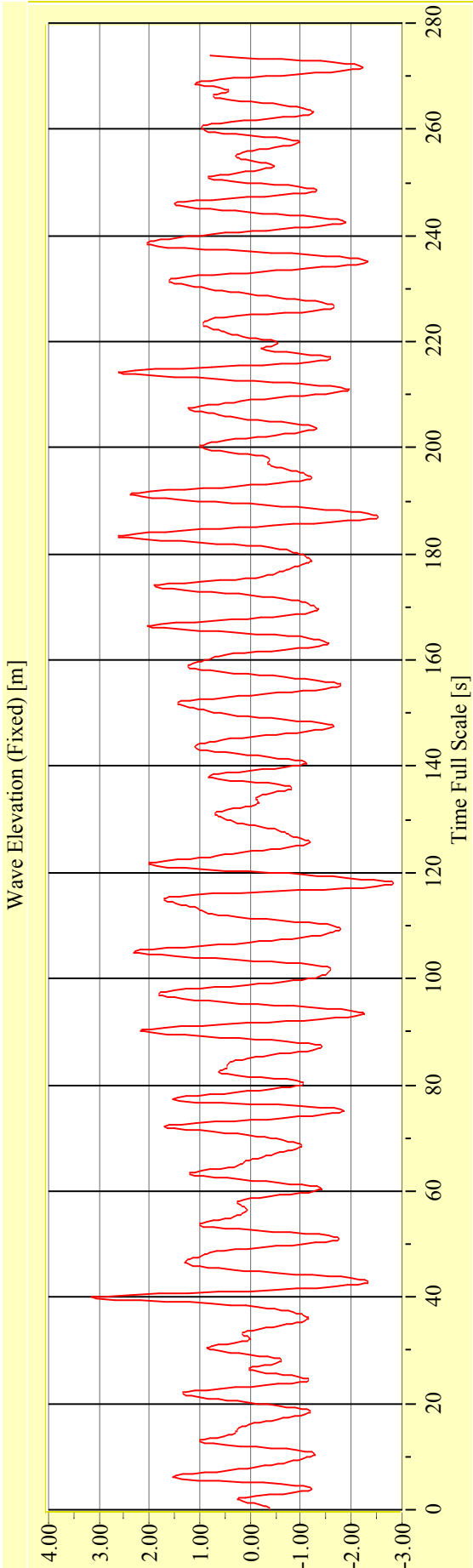
**Date: 11.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

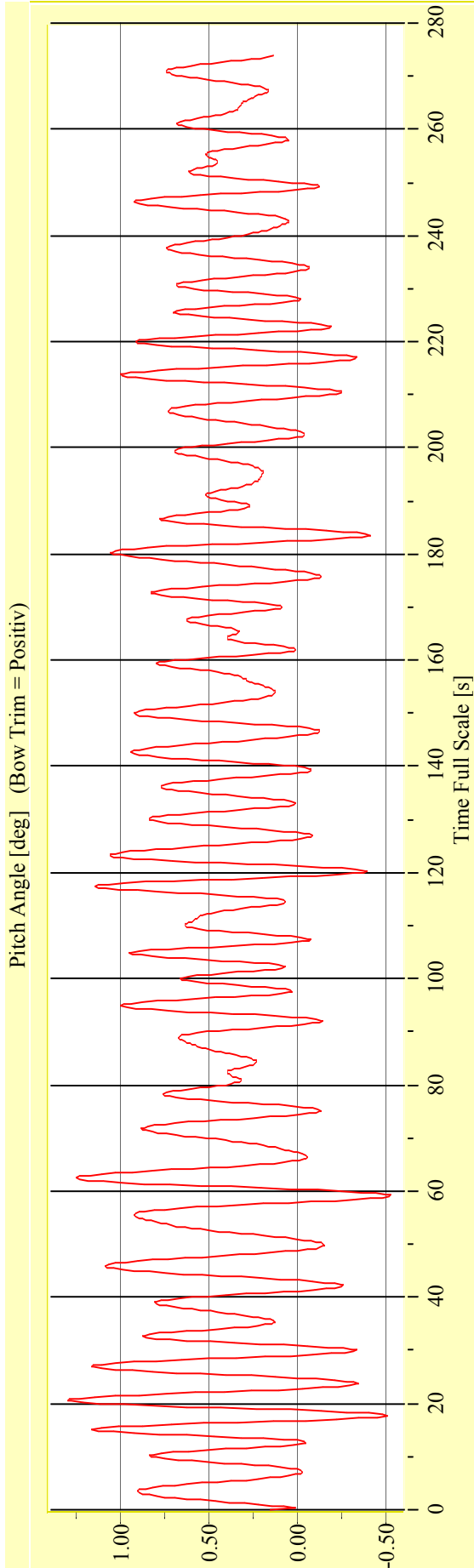
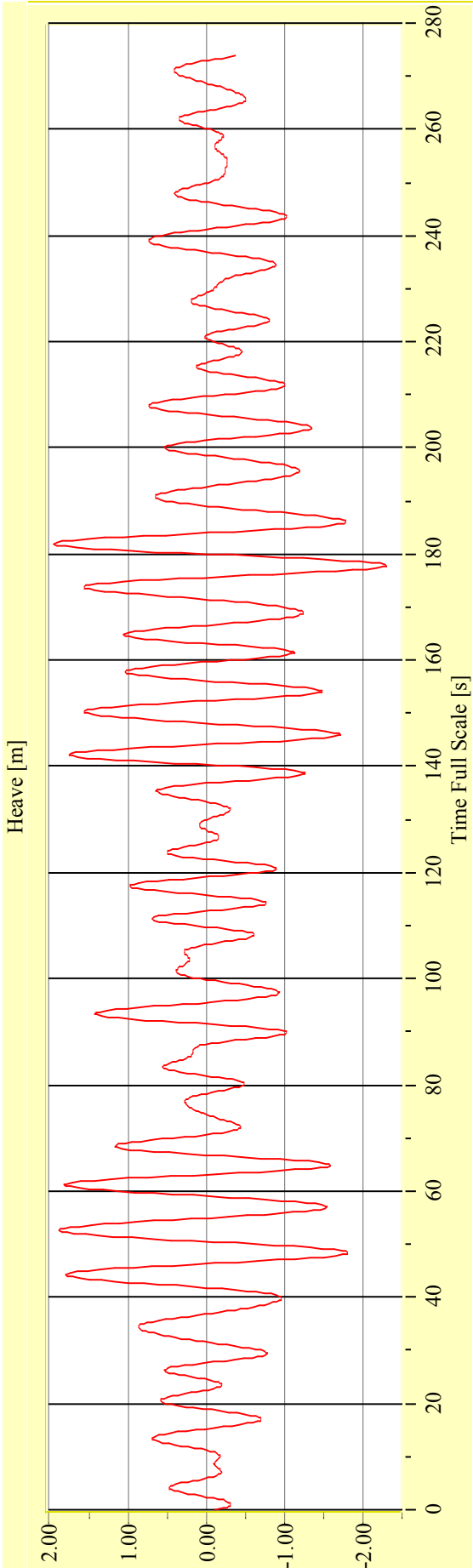
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29678-09**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**



**Date: 11.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29678-09**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**



**Date: 11.05.2010**

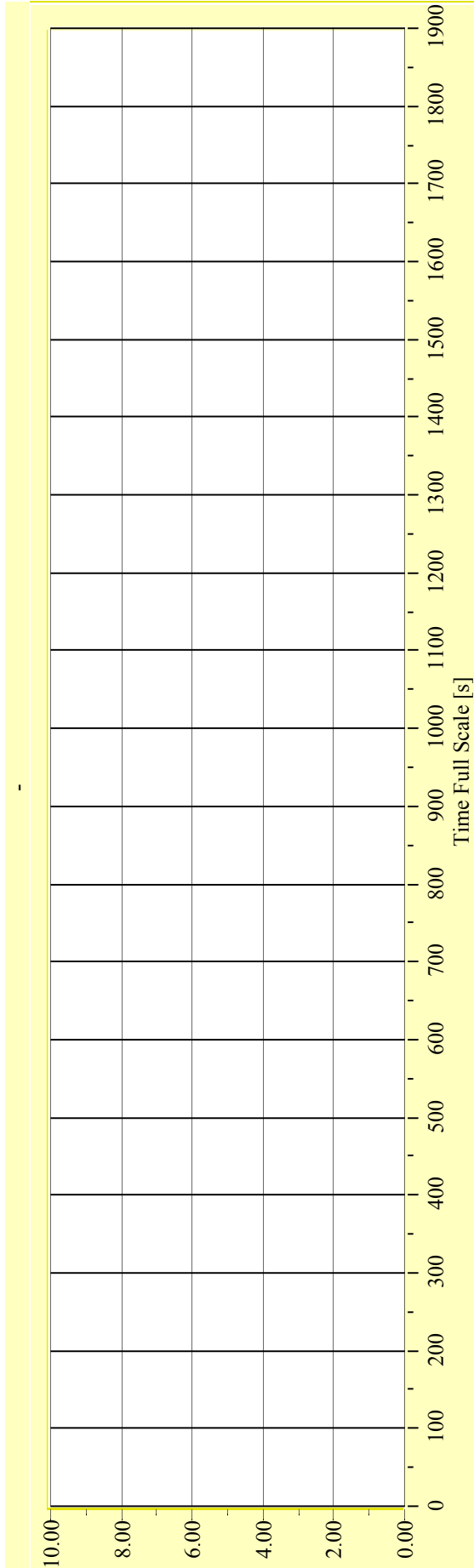
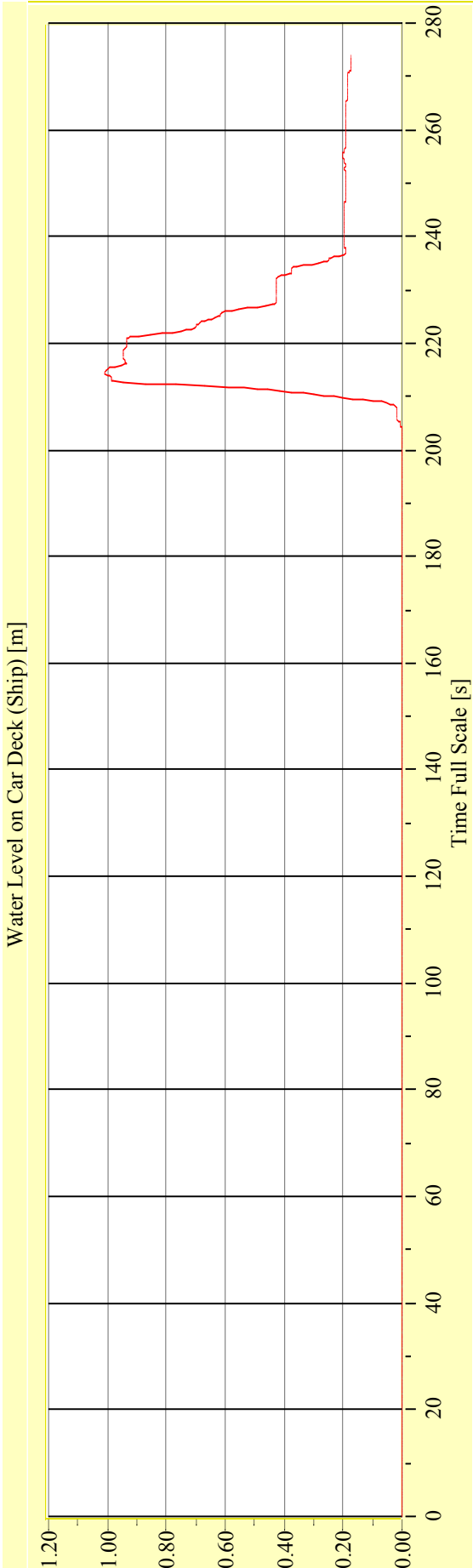
**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29678-09**      **Target Waves: Hs = 4,0 m Tp = 8,0 s**      **gamma = 3,3**



**Date: 11.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

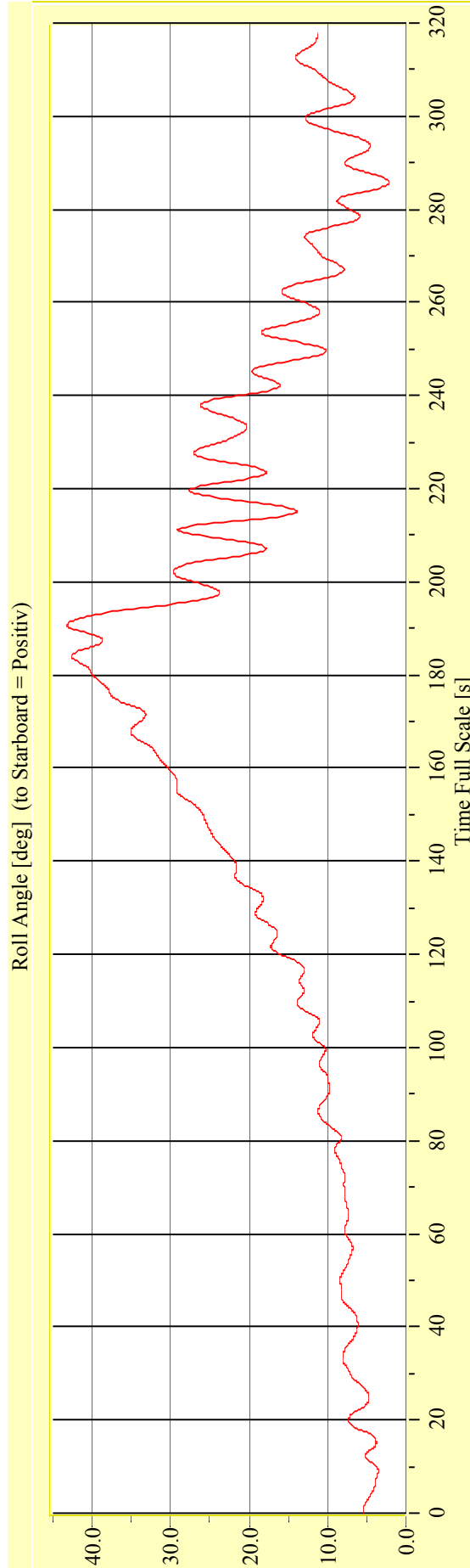
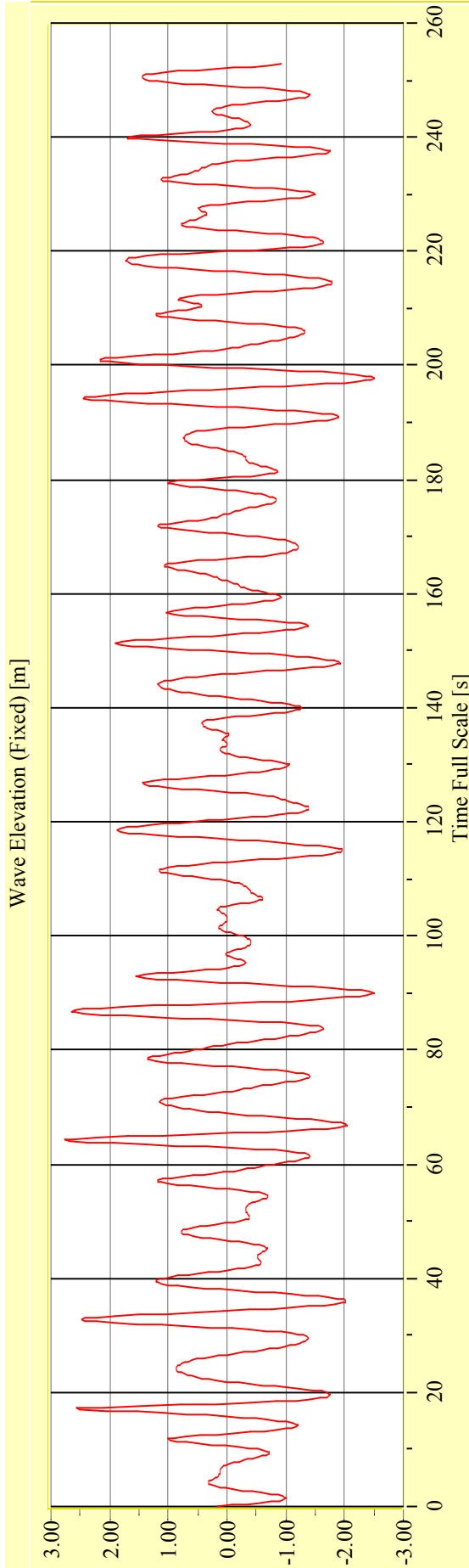
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29678-10**

**Target Waves: Hs = 4.0 m Tp = 8.0 s**

**gamma = 3,3**



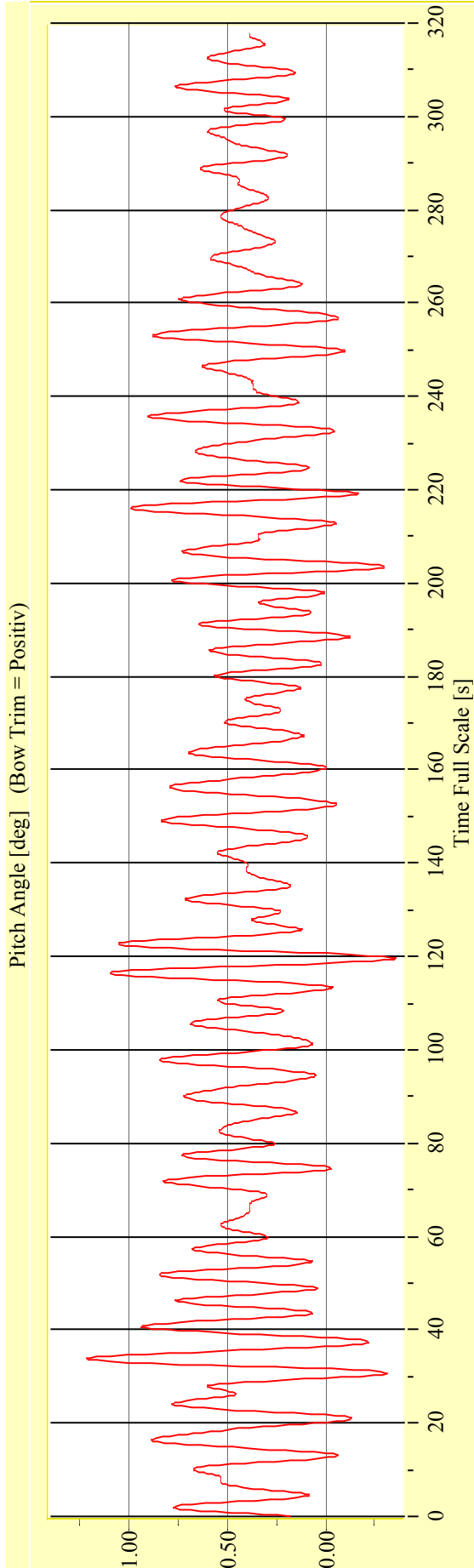
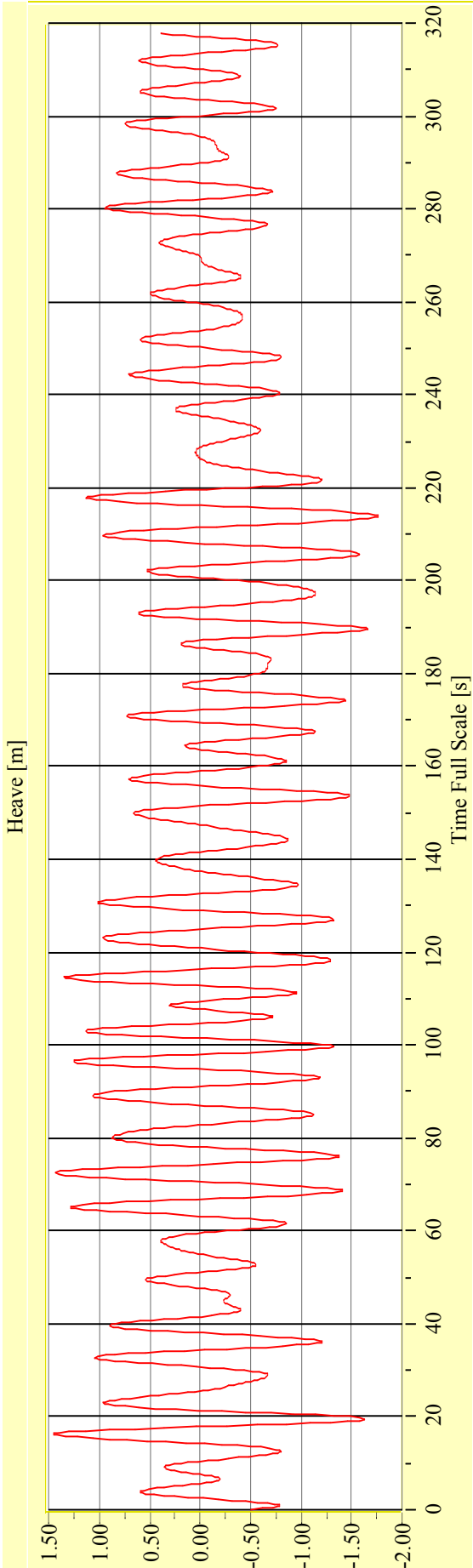
**Date: 11.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29678-10**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**



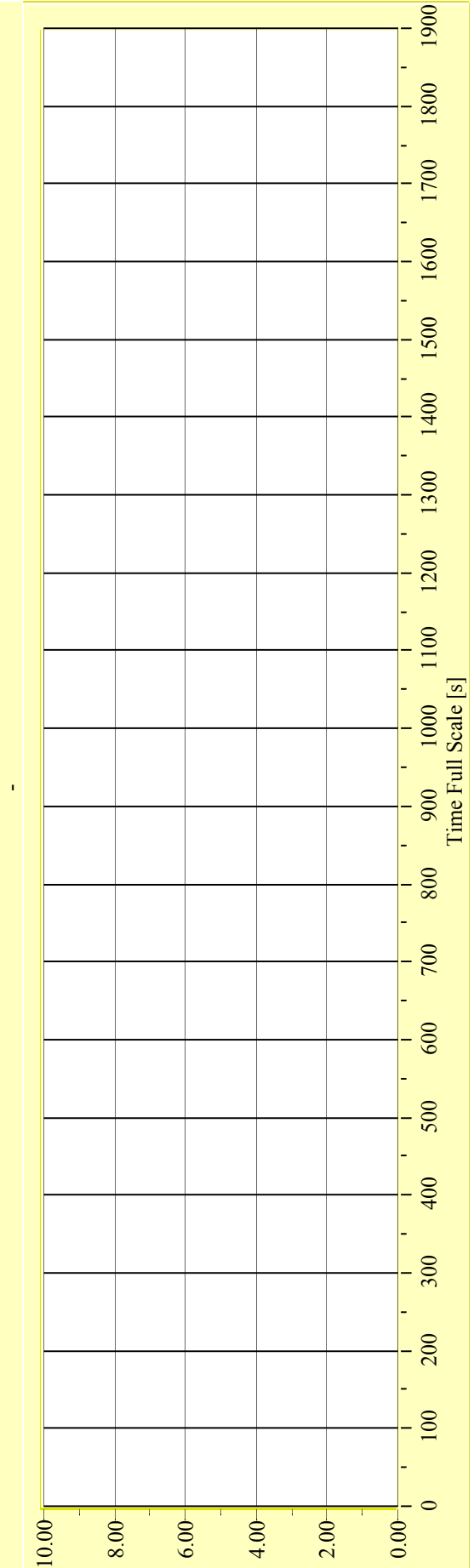
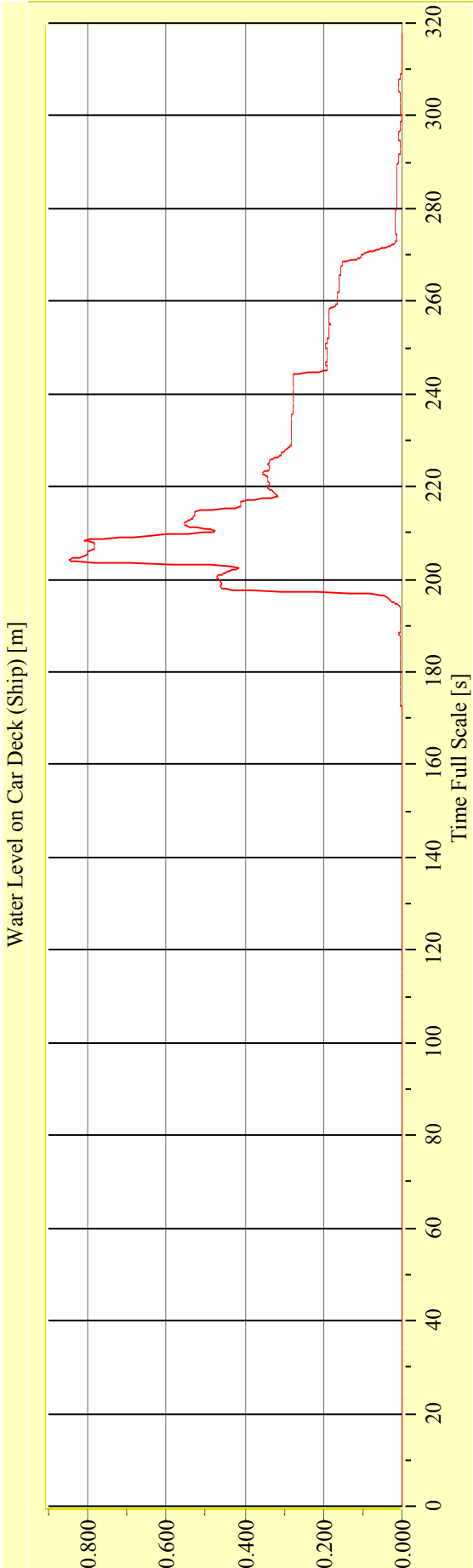
**Date: 11.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

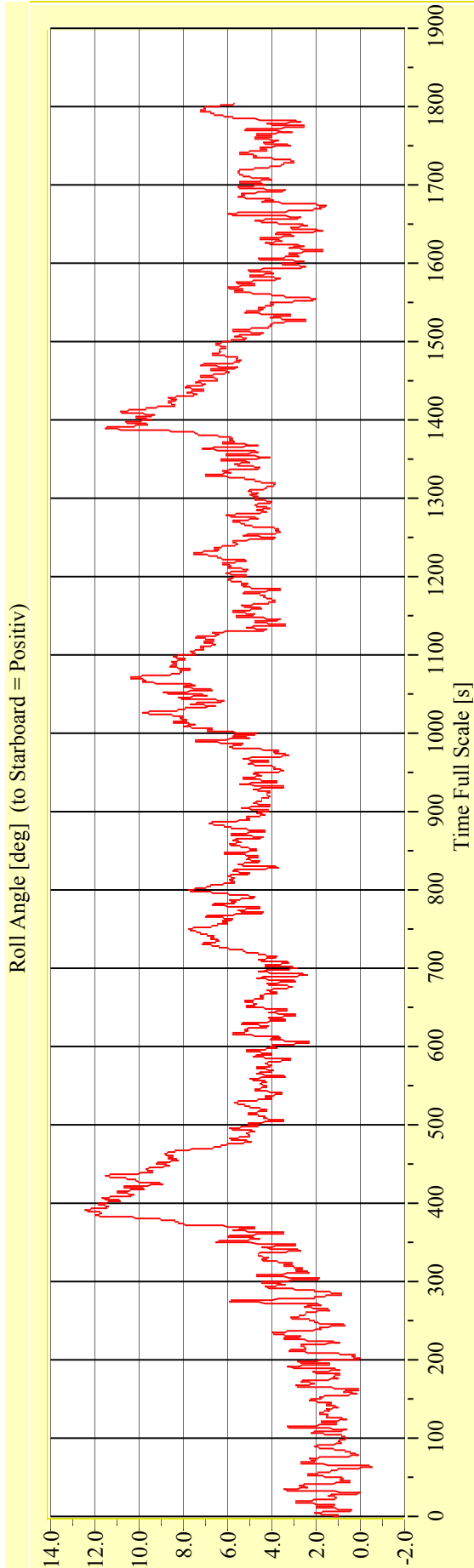
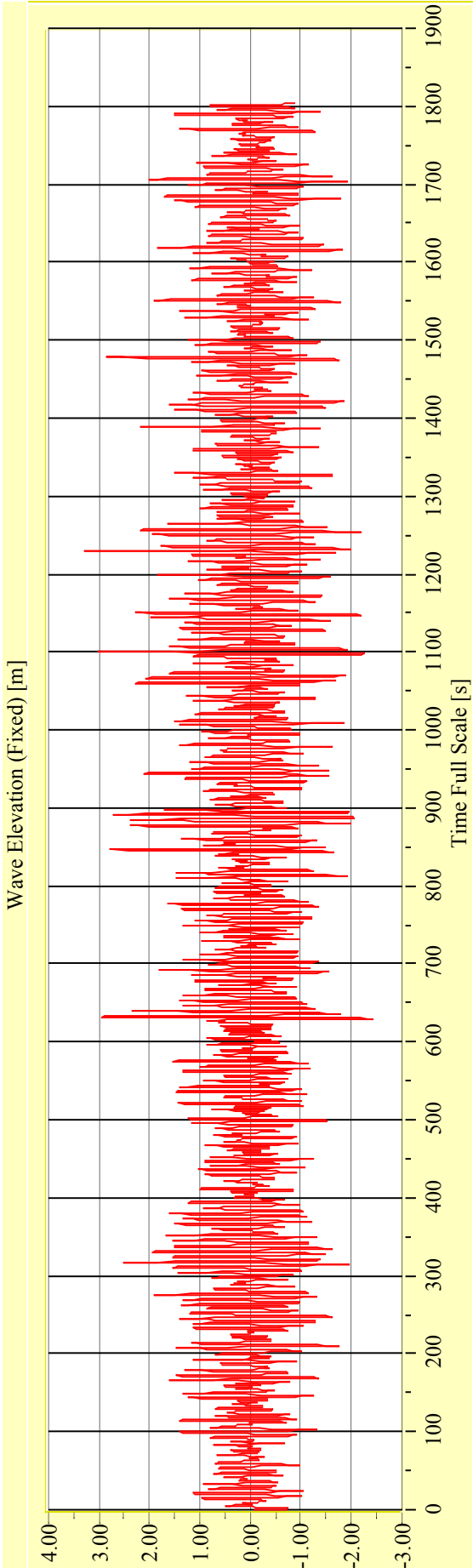
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29678-10**      **Target Waves: Hs = 4,0 m Tp = 8,0 s**      **gamma = 3,3**



**Date: 11.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29680-01**      **Target Waves: Hs = 3,0 m Tp = 6,928 s**      **gamma = 3,3**



**Date: 12.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

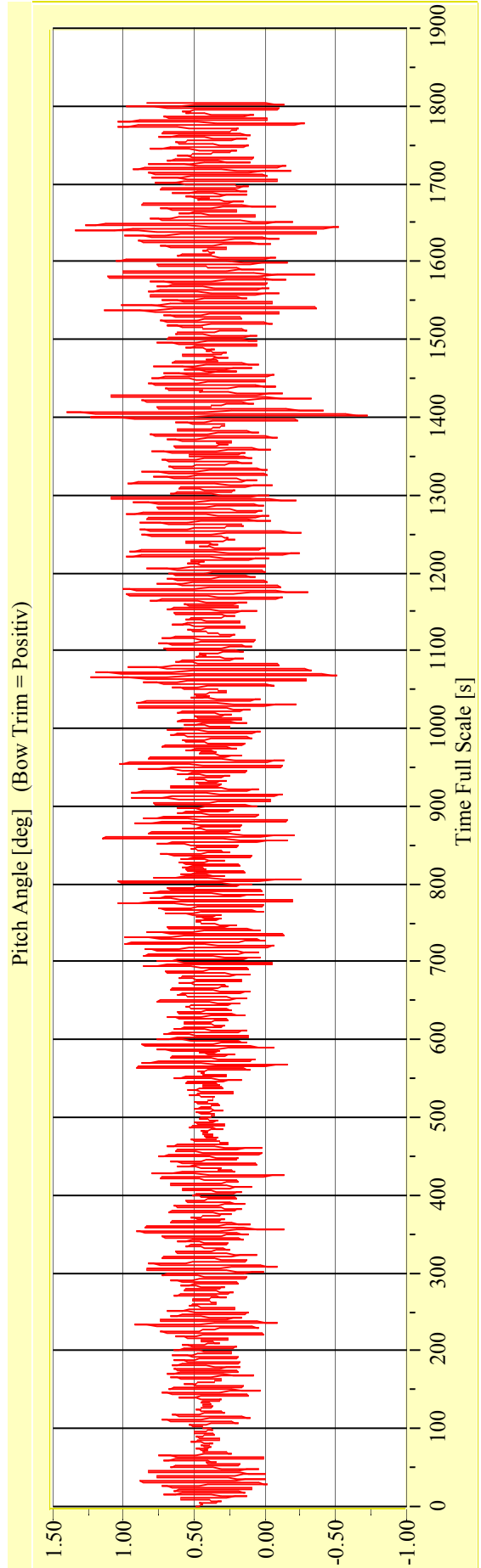
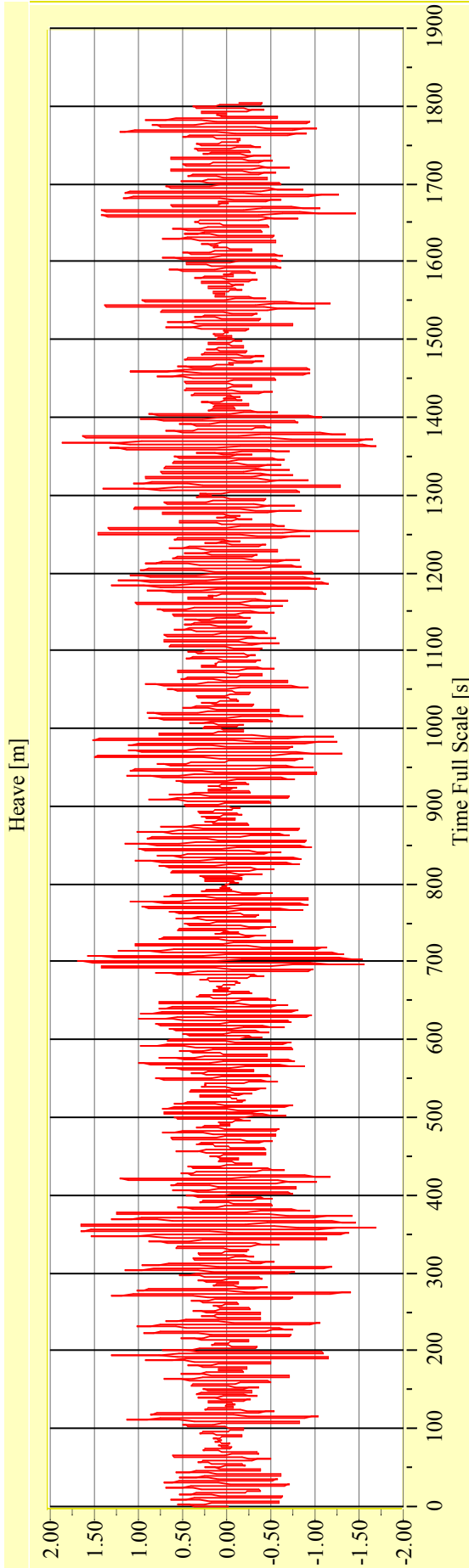
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29680-01**

**Target Waves: Hs = 3,0 m Tp = 6,928 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

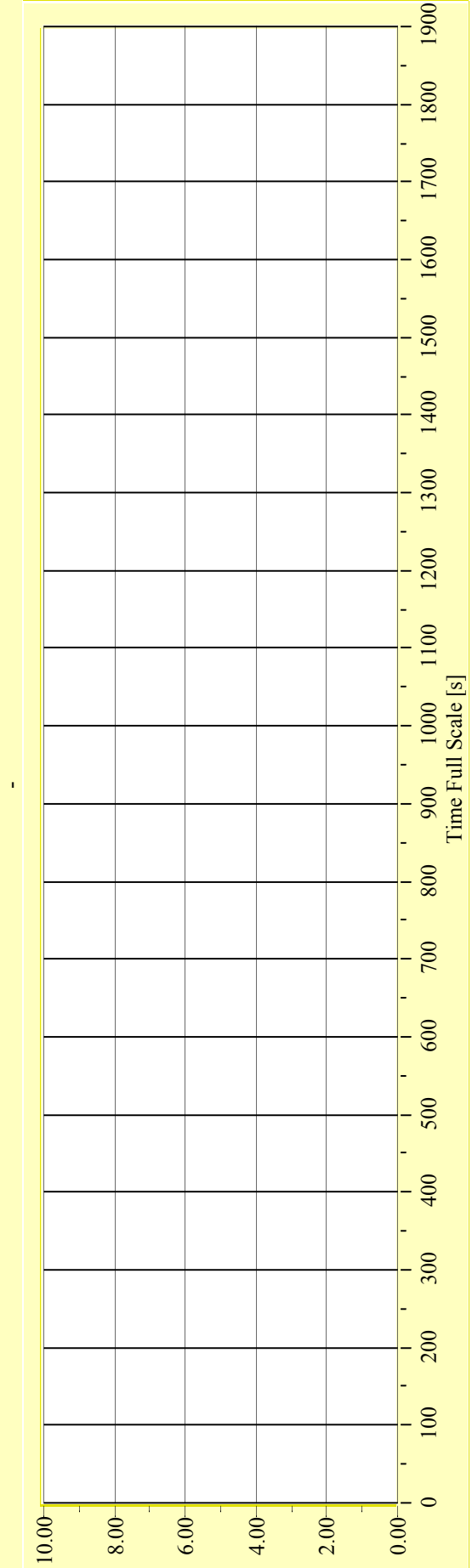
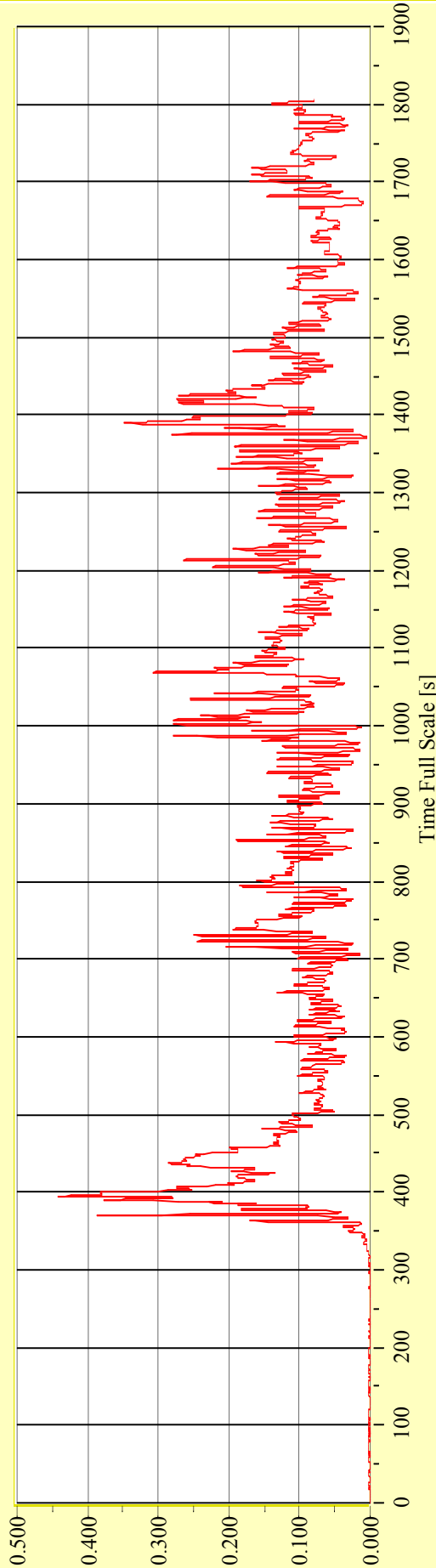
**Model No. 2446**

**Test No. 29680-01**

**Target Waves: Hs = 3,0 m Tp = 6,928 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Date: 12.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

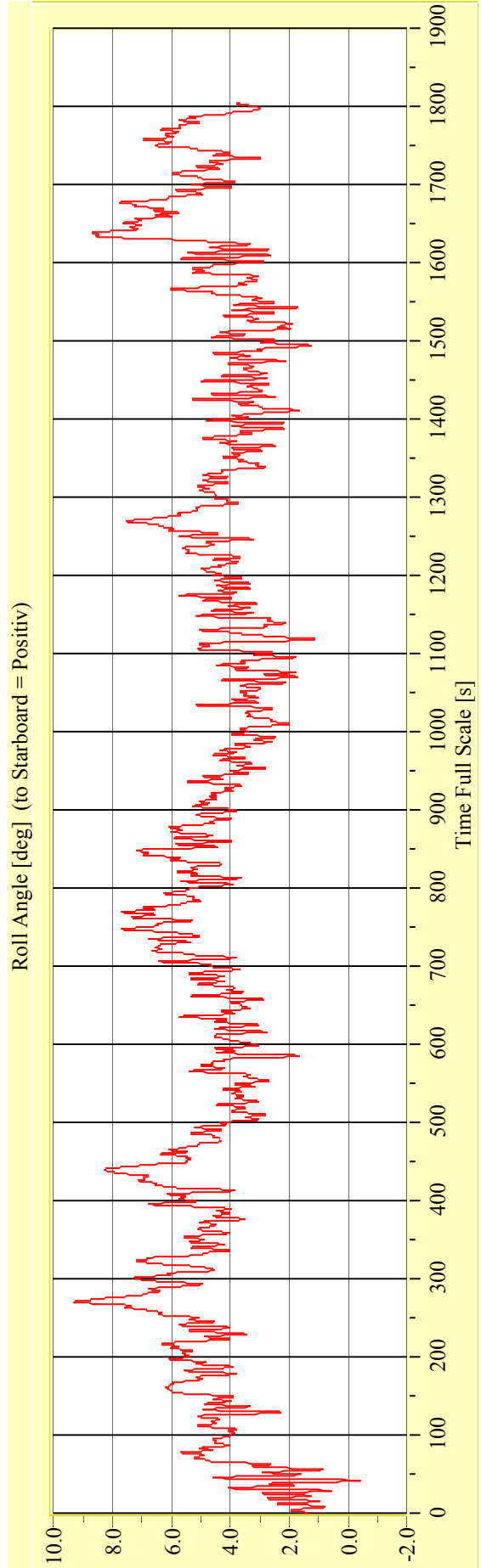
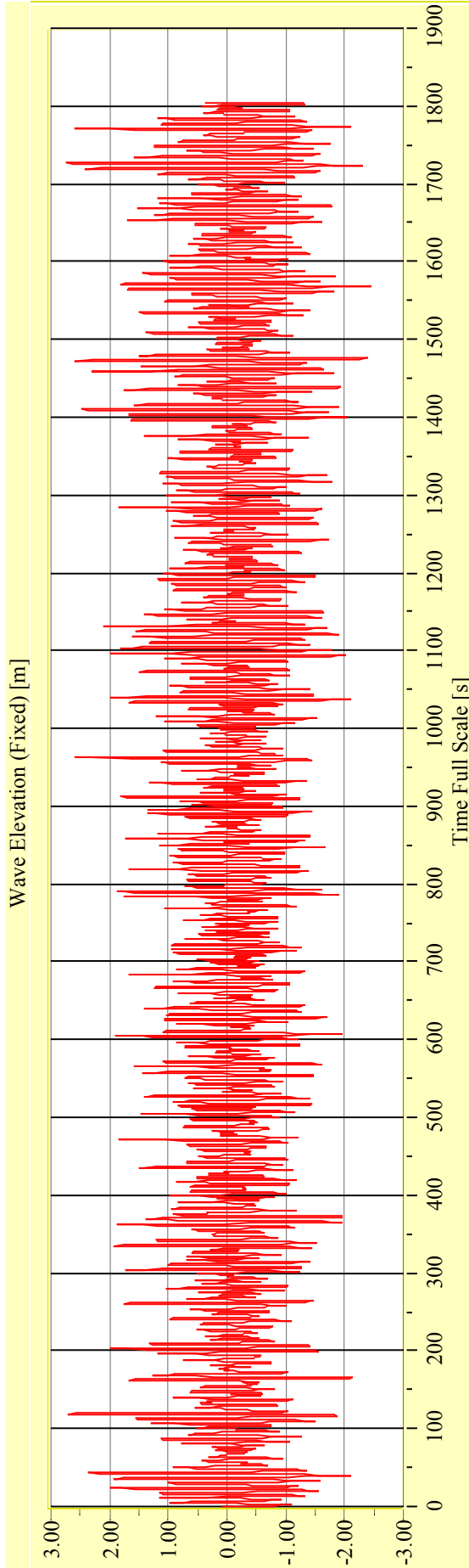
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29680-02**

**Target Waves: Hs = 3,0 m Tp = 6,928 s**

**gamma = 3,3**





**Irregular Beam Seas**

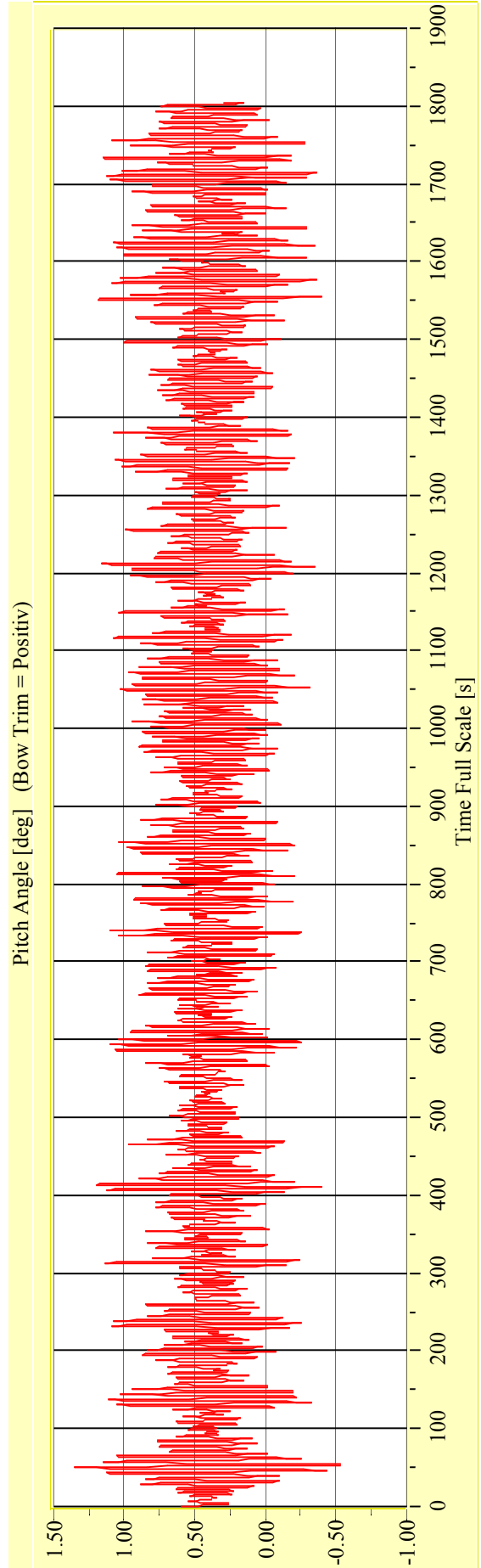
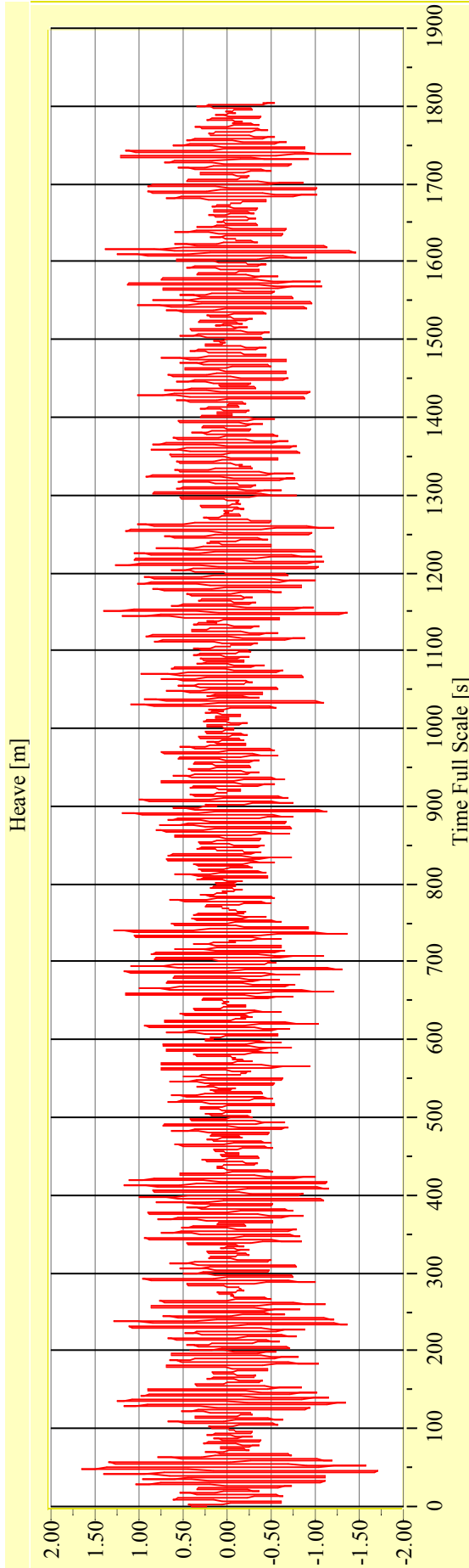
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29680-02**

**Target Waves: Hs = 3,0 m Tp = 6,928 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

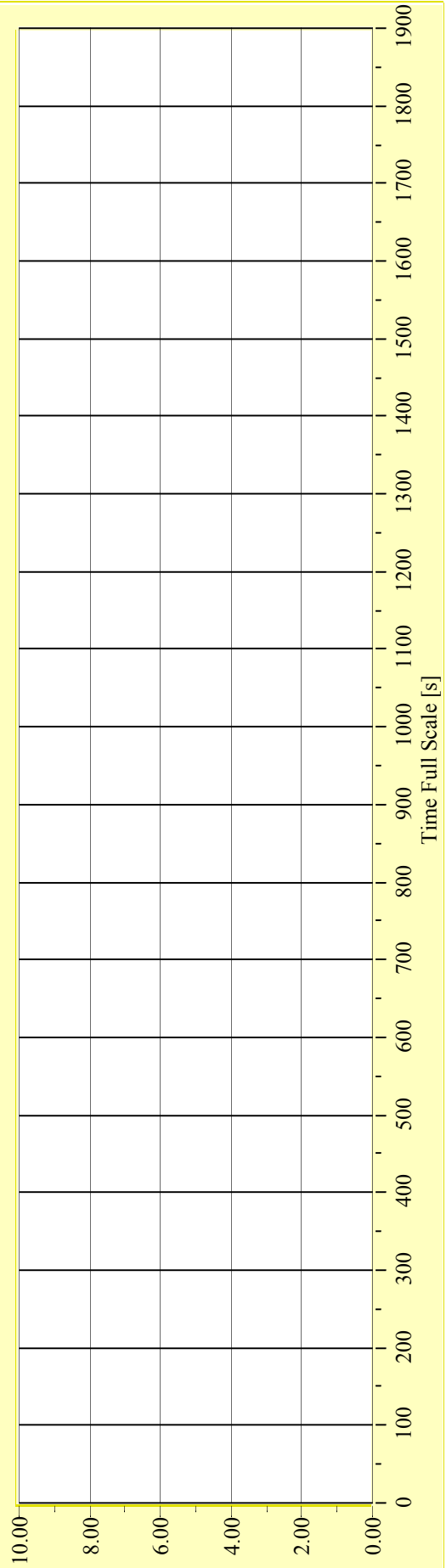
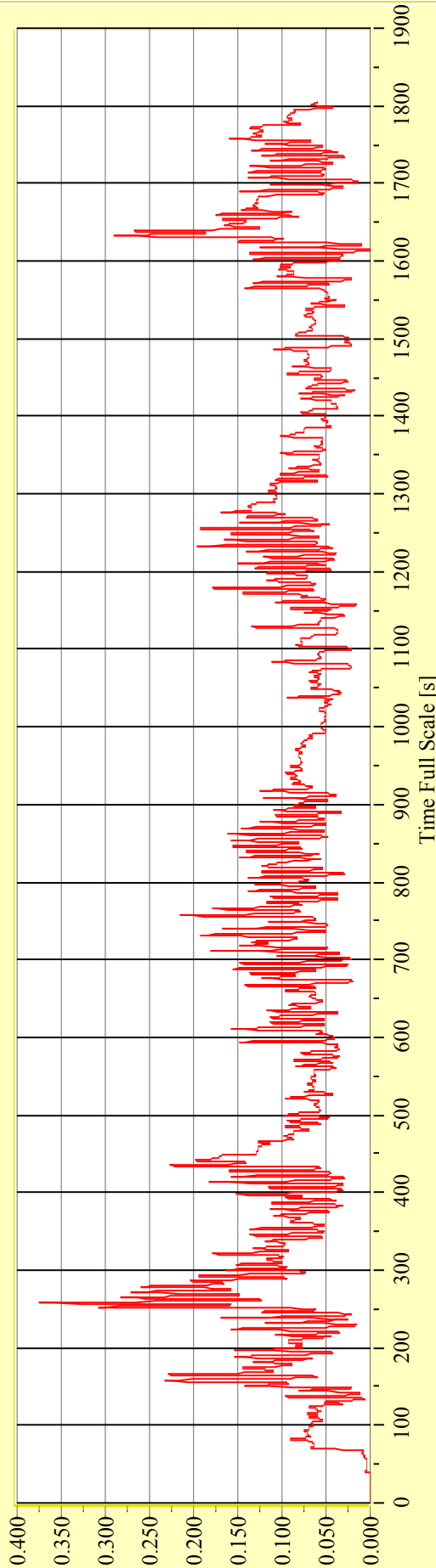
**Model No. 2446**

**Test No. 29680-02**

**Target Waves: Hs = 3,0 m Tp = 6,928 s**

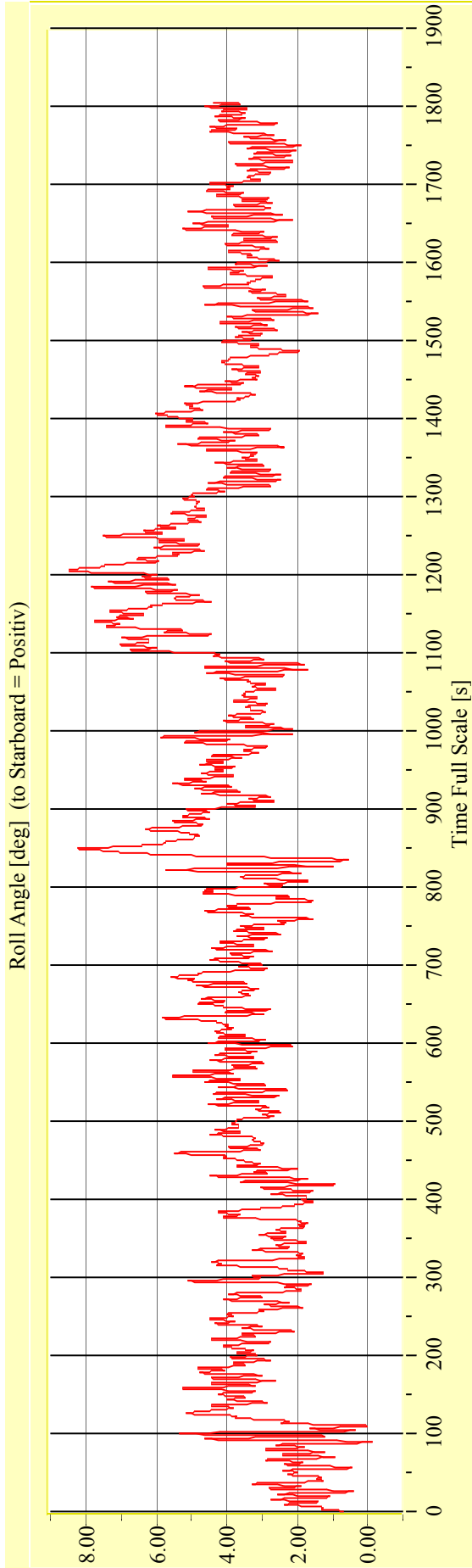
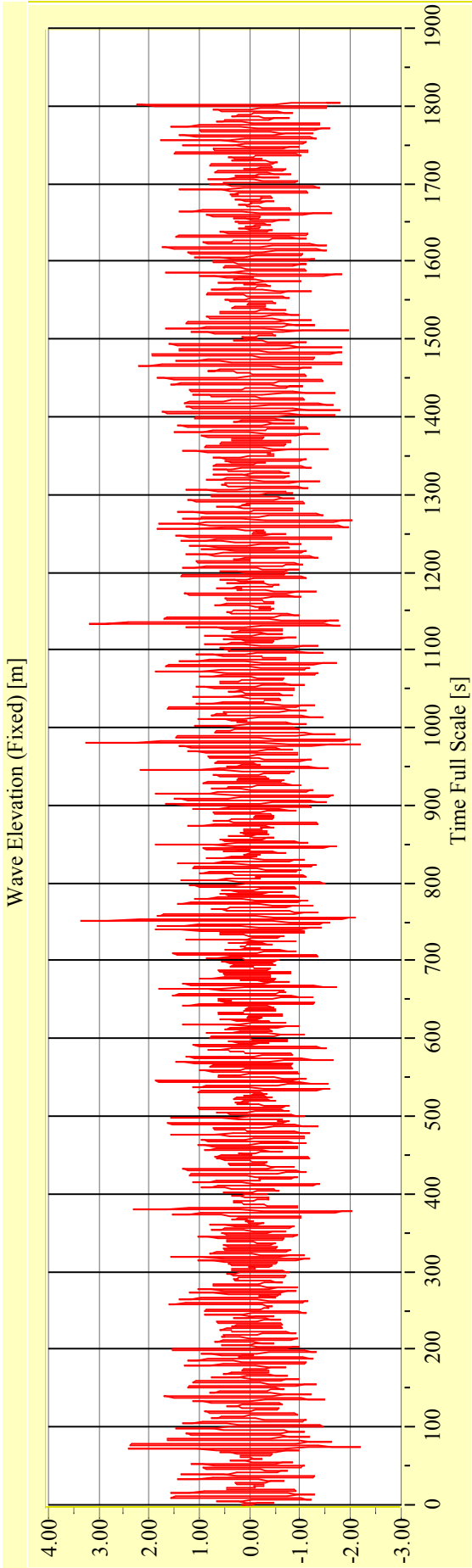
**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Irregular Beam Seas**

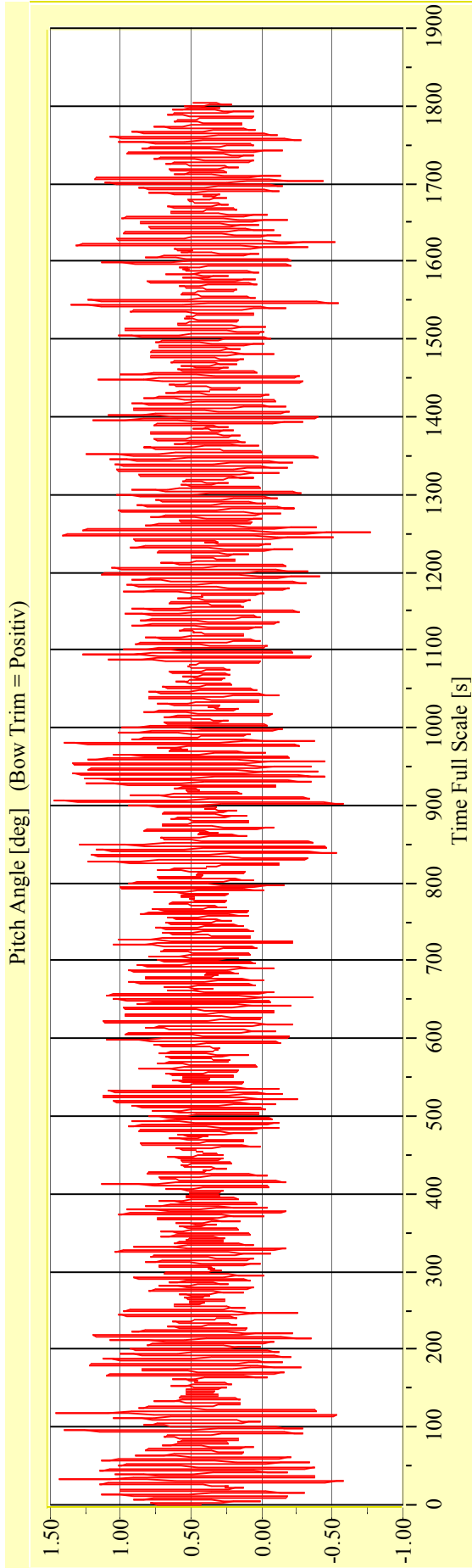
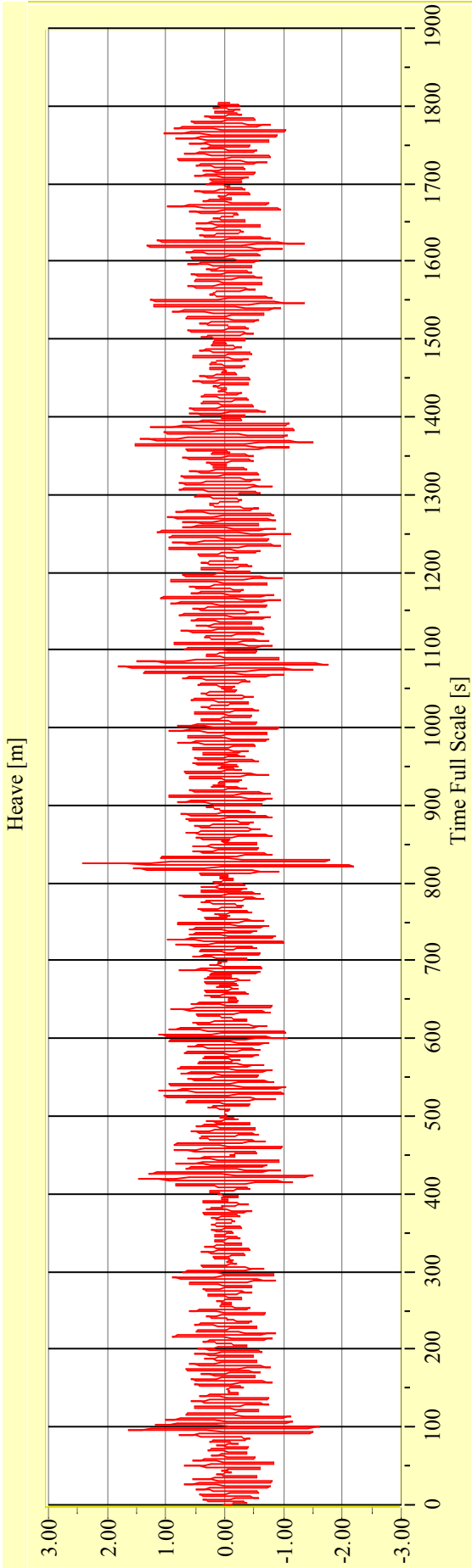
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29680-03**      **Target Waves: Hs = 3,0 m Tp = 6,928 s**      **gamma = 3,3**



**Date: 12.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29680-03**      **Target Waves: Hs = 3,0 m Tp = 6,928 s**      **gamma = 3,3**



**Date: 12.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**

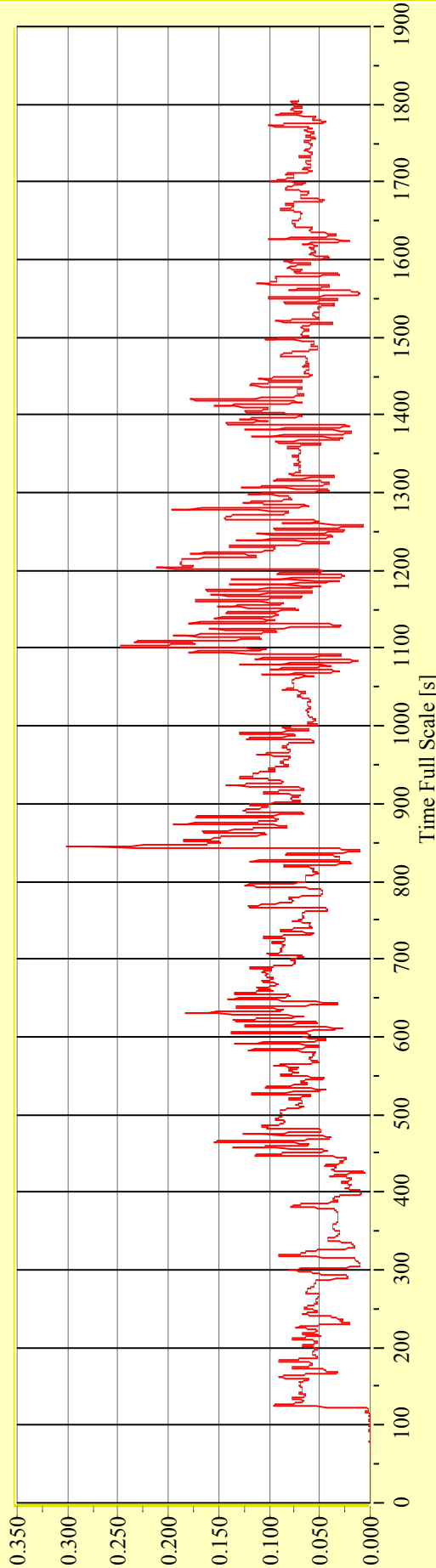
**Model No. 2446**

**Test No. 29680-03**

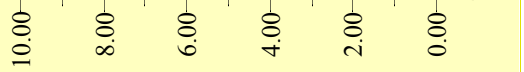
**Target Waves: Hs = 3,0 m Tp = 6,928 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



Time Full Scale [s]



Time Full Scale [s]

**Date: 12.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

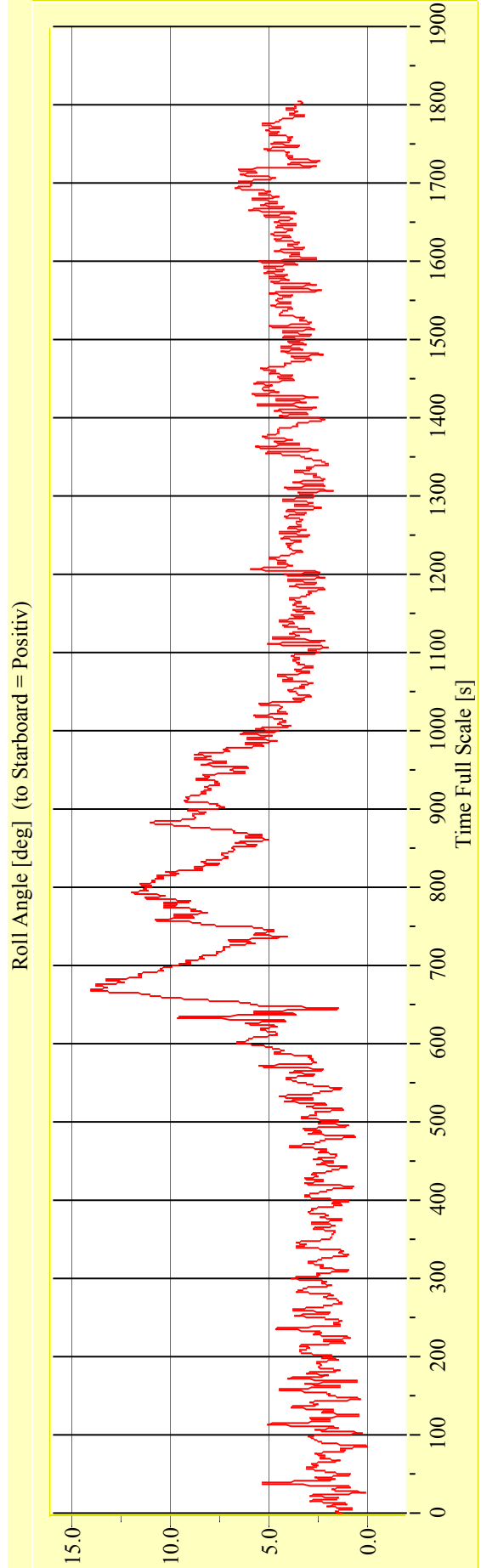
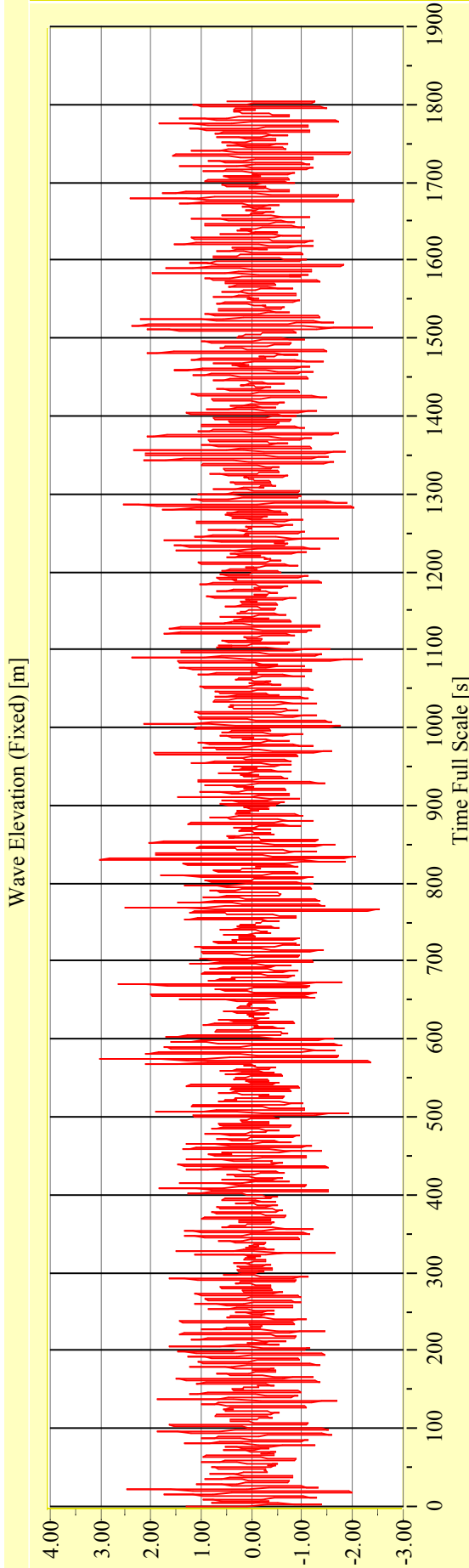
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29680-04**

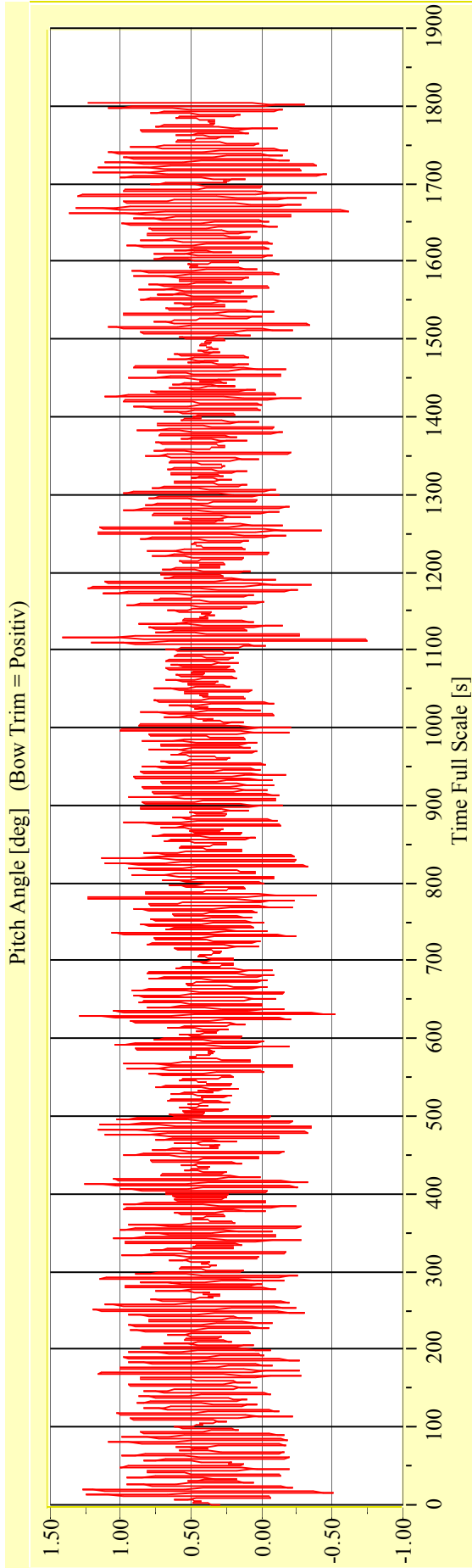
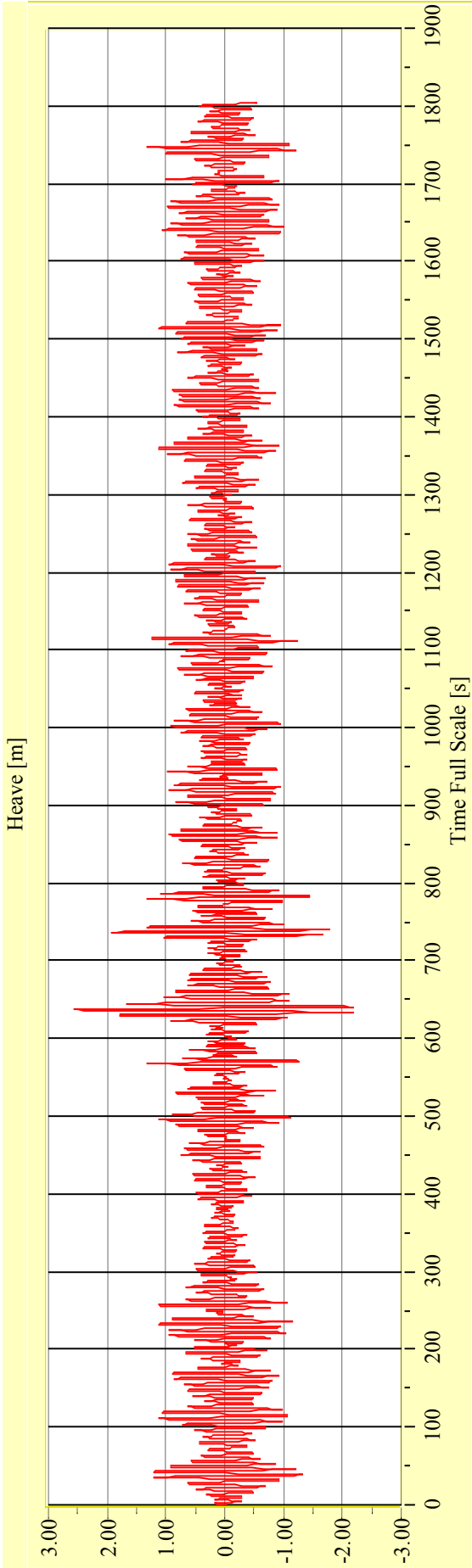
**Target Waves: Hs = 3,0 m Tp = 6,928 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29680-04**      **Target Waves: Hs = 3,0 m Tp = 6,928 s**      **gamma = 3,3**



**Date: 12.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**

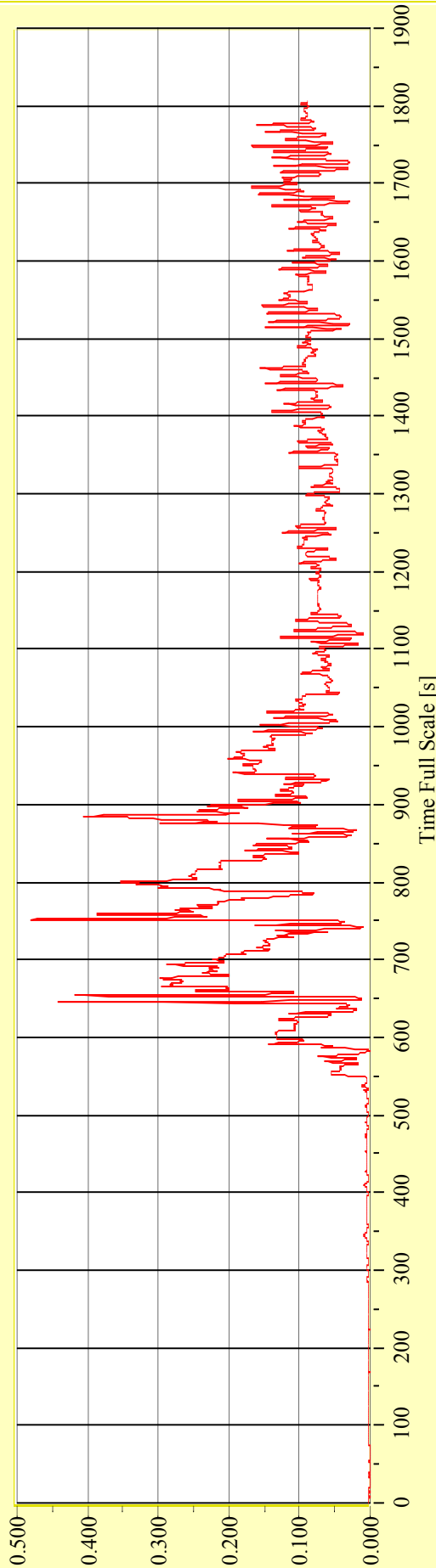
**Model No. 2446**

**Test No. 29680-04**

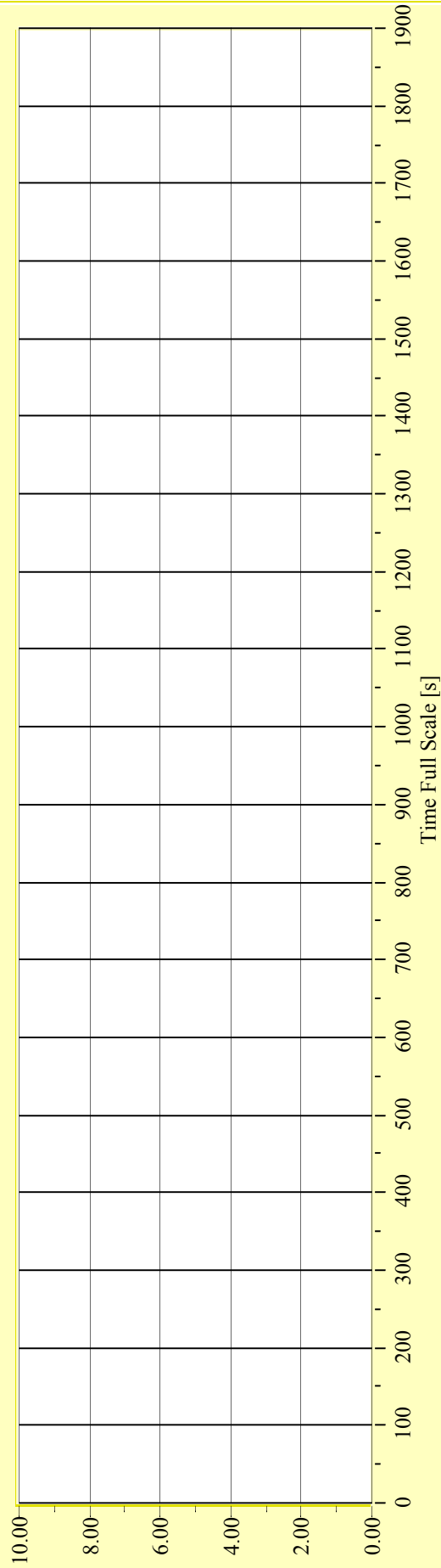
**Target Waves: Hs = 3,0 m Tp = 6,928 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



-



**Date: 12.05.2010**

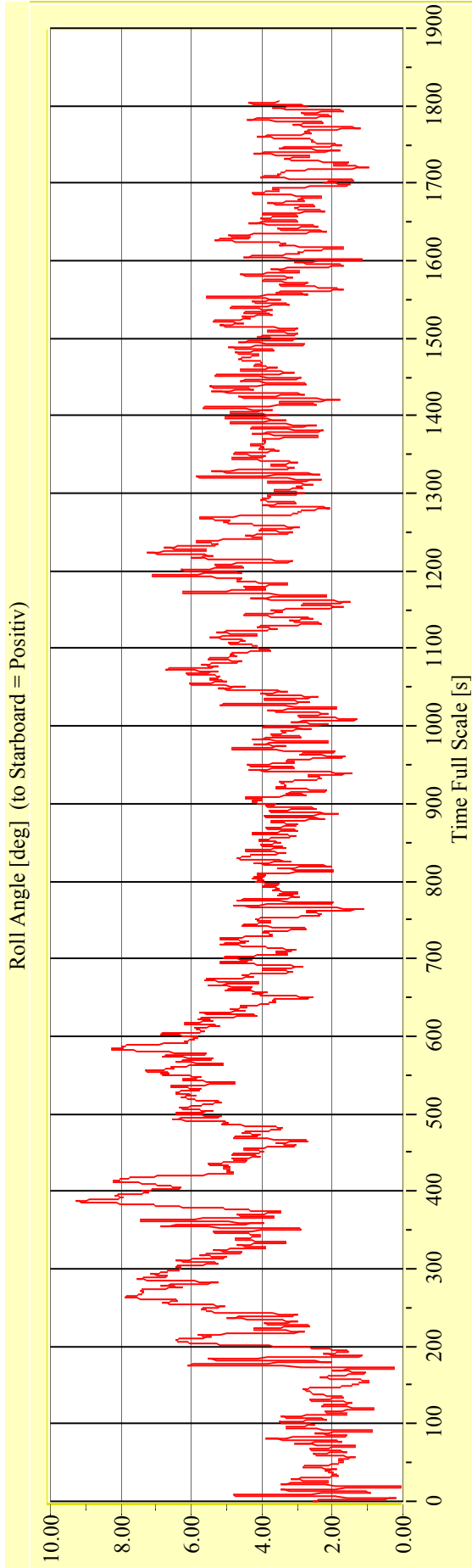
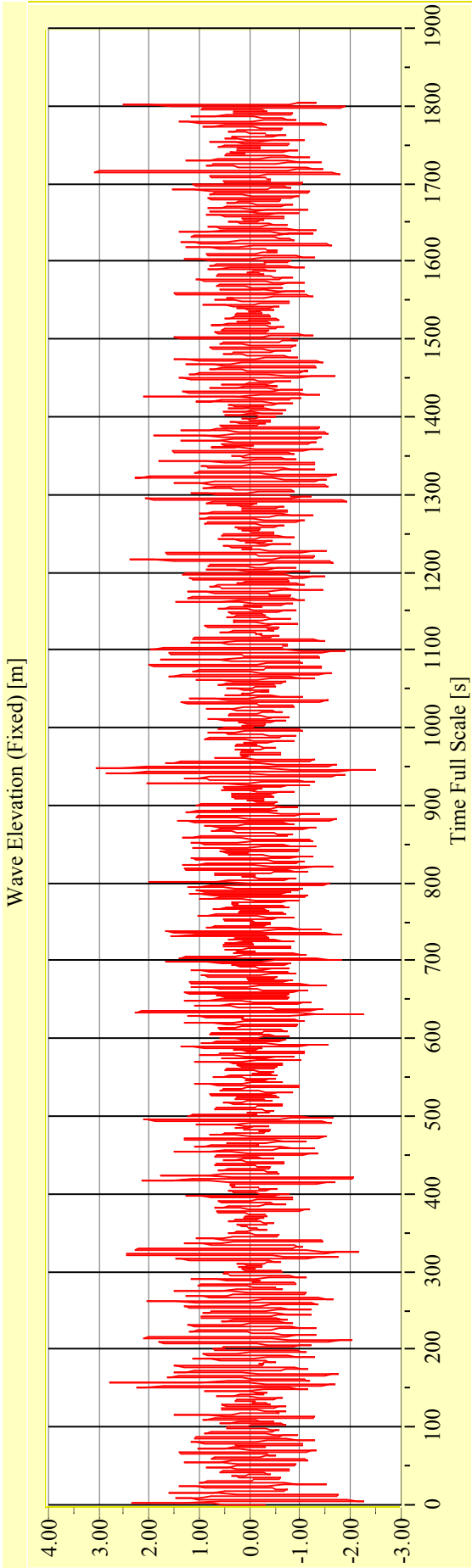
**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29680-05**      **Target Waves: Hs = 3,0 m Tp = 6,928 s**      **gamma = 3,3**



**Date: 12.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

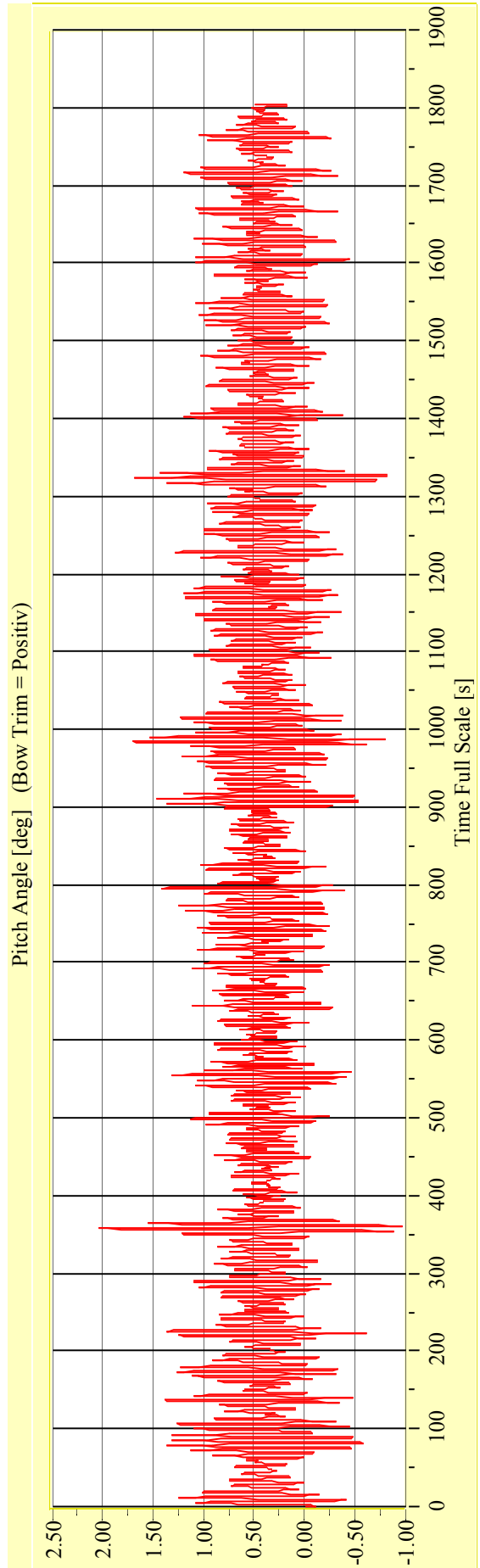
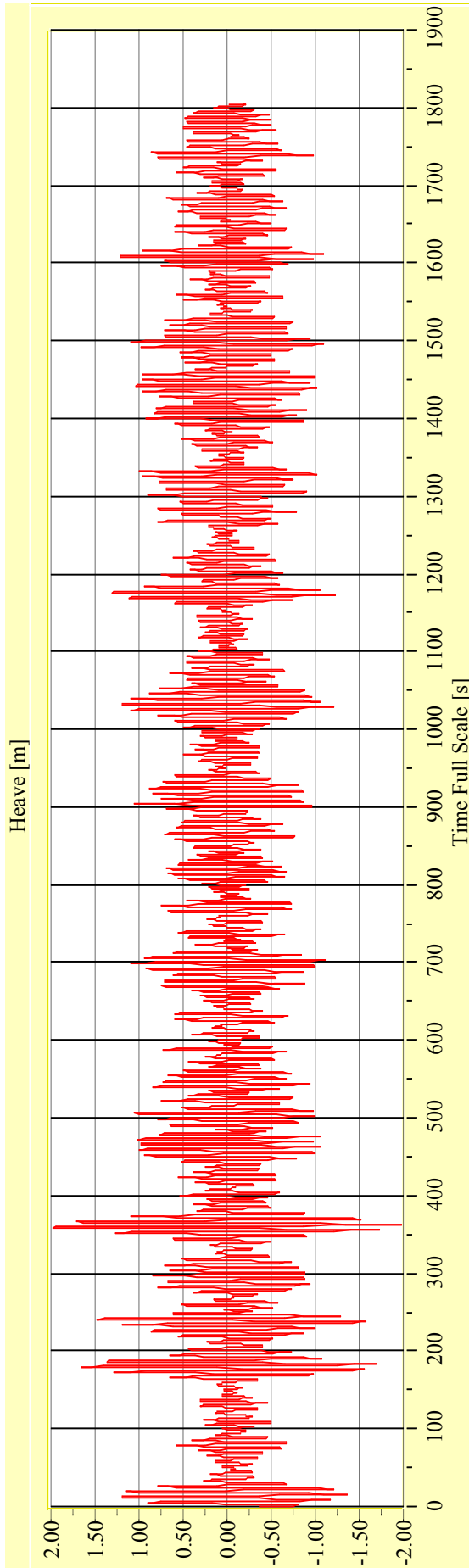
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29680-05**

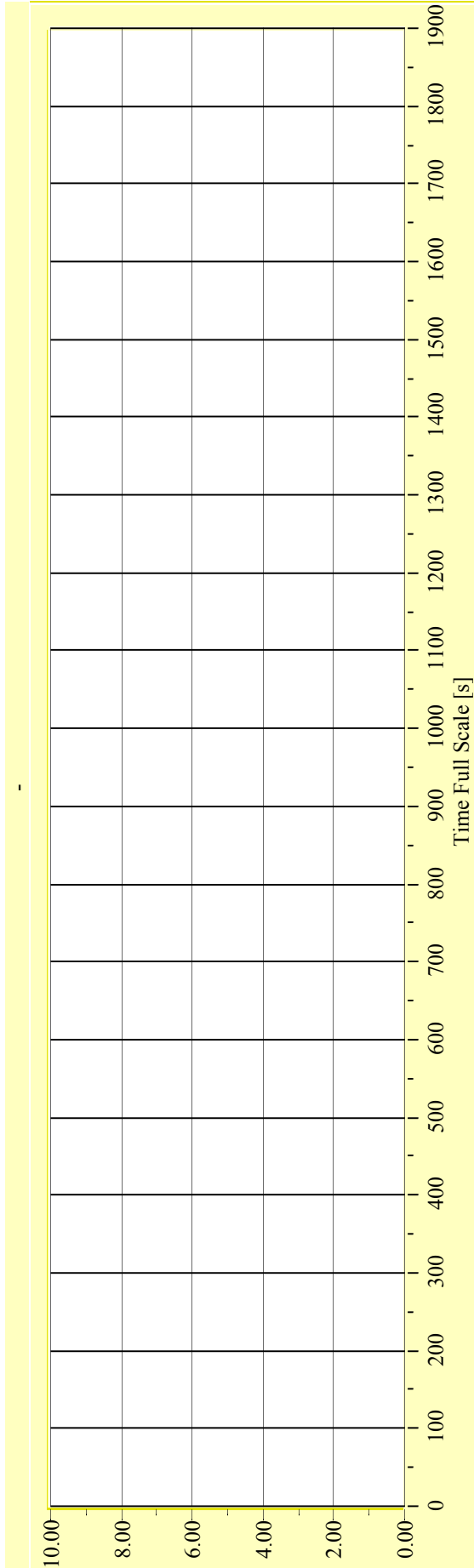
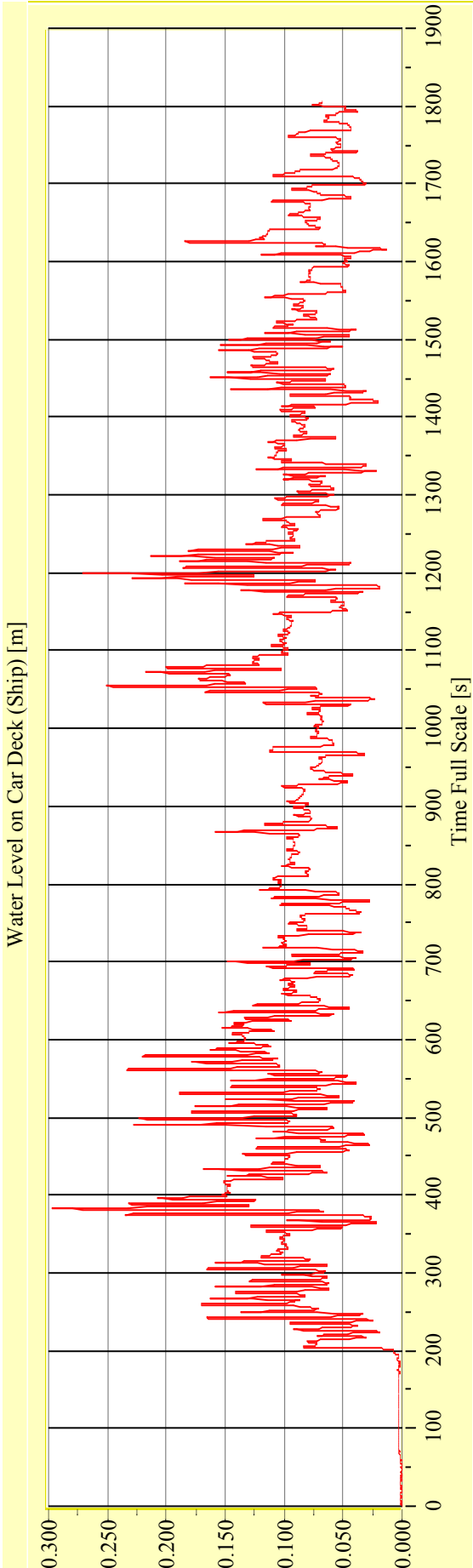
**Target Waves: Hs = 3,0 m Tp = 6,928 s**

**gamma = 3,3**



**Irregular Beam Seas**

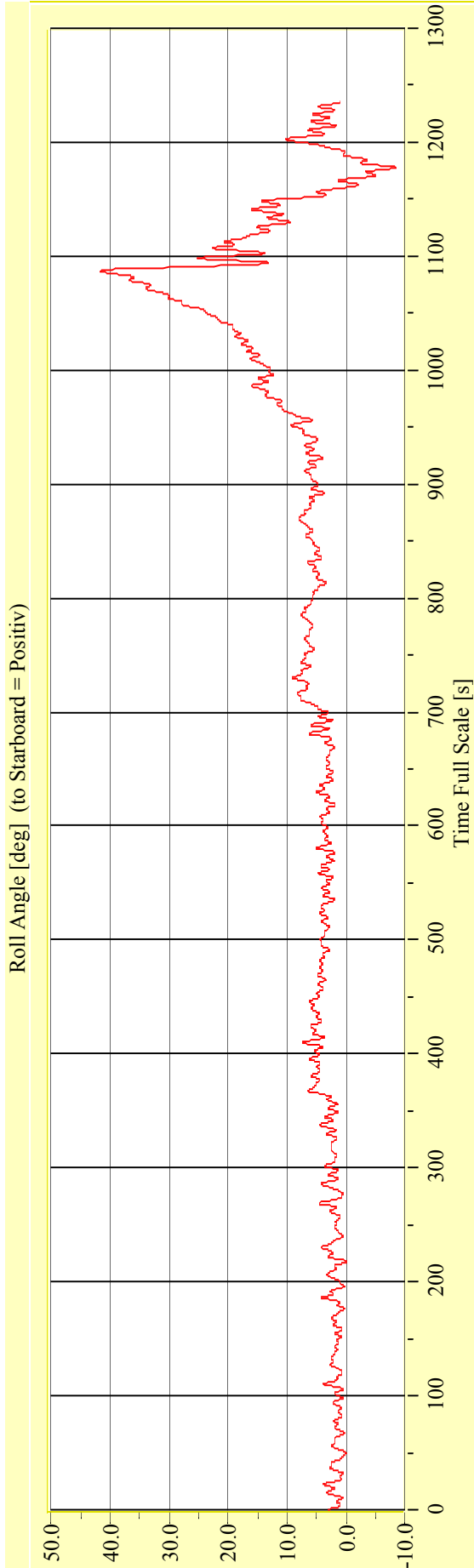
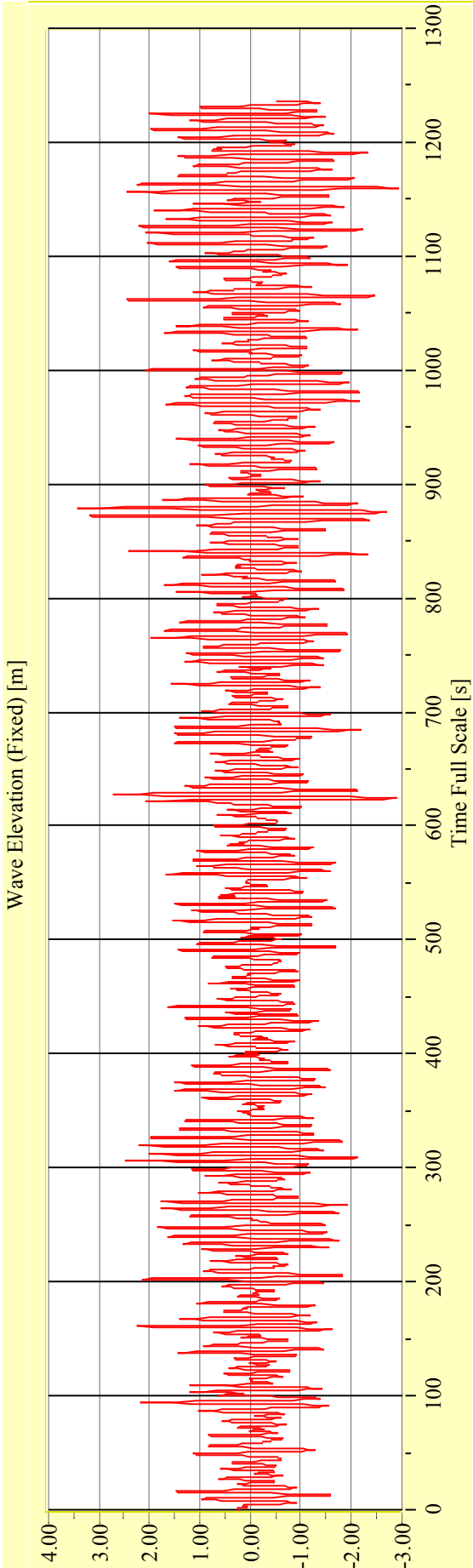
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29680-05**      **Target Waves: Hs = 3,0 m Tp = 6,928 s**      **gamma = 3,3**



**Date: 12.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

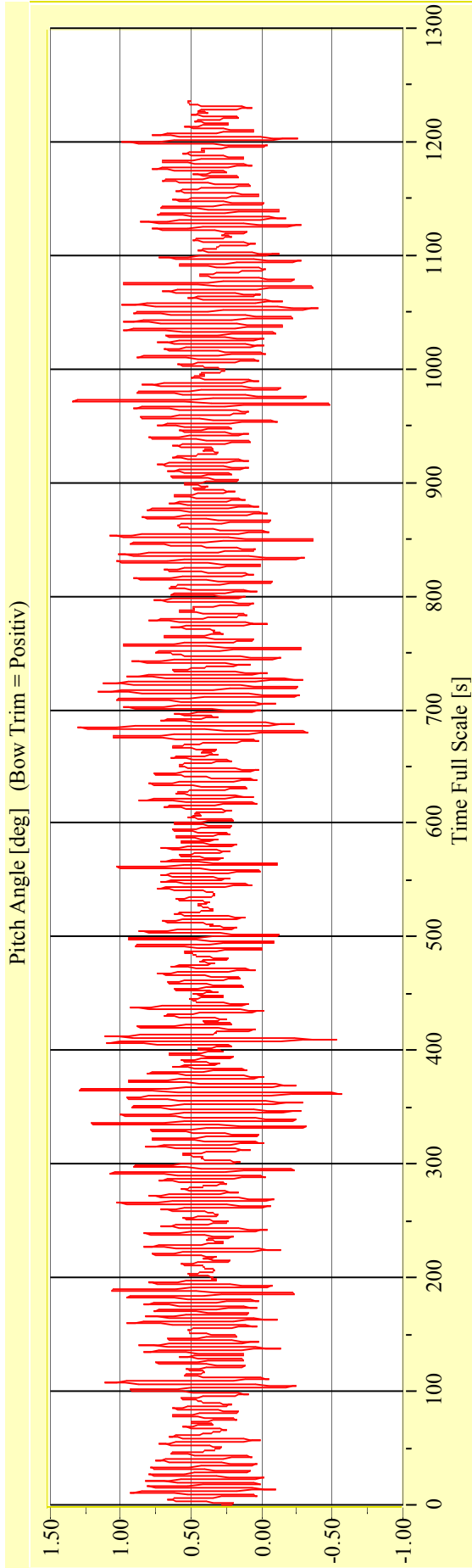
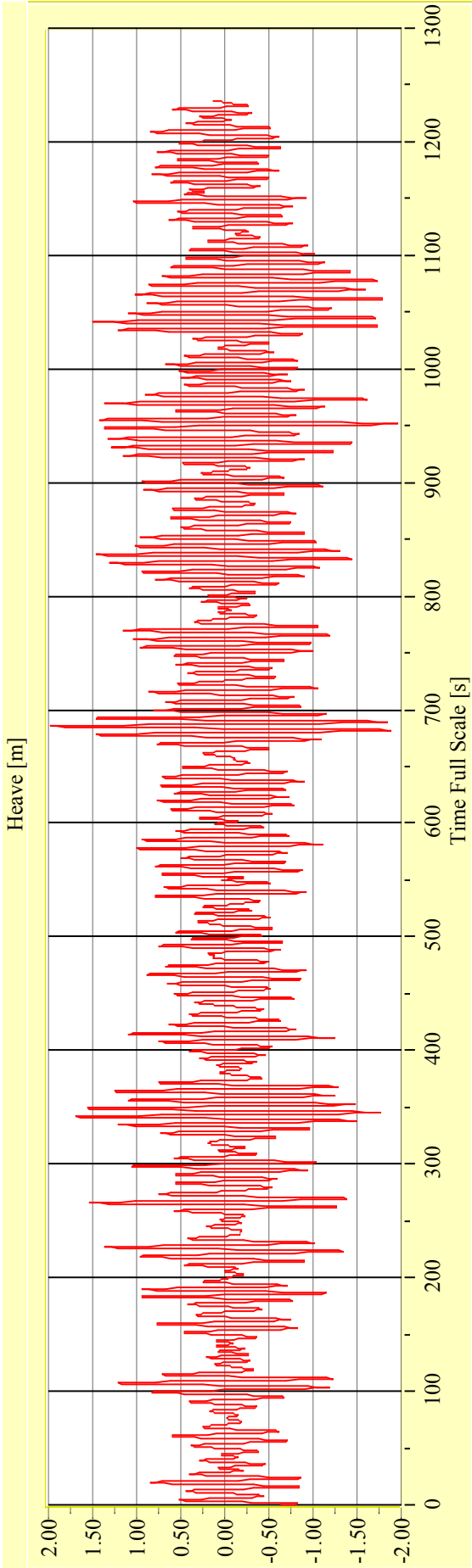
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29681-01**      **Target Waves: Hs = 3,5 m Tp = 7,483 s**      **gamma = 3,3**



**Date: 12.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29681-01**      **Target Waves: Hs = 3,5 m   Tp = 7,483 s**      **gamma = 3,3**



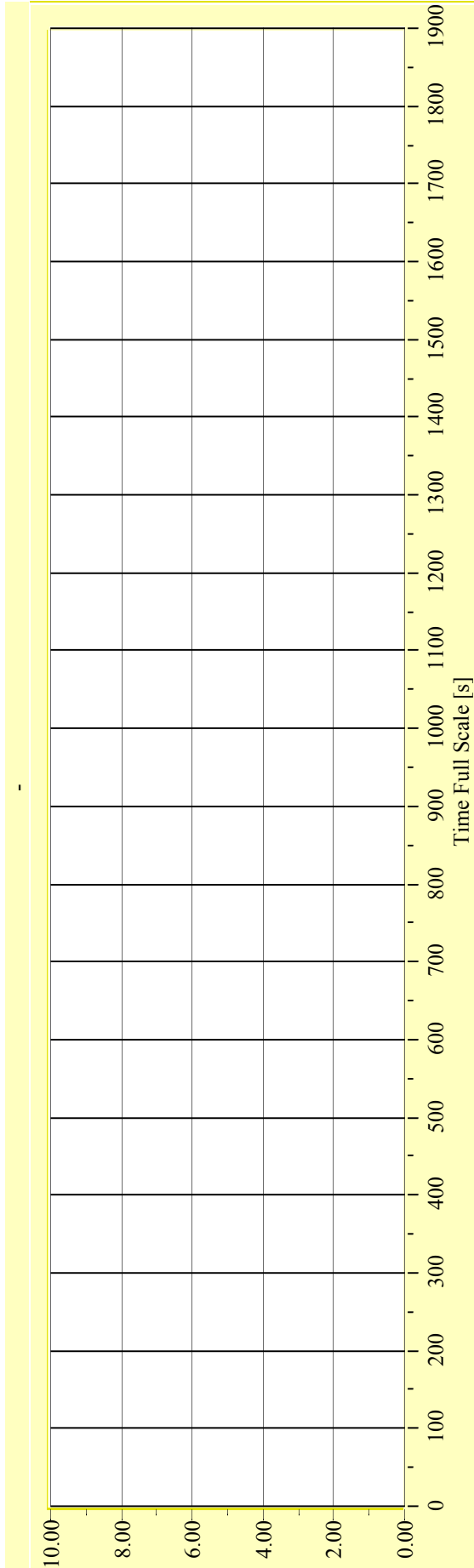
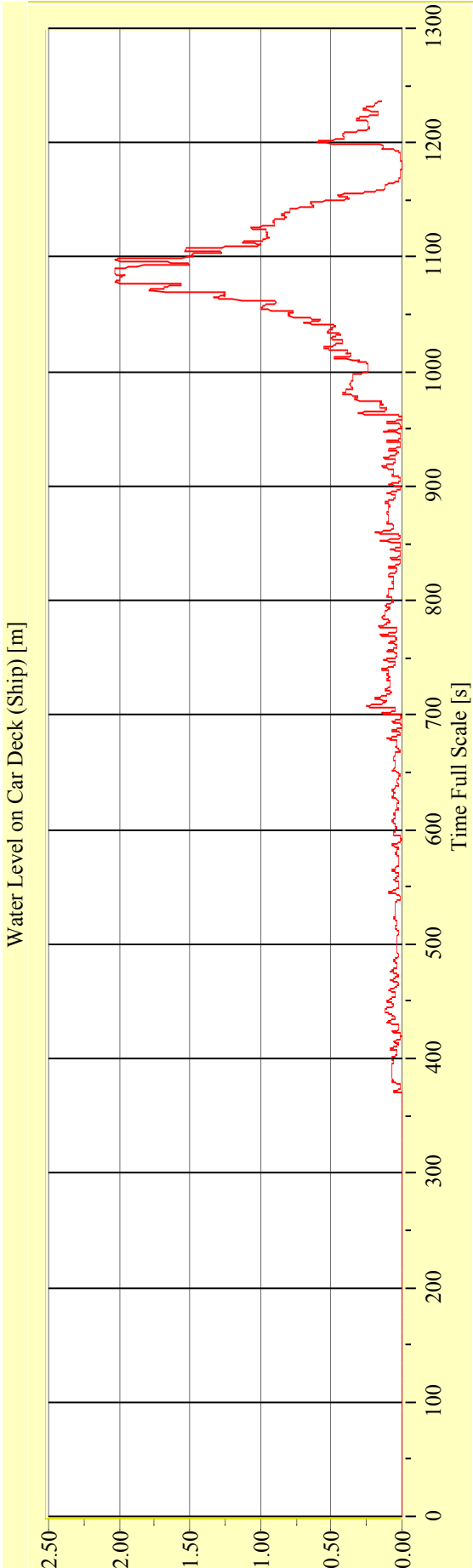
**Date: 12.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29681-01**      **Target Waves: Hs = 3,5 m Tp = 7,483 s**      **gamma = 3,3**



**Date: 12.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

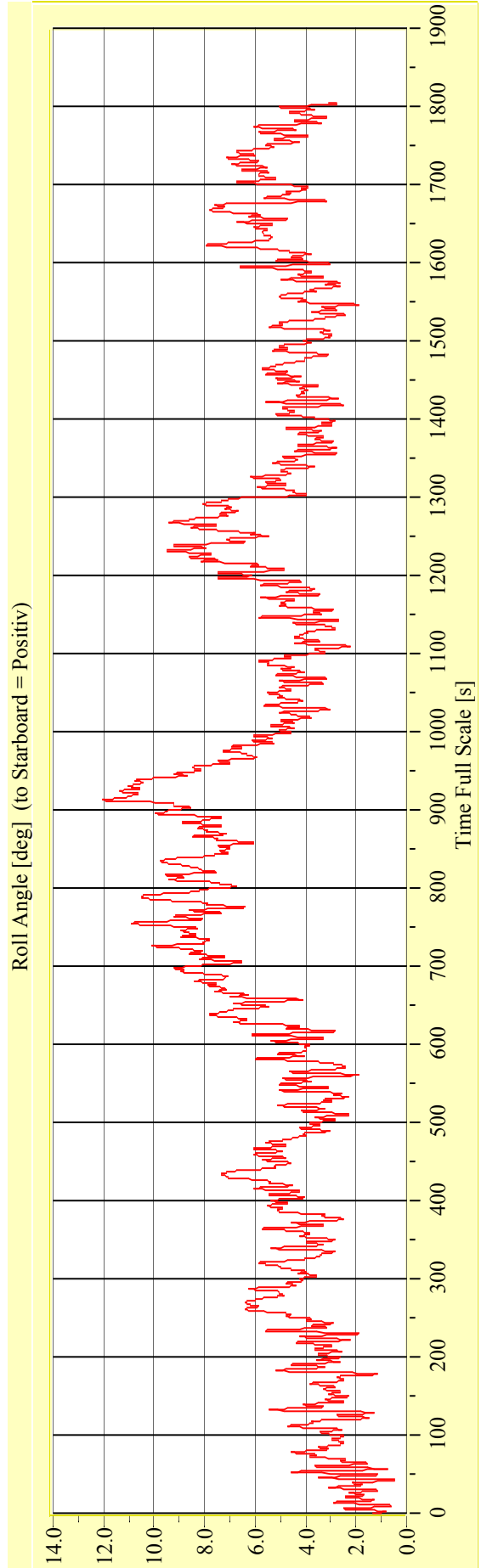
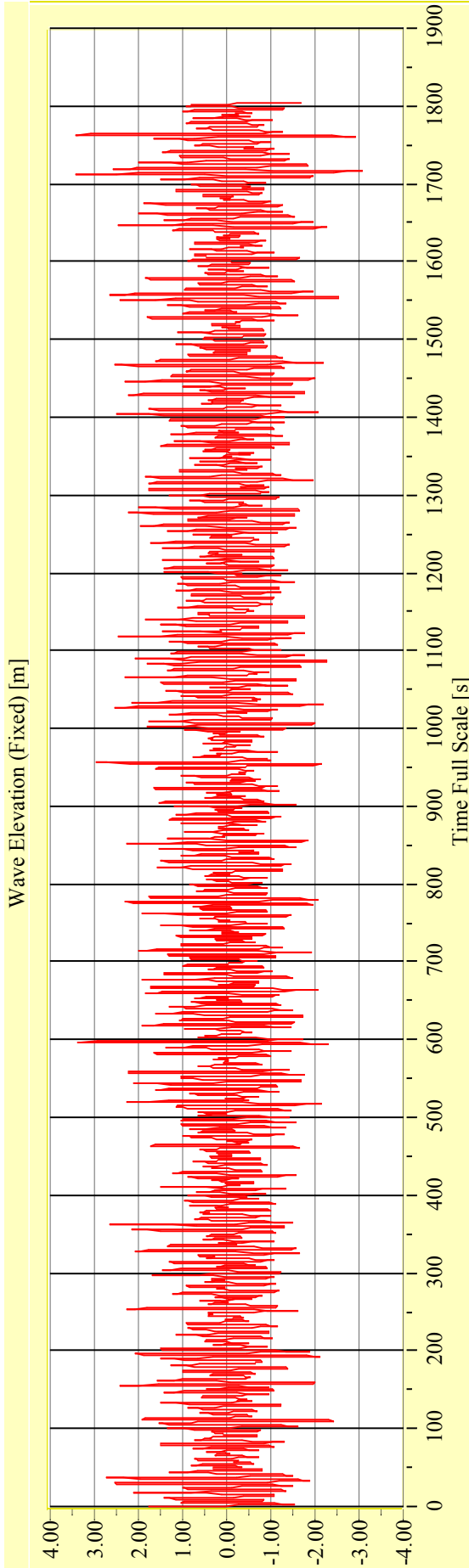
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29681-02**

**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**



**Irregular Beam Seas**

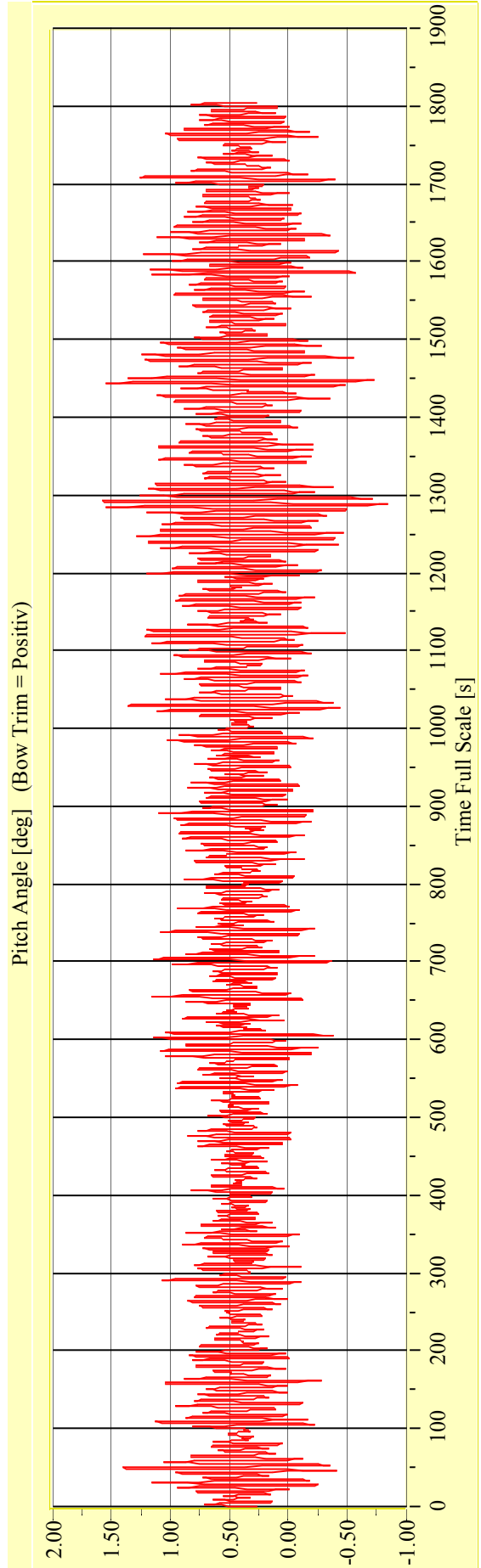
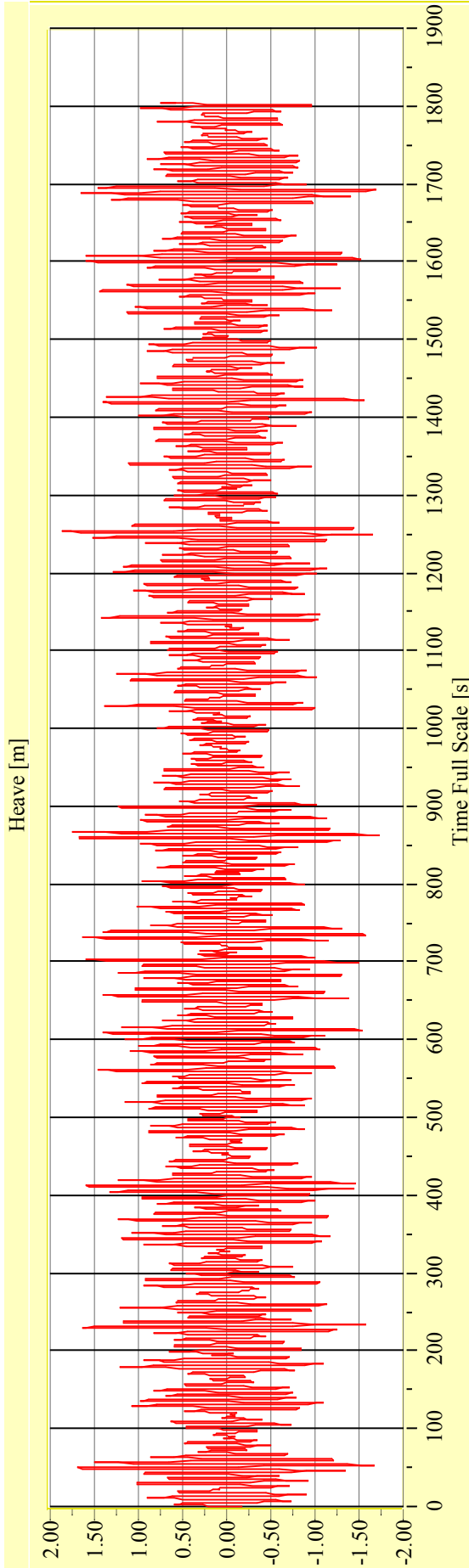
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29681-02**

**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**





**Irregular Beam Seas**

**Vienna Model Basin**

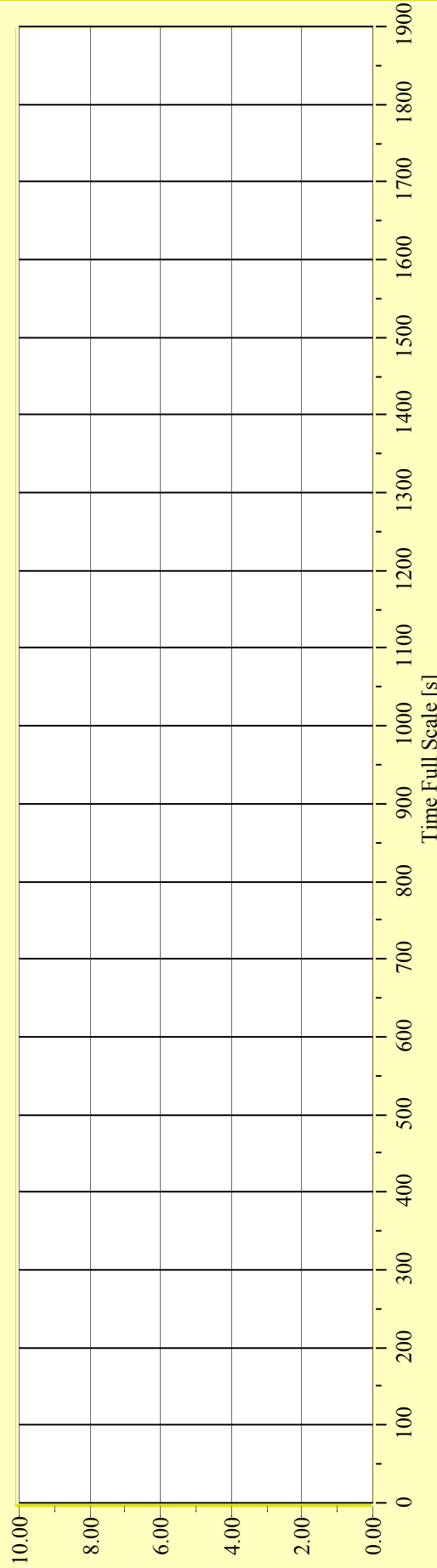
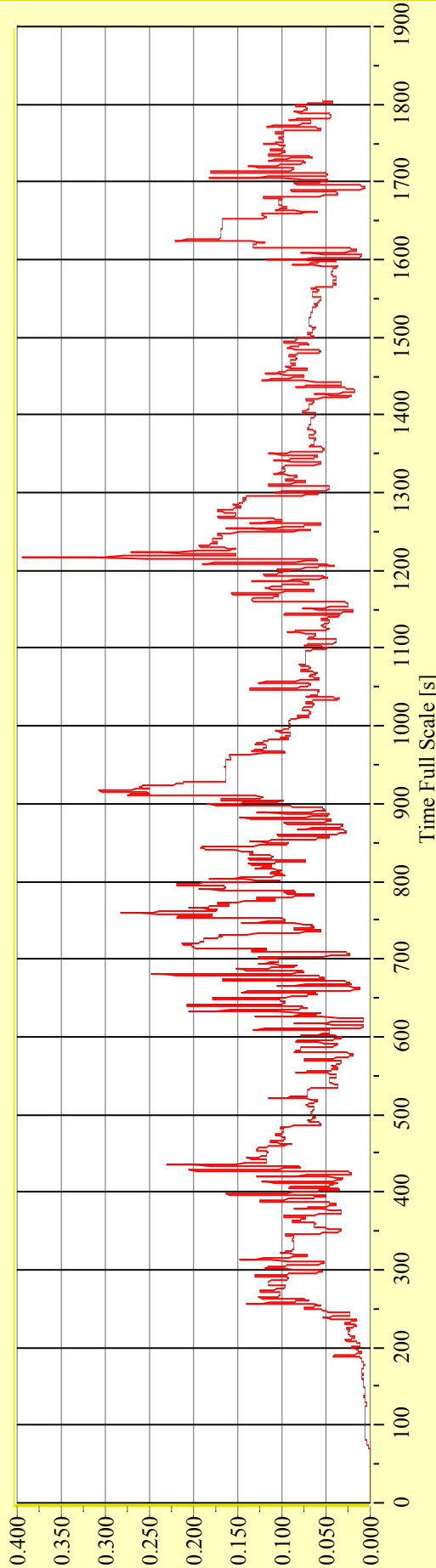
**Model No. 2446**

**Test No. 29681-02**

**Target Waves: Hs = 3,5 m Tp = 7,483 s**

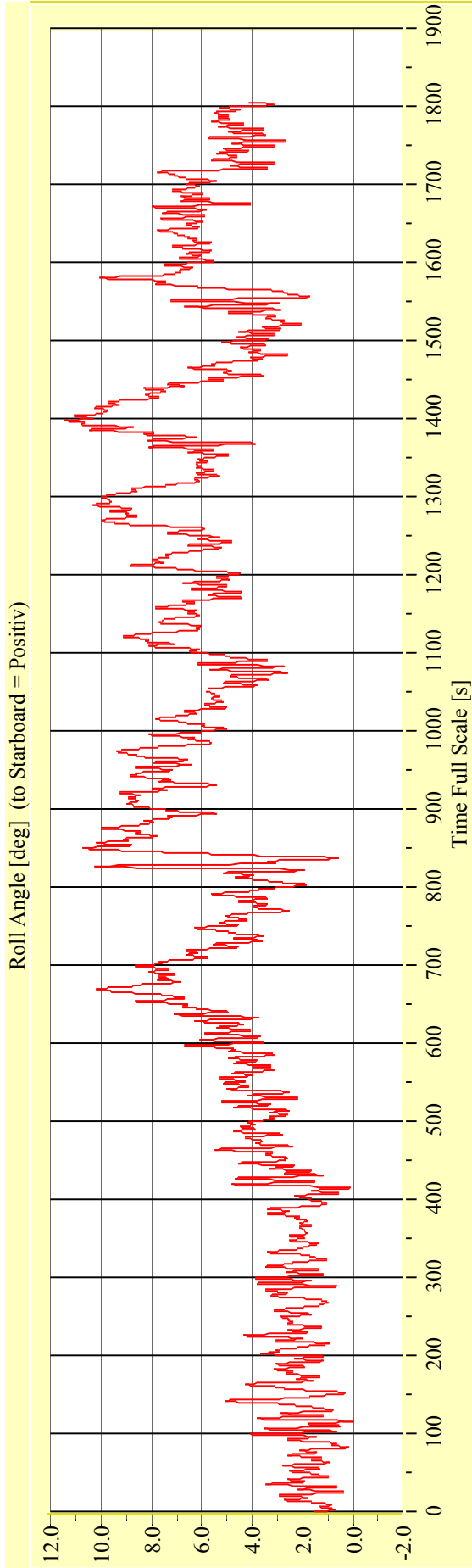
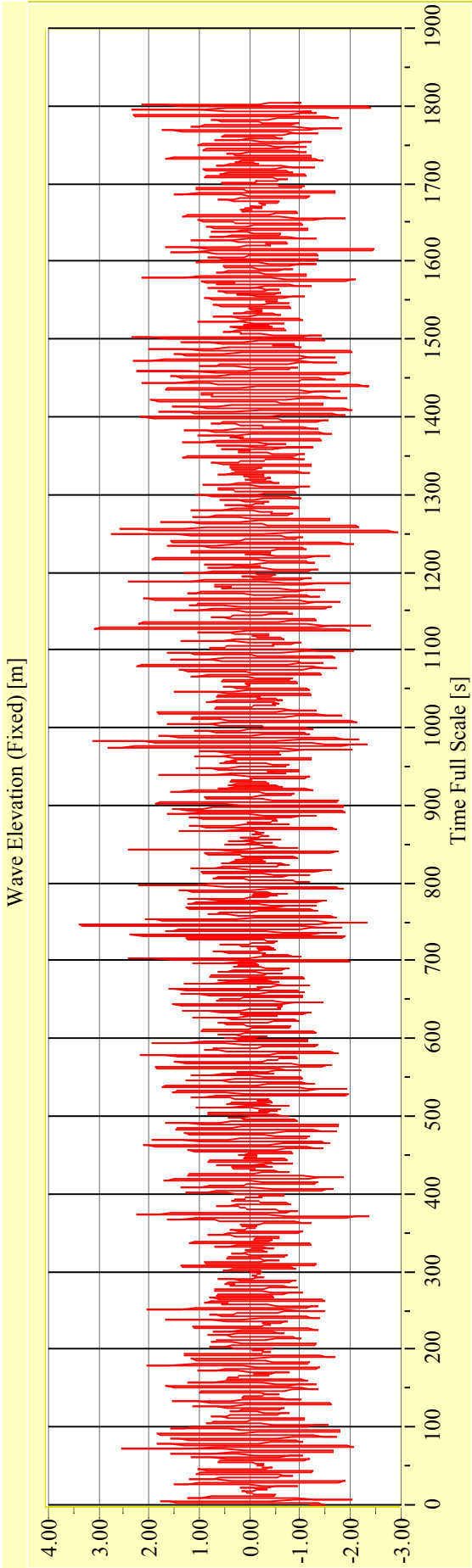
**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29681-03**      **Target Waves: Hs = 3,5 m   Tp = 7,483 s**      **gamma = 3,3**



**Date: 12.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

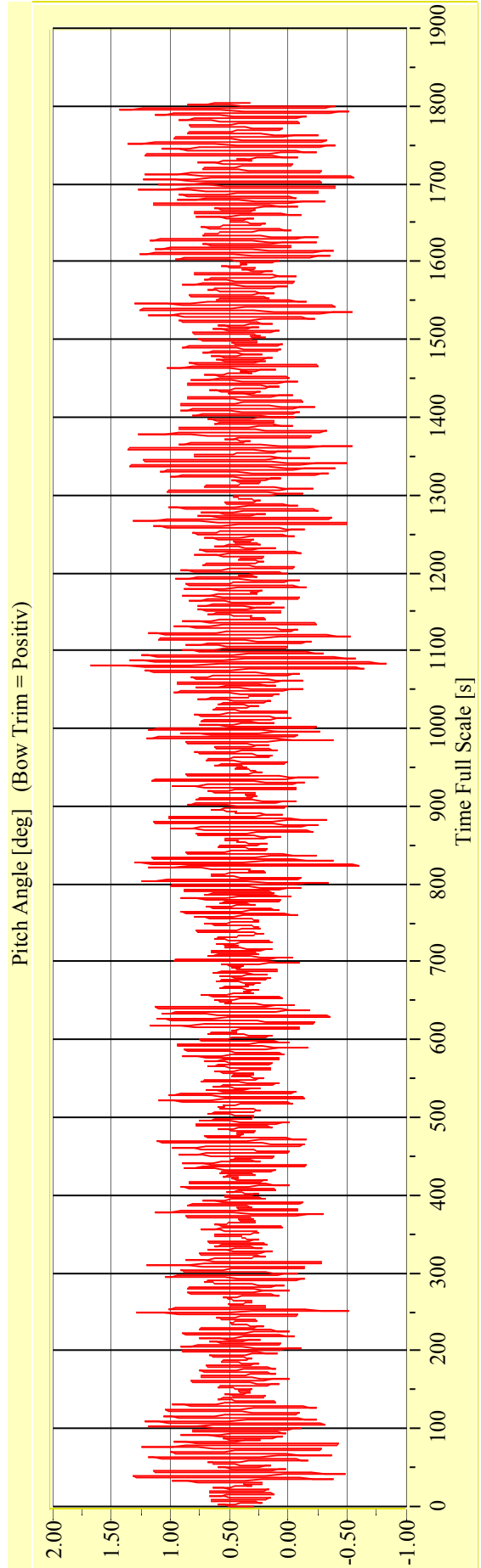
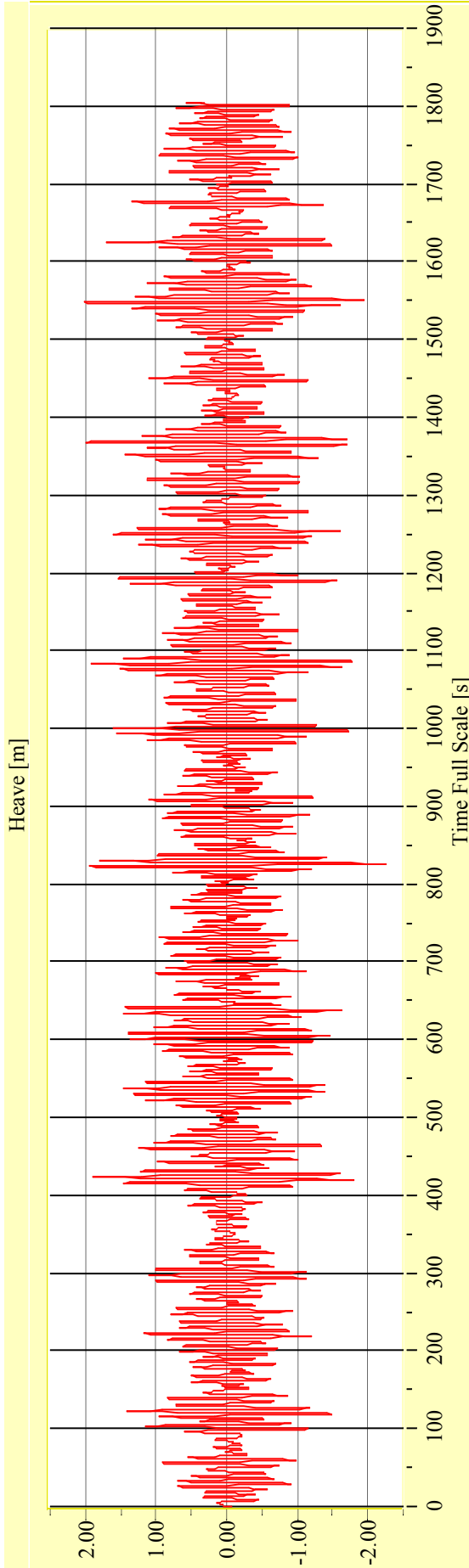
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29681-03**

**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

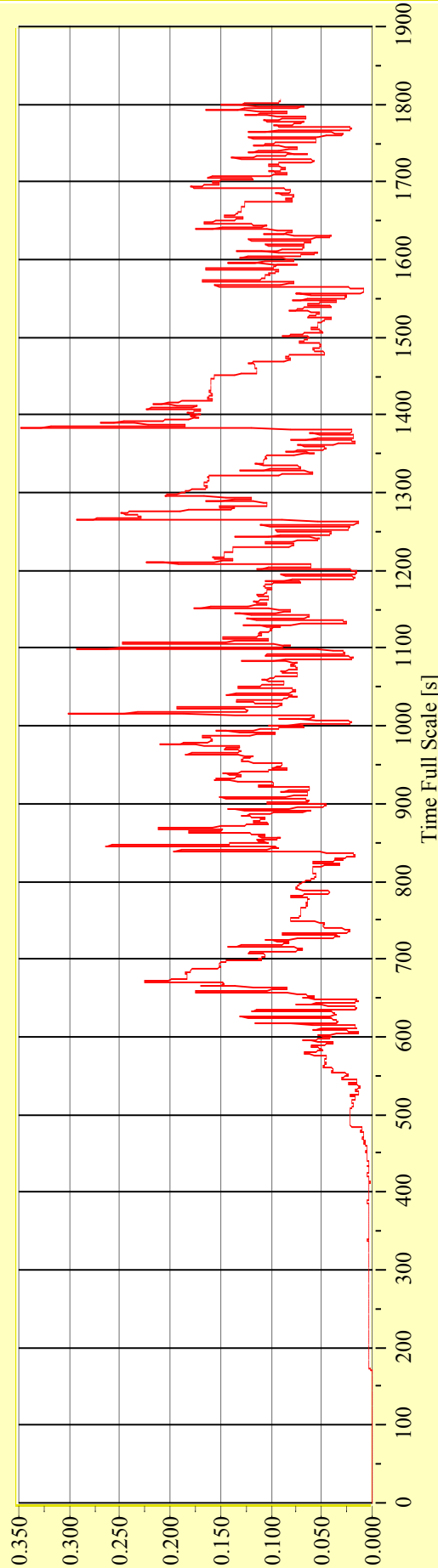
**Model No. 2446**

**Test No. 29681-03**

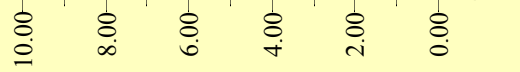
**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



Time Full Scale [s]



Time Full Scale [s]

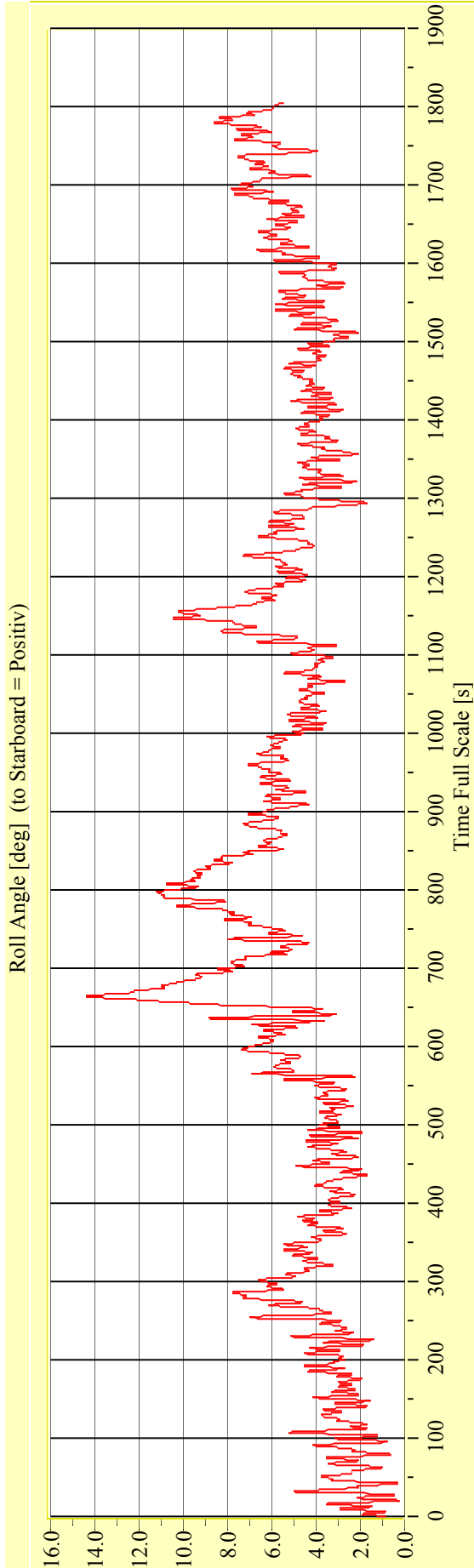
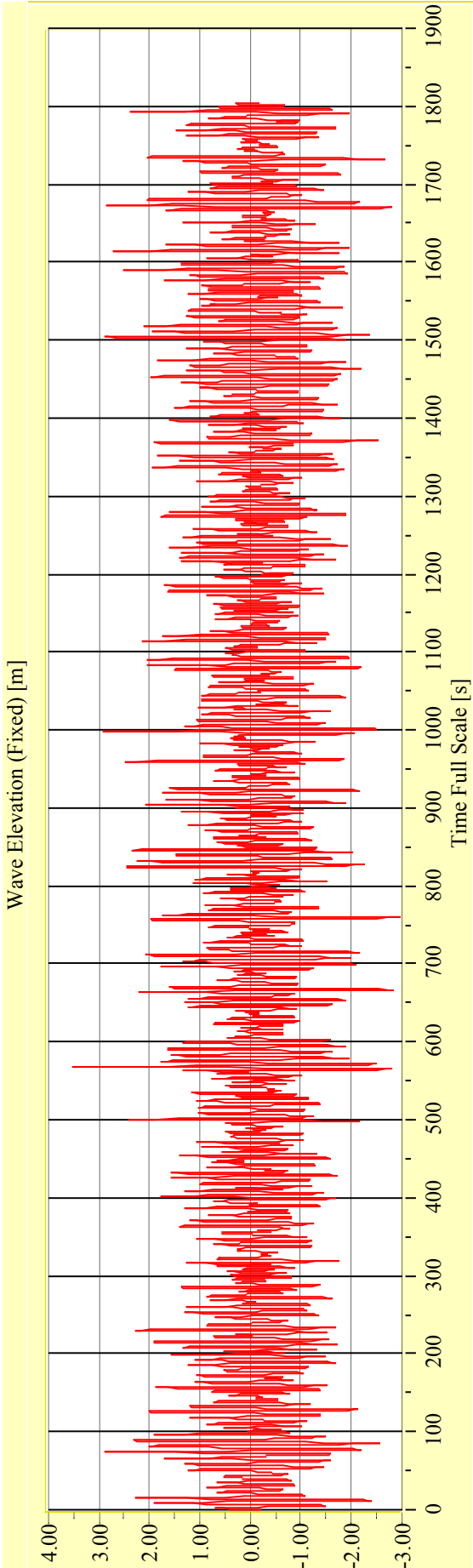
**Date: 12.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29681-04**      **Target Waves: Hs = 3,5 m Tp = 7,483 s**      **gamma = 3,3**



**Date: 12.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

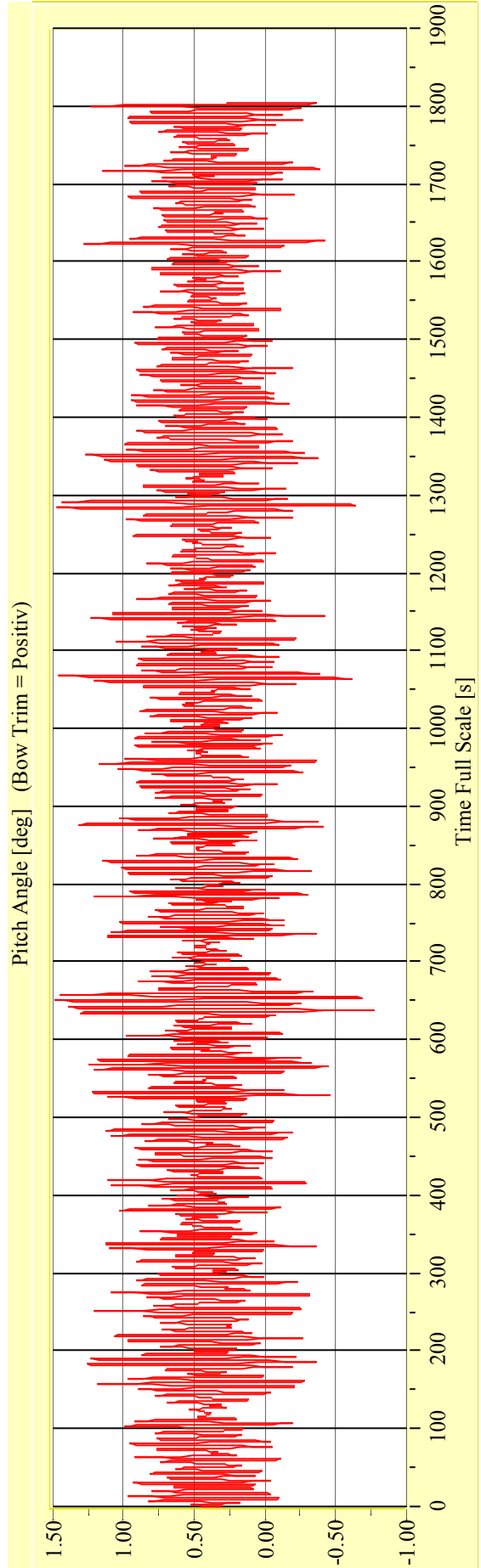
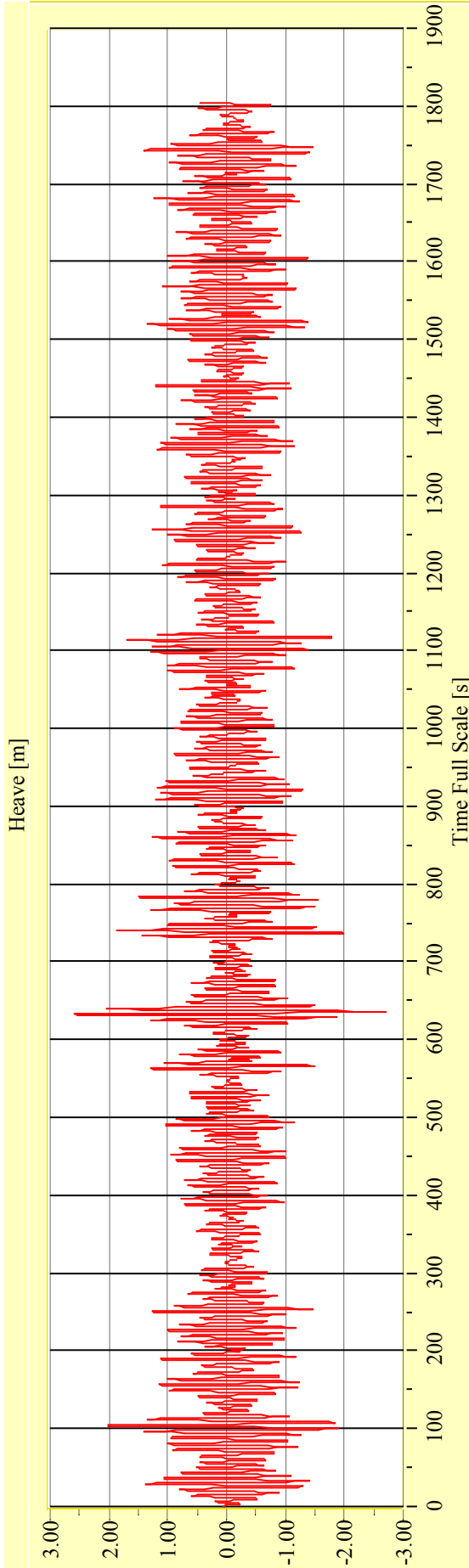
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29681-04**

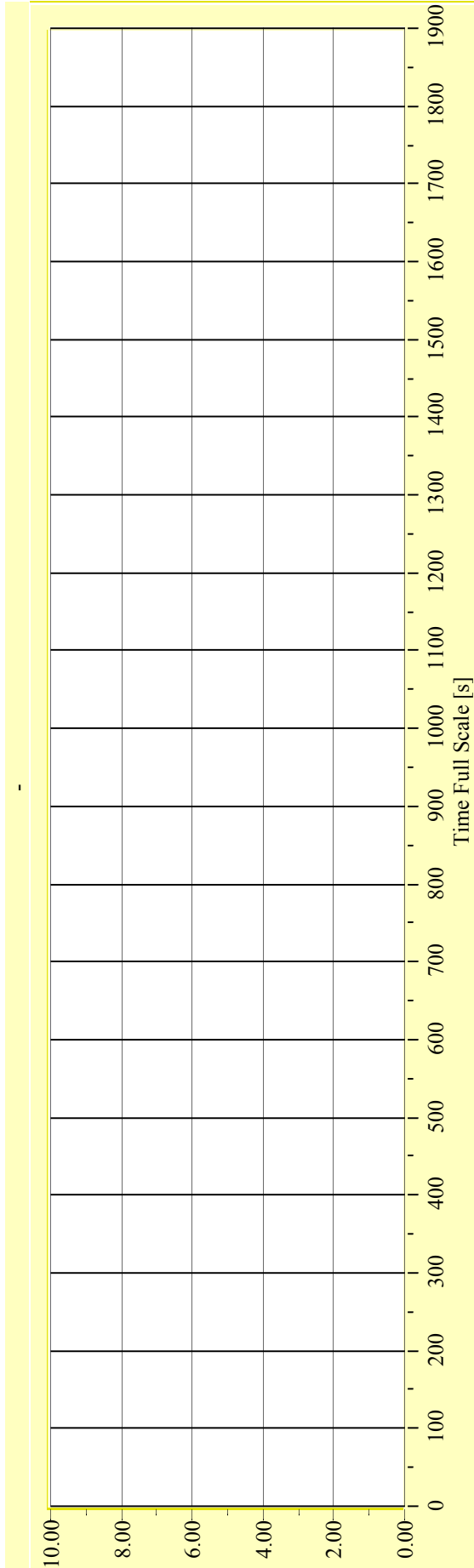
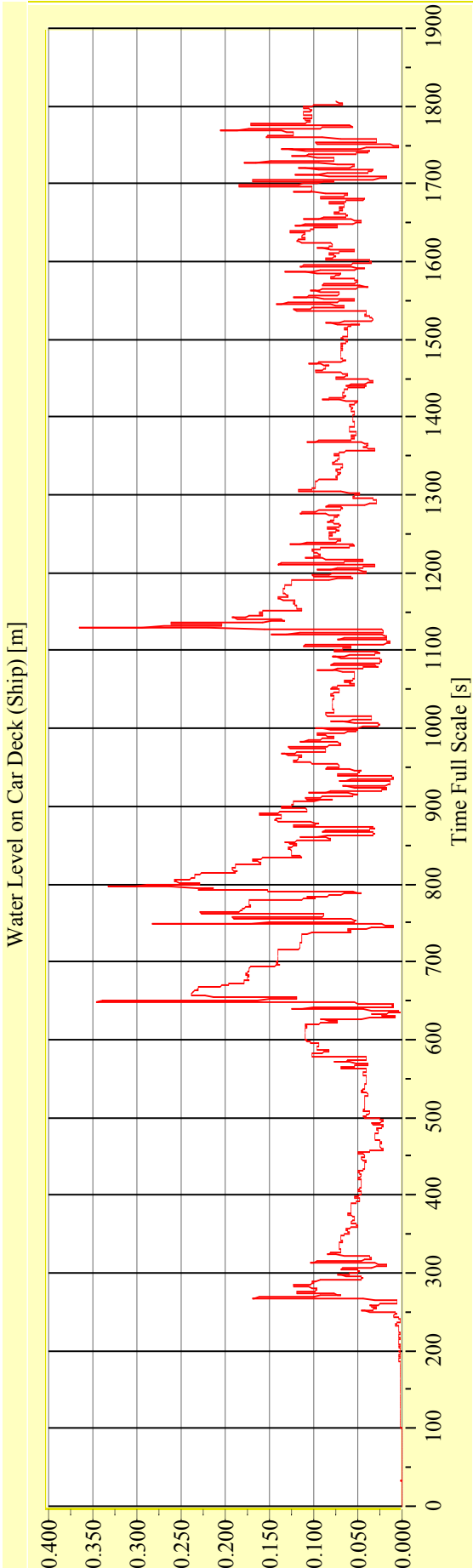
**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29681-04**      **Target Waves: Hs = 3,5 m Tp = 7,483 s**      **gamma = 3,3**



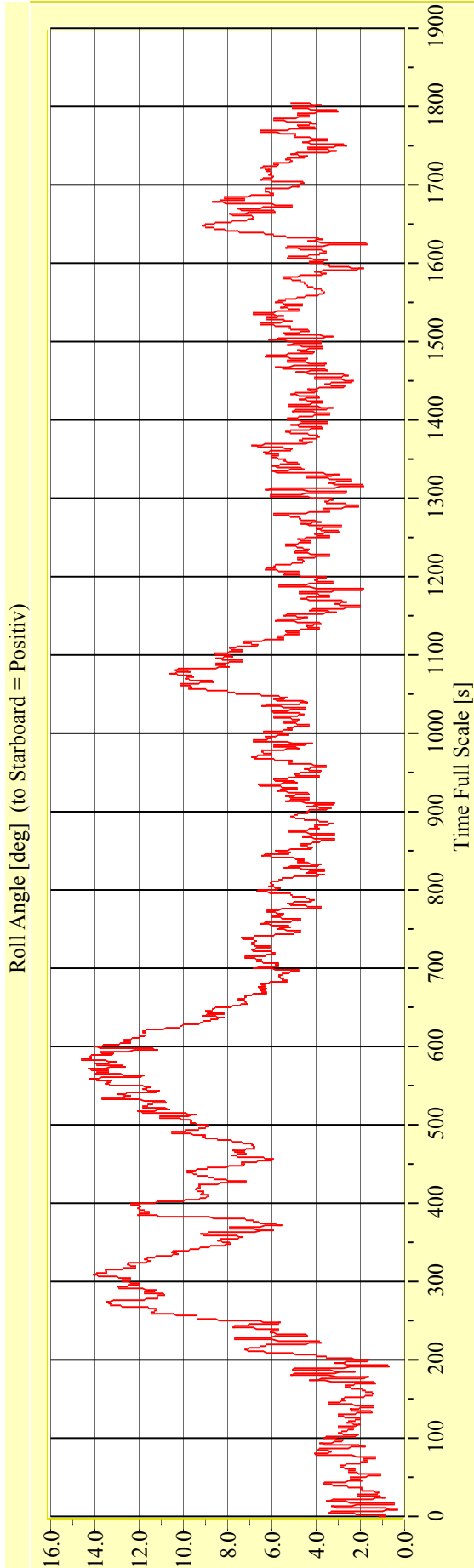
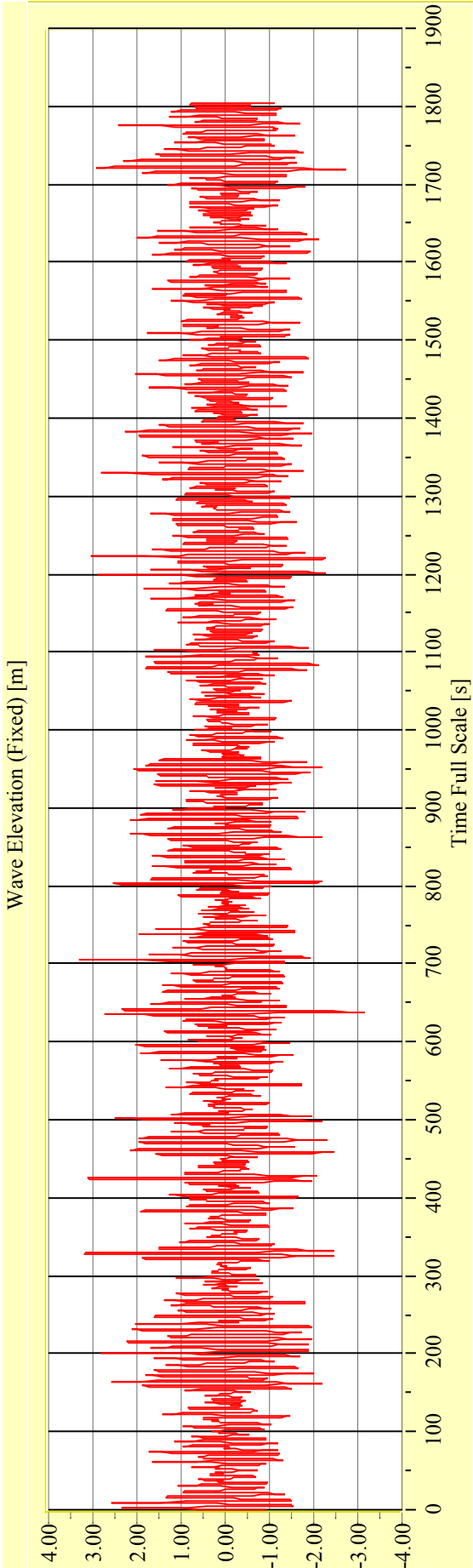
**Date: 12.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29681-05**      **Target Waves: Hs = 3,5 m Tp = 7,483 s**      **gamma = 3,3**



**Date: 12.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**



**Irregular Beam Seas**

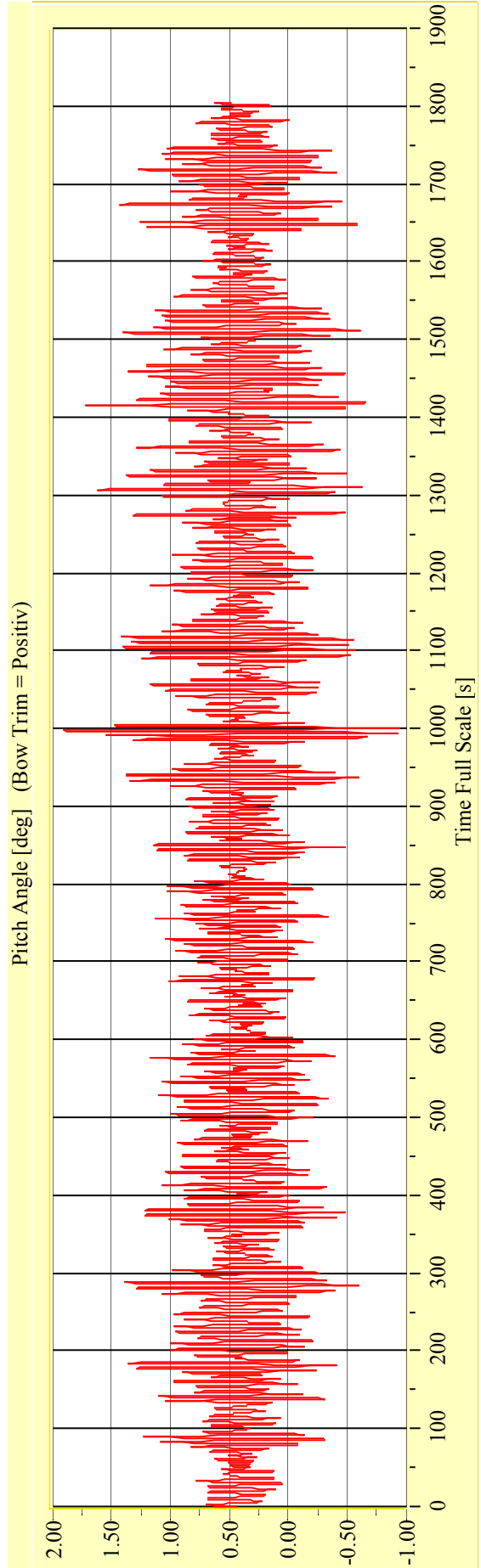
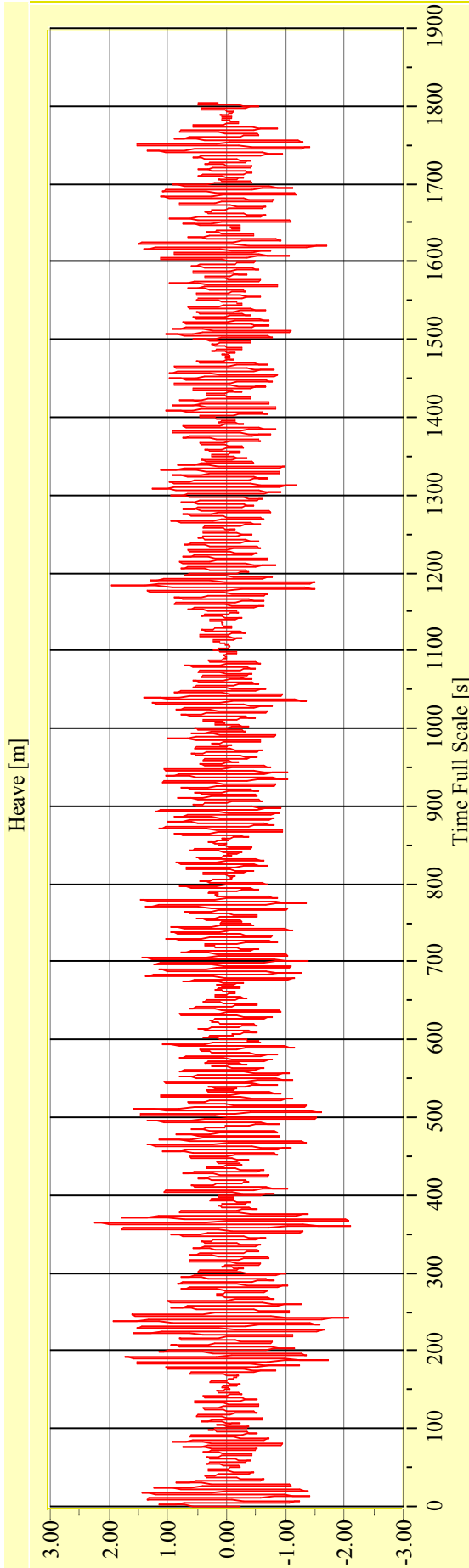
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29681-05**

**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

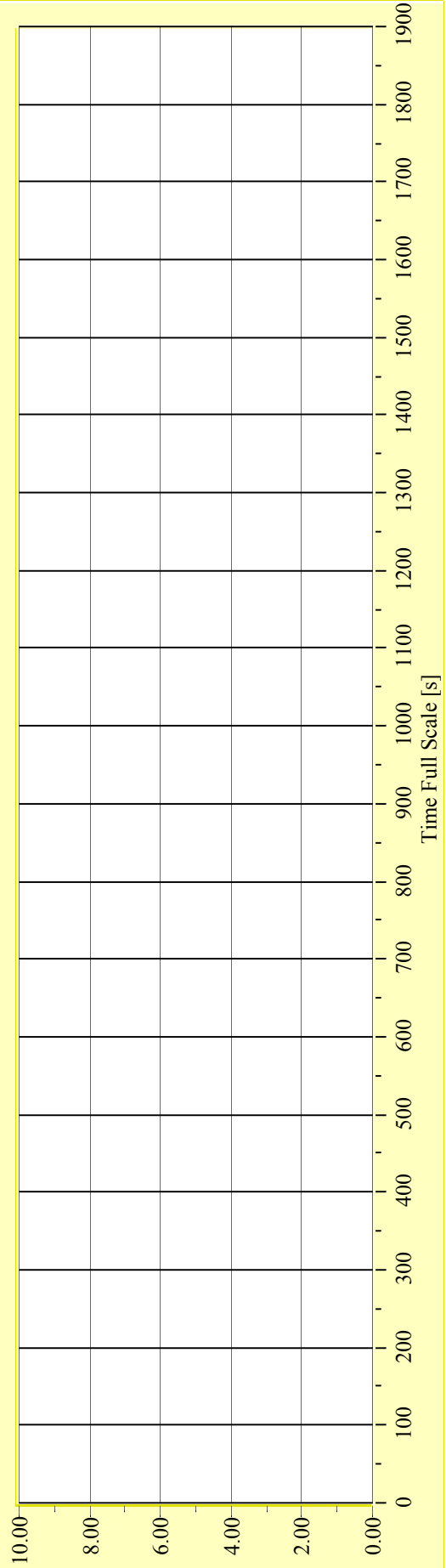
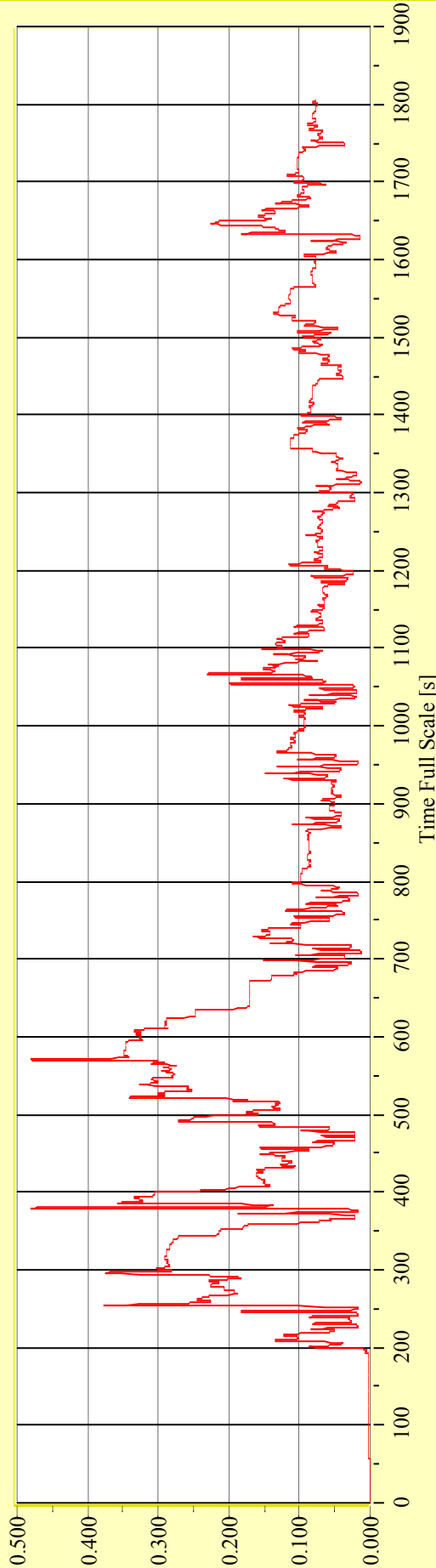
**Model No. 2446**

**Test No. 29681-05**

**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Irregular Beam Seas**

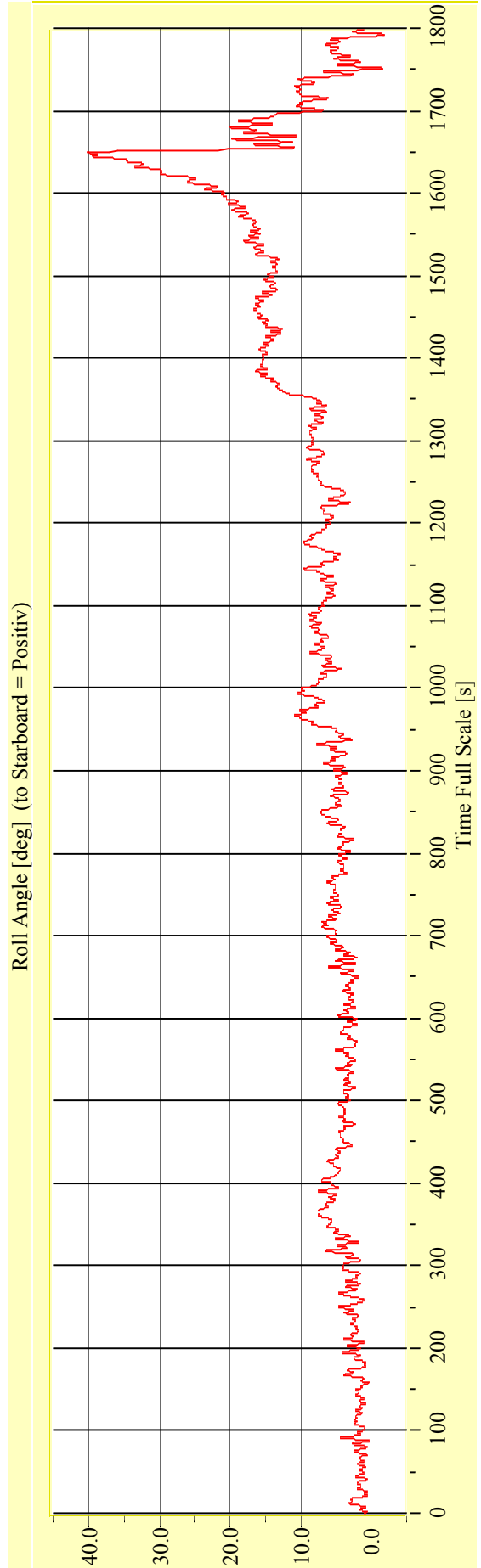
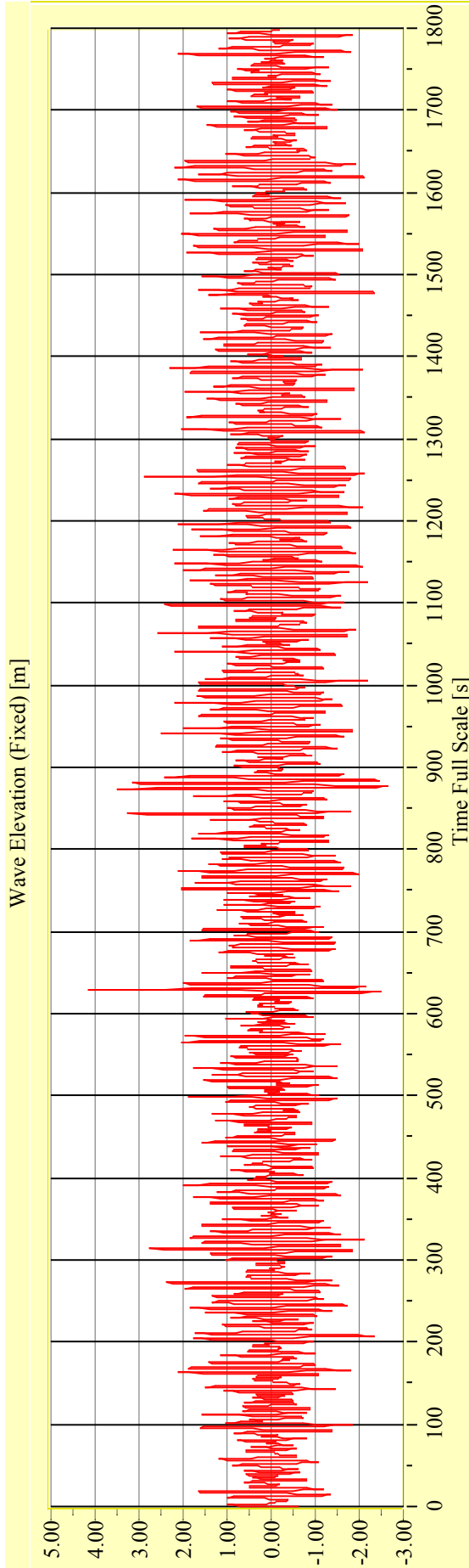
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29681-06**

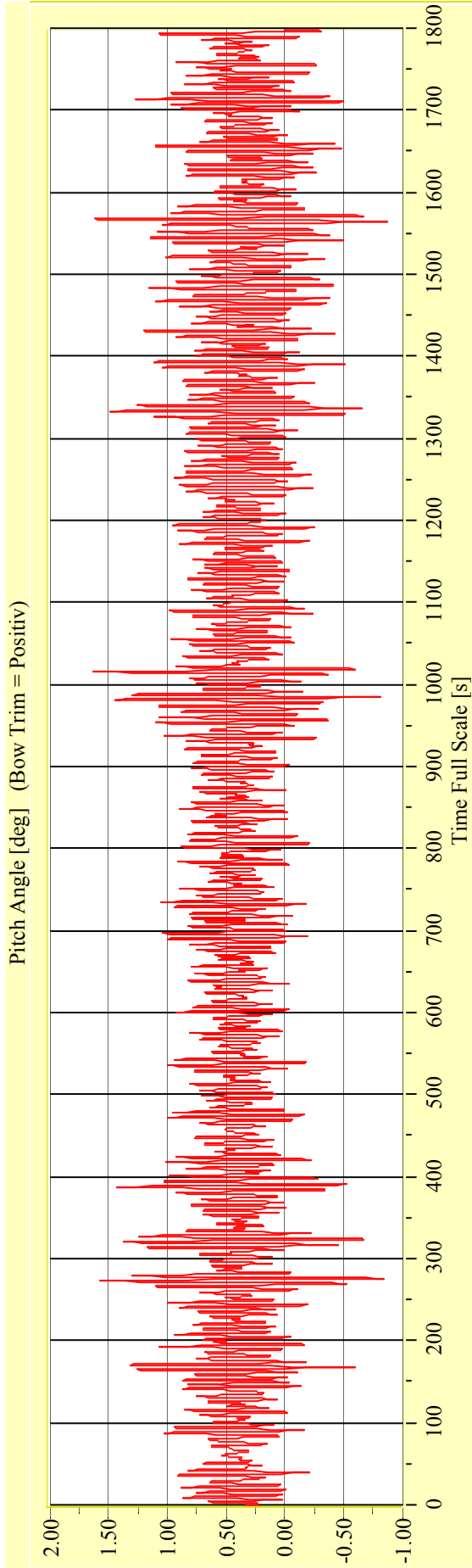
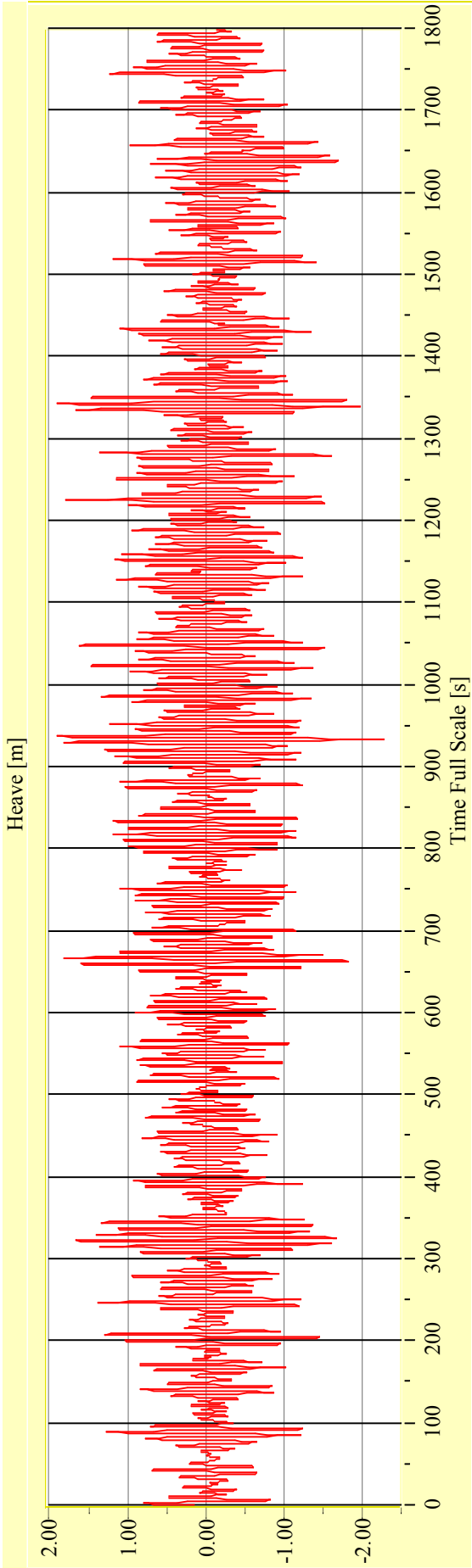
**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**



**Irregular Beam Seas**

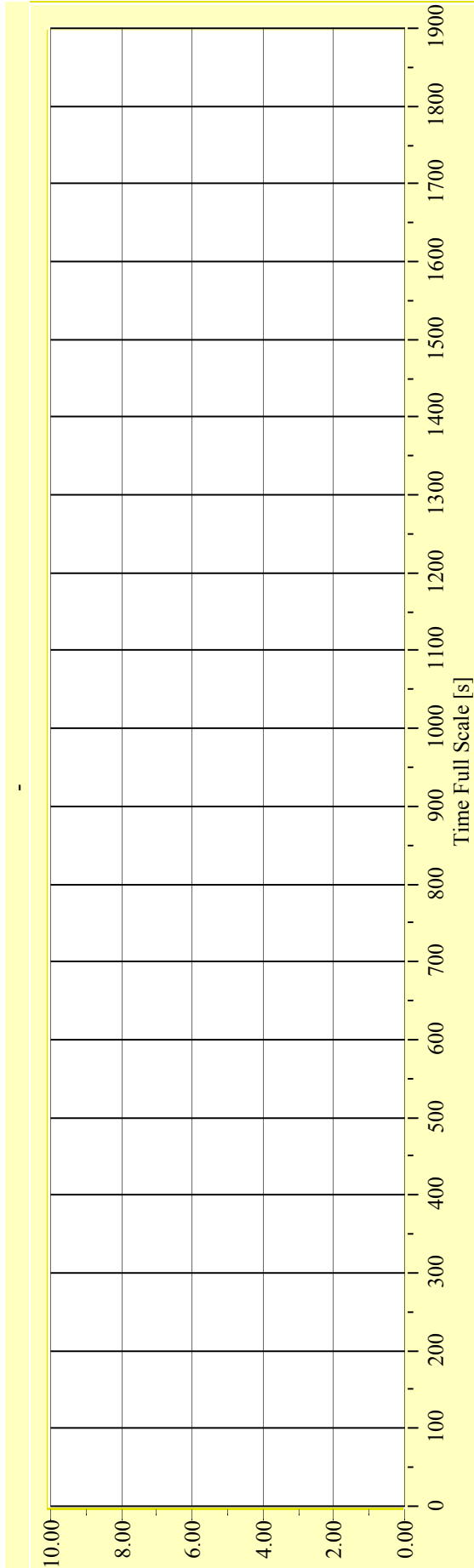
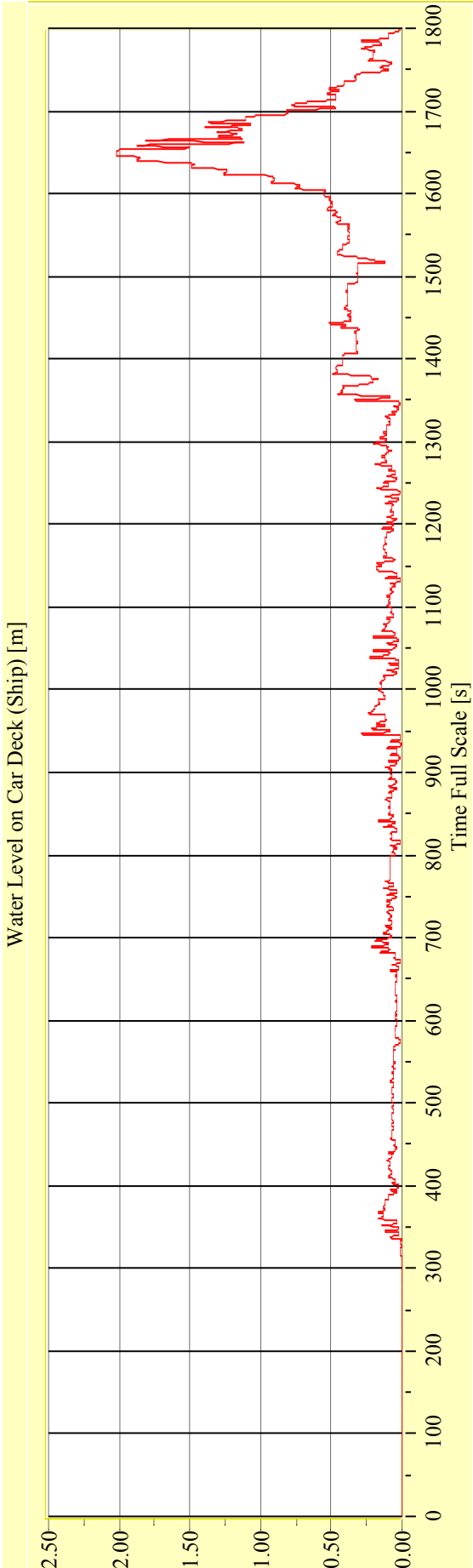
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29681-06**      **Target Waves: Hs = 3,5 m Tp = 7,483 s**      **gamma = 3,3**



**Date: 14.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

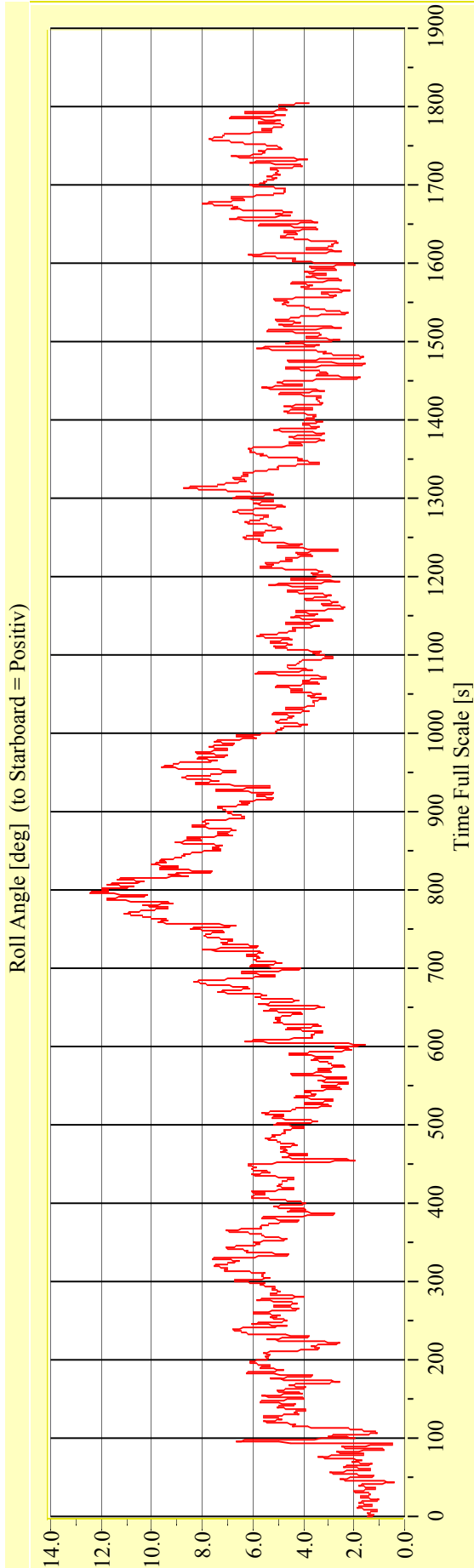
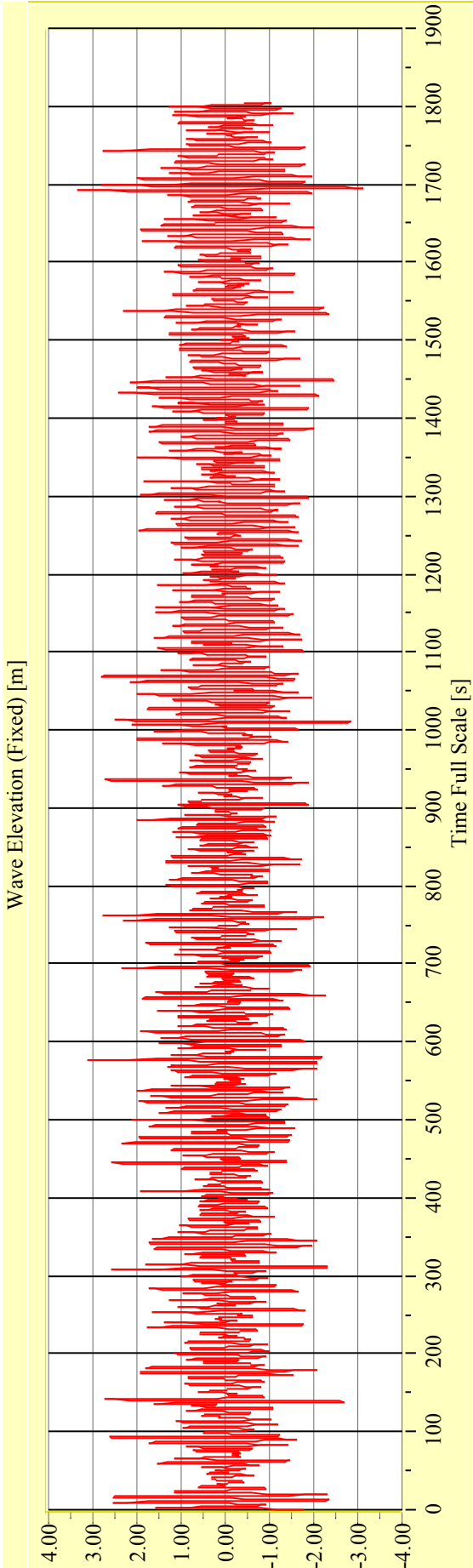
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29681-06**      **Target Waves: Hs = 3,5 m Tp = 7,483 s**      **gamma = 3,3**



**Date: 14.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29681-07**      **Target Waves: Hs = 3,5 m Tp = 7,483 s**      **gamma = 3,3**



**Date: 14.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

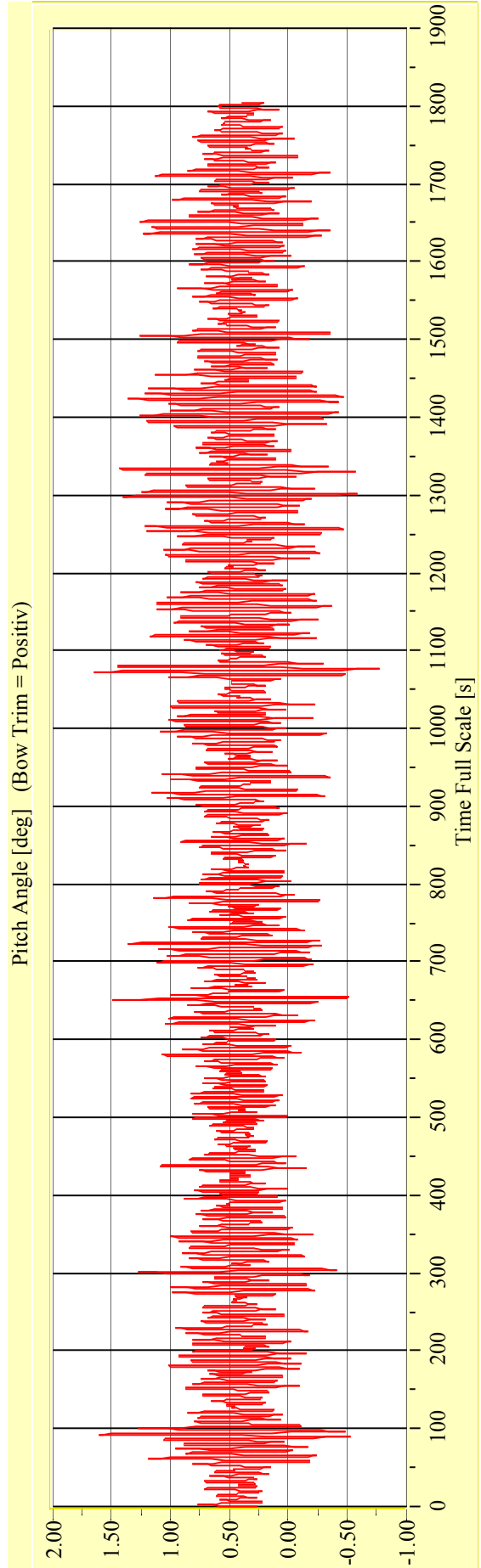
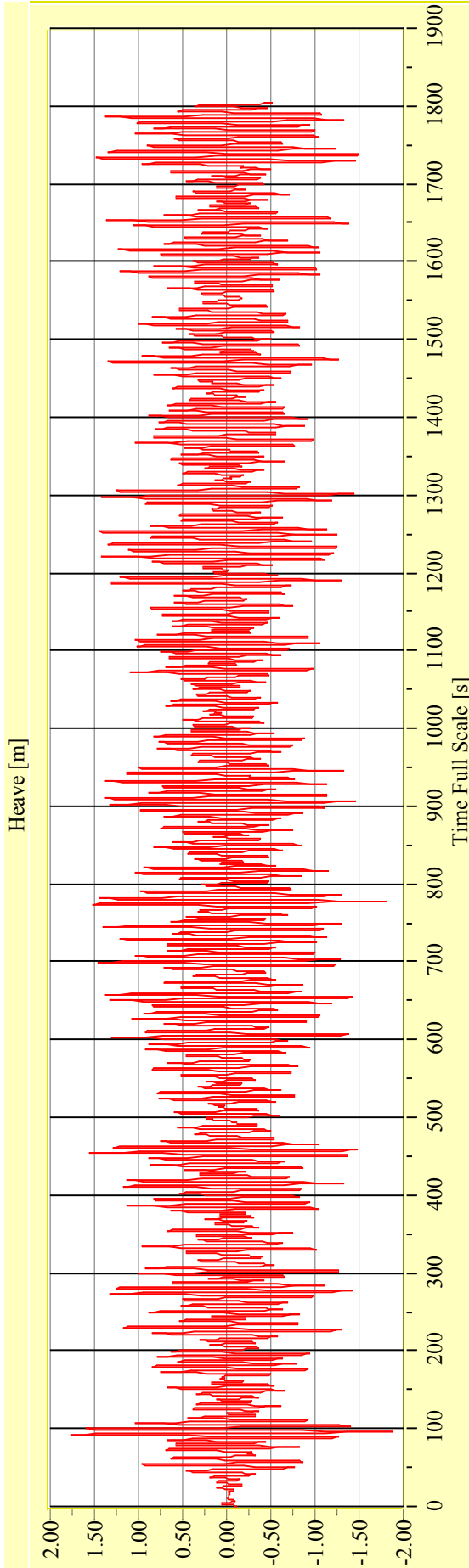
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29681-07**

**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

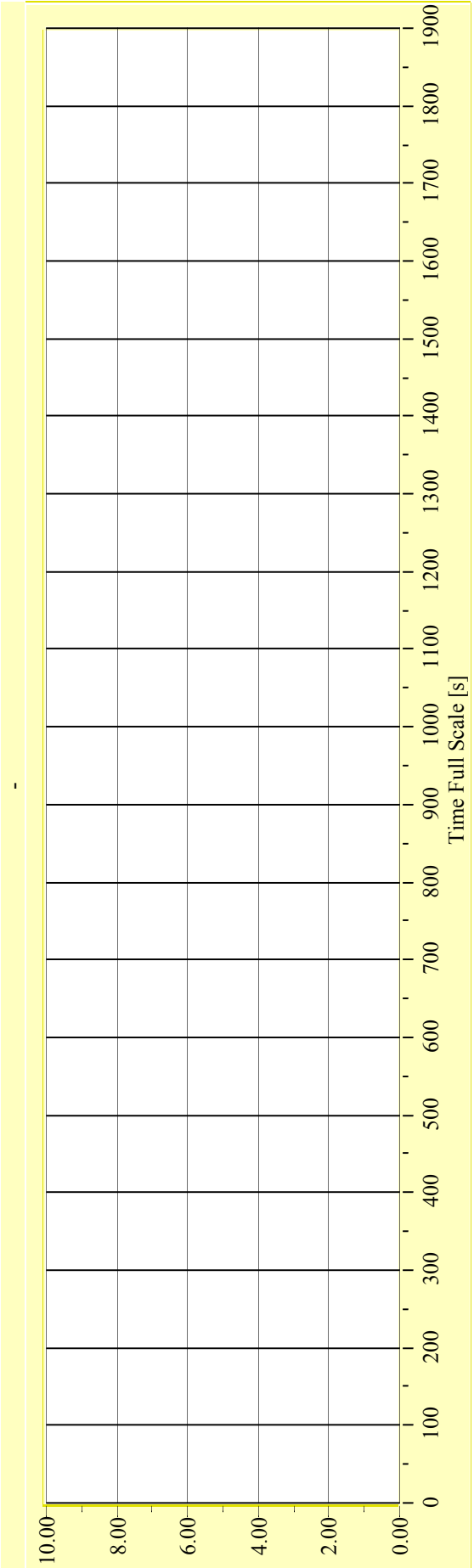
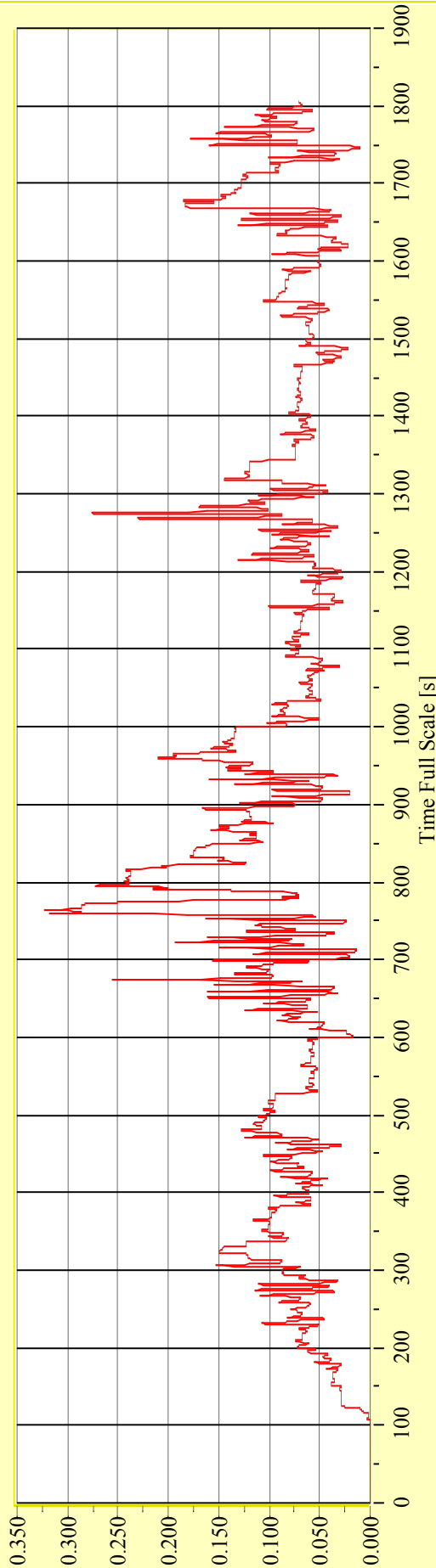
**Model No. 2446**

**Test No. 29681-07**

**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**

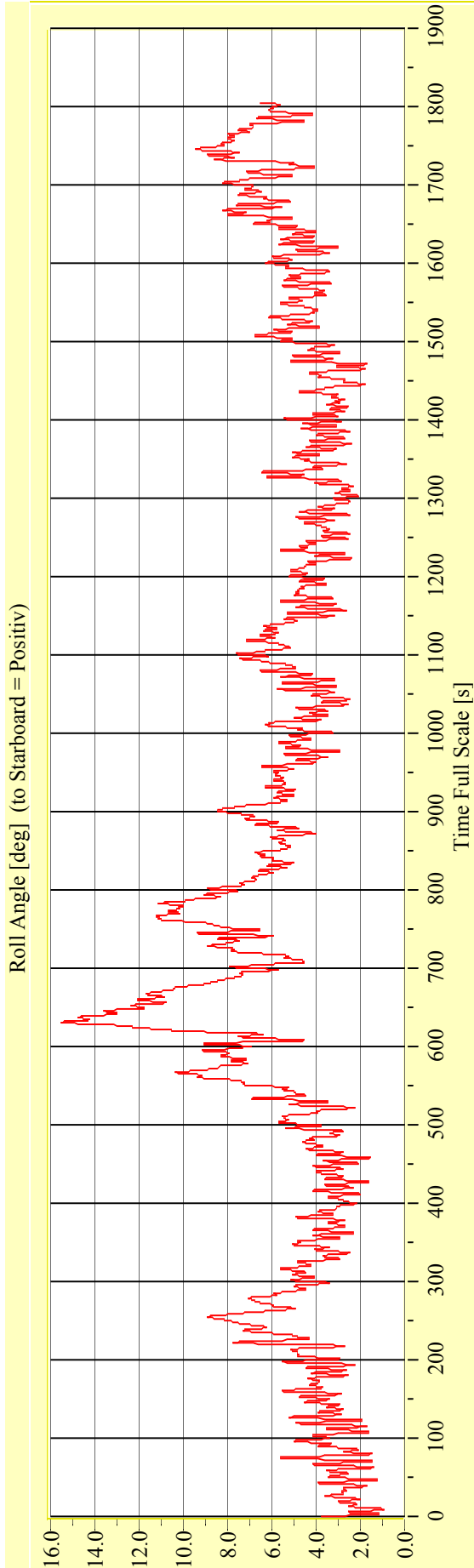
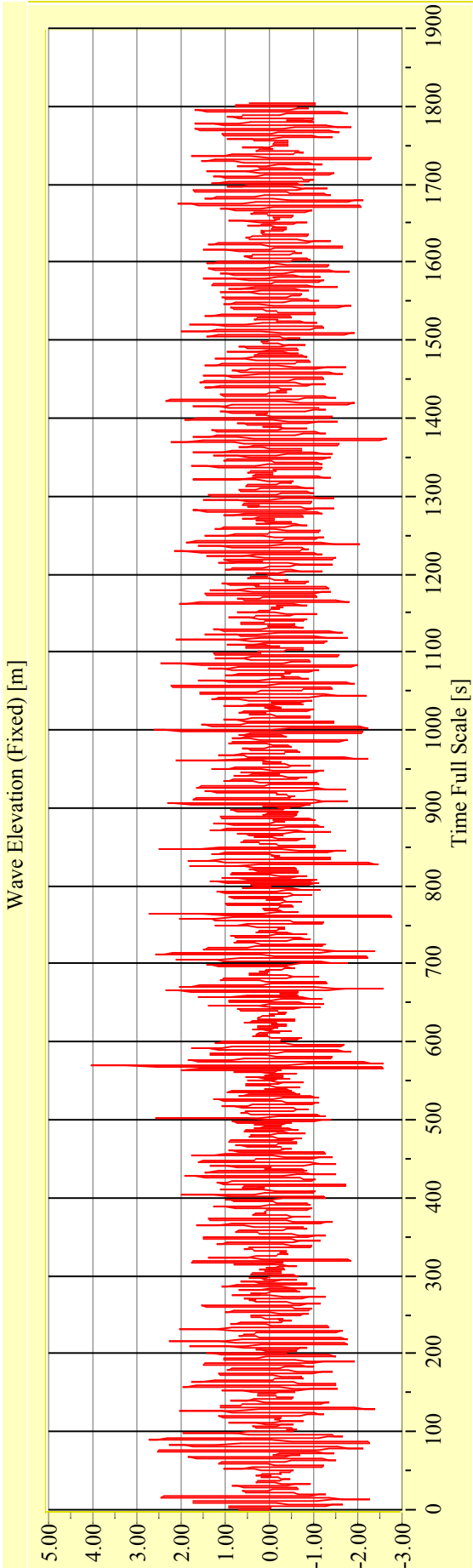
Water Level on Car Deck (Ship) [m]





**Irregular Beam Seas**

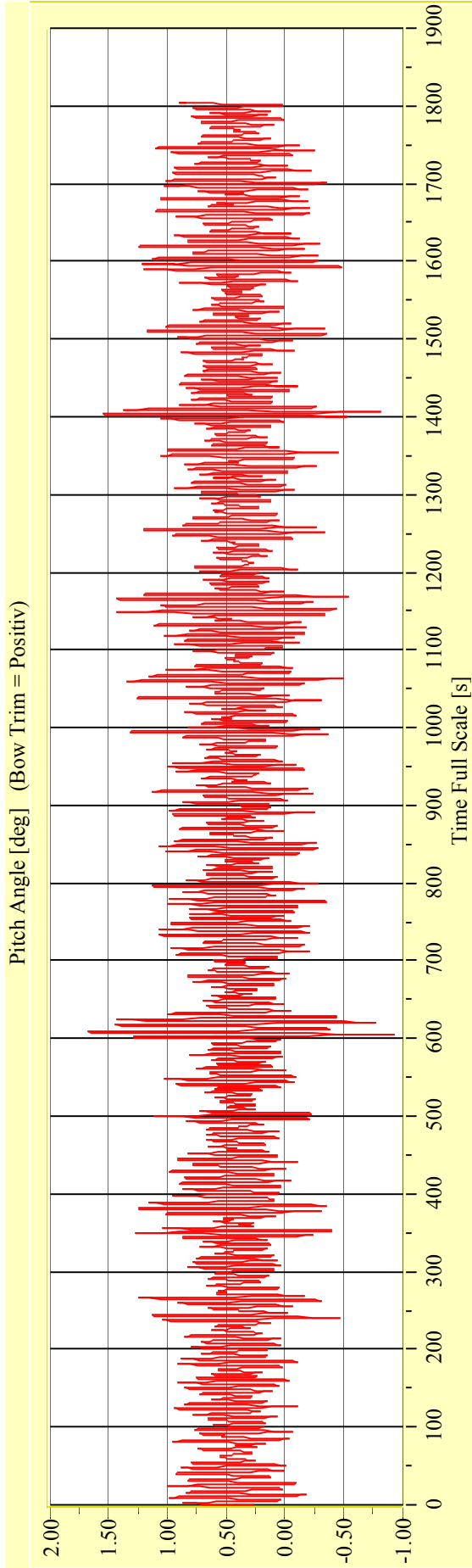
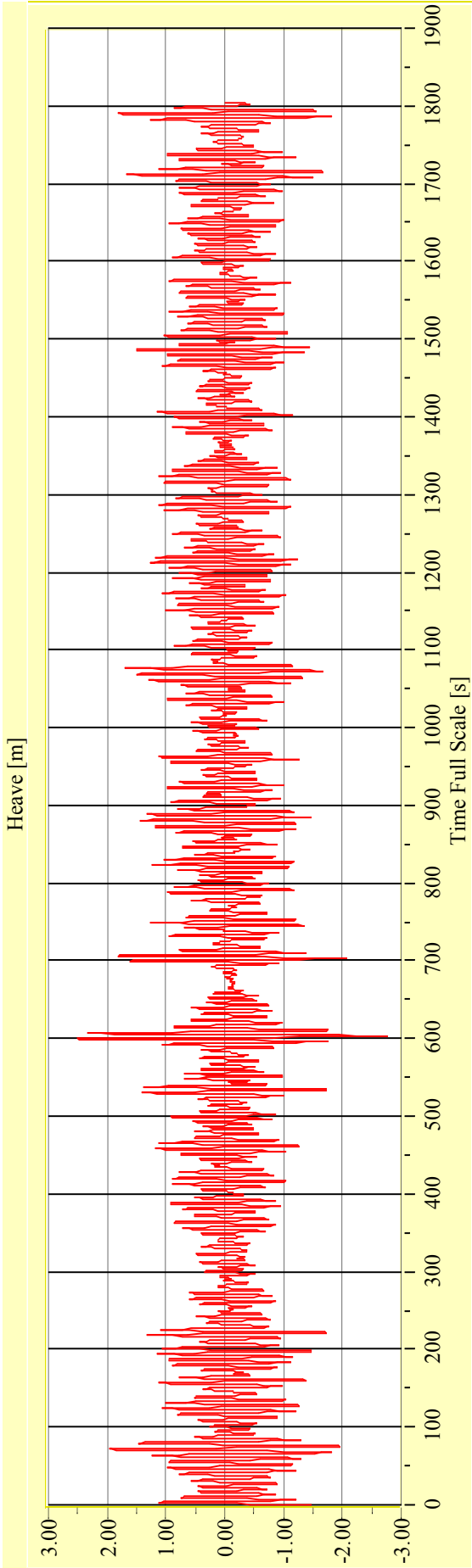
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29681-08**      **Target Waves: Hs = 3,5 m Tp = 7,483 s**      **gamma = 3,3**



**Date: 14.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29681-08**      **Target Waves: Hs = 3,5 m Tp = 7,483 s**      **gamma = 3,3**



**Date: 14.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**

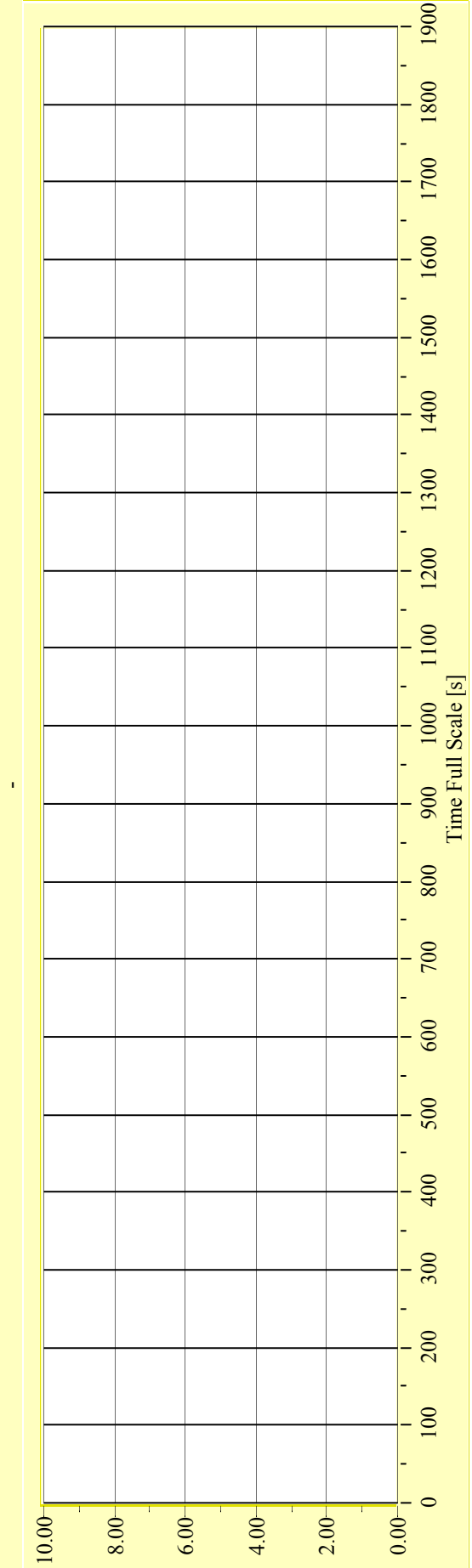
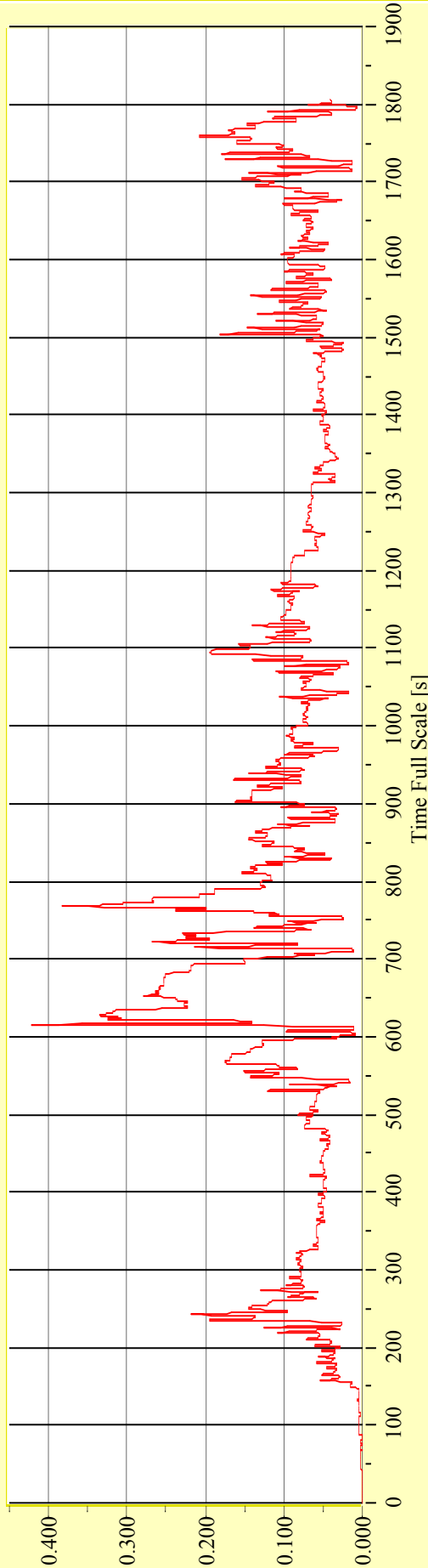
**Model No. 2446**

**Test No. 29681-08**

**Target Waves: Hs = 3,5 m Tp = 7,483 s**

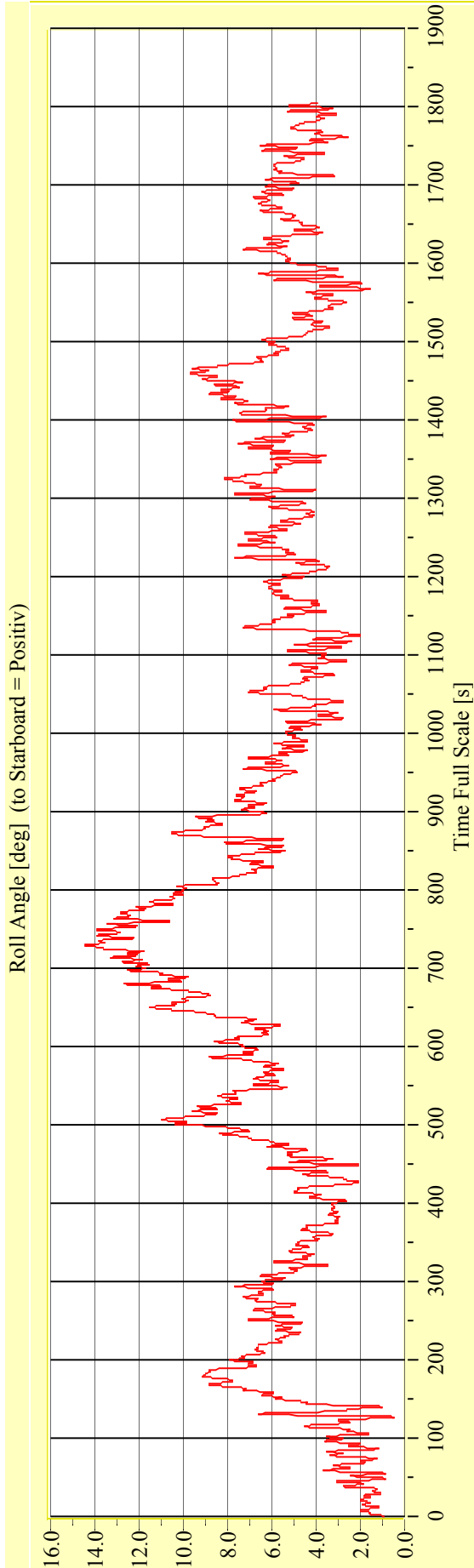
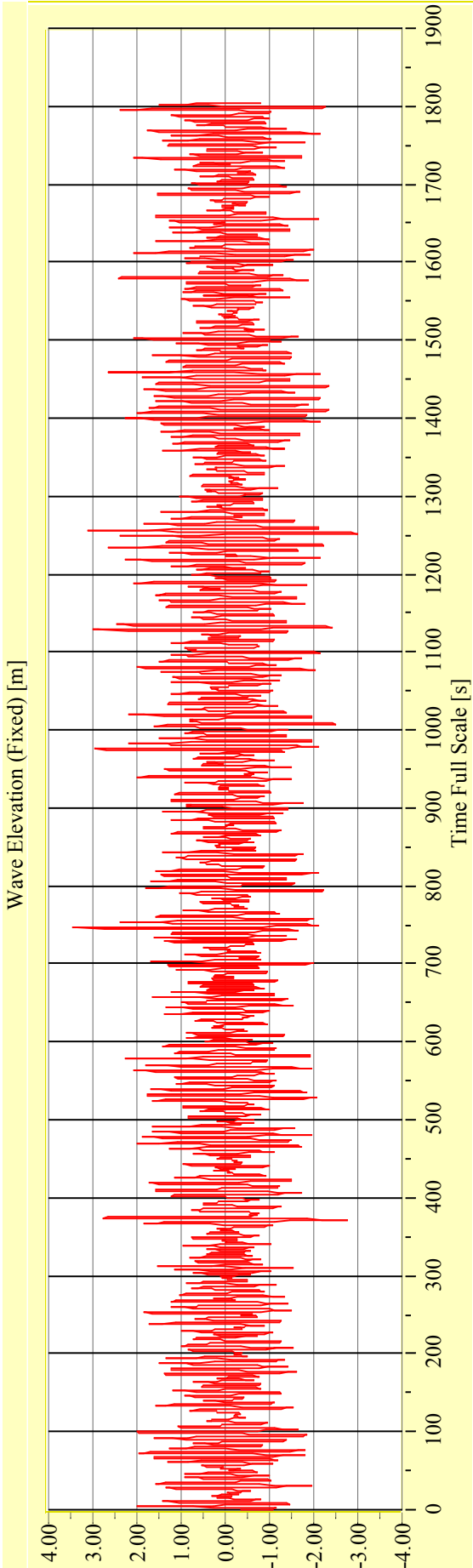
**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29681-09**      **Target Waves: Hs = 3.5 m Tp = 7.483 s**      **gamma = 3,3**



**Date: 14.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

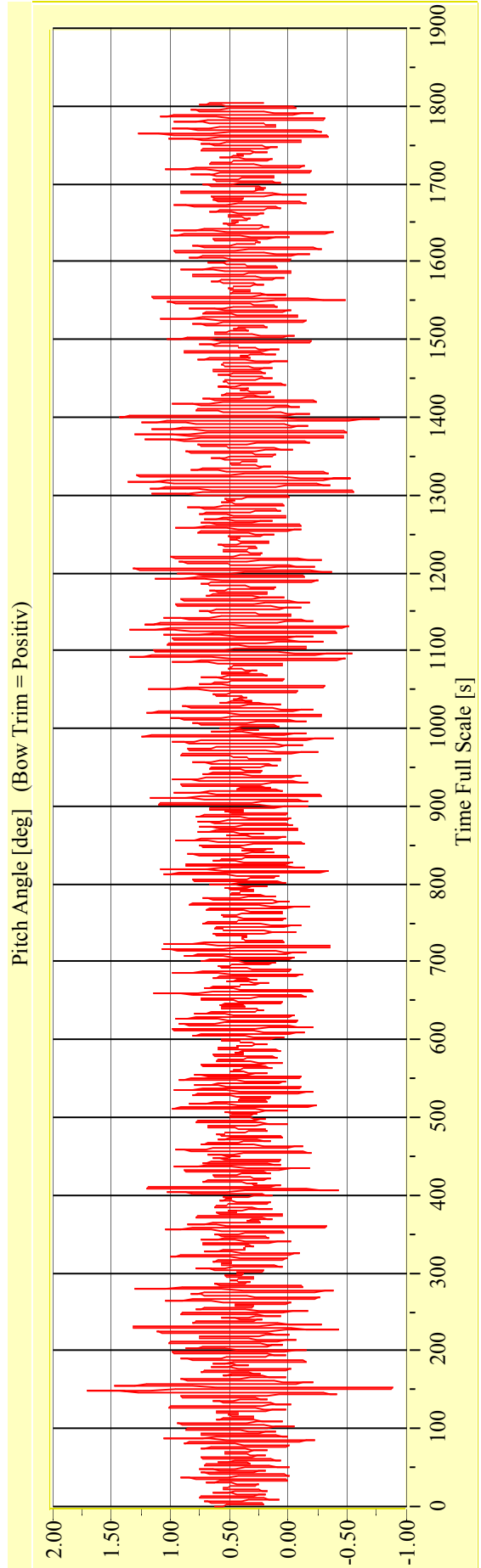
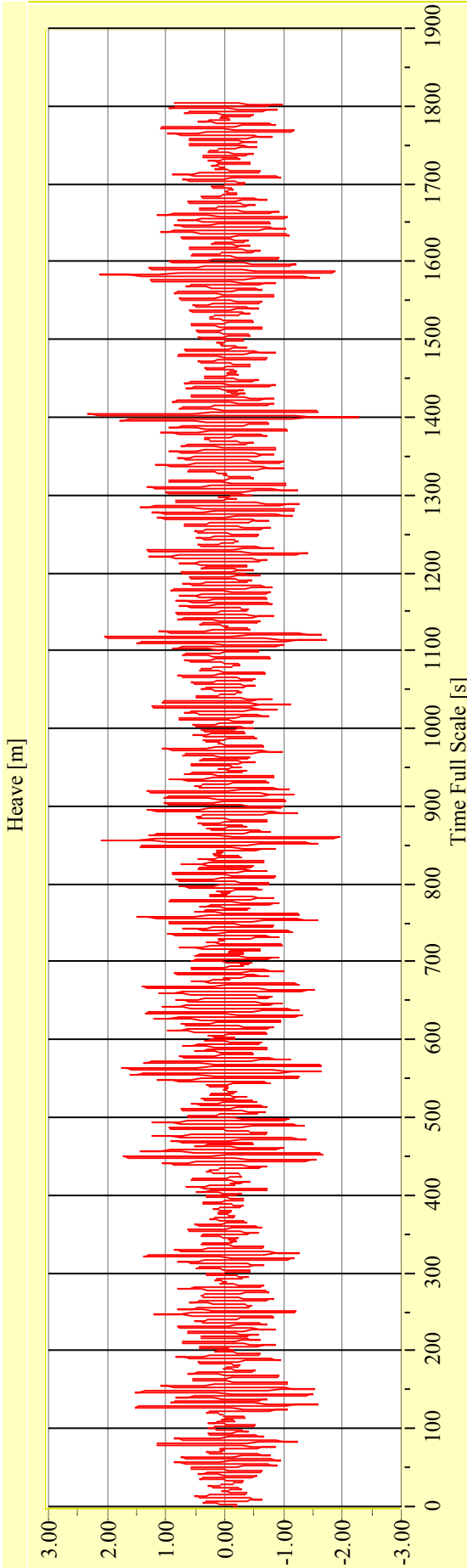
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29681-09**

**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

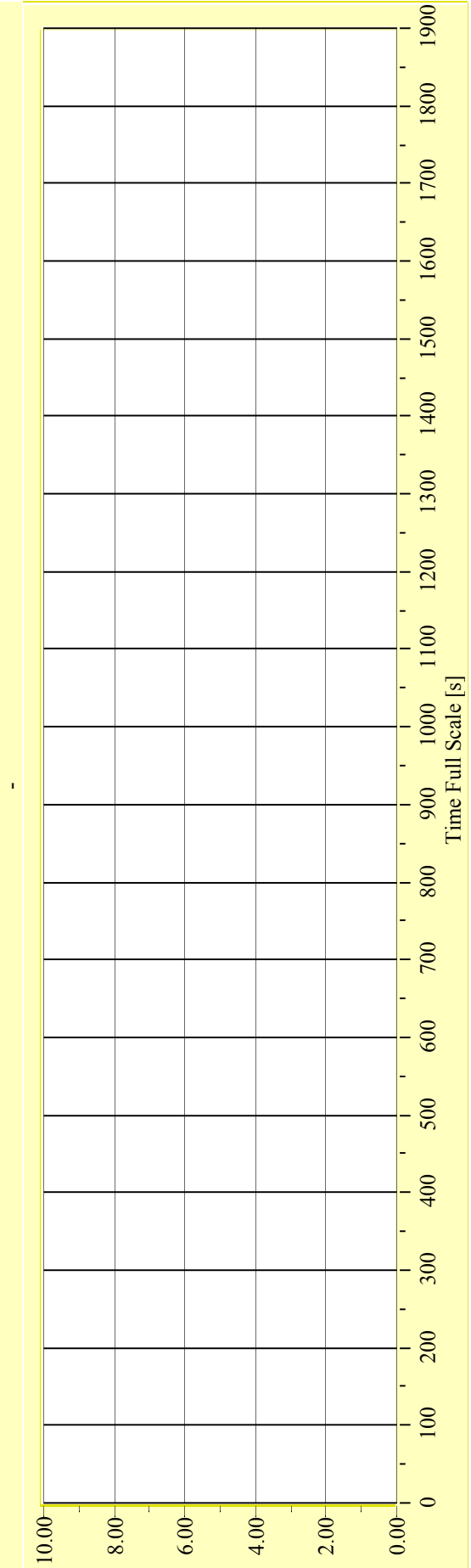
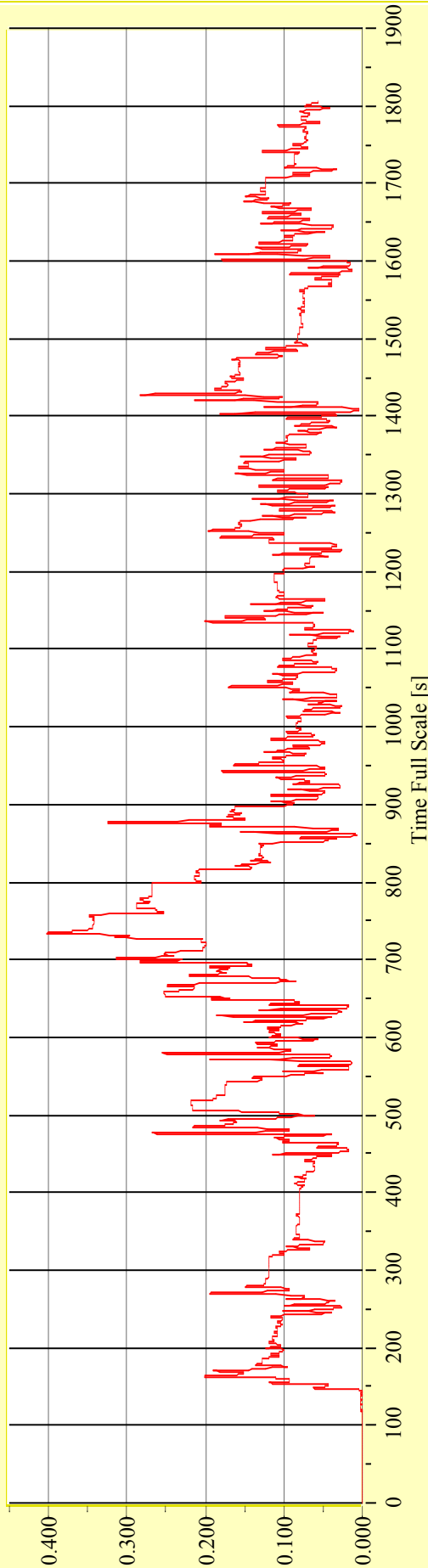
**Model No. 2446**

**Test No. 29681-09**

**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Irregular Beam Seas**

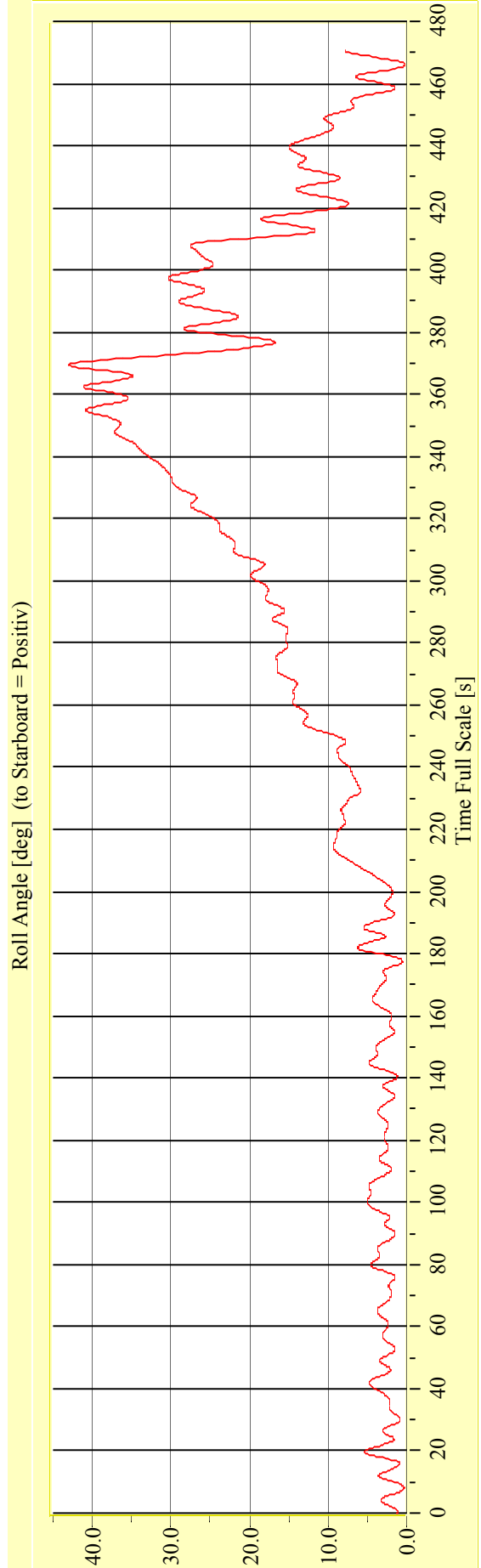
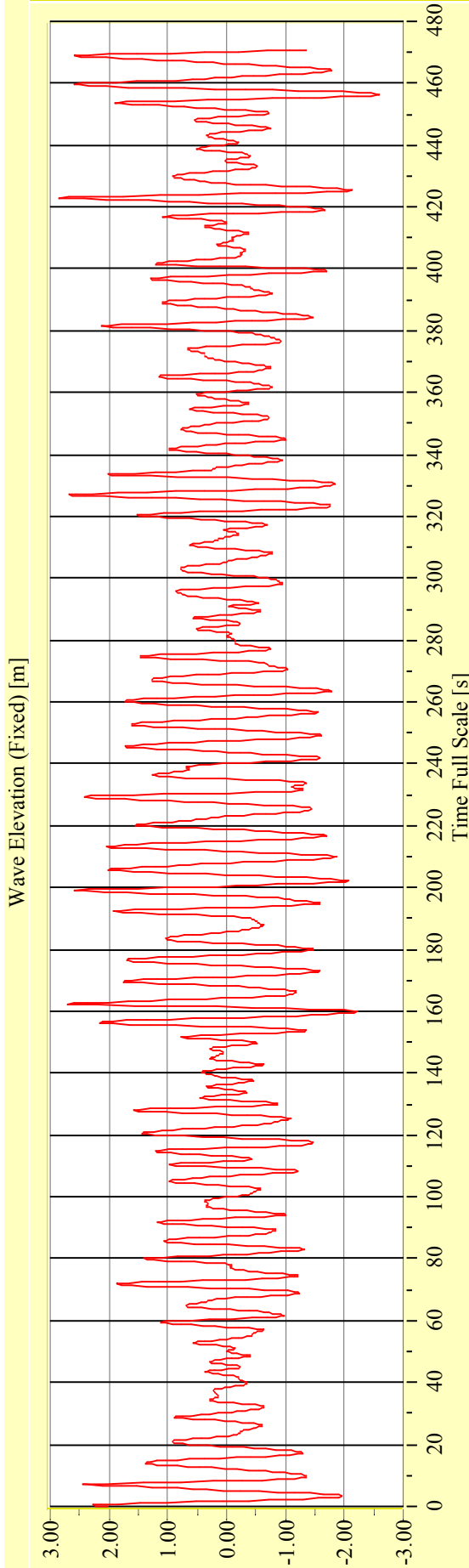
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29681-10**

**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**



**Irregular Beam Seas**

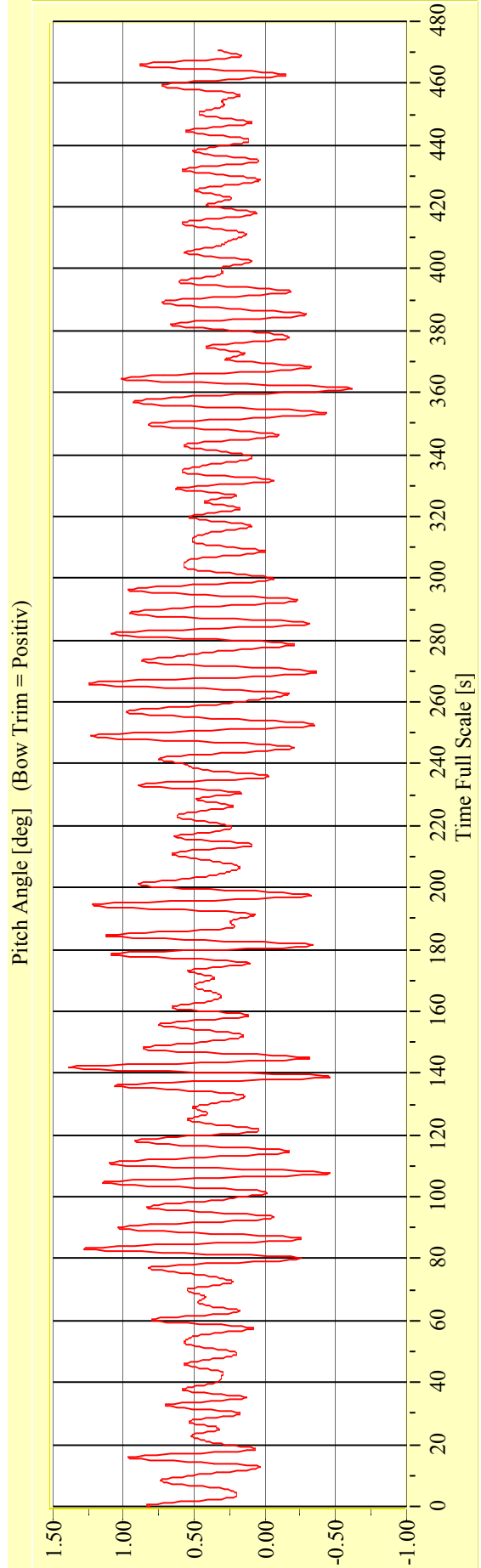
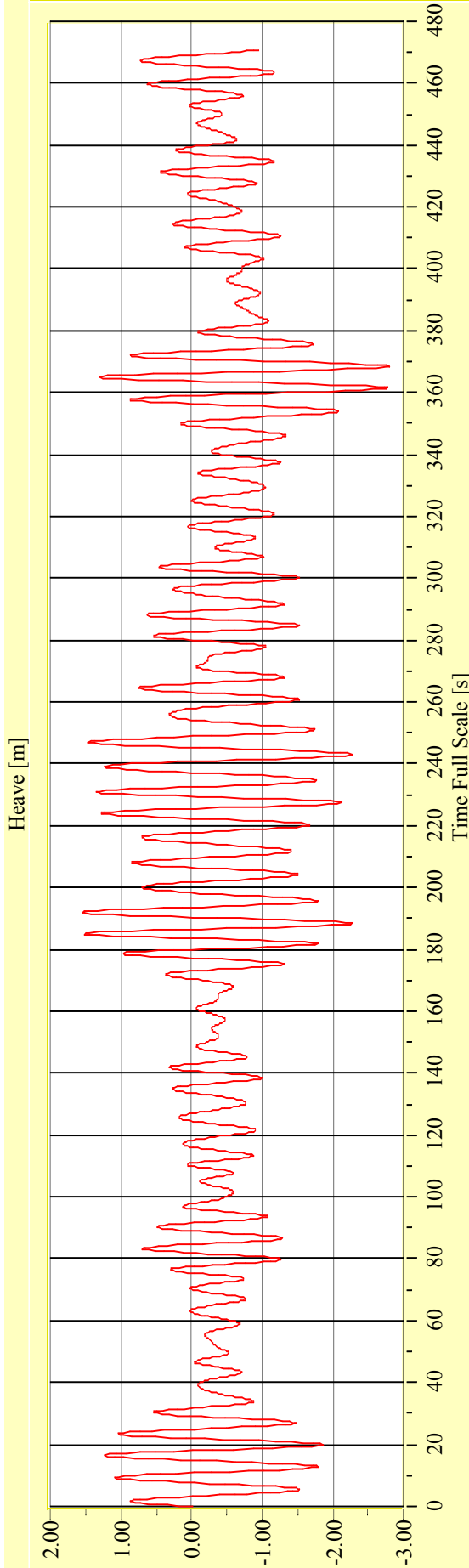
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29681-10**

**Target Waves: Hs = 3,5 m Tp = 7,483 s**

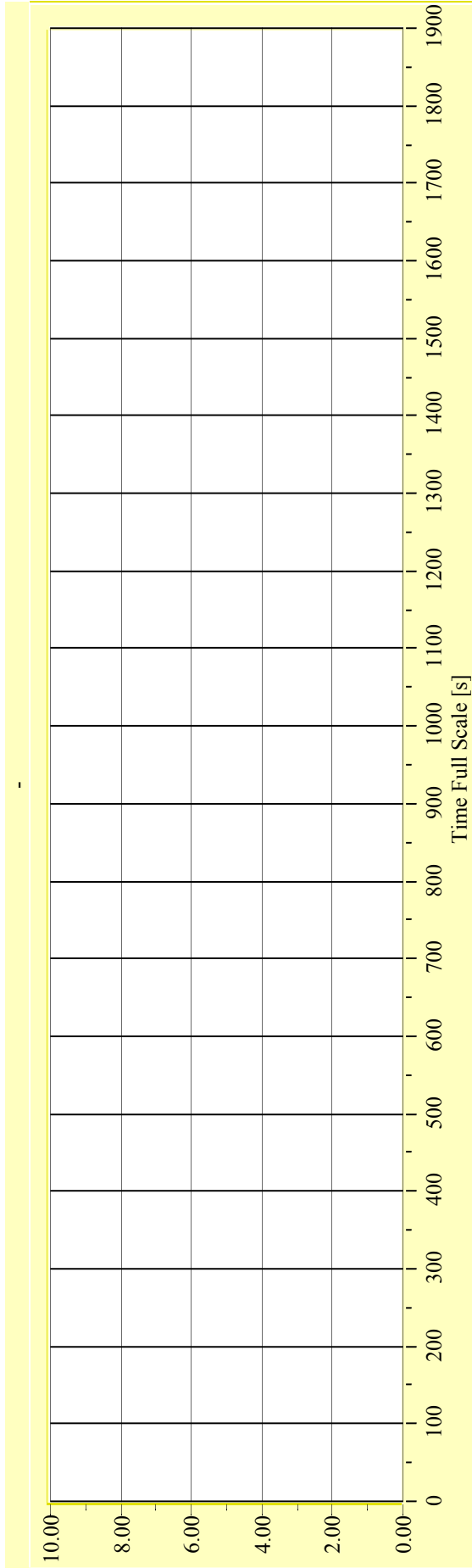
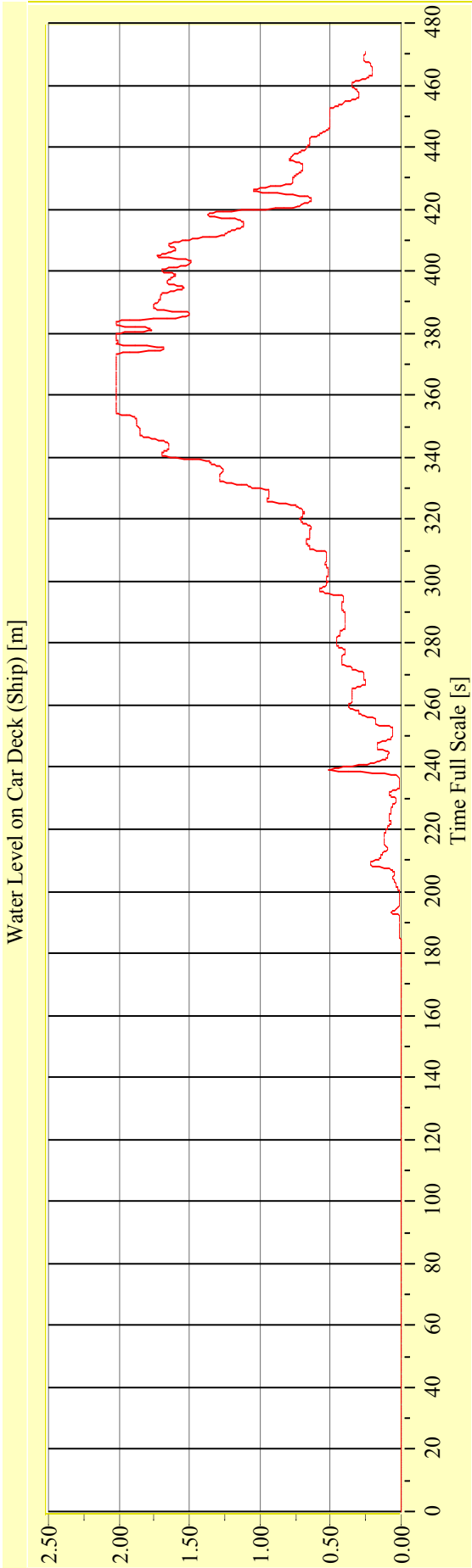
**gamma = 3,3**





**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29681-10**      **Target Waves: Hs = 3,5 m Tp = 7,483 s**      **gamma = 3,3**



**Date: 14.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

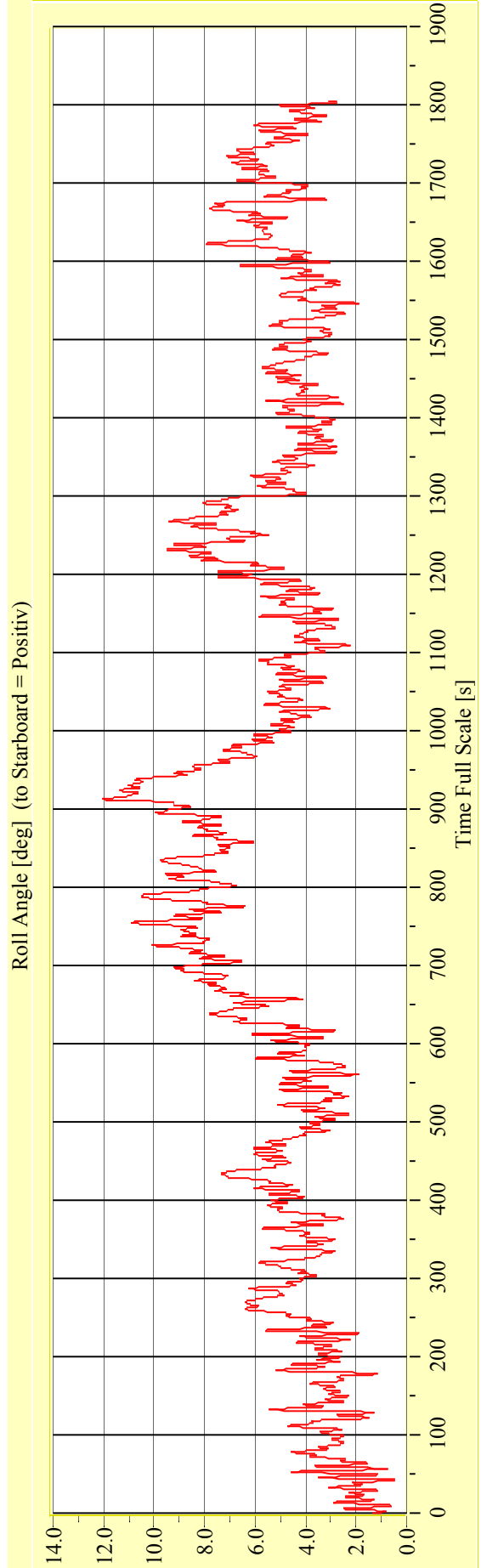
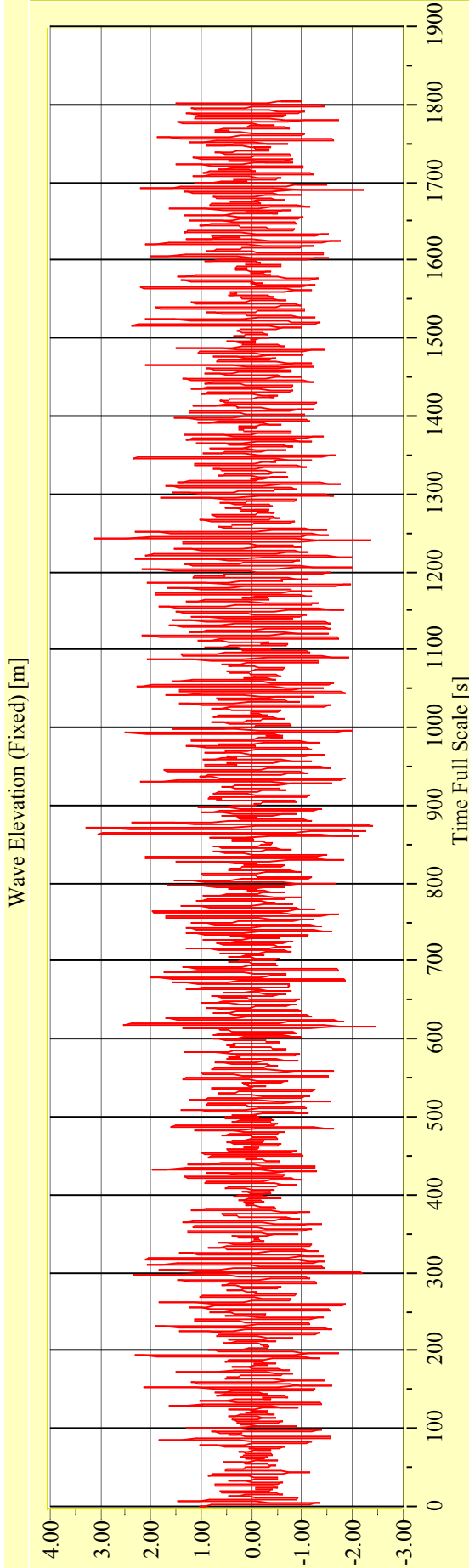
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29682-01**

**Target Waves: Hs = 3,25 m Tp = 7,211 s**

**gamma = 3,3**



**Irregular Beam Seas**

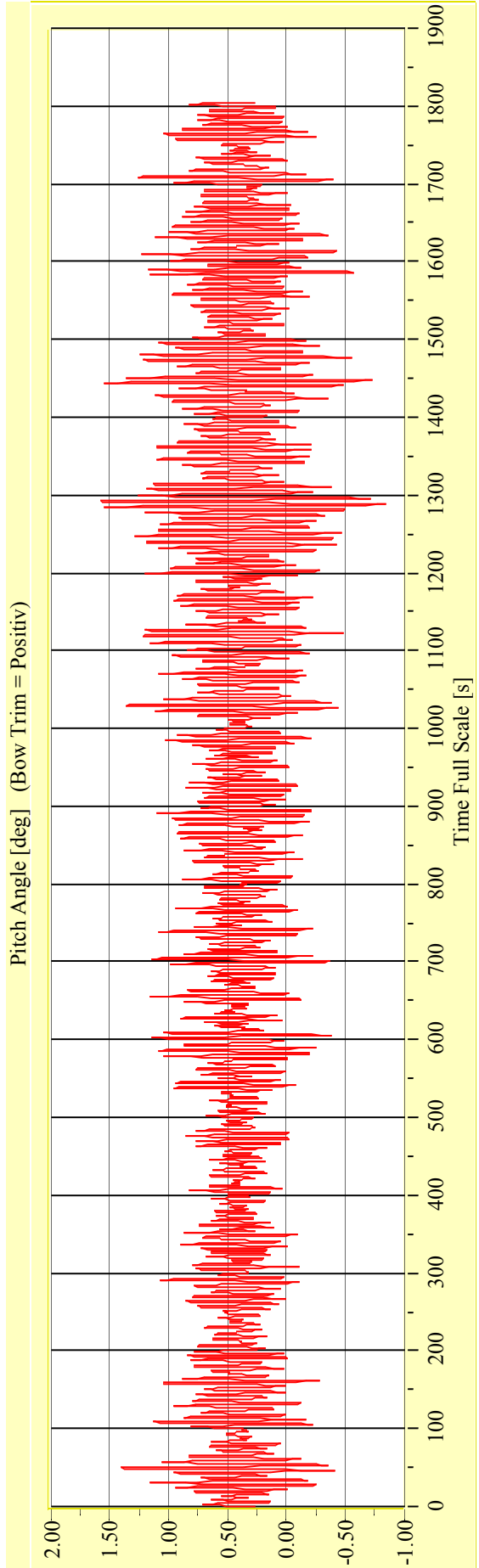
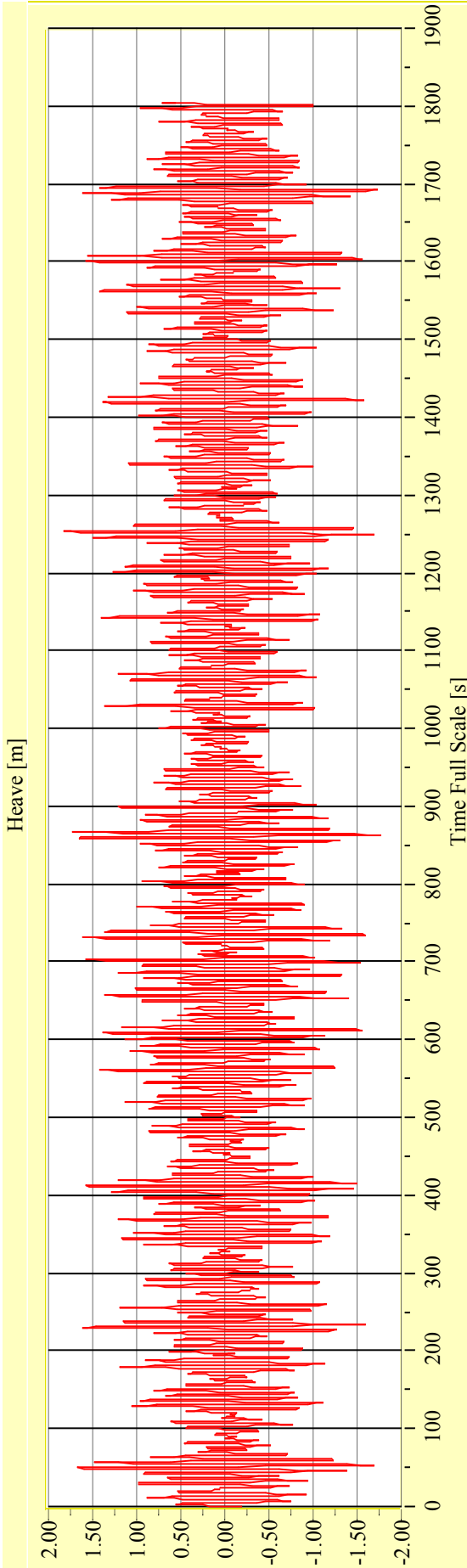
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29682-01**

**Target Waves: Hs = 3,25 m Tp = 7,211 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

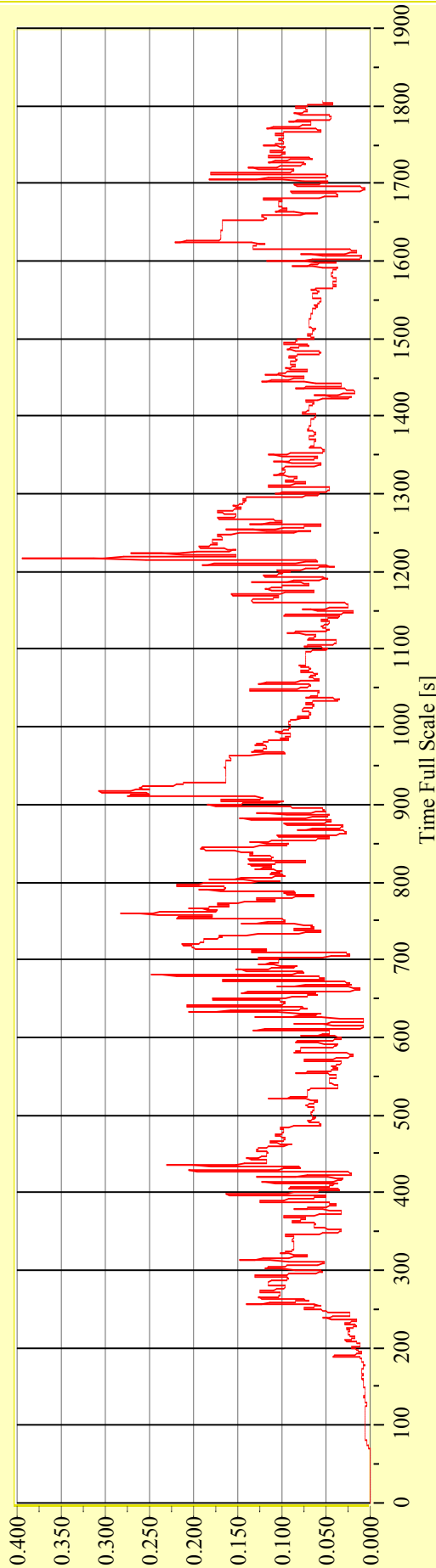
**Model No. 2446**

**Test No. 29682-01**

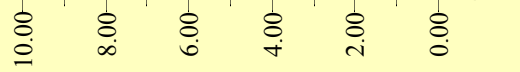
**Target Waves: Hs = 3,25 m Tp = 7,211 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



Time Full Scale [s]



Time Full Scale [s]

**Date: 12.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

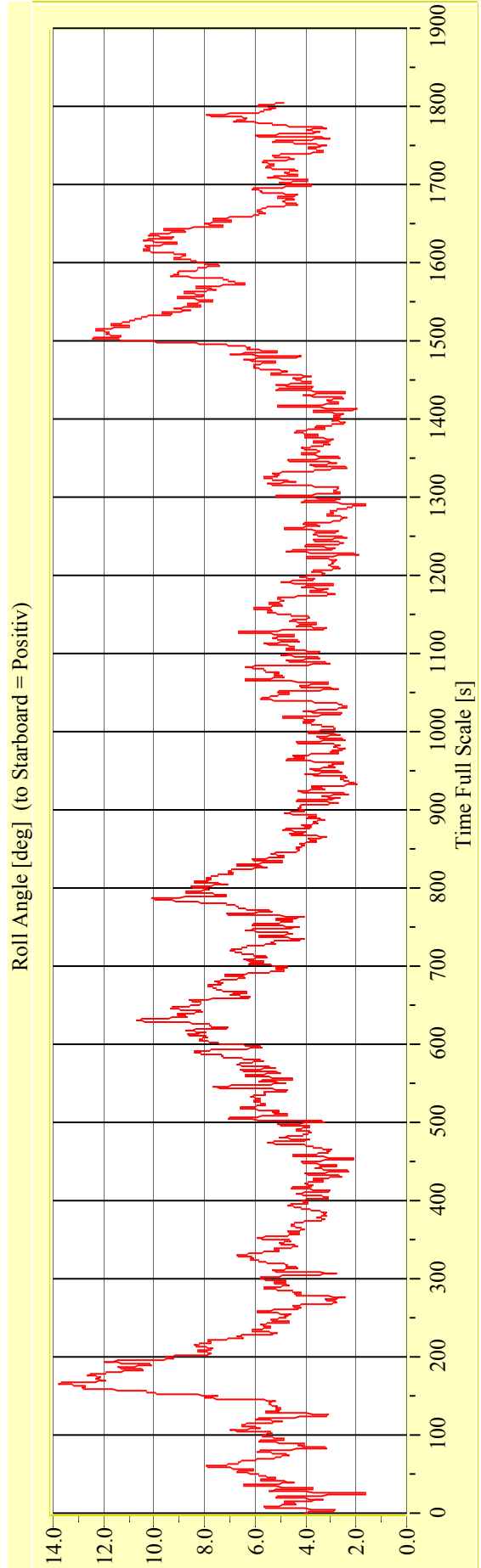
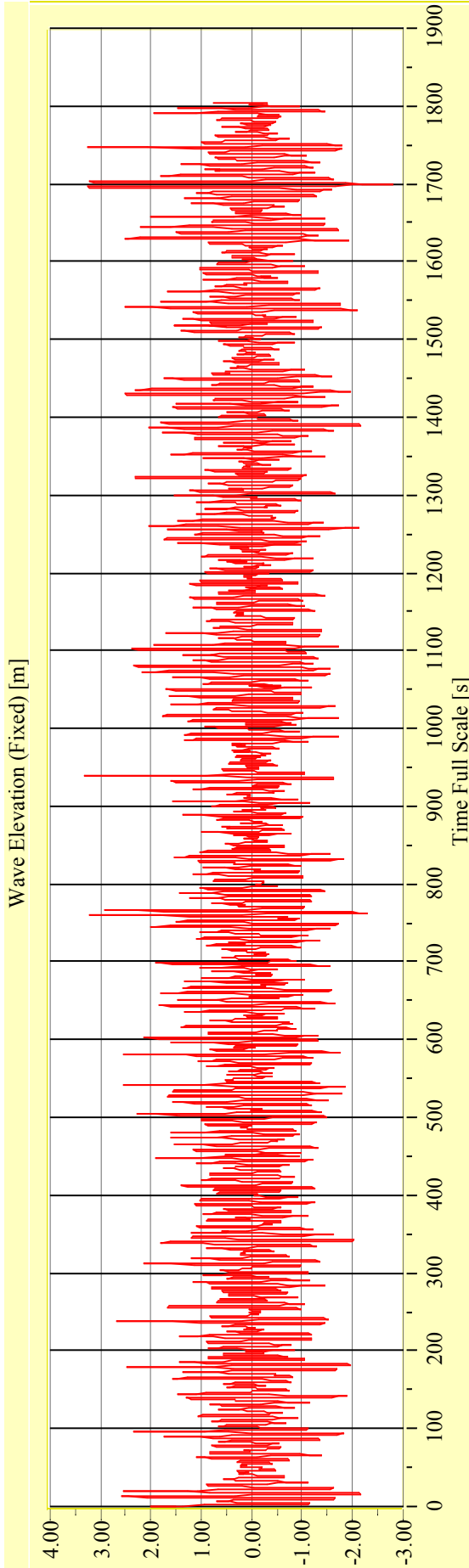
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29682-02**

**Target Waves: Hs = 3,25 m Tp = 7,211 s**

**gamma = 3,3**



**Date: 12.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

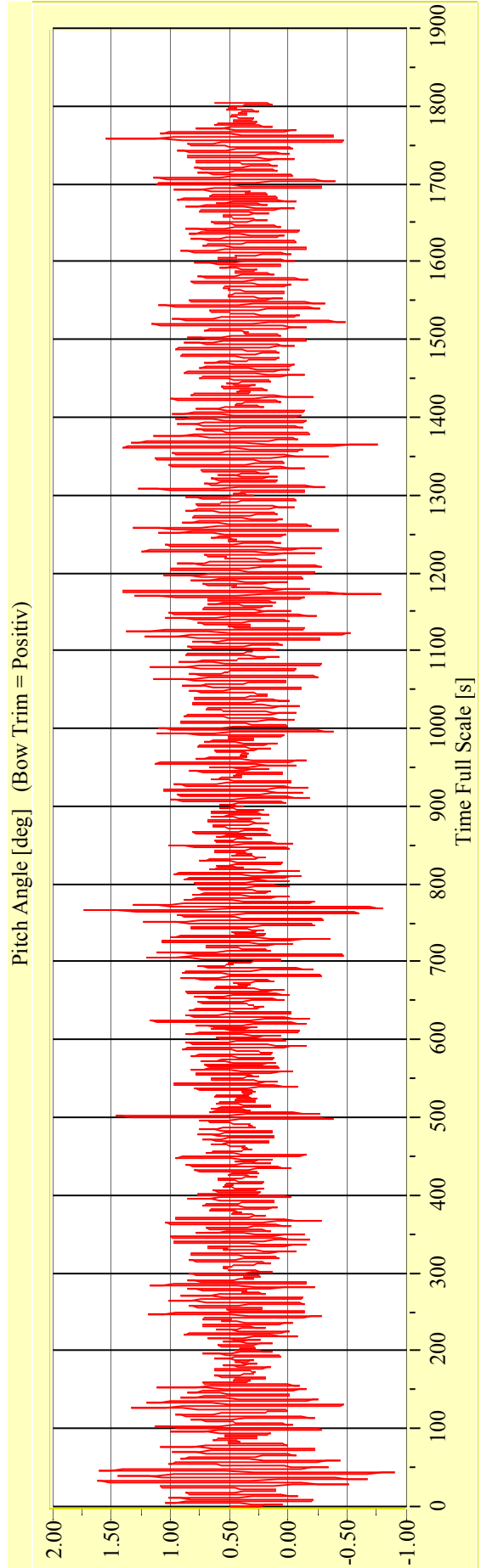
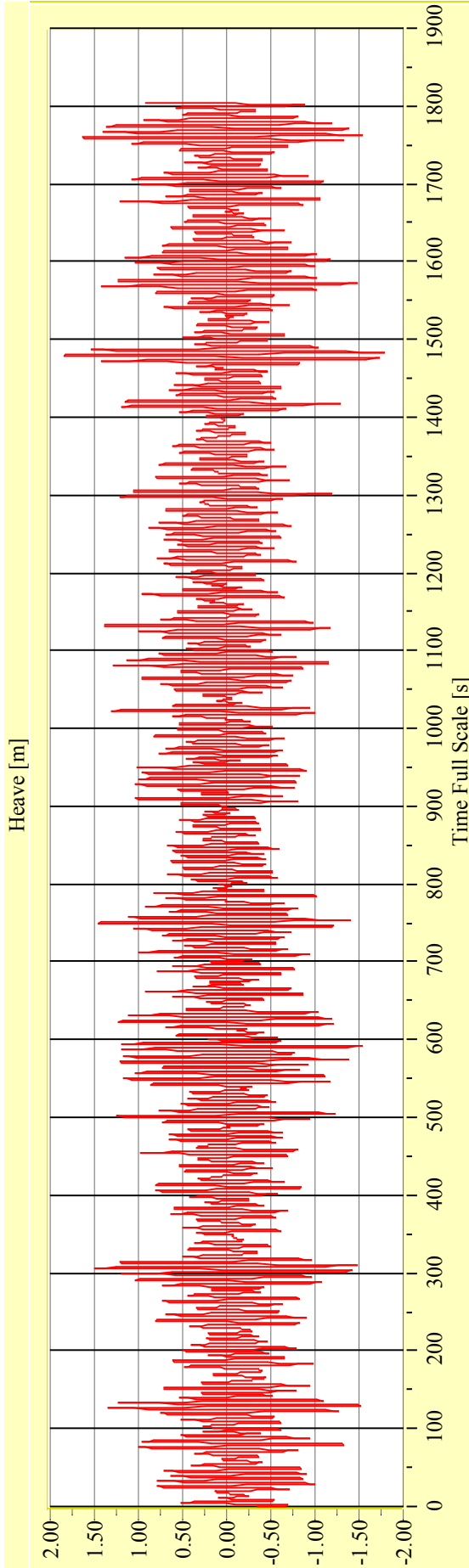
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29682-02**

**Target Waves: Hs = 3,25 m Tp = 7,211 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

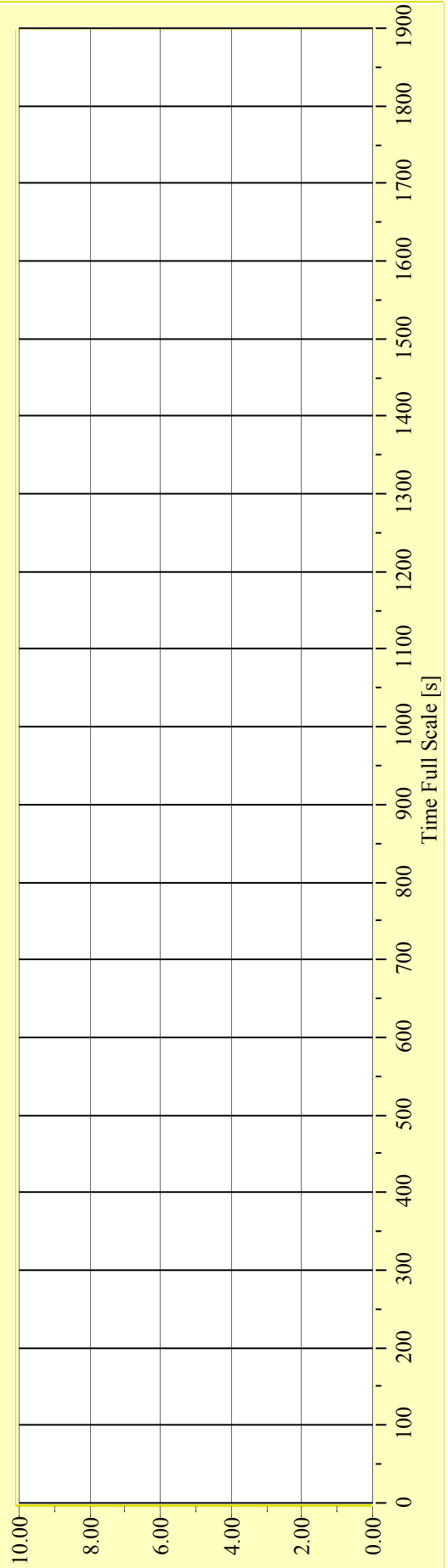
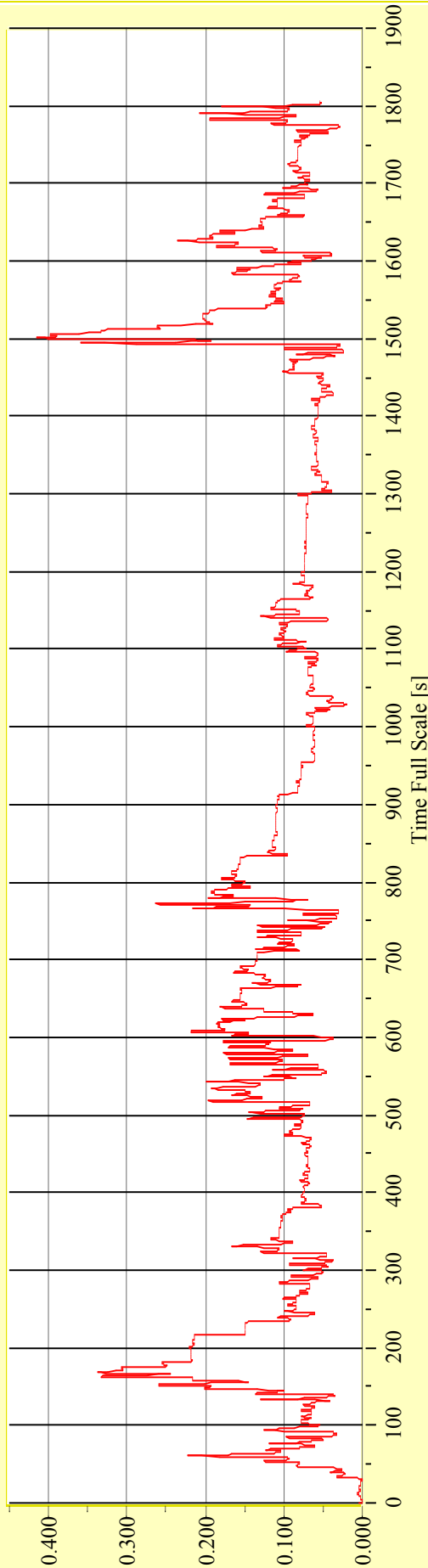
**Model No. 2446**

**Test No. 29682-02**

**Target Waves: Hs = 3,25 m Tp = 7,211 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Date: 12.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

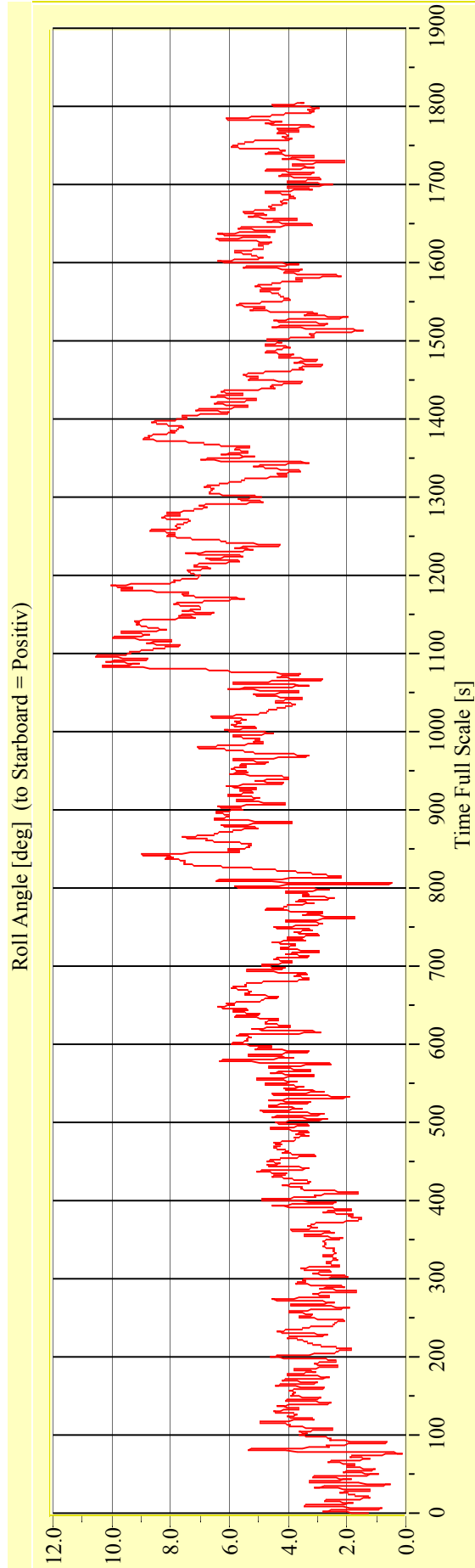
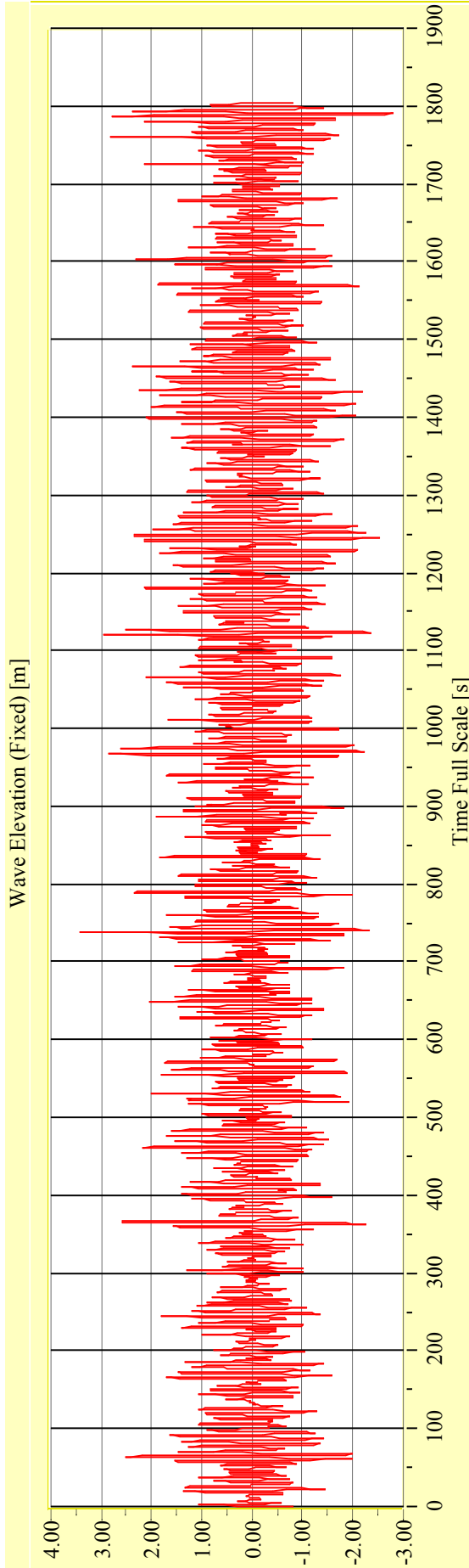
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29682-03**

**Target Waves: Hs = 3,25 m Tp = 7,211 s**

**gamma = 3,3**



**Date: 12.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**



**Irregular Beam Seas**

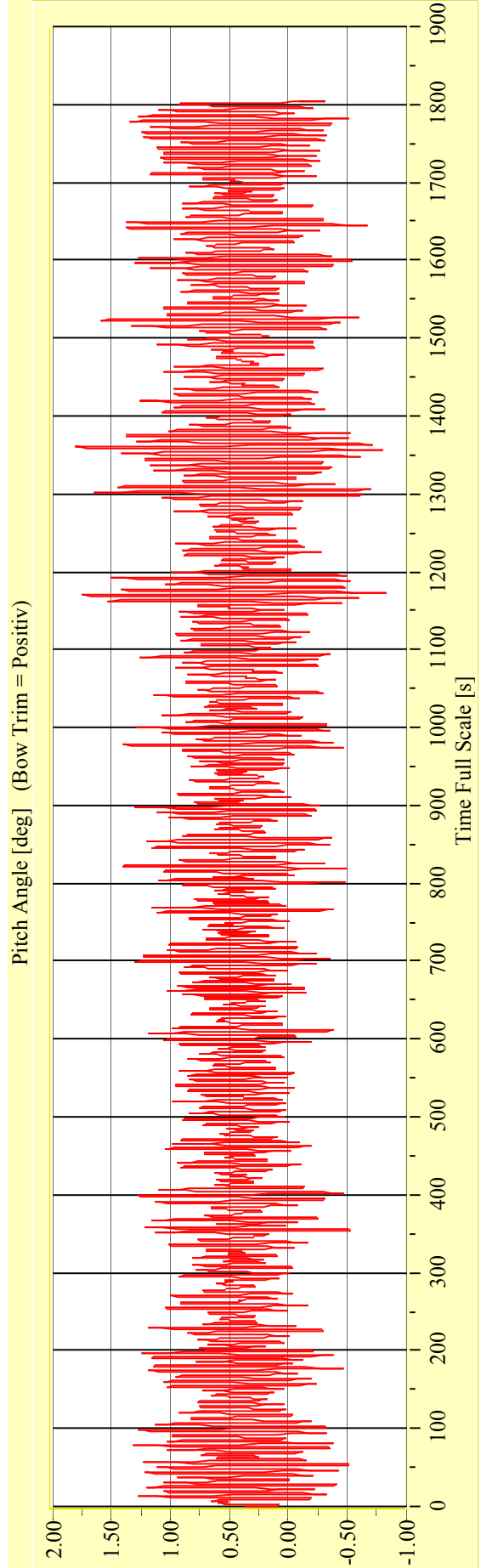
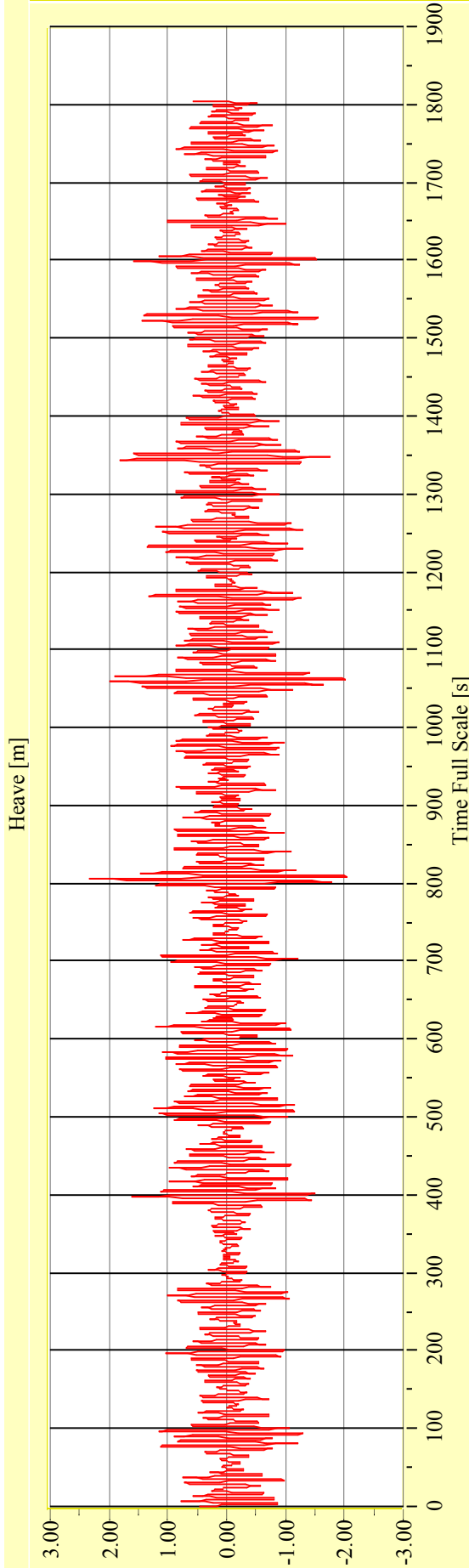
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29682-03**

**Target Waves: Hs = 3,25 m Tp = 7,211 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

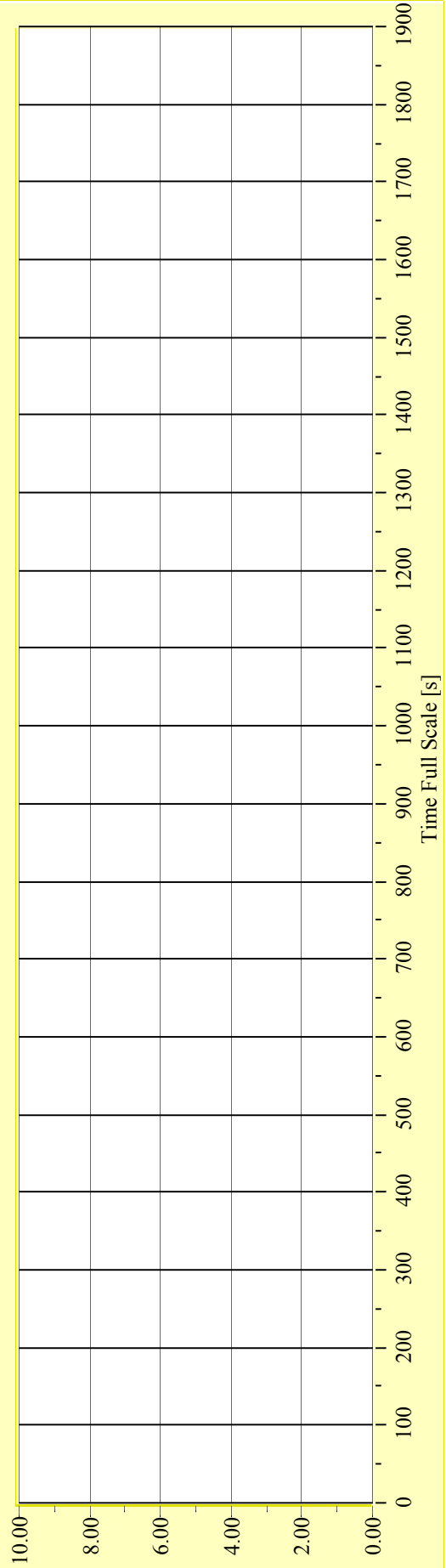
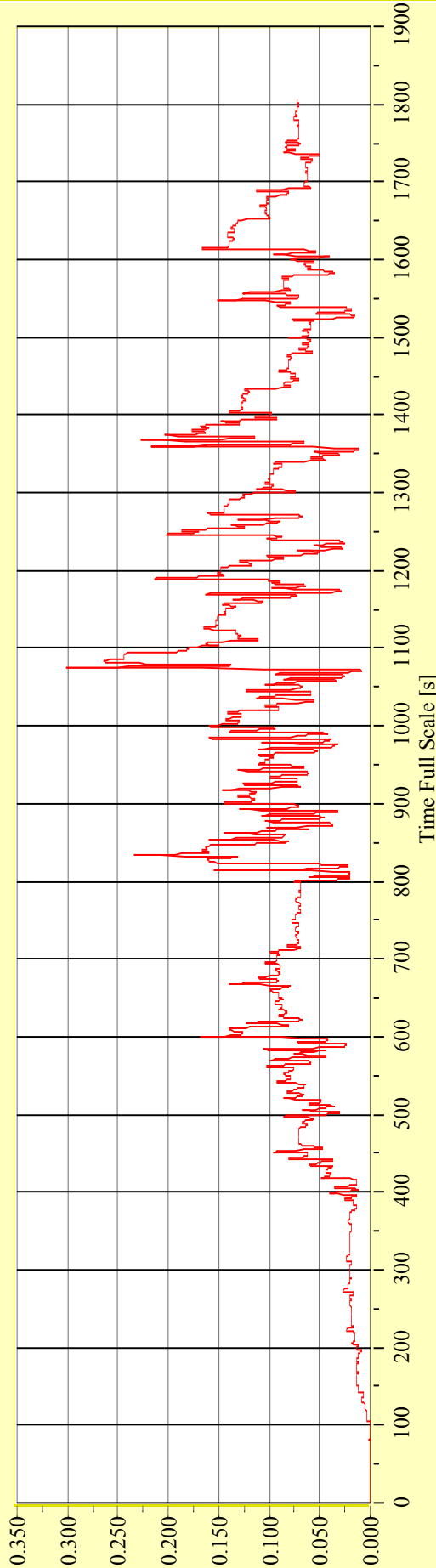
**Model No. 2446**

**Test No. 29682-03**

**Target Waves: Hs = 3,25 m Tp = 7,211 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Date: 12.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

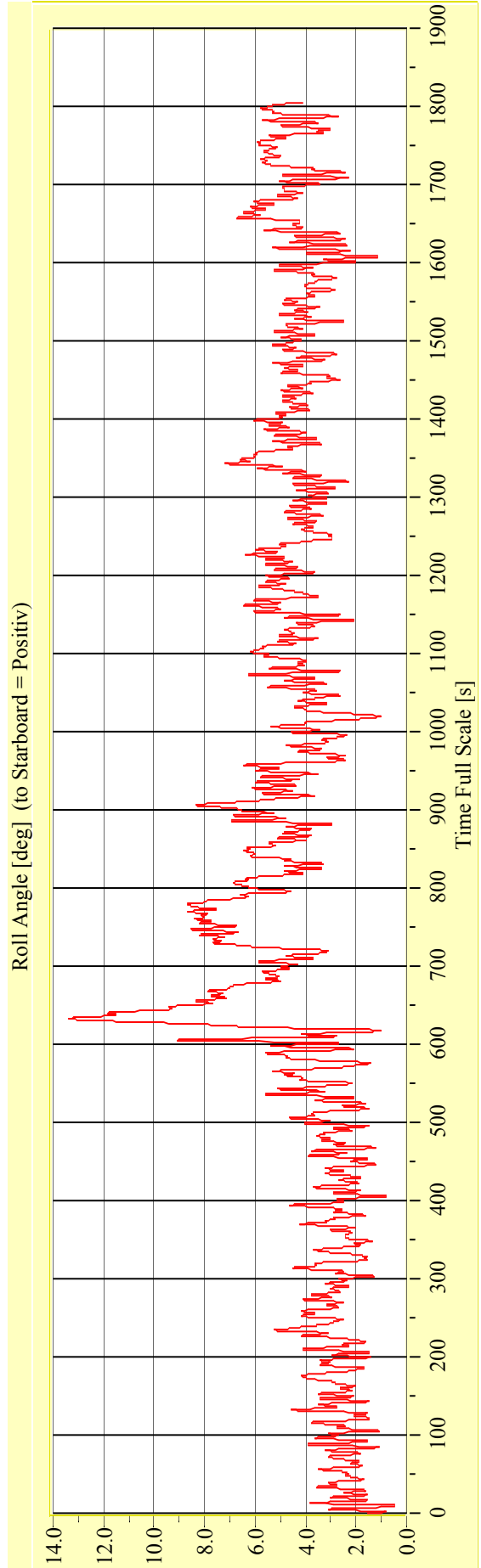
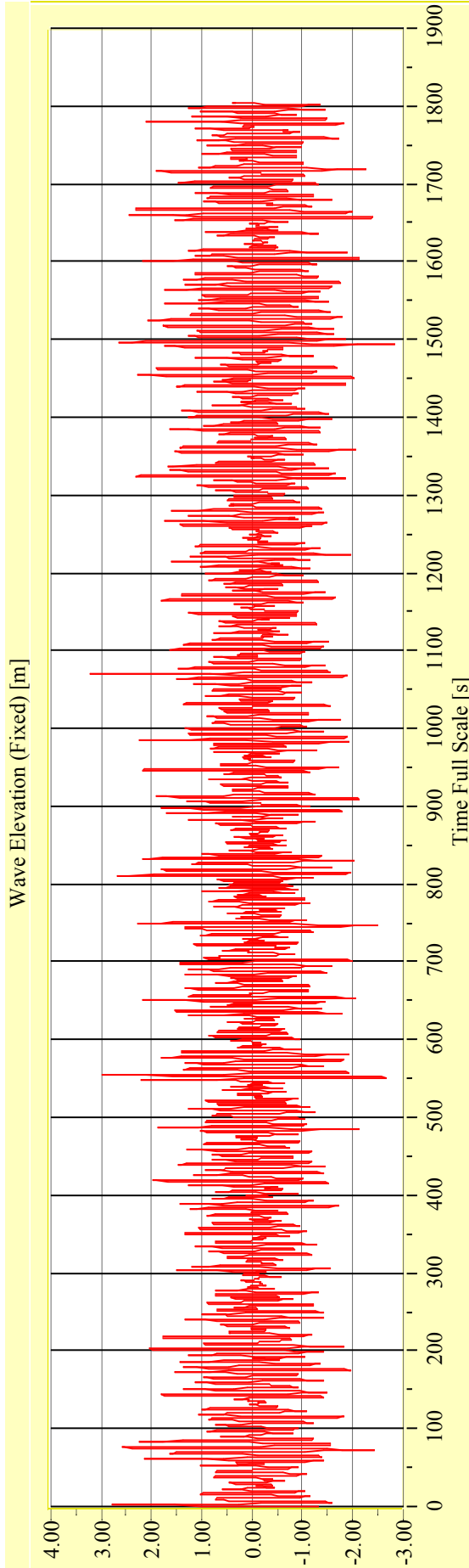
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29682-04**

**Target Waves: Hs = 3,25 m Tp = 7,211 s**

**gamma = 3,3**



**Irregular Beam Seas**

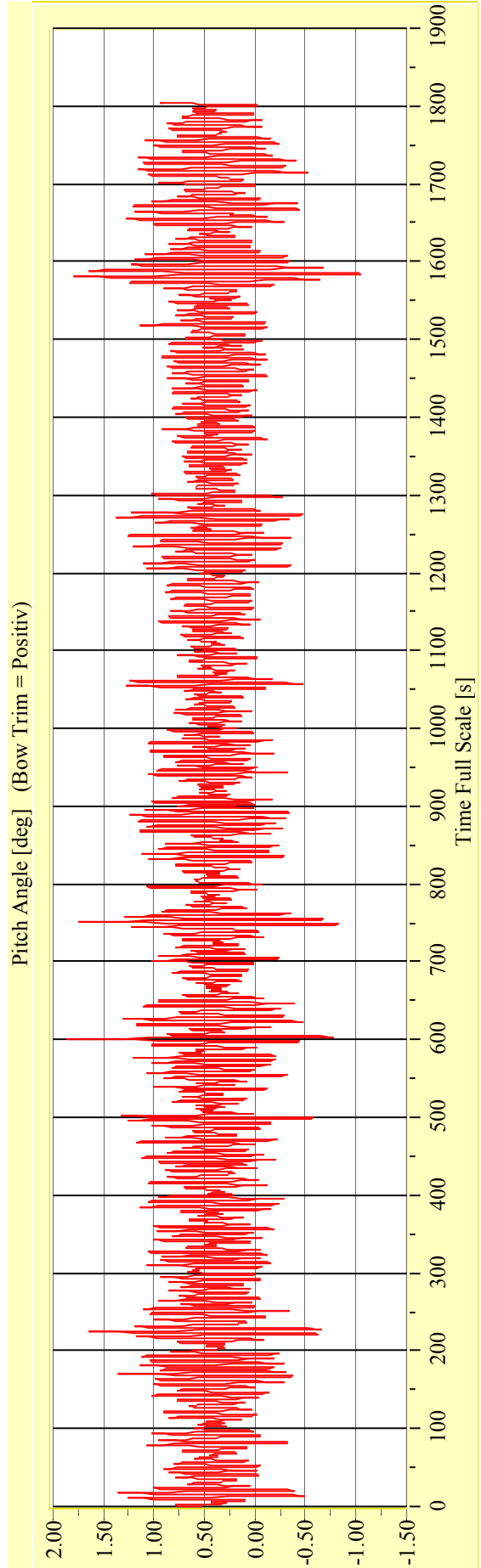
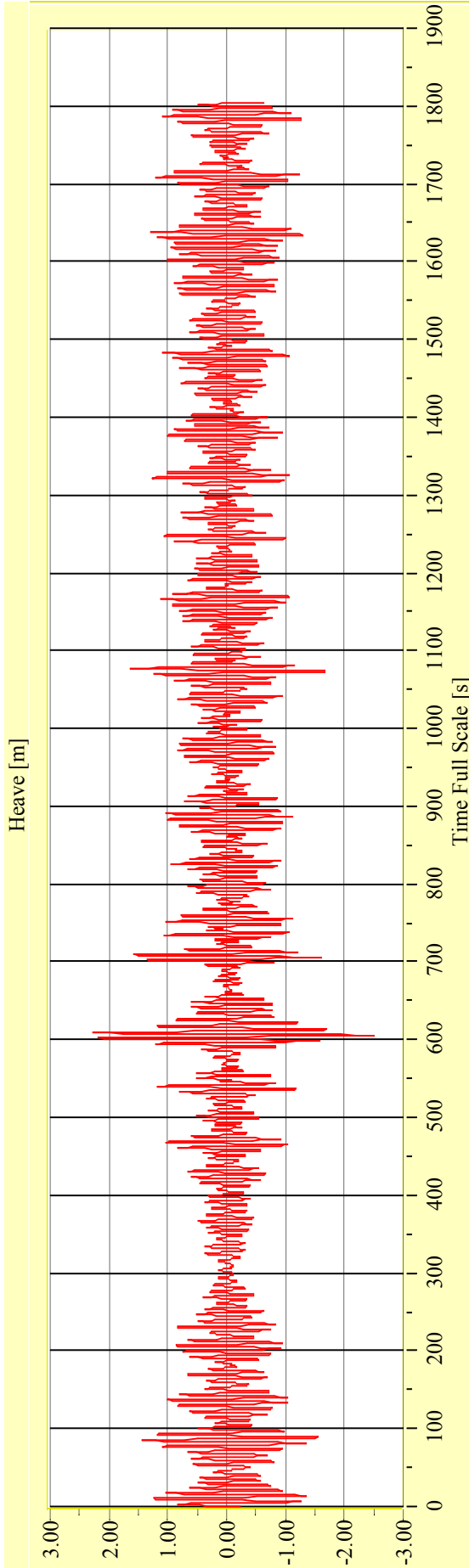
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29682-04**

**Target Waves: Hs = 3,25 m Tp = 7,211 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

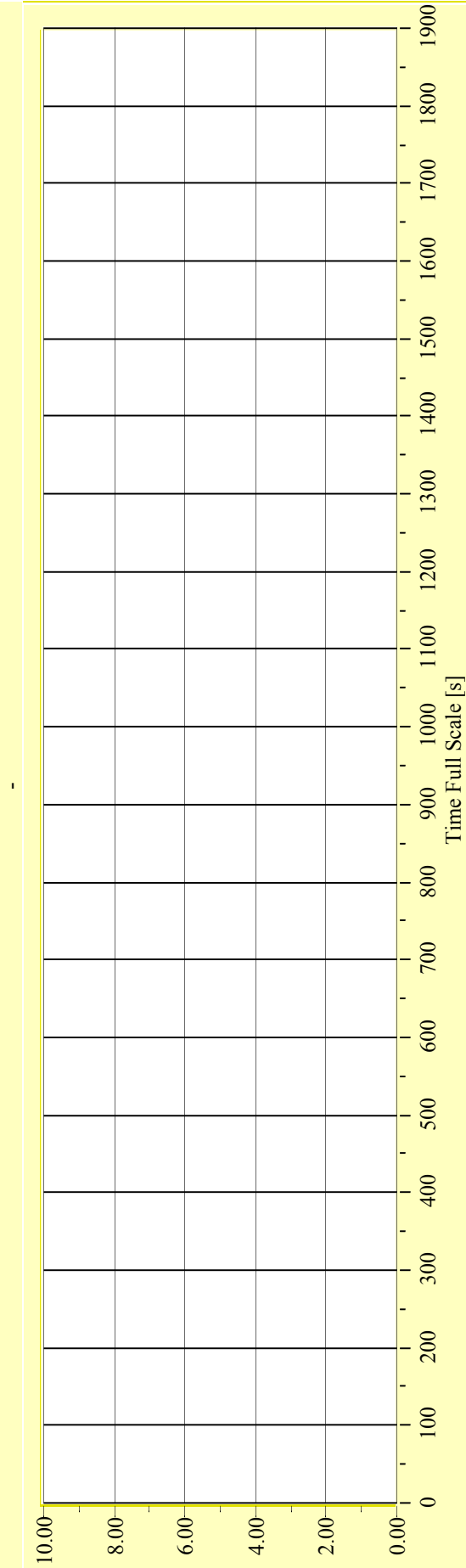
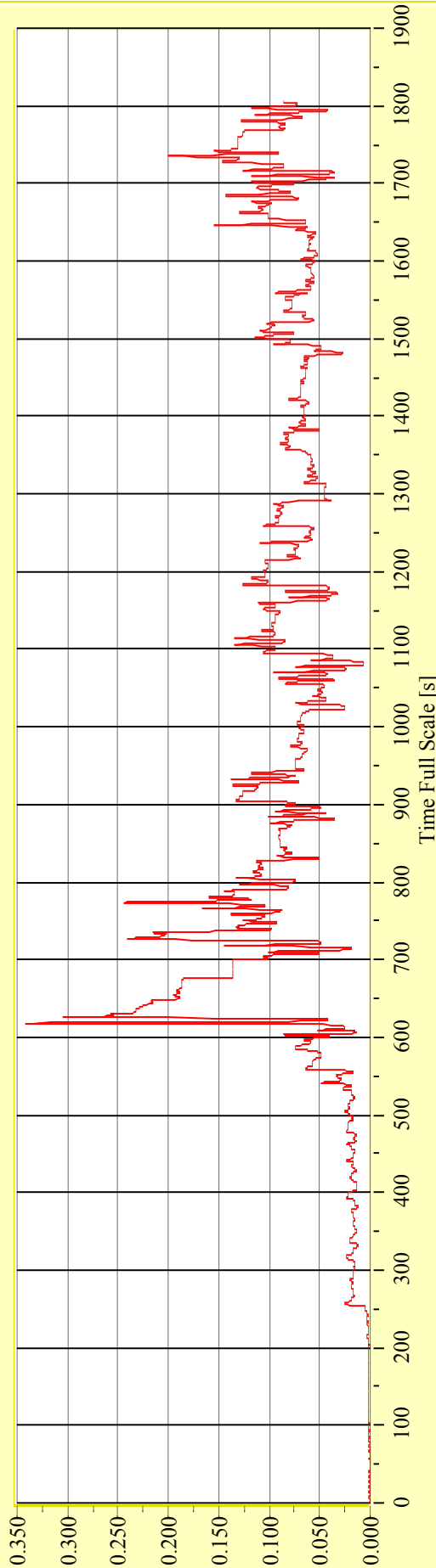
**Model No. 2446**

**Test No. 29682-04**

**Target Waves: Hs = 3,25 m Tp = 7,211 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Irregular Beam Seas**

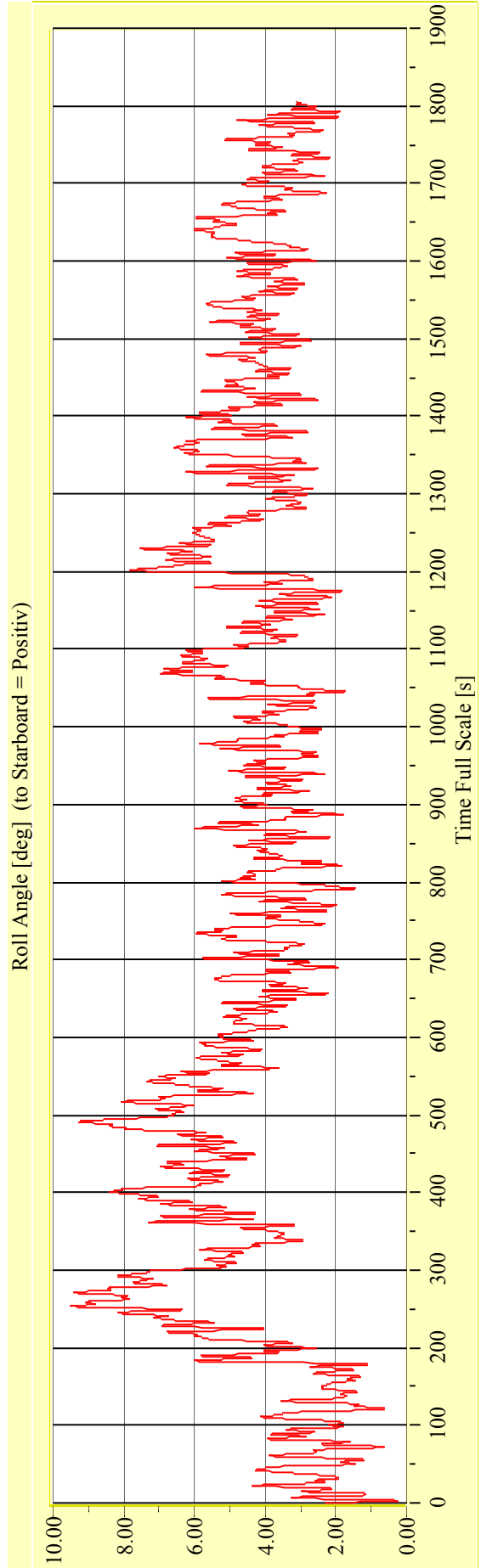
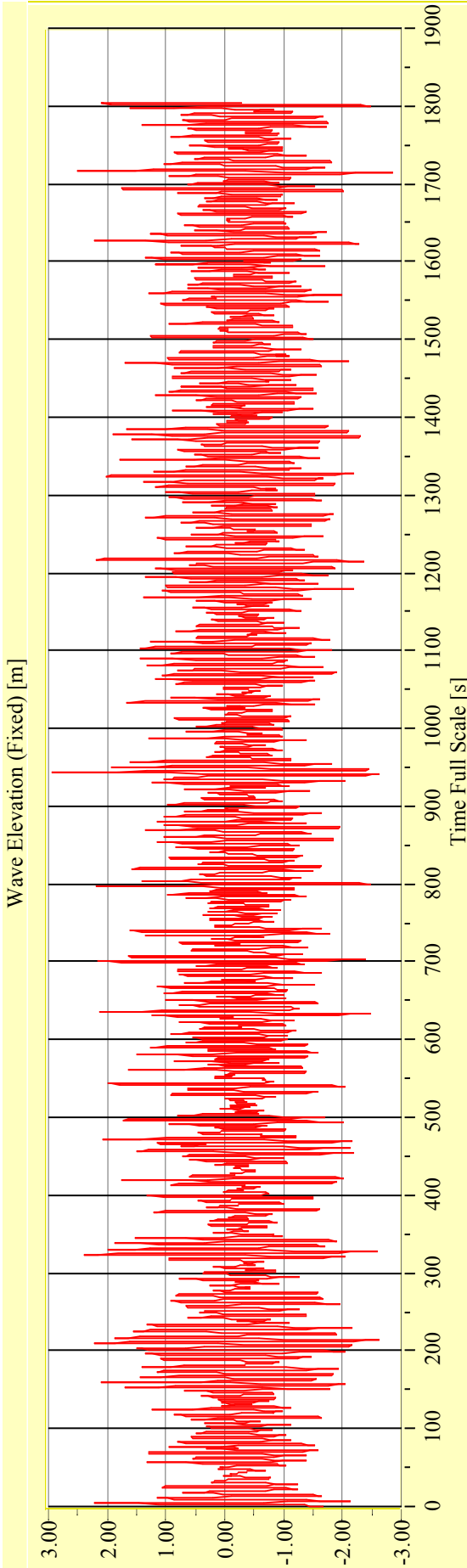
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29682-05**

**Target Waves: Hs = 3,25 m Tp = 7,211 s**

**gamma = 3,3**



**Irregular Beam Seas**

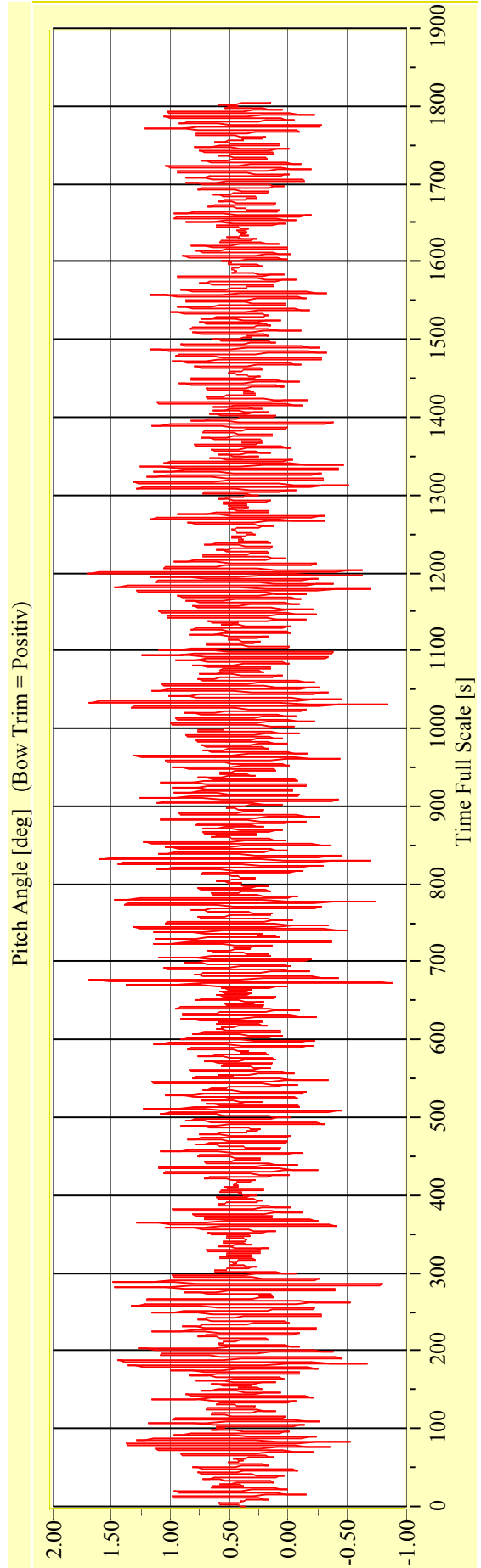
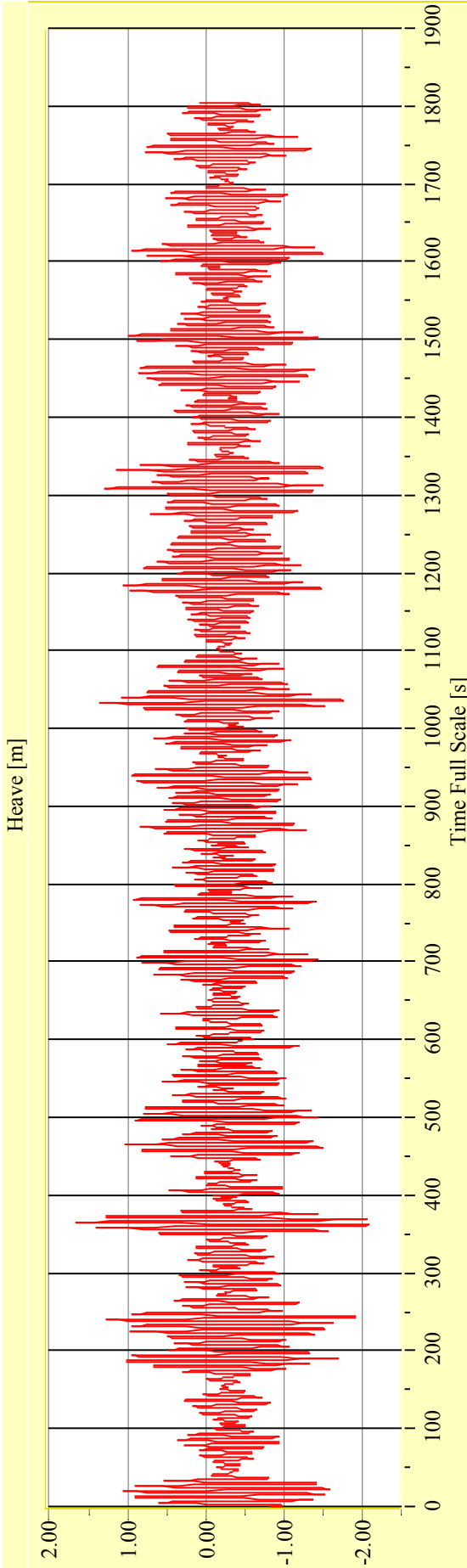
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29682-05**

**Target Waves: Hs = 3,25 m Tp = 7,211 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

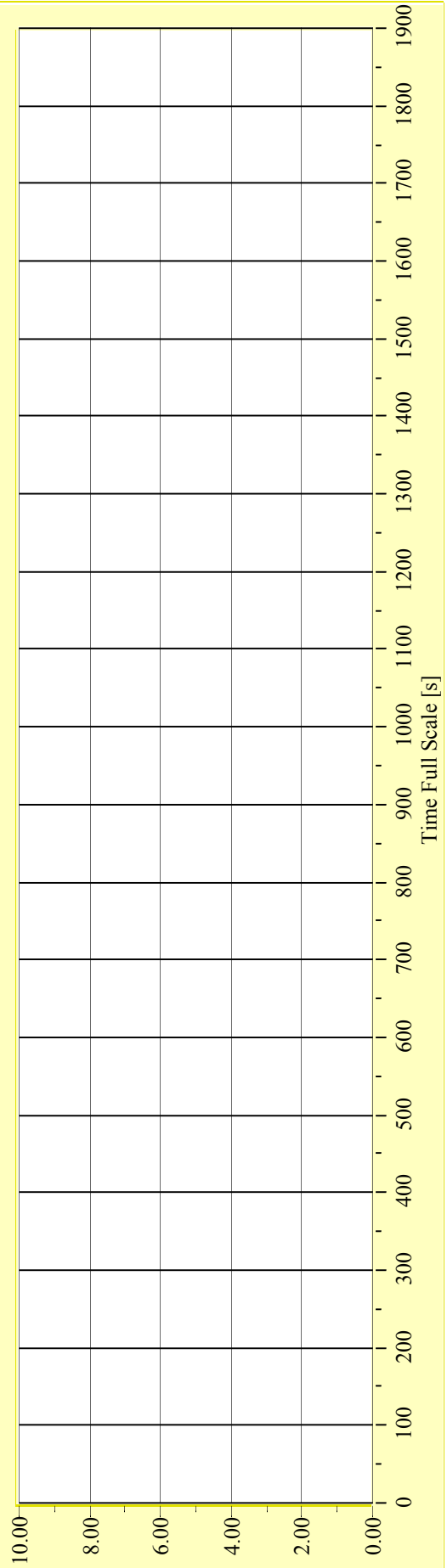
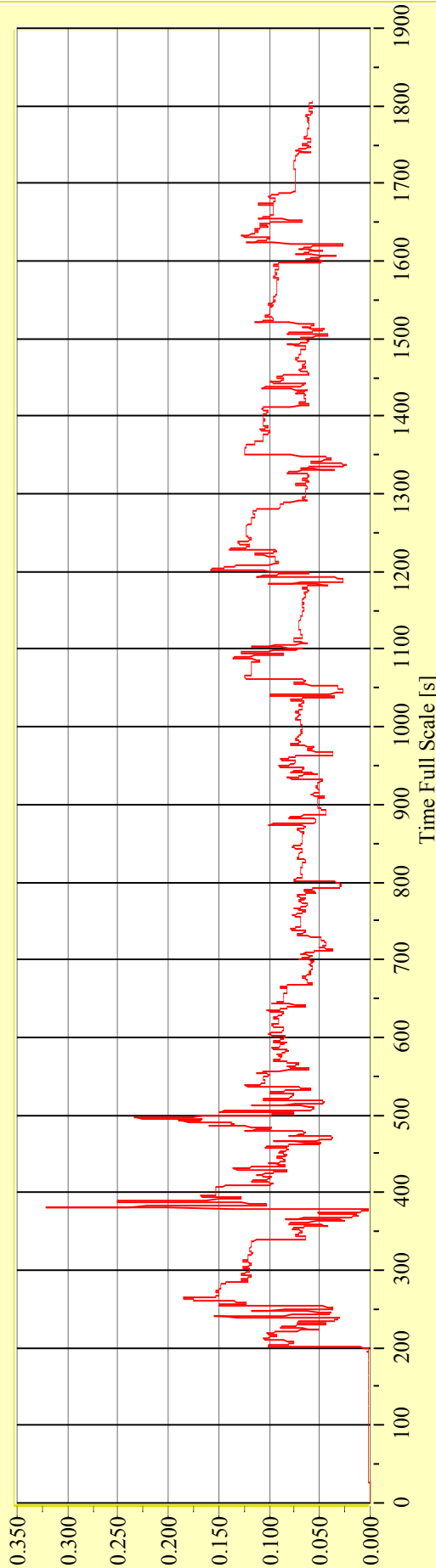
**Model No. 2446**

**Test No. 29682-05**

**Target Waves: Hs = 3,25 m Tp = 7,211 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Date: 12.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**



**Irregular Beam Seas**

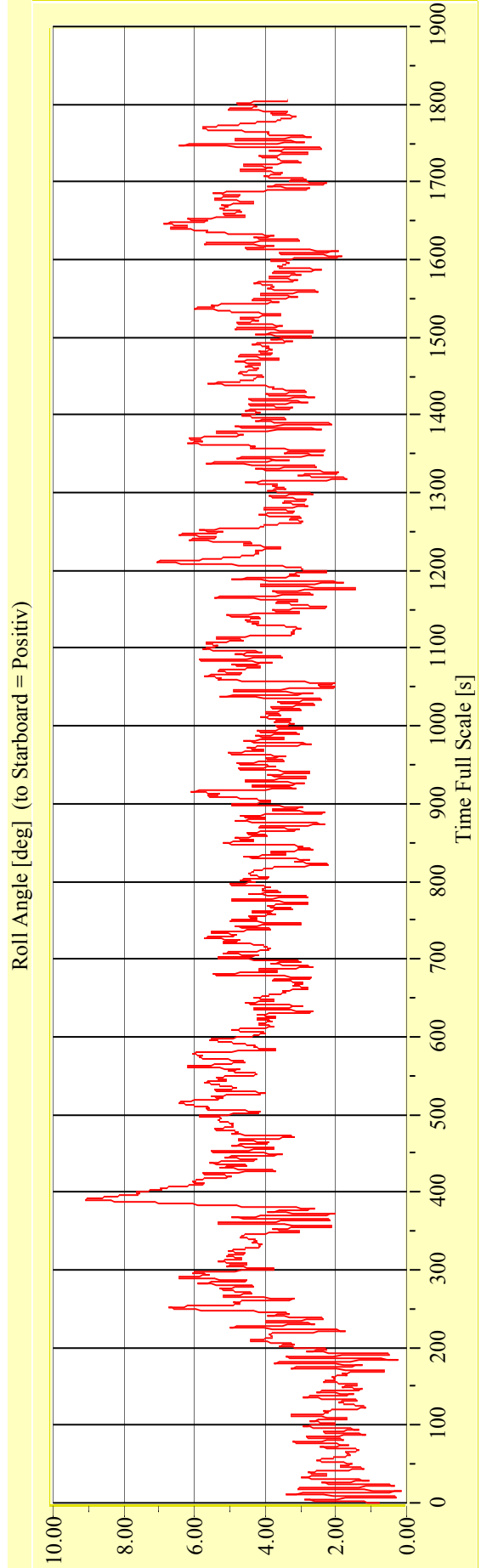
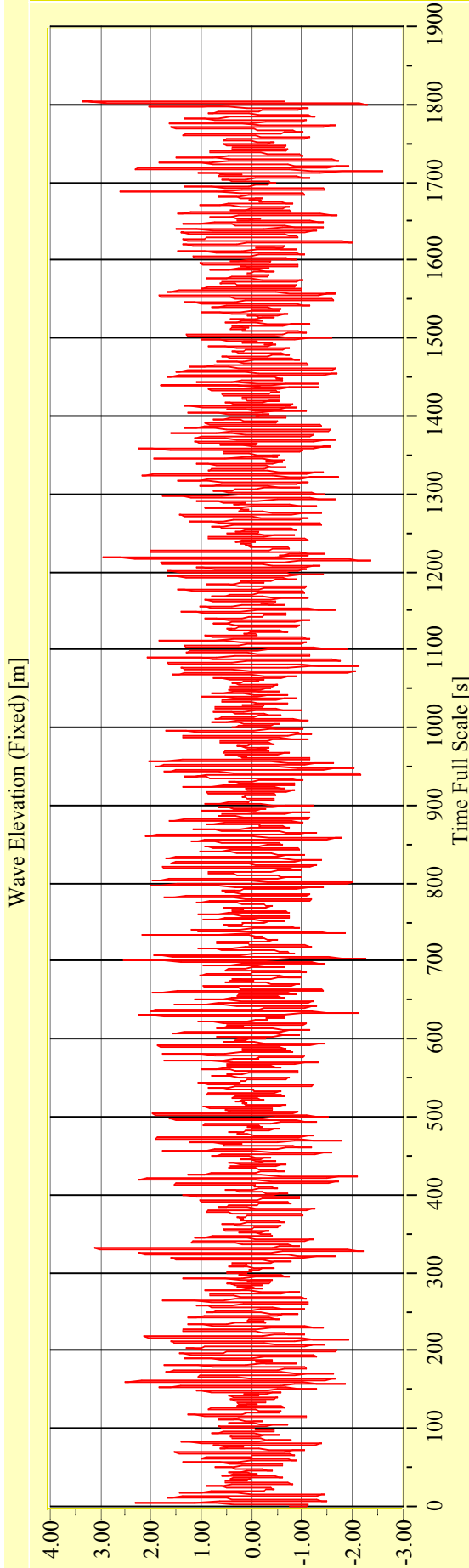
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29682-06**

**Target Waves: Hs = 3,25 m Tp = 7,211 s**

**gamma = 3,3**



**Irregular Beam Seas**

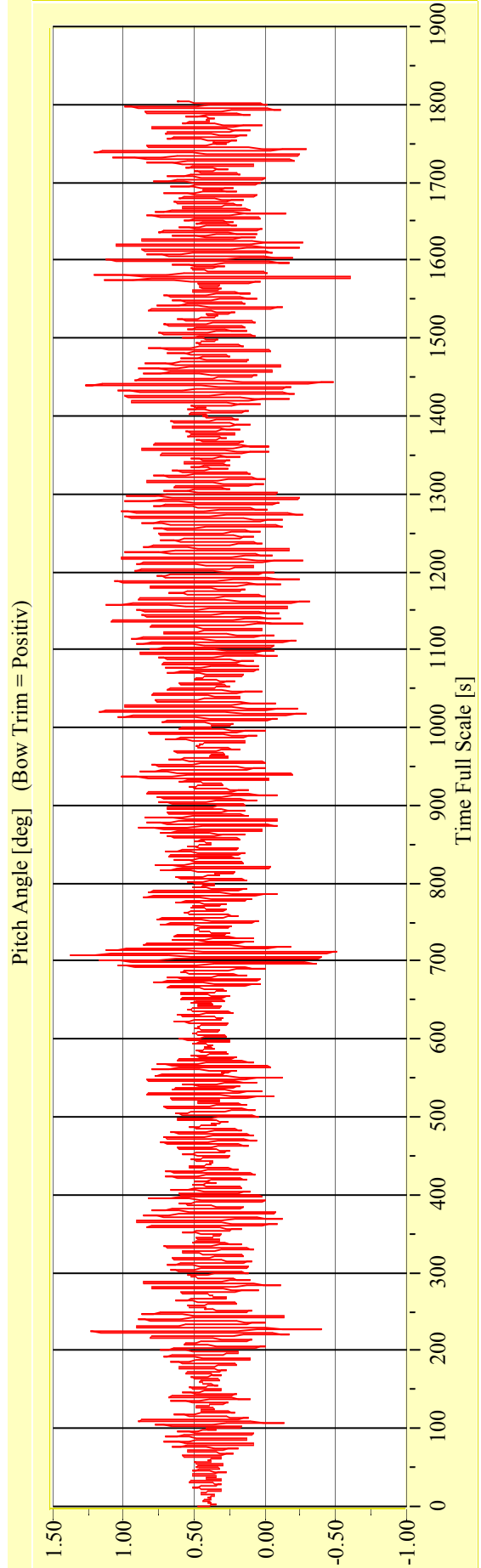
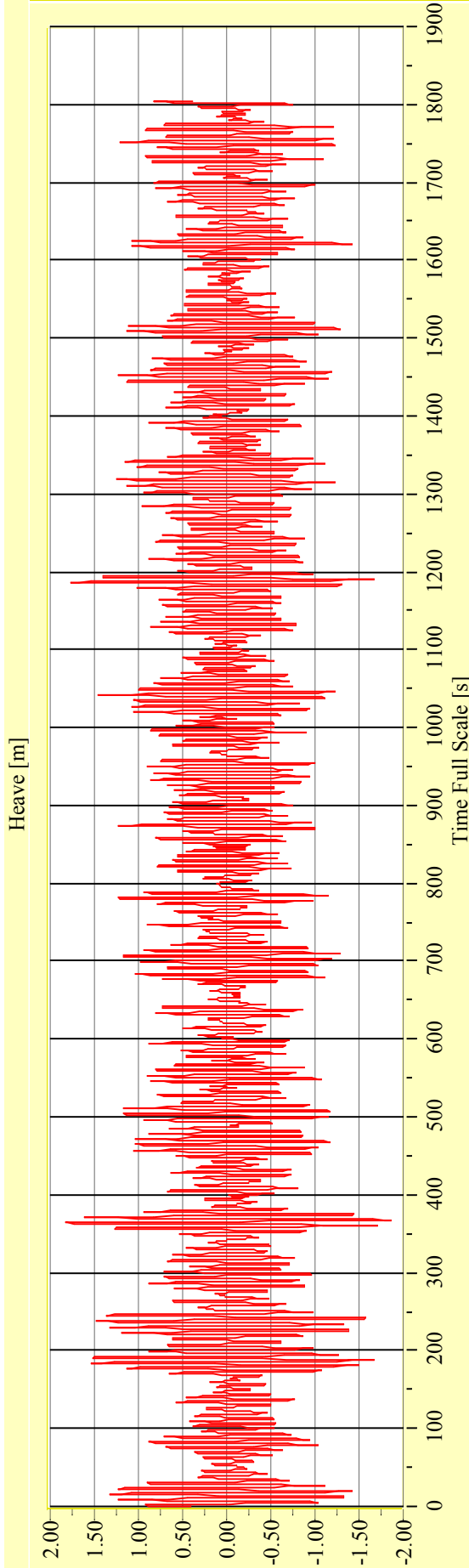
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29682-06**

**Target Waves: Hs = 3,25 m Tp = 7,211 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

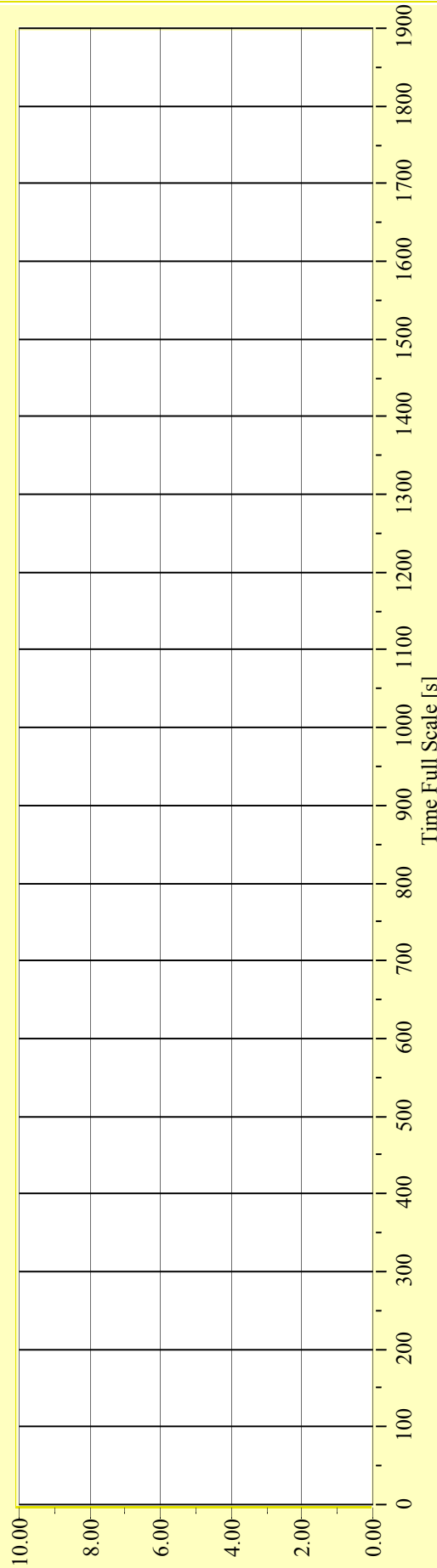
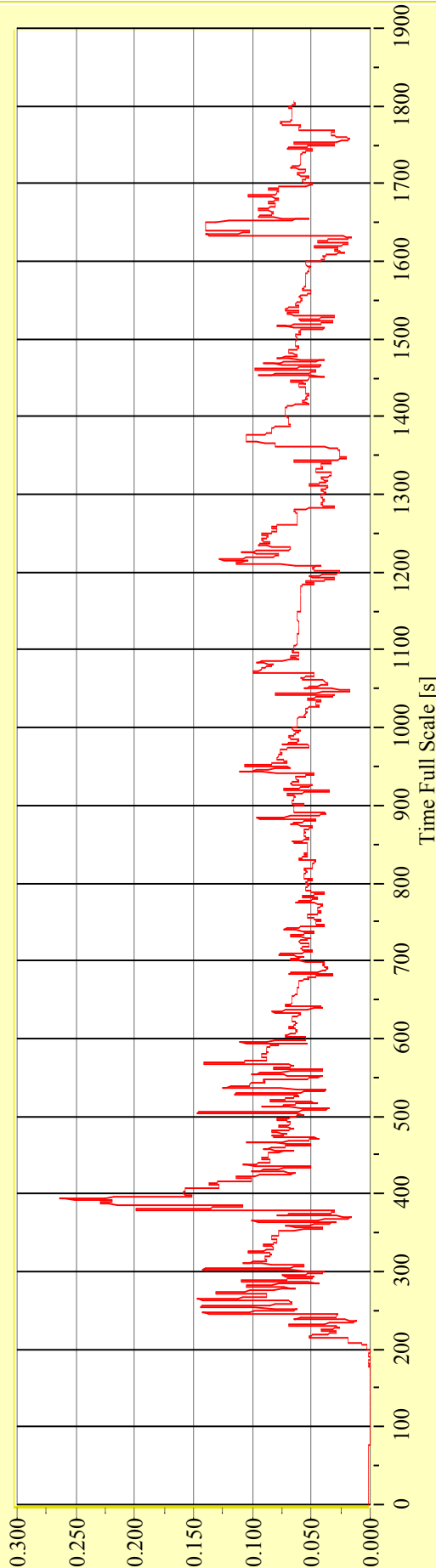
**Model No. 2446**

**Test No. 29682-06**

**Target Waves: Hs = 3,25 m Tp = 7,211 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Date: 14.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

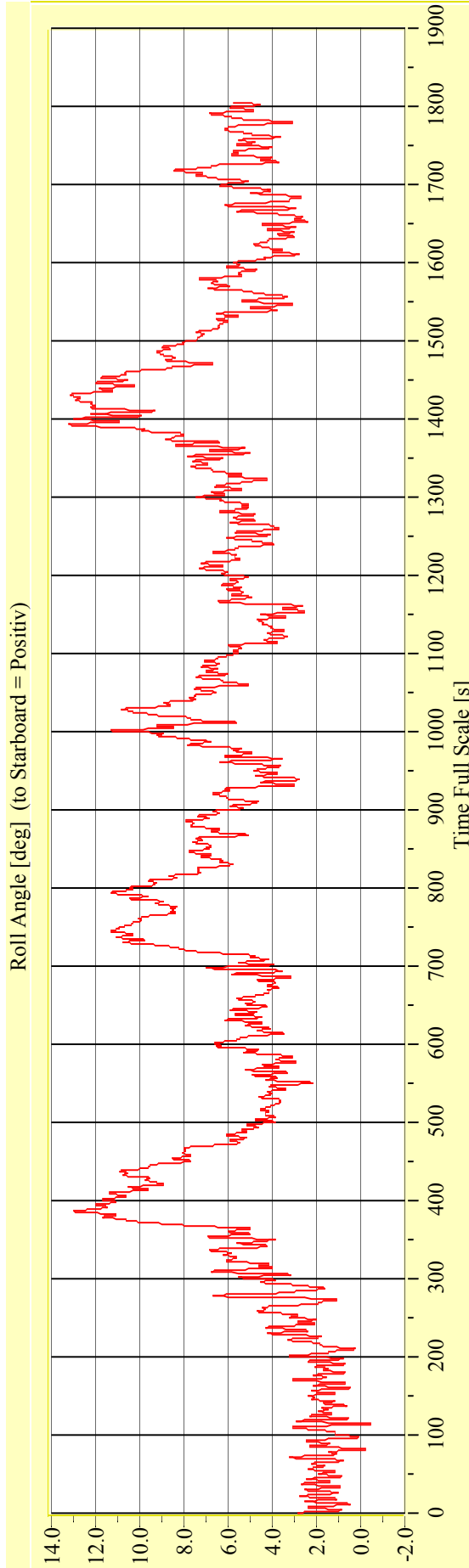
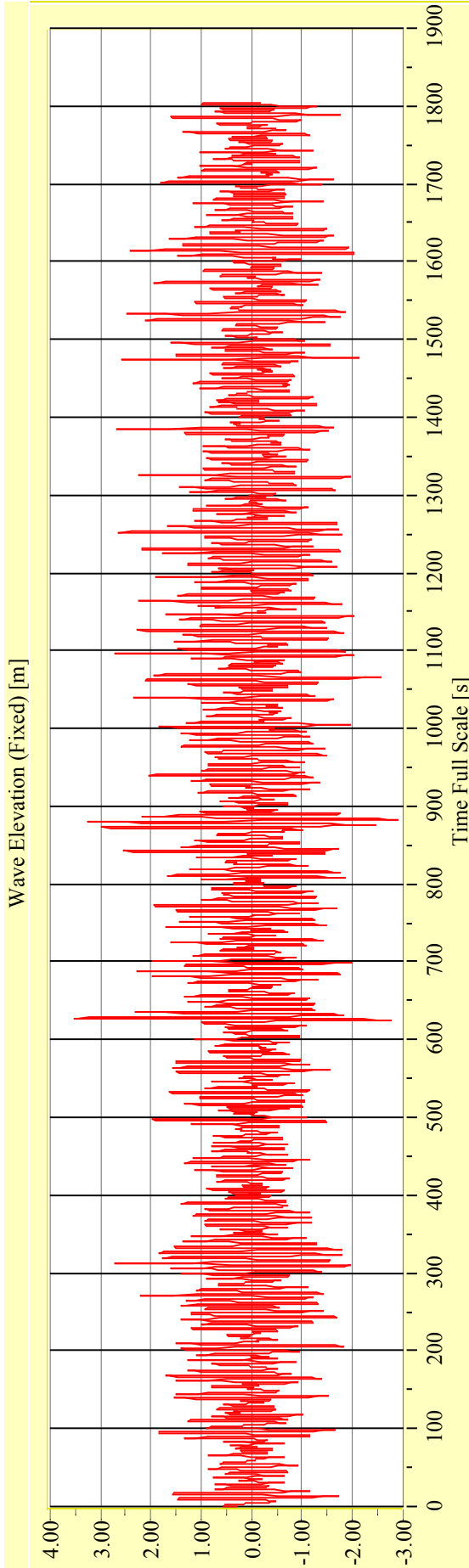
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29682-07**

**Target Waves: Hs = 3,25 m Tp = 7,211 s**

**gamma = 3,3**



**Date: 14.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

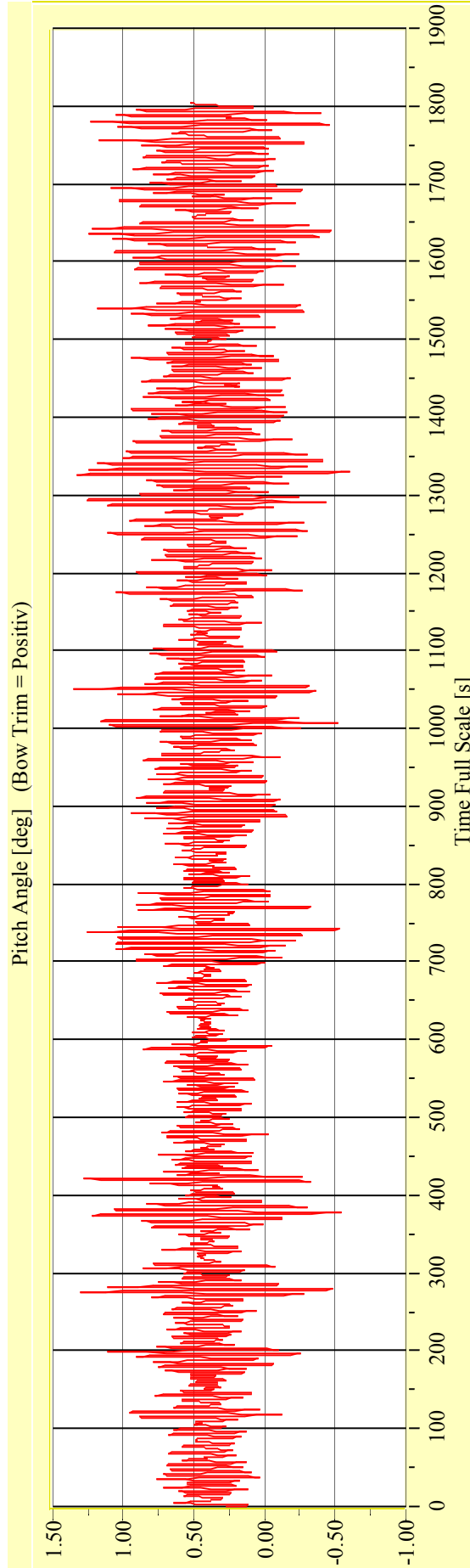
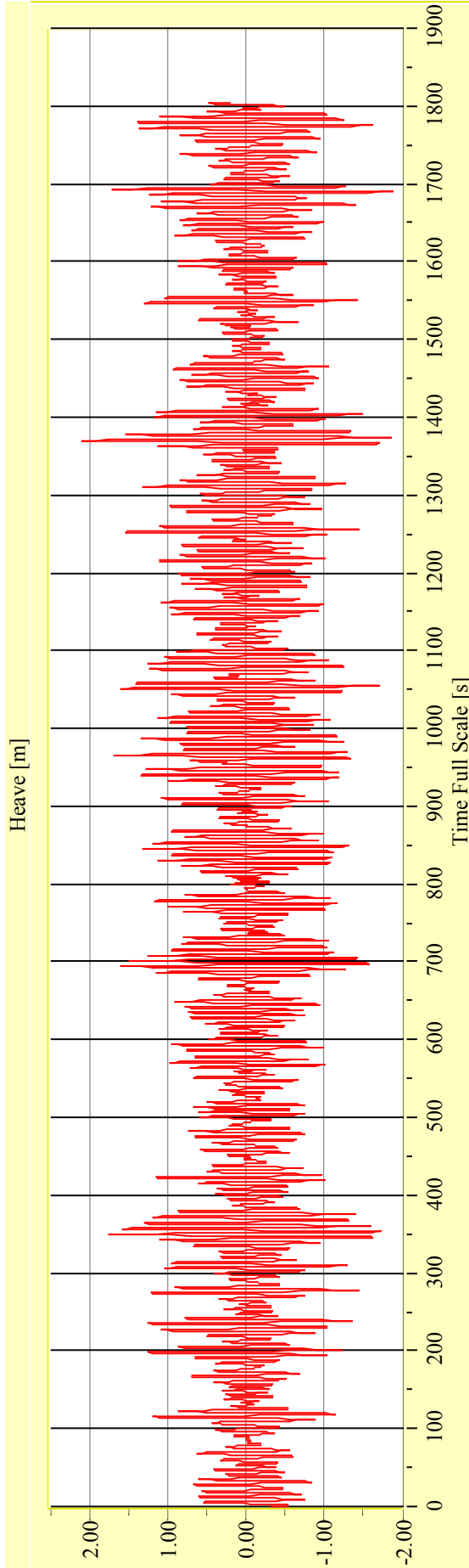
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29682-07**

**Target Waves: Hs = 3,25 m Tp = 7,211 s**

**gamma = 3,3**



**Date: 14.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**

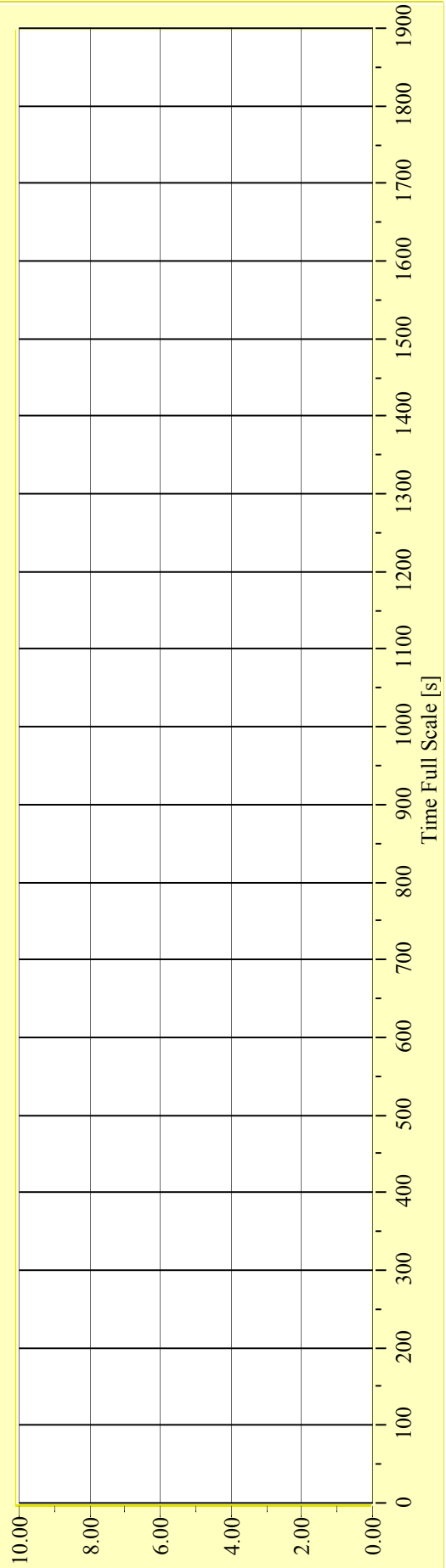
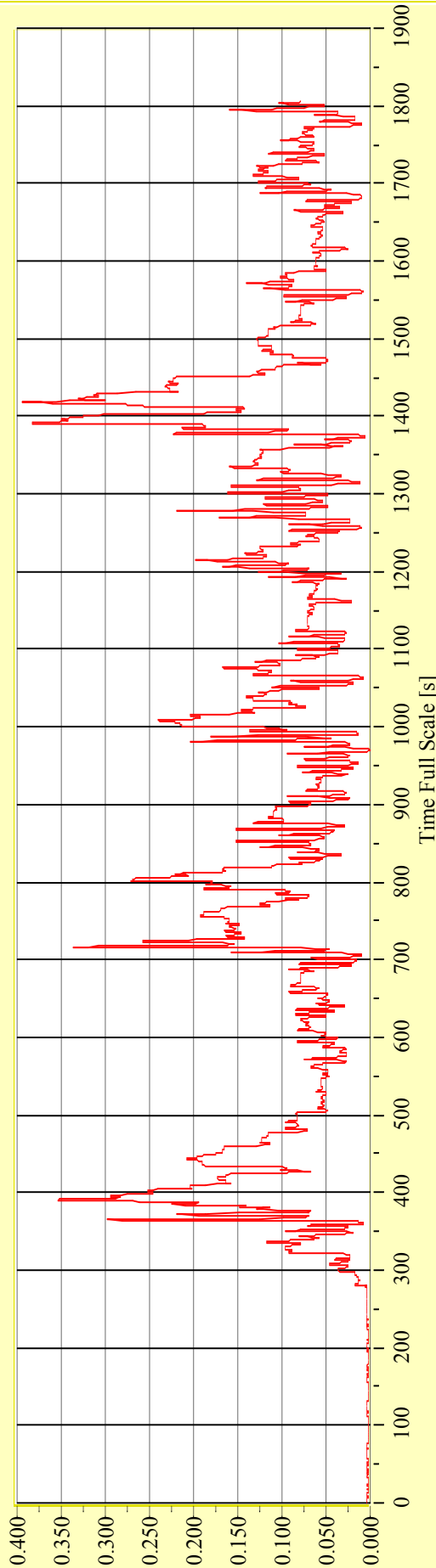
**Model No. 2446**

**Test No. 29682-07**

**Target Waves: Hs = 3,25 m Tp = 7,211 s**

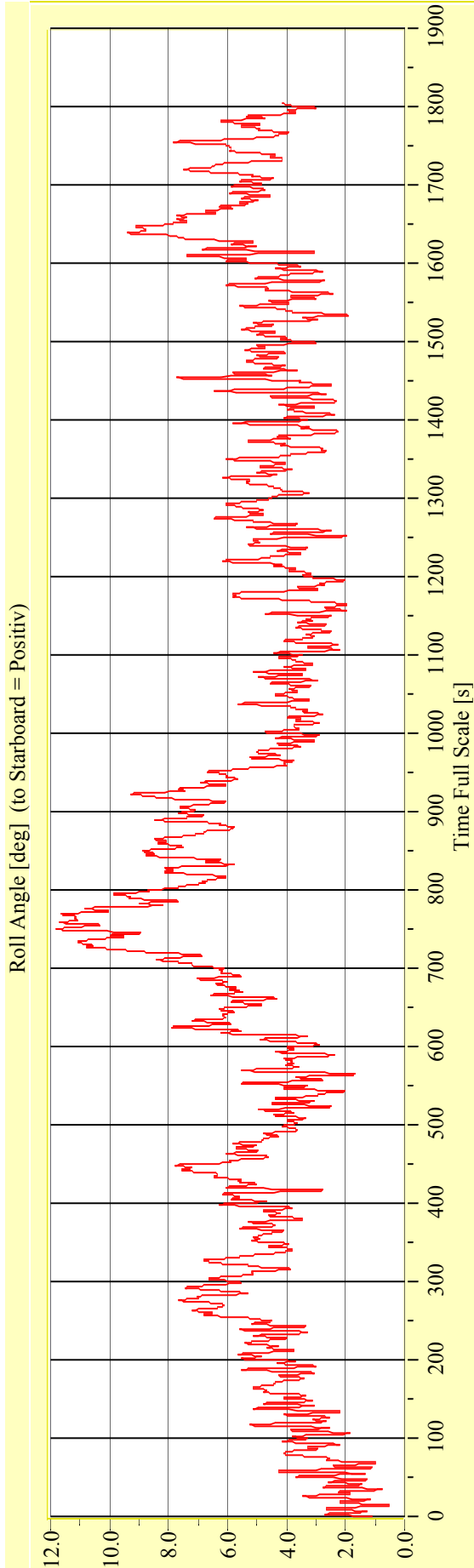
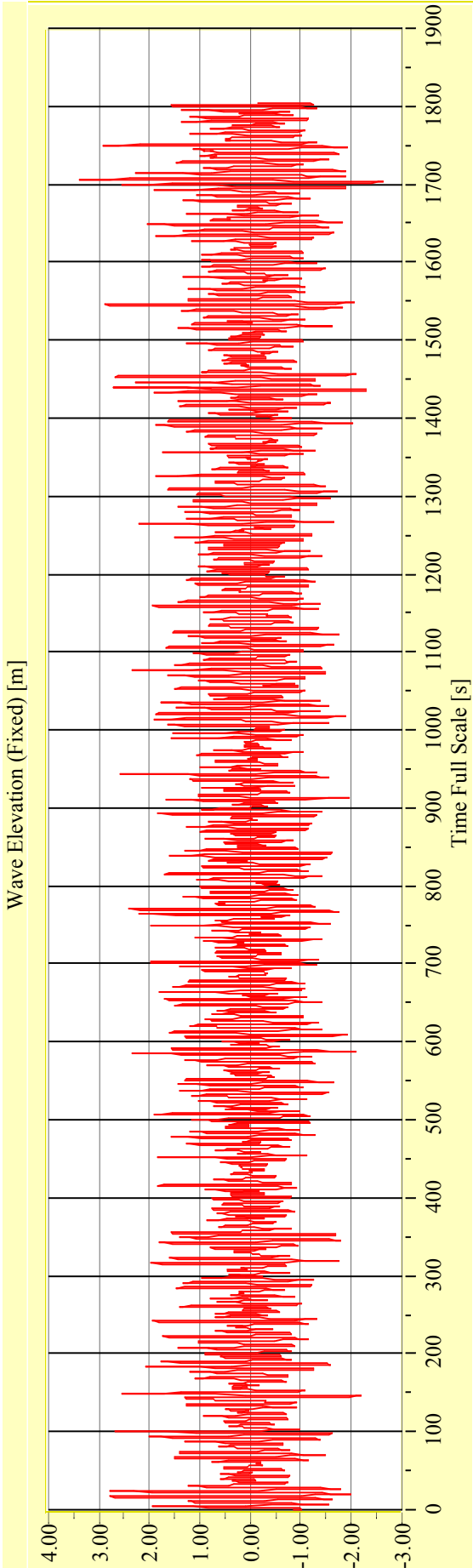
**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29682-08**      **Target Waves: Hs = 3,25 m Tp = 7,211 s**      **gamma = 3,3**



**Date: 14.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

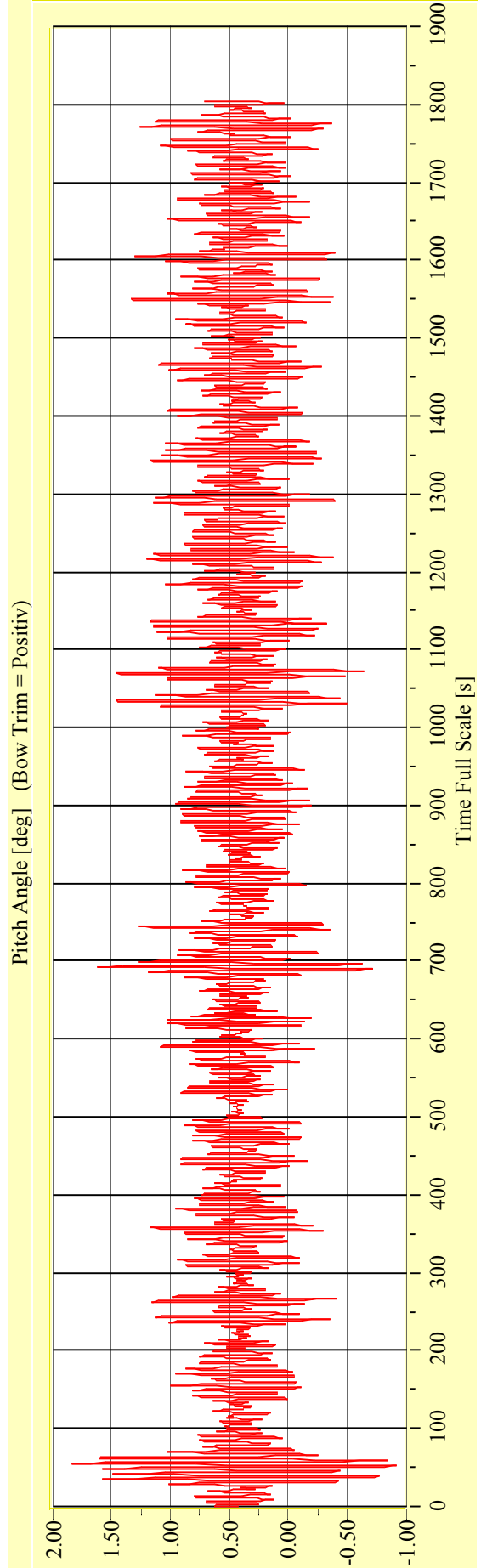
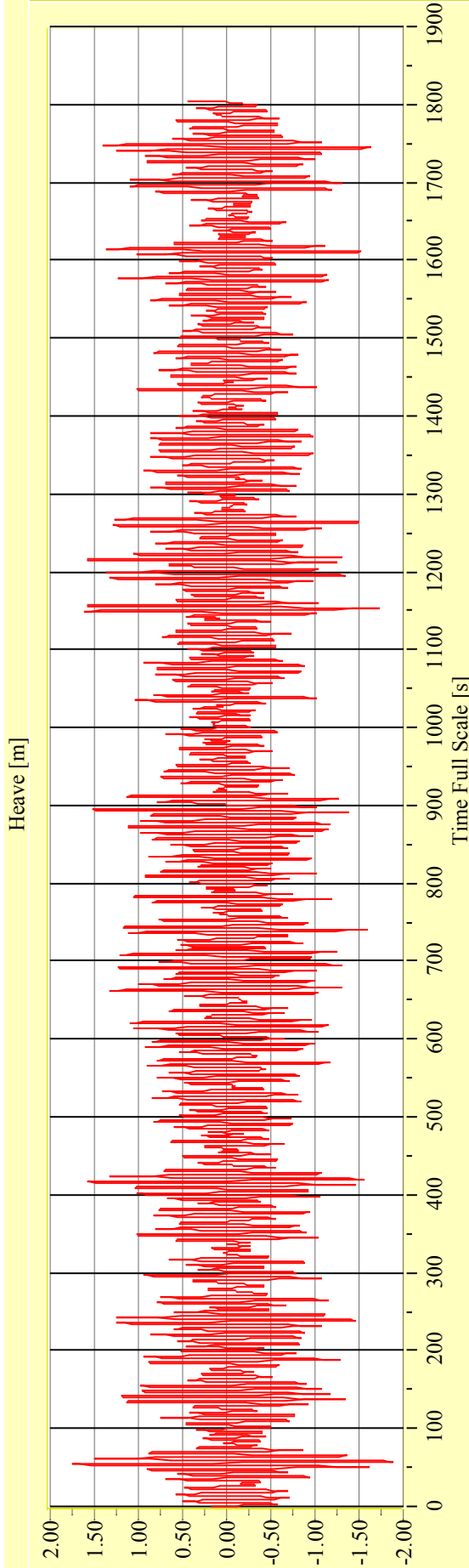
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29682-08**

**Target Waves: Hs = 3,25 m Tp = 7,211 s**

**gamma = 3,3**





**Irregular Beam Seas**

**Vienna Model Basin**

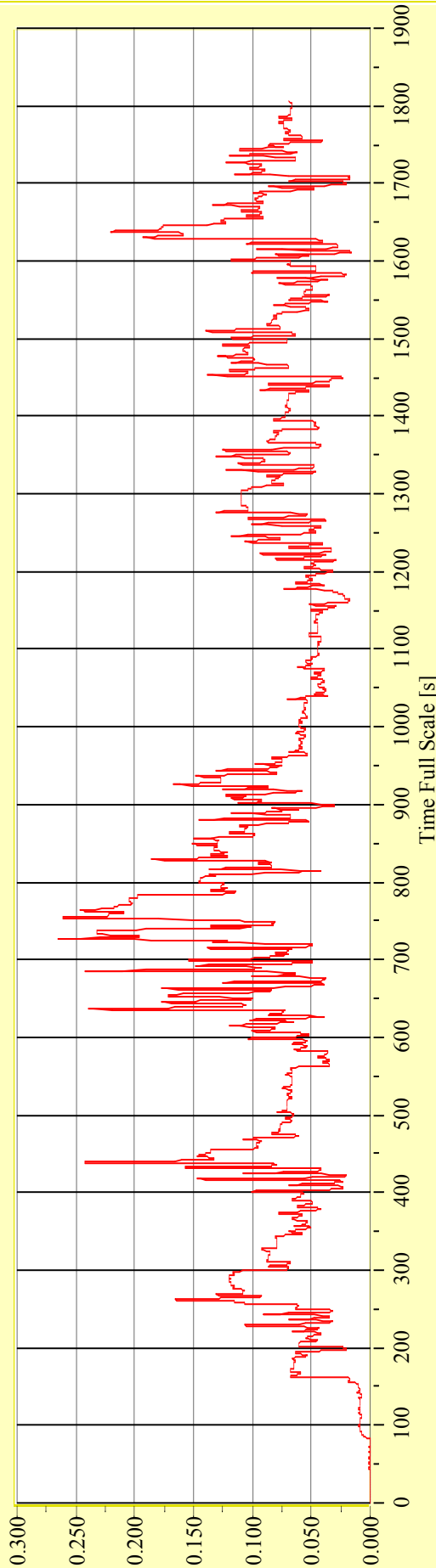
**Model No. 2446**

**Test No. 29682-08**

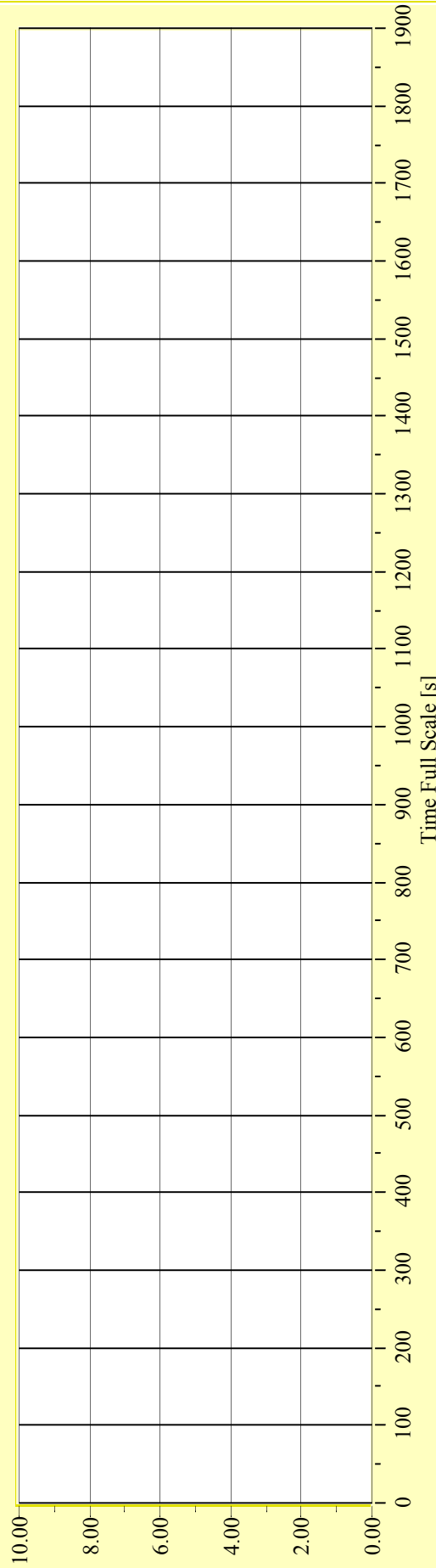
**Target Waves: Hs = 3,25 m Tp = 7,211 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



Time Full Scale [s]



Time Full Scale [s]

**Date: 14.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

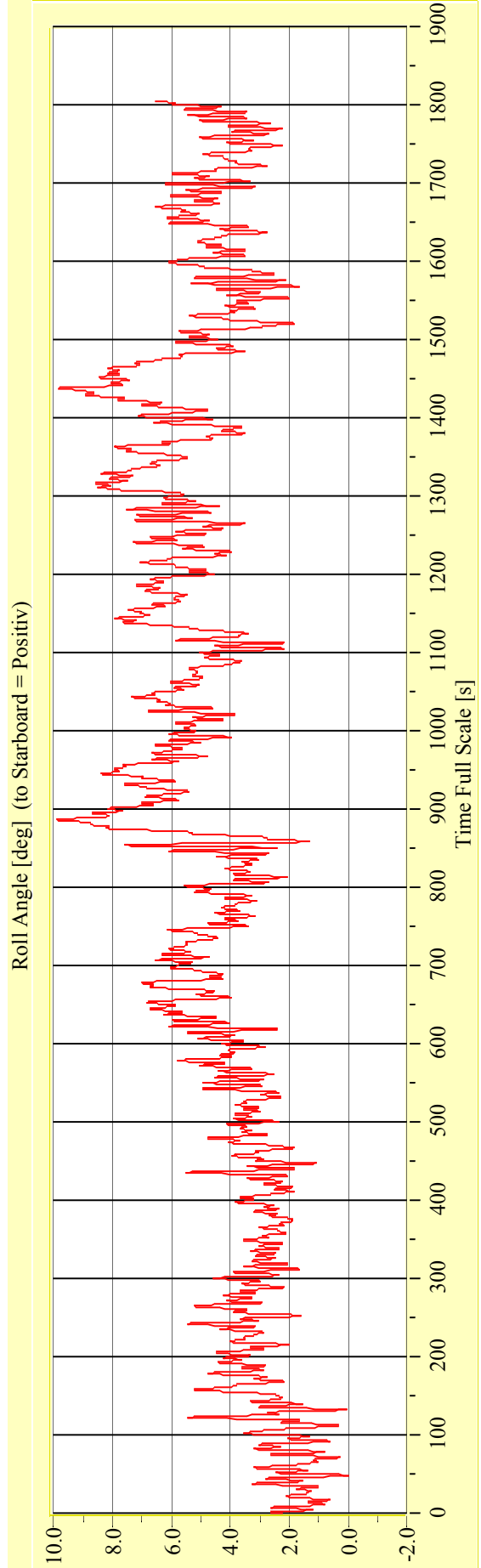
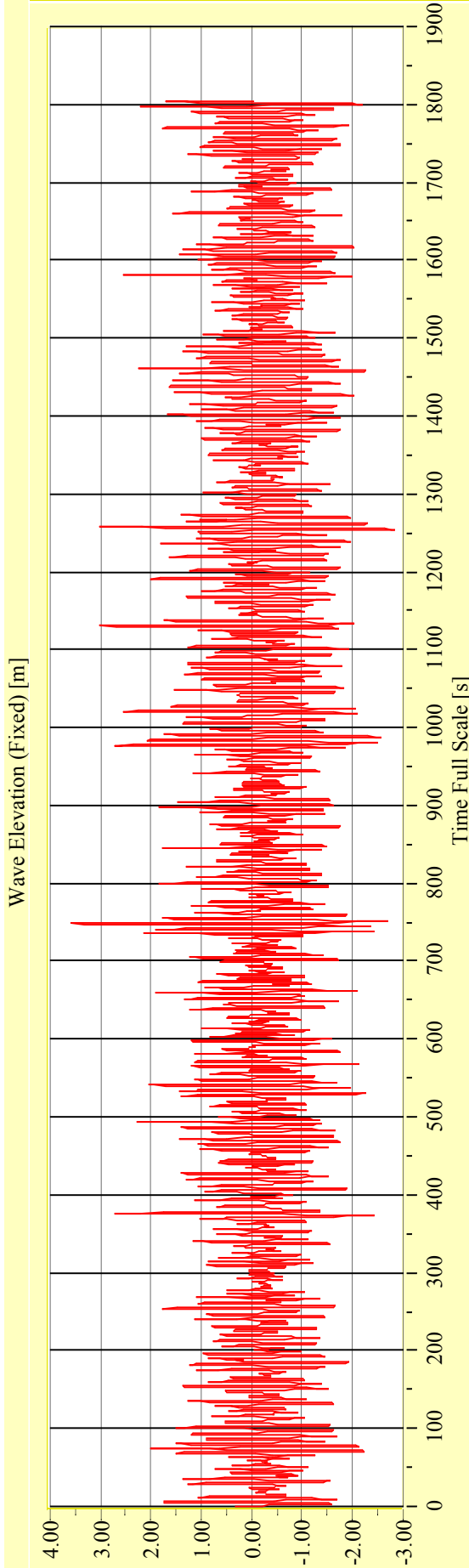
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29682-09**

**Target Waves: Hs = 3,25 m Tp = 7,211 s**

**gamma = 3,3**



**Irregular Beam Seas**

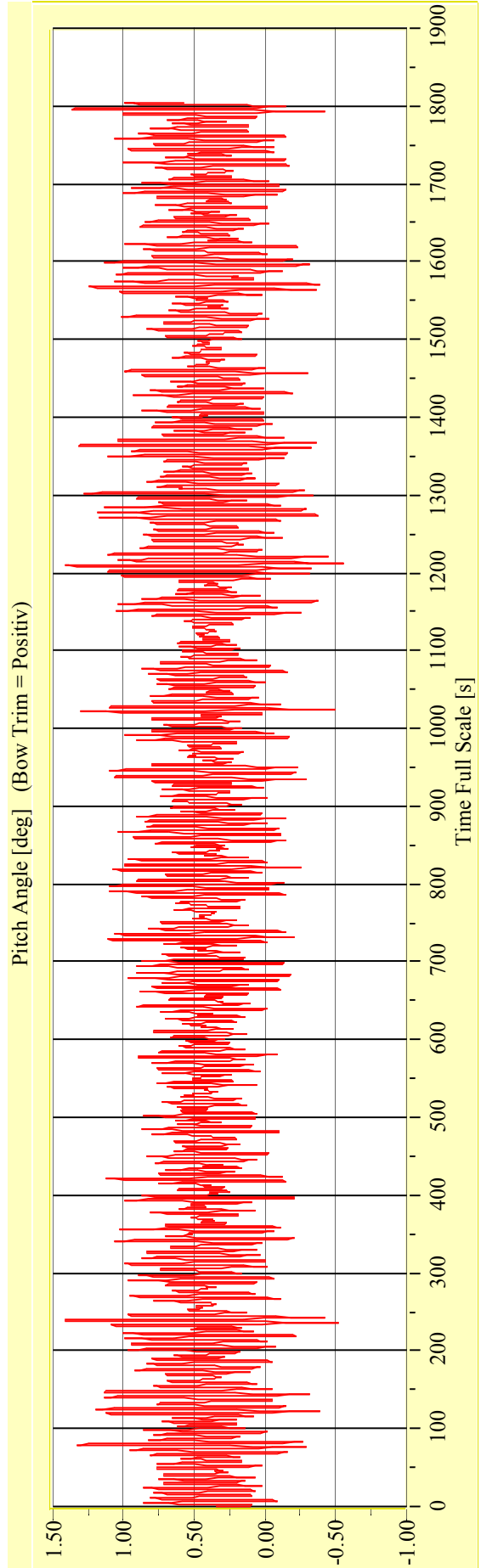
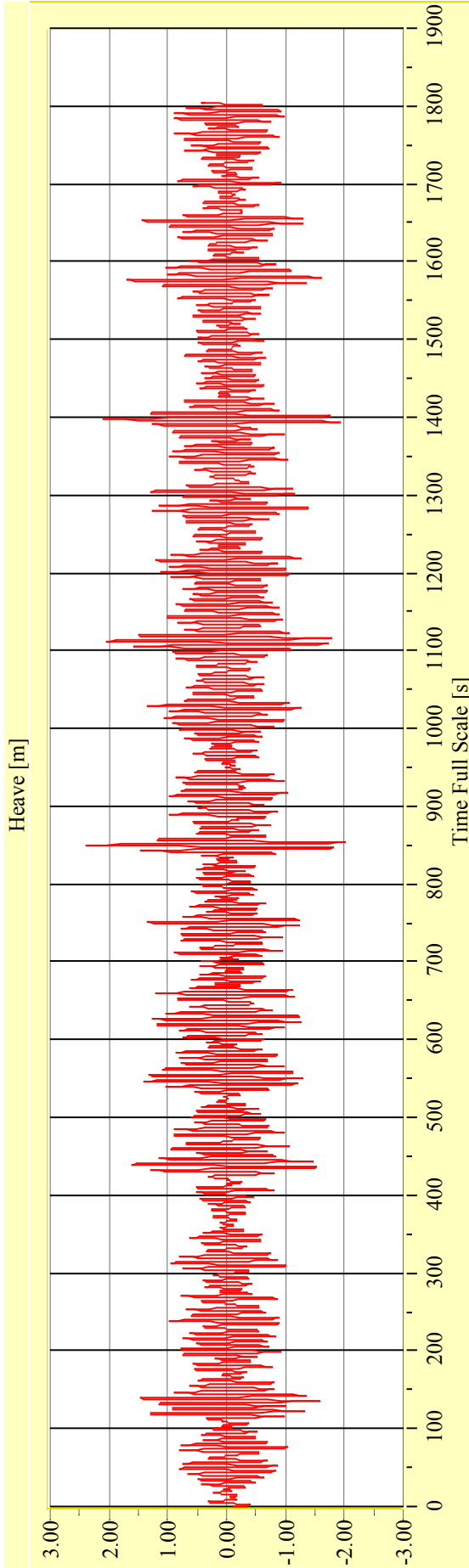
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29682-09**

**Target Waves: Hs = 3,25 m Tp = 7,211 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

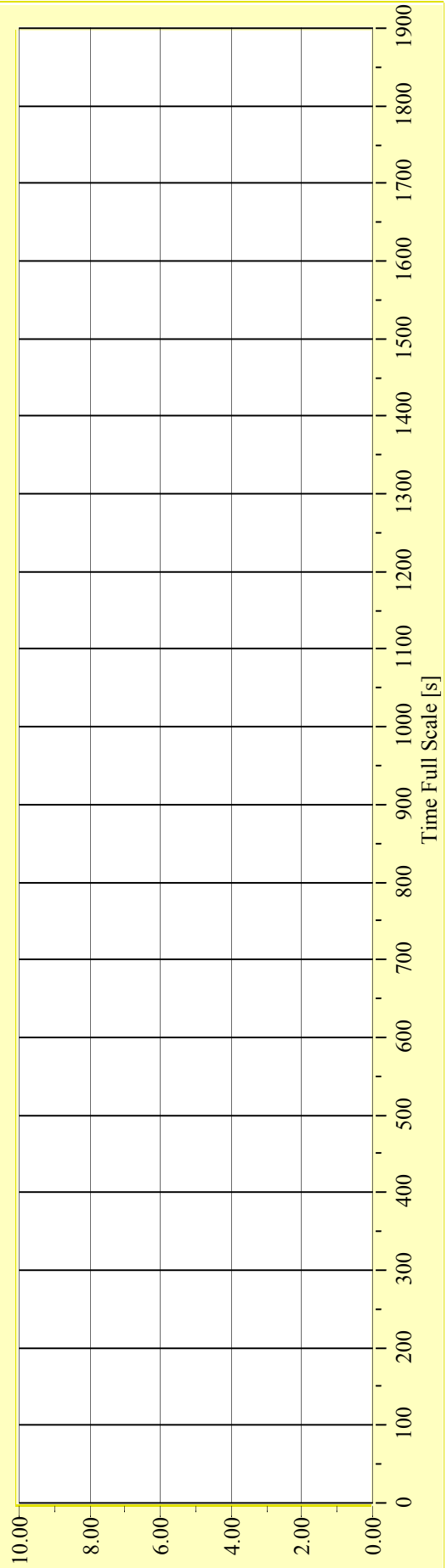
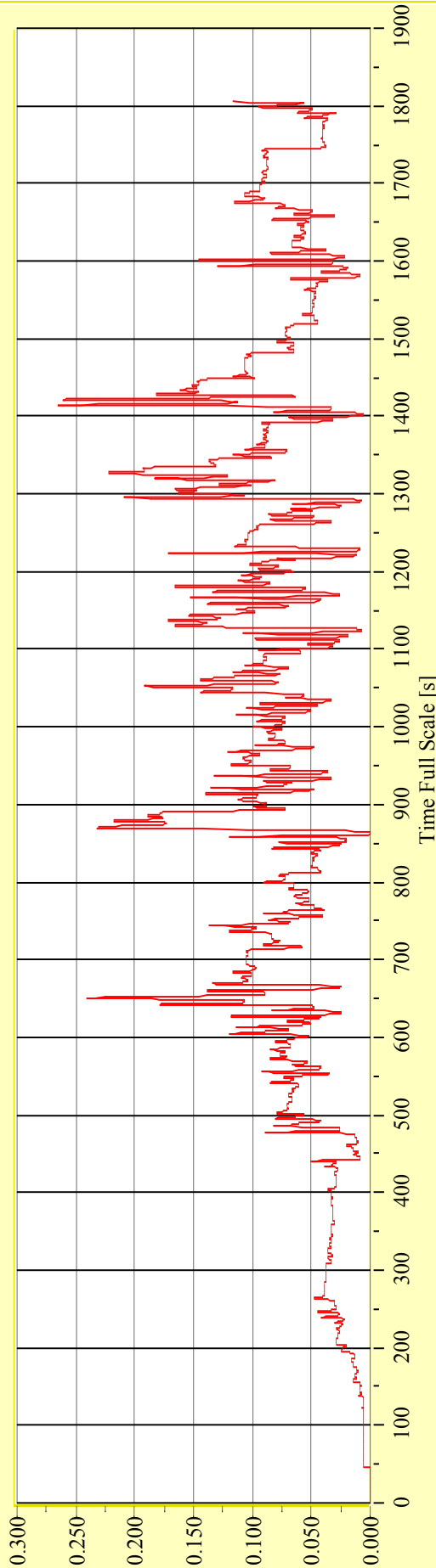
**Model No. 2446**

**Test No. 29682-09**

**Target Waves: Hs = 3,25 m Tp = 7,211 s**

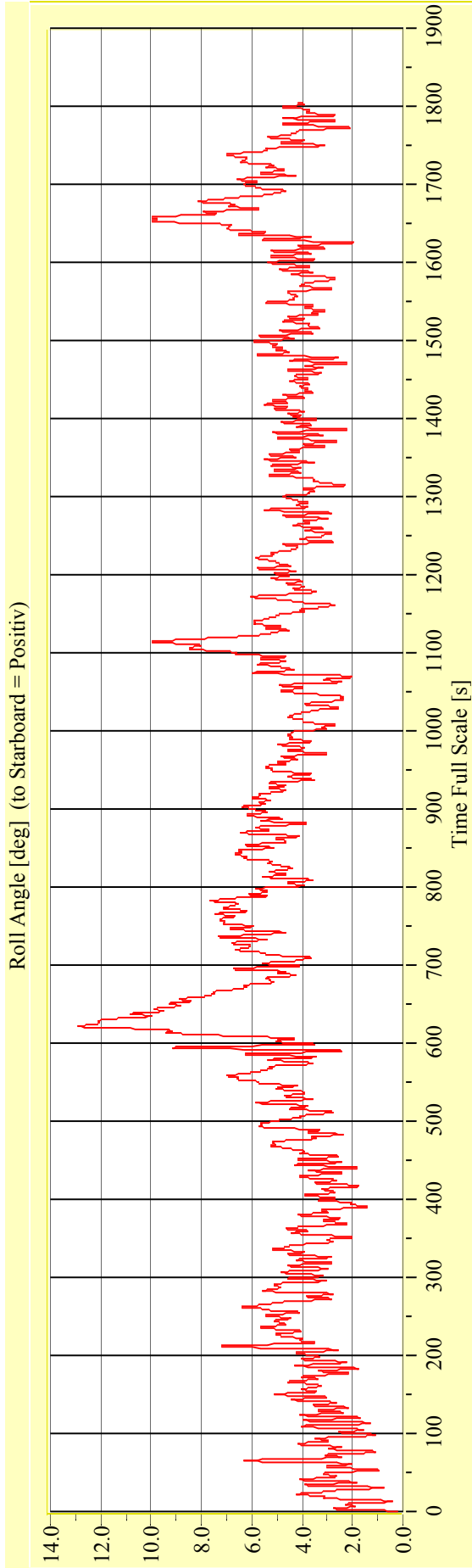
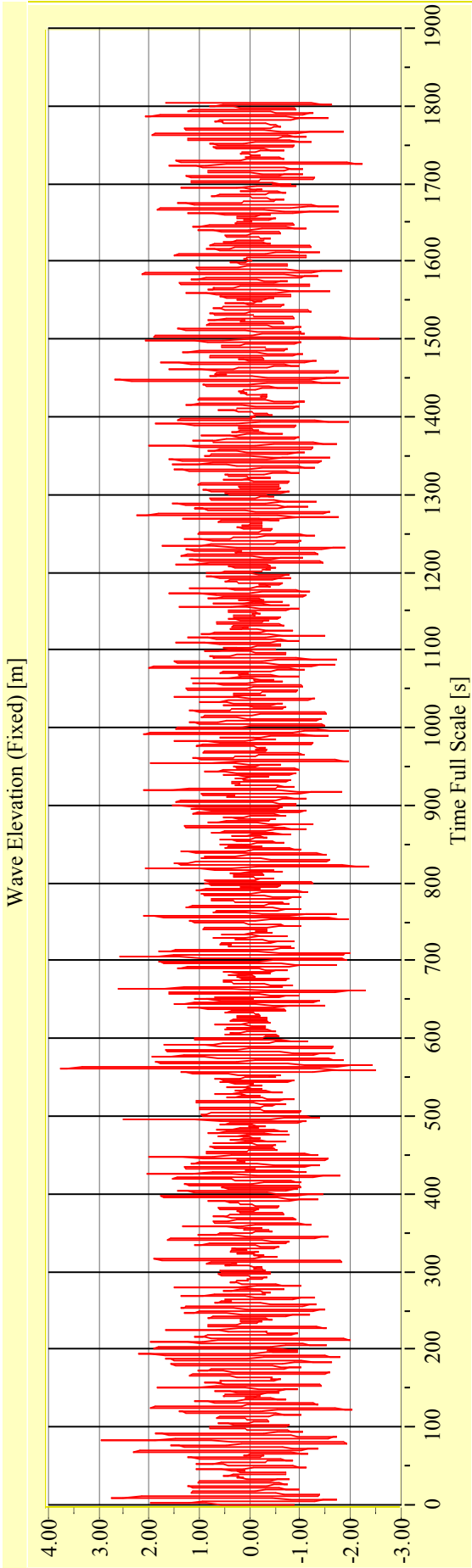
**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29682-10**      **Target Waves: Hs = 3,25 m Tp = 7,211 s**      **gamma = 3,3**



**Date: 14.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

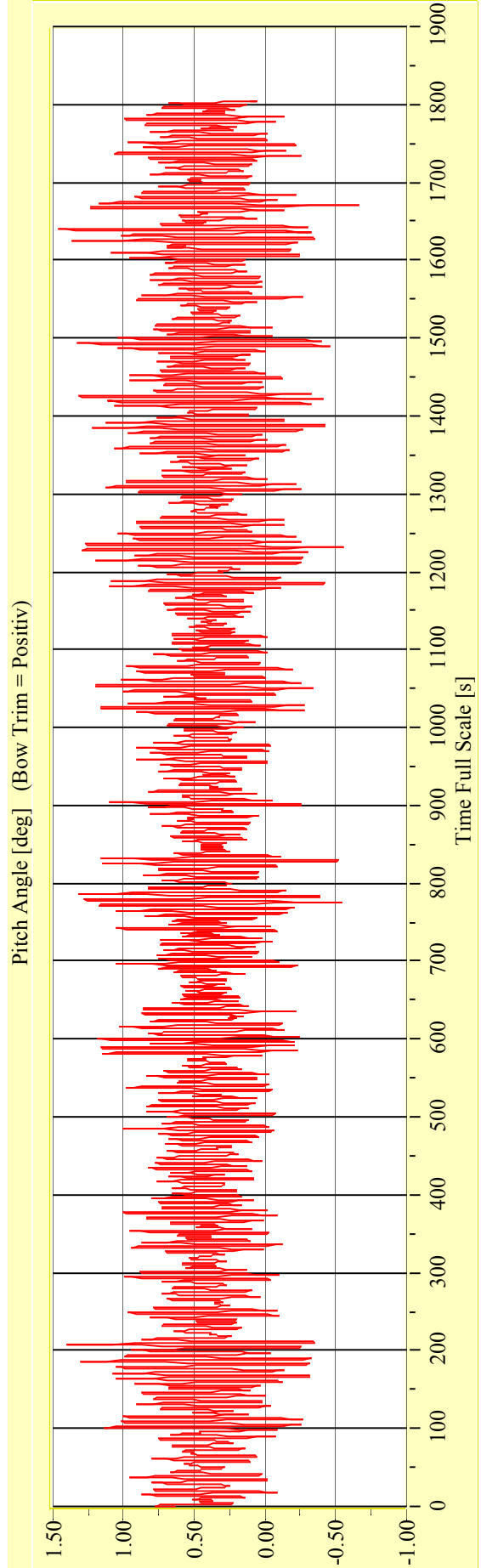
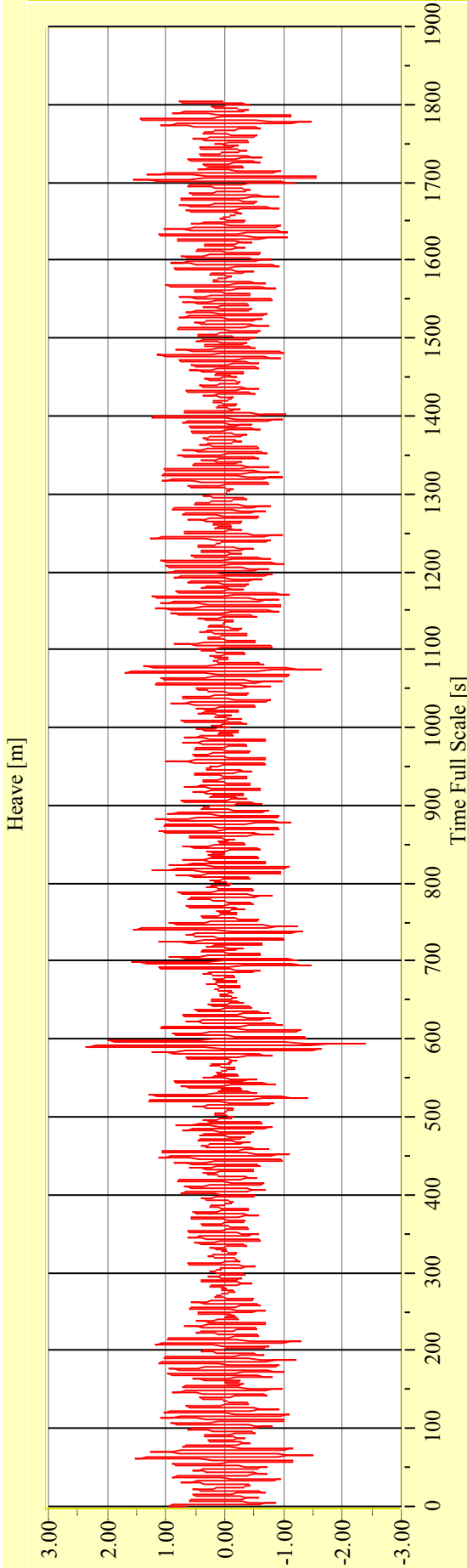
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29682-10**

**Target Waves: Hs = 3,25 m Tp = 7,211 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

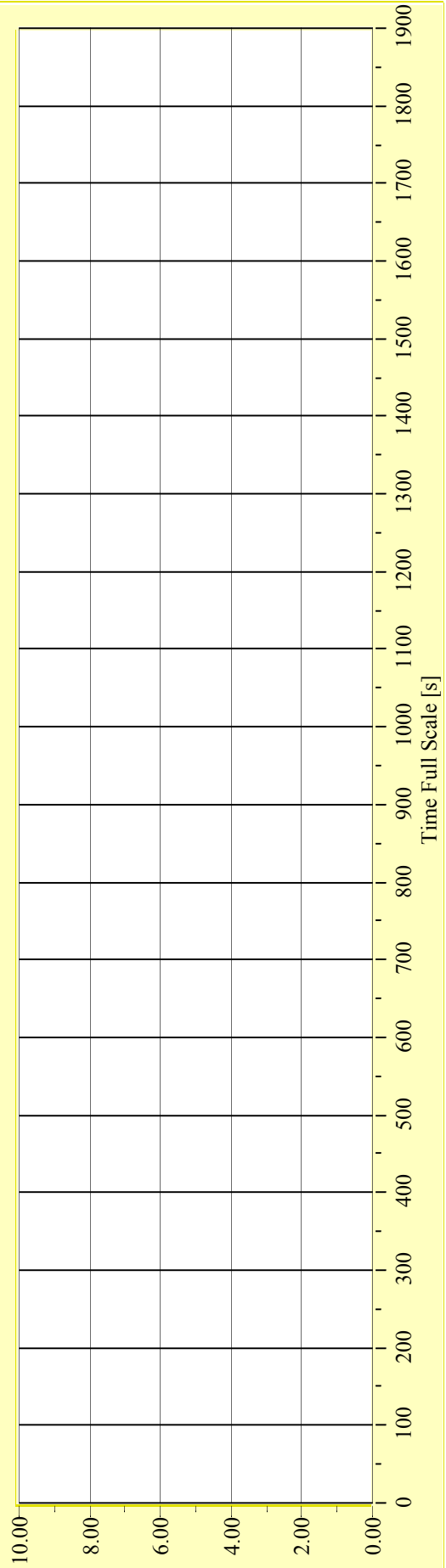
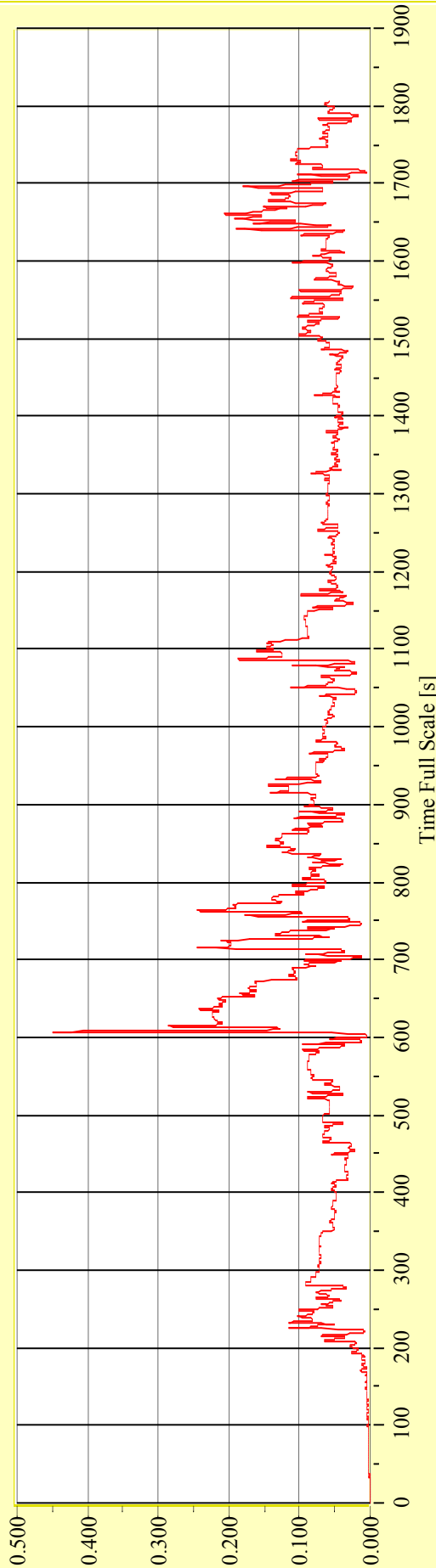
**Model No. 2446**

**Test No. 29682-10**

**Target Waves: Hs = 3,25 m Tp = 7,211 s**

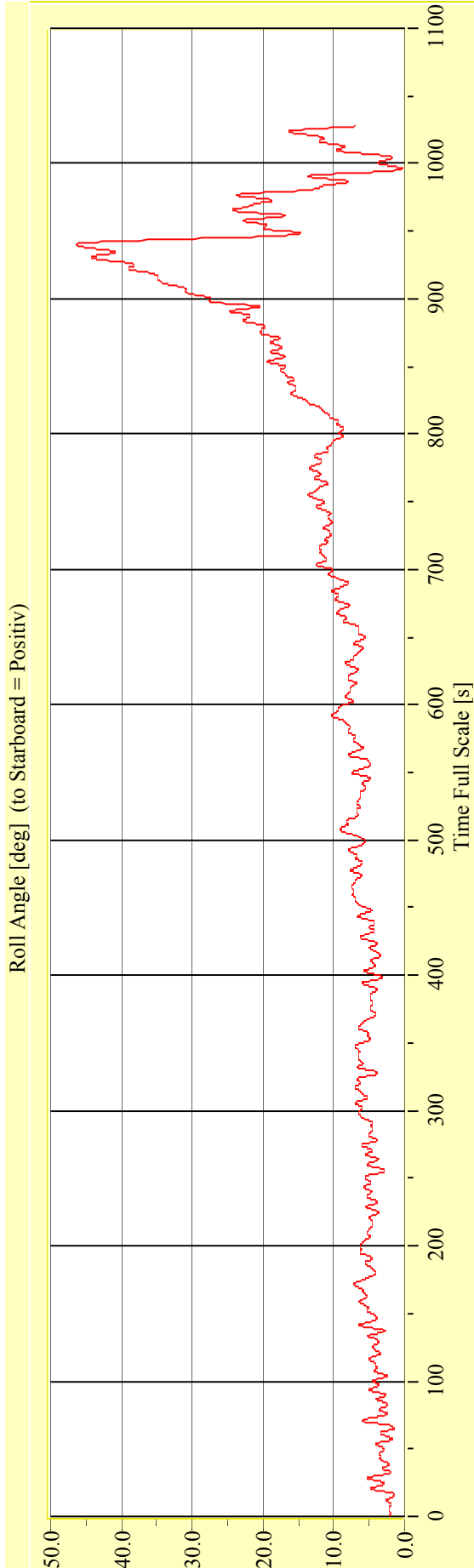
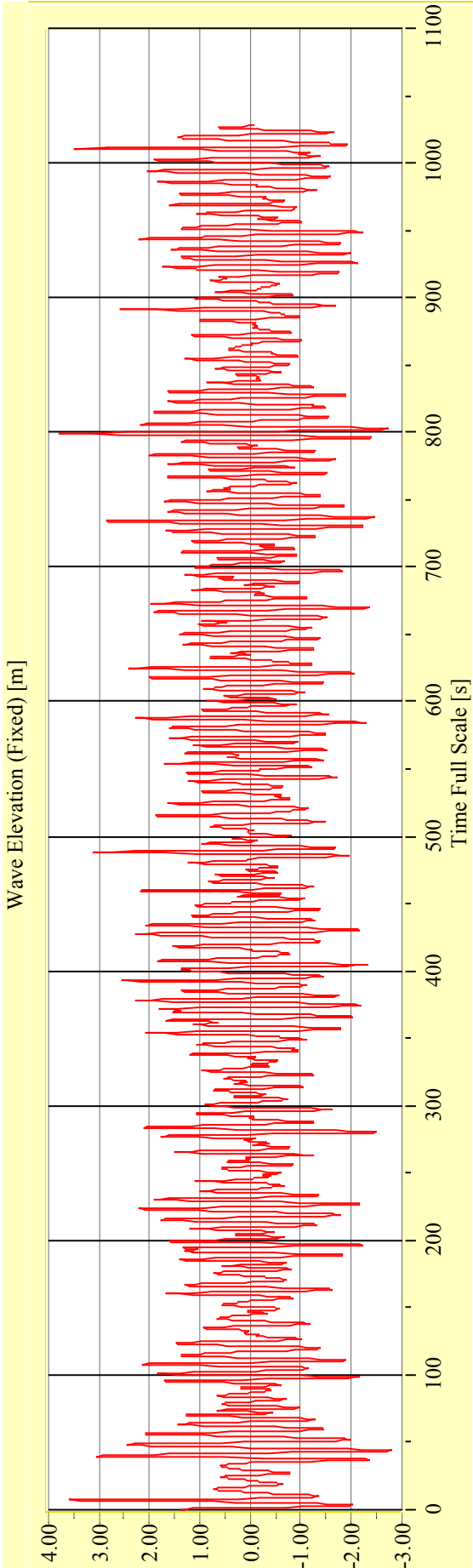
**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29683-01**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**

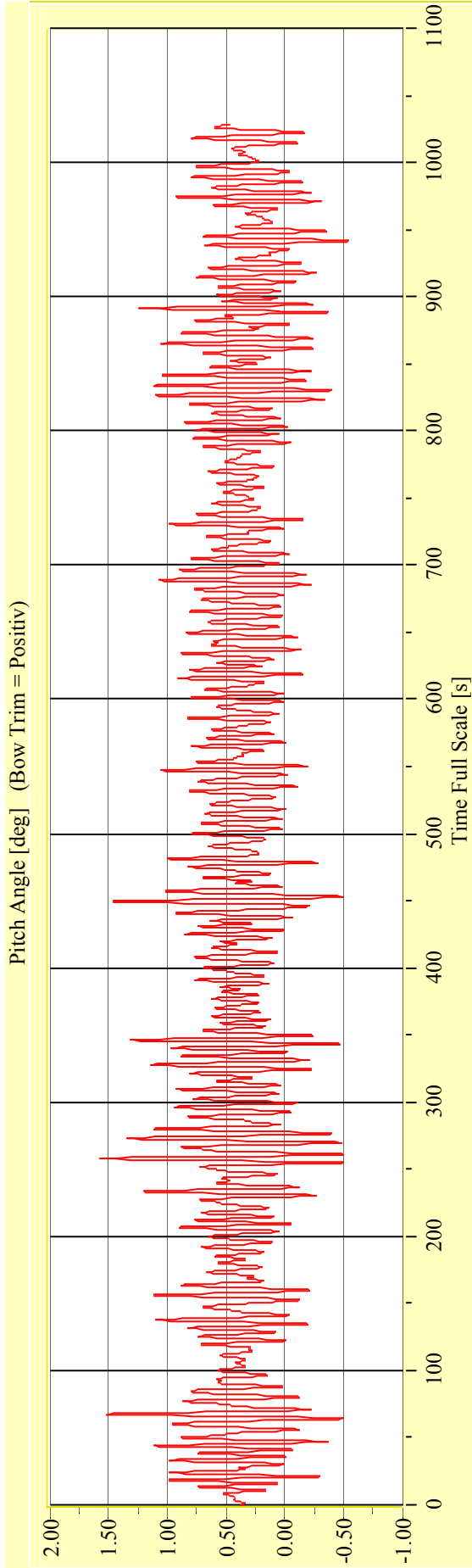
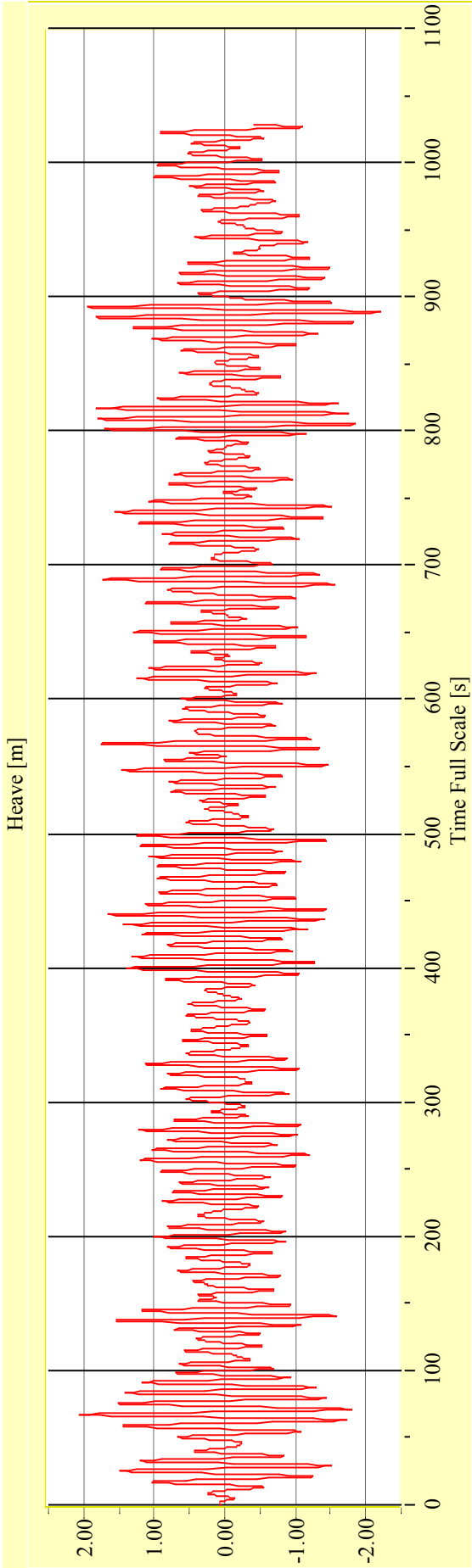


**Date: 14.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29683-01**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**



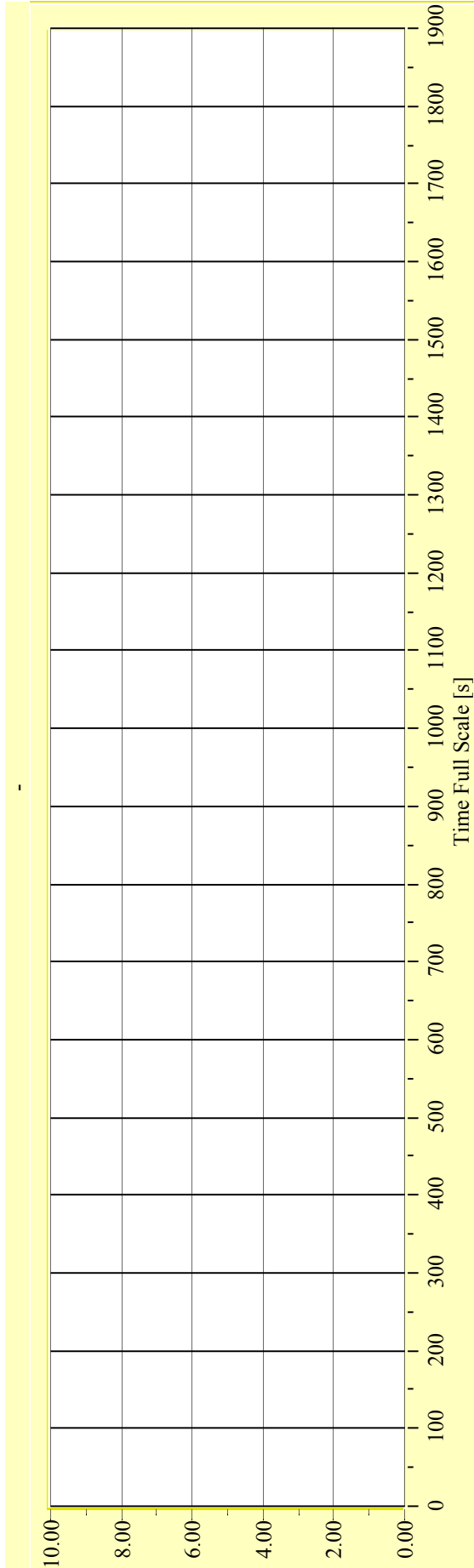
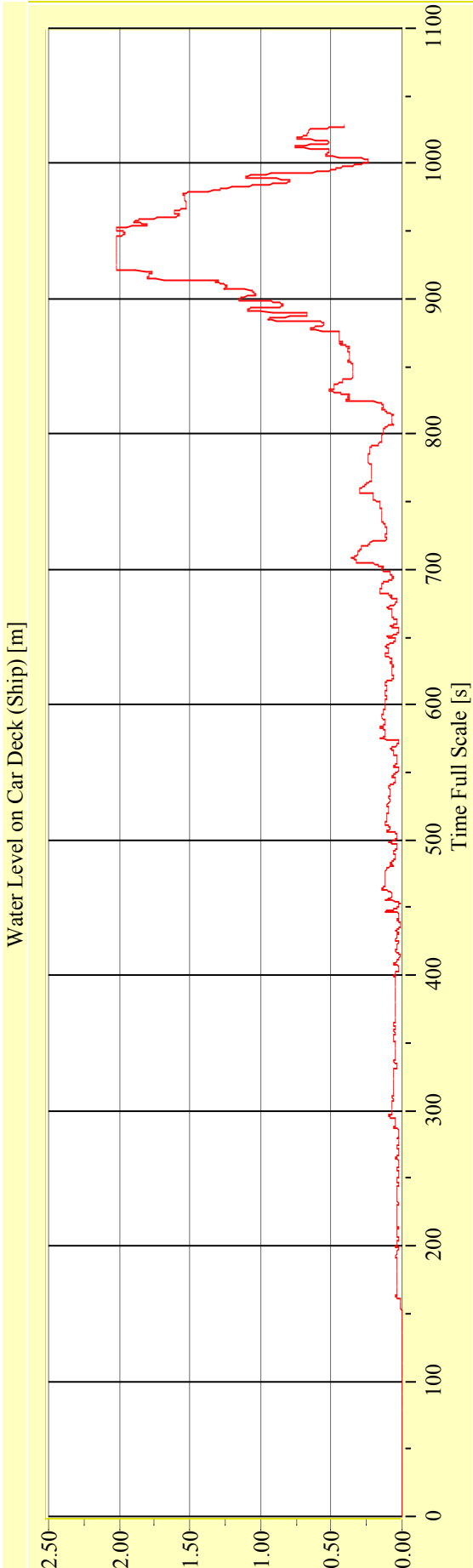
**Date: 14.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

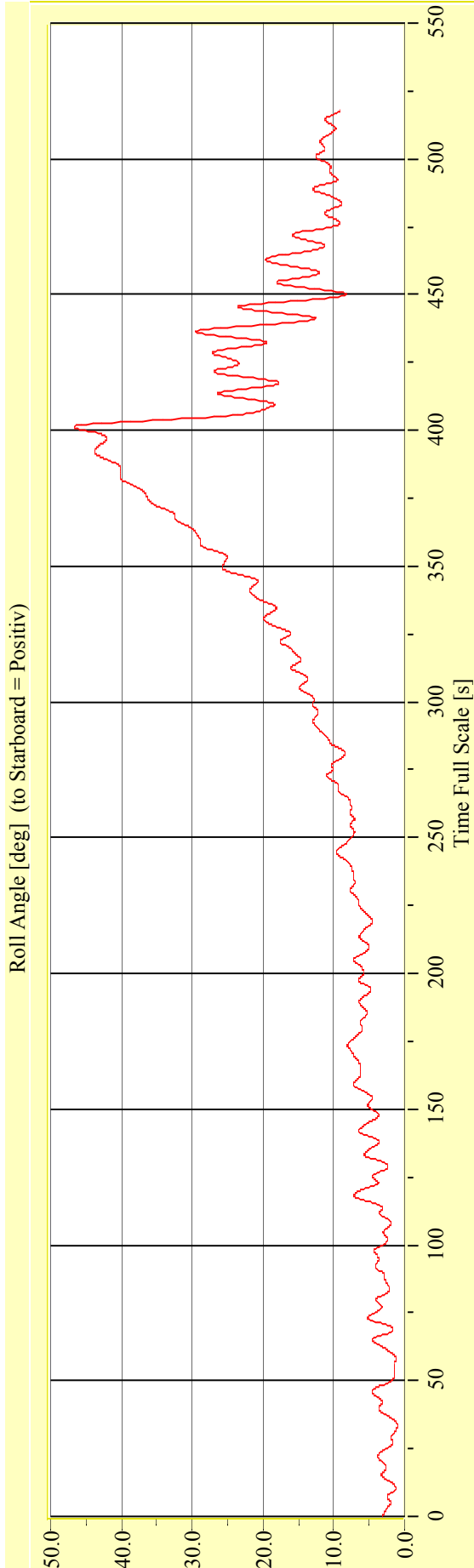
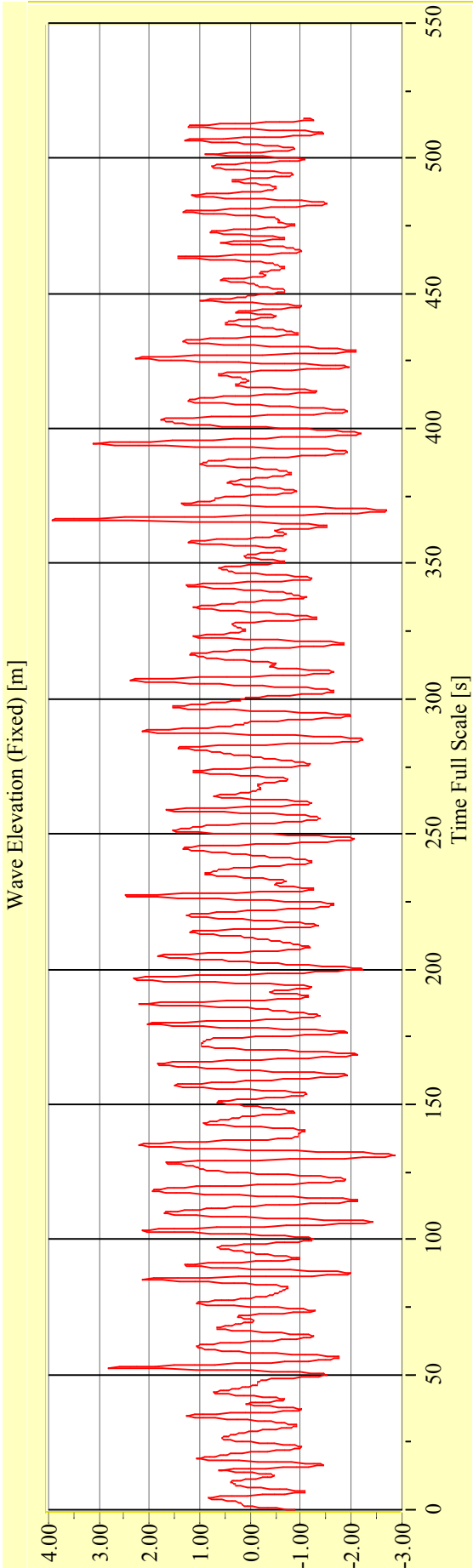
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29683-01**      **Target Waves: Hs = 4,0 m Tp = 8,0 s**      **gamma = 3,3**



**Date: 14.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29683-02**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**



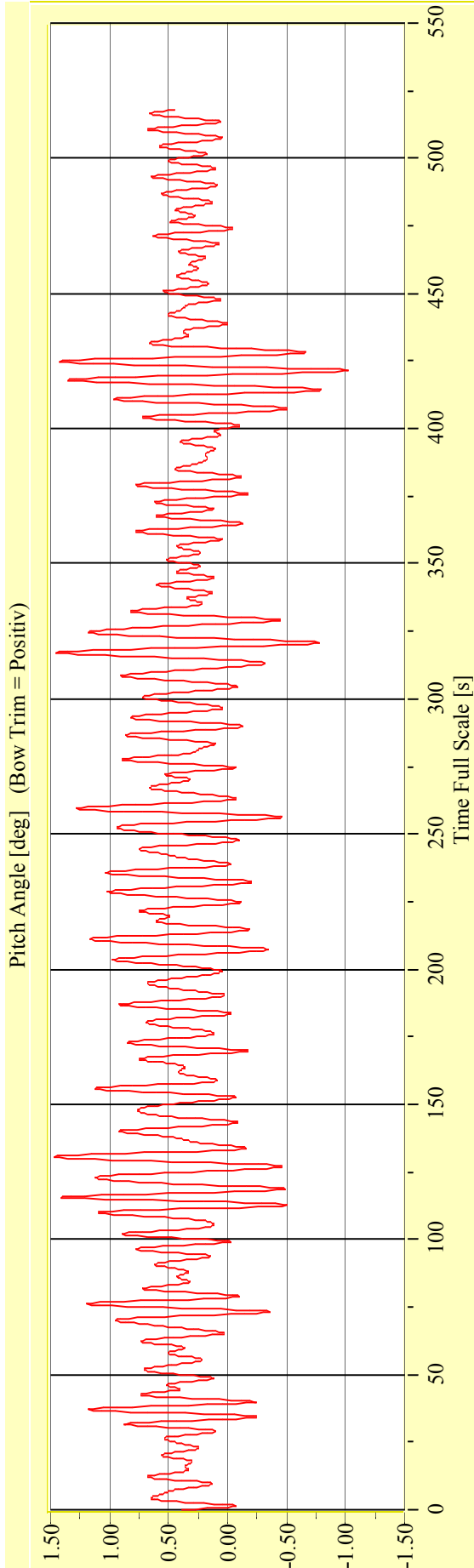
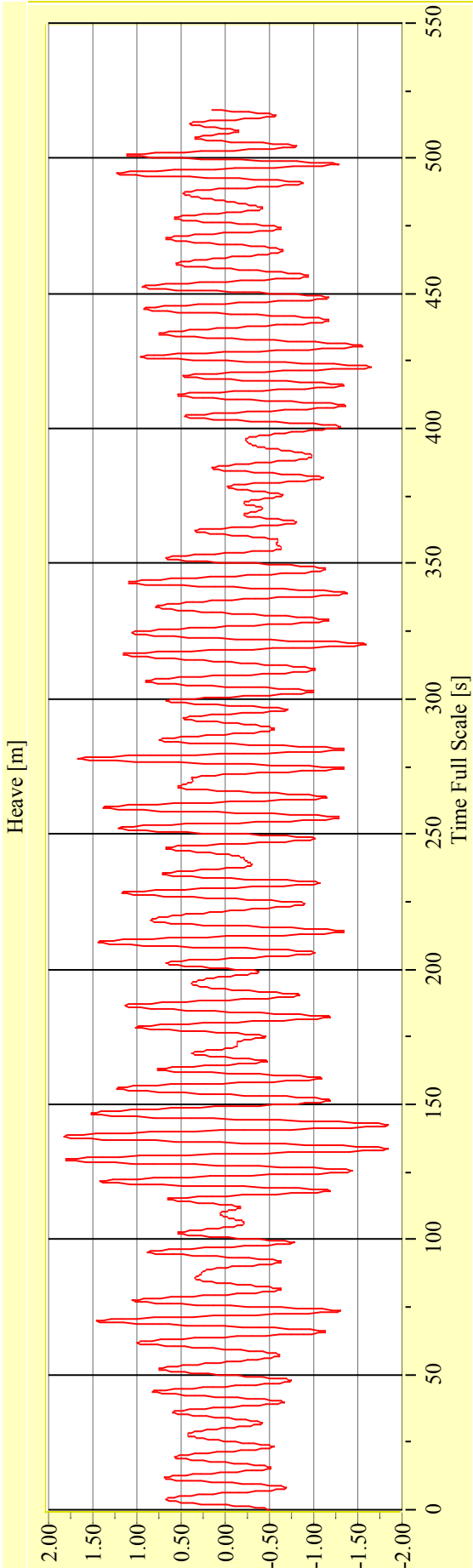
**Date: 14.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29683-02**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**



**Date: 14.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**

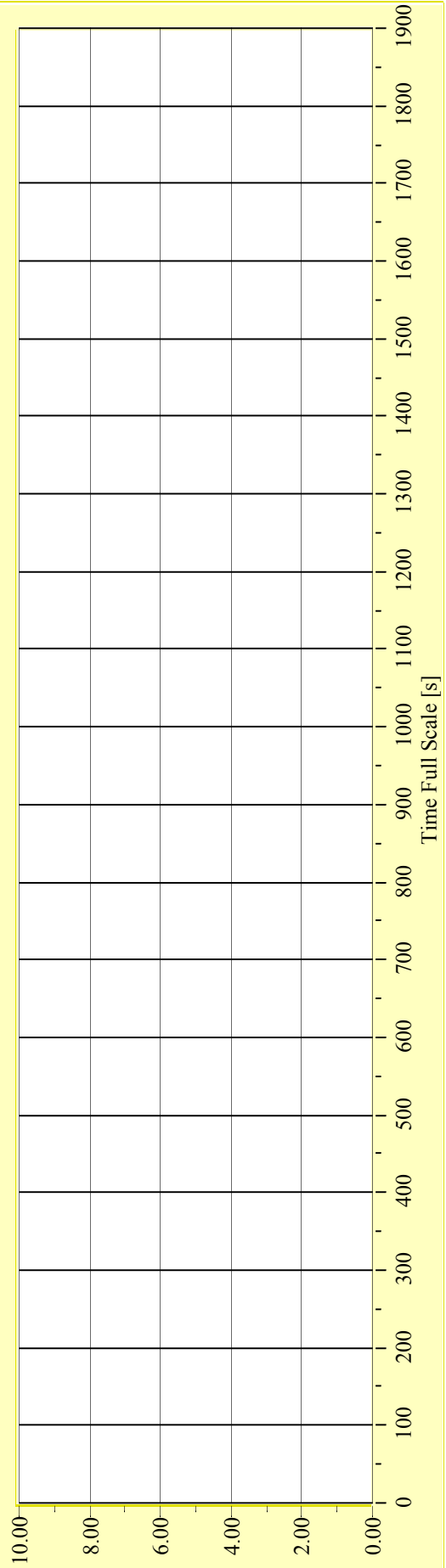
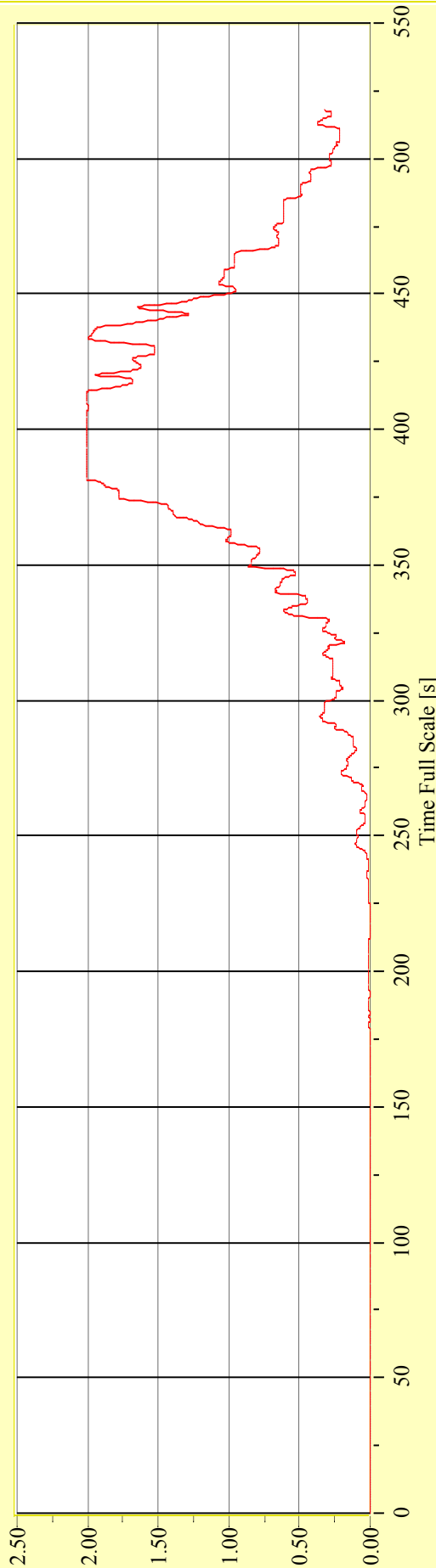
**Model No. 2446**

**Test No. 29683-02**

**Target Waves: Hs = 4.0 m Tp = 8.0 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Date: 14.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**

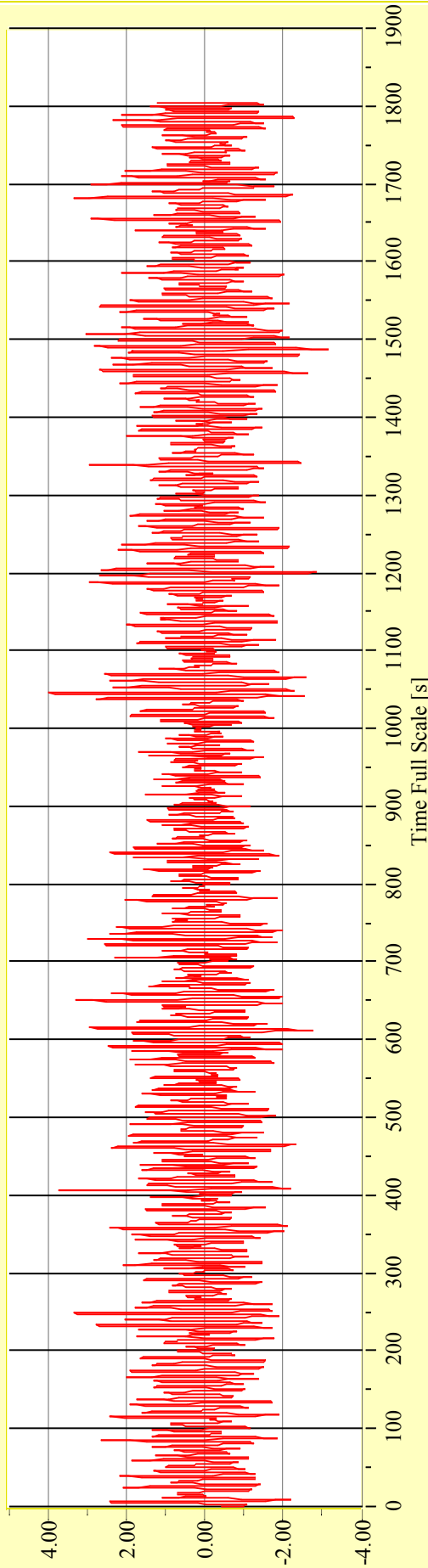
**Model No. 2446**

**Test No. 29683-03**

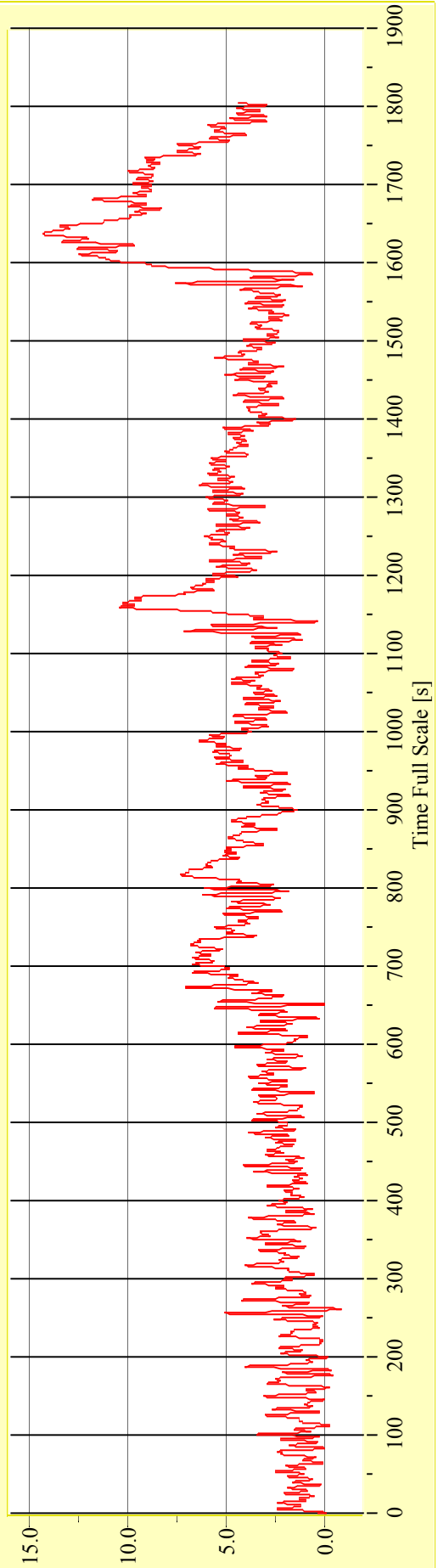
**Target Waves: Hs = 4.0 m Tp = 8.0 s**

**gamma = 3,3**

Wave Elevation (Fixed) [m]



Roll Angle [deg] (to Starboard = Positiv)



**Irregular Beam Seas**

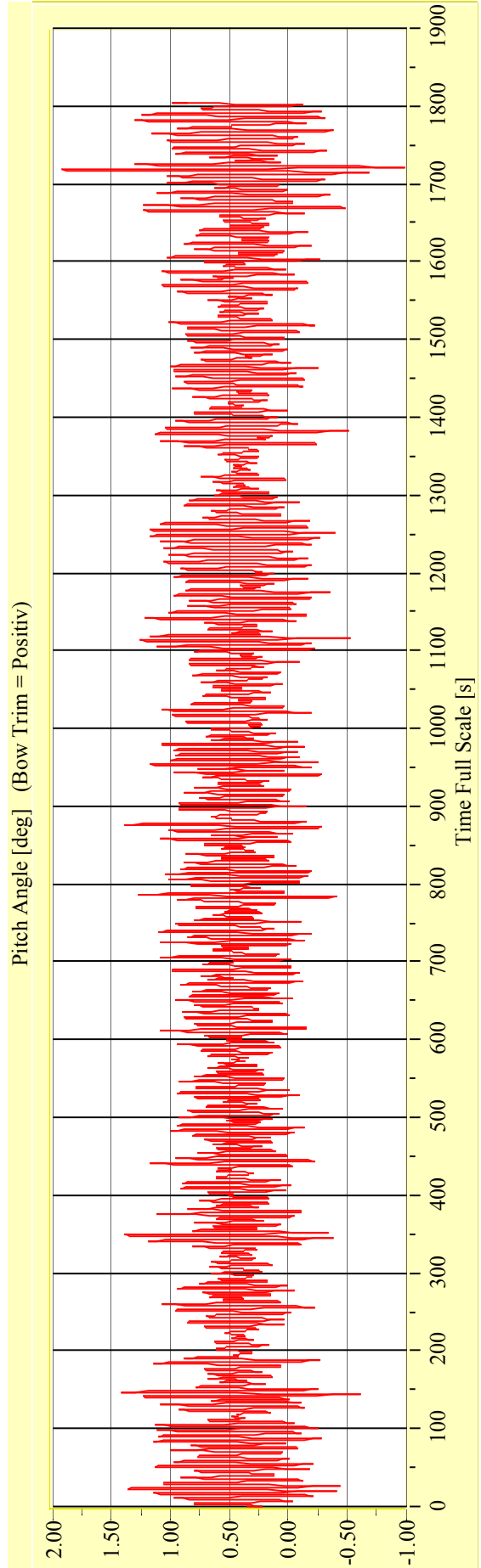
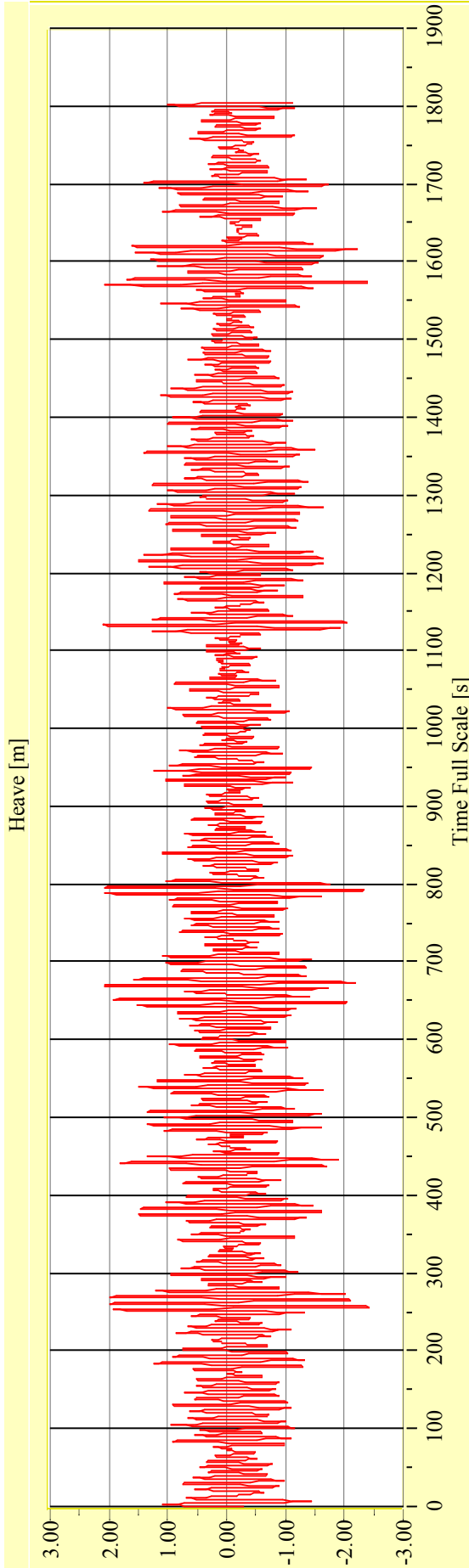
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29683-03**

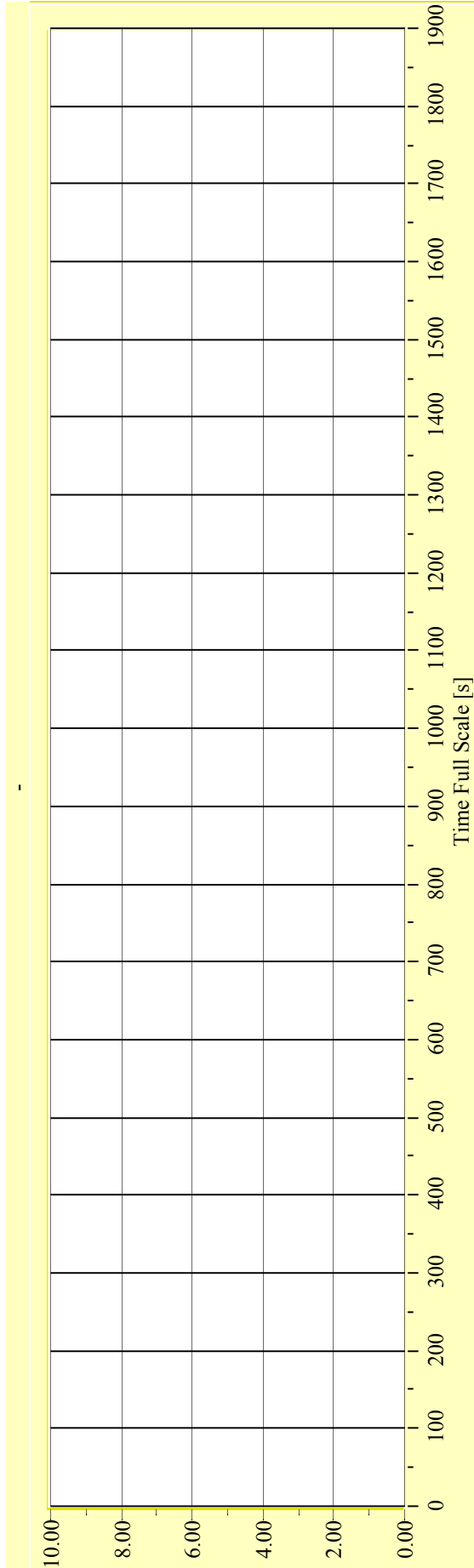
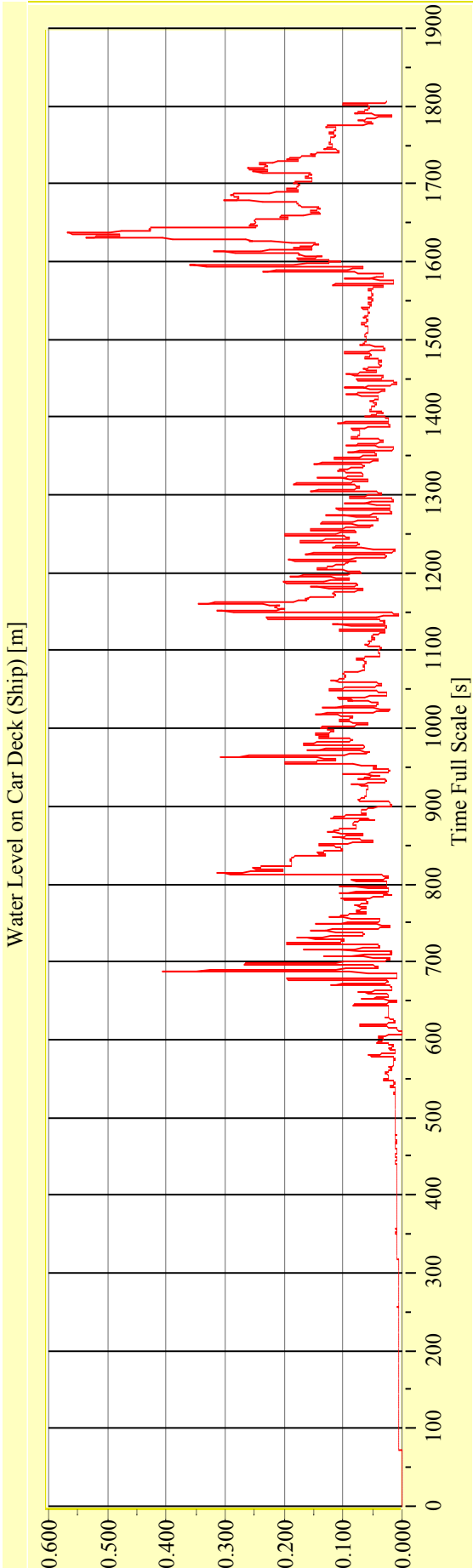
**Target Waves: Hs = 4.0 m Tp = 8.0 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29683-03**      **Target Waves: Hs = 4,0 m Tp = 8,0 s**      **gamma = 3,3**

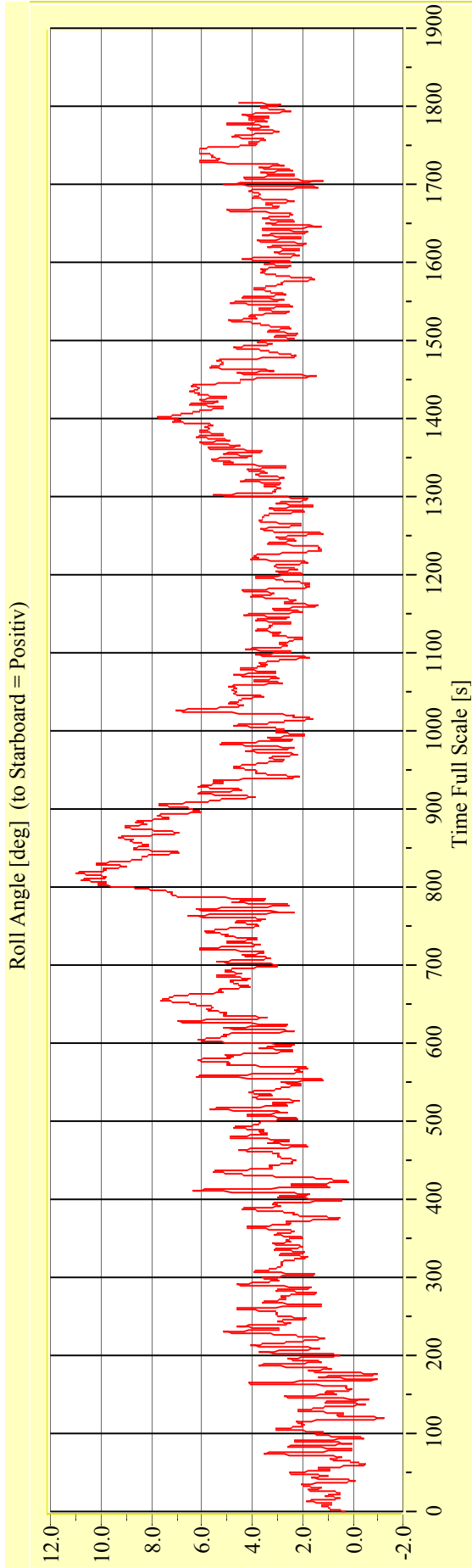
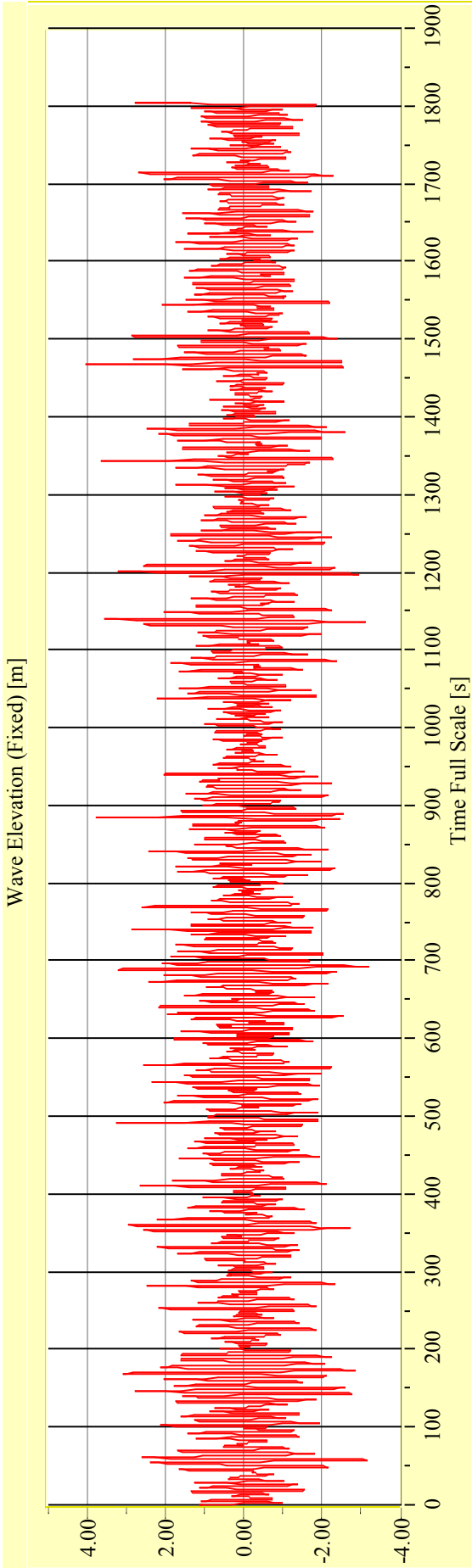


**Date: 14.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29683-04**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**



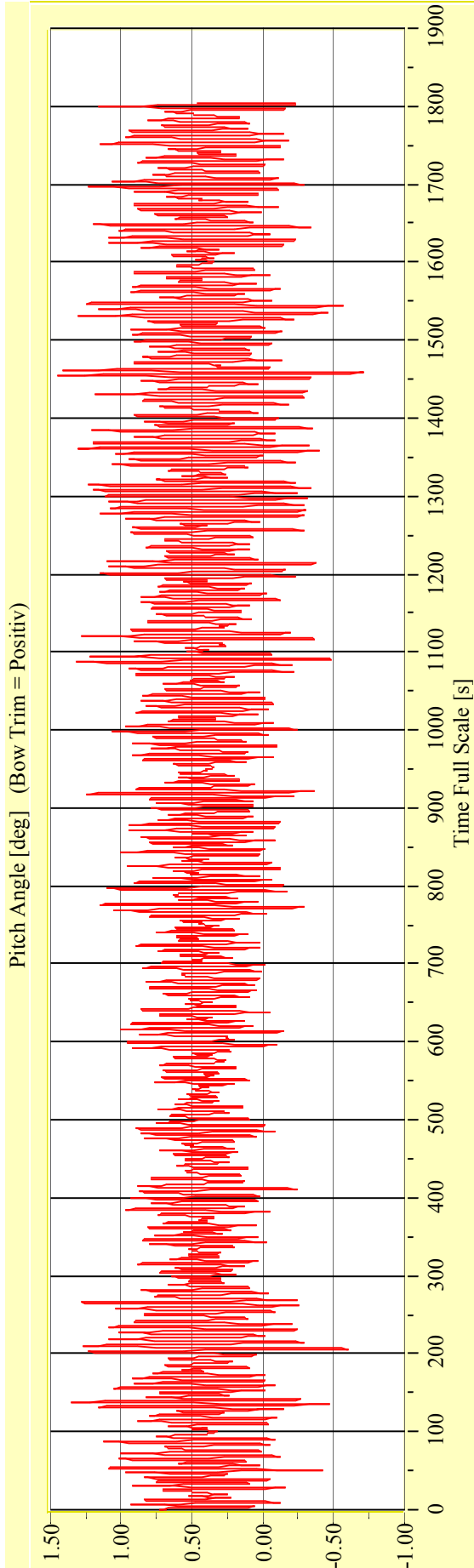
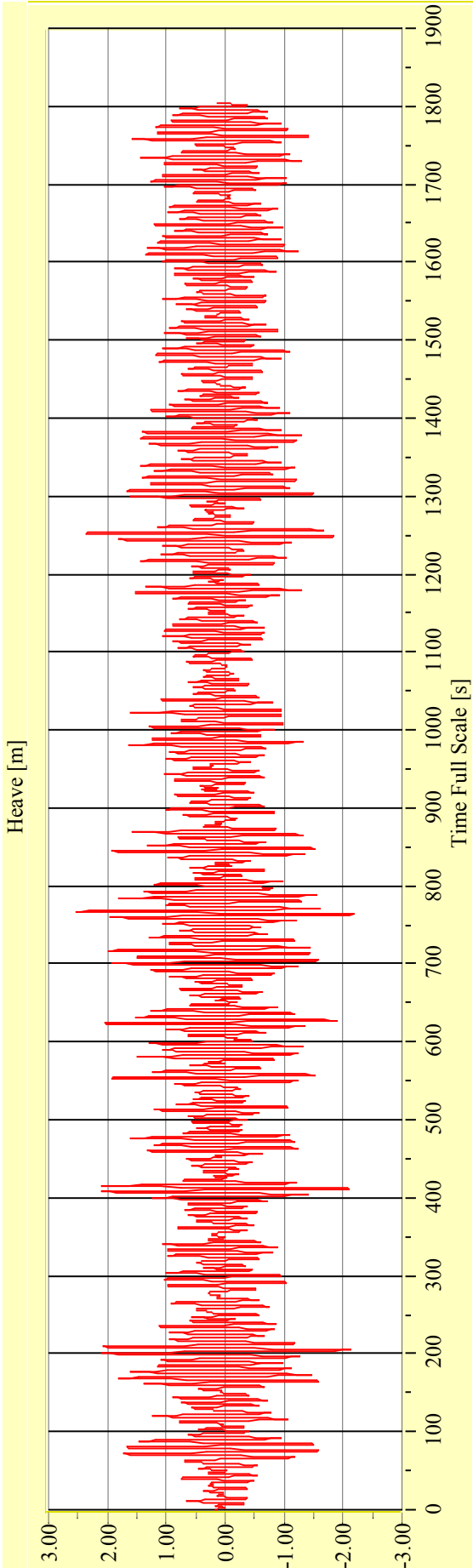
**Date: 14.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29683-04**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**



**Date: 14.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**

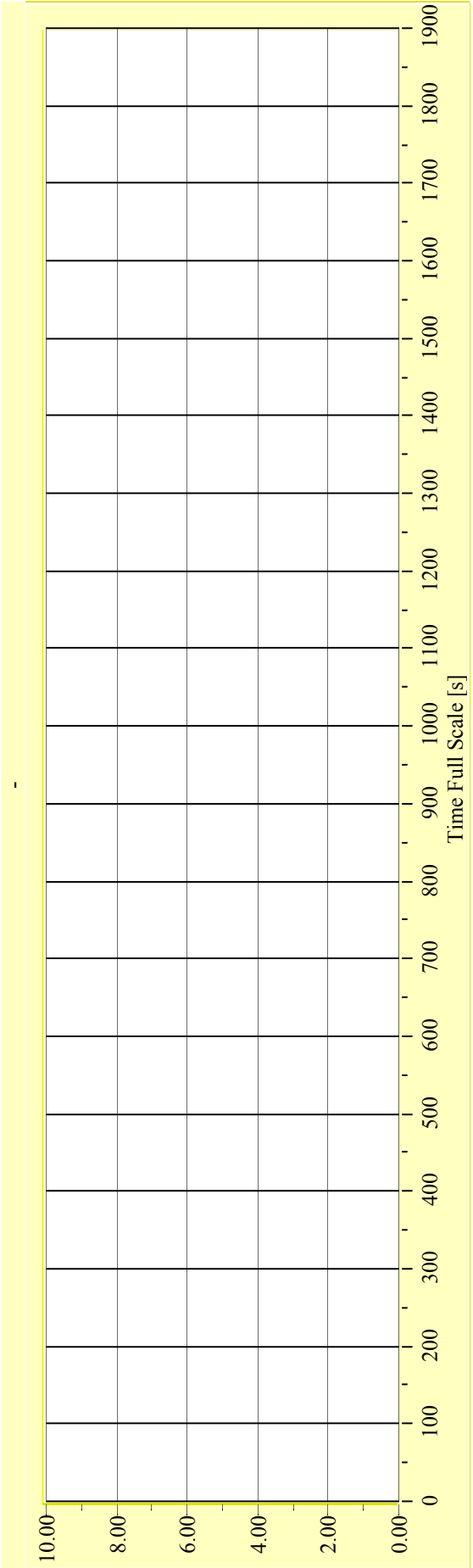
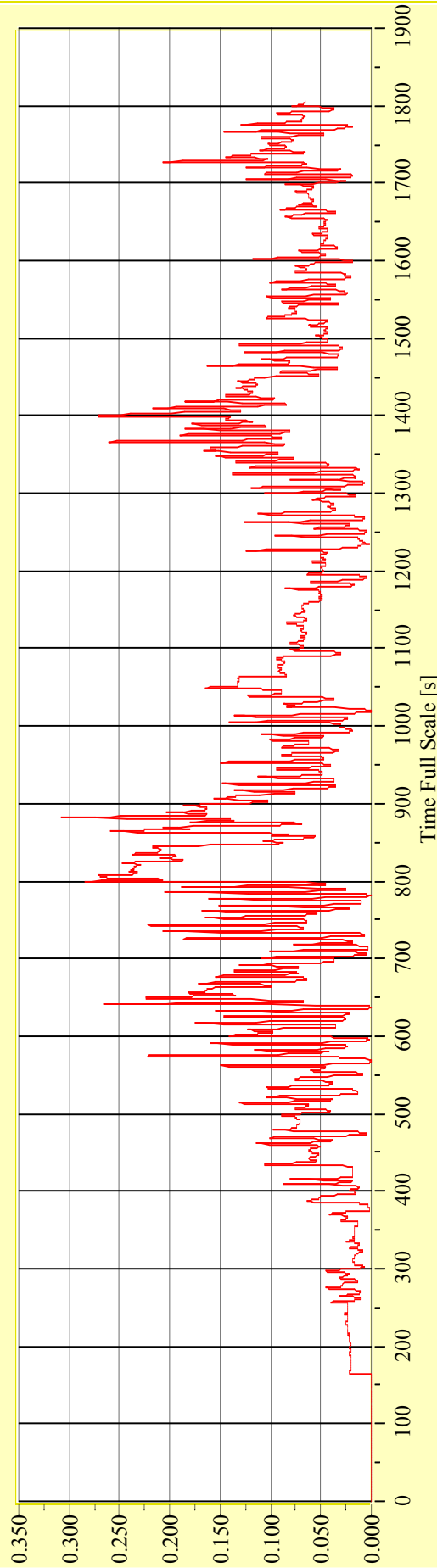
**Model No. 2446**

**Test No. 29683-04**

**Target Waves: Hs = 4.0 m Tp = 8.0 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



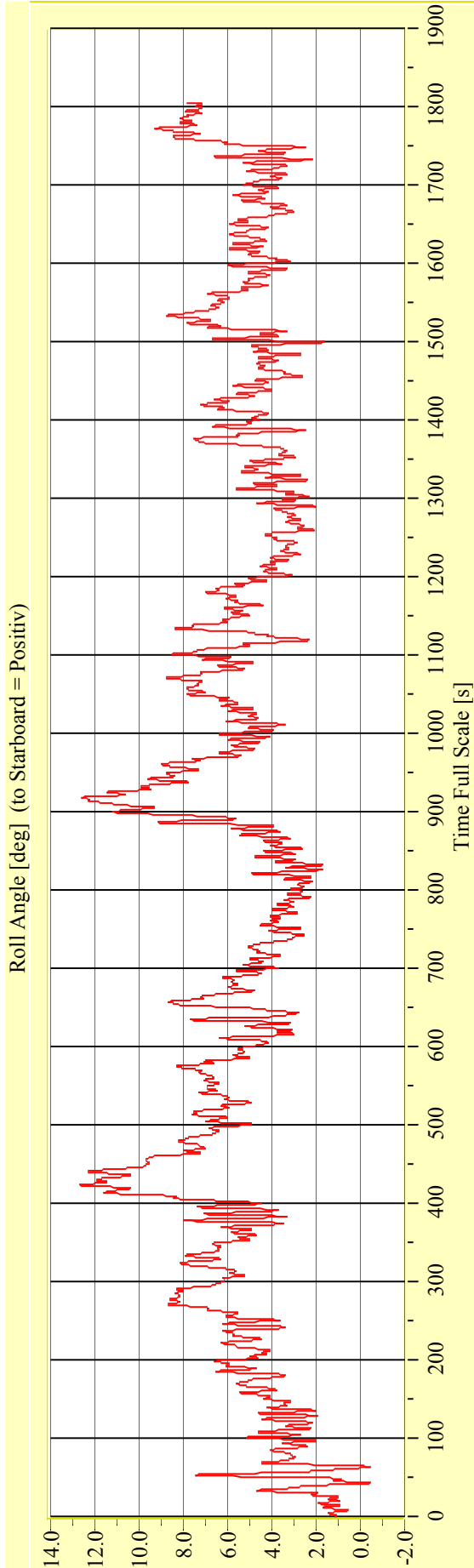
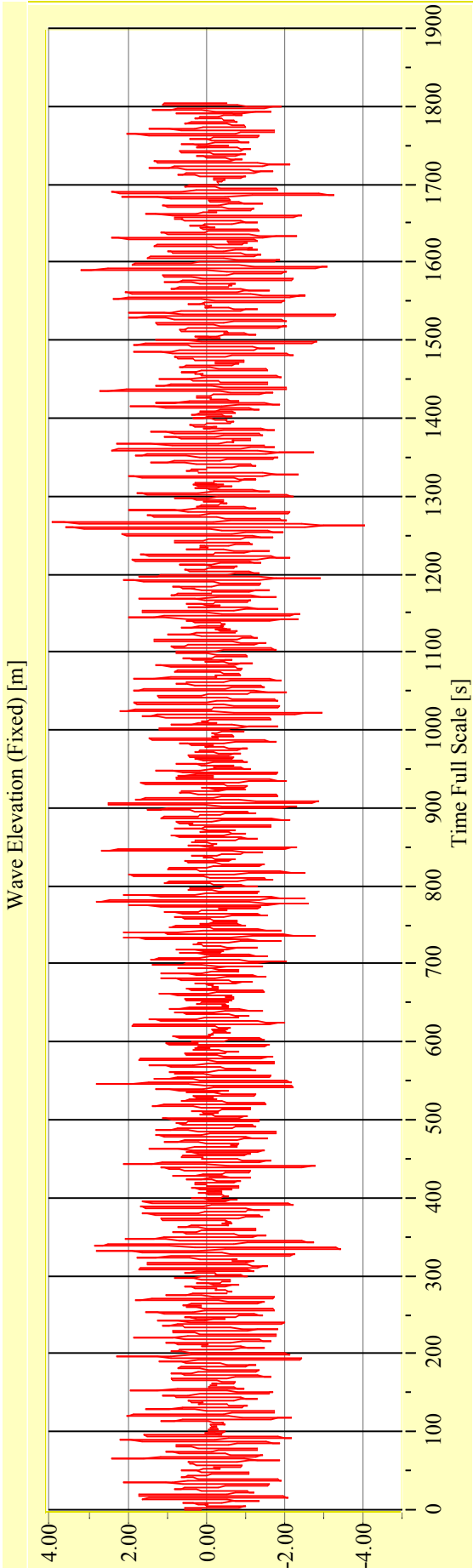
**Date: 14.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29683-05**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**



**Date: 14.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

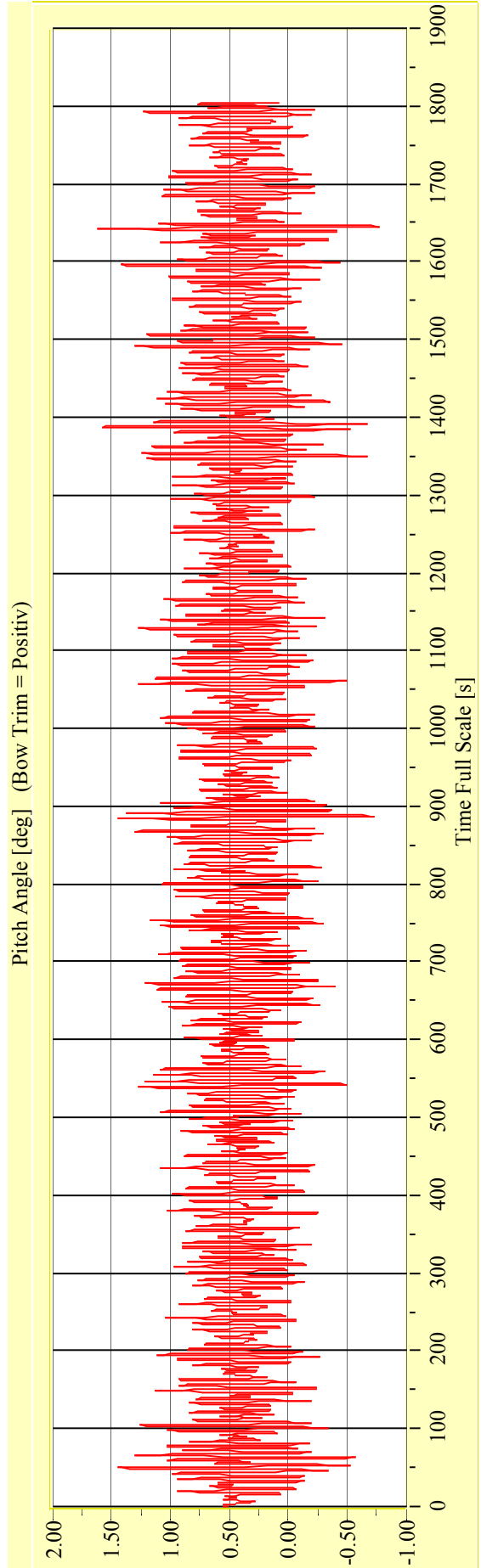
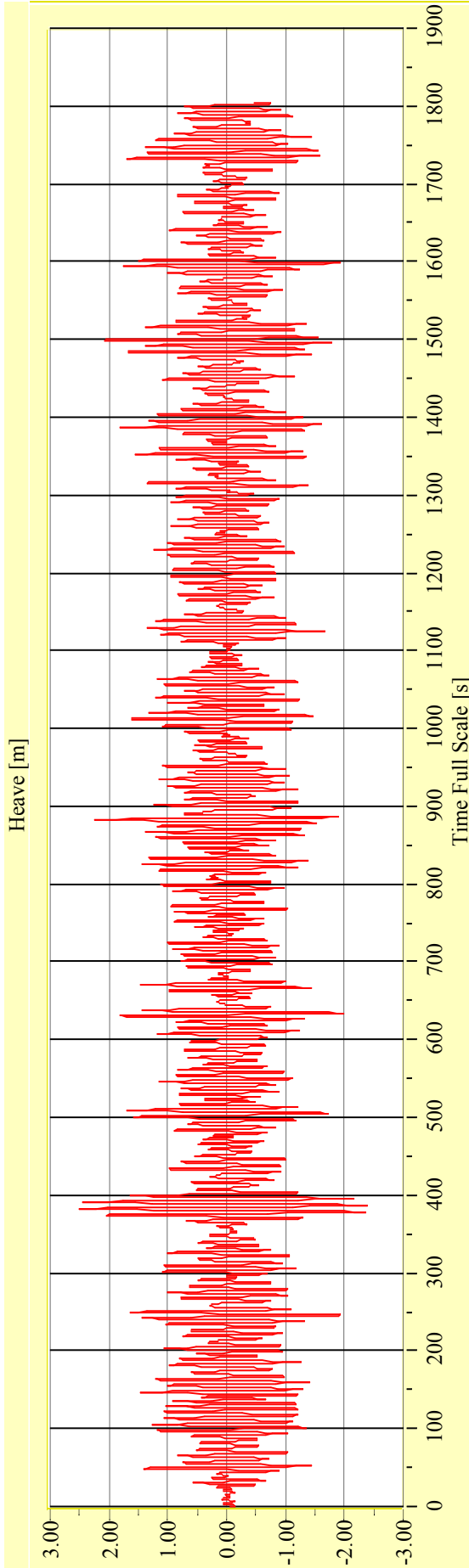
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29683-05**

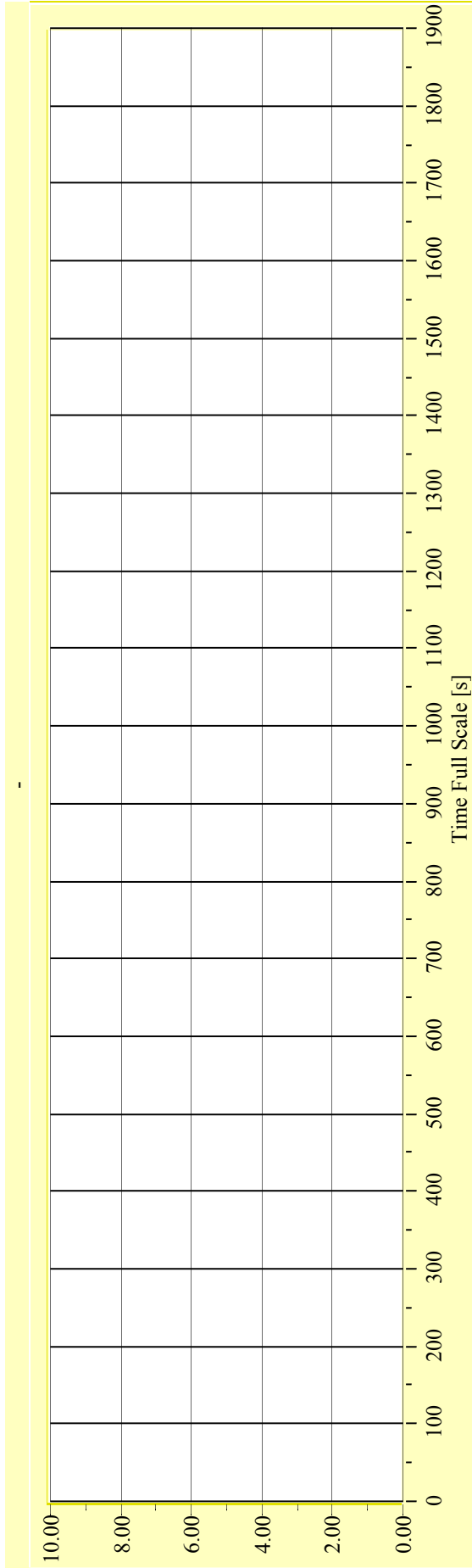
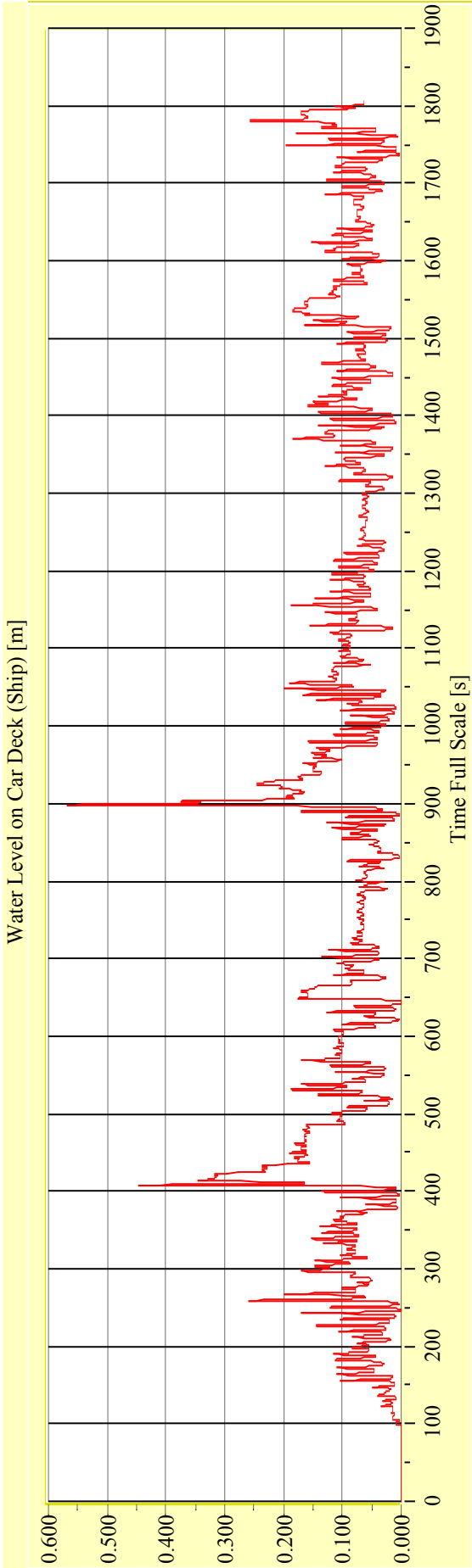
**Target Waves: Hs = 4.0 m Tp = 8.0 s**

**gamma = 3,3**



**Irregular Beam Seas**

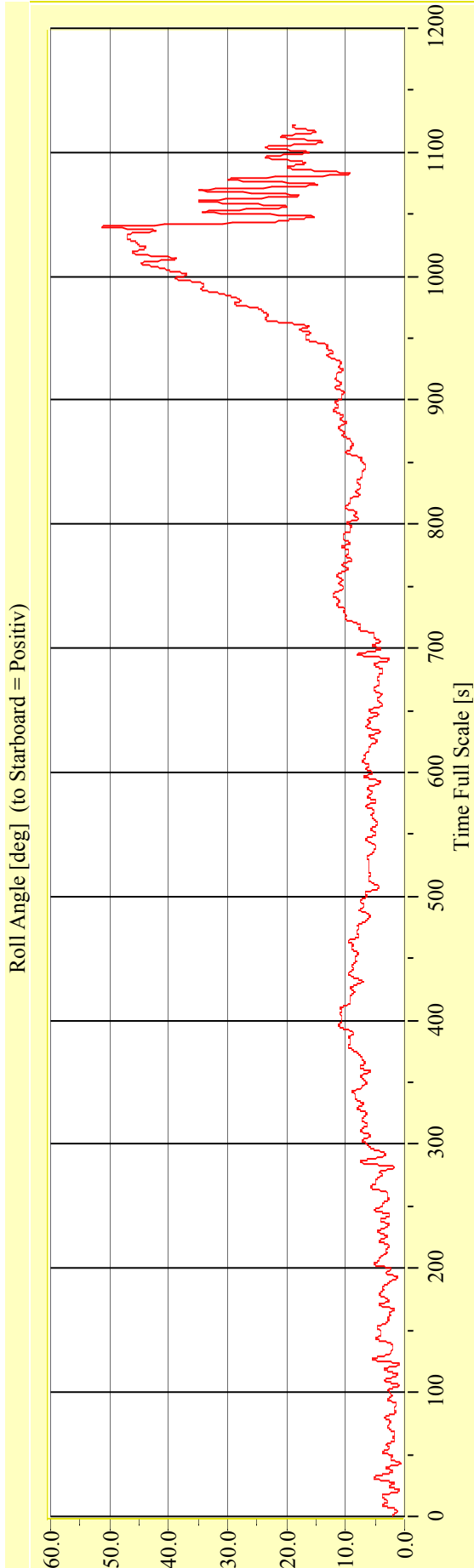
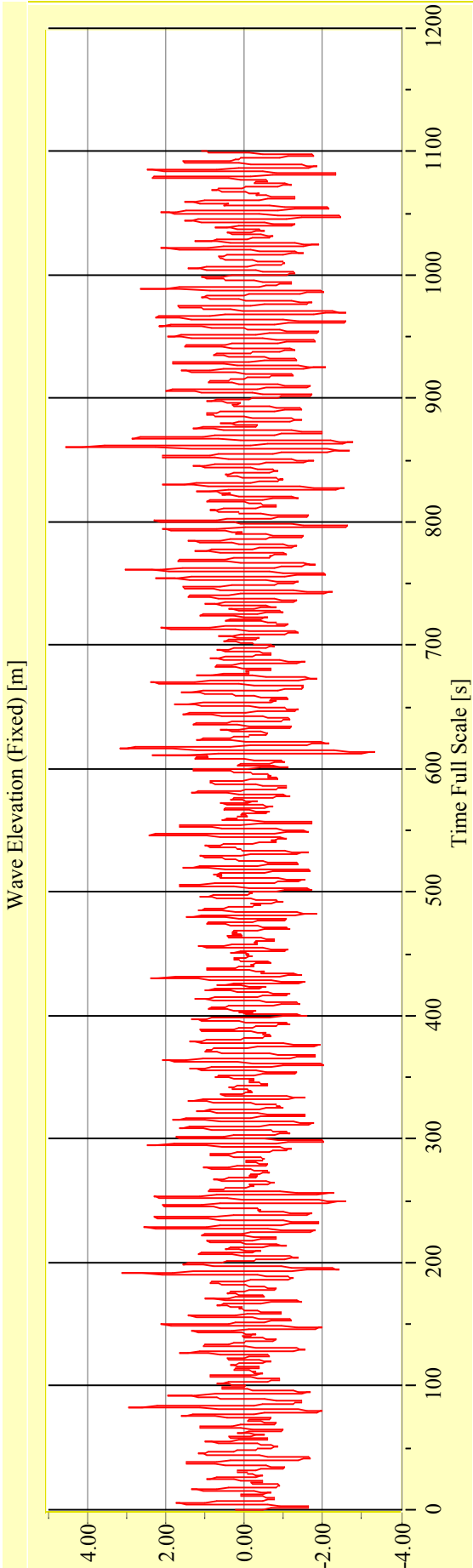
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29683-05**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**



**Date: 14.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

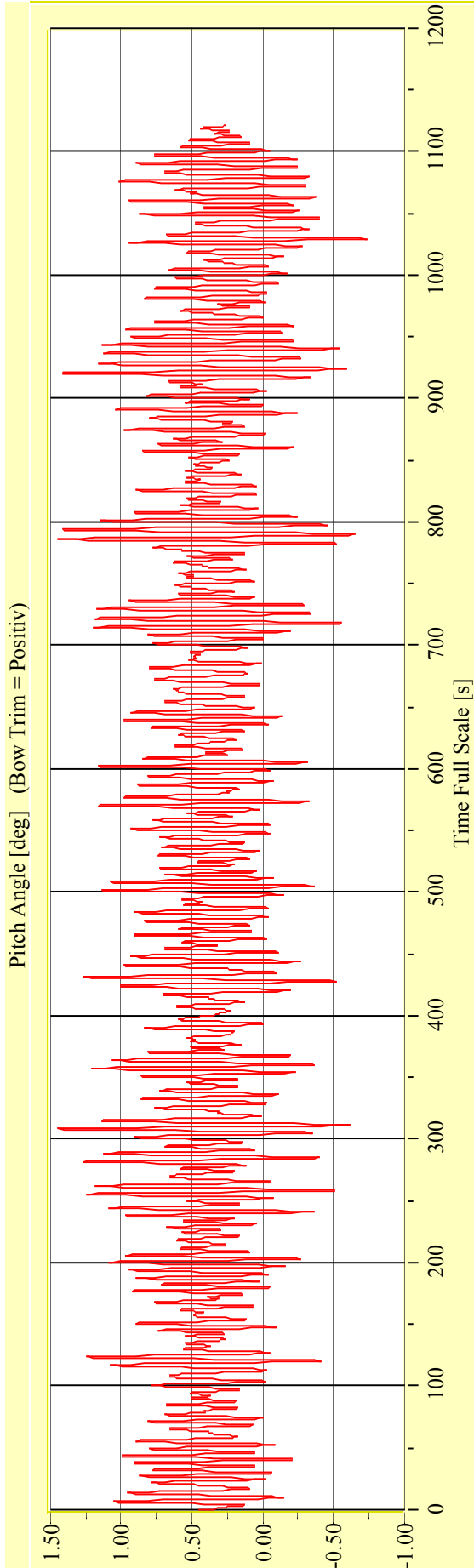
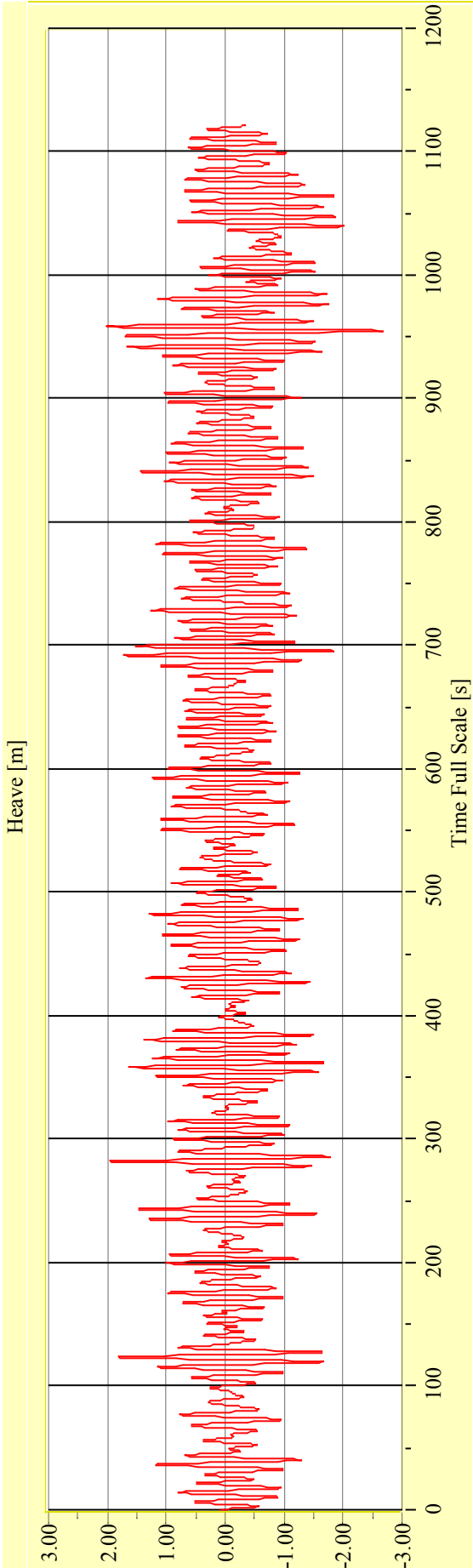
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29683-06**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**



**Date: 14.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29683-06**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**

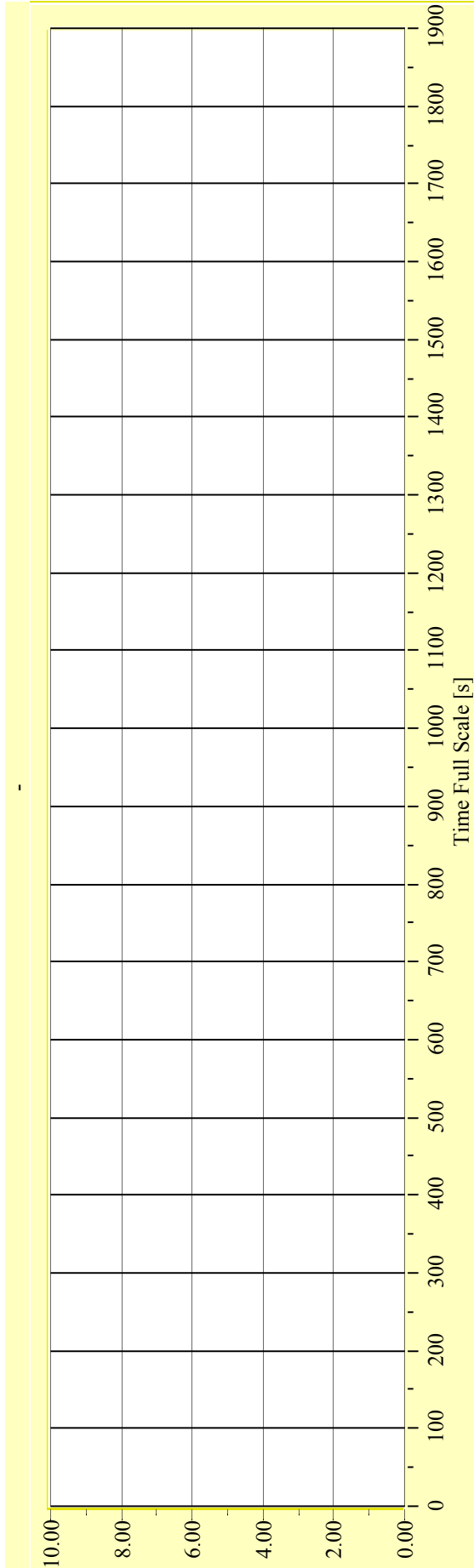
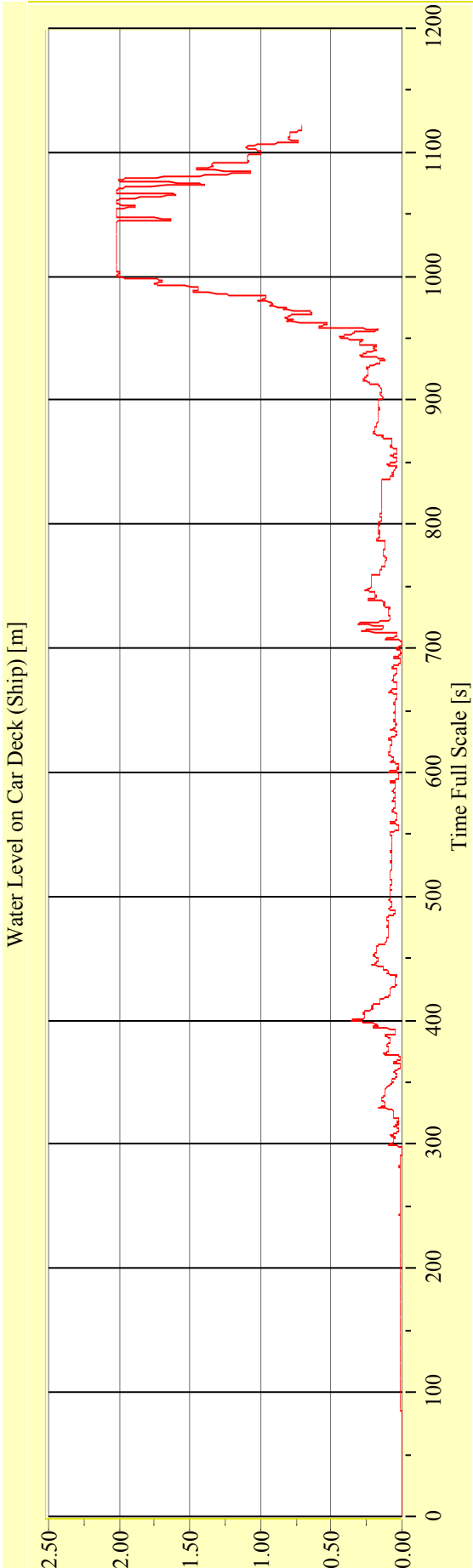


**Date: 14.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29683-06**      **Target Waves: Hs = 4,0 m Tp = 8,0 s**      **gamma = 3,3**



**Date: 14.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

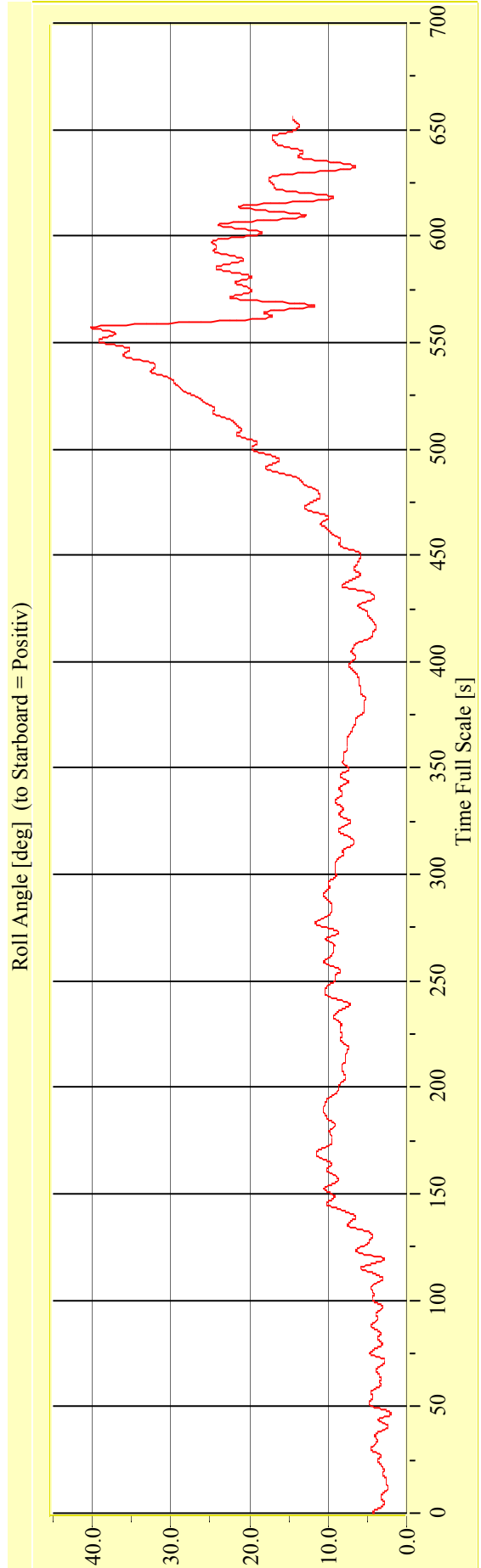
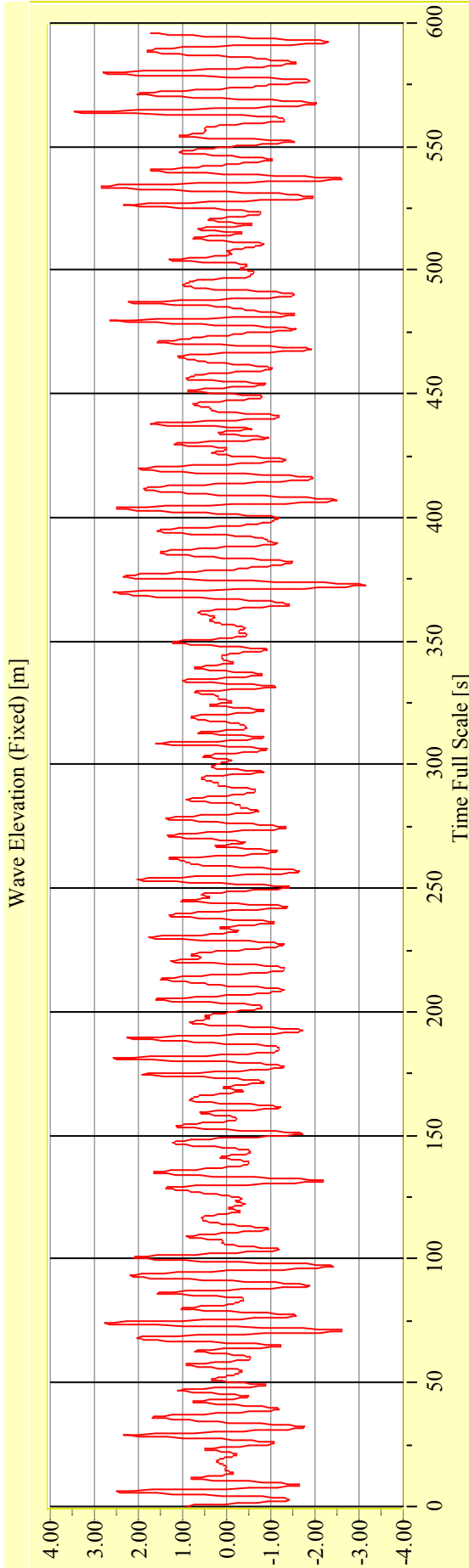
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29683-07**

**Target Waves: Hs = 4.0 m Tp = 8.0 s**

**gamma = 3,3**



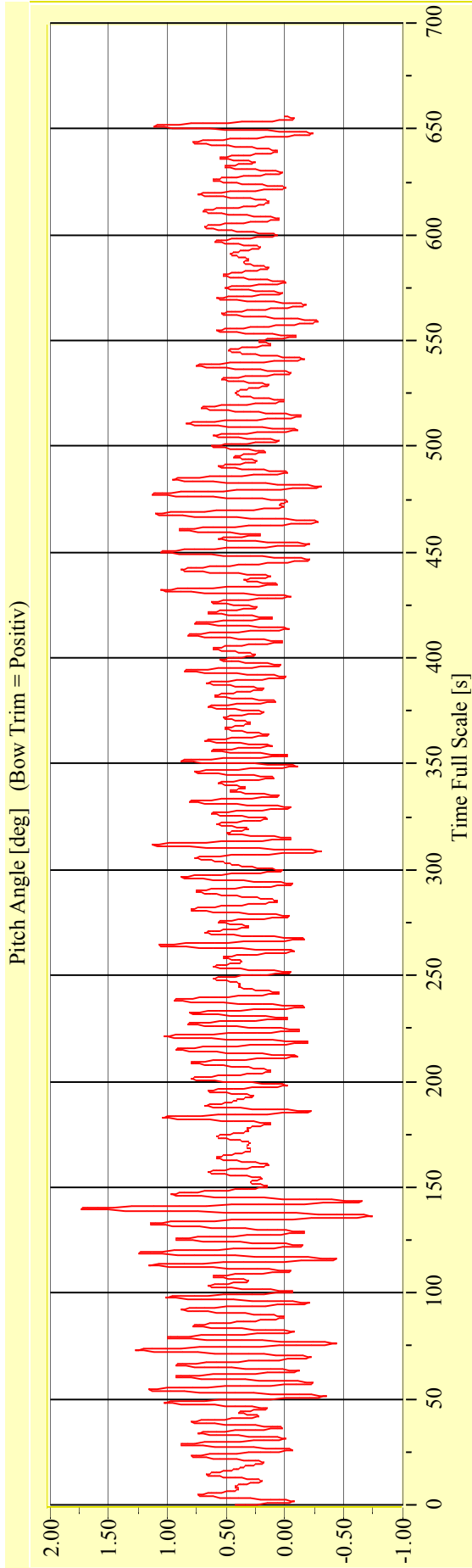
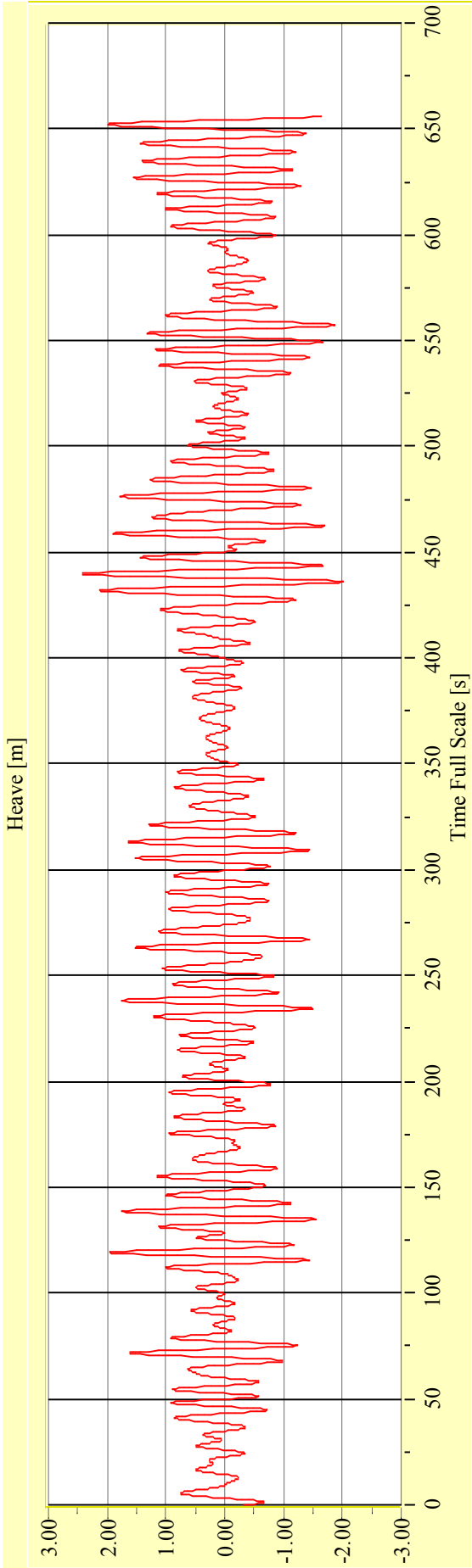
**Date: 14.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

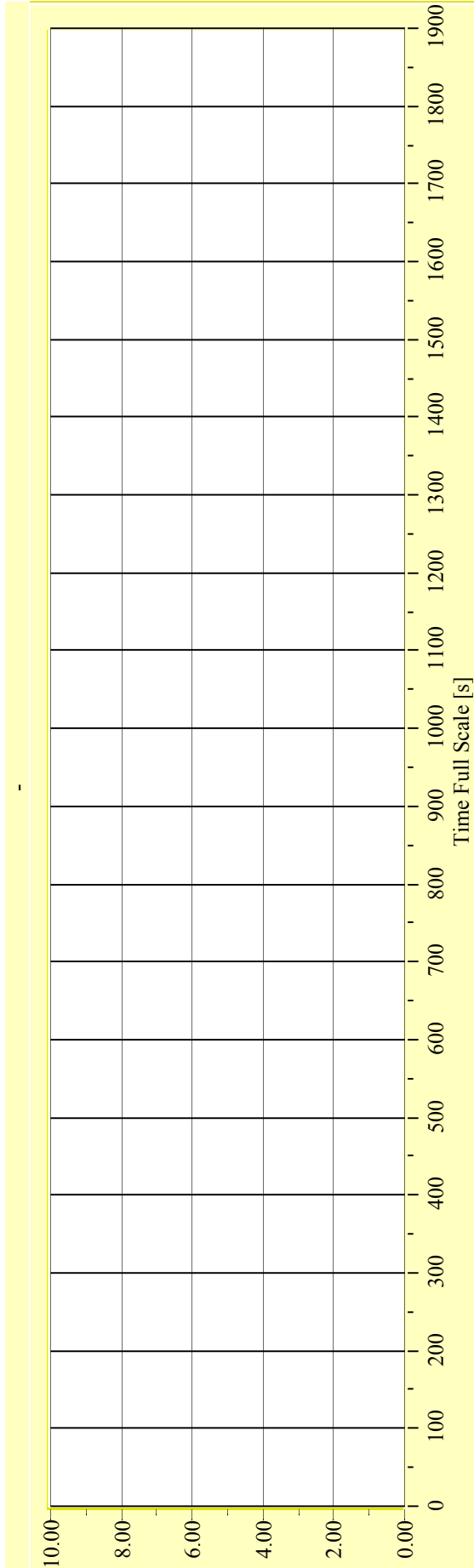
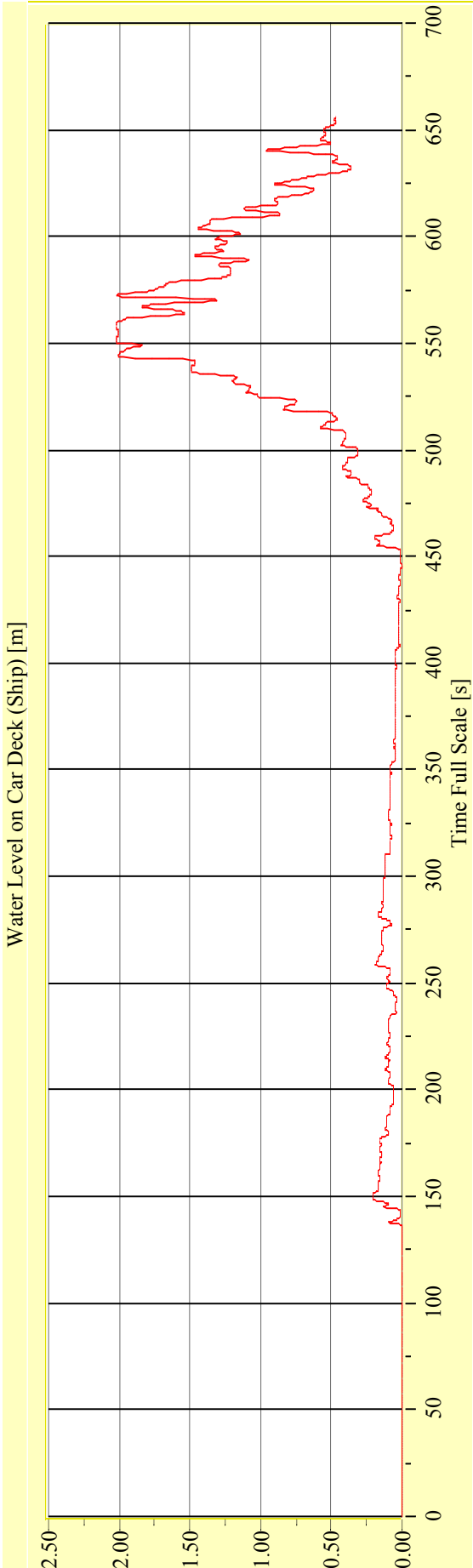
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29683-07**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**



**Date: 14.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29683-07**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**



**Date: 14.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

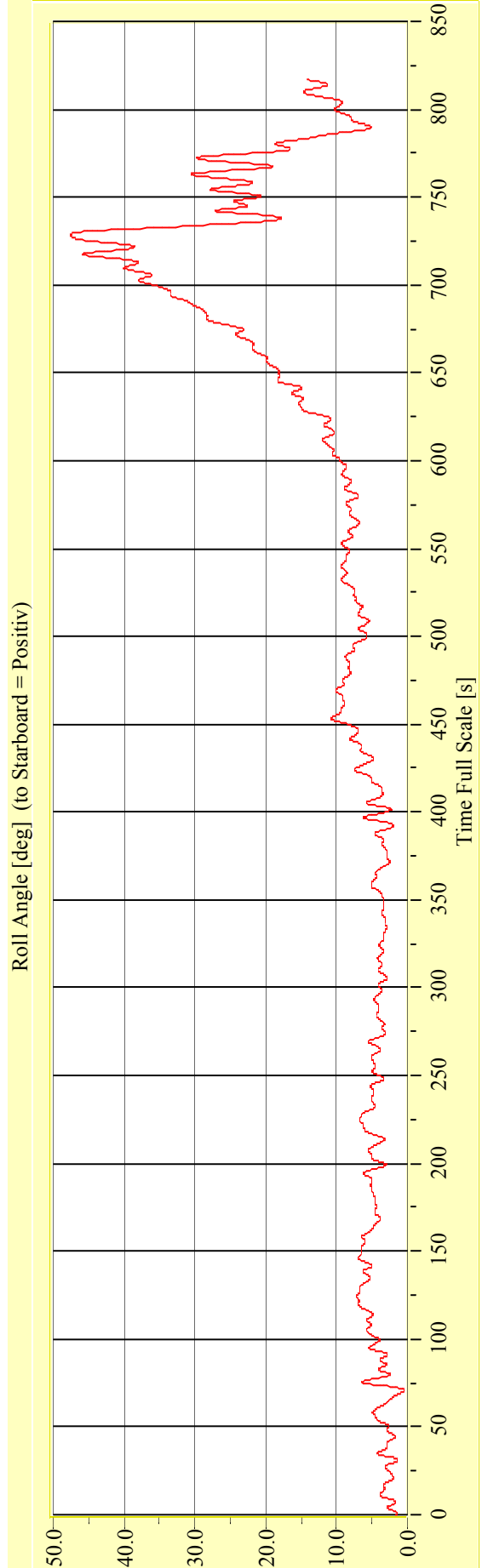
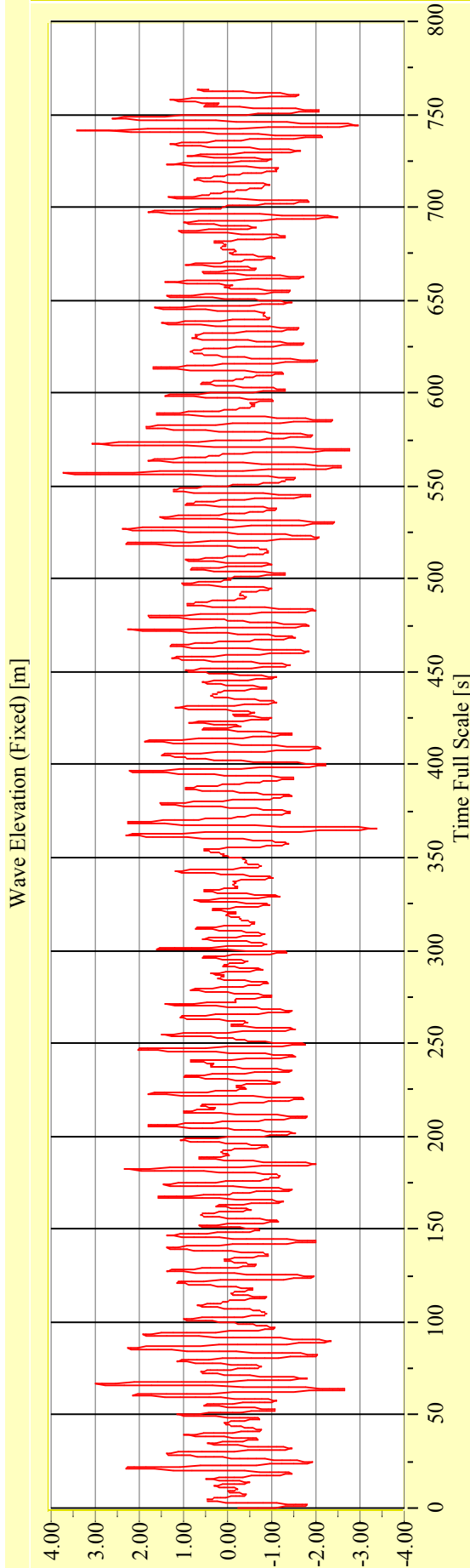
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29683-08**

**Target Waves: Hs = 4.0 m Tp = 8.0 s**

**gamma = 3,3**



**Date: 14.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

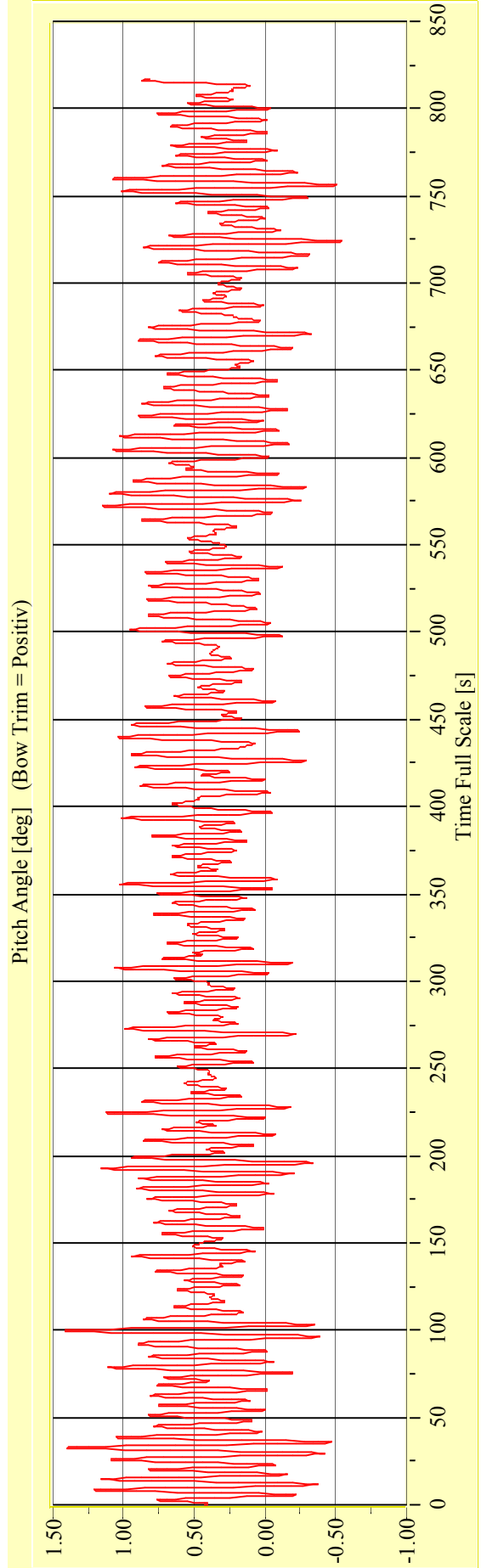
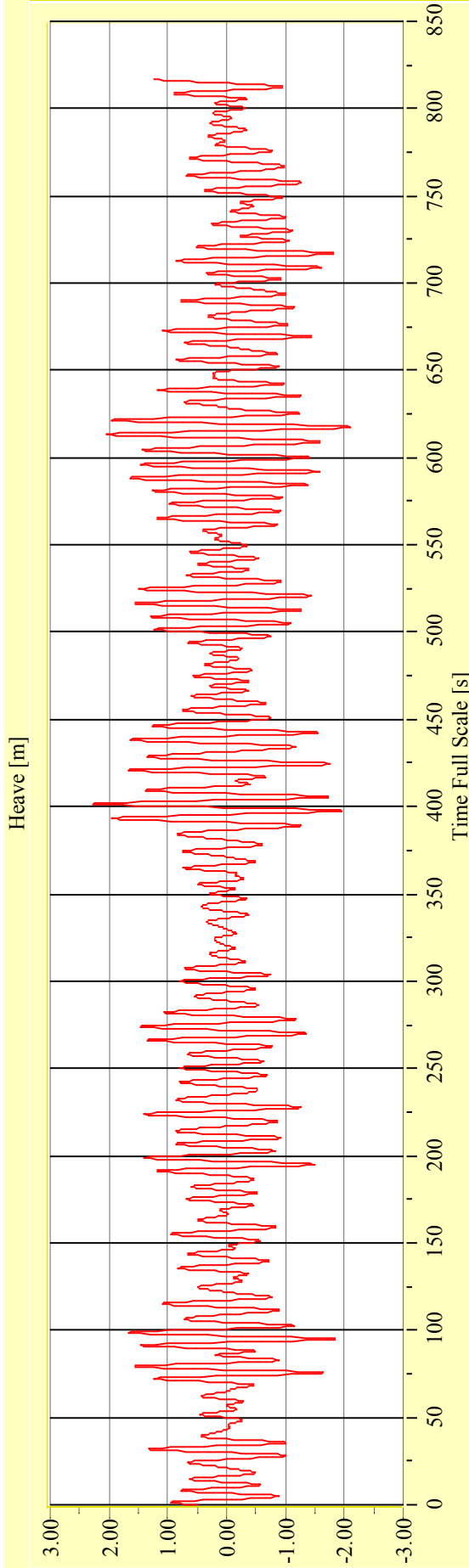
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29683-08**

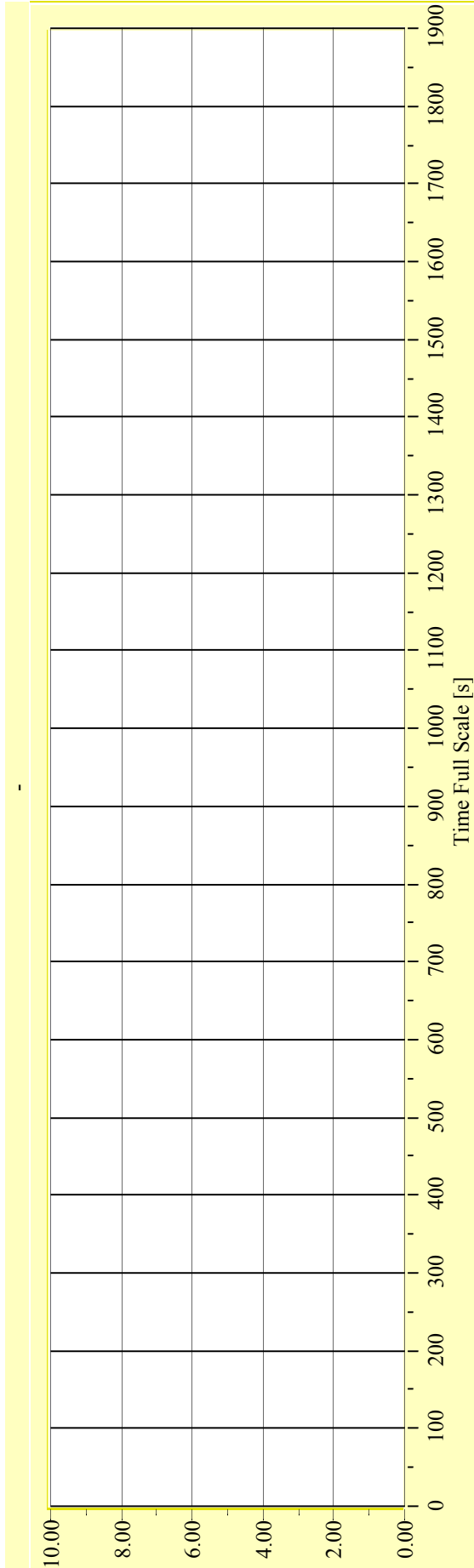
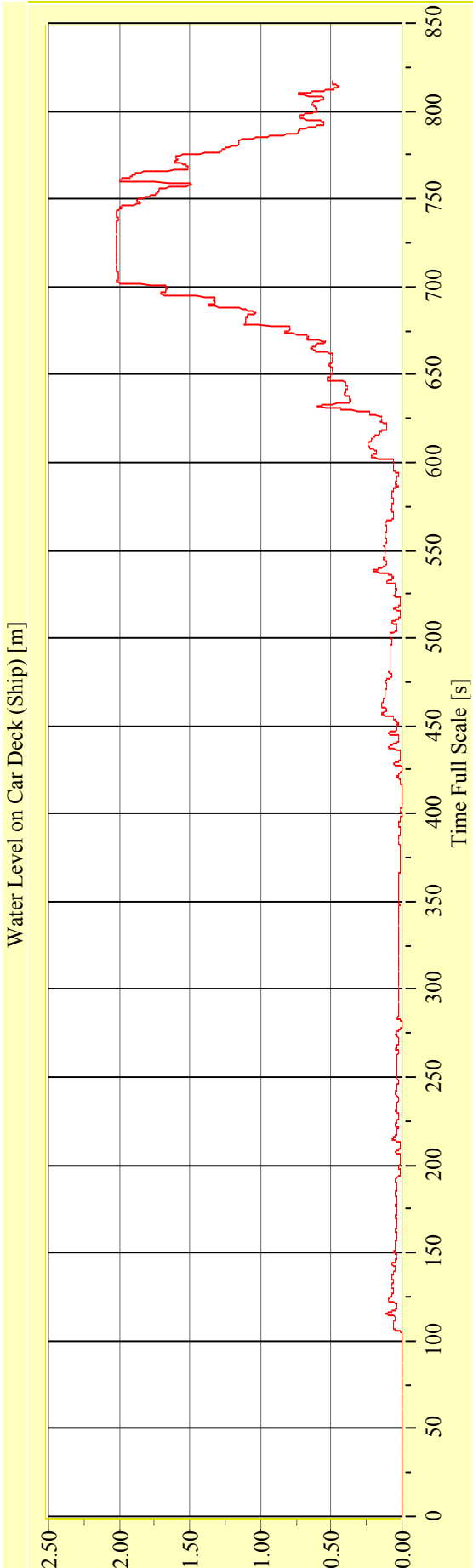
**Target Waves: Hs = 4.0 m Tp = 8.0 s**

**gamma = 3,3**



**Irregular Beam Seas**

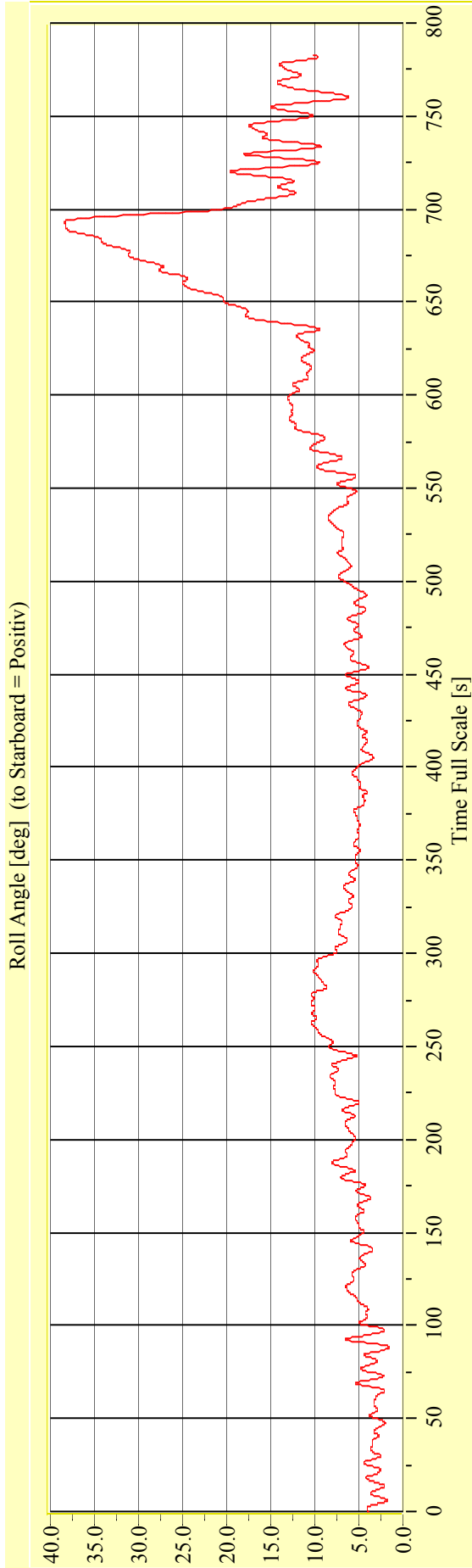
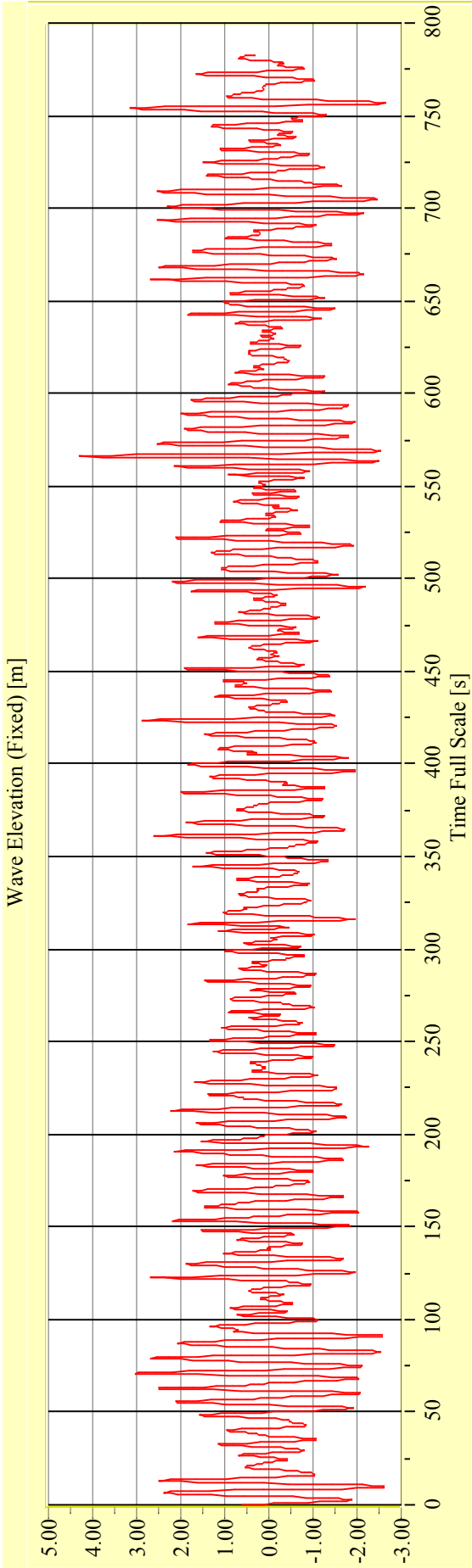
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29683-08**      **Target Waves: Hs = 4,0 m Tp = 8,0 s**      **gamma = 3,3**



**Date: 14.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29683-09**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**

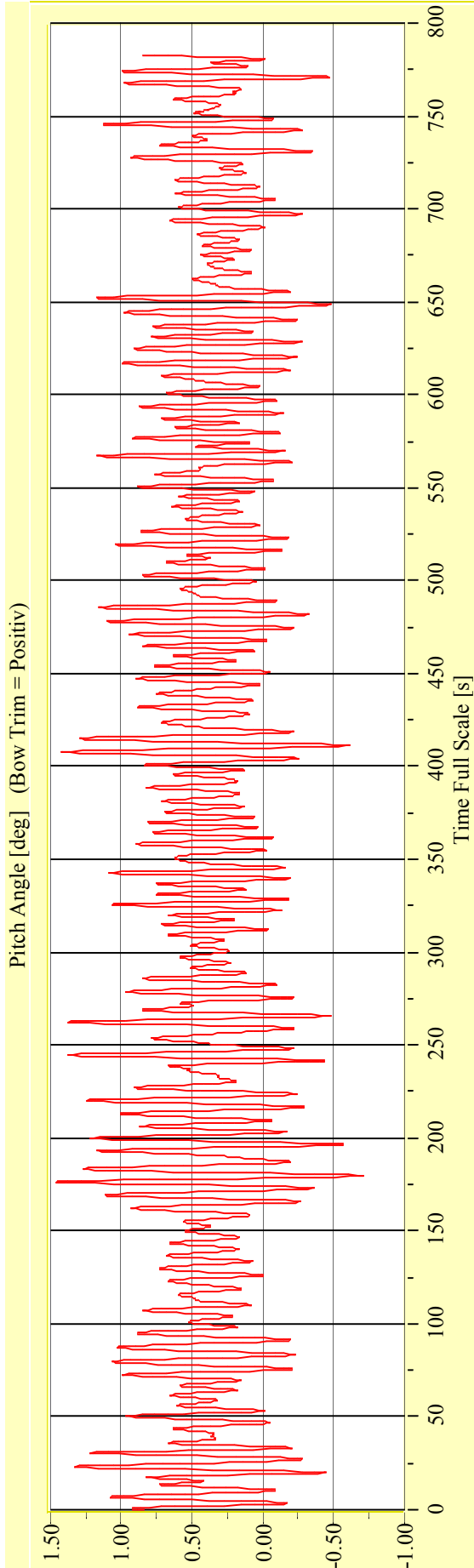
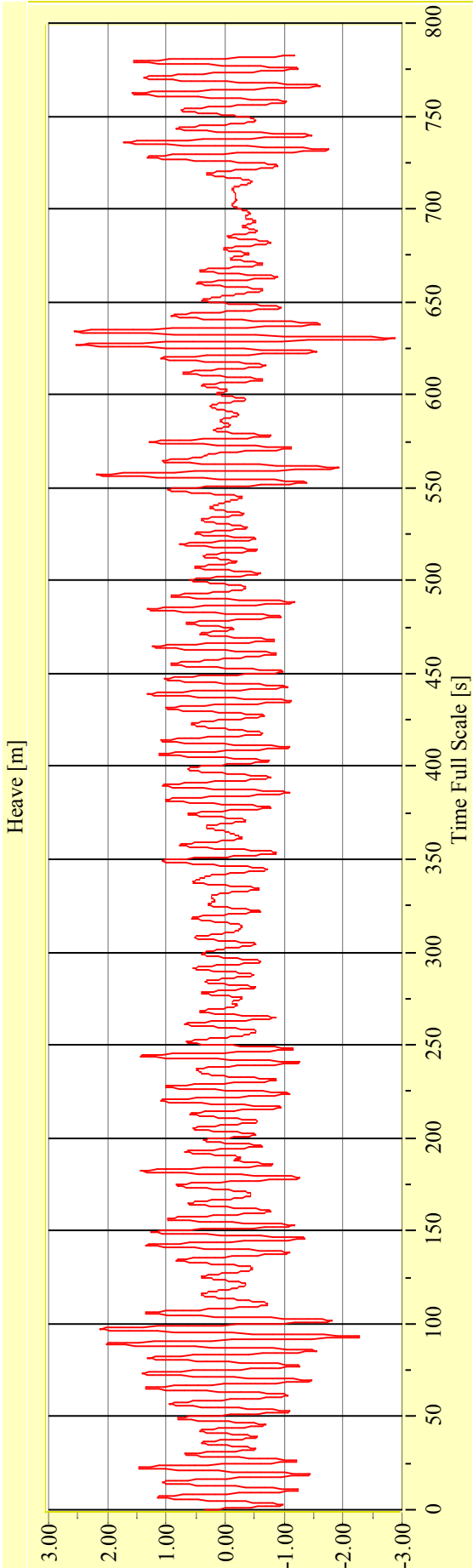


**Date: 14.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**



**Irregular Beam Seas**

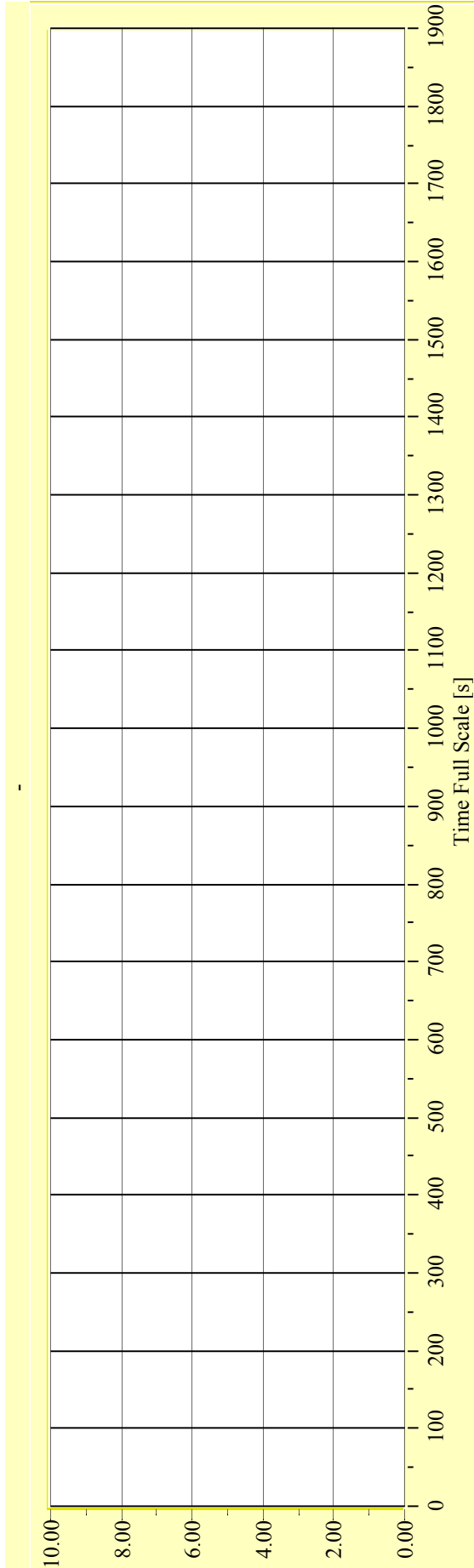
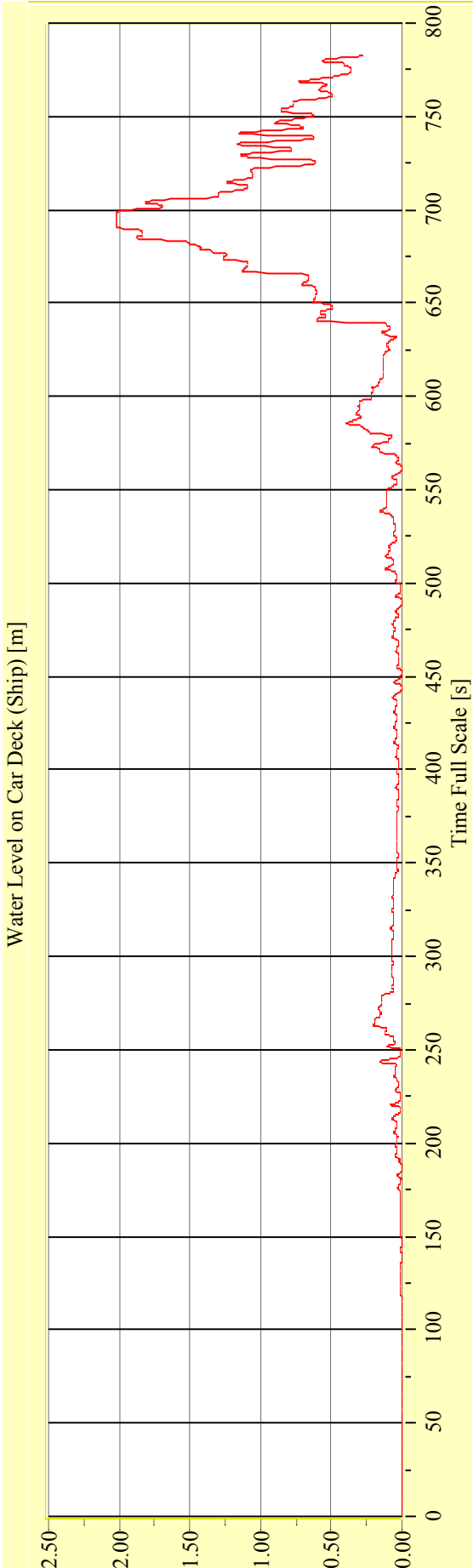
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29683-09**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**



**Date: 14.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

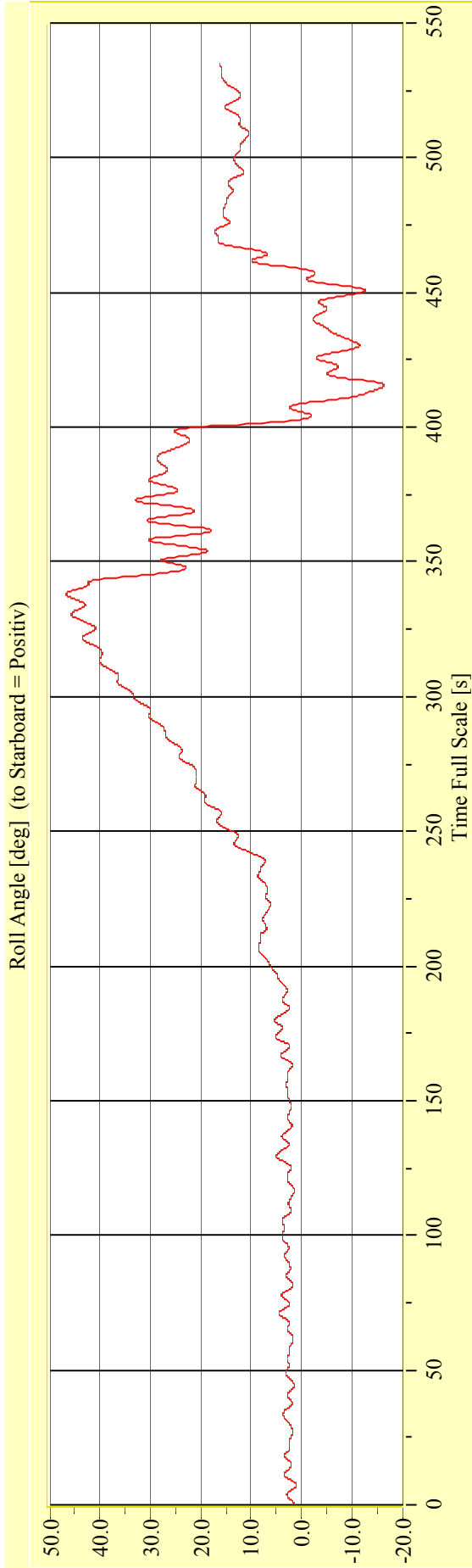
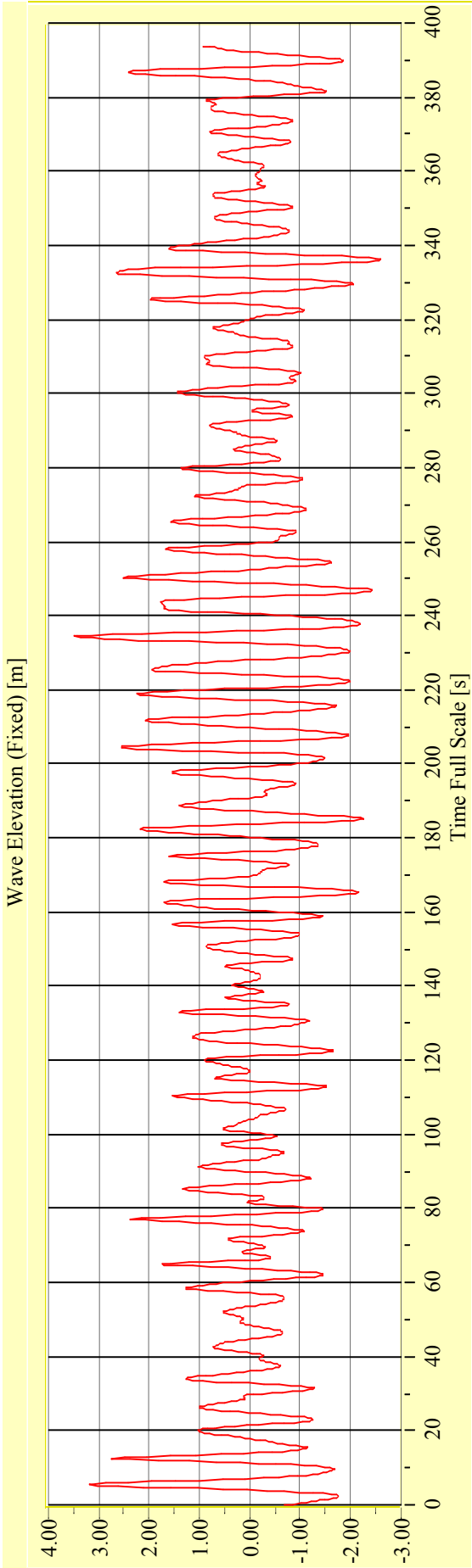
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29683-09**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**



**Date: 14.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

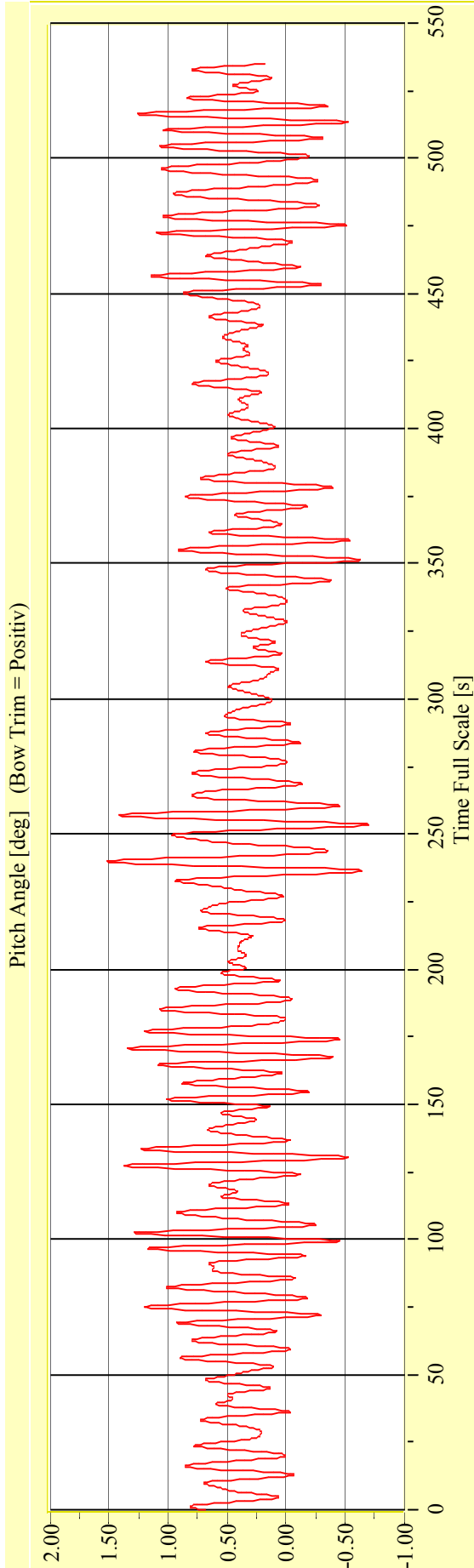
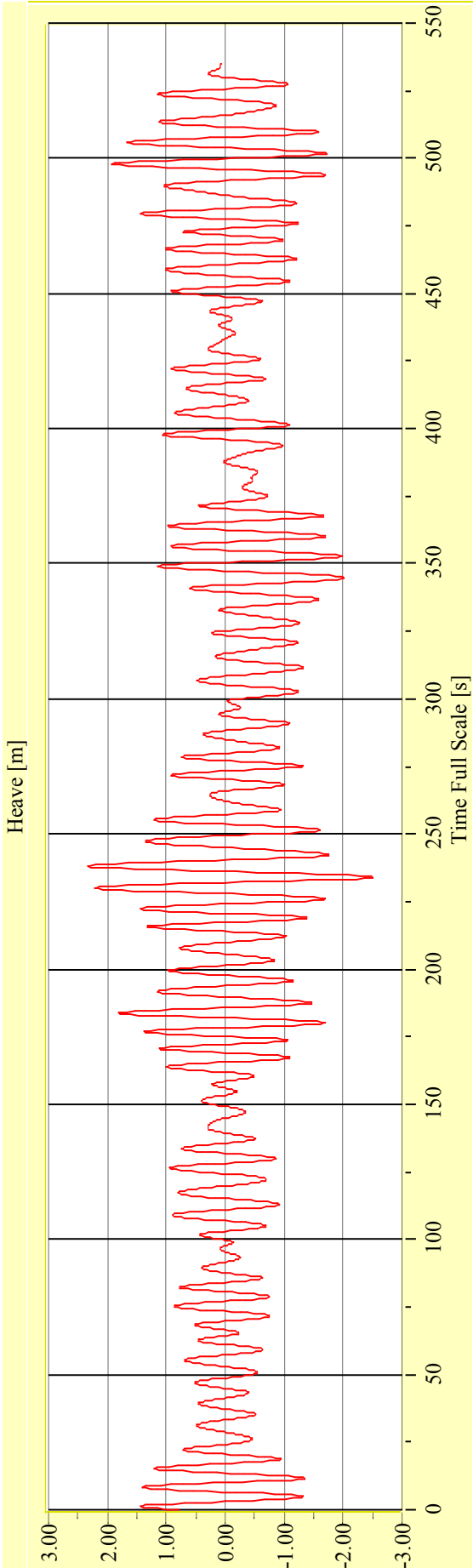
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29683-10**      **Target Waves: Hs = 4,0 m Tp = 8,0 s**      **gamma = 3,3**



**Date: 14.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

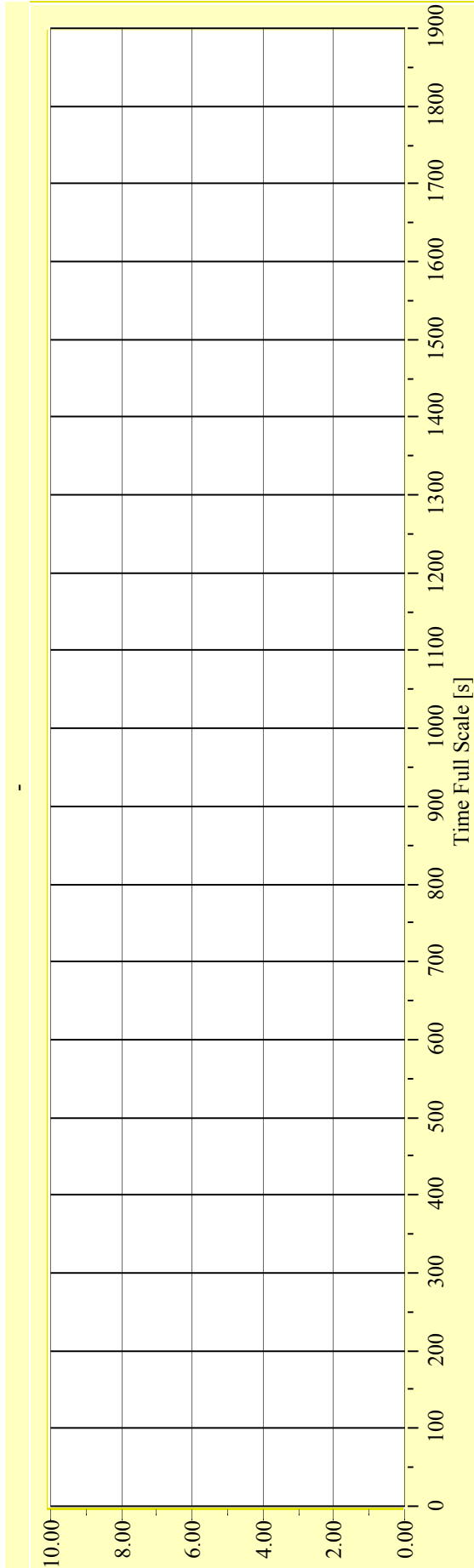
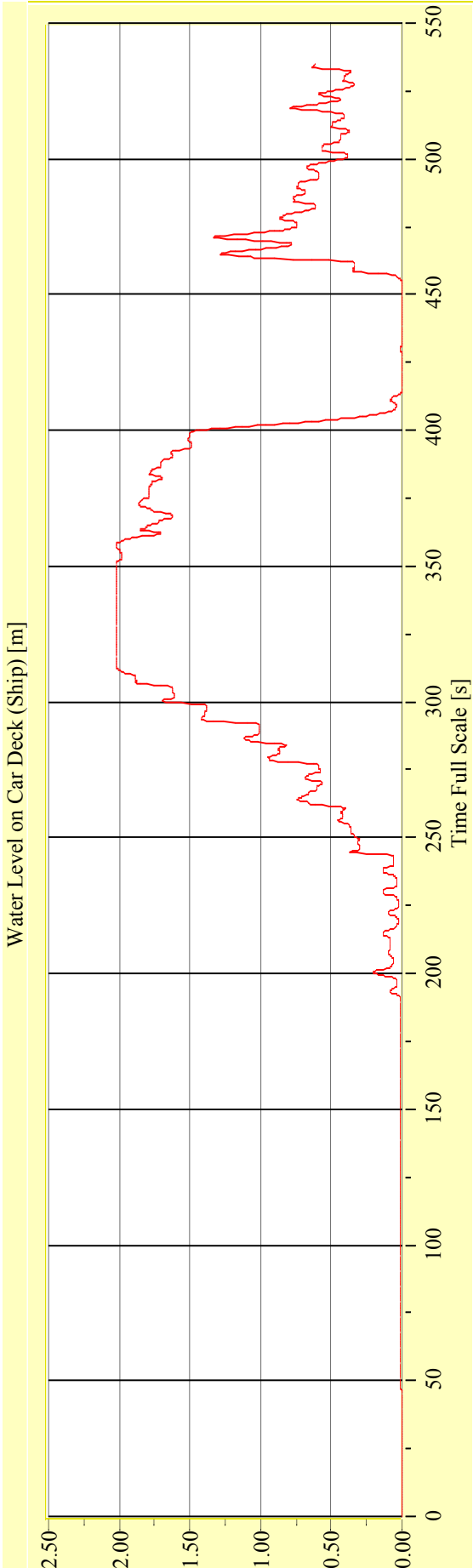
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29683-10**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**



**Date: 14.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29683-10**      **Target Waves: Hs = 4,0 m Tp = 8,0 s**      **gamma = 3,3**



**Date: 14.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

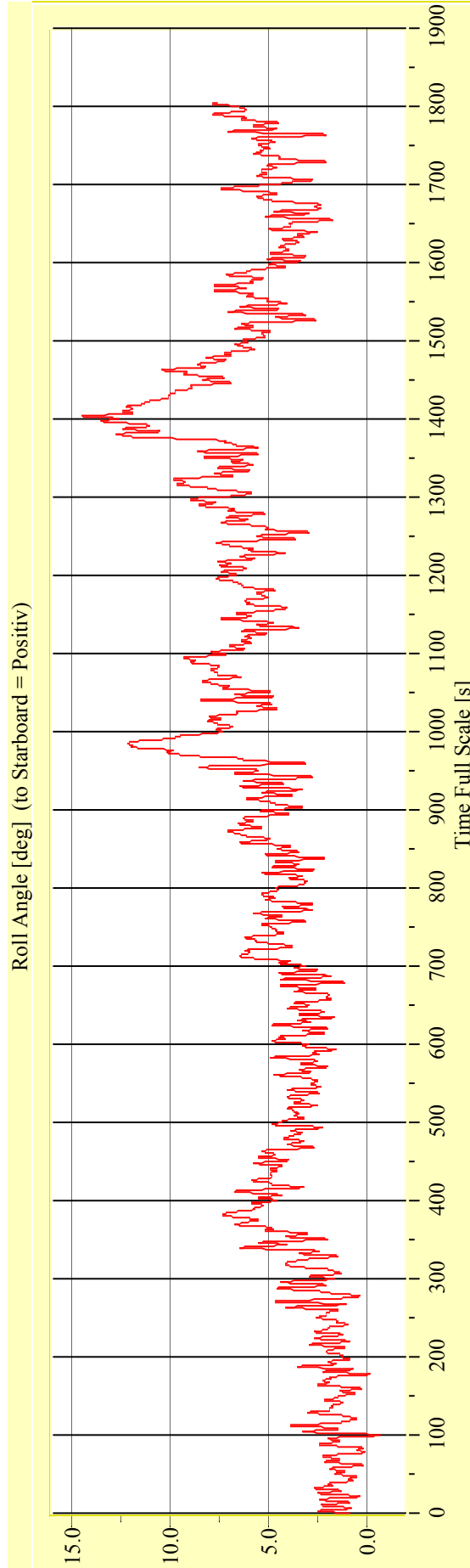
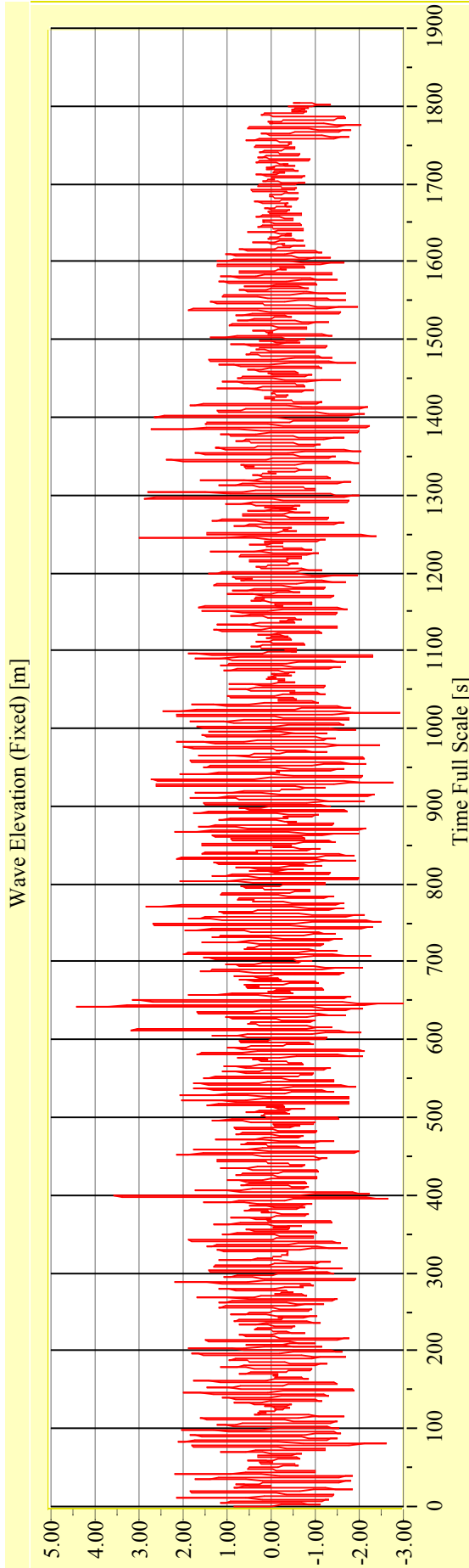
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29687-01**

**Target Waves: Hs = 3,75 m Tp = 7,746 s**

**gamma = 3,3**



**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

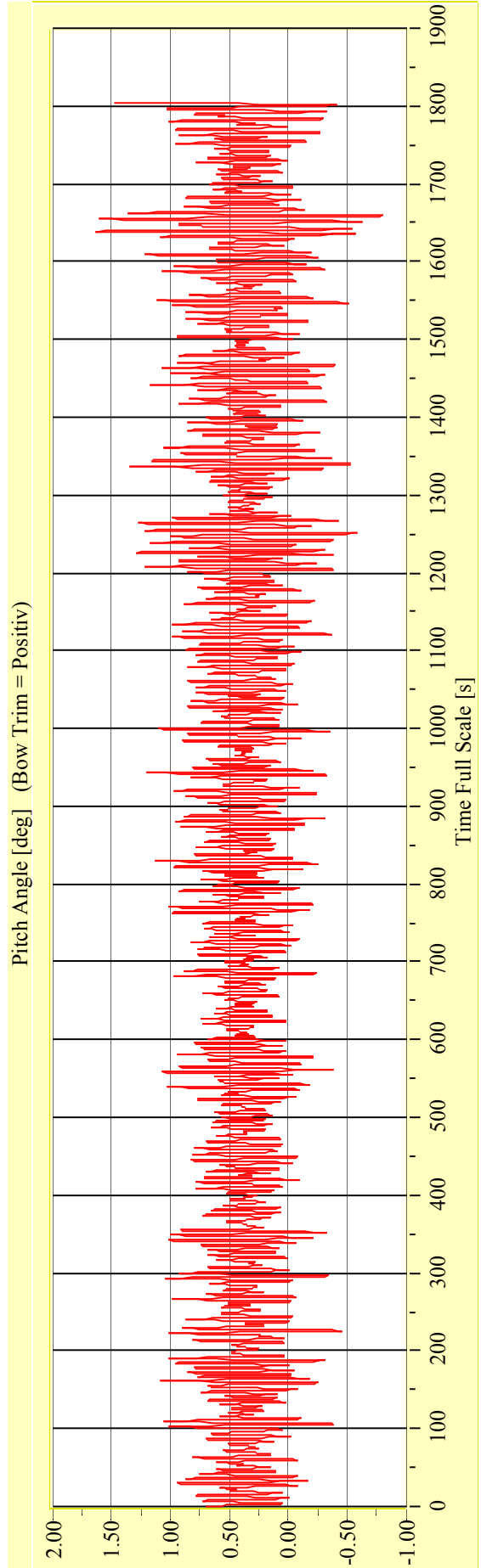
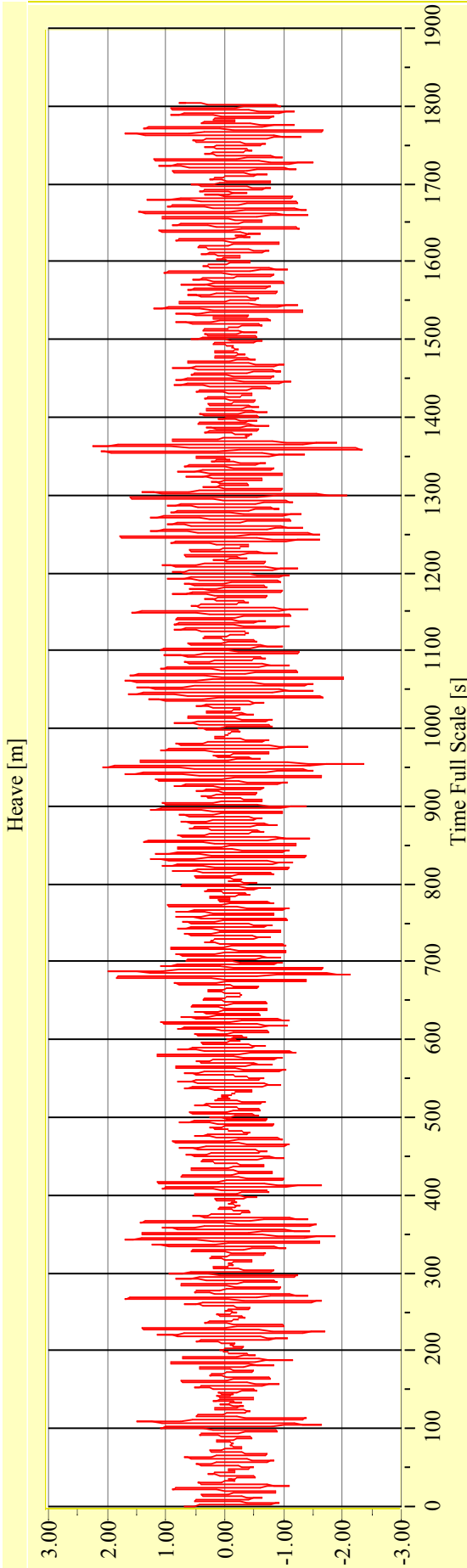
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29687-01**

**Target Waves: Hs = 3,75 m Tp = 7,746 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

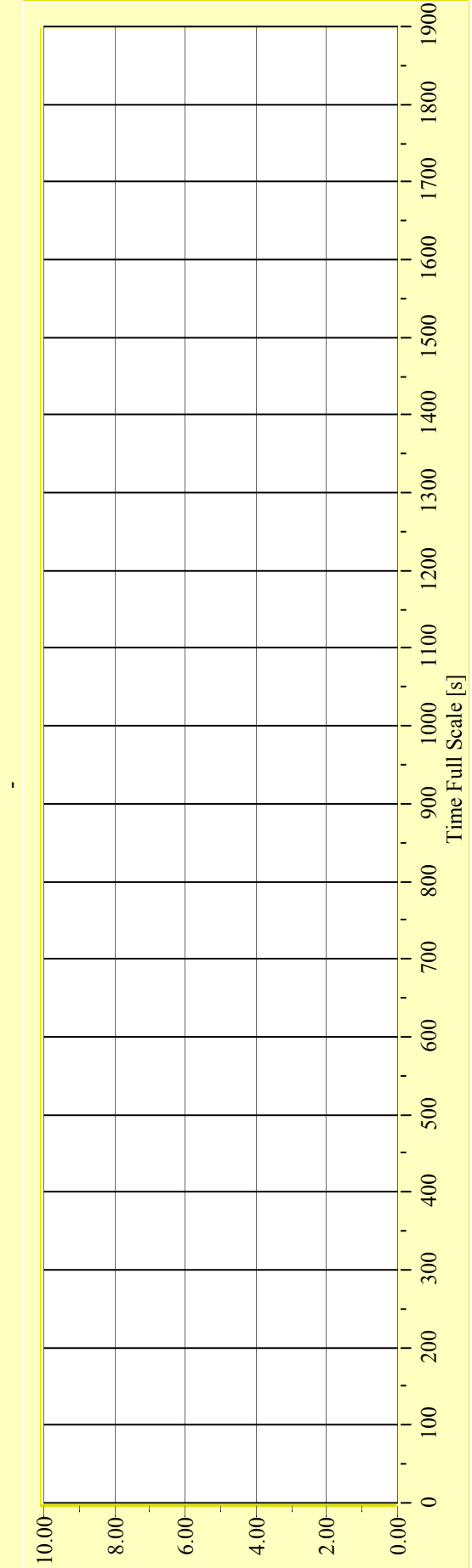
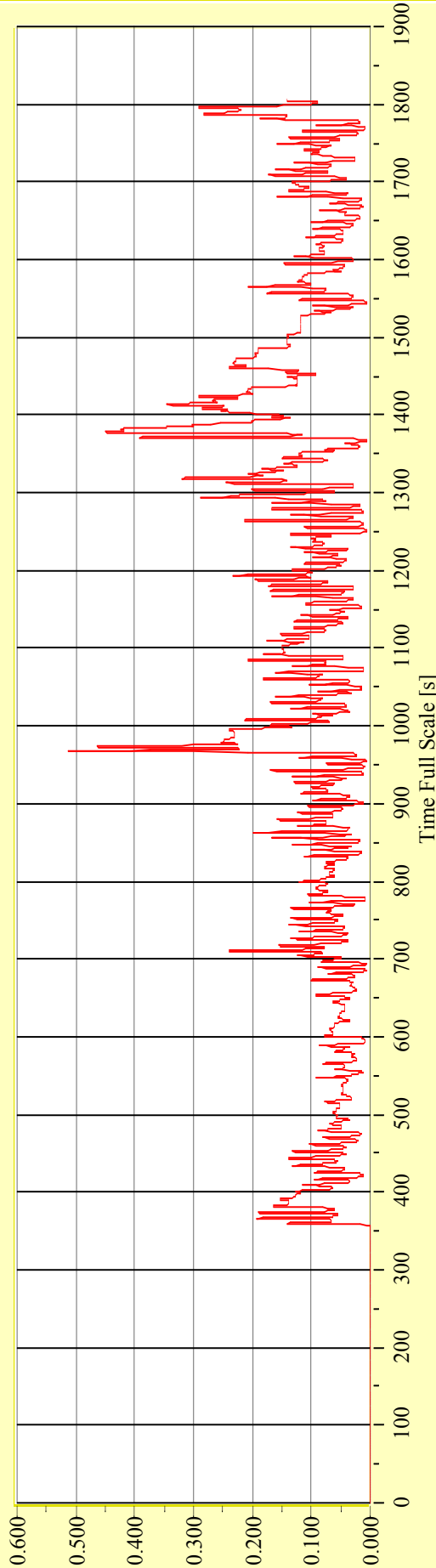
**Model No. 2446**

**Test No. 29687-01**

**Target Waves: Hs = 3,75 m Tp = 7,746 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**



**Irregular Beam Seas**

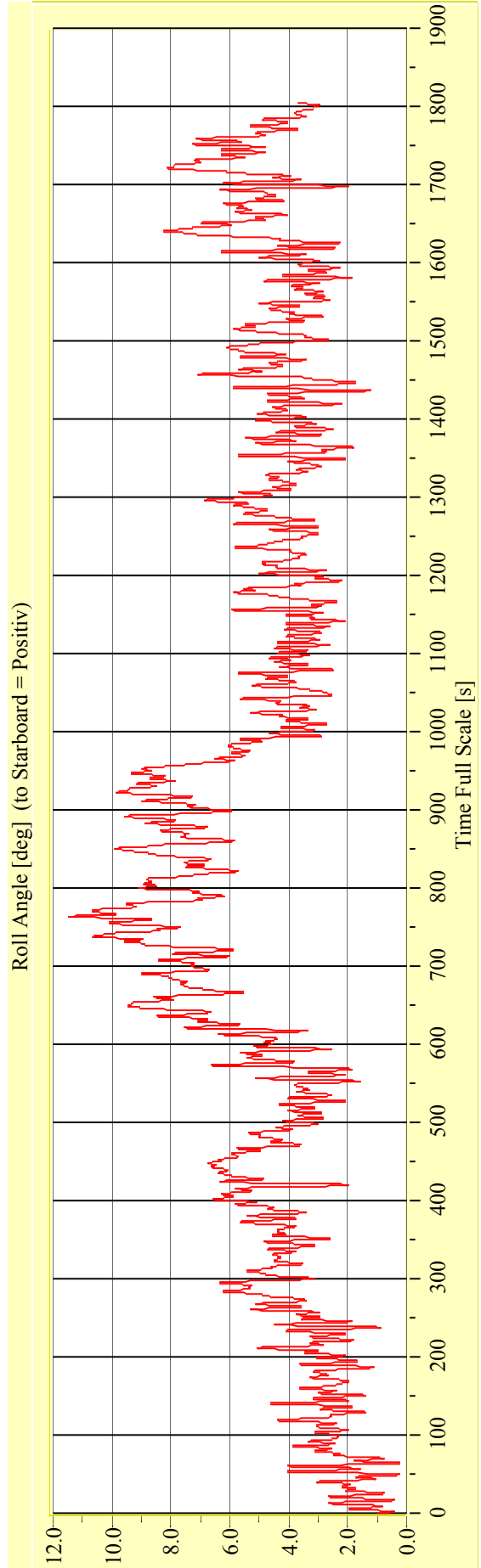
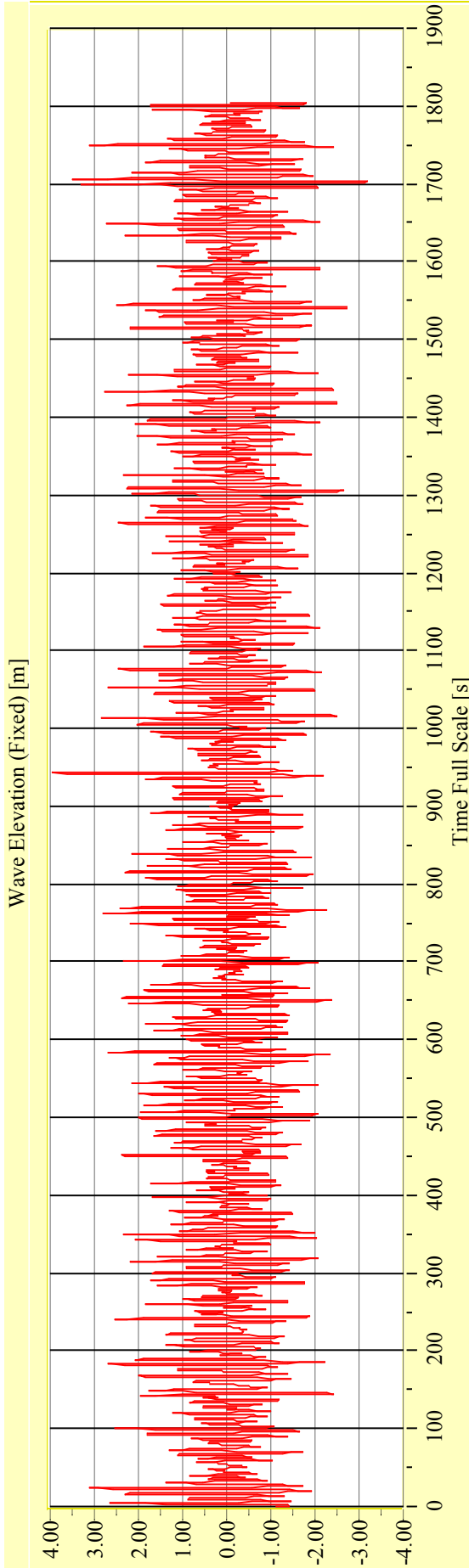
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29687-02**

**Target Waves: Hs = 3,75 m Tp = 7,746 s**

**gamma = 3,3**



**Irregular Beam Seas**

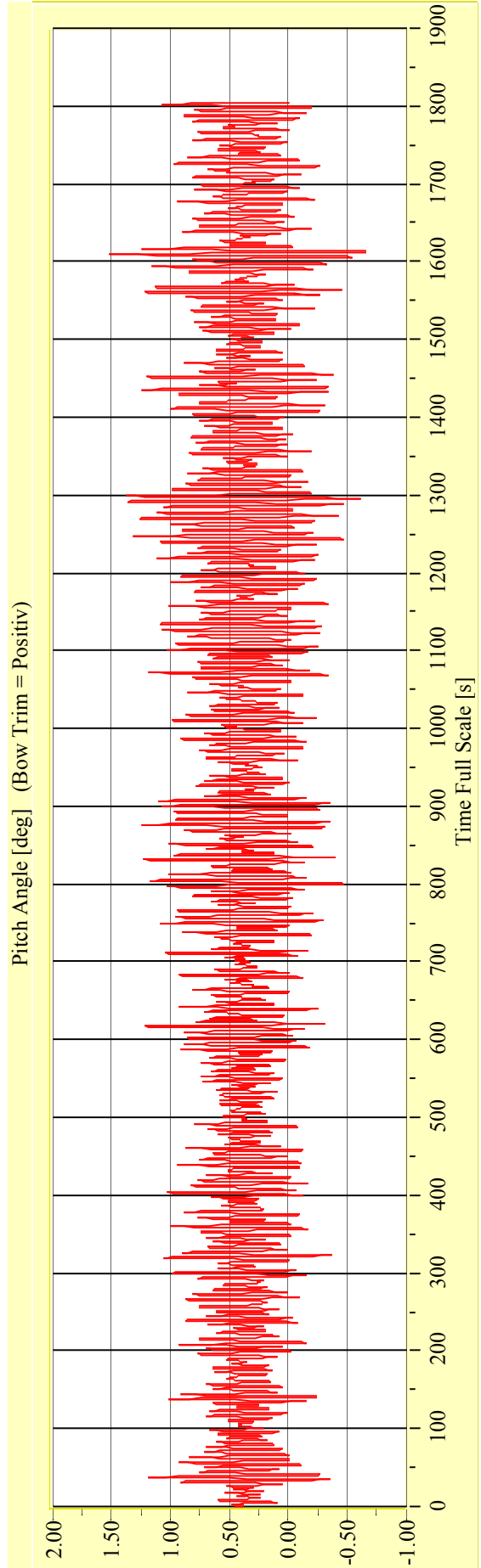
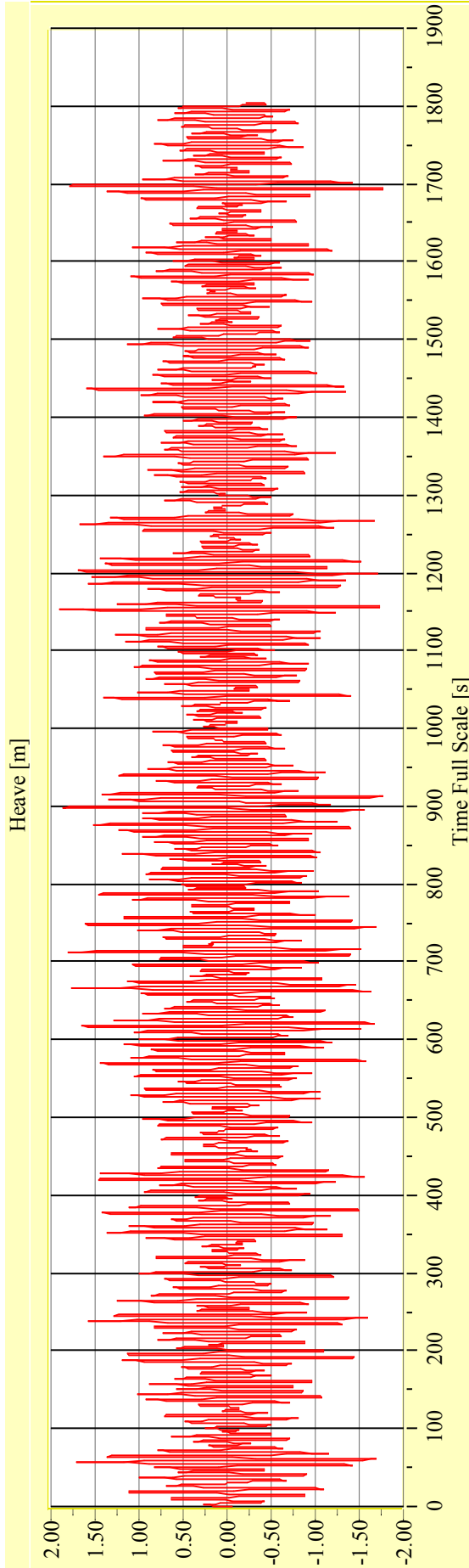
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29687-02**

**Target Waves: Hs = 3,75 m Tp = 7,746 s**

**gamma = 3,3**



**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**

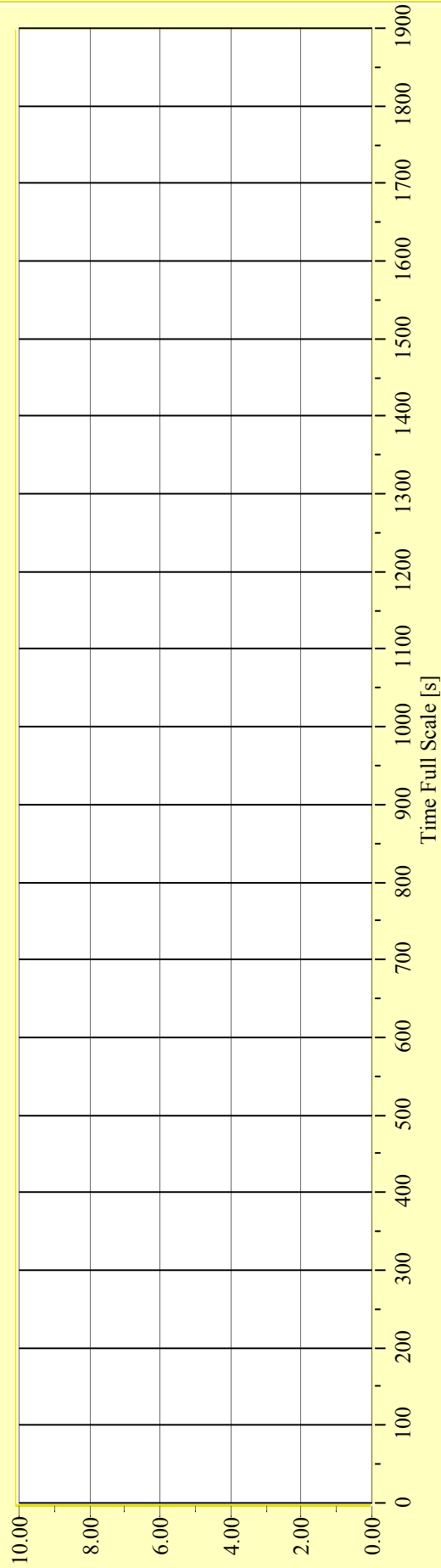
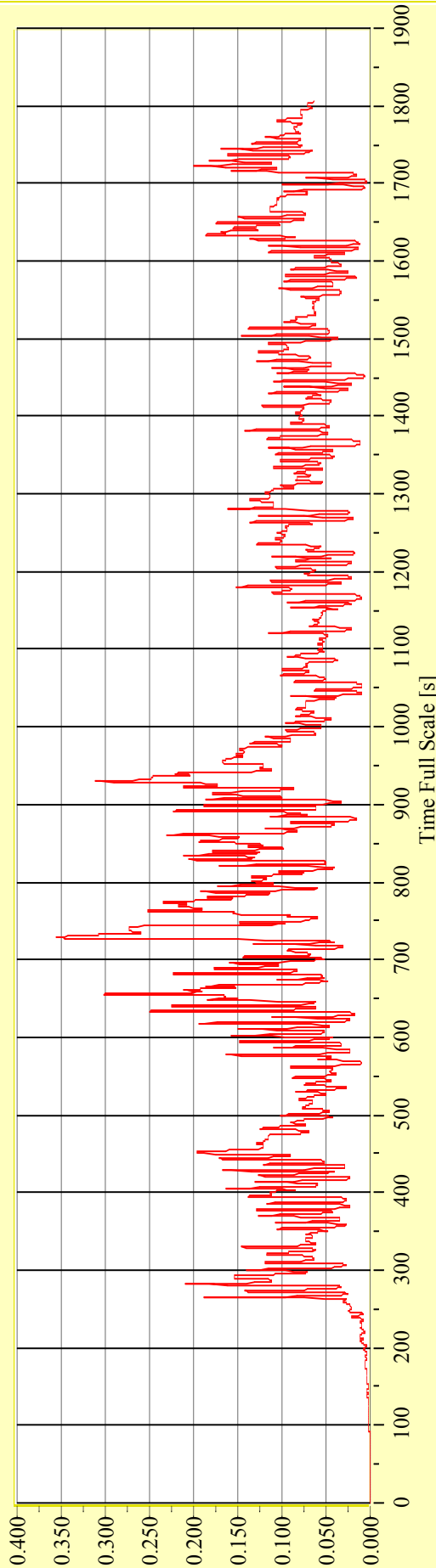
**Model No. 2446**

**Test No. 29687-02**

**Target Waves: Hs = 3,75 m Tp = 7,746 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

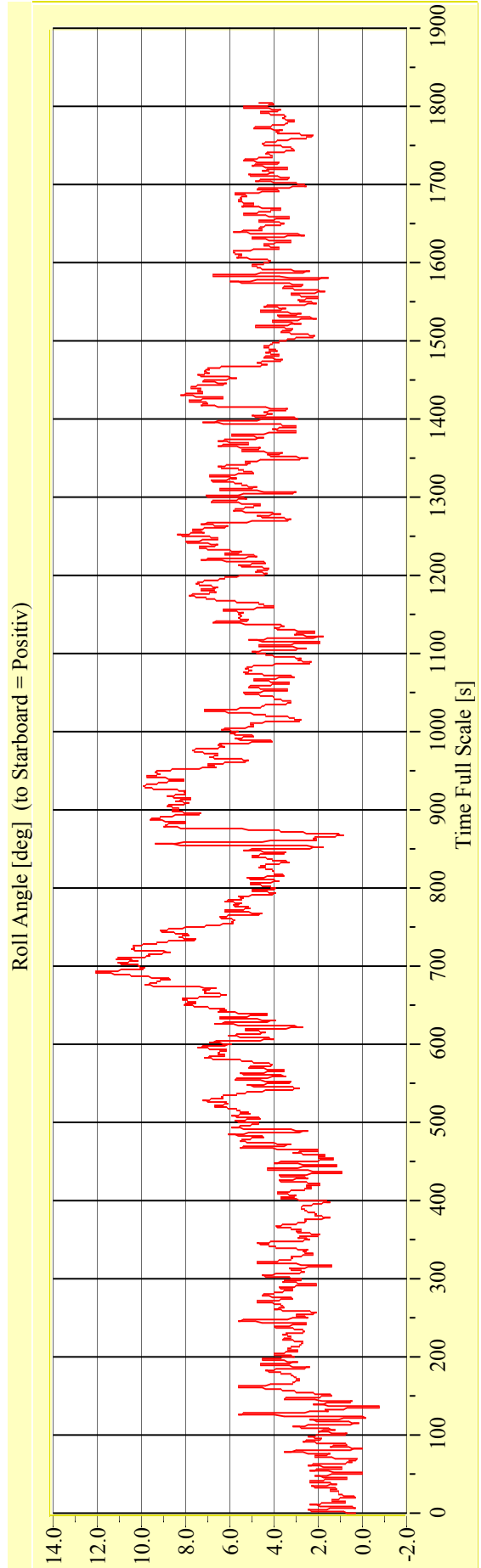
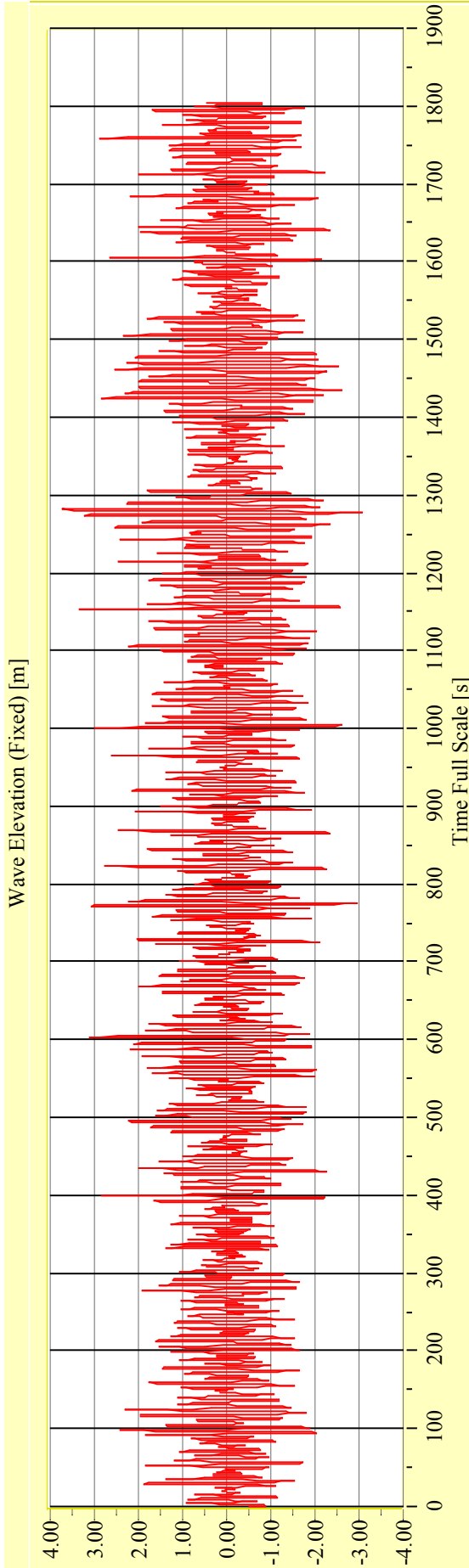
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29687-03**

**Target Waves: Hs = 3,75 m Tp = 7,746 s**

**gamma = 3,3**



**Irregular Beam Seas**

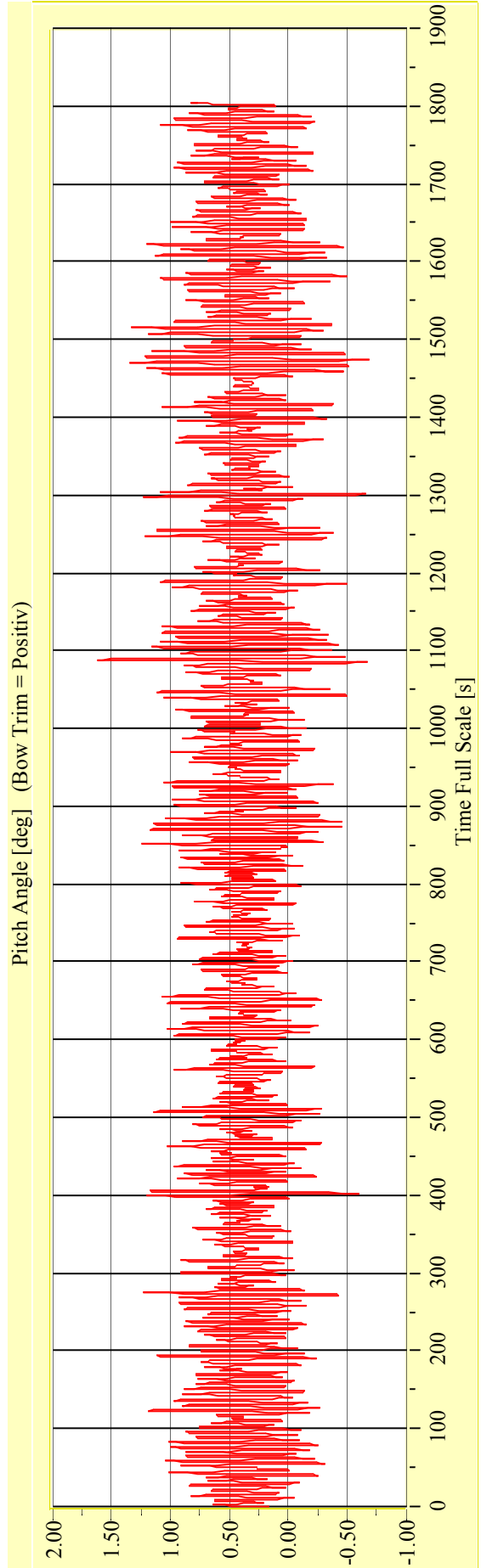
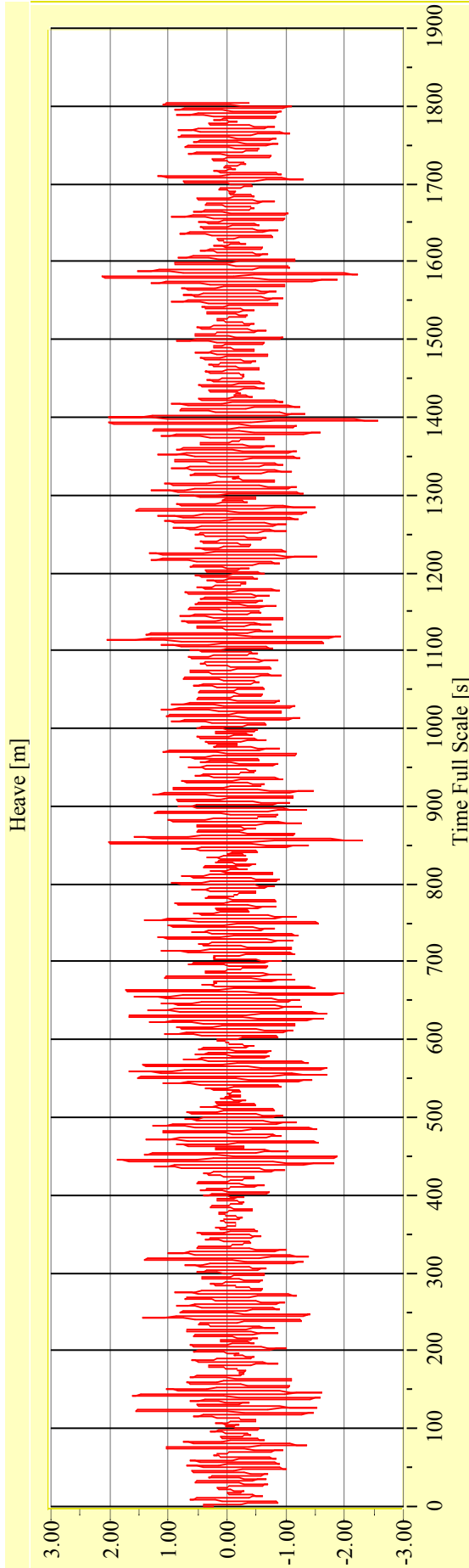
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29687-03**

**Target Waves: Hs = 3,75 m Tp = 7,746 s**

**gamma = 3,3**



**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**

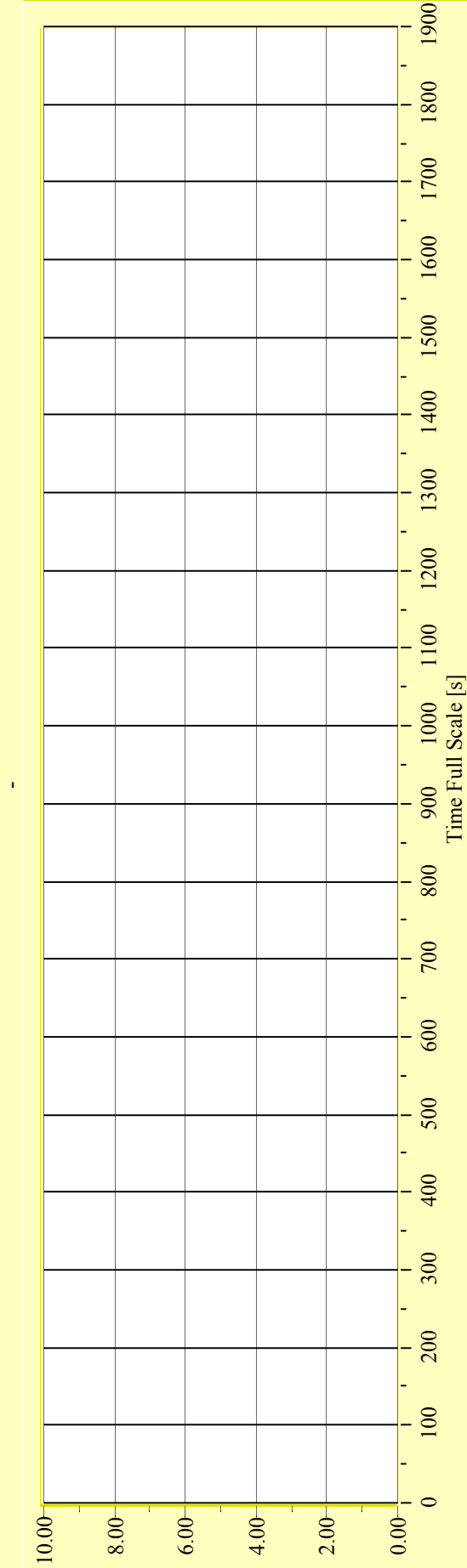
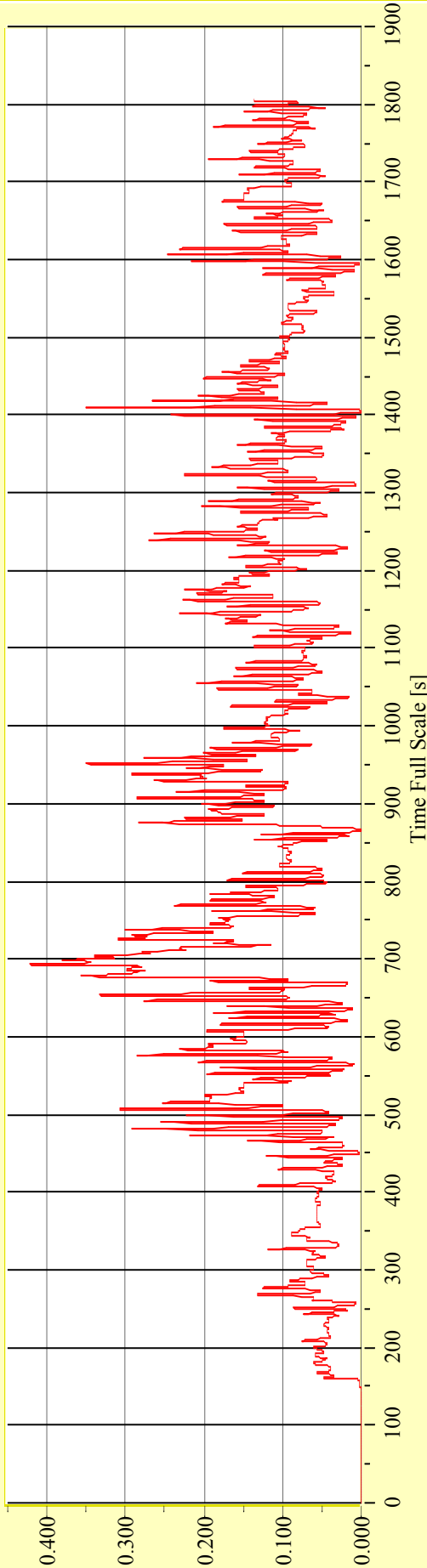
**Model No. 2446**

**Test No. 29687-03**

**Target Waves: Hs = 3,75 m Tp = 7,746 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

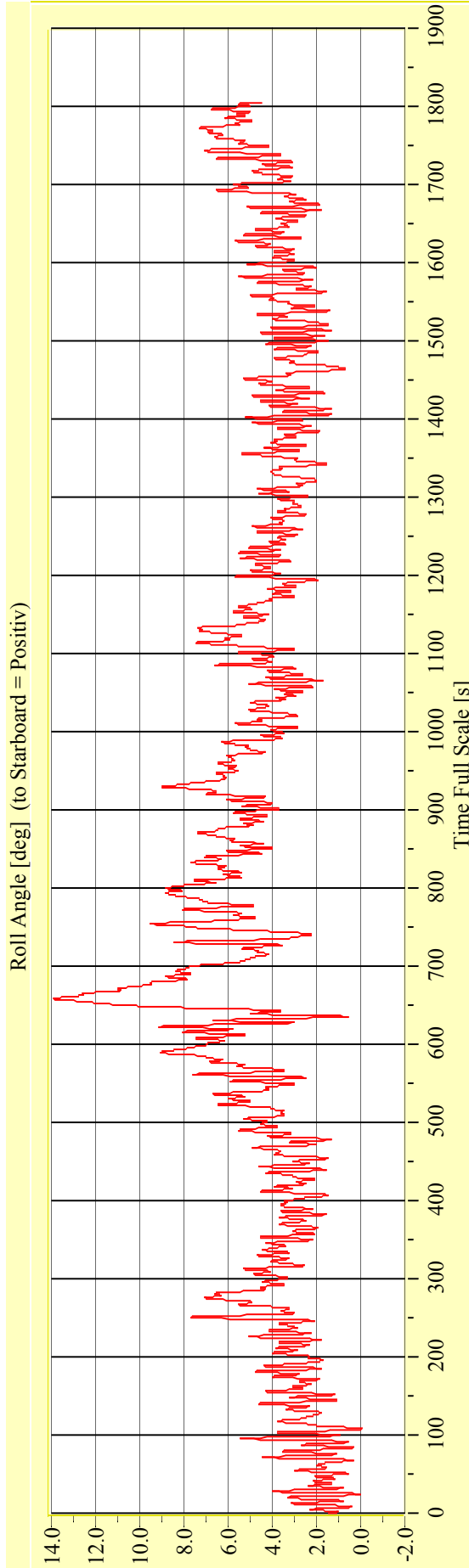
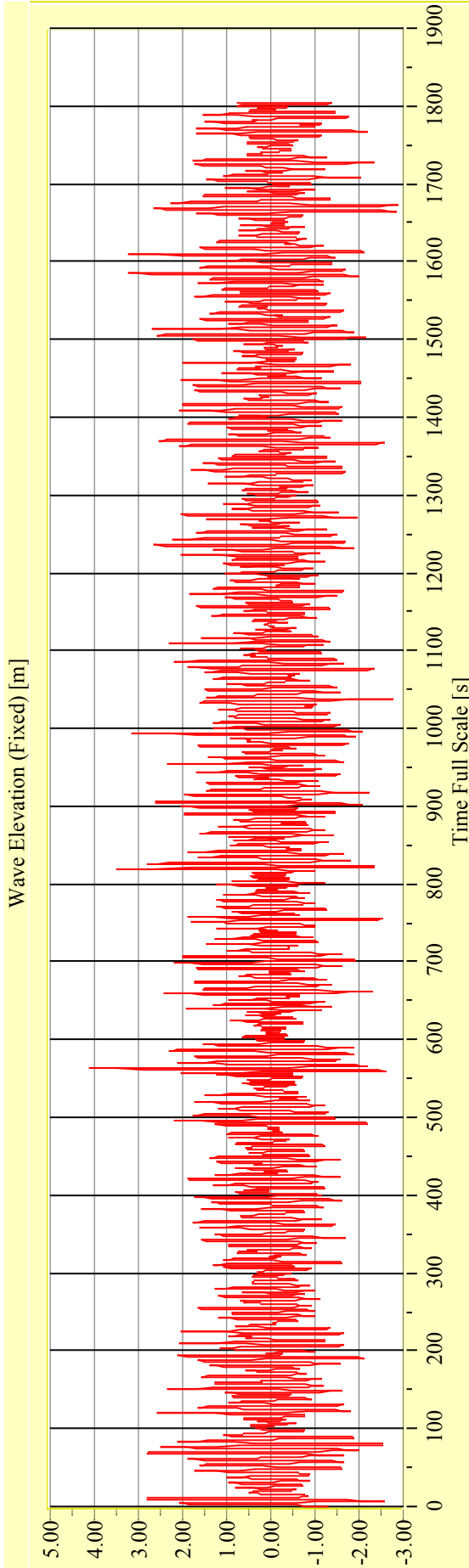
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29687-04**

**Target Waves: Hs = 3,75 m Tp = 7,746 s**

**gamma = 3,3**



**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

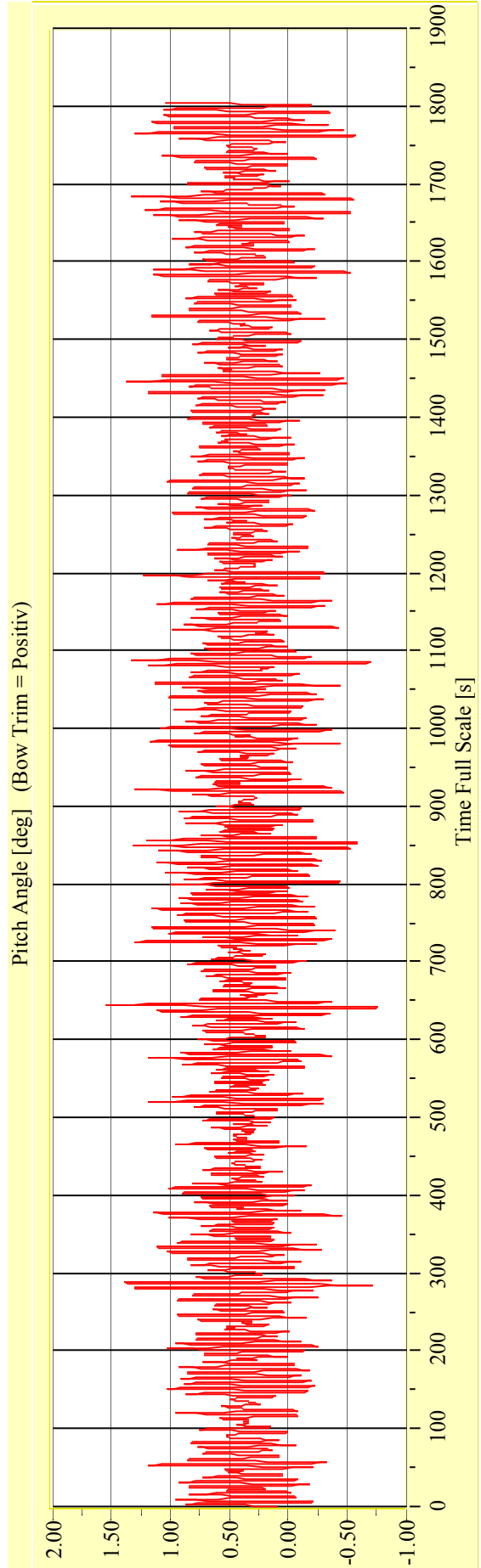
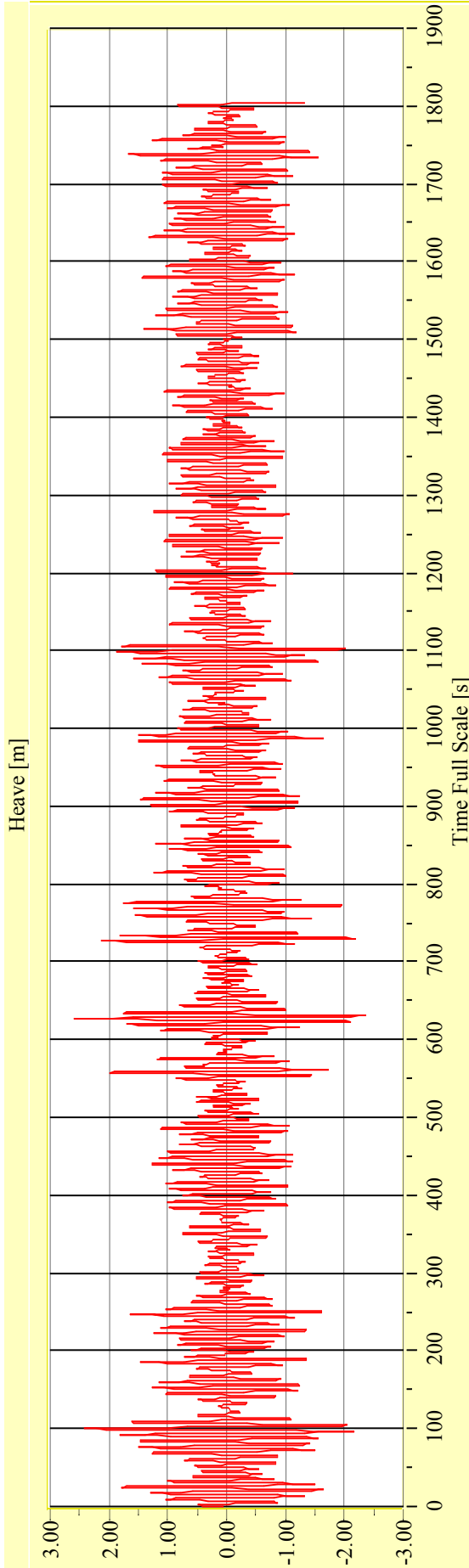
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29687-04**

**Target Waves: Hs = 3,75 m Tp = 7,746 s**

**gamma = 3,3**





**Irregular Beam Seas**

**Vienna Model Basin**

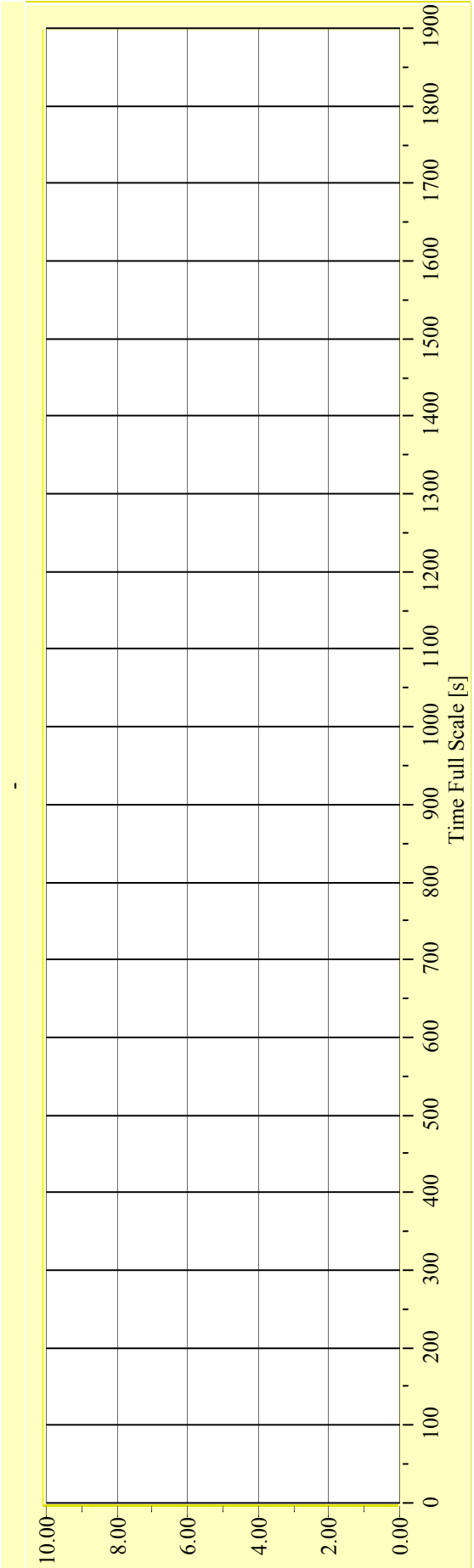
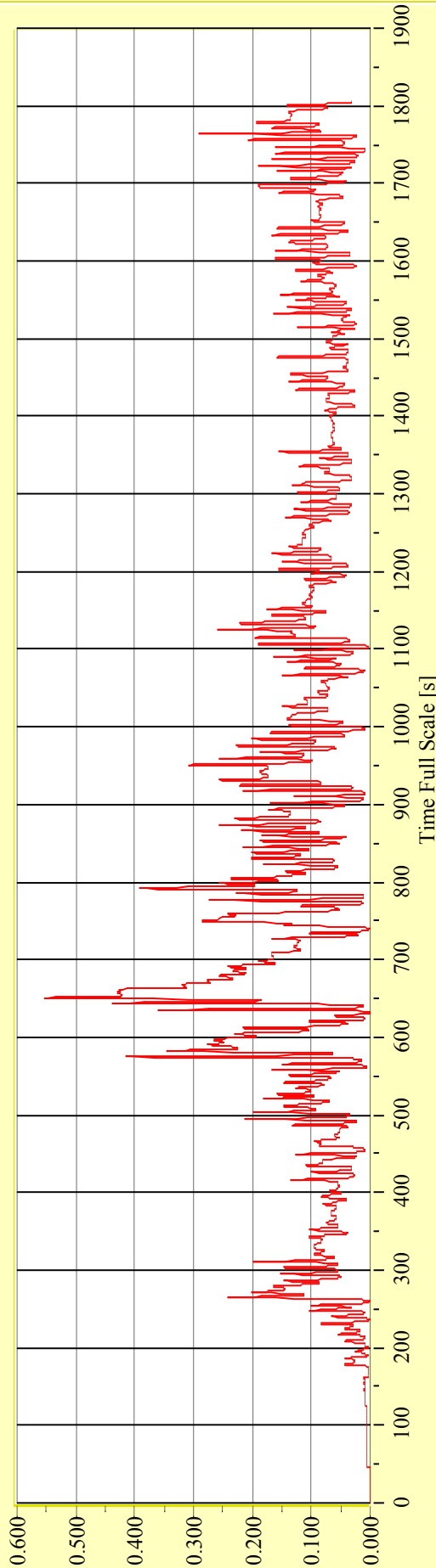
**Model No. 2446**

**Test No. 29687-04**

**Target Waves: Hs = 3,75 m Tp = 7,746 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**

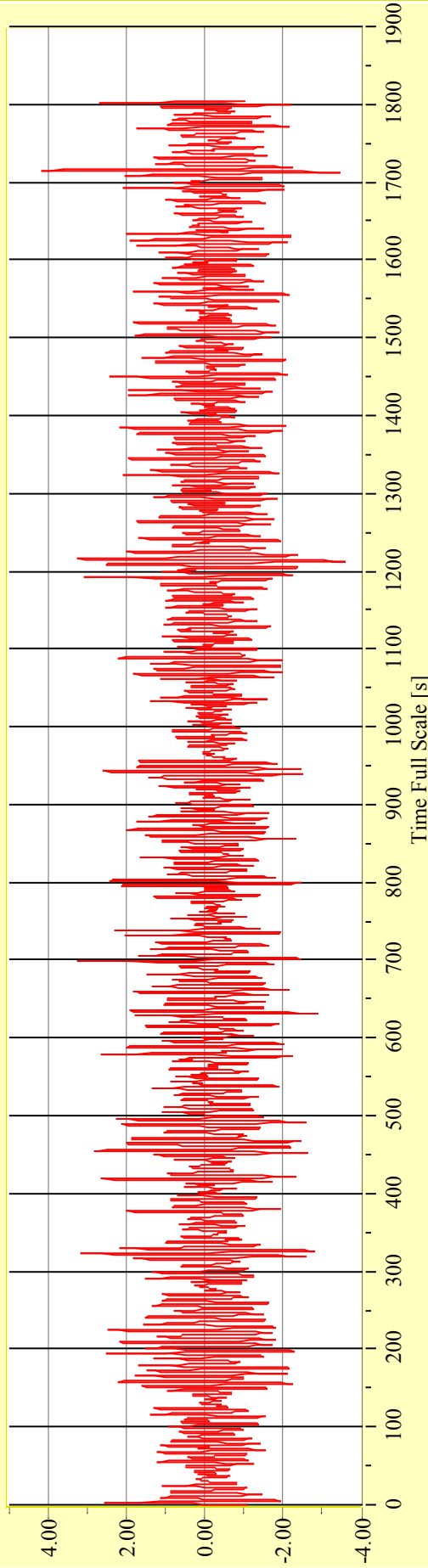
**Model No. 2446**

**Test No. 29687-05**

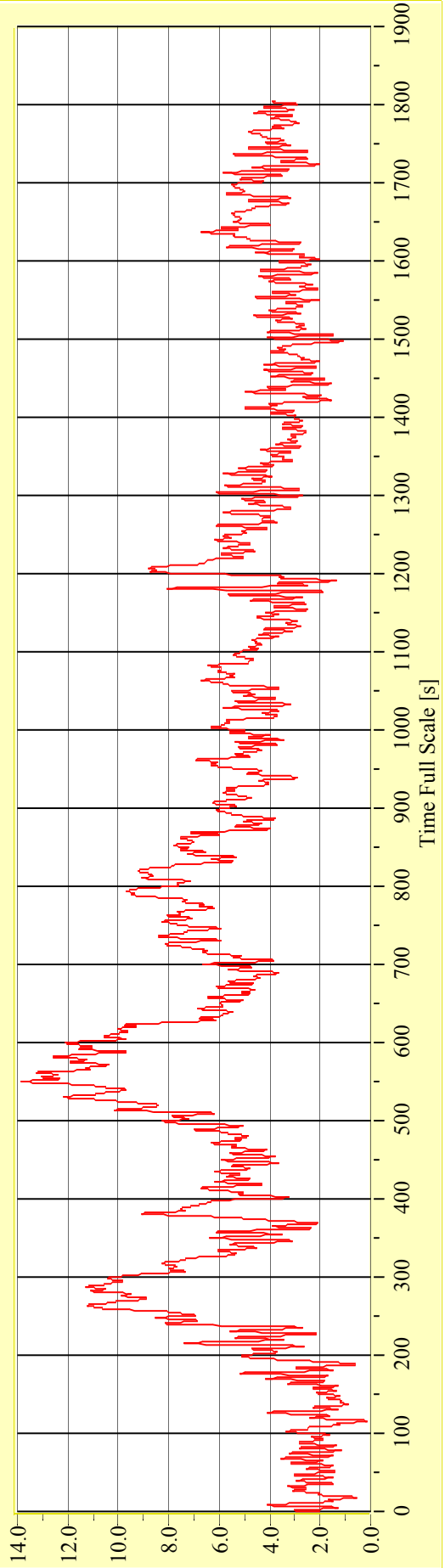
**Target Waves: Hs = 3,75 m Tp = 7,746 s**

**gamma = 3,3**

Wave Elevation (Fixed) [m]



Roll Angle [deg] (to Starboard = Positiv)



**Irregular Beam Seas**

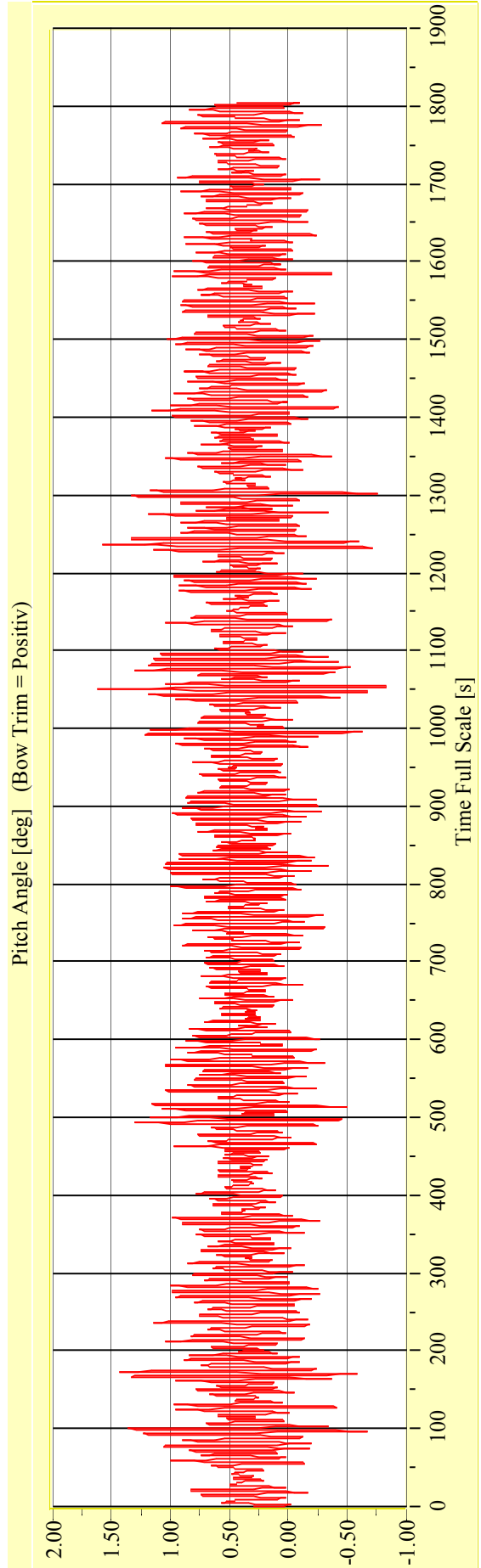
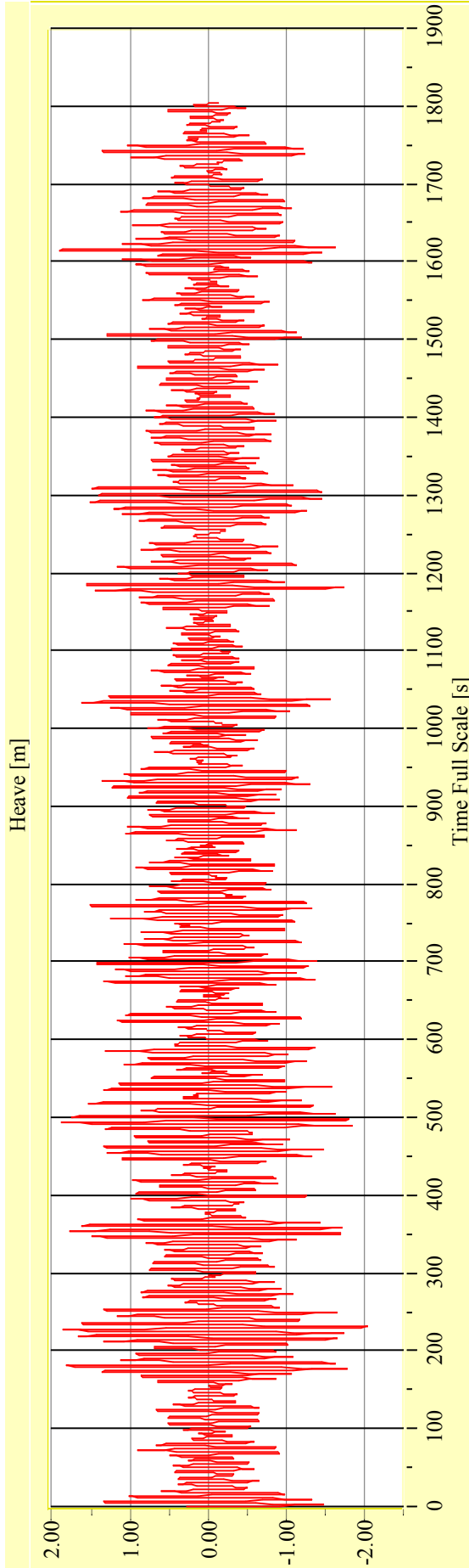
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29687-05**

**Target Waves: Hs = 3,75 m Tp = 7,746 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

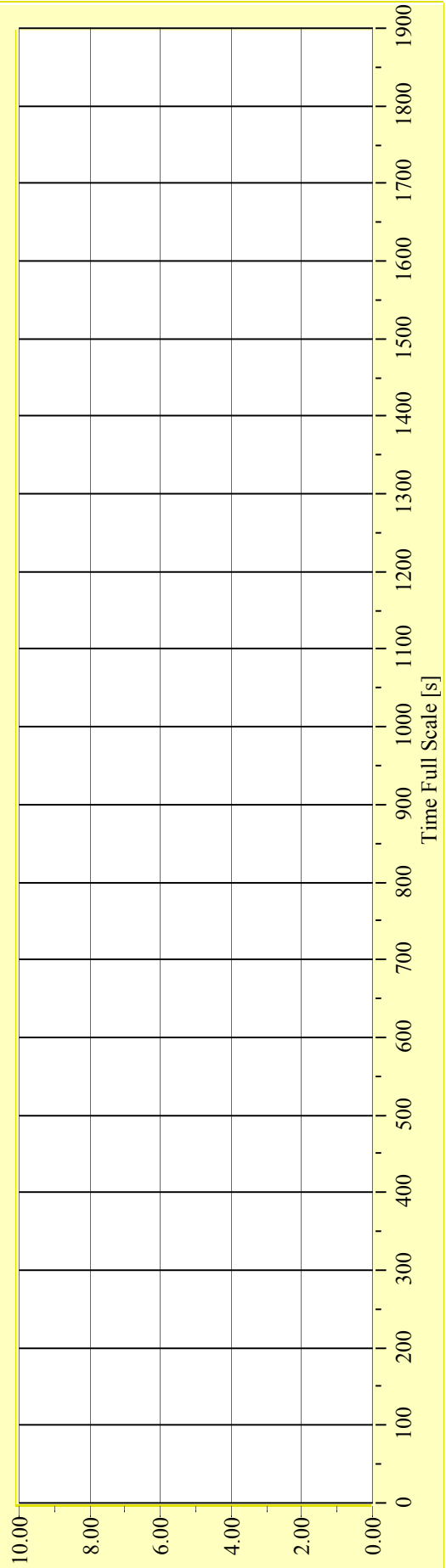
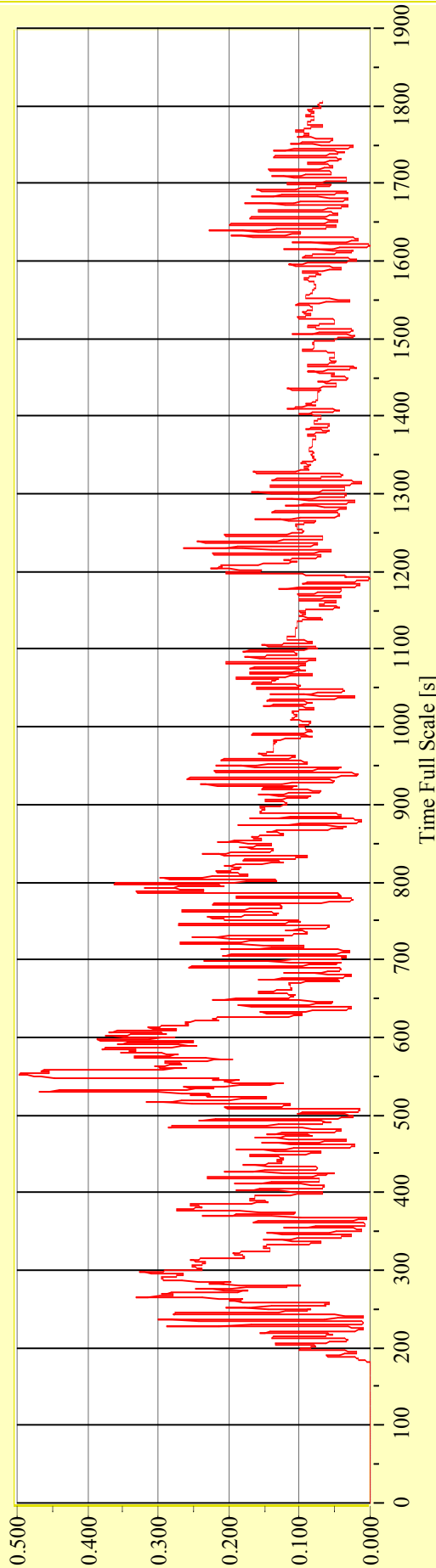
**Model No. 2446**

**Test No. 29687-05**

**Target Waves: Hs = 3,75 m Tp = 7,746 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



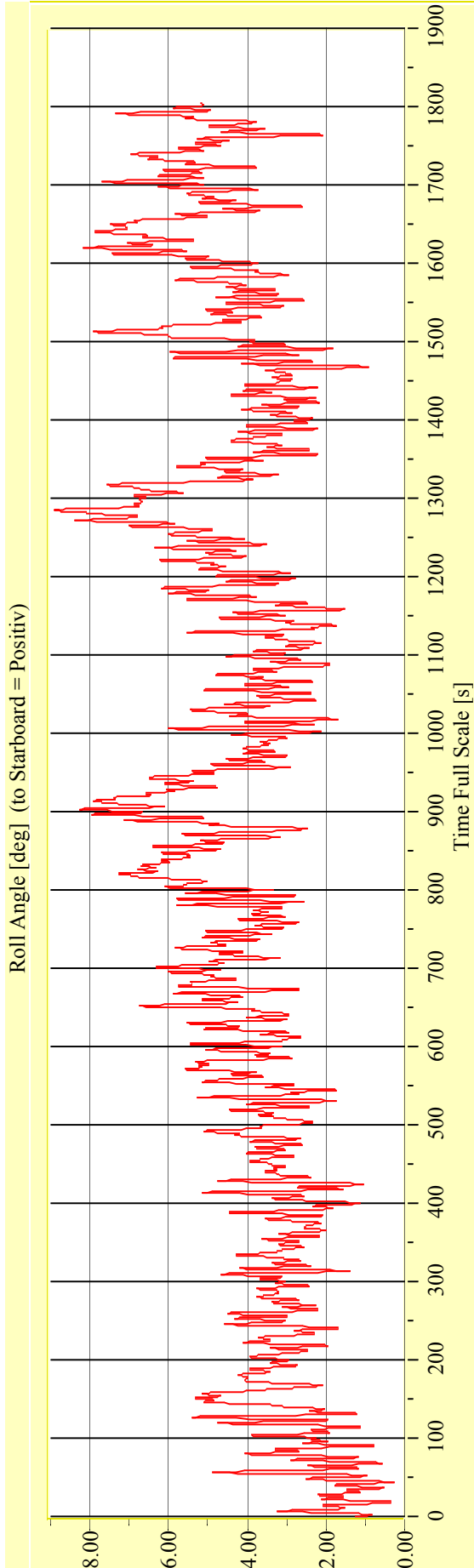
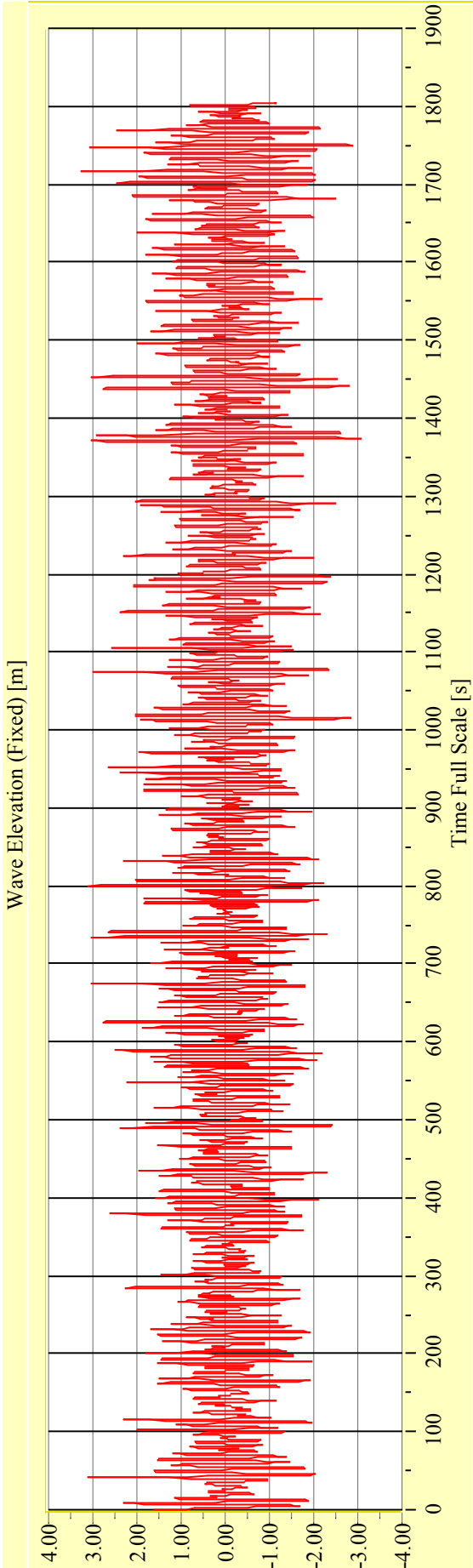
**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29687-06**      **Target Waves: Hs = 3,75 m Tp = 7,746 s**      **gamma = 3,3**



**Date: 20.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

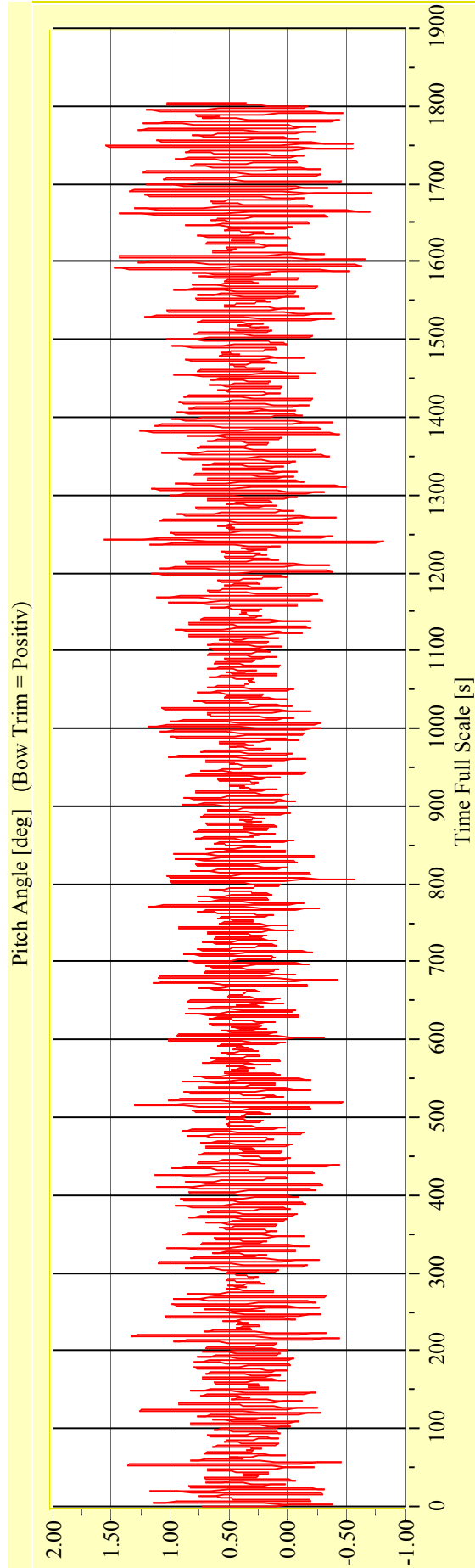
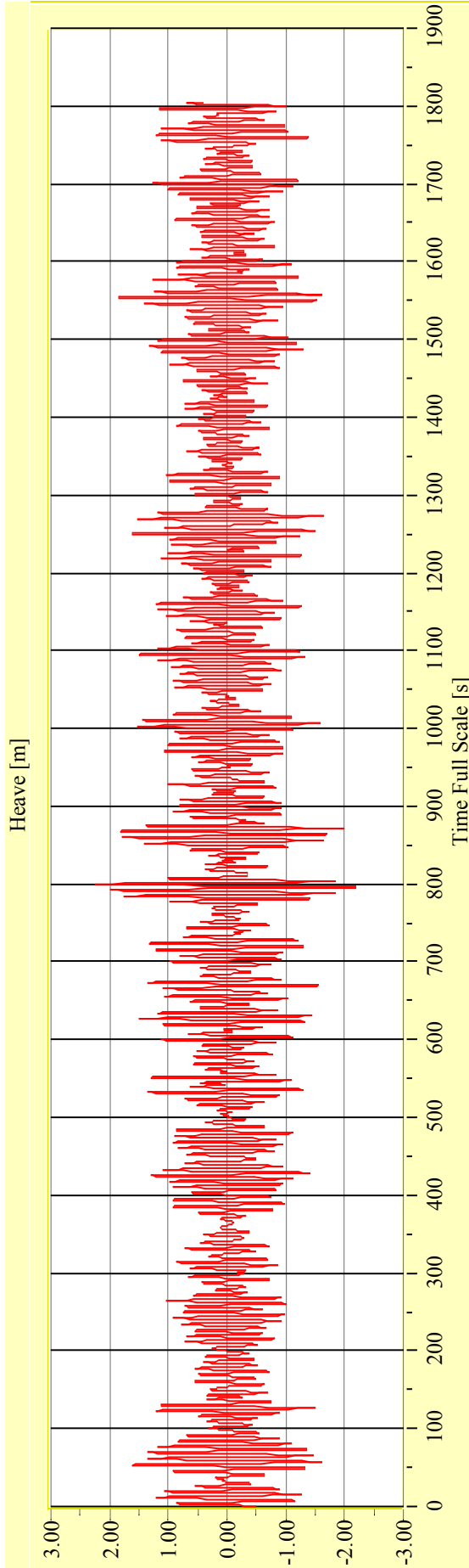
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29687-06**

**Target Waves: Hs = 3,75 m Tp = 7,746 s**

**gamma = 3,3**



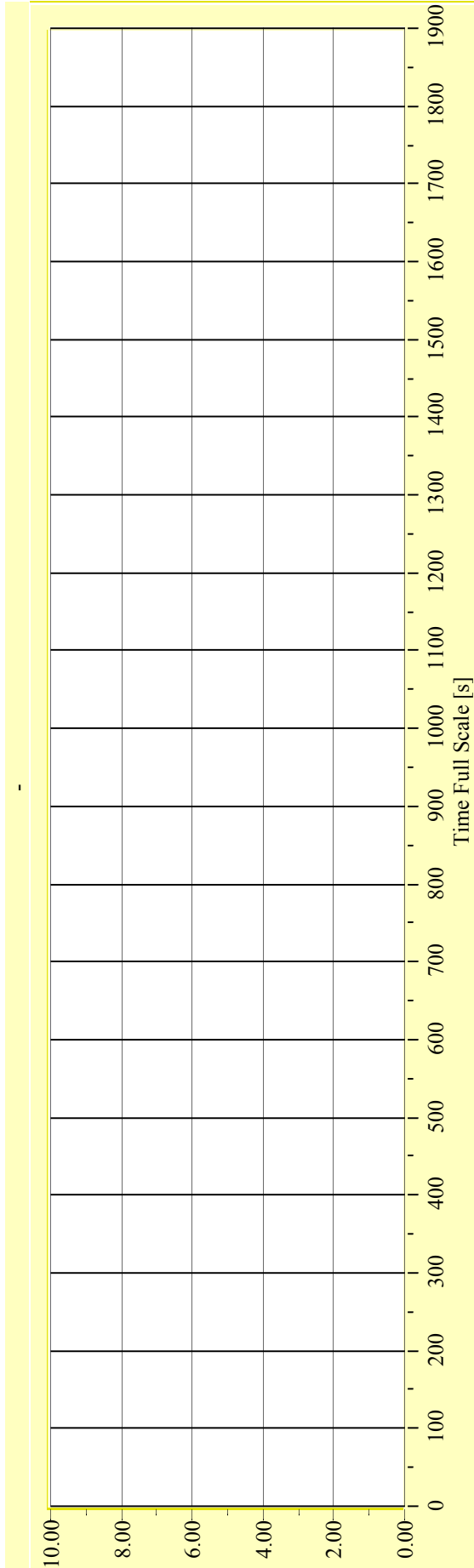
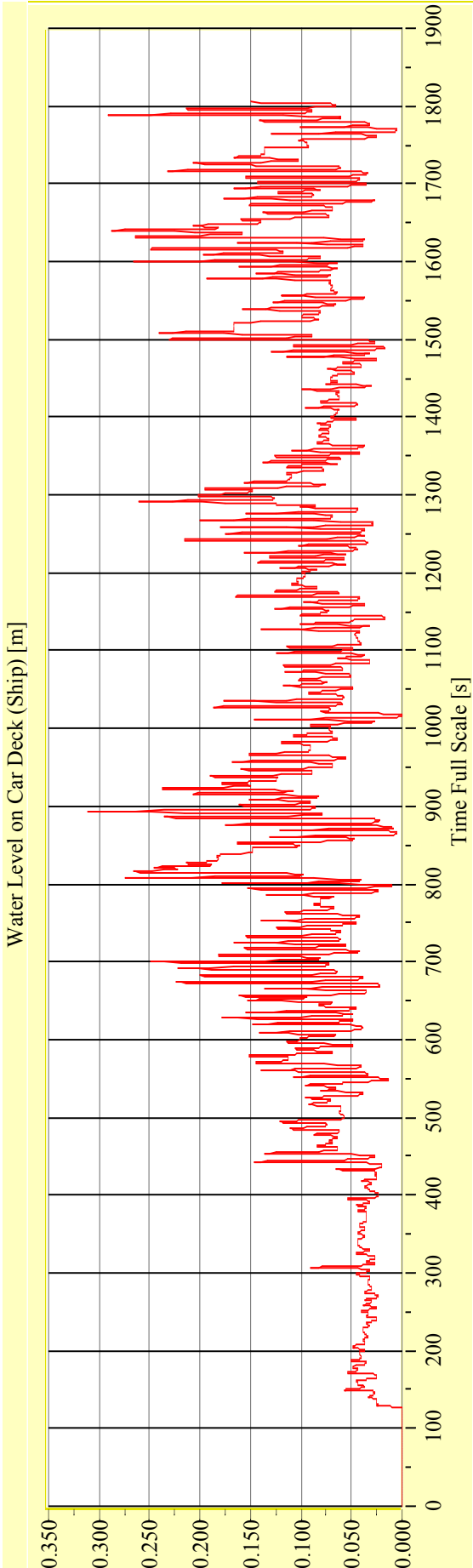
**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

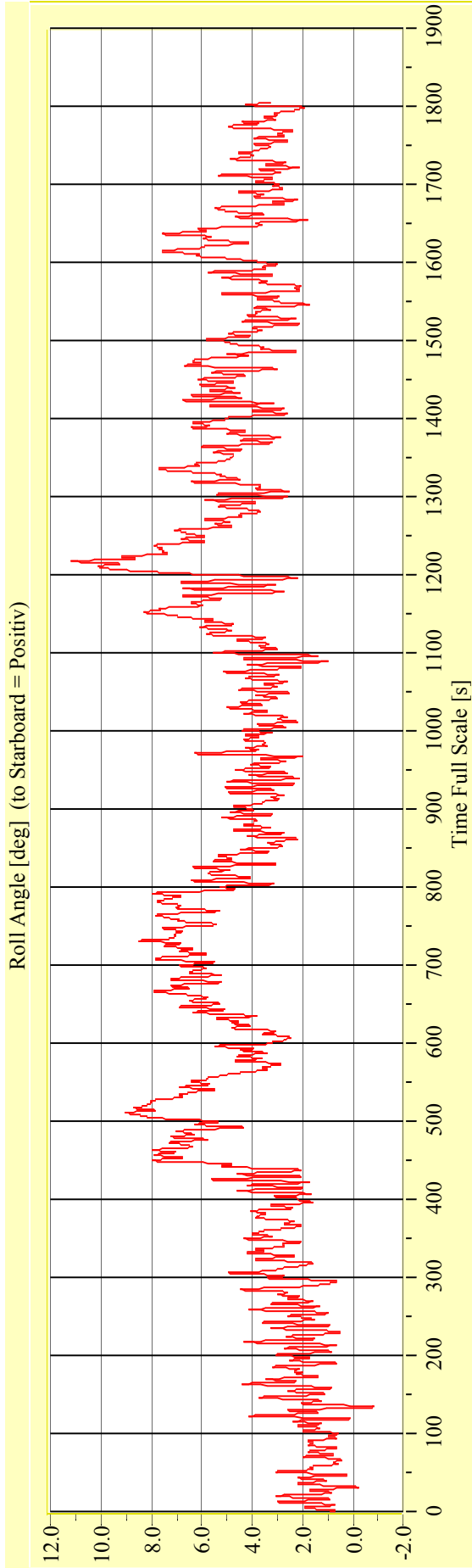
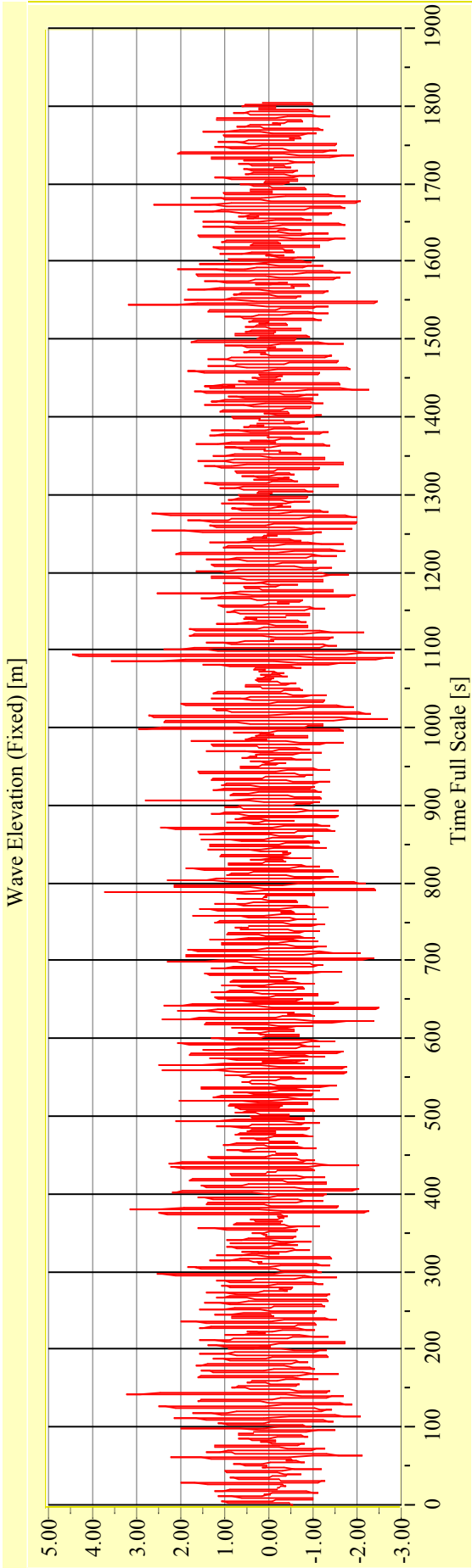
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29687-06**      **Target Waves: Hs = 3,75 m Tp = 7,746 s**      **gamma = 3,3**



**Date: 20.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29687-07**      **Target Waves: Hs = 3,75 m Tp = 7,746 s**      **gamma = 3,3**



**Date: 20.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**



**Irregular Beam Seas**

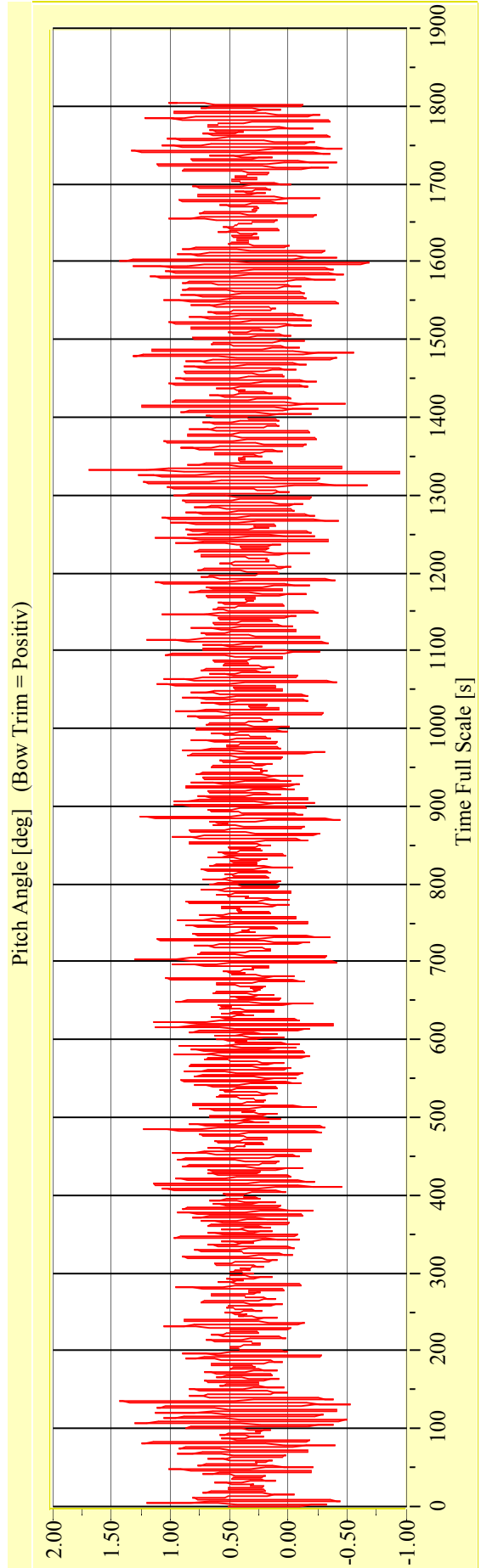
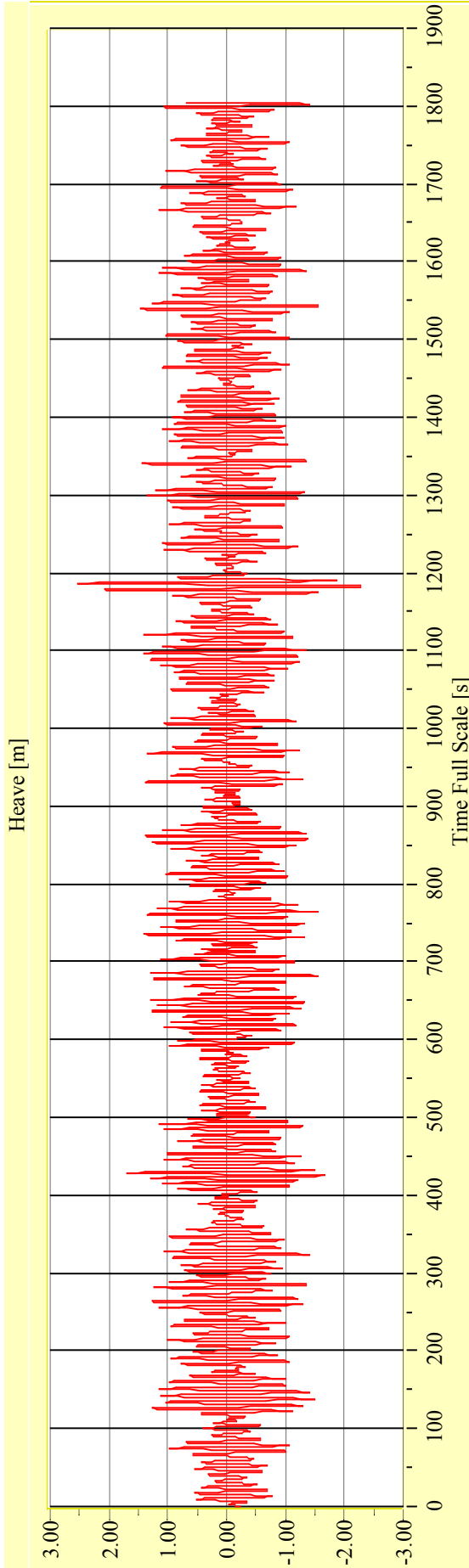
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29687-07**

**Target Waves: Hs = 3,75 m Tp = 7,746 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

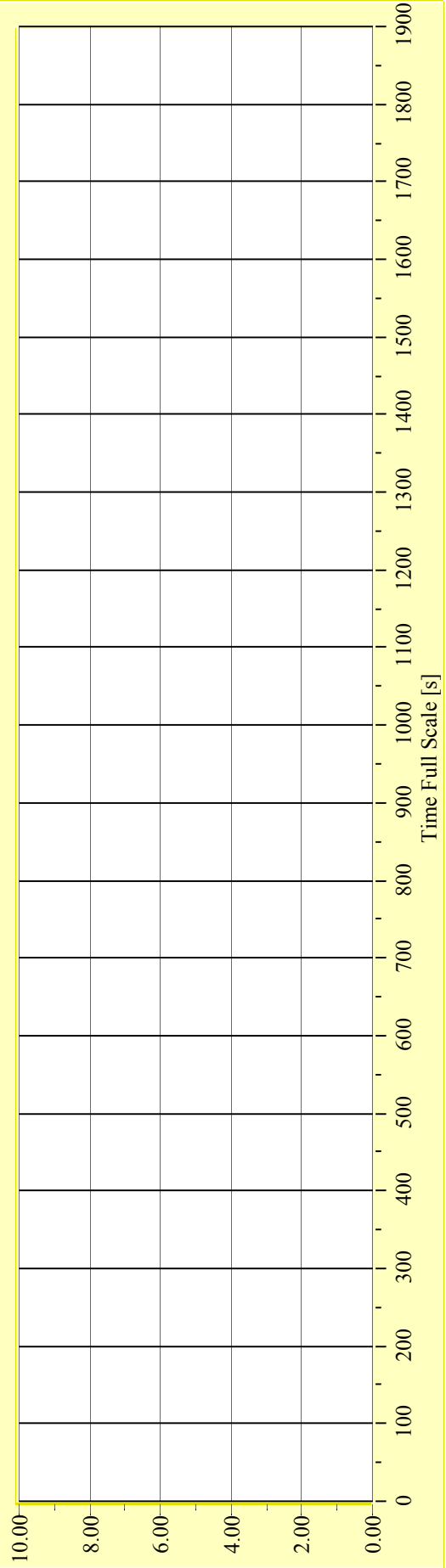
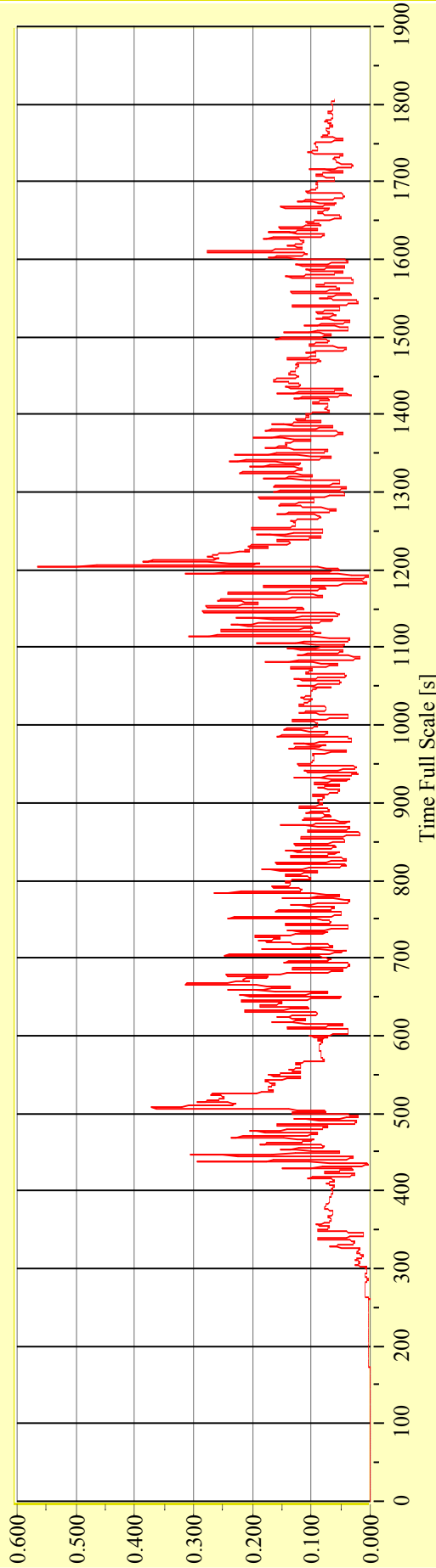
**Model No. 2446**

**Test No. 29687-07**

**Target Waves: Hs = 3,75 m Tp = 7,746 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

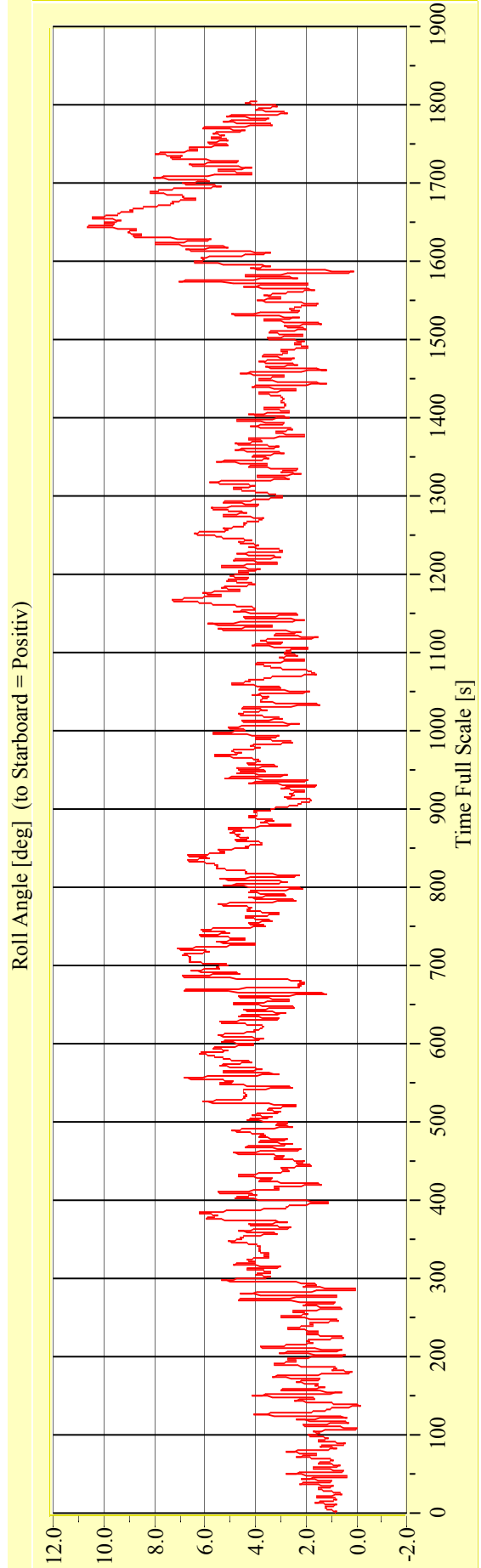
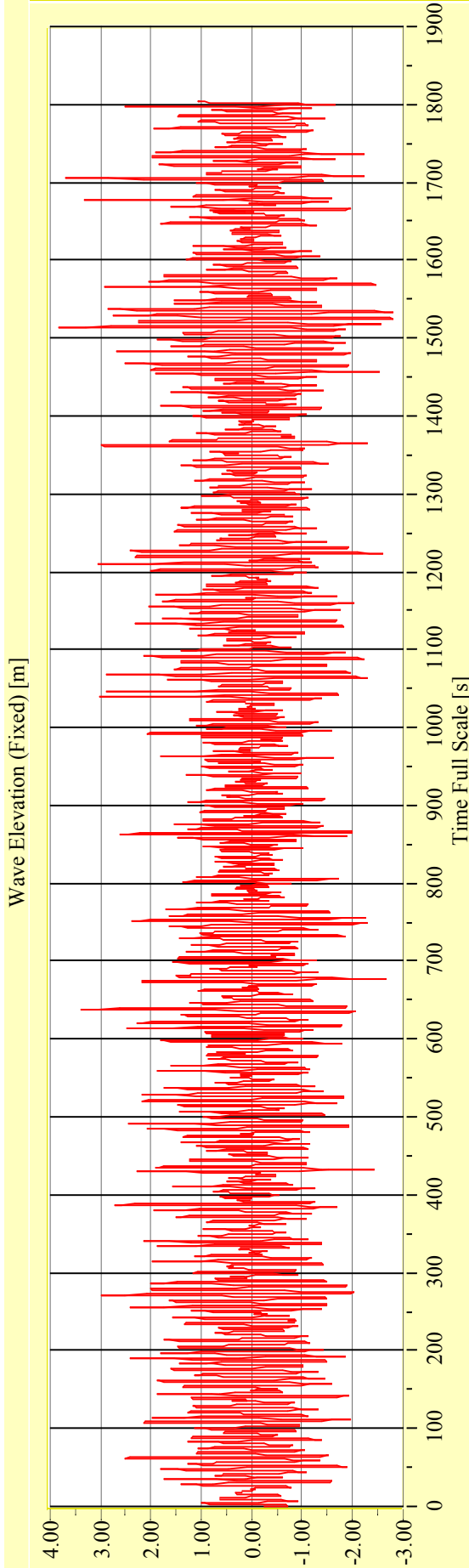
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29687-08**

**Target Waves: Hs = 3,75 m Tp = 7,746 s**

**gamma = 3,3**



**Irregular Beam Seas**

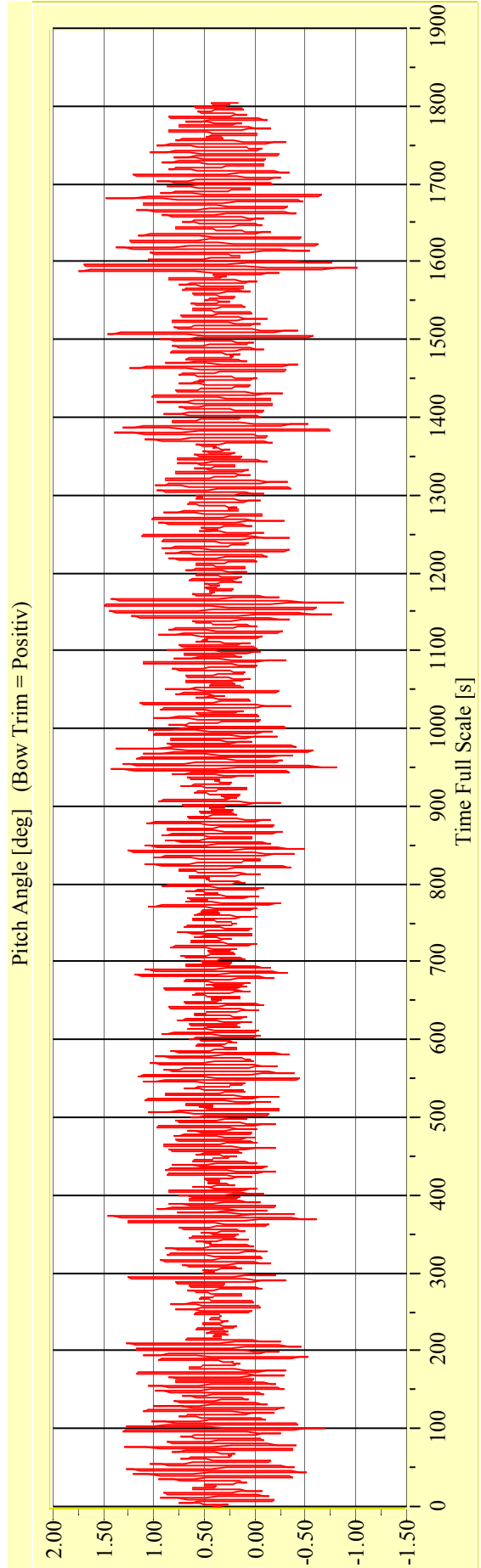
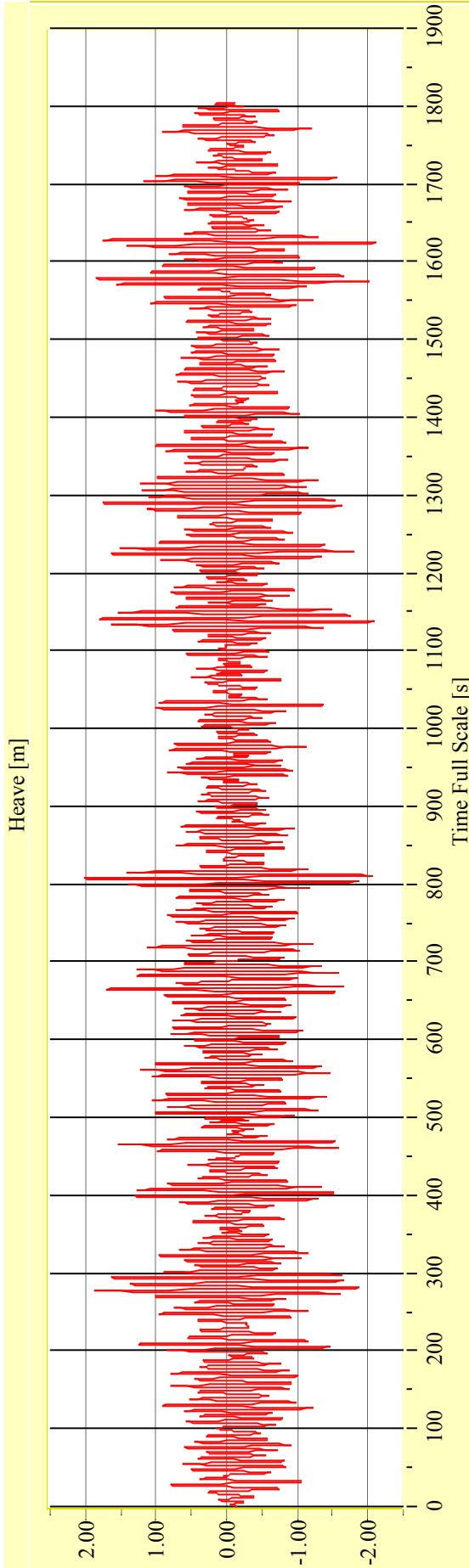
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29687-08**

**Target Waves: Hs = 3,75 m Tp = 7,746 s**

**gamma = 3,3**



**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**

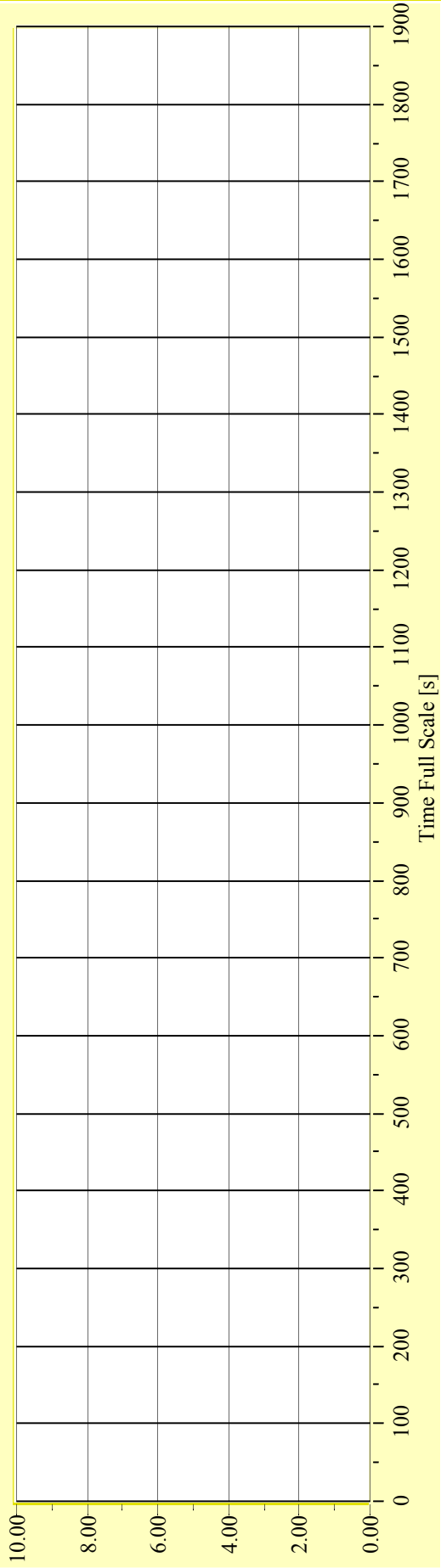
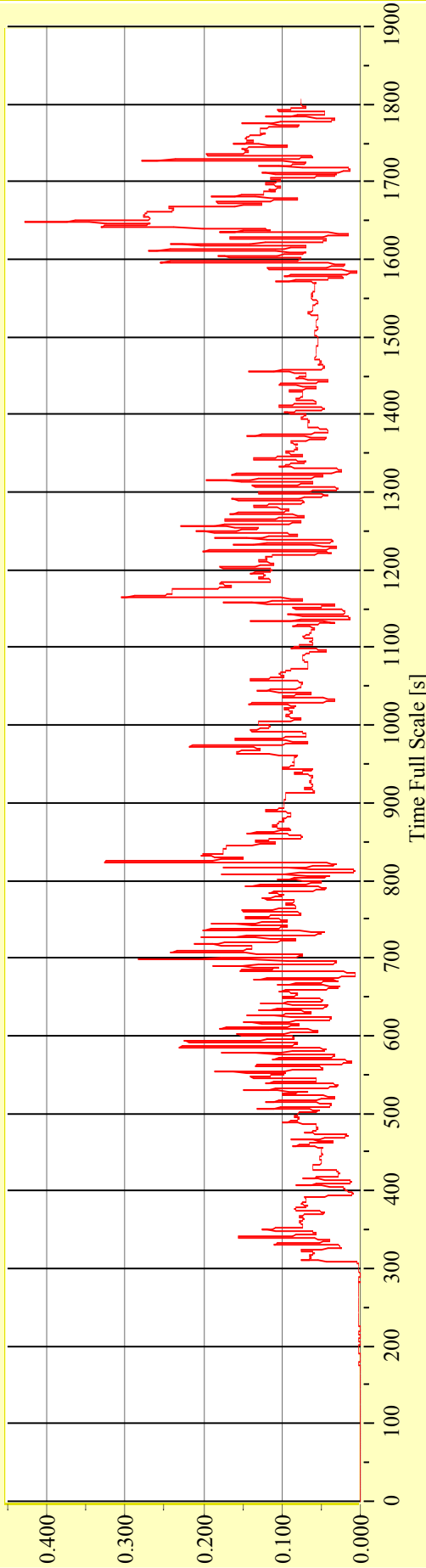
**Model No. 2446**

**Test No. 29687-08**

**Target Waves: Hs = 3,75 m Tp = 7,746 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

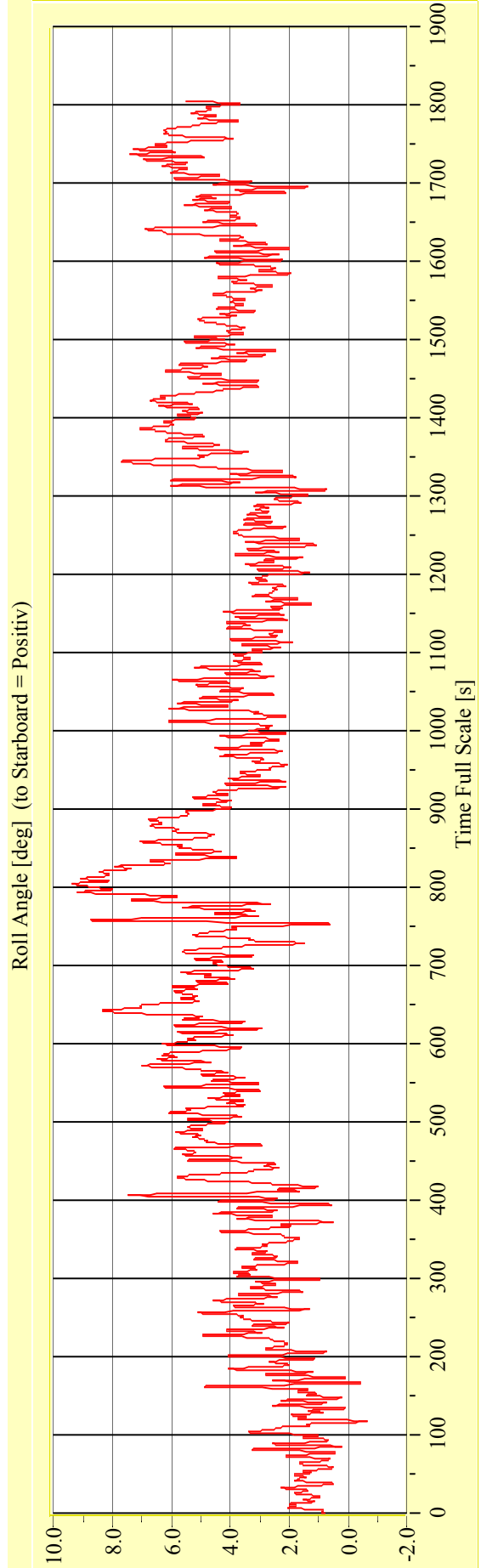
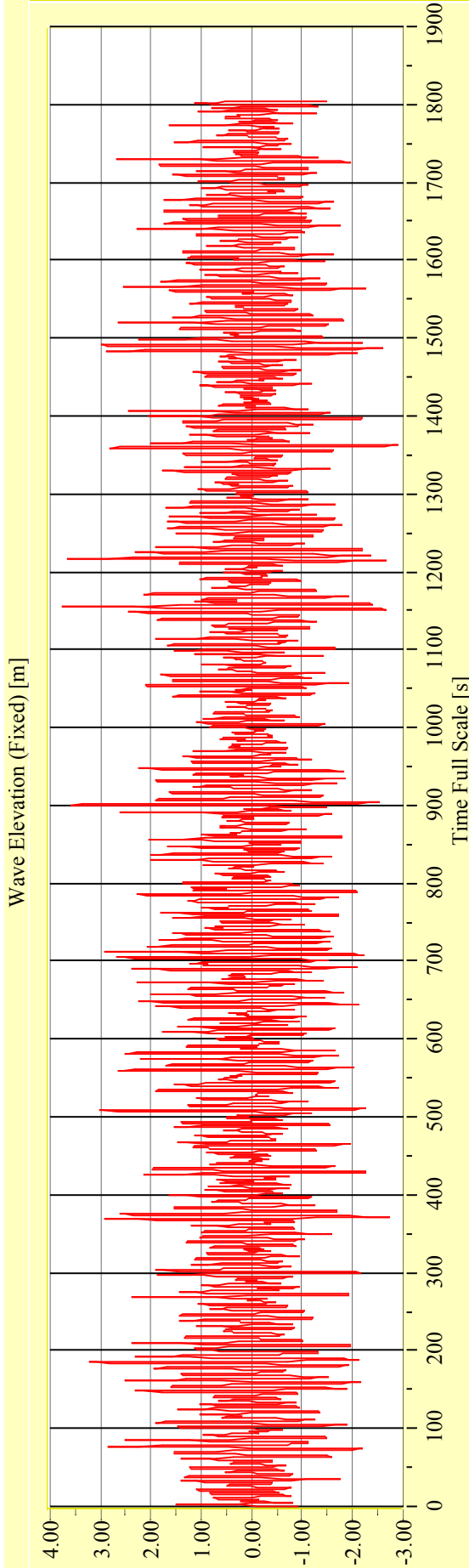
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29687-09**

**Target Waves: Hs = 3,75 m Tp = 7,746 s**

**gamma = 3,3**



**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

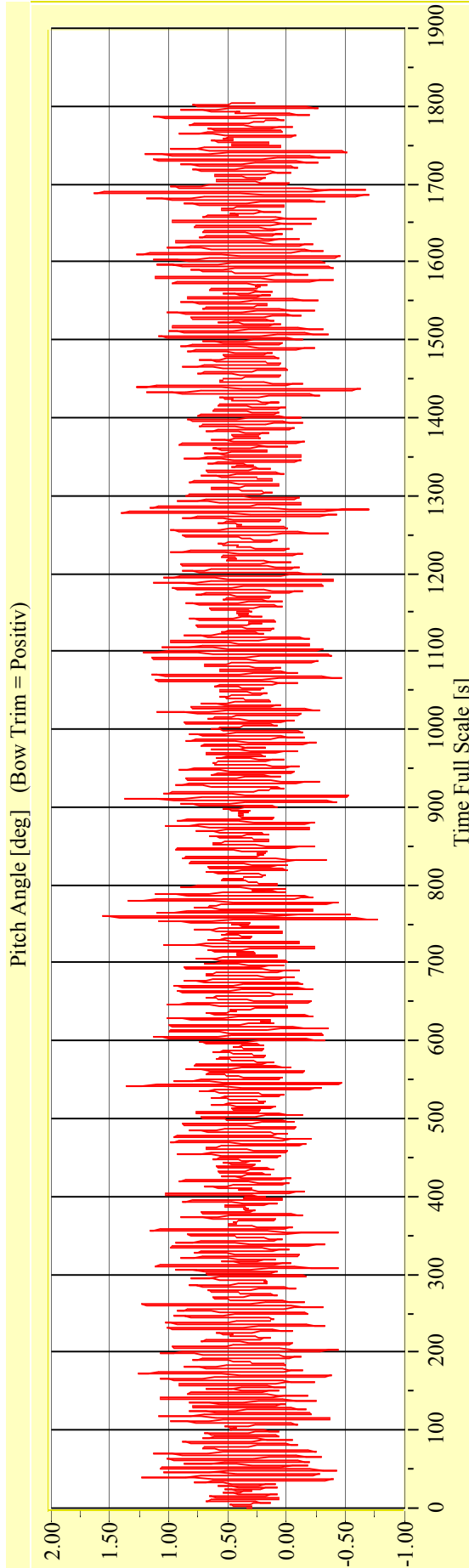
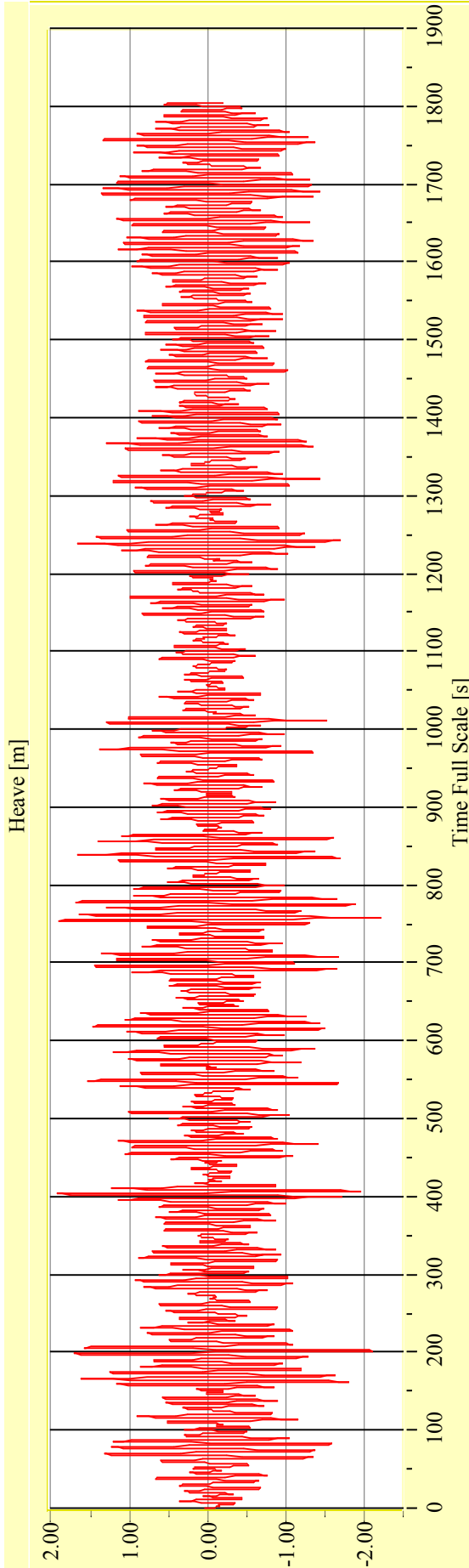
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29687-09**

**Target Waves: Hs = 3,75 m Tp = 7,746 s**

**gamma = 3,3**



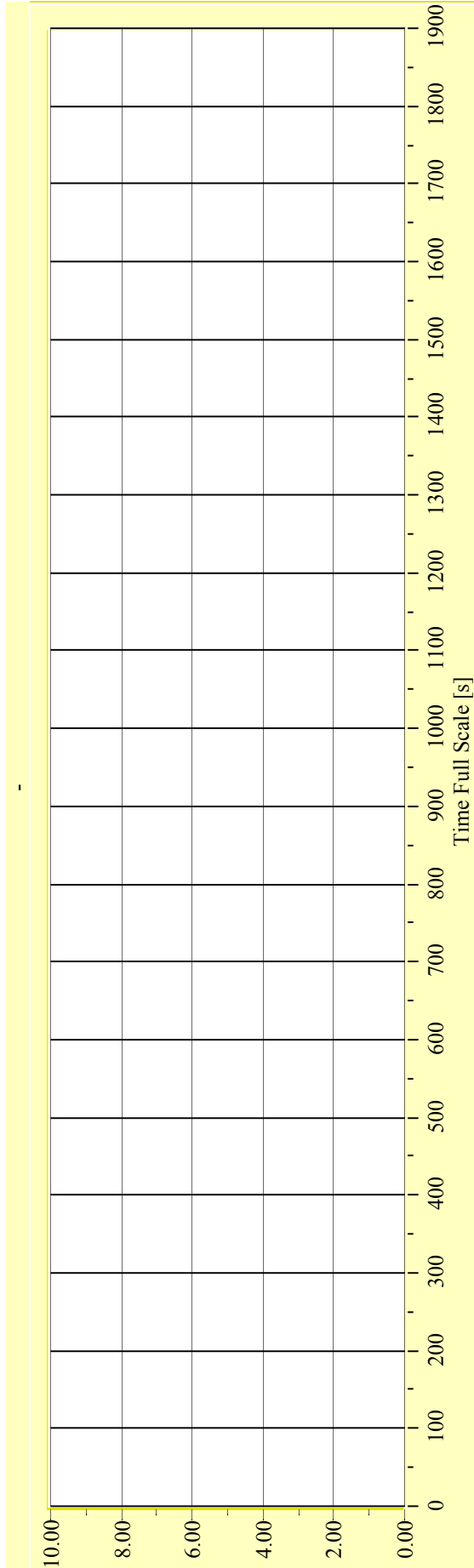
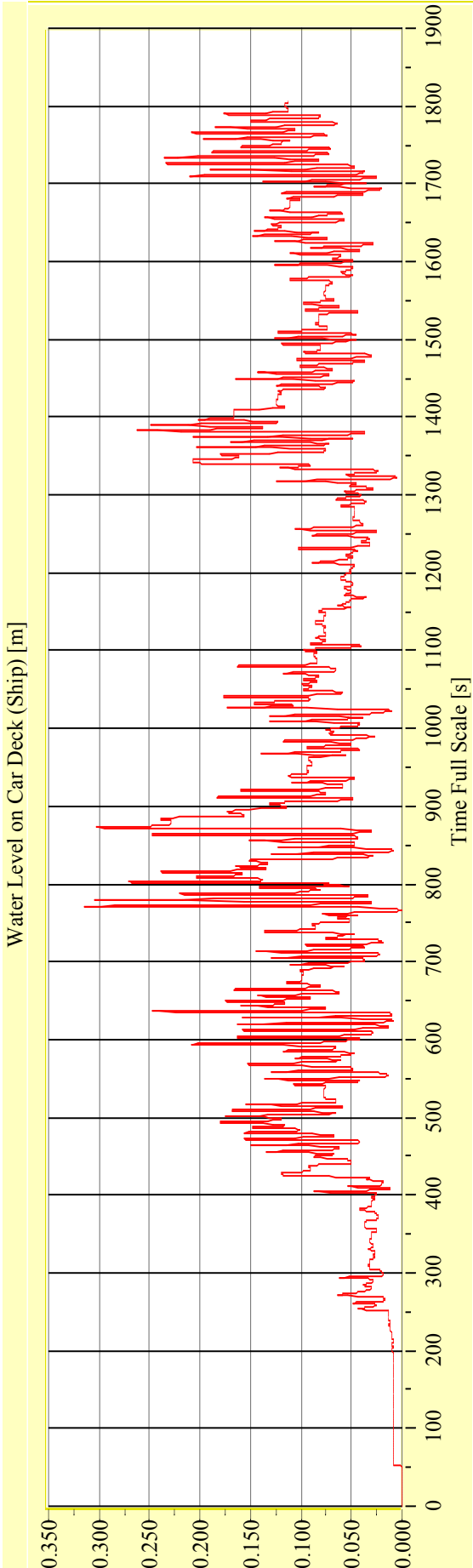
**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29687-09**      **Target Waves: Hs = 3,75 m Tp = 7,746 s**      **gamma = 3,3**



**Date: 20.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**



**Irregular Beam Seas**

**Vienna Model Basin**

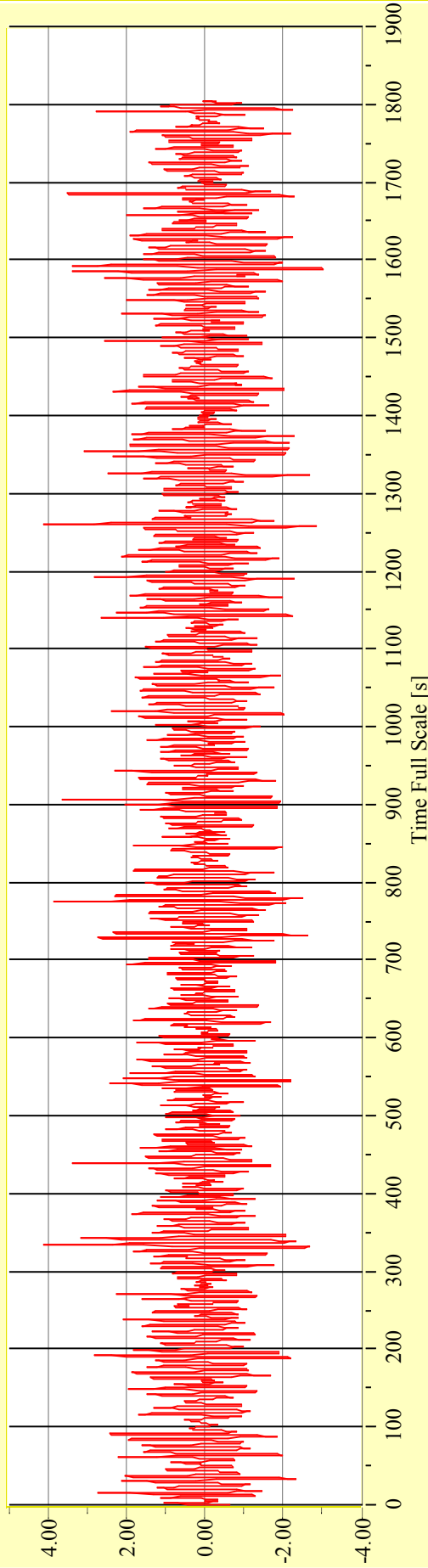
**Model No. 2446**

**Test No. 29687-10**

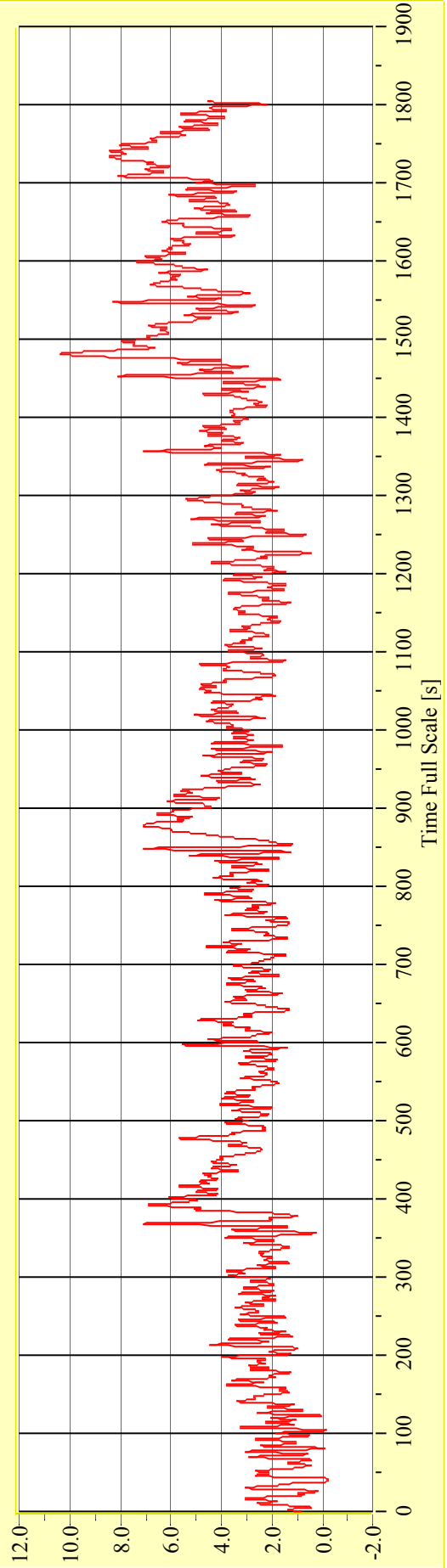
**Target Waves: Hs = 3,75 m Tp = 7,746 s**

**gamma = 3,3**

Wave Elevation (Fixed) [m]



Roll Angle [deg] (to Starboard = Positiv)



**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

Irregular Beam Seas

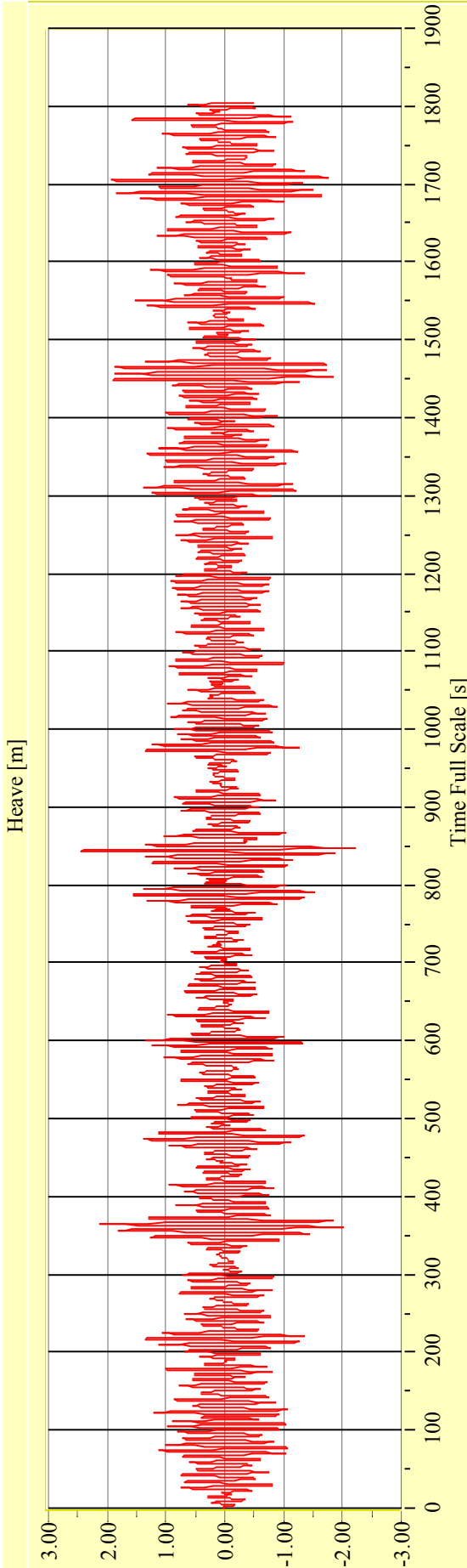
Vienna Model Basin

Model No. 2446

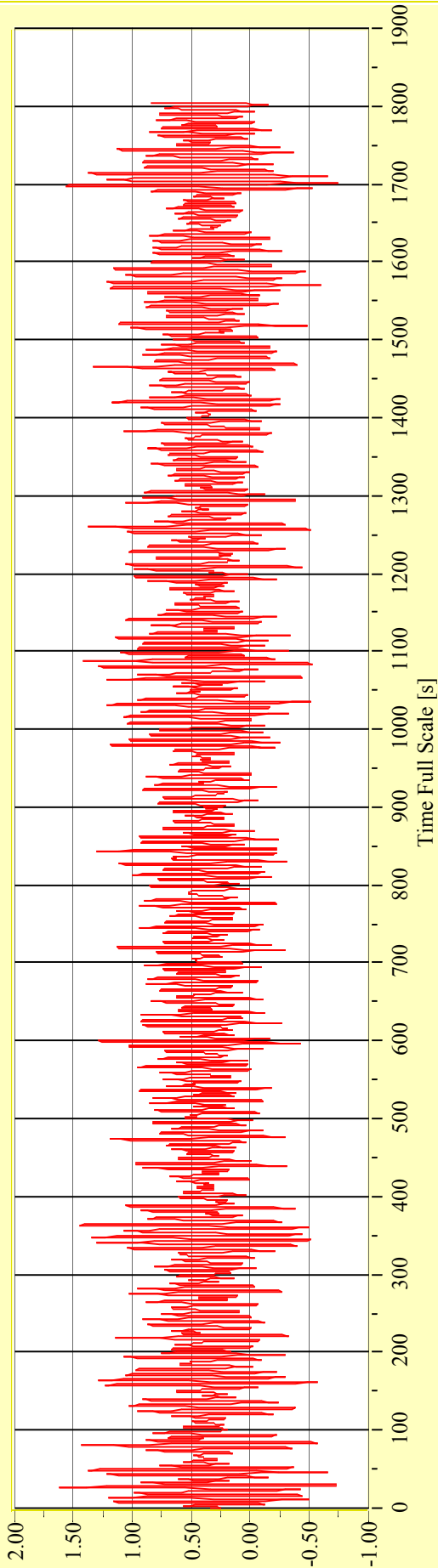
Test No. 29687-10

Target Waves: Hs = 3,75 m Tp = 7,746 s

gamma = 3,3



Pitch Angle [deg] (Bow Trim = Positiv)



Date: 20.05.2010

Project: EMSA 1

Damage 1: R7\_S7-9.1.0-1

**Irregular Beam Seas**

**Vienna Model Basin**

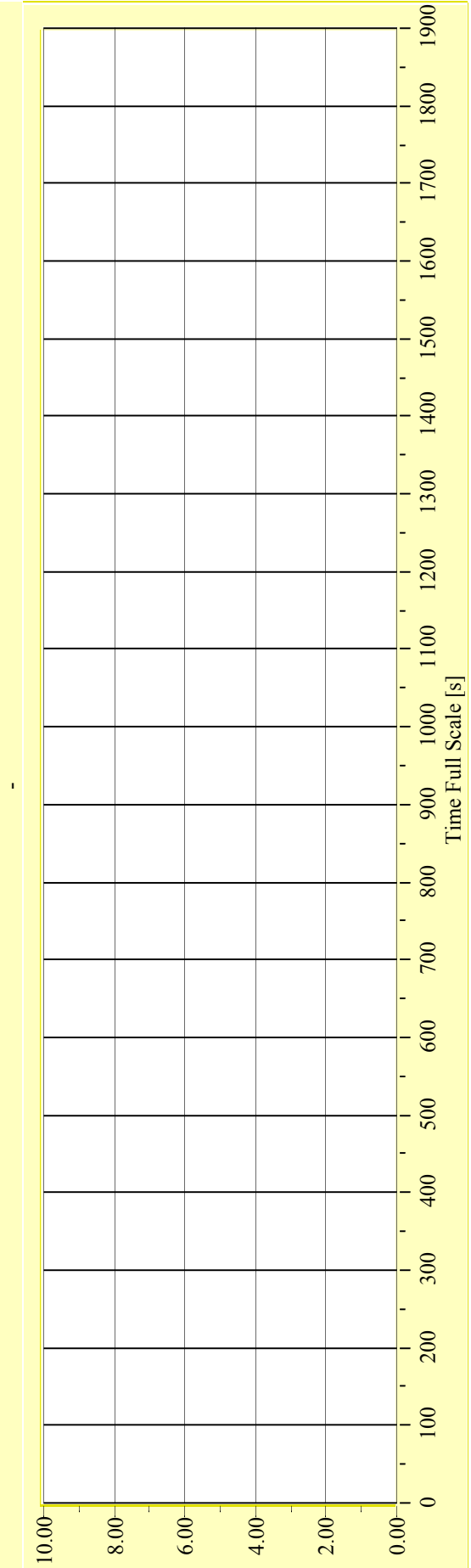
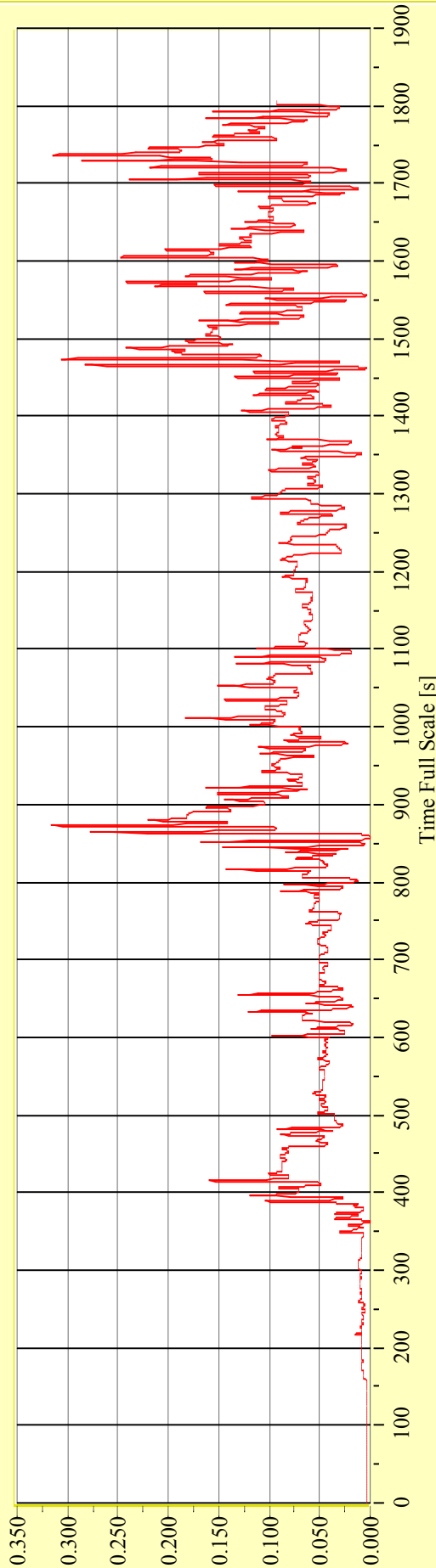
**Model No. 2446**

**Test No. 29687-10**

**Target Waves: Hs = 3,75 m Tp = 7,746 s**

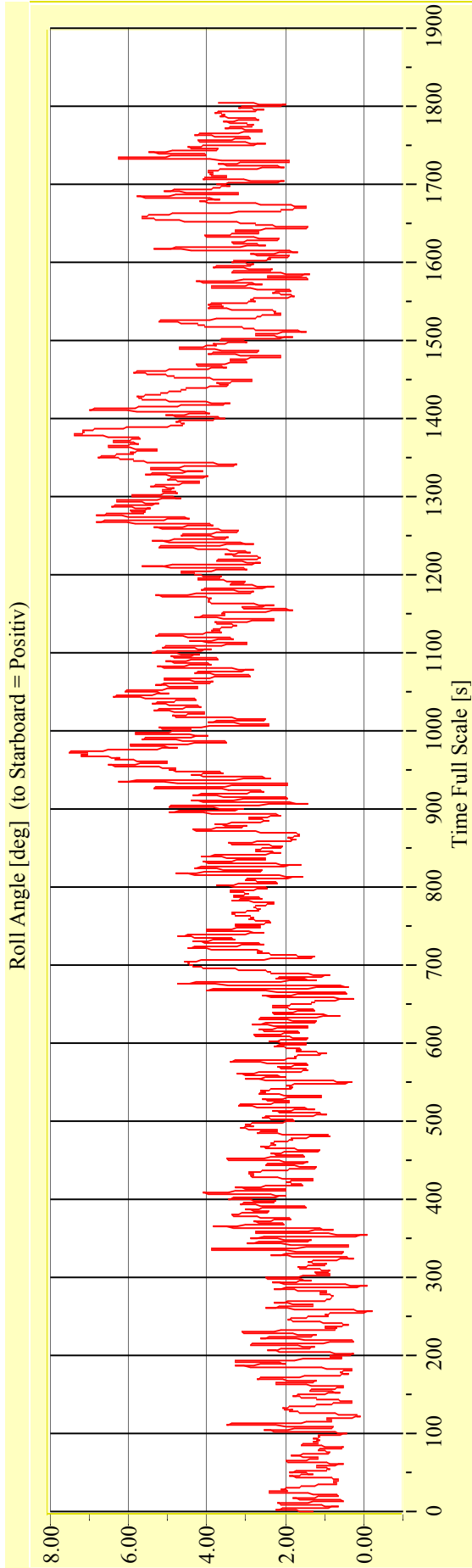
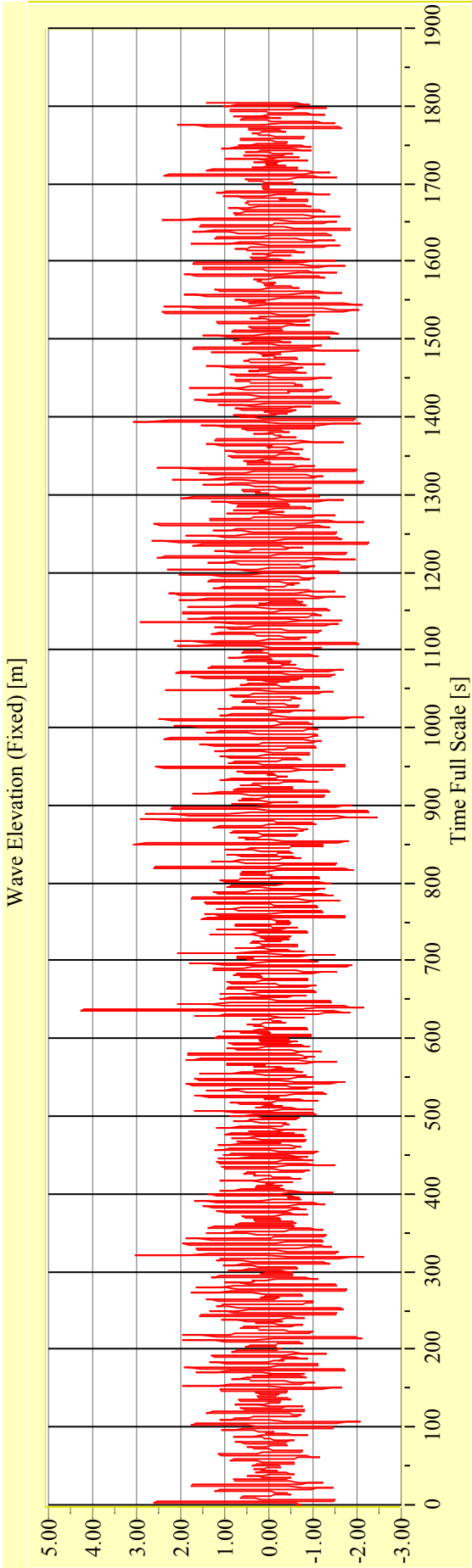
**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29688-01**      **Target Waves: Hs = 3,5 m Tp = 7,483 s**      **gamma = 3,3**



**Date: 20.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

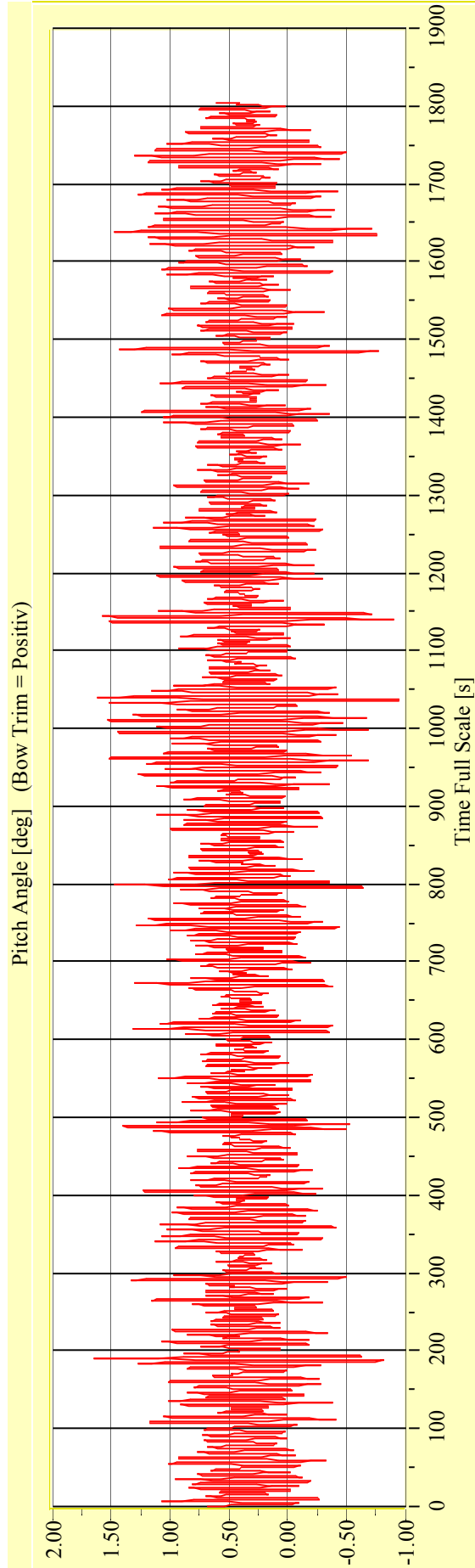
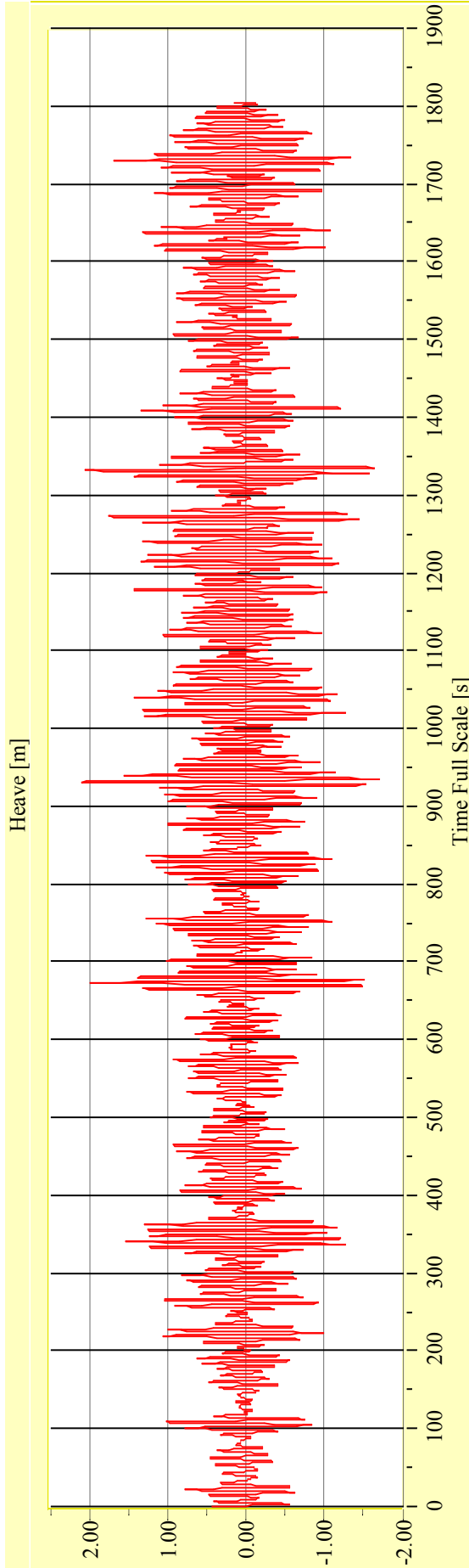
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29688-01**

**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

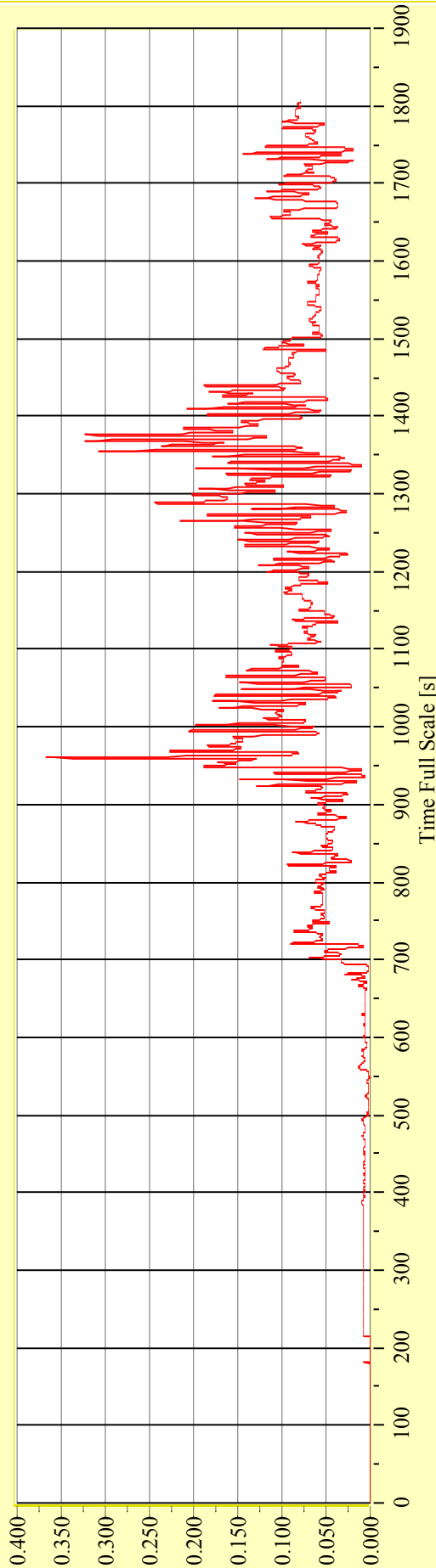
**Model No. 2446**

**Test No. 29688-01**

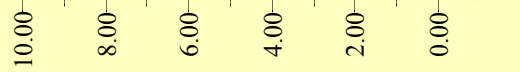
**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



Time Full Scale [s]



Time Full Scale [s]

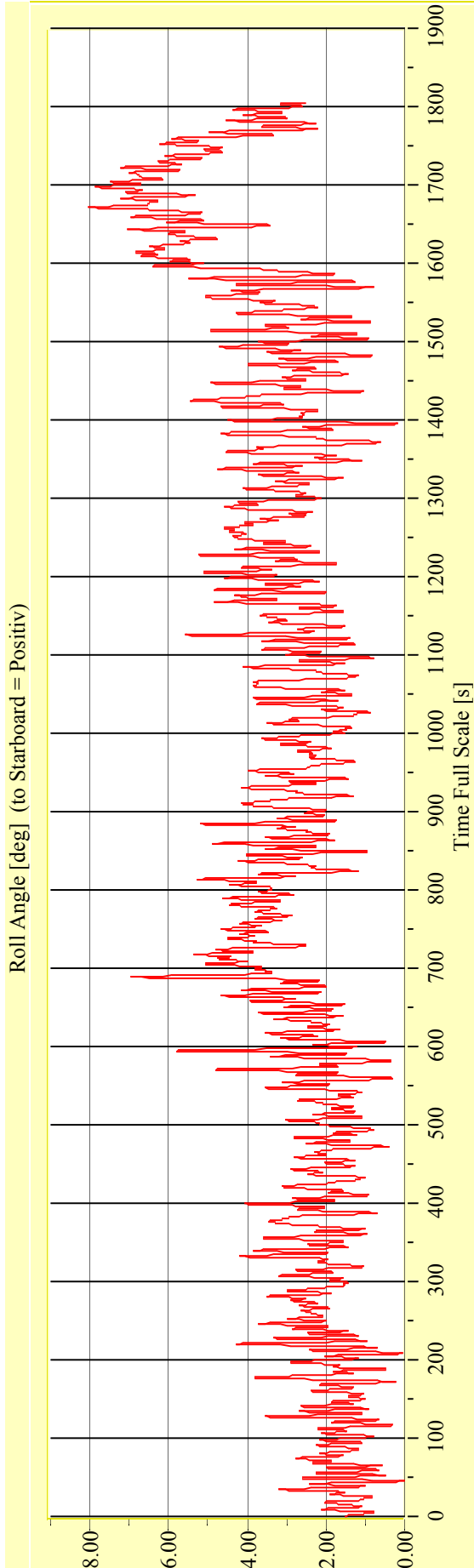
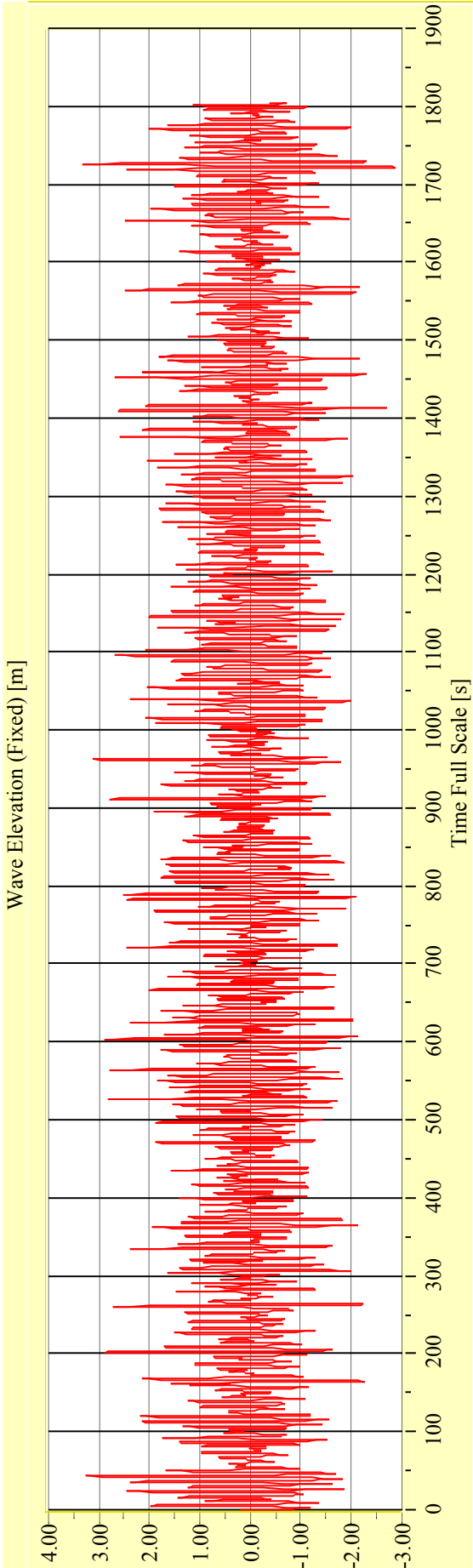
**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29688-02**      **Target Waves: Hs = 3.5 m Tp = 7,483 s**      **gamma = 3,3**



**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

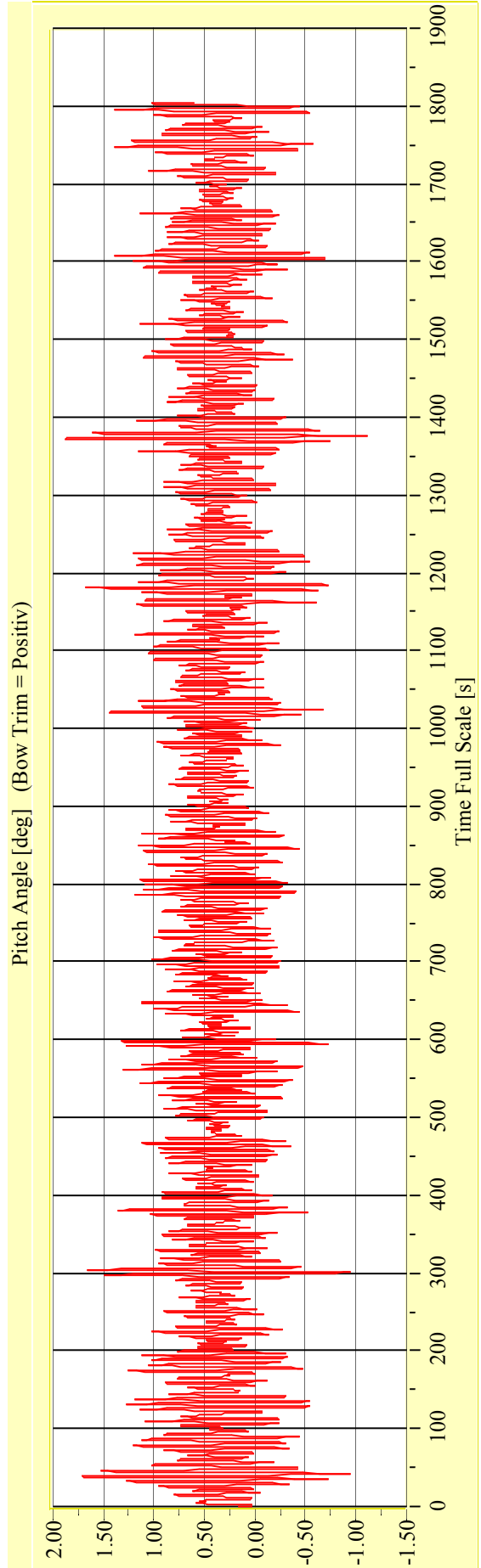
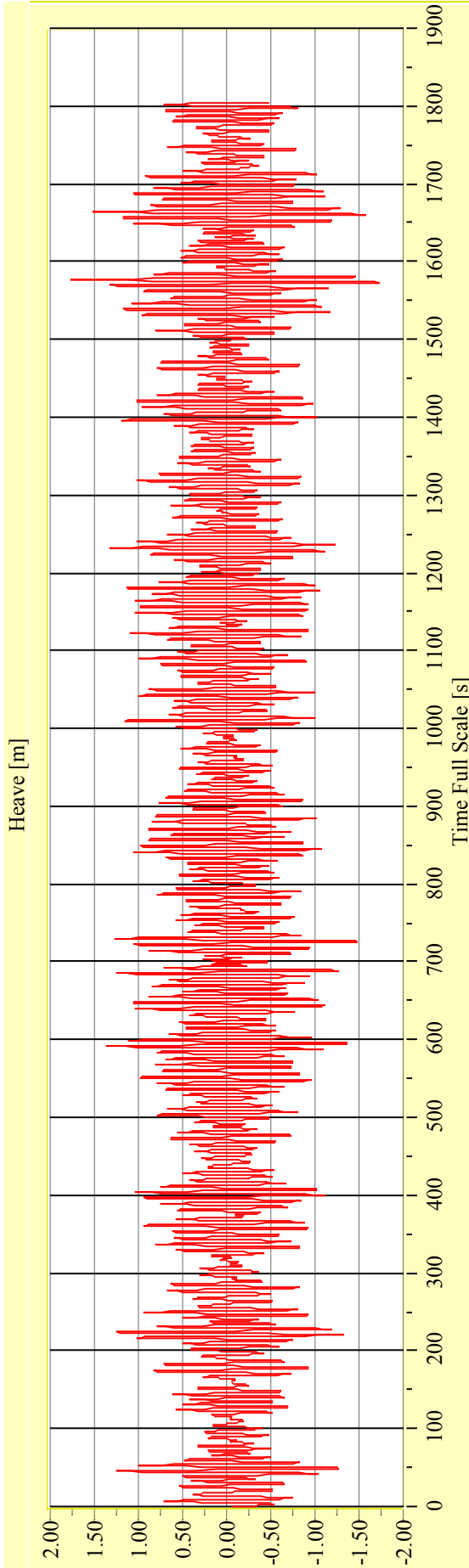
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29688-02**

**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**





**Irregular Beam Seas**

**Vienna Model Basin**

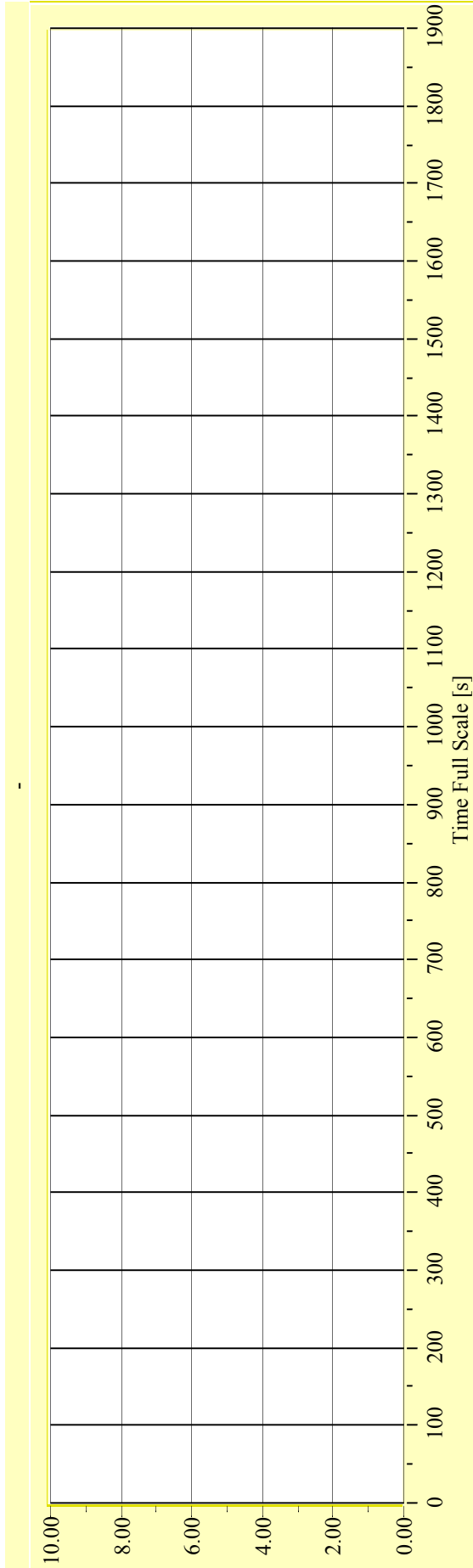
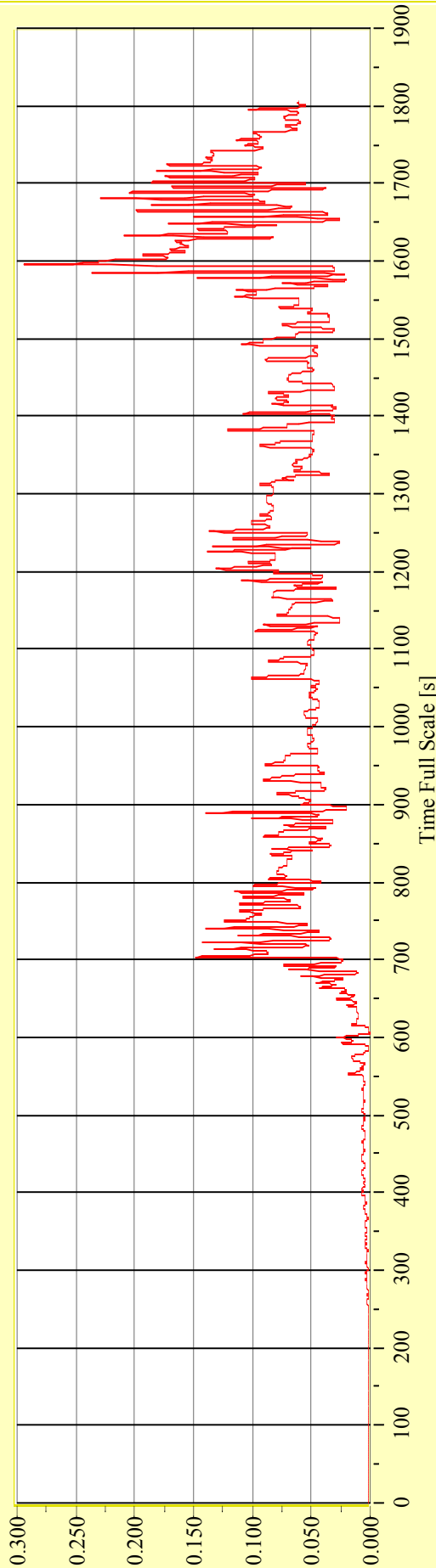
**Model No. 2446**

**Test No. 29688-02**

**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



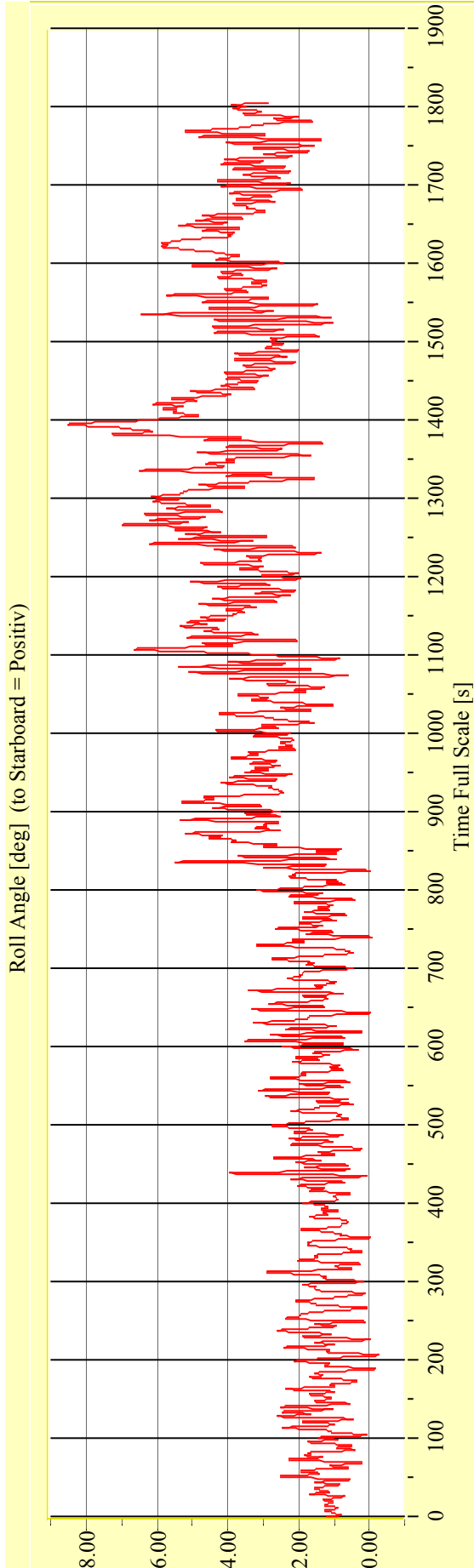
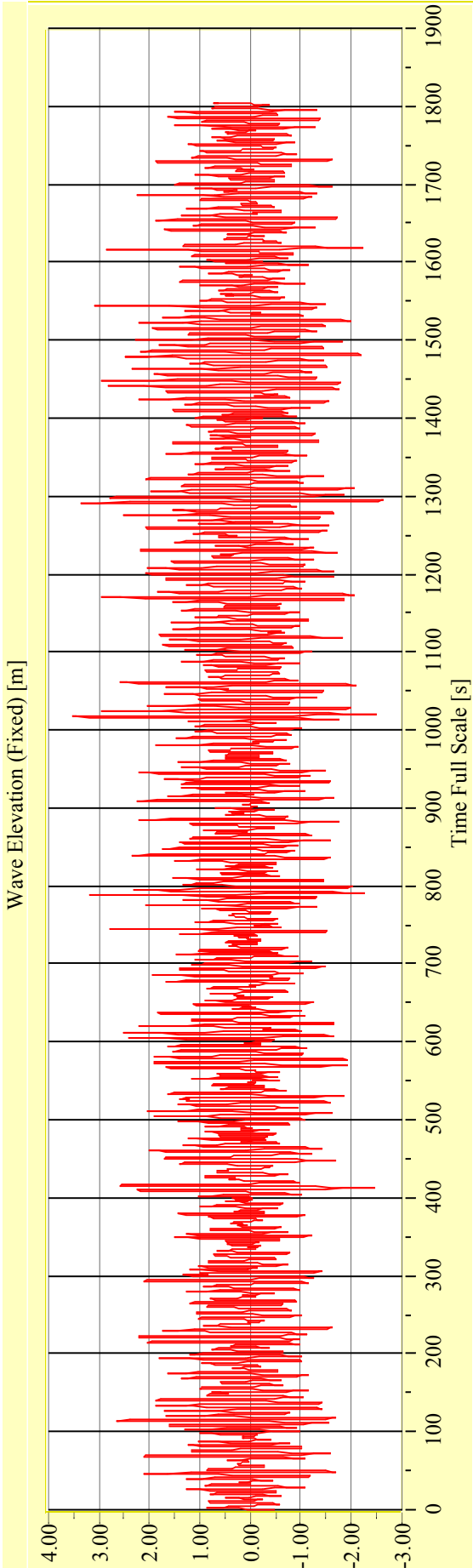
**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29688-03**      **Target Waves: Hs = 3,5 m   Tp = 7,483 s**      **gamma = 3,3**



**Date: 20.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

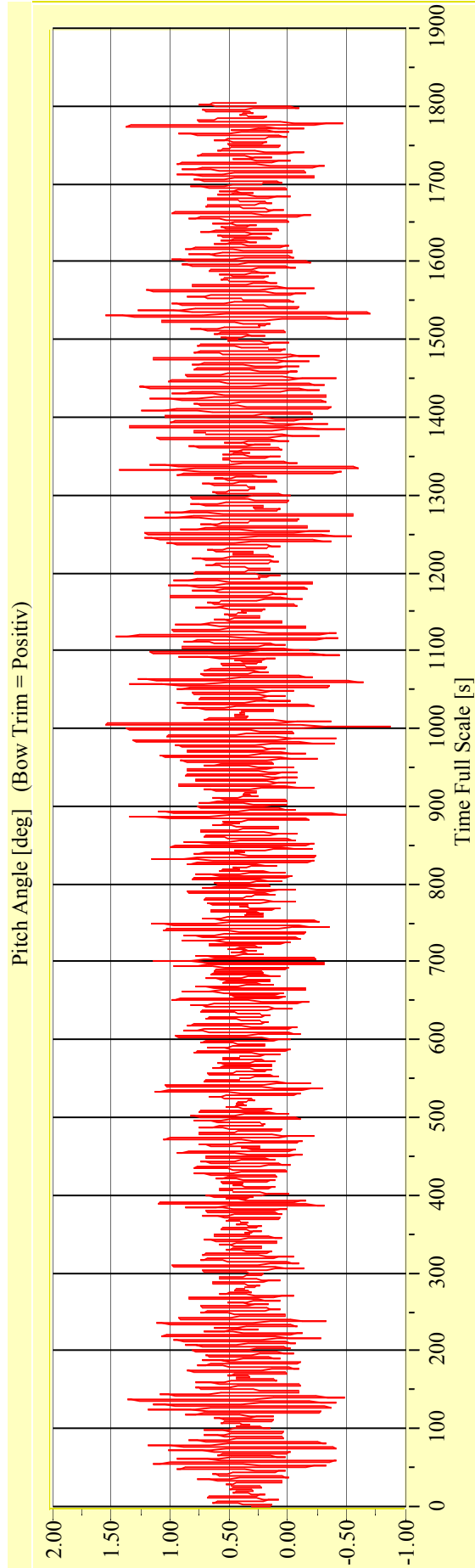
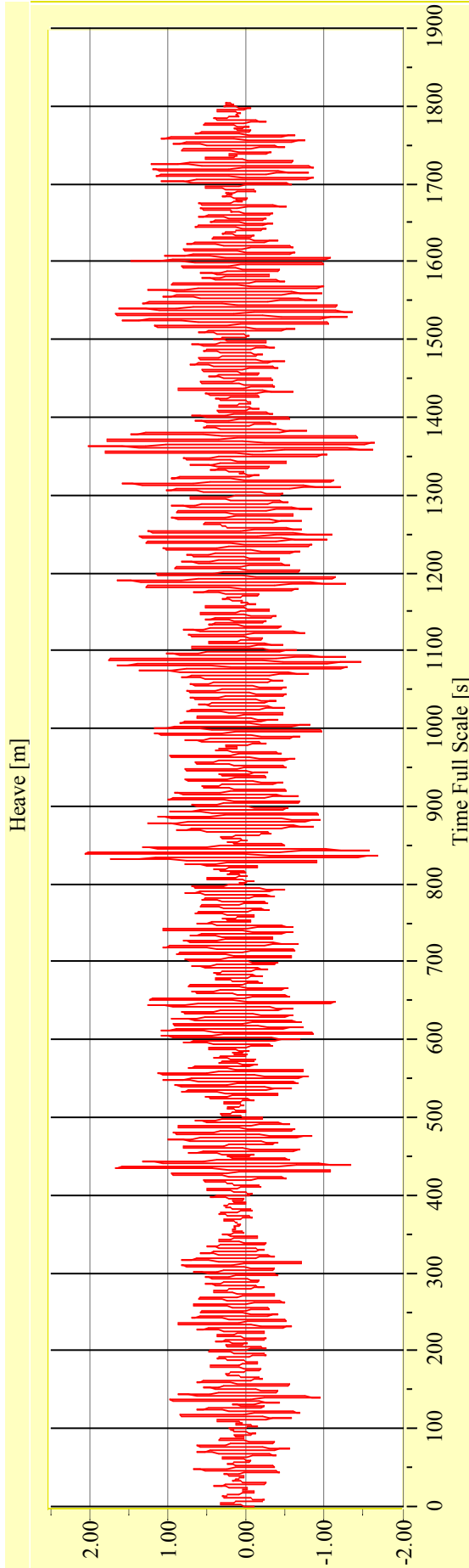
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29688-03**

**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**



**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

Irregular Beam Seas

Vienna Model Basin

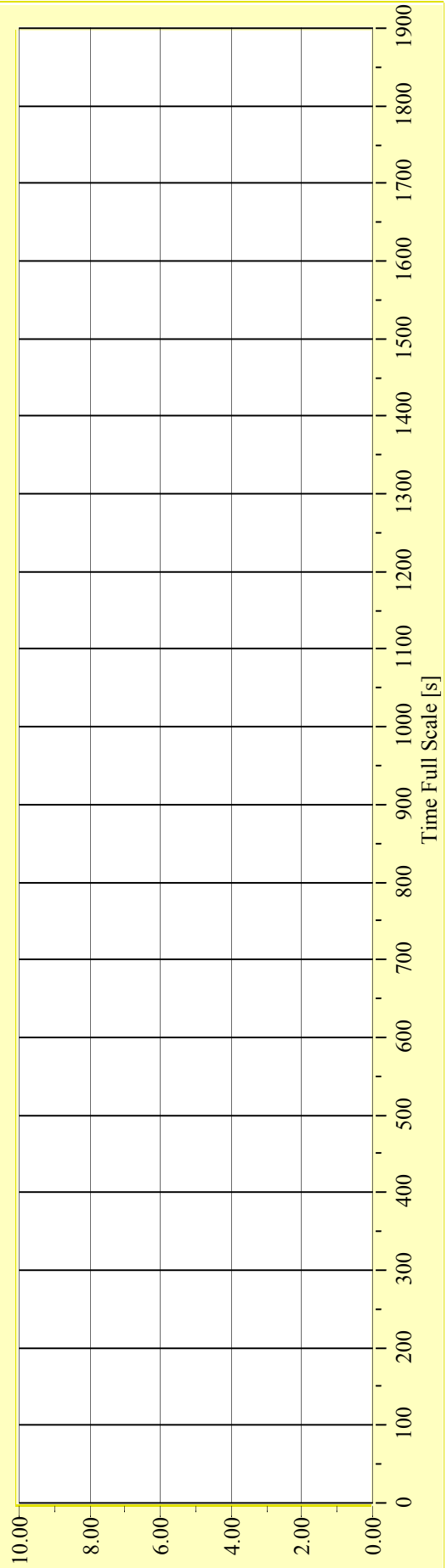
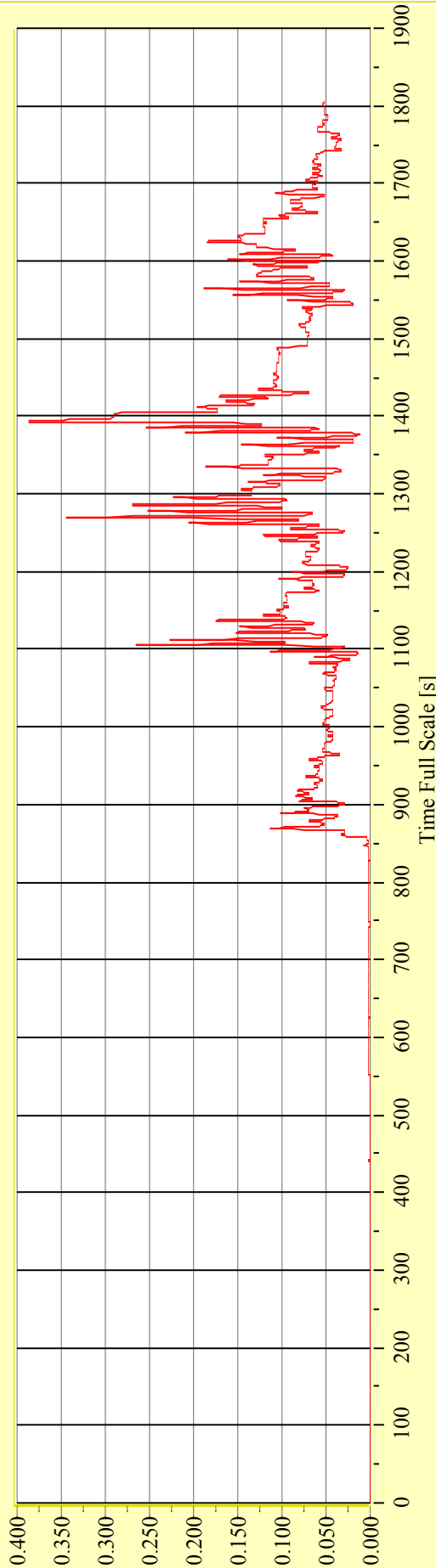
Model No. 2446

Test No. 29688-03

Target Waves: Hs = 3,5 m Tp = 7,483 s

gamma = 3,3

Water Level on Car Deck (Ship) [m]



**Irregular Beam Seas**

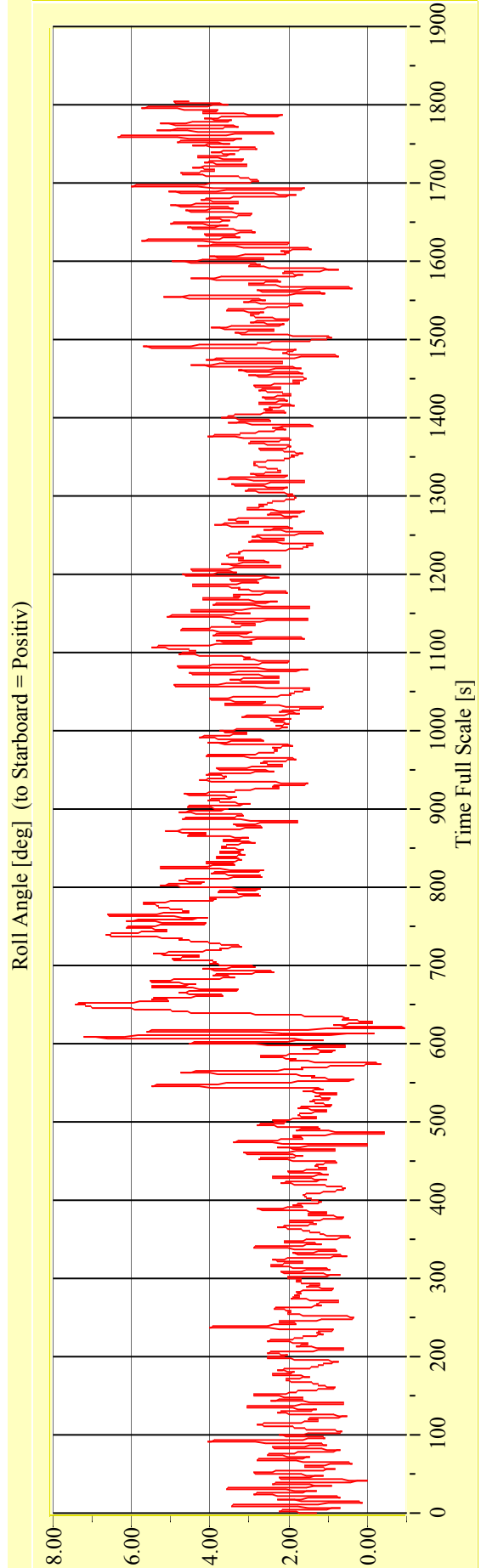
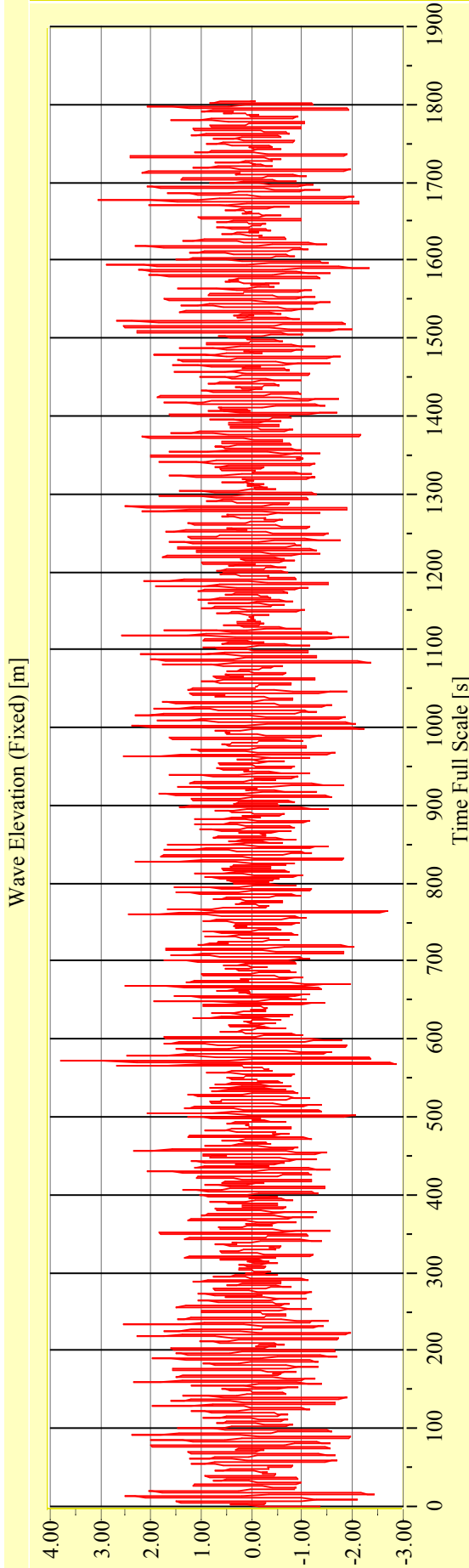
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29688-04**

**Target Waves: Hs = 3.5 m Tp = 7,483 s**

**gamma = 3,3**



**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

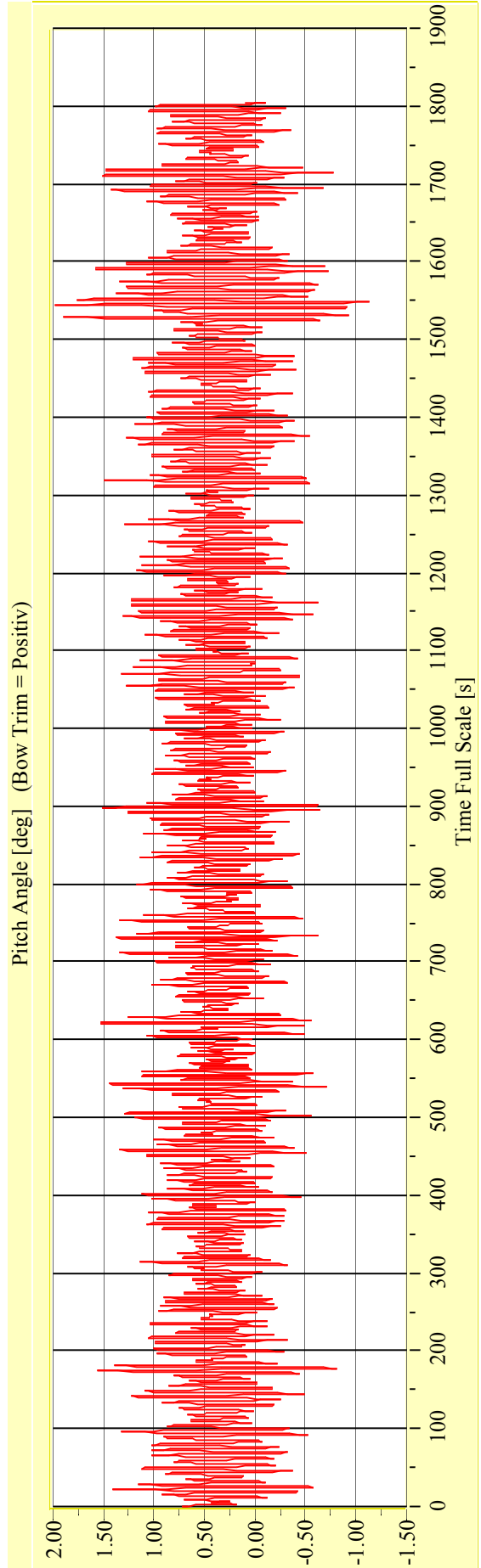
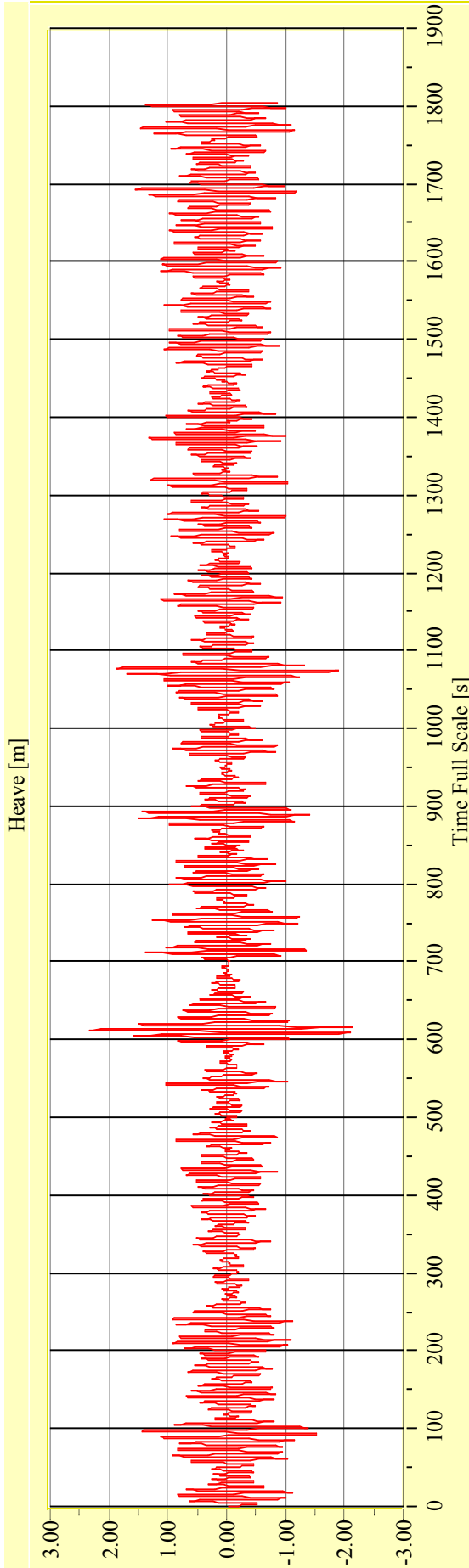
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29688-04**

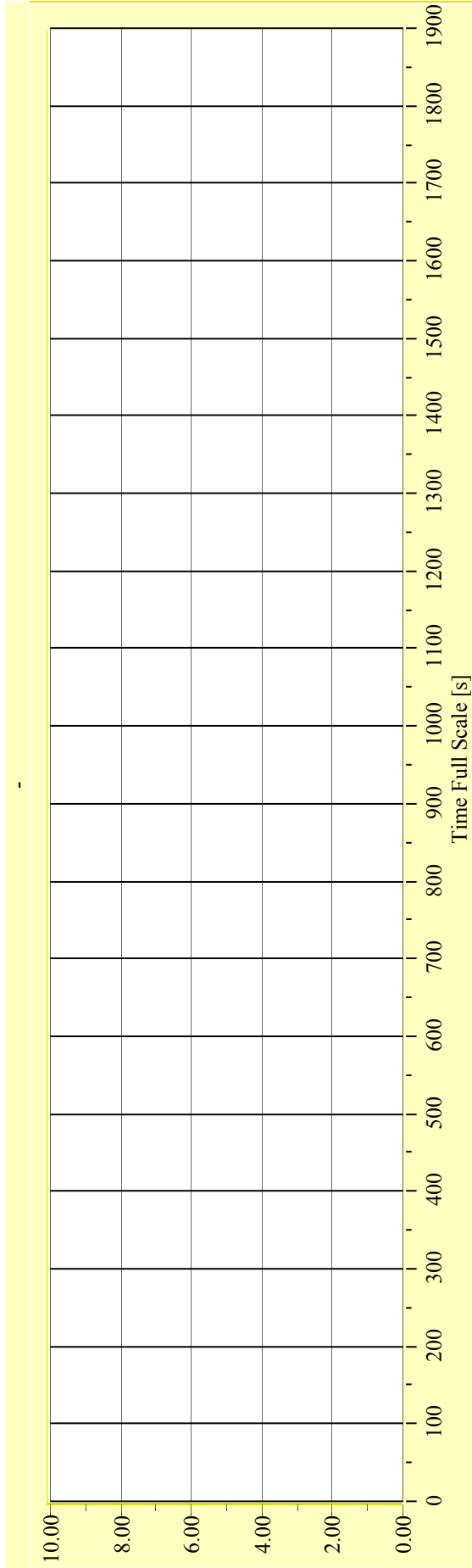
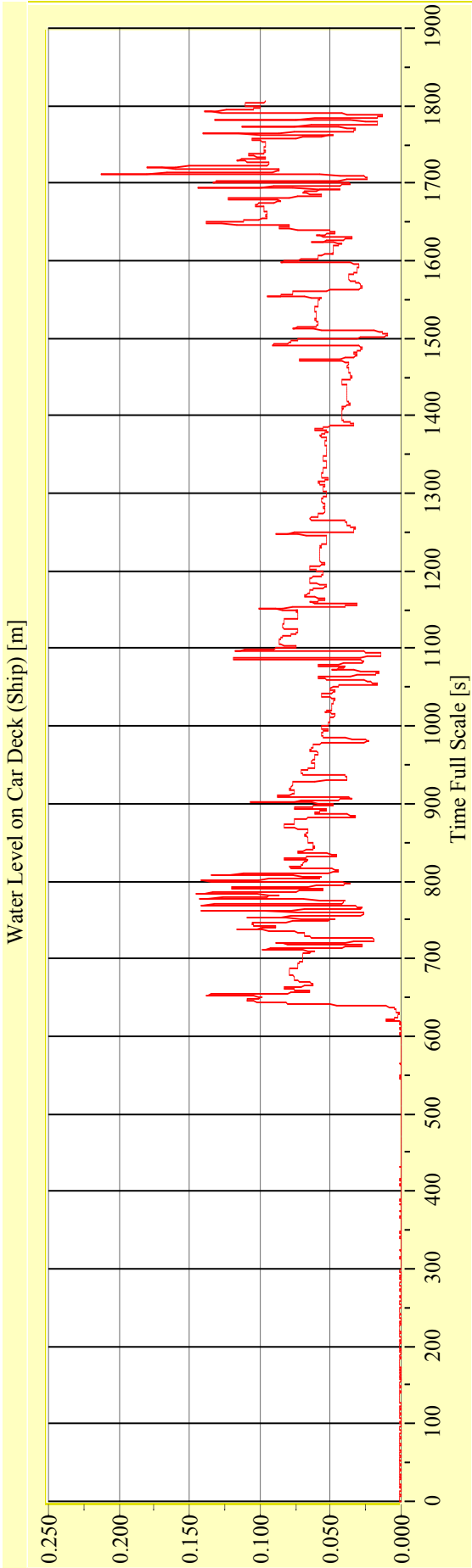
**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**



**Irregular Beam Seas**

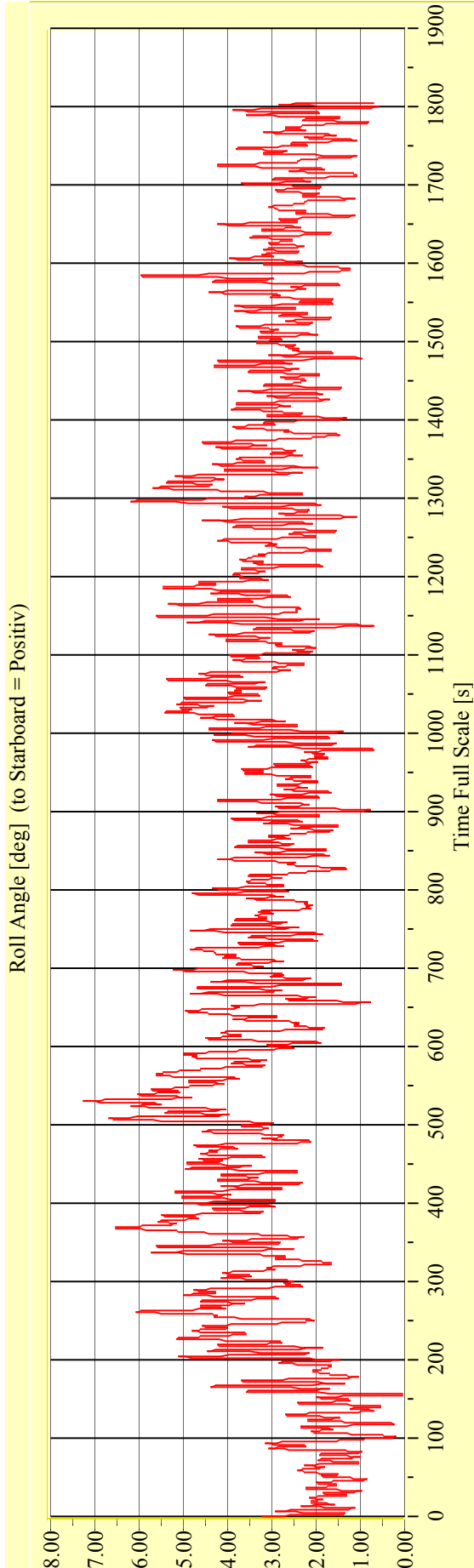
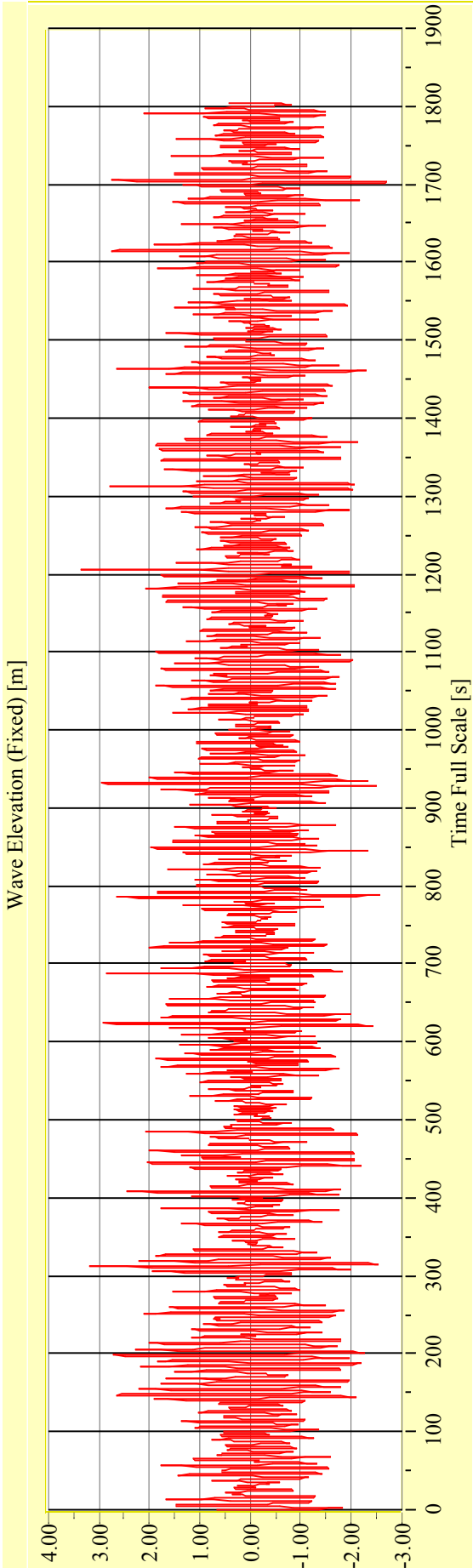
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29688-04**      **Target Waves: Hs = 3,5 m Tp = 7,483 s**      **gamma = 3,3**



**Date: 20.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29688-05**      **Target Waves: Hs = 3,5 m Tp = 7,483 s**      **gamma = 3,3**



**Date: 20.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**



**Irregular Beam Seas**

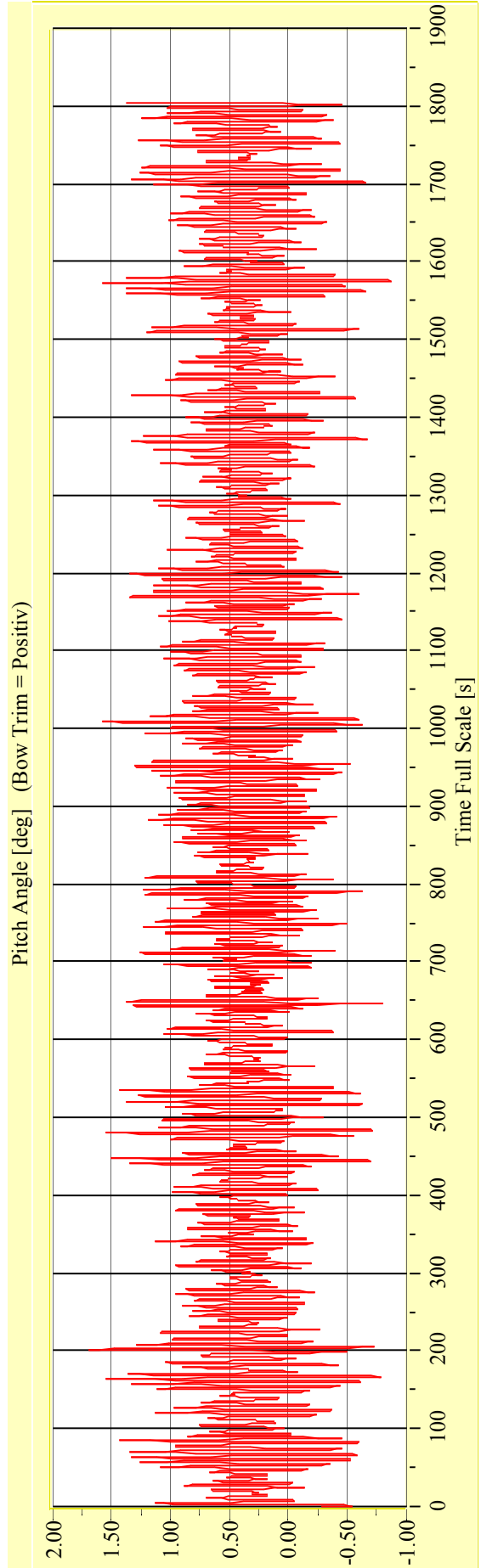
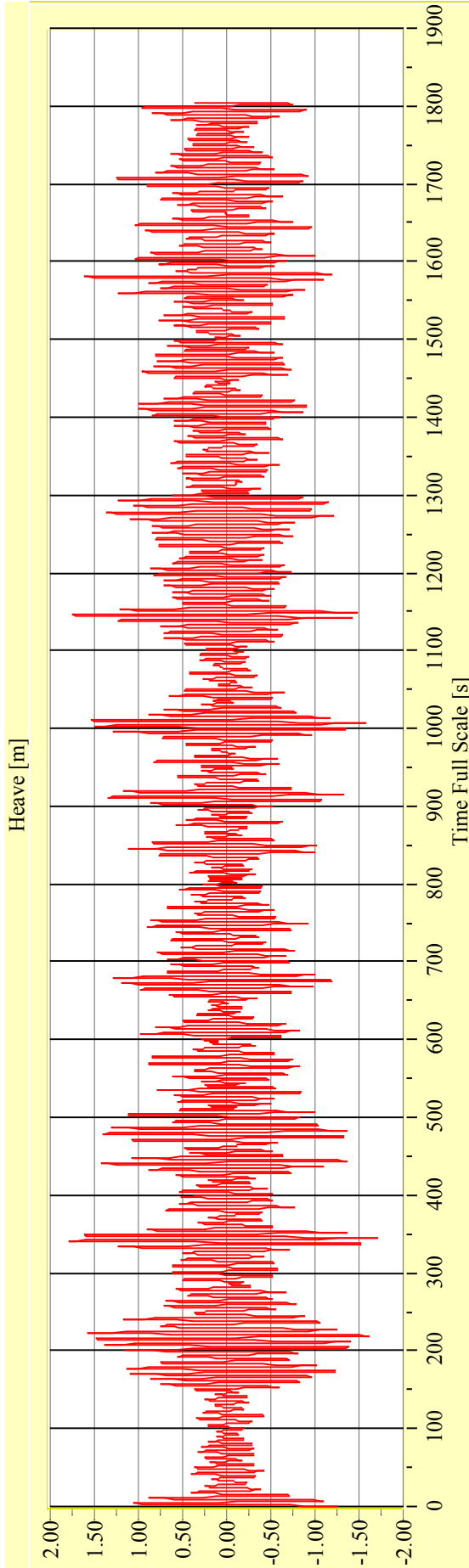
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29688-05**

**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

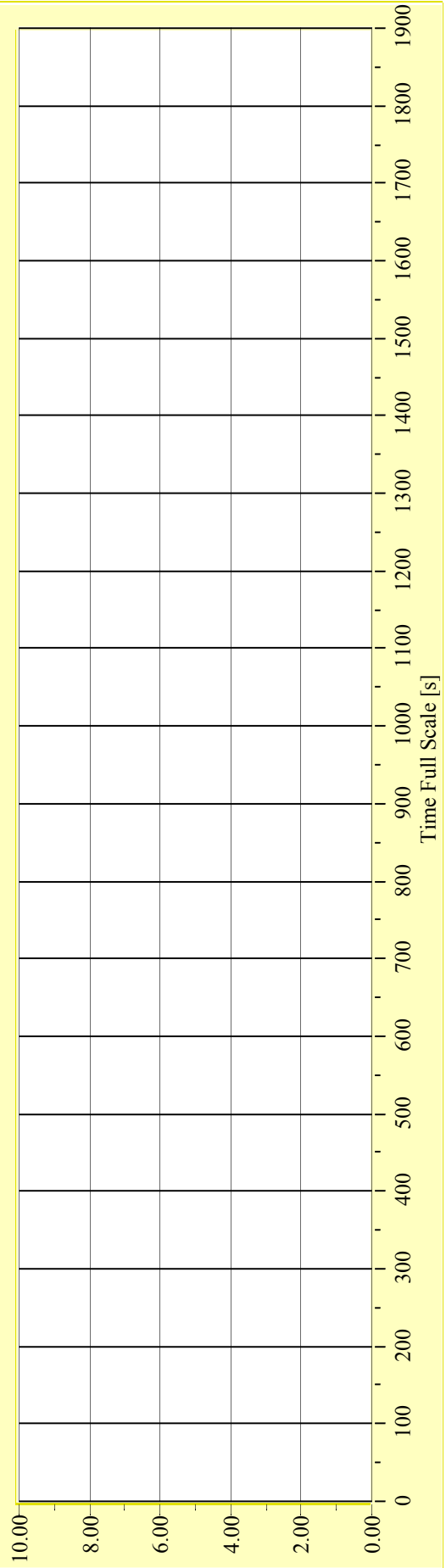
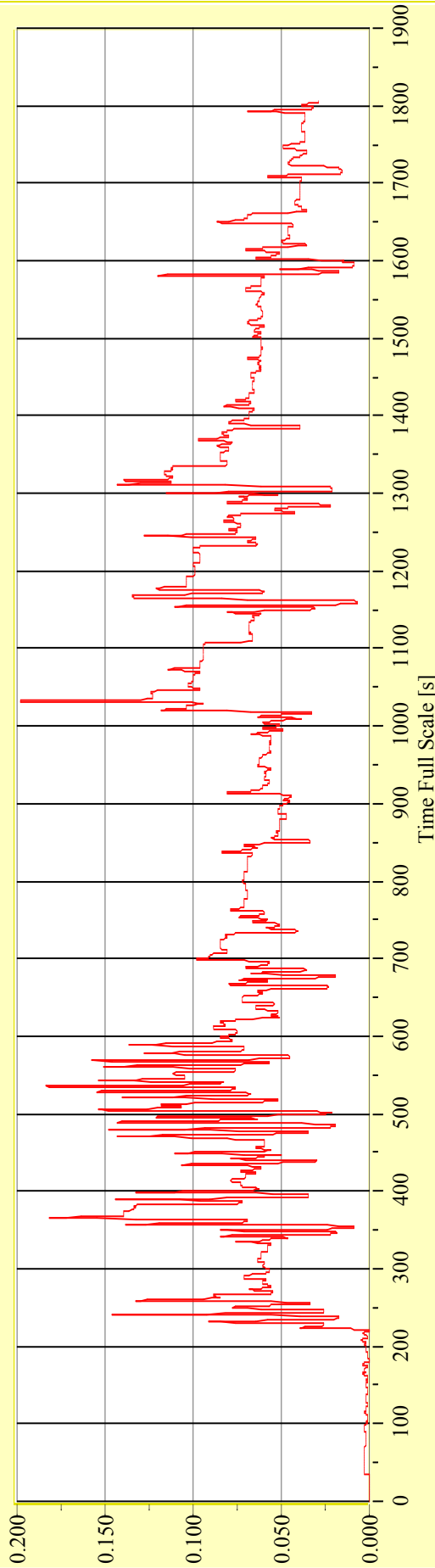
**Model No. 2446**

**Test No. 29688-05**

**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Irregular Beam Seas**

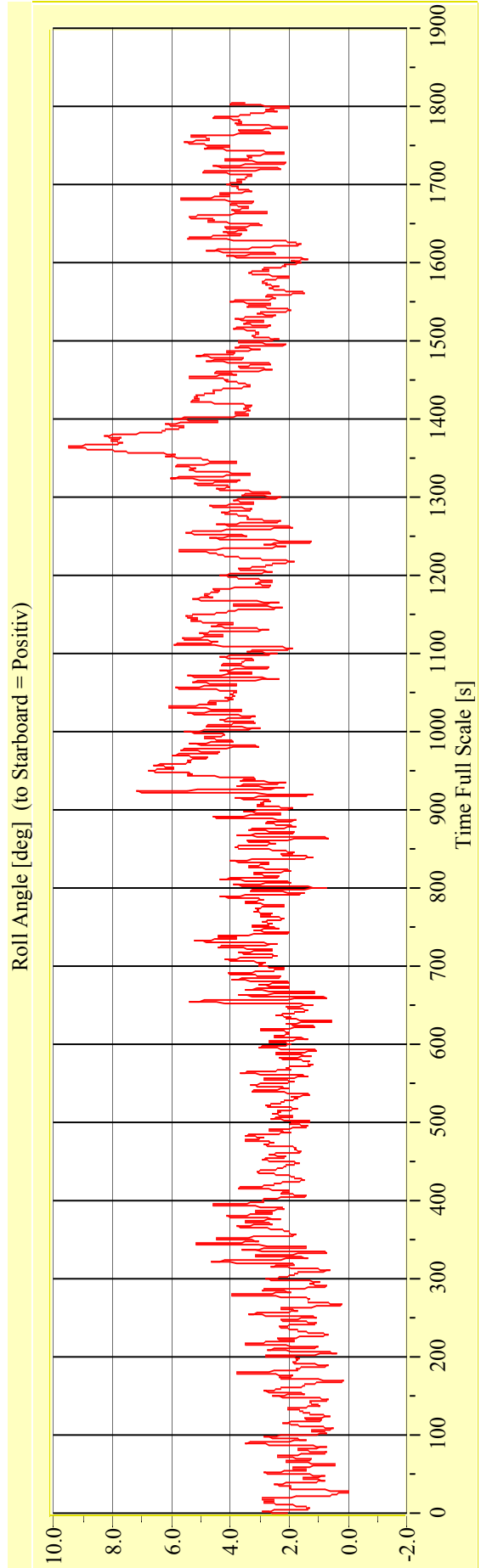
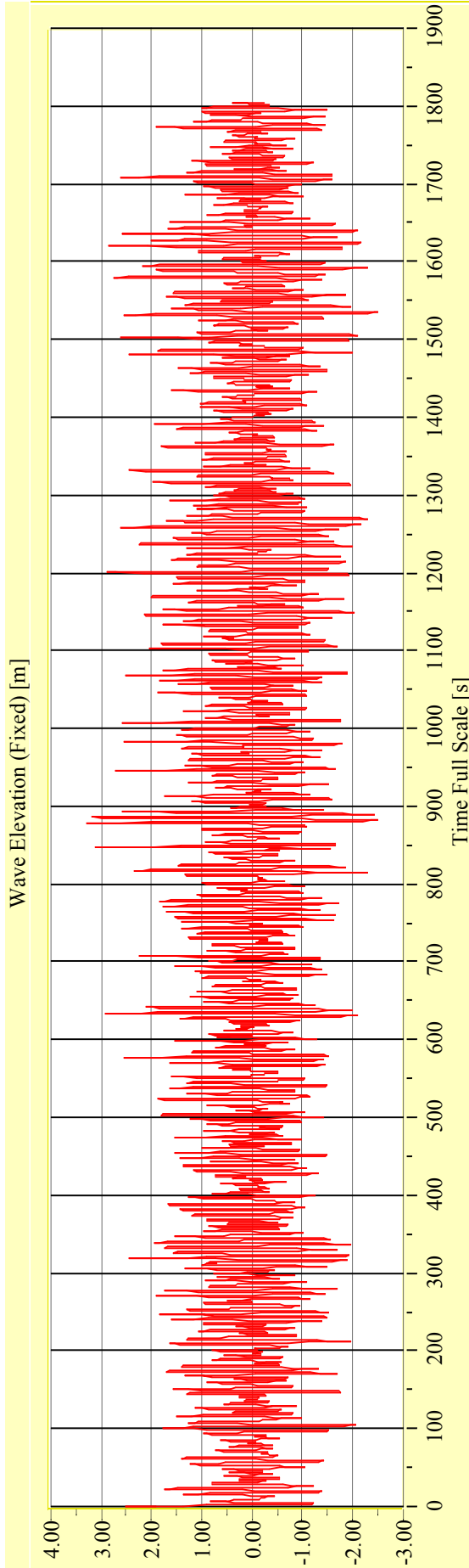
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29688-06**

**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**



**Irregular Beam Seas**

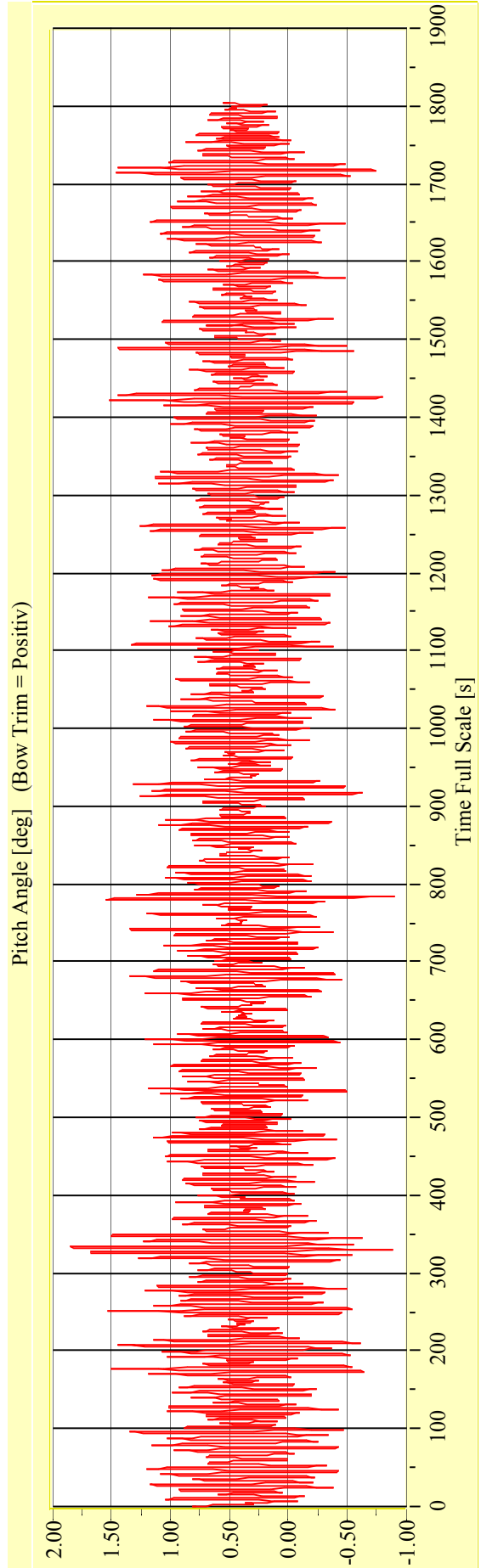
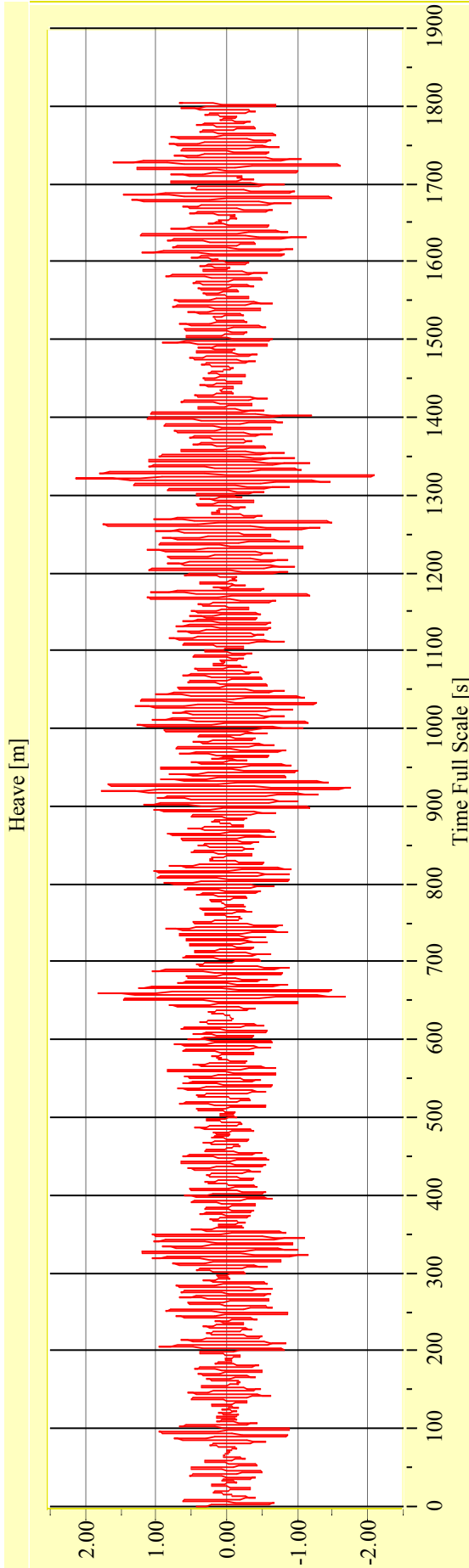
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29688-06**

**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

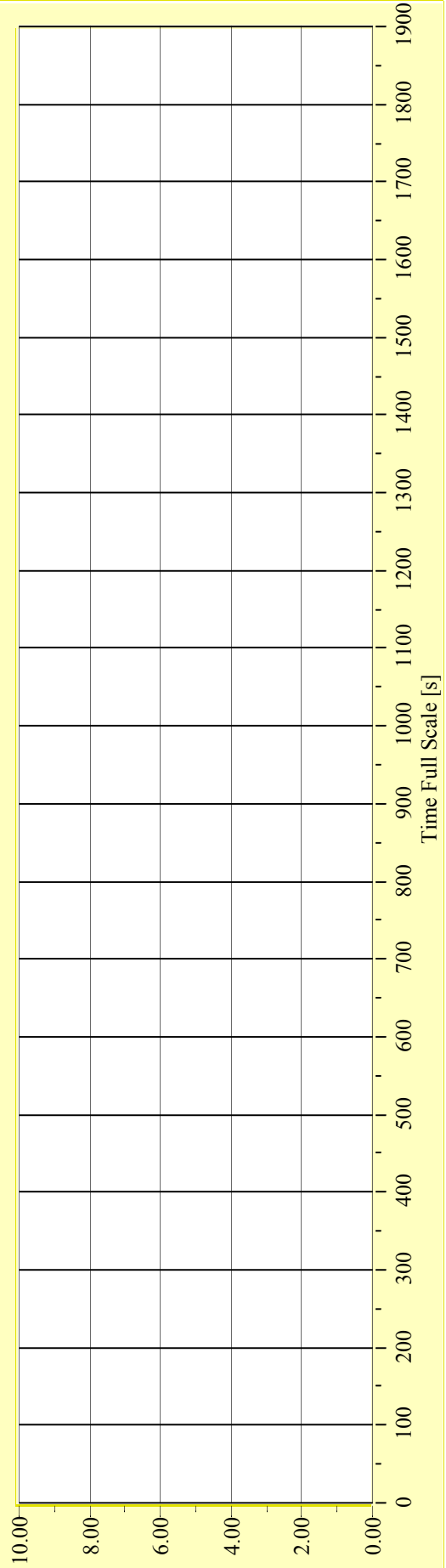
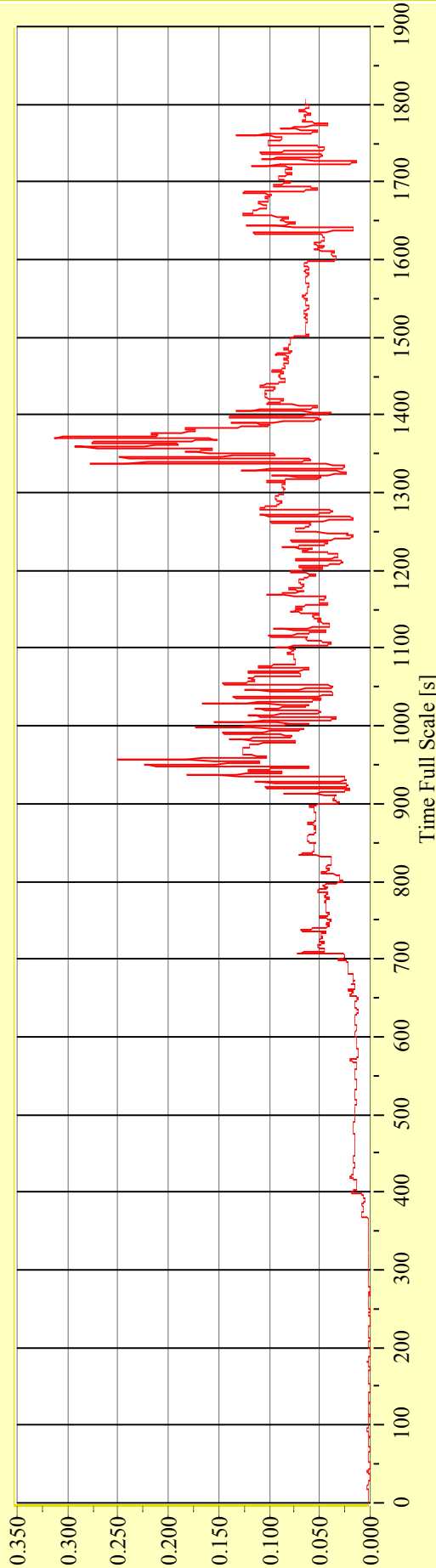
**Model No. 2446**

**Test No. 29688-06**

**Target Waves: Hs = 3,5 m Tp = 7,483 s**

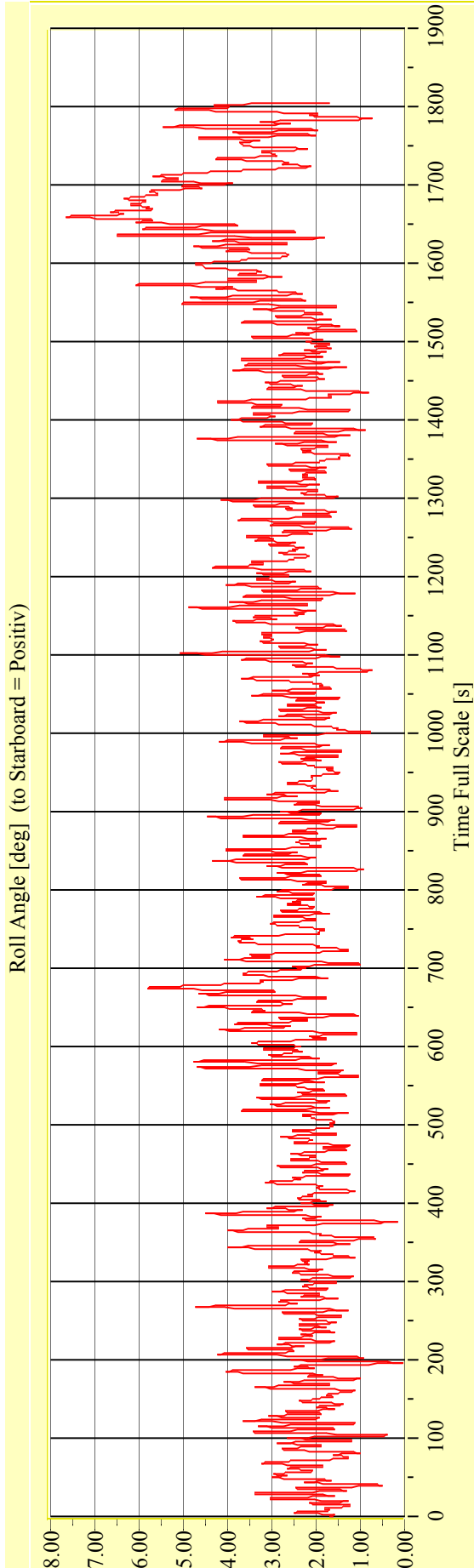
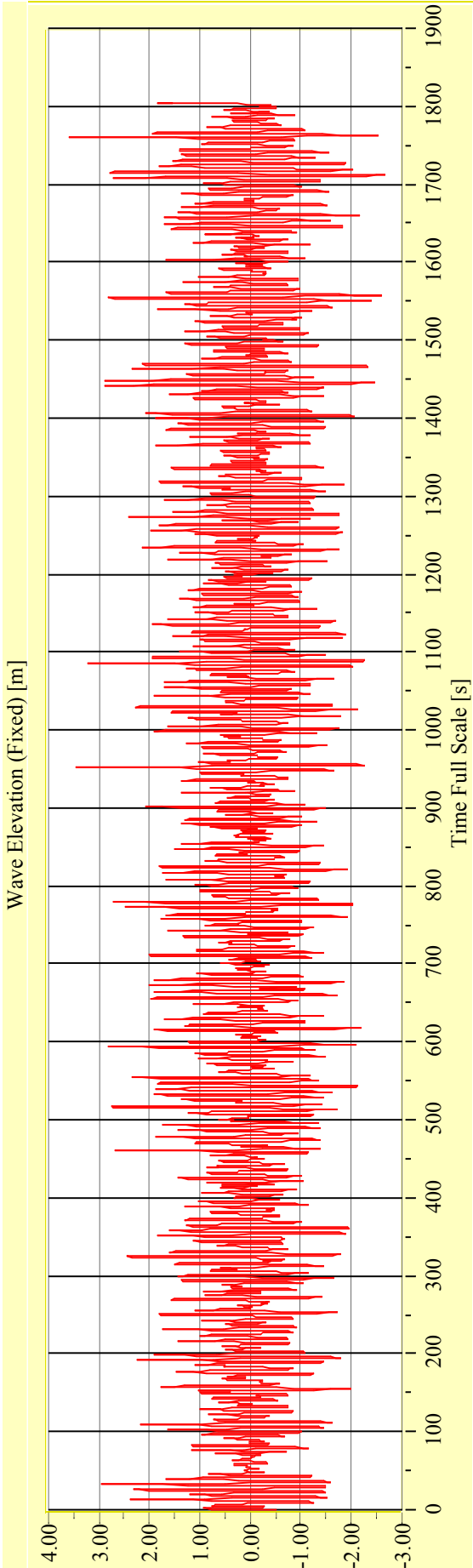
**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29688-07**      **Target Waves: Hs = 3,5 m Tp = 7,483 s**      **gamma = 3,3**



**Date: 20.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

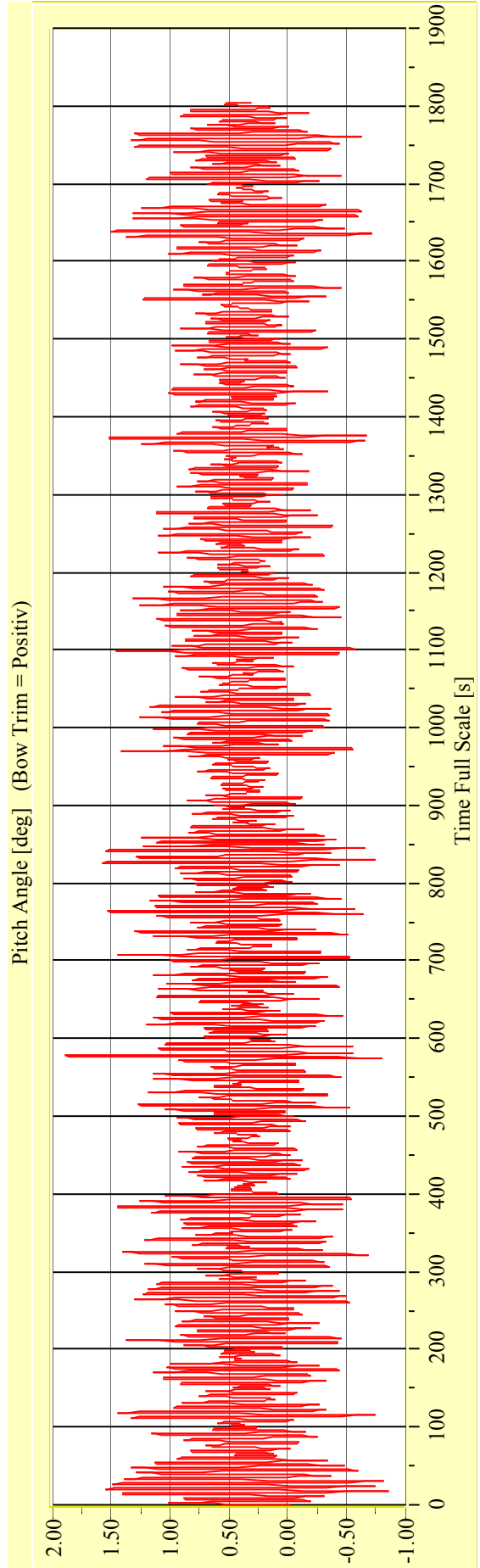
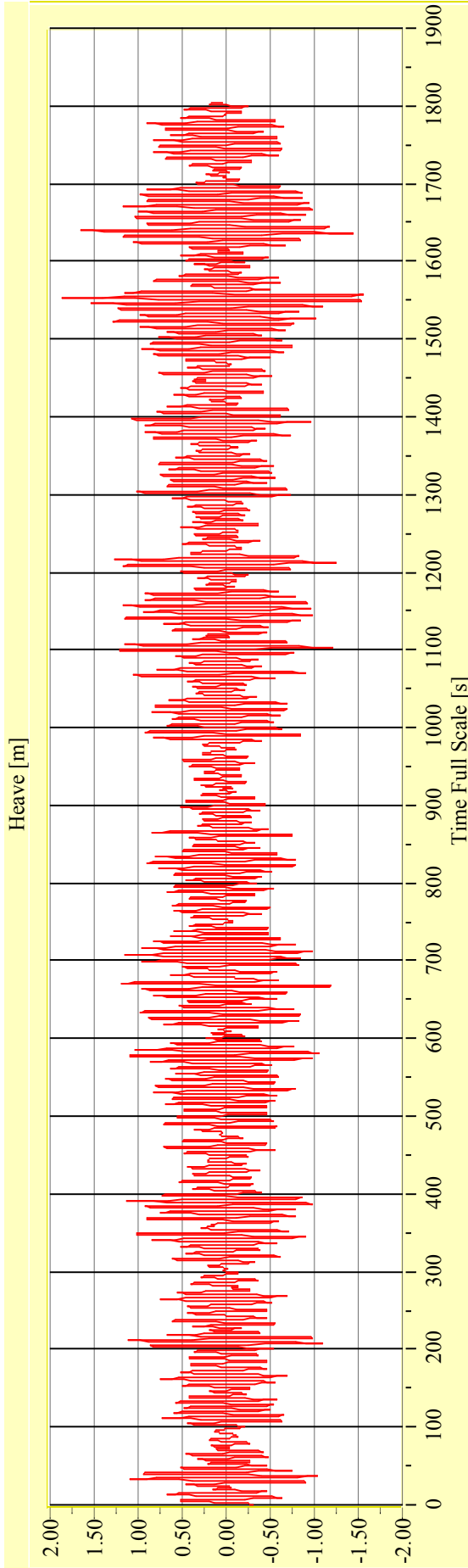
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29688-07**

**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**



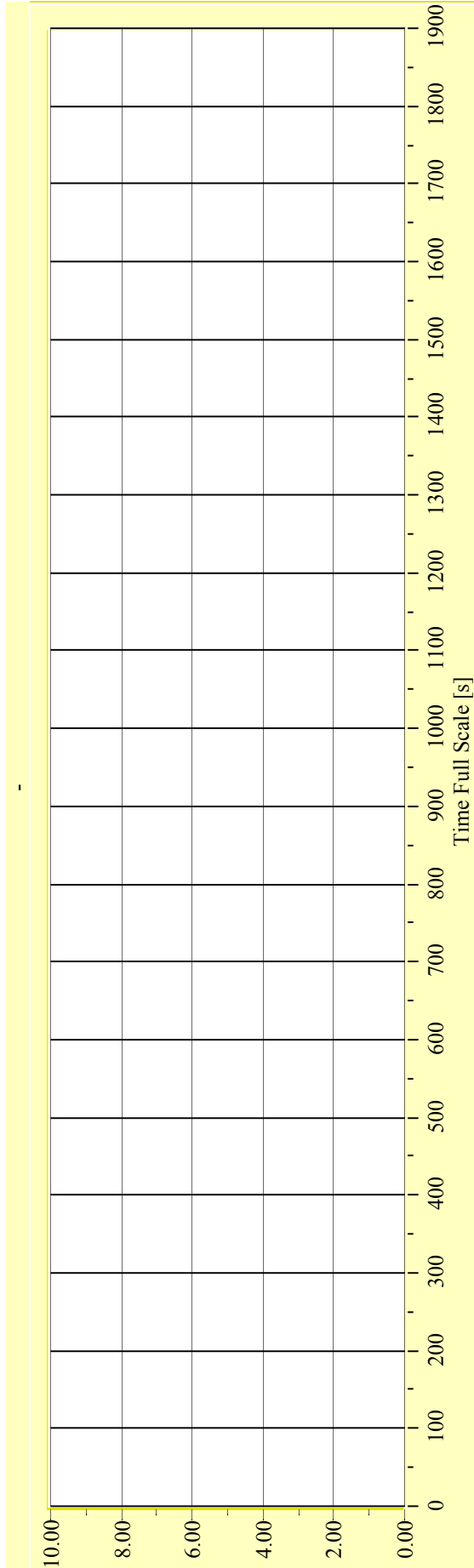
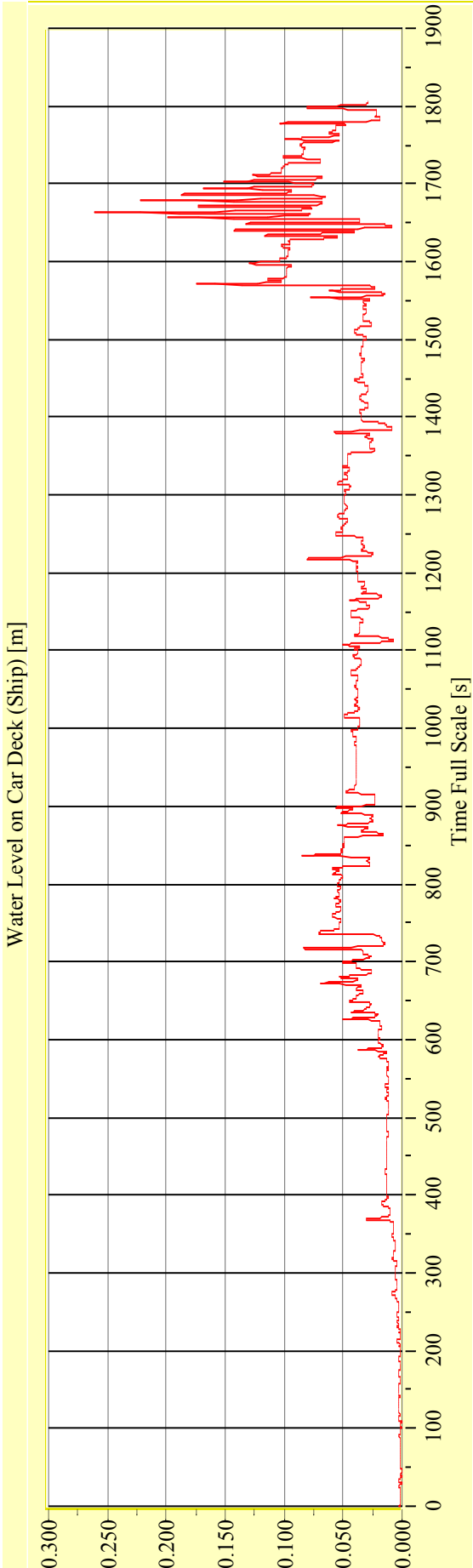
**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29688-07**      **Target Waves: Hs = 3,5 m Tp = 7,483 s**      **gamma = 3,3**



**Date: 20.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**



**Irregular Beam Seas**

**Vienna Model Basin**

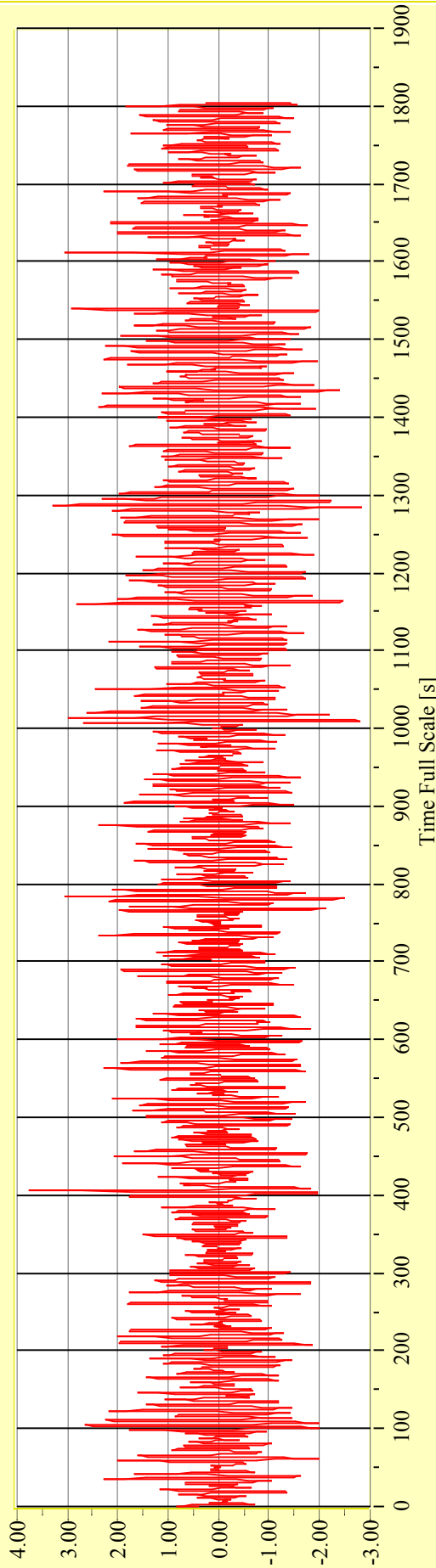
**Model No. 2446**

**Test No. 29688-08**

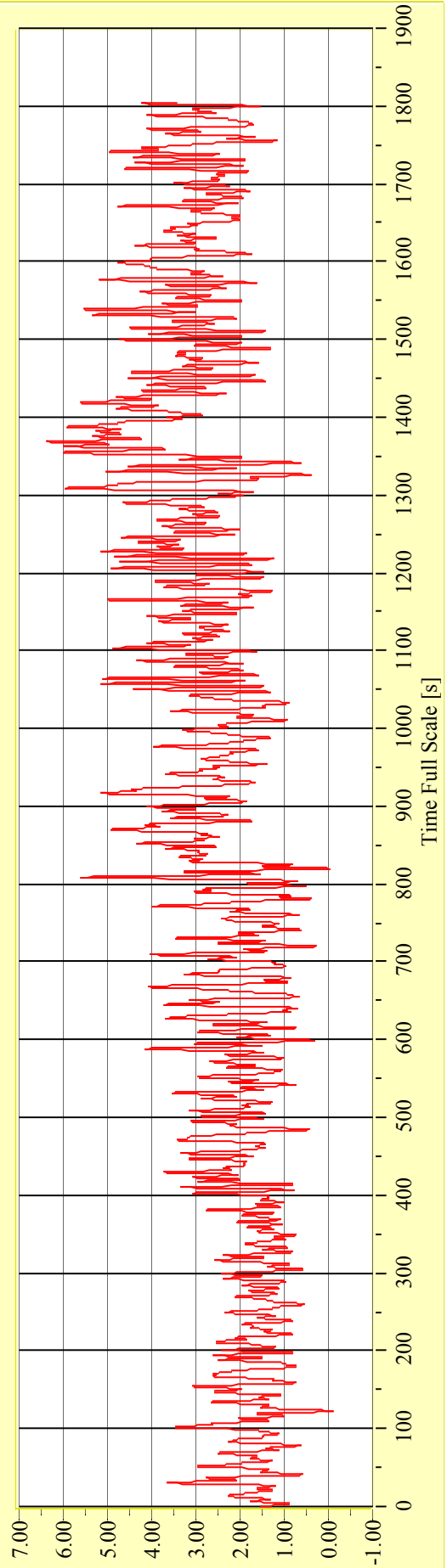
**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**

Wave Elevation (Fixed) [m]



Roll Angle [deg] (to Starboard = Positiv)



**Irregular Beam Seas**

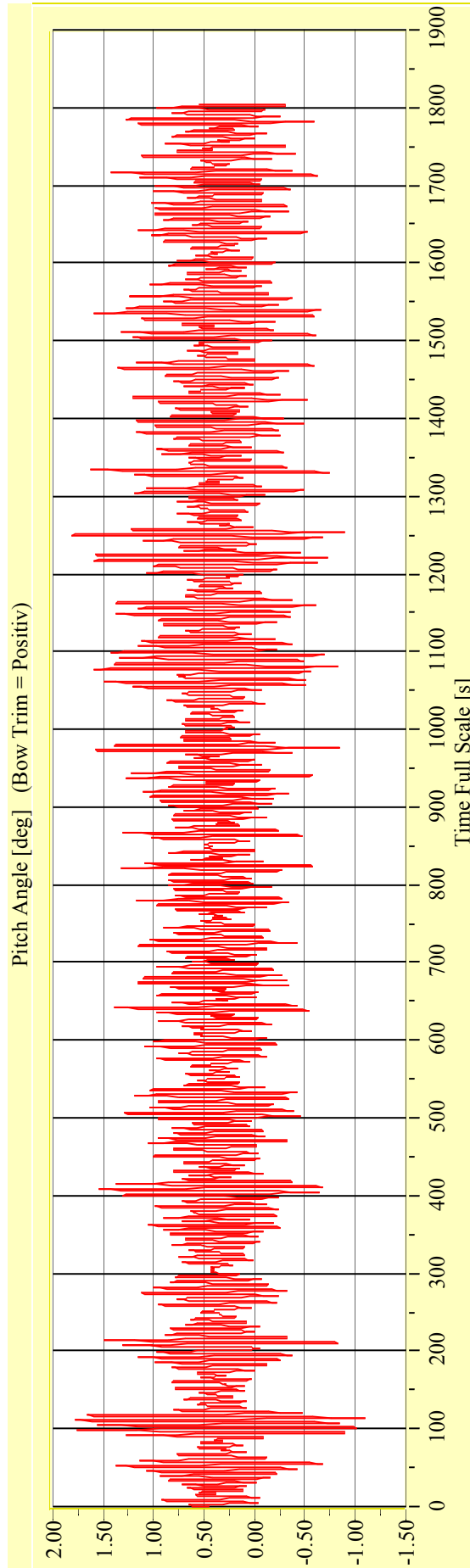
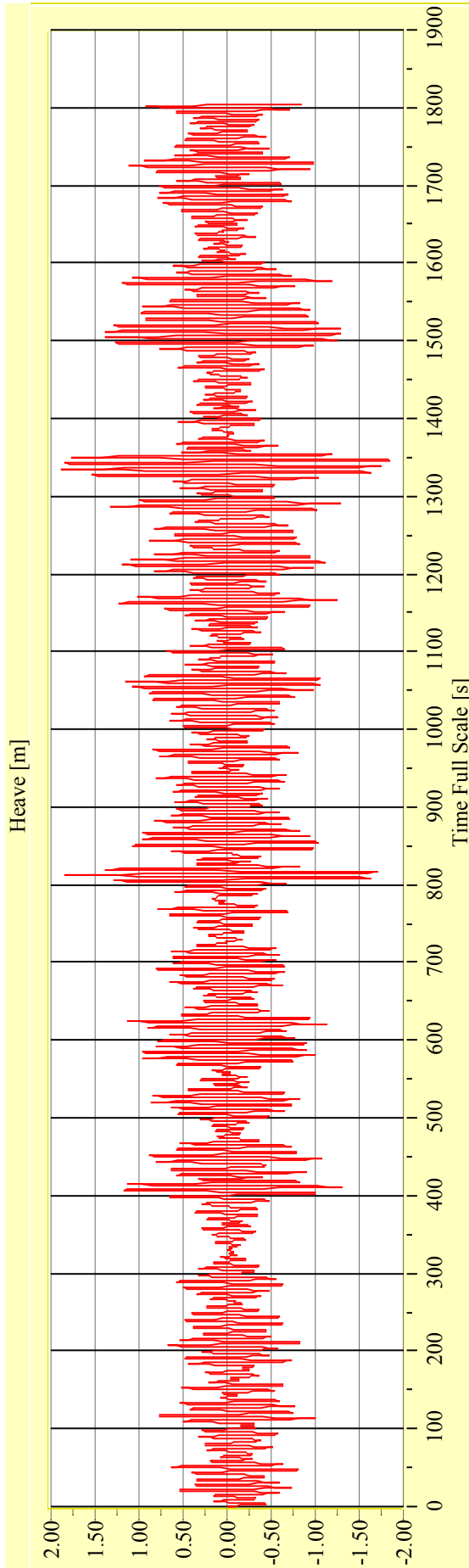
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29688-08**

**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**



**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**

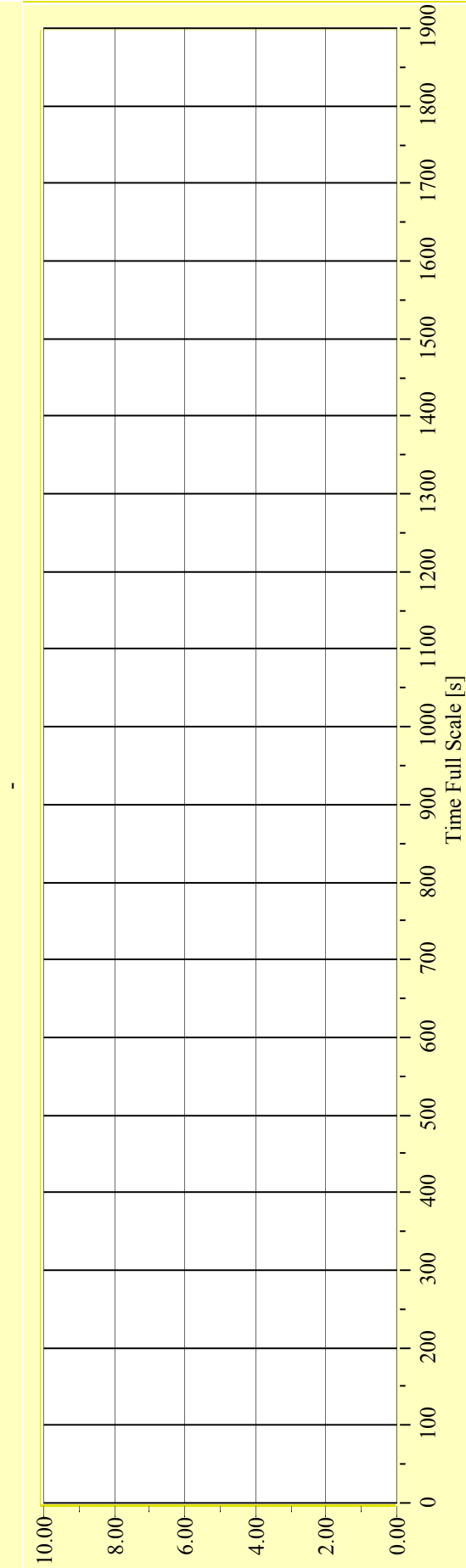
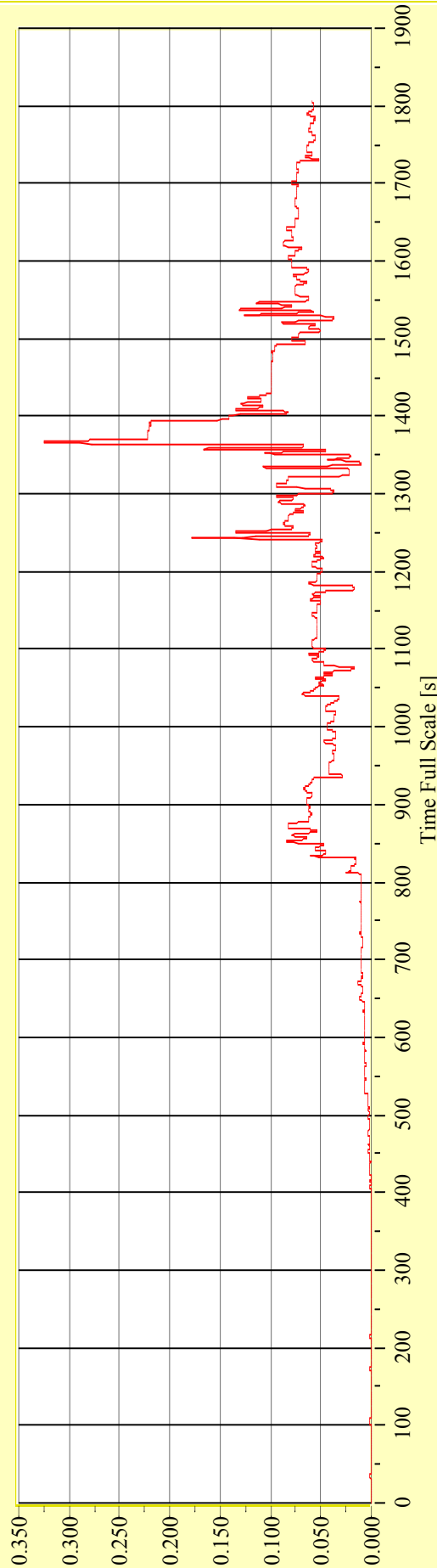
**Model No. 2446**

**Test No. 29688-08**

**Target Waves: Hs = 3.5 m Tp = 7,483 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**

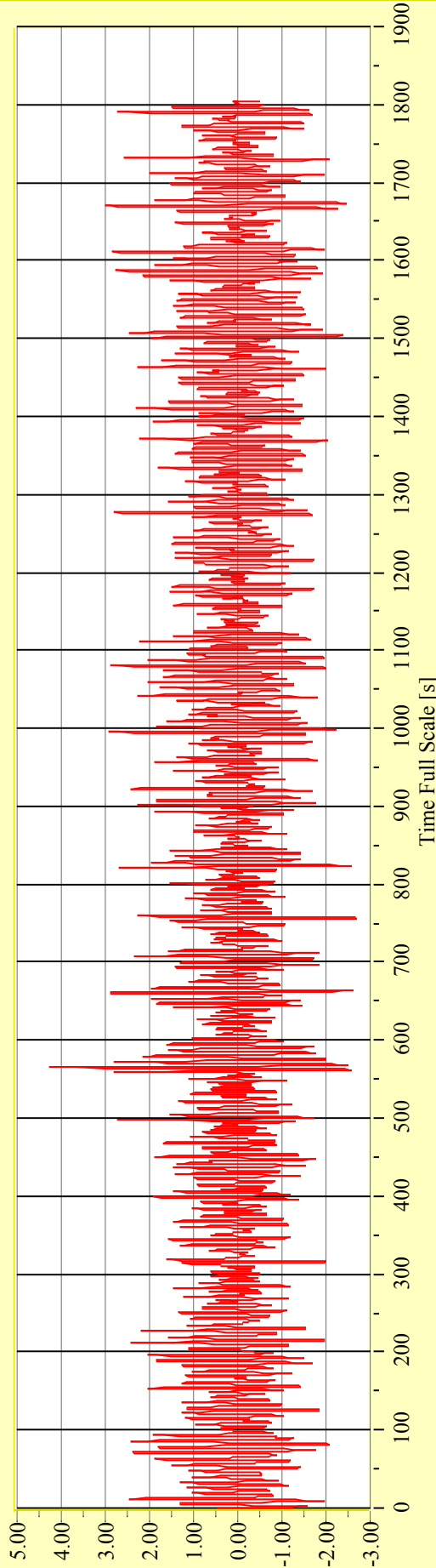
**Model No. 2446**

**Test No. 29688-09**

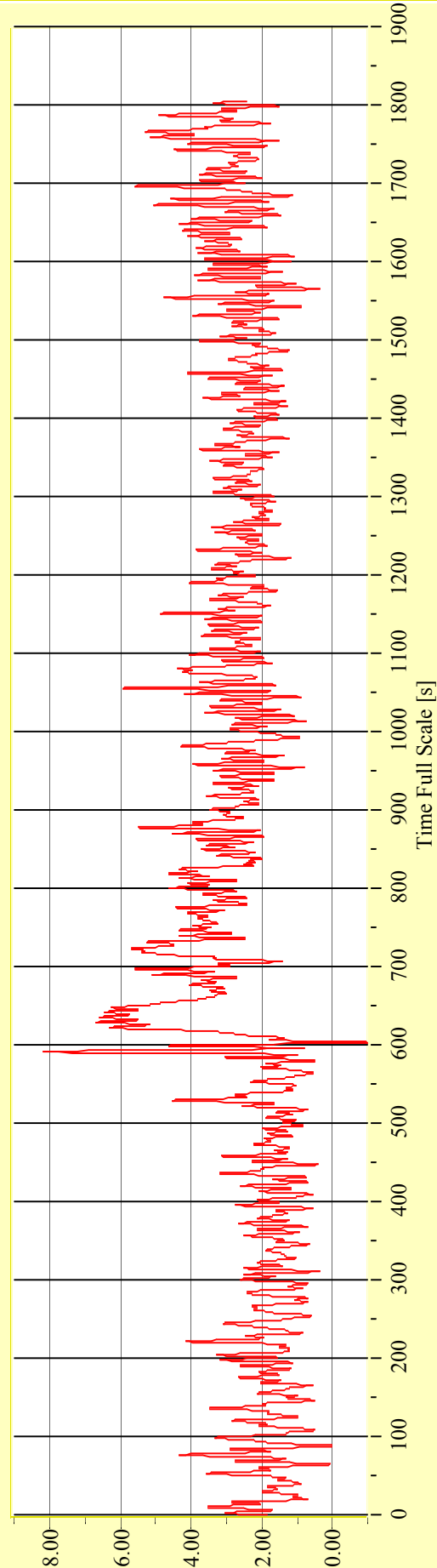
**Target Waves: Hs = 3.5 m Tp = 7,483 s**

**gamma = 3,3**

Wave Elevation (Fixed) [m]



Roll Angle [deg] (to Starboard = Positiv)



**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

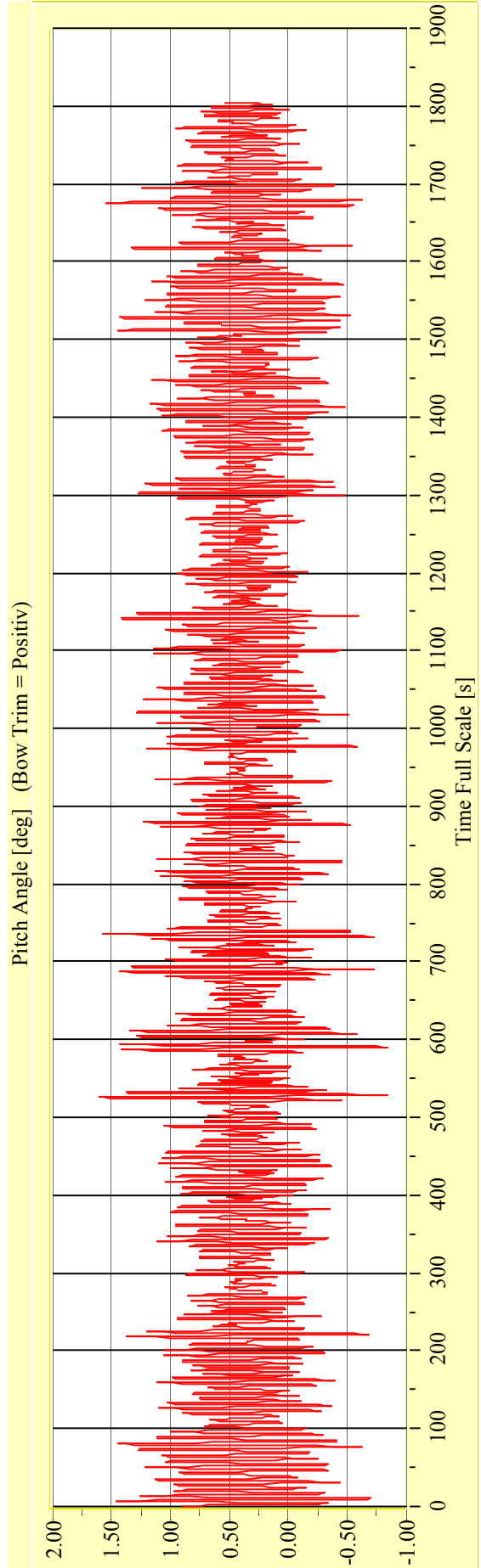
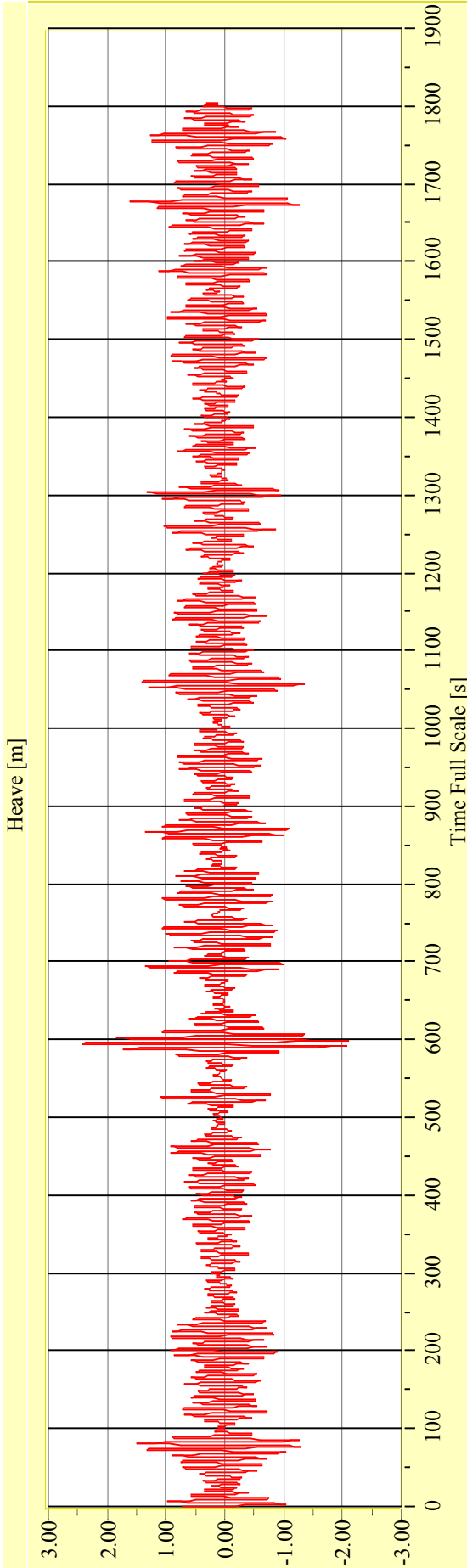
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29688-09**

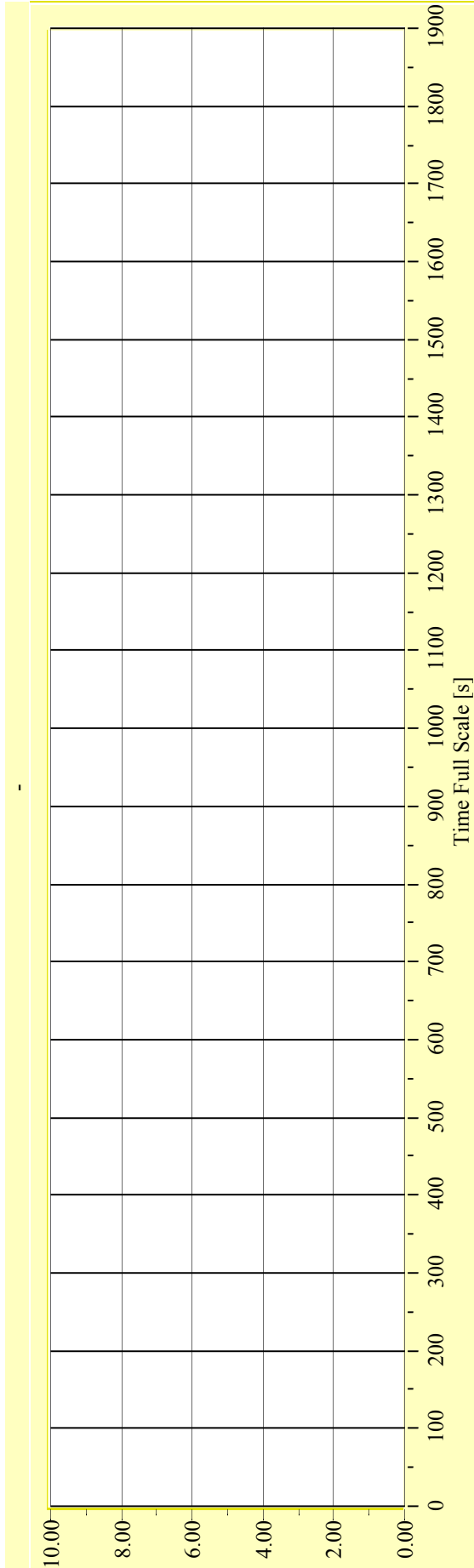
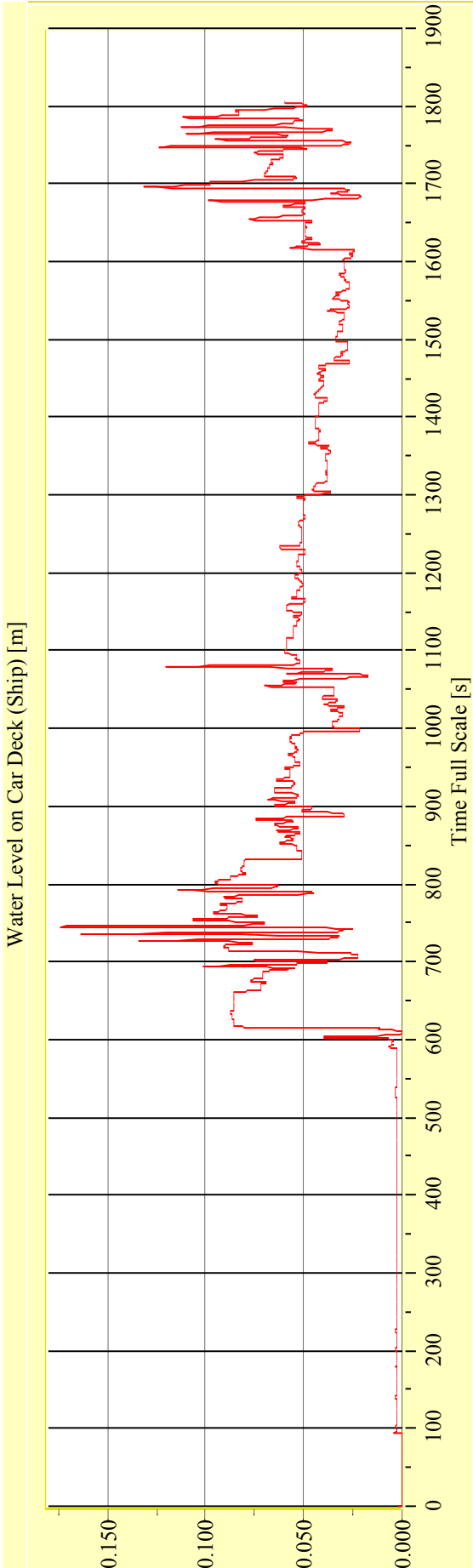
**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29688-09**      **Target Waves: Hs = 3,5 m Tp = 7,483 s**      **gamma = 3,3**



**Date: 20.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

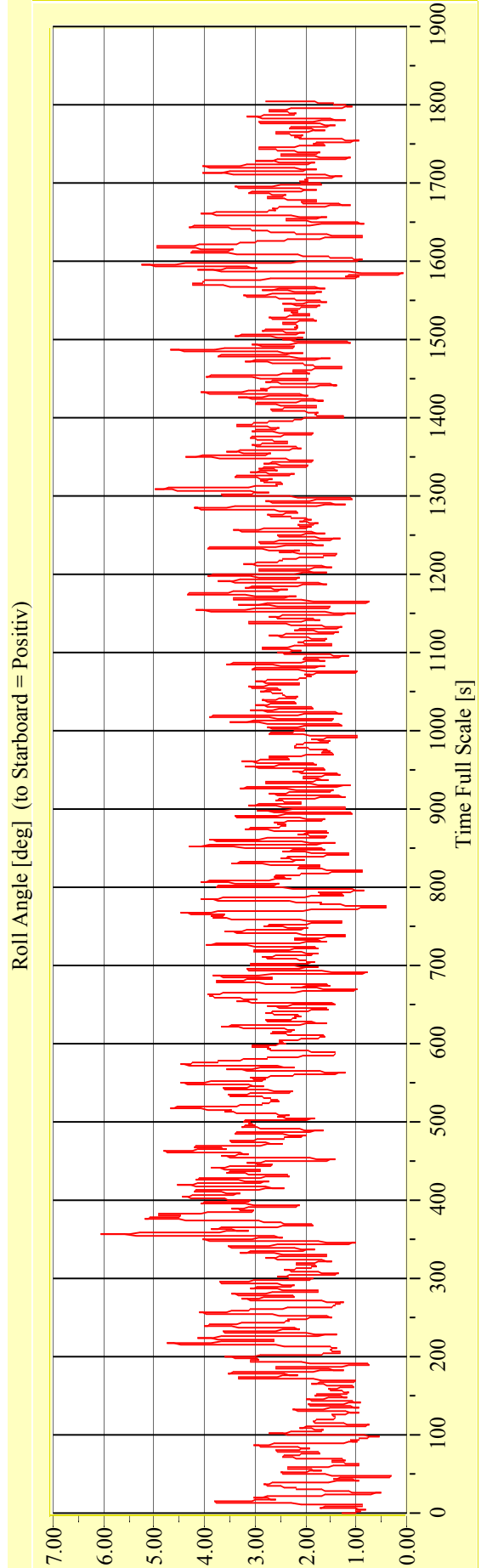
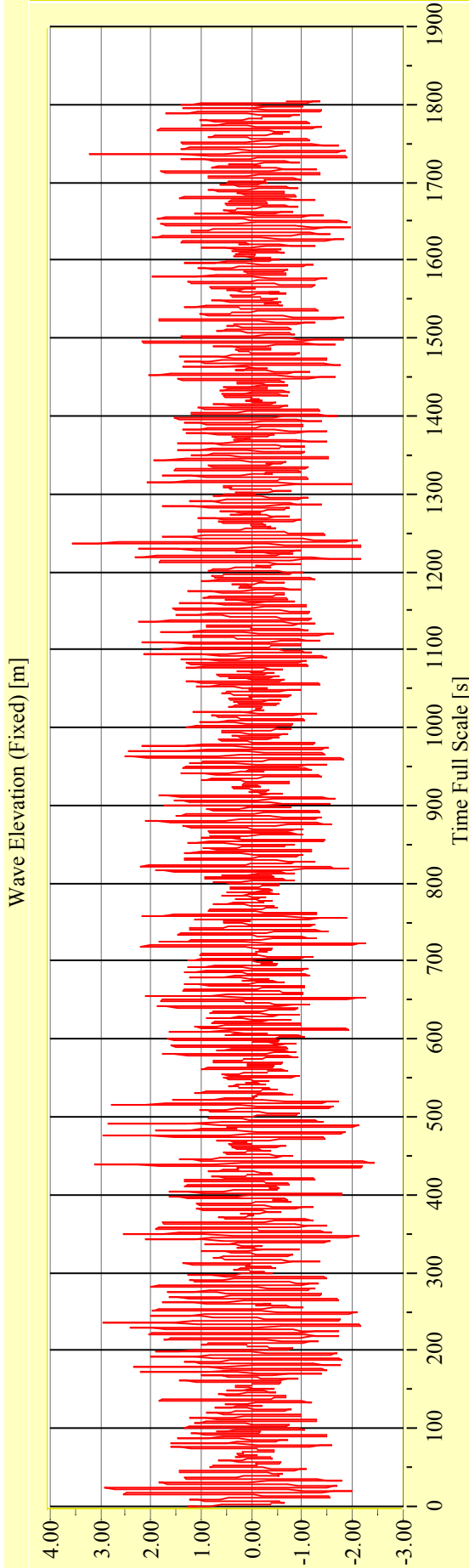
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29688-10**

**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**



**Irregular Beam Seas**

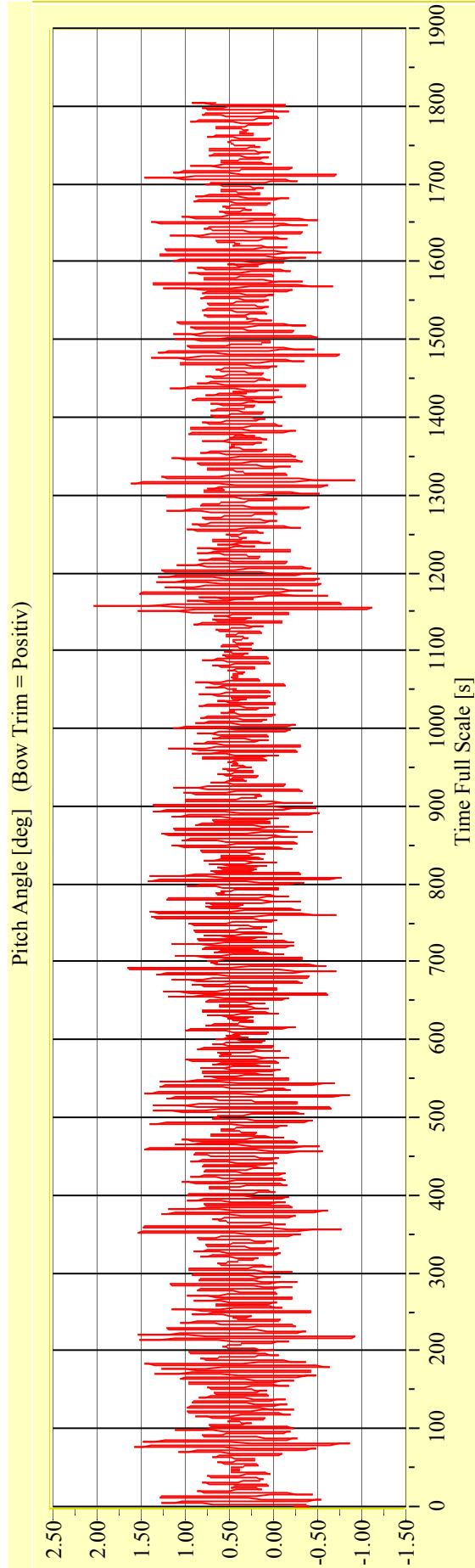
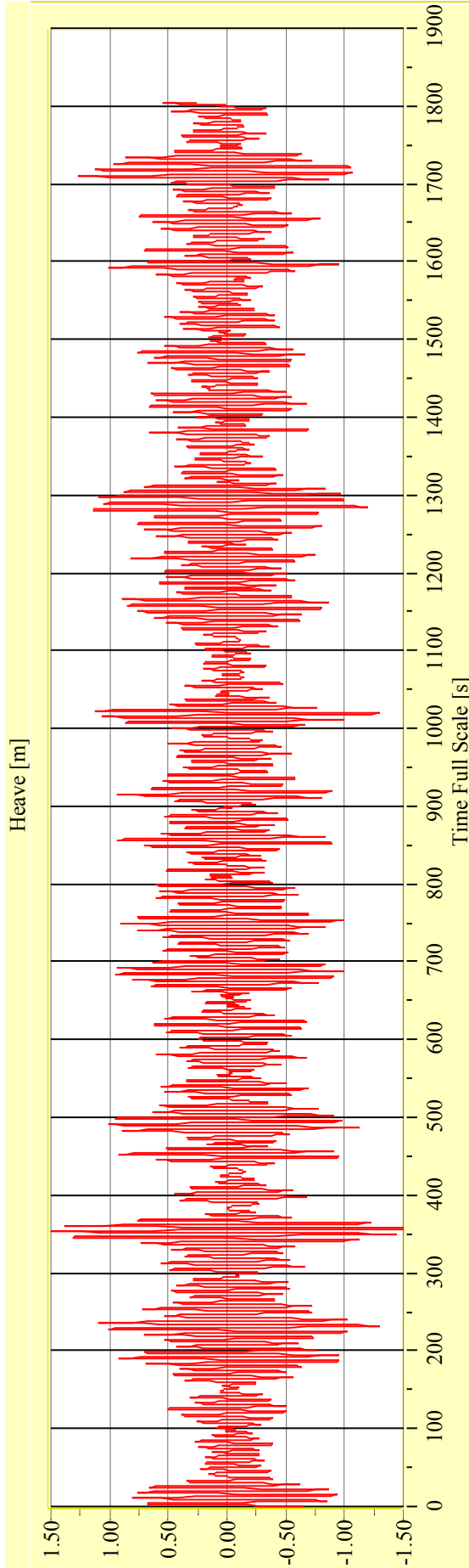
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29688-10**

**Target Waves: Hs = 3,5 m Tp = 7,483 s**

**gamma = 3,3**



**Date: 20.05.2010**

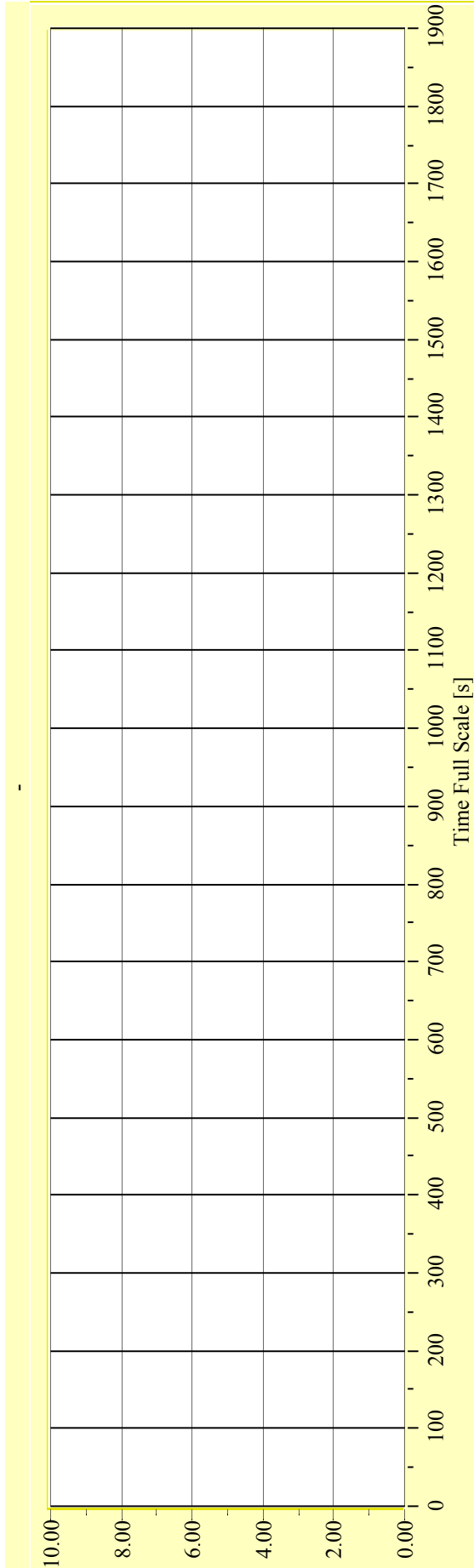
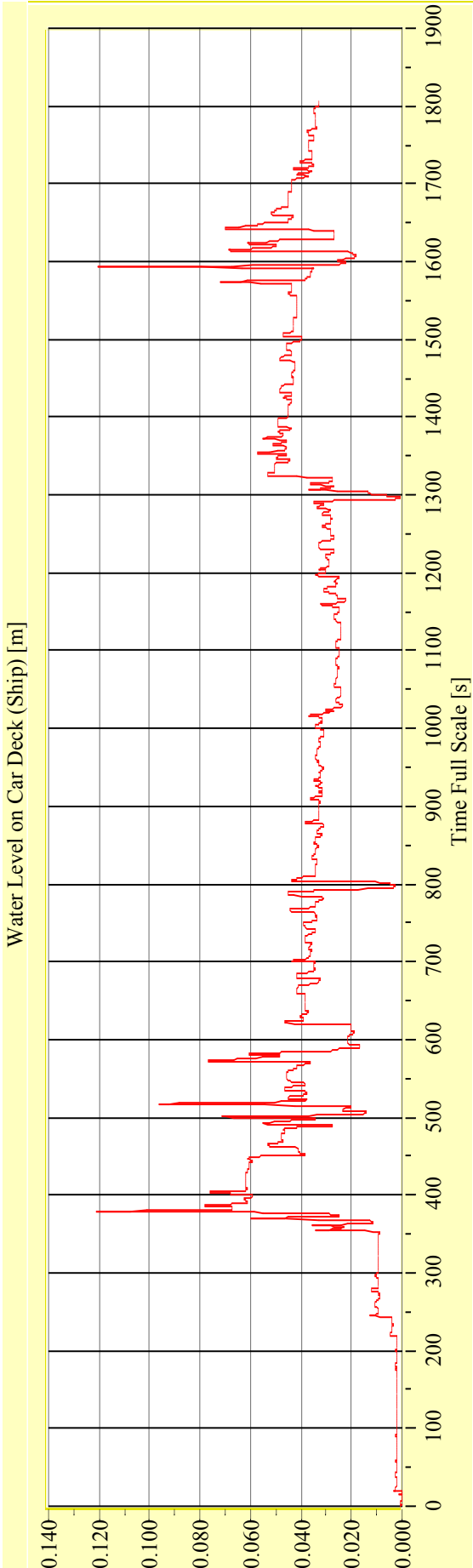
**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29688-10**      **Target Waves: Hs = 3,5 m Tp = 7,483 s**      **gamma = 3,3**



**Date: 20.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**

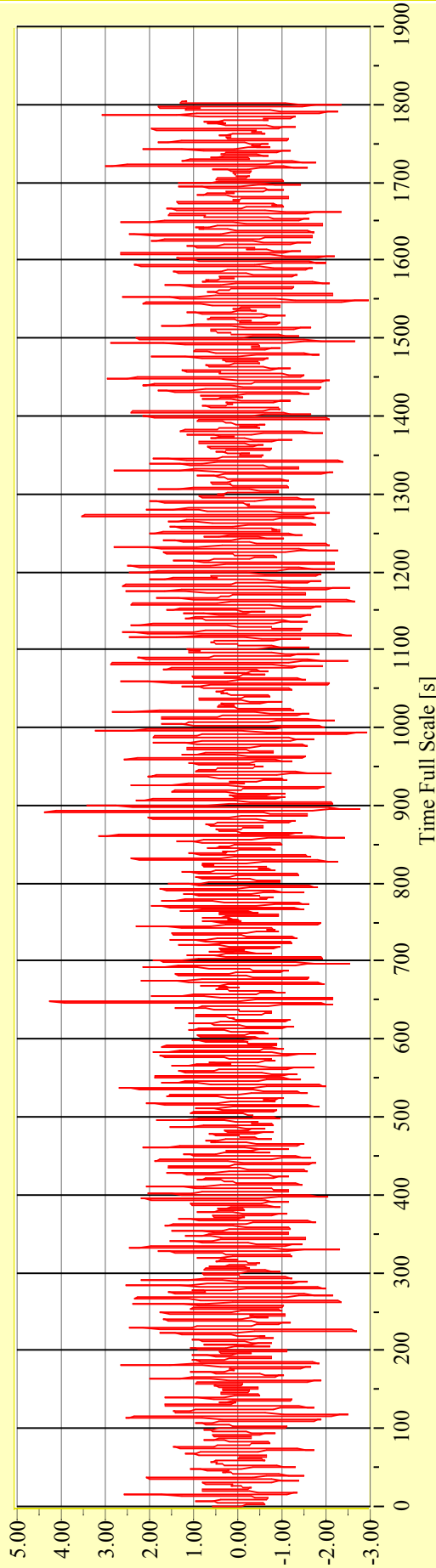
**Model No. 2446**

**Test No. 29689-02**

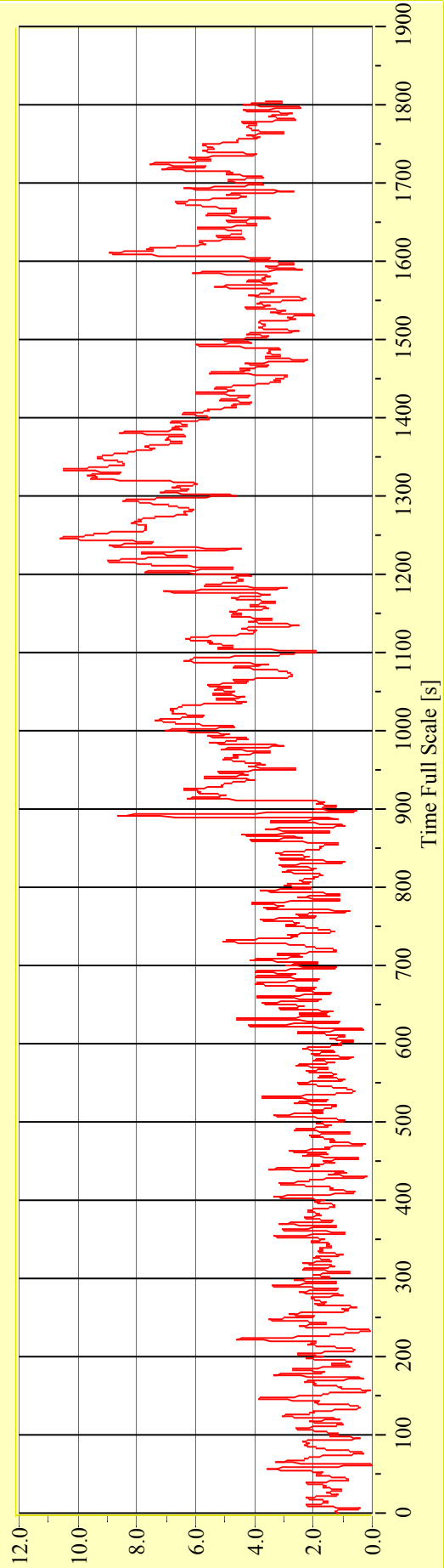
**Target Waves: Hs = 4,25 m Tp = 8,246 s**

**gamma = 3,3**

Wave Elevation (Fixed) [m]



Roll Angle [deg] (to Starboard = Positiv)



**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

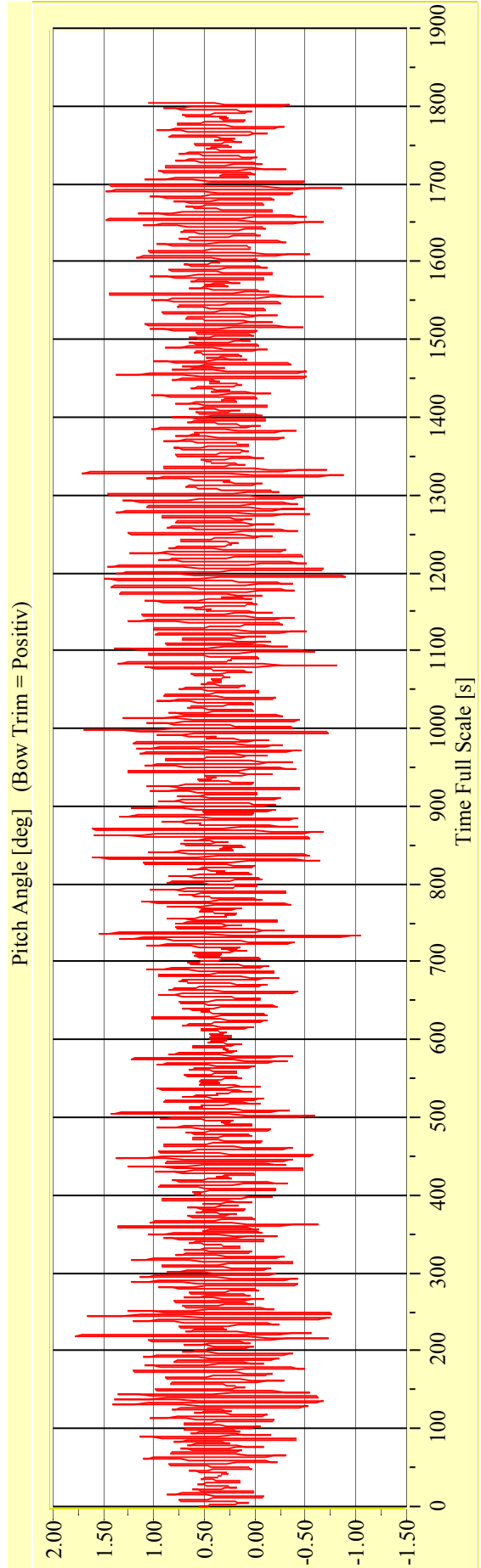
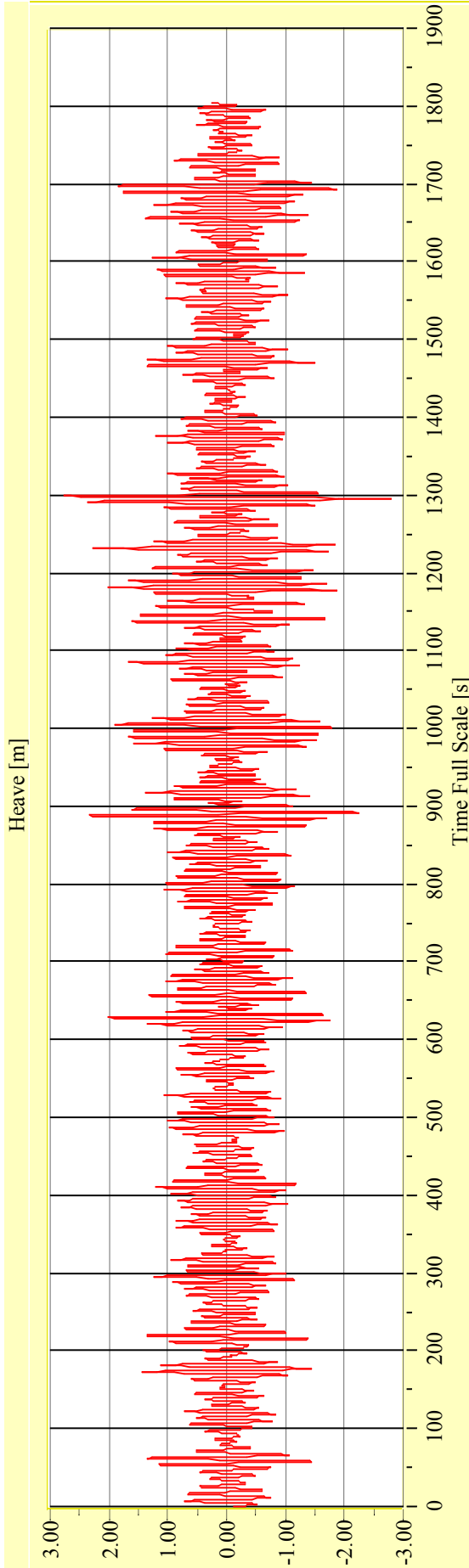
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29689-02**

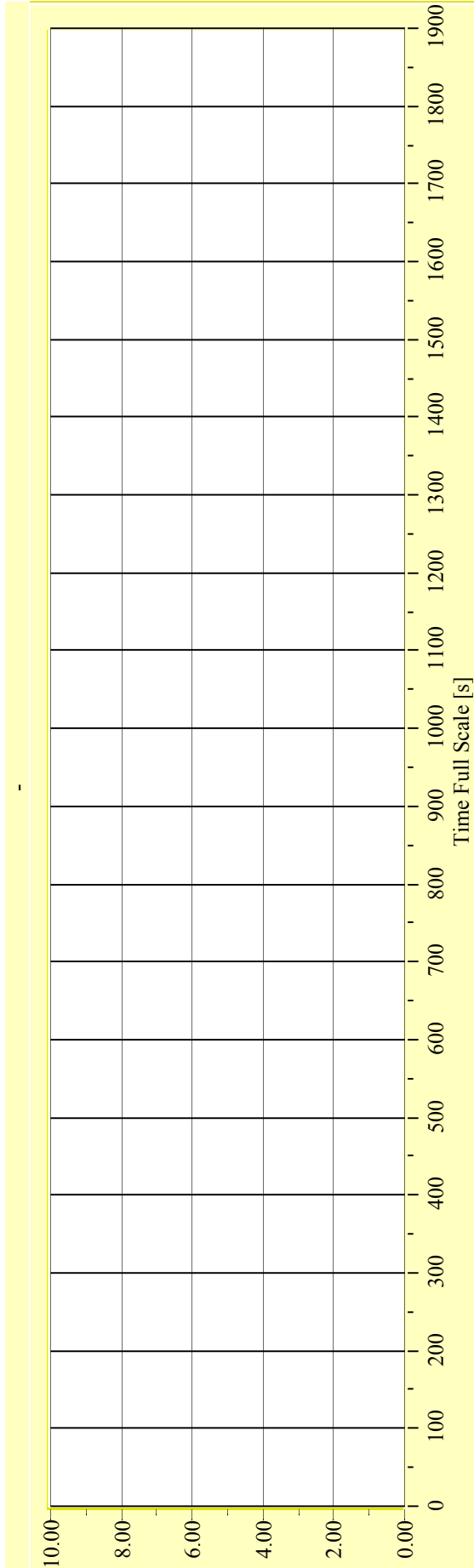
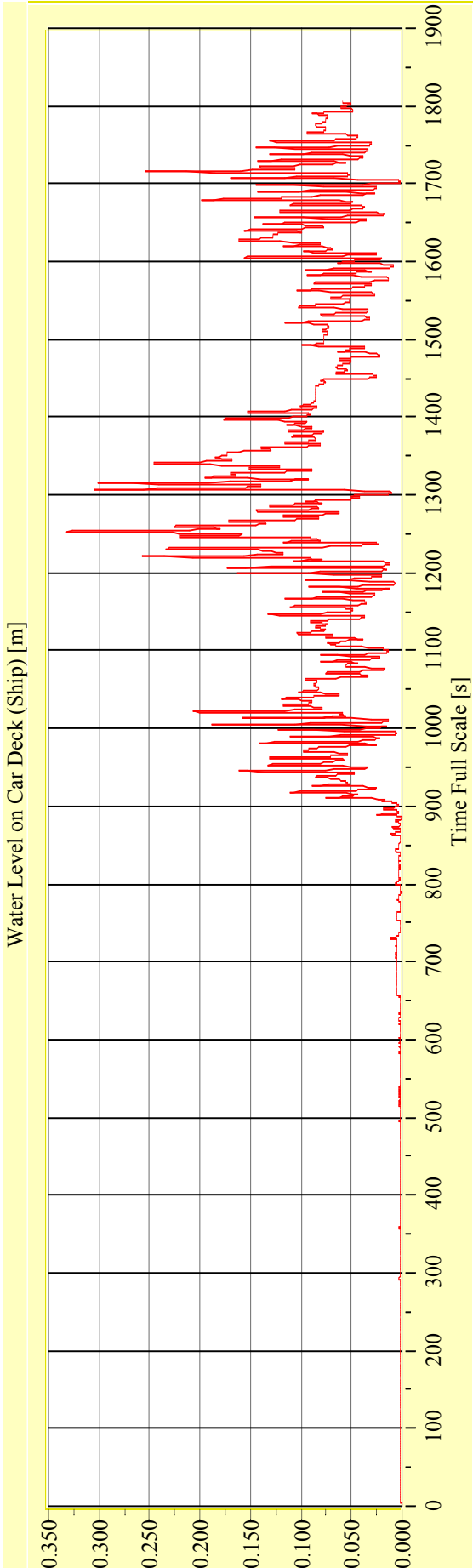
**Target Waves: Hs = 4,25 m Tp = 8,246 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29689-02**      **Target Waves: Hs = 4,25 m Tp = 8,246 s**      **gamma = 3,3**



**Date: 20.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**

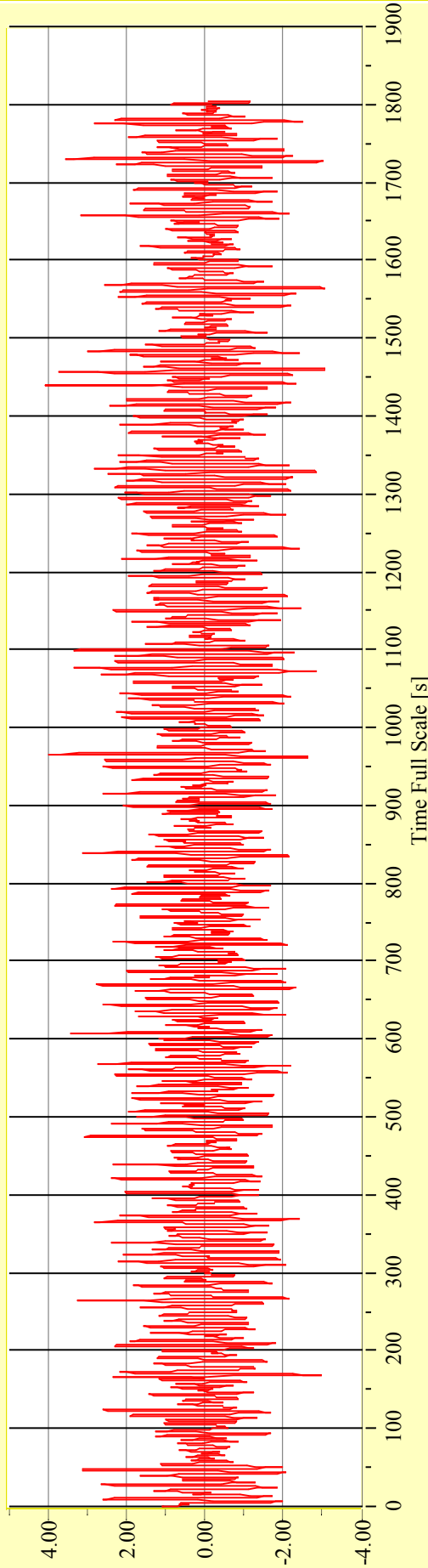
**Model No. 2446**

**Test No. 29689-03**

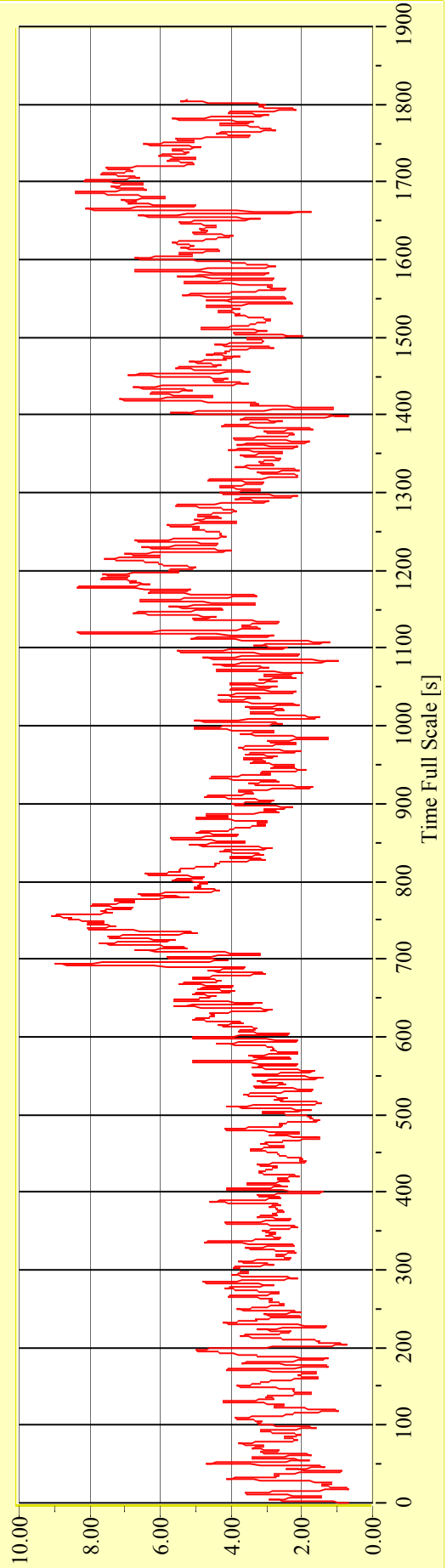
**Target Waves: Hs = 4,25 m Tp = 8,246 s**

**gamma = 3,3**

Wave Elevation (Fixed) [m]



Roll Angle [deg] (to Starboard = Positiv)



**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

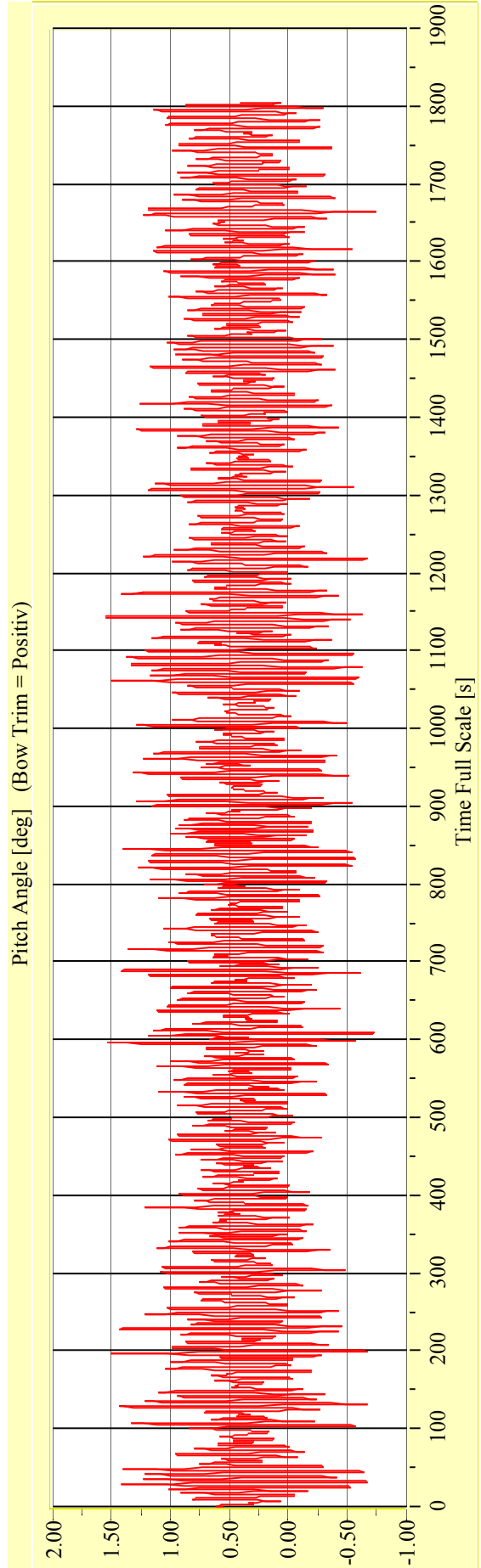
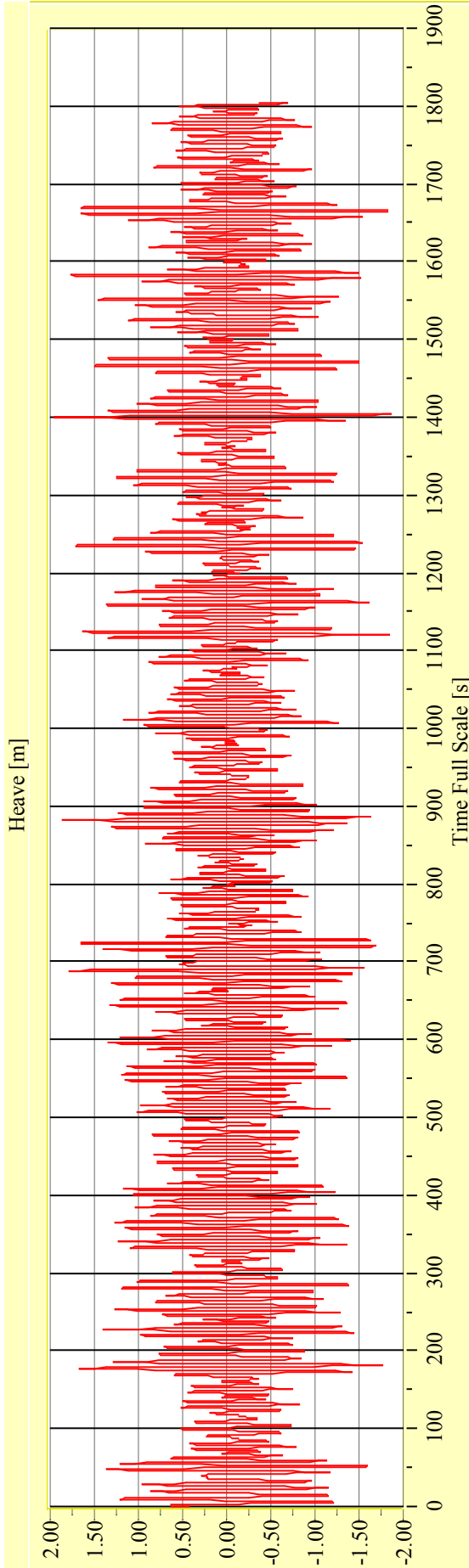
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29689-03**

**Target Waves: Hs = 4,25 m Tp = 8,246 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

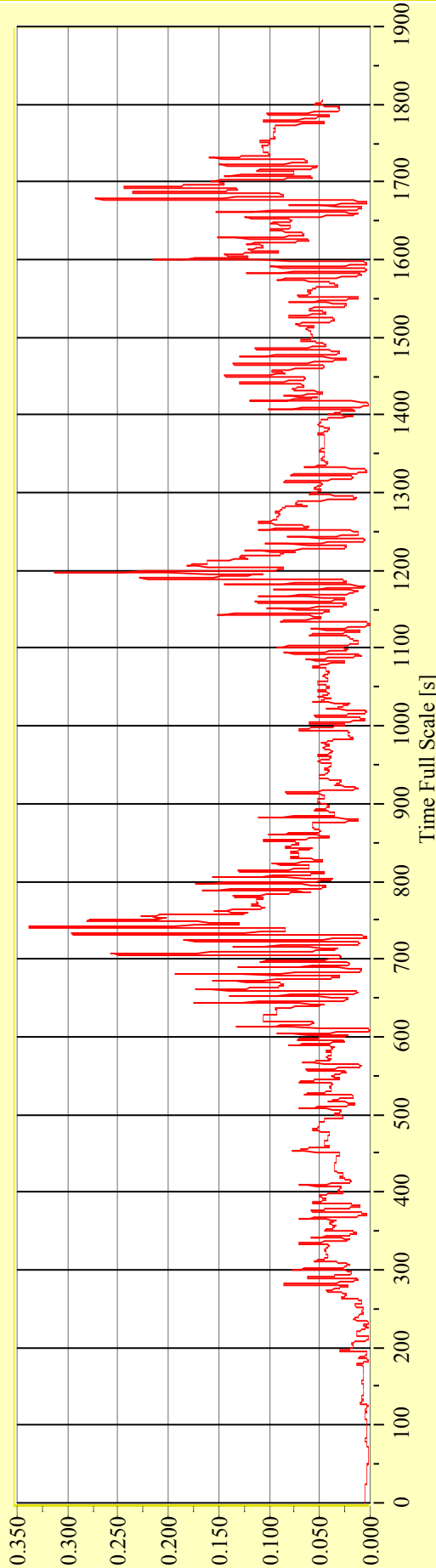
**Model No. 2446**

**Test No. 29689-03**

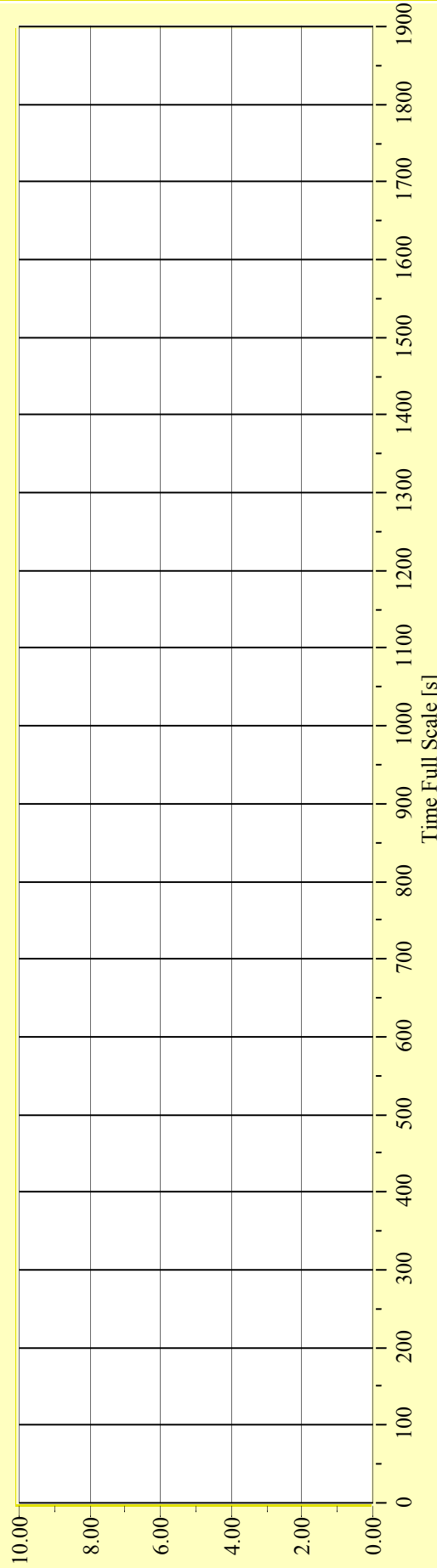
**Target Waves: Hs = 4,25 m Tp = 8,246 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



Time Full Scale [s]



**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**

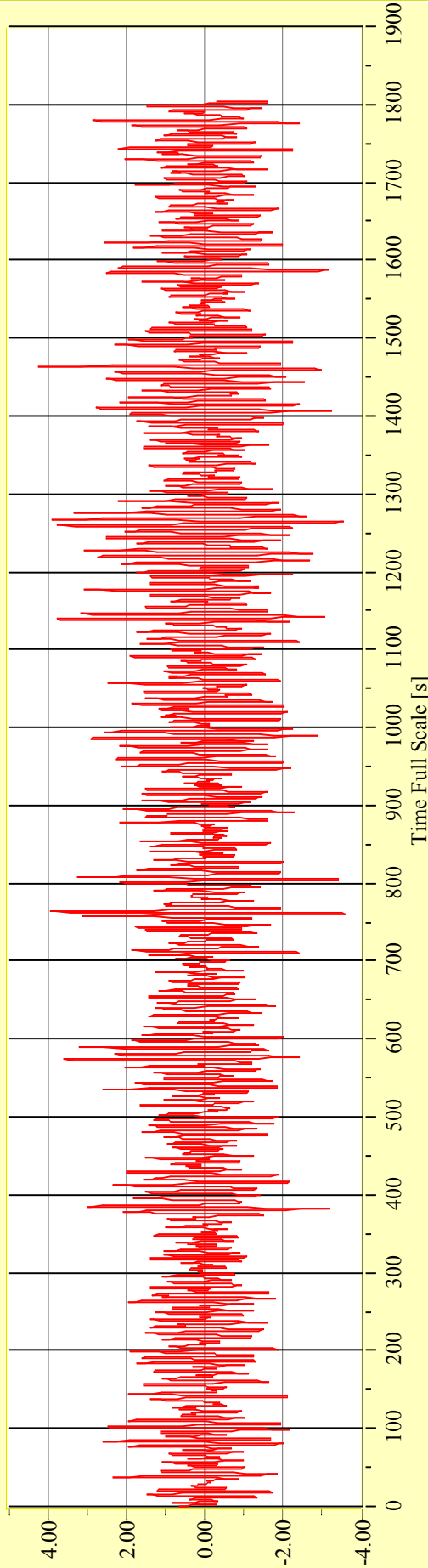
**Model No. 2446**

**Test No. 29689-04**

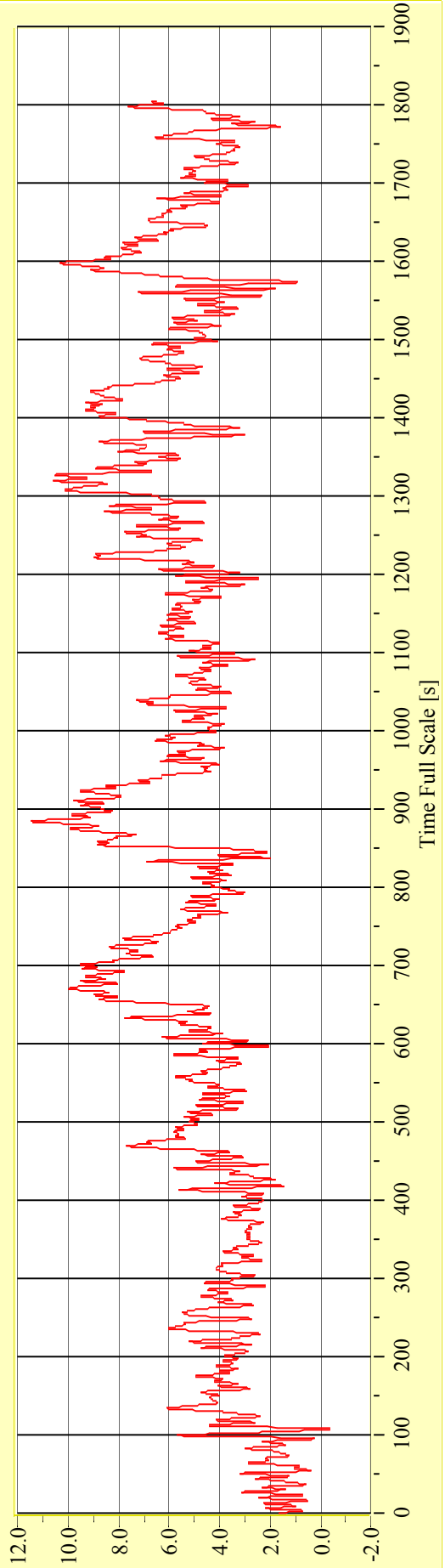
**Target Waves: Hs = 4,25 m Tp = 8,246 s**

**gamma = 3,3**

Wave Elevation (Fixed) [m]



Roll Angle [deg] (to Starboard = Positiv)



**Date: 20.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**



**Irregular Beam Seas**

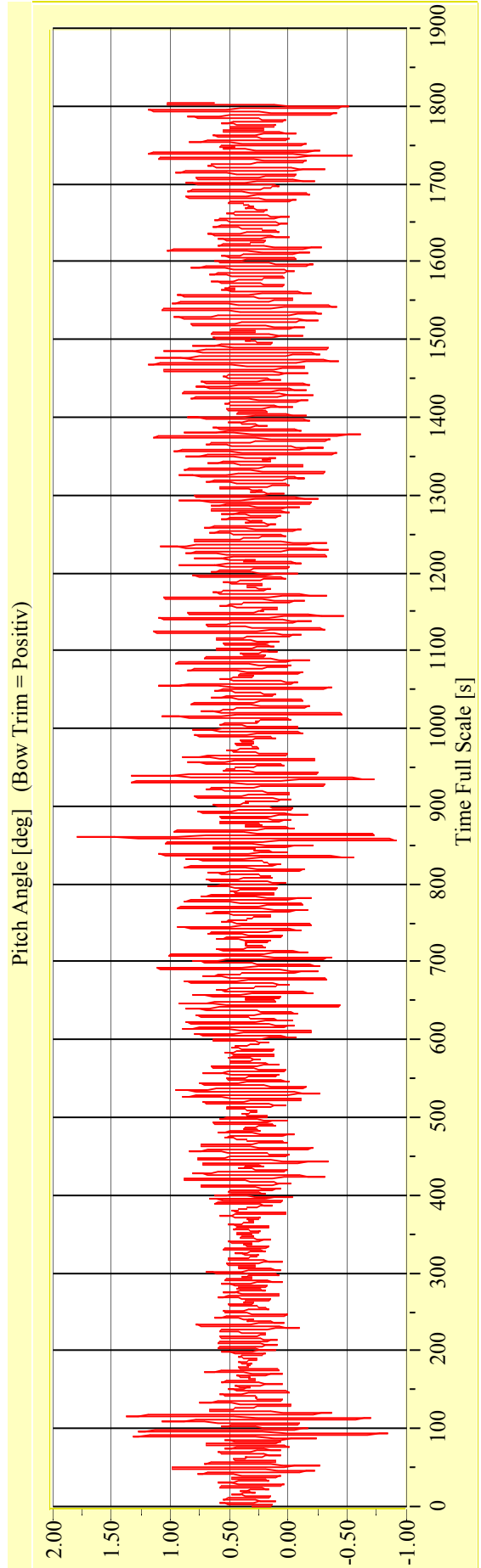
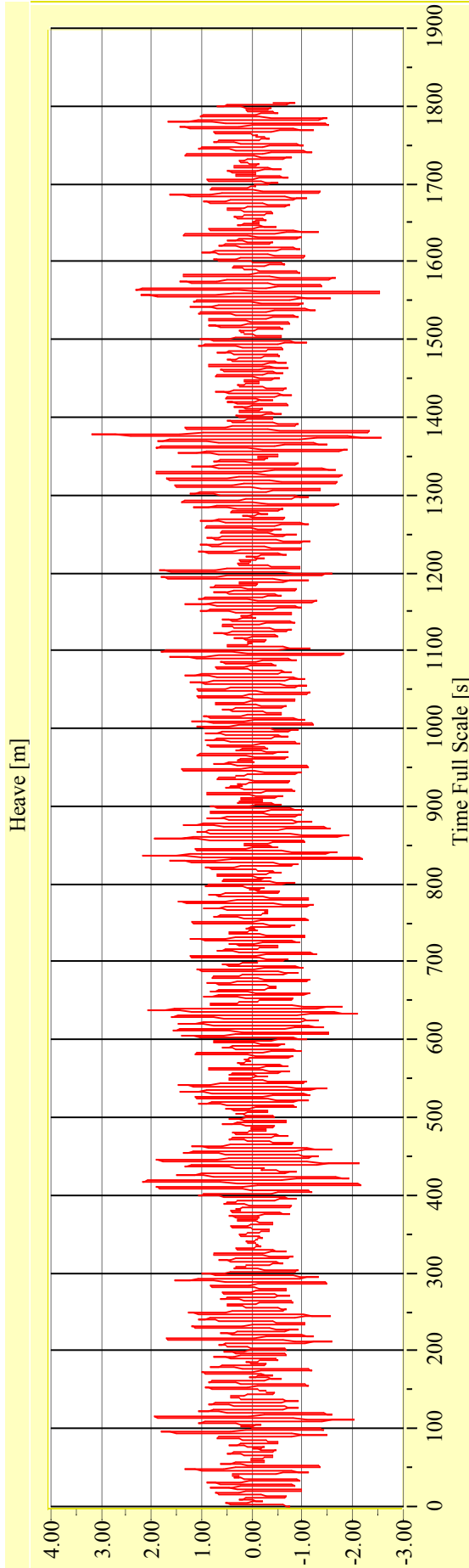
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29689-04**

**Target Waves: Hs = 4,25 m Tp = 8,246 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

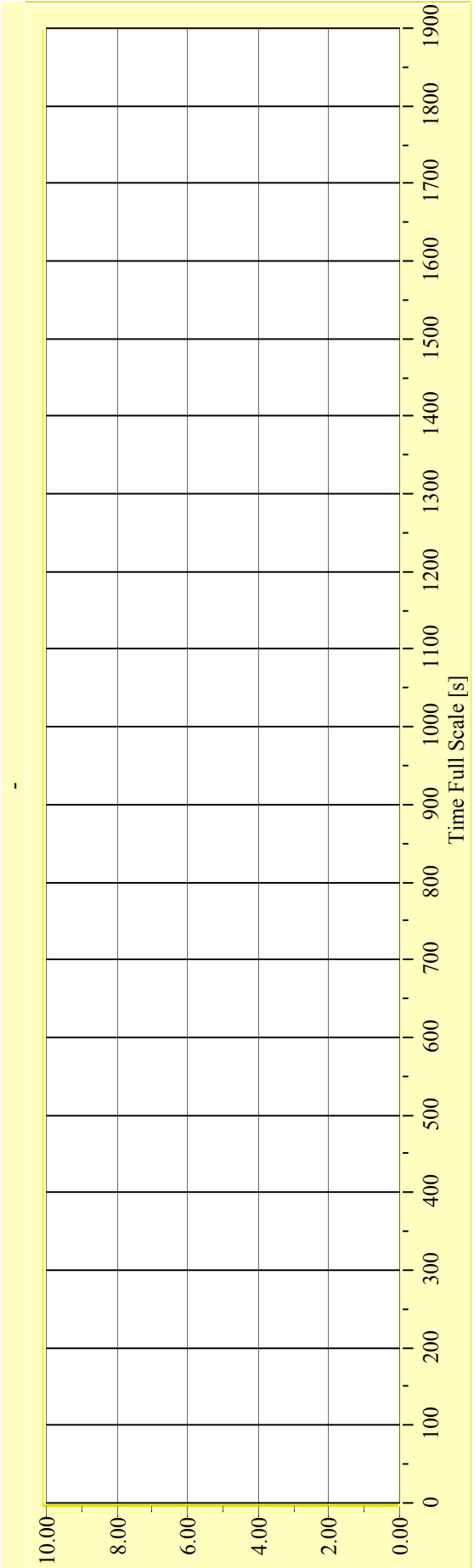
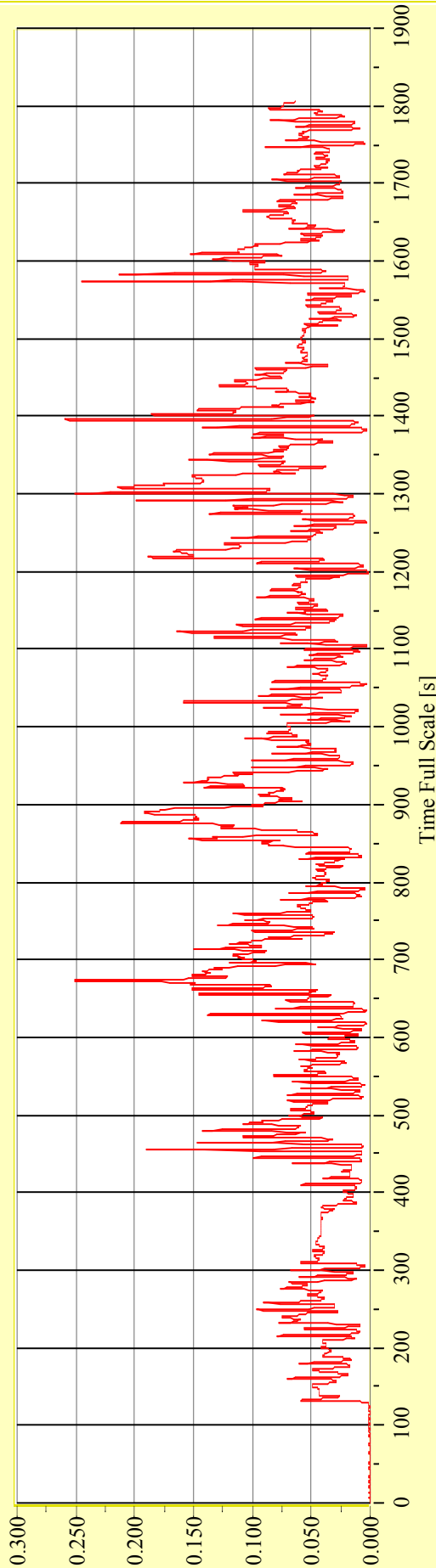
**Model No. 2446**

**Test No. 29689-04**

**Target Waves: Hs = 4,25 m Tp = 8,246 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Irregular Beam Seas**

**Vienna Model Basin**

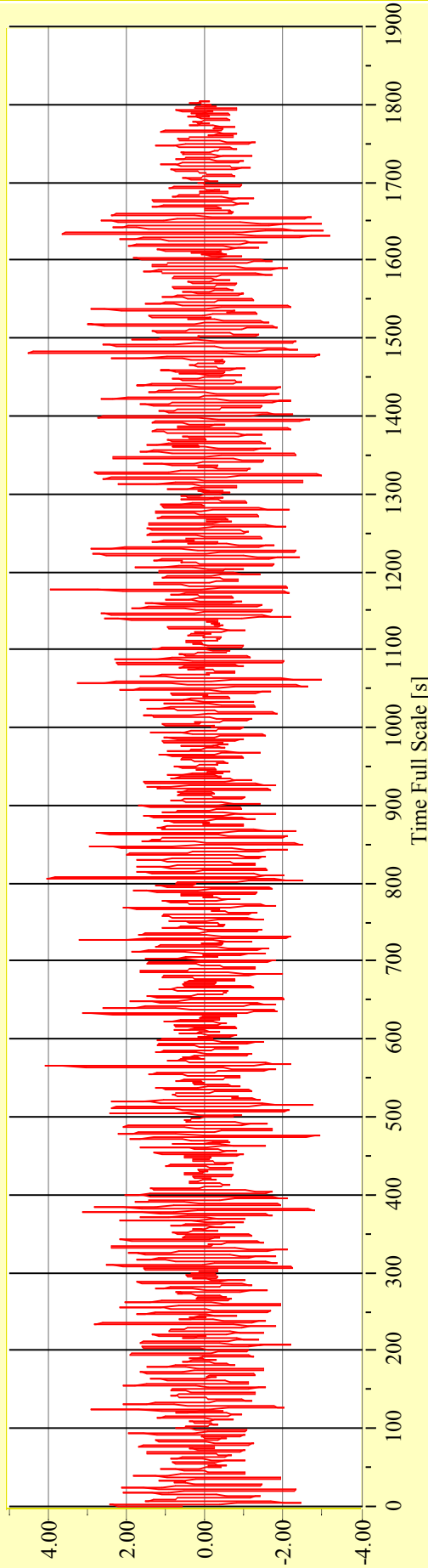
**Model No. 2446**

**Test No. 29689-05**

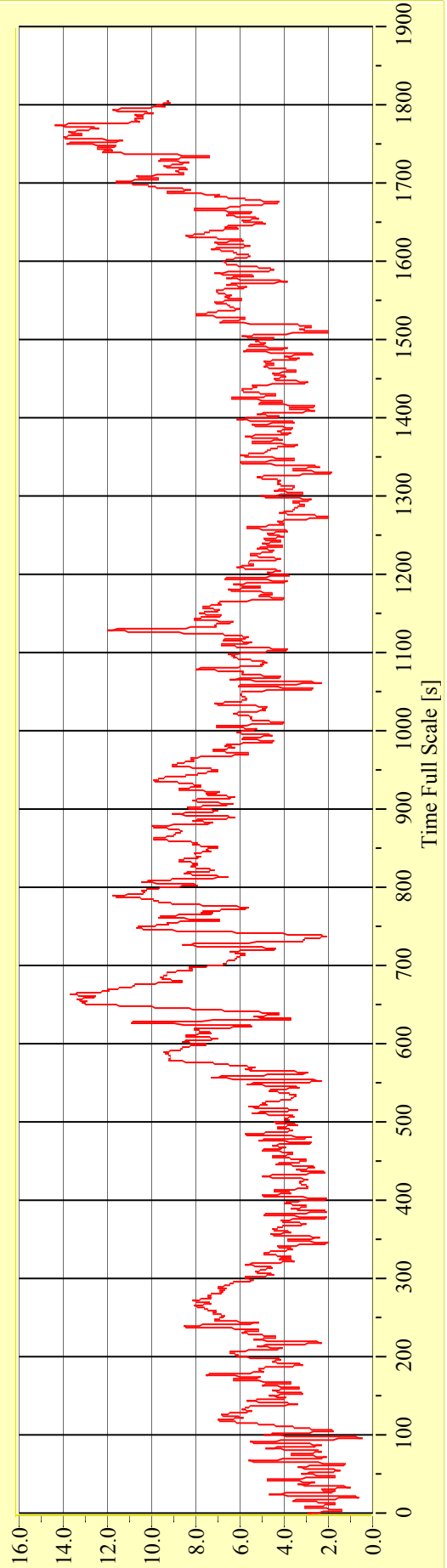
**Target Waves: Hs = 4,25 m Tp = 8,246 s**

**gamma = 3,3**

Wave Elevation (Fixed) [m]



Roll Angle [deg] (to Starboard = Positiv)



**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

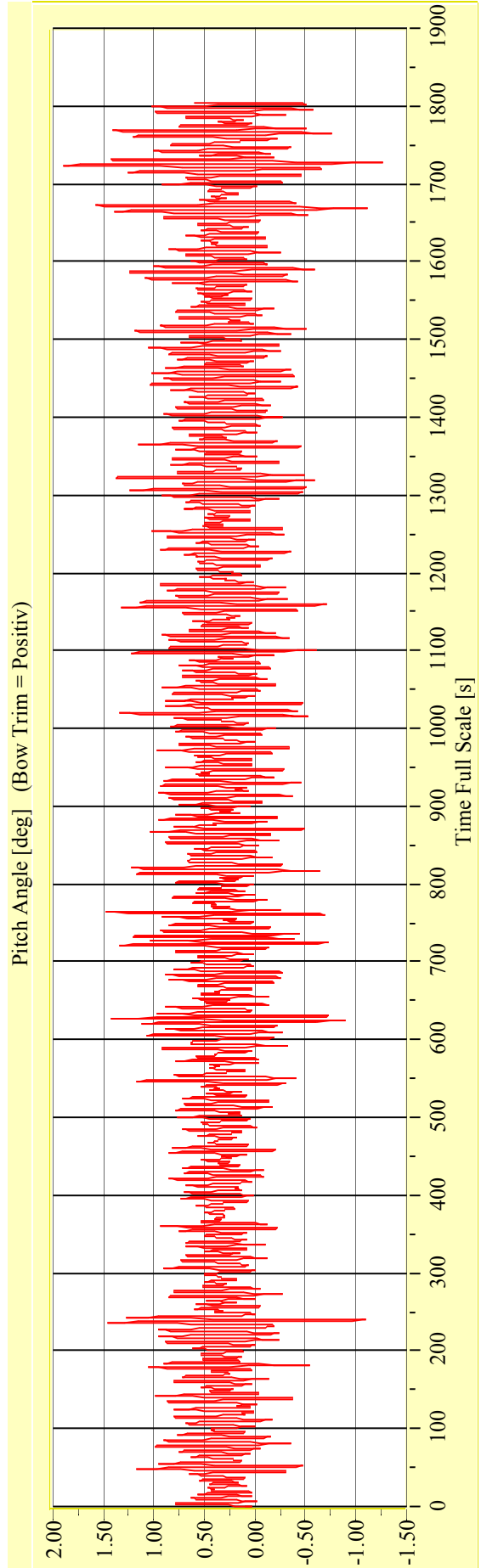
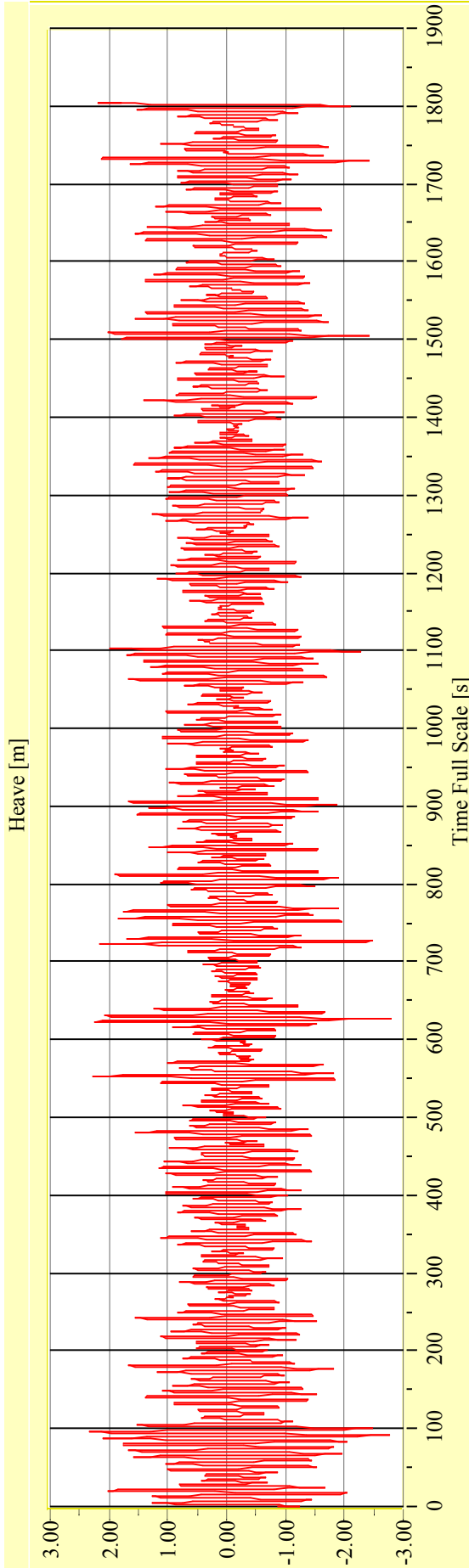
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29689-05**

**Target Waves: Hs = 4,25 m Tp = 8,246 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

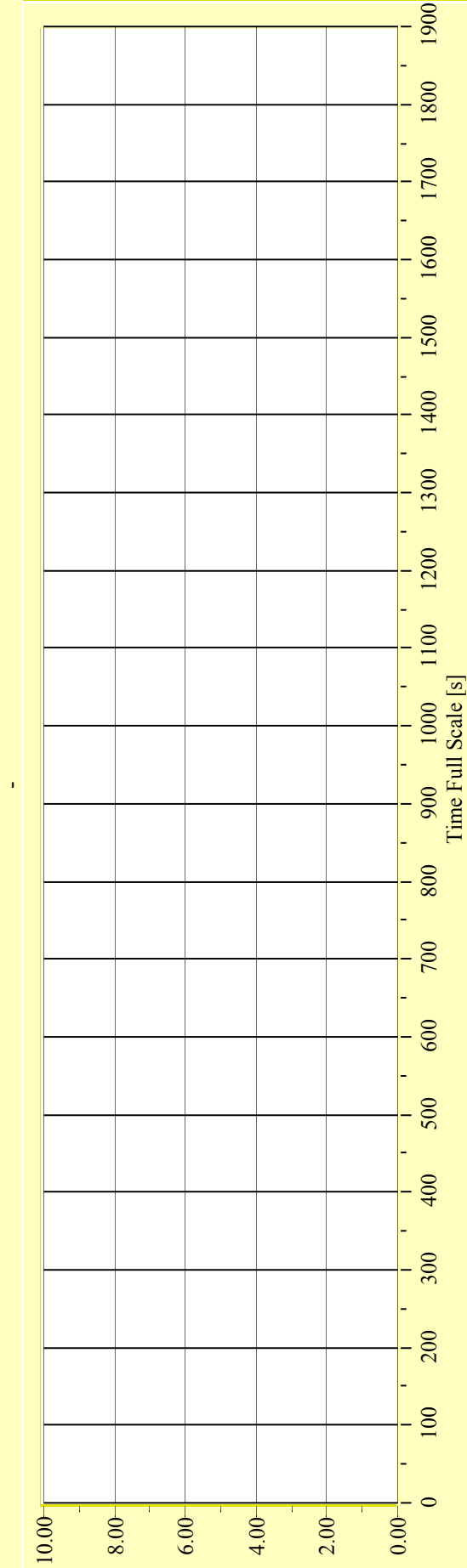
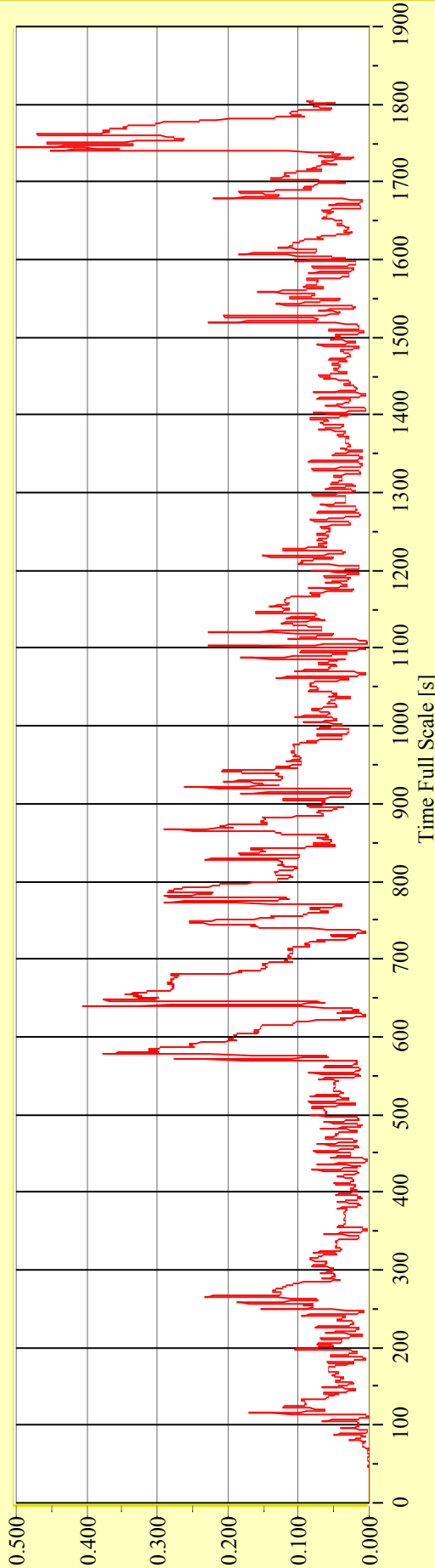
**Model No. 2446**

**Test No. 29689-05**

**Target Waves: Hs = 4,25 m Tp = 8,246 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



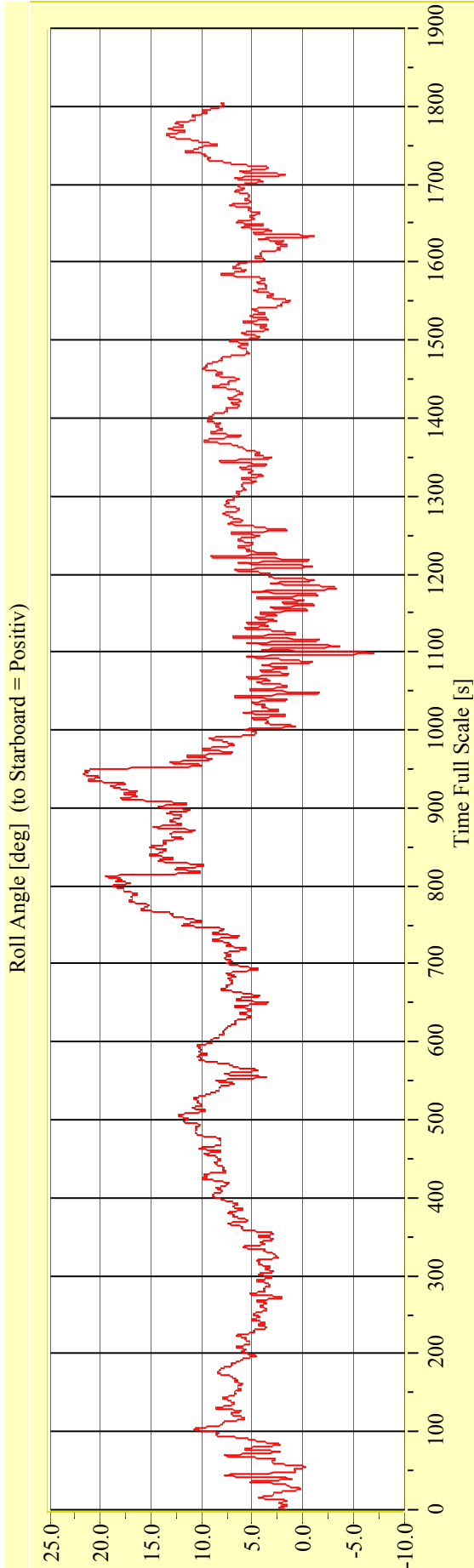
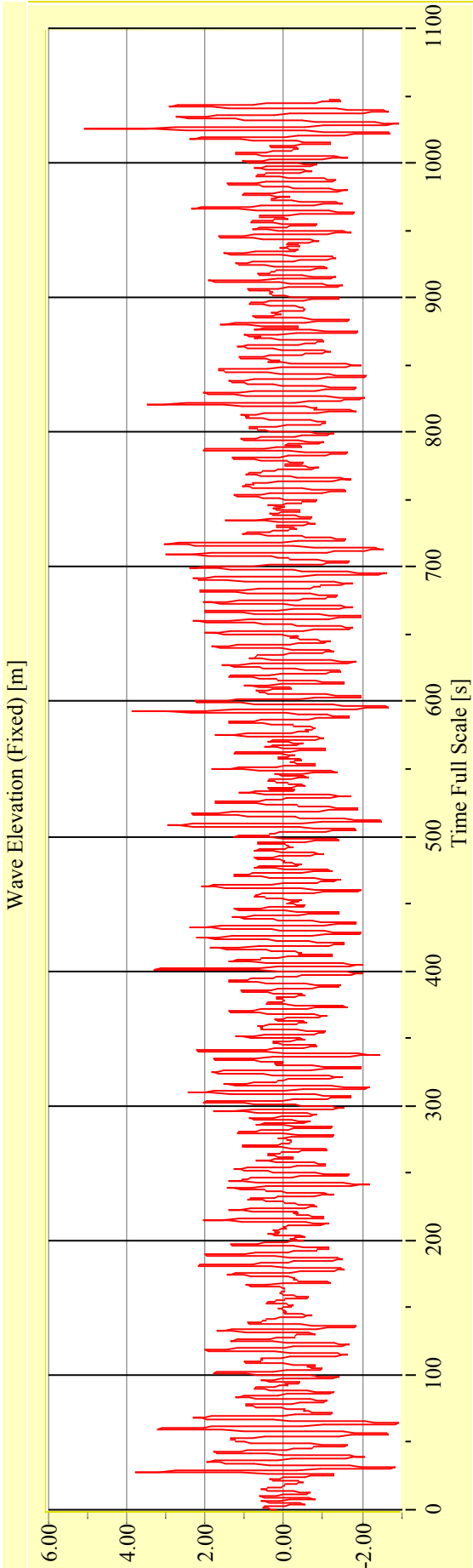
**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29689-06**      **Target Waves: Hs = 4,25 m Tp = 8,246 s**      **gamma = 3,3**



**Date: 21.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

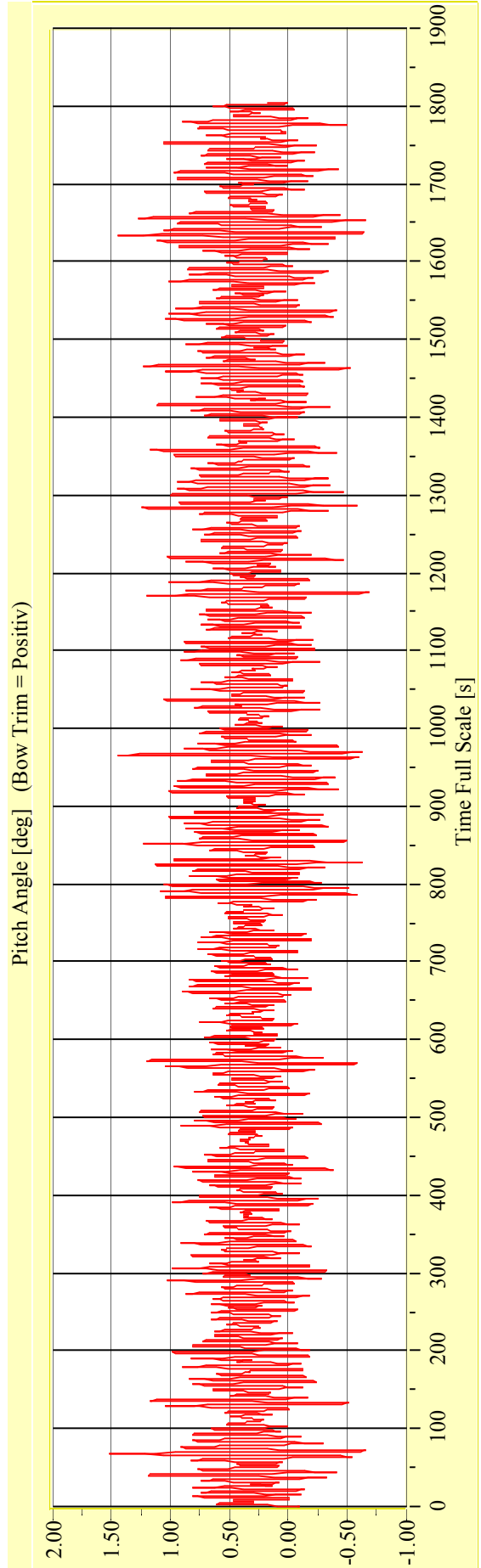
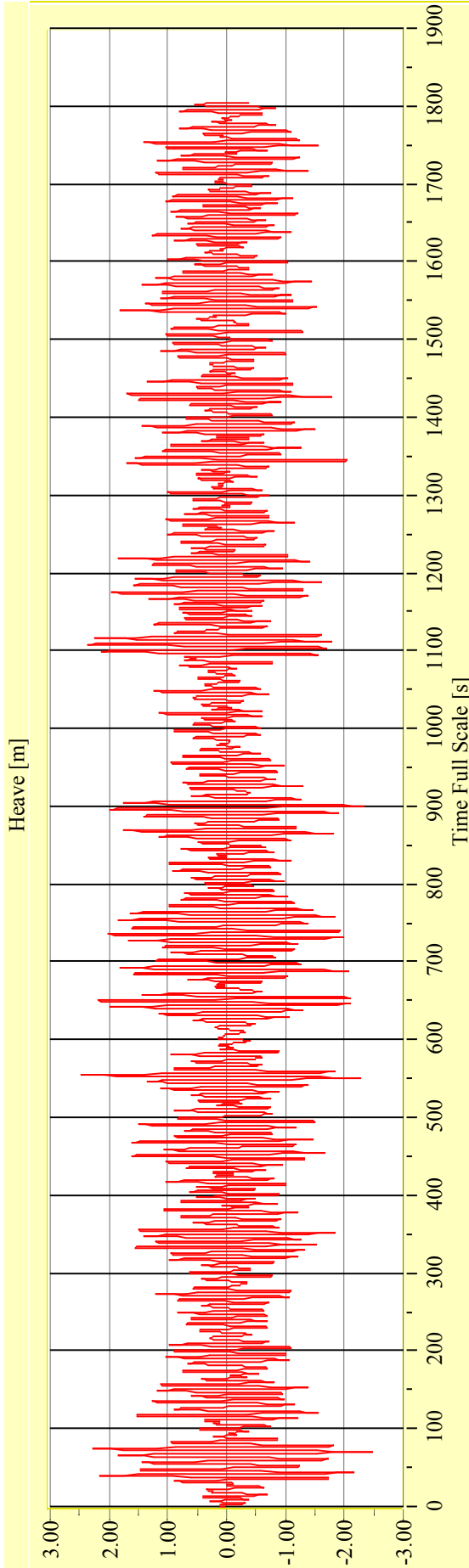
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29689-06**

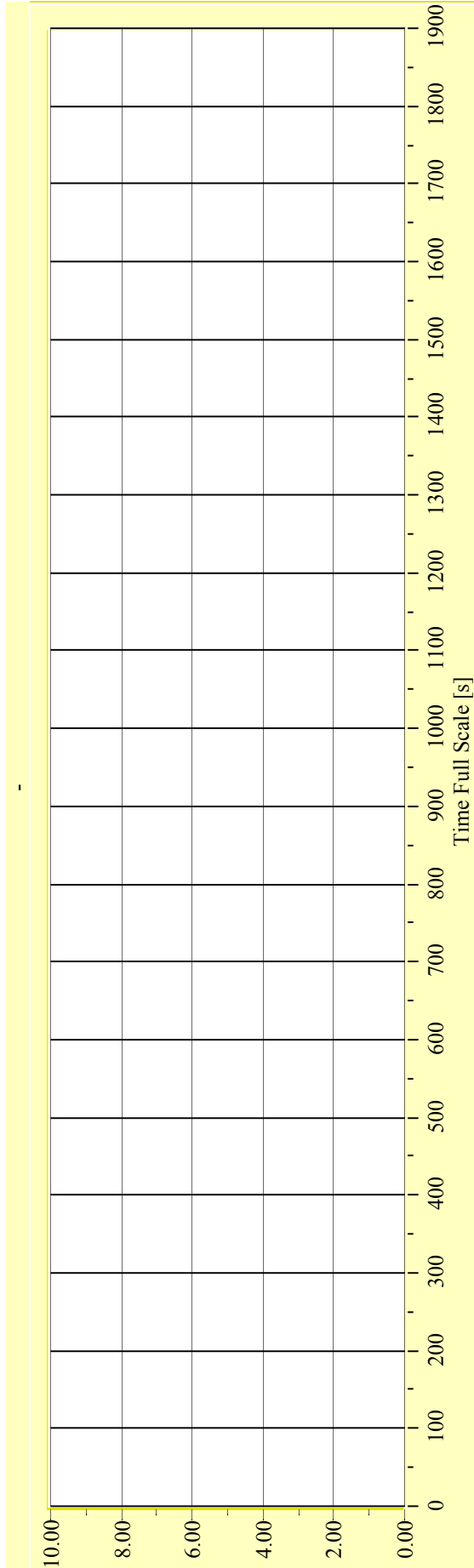
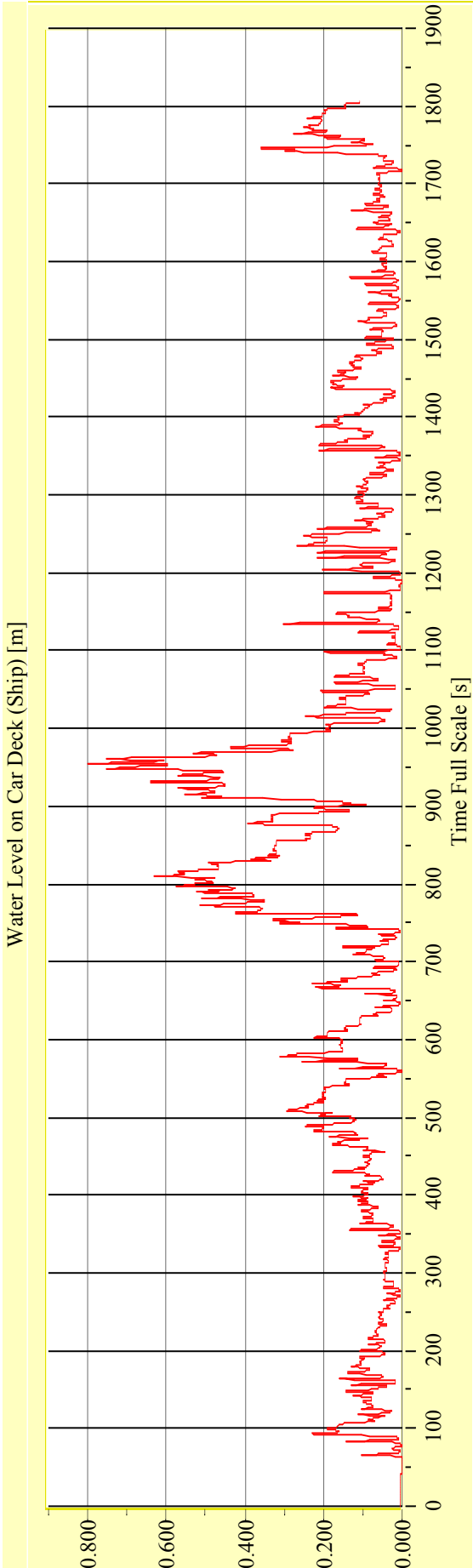
**Target Waves: Hs = 4,25 m Tp = 8,246 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29689-06**      **Target Waves: Hs = 4,25 m Tp = 8,246 s**      **gamma = 3,3**

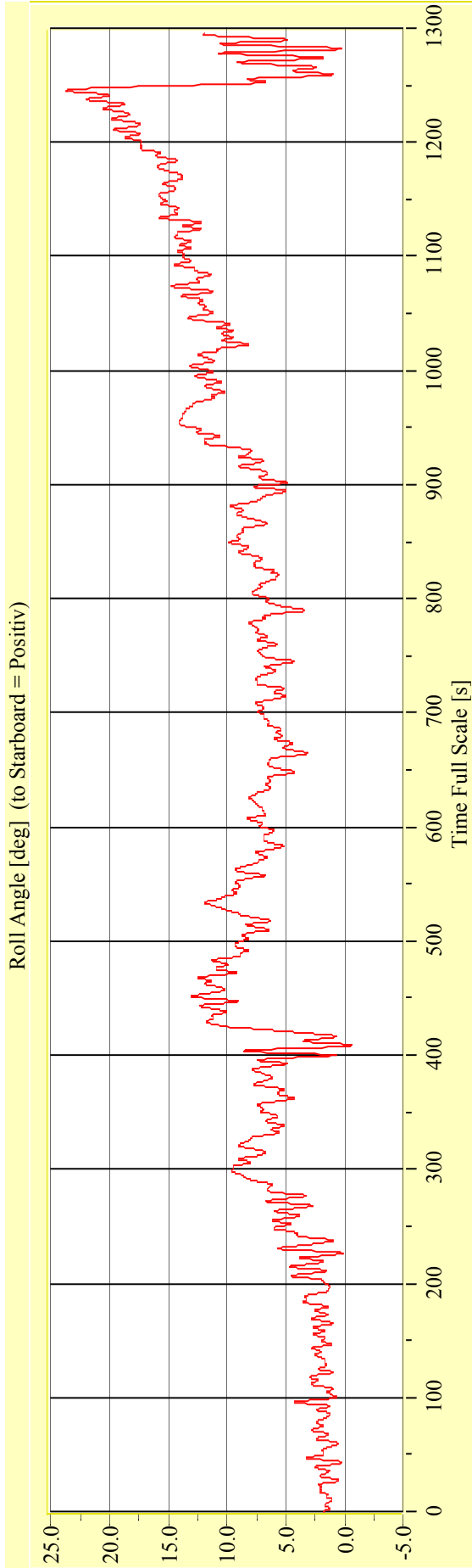
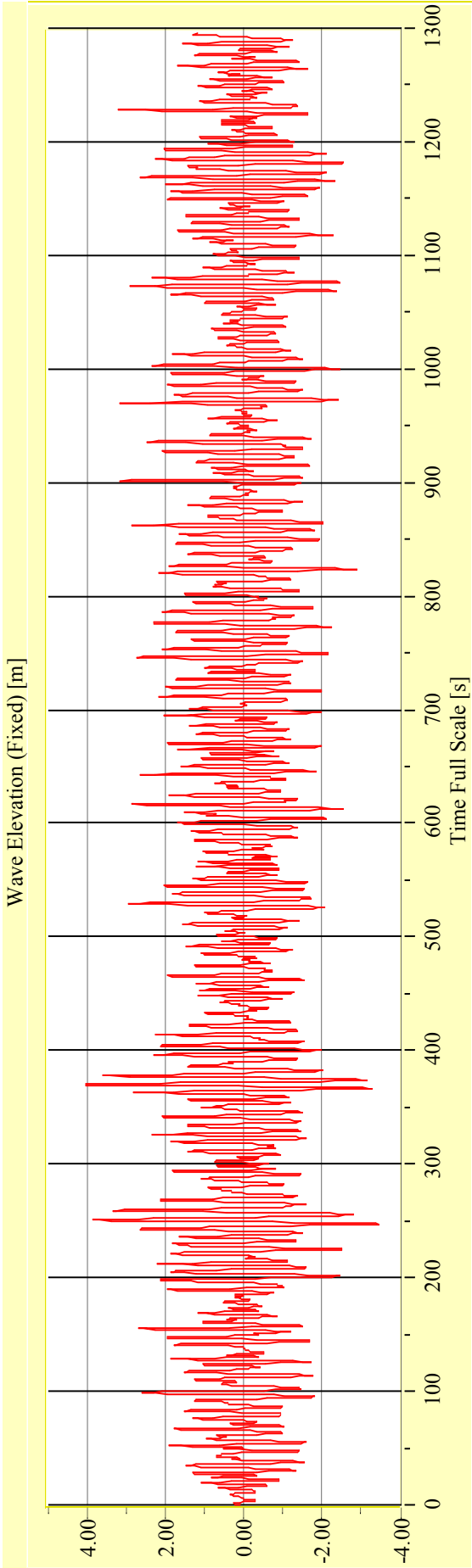


**Date: 21.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29689-07**      **Target Waves: Hs = 4,25 m Tp = 8,246 s**      **gamma = 3,3**



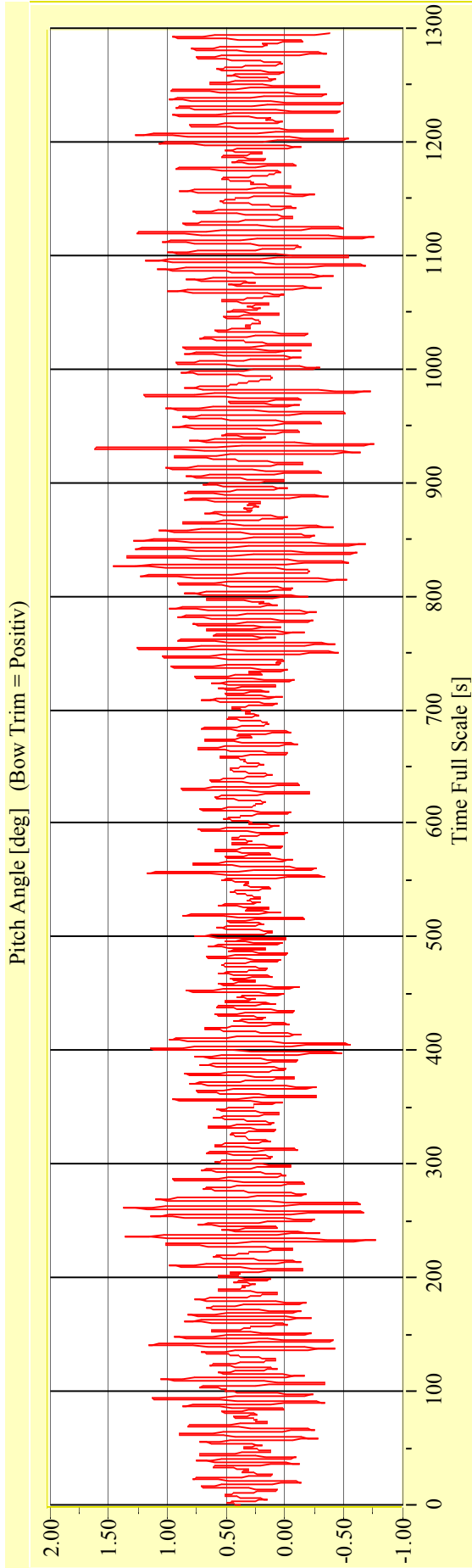
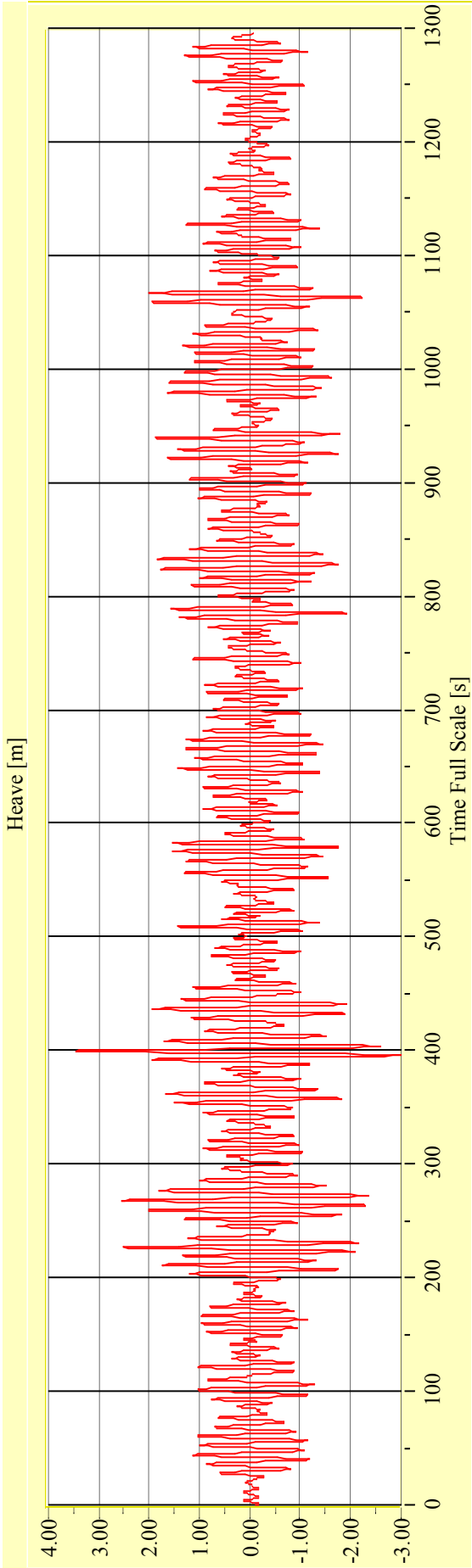
**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29689-07**      **Target Waves: Hs = 4,25 m Tp = 8,246 s**      **gamma = 3,3**



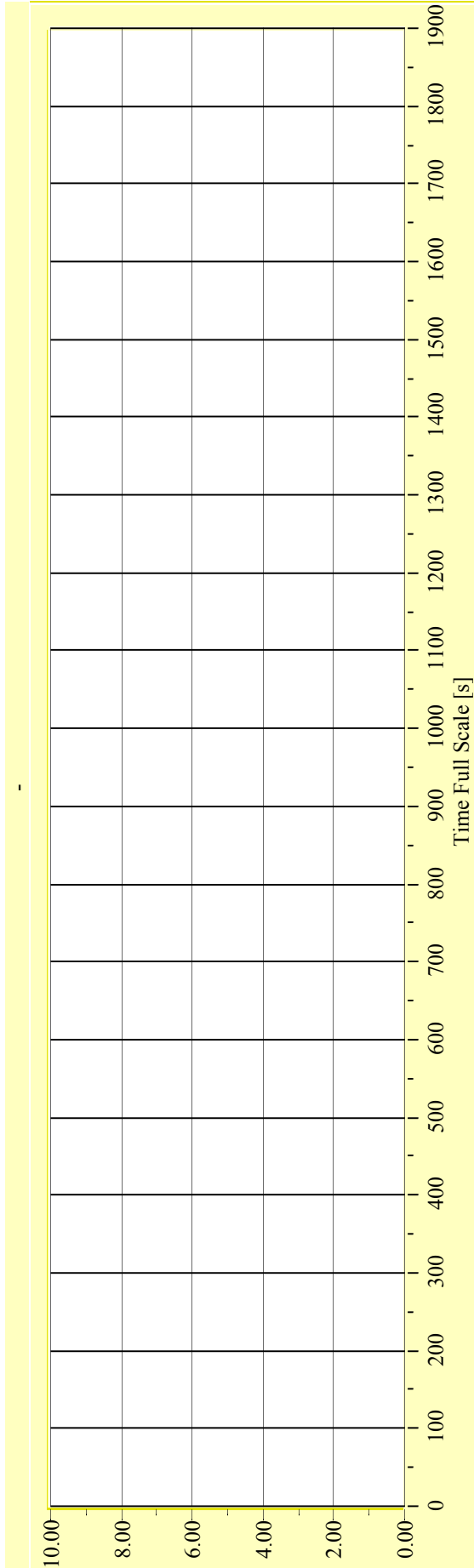
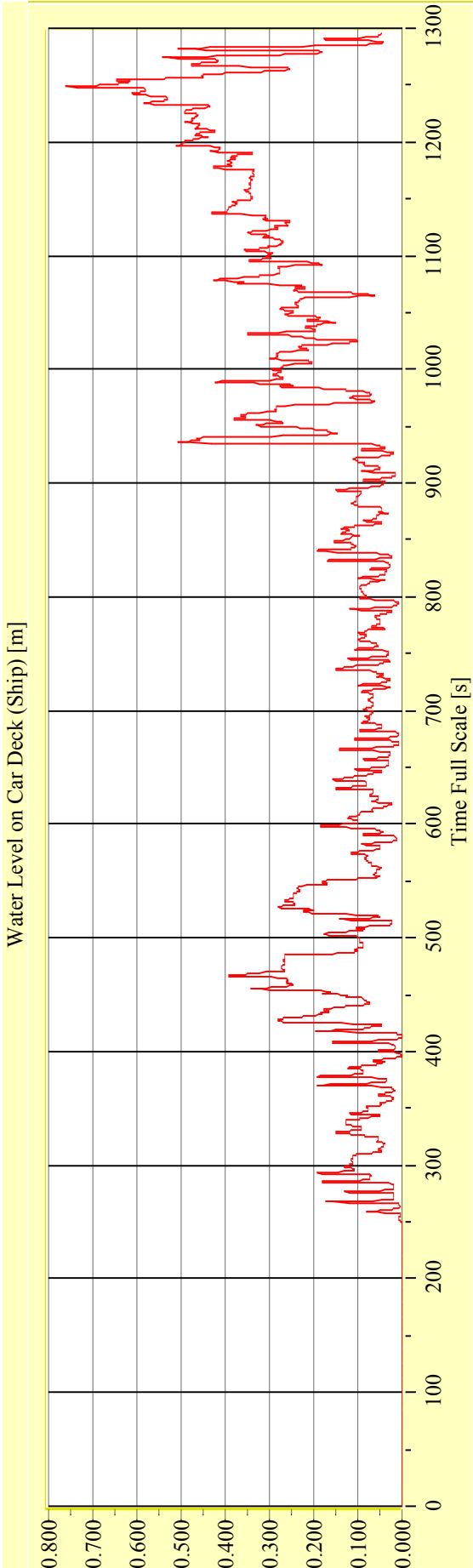
**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29689-07**      **Target Waves: Hs = 4,25 m Tp = 8,246 s**      **gamma = 3,3**



**Date: 21.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

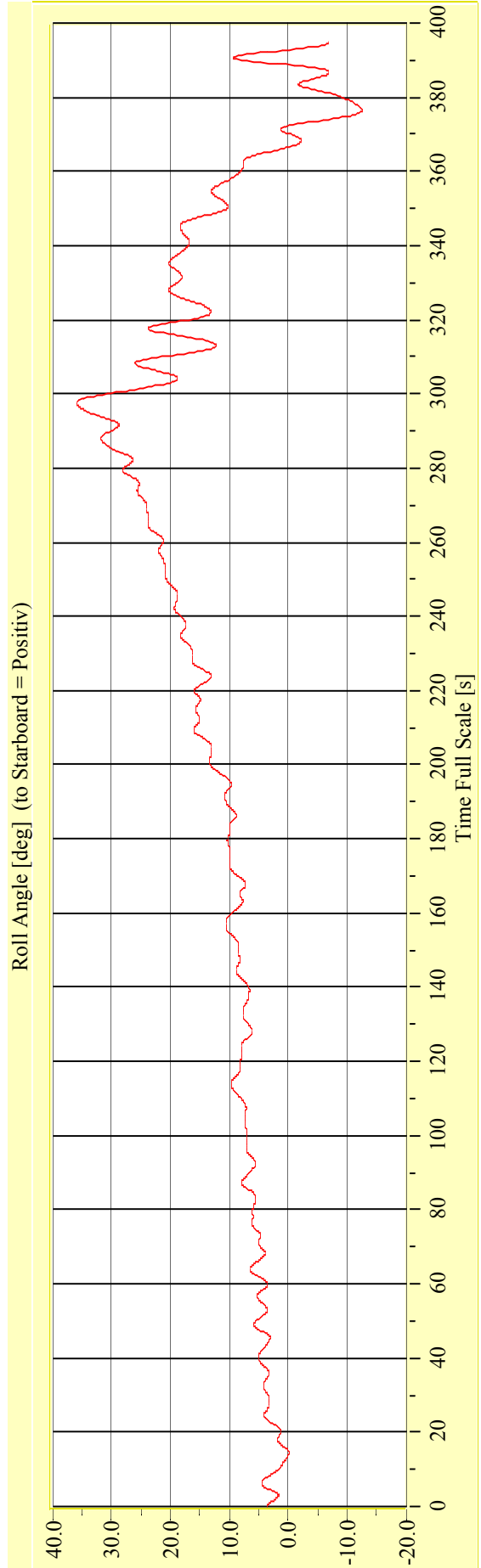
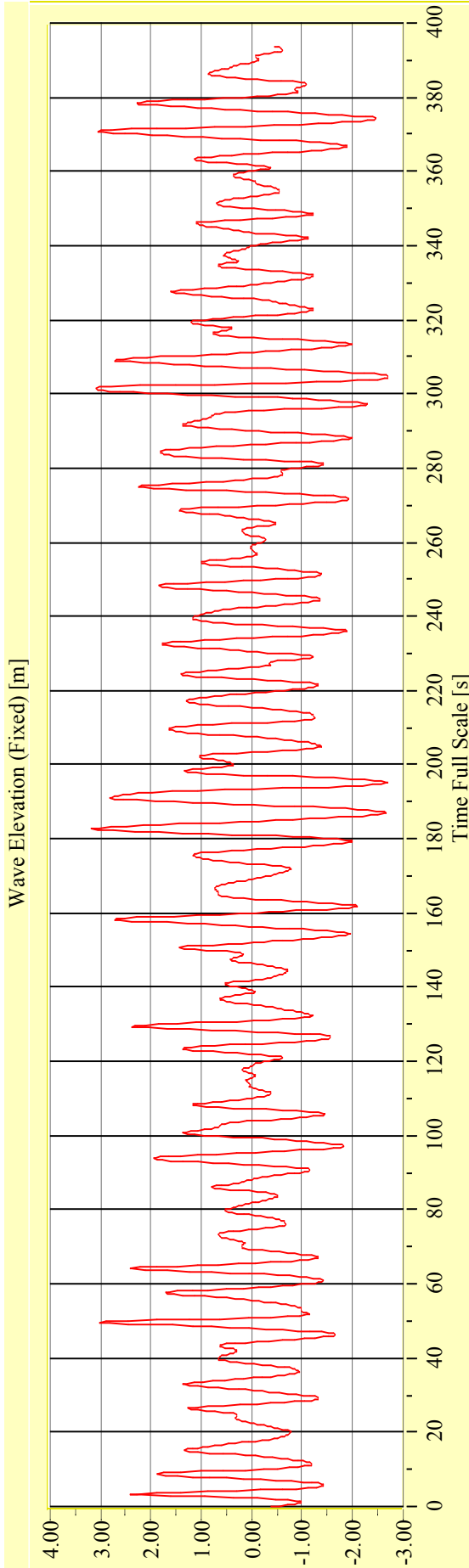
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29689-08**

**Target Waves: Hs = 4,25 m Tp = 8,246 s**

**gamma = 3,3**



**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

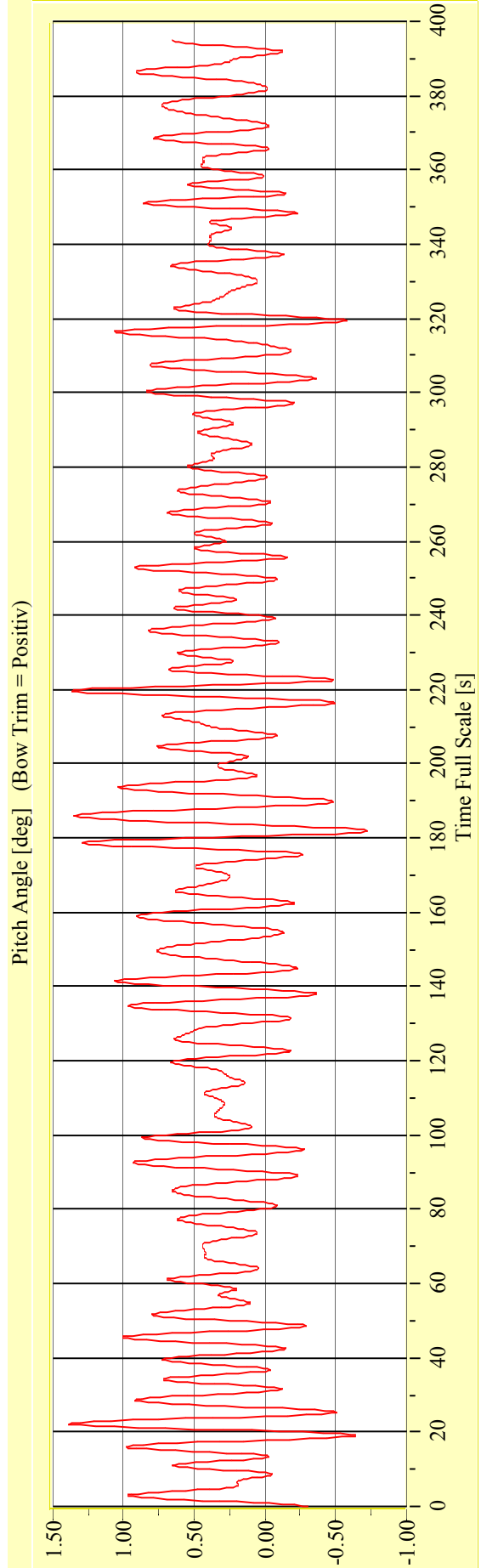
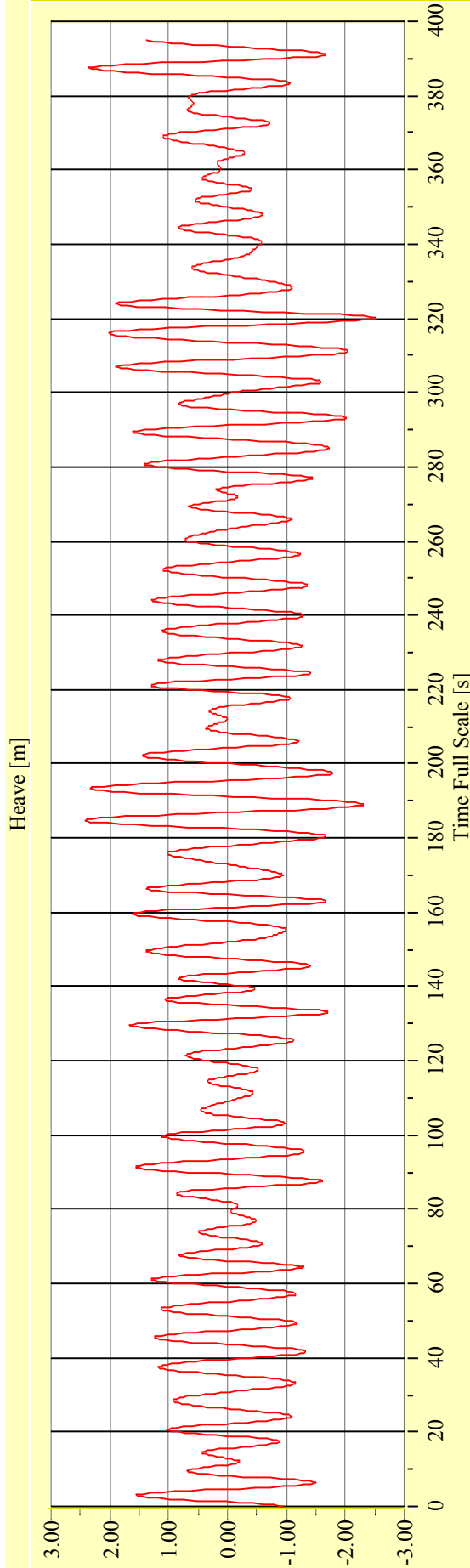
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29689-08**

**Target Waves: Hs = 4,25 m Tp = 8,246 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

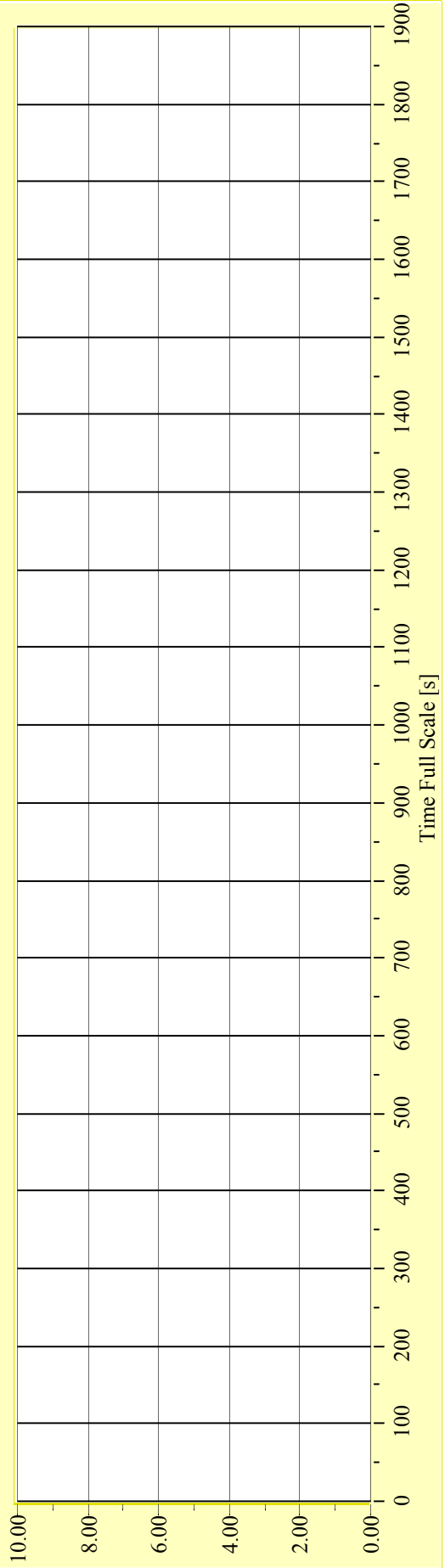
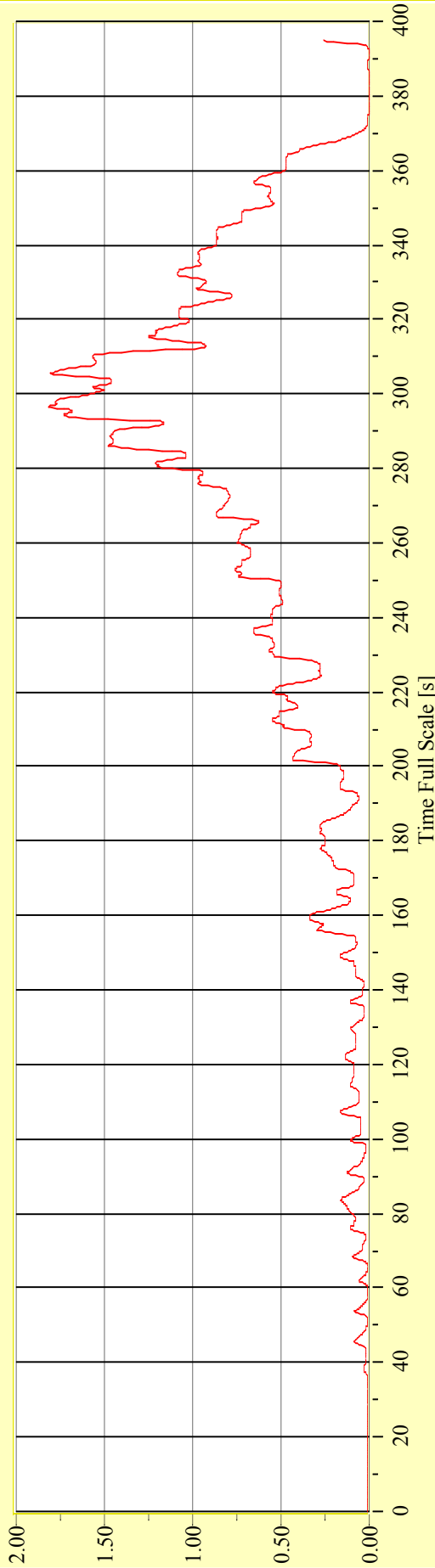
**Model No. 2446**

**Test No. 29689-08**

**Target Waves: Hs = 4,25 m Tp = 8,246 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**

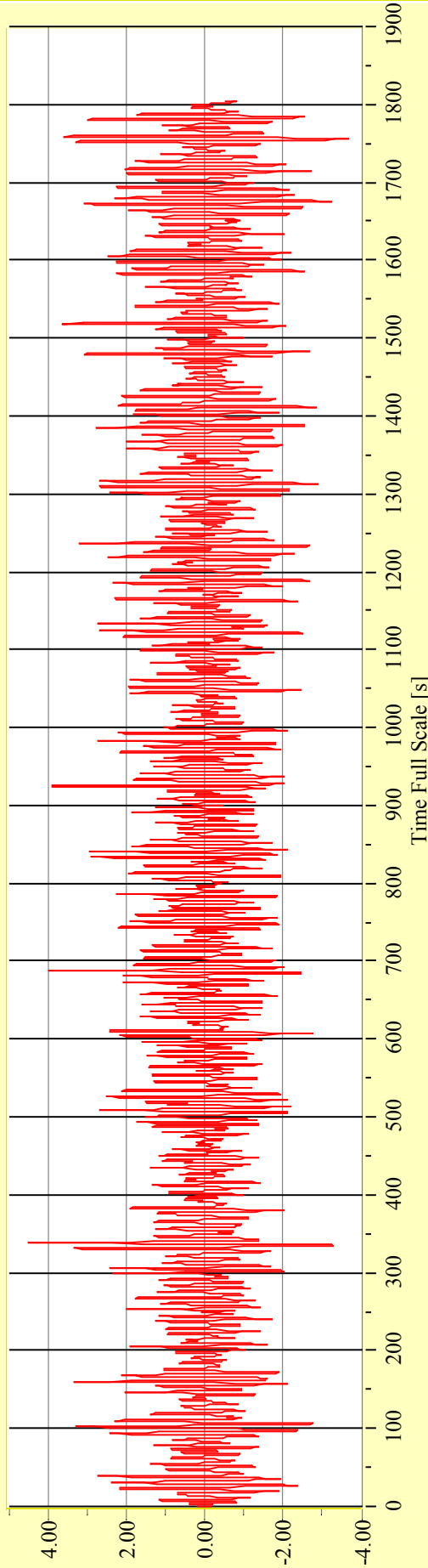
**Model No. 2446**

**Test No. 29689-09**

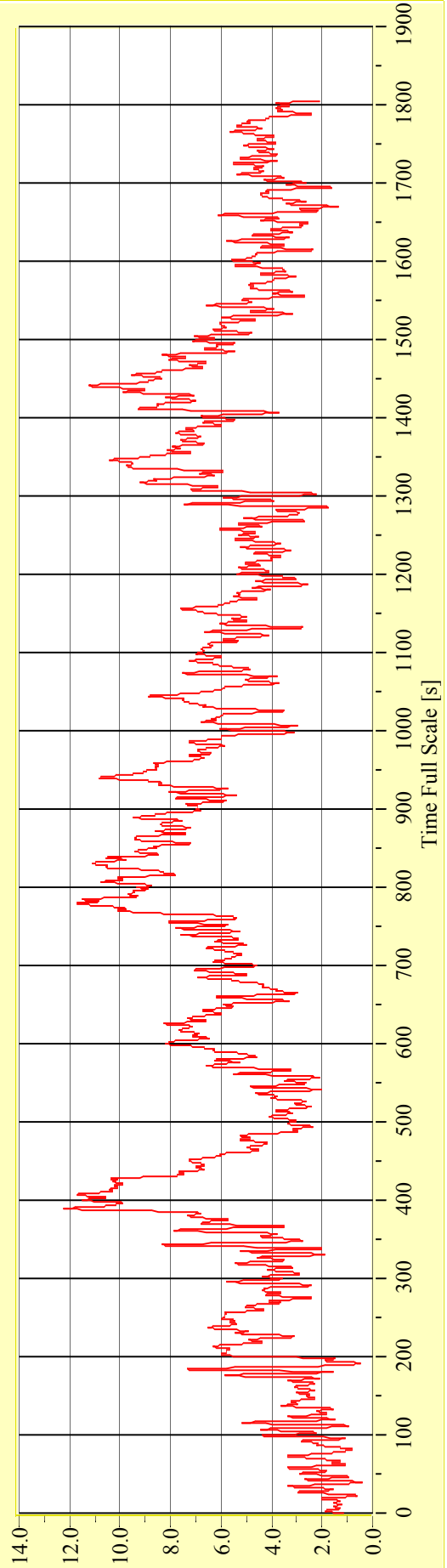
**Target Waves: Hs = 4,25 m Tp = 8,246 s**

**gamma = 3,3**

Wave Elevation (Fixed) [m]



Roll Angle [deg] (to Starboard = Positiv)



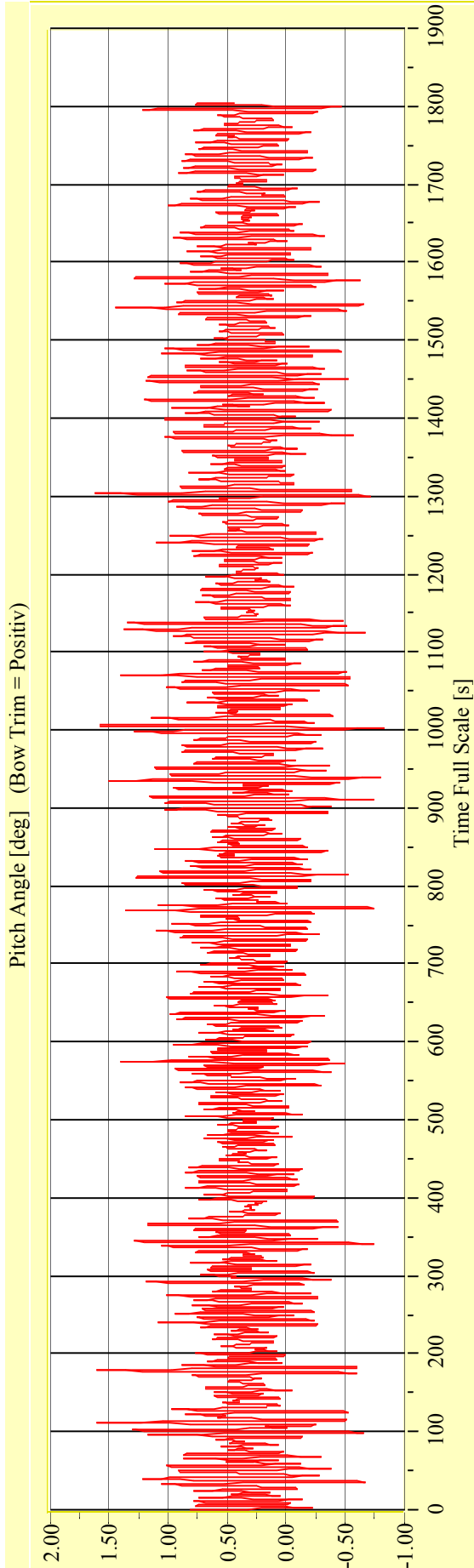
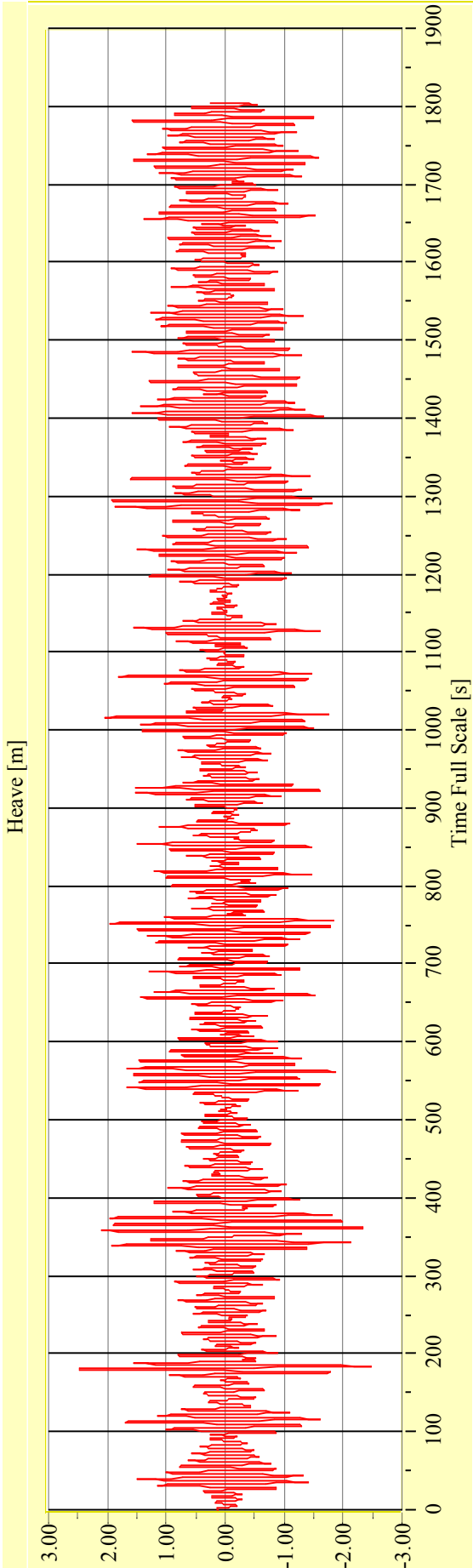
**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29689-09**      **Target Waves: Hs = 4,25 m Tp = 8,246 s**      **gamma = 3,3**



**Date: 21.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**



**Irregular Beam Seas**

**Vienna Model Basin**

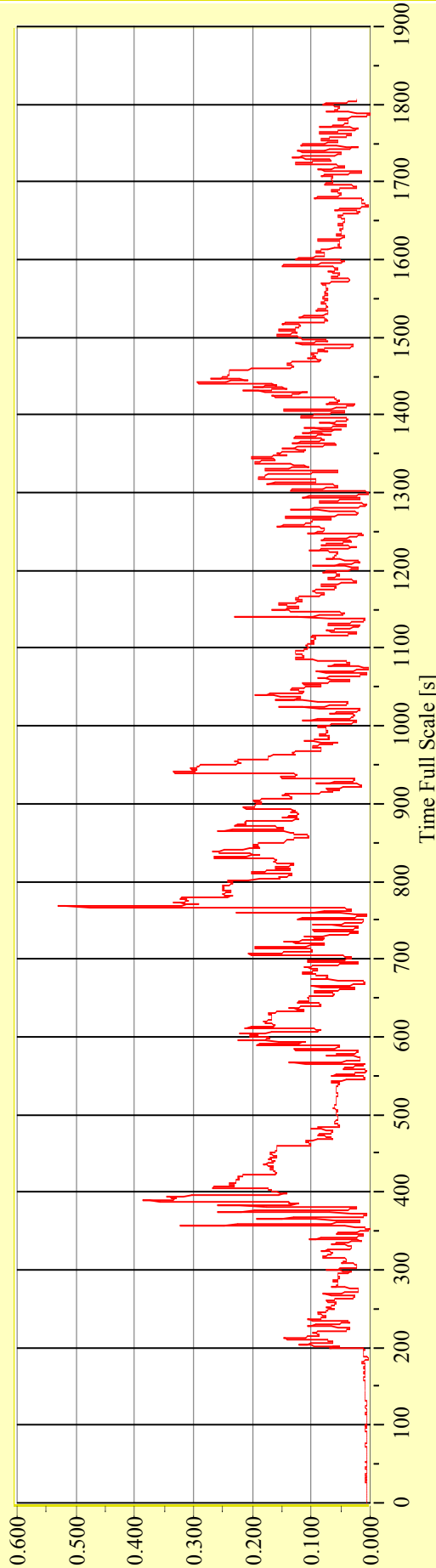
**Model No. 2446**

**Test No. 29689-09**

**Target Waves: Hs = 4,25 m Tp = 8,246 s**

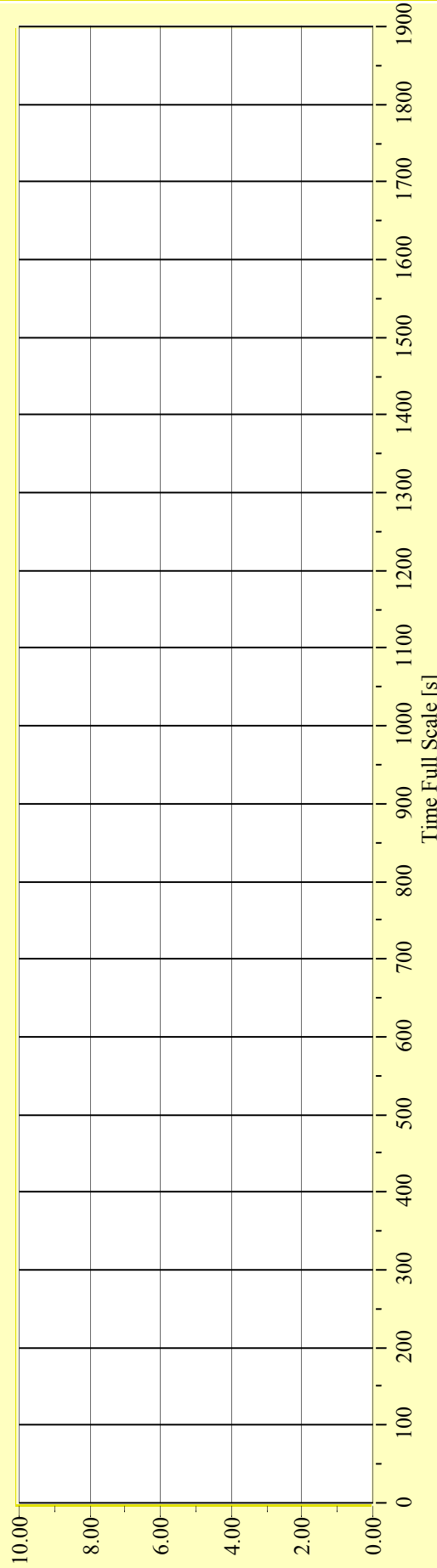
**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



Time Full Scale [s]

-



Time Full Scale [s]

**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

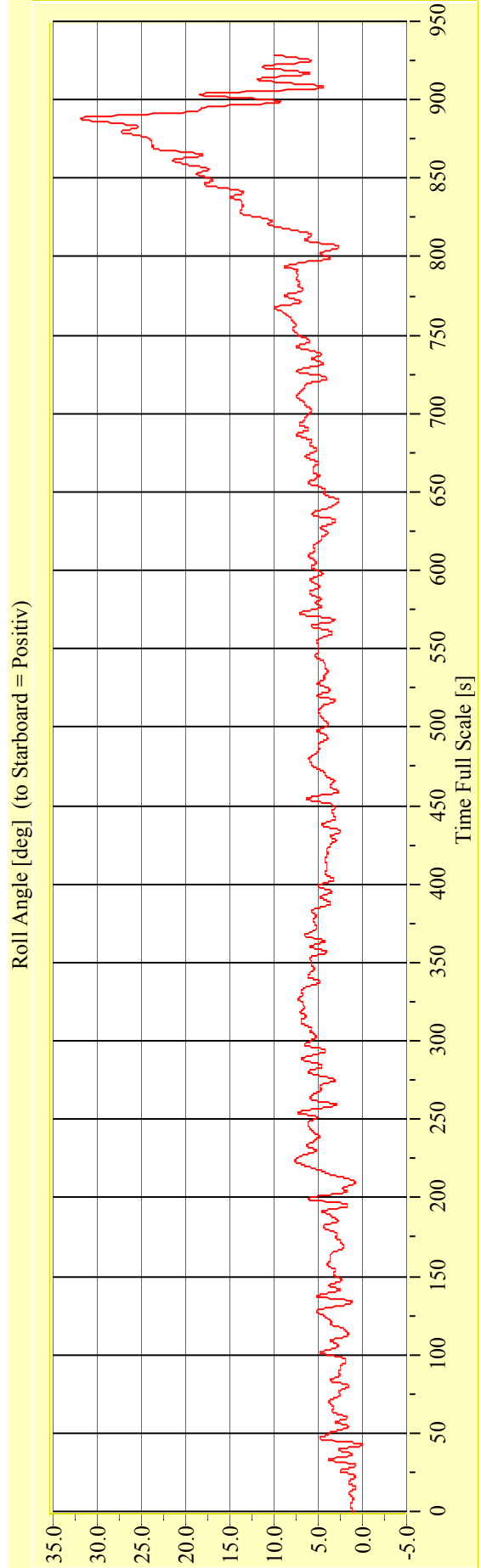
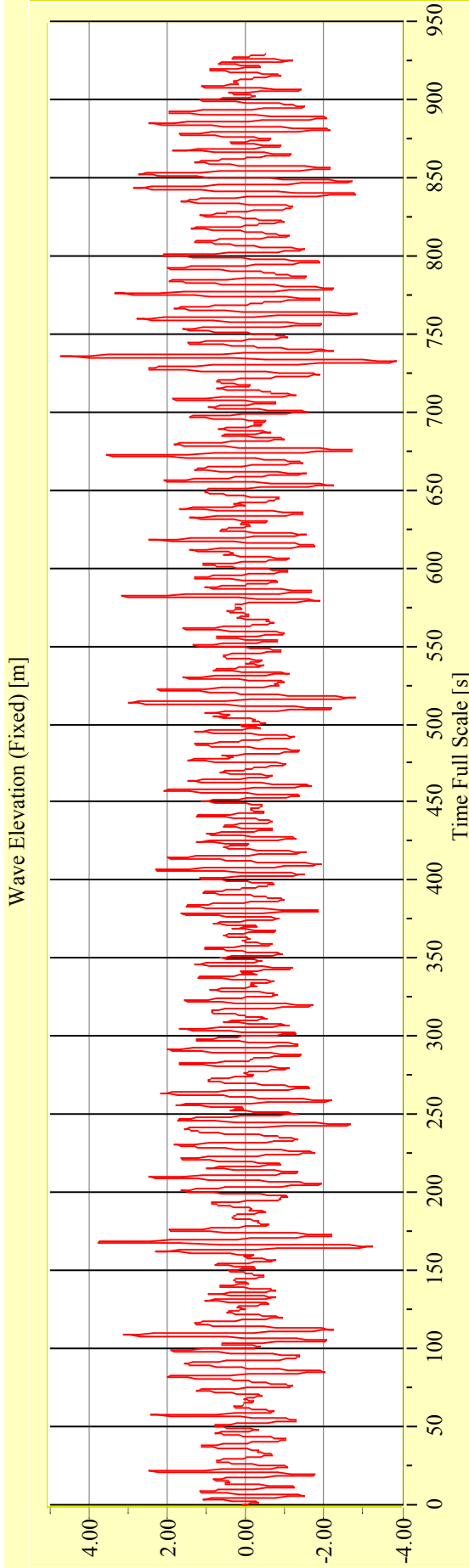
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29689-10**

**Target Waves: Hs = 4,25 m Tp = 8,246 s**

**gamma = 3,3**



**Irregular Beam Seas**

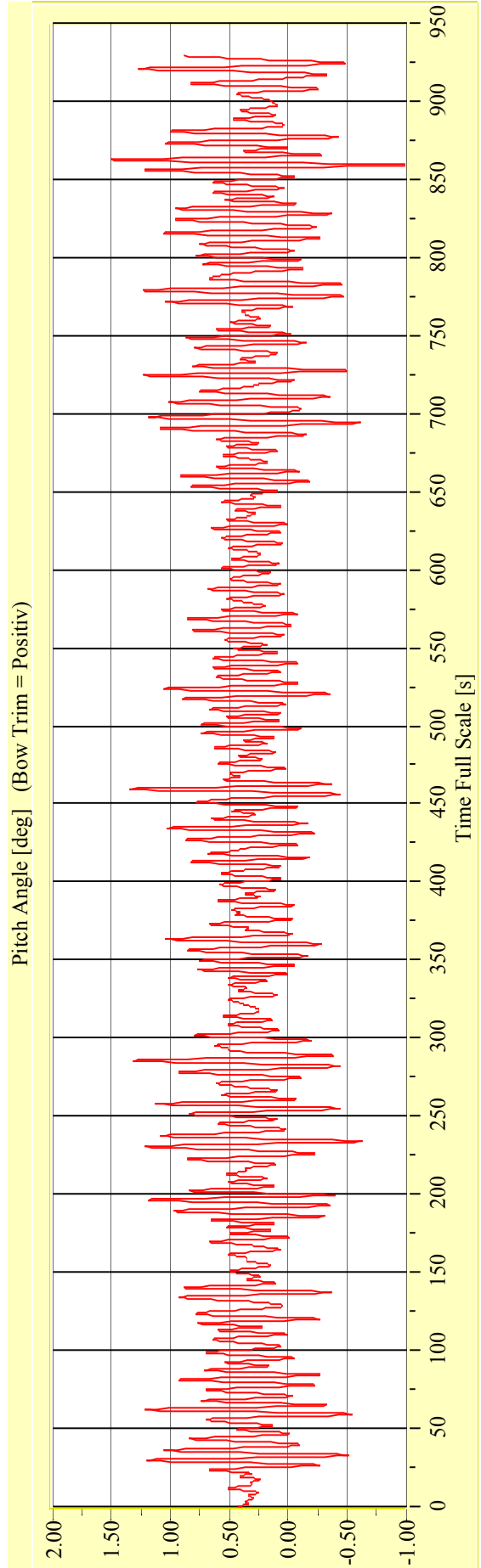
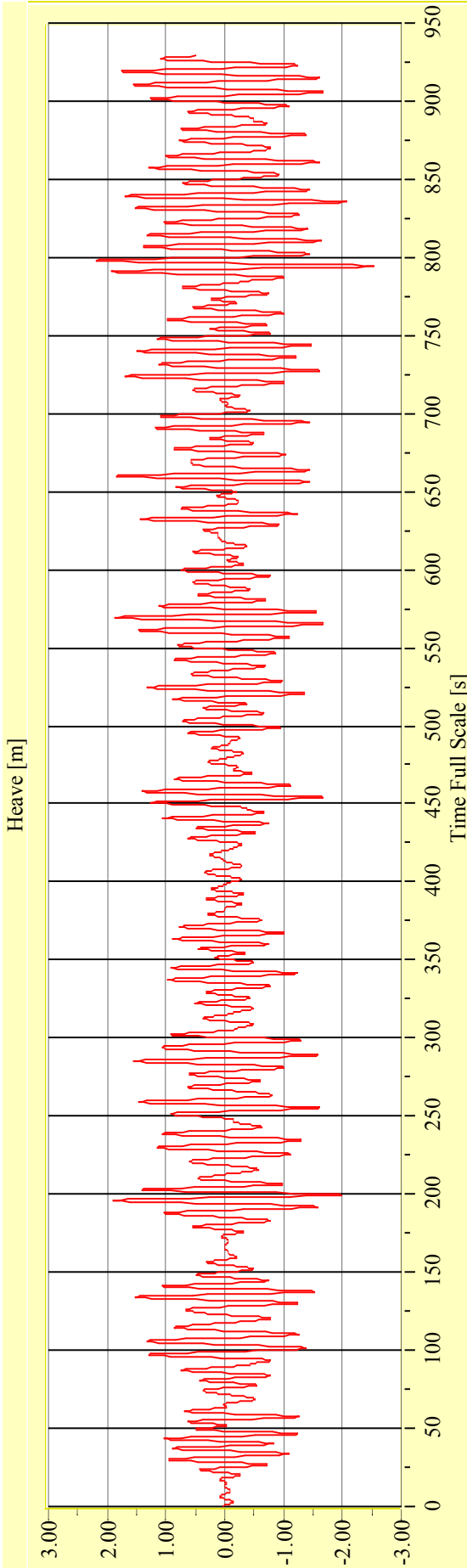
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29689-10**

**Target Waves: Hs = 4,25 m Tp = 8,246 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

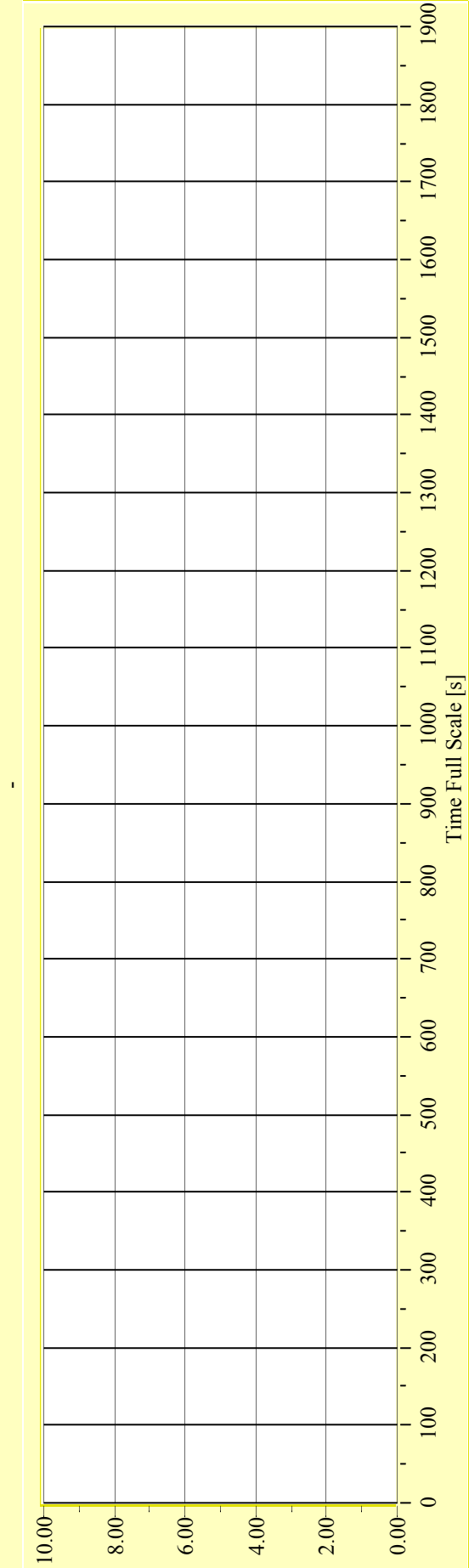
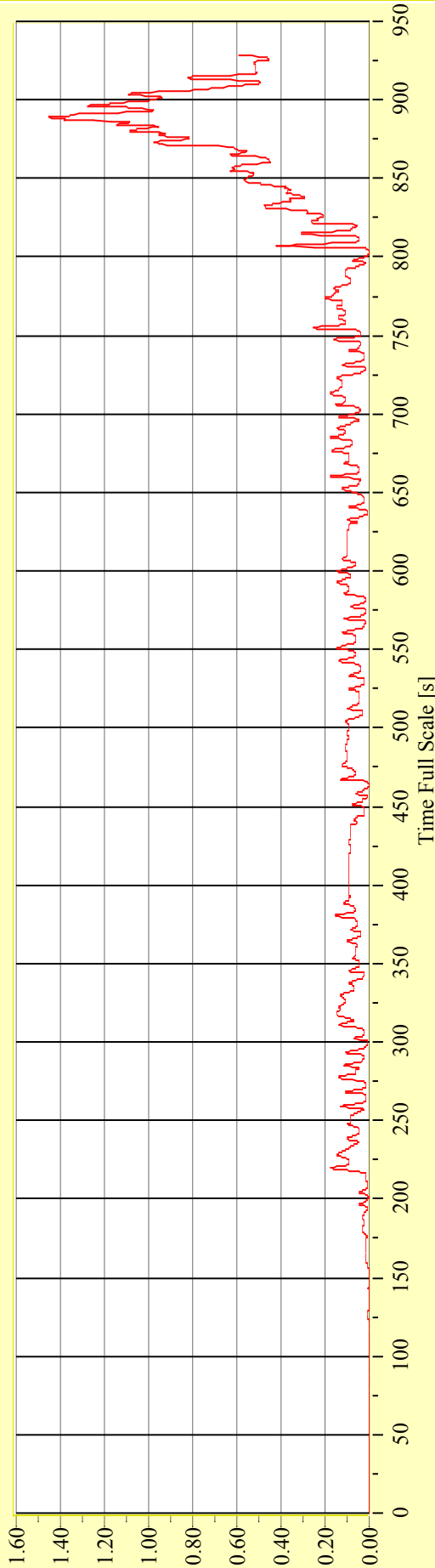
**Model No. 2446**

**Test No. 29689-10**

**Target Waves: Hs = 4,25 m Tp = 8,246 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

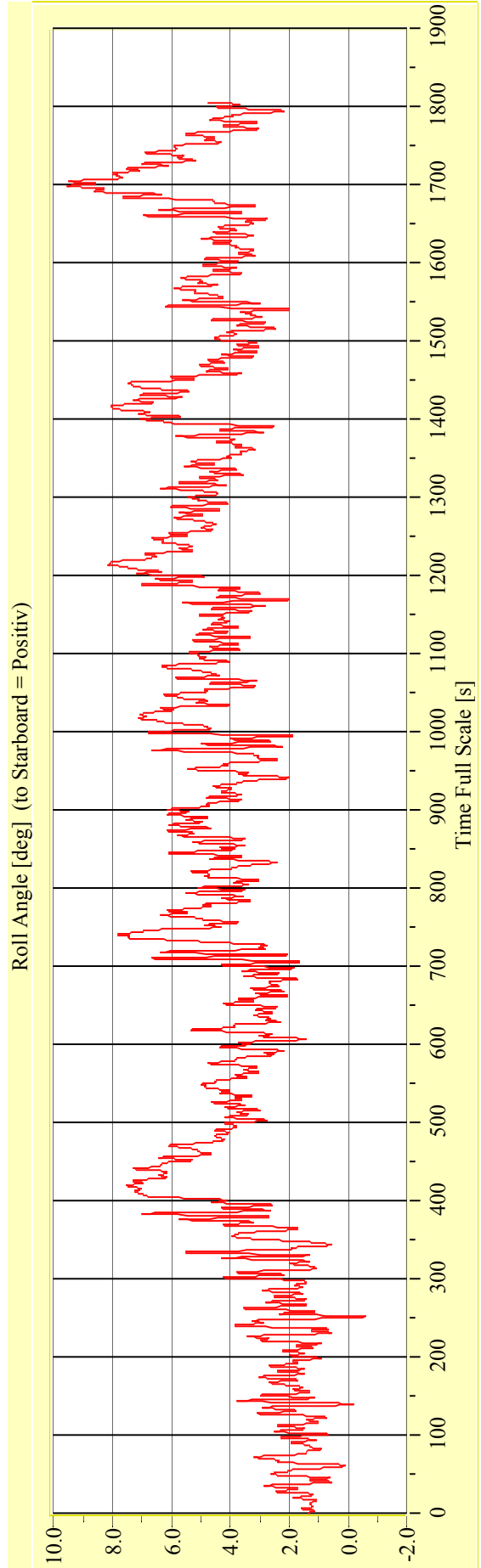
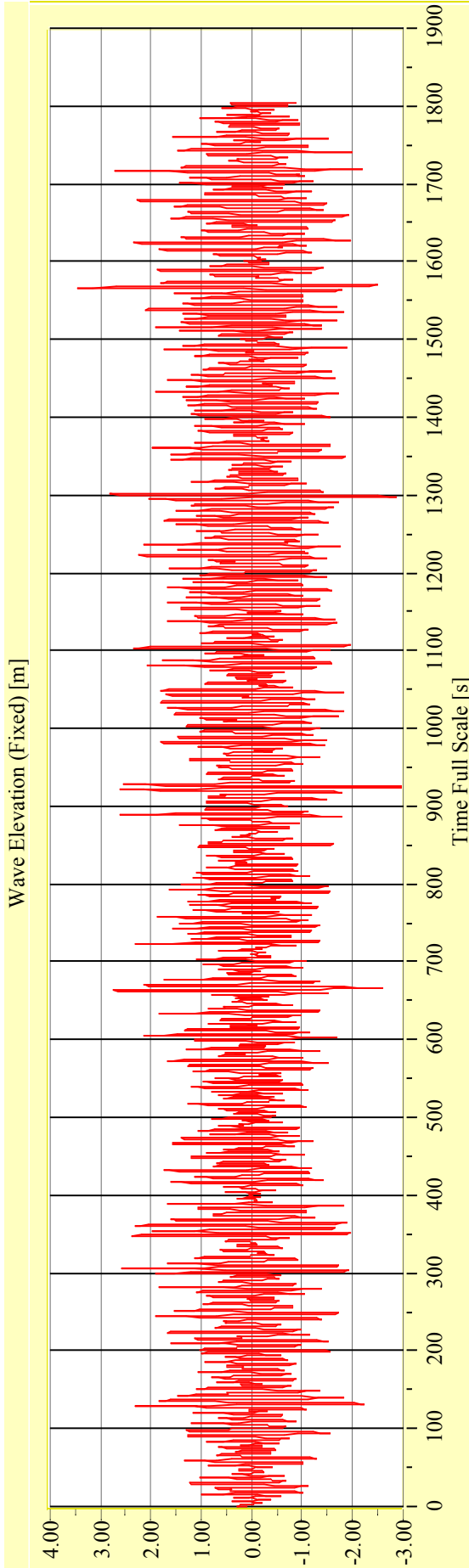
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29690-01**

**Target Waves: Hs = 3,35 m Tp = 7,321 s**

**gamma = 3,3**



**Irregular Beam Seas**

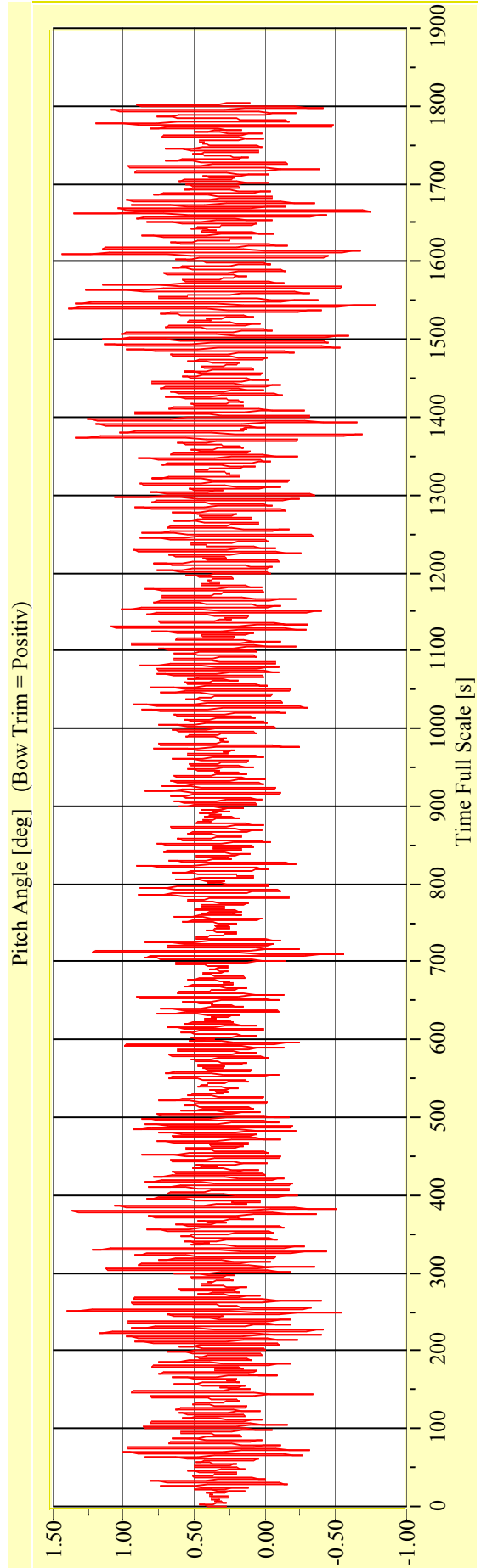
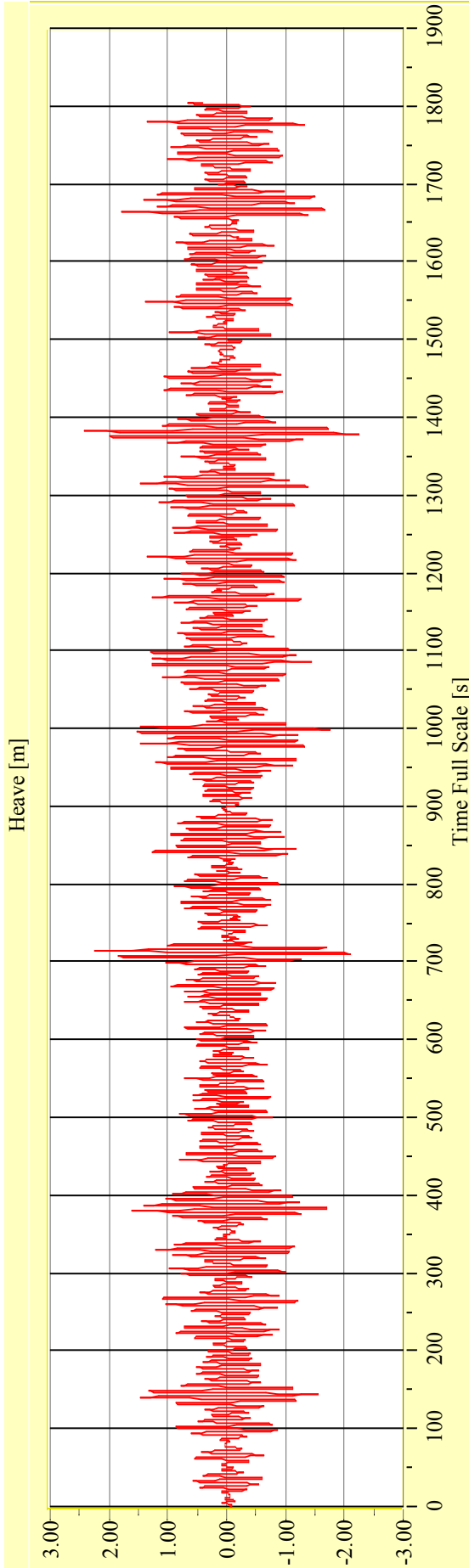
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29690-01**

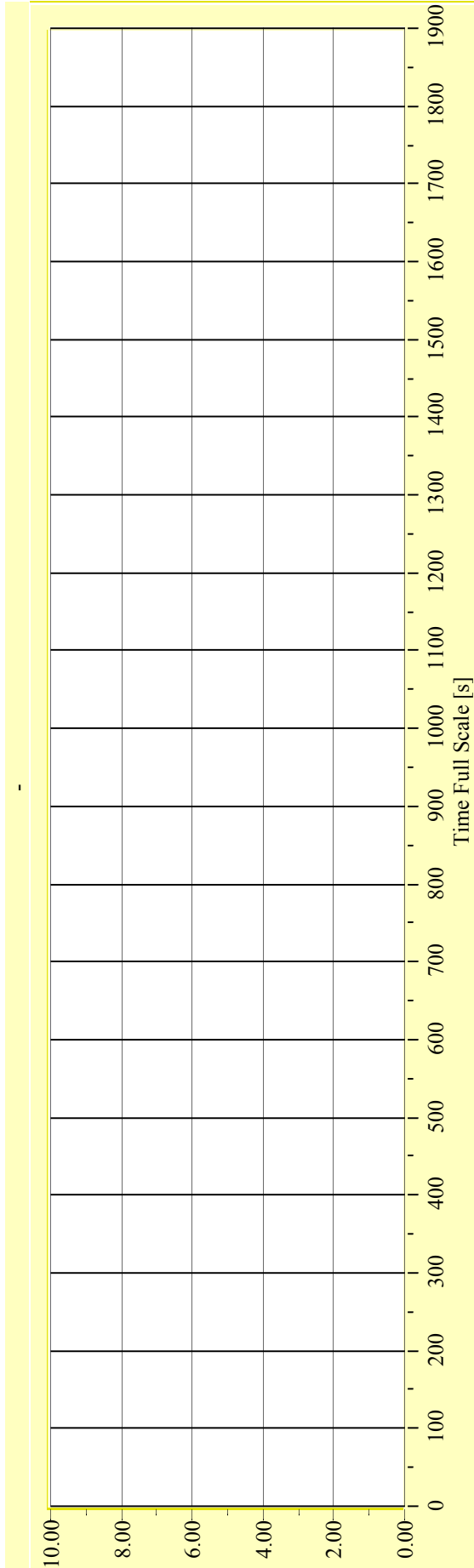
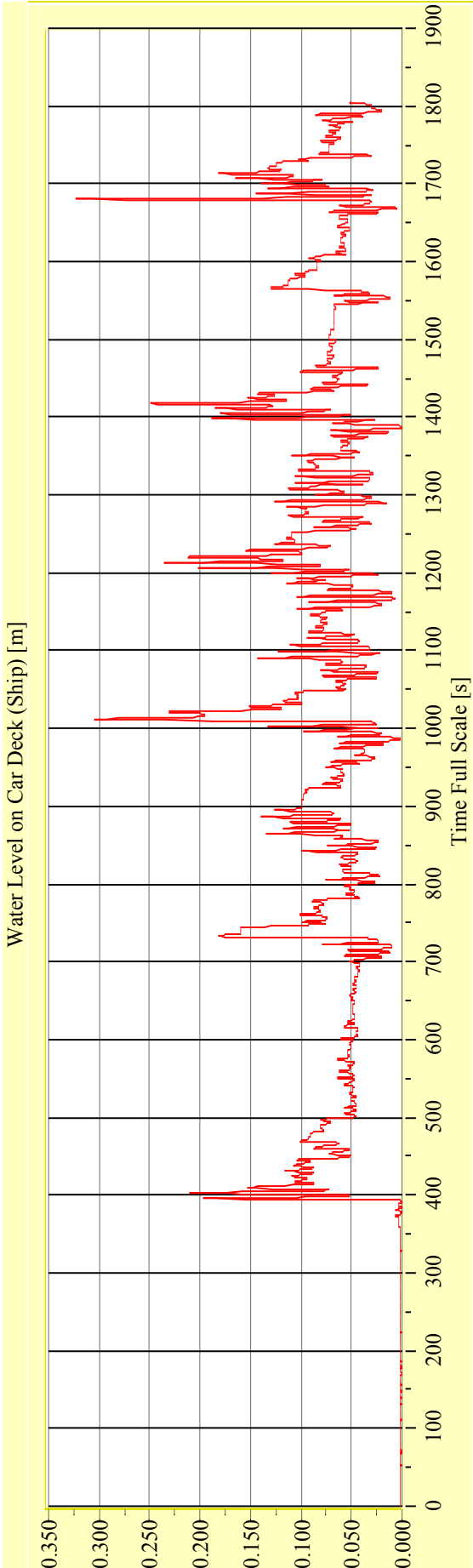
**Target Waves: Hs = 3,35 m Tp = 7,321 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29690-01**      **Target Waves: Hs = 3,35 m Tp = 7,321 s**      **gamma = 3,3**



**Date: 21.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

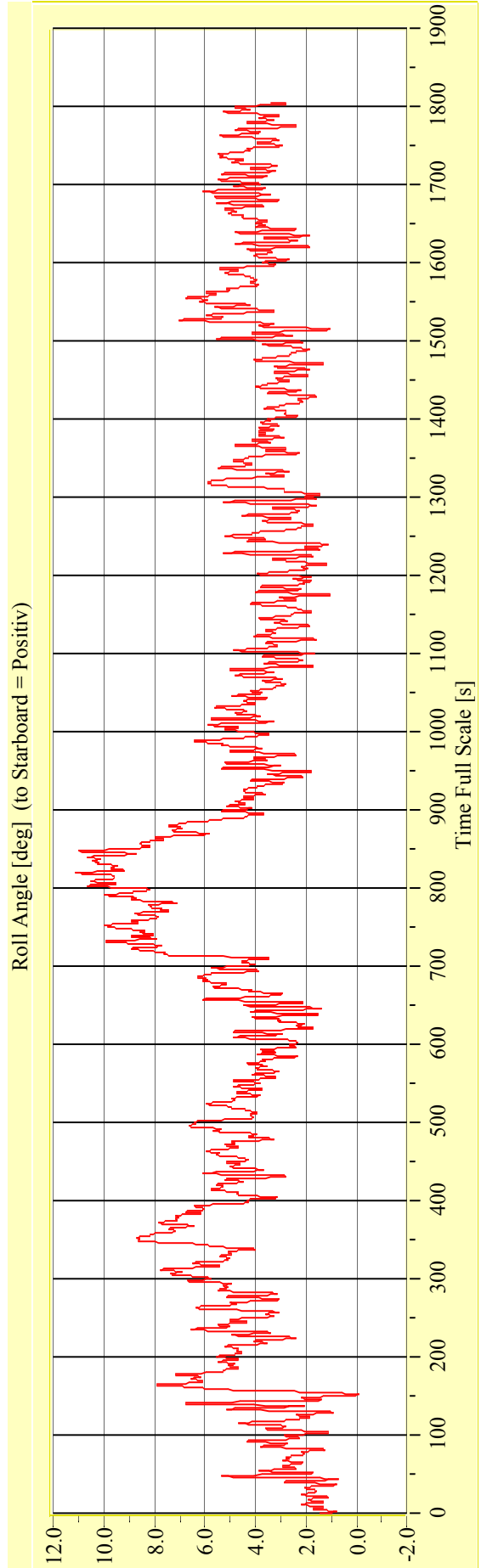
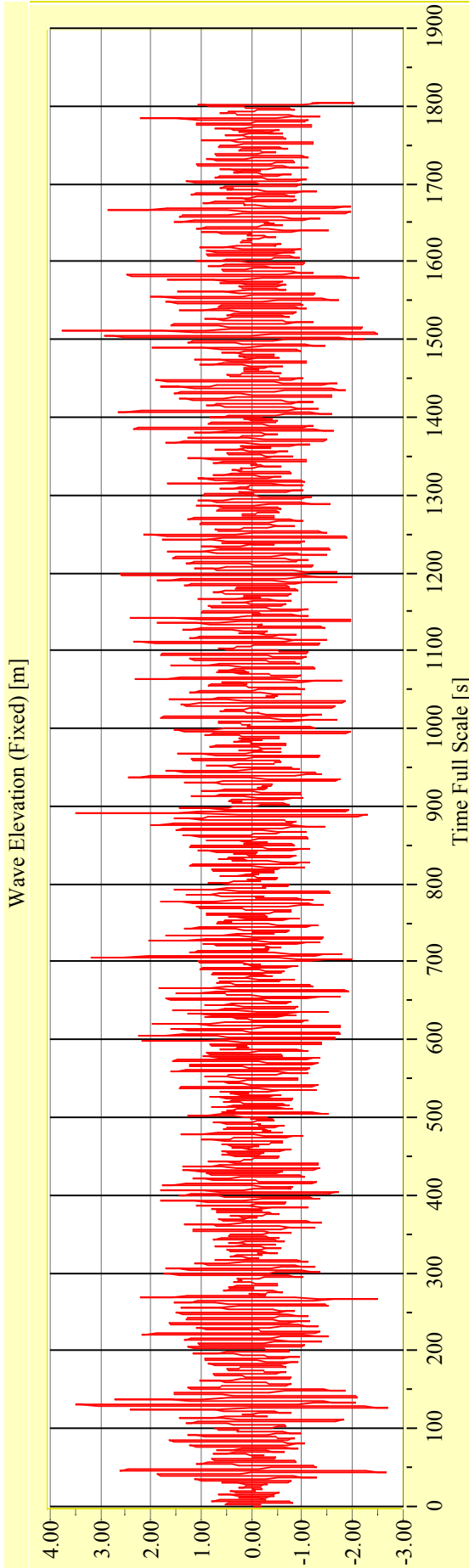
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29690-02**

**Target Waves: Hs = 3,35 m Tp = 7,321 s**

**gamma = 3,3**





**Irregular Beam Seas**

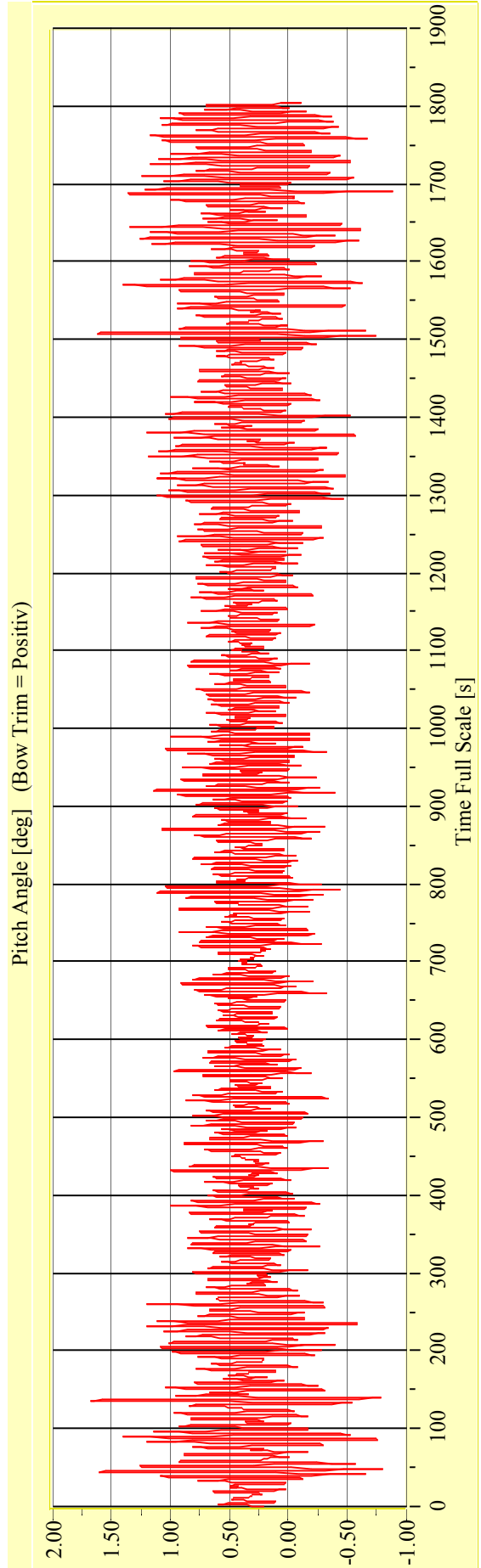
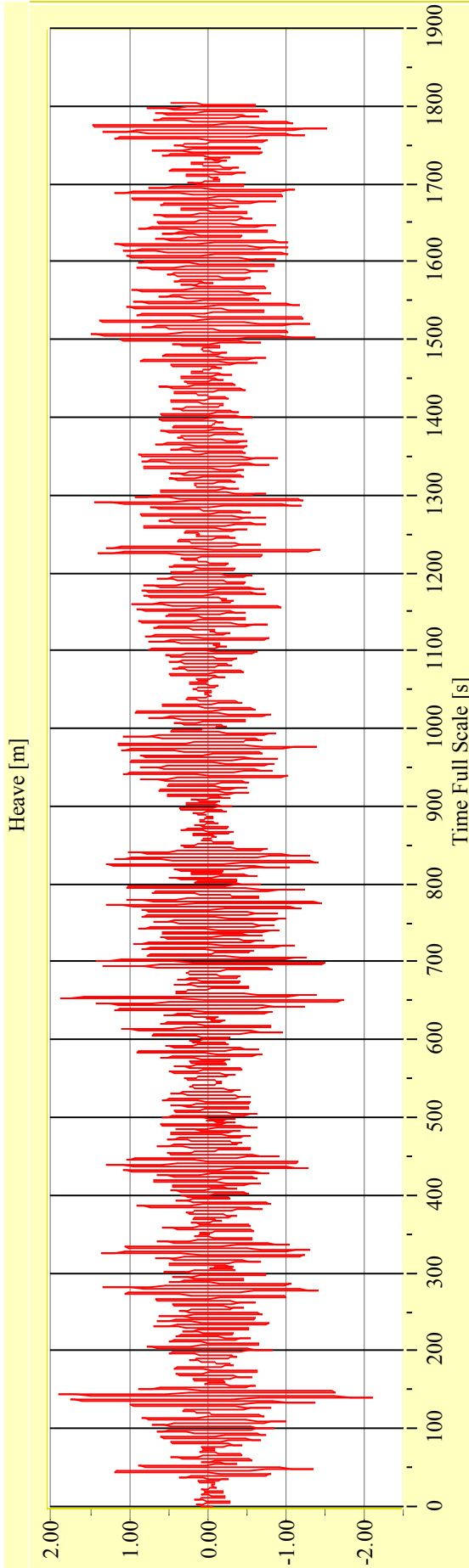
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29690-02**

**Target Waves: Hs = 3,35 m Tp = 7,321 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

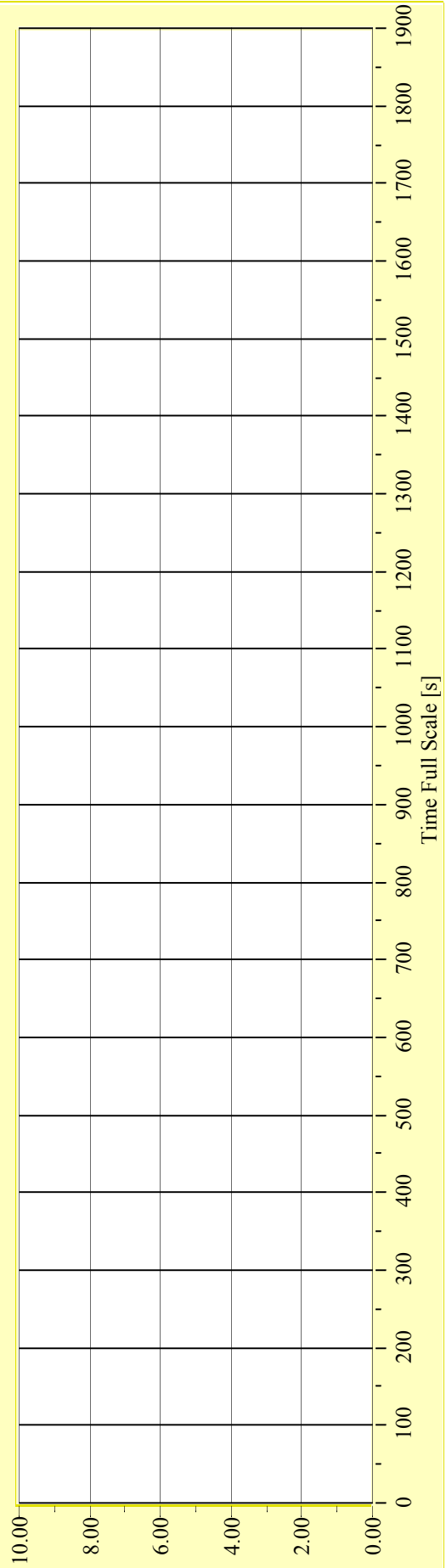
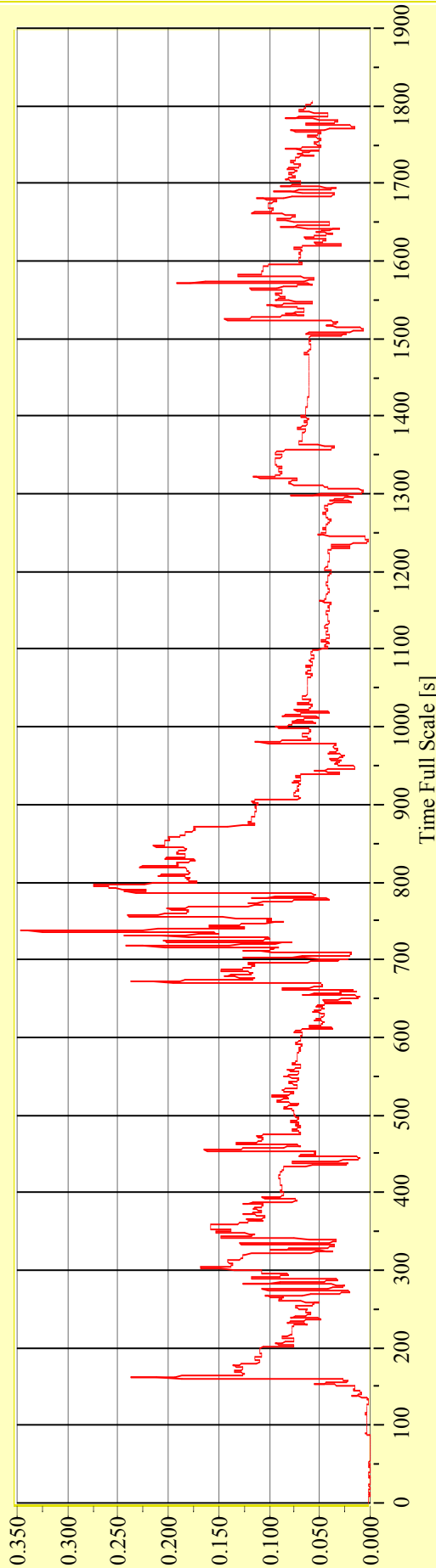
**Model No. 2446**

**Test No. 29690-02**

**Target Waves: Hs = 3,35 m Tp = 7,321 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



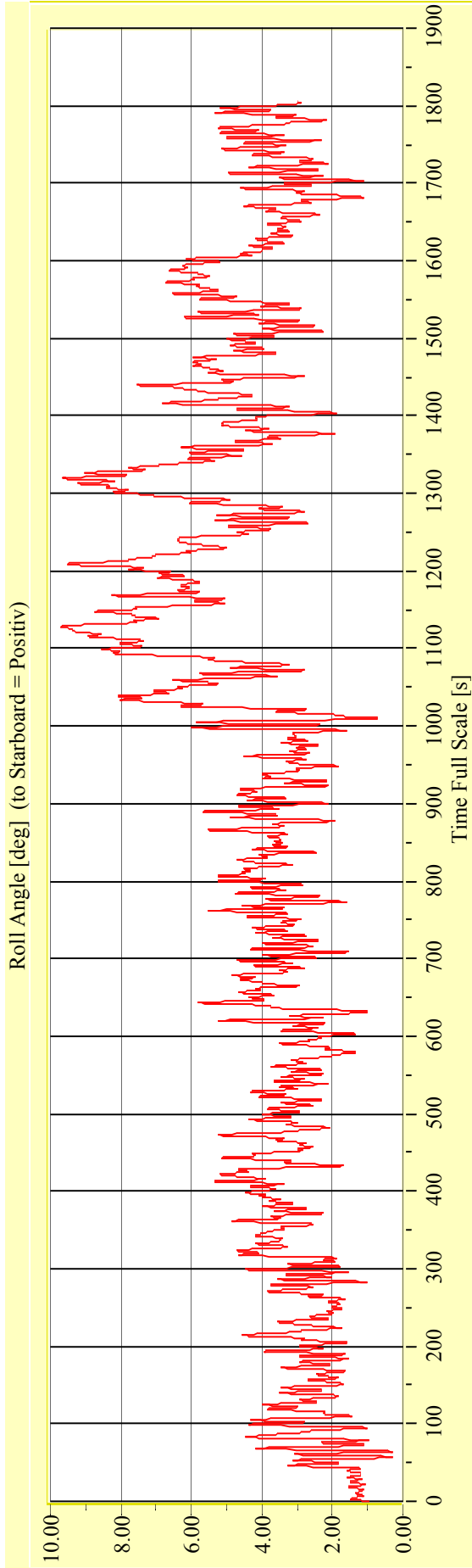
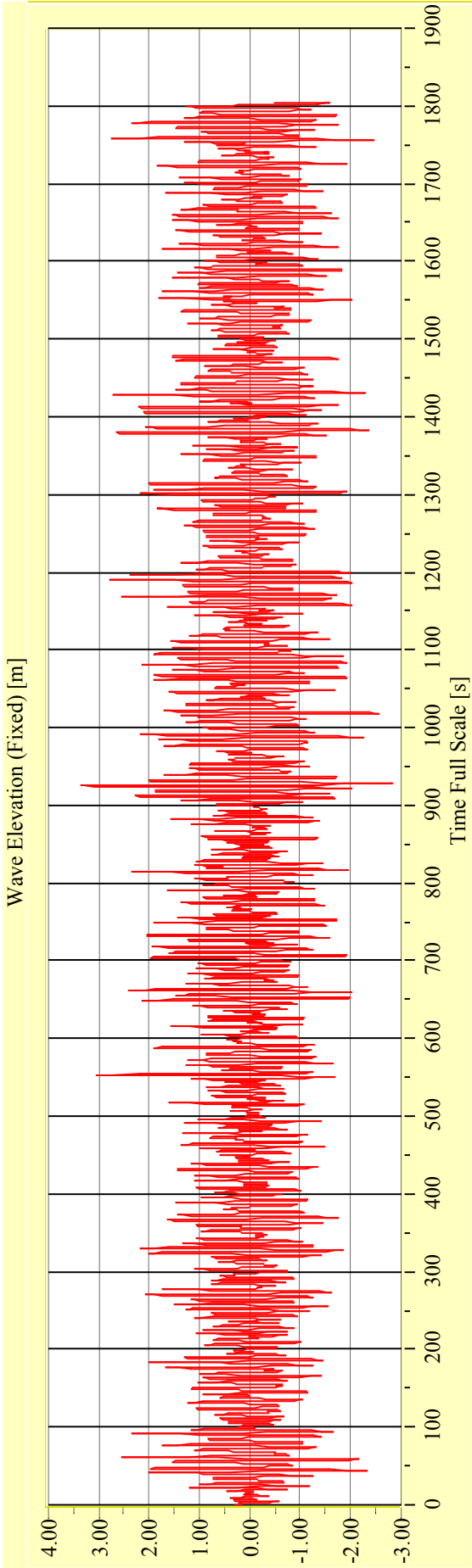
**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

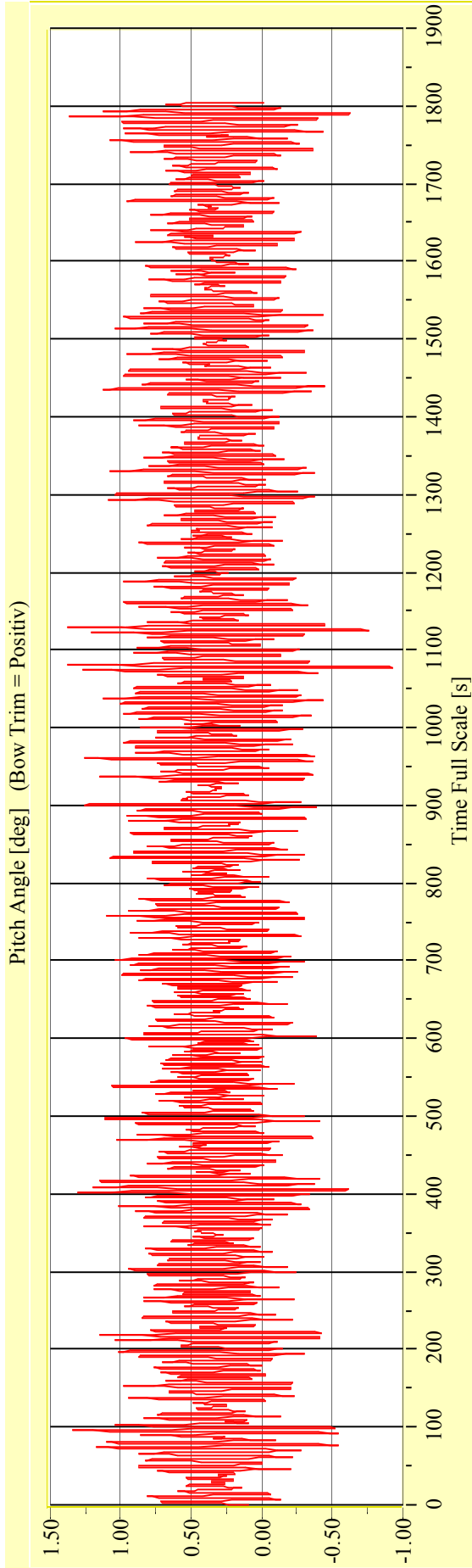
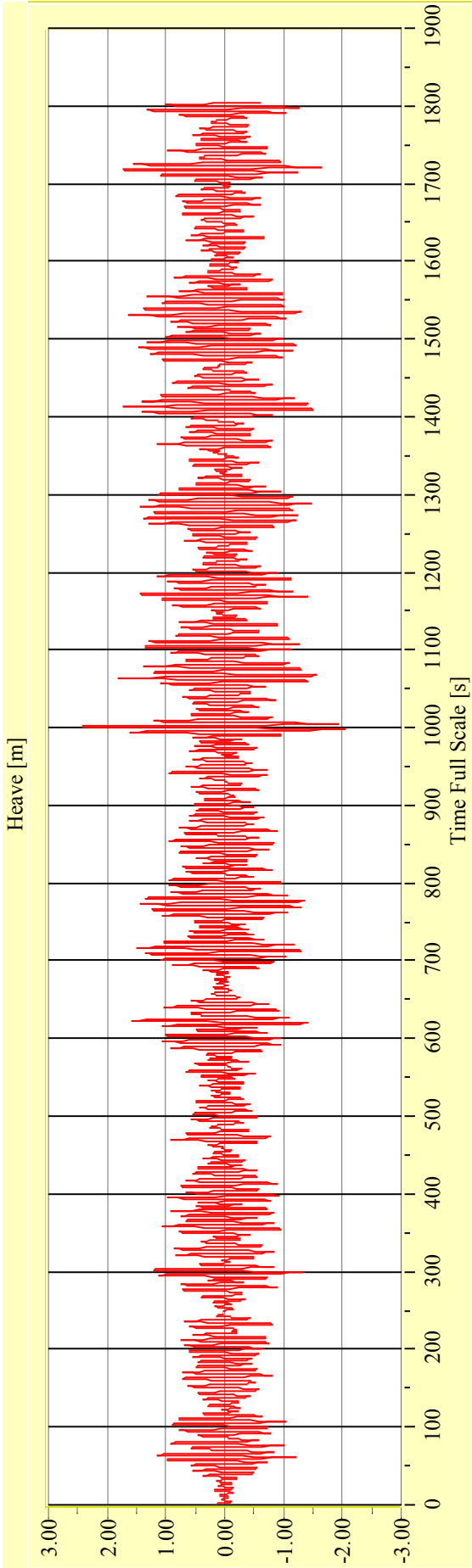
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29690-03**      **Target Waves: Hs = 3,35 m Tp = 7,321 s**      **gamma = 3,3**



**Date: 21.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29690-03**      **Target Waves: Hs = 3,35 m Tp = 7,321 s**      **gamma = 3,3**



**Date: 21.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**

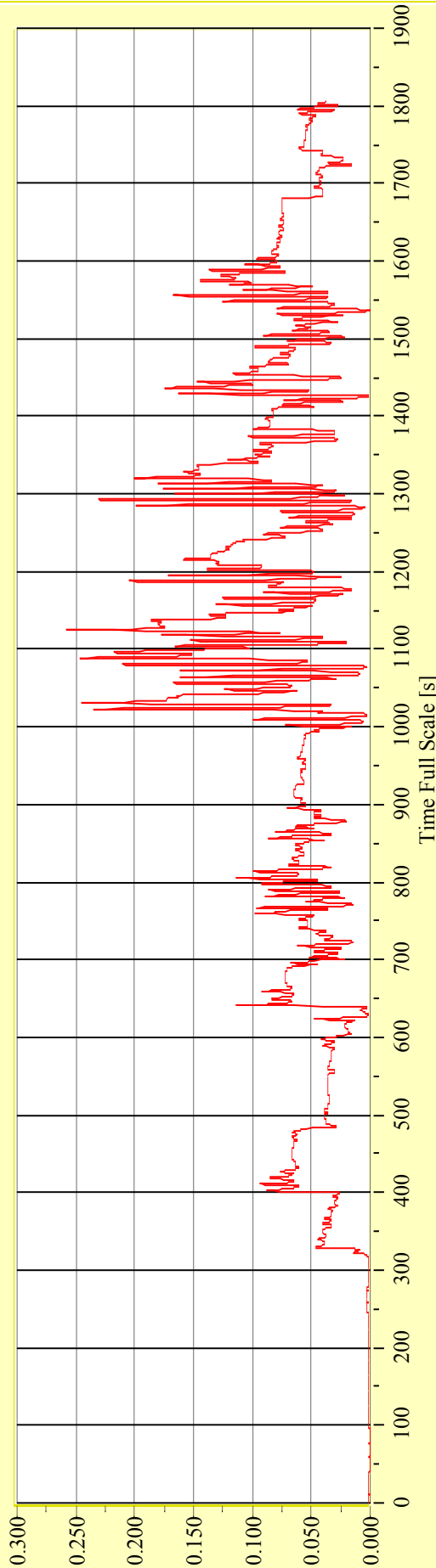
**Model No. 2446**

**Test No. 29690-03**

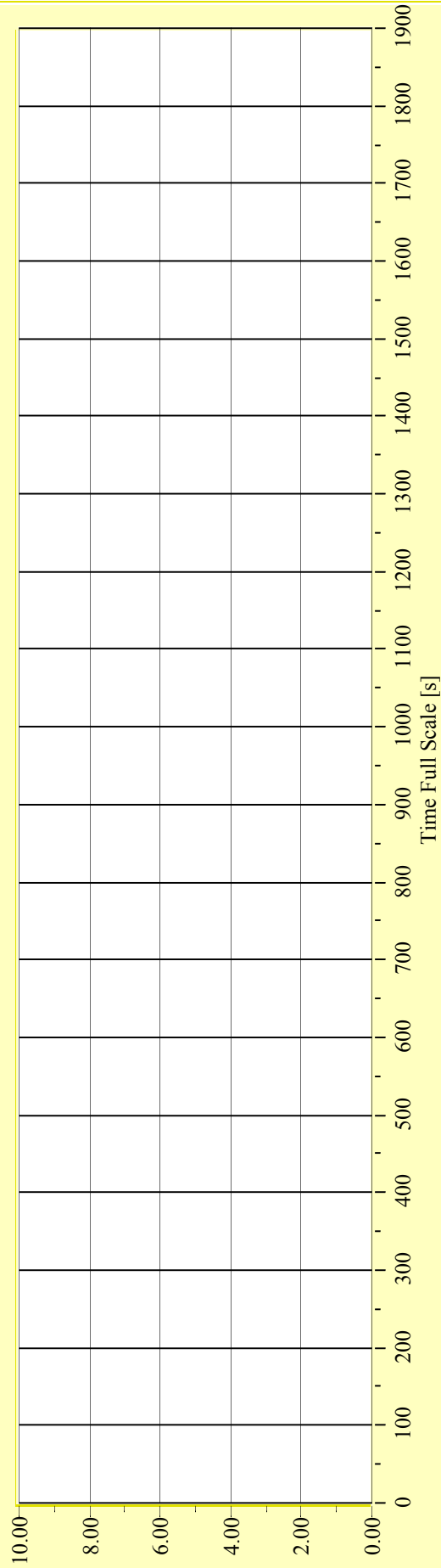
**Target Waves: Hs = 3,35 m Tp = 7,321 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



-



**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

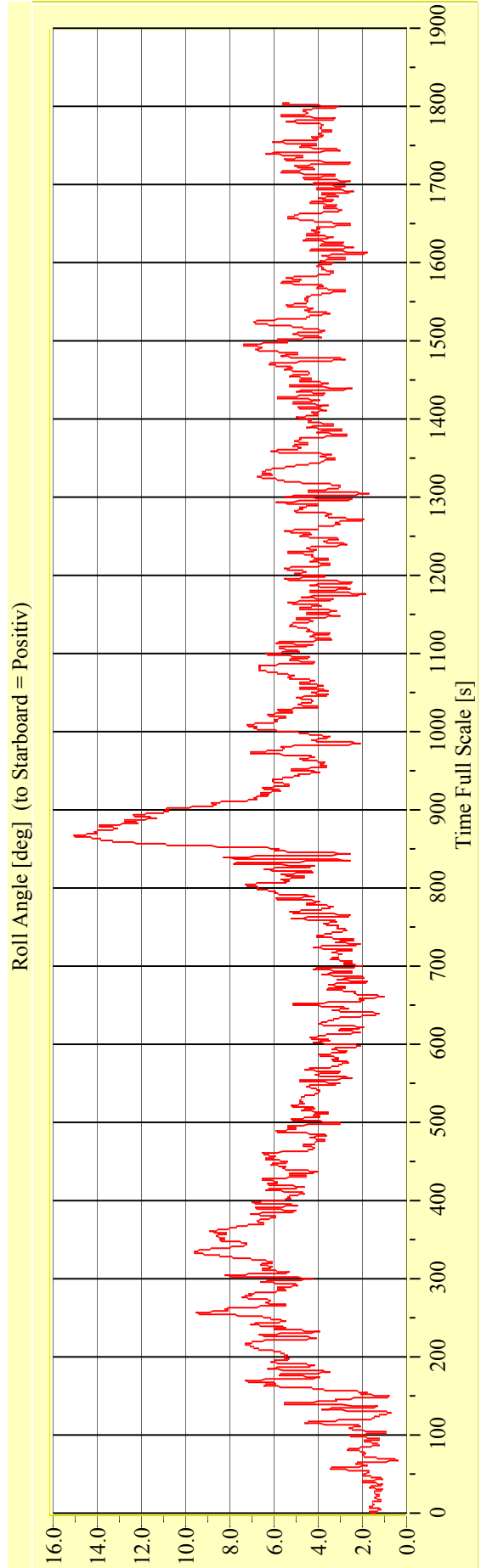
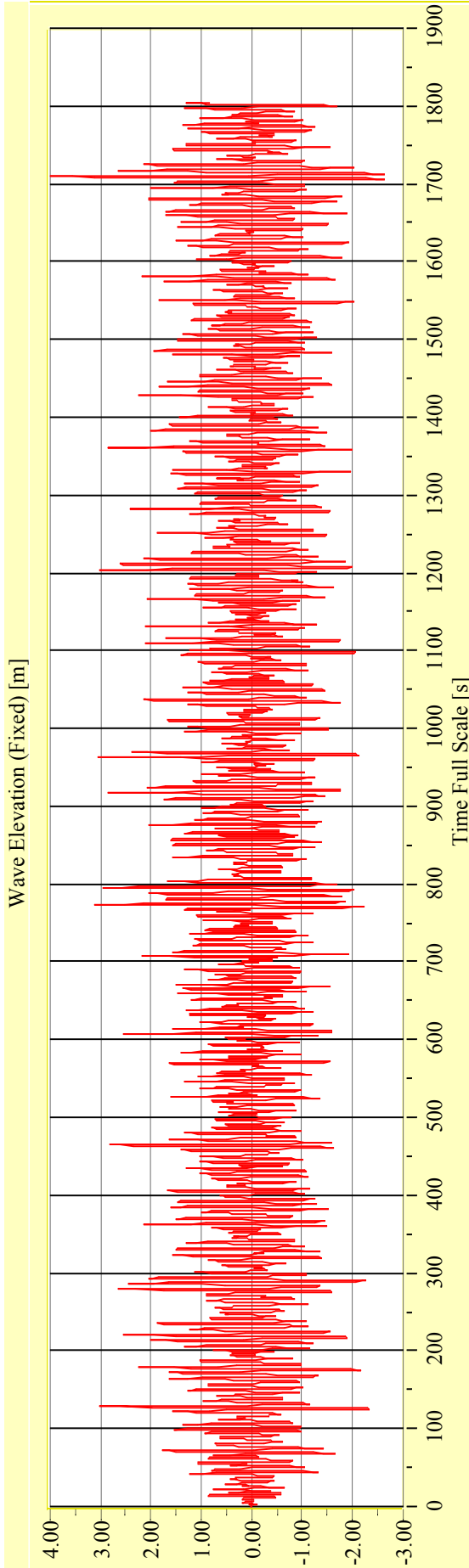
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29690-04**

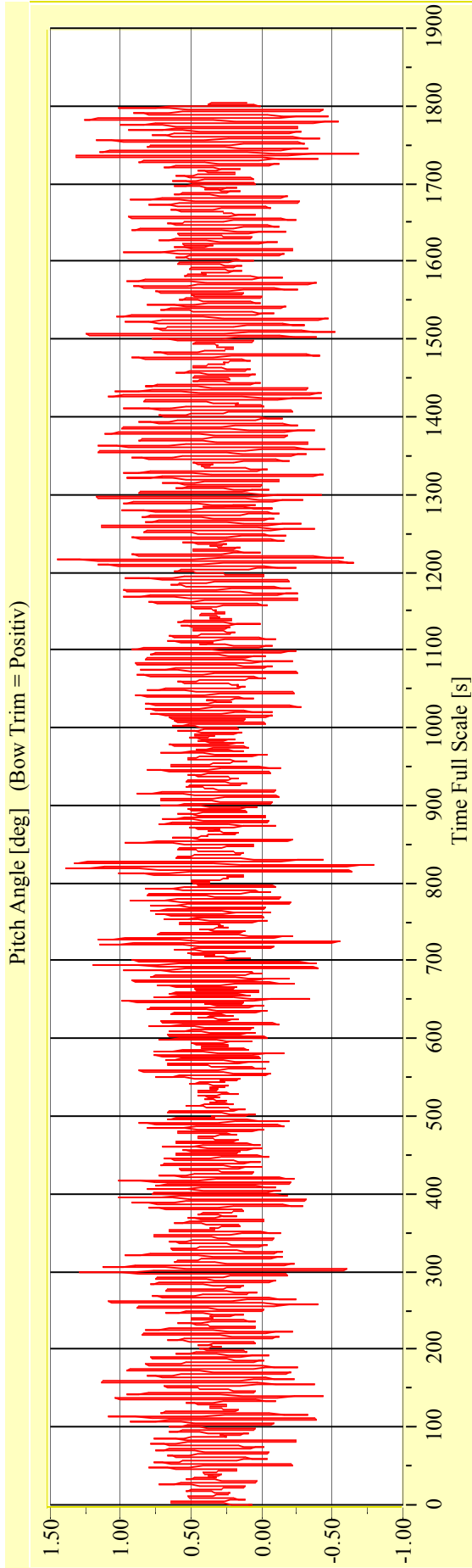
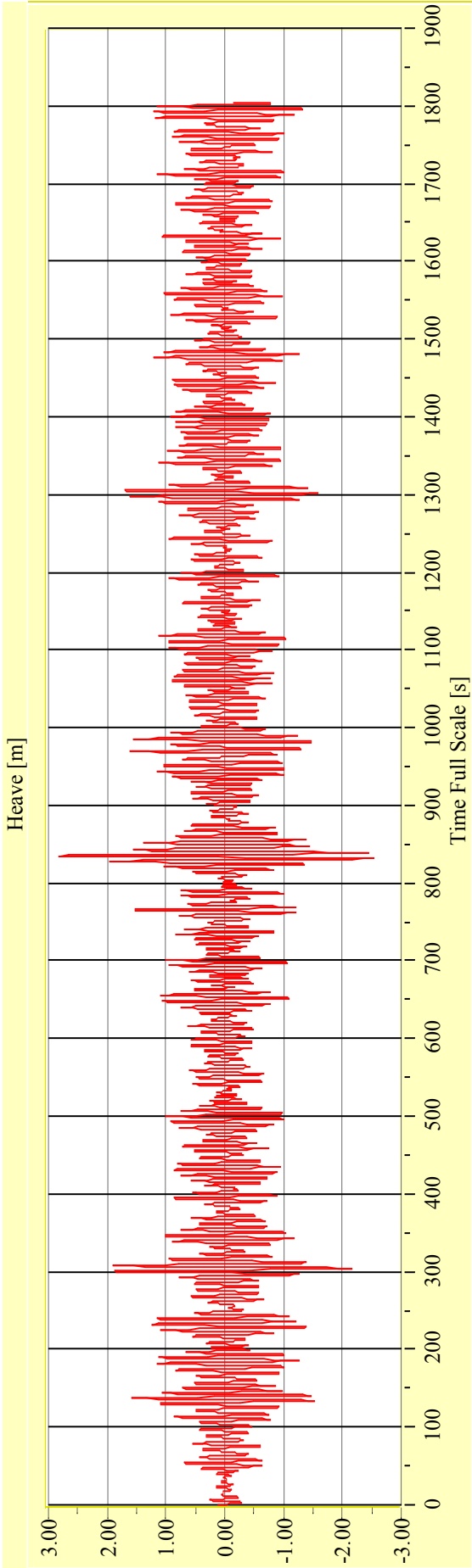
**Target Waves: Hs = 3,35 m Tp = 7,321 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29690-04**      **Target Waves: Hs = 3,35 m Tp = 7,321 s**      **gamma = 3,3**



**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**

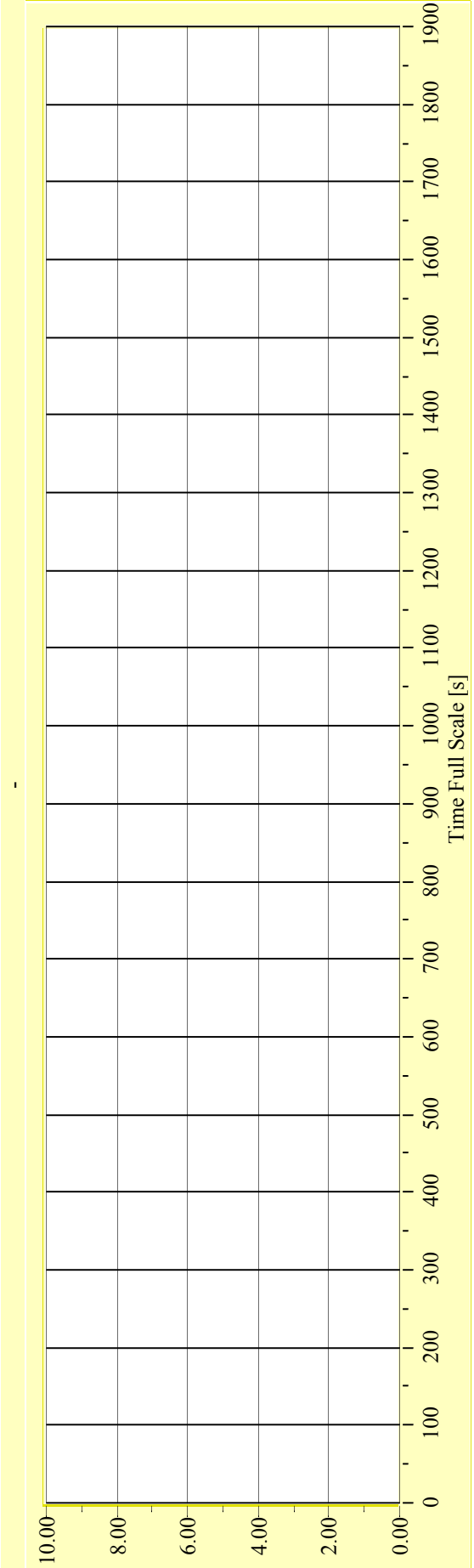
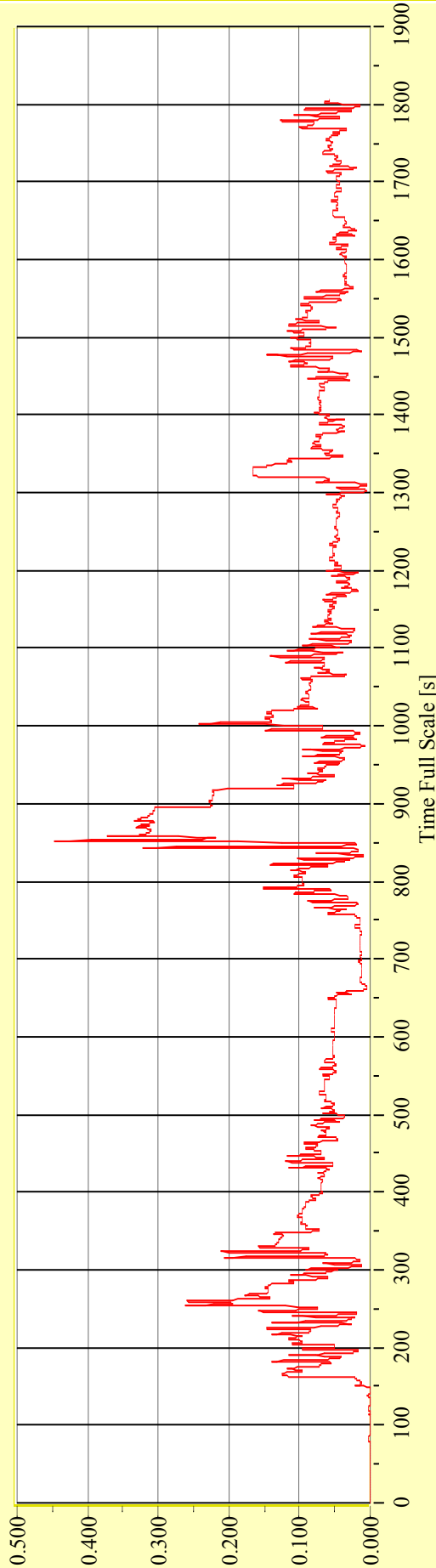
**Model No. 2446**

**Test No. 29690-04**

**Target Waves: Hs = 3,35 m Tp = 7,321 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Date: 21.05.2010**

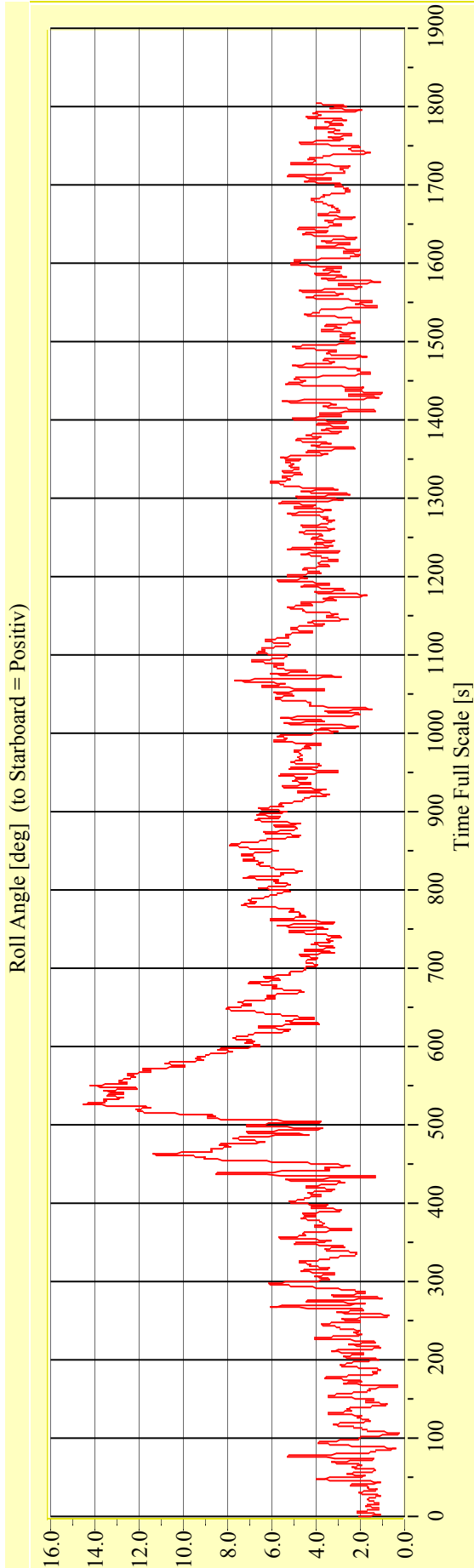
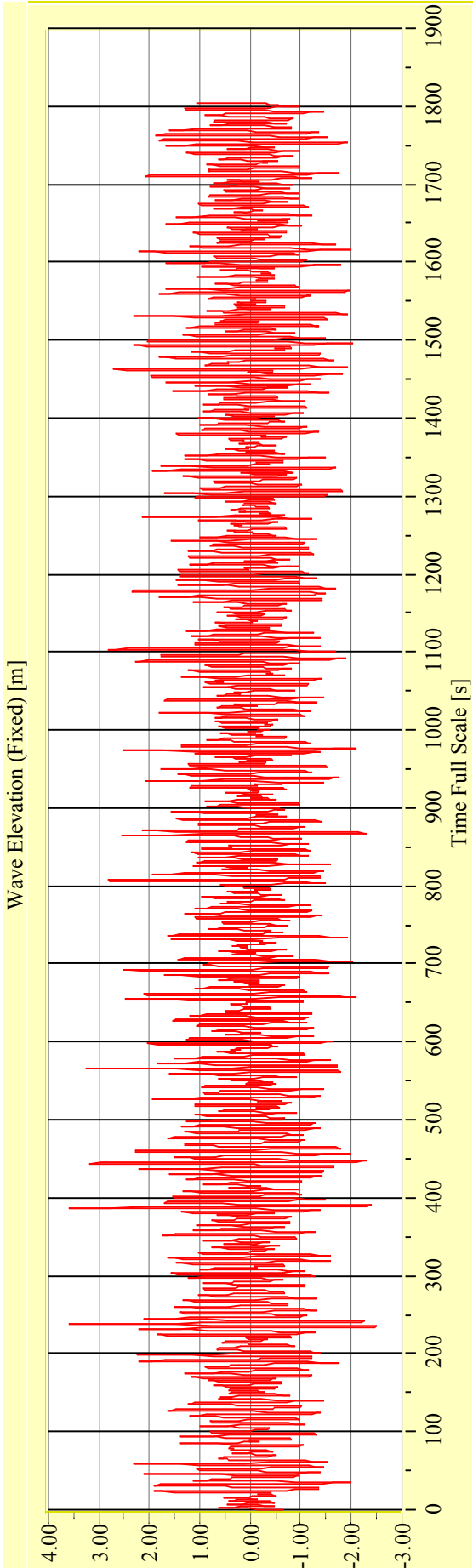
**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29690-05**      **Target Waves: Hs = 3,35 m Tp = 7,321 s**      **gamma = 3,3**



**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

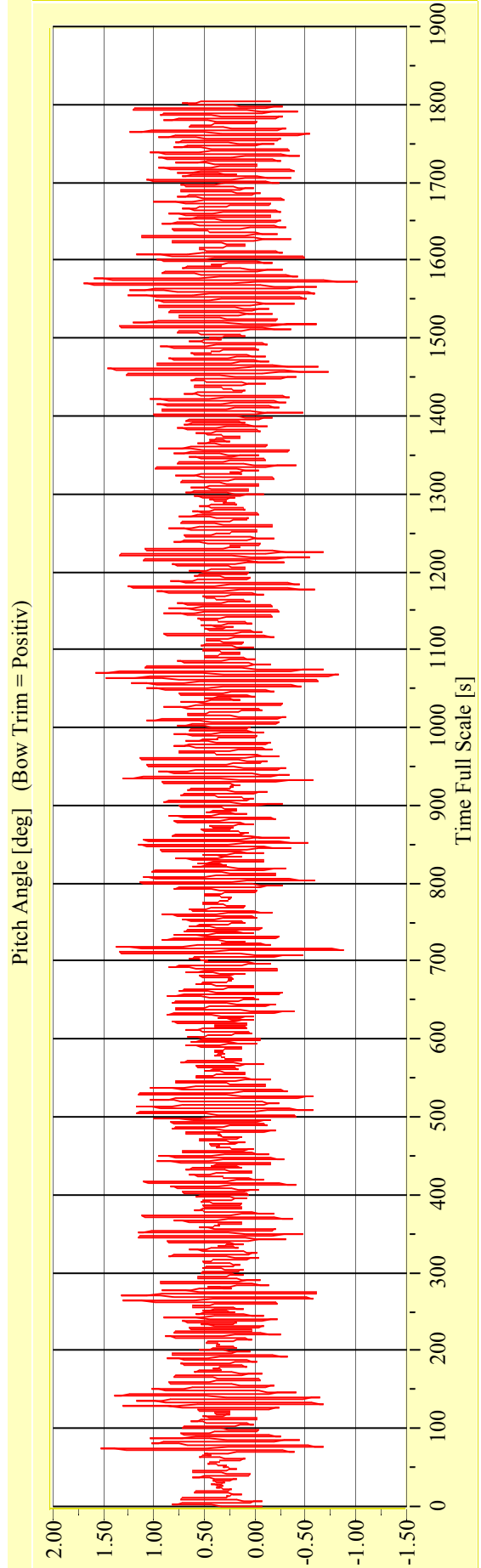
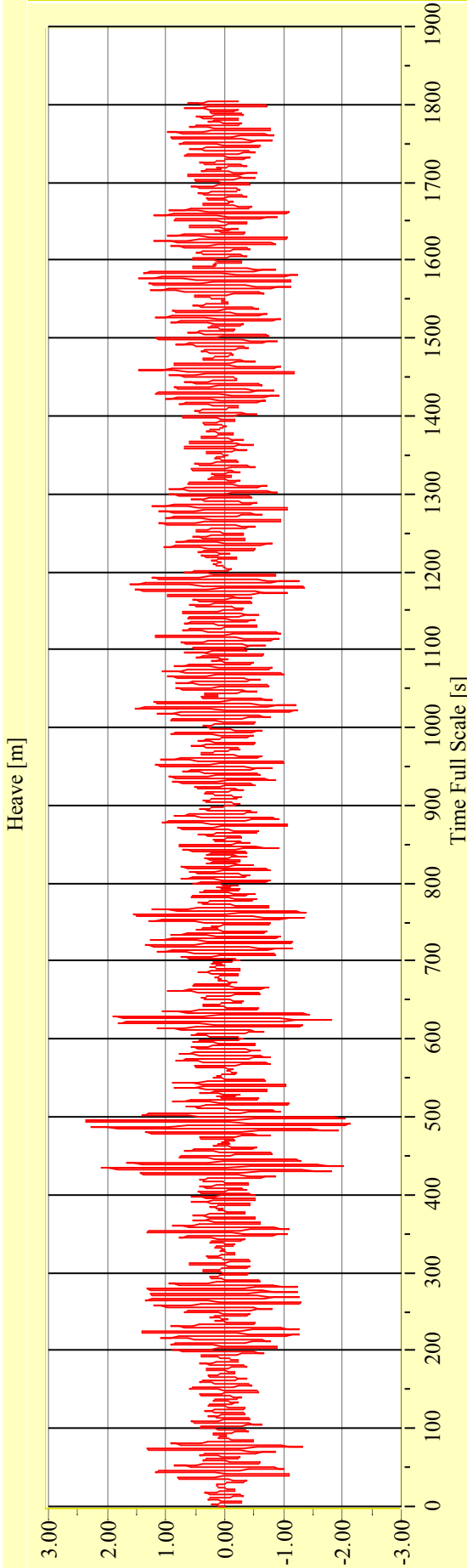
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29690-05**

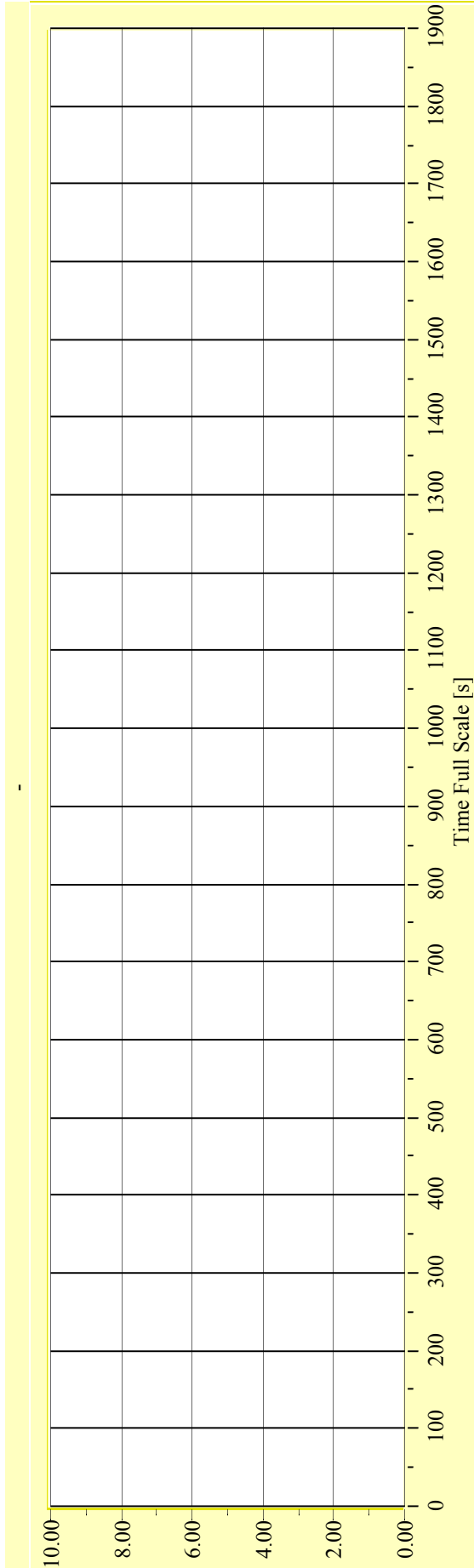
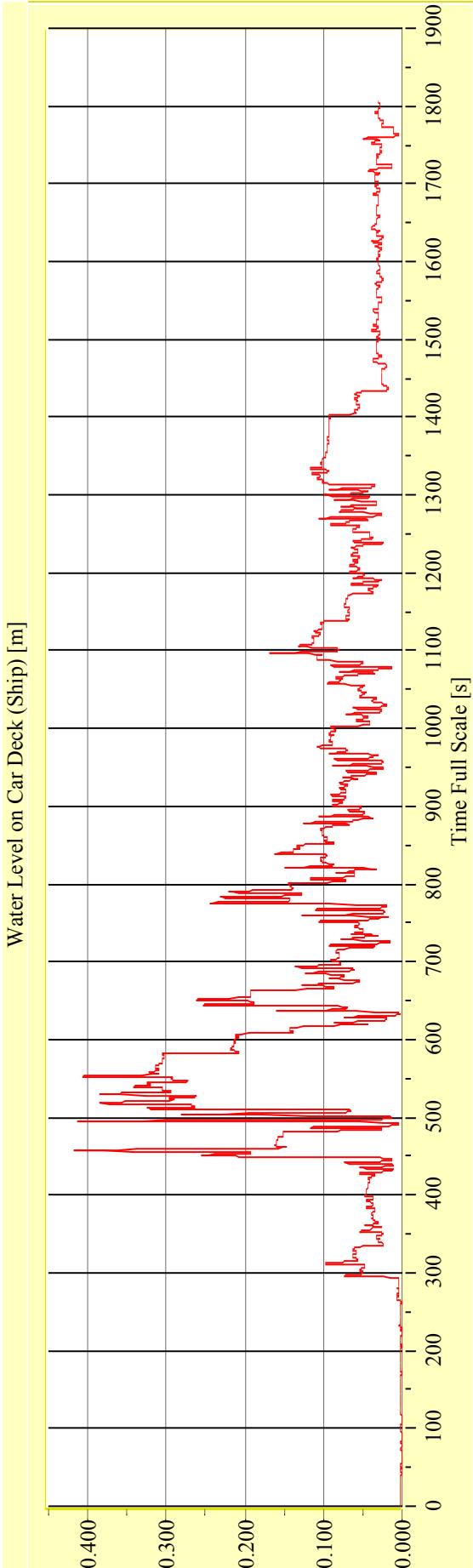
**Target Waves: Hs = 3,35 m Tp = 7,321 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29690-05**      **Target Waves: Hs = 3,35 m Tp = 7,321 s**      **gamma = 3,3**



**Date: 21.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

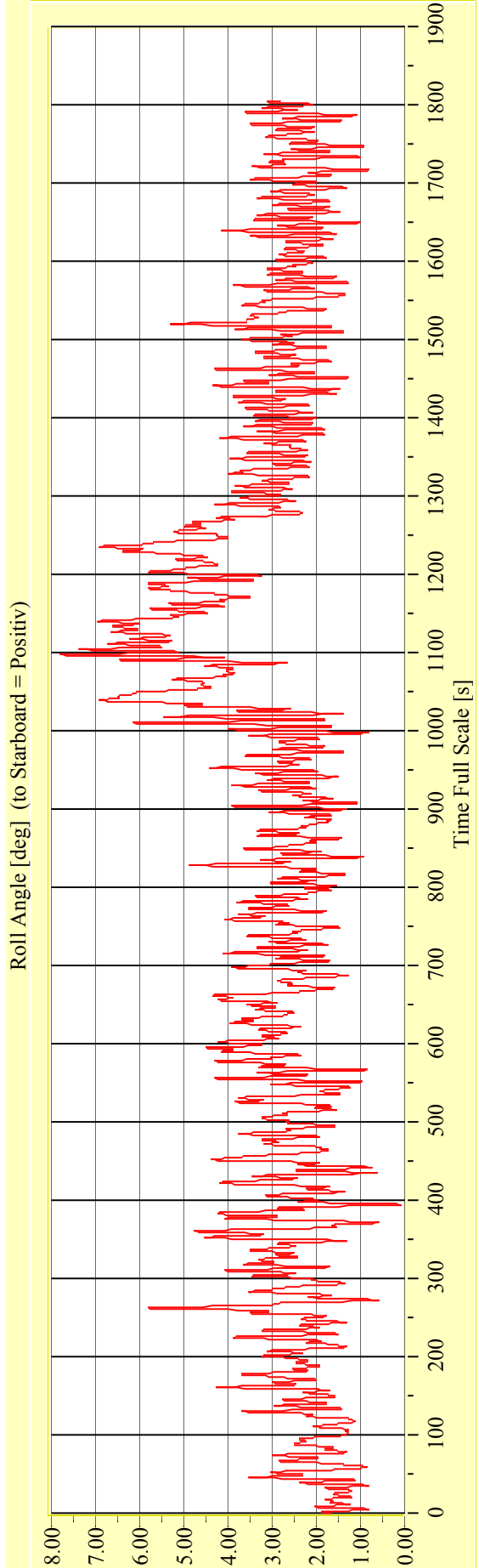
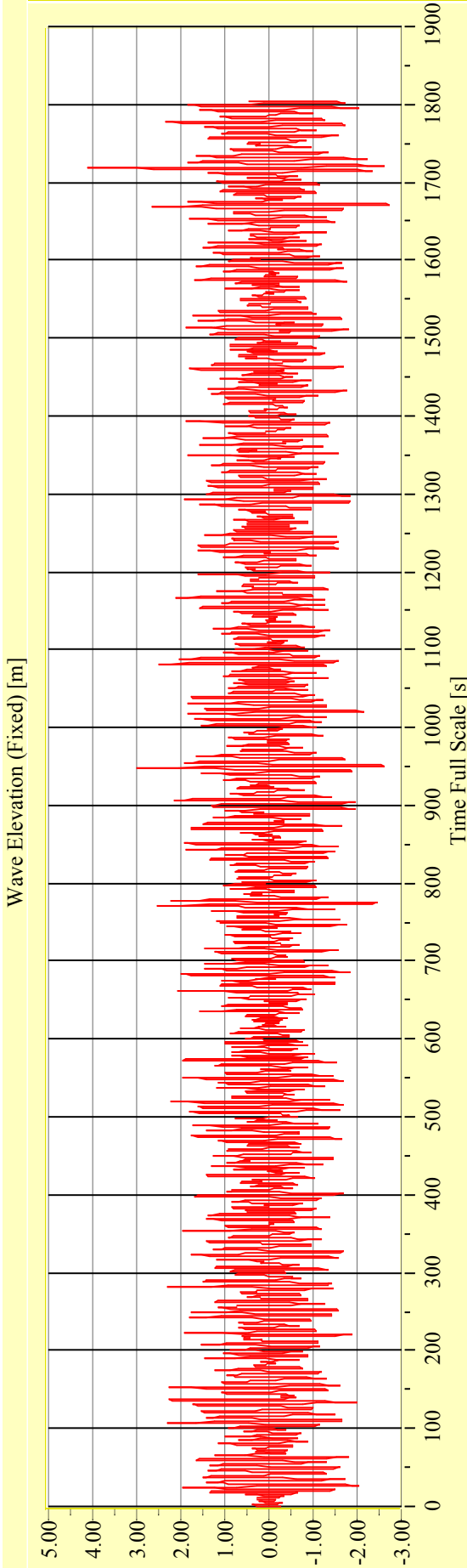
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29690-06**

**Target Waves: Hs = 3,35 m Tp = 7,321 s**

**gamma = 3,3**



**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

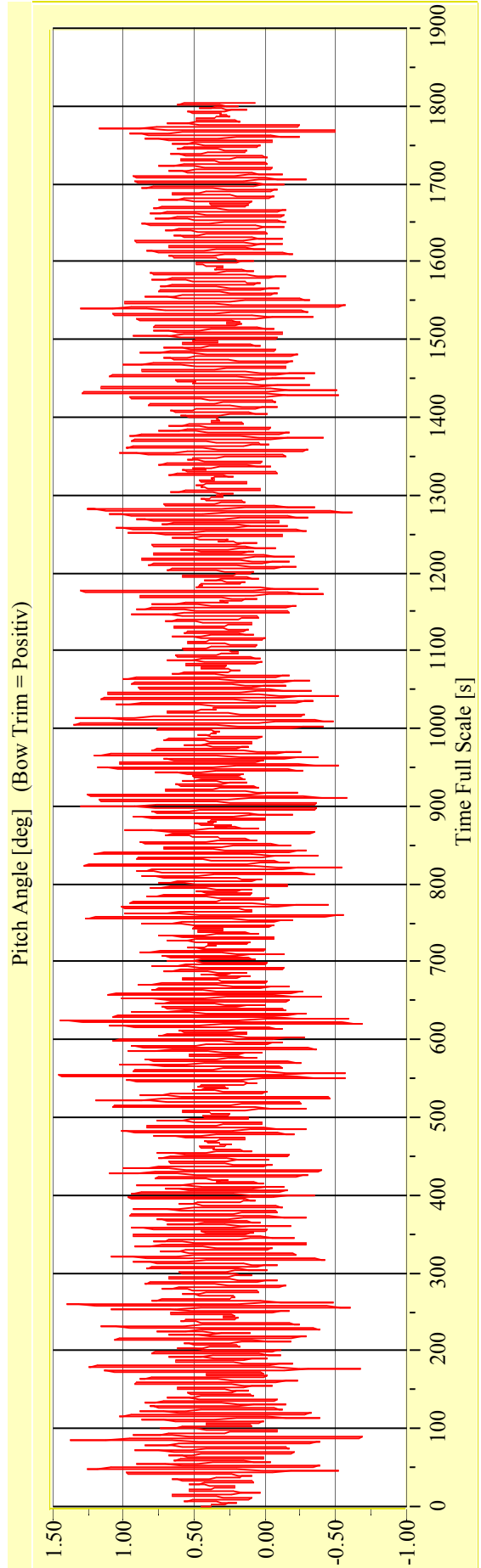
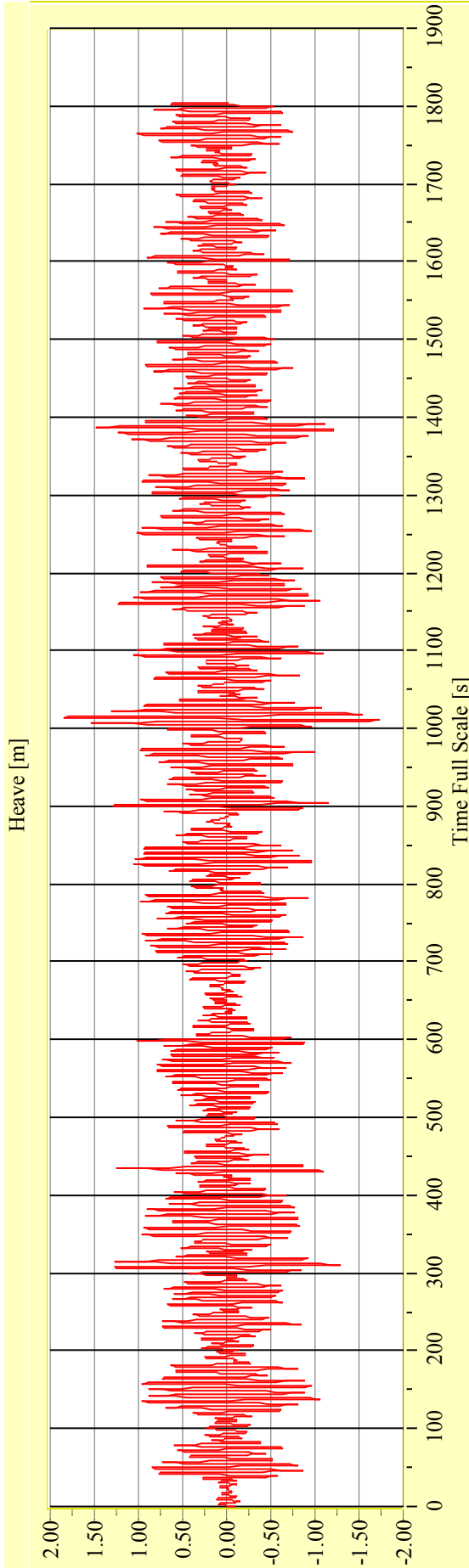
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29690-06**

**Target Waves: Hs = 3,35 m Tp = 7,321 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

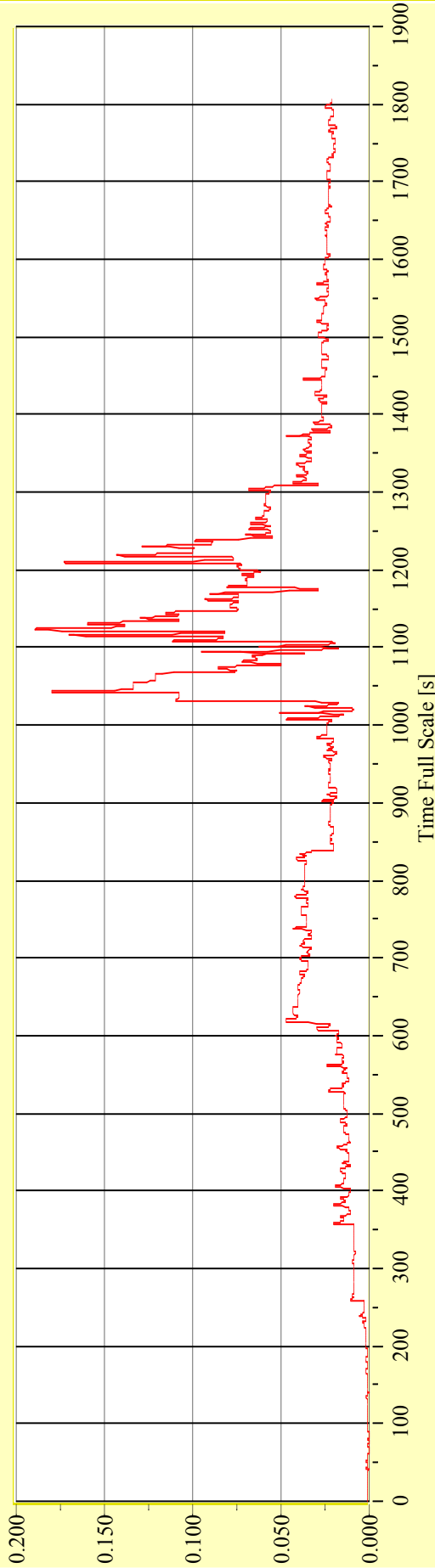
**Model No. 2446**

**Test No. 29690-06**

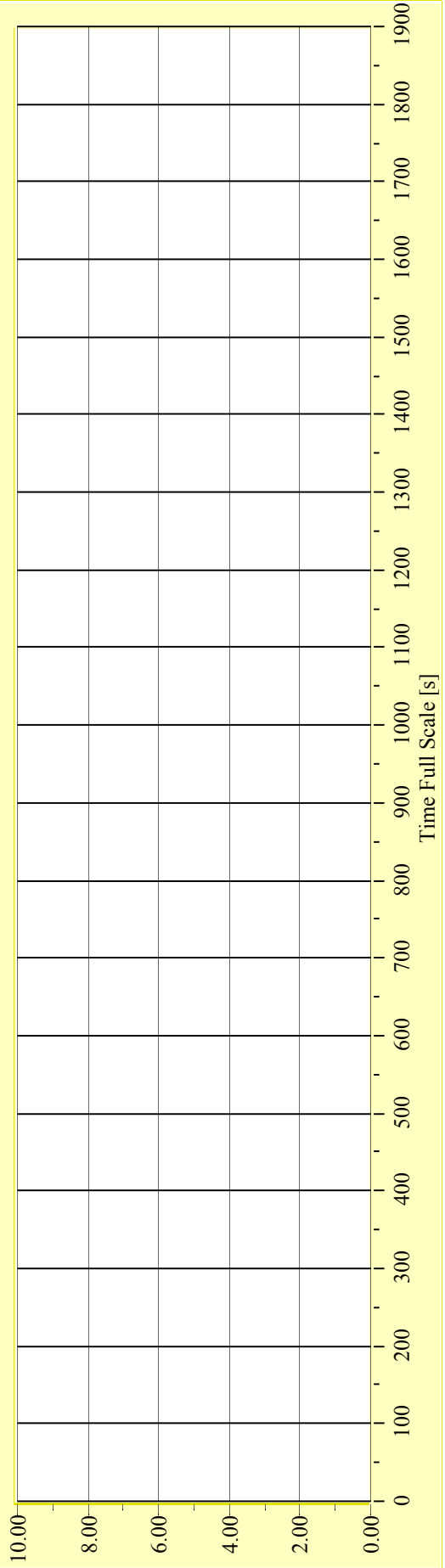
**Target Waves: Hs = 3,35 m Tp = 7,321 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



-



**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

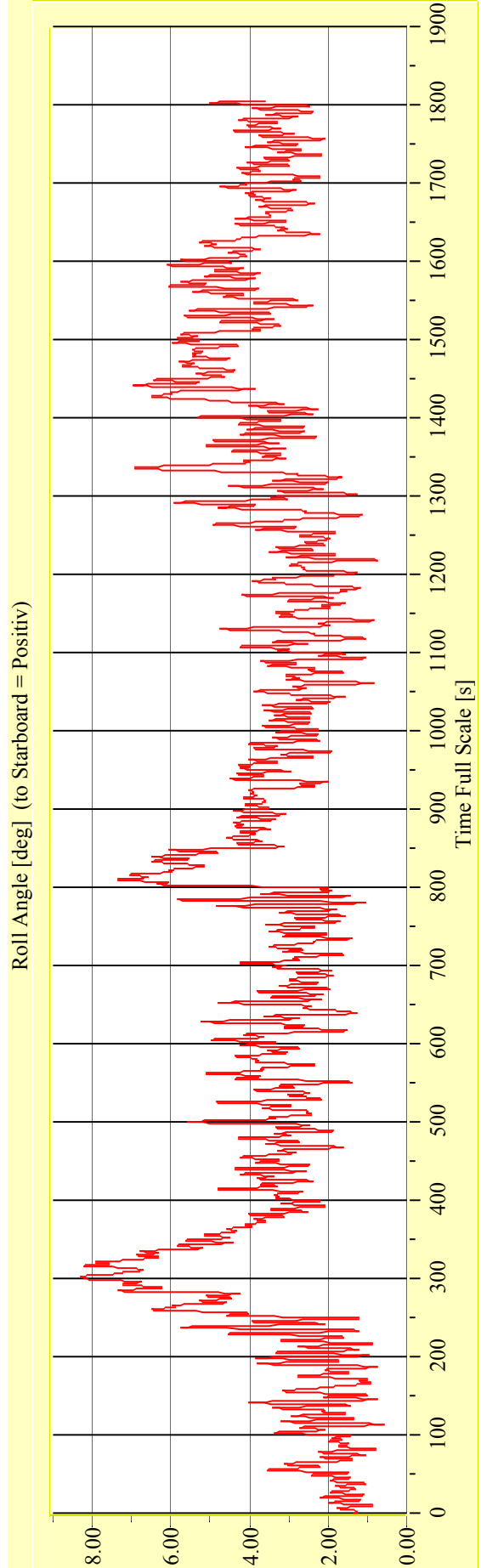
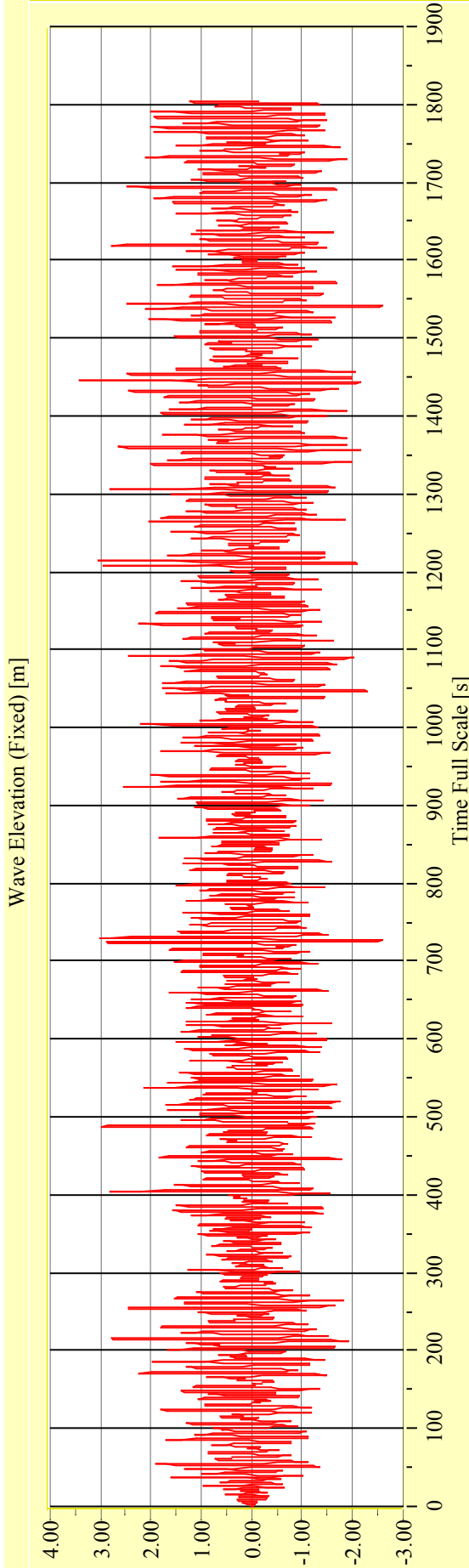
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29690-07**

**Target Waves: Hs = 3,35 m Tp = 7,321 s**

**gamma = 3,3**



**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

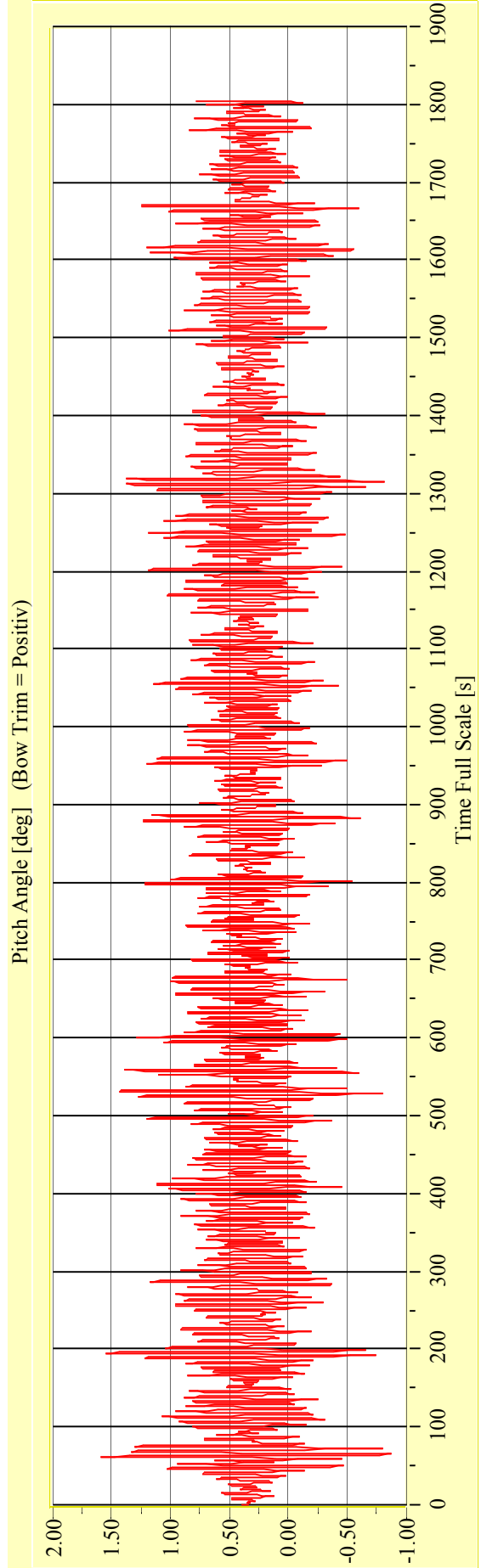
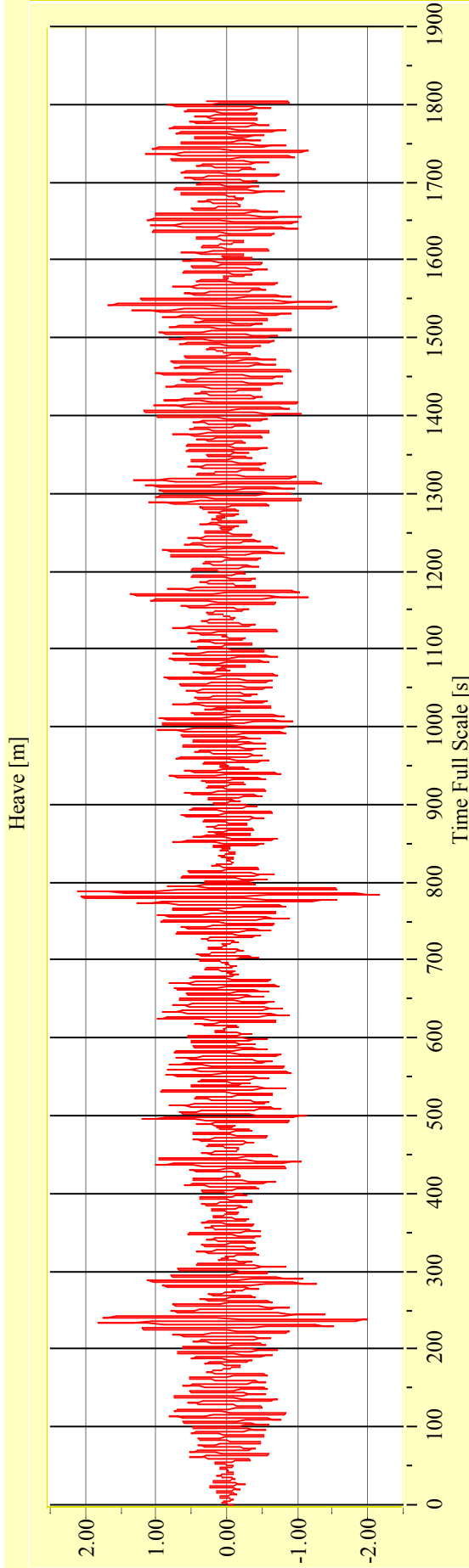
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29690-07**

**Target Waves: Hs = 3,35 m Tp = 7,321 s**

**gamma = 3,3**



**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**



Irregular Beam Seas

Vienna Model Basin

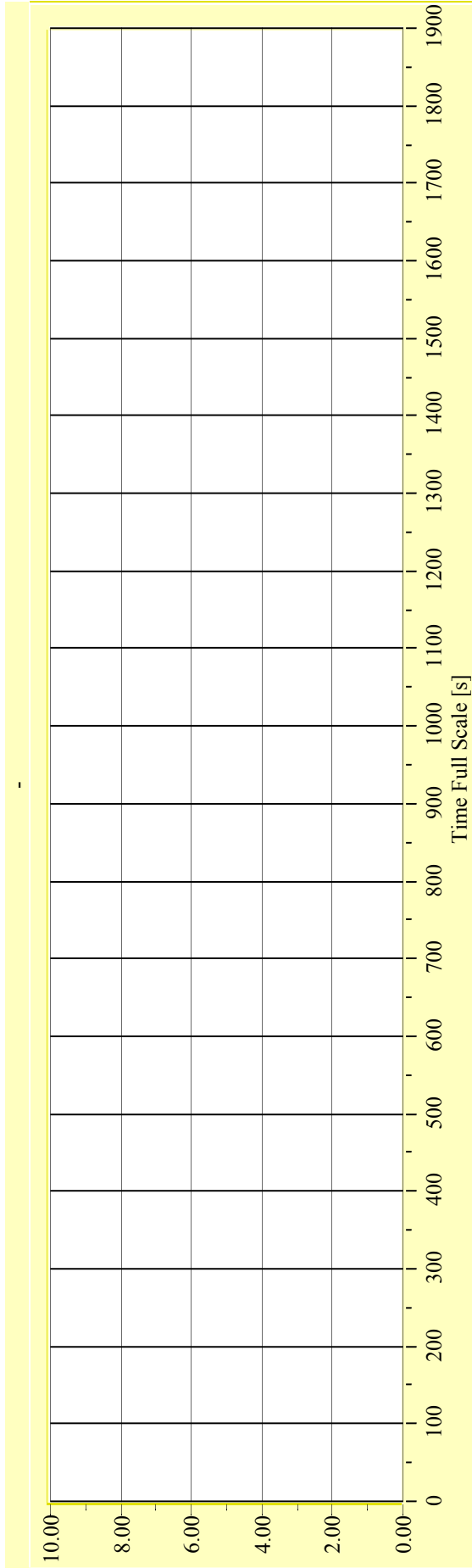
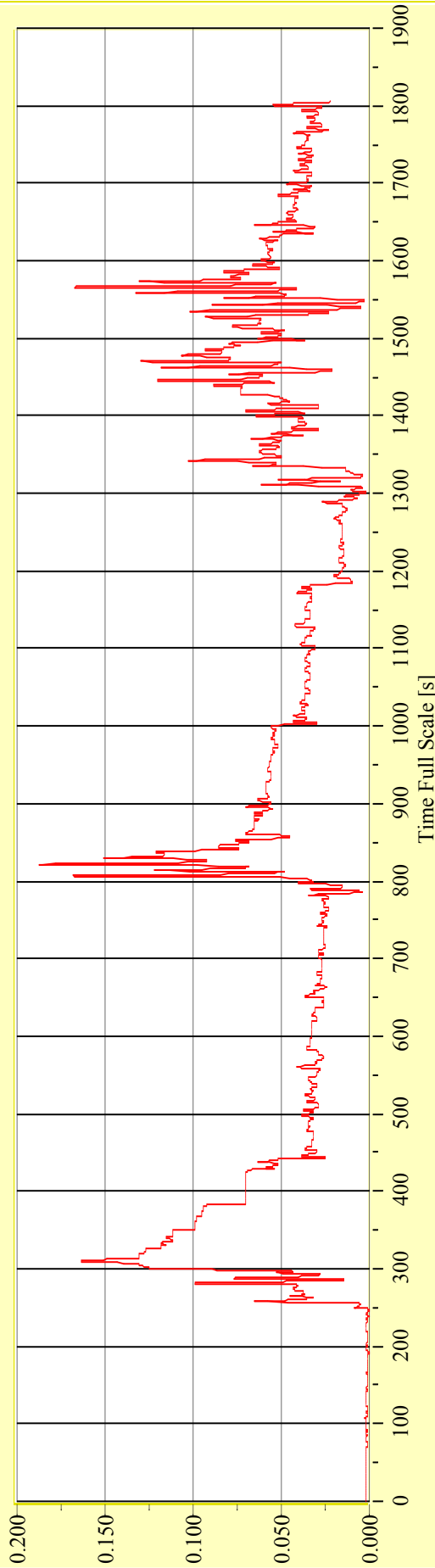
Model No. 2446

Test No. 29690-07

Target Waves: Hs = 3,35 m Tp = 7,321 s

gamma = 3,3

Water Level on Car Deck (Ship) [m]



Date: 21.05.2010

Project: EMSA 1

Damage 1: R7\_S7-9.1.0-1

**Irregular Beam Seas**

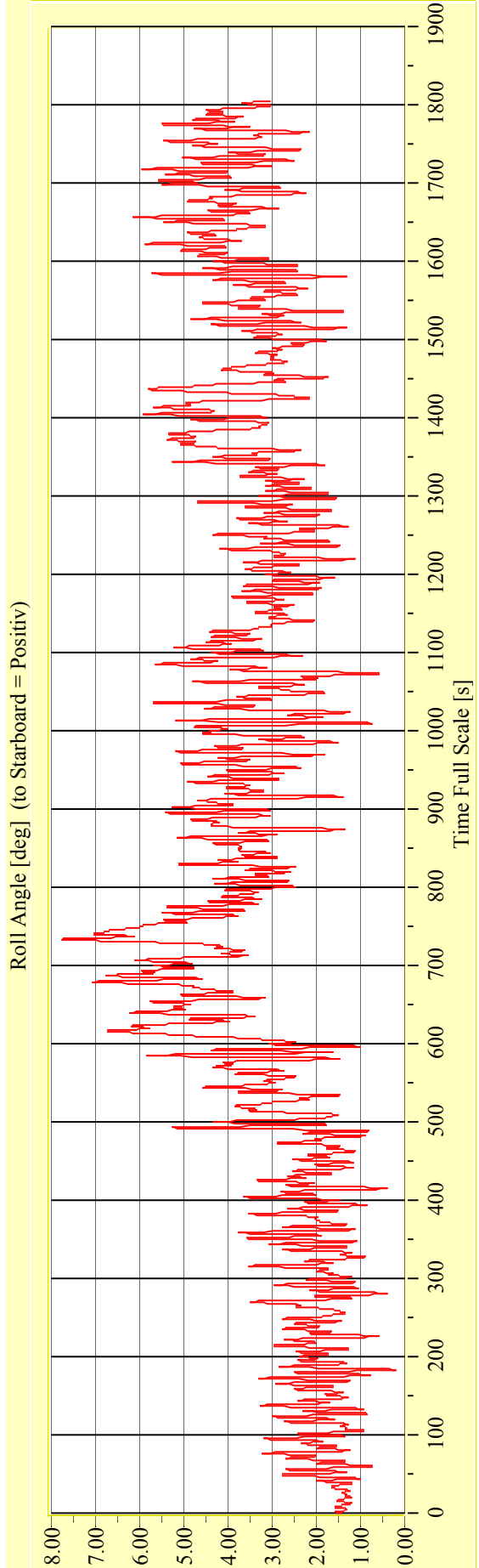
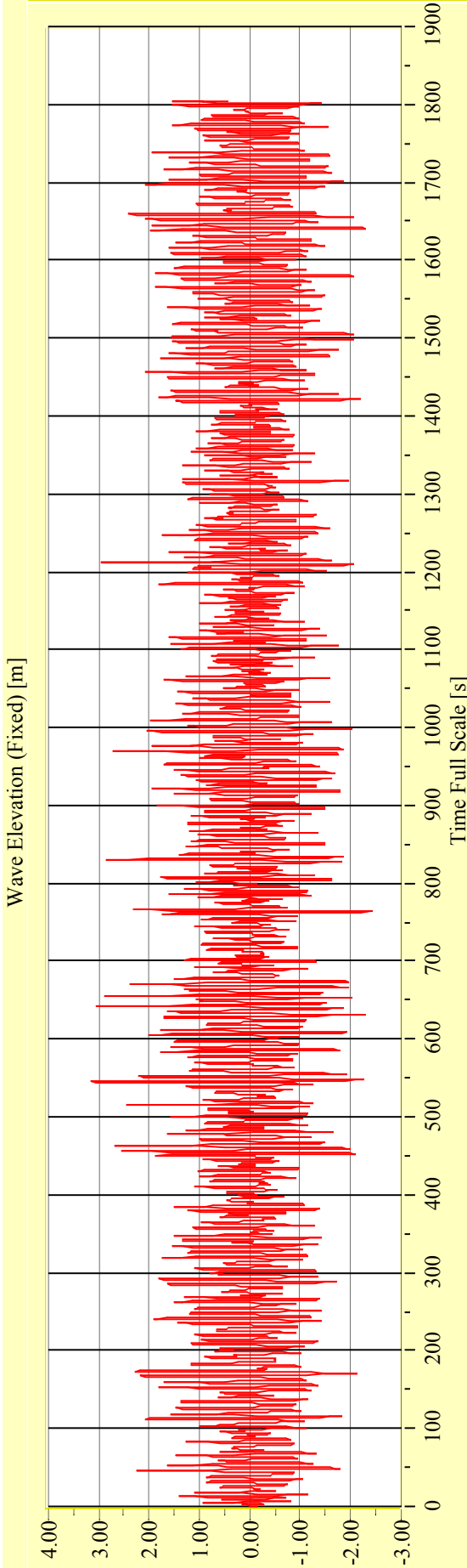
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29690-08**

**Target Waves: Hs = 3,35 m Tp = 7,321 s**

**gamma = 3,3**



**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

Irregular Beam Seas

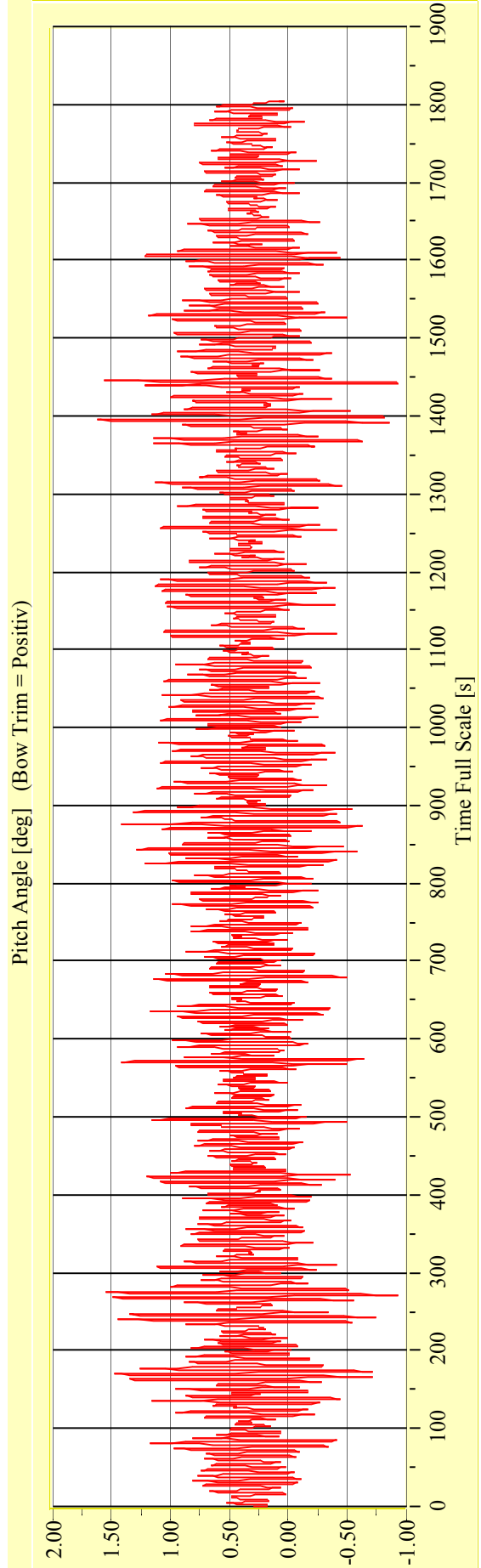
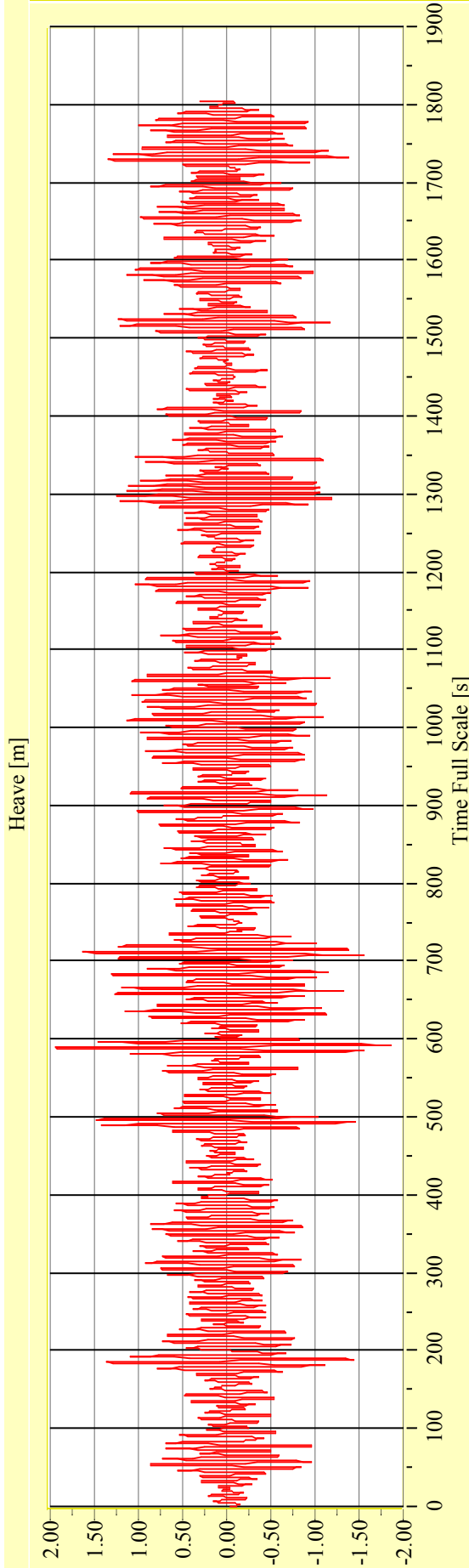
Vienna Model Basin

Model No. 2446

Test No. 29690-08

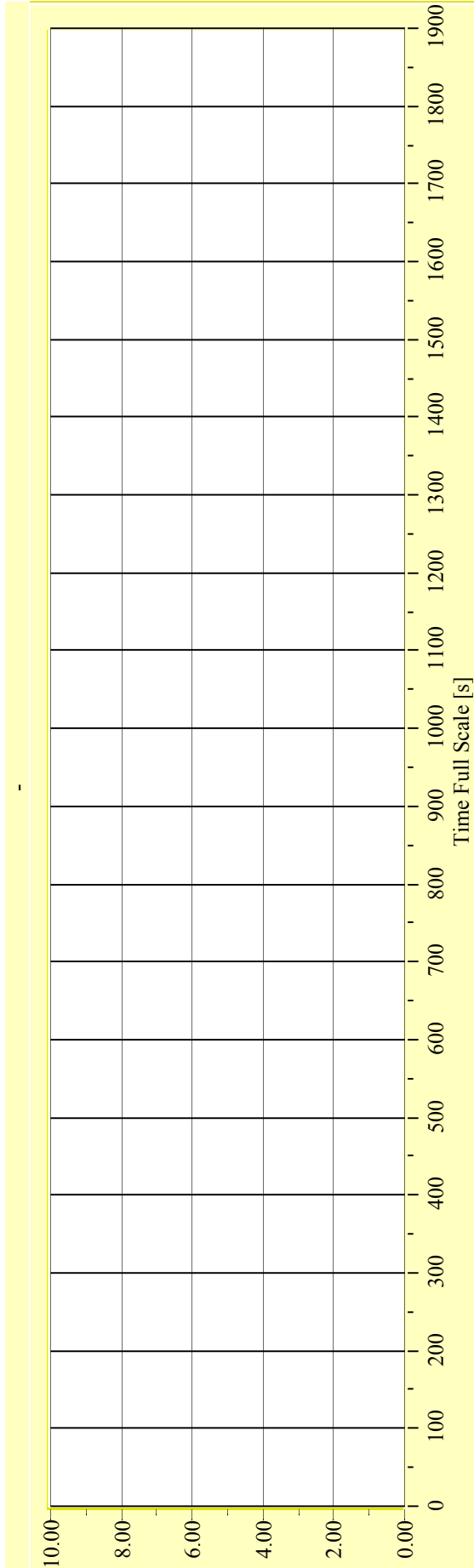
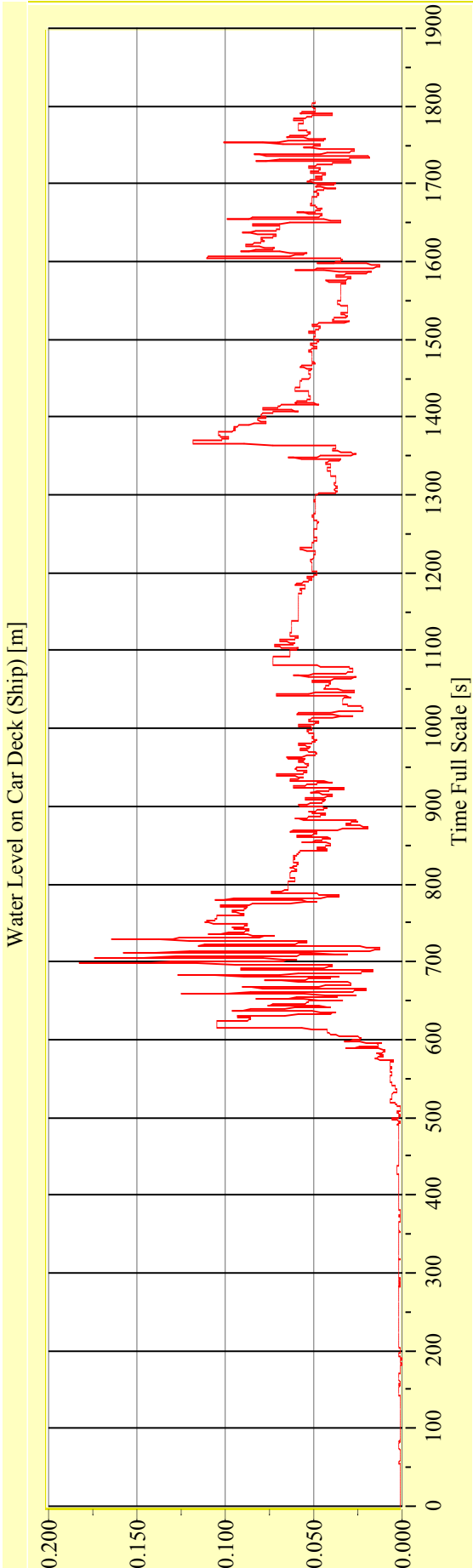
Target Waves: Hs = 3,35 m Tp = 7,321 s

gamma = 3,3



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29690-08**      **Target Waves: Hs = 3,35 m Tp = 7,321 s**      **gamma = 3,3**



**Date: 21.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

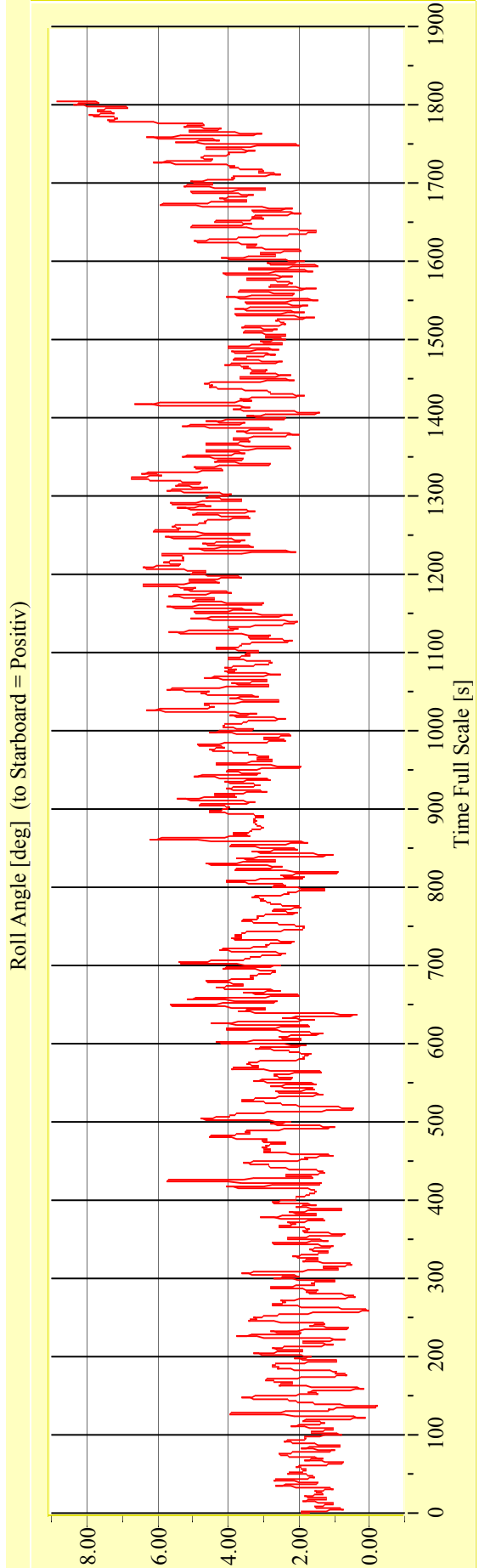
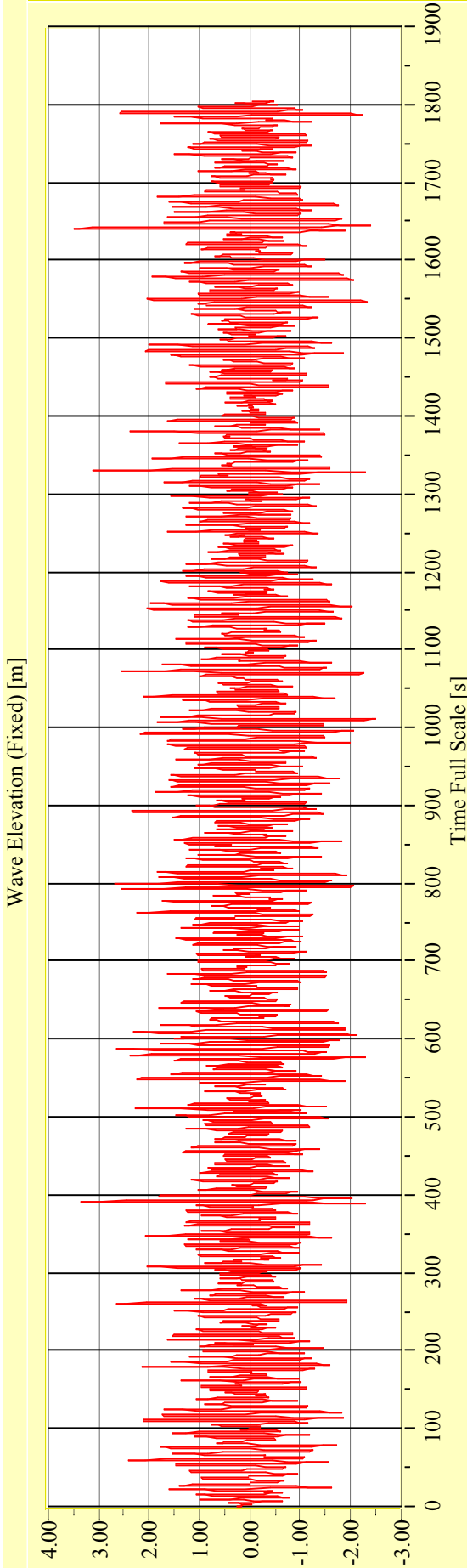
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29690-09**

**Target Waves: Hs = 3,35 m Tp = 7,321 s**

**gamma = 3,3**



**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

Irregular Beam Seas

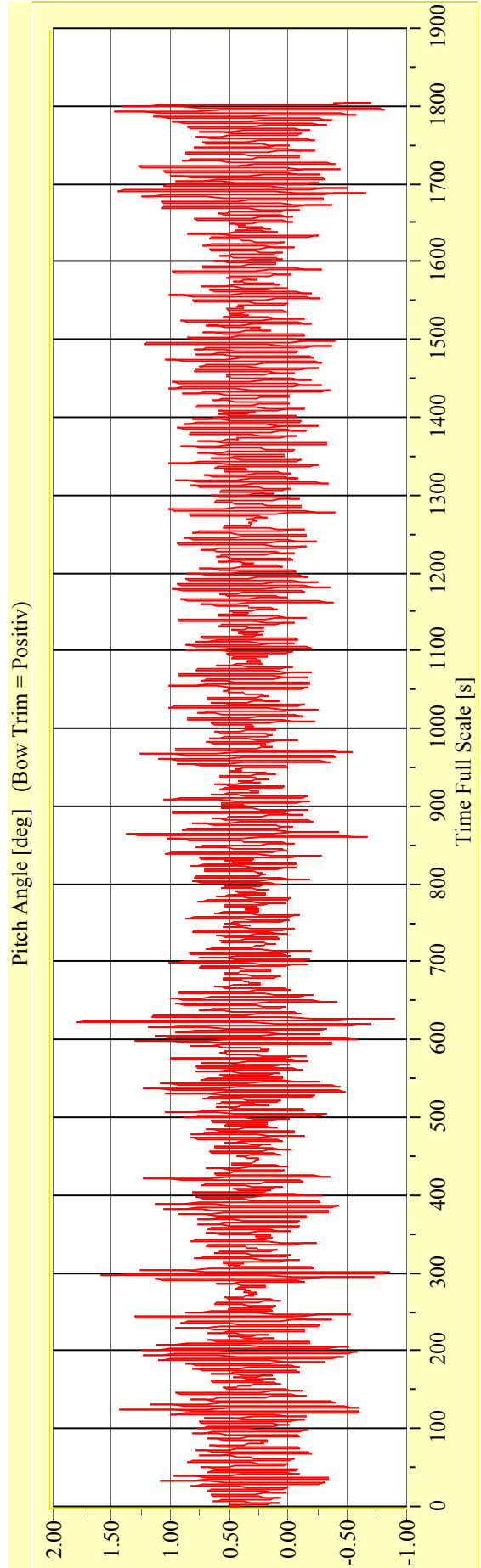
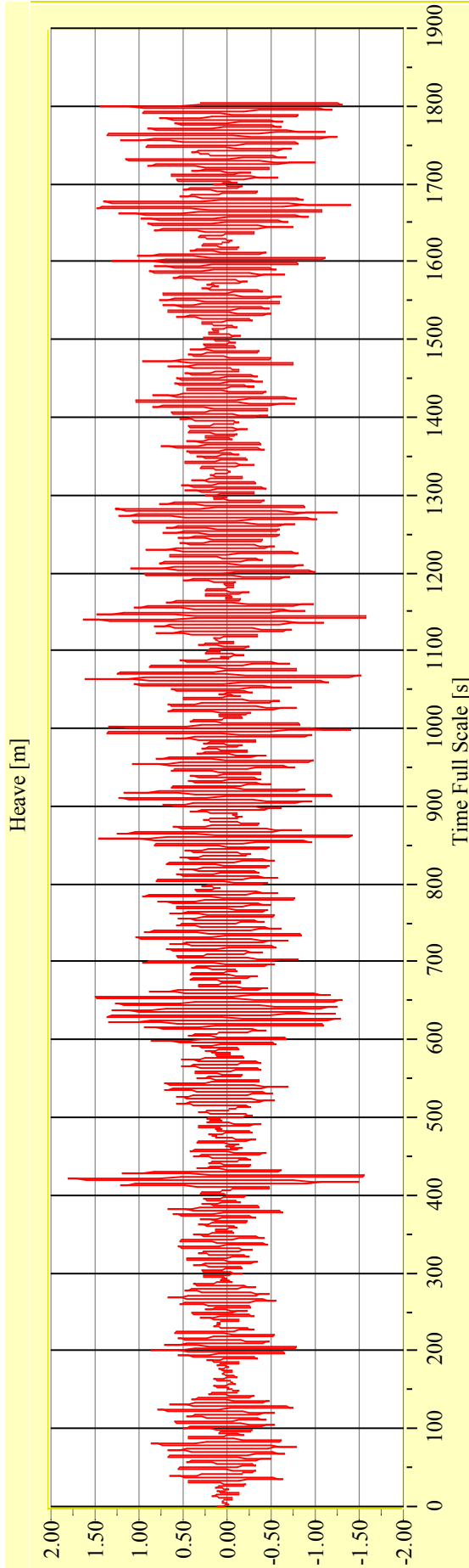
Vienna Model Basin

Model No. 2446

Test No. 29690-09

Target Waves: Hs = 3,35 m Tp = 7,321 s

gamma = 3,3



**Irregular Beam Seas**

**Vienna Model Basin**

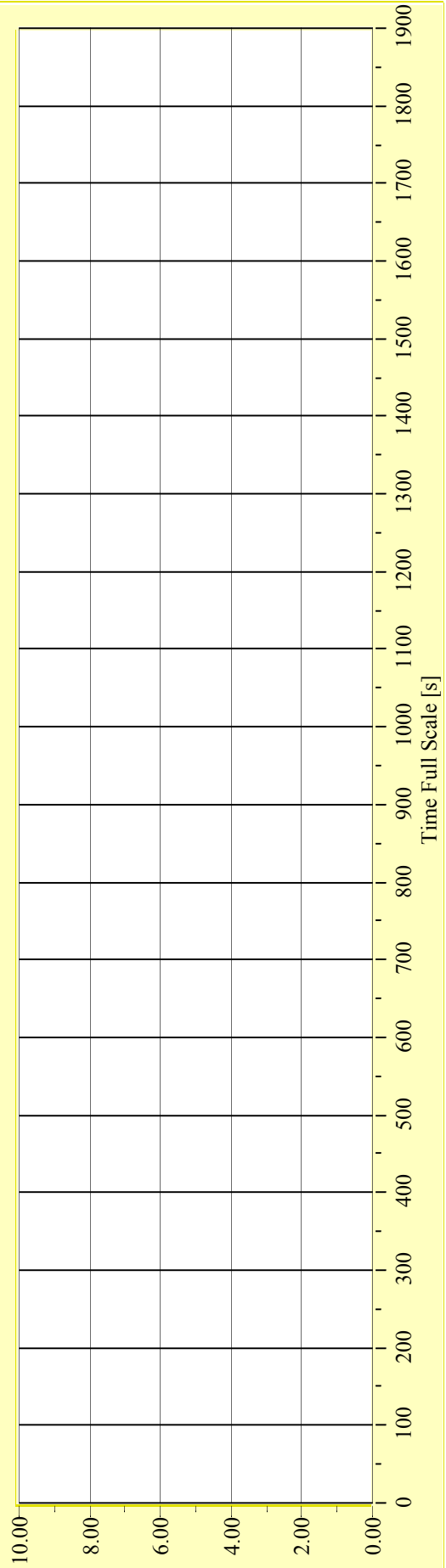
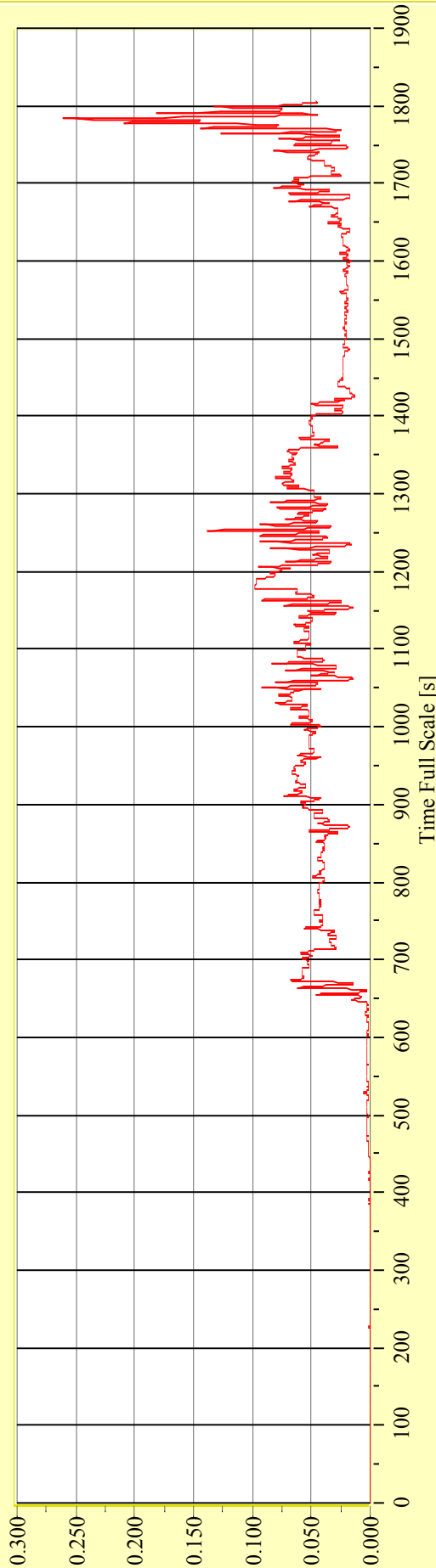
**Model No. 2446**

**Test No. 29690-09**

**Target Waves: Hs = 3,35 m Tp = 7,321 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Irregular Beam Seas**

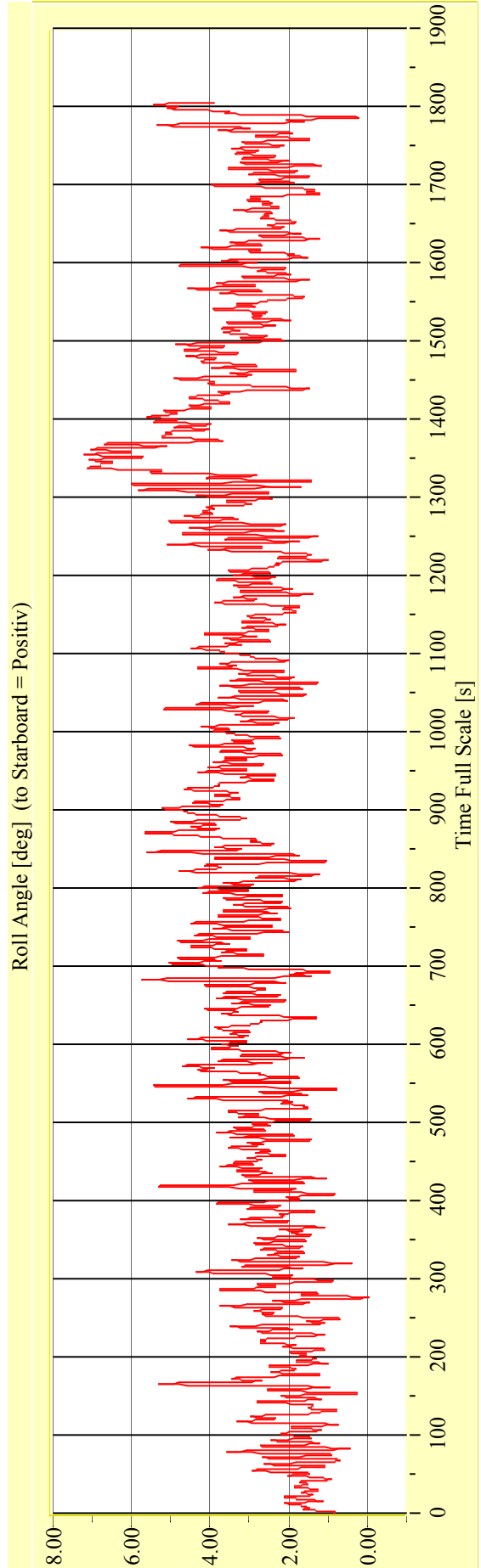
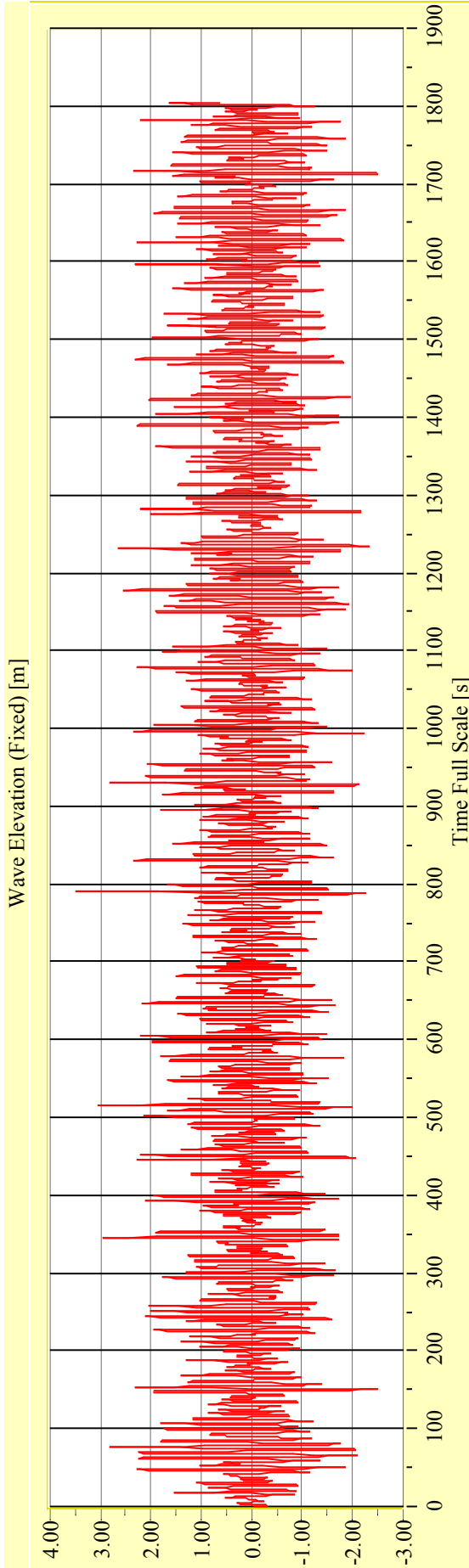
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29690-10**

**Target Waves: Hs = 3,35 m Tp = 7,321 s**

**gamma = 3,3**





**Irregular Beam Seas**

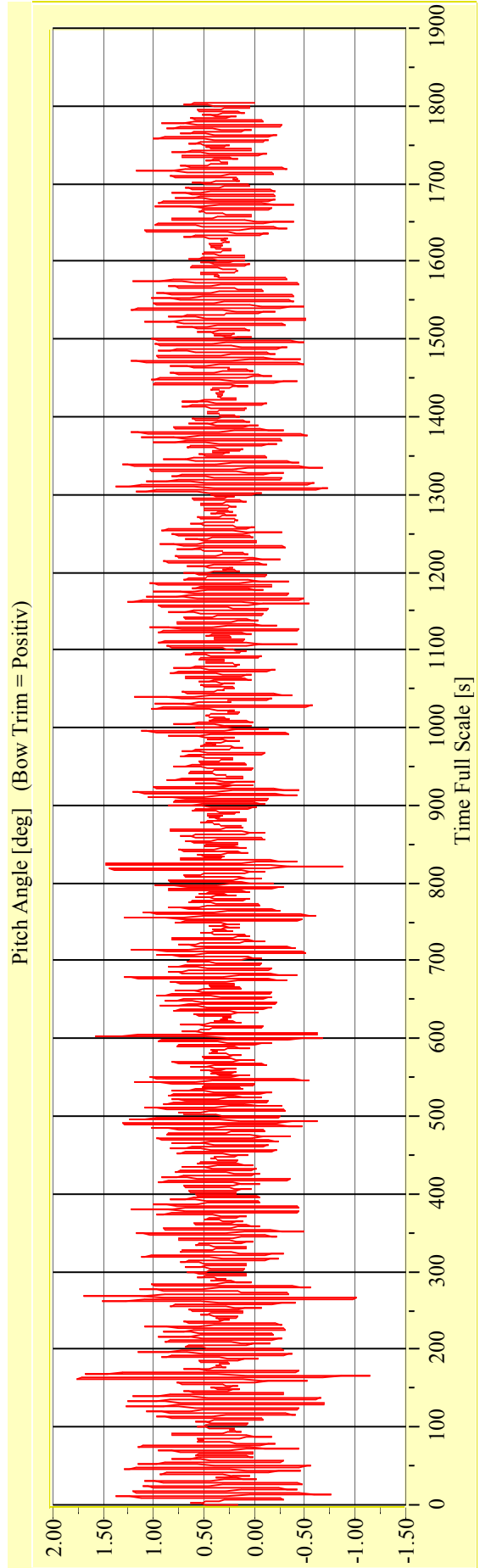
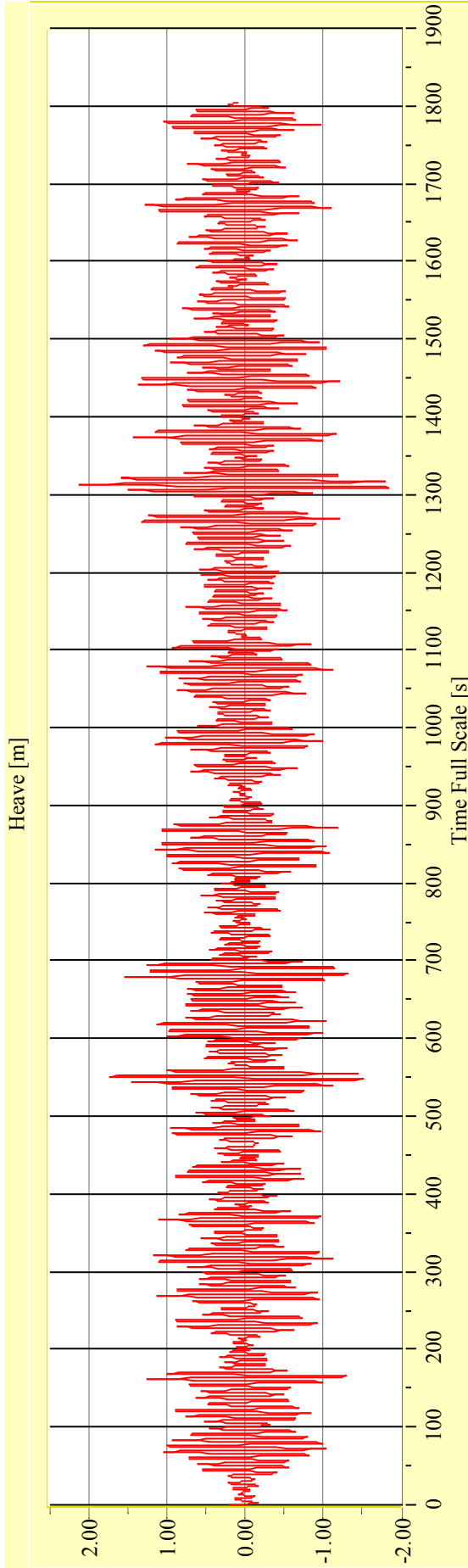
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29690-10**

**Target Waves: Hs = 3,35 m Tp = 7,321 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

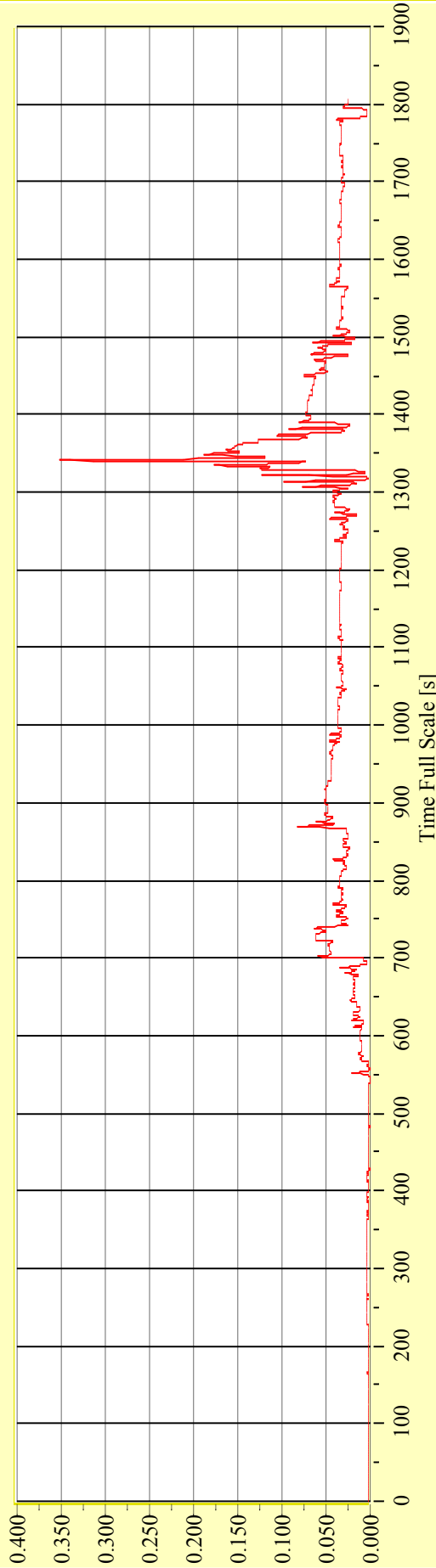
**Model No. 2446**

**Test No. 29690-10**

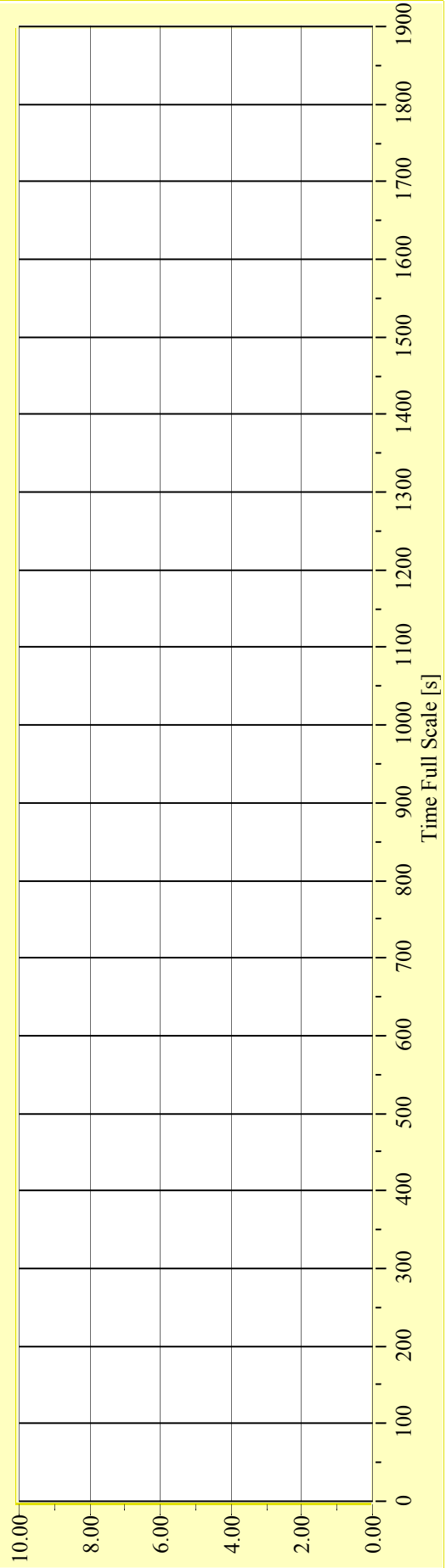
**Target Waves: Hs = 3,35 m Tp = 7,321 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



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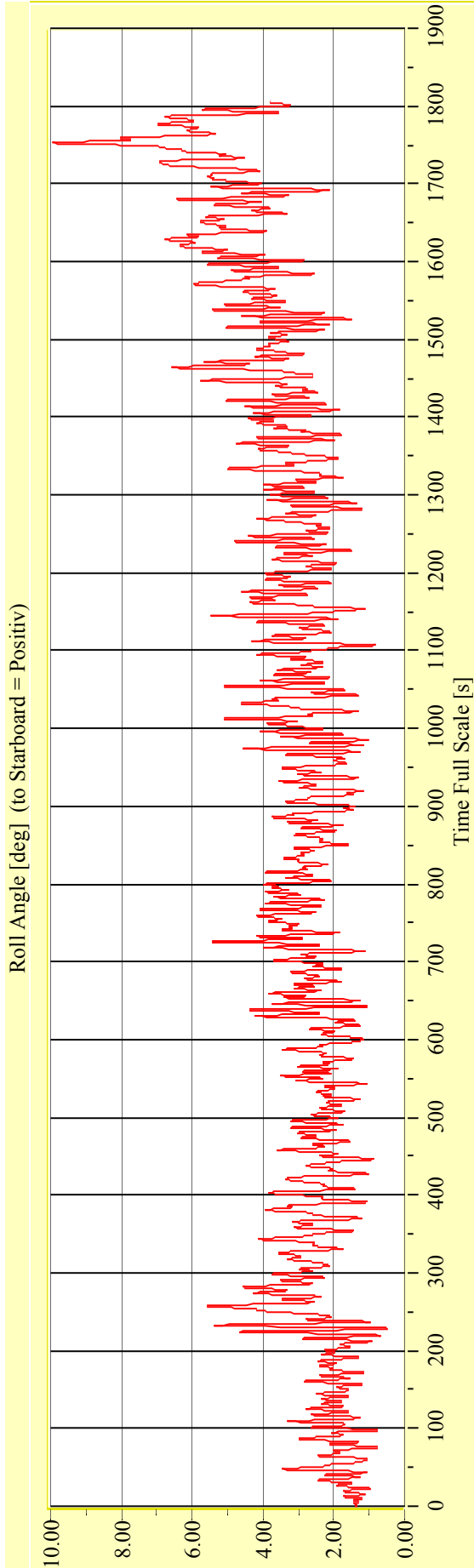
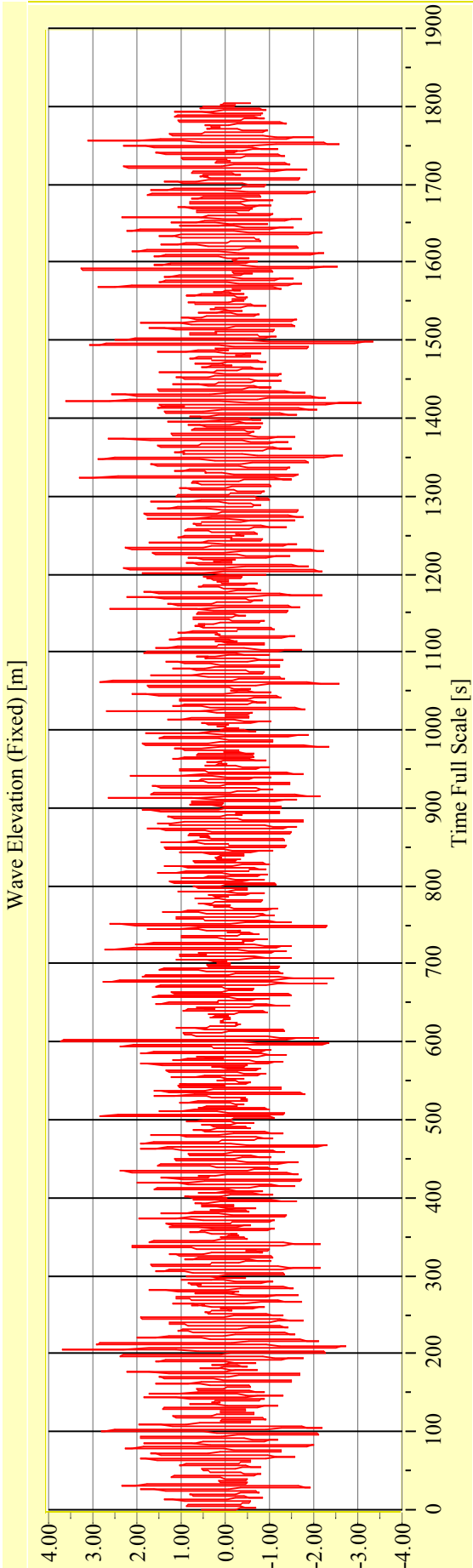
**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

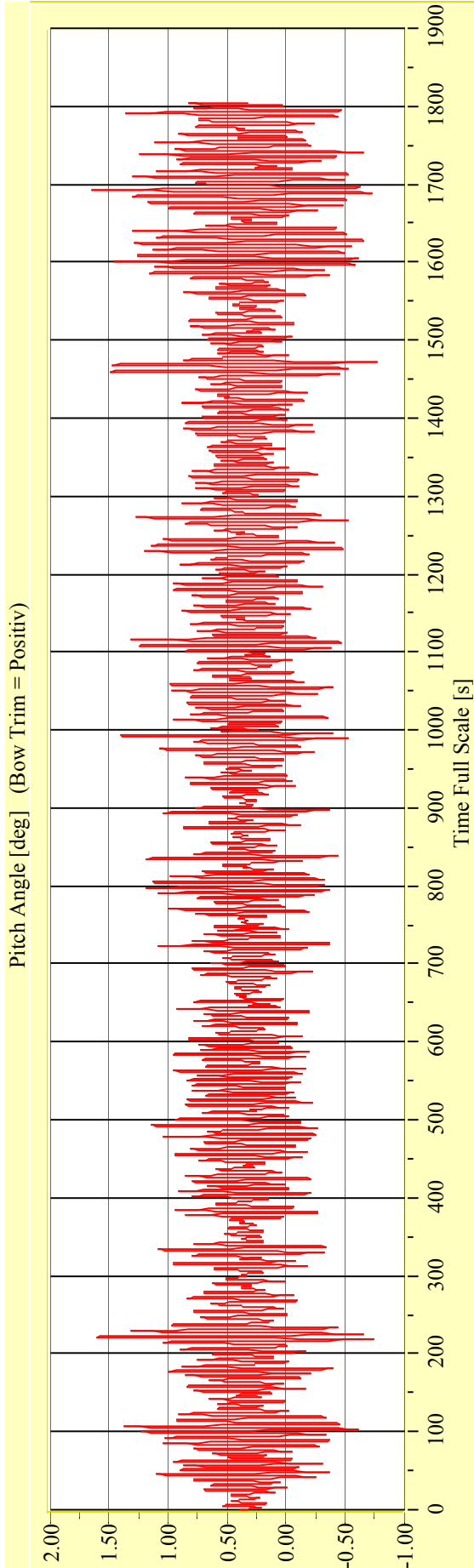
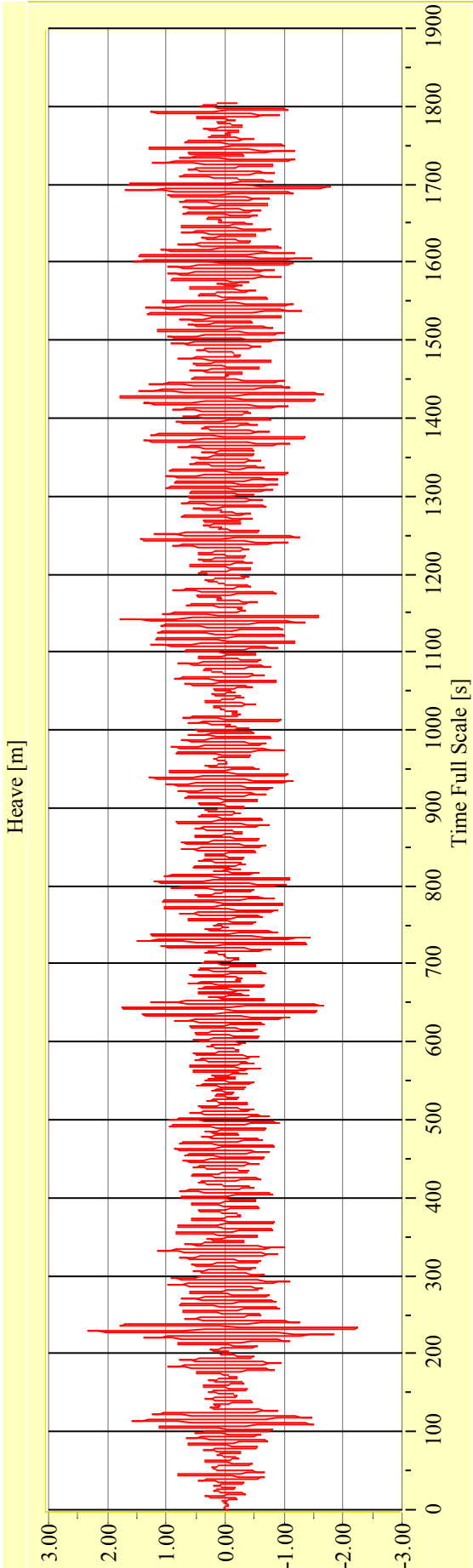
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29691-01**      **Target Waves: Hs = 3,9 m Tp = 7,899 s**      **gamma = 3,3**



**Date: 21.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

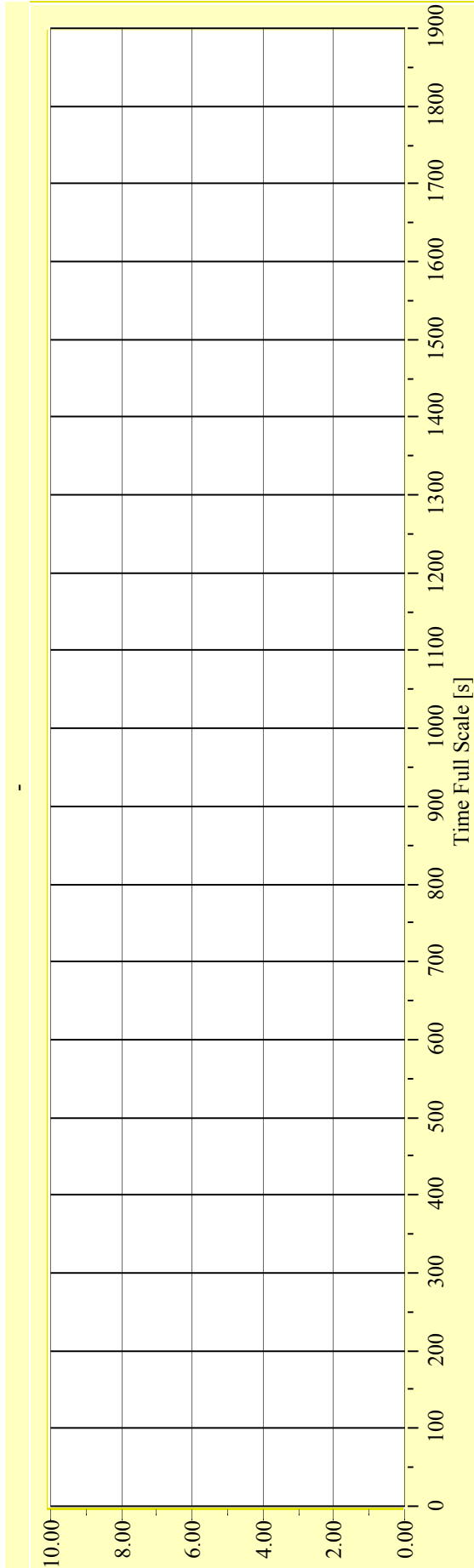
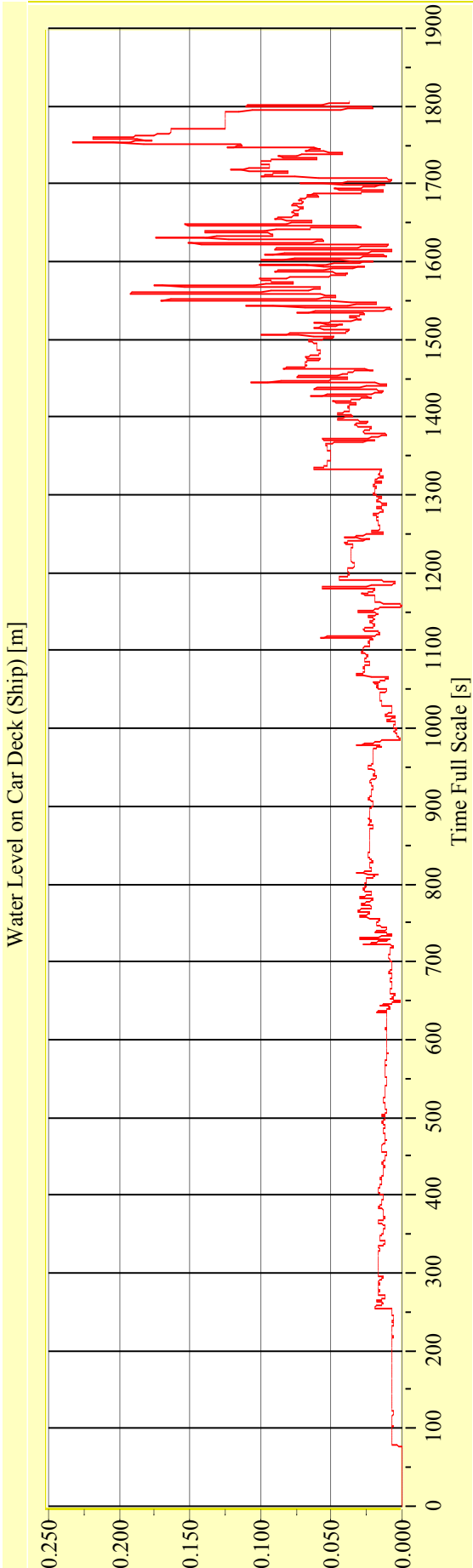
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29691-01**      **Target Waves: Hs = 3,9 m Tp = 7,899 s**      **gamma = 3,3**



**Date: 21.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29691-01**      **Target Waves: Hs = 3,9 m Tp = 7,899 s**      **gamma = 3,3**



**Date: 21.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

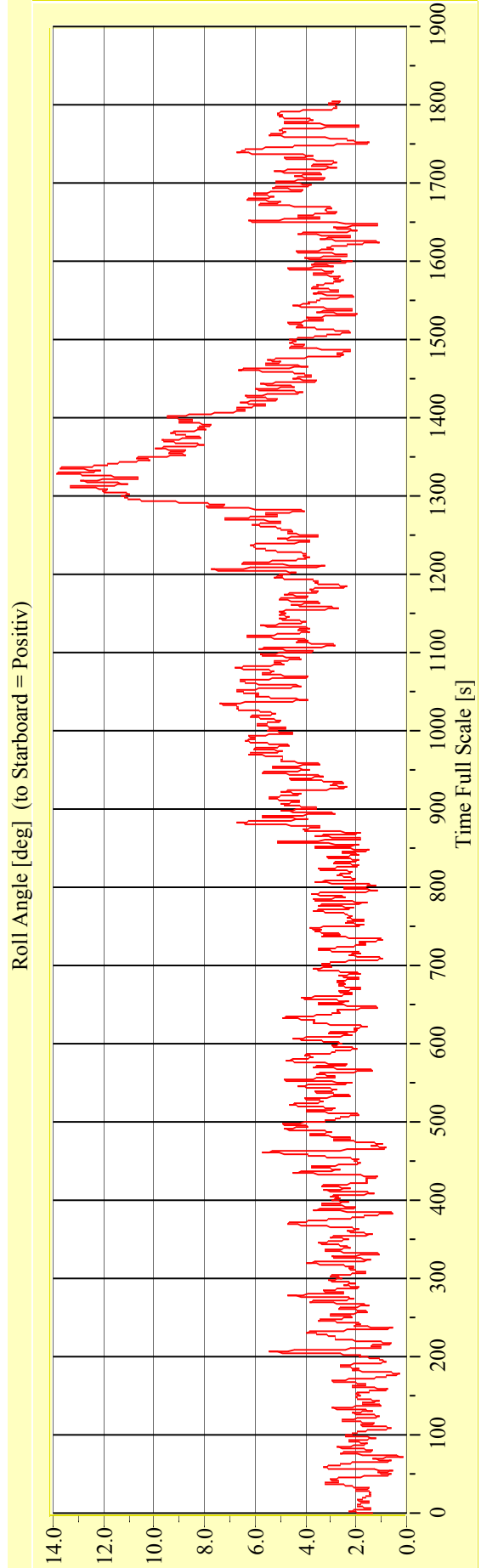
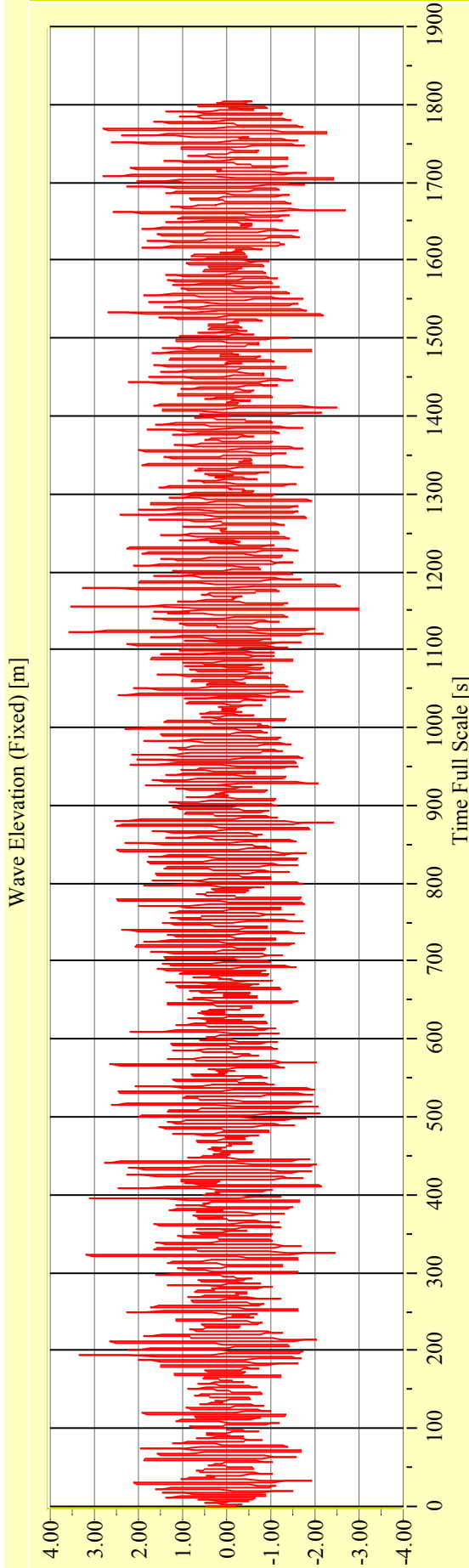
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29691-02**

**Target Waves: Hs = 3,9 m Tp = 7,899 s**

**gamma = 3,3**



**Irregular Beam Seas**

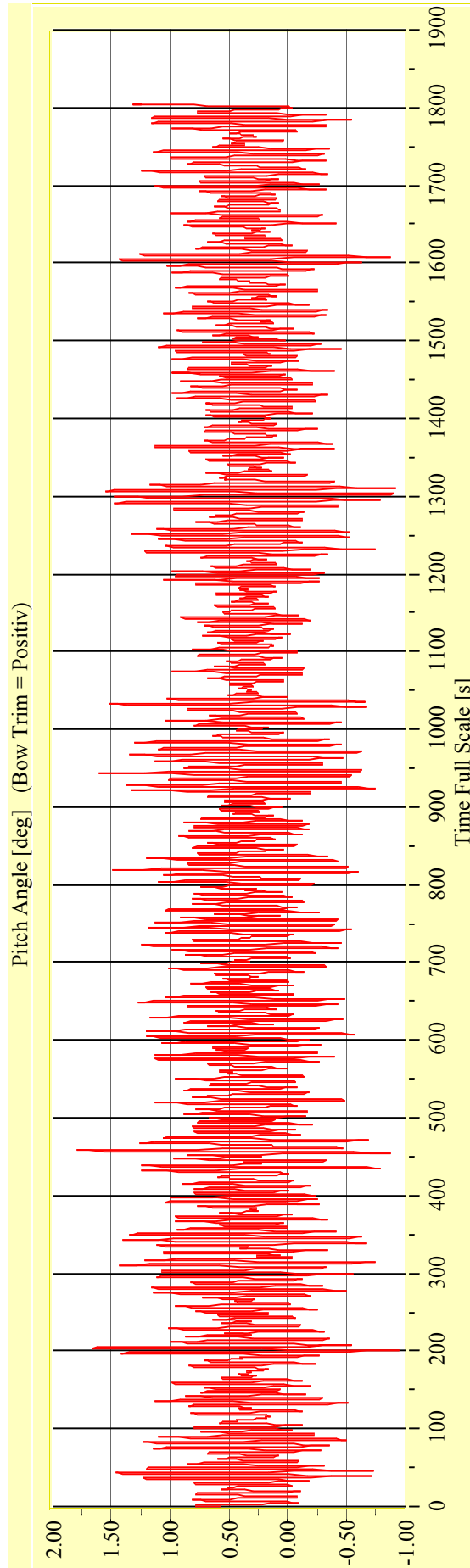
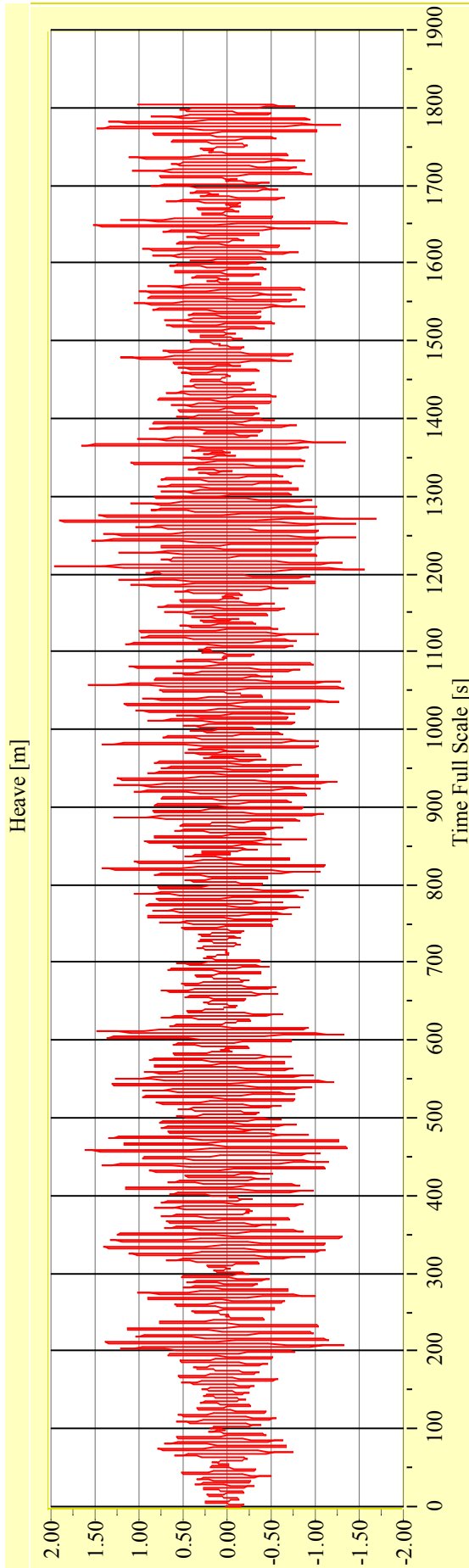
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29691-02**

**Target Waves: Hs = 3,9 m Tp = 7,899 s**

**gamma = 3,3**



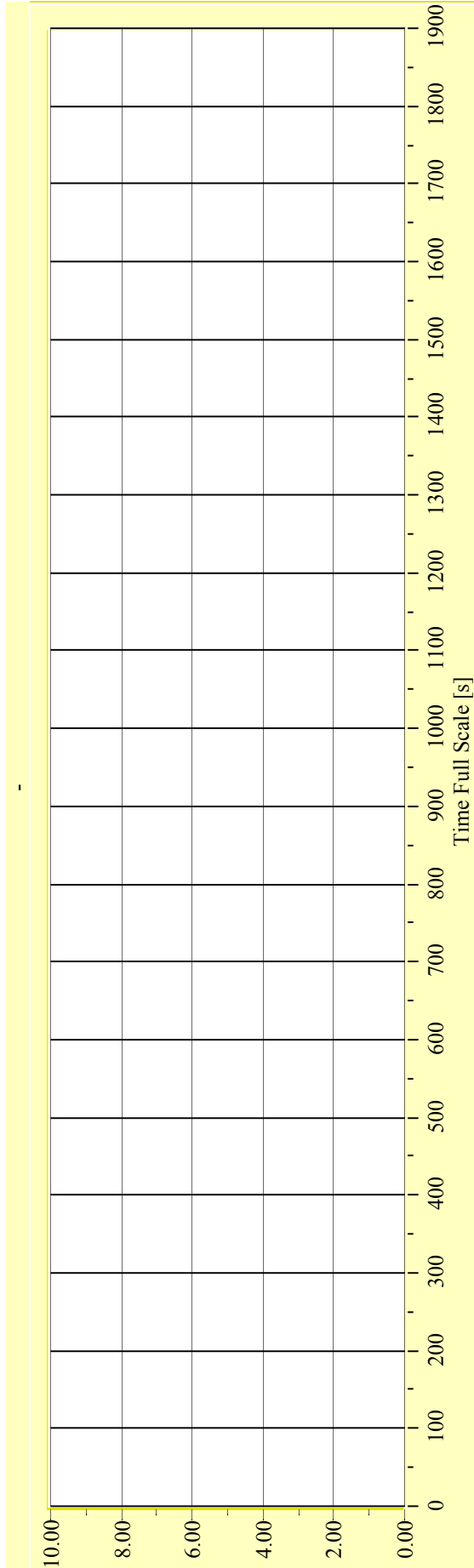
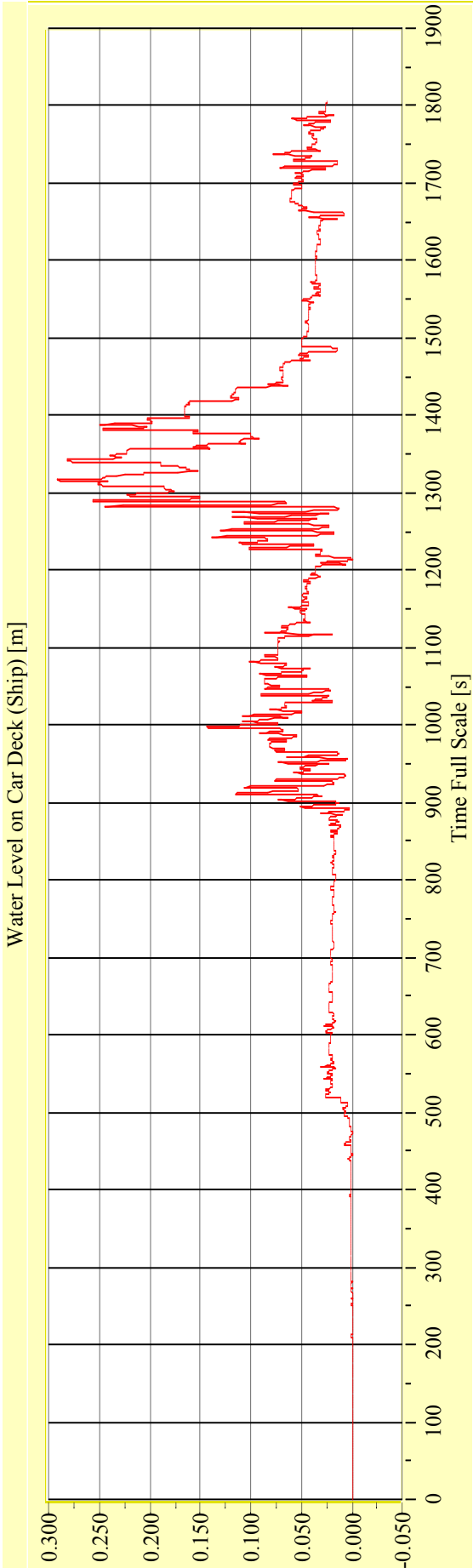
**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29691-02**      **Target Waves: Hs = 3,9 m Tp = 7,899 s**      **gamma = 3,3**



**Date: 21.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**



**Irregular Beam Seas**

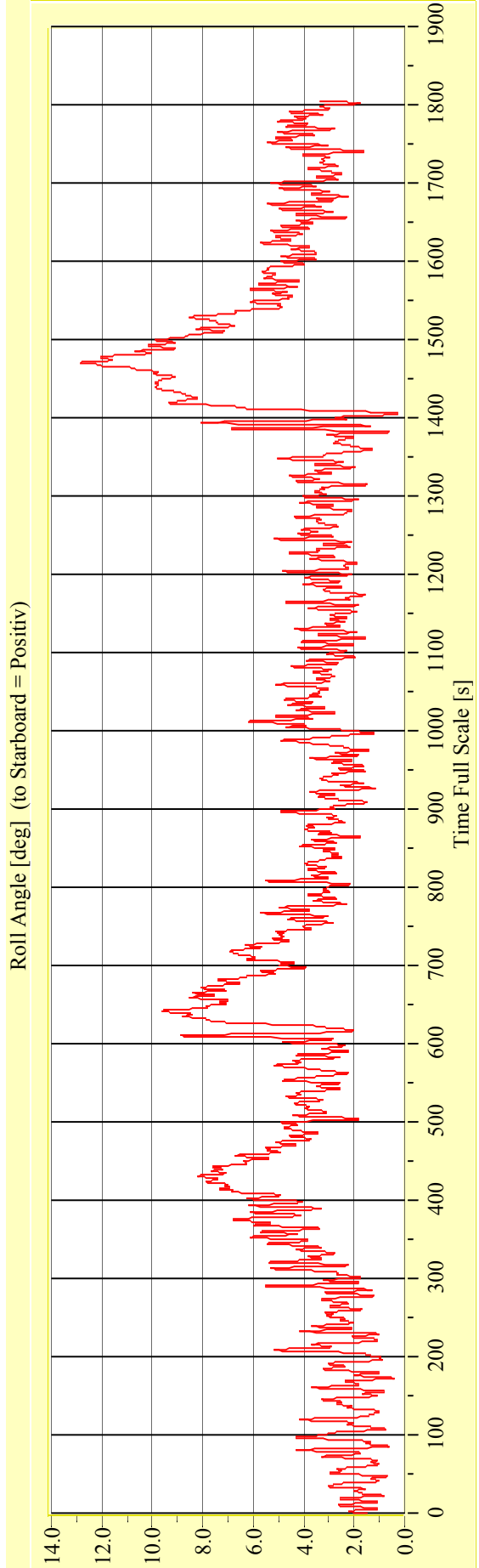
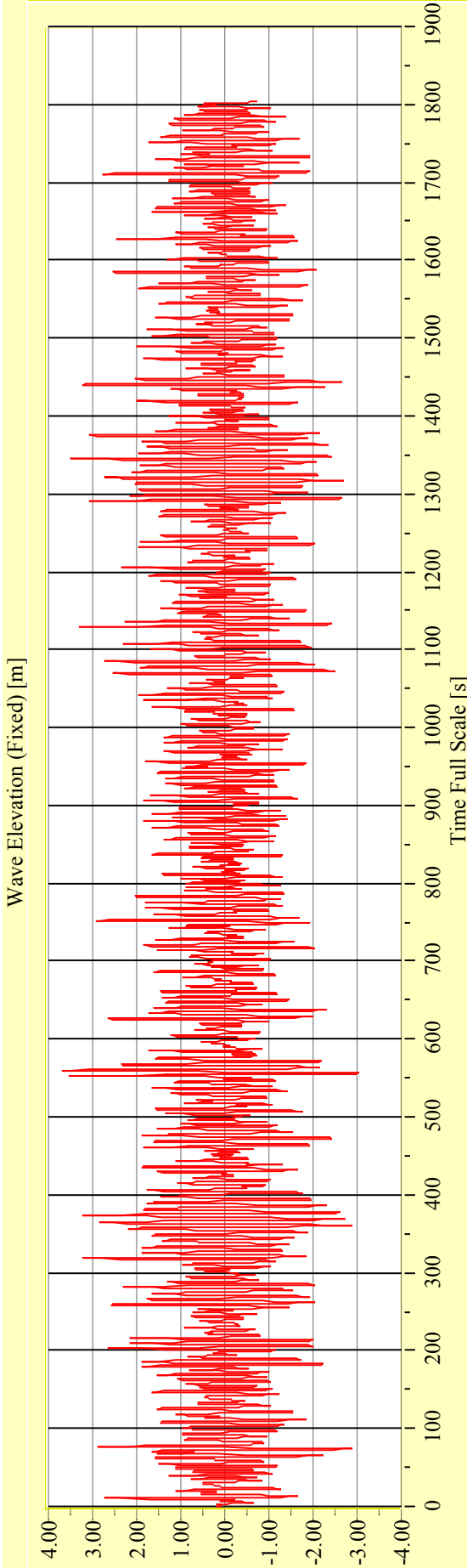
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29691-03**

**Target Waves: Hs = 3,9 m Tp = 7,899 s**

**gamma = 3,3**



**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

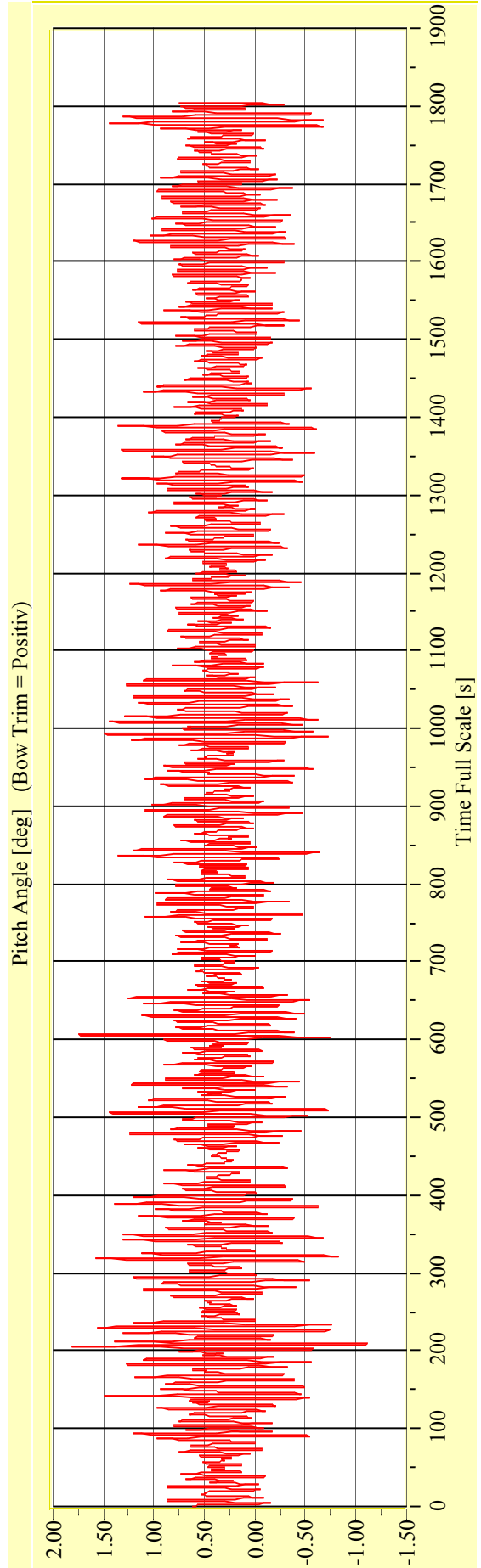
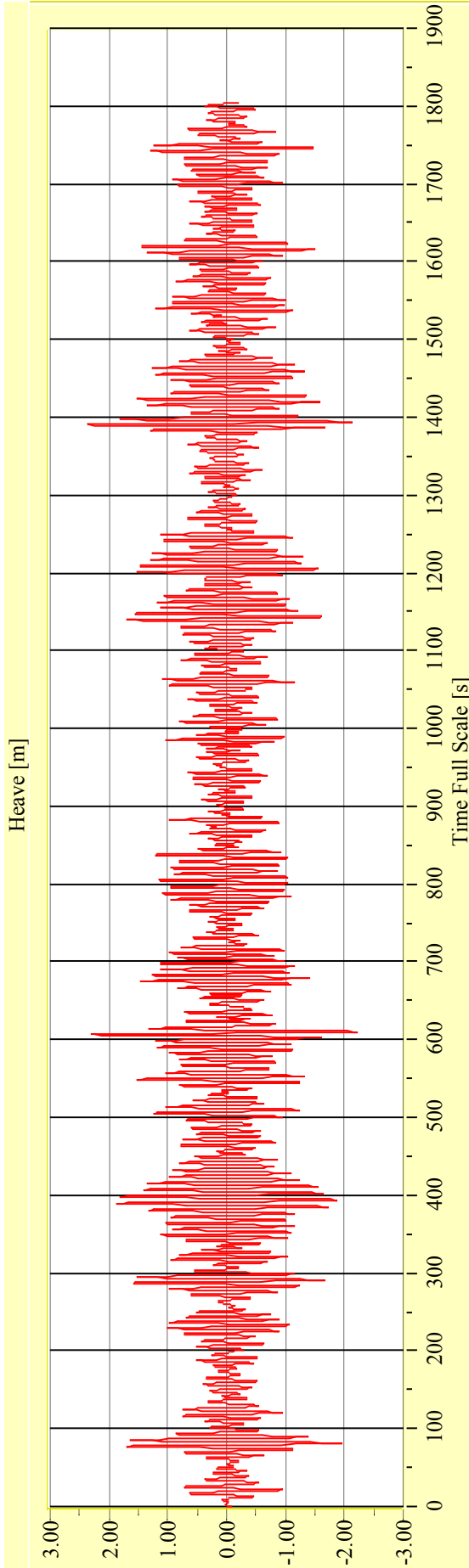
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29691-03**

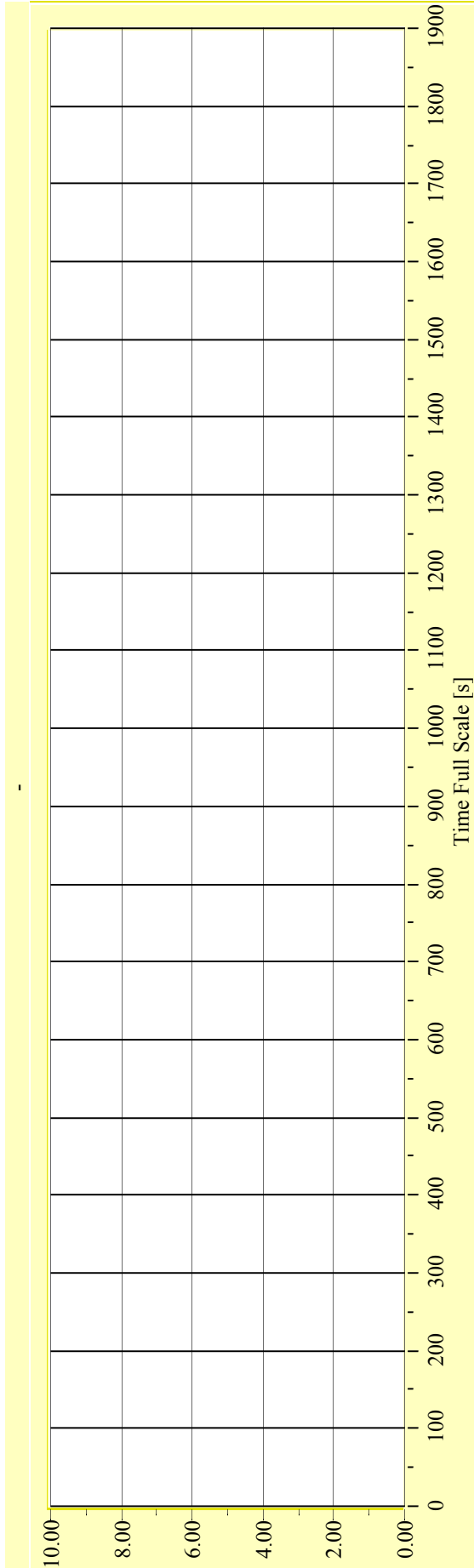
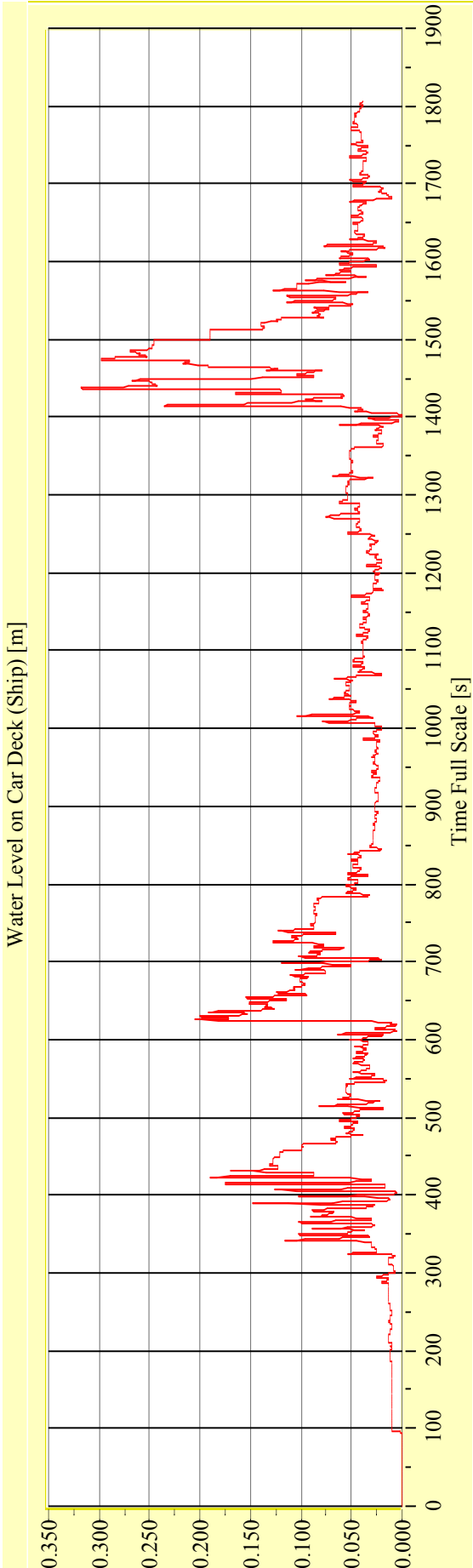
**Target Waves: Hs = 3,9 m Tp = 7,899 s**

**gamma = 3,3**



**Irregular Beam Seas**

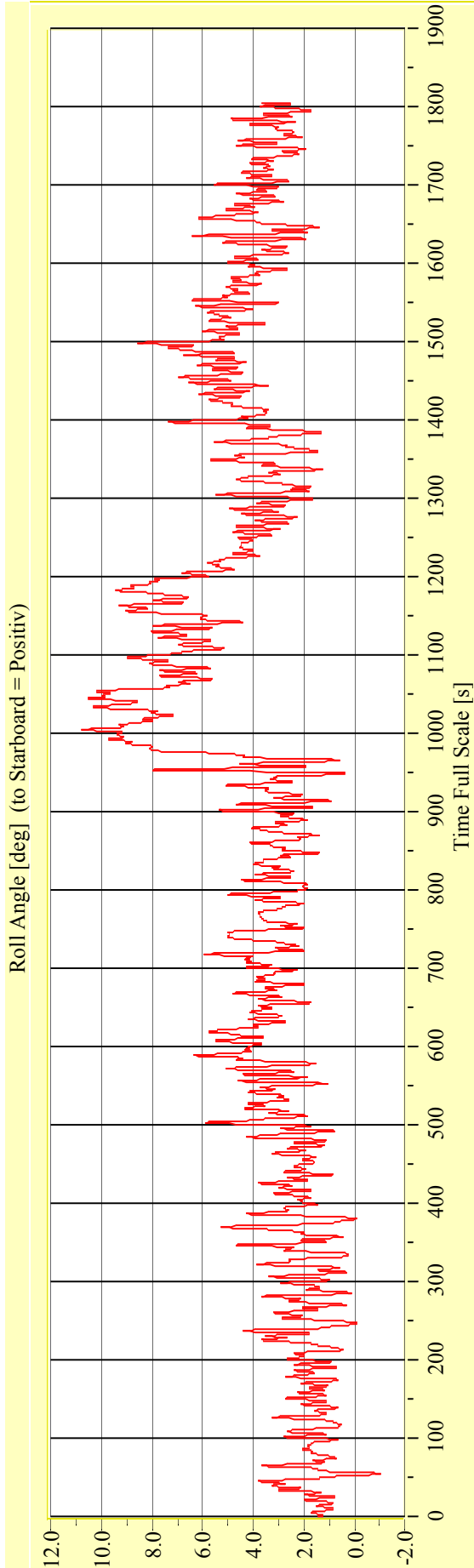
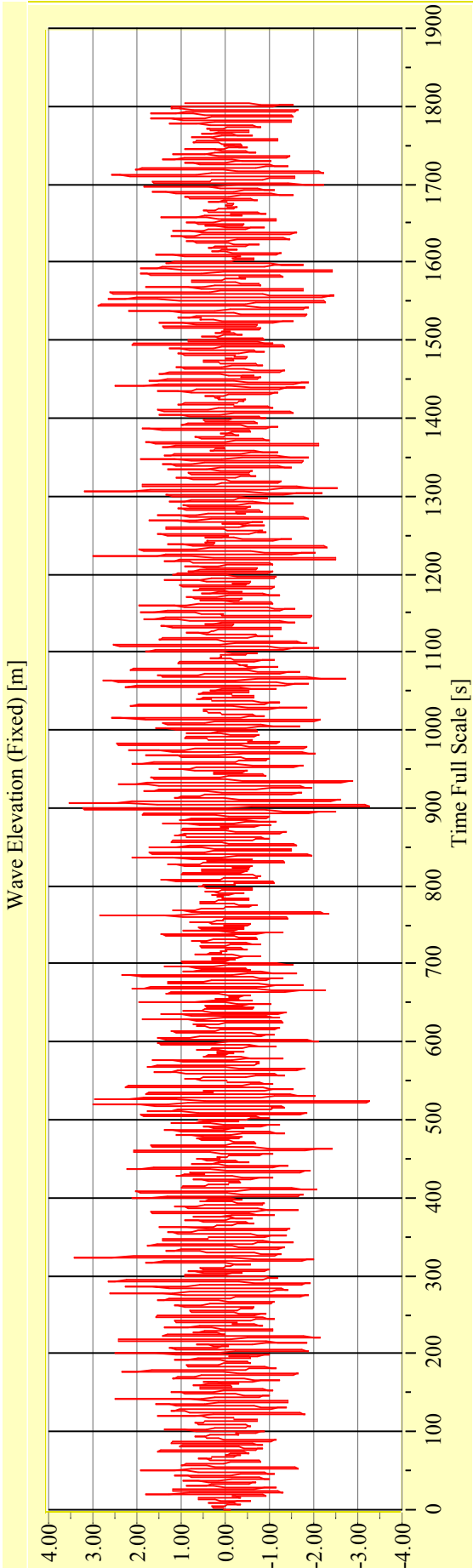
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29691-03**      **Target Waves: Hs = 3,9 m Tp = 7,899 s**      **gamma = 3,3**



**Date: 21.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29691-04**      **Target Waves: Hs = 3,9 m Tp = 7,899 s**      **gamma = 3,3**



**Date: 21.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

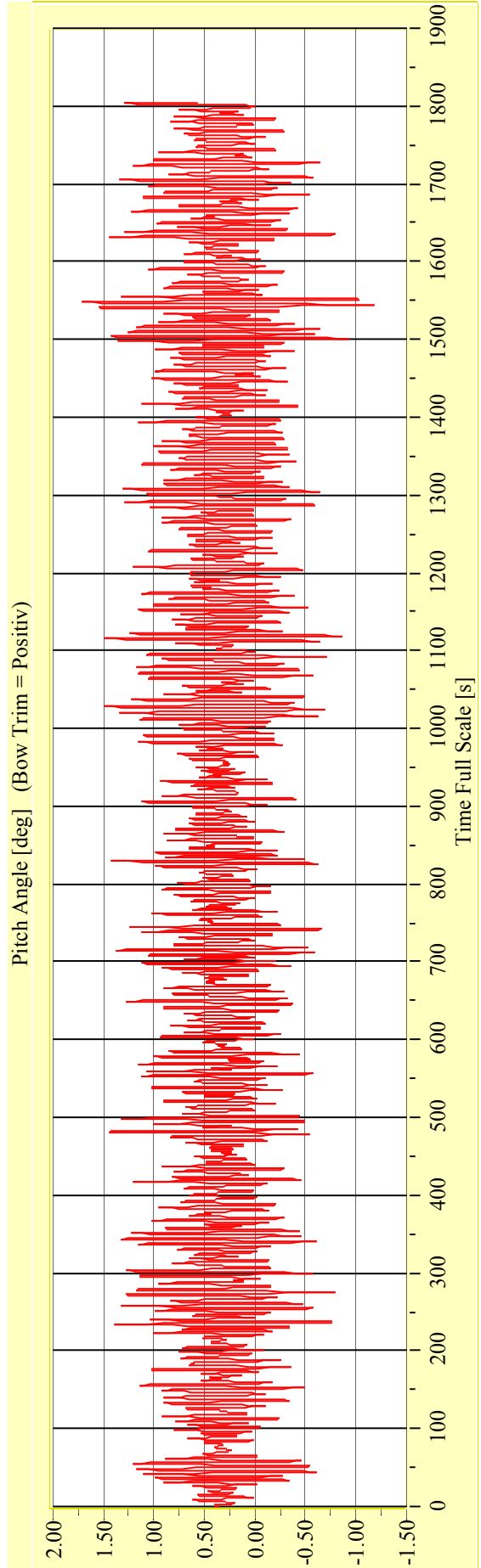
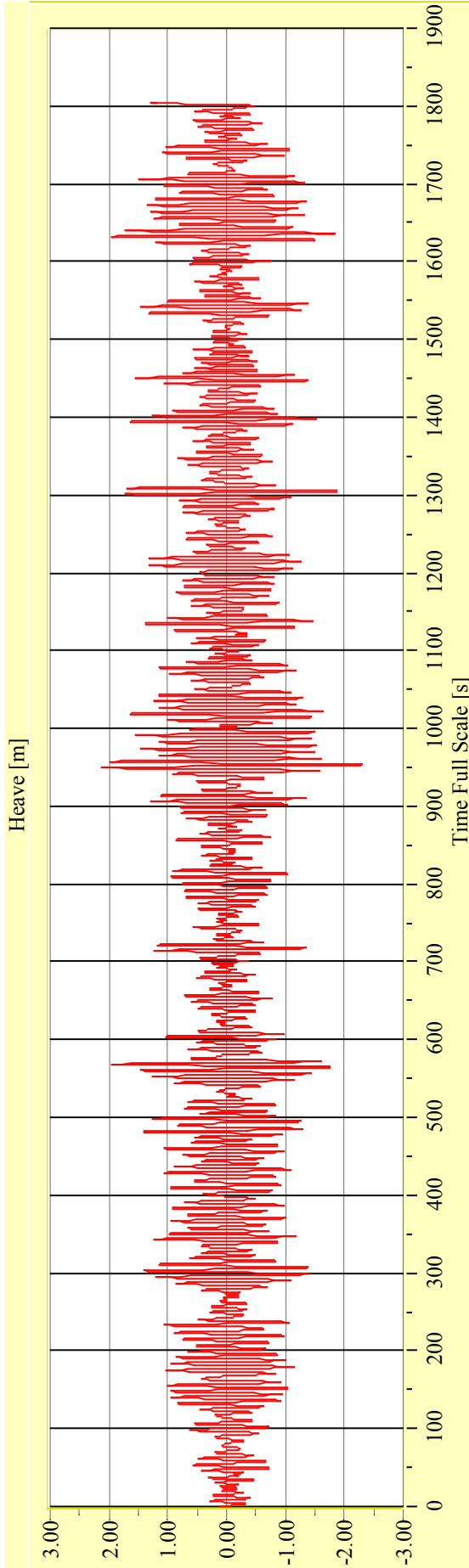
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29691-04**

**Target Waves: Hs = 3,9 m Tp = 7,899 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

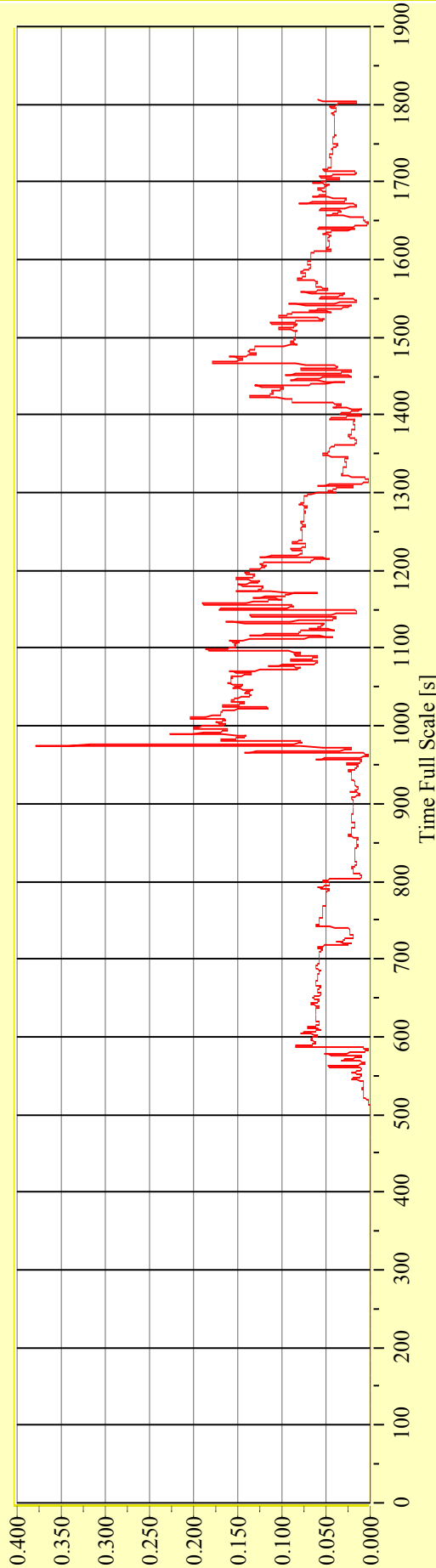
**Model No. 2446**

**Test No. 29691-04**

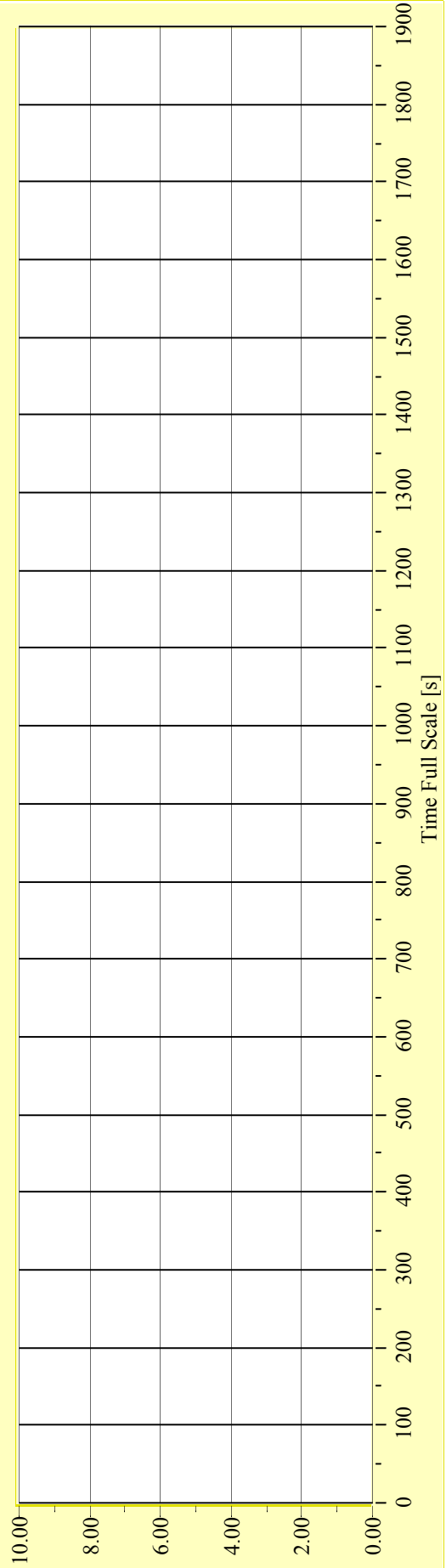
**Target Waves: Hs = 3,9 m Tp = 7,899 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



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**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

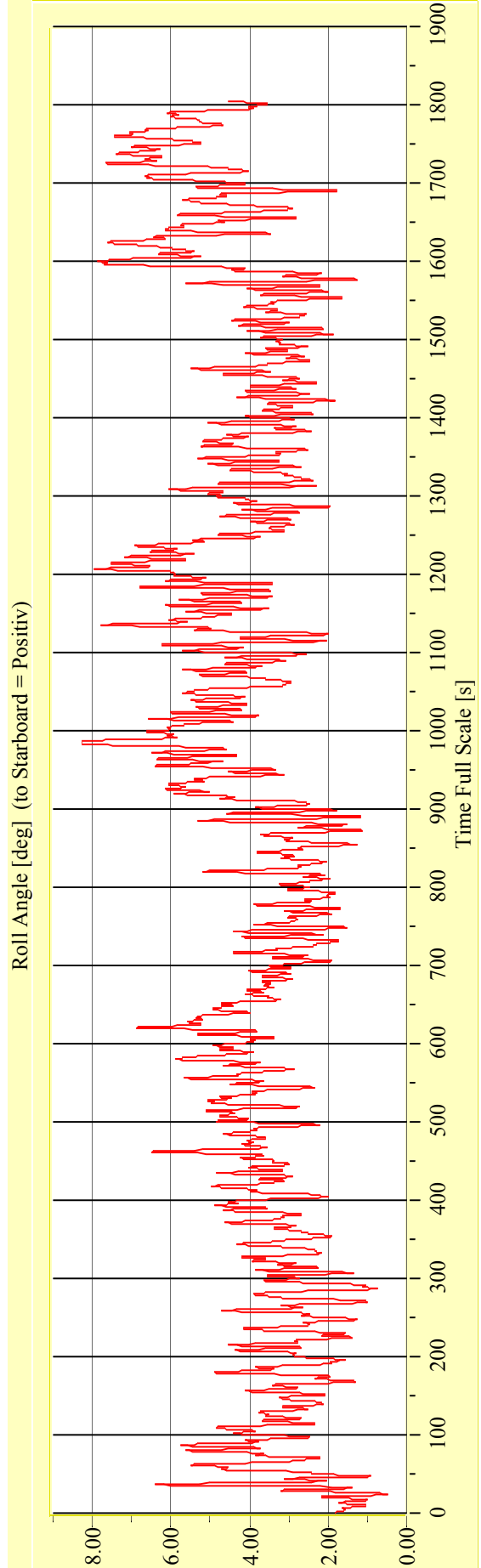
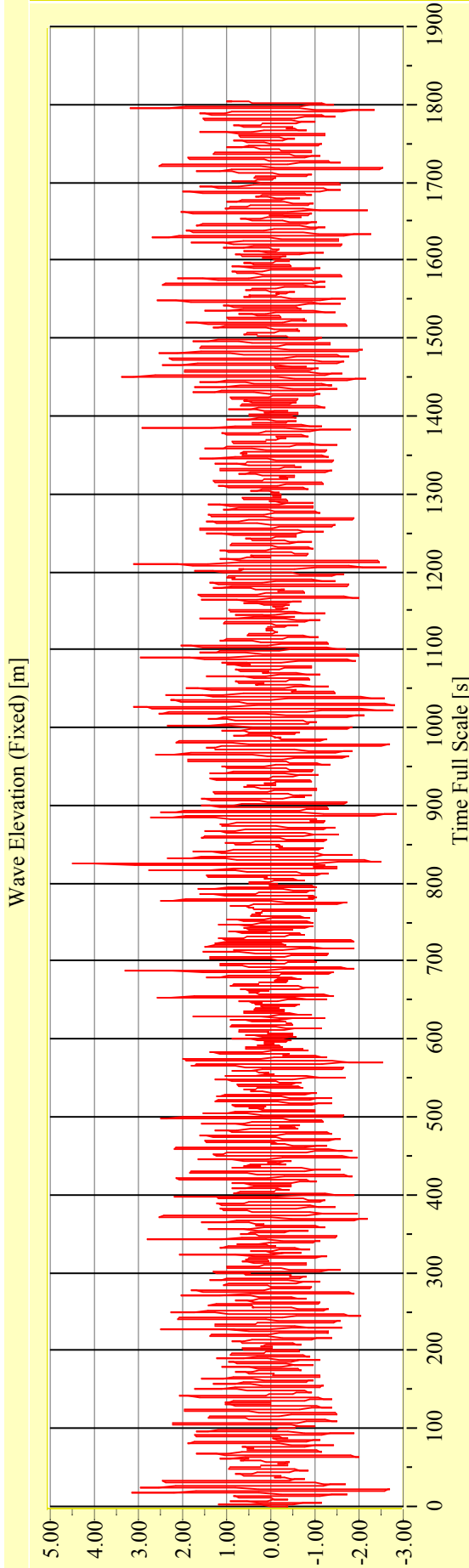
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29691-05**

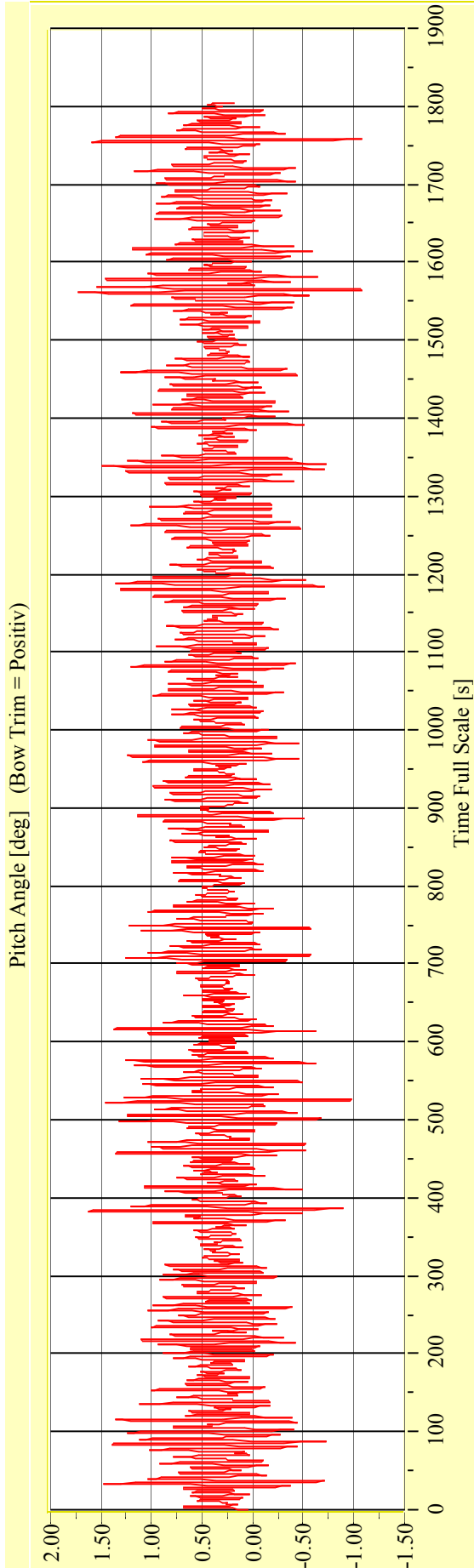
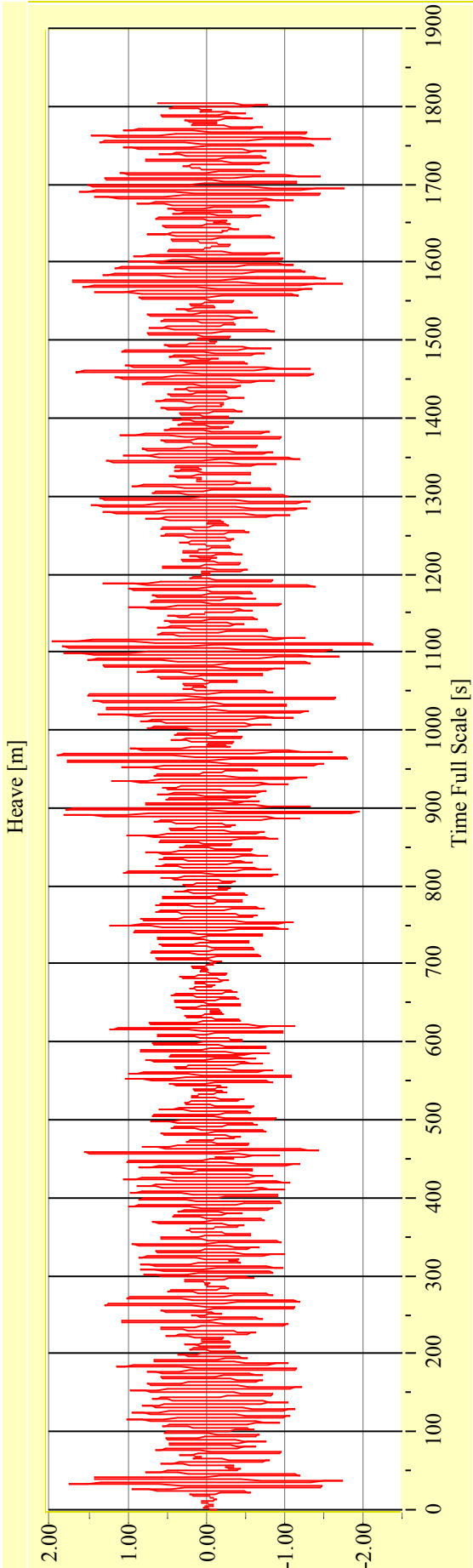
**Target Waves: Hs = 3,9 m Tp = 7,899 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29691-05**      **Target Waves: Hs = 3,9 m   Tp = 7,899 s**      **gamma = 3,3**

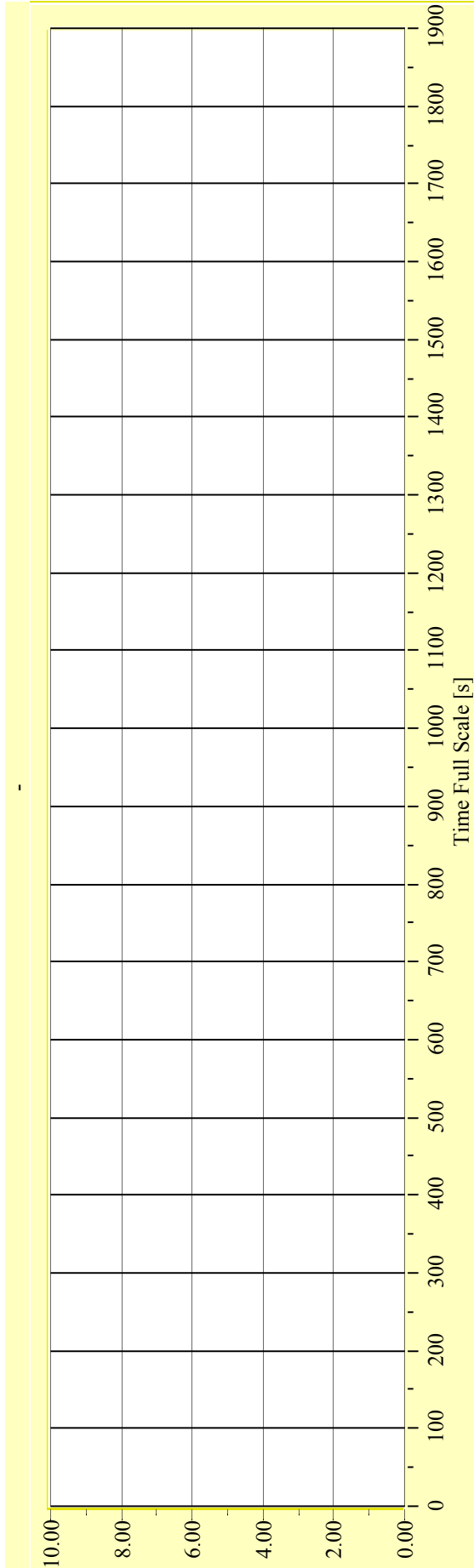
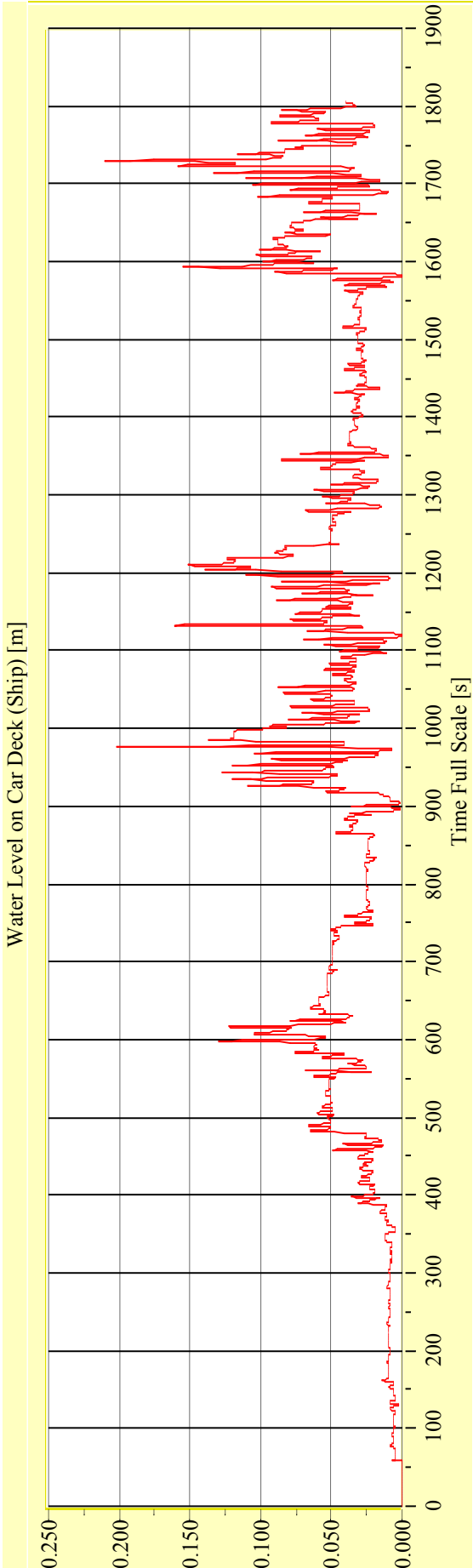


**Date: 21.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**



**Irregular Beam Seas**

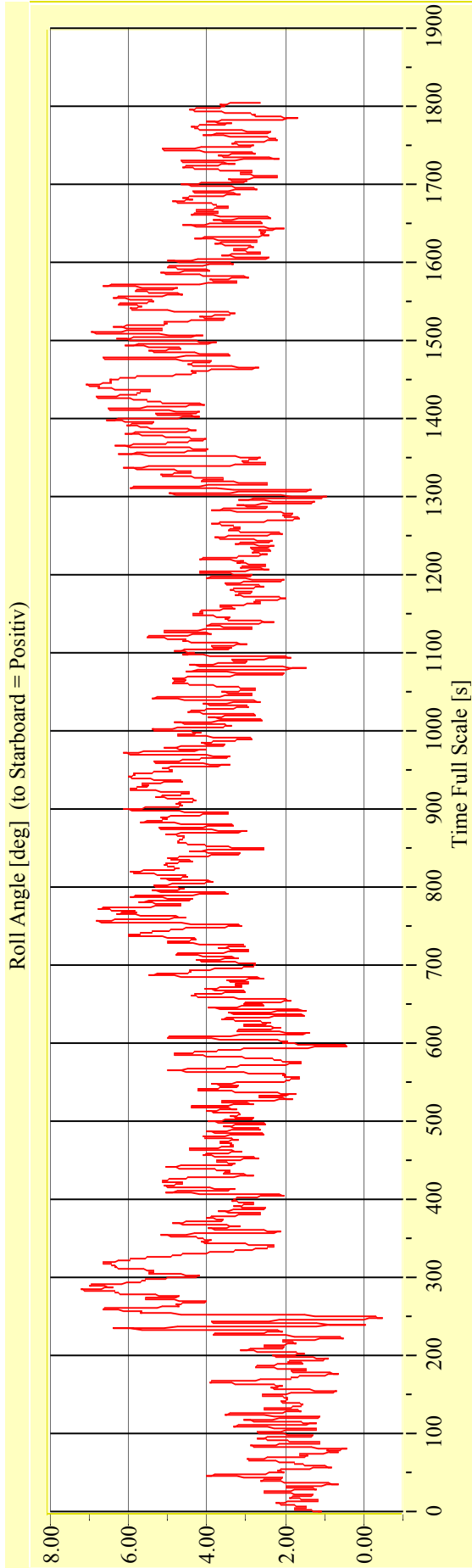
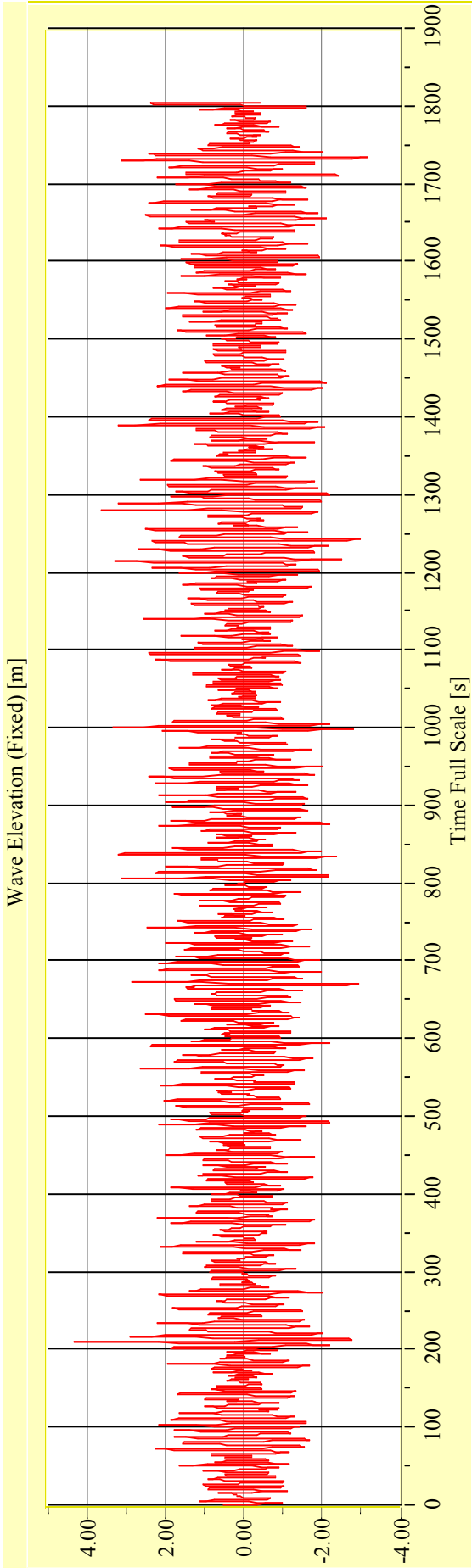
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29691-05**      **Target Waves: Hs = 3,9 m Tp = 7,899 s**      **gamma = 3,3**



**Date: 21.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

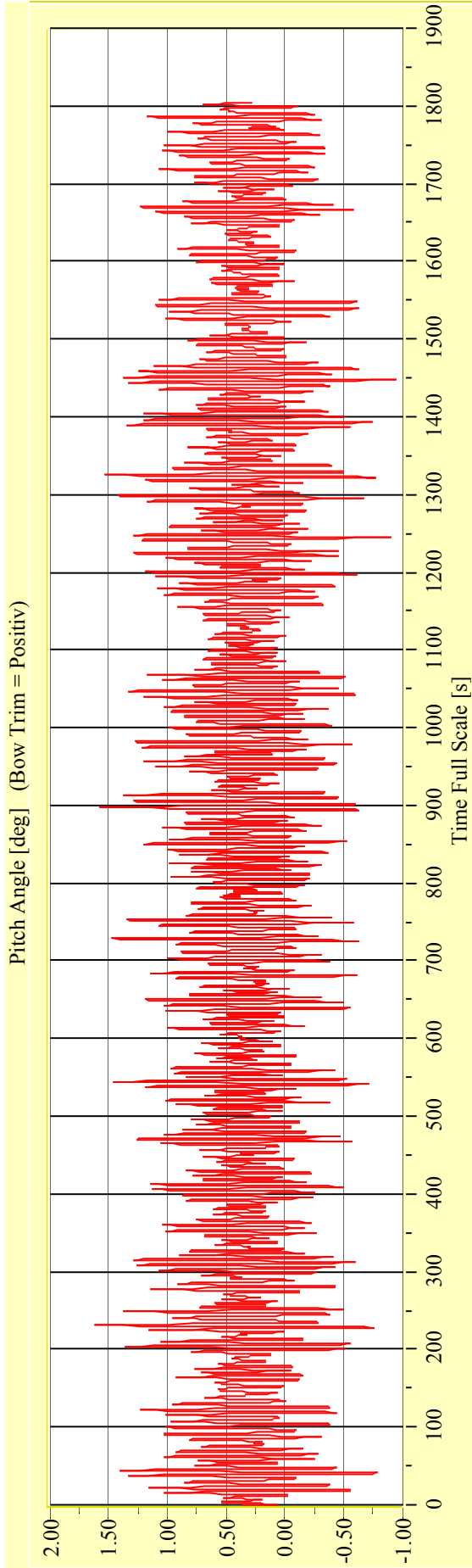
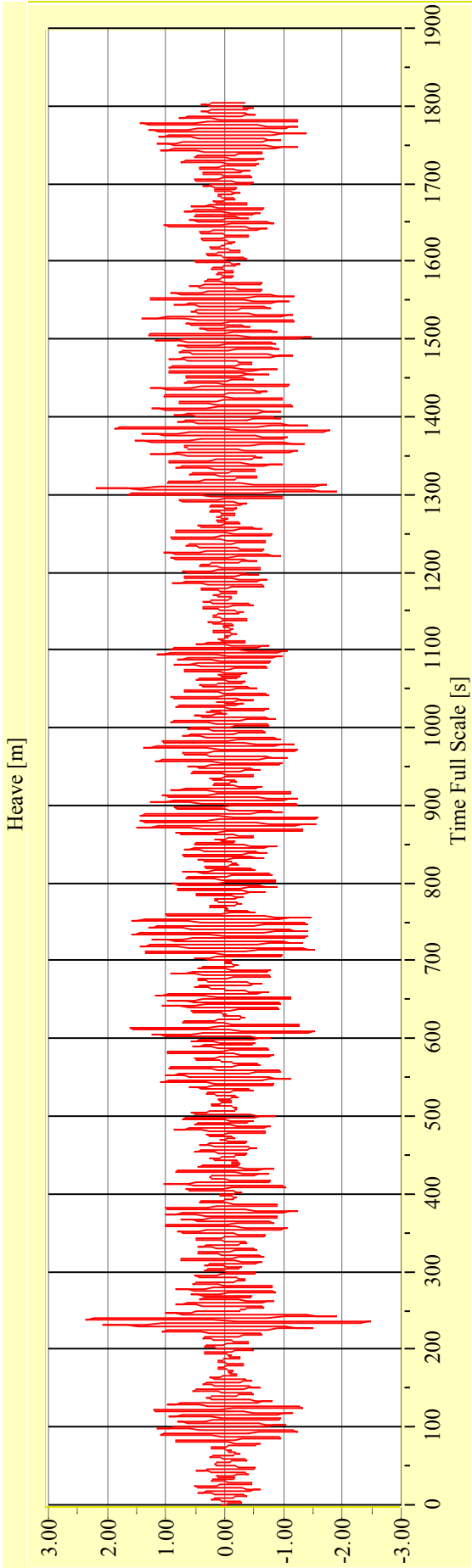
**Vienna Model Basin**      **Model No. 2446**      **Test No. 29691-06**      **Target Waves: Hs = 3,90 m Tp = 7,899 s**      **gamma = 3,3**



**Date: 21.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29691-06**      **Target Waves: Hs = 3,90 m Tp = 7,899 s**      **gamma = 3,3**



**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**

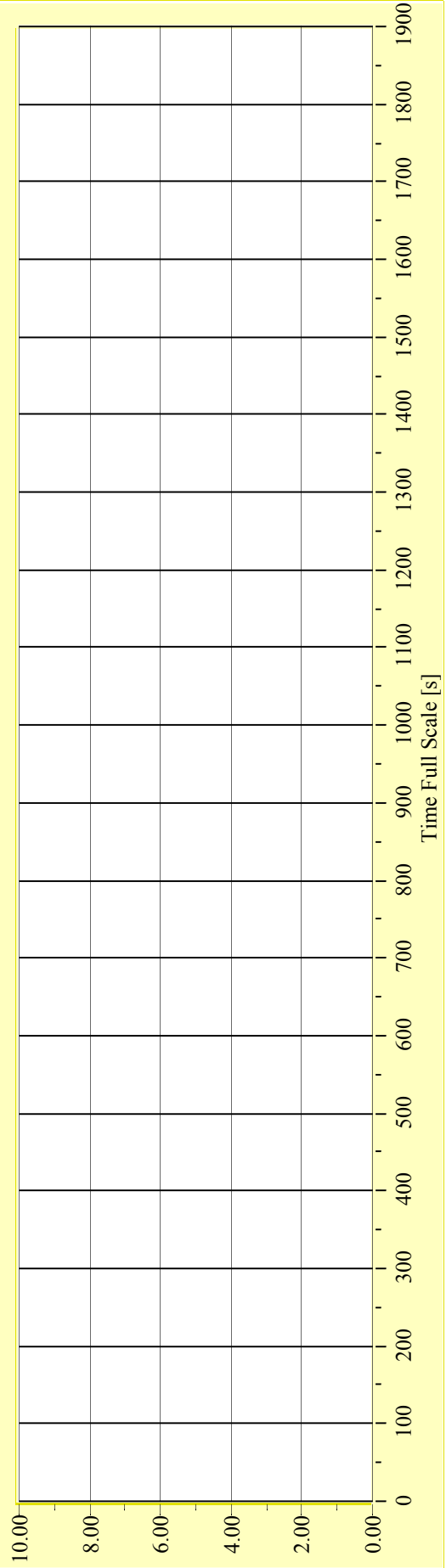
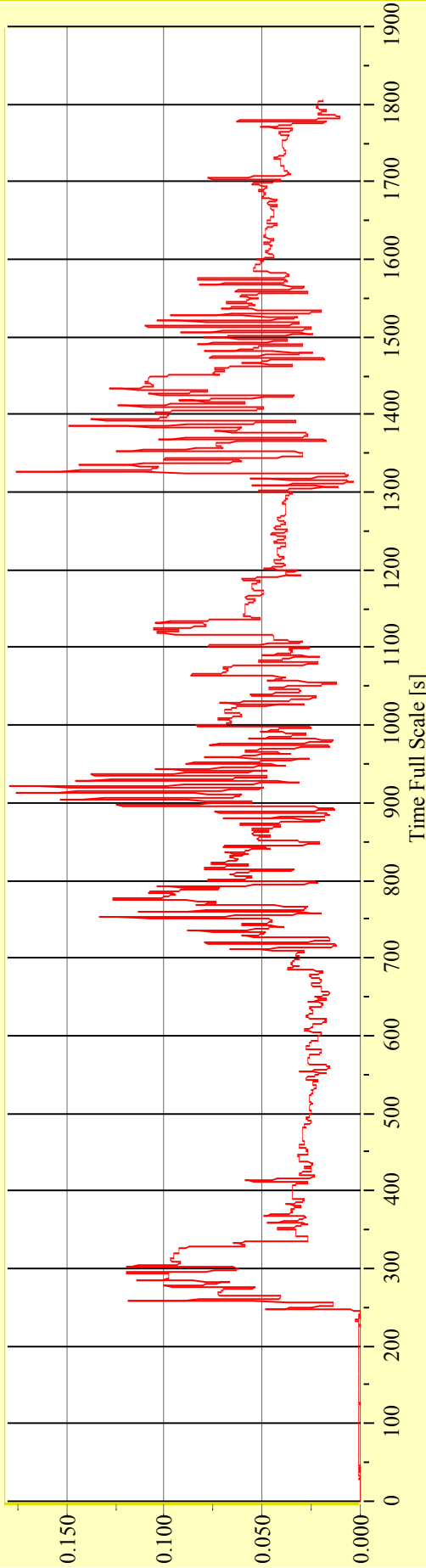
**Model No. 2446**

**Test No. 29691-06**

**Target Waves: Hs = 3,90 m Tp = 7,899 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

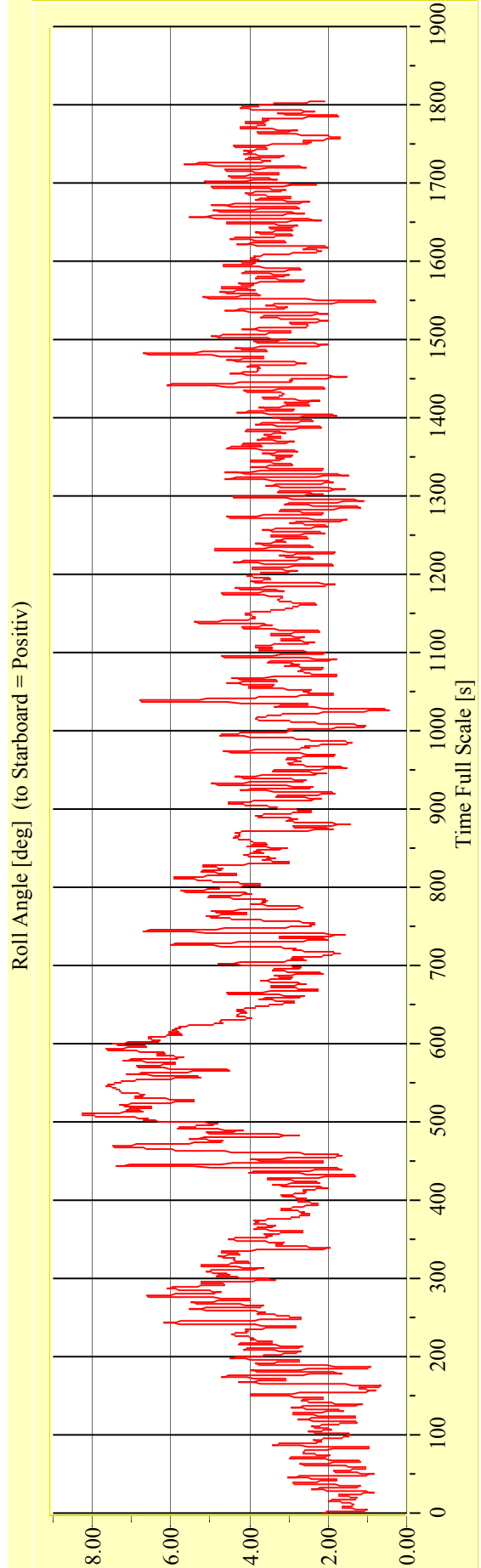
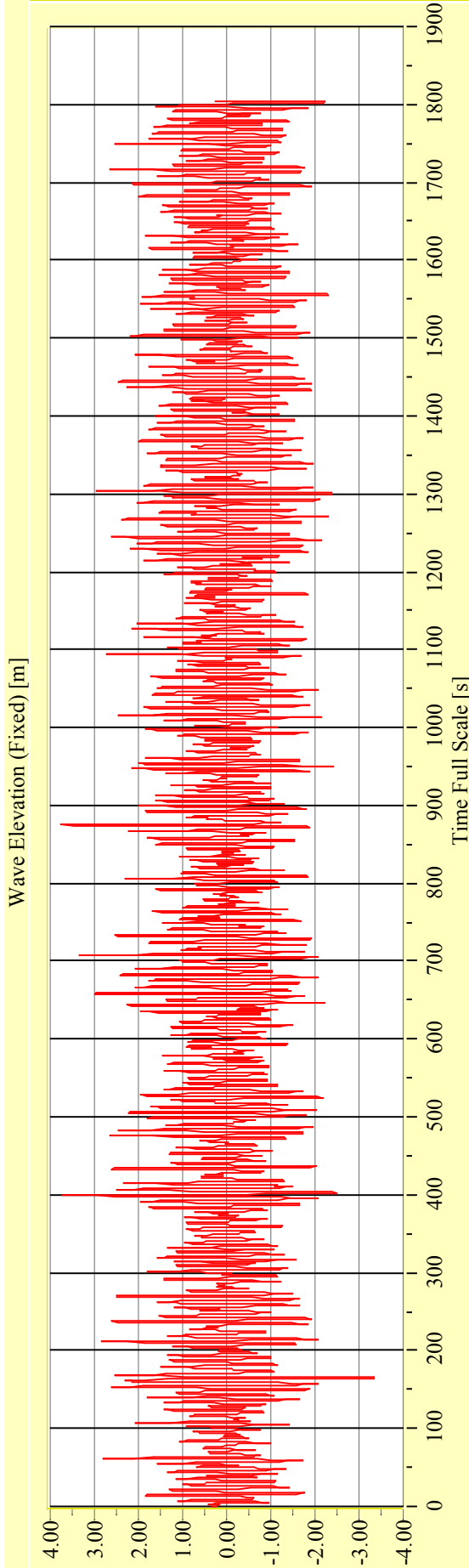
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29691-07**

**Target Waves: Hs = 3,90 m Tp = 7,899 s**

**gamma = 3,3**



**Irregular Beam Seas**

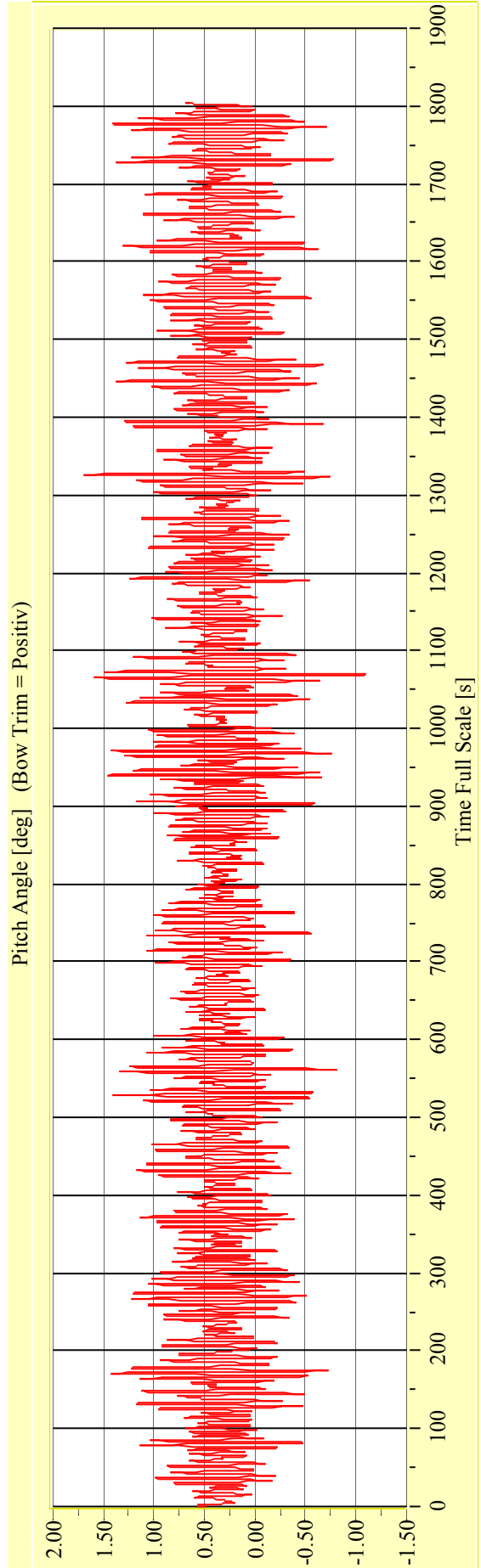
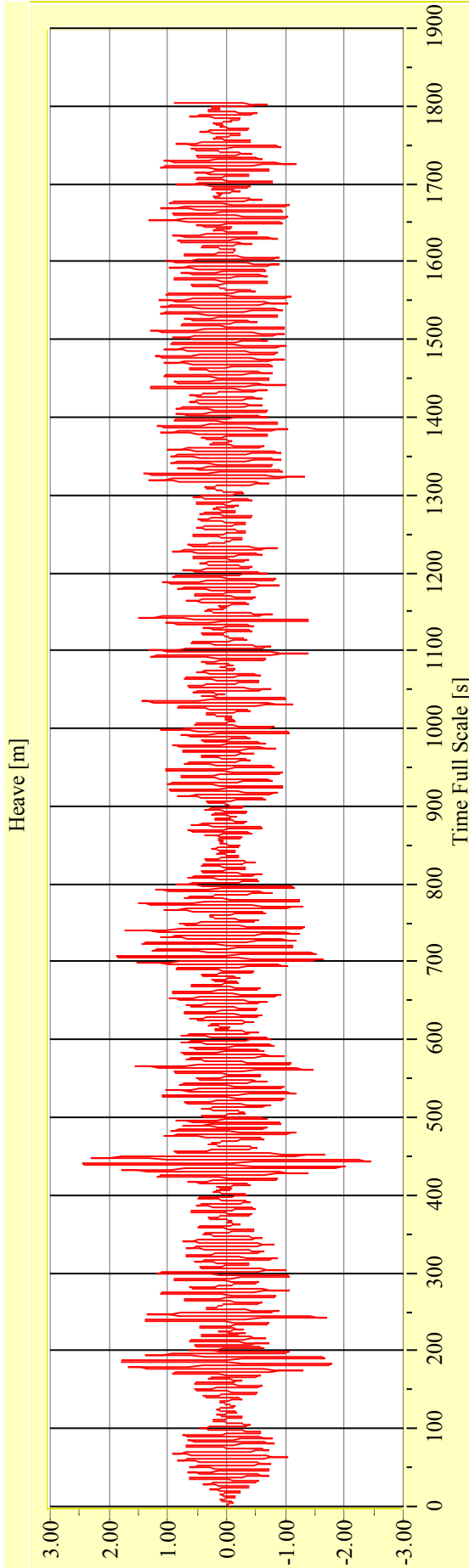
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29691-07**

**Target Waves: Hs = 3,90 m Tp = 7,899 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

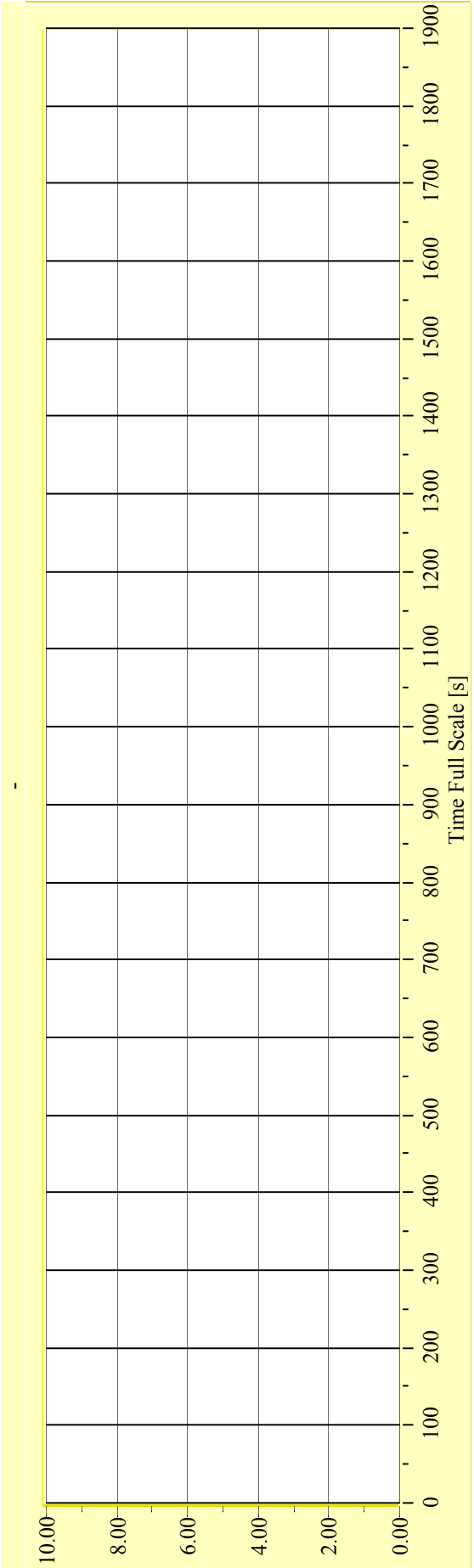
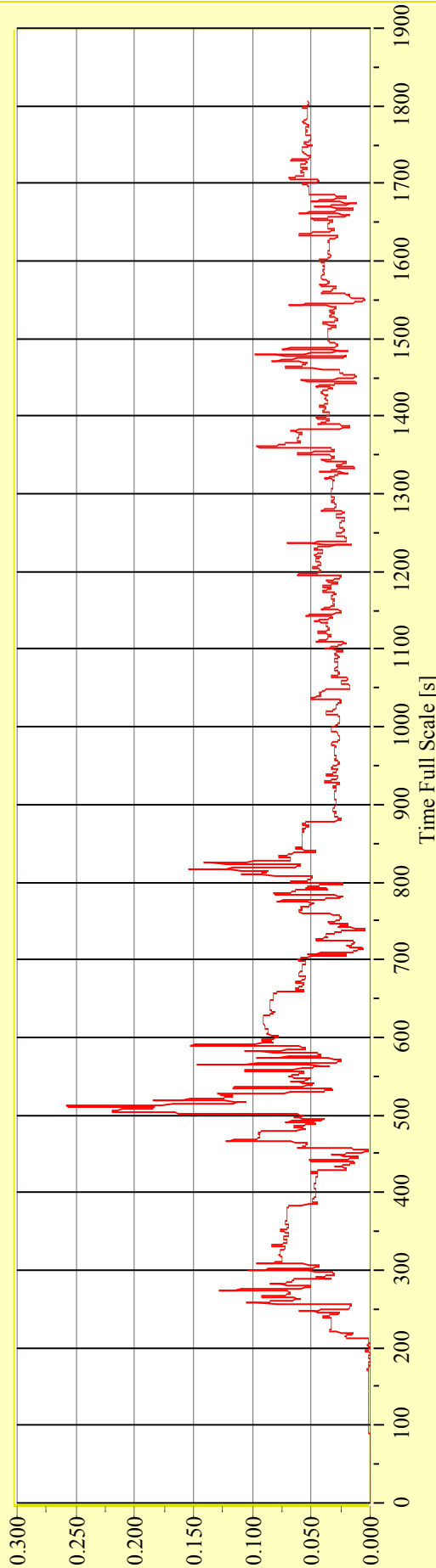
**Model No. 2446**

**Test No. 29691-07**

**Target Waves: Hs = 3,90 m Tp = 7,899 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**

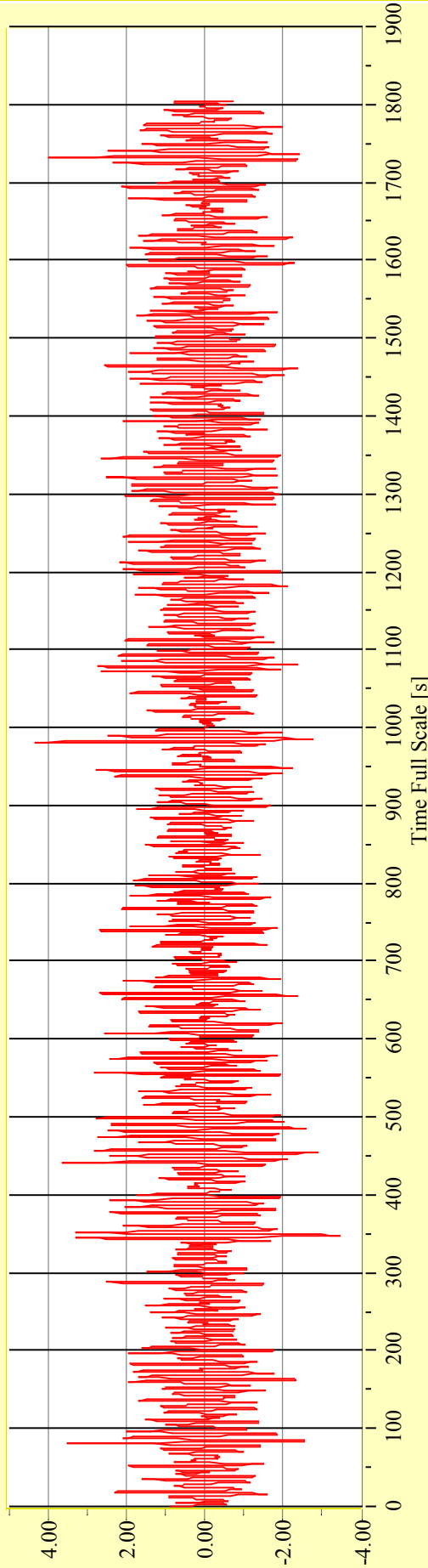
**Model No. 2446**

**Test No. 29691-08**

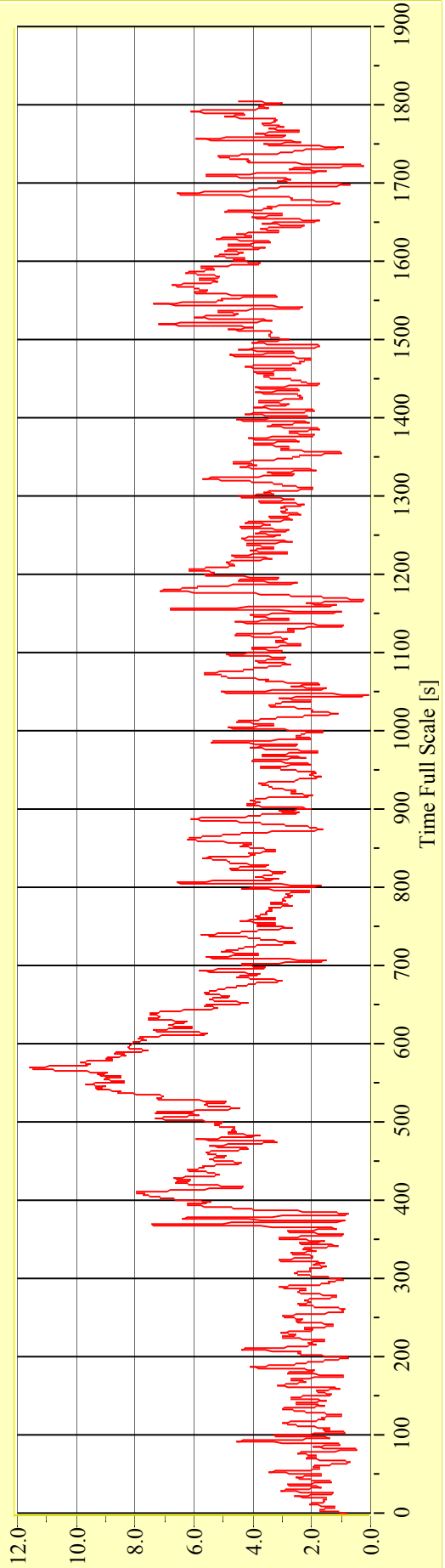
**Target Waves: Hs = 3,90 m Tp = 7,899 s**

**gamma = 3,3**

Wave Elevation (Fixed) [m]



Roll Angle [deg] (to Starboard = Positiv)



**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**



**Irregular Beam Seas**

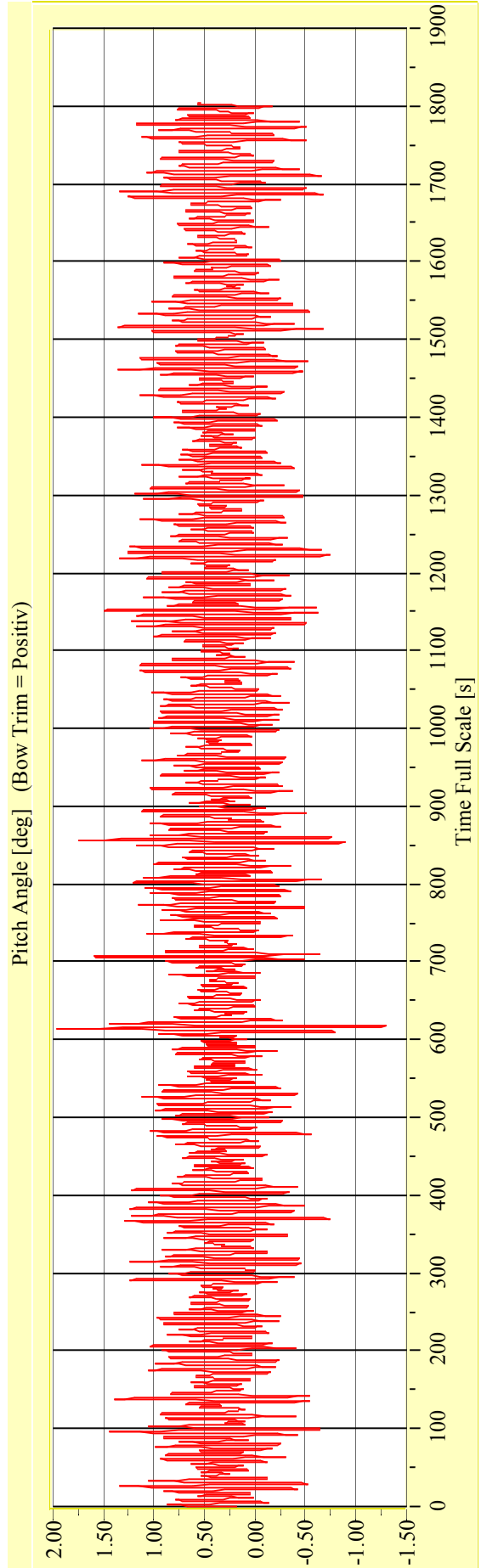
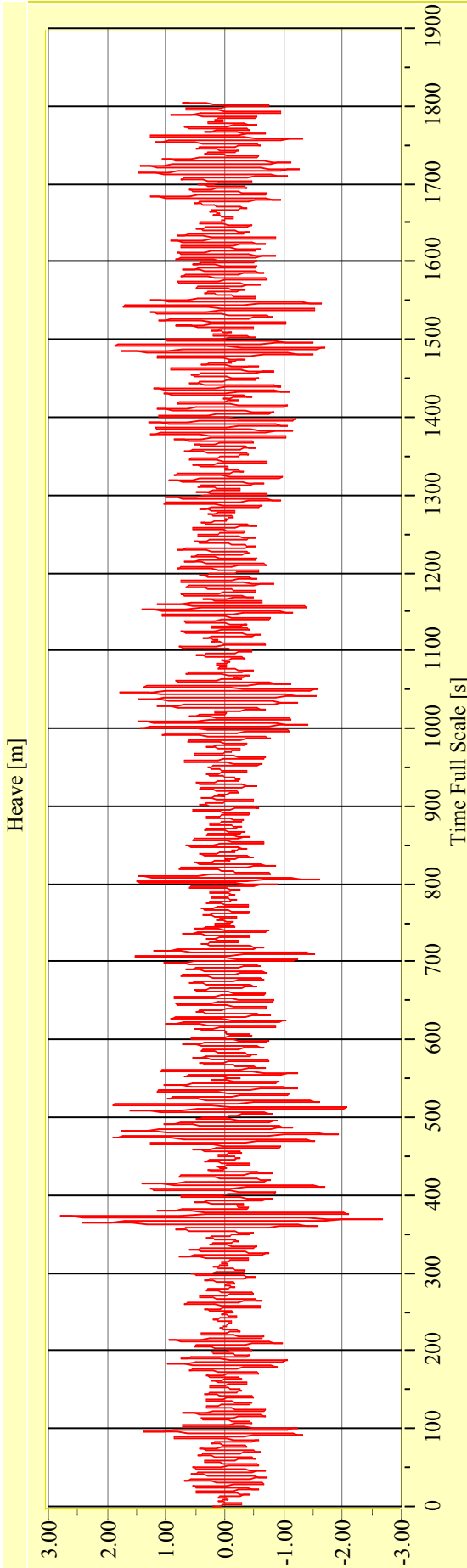
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29691-08**

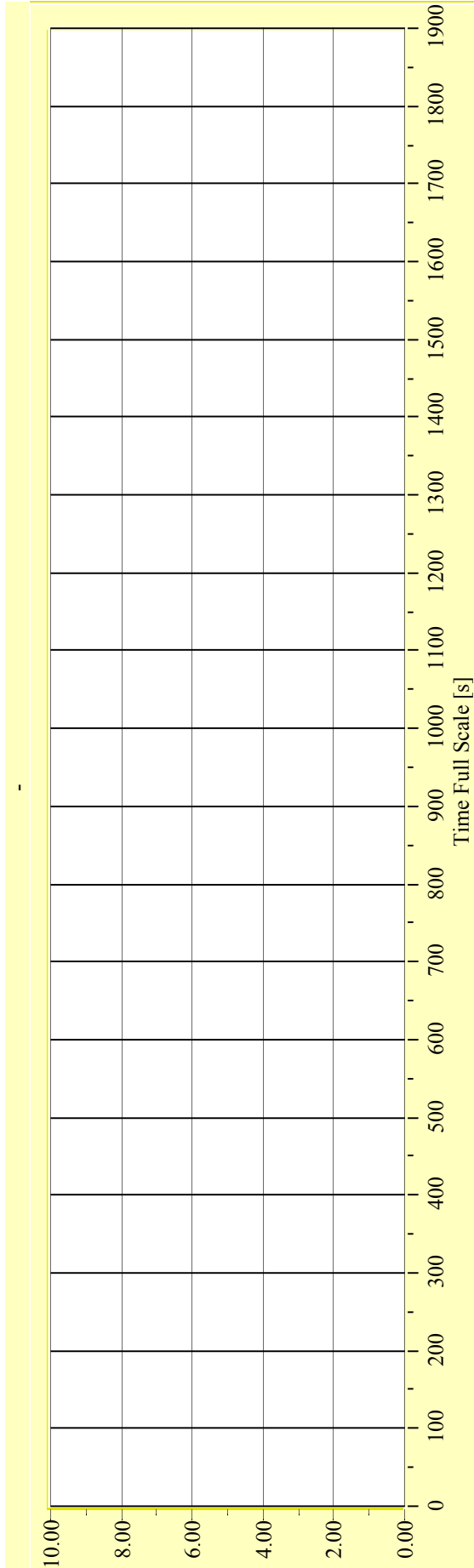
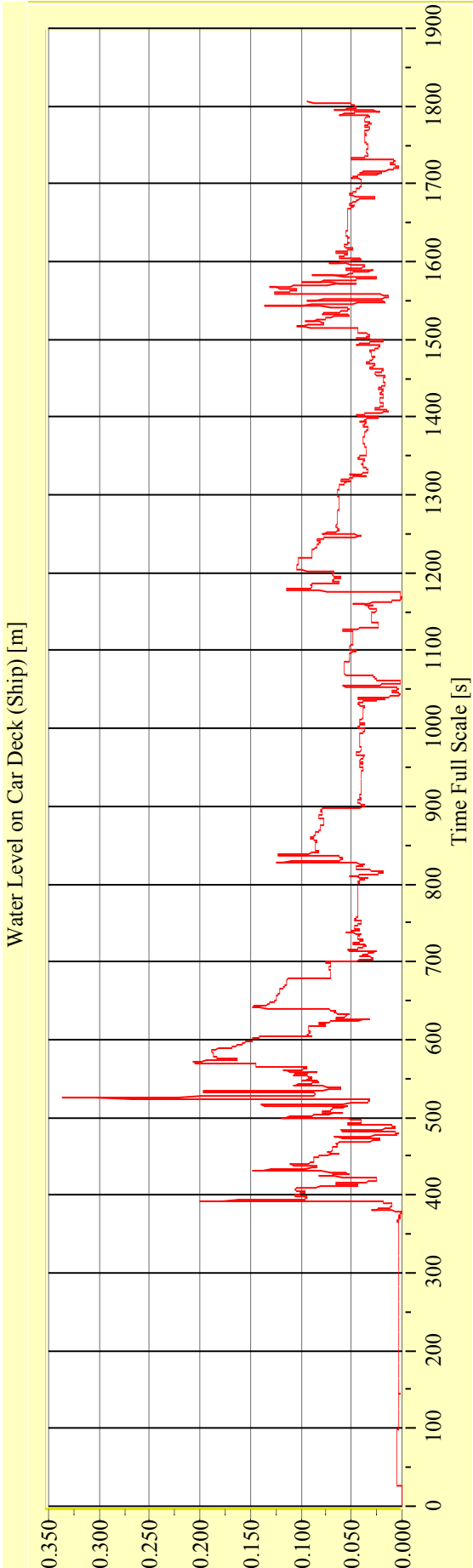
**Target Waves: Hs = 3,90 m Tp = 7,899 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29691-08**      **Target Waves: Hs = 3,90 m Tp = 7,899 s**      **gamma = 3,3**



**Date: 21.05.2010**      **Project: EMSA 1**      **Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**

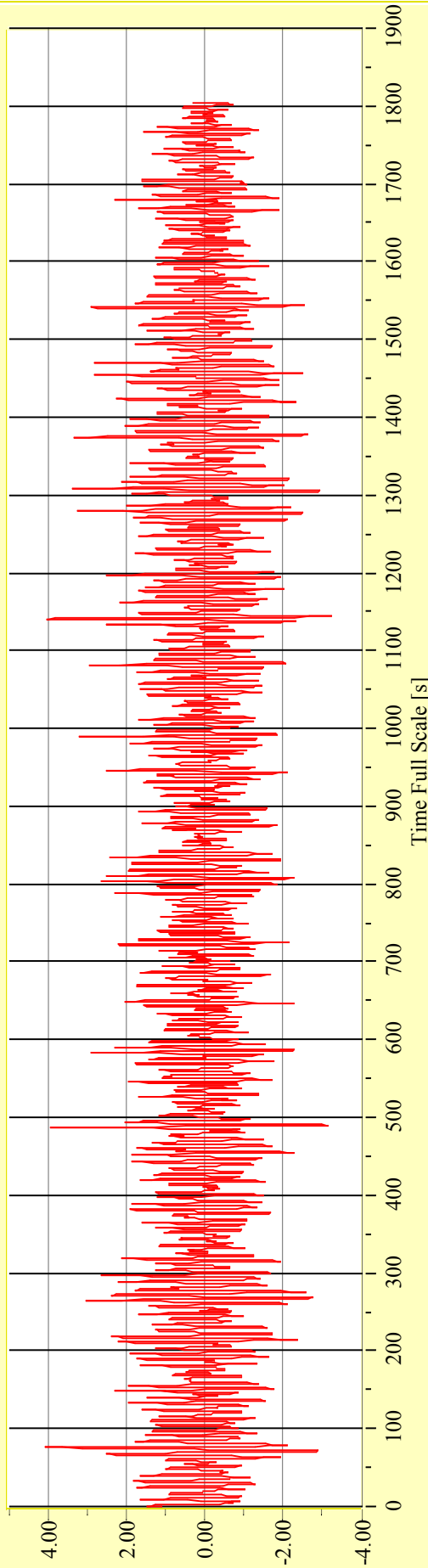
**Model No. 2446**

**Test No. 29691-09**

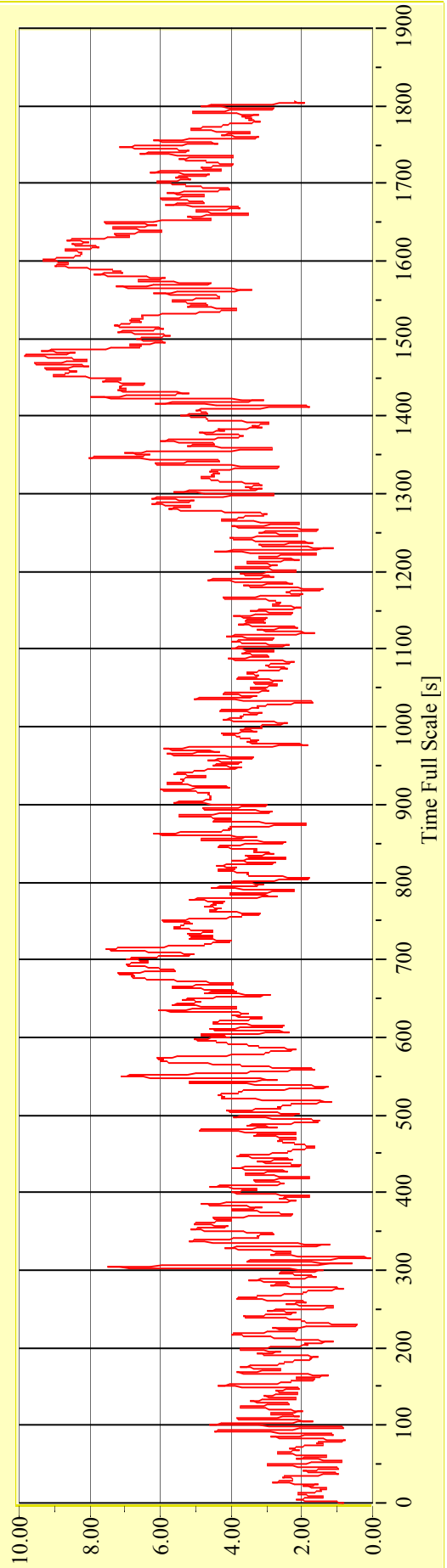
**Target Waves: Hs = 3,90 m Tp = 7,899 s**

**gamma = 3,3**

Wave Elevation (Fixed) [m]



Roll Angle [deg] (to Starboard = Positiv)



**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

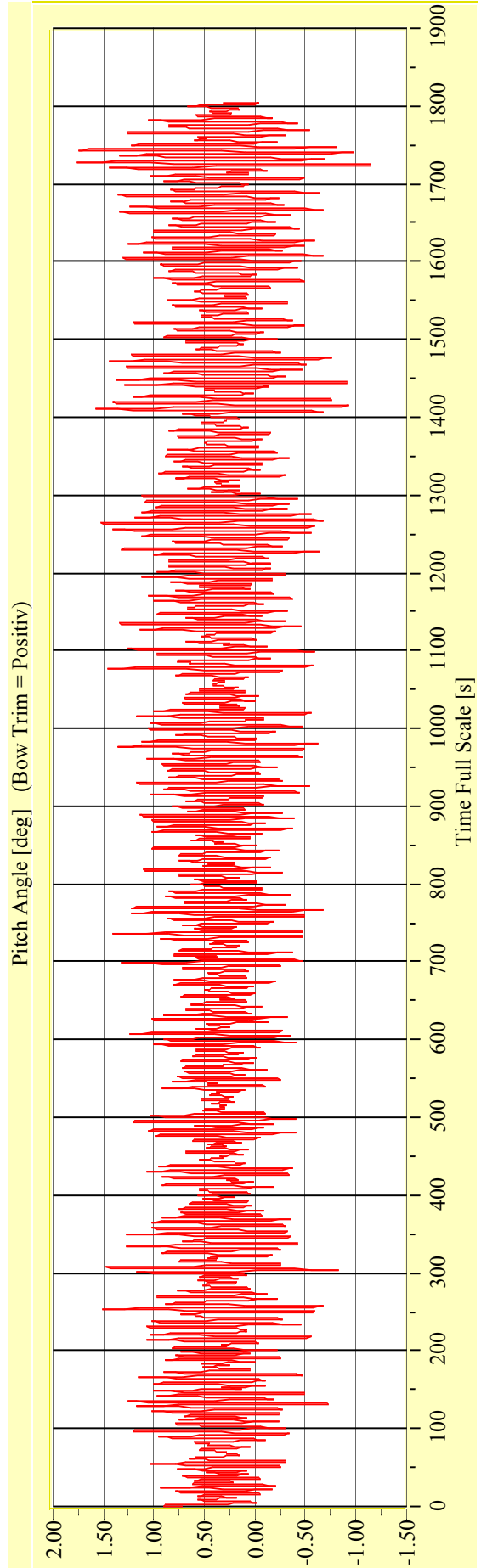
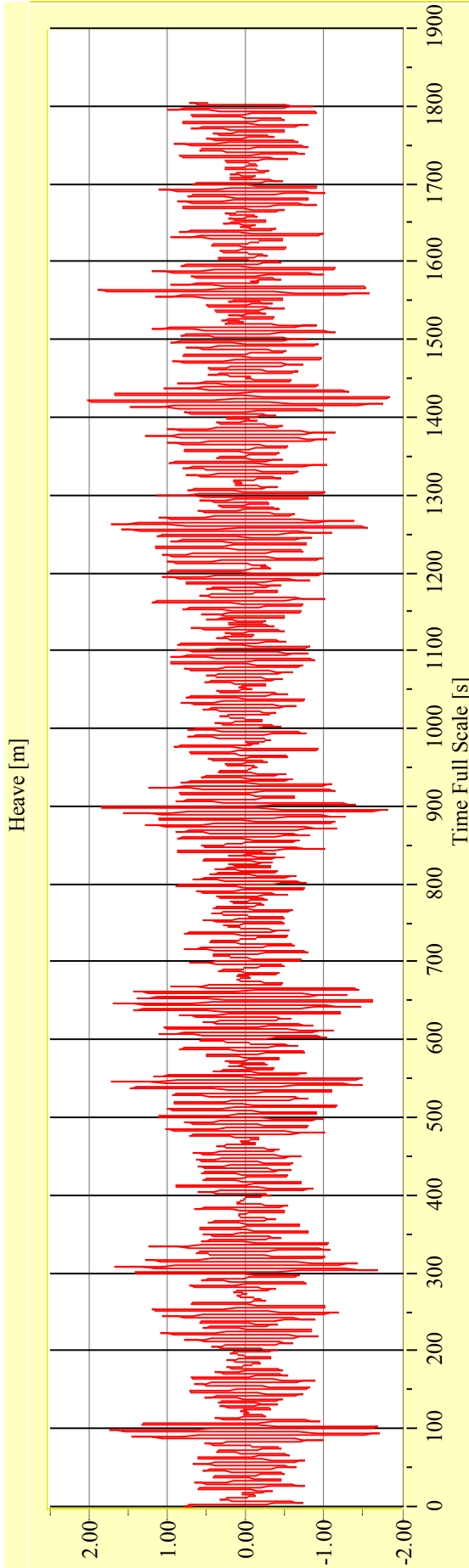
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29691-09**

**Target Waves: Hs = 3,90 m Tp = 7,899 s**

**gamma = 3,3**



**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

**Vienna Model Basin**

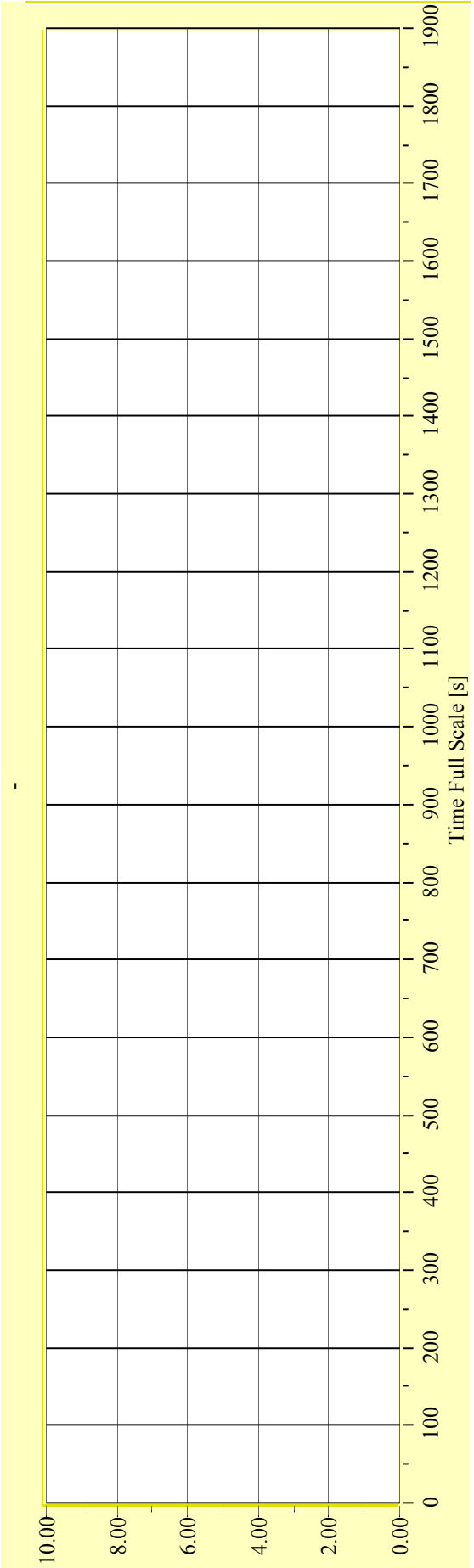
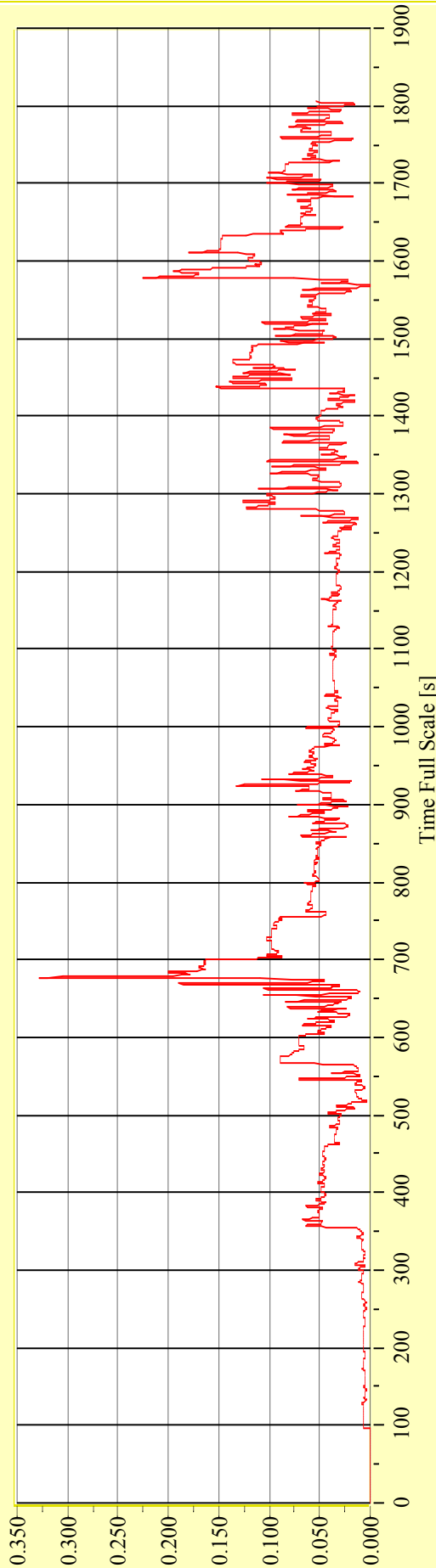
**Model No. 2446**

**Test No. 29691-09**

**Target Waves: Hs = 3,90 m Tp = 7,899 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Irregular Beam Seas**

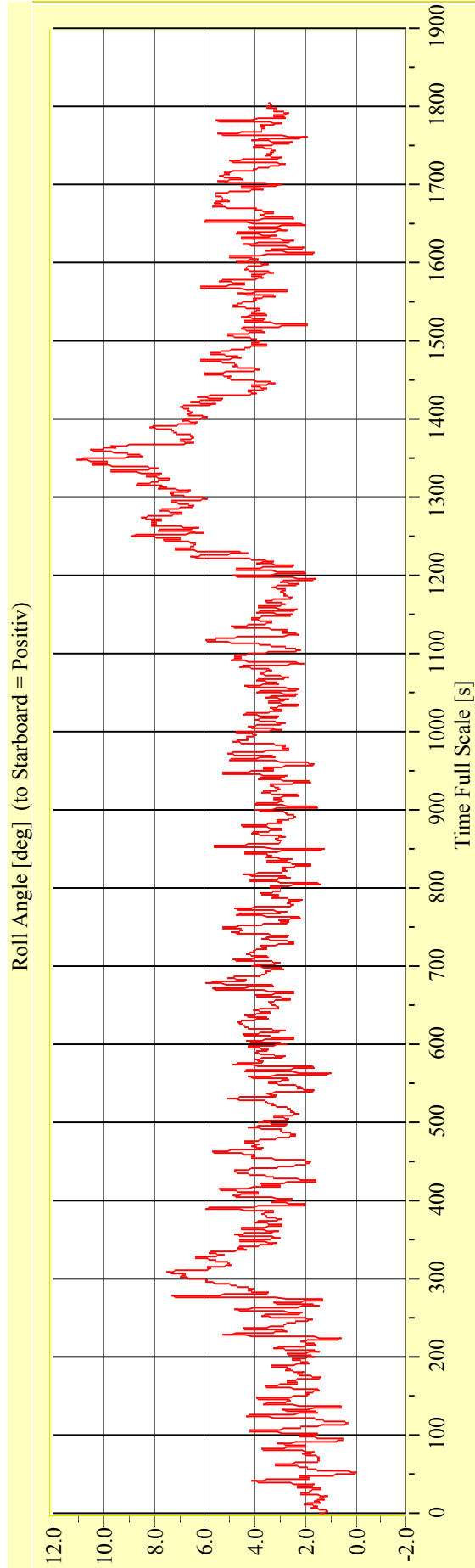
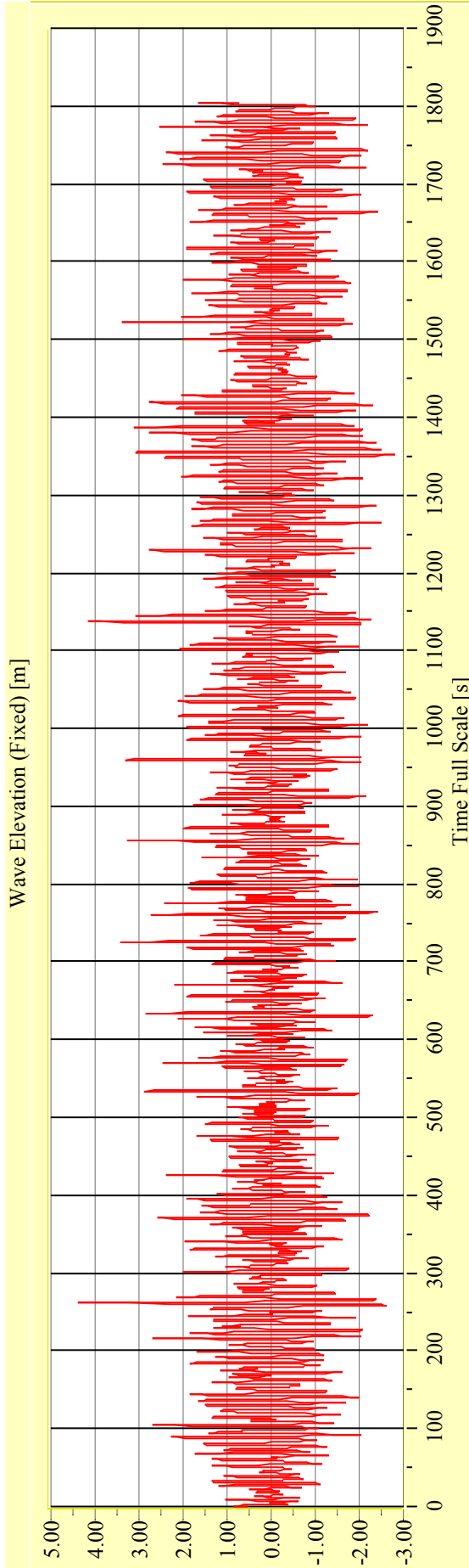
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29691-10**

**Target Waves: Hs = 3,90 m Tp = 7,899 s**

**gamma = 3,3**



**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**

**Irregular Beam Seas**

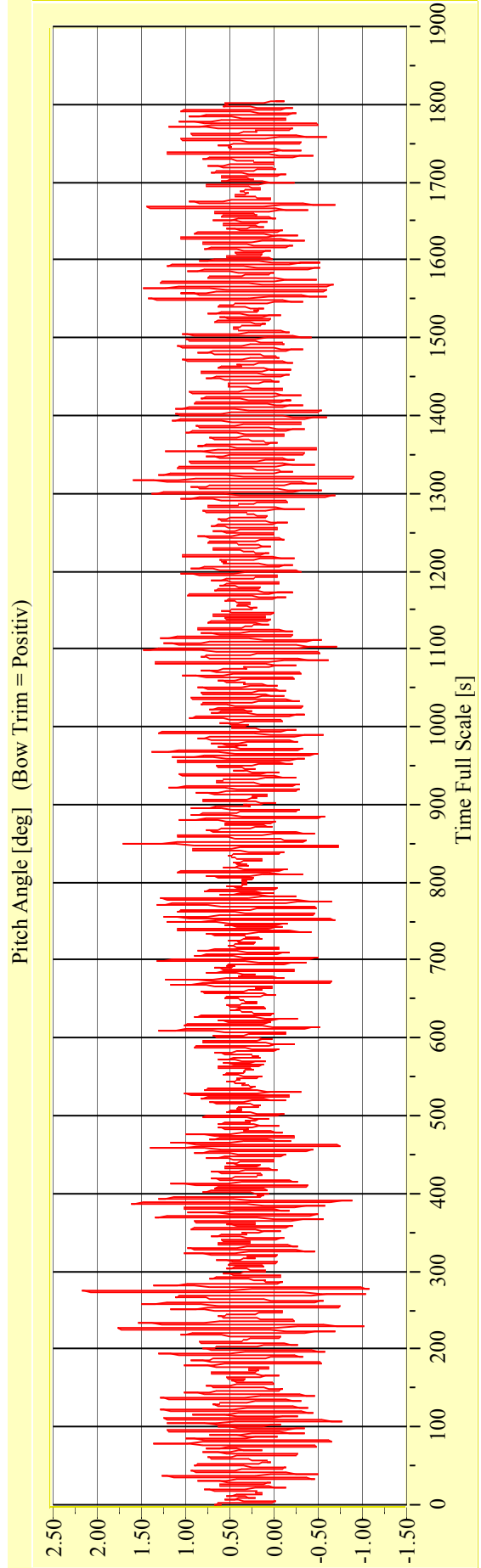
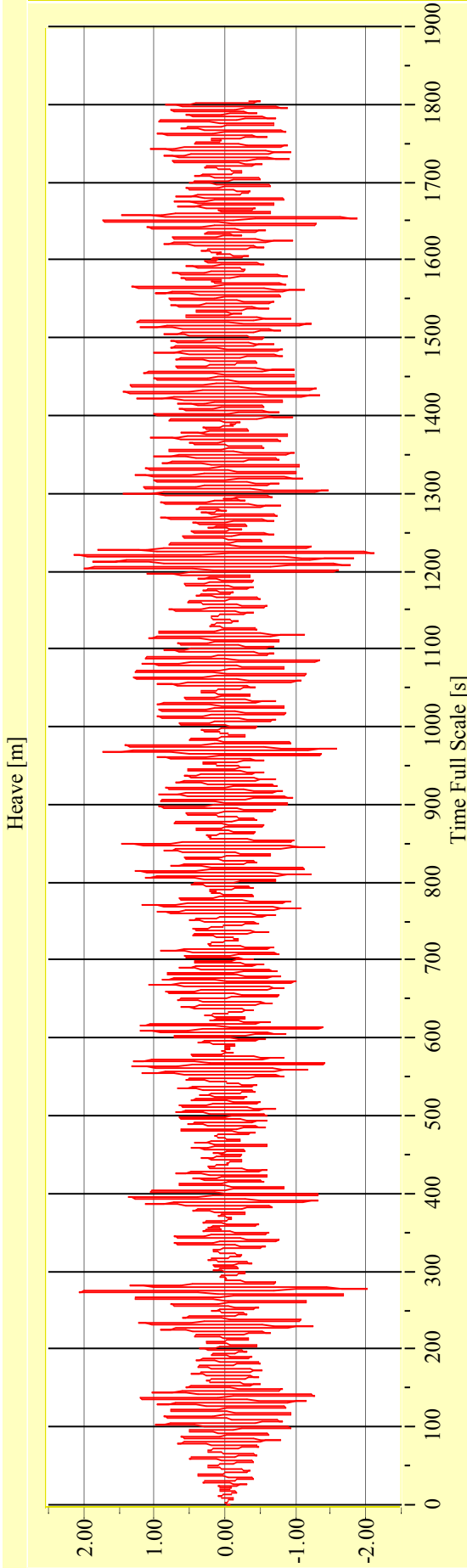
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29691-10**

**Target Waves: Hs = 3,90 m Tp = 7,899 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**

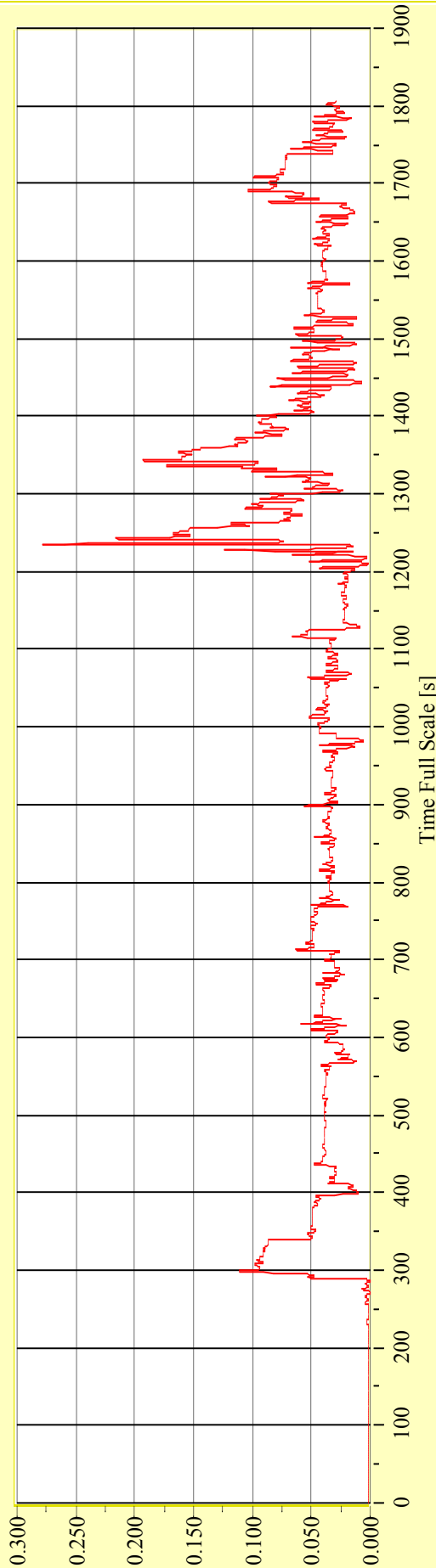
**Model No. 2446**

**Test No. 29691-10**

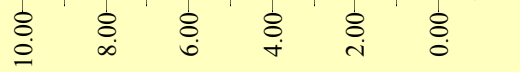
**Target Waves: Hs = 3,90 m Tp = 7,899 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



Time Full Scale [s]



Time Full Scale [s]

**Date: 21.05.2010**

**Project: EMSA 1**

**Damage 1: R7\_S7-9.1.0-1**





## **APPENDIX C1**

### **MODEL TEST PROTOCOL**

**Model No. 2446**

**Project: "EMSA 1"**

**Damage Case-2 R7\_P6-7.4.0**

Details of the dimensions and the damage conditions

## GENERAL PARTICULARS

Model Scale = 1: 25

	SHIP (m)	MODEL (mm)	NOTES	CHECKED
<b>MAIN DIMENSIONS</b>				
LMOD	111.900	4476.0		-
LBP	104.400	4176.0		<b>4175</b>
BMLD	18.600	744.0		<b>741</b>

<b>LONGITUDINAL POSITION OF DAMAGE 1 R7_S7-9.1.0-1</b>				
Aft Bulkhead	38.400	1536.0	From AP (#0)	
Fwd Bulkhead	57.600	2304.0	From AP (#0)	

<b>LONGITUDINAL POSITION OF DAMAGE 2 R7_P6-7.4.0</b>				
Aft Bulkhead	26.400	1056.0	From AP (#0)	<b>1056.0</b>
Fwd Bulkhead	48.000	1920.0	From AP (#0)	<b>1920.0</b>

Shell Plate Thickness      5      mm

*Alistair Murphy (Sas)*  
*Boyer (Trafi)*

**INTACT DRAUGHTS - DAMAGE 2**

**TEST DATE: 26th to 30th April 2010**

*Alister Murphy (SAS)*  
*Alvin [unclear] (SVA)*  
*[unclear] (Traffic)*  
**Port**

FP	
Full Size	4.500 m
Model	180.0 mm
Check	180 mm

**Marked aft of FP due to form of bulb. OK as even keel condition.**



**Starboard**

Midship	
Full Size	4.500 m
Model	180.0 mm
Check	180 mm

Midship	
Full Size	4.500 m
Model	180.0 mm
Check	180 mm

Quarter	
Full Size	4.500 m
Model	180.0 mm
Check	180 mm

Quarter	
Full Size	4.500 m
Model	180.0 mm
Check	180 mm

AP	
Full Size	4.500 m
Model	180.0 mm
Check	X mm

AP	
Full Size	4.500 m
Model	180.0 mm
Check	X mm

**Could not be marked due to hull form**

**Could not be marked due to hull form**

**DAMAGE DRAUGHTS - DAMAGE 2**

*Alistair Murphy (SAS)*  
*Alumna (SVA)*  
*Zif (Traf)*

FP	
Full Size	5.020 m
Model	200.8 mm
Check	<b>201.0</b> mm

Static Heel	
1,300	degree(s)

Port

Starboard



Midship	
Full Size	5.757 m
Model	230.3 mm
Check	<b>230.5</b> mm

Beam 741 mm	
Midship	
Full Size	5.336 m
Model	213.4 mm
Check	<b>213.5</b> mm

Quarter	
Full Size	6.020 m
Model	240.8 mm
Check	<b>241.0</b> mm

Beam 742 mm	
Quarter	
Full Size	5.599 m
Model	224.0 mm
Check	<b>224.0</b> mm

AP	
Full Size	6.283 m
Model	251.3 mm
Check	<b>251.5</b> mm

Beam 744 mm	
AP	
Full Size	5.862 m
Model	234.5 mm
Check	<b>234.5</b> mm

**Slight deformation in Beam**  
**No change to beam measurements**  
**when measured in air and in water.**

## DAMAGE OPENING - DAMAGE 2

	SHIP (m)	MODEL (mm)	NOTES	CHECKED
<b>DAMAGE OPENING</b>				
DMLD	6.30	252.0	Cardeck at V	252.0
Length	6.240	249.6	3%Ls + 3.0m	250.0
Dist from AP (#10)	38.40	1536.0		1536.0
B/5	5.58	223.2	from CL	223.0
	3.72	148.8	from BEXT	148.0

Alistair Murphy. (SAS)  
 [Signature] (SVA)  
 [Signature] (Traffi)



Alistair Murphy. (Sas) ~~Ziff~~ (Trati)

MODEL TEST EXPERIMENTS - DAMAGE 2

29th. 16 ← 28th

RUN	Hs TARGET	Hs FIX	Hs TRAV	COMMENTS
1.1	4	4.0996		Much accumulation!
1.2	4	4.0170		As above
1.3	4	4.0249		Heels to ~10° then rolls about then.
1.4.0	4	4.0350		<del>Capsized after 15-20°</del>
Run 1.4.0 rejected as weight shifted.				
Run repeats run 1.4 wave.				
2.4.1	4	4.02		Survive. Heel away from damage
2.4.2	4	4.0532		Survive
2.5	4	4.044		Survive 9/10
2.6	4	4.0388		Survive
2.7	4	4.034		Survive
2.8	4	4.0204		Survive
2.9.0	4	4.0822		→ Capsized ~20°
2.10	4	4.0481		Survive but just in time. 20°
2.9.1	4	4.0682		→ Capsized
Change wave: 3.75m				
2.11	1	3.7983		→ Capsize
2.12	3	3.8038		Survive 3.75m ~13°
2.13	3	3.7892		Survive.
2.14	4	3.7745		Survive 7/10
2.15	5	3.785		→ Capsize
2.16	6	3.7687		→ Capsize
2.17	2	3.7994		Capsize
2.18	5	3.7882		Capsize
2.19	9	3.7959		Capsize
2.20	10	3.7442		Capsize.
3.21	1	3.512	3.5	Survive
3.22	1	3.29	↑	Survive 3.50m.
3.23	2	3.287	↑	Survive
3.24	3	3.285	3.25	Survive 2/5.
3.25	4	3.290	↓	Capsize
3.26	5	3.301	↓	Capsize 3.25m.
3.27	2	3.5698	↑	Survive.
3.28	3	3.5554	3.5	Survive 2/5
3.29	4	3.5297	↓	capsize.
3.30	5	3.5082	↓	Capsize.

MAX ROLL  
15°  
12°  
14°

12°  
15°  
15°  
16°  
16°  
20°  
20°

13°  
7/10

8th



## **APPENDIX D1**

### **STATISTICS OF WAVES AND ROLL MOTIONS**

**Model No. 2446**

**Project: “EMSA 1”**

**Damage Case-2 R7\_P6-7.4.0**

**Roll Test in Air Measurements**

**Pitch Test in Air Measurements**

**Spectral Characteristics of the Target and Measured Waves**

**Summary of the Measured Wave and Roll Time Realisations**





## **Roll in Air Measurements**

**Model No. 2446**

**Project: "EMSA 1"**

**Damage Case-2 R7\_P6-7.4.0**

Vienna Model Basin Ltd.

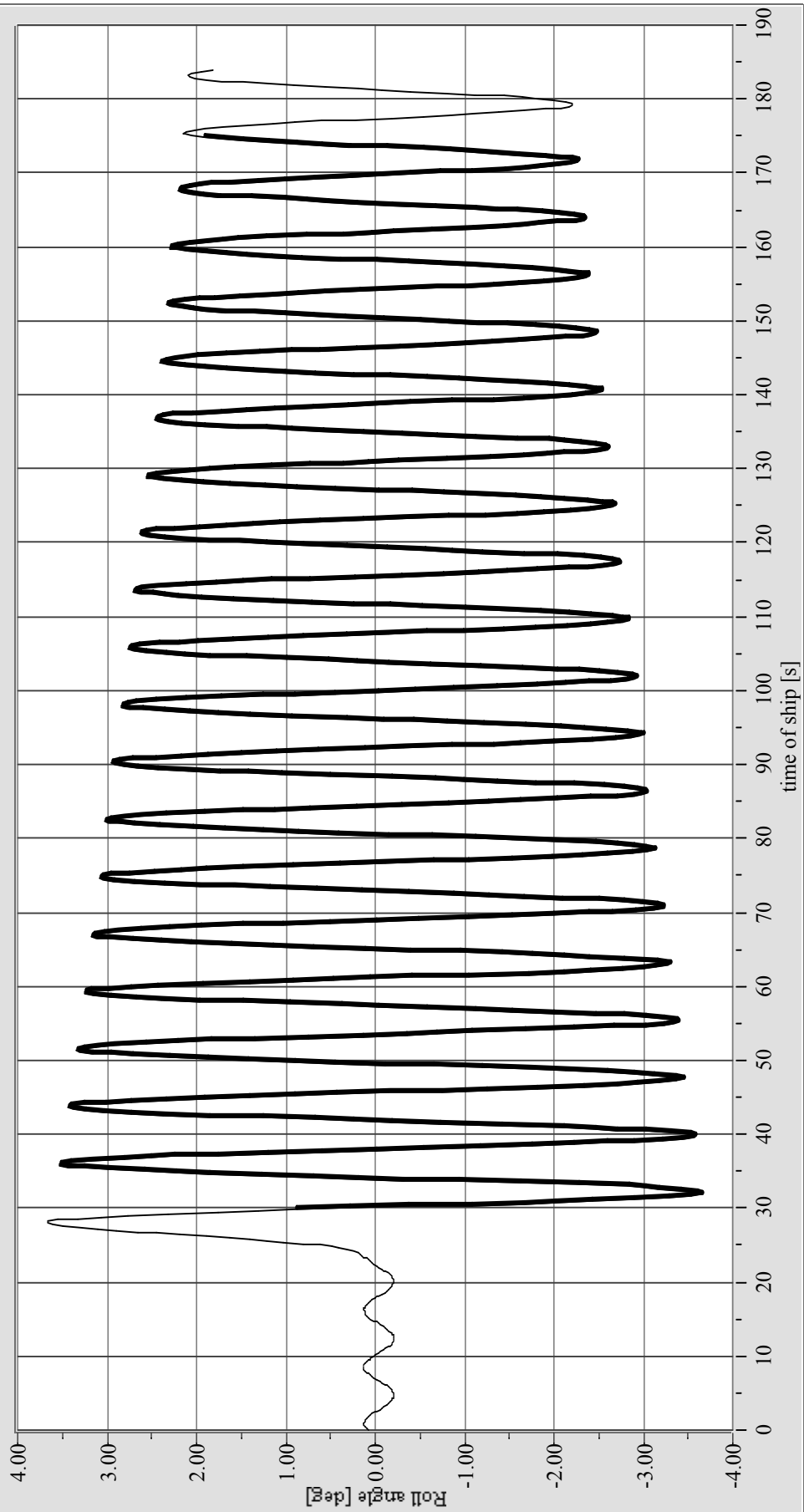
Roll Test in Air

Model No. 2446

Test No. 29662-05

No bilge keels

PLOT\_1



Period (Model / Ship) = 1.5506 s / 7.7529 s

Project: EMSA 1



## **Pitch in Air Measurements**

**Model No. 2446**

**Project: "EMSA 1"**

**Damage Case-2 R\_P6-7.4.0**

Vienna Model Basin Ltd.

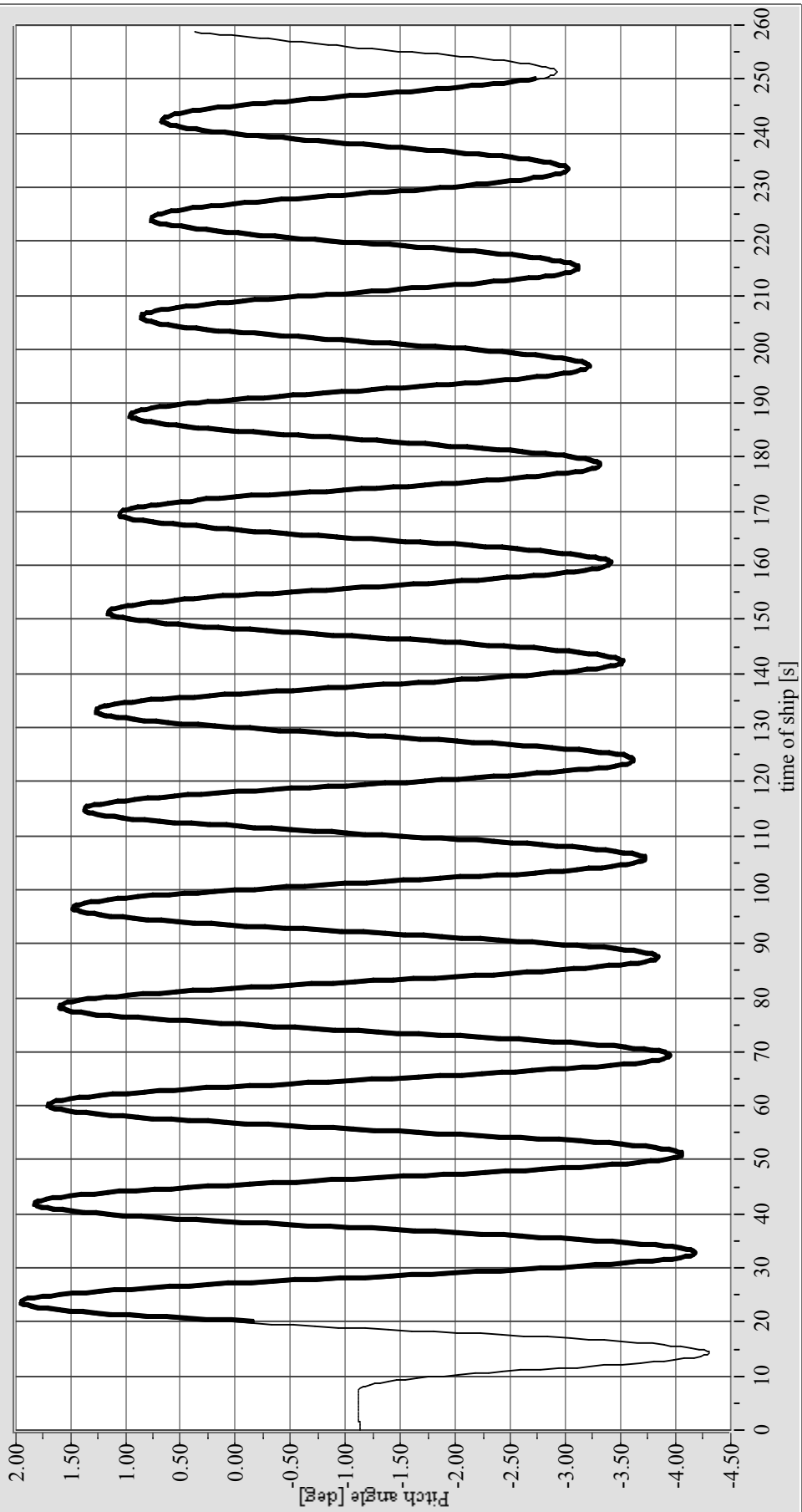
Pitch Test in Air

Model No. 2446

Test No. 29662-12

No bilge keels

PLOT\_1



Period (Model / Ship) = 3.6467 s / 18.2333 s

Project: EMSA 1



## **Spectral Characteristics of the Target and Measured Waves**

**Model No. 2446**

**Project: “EMSA 1”**

**Damage Case-2 R7\_P6-7.4.0**

**Hs = 4.00 m**



## WAVE MEASUREMENT DURING THE TESTS

### Location 1 (Arc 29) Wave Probe-1 DHI-834

**Model No.:** 2446

**Test No.:** 29663-01 to 11

**Project:** EMSA 1

**Damage 2:** R7\_P6-7.4.0

**Wave Type:** Jonswap

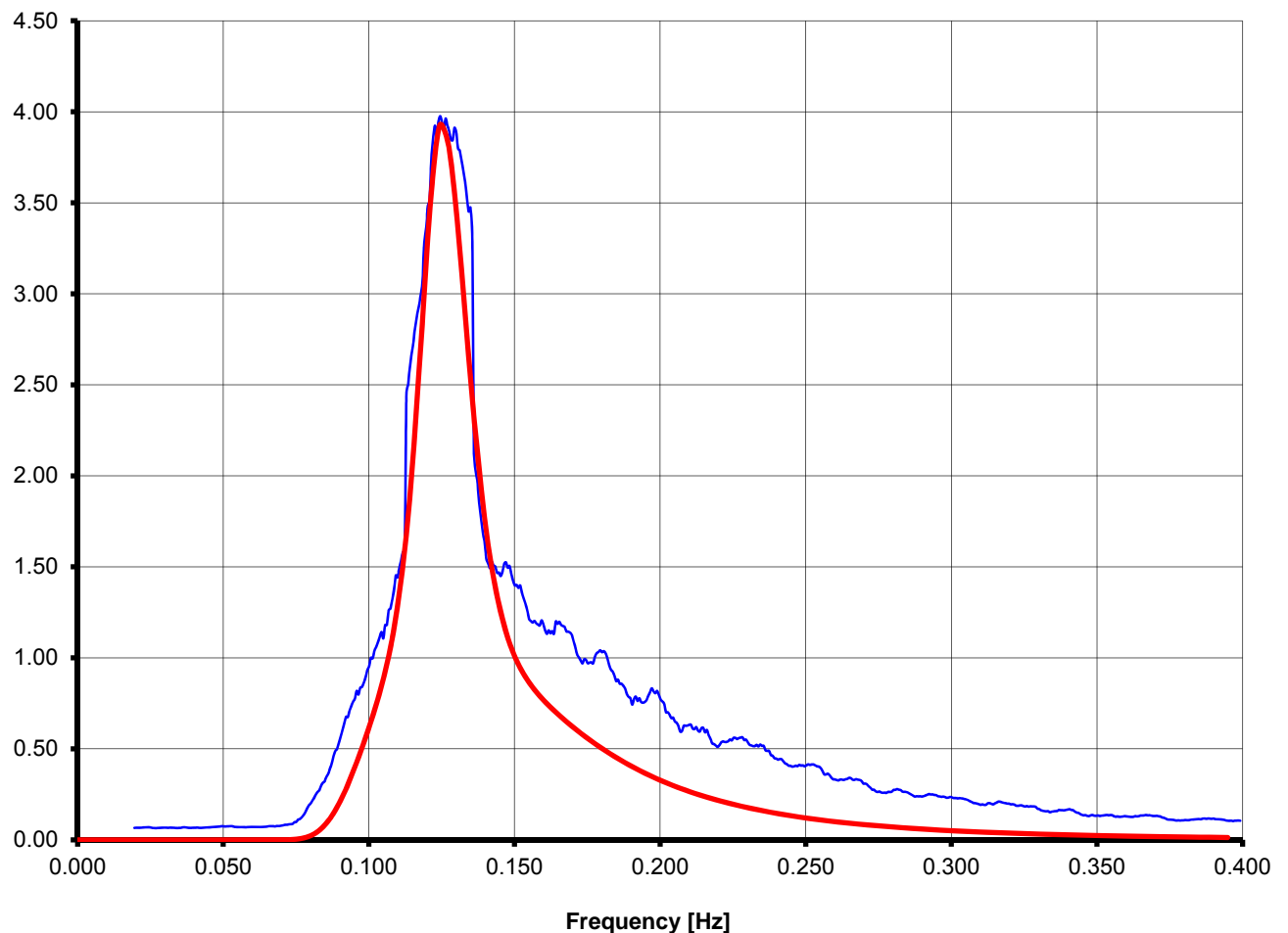
**Scale:** 25.00

#### Short Waves

Parameter	Value	Units
$H_s$	<b>4.000</b>	m
gamma	3.300	
$T_p$	8.000	s
$T_z$	6.226	s

### Spectral Characteristics

**Spectral Density  $S(\omega)$  [m<sup>2</sup>.s]**



— Measured Wave Spectrum      — Target Wave Spectrum

# WAVE MEASUREMENT DURING THE TESTS (FIXED WAVE PROPE)

**Model No.:** 2446

**Test No.:** 29663-01 to 11

**Project:** EMSA 1

**Damage 2:** R7\_P6-7.4.0

**Wave Type:** Jonswap,  $\gamma = 3.3$

**Scale:** 25.00

Target of the Waves			Variation of the Waves		
H <sub>s</sub>	T <sub>P</sub>	T <sub>Z</sub>	H <sub>s</sub>	T <sub>P</sub>	T <sub>Z</sub>
[m]	[s]	[s]	[m]	[s]	[s]
<b>4.000</b>	8.000	6.226	4.000 - 4.100	7.800 - 8.200	5.914 - 6.537

No. of the Test	Wave No.	Location 1 (Wave Probe-1 DHI-834)			Location 2 (Wave Probe-2 DHI-835)			Location 3 (Wave Probe-3 DHI-836)		
		H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>
[ ]		[m]	[s]	[s]	[m]	[s]	[s]	[m]	[s]	[s]
29663-01	29663-01	4.0996	7.971	6.181						
-02	-02	4.0170	8.165	6.482						
-03	-03	4.0249	7.820	5.946						
-04	-04	4.0532	8.161	6.476						
-05	-05	4.0480	7.916	6.095						
-06	-06	4.0388	7.851	5.994						
-07	-07	4.0340	8.160	6.474						
-08	-08	4.0704	8.037	6.284						
-09	-09	4.0822	7.926	6.111						
-10	-09	4.0682	8.001	6.228						
-11	-10	4.0481	7.924	6.108						



## **Spectral Characteristics of the Target and Measured Waves**

**Model No. 2446**

**Project: "EMSA 1"**

**Damage Case-2 R7\_P6-7.4.0**

**Hs = 3.75 m**





## WAVE MEASUREMENT DURING THE TESTS

### Location 1 (Arc 29) Wave Probe-1 DHI-834

**Model No.:** 2446

**Test No.:** 29664-01 to 10

**Project:** EMSA 1

**Damage 2:** R7\_P6-7.4.0

**Wave Type:** Jonswap

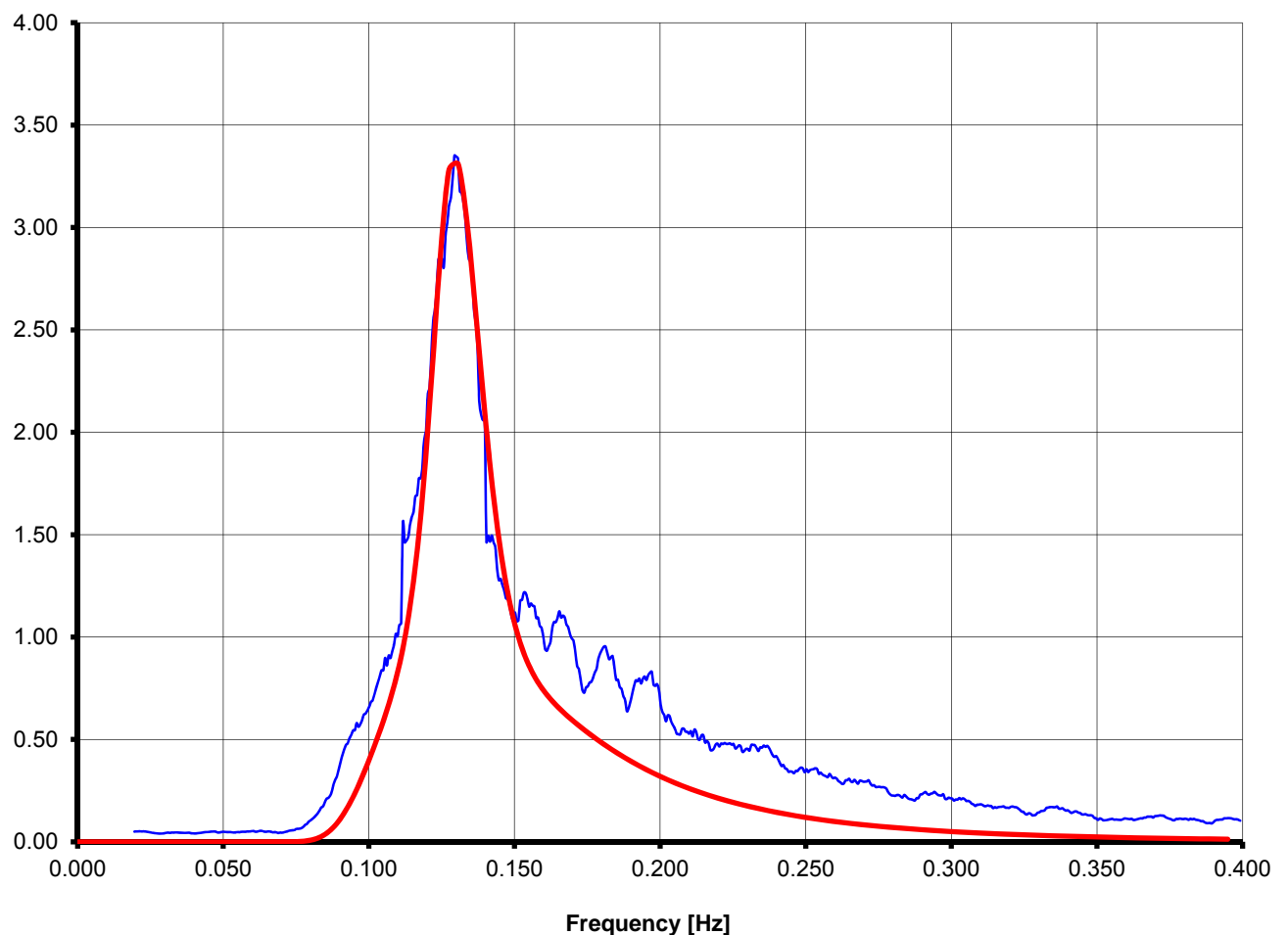
**Scale:** 25.00

### Short Waves

Parameter	Value	Units
$H_s$	<b>3.750</b>	m
gamma	3.300	
$T_p$	7.746	s
$T_z$	6.028	s

## Spectral Characteristics

**Spectral Density  $S(\omega)$  [ $m^2 \cdot s$ ]**



— Measured Wave Spectrum      — Target Wave Spectrum

# WAVE MEASUREMENT DURING THE TESTS (FIXED WAVE PROPE)

**Model No.:** 2446

**Test No.:** 29664-01 to 10

**Project:** EMSA 1

**Damage 2:** R7\_P6-7.4.0

**Wave Type:** Jonswap,  $\gamma = 3.3$

**Scale:** 25.00

Target of the Waves			Variation of the Waves		
H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>
[m]	[s]	[s]	[m]	[s]	[s]
<b>3.750</b>	7.746	6.028	3.750 - 3.844	7.552 - 7.940	5.727 - 6.329

No. of the Test	Wave No.	Location 1 (Wave Probe-1 DHI-834)			Location 2 (Wave Probe-2 DHI-835)			Location 3 (Wave Probe-3 DHI-836)		
		H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>
[ ]		[m]	[s]	[s]	[m]	[s]	[s]	[m]	[s]	[s]
29664-01	29664-01	3.7983	7.879	6.235						
-02	-02	3.8038	7.778	6.078						
-03	-03	3.7892	7.567	5.750						
-04	-04	3.7745	7.732	6.007						
-05	-05	3.7850	7.915	6.291						
-06	-06	3.7687	7.842	6.178						
-07	-07	3.7994	7.591	5.787						
-08	-08	3.7882	7.557	5.735						
-09	-09	3.7959	7.784	6.087						
-10	-10	3.7542	7.663	5.898						



## **Spectral Characteristics of the Target and Measured Waves**

**Model No. 2446**

**Project: "EMSA 1"**

**Damage Case-2 R7\_P6-7.4.0**

**Hs = 3.25 m**



## WAVE MEASUREMENT DURING THE TESTS

### Location 1 (Arc 29) Wave Probe-1 DHI-834

**Model No.:** 2446

**Test No.:** 29665-01 to 05

**Project:** EMSA 1

**Damage 2:** R7\_P6-7.4.0

**Wave Type:** Jonswap

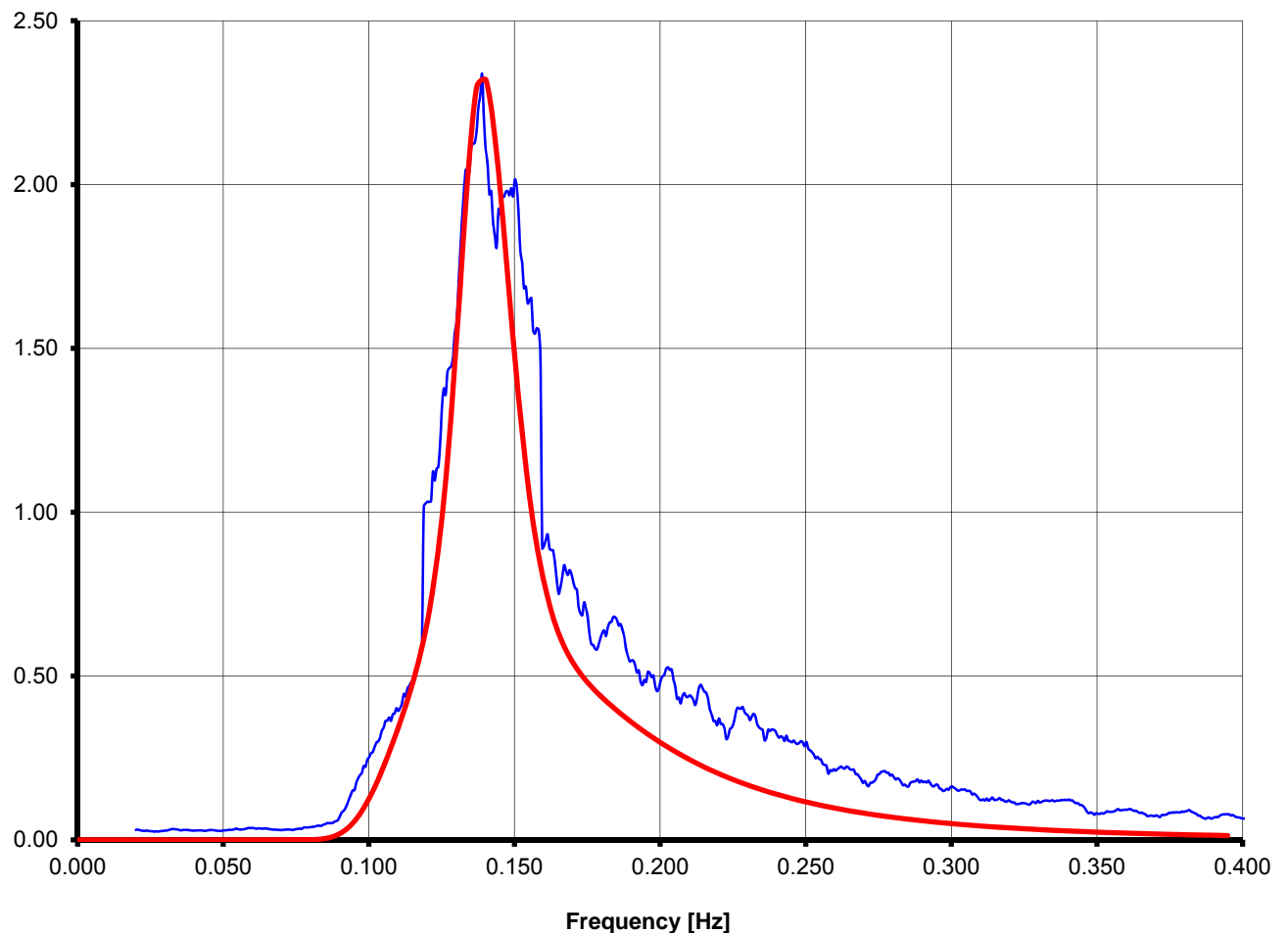
**Scale:** 25.00

#### Short Waves

Parameter	Value	Units
$H_s$	<b>3.250</b>	m
gamma	3.300	
$T_p$	7.211	s
$T_z$	5.612	s

### Spectral Characteristics

**Spectral Density  $S(\omega)$  [ $m^2 \cdot s$ ]**



# WAVE MEASUREMENT DURING THE TESTS (FIXED WAVE PROPE)

**Model No.:** 2446

**Test No.:** 29665-01 to 05

**Project:** EMSA 1

**Damage 2:** R7\_P6-7.4.0

**Wave Type:** Jonswap,  $\gamma = 3.3$

**Scale:** 25.00

Target of the Waves			Variation of the Waves		
H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>
[m]	[s]	[s]	[m]	[s]	[s]
<b>3.250</b>	7.211	5.612	3.250 - 3.331	7.031 - 7.391	5.331 - 5.892

No. of the Test	Wave No.	Location 1 (Wave Probe-1 DHI-834)			Location 2 (Wave Probe-2 DHI-835)			Location 3 (Wave Probe-3 DHI-836)		
		Hs	Tp	Tz	Hs	Tp	Tz	Hs	Tp	Tz
[ ]		[m]	[s]	[s]	[m]	[s]	[s]	[m]	[s]	[s]
29665-01	29665-01	3.2918	7.187	5.575						
-02	-02	3.2867	7.274	5.710						
-03	-03	3.2849	7.384	5.881						
-04	-04	3.2921	7.228	5.638						
-05	-05	3.3015	7.153	5.521						



## **Spectral Characteristics of the Target and Measured Waves**

**Model No. 2446**

**Project: "EMSA 1"**

**Damage Case-2 R7\_P6-7.4.0**

**Hs = 3.50 m**



## WAVE MEASUREMENT DURING THE TESTS

### Location 1 (Arc 29) Wave Probe-1 DHI-834

**Model No.:** 2446

**Test No.:** 29666-01 to 05

**Project:** EMSA 1

**Damage 2:** R7\_P6-7.4.0

**Wave Type:** Jonswap

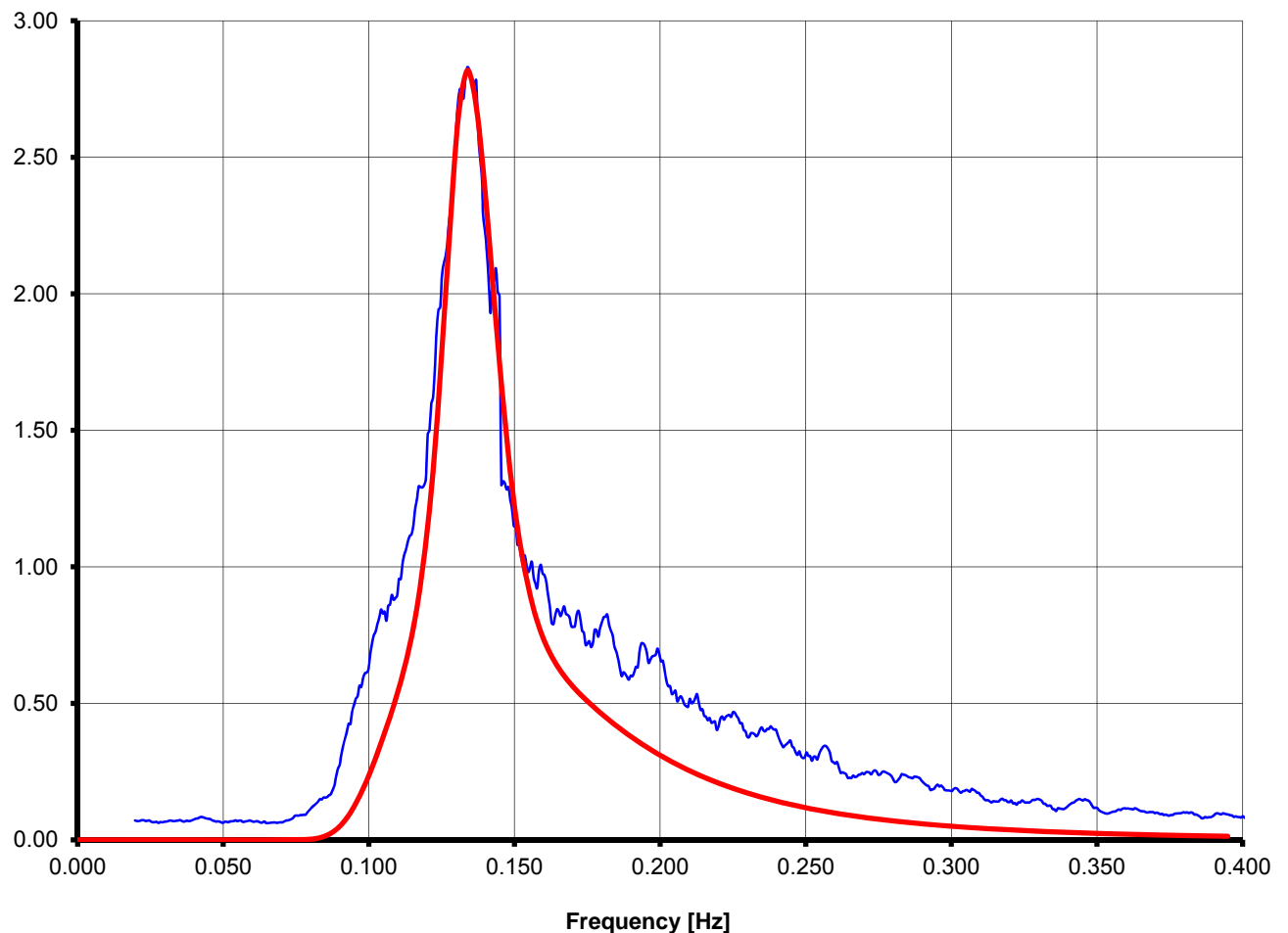
**Scale:** 25.00

#### Short Waves

Parameter	Value	Units
$H_s$	<b>3.500</b>	m
gamma	3.300	
$T_p$	7.483	s
$T_z$	5.824	s

### Spectral Characteristics

**Spectral Density  $S(\omega)$  [m<sup>2</sup>.s]**



— Measured Wave Spectrum      — Target Wave Spectrum

# WAVE MEASUREMENT DURING THE TESTS (FIXED WAVE PROPE)

**Model No.:** 2446

**Test No.:** 29666-01 to 05

**Project:** EMSA 1

**Damage 2:** R7\_P6-7.4.0

**Wave Type:** Jonswap,  $\gamma = 3.3$

**Scale:** 25.00

Target of the Waves			Variation of the Waves		
H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>
[m]	[s]	[s]	[m]	[s]	[s]
<b>3.500</b>	7.483	5.824	3.500 - 3.588	7.296 - 7.670	5.532 - 6.115

No. of the Test	Wave No.	Location 1 (Wave Probe-1 DHI-834)			Location 2 (Wave Probe-2 DHI-835)			Location 3 (Wave Probe-3 DHI-836)		
		H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>
[ ]		[m]	[s]	[s]	[m]	[s]	[s]	[m]	[s]	[s]
29663-01	29663-01	3.5212	7.605	6.012						
-02	-02	3.5698	7.605	6.013						
-03	-03	3.5554	7.628	6.048						
-04	-04	3.5297	7.400	5.693						
-05	-05	3.5082	7.377	5.659						





## **Spectral Characteristics of the Target and Measured Waves**

**Model No. 2446**

**Project: "EMSA 1"**

**Damage Case-2 R7\_P6-7.4.0**

**Hs = 2.50 m**



## WAVE MEASUREMENT DURING THE TESTS

### Location 1 (Arc 29) Wave Probe-1 DHI-834

**Model No.:** 2446

**Test No.:** 29675-01 to 05

**Project:** EMSA 1

**Damage 2:** R7\_P6-7.4.0

**Wave Type:** Jonswap

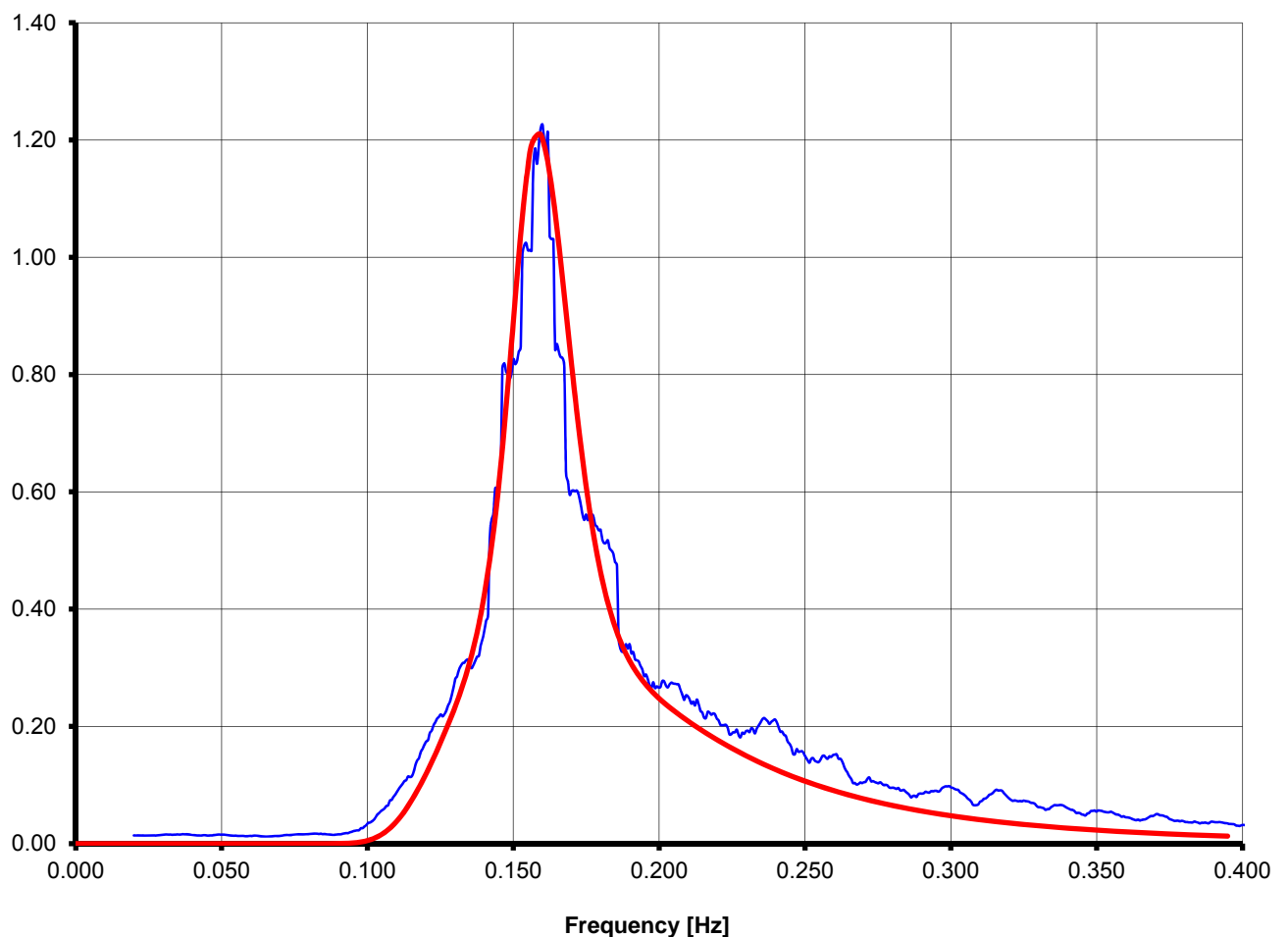
**Scale:** 25.00

#### Short Waves

Parameter	Value	Units
$H_s$	<b>2.500</b>	m
gamma	3.300	
$T_p$	6.325	s
$T_z$	4.922	s

### Spectral Characteristics

**Spectral Density  $S(\omega)$  [m<sup>2</sup>.s]**



— Measured Wave Spectrum      — Target Wave Spectrum

# WAVE MEASUREMENT DURING THE TESTS (FIXED WAVE PROPE)

**Model No.:** 2446

**Test No.:** 29675-01 to 05

**Project:** EMSA 1

**Damage 2:** R7\_P6-7.4.0

**Wave Type:** Jonswap,  $\gamma = 3.3$

**Scale:** 25.00

Target of the Waves			Variation of the Waves		
H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>
[m]	[s]	[s]	[m]	[s]	[s]
<b>2.500</b>	6.325	4.922	2.500 - 2.563	6.166 - 6.483	4.676 - 5.168

No. of the Test	Wave No.	Location 1 (Wave Probe-1 DHI-834)			Location 2 (Wave Probe-2 DHI-835)			Location 3 (Wave Probe-3 DHI-836)		
		H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>	H <sub>s</sub>	T <sub>p</sub>	T <sub>z</sub>
[ ]		[m]	[s]	[s]	[m]	[s]	[s]	[m]	[s]	[s]
29675-01	29675-01	2.5009	6.400	5.039						
-02	-02	2.5224	6.210	4.744						
-03	-03	2.5386	6.190	4.712						
-04	-04	2.5375	6.431	5.088						
-05	-05	2.5527	6.235	4.782						



## **Spectral Characteristics of the Target and Measured Waves**

**Model No. 2446**

**Project: "EMSA 1"**

**Damage Case-2 R7\_P6-7.4.0**

**Hs = 4.25 m**



## WAVE MEASUREMENT DURING THE TESTS

### Location 1 (Arc 29) Wave Probe-1 DHI-834

**Model No.:** 2446

**Test No.:** 29676-01 to 05

**Project:** EMSA 1

**Damage 2:** R7\_P6-7.4.0

**Wave Type:** Jonswap

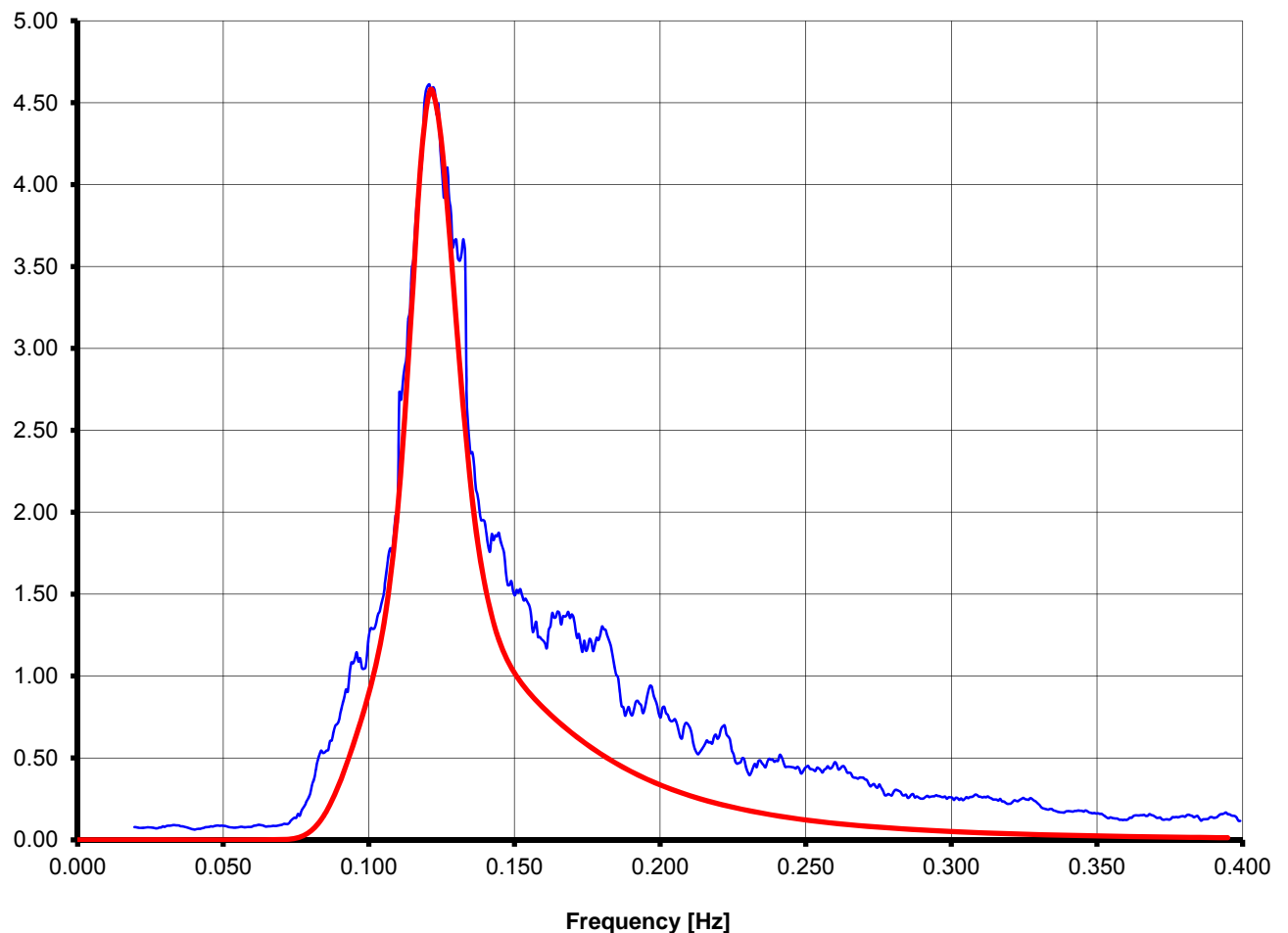
**Scale:** 25.00

#### Short Waves

Parameter	Value	Units
$H_s$	4.250	m
gamma	3.300	
$T_p$	8.246	s
$T_z$	6.417	s

### Spectral Characteristics

**Spectral Density  $S(\omega)$  [m<sup>2</sup>.s]**



— Measured Wave Spectrum      — Target Wave Spectrum

# WAVE MEASUREMENT DURING THE TESTS (FIXED WAVE PROPE)

**Model No.:** 2446

**Test No.:** 29676-01 to 05

**Project:** EMSA 1

**Damage 2:** R7\_P6-7.4.0

**Wave Type:** Jonswap,  $\gamma = 3.3$

**Scale:** 25.00

Target of the Waves			Variation of the Waves		
H <sub>s</sub>	T <sub>P</sub>	T <sub>Z</sub>	H <sub>s</sub>	T <sub>P</sub>	T <sub>Z</sub>
[m]	[s]	[s]	[m]	[s]	[s]
<b>4.250</b>	8.246	6.417	4.250 - 4.356	8.040 - 8.452	6.096 - 6.738

No. of the Test	Wave No.	Location 1 (Wave Probe-1 DHI-834)			Location 2 (Wave Probe-2 DHI-835)			Location 3 (Wave Probe-3 DHI-836)		
		Hs	Tp	Tz	Hs	Tp	Tz	Hs	Tp	Tz
[ ]		[m]	[s]	[s]	[m]	[s]	[s]	[m]	[s]	[s]
29676-01	29676-01	4.3079	8.298	6.497						
-02	-02	4.2906	8.361	6.596						
-03	-03	4.2974	8.296	6.495						
-04	-04	4.2993	8.244	6.414						
-05	-05	4.2922	8.106	6.198						



**Summary of the Measured Wave and Roll Time  
Realisations**

**Model No. 2446**

**Project: “EMSA 1”**

**Damage Case-2 R7\_P6-7.4.0**



# Sea Keeping Test in Irregular Seas (Statistics)

Evaluation of Damage (Ship Values)

Model No.: 2446

Test No.: 29663-01 - 10

Project: EMSA

Hs [m] = 4.00

Damage 2: R7\_P6-7.4.0

Scale = 25.00

Test No.	Description	RMS (SD) Value	Significant Value	max	min	mean	Drift [m]	Duration of the Tests [min]
29663-01	Roll Angle [deg]*	3.037	12.149	3.706	-14.983	-6.089	734.4	30
	Pitch Angle [deg]**	0.413	1.651	0.551	-2.596	-0.905		
	Heave	0.766	3.064	2.882	-3.106	-0.115		
	Wave Elevation (fix) [m]			3.335	-3.081	-0.103		
-02	Roll Angle [deg]*	1.852	7.407	-0.268	-11.831	-6.927	750.3	30
	Pitch Angle [deg]**	0.364	1.458	0.826	-2.480	-0.906		
	Heave	0.661	2.644	1.982	-2.134	-0.079		
	Wave Elevation (fix) [m]			4.187	-3.355	-0.154		
-03	Roll Angle [deg]*	2.500	10.001	0.437	-14.207	-7.607	795.1	30
	Pitch Angle [deg]**	0.371	1.484	0.412	-2.511	0.984		
	Heave	0.687	2.747	2.275	-2.323	-0.109		
	Wave Elevation (fix) [m]			4.209	-3.357	-0.042		
-04	Roll Angle [deg]*	3.995	15.981	1.096	-28.352	-10.456	713.1	30
	Pitch Angle [deg]**	0.423	1.690	1.100	-3.002	-1.007		
	Heave	0.669	2.674	2.681	-2.735	-0.096		
	Wave Elevation (fix) [m]			4.125	-2.951	-0.199		
-04.2	Roll Angle [deg]*	1.997	7.989	0.455	-11.918	-6.723	855.2	30
	Pitch Angle [deg]**	0.407	1.627	0.733	-2.844	-0.940		
	Heave	0.679	2.717	2.482	-2.488	-0.097		
	Wave Elevation (fix) [m]			4.238	-2.917	-0.064		
-05	Roll Angle [deg]*	2.697	10.789	-0.589	-14.917	-8.758	880.8	30
	Pitch Angle [deg]**	0.403	1.612	0.329	-2.254	0.962		
	Heave	0.689	2.756	2.178	-2.556	-0.151		
	Wave Elevation (fix) [m]			4.098	-3.844	-0.061		
-06	Roll Angle [deg]*	2.495	9.978	-0.122	-14.702	-8.116	799.7	30
	Pitch Angle [deg]**	0.440	1.762	0.427	-2.448	-0.961		
	Heave	0.739	2.956	2.526	-2.192	0.070		
	Wave Elevation (fix) [m]			3.481	-3.071	-0.095		
-07	Roll Angle [deg]*	3.364	13.457	-0.398	-16.171	-9.949	878.3	30
	Pitch Angle [deg]**	0.435	1.741	0.659	-2.419	-0.980		
	Heave	0.730	2.919	2.634	-2.626	-0.018		
	Wave Elevation (fix) [m]			3.553	-3.900	-0.158		
-08	Roll Angle [deg]*	3.156	12.623	1.915	-16.879	-9.681	775.4	30
	Pitch Angle [deg]**	0.489	1.957	0.914	-3.276	-0.974		
	Heave	0.724	2.896	2.444	-2.564	-0.080		
	Wave Elevation (fix) [m]			4.129	-2.915	0.039		
-09	Roll Angle [deg]*	4.865	19.460	-0.207	-24.500	-11.486	633.7	30
	Pitch Angle [deg]**	0.422	1.690	0.286	-2.425	-0.991		
	Heave	0.735	2.938	2.457	-2.533	-0.105		
	Wave Elevation (fix) [m]			3.871	-3.092	-0.037		
-09.1	Roll Angle [deg]*	5.194	20.774	10.609	-26.597	-10.200	373.5	30
	Pitch Angle [deg]**	0.447	1.790	0.302	-2.612	-0.956		
	Heave	0.785	3.141	2.378	-2.516	-0.052		
	Wave Elevation (fix) [m]			3.458	-2.813	-0.100		



-10	Roll Angle [deg]*	3.062	12.247	-0.475	-20.664	-10.061	787.6	30
	Pitch Angle [deg]**	0.447	1.788	0.576	-2.772	-0.965		
	Heave	0.690	2.762	2.828	-2.786	-0.127		
	Wave Elevation (fix) [m]			3.963	-3.353	-0.060		



# Sea Keeping Test in Irregular Seas (Statistics)

Evaluation of Damage (Ship Values)

Model No.: 2446

Test No.: 29664-01 - 10

Project: EMSA

Hs [m] = 3.75

Damage 2: R7\_P6-7.4.0

Scale = 25.00

Test No.	Description	RMS (SD) Value	Significant Value	max	min	mean	Drift [m]	Duration of the Tests [min]
29664-01	Roll Angle [deg]*	5.458	21.831	-0.212	-26.039	-8.293	632.0	30
	Pitch Angle [deg]**	0.408	1.633	0.551	-2.687	-0.896		
	Heave	0.677	2.706	2.760	-2.510	-0.099		
	Wave Elevation (fix) [m]			4.183	2.780	-0.113		
-02	Roll Angle [deg]*	2.009	8.037	-0.862	-13.462	-6.821	715.7	30
	Pitch Angle [deg]**	0.431	1.723	0.571	-2.457	-0.883		
	Heave	0.633	2.532	2.388	-2.464	-0.049		
	Wave Elevation (fix) [m]			4.101	-2.842	-0.006		
-03	Roll Angle [deg]*	4.316	17.266	-0.808	-22.172	-8.721	730.9	30
	Pitch Angle [deg]**	0.435	1.738	0.776	-2.542	-0.901		
	Heave	0.635	2.540	2.450	-2.576	-0.159		
	Wave Elevation (fix) [m]			3.464	-3.033	-0.096		
-04	Roll Angle [deg]*	2.014	8.055	1.557	-12.094	-7.180	745.8	30
	Pitch Angle [deg]**	0.405	1.620	0.702	-2.407	-0.884		
	Heave	0.603	2.412	2.804	-2.512	-0.095		
	Wave Elevation (fix) [m]			4.323	-2.854	0.011		
-05	Roll Angle [deg]*	6.155	24.622	-1.123	-26.750	-11.580	343.9	30
	Pitch Angle [deg]**	0.429	1.718	0.299	-2.441	-0.945		
	Heave	0.734	2.934	2.031	-2.201	-0.294		
	Wave Elevation (fix) [m]			3.783	-2.605	-0.009		
-06	Roll Angle [deg]*	5.176	20.702	-4.160	-27.391	-12.995	141.3	30
	Pitch Angle [deg]**	0.416	1.664	0.297	-2.120	-0.974		
	Heave	0.579	2.315	1.549	-1.719	-0.238		
	Wave Elevation (fix) [m]			2.705	-2.453	0.000		
-07	Roll Angle [deg]*	4.294	17.176	-2.261	-24.091	-9.589	428.5	30
	Pitch Angle [deg]**	0.380	1.518	0.425	-2.212	-0.908		
	Heave	0.605	2.419	1.530	-2.082	-0.163		
	Wave Elevation (fix) [m]			3.490	-2.696	0.133		
-08	Roll Angle [deg]*	4.848	19.390	-2.857	-26.665	-10.166	373.8	30
	Pitch Angle [deg]**	0.435	1.741	0.306	-2.416	0.916		
	Heave	0.610	2.438	1.968	-2.136	-0.190		
	Wave Elevation (fix) [m]			3.499	-2.744	-0.110		
-09	Roll Angle [deg]*	5.145	20.582	-2.522	-27.670	-10.245	266.4	30
	Pitch Angle [deg]**	0.388	1.553	0.445	-2.174	-0.906		
	Heave	0.664	2.657	1.905	-2.139	-0.221		
	Wave Elevation (fix) [m]			2.978	-2.456	-0.057		
-10	Roll Angle [deg]*	5.516	22.063	-2.543	-26.228	-11.301	226.7	30
	Pitch Angle [deg]**	0.403	1.610	0.286	-2.164	-0.920		
	Heave	0.615	2.461	2.192	-2.156	-0.142		
	Wave Elevation (fix) [m]			4.439	-2.773	0.012		



## Sea Keeping Test in Irregular Seas (Statistics)

Evaluation of Damage (Ship Values)

**Model No.: 2446**

**Test No.: 29665-01 - 05**

**Project: EMSA**

**Hs [m] = 3.25**

**Damage 2: R7\_P6-7.4.0**

**Scale = 25.00**

Test No.	Description	RMS (SD) Value	Significant Value	max	min	mean	Drift [m]	Duration of the Tests [min]
29665-01	Roll Angle [deg]*	2.373	9.492	-0.002	-11.693	-6.191	760.2	30
	Pitch Angle [deg]**	0.365	1.461	0.488	-2.399	-0.868		
	Heave	0.516	2.065	2.060	-1.922	0.021		
	Wave Elevation (fix) [m]			3.485	-2.627	-0.034		
-02	Roll Angle [deg]*	1.675	6.702	0.634	-11.668	-7.074	852.5	30
	Pitch Angle [deg]**	0.392	1.567	0.716	-2.403	-0.888		
	Heave	0.515	2.062	2.031	-1.957	-0.060		
	Wave Elevation (fix) [m]			3.306	-3.118	-0.015		
-03	Roll Angle [deg]*	1.728	6.910	2.344	-12.101	-6.717	851.9	30
	Pitch Angle [deg]**	0.334	1.338	0.403	-2.412	-0.887		
	Heave	0.514	2.054	2.358	-2.670	-0.101		
	Wave Elevation (fix) [m]			3.640	-2.829	-0.195		
-04	Roll Angle [deg]*	4.872	19.487	1.280	-22.712	-8.380	647.2	30
	Pitch Angle [deg]**	0.419	1.675	0.702	-2.554	-0.928		
	Heave	0.558	2.232	2.083	-2.185	-0.083		
	Wave Elevation (fix) [m]			3.015	-2.445	-0.055		
-05	Roll Angle [deg]*	5.000	20.000	0.540	-31.815	-9.695	742.8	30
	Pitch Angle [deg]**	0.374	1.498	0.464	-2.468	-0.934		
	Heave	0.558	2.231	2.094	-2.438	-0.211		
	Wave Elevation (fix) [m]			3.403	-2.918	-0.185		



## Sea Keeping Test in Irregular Seas (Statistics)

Evaluation of Damage (Ship Values)

**Model No.: 2446**

**Test No.: 29666-01 - 05**

**Project: EMSA**

**Hs [m] = 3.50**

**Damage 2: R7\_P6-7.4.0**

**Scale = 25.00**

Test No.	Description	RMS (SD) Value	Significant Value	max	min	mean	Drift [m]	Duration of the Tests [min]
29666-01	Roll Angle [deg]*	2.335	9.339	0.160	-10.159	-5.307	731.5	30
	Pitch Angle [deg]**	0.367	1.466	0.522	-2.596	-0.862		
	Heave	0.546	2.186	1.952	-2.010	-0.076		
	Wave Elevation (fix) [m]			3.888	-2.802	-0.114		
-02	Roll Angle [deg]*	4.575	18.302	-0.335	-18.517	-8.354	803.0	30
	Pitch Angle [deg]**	0.399	1.595	0.511	-2.486	-0.881		
	Heave	0.622	2.490	2.108	-2.188	-0.188		
	Wave Elevation (fix) [m]			3.522	-2.762	-0.017		
-03	Roll Angle [deg]*	1.876	7.502	-0.083	-11.090	-6.605	794.6	30
	Pitch Angle [deg]**	0.405	1.620	0.493	-2.538	-0.864		
	Heave	0.567	2.268	2.142	-1.832	0.020		
	Wave Elevation (fix) [m]			3.394	-2.851	0.074		
-04	Roll Angle [deg]*	5.582	22.330	5.612	-28.834	-9.535	584.3	30
	Pitch Angle [deg]**	0.396	1.585	0.504	-2.394	-0.940		
	Heave	0.587	2.348	2.501	-2.735	-0.204		
	Wave Elevation (fix) [m]			3.618	-3.011	-0.061		
-05	Roll Angle [deg]*	4.921	19.682	-0.140	-27.749	-9.033	587.3	30
	Pitch Angle [deg]**	0.397	1.588	0.315	-2.516	-0.927		
	Heave	0.580	2.319	2.644	-2.652	-0.221		
	Wave Elevation (fix) [m]			4.219	-3.099	0.237		



## Sea Keeping Test in Irregular Seas (Statistics)

Evaluation of Damage (Ship Values)

**Model No.: 2446**

**Test No.: 29675-01 - 05**

**Project: EMSA**

**Hs [m] = 2.50**

**Damage 2: R7\_P6-7.4.0**

**Scale = 25.00**

Test No.	Description	RMS (SD) Value	Significant Value	max	min	mean	Drift [m]	Duration of the Tests [min]
29675-01	Roll Angle [deg]*	1.028	4.113	-0.994	-8.464	-5.234	785.6	30
	Pitch Angle [deg]**	0.276	1.104	0.072	-2.138	-0.927		
	Heave	0.353	1.411	1.530	-1.464	-0.058		
	Wave Elevation (fix) [m]			3.204	-2.851	-0.051		
-02	Roll Angle [deg]*	1.607	6.427	-0.029	-9.673	-5.812	840.9	30
	Pitch Angle [deg]**	0.297	1.187	0.029	-2.081	-0.945		
	Heave	0.406	1.623	1.732	-1.746	-0.020		
	Wave Elevation (fix) [m]			-2.374	-2.291	-0.211		
-03	Roll Angle [deg]*	1.661	6.642	-0.389	-9.436	-5.709	861.4	30
	Pitch Angle [deg]**	0.312	1.249	0.122	-2.027	0.935		
	Heave	0.414	1.656	1.788	-1.818	-0.040		
	Wave Elevation (fix) [m]			2.745	-2.442	-0.055		
-04	Roll Angle [deg]*	1.718	6.871	-0.410	-9.731	-5.612	862.2	30
	Pitch Angle [deg]**	0.315	1.259	0.104	-1.955	-0.935		
	Heave	0.398	1.594	1.636	-1.576	-0.042		
	Wave Elevation (fix) [m]			2.519	-1.757	-0.028		
-05	Roll Angle [deg]*	1.261	5.043	-0.364	-8.838	-5.368	747.6	30
	Pitch Angle [deg]**	0.352	1.410	0.245	-2.099	-0.930		
	Heave	0.370	1.481	1.655	-1.619	-0.041		
	Wave Elevation (fix) [m]			2.292	-1.694	-0.028		



## Sea Keeping Test in Irregular Seas (Statistics)

Evaluation of Damage (Ship Values)

**Model No.: 2446**

**Test No.: 29676-01 - 05**

**Project: EMSA**

**Hs [m] = 4.25**

**Damage 2: R7\_P6-7.4.0**

**Scale = 25.00**

Test No.	Description	RMS (SD) Value	Significant Value	max	min	mean	Drift [m]	Duration of the Tests [min]
29676-01	Roll Angle [deg]*	2.633	10.533	3.751	-13.928	-6.791	816.2	30
	Pitch Angle [deg]**	0.434	1.734	1.577	-3.539	-0.993		
	Heave	0.740	2.960	2.481	-2.453	-0.141		
	Wave Elevation (fix) [m]			5.030	-2.758	0.129		
-02	Roll Angle [deg]*	2.617	10.468	4.648	-13.417	-6.723	818.7	30
	Pitch Angle [deg]**	0.416	1.663	0.914	-2.732	-0.994		
	Heave	0.762	3.049	2.506	-2.792	-0.108		
	Wave Elevation (fix) [m]			4.884	-3.032	0.022		
-03	Roll Angle [deg]*	2.610	10.411	0.720	-16.481	-8.959	909.7	30
	Pitch Angle [deg]**	0.504	2.017	1.958	-3.870	-4.049		
	Heave	0.745	2.978	2.138	-2.336	-0.151		
	Wave Elevation (fix) [m]			4.139	-3.360	0.037		
-04	Roll Angle [deg]*	2.641	10.564	0.284	-15.217	-8.036	869.4	30
	Pitch Angle [deg]**	0.419	1.676	0.655	-2.711	-1.033		
	Heave	0.762	3.047	2.135	-2.573	-0.029		
	Wave Elevation (fix) [m]			4.141	-3.286	0.031		
-05	Roll Angle [deg]*	2.272	9.087	2.498	-15.649	-8.145	914.3	30
	Pitch Angle [deg]**	0.463	1.853	0.583	-2.981	-1.036		
	Heave							
	Wave Elevation (fix) [m]							



## **APPENDIX E1**

### **TIME HISTORIES OF THE EXPERIMENTS WAVE AND ROLL TIME HISTORIES**

**Model No. 2446**

**Project: "EMSA 1"**

**Damage Case-2 R7\_P6-7.4.0**

**Irregular Beam Seas**

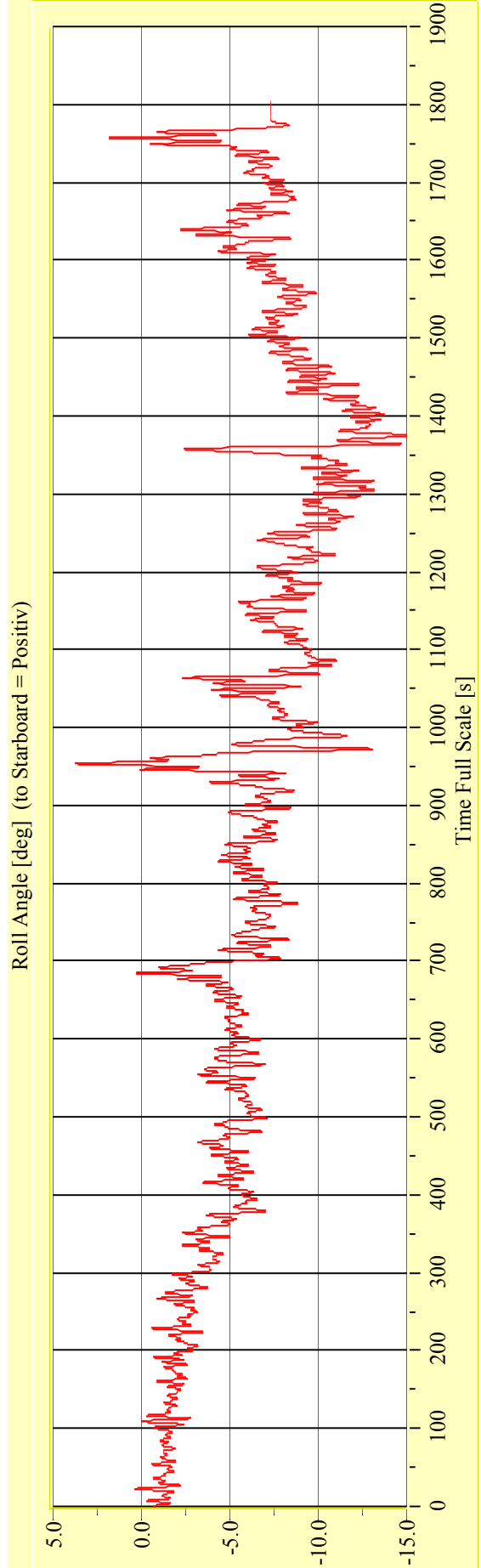
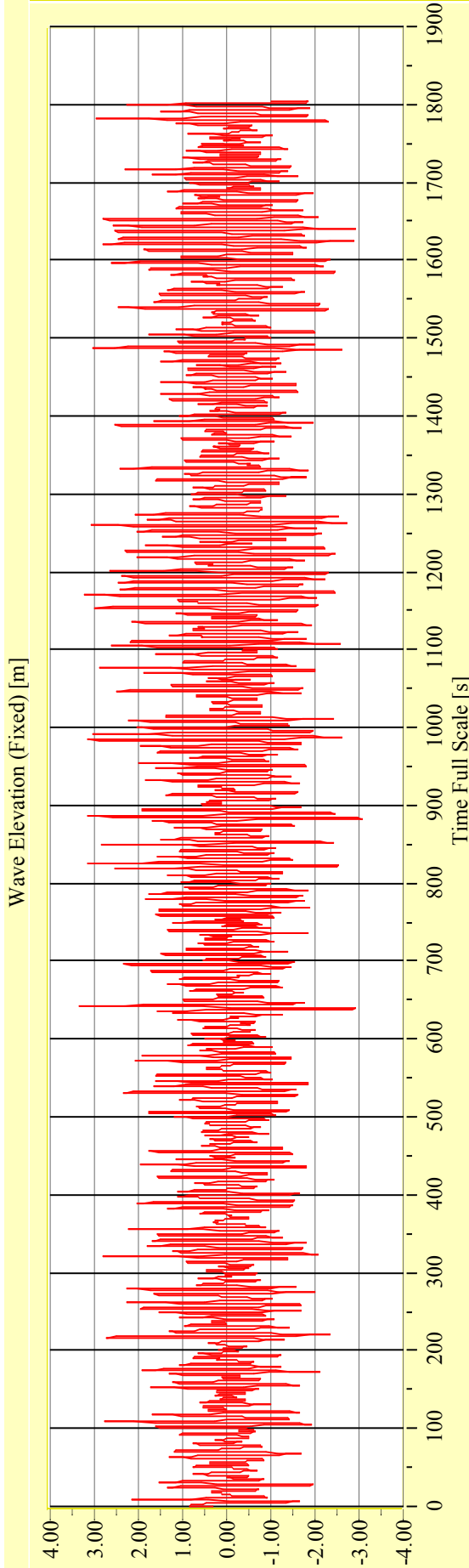
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29663-01**

**Target Waves: Hs = 4.0 m Tp = 8.0 s**

**gamma = 3,3**





**Irregular Beam Seas**

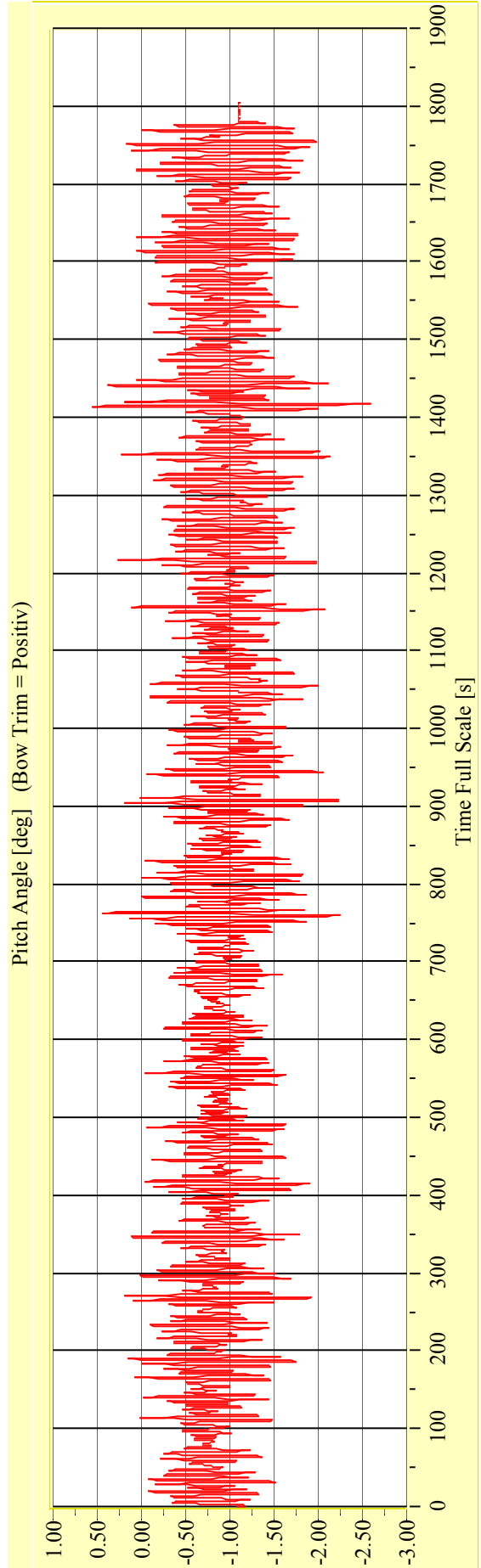
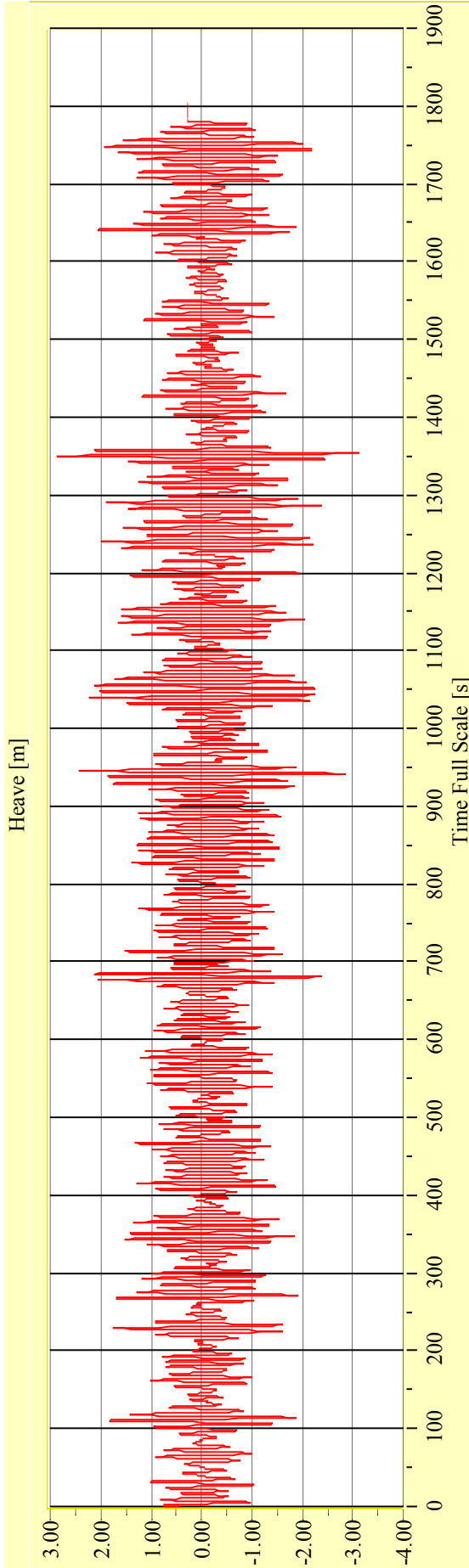
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29663-01**

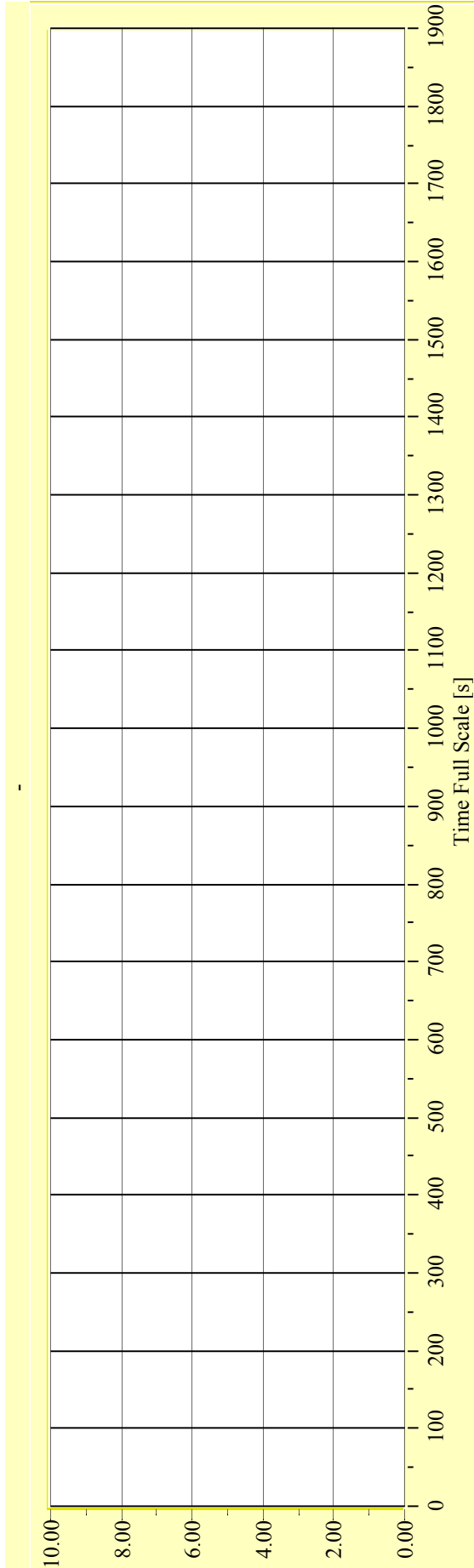
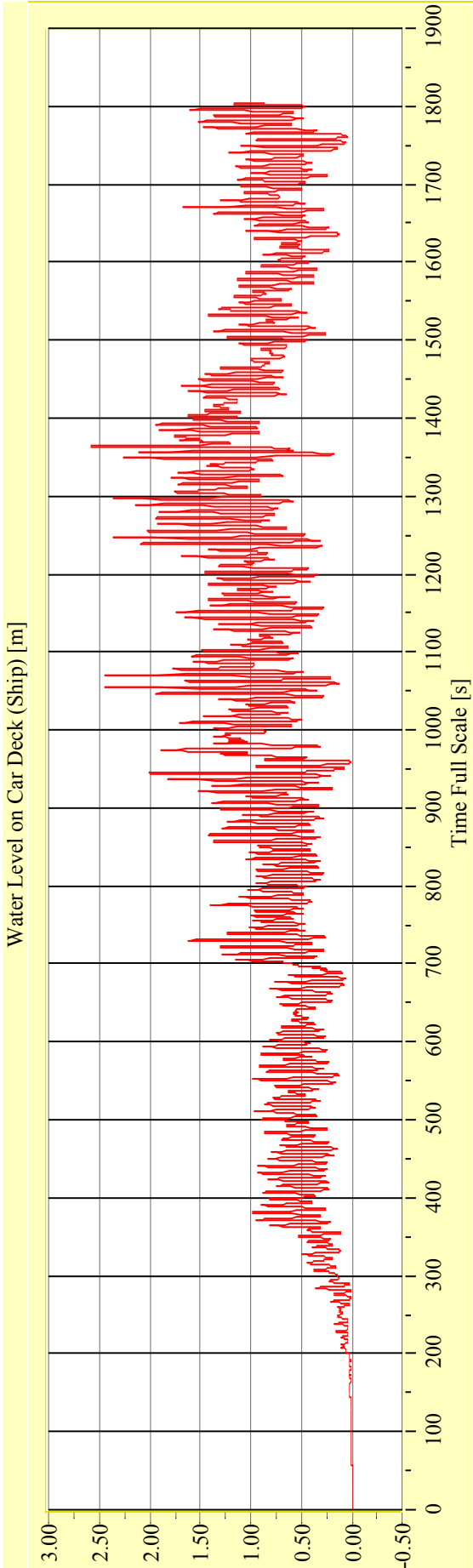
**Target Waves: Hs = 4.0 m Tp = 8.0 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29663-01**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**



**Date: 28.04.2010**      **Project: EMSA 1**      **Damage 2: R7\_P6-7.4.0**

**Irregular Beam Seas**

**Vienna Model Basin**

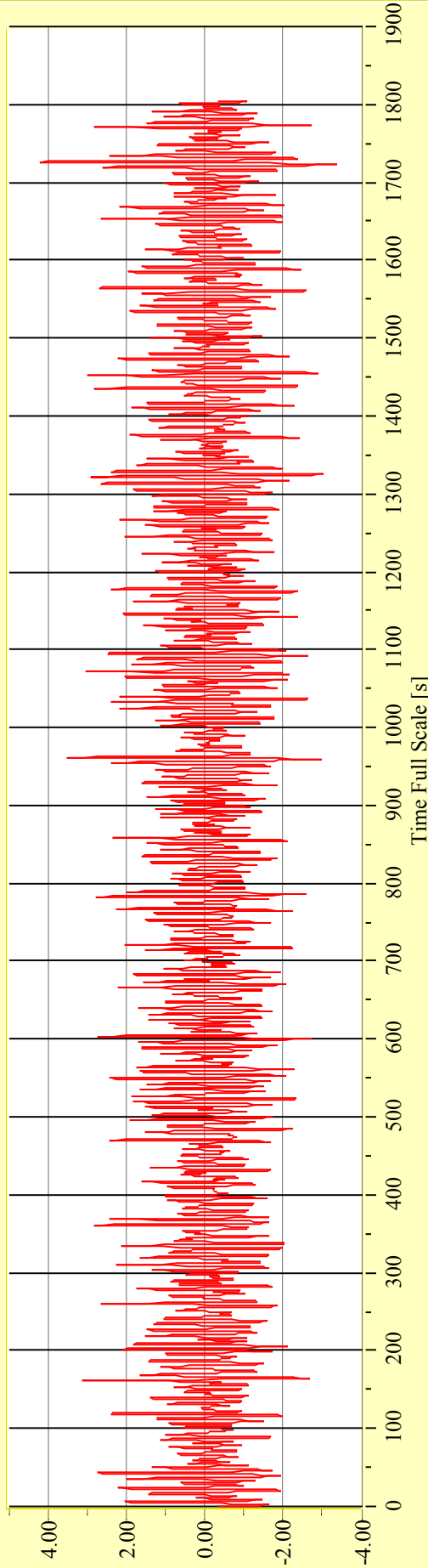
**Model No. 2446**

**Test No. 29663-02**

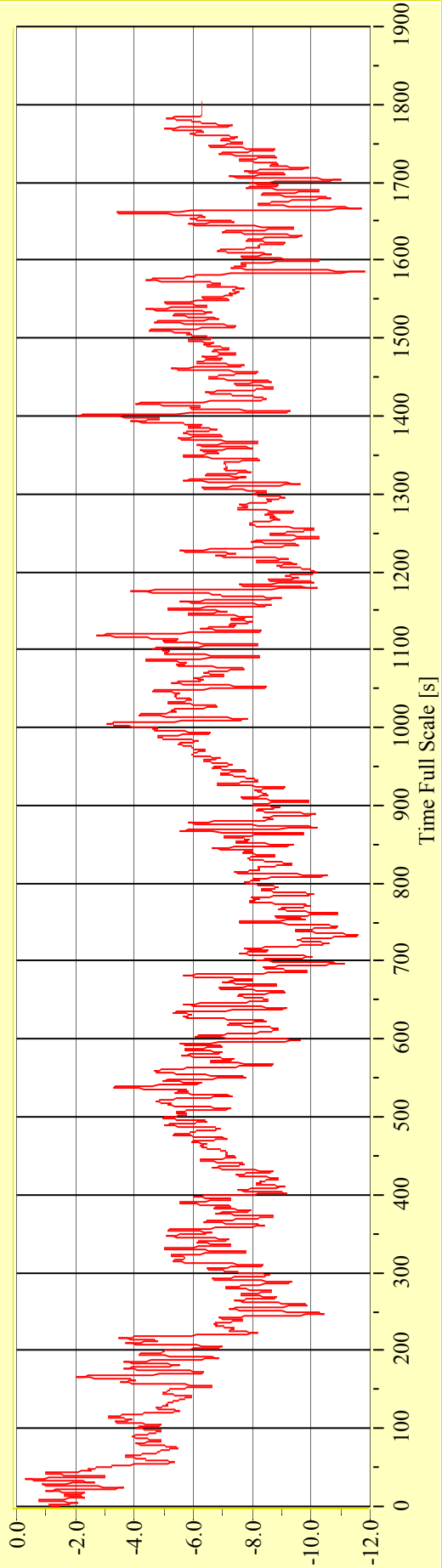
**Target Waves: Hs = 4.0 m Tp = 8.0 s**

**gamma = 3,3**

Wave Elevation (Fixed) [m]



Roll Angle [deg] (to Starboard = Positiv)



Irregular Beam Seas

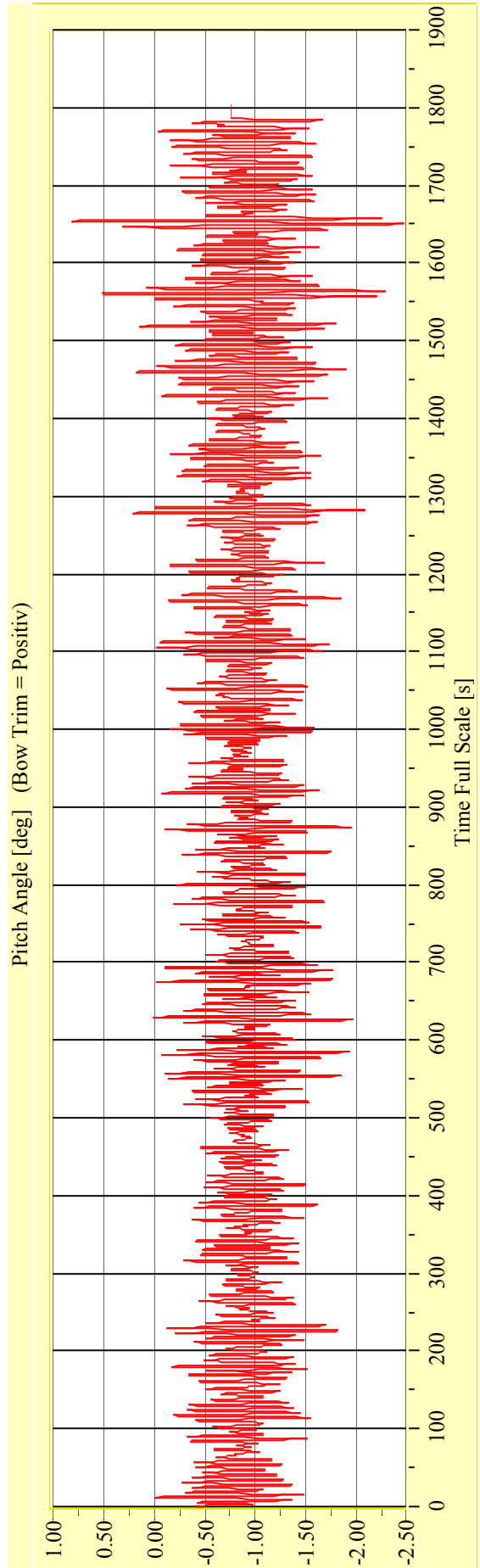
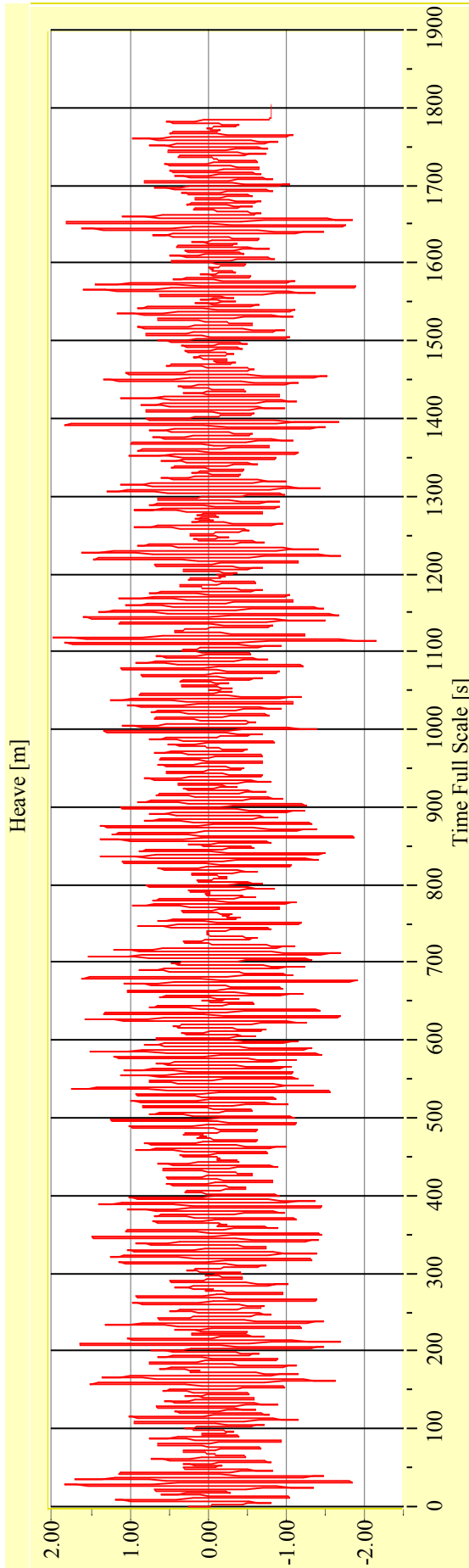
Vienna Model Basin

Model No. 2446

Test No. 29663-02

Target Waves: Hs = 4.0 m Tp = 8.0 s

gamma = 3,3



**Irregular Beam Seas**

**Vienna Model Basin**

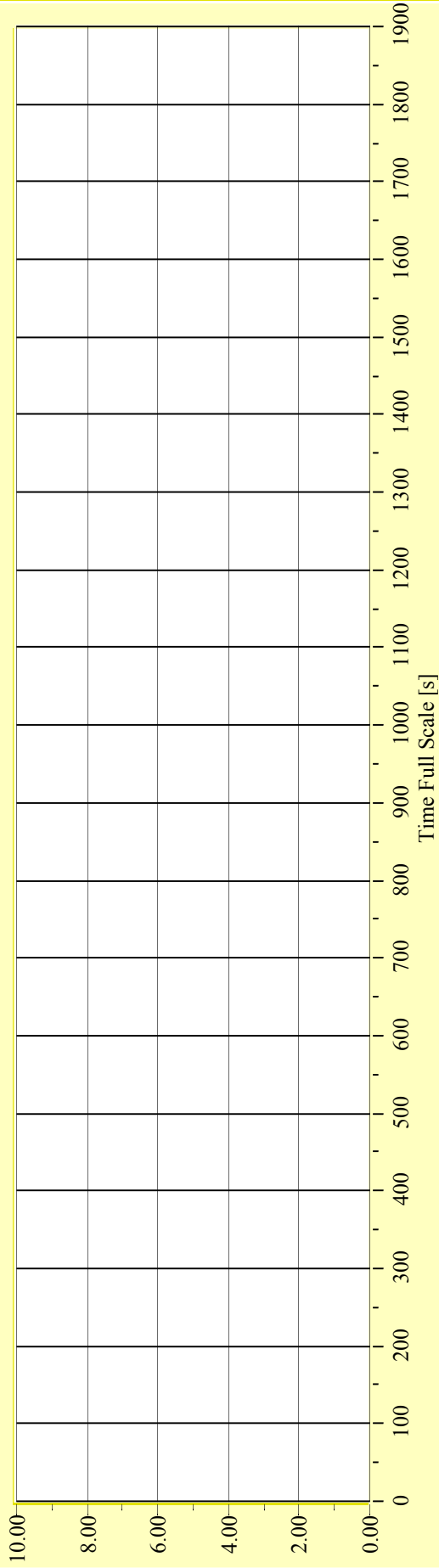
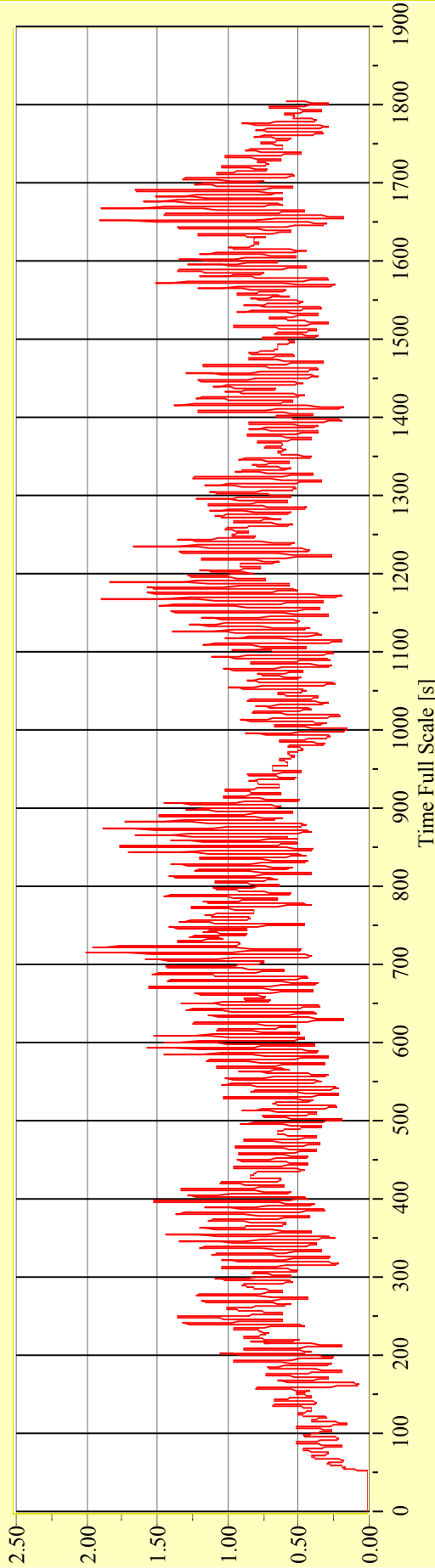
**Model No. 2446**

**Test No. 29663-02**

**Target Waves: Hs = 4.0 m Tp = 8.0 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



**Date: 28.04.2010**

**Project: EMSA 1**

**Damage 2: R7\_P6-7.4.0**

**Irregular Beam Seas**

**Vienna Model Basin**

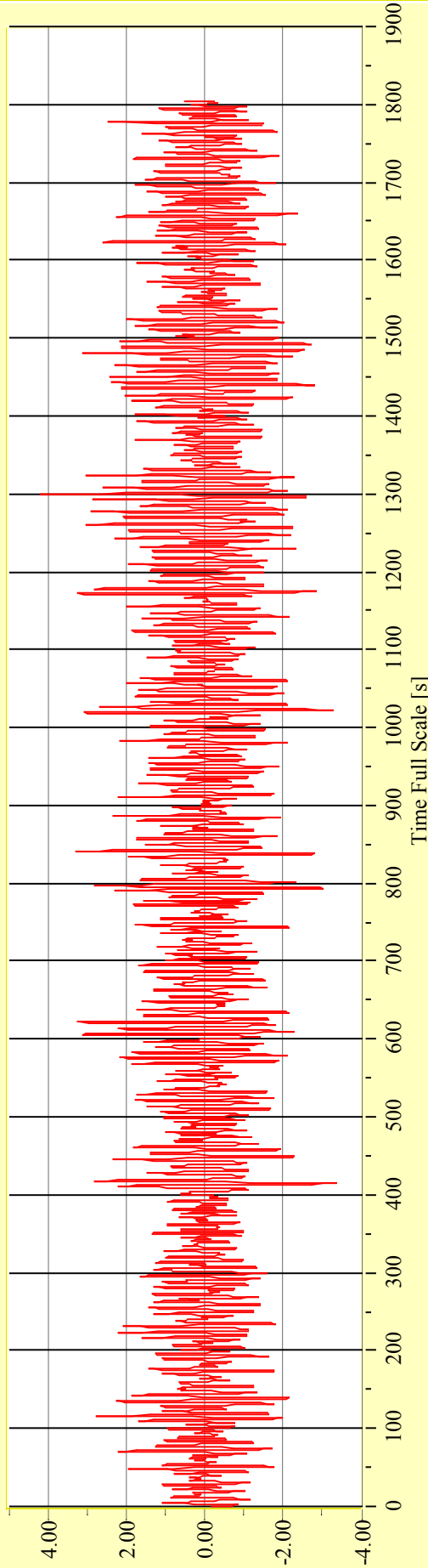
**Model No. 2446**

**Test No. 29663-03**

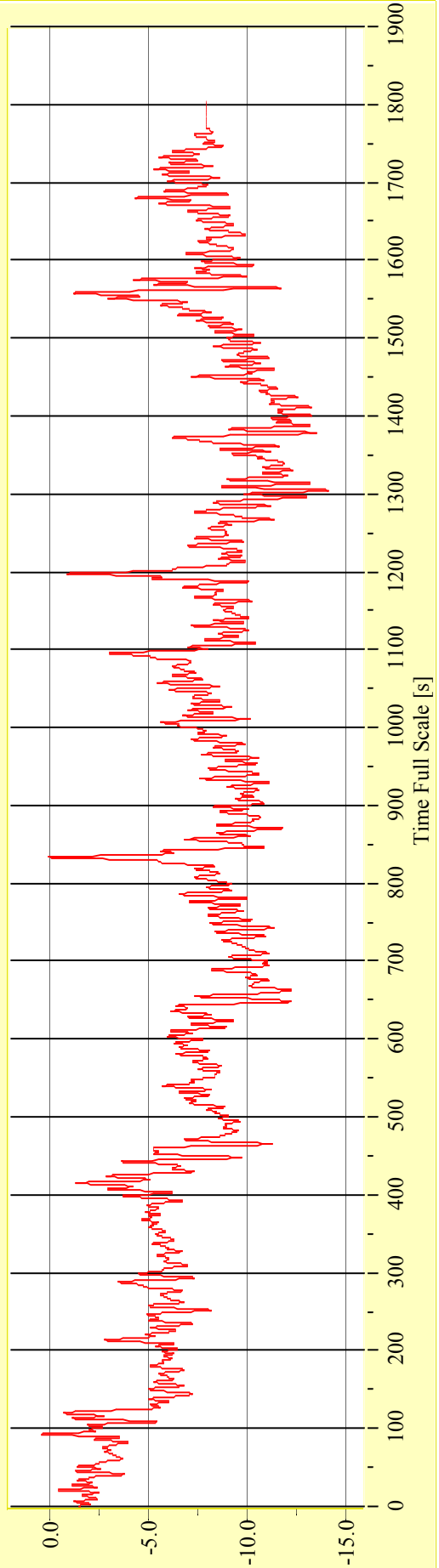
**Target Waves: Hs = 4.0 m Tp = 8.0 s**

**gamma = 3,3**

Wave Elevation (Fixed) [m]



Roll Angle [deg] (to Starboard = Positiv)



**Irregular Beam Seas**

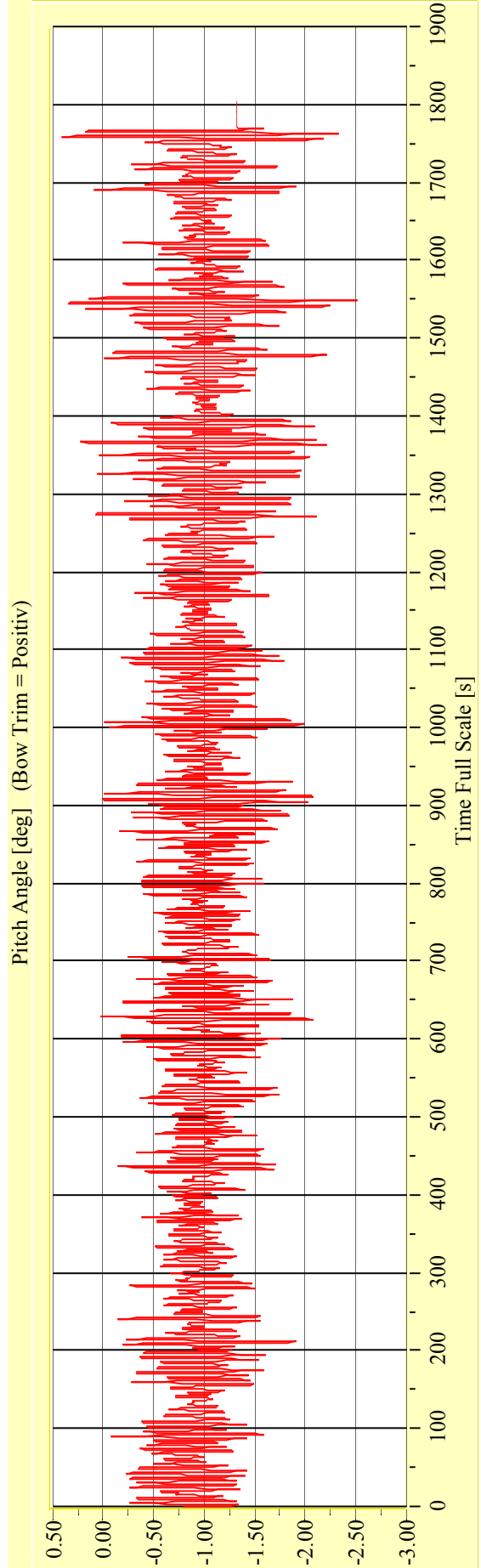
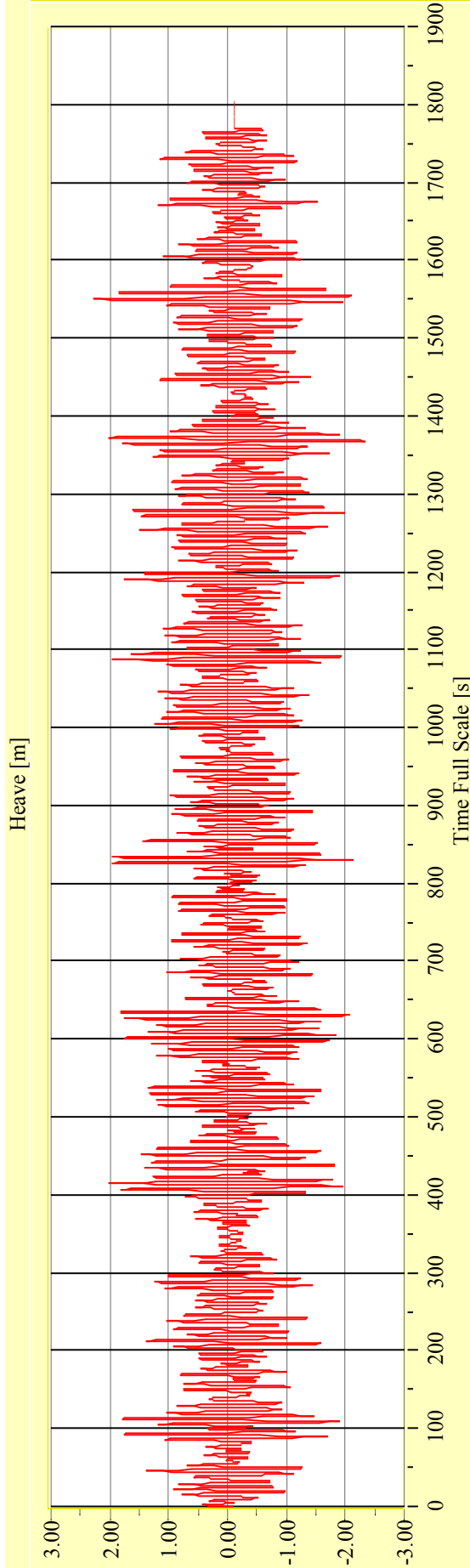
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29663-03**

**Target Waves: Hs = 4.0 m Tp = 8.0 s**

**gamma = 3,3**



Irregular Beam Seas

Vienna Model Basin

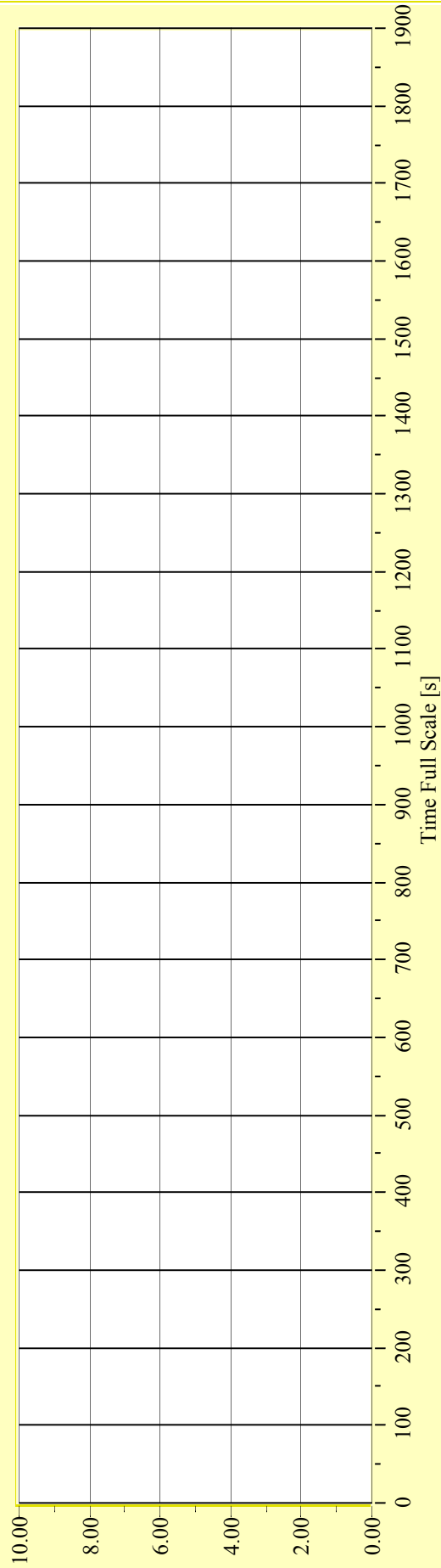
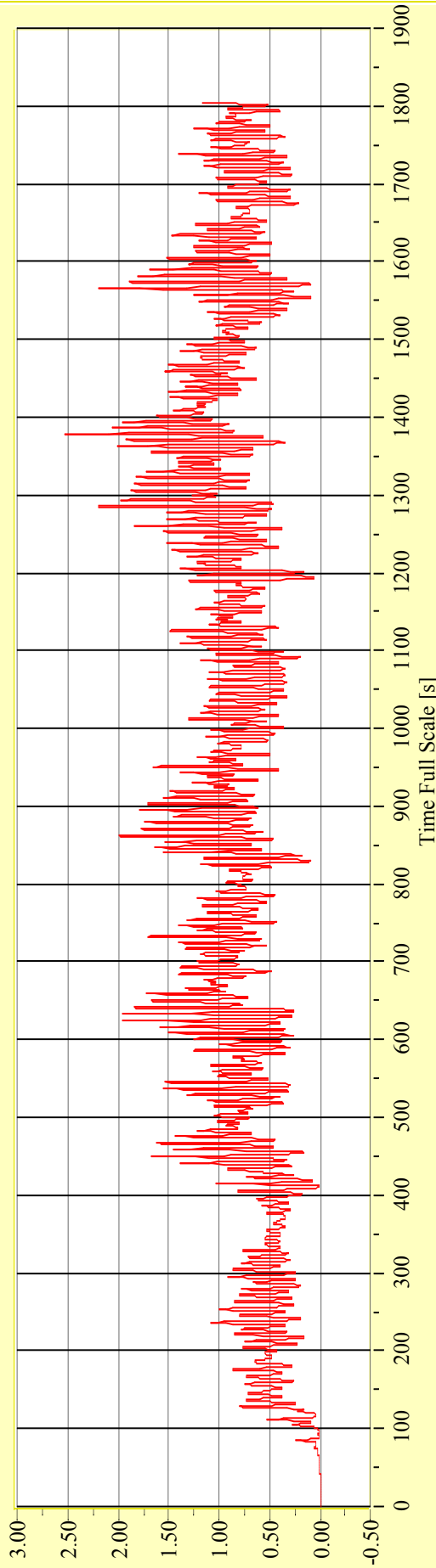
Model No. 2446

Test No. 29663-03

Target Waves: Hs = 4.0 m Tp = 8.0 s

gamma = 3,3

Water Level on Car Deck (Ship) [m]





**Irregular Beam Seas**

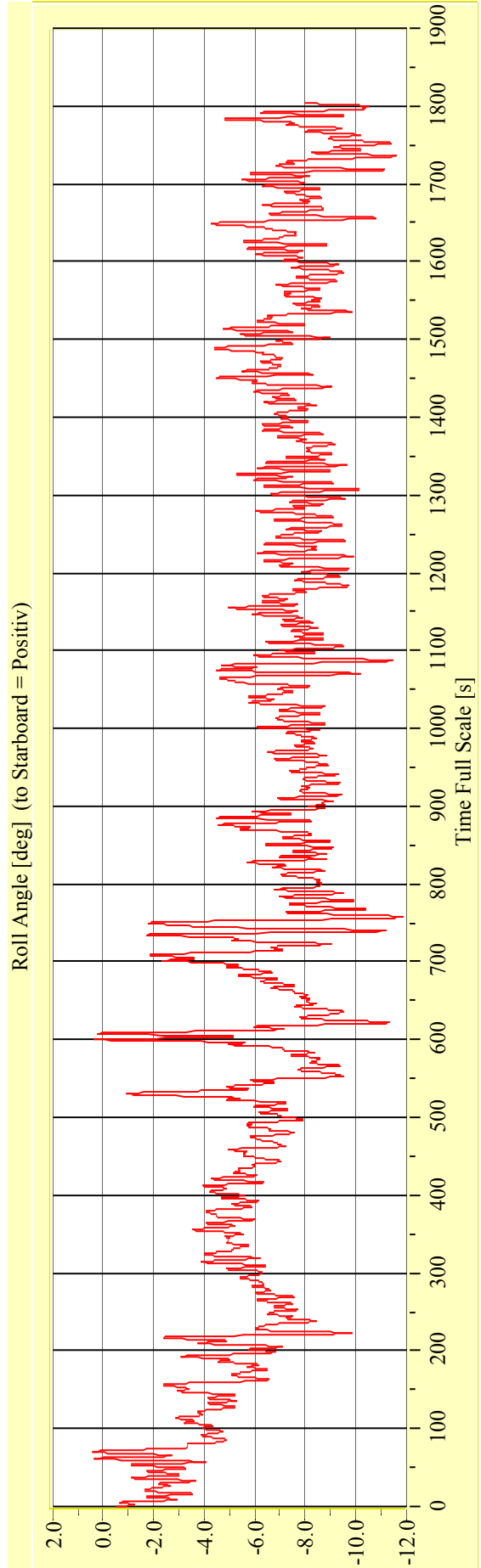
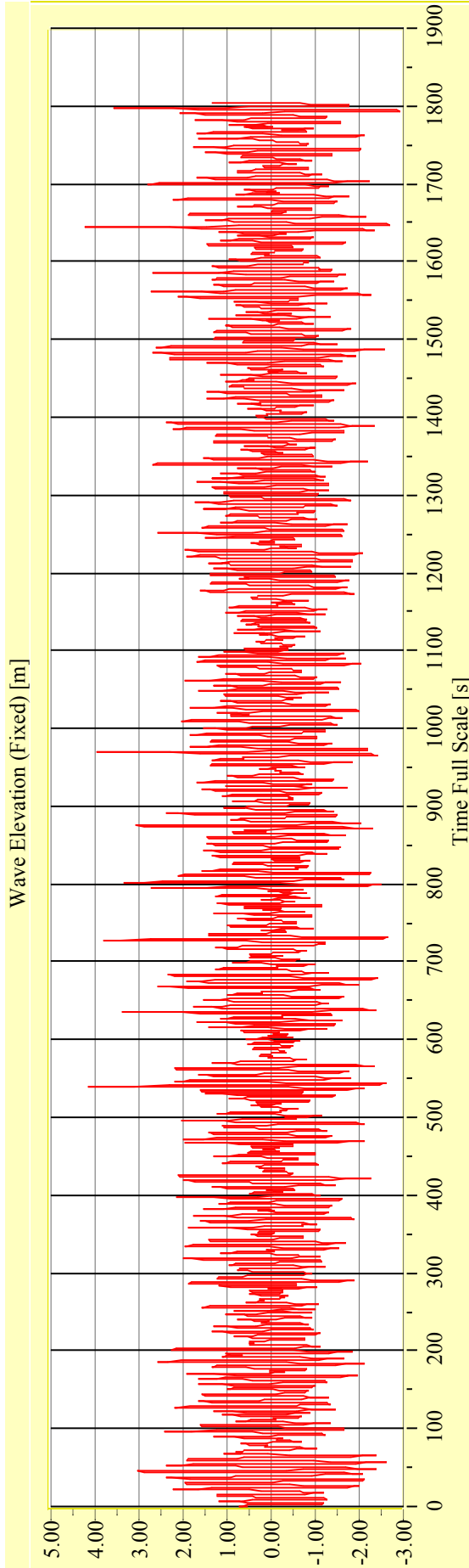
**Vienna Model Basin**

**Model No. 2446**

**Test No. 29663-04.2**

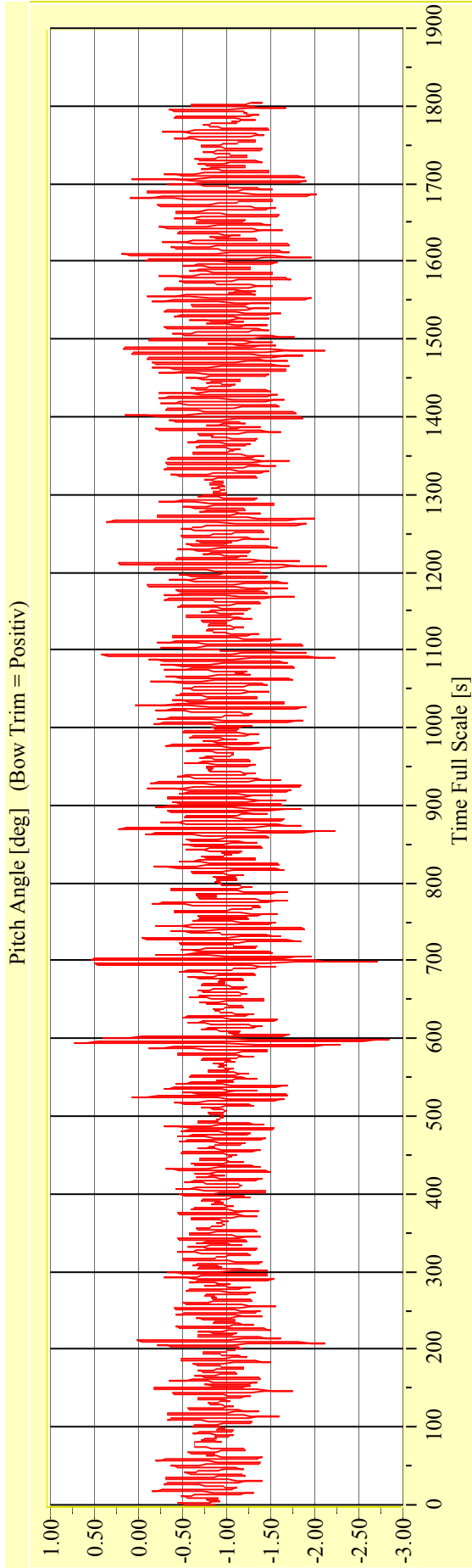
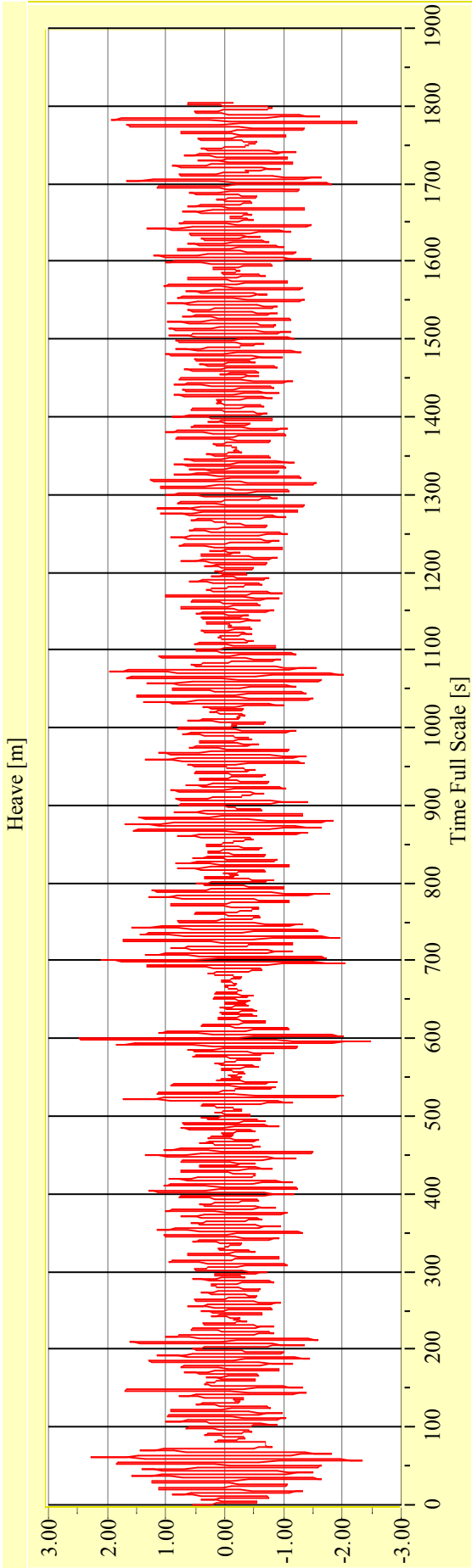
**Target Waves: Hs = 4.0 m Tp = 8.0 s**

**gamma = 3,3**



**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29663-04.2**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**



**Date: 28.04.2010**      **Project: EMSA 1**      **Damage 2: R7\_P6-7.4.0**

**Irregular Beam Seas**

**Vienna Model Basin**

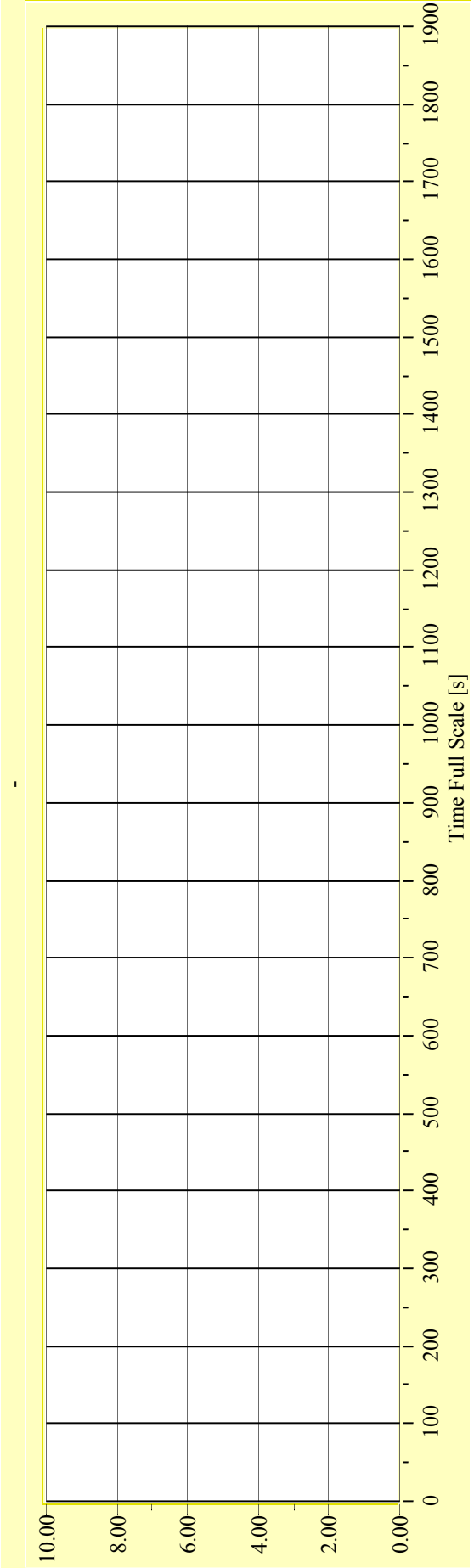
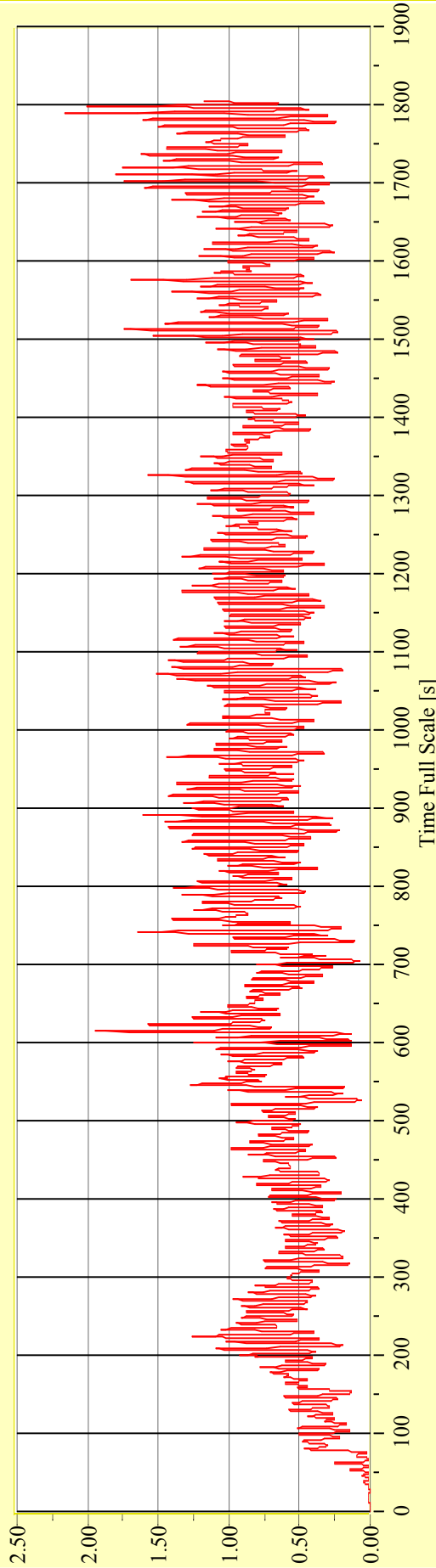
**Model No. 2446**

**Test No. 29663-04.2**

**Target Waves: Hs = 4.0 m Tp = 8.0 s**

**gamma = 3,3**

Water Level on Car Deck (Ship) [m]



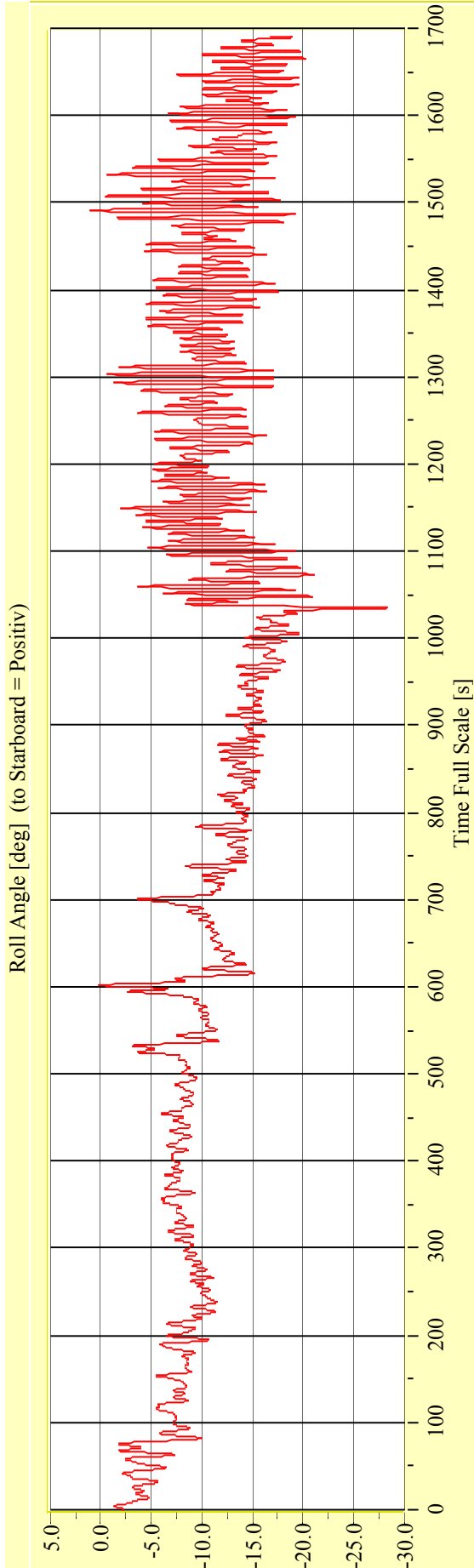
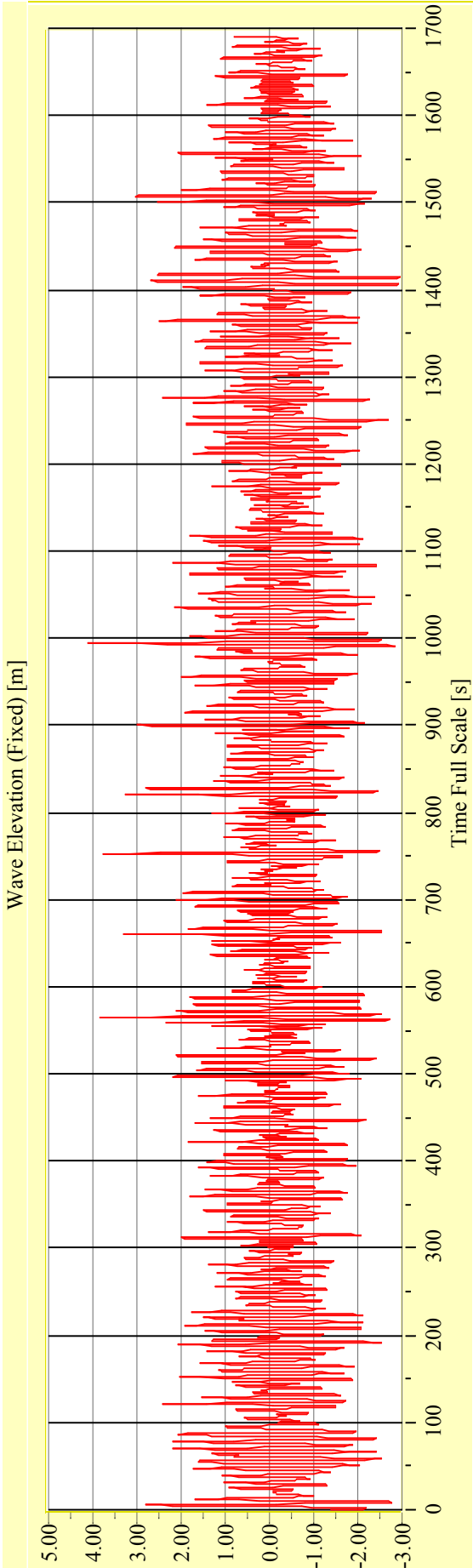
**Date: 28.04.2010**

**Project: EMSA 1**

**Damage 2: R7\_P6-7.4.0**

**Irregular Beam Seas**

**Vienna Model Basin**      **Model No. 2446**      **Test No. 29663-04**      **Target Waves: Hs = 4.0 m Tp = 8.0 s**      **gamma = 3,3**



**Date: 28.04.2010**      **Project: EMSA 1**      **Damage 2: R7\_P6-7.4.0**