

SAT Quality Indicators & Doppler Effect measurements

5th Automated Behavior Monitoring and Advanced Analytics (ABM) Workshop

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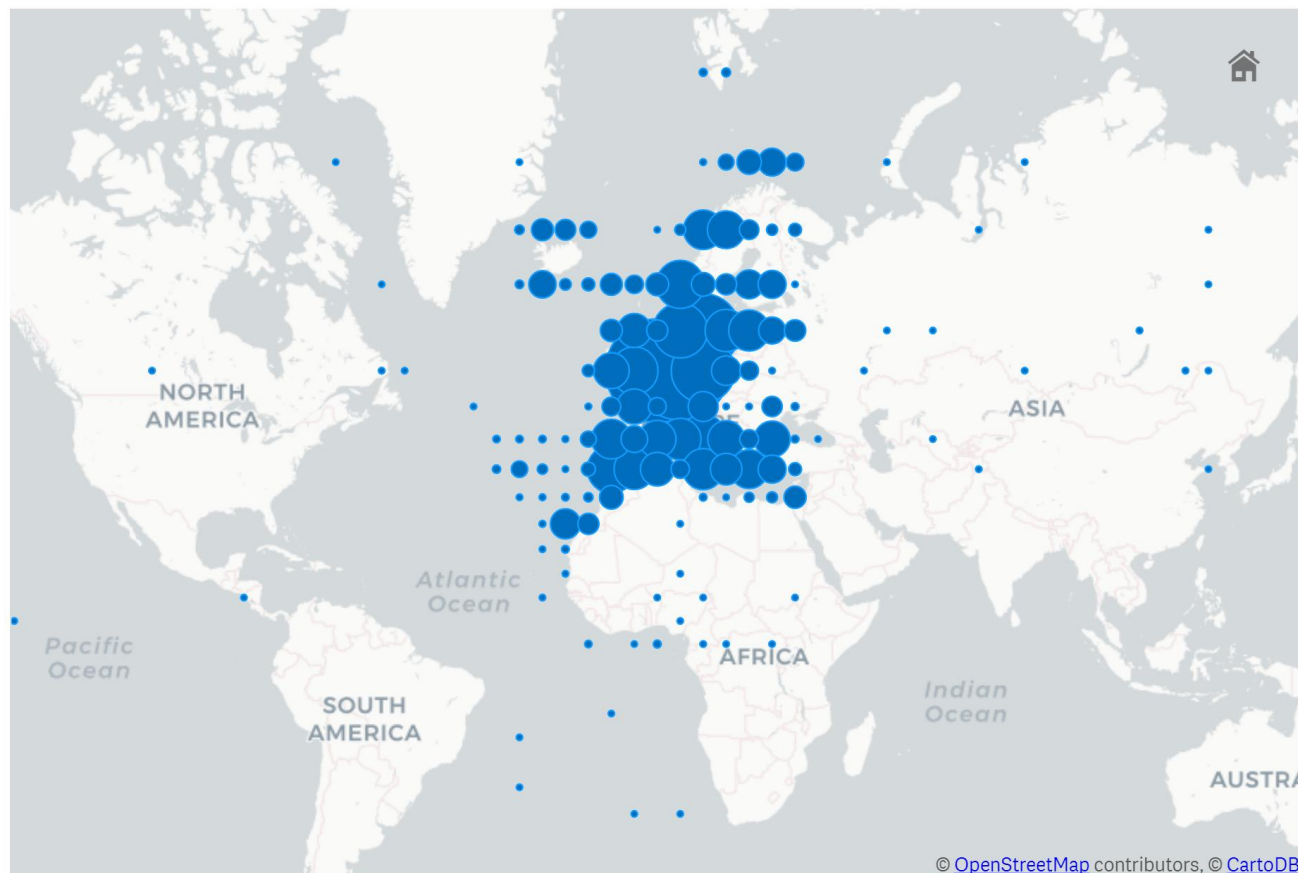
Department C: Coordination and Innovation

Lisbon, 4th December 2019



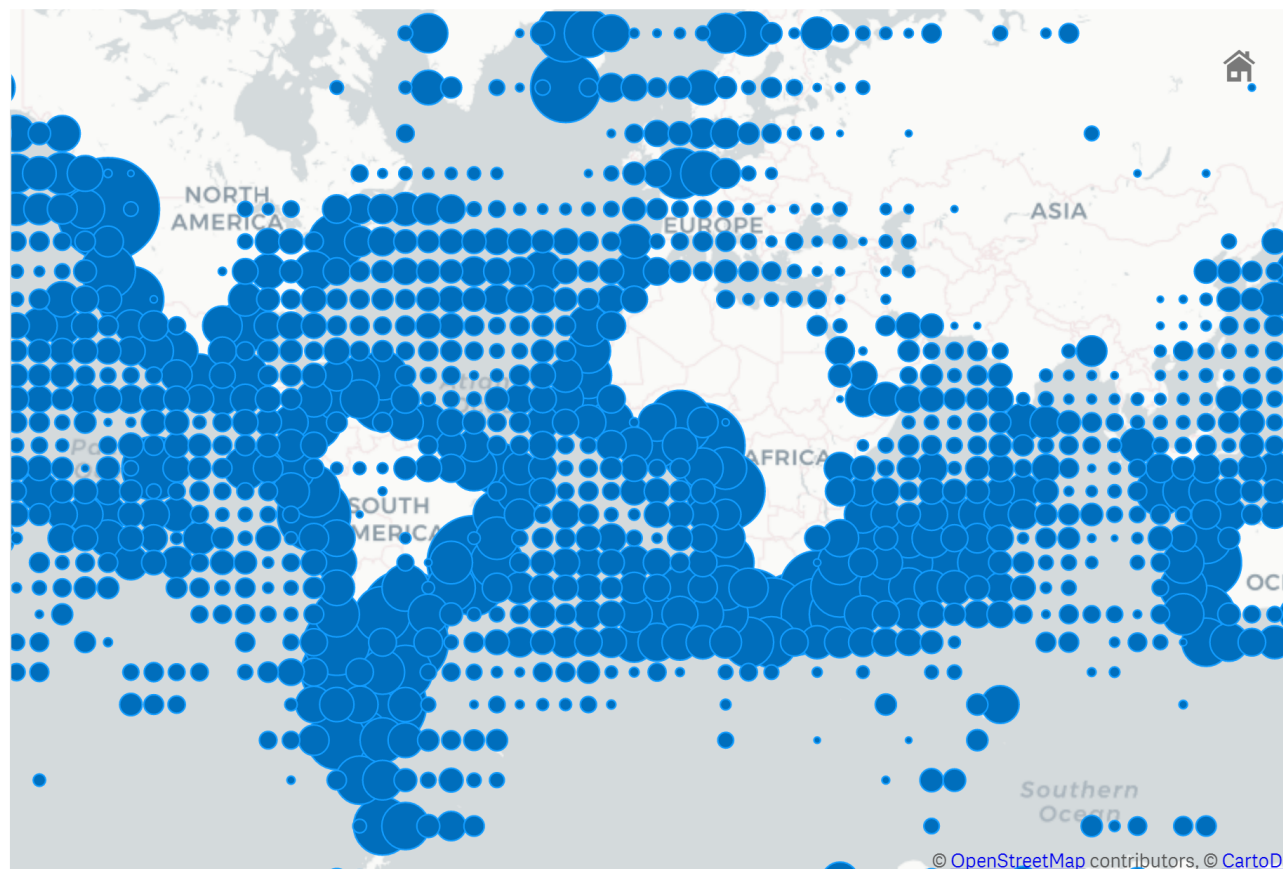
T-AIS Coverage

#Positions by 5x5 grid
Volume (size)



SAT-AIS Coverage

#Positions by 5x5 grid
Volume (size)



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Norway:

- AISSat-1
- AISSat-2
- NorSat-1
- NorSat-2
- 2x ground stations



Luxspace (OrbComm)

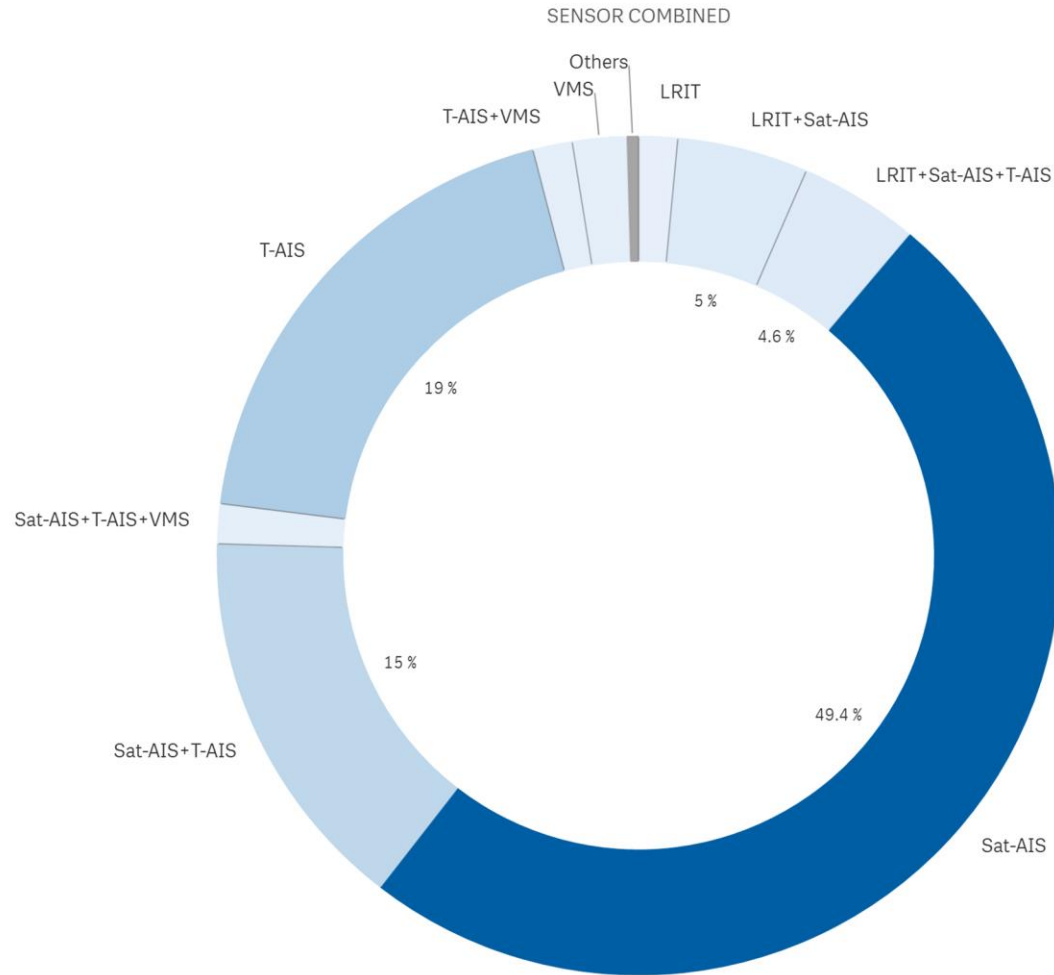
- 14x Orbcomm 2nd Generation constellation
- 2x AprizeSat
- 16x ground stations.



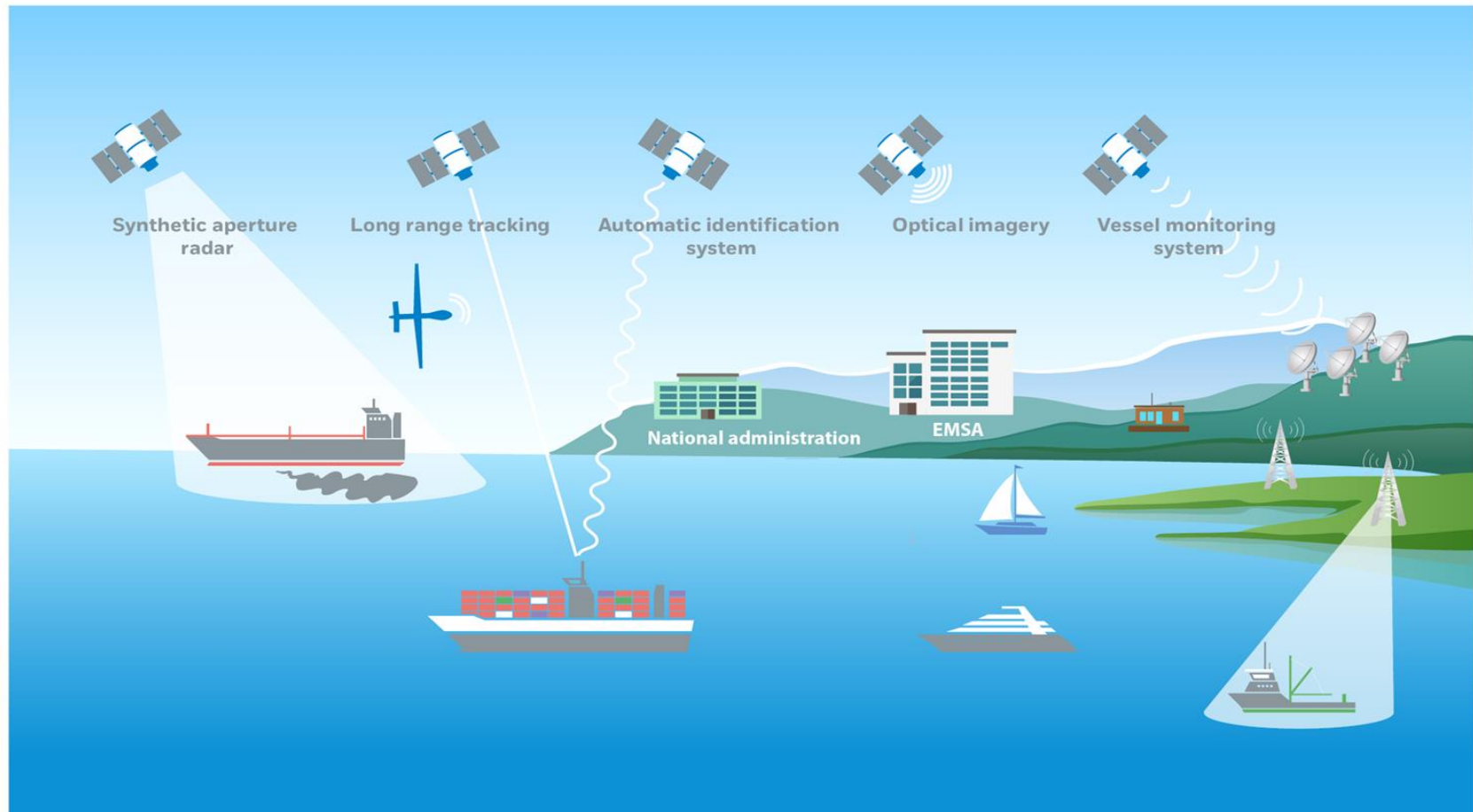
Hisdesat (ExactEarth):

- 58x Iridium NEXT constellation
- 7x in-orbit spares
- 3x Ground Stations

#Vessels by Combination of sensors in last 30 days



Satellite Data Sources



Main factors having negative impact on AIS performance:

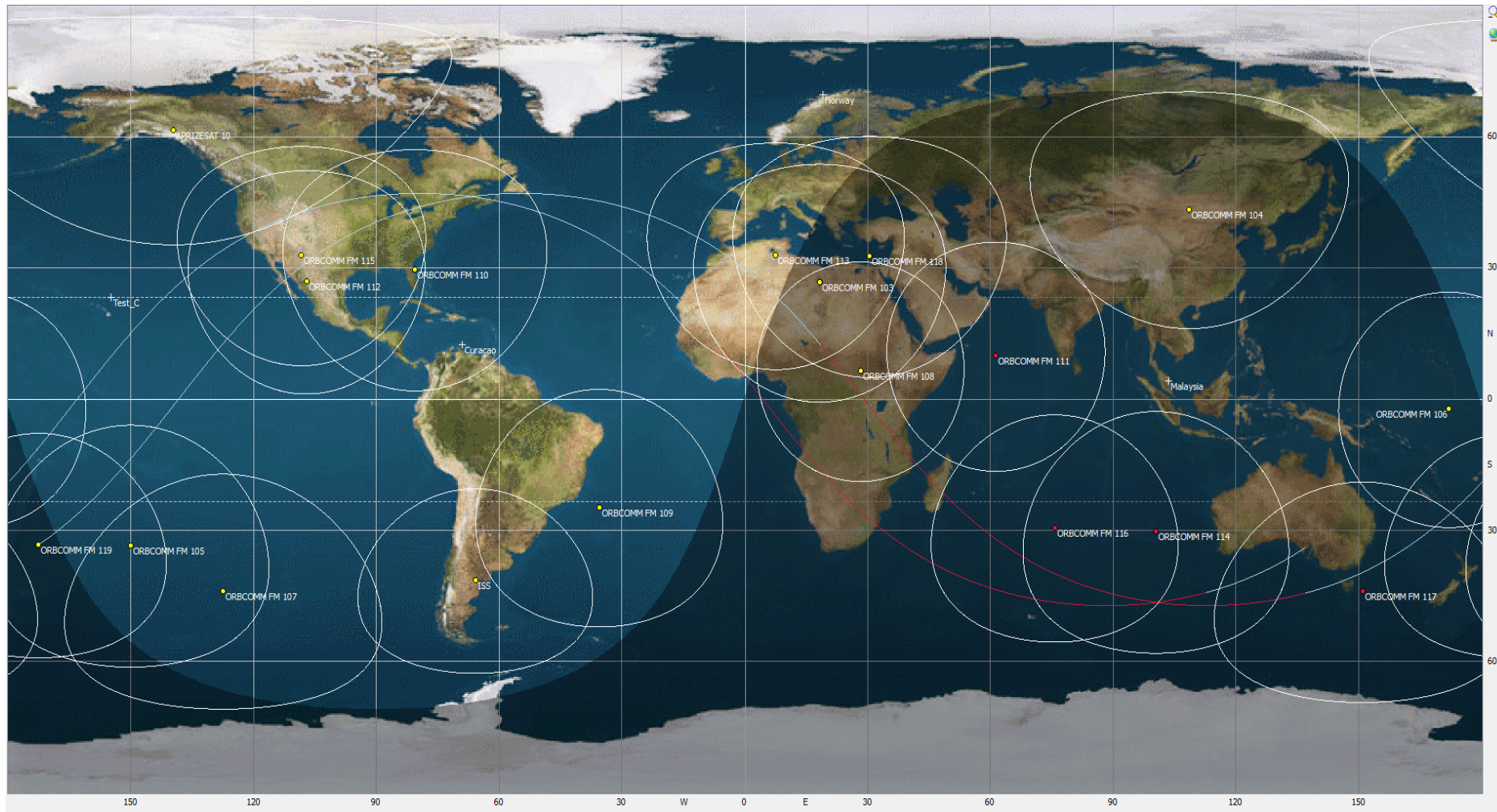
- **congested areas** – traffic density makes likely that the radio emissions transmitted by a large volume of AIS transponders cause message collision (reception of an AIS message at the same time or the saturation of the receiver);
- **VHF antenna propagation** – due to characteristic of the VHF antenna sets, which are used on board of ships, the signal emitted vertically is much lower than horizontal emission. In addition, line of sight might be obstructed or due to the incorrect installation (cable loss) the Tx power might be limited.
- **land mobile devices** - The regulatory status of SAT- AIS states that maritime AIS frequencies are only on a secondary basis - in some countries the 162MHz band is used for voice communication by TAXI operators;
- **other RF noise interferences** – urban/industrial areas or offshore installations have significant negative impact on the overall AIS data exchange performance.

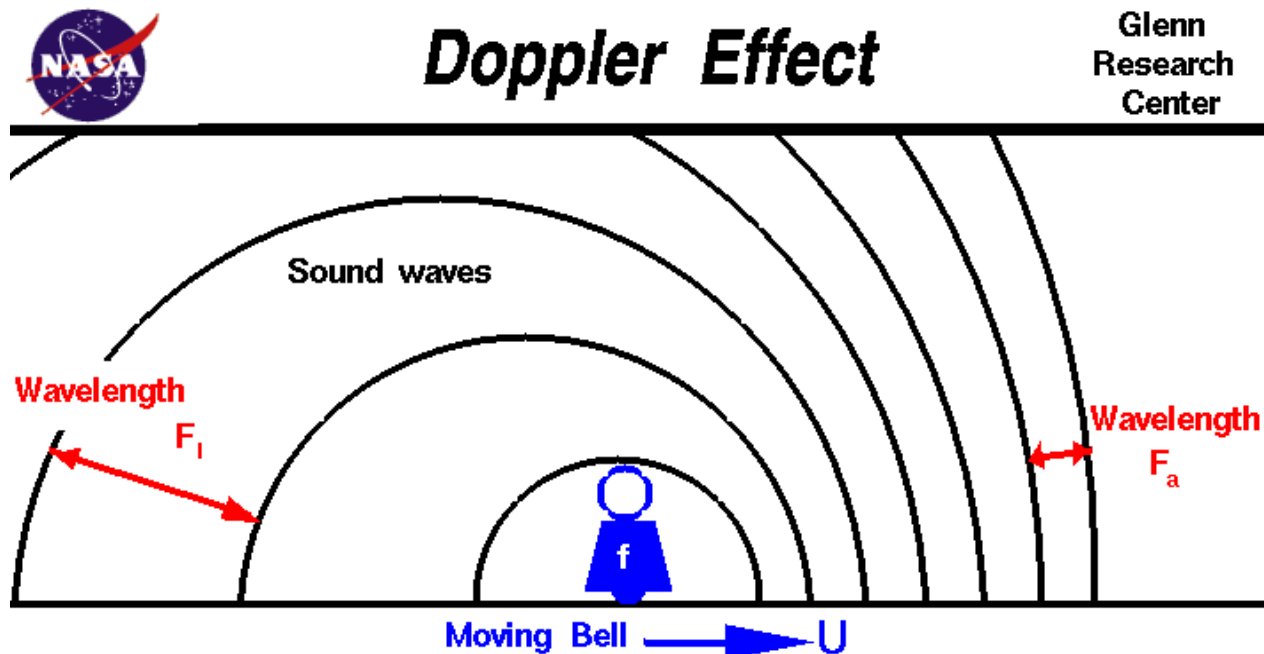
- VDES: a means for facilitating digital data exchange - in line with the European Commissions' perspective on Digitalization and EMSA strategy plan;
- Providing support to the European Commission and Member States on matters related to VDES (i.e. at IMO on EU coordinated position on VDES for WRC 19);
- Collaborating further with ESA on VDES following the successful joint ESA-EMSA SAT-AIS initiative - EMSA is providing global SAT-AIS data services to its providers;
- Expanded the remit of the EU SAT-AIS Collaborative Forum (EMSA Chairs) also to cover VDES;
- Sees huge potential for VDES (VDES-SAT) particularly in providing the means to enable a ship to transmit and receive data packages to a coastal administration.
- Teamed up with ESA and Norway for a VDE-SAT demonstration activity presently under preparation.

For all provided AIS messages, the parameter aiming at providing information on the data quality shall contain a 2-digit number where the first digit refers to the level of processing to which the data has been subjected to before being sent through the proxy. The second digit represents quality of the position/ level of confidence. Data quality indicators shall cover at least the three following reports:

- a) **A valid position report** - element **Q=32 - a valid position**. The measured and computed values are close enough for the message to be considered valid. In any case, at least it can be determined for sure that the reported position is within the satellite footprint;
- b) **An invalid position report** - element **Q=31 – an invalid position**. There is a discrepancy between the measured and the computed values;
- c) **An uncertain position report** - Element **Q=12 – the status of the position is uncertain**. The Contractor does not have enough information to perform the check. This applies for example to messages which do not contain a position information or do not contain a valid position information.

Satellite constellation





Wavelength (λ) X Frequency (f) = Speed of Sound (a)

Long Wavelength ~ Low Frequency

Short Wavelength ~ High Frequency

Leaving: $F_l = f \frac{a}{a + U}$

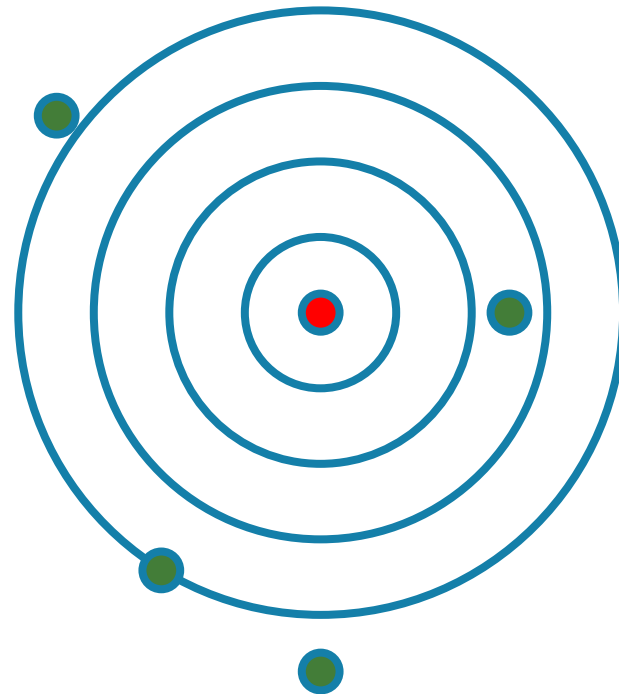
Lower Pitch $F_l < f$

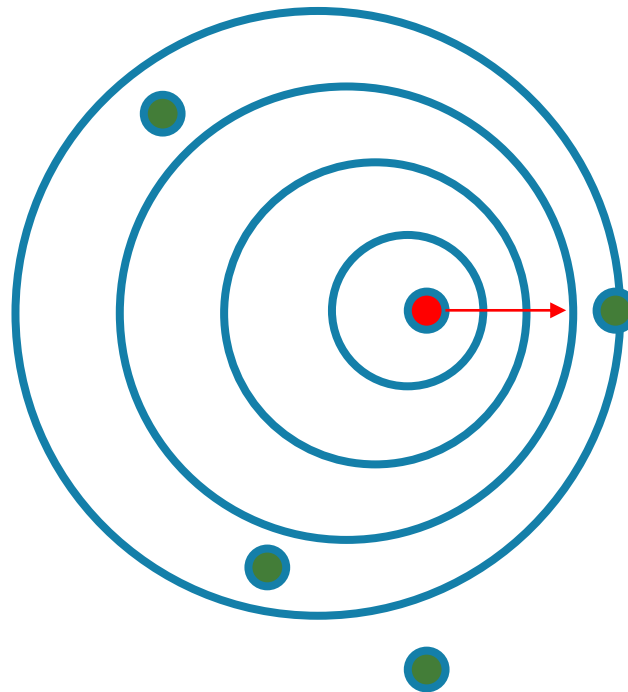
Approaching: $F_a = f \frac{a}{a - U}$

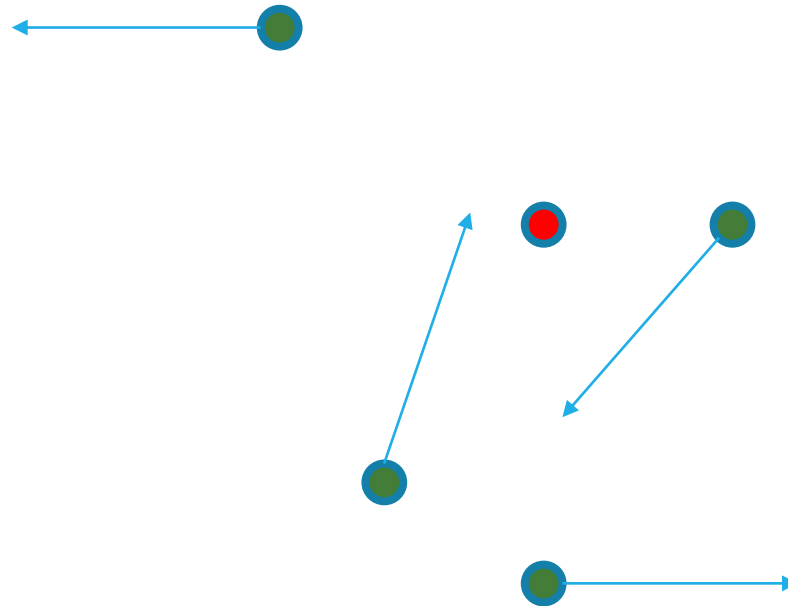
Higher Pitch $F_a > f$

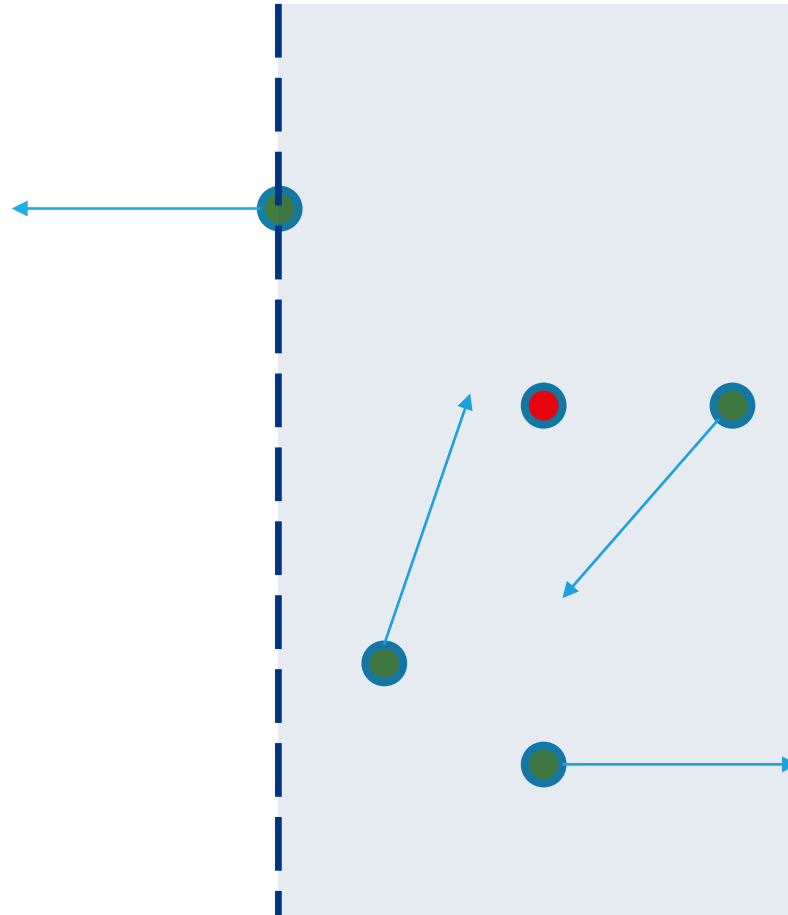
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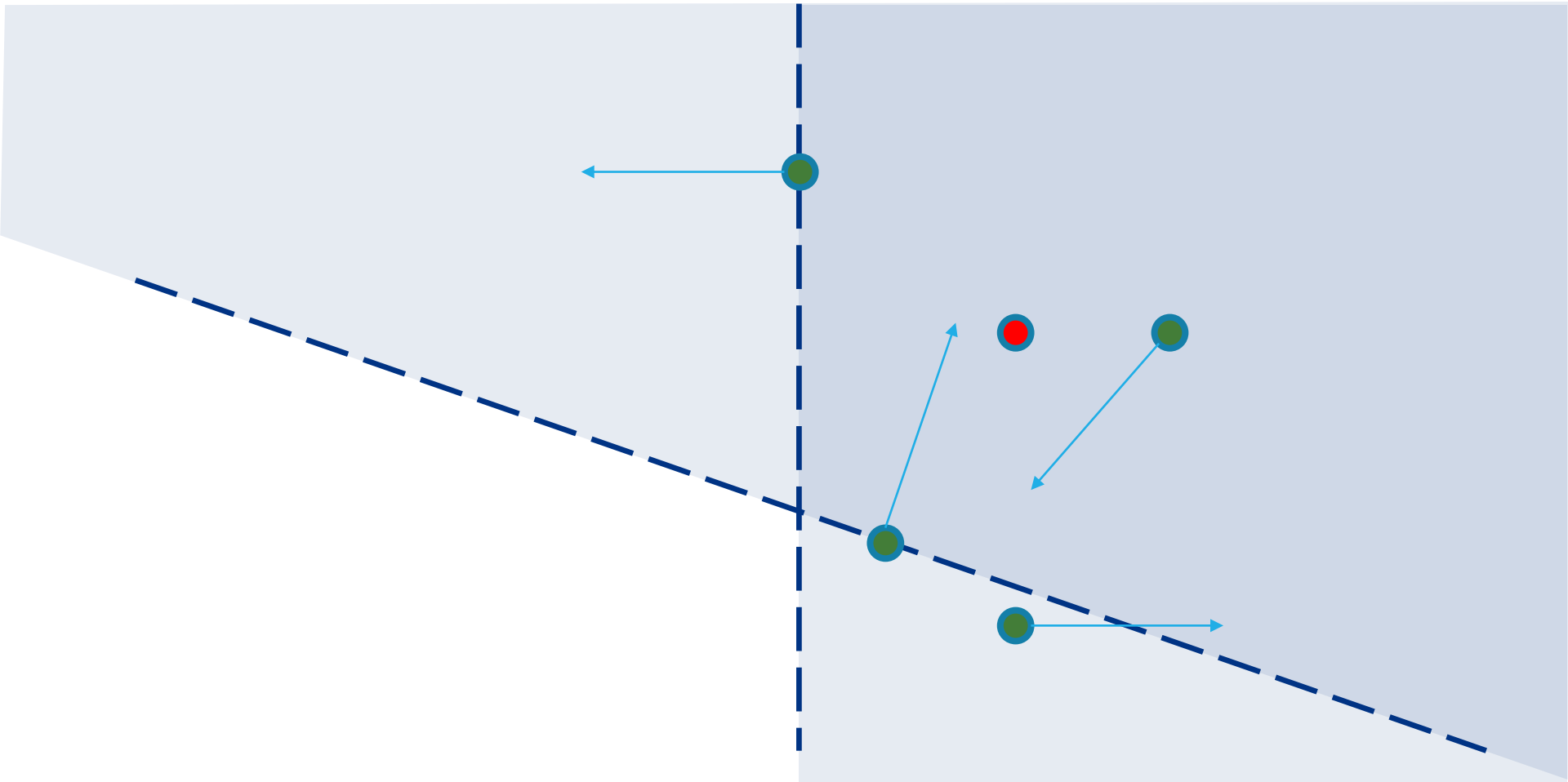
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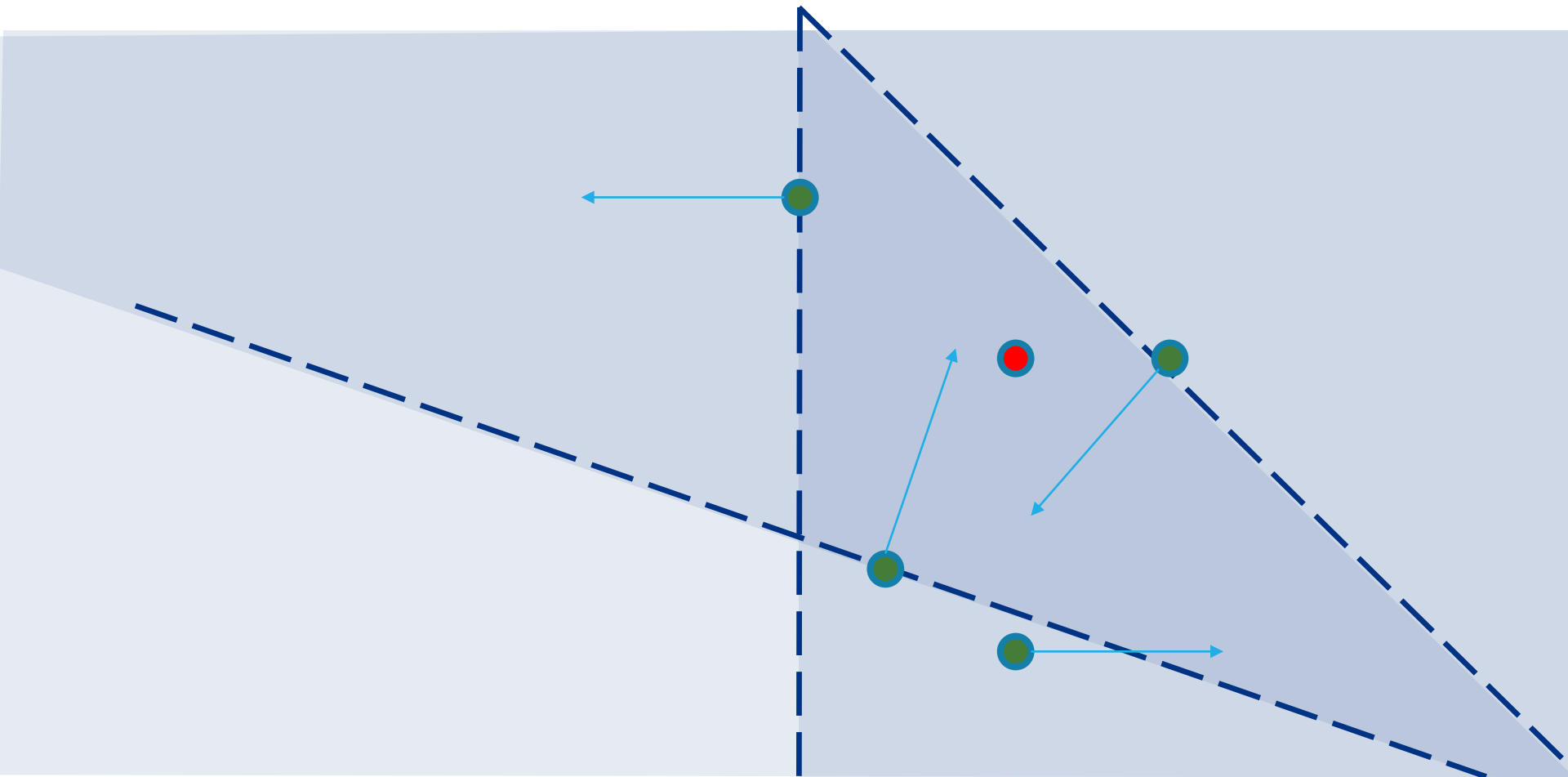


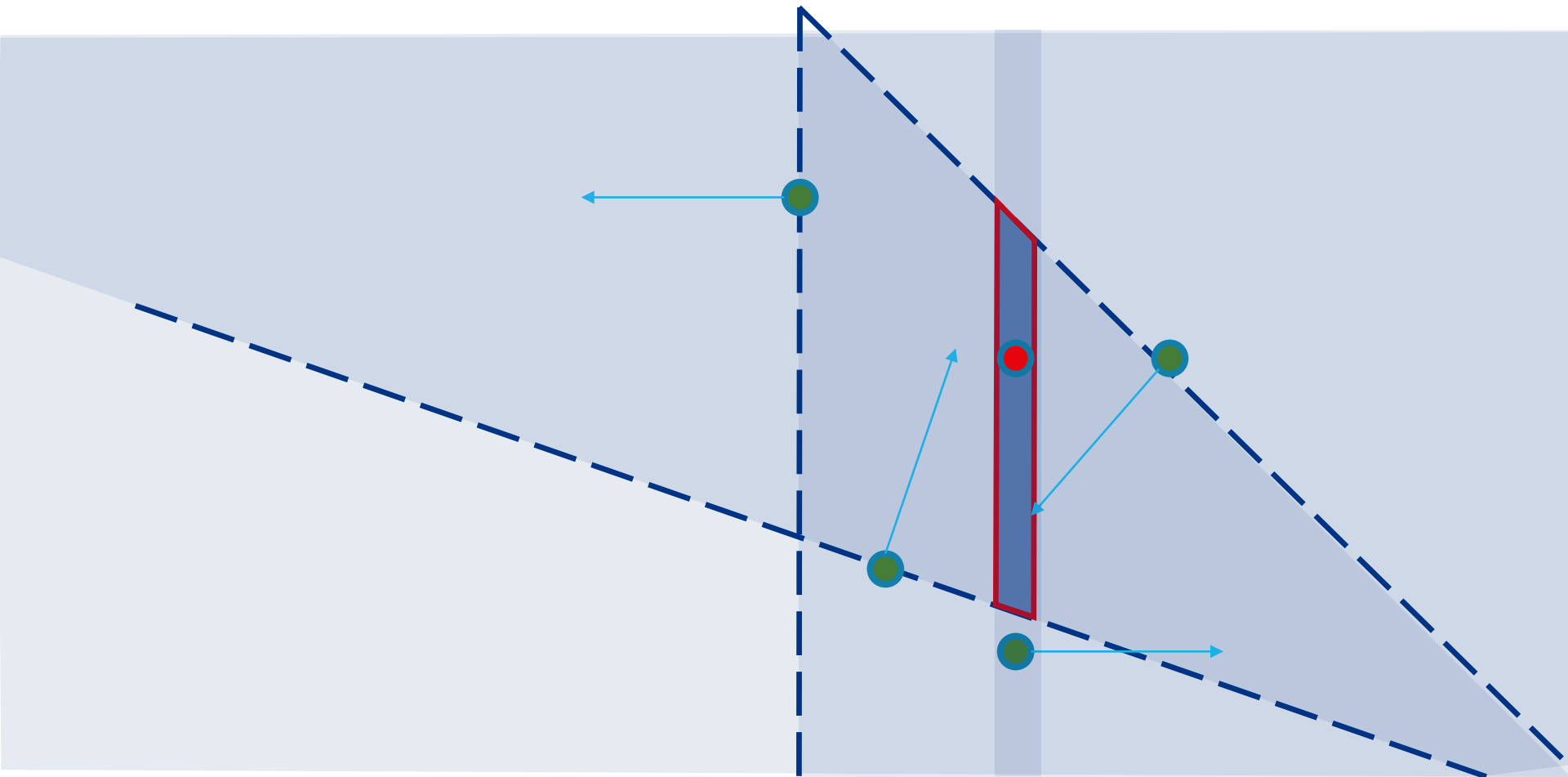


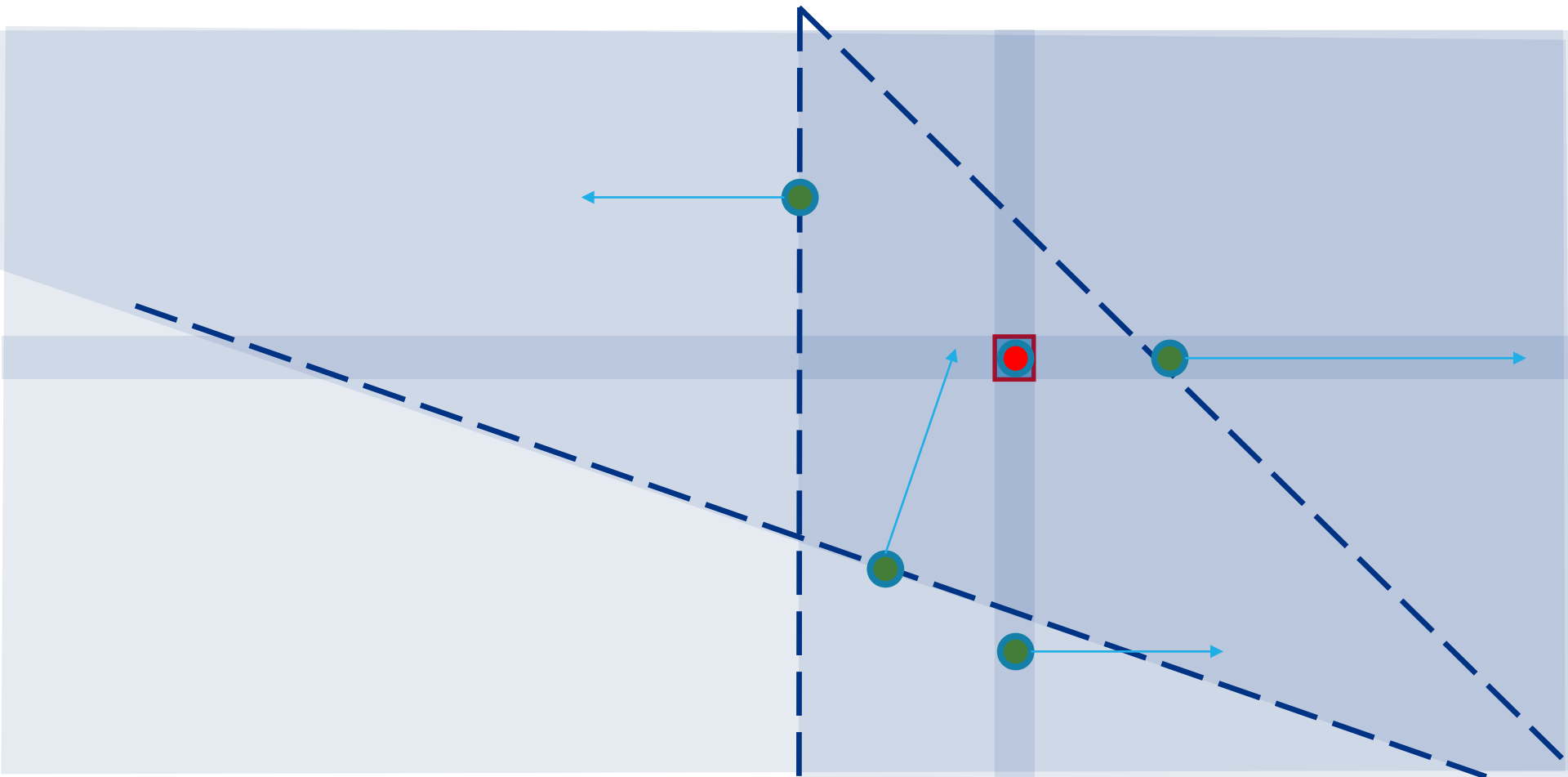












Thank you Any questions?

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