

(Wavemill : Ocean Current Radar)

The Wavemill radar will obtain high quality ocean surface data from four beam footprints on two swaths, each of 100 km width.

This data includes : -

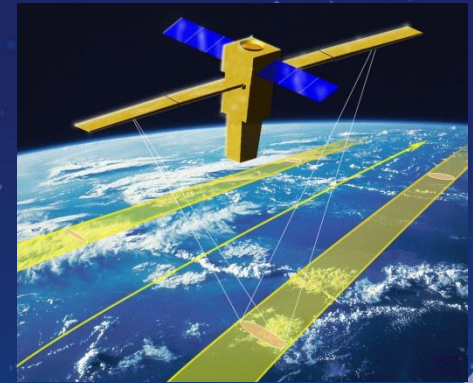
Ocean & coastal surface current speed and direction

Geostrophic (gravity effect) currents & eddies

Sea surface height and slope

Swell products

This information is of critical importance to the study of climate change and rising sea levels.

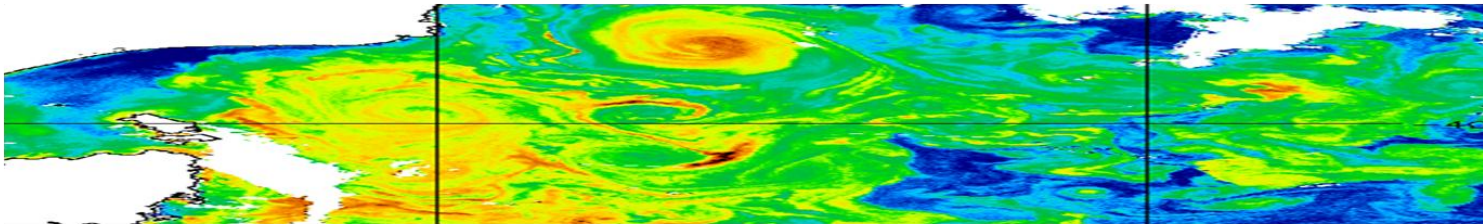
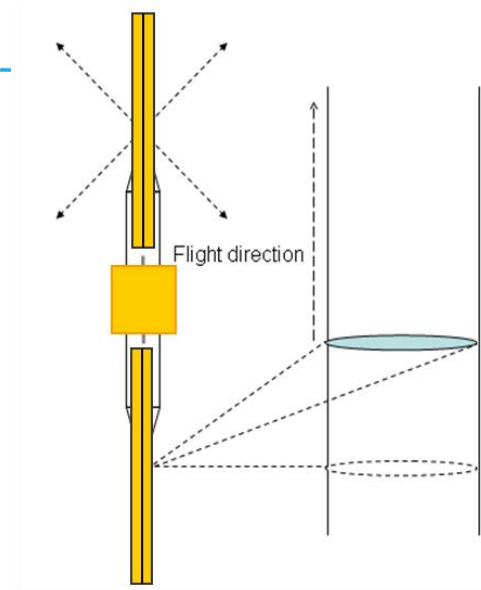


Byron Richards

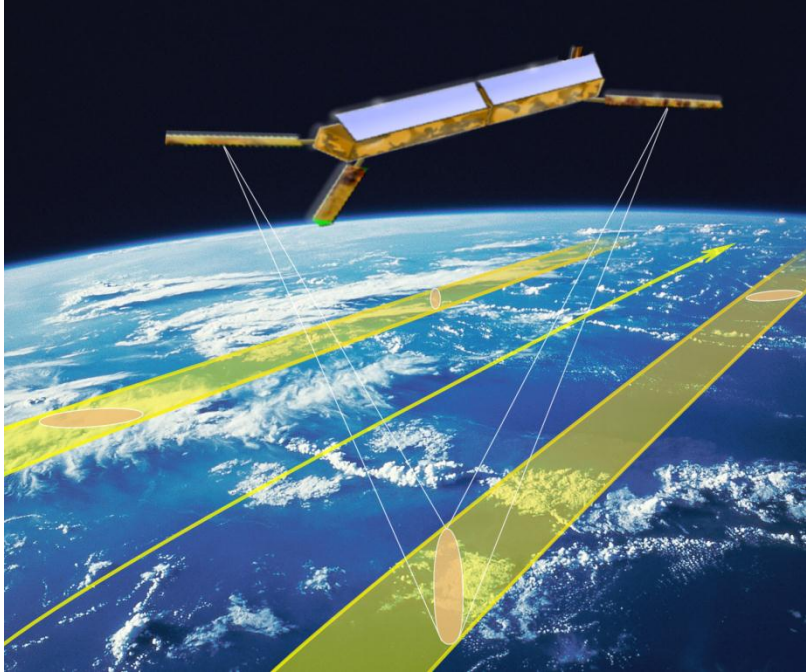
29th July 2013

Wavemill Concept

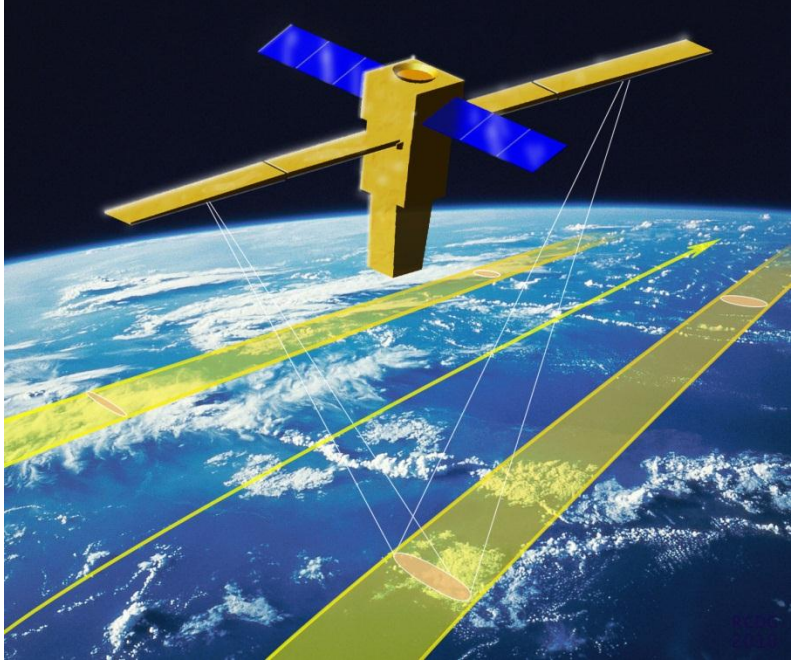
- Wavemill is a mission/instrument concept for a spaceborne **interferometric synthetic aperture radar**
- Across track (XTI) and along track (ATI) interferometry in a single instrument and pass to measure:
 - Sea surface currents
 - Sea surface winds
 - Sea surface height (secondary)
- Fulfills strong scientific and user-needs for open ocean and coastal regions



Wavemill Ocean Current Radar

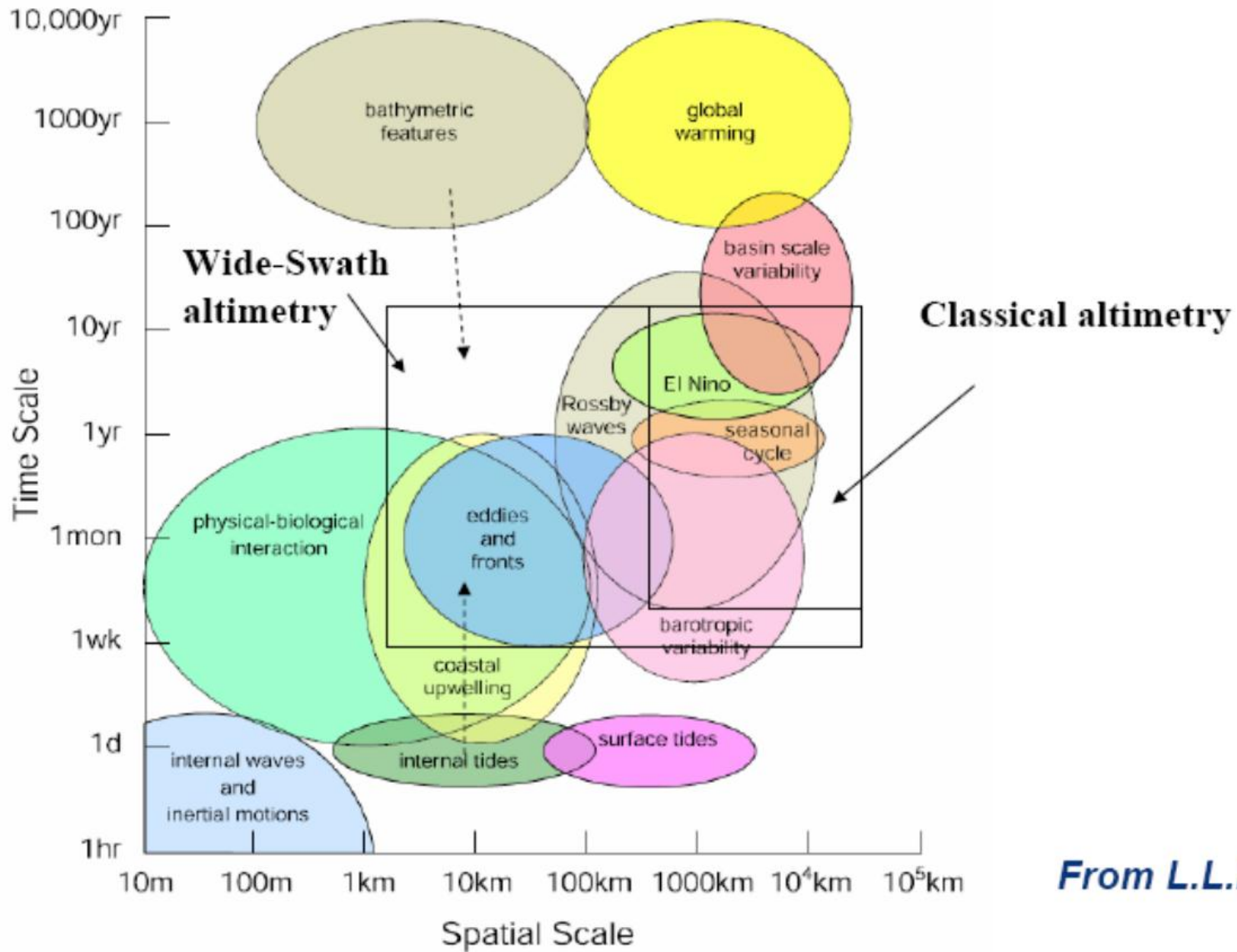


Original Four Antenna Concept



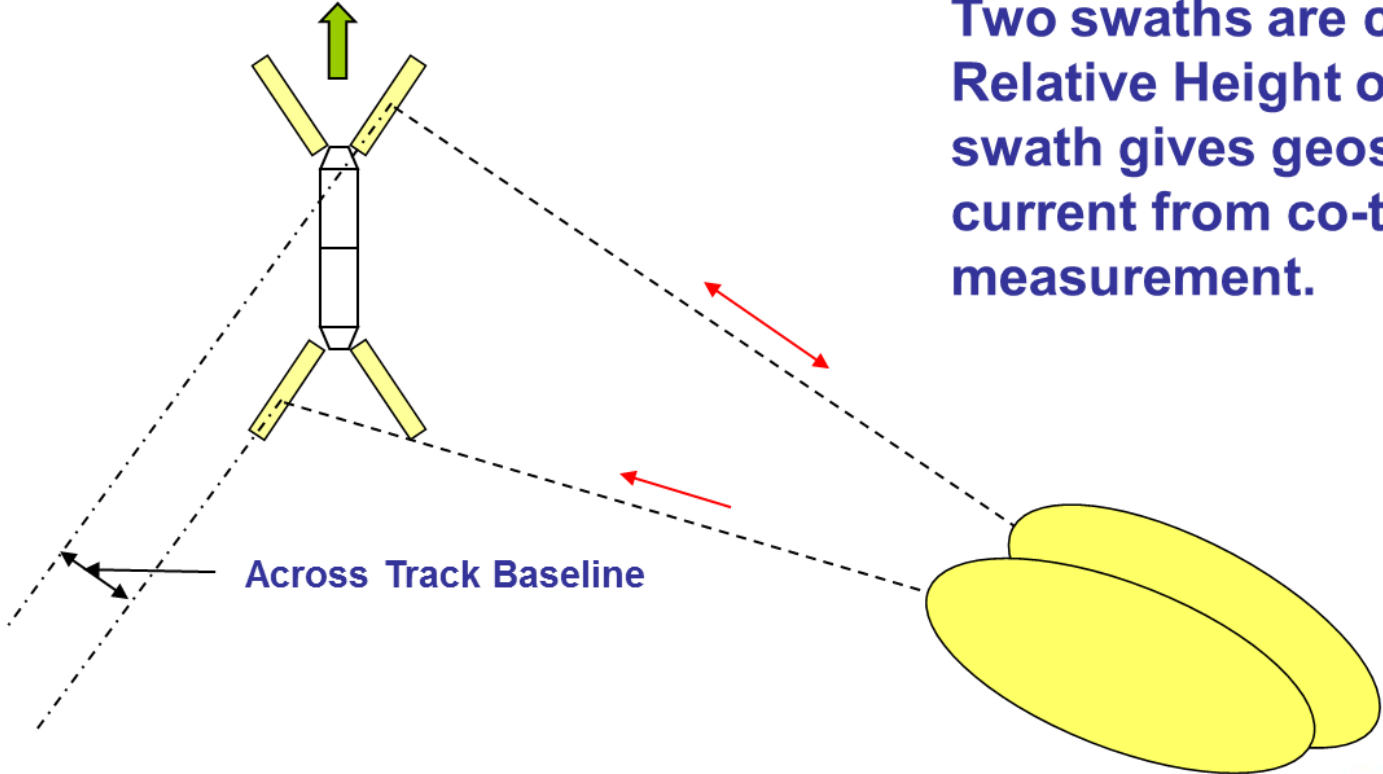
Two Phase Centre 'Javelin' Concept

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From L.L.Fu

Measurement of Sea Surface Height

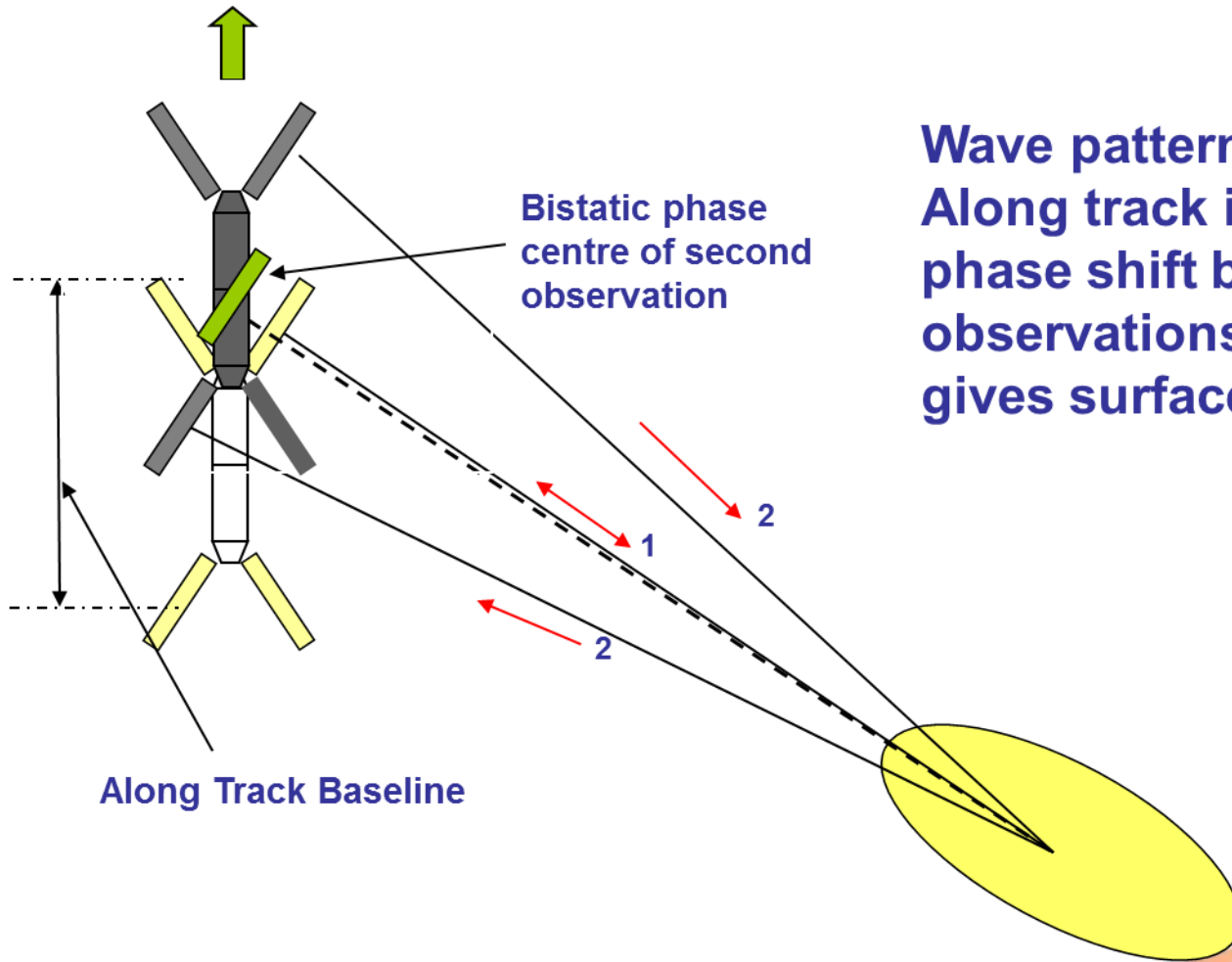


Two swaths are co-time.
Relative Height over entire
swath gives geostrophic
current from co-time
measurement.

Across Track Baseline

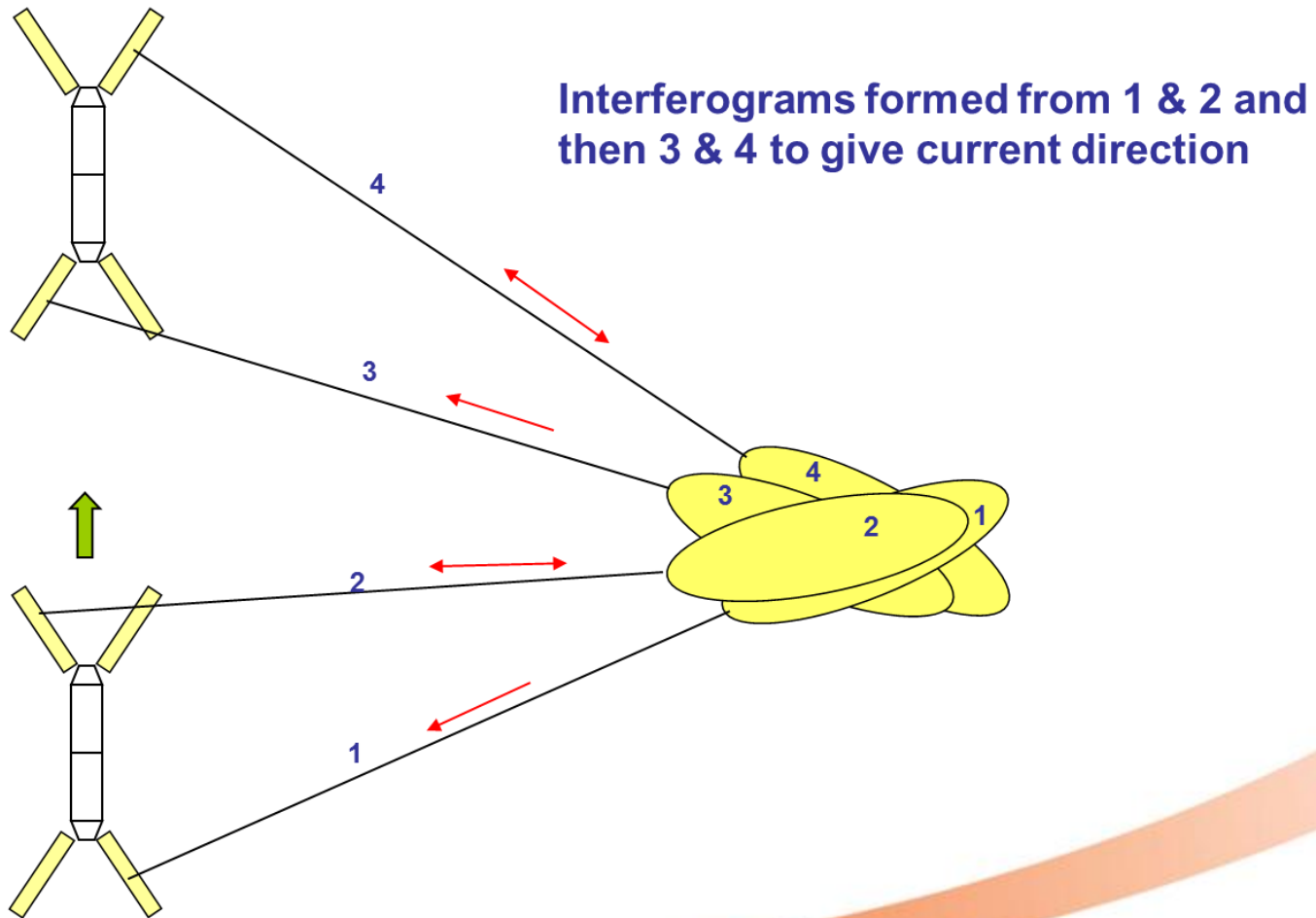
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Measurement of Current Velocity

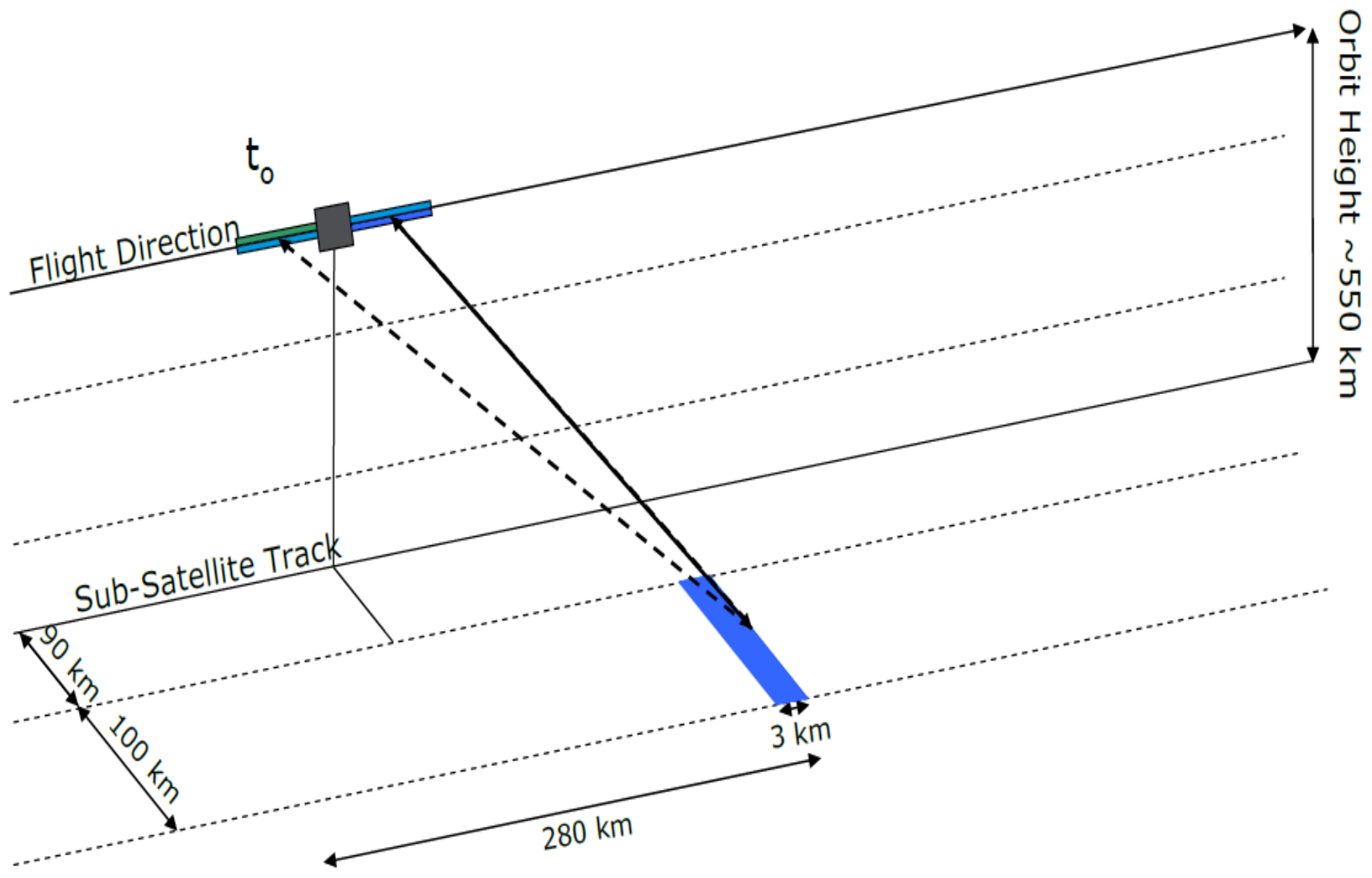


**Wave pattern is still coherent
Along track interferometry from
phase shift between
observations due to motion
gives surface current.**

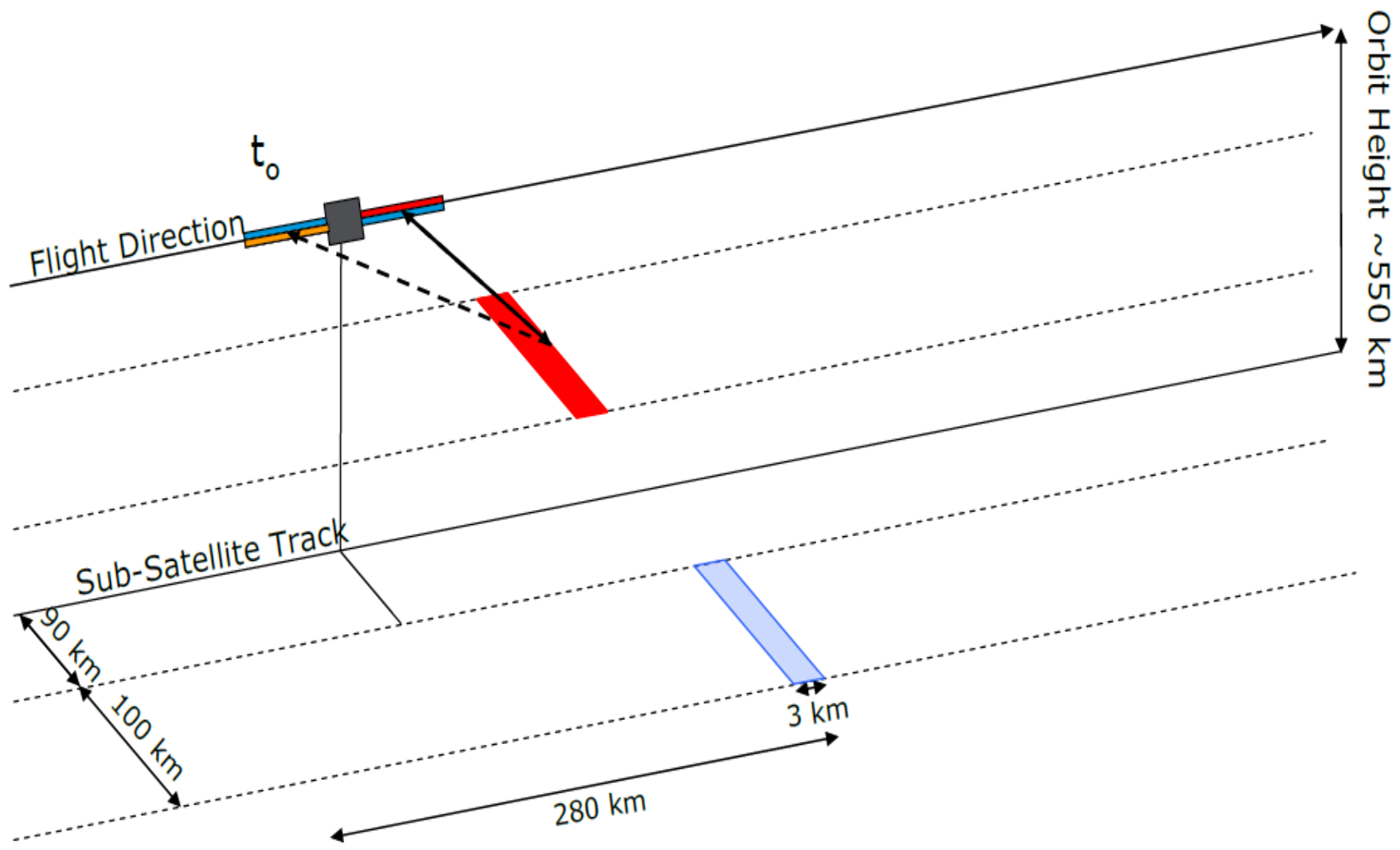
Measurement of Current Direction



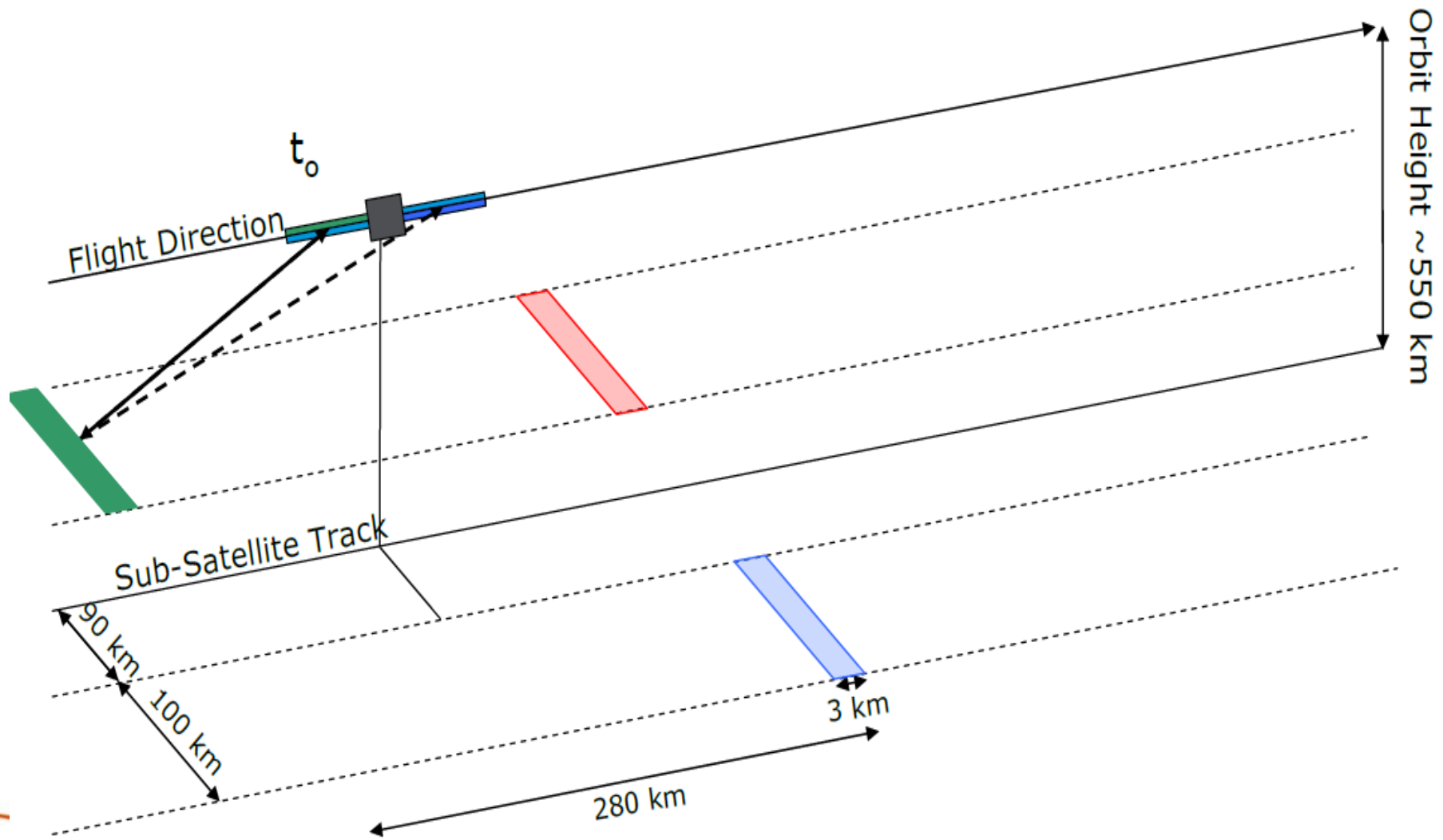
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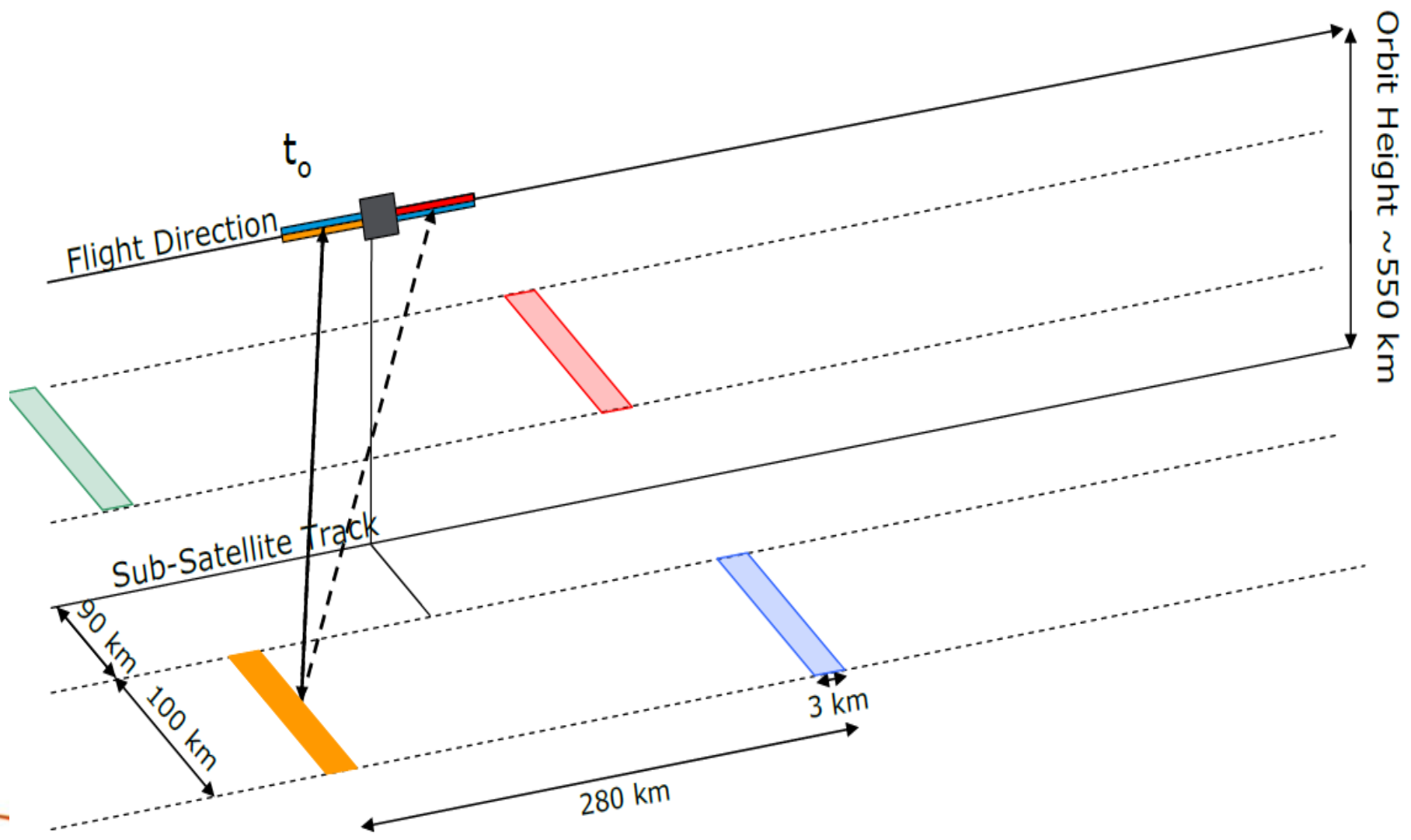
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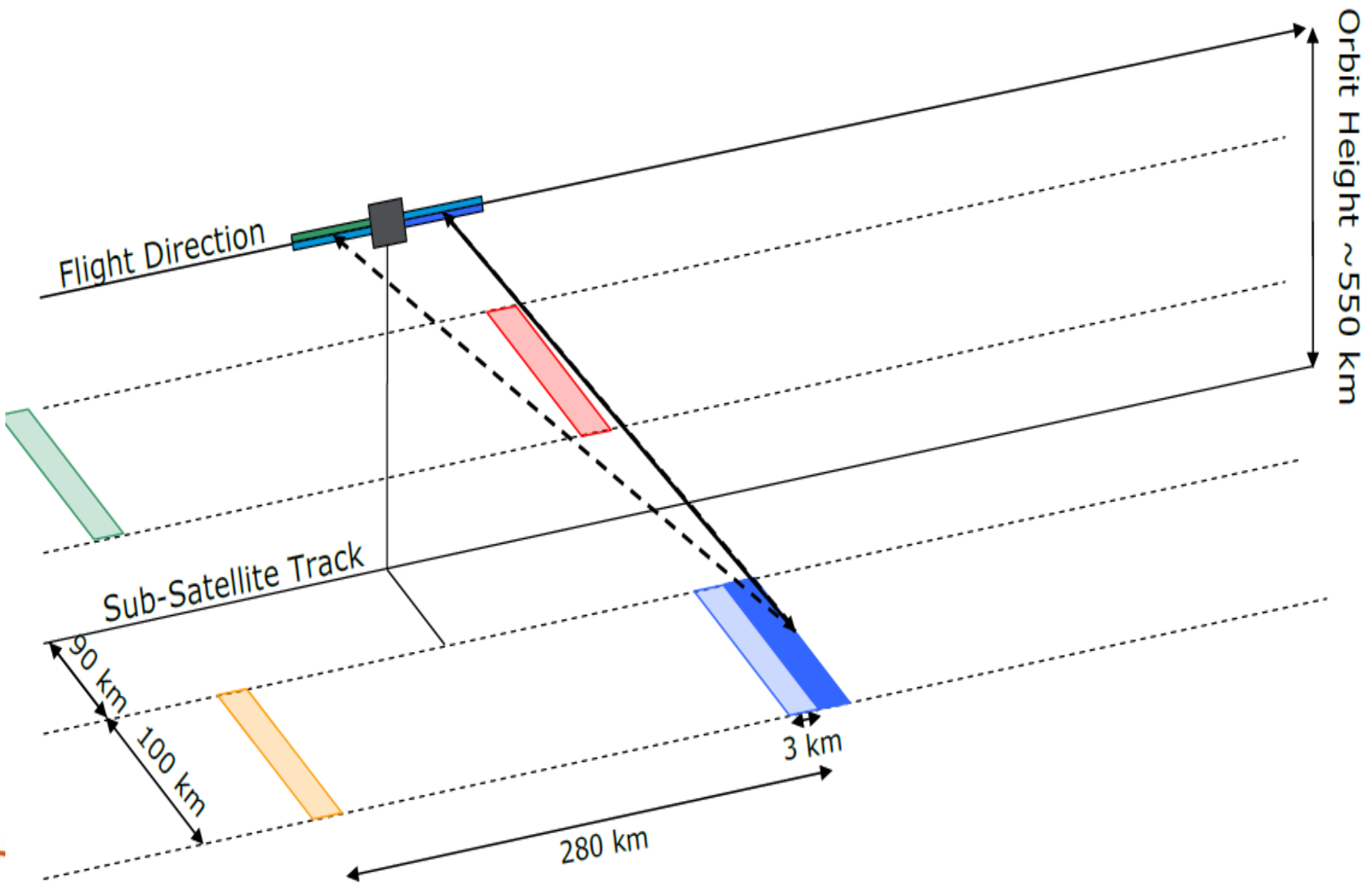
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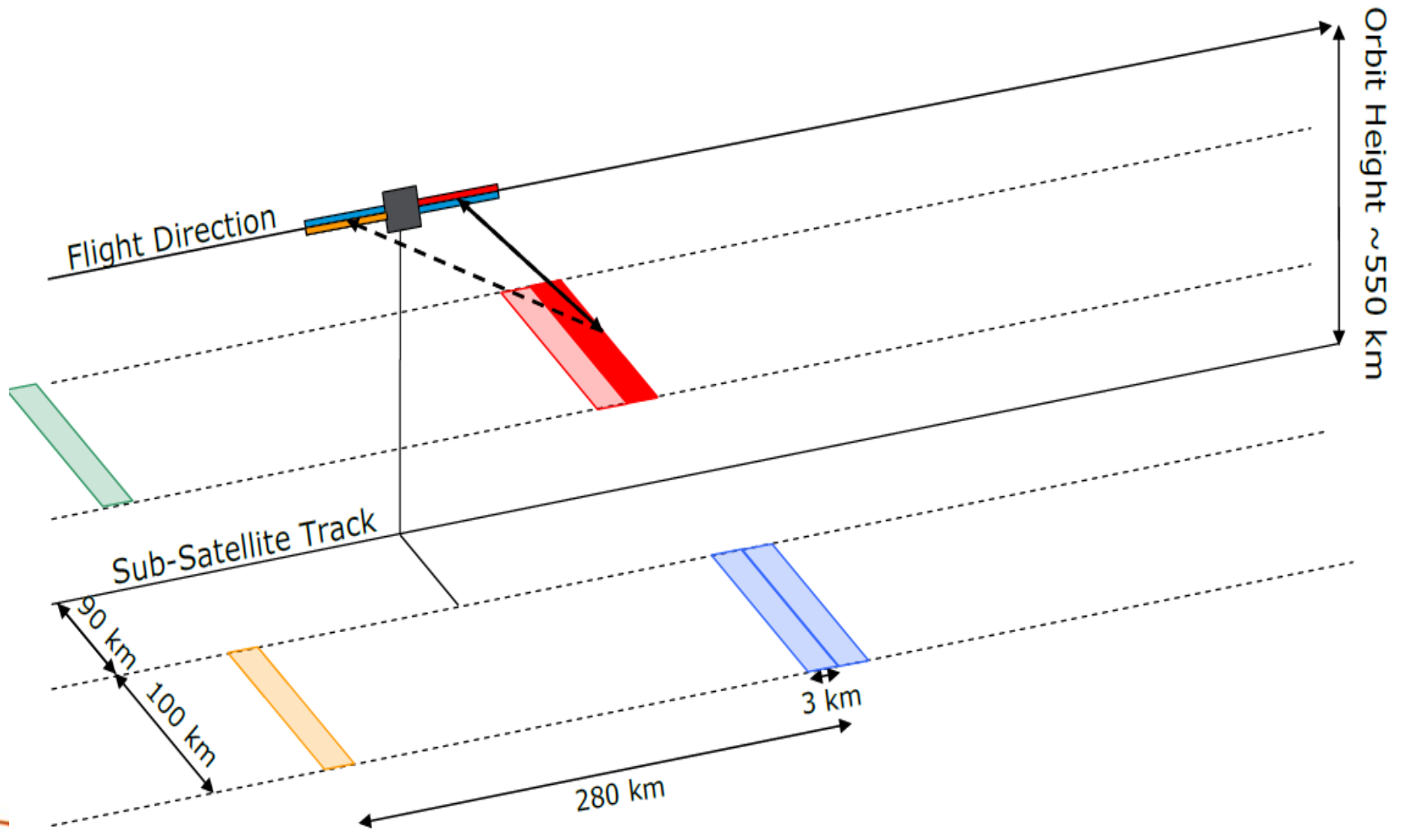
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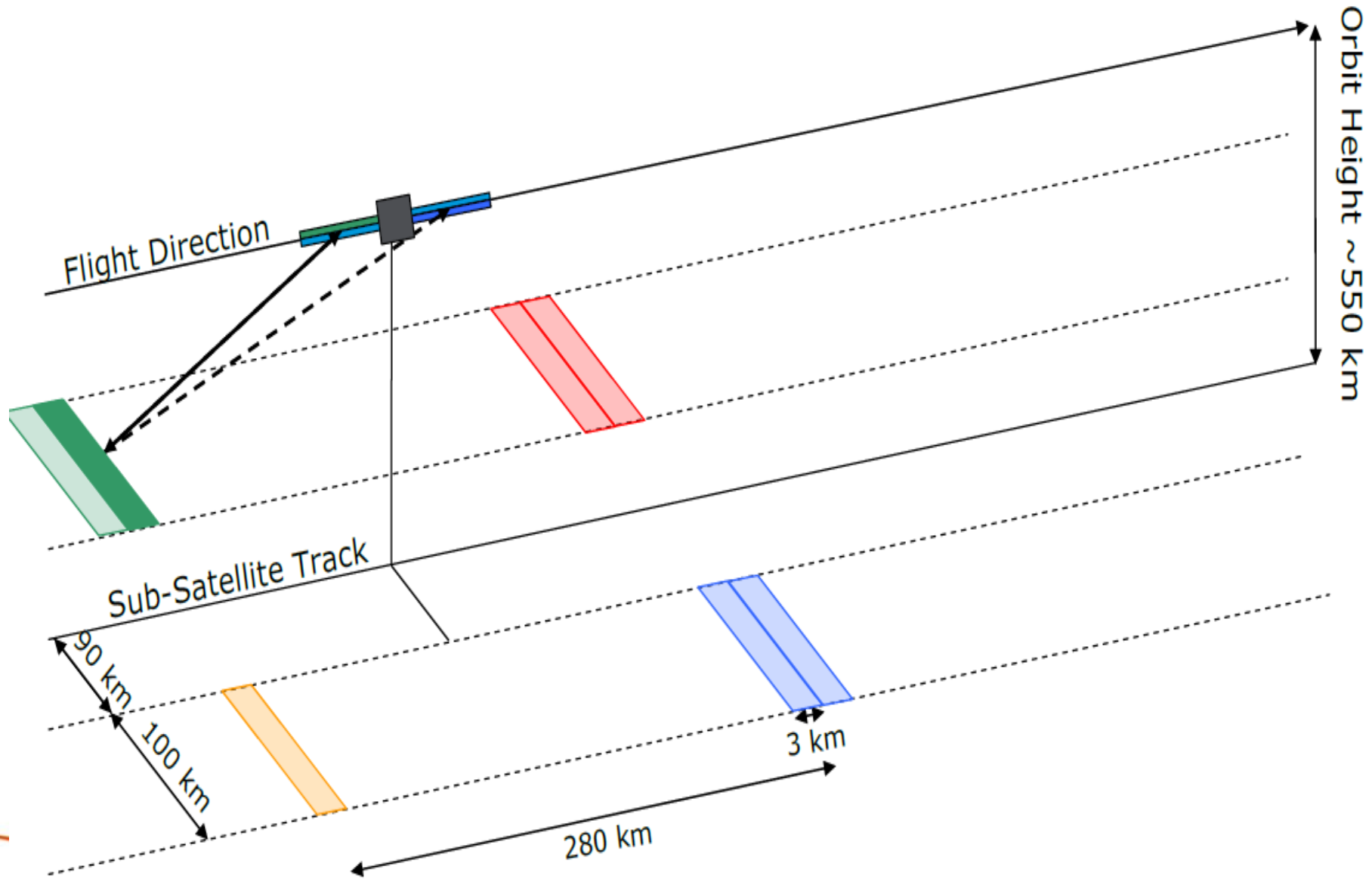
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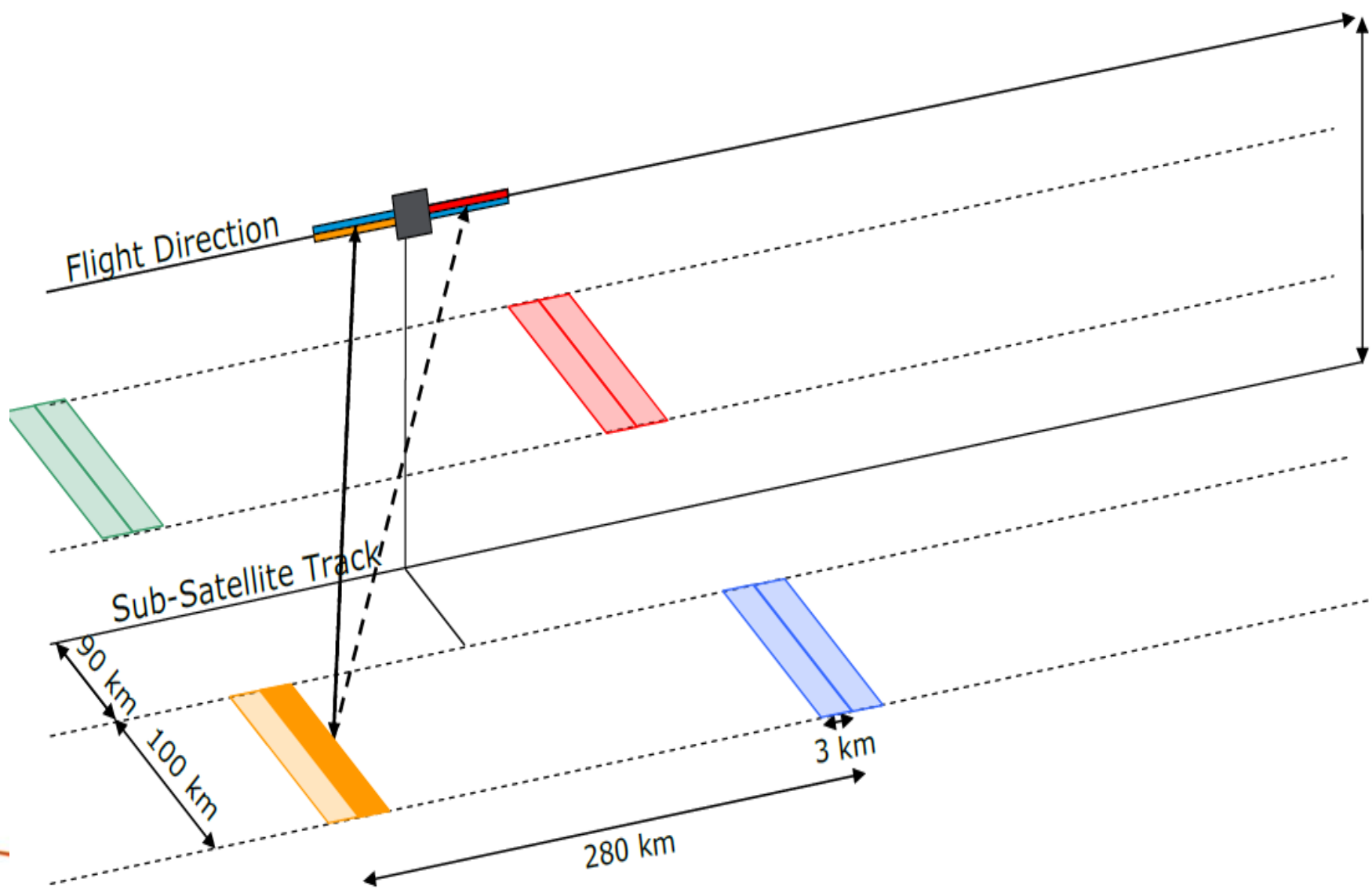
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Orbit Height ~ 550 km



Flight Direction

Sub-Satellite Track

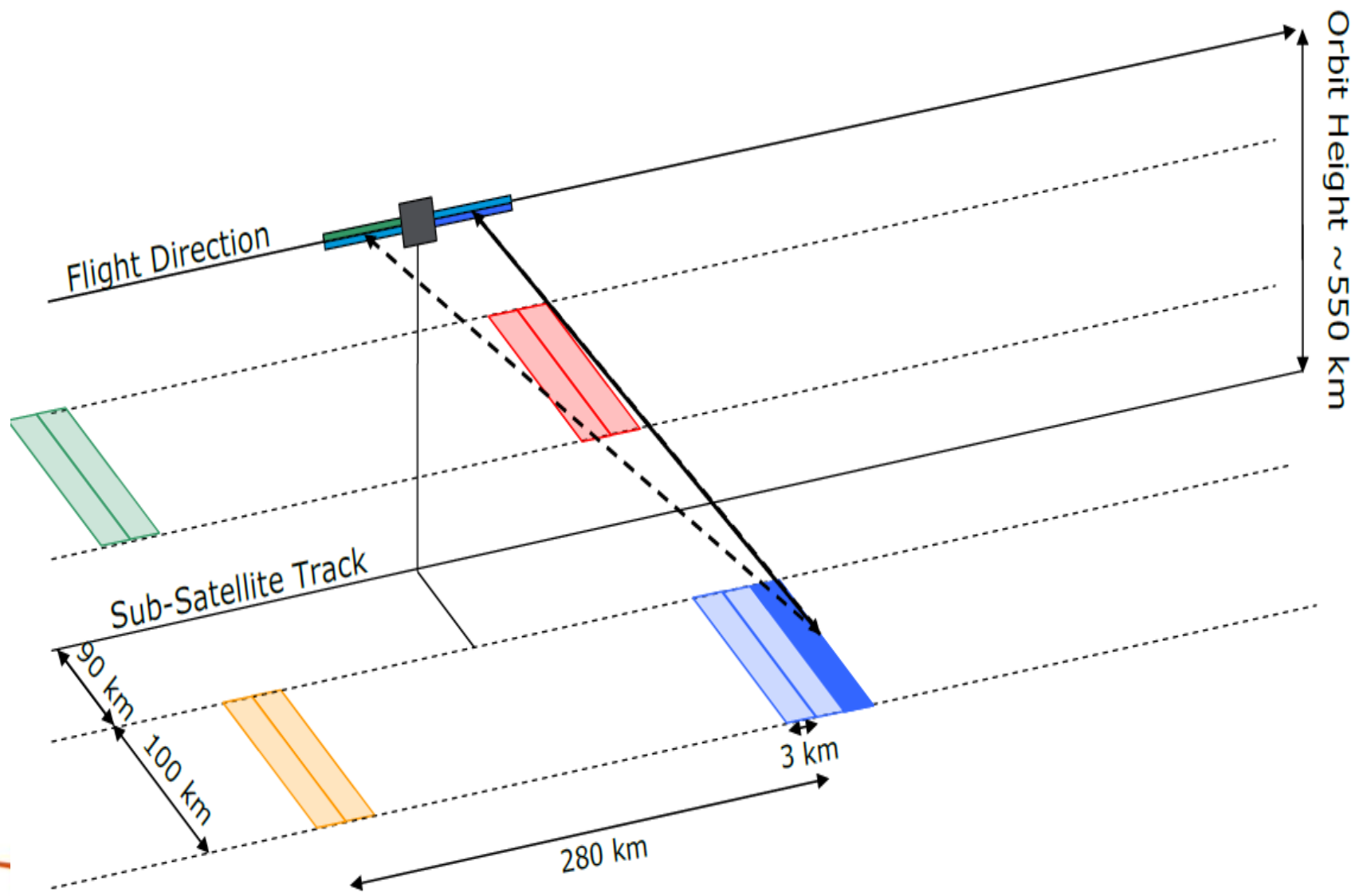
90 km
100 km

280 km

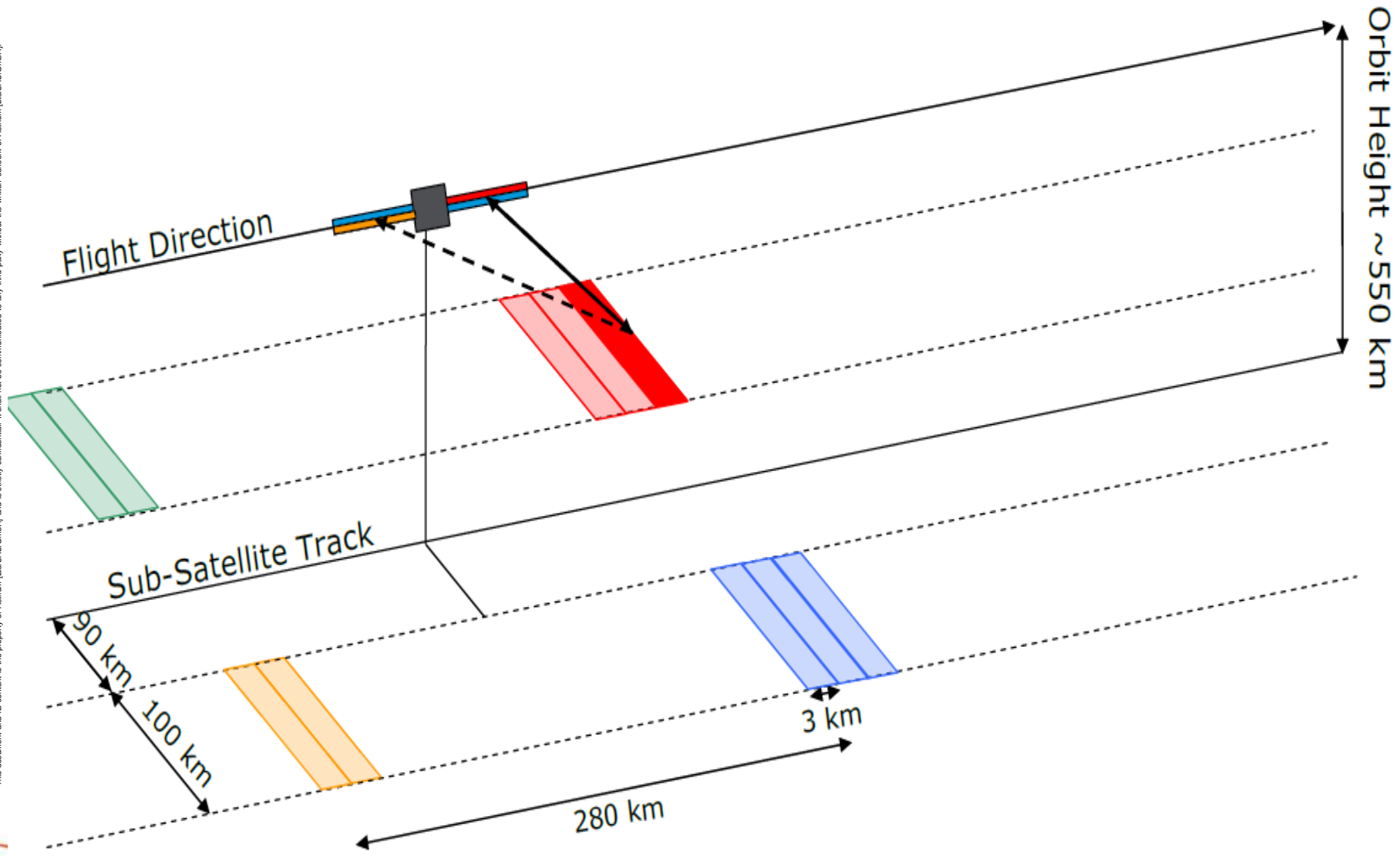
3 km

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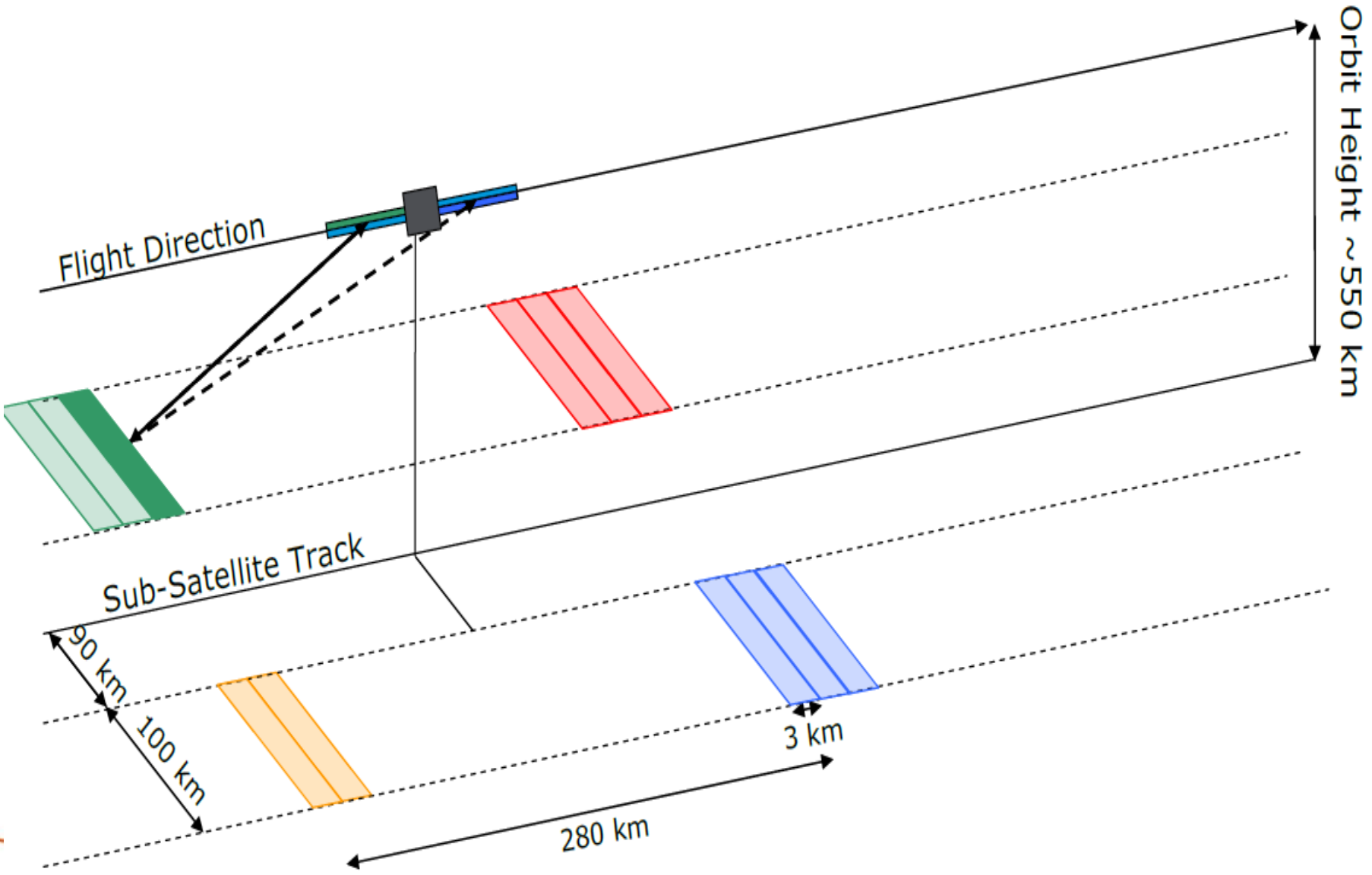
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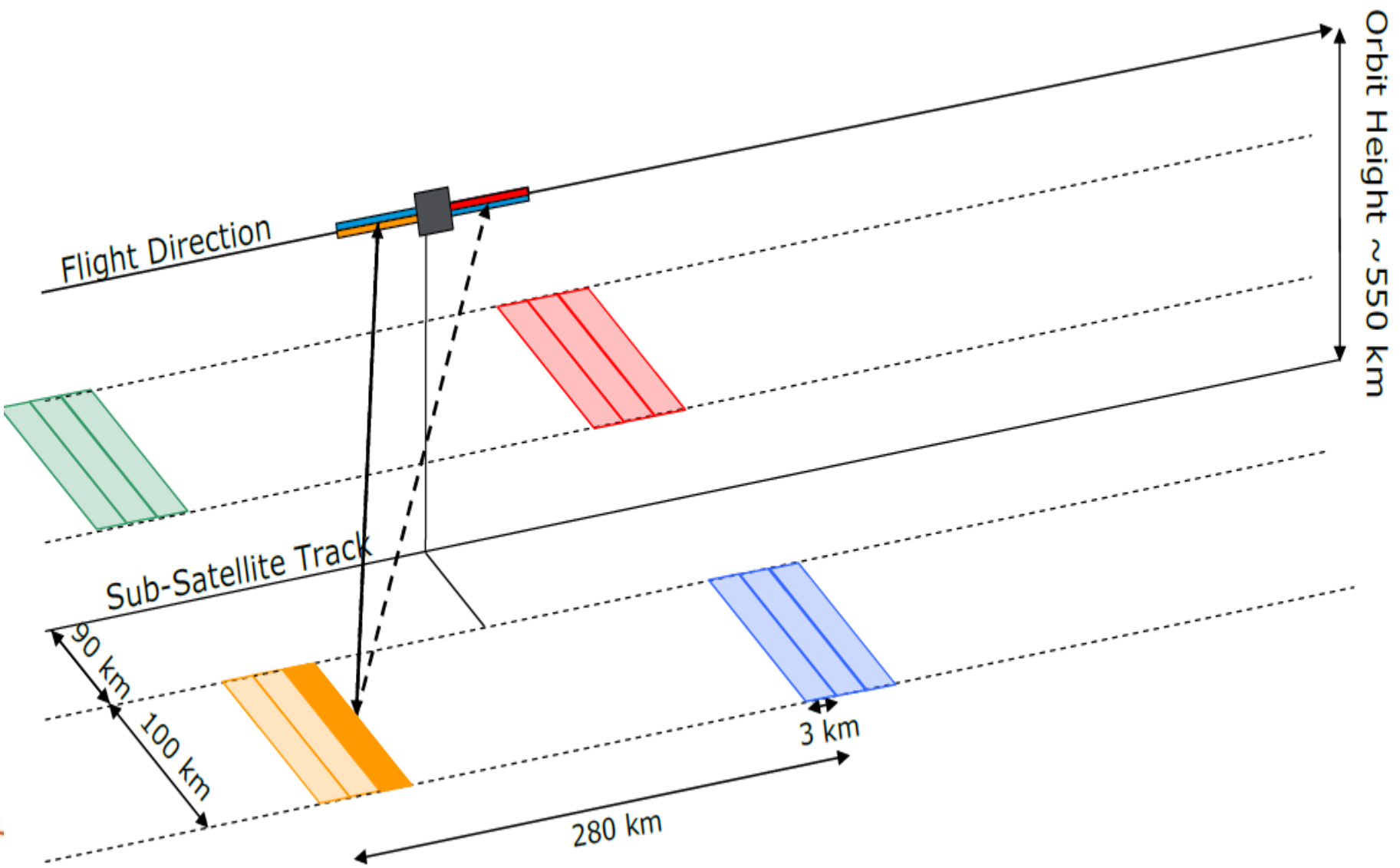
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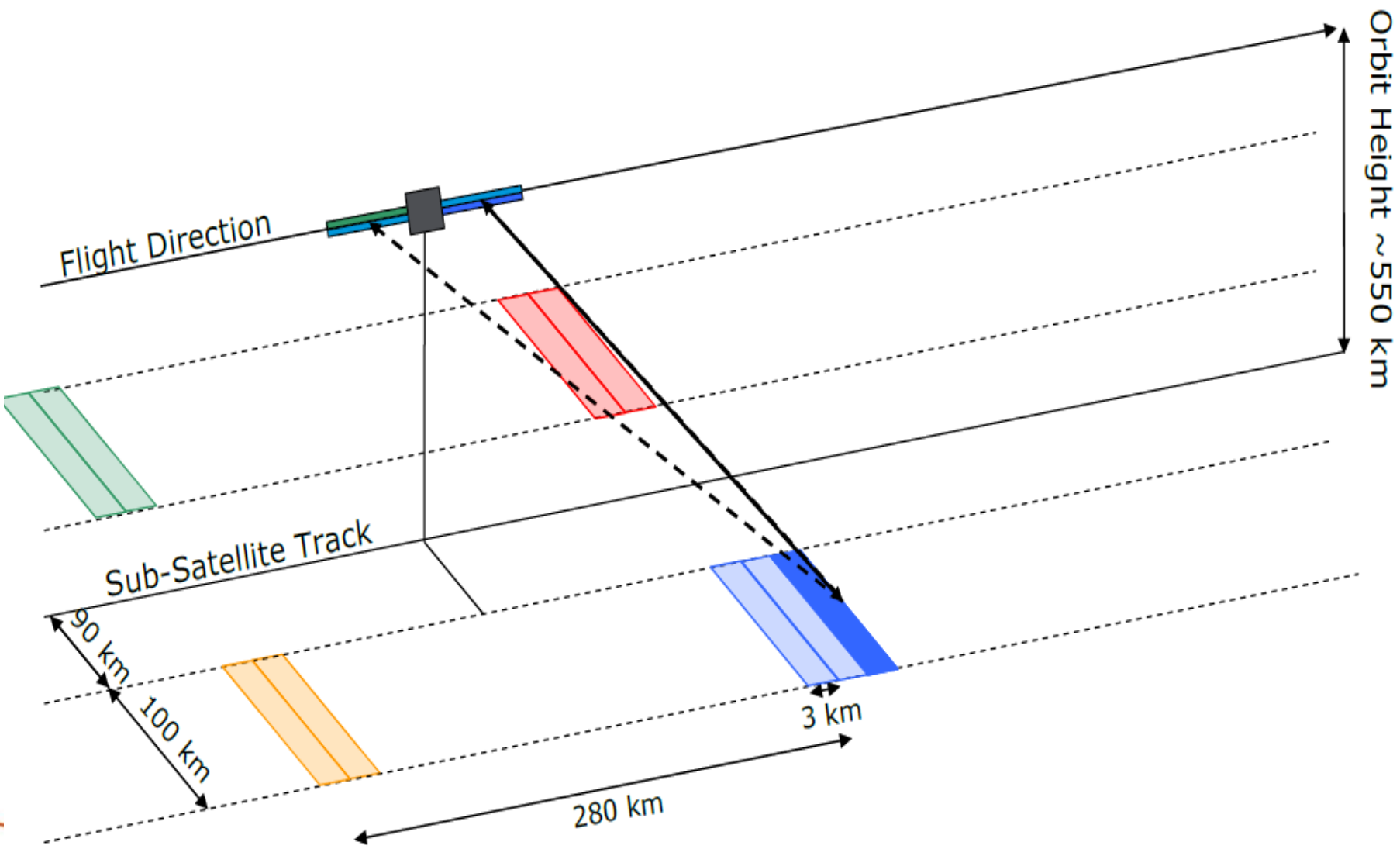
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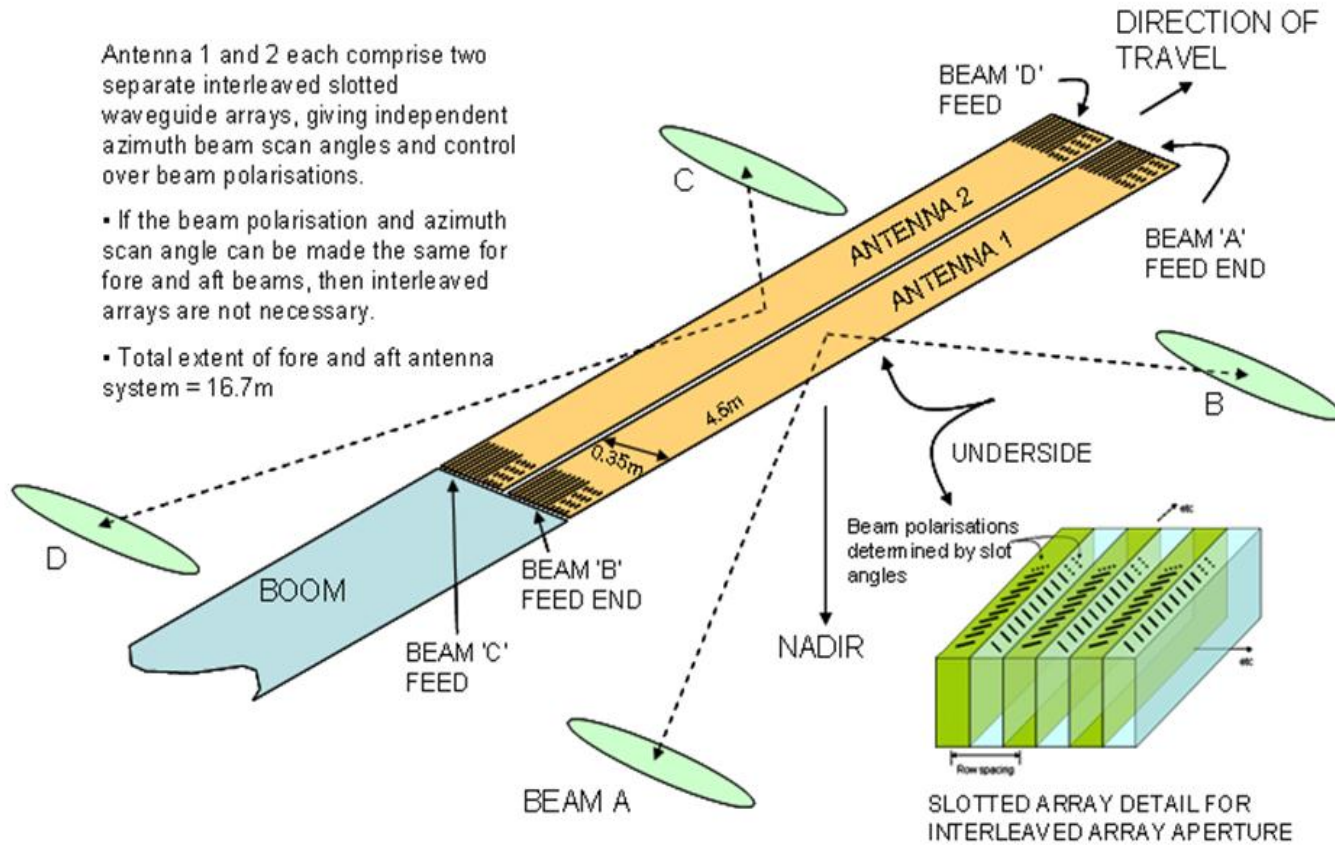
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Antenna 1 and 2 each comprise two separate interleaved slotted waveguide arrays, giving independent azimuth beam scan angles and control over beam polarisations.

- If the beam polarisation and azimuth scan angle can be made the same for fore and aft beams, then interleaved arrays are not necessary.

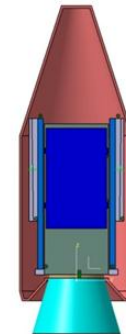
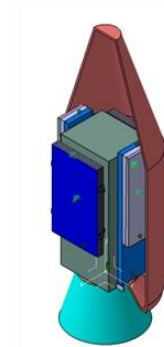
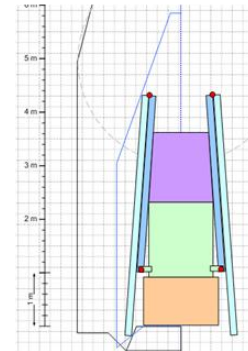
- Total extent of fore and aft antenna system = 16.7m



Planar Interleaved Antennas for Independent Beam and Polarisation Control

Platform Design

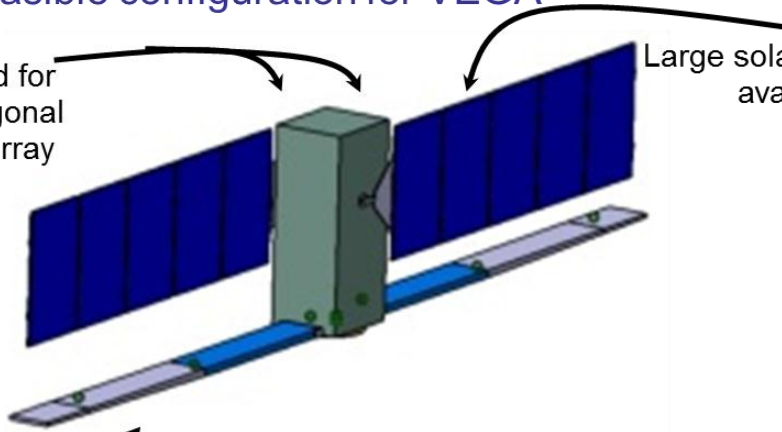
- Can now fit within the VEGA fairing
- Folding antenna design improved packaging efficiency considerably
- Power available from solar array area is now *more* than that required by platform/payload
- Limiting factor is free structure area for radiators (but we have some ideas!)
- Overall, a feasible configuration for VEGA



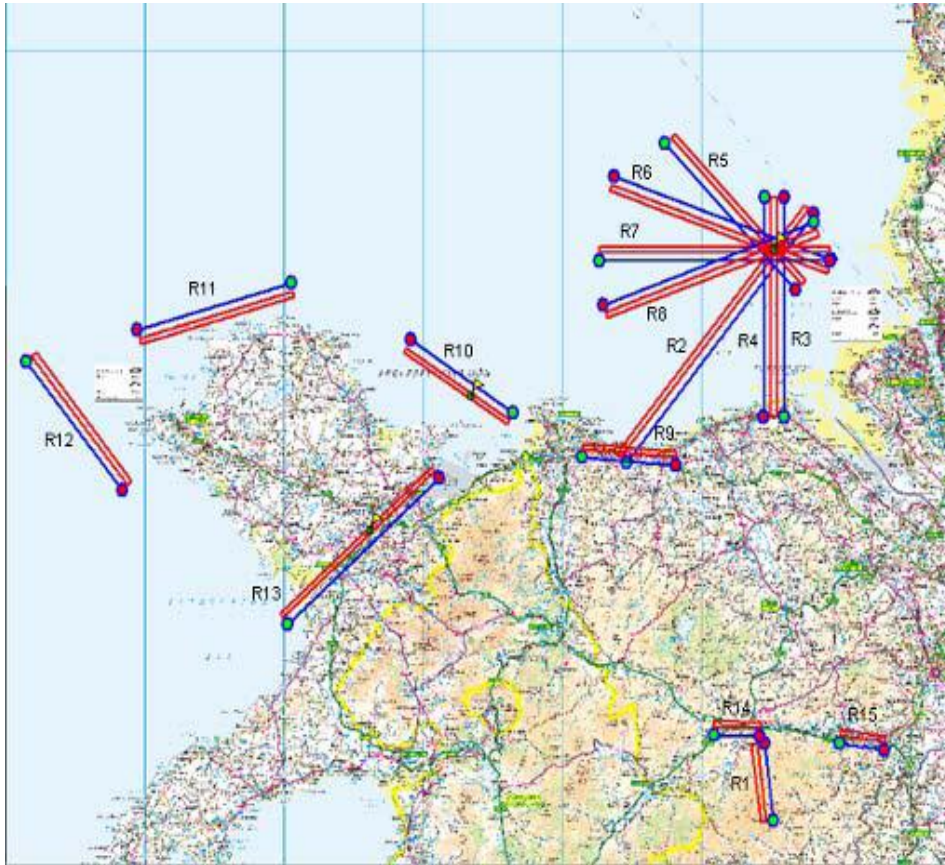
Cold side fully used for radiator, plus orthogonal side behind solar array

Large solar array area available

Folding antenna showing uneven split

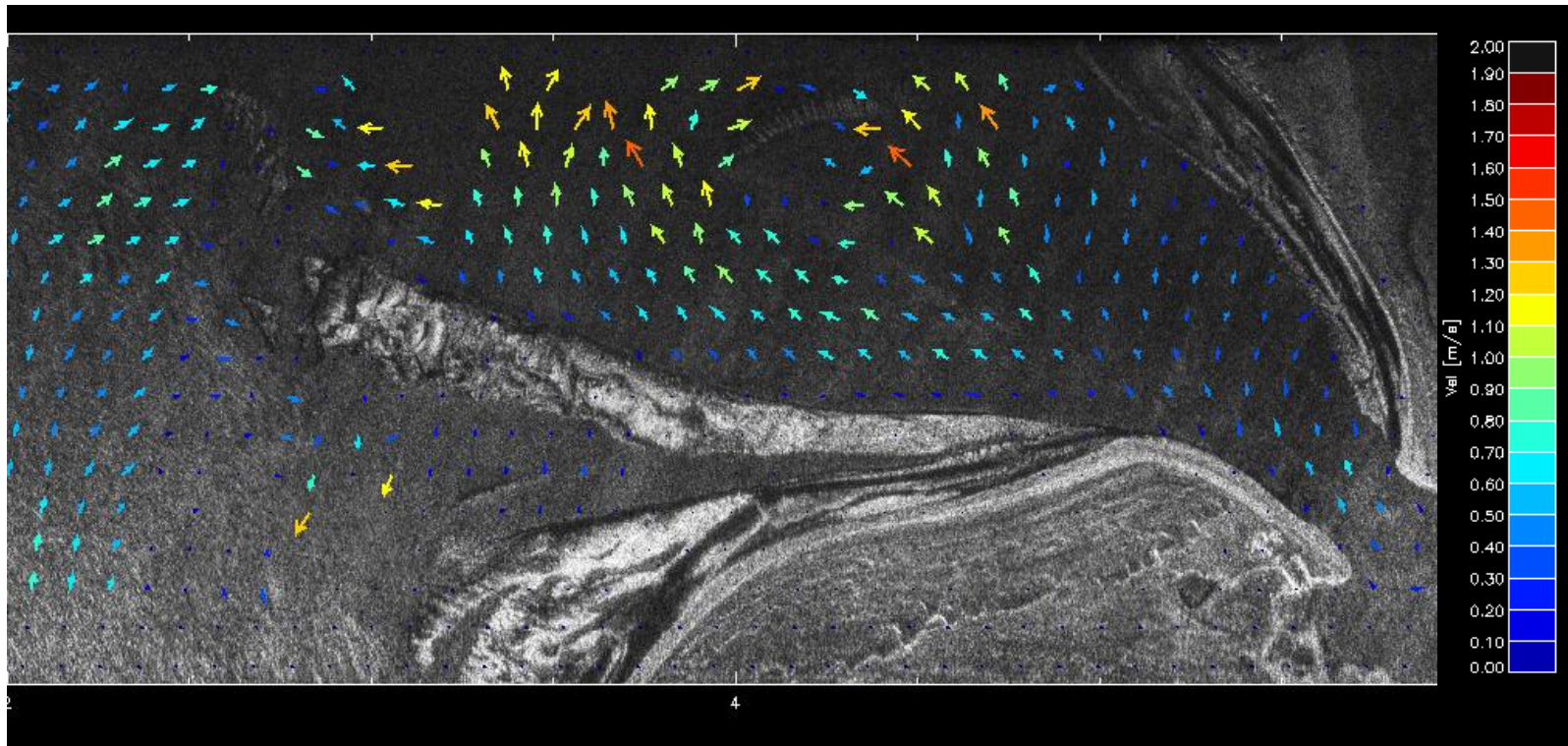


Proof of Concept Airborne Campaign



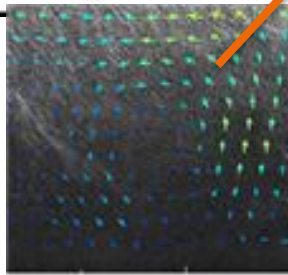
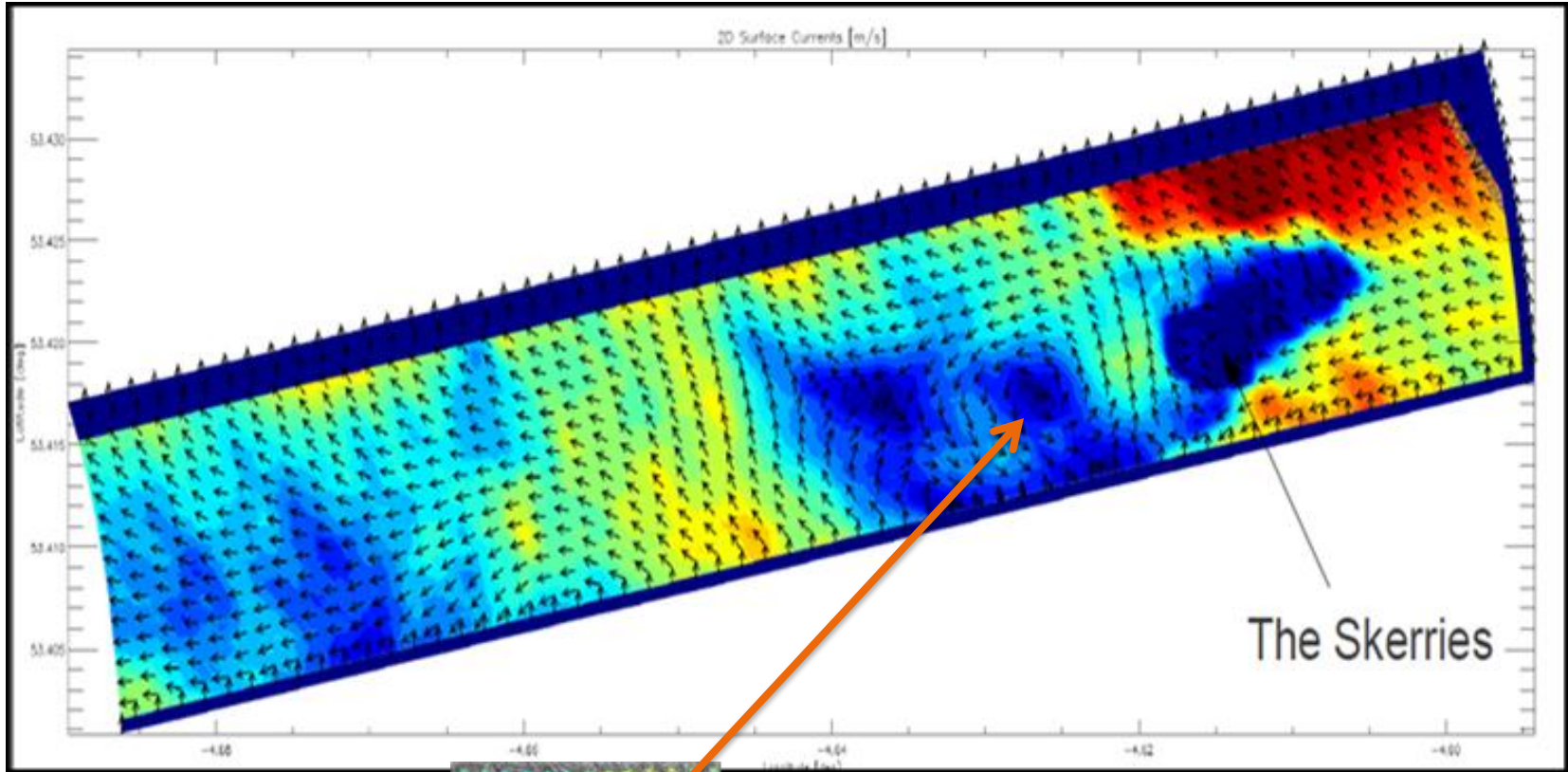
2D Surface Current Data

Menai Straits: Changing and Turbulent currents



Section of R13 (not correct orientation)

Whirlpool in the lee of the Skerries, Anglesey



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