EE11 Mission Information Day - NITROSAT System Development

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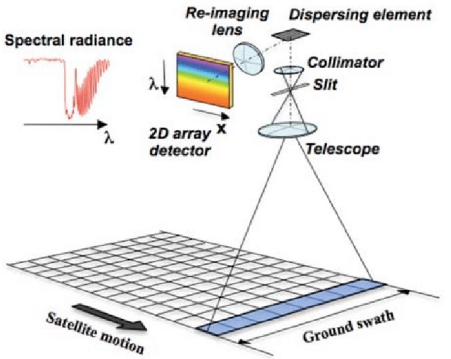
Repeat of main requirements (Level 1 aka radiance)

• Measurement Technique	VIS and TIR spectrometric imagery
• Measurement Area	Land within +/- 55 deg Lat, possibly shipping routes, full cover (no gaps)
• Measurement Repeats	Between 1 week and 1 month
• Spectrometric range	400-490 nm for VIS and 925-975 cm^{-1} for TIR, goal 750-1250 cm^{-1} *10.25-10.81 μm* *8.0-13.3 μm*
• Spectral Resolution	0.6 nm for VIS and 1.6 cm^{-1} for IR, goal 0.5 cm^{-1}
• Spatial Resolution	500 m, goal 250 m
• Optical quality	SPSF requirement, and MTF integrated energy above Niquyst < 10% of total
• Radiometric Sensitivity	VIS SNR 600 with goal 1200, TIR NEDT 0.2 K with 0.05 K goal
• Radiometric Accuracy	ARA 5% VIS, 0.5 K TIR

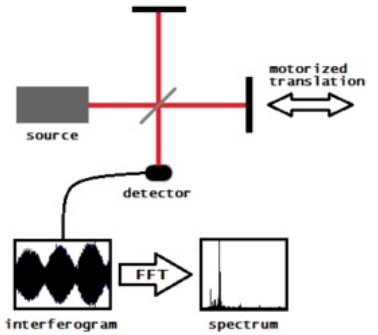
Mission Challenges from a technical point of view

- NITROSAT has classical mission architecture: 1 Satellite, 1 GS, FOS/PDGS, VEGA-C launcher
- Most challenges are thus in the payload, including 2 passive optical spectrometers, 1 in VIS and 1 in TIR
  - Possible combination of high repeat (2/m) and resolution (500 m) could lead to high swath for some options
  - High sensitivity requirements (0.05 K for TIR/600 SNR for VIS).
- For the IR instrument also high spectral resolution challenging requirement (1.6 – 0.5 cm^{-1})

- VIS and TIR spectrometer instruments are established types and have plenty of heritage
  - Main options for spaceborne imaging spectrometers are dispersive versus FTS principles
  - OMI, TROPOMI, S5 for VIS
  - IASI, IRS, MIPAS, CO2M (SWIR) for TIR
  - Requirements considered feasible overall



Principle of dispersive pushbroom spectrometer
For illustration only (not NITROSAT-specific)



Principle of Fourier Transform spectrometer
For illustration only (not NITROSAT-specific)

Mission Challenges from a technical point of view

- ESA identifies the following main trades linked to these challenges
  - Orbit type
    - Inclined orbit could allow better repeat than SSO, at cost of non-standard platform/spacecraft
    - ESA confirmed internally that non-SSO orbits are reachable from VEGA-C CST launch
  - Swath vs repeat and instrument configuration
    - Swath ranges likely from ca. 80 to over 200 km or more
    - Considering resolution & oversampling needed may need up to ~1000 px IR detector length, seen as driver
    - Doubling smaller instruments to achieve larger overall swath could also be an option
    - VIS instrument likely needs ca. 2x IR instrument swath (only images in daytime)
  - IR instrument concept
    - Quite likely that step-and-stare FTS is needed due to stringent requirements, which is a complex instrument
    - If so, potential critical issue in performance at swath edges could lead to needing to do FT on-ground (with critical impact on data flow)

Key Technologies

- Detector technologies for TIR instrument - MCT detector most likely, including active cooling
- If new detectors are required they will need pre-development and qualifications
- If FTS spectrometry is selected for IR, fine mechanism, metrology and light source are key technologies
- If special devices are needed for edge-of-swath correction they will need special pre-developments