

ASPECT

Cubesat Instrumentation Concept for Asteroid Exploration:
The ASPECT Platform

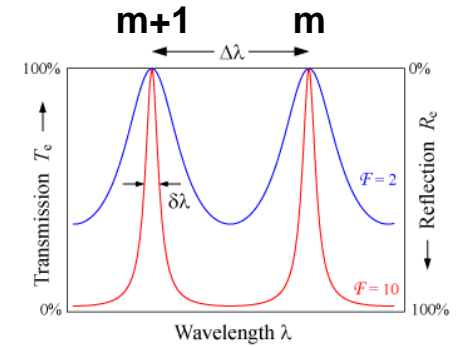
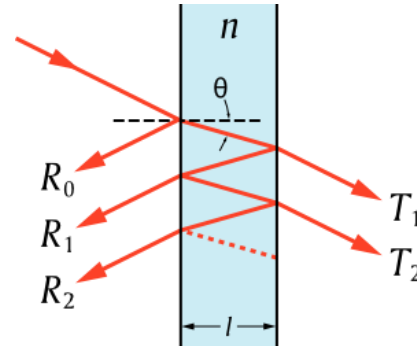
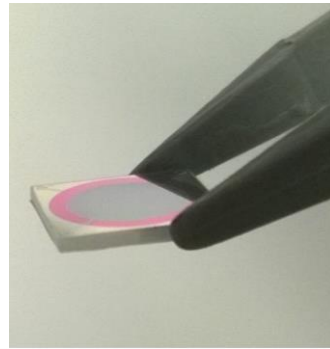
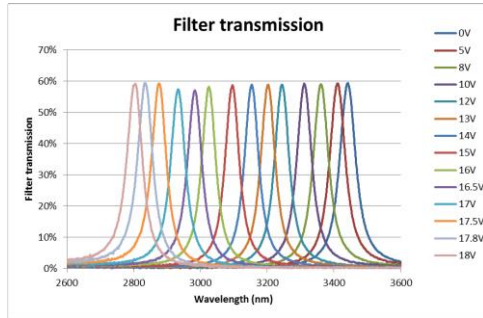
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Fabry-Perot Interferometer

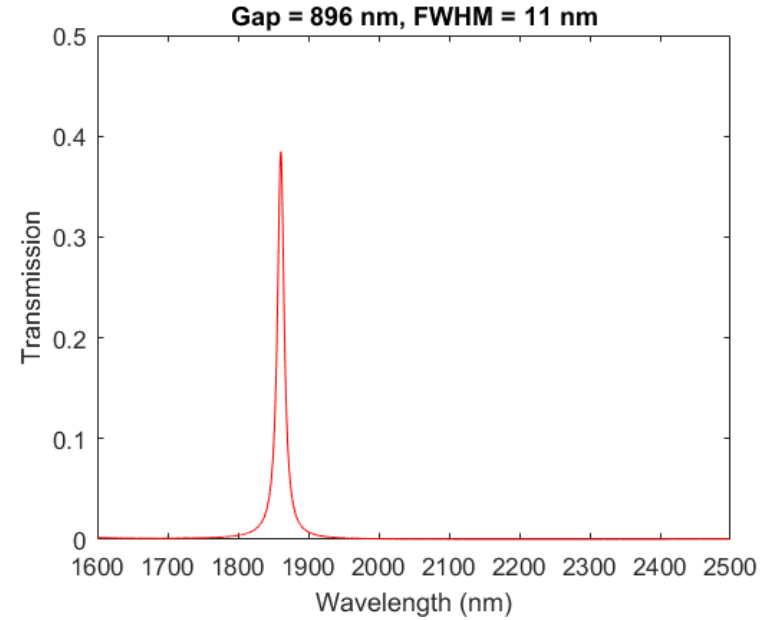
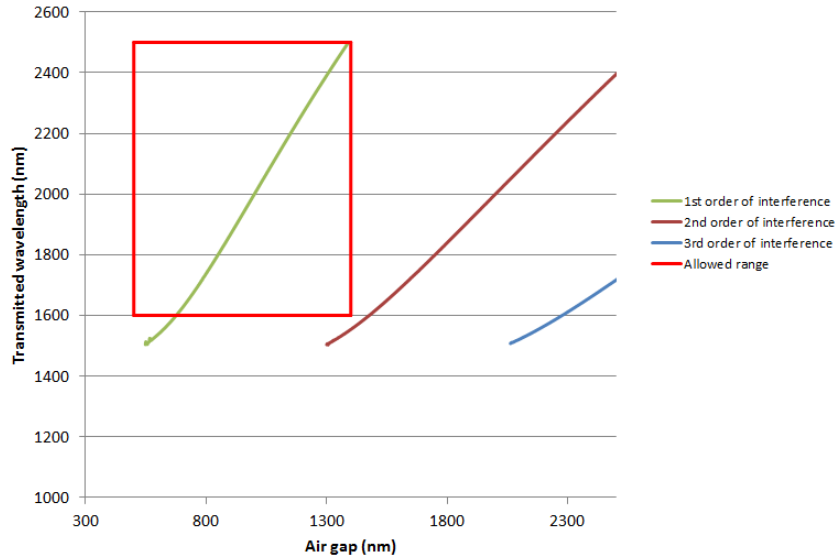
- Two parallel mirrors separated by a cavity
- Acts as an optical resonator
- Can be used as a tunable passband filter



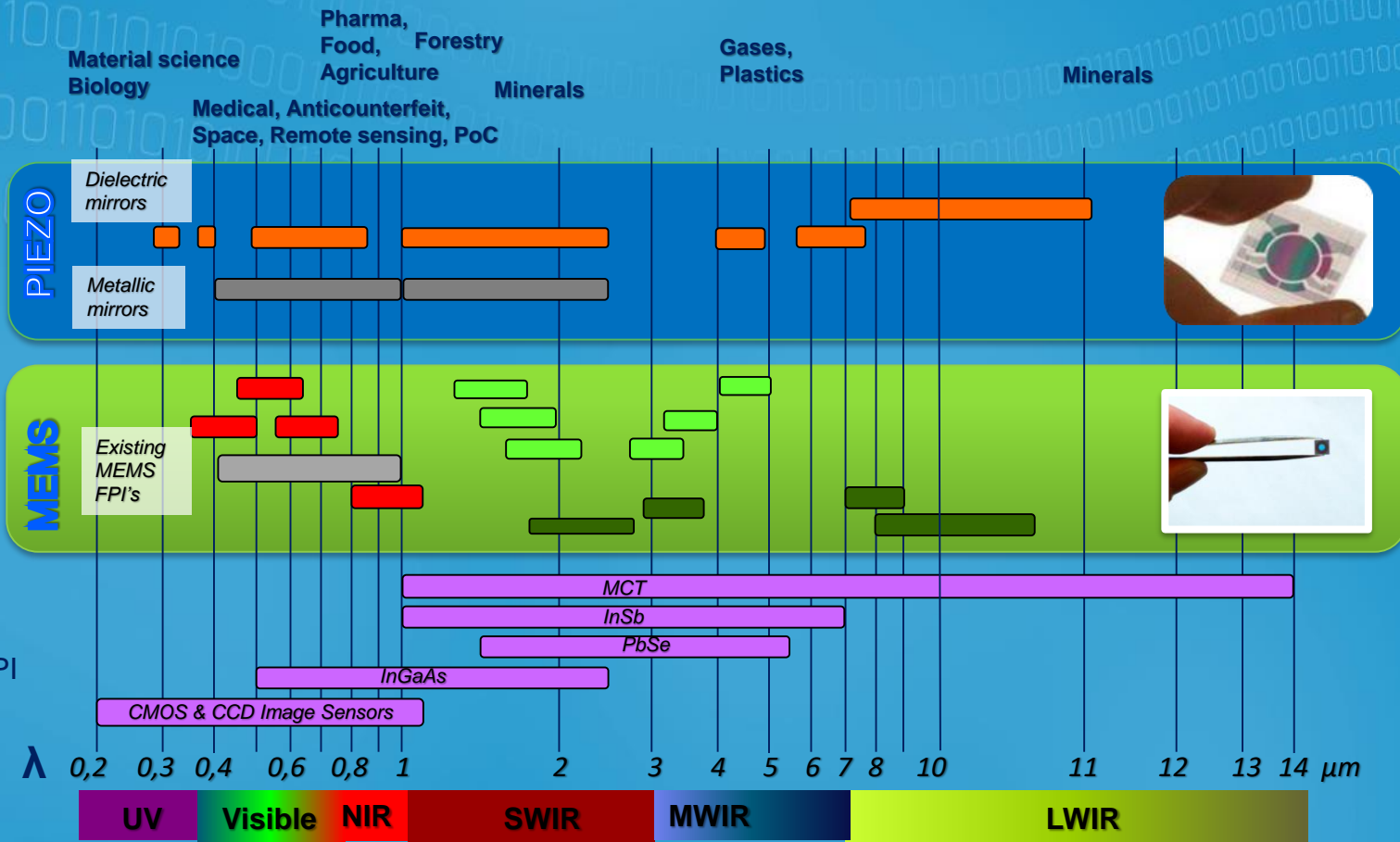
$$\lambda_n = \frac{2 * n * l * \cos(\theta)}{m}$$

$$m=1,2,3,\dots$$

Fabry-Perot Interferometer



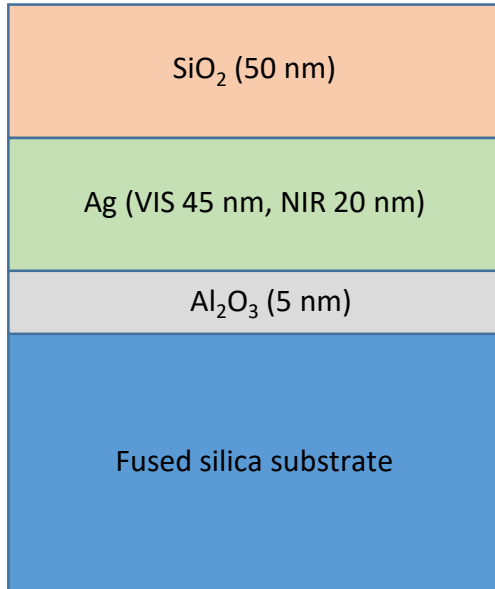
FPI platforms and examples of realized filters



Different mirror solutions

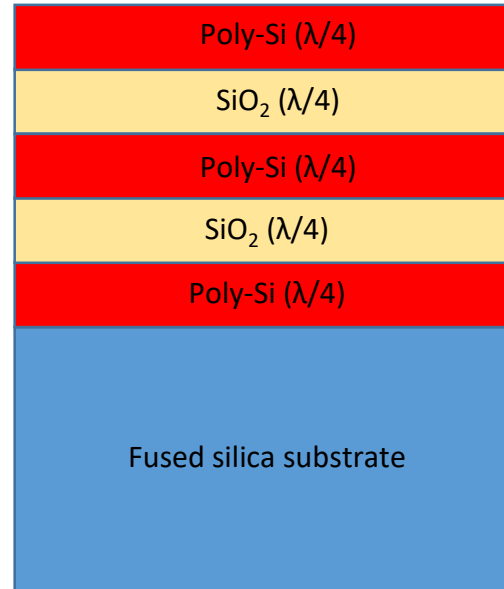
VIS/NIR mirror structure

Simple metallic mirror



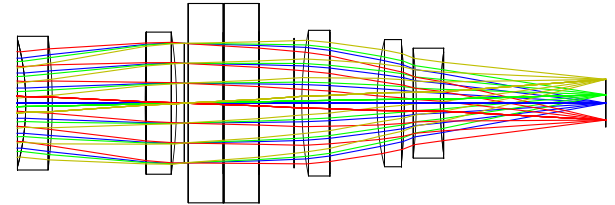
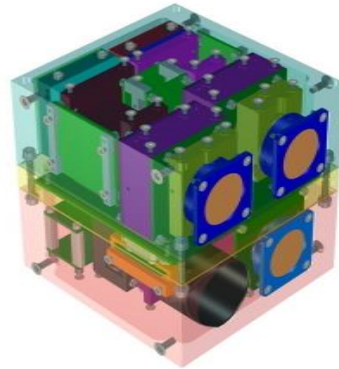
SWIR mirror structure

Bragg mirror, optimized for a certain wavelength

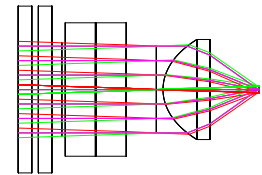


First ASPECT concept

- Developed originally for ESA's Asteroid Impact Mission during 2015 – 2017
- Originally for a 3U cubesat
- 1U envelope for the instrument
- 2 spectral imagers measuring from 500 nm to 1600 nm
- 1 spectrometer measuring from 1600 nm to 2500 nm

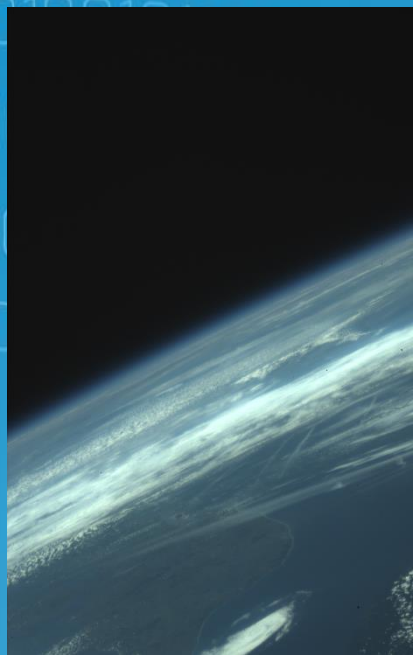


Optics model for the VIS channel

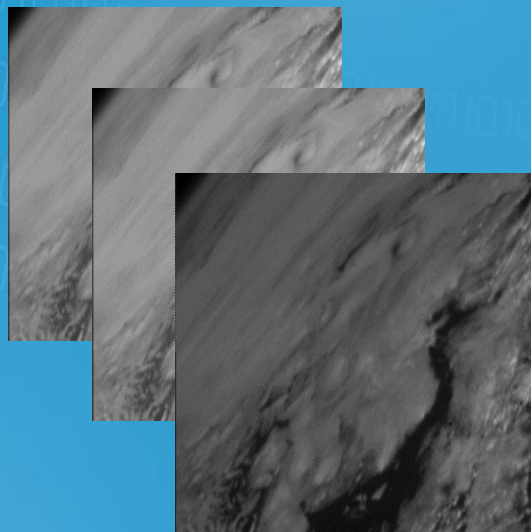


Optics model for the SWIR spectrometer

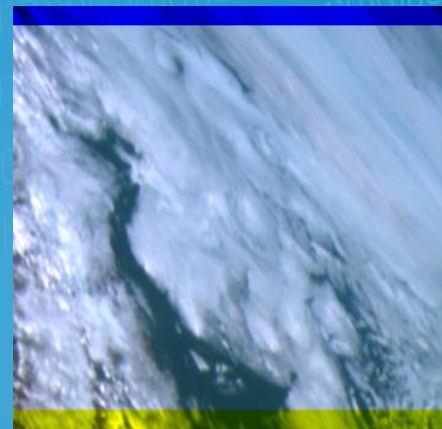
Example: First images from Aalto-1 Spectral Imager



RGB image



Spectral images

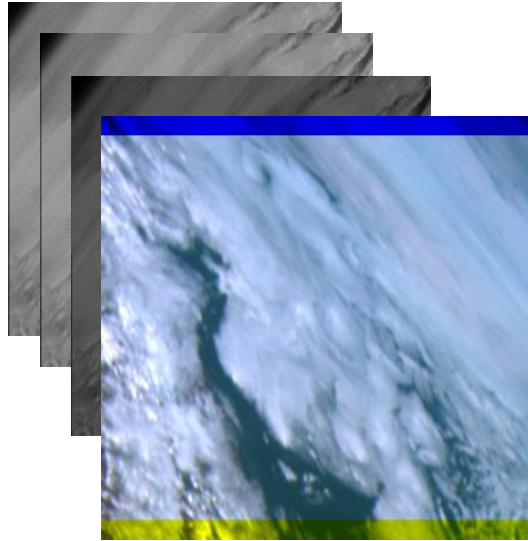


False color image: red pixels show 711 nm, green pixels 536 nm, blue pixels 509 nm.

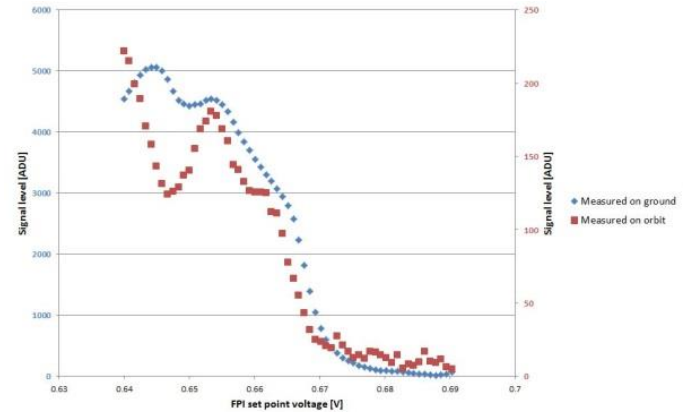
Example: First images from Aalto-1 Spectral Imager



RGB image
July 5, 2017

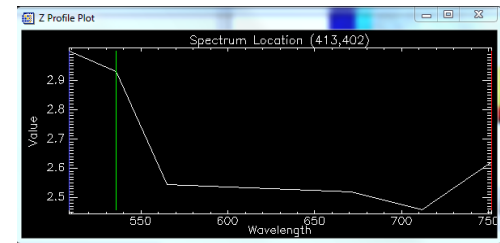
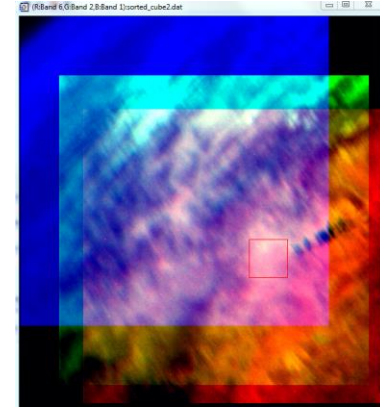


Spectral image (509
nm, 536 nm, 711 nm)
August 3, 2017



Calibration spectrum
September 5, 2017

Next images from Aalto-1 Spectral Imager

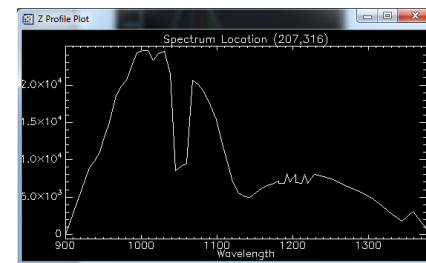
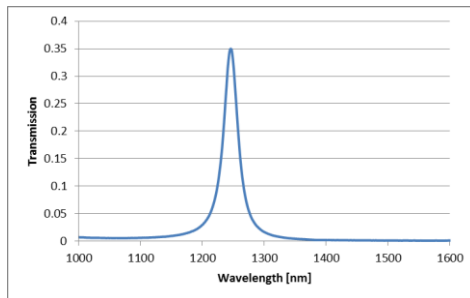


Example: NIR Spectral Imager for nanosatellites

NIR spectral imager weighing less than 500 g

Measuring from 900 nm to 1400 nm (1000 nm – 1600 nm also possible)

To be launched in Q2-Q3/2018 on the Reaktor Hello World Satellite



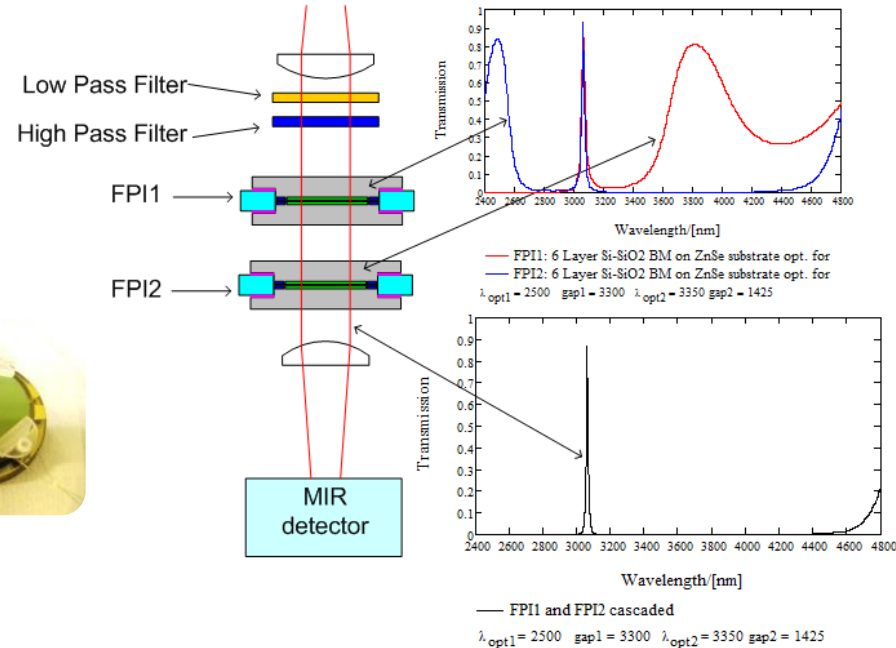
3 um concept

- Si-SiO₂ Bragg mirrors on ZnSe substrate
- Single instrument measuring from 2.5 um to 4.0 um
- Single point detectors enable low cost devices
- Very compact instrument: ~0.25 U
- Spectral resolution ~20 – 30 nm
- Optical apertures up to 25 mm

 High SNR!



The same concept can also be used with imaging detectors if available for use



FPI1 and FPI2 Fabry-Perot Interferometers in series. Total transmission contains only one spectral band.



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through science-based innovations.**



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