

EnMAP
Hyperspectral Imager



HYPERSENSPECTRAL Workshop 2022

EnMAP In-flight Calibration Status

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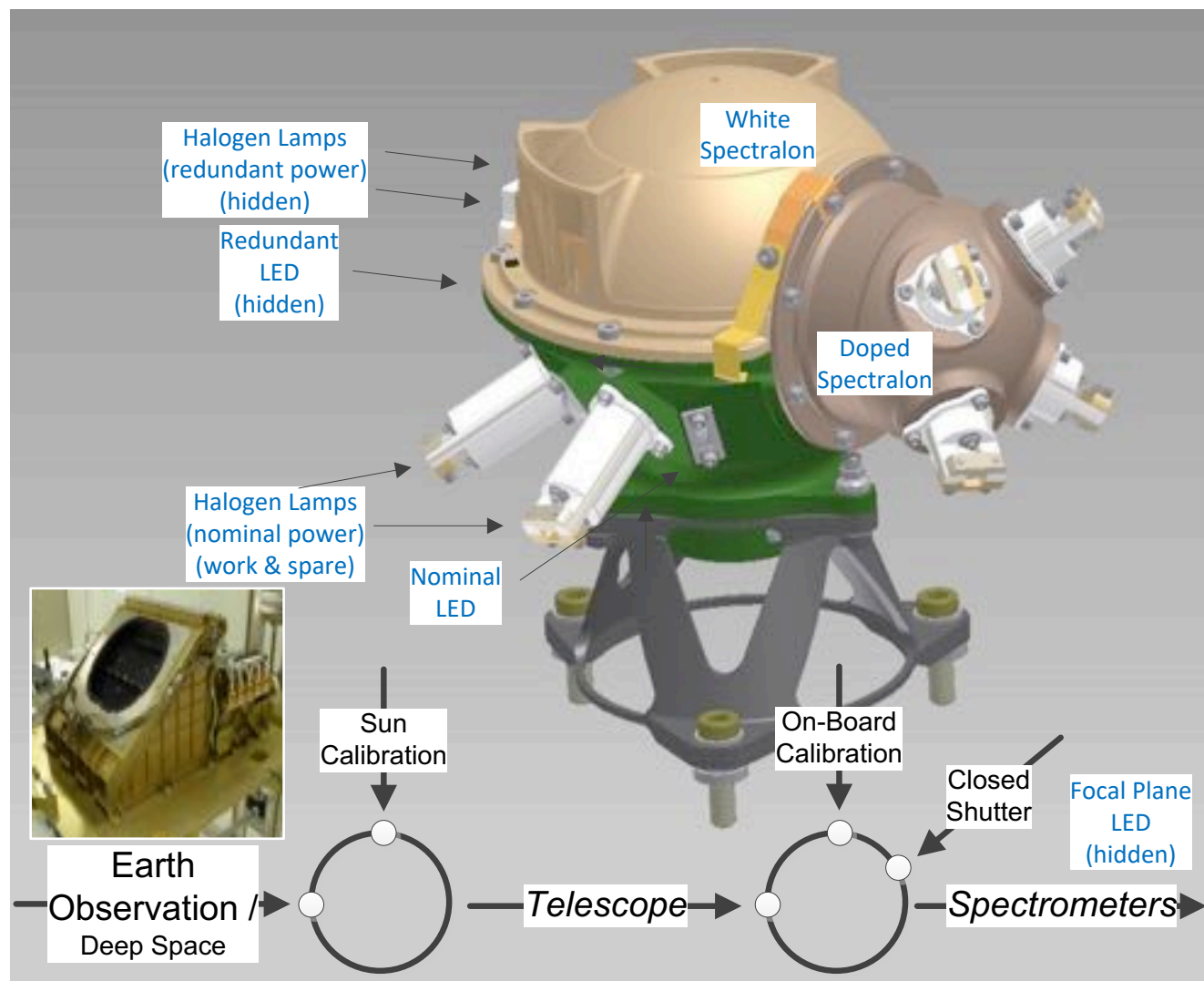
GFZ
Helmholtz-Zentrum
POTS DAM



DLR

OHB
SYSTEM

EnMAP – On-Board Calibration Equipment

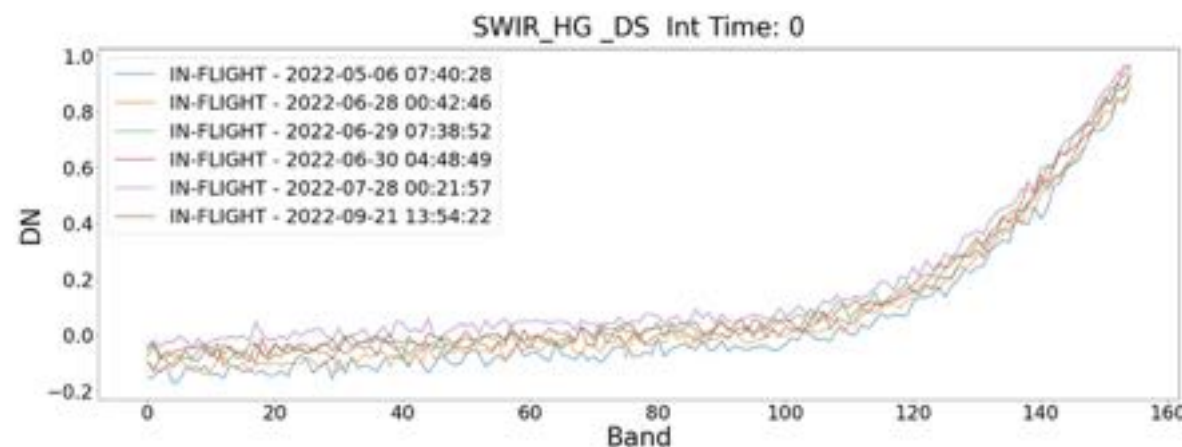
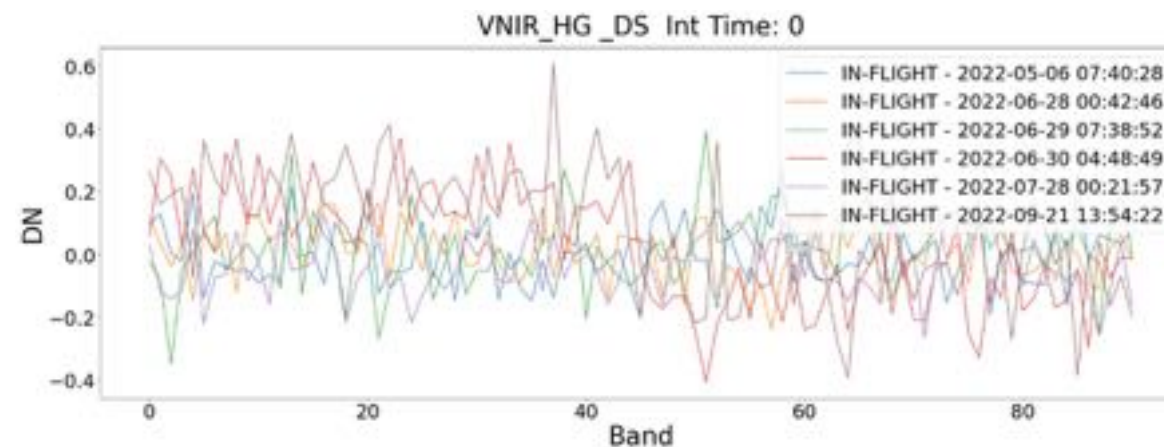


- Closed Shutter [Dark Measurement]
- Deep Space [Dark Measurement / Shutter Emission]
- Sun Calibration [Absolute Radiometry]
- White Spectralon [Relative Radiometry]
- Doped Spectralon [Spectral]
- Focal Plane LED [Linearity]

Source: OHB

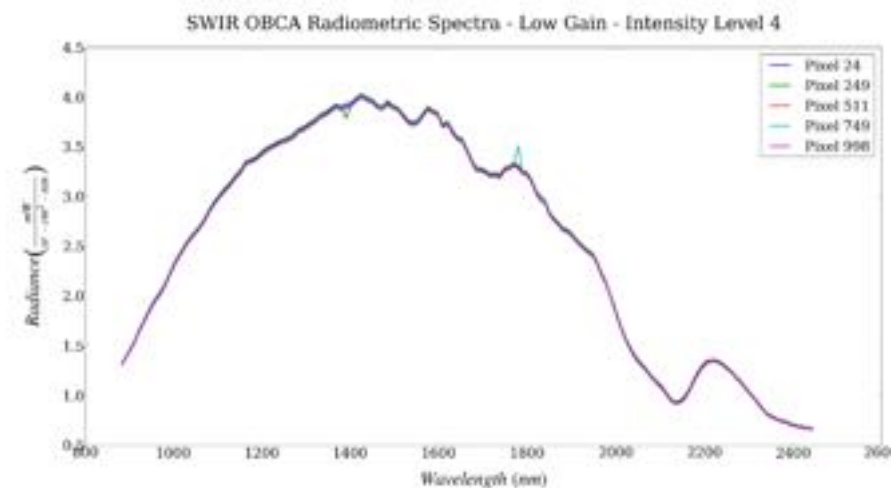
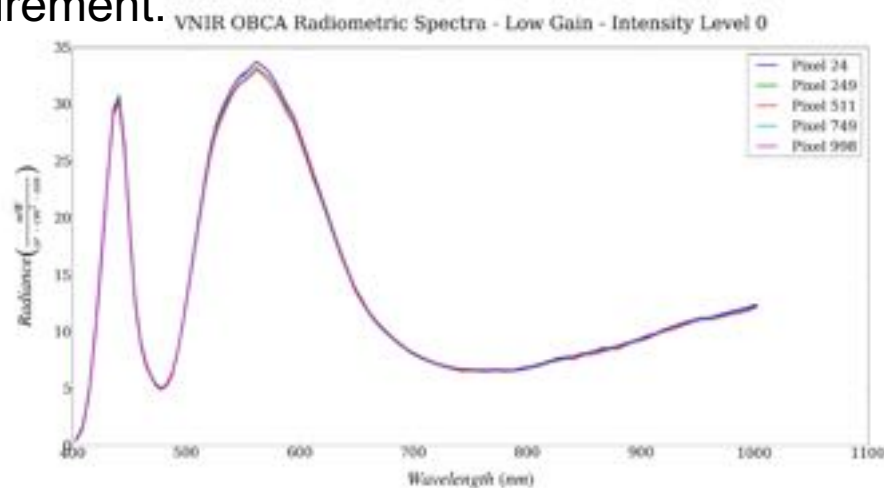
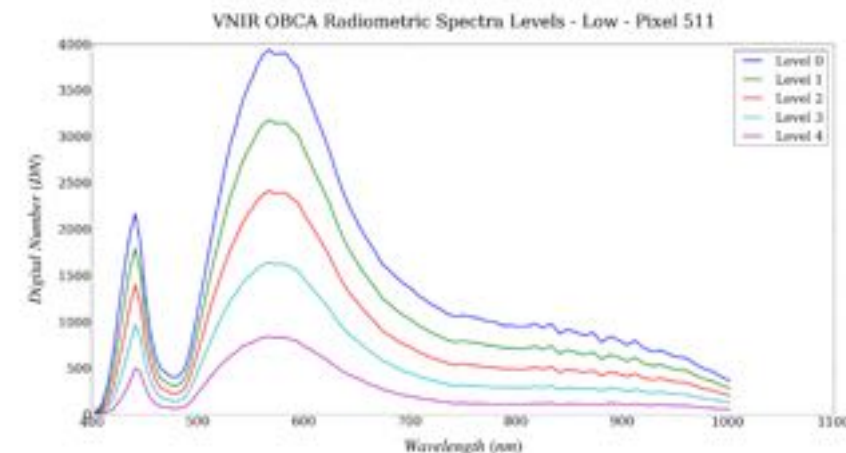
EnMAP – Dark Signal and Deep Space Measurement

- Dark Current measurements are available for all Calibration and Earth datatakes.
- No significant changes were noticed in the dark measurements (less than 2 DNs for both sensors and both gains)
- Deep Space analysis computed: shows negligible shutter thermal contribution (around 1 DN for higher SWIR wavelengths).



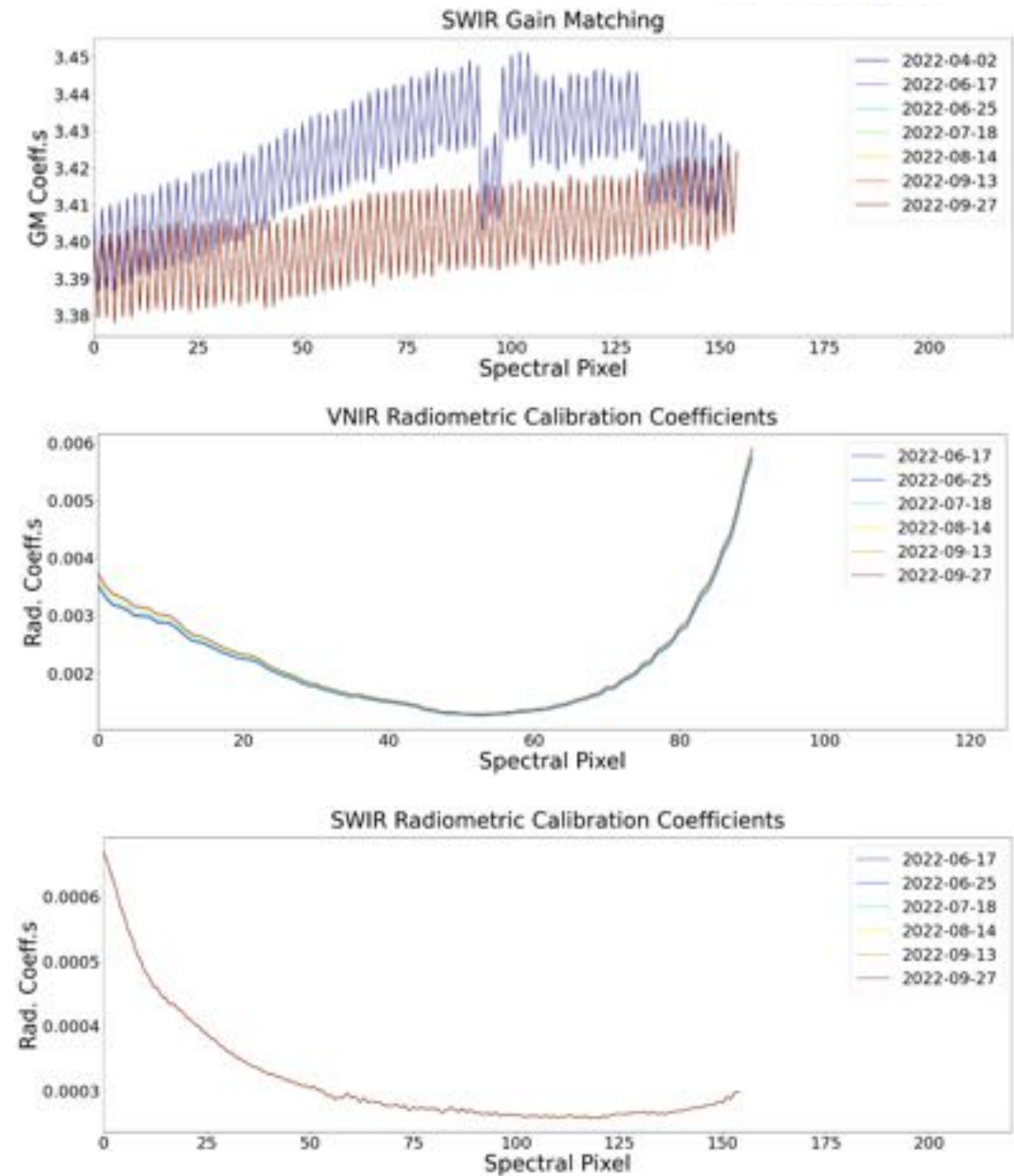
EnMAP – Relative Radiometric Measurement

- Halogem Lamp and LED illuminate the White Spectralon at 5 different illumination levels.
- VNIR sensor showed unexpected overtime variability that has been closely monitored (1% between consecutive measurements) and there is a consistent indication that it is reducing in intensity.
- The SWIR sensor is very stable in both gain settings.
- New reference tables have been created following each measurement.



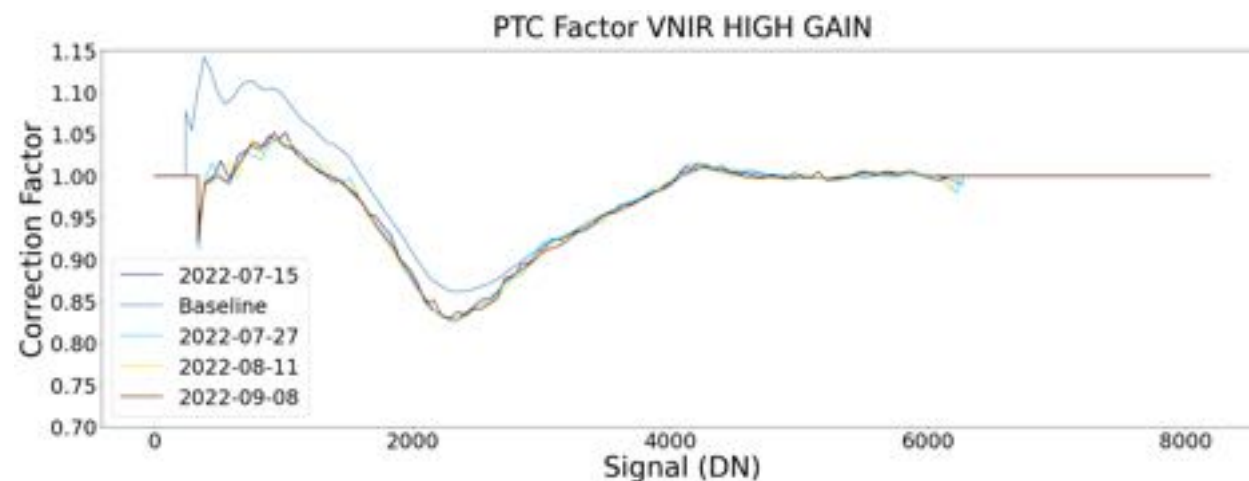
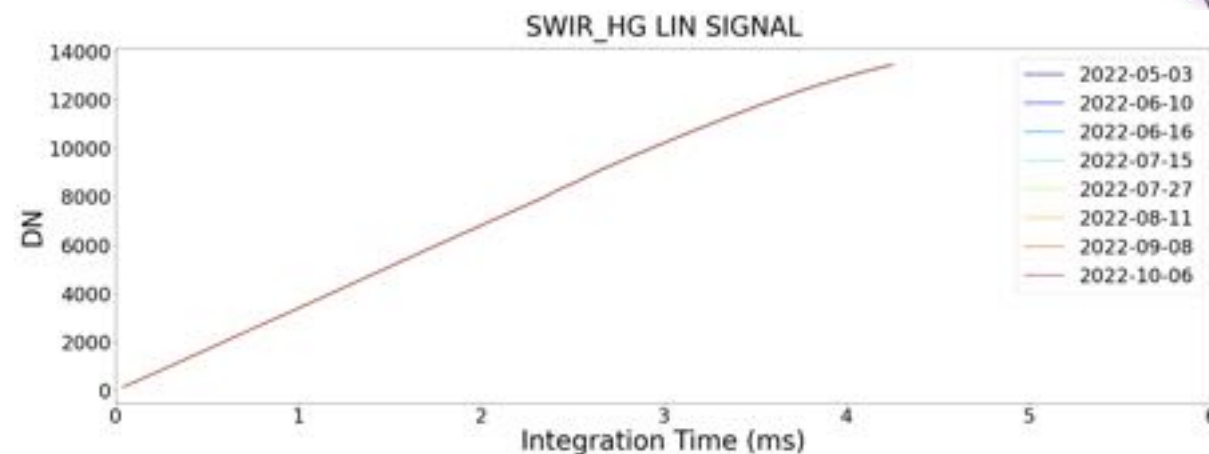
EnMAP – Absolute Radiometric Measurement

- The Full Aperture solar Diffuser Assembly (FADA) is used for absolute radiometric calibration.
- Initial RNU coefficient update provided significant improvement with respect to preflight values on early images.
- Gain Matching coefficient showed variations with respect to the preflight values in particular on the SWIR sensor with considerable pattern change.
- VNIR variability requires regular calibration coefficient updates in order to maintain the sensor inside the mission requirements.
- The SWIR sensor shows stable in-flight performance.



EnMAP – Linearity Measurement

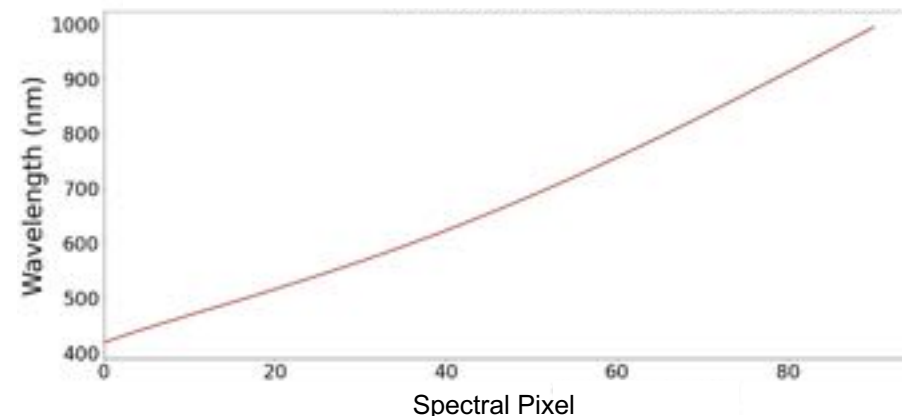
- Linearity Measurement is composed of multiple cycles of acquisitions at increasing integration times using the Focal Plane LED with a fixed illumination level.
- No changes were detected on the PTC curve during commissioning but there has been a change in the correction factors in VNIR high gain from preflight to inflight.
- No relevant changes in the SWIR linearity correction were detected.
- No new Linearity Calibration tables have been created.



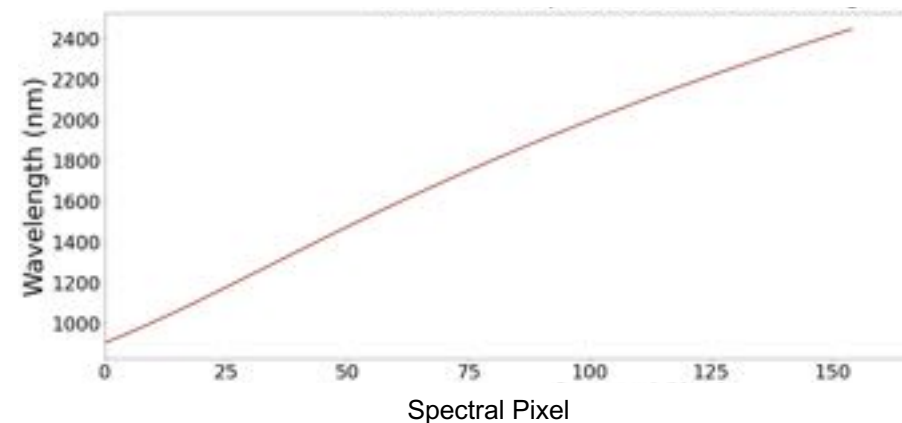
EnMAP – Spectral Measurement

- Central Wavelengths changed after launch:
 - 0.5% change in VNIR
 - 0.17% in SWIR
- In-Flight Measurements show good spectral stability
- Two Spectral Calibration Updates performed
 - Latest on 25.06.2022

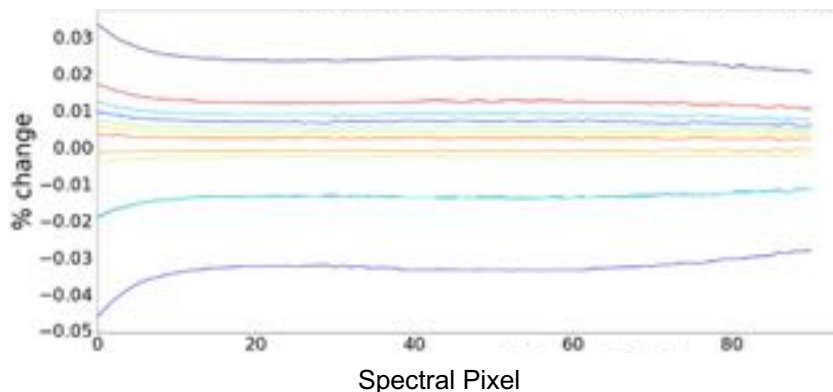
VNIR Central Wavelengths



SWIR Central Wavelengths



VNIR Spectral Shift Change



- 2022-04-28
- 2022-05-10
- 2022-06-09
- 2022-06-25
- 2022-07-08
- 2022-07-12
- 2022-07-22
- 2022-08-06
- 2022-08-20
- 2022-08-24
- 2022-09-11
- 2022-09-17
- 2022-10-01

Summary of the Commissioning Activities

- Major Activities
 - Execution of CAL procedures and generation of new in-flight calibration tables
 - Generation of quarterly reports for Radiometric and Spectral calibration
 - Analysis of results and issues during commissioning
- Statistics
 - Analysis of 53 calibration datatakes
 - 1 CTB_DPM update (in-flight)
 - 5 CTB_RAD updates (in-flight, first calibration 17.06.2022)
 - 2 CTB_SPC updates (in-flight, first calibration 10.05.2022)
 - 1 REF_DPM update (in-flight)
 - 1 REF_DRK update (in-flight)
 - 3 REF_LIN update (in-flight)
 - 5 REF_LMP updates (in-flight)
 - 1 REF_SPC update (in-flight)
 - 5 REF_SUN updates (in-flight)