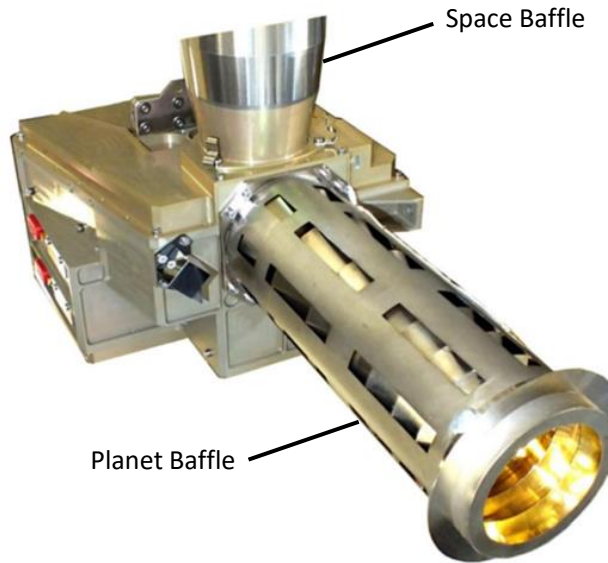
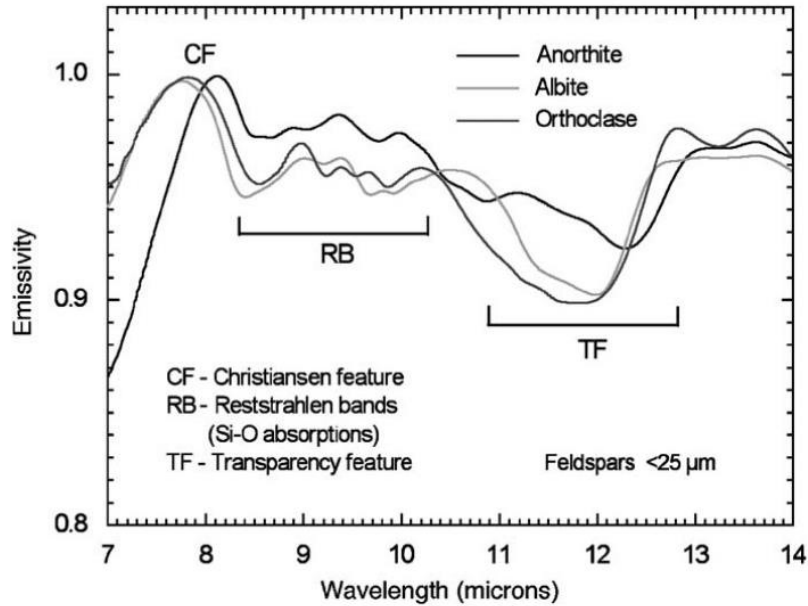


# MERTIS — Mercury Radiometer and Thermal Infrared Spectrometer

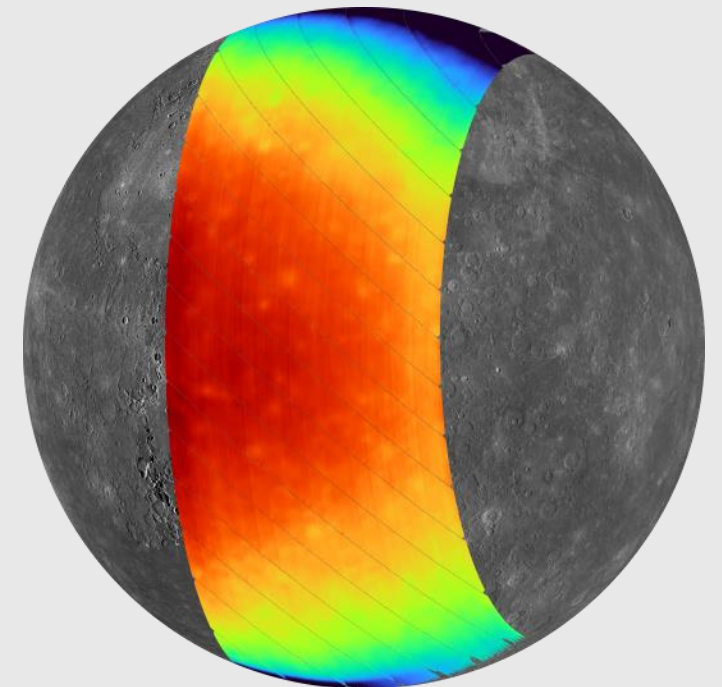


## OBJECTIVES

1. Study of Mercury's surface composition
2. Identification of rock-forming minerals
3. Mapping of the surface mineralogy
4. Study of surface temperature variations and thermal inertia

- **TIS** (Thermal Infrared Spectrometer)
  - Day-side emissivity maps in **7-14 μm** range
- **TIR** (Thermal Infrared Radiometer)
  - Day and night-side temperature maps in **7-40 μm** range
- Calibration: Two onboard blackbodies + deep-space view
- Spatial resolution (TIS): ~500 m per pixel from orbit

(Hiesinger et al., 2010; Benkhoff et al., 2021)



# Planetary Spectroscopy Laboratory (PSL)

Three identical Bruker VERTEX 80 V Vacuum FTIR

- Reflectance
- Transmissivity
- Emissivity

Hyperion 2000 FTIR Microscope

- Micro spectroscopic on mm-scaled samples

Emissivity Chamber

- VNIR and MIR measurements on heated samples
- Vacuum environment
- High sample T with induction heating (up to 1300 K)

Cryochamber

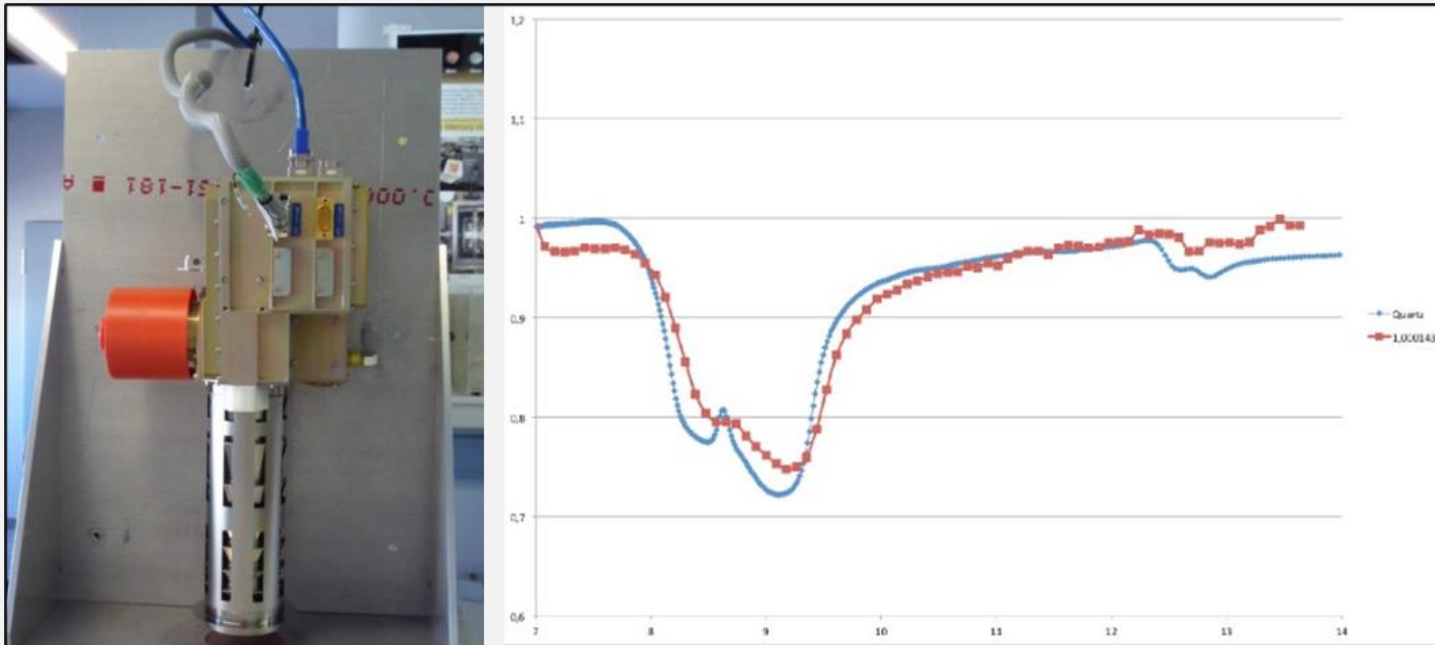
- High-vacuum chamber
- Nitrogen purged glovebox
- Temperatures below 150 K

Spectral Range:  $0.2 - 200 \mu\text{m}$   
Temperature Range:  $150 - 1300 \text{ K}$



The Planetary Spectroscopy Laboratory and its external units: Hyperion microscope, the emissivity chamber and the cryochamber (modified after Helbert et al., 2024)

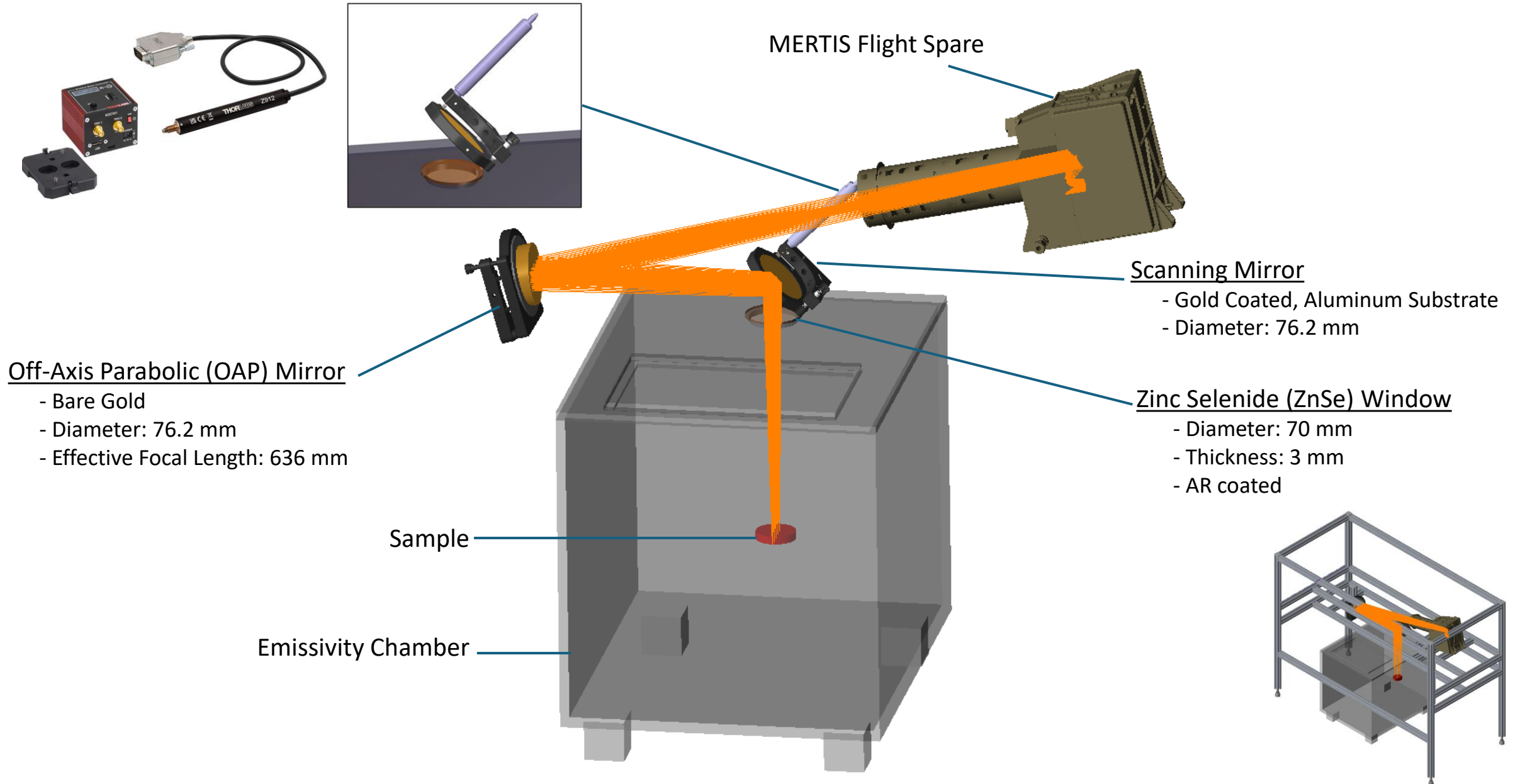
## MERTIS Emulator - Challenges



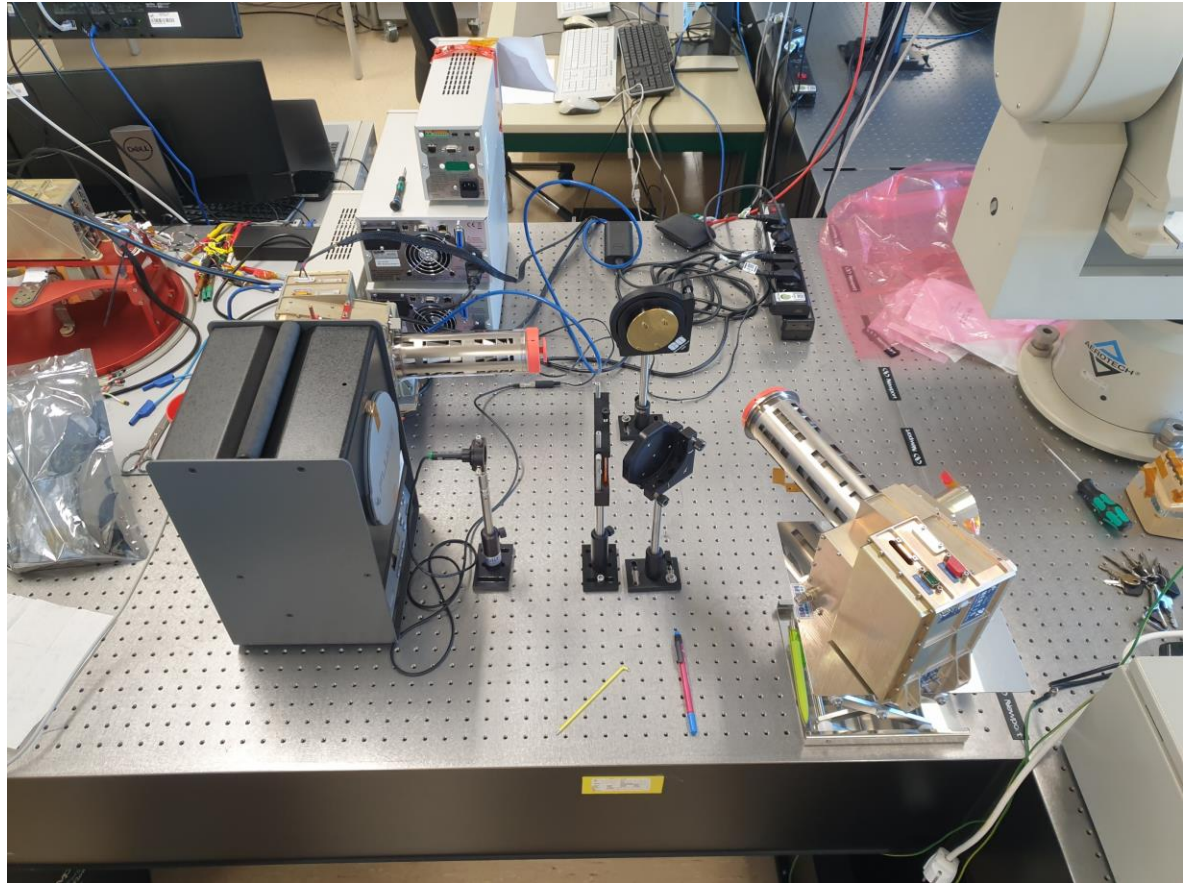
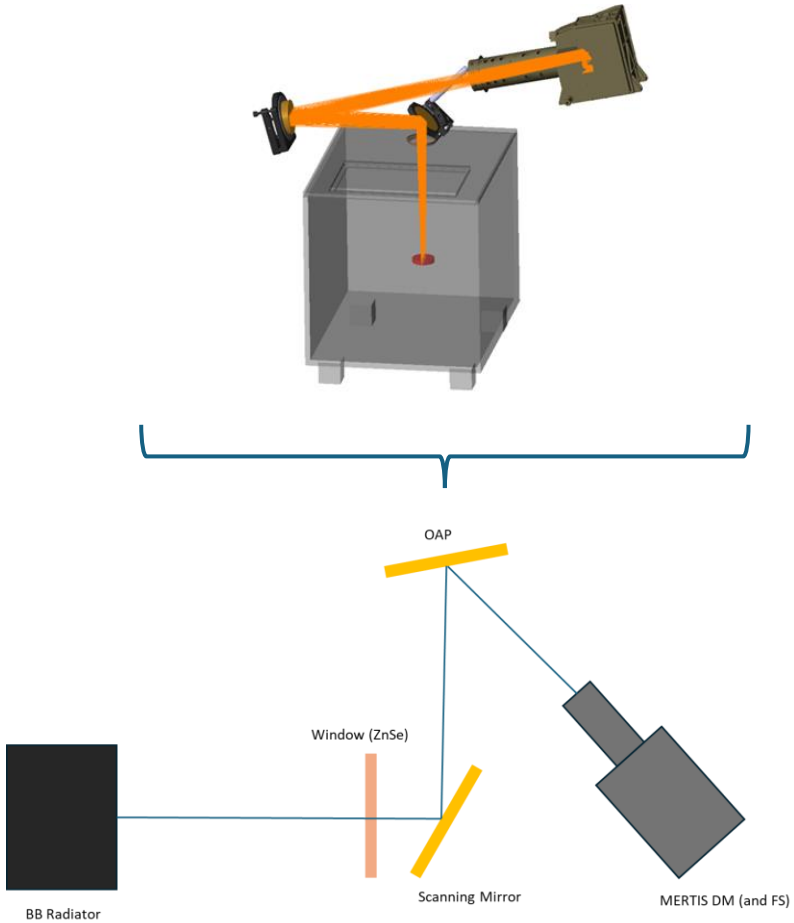
On left, MERTIS flight model mounted on the emissivity chamber. On right, comparison of a spectra of a quartz sample at 500 °C with the Bruker spectrometer (blue) and with the MERTIS development model (red). (Helbert et al., 2013)

- Push-broom instrument design
  - To create an image, either the instrument or the sample needs to move
- Distance between the instrument and the sample
  - MERTIS was designed to look at infinity. In laboratory environment, the distance between the sample and the instrument is limited

# MIMIC - Design Overview



# MIMIC – Calibration Setup



# MIMIC – Calibration

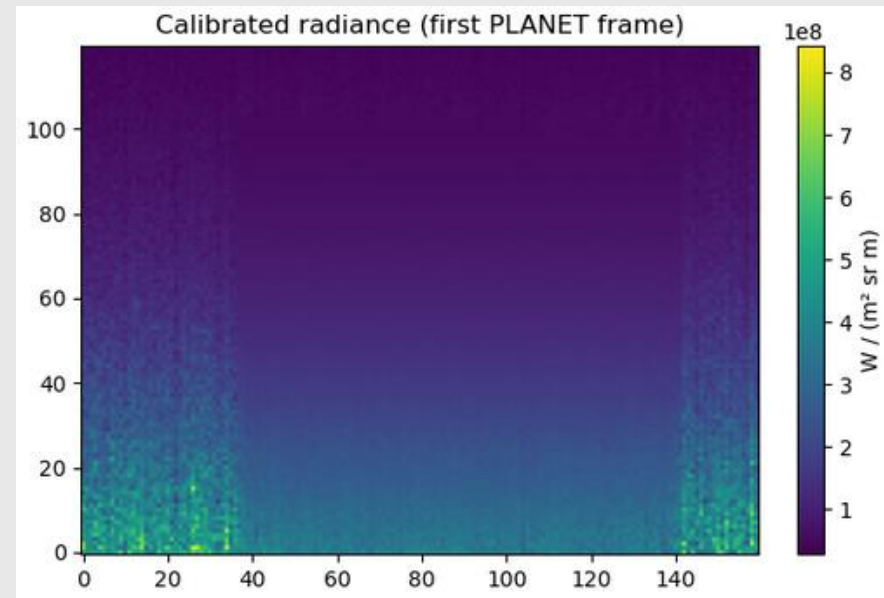
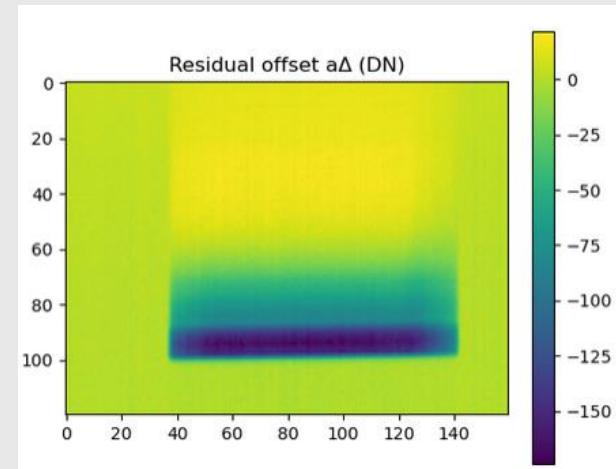
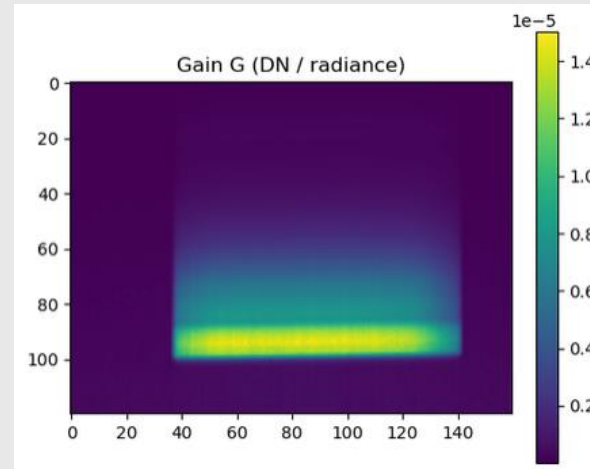
- 4 measurements at different T steps:
  - 500, 550, 600 and 650 K
- Good linearity when BB300 is subtracted from PLANET

$$\Delta D_{ij,r} = a_{ij}^{\Delta} + G_{ij} \Delta L_{ij,r}$$

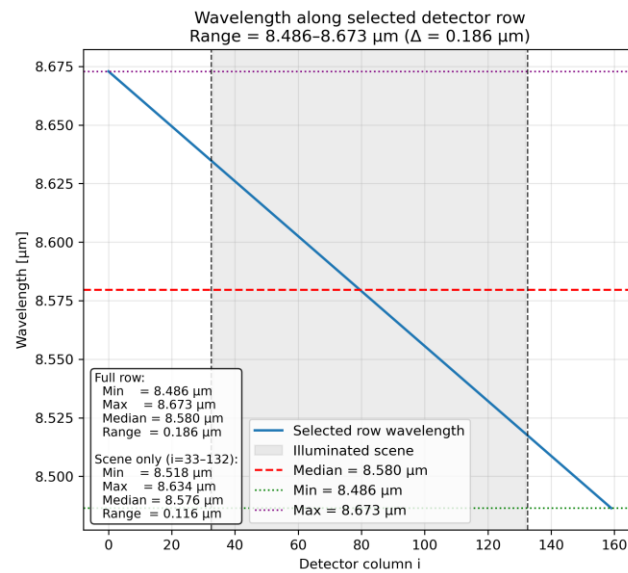
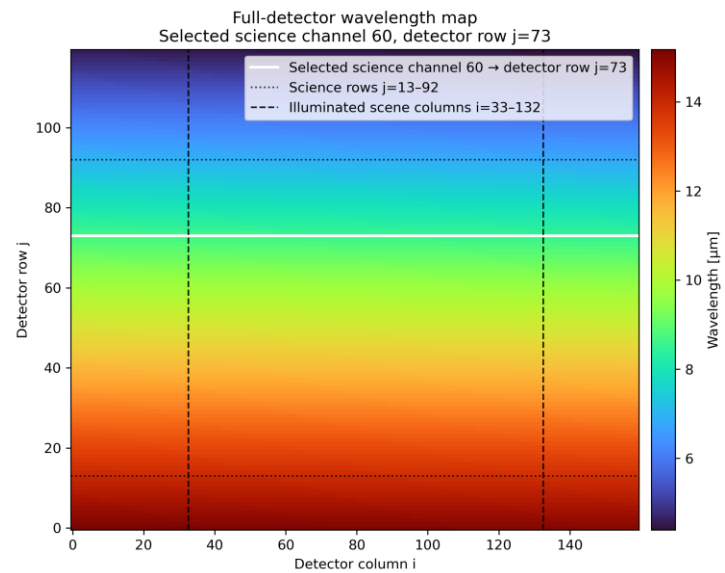
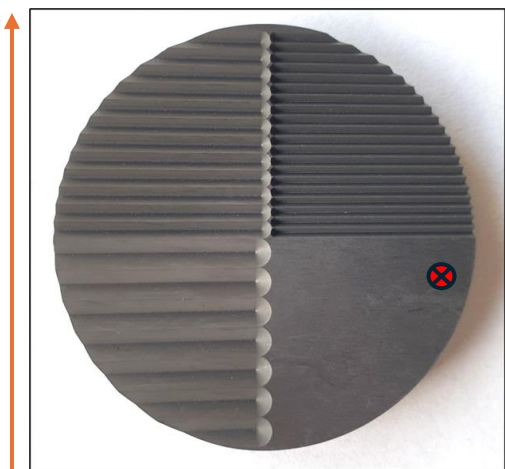
Offset
Gain

$$\Delta D_{ij,r} = D_{ij,r}^{\text{PLANET}} - D_{ij,r}^{\text{BB300}}$$

$$\Delta L_{ij,r} = L(\lambda_{ij}, T_r^{\text{BB}}) - L(\lambda_{ij}, T^{\text{BB300}})$$



BB radiator at 600K, inverted



Science channel 60, detector row j=73, λ median=8.580 μm (8.486-8.673 μm)

