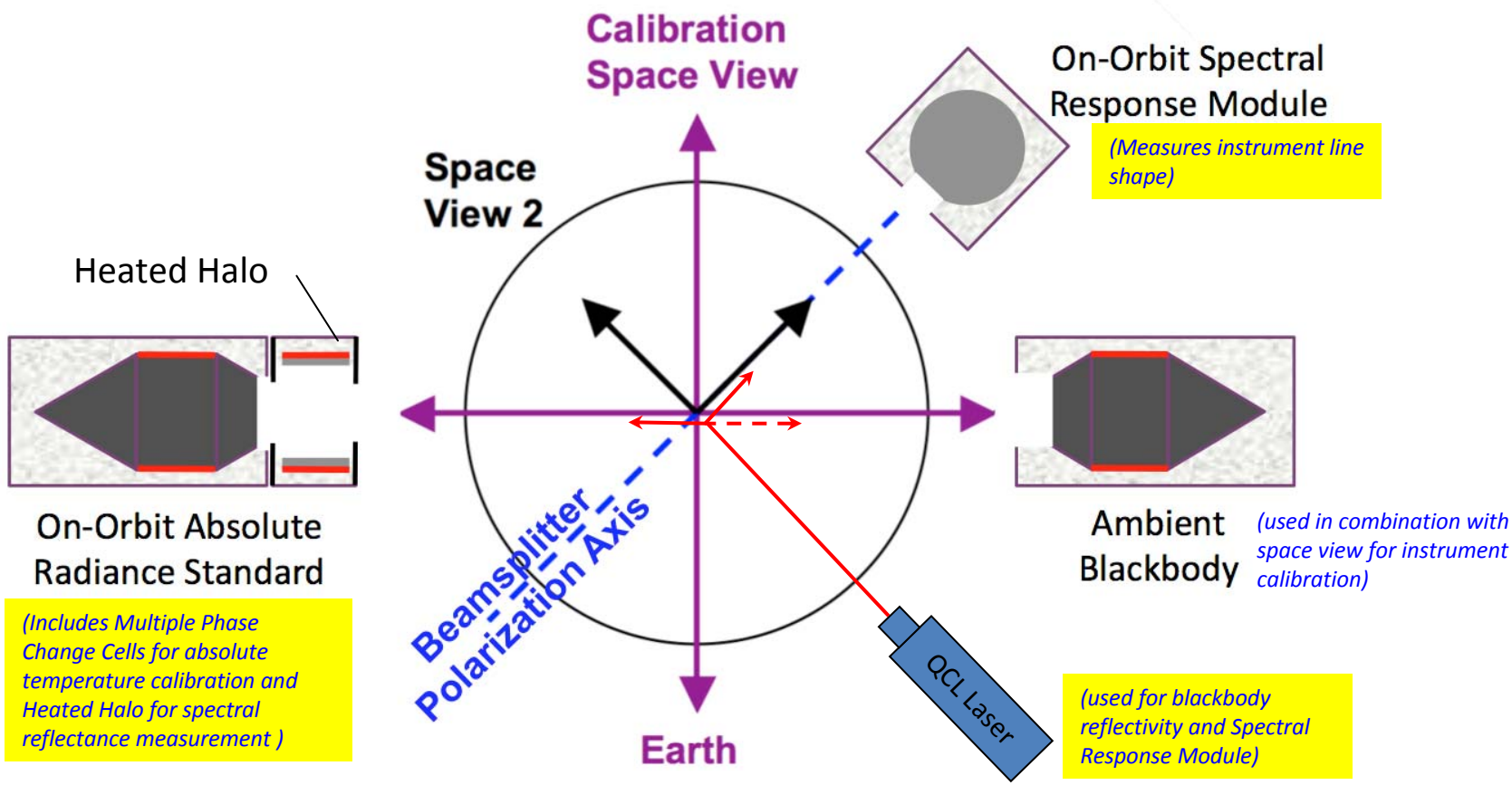
Mid-infrared lasers for radiometric assessment

John Dykema

CLARREO SDT, April, 2013

NASA-LaRC

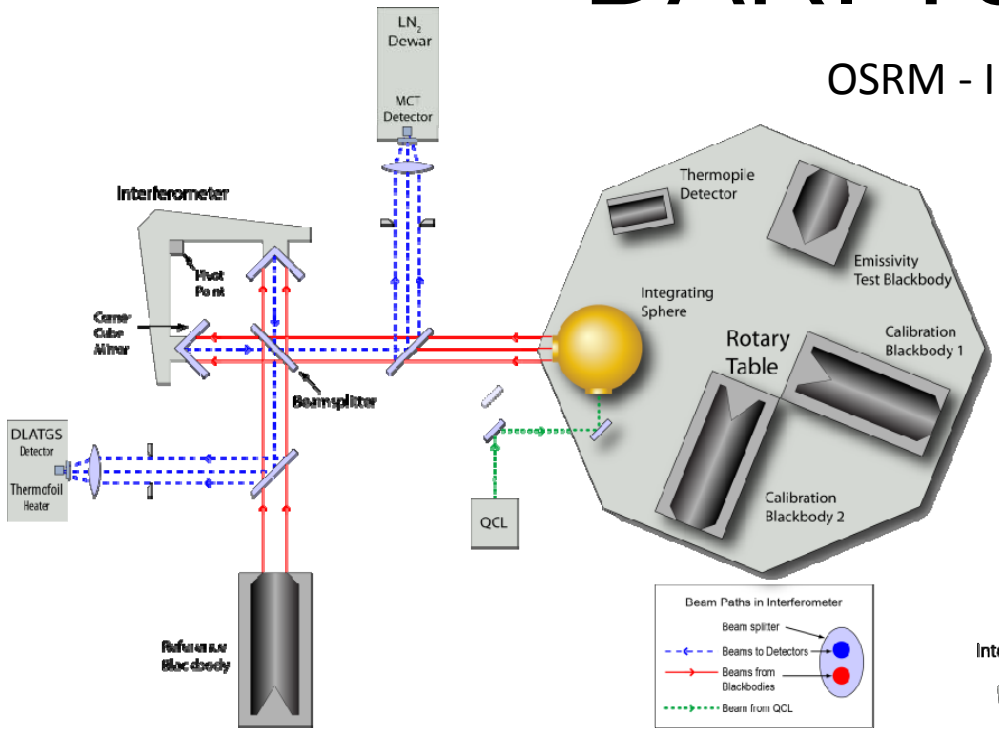
On-orbit Test/Validation (OT/V) Modules



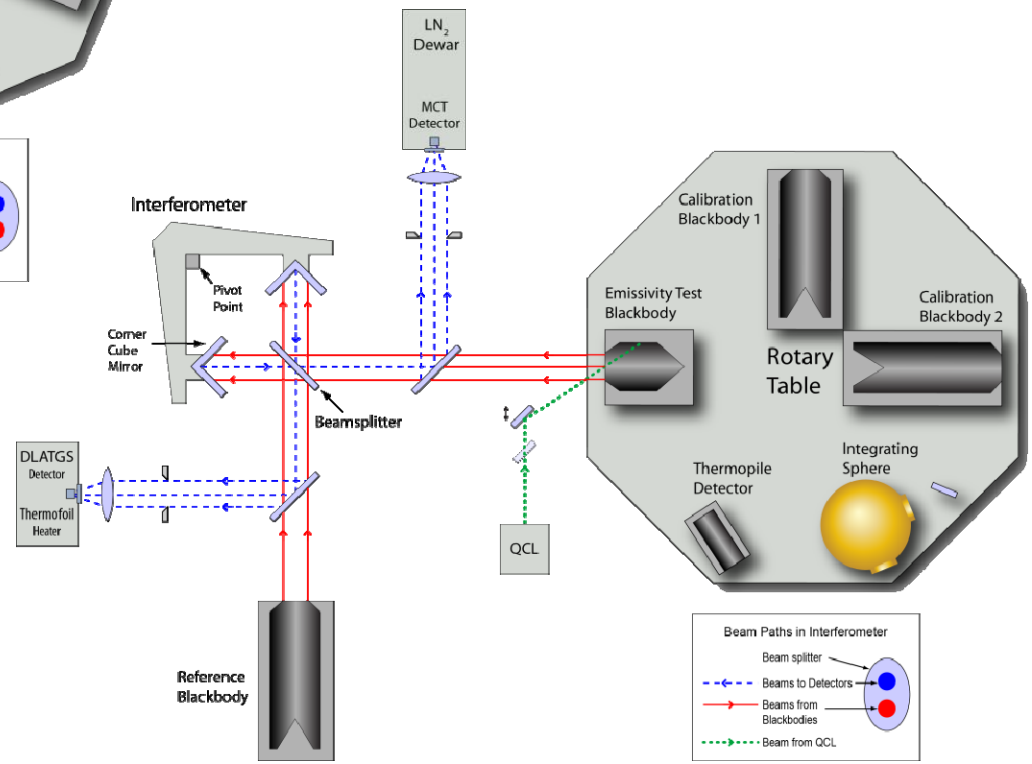
Viewing configuration providing immunity to polarization effects.

DARI Testbed

OSRM - ILS

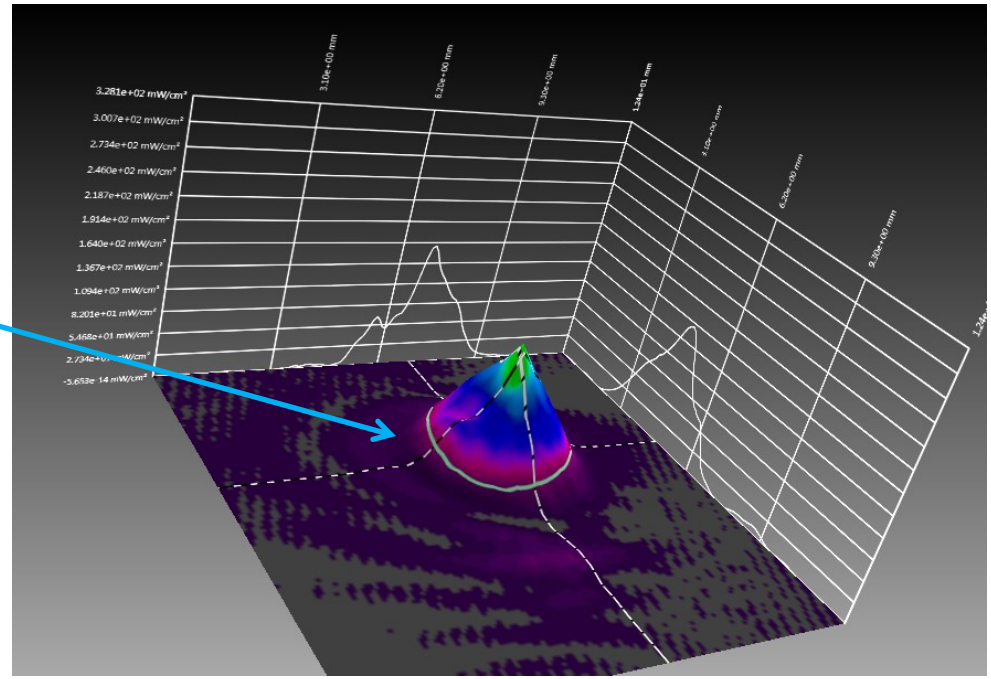


OCEM – emissivity

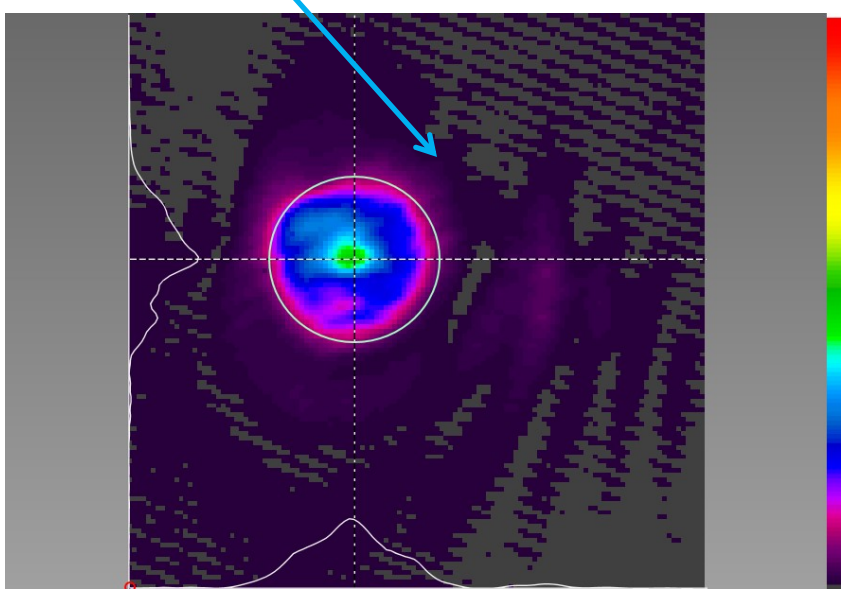


Beam Waist at Blackbody Aperture

Beam waist 4 mm at blackbody aperture

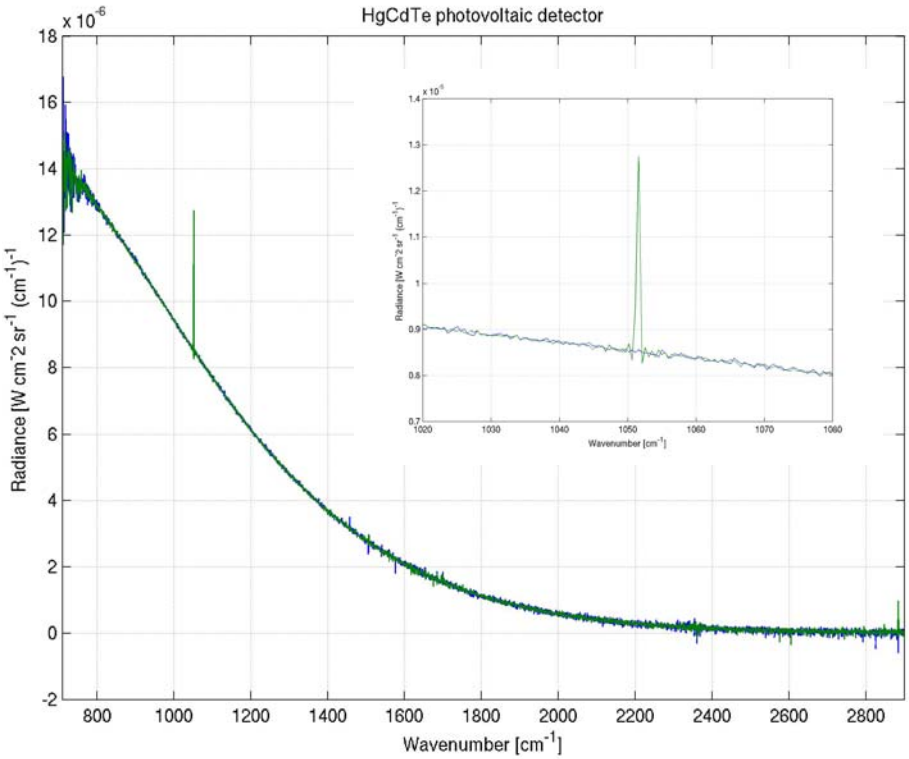


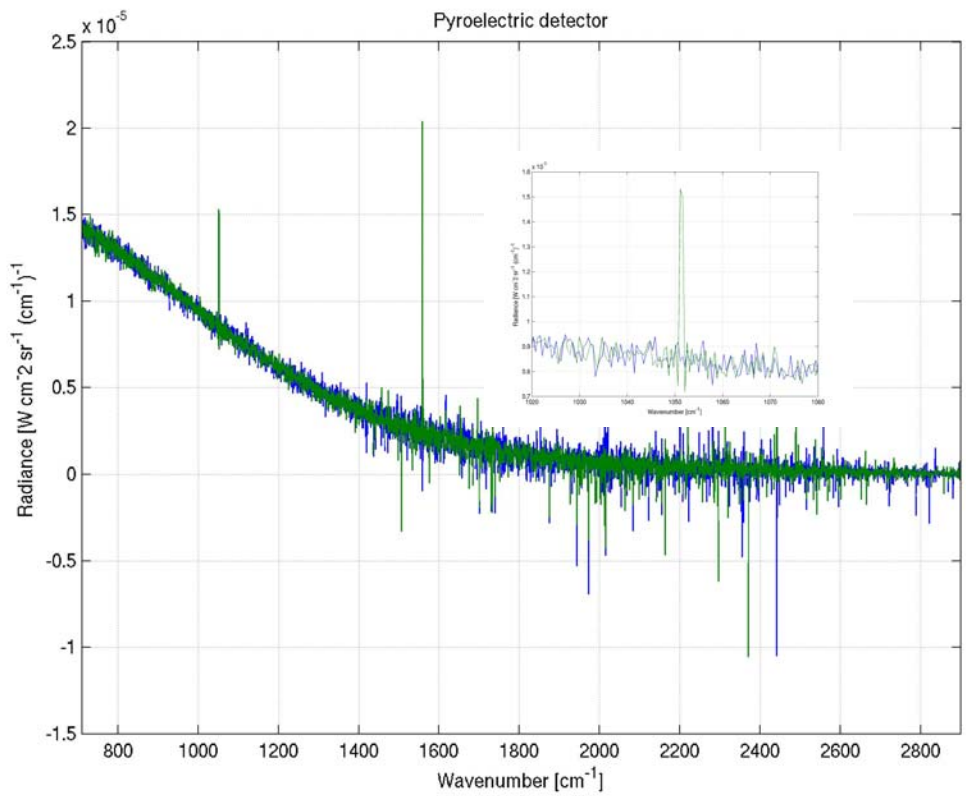
3-D perspective of beam profile at blackbody aperture



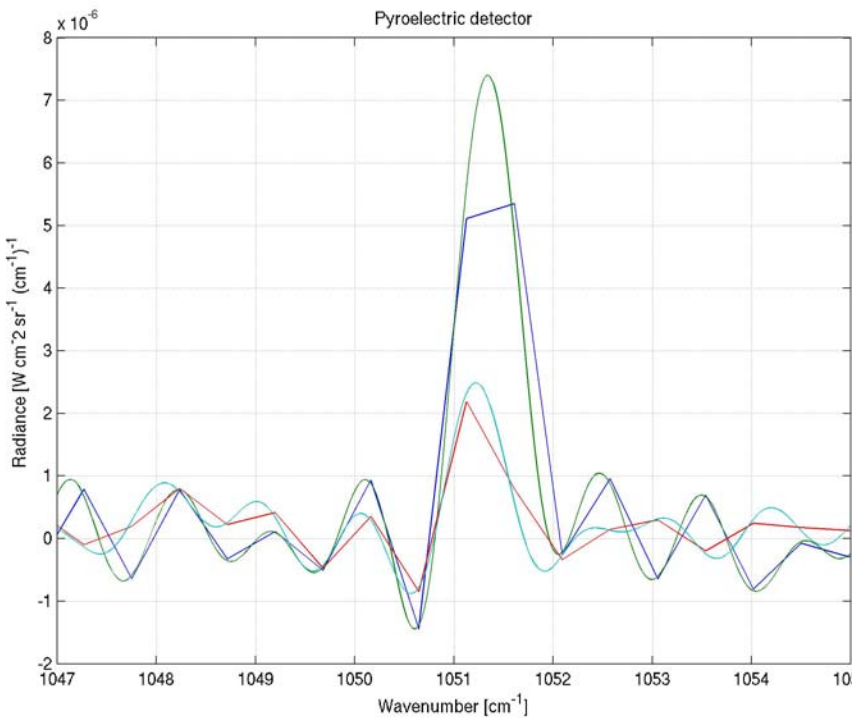
Plane of blackbody aperture

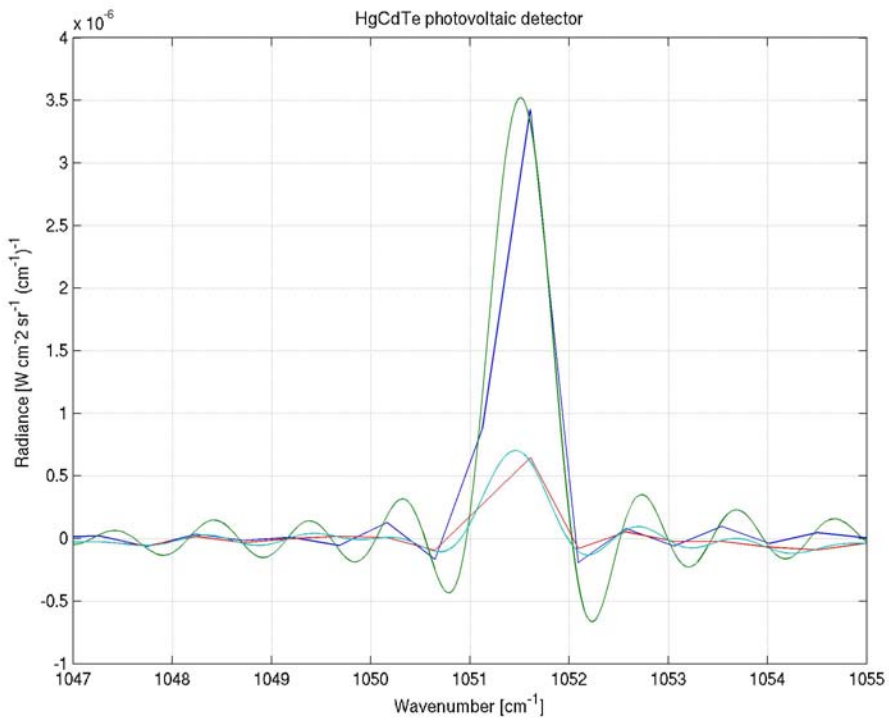
Calibrated unapodized reflectance spectra



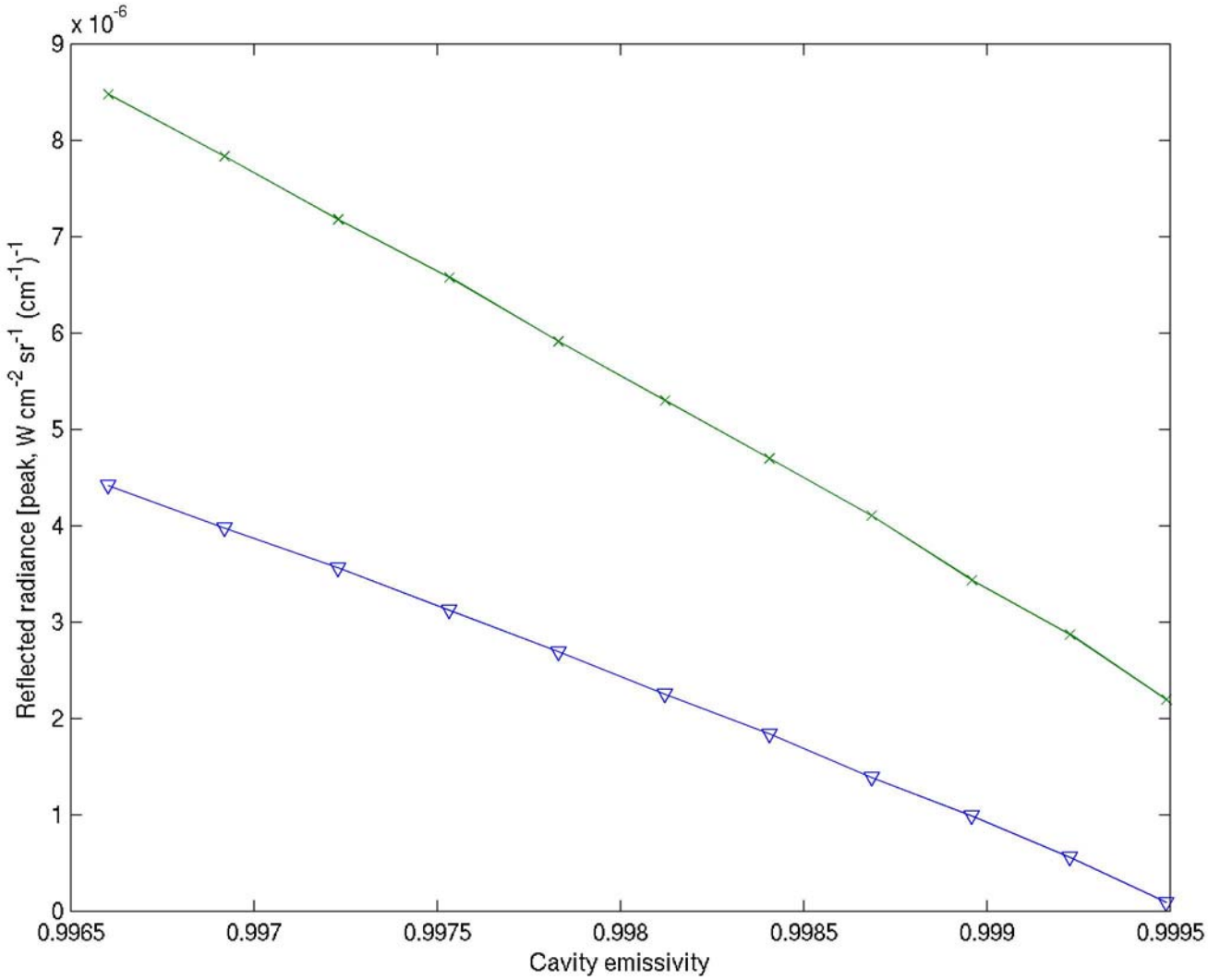


Reflectance spectra -- processed

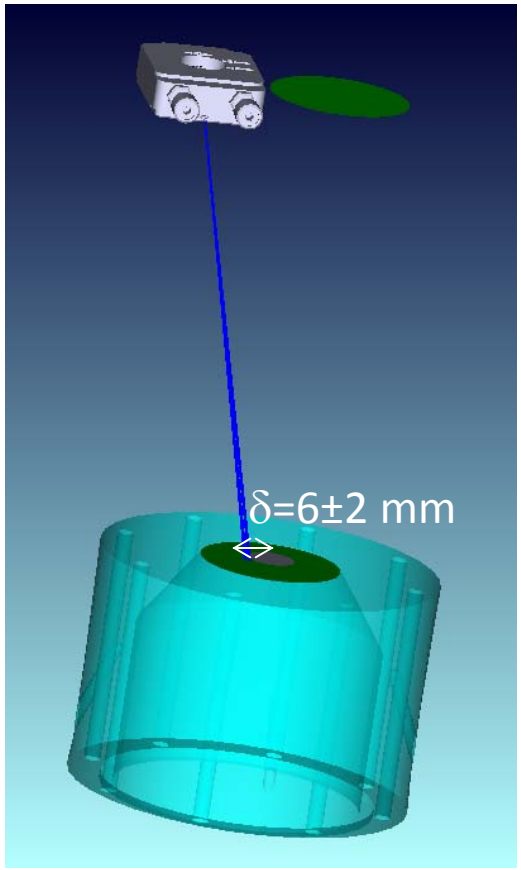


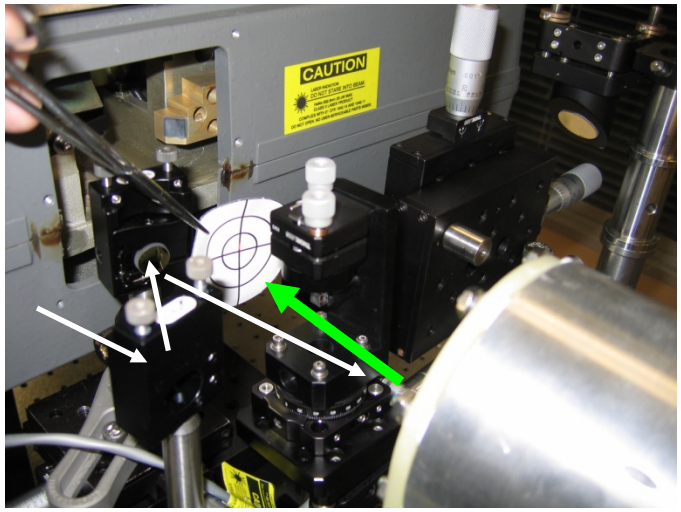


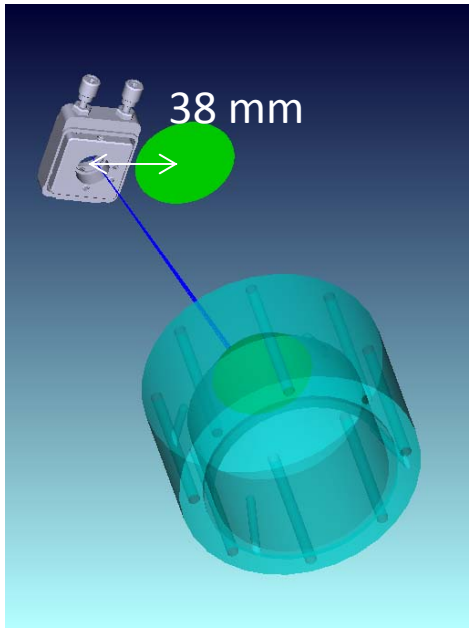
Predicted reflectance from optical model

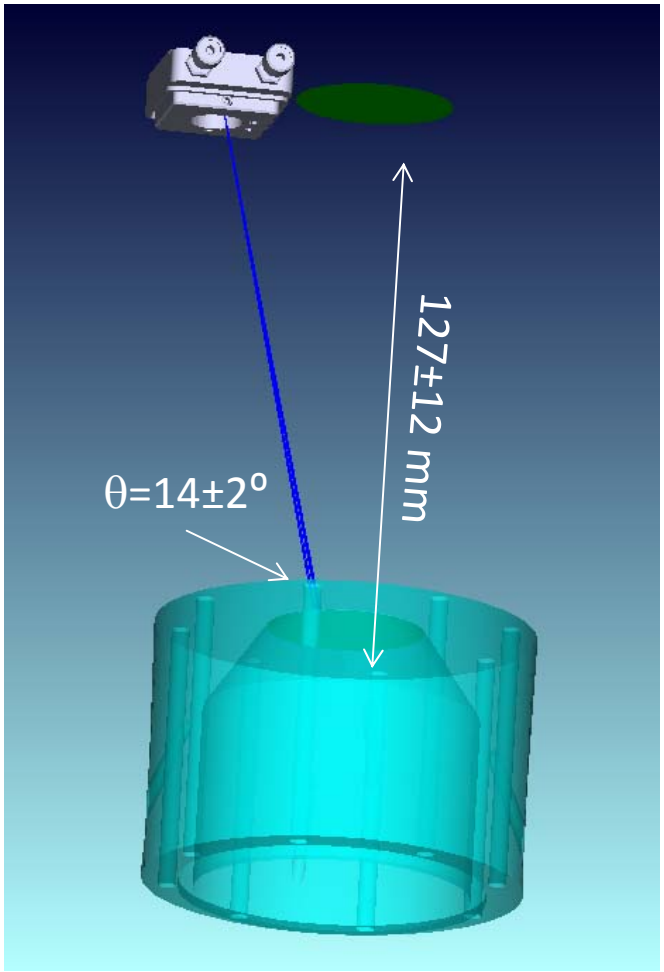


Measurement Geometry

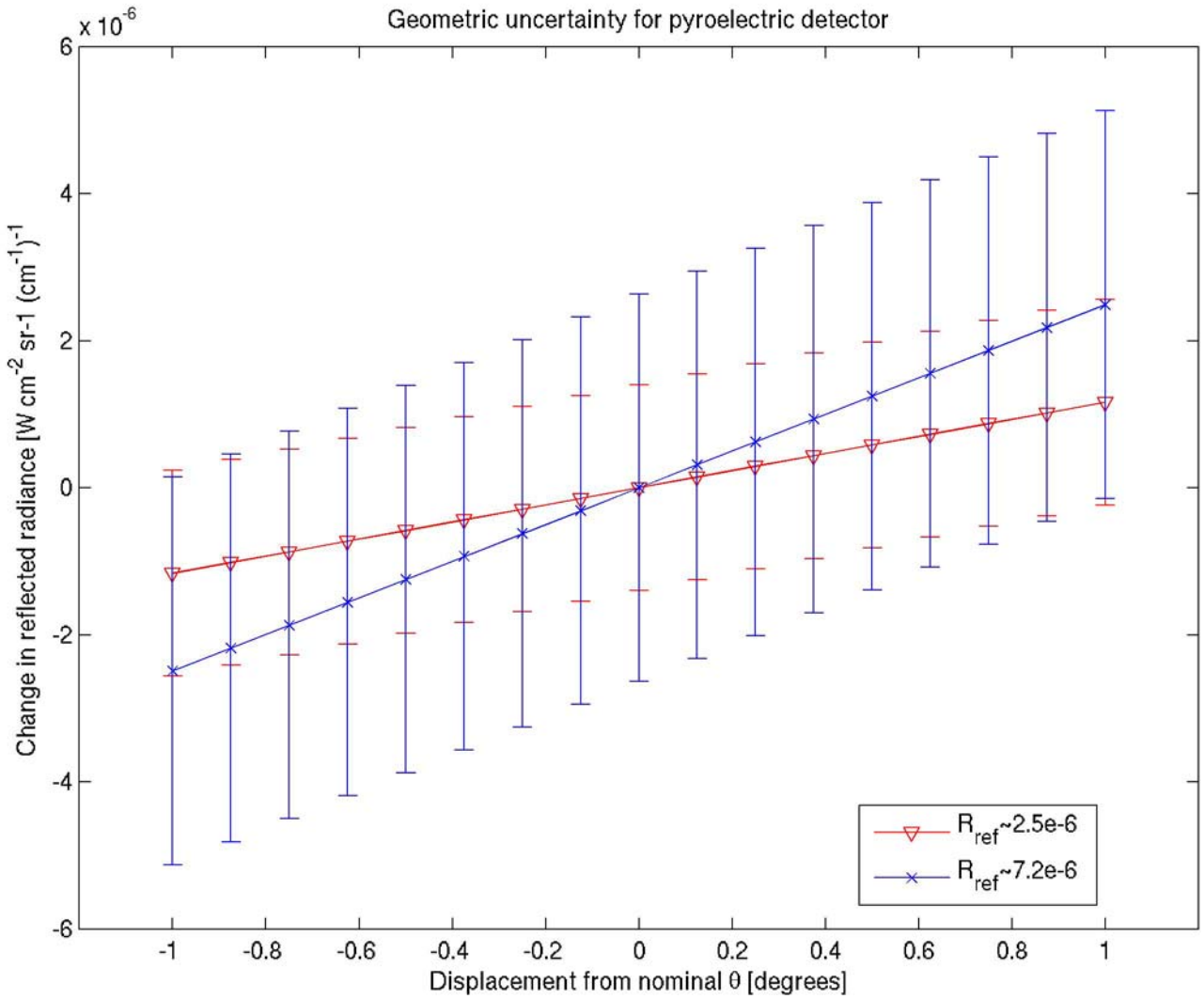




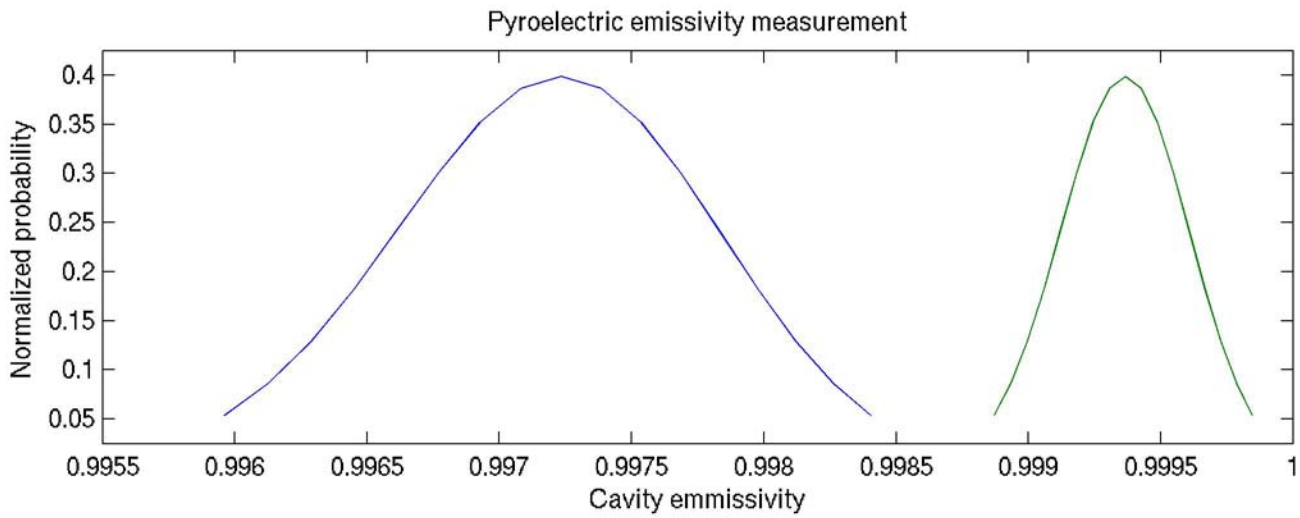


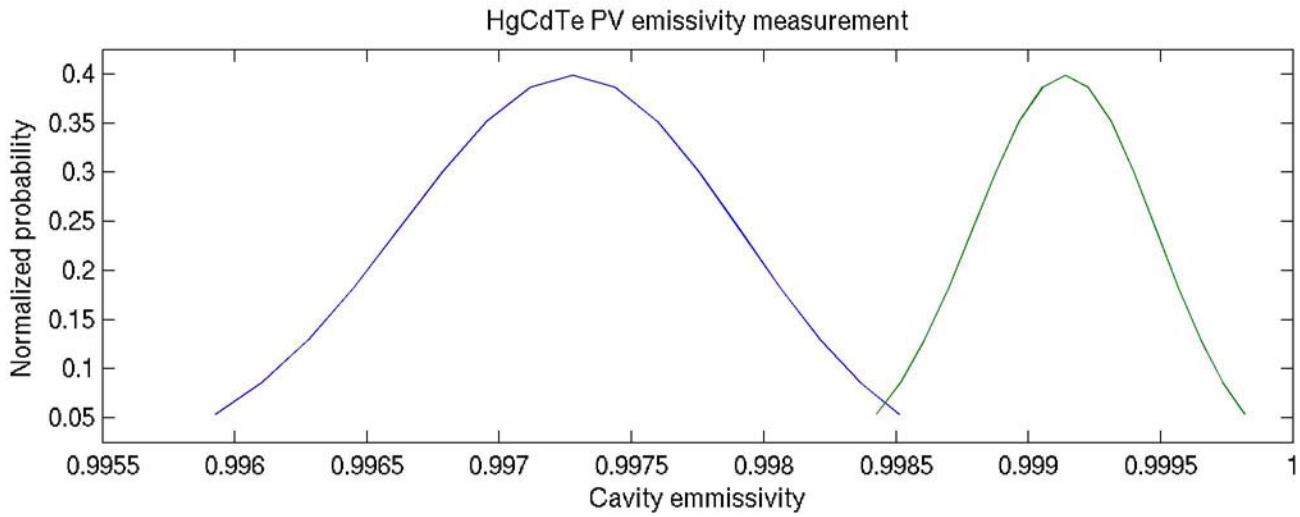


Leading uncertainty from illumination geometry

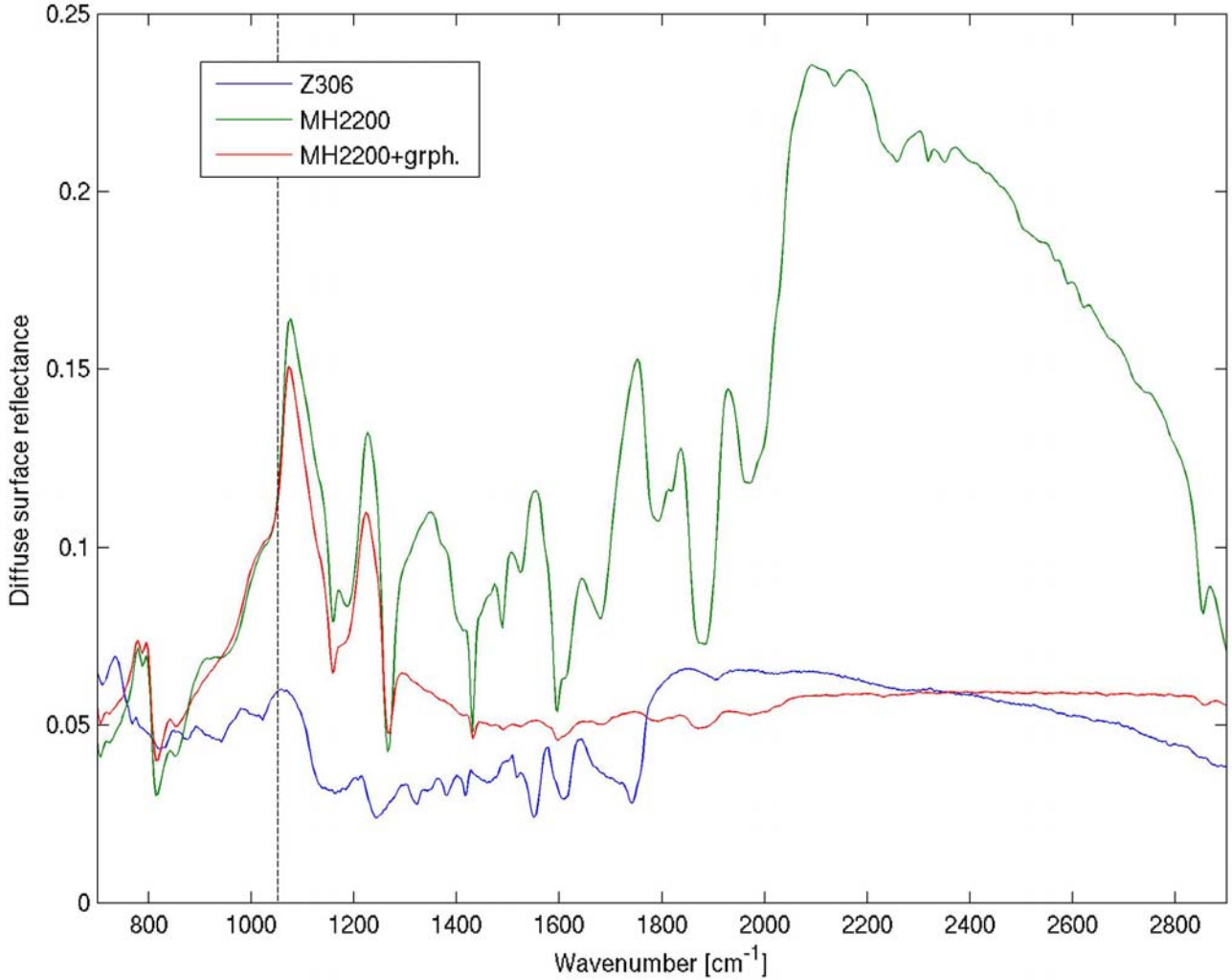


Cavity Emissivity and Uncertainty



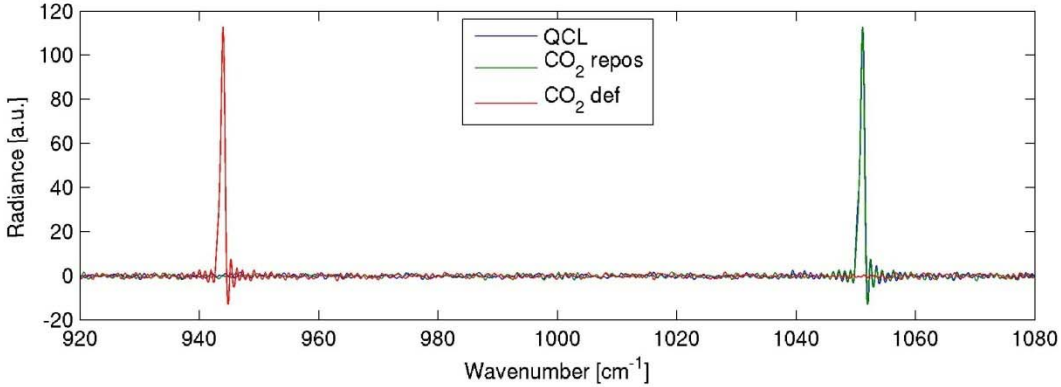


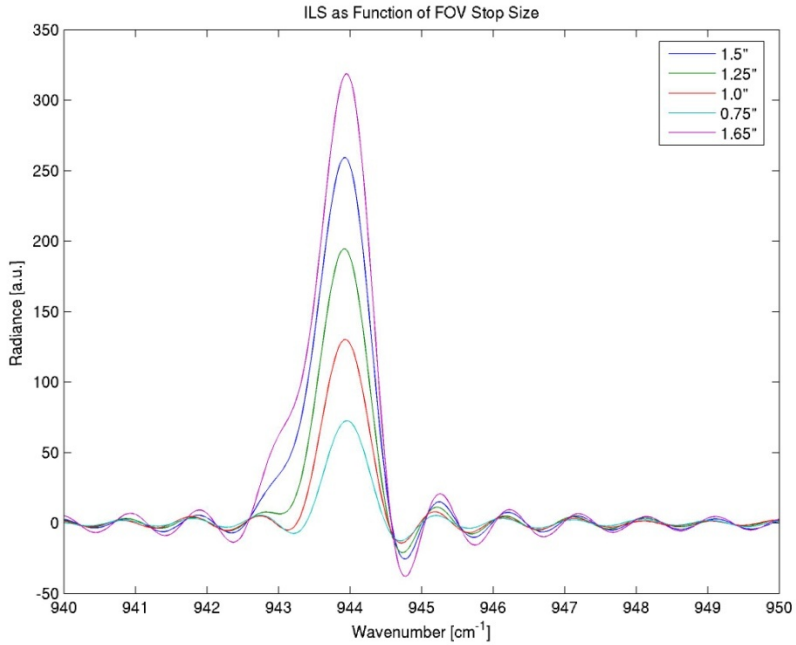
Black paint options



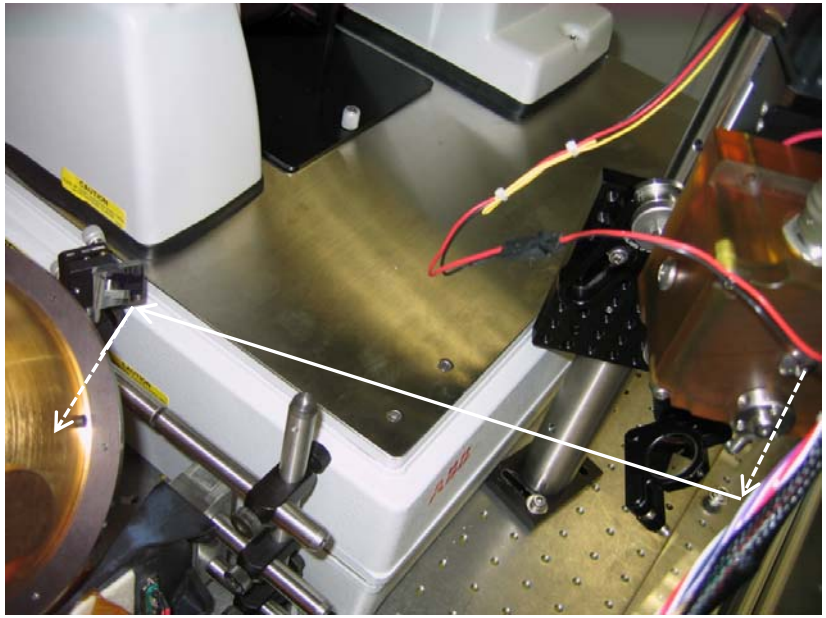
Measurements: Leonard Hanssen and Sergey Mekhontsev, NIST

Spectral calibration - ILS



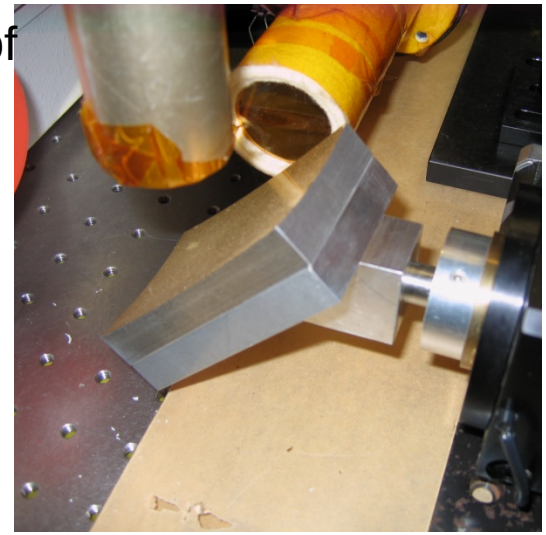


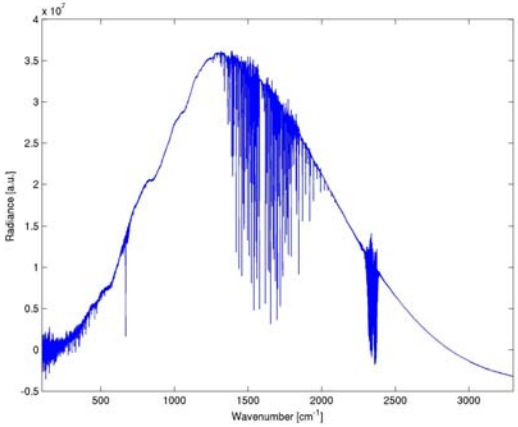
OCEM off Scene Select Mirror



QCL path

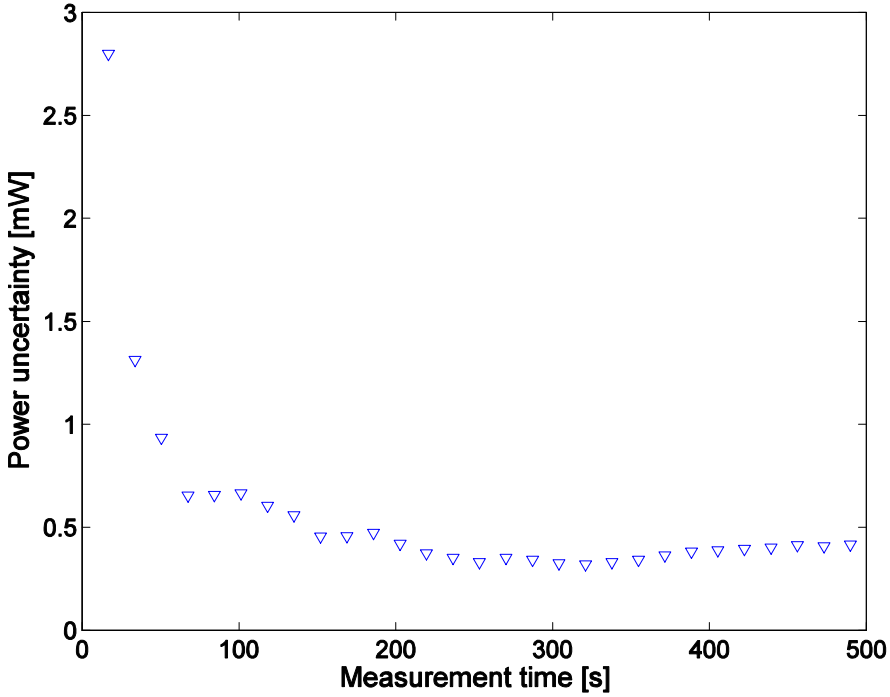
Detail of toroidal mirror



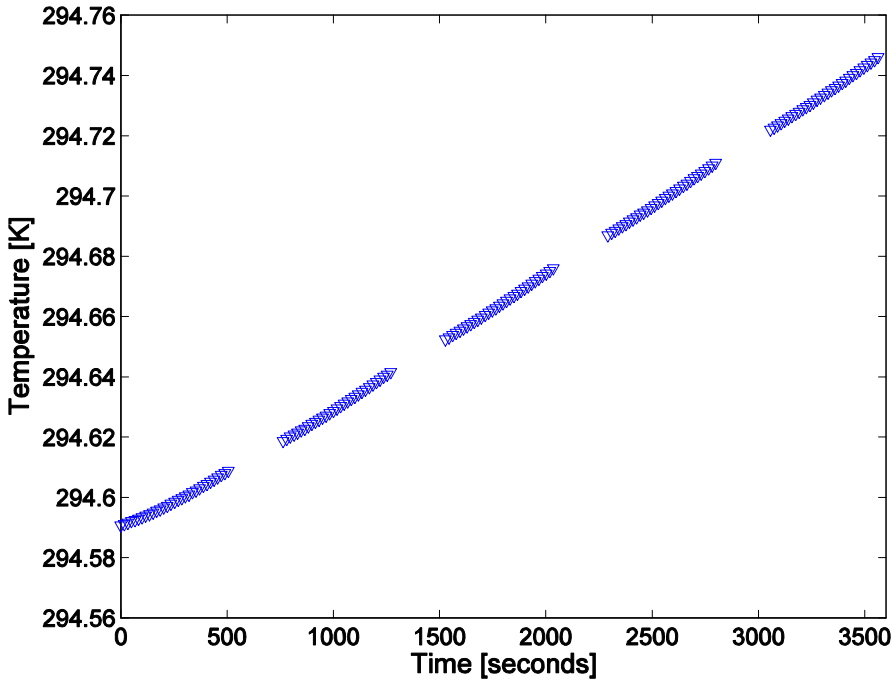


Blackbody baffles and sphere

QCL Power Normalization Results



Vacuum (<2×10^{-5} torr)



Feedback to Requirements

- Update QCL power requirement for emissivity measurements
  - Flow down to thermal, electrical requirements
- Refine ILS requirement and cross-check against radiometric requirements
- Develop approach to defining geometric constraints on QCL location
- Quantify impact of thermal drift on power normalization

Concluding Perspective

Intercomparison of integrated IASI and AATSR calibrated radiances at 11 and 12 µm

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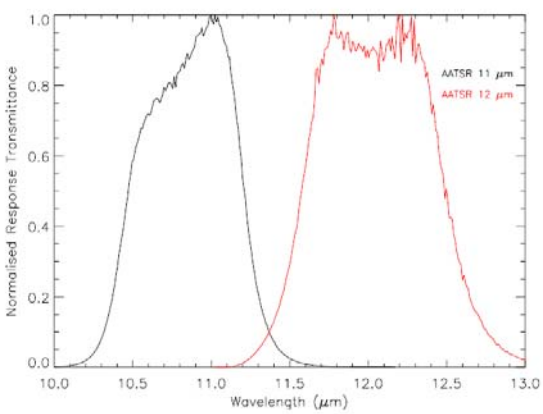

Fig. 2. Spectral filter functions for the 11 µm and 12 µm channels for the Advanced Along-Track Scanning Radiometer (AATSR) on Envisat (ESA, 2008).

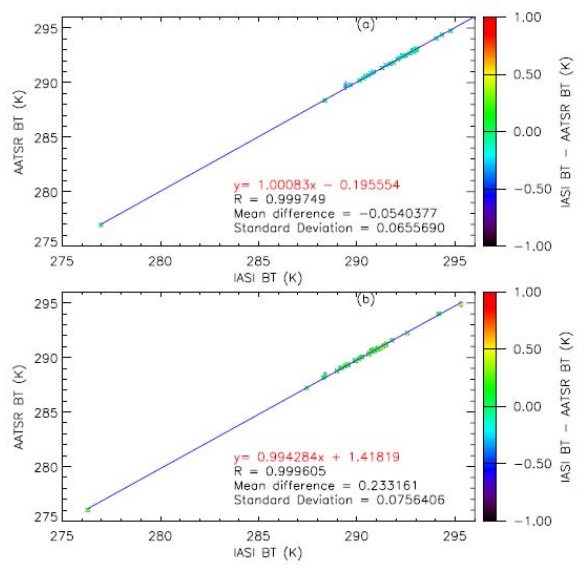

Fig. 4. Comparison of 11 µm and 12 µm IASI equivalent BTs minus mean AATSR BTs in each IASI pixel: **(a)** 11 µm; **(b)** 12 µm. All match-ups have been selected over the oceans and represent clear sky conditions. For both the 11 µm and the 12 µm comparison there were a total of 41 clear IASI pixels.

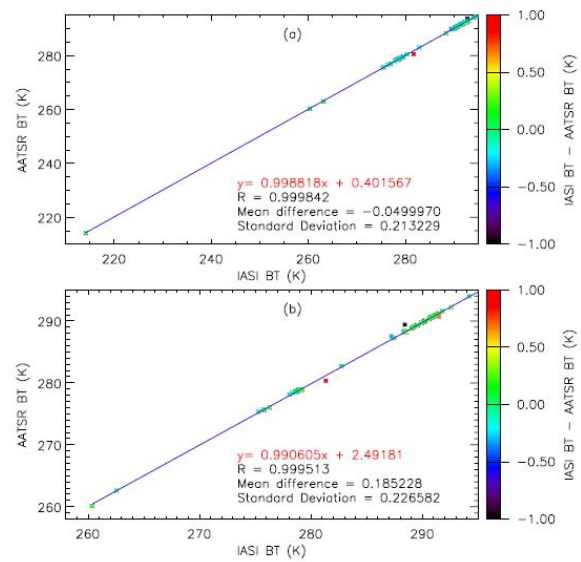

Fig. 5. Comparison of 11 µm and 12 µm IASI equivalent BTs minus mean AATSR BTs in each IASI pixel: **(a)** 11 µm; **(b)** 12 µm. All match-ups have been selected over the oceans and represent homogenous conditions (see Sect. 3.4). For both the 11 µm and the 12 µm comparison there were a total of 66 IASI pixels which met this criteria, which in both cases was comprised of 41 clear, and 25 fully cloudy, IASI pixels.