IRS Special Scan Laws

Pierre Dussarrat
Remote Sensing Scientist

IRS-MAG 03/06/2025

IRS Special Scan Laws

- 3 key characterization activities for IRS L1 calibration, requiring special scan laws:
  - FIM (flip-in mirror)
  - FS (front section)
  - IF (in-field) straylight

- Additional special scan laws designed by EUM (with support of OHB), extending industry commissioning activities:
  - With improved accuracy (configurations and statistics)
  - EUM taking responsibility of processing and analysis
  - Exercised during commissioning and easily repeatable during IRS lifetime

Flip-in Mirror Characterization

- **FIM = Flip-in Mirror intercepting the light to point toward the BB target and DS1**

- The transmission of the instrument core section is given by (re-evaluated every ~15min):

$$R_c(\nu) = \tau_{FIM}(\nu) \times \frac{BB(\nu) - DS1(\nu)}{\Gamma(\nu, T_{BB})}$$

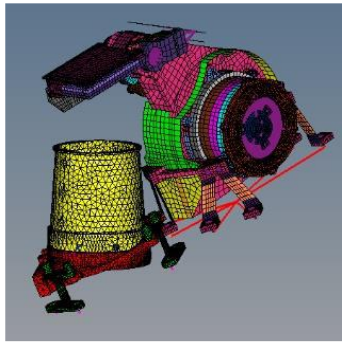
- A good knowledge of the FIM reflectivity is paramount for accurate L1 calibration !

- To evaluate $\tau_{FIM}(\nu)$ in-flight, we analyse the change of signals of DS1 while heating the FIM.

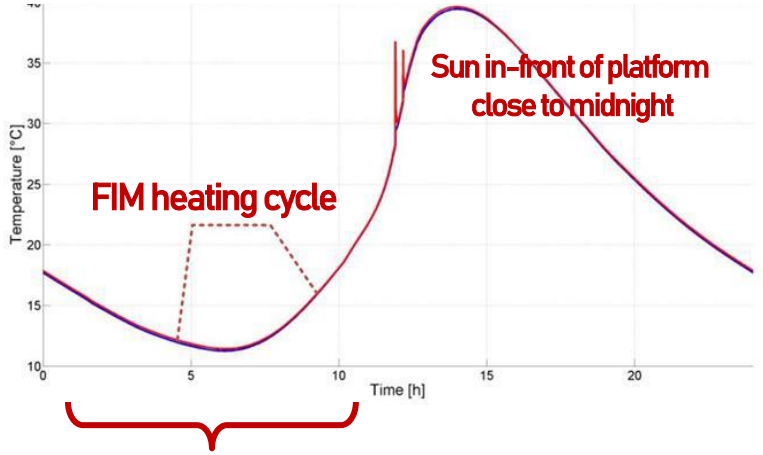
- By doing so, we evaluate the FIM emissivity $\epsilon_{FIM}(\nu)$ and therefore, its reflectivity:

$$\tau_{FIM}(\nu) = 1 - \epsilon_{FIM}(\nu)$$

FIM mechanism



FIM temperature simulation



Afternoon (stable conditions)

- Special scan:
  - Afternoon (most stable conditions)
  - Switch to DS1 (mostly) acquisitions at 14:00
  - FIM heating starting at 15:30 (lasts ~30min)
  - Stops at 18:00

- To be tested twice during commissioning (6 months apart) to analyse stability

Front Section Characterization

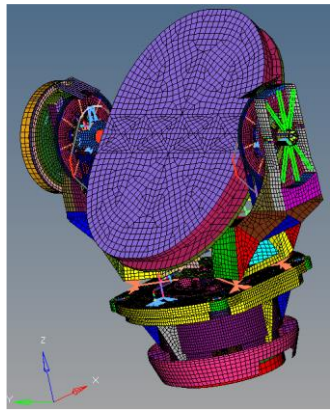
- **FS = Front Section including scanning mirror used to target EV and DS2 views**

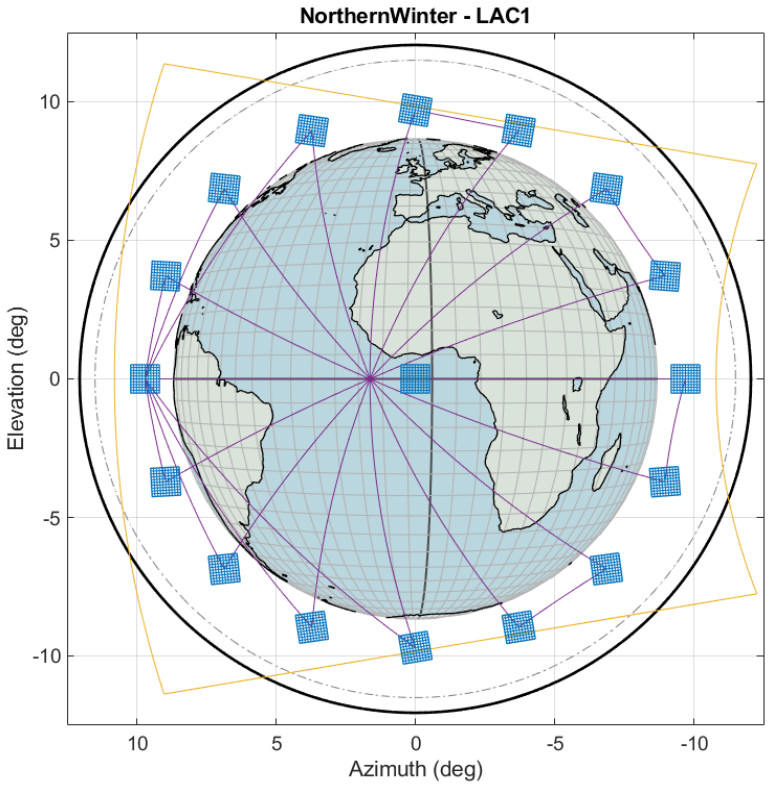
- The transmission of the instrument front section $\tau_{FS}(\nu)$ is needed to calibrate the L1 products:
  - Impact the instrument gain (absorption)
  - Impact the instrument offset (self-emission)
  - Both depending on the scan mirror angle (E-W)

- A good knowledge of the FS reflectivity and emissivity is paramount for accurate L1 calibration !

- To evaluate $\tau_{FS}(\nu)$ and $\Delta\tau_{FS}(\nu)$ in-flight, we analyse the change of signals of the DS2 – DS1 for many angular positions:
  - Alternating between symmetric DS2 positions
  - Interleaving DS1 views (during scan rally)
  - Interleaving "west" DS2 to track background drifts

SCA mechanism





- Special scan:
  - Afternoon (most stable conditions)
  - Repeat the special scan laws (lasting 15 min) for 4 to 6h

- To be tested twice during commissioning (6 months apart) to analyse stability

IF-Straylight Characterization

- **IF straylight = In-field straylight caused by spurious reflections and scattering within the instrument**

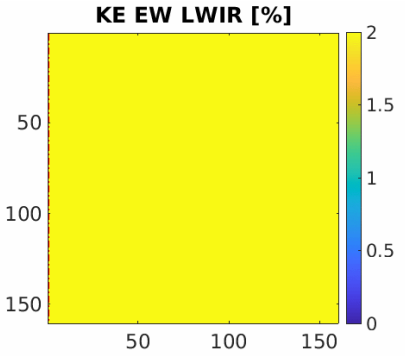
- EUM has put a large effort in understanding the sources of straylight and impacts on L1 calibration (with support of OHB)
  In-field straylight correction is expected in IDPF-S next version (H1-2026)

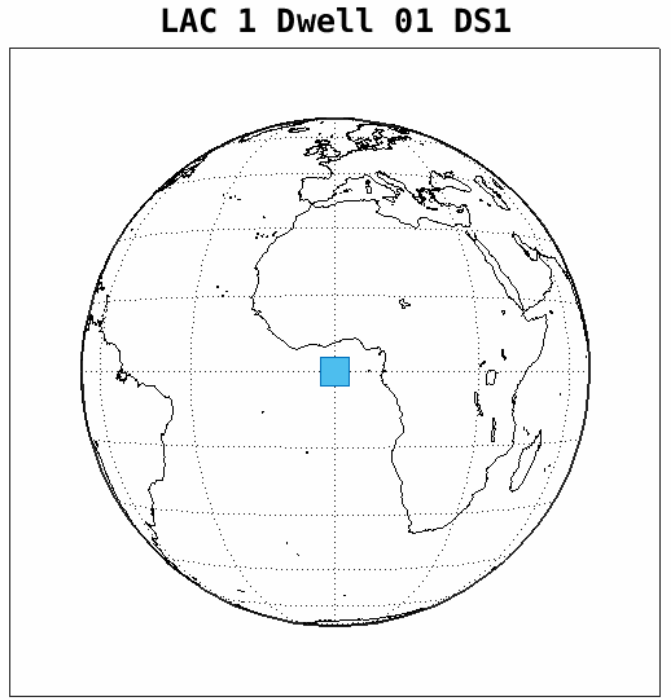
- Models have been correlated with on-ground measurements (KE), but in-flight characterization is essential

- To evaluate the IF-straylight, we plan performing:
  - "Limb" scanning, successive views crossing the limb, starting in DS and finishing fully on Earth
  - Repeated all around the Earth's disk
  - Interleave calibration views (BB-DS1)

- The retrieval of the straylight "kernels" will be performed by analysis of the residual signals in space

KE sweep (TVAC)

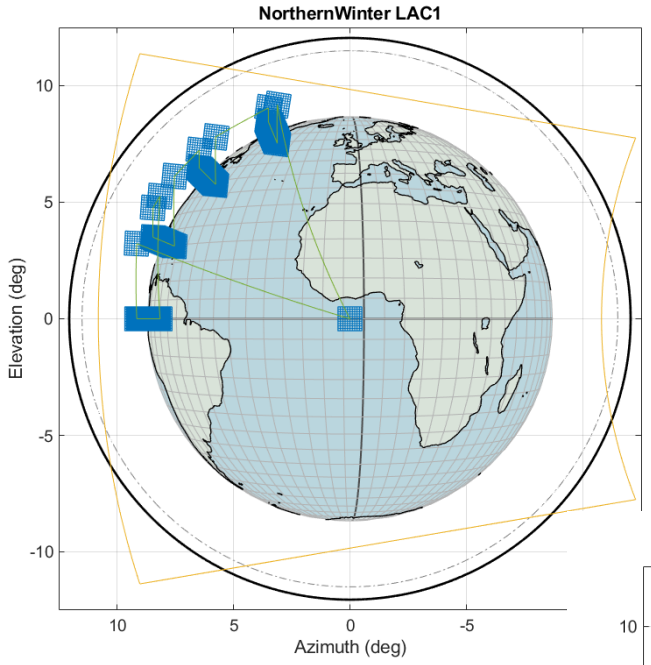


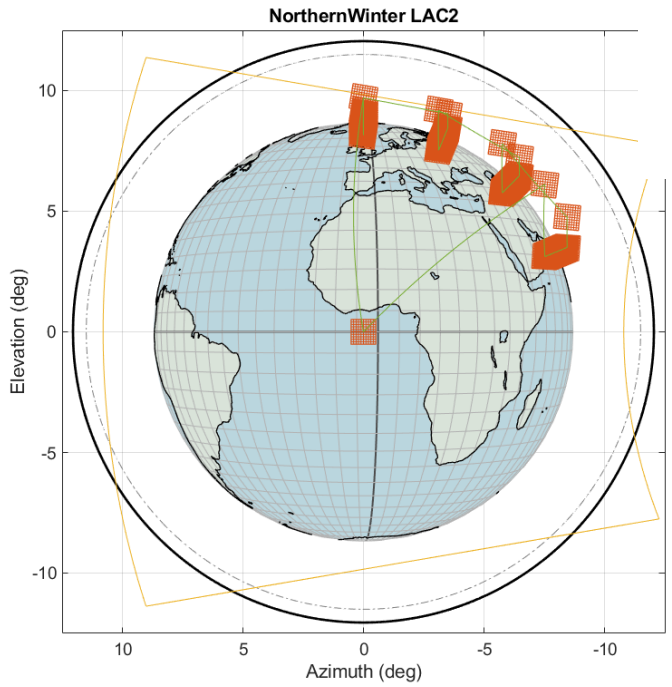


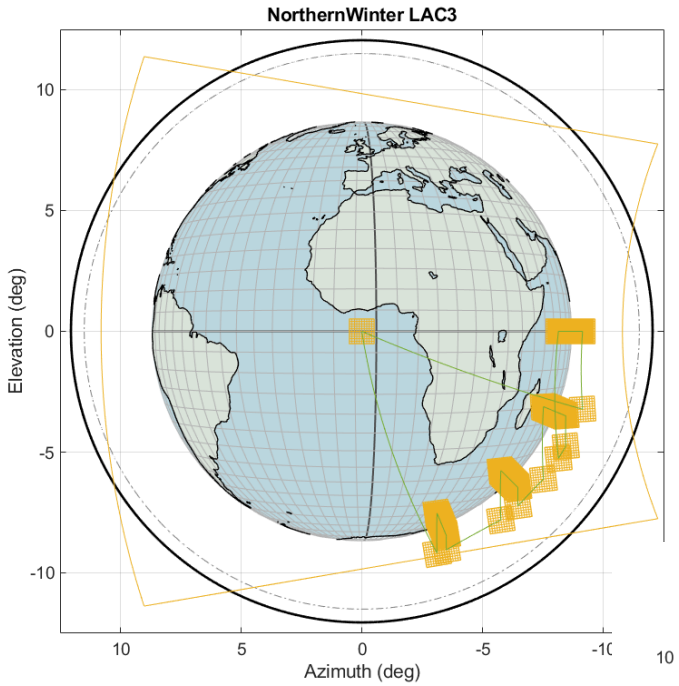
- Special scan:
  - Afternoon (most stable conditions)
  - Alternate between 4 special scan laws (lasting 15 min each) for 4 to 6h
  - Repeat on a different day for diversity (shuffling the atmospheric scenes)

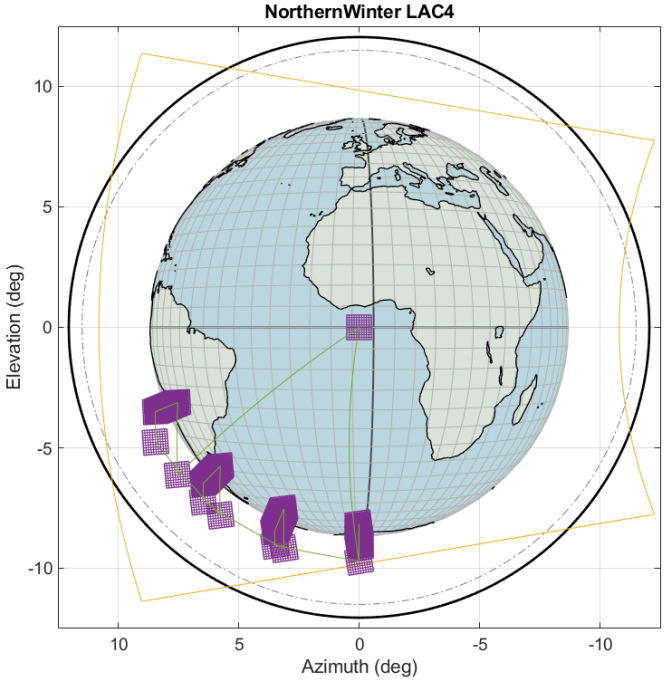
- To be tested once during commissioning

IF-Straylight Characterization









Thank you!

Questions are welcome.