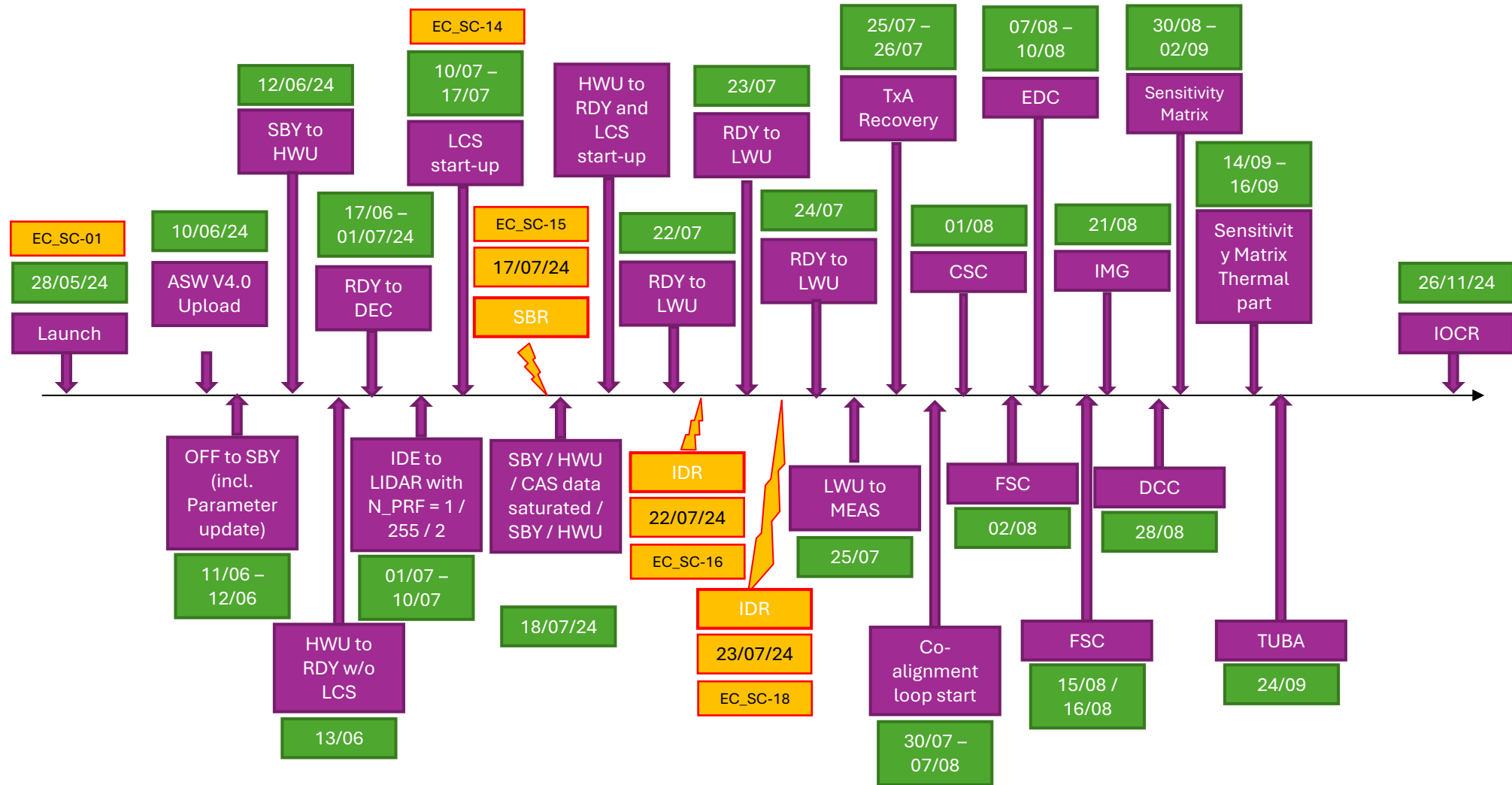# Atlid Integrated Commissioning Team Presentation

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1st ESA-JAXA EarthCARE In-Orbit Validation Workshop
14 – 17 January 2025 | VIRTUAL EVENT

Instrument Commissioning – Timeline
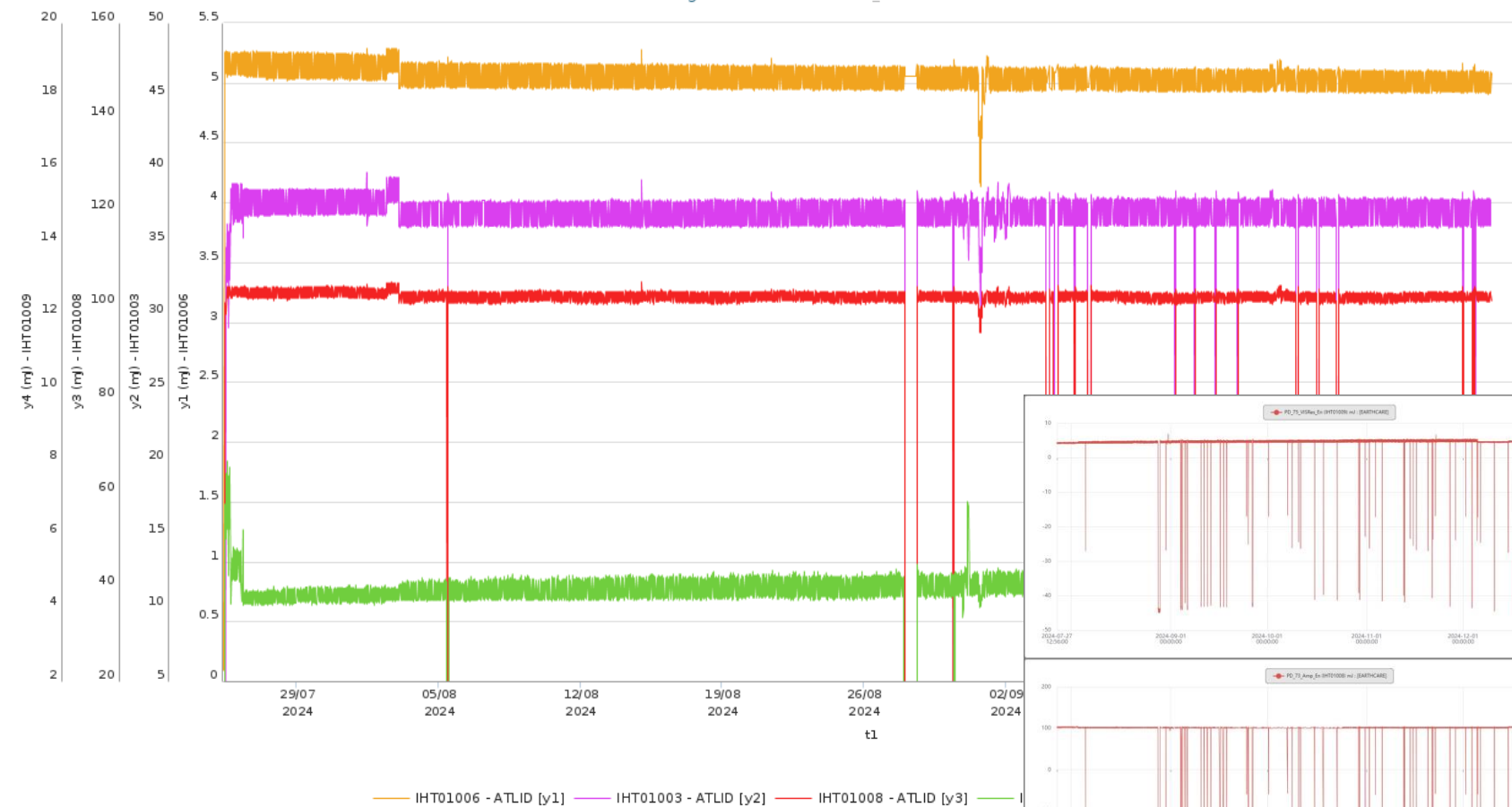
Instrument Commissioning

In a Nutshell:

- IOV plan reshuffled to accommodate Cal/Val activities (delayed launch, prolonged platform commissioning)
- 69 SORs have been signed and implemented for ATLID,
- 9 SOPs needed adjustments, 1 new SOP has been written,
- 5 ACR occurred at ATLID level and are by now all closed.

- **EC_SC-1: Power commanded to ATLID LCS Inhibition heater updated**:
  - **Insufficient LCS LHP inhibition power required correction by ground TC during LEOP.** Anomaly is considered solved by update of CSW and increase of baseline inhibition heating power for ATLID PLH A- and B-side from 7W to 11,5W (total heating power for 7 LHP). Anomaly is considered solved.

- **EC_SC-14: Non-nominal ATLID mode transition RDY to LWU, with only 4 LHP started:**
  - In spite of many attempts (boost/relax), **only 4 out of 7 Laser Cooling System (LCS) Mini Loop Heatpipes have started**. Start of 6 LHPs was the planned baseline, B3, B8, B6 have not started. However, already 4 LHPs found to provide sufficient laser thermal map stability, for laser operation with nominal performance. Laser thermal map settings could be well tuned for the actual LHP configuration. Anomaly is considered solved.

- **EC_SC-15: ATLID in SBR during long boost**:
  - Minor error during non-nominal LHP boost/relax sequence. **BSMFE temperature monitoring too low**. Anomaly is considered solved. Will no more be repeated.

- **EC_SC-16: ATLID in IDR during LWU transition 1 (SOR ASD035):**
  - Minor error during non-nominal RDY-LWU transition: **PLH MO_AM temperature triggered** due to too low monitoring and unexpected long convergence. However, the ASW FCP-I-105 (RDY-LWU) timeout condition of step 1 would have be expected triggering the IDR before the observed S12 triggering. Root cause explanation by CGI in Functional IOV Report. Anomaly is considered solved.

- **EC_SC-18: ATLID in IDR during LWU transition 2 (SOR ASD036):**
  - **Trigger of SHC temp OOL** during RDY-LWU mode transition. Understood and corrected by minor update of THC/SHC temp monitoring limits and thermal control loop PID setting. Anomaly is considered solved.
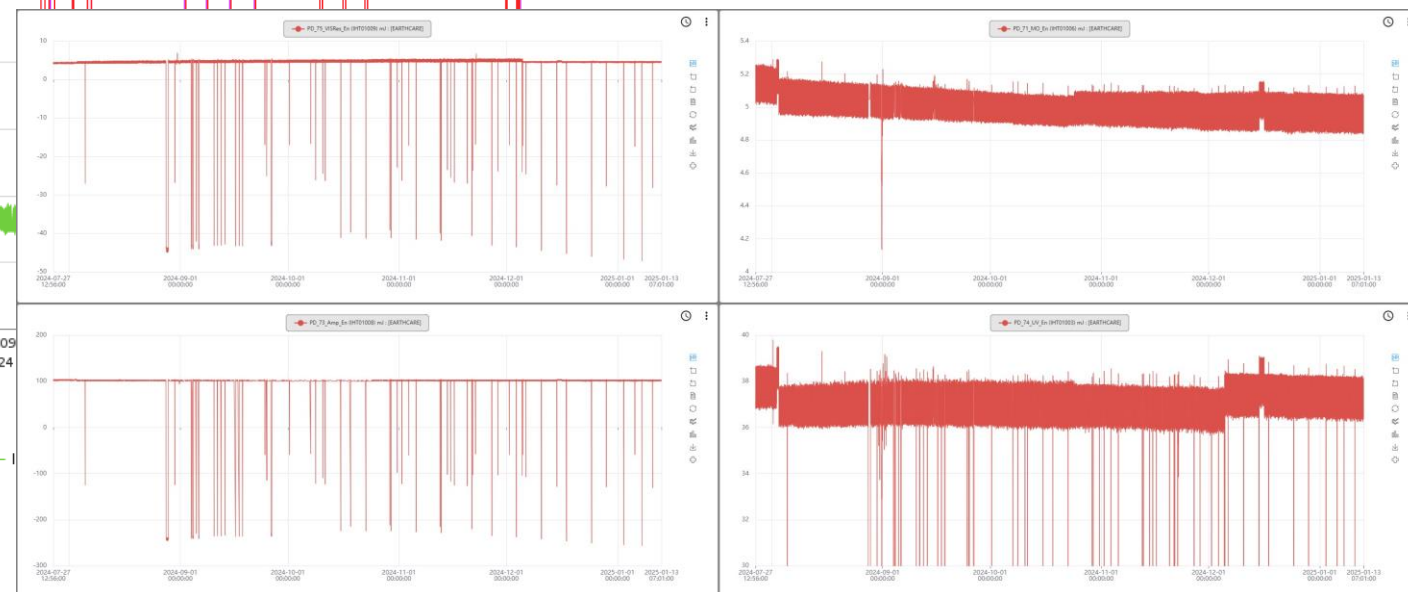
Instrument Energy Trend

ATLID Laser Energies trend since BOL
Orange: MO Energy
Purple: UV Energy
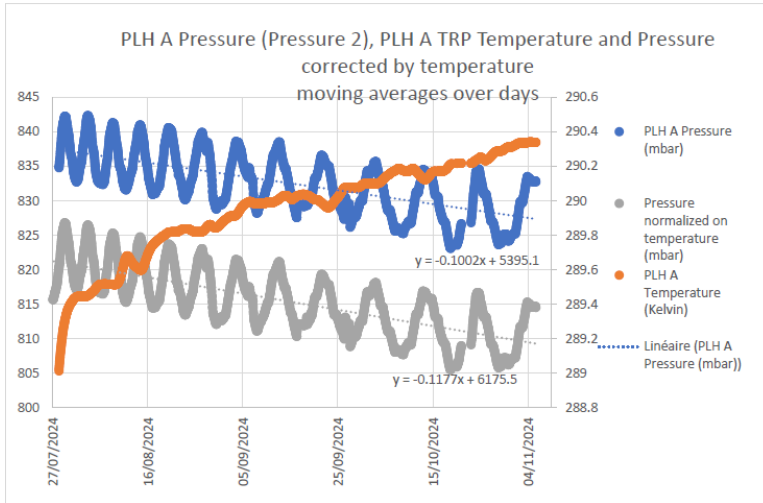Red: Amplifier Energy
Green: Visible Energy

PLH A Pressure (Pressure 2), PLH A TRP Temperature and Pressure corrected by temperature moving averages over days

PLH B Pressure (Pressure 1), PLH B Temperature and Pressure corrected by temperature moving averages over days

PLH A

A loss of 0.1 mbar per day can be observed which is even at 0.12 mbar considering the corresponding temperature evolution (increase of global environment temperature and therefore PLH A temperature is also increasing over this period, but pressure is decreasing while it should increase also). As minimum authorized pressure value is at 227 mbar (as per On board Monitoring), by starting at 840 mbar, this will give a lifetime close to **14 years**.
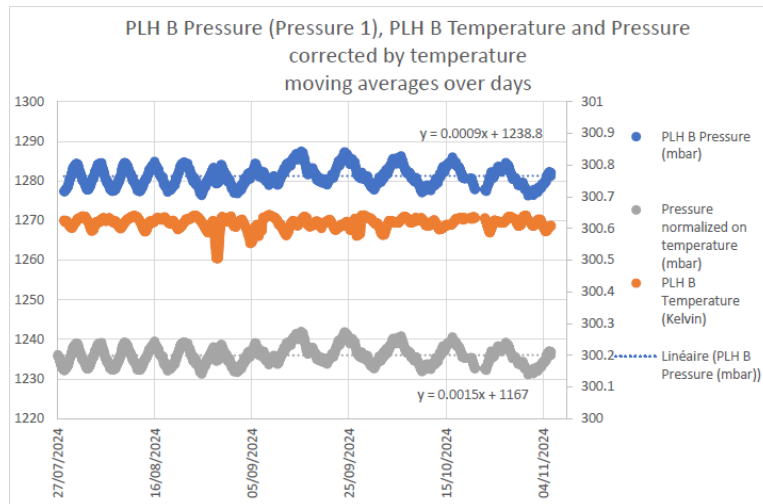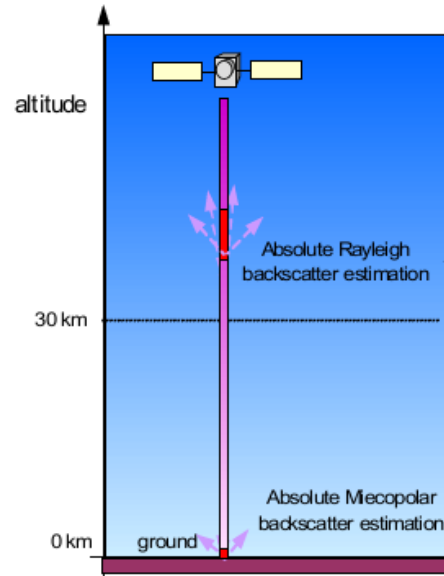
PLH B

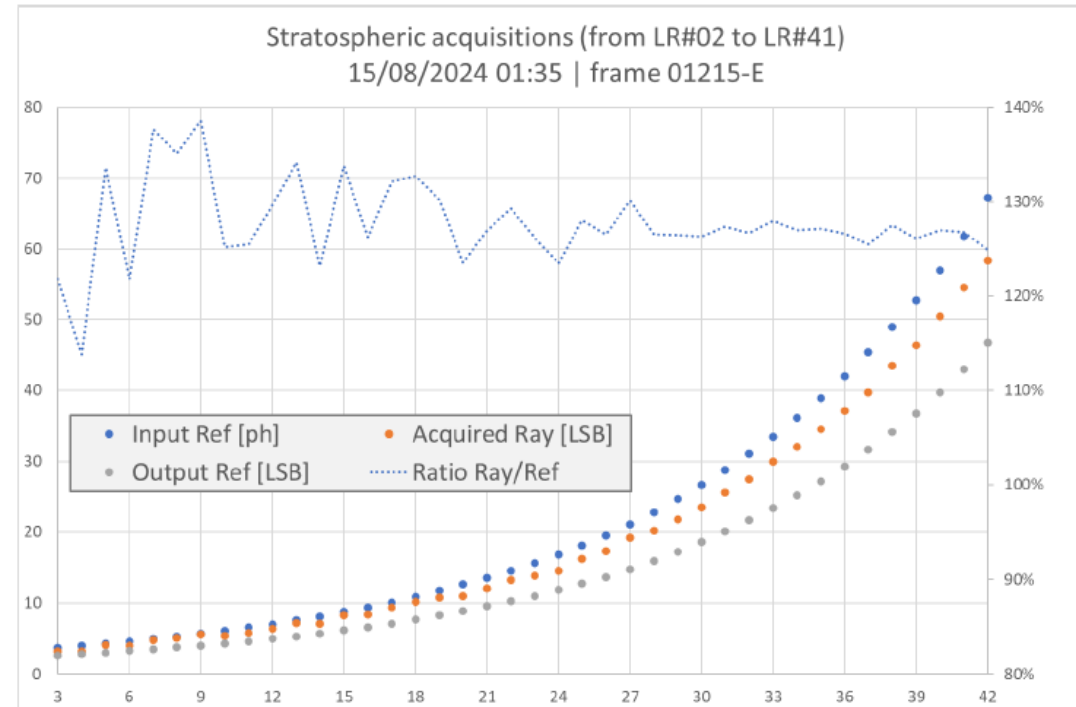Not possible to detect any measurable leak.

Recommendation:

No change planned to be performed. Instrument has sufficient pressurisation to meet 10+ years of operations as predicted on ground.

Rayleigh/ Mie LIDAR constants

- **Using stratospheric Rayleigh signal,** assuming pure Rayleigh backscattering from 25km till 40km, with LR#02 till LR#41

- Rayleigh signal output is compared to the molecular reference signal expected from atmospheric data with P and T.

Frame 01215-E : mean signal over 665 s (4800 km ALT)

Stratospheric acquisitions (from LR#02 to LR#41)
15/08/2024 01:35 | frame 01215-E

- Input Ref [ph]   · Acquired Ray [LSB]
- Output Ref [LSB]   ···· Ratio Ray/Ref

- Rayleigh signal is very low in upper part of the stratosphere: less than 5 LSB. Ratio is less noisy in lower part where signal is above 30 LSB

- **LIDAR constant average value is 125% of prediction**
- **This prove the excellent link budget,** relying on all good optics transmission.

Cross Polarisation Channel calibration

Depolarisation ratio at first reported slightly lower than literature for cirrus cases :
Investigation on-going : revisit of some payload properties definition to be consistent with algorithm

Analysis courtesy of KNMI
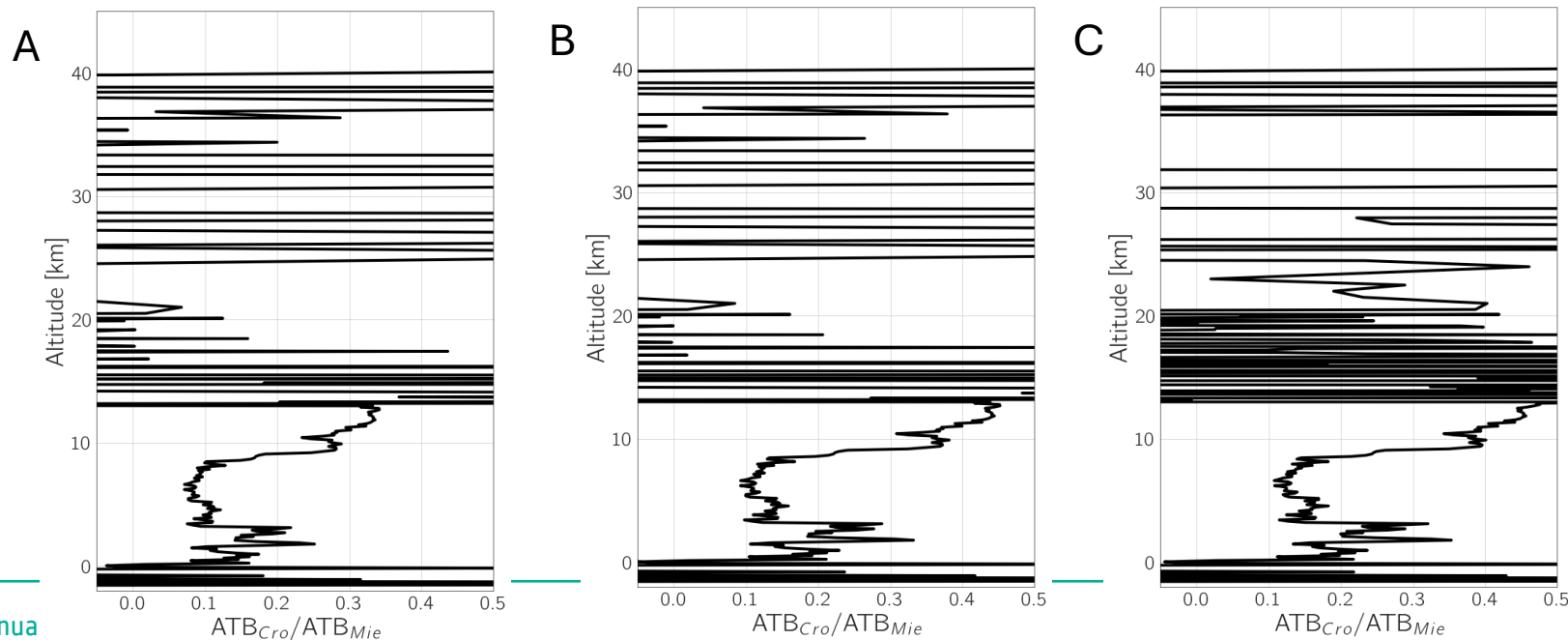
Comparisons of scenarios using the frame 01752 :

A) Correction of the subtracted offset-level --> included in ECGP v4.6
B) Refinement of some transmission parameters --> included in ECGP v4.6
C) Refinement of some detector sensitivity parameters

Improvement of the results w.r.t expected results

Analysis still on-going

To be confirmed on larger dataset

- **Dark current and Total noise in darkness**

  No trend observed on noise and dark current

  Hot pixel appearance, managed by TUBA and processing.

Phase	Date	Orbit frame#	noise 100m sample [e- RMS]		
			Mie	Ray	Xpo
ATL-600 Nacc=2	13/06/24	00241-G	2,09	2,14	2,13
ATL-800 Nacc=2	03/07/24	00555-A	2,09	2,13	2,13
ATL-1100 Nacc=2	18/07/24	00786-H	2,13	2,18	2,13
TUBA Nacc=2	10/09/24	01623-H	2,09	2,13	2,13

- **Fiber detector relative position**
  - No significant difference found before (2019) and after launch (2024) 0.8µm while expected 15µm max.
 - No further trend needed.

- **Frequency co registration**
  - Co registration Frequency drift between receiver HSR Etalon and laser emission measured during FSC
  - 0.6MHz per day trend=> FSC periodic correction would be needed only every 3 weeks instead of weekly basis foreseen

1031H	2024/08/03 06:18:00	616
1043h-1044A	2024/08/04 00:57	616
1058H – 1059A	2024/08/05 00:09	616
1230A	2024/08/16 00:04	615
01728	2024/09/17	614
02241H-02242A	2024/10/20	614

- **Divergence evolution**
  - No significant average divergence evolution found since calibration (EDC)(<2%)
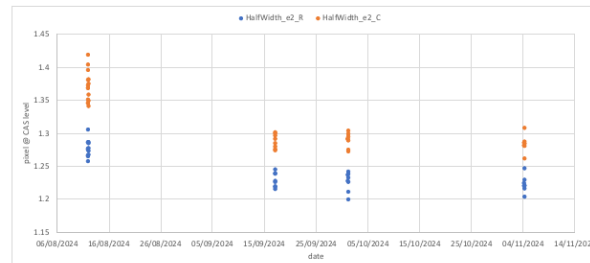
- **Pressure of PLH**
  - 0.12mbar/ day in worst case for PLHA leads to over 14 years
  - Min PLH pressure operation is 227mbar, current pressure above 1100mbar.
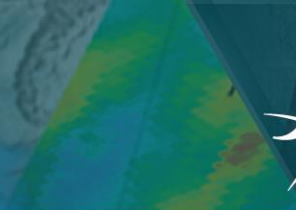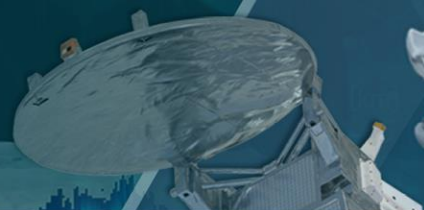
- **Energy**
  - 0.005mJ per day trend in UV.=> maximum 5mJ degradation over 3 years.
  - Compensation possible: at MO level, at AMP level, at frequency selection. The usual level of compensation done on ground can easily compensate for the slight drift observed.
  - Lifetime prediction is difficult because it is not known if full range of correction available can be linearly extrapolated.

- **Other parameters difficult to assess**
  - High fluence Optics long term exposure vs LIDT
  - Laser Induced Contamination on long term
  - Other aging.

Lifetime estimation goes well beyond mission of 36 months with current ATLID configuration (B side)

Thank you

Questions