ROUND TABLE DISCUSSIONS

STCE Workshop

On-orbit degradation of solar and space weather Instruments

– Lesson learned –

Goals & objectives

I. To implement a **Lessons Learned** process to identify which system/components/approaches :
   - already works (from previous and ongoing missions),
   - or should be ruled out.

   To provide **good practices** and innovative approaches to reduce or correct as strongly as possible expected degradations.

II. To initiate **new studies** that will provide regular feedback and continuous activities to **increase the lifetime** of future space missions.

I- Lessons Learned: Review from flight experiences

Observed degradation (identifying)	Mechanism (s)/ Cause(s) (understanding)	Prevention/correction methods (analysing)
Definition	**Origin** - on-ground (launch) environment - Material, design - …	**Pre-flight calibration and laboratory testing** - Tests and calibration campaigns - Radiations tests & models (sum of all interactions) Good practices - cleanliness (rules/guidelines) - Instrument modeling (radiometric) - operational precautions - …
What happened - loss/increase of signal - noises and DC increase - spectral shift - straylight (coating) - signal drifts - linearity - failure - …	**Space environment (influence)** - orbits - vacuum (P) and T° - contamination species - radiation (damage) - wavelength (ionization) - exposure (duty cycle) - …	**On board calibration** - mathematical methods - methods and procedures (bake out, …) - on-board calibration (door, light sources, …) - cross-instrument calibrations - reference instruments (redundancy) - …

I- Lessons Learned: Proven technologies

Instruments (subsystem level)	Wavelength range (band pass)	Instruments (mission)	Performance (Lifetime / remarks)
Photodetectors (single pixel) - Diamond (MSM, PIN) - Si AXUV	1-220 nm 1-121 nm	LYRA/PROBA2 LYRA/PROBA2	>2 years (stability MSM) >2 years (SAA sensitive)
Imagers (2D arrays) - CCD (front side) - CCD (back side) - APS-CMOS (FS) + coating (P43) - APS-CMOS (BS) - FPA (hybrid)	17nm	SWAP/PROBA2	>2years (hot pixels)
Filters - Interferential – MgF2 (Acton) - Metallic (Luxel)	Ly-a and 200-220nm Zr (6-20nm), Al (17-40nm)	LYRA LYRA -SWAP	Risky (proton and UV sensitive) >2years (no pinhole, contam.)
Mirror (MLM) / gratings - -			
Others			

II- **New studies**: To improve solar space instrumentation

Design (recommendation)	**Priority/ performance (motivation)**	**Development time (Maturity)**
Photodetectors (single pixel) - WBGM EUV-VUV detectors - …	Rad-hard → band pass (1-360 nm)	1-2 years (AlN MSM available)
Imagers (2D arrays) - EUV coating - EUV APS-CMOS (Backside illum.) - EUV-VUV FPA (WBGM)	stability (vs P43) radiation hard (vs CCD) Rad-hard (AlGaN vs Si)	ongoing (High) ongoing (1-2 years → EUI FM, medium) Proof of concept (→ BOLD, low)
Filters - EUV-VUV porous filters - EUV metallic multilayer	Rad-hard Zr/Al , Mg/Al	Stand by (High) Proof of concept (→ EUI, high)
Mirror (MLM) / gratings -		
Others - UV Leds (onboard calibration) - New materials - Innovative technologies - Design process	Rad-hard, stability (T°)	Prototypes (commercially available)

IV- Miscellaneous & Conclusion