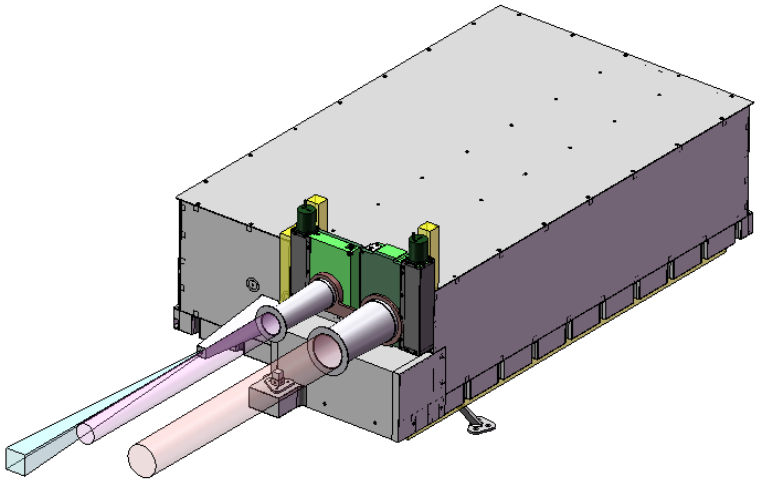
Introduction to the Extreme Ultraviolet Imager (EUI) telescopes onboard Solar Orbiter



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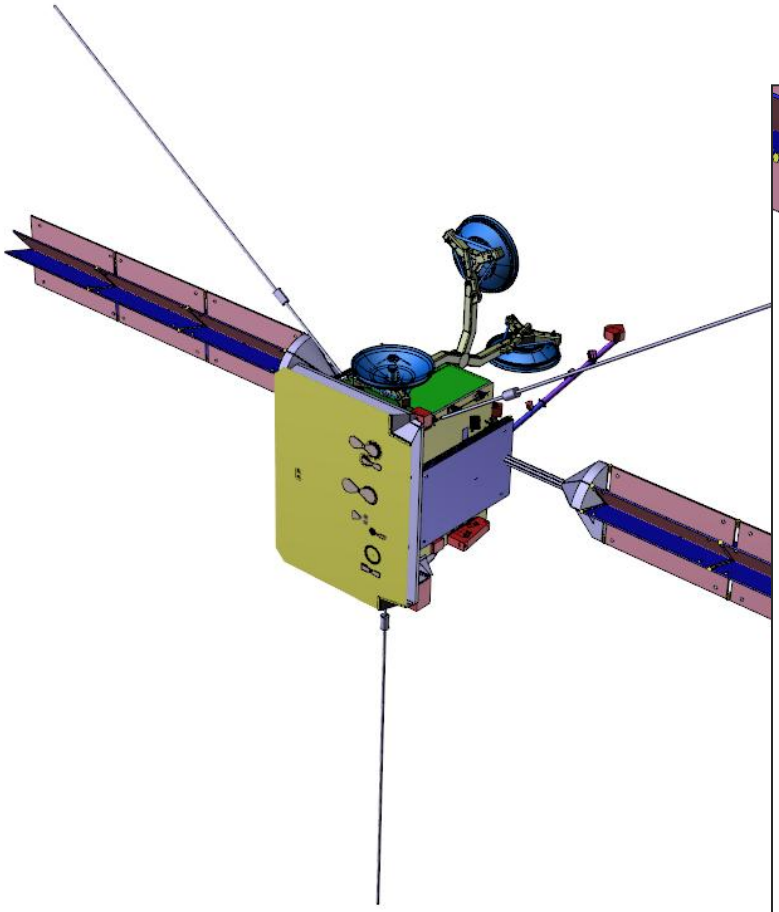
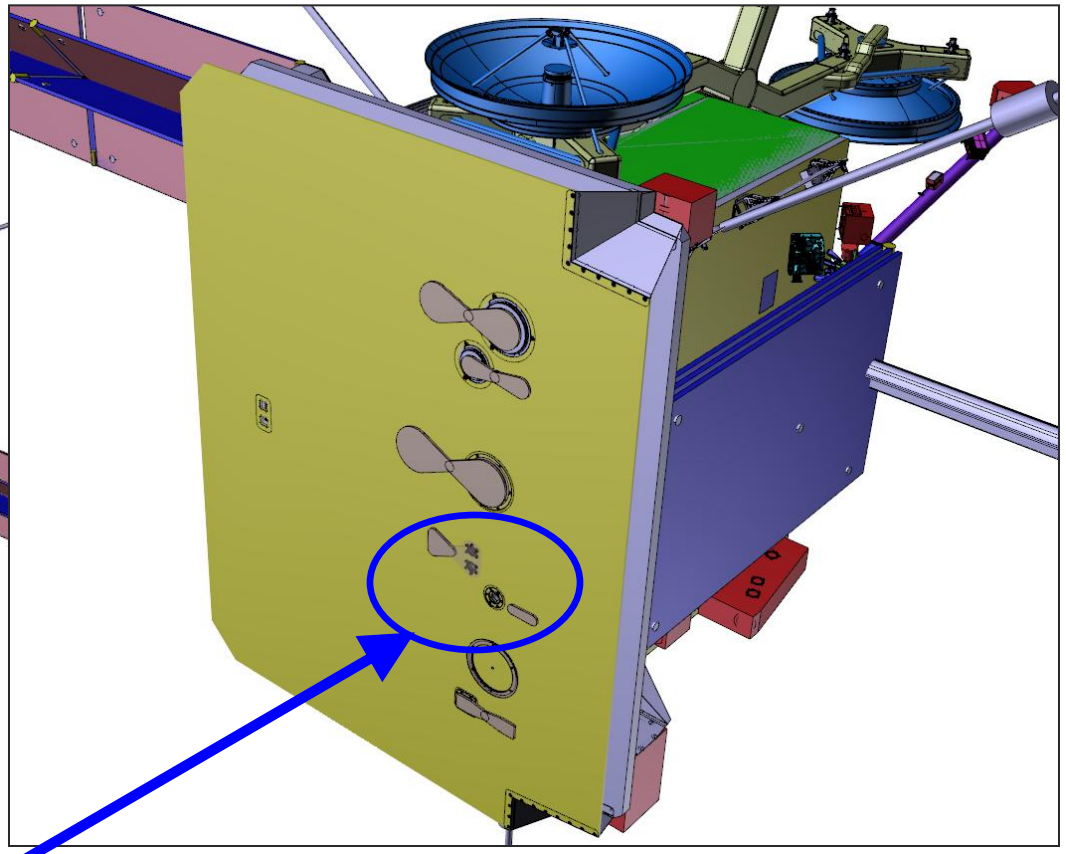
Solar Orbiter





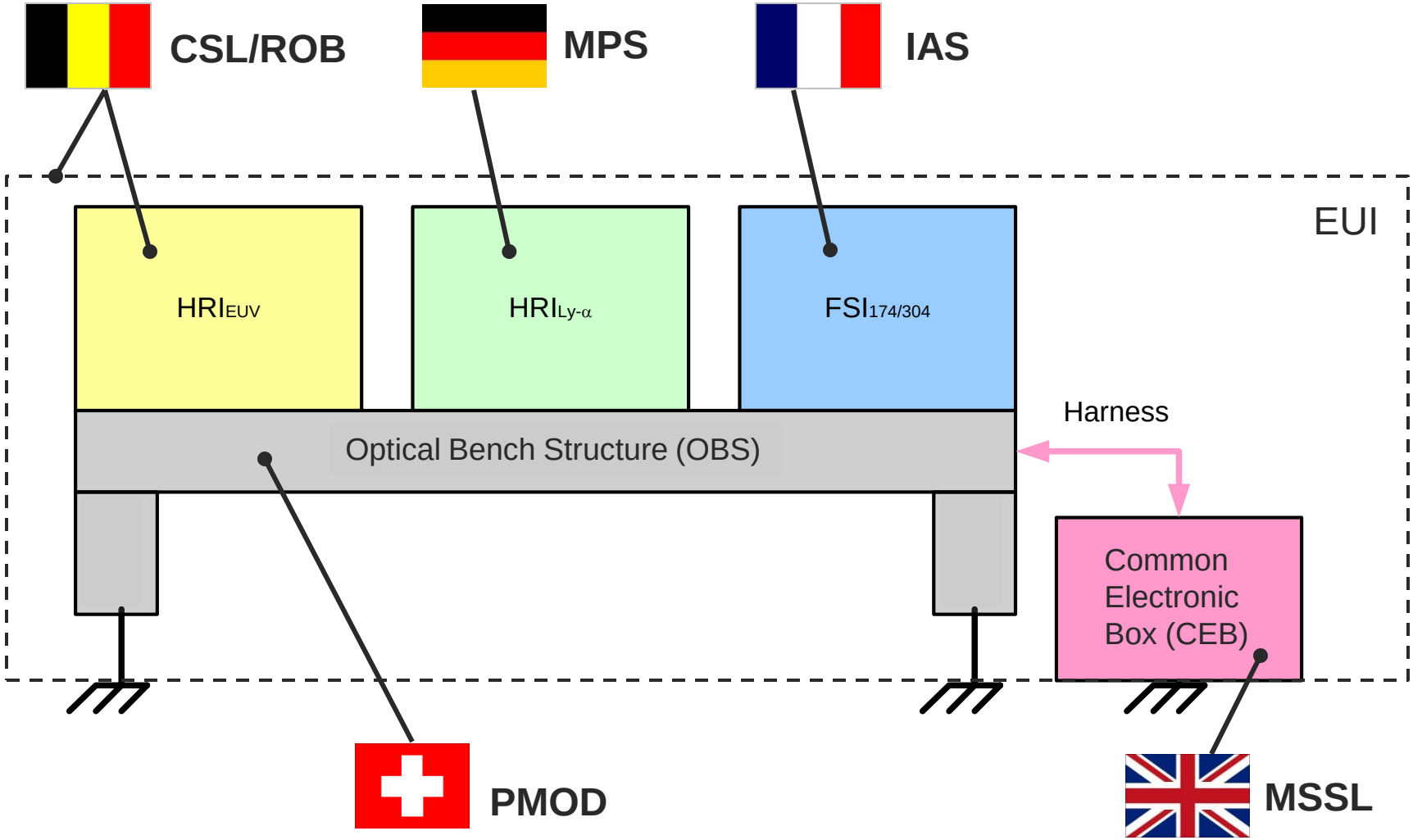
EUI entrance apertures

EUI instrument

- EUI is composed of three channels
  - EUV full-sun (FSI) and high resolution (HRI_{EUV}) imagers
  - Ly-a high resolution (HRI_{Lya}) imager

Channel	Parameter	Values
FSI	Passbands	17.4 nm & 30.4 nm
	FOV	3.8 arcdeg (⇔ 2 Sun Ø)
	Resolution (2 px)	9 arcsec (⇔ 1800 km, 3k² px)
	Cadence	600 s
HRI_{EUV}	Passbands	17.4 nm
	FOV	0.28 arcdeg (⇔ 15% Sun Ø)
	Resolution (2 px)	1 arcsec (⇔ 200 km, 2k² px)
	Cadence	≥ 1 s
HRI_{Lya}	Passband	121.6 nm
	FOV	0.28 arcdeg (⇔ 15% Sun Ø)
	Resolution (2 px)	1 arcsec (⇔ 200 km, 2k² px)
	Cadence	≤ 1 s

EUI consortium overview

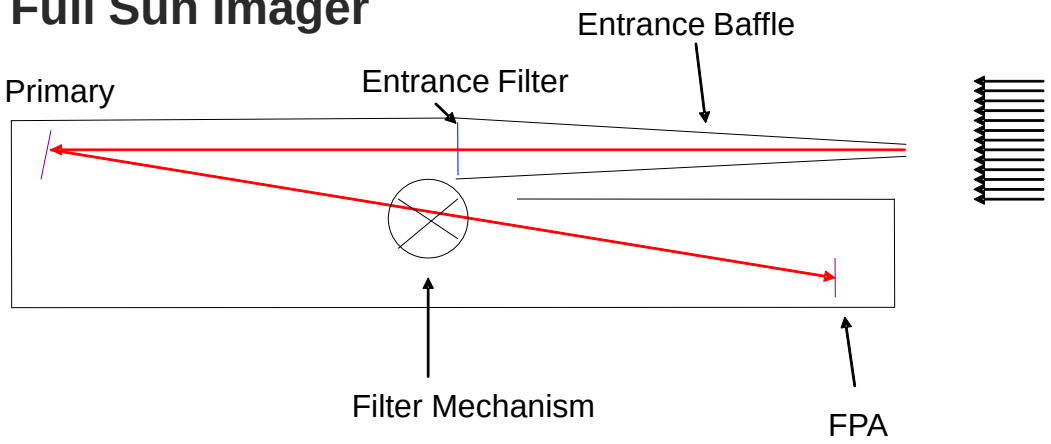


EUI design overview

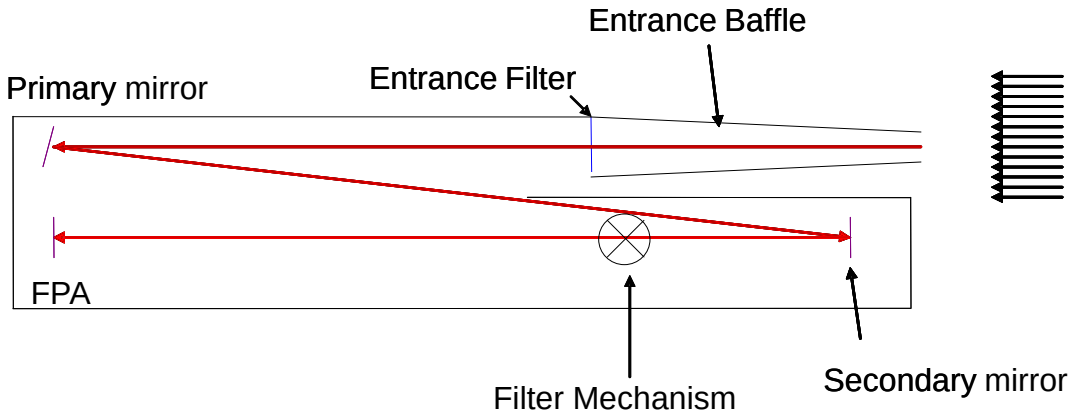
- Heritage
  - PROBA2-SWAP → HRI optical design, detector & filters
  - HERSCHEL Rocket → FSI optical design
  - SOHO-EIT, STEREO-EUVI → EUV multilayers mirror coatings
- Passive thermo-mechanical design
  - No active control, passive detector cooling
  - Low CTE optical bench
  - Heat rejection entrance baffles
- Compact
  - Small entrance apertures
  - Three channels on a single optical bench
- Low telemetry
  - Compression and on-board data processing/selection

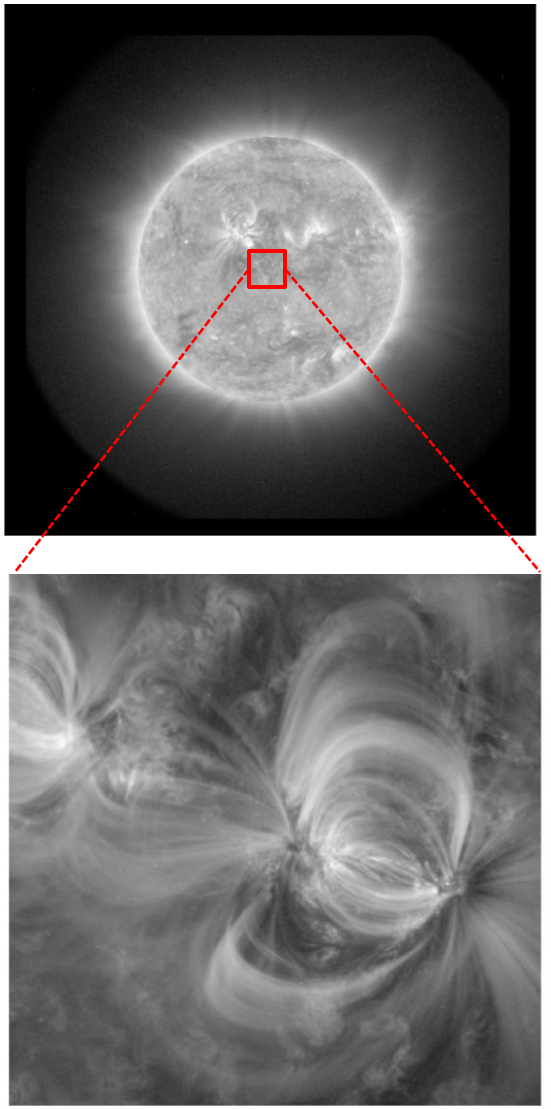
EUI design overview

Full Sun Imager

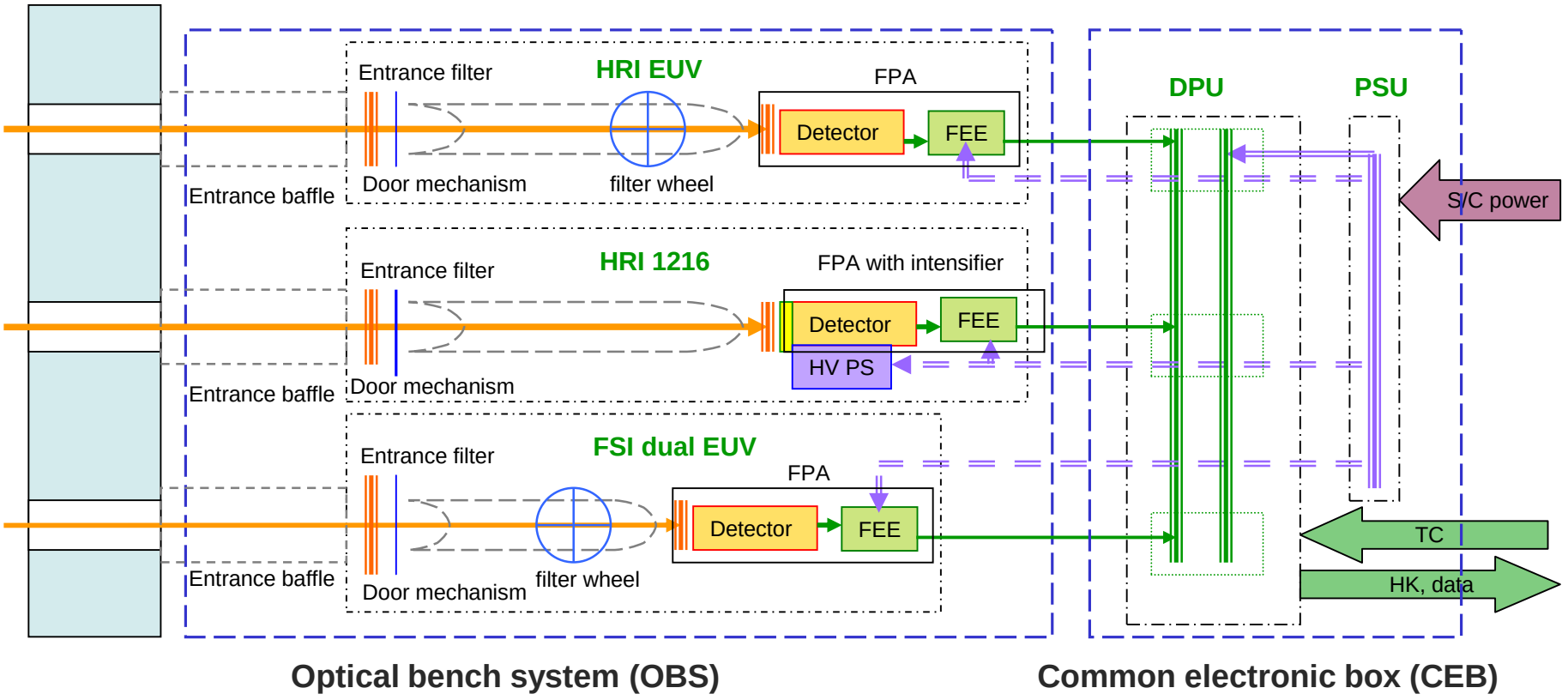


High Resolution Imager

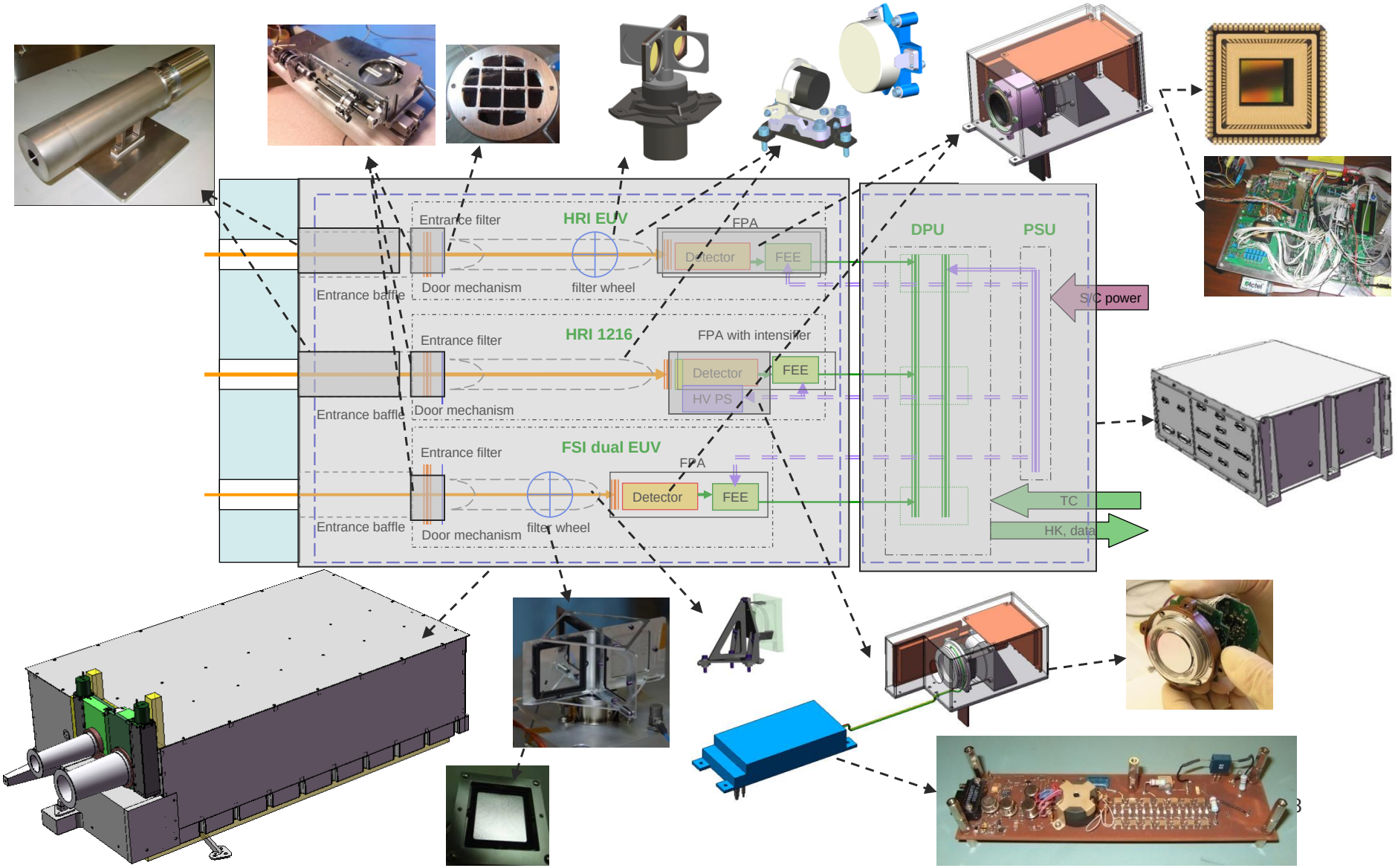




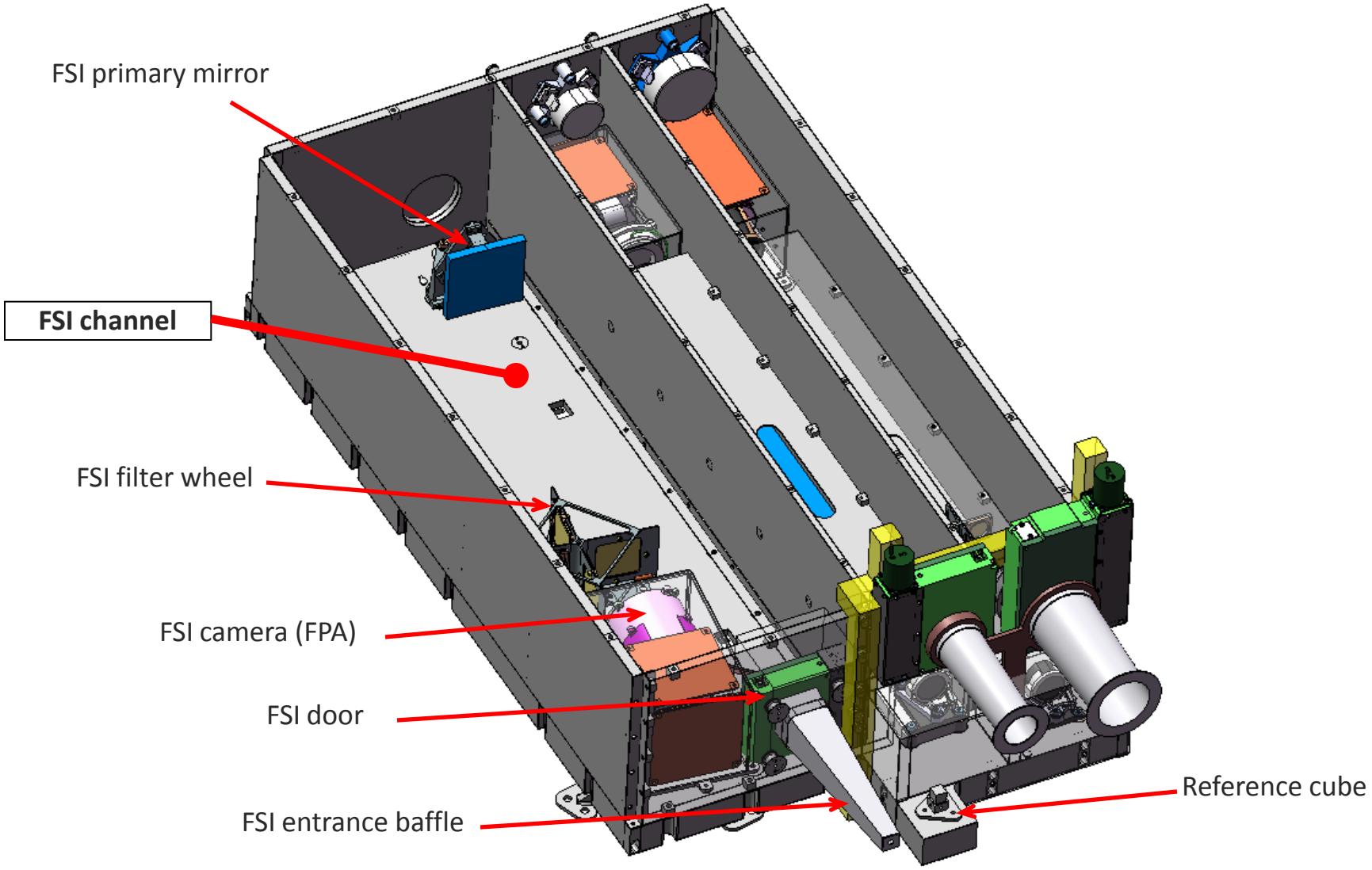
EUI functional diagram



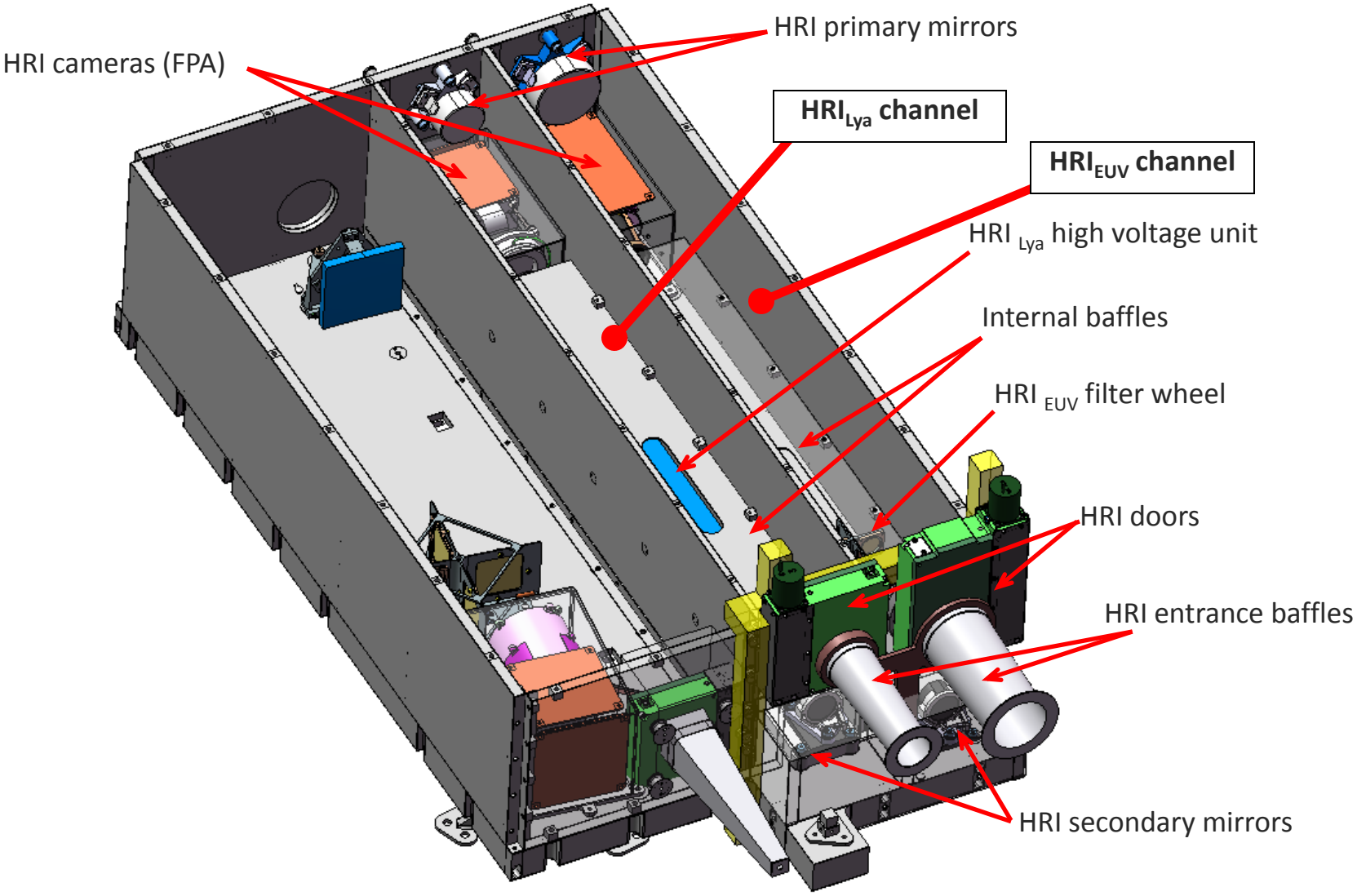
EUI units and sub-systems



Full Sun Imager

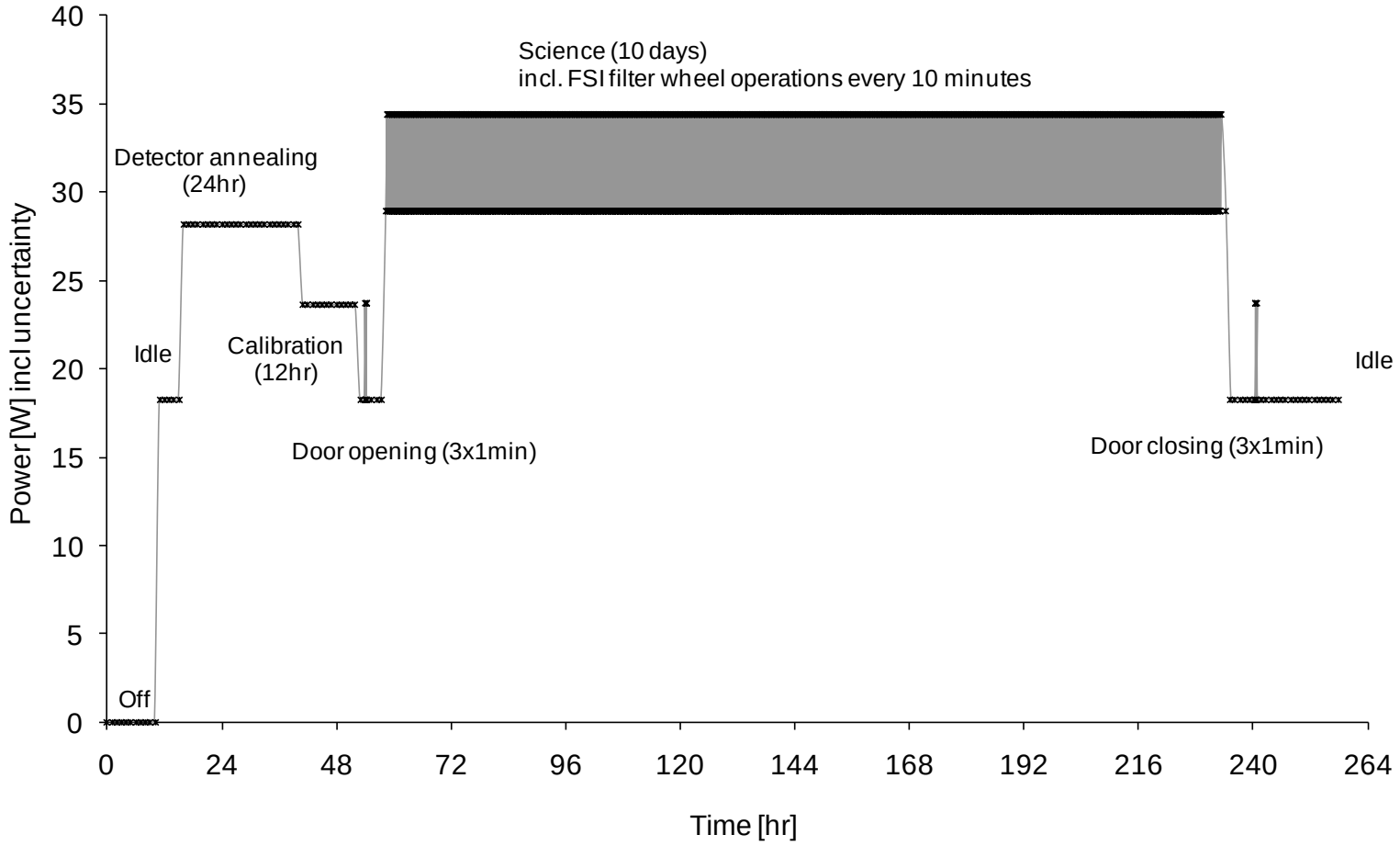


High Resolution Imagers



EUI observation sequence

- Synoptic (FSI channel)
- Nominal science windows (3 x 10 days per orbit)



Mission lifetime

- Lifetime ~ 15 years
  - 0.5 year of instrument AIT
  - 2.5 years of S/C AIT
  - 2 years of possible launch delay
  - 7 years of nominal space mission duration
  - 3 years of extended mission in space after launch
- Orbit down to 0.28 AU
  - Radiation level
  - Micrometeorite

Potential ageing and degradation

- Entrance baffles → increased absorbed heat
- Entrance filters → pinholes (straylight)
- Mirror coating → spectral range
- Detectors → decrease SNR, image artifacts
- Electronics (FEE and CEB) → potential loss of functionalities

Design impacts

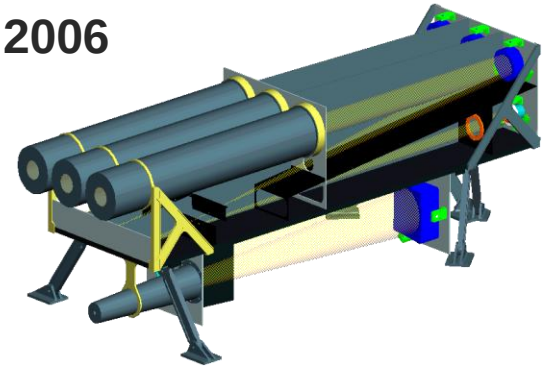
- Redundancies
  - EUV filters (filter wheel)
- Cleanliness
  - Internal doors
  - Purging and venting
  - Material selection
  - MoS_2 in mechanism
  - Bake out from parts to unit level
- Electronics
  - Outside optical cavity (except FEE)
  - Annealing heaters
  - Calibration LED
  - Radiation hard components
- Heat shield doors

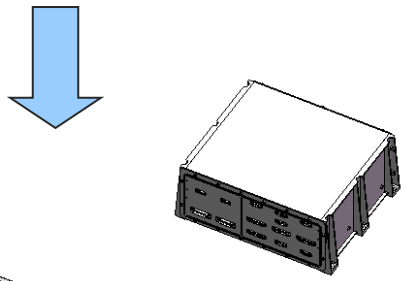
Calibration

- On-ground calibration
  - End-to-end response and characterization
  - Prepare for in-flight calibration
- In-flight calibration
  - Before each observation period
  - Set of images
    - Dark images (dark current and image offset)
    - Over-exposed images (saturation behavior)
    - Smeared images and LED images (flat field)
    - High-cadence sequences (noise statistics)
  - Image correction
    - On-board pre-compression calibration
    - On-ground post-decompression calibration

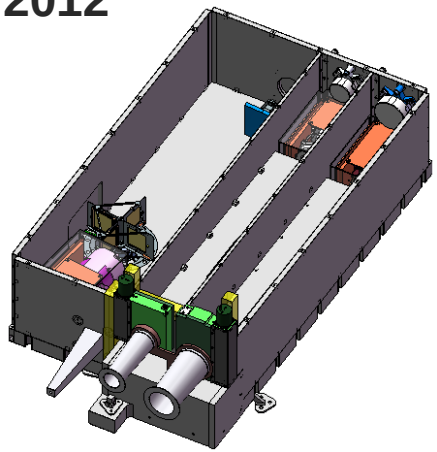
Conclusions

2006





2012



- Design has evolved for 6 years
- Ageing and degradation aspects are taken into account in the design
- Successful PDR in March 2012
- All key technologies (detector, mirror coating, filters, baffles) are at TRL5
- Phase C has started with industrial sub-contracts
- STM model in February 2013