

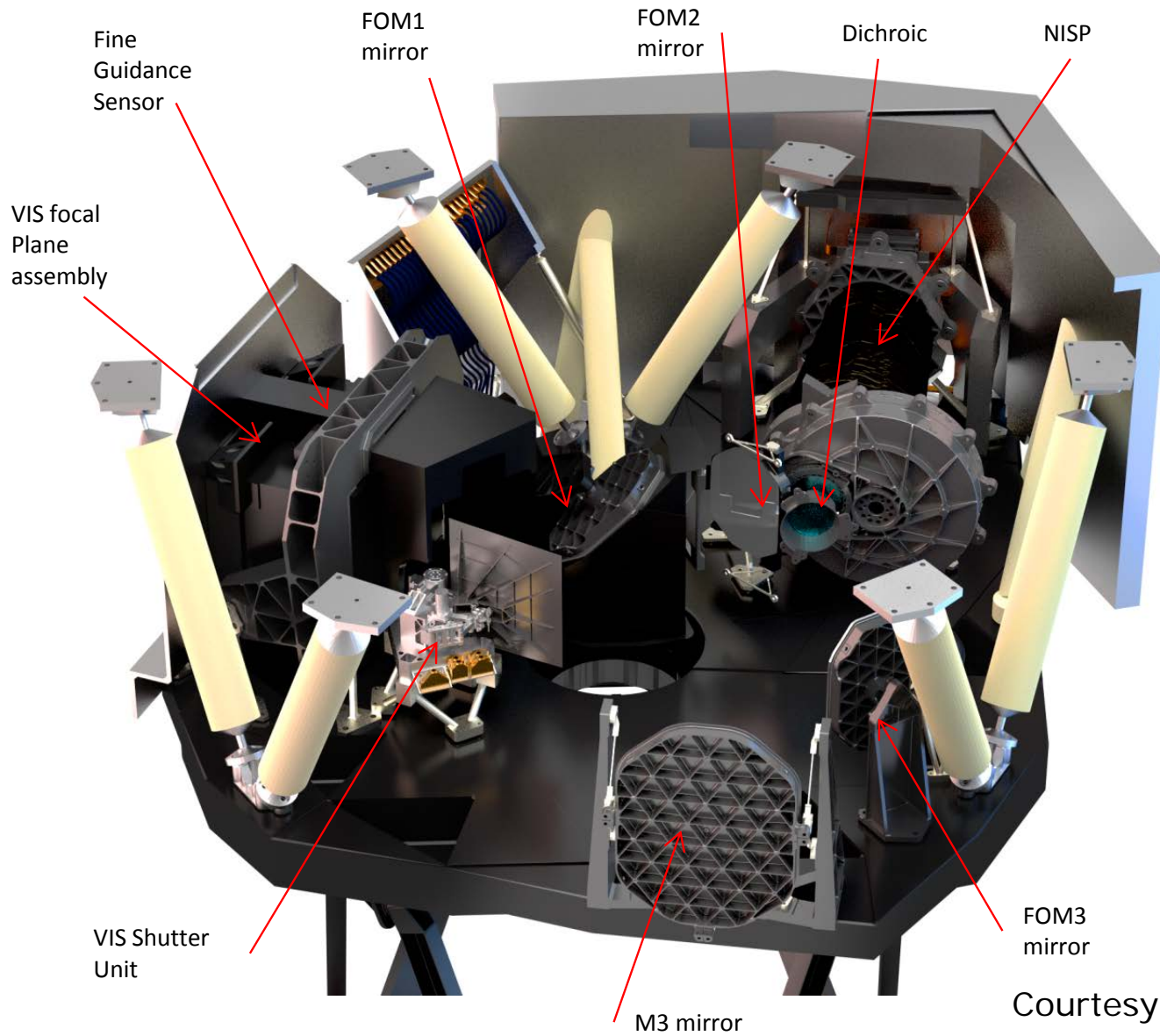
# *VIS Instrument Development Status*

Euclid Consortium Meeting  
London 5<sup>th</sup> – 8<sup>th</sup> June 2017

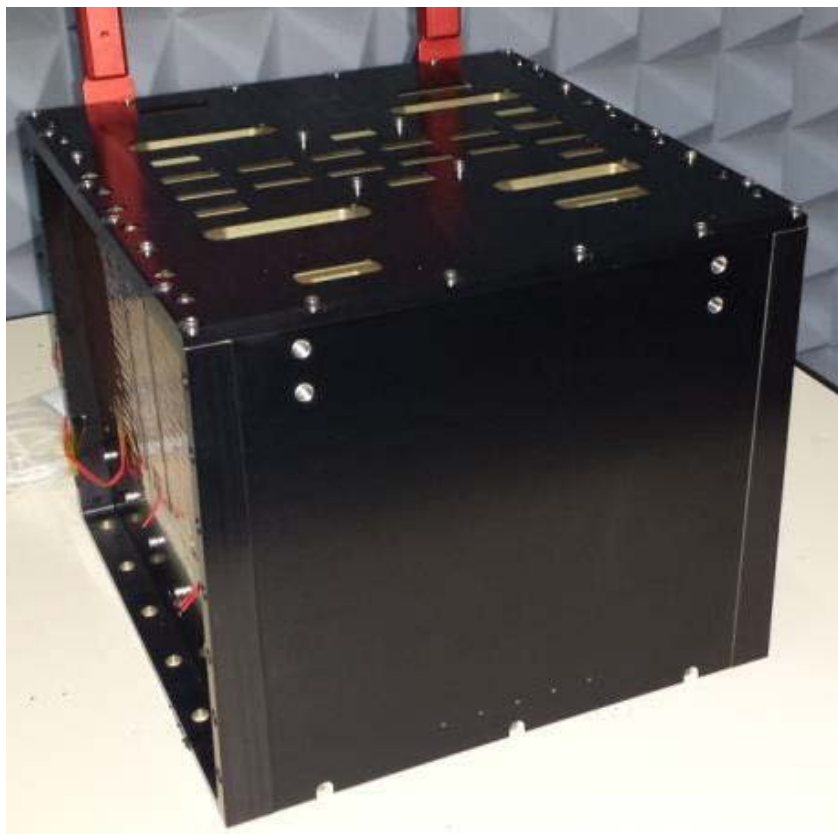
Sabrina Pottinger

on behalf of the VIS team  
and the Euclid Consortium

- VIS Instrument hardware description
- Electrical Model Instrument status
- Calibration activities
- Technical issues and solutions
- Schedule
- Instrument Critical Design Review
- Future activities
- Acknowledgements

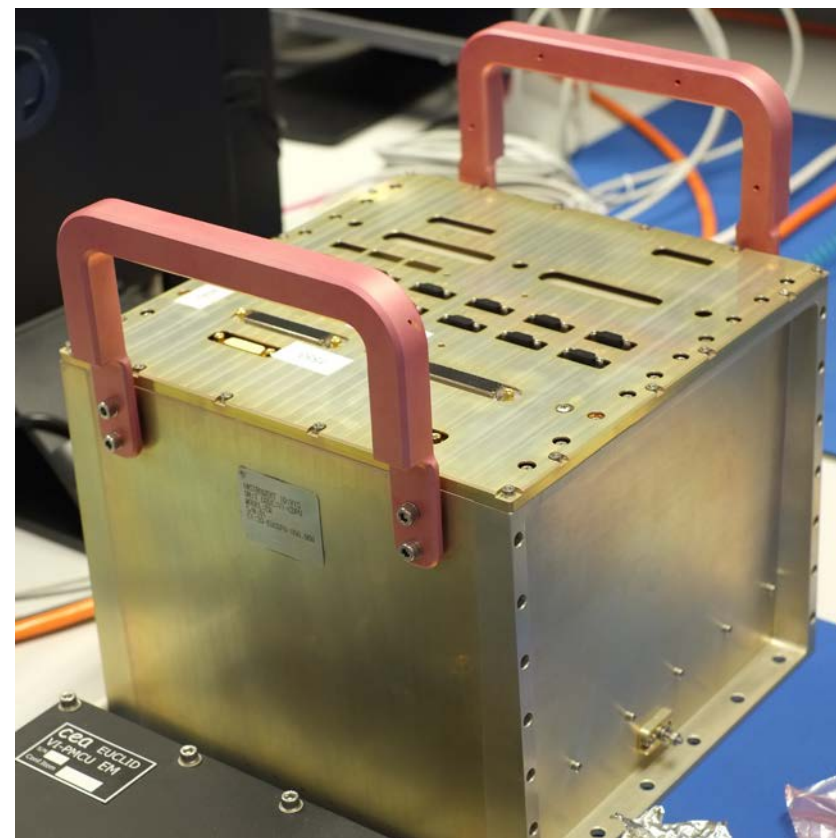


Courtesy of Airbus D&S



## Structural Thermal Model CDPU

- Mechanically representative of flight model with the exception of minor differences in base plate hole pattern
- Capability to dissipate equivalent power levels as flight unit



## Electrical Model CDPU

- Controls EM instrument timings, compresses and transmits data to the S/C simulator
- Capability to generate simulated data of 12 detector chains
- Electrically representative of flight model
- No redundant side present

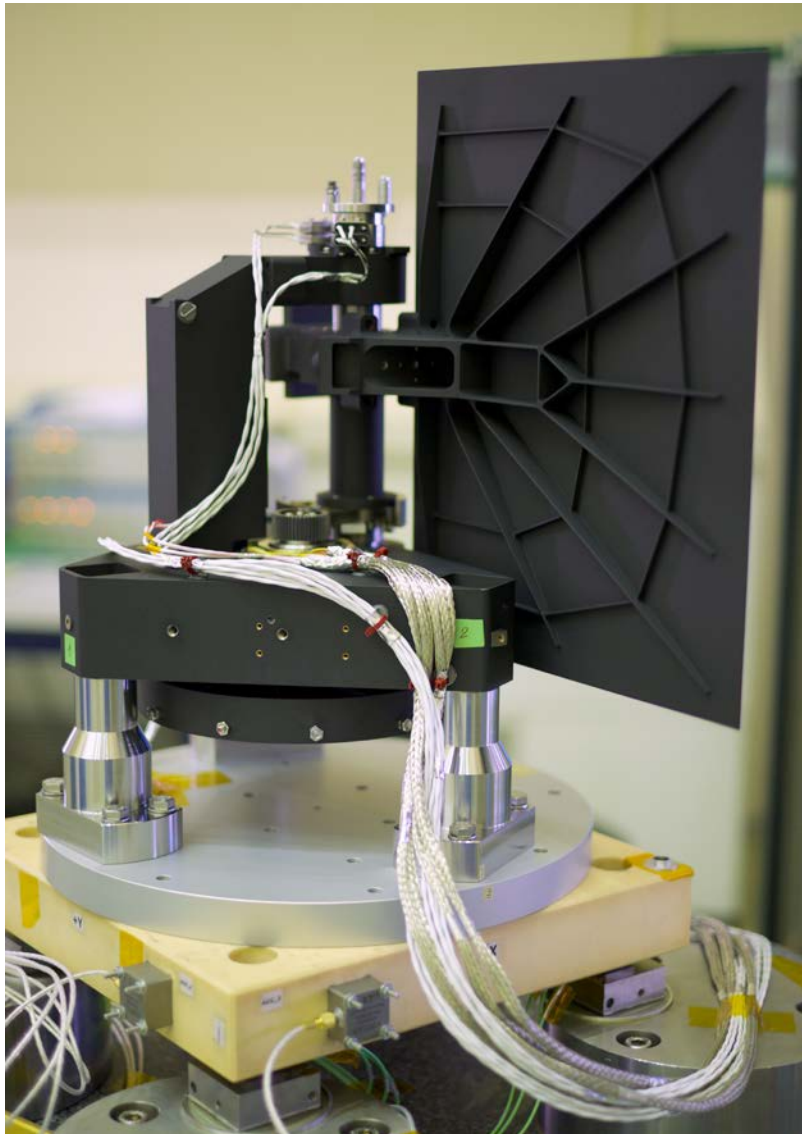
## Structural Thermal Model PMCU

- Fully mechanically representative of flight model
- Capability to dissipate equivalent power levels as flight unit



## Electrical Model PMCU

- Capability to turn on/off calibration unit LEDs, drive shutter unit and monitor Focal Plane Assembly temperature
- Electrically representative of flight model
- No redundant side present



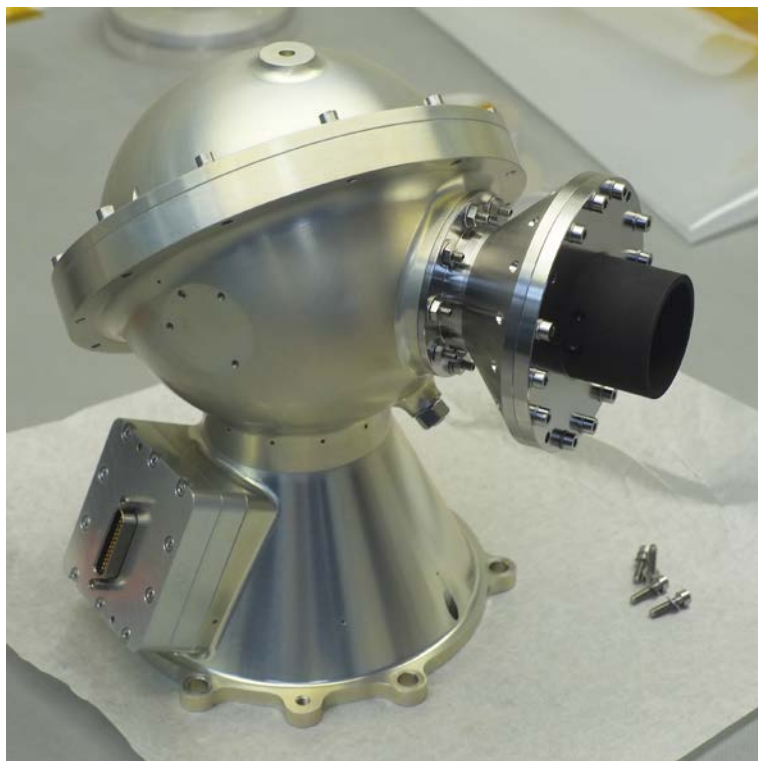
## Structural Thermal Model RSU

- Mechanically representative of flight model with some exceptions
- No hold down release mechanism
- Shutter leaf width increased by approximately 20 mm



## Electrical Model RSU

- Electrically representative of flight model
- Main motor and end switches are present. The hold down release mechanism is present but is now omitted from flight model

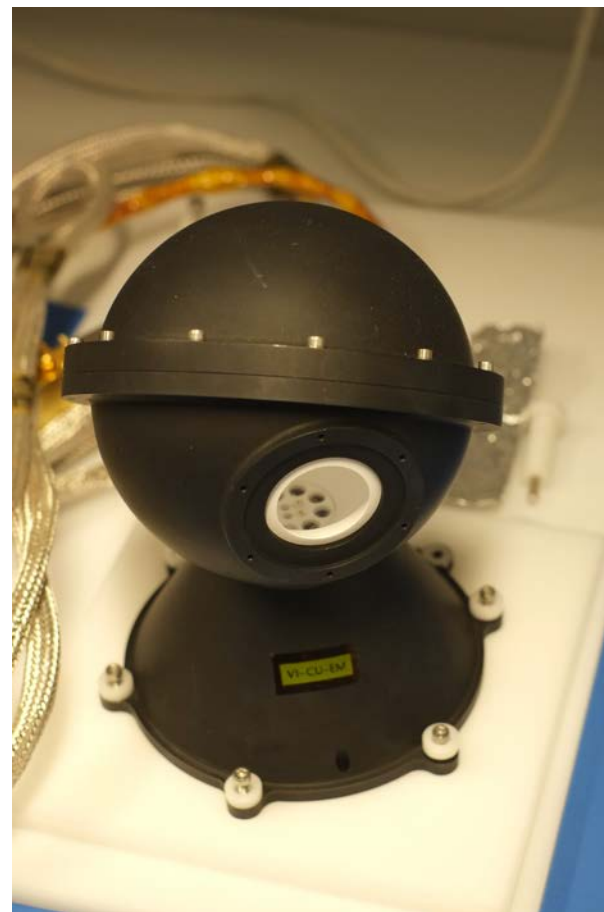


## Structural Thermal Model CU

- Design enhancements implemented compared to EM CU
- Lens and baffle collimate beam and reduce stray light
- A filter is present to eliminate the risk of photon emission due to electromagnetic interference

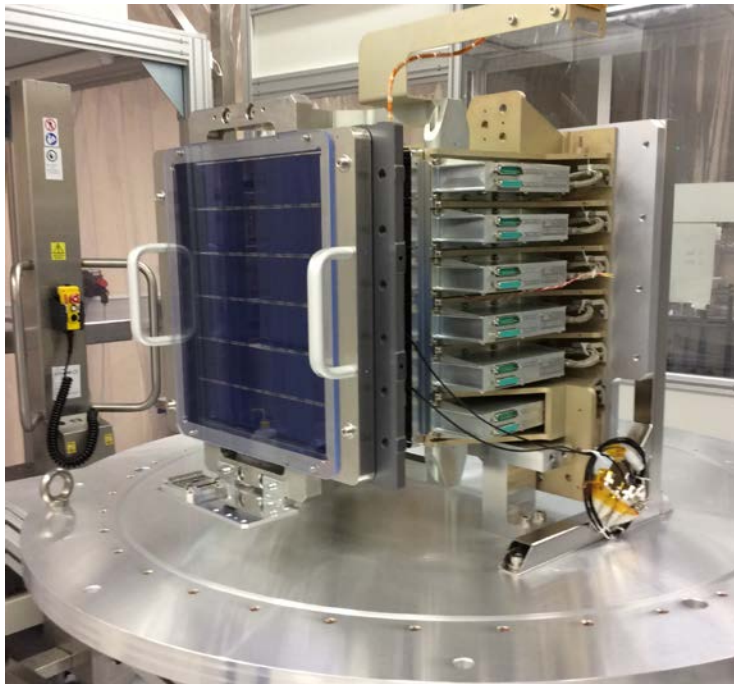
## Electrical Model CU

- Electrically representative of flight model, no EMC filter present
- 6 LEDs are integrated, no redundant LEDs present



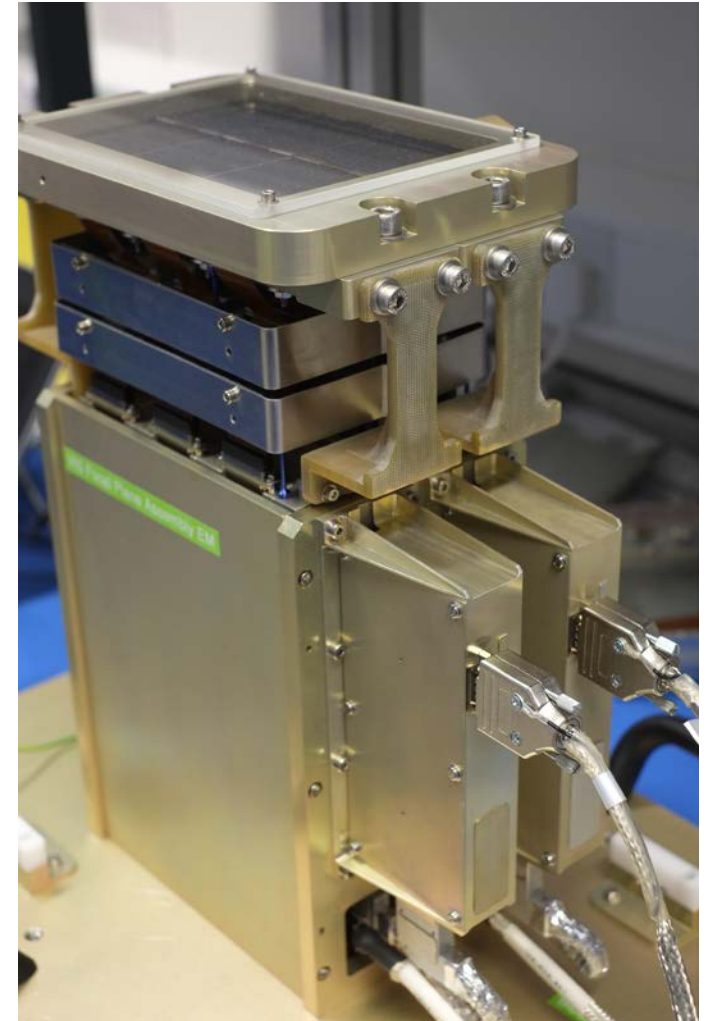
## Structural Thermal Model FPA

- Fully representative of flight model in terms of mechanical and thermal characteristics
- The STM will be used to de-risk testing performed on the FM at MSSL-UCL

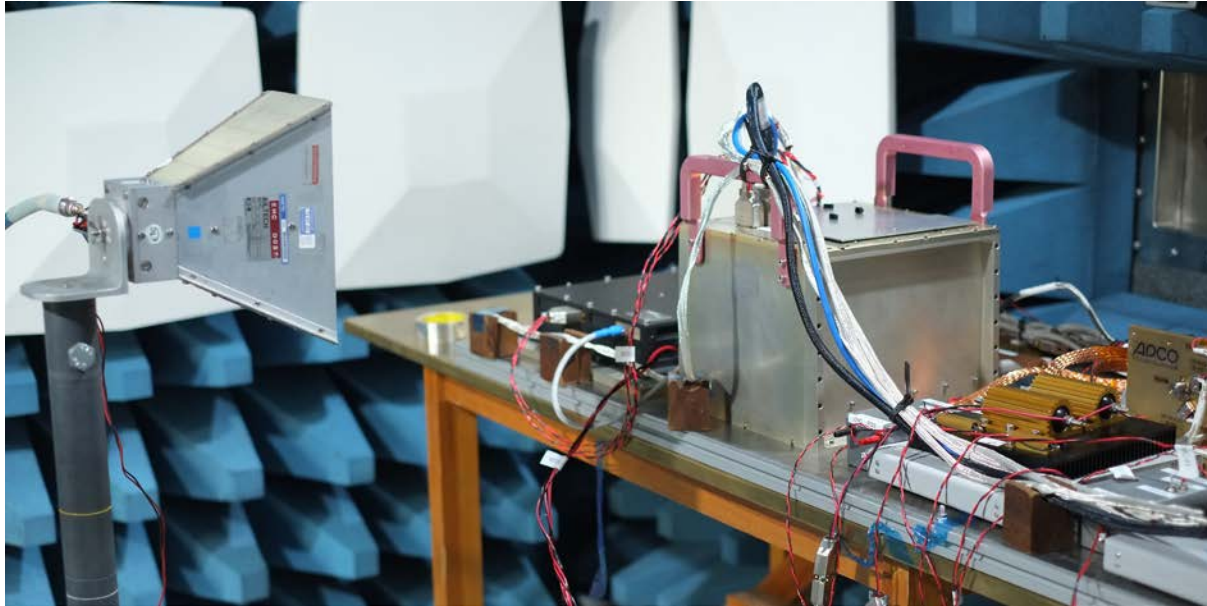


## Electrical Model FPA

- A reduced version of the flight model consisting of 2 detector chains instead of 12
- Each detector chain is electrically representative of the flight hardware



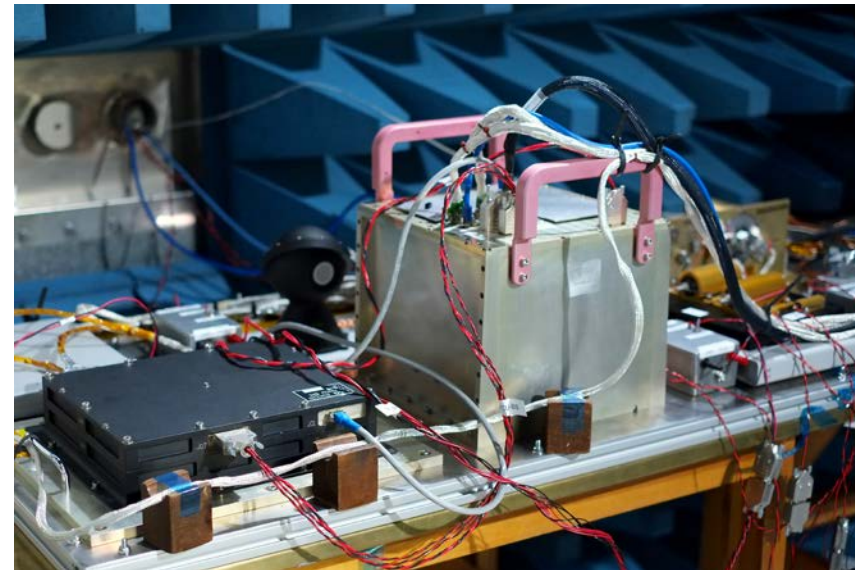




VIS Electrical Model subsystems connected with ESA provided harness undergoing electromagnetic compatibility (EMC) testing

Photographs courtesy of A. Short (ESA Project)

- The instrument has shown nominal operation throughout the 3 week duration of the EMC test
- Compliance was shown with conducted and radiated emissions
- Some non compliances were observed at specific frequencies during conducted and radiated susceptibility tests. This is under investigation by the VIS team and ESA
- End to end operation of the instrument with the fully representative spacecraft simulator will be demonstrated in near term activities

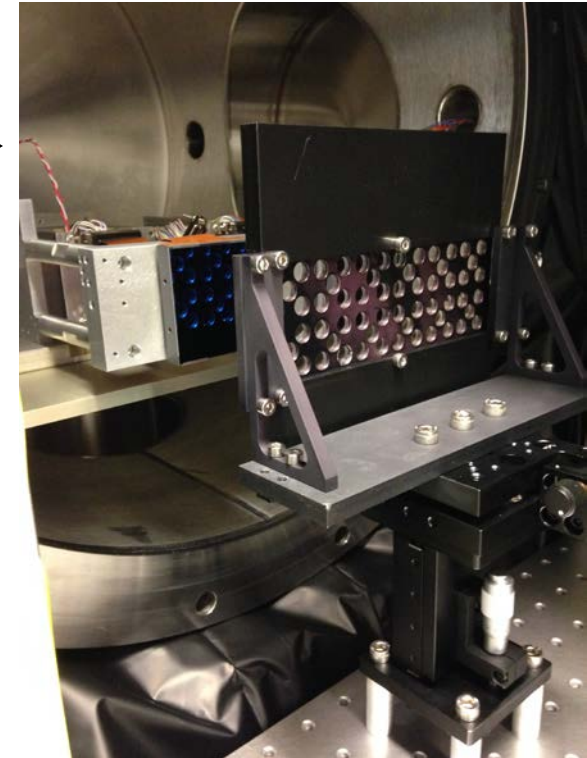




← Calibration facility

Optical source used for point spread function calibration →

Mechanical jig used to support detector chain



- The calibration process is defined in the ground calibration plan. Approximately 24 performance requirements undergo verification by test
- Brighter-fatter effect: Algorithms are under development to correct for increasing FWHM with increasing intensity of light source. Initial outputs are encouraging but further refinement is needed
- Work is underway to convert performance data analysis scripts into a calibration pipeline that will release “calibration data products”

- STM FPA thermal dissipation found to be higher than expected during thermal testing
  - Power dissipation from CCDs was found to be higher than reported by the device supplier
  - Extensive testing performed at CEA has shown good agreement with thermal model
  - Initial outputs from PLM thermal model indicates that the increased power can be managed at PLM level due to the margins carried for thermal management
- RSU microvibrations are higher than requirements
  - The microvibrations generated will impact the quality of point spread function measurements
  - The opening/closing time of the RSU will be reduced to alleviate the problem
  - The team at University of Geneva and their subcontractor APCO have identified a design solution to further reduce the level of microvibrations generated

- Stray light reflected from the RSU leaf when closed
  - There is the potential for the stray light to be diffracted onto the FPA optical surface
  - Simulations indicate that the impact on VIS core science will be negligible. Further analysis will be conducted by MSSL, ESA and Airbus in order to verify this conclusion
- Electrical cross talk measured on the EM ROE is non compliant
  - Layout changes of inductors are implemented in the ROE QM and FM and have resulted in improvements to some degree but we remain non compliant with the requirement
  - The cross talk will be corrected using post processing methods
- Normal business to identify non compliances during the development and manufacturing phase. We will continue to identify solutions as issues are identified.

## **STM Delivery: 2017-07-28** (inc. 15 days margin)

- There is no instrument level testing performed for STM VIS. All subsystem level testing is completed and units are delivered to MSSL-UCL
- A handling de-risking exercise will be conducted with the STM FPA. This process is driven by conflicting demand on thermal vacuum facility from internal projects at MSSL. There is now increased schedule pressure on the STM, we are operating without margin.
- ESA have noted that the higher level need for the STM instrument is not critical at this stage.

## **EM Delivery: 2017-07-28** (inc. 20 days margin)

- Delays to spacecraft simulator SCOE delivery resulted in delayed interface verification. Corrective measures for the 1553 interface problem will impact the EM schedule.
- EMC testing was conducted with some non-conformances identified. Identifying the scope of further EMC testing and conducting additional testing will impact the EM schedule
- Assessment of the remaining activities for the EM and schedule consolidation is required to confirm if delivery within the margin can be maintained

## **FM Delivery: 2018-12-31** (inc. 40 days margin)

- Detector chain electronics manufacture and test drives the FM schedule.
- Delays were experienced with the delivery of EEE components. Sufficient quantities of components are now delivered to enable manufacturing KO. Final deliveries are anticipated by the end of the month.
- Printed circuit boards are manufactured and ready for population.
- The manufacturing readiness review for QM/FM units will take place this month.
- In order to optimise the test and calibration process, facilities and support equipment will support parallel testing of units and the calibration of two detector chains simultaneously.
- In order to further assess the realism and robustness of the schedule an external review of the schedule is being conducted by UKSA in conjunction with ESA.

- ICDR Board meeting was held in March 2017 and confirmed the review could not be formally closed at that stage as 2 of 8 review objectives were not successfully passed
  - Verify that the overall verification and validation programme, preparation for the manufacturing and AIT activities are adequate and that all tools, jigs and model development are coherent with the planned system level activities
  - Verify that all technical and programmatic risks have been identified and that adequate mitigation actions are in place
- Main issues as understood by the VIS Team are:
  - FM schedule (addressed by external review)
  - AIT planning (addressed by updated AIT Plan delivered to ESA/industry)
  - Product Assurance (addressed by augmentation of PA support by additional 1FTE)
- It was noted by the panel and Board that no technical issues were identified during the review process
- ECL has required more detailed oversight of the VIS programme
- CDR closeout revisited in June/July 2017, on the basis of an updated Panel Report



- Completion of EM VIS test campaign and delivery of the instrument to ESA
- Delivery of STM instrument to ESA
- Closure of Instrument Critical Design Review and completion of all associated actions
- Completion of the VIS Instrument Software Critical Design Review
- Completion of qualification model programmes for the ROE, RPSU, PMCU, CU and RSU
- Start flight hardware manufacture



UoG & APCO – Switzerland, IAPS & OHB – Italy, CEA – France, IAS – France, OU – UK,  
MSSL – UK  
ESA, Thales, Airbus  
Funding Agencies: ASI, CNES, UKSA

Questions?