



VIS Status

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On behalf of the VIS SW
Development Team

INAF IAPS



6° Meeting Nazionale Collaborazione Euclid ITALIA
19 - 20 Gennaio 2023



Presentation outline



- Euclid system and VIS
- VIS CDPU
- VIS Operational concept
- VIS On Board Software



Euclid – Assembled Spacecraft



Agenzia
Spaziale
Italiana



@TAS-I 1st July 2022

The finished spacecraft measures 4.7 meters tall by 3.7 meters wide. Fully fueled, it will have a mass of 2,160 kilograms.



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Slide 3

Euclid – Environmental Tests campaign



Credits: TAS-I



Credits: TAS-I



Credits: TAS-I

@TAS-S Cannes
August 2022



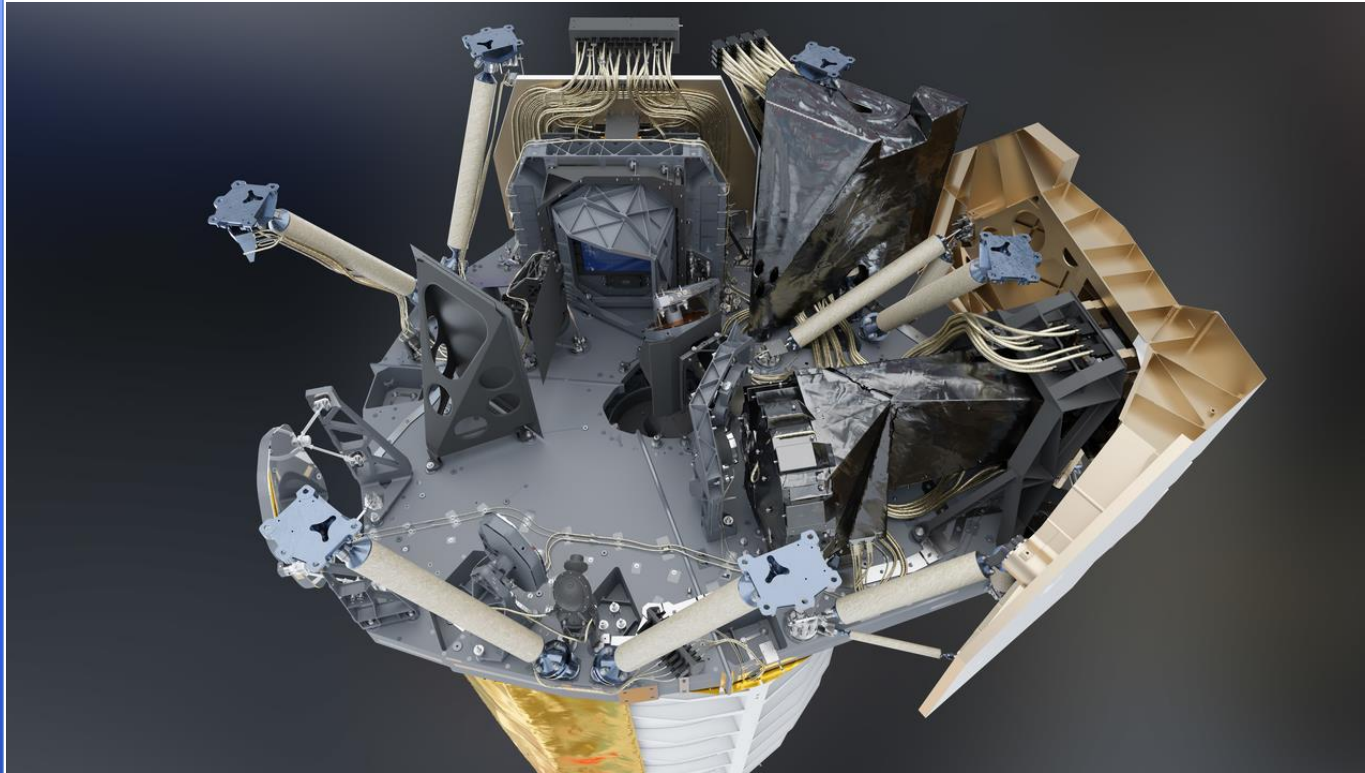
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Euclid Payload Module



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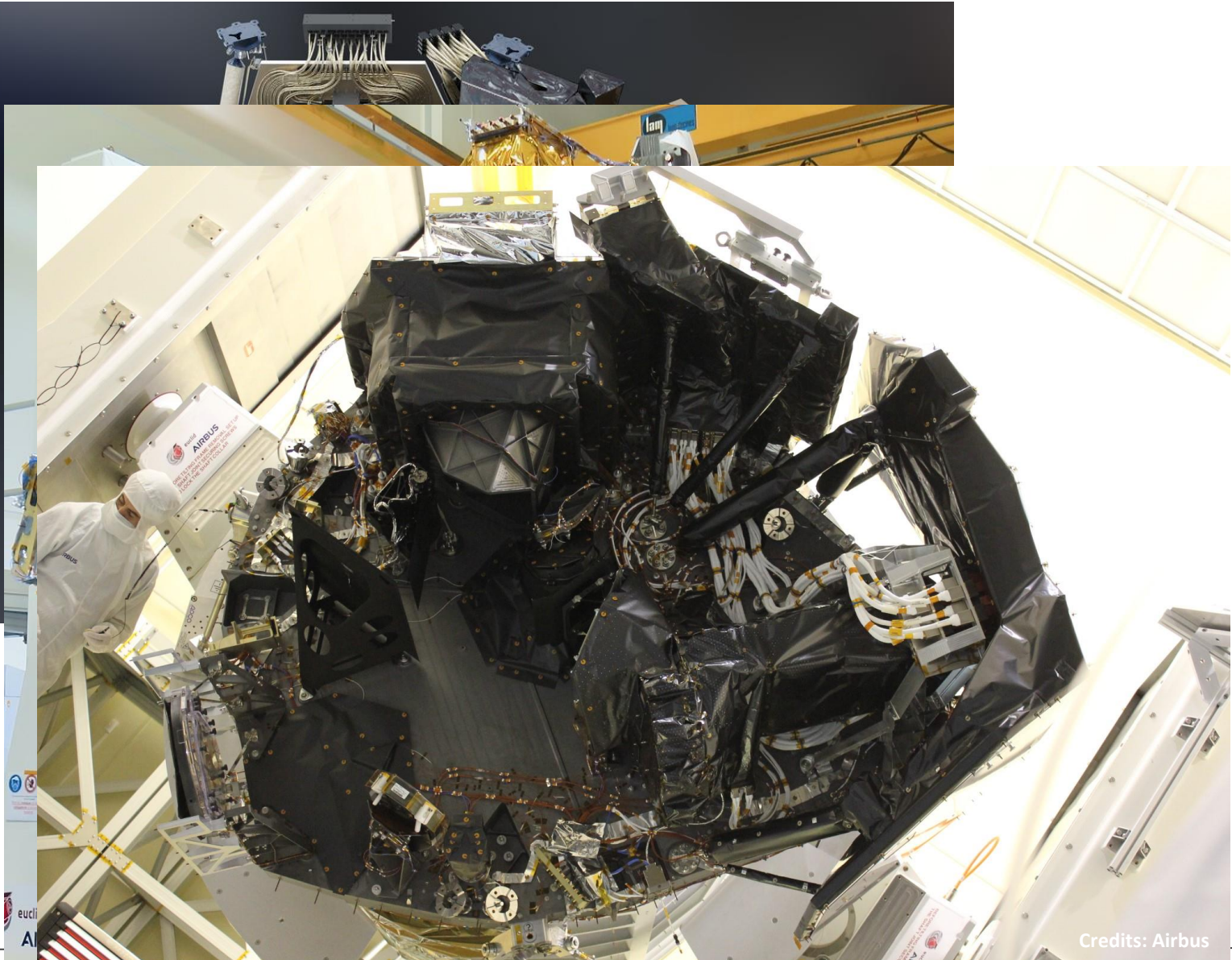
Titolo/Autore

Slide 5

Euclid Payload Module



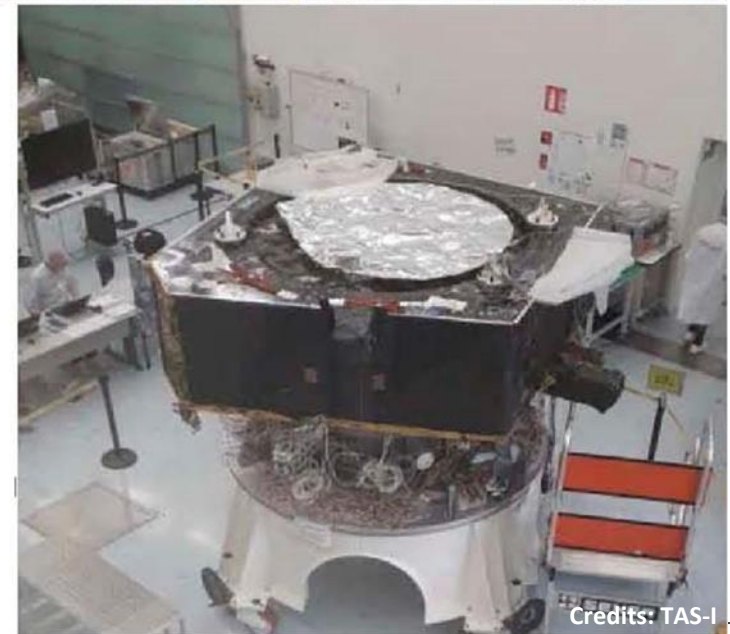
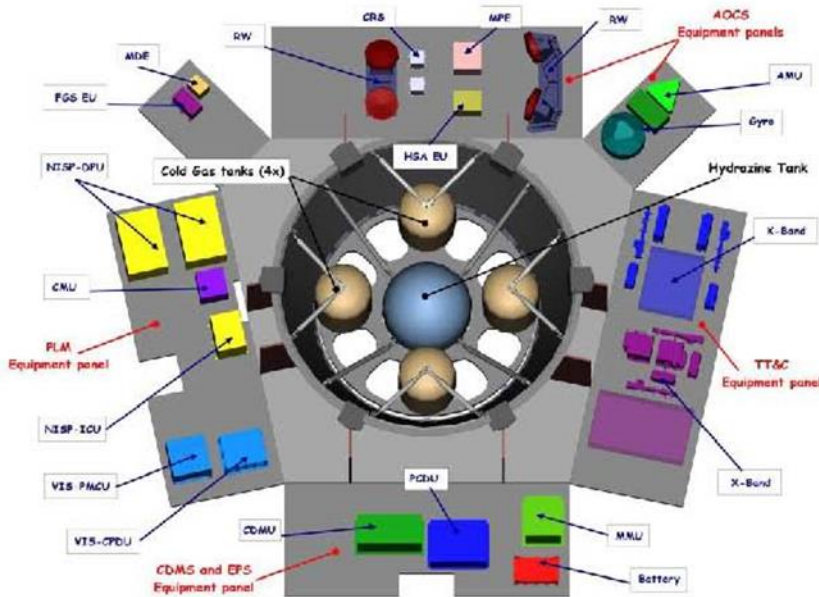
Euclid Payload Module



Credits: Airbus



Euclid Service Module



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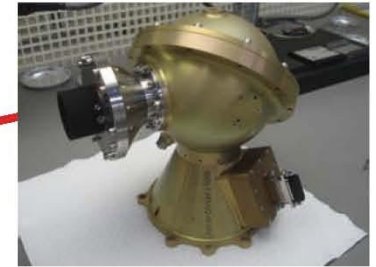
Reminder: VIS instrument



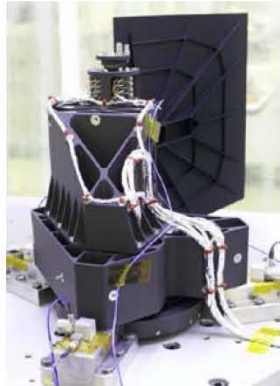
FPA
(Focal Plane Assembly)



**Payload
Module**



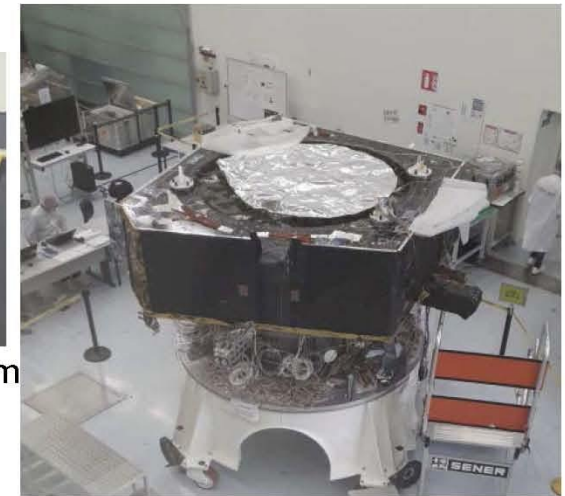
CU
(Calibration Unit)



RSU
(Readout
Shutter
Unit)



PMCU (Power & Mechanism
Control Unit) &
CDPU (Control, Data
Processing Unit)

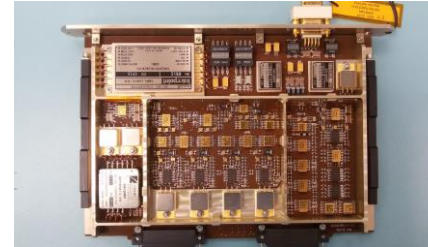


Service Module (warm)

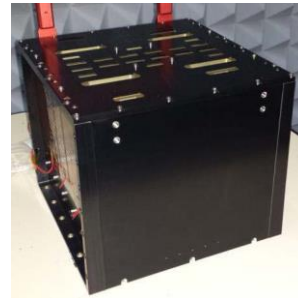
VIS CDPU – Industrial providers



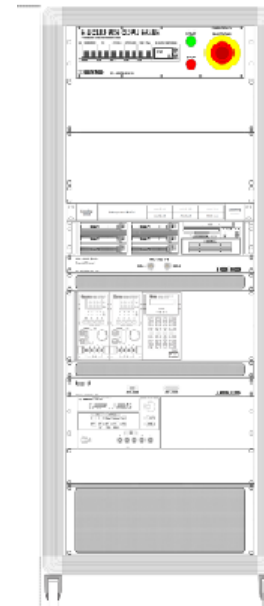
OHB Italia S.p.A.



S.A.B. AEROSPACE S.R.L.



TEMIS S.R.L.

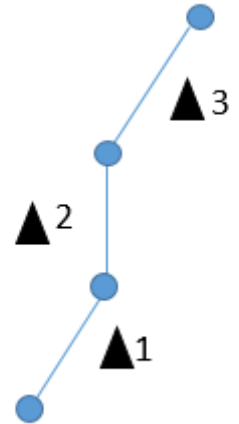


VIS operational concept

Euclid dither strategy = four dithered exposures

- to cover gaps between active detector pixels in the focal plane array;
- to permit the super-sampling of the system point-spread-function (PSF);
- to place the star and galaxy images in different positions with respect to the detector readout nodes, to allow separation of CTI-induced effects and intrinsic source characteristics and to avoid CCD cosmetic defects;
- to minimize the number of cosmic ray events and allow the identification and rejection of them; to limit the number of saturated objects.

The Euclid Survey reference dithering sequence is achieved at Euclid Spacecraft level and therefore is applicable to both VIS and NISP instruments.



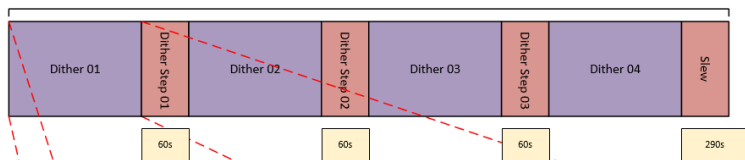
VIS operational concept: a small set of calibration and science exposures which are repeated, at various frequencies, thousands of times over the course of the mission → the VIS operations can be considered to be simple, repetitive and replicated for every stage in the Spacecraft's step and stare dither/slew strategy

Instrument	%pixels with at least 3 exposures	%pixels with 4 exposures
VIS	96.5%	49.5%

VIS ROS and Baseline Sequence



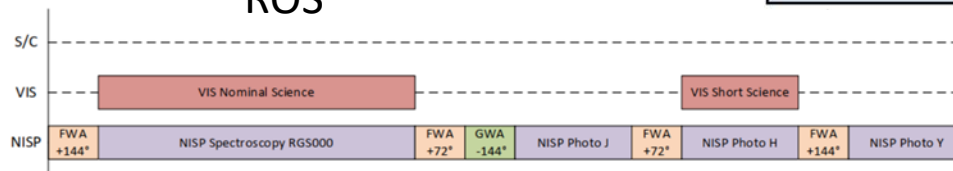
Nominal Science Observation Sequence



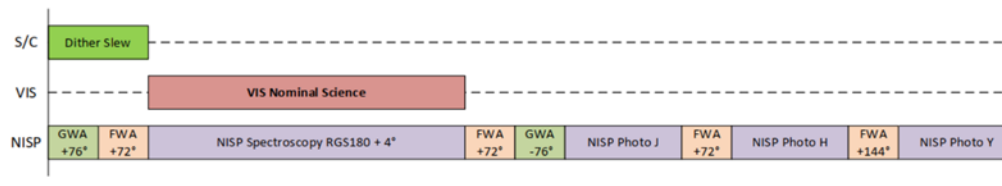
-Nominal science observation	- Nominal science observation	- Nominal science observation	- Nominal science observation
-Short science observation (15 per day)	- Reserved for 2 nd short science observation (telemetry permitting)	Bias sequence (1 per day) - Trap-pumping calibration (6 per day)	- Flat-field sequence (6 per day) - Dark sequence (4 per day) - Charge injection sequence (8 per day)

Dither #1

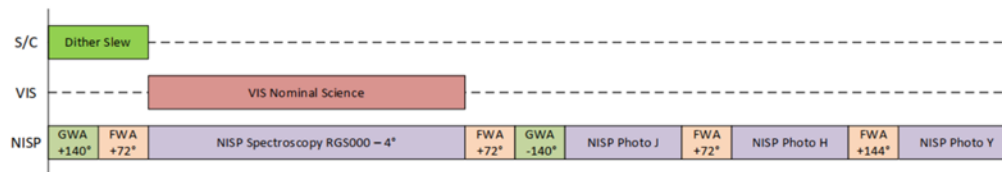
ROS



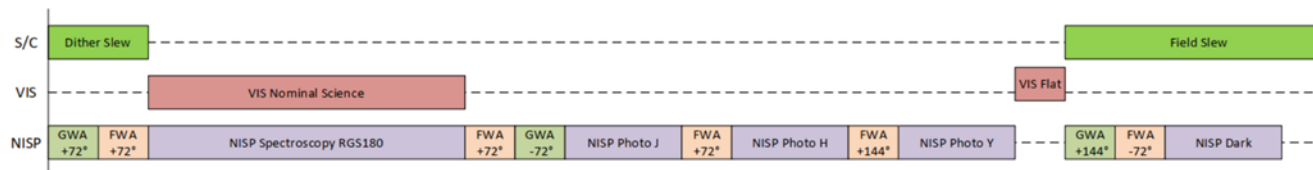
Dither #2



Dither #3



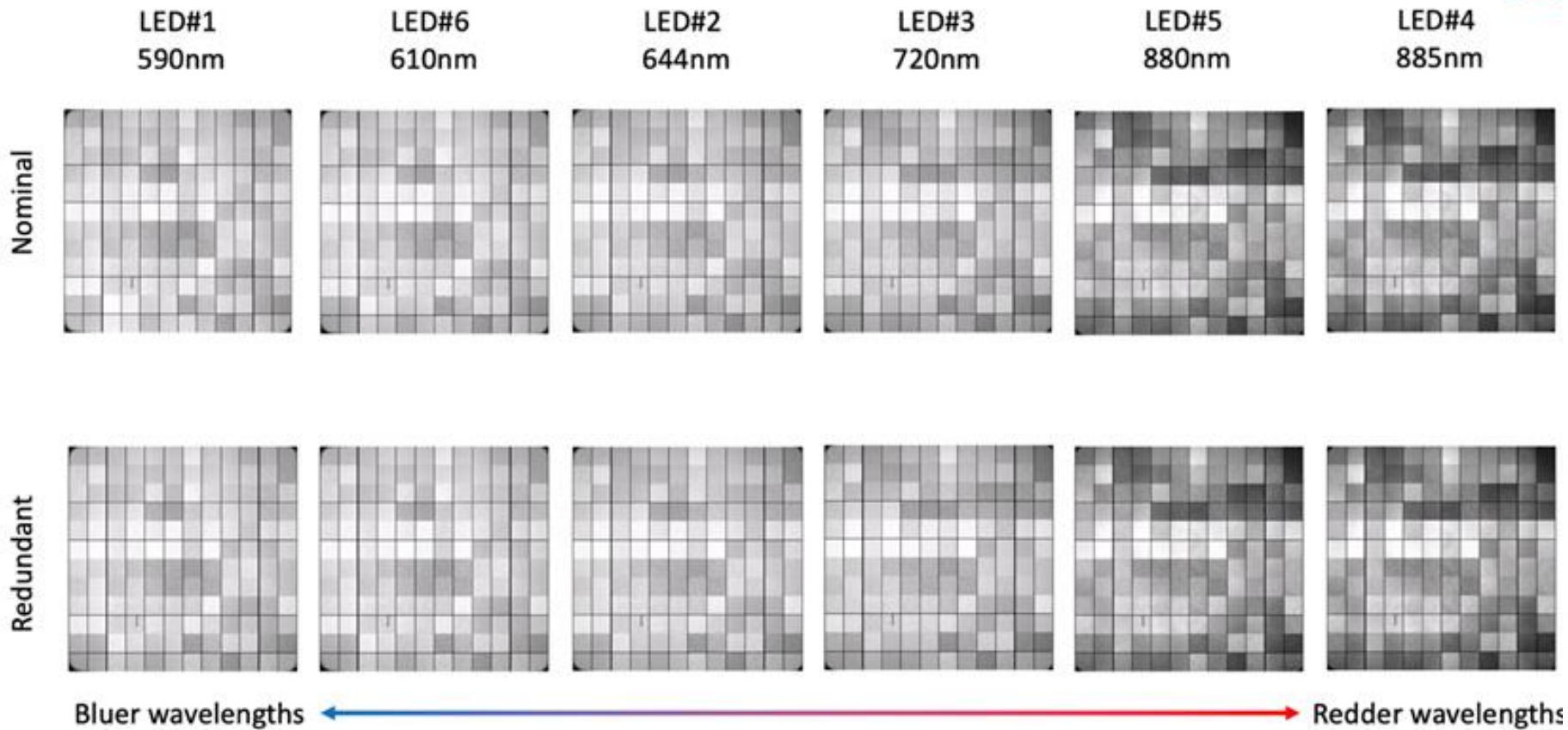
Dither #4



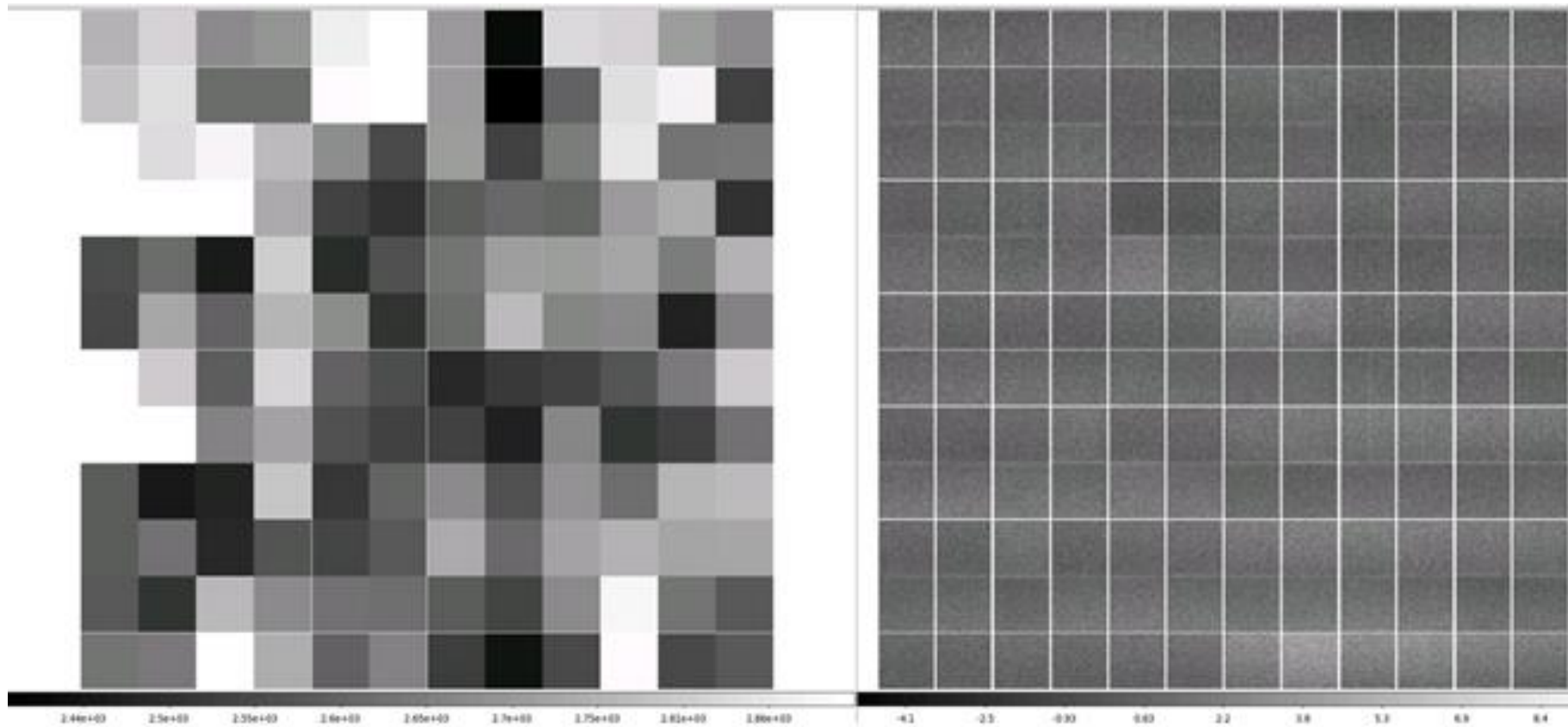
Flat Fields



Flat fields for all 6 Calibration Unit wavelengths for nominal & redundant sides



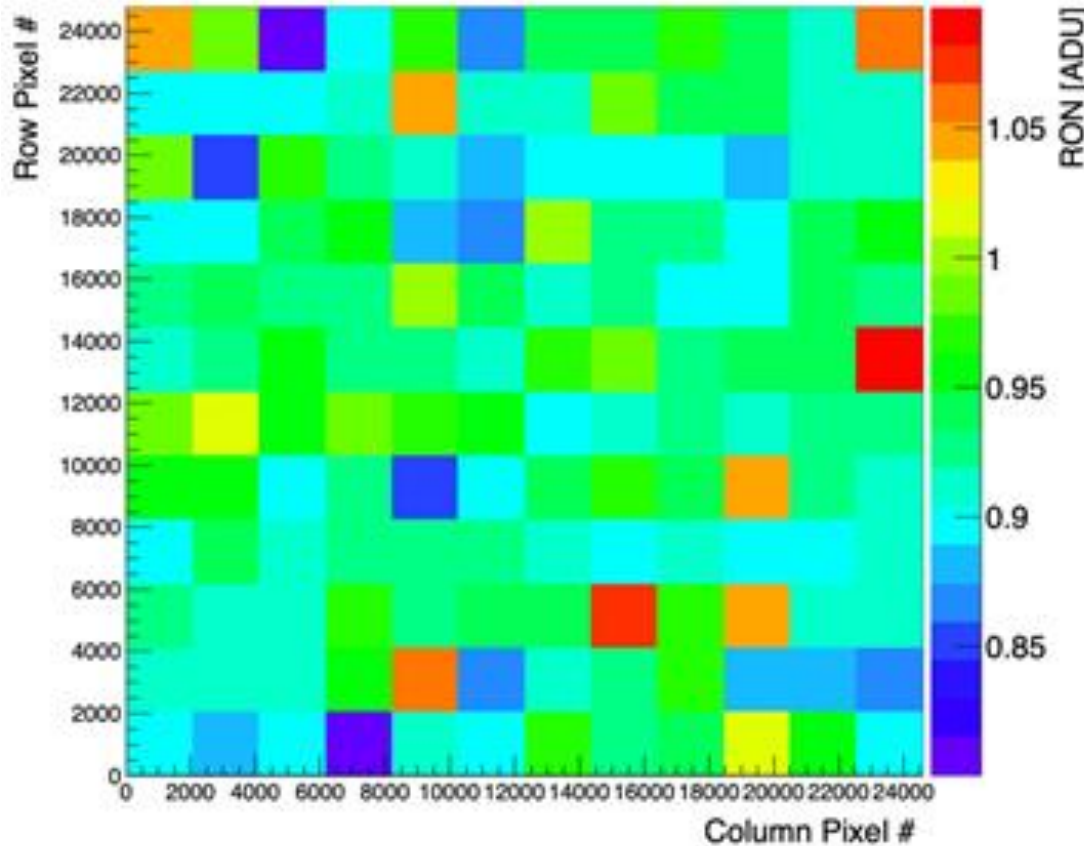
Bias before and after processing by OU-VIS



Readout noise



Mean Readout Noise (Serial Overscan)



Readout noise
<3.8 e-
(spec ≤ 4.5 e-);

1 ADU = 3.5 e-

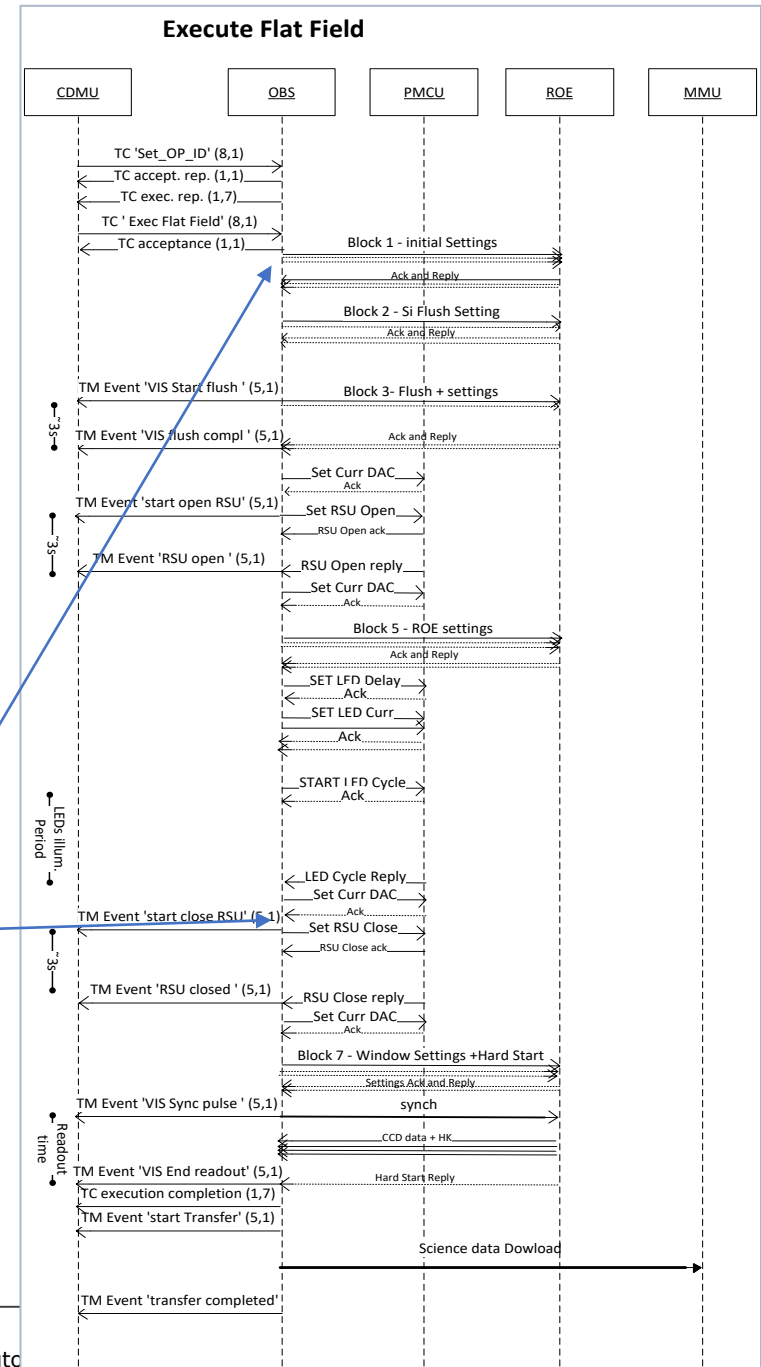


RSU Flag

The AOCS must be informed about RSU movements. The baseline concept was to manually inform the AOCS by an entry in the MTL that is released at the same time when the VIS RSU is starting to move. However, to simplify operational planning and to manage timing uncertainties in the VIS sequences it was decided to introduce an event-based mechanism to inform the AOCS of an impending RSU movement. For this to work an event must be generated a few seconds before the actual RSU movement.

RSU Events

Consistency check on compatibility of RSU Events delay time with Exposure time and LED Cycle time to be done On Board.
Overall measurement durations increased by $2 * \text{RSU Delay time}$



- Number of files: 180
- Lines of code: 90100
- 127 Look up tables
- Total number of monitored HK parameters: 782
- Total Number of CDPU HW+SW requirements: 898
Total number of CDPU SW requirements: 250
Total number of CDPU requirements Applicable to OBS: 240
- All CDPU requirements applicable to OBS have a verification method:
141 reqs. covered by Review/inspection (60%)
92 reqs. covered by Tests (39%)

VIS Flight SW and MIB



- ASW 3.1.1 - A new issue of ASW has been delivered on November 2nd 2022, implementing some new requirements:
 - New requirement to provide a RSU event at a configurable time (new events + new TC + configuration logic)
 - New requirements about onboard timeouts calculation
 - New requirements about EEPROM stored LUTs handling
- MIB – v 3.5.0



Version tree of VIS ASW

CDPU v 0.1.0

It works with PMCU,
ROE and MMU OHB
EGSE

CDPU v 0.4.1

OBS for VIS EM EMC test campaign.

CDPU v 0.4.x
ROE-EM

CDPU v 0.5.x
ROE-QM

CDPU v 1.0.0
VIS-EM

CDPU v 2.0
VIS-QM

CDPU v 3.0
VIS-FM

CDPU v 3.0.8

CDPU v 3.1.1

OBS on VIS EM
@ TAS-I

OBS on VIS EM/QM
@ TAS-I

OBS on VIS FM @
CEA- ADS

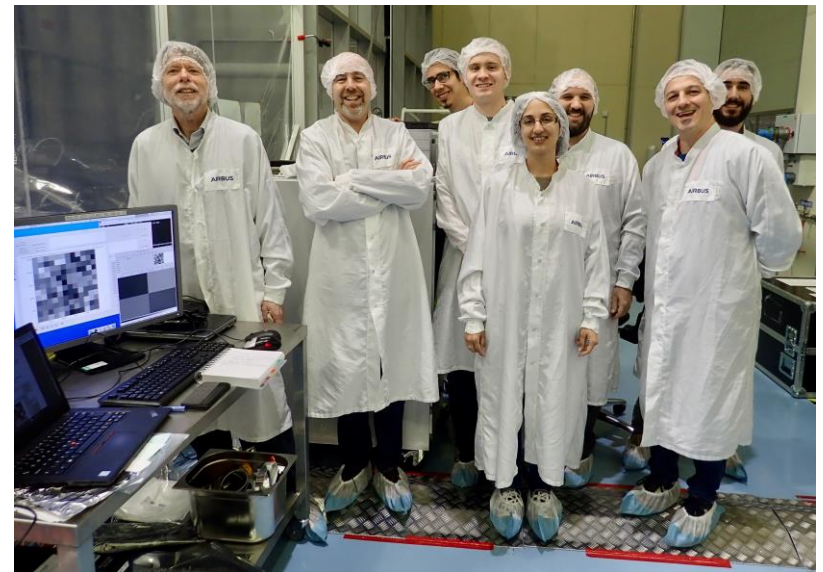
OBS on VIS FM @ ADS
TV tests

OBS on VIS FM @ SVT

VIS team



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



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