



Agenzia Spaziale Italiana



Instrument Operation Team

6° Meeting Euclid Italia - Roma – 19th January 2023

Erik Romelli
IOT Deputy Coordinator

Anna Gregorio
IOT Coordinator

Euclid Instrument Operations



Ideally, the **Survey defined at launch should be the one valid** for the rest of the mission

However...

- Assumptions on performance have to be reassessed with System In Flight
- Unknown systematics may appear
- Room for optimization may be found (i.e. Calibration Strategy)
- Instrumental or System problems found
- Punctual operational problems -> May need local alterations

Instrument Operation Team (IOT):

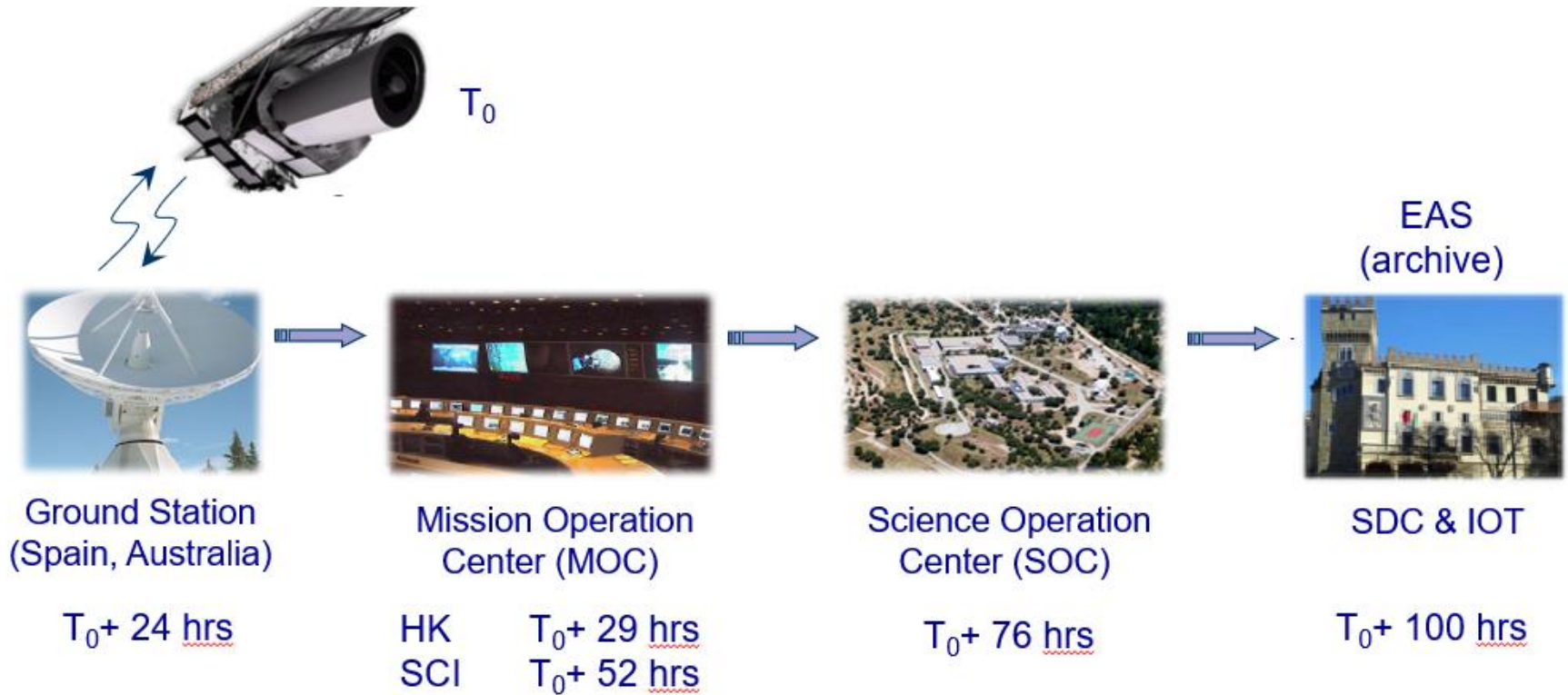
- Maintenance and operations of the Euclid instruments
- Connection point between the EC SGS and the SOC

During the operations:

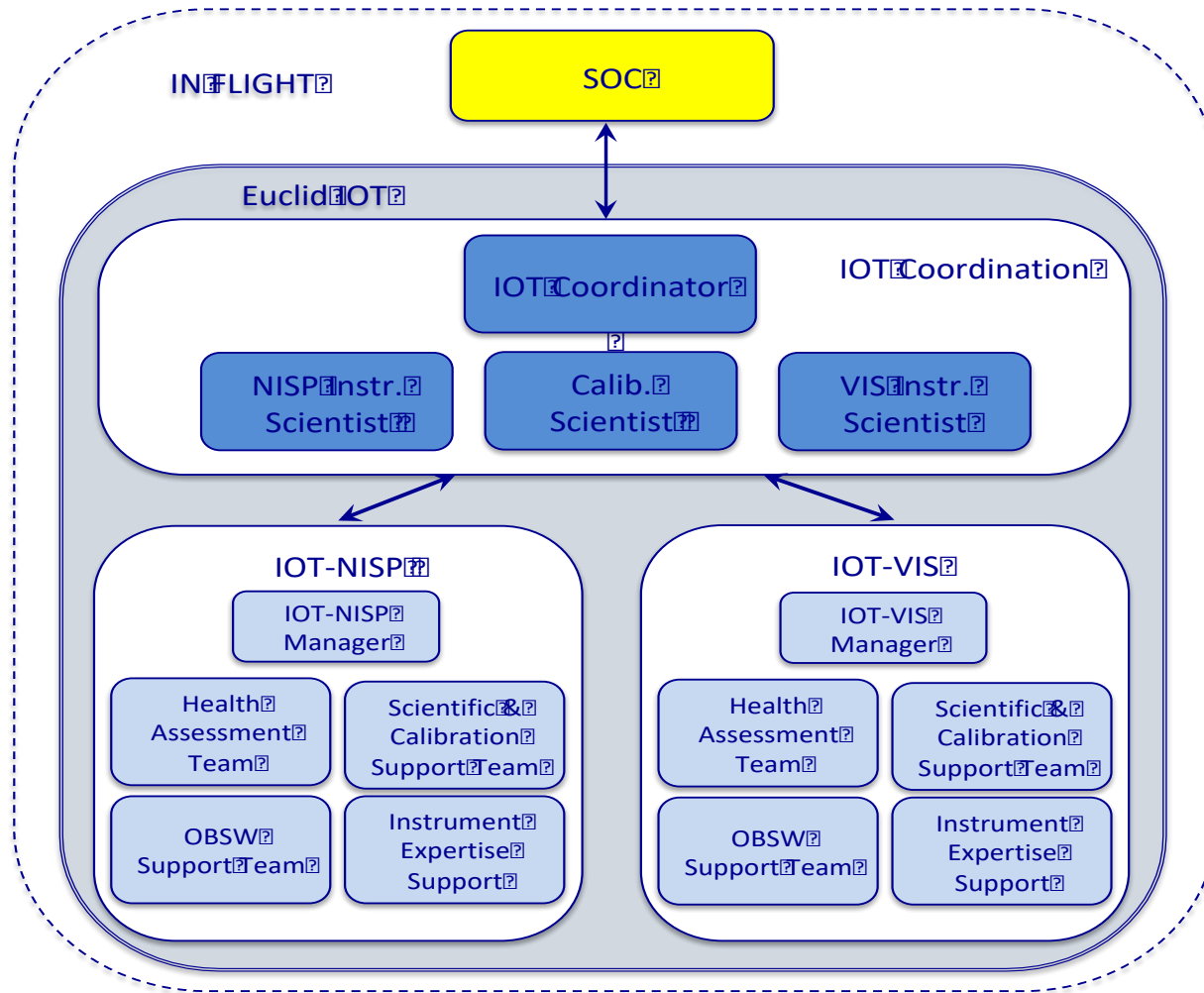
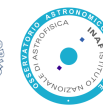
- Commissioning, performance verification and monitoring of VIS and NISP
- Assist the SOC in planning the mission.



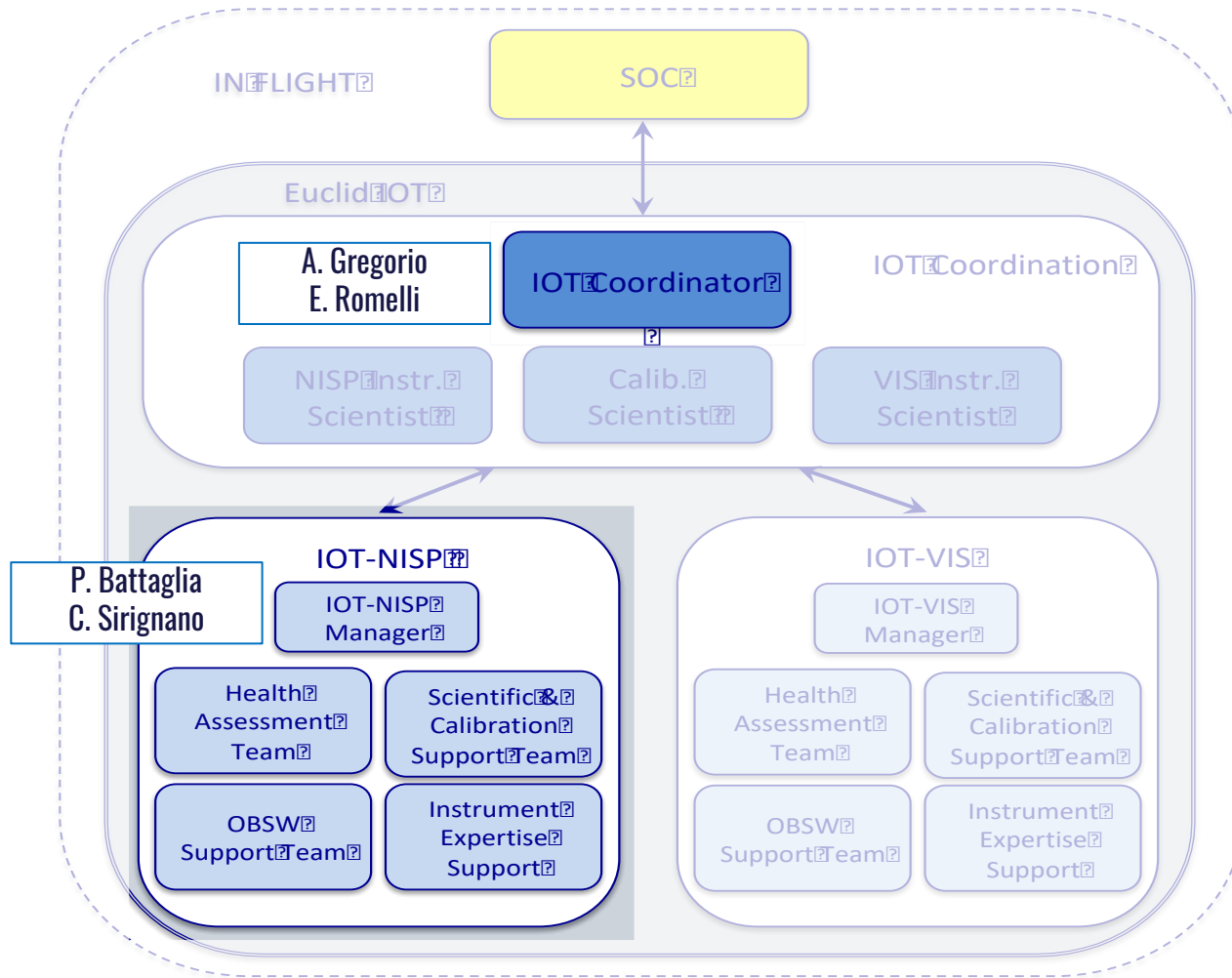
Euclid Instrument Operations



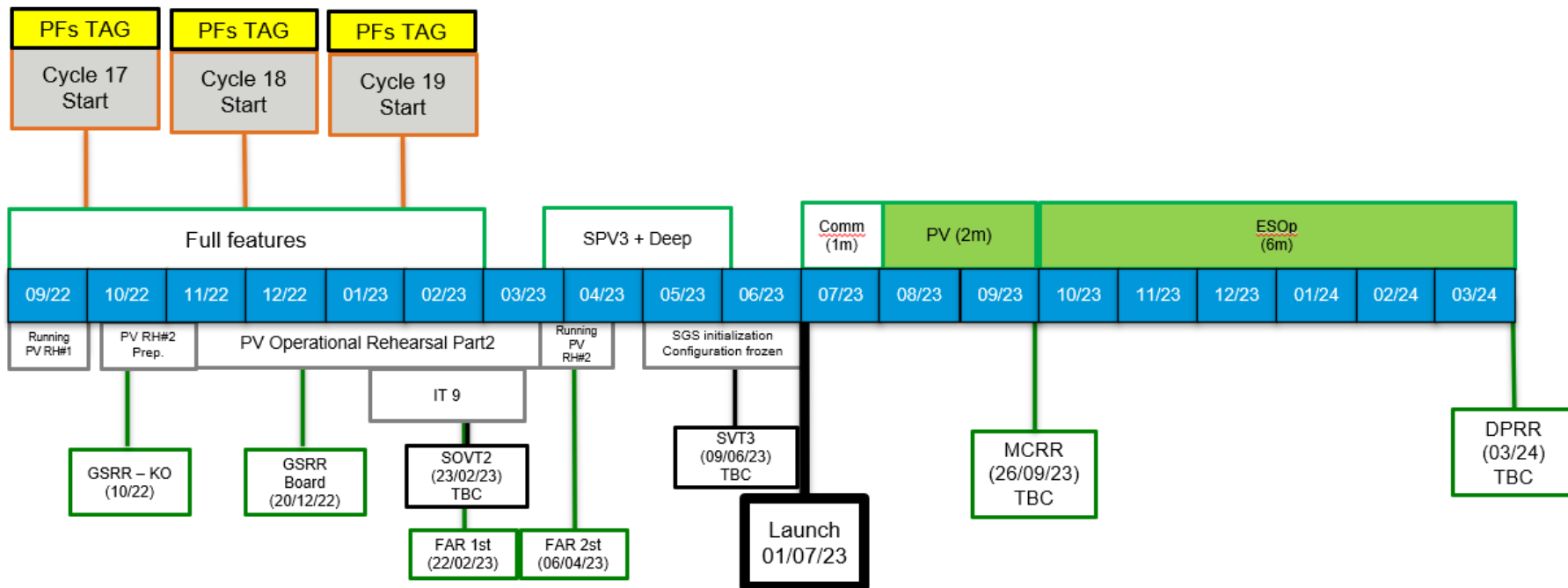
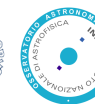
The IOT management structure



The IOT management structure



Timing and Logistics



PV Phase:

- 2 people (VIS and NISP) @MOC for 1 week
- 8-10 people @SOC for 2 weeks



Daily Operations	- Health assessment & reports
Long term activities	- Trends & reports
Planning operations	- Instrument Commanding Requests (ICRs)
Calibration	- Process & evaluate calibration observations - Implement new calibration requests - Update routine calibration plan
Maintenance activities	


IOT Dedicated tools:

- Instrument Operations Data Analysis (IODA)  G. Riccio, S. Cavuoti, M. Brescia
- Instrument Commanding Request Tool (ICRTool)  E. Romelli, D. Tavagnacco

IOT Activities

Daily Operations	- Health assessment & reports	IODA
Long term activities	- Trends & reports	IODA
Planning operations	- Instrument Commanding Requests (ICRs)	ICRTool
Calibration	- Process & evaluate calibration observations	IODA
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	- Update routine calibration plan	
Maintenance activities		

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System Operations Validation Test (SOVT)



Goal: test most of the IOT activities

Reference documentation:

- EUCL-OTS-PL-8-015: Instrument Operation
- EUCL-OTS-PL-8-012: Euclid IOT Integration, Validation and Verification Plan

Process / Activity	Activity Title	Validation	IOT Tool
IHA / IHA1 Test-1100	The Daily Analysis	SOVT-1	IODA
IHA / IHA2 Test-1200	Weekly Reporting	SOVT-1	IODA
IHA / IHA3 Test-1300	The Trend Analysis	SOVT-1	IODA
ICS / ICS1 Test-2100	The Procedure Handling	SOVT-1 SOVT-2	ICR Tool
ICS / ICS2 Test-2200	ICR Archiving	SOVT-1 SOVT-2	ICR Tool
ICA / ICA1 Test-3100	Process and Evaluate Calibration	SOVT-1	IODA



System Operations Validation Test (SOVT)

SOVT-1

NISP & VIS Test Reports
SGS SOVT-1 Test Report v. 1.0

Monitoring:

- IODA – installed and tested on NISP side
- Late data availability on EAS to implement and test data before SOVT-1
- Tests on IODA opened some issues → feedback for SOVT-2 preparation

ICR generation:

- ICRTTool installed and used by both VIS and NISP
- ICRs correctly generated and released to SOC
- Feedback from both VIS and NISP teams

SOVT-2

Dry run from 23rd Jan to 2nd Feb.

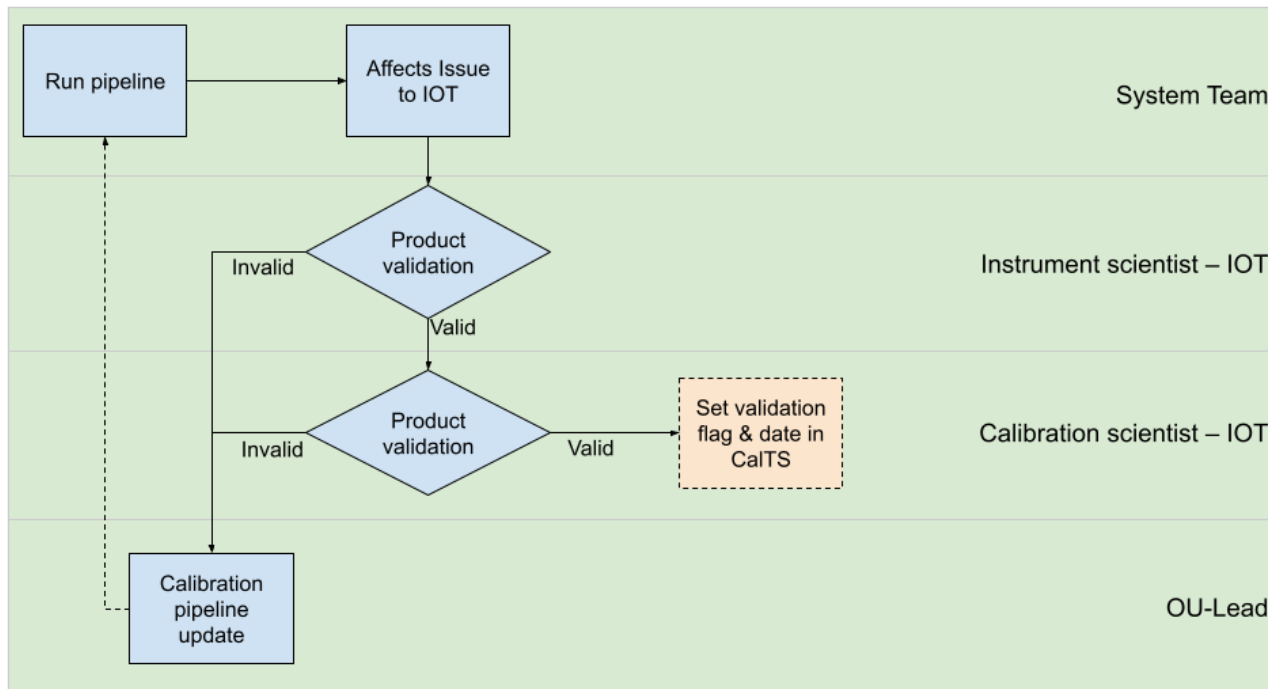
Actual test campaign from 15th Feb. to 24th Feb.

PV Rehearsal

Goal: simulate the Performance Verification phase

Reference documentation:

- EUCL-OTS-TN-8-018: Calibration Products Monitoring and Validation



PVRH #1 and PVRH #2

EUCL-CNE-TR-8-016: Euclid SGS PV Rehearsal Test Plan and Report

Production Status		Validation Status		
Completed	28	Valid	3	7
Not supported yet	2	Validated by IS	9	3
Blocked	3	In Progress	6	4
Total	33	Partially valid	1	1
		Invalid	2	6
		NA	12	12
		Total	33	33

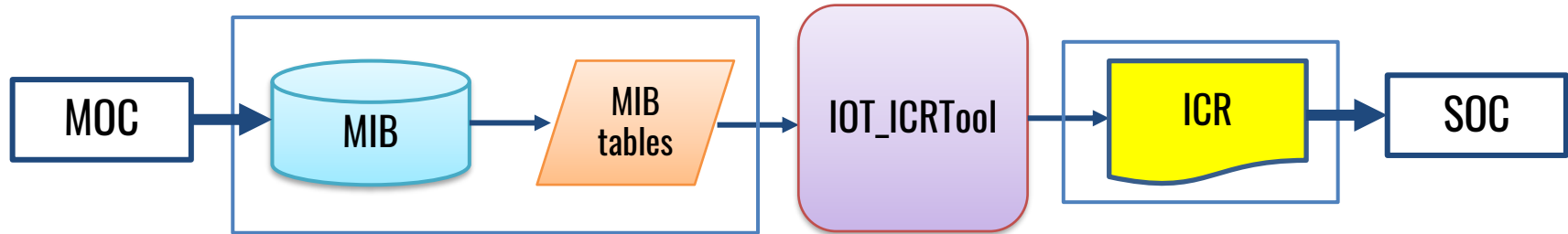
PVRH #1 was the first exercise involving the full chain

What can we do better?

- Close and continuous connection among all key actors
- More focused PVRH preparatory phase

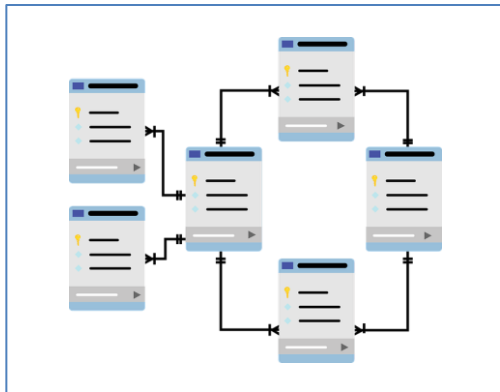
Next step: getting ready for PVRH #2 starting 28th of March

The ICRTool in a nutshell



MIB Tables

Sequences of telecommands and related attributes

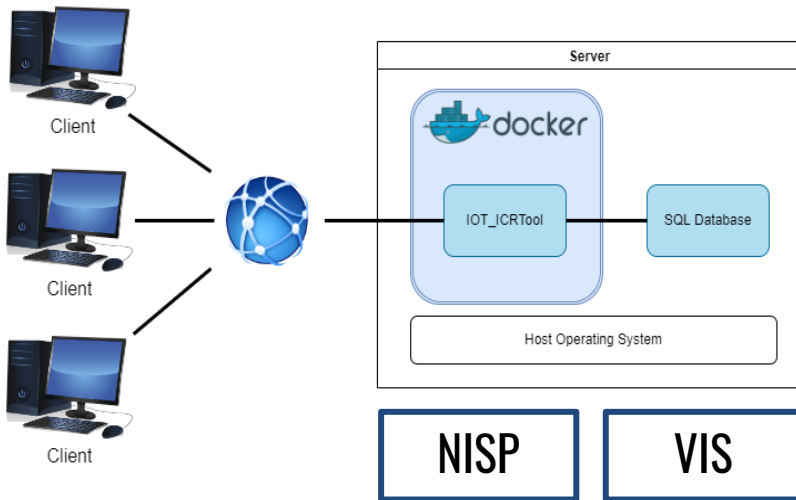
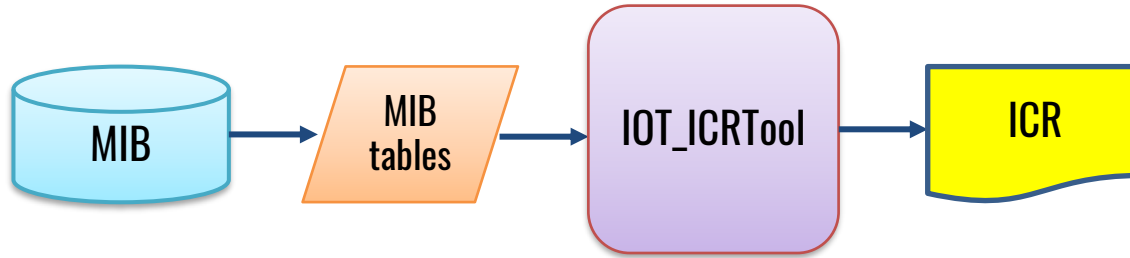


ICR: Instrument Commanding Request

- ❑ Set of instructions for the spacecraft instruments
- ❑ The mechanism by which IOT may ask for activities not covered by the Reference Survey Definition.
- ❑ XML file containing sequences of parameters and their values, needed to perform a specific Activity

E. Romelli, D. Tavagnacco

The ICRTool in a nutshell



ICRTool

A web application providing a user-friendly interface to:

- Handle sequences and parameters
- Create the ICR as agreed in the IOT-SOC ICD
- Export the ICR as XML file

<https://euclid.roe.ac.uk/projects/icrtool/wiki>

E. Romelli, D. Tavagnacco

ICRTool documentation



Redmine page: <https://euclid.roe.ac.uk/projects/icrtool/wiki>

Open Issues: <https://euclid.roe.ac.uk/projects/icrtool/issues>

GitLab project: https://gitlab.euclid-sgs.uk/SDC-IT/iot_icrtool

EUCL-OTS-DDD-8-007: <https://euclid.roe.ac.uk/dmsf/files/11968/view>

E. Romelli, D. Tavagnacco



Instrument Operations Data Analysis - IODA



*IODA is a portable, multi-tasking and multi-user web application, specialized for **tabular/image data analysis and monitoring**, equipped with a local data repository and organized as a series of software modules specialized on several multi-process and multi-thread tasks*

➤ **Monitoring, report generation and delivery**

- Periodic
- On demand

➤ **Visualization/Exploration**

- Trend analysis

➤ **Statistics**

- On Tables and Images

➤ **Machine/Deep Learning**

- Regression/classification experiments on available data

3 USE CASES

- **HKTM** - LE1 HouseKeeping Telemetry
- **SCIENCE TM** - Telemetry related to scientific images (LE1 & LE2)
- **CALIBRATION** - LE2 DPs monitoring

5 MONITORED SYSTEMS

- **NISP** : HKTM, SCIENCE TM
- **VIS** : HKTM, SCIENCE TM, CALIBRATION
- **QLA** : under SCIENCE TM (JSON reports from SOC)
- **NIR** : CALIBRATION
- **SIR** : CALIBRATION

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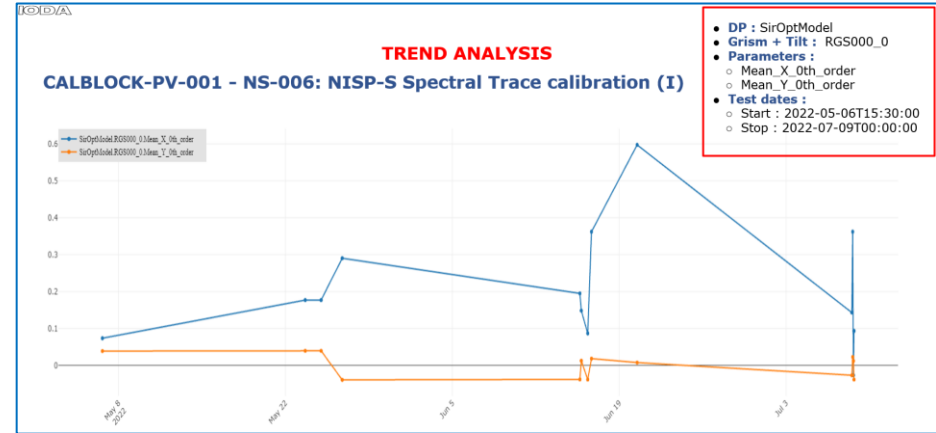
- Trend analysis

➤ Statistics

- On Tables and Images

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Statistical Analysis

- DP : SirOptModel
- Grism + Tilt : RGS000_0
- Parameters :
 - Mean_X_0th_order
 - Mean_Y_0th_order
- Test dates :
 - Start : 2022-05-06T15:30:00
 - Stop : 2022-07-09T00:00:00

SirOptModel.RGS000_0.Mean_X_0th_order	
Mean	0.305958
Standard Deviation	0.156104
Median	0.176745
Min	-0.02689356915652752
Max	0.597315192225952
RMS	0.258432
Variance	0.024368
Kurtosis	0.670334
Skewness	1.002238
MAD	0.090042
NMAD	0.133494

SirOptModel.RGS000_0.Mean_Y_0th_order	
Mean	0.000628
Standard Deviation	0.030964
Median	0.01191
Min	-0.0302814464867115
Max	0.0392677448099376
RMS	0.03097
Variance	0.000959
Kurtosis	-1.375987
Skewness	-0.191544
MAD	0.027258
NMAD	0.04056

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Instrument Operations Data Analysis - IODA



Open Issues on the IODA Dev Team desk:

- **VIS is very late in re-defining data format & content**
 - All already done for getting VIS data from EAS is to discard (again)
 - VIS SCIENCE TM/CALIB to re-engineer and very short time to complete
- **Only few days ago we obtained the access to IODA VIS machine**
- **QLA analysis optimization requires some additional info into QlaReport metadata to speed-up data retrieval**
- **NISP parameters list to be updated on IODA**
- **Machine learning tools upgrade in progress**
- **CALBLOCKS**
 - Some DPs for CALIBRATION have been already implemented, but more info are required to cover **all Calblocks required tests**
 - In principle some Calblocks tests could be performed by IODA, but they need *ad hoc* advanced tools to design, implement & test. **This can not be done in a short time**

G. Riccio, S. Cavuoti, M. Brescia



Instrument Operations Data Analysis - IODA



Official Redmine WIKI Page

<https://euclid.roe.ac.uk/projects/ioda-euclid-operations-data-analysis-software-system/wiki>

Current IODA Docker & Code Repository

<https://drive.google.com/drive/folders/1qgF6KBNYg8HsKagguxJU2v1kKD9D6J8K?usp=sharing>

IODA Architectural Design Description Document (copy available on Code repository)

<https://euclid.roe.ac.uk/dmsf/files/13722/view>

IODA User Manual (copy available on Code repository)

<https://euclid.roe.ac.uk/dmsf/files/13732/view>

IODA Video Tutorials (set of video tutorials describing IODA features and functionalities)

https://drive.google.com/drive/folders/17GhEDAw_E7Cxrqd2z_mJugmSBCDwC25z

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