2° Forum della Ricerca Sperimentale e Tecnologica

Mini Grant 2023

Enhancement of the INAF OAS Bologna Lab dedicated to space-borne Near-Infrared detectors

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Maintenance Setup for Euclid's Near-Infrared Spectro-Photometer On-Board Software

EQM model of NISP warm electronics:

- 1 Data Processing Unit (DPU)
- 1 Instrument Control Unit (ICU)

EQM model of NISP Opto-Mechanical Assembly subsystems:

- 1 Filter & 1 Grism Wheel Array

FS model of NISP detector chain:

- 8 Sensor Chip Electronic (SCE)
- 2 Sensor Chip Assembly H2RG (SCA)

An EGSE and the Instrument Workstation complete the setup (not shown in Fig. 1)

INAF OAS Lab is also instrumented with:

- 2 Stand-Alone Readout Systems:
  - ➢ Markury LTE
  - ➢ Teledyne SAM board

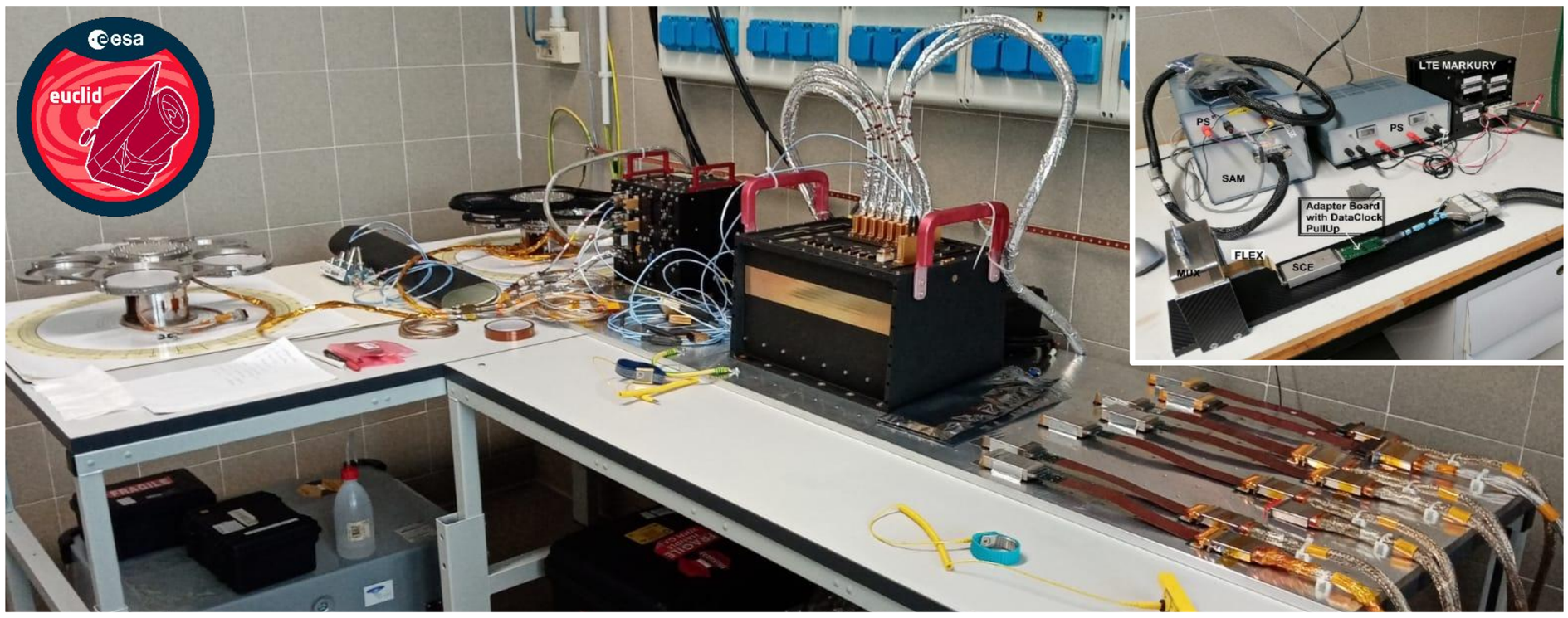


Figure 1. Maintenance Setup for Euclid's Near-Infrared Spectro-Photometer Onboard Software

Cryo Thermal Vacuum System for Enhanced Operability

Founded by INAF MiniGrant 2023, INAF OAS Lab is equipped with a Thermal Vacuum (~ 10^{-5} mbar) and a Cryogenic System (see Fig. 2) to operate H2RG at ~ 90 K, and SIDECAR ASIC at ~ 135 K.

- Nominally operate Euclid NISP detectors
- Host flight-like H2RG NIR detectors for test and qualification purposes

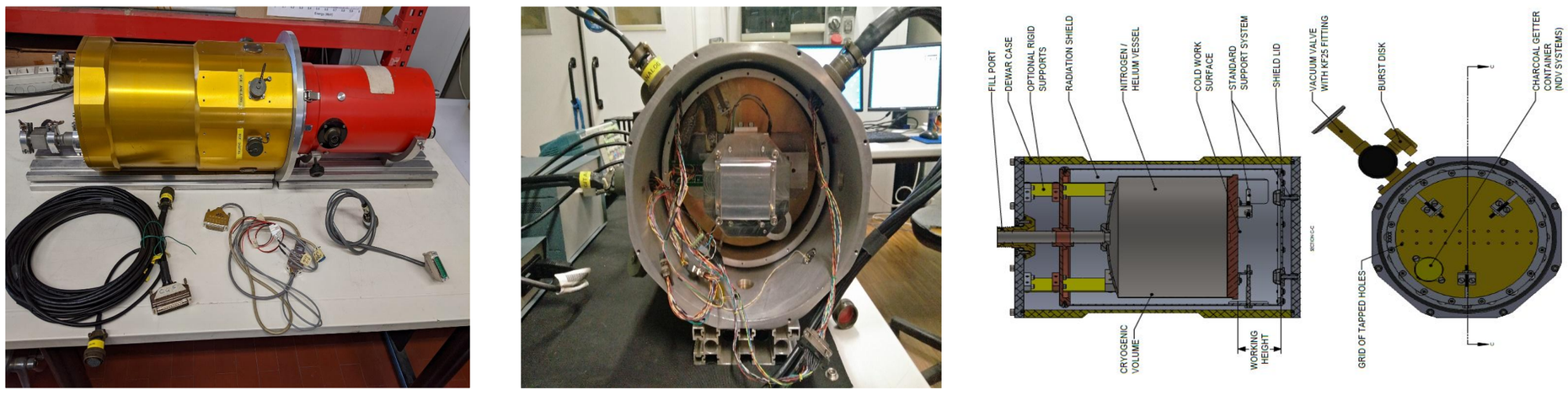


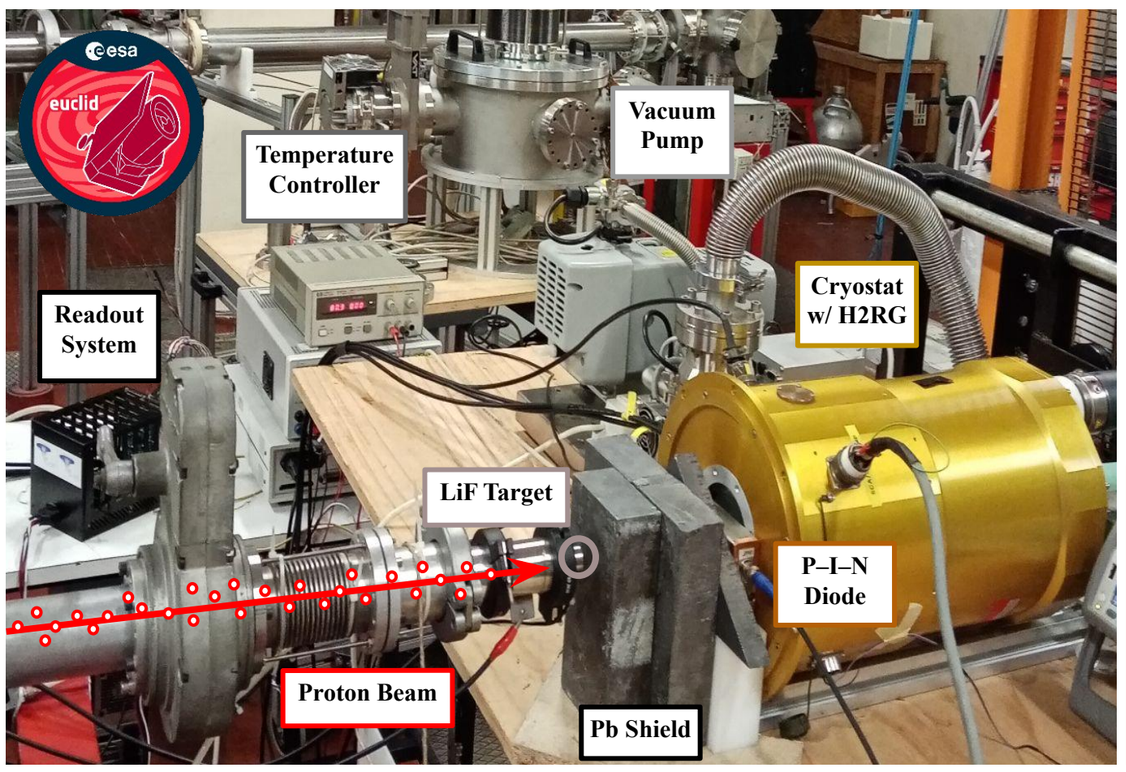
Figure 2. Cryogenic Setup hosting Euclid H2RG detector (flight-like)

Current and Future Experiments with the Cryo Thermal Vacuum System

Besides the maintenance duties, several activities are undergoing/foreseen taking advantage of operating the H2RGs under cryo thermal vacuum conditions.

Euclid's H2RG sensitivity to proton hits

Fig. 3 shows the setup of the tests done operating NISP H2RG detectors under cryogenic conditions (see left panel).
During the test the detector was exposed to a proton beam of 4 MeV interacting with a LiF target. The energy of the neutrons from the Li(p,n) reaction is ~ 2.3 MeV.
Recoil protons from neutron interaction with a polyethylene target (2mm thick) interact with NISP detectors. Proton's signal is identified as a jump in the charge collection ramp (see right panel).
Test performed at INFN Legnaro Laboratory.



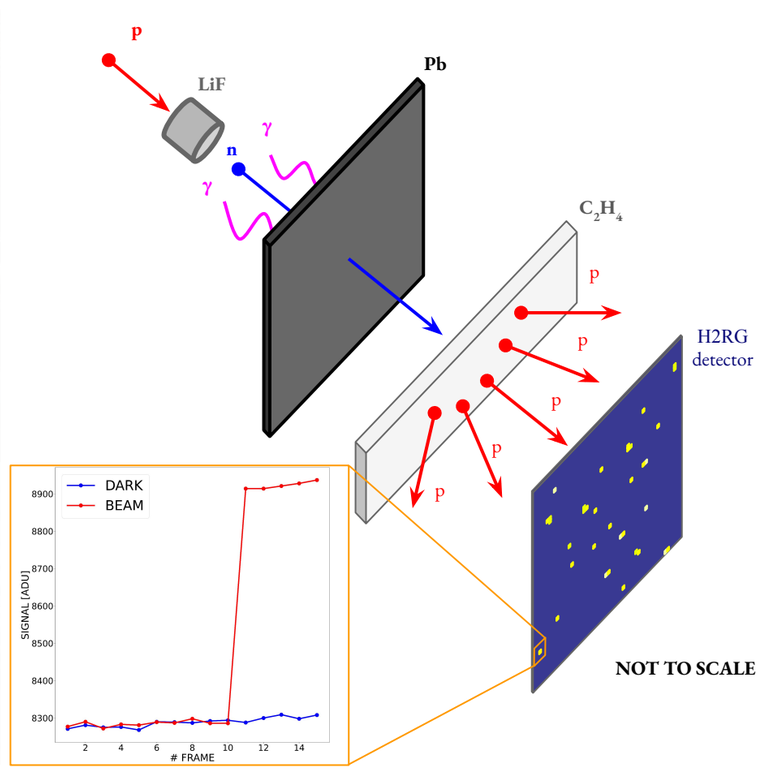
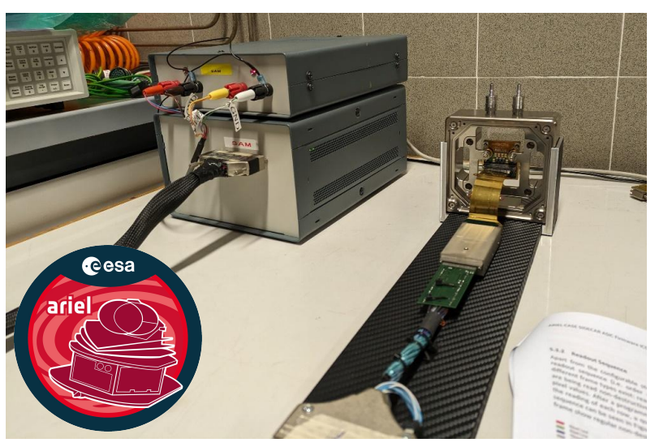
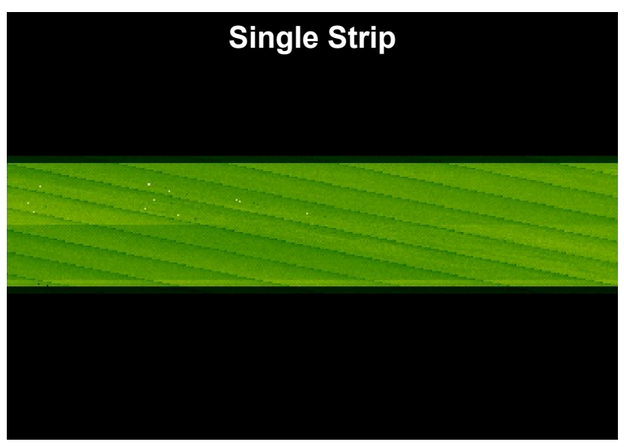


Figure 3. Proton beam (~ MeV) hitting a Euclid H2RG detector (flight-like) that implements the NISP readout technique

Ariel's H2RG FGS capabilities

Fig. 4 shows the first test of Ariel's CASE (ASIC firmware) which implements new features with respect to Euclid's firmware that will be used in Ariel's Fine Guidance System (FGS).
Current preliminary tests are performed at room temperature, and it is foreseen to repeat them under cryogenic conditions for performance verification.





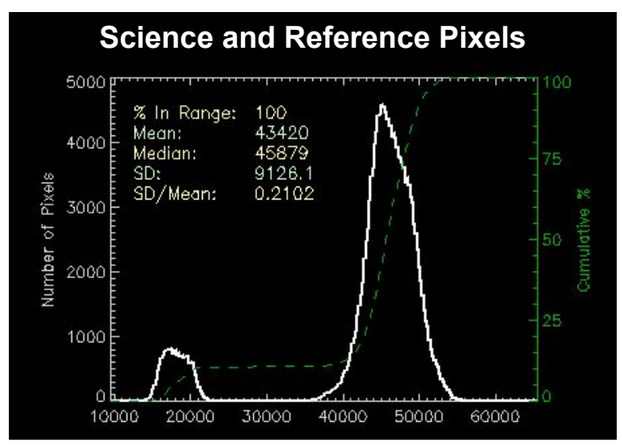


Figure 4. First test and results of the Ariel ASIC firmware (CASE) at room temperature