

CHARACTERIZATION OF INFRARED DETECTORS FOR THE EUCLID NISP INSTRUMENT: FACILITIES DESIGN AND VALIDATION

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Euclid is a wide-field mission for the cartography of the dark Universe lead by European Space Agency (ESA) and the Euclid Consortium that is to launch on 2020. This mission was selected within the Cosmic Vision program and aims at bringing more understanding on the nature of the recent acceleration of the expansion of the Universe and the possible related nature of dark matter and dark energy.

Cosmology & Euclid



Dark Energy

- Present acceleration of the expansion of The Universe
- Baryonic Acoustic Oscillations (BAO): distribution of galaxies
- Spectroscopy: detection of H α line

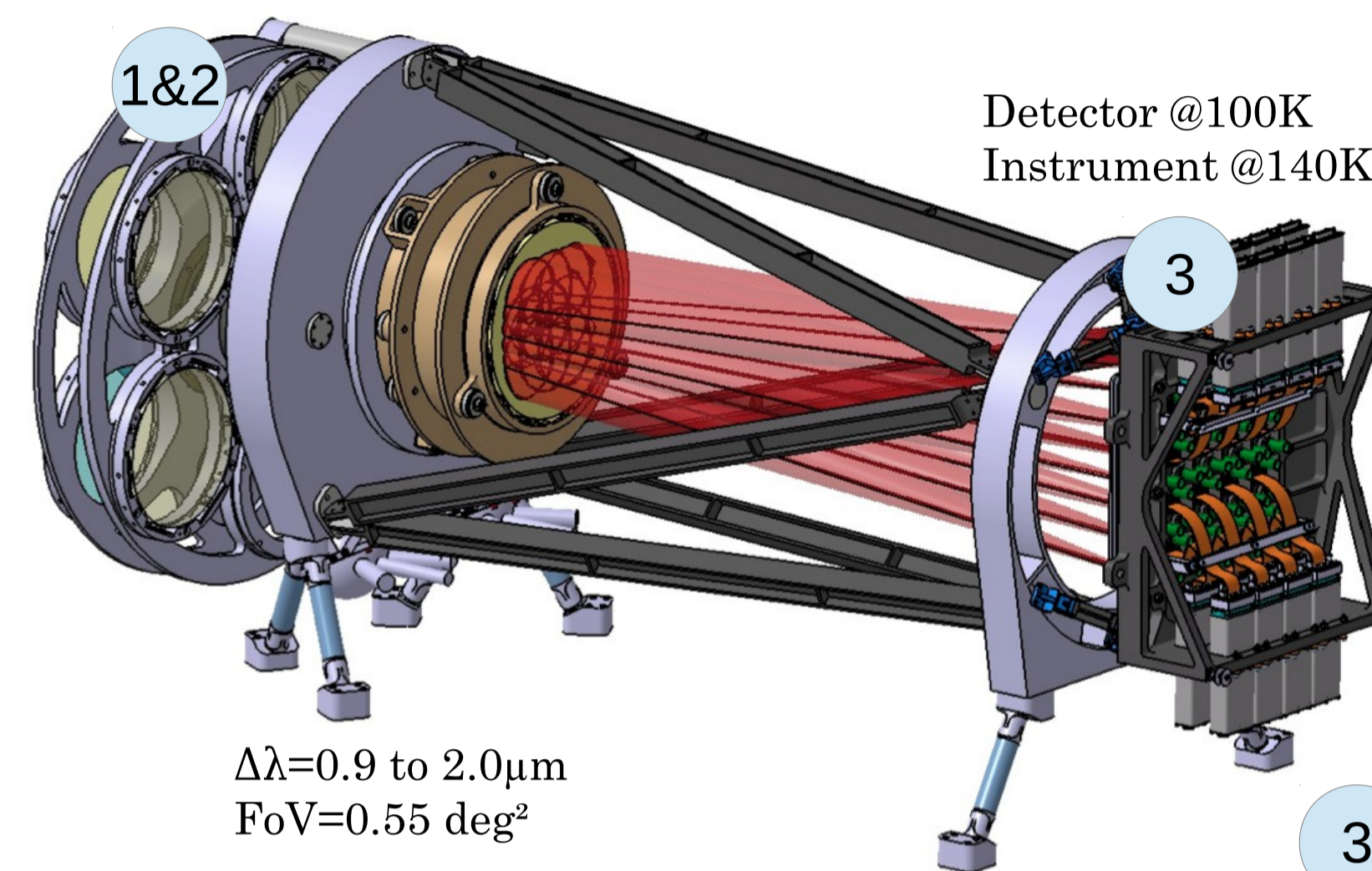
Dark Matter

- Heavier mass of galaxies than observed
- Weak Lensing (WL): shape of galaxies
- High quality imager & photometry

Method - Multi cosmological probes

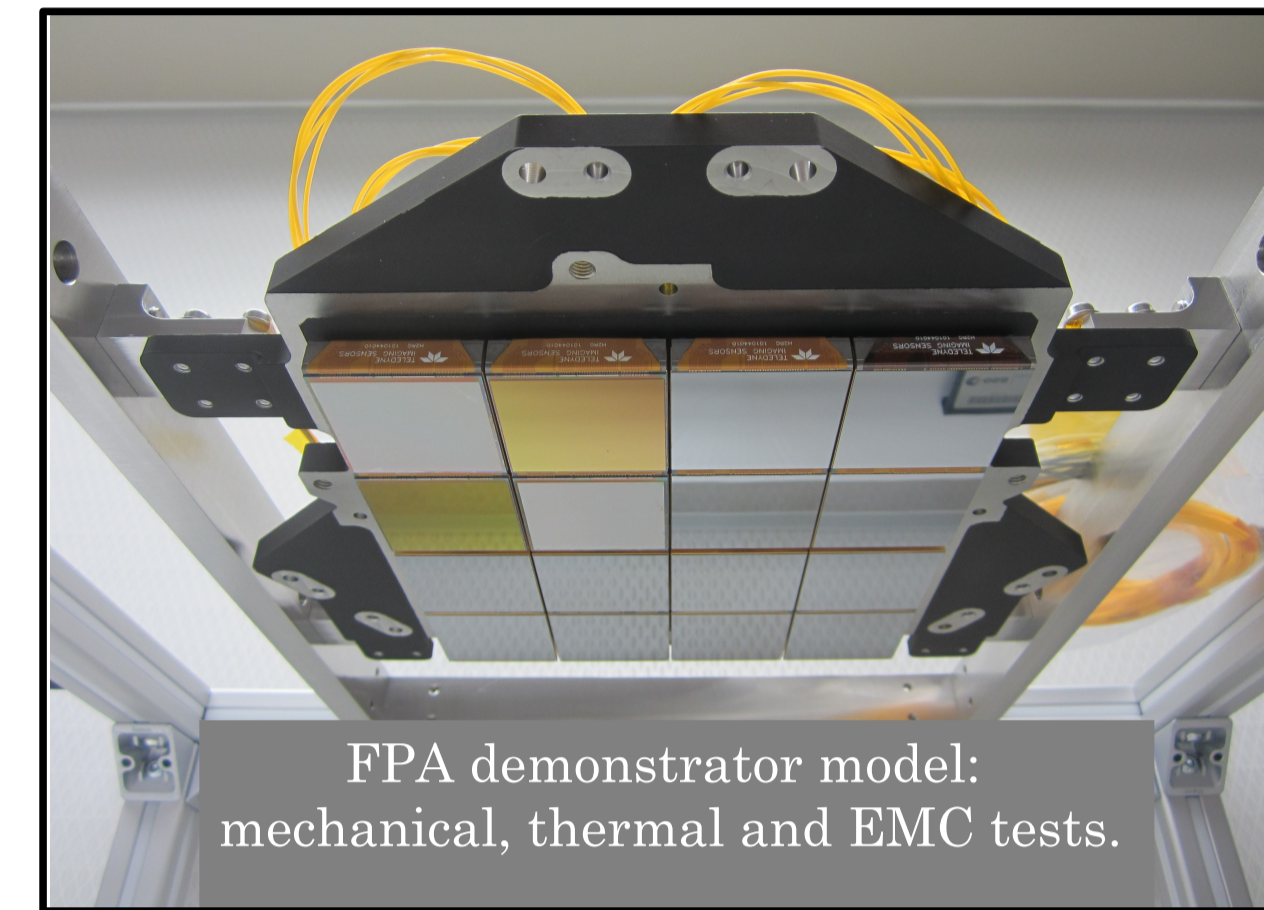
- High precision measurements <1%

The NISP instrument



1
Photometer
Y, J, H filters
0.3 arcsec/pixel
MACC(3/4,16,xx)
100s exposure

2
Slitless spectrometer
3 red and 1 blue grisms
 2.10^{-16} erg/cm²/pix
MACC(15,16,13)
560s exposure



NISP IR detectors

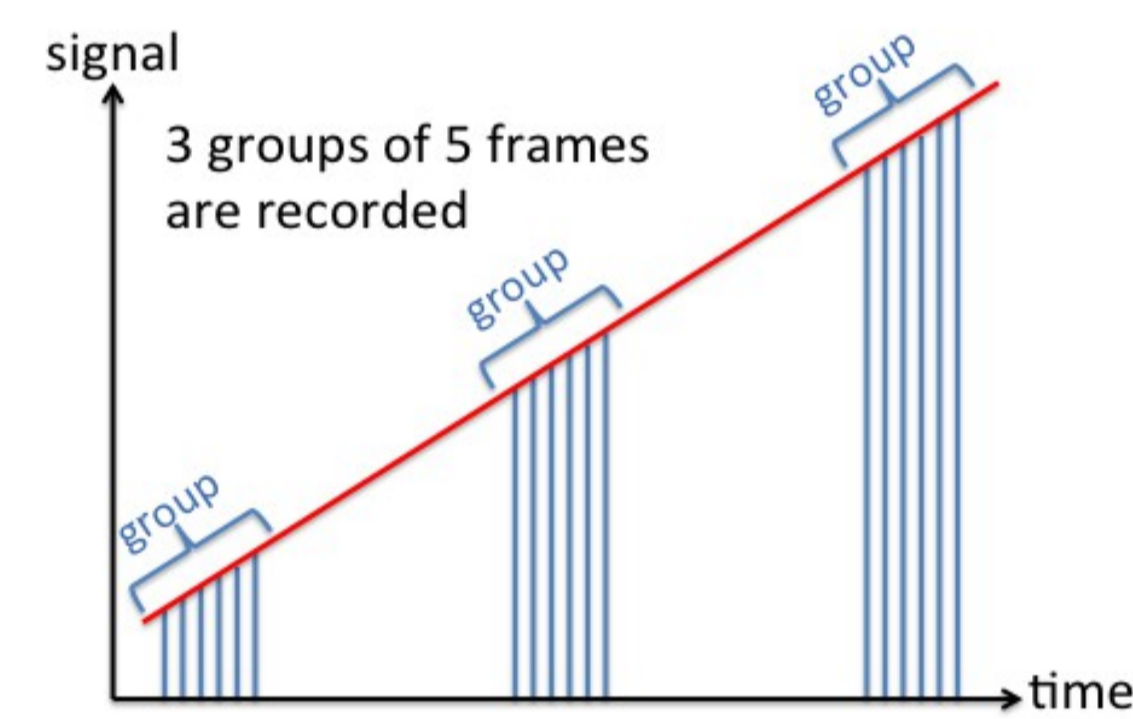
16 detectors in the FPA
2048x2048 hybrid pixels
18 μm pitch / 2.3 μm cut-off
Provided by TIS under ESA/NASA contract

Limited telemetry

- Transfer of slopes and error
- Need for characterization

Readout strategy - Non destructive MACC

- Average down readout noise
- Detection of cosmic rays



Euclid survey

- 15,000 deg² over 6 years
- 10s of millions of galaxies
- z between 0.9 and 2.0

Control of systematics

- Frequent calibration
- Detailed *a priori* knowledge of instruments

Facilities and first results

Name	Requirements for 95 % of pixels	Accuracy
Dark	<0.07 e-/s	< 3%
Total noise	9e- (photo), 13e- (spectro)	< 1e-
QE	> 75% on spectral range	< 5 %
Linearity	< 1% of the full well	< 0.3% after correction
IPC	< 2%	0.3 % (mean)
Persistence	< 10% of the dark mean value after 5 hours	< 0.5 % after correction

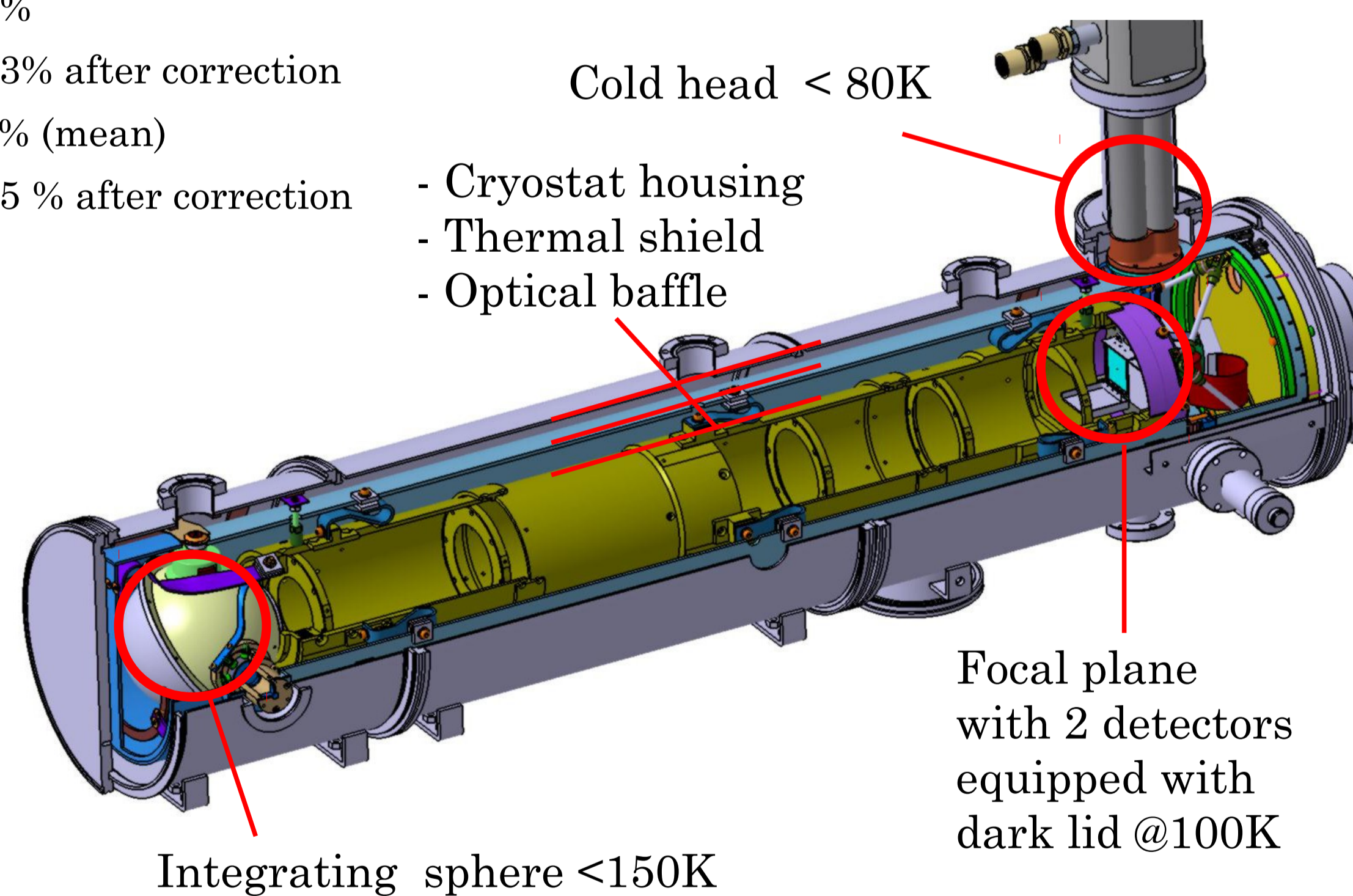
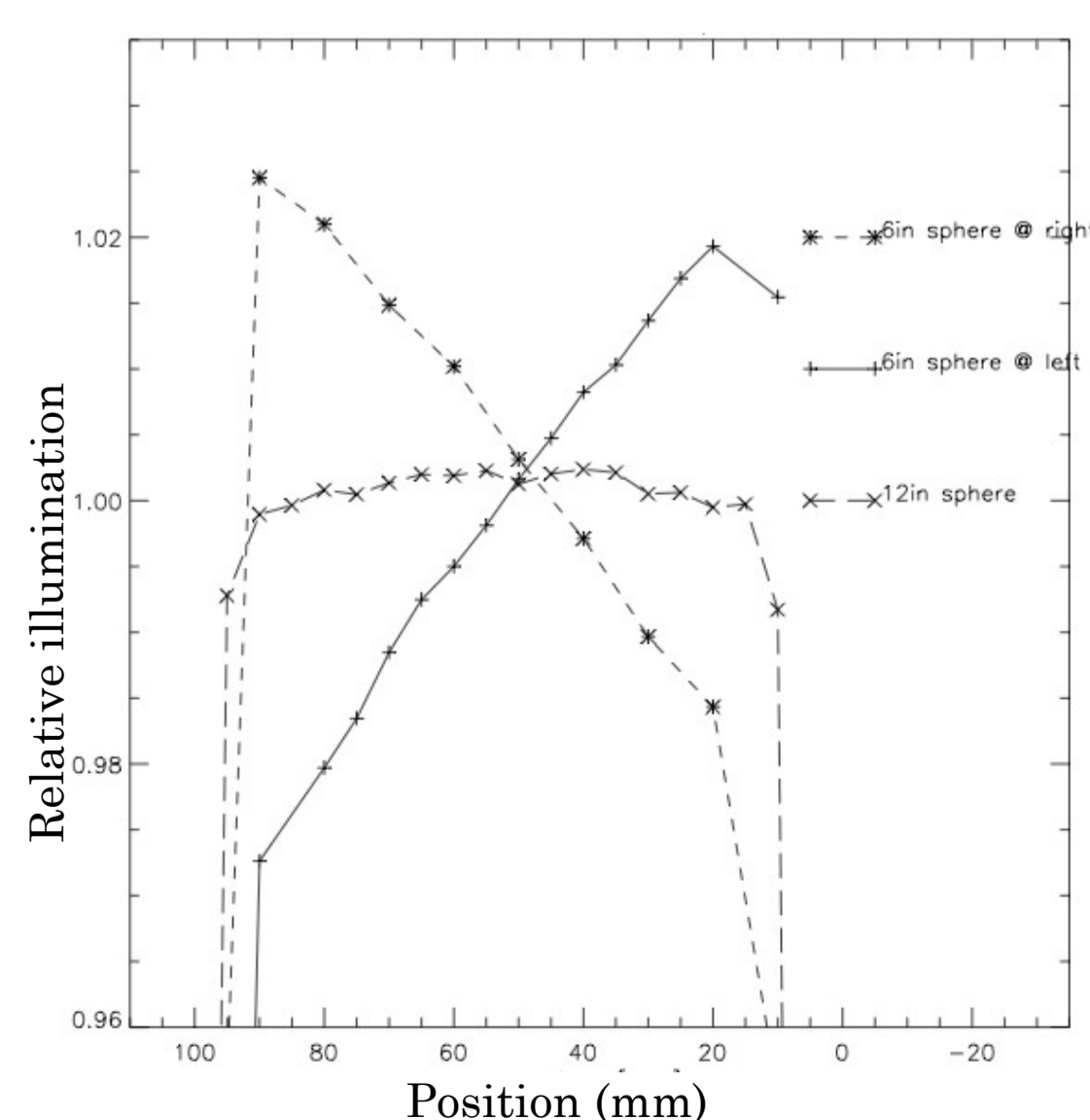
Illumination



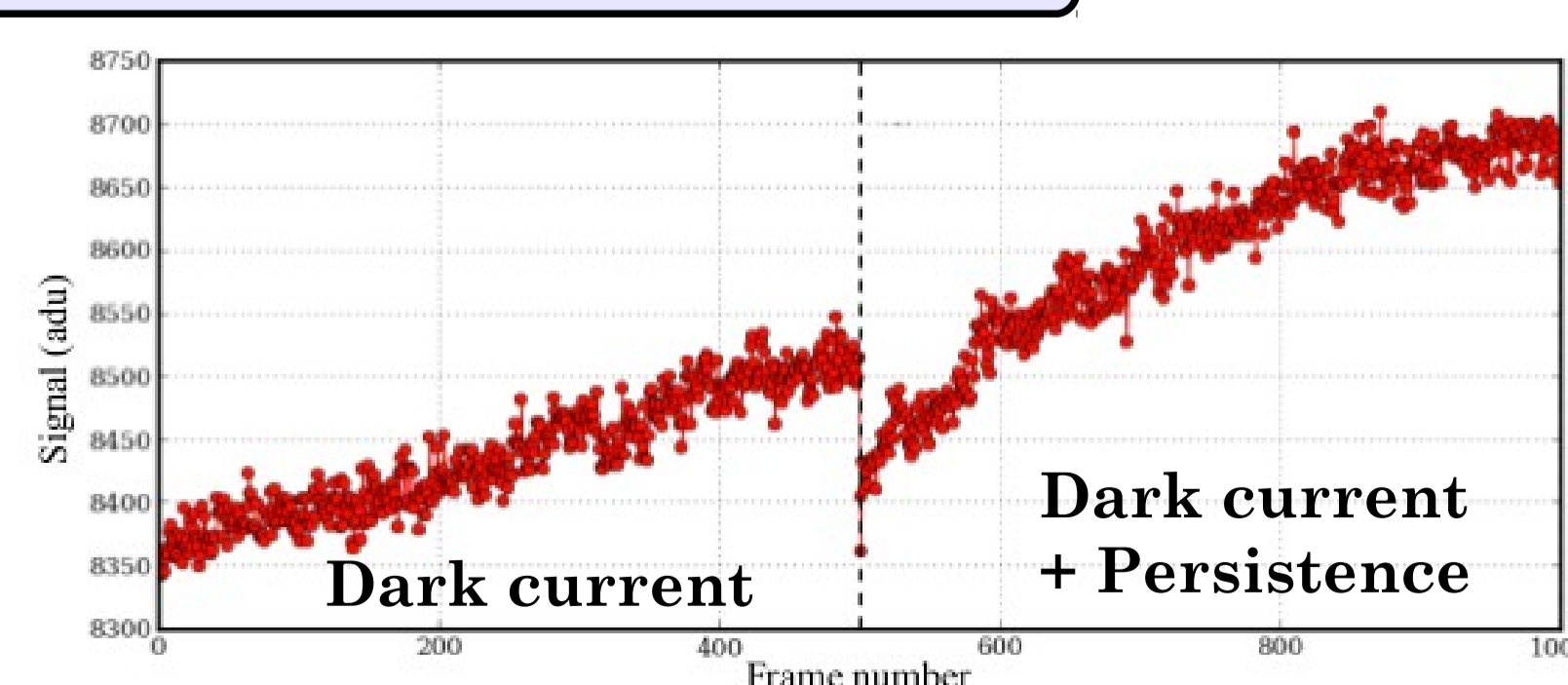
Gold plated 6 in integrating sphere with its black coated optical baffle (0.9 m long)

Flat illumination:

- 5% non-uniformity due to sphere
- 1% reachable with better sphere



Persistence

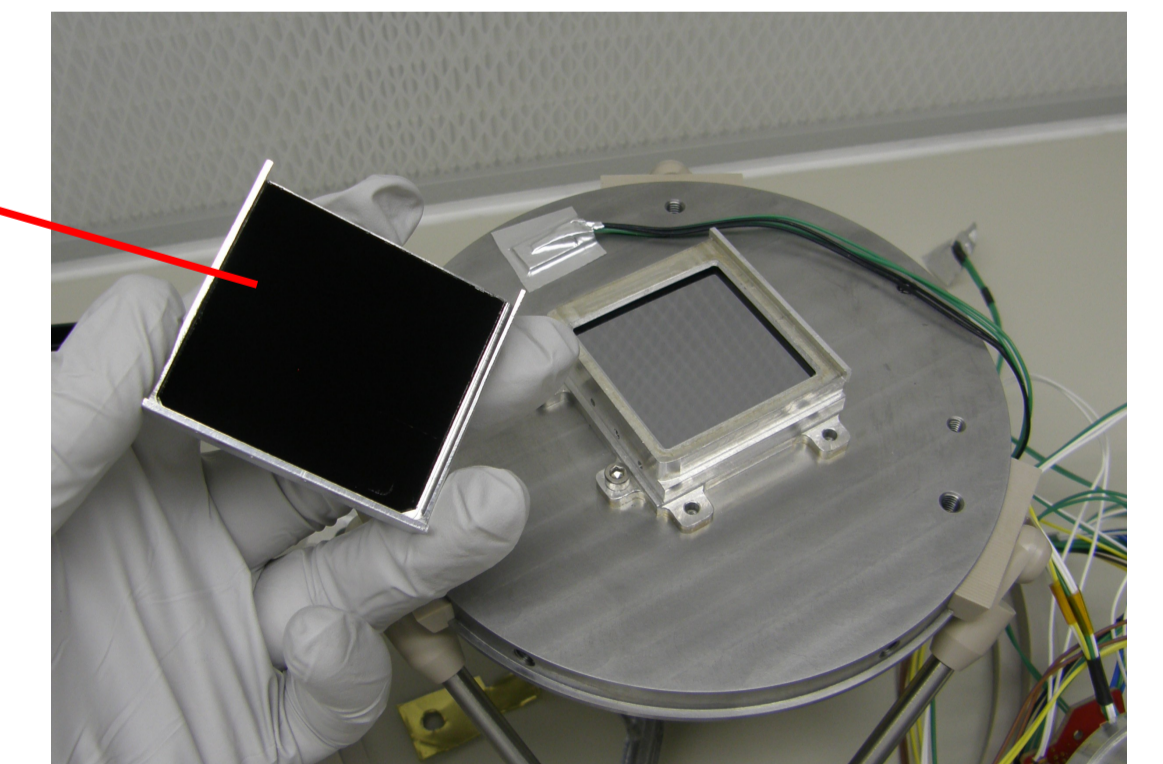


Non-linear persistence signal impacting the slope of following acquisitions

Dark

3 layers of protection from thermal and stray light: remotely handled dark lid @100K, optical baffle < 150K and thermal screen

IR absorbing black cover



Mean CDS noise = 13.5 ± 0.35 adu
2 ramps of 500 frames @ 250mV bias

Summary

Dedicated facilities, being assembled and validated at CPPM, will be ready before the end of this year.

First results of commissioning show that facilities enable to reach the accuracies required for the characterization of the detectors.