Euclid status & early results

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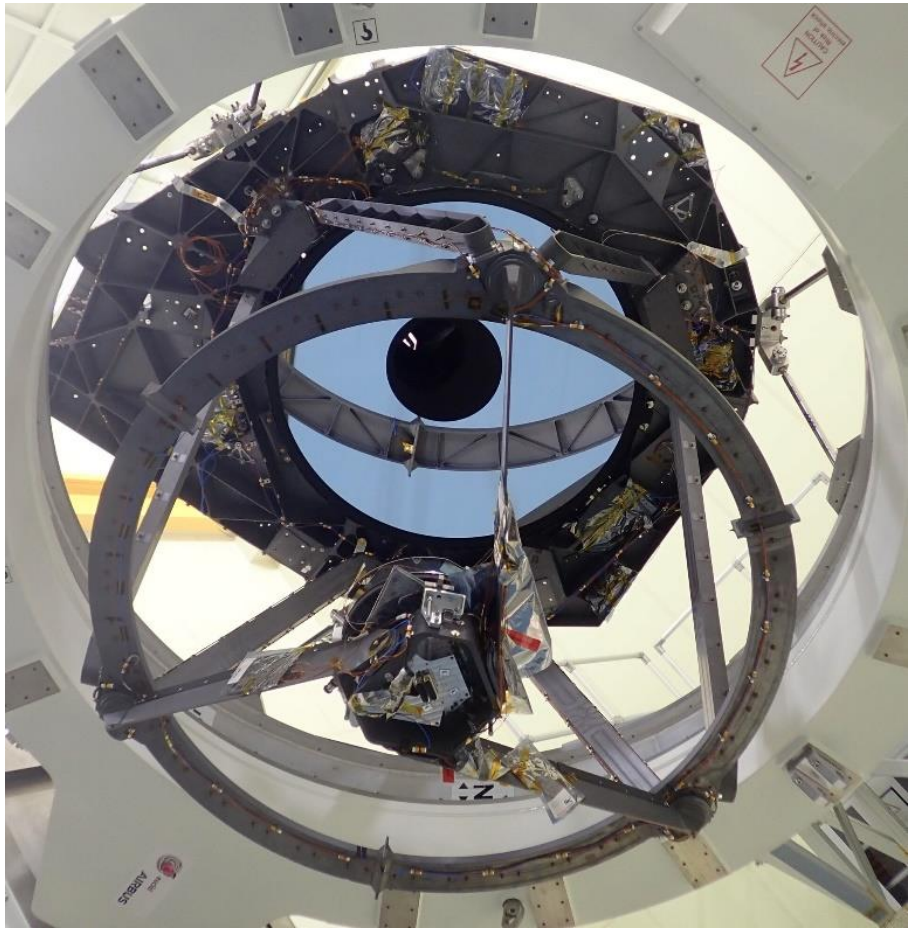
for the Euclid Consortium

Outline

- Euclid launch & transfer to L2
- What does Euclid observe?
- Commissioning images
- Early problems & solutions
- Euclid time-line
- Early Release Objects

Euclid

- Ca 4.7m tall, 3.7m wide
- 1988kg launch mass
- 1.2m primary mirror
- Near-infrared & optical instruments.
- Launch: July 1st, 2023 on SpaceX Falcon 9
- Daily data rate of ca 100GB compressed data
- Nominal mission duration of 6 years, extension possible.



‘eye of Euclid’ ©Airbus


STRONGBACK RETRACT
STARTUP
LIFTOFF
MAX-Q
MECO
FAIRING
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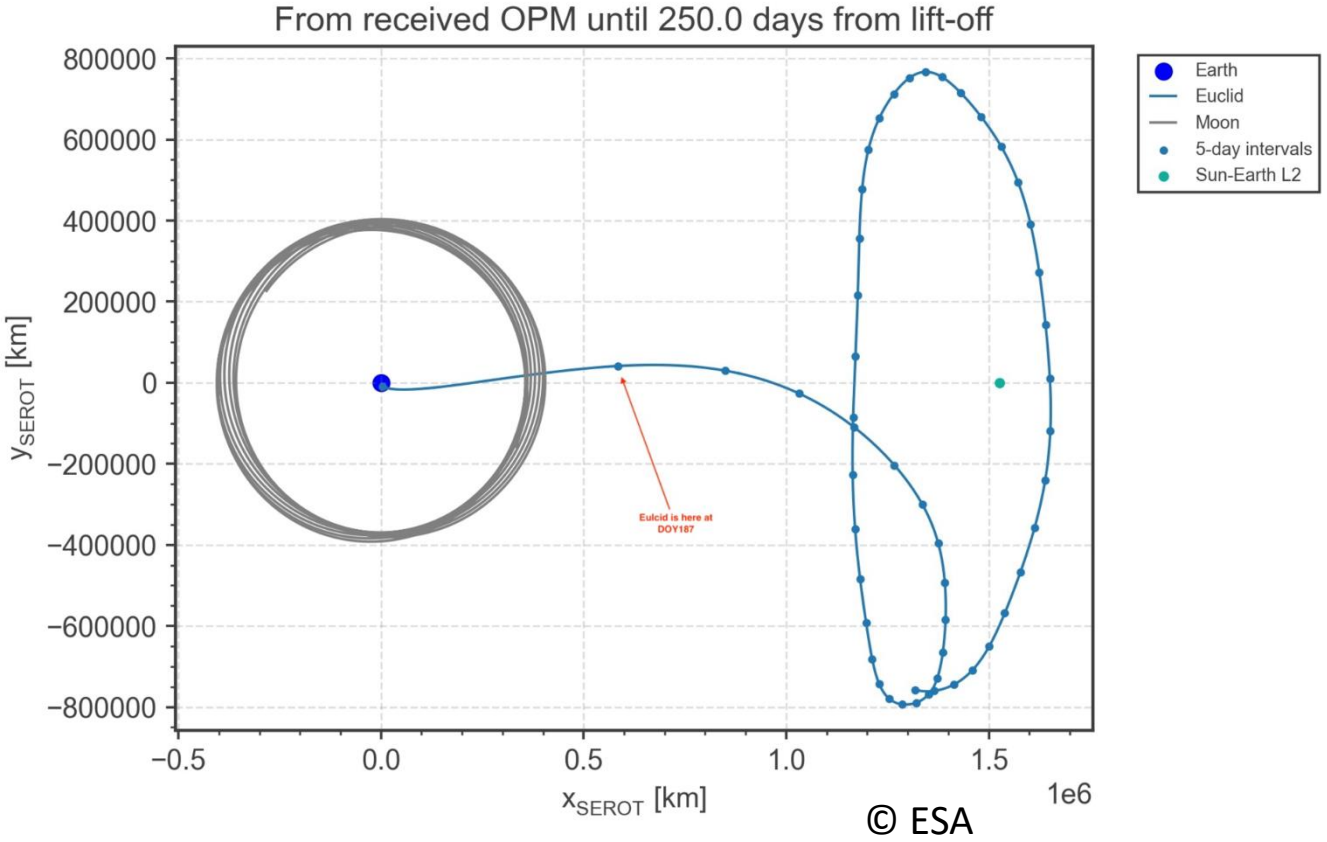
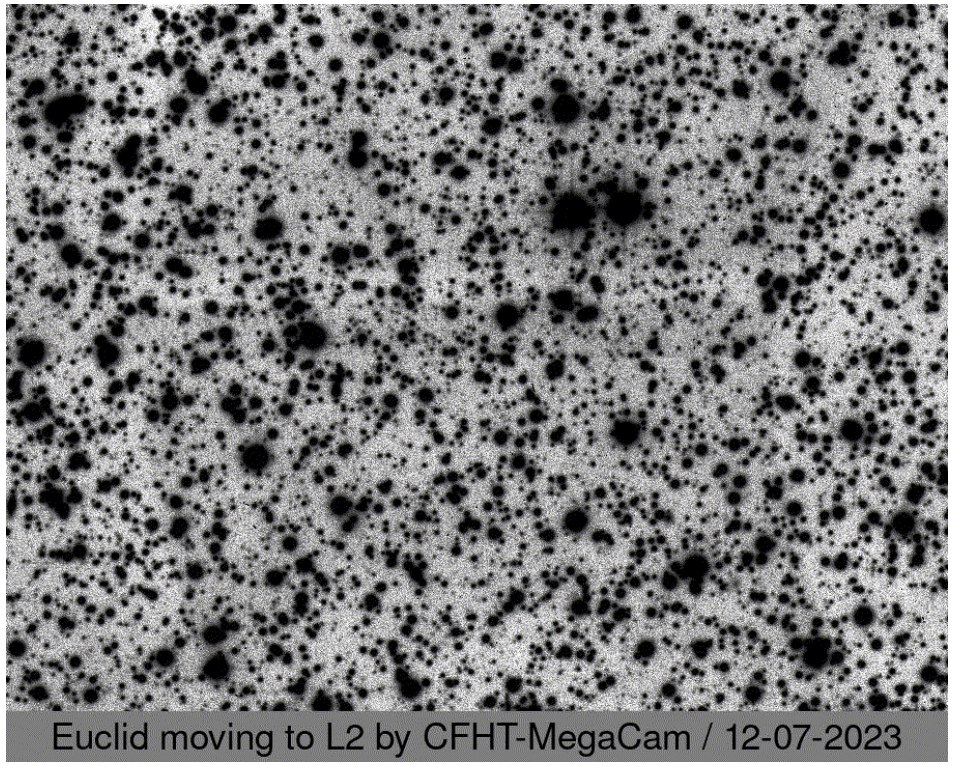
EUCLID
STARTUP
THE FALCON 9 FLIGHT COMPUTERS HAVE TAKEN CONTROL OF THE COUNTDOWN

Euclid transfer

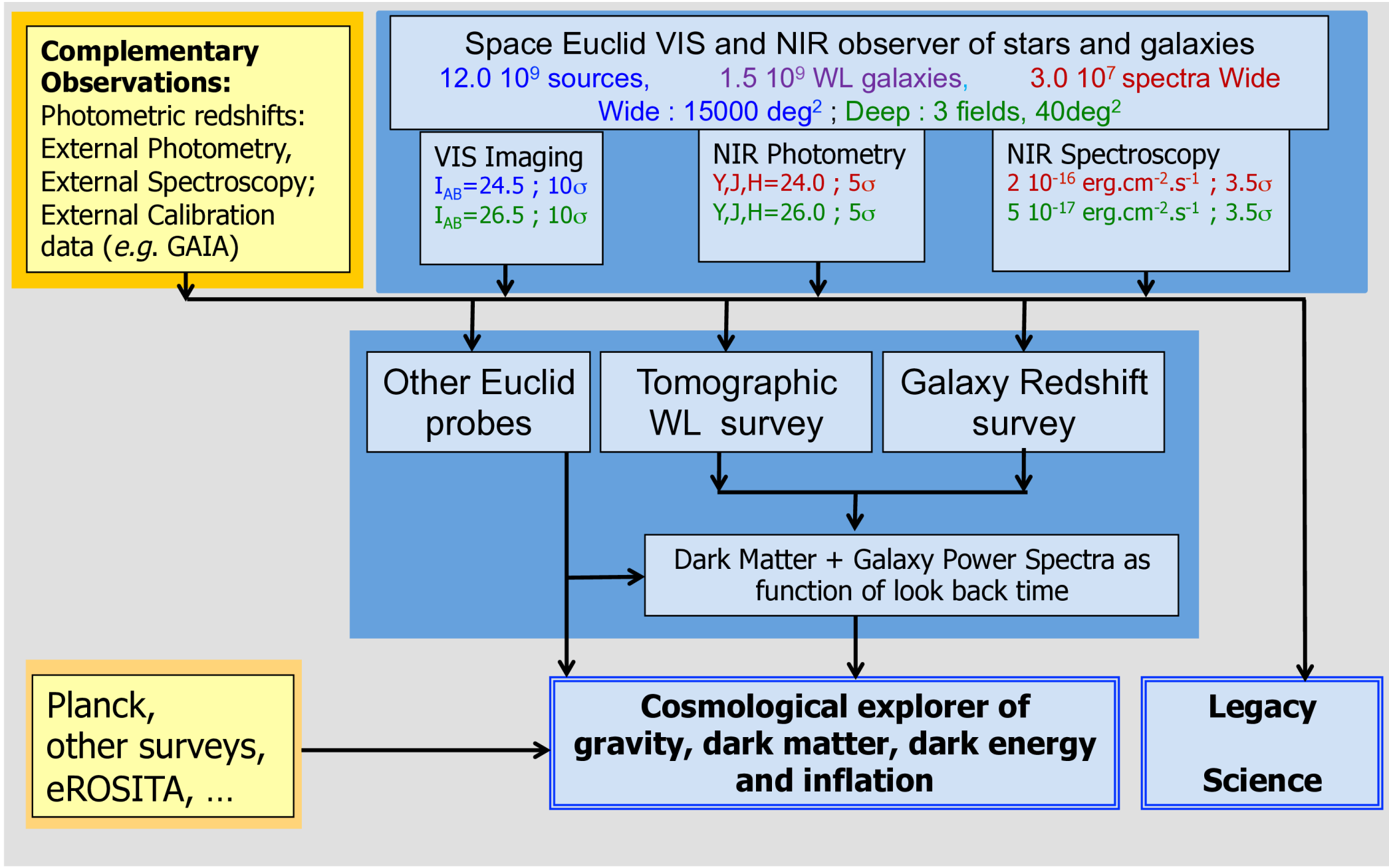


© ESA



Euclid moving to L2 by CFHT-MegaCam / 12-07-2023

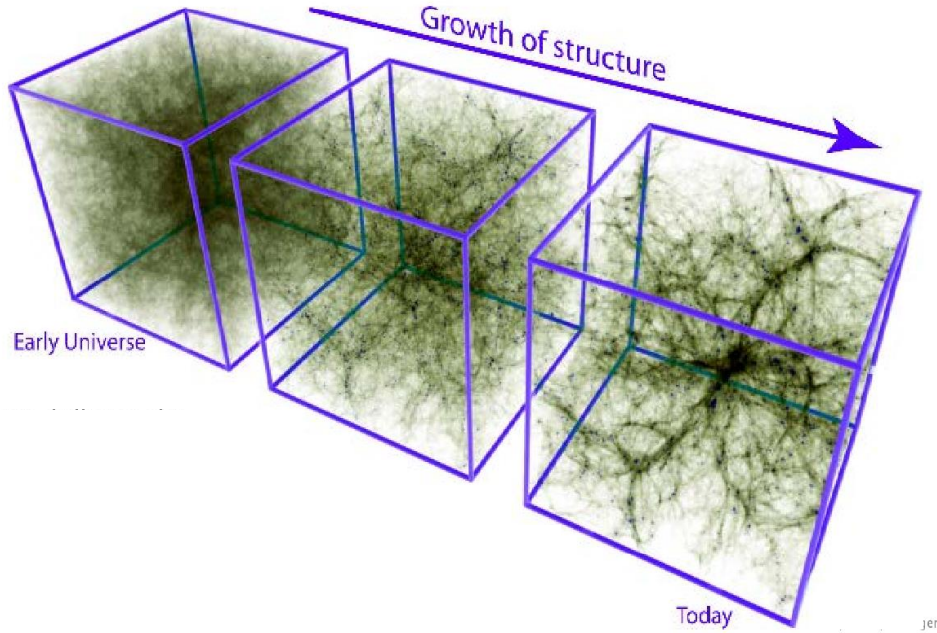
Euclid observations

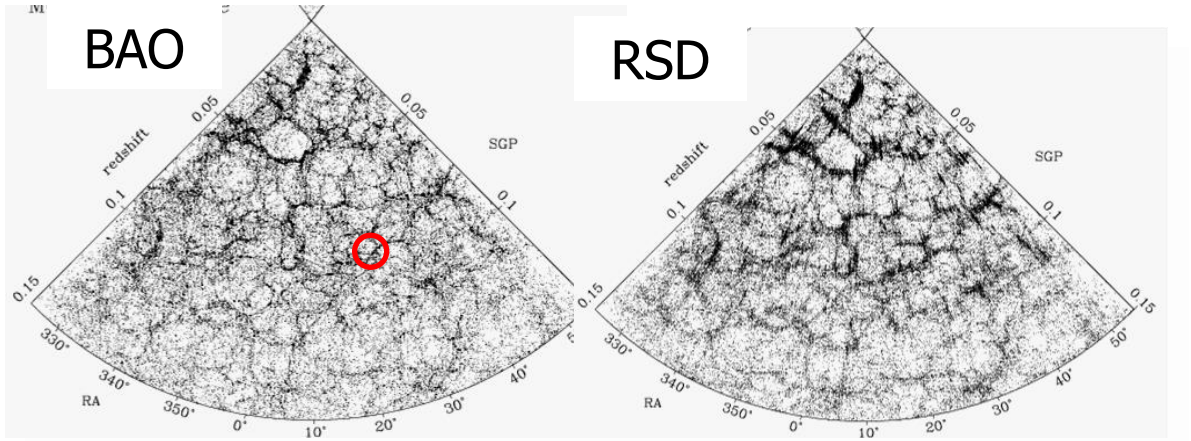


Galaxy clustering: BAO / RSD / P(k)

3-D position measurements of galaxies over 0.7<z<1.8

- Probes expansion rate of the Universe (BAO) and clustering history of galaxies induced by gravity (RSD); expansion history, structure growth / ψ potential
- Need high precision 3-D distribution of galaxies with spectroscopic redshifts.
- 30 million spectroscopic redshifts with 0.001 (1+z) accuracy over 15,000 deg^2

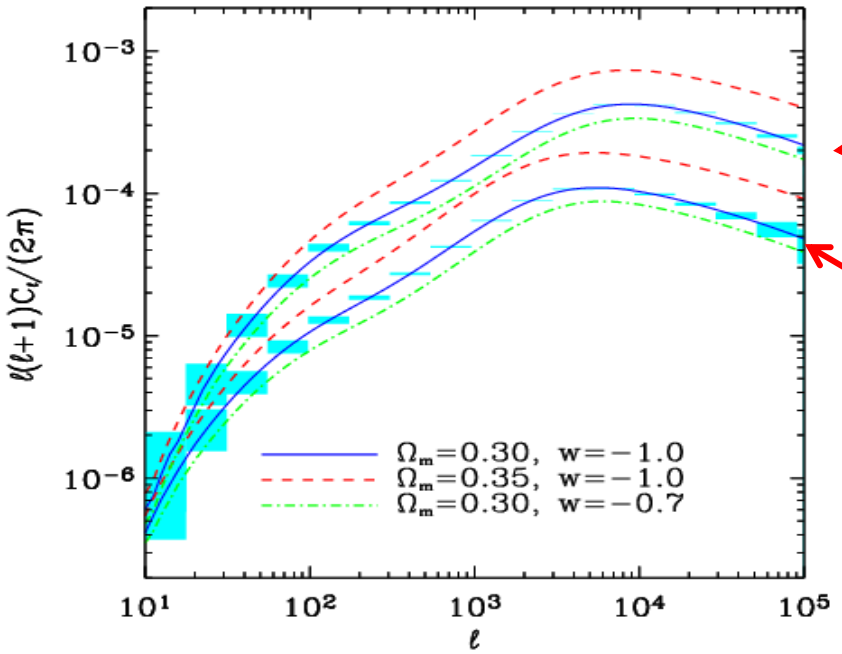


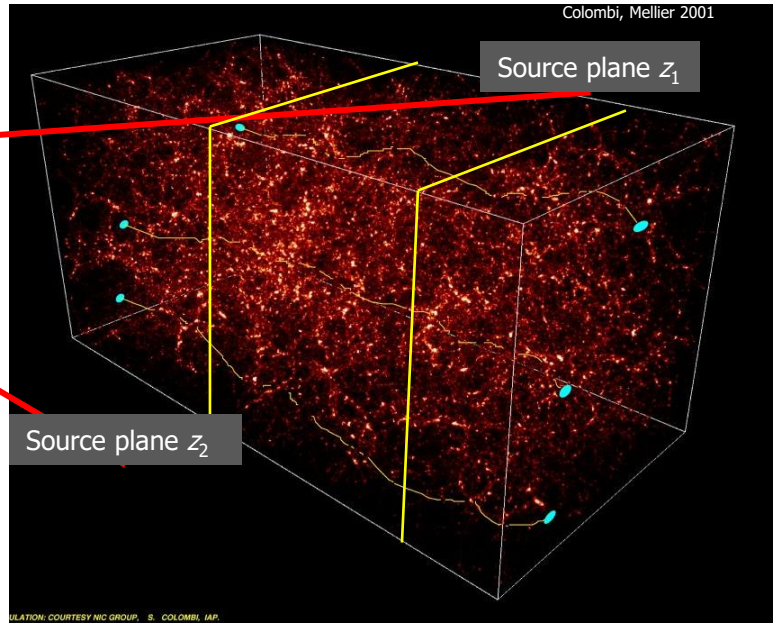


Weak lensing / photometric survey

Cosmic shear over 0<z<2

- Probes distribution of matter (Dark +Luminous): expansion history, lensing potential φ+ψ.
  → Shapes+distance of galaxies: shear amplitude, and bin the Universe into slices.
  → "Photometric redshifts" sufficient for distances: optical+NIR data.
- WL + GCp (3x2pt) with 1.5 billion galaxies over 15,000 deg^2

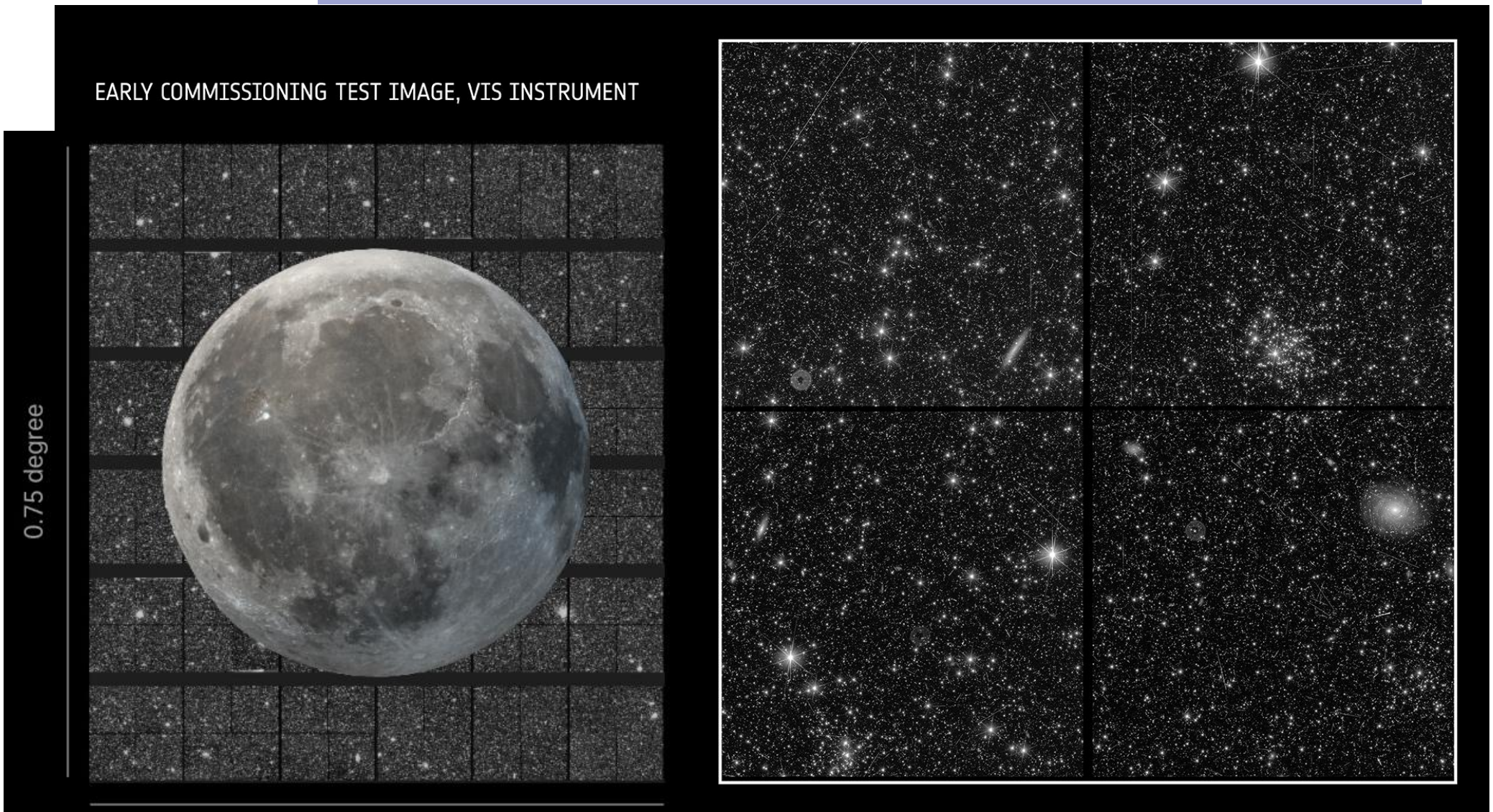




VIS commissioning

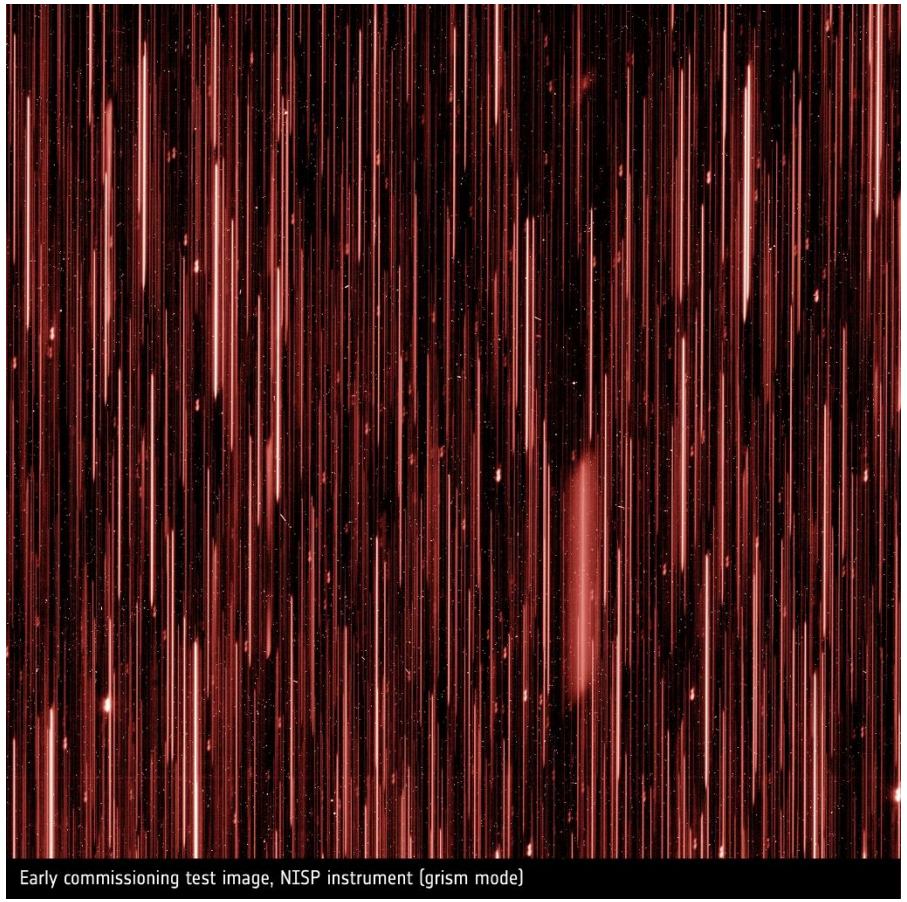
FOV 42’x44’

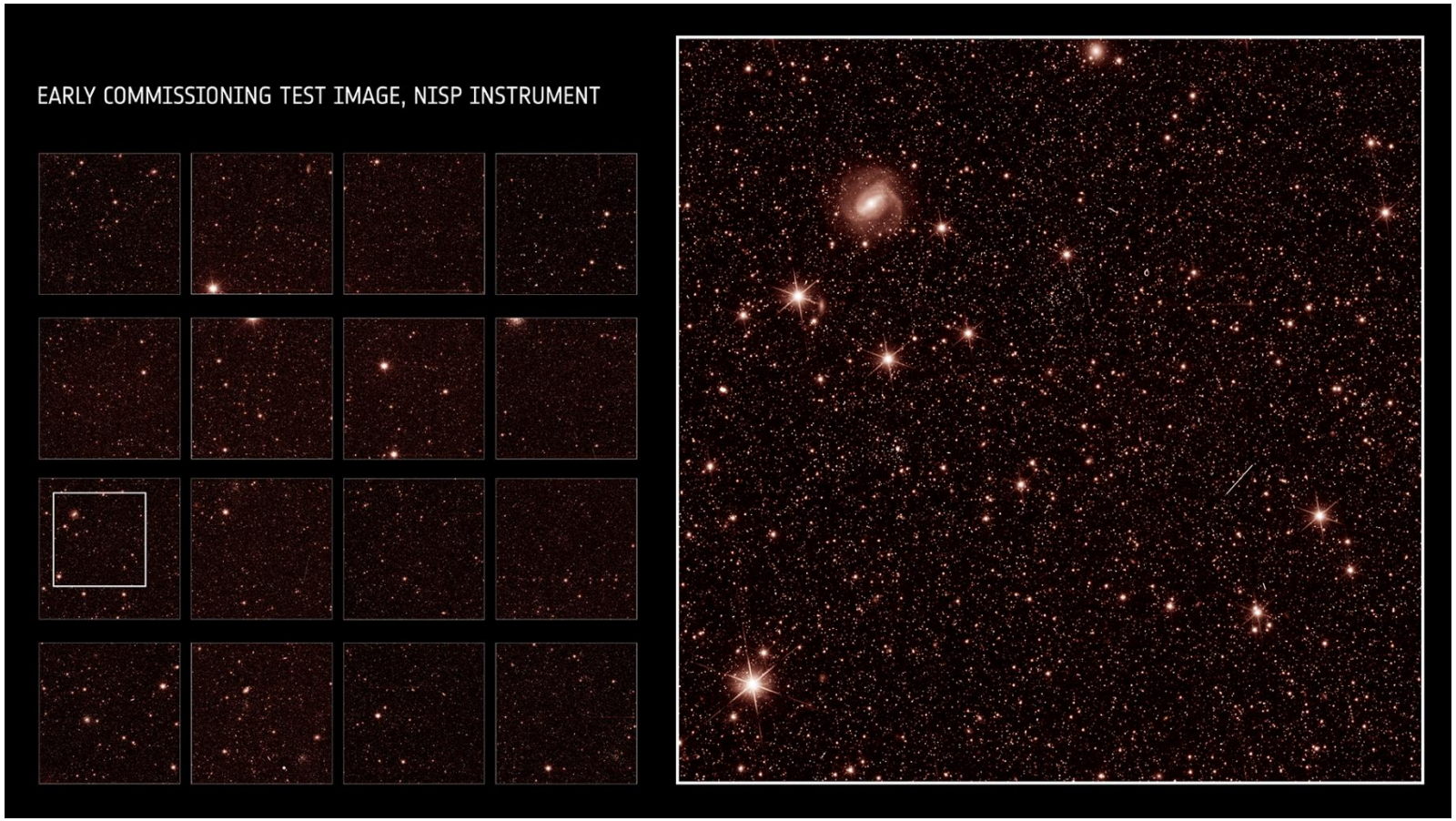
VIS:
36 Si CCD’s
4096x4132
0.1”/pixel
530-920 nm



NISP commissioning

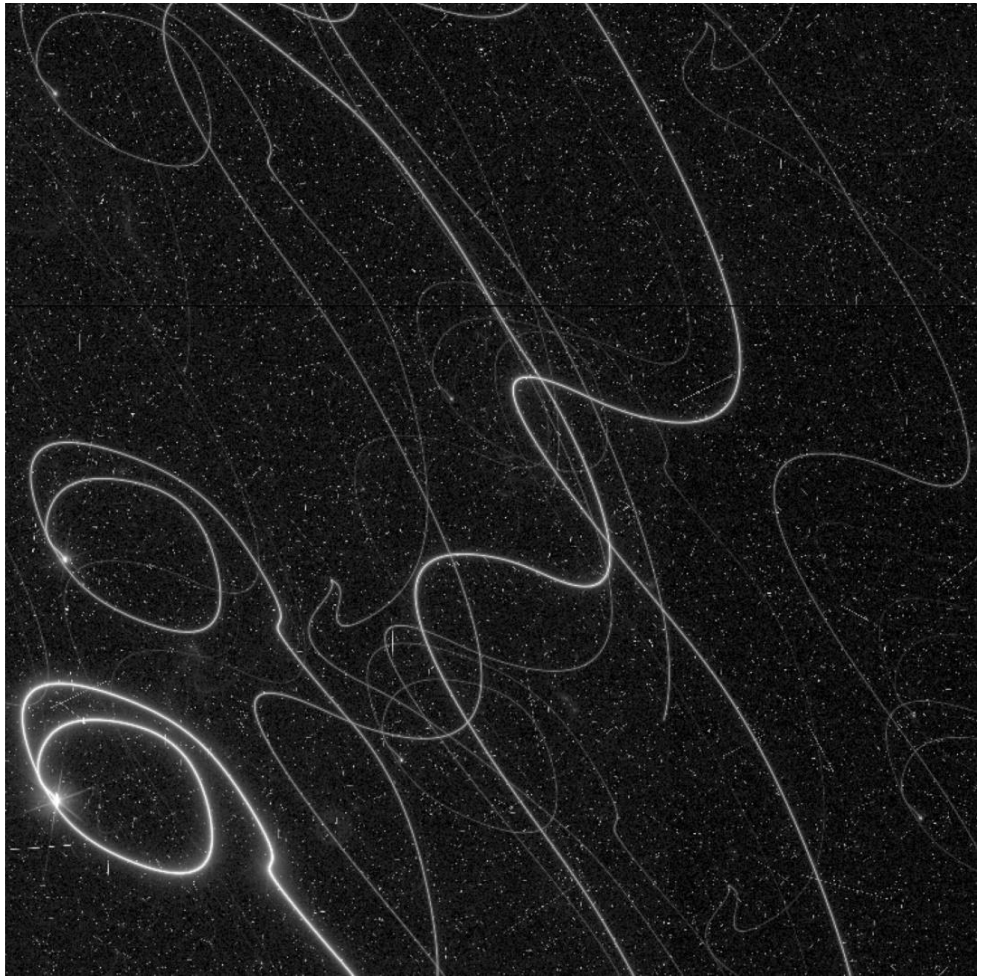
FOV 42’x44’ **NISP**: 16 HgCdTe arrays 2048x2048 0.3”/pixel Y/J/H-band imaging & R>400 slitless spectr.


Early commissioning test image, NISP instrument (grism mode)

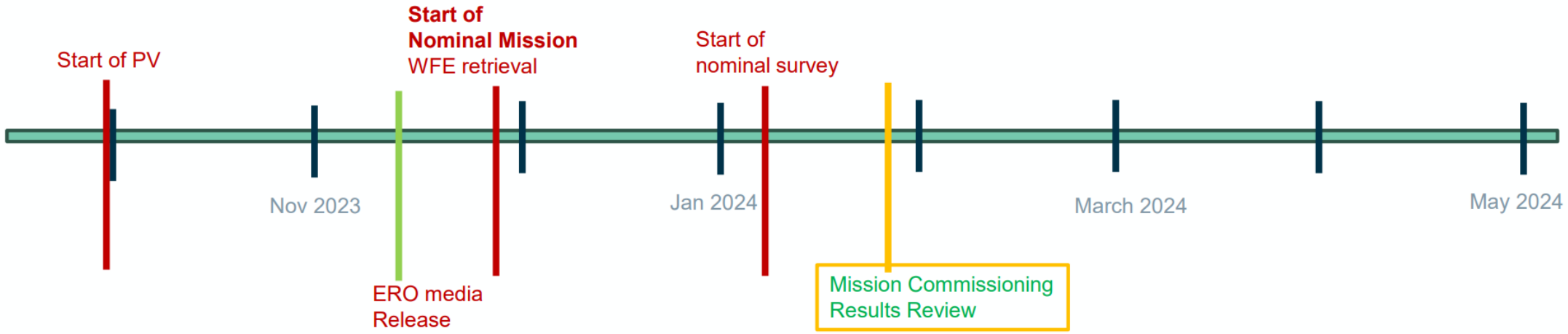


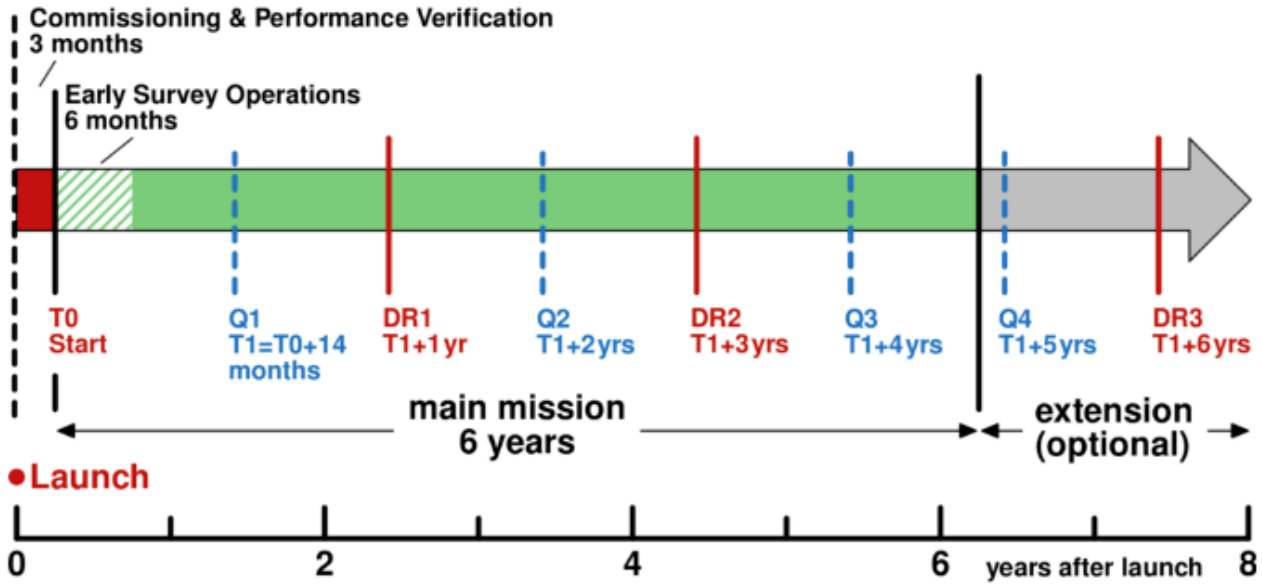
Problems & solutions

- Cosmic rays: A fact of life at L2 …
- Straylight: A thruster nozzle scatters light past the sun shield through the thermal insulation and via a VIS shutter mounting leg to the VIS focal plane. Requires turning the satellite so that the nozzle is in the sun shield shadow.
- X-rays from solar flares: X-rays can penetrate the sun shield in the gaps between the solar panels and deposit energy in some of the VIS detectors. No damage to CCD's but will have to be mitigated.
- Fine Guidance Sensor: Uses CCD's at the edge of the focal plane. Cosmic rays were mistaken as guide stars, leading to a loss of tracking. A software patch has restored nominal performance.



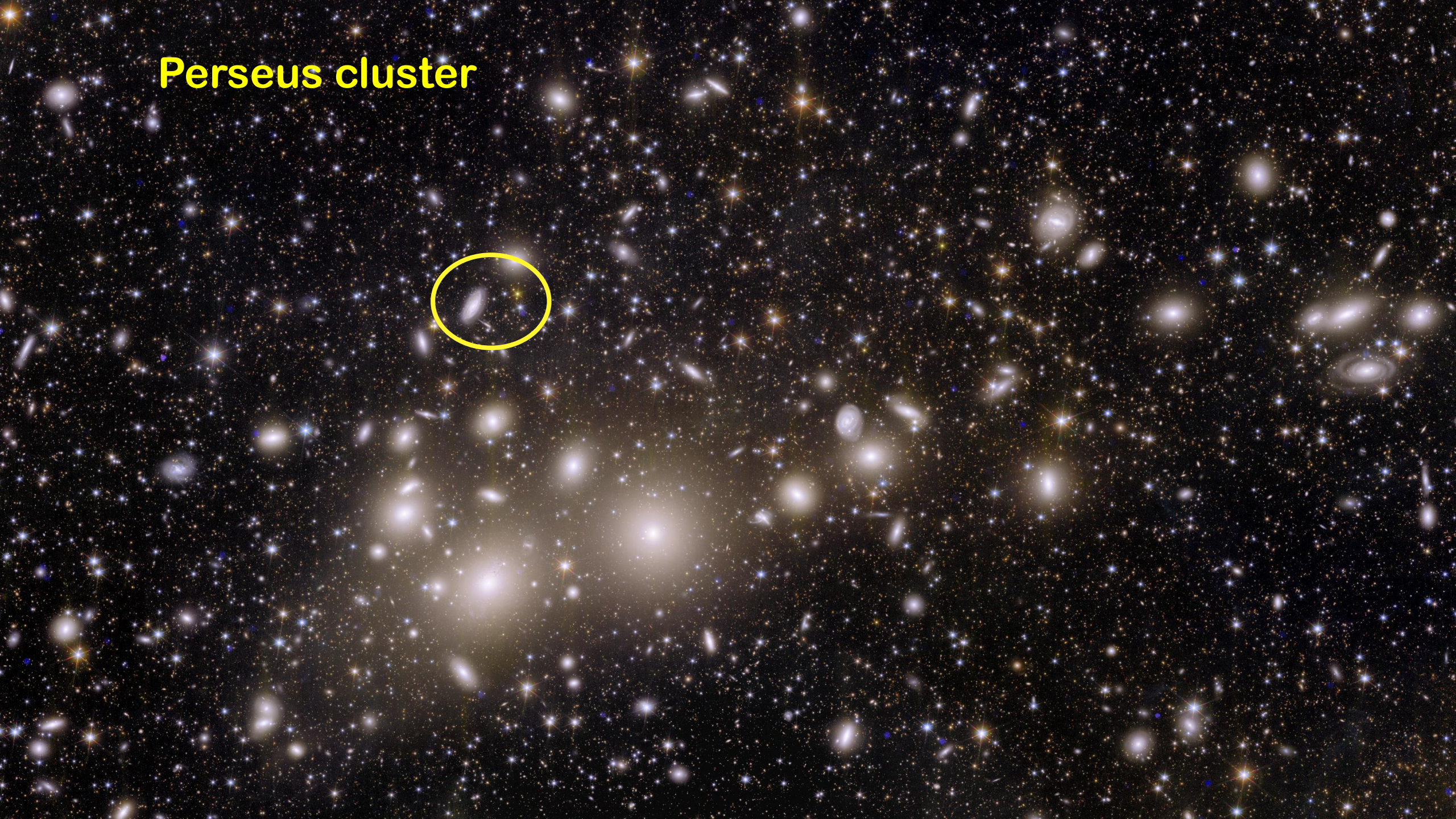
Euclid timeline

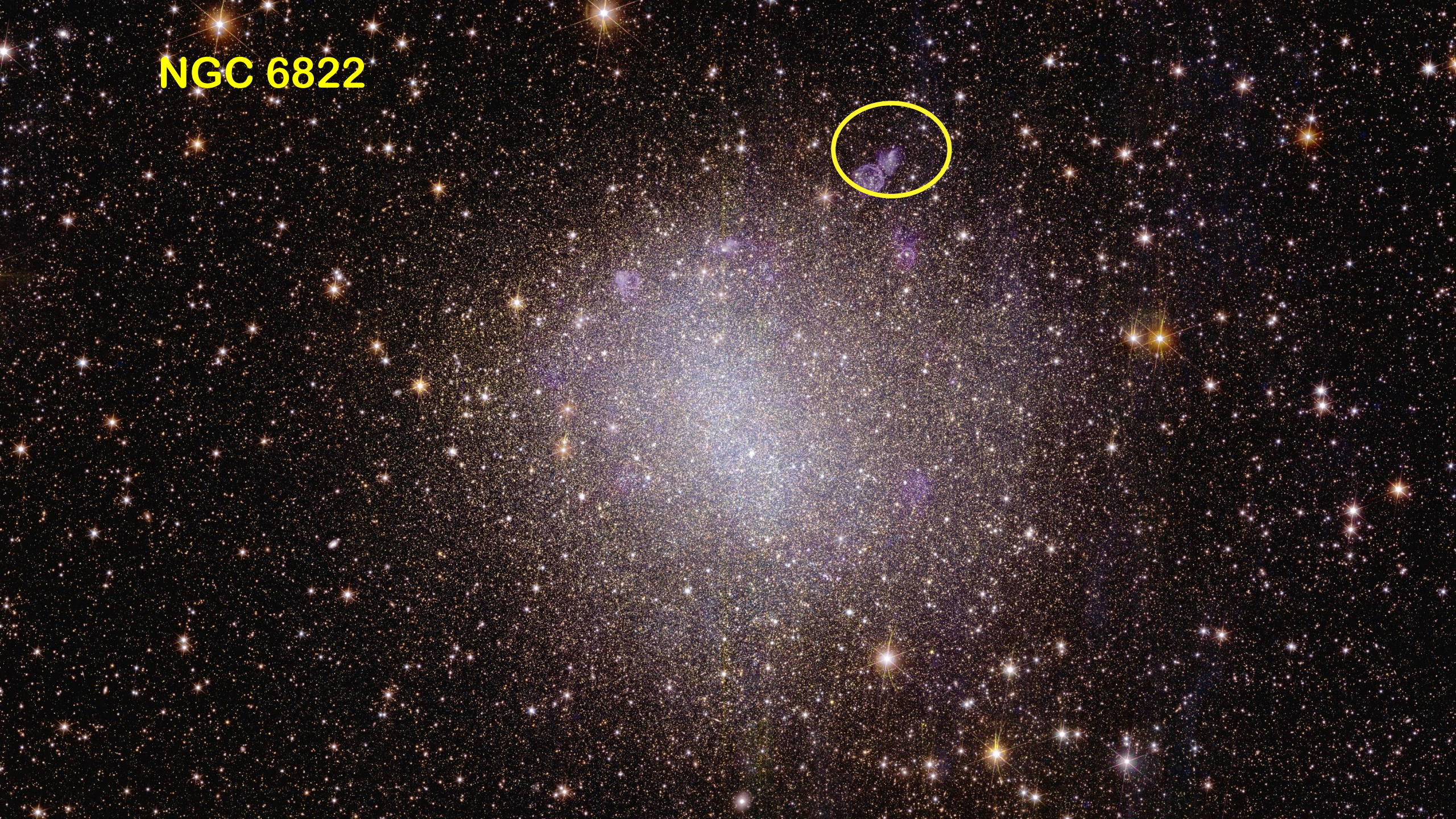


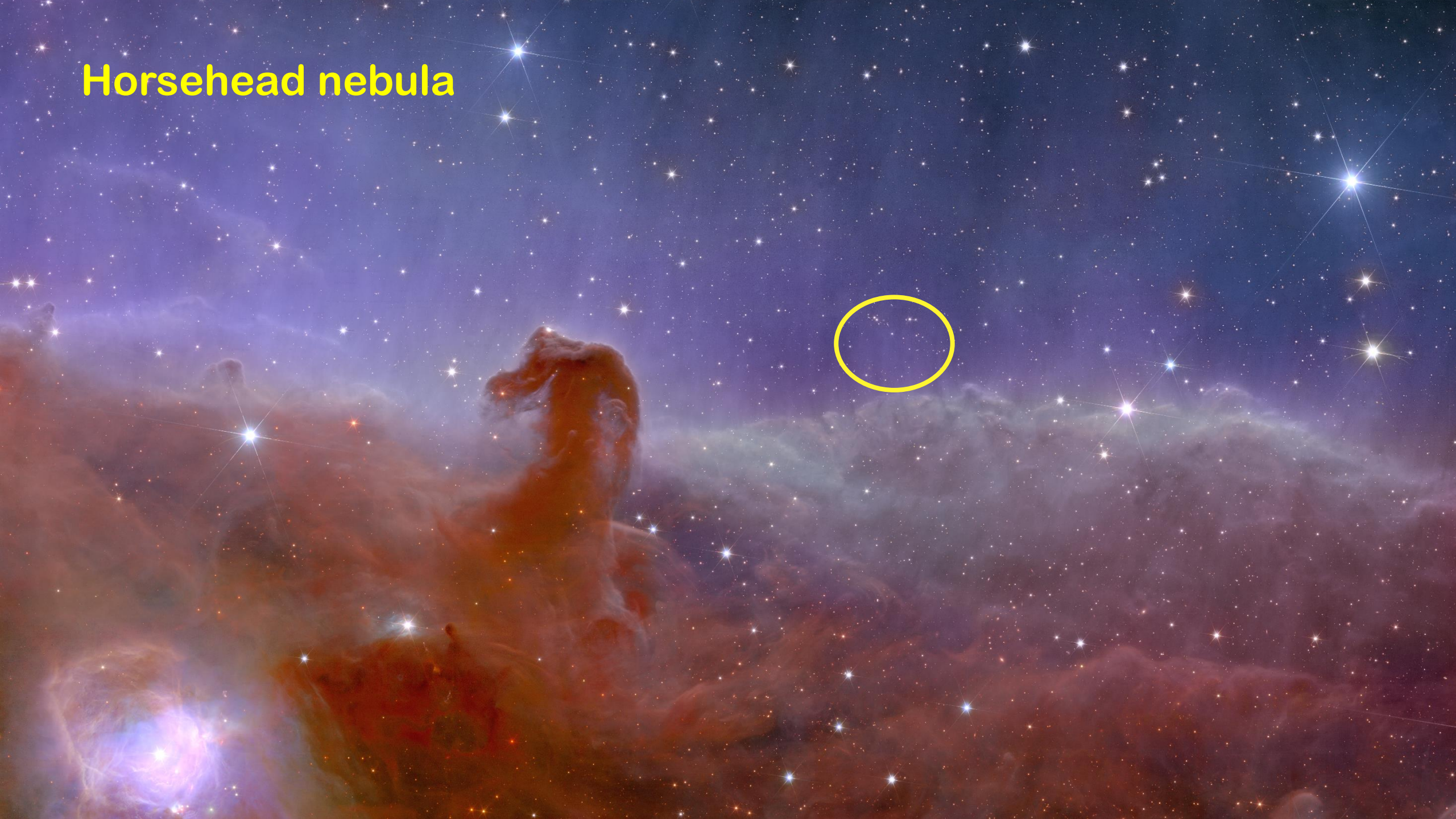


Early Release Objects

- Targets with strong outreach merit to highlight Euclid capabilities
- Total Euclid time for *whole* ERO programme: ca 1 day
  - Euclid data rate: ca 100GB compressed data / day
- Standard 0.7 deg^2 observing blocks (~ 1/30000 of Euclid survey)
- VIS [600Mpix], NISP Y/J/H [45 Mpix], NISP spectra (not yet released)
- Released images:
  - Perseus cluster : d ~ 74 Mpc, over 1k galaxies (ca 50k galaxies in the image)
  - Spiral galaxy IC342
  - Irregular galaxy NGC 6822 : d ~ 500 kpc (local group), Cepheid host (Hubble)
  - Globular cluster NGC 6397
  - Horsehead nebula (Hα in blue, dust in red)


Perseus cluster


NGC 6822


Horsehead nebula

Summary

- Euclid was successfully launched and is operating nominally now.
  - Space is hard …
  - See https://esa.int/euclid for stories, images, etc
- First ‘ERO’ image release – have a look, they are impressive.
  - Images can be found on ESA webpage, link to story
- In January 2024 ERO science papers & overview paper will appear
  - Complementing ‘pre-launch’ papers that have appeared over the last year
- Ca February 2025: ‘Quick-look’ release for astrophysics
- Ca February 2026: DR1 with first cosmology results
- Exciting times!! ☺


Thank you!