



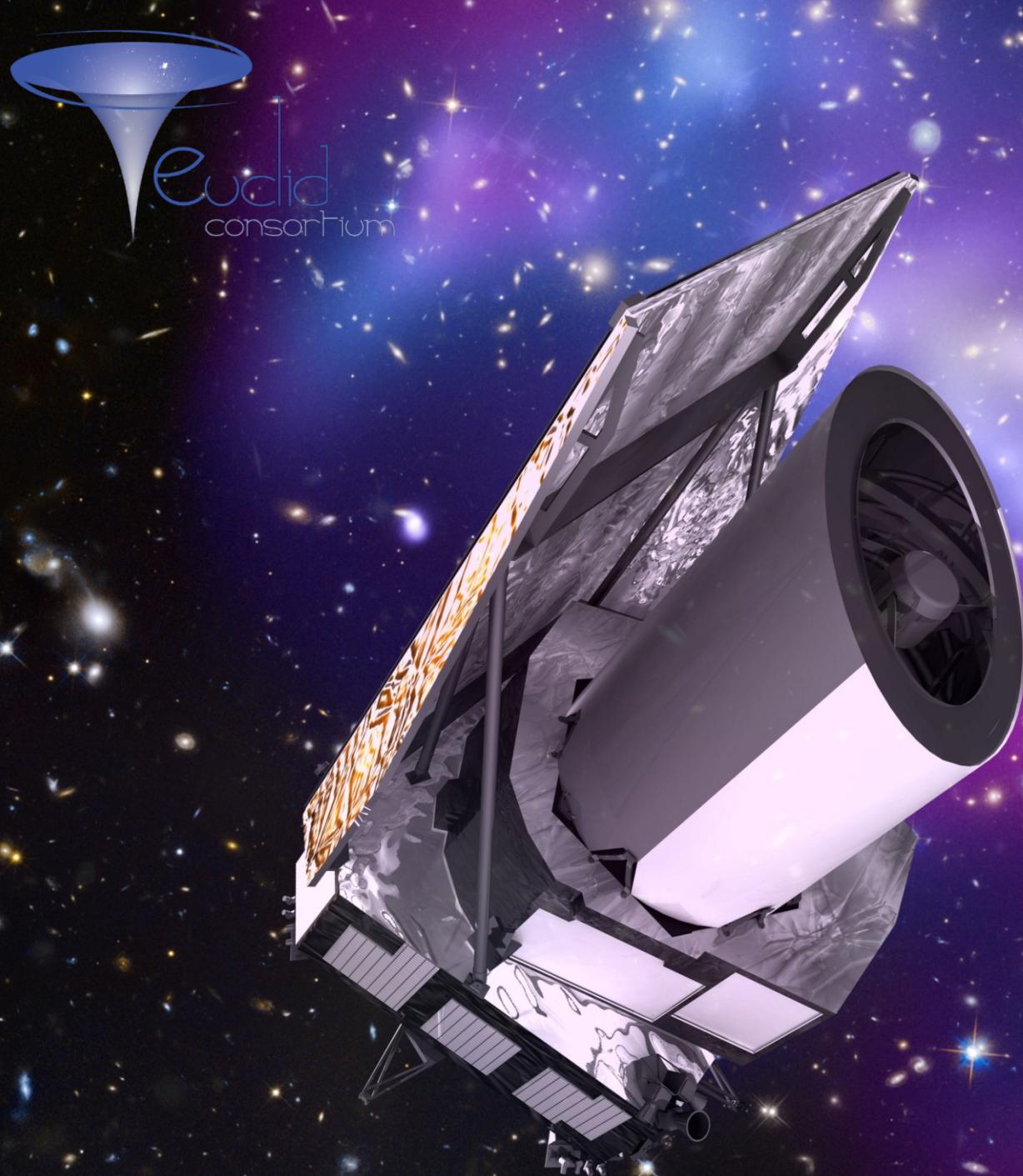
## Meeting annuel Euclid-France 2014

# Euclid 2014

Lyon - Villeurbanne  
4 et 5 décembre 2014

Welcome, on behalf of  
the LOC and SOC

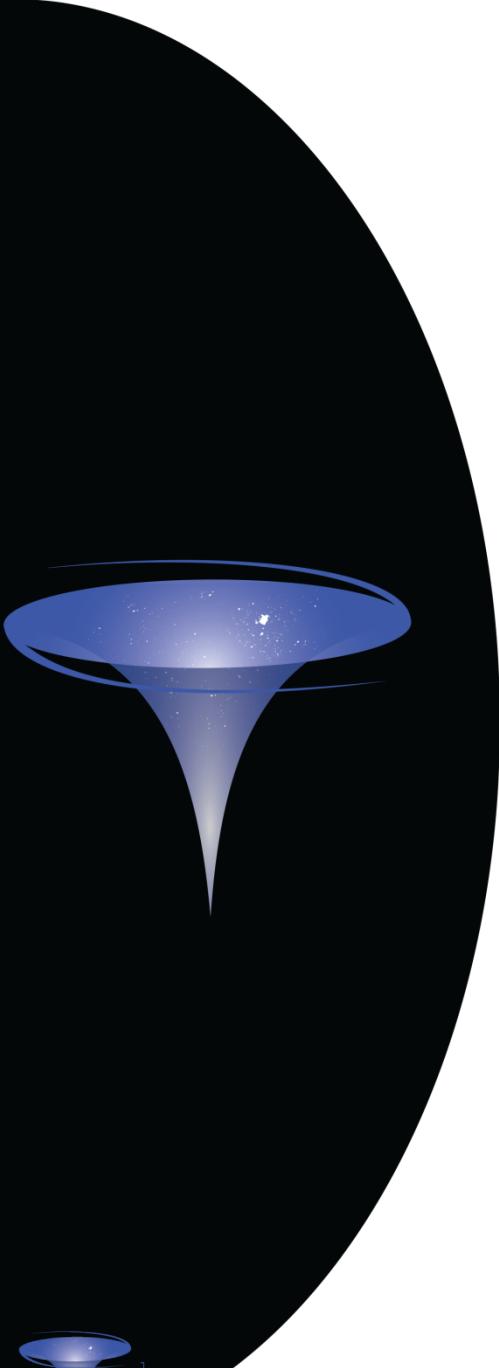




euclid  
consortium



# Euclid progress report



## **1. Euclid (reminder)**

## **2. Progress Report**

## **3. Summary**

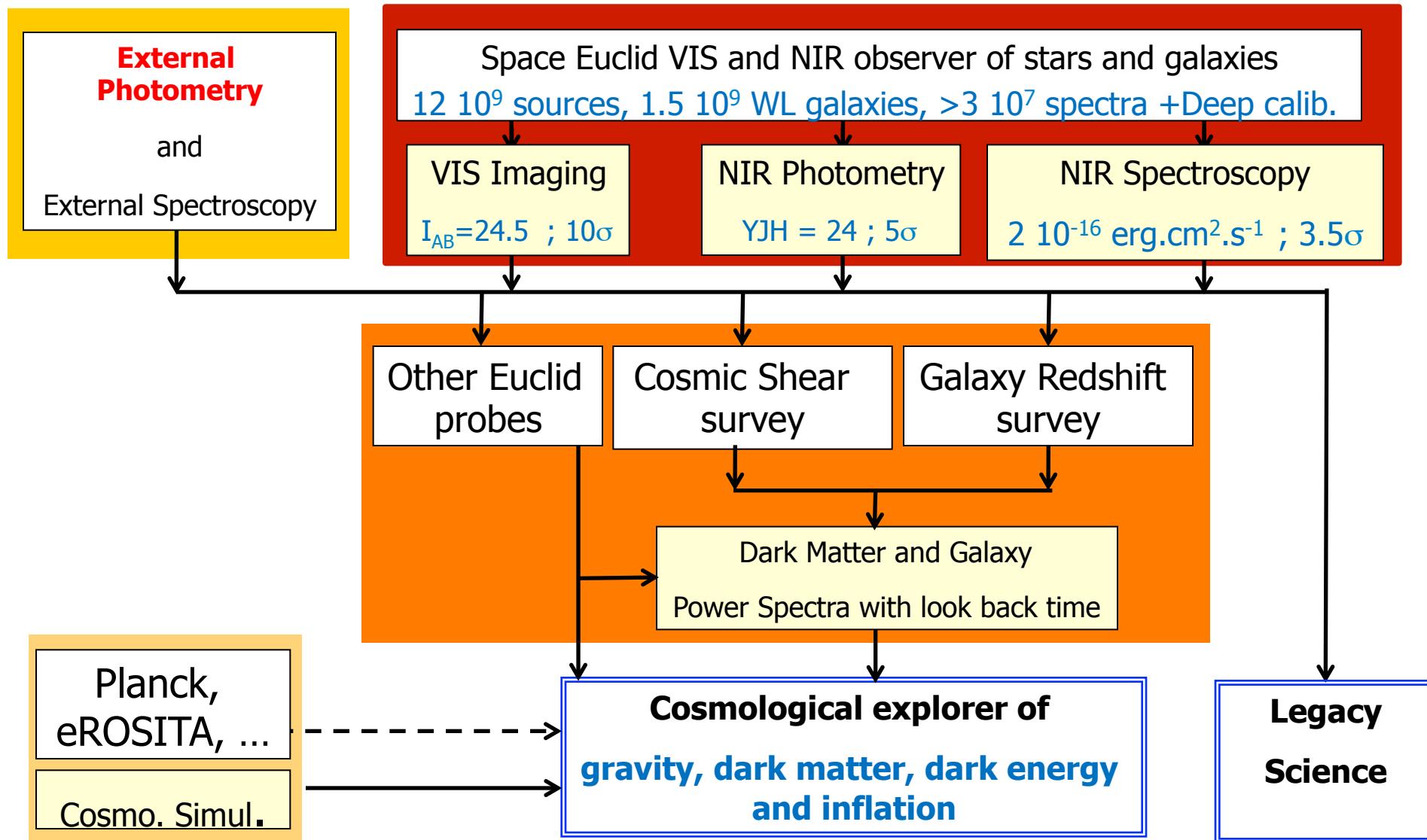


# Euclid Primary Objectives: the Dark Universe

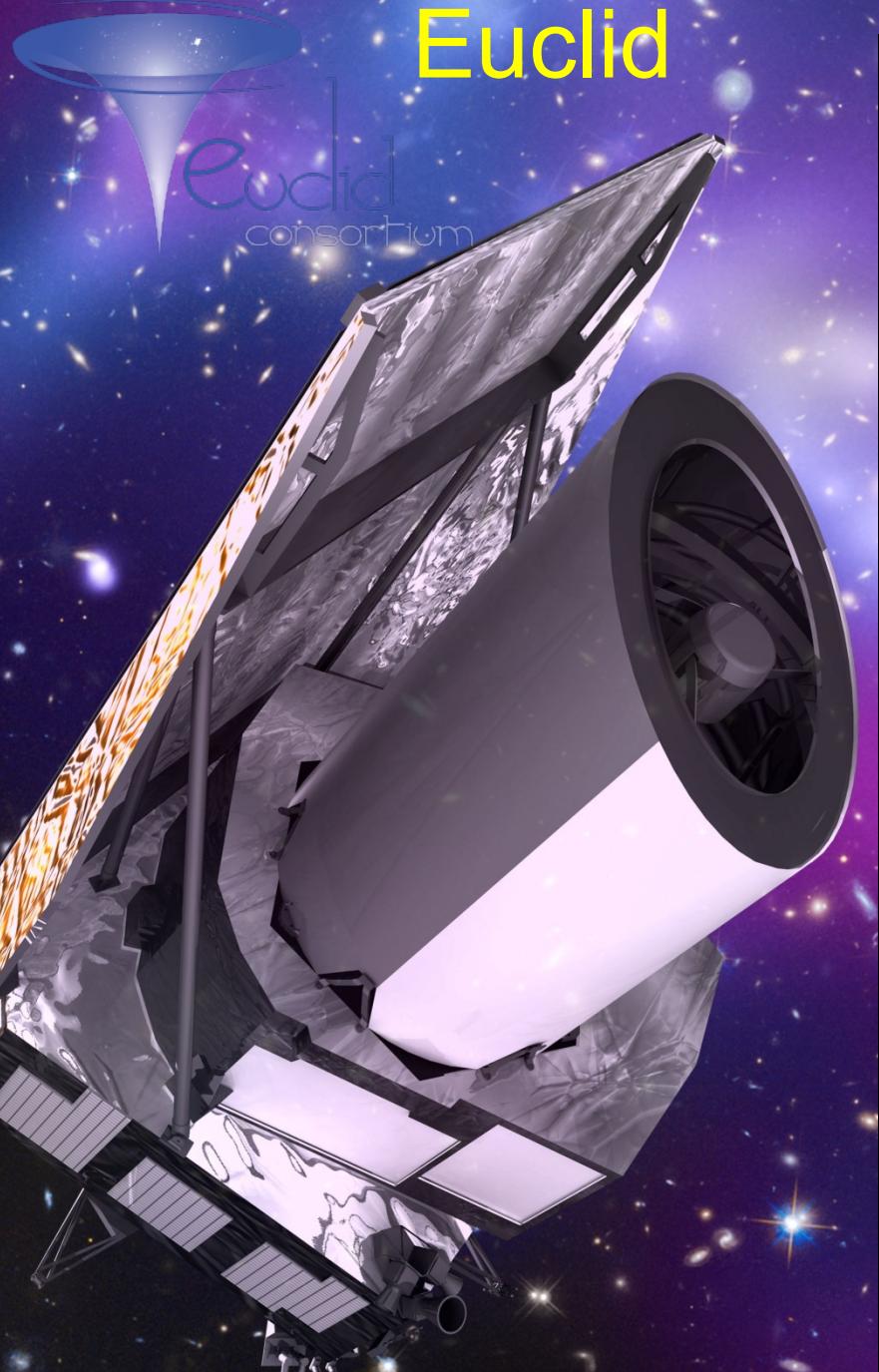
- Understand the origin of the Universe's accelerating expansion
- Probe the properties and nature of Dark Energy and Gravity,
- Probe the effects of Dark Energy, Dark Matter and Gravity by:
  - Using at least 2 independent but complementary probes (**5 probes**)
  - Tracking their observational signatures on the
    - Geometry of the universe: Weak Lensing (WL), Galaxy Clustering (GC)
    - Cosmic history of structure formation: WL, Redshift-Space Distortion (RSD), Clusters of Galaxies (CL)
  - Controlling systematic residuals to an unprecedented level of accuracy.



# Euclid Survey Machine: 15,000 deg<sup>2</sup> + 40 deg<sup>2</sup> deep



# Euclid

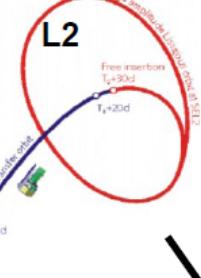


- **ESA-led mission**
- Selected in Oct. 2011 - Fully funded
- Partners: ESA, TAS, Airbus DS, Euclid Consortium (EC)
- Cost: ~ 850 Meuros (~ 2/3 ESA; ~1/3 EC)
- Overall Mass: ~2020 kg
- Power : 1710 W
- Telescope :
  - 1.2m aperture primary ,SIC, 3 mirror anastigmat
- **2 Instruments (VIS, NISP); 2 channels**
  - Wide field instrument, VIS: 36 e2v 4kx4k CCDs
  - 576 M pixels, 0.11 arcsec/pix, 0.53 deg<sup>2</sup> FoV
  - Photom.+spectrom.: 16 H2GR HgCdTe detectors;
  - 64 Mpixels, 0.30 arcsec/pix, 0.53 deg<sup>2</sup> FoV (=VIS)
  - Grism slitless (1B 920-1250nm+ 3R 1250-1850 nm grisms)
- Downlink Rate: X/X + K-band to Ground Station 55 Mbits/s.  
850 Gbit/day to transfer 4hr/day.
- Ground Segment: ESA (50%,) EC (50%, EC leads science and external data): 1.5 billion galaxies for WL, 30 million redshifts, 12 billion sources (3sigma)
- L2 orbit
- Launch Vehicle – Soyuz-Fregat
- Launch date 2020, from Kourou space port
- **6.25 years mission+additional surveys (exopl, SN)**
- **Main surveys: 15,000 deg<sup>2</sup>+40 deg<sup>2</sup> 2 mag. deeper**
- Science drivers: DE: 5 probes WL, BAO, RSD, CL, ISW
- Science leads:Euclid Consortium

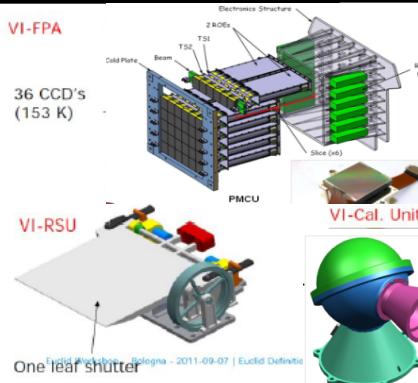
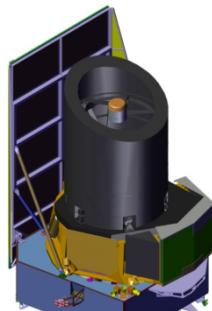
# The Euclid Mission in one slide

Soyuz@Kourou

Q1 2020



PLM+SVM: 2010-2019



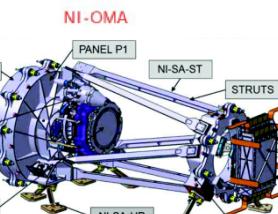
VIS imaging:  
2010-2020

(VIS team)

**VIS**

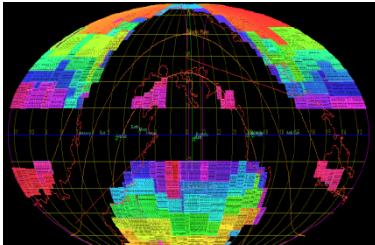
NIR spectro-imaging

**NISP**



2010-2020 (NISP team)

Surveys: 2010-2028 (Survey WG)



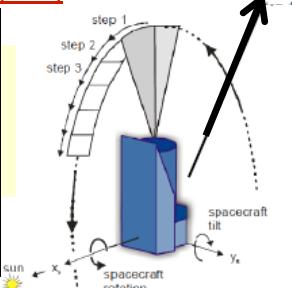
6 yrs - 15,000 deg<sup>2</sup>

Commissioning – SV

Euclid opération:

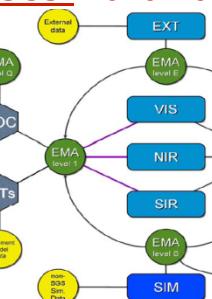
5.5 yrs: Euclid Wide+Deep

+: SNIa, mu-lens, MW?



Ground data

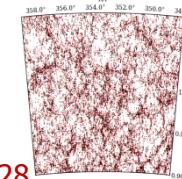
SGS: 2010-2028



~50 PB data processing (EC-SGS team)



SWG:  
2019-2028

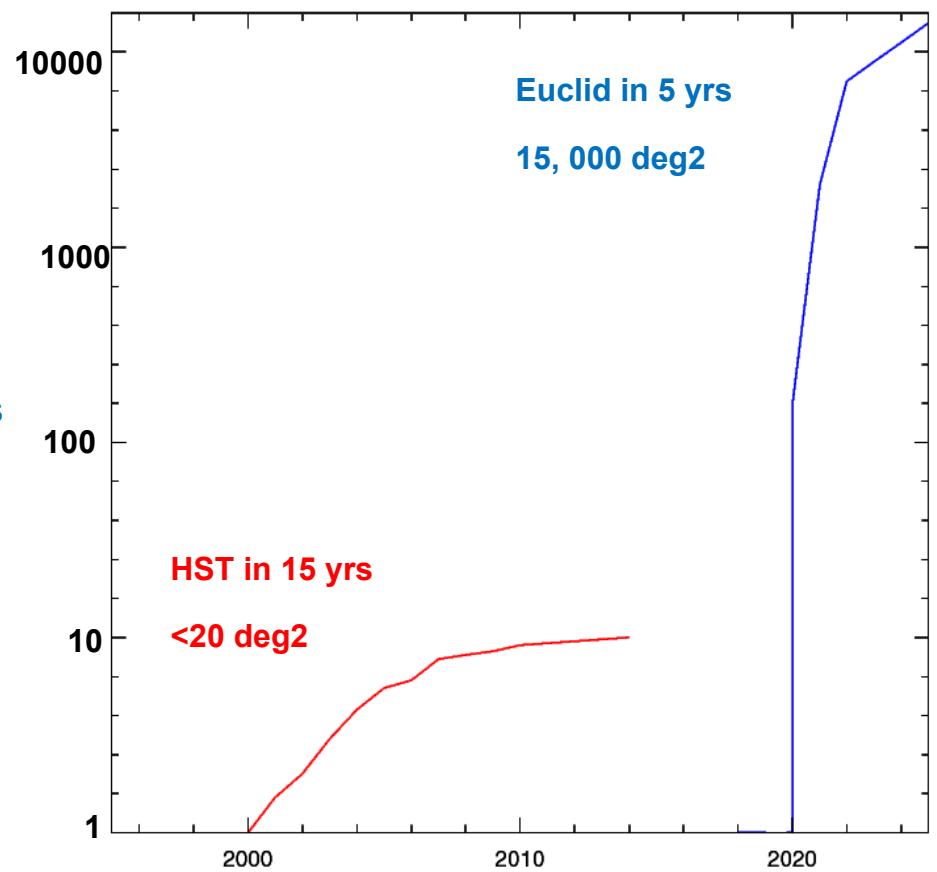


Science analyses

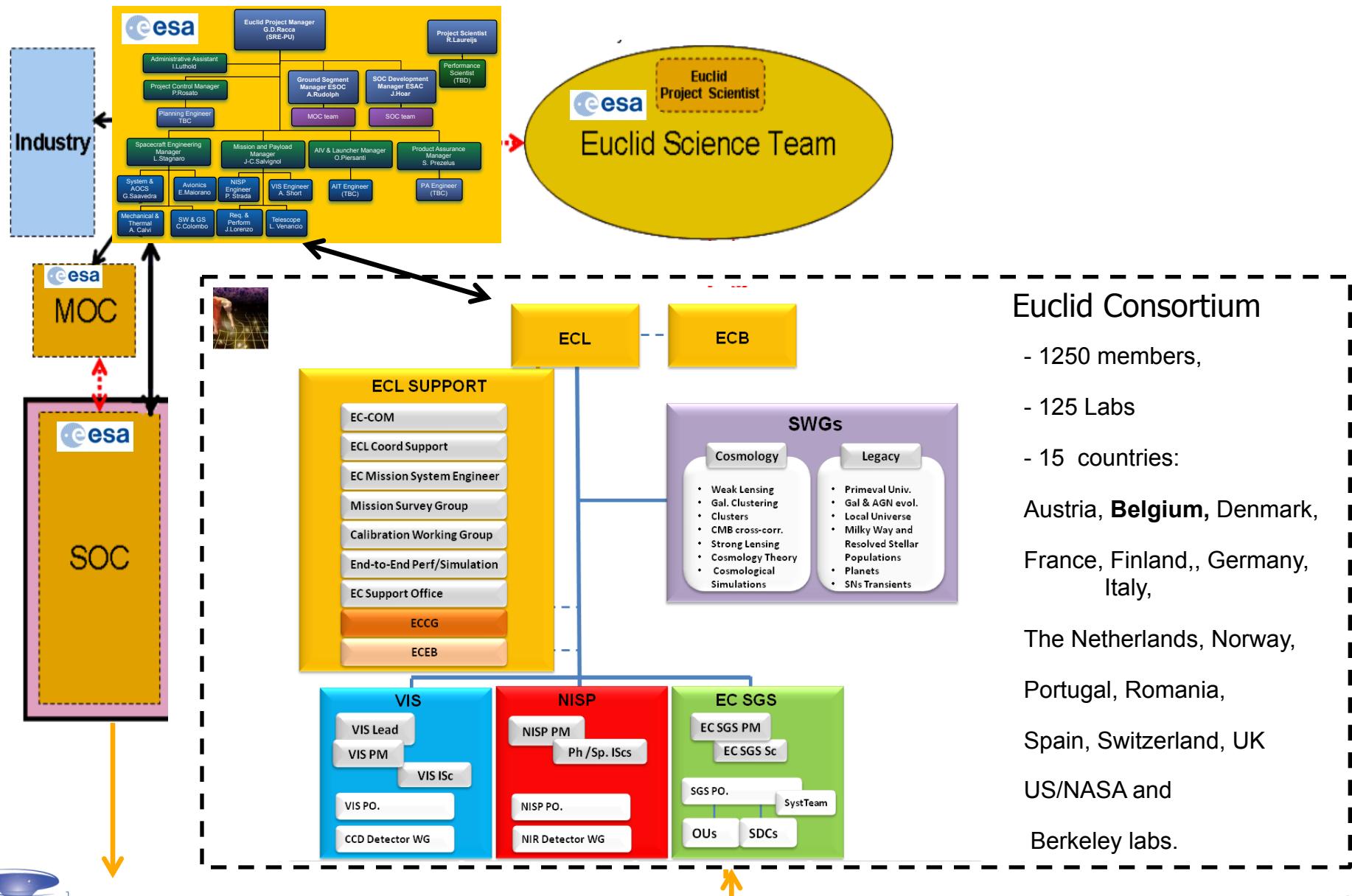
# Euclid Legacy: revolution in wide field surveys

- Very large samples
  - Diversity of populations
  - Distribution functions
  - ~50,000 clusters of galaxies
- Exquisite imaging of galaxies
  - Morphological studies, mergers, strong galaxy-scale lenses
- Strong and Weak Lensing
  - Galaxy evolution as function of halo properties
  - Galaxy alignment
  - 5000 clusters with giant arcs
- Huge volumes and numbers
  - Rare sources, probing the extremes
- NIR Spectroscopy
  - Metals, star formation@  $z>1$
  - Cool stars
  - Very high- $z$  QSOs

From J. Brinchmann 2013

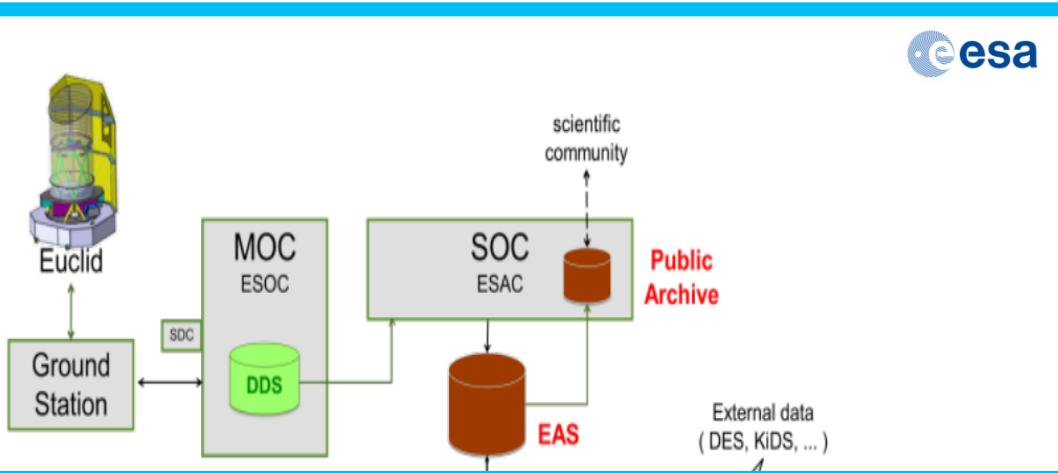


# Euclid Collaboration/Consortium



# Science Ground Segment: EC, ESAC, ESOC, SDC

Courtesy: F. Pasian, M. Sauvage, J. Hoar, C. Dabin EC SGS and ESAC



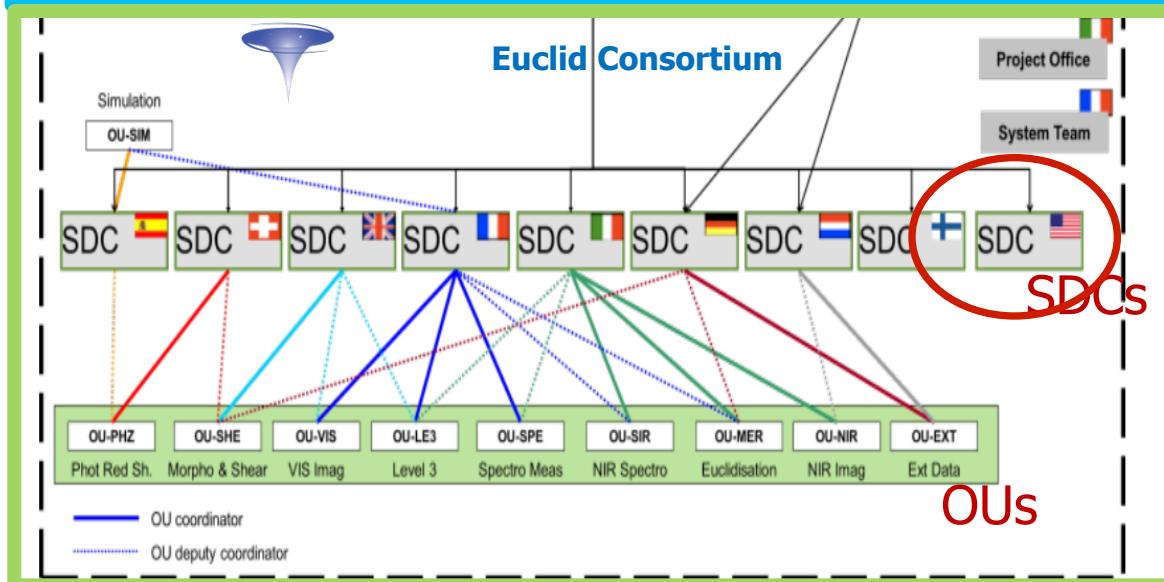
## Complex organisation:

- 10 Organisation Units
- 9 Science Data Centers

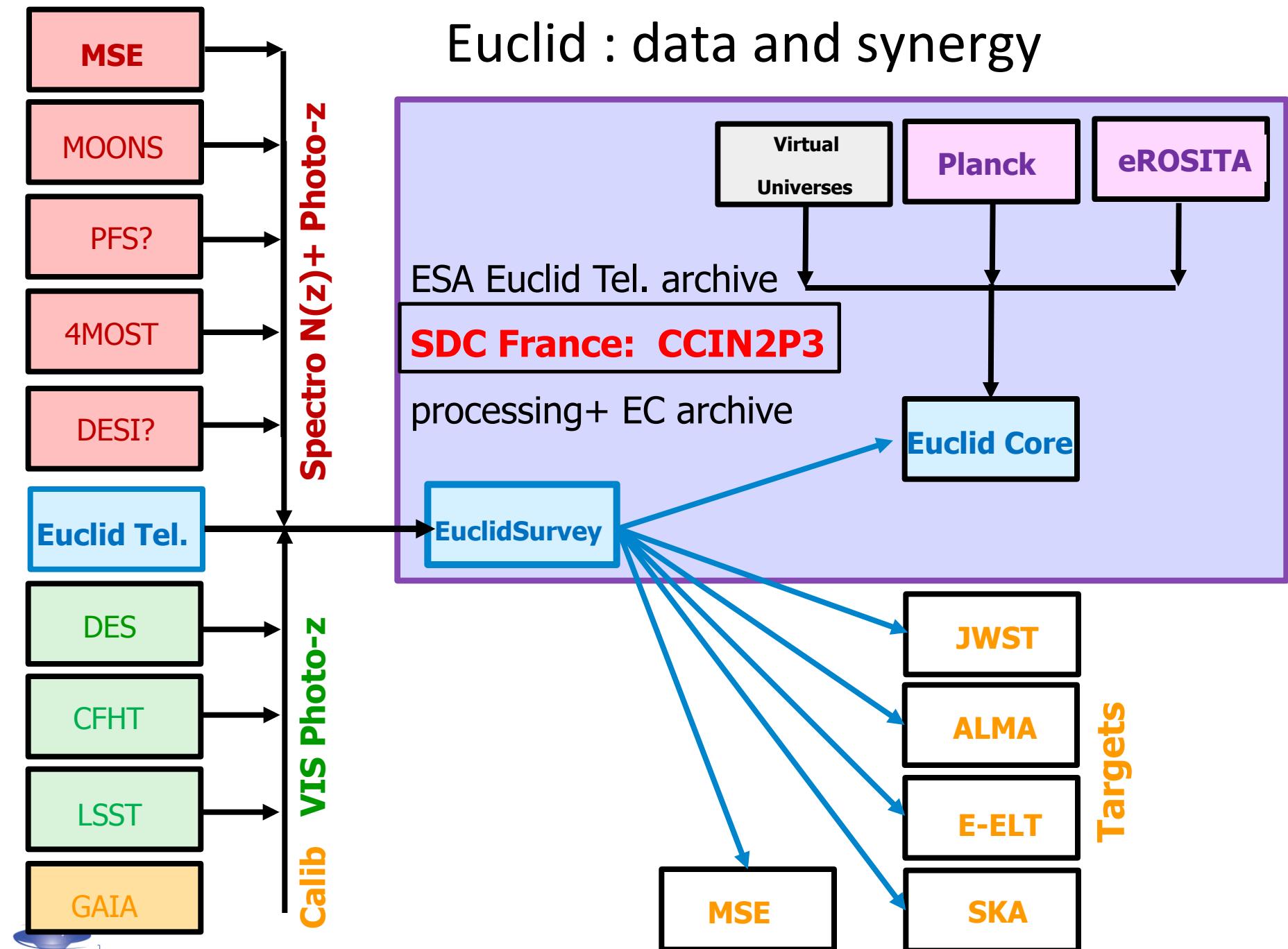
**Data:** huge volumes,  
heterogeneous data sets

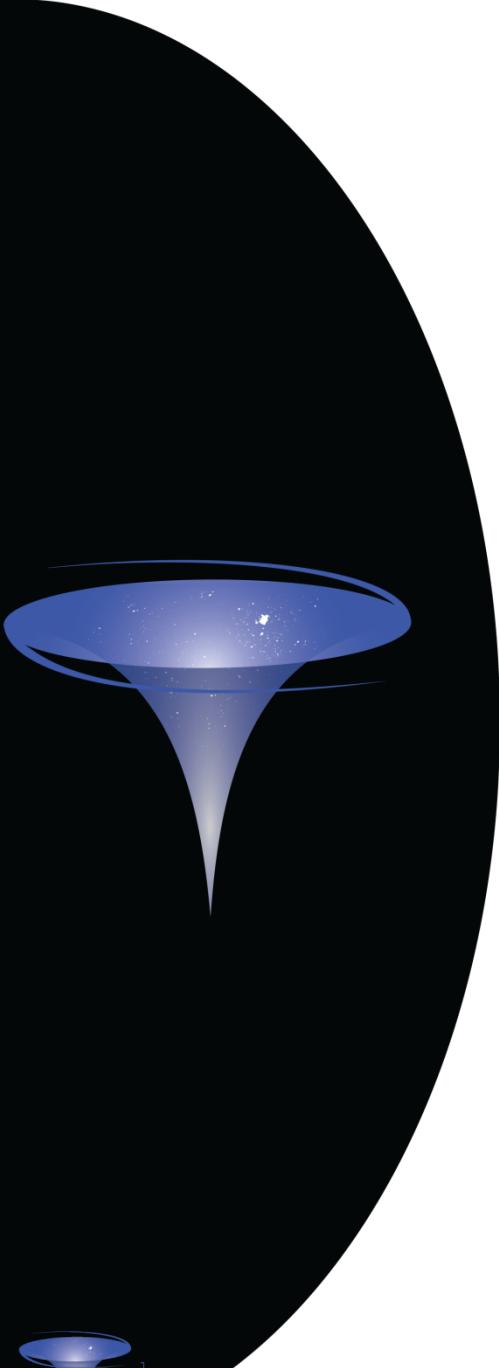
- VIS+NIR imagery and morphometry, photometry , spectroscopy
- data from ground and space
- ~100 Pbytes
- 1+ million images
- $> 10^{10}$  sources ( $>3$ -sigmas)

Cost SGS = 50% of Euclid Consortium contributions.



# Euclid : data and synergy





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**3. Summary**



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- Fabio Pasian
- Steve Warren
- PLM, SVM and SGS status
- VIS, NISP PDR (M. Berthé, T. Maciaszek)
- Sub-system PDR (M. Berthé, T. Maciaszek)
- Straylight analysis
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- Calibration review
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- Fabio Pasian replaced by A. Zacchei Jan 1st
- Steve Warren resigned Dec. 2: position empty
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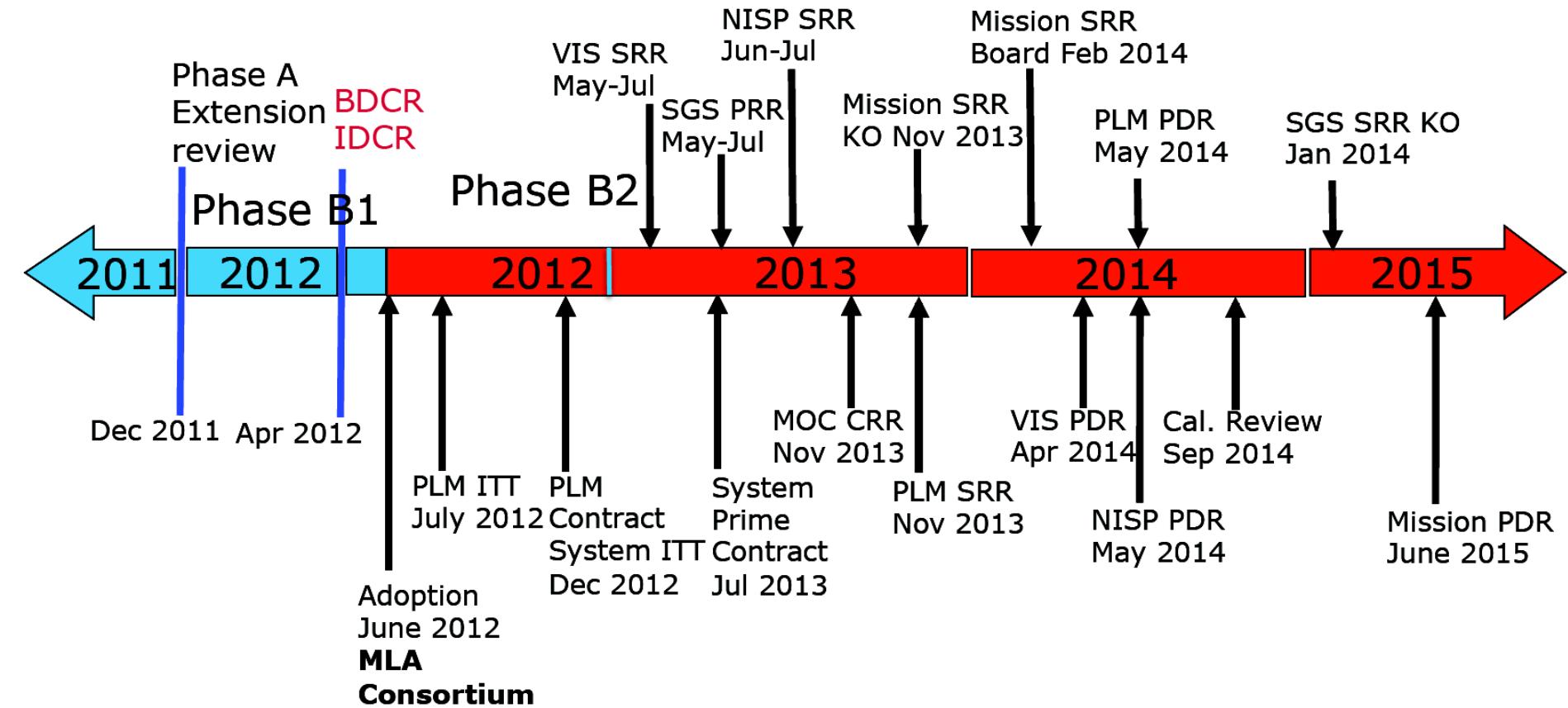


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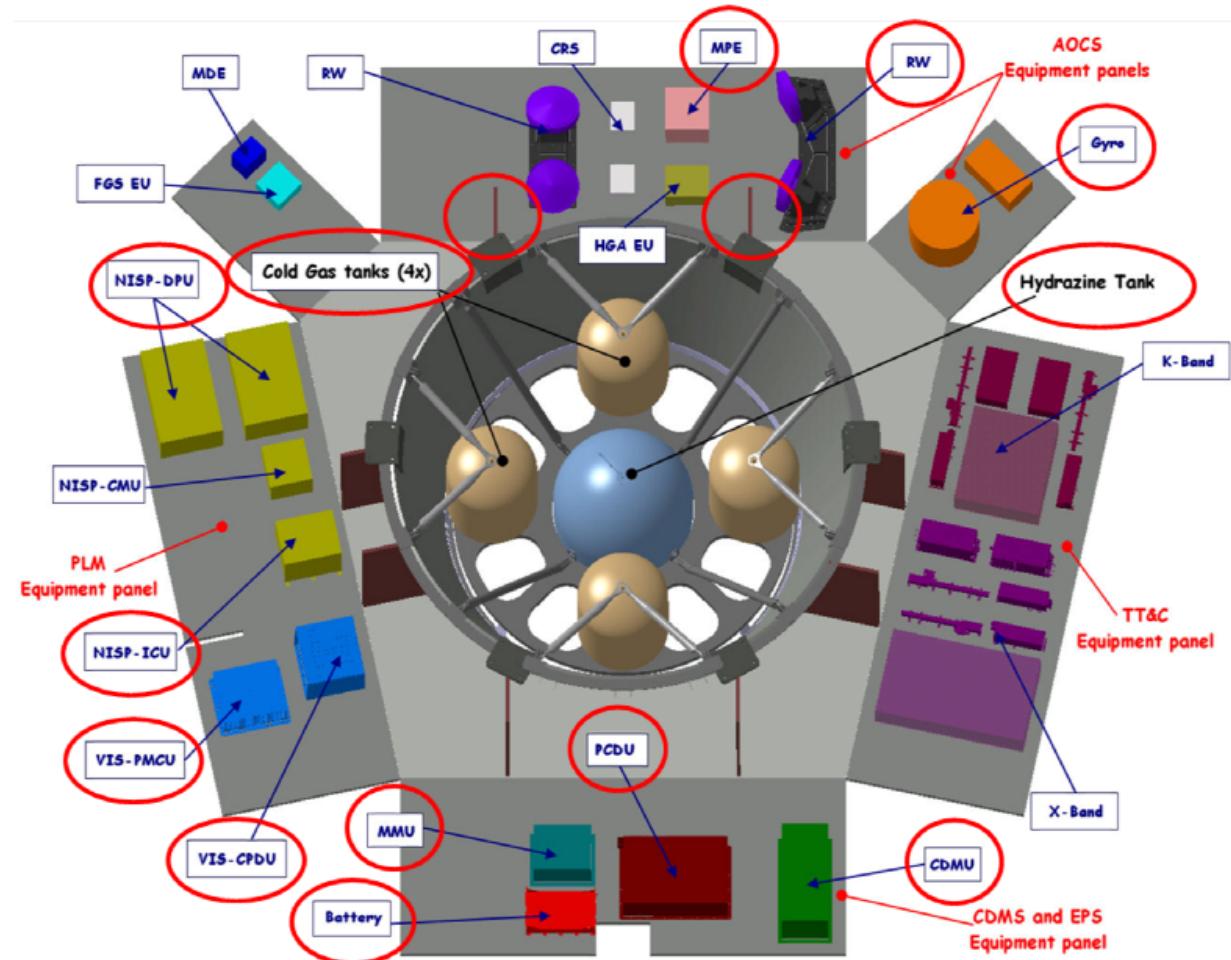
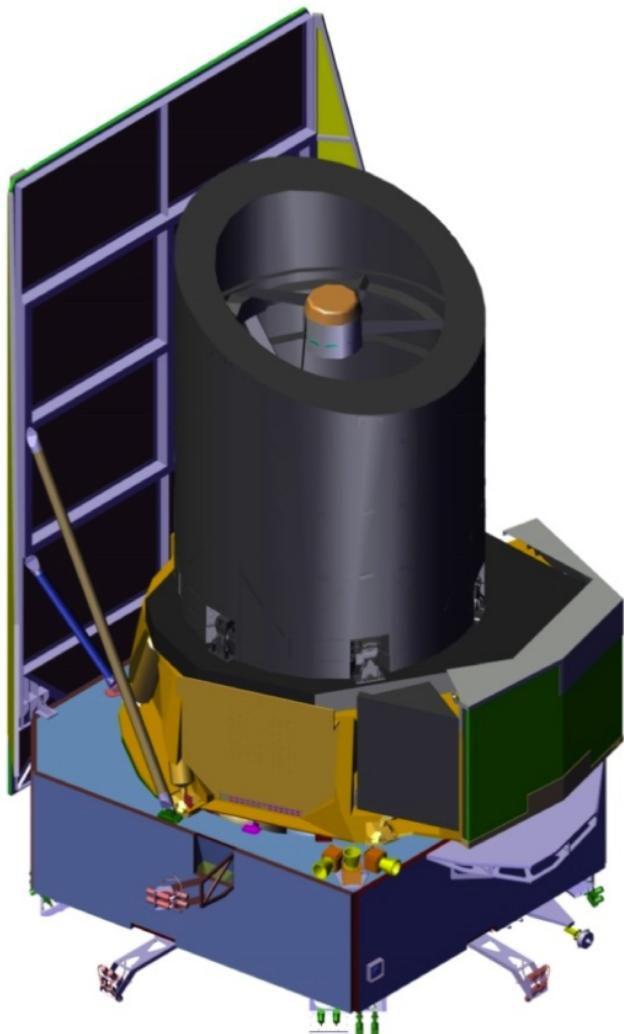
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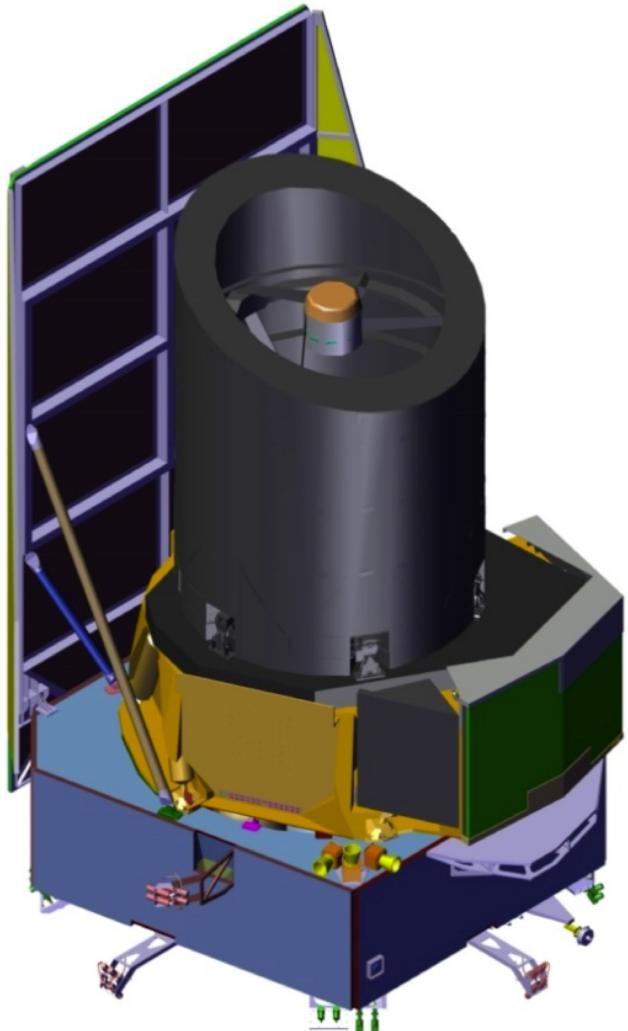
# Euclid : status, December 2014



# Euclid Spacecraft



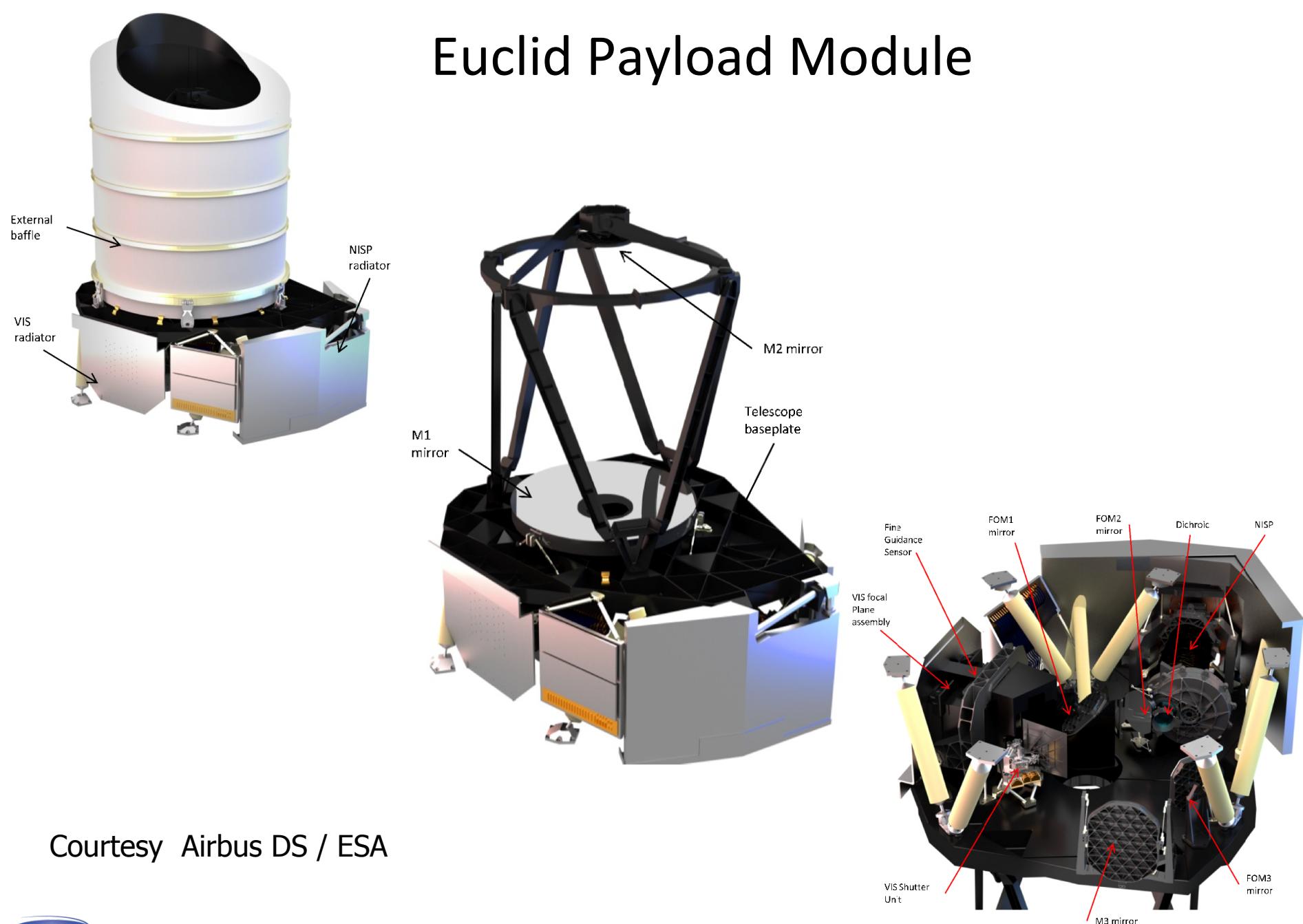
# Euclid Spacecraft Industrial Procurement



- Reaction Wheel Assembly to Rockwell (DE) and Bradford (NL)
- Fine Guidance Sensor to Selex-Galileo (IT)
- Structure to CASA (ES)
- Sunshield to SpaceTech (DE)
- Telemetry, Tracking and Command subsystem to TAS-ES
- Central Checkout System to TERMA (NL)
- Command and Data Management System under evaluation
- Power Conditioning and Distribution Unit under evaluation

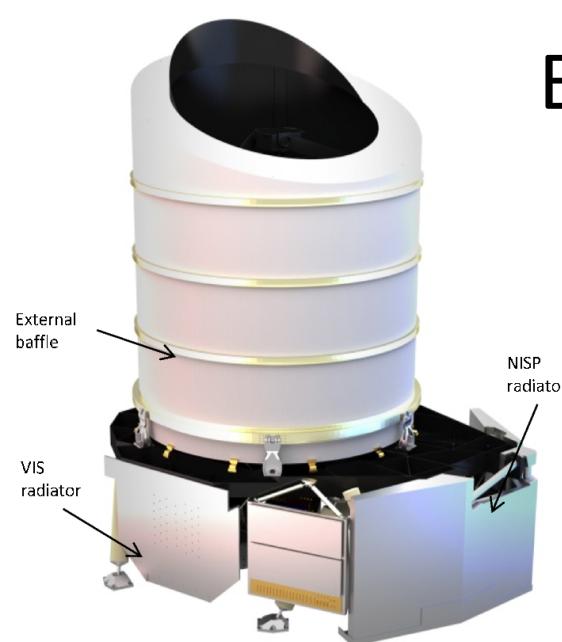


# Euclid Payload Module

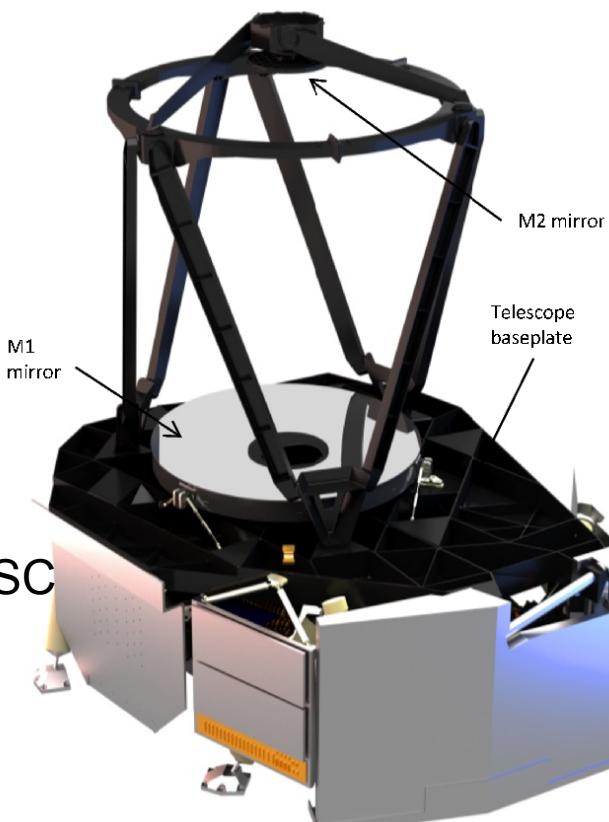


Courtesy Airbus DS / ESA

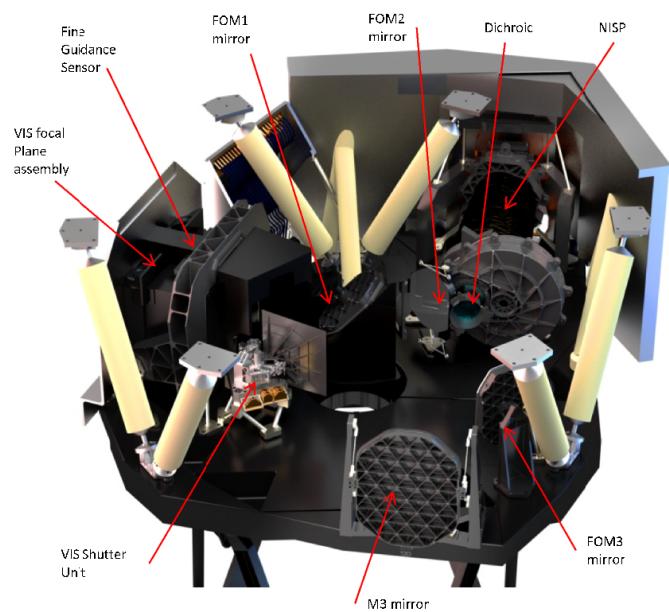
# Euclid Payload Module Procurement



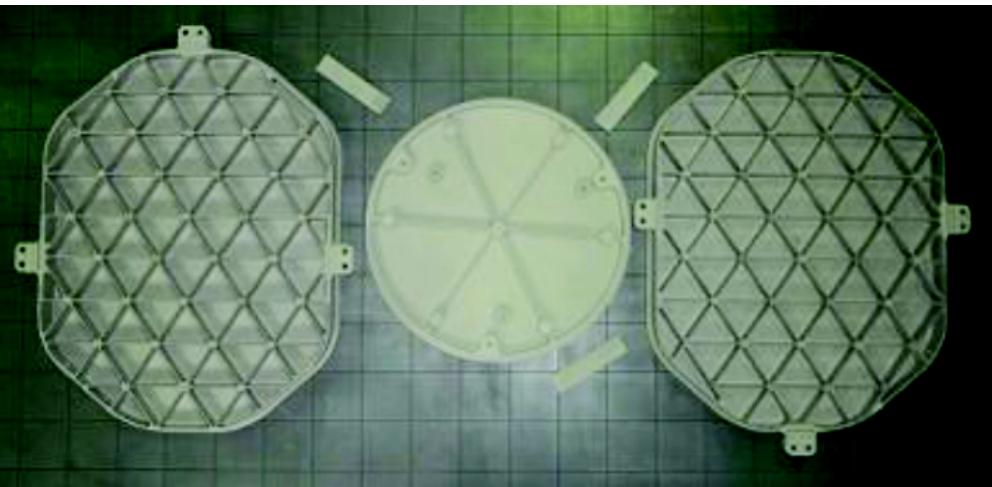
- Ceramic structures to Boostec (FR)
- M1 polish/coating to REOSC (FR)
- M2/M3 polish/coating to AMOS (BE)
- Collimator to AMOS
- Thermal Analysis to LKE (CZ)



- Dichroic to OBJ (DE) and Scott (CH) in parallel
- Telescope baffle to QinetiQ (BE)
- M2 mechanism to SENER (DK)
- Product Assurance support to ATEXIS (RO)



# Euclid Payload Module Hardware



FoM 1, M2 and FoM 3

FoM2

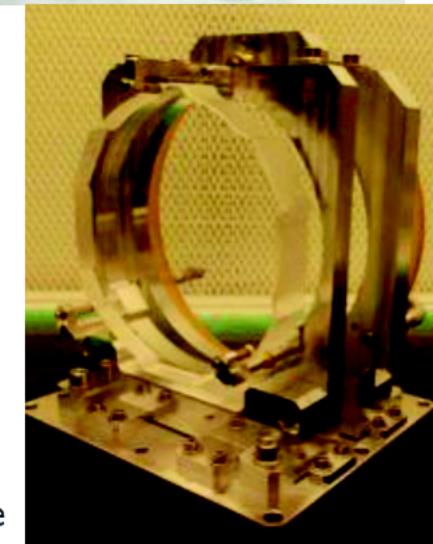


M1



M3

Dichroic plate



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# H2020

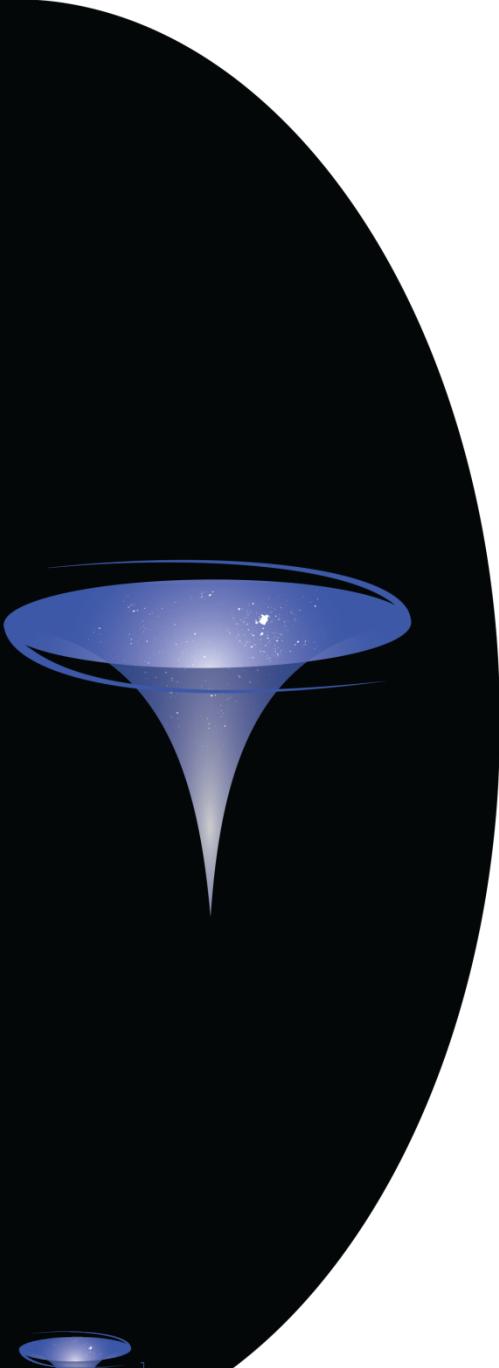
- ASTERICS submitted as a Horizon 2020 project:  
EC leads: F. Pasian and Y. Mellier
  - topic is preparing a common infrastructure for ESFRI and world-class A&A research projects (Euclid is one of them)
  - would allow to cover aspects related to the SGS e-infrastructure such as Authentication&Authorisation and Workflows – contribution to System team activities
- 1 proposal on numerical simulations: letter of support from ECL/ECB
- 1 SPACE proposal under discussion
- Please send email to ECL for any H2020 proposal Euclid-related you may propose or contribute to



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- Steve Warren
- PLM, SVM and SGS status
- VIS, NISP PDR : NIR Detectors
- Sub-system PDR (M. Berthé, T. Maciaszek)
- Straylight analysis: critical issue. Under study
- SRR SGS preparation (M. Poncet)
- Calibration review: report issue on Dec. 8
- Additional surveys: pending mission PDR, TAS
- MegaCam Nord (J.-C. Cuillandre, R. Ibata):BoD
- LSST: E. Gangler;  
Euclid-LSST letter
- WFIRST meeting → European contribution
- Tracking Task Force: Oct 18, document in preparation
- E2E :KoM Oct30 ,Miss. PDR
- Astromatic: (M. Poncet?)
- Athena: (A. Blanchard)
- H2020 proposal: next slide
- COSPAR, Farnborough 2014
- Le Bourget 2015
- UAI 2015





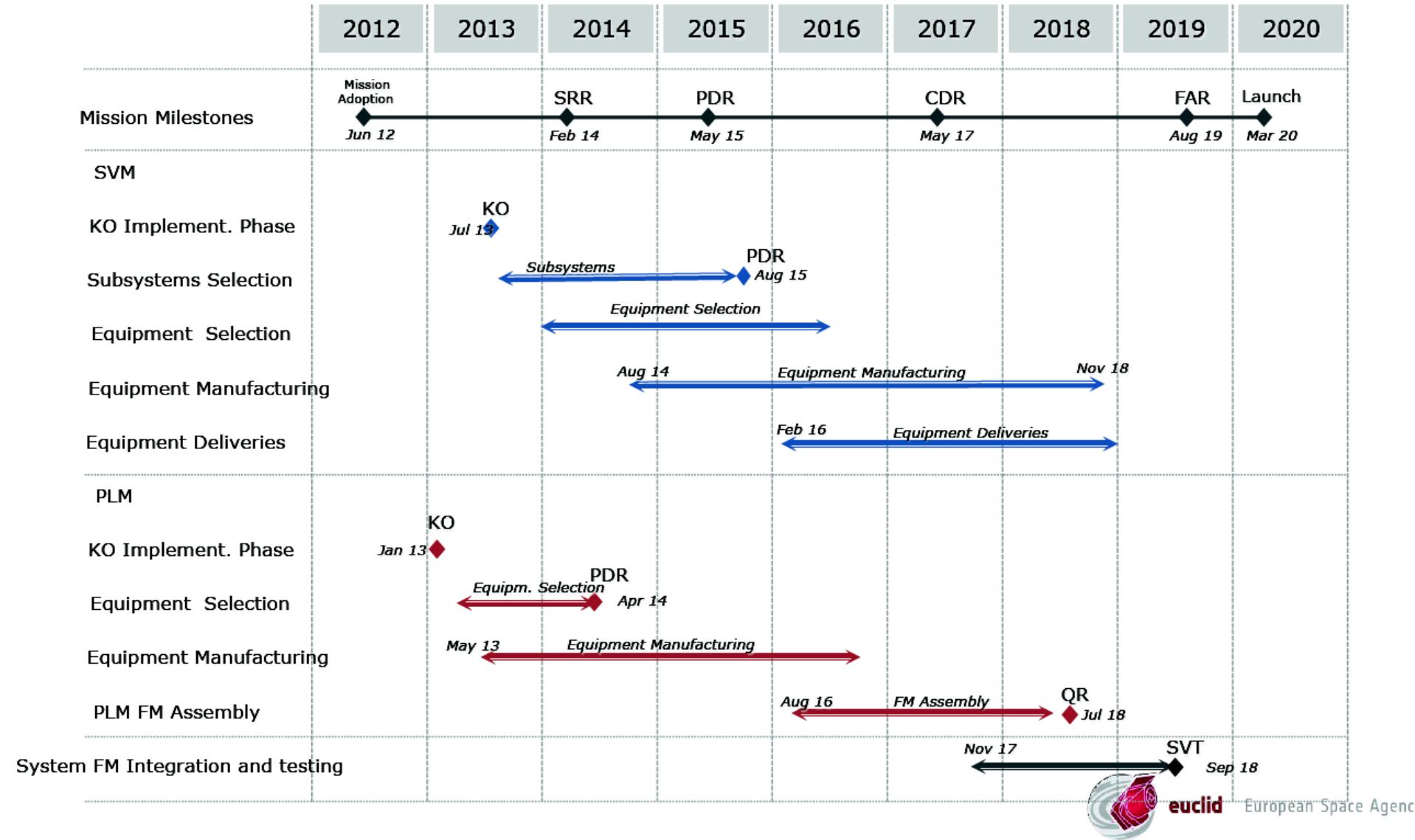
**1. Euclid**

**2. Progress Report**

**3. Summary**



# Euclid Schedule SVM and PLM (Oct)



Courtesy. G. Racca/ESA



# Important dates coming

- SRR SGS (data Pack Jan 12 2015)
- Mission PDR (June 2015)
- Alumni Day in Paris June 2015
- Euclid Annual Meeting in Lausanne June 2015
- ICDR end 2015



# Challenges of Euclid

- **EC Management:** 1250 persons, 120 labs, 14 countries:
- **Data management and processing:** huge volume, multi-wavelength data, ground + space, NIR+VIS, 10 SDCs , archive → data, algorithm and hardware challenges
- **Shape measurements/systematics**
  - Control multiplicative and additive biases, shape measurement algorithms
- **Photometric redshifts:**
  - Ground based photometry in 4 bands : 15,000 deg<sup>2</sup> (i.e. north and south)
- **Numerical simulations** with power spectrum to a 1% accuracy :
  - Underlying physics: e.g. numerical simulations with baryons
  - Numerical simulations of a large number of DE, GR models
  - $10^3$  to  $10^5$  simulations to estimate covariance matrices
- **End-to-End performances**
- **Spectroscopic surveys to:**
  - Calibrate deep photo-z and understand BAO and RSD samples



# Summary: the post-Planck cosmology mission

Euclid will

Explore the dark universe as a whole: DE, DM, MG (in particular neutrinos), inflation

Use 5 cosmological probes, with at least 2 independent

Get the percent precision on w and the growth factor

Prepare a revolution for wide field VIS and NIR surveys

Prepare the next generation wide field panchromatic all sky surveys: GAIA, LSST, WFIRST, e-ROSITA, SKA

Euclid Legacy = 12 billion sources, >30 million redshifts;

A mine of images and spectra for the community for years;

A reservoir of targets for JWST, E-ELT, TMT, ALMA, VLT

A set of astronomical catalogues useful until 2040+

**A fantastic project for next generation scientists**





Thank you!

# Euclid

## 2014

Lyon - Villeurbanne  
4 et 5 décembre 2014

Thanks to the LOC for  
the organisation!

