The Euclid Mission Planning

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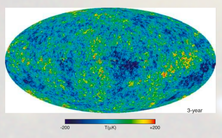
Abstract

Euclid is a high-precision survey mission of the ESA cosmic vision 2020-2025 to be launched in 2020. Its main objective is to understand the origin of the Universe accelerated expansion and the nature of dark matter, dark energy and gravity. During its 6 years nominal mission it will perform a wide survey (15.000 deg^2) of the cosmological sky and a number of deep surveys. The Euclid Survey System (ESS) is being developed at ESA Science Operation Centre (SOC) and it mains functions are to plan, visualize, validate and inspect the evolution of the Euclid mission.

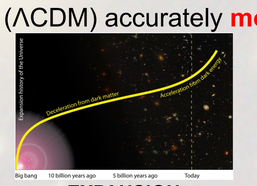
The Euclid Science

• **ΛCDM** accurately *models* observations:

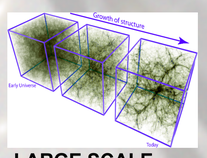
The standard model (ΛCDM) accurately **models** the Universe:



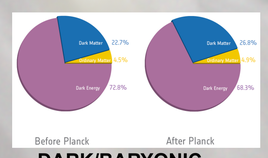
CMB



EXPANSION



LARGE SCALE STRUCTURE



DARK/BARYONIC FRACTION

Euclid is a survey mission to **understand** the dark and accelerating universe:

- The nature of dark matter/energy (eq. of state)
- How structures are affected by the expansion history of the Universe
- Validity of GR over cosmological scales, measure |γ|<0.01 (1σ)
- Cosmic structures

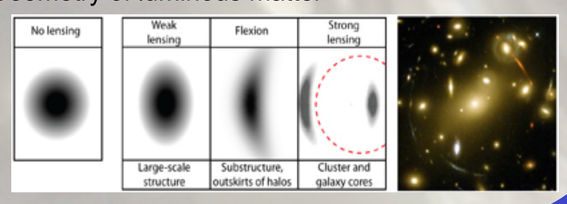
Two complementary cosmological probes:

Galaxy Clustering

Measuring accurate redshifts of >10^7 Galaxies (>3500 galaxies/deg^2)
Baryon Acoustic Oscillations (BAOs).Geometry of luminous matter
z-space distortions

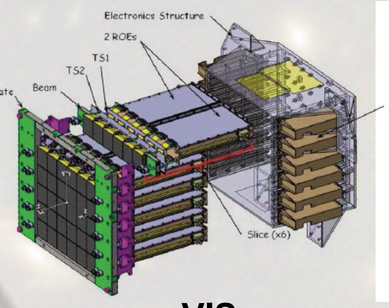
Weak Gravitational Lensing

Measuring the shape of >10^9 galaxies
Shear power spectrum vs z ->
Cosmic acceleration
Growth factor γ

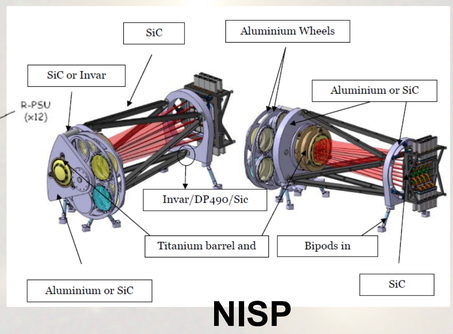


The Euclid Payload

Telescope	1.2m Korsch, 3-mirror anastigmat, f=24.5m				
Instrument	**VIS**	**NISP**			
FoV	.787x.709 (0.56) deg^2	.763°x.722 (0.55) deg^2			
Capability	Visual Imaging	NIR imaging photometry			NIR slitless-spectroscopy
Spectral coverage	550-900 nm	Y 920-1146nm	J 1146-1372nm	H 1372-2000nm	1100-2000nm
Sensitivity	24.5(10σ) ext.	24 (5σ) point	24 (5σ) point	24 (5σ) point	310^{-16} erg cm^{-2} s^{-1}(3.5σ)
Detectors	36x4K^2 CCDs (0.57 Gpix)	16 x 2K^2 HAWAII-2RG HgCdTe detectors			
Pixel size	0.1”	0.3”			



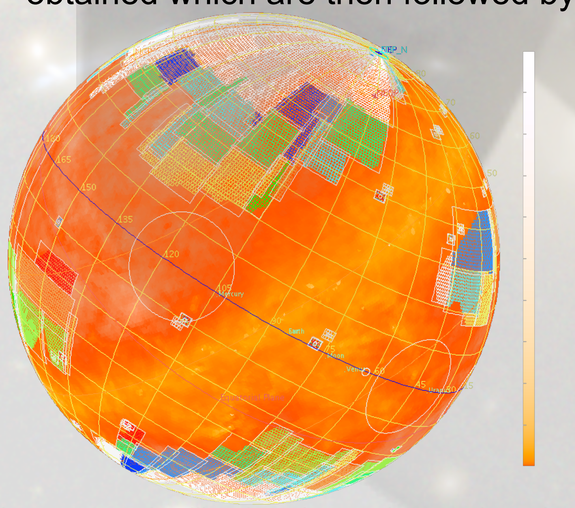
VIS



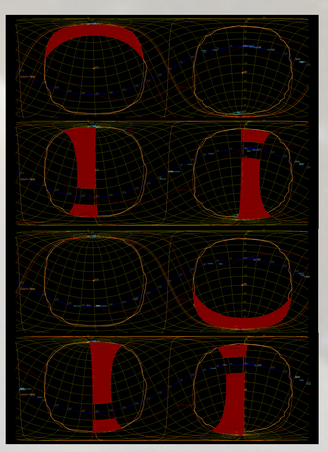
NISP

The Euclid Surveys

During Euclid mission, Euclid will perform one wide survey (>15000 deg^2) and a number of deep surveys near the ecliptic poles (40 deg^2). Interlaced with these surveys, a calibration program need to be also executed. Several static factors needs to be taken into account to define the surveys regions (galactic extinction, zodiacal light, density of stars and galaxies, straylight, etc.). The survey is also dynamically constrained to observe within a 23-degree band at 90 degrees from the Sun for thermal stability reasons and by the planets to avoid straylight.
In each field, four dithers are executed and for each of those dithers a simultaneous VIS image and a NISP slitless spectroscopy exposures are obtained which are then followed by three photometric NISP observations.

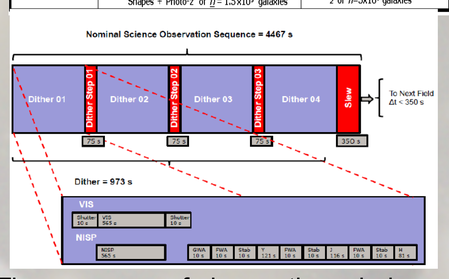


Wide survey and calibration observations projected over the galactic extinction map

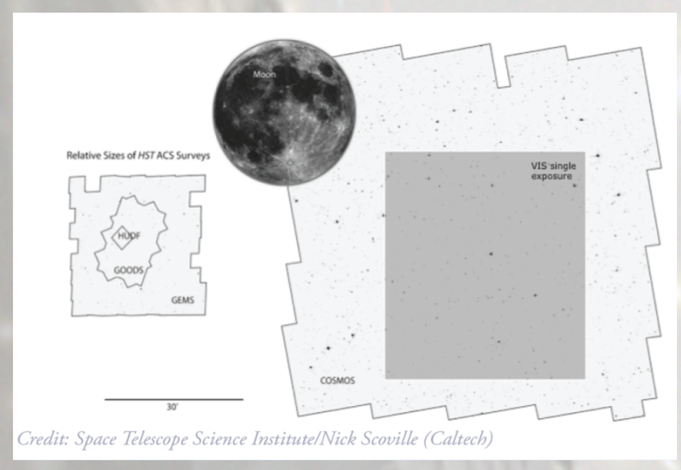


Evolution of visibility region throughout the year

SURVEYS						
	Area (deg2)	Description				
Wide Survey	**15,000 deg^2**	Step and stare with 4 dither pointings per step.				
Deep Survey	**40 deg^2**	In at least 2 patches of > 10 deg^2 2 magnitudes deeper than wide survey				
Wavelength range	550– 900 nm	Y (920-1146nm),	J (1146-1372 nm)	H (1372-2000nm)	1100-2000 nm	
Sensitivity	24.5 mag 10σ extended source	24 mag 5σ point source	24 mag 5σ point source	24 mag 5σ point source	3 10^{-16} erg cm-2 s-1 3.5σ unresolved line flux	
	Shapes + Photo-z of n = 1.5x10^8 galaxies			z of n=5x10^7 galaxies		



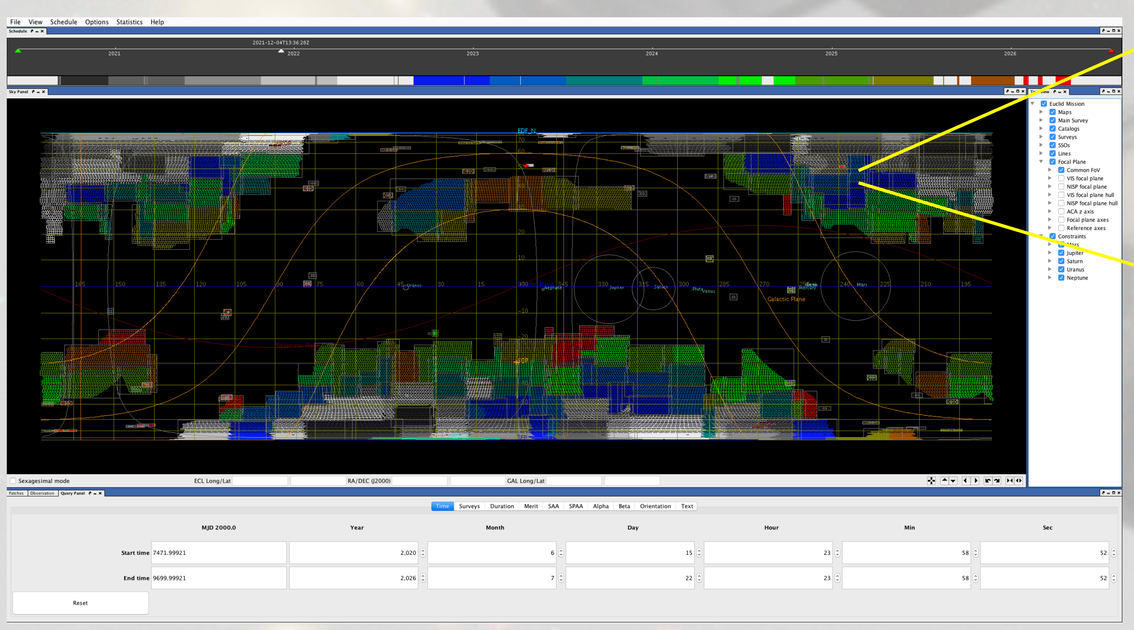
The sequence of observations during a nominal field observation

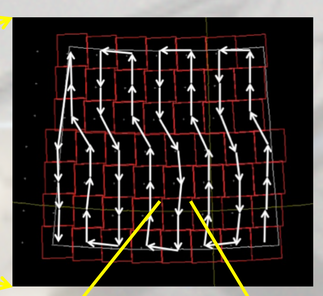


Comparison of a single Euclid field with respect to other surveys

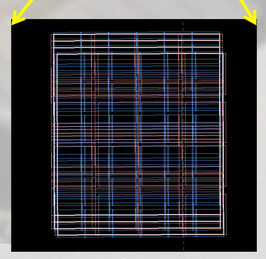
The Euclid Survey Software System (ESS)

The ESS is the software package in charge of the planification, visualization, validation and inspection of the past, present and future of the mission. It will take the Reference Survey generated from the Euclid Consortium and after validation it will converted to time-tagged pointing commands to ESA’s Mission Operation Centre (MOC). The ESS is implemented 100% in java and using GWT for the web components. It is fully OO and implemented using highly reusable components where the basic functionality is available: math, ephemerides, region representation, tessellation (HEALPIX& HTM), DB access, astrometry, etc.

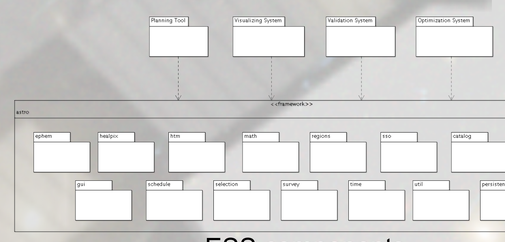




Patch visiting scheme



A field with the four dithers, VIS and NISP detectors superimposed



ESS components

A web interface to the survey.

euclid consortium

Isdefe

Questions/comments/want a demo? chase me or drop an email to: pedro.gomez@esa.int