# CC-IN2P3
# Journée des expériences 2017
# **Euclid**

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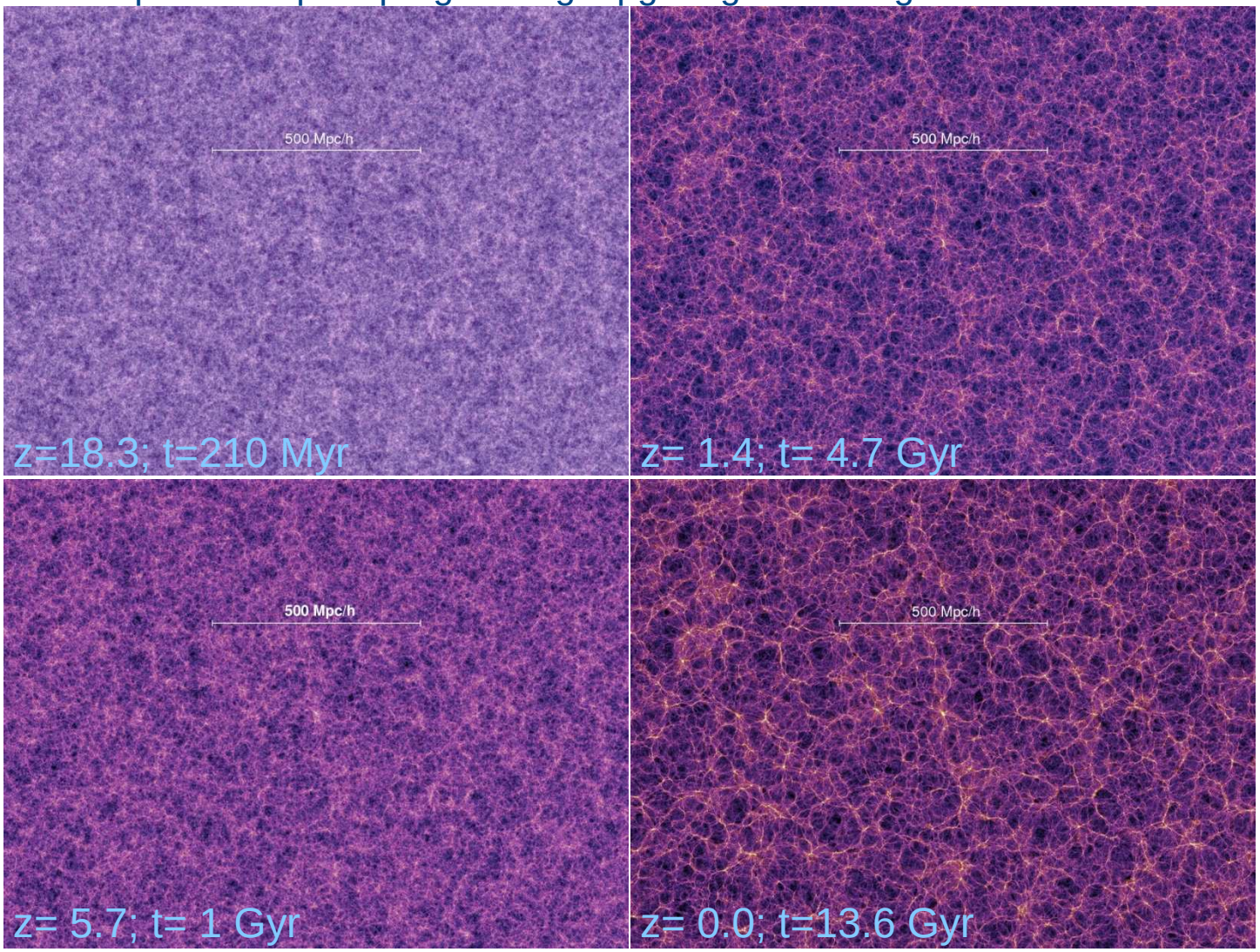
# The Core of Our Work



Much of what Euclid will do is look at the structure in the Universe.

- Dark Matter "helps" structure form gravitationally
- Dark Energy accelerates expansion and "retards" structure formation

http://wwwmpa.mpa-garching.mpg.de/galform/virgo/millennium/

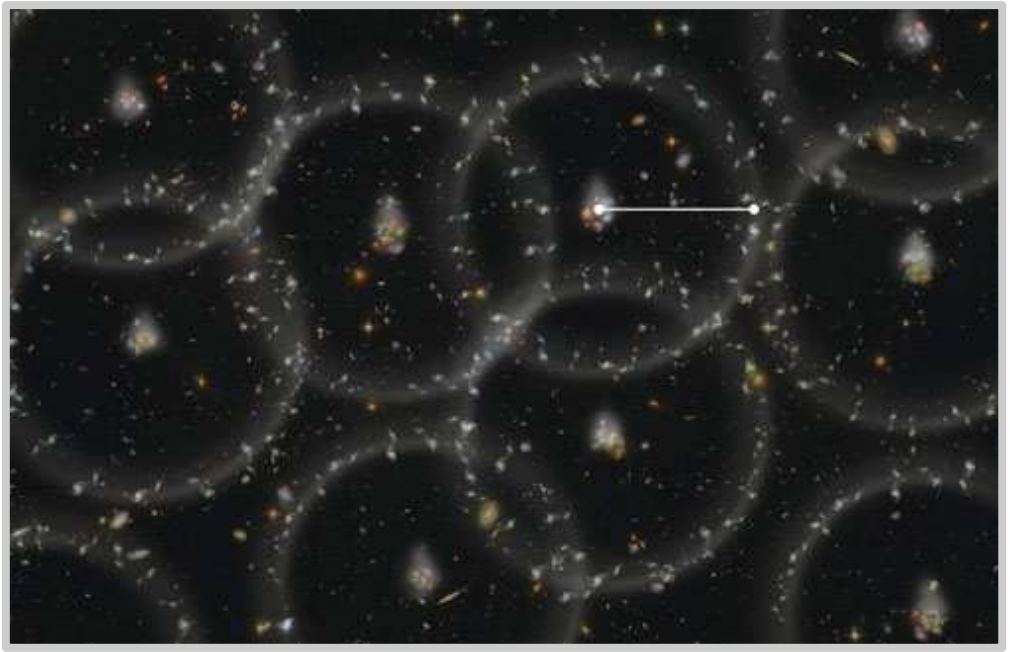


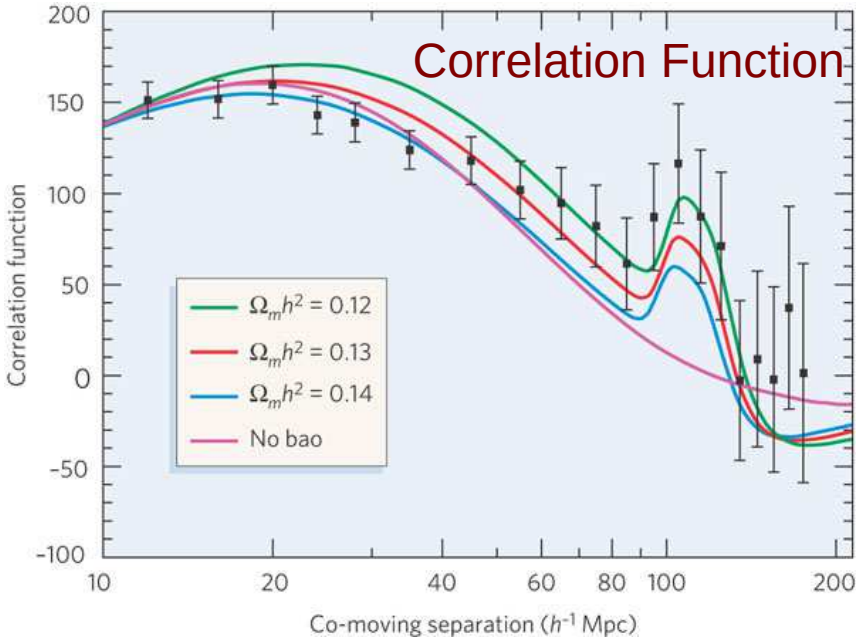

We thus want to make maps (& statistics) of "structure" as a function of time to understand both.

# Structure Informs us about Dark Matter



- Dark Matter (we believe) interacts only via gravity and contributes significantly to the number and sizes of large-scale structures we see in the Universe today.
- By studying these structures in ever more detail, then, we can hope to understand more about the nature of Dark Matter





# Structure Informs us about Dark Energy



- The Universe is expanding.
- The faster it expands, the more this expansion "counteracts" gravity and the less large scale structure we will have in the universe.
- Thus, by studying the amount of structure we have as a function of time, we can investigate the expansion and Dark Energy (and/or alternate theories of gravity)

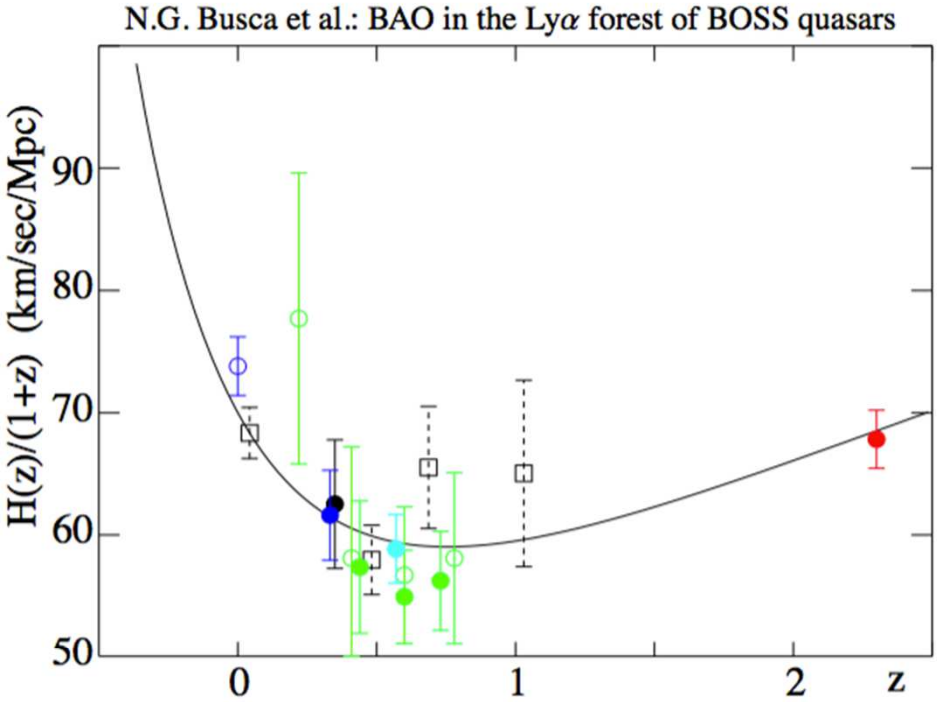
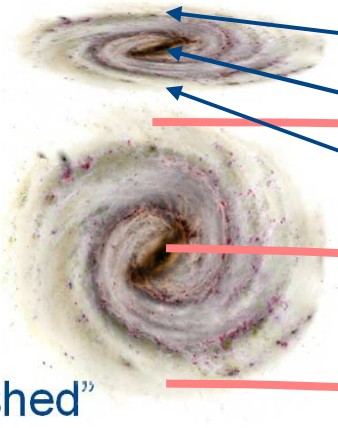



**Fig. 21.** Measurements of $H(z)/(1+z)$ *vs* $z$ demonstrating the acceleration of the expansion for $z < 0.8$ and deceleration for $z > 0.8$. The BAO-based measurements are the filled circles: [this work: red], [Xu et al. (2012): black] [Chuang & Wang (2012): blue], [Reid et al. (2012), cyan], and [Blake et al. (2012): green]. The open green circles are from WiggleZ (Blake et al., 2011b) Alcock-Paczynski data combined with supernova data yielding $H(z)/H_0$ (without the flatness assumption) plotted here assuming $H_0 = 70 \mathrm{km\,s^{-1}Mpc^{-1}}$. The open blue circle is the $H_0$ measurement of Riess et al. (2011). The open black squares with dashed error bars show the results of Riess et al. (2007) which were derived by differentiating the SNIa Hubble diagram and assuming spatial flatness. (For visual clarity, the Riess et al. (2007) point at $z = 0.43$ has been shifted to $z = 0.48$.) The line is the ΛCDM prediction for $(h, \Omega_M, \Omega_\Lambda) = (0.7, 0.27, 0, 73)$.

# Lensing Shear



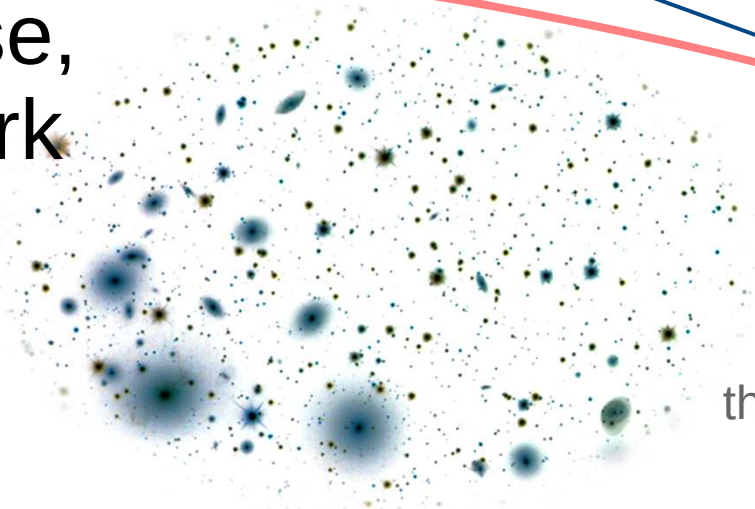


The distant galaxy seems to get "squashed"

Lensed light from our distant galaxy

http://images.gizmag.com/hero/top-five-astronomical-objects-new-telescope-22.jpg

Lensing, of course, tells us about Dark Matter.



Dark Matter between us & the distant galaxy bends the light from the Galaxy

But in addition, by mapping the Dark Matter with lensing in many different directions and at many different distances, we can again map larger scale structure and so also investigate Dark Energy.

# Euclid Mission at a glance

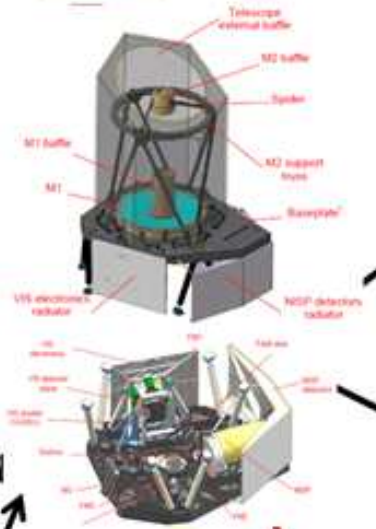
Euclid Consortium

esa

Soyuz@Kourou

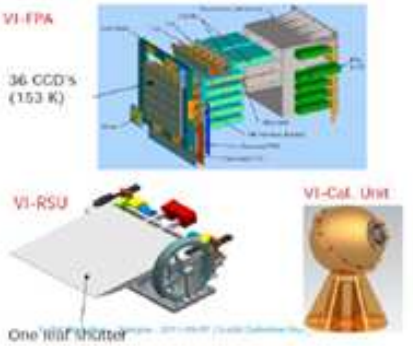
Q4 2020


PLM+SVM: 2010-2019



VIS imaging: 2010-2020

(VIS team)



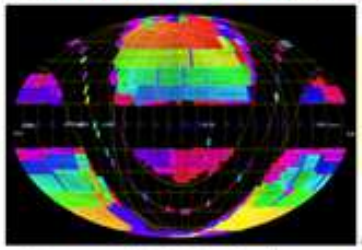

VIS

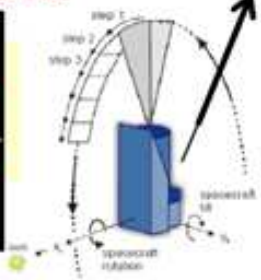
NIR spectro-imaging

2010-2020 (NISP team)

NISP


Surveys: 2010-2028 (Survey WG)





6 yrs - 15,000 deg$^2$

Commisionning – SV

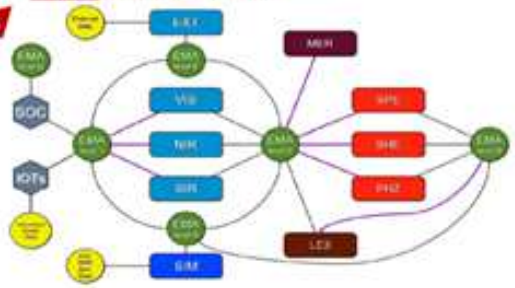
Euclid opération:

5.5 yrs:Euclid Wide+Deep

+: SNIa, mu-lens, MW?

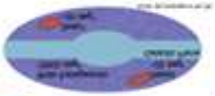
Ground data

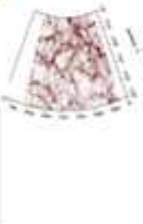
SGS: 2010-2028



SWG:

2019-2028





20-30 PB data processing (EC-SGS team) — Science analyses

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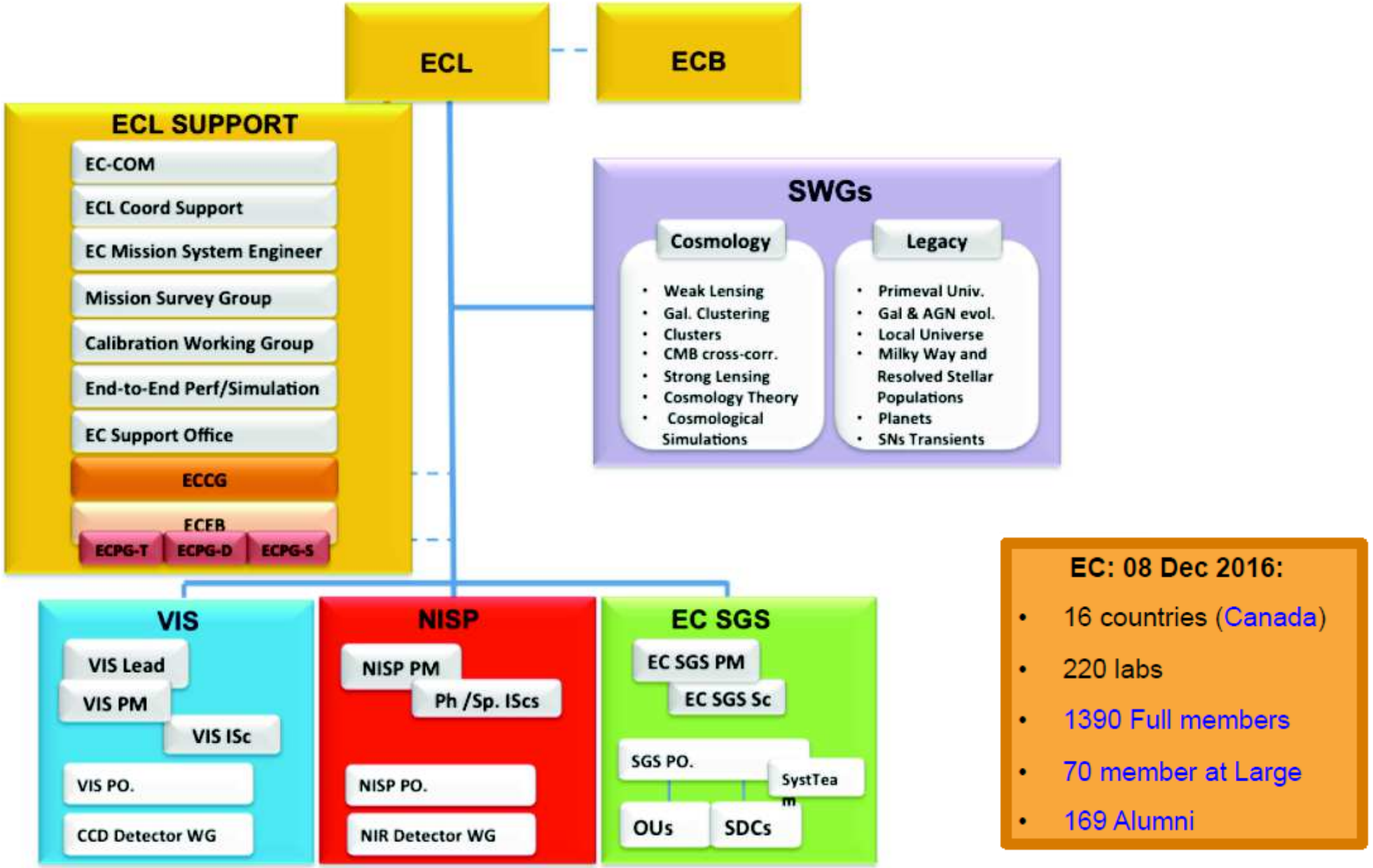
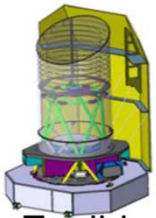
# Euclid Consortium





# Euclid Science Groud Segment (SGS)

Euclid Consortium

Euclid

Ground Station

SDC

MOC
ESOC

DDS

SOC
ESAC

Public Archive

scientific community

EAS

External data
( DES, KiDS, ... )

Project Office

System Team

Simulation

OU-SIM

SDC SDC SDC SDC SDC SDC SDC SDC SDC

| OU-PHZ | OU-SHE | OU-VIS | OU-LE3 | OU-SPE | OU-SIR | OU-MER | OU-NIR | OU-EXT |
|---|---|---|---|---|---|---|---|---|
| Phot Red Sh. | Morpho & Shear | VIS Imag | Level 3 | Spectro Meas | NIR Spectro | Euclidisation | NIR Imag | Ext Data |

OU coordinator

OU deputy coordinator



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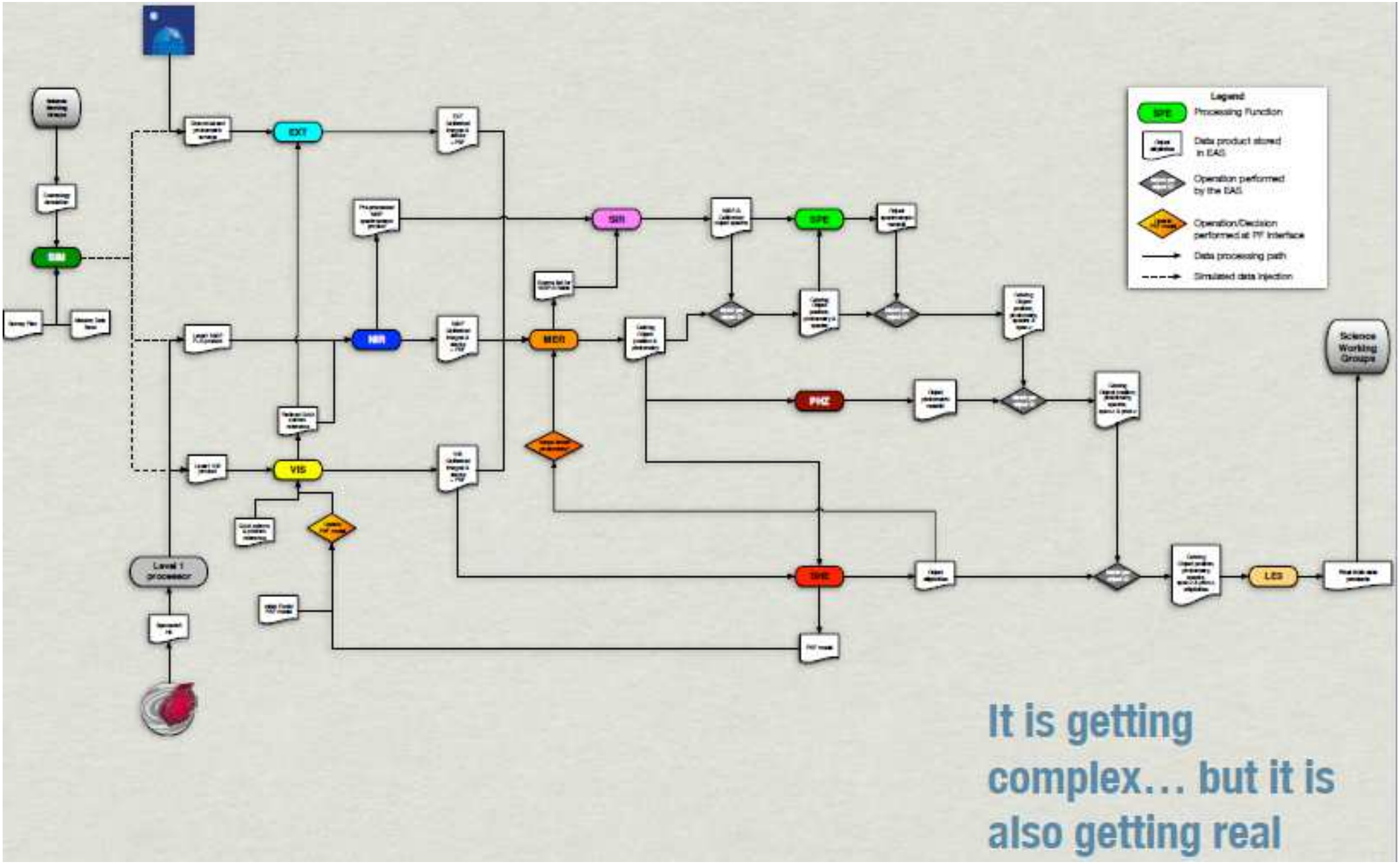
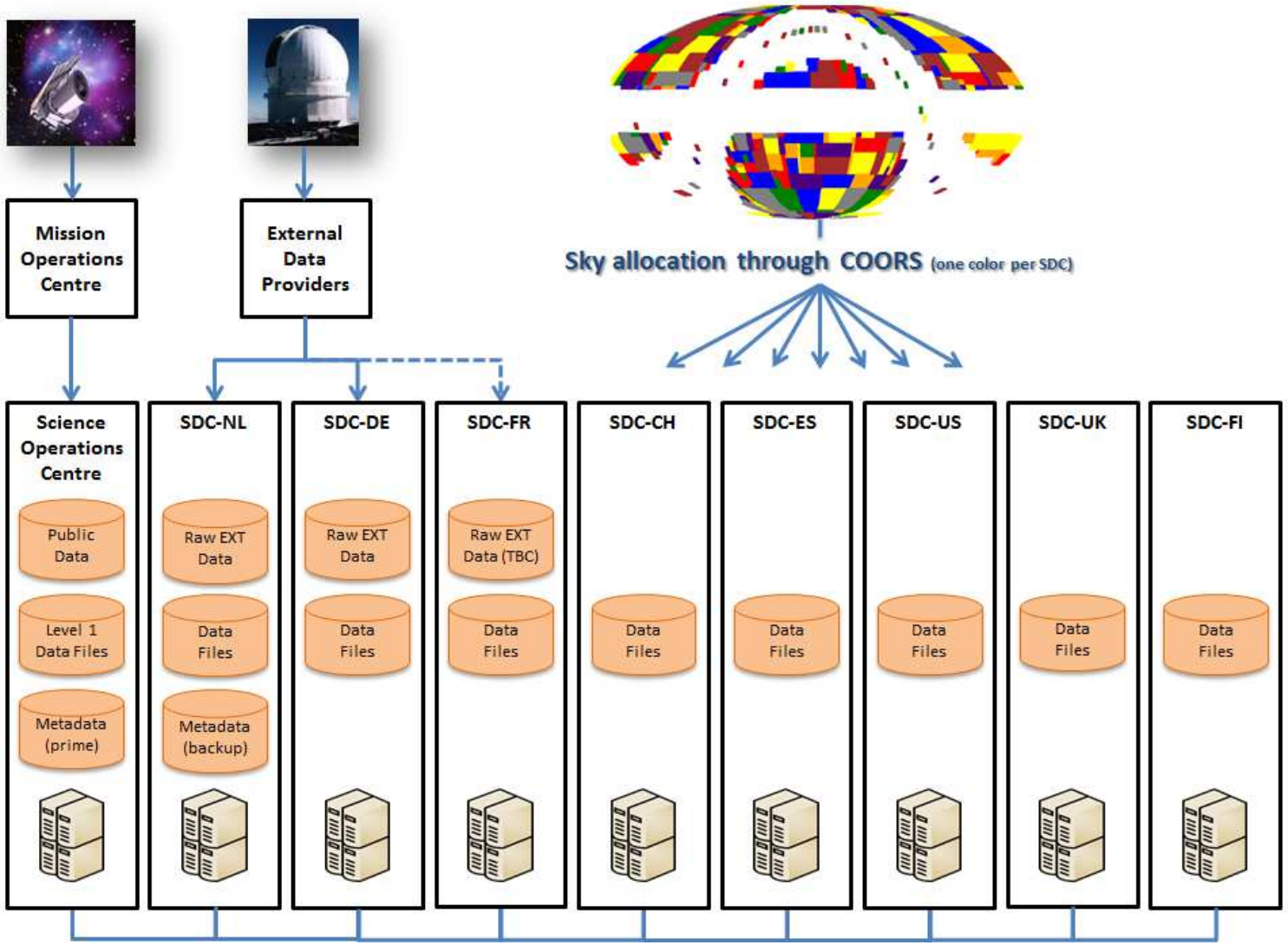
# Euclid – Pipeline de production

Euclid Consortium



# Euclid SGS Architecture

Euclid Consortium




SDCs are both storage and processing nodes

Data storage and processing allocated by sky area



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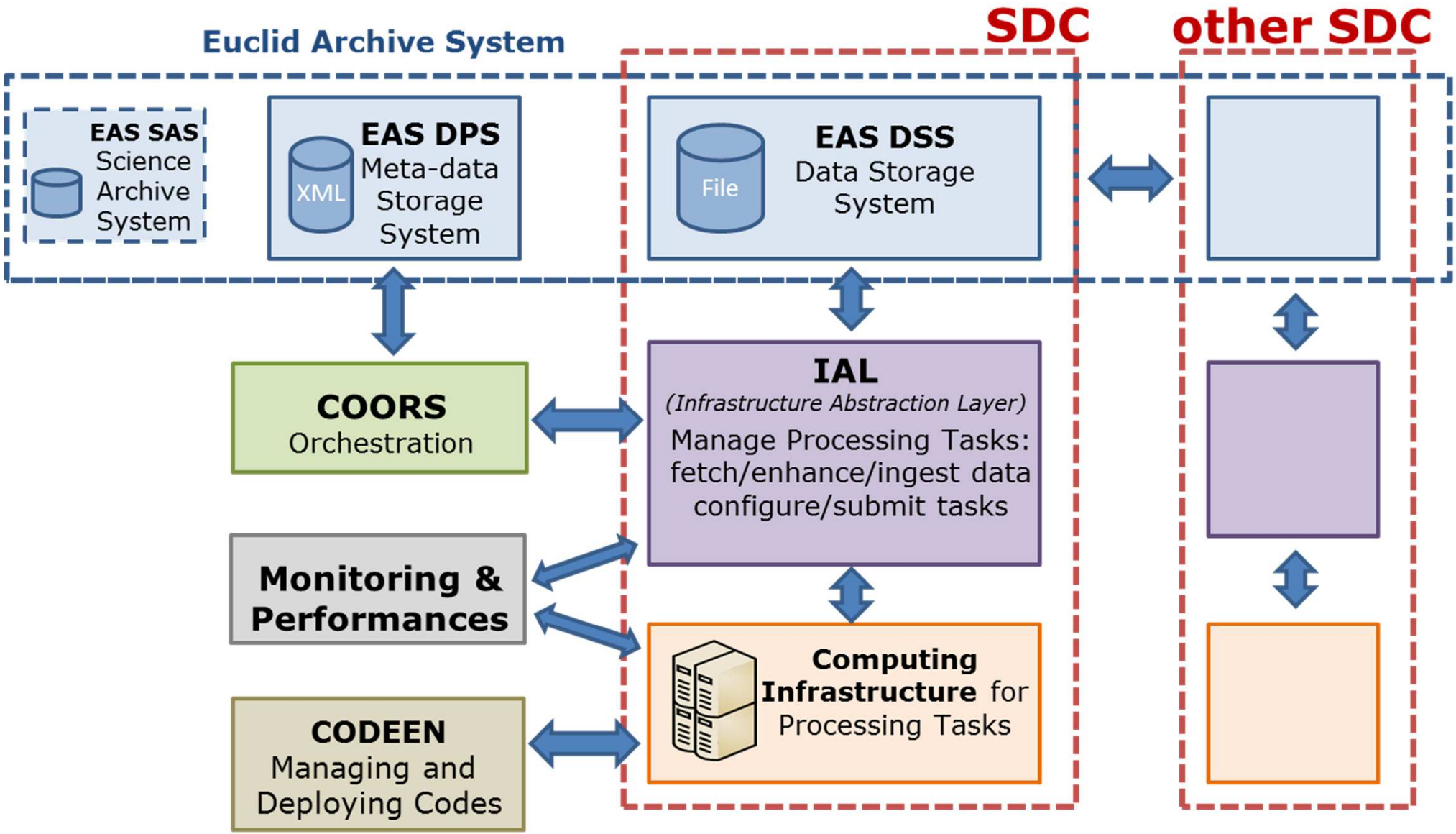
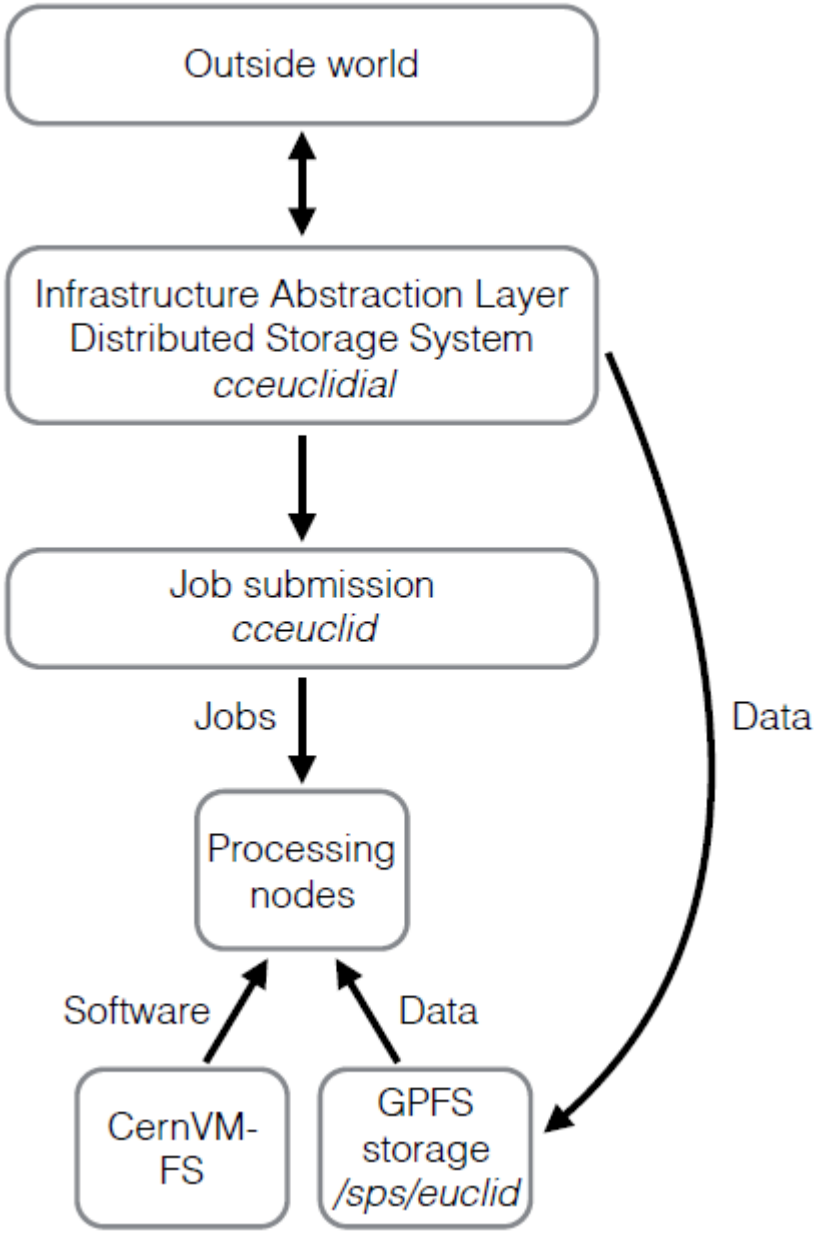
# Euclid SGS Components

Euclid Consortium



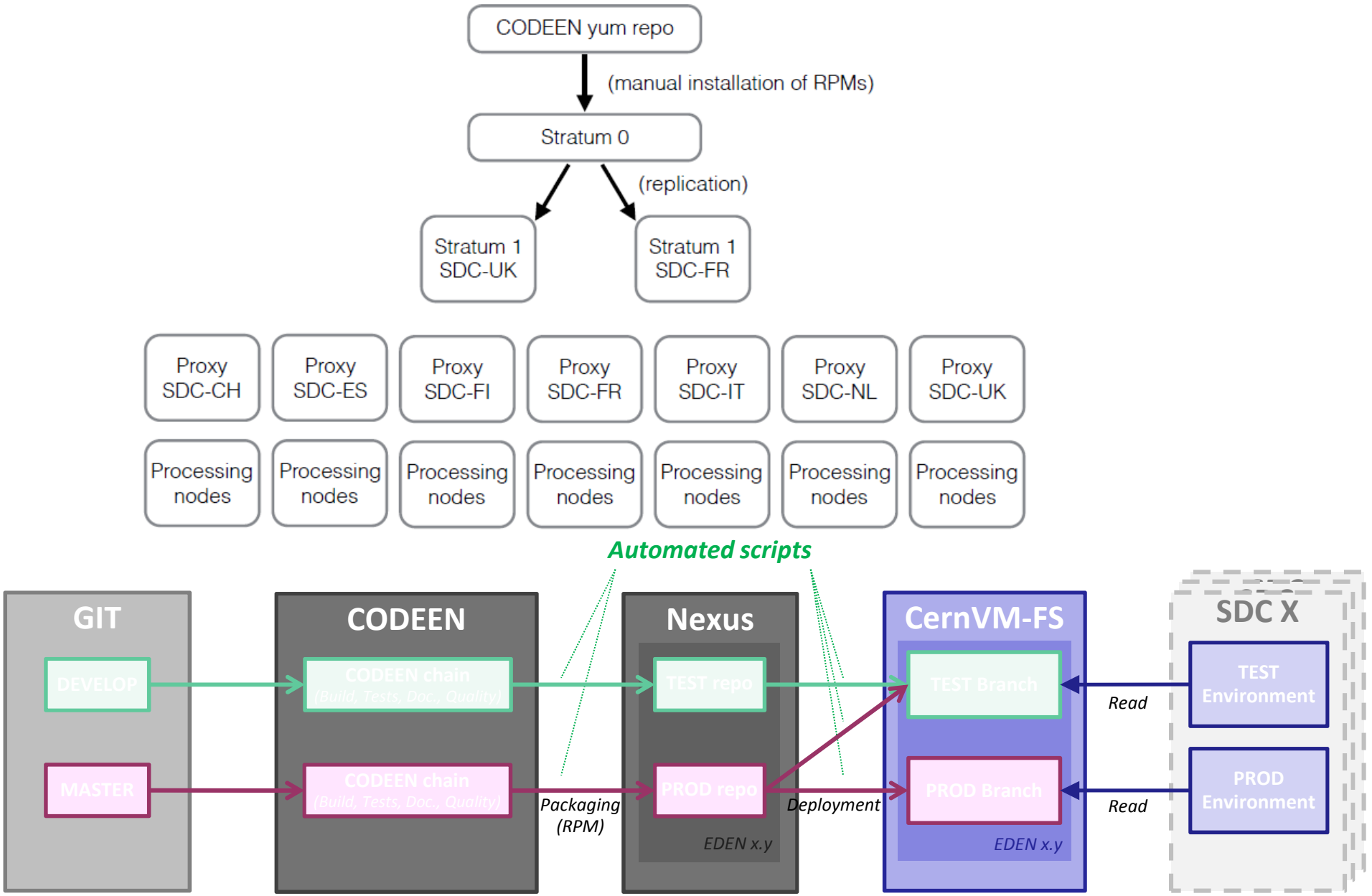
# Euclid @ CC-IN2P3 – cinématique

Euclid Consortium



# Euclid @ CC-IN2P3 - cvmfs

Euclid Consortium



# Euclid @ CC-IN2P3 – Moyens en place



- Composants SGS
  - trois machines de service dédiées : cceuclidial (IAL / DSS), cceuclid (soumission des jobs), et le slave Jenkins. VM CentOS 7 hébergées dans OpenStack
  - .
- Un tenant OpenStack euclid (utilisé pour des tests)
  - Cluster virtuel élastique (HTCondor, elactic) de µCernVM
- Cluster de processing CentOS7: baseline de production Euclid
  - Baseline = HTC
  - Challenges, SPV, Simulations, prototypes…
- HTC-Euclid: tests (un seul utilisateur)

# Euclid @ CC-IN2P3 – Moyens en place

Euclid Consortium

- Un slave Jenkins pour la plateforme d'intégration continue CODEEN
- Un stratum 1 pour l'infrastructure de déploiement continu cvmfs
- Stockage
  - Ressources SPS pour les jobs de processing
  - iRODS pour le partage de données de tests et de simulations, et interface HPSS
    - 1 compte générique en lecture seule
    - 1 compte par activités en lecture/écriture
- 92 comptes actuellement rattachés aux activités Euclid

# Euclid @ CC-IN2P3 – Généralités



- Le CC-IN2P3 fournit l'infrastructure de production pour le SDC-FR Euclid

- Une convention CNES-IN2P3 a été établie
  - Tranche ferme pour les phases C2/D (2015-2020)
  - Tranche conditionnelle pour les phase E1/DR1 (2021-2022)
  - Roadmap des moyens de stockage, de processing et de réseau mis à disposition par le CC-IN2P3
  - Financement CNES de CDD et mission
    - De 1 à 3 CDD en support à Euclid
  - Modalités de suivi des ressources et activités
    - Note de gouvernance, manuel utilisateur
    - Comité directeur en début d'année
    - Projet Redmine dédié

# Euclid @ CC-IN2P3 – Généralités



- Le CC-IN2P3 participe au développement et activités du SGS Euclid:
  - Support aux activités du SGS
  - Intégration des composants SGS
  - Challenges scientifiques et techniques
  - Support aux tests d'intégration et de validation
  - Run de production pipeline Euclid
  - Testbed, bench
  - …

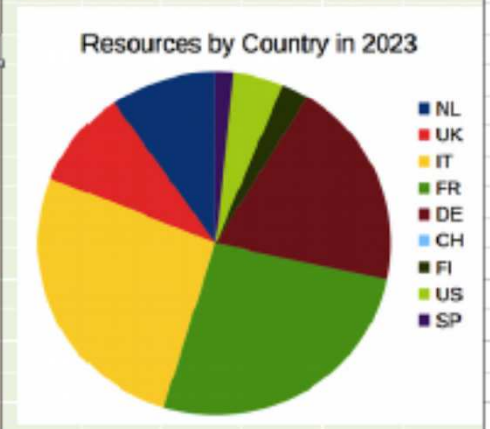
# Euclid @ CC-IN2P3 - Roadmap

Euclid Consortium

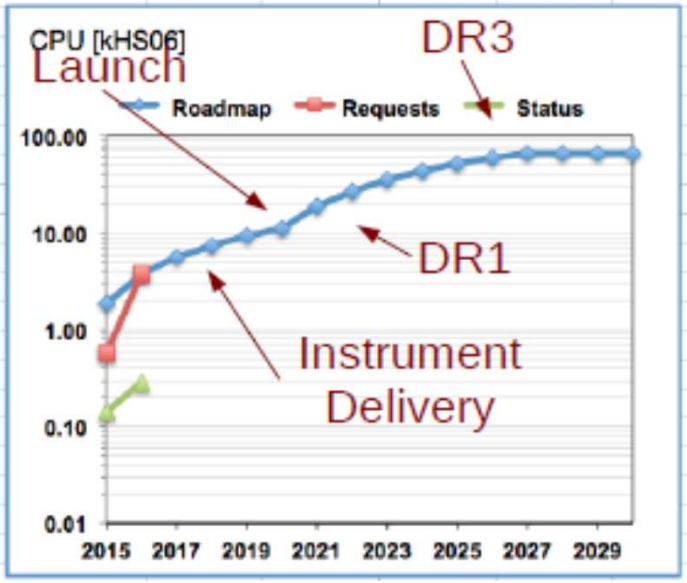
PM2016 — *Units : CPU [kHS06] / Storage [PB]*

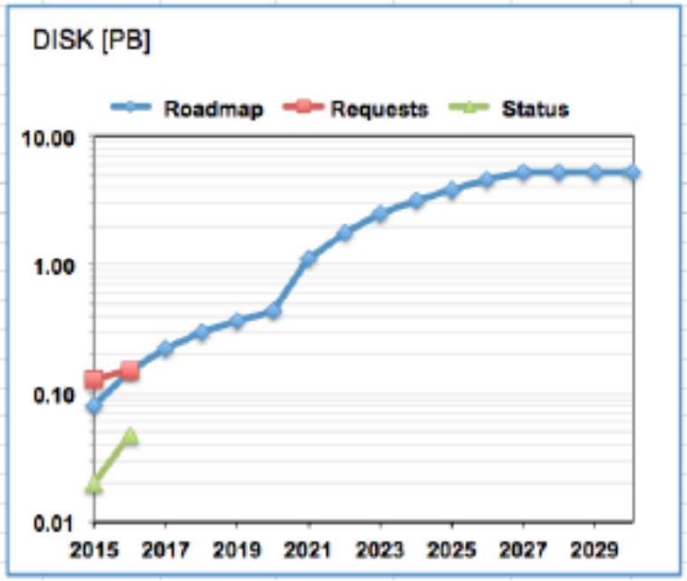
| Years | Total Euclid CPU | Total Euclid Disk | Total Euclid Tape | CC-IN2P3 CPU | CC-IN2P3 Disk | CC-IN2P3 Tape | CC-IN2P3 increment CPU | CC-IN2P3 increment Disk | CC-IN2P3 increment Tape | Requests CPU | Requests Disk | Requests Tape | Status [% requests] CPU | | Status [% requests] Disk | | Status [% requests] Tape | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2015 | 6.24 | 0.271 | 2.706 | 1.87 | 0.08 | 0.81 | 1.87 | 0.08 | 0.81 | 0.570 | 0.13 | 0.10 | 0.143 | 25% | 0.020 | 15% | 0.005 | 5% |
| 2016 | 12.49 | 0.508 | 5.081 | 3.75 | 0.15 | 1.52 | 1.88 | 0.07 | 0.71 | 3.747 | 0.152 | 1.524 | 0.285 | 8% | 0.048 | 31% | 0.014 | 1% |
| 2017 | 18.73 | 0.746 | 7.457 | 5.62 | 0.22 | 2.24 | 1.87 | 0.07 | 0.71 | | | | | | | | | |
| 2018 | 24.98 | 0.983 | 9.832 | 7.49 | 0.29 | 2.95 | 1.88 | 0.07 | 0.71 | | | | | | | | | |
| 2019 | 31.22 | 1.221 | 12.208 | 9.37 | 0.37 | 3.66 | 1.87 | 0.07 | 1.52 | | | | | | | | | |
| 2020 | 37.50 | 1.458 | 14.583 | 11.25 | 0.44 | 4.37 | 3.76 | 0.15 | 1.43 | | | | | | | | | |
| 2021 | 64.29 | 3.750 | 37.500 | 19.29 | 1.13 | 11.25 | 9.91 | 0.76 | 7.59 | | | | | | | | | |
| 2022 | 91.07 | 6.042 | 60.417 | 27.32 | 1.81 | 18.13 | 9.91 | 0.76 | 7.59 | | | | | | | | | |
| 2023 | 117.86 | 8.333 | 83.333 | 35.36 | 2.50 | 25.00 | 9.91 | 0.76 | 8.40 | | | | | | | | | |
| 2024 | 144.64 | 10.625 | 106.250 | 43.39 | 3.19 | 31.88 | 9.91 | 0.76 | 8.30 | | | | | | | | | |
| 2025 | 171.43 | 12.917 | 129.167 | 51.43 | 3.88 | 38.75 | 11.79 | 0.84 | 14.46 | | | | | | | | | |
| 2026 | 198.21 | 15.208 | 152.083 | 59.46 | 4.56 | 45.62 | 17.95 | 1.45 | 14.46 | | | | | | | | | |
| 2027 | 225.00 | 17.500 | 175.000 | 67.50 | 5.25 | 52.50 | 17.94 | 1.45 | 15.27 | | | | | | | | | |
| 2028 | 225.00 | 17.500 | 175.000 | 67.50 | 5.25 | 52.50 | 9.91 | 0.76 | 8.30 | | | | | | | | | |
| 2029 | 225.00 | 17.500 | 175.000 | 67.50 | 5.25 | 52.50 | 9.91 | 0.76 | 14.46 | | | | | | | | | |
| 2030 | 225.00 | 17.500 | 175.000 | 67.50 | 5.25 | 52.50 | 11.79 | 0.84 | 14.46 | | | | | | | | | |

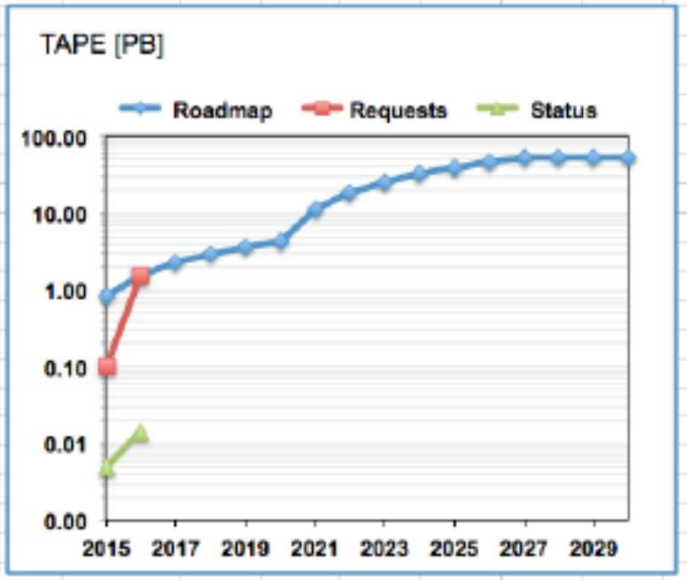
France is expected to provide 20-30% of computing resources needed Euclid product deliveries.




Rachid Lemrani



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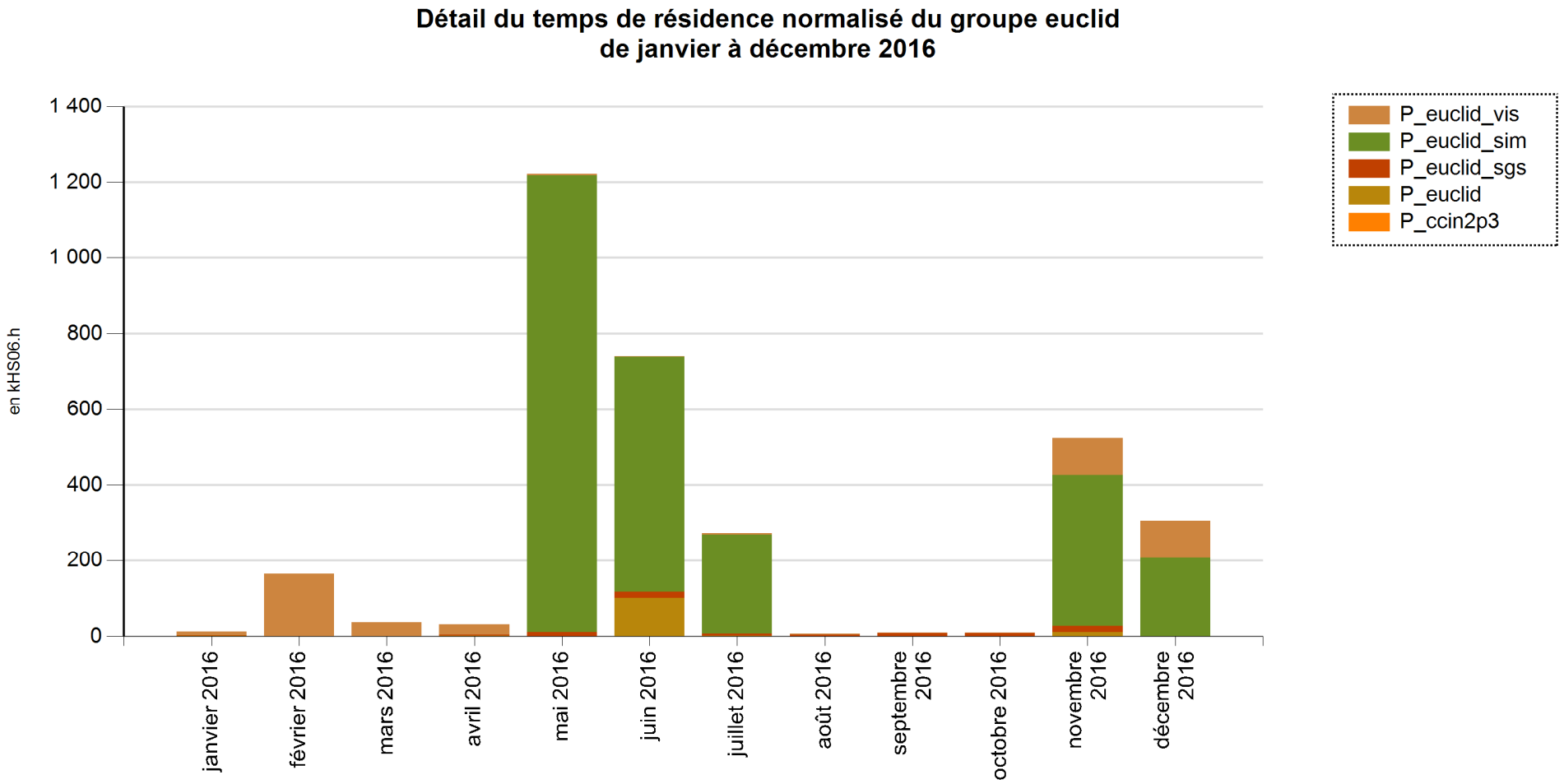
# Euclid@ CC-IN2P3 – Conso. 2016

Euclid Consortium



# Euclid @ CC-IN2P3 – Requêtes 2017

Euclid Consortium

2017 summary requests for Euclid experiment by Rachid Alaoui Lemrani:

| | 1st quarter | 2nd quarter | 3rd quarter | 4th quarter | Overall for 2017 |
|---|---|---|---|---|---|
| CPU units: | 4000000 HS06 (H) | 12000000 HS06 (H) | 12000000 HS06 (H) | 4000000 HS06 (H) | 32000000 HS06 (H) |
| CPU comments: | E2E : 10 MHS06.h / SPV : 17 MHS06.h (2eme&3eme trimestres) / VIS PF : 2,5 MHS06.h / SIM 3 MHS06.h (Total : 2/3 de la roadmap) | | | | |
| | 1st quarter | 2nd quarter | 3rd quarter | 4th quarter | Overall for 2017 |
| HPSS mass storage: | 500000 GiB | | | | 500000 GiB |
| Mass storage comments: | Accédé via irods : SPV : 200 TB, E2E 20 TB, SIM : 30 TB, NISP : 200TB (Total : 1/4 de la roadmap) | | | | |
| | 1st quarter | 2nd quarter | 3rd quarter | 4th quarter | Overall for 2017 |
| Semiper (SPS): | 132000 GiB | | | | 132000 GiB |
| iRods: | 30000 GiB | | | | 30000 GiB |
| Disk storage comments: | VIS 30 TB, SPV : ~60 TB (30% d'HPSS), E2E : 15 TB, SIM : 45 TB (correspond à la roadmap 2017) | | | | |

- Activités 2017
  - Challenge Scientifique n° 3 (SCI3)
  - Science Performance Verification n° 02 (SPV02)
  - Simulations SIM, VIS et PSF
  - Tests des prototypes MER, SIR, VIS
  - …

# Euclid @ CC-IN2P3 - perspectives

Euclid Consortium

- Rédaction d'un dossier d'architecture, d'un manuel d'opérations
- Expansion du cluster CentOS7
- Participation aux challenges à venir
- Migration de la plateforme d'intégration et de déploiement continu (CODEEN) actuellement hébergé à l'APC dans le cloud Openstack du CC-IN2P3
- Utilisation du cluster GPU pour des tests d'algorithmes de machine learning