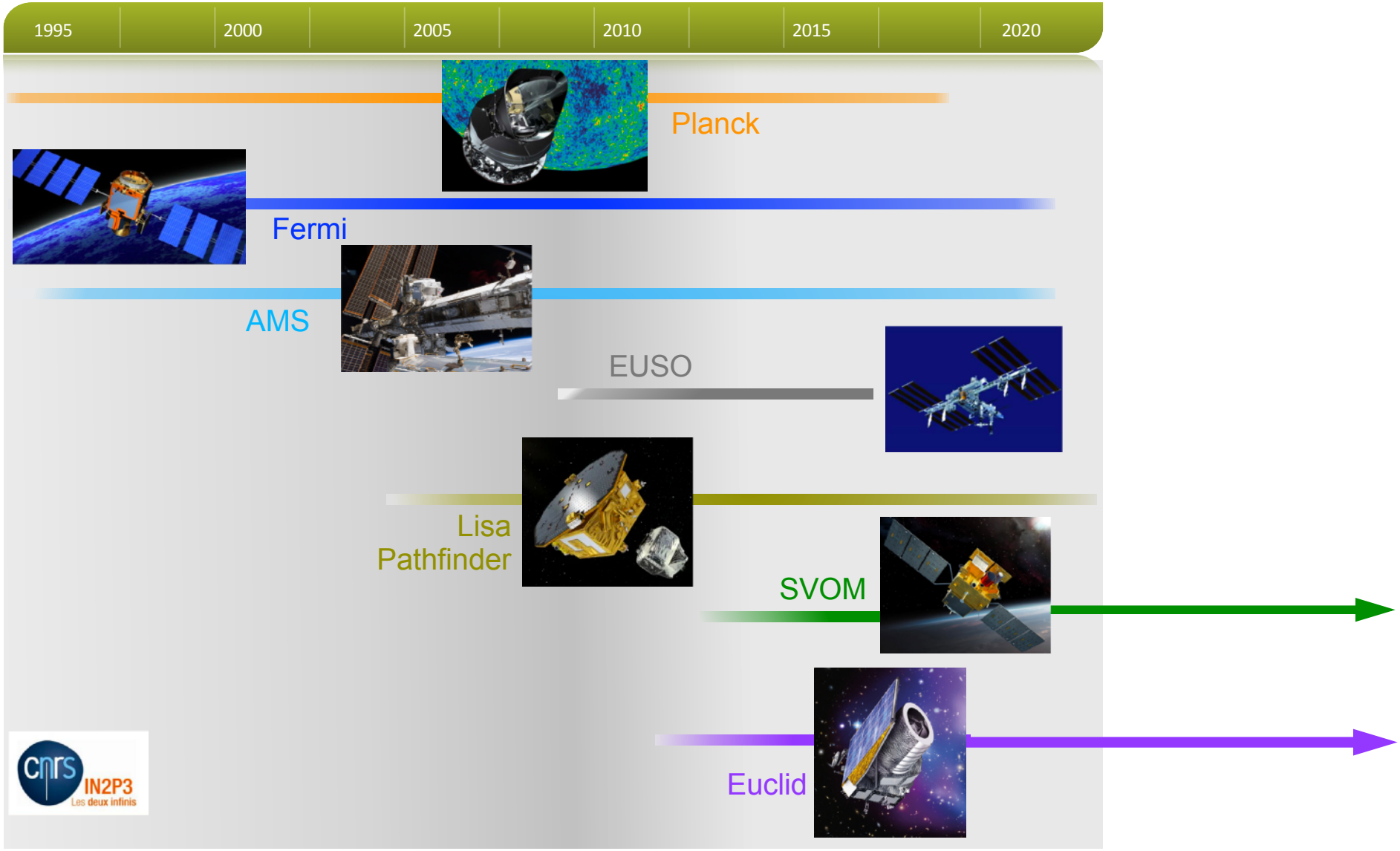
IN2P3 in Space Part I
« Summary » and next steps

June 2020 IN2P3 scientific council

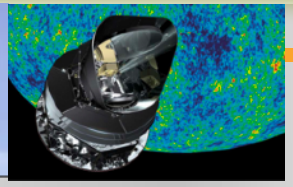
IN2P3 in space: past and present (discussed today)



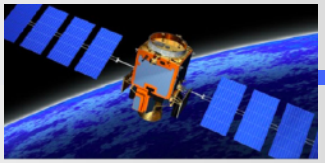
Complementary balloon adventures

1995 | 2000 | 2005 | 2010 | 2015 | 2020

Archeops



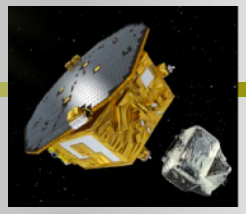
Planck



Fermi

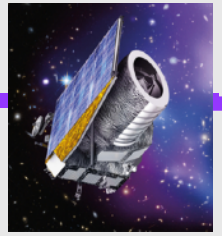
AMS

EUSO



Lisa Pathfinder

SVOM



Euclid

cnrs IN2P3 Les deux infinis

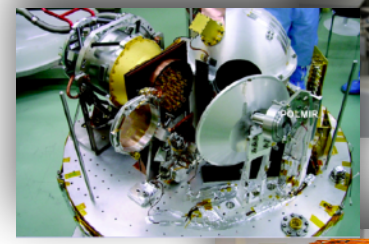
Involvement of IN2P3 teams at each step

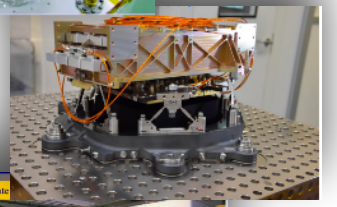
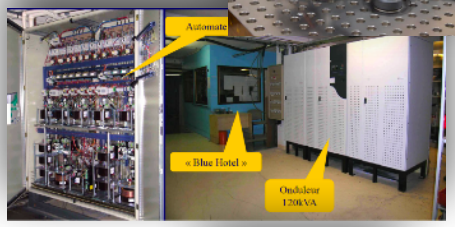
Instrumental deliveries

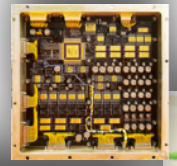
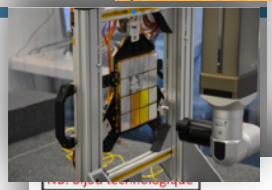
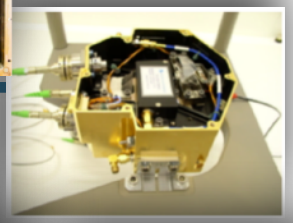
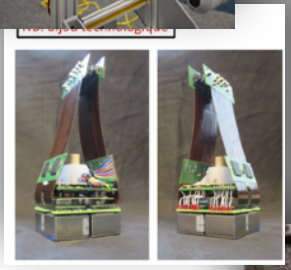
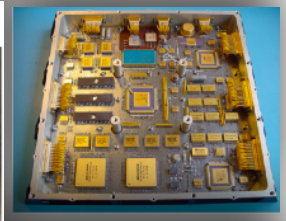
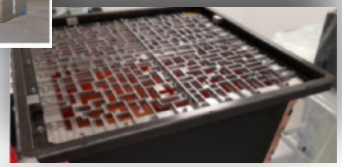
Integration, calibration

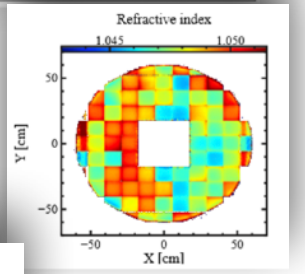
Data analysis and simulations

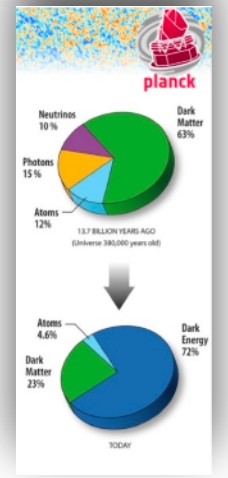
Scientific results
- astroparticles
- cosmology

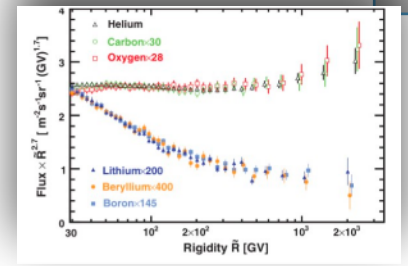






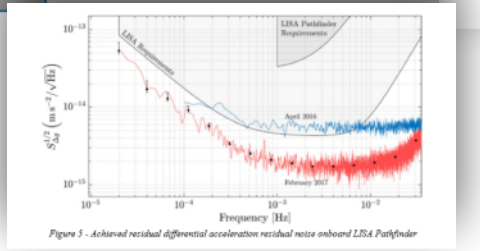
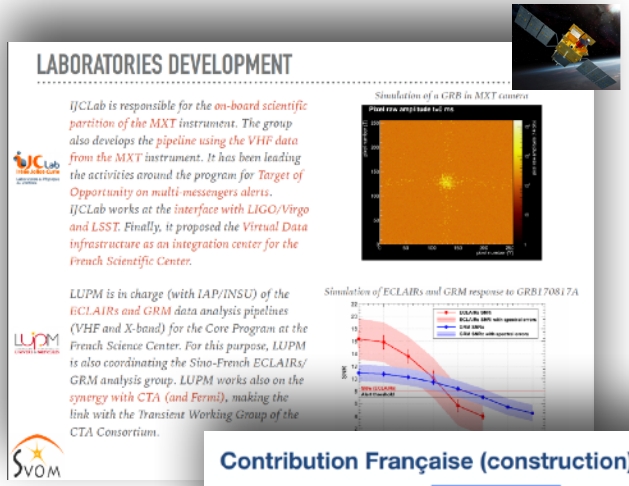


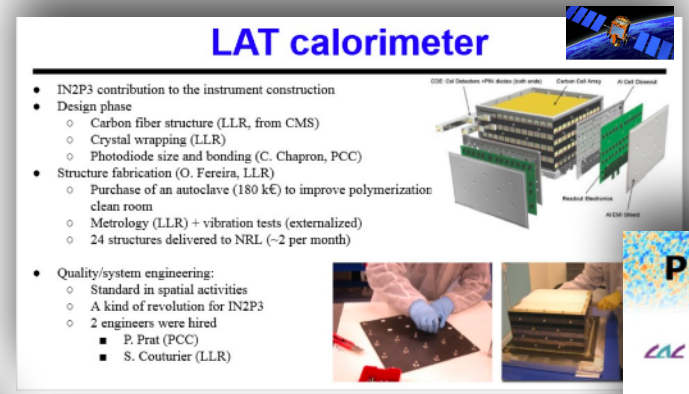
Figure 5 - Achieved residual differential acceleration residual noise onboard LISA Pathfinder

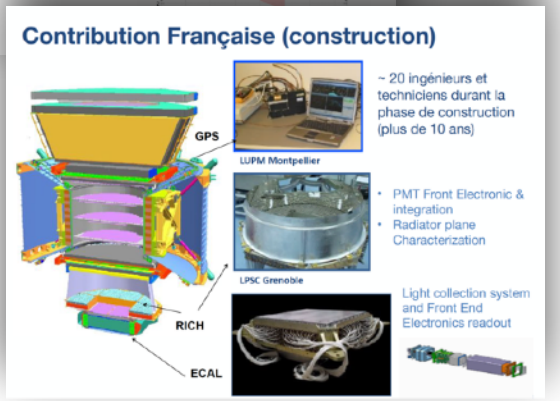
Space instruments instrumental deliveries

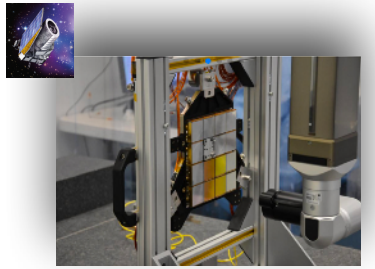
Contributions in various technical domains for space instruments construction:

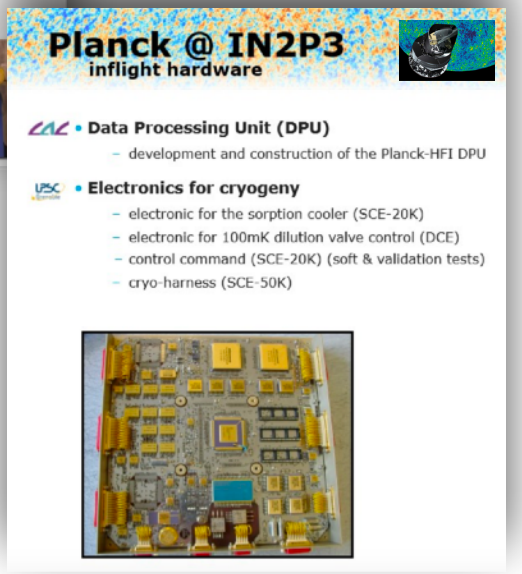
- conception, realisation and delivery of detection systems
- mechanics for flight models: design and fabrication
- electronics & computing for on-board processing unit
- electronics for on-board cryogenic systems
- …





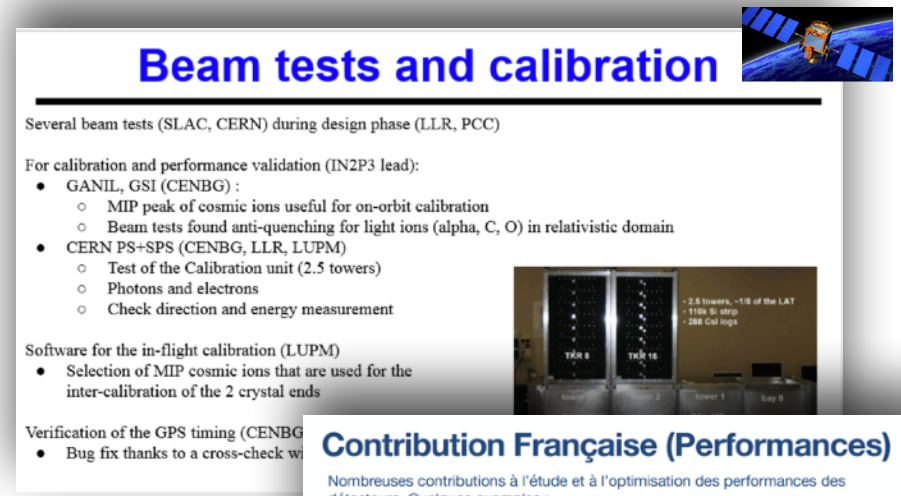


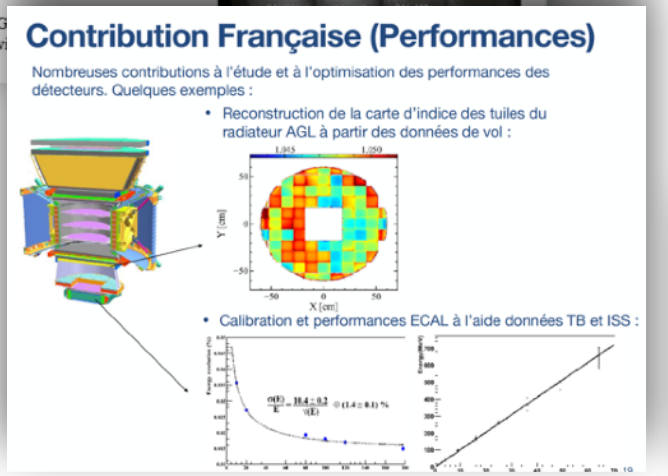


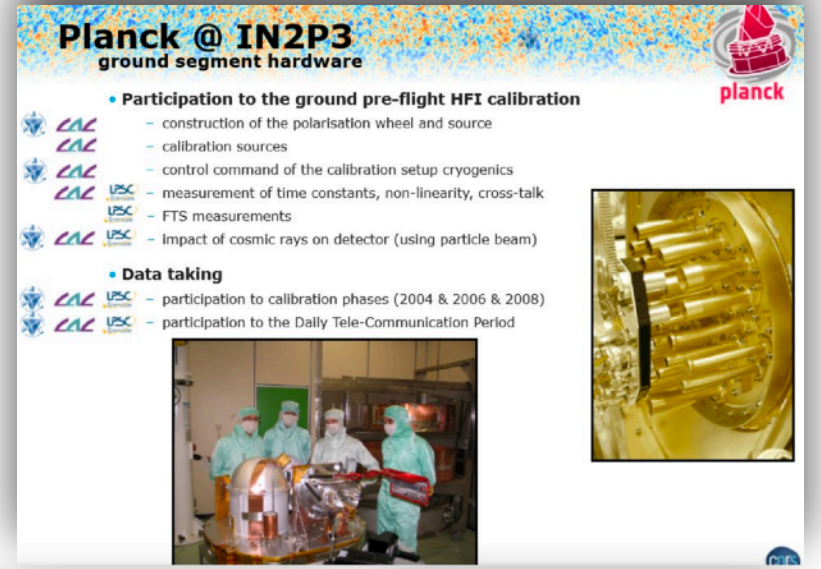


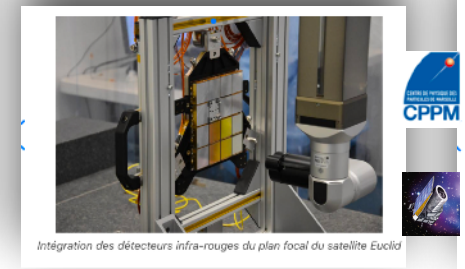
Space instruments AIT/AIV/Calibration

Large involvements of IN2P3 teams in characterisation and calibration of instruments
- from component level characterisation
- to integrated level calibration operations in cold environment (in dedicated cryostats)
- design, fabrication and deliveries of Ground Segment Equipment for such activities
- till in-flight calibration operations

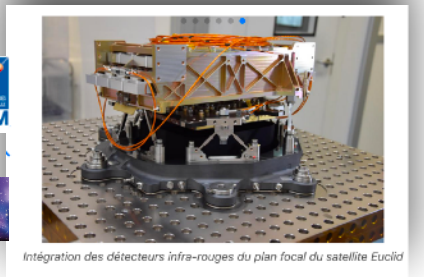






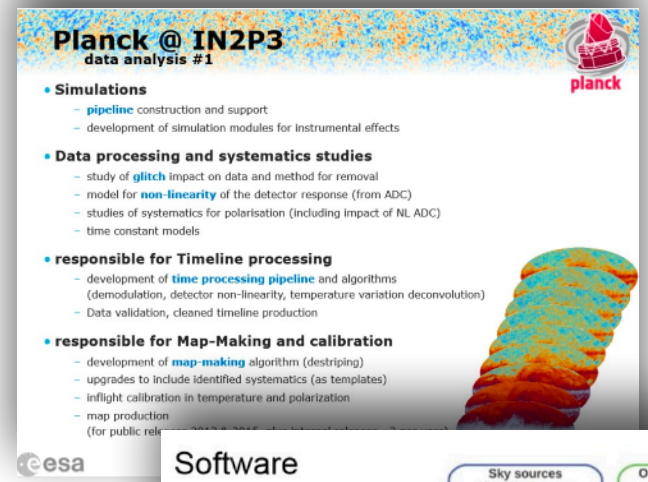


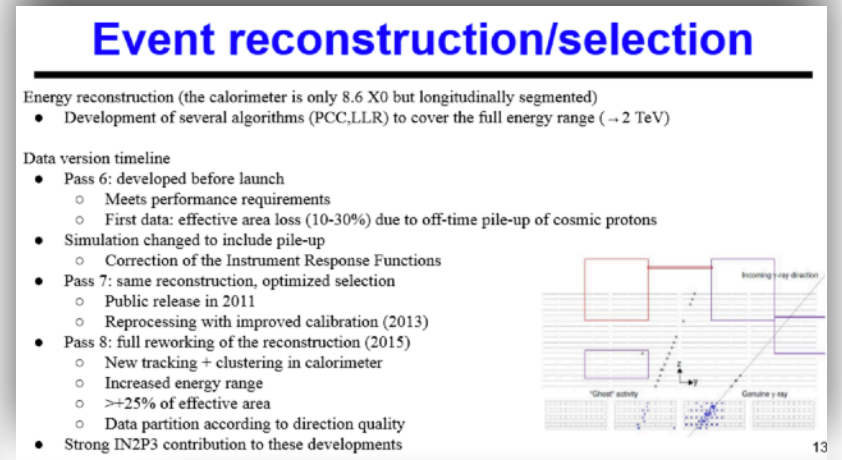
Intégration des détecteurs infra-rouges du plan focal du satellite Euclid

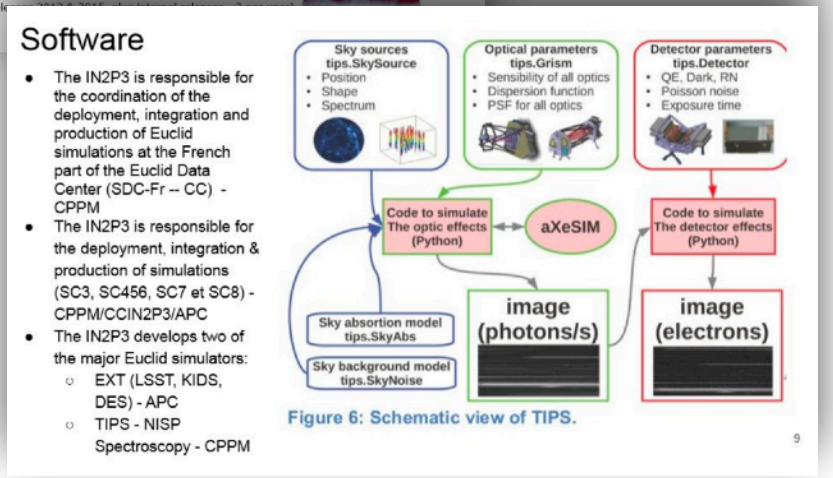

Intégration des détecteurs infra-rouges du plan focal du satellite Euclid

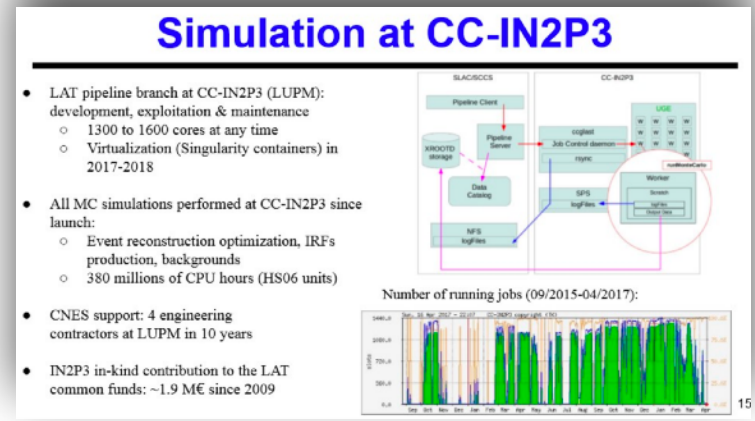
Data Analysis & simulations

- Data analysis activities in close link with instrumental developments
- Simulations, production, data processing,
- Instrumental systematics & the end of the statistics dominated error bars
- Close interactions between scientific and technical teams
- Key role of CC-IN2P3 data center for some missions
- (not to mention shifts, participation in IOT…)



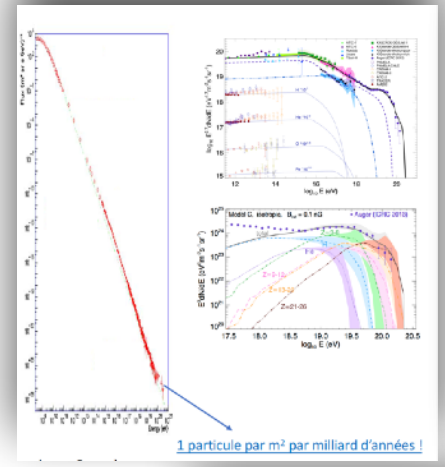


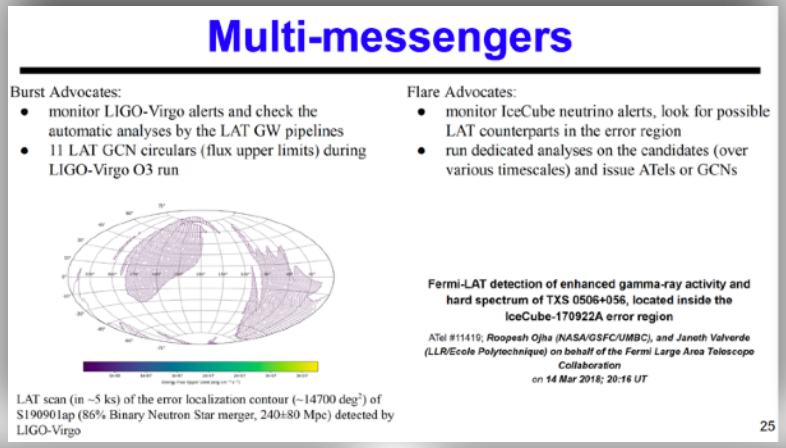


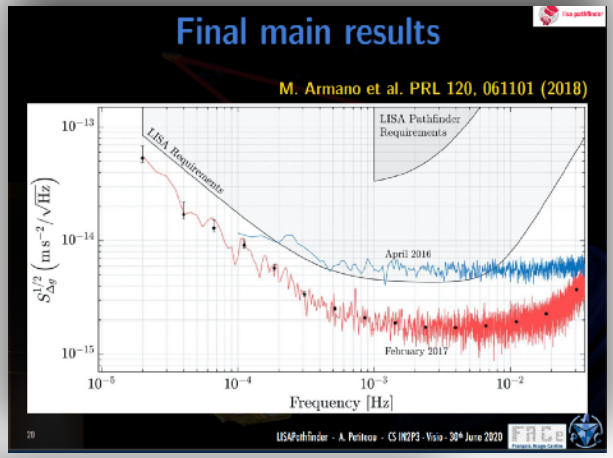


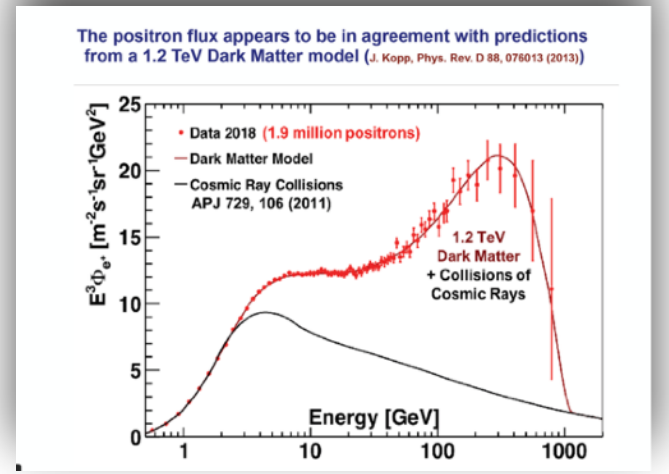
Astroparticles physics: results ! and prospects

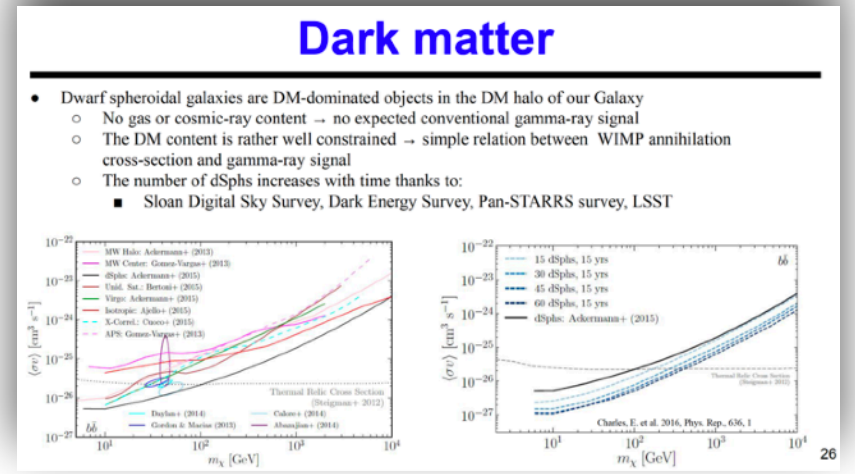
- Better characterise and hence understand the physical processes at the origin of the cosmic messengers: gamma rays, neutrinos, cosmic rays, gravitational waves…
- constrain the models of SN, Pulsars, AGN/Blazars, …
- hopefully get insiders to the nature of Dark Matter.



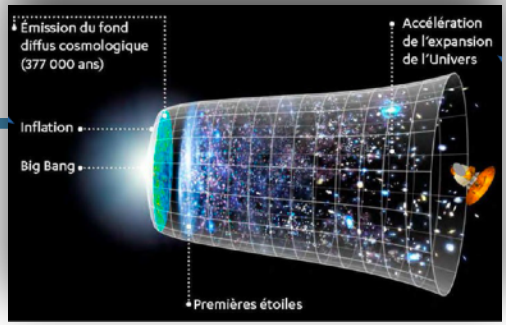




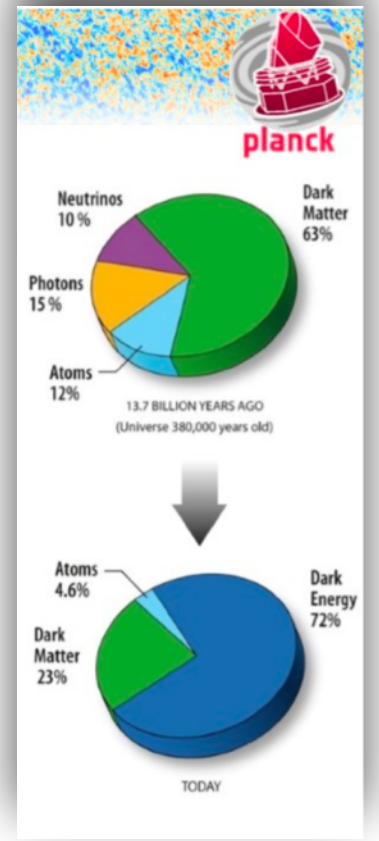


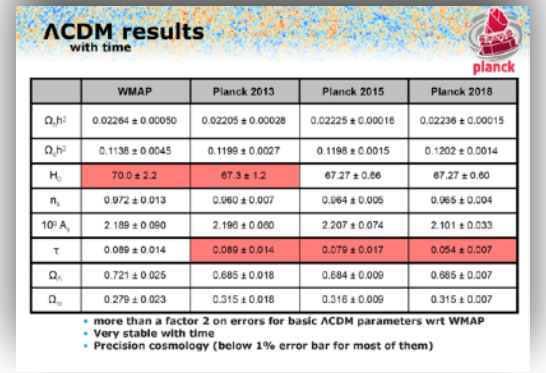


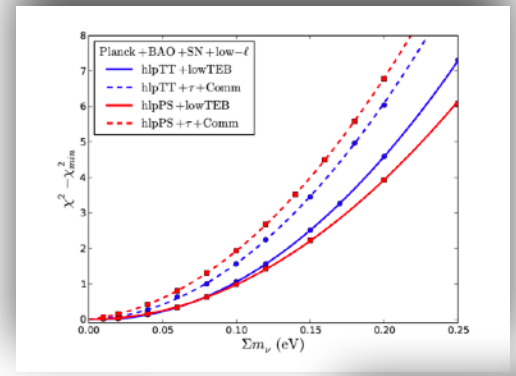
Cosmology: results ! and prospects

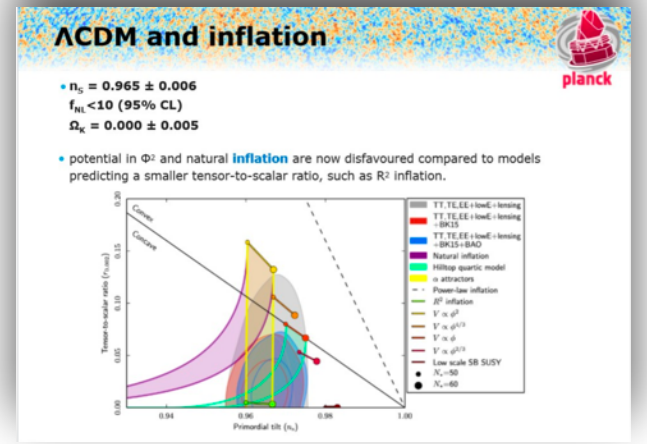


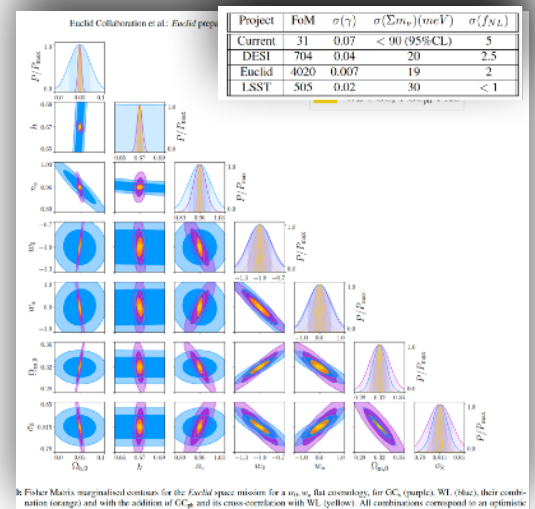
- ΛCDM and precision cosmological physics
- Tests of robustness of the concordance model
- Dark Matter and Neutrino sector constraints through cosmo
- Further constrain inflation and reheating physics (coupled with hep physics)
- Understand the accelerated expansion: a new energy component with a repulsive action, or a modification of general relativity





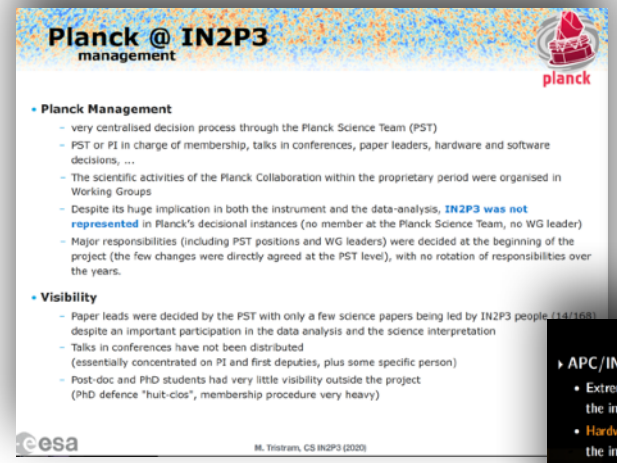


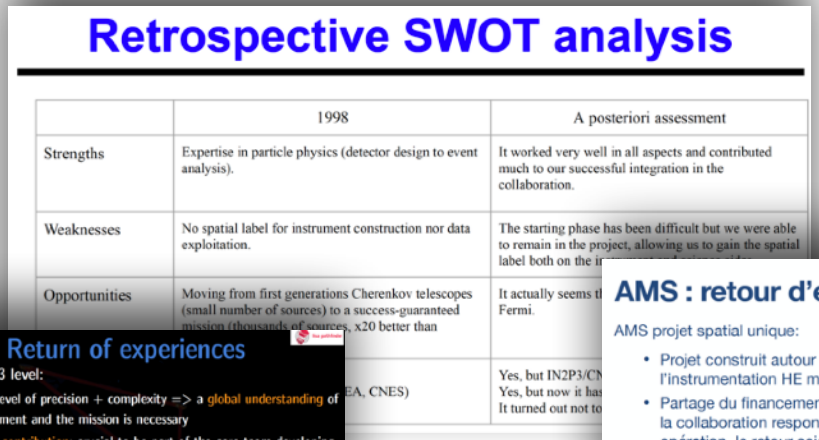


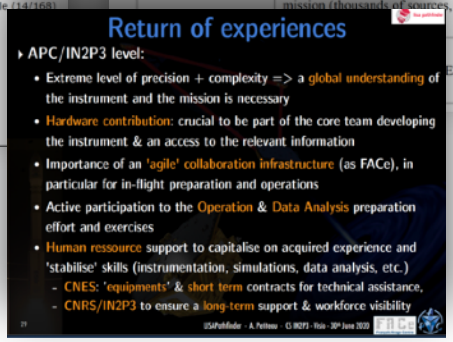


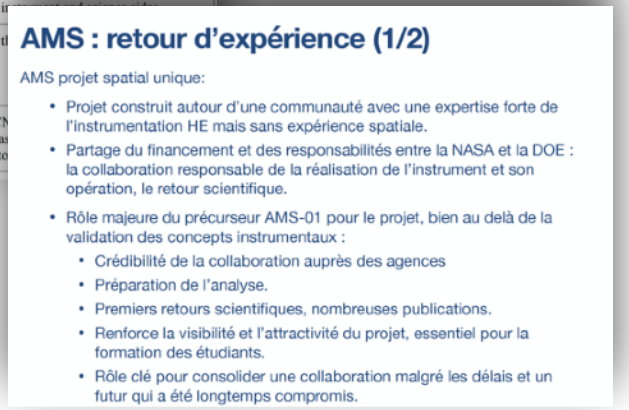
Return of Experience

- Learn from past experience to build the future
  - Space methodology in instrumental work (quality, new procedures…)
  - Confidence of space agencies in IN2P3 labs / CNES Space label for IN2P3 labs ?
  - The PI/consortium wrt Spokesman/collaboration model
  - Importance of hardware delivery to be part of core teams
  - The pressure of open data and scientific results deadlines
  - Data: properties of PI at the end of the mission ?
  - The relation with other partners in France and its evolution with time
- …… A lot to be digested and thought further …



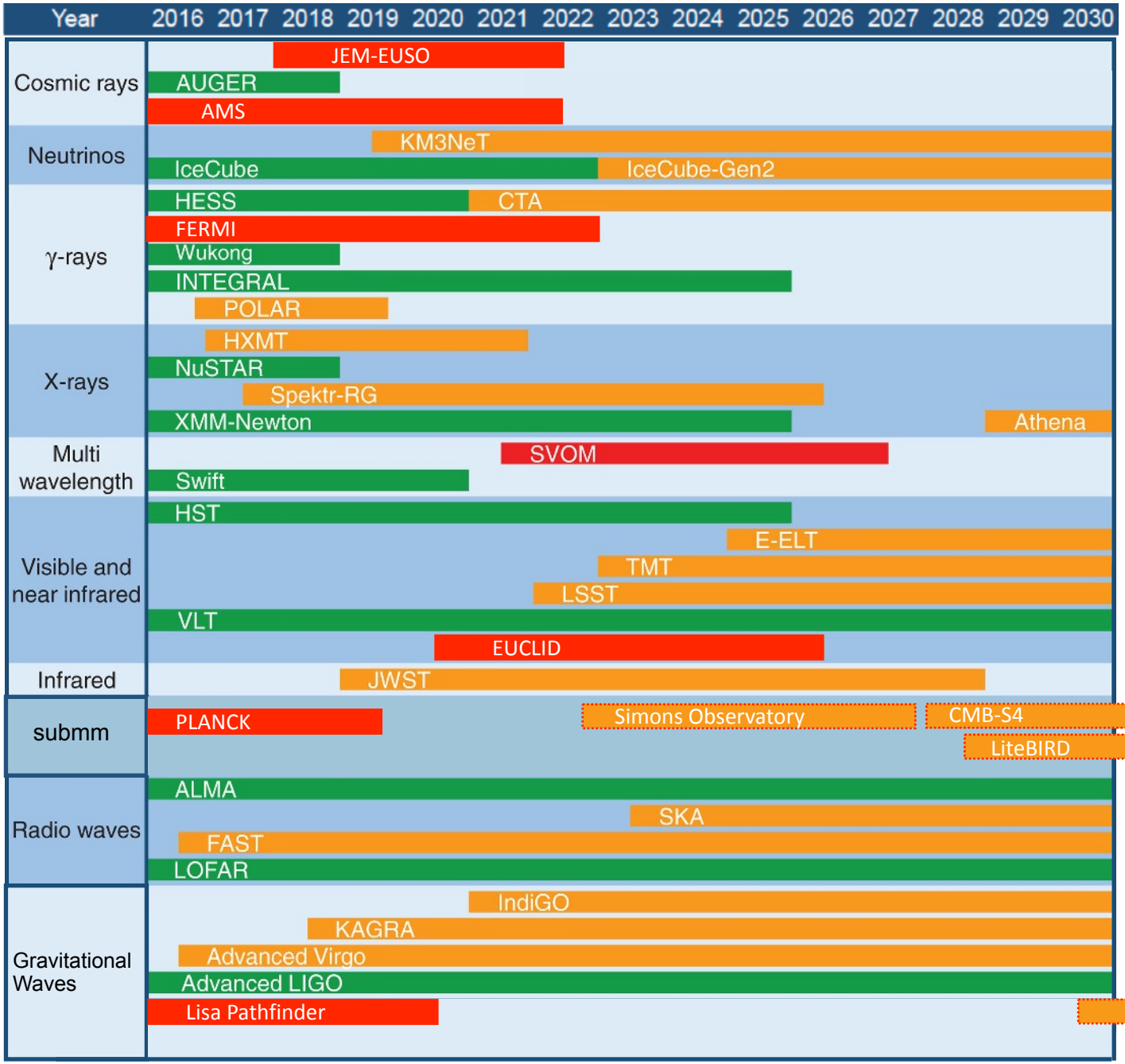






discussed today

Ground/space complementarity



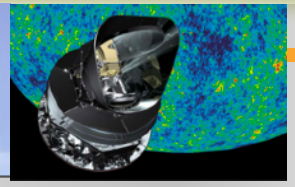
- Coherent scientific program combining ground and space (and balloon) experiments
  > astroparticles
  > cosmology

adapted from Astronomische Nachrichten, Volume: 338, Issue: 9-10, Pages: 978-983, First published: 28 November 2017, DOI: (10.1002/asna.201713415)

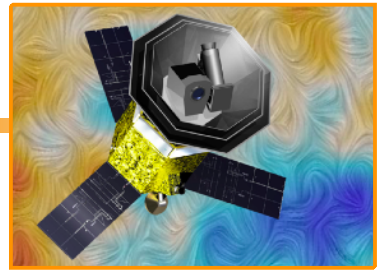
For next Scientific Council ….. More Space @ IN2P3 …

1995 | 2000 | 2005 | 2010 | 2015 | 2020

Archeops



Planck



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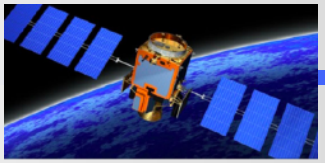
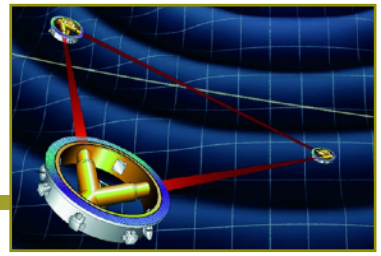


Fermi

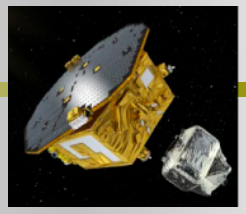
AMS

EUSO

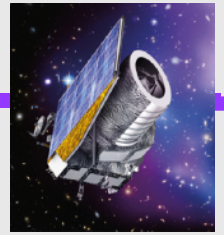


LISA

Lisa
Pathfinder



SVOM

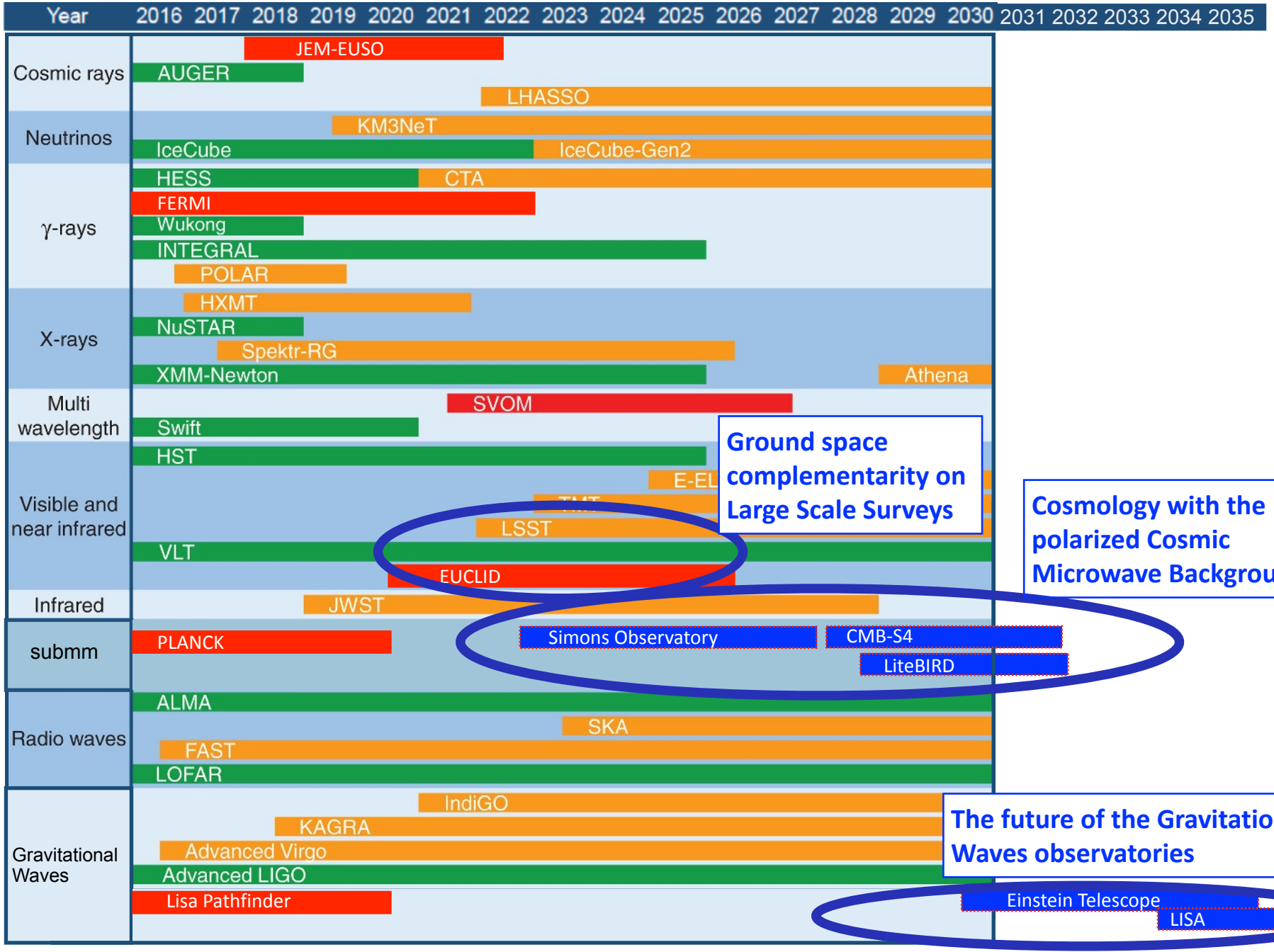


Euclid

cnrs IN2P3 Les deux infinis

discussed today | for next CS

More Space @ IN2P3 …and beyond !



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Thanks a lot to all the speakers and referees

….Not yet finished: private session of the CS tomorrow

And let’s keep in touch in autumn !

The scientific council members