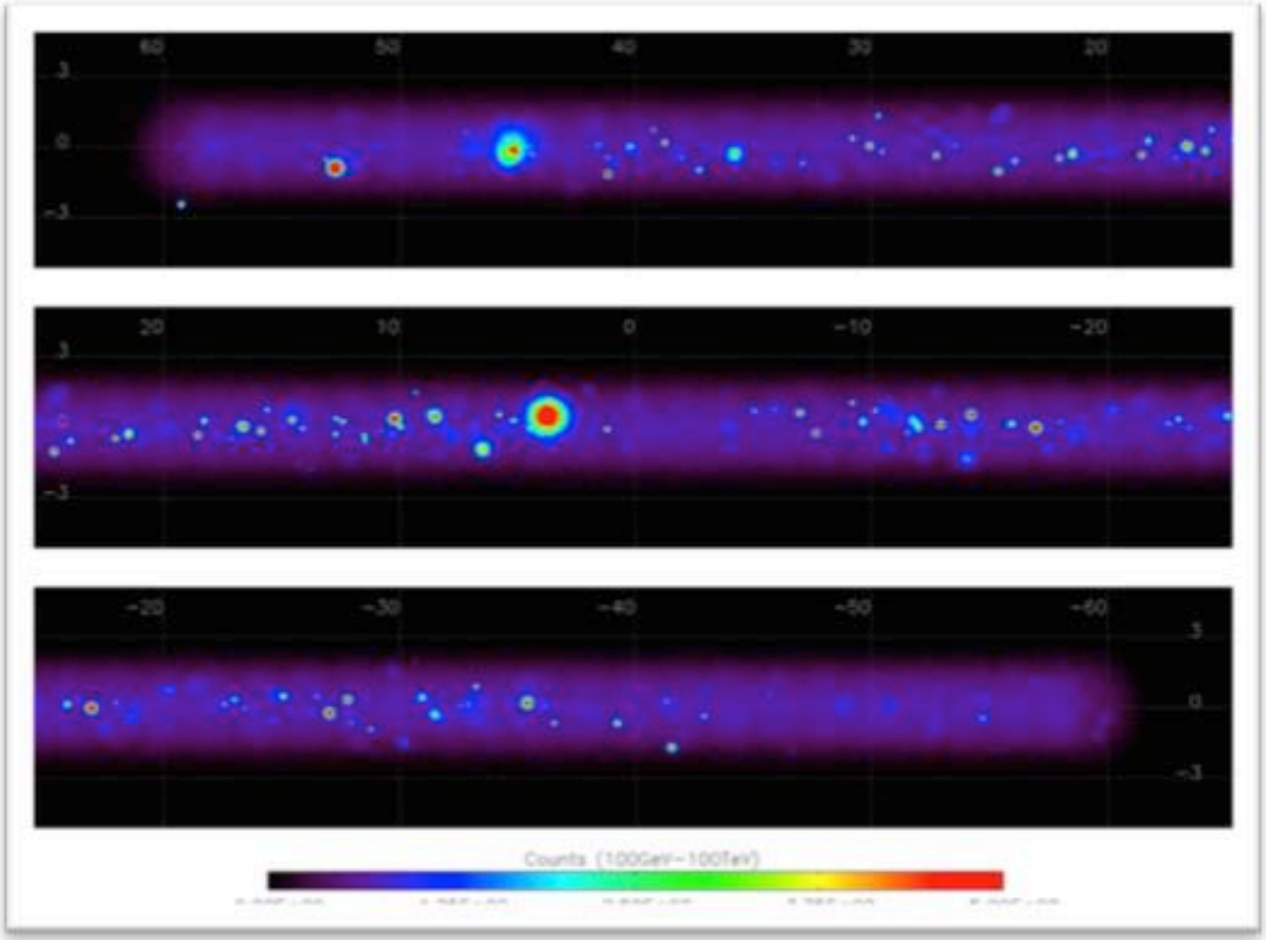
Preparing OCEVU's CTA Science



Jürgen Knödlseder

cta Sci – cherenkov telescope array

OCEVU

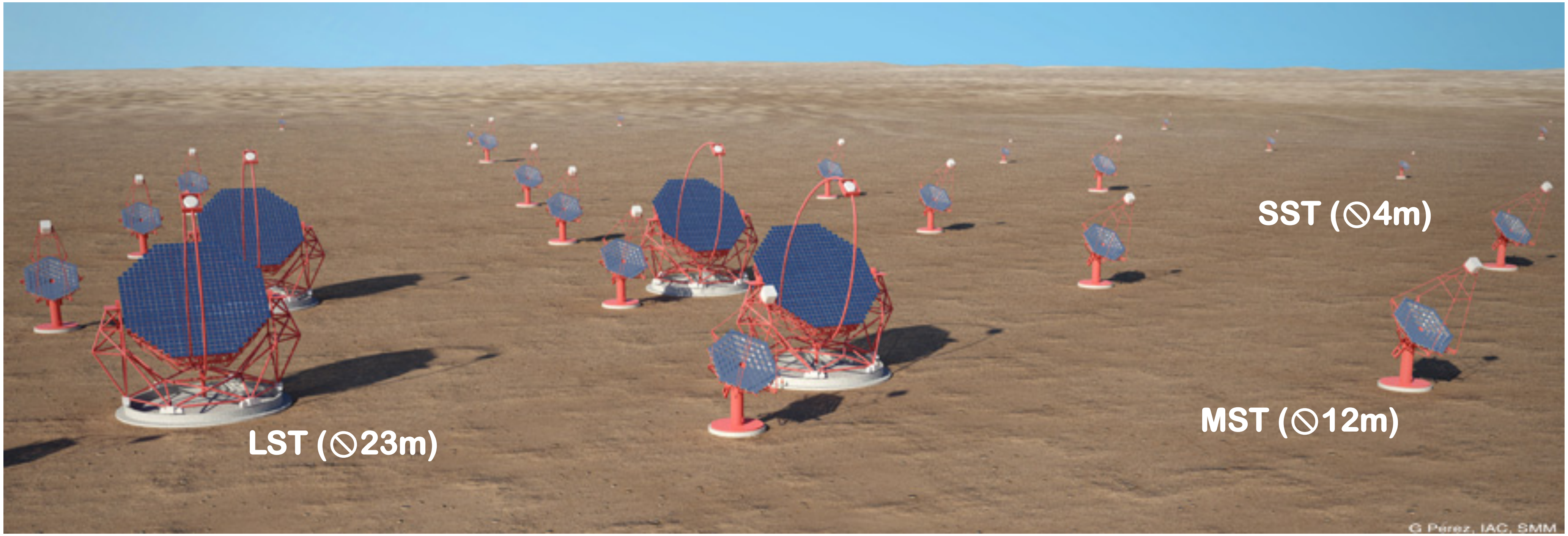
CENTRE DE PHYSIQUE DES PARTICULES DE MARSEILLE – CPPM

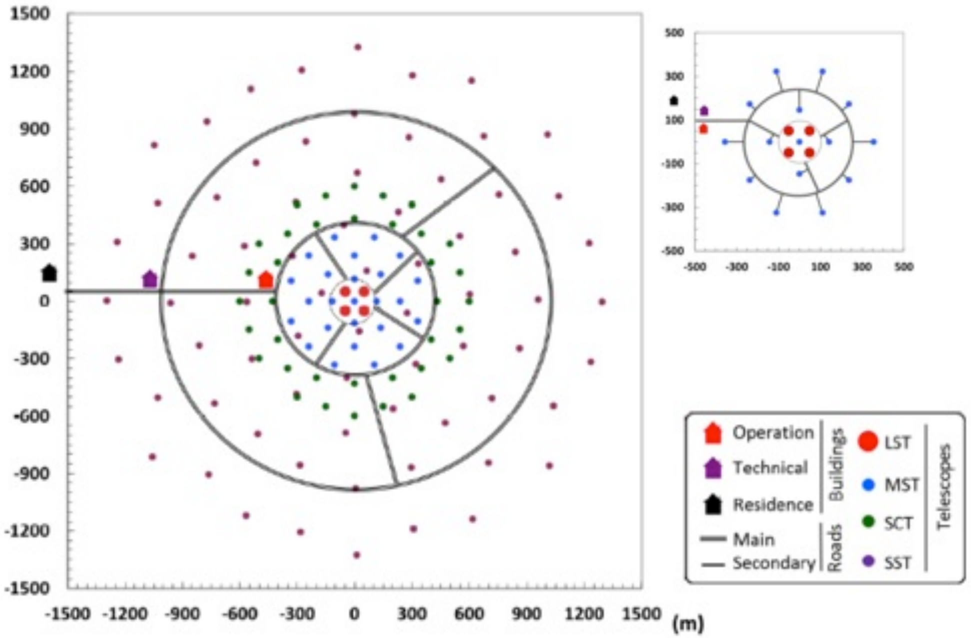
irap – astrophysique & planétologie

LUPM – LABORATOIRE UNIVERS & PARTICULES MONTPELLIER

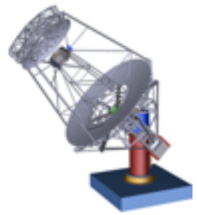
OCEVU Astro Workshop, 19-20 January 2015, Marseille

The CTA Observatory





SCT (⌀10m)



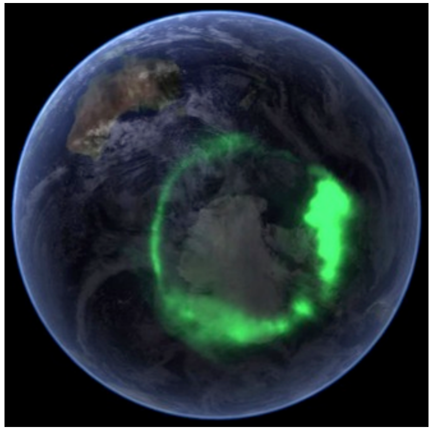
Characteristics

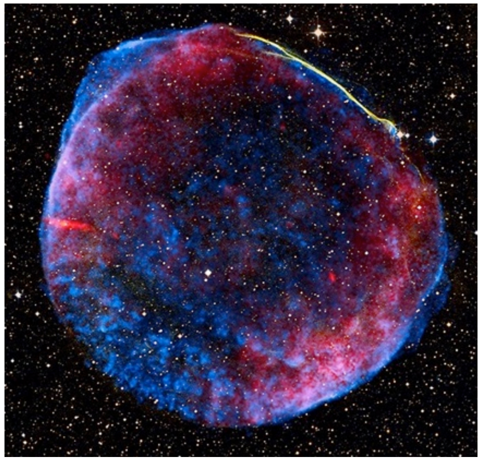
2 sites (north & south)
3 telescope size classes
About 120 telescopes in total
South U.S. extension with about 25 SCT telescopes

CTA Key Science

cosmic rays

Origin of cosmic rays
Acceleration physics
Impact on environment





black holes

Role as particle accelerators
Acceleration physics
Probes of the Universe

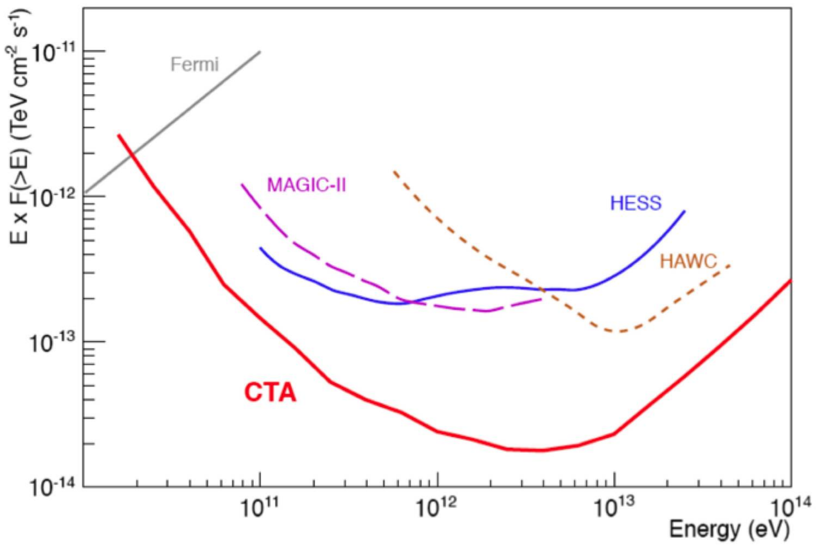
dark matter

Nature of dark matter

χ

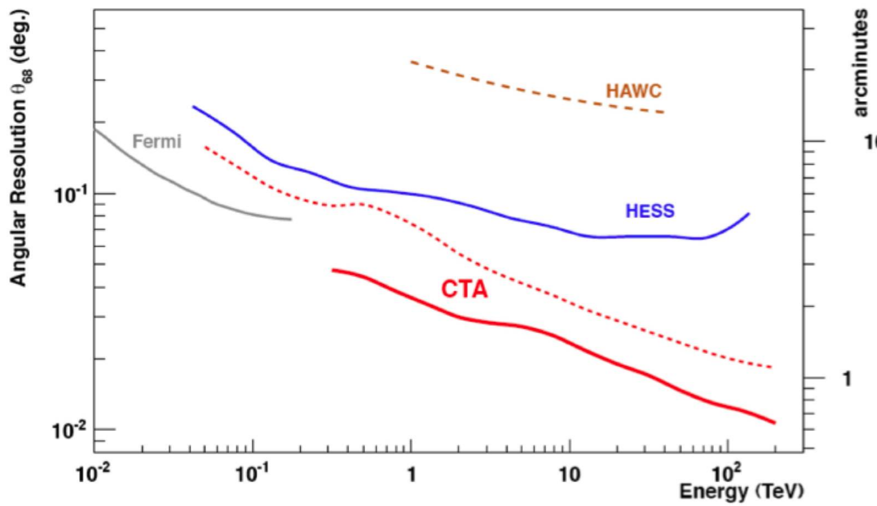
Expected performance

Sensitivity gain
- access VHE populations across whole Galaxy
- sample fast variability (AGN, GRB)



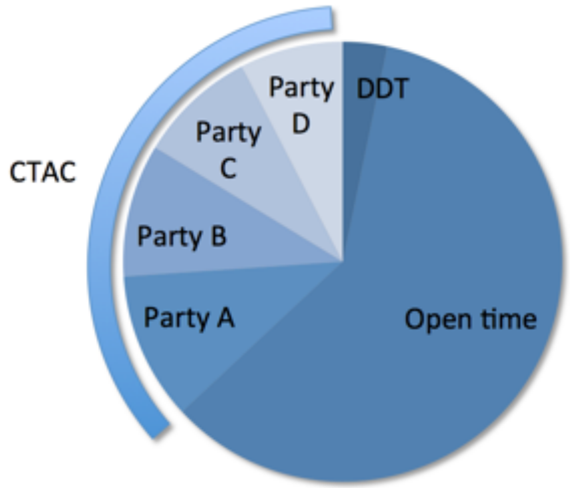
FoV > 8°
- measure diffuse emissions
- efficient survey of large fields

Arcmin angular resolution
- resolve extended sources (SNR, starbursts)



Broad energy coverage
- < 100 GeV to reach higher redshifts
- > 10 TeV to search for PeVatrons

CTA Data Access

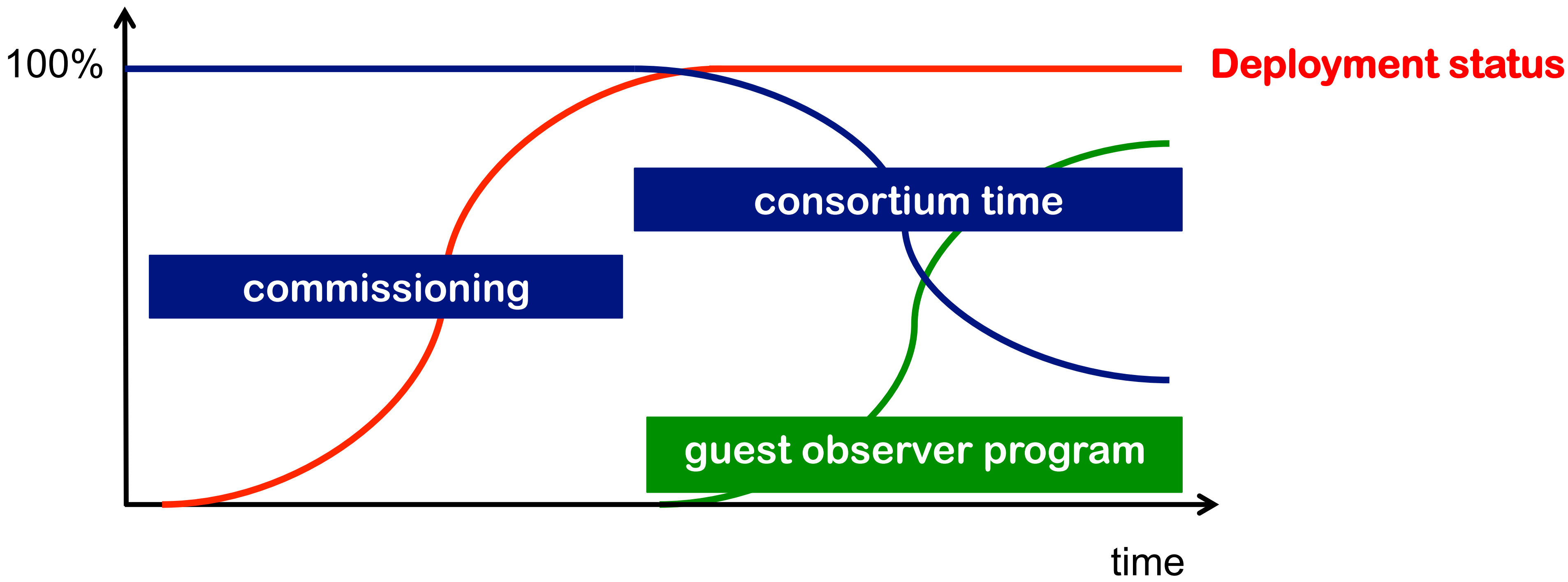


Current assumptions

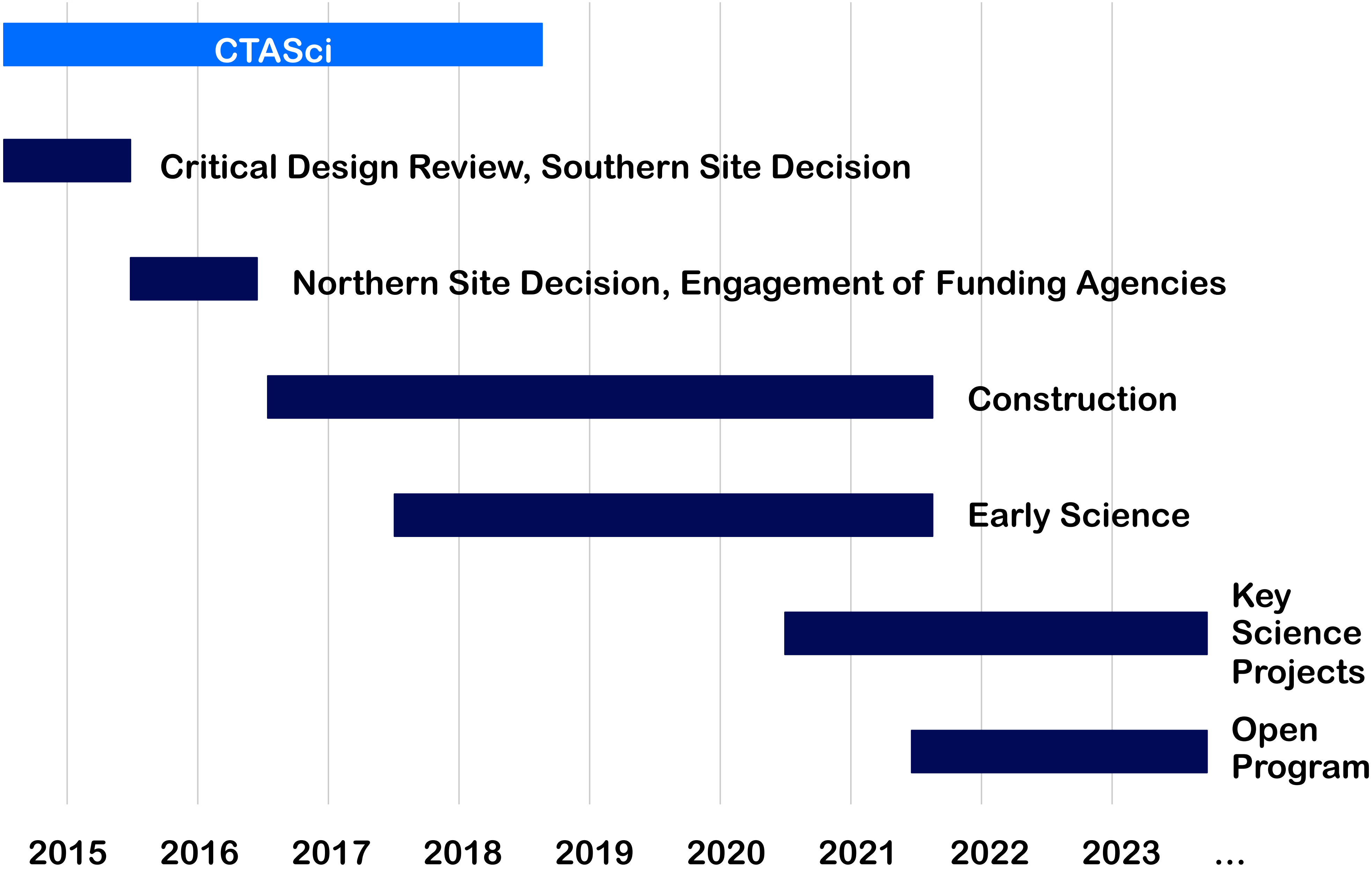
CTA parties pool the observing time in:

- Open time (for scientists of party countries)
- Consortium time (Key Science Projects)

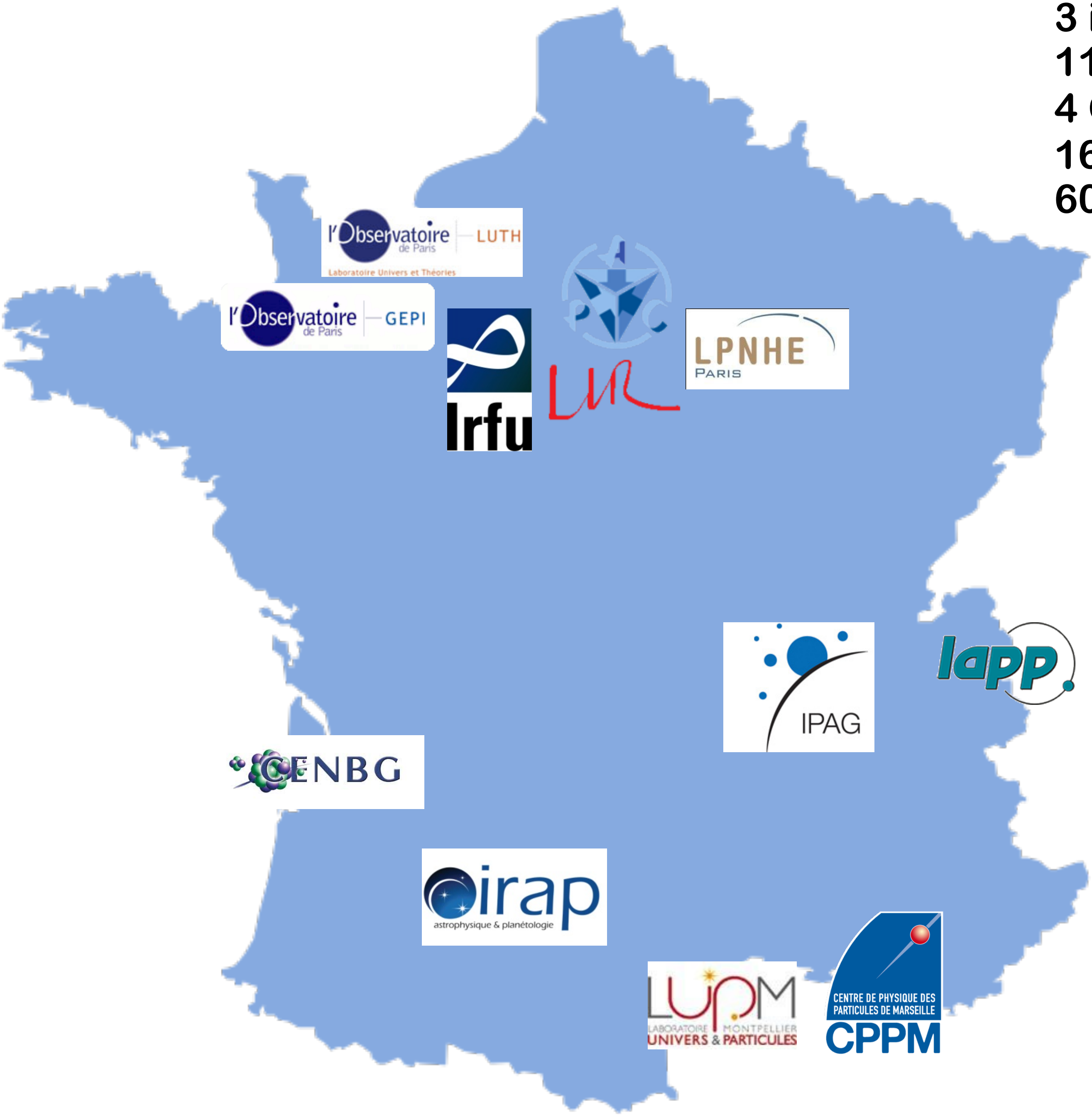
All data will become public after a typical proprietary period (possibly one year)



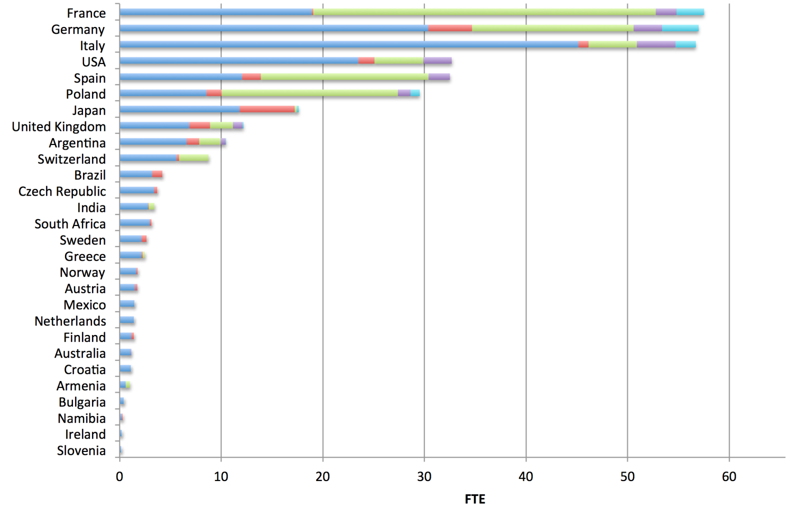
CTA Calendar



French participation

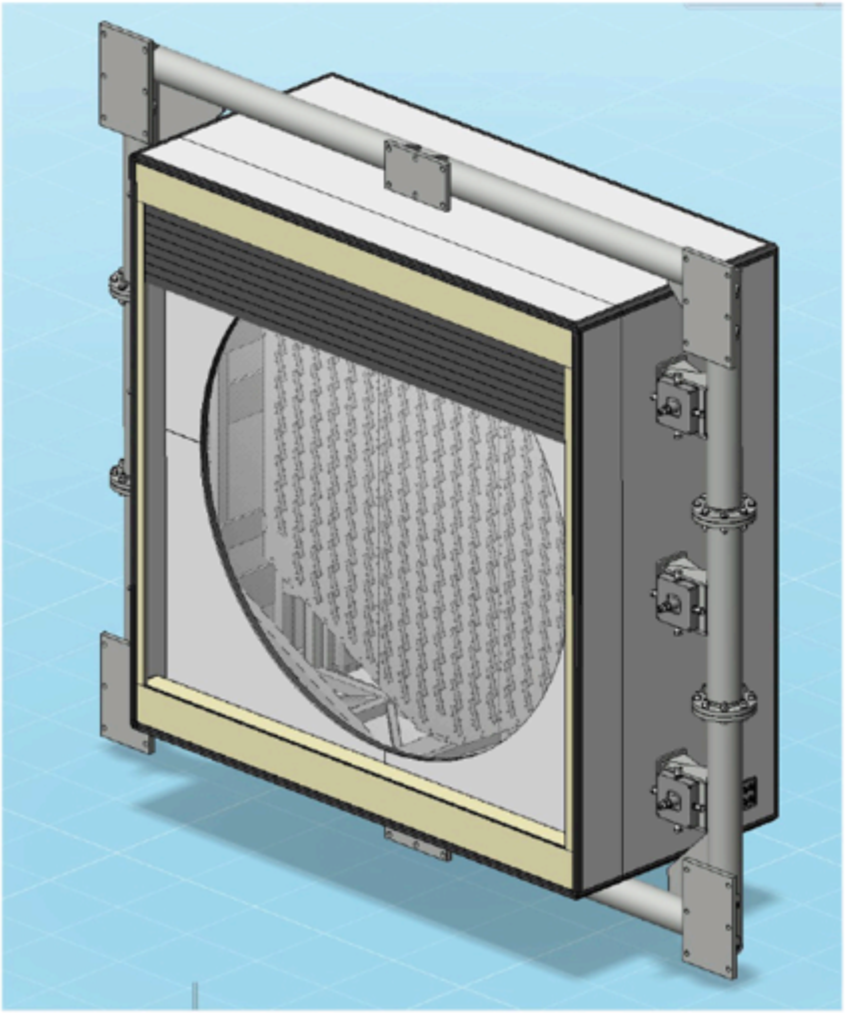


3 institutes (INSU, IN2P3, IRFU)
11 CNRS laboratories
4 CEA services
160 people
60 FTE



France is a main pillar of the CTA project

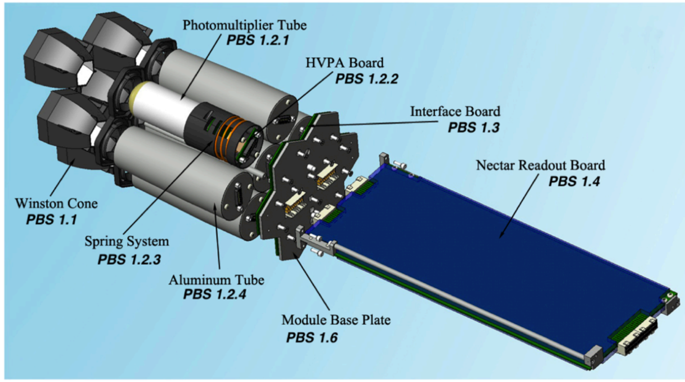
French contributions - NectarCAM



Modular PMT-based camera for the CTA medium-size telescopes (MST)

Dimensions: 2.8 x 2.9 x 1.2 m^3
Weight: 1.9 tonnes
Power consumption: 7 kW
1855 pixels / 265 modules

CPPM: DAQ
IRAP: Focal Plane Instrumentation
LUPM: Calibration

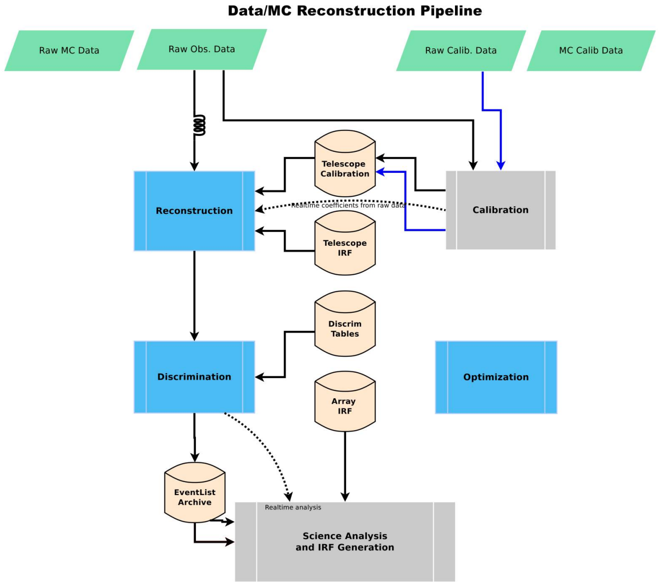


Financially supported by OCEVU (NectarE2E)

APC, CPPM (Centre de Physique des Particules de Marseille), IPAG, irap (astrophysique & planétologie), Irfu, lapp, LUTH, LPNHE Paris, LUPM (Laboratoire Univers & Particules Montpellier)

DESY, Ciemat (Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas), GAE, ICCUB (Institut de Ciències del Cosmos), IFAE

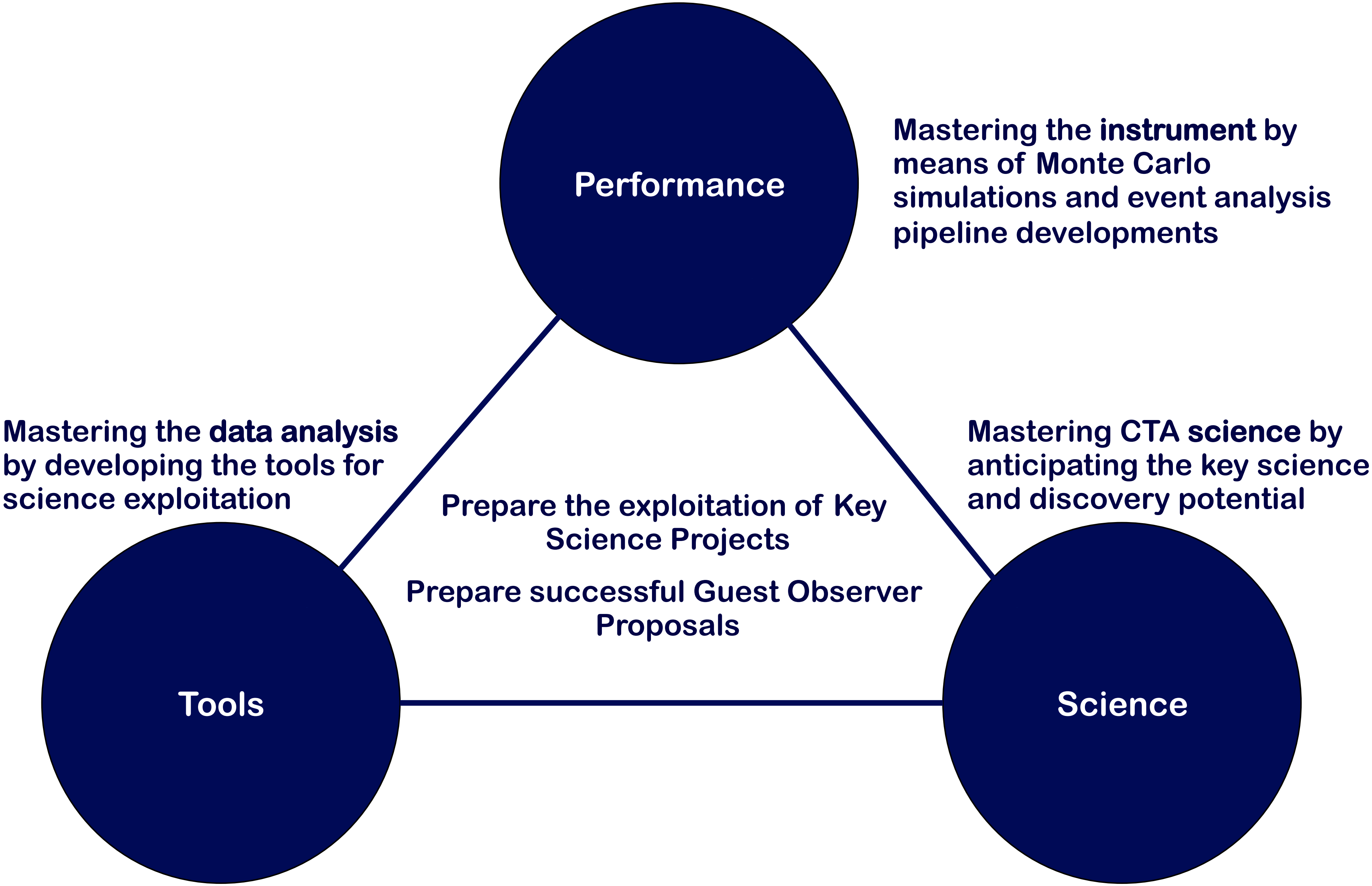
French contributions - Data Management



Bid for the Data Centre and provision of related services (processing and simulation pipelines, science analysis tools, proposal handling system, VO compliance)

Simulations and science analysis tools supported by OCEVU (CTASci)

CTASci Goals



CTASci Tasks

Performance

Optimize the high-energy point spread function to achieve the best angular resolution possible

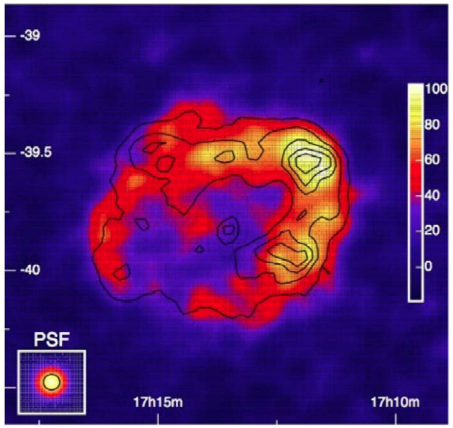
Optimize the survey capabilities of CTA (divergent mode)

Study IRF handling

Tools

Develop tools for source extraction, morphology and spectral studies, and catalogue generation

Perform science simulations (Data Challenges)

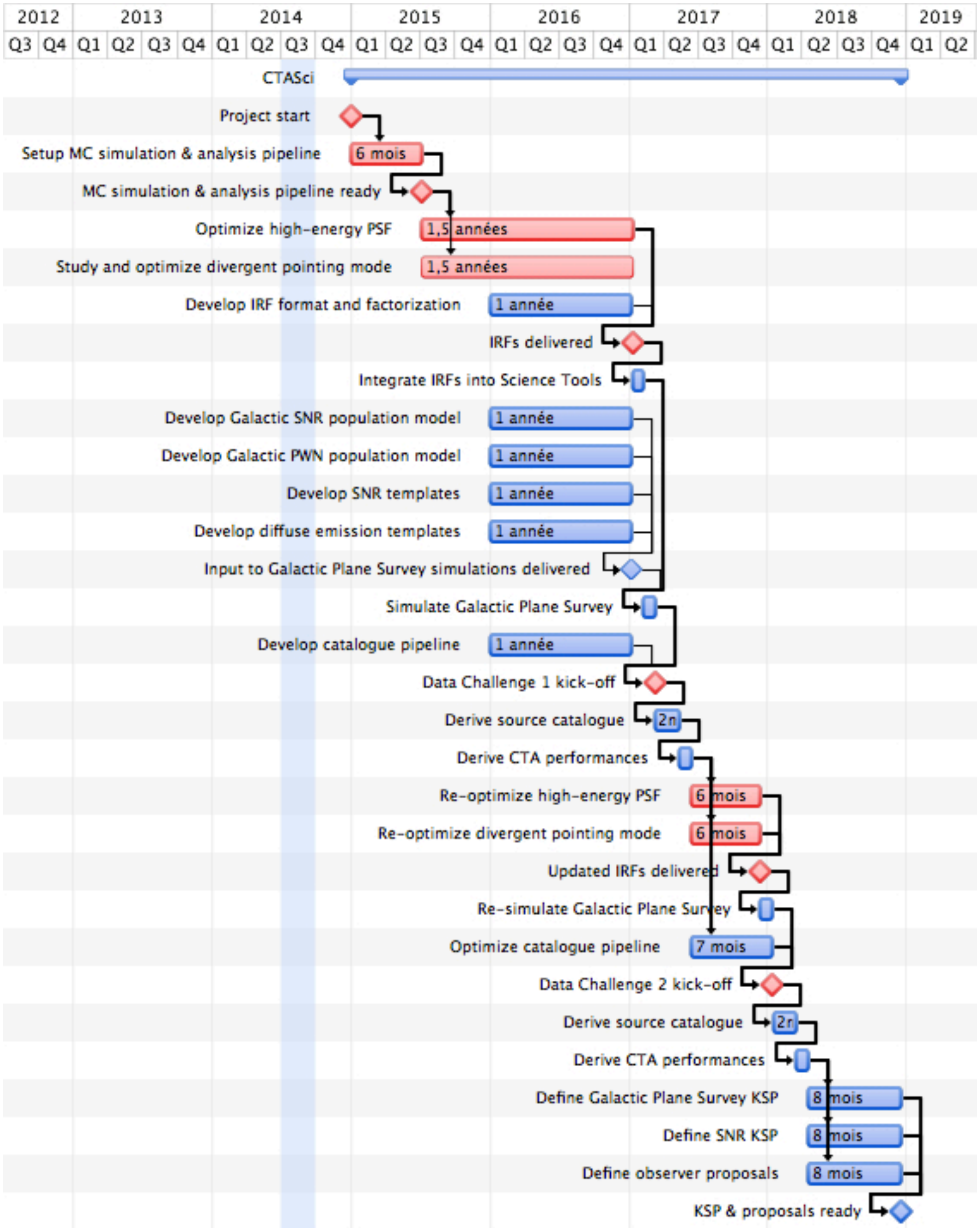


Science

Model SNR population and gamma-ray emission (templates, spectra)

Analyse survey simulations

CTASci Project



Establishing a dynamic scientific environment within OCEVU to prepare the science return for CTA

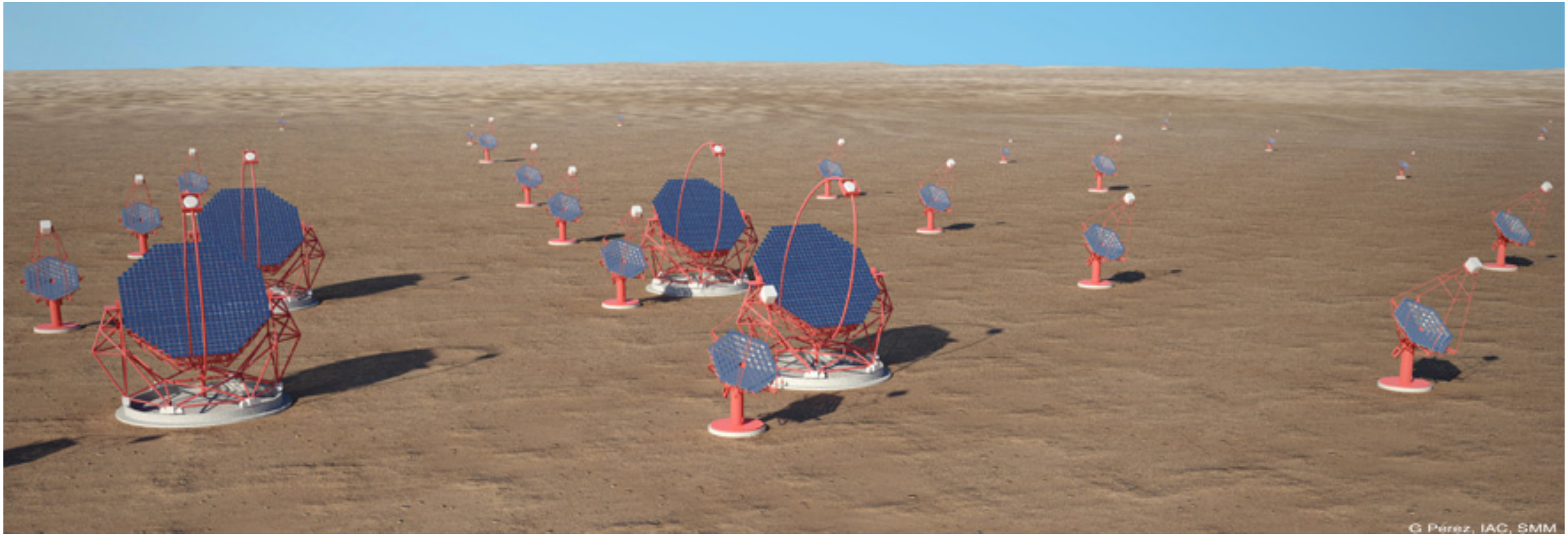
Labs: CPPM, IRAP, LUPM
Duration: 4 years
Resources: 13 people, 3 ETP

Funding:
granted: 1 post-doc (2015-2017)
requested: 1 post-doc (2016-2018)
1 PhD (2016-2018)
5 k€/year for travelling & workshop

Topical workshops (1/year), e.g.:

- links between gamma rays and neutrinos
- links between gamma rays and X-rays (in light of Athena)
- gamma ray bursts in the era of Fermi, CTA and SVOM

Take home message



CTA will be a major research infrastructure for high-energy astronomy for the next decades

OCEVU labs are heavily involved in developing CTA

CTASci supports the establishment of a dynamical scientific environment within OCEVU to maximise CTA science return