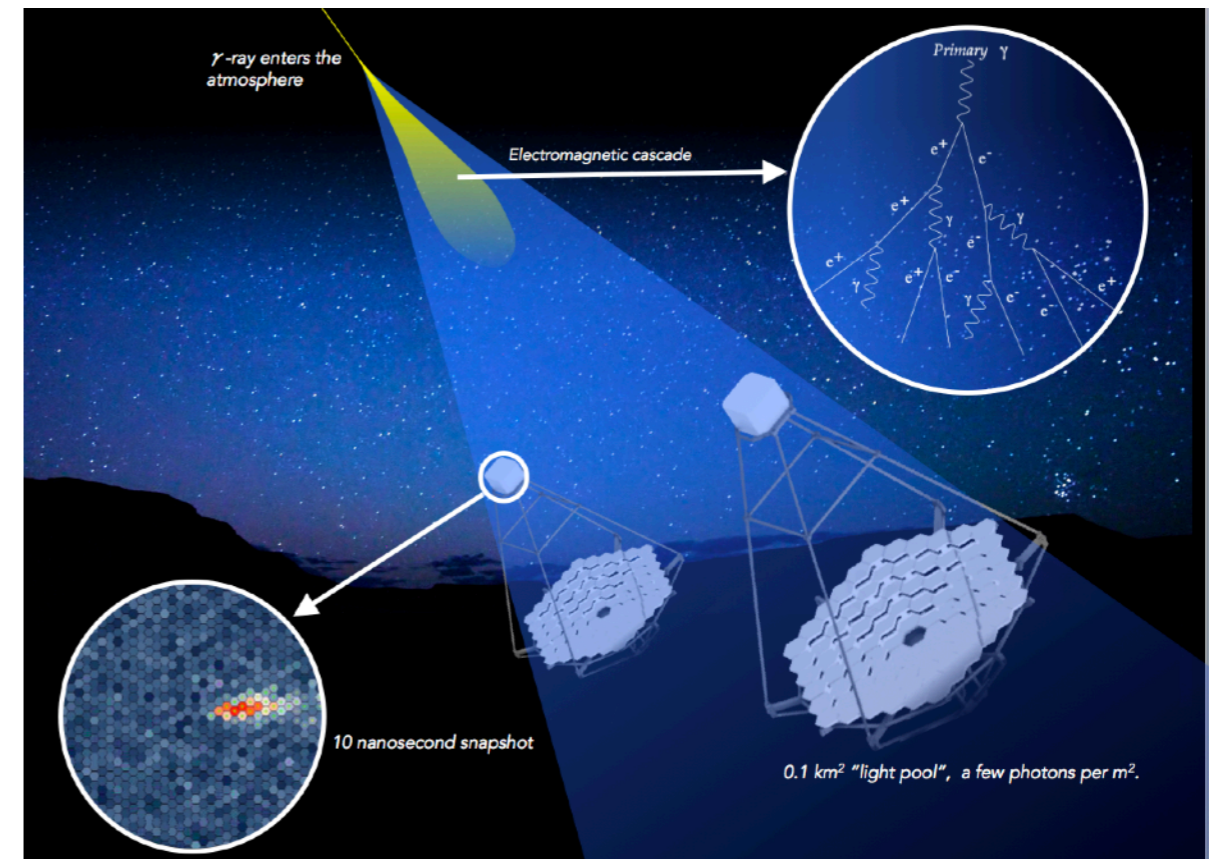
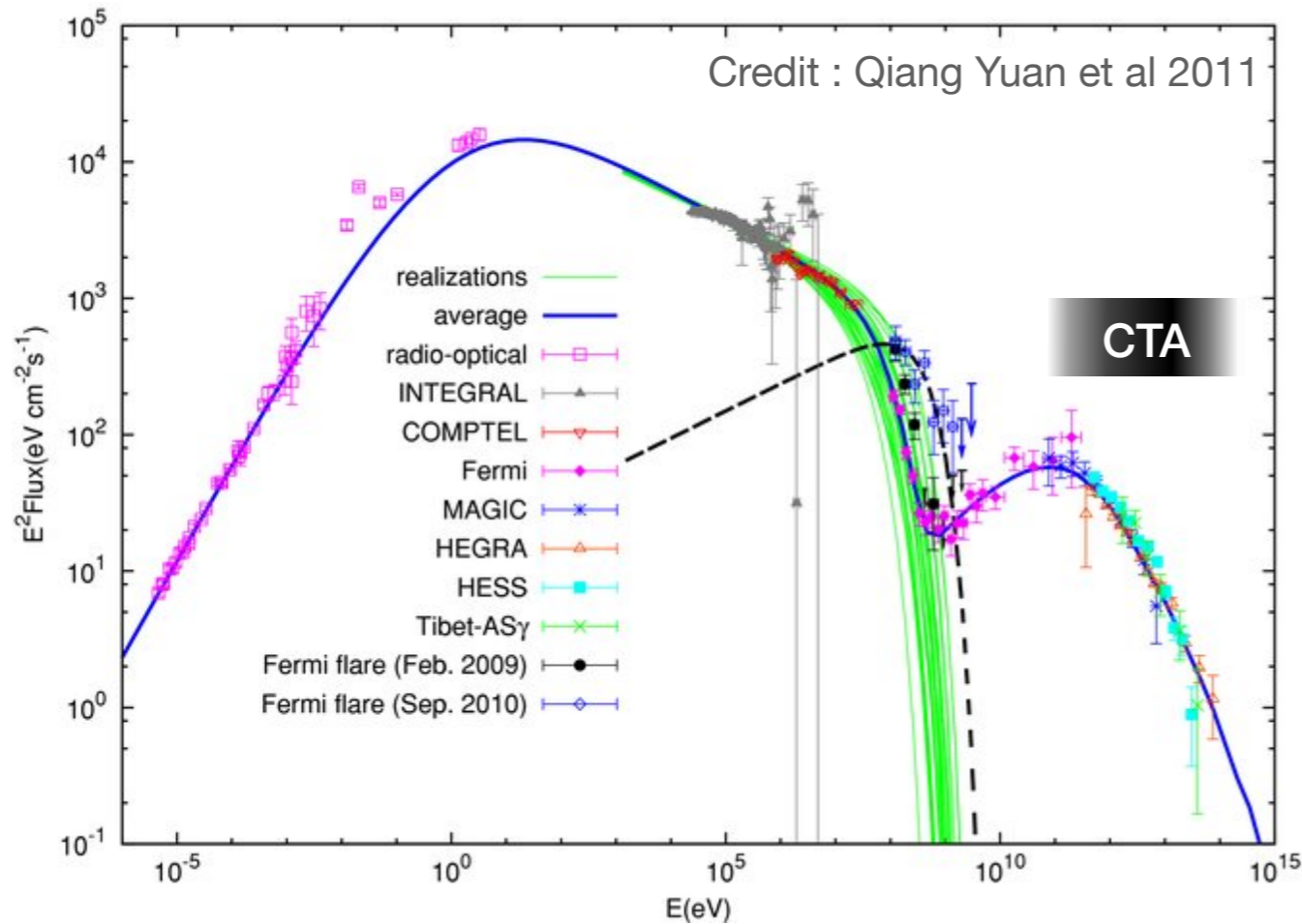


CTA-France

The Cherenkov Telescope Array



Credit CTAO

- Observatory to probe the origin of cosmic gamma-rays at energies between 10's of GeV and 100's of TeV
- Built on success of H.E.S.S., MAGIC and VERITAS...
- But ten times more sensitive and many times more flexible.

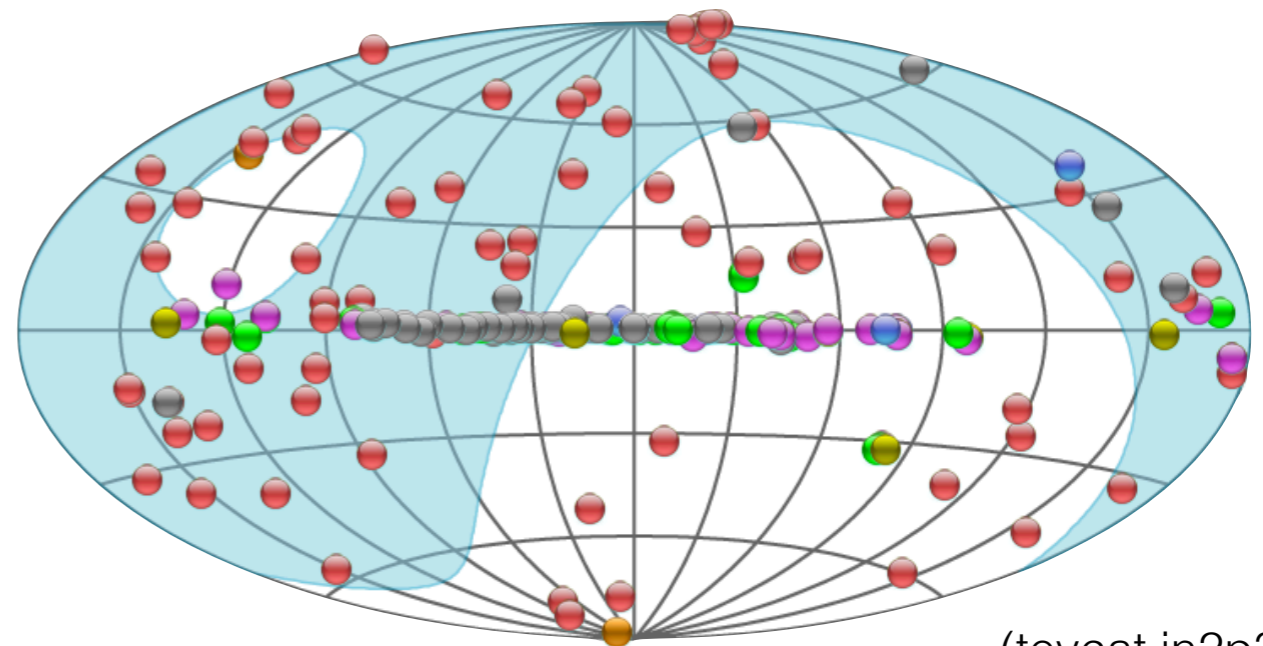
CTA : one observatory, two sites

CTA-N : 4 LST, 5–15 MST
Effective area @10TeV : $8 \times 10^5 \text{ m}^2$
Focus on extra-galactic sources

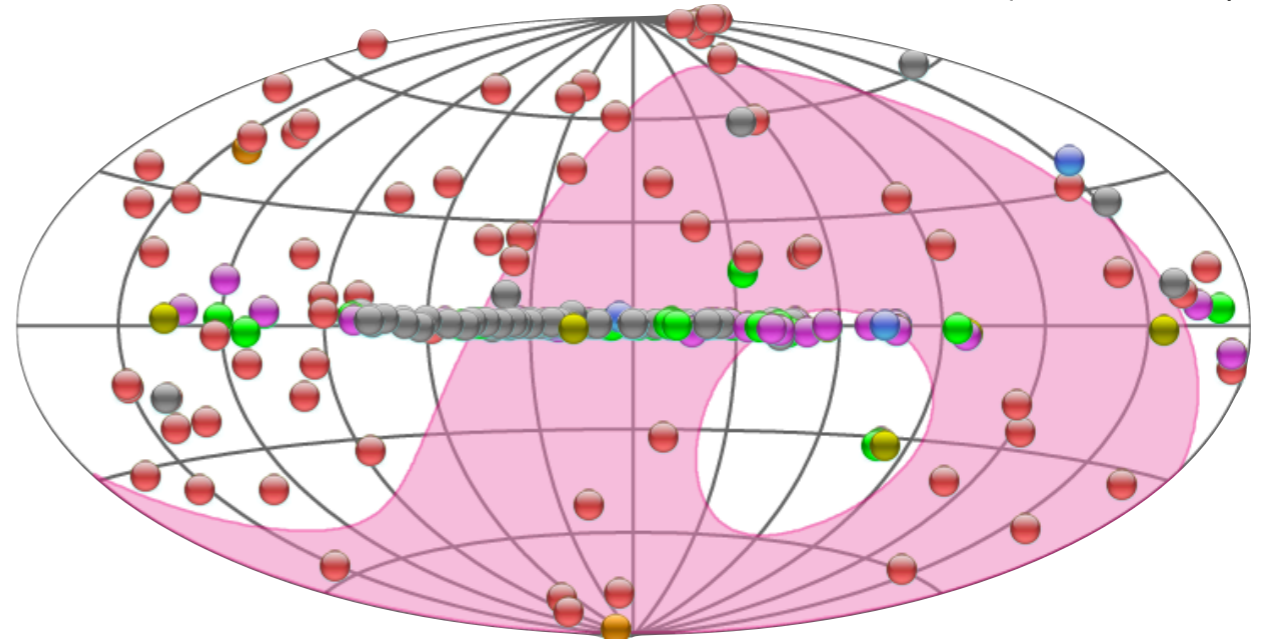


CTA-N : La Palma

CTA-S : Paranal, Chile



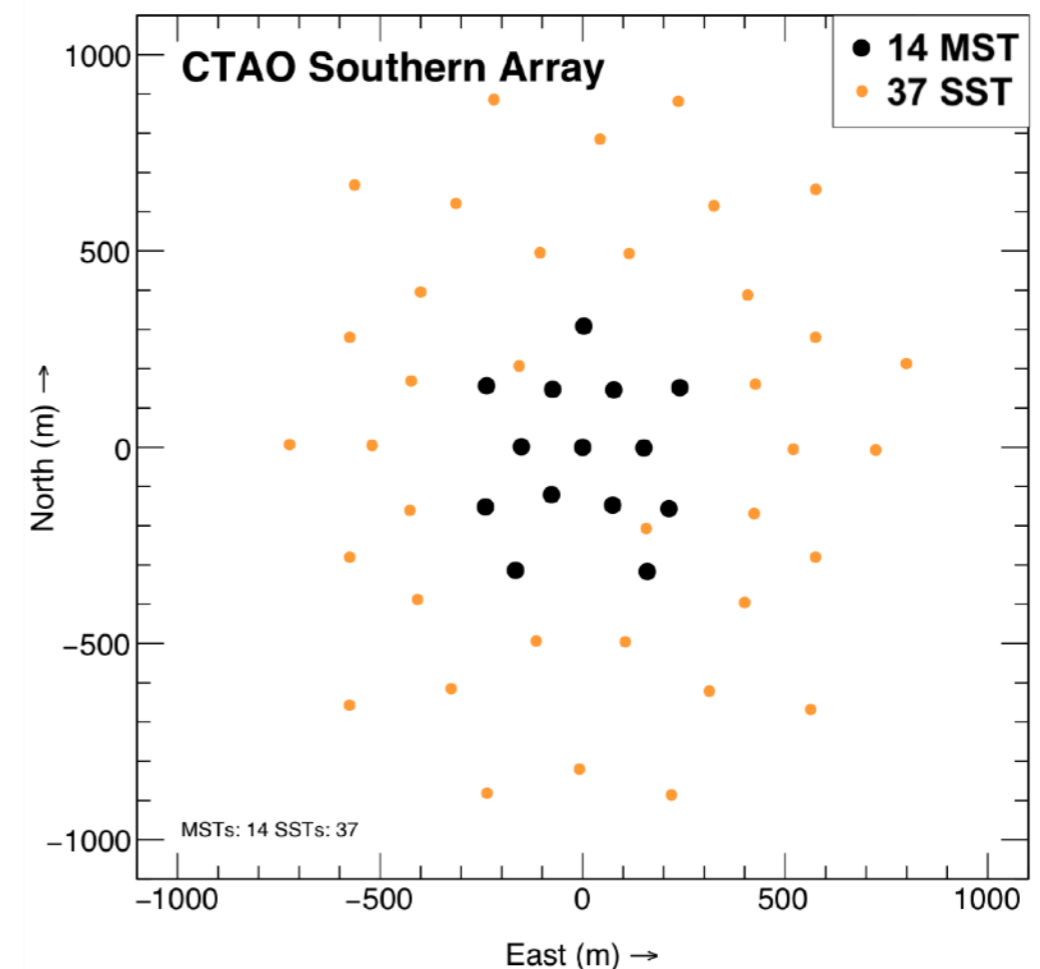
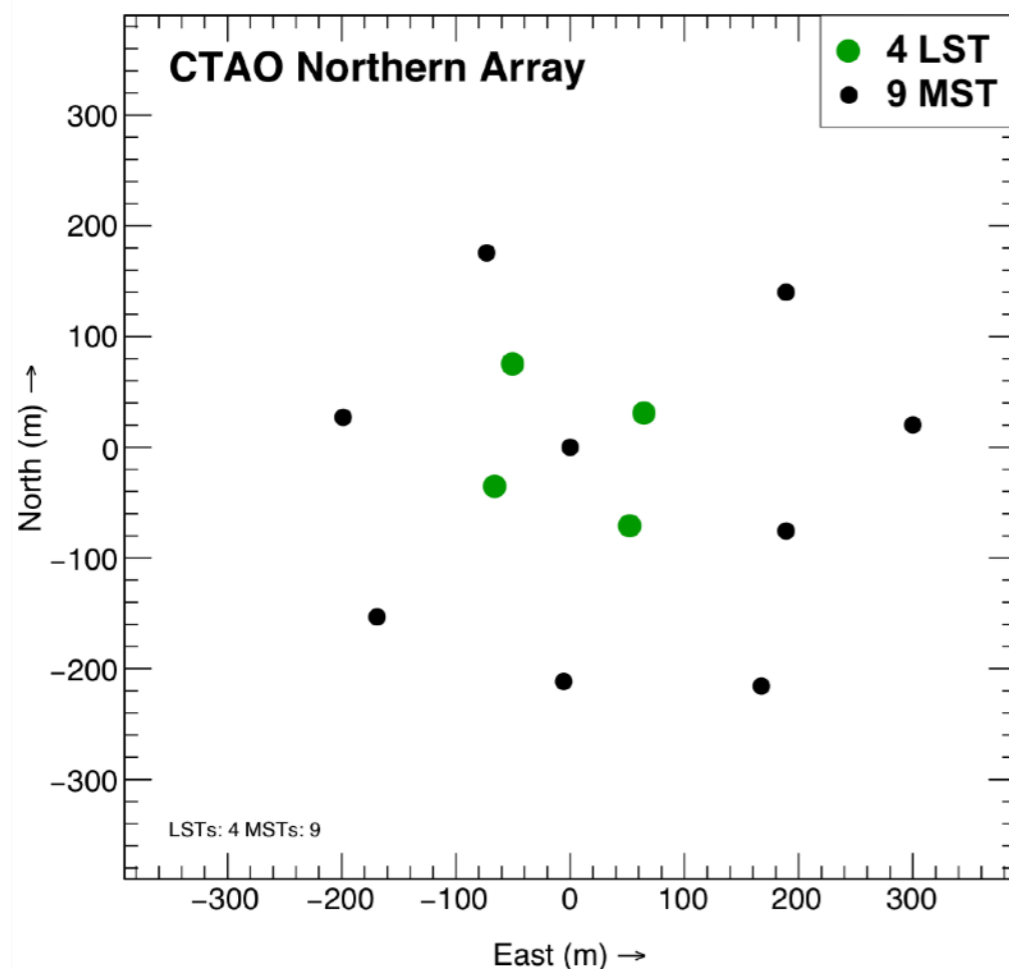
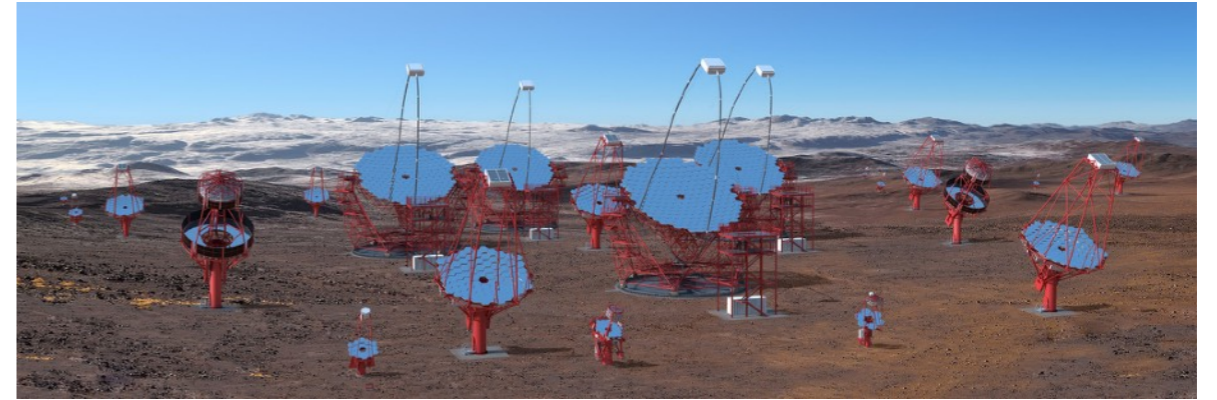
(tevcad.in2p3.fr)



CTA-S : 0–4 LST, 15+ MST, 50 SST
Effective area @10TeV : $3 \times 10^6 \text{ m}^2$
Optimised for observation of Galaxy

- Some sources accessible to both sites - ~4 hour offset in longitude will allow these to be observed for somewhat longer periods if necessary.
- Same analysis & simulations tools for both sites. Some common hardware.

CTA : one observatory, two sites

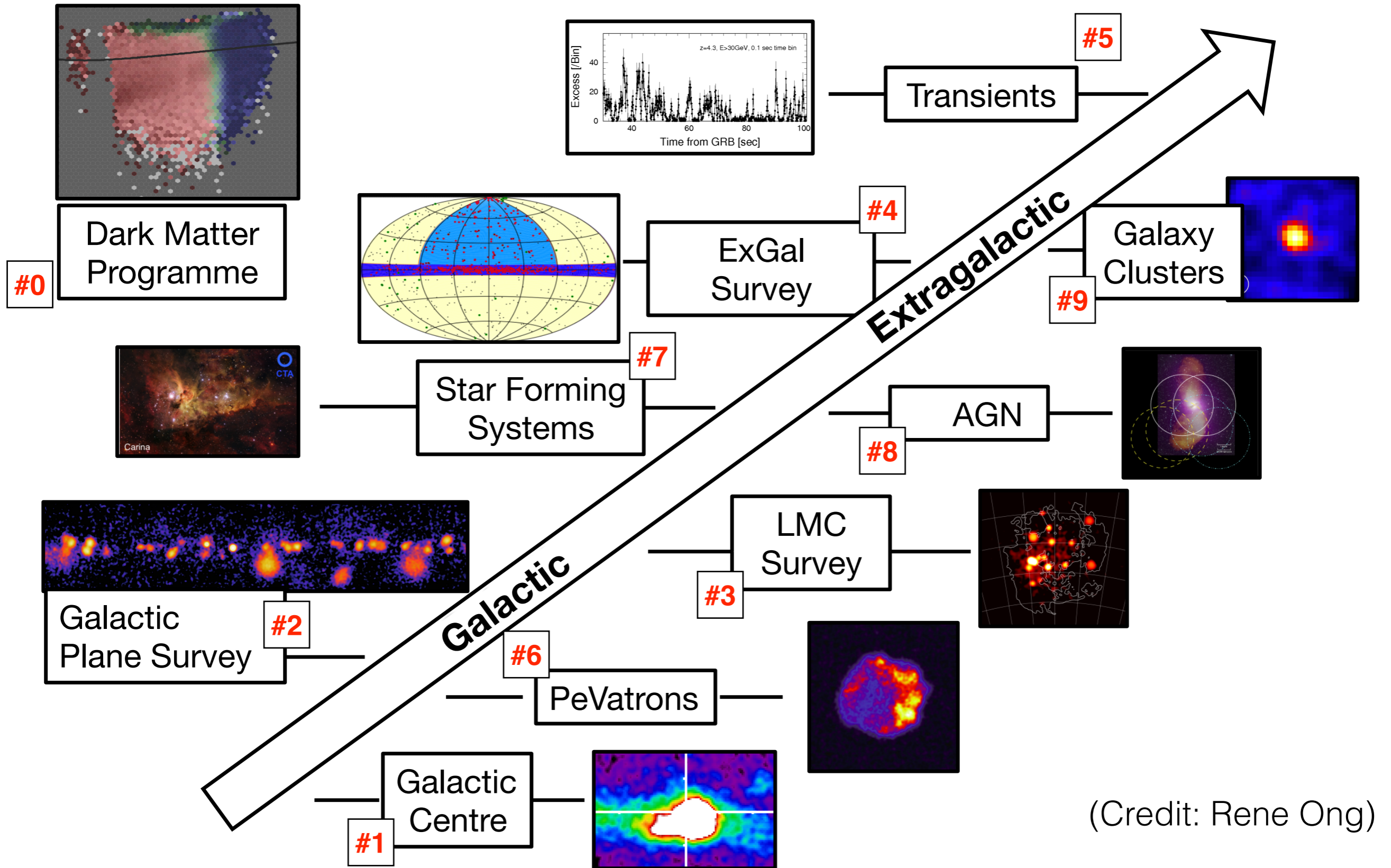


(*) highest photons absorbed while propagating in extra-galactic space, so optimise Northern site for lower energies (LSTs), and Southern site for high energies (SSTs)

Principal CTA advances

- **Two sites** — full sky visible, double available science. First extra-galactic survey (1/4 sky) will complement deep Galactic survey.
- **Large area** — more gamma rays gives improved instantaneous sensitivity; particularly important for transients.
- **Many telescopes** — improved reconstruction, proton rejection and angular resolution, particularly at high energies.
- **Large field of view** — increased science efficiency - particularly for survey and for serendipitous detection of transients (GRBs).
- **Energy range** — three telescope classes extend energy range. Understand spectra & variability at highest energies.
- **Lower PMT gain** — safely operate in moonlight extending limited number of hours of observation available.
- **Focus on “quality”** — requirement for larger telescope availability improves science yield and uniformity of data taking.
- **Faster electronics, data processing, rapid pointing...**

CTA key-science projects

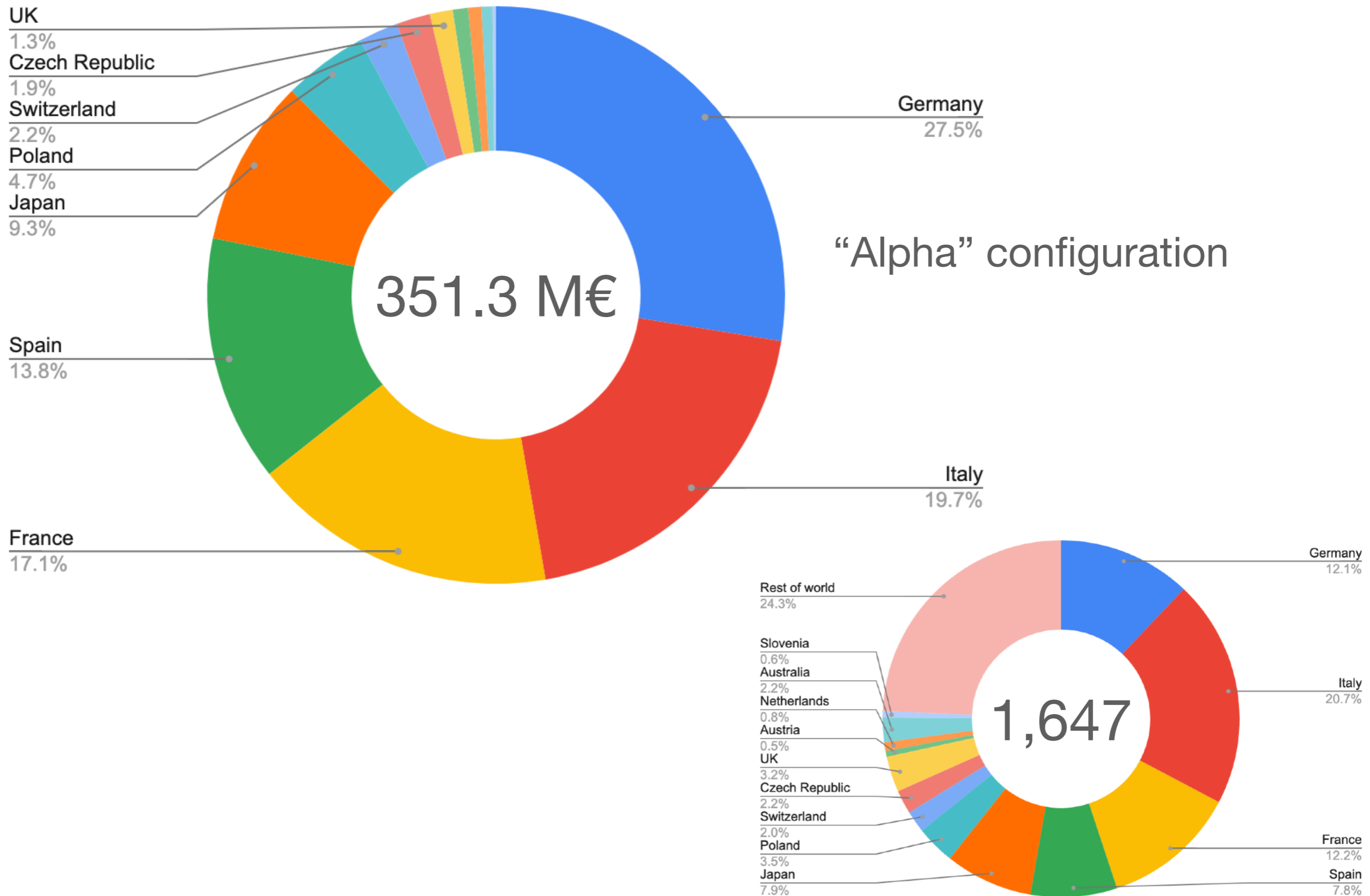


(Credit: Rene Ong)

CTA organisation

- Observatory (CTAO) - ERIC (but presently gGmbH)
 - Owns, operates and maintains the telescopes. Processes and distributes data. Drafts and implements observing schedule. Evaluates proposals for observations (open time)
 - Headquarters Bologna, Italy
 - Data center DESY Berlin
 - Northern site IAC, La Palma, Spain
 - Southern site ESO, Paranal, Chile
 - Managing director, ERIC council, Board of Governmental reps.
 - Germany, Italy, France, Spain, Japan & others + ESO (& possibly US)
- Consortium (CTAC)
 - MoU between scientists who have developed KSP program and developed CTA hardware contributed to CTAO as IKC.
 - Exploits KSP data under agreement with CTAO.

Participation by country



CTA in France

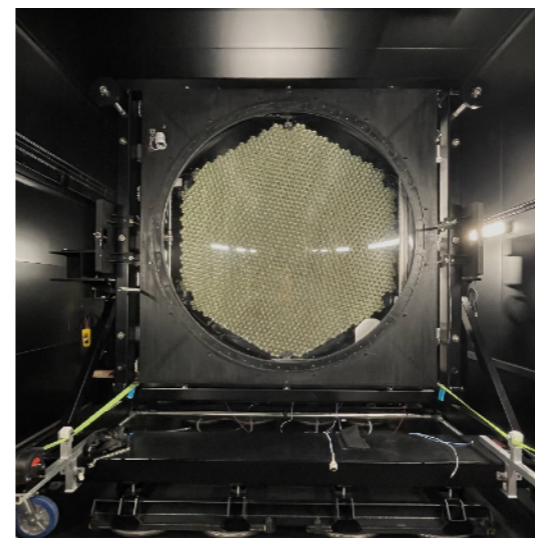
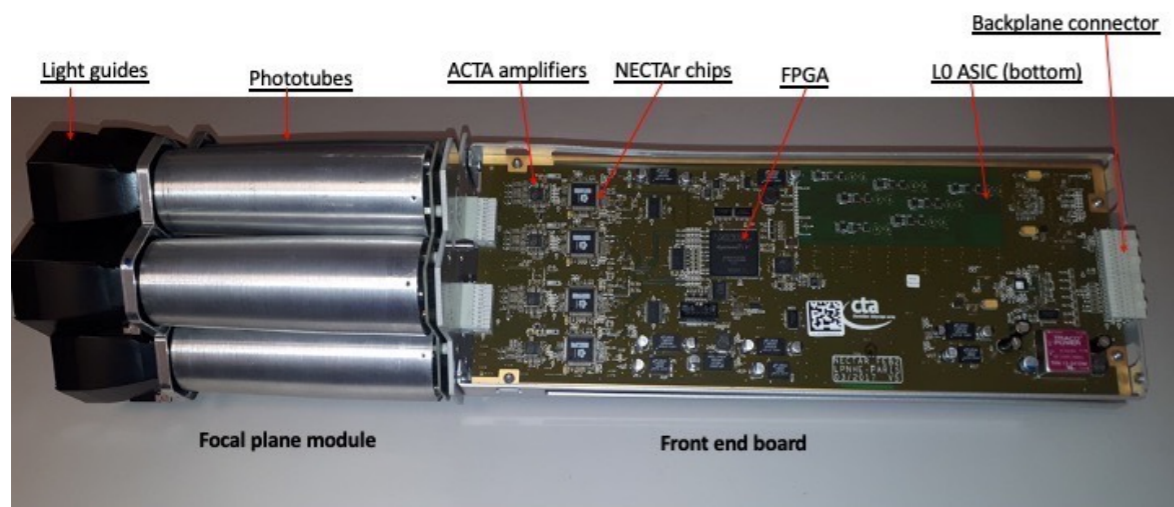
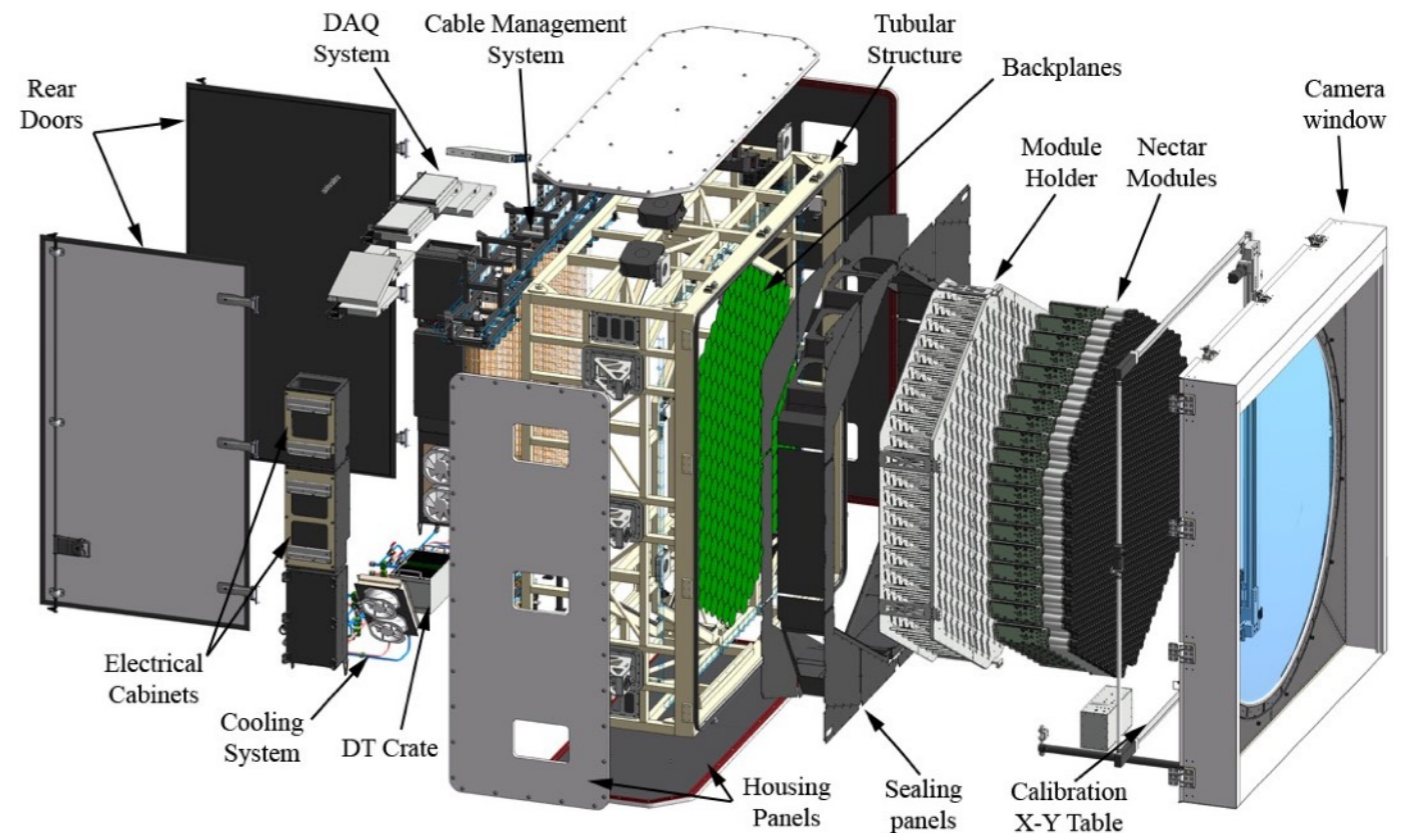
- How big is CTA community in France ?
 - 182 members of CTA France mailing list (scientific & technical)
 - 78 participants to “Journée scientifique CTA-France 2023”
 - 89 French signatures to recent CTA KSP preparation paper
- Many participating entities : APC, CPPM, IJCLAB, IPAG, IRAP, IRFU (DAp, DPhP, DESIP, SIS), LAPP, LLR, LP2I, LPNHE, LUPM, Obs Côte Azur, Obs Paris
- Funding from TGIR 51,76 M€ (2018)
- IKCs : NectarCAM (x9), LST arches, drives, DAQ, clocks (x4), SST mechanics, mirrors (7 sets of 87), LIDAR, science analysis software, real-time analysis, data management, proposal handling, ...

“CTA France”

- Entity to manage CTA in France, (re)established formally by the three institutes involved (CEA, INSU, IN2P3) in 2022.
- Comité de pilotage : adjoint director from INSU, IRFU, IN2P3 and president of Obs Paris
 - Manages funds allocated to CTA, follows progress of French commitments to CTA, interacts with CTAO management.
- Comité de CTA France :
 - One scientist from INSU, IRFU and IN2P3 (with presidency rotating each year) and one scientist from each lab
 - Promotes information exchange between French scientists
 - Organises yearly scientific colloquium for CTA community

NectarCAM development in France

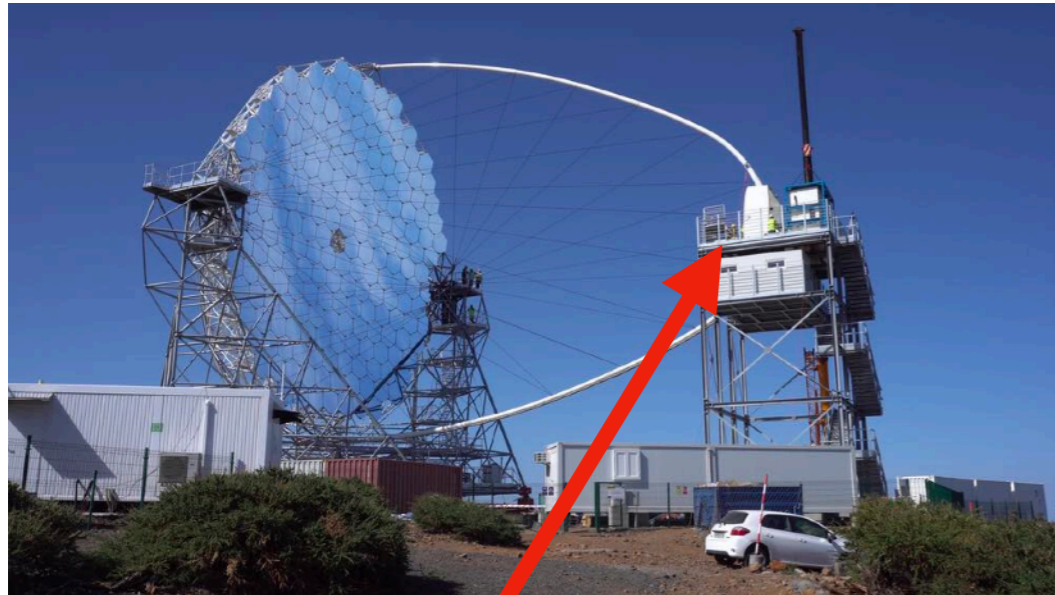
A camera for the CTA MST telescopes



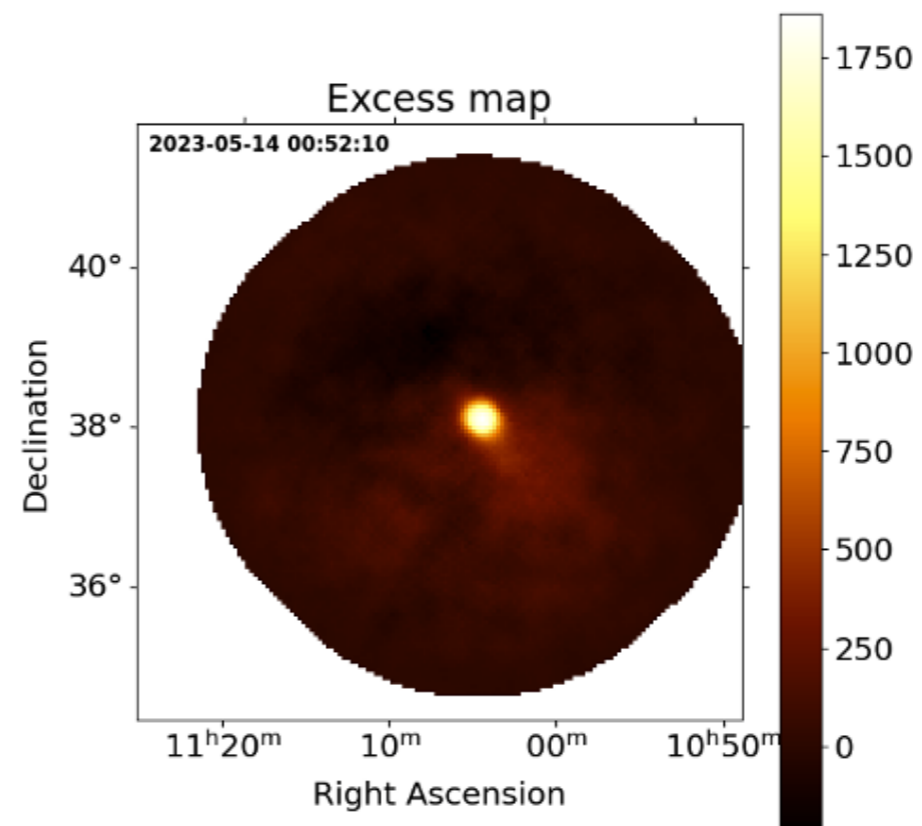
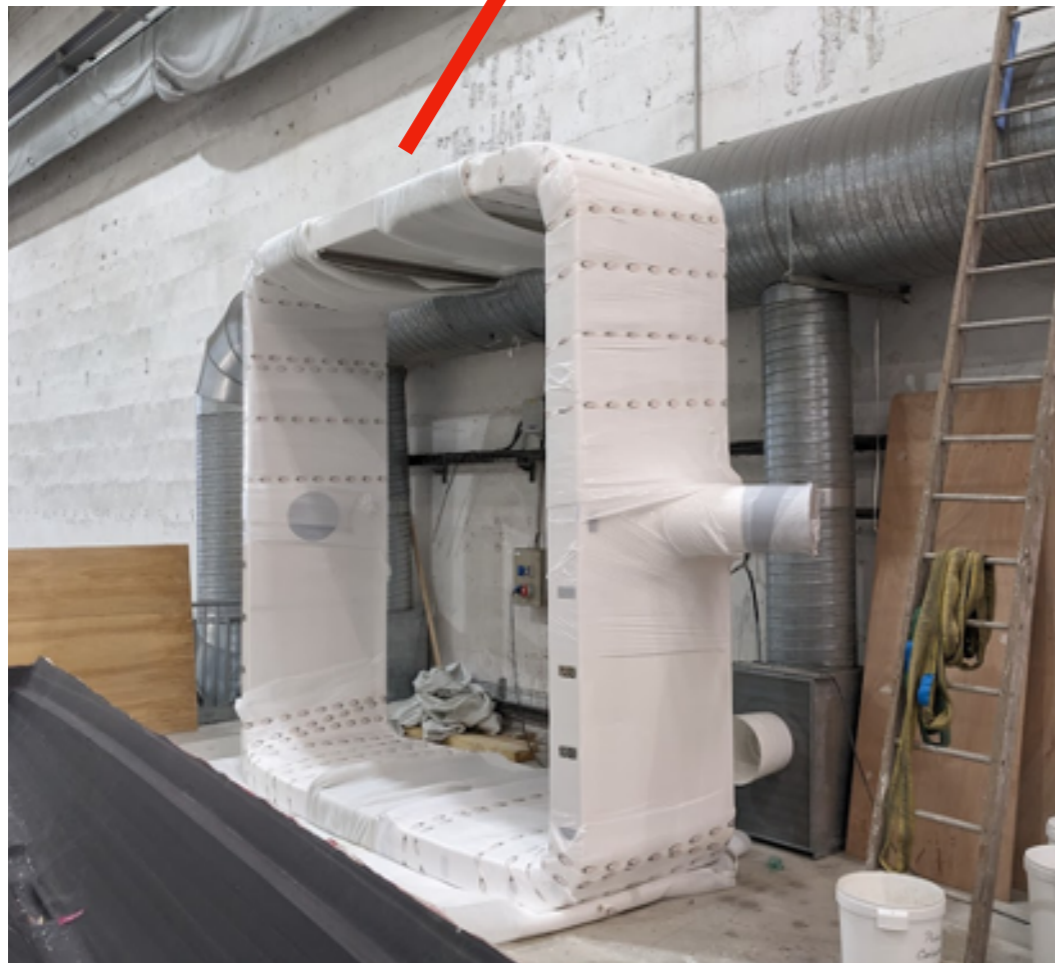
France will provide nine NectarCAMs to CTA for Northern site.

(Credit: J.-F. Glicenstein)

LST development in France



- France is providing the camera support structure, arches & drive system for the LSTs at La Palma
- Low-weight carbon fibre structure to allow fast slewing to GRBs.



- Sky map of LST-1 data from Mrk421 shows clear detection with single telescope.

- RTA system (especially important for GRBs), capable of operating at 7kHz with good sensitivity.

LST 2-4 construction progress

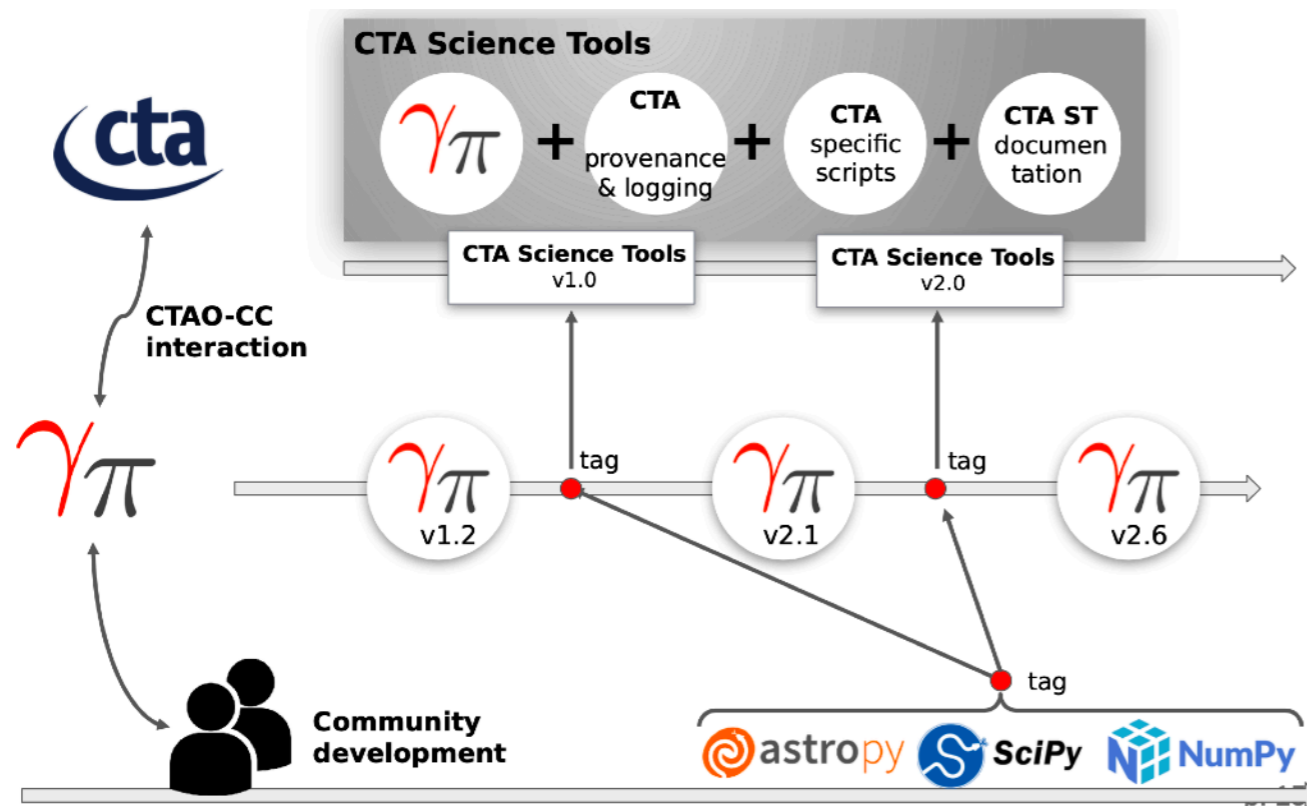


- Civil engineering advancing for foundations of LST 2-4
- Build-out of structures planned for 2024-2025, with MST-1 also.
- Cameras for LST 2-4 already at IAC.

(Credit: F. Acero)

Software development in France

gammaPy : the science analysis tools for CTA



- gammaPy : multi-year project to develop an open framework for analysis of gamma-ray data from Fermi, HESS, CTA etc...
- Be “serious” about development, use open-source best practices.
- Strong management team with project manager and lead developer in France.
- Proposed to CTAO as foundation of official CTA science analysis tools (SAT), and selected. gammaPy team will provide SAT as IKC to CTAO. Development of gammaPy will be synchronised with CTA SAT.
- <https://gammapy.org/>