CTA & NectarCAM

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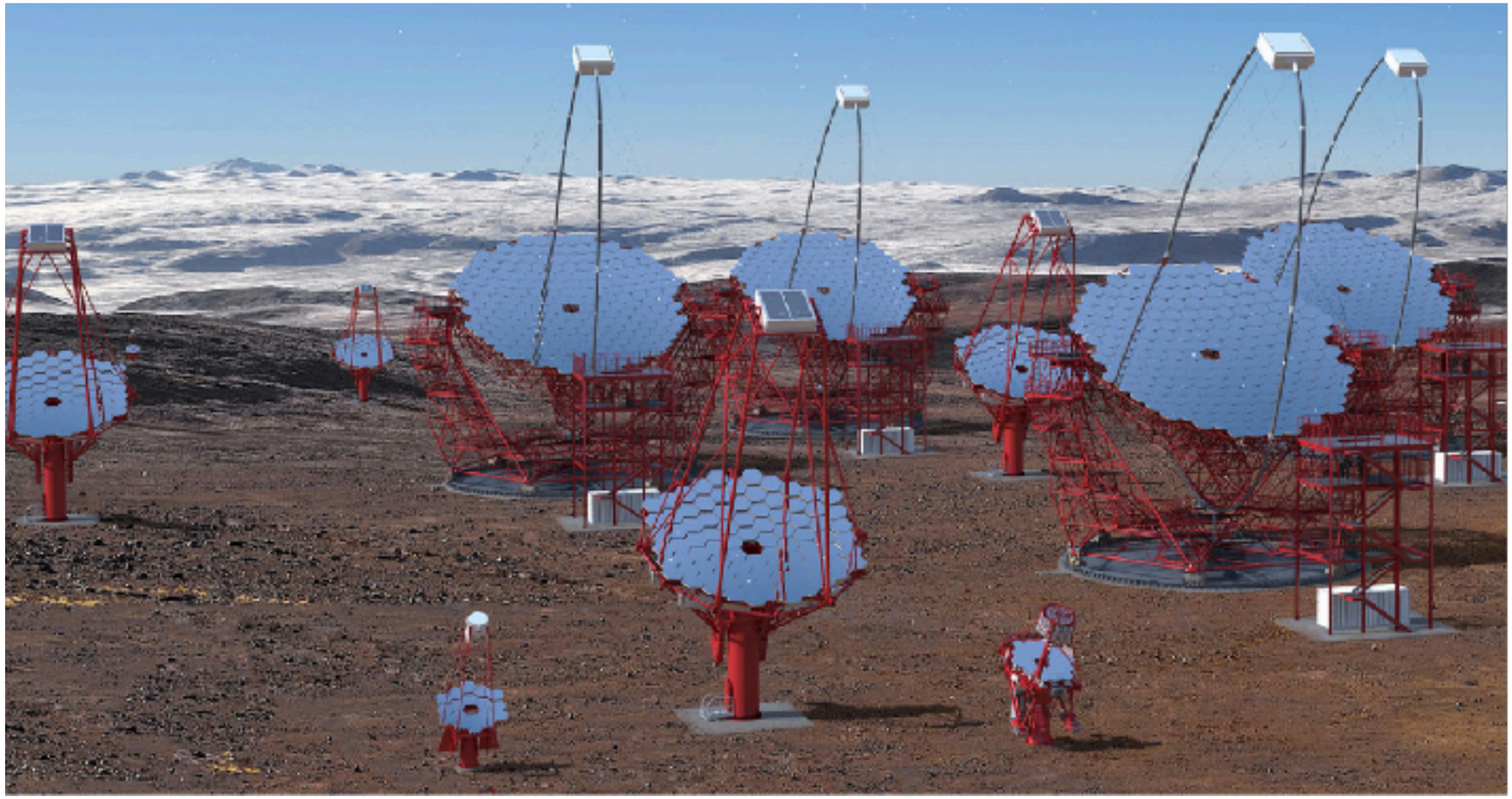
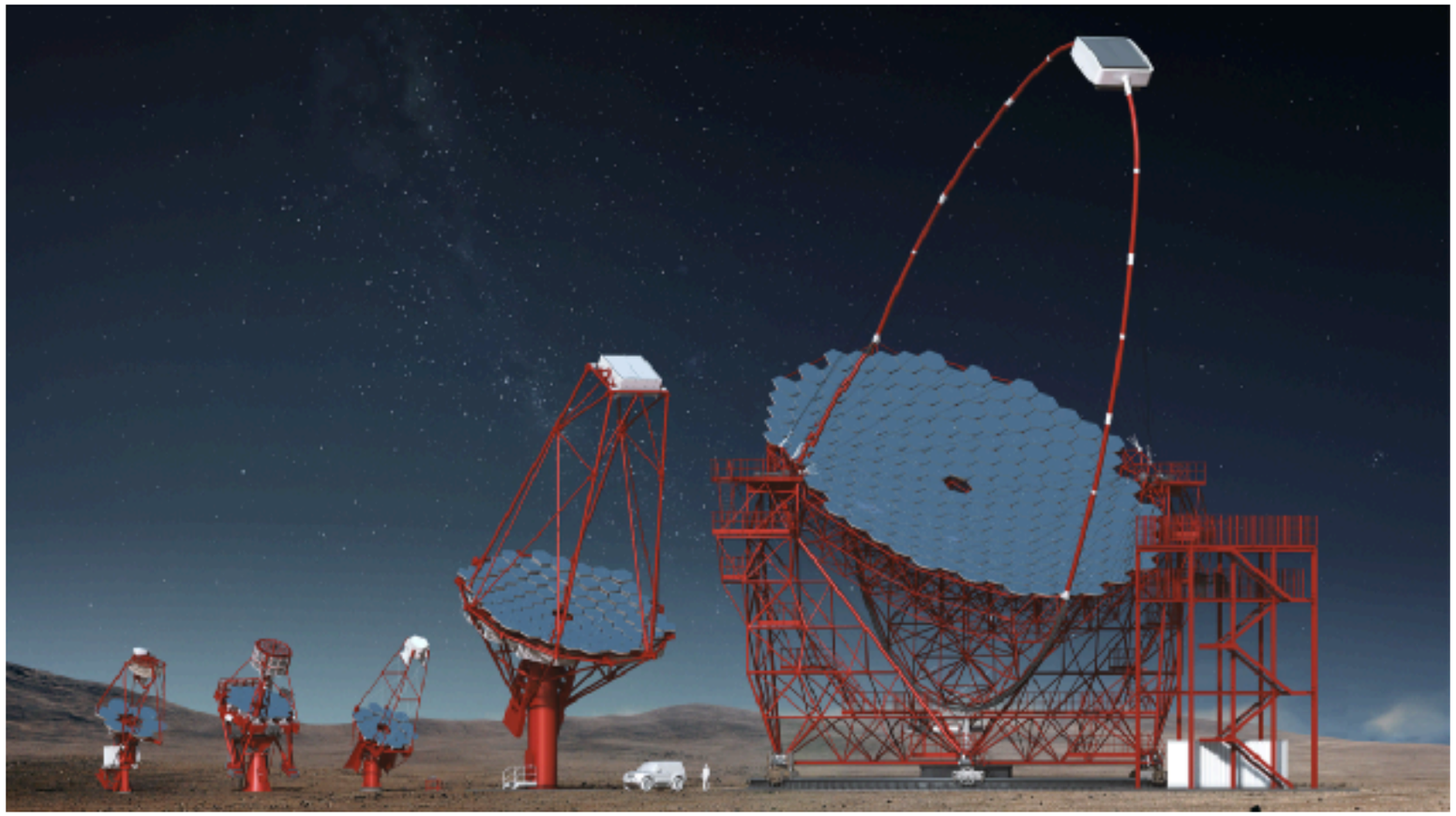
CS LLR 2017-06-01

Cherenkov Telescope Array (CTA)



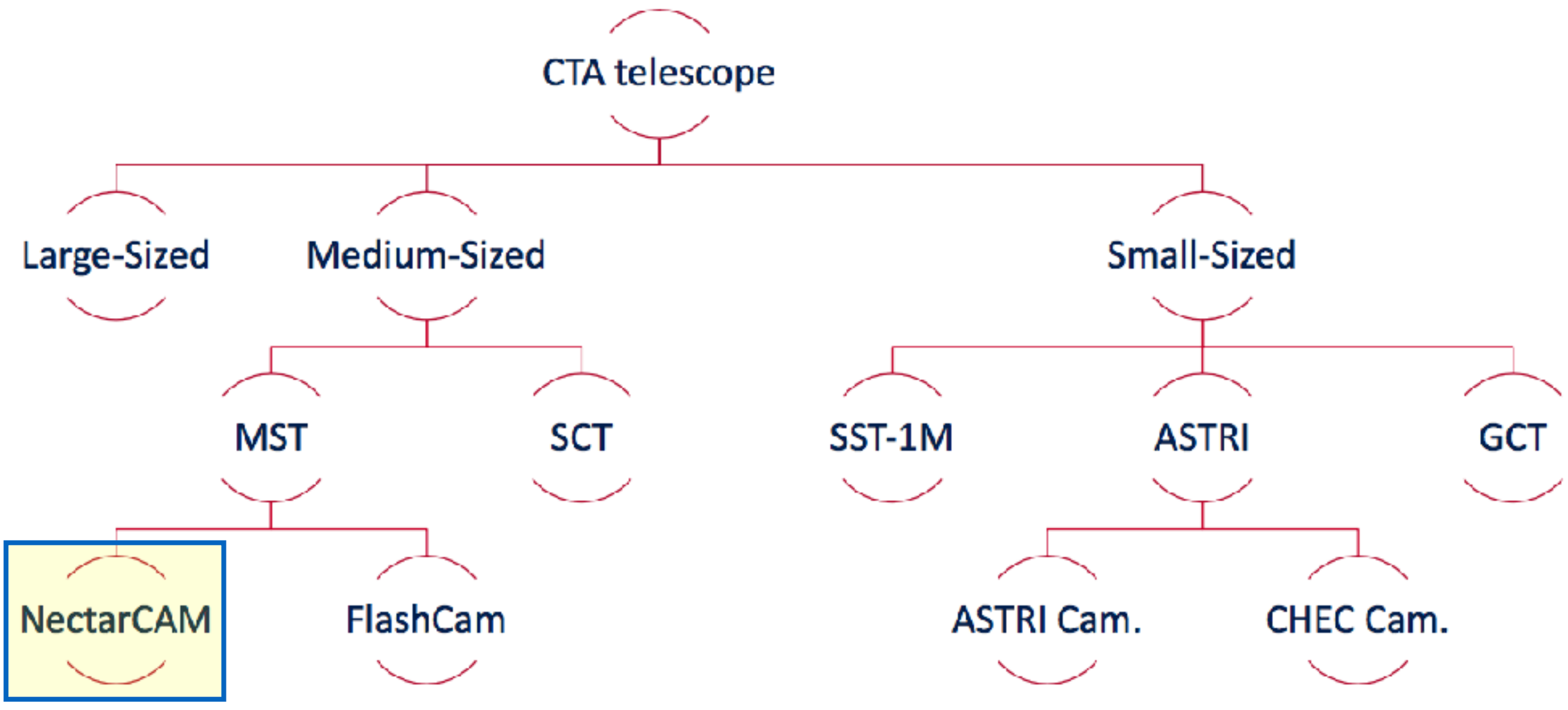
- Observatory for very-high-energy gamma-ray astronomy (20 GeV - 300 TeV) with ultimate sensitivity increase of ~10
- Arrays of three classes of telescopes using *imaging atmospheric Cherenkov effect*.
- Two sites : Paranal (Chile) and La Palma (Canary Islands, Spain)

Cherenkov Telescope Array (CTA)



- Three classes of telescope:
  - large (LST), ϕ=23m, north (& south?);
  - medium (**MST**), ϕ=12m, north & south, and
  - small SST, ϕ=1–2m, south.
- **NectarCAM** - one of the camera designs for the MST telescope: France, Spain, Germany. Prototype planned for northern site at La Palma

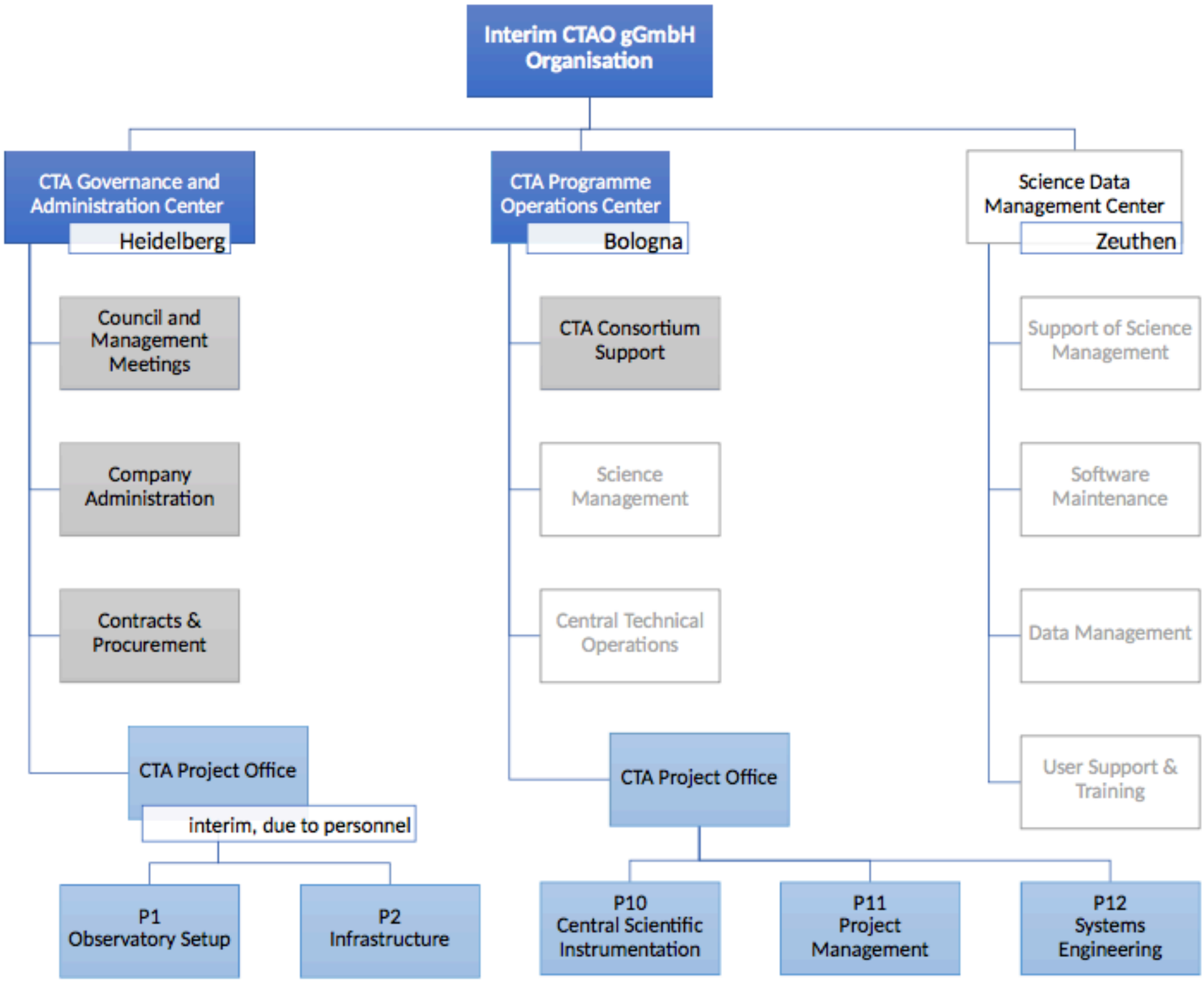
Telescope tree



Towards the final legal entity

- **CTA Consortium (CTAC)** — agreement between scientists and agencies to participate in construction and operation of CTA. Defines rights and responsibilities of collaborators.
- **CTA Observatory (CTAO)** — legal structure that will own and operate telescopes, project office, negotiate site agreements etc. Stake holders are funding agencies in member countries.
  - Today structure is **CTAO-GmbH** with seat in Germany
  - Future structure to be **CTAO-ERIC** : “European Research Infrastructure Consortium” with seat in Italy (13 ERICs exist, e.g. European Spallation Source in Lund). Application takes 9 months, including translating documents to all EU languages (including Irish!!).

Current interim organisation



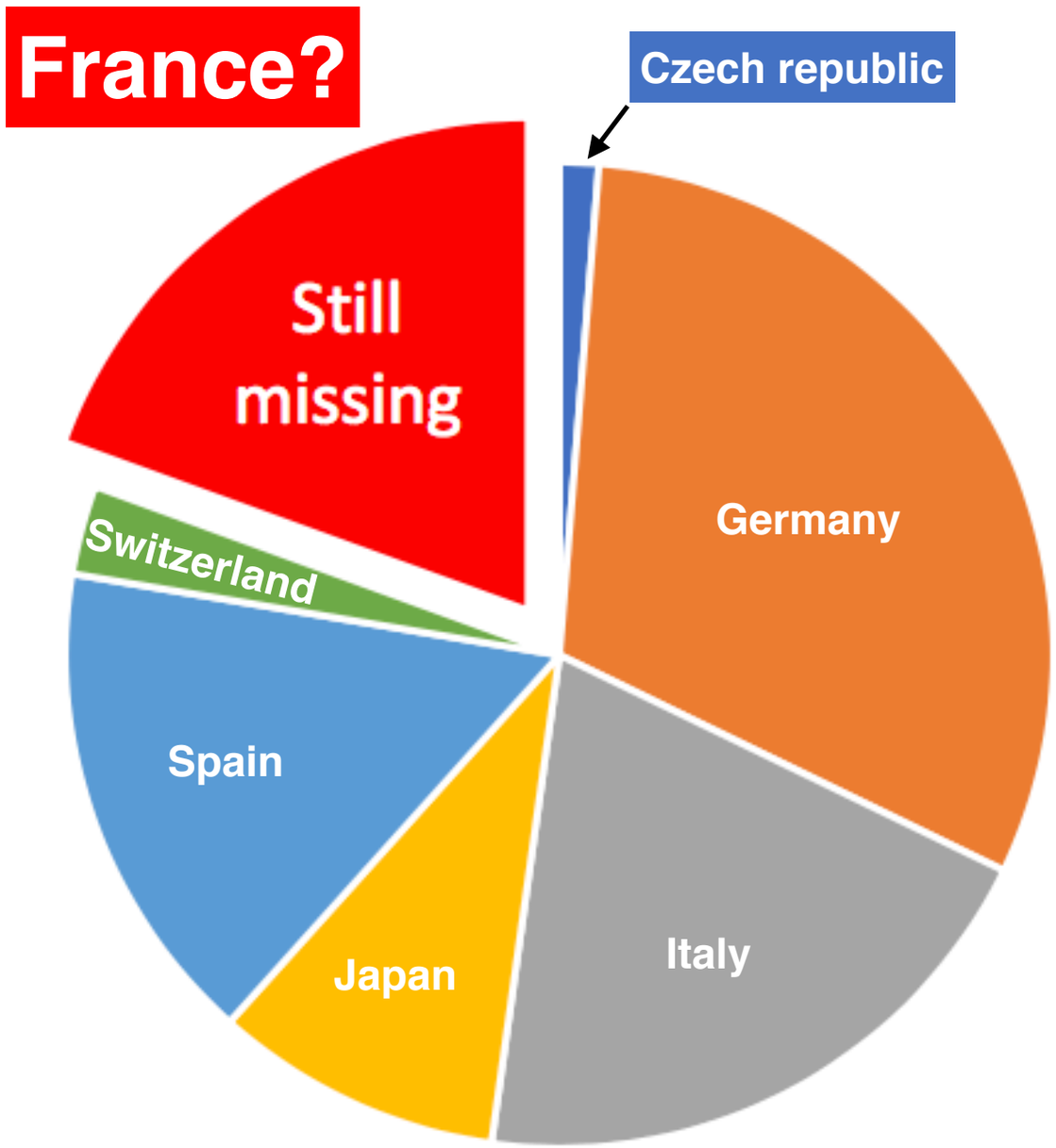
Site hosting agreements

- **IAC on La Palma** : hosting agreement signed a year ago.

- **ESO in Chile** : ESO council and CTAO council agreed on a hosting agreement in December 2016
  - CTAO on land of ESO
  - CTAO defines construction and operation
  - CTAO may use services from ESO, if available
  - CTA material will be owned by ESO (-> VAT exemption) ESO will operate on behalf of CTAO
  - However, still not signed.

Threshold & Funding

- Cost of full proposed observatory is ~450M€
- “Threshold” observatory defined at which point it makes sense to start construction — 250M€
  - N: 4xLST, >5xMST
  - S: >15xMST, 50xSST
- Funding identified for 80% of threshold, still missing is the “French” contribution of 52M€



TGIR funding situation

EAOM 2017-05-29

Evénements attendus en 2017/ Objectifs

Rapport HC TGIR et décisions CD TGIR de Février :

- Participation aux upgrades Phase II LHC : oui –
- Participation française à CTA : oui/non, à quelle hauteur ?

Feu vert (concret = financements !) fortement attendu par les équipes

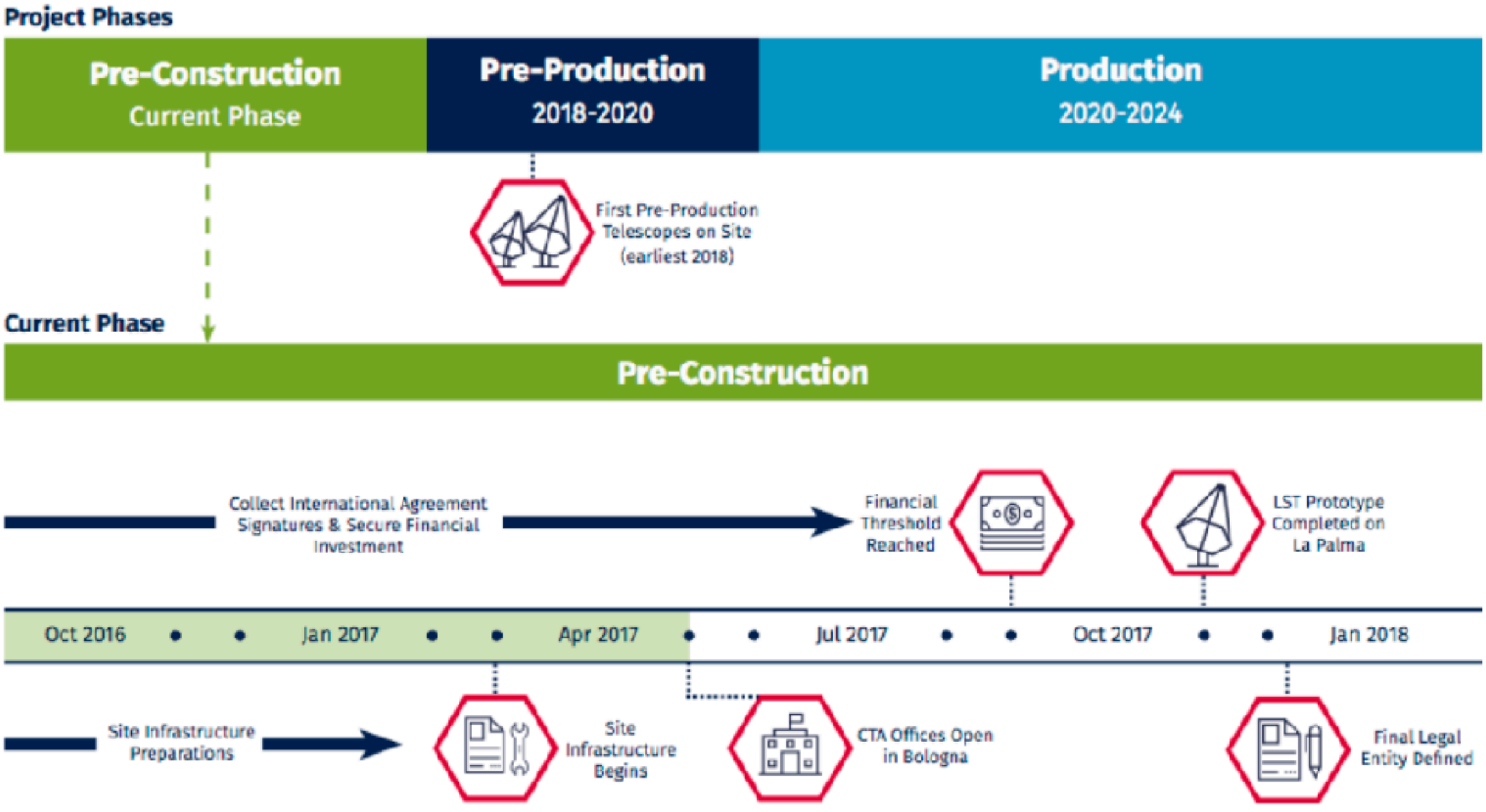
Objectifs 2017 :

- Démarrer la construction de ces grands équipements (durée 6-8 ans)
- Mise en service de Virgo (2nd semestre 2017).
- Mise en service SPIRAL2 (inauguré en 11/16) et finalisation schémas financement phase 1 (11 M€ à trouver).
- Décisions participations Auger-Prime (CSI 2/17), BELLE-II (cf. CSI 6/17)
- Important travail de mise à jour de la feuille de route IR nationales, de la liste ESFRI, Prospectives nationales -> début 2018

5/5/2017 Visites Laboratoires 2017 12

- Feb 2017: CTA recommended by HC TGIR and approved by CD
- … **but** funding level not yet decided: 0M€ « x < 52M€
- … **nor** is funding profile for coming years decided

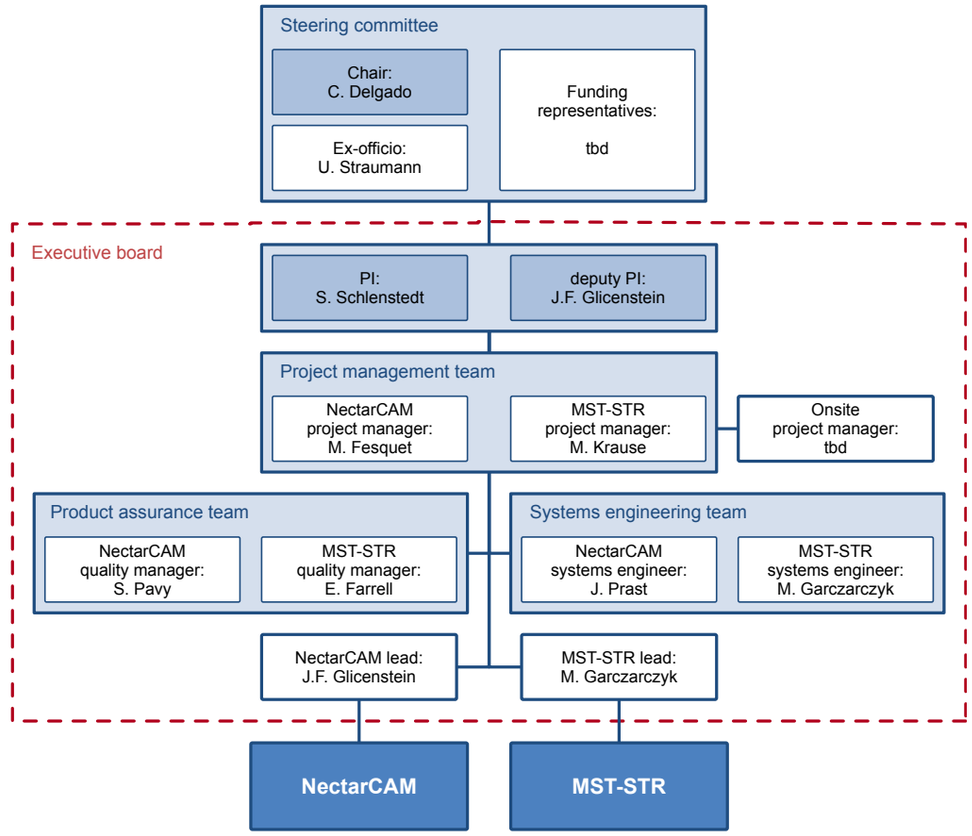
CTA timeline



P2IO and CANEVAS

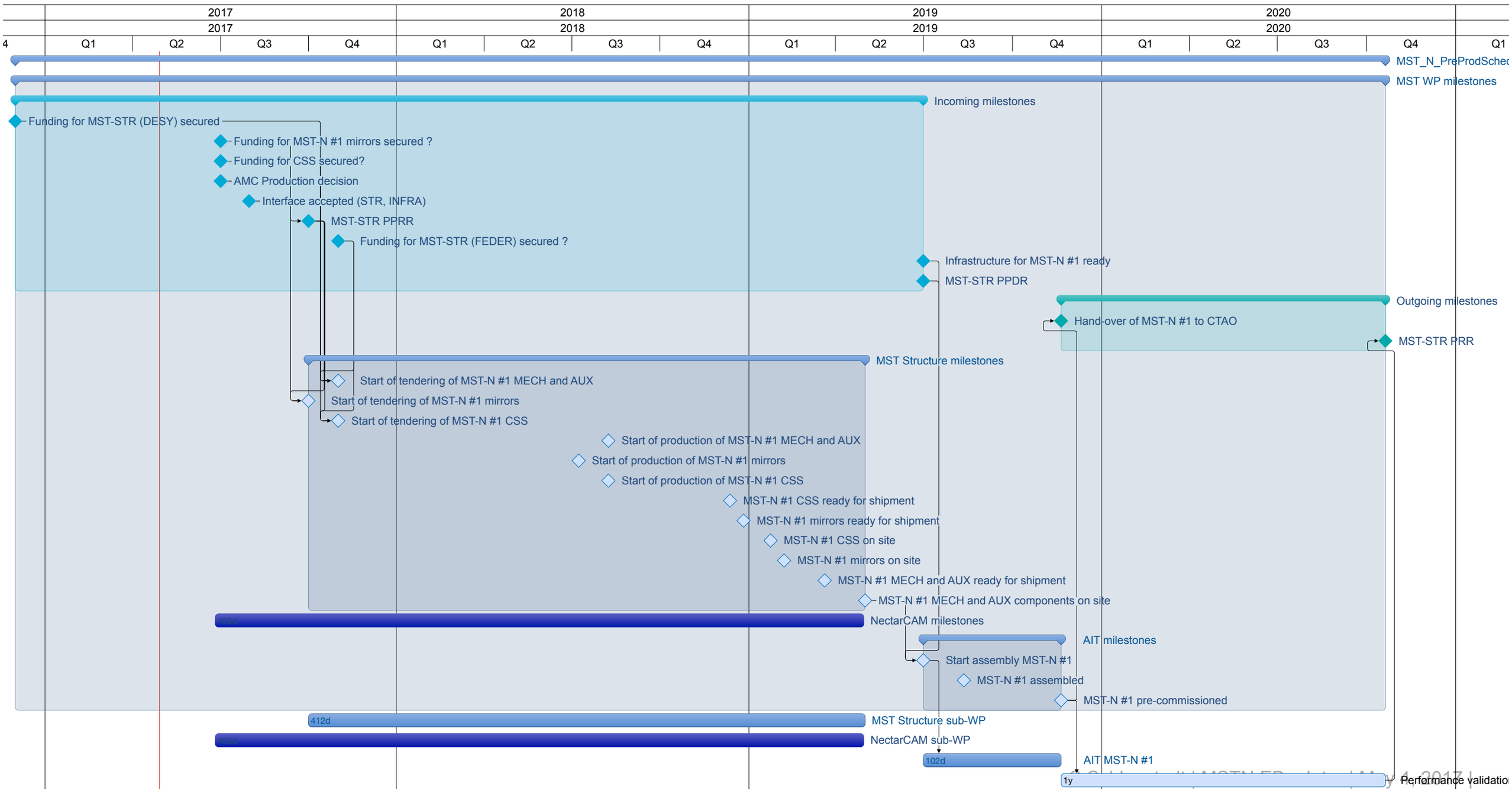
- CANEVAS : project to build partially instrumented NectarCAM camera that will become Qualification Model
- LLR : 100k€ for postdoc, 155k€ for hardware:
  2016: 23k€, **2017: 117k€**, 2018: 15k€
- Personnel : 2-year postdoc to help offset loss of manpower in group over last few years (Berrie & Bruno)
- Equipment : build core of camera (structure, modules, cooling, racks, window)
- **This allows NectarCAM timeline to continue before TGIR decision is made.**
- TGIR will be needed to finish fully equipped camera.

MST North (MSTN) sub-consortium



- Sub-consortium to build and operate one MST telescope with NectarCAM qualification model at Observatorio del Roque de los Muchachos (ORM) on La Palma
- MoU between responsible parties :
  - Instituto de Astrofísica de Canarias (IAC, Site),
  - DESY, U. de Sao Paolo (MST), and
  - CIEMAT, DESY, IN2P3, INSU, IRFU (NectarCAM)
- Defines scope, governance, responsibilities, contributions, equipment, commissioning, liability…
- Funding : FEDER funds, DESY, P2IO, other LABEXs, TGIR

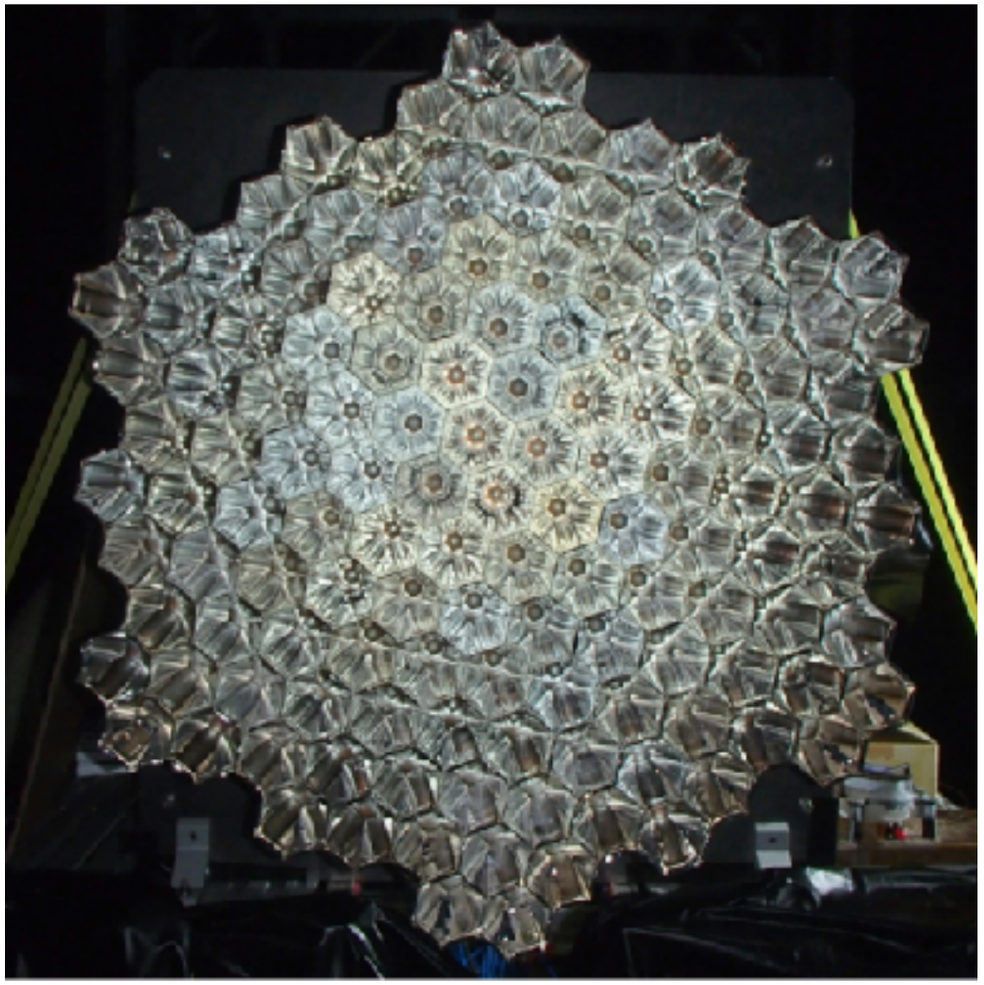
MSTN timeline (aligned to NectarCAM)



LST prototype @ La Palma

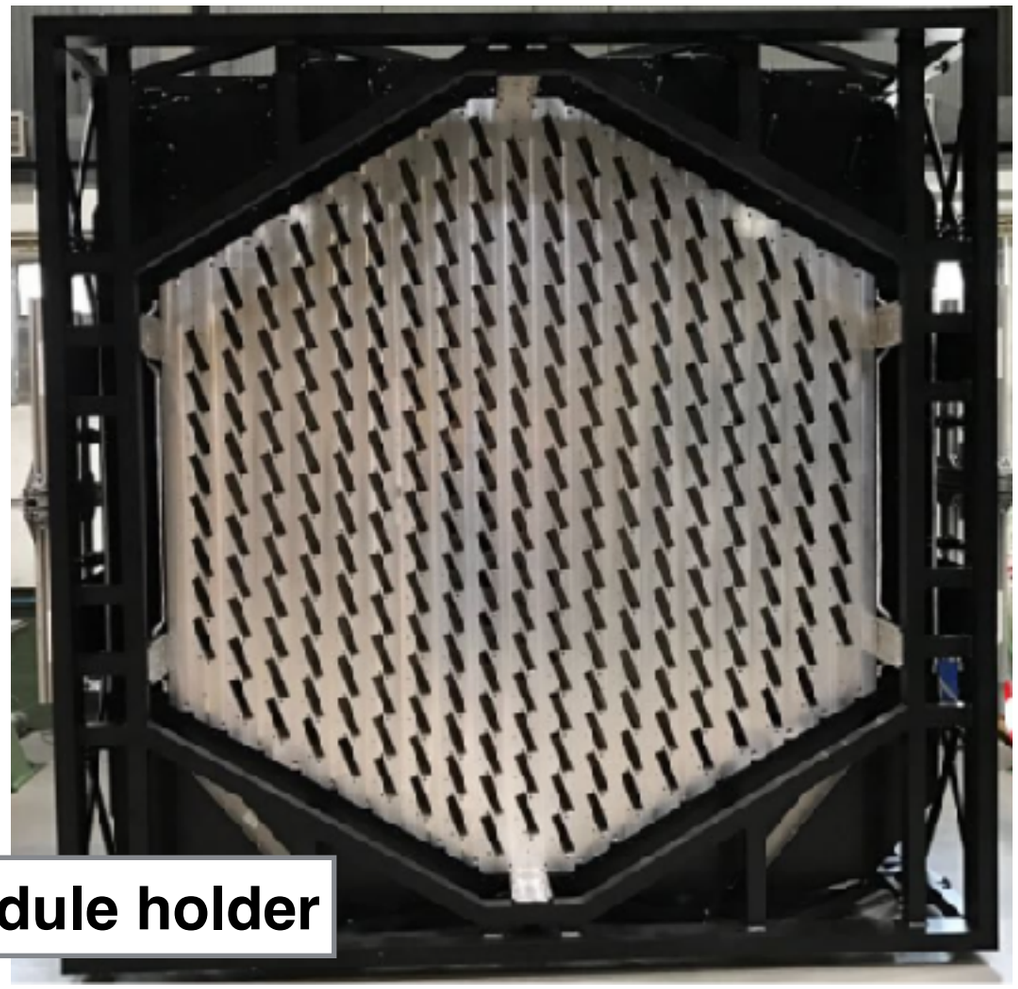
- Installation on La Palma started; but delayed due to permitting problems at local level.

LST prototype camera



- LST camera design very similar to NectarCAM - main difference is front-end board : LST uses Dragon ASIC, MST uses Nectar
- Common LST and NectarCAM mechanical design tasks split between CIEMAT (Spain) and LLR

LST prototype camera



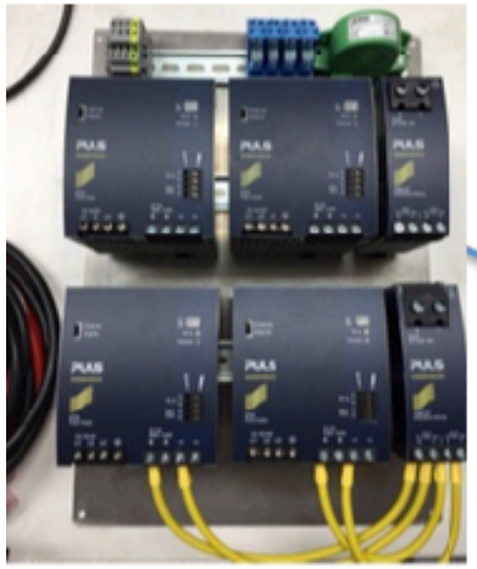
Module holder

Enclosure

- LST mechanical components identical to those of NectarCAM.
- NectarCAM module holder being assembled @IRFU this week
- NectarCAM enclosure is a major **CANEVAS** responsibility of LLR, to be ordered in September (for delivery to IRFU).

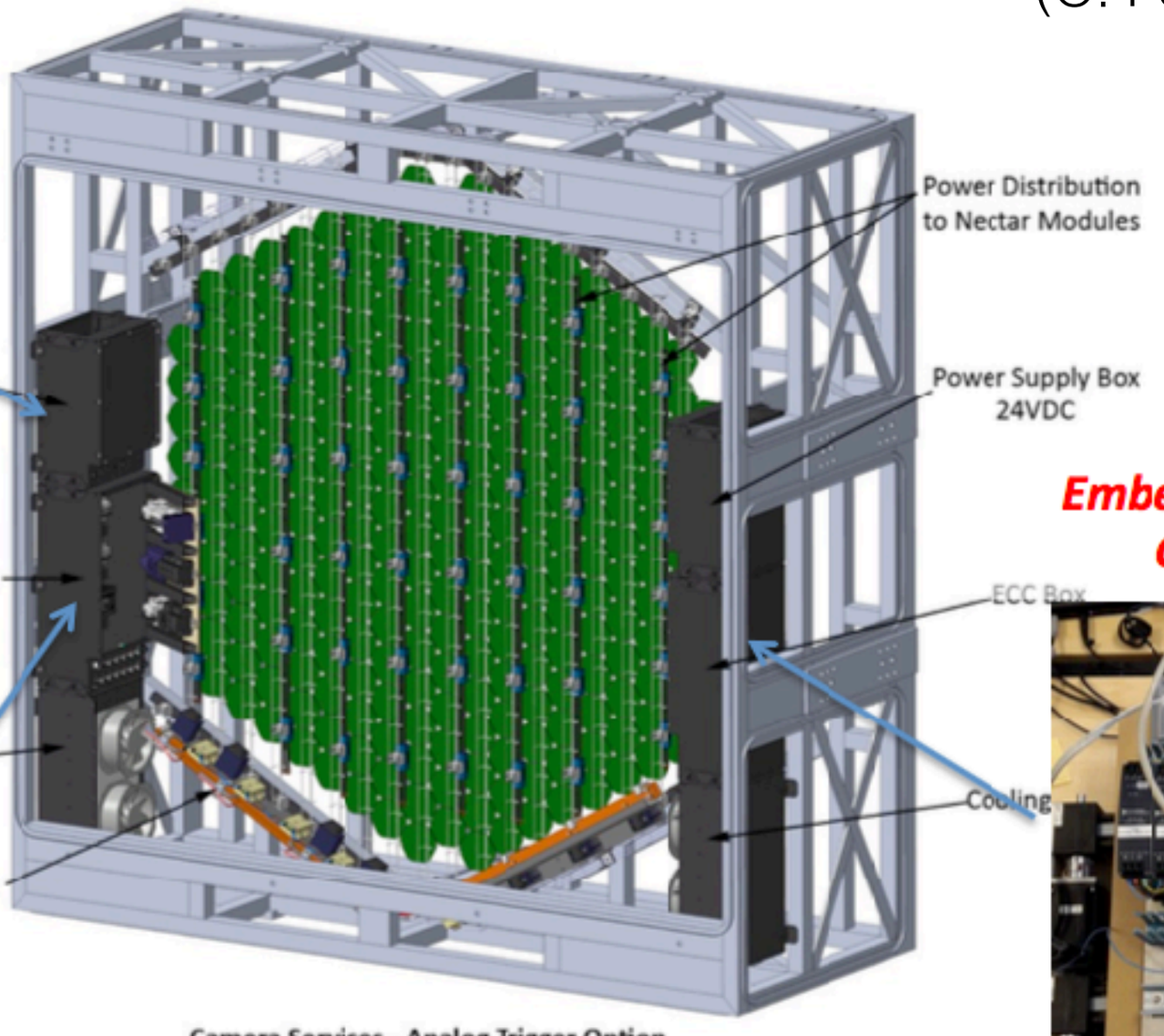
Mechanics at rear of camera

(O. Ferreira, LLR)



Power Supply Box

Power Distribution Box

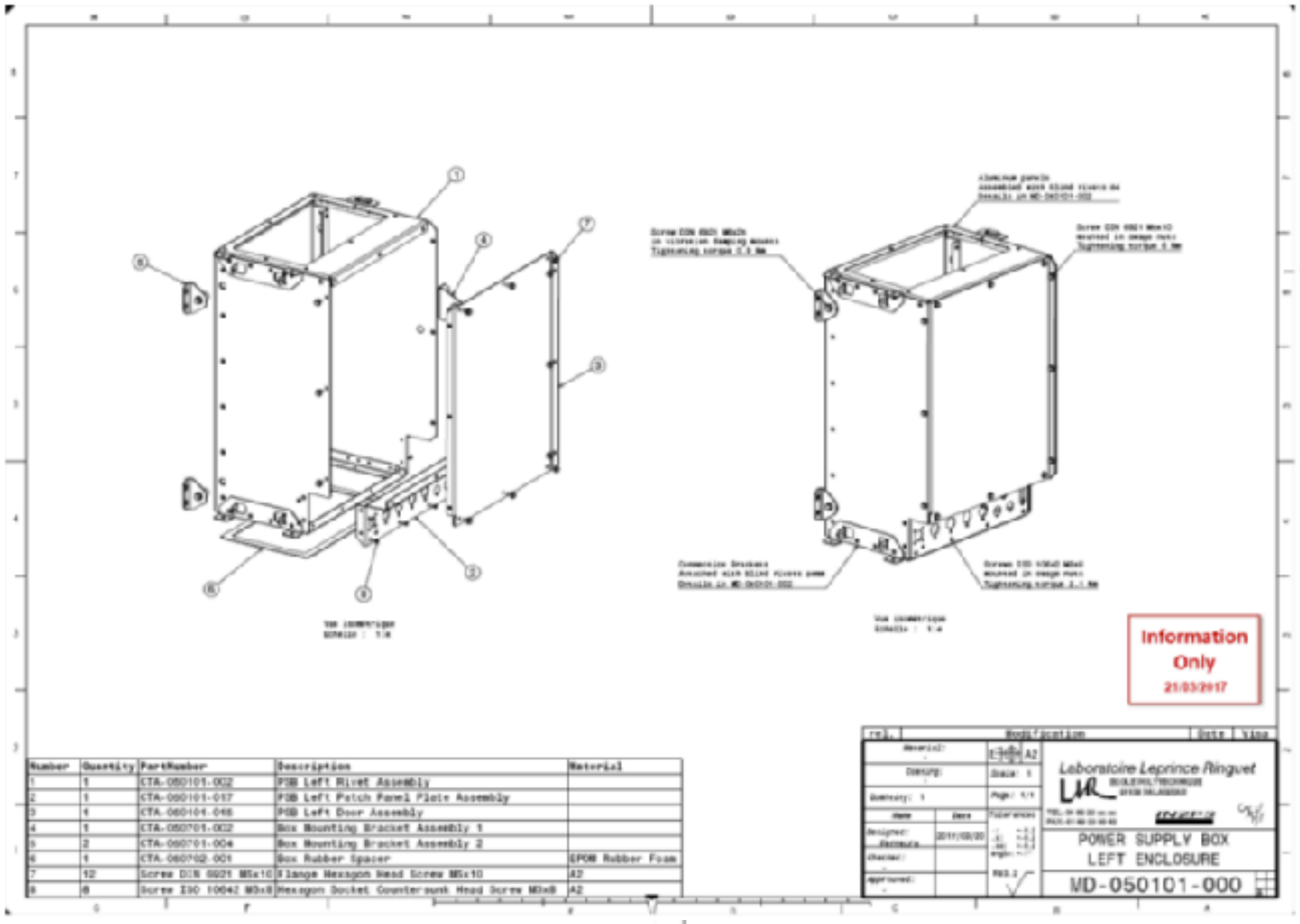


Camera Services - Analog Trigger Option

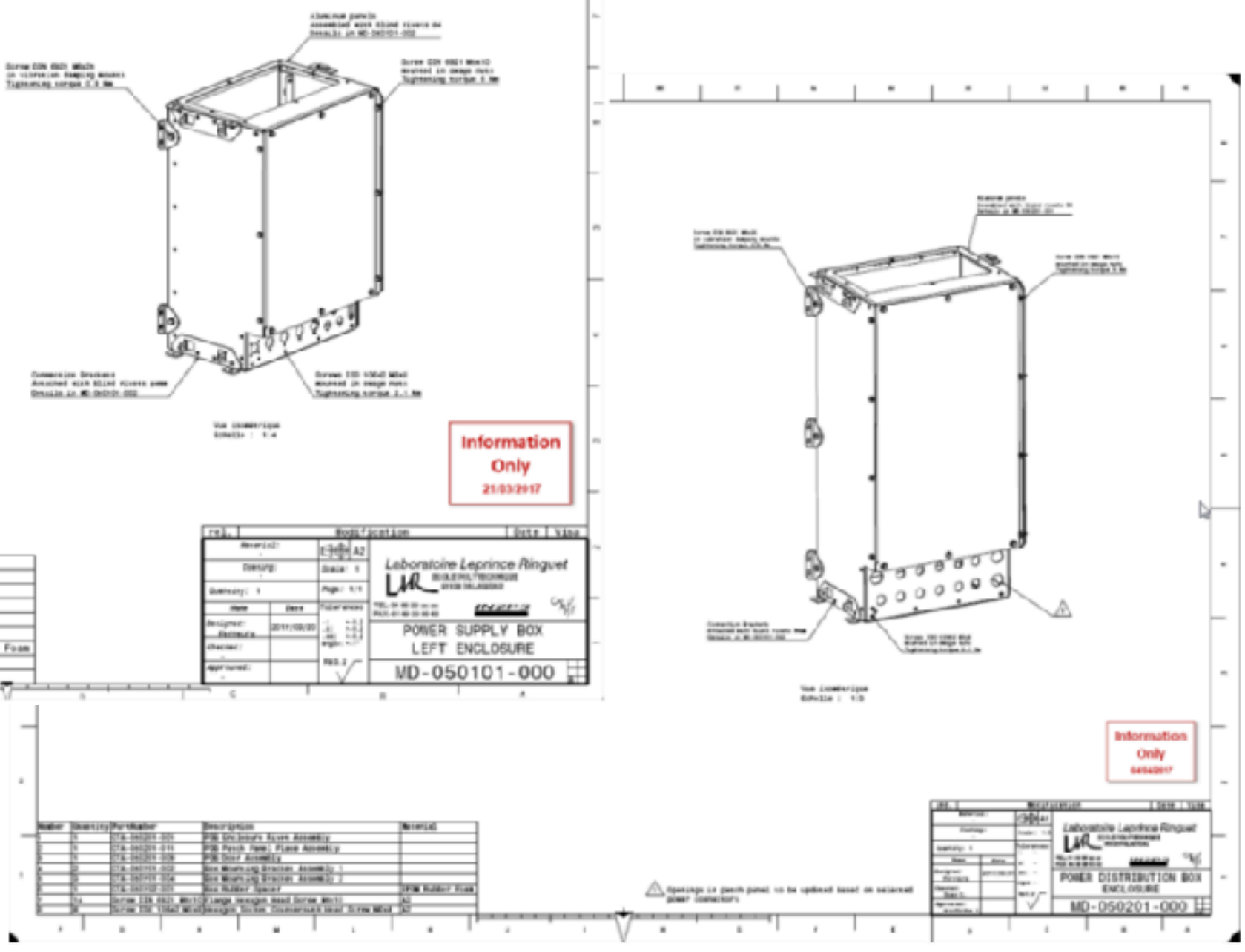
Embedded Camera Controller

Mechanics at rear of camera

(O. Ferreira, LLR)



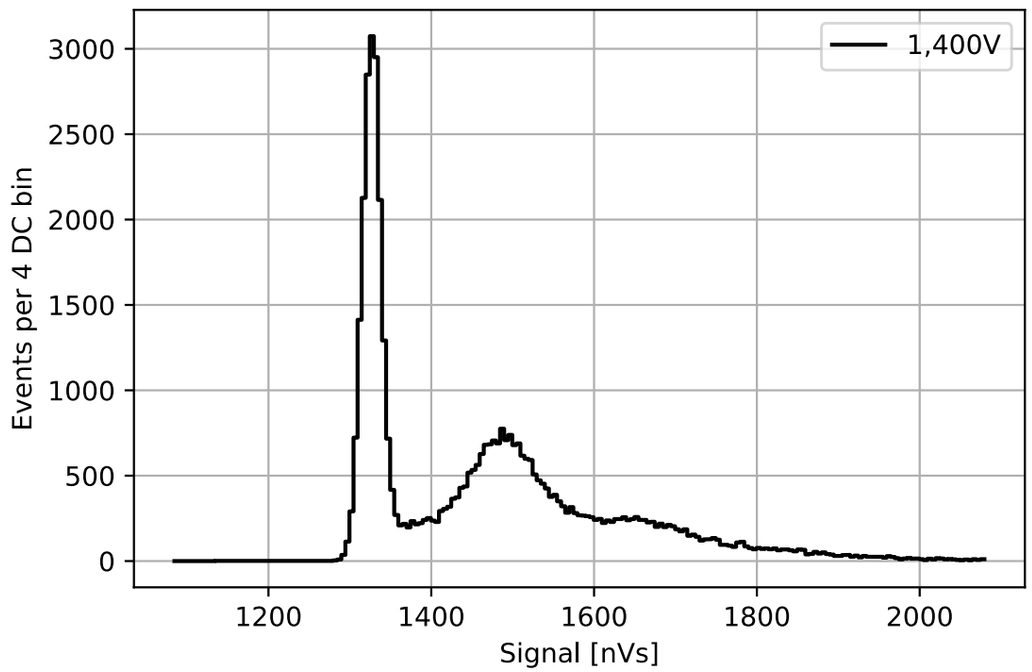
Number	Quantity	PartNumber	Description	Material
1	1	CTA-050101-002	PDB Left Rivet Assembly	
2	1	CTA-050101-017	PDB Left Patch Panel Plate Assembly	
3	1	CTA-050101-048	PDB Left Door Assembly	
4	1	CTA-050701-002	Box Mounting Bracket Assembly 1	
5	2	CTA-050701-004	Box Mounting Bracket Assembly 2	
6	1	CTA-050702-001	Box Rubber Spacer	EPDM Rubber Foam
7	12	Screw DIN 6921 M8x16	Flange Hexagon Head Screw M8x16	A2
8	8	Screw ISO 10642 M8x8	Hexagon Socket Countersunk Head Screw M8x8	A2

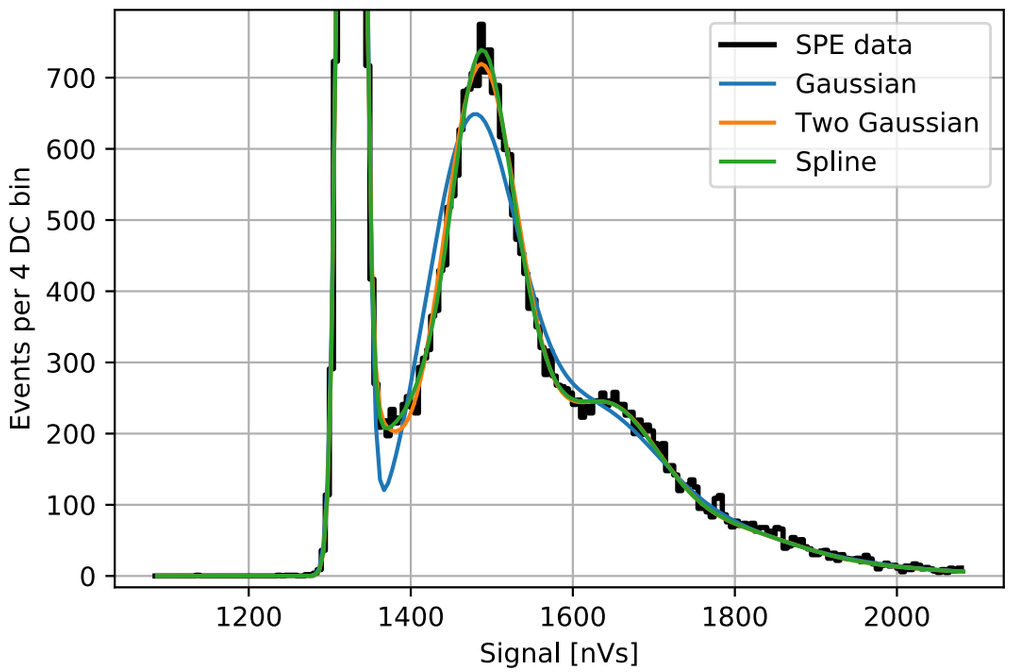


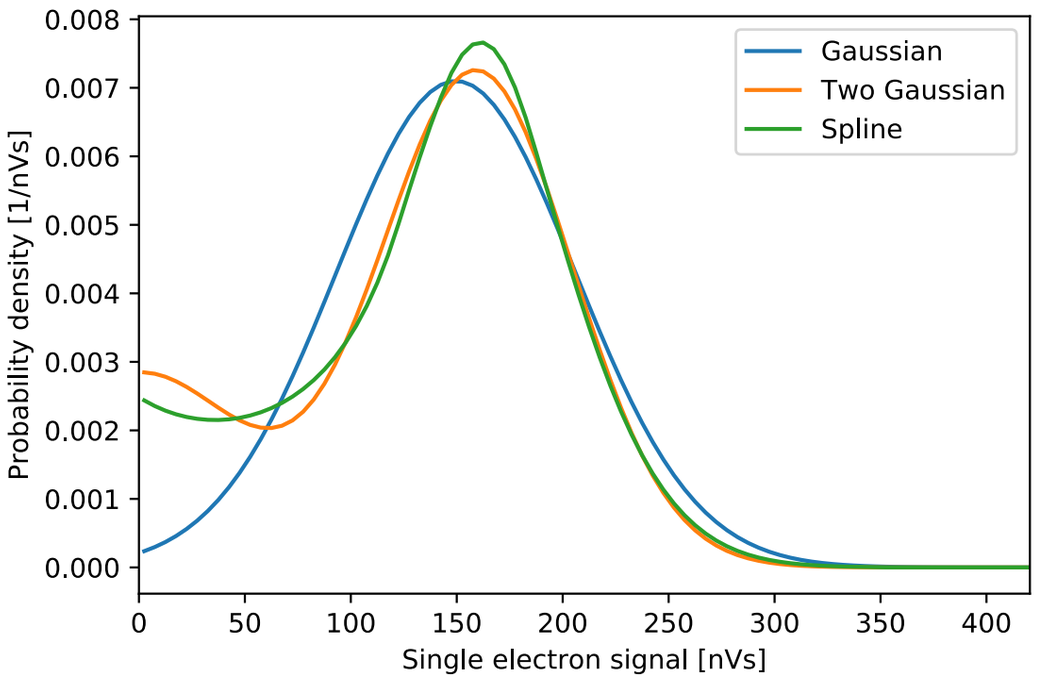
Fabrication drawings for LST. Nearly identical for NectarCAM.

Calibration

(S. Fegan, S. Caroff, J. Nanni, LLR)







- LLR responsible for coordination of calibration tasks for NectarCAM
- Develop and test new algorithms for calibration : PMTs, muons etc…
- This positions us to be able to quickly exploit science data from first telescope.

Product Assurance

(S. Pavy, LLR)

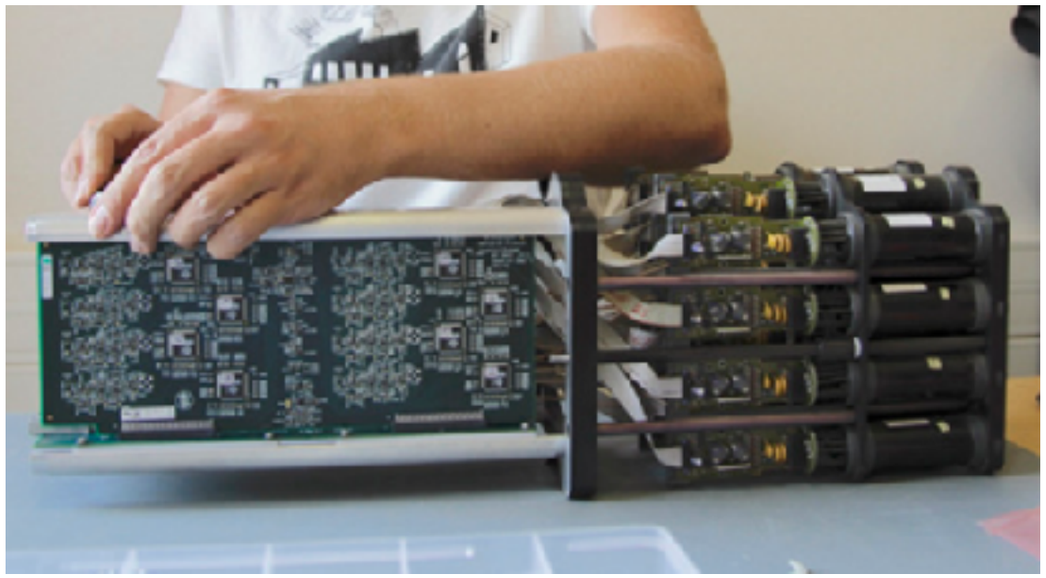
- Coordination of product assurance package for MSTN consortium

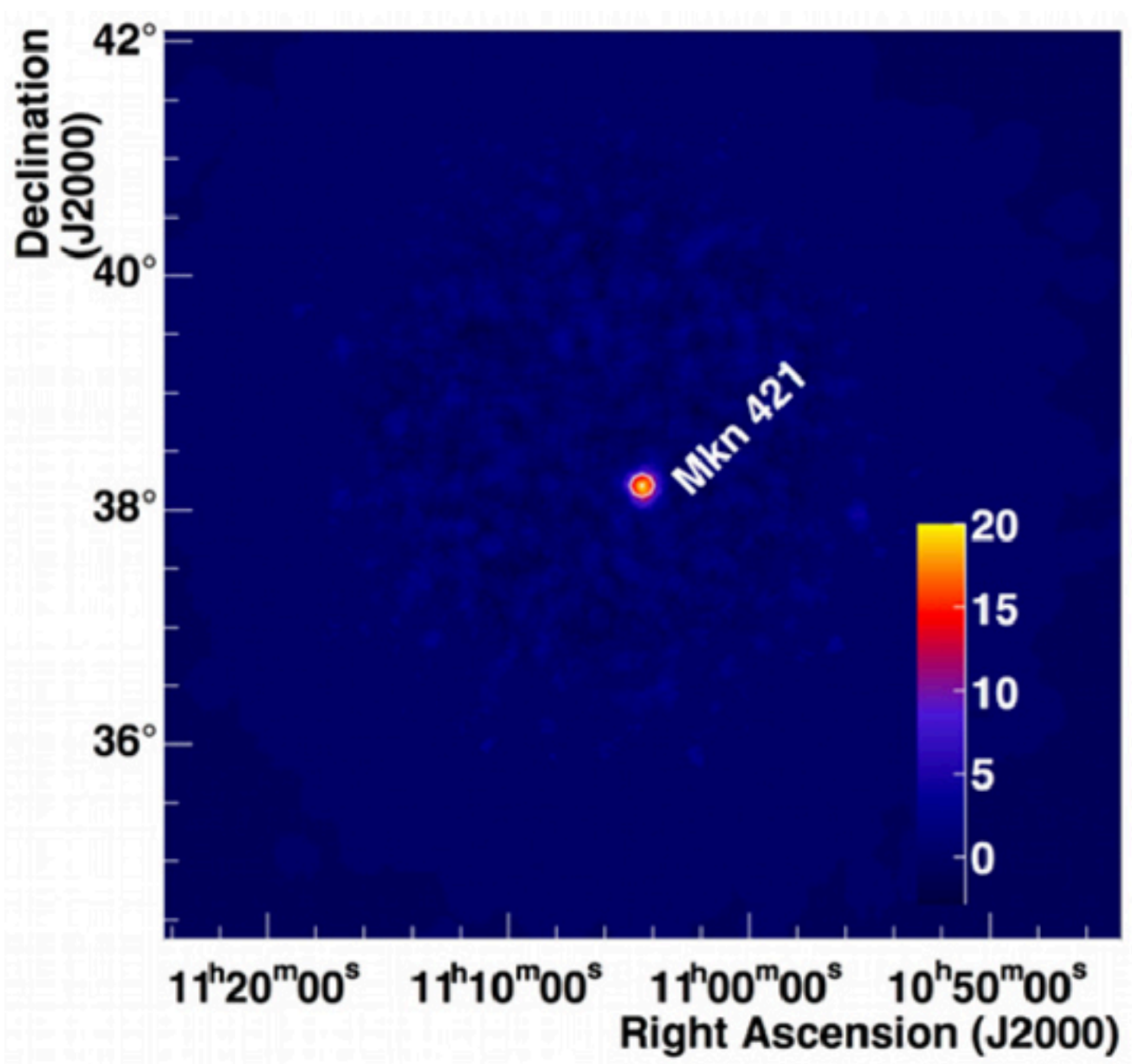
- NectarCAM manufacturing readiness reviews :
  - Light concentrator MRR completed with large LLR contribution
  - FEB MRR this Friday at LPNHE

- Documentation for NectarCAM

- Management of non-conformance procedures

First gamma-ray source detection by Nectar-based camera (HESS-U)





Credit : HESS / DESY