cherenkov telescope array

Status and results of the prototype LST of CTA

Daniel Mazin for the CTA LST project

LST of CTA

cherenkov telescope array

LST presentations at ICRC2021:

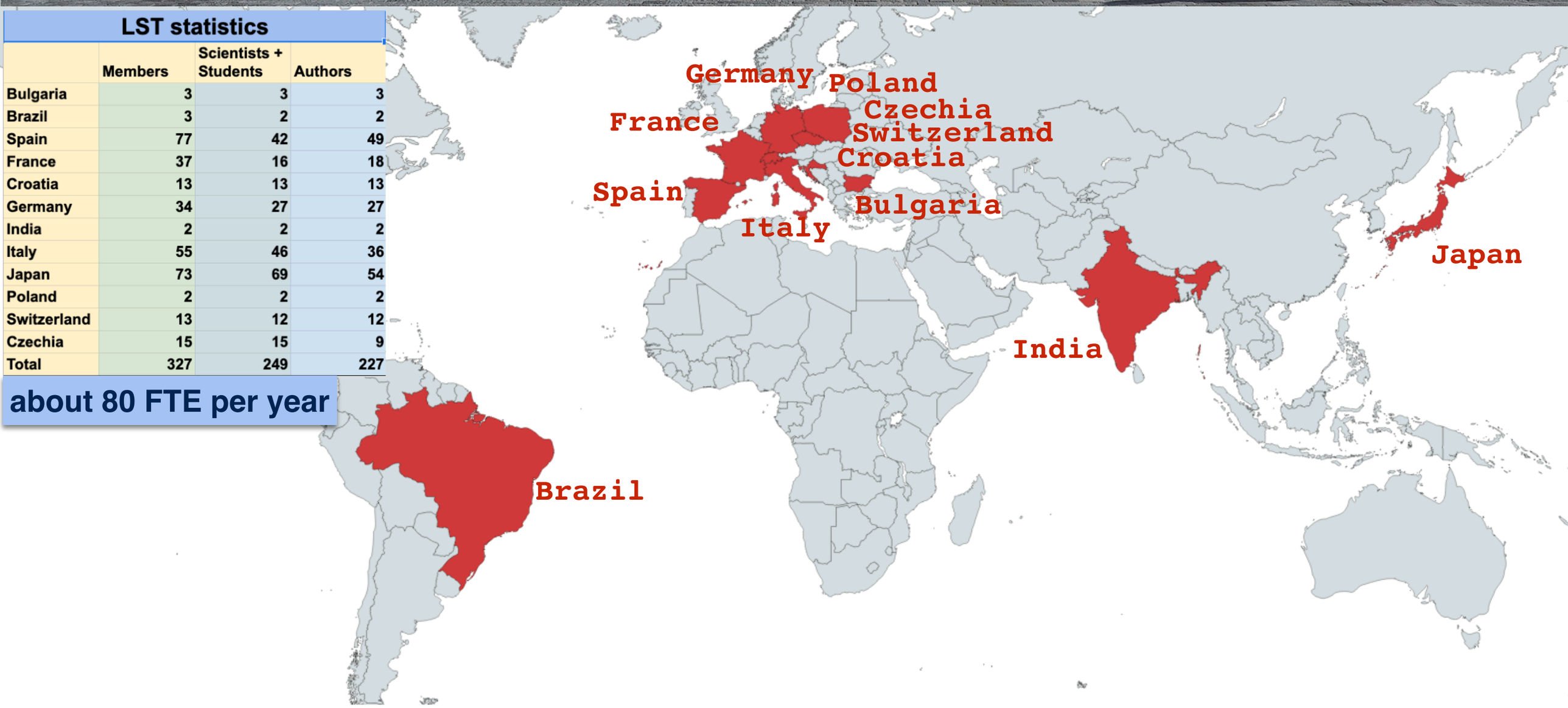
- LST Camera Calibration - Yukiho Kobayashi et al.
- Physics Performance of the Large-Sized Telescope Obtained with Crab Nebula data - Rubén Lopez Coto et al.
- LST-1 - MAGIC cross calibration and joint performance - Yoshiki Ohtani et al.
- CTA Large Size Telescope real data analysis using convolutional neural networks - Mathieu de Bony de Lavergne et al.
- Reconstruction of extensive air shower images using a likelihood maximization technique exploiting both spatial and temporal information from imaging atmospheric Cherenkov telescopes: application to LST - Gabriel Emery et al.
- Monitoring the telescope pointing using the stars reflected in the Cherenkov camera: application to LST-1 - Luca Foffano et al.
- LST-1 Transient Program - Alessandro Carosi et al.
- LST-1 Camera Commissioning - Takayuki Saito et al.
- Development of an advanced SiPM camera for the Large Size Telescope of the Cherenkov Telescope Array Observatory - Matthieu Heller et al.

LST team

LST collaboration meeting, La Palma, October 2018

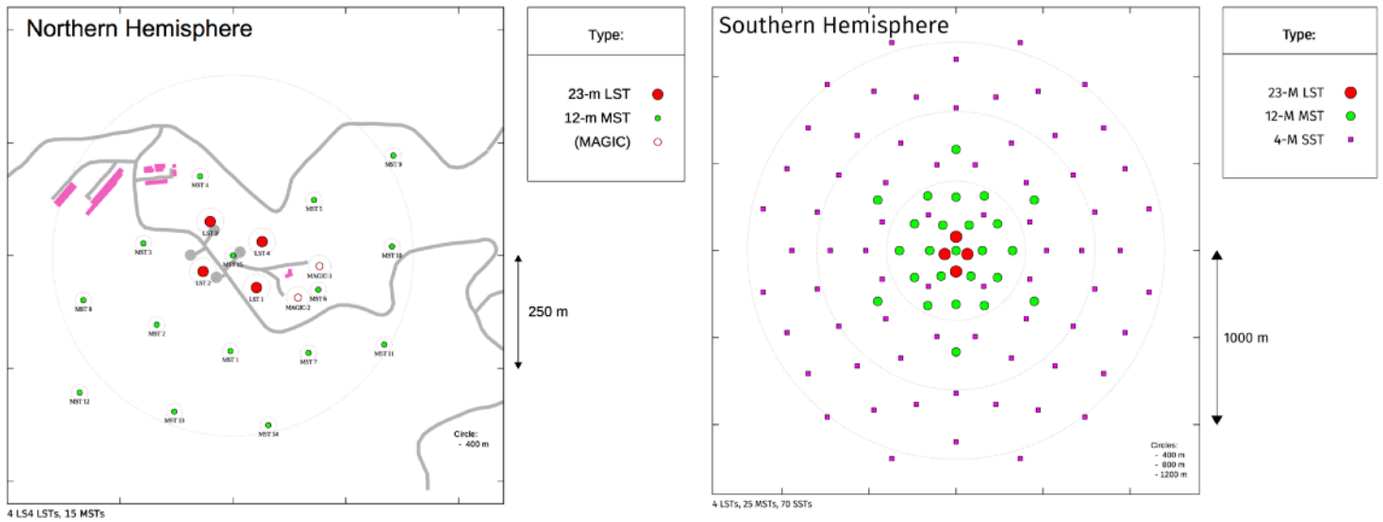
LST statistics			
	Members	Scientists + Students	Authors
Bulgaria	3	3	3
Brazil	3	2	2
Spain	77	42	49
France	37	16	18
Croatia	13	13	13
Germany	34	27	27
India	2	2	2
Italy	55	46	36
Japan	73	69	54
Poland	2	2	2
Switzerland	13	12	12
Czechia	15	15	9
Total	327	249	227

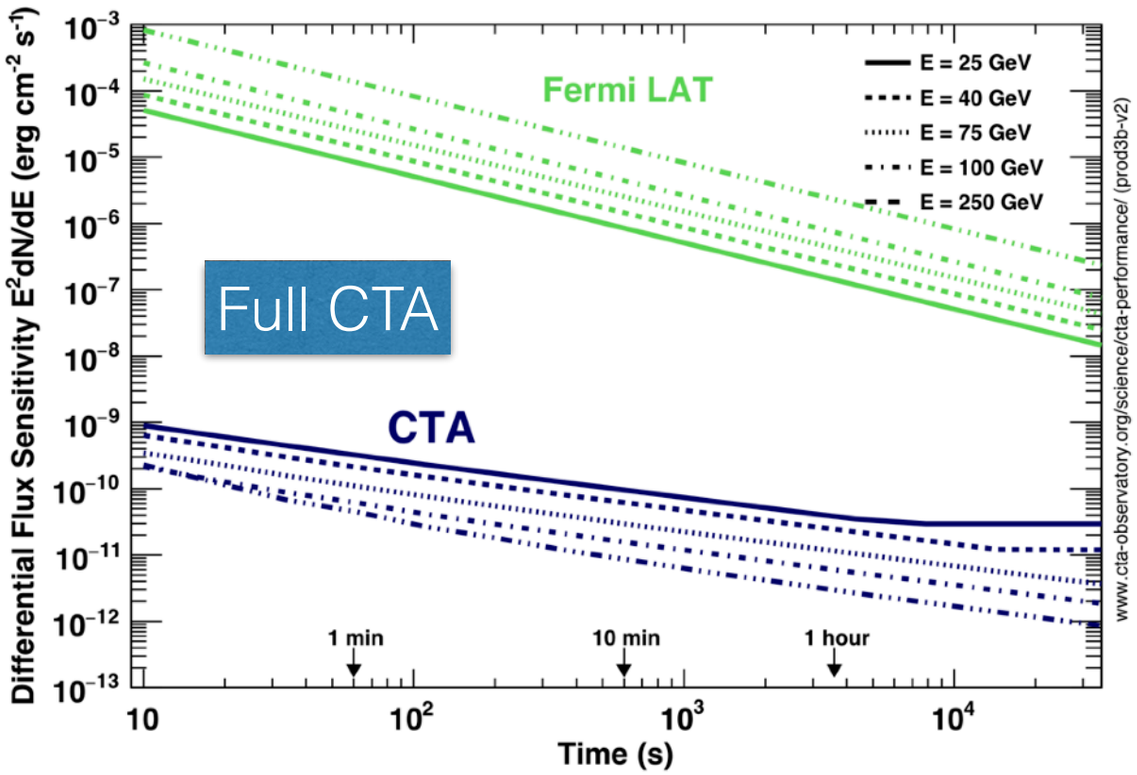
about 80 FTE per year

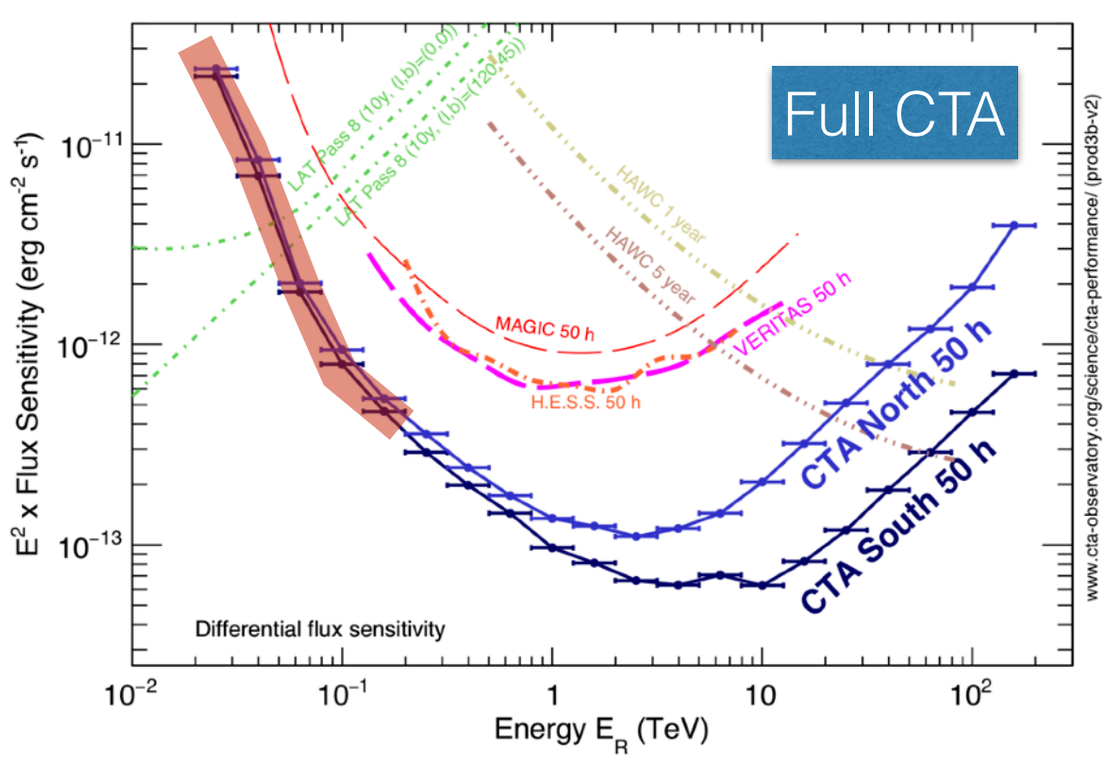


LST Key Numbers

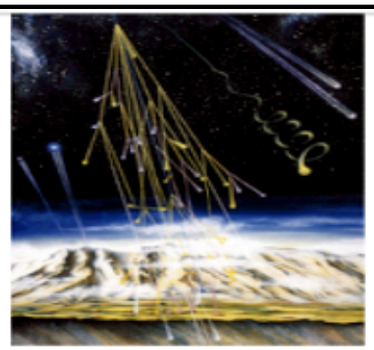
- goal: 4 x 23m telescopes per array
  - Alpha configuration funded: 4 LST in North, 0 LST in South
- Energy range: > 20 GeV
- Rapid slewing to transients: < 20 sec

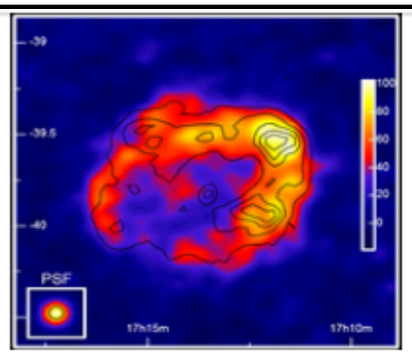






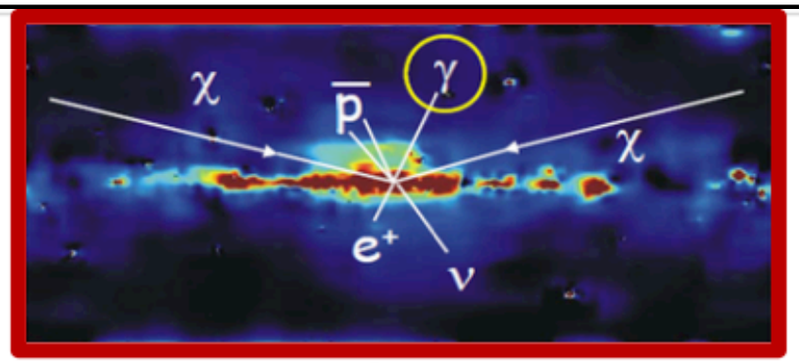
LST motivation





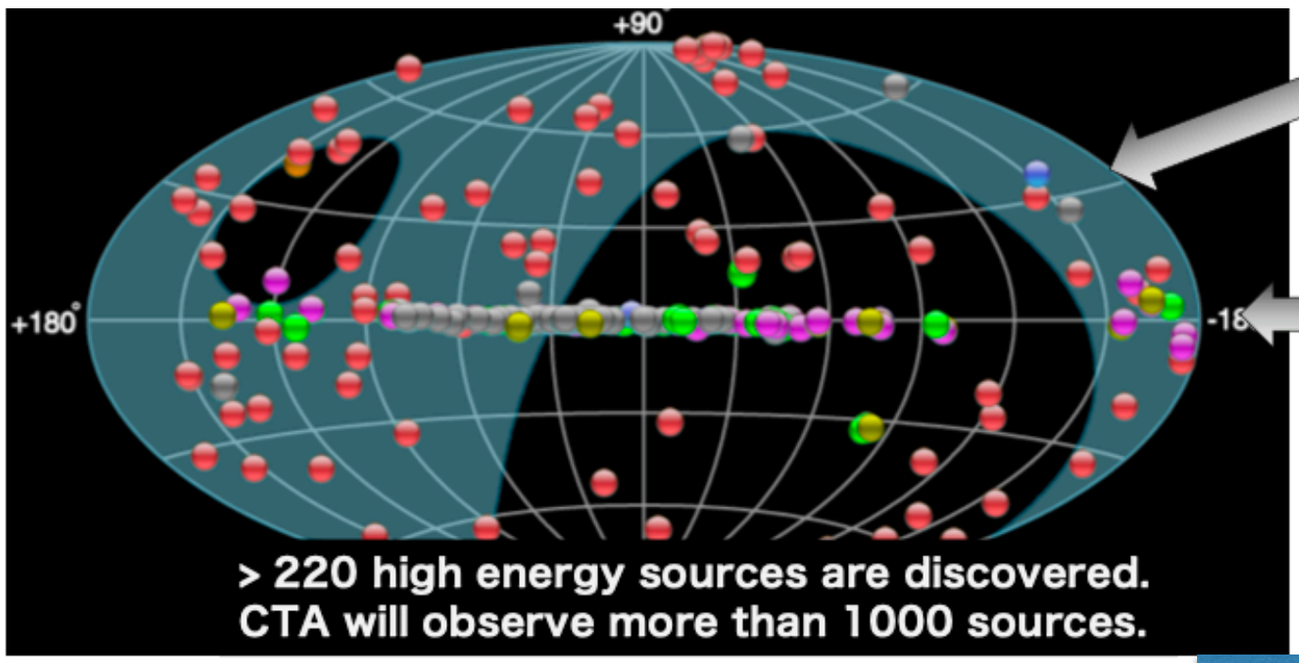
Cosmic Ray Origin

Super Massive Black Holes



Dark Matter Search (Discovery)

- Origin and Role of Cosmic Rays
- Probing extreme environments (AGNs, SNRs…)
- Search for Dark matter and new physics

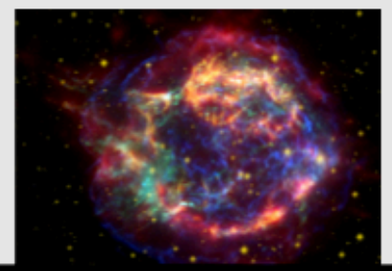


Extragalactic Sources

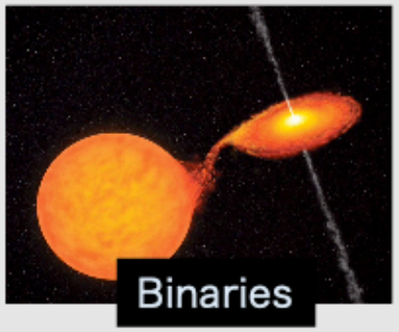
Active Galactic Nuclei

Gamma Ray Bursts

Galactic Sources



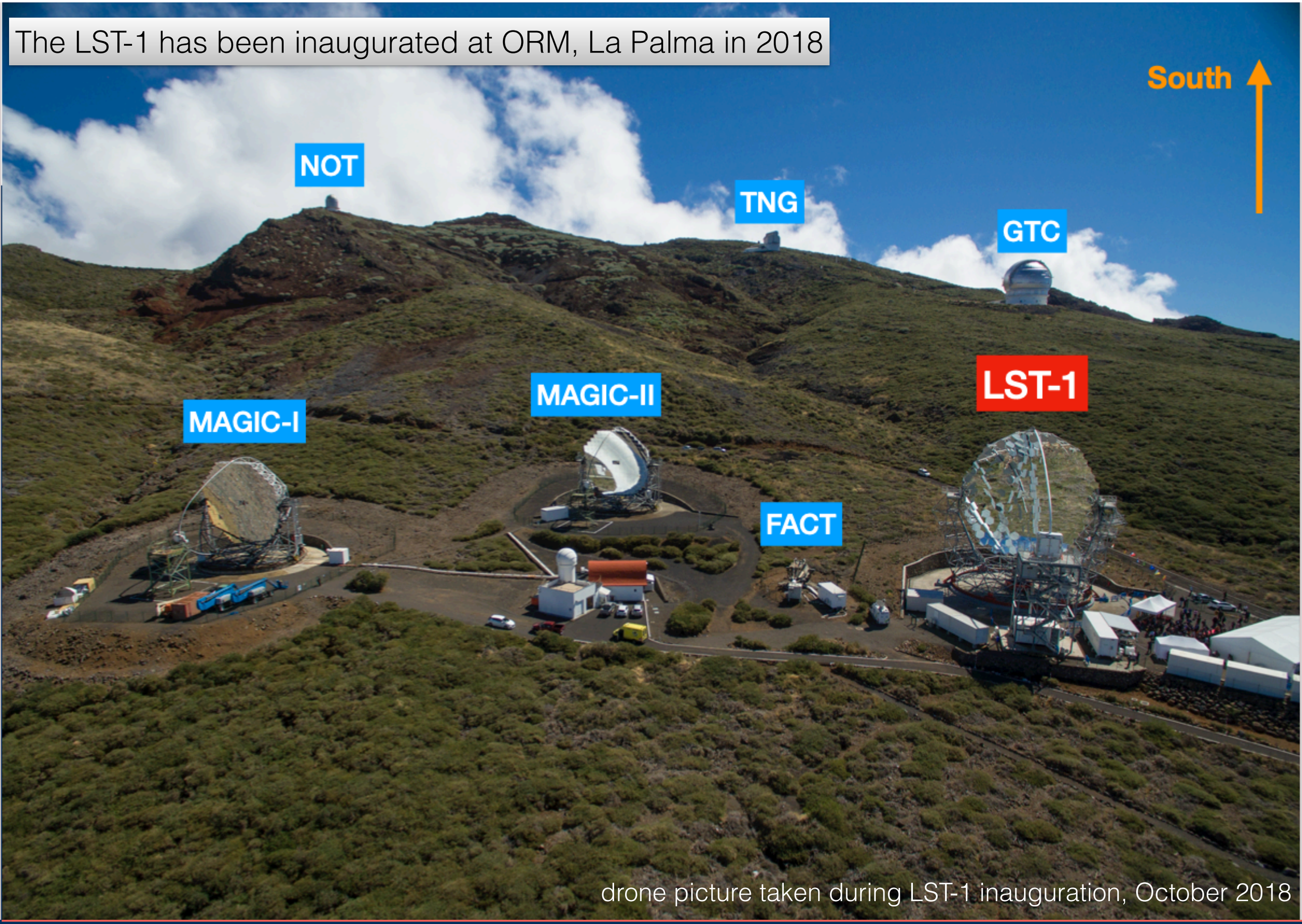
Super Nova Remnants



Binaries

Acharya B. S. et al. (the CTA Consortium),
Science with the Cherenkov Telescope Array, (2019) doi: 10.1142/10986

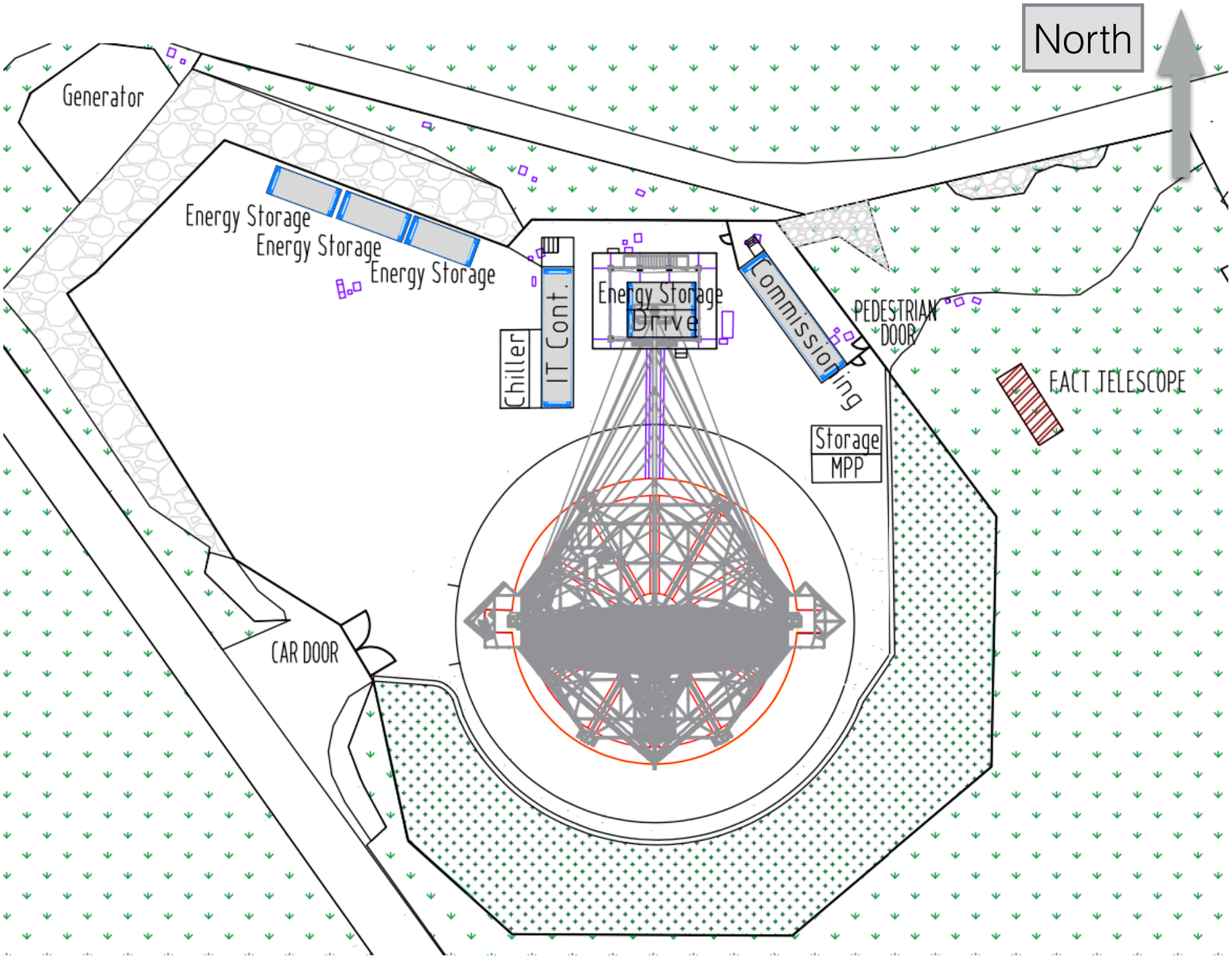
The LST-1 has been inaugurated at ORM, La Palma in 2018



drone picture taken during LST-1 inauguration, October 2018

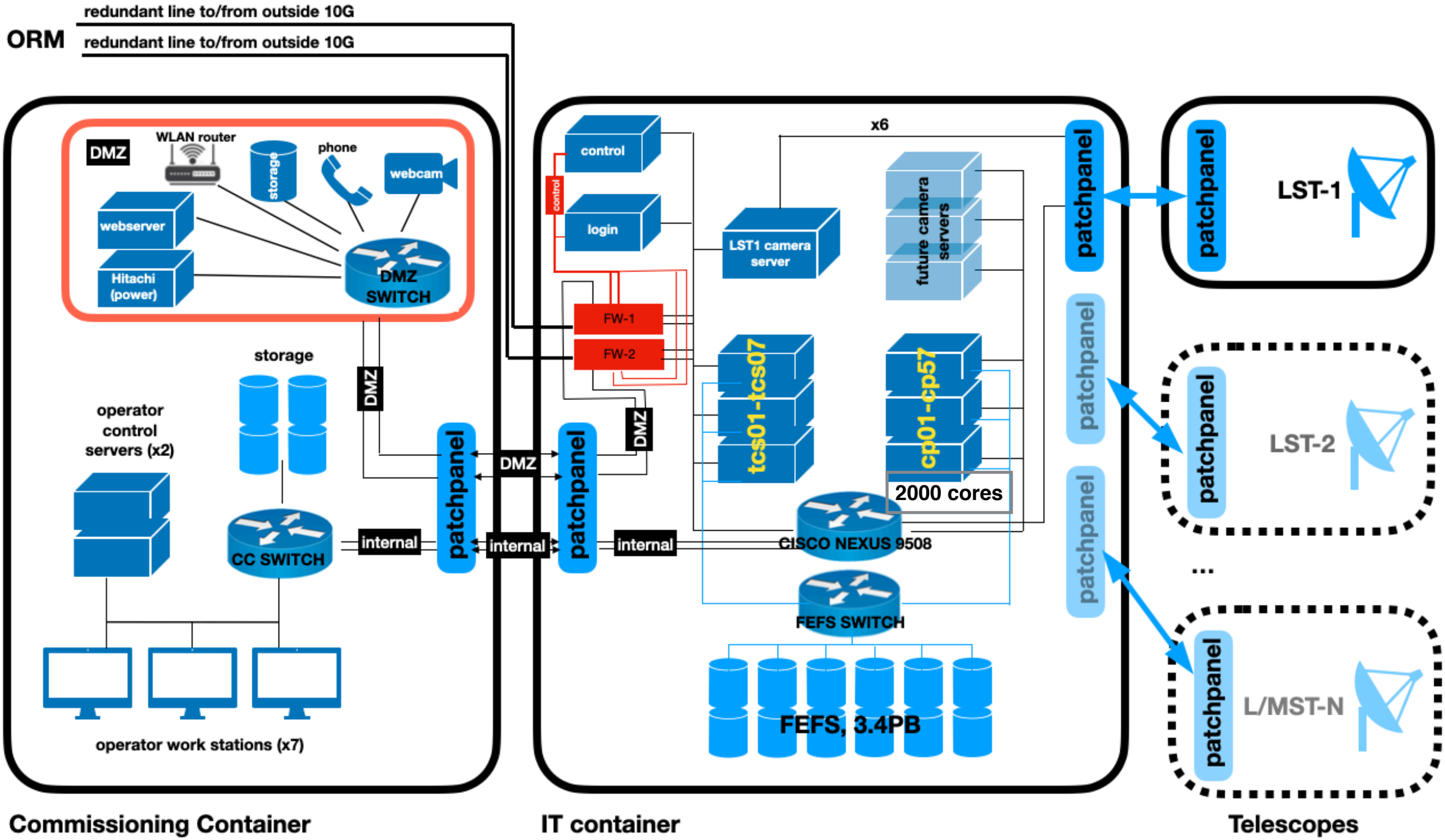
LST-1 infrastructure

- Profit from available infrastructure at the ORM of IAC
- Added
  - Power line
  - Diesel generator
  - onsite IT center
  - Commissioning container
  - Storage and tools container



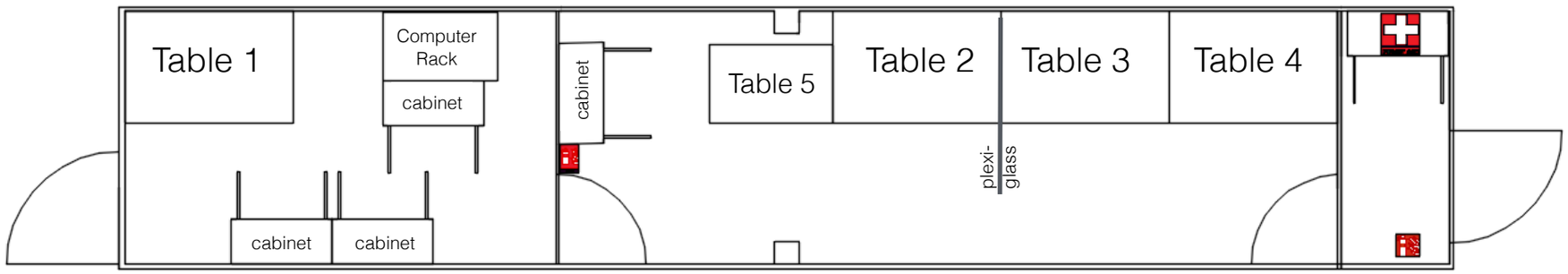
IT infrastructure

cherenkov telescope array



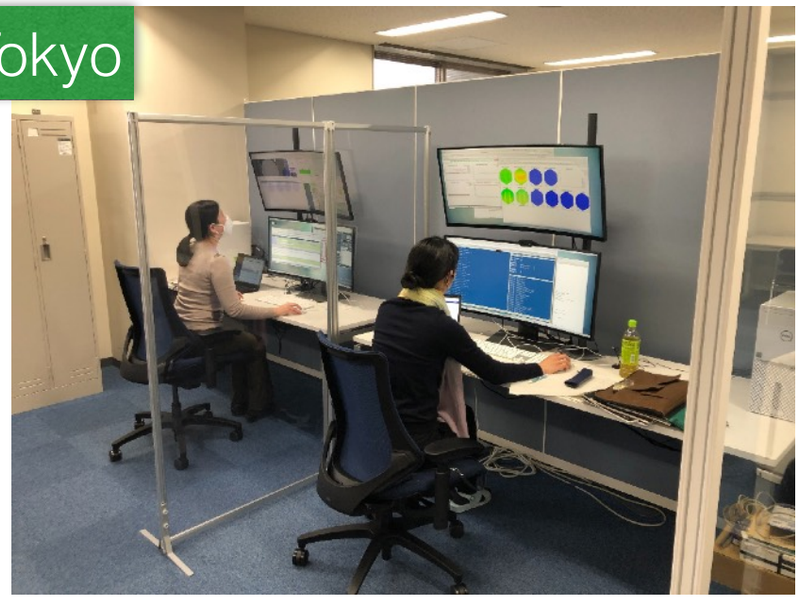
Commissioning Container

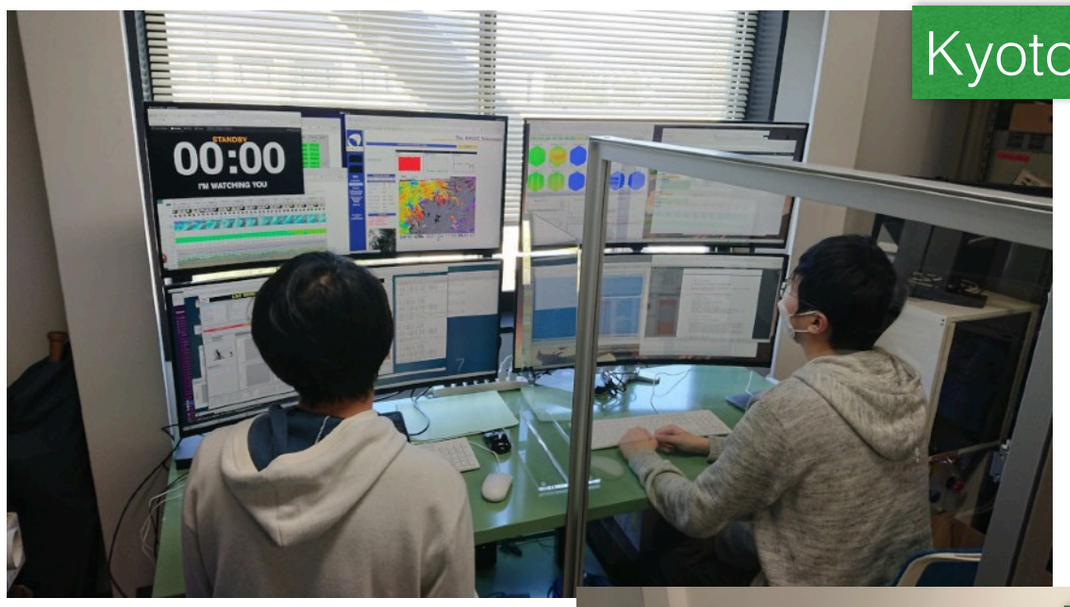
- Allows up to 4 people working inside (COVID-19 reduced to 3)
- Connection to the telescope through the IT container
- Close to the telescope in case of troubles



Remote Operations

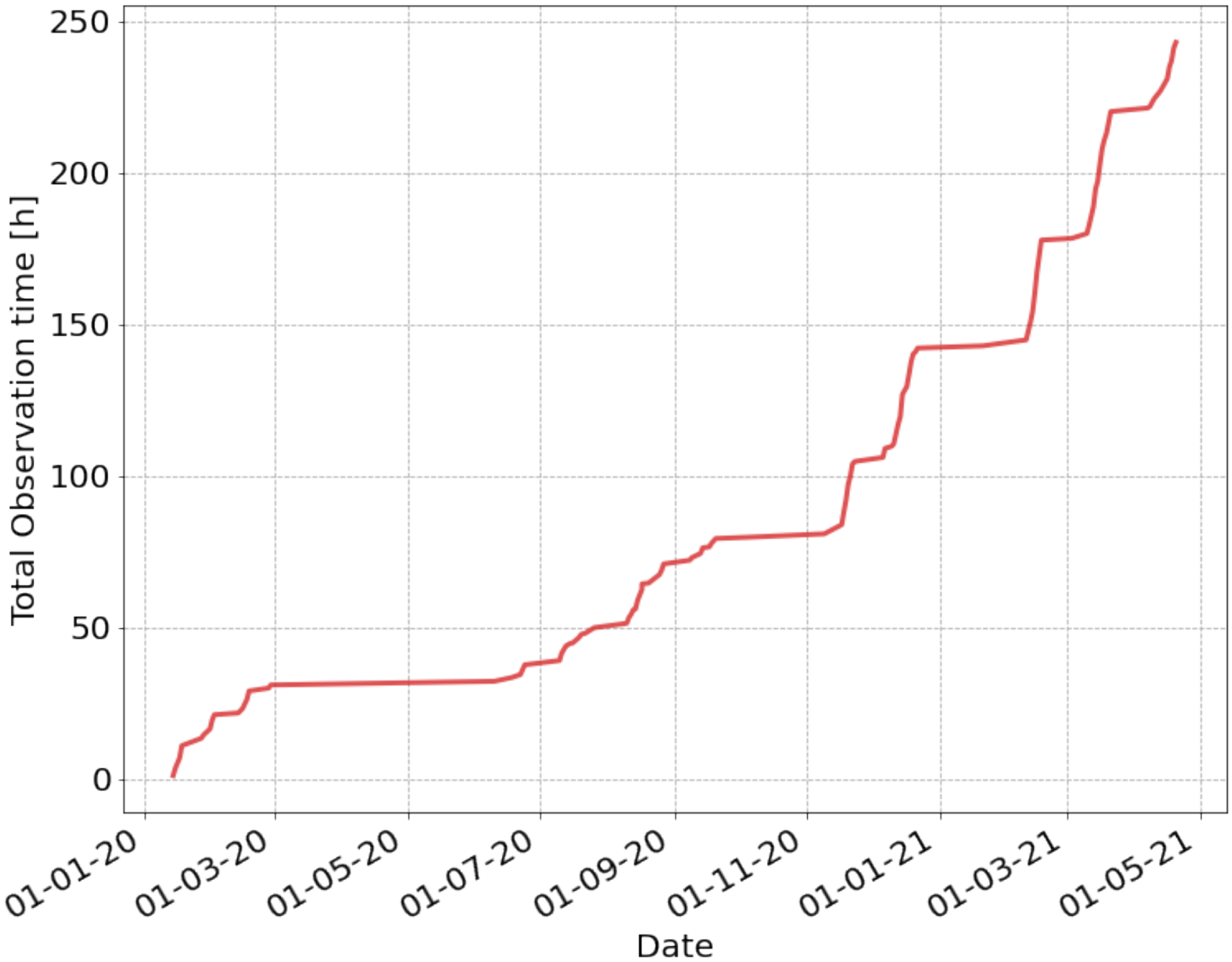
- We implemented **semi-remote** operations: there are at least two people on-site (close by) while the telescope is operated from remote
- So far the experience is quite good, we won't drop it after COVID-19





LST1 Commissioning

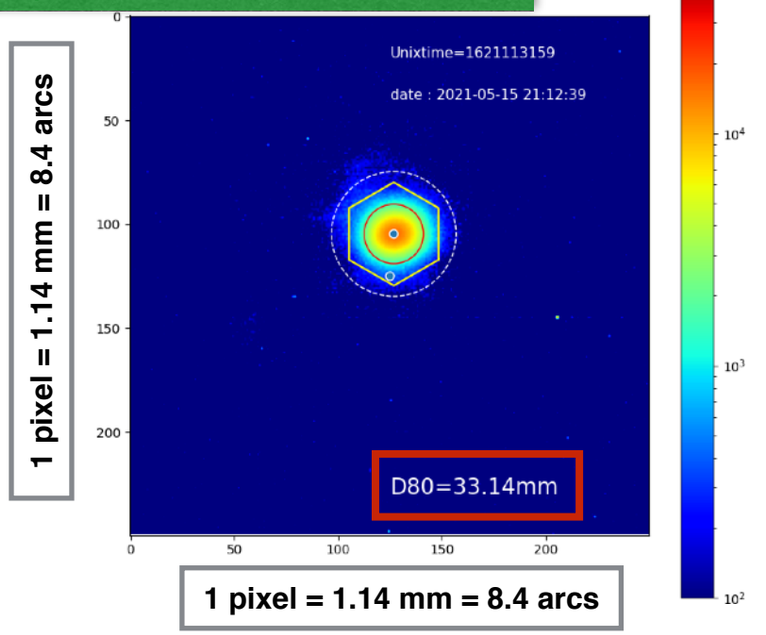
243hr taken Jan 2020 - May 2021



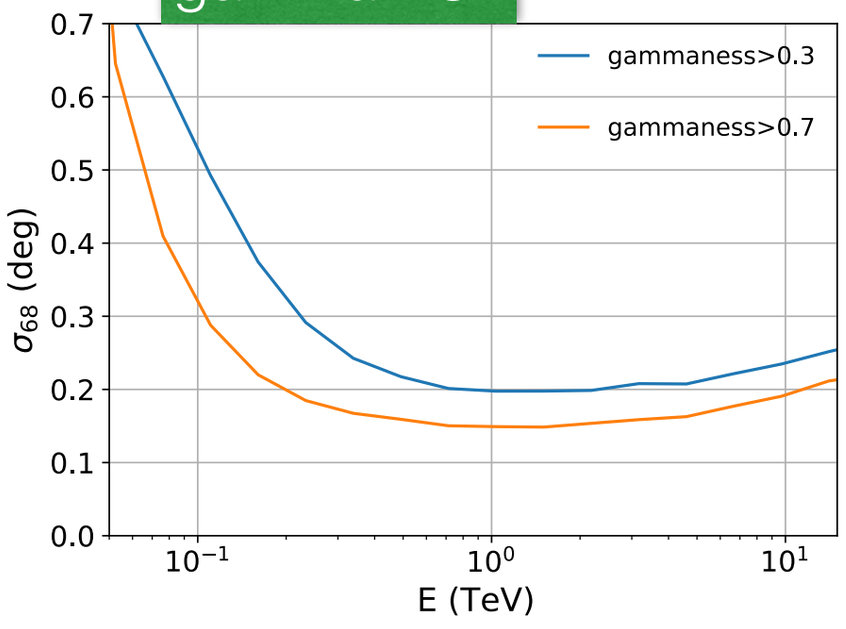
LST1 Commissioning

cherenkov telescope array

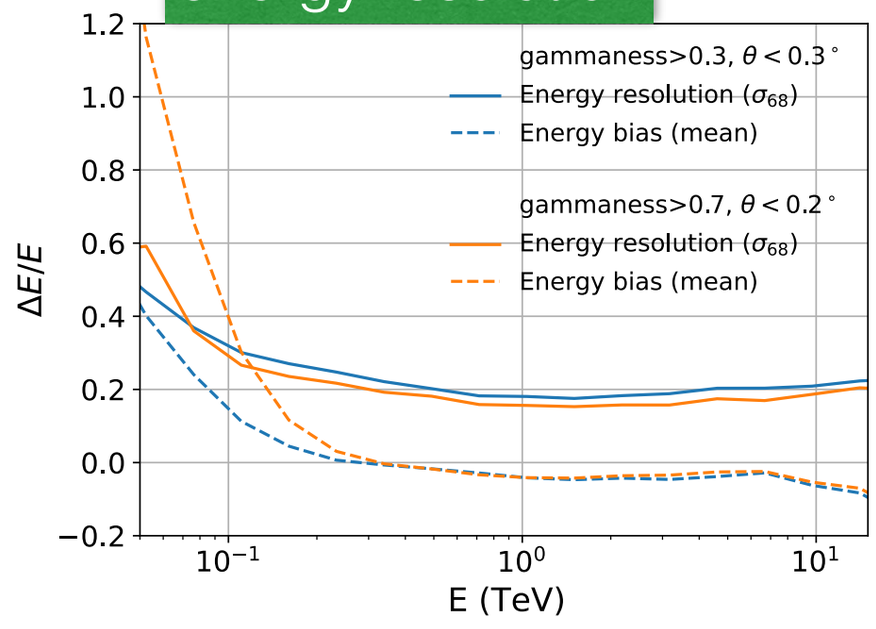
optical PSF, on-axis

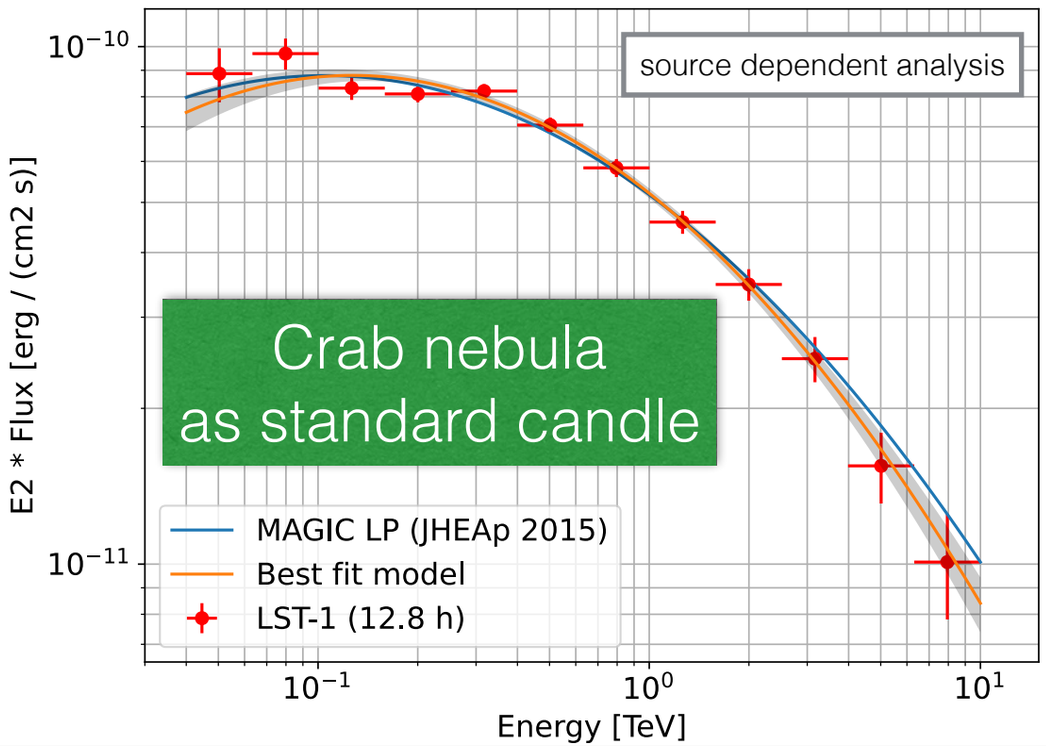


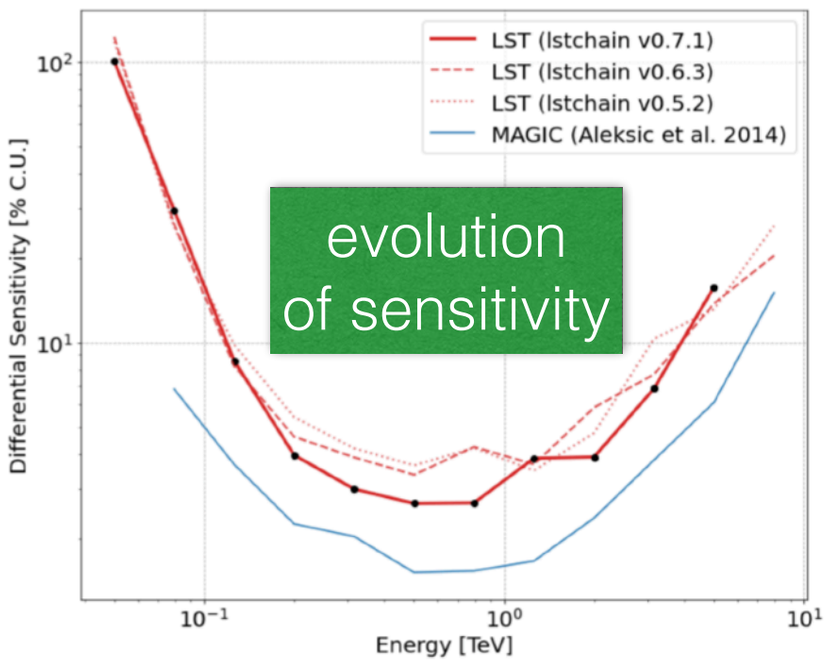
gamma-PSF



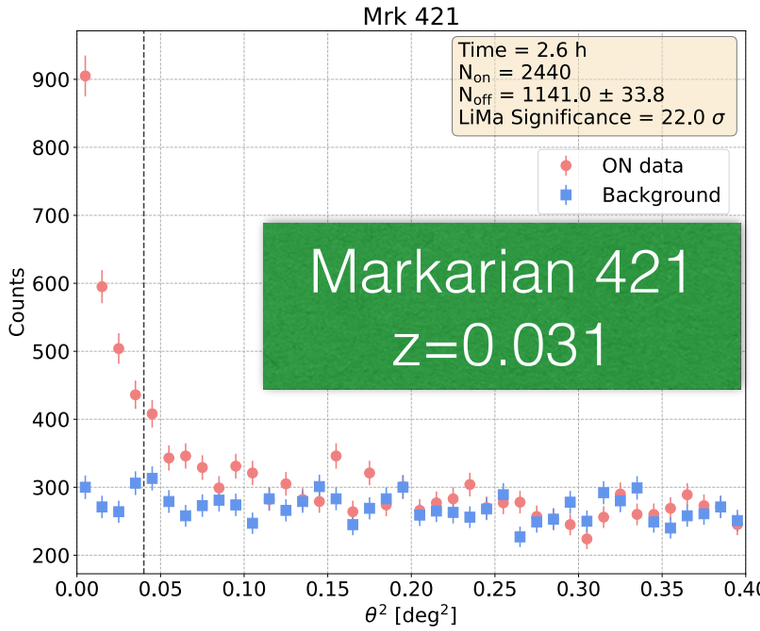
energy resolution

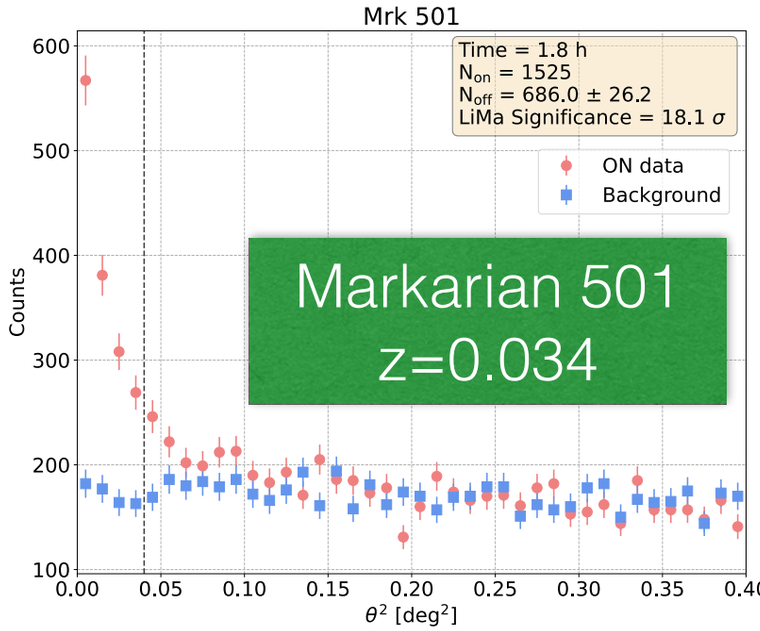


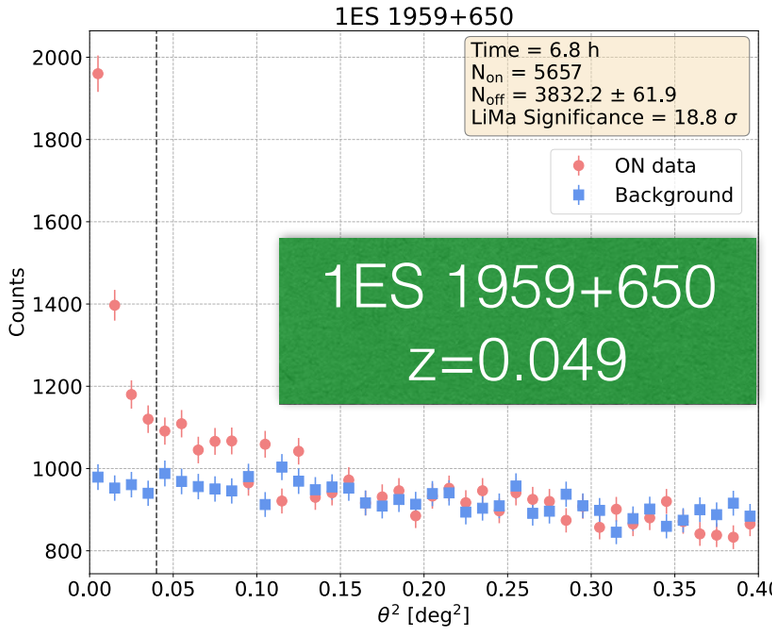


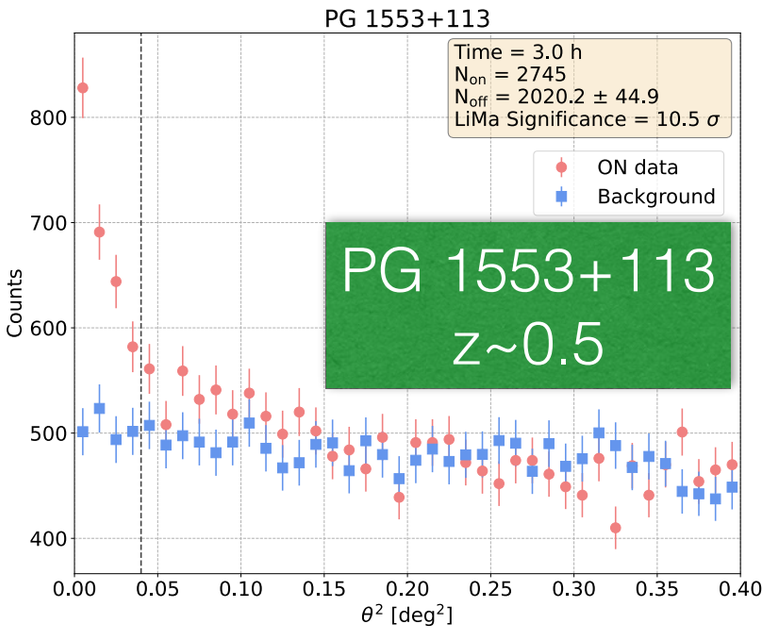


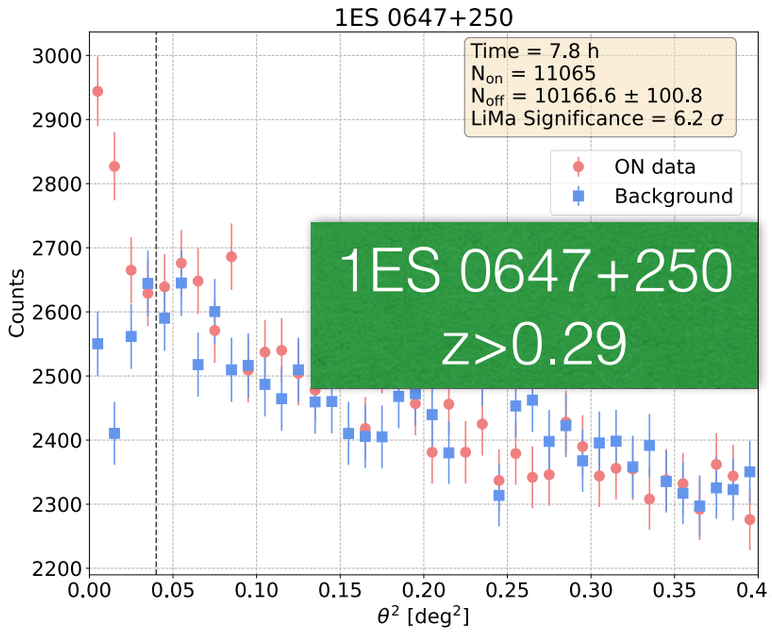
Detection of several blazars and Crab pulsar

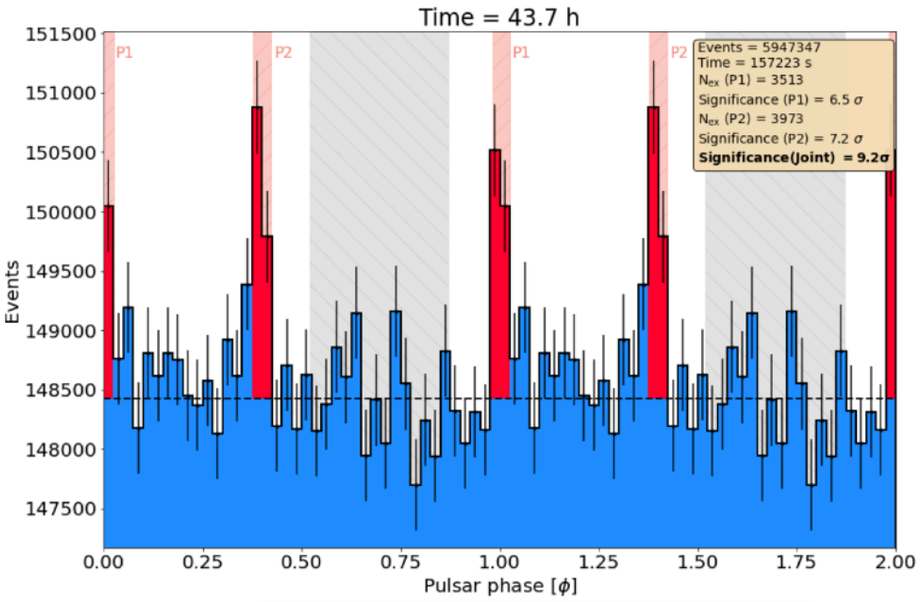






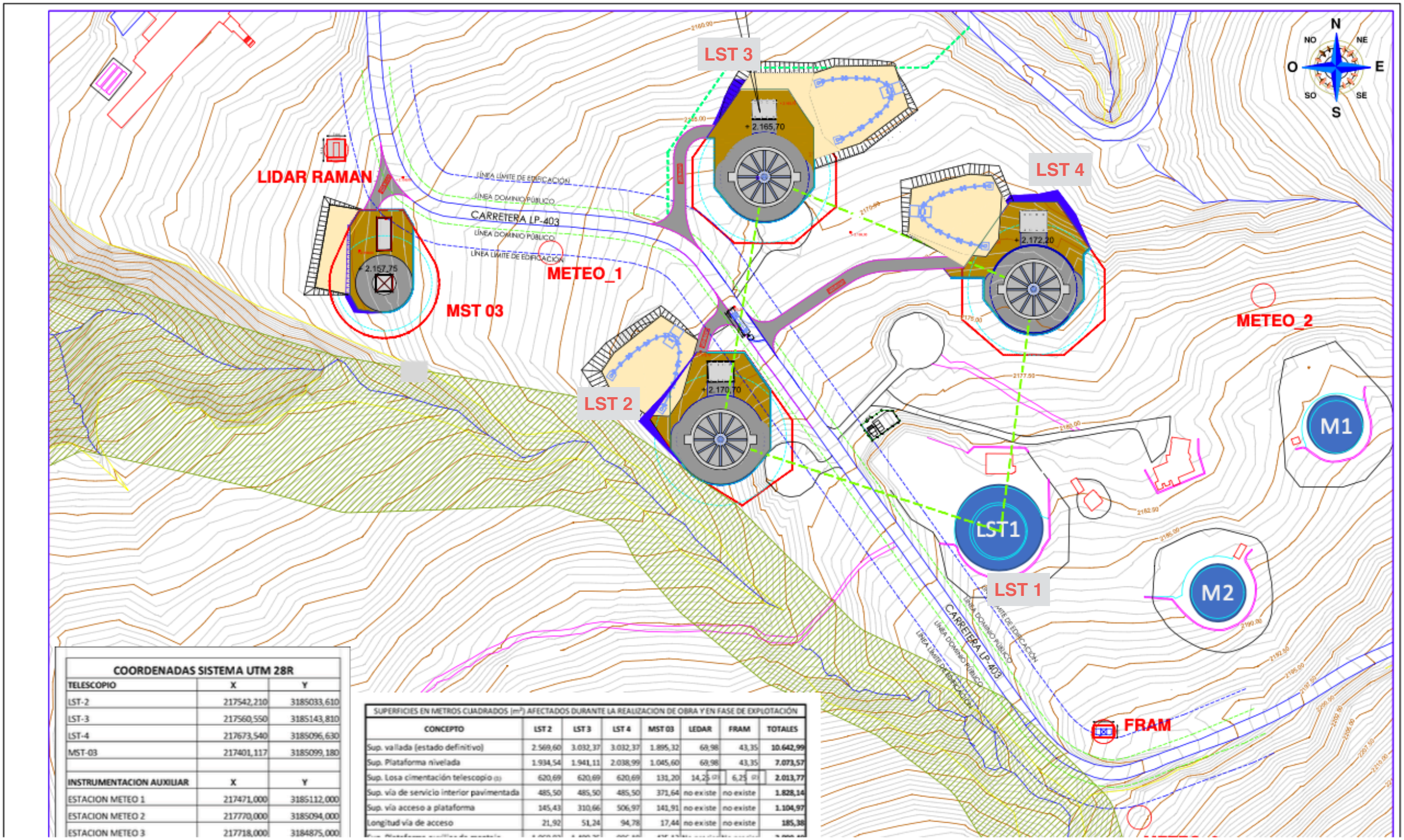






Crab pulsar

CTA North Phase I Installation Plan
LST1-4 location



COORDENADAS SISTEMA UTM 28R		
TELESCOPIO	X	Y
LST-2	217542,210	3185033,610
LST-3	217560,550	3185143,810
LST-4	217673,540	3185096,630
MST-03	217401,117	3185099,180
INSTRUMENTACION AUXILIAR	X	Y
ESTACION METEO 1	217471,000	3185112,000
ESTACION METEO 2	217770,000	3185094,000
ESTACION METEO 3	217718,000	3184875,000

SUPERFICIES EN METROS CUADRADOS (m^2) AFECTADOS DURANTE LA REALIZACION DE OBRA Y EN FASE DE EXPLOTACIÓN

CONCEPTO	LST 2	LST 3	LST 4	MST 03	LEDAR	FRAM	TOTALES
Sup. vallada (estado definitivo)	2.569,60	3.032,37	3.032,37	1.895,32	69,98	43,35	**10.642,99**
Sup. Plataforma nivelada	1.934,54	1.941,11	2.038,99	1.045,60	69,98	43,35	**7.073,57**
Sup. Losa cimentación telescopio (1)	620,69	620,69	620,69	131,20	14,25 (2)	6,25 (2)	**2.013,77**
Sup. vía de servicio interior pavimentada	485,50	485,50	485,50	371,64	no existe	no existe	**1.828,14**
Sup. vía acceso a plataforma	145,43	310,66	506,97	141,91	no existe	no existe	**1.104,97**
Longitud vía de acceso	21,92	51,24	94,78	17,44	no existe	no existe	**185,38**

LST2-4 components production

cherenkov telescope array

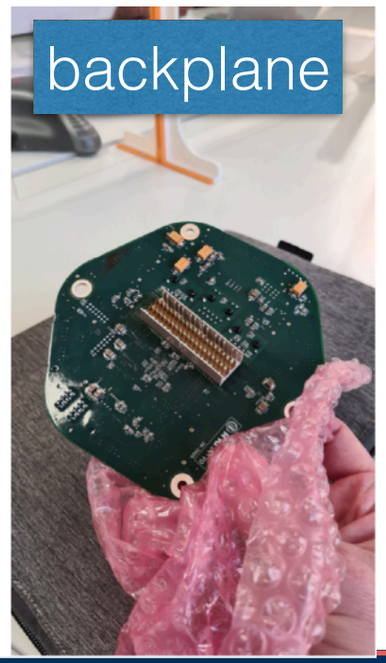
- 98% on the way or done. Actuators and special interface plates to be done

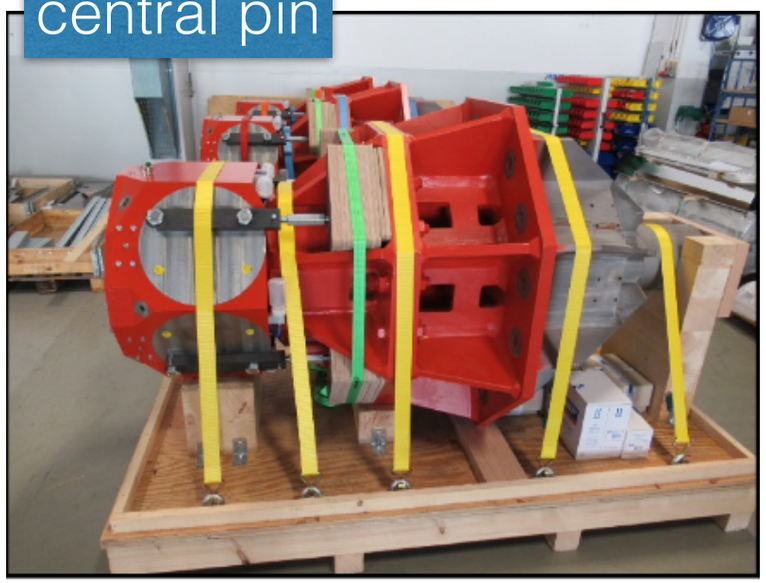

assembled rail LST4


cable chain


Tubes for understructure


Camera


backplane


central pin


Camera frame

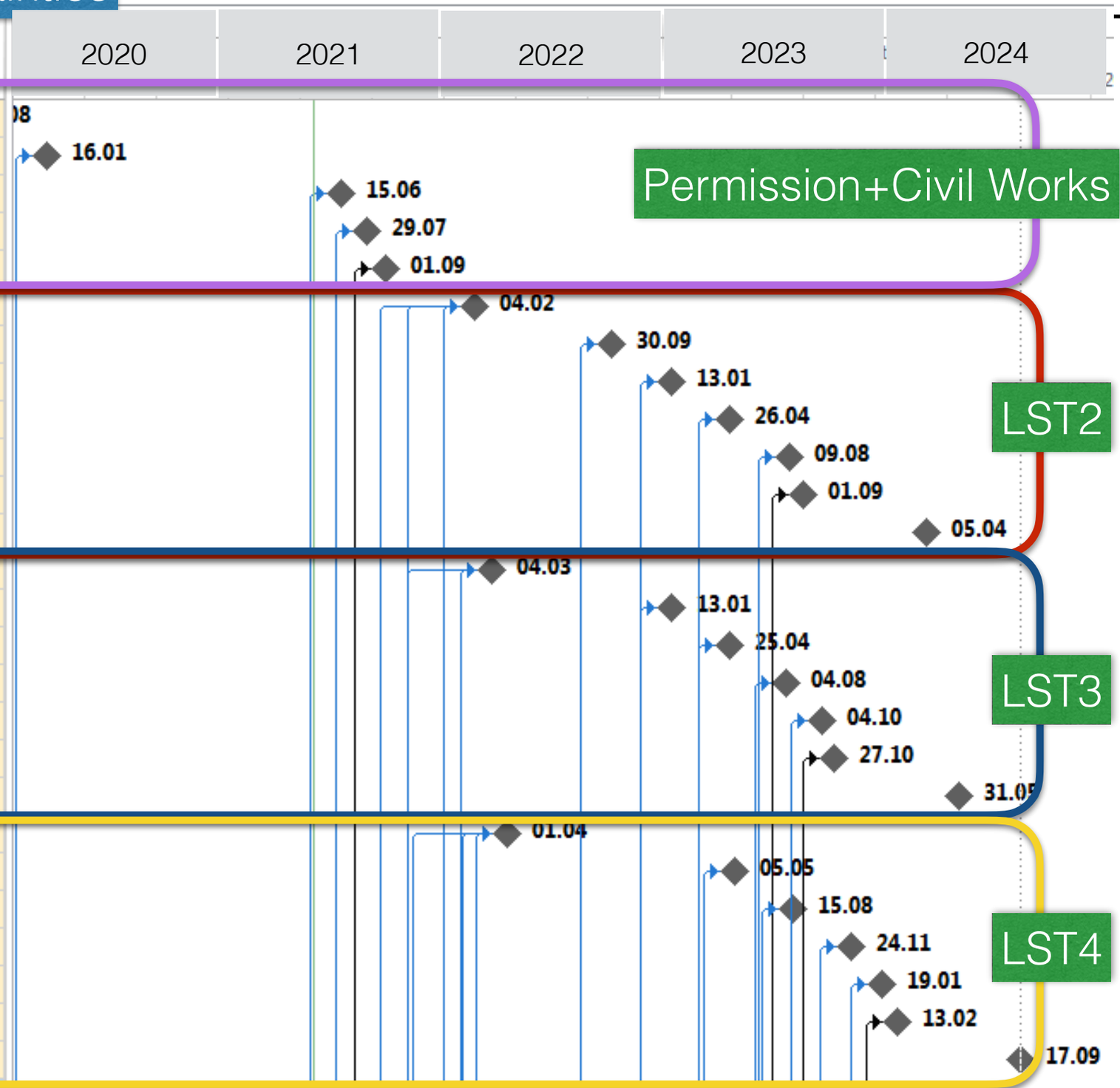
Status: April 2021

LST2-4 construction schedule

cherenkov telescope array

with contingency but also with uncertainties

	Task Name	Duration	Start
1	Sign Contract for Short Project	0 days	01.08.19
2	Basic project ready for submission	0 days	16.01.20
3	All Permissions granted	0 days	15.06.21
4	Sign civil work contract	0 days	29.07.21
5	Civil Works start	0 days	01.09.21
6	LST2 construction starts	0 days	04.02.22
7	LST2 dish and structure united	0 days	30.09.22
8	LST2 CSS installed	0 days	13.01.23
9	LST2 mirrors installed	0 days	26.04.23
10	LST2 camera installed	0 days	09.08.23
11	LST2 construction completed	0 days	01.09.23
12	LST2 ready for acceptance	0 days	05.04.24
13	LST3 construction starts	0 days	04.03.22
14	LST3 dish and structure united	0 days	13.01.23
15	LST3 CSS installed	0 days	25.04.23
16	LST3 mirrors installed	0 days	04.08.23
17	LST3 camera installed	0 days	04.10.23
18	LST3 construction completed	0 days	27.10.23
19	LST3 ready for acceptance	0 days	31.05.24
20	LST4 construction starts	0 days	01.04.22
21	LST4 dish and uscture united	0 days	05.05.23
22	LST4 CSS installed	0 days	15.08.23
23	LST4 mirrors installed	0 days	24.11.23
24	LST4 camera installed	0 days	19.01.24
25	LST4 construction completed	0 days	13.02.24
26	LST4 ready for acceptance	0 days	17.09.24



Summary

- The project is going well, thanks to a large effort by the LST team
- A few lessons learned, no show stoppers
- Working hard to finish commissioning of LST1 to release some pressure and gain momentum for the LST2-4 construction.
- We need to do the commissioning right, we do not want to come back to issues.
- LST2-4 construction is about to start. Target ground breaking in September 2021
- Looking forward to deliver physics data soon!

BACKUP

backup

cherenkov telescope array

Latest news from last week

Announcement
2021-June-25

The Board of Governmental Representatives Approves the CTAO's Cost Book and Scientific & Technical Description

In particular, it includes the configuration of the telescope arrays at the two sites for the first construction phase, named "Alpha Configuration." This configuration includes 4 Large-Sized Telescopes (LSTs) and 9 Medium-Sized Telescopes (MSTs) in the northern array located on La Palma (Spain), and 14 MSTs and 37 Small-Sized Telescopes (SSTs) in the southern array situated in the Atacama

The CTAO ERIC is expected to be established in 2022, after which construction on the sites will take place for around five years.

J. Cortina, EAS meeting 2021, SS27 symposium 4

backup

cherenkov telescope array

CTA: sensitivity vs energy