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# LST Status report



Mosè Mariotti x F2F meeting, 19-nov-2019

Sarah A. Brands, 2018

# Outline

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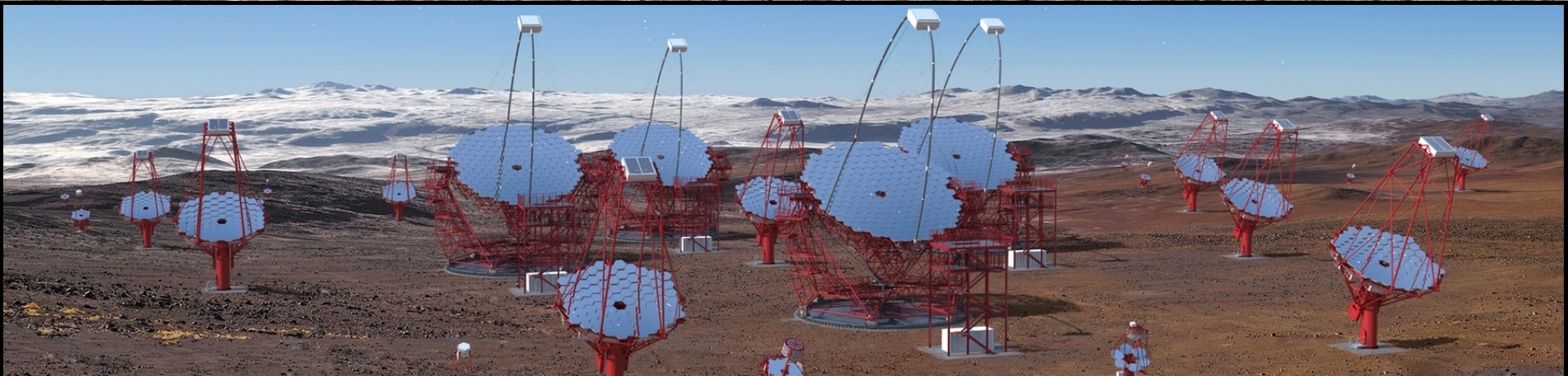
LST report from general LST project

LST and INFN involvement

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# Status of the LST Project

Extract from general report of Masahiro Teshima at recent Bologna consortium meeting



# LST sub-consortium



Country	People in CTA	People in LST	FTE in CTA	FTE LST total	FTE LST Student	FTE LST others	FTE LST scaled
Germany (MPI only)	249	31	99,88	10,6	1,6	9	9,8
Japan	144	66	50,60	18,55	9,2	9,15	13,75
Spain	116	55	53,44	28,62	4,5	24,12	26,37
Italy	292	40	115,40	12,4	2	10,4	11,4
France	233	21	89,63	10,2	0,6	9,6	9,9
Brazil	46	3	16,30	0,6	0	0,6	0,6
Croatia	11	6	2,80	1,8	0,4	1,4	1,6
Sweden	15	0	2,00	0	0	0	0
Poland	67	1	17,90	0,15	0	0,15	0,15
TOTAL	1173,00	223,00	447,95	82,92	18,30	64,42	73,57

~80 FTE every year

and newly joined

- Switzerland
- Bulgaria

**Mission 2:**  
Four LSTs at CTA-S

**Mission 1:**  
Four LSTs at CTA-N

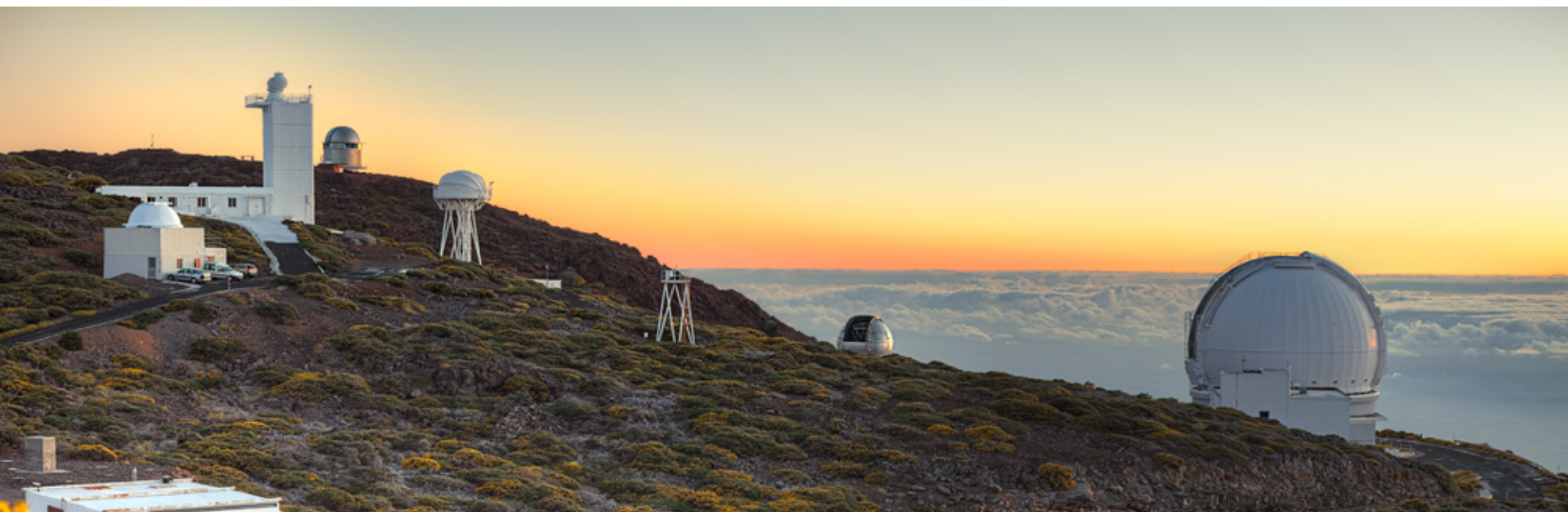




cherenkov  
telescope  
array

# CTA North

Observatorio del Roque de los Muchachos

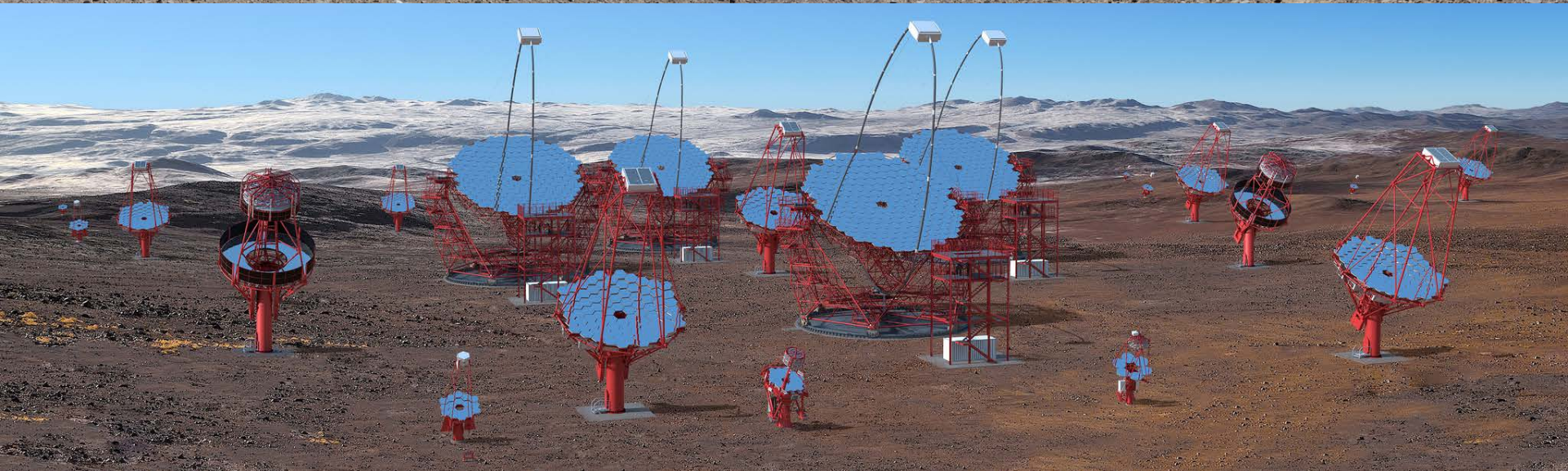




# CTA South

ESO site Chile Paranal

In December 2018 MoUs were signed

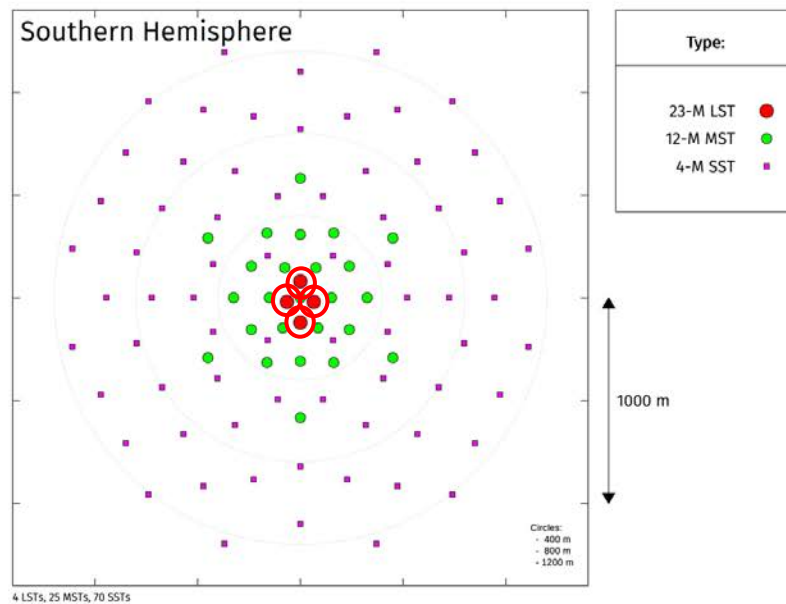
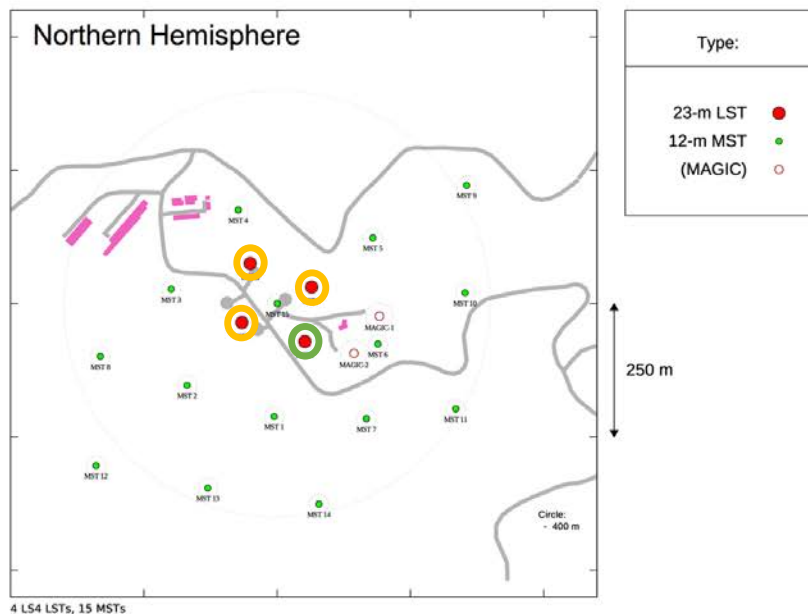
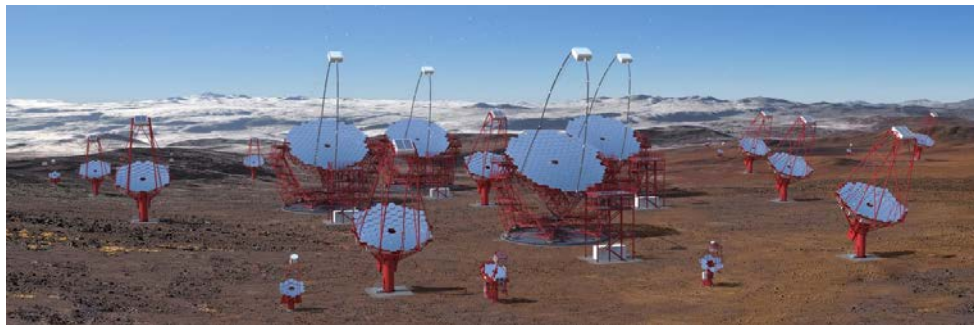


# Two sites for all sky observatory

Roque de los Muchachos Observatory  
La Palma, Spain



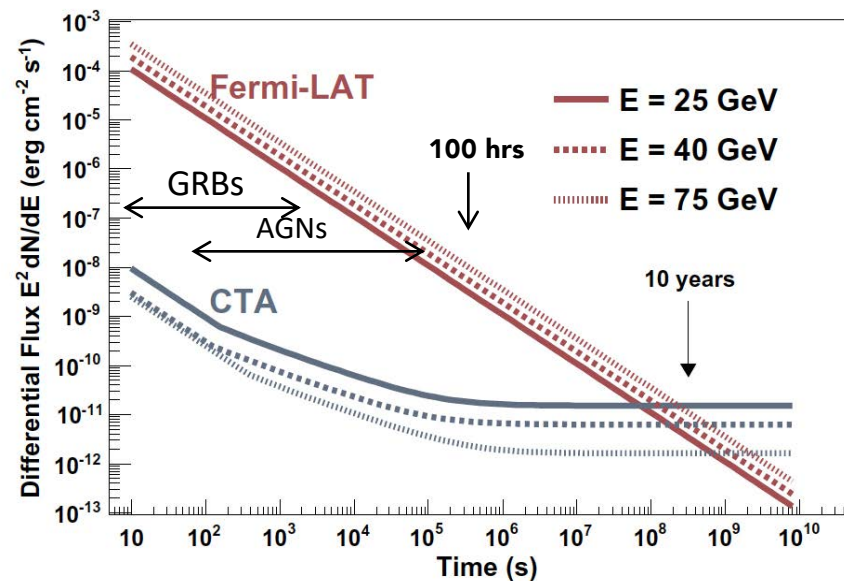
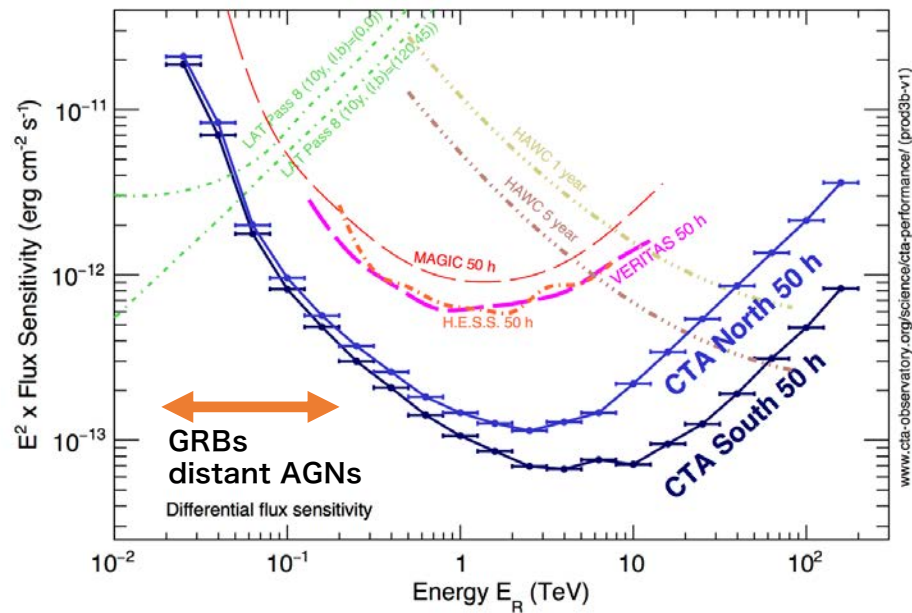
Paranal, Chile





cherenkov  
telescope  
array

# Sensitivity x10, Angular Resolution x2 Energy Range 20GeV~200TeV

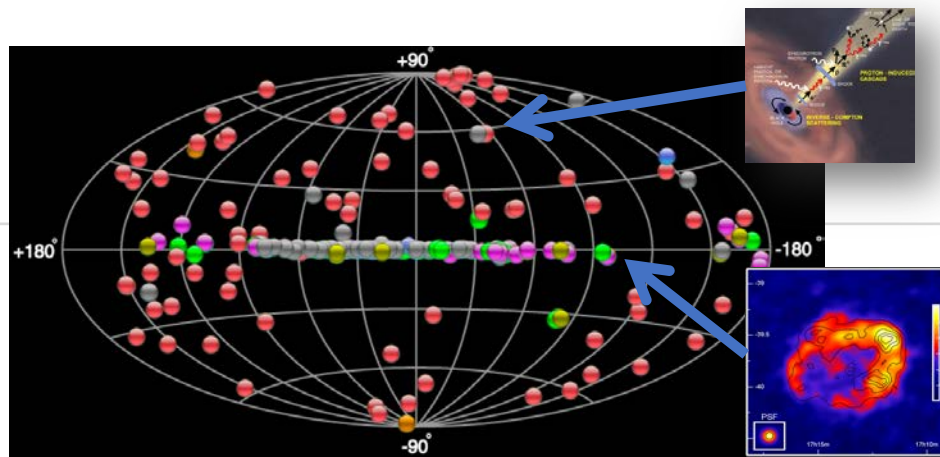


- CTA-LST array contributes to the sensitivity in low energies >20GeV
- Distant AGNs are observable up to  $z=2$ , and GRBs up to  $z=4$
- X10000 sensitivity for GRBs and AGN flares than Fermi
- GRB Prompt emission, and evolution of afterglow with the fast rotation (20 sec)



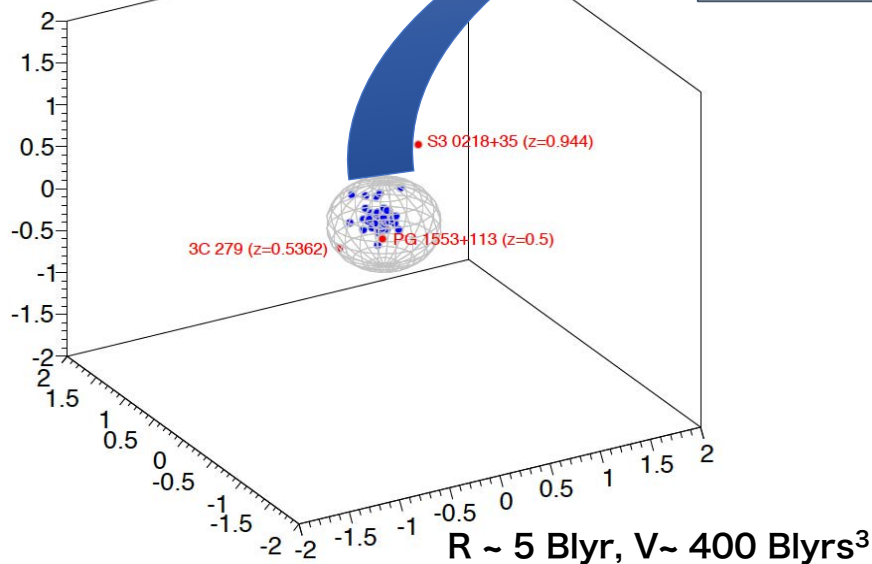
cherekov  
telescope  
array

## CTA: Ultimate Survey Machine



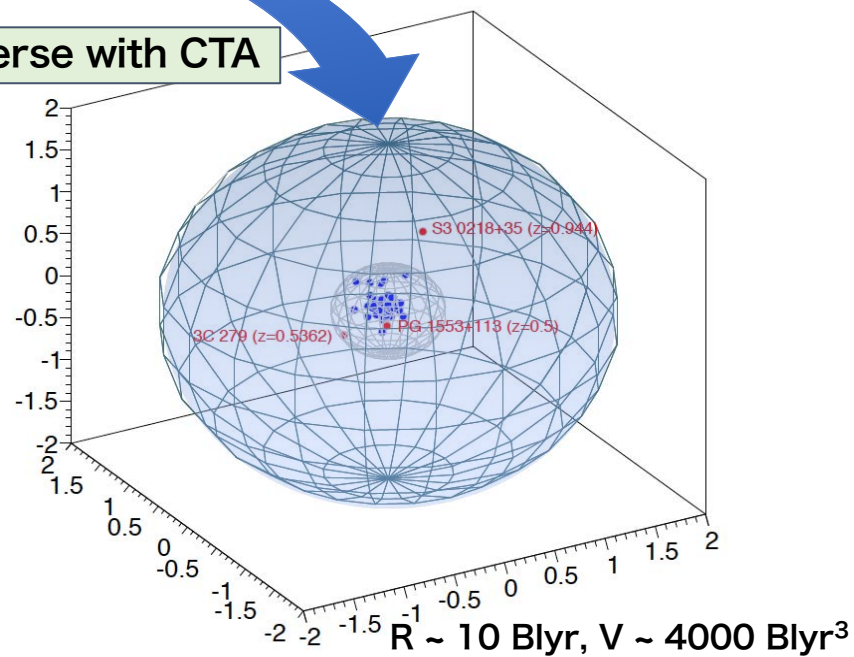
~200 VHE gamma ray sources have been discovered

### Observed Universe at V.H.E.



9 Byr after Big Bang

### Visible Universe with CTA



Early Universe, 1.6Byr after Big Bang

# Large Size Telescope

Mirrors: JP

Interface plates: JP, DE, BR

Actuators: JP, CH

CMOS: JP

calibration:  
IT, HR, IN, DE

Tension cables: IT

Camera Support  
Structure: FR

Camera electronics: JP, IT, ES  
Camera mechanics: ES  
Camera safety: FR

Telescope  
structure: DE

Rail: DE

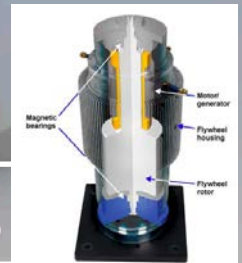
Bogies: ES

Camera Access Tower: DE

Foundation: ES

Drive and main  
el. cabinet: FR

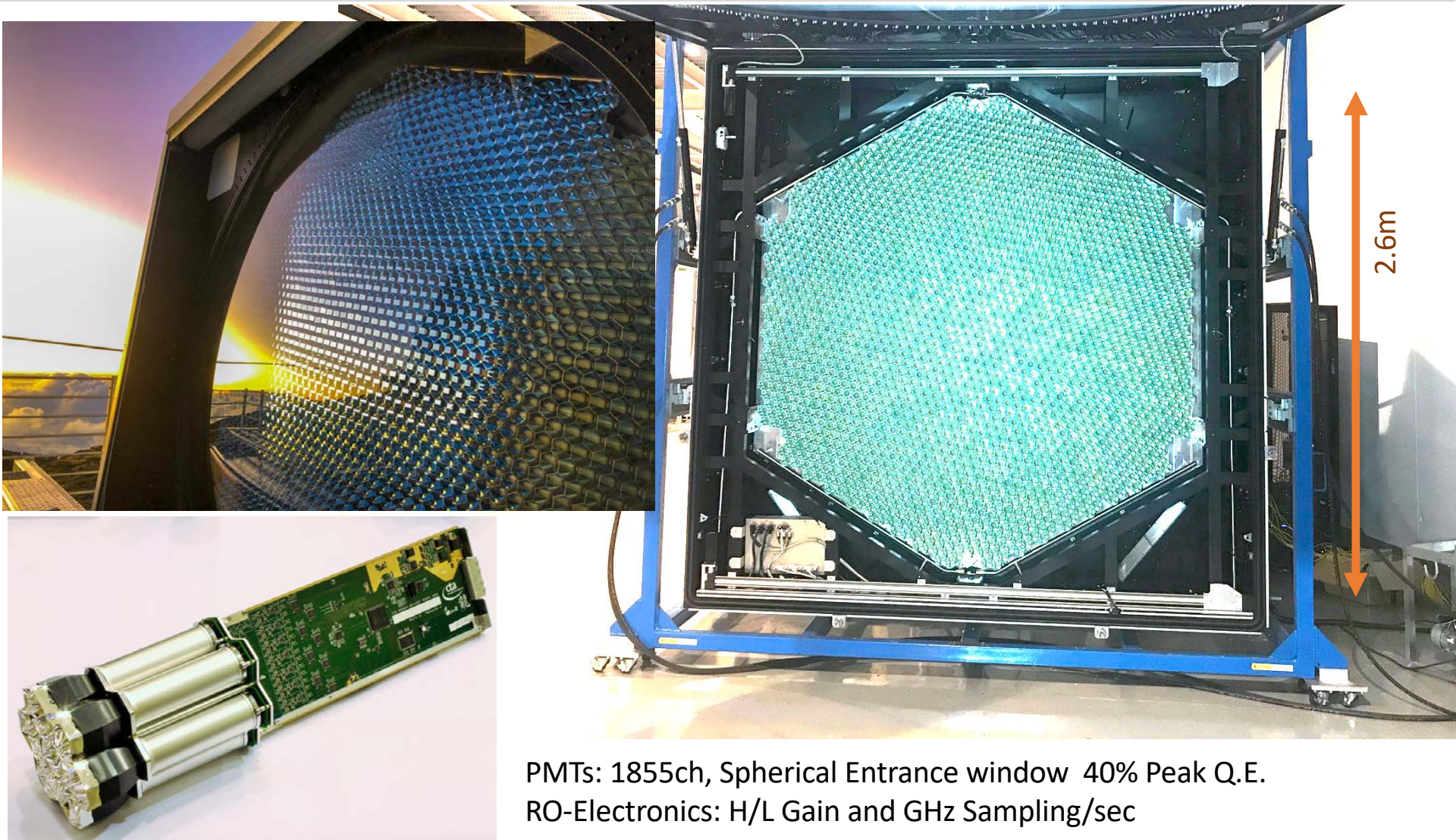
FlyWheels (2x300kW)  
energy storage and UPS: JP





cherenkov  
telescope  
array

# LST1: Camera assembly at MIRCA, September 2018



PMTs: 1855ch, Spherical Entrance window 40% Peak Q.E.  
RO-Electronics: H/L Gain and GHz Sampling/sec

# CAST 1: Camera rolled in 25 Sep 2018



# LST1 Inaugurated

on 10 October 2018

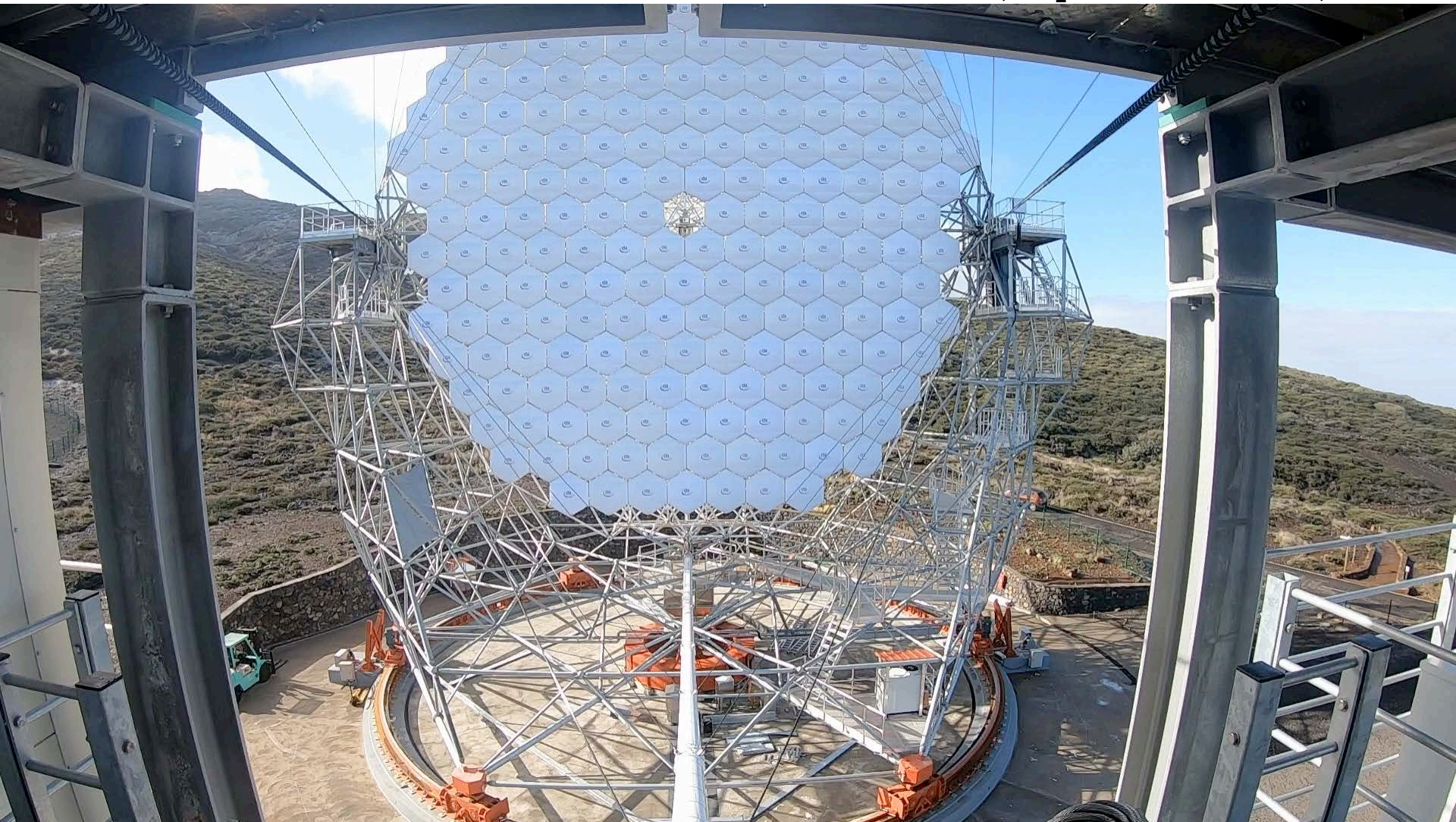


In Feb 2019 LST1 is awarded with 21<sup>st</sup> Cent. Technology 2019



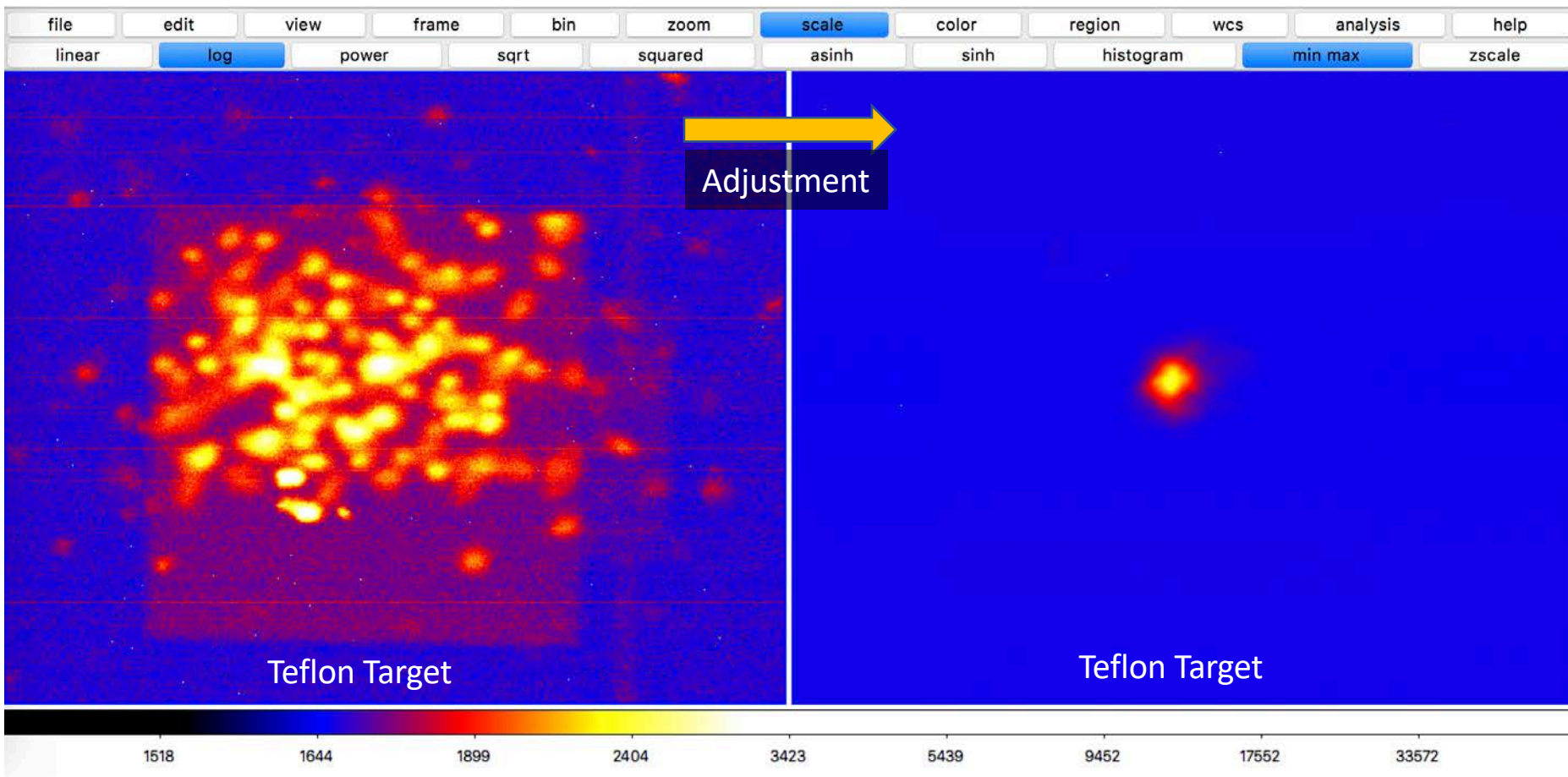
cherenkov  
telescope  
array

# Fast Rotation of LST1 for GRB observations (April 2019)



# Active Mirror Control and PSF (Image of Arcturus) May 2019

PSF < 0.1 degrees in diameter → D80 = 0.05 degrees reached



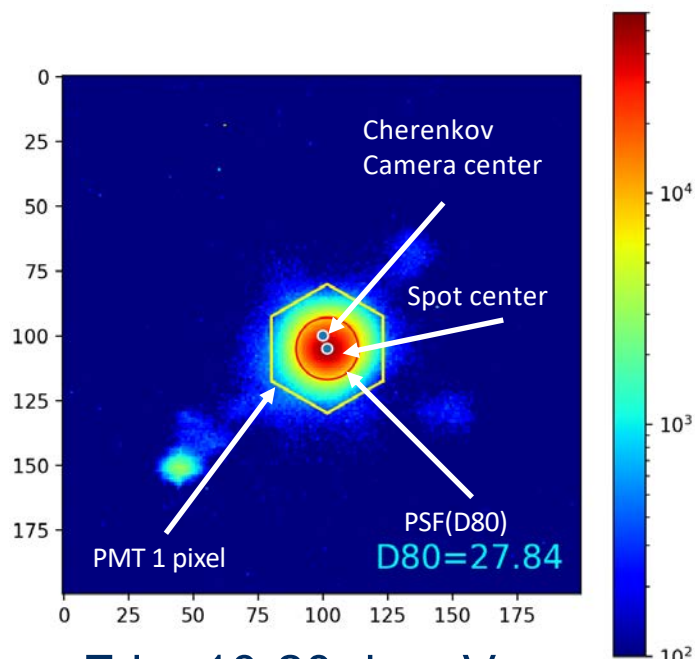


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telescope  
array

# LST1: PSF measurement

D80 in mm. 1.14 mm / pix, 0.0023 deg / pix  
Req.: D80 < ~25 mm (0.05 deg) at FoV center

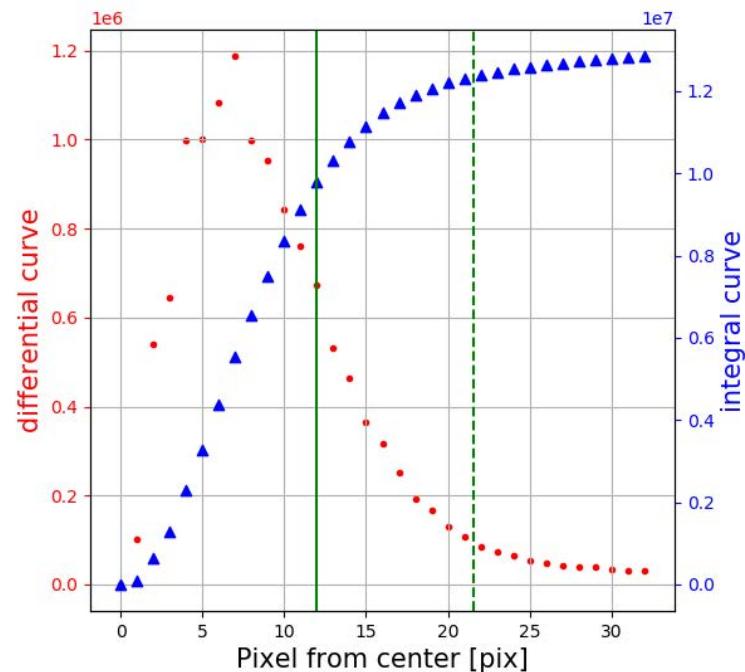
Aug 2019 (Zd=10-20)



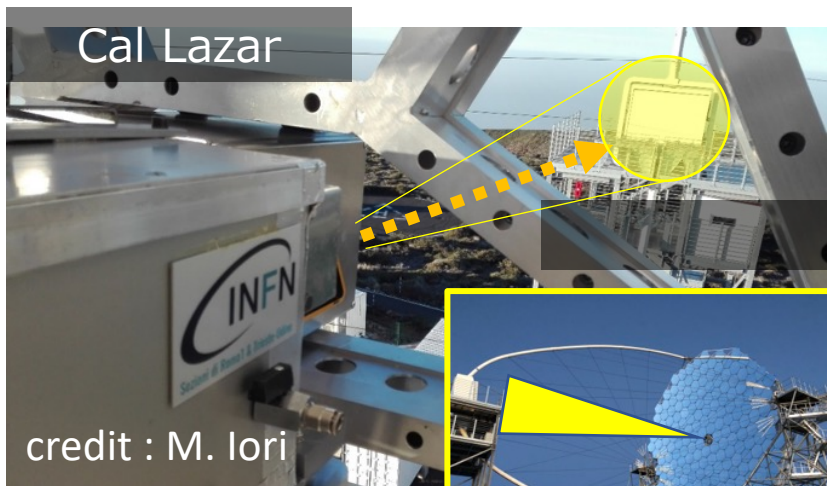
Zd = 10-20 deg, Vega

Off center spots are under investigation

D80= 28 mm

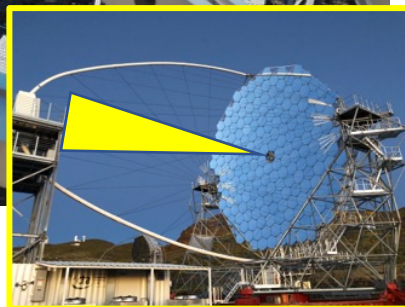
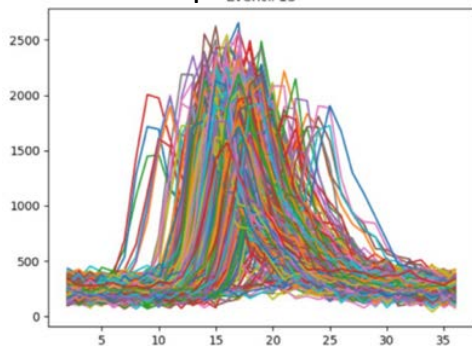


# PMT gain calibration

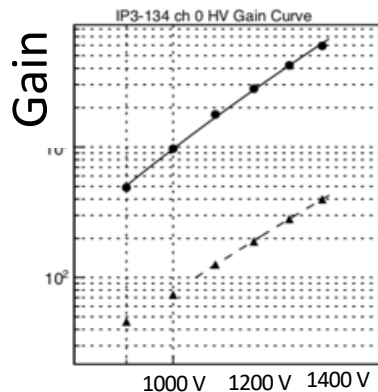


- Wave length 355nm
- Pulse Width 2nsec
- Lazar Stability 1%
- Uniformity <2%

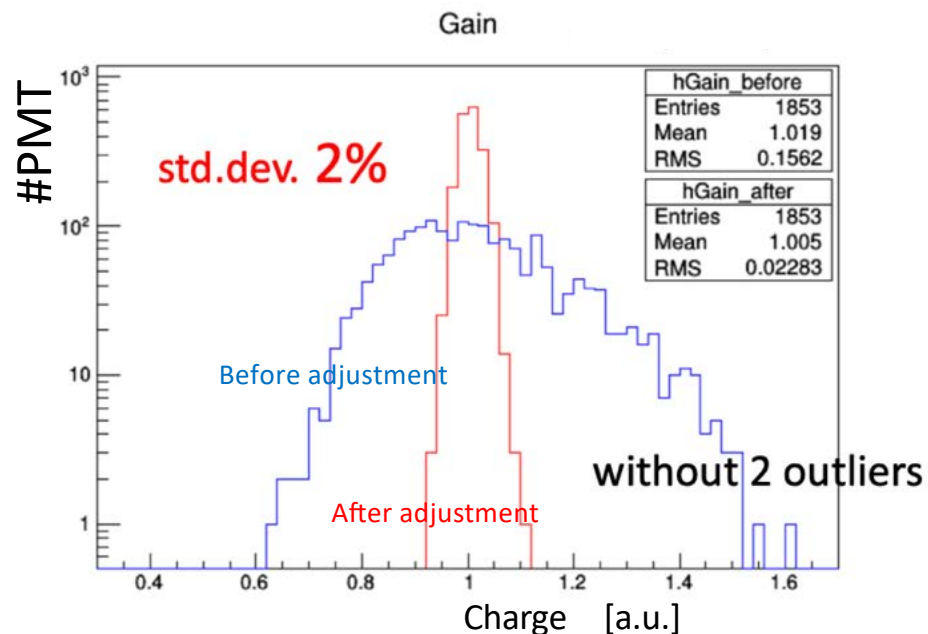
Pulse shapes before calib.



Gain vs HV relation



HV

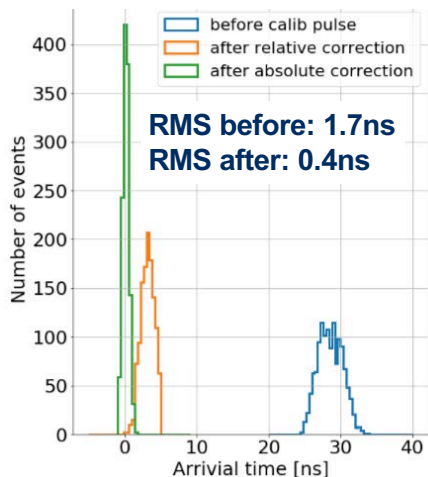




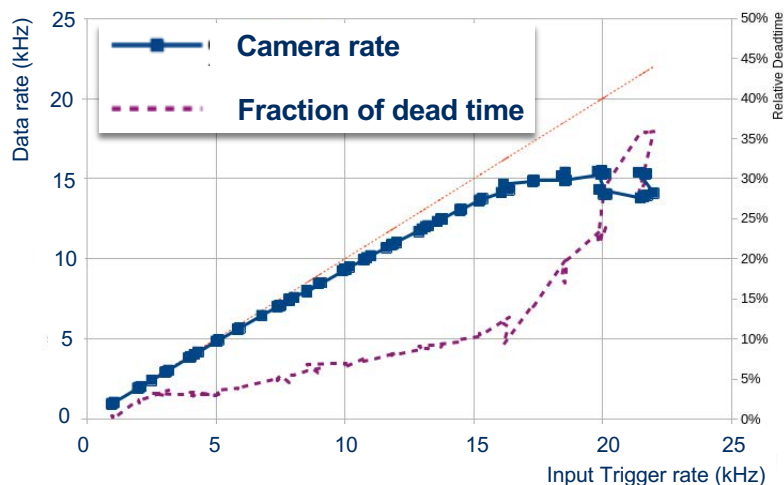
cherenkov  
telescope  
array

# LST1: camera performance

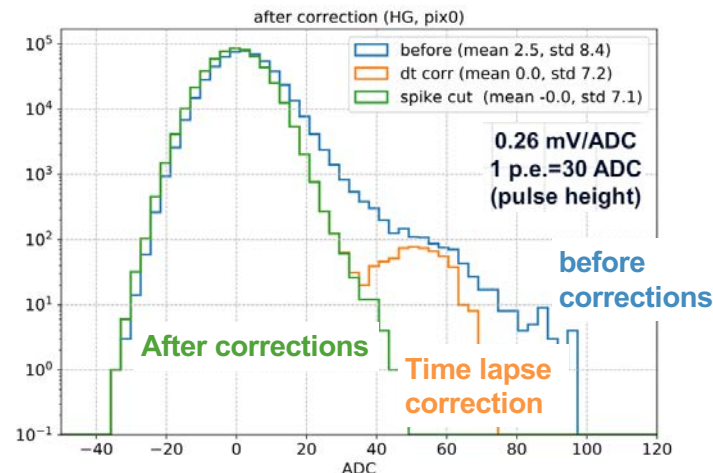
## Time resolution, calibration pulses (80p.e)



## Data rates



## Electronics noise level

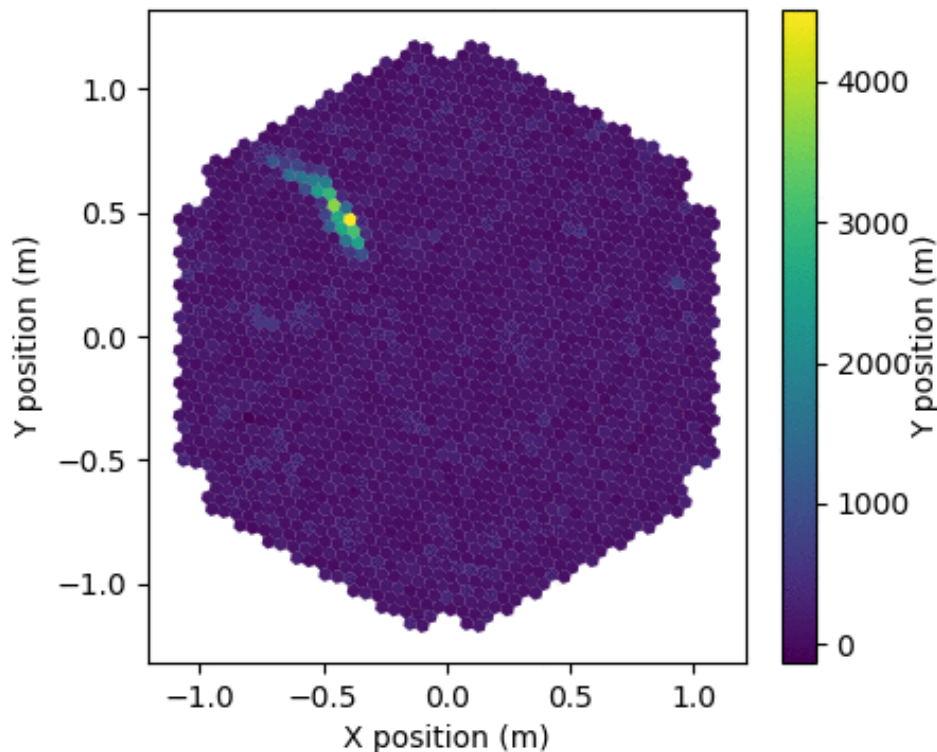


- Noise level
  - 5.9 ADC (0.20p.e.) due to electronics noise
  - 29.5 ADC (0.98p.e.) with HV on in dark patch (dominated by NSB)
- Time accuracy at 400ps level
- Can handle data rates according to specs

# Test Observation August 2019

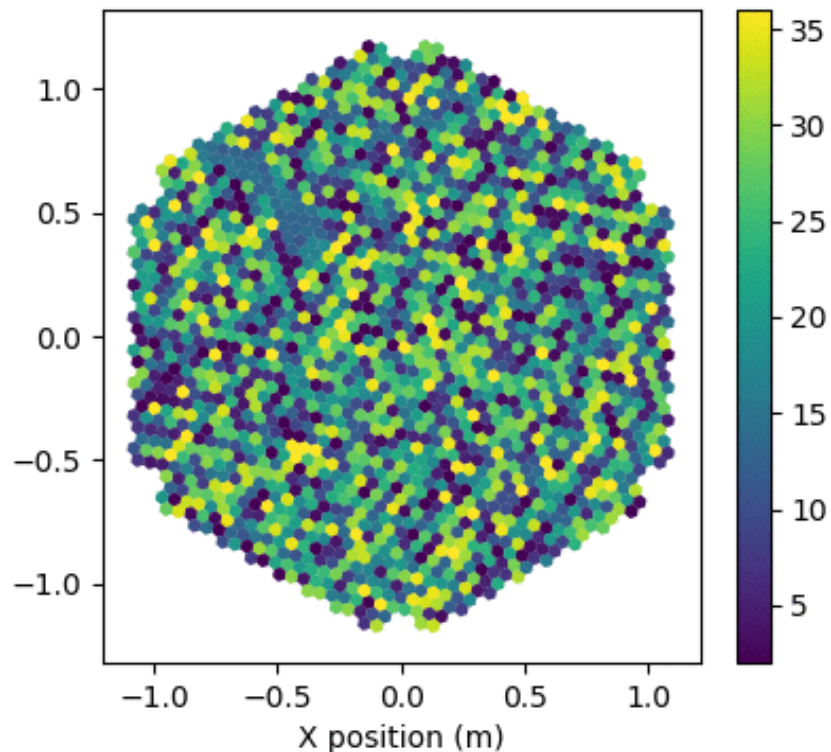
## Trigger is not optimized yet

Charge: Event ID 106457



Charge

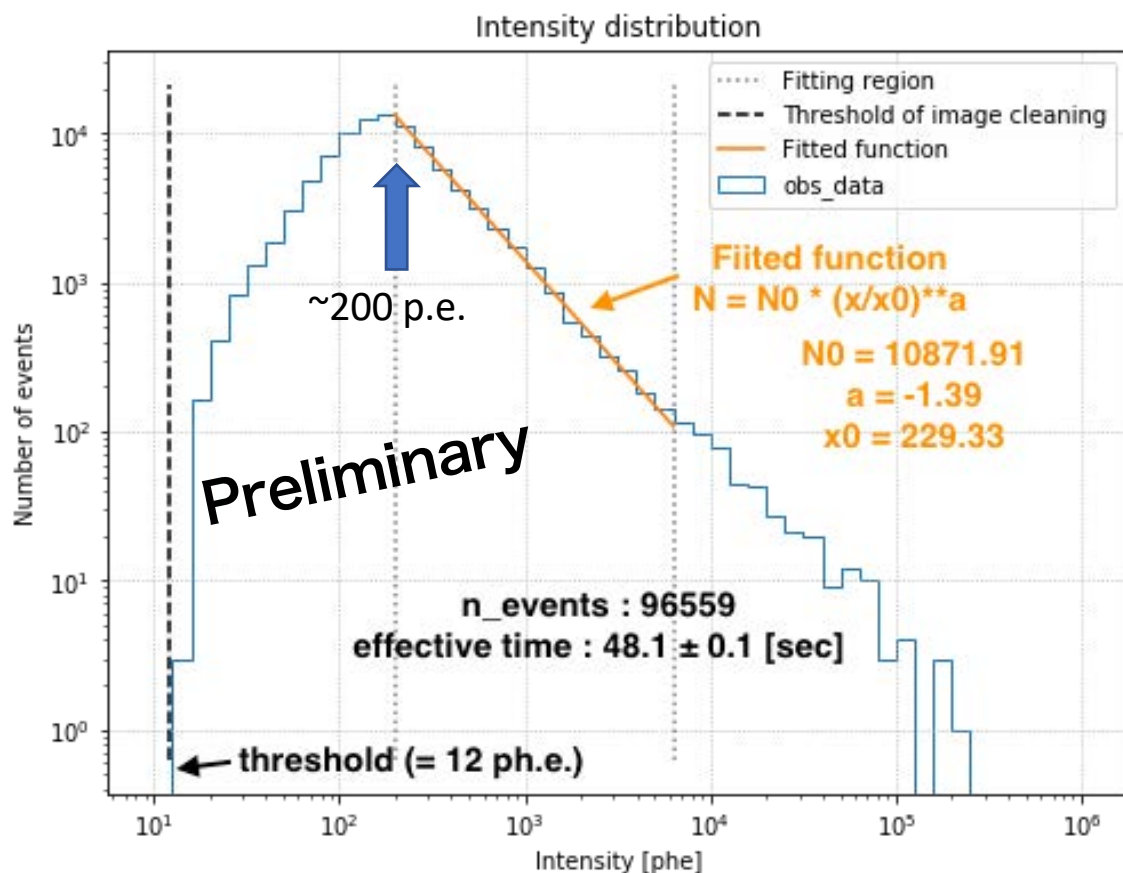
Peak Slice



Timing

# Test observation

## Trigger is not optimized yet



Run # : 1321

Event rate : 1837 Hz

Pedestal: 50Hz

Size(p.e.)(Med) : 200 p.e.  $\rightarrow$

Eth for gamma: 60 GeV

$d \log N / d \log \text{Size} \propto E^{-1.39}$

Acceptance  $\propto E^{0.25}$  (from M.C.)

$d \log N / d \log E \propto E^{-1.65}$

$\rightarrow$  Consistent with P + He spectrum

# LST CDR

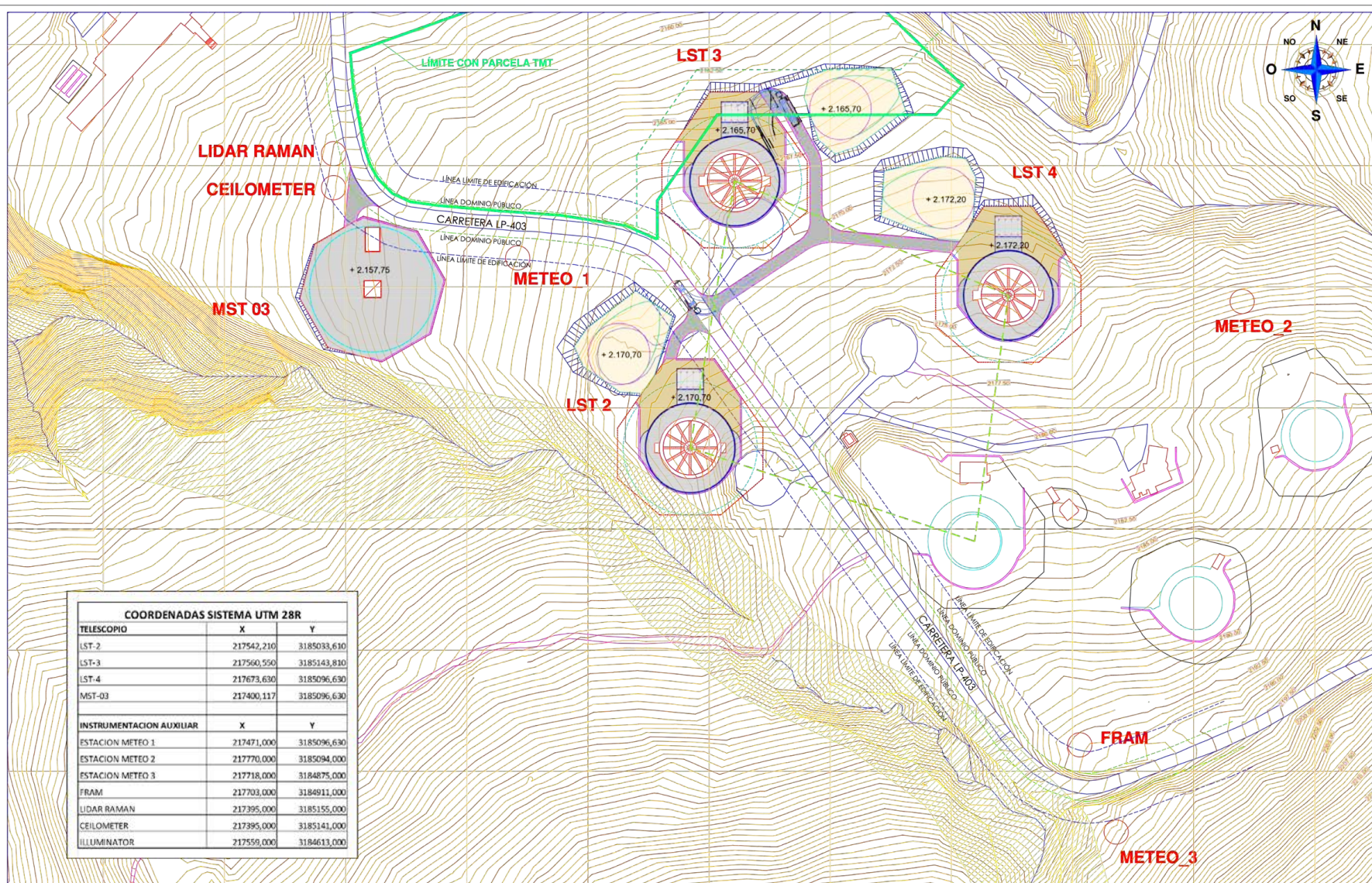
**from 15 to 17 Oct at MPP**

- The LST CDR f2f meeting took place from 15 to 17 Oct at MPI for Physics in Munich. About 50 people attended, from the LST team, review panel members (external and CTAO) and observers. The meeting was very constructive and held in a good atmosphere.
- Most of the items raised by the review panel could be closed either before the f2f meeting or at the meeting. The remaining items were classified into major and minor items.
- The review panel identified a number of action items and further discussion points but no showstopper.
- Once the final review report is available from the review panel, CTAO and LST will discuss how to proceed with the intention to close the raised items as soon as possible, thus completing the full scope of the CDR.
- The CDR can be declared as fully passed once major open review items are closed.



cherenkov  
telescope  
array

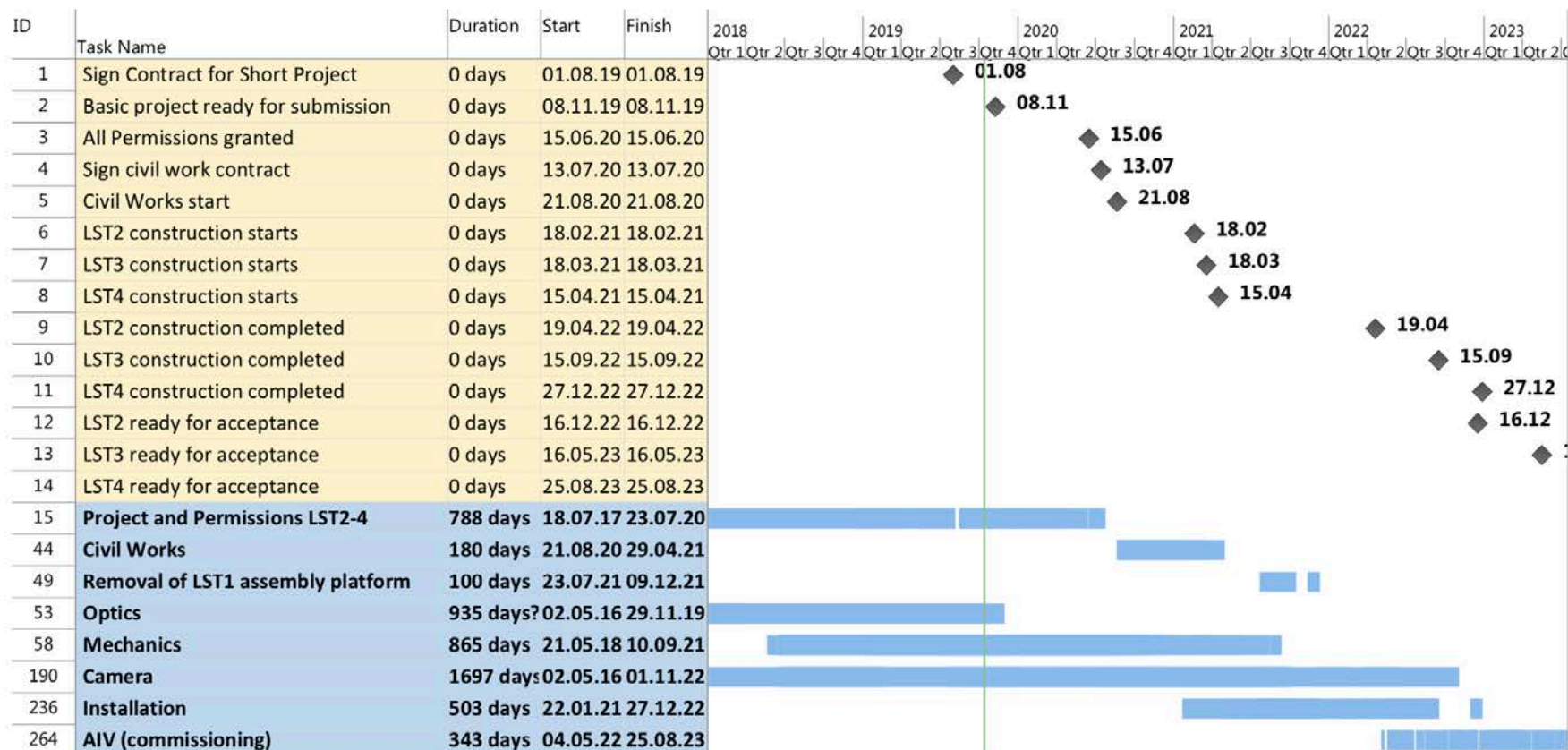
# LST2-4





cherenkov  
telescope  
array

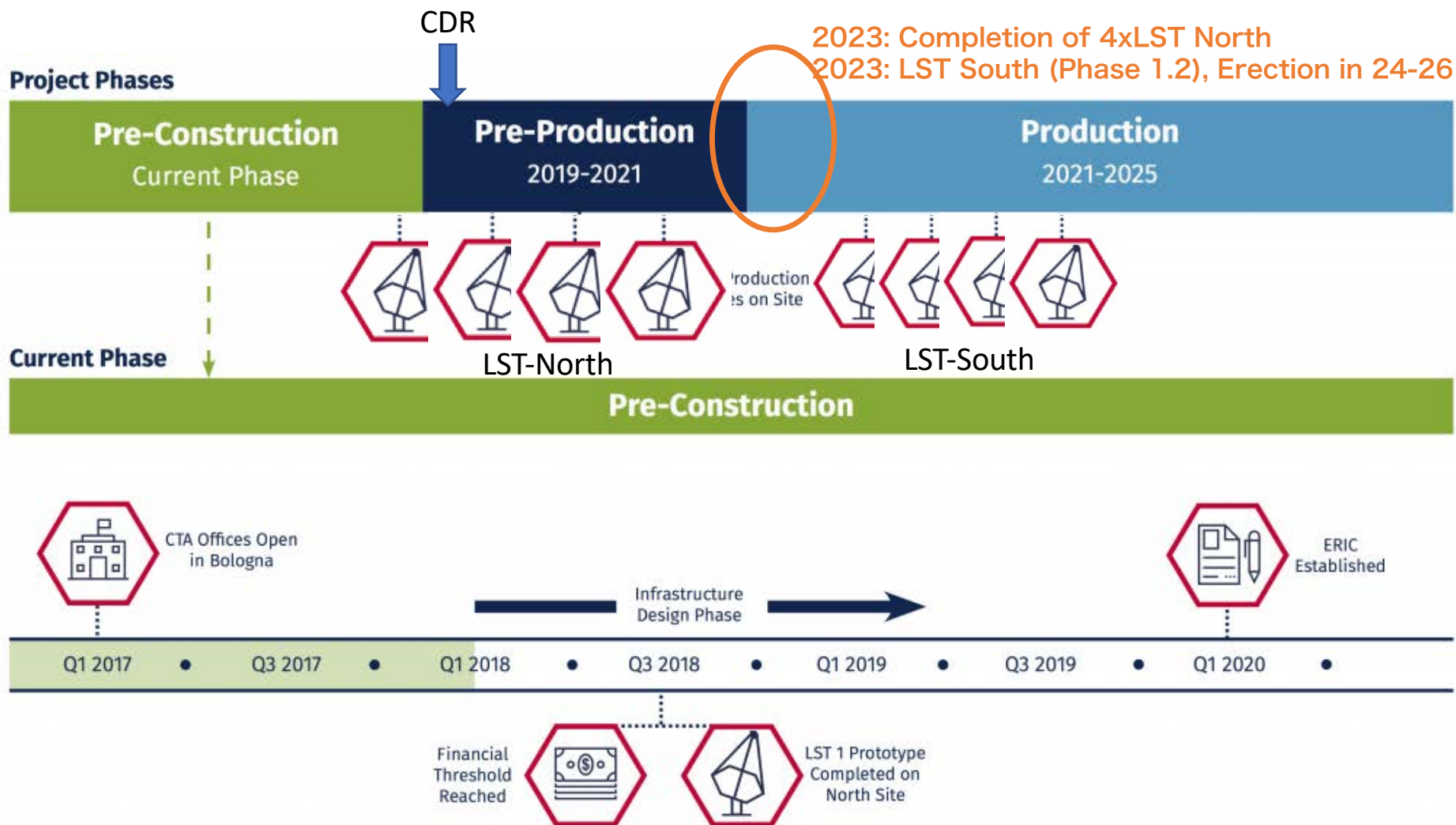
# LST2-4





cherenkov  
telescope  
array

# Time line for CTA and CTA-LSTs





# LST General Meeting, Marseille, France, December 2019

2-5 December 2019

Europe/Paris timezone

## Overview

[Timetable](#)

[Participant List](#)

[Marseille Travel Information](#)

[Meeting Venue](#)

[Accommodation](#)

[Registration](#)

[Dinner](#)

[Internet Access](#)

## Contact

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The biannual meeting of the Large Size Telescope Collaboration of the CTA consortium will take place in Marseille from 2 December to 5 December 2019.



