CTA, with focus on LST

Masahiro Teshima

ICRR, The University of Tokyo
Max-Planck-Institute for Physics

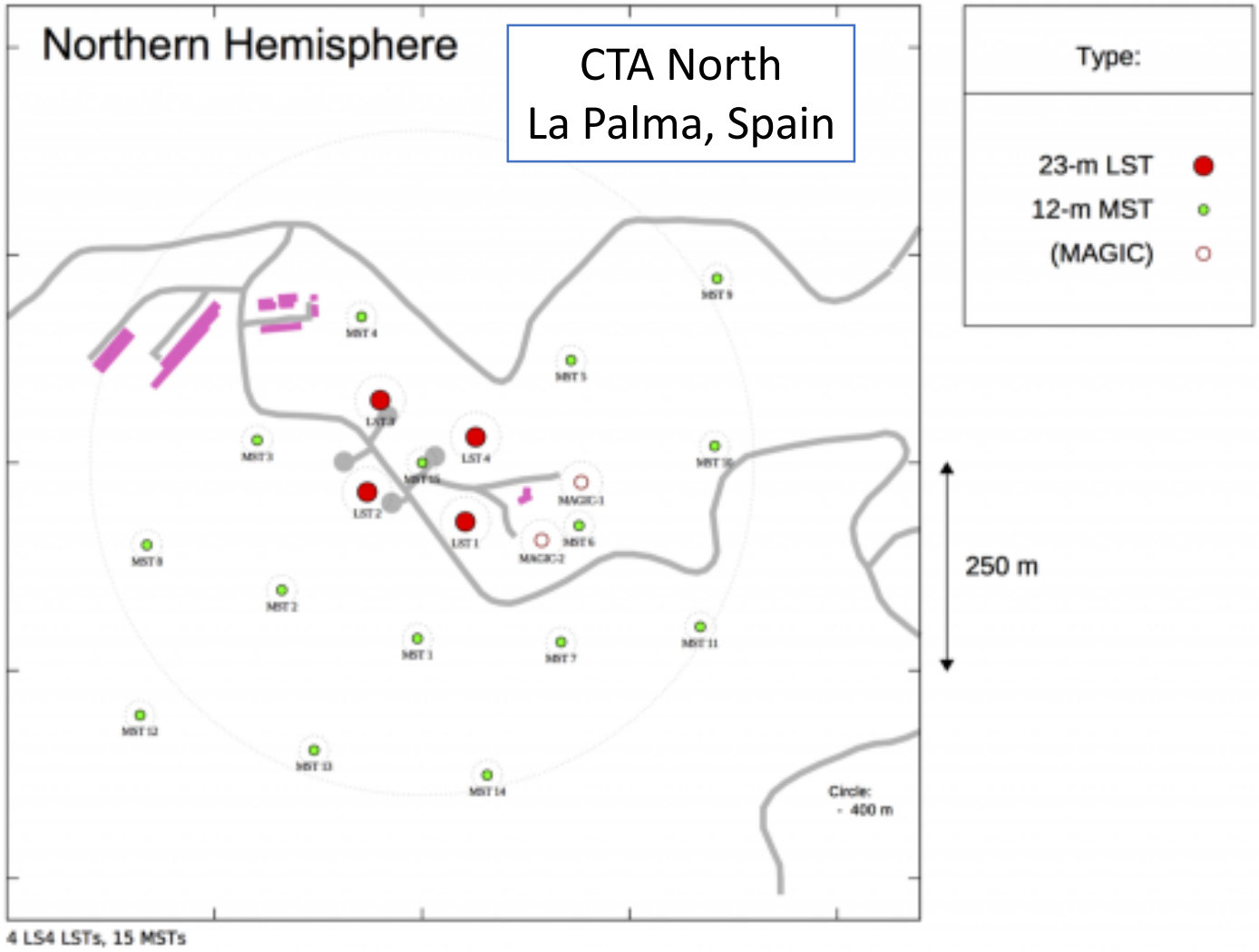
cherenkov telescope array

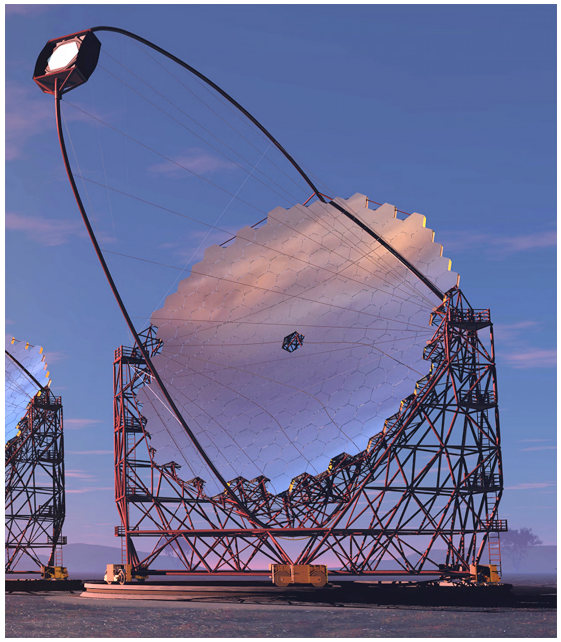
CTA North at ORM

Observatorio del Roque de los Muchachos

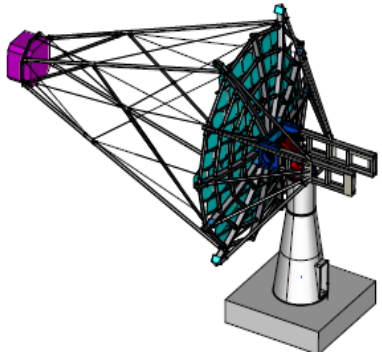
CTA North Array Configurations

CTA Observatory consists of two sites, Chile Paranal and Spain Canary Island to coverall sky.





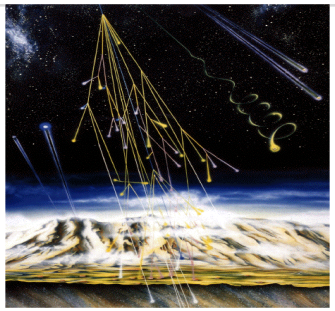
LST 23m Low-Energy



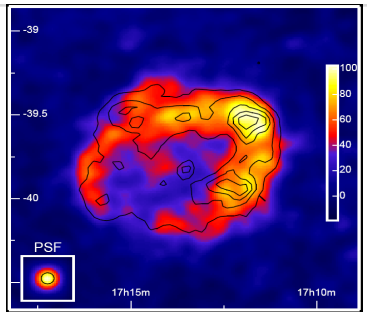
MST 12m
Mid-Energy

cherenkov telescope array

Science with CTA
Energy frontier of Astrophysics

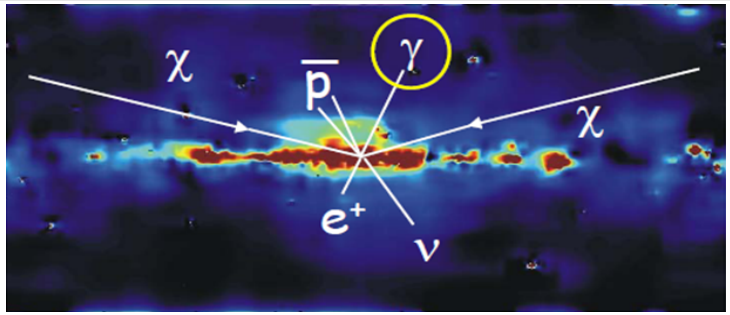


Origin of CR
UHECR



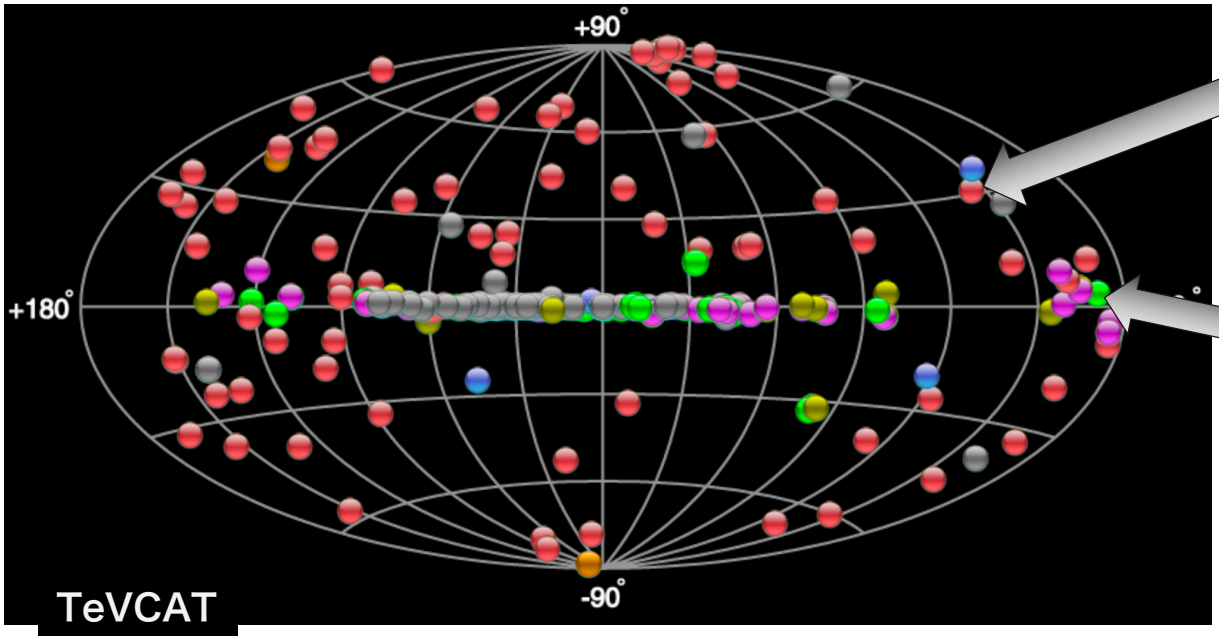
Cosmic Accelerators

Super Massive
Blackhole

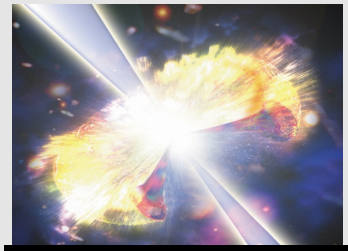


Dark Matter

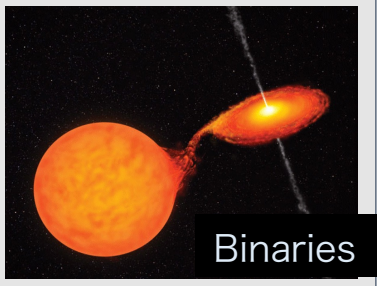
- Origin of Cosmic Rays (Cosmic Accelerators)
- High Energy Phenomena around Blackholes
- Gamma Rays from Dark Matter Annhilation



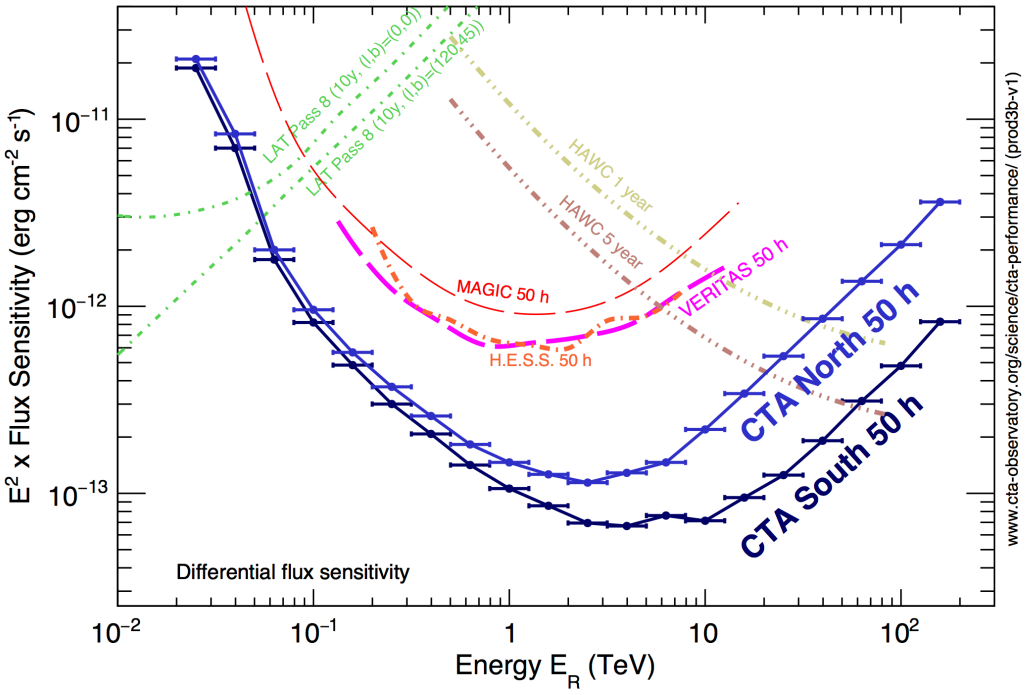
Extragalactic

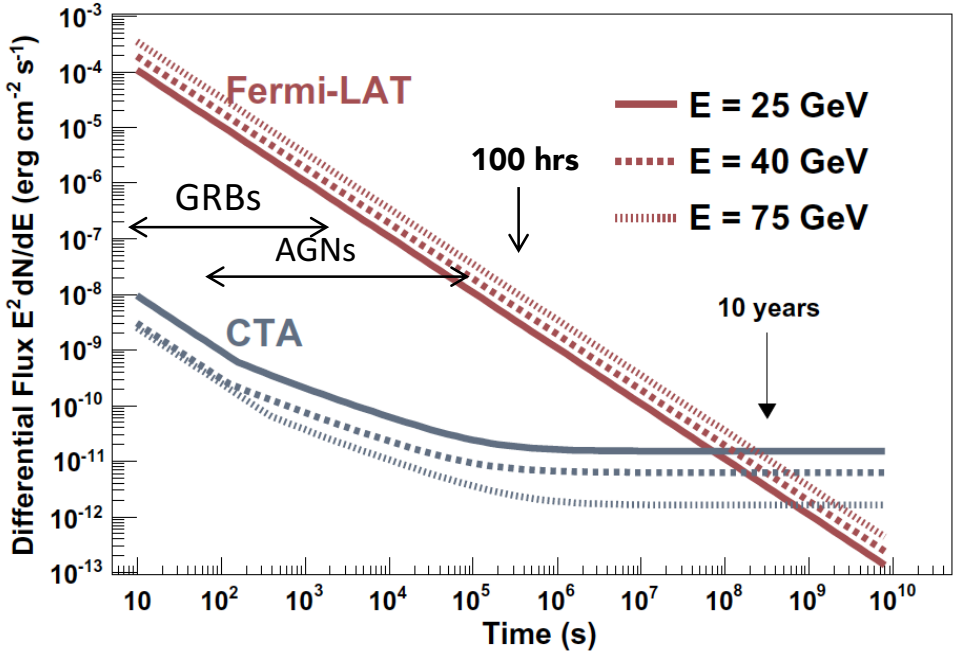


Galactic Sources



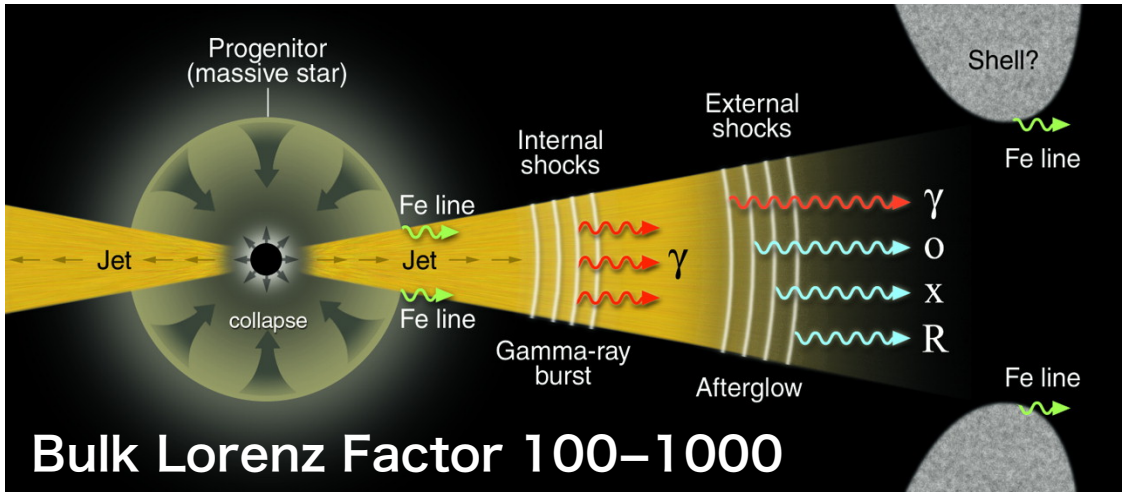
CTAN-LST Array
Sensitivity x3, Angular Resolution x2
Energy Range > 20GeV

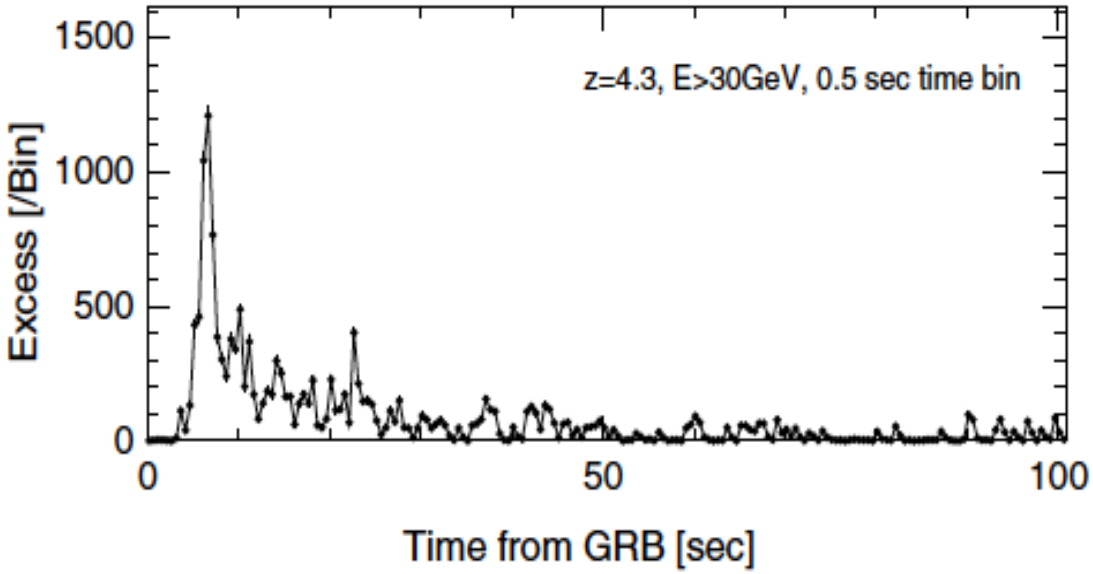




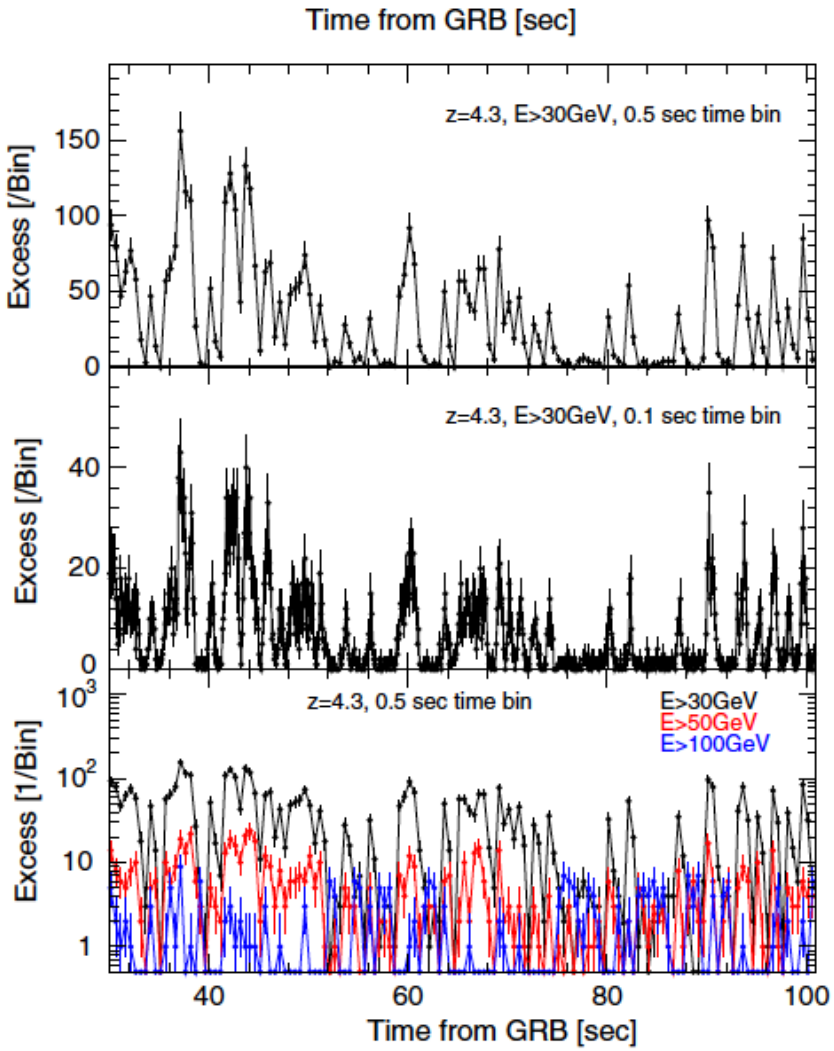
- CTA-LST array contributes to the sensitivity in low energies
- >20GeV Threshold Energy
- Distant AGNs are observable up to z=2
- X10000 sensitivity for GRBs and AGN flares than Fermi
- First firm observation of GRBs from ground

GRBs: good targets for CTA-LSTs
Study the newborn baby black holes



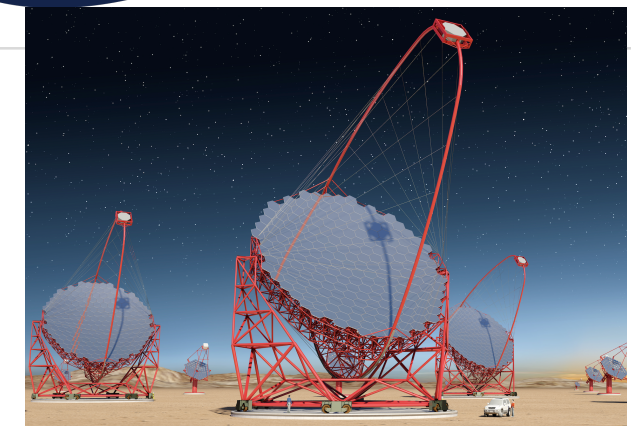


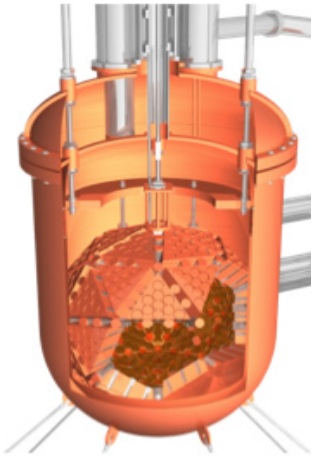
CTA Simulation
(Template GRB080916C)



Toward the discovery of Dark Matter
Complementarity with different approaches

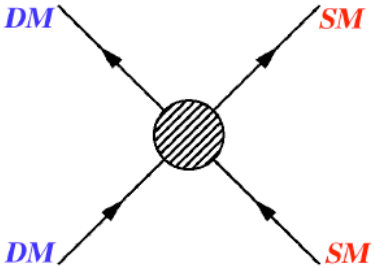
cherenkov telescope array



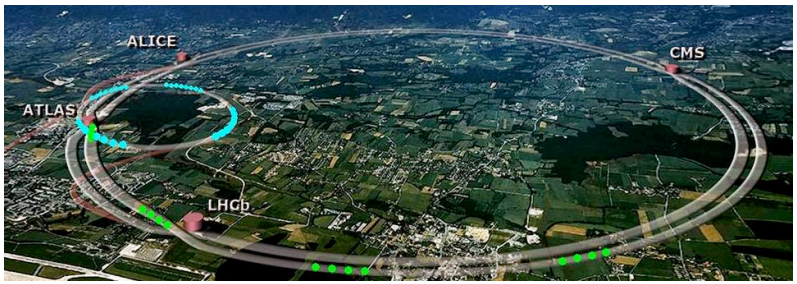


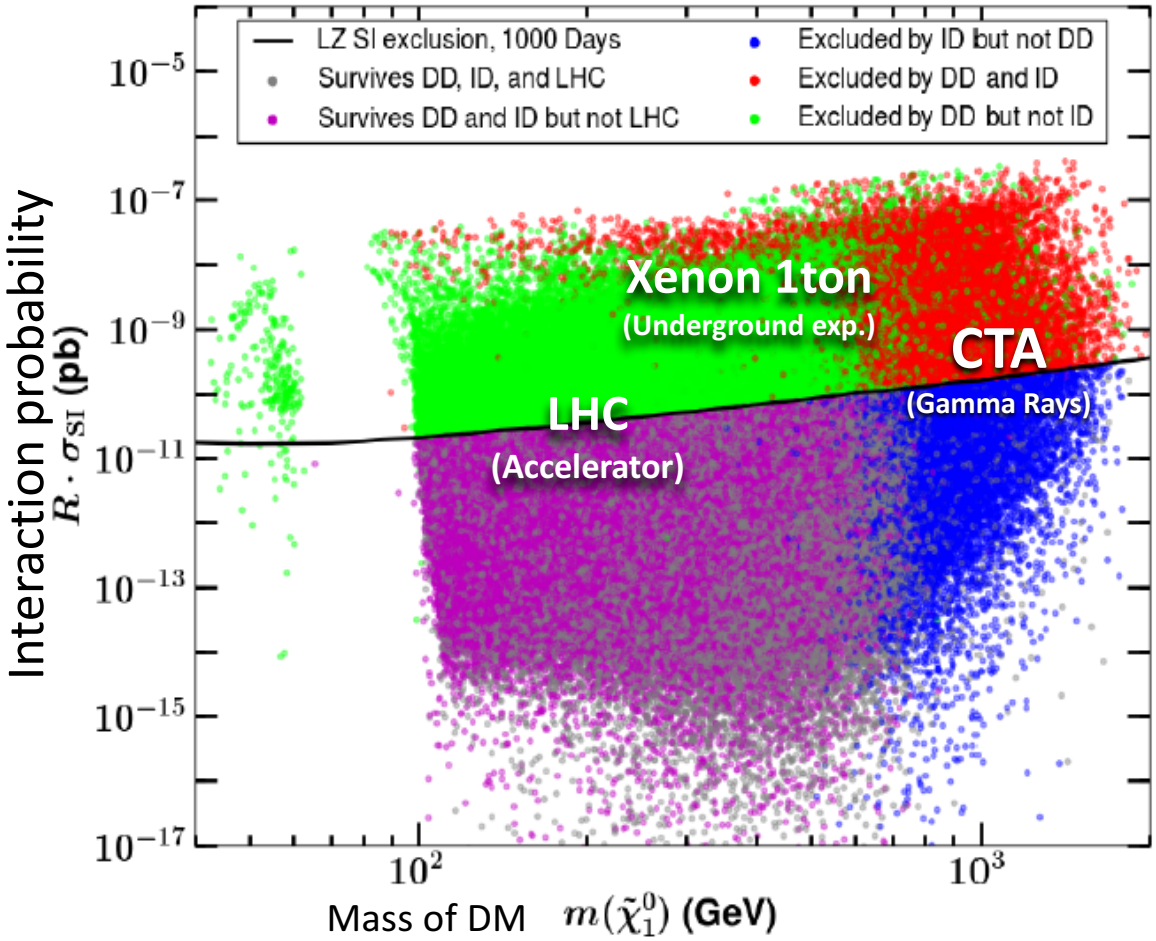
thermal freeze-out (early Univ.)
indirect detection (now)

direct detection

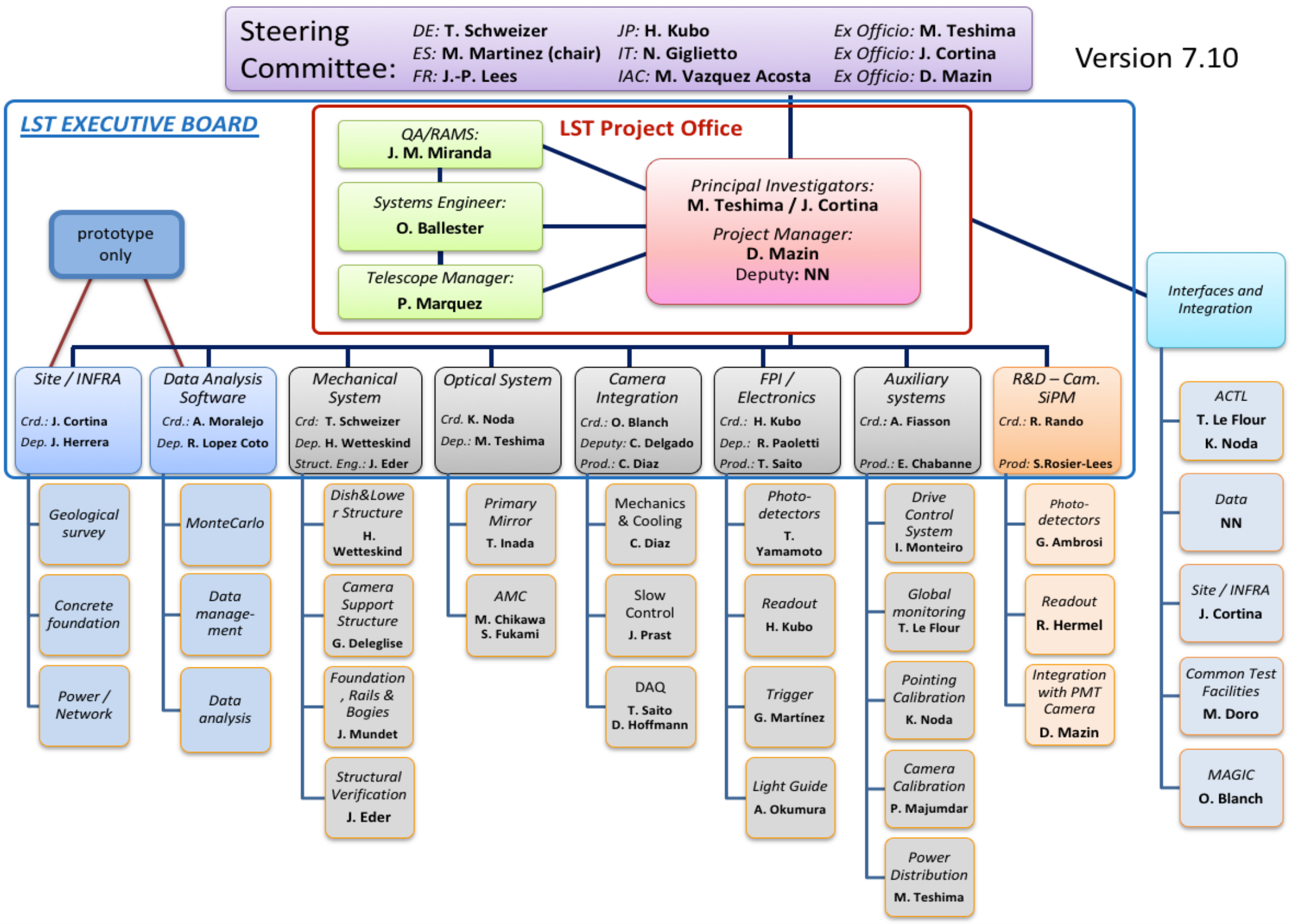


production at colliders





- Explore Dark Matter in the Galactic Center and Dwarf Sph. Galaxies
- CTA has the best sensitivity above 700GeV

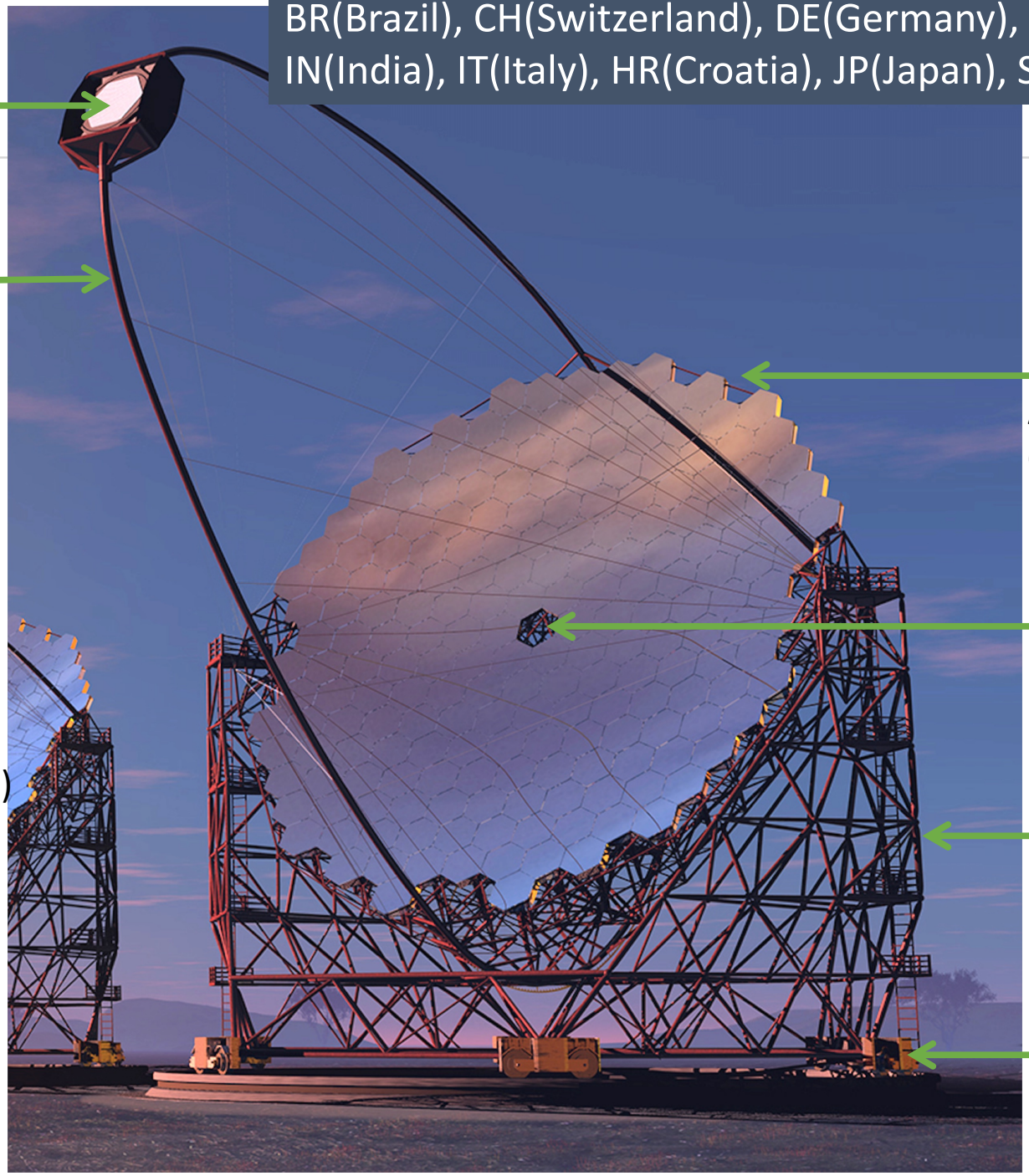

Steering Committee:
DE: T. Schweizer
ES: M. Martinez (chair)
FR: J.-P. Lees
JP: H. Kubo
IT: N. Giglietto
IAC: M. Vazquez Acosta
Ex Officio: M. Teshima
Ex Officio: J. Cortina
Ex Officio: D. Mazin
Version 7.10
LST EXECUTIVE BOARD
LST Project Office
QA/RAMS: J. M. Miranda
Systems Engineer: O. Ballester
Telescope Manager: P. Marquez
Principal Investigators: M. Teshima / J. Cortina
Project Manager: D. Mazin
Deputy: NN
prototype only
Interfaces and Integration
Site / INFRA
Crd.: J. Cortina
Dep. J. Herrera
Data Analysis Software
Crd.: A. Moralejo
Dep. R. Lopez Coto
Mechanical System
Crd: T. Schweizer
Dep. H. Wetteskind
Struct. Eng.: J. Eder
Optical System
Crd. K. Noda
Dep.: M. Teshima
Camera Integration
Crd.: O. Blanch
Deputy: C. Delgado
Prod.: C. Diaz
FPI / Electronics
Crd.: H. Kubo
Dep.: R. Paoletti
Prod.: T. Saito
Auxiliary systems
Crd.: A. Fiasson
Prod.: E. Chabanne
R&D – Cam. SiPM
Crd.: R. Rando
Prod: S.Rosier-Lees
Geological survey
Concrete foundation
Power / Network
MonteCarlo
Data manage-ment
Data analysis
Dish&Lowe r Structure
H. Wetteskind
Camera Support Structure
G. Deleglise
Foundation , Rails & Bogies
J. Mundet
Structural Verification
J. Eder
Primary Mirror
T. Inada
AMC
M. Chikawa
S. Fukami
Mechanics & Cooling
C. Diaz
Slow Control
J. Prast
DAQ
T. Saito
D. Hoffmann
Photo-detectors
T. Yamamoto
Readout
H. Kubo
Trigger
G. Martínez
Light Guide
A. Okumura
Drive Control System
I. Monteiro
Global monitoring
T. Le Flour
Pointing Calibration
K. Noda
Camera Calibration
P. Majumdar
Power Distribution
M. Teshima
Photo-detectors
G. Ambrosi
Readout
R. Hermel
Integration with PMT Camera
D. Mazin
ACTL
T. Le Flour
K. Noda
Data
NN
Site / INFRA
J. Cortina
Common Test Facilities
M. Doro
MAGIC
O. Blanch

CTA-LST Project : Big International Effort

BR(Brazil), CH(Switzerland), DE(Germany), ES(Spain), FR(France), IN(India), IT(Italy), HR(Croatia), JP(Japan), SE(Sweden)

Focal Plane Instr.
Electronics (JP/IT/ES)
Camera body (ES)

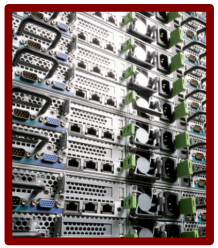
Camera Supporting Structure (FR/IT)



Mirror (JP)
Interface Plate(DE/BR/JP)
Actuator (JP/CH)
CMOS-Cam (JP)

Star Guider (SE)
Calibration Box (IN/IT)

Flywheel, UPS (JP)
Computers, network (JP)
INFRA (ES)



Structure (DE/ES)
Access Tower (DE/ES)

Drive (ES/FR)
Bogie (ES/DE/IT)
Rail (ES/DE)
Foundation (ES)

cherenkov telescope array

LST1 construction

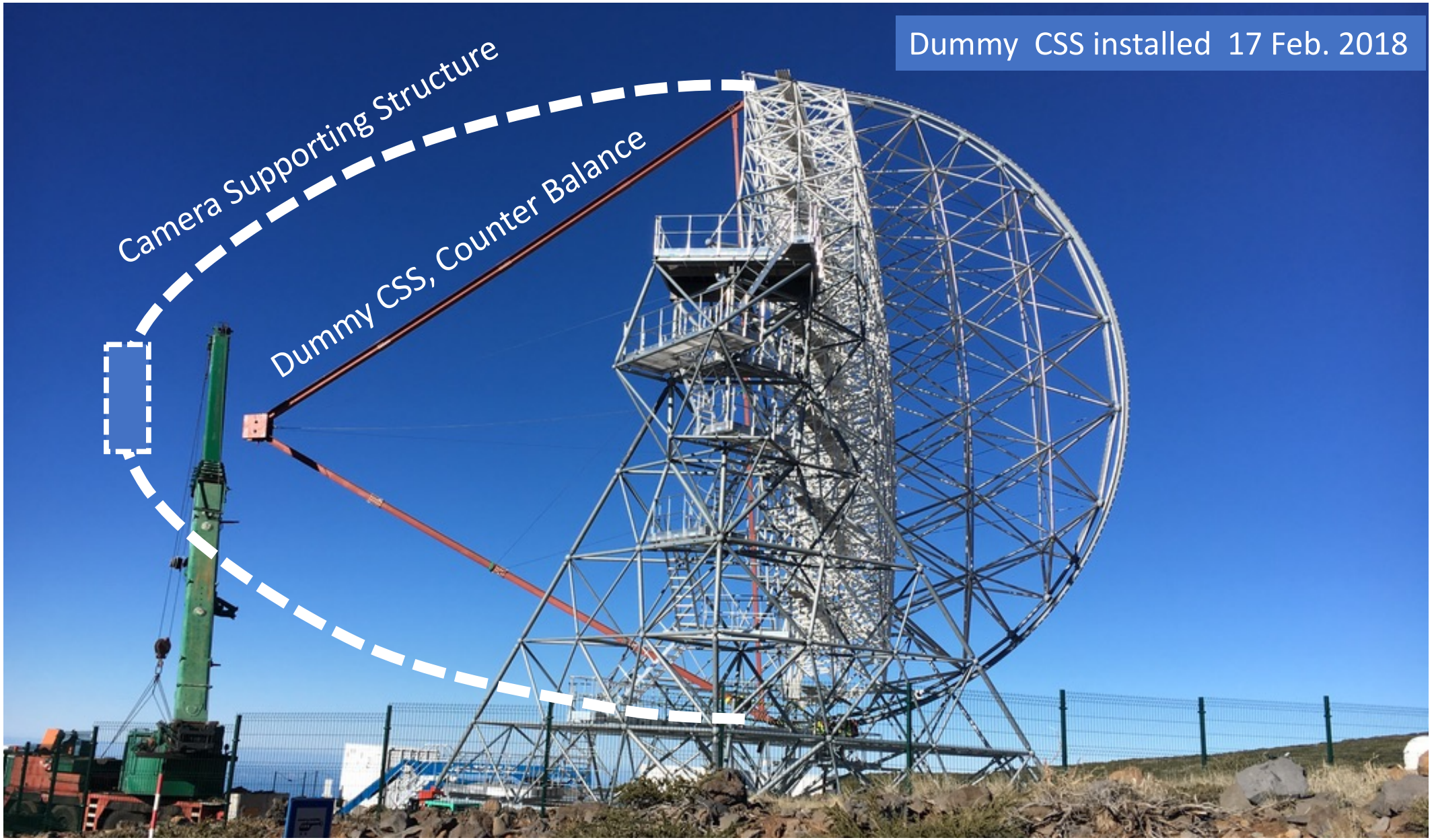
cherenkov telescope array

LST1 construction

Very good test for the ice load

cherenkov telescope array

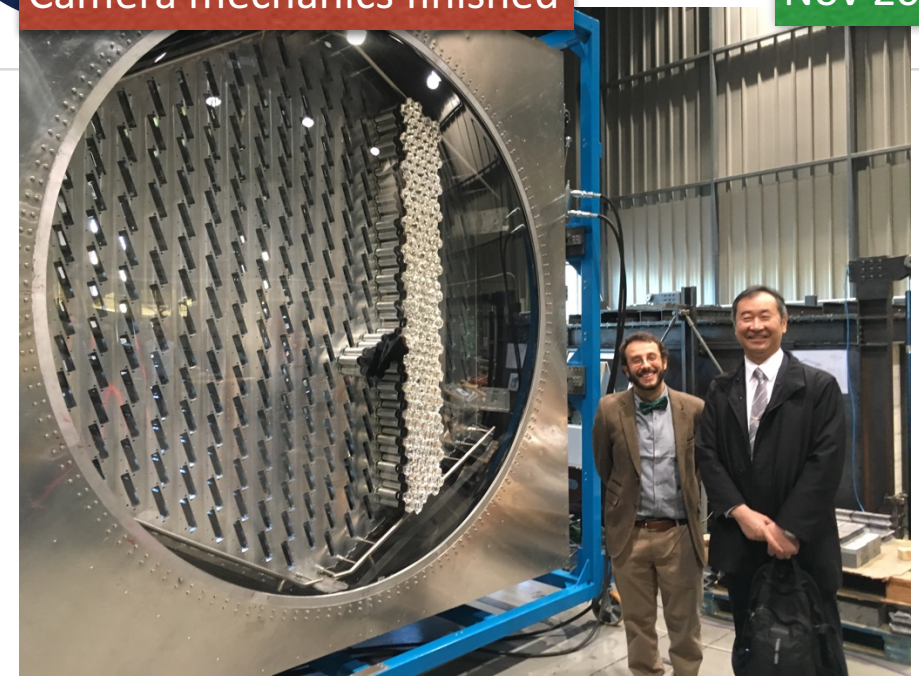
CTA LST1 Construction
Dummy CSS for balancing



Status of LST1 construction

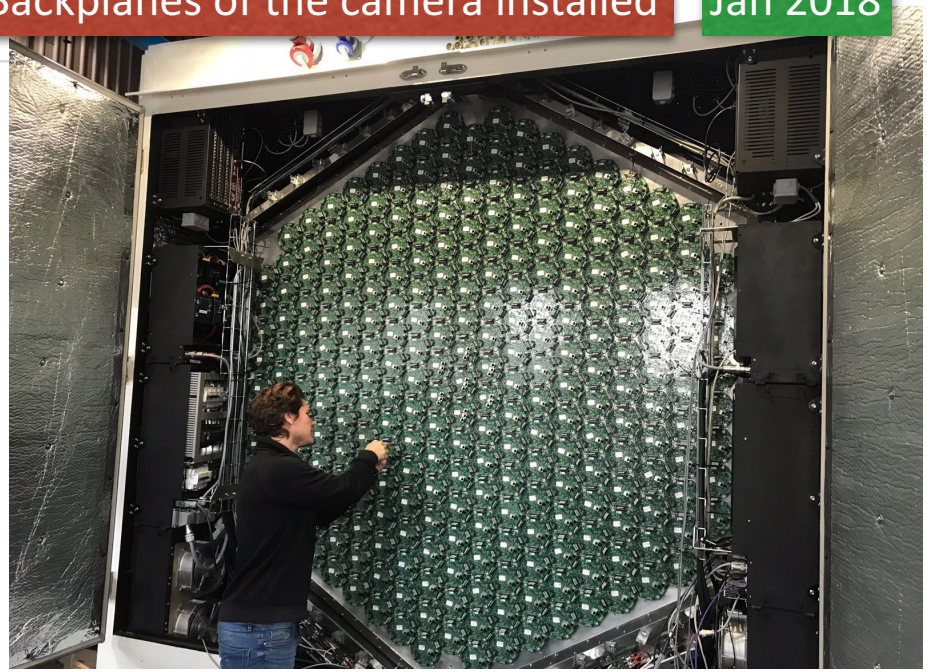
Camera mechanics finished

Nov 2017



Backplanes of the camera installed

Jan 2018



IT computer center installed, 2k Cores, 3PB

Dec 2017

Power and Network ready

Mar 2018

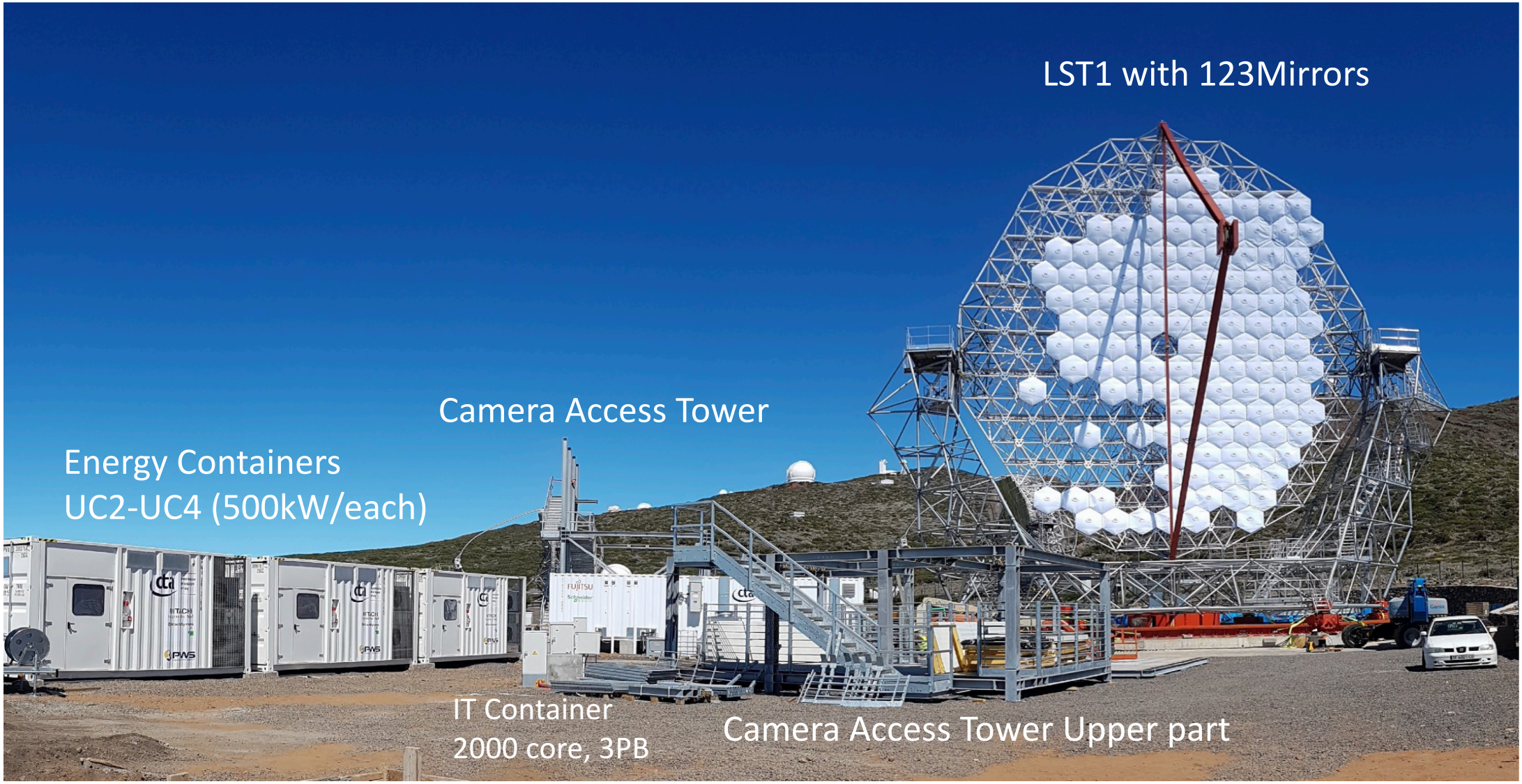
Diesel

ATS, Transformer

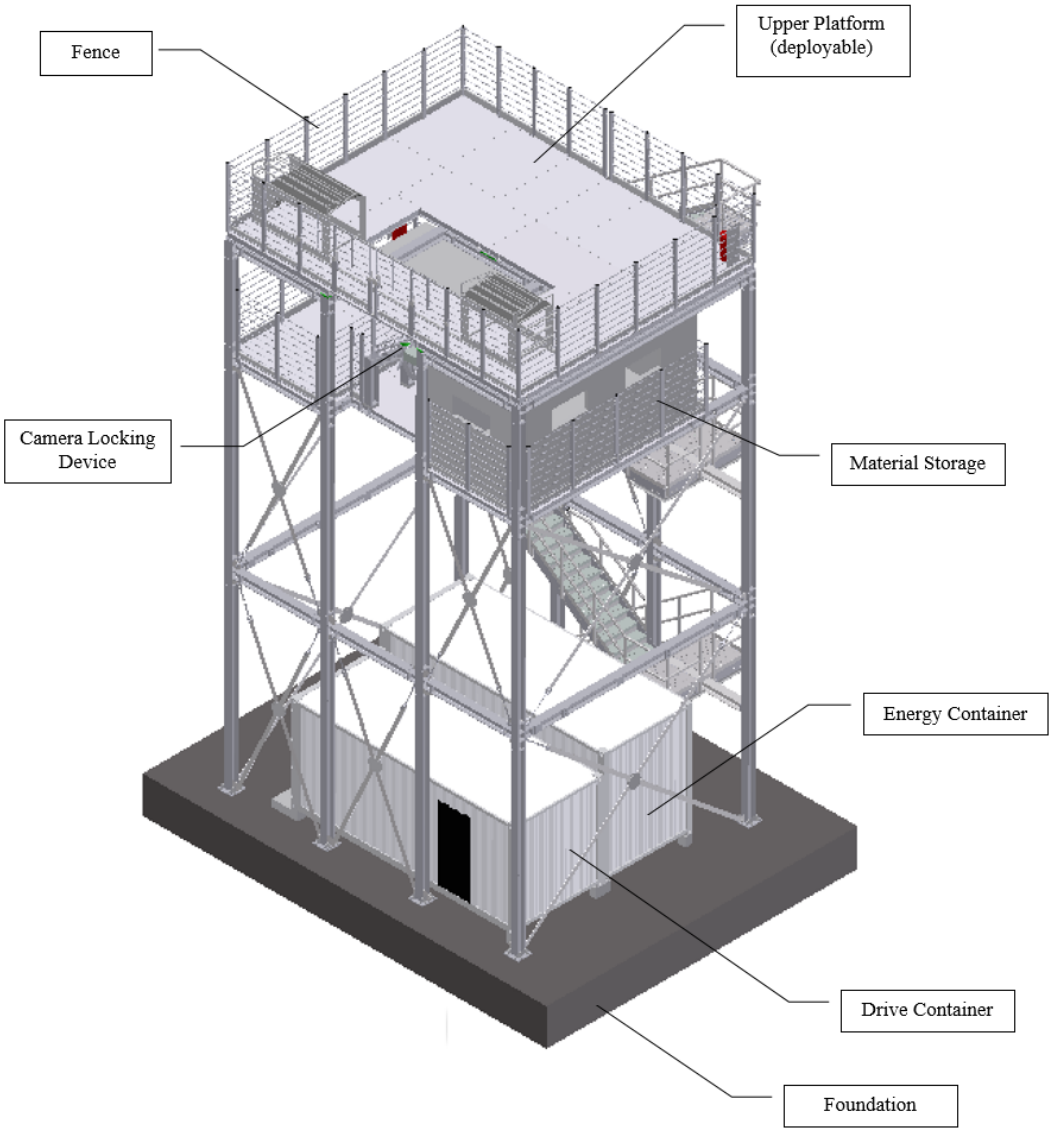
500kW Flywheel Power Units

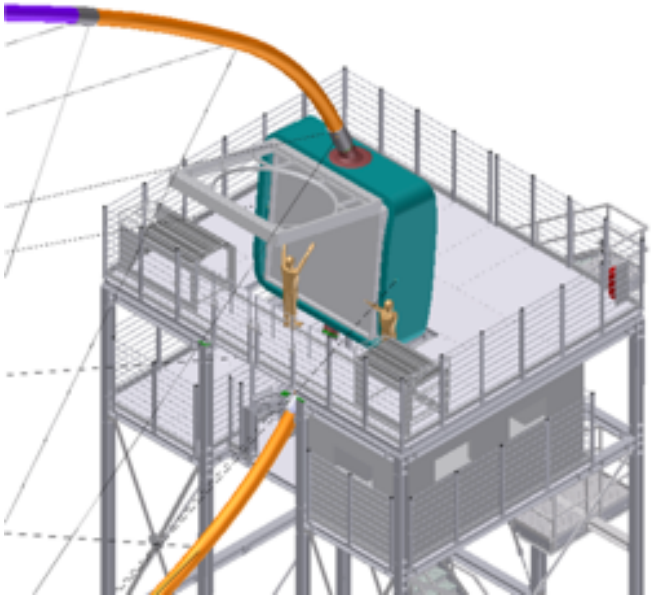
cherenkov telescope array

The LST-1 Site
on 11. May 2018



Camera Access Tower



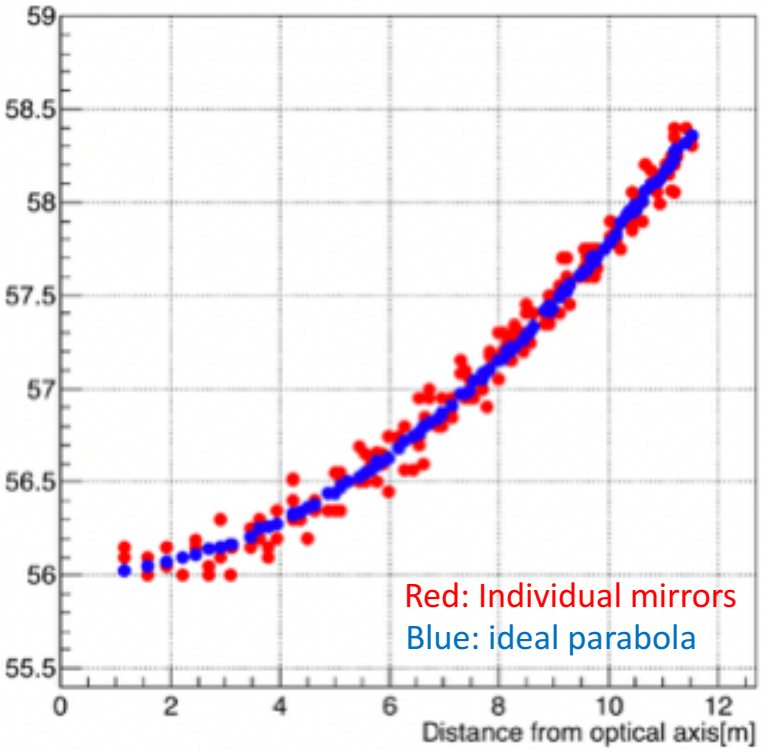


cherenkov telescope array

198 Mirrors for LST1

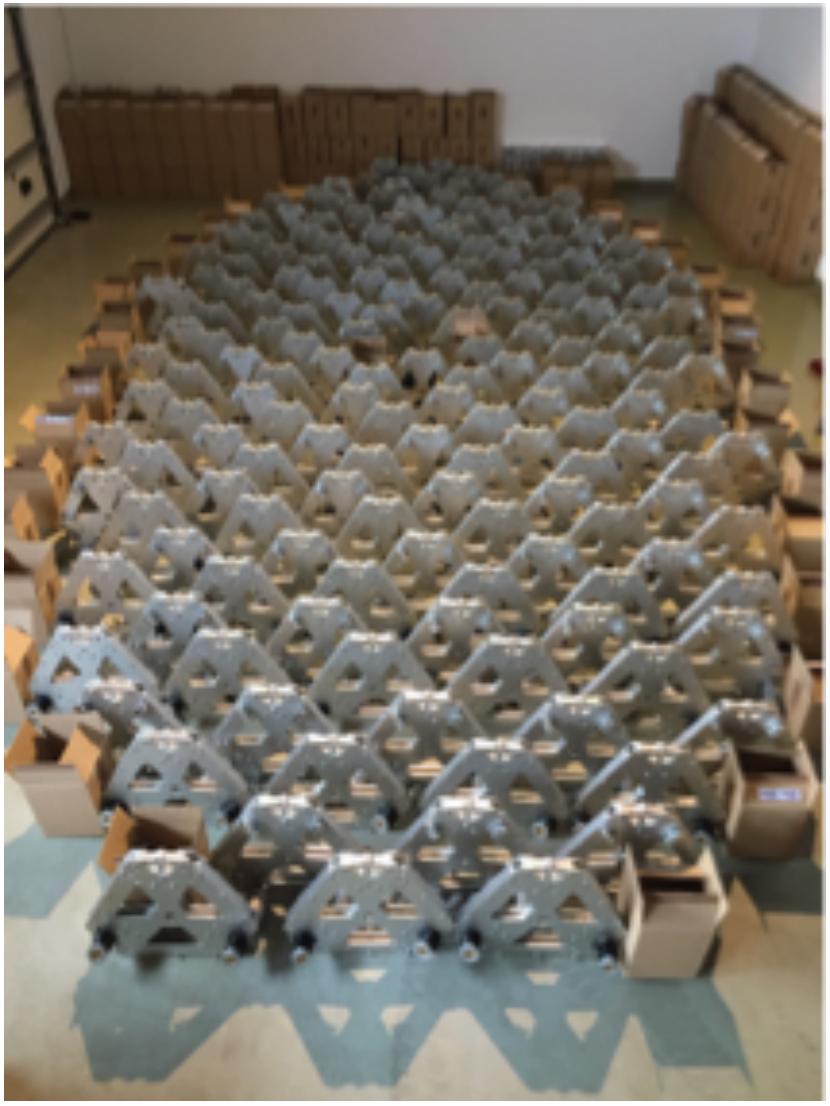
198 Mirrors are brought to the LST1 site

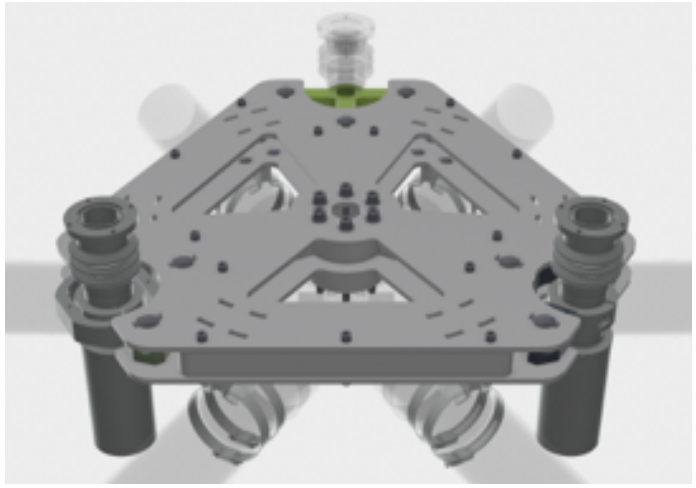
The Radius of Curvature of mirrors as a function of distance of the center



Preparation of Interface Plates and Actuators in MIRCA

Assembled Interface plates and Actuators



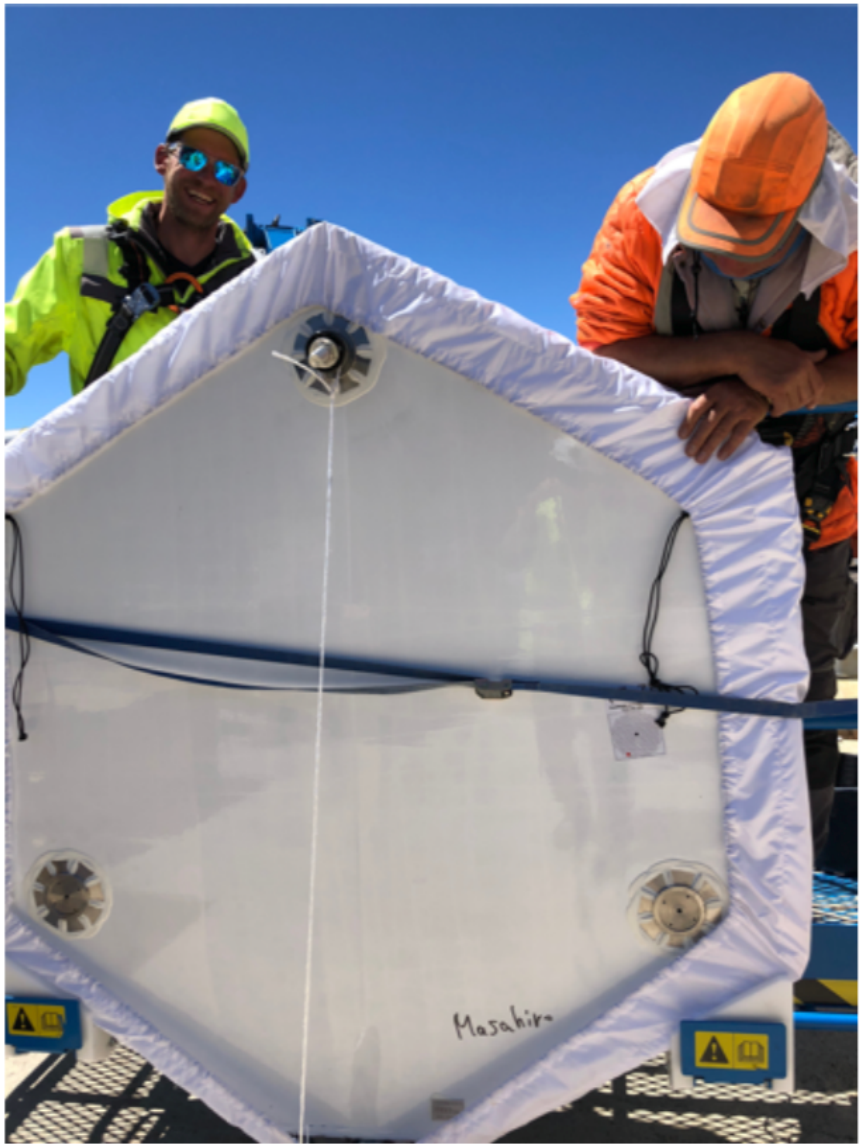


cherenkov telescope array

LST1 construction

Installing Mirror Interface Plates and actuators

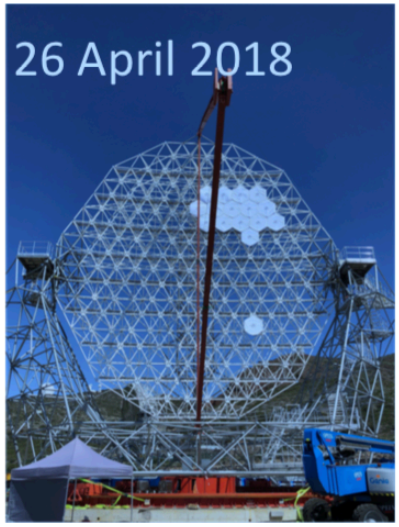
Mirror Installation

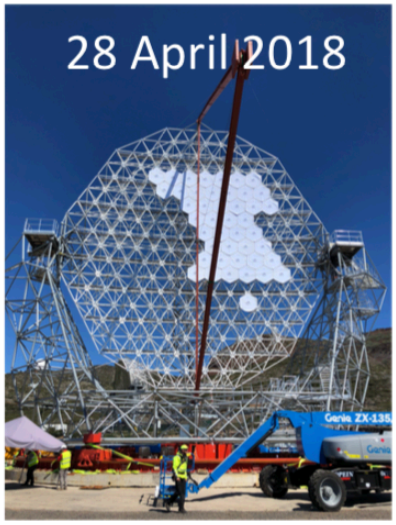


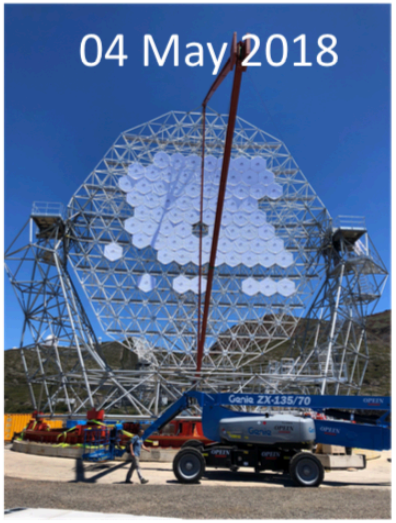
There is 'Martin' mirror as well ;)

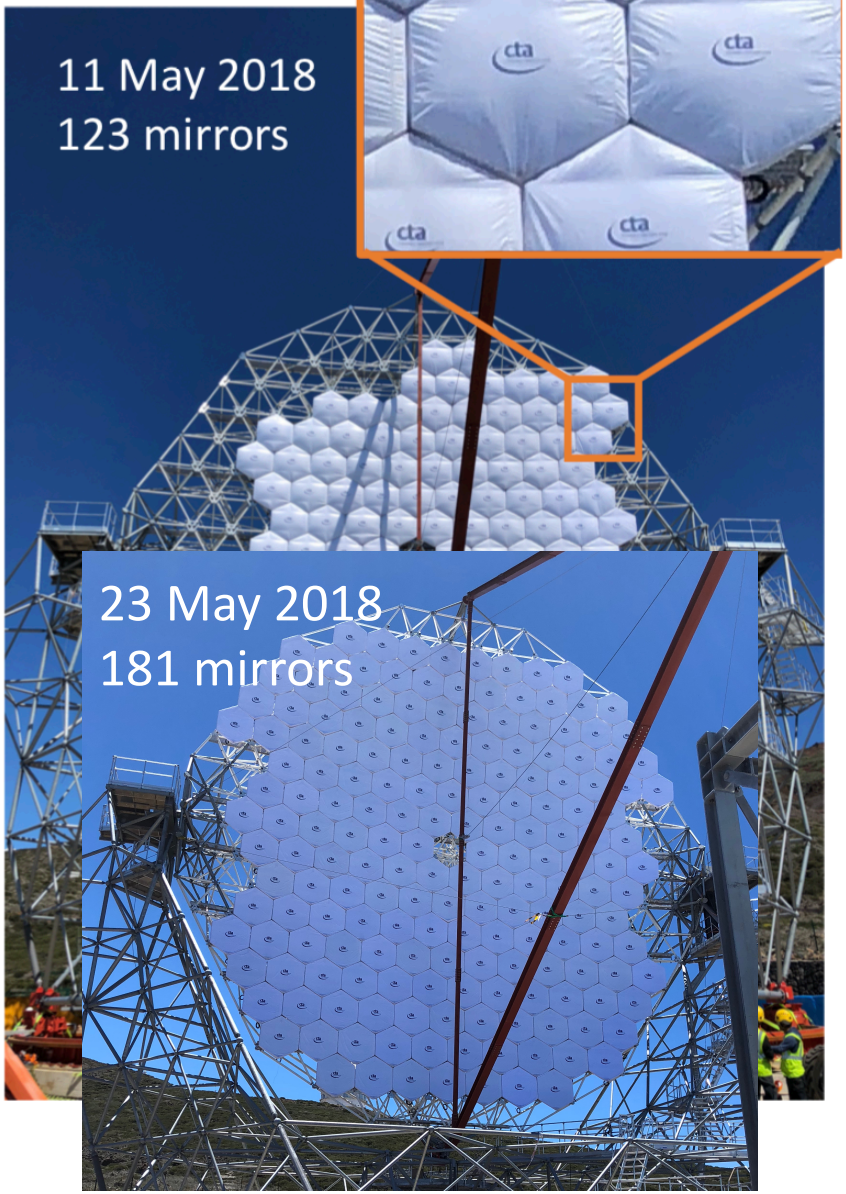
cherenkov telescope array

Mirror installation is on-going









Camera Supporting Structure by LAPP/IN2P3

Camera support structure :

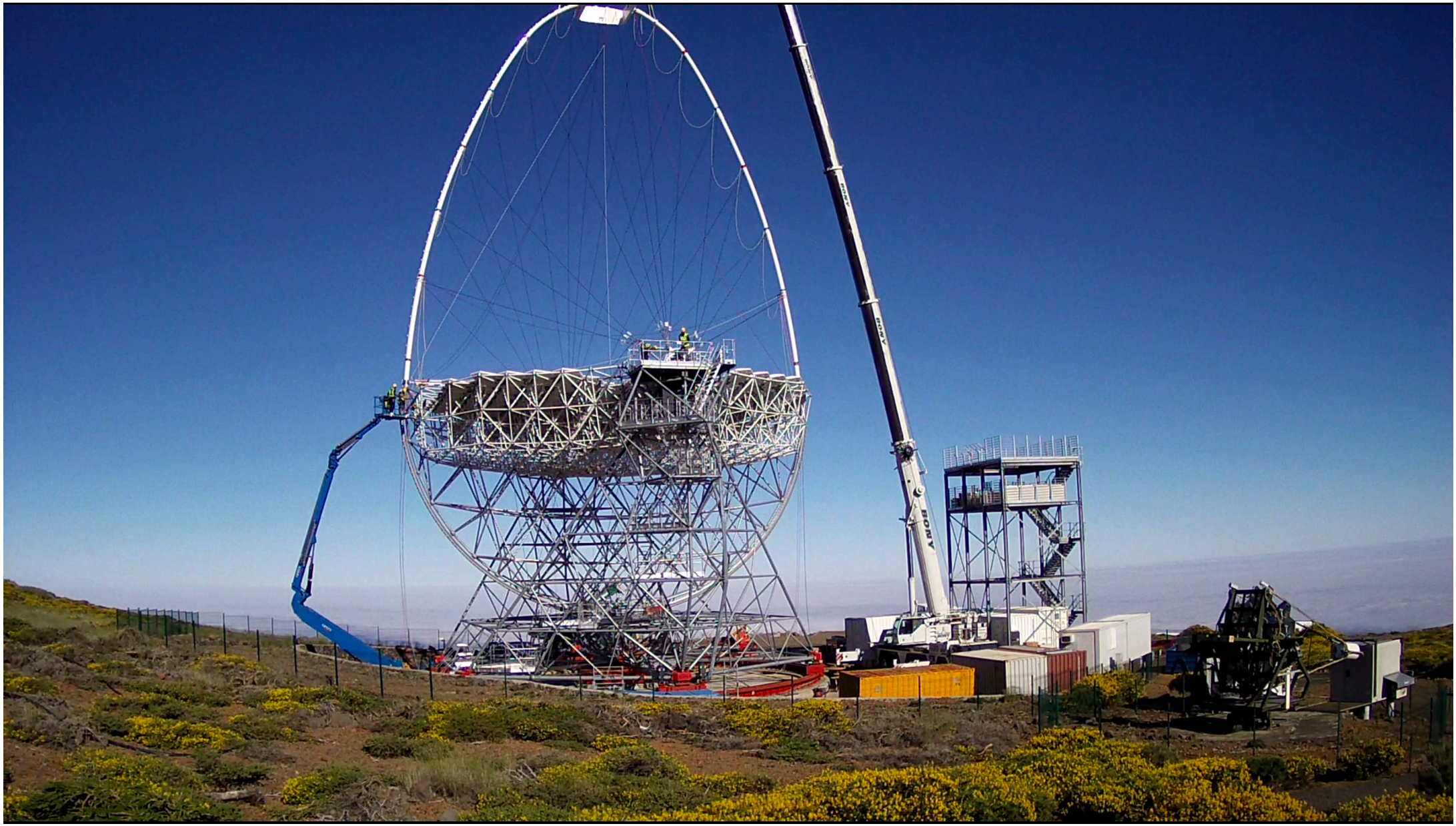
- production : finished
- Trial mounting : done in February
- Shipment : in progress
- Expected arrival date on site : 21 May

cherenkov telescope array

Camera Supporting Structure on the trailer

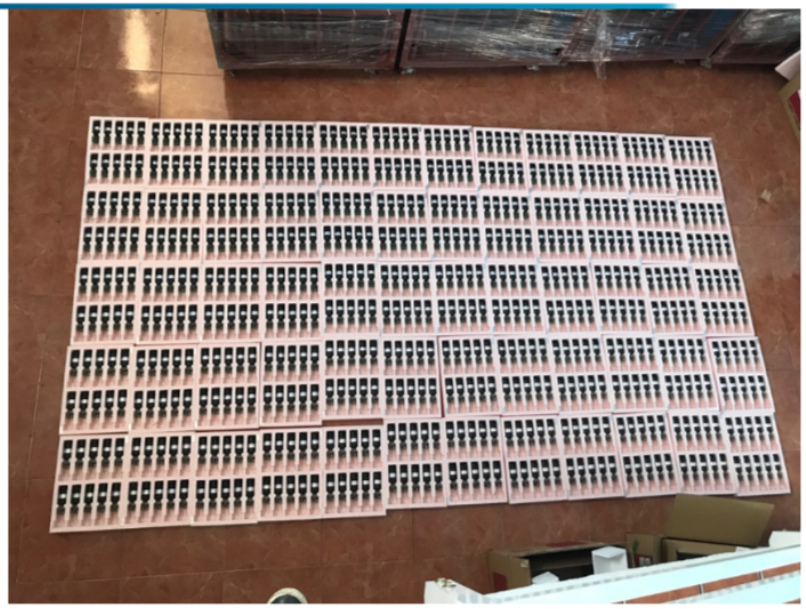
cherenkov telescope array

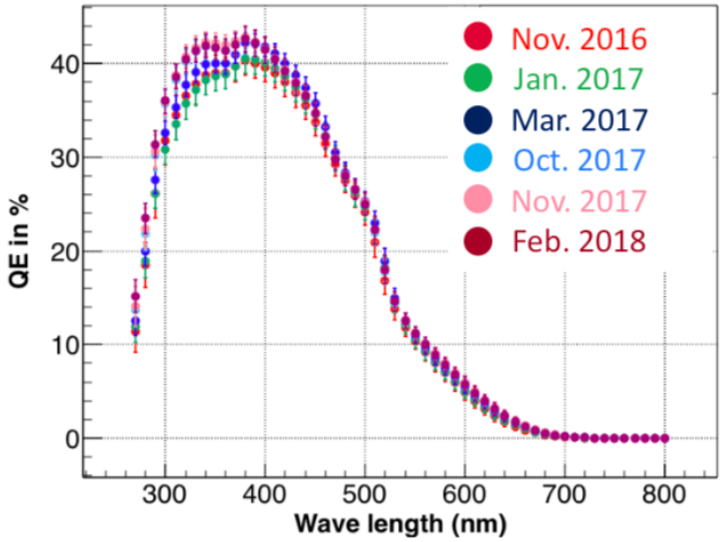
LST1 Status 2018.06.22
Camera Support Structure Arch

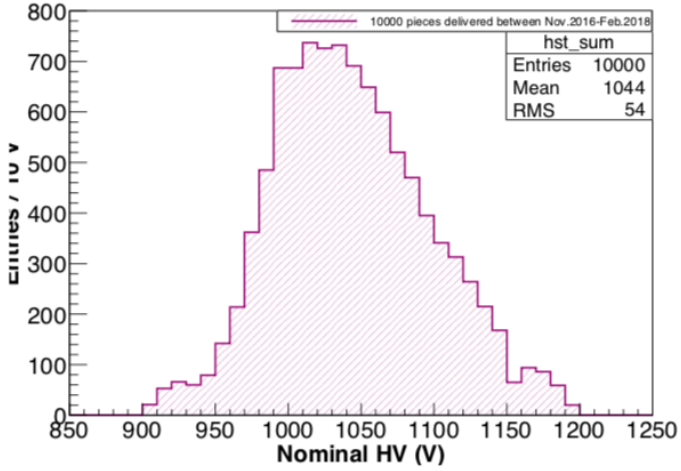


Modules for LST2-4+: PMTs

- 7-dynote 10000 PMTs delivered.
  - LST1 PMTs are with 8 dynodes.
- **QE peaked at 370 nm and >40%**
  - Slightly better than LST1
- HV at Gain 40k ranges 900 – 1200 V.
  - This diversity will be compensated by the attenuation in preamp.

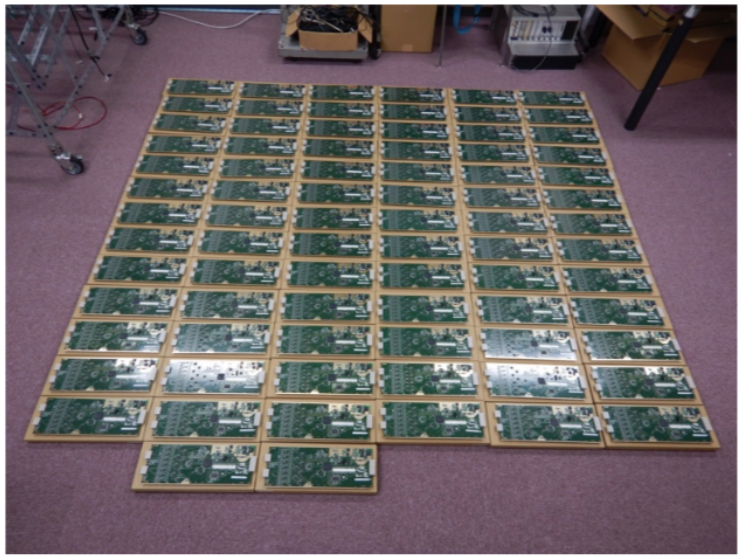


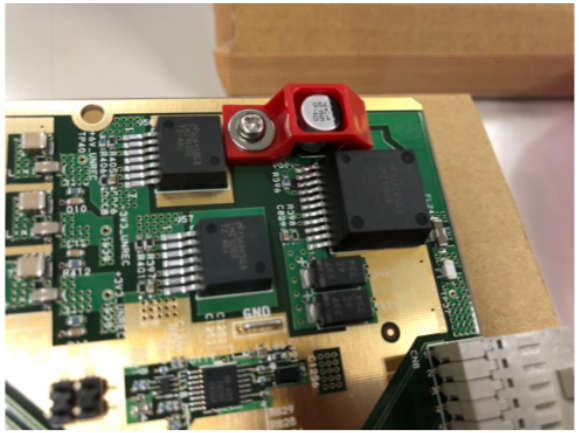




Modules for LST2-4: Dragon boards

- 1100 Dragon boards delivered
- Difference w.r.t. 1st LSTs are
  - Sine wave injection circuit
  - Temperature and Humidity sensor
  - Voltage monitor
  - Other minor things
- 750 boards have a bad regulator. They are being replaced now.
- ~0.1% of DRS4 chips have also problems. They are being replaced.
- Big capacitor will be protected with an additional plastic piece

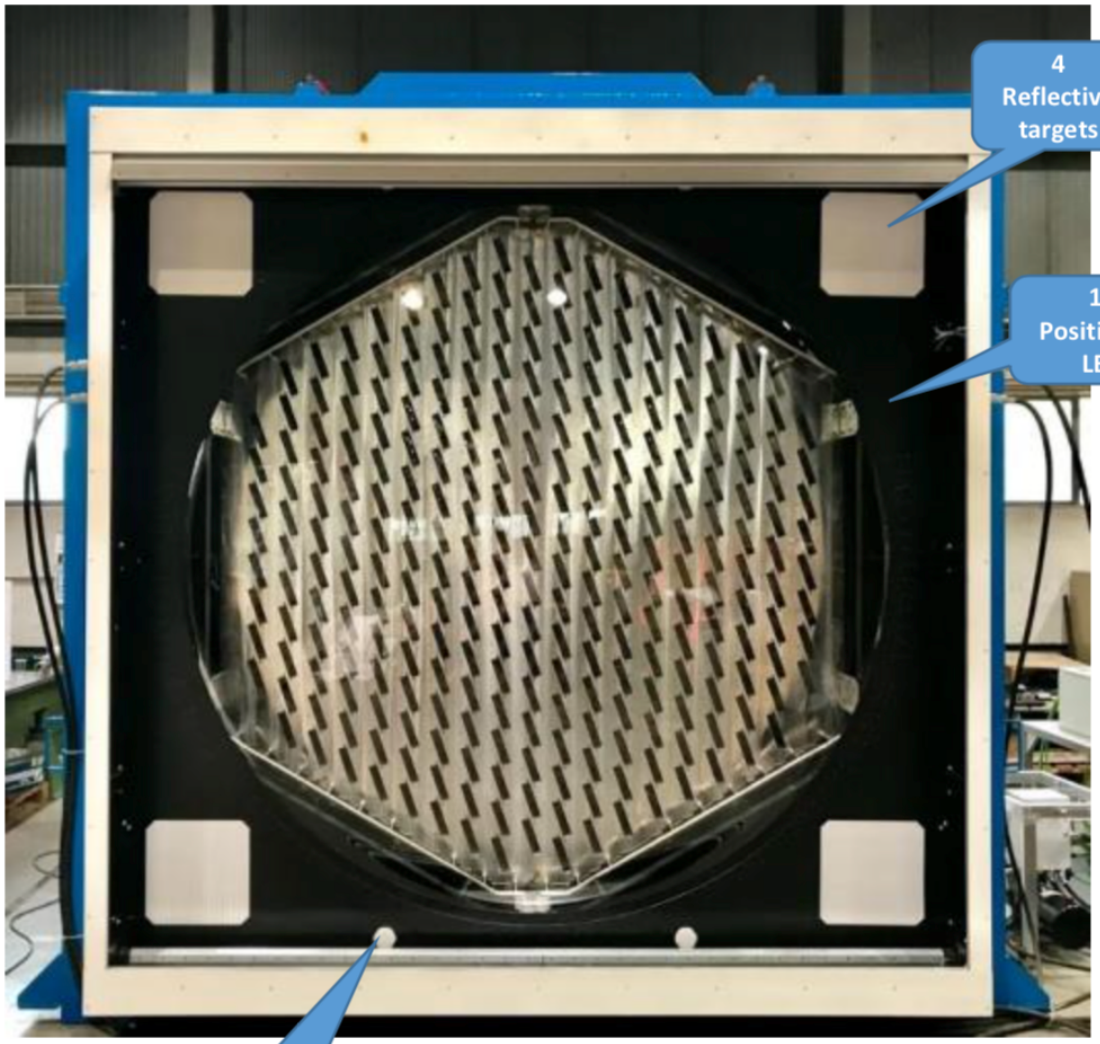




Camera Overview

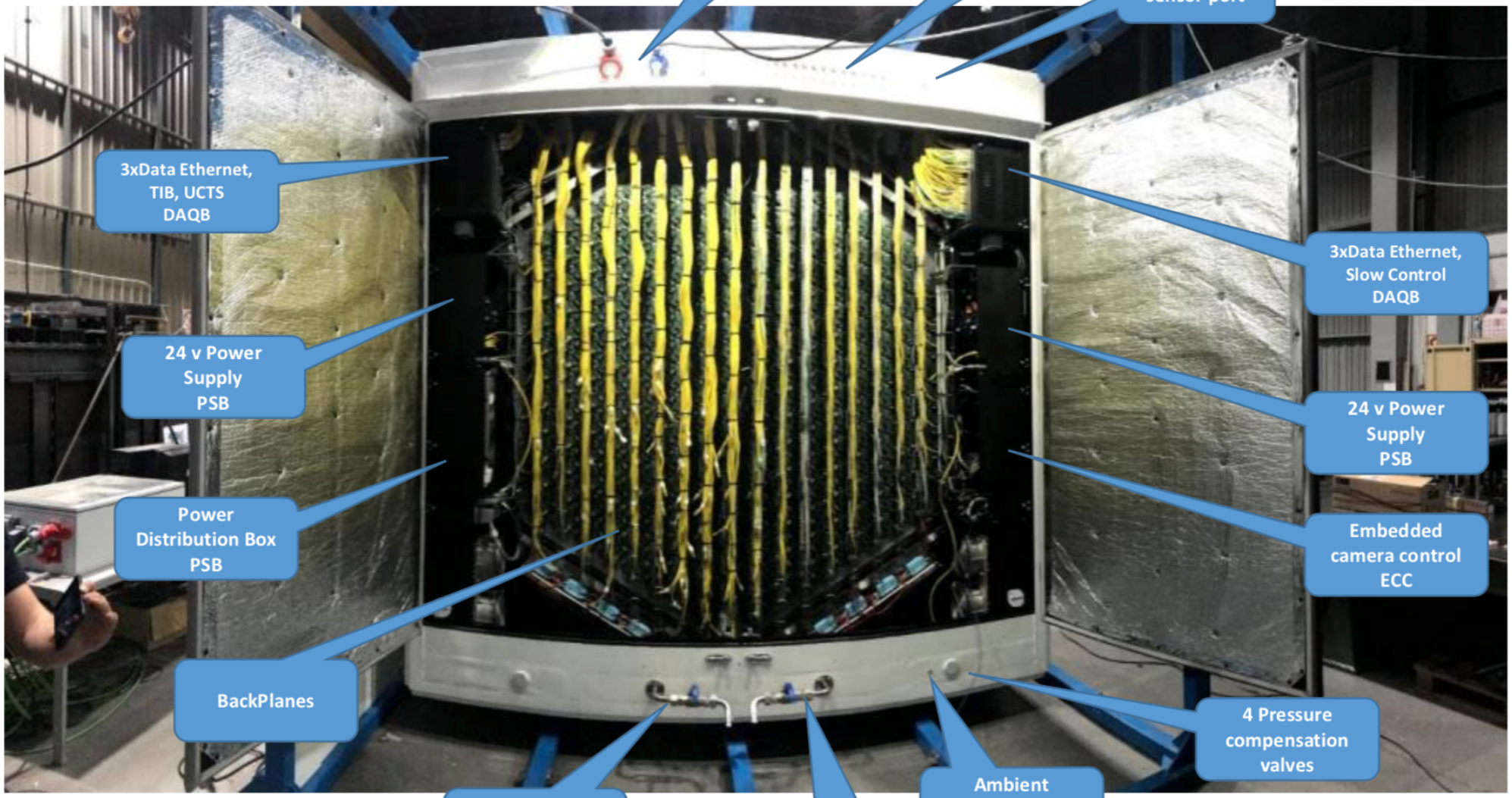
Front Part

Camera dimensions:
2895x2895x1500 mm
Weight:
2077 kg



Camera Overview

Back Part



Camera Transport “CIEMAT”

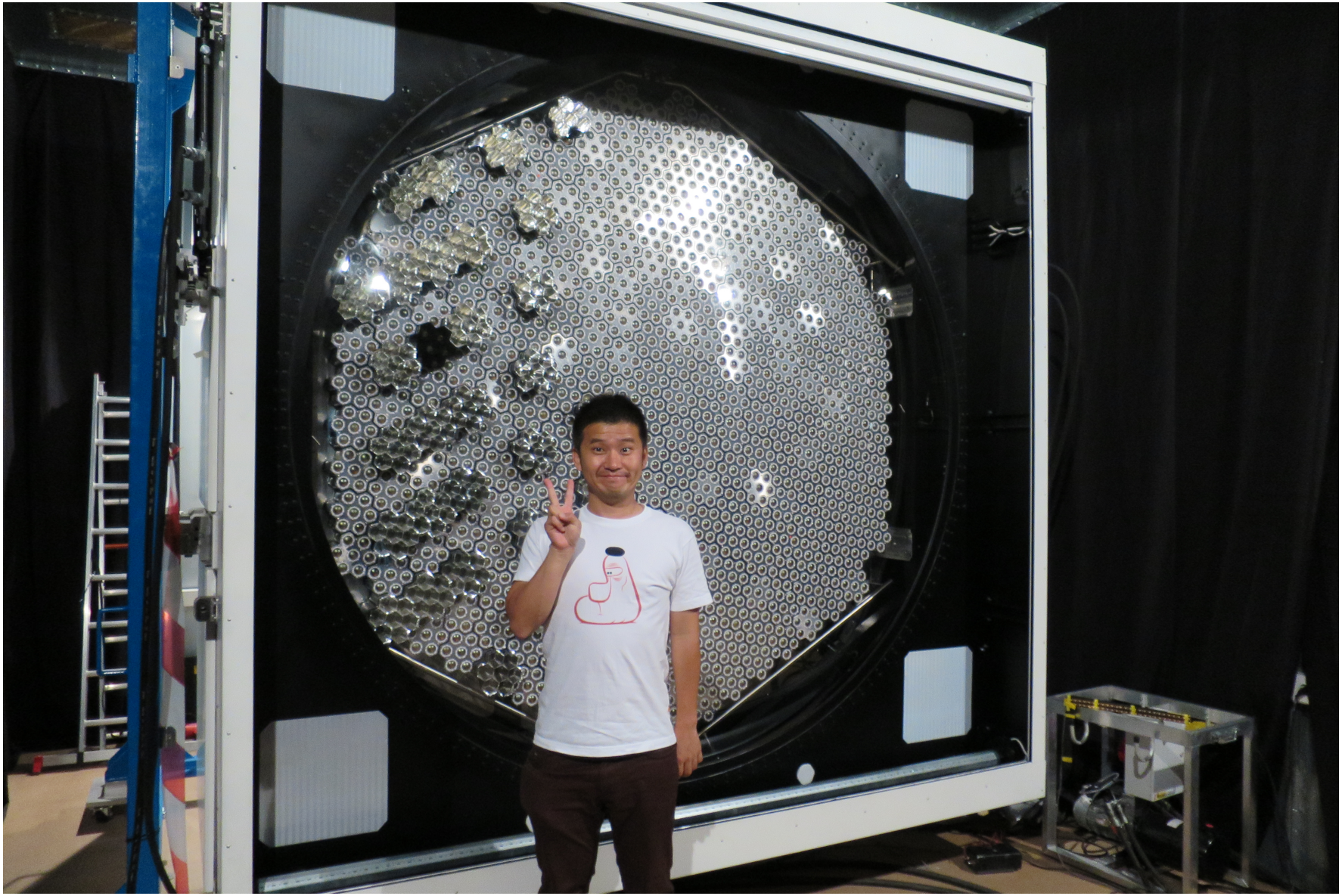
Ciemat
Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas

GOBIERNO DE ESPAÑA
MINISTERIO DE ECONOMÍA, INDUSTRIA Y COMPETITIVIDAD

26th April

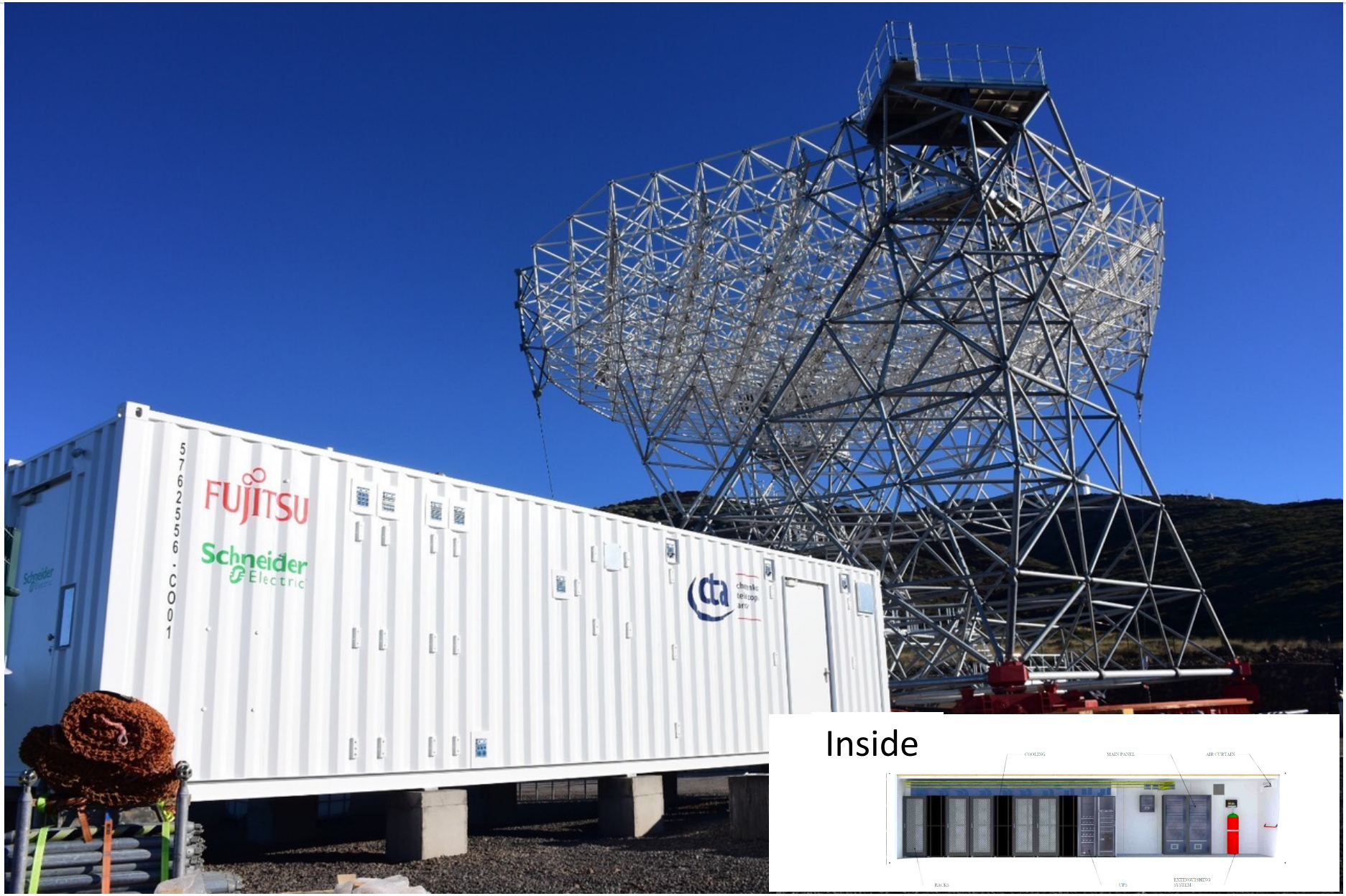
cherenkov telescope array

Integration and final test on-going at IFAE



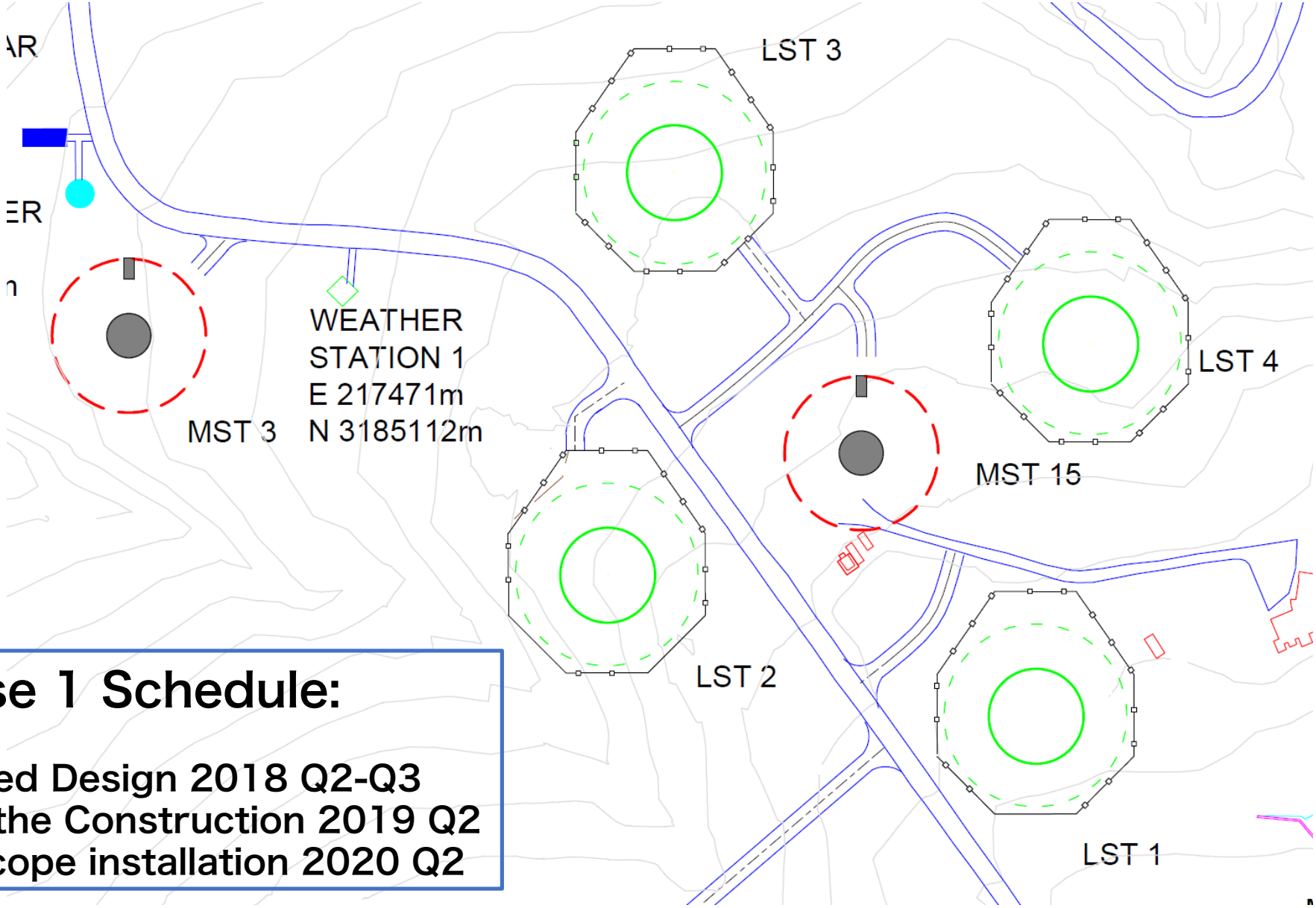
cherenkov telescope array

CTA North IT System 2000 cores, 3PBytes




28 June 2018
Camera Access Tower
IT Container
2000 Core, 3PB

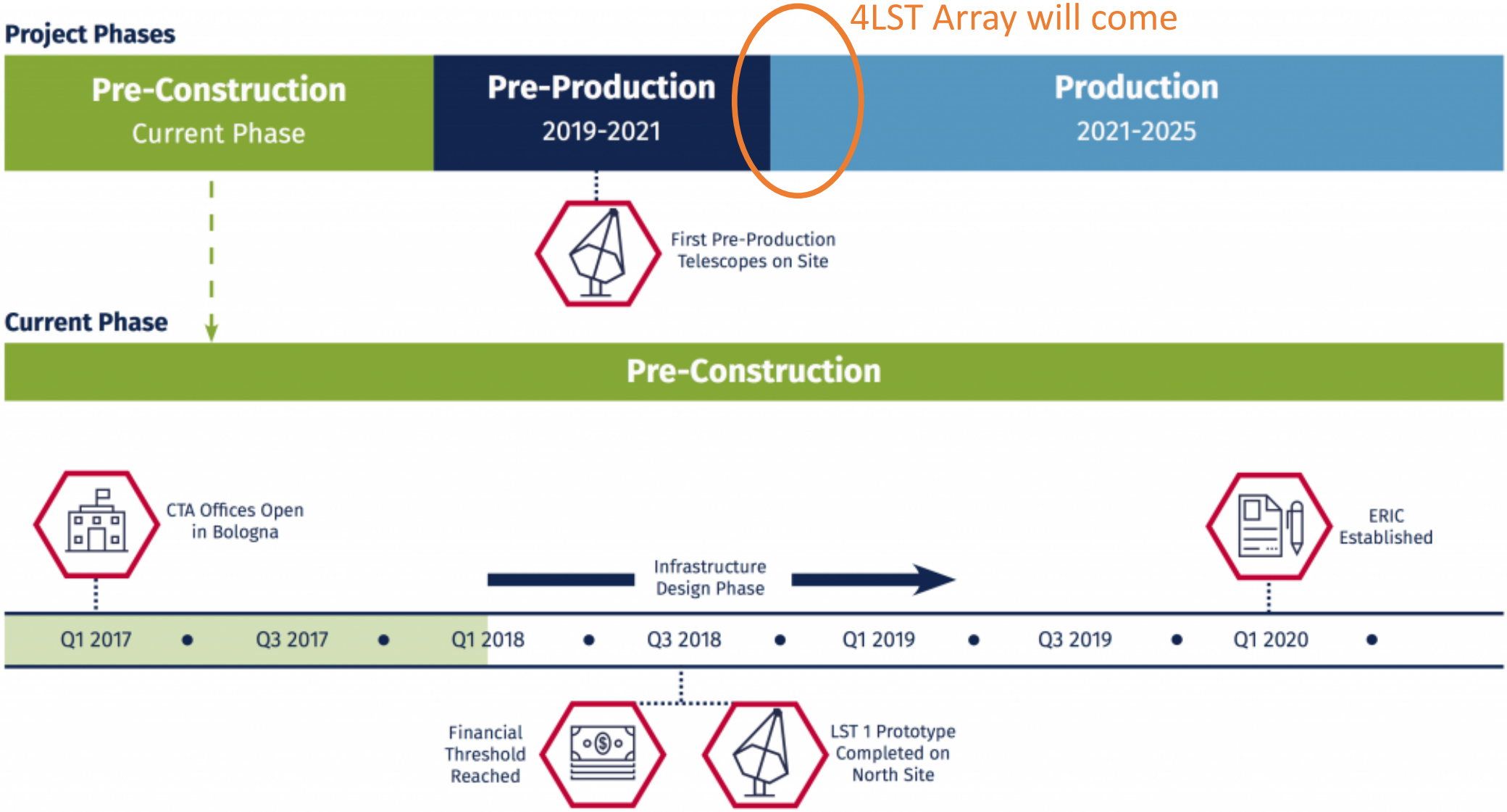
CTA-N INFRA in Phase 1



Phase 1 Schedule:

Detailed Design 2018 Q2-Q3
Start the Construction 2019 Q2
Telescope installation 2020 Q2

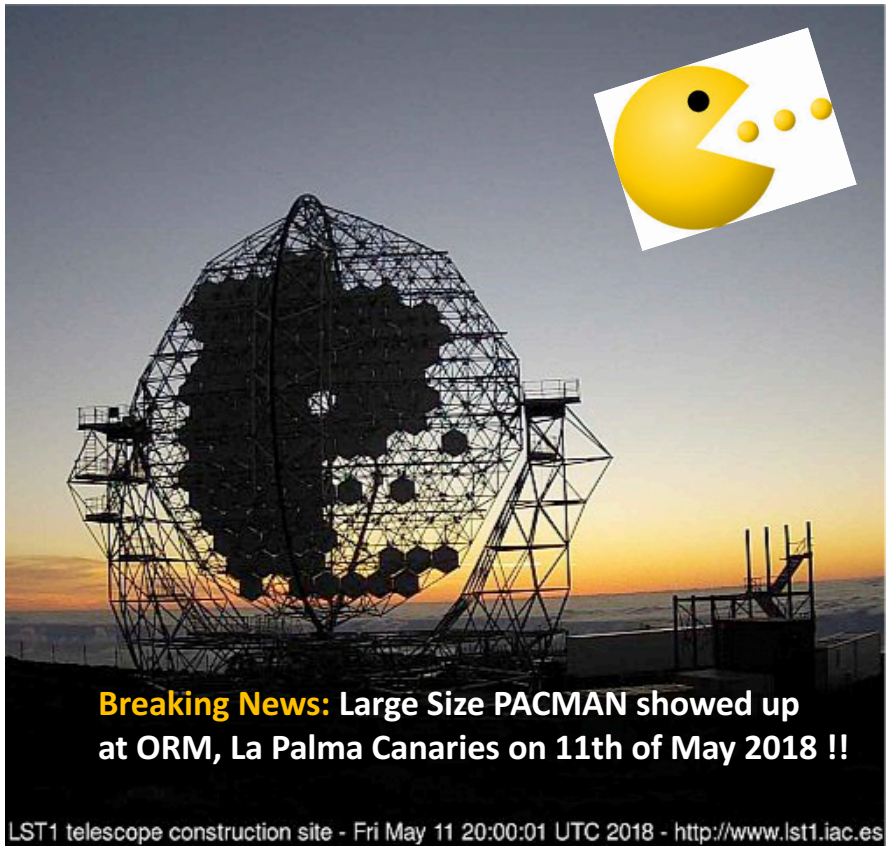
Time Schedule by CTAO



Summary

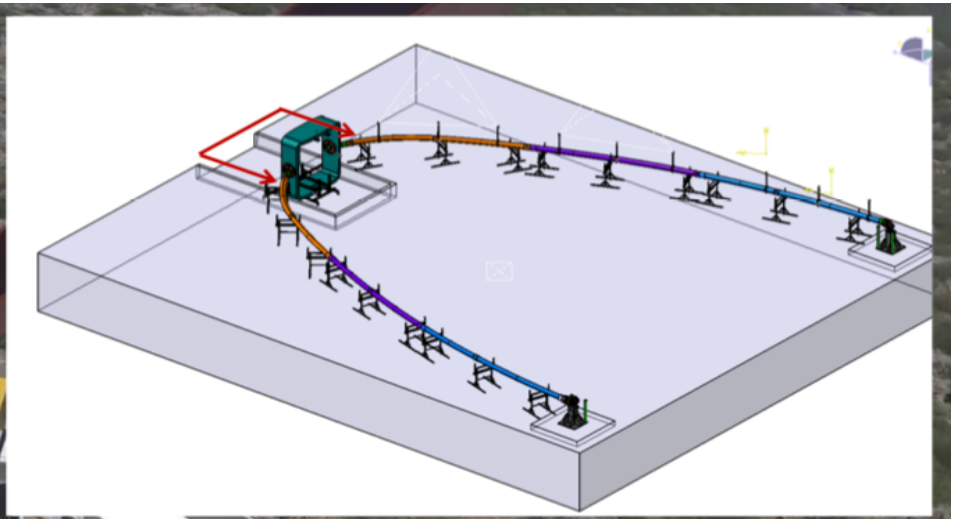
- The construction of LST1 is going very smooth
- So far we did not see any major problem in the LST1 construction and also LST components
- We expect the first light in Sep 2018
- We appreciate the INFRA work for LST2-4 and MST3,15 is ongoing by PO and IAC

- October 10, 2018, Inauguration of LST1 is scheduled




cta
cherenkov
telescope
array

Mounting of Camera support structure (CSS) Mid June 2018



- CSS
- Dummy

- 1) Finishing the accesstower, freeing space
- 2) unmounting of Counter weight
- 3) Installation of CSS