cherenkov telescope array

LST optics : mirror alignment

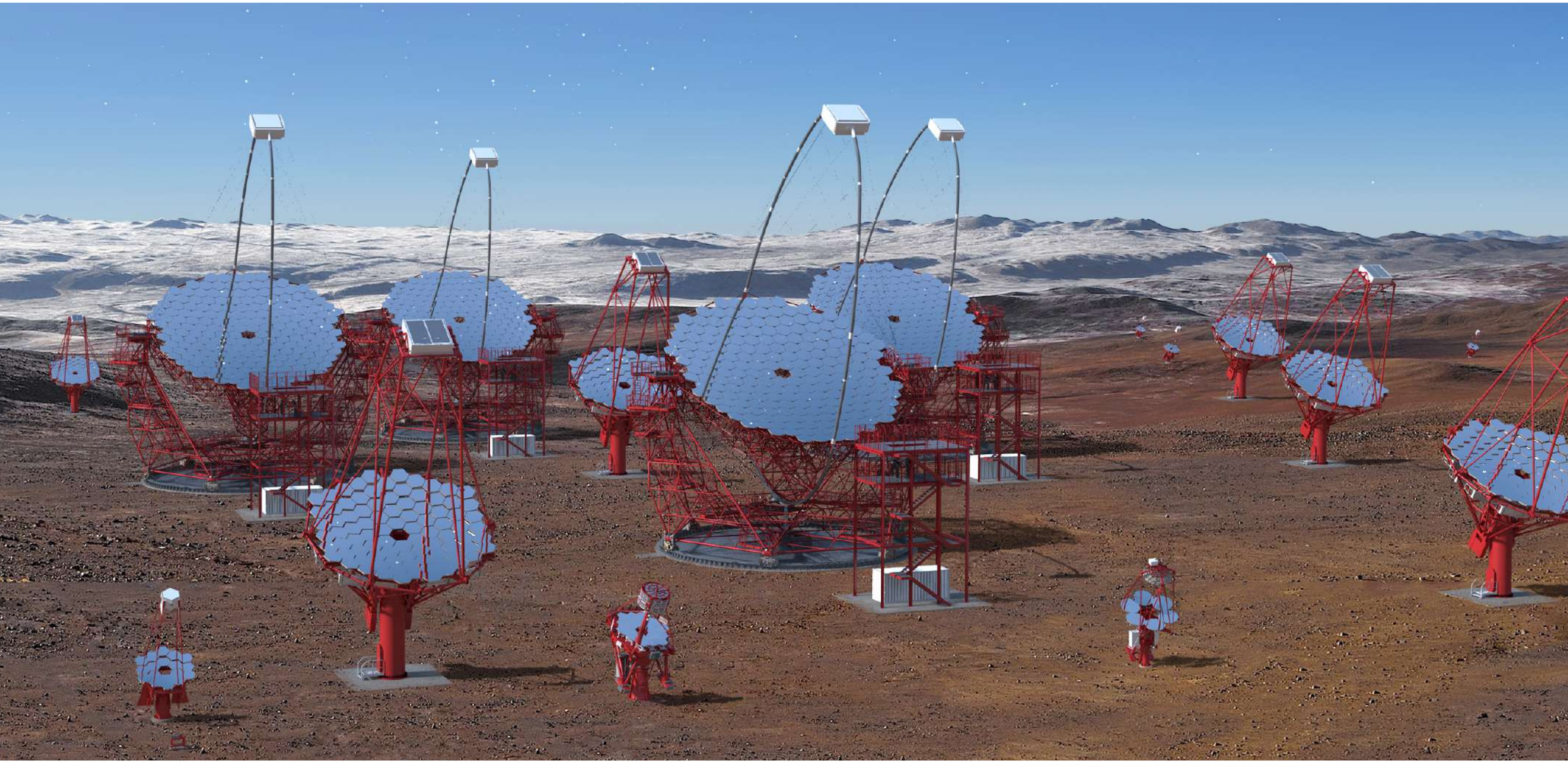
Ulisses Barres - CTA Rio / CBPF

MINISTÉRIO DA CIÊNCIA, TECNOLOGIA, INOVAÇÕES E COMUNICAÇÕES

BRASIL GOVERNO FEDERAL

CBPF Centro Brasileiro de Pesquisas Físicas

FAPERJ Fundação Carlos Chagas Filho de Amparo à Pesquisa do Estado do Rio de Janeiro



Summary

- Introduction
- Infrastructure
- Telescope overview
- Optics
- Interface plate
- LST-1 prototype
- Future steps: full array

The LST team

- A sub-consortium within CTA for the construction of the Large Size Telescopes.

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LST

MST

SST

The LST team

- A sub-consortium within CTA for the construction of the Large Size Telescopes.
- The only with current demands for paying common funds because it is the first installation on site @ La Palma.
- Means for stable contribution need to addressed, about 3 kEUR per year

Steering Committee:

DE: **T. Schweizer**
ES: **M. Martinez (chair)**
FR: **J.-P. Lees**
JP: **H. Kubo**
IT: **N. Giglietto**

Ex Officio: **M. Teshima**
Ex Officio: **J. Cortina**
Ex Officio: **D. Mazin**
IAC: **M. Vazquez Acosta**

Version 6.94

LST EXECUTIVE BOARD

LST Project Office

QA/RAMS: **J. M. Miranda**

Systems Engineer: **O. Ballester**

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**
  - *Geological survey*
  - *Concrete foundation*
  - *Power / Network*
- *Data Analysis Software* — *Crd.:* **A. Moralejo**
  - *MonteCarlo*
  - *Data manage-ment*
  - *Data analysis*
- *Mechanical System* — *Crd:* **T. Schweizer**; *Dep.* **H. Wetteskind**
  - *Dish&Lower Structure* — **H. Wetteskind**
  - *Camera Support Structure* — **G. Deleglise**
  - *Foundation, Rails & Bogies* — **J. Mundet**
- *Optical System* — *Crd.* **NN**; *Deputy:* **K. Noda**; *Prod.:* **M. Teshima**
  - *Primary Mirror* — **M. Hayashida**
  - *AMC* — **M. Chikawa**
    - Mirror Interface plates
- *Camera Integration* — *Crd.:* **O. Blanch**; *Deputy:* **C. Delgado**; *Prod.:* **C. Diaz**
  - Mechanics & Cooling — **C. Diaz**
  - Slow Control — **J. Prast**
  - DAQ — **D. Nakajima**
- *FPI / Electronics* — *Crd.:* **H. Kubo**; *Dep.:* **R. Paoletti**
  - *Photo-detectors* — **T. Yamamoto**
  - *Readout* — **H. Kubo**
  - *Trigger* — **G. Martínez**
  - *Light Guide* — **A. Okumura**
- *Auxiliary systems* — *Crd.:* **A. Fiasson**; *Prod.:* **E. Chabanne**
  - *Drive Control System* — **I. Monteiro**
  - *Global monitoring* — **T. Le FLour**
  - *Pointing Calibration* — **K. Noda**
  - *Camera Calibration* — **P. Majumdar**
  - *Power Distribution* — **M. Teshima**
- *R&D – Cam. SiPM* — *Crd.:* **R. Rando**; *Prod:* **S.Rosier-Lees**
  - *Photo-detectors* — **G. Ambrosi**
  - *Readout* — **R. Hermel**
  - *Integration with PMT Camera* — **D. Mazin**

- *ACTL* — **T. Le Flour**, **K. Noda**
- *Data* — **P. Colin**
- *Site / INFRA* — **J. Cortina**
- *Common Test Facilities* — **M. Doro**
- *MAGIC* — **O. Blanch**

Mirror Interface plates

A contribution “the size of our shoes”

Elemar
Metal-mecânica e Soluções

- Design and construction of 200 IF plates for the LST-1 mirrors.
- Design was done at CBPF Mechanics Workshop (leader Rodrigo Félix).
- Production by ELEMAR, company in Campinas.
- Total price tag ~ 600 kBRL (funded by FAPERJ via Temáticos 2013 and 2015).

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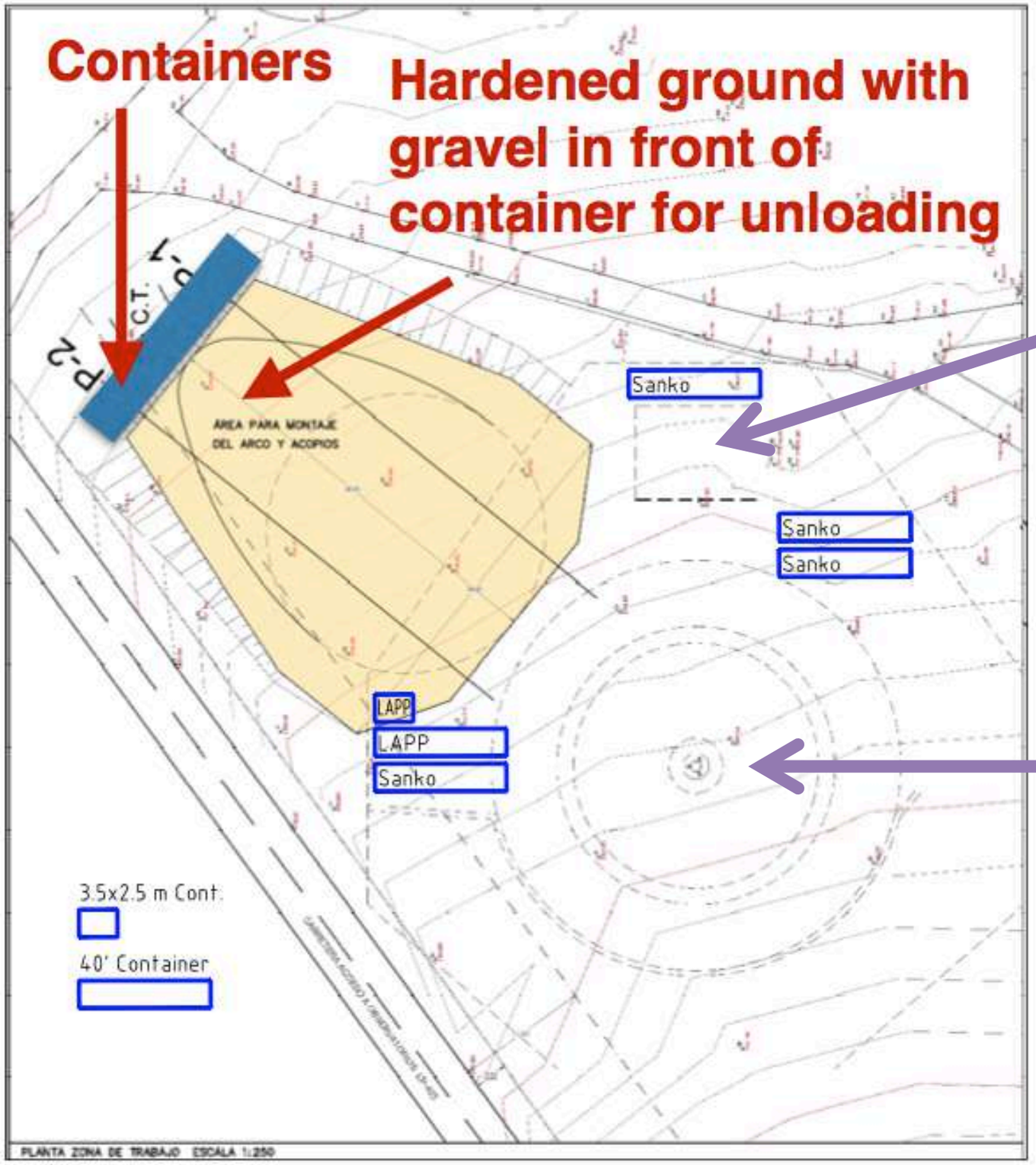
Status of Rio/CBPF in the CTA Collaboration

- Member of Consortium Board (U. Barres)
- Team responsible of LST in Brazil
- CBPF/Rio hosted the General CTA Meeting this May (first CTA meeting outside the EU-US-JAPAN axis)

Preparation of the area

IFAE, IAC



Camera access tower foundation

Telescope foundation

LST1 foundation: The area in July 2016

October 2016: ¼ iron reinforcement

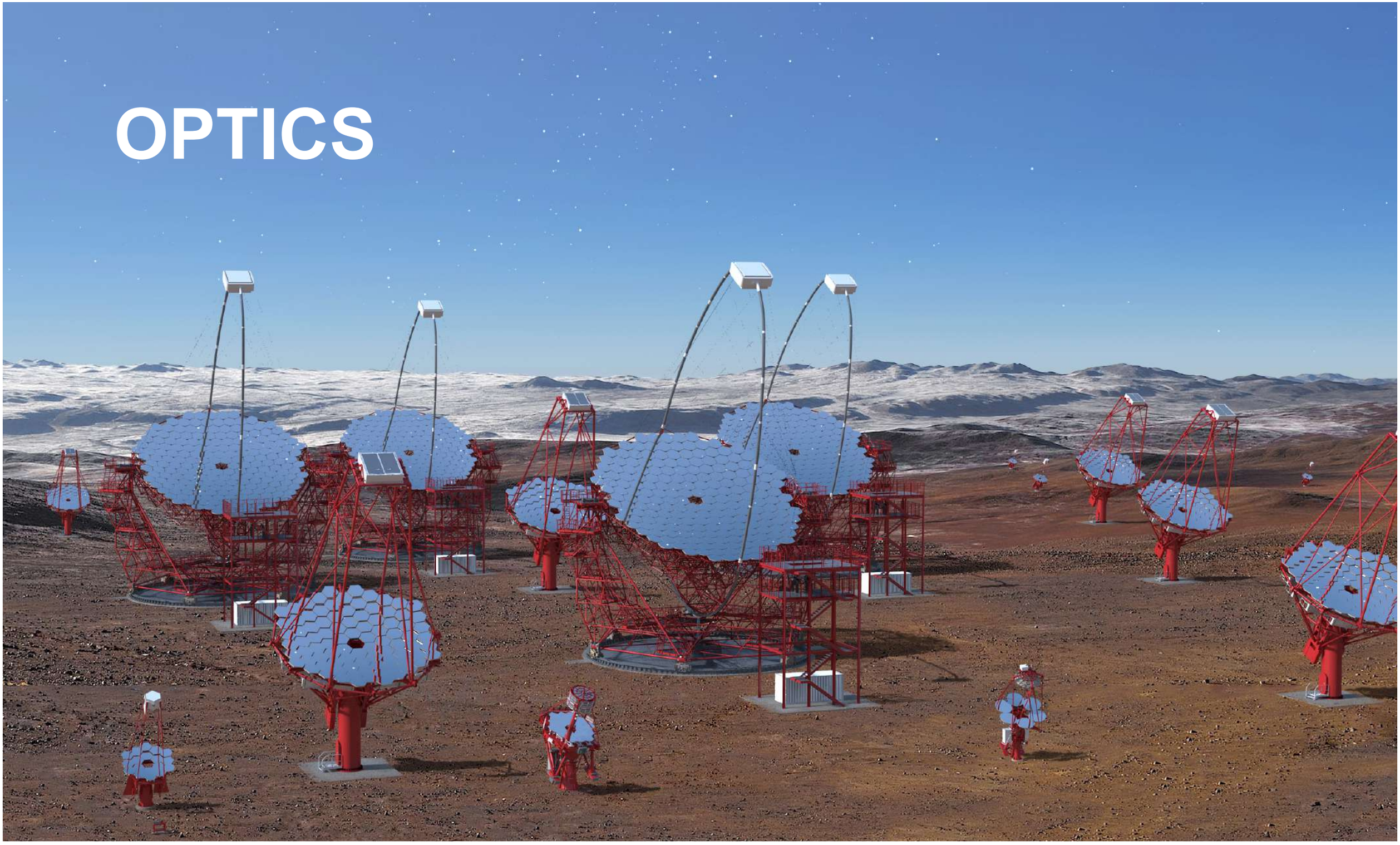
End Nov 2016: wheel almost finished

Mid Dec 2016: concreting finished

APPROVAL FOR BEGINNING OF CONSTRUCTION GIVEN IN EARLY JULY

cherenkov
telescope
array

OPTICS



Mirror production

Japan

ICRR

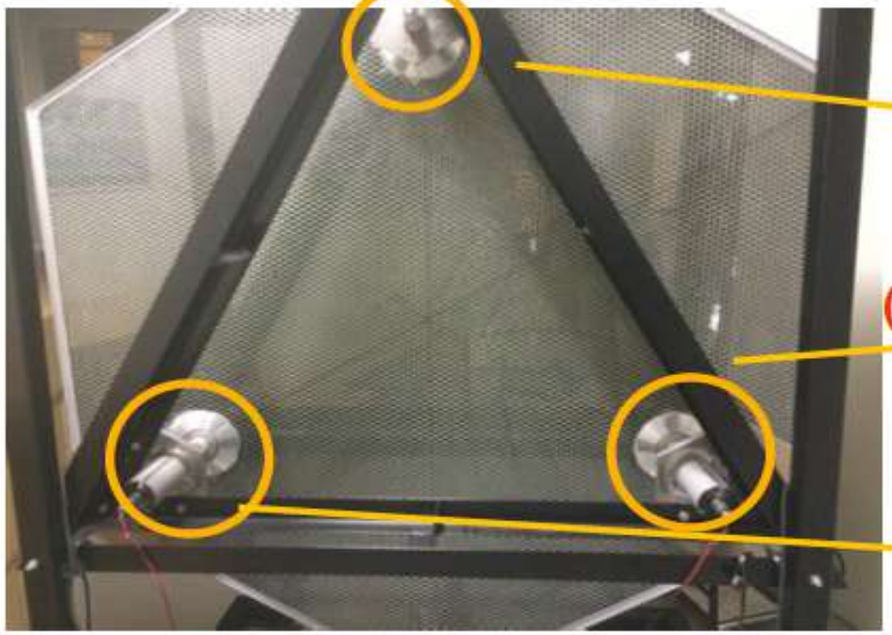
- We need 200 mirrors for LST1.
  - 200 are already in La Palma.
  - 200 more are on their way from Japan.

- All in all, we have enough mirrors for LST1.

Active Mirror Control (AMC)

ICRR, U ZURICH HAMBURG

Introduction : Devices of AMC system



Zurich Actuators

others :

- PC (PCM3363 -> NUC5PPYH)
- network switch
- thermometer etc...

Interface plate : status

CBPF

- Enough project money for the first LST-1 telescope approved
- Circa 220 plates (incl. spares) are required for LST1
  - Project concluded @ CBPF in OCT 2016
  - Prototype built and sent to Munich for tests in DEC 2016
  - OK for production in May 2017
    - First 1/2 produced by ELEMAR by July 2017 - under delivery.
    - Due date for full batch @ La Palma by Boreal Winter 2017/18
    - Currently lacking circa 300 kBRL (1/3) to complete full production
- Money was approved at FAPERJ thematic project in 2015, but money never credited.

Interface plate : status

CBPF

- Relation to industry in instrumentation projects is important
- But projects can be made more cost effective using the workshop infrastructures at institutes
  - CBPF could not mass-produce entire plates alone
  - But inter-institutional collaboration could make it possible
    - at reduced project cost
    - justifying the infrastructure acquired
    - developing and improving know-how in-house
- It is necessary to coordinate the institutes infrastructures in a centralised way, managing inter-institutional collaboration

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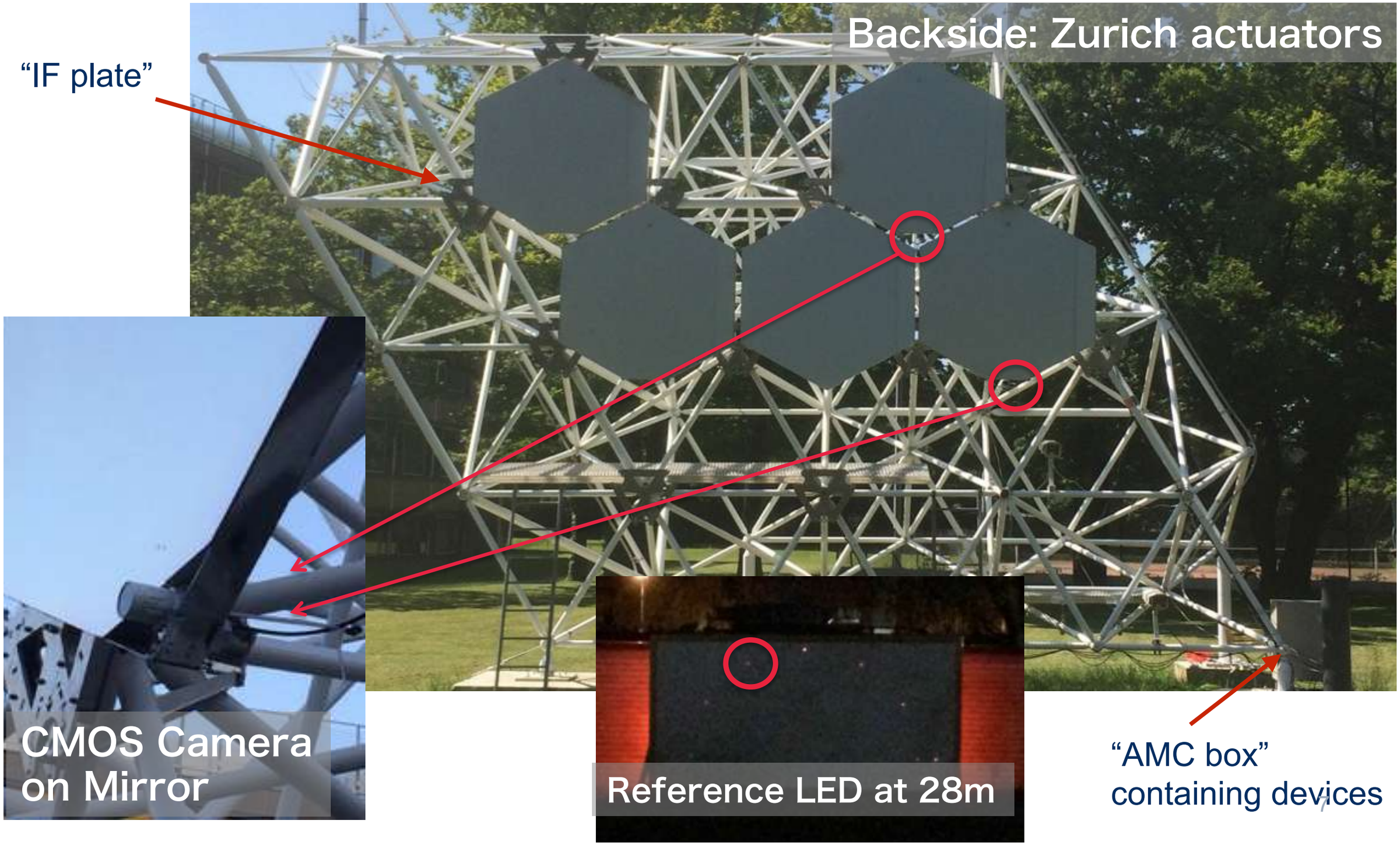
RENAFAE could be the the central to managing this x-institutional instrumentation infrastructure

Mirror alignment (AMC) tested at the test structure at MPI Munich



Interface plates developed at CBPF

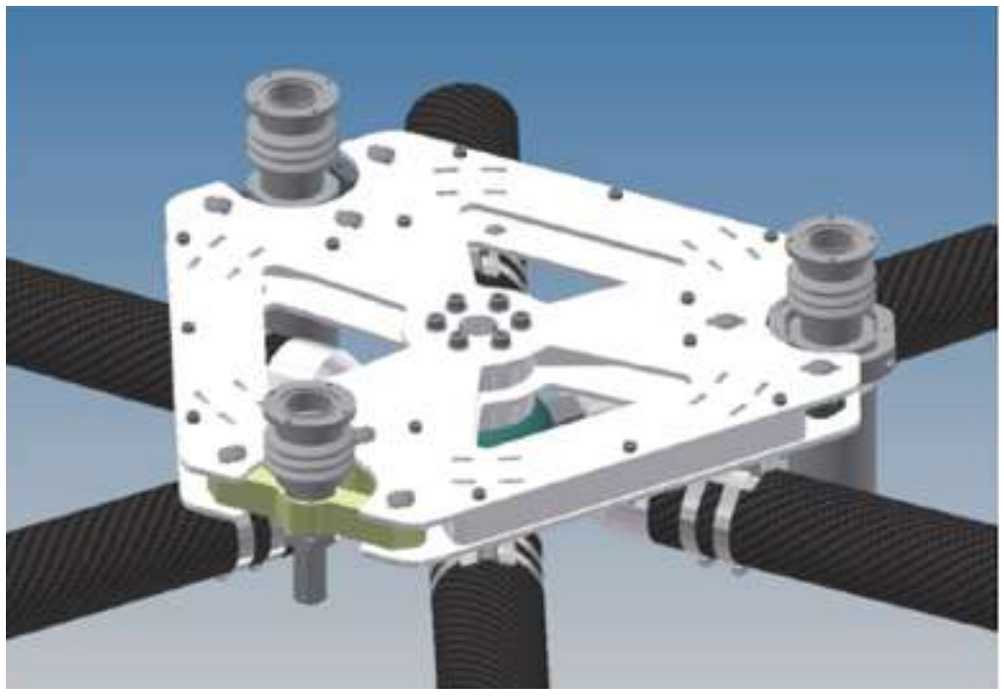
CBPF, MPI, ICRR

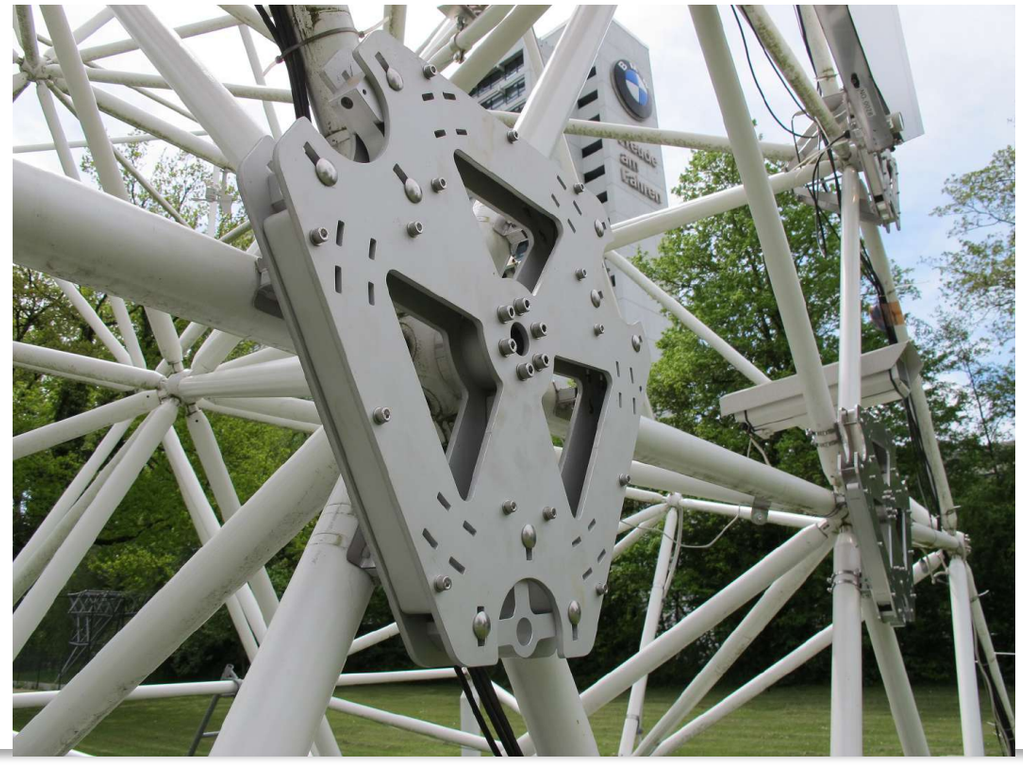
- Mirrors are supported by 3 triangle parts called “interface plate”.

  Concept started in Japan, but taken over at CBPF

  Project concluded in collaboration with MPI Munich

  Prototype and mass-production by CBPF / ELEMAR





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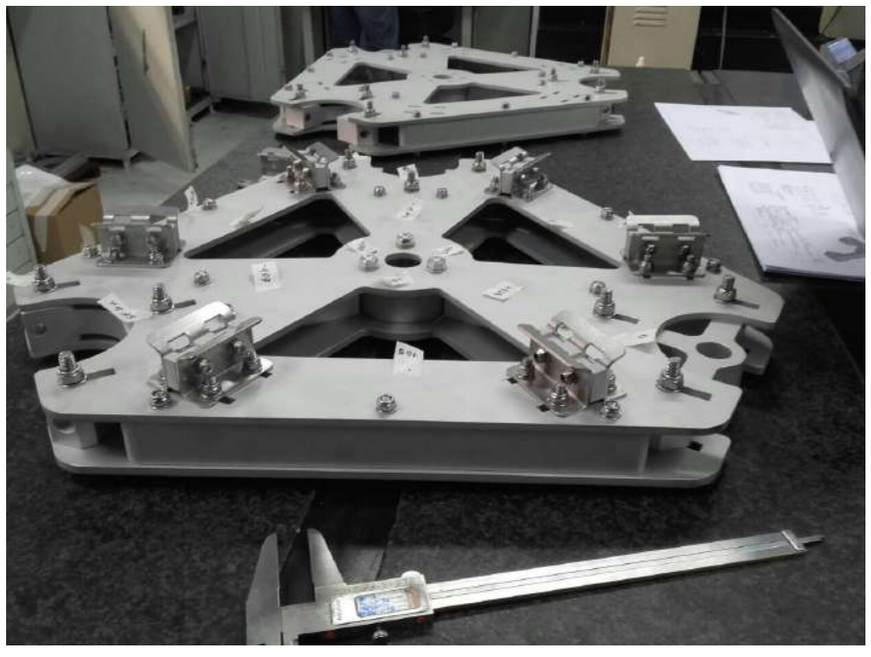
First batch at Elemar Metal-mecânica e Soluções a month ago.



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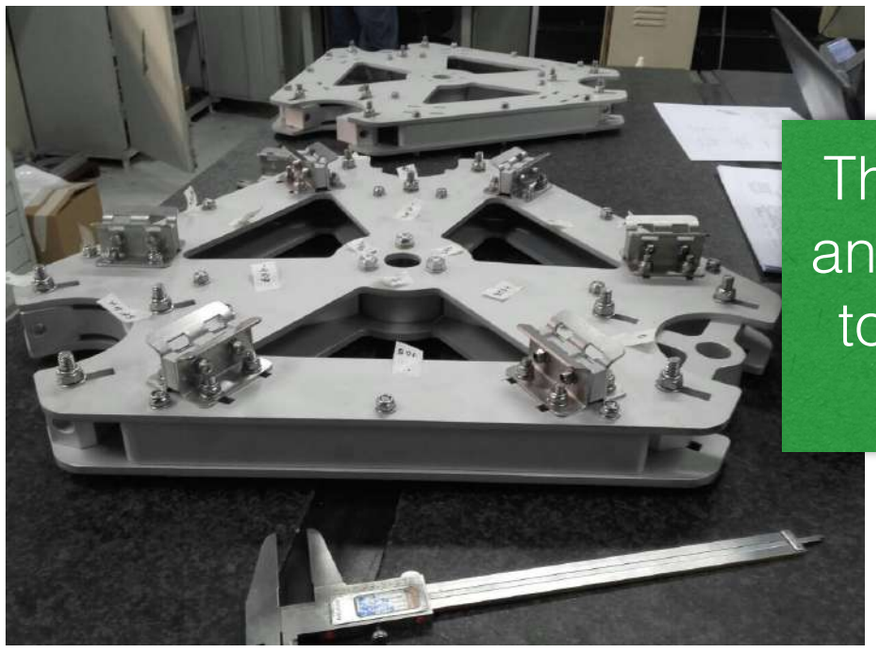
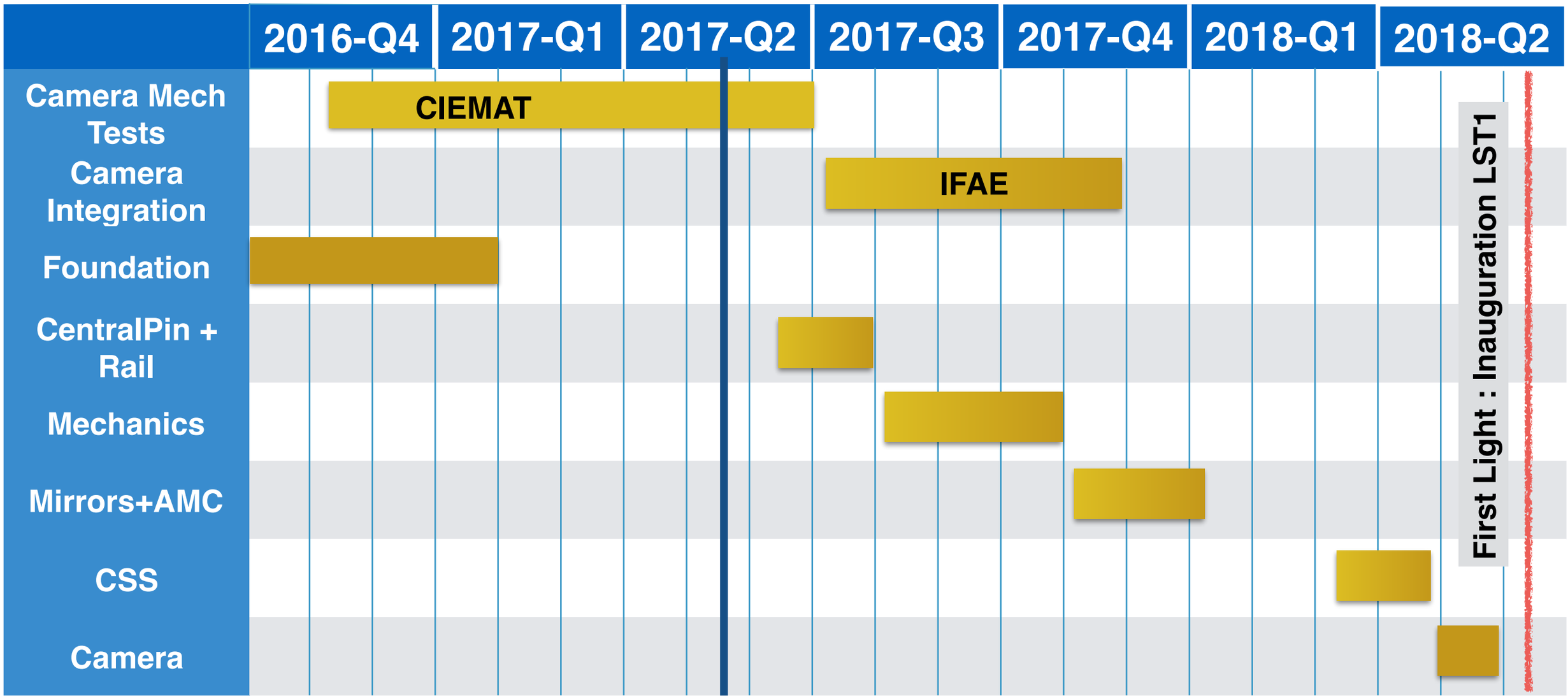


The full piece, which is Al-alloy and steel, and circa 0.5 m side-to-side, deforms under 30 μm under 500 N force.

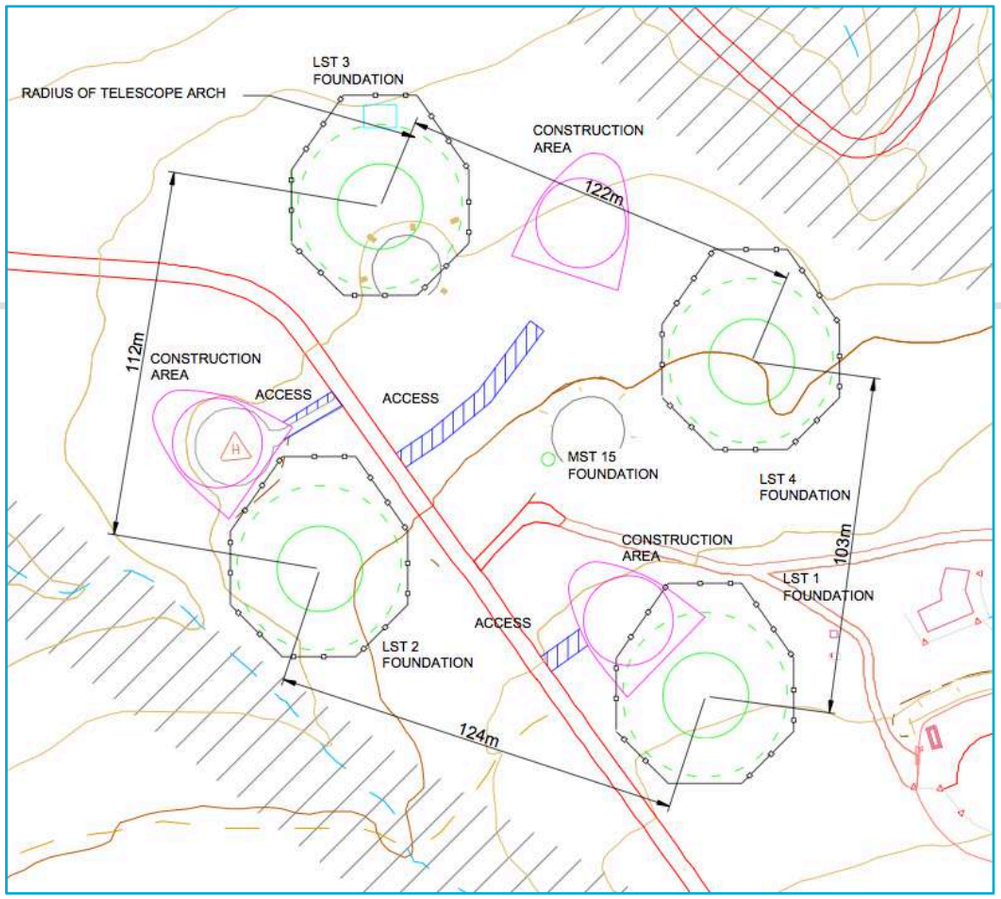
Schedule



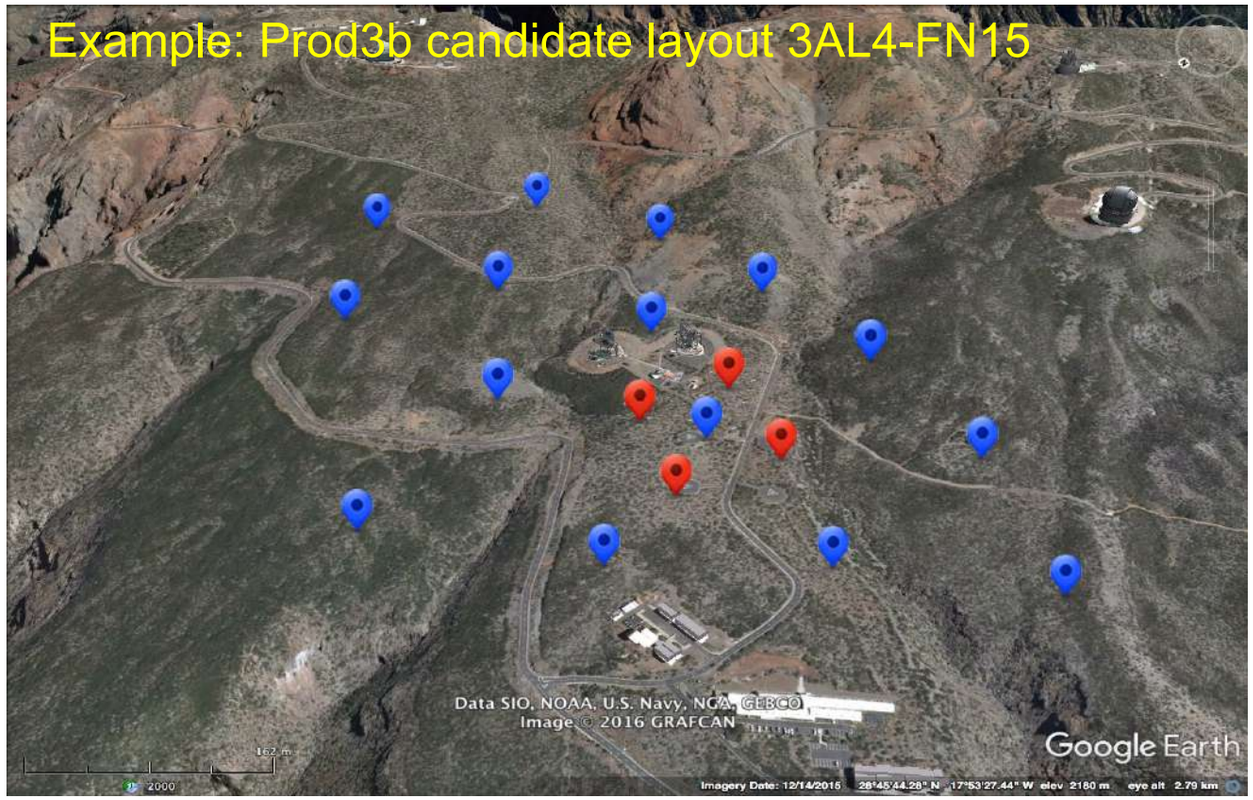
we are here

LST 2-4 in La Palma

- We know that it can take ~2 years to get foundation built. It's important to start the administrative process for LST 2-4: CTAO is hiring company to draft a construction project.



- Essential for that project: define telescope locations. Ongoing. Similar to the Paranal case, a Prod-3b MC production was needed after the 2016 recommendations on baseline layouts were issued:
  - Avoid LST-2 conflict with restricted area: LST square $\Longrightarrow$ diamond



The End