



# GCT project: structure and mirrors

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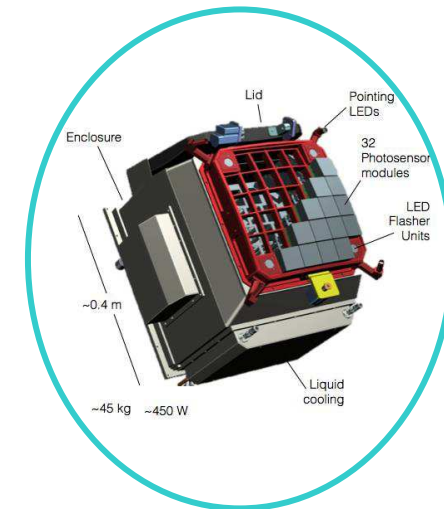
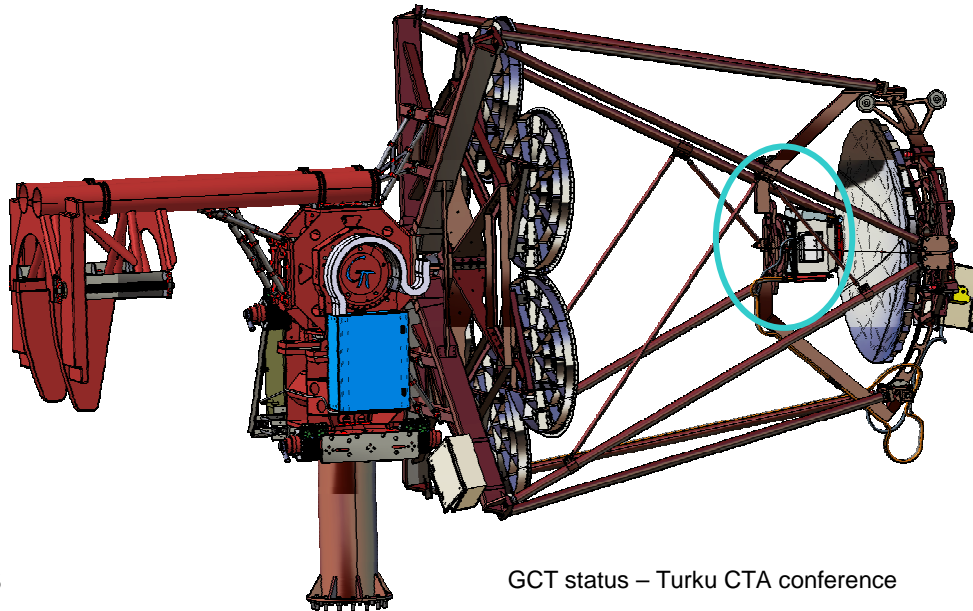
May 5<sup>th</sup>, 2015. Turku

# GCT project, status and perspectives

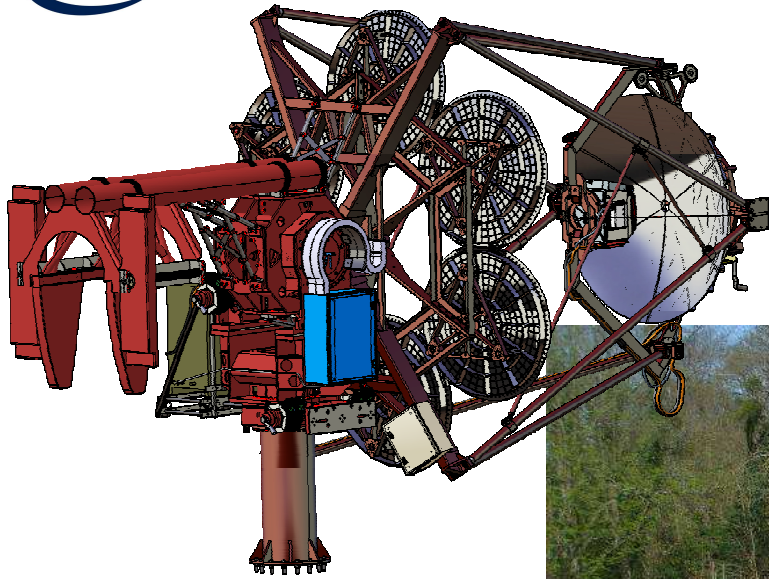
- GCT collaboration
- Integration of GCT structure
- Progress on mirror manufacturing
- Progress on control command
- Next steps

# GCT collaboration

- GCT structure is built at the Observatoire de Paris → details in this talk
  - Mirrors and control command systems are in progress and soon on site.
- GCT structure analyzed by J. Eder and structure is validated for both Southern sites.
- Camera – CHEC M is currently commissioning
- MC Simulation – group is organized and simulations will start between SST
  - Install a SQM at Meudon



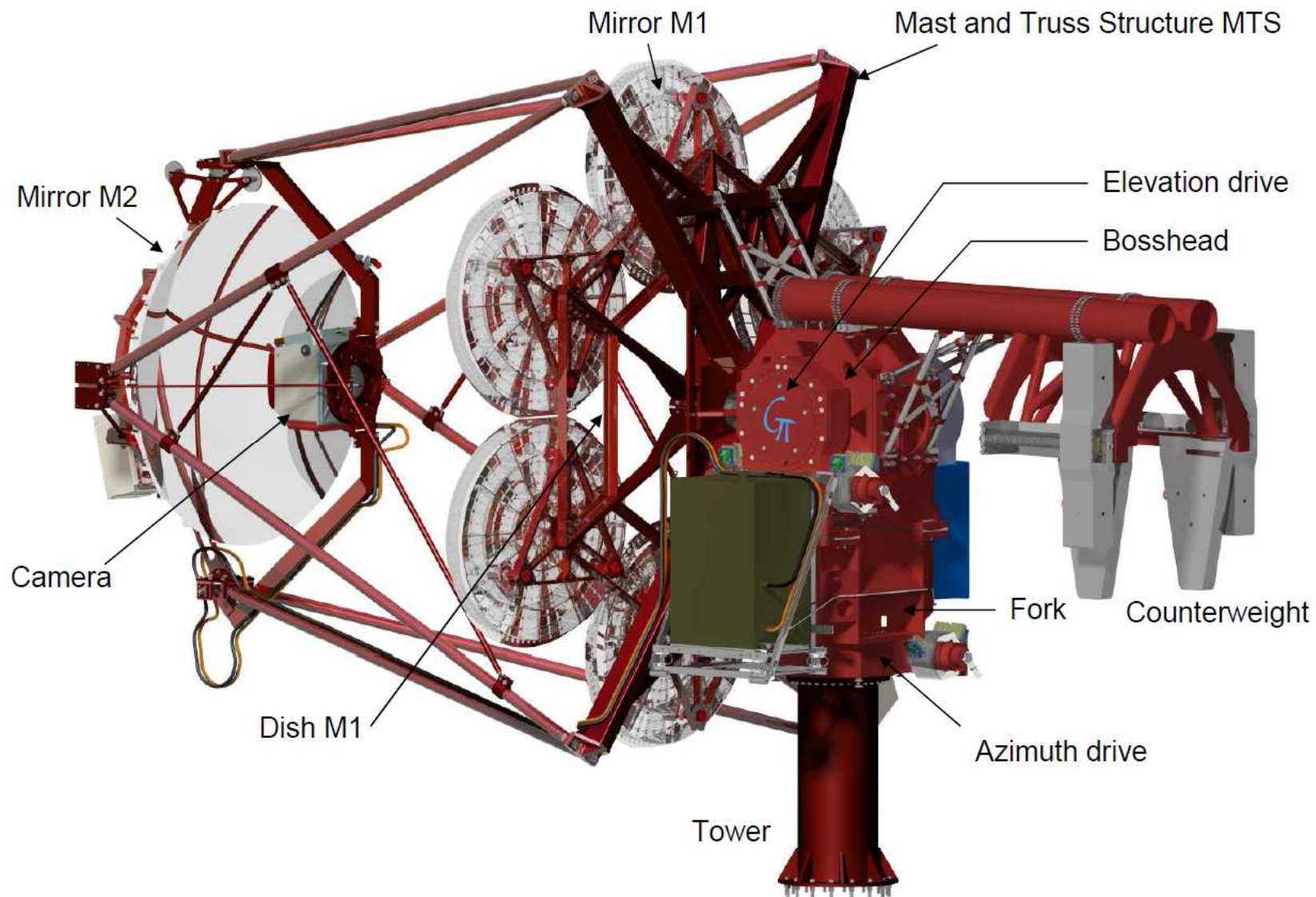
The GCT structure on site in Meudon.



May 5<sup>th</sup>, 2015

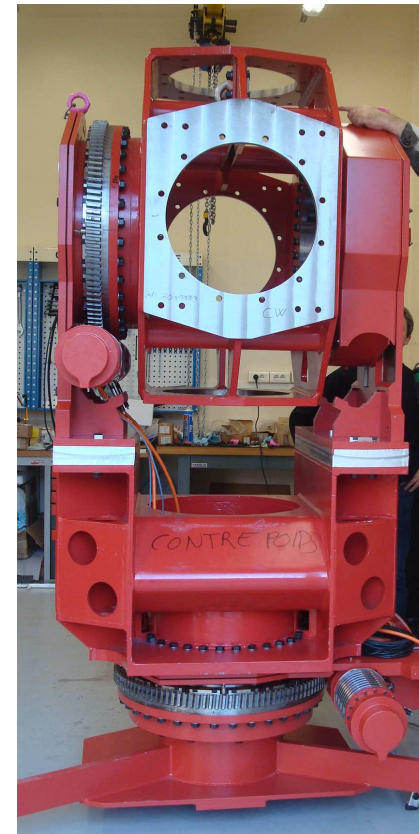
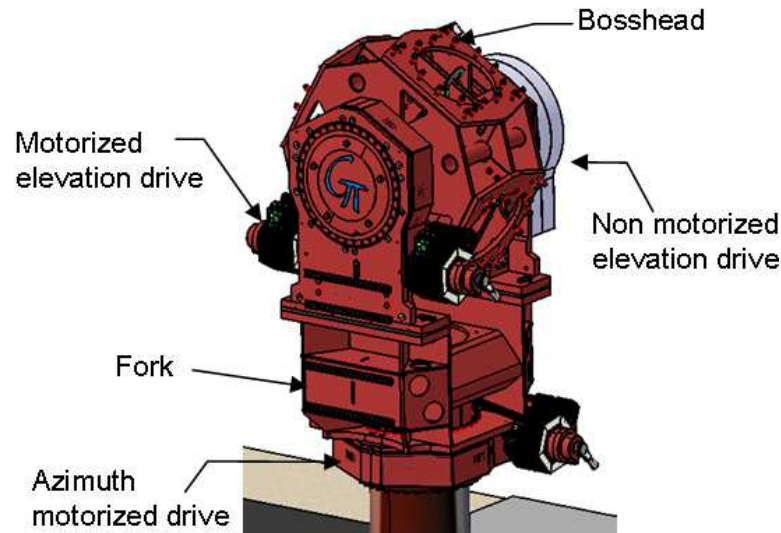
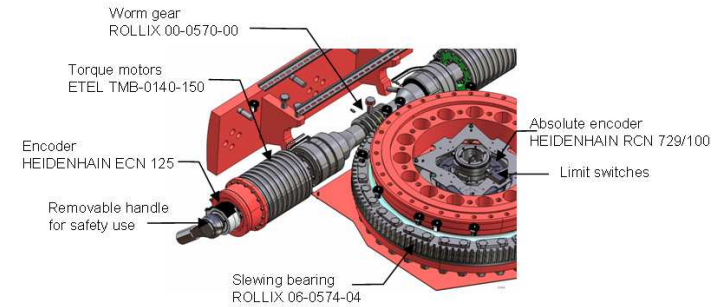


# GCT overview



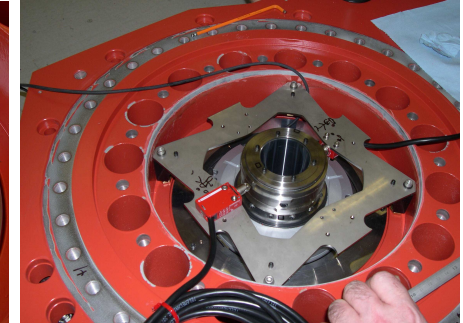
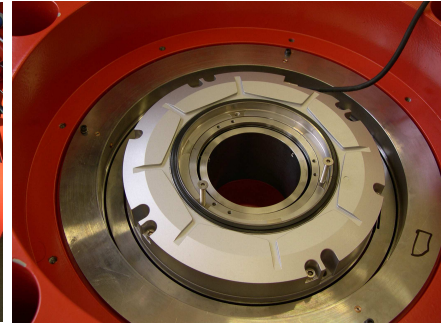
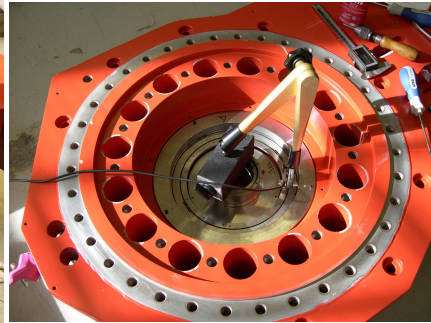
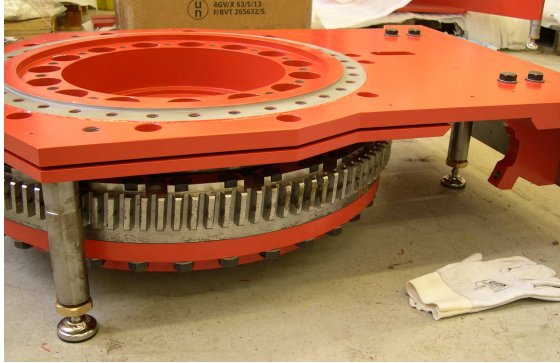
# Alt-Azimuthal System

- Azimuth and elevation drives:
  - 2 motor shaft to mount
    - Worm gear / Motors / Encoders
  - 3 bearings systems
    - Slewing bearing / Encoders / Limit switches
    - Centering and
- Assembly of the 5 main parts of AAS made at OP by the team.





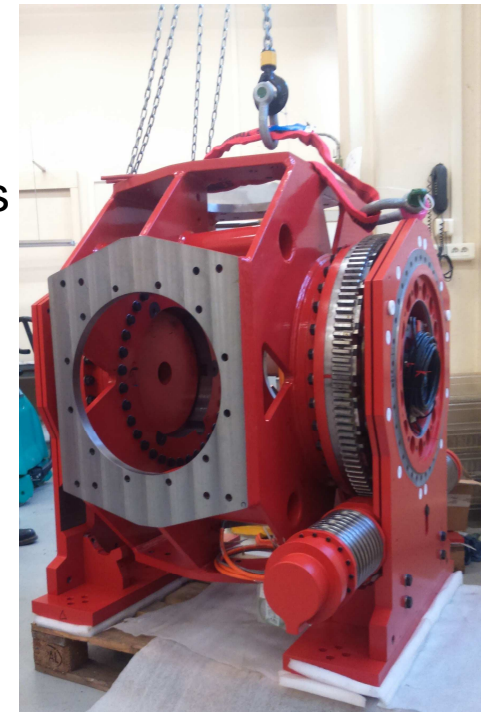
# Assembly of AAS



Encoder and limit switches



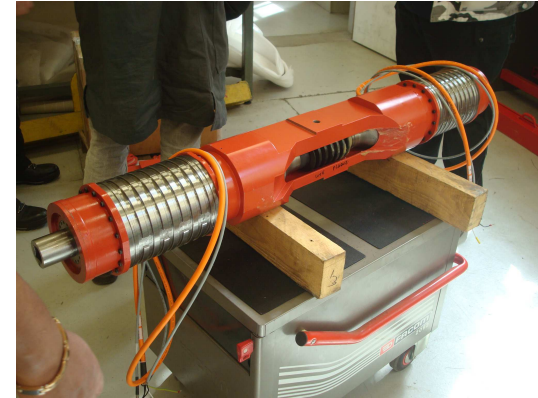
Assembly of drives on mechanics



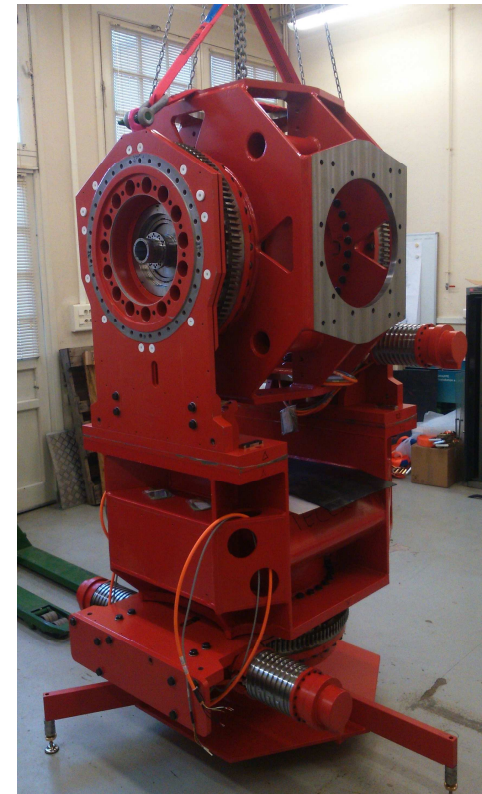


# Assembly of AAS

Assembly of motor shaft



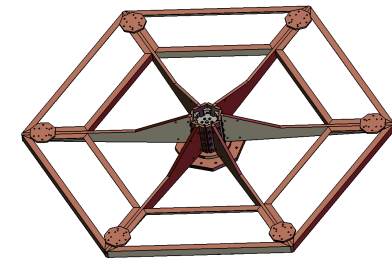
Assembly of AAS



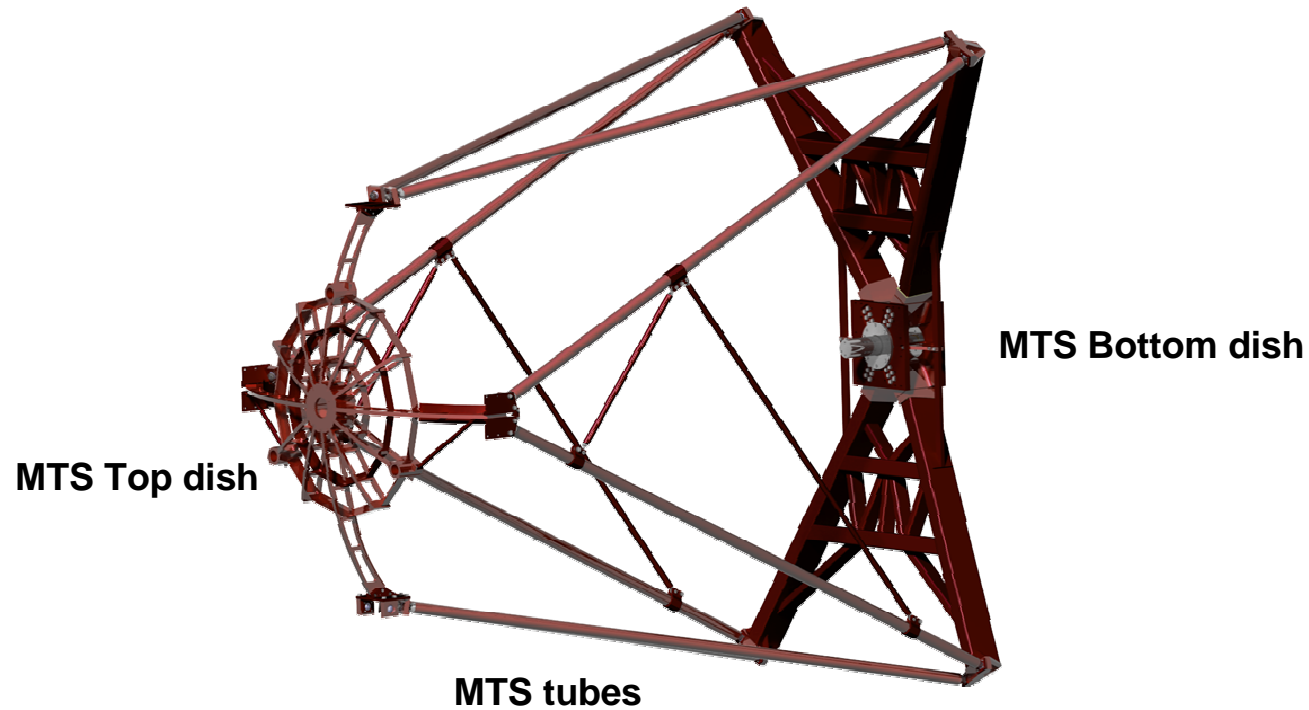


# Optical Support Structure

- OSS is the structure holding the optics and camera.
  - MTS structure using a Serrurier configuration
  - Dish M1 is an hexagonal structure



**M1 dish**



# Optical Support Structure

- Integration test in industry of OSS
- Delivery of MTS bottom dish and dish M1 pre-assembled.
- Delivery of OSS by cranes:
  - Bottom dish and dish M1
  - Top dish
  - Counterweight
  - MTS tubes



May 5<sup>th</sup>, 2015



GCT status – Turku CTA conference



# Assembly of OSS



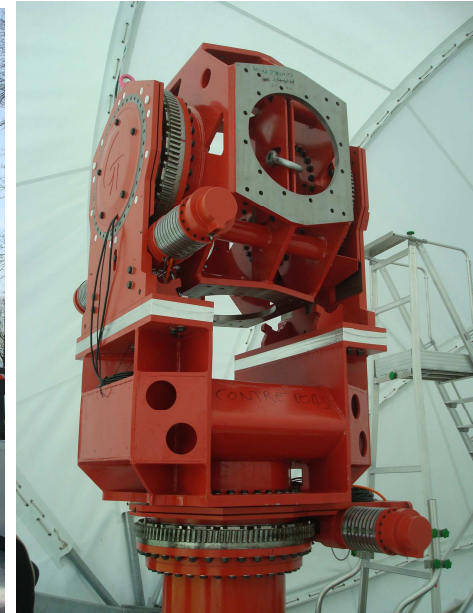
Thursday 9th April



# Assembly of GCT structure



AAS on tower  
Friday 10th April  
morning







OSS on AAS  
Friday 10th April  
afternoon (2h)







Counterweight  
on structure

Friday 10th April  
afternoon (2h)





# GCT installed

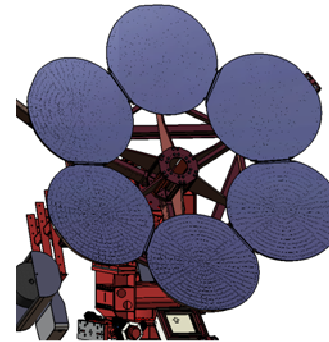
- Equipment:
  - 1 crane
  - 1 cherry picker
  - 1 forklift
- FTE for assembly
  - 2 to 3 people
  - Plus one to ensure safety
- 2 days GCT mounted



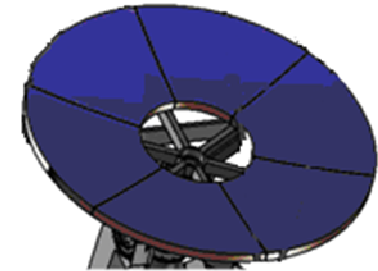
Friday 10th April 5pm

# Mirrors M1 and M2

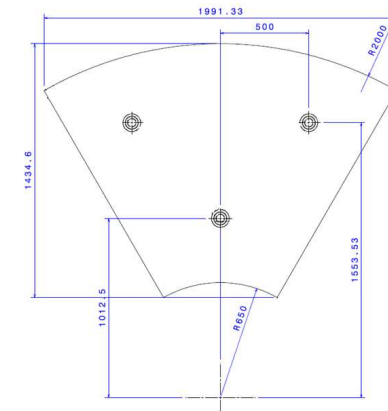
- Manufacturing solution for GCT mirror
  - 1/ machining of aluminium
    - Reflective surface with the appropriate shape
- Back surface with stiffeners (FEA studies)
  - 2/ polishing to reach a roughness of  $0.02 \mu\text{m}$
  - 3/ coating to increase the reflectivity
- M1 composed of 6 petals.
  - 2 solutions: one for prototype and one for CTA
    - CTA: mirror tile 1991 mm – effective area  $10 \text{ m}^2$
    - SST-GATE: mirror tile  $1.48 \text{ m}^2$  – effective area  $6.8 \text{ m}^2$
- M2 assembled as monolithic mirror
  - For prototype : M2 in 6 petals
    - Machined as 6 petals
    - Polished as monolithic structure
    - Coated as petals and then re-assembled
  - For CTA : M2 monolithic



M1 prototype petal



M1 larger petal

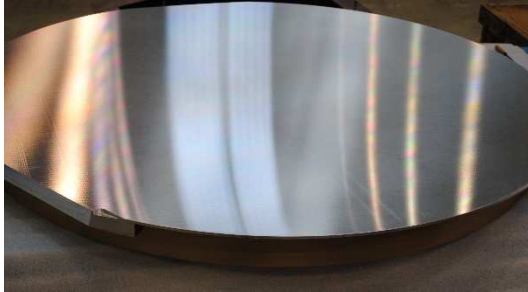




# Manufacturing of mirrors M1

## Mirror M1

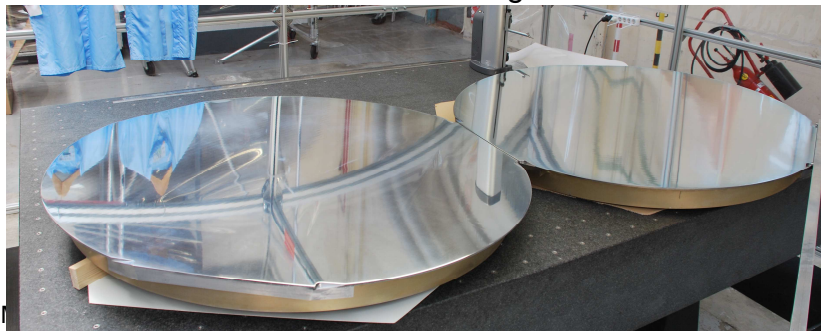
After machining



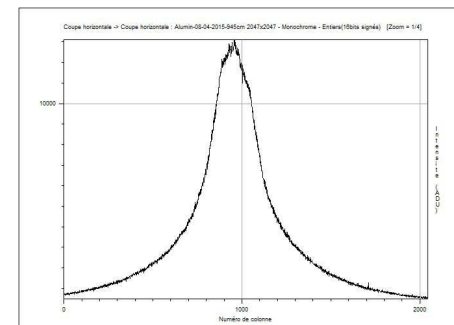
After polishing



After coating



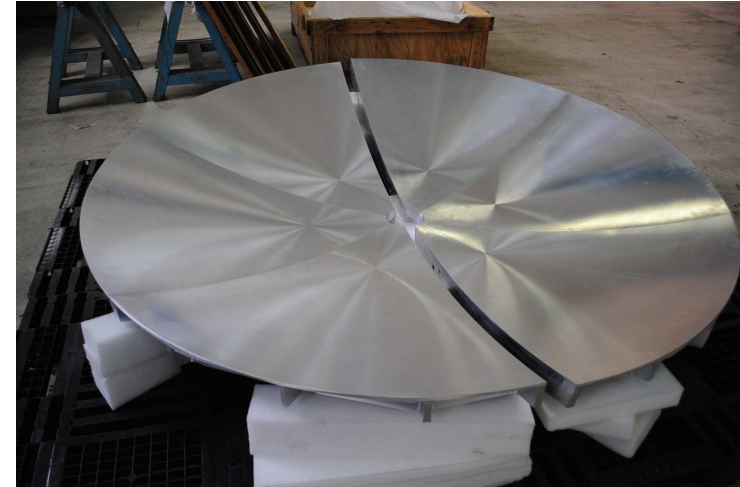
- Two petals M1 are finished
- Test at CEA IRFU done for the two segments
  - Results still have to be analyzed (help of Clementina Medina)
  - Nickel coating do not seem to improve the surface.
- Coming test
  - With M1 and M2
  - Final test with M2 planned beginning in June



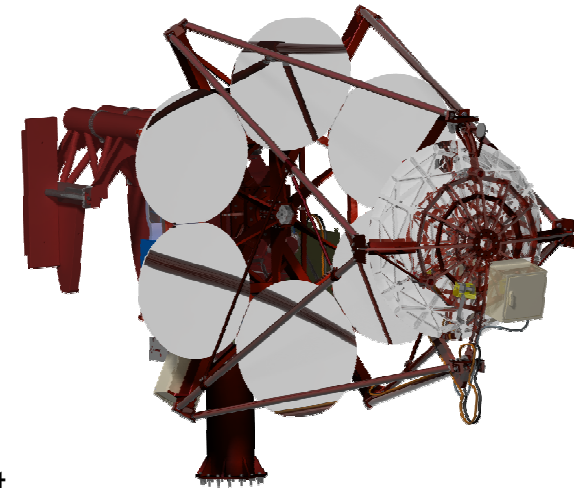
# Manufacturing of mirrors

After machining

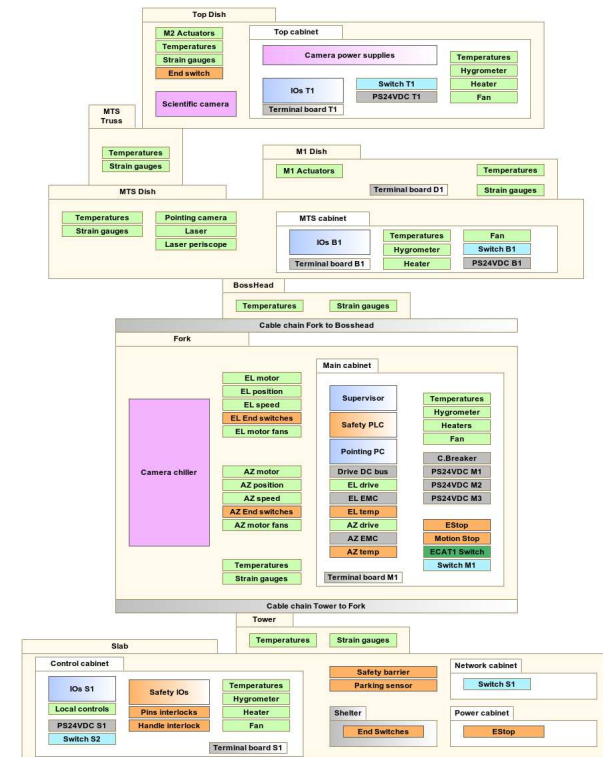
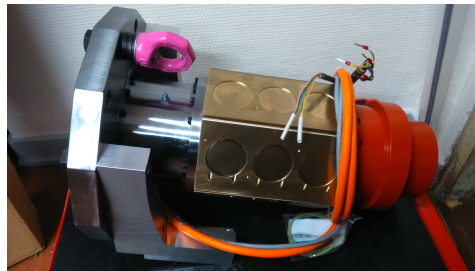
- Manufacturing of Secondary mirror started
  - 6 petals machined and assembled by pins to form a monolithic.
  - Same process than primary mirror.
- Machining finished, assembly to form a monolithic is well working.
- Polishing started and will be delivered end of May.



# Auxiliary: Control command



- TCS architecture
  - All modules listed in details – updated in PBS
  - Cabinets and TCS modules priority 1 were delivered
  - Layout plan of electric cables finished and wiring will start coming weeks
- Test of the control command software
  - Beckhoff modules installed in test system with one additional motor.
  - Communication established between motors and software.
  - Successful test of the software to control motors.
  - Safety software and hardware progressively tested on prototype test bench.

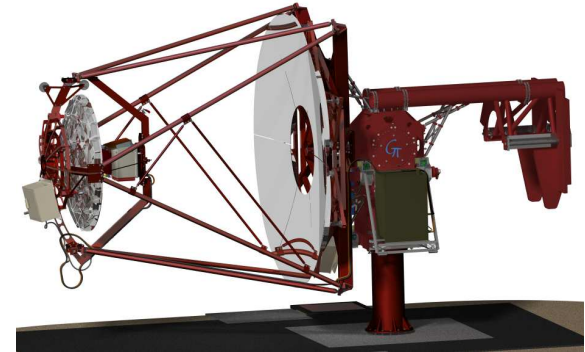


# Next steps in pre-construction

- Installation of mirrors → End of June
  - 3 weeks plan to mount and align mirrors.
- End of manufacturing and Installation of camera system in next months.
- Installation of cabinets
  - Cabinets wired and installed on the structure.
  - Test of software on the structure planned during summer.
- Test phase on the structure → start now till end of year
  - Install sensors, test of structure
  - Install camera end of September for tests oriented Science.



# Next steps toward CTA



- Feedback started with industries to establish
  - How better improve the systems (ease the production, decrease cost...)
  - How change system for a mass production (change some process, some material...)
  - Objective is to prepare call for tender for next CTA phases
- Application for assessment phase to prepare the CTA mass production
  - R&D on metallic mirrors to improve the quality
  - Modification on some mechanics drawings for the series after the feedbacks
- Subvention for GCT-3 applied at Region Ile de France for mechanical structure auxiliary and secondary (global grant 600 k€)
- Progress with CTA France to prepare the CTA production phase and apply for support from French Ministry.



Thank you !



May 5<sup>th</sup>, 2015. Turku