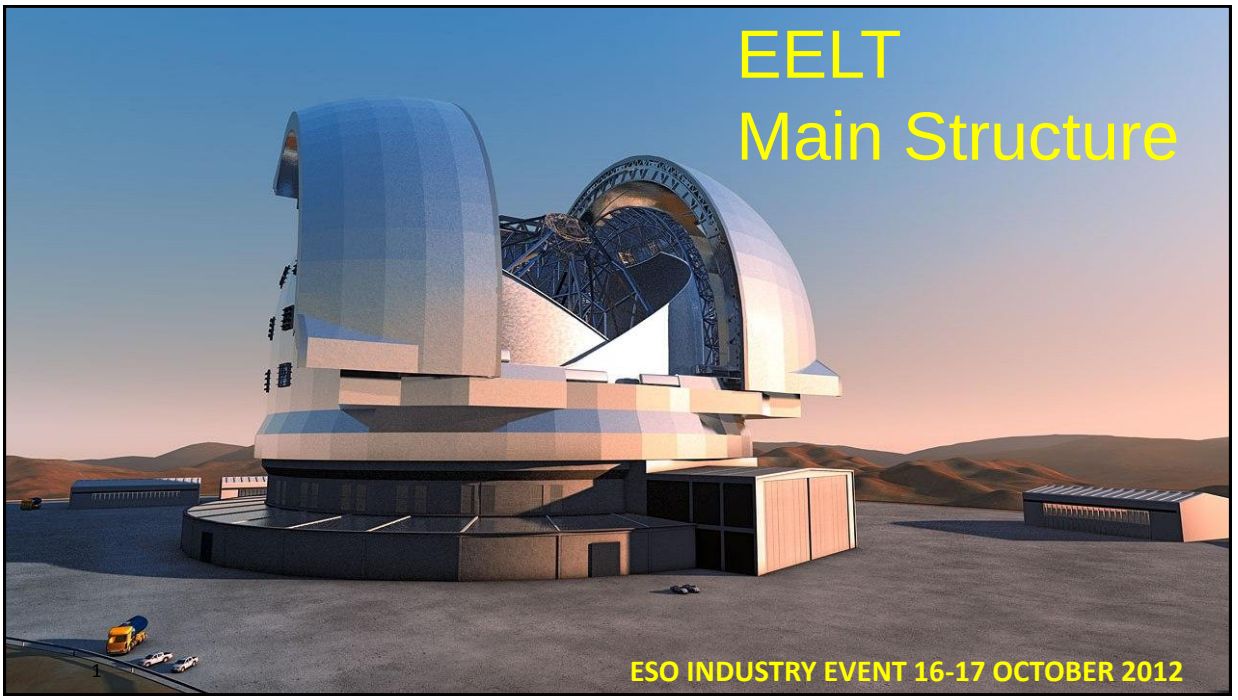
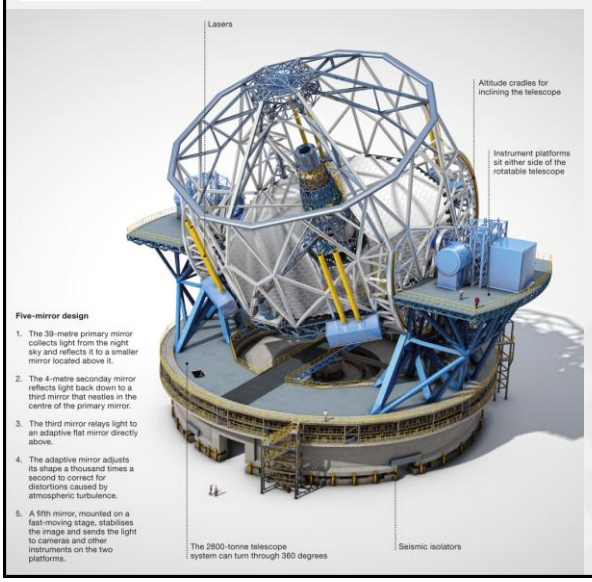


MS REQUIREMENTS I

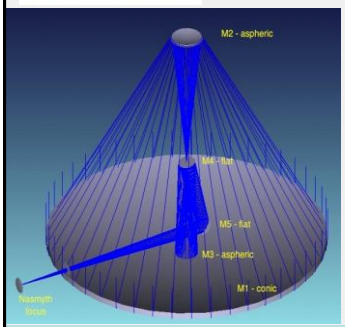


- **Functional**
  - Housing of the Optomechanical Units. Structural support and cabling, routing, piping for power, fluids and data.
    - Five mirror units
    - One Atmospheric Dispersion Compensator
    - One Calibration Unit
    - Two Prefocal Stations
    - Six Laser Guide Star Units
    - Six Nasmyth Instruments
    - One Coudé feed
    - Coarse Alignment Metrology
  - Pointing
    - Tracking
    - Slewing
    - Offsetting

OPERATIONAL RANGE
Azimuth rot. ± 270°
Altitude rot. from 89°to 20°

  - Access
  - Handling

MS REQUIREMENTS II



- Performance
  - Tracking with wind disturbances #1469
  - Altitude and azimuth tracking errors shall be equal to or less than:
    - 0.3 arcsec rms, integrated up to 1Hz frequency (~ 20 µm rms at altitude encoder located at 14m radius).
    - 0.003 arcsec rms, integrated over 1 Hz to 4 Hz (off loaded to M5)
    - 0.001 arcsec rms, integrated over frequencies larger than 4 Hz (off loaded to M4)

Main Structure has complex iteration with optomechanical units.
ESO System Engineering

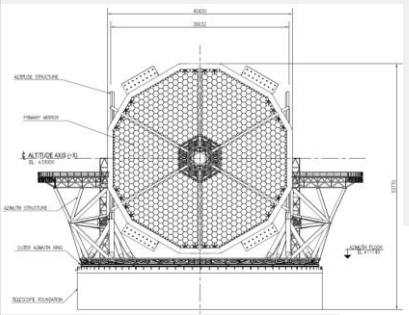
Verification Process. Contractor's System Engineering

Design	Analysis	Inspection	Tests
Review of design, Error Budgets allocation and lower level specifications.	Review of FE and Control analyses, Error Budget allocation.	As required.	Validation of models by test. Injection of wind torque disturbance signal, based on wind Power Spectral Density. Combine results and Errors Budget allocations.

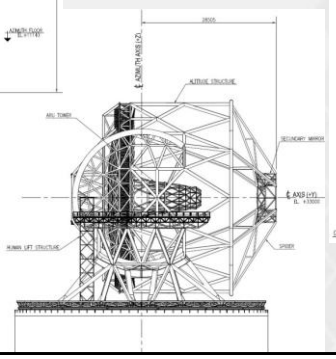
BASELINE DESIGN - PRODUCT TREE

4

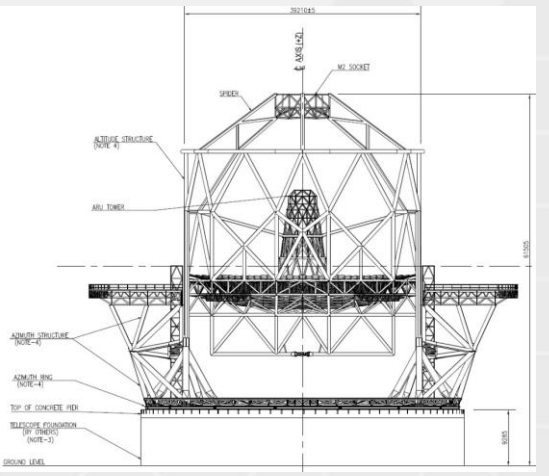
OVERALL DIMENSIONS



Diameter ~71 m
Height ~62 m

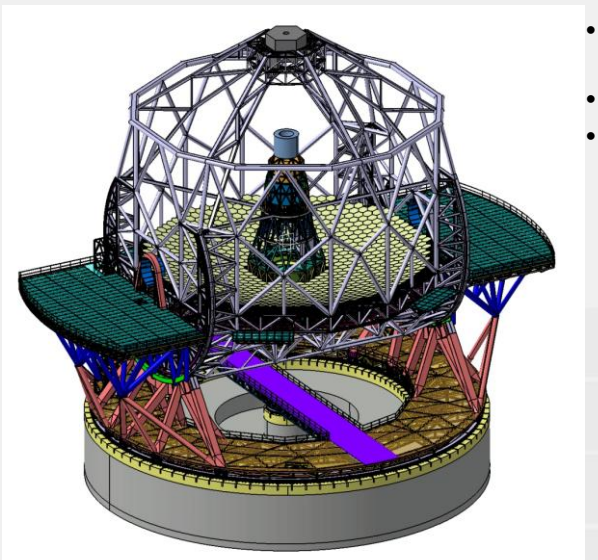


Pointing horizon

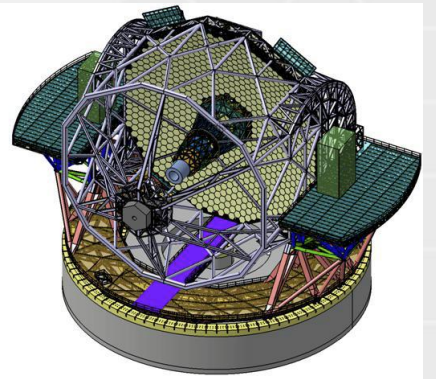


Pointing zenith

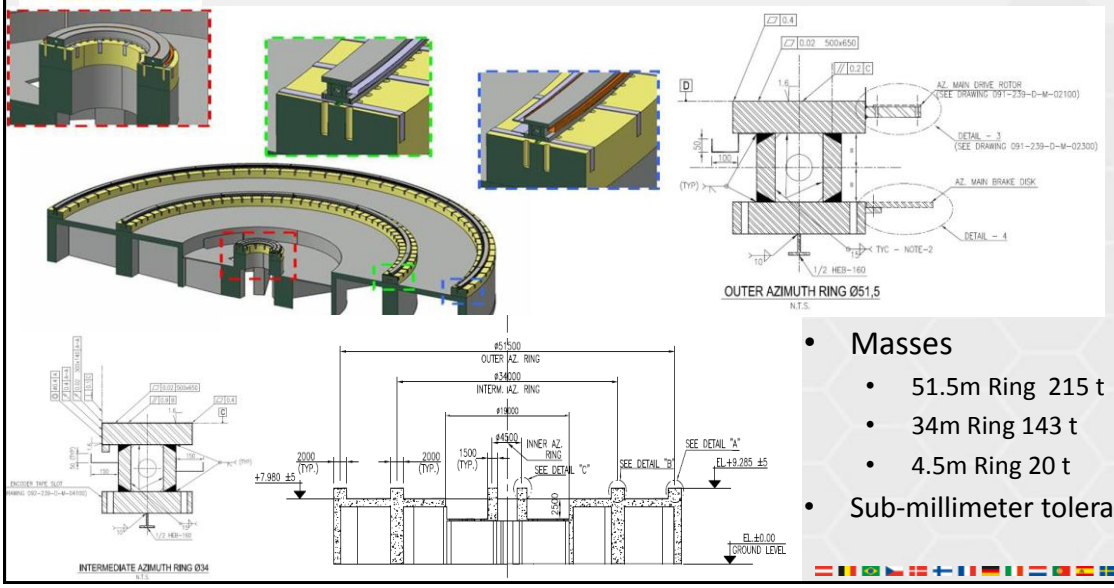
MS OVERALL DESIGN



- Total E-ELT rotating mass ~ 2,800 t
  - Total Main Structure rotating mass ~2250 t
- Total E-ELT power demand ~1400 kVA
- Total E-ELT cooling ~ 600 kW



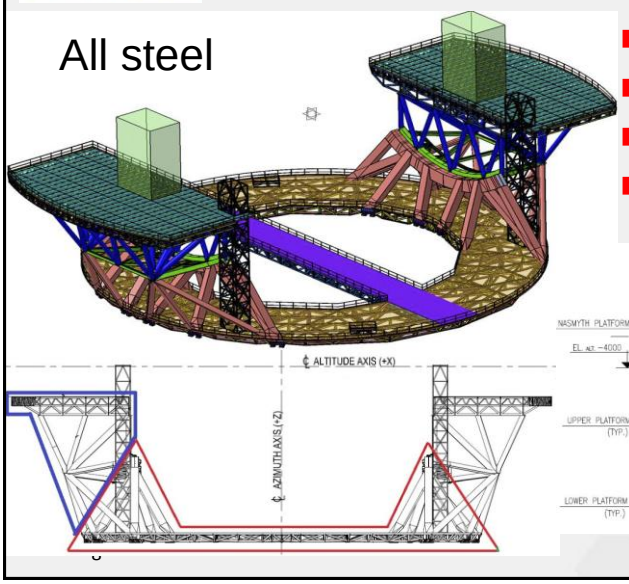
AZIMUTH RINGS



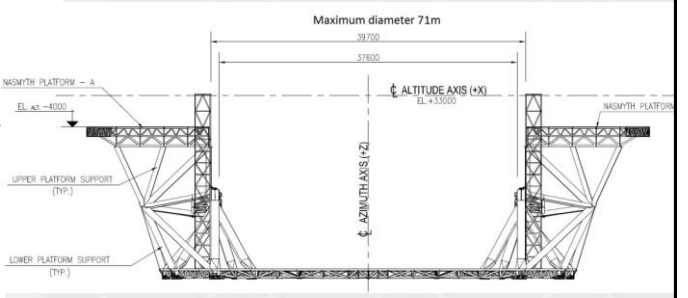
- Masses
  - 51.5m Ring 215 t
  - 34m Ring 143 t
  - 4.5m Ring 20 t
- Sub-millimeter tolerance

AZIMUTH STRUCTURE

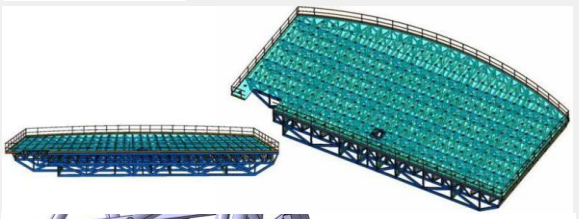
All steel



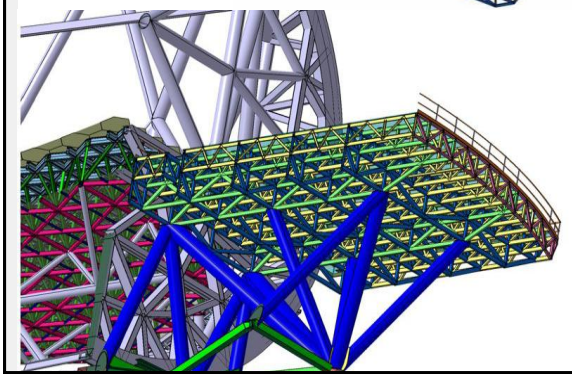
- Total Mass 1288 t
- Structure 898 t
- Floor structures 88 t
- Azimuth non-structural mass 214.5 t

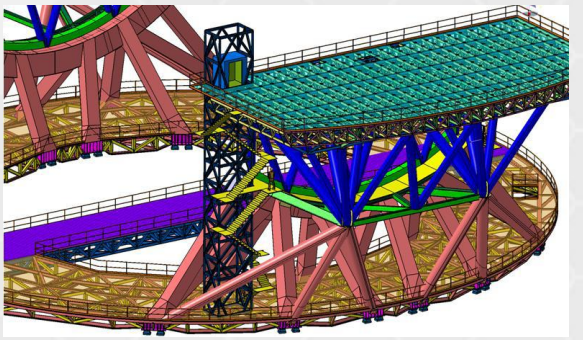


NASMYTH PLATFORMS

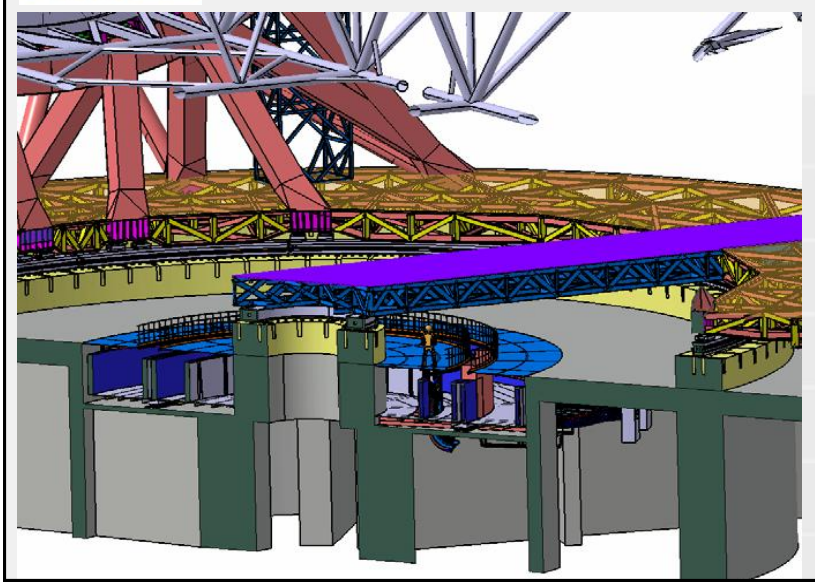


- Size 29 x 15 m^2
- 2 PFS 56 t
- 6 Instruments 140 t
- Grid of I/F flanges (1x1m^2)

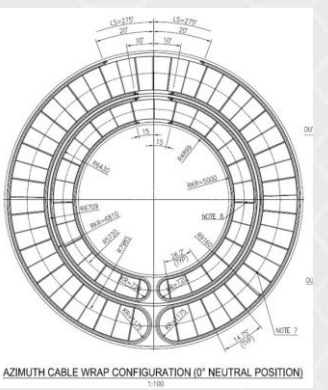




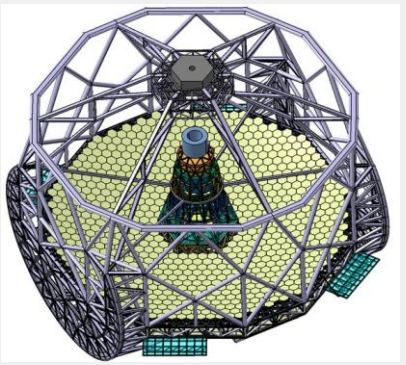
AZIMUTH CABLE WRAP

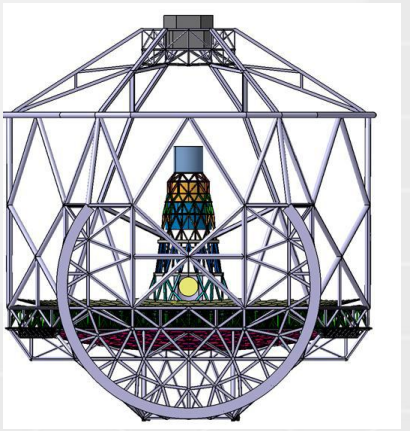


- 4 Chains
- Own drive unit
- Mass 32 t



ALTITUDE STRUCTURE

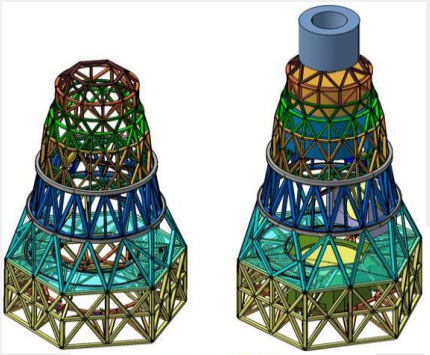


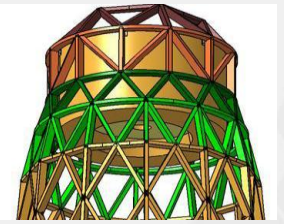


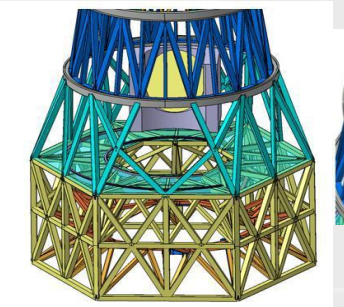
- Total Mass 1498 t
- Structure 1064 t
- Floor structures 31 t
- Altitude non-structural mass 403 t

All steel

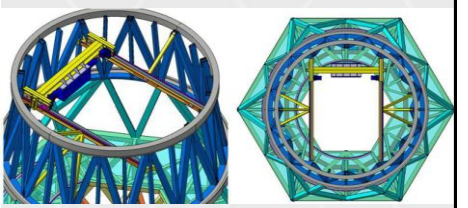
Adaptive Relay Unit TOWER



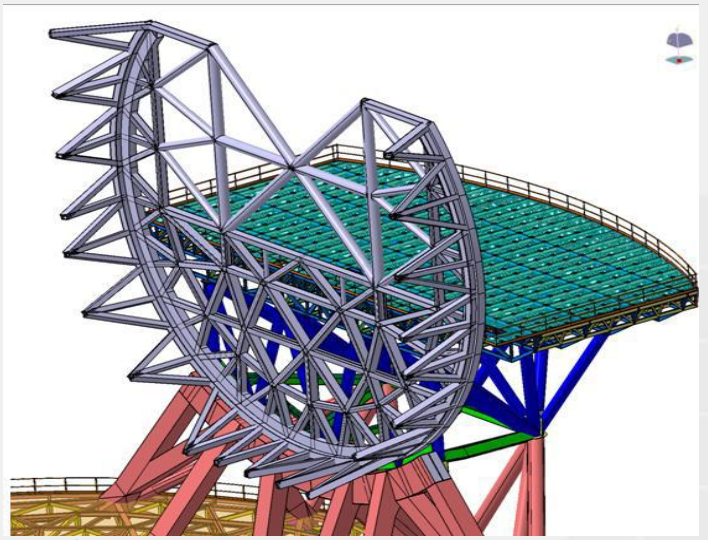




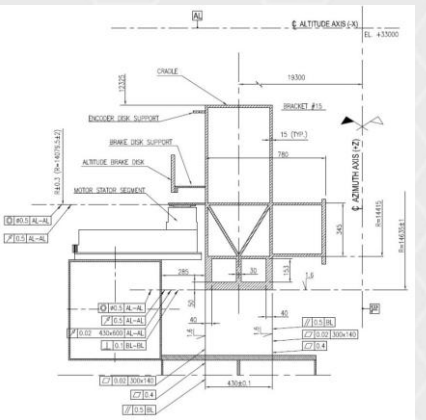
- 5 Hosted Units
- M3, M5 crane
- Assembly and Access
- Rails of the M1 segment crane



ALTITUDE CRADLES



- Mass 1 cradle 200 t.
- Sub-millimeter tolerance



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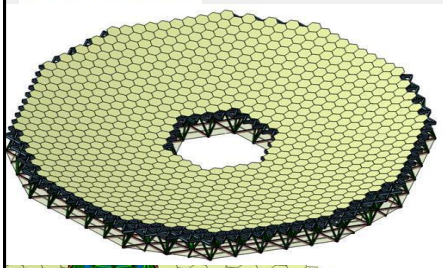
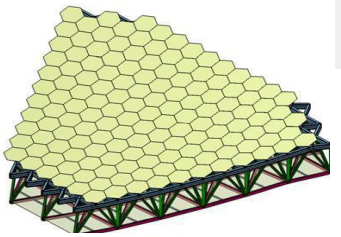
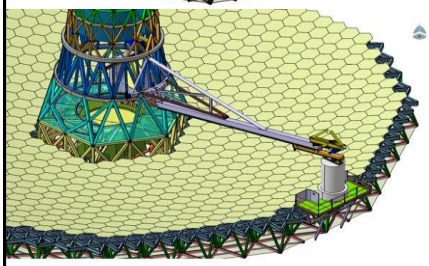
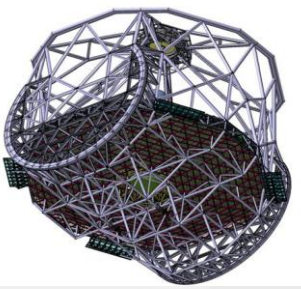
M1 CELL and SEGMENTS HANDLING

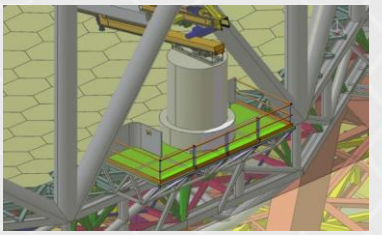








- Structure Mass 206 t.
- Floor mass 28 t.
- 798 segment dummies ~320 t.
- M1 segment crane 6 t.



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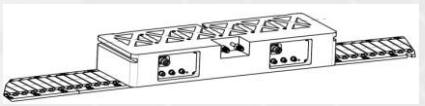
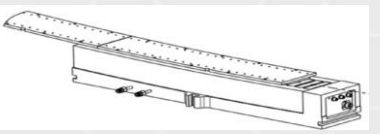
DRIVE and ENCODER SYSTEMS

- AZIMUTH: 24 axial single gap coil sections
  - Section: 800 mm wide, airgap 2.9 mm, mass 76 kg
  - 206 magnet segments, rotor diameter 50,76 mm
  - ➢ Torque + 10% margin
    - Continuous 577,158 Nm
    - Non continuous 3,707,501 Nm
    - Heat dissipation 44.8 W per section (continuous torque), water cooled
  - ➢ Encoder: 360º circular tape (34m ring), 4 scanning heads



- ALTITUDE: 16 cylindrical single gap coil sections
  - Section:1100 mm wide, airgap 2.9 mm, mass 169 kg
  - 88 magnet segments, rotor diameter 14,1 mm
  - ➢ Torque + 10% margin
    - Continuous 605,475 Nm
    - Non continuous 2,084,093 Nm
    - Heat dissipation 206 W per section (continuous torque), water cooled
  - ➢ Encoder: 2x110º segment tape (cradle), 2x2 scanning heads



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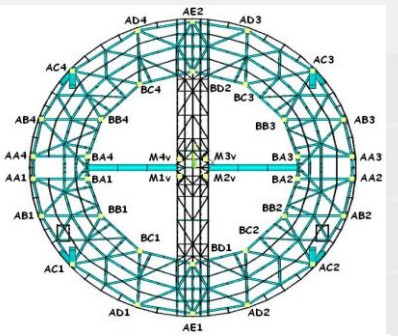
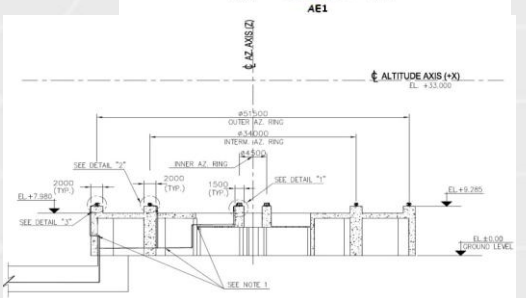
BEARINGS SYSTEM



Hydrostatic Bearing System

- 60 bearings 600x420mm^2, 550 kg
- 86 bearings 340x130mm^2, 75 kg
- Oil Supply System (Dome Auxiliary Building)
  - ➢ 590 l/min at 15ºC oil temperature
  - ➢ 141 kW Total installed power
  - ➢ 97 kW Maximum power dissipation
  - ➢ 110 bar Pressure at the bearings
  - ➢ Oil tank 12,000 liters
  - ➢ Oil cooling 340 kW
  - ➢ Oil recovering system, gravity return piping



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MISCELLANEOUS

- **AUXILIARY EQUIPMENT**
  - 2 Azimuth motorized locking pins
  - 2 Altitude motorized locking pins (M2 unbalance)
  - Azimuth: 8 shock absorbers + 4 end stops
  - Altitude: 4 shock absorbers + 4 end stops
  - Azimuth 24 brakes (51.5 m ring)
  - Altitude 12 brakes (Cradles)
  - Azimuth and Altitude motorized auxiliary drives
- **COOLING PUMPING and DISTRIBUTION SYSTEM**
  - Design cooling power 599 kW includes MS and Hosted Units
  - Operating flow Q = 75.6 m^3/h
- **COMPRESSED AIR DISTRIBUTION SYSTEM**
  - Maximum demand 211 l/min Hosted Units (SCPs)
- **ELECTRICAL DISTRIBUTION SYSTEM**
  - Total power demand 1386 kVA
    - MS Azimuth & Altitude rotation: 230kVA
    - Oil cooling & pumping system: 800kVA
    - Hosted units: 270kVA
    - Miscellaneous other loads (Lifts, cranes, cable wraps, etc): 86kVA
- **MS LOCAL CONTROL SYSTEM**
- **DUMMIES** ~ 565 t.

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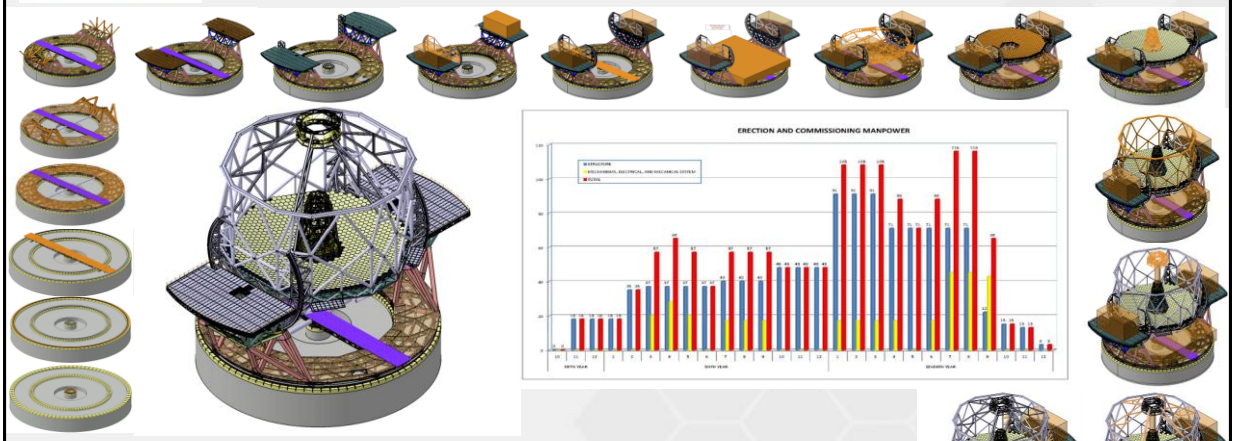
SITE INTEGRATION



- Site machining azimuth rings and cradles
- Availability of Dome kinematics and AC
- Minimize welding on site

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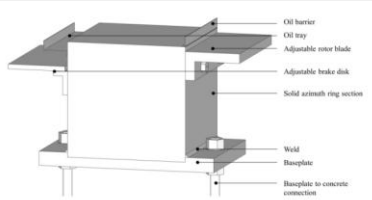
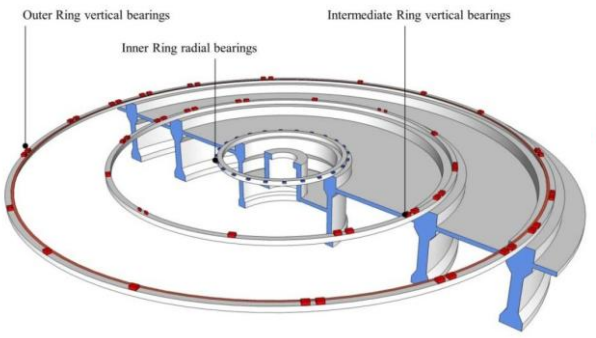
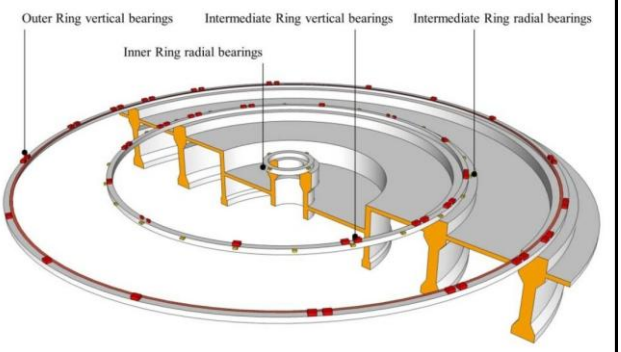
CONSTRUCTION. DESIGN ALTERNATIVES



Foundation Interface





DISCIPLINES AND TECHNOLOGIES

- Mechanical Engineering.
  - Structure and Mechanisms
    - Stress, Static, Dynamic, Buckling, Fatigue, Thermal, Earthquake, Safety, Wind.
- Electrical and Electronics Engineering.
  - Power transmission
  - EMC
  - Control Engineering
  - Software Engineering
- Civil Engineering.
- Fire protection Engineering.
- RAMS.

- Large welded and bolted structures.
- Accurate machining & alignment.
- Dimensional stability.
- Accurate, robust kinematics control.
  - Hydrostatic bearing.
  - Direct drive motor.
  - Strip encoder.
- Logistics.
  - Transport
  - Site integration
- Verification.

SYSTEM ENGINEERING and QUALITY ASSURANCE


EELT
Main Structure
Thank you !
QUESTIONS ?
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