

Precision engineering

Introduction by Rob van der Meer,
Paul Hieltjes, Ramon Navarro

Content



Precision engineering for the Einstein telescope

- Rob van de Meer ILO Einstein telescope

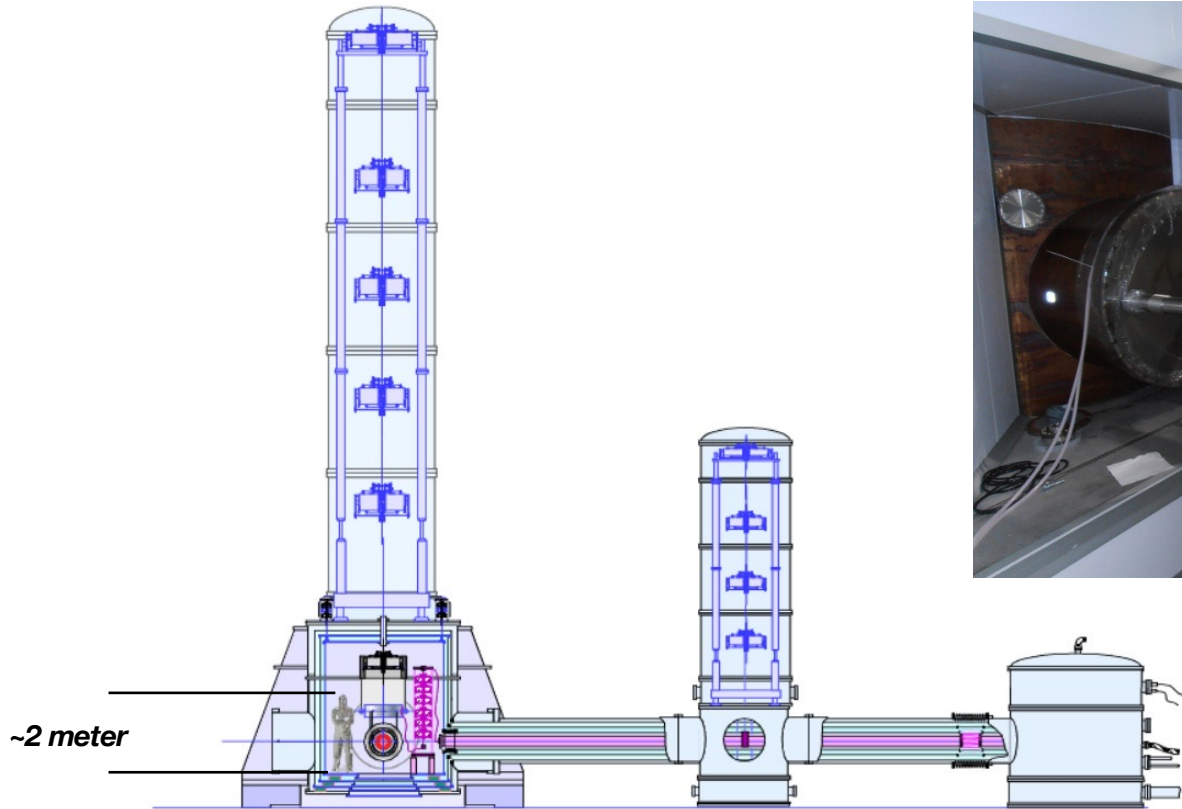
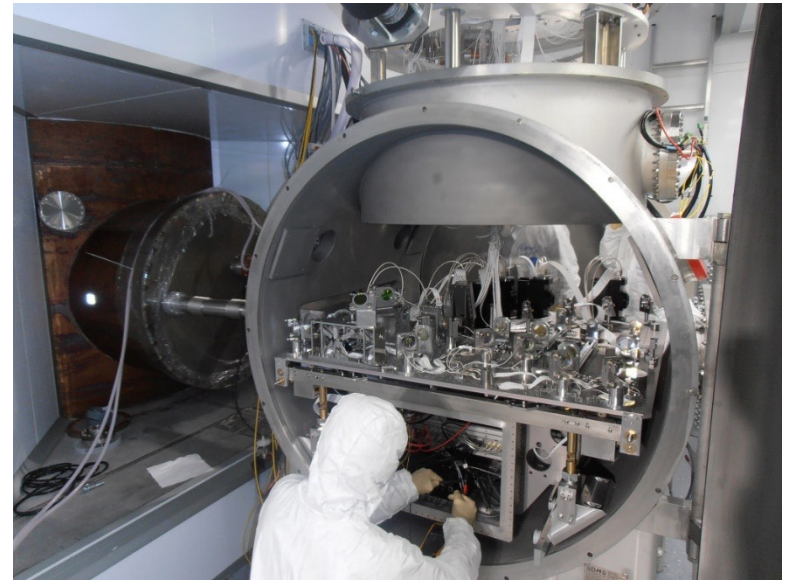
Precision Engineering with SRON Leiden

- Paul Hieltjes

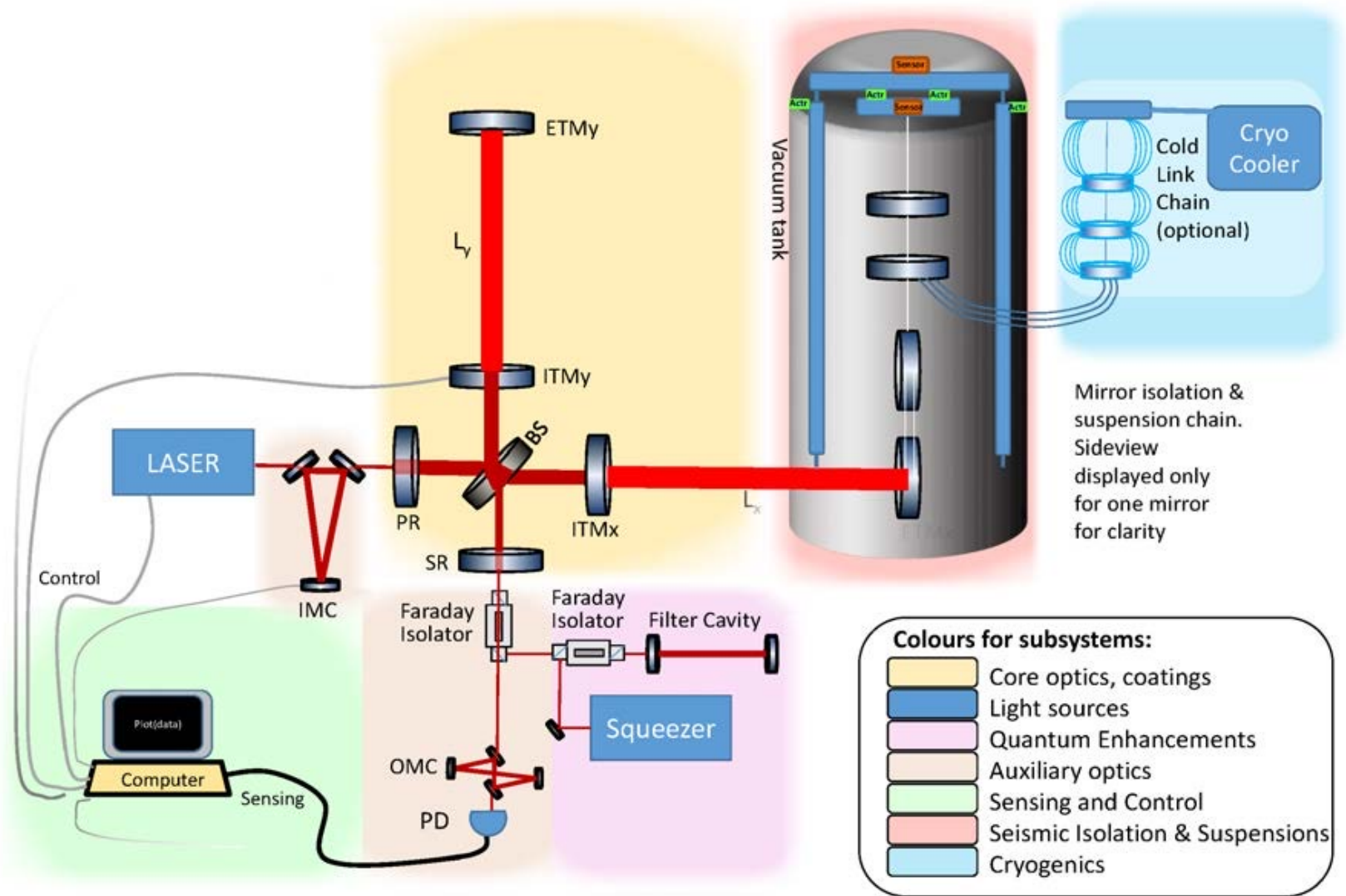
Precision Engineering with Nova

- Ramon Navarro

Precision engineering for the Einstein Telescope



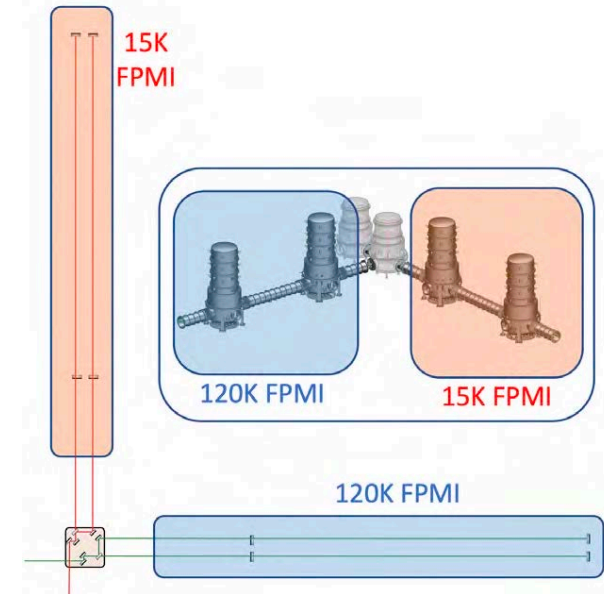
Brief general information on ET



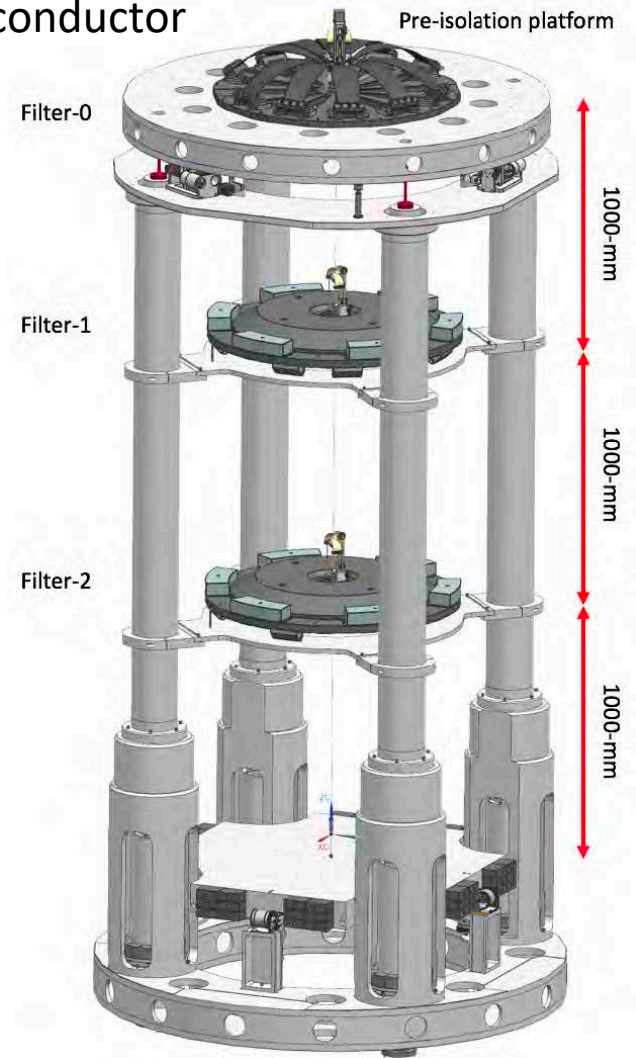
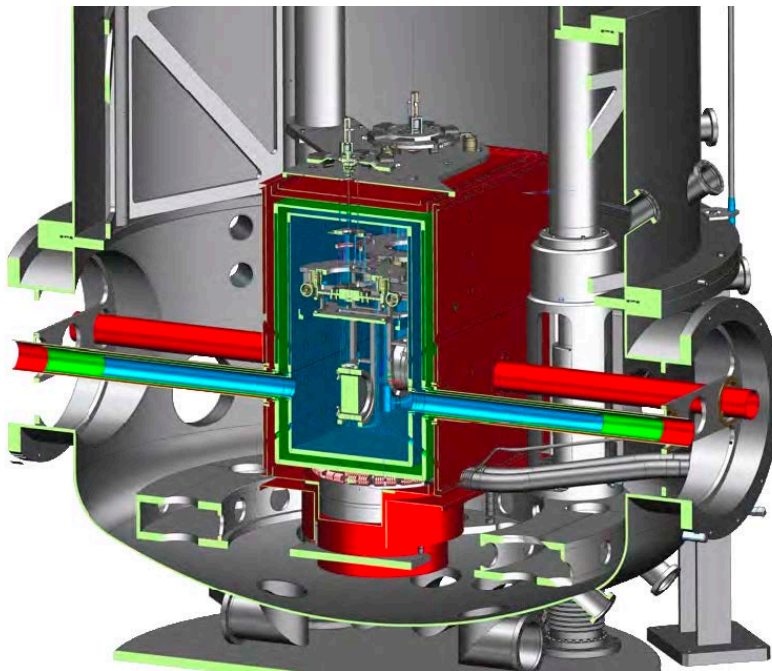
ETpathfinder facility Maastricht



- <https://www.etpathfinder.eu/research/>
- Design document
- Clean room 20 x 30 m (ISO 14644-1 class 8)
- UHV Vacuum facility
- Cooling to 120 K and 15 K



- Testing new mirror material: Silicon crystalline semi-conductor
- Testing mirrors at low temperature 120 K and 15 K
- Testing new lasers at 1550 – 2100 nm
- Testing vibration reduction
- Component cleaning
- Sensors, actuators



Einstein Telescope



ET2SMEs project

- **Precision Mechanics and Mechatronics**
 - Vibration isolation systems for stringent conditions (ultra-high vacuum, cryogenic)
 - Need for displacement sensors, actuators, blades, suspension wires, inertial sensors
 - Very clean components (impurities allowed) and very strict cleaning procedures
 - Limited amount of materials (e.g. margin) available
-
- Catalogue of required technologies:
<https://et2smes.eu/et-technologies-catalogue/>

Collaboration opportunities



1. Next 2 – 5 years
 - R&D and bringing parts to higher TRL level
 - Silicon mirrors as thick as possible 15 – 60 CM diameter and thickness.
 - Materials, coatings, support system, vacuum connection
2. 5 – 10+ years prepare for prototype phase and larger orders.
 - Possibilities for quality checking, coating, handling
 - Show you can do better than us.

More information in parallel workshop



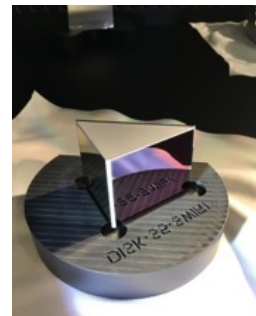
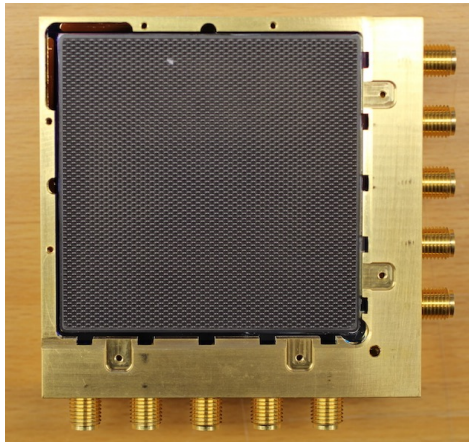
www.etpathfinder.eu

SRON's New Building in Leiden en Groningen

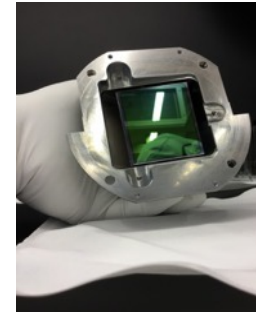


SRON heritage on precision engineering

- High accuracy (infra-red)Optical lenses (e.g. Veldlaser)
- Optical gratings for Sentinel 5 (e.g. Phillips, VDL)
- Optical module for SPEX-one (TNO, Airbus)
- Xray Camera chips mounting, and gluing (Neways)
- Many other examples of Space instrumentation



Immersed
grating on
inspection
disk



Immersed
Grating in
mechanical
housing



Grating in
storage
container

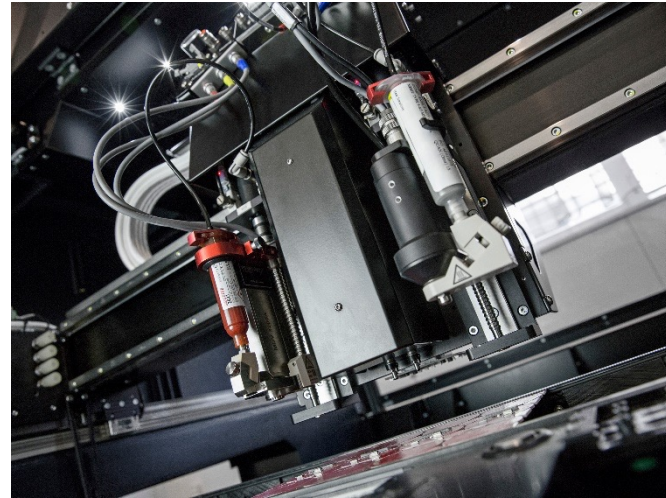
New building => new eco-system

- The move to Leiden is one element of the SRON strategy to become a bigger part of the space related environment around “South Holland”
 - Space Campus Noordwijk
 - Leidse Instrument makers school (LIS)
 - Leiden Institute of Advanced Computer Science (LIACS)
- We are also open to look for Public Privat Partnership to share our heritage and give a boost to companies in participating in Big Science (tenders)

Some facilities



optical



electronics



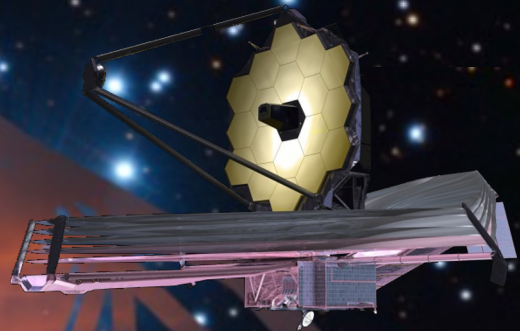
mechanical



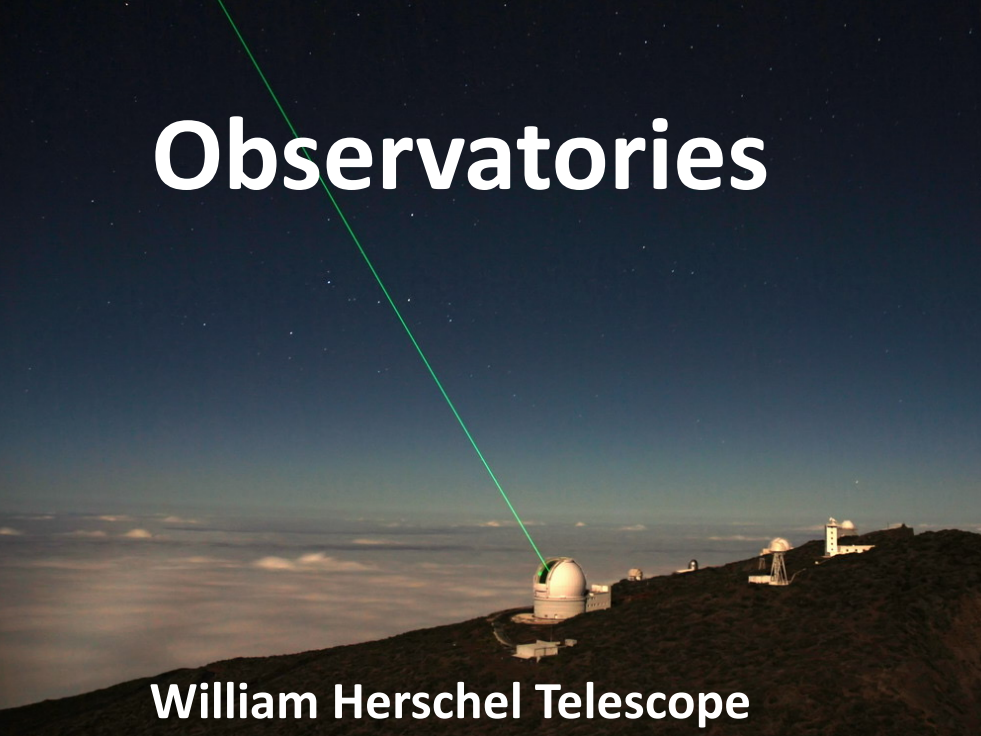
Integration in cleanroom



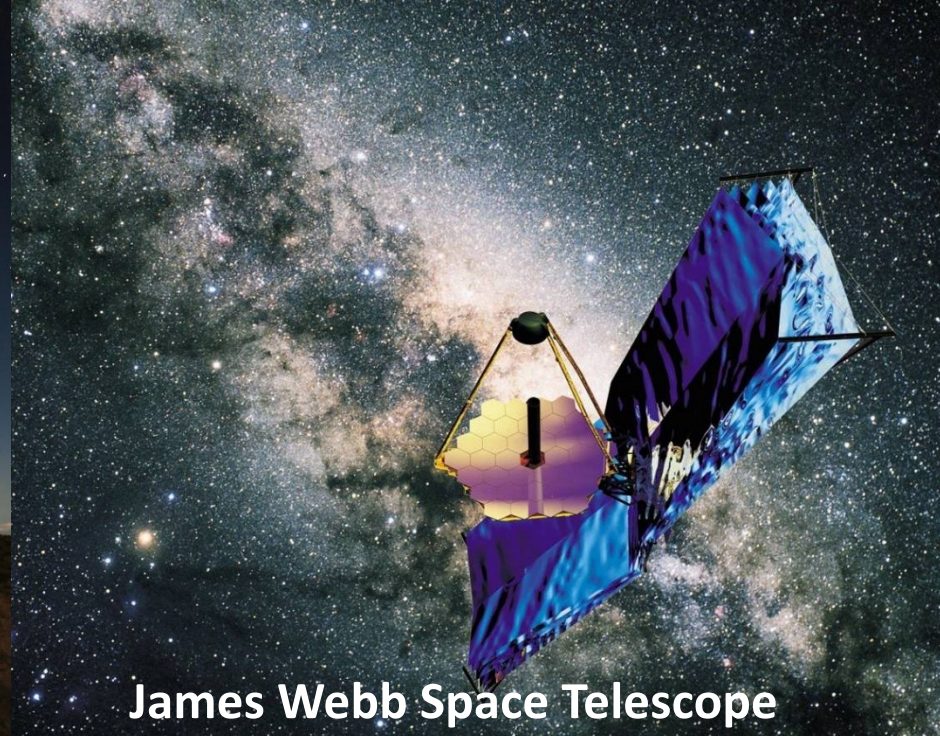
Netherlands Research School for Astronomy



Observatories



William Herschel Telescope



James Webb Space Telescope

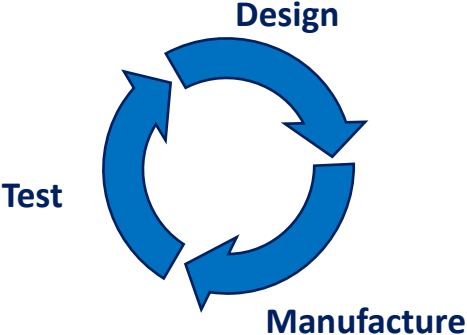
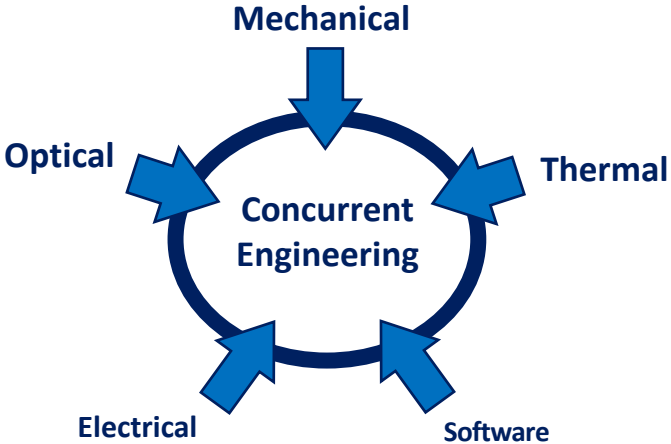
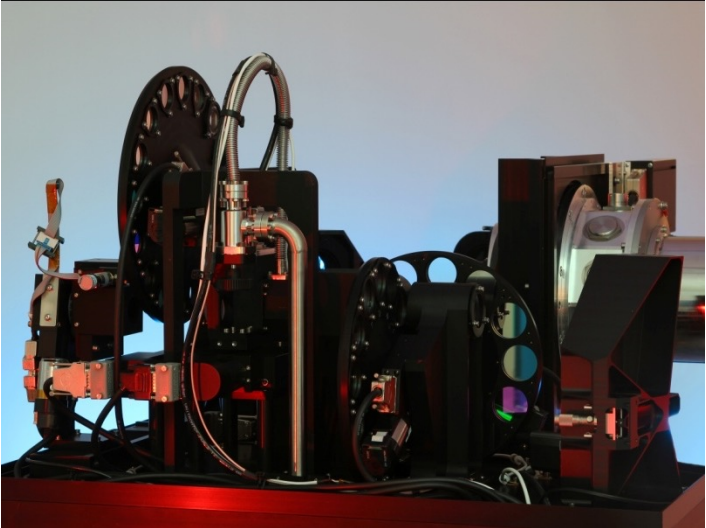
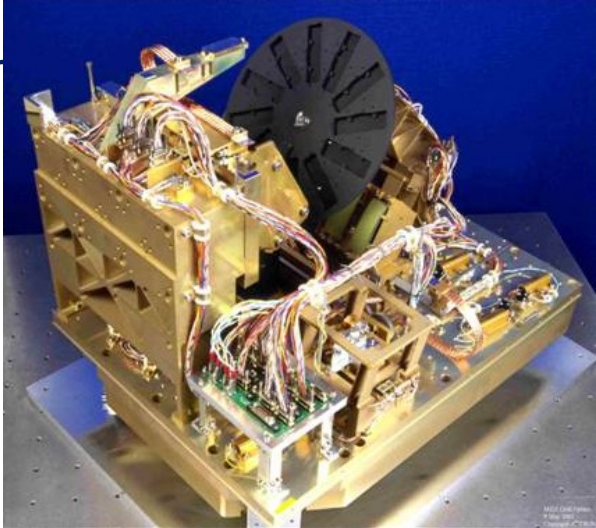
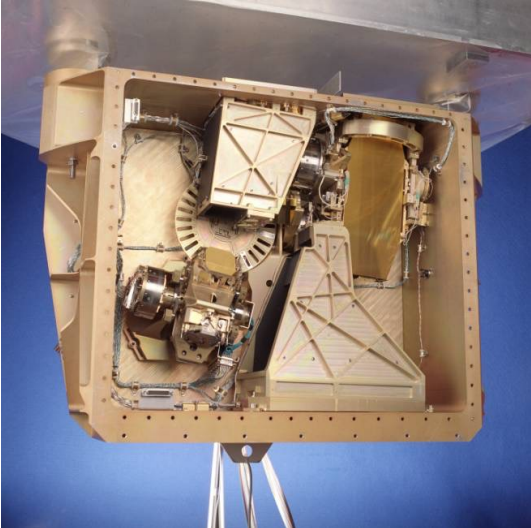


ESO Very Large Telescope

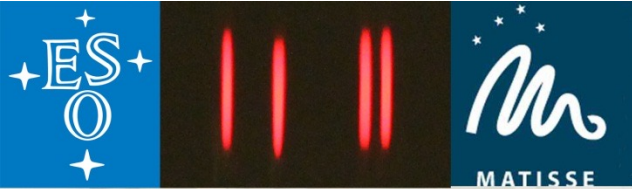


ESO Extremely Large Telescope

Optical Infrared Instrumentation



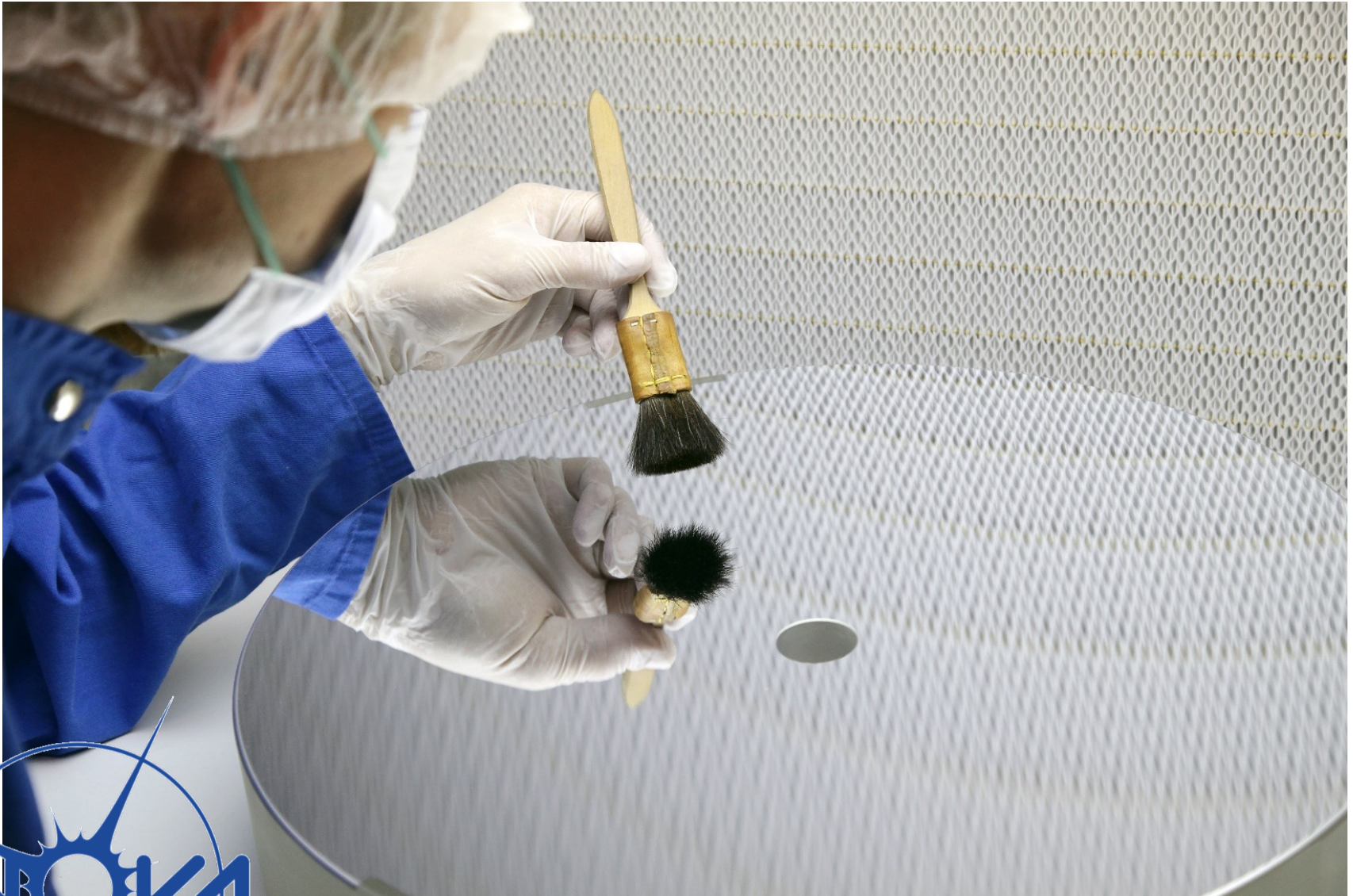
MATISSE



Cleanroom Integration and Assembly



Manufacturing and Testing Optics: single nm accuracy



Mechanical Manufacturing: single um accuracy



NOVA Technologies

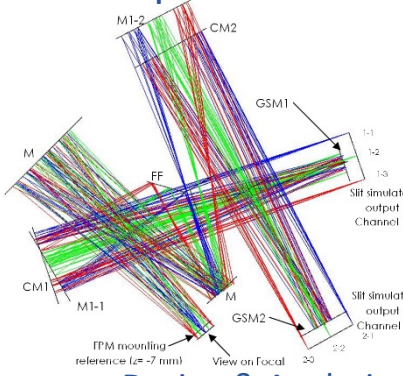
Optical

Mechanical

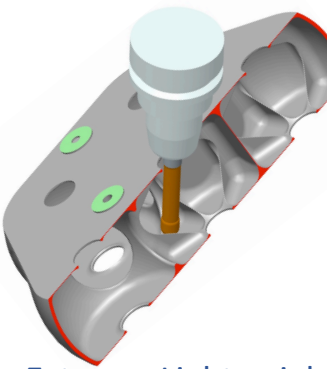
Cryogenic

System

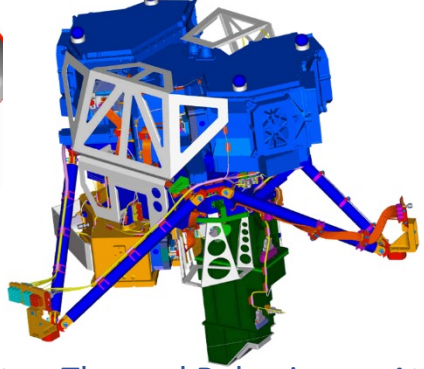
Design



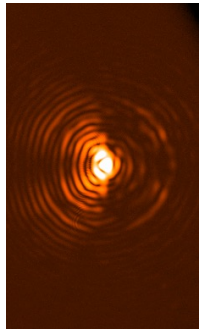
Design & Analysis



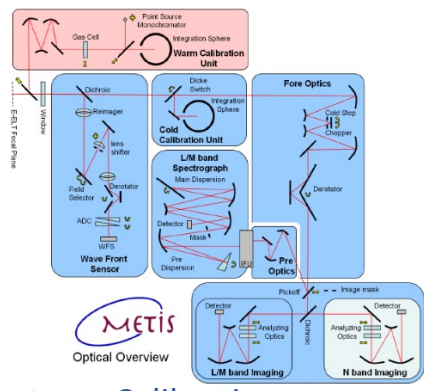
Extreme Lightweight



Thermal Behavior



Atmospheric Effects

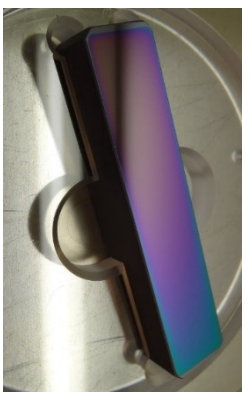


Calibration

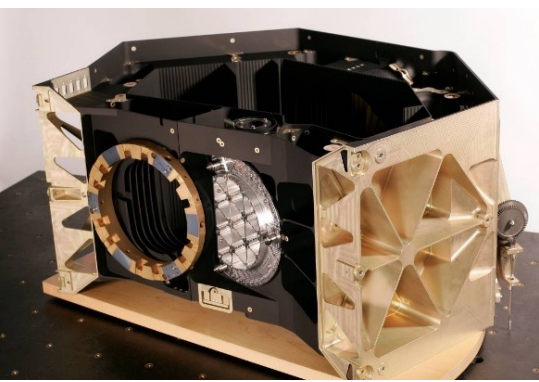
Manufacture



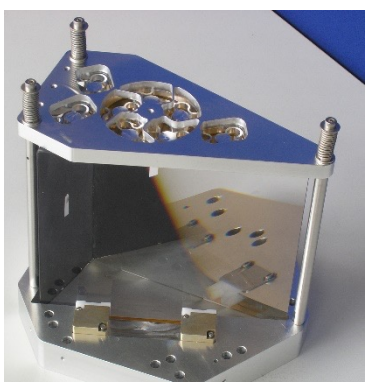
Aluminium polishing



Optical polishing



5 axis CNC milling

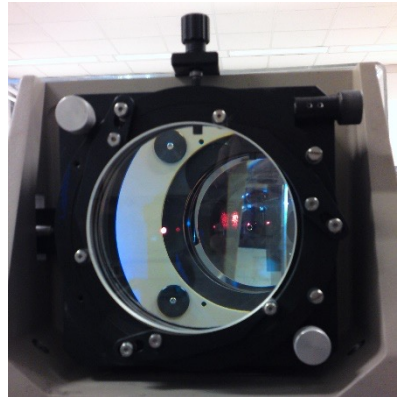


Thermal solutions



Mechanisms

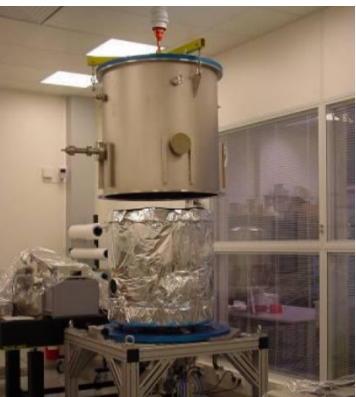
Test



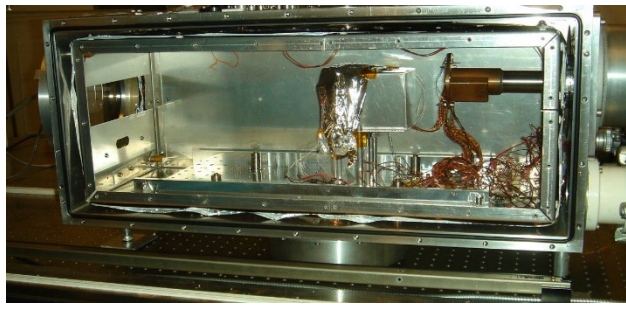
150mm Interferometer



Spectral 200nm-30µm



20 Kelvin or lower



cryogenic opto-mechanical tests