STATUS UPDATE ON THE NEW SPACE CALIBRATION FACILITY AT TNO

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TNO innovation for life

CSI Calibration Space Instruments

AVS 66TH INTERNATIONAL SYMPOSIUM & EXHIBITION

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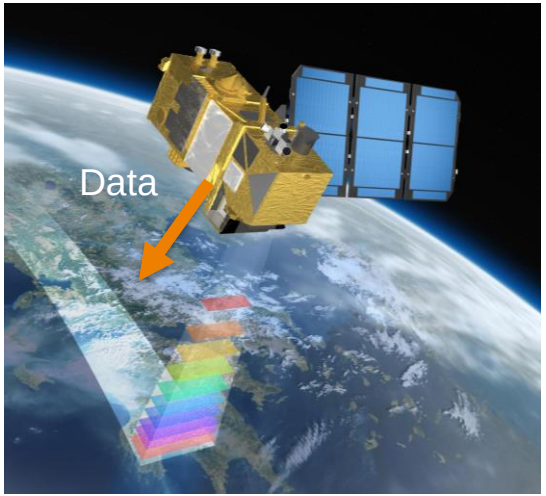
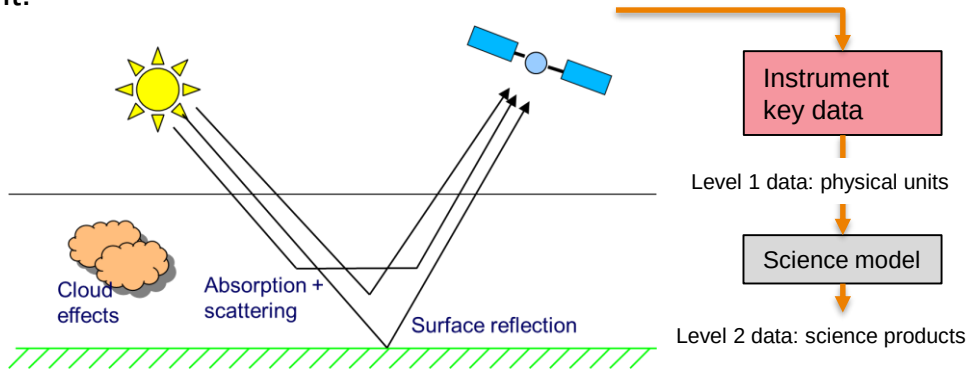
OUTLINE

- Why is calibration needed?
- Current facility at TNO
- Introduction CSI
- Design of CSI Thermal Vacuum Chamber
  - Vacuum plant
  - Thermal plant
- Instrument Mechanical Manipulation System
- Conclusion

WHY IS CALIBRATION NEEDED

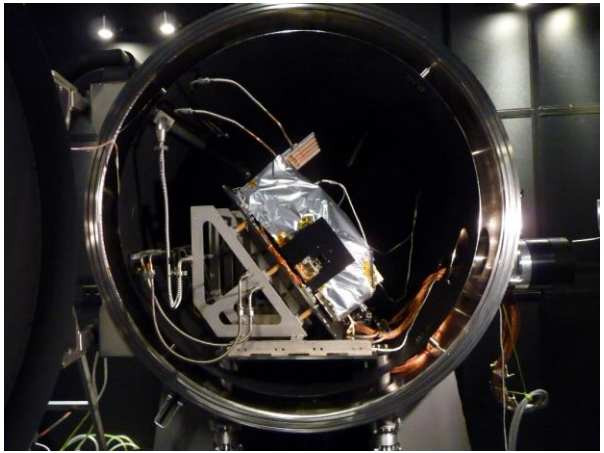
- The received data on earth would have two unknowns if there were no calibration
  - Earth radiance
  - Instrument response
- Instruments need calibration on the generated output, this requires a realistic space environment:
  - Temperature
  - Pressure
  - And known (optical) input conditions

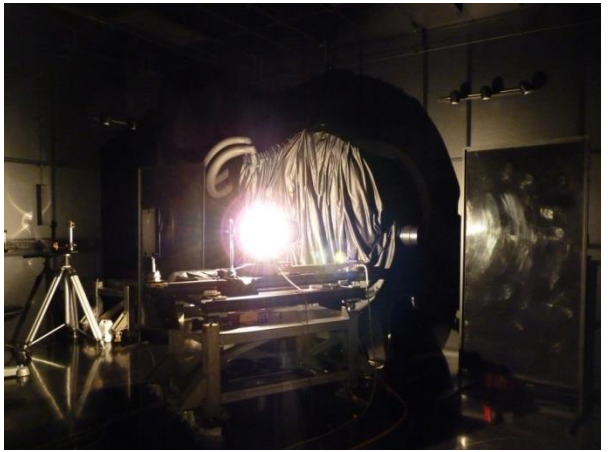




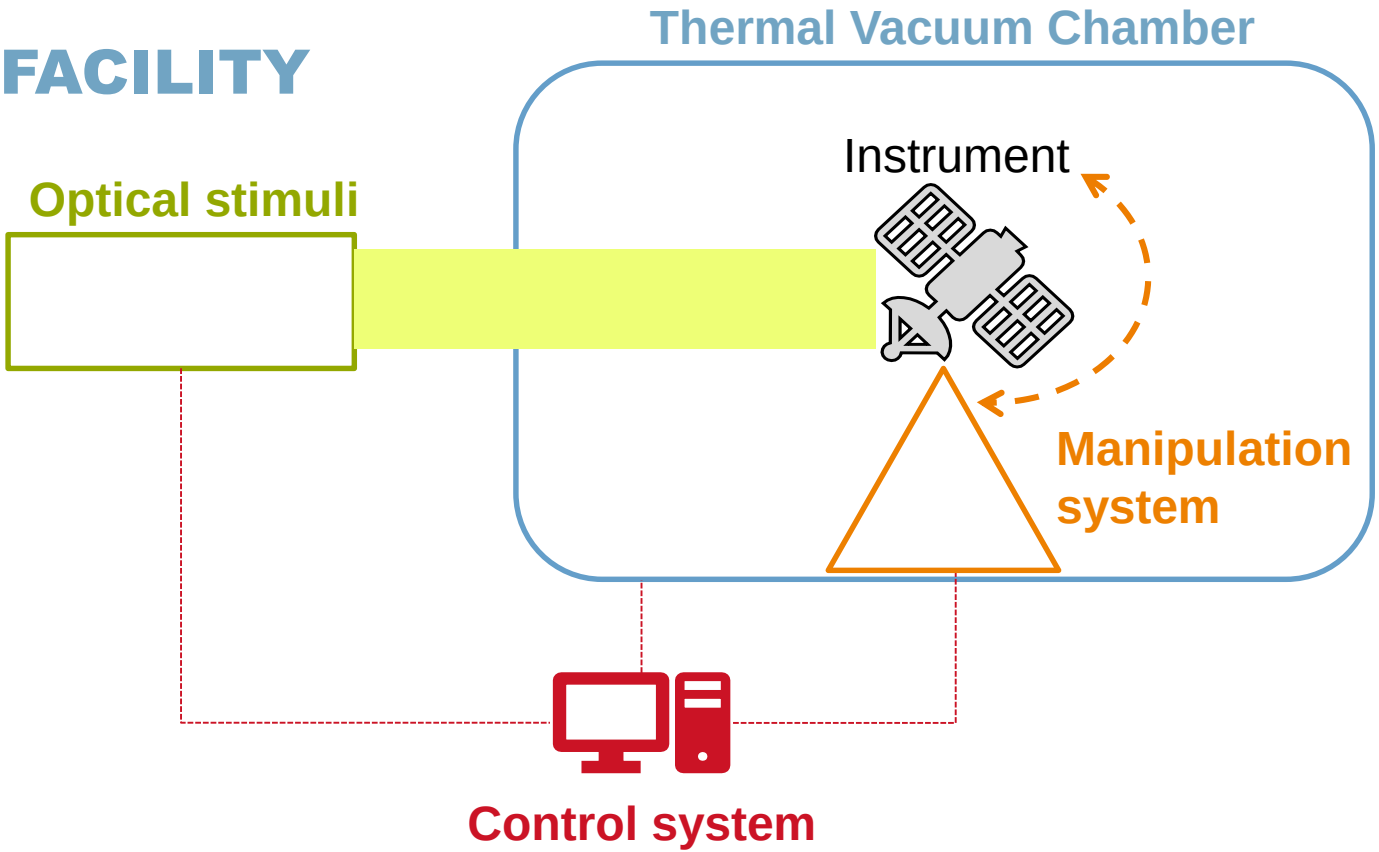
CURRENT FACILITY AT TNO

- Vacuum Calibration Facility (VCF)
- TVC in a dark clean room
- Diameter shroud 1,5 meter, length 2 meter

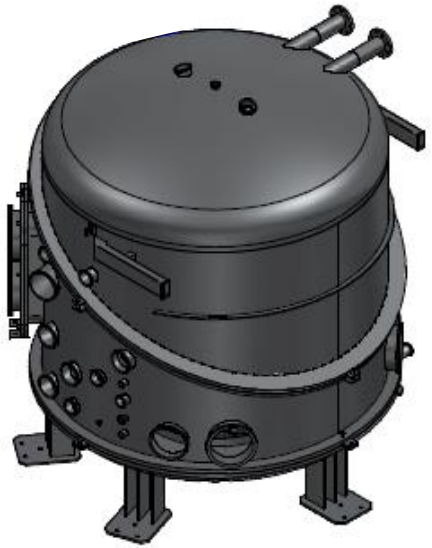




CSI FACILITY



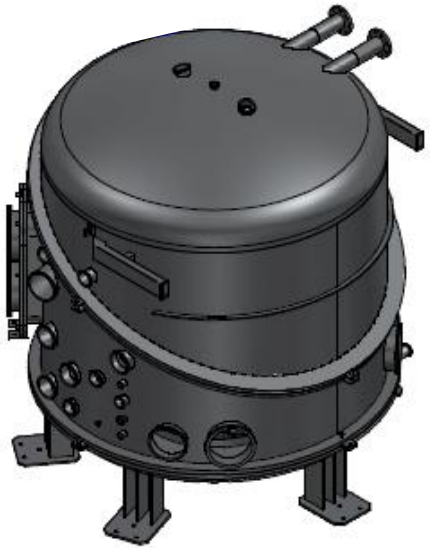
CSI: THERMAL VACUUM SYSTEM

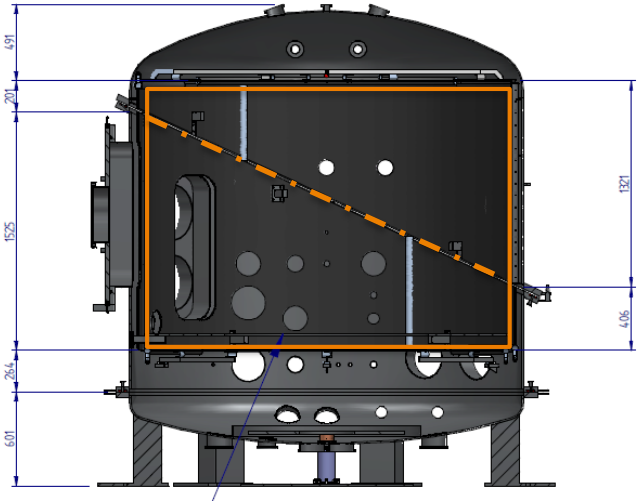


- Thermal Vacuum Chamber
  - Size: vertical cylinder of 2.7 m diameter and 2.5 m height
  - Inner shroud diameter of 2.4 m diameter and 1.6 m height
  - Shroud covering the full volume of the vessel
    - temperature range: -80 °C to + 80 °C
    - temperature rate of change: up to 3 °C/min
  - Two independent cold plate systems (or inner shroud)
    - temperature range: -173 °C to + 80 °C
  - Anticipated temperature stability of the instrument: <0.2 °C
  - Bake-out temperature: >100 °C
  - Ultimate pressure chamber: < 1x10-7 mbar

ACS

Angelantoni MORE THAN YOU THINK

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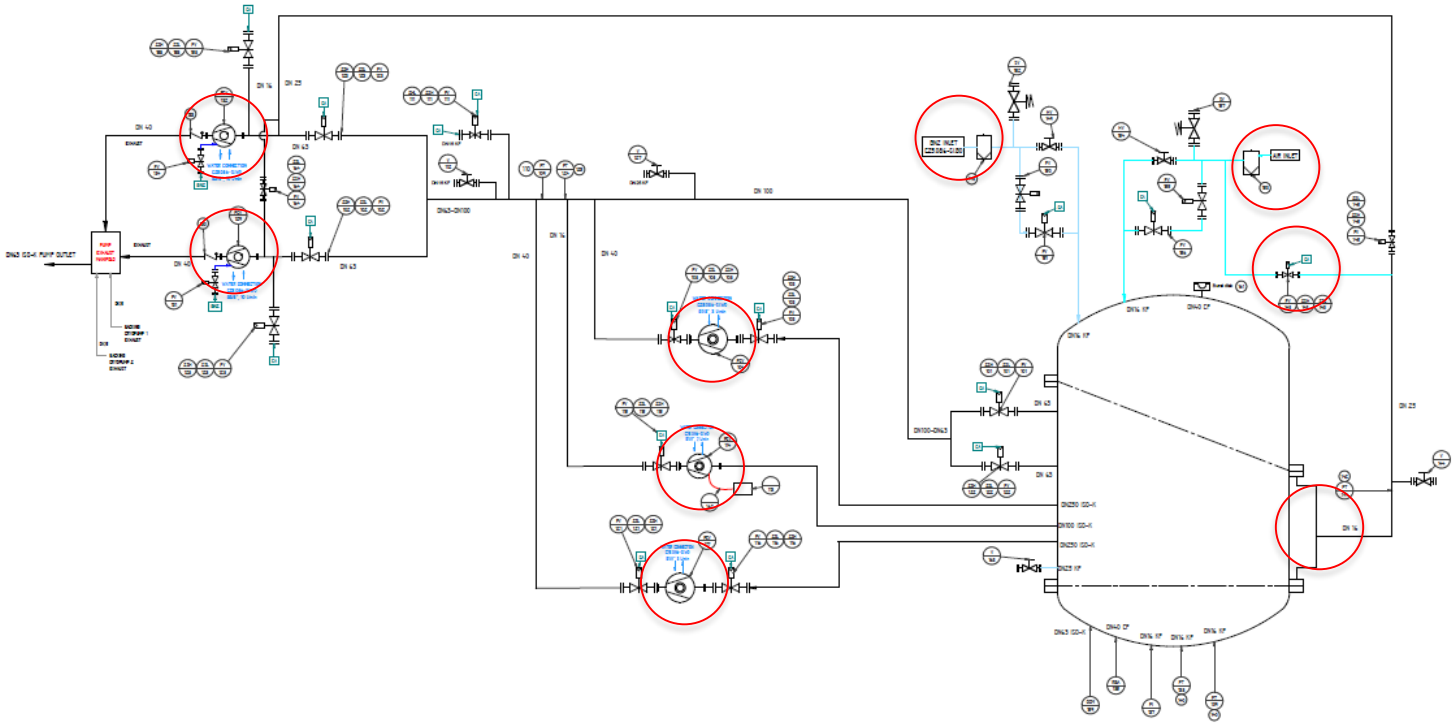
VACUUM AND THERMAL FACILITY



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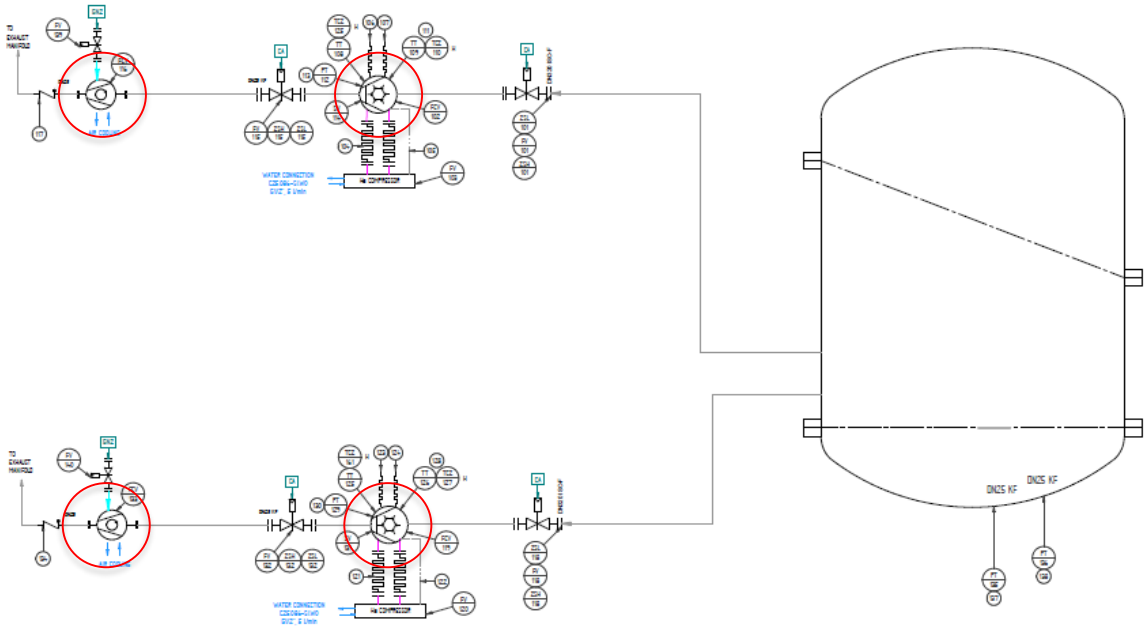

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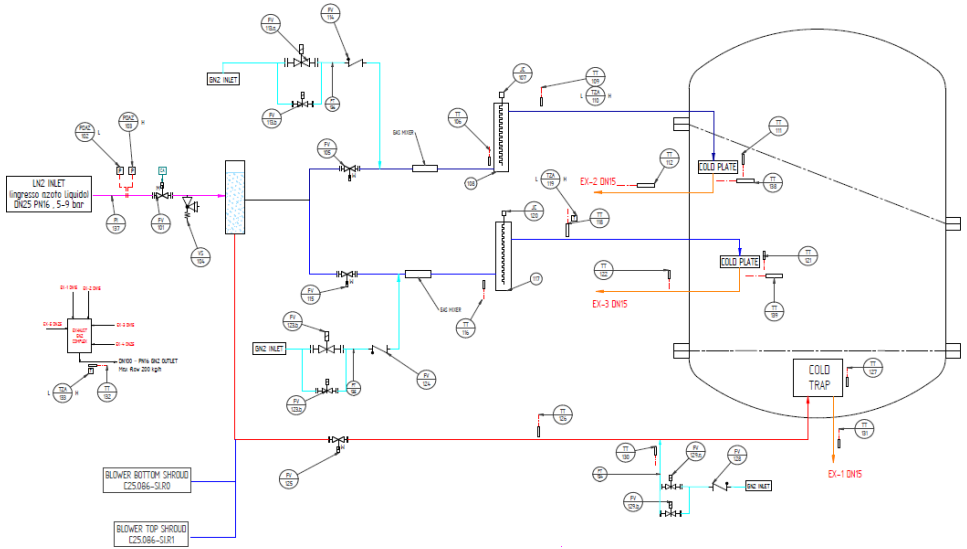
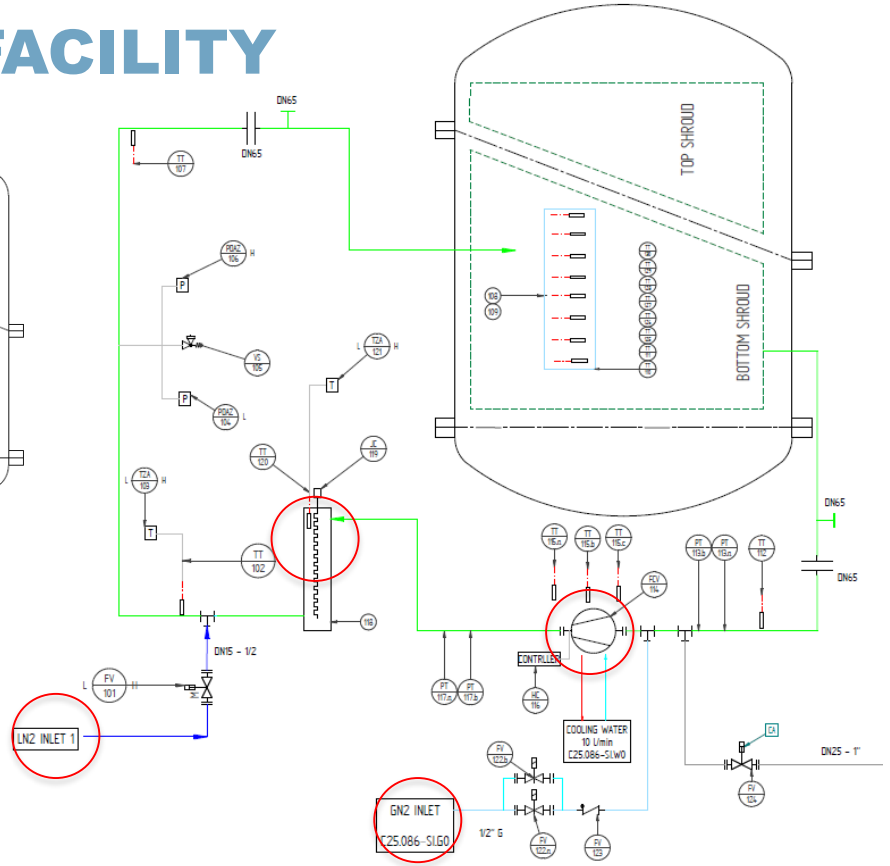
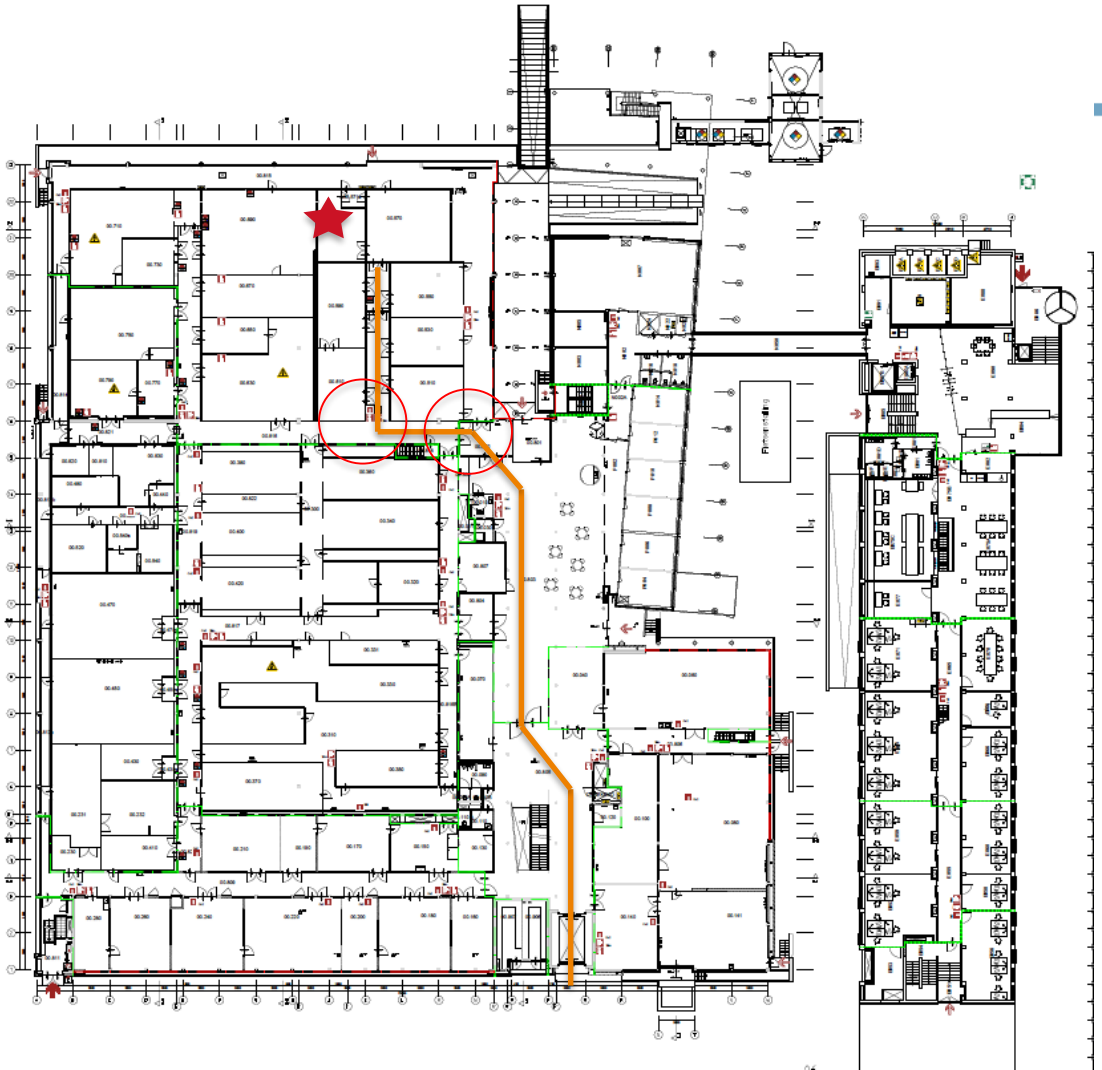
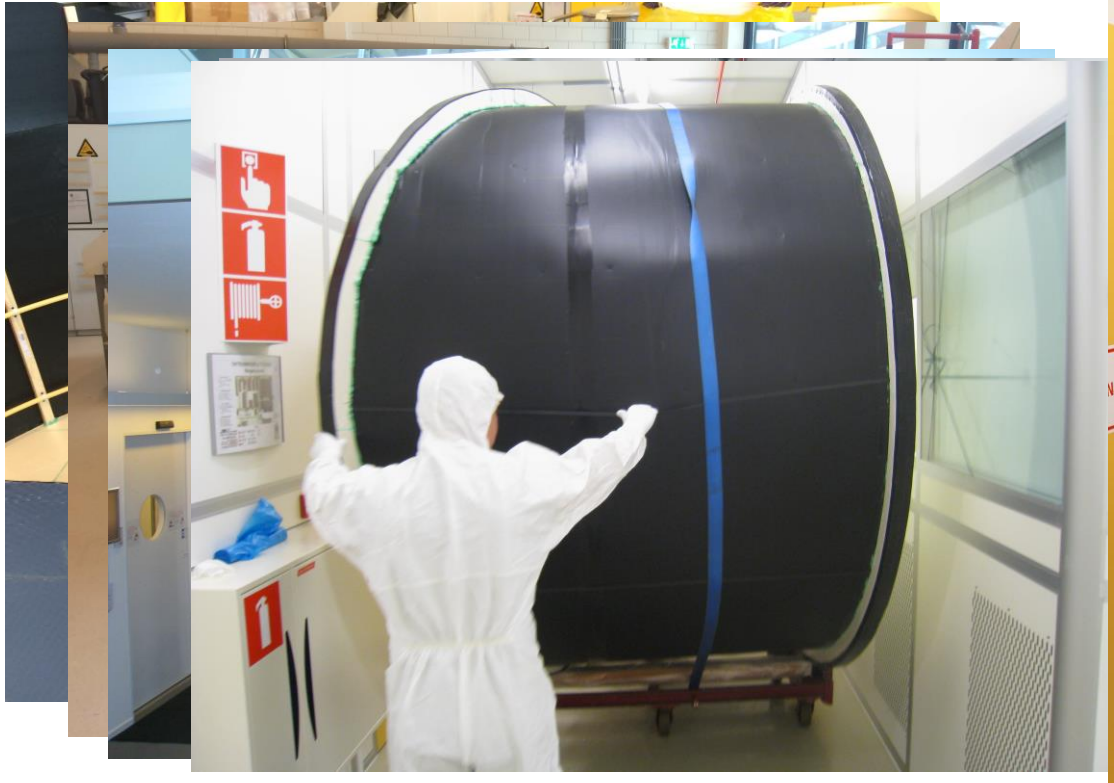




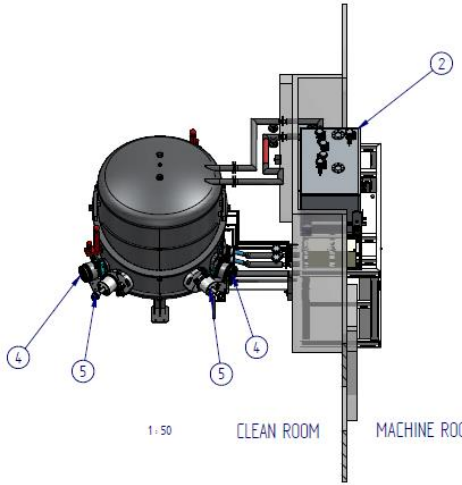
INTERNAL



INTERNAL TRANSPORT TEST



CLEAN ROOM



VCF

Docking of top vessel

Instrument entrance

Instrument assembly room

CSI

Optical stimuli ports

Machine room

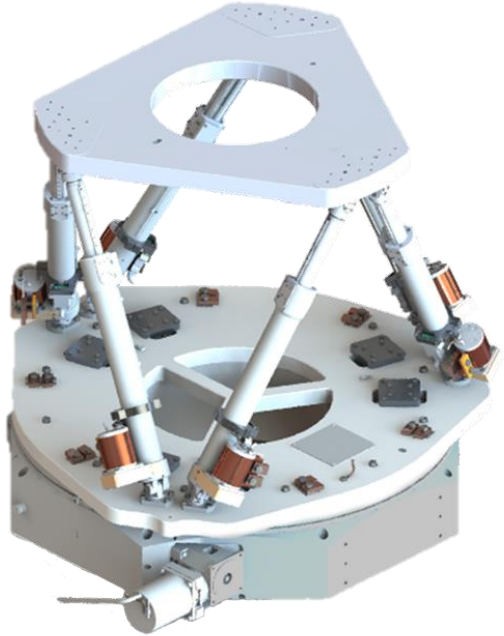
P00 570

P00.571

1 : 50

MECHANICAL MANIPULATION SYSTEM

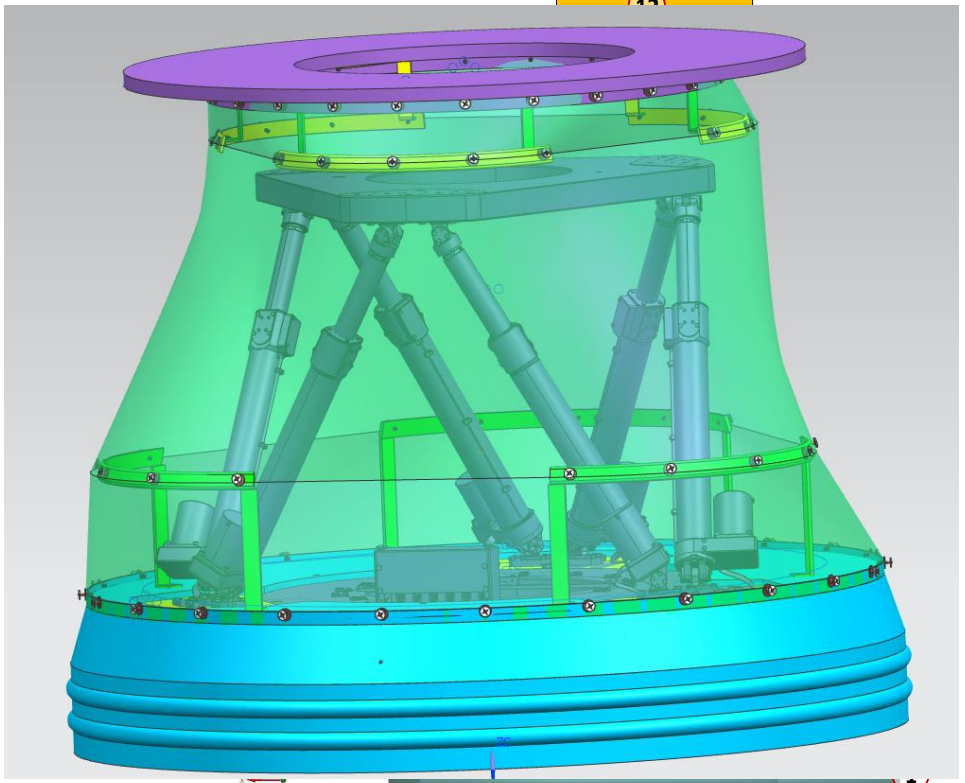
- The instrument has to be illuminated at many different angle relative to the optical stimuli
- Custom developed version of Symétrie Zonda hexapod on top of a Huber rotation stage
  - Increased mechanical stability over a large temperature range
- Maximum allowed instrument mass with manipulation 300 kg
- Rotation stage:
  - Instrument rotation: +/- 175°
- Hexapod:
  - Translation and rotation in 6 DOF
  - Maximum tilt is >15°
- Instrument pointing accuracy: < 0.001°



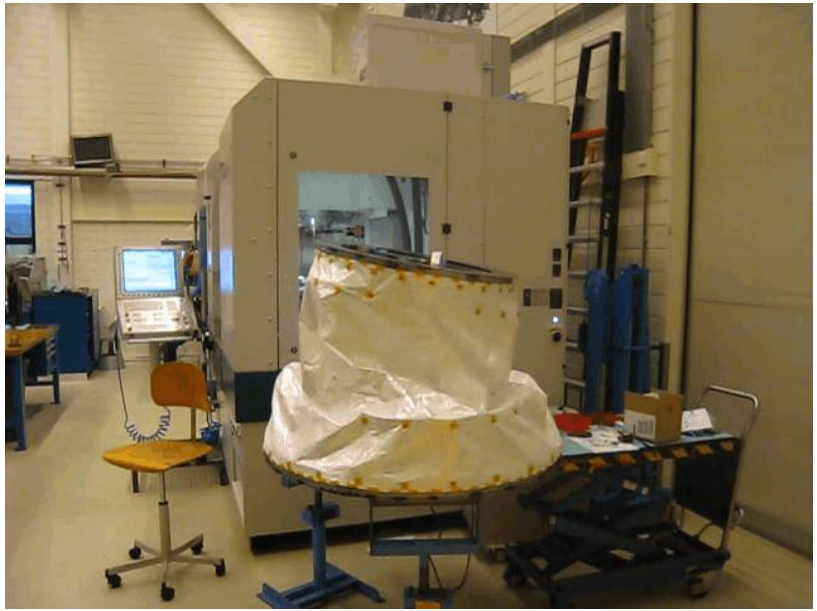
Symétrie

THERMAL CONSTRAINTS MANIPULATION SYSTEM

- TVC temperature range -80°C to +100°C during bake-out
- Hexapod and rotation table operation window +10° to +50°C
- Hexapod and rotation table survival temperature +10°C to +100°C



THERMAL CONSTRAINS MANIPULATION SYSTEM

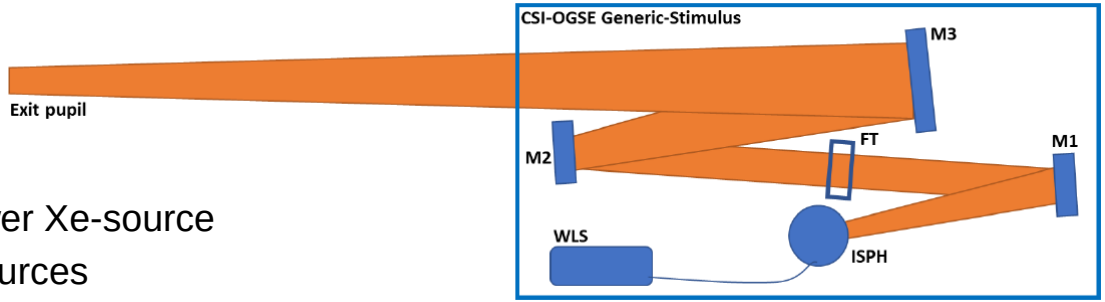


CONCLUSION

- TNO has a long heritage in the development of optical earth observation instruments, calibration units and calibrations
- TNO is investing in a new calibration system to remain a frontrunner in the space domain
- CDR for both the TVC and Manipulation system are finished and building has started
- CSI fully integrated and functional 1st of January 2021
- Goal is to have the most stable and clean TVC in the world!

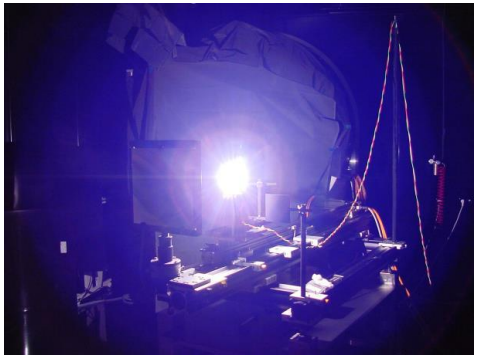

THANK YOU FOR YOUR ATTENTION
Take a look:
TNO.NL/TNO-INSIGHTS
TNO innovation for life
CSI
Calibration Space Instruments

OGSE



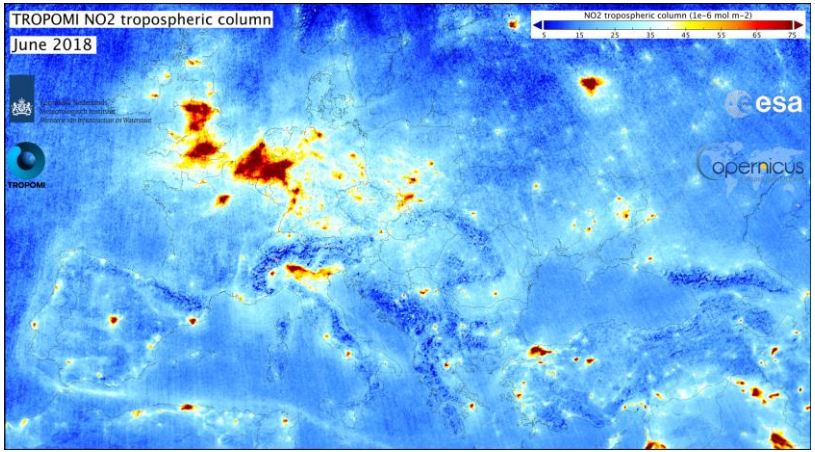
- New:
  - Generic Collimator with high power Xe-source
  - Possibility to simply add other sources

- Existing
  - FEL lamp setup + flat panel diffuser for absolute radiometric calibration
  - Integrating spheres
  - EKSPLA Tuneable laser
  - SLS
  - Slit function stimulus



RECENT TNO HERITAGE IN THE SPACE DOMAIN

TROPOMI on Sentinel 5P



Launched in 2017