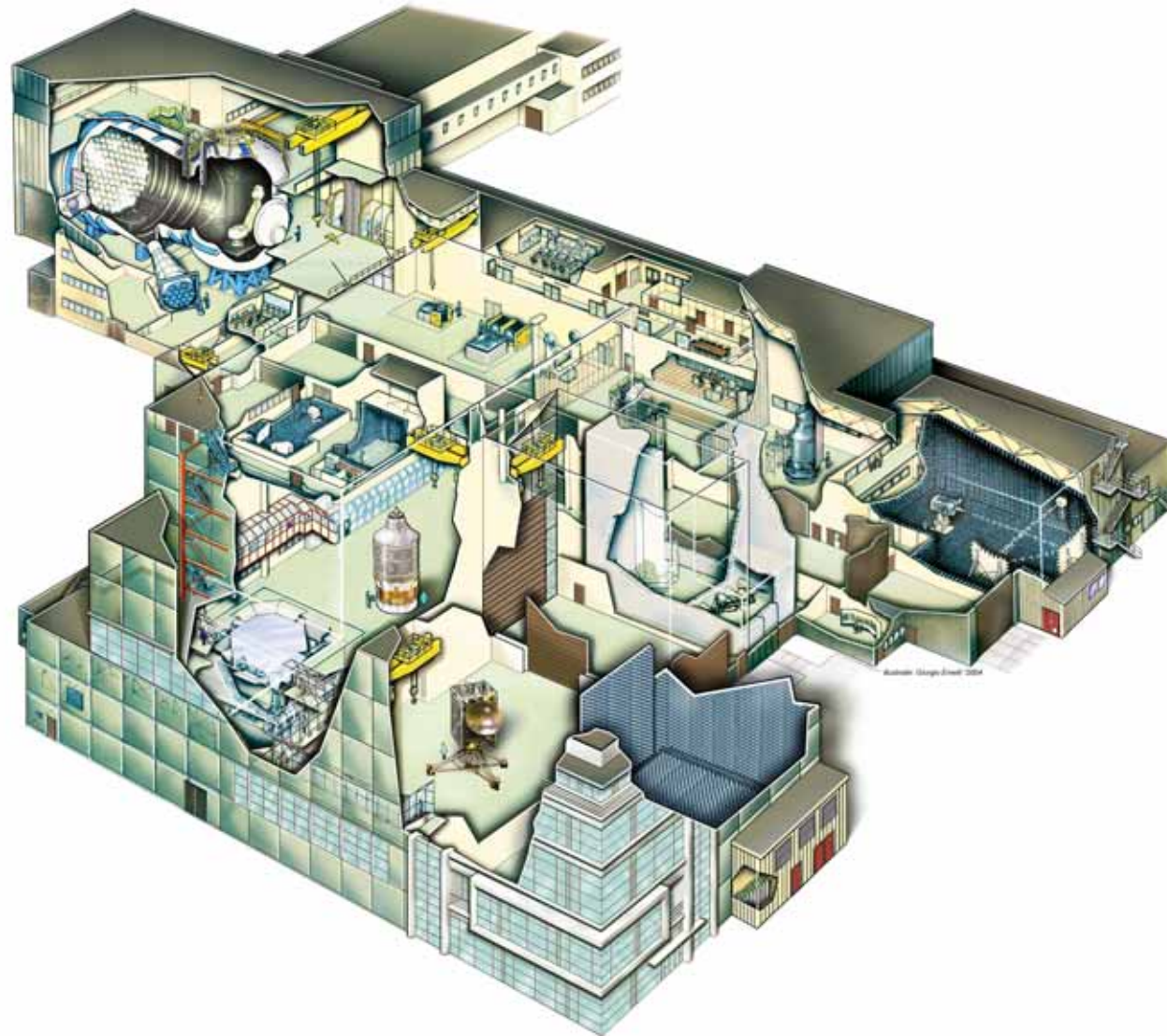




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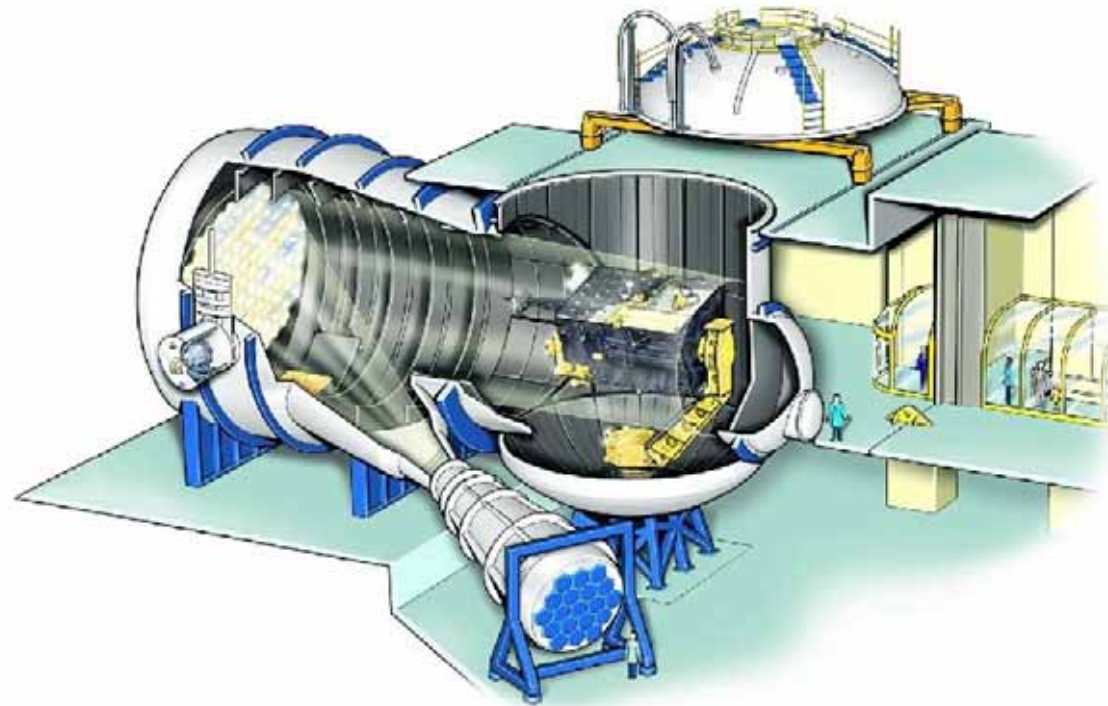
The ESTEC Test Centre in The Netherlands





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The parties involved



ESA:

Facilities owner

ETS:

Marketing, Management Operation & Sales of the
ESTEC Test Centre

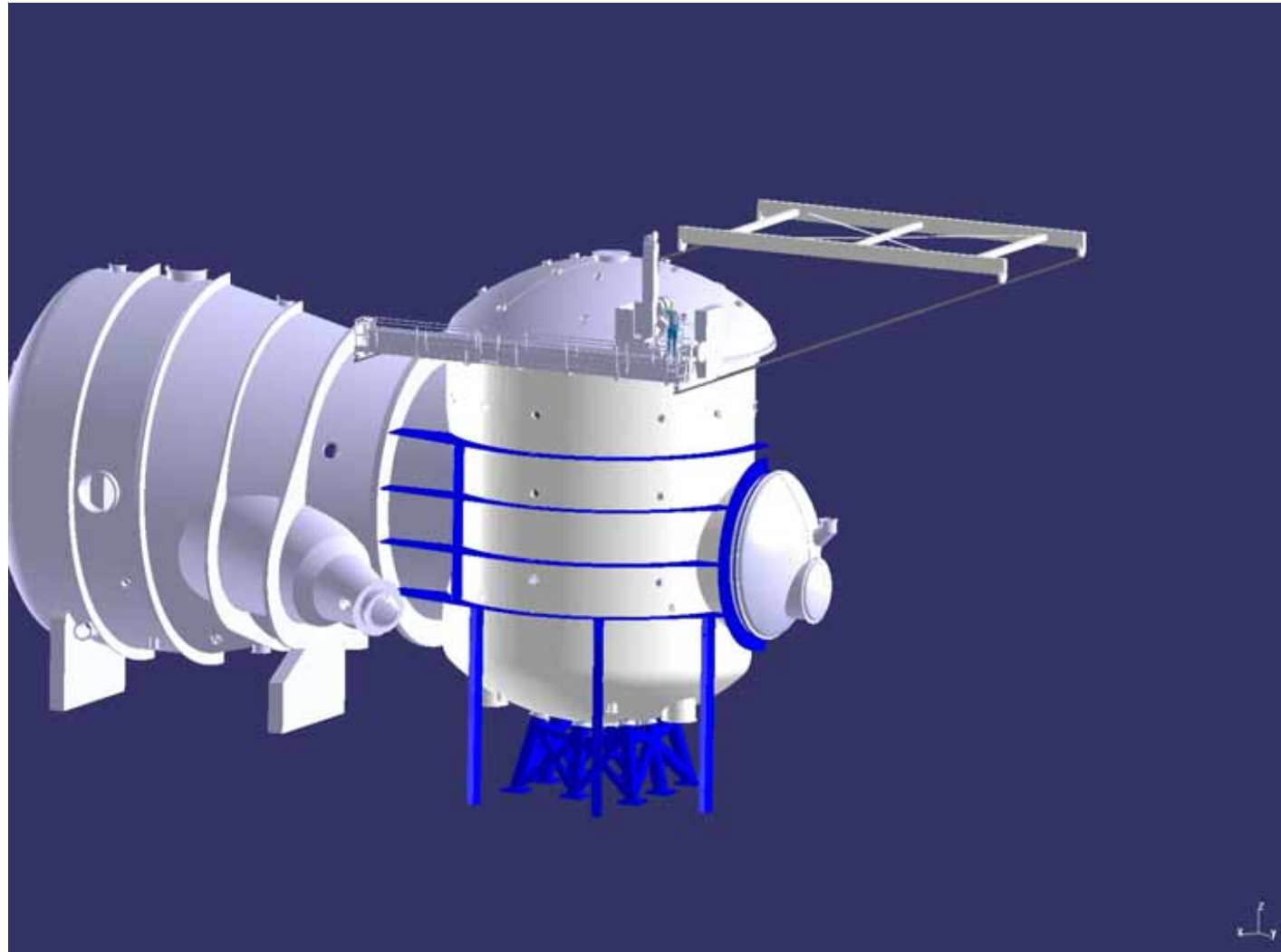
IABG & INTESPACE:

ETS shareholders



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A LSS facility tour





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The Large Space Simulator (I)

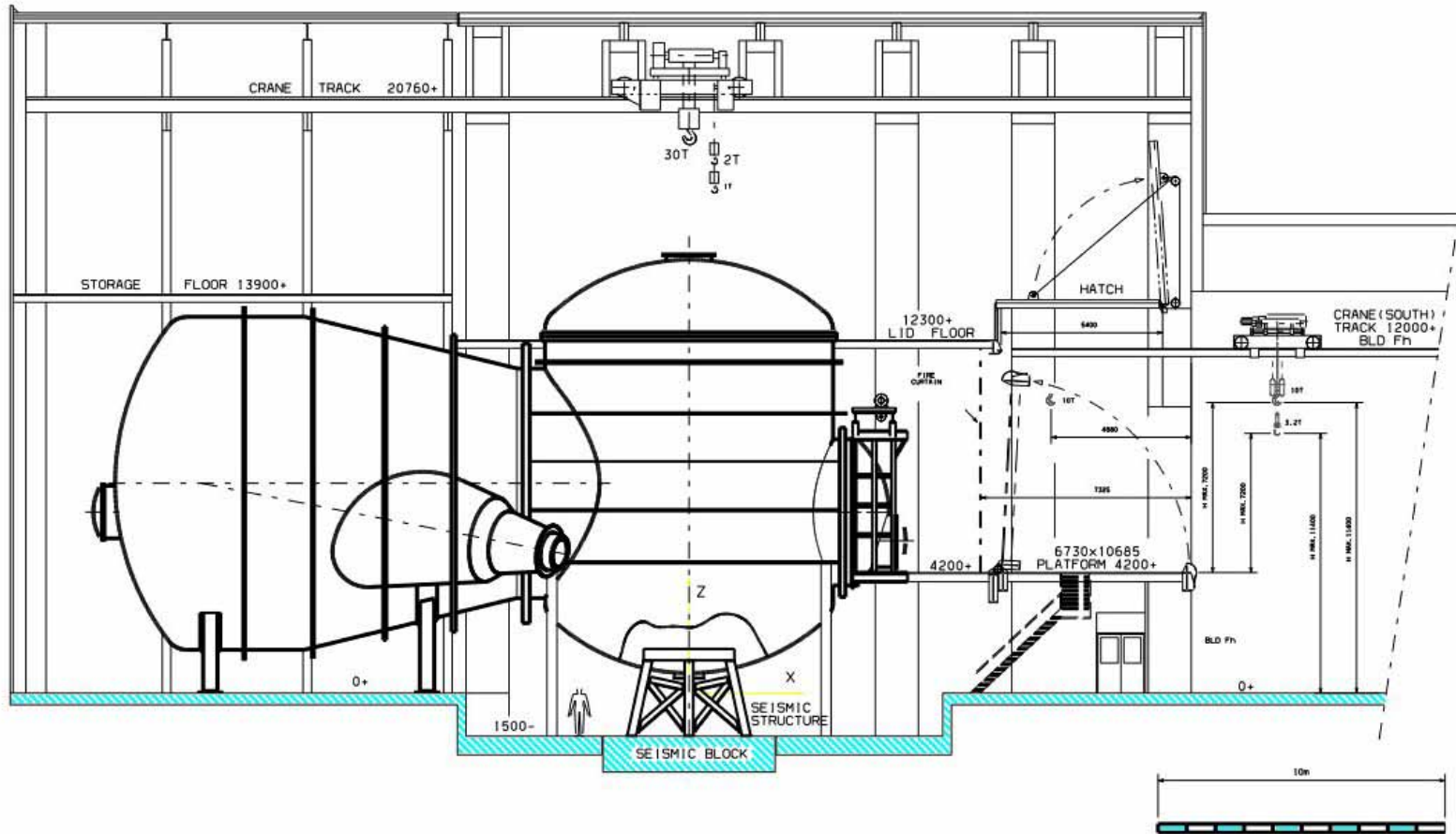
The Subsystems of LSS:

- HVP: 10^{-6} mBar
- MS: Yoke, Gimbal Stand
- SUSI: 2 SC, 6 m diameter (upgrade to 10 SC possible)
- SNSE: 100 - 350 K



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The Large Space Simulator (II)



Building view



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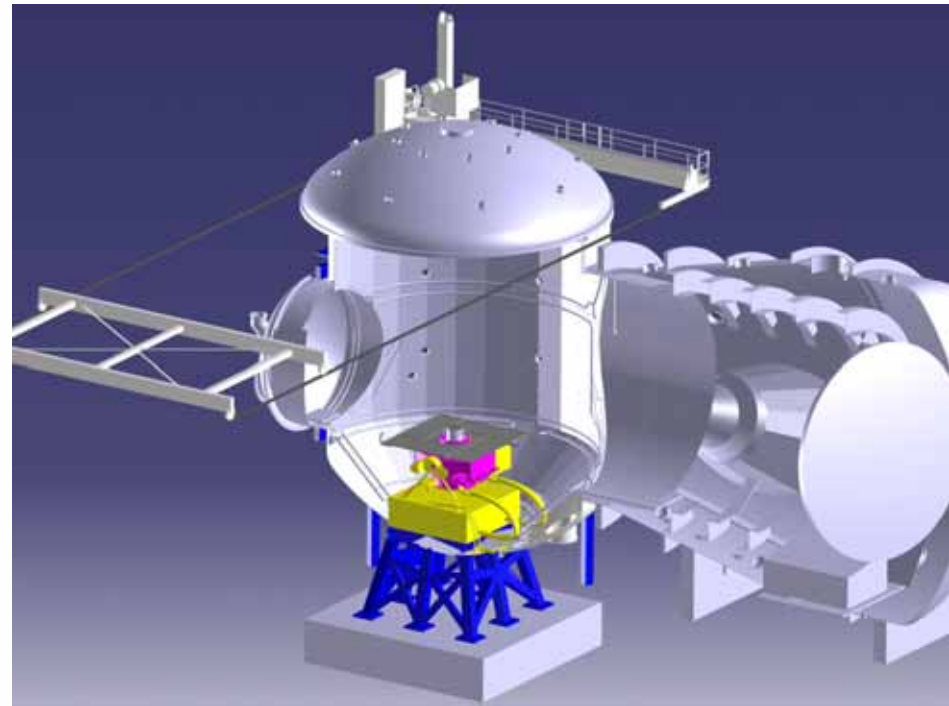
The Motion System (I)

Yoke:

- 180 ° Rotation
- Position accuracy: $\pm 0.4^\circ$
- Allowed Flexion Moment
at I/F: 209 kNm

Gimbal Stand:

- $\pm 30^\circ$ Rotation
- Position accuracy: $\pm 0.1^\circ$
- Allowed Flexion Moment
at I/F: 75 kNm





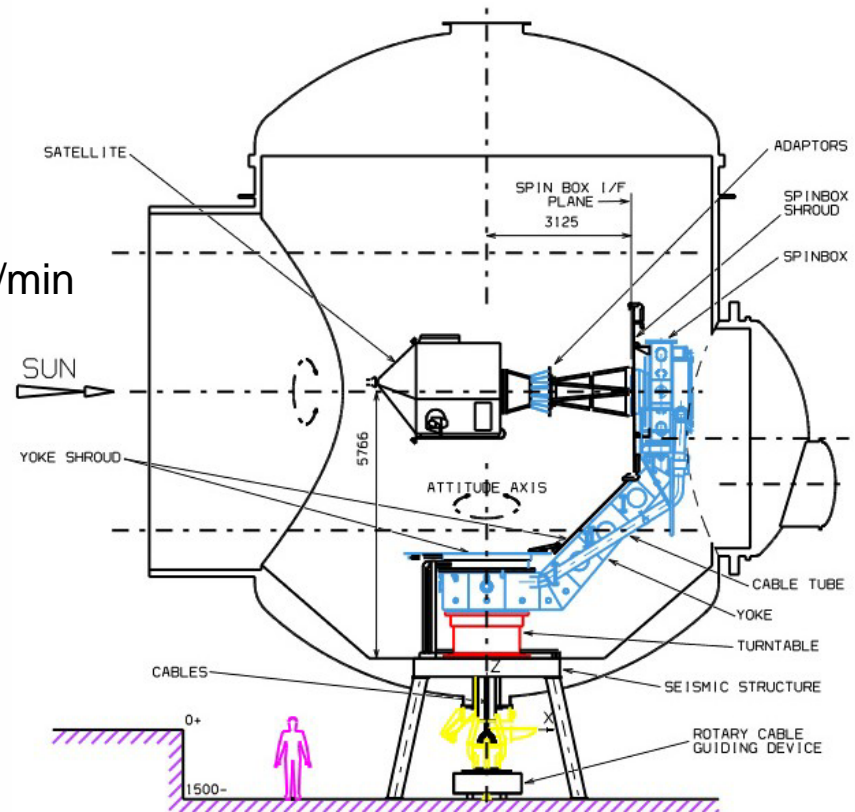
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The Motion System (II)

- Yoke installation in 2 positions
- Specimen mass: < 5000 kg

Spin Box:

- Speed Range: 10-60 Deg./min
- Max. braking torque: 630 Nm
- Max acceleration: 1 rads^{-2}
- Max. allowed moment: 630 Nm



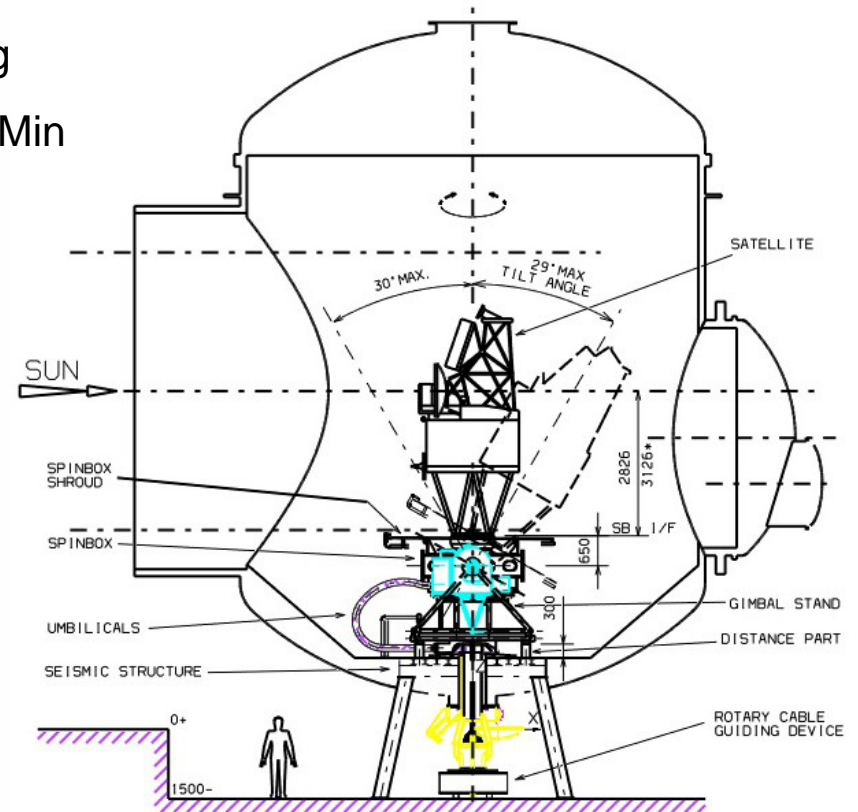
Motion System in Yoke configuration



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The Motion System (III)

- GS installation in 2 positions
- Specimen mass: < 5000 kg
- Speed Range: 1-3 Deg./Min
- Max acceleration: 1 rads-2
- Max. allowed moment on S.B. axis: 630 Nm

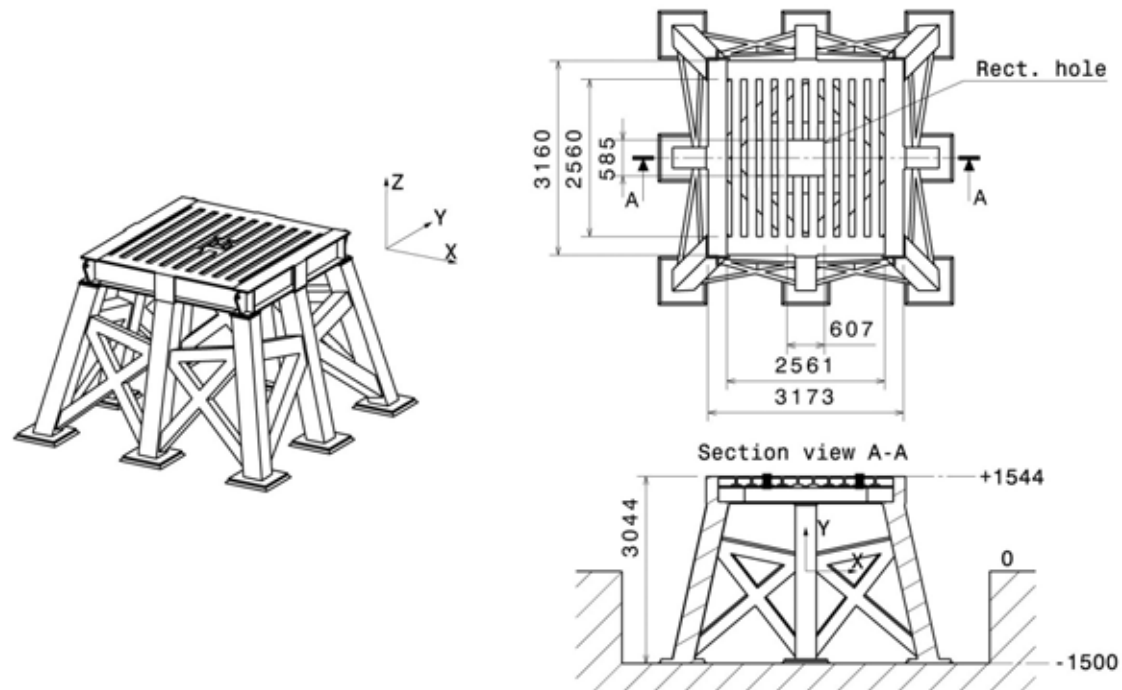


Motion System in Gimbal Stand configuration



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The Seismic Table



Mechanical noise transmitted to specimen: $10^{-3} \text{ mg}^2\text{Hz}$ [0-20 Hz]



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The High Vacuum Pumping System (I)

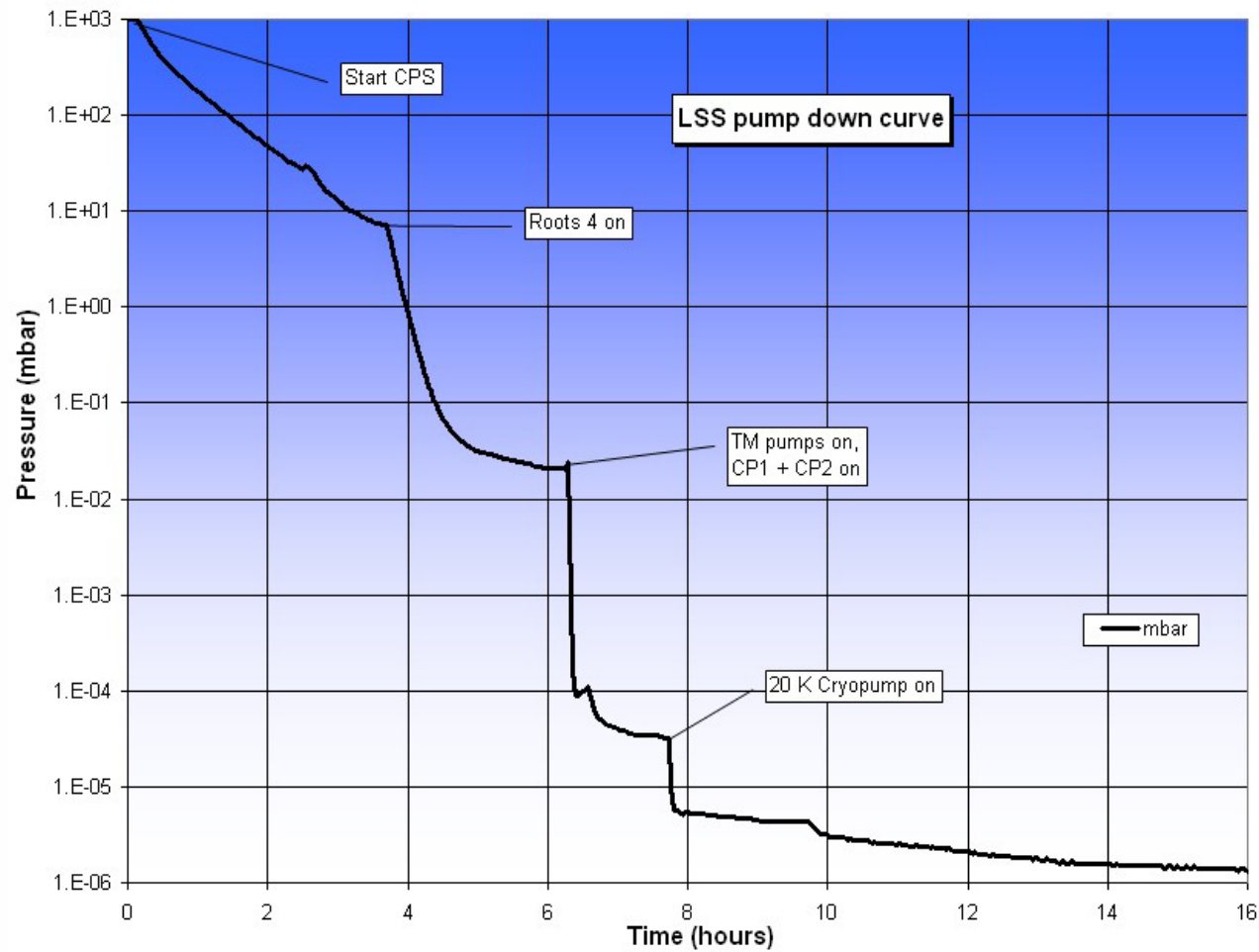
- Primary Vacuum: 10^{-3} mbar -14000 m³/Hour (air)
- Root: 10^{-3} mbar -20000 m³/Hour (air)
- 4 TM: 10^{-5} mbar -8000 m³/Hour (air)
- 2 * 20 K Cryo-pumps: 48 m³/s (Nitrogen)
- 4k Helium Cryo-pump: 400 m³/s (Nitrogen)



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The High Vacuum Pumping System (II)

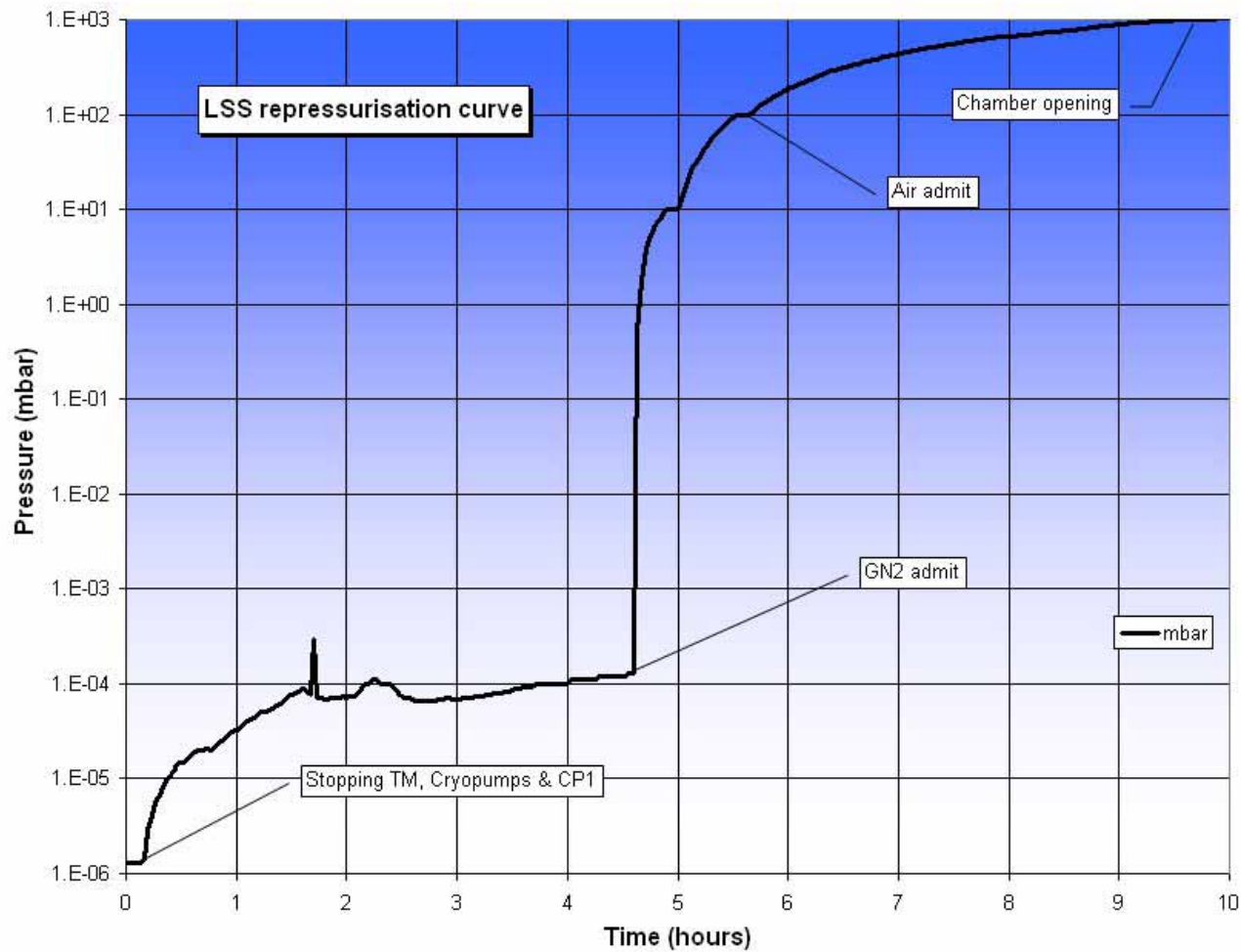


LSS Pump-down curve



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The High Vacuum Pumping System (III)





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The SNSE System (I)

Shrouds Liquide Mode:

- Shroud Temp: <math><100\text{ K}</math> (10K max gradient)
- Max heat load: 170 kW (LN₂ mode)

Shrouds Gas Mode:

- Shroud Temp: 150 - 350 K (30K max gradient)
- Max heat load: 10 kW (GN₂ mode)

Shrouds (Chemglaze Z306):

- Emissivity: 0.9
- Absorbtivity: 0.95

Auxiliaries:

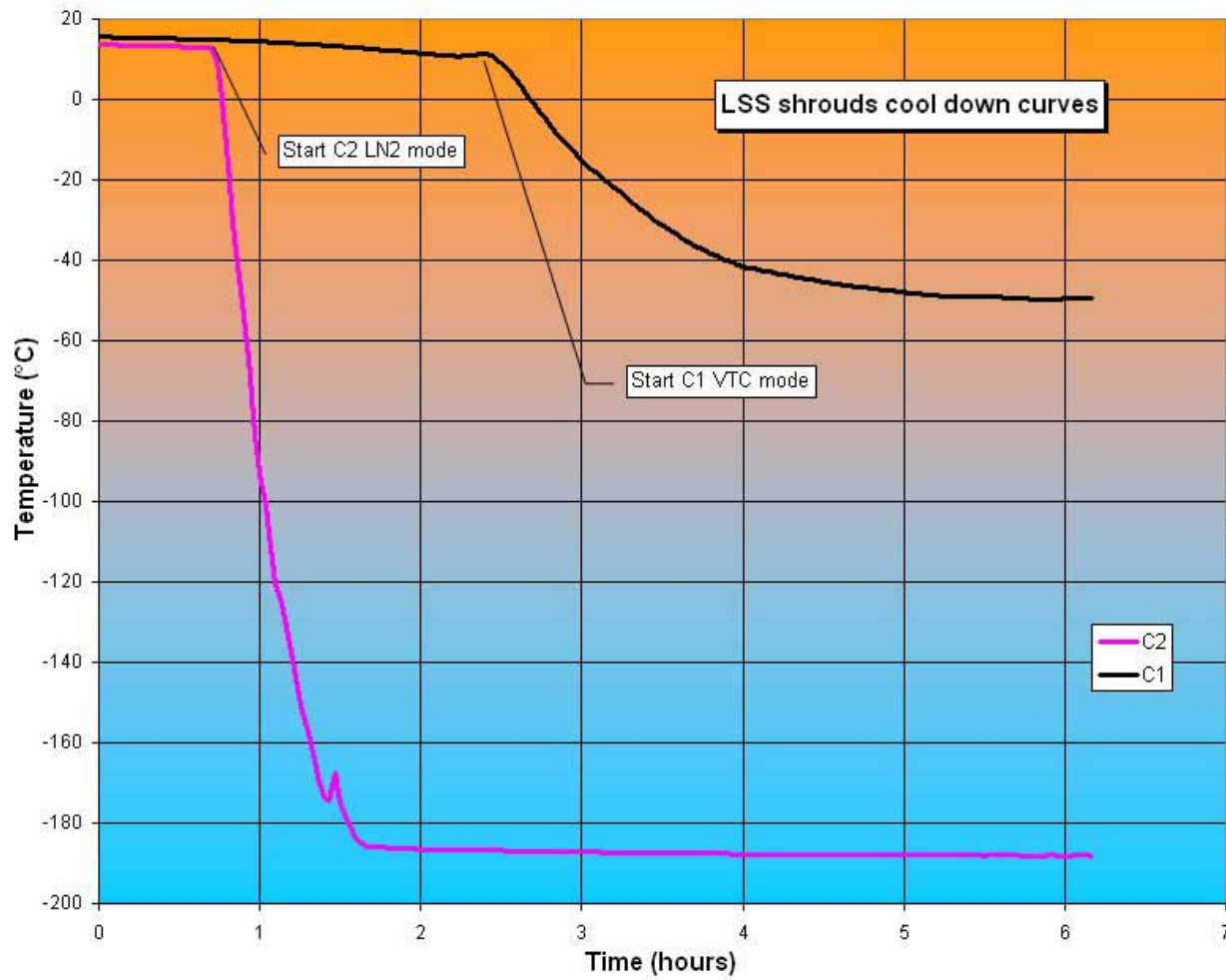
- GHe Close loop circuit: 20 Watt heat load at 30 K
- 2 LN2 lines: Flow rate 30-300 l/hr at 3 bar
- GHe open loop: Flow rate 3 kg/hr at 200 mbar



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The SNSE System (II)

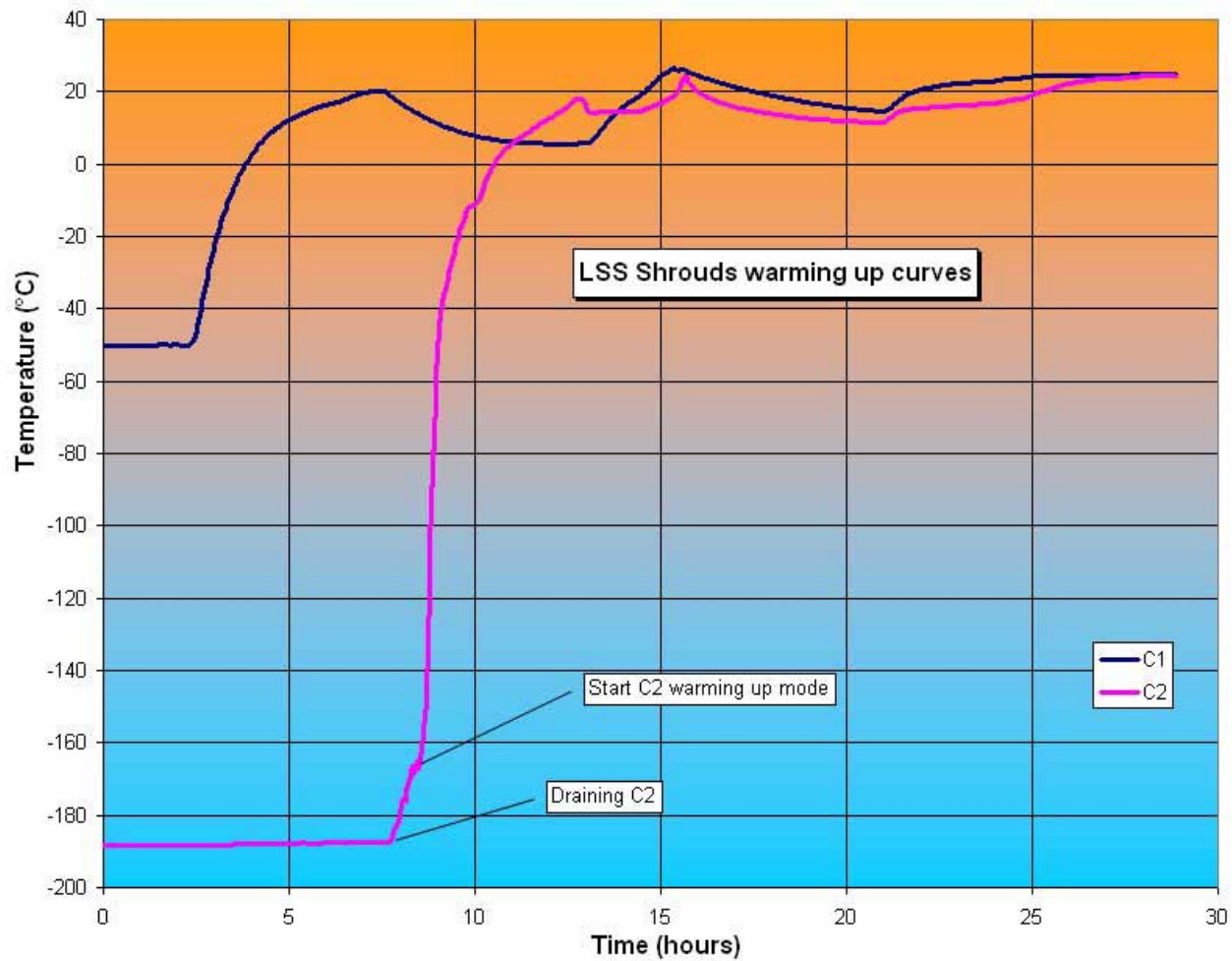


LSS shrouds cool-down curves



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The SNSE System (III)



LSS shrouds warm-up curves



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The Sun Simulator (I)

- Test Volume: 6 m Φ - 5 m Length
- Max Flux level: 2600 W/m²
- Flux intensity distribution: $\pm 4\%$ w.r.t Ref. Plane
- Flux intensity distribution: $\pm 6\%$ w.r.t Ref. Volume
- Emissivity: 0.015
- Absorptivity: 0.13
- Collimation Angle: $\pm 1.9^\circ$

2006 Upgrades:

- Eclipses simulation

2008 Upgrades:

- 10 Solar Constant on 3 m Φ

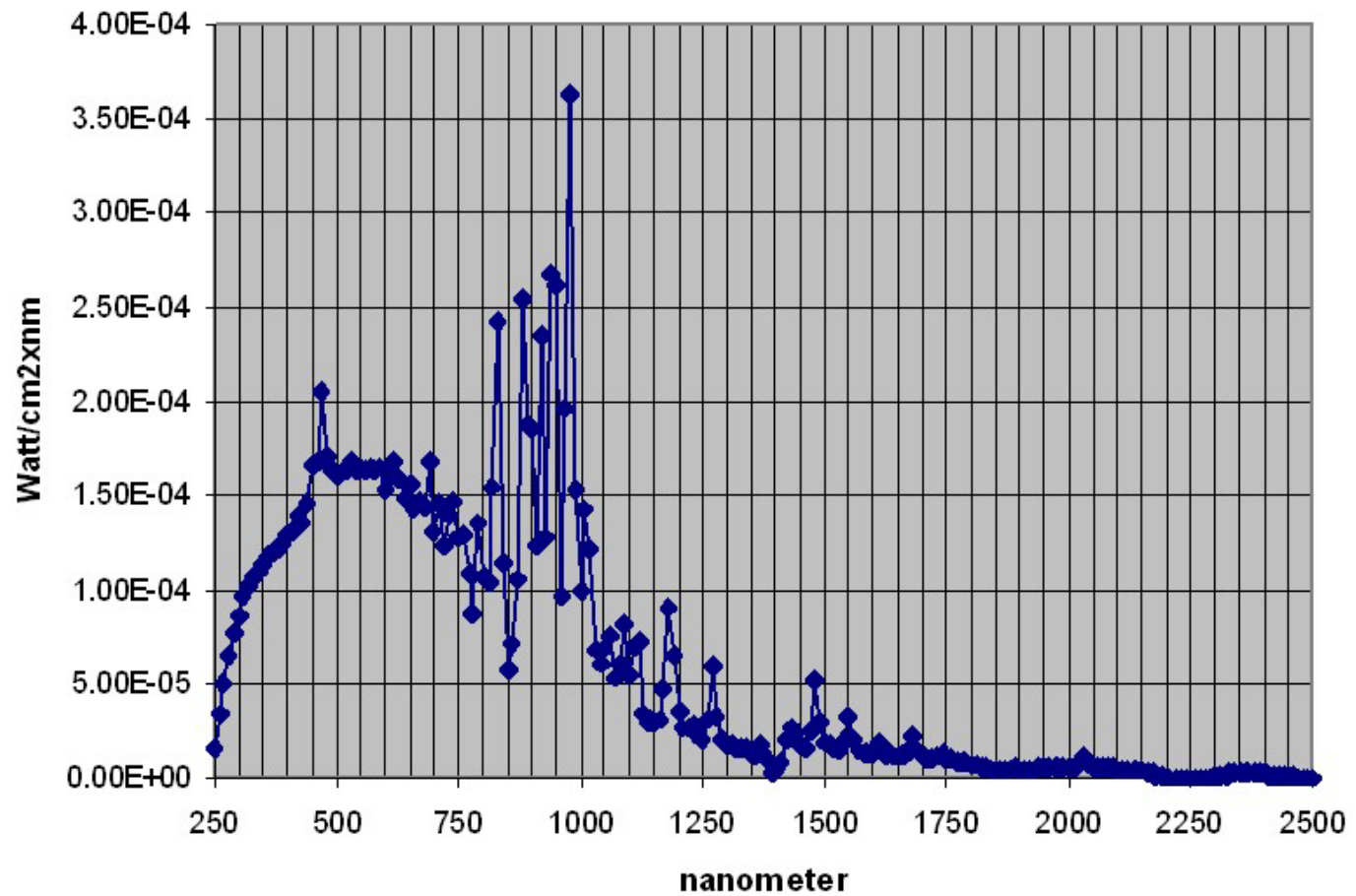


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The Sun Simulator (II)

SUSI IRRADIANCE AT 1378 W/m²





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The Thermal Data Handling System (I)

Analogue (direct) channels:

- Voltage measurements
- Current measurements
- Resistance measurements
- Thermocouple types B, E, J, K, N, R, S, T
- Resistance temperature devices (Pt-100, Thermistors, etc.)

Analogue (multiplexed) channels:

- T-type thermocouples
- Pt-100, Pt-500

Digital channels (for facility house keeping only)



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The Thermal Data Handling System (II)

Channel Availability:

<i>Description</i>	<i>Connecting unit</i>	<i>No. channels</i>
LSS facility		
Multiplexed T-type thermocouples	VTR/DCU	864
T-type thermocouples	VTR	144
Pt 100 and Pt 500 thermometers	PTDCU	112 (104 + 8)
Analogue channels	HP 34970A	540 *)



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The Thermal Data Handling System (III)

Channel Availability via Slip Ring Unit:

<i>Description</i>	<i>Internal connector</i>	<i>External connector</i>	<i>no. connectors</i>	<i>no. channels</i>
Thermocouple signal direct lines	D-type	D-type	12	216
1 A power lines	Deutsch 13084-37-SY-5020	Deutsch DS07-37-SY-059	6	144
5 A power lines	Deutsch 13084-37-2SY-5020	Deutsch DS07-37-2SY-059	5	49
15 A power lines	Deutsch 13084-37-3S-5020	Deutsch DS07-37-3S-059	8	32
100 kHz signal channels	Deutsch 13084-37-S-5020	Deutsch DS07-37-S-059	2	24
10 MHz signal channels	Deutsch 13084-37-SB-5020	Deutsch DS07-37-SB-059	2	16
VHF signal channels	BNC	BNC	8	8
UHF	SMA	SMA	2	2



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The Thermal Data Handling System (IV)

Available Power Supply Units:

<i>Description</i>	<i>Power (W)</i>	<i>V/A range</i>	<i>No. units</i>
Konstanter MSP24	24	40 V / 0.6 A	40
Konstanter SSP240	240	40 V / 6 A or 80 V / 3 A	84

Control modes:

- Thermostatic
- Fine Control law (constant power and steady temperature)



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Projects 1990 to 2005

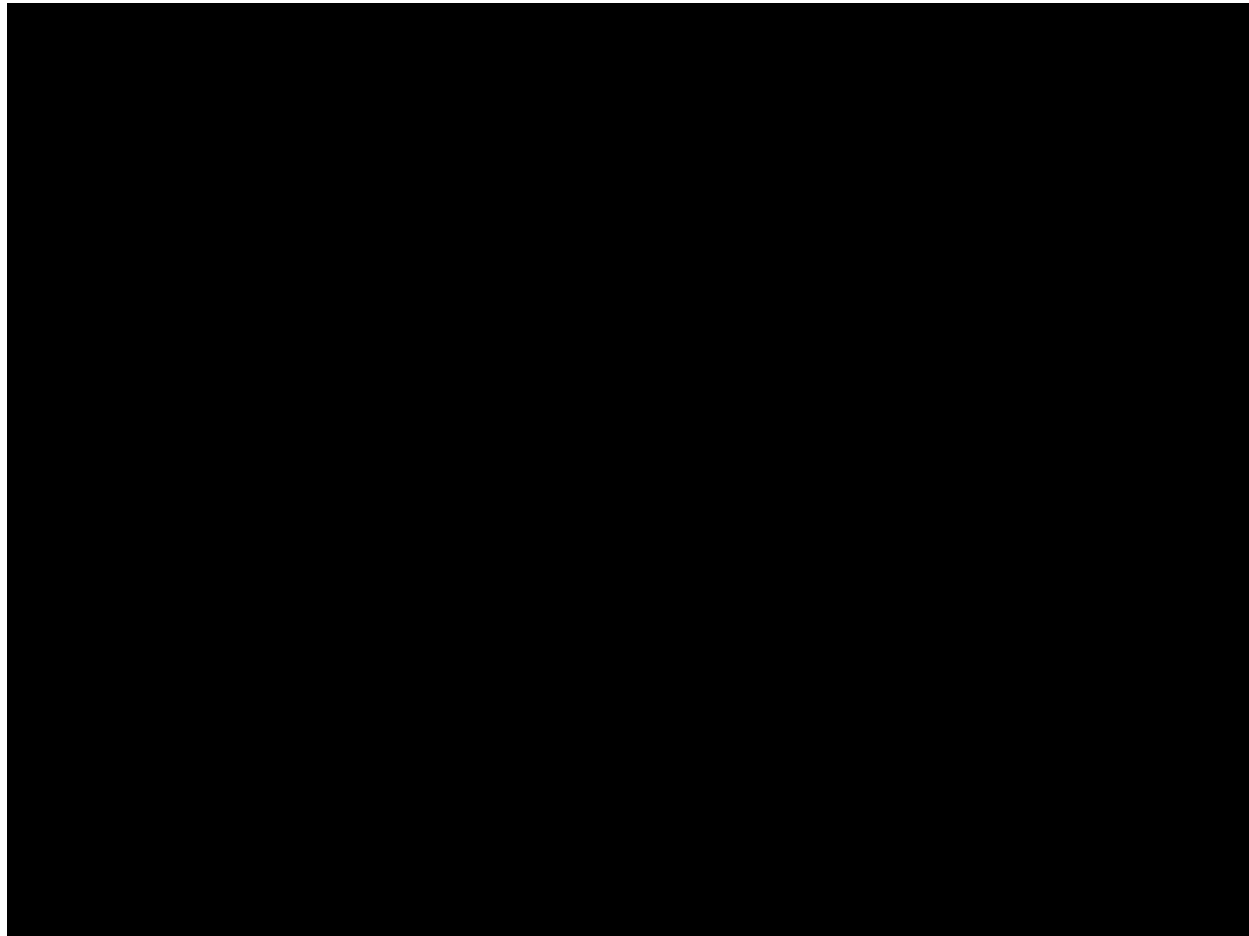
1991-1993	INTELSAT 7-8
1993	ERS 2
1994	ISO
1995	SAX
1996	ENVISAT
1997	XMM STM
1998	ARTEMIS, MSG STM, INTEGRAL STM
1999	XMM FM
2001	HUBBLE SOLAR ARRAYS
2002	INTEGRAL PFM, ROSETTA, ATV,
2003	METOP FM1, SMART 1
2004	METOP FM2, ATV PFM
2005	Herschel STM, SMOS PLM, GSTB-V2A



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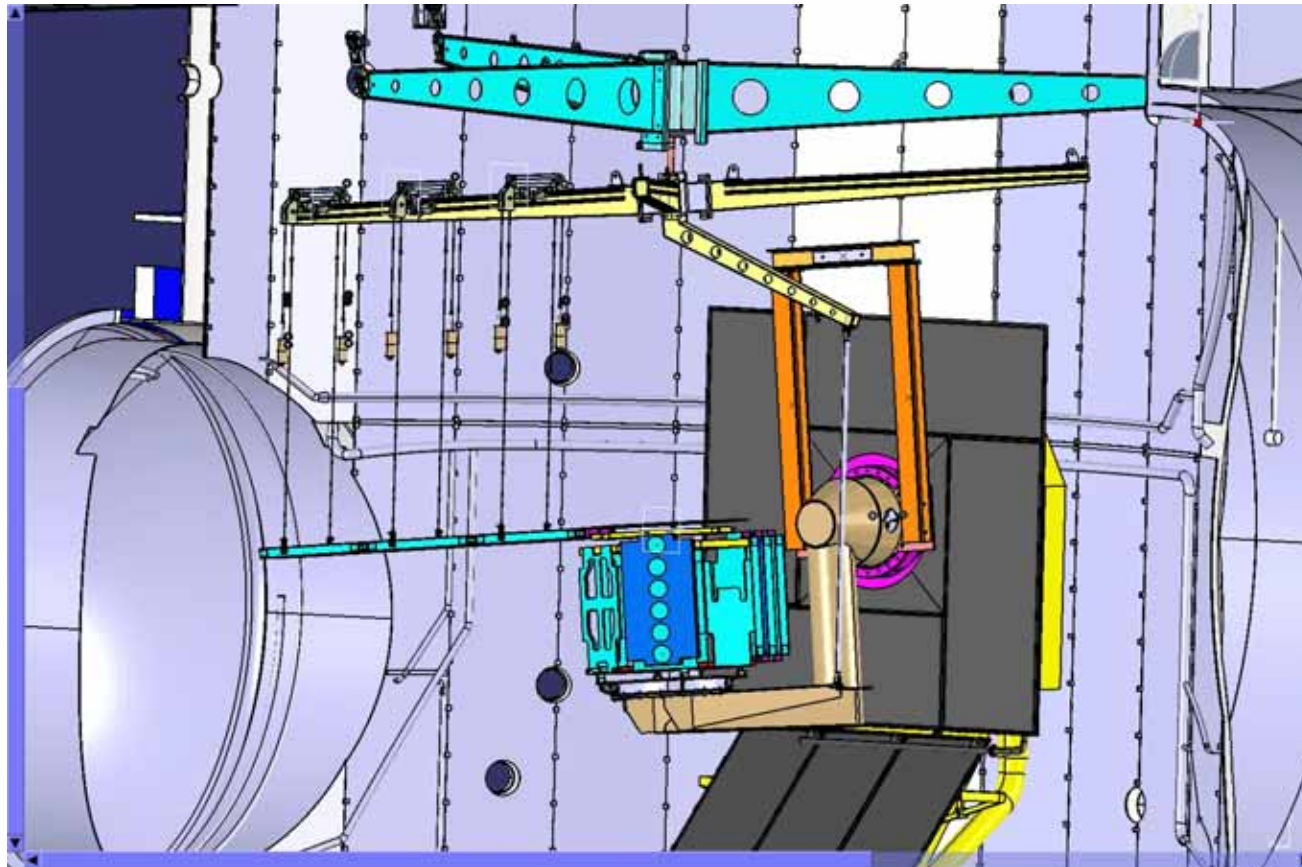
SMOS PLM Test setup in LSS





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SMOS PLM kinematic in LSS





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Projects 2006 and later

- GOCE FM
- AMS 02
- HERSCHEL FM
- AEOLUS FM
- PLANCK
- GAIA
- BEPI COLOMBO



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Using the ESTEC Test Centre

Direct relationship with ETS:

- RFQ
- Documentation Review
- Technical Meeting
- Preliminary facility booking
- ETS quotation
- Technical & contractual negotiation
- Agreement (Contract with ETS)

ETS Contact:

Dr. Ralf Effenberger, Managing Director

Ralf.Effenberger@esa.int

Tel +31 (0)71 565 42 90

www.european-test-services.net



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