Institute of Experimental Physics

Department of Space Physics

Over 60 years of Space Research Experience in Kosice, Slovakia

Prof. Juraj Dubinský
(*1914 – †1994)

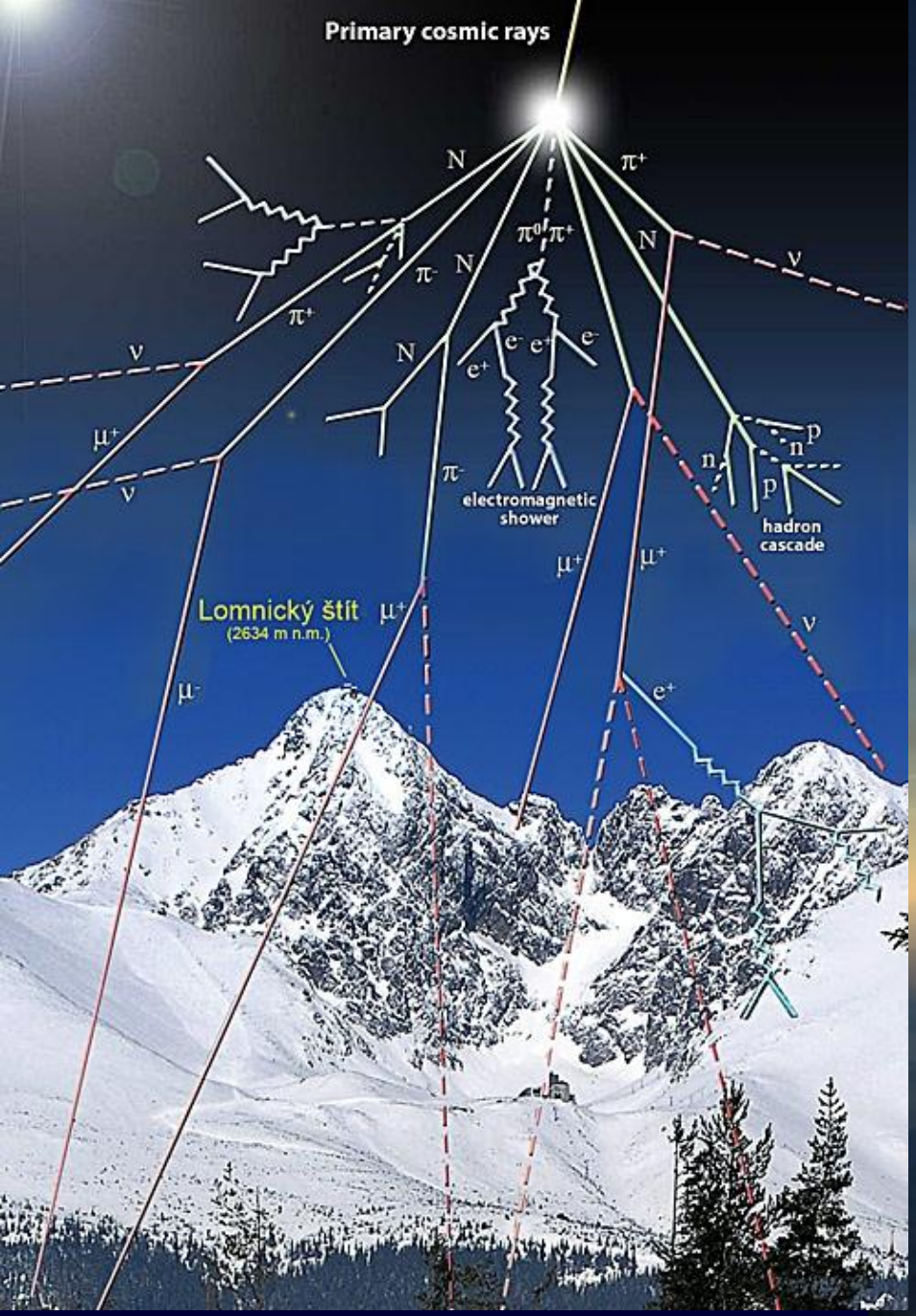
Founder of Space Research tradition in Kosice. Cosmic rays measurements since 1950 at Lomnicky Stit mountain observatory. His group joined INTERKOSMOS programme already in 1966.

Prof. Karel Kudela

Most influential science and managerial leader in history of the Department of Space Physics. Head of the Department 1980 – 2010.

Dr. Jozef Rojko
(*1934 – †2011)

Founder of Space Technology tradition in Kosice, leading designer of many spaceborne scientific devices for INTERKOSMOS and later Russian missions 1973-1996.



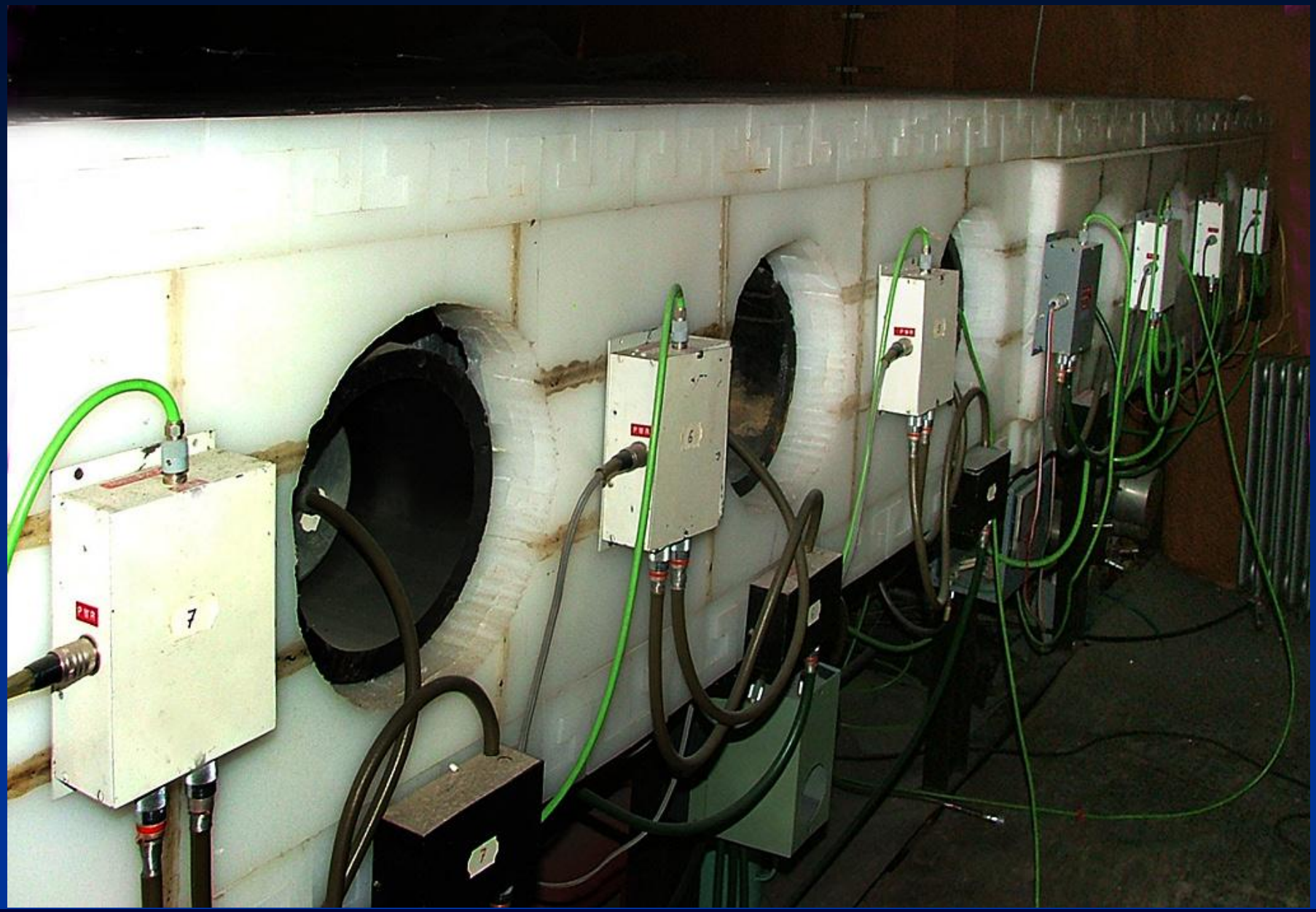
Mountain observatory at

Lomnicky stit (2634 m above sea level)

is equipped with cosmic rays detector since 1957 (YGI)

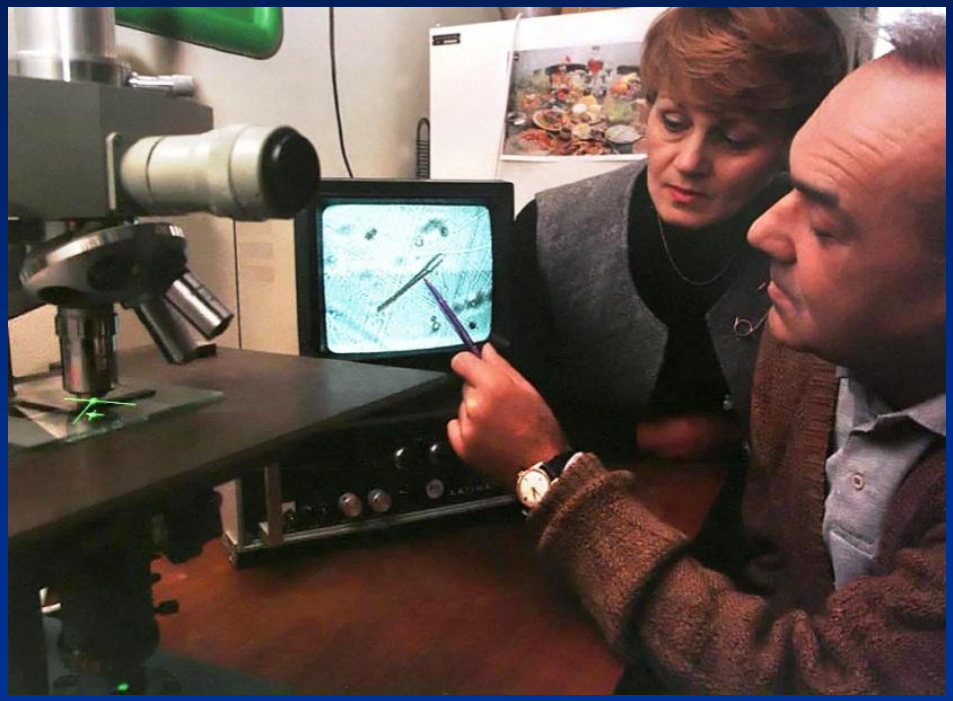
(http://neutronmonitor.ta3.sk)

Neutron monitor at Lomnicky Stit



A milestone: Participation in INTERKOSMOS

- First spaceborne experiments with IEP-SAS participation concerned the solid state nuclear emulsions on recovery payloads of INTERKOSMOS satellites since 1970.



Dr. Ladislav Just
(*1946 – †2004)

A milestone: SK-1

The first electronic spaceborne particle detector that was developed by the space-technology group at IEP-SAS, was launched in 1977 on board of INTERKOSMOS-17 satellite.

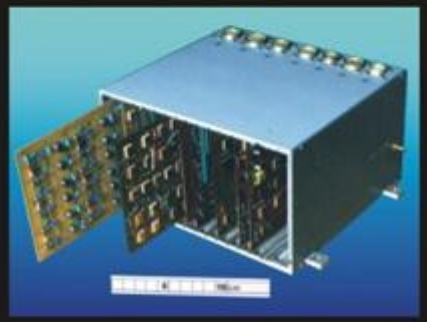
SK-1
Interkozmos-17 (1977)

DOK-T
Prognoz-10 (1981)

DOK-1
Intershock (1985)

SPE-1
Active (1989), MIR (1996)

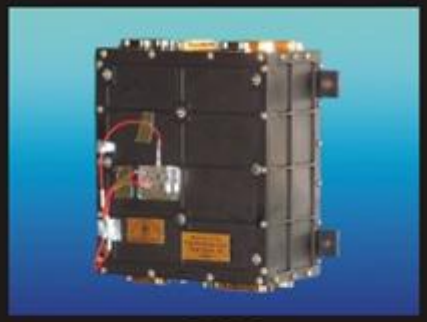
DOK-S
Active (1989)...1996 (4x)



SONG-E
Coronas-I (1994), -F.(2001)

DOK-2
Interball (1995, 1996)

SLED-2
MARS-96 (1996)



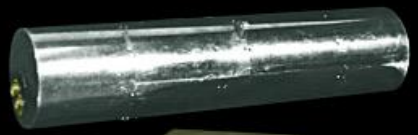
ESS
ESA-Rosetta (2004)

NUADU
Double Star (2004)

PEEL
HotPay-2 (2008)

MEP-2
Spectrum-R (2011)

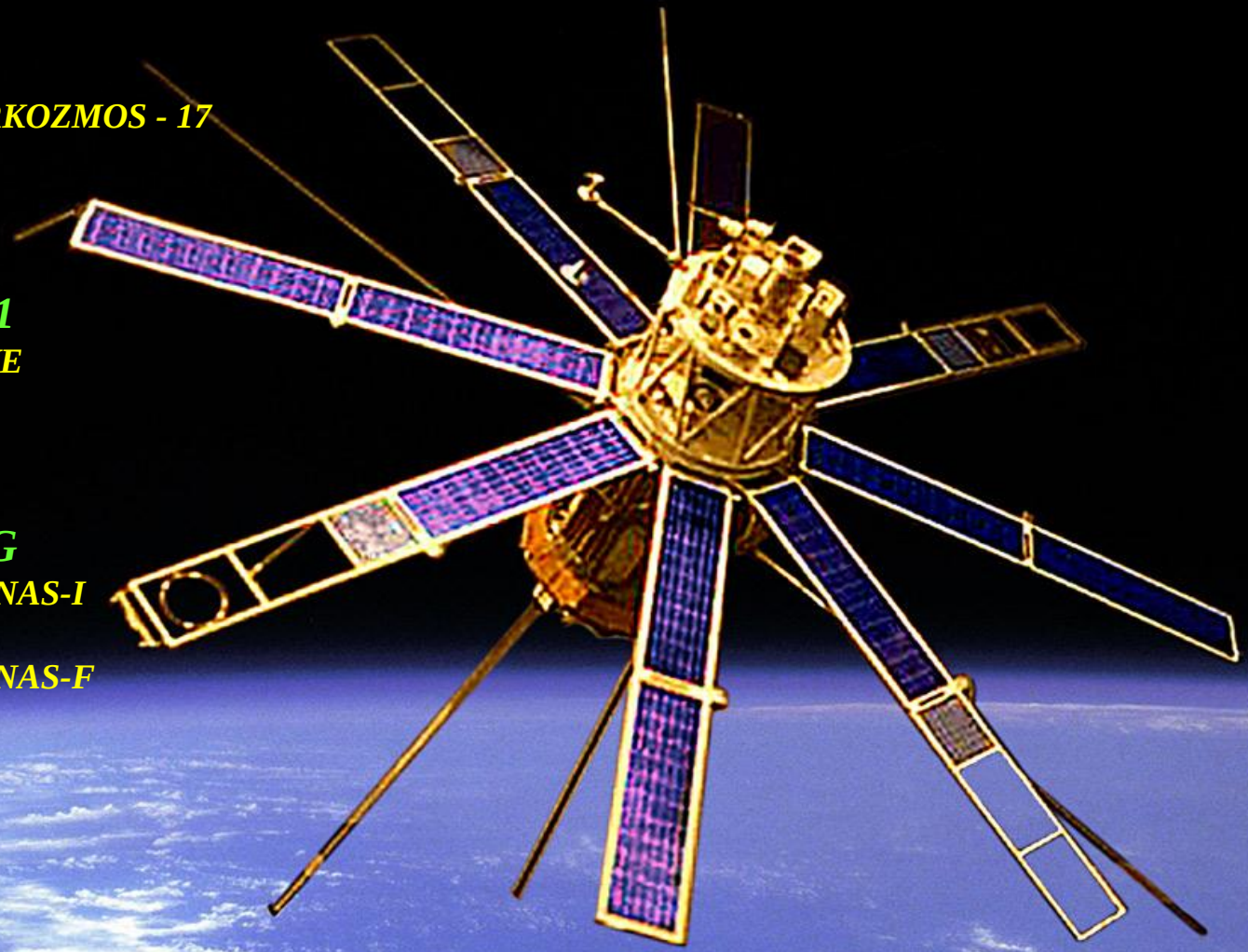
Satellite AUOS-Z



SK-1
INTERKOZMOS - 17
(1977)

SPE-1
ACTIVE
(1989)

SONG
CORONAS-I
(1994)
CORONAS-F
(2001)



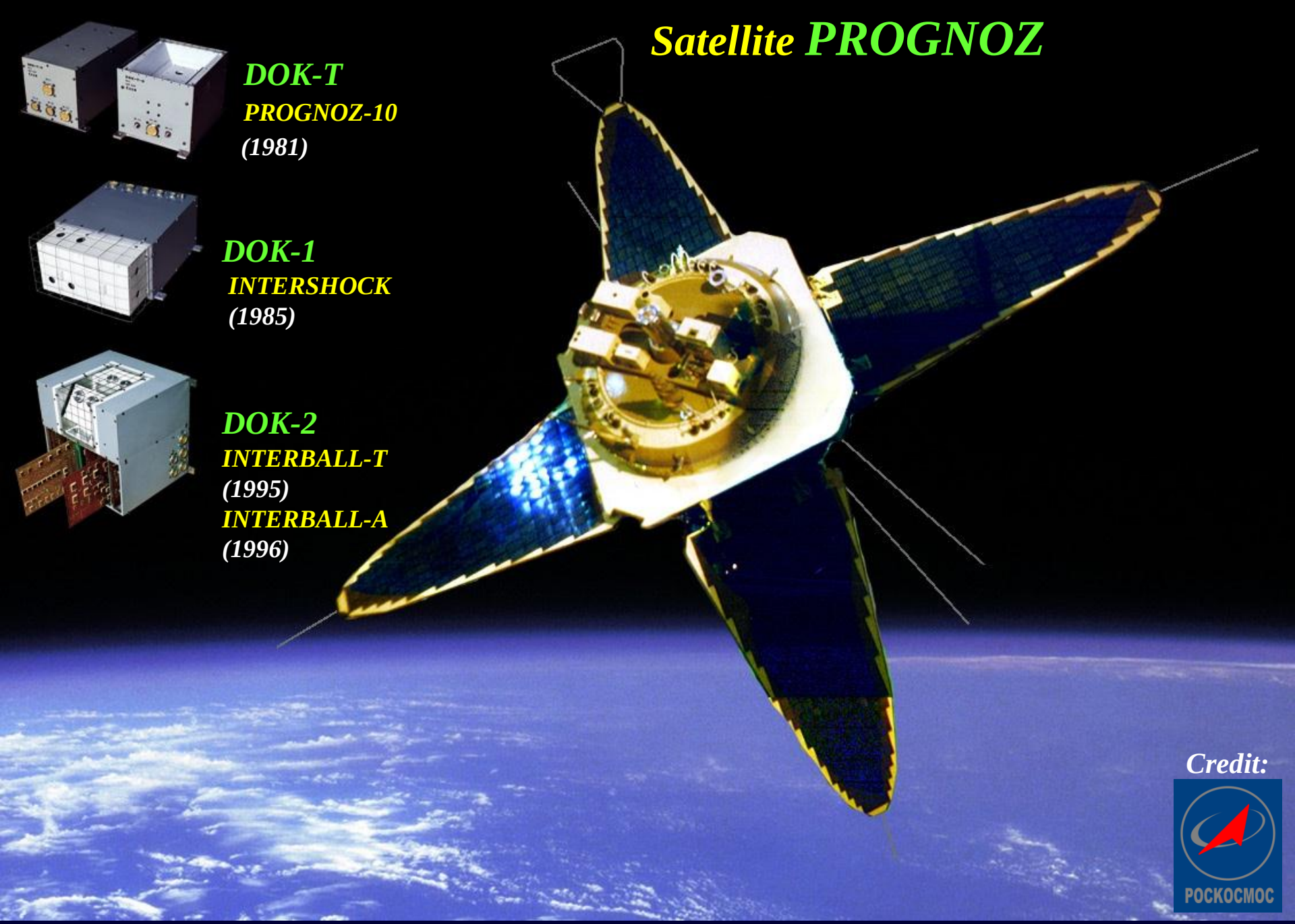
Credit:

Satellite PROGNOZ

DOK-T
PROGNOZ-10
(1981)

DOK-1
INTERSHOCK
(1985)

DOK-2
INTERBALL-T
(1995)
INTERBALL-A
(1996)



Credit:

Satellite MAGION

DOK-S

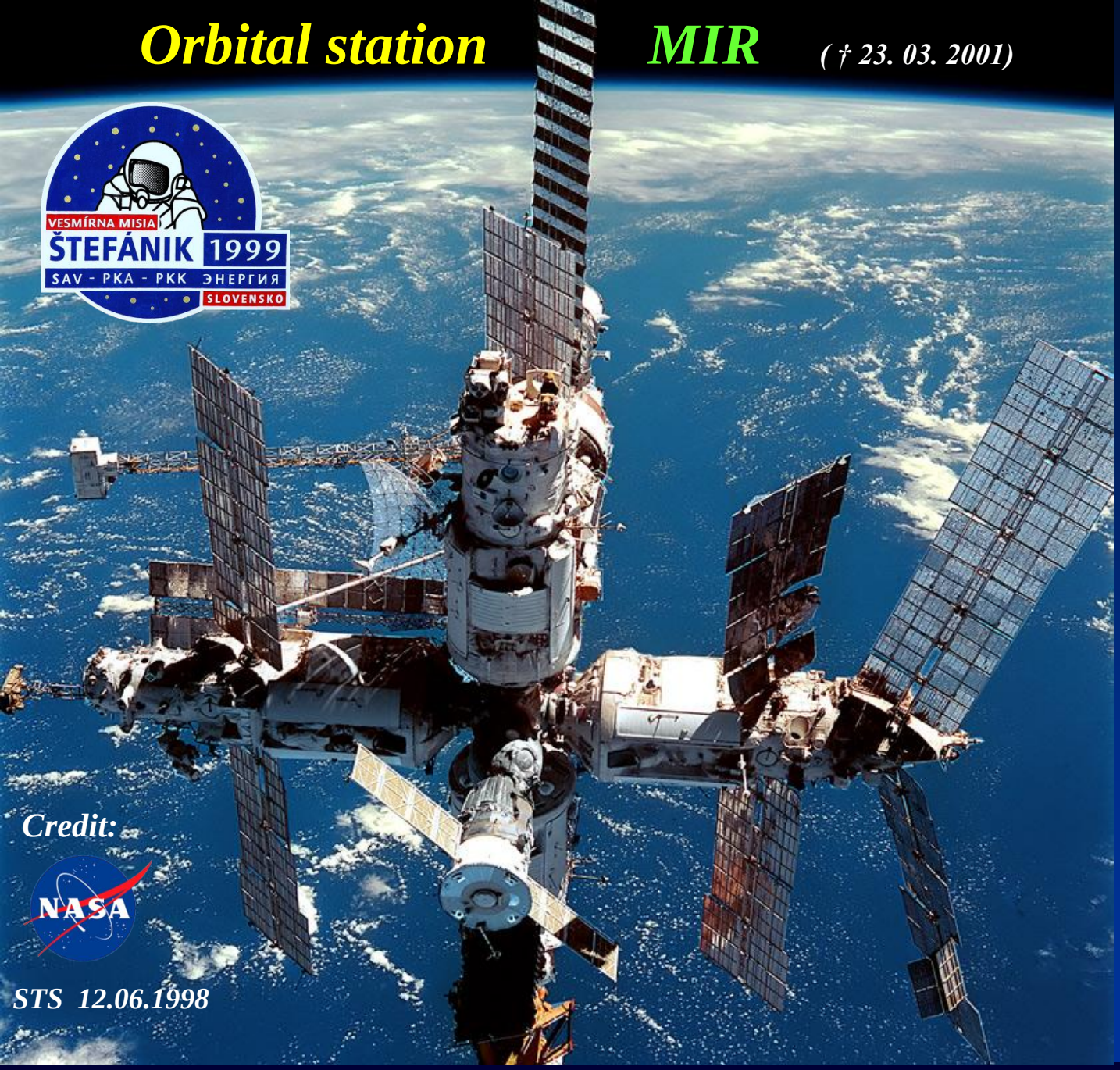
MAGION-2, ACTIVE (1989)

MAGION-3, APEX (1991)

MAGION-4, INTERBALL-T (1995)

MAGION-5, INTERBALL-A (1996)

Orbital station MIR († 23. 03. 2001)

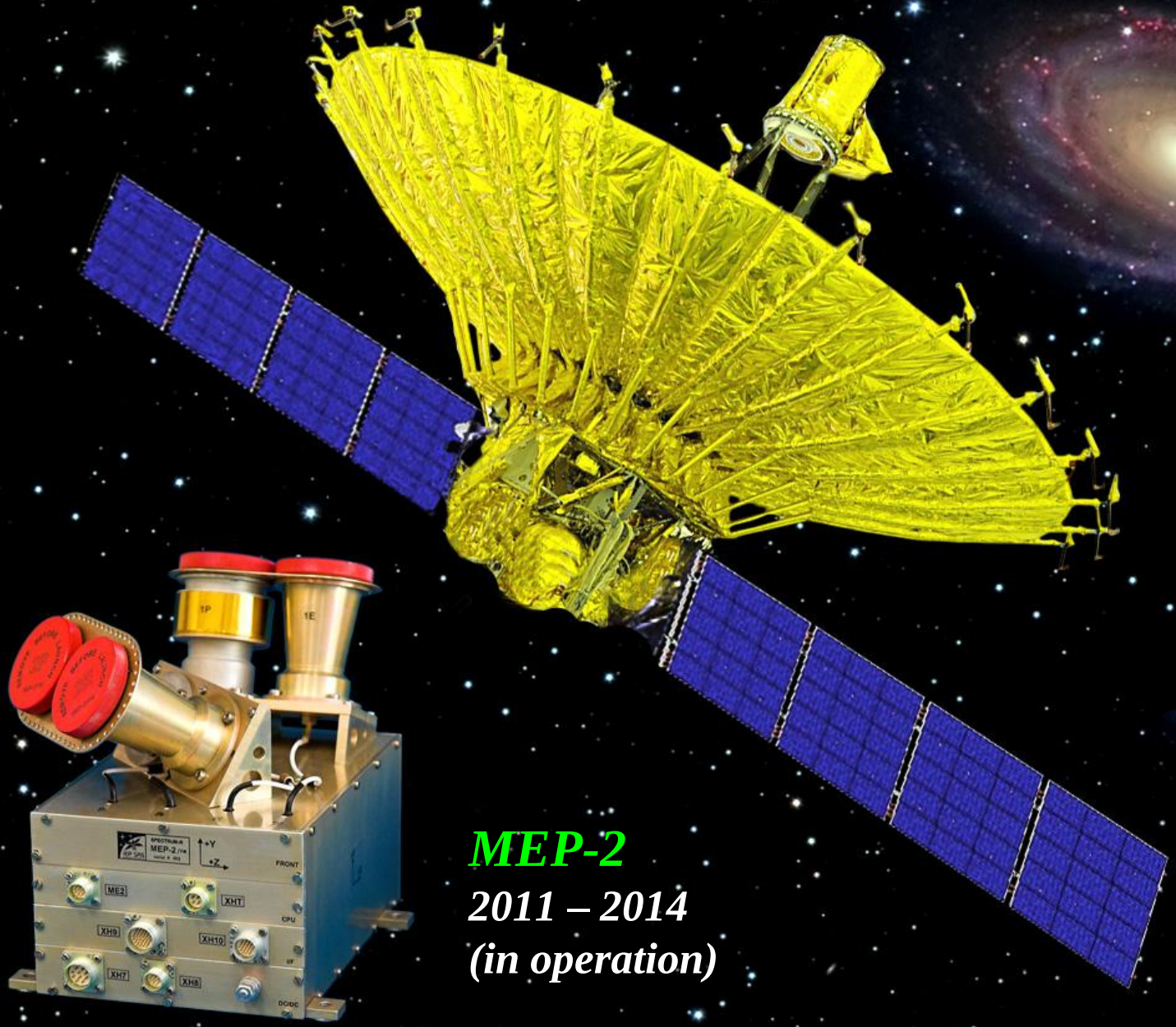


SPE-1M (1996)

DOSIMETRY
Mission ŠTEFÁNIK
(1999)

Ivan BELLA

Spectrum-RADIOASTRON



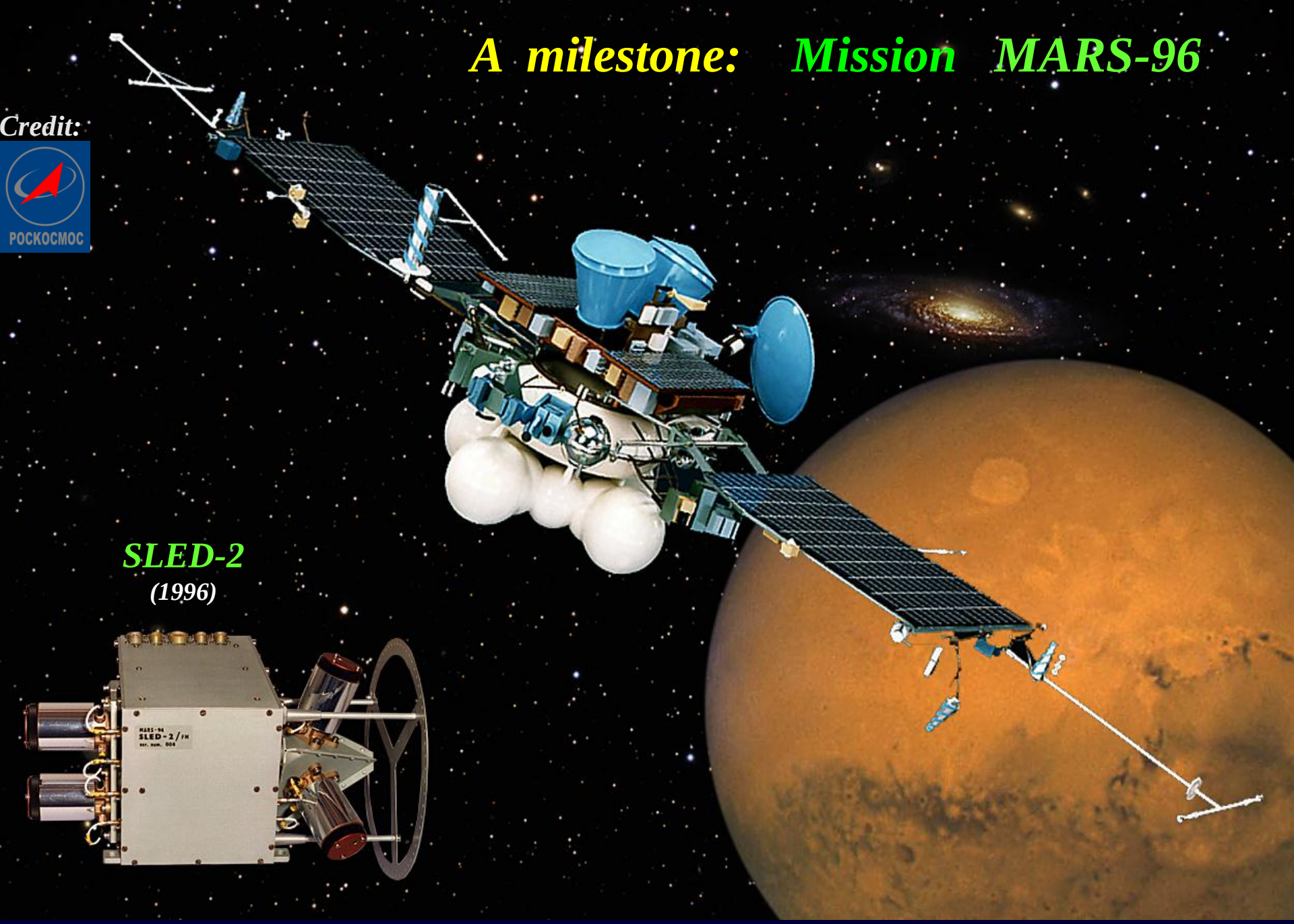
MEP-2

2011 – 2014

(in operation)

A milestone: Mission MARS-96

Credit:



SLED-2
(1996)

A milestone: Mission MARS-96

- Energetic particle spectrometer SLED-2 - joint development (1989-1996), with ESA members Space Technology Ireland (STIL) and Max-Planck Institute for Aeronomie MPAe, Germany (presently MPS, Goettingen).

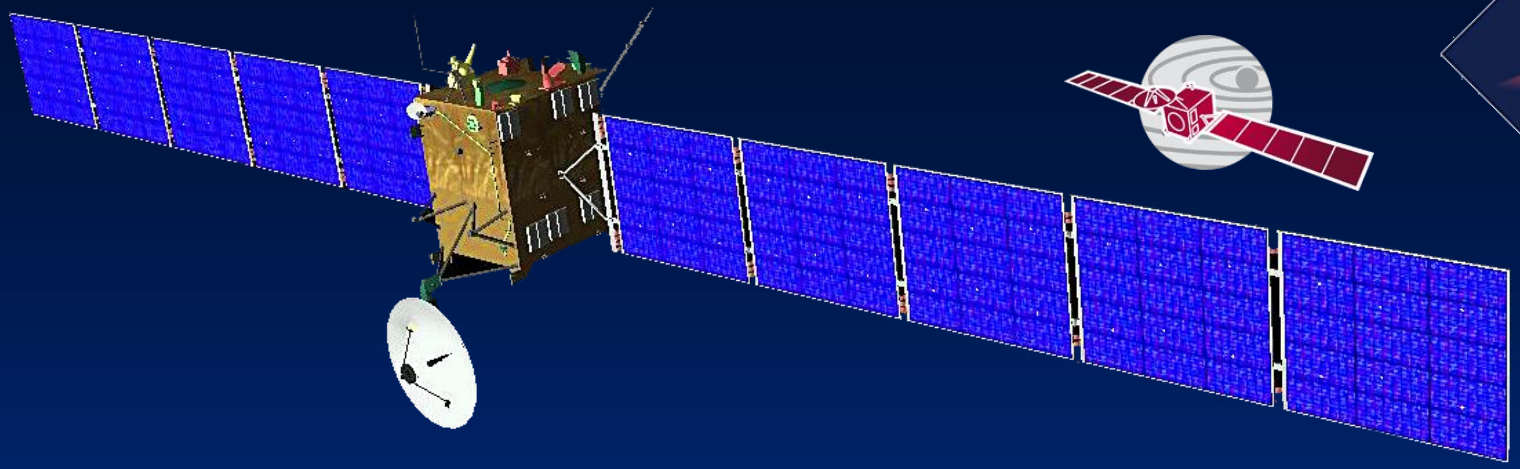
- Although the mission failed due to thruster malfunction, lot of technological know-how by ESA standards was transferred to IEP-SAS from STIL and MPAe.

- Very good references resulted to invitations from STIL to contribute to ESA missions Rosetta, Double Star, BepiColombo and JUICE


SLED
Credit:
РОСКОСМОС

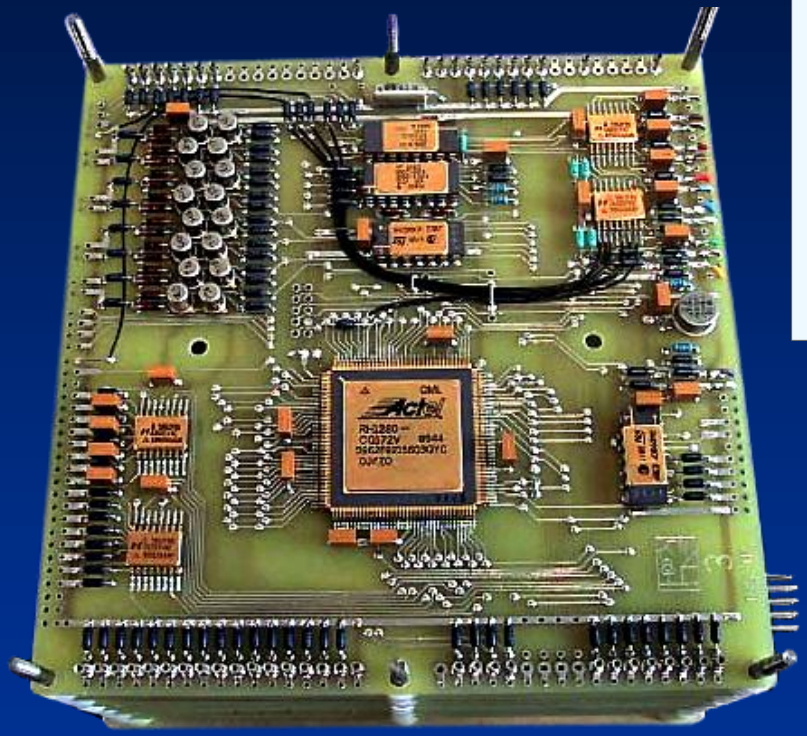
Launch of MARS-96 from Baykonour *16-NOV-1996*

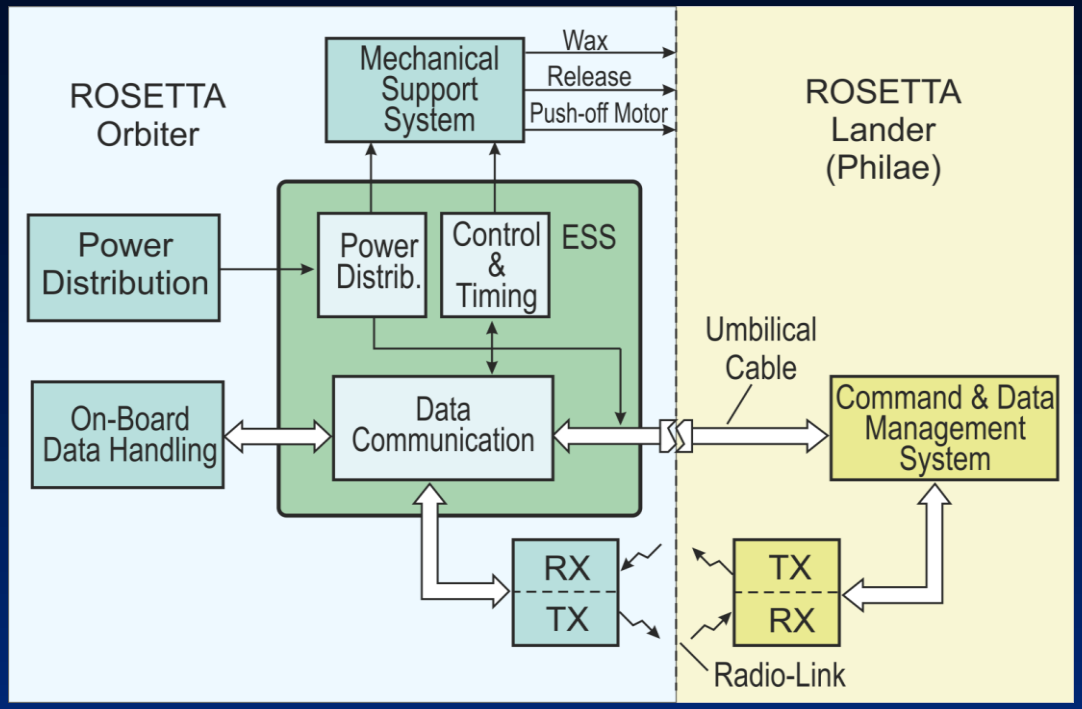
Contribution to mission ESA-Rosetta



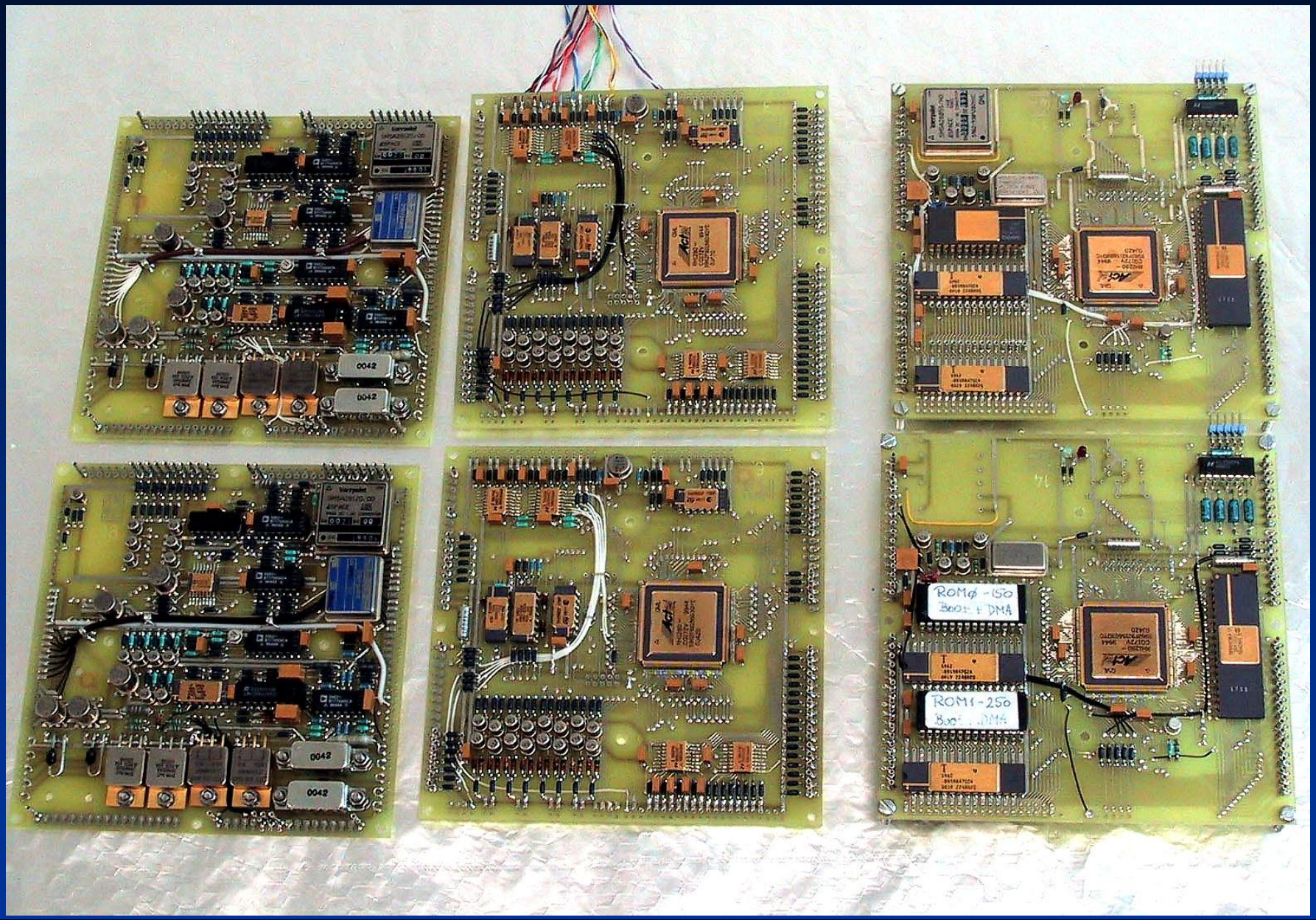
- Based on good references from MARS-96, IEP SAS was invited by Space Technology Ireland (STIL) to participate on development of the Rosetta Electrical Service System ESS
- STIL (Ireland) as a regular ESA member got a contract from ESA for ESS development
- The ESS unit is a flight critical hardware designed to control the separation of Lander Philae from Orbiter and also the communication between them (umbilical cable/radio link).
- The ESS performed perfectly during the Lander separation and communication until the Lander hibernation due to lack of energy

The ESS processor





The ESS construction (STIL, Maynooth, Ireland)

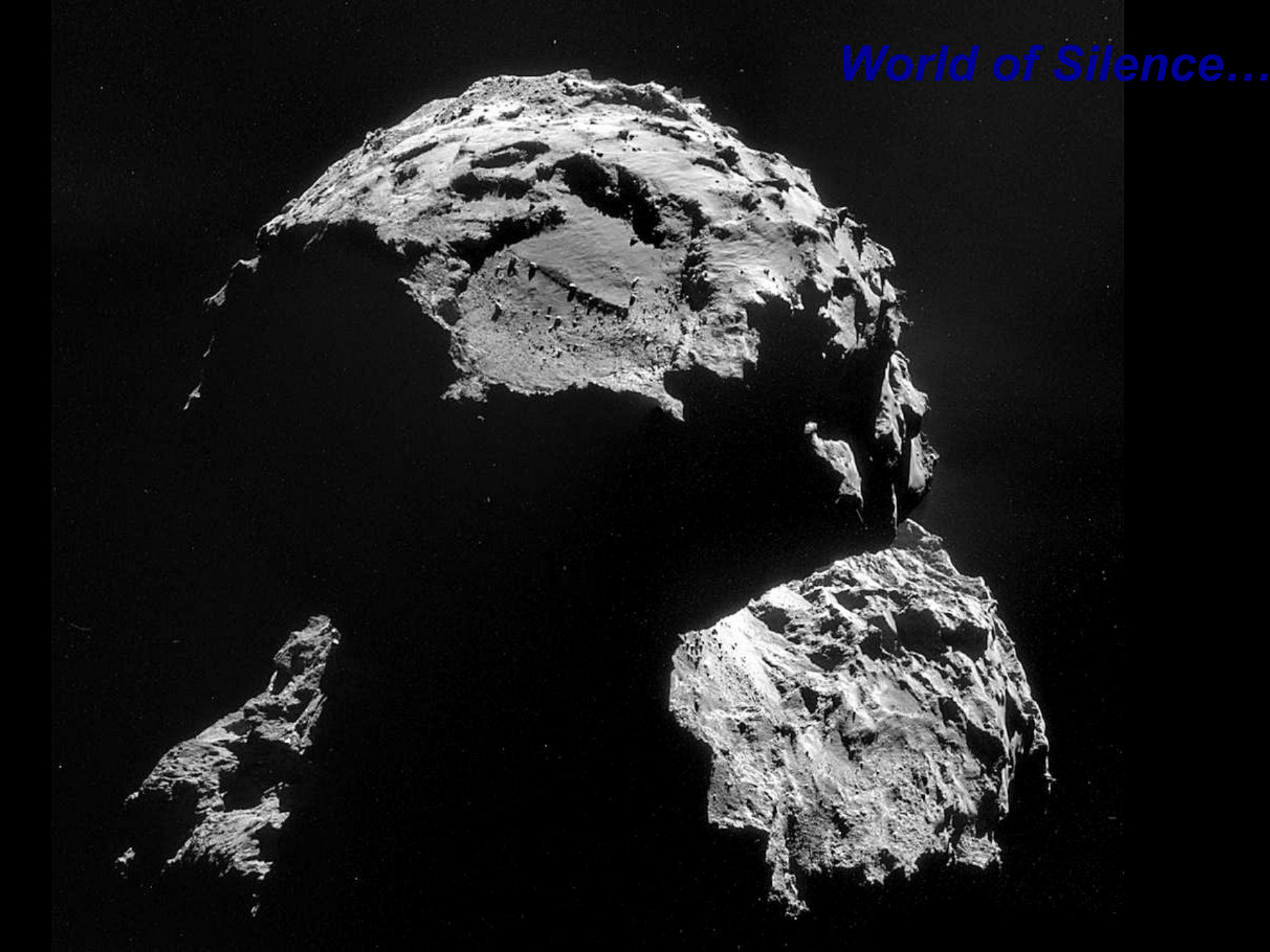


ESS installed on board of ROSETTA / Orbiter

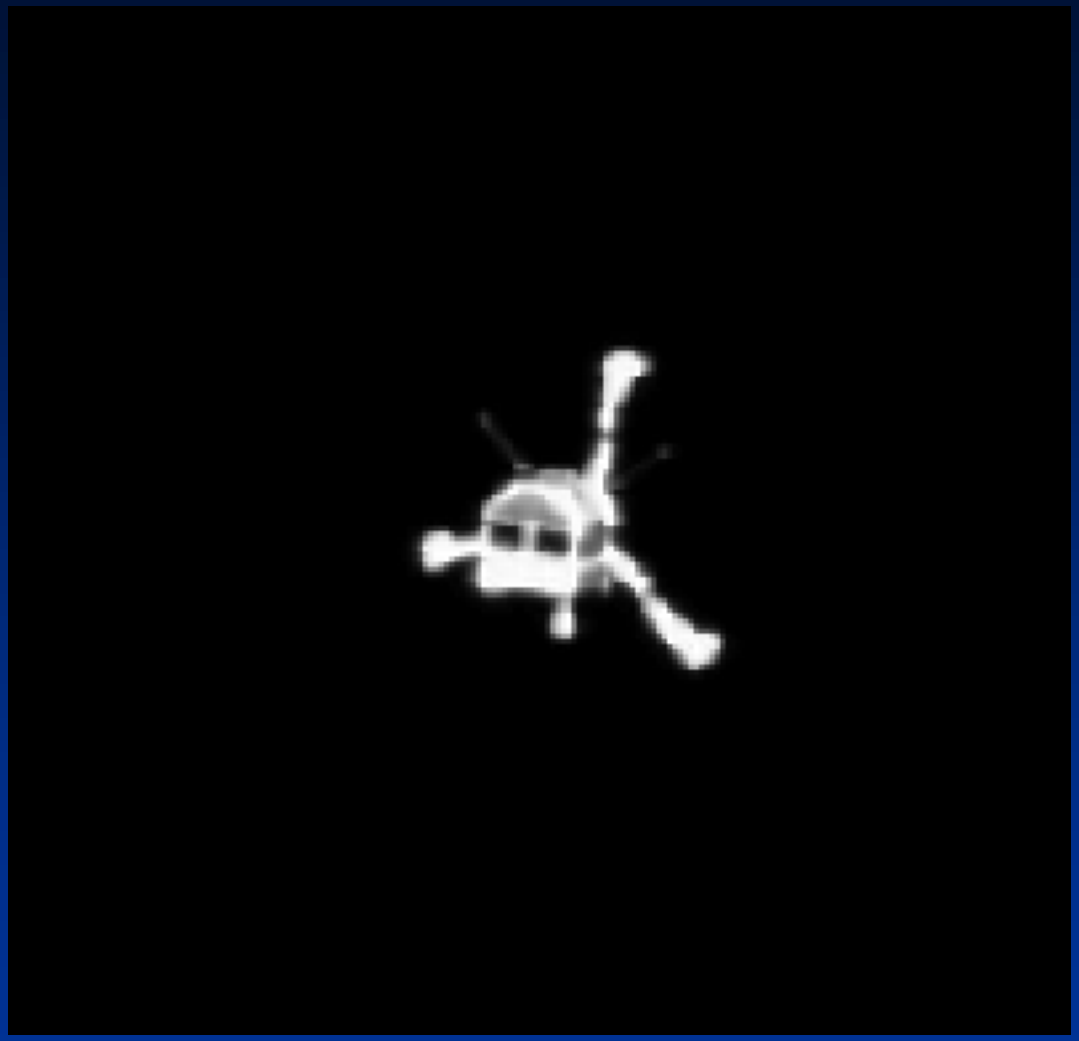
Rosetta launch (2-MAR-2004)

Comet Rendezvous (6-AUG-2014)


World of Silence…


World of Silence…

Lander separation and descent *(12-NOV-2014)*



Authentic video from Lander separation and descent recorded from the Orbiter board.

Philae was pushed off the Rosetta Orbiter using the ESS controlled ejection device with separation velocity of 19 cm/s.

The Mechanical support system MSS and Electrical support system ESS performed this delicate operation flawlessly.

Welcome to a Comet *(real CIVA photo)*

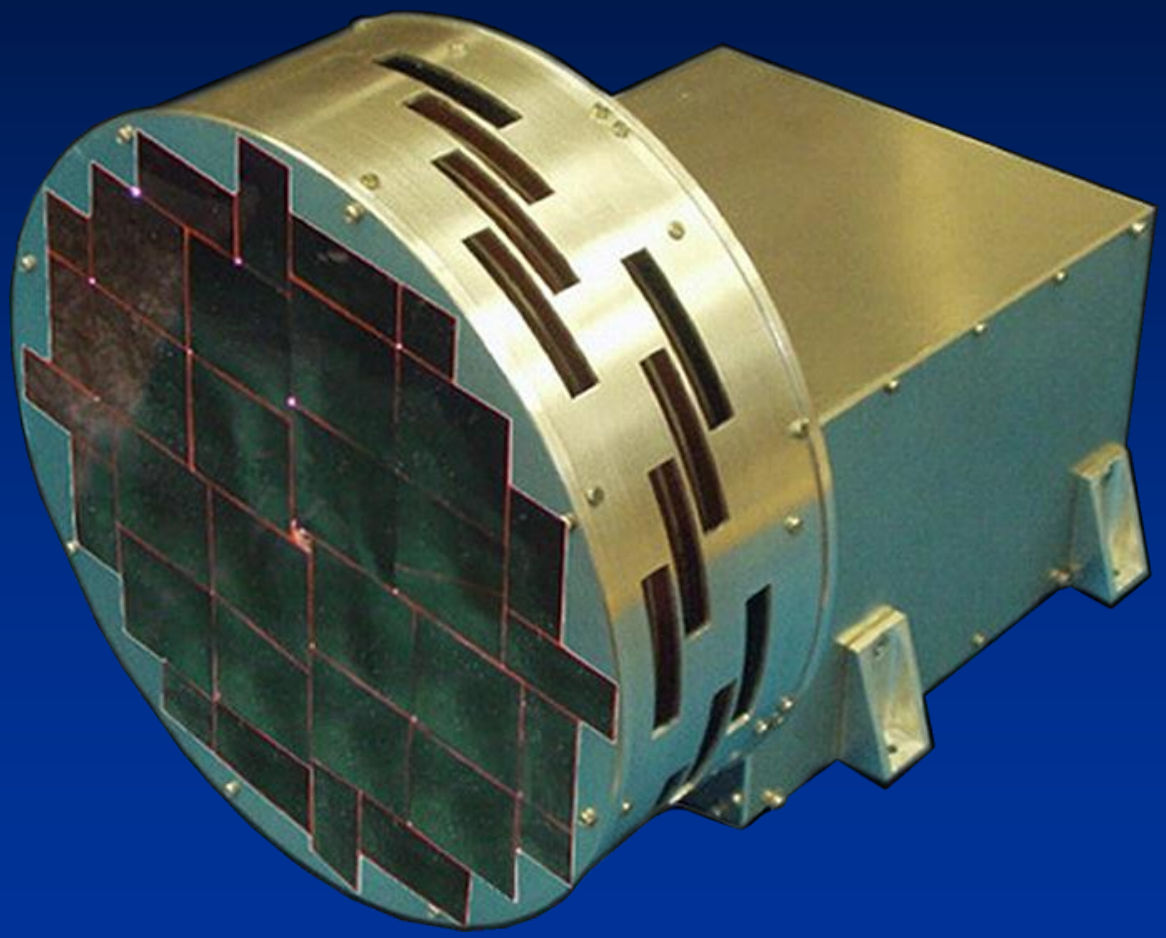
Project Double Star

(ESA + CNSA)

- Cooperation of ESA and Chinese National Space Agency CNSA.
- Two research satellites TC-1 and TC-2 joined the ESA-Cluster mission to provide a coordinated measurements with 6 satellites.
- The Energetic Neutral Atom imager **NUADU** developed at IEP-SAS in cooperation with STIL-Ireland, IRF-Sweden and CSSAR-China, operated f or 5 years (2004-2009) on board of TC-2.

Double Star NUADU

Neutral Atom Imager



CNSA

esa

THE JOHNS HOPKINS UNIVERSITY

spais teicneolaíocht éire teoranta
Space Technology Ireland

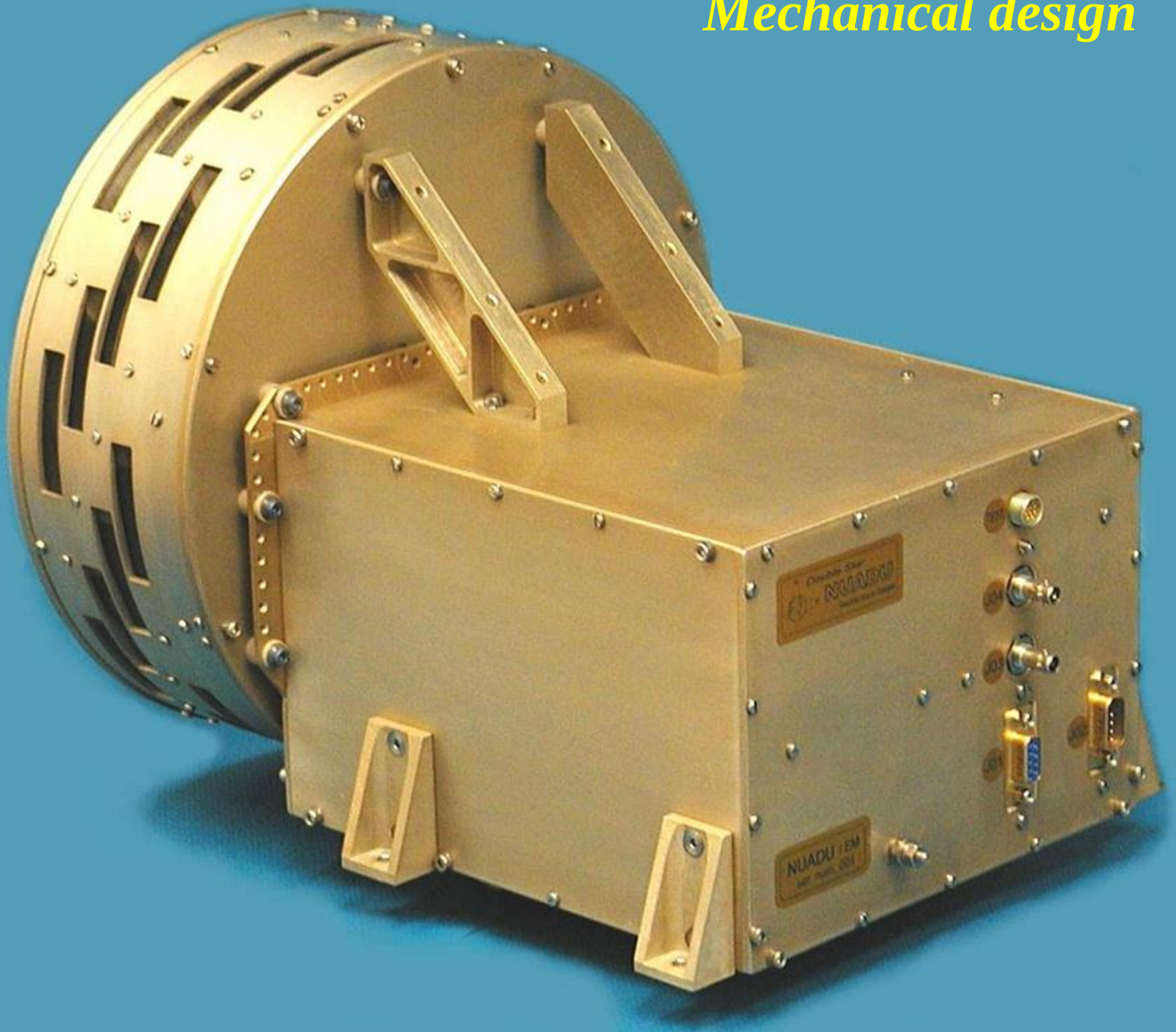
CENTER FOR SPACE SCIENCE AND APPLIED RESEARCH
中国科学院空间科学与应用研究中心

IRF

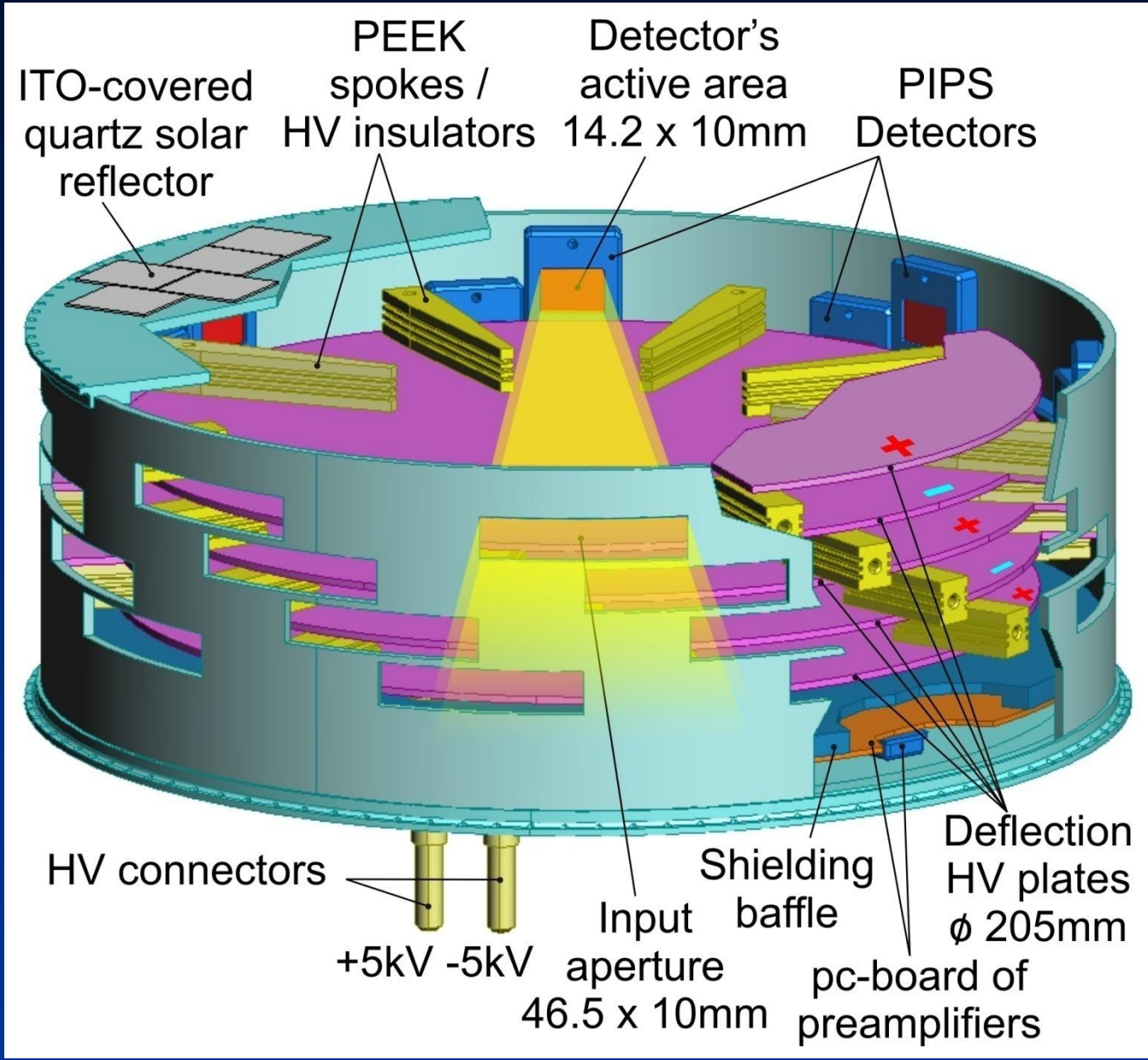
IEP SAS
SPACE PHYSICS

cnes

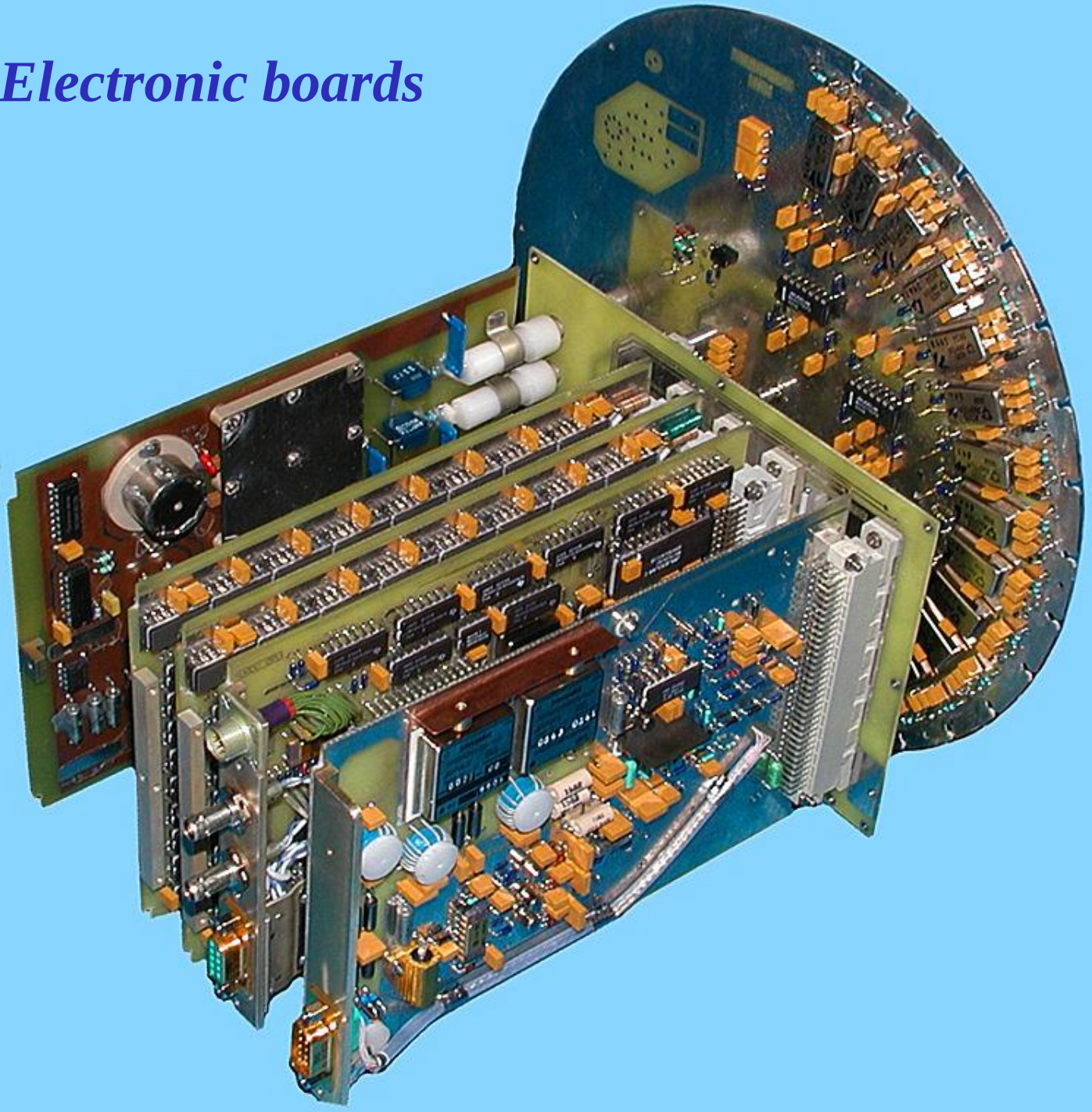
Mechanical design



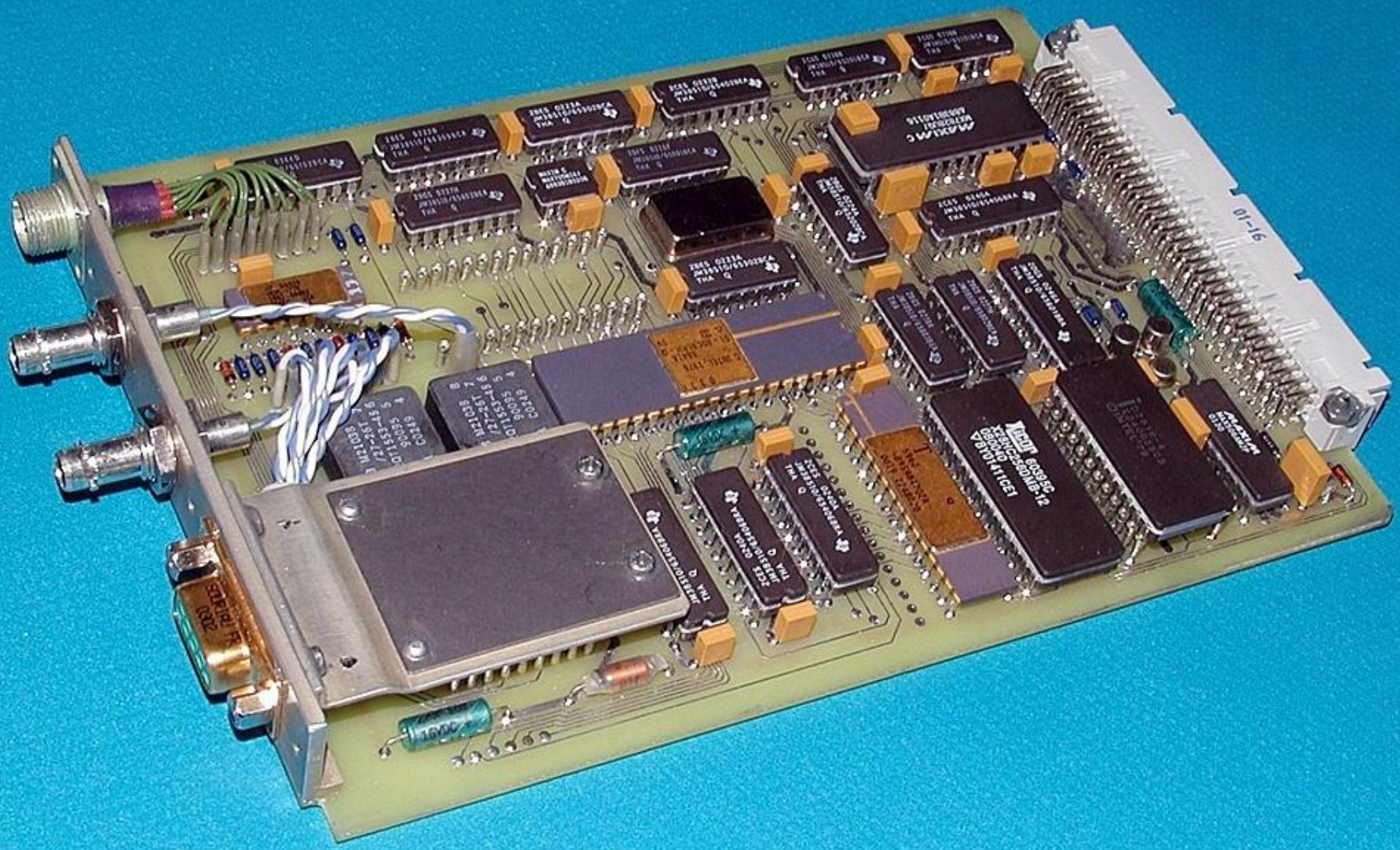
Sensor design



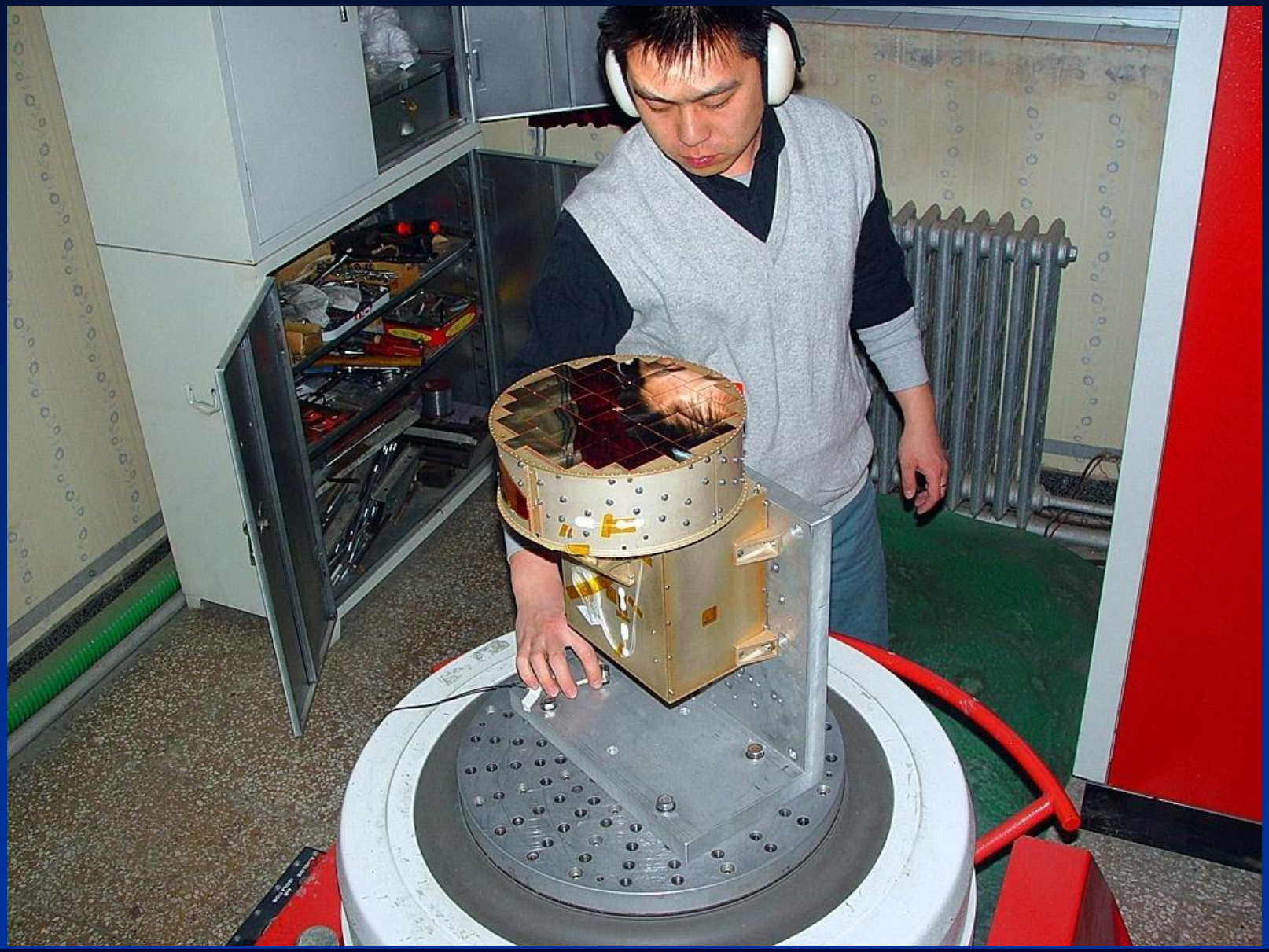
Electronic boards



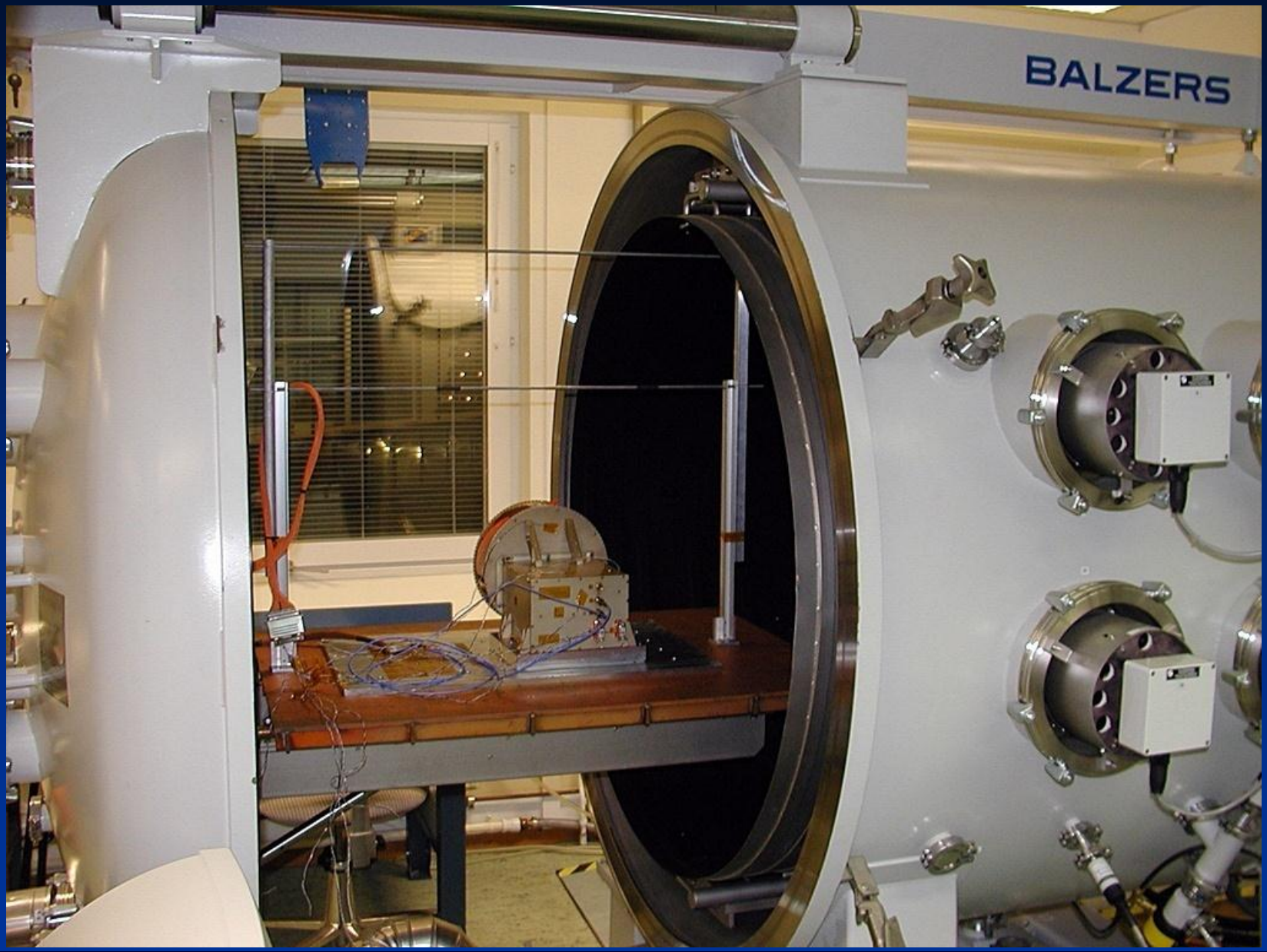
Data Processing Unit



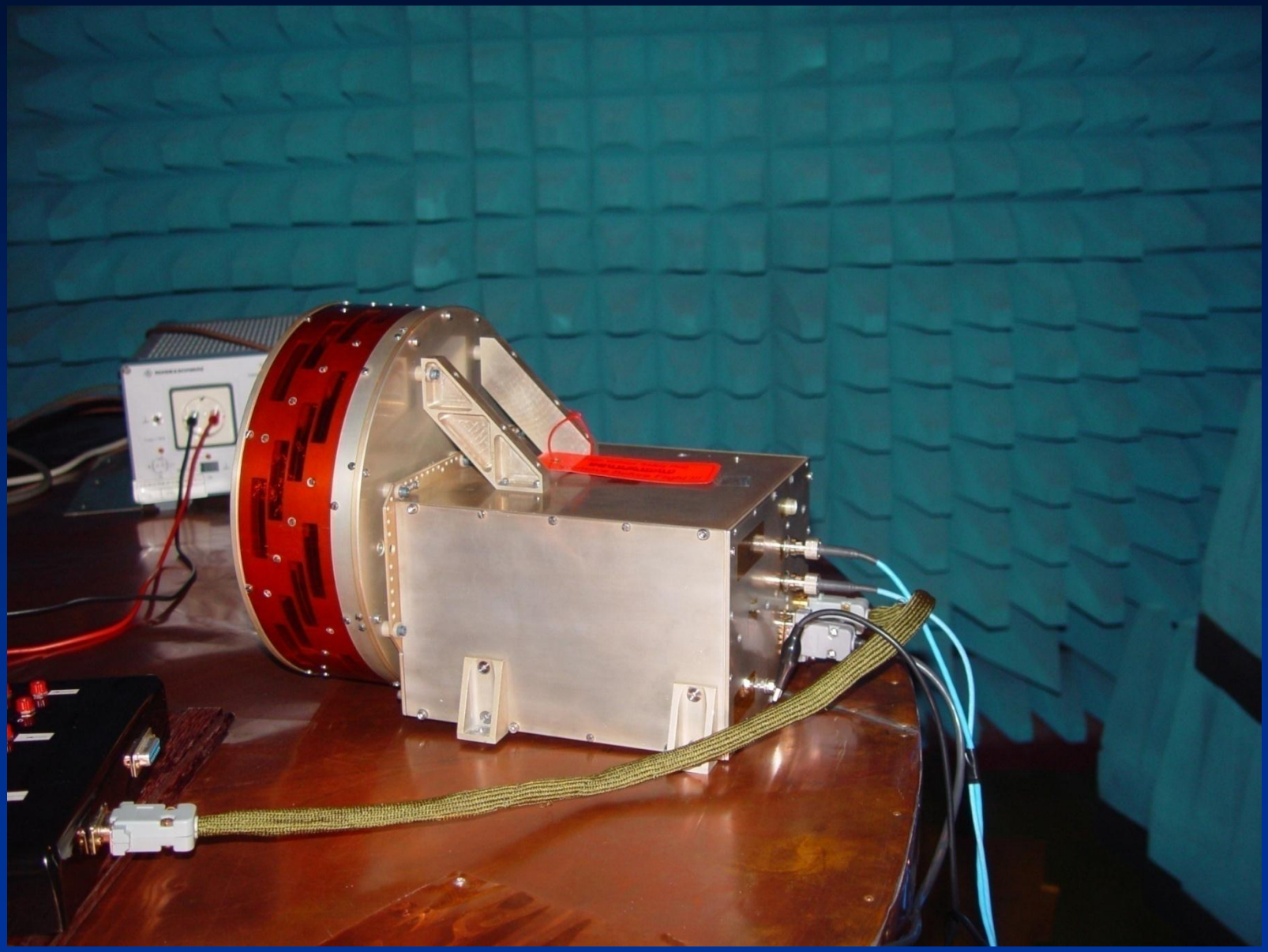
Vibration qualification tests at CSSAR, Beijing



Thermal-Vacuum Qualification tests at IRF, Kiruna



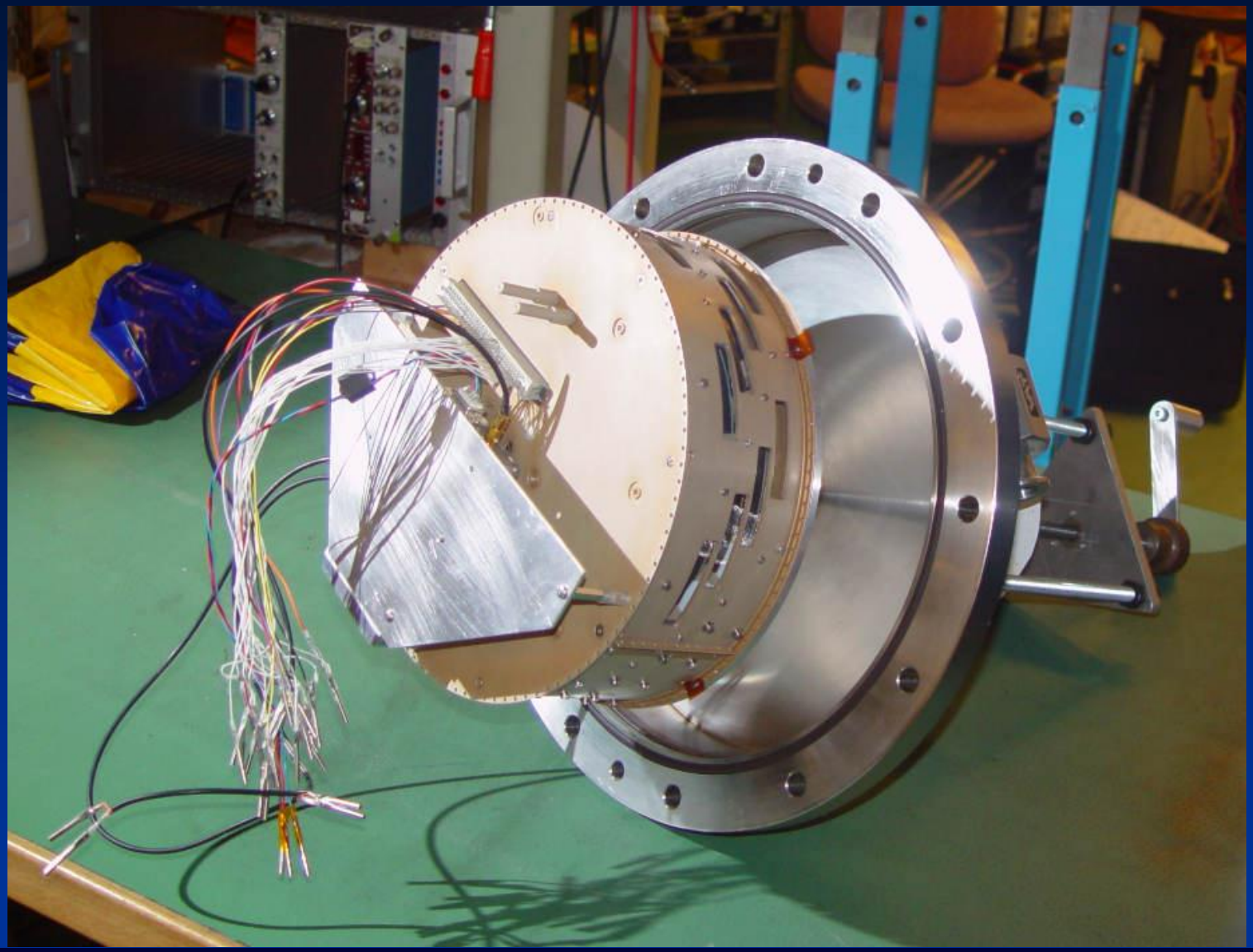
EMC qualification tests at CSSAR, Beijing

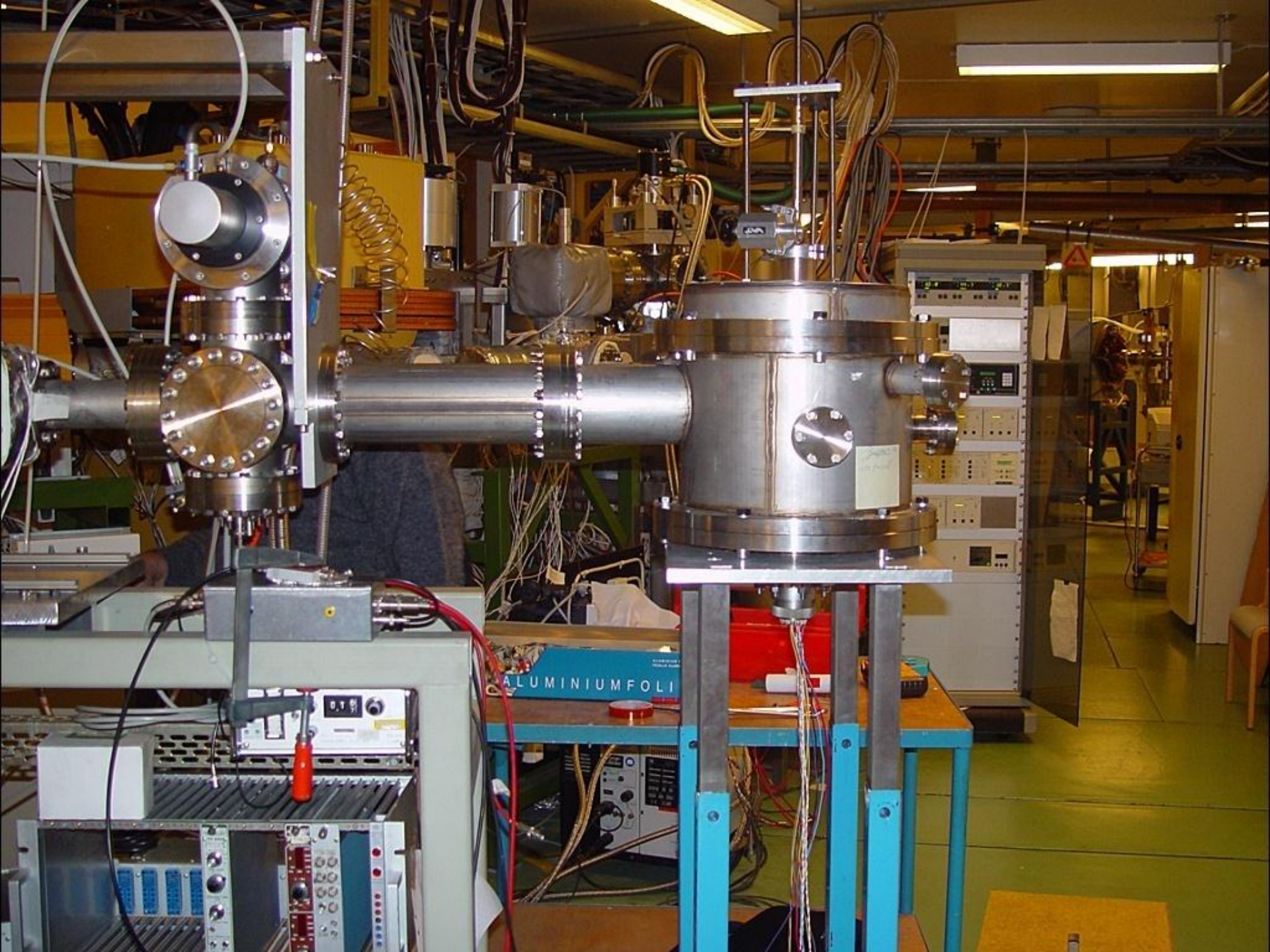


Calibration at MSL, Stockholm

Hydrogen ENA
512.4 keV
293.0 keV
150.6 keV
60.4 keV

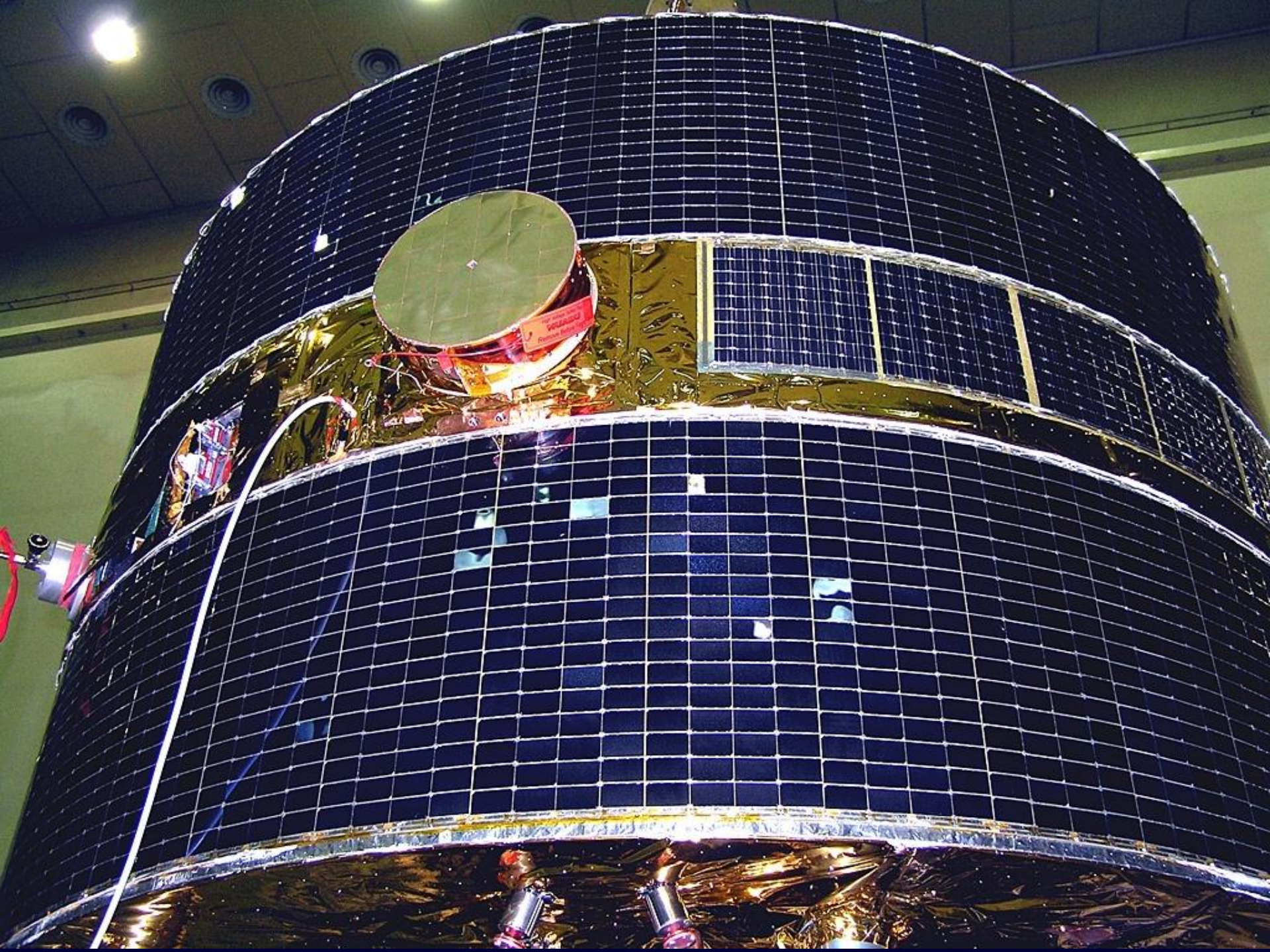
Oxygen ENA
501.8 keV
393.5 keV
301.1 keV
229.9 keV
149.8 keV

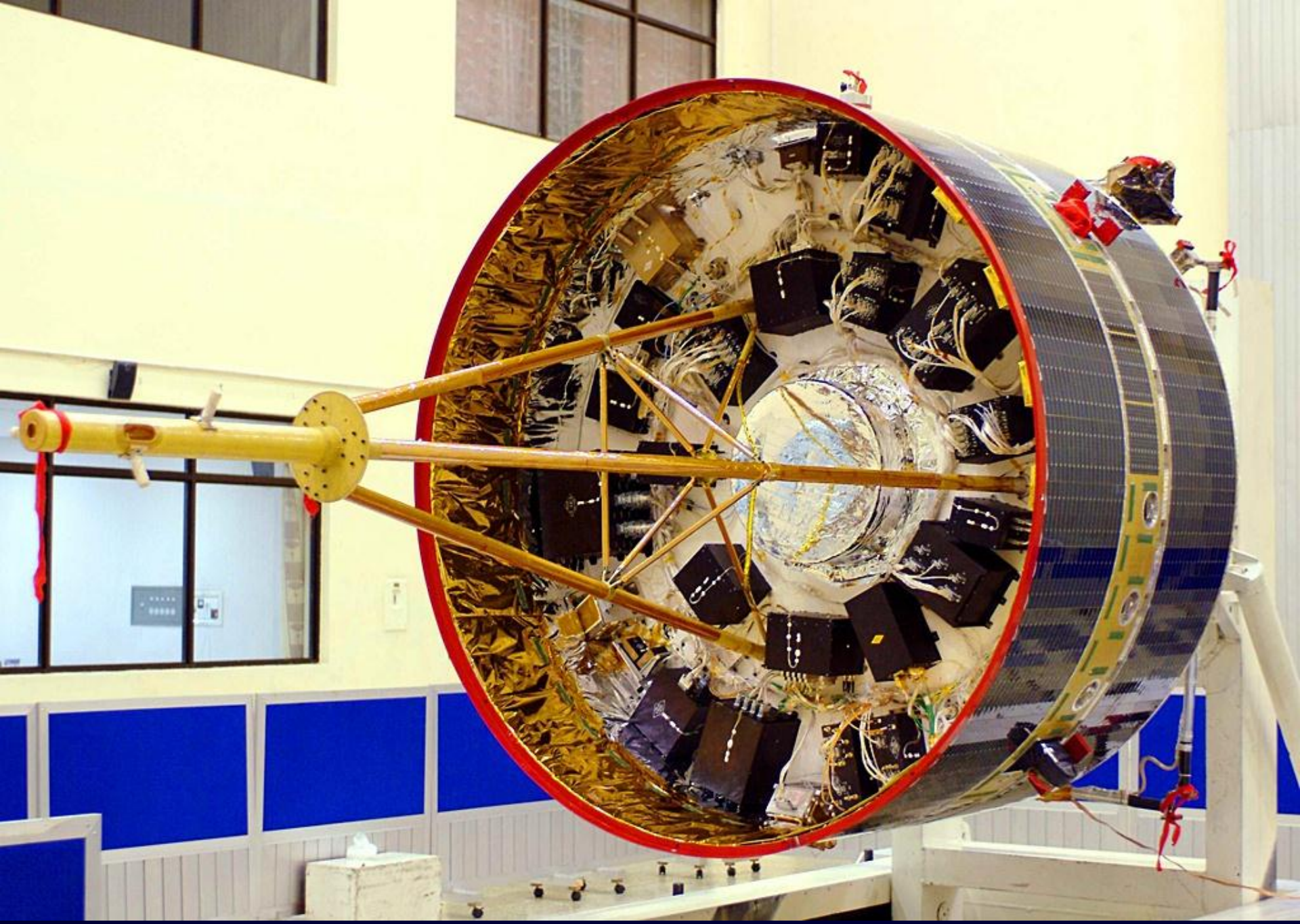


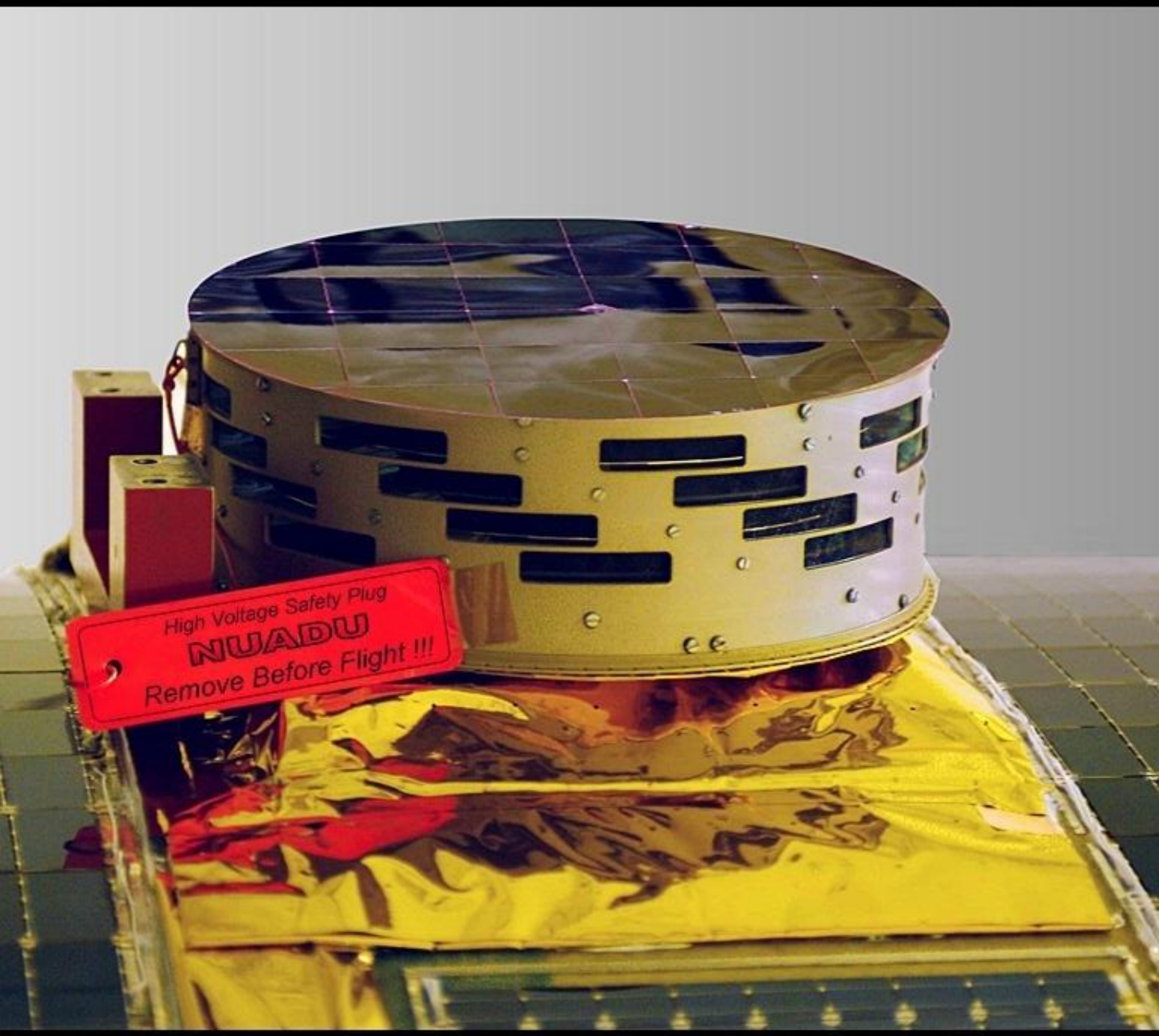

ALUMINIUMFOLI

Software developmennt (CSSAR, Beijing)

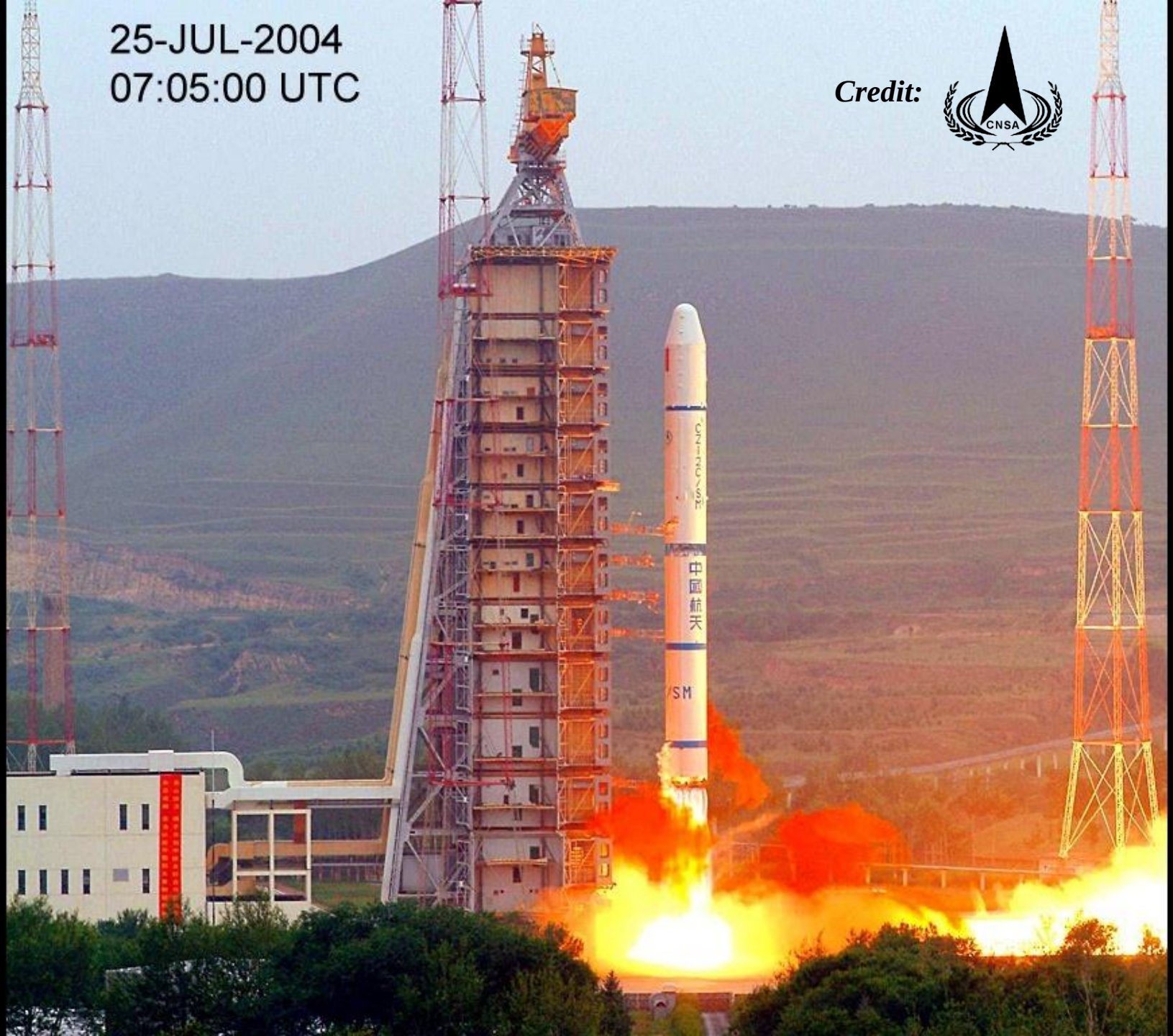
Launch Campaign at Taiyuan Satellite Launch Centre





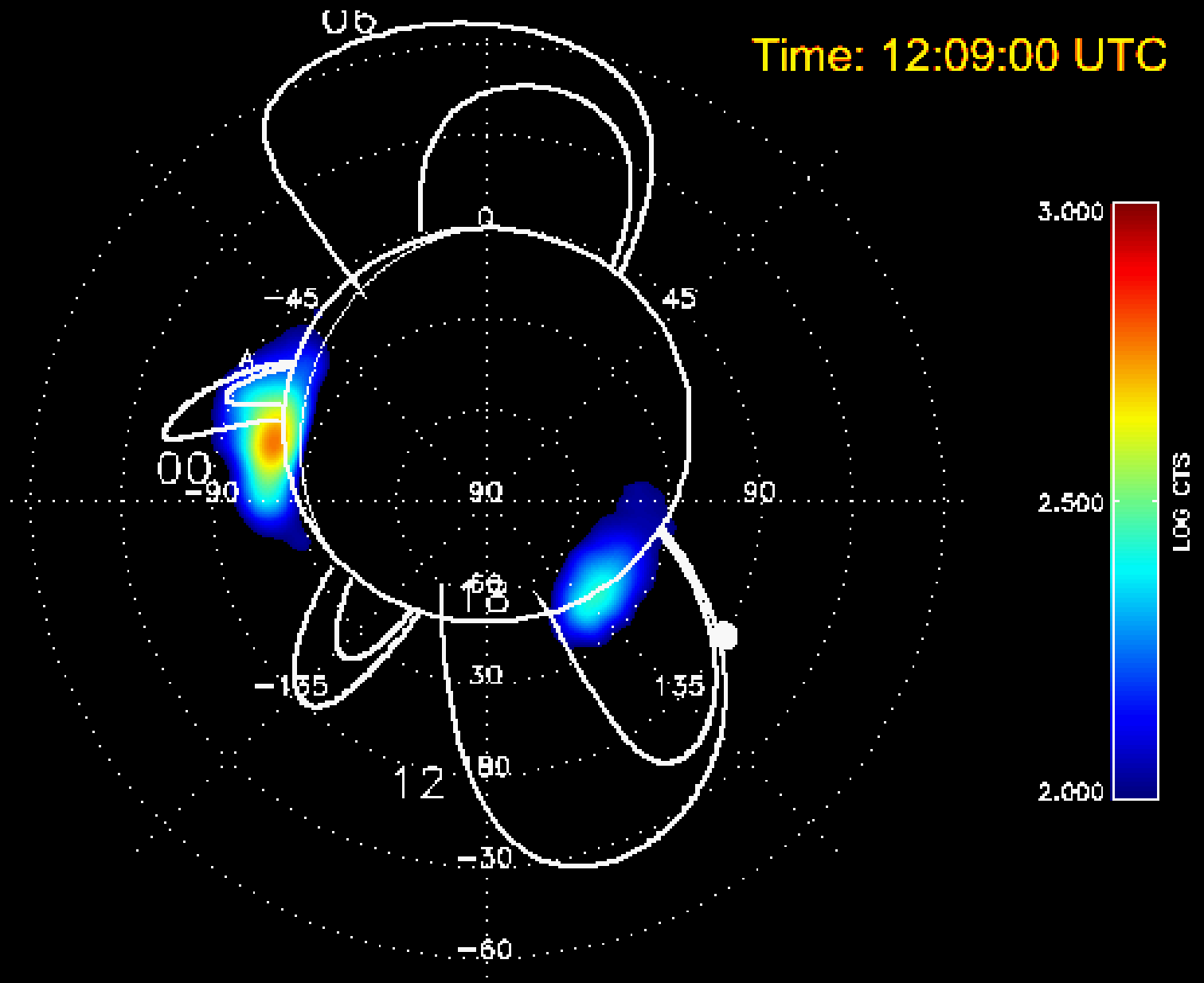

High Voltage Safety Plug
NUADU
Remove Before Flight !!!


中国航天
双星计划
DOUBLE STAR
esa

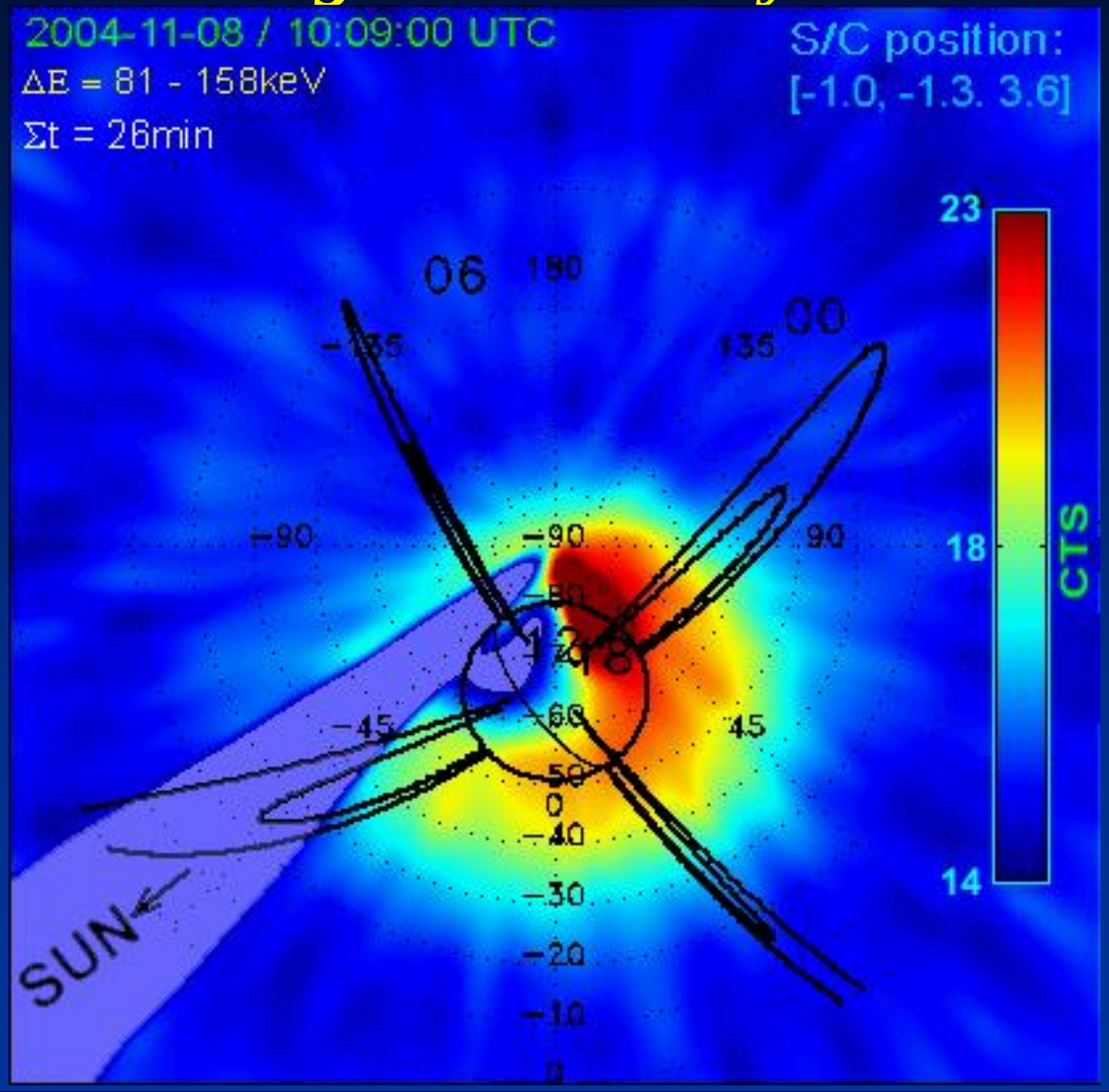

25-JUL-2004
07:05:00 UTC
Credit:
CNSA
中国航天
SM

Double Star / TC-2 Post-Launch Banquett

NUADU ENA IMAGE AT SOUTH POLE (50keV) 14-SEP-2004

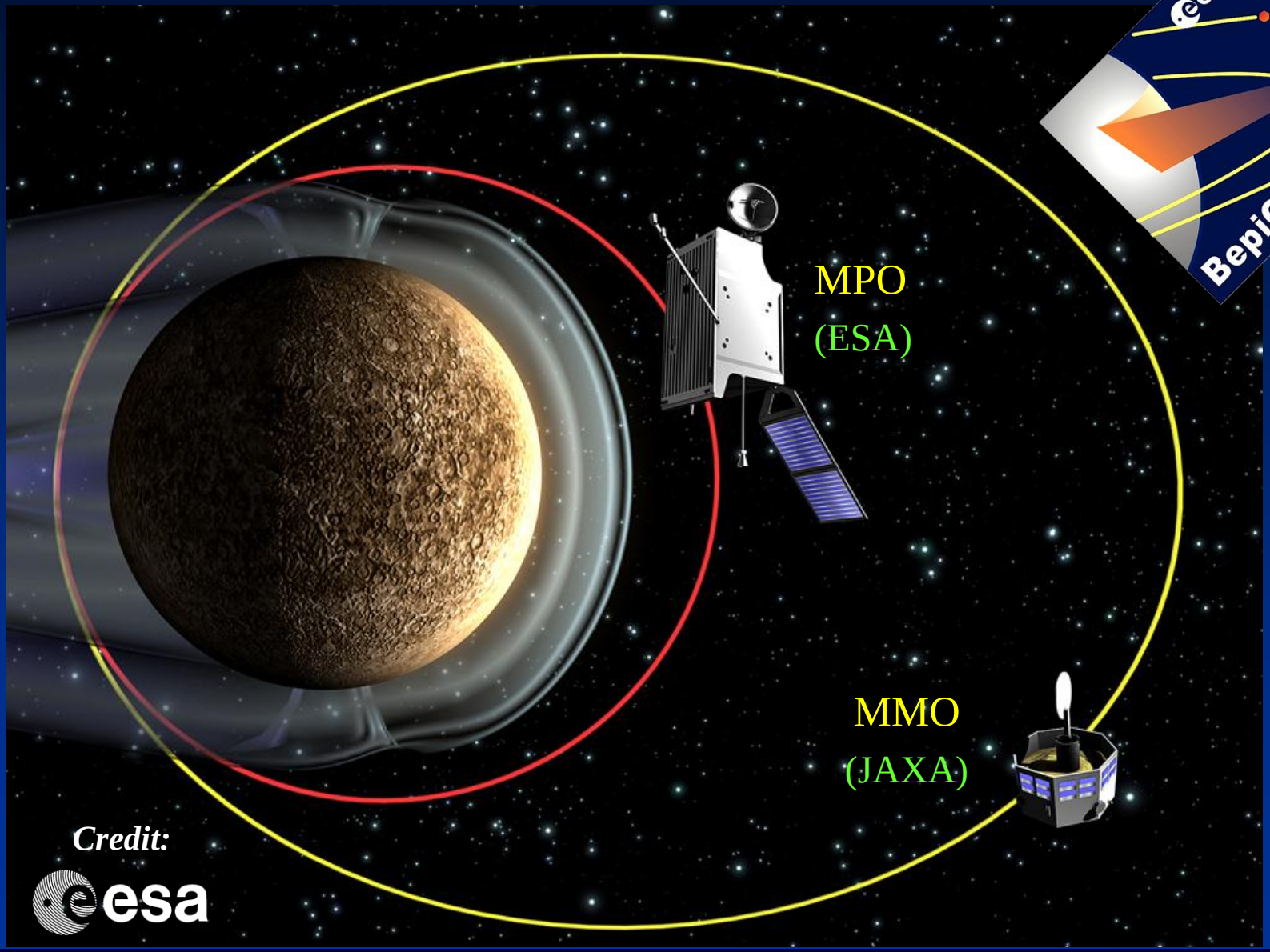


Magnetic Storm on 8.11.2004 and the Ring Current ENA image recorded by NUADU



International Award of Slovak Academy of Sciences to prof. Susan McKenna-Lawlor (STIL director, 2005)

Contribution to mission ESA-BepiColombo

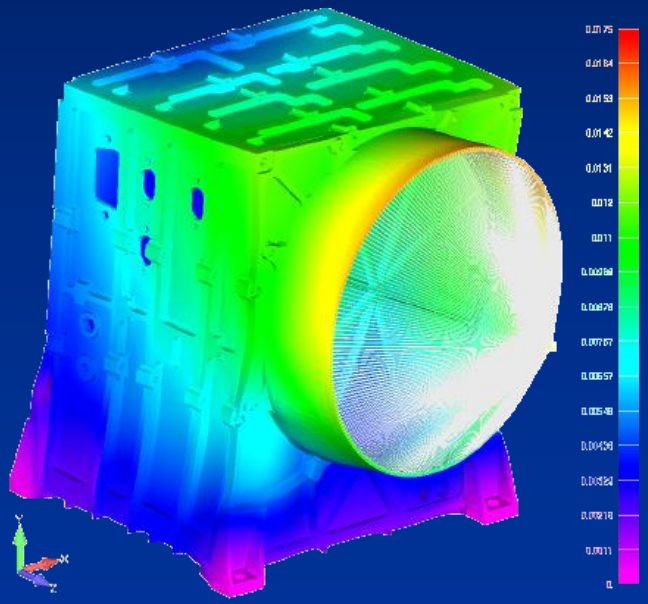


Contribution to ESA-BepiColombo mission

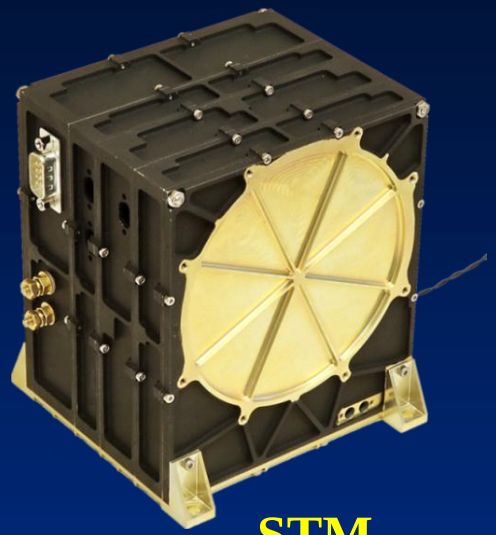
- In cooperation with Space Technology Ireland (STIL) and Austrian Space Research Institute (IWF) in Graz, IEP-SAS contributed to development and manufacture of PICAM (Planetary Ion CAMera) unit for mission to planet Mercury.

- The contribution concerns development and manufacture of the electronic box mechanical structures.

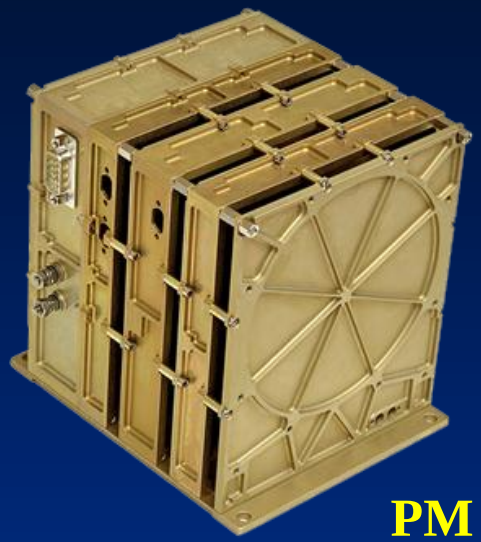
- The subcontractor for finite element analyses (FEA) and a precise manufacture of the mechanical parts on 5-axis milling centre was Slovak technological company Q-Products.



6 Models already delivered



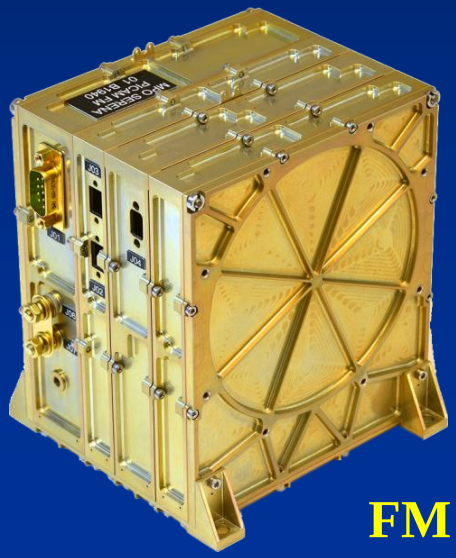
STM



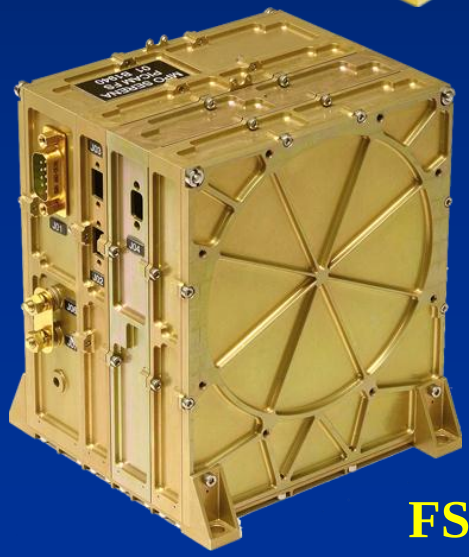
PM

EM

QM

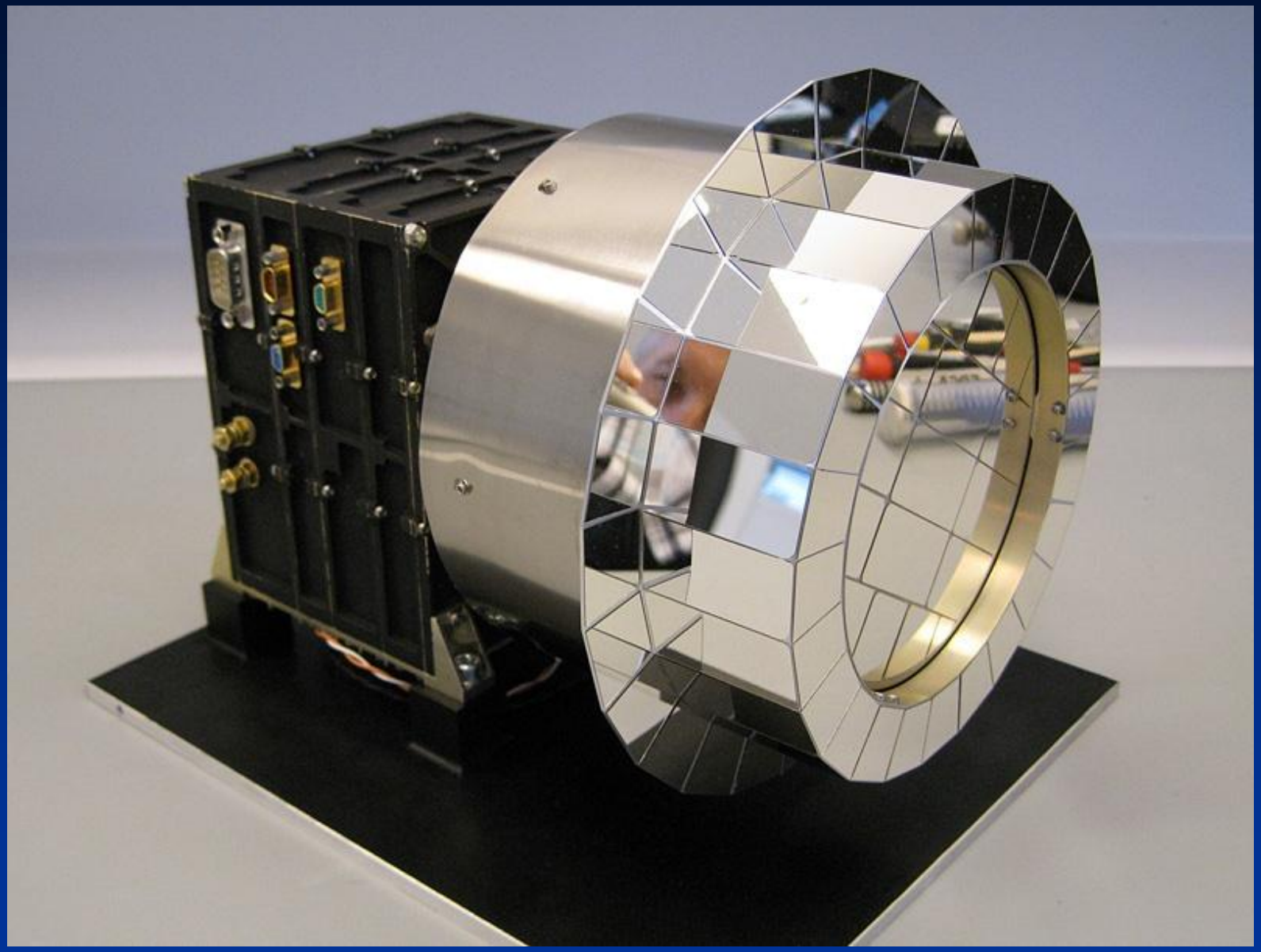


FM



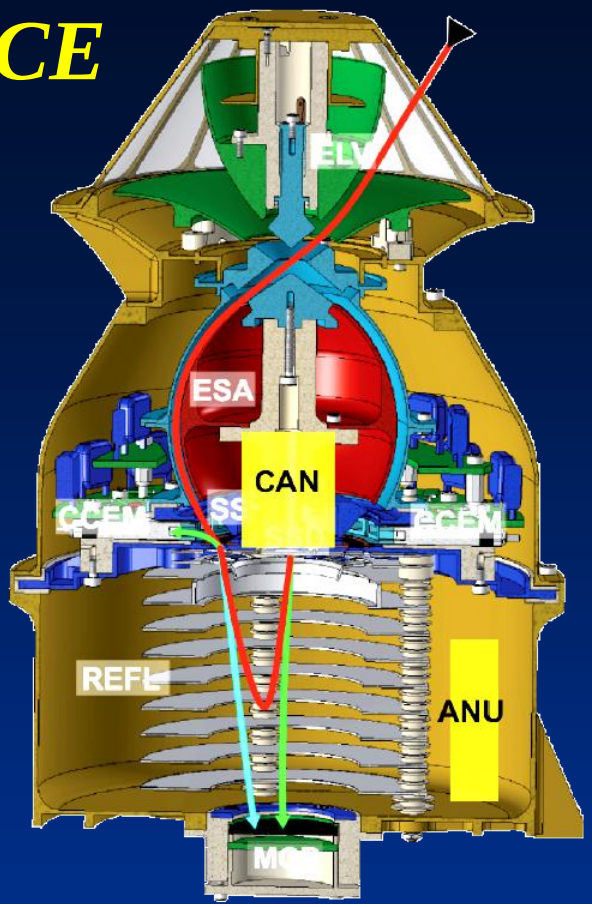
FS

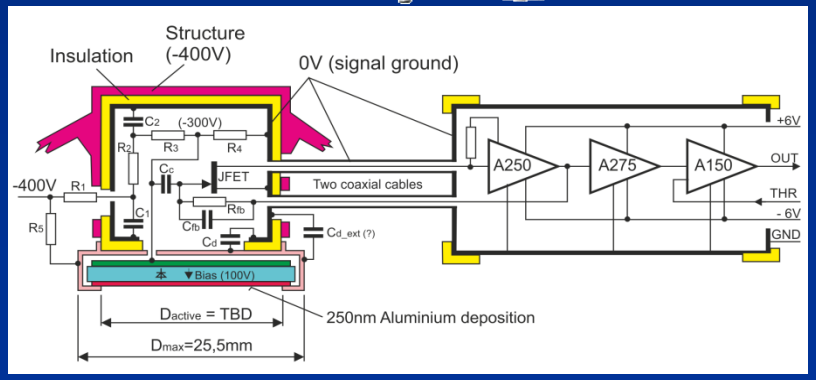
PICAM / STM with the Sensor



Contribution to mission ESA-JUICE

In cooperation with Space Technology Ireland (STIL) and Swedish Institute for Space Physics (IRF) in Kiruna, IEP-SAS contributes to development of PEP (Plasma Environment Package) suite with development of Anti-coincidence detector for ion-optics of the JDC sensor (Jovian plasma Dynamics and Composition analyzer).





Development and testing facilities at IEP-SAS

Clean room 12m^2

EMC laboratory (Faraday cage) with radiated and conductive testing system NARDA-PMM. (under development)

Thermal-vacuum chamber 150L, Scroll + Turbomolecular pumping system Varian, variable feed-through system

Vibration system
Bruel&Kjaer / LDS,
Shaker V780,
power amplifier HPAK,
control system LASER LAS-200,
Analyzer of impacts VIB-E-220

Thanks for your attention!