Space research and ESA projects – FEE CTU in Prague

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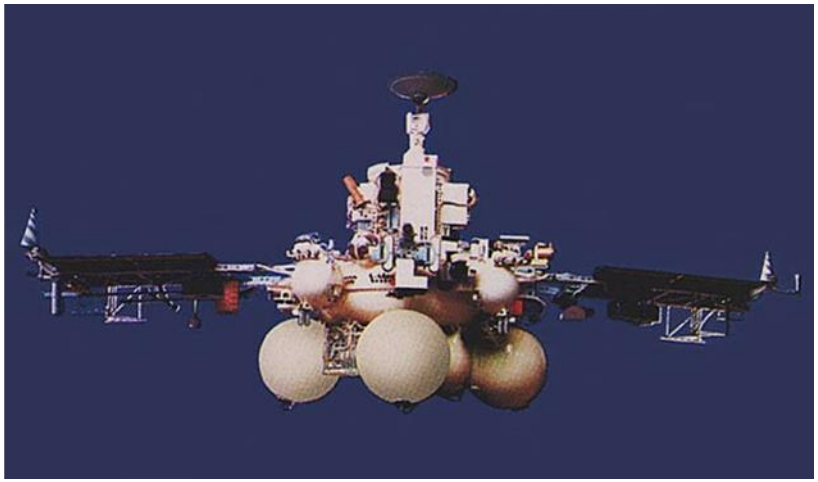
About us …

- **The Czech Technical University in Prague (CTU) is one of the biggest and oldest technical universities in Europe**
- CTU currently has eight faculties and about 18,000 students
- More than 160 study programmes
- High positions in QS World University Rankings
- Faculty of Electrical Engineering (FEE) – study close to research activities, faculty generates about 30% of the CTU research
- **https://www.cvut.cz/en/**

Space activities in the past (1975 – 1990)

- **Participation in the INTERKOSMOS space program (FEE CTU in Prague)**
  - TEREK – rtg telescope and coronagraph (development of electronic)
  - Phobos -1 and Phobos -2
  - Close cooperation with Astronomical Institute of the Czech Academy of Sciences



Space activities in the past (1990 – 2003)

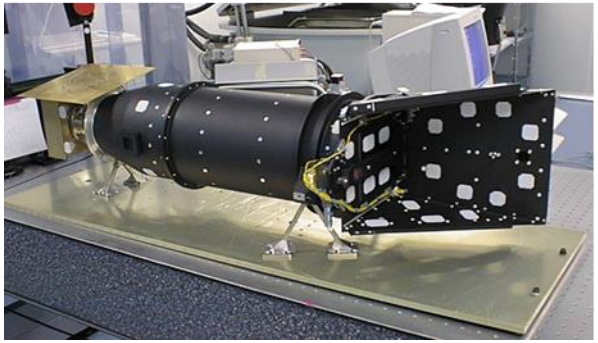
Participation on the Czech **MIMOSA** satellite

- design on-board three-axis **magnetometer** (FEE CTU in Prague)
- Satellite topology for minimization of their magnetic field
- Close cooperation with Astronomical Institute of the Czech Academy of Sciences, the Czech company Space Device

Space activities in the past (1995 – 2005)

Participation on the **INTEGRAL** mission

- observatory with concurrent X-ray and optical monitoring.
- INTEGRAL – launch October 17, 2002
- **Optical Monitoring Camera** (OMC) - device
- Data compressions and analyses, OMC test device, ground-based support and telescopes (BOOTES)



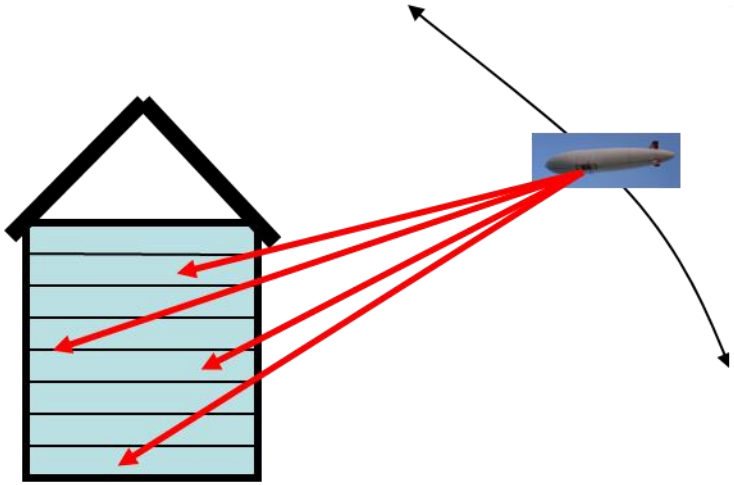
Space activities in the past (2008 – 2015)

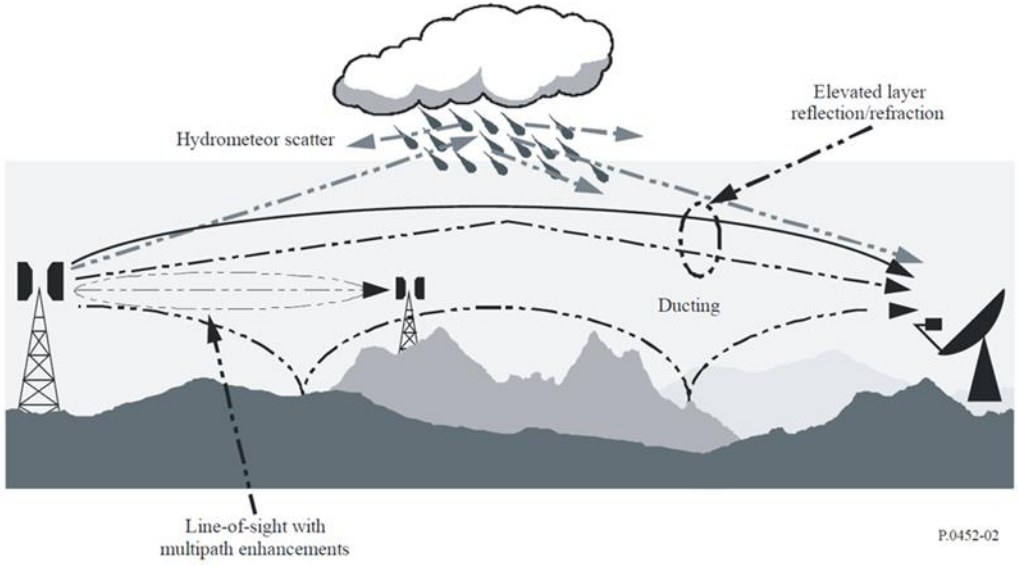
Penetration Measurement and Modelling for Satellite Communication (ESA PECS project)

- L, S, C – Band (2.0, 3.5, 5.0 GHz)
- Penetration into buildings

MOFINT – Propagation Models (ESA Contract)

- Propagation Models for Interference and Frequency Coordination Analysis
- Measurement and modelling of the microwave propagation

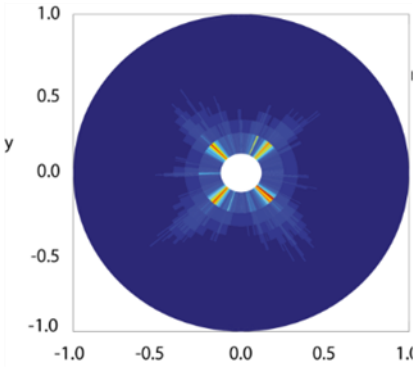


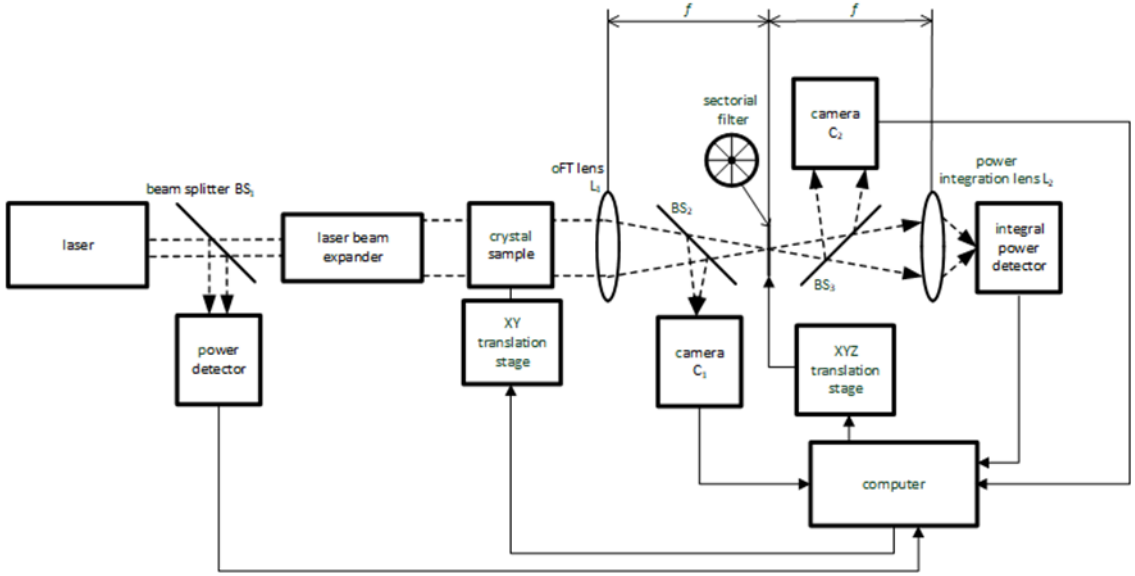


IR optical elements development

Participation on the development of new optical elements based on the **Calomel crystals** for space applications

- PI - **BBT Materials Processing, Ltd** (Czech company) and cooperation with companies FASTLITE (France) and Altran (Italy) – many ESA projects
- Development of the method for optical quality of Calomel crystals assessment **DEMON** (Quality Evaluation Methods for Calomel Optical Elements, 2011 - 2014)





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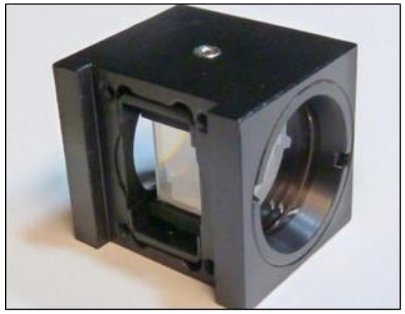
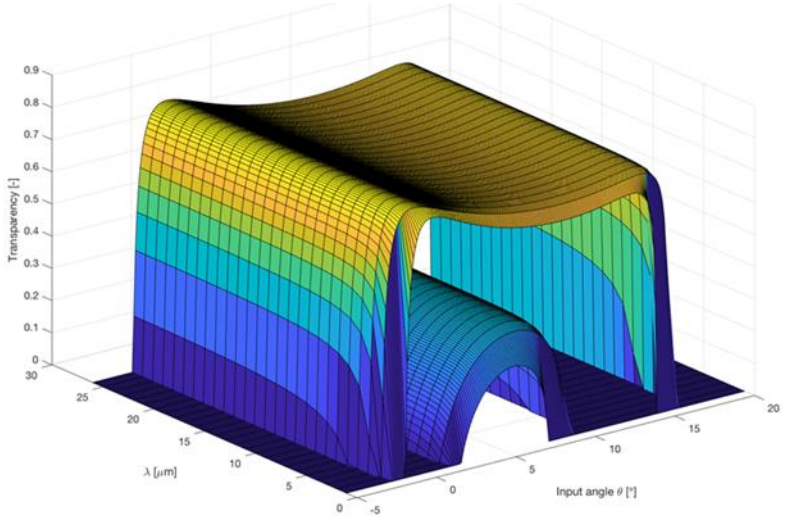
- Development of the method for optical quality of Calomel crystals assessment DEMON (Quality Evaluation Methods for Calomel Optical Elements, 2011 - 2014)
- New polarizers for the VIS – 10 microns band (**IAPETHOS** - Infrared Advanced Polarizer for Space and Other Applications, 2014 - 2015)





IR optical elements development

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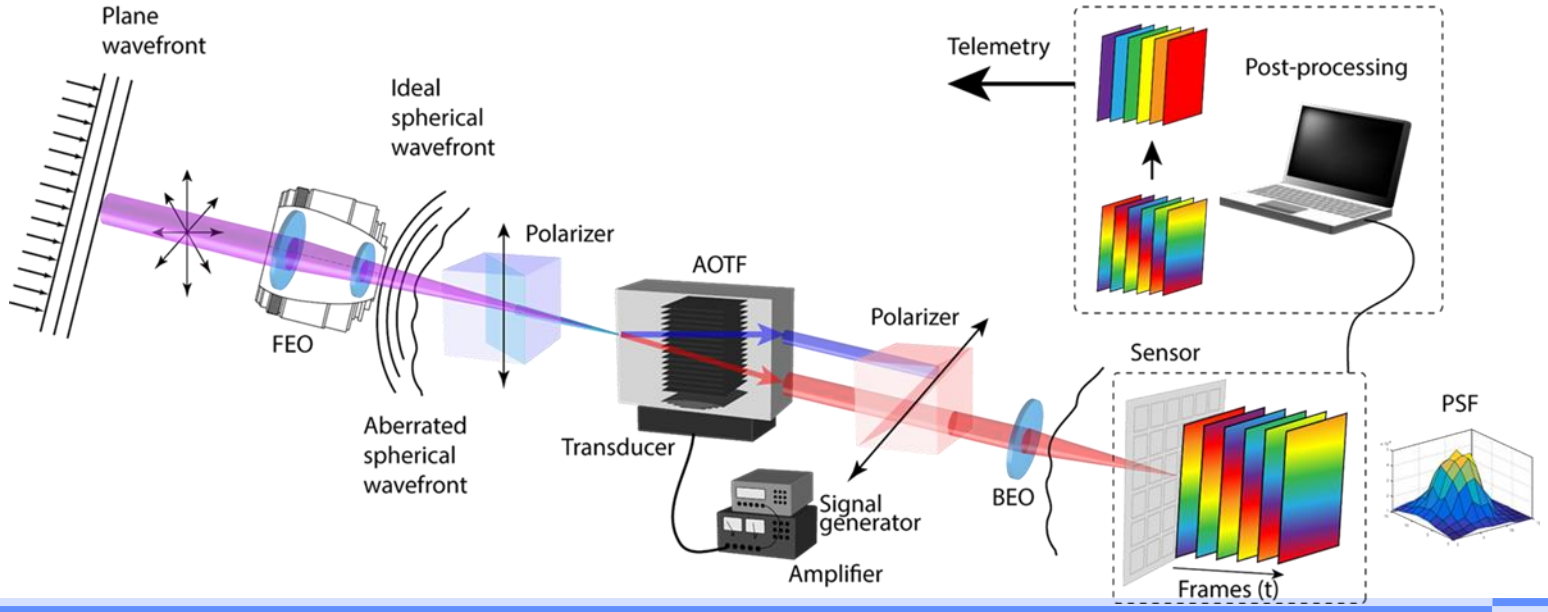
- Thermal Hyperspectral Imaging System - **THETIS (Thermal Hyper-spectral Imaging System Breadboard Requirement Definition and Design)**
- since 2016
- AOTF (Acousto-optical tunable filter), 9 μm, spectral resolution 8-12 nm, swath 50km, FOV 3°
- PI - BBT Materials Processing (Czech company) and cooperation with companies FASTLITE (France) and Altran (Italy)



VZLUSAT – CTU students participation

VZLUSAT – VZLU nanosatellite in space since June 23, 2017

- FEE CTU students and teachers participation
- Excellent opportunity for a **high quality practice** for our students
- Electronic development, testing and data processing

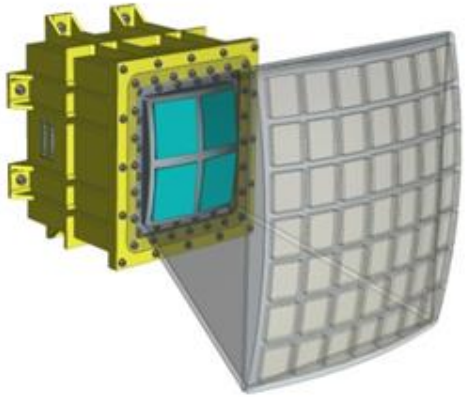
THESEUS, SMILE– future missions

THESEUS – Transient High Energy Sources and Early Universe Surveyor

- Lead proposer – Lorenzo Amati (INAF – IASF Bologna, Italy)
- Payload Consortium (Italy, UK, Spain, Denmark, Poland, Czech Republic, ESA (+ France, Hungary, Slovenia, Ireland)

SMILE - Solar wind Magnetosphere Ionosphere Link Explorer

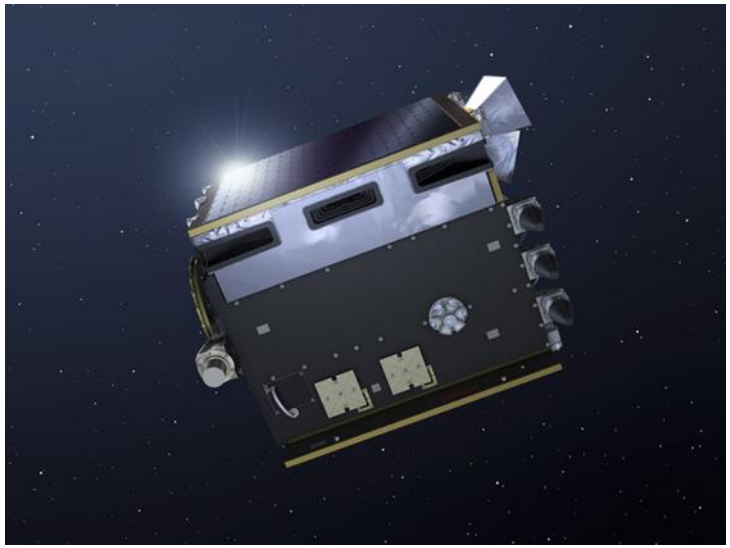
- The Soft X-ray Imager (SXI)
- Soft X ray telescope with lobster Eye type optics



CTU – space activities

MEDIPIX detector

- Institute of Experimental and Applied Physics, CTU
- Photon counting detector, spectral coverage > 3 keV
- Space radiation dosimetry, VZLUSAT and ESA minisatellite Proba V (launch 2013)



CTU – space activities

Measurement in weak optical signals

- Prof. Prochazka group - Faculty of Nuclear Sciences and Physical Engineering, CTU
- Solid state photon counters and their applications in space missions
- Solid state detectors for picosecond timing resolution
- New measurements and diagnostic methods in weak optical signals detection

Missions

- Laser altimeter for mars mission MARS 92/96, Russia, 1990-1996
- Photon counting LIDAR for NASA Mars Polar Lander, 98, NASA, 1998
- Portable Calibration Standard - unique measurement and diagnostic tool accepted by international scientific community as a reference, operated and applied on 6 satellite laser stations on 3 continents, 1999-2006
- Laser altimeter timing system for planetary exploration, project for German Space Agency DLR, 2005-6
- Photon counting detector for Laser Time Transfer, China, 2007-2012, 4 satellites
- Photon counting detector for Time Transfer by Laser Light, NASA CNES mission Jason-2, 2008

SPACEMASTER – STUDY PROGRAMME

- **SpaceMaster – International master degree study programme**
- Joint Master Degree Course in Space Science and Technology
- Erasmus Mundus Joint Master Degree Course in Space Science and Technology
- Courses of space physics, space engineering, electronics, data analysis and programming, navigation, etc.

- Consortium of 5 Universities responsible for the SpaceMaster Course:
  - Luleå University of Technology (**LTU**), Sweden (Coordinating University)
  - Cranfield University (**CU**), United Kingdom
  - Czech Technical University in Prague (**CTU**), Czech Republic
  - University of Tokyo, Graduate School of Science (**Todai**), Japan
  - Université Toulouse III - Paul Sabatier (**UT3**), France

- http://spacemaster.eu/

FEE CTU Space Activities - Conclusion

- Selected projects and space missions have been presented

- FEE CTU – research interconnected with education (**link to education**)
- FEE CTU has **longtime tradition** in the space research (INTERKOSMOS, NASA, ESA)

- Space activities
  - **cooperation students and teachers**
  - collaboration with the Academy of Sciences, industrial companies, and international projects

- **Expertise in the field**
  - electrical engineering (batteries, solar cells, ..)
  - electronics
  - telecommunications (radio-engineering, navigation, …)
  - informatics – data processing, computer engineering, cybernetic
  - sensor and photonic systems

Thank you for your attention…