Art of Technology

Innovative Electronics

Design and Development Services

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Company Overview

- Contract Developer
  - From Concept Study to Series Production
  - Electronic design, review / 2nd opinion, development and **miniaturisation**
  - Industrial including ATEX, Medical and Space
- Established 1999
  - Spin-off (ETH, Zurich)
  - Privately owned (100%)
  - 15 employees
- ISO9001 and ISO13485
  - Medical devices & active medical implants

TECHNOPARK® ZÜRICH

Design & Consultancy Services

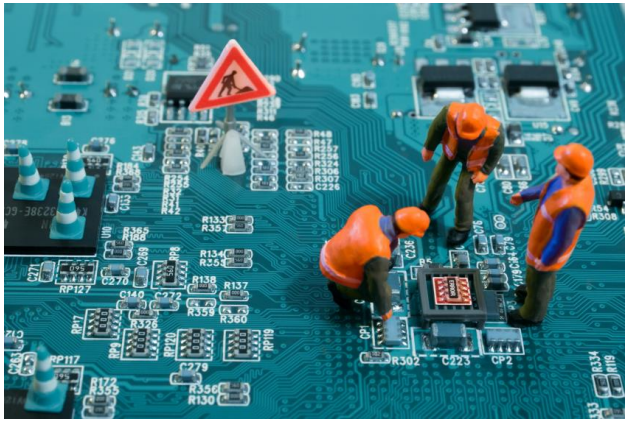
- Research & technology studies
- Review services
  - design review
  - second opinion
  - troubleshooting
- HW and SW system development
- Production set-up and support
- Support for start-up companies and universities

Core Expertise

- System miniaturisation
- Analogue and digital electronics
- Low power electronics
- Power management
- Cryptography and data security
- High and low level embedded software
- High reliability
- Harsh environments (ATEX, space, medical)
- Standard and special technologies
  - SMD, HDP, 3D-MID
  - chip size packages, chip-on-chip
  - bare dies with wire bonding
  - flip-chip, TAB

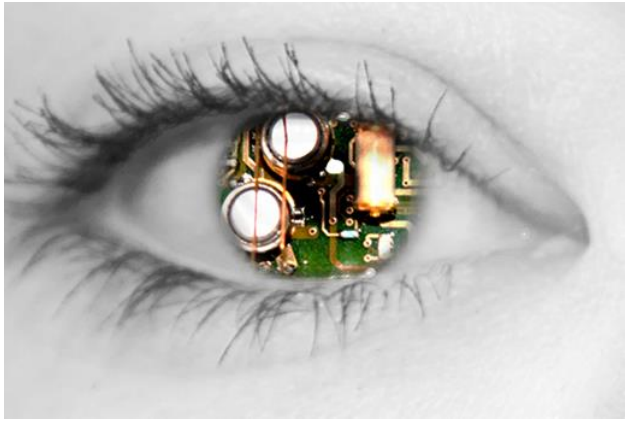
Typical Applications

Data Communications & Data Security



Industrial

Medical Devices & Active Implants



Optical Systems

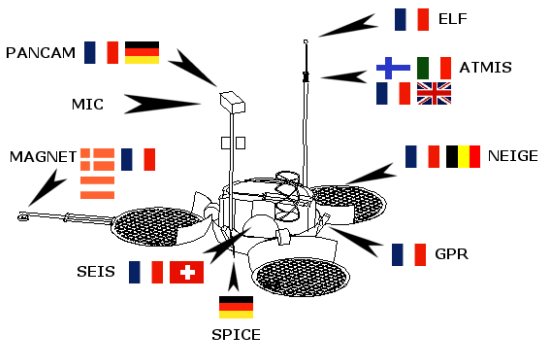
Space

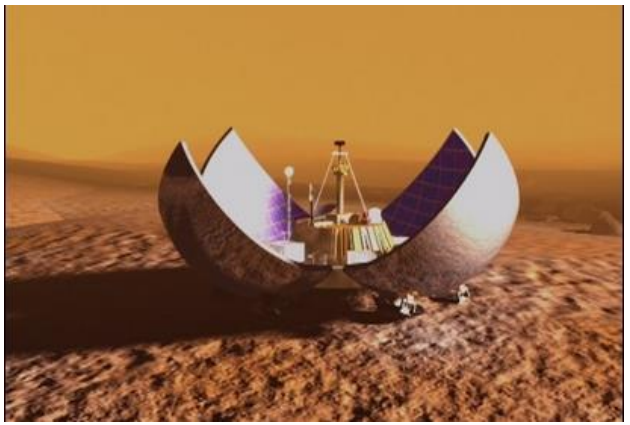
High Reliability & Harsh Environments

Space: NETLANDER™

- Mars Landing Probe (2001)
  - Network of four identical landers performing simultaneous measurements in order to study the internal structure of Mars, its sub-surface and its atmosphere.

- Two SEISmometers to study tremors on Mars and locate reservoirs of water or ice
  - very broad band (2-axis)
  - short period (3-axis)

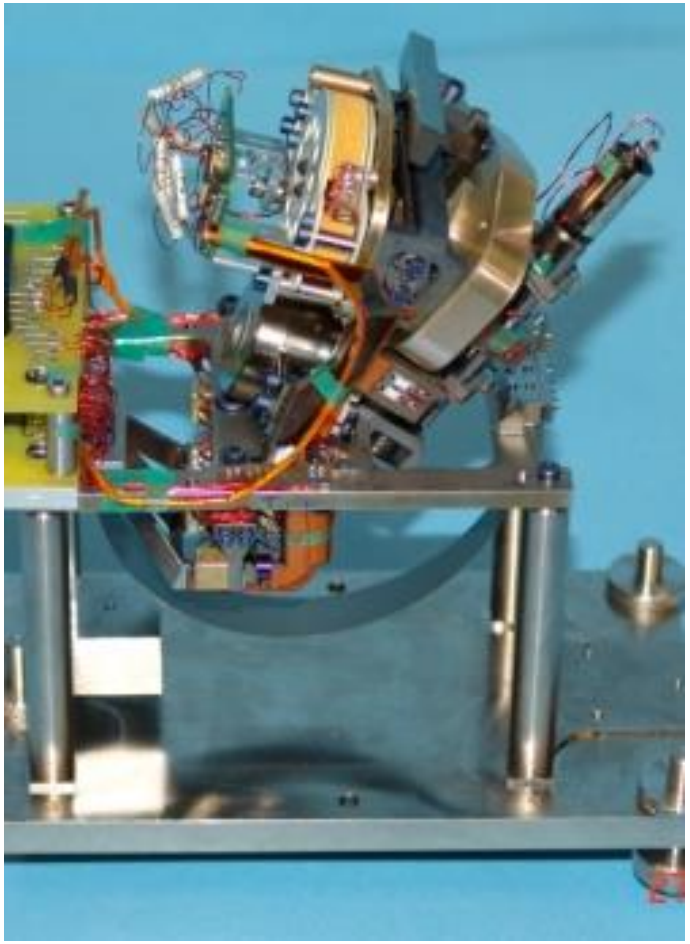




Space: NETLANDER™ - SEIS

- SEISmometer Electronics
  - Feasibility study and technology evaluation of main and auxiliary controllers and motor drive electronics

- SEIS-MC and SEIS-AC modules
  - system analysis & critical properties review
  - evaluate high density packaging technologies
  - identify ASIC technology for (digital) circuits
  - review miniaturisation potential
  - check availability of components
  - analyse FM development & qualification costs



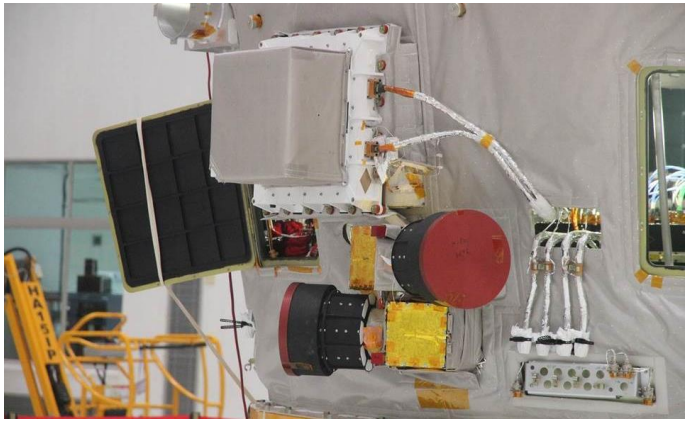
Space: POLAR

- Detection of Gamma Ray Bursts (GRBs)
- Highly sensitive detector using Compton Scattering Effect to measure polarisation of incoming photons
- Concept to FM (2008 - 2014)
  - swiss experiment (ISDC, Univ. of Geneva)
  - scheduled for two to three years operation
  - only non-Chinese experiment on Tiangong-2
  - launched on 15th September 2016

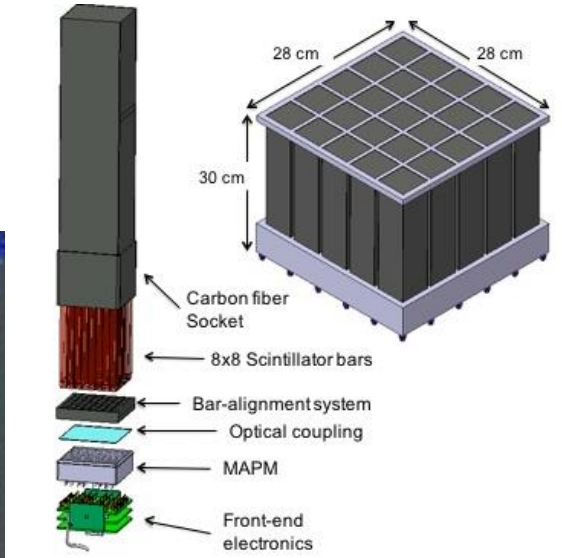
Space: POLAR

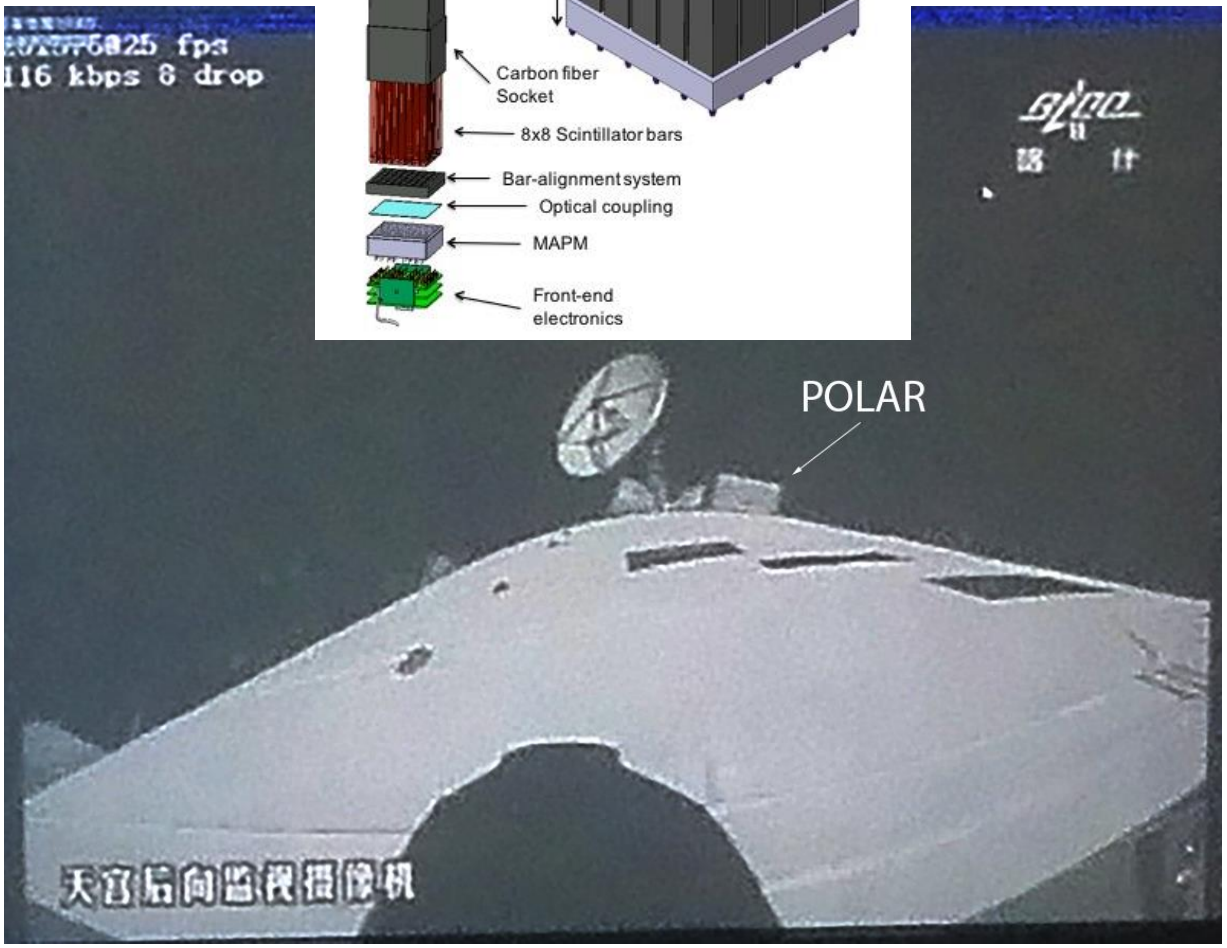
- Feasibility Study
  - evaluate design of existing front end electronics
  - identify potential design errors or weaknesses
  - provide recommendations to increase reliability of manufacturing and overall system.
- High Voltage Power Supply (HVPS)
  - system reverse engineering from breadboard
  - system re-design, development and manufacture
  - 26 settable power sources (on 3 prints)
  - 300 - 500 components per board (300mm x 60mm, 6 layers)
- Low Voltage Power Supply (LVPS)
  - system feasibility study, design, development and manufacture
  - 82 switchable power sources (2 prints)
  - 800 - 1’300 components per board (300mm x 60mm, 8 layers)
- Component procurement and production of EQM, QM’s and FM
  - (at customers choice of manufacturers)
- Support qualification and acceptance tests including EMC

Space: POLAR




POLAR
各系统备战 载人航天再启程
天宫二号：总装完成 开始联合测试

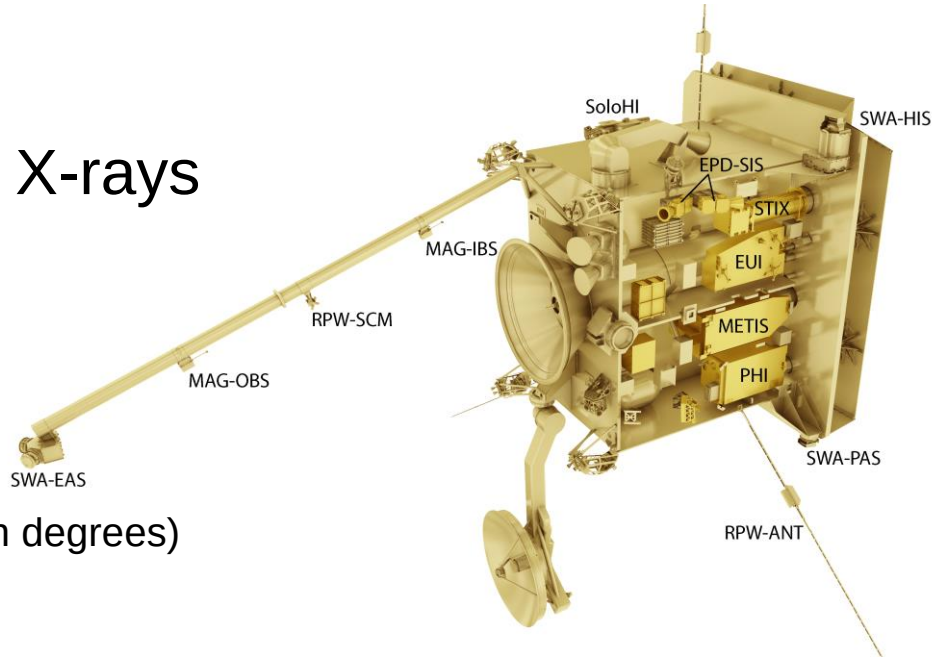

28 cm
28 cm
30 cm
Carbon fiber
Socket
8x8 Scintillator bars
Bar-alignment system
Optical coupling
MAPM
Front-end
electronics


116 kbps 8 drop
POLAR
天宫后向监视摄像机

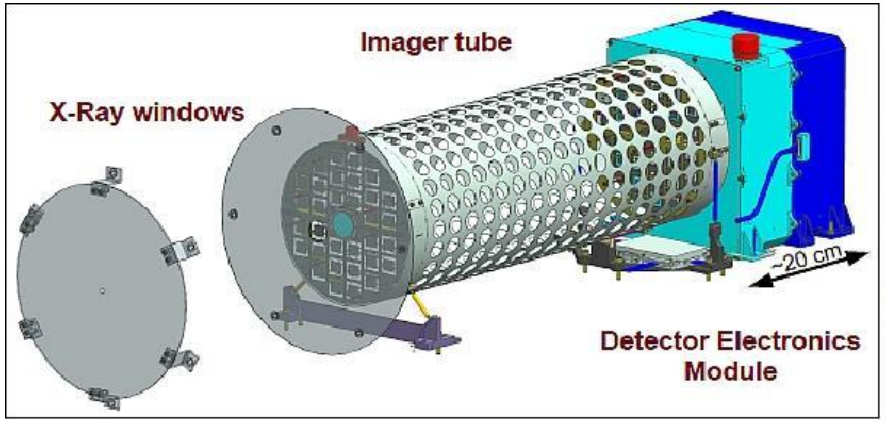
Space: STIX

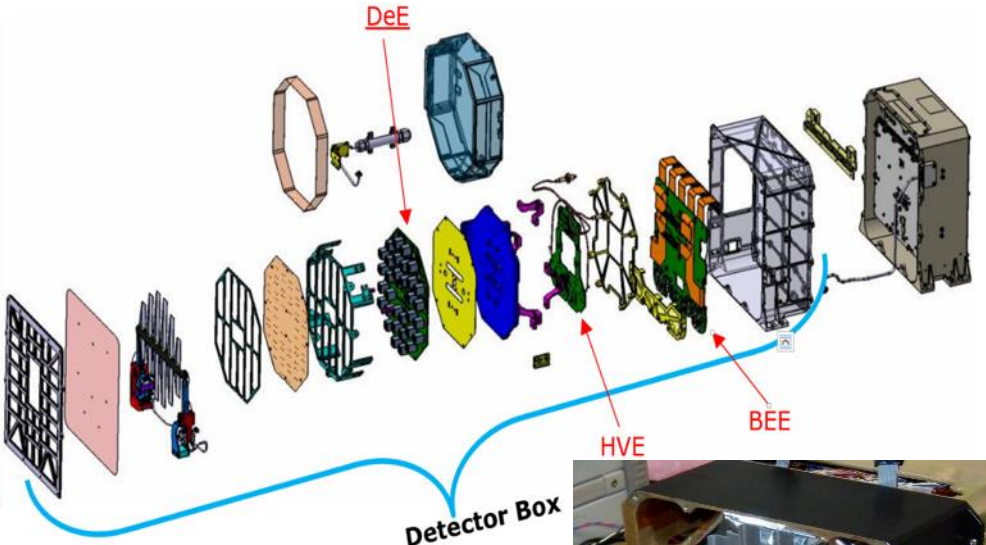
- Solar Orbiter (launch scheduled 2019)
  - explore how sun creates & influences heliosphere
  - understand risks caused by space weather

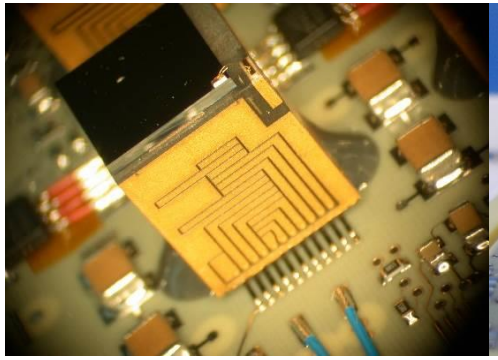
- Spectrometer Telescope Imaging X-rays
  - Swiss experiment (FHNW)
  - create images & spectra
    - thermal & non-thermal x-rays
    - time, location, intensity & spectra
      - accelerated electrons
      - high temperature plasma (>10 million degrees)

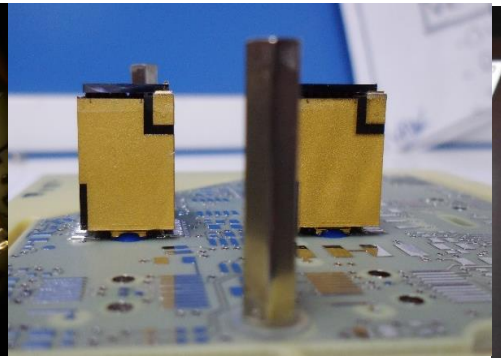


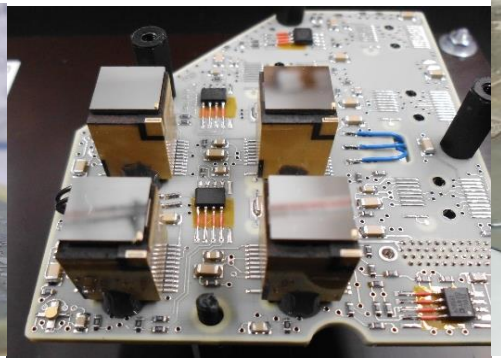
Space: STIX

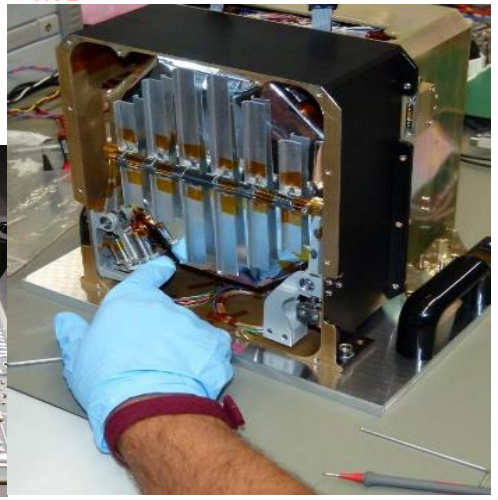

Imager tube
X-Ray windows
~20 cm
Detector Electronics Module


DeE
HVE
BEE
Detector Box



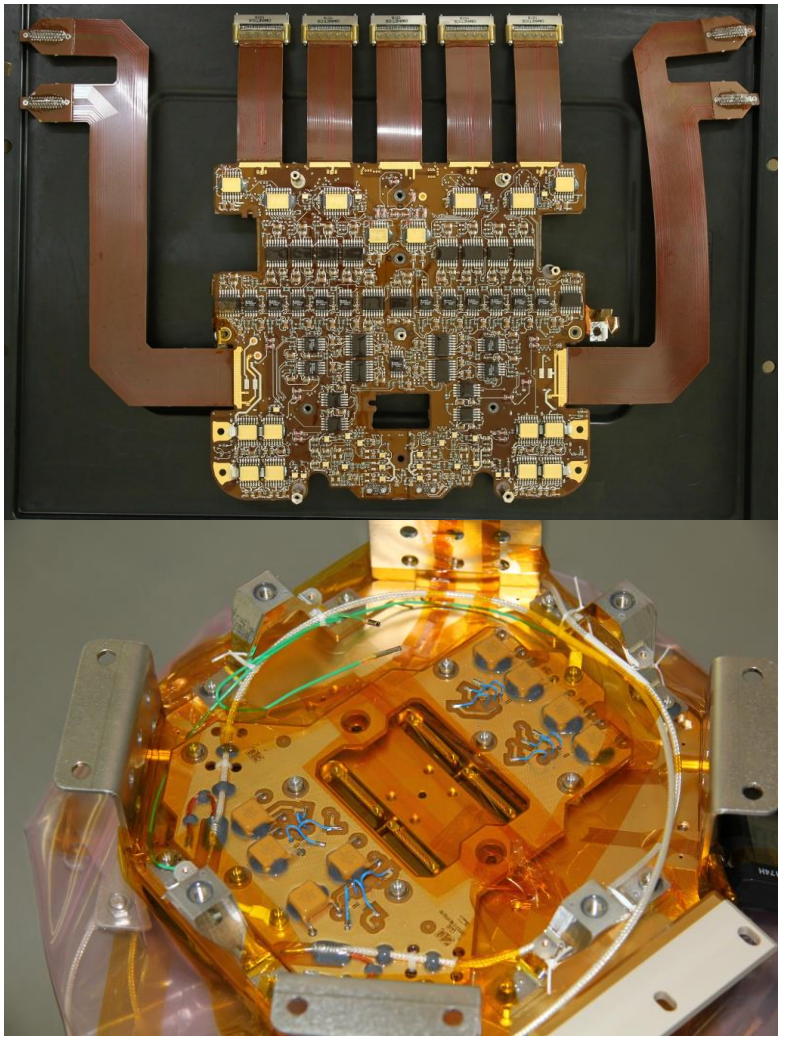






Space: STIX

- Support System Design
  - Interface to IDPU and PSU
  - Interface to attenuator mechanism
- Detector Electronic Board
  - Design, Development & Test
  - 2 W total thermal power
- High Voltage Electronic Board
  - Design, Development & Test of filter and distribution network
- Backend Electronic Board
  - Design, development & Test: Sensor Interface, Attenuator Driver
  - Minimize thermal conduction
- Support Instrument Integration and Test
  - Integration and test procedures
  - EMC, radiation, shock & vibration: qualification and acceptance tests

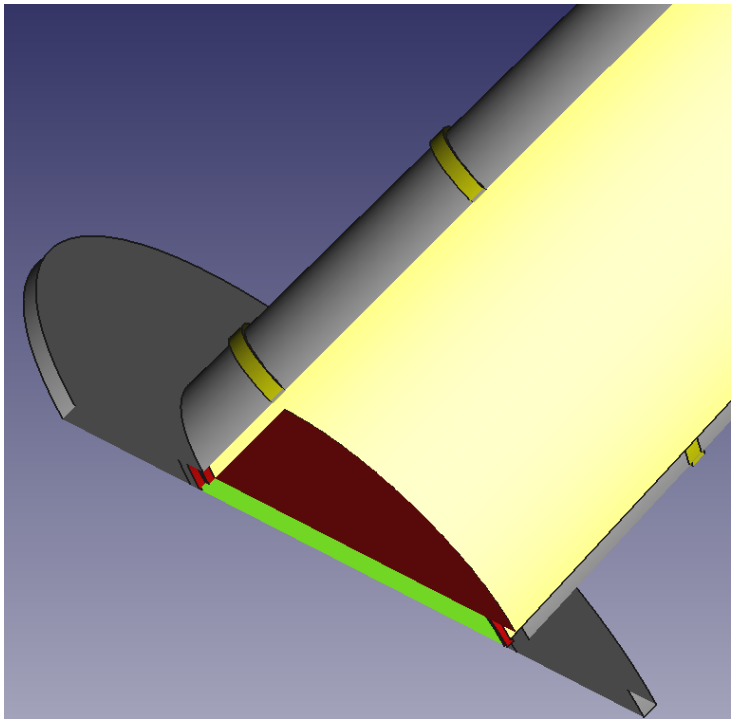


Space: 3D-MID4space (ARTES 5.1)

- Characterise suitability of 3D-MID technologies, manufacturing techniques, processes and materials for space telecom applications… target TRL5
- Identify critical issues & recommendations, or modifications that may be required, lessons learned and conclusions
- Design, build and characterize test samples demonstrator applications
  - Mechanical Properties
  - Tensile Strength
  - Adhesion (Hot Pin Pull, Shear, Bond Wire Pull)
  - RF Properties
  - Resistance / Isolation
- Propose possible follow on activities and road map to increase TRL

Space: 3D-MID4space Helix Antenna

- Quite huge dimensions (l=165mm) for injection moulding
- Challenging construction
  - “constant” wall thickness
  - No seams in metallised area
- Challenging metallisation
  - Need to rotate and shift the body for laser structuring
  - Need for hatched base plate structure

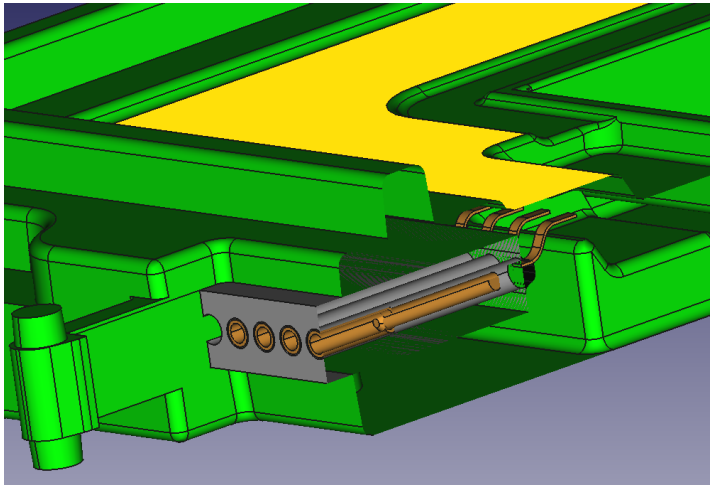


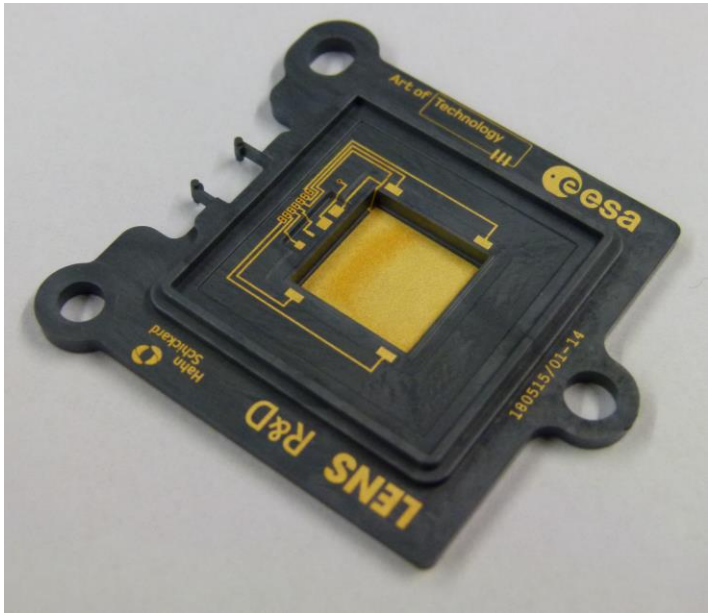
Selected solution:

- Constant wall thickness
- No seams
- But 2 (simple) parts which need to be soldered

Space: 3D-MID4space Sun Sensor

- Single piece injection moulded case
  - Simple moulding tool (2 pieces)
  - “Constant” wall thickness
  - Restrictions for laser writing of metallised tracks
  - Field Of View to be defined by case to avoid window alignment
- Standard connector
  - Directly inserted in mould tool before case moulding
  - Pins completely covered by plastics, electrical connections provided by laser drilled vias to tracks
  - Connector lock using hooks instead of screws
- Assembly
  - SMT mounting / soldering (resistor)
  - Die and wire bonding (4 quadrant diode, thermistor)





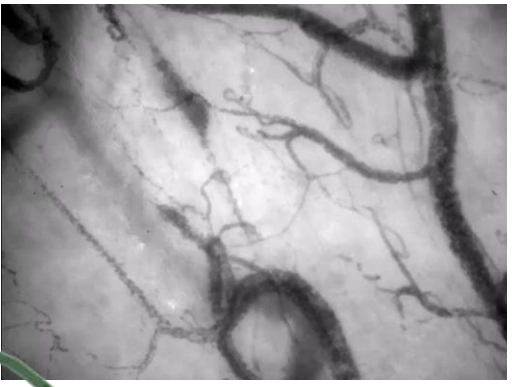
Active Medical Implants

- Ascites suction pump
  - pressure, temperature & motion sensors
  - wireless data transfer & re-charging
  - fully sterilisable
  - <100 grams
  - lifetime > 2 years, > 2000 l fluid

- Long Bone Lengthening Device
  - fully encapsulated motorised part
  - totally biocompatible mobile systems
  - bi-directional transmission of data
  - wireless power transfer from control box to implant

Medical Devices

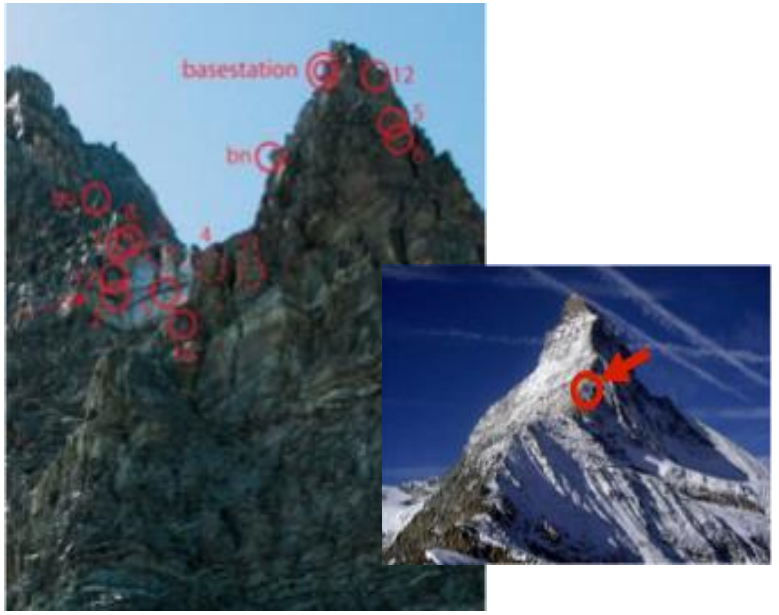
- Medical camera system
  - high resolution digital imaging with illumination



- Wearable device(s)
  - pulse, skin temperature, ECG
  - movement (and helplessness)
  - blood glucose, blood pressure, SpO2
  - wireless data transfer, alarm button, GSM

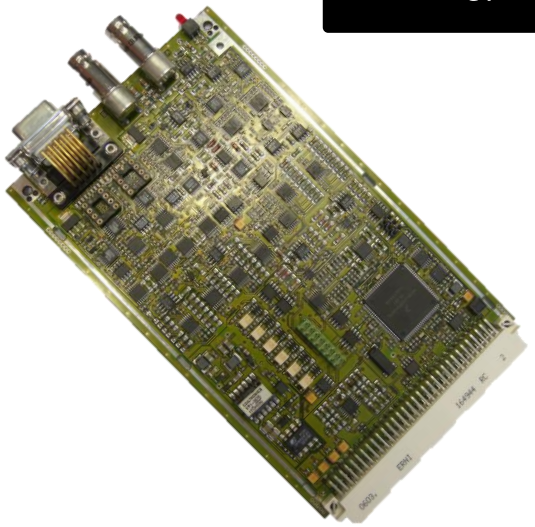
Scientific: ETH Permasense

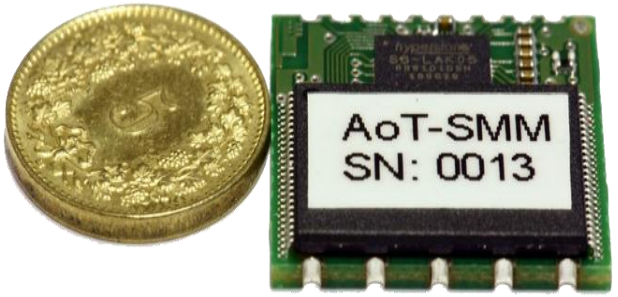
- Permafrost Monitoring: in 6 mont
  from prototype to small series
- Support for ~25 Sensors
  - temperatures, conductivity, gap
    distance, ice pressure, water pressu
  - Measurement interval 1-60 min
- Extreme environmental conditions
  - −40 to +65° C, ΔT ≦5° C/min
  - rock fall, ice, frost, avalanches, lightning
- Data transmission nearly in real-time
- Long time stable & reliable
  - ≧99% data yield
  - 3 years autonomous operation



Industrial

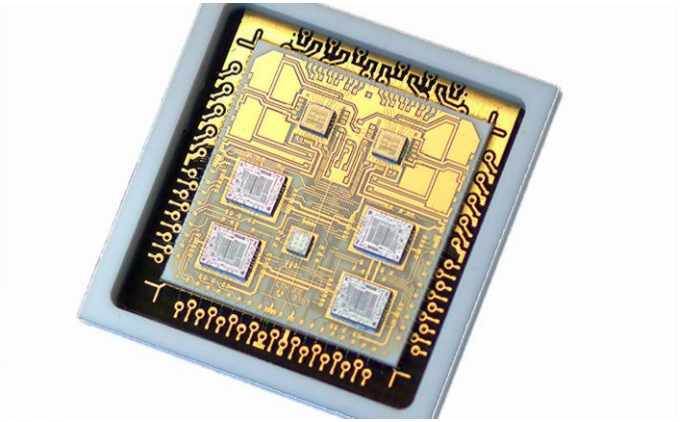
- General purpose voltage amplifier
- Optical temperature measurement
- High EMV environment
  Small & Low Power
  - Sensor/Logger: Φ9.6 x 40mm, 2 years from coin cell
- Power modules
- Intrinsic safe electronics for potentially explosive environments
  - GSM / BT / 802.15.4 / NFC Communication
  - Solar Charger
  - GPS Position Detection
  - Ultrasonic Sensor
- Solderable Memory Module (SMM)
  - high vibration environment
  - SD/MMC compatible interface





Data Communications

- Wireless communication
  - ISM 433 MHz, 868 MHz, 2.4 & 5 GHz
  - GSM, GPRS, LTE
  - Bluetooth, Bluetooth LE
  - RFID, NFC, WLAN
  - Satellite up to 12 GHz, 77 GHz (terrestrial)



- Wired Communication
  - Data over Supply (DoS)
  - Ethernet, USB
  - Field-Bus, Profi-Bus, M-Bus, HART

Optical Systems

- 3D-MID camera system

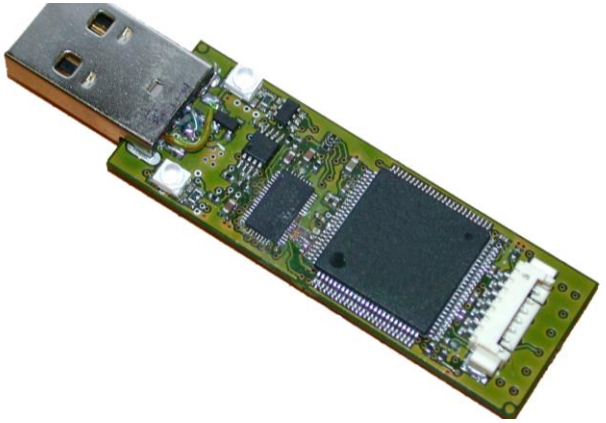
- Industrial
  - IP65 water meter, 2 cameras
  - RFID reader for label data

- Consumer
  - 360° panoramic ball camera
  - 36 cameras, simultaneous trigger

Data Security

- Uni-directional Network Link
  - authentication, authorisation
  - privacy (encryption)

- Secure USB Stick
  - encryption on stick
  - smart card and password
  - small embedded processor
  - strong encryption algorithm



Possible AoT Contribution to SKA

- Review / 2nd opinion
  - Support Contractor Qualification
  - Electronic System Design Review
- Electronic Design
  - Experience with University/Science Customers: POLAR, STIX (Astrophysics), ETH Permasense (Environmental Sciences), …
  - Experience in Harsh Environment (Space, Deep Sea, Alpine: in particular Temperature Range and Transients)
  - Experience in Low Noise (STIX instrument declared EMC Quiet) and Low Power
- Production & Test
  - Volumes from Samples/Small Series to Mass Production
  - Either selected by Art of Technology or by Customer