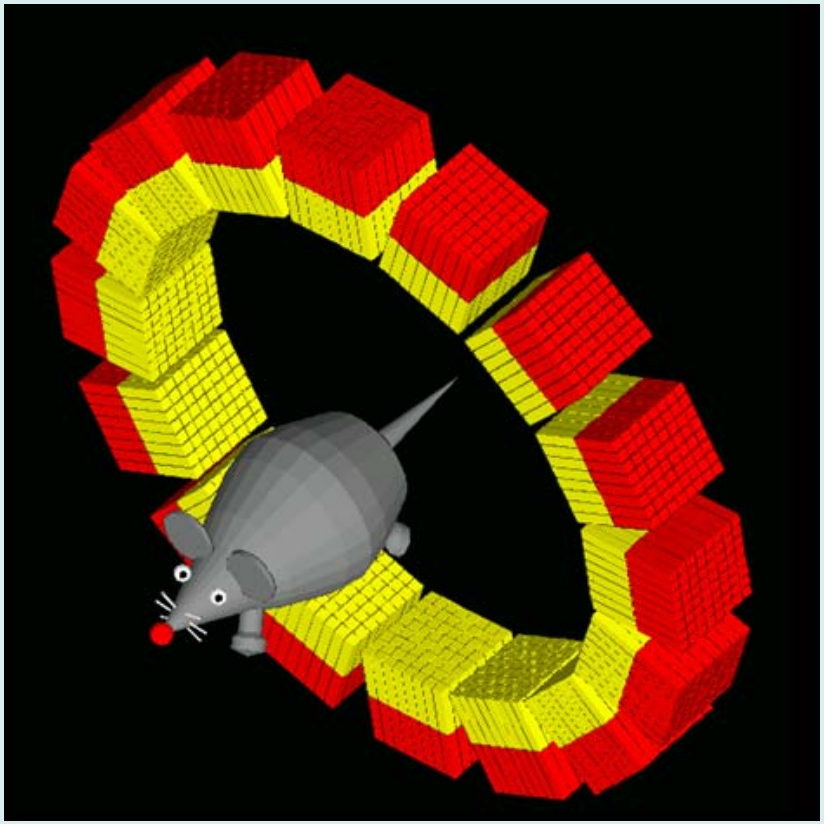
Institute of Nuclear Research of the Hungarian Academy of Sciences ATOMKI, Department of Electronics

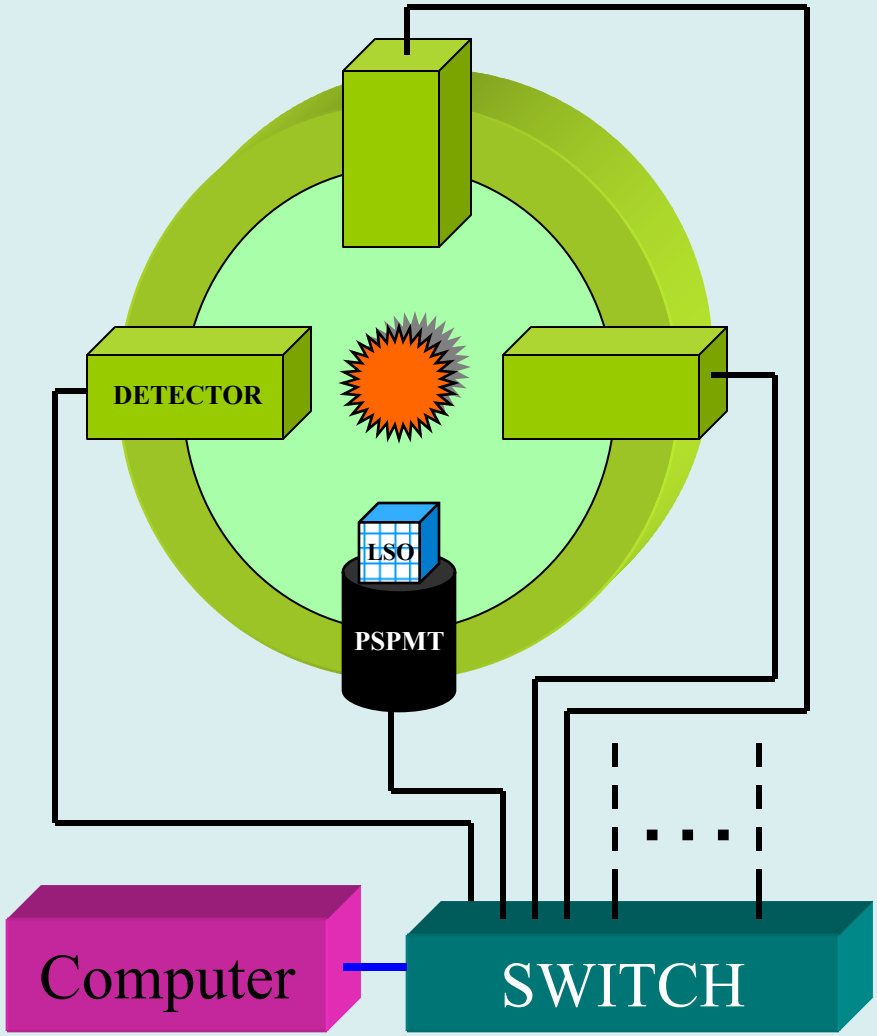
Presented by:

Dezső Novák

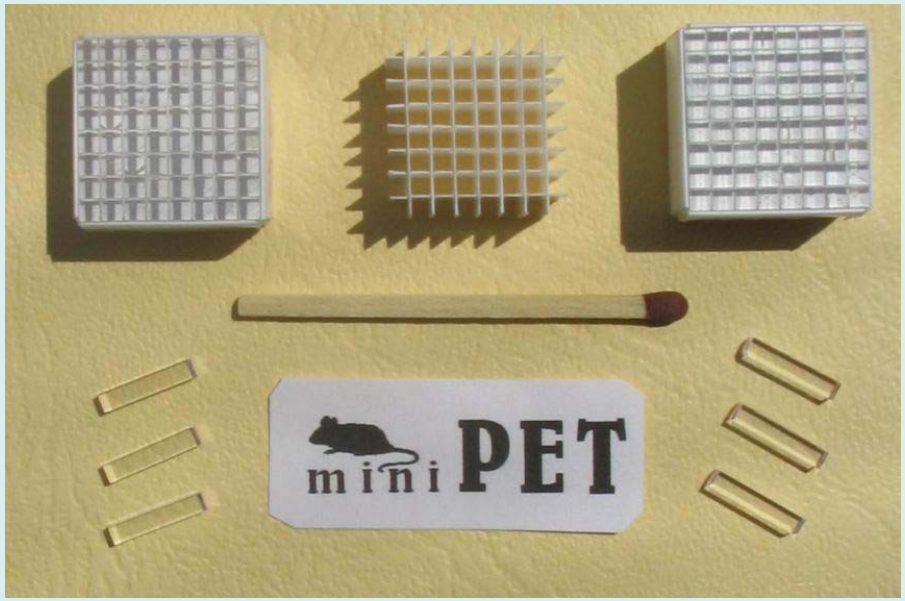
- Small animal PET camera
- Radiation Hardness tests
- CERN – CMS – Muon Barrel Alignment

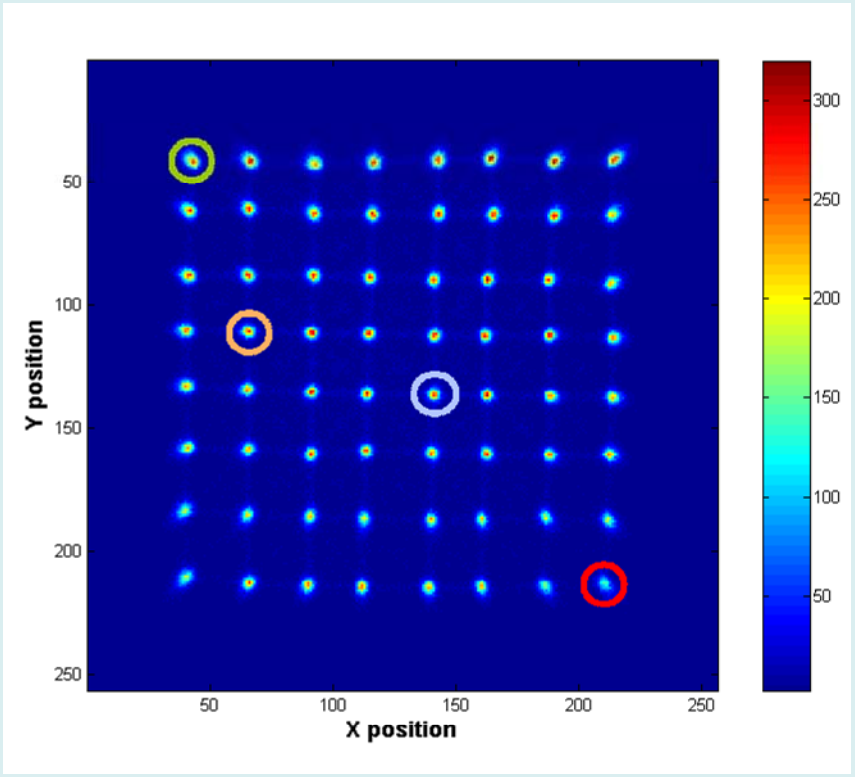
miniPET

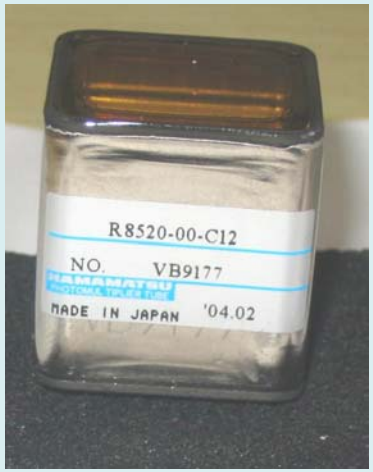




Crystal block



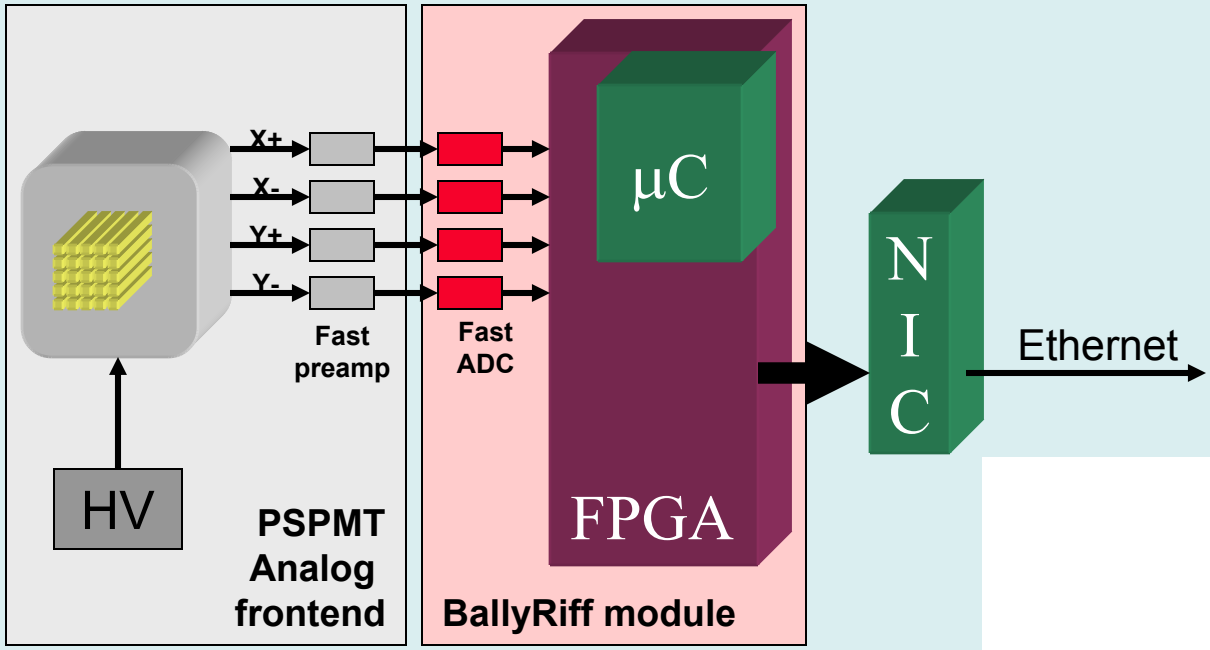


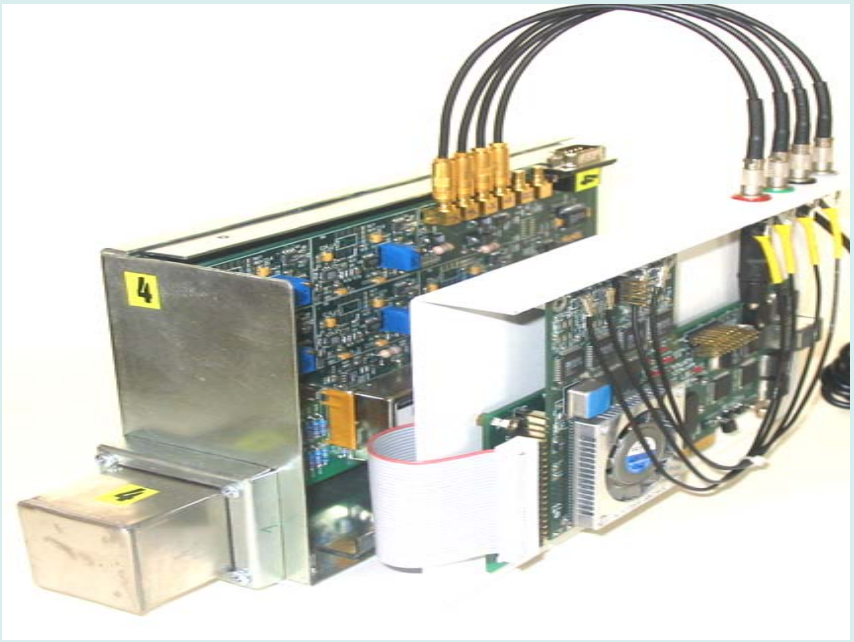


Detector

- 2*2*10 mm^3 LSO scintillator crystal
- 8x8 crystal/detector
- Position Sensitive PhotoMultiplier Tube

Block scheme of the DAQ module

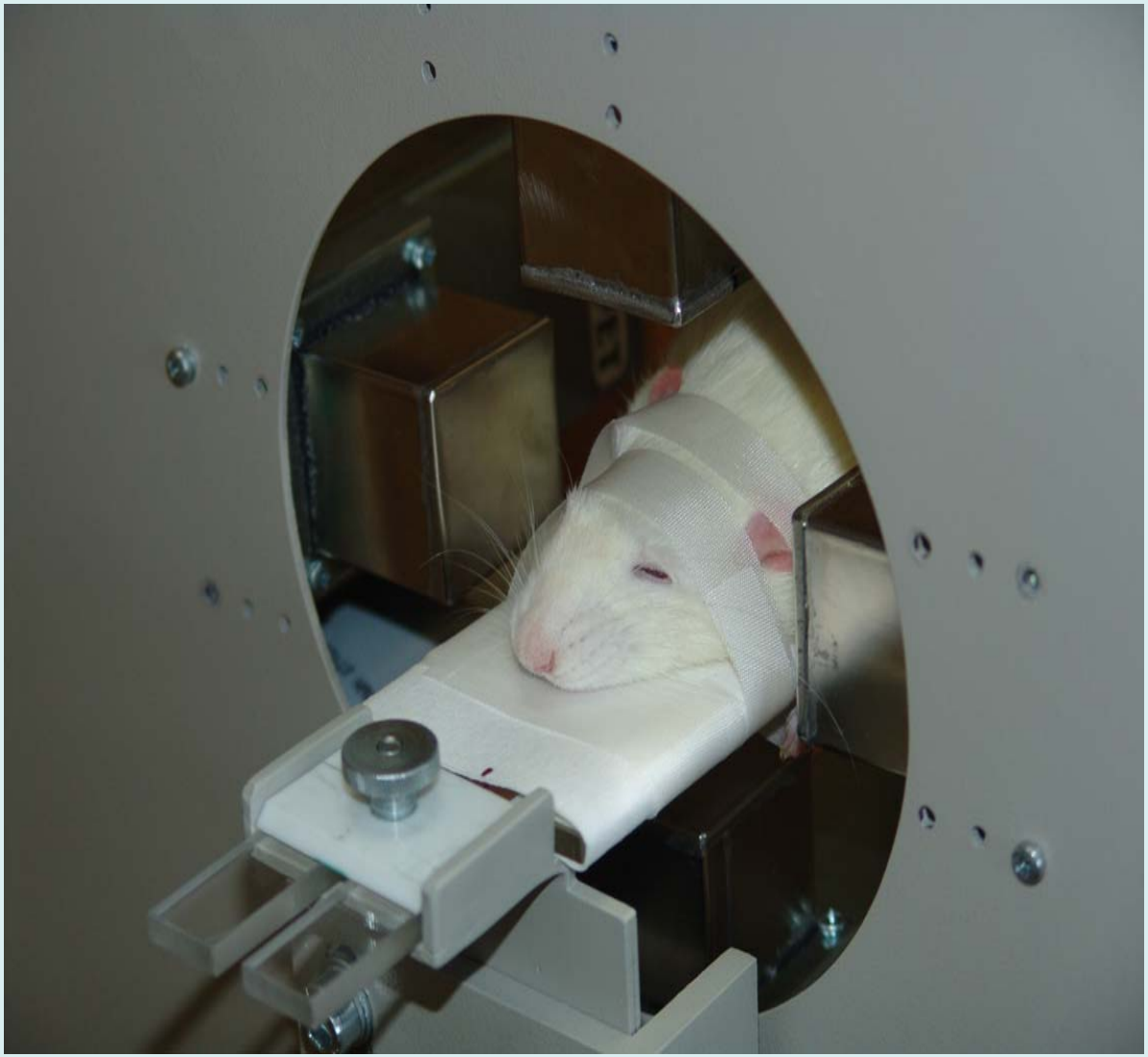


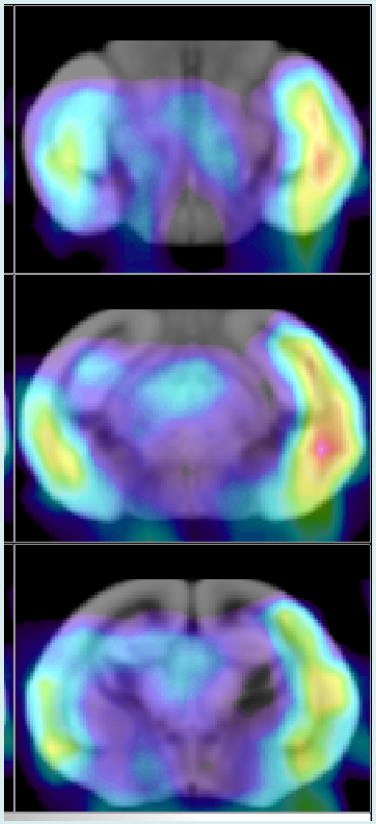


Signal processing tasks in the FPGA

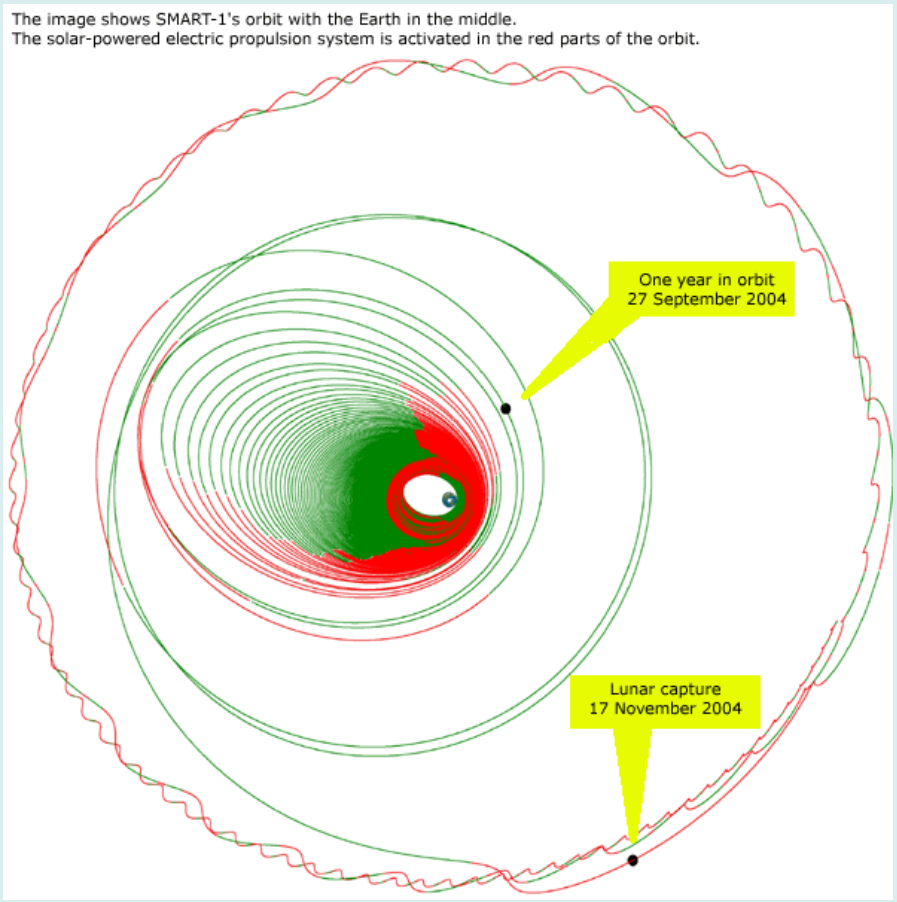
- Base line restoration
- Pulse recognition
- Time stamp
- Energy calculation

Rat image



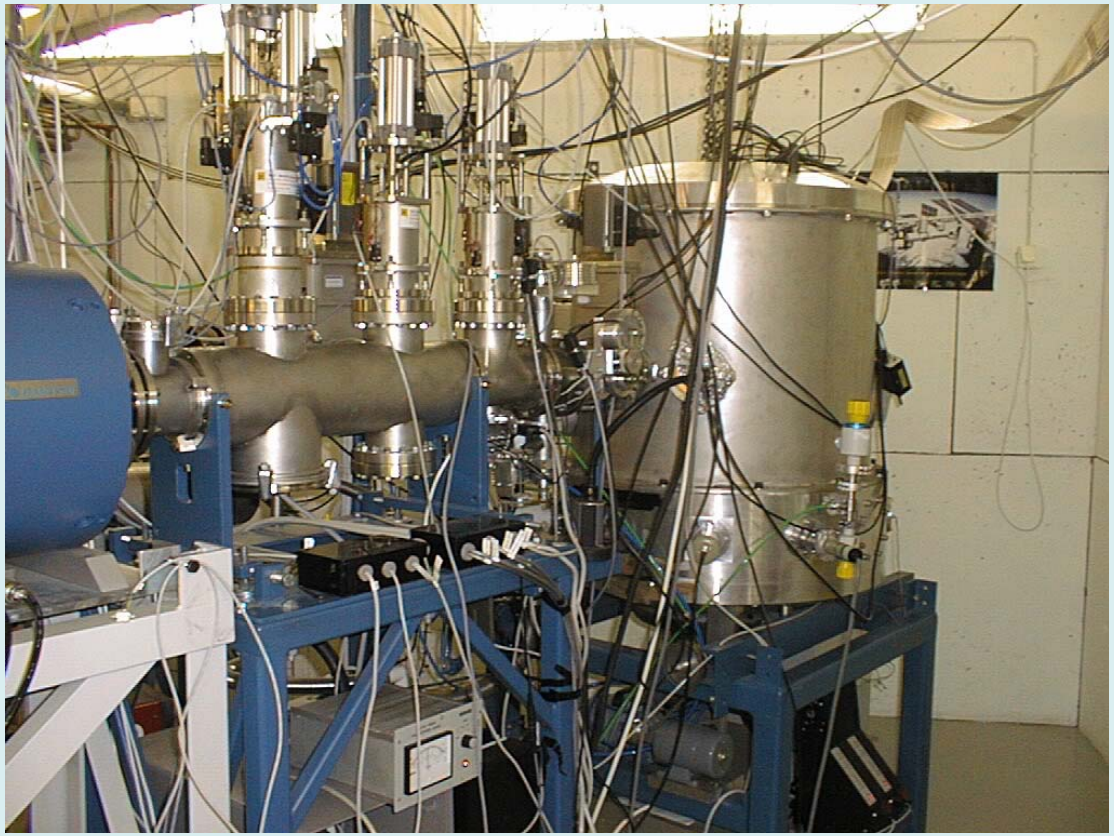


The SMART-1 Mission



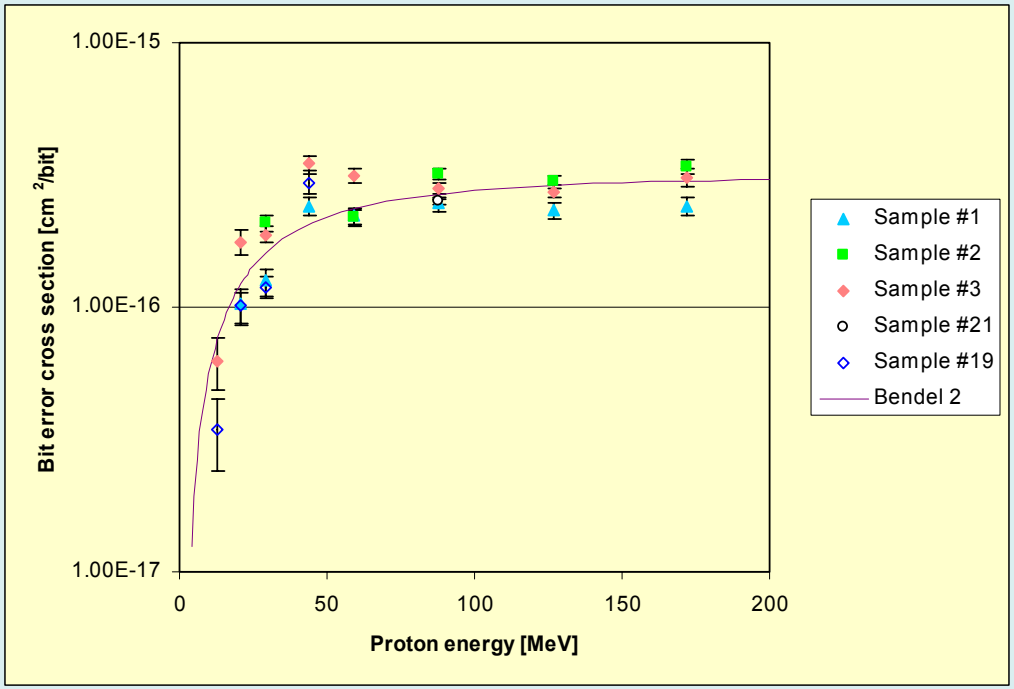
- 2003-2006
- 400 days to achieve lunar capture
- Size: 1 m^3, 350 kg
- Fuel: 82 kg Xenon

The Radiation Hardness Tests



- Proton, gamma, heavy ion irradiation
- Memory components: DRAM, FIFO, SRAM (passed)
- Satellite cover foil (failed)

Radiation Hardness Test Results

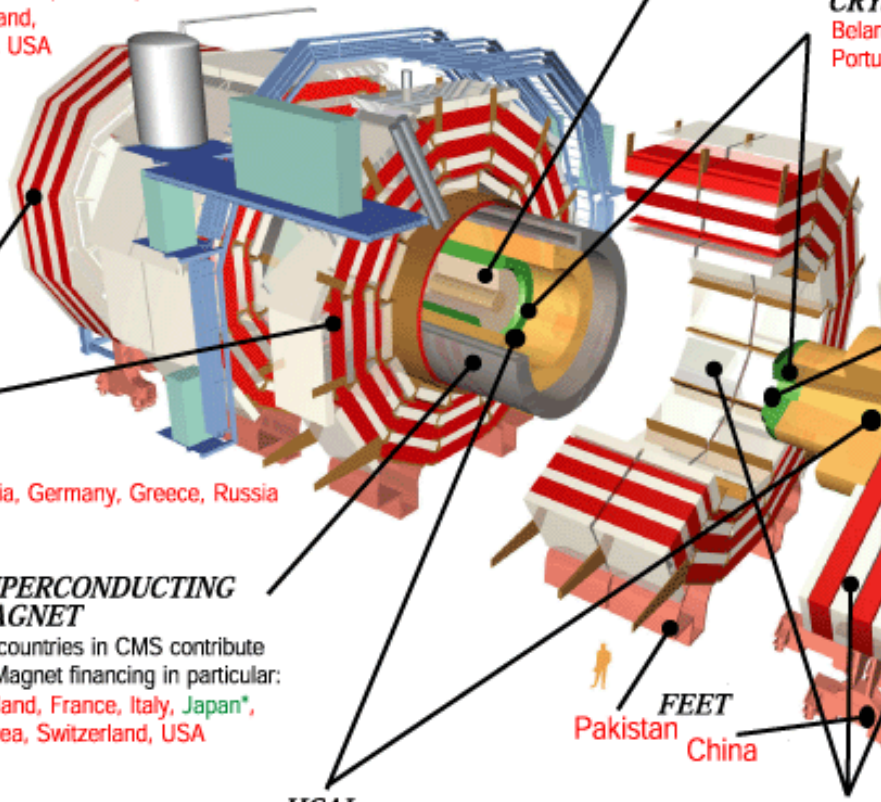


Nr of errors

- 4+1 Gbit DRAM
  - Quiet environment 475
  - Worst week 44000
- 128Kx8bit SRAM
  - Quiet environment 0.7
  - Worst week 63
- 2Kx9bit FIFO
  - Quiet environment 0.9
  - Worst week 92

The CMS detector

31 Nations, 150 Institutions, 1870 Scientists



TRIGGER & DATA ACQUISITION
Austria, CERN, Finland, France, Greece, Hungary, Italy, Korea, Poland, Portugal, Switzerland, UK, USA

TRACKER
Austria, Belgium, CERN, Finland, France, Germany, Italy, Japan*, Switzerland, UK, USA

CRYSTAL ECAL
Belarus, CERN, China, Croatia, Cyprus, France, Italy, Japan*, Portugal, Russia, Switzerland, UK, USA

PRESHOWER
Armenia, Belarus, CERN, Greece, India, Russia, Taiwan (PC), Uzbekistan

RETURN YOKE
Barrel: Czech Rep., Estonia, Germany, Greece, Russia
Endcap: Japan*, USA

SUPERCONDUCTING MAGNET
All countries in CMS contribute to Magnet financing in particular:
Finland, France, Italy, Japan*, Korea, Switzerland, USA

FEET
Pakistan
China

FORWARD CALORIMETER
Hungary, Iran, Russia, Turkey, USA

HCAL
Barrel: Bulgaria, India, Spain*, USA
Endcap: Belarus, Bulgaria, Russia, Ukraine
HO: India

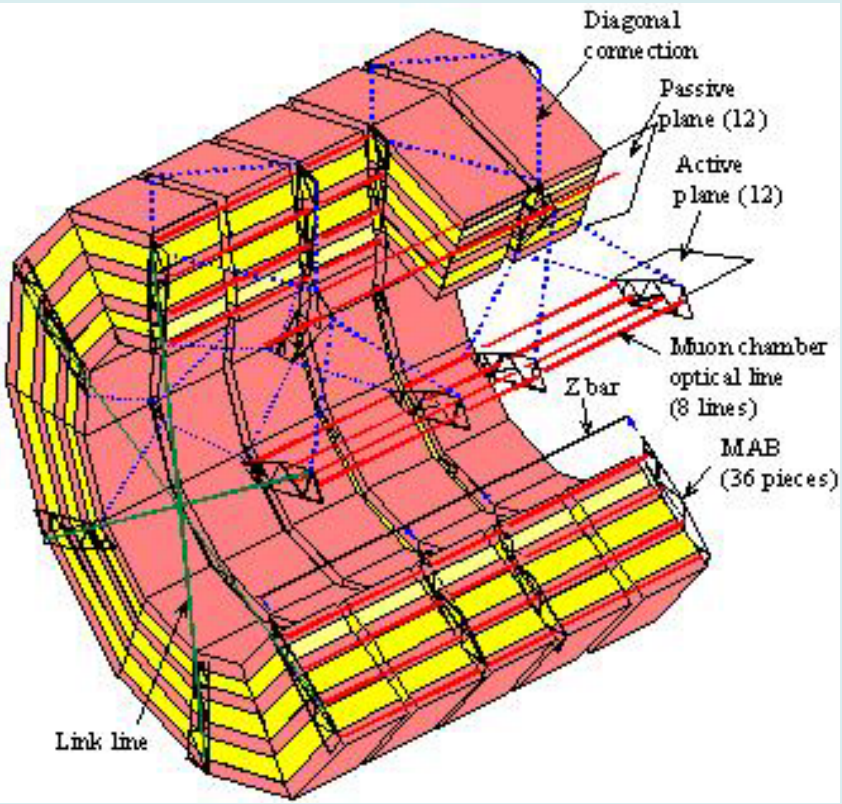
MUON CHAMBERS
Barrel: Austria, Bulgaria, CERN, China, Germany, Hungary, Italy, Spain,
Endcap: Belarus, Bulgaria, China, Korea, Pakistan, Russia, USA

* Only through industrial contracts

Total weight	**:**	**12500 T**
Overall diameter	**:**	**15.0 m**
Overall length	**:**	**21.5 m**
Magnetic field	**:**	**4 Tesla**

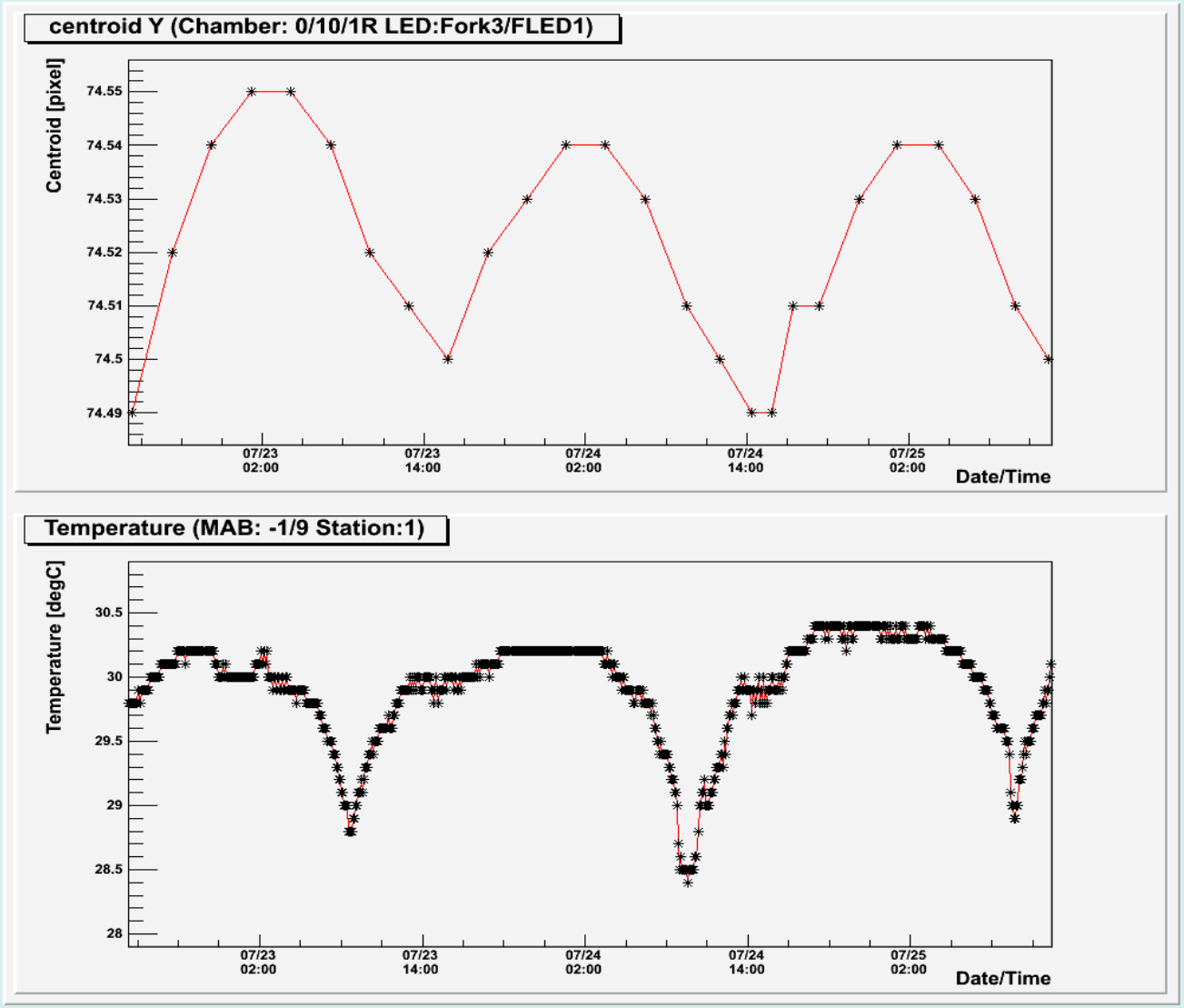
The Muon Barrel Alignment System

- Rigid structures (MABs, z-bars)
- Video-camera boxes (on the MABs)
- LED holders (called forks, on the chambers)
- Diagonal and Z-LED holders (on the MABs and Z-bars)
- Board computers (one for each MAB)



Results of the Magnet Test

0.05 pixel
~ 20 μm



Department of Electronics

- Medical imaging, Digital Signal Processing
  - Scintillation Detector development, PIN diode, PMT
  - Analog front-end electronics
  - FPGA based digital data processing
  - DSP algorithms for signal evaluation: CFD, time stamp
  - Medical Image reconstruction and processing
  - Small animal PET camera, Mobile gamma camera for heart studies (CARDIOTOM).
- Radiation hardness tests: neutron, proton and gamma irradiation.
  - CERN-FERMI, CERN-CMS, CERN-ALICE, CERN-RD42, ESA-SMART-1, SSC Prisma
- Nuclear Electronics:
  - Euroball, CERN-CMS-alignment