

Virtual Laboratory for Detector Technologies

Situation in Karlsruhe

Contribution

- **WP1.1:** Electronics System Development
 - Large-scale testing
- **WP1.2:** Sensors: Material, Design and Characterisation
 - Probe stations
 - TCT in cryostat
 - Irradiations (x-ray, protons and contact to neutrons)
- **WP1.3:** Detector Systems: Development, Infrastructure and Testing
 - Workshop with experience in construction of modules and larger structures
 - Clean room
 - Coordinate Measurement Machine
 - Wire bonder
 - Module teststands (sources, cosmics, LED)

Manpower

2 x Professors

6 x Scientific staff

4 x Diploma students

2 x PhD students

3 x Technicians

Arbitrary sorting !!!

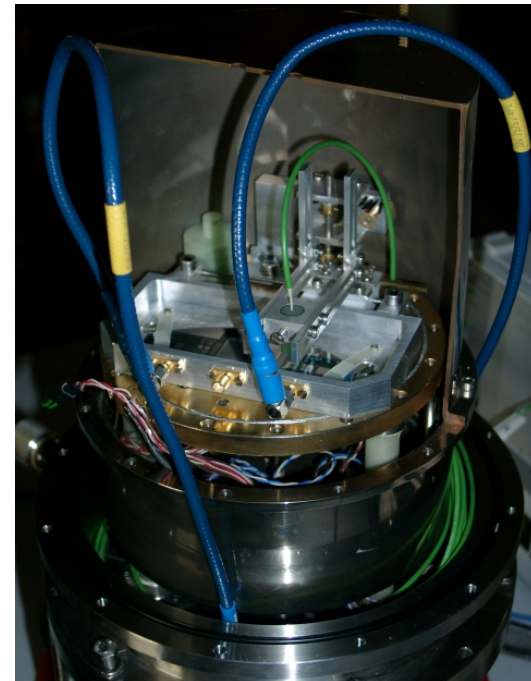
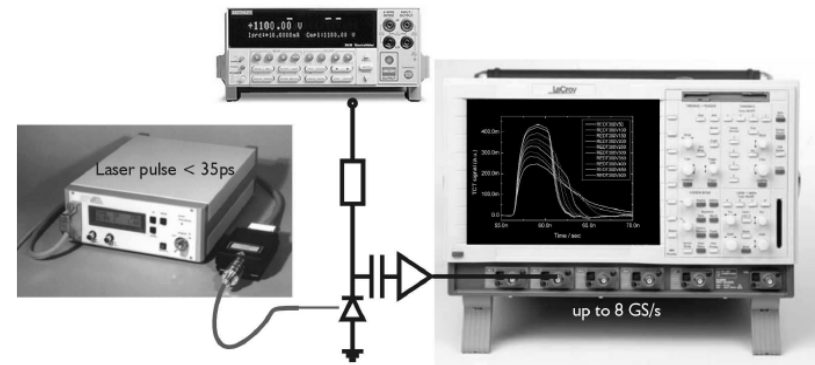
Probe Stations

- 2 homemade flexible probe stations to measure all relevant sensor and process quantities
- 6" cold chuck ($\sim -10^{\circ}\text{C}$) for measurements after irradiation
- Very flexible
 - individual needles
 - bias travels with sensor
- Switching matrix
- RH control
- LCR, electrometer, HV, quasistatic CV
- Camera (incl. frame grabber)

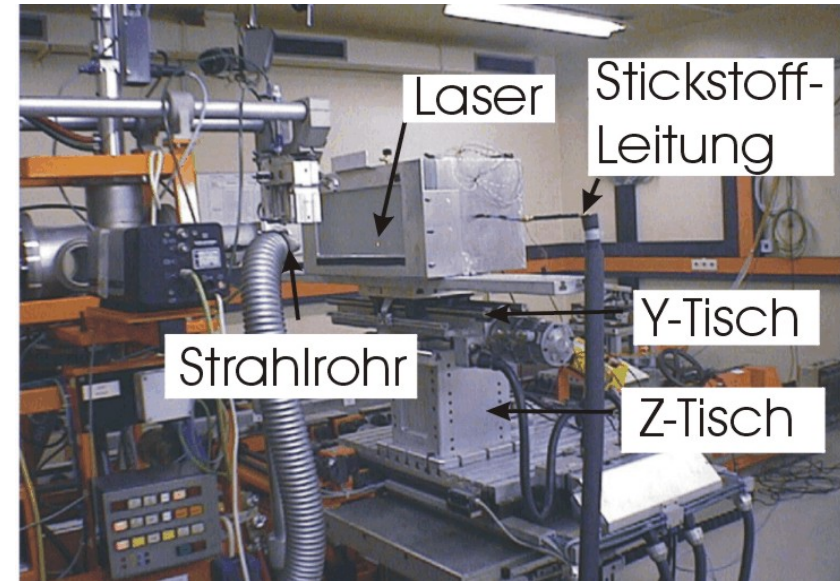


TCT Setup

- Scope with 8GS/s
- Fast amplifier
- Lasers:
 - 670nm (<35ps)
 - 1050nm (1ns)
- Sources: Am^{241} , Sr^{90}
- Mounted in dewar, cooling down to $\sim 100\text{K}$

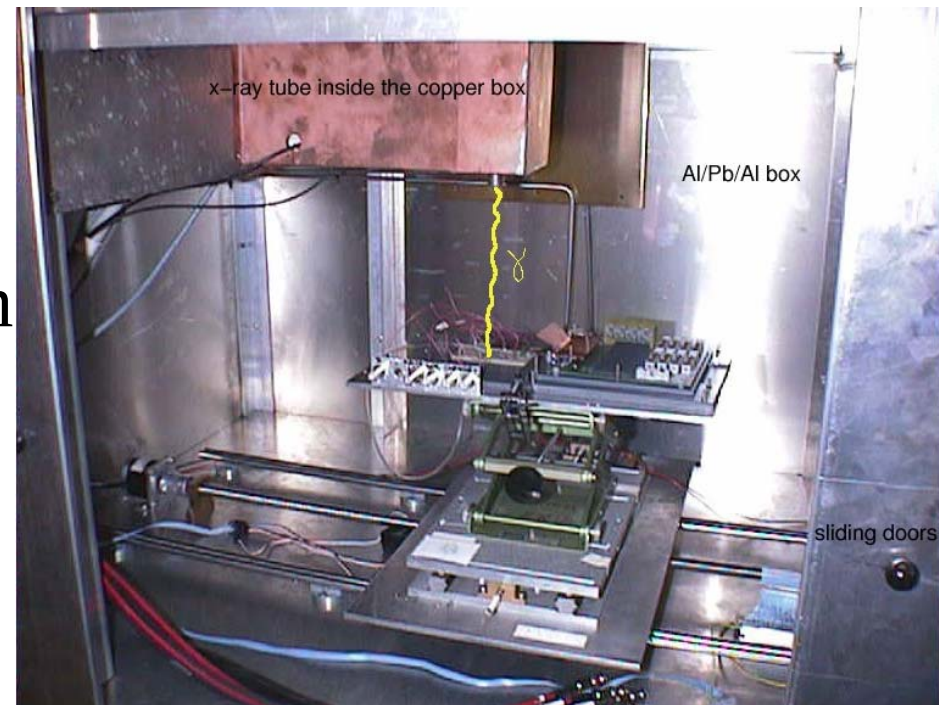


- Energy range: 15 – 38 MeV
(we use 26MeV with $\kappa=1.85$)
- Currents: 20nA – 100 μ A
(we use $\sim 1\mu$ A)
- Beam spot: $\sigma \sim 5$ mm
- Beam wobbled: 15mm x 15mm
- Samples are put in insulated movable box
 - area: 400mm x 200mm
 - cooled down to -20°C – -50°C using cold nitrogen gas
 - samples are scanned several times with line distance of 1mm
- Dosimetry is done by activation measurement of Ni-foils using Ni⁵⁷-line
- Examples:
 - Diodes on 25mm x 45mm irradiated up to 10¹⁶n/cm² takes 60min at 3 μ A
 - Sensor 100mm x 100mm irradiated up to 10¹⁴n/cm² takes 20min at 2 μ A

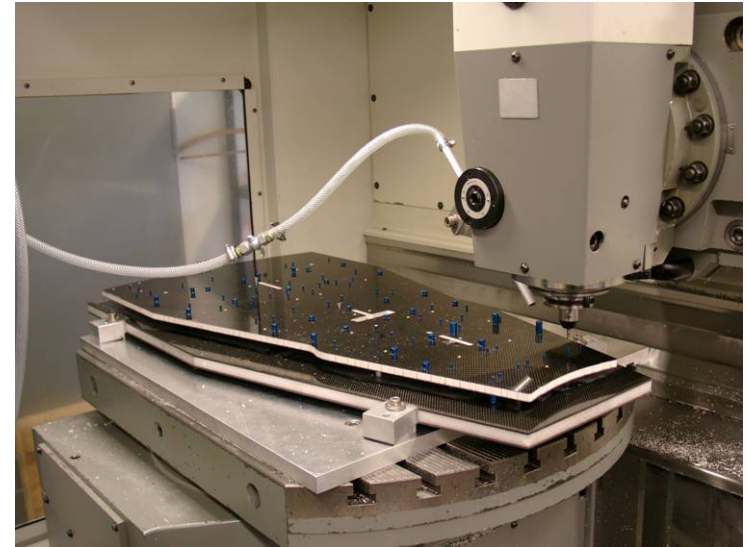


X-ray Setup

- Power supply: max. 60kV @ 20mA
- Cu-target
- Movable stage:
manual 400x200mm
PC controlled 50x100mm
- Temperature:
-10°C – 30°C
- Used for DEPFET
(Q. Wei, HLL München)



- Materials: Metal, GFK, CF, Wood
- Machines:
 - 3 x CNC miller
 - 1 x CNC lathe
 - 1 x Cycle lathe
 - several manual millers and lathes
- Welding shop
- Joinery
- Also access to FZK central workshop



CMS Tracker Petal under construction on CNC miller

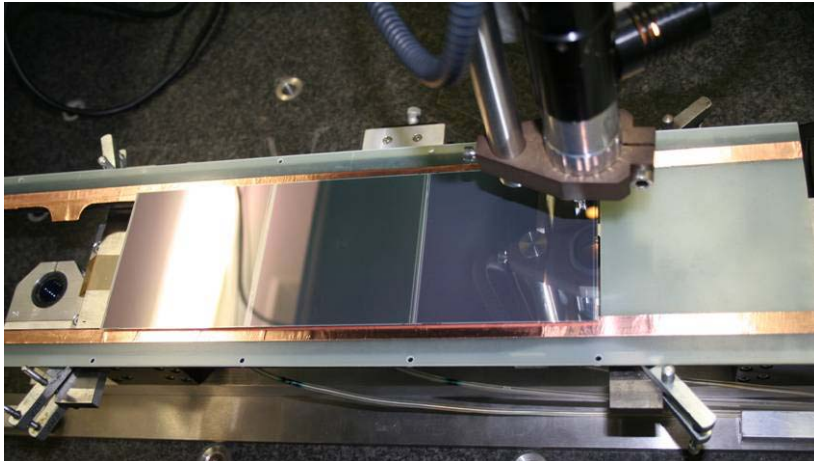
Clean Room

- Area: 10m x 6m
- Class: 10'000
- Currently equipped for petal production and testing

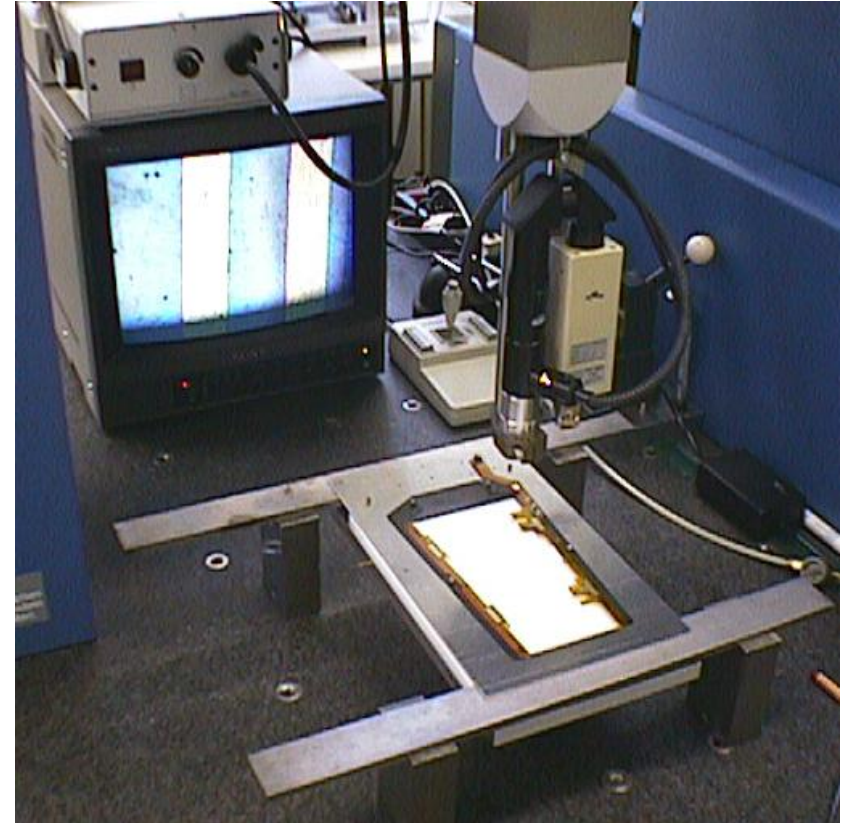


Coordinate Measurement Machine

- CMM from Zeiss
- Accessible volume: 54x50x32cm³
- Accuracy:
 - xy: ~5μm
 - z: ~10μm
- Situated in small clean room (~12m²)



SiLC ladder during construction



CMS Tracker Endcap module
under investigation

Industrial Bonding Machine

- Type:
Hesse und Knipps Bondjet 710 M
- Travel: 180x255x25 mm
- Pitch: 80 μ m
- Used wire:
25 μ m Al(1%Si)
- CMS modules bonded
so far: ~900
- Also used for SiLC ladder and many
structures for irradiations
- Hand held pull
tester
- High precision
pull-tests in nearby IPE

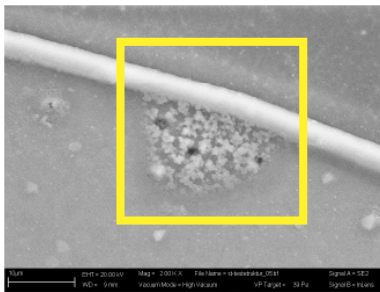


- ARCS and CMS like readout
- Trigger for cosmics or Sr^{90}
- HV up to $1000\text{V}@1\text{mA}$
- Cooling
- Additional cosmic telescope for resolution measurements in preparation

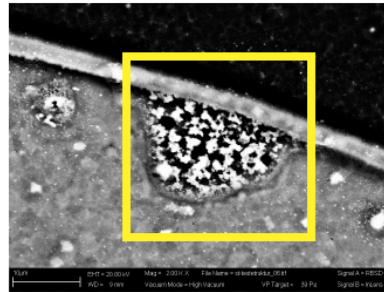


Further Contacts

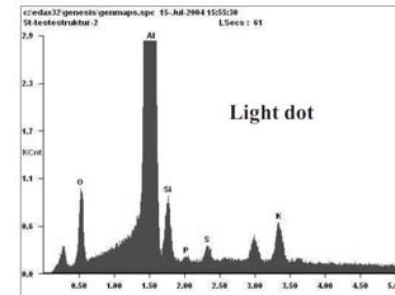
- ITC: ESEM-EDX (Environmental Scanning Electron Microscope - Energy Dispersive X-ray spectroscopy)



ESEM



EDX map



EDX
element analysis

- IMF: X-ray diffraction

Additional Important Infrastructure



Not virtual !

Please, help yourself outside