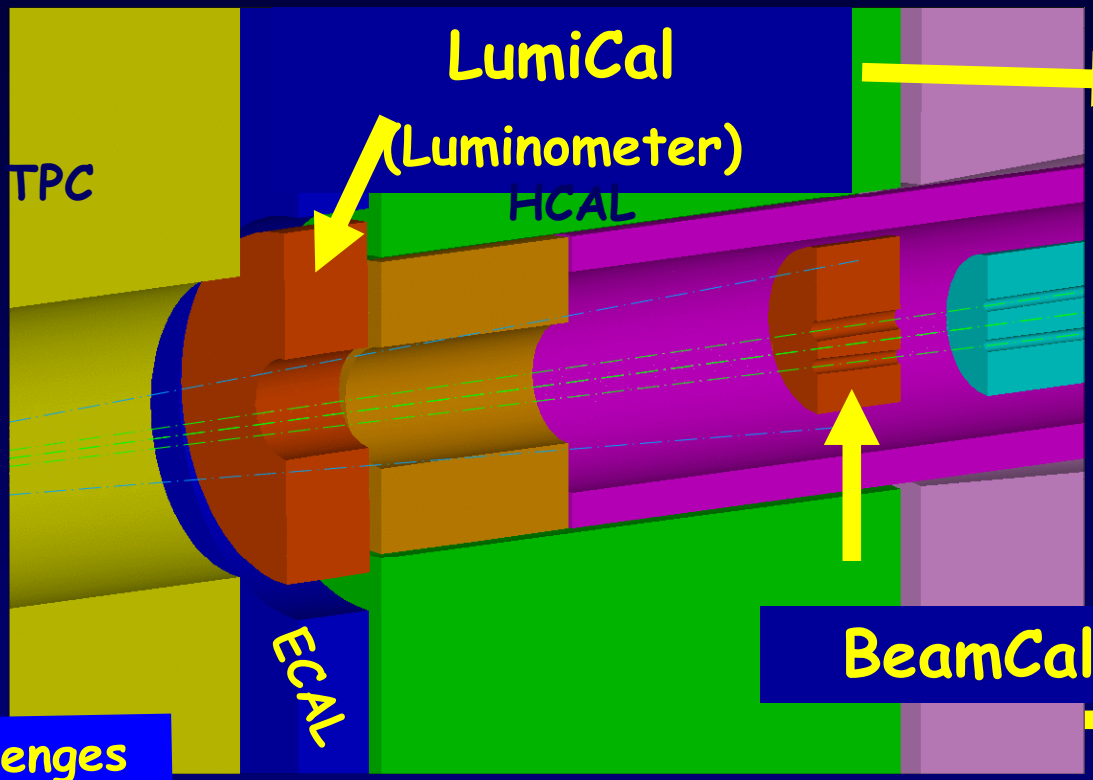
VFCAL Report

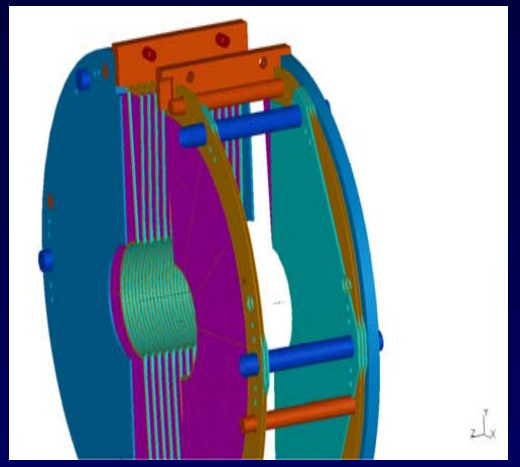
W. Lohmann, DESY

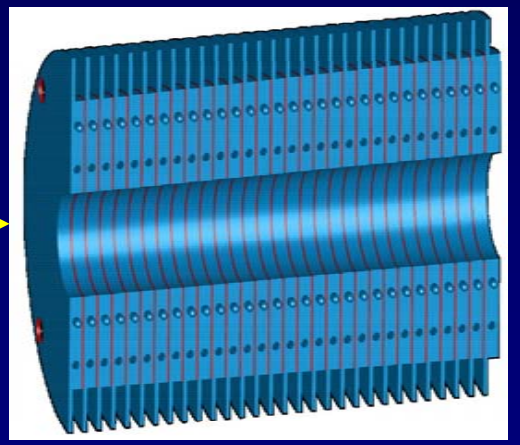
- Infrastructure for sensor diagnostics & Sensor test facilities at testbeams
- FE Electronics
- Laser Alignment
- Sensor Production

Labs involved: Cracow UST, Cracow INP PAN, Prague (AS), Tel Aviv Univ. DESY (Z.)

Current design (Example ILD, 14 mrad):







Challenges

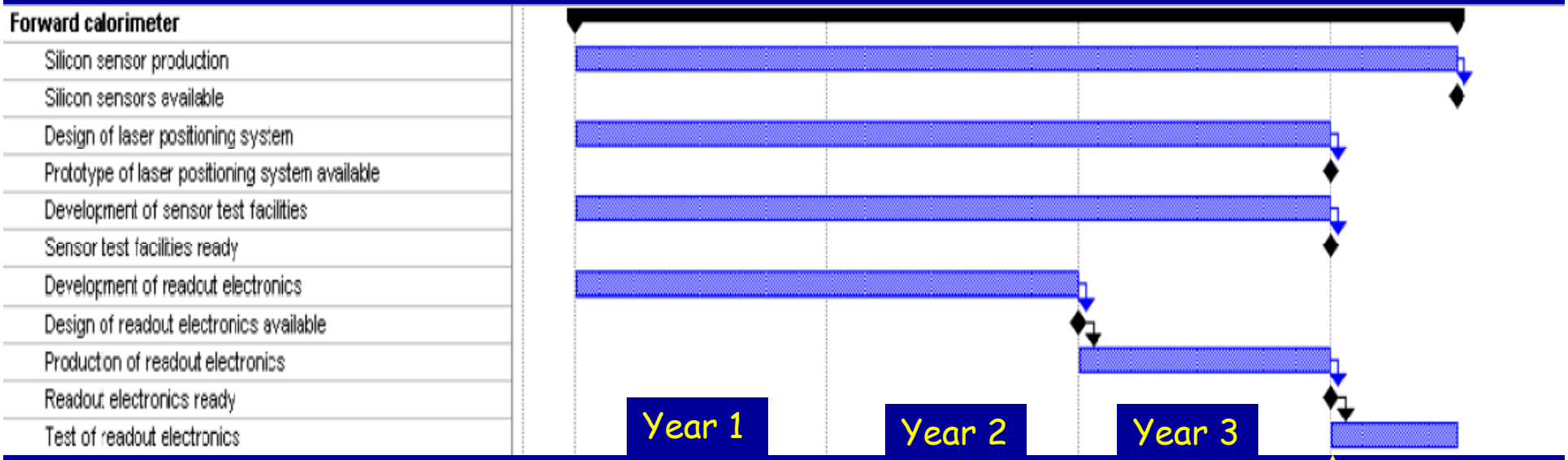
LumiCal: -control of position on ~100 μm level
-control of the inner acceptance radius on ~μm level

BeamCal: -radiation hard sensors (~10 MGy/year)

Both: -compact (smallest possible Moliere radius)
-readout after each BX

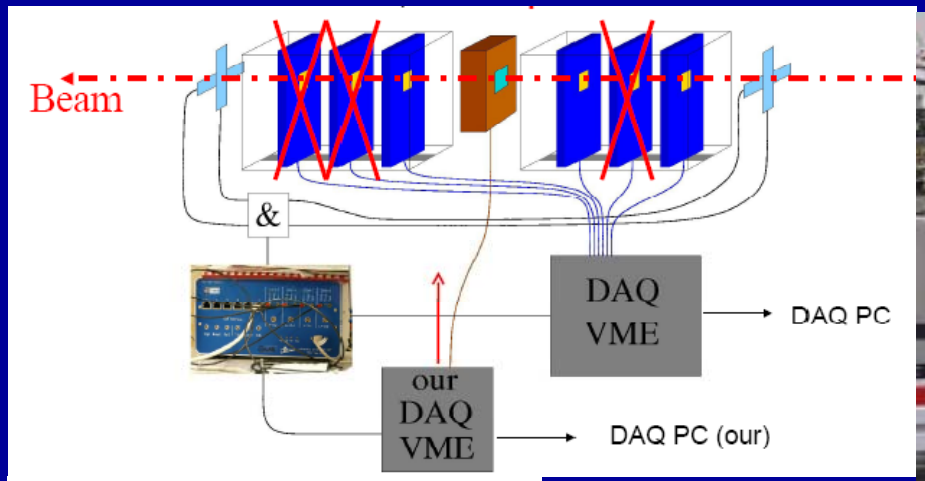
FCAL Collaboration
High precision design

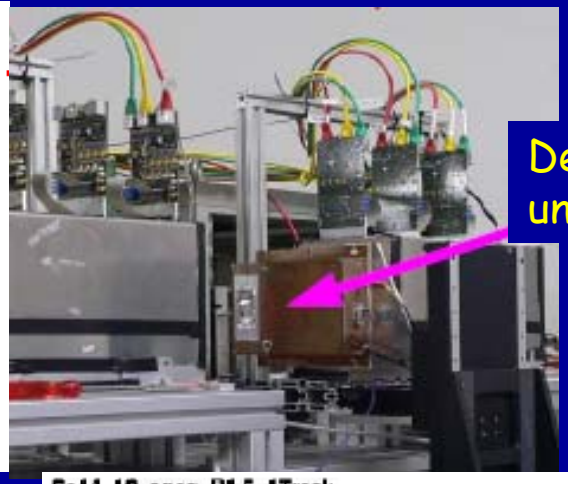
EUDET worksheet



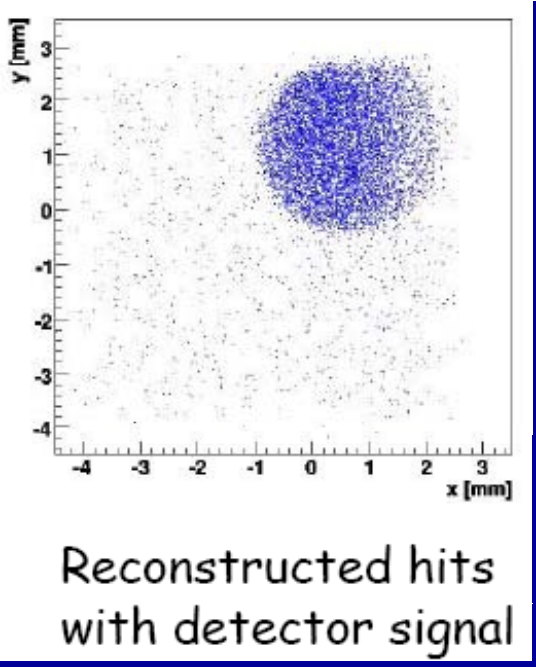
Infrastructure for Sensor Tests

Testbeam equipment for sensor performance studies using the EUDET telescope



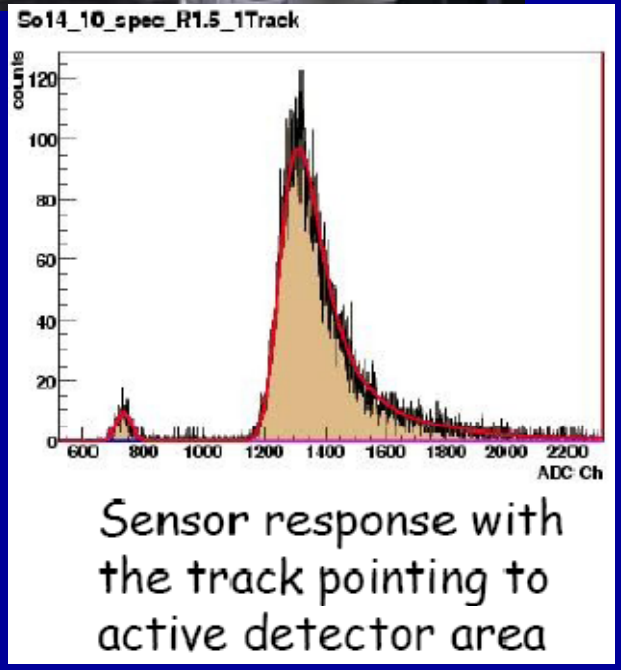


Detector under test



Reconstructed hits with detector signal

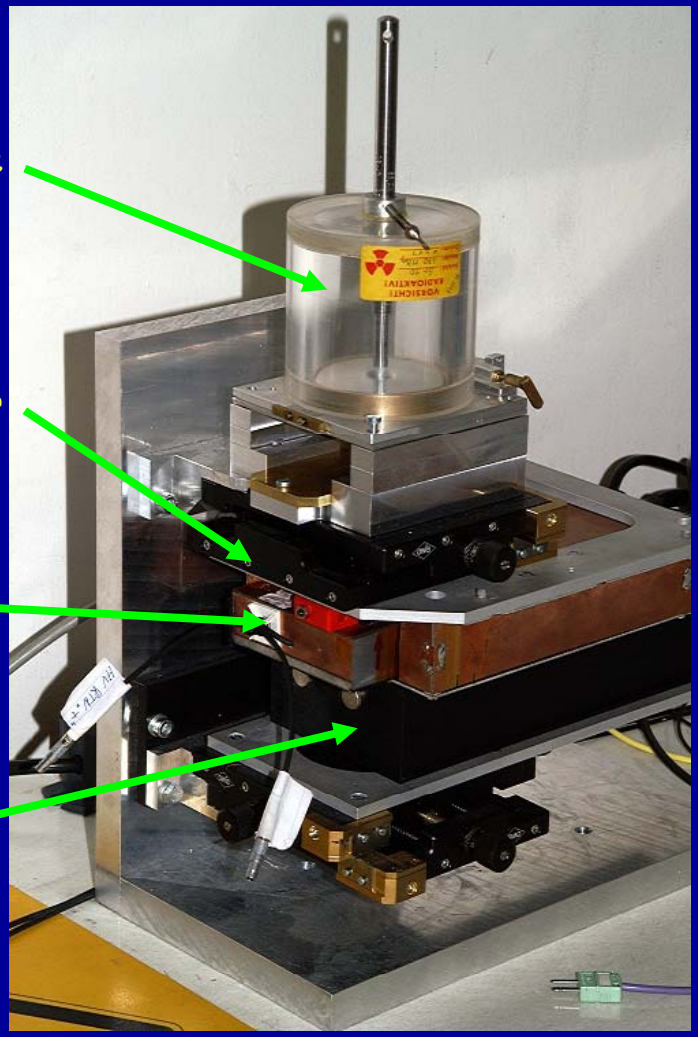
Goal: precise measuremnt of the reponse of sCVD diamonds

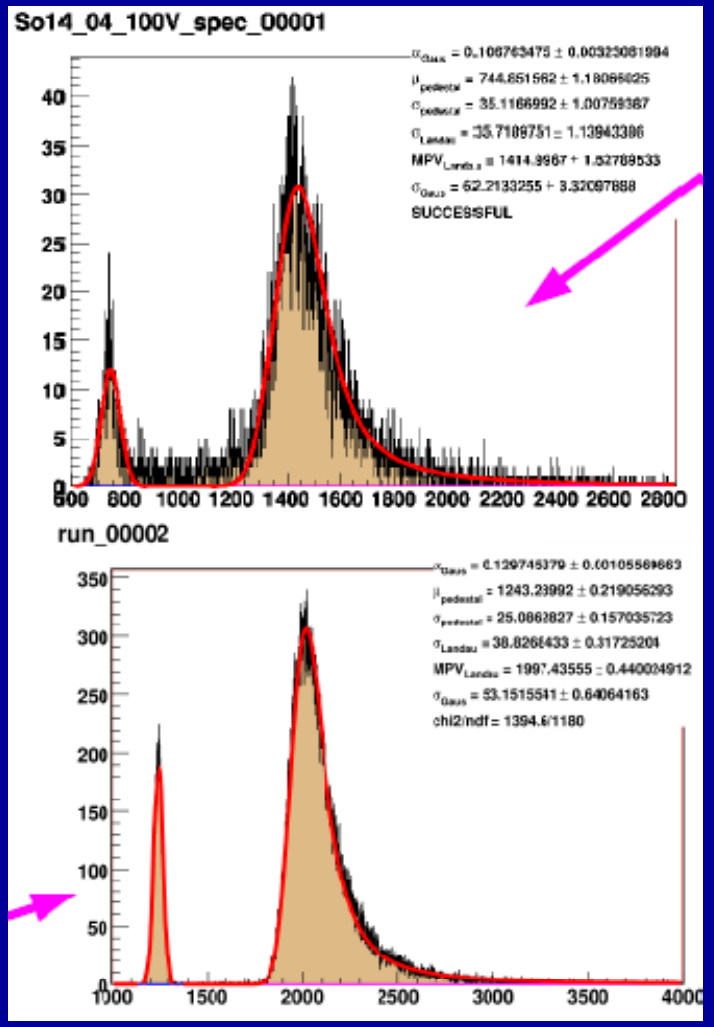


Sensor response with the track pointing to active detector area

Infrastructure for Sensor Tests

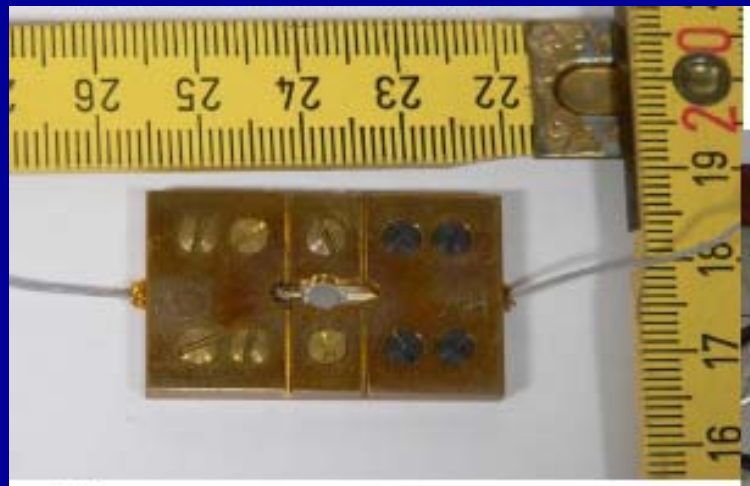
Upgrade of trigger counters and collimators – significant improvement for spectrum measurements using ^{90}Sr source

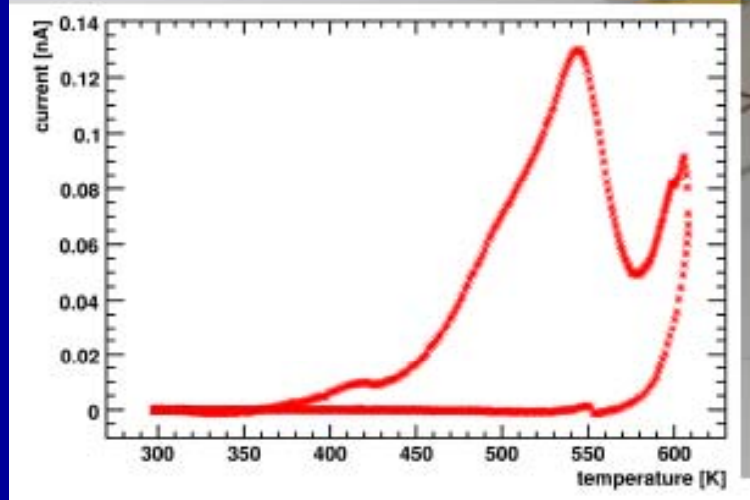




Setup for TSC measurements

Diagnostics of sCVD diamond sensors after radiation damage





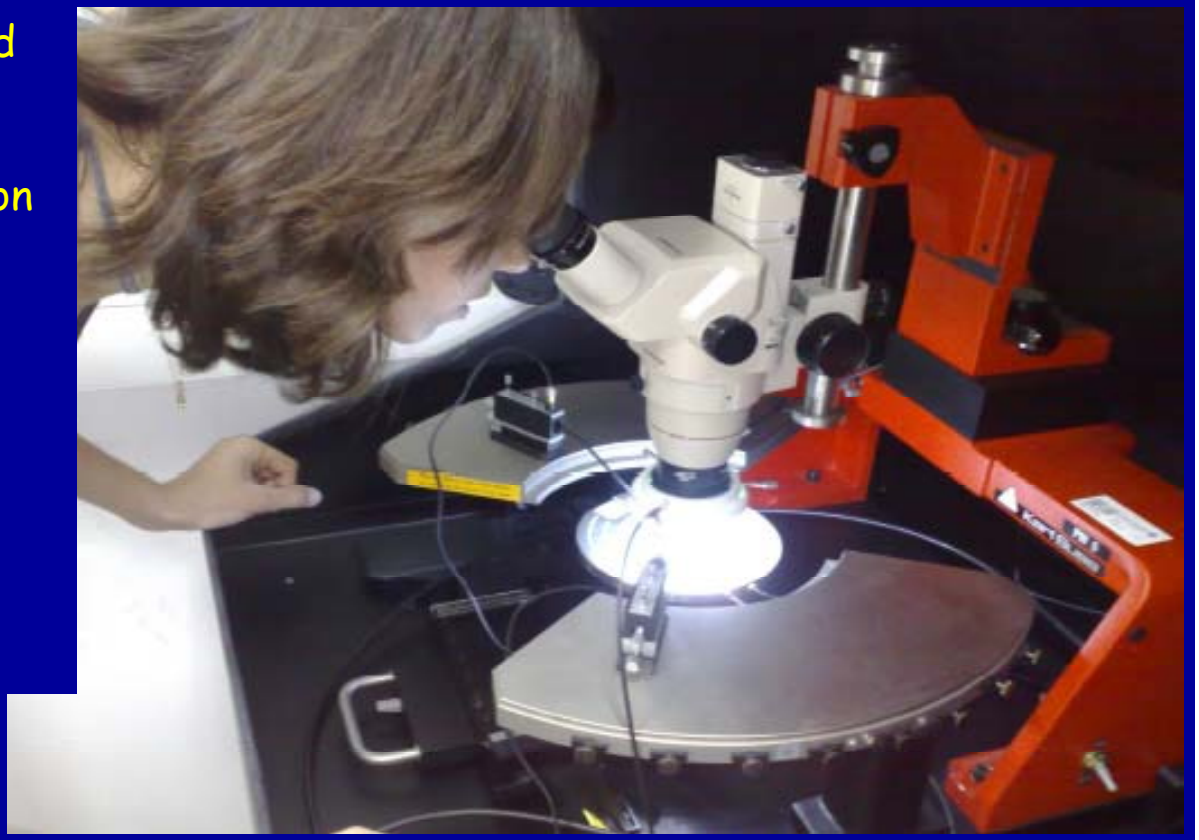
Silicon lab in Tel Aviv

A dedicated silicon lab is created in Tel Aviv:

- Computer monitored prob station
- Computer supported I(V), C(V) measurements

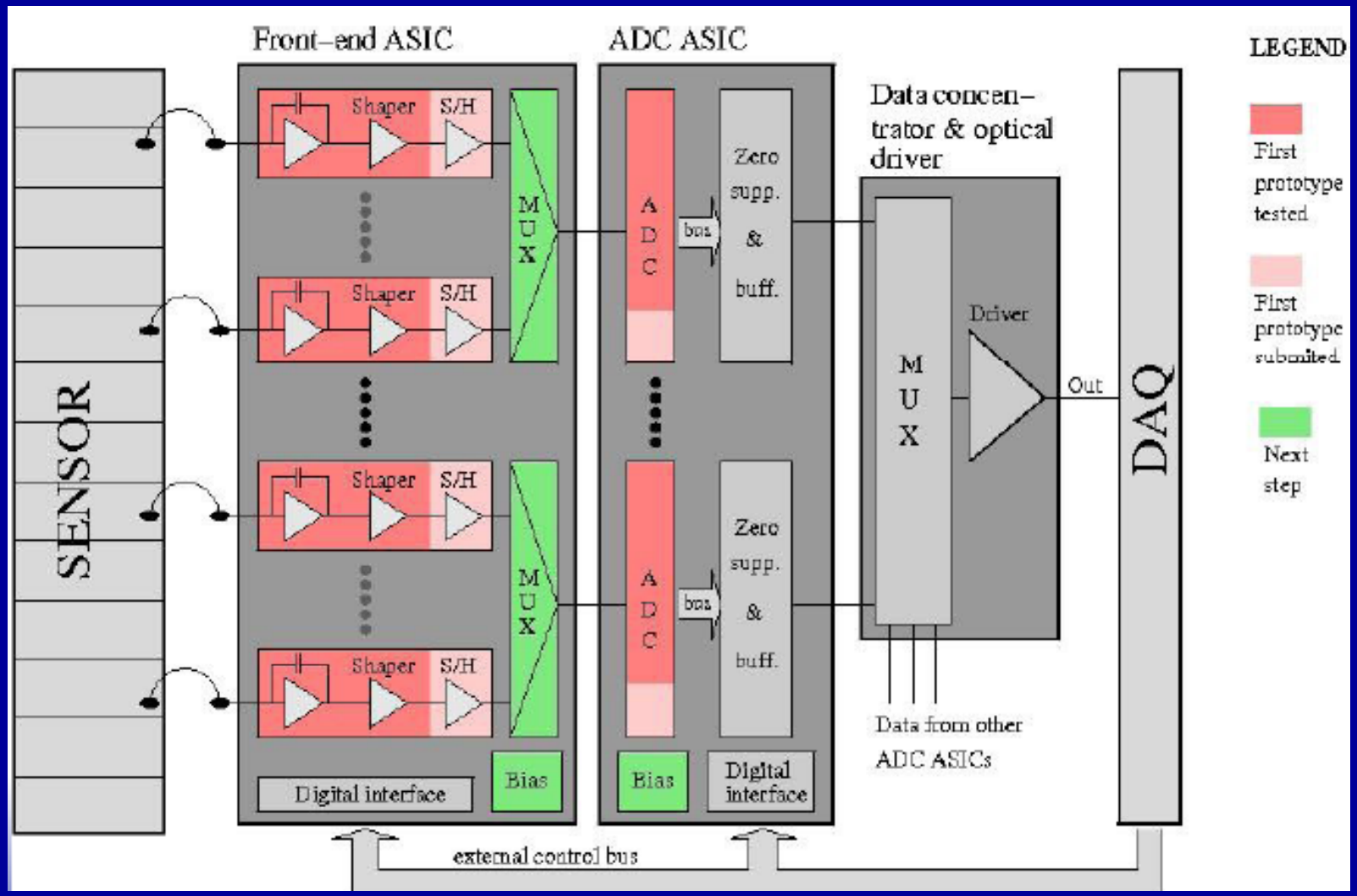
in preparation:

- clean room
- spectroscopic set-up



A dedicated HEP lab building is designed for detector R&D, planned to be ready mid 2009

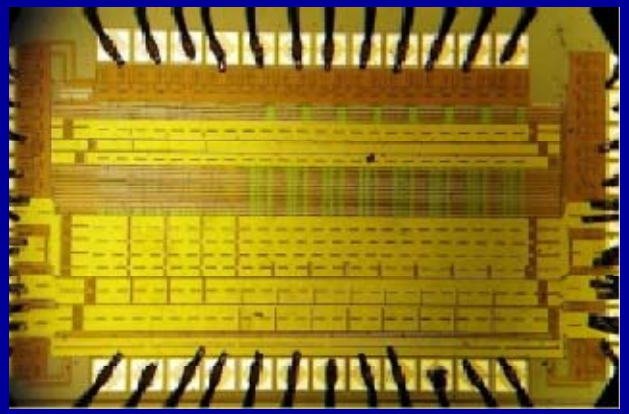
FE Electronics

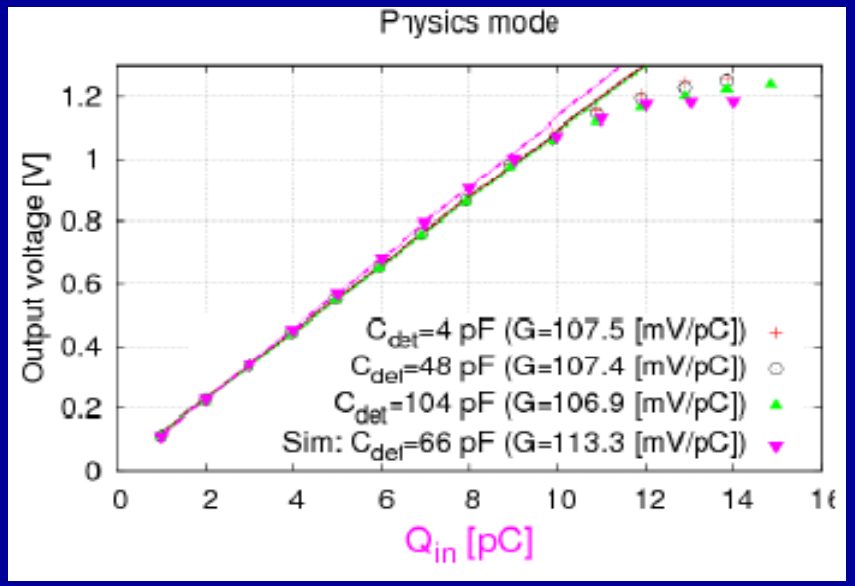


Developed in AMS 0.35 µm technology, several prototypes of the analog and digital part tested

FE Electronics

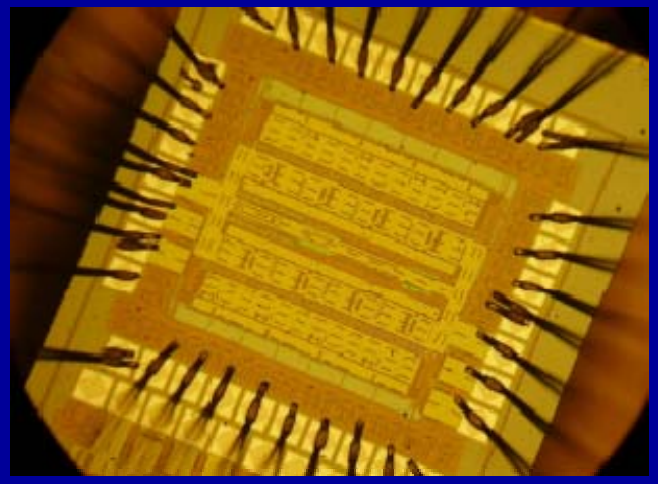
FE Asic:
8 channles per chip, 4 with MOS feedback resistance,
4 with passive Rf feedback





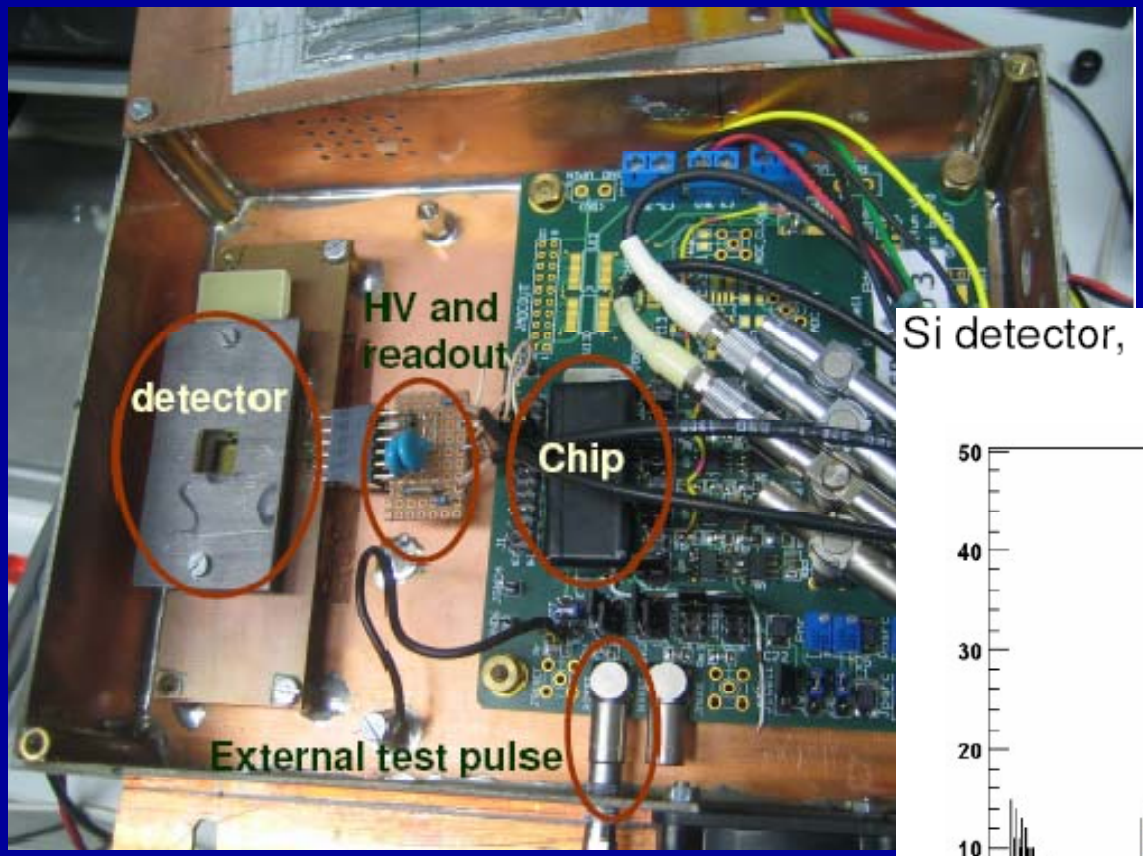
ADC Asic:
Pipeline architecture
10 bit resolution
Maximum sampling rate 35 MHz

First prototypes needed improvement,
Submission ADC and DAC Sept. 2008
Prototypes expected Nov. 2008

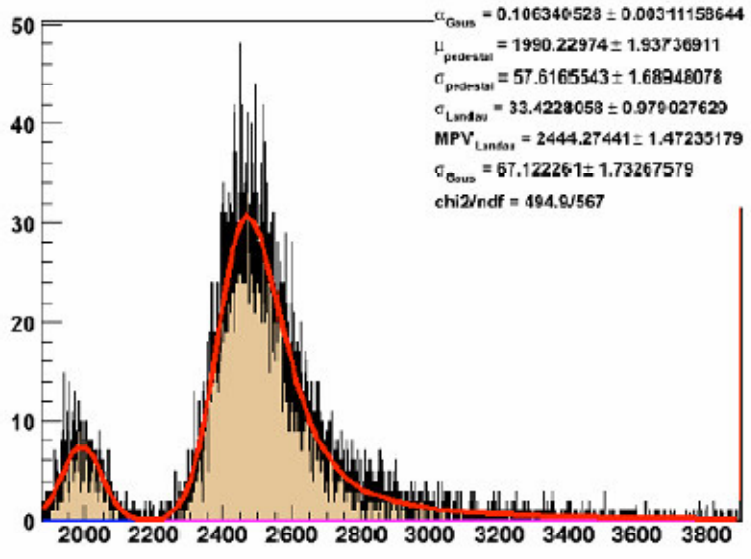


FE Electronics

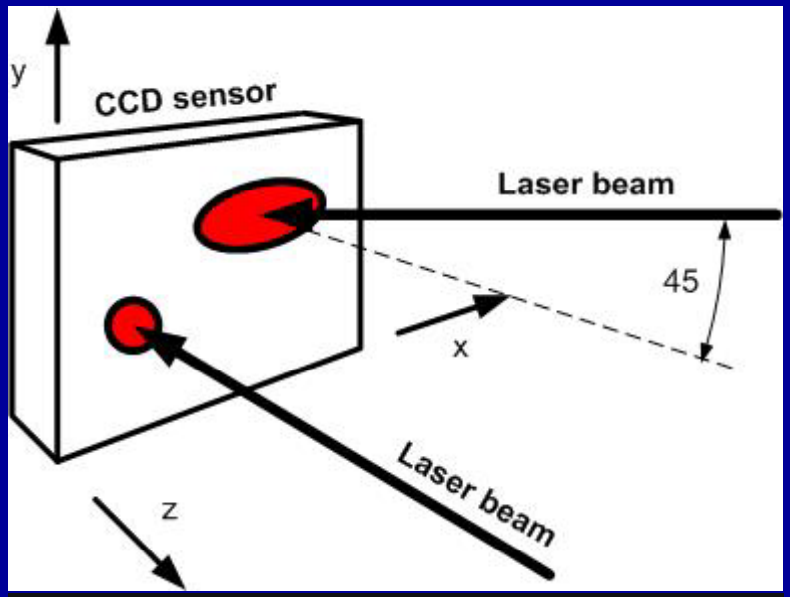
First successful tests of the analog part with a single pad sensor

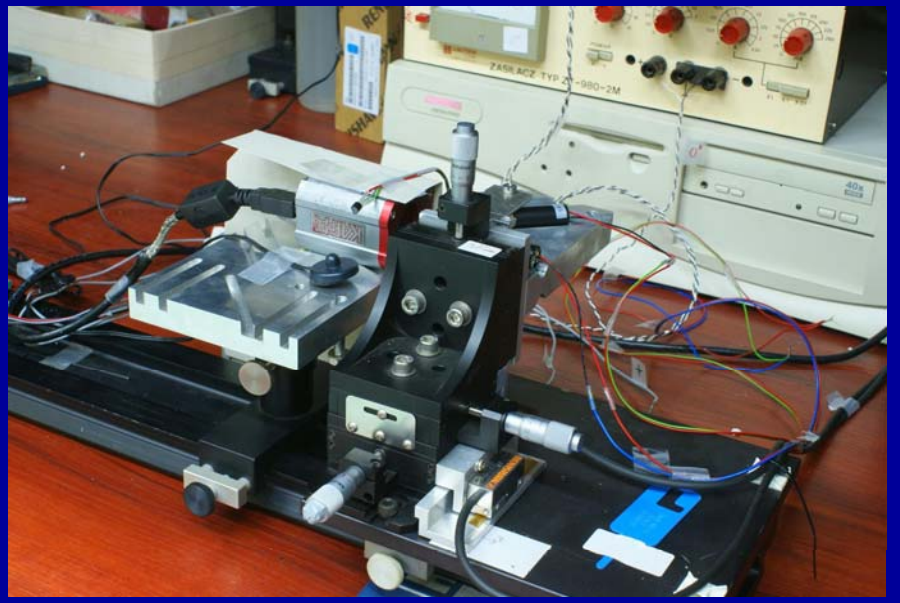


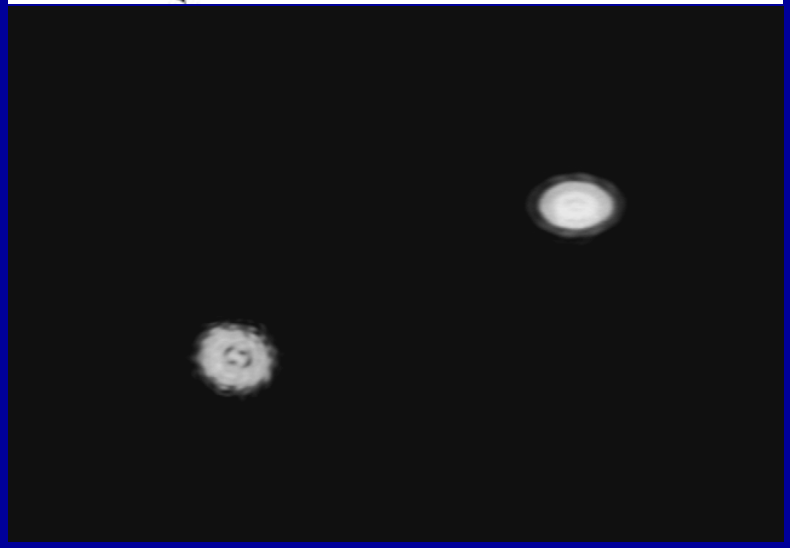
Si detector, MOS preamp.



Laser Position Monitoring







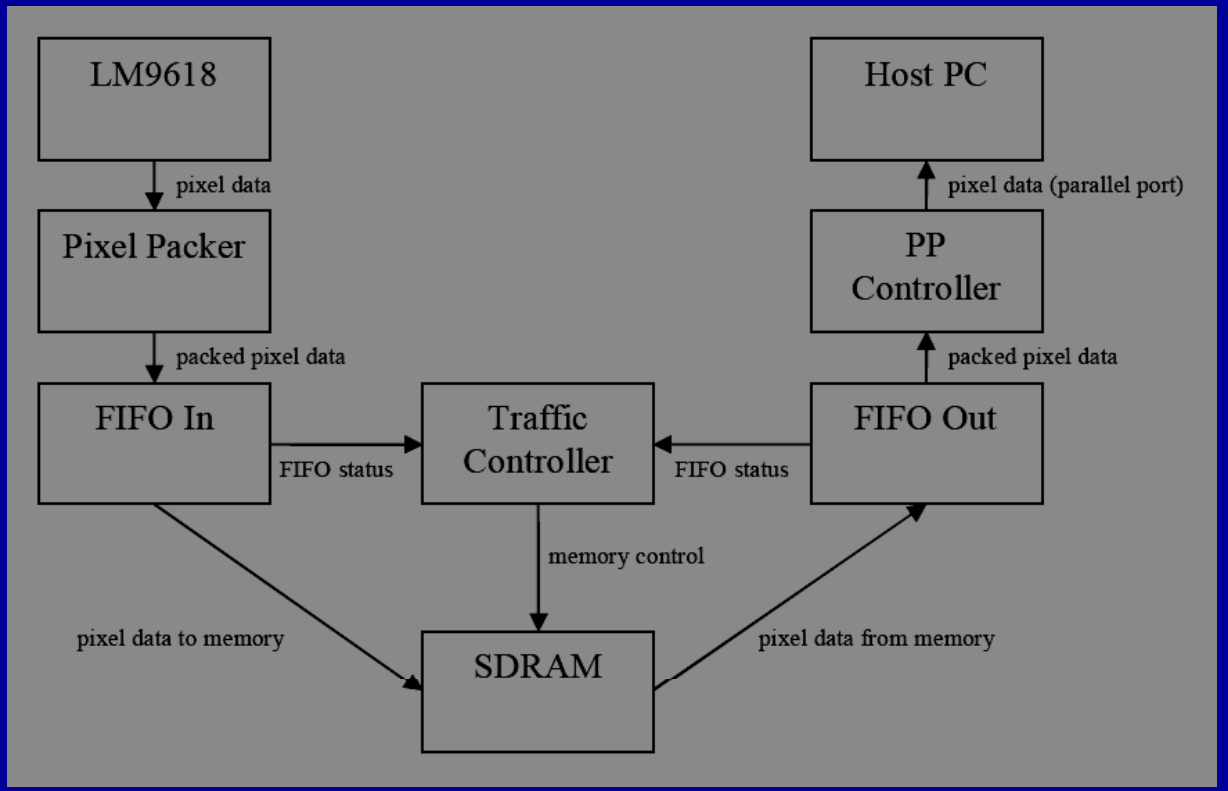
Over short distances accuracies reached:
Displacements in the x-y plane: +-0.5 µm
Displacements in z direction: +- 1.5 µm

Laser Position Monitoring

Scheme of the readout and monitoring electronics

Dedicated
CMOS sensor

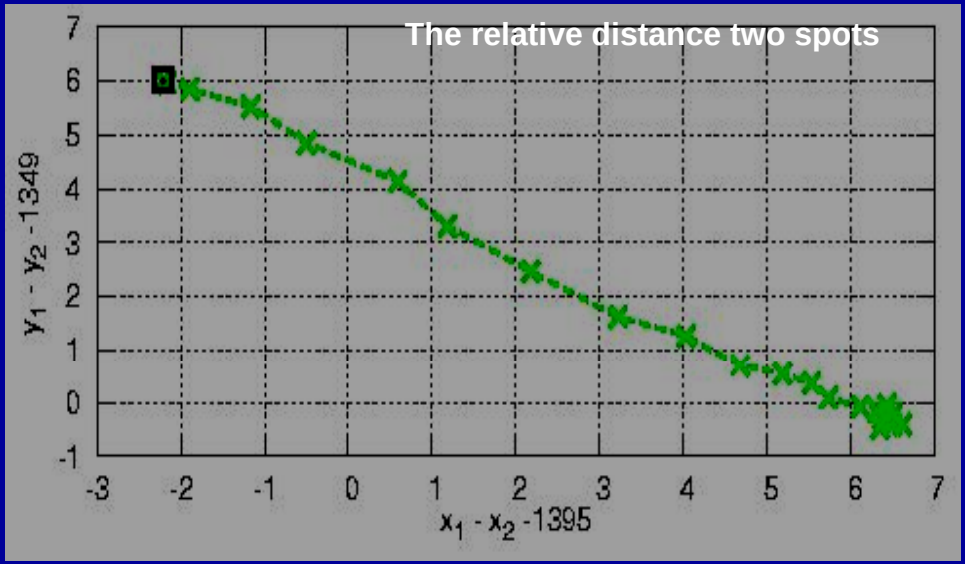
Displacement calculations

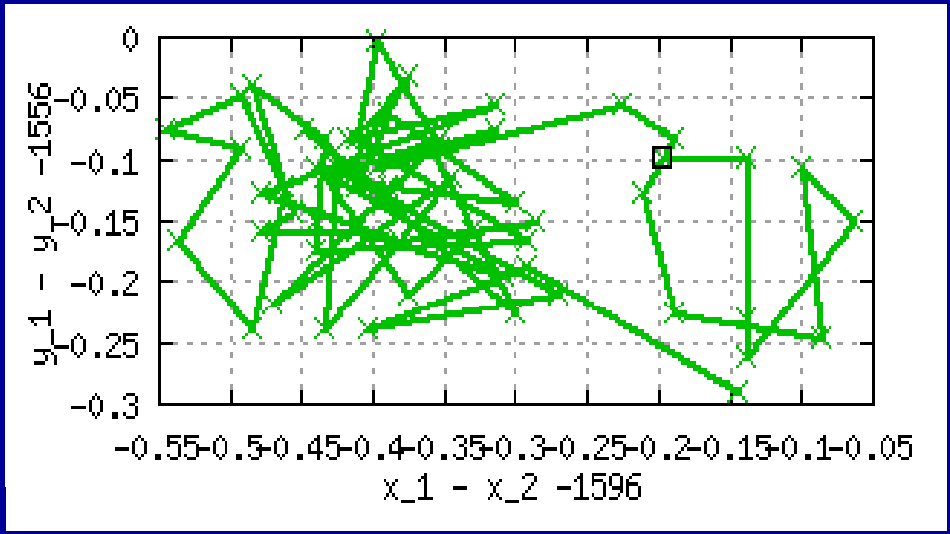


Laser Position Monitoring

Impact of temperature changes

Gradient: 1 µm/^{0}C

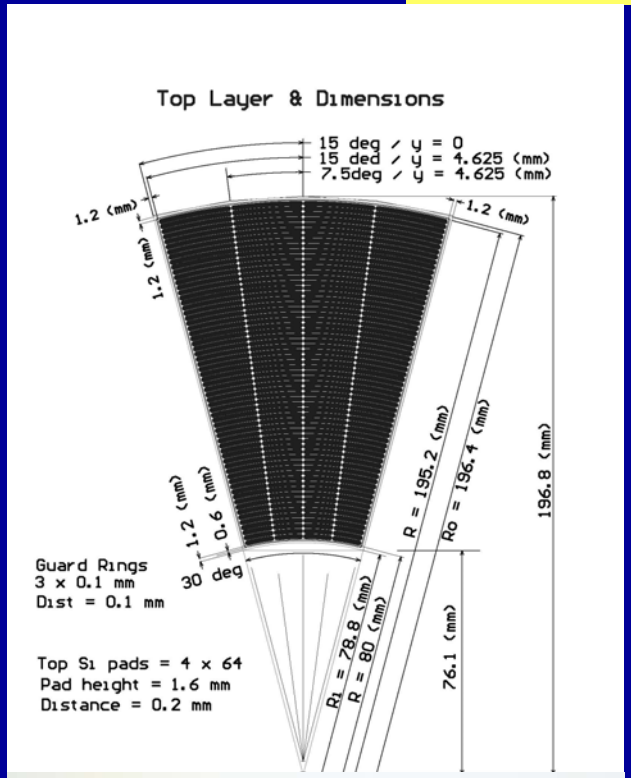


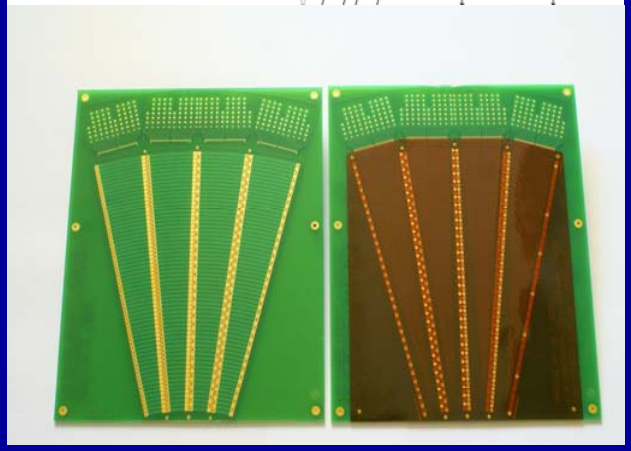


Long term tests (> 24 hours)
Relative distance between the two laser beams

Stable within +- 0.5 µm

Sensor Production



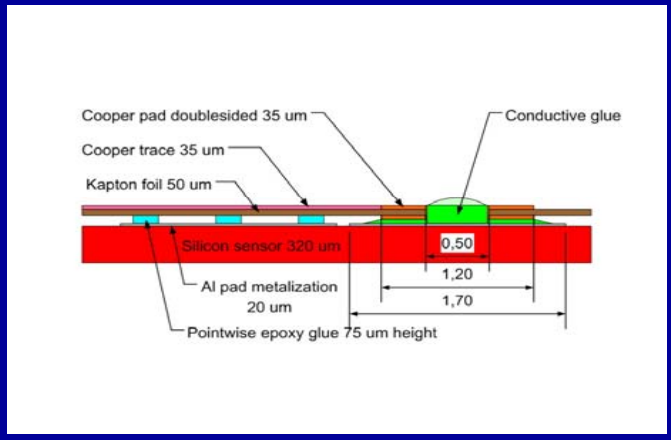


N-type silicon, p^+ strips, n^+ backplane,
Crystal Orientation <100>
320 μm thickness ± 15 μm
Strip pitch: 1800 μm
Strip p^+ width: 1600 μm
Strip Al width: 1700 μm

Masks for prototypes ready (Hamamatsu)

Prototype sensors just in the process to be ordered

In parallel: development of the fanout



Summary

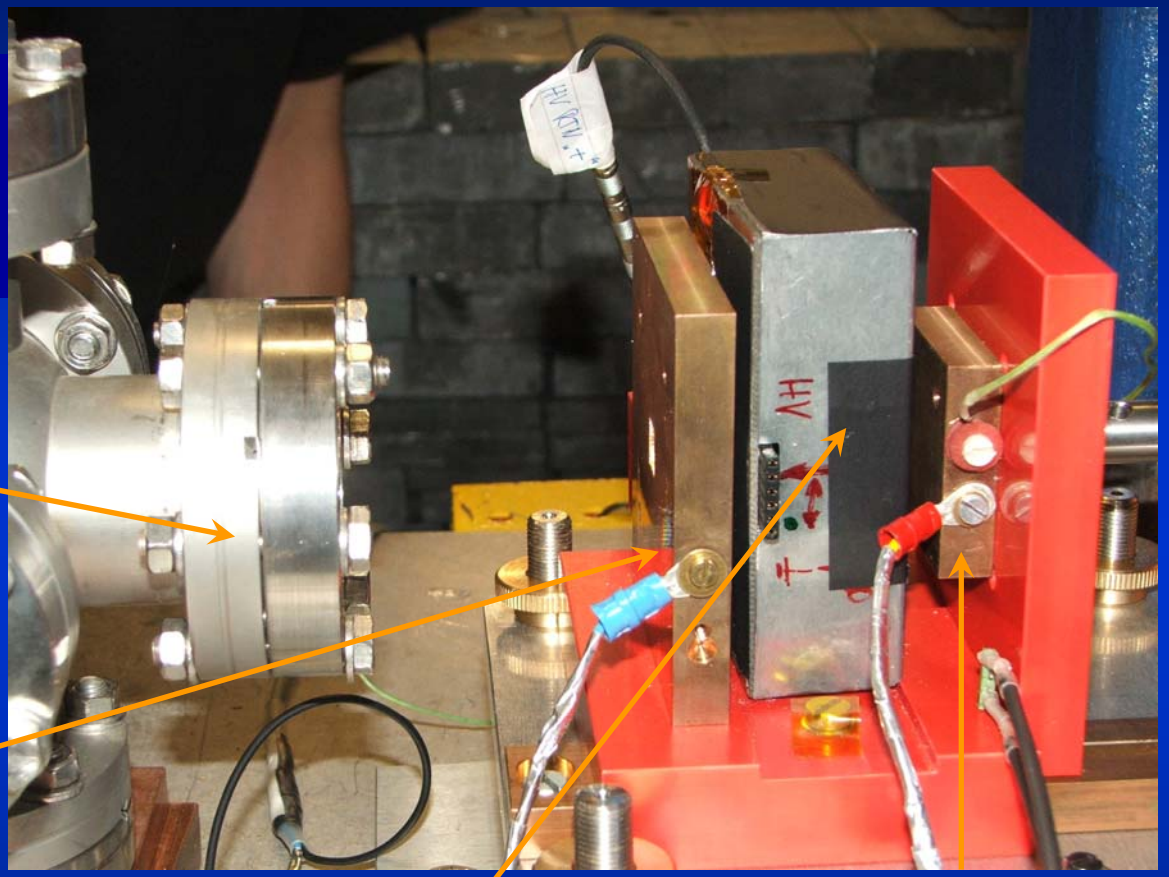
- Laboratory and beam-test infrastructure is created/improved/completed
  EUDET memo before end of the year
  will be used intensively in future
- First FE ASICS are produced, tests almost completed, second submission of the ADC done
  EUDET memo before end of the year
  EUDET extension will be used for updates/higher complexity
- Prototype of a laser positioning monitoring system is built, matches the accuracy requirements on small distances
  EUDET memo before end of the year

VFCAL is 'on schedule'

Test Beam Equipment and sensor tests

Setup used for radiation hardness tests at the SDALINAC accelerator

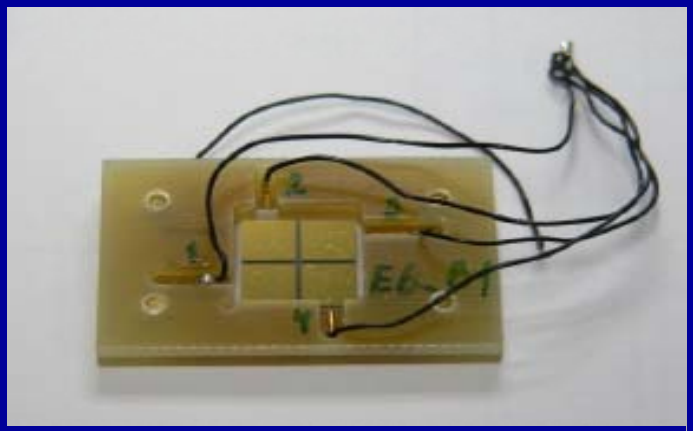
TU Darmstadt



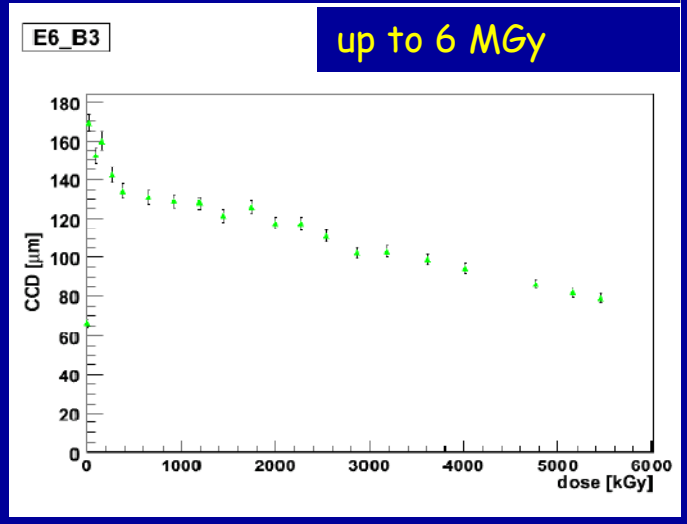
Completed and more comfortable: more efficient use of the beam

Test Beam 2007

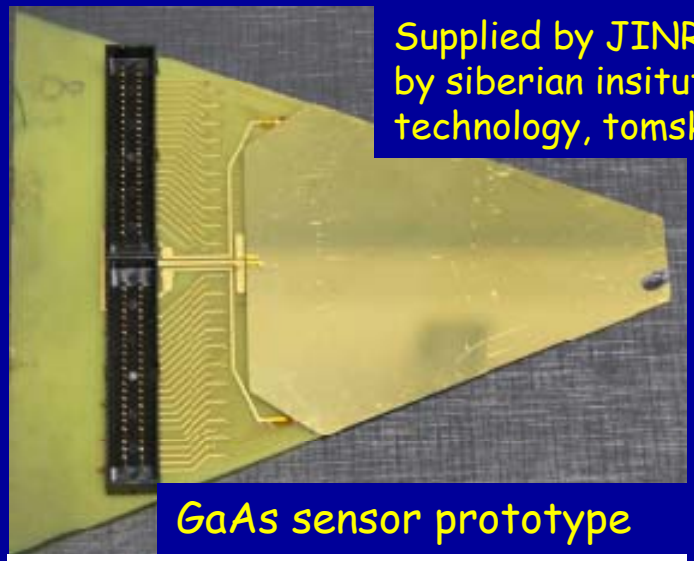
- Completion of Diamond sensor tests
- Test of GaAs sensors
- Test of rad. Hard Si sensors, delivered by BNL and Prague



diamond sensor prototype

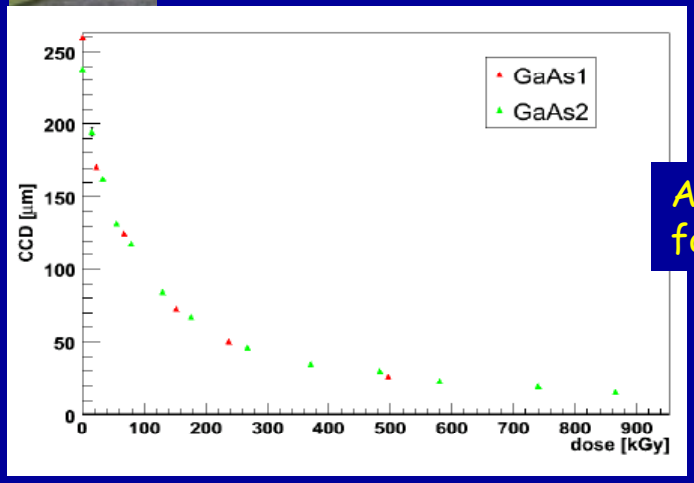


up to 6 MGy



Supplied by JINR, produced by siberian insitute of technology, tomsk

GaAs sensor prototype



About factor 10