VFCAL sensor test facilities

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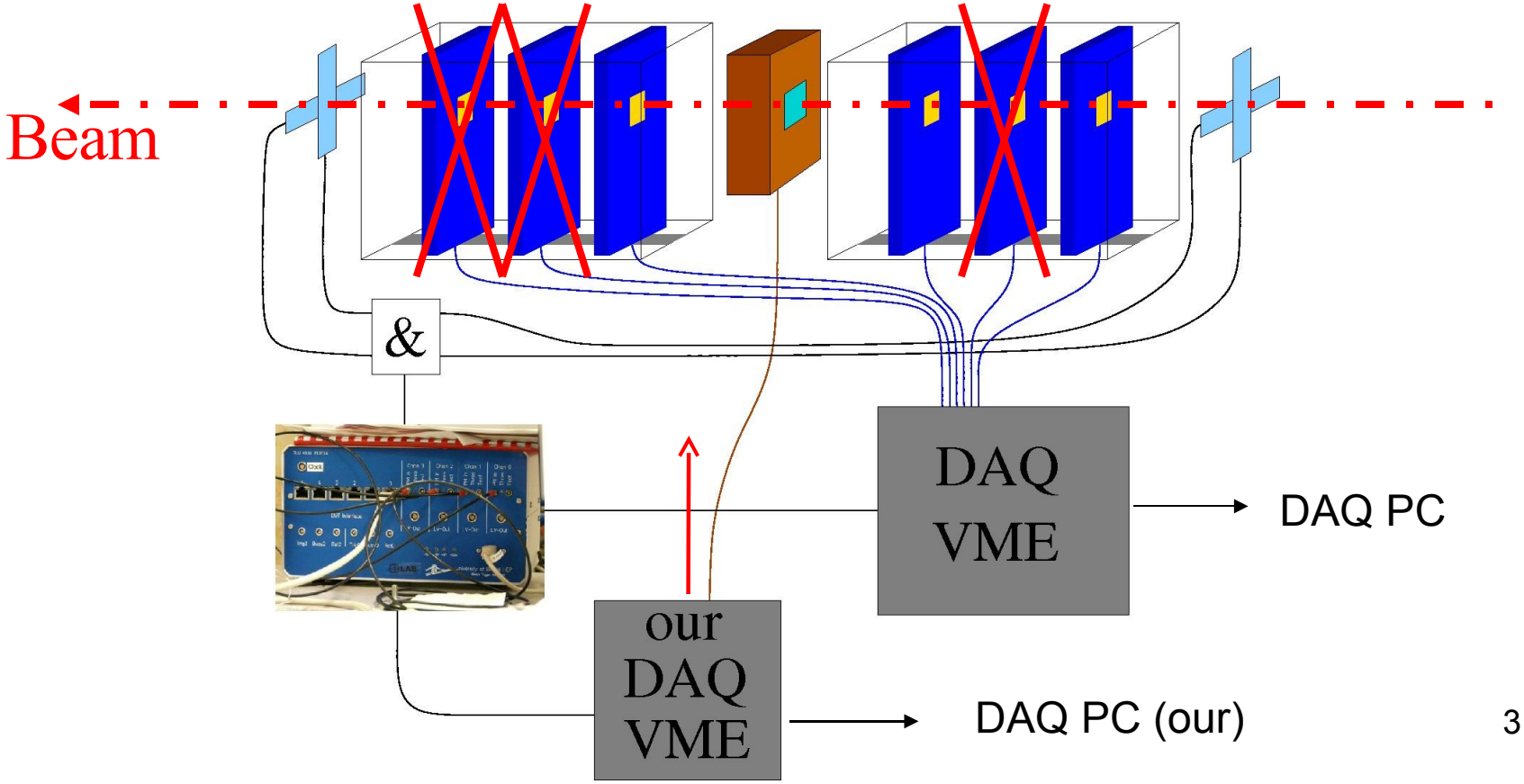
Outline

- Testbeam @ DESY-Hamburg
- Upgrade of DESY-Zeuthen setup:
- New triggering scheme
- TSC measuring setup
- Testbeam @ TU-Darmstadt
- Sensors under test
- Silicon Lab at Tel-Aviv University
- Summary

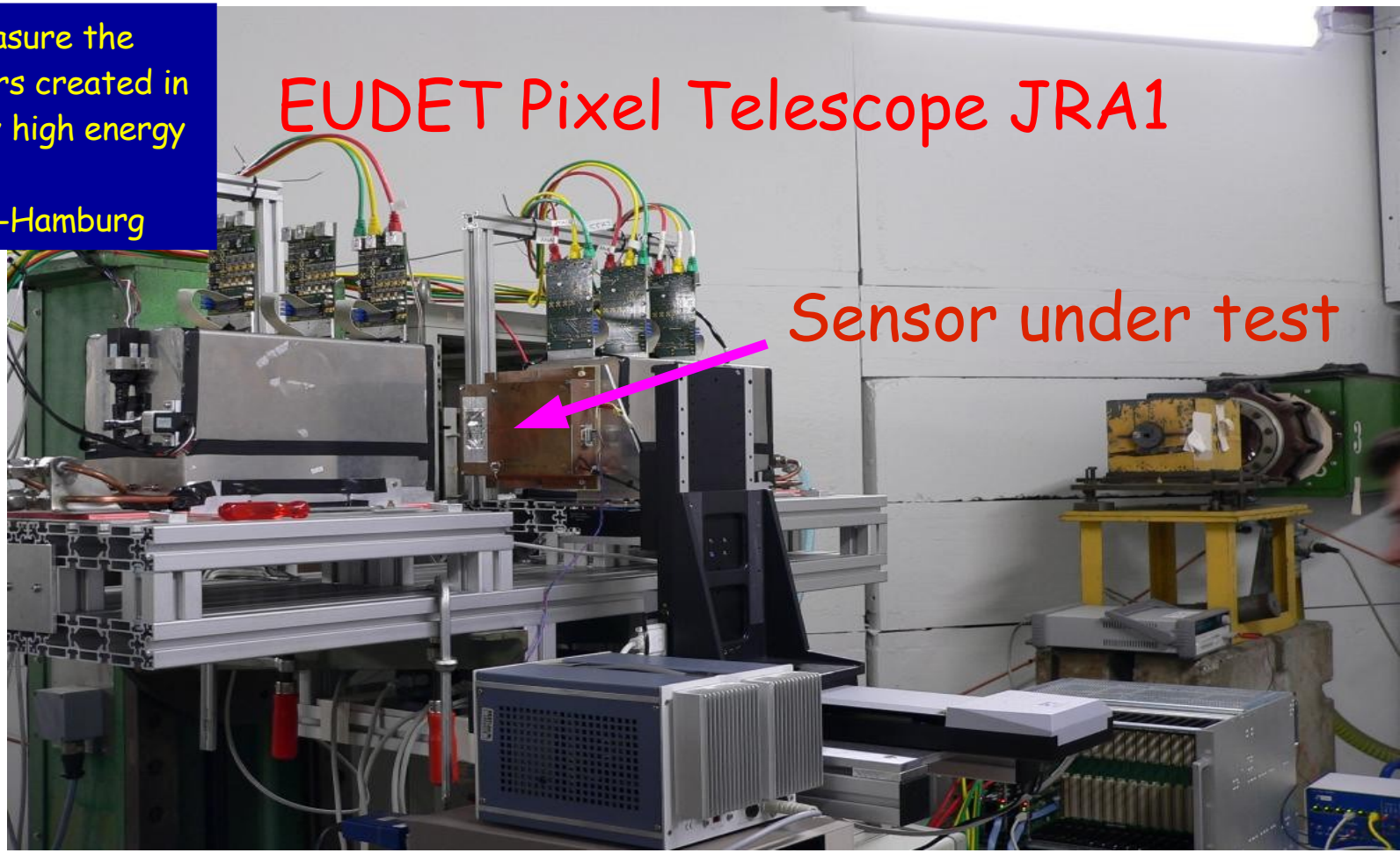
Testbeam @ DESY-Hamburg

- CCD @ EUDET Pixel Telescope JRA1 for scCVD diamond, Si - space resolved hits

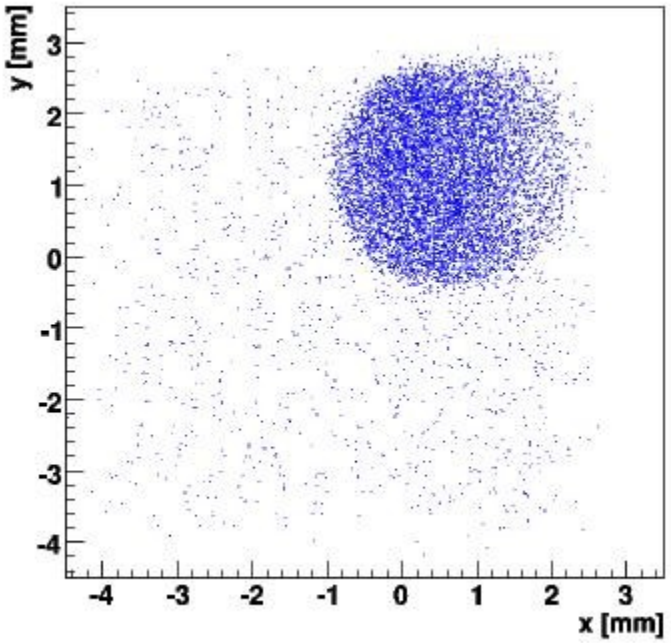


Testbeam @ Hamburg

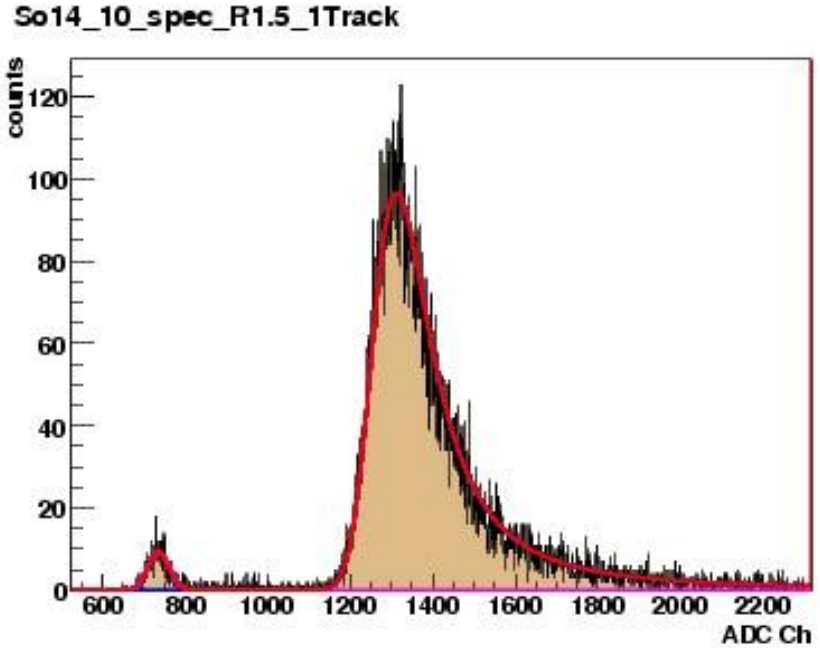
Setup used to measure the number of e-h pairs created in scCVD diamond by high energy electrons.
Beam-24 @ DESY-Hamburg



Data from testbeam @Hamburg

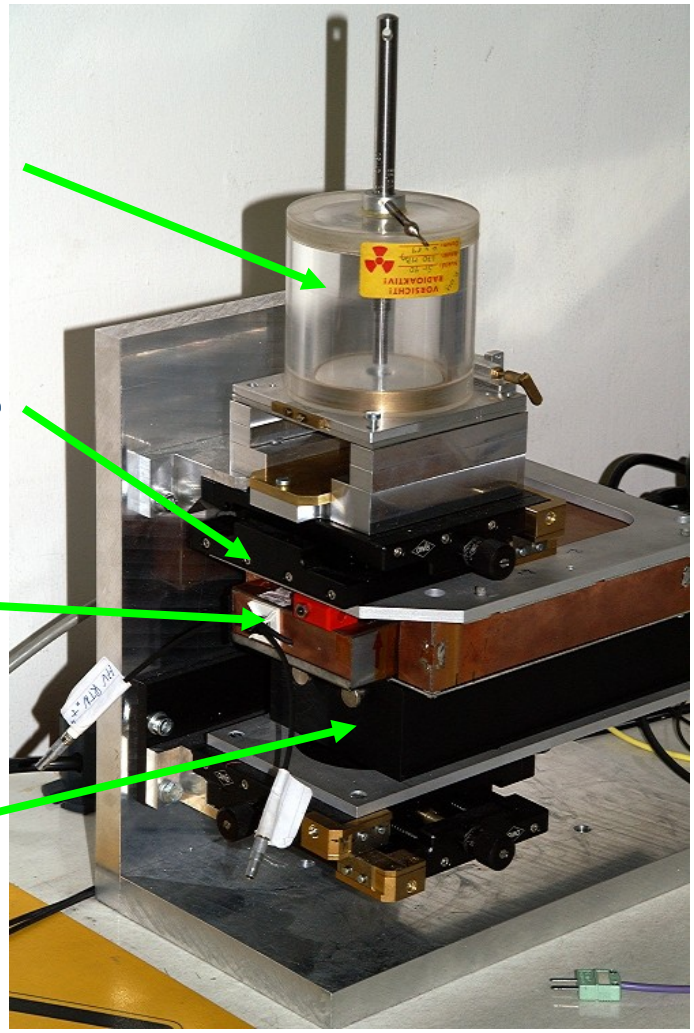


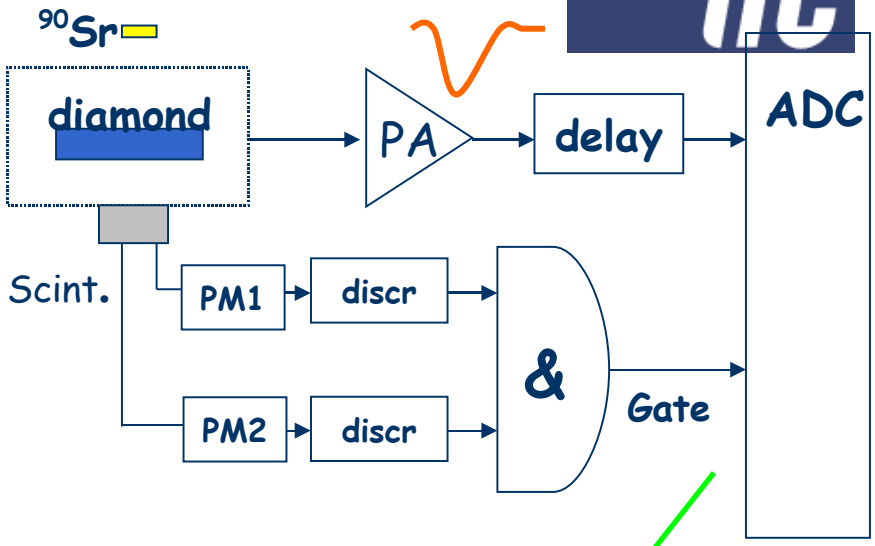
Reconstructed hits with detector signal

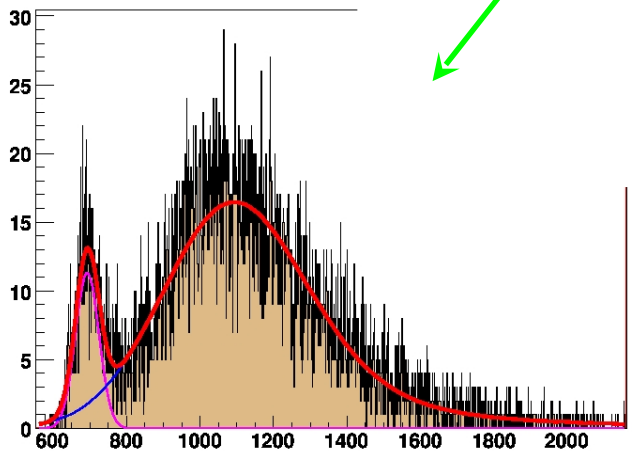


Sensor response with the track pointing to active detector area

MIP?? Response of sensors







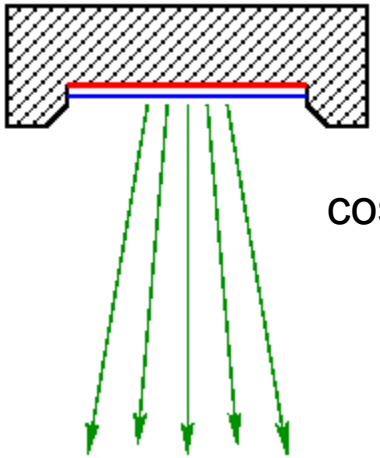
typical spectrum of an E6 sensor

^{90}Sr source spectrum

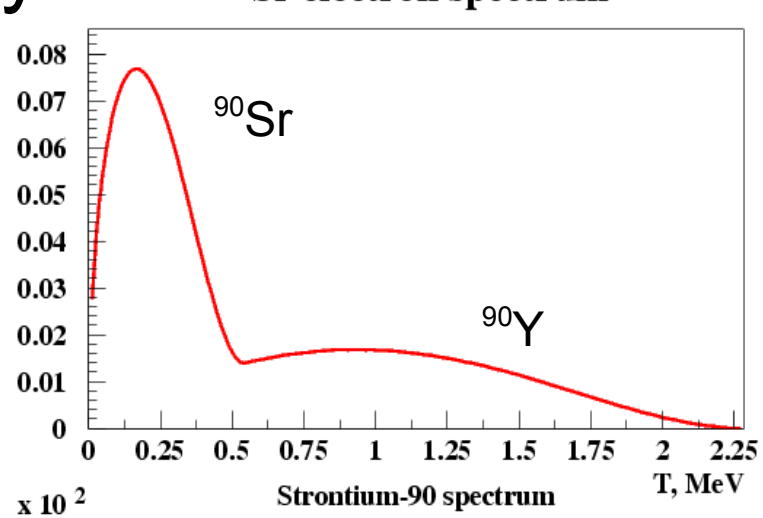
Electrons from β-decay:

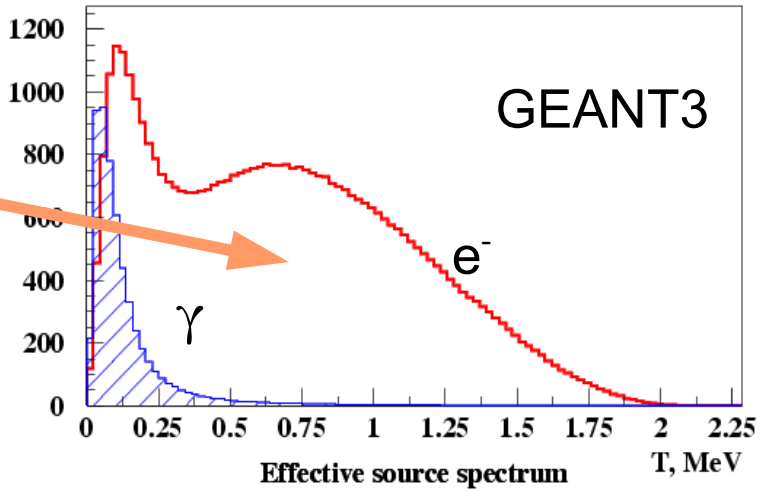
$$\frac{dN(T)}{dT} \propto Ep\,(T_{max} - T_e)^2$$

^{90}Sr —β, 27.7 y, 0.546 MeV→ ^{90}Y —β, 64 h, 2.283 MeV→ ^{90}Zr

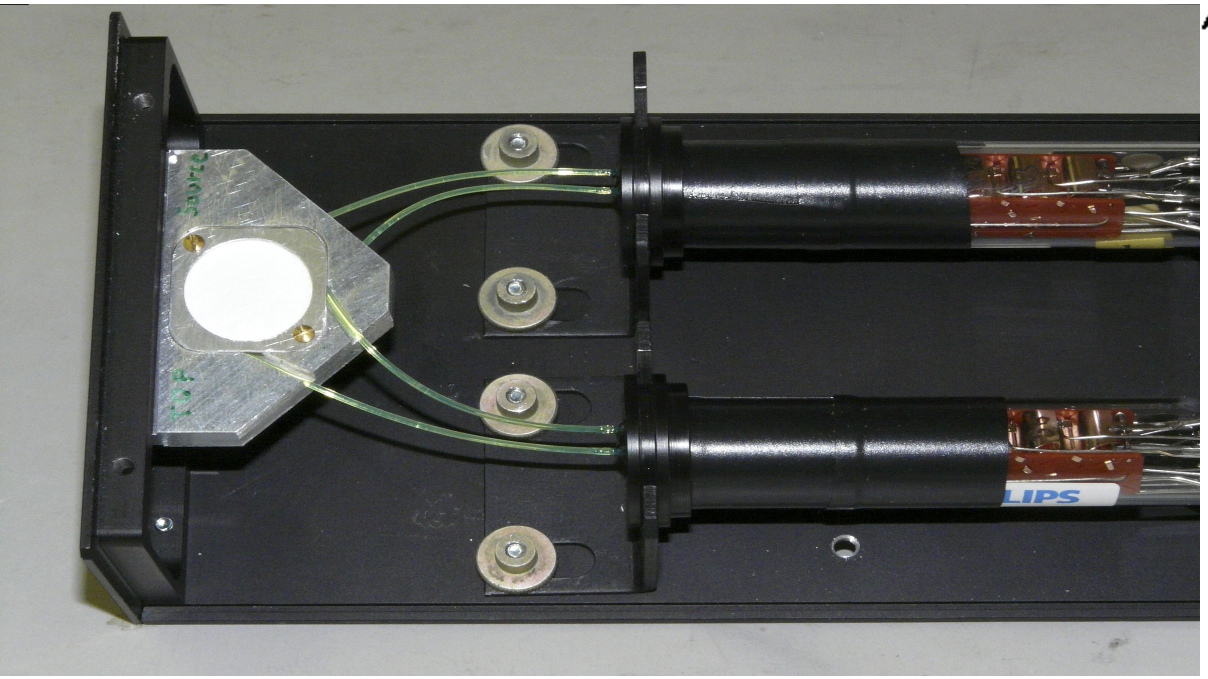


cos(θ) > 0.97

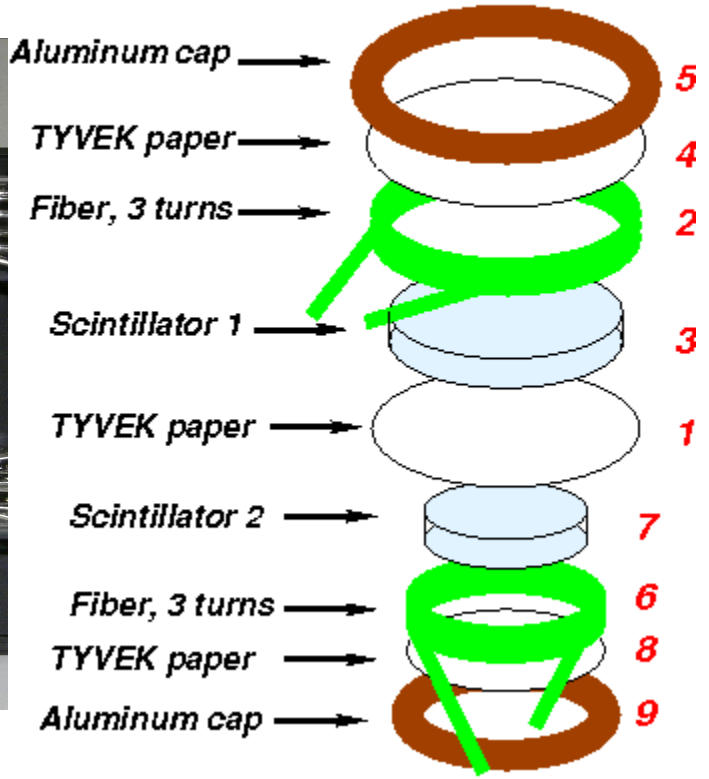




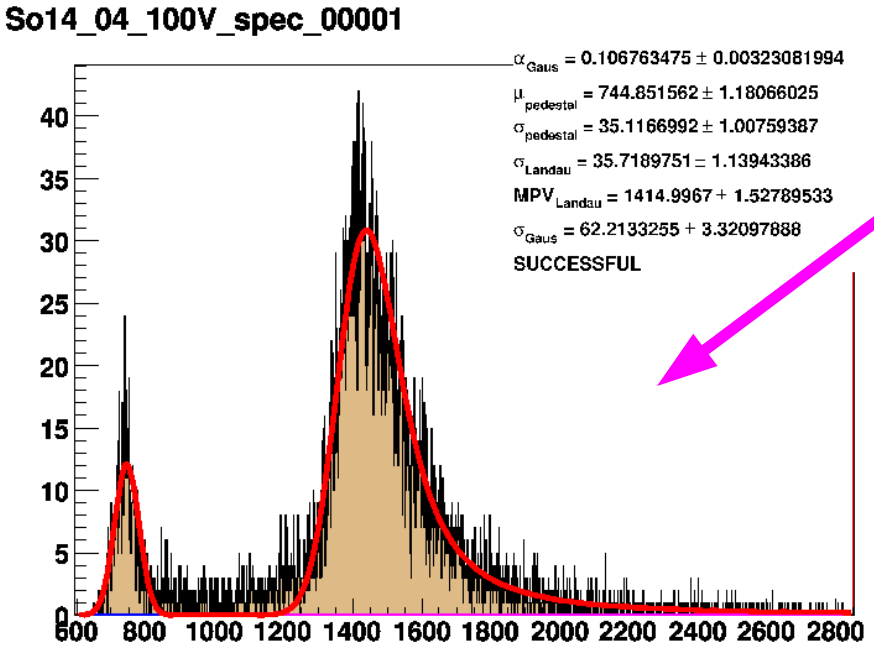
Trigger box with new counters



Assembly of trigger box counter

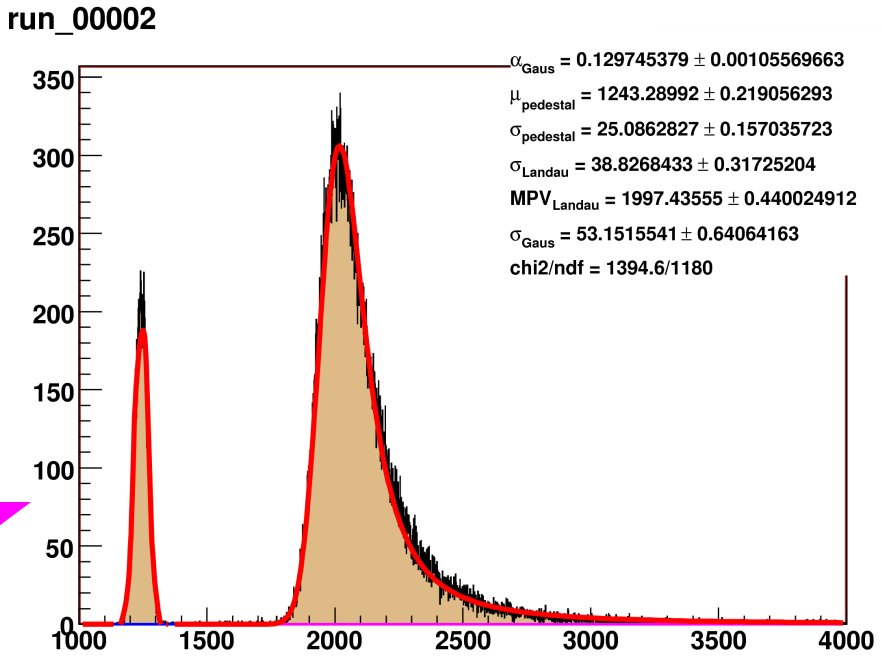


^{90}Sr Setup: scCVD Diamond spectrum



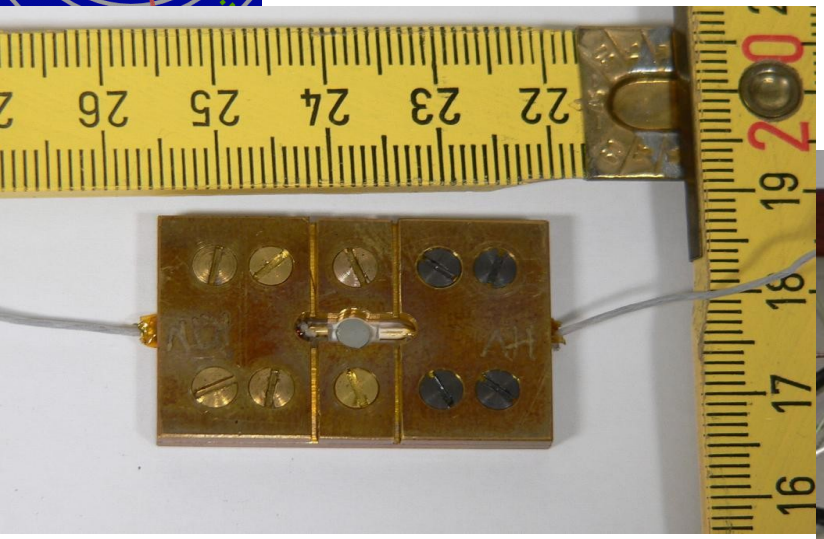
Before upgrade

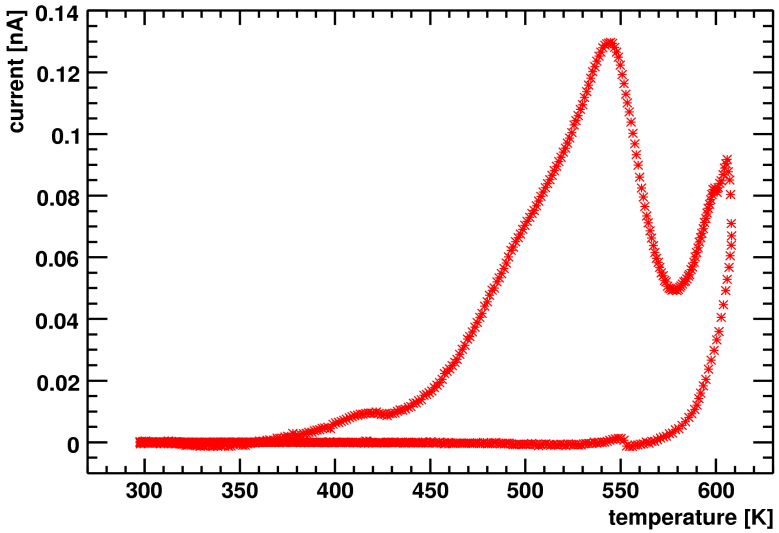
100 K events run: 20 min data taking:

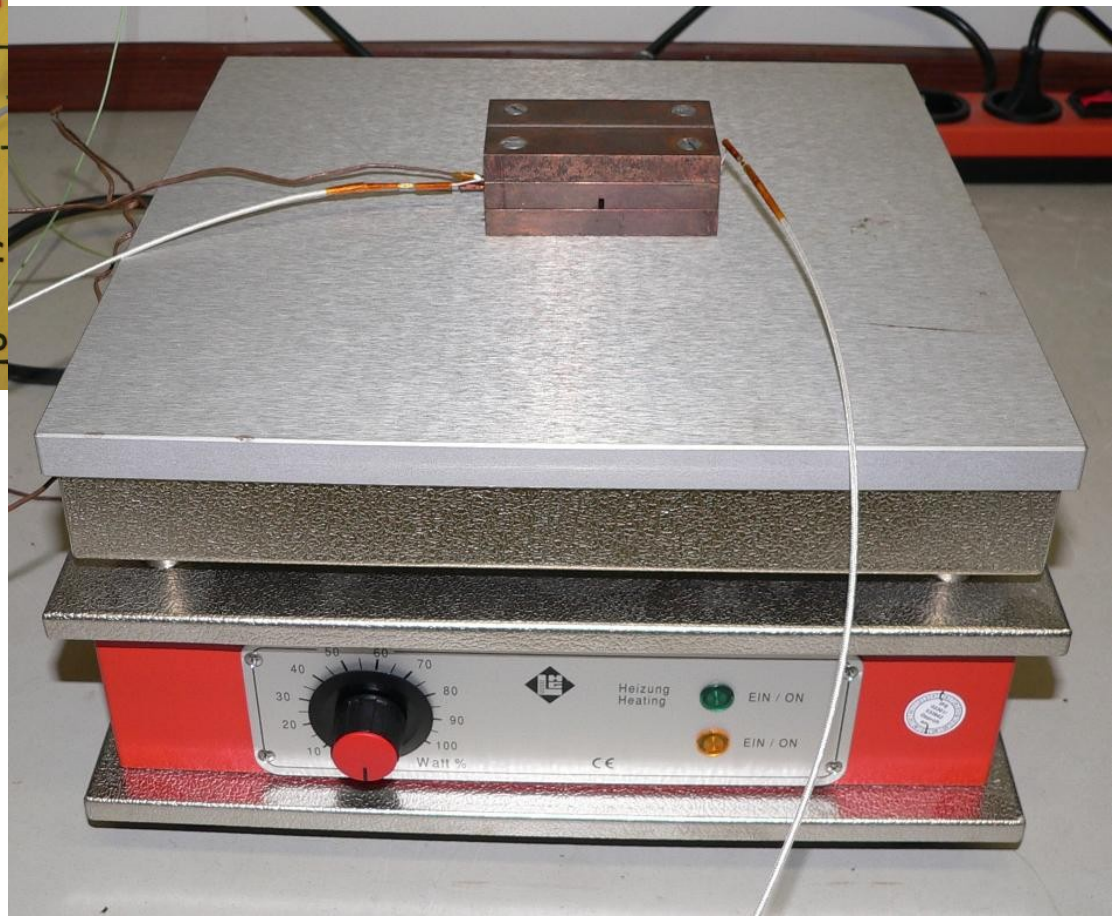


New trigger counters
+optimized collimators

TSC measurements setup

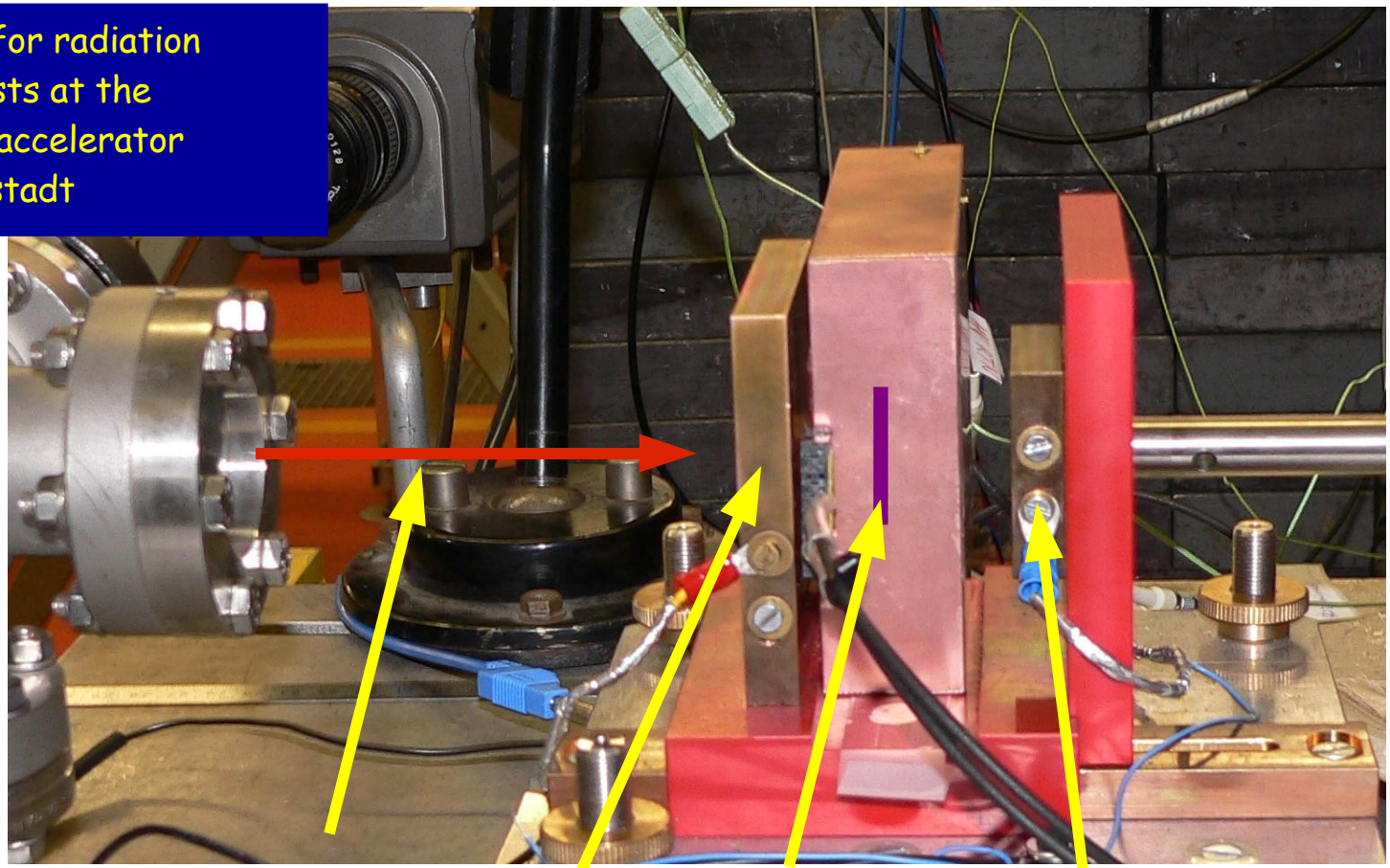






Testbeam Setup @ TU-Darmstadt

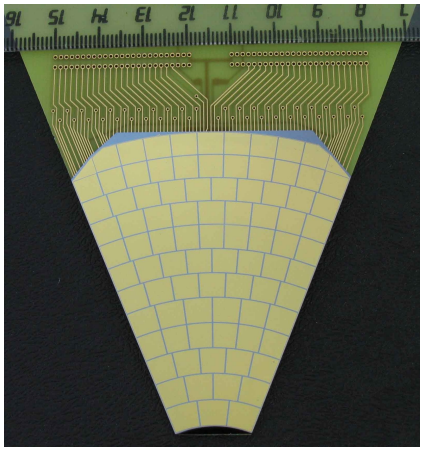
Setup used for radiation hardness tests at the SDALINAC accelerator @ TU Darmstadt



Sensor Materials under Investigation

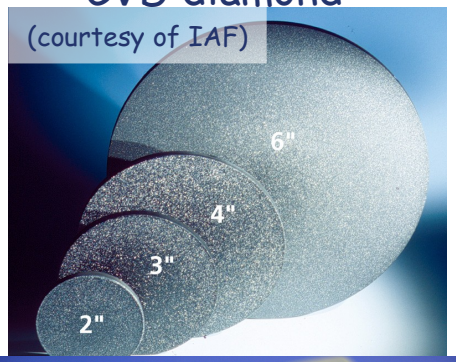
- GaAs (baseline):
  - semi-insulating GaAs, doped with Sn and compensated by Cr
  - produced by the Siberian Institute of Technology
  - available on (small) wafer scale
- pCVD diamonds:
  - radiation hardness under investigation (e.g. LHC pixel detectors)
  - high mobility, low $\varepsilon_R = 5.7$, thermal conductivity availability on wafer scale
- SC CVD diamonds:
  - large and fast signal
  - available in sizes of few mm^2
- New: Sapphire, Quartz:
  - relatively cheap
  - available in large sizes (<12")

CVD = Chemical Vapor Deposition

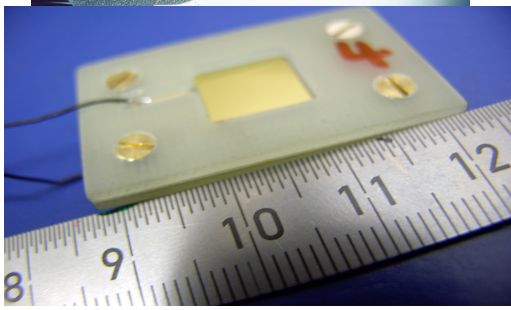


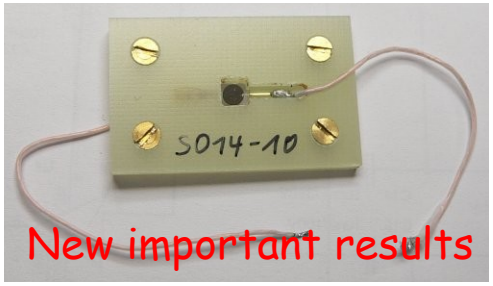
GaAs

polycrystalline CVD diamond



Single crystal CVD diamond





New important results

Sapphire

Tel-Aviv Uni Silicon Lab

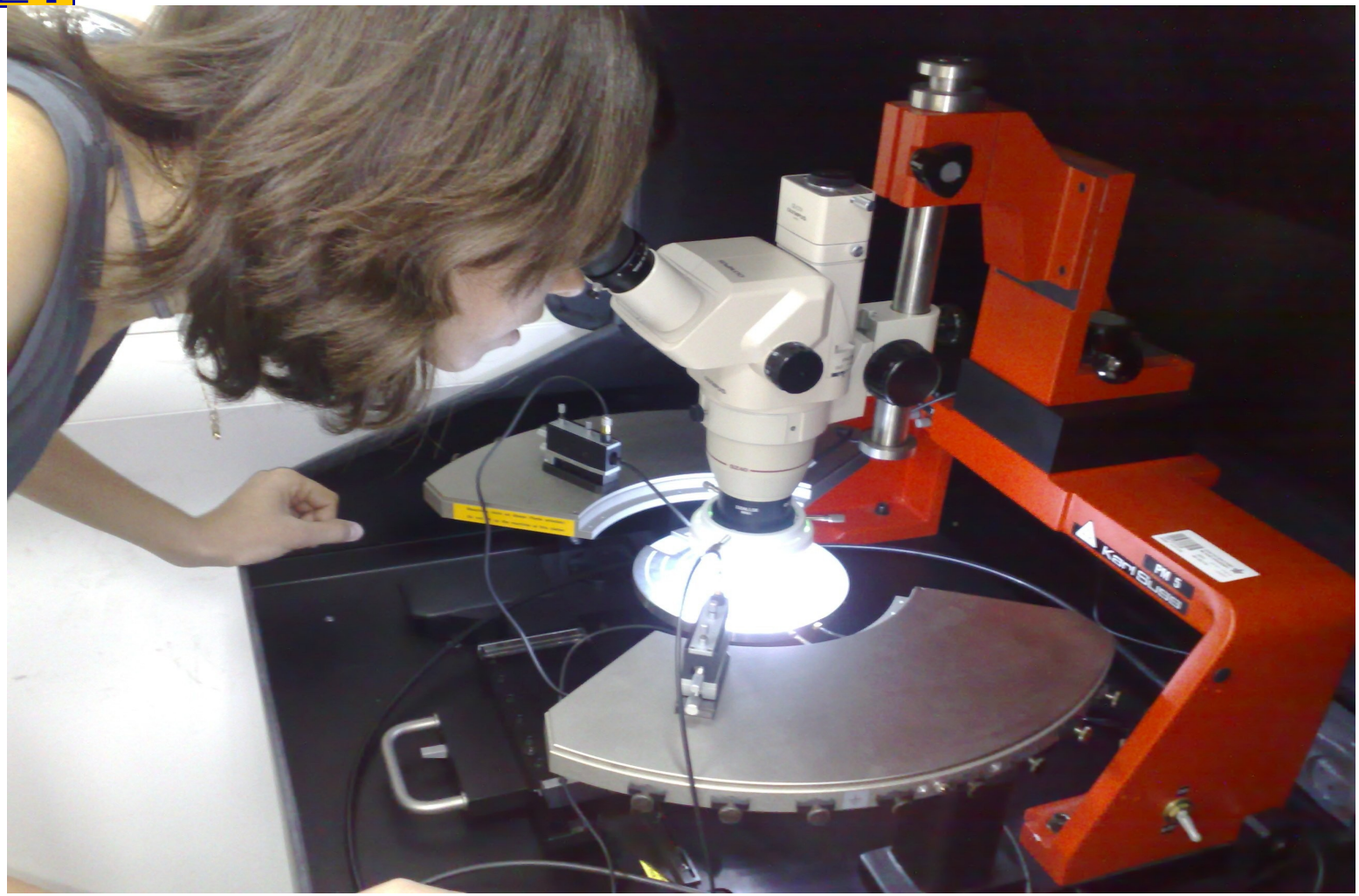
In the last months dedicated HEP lab building was designed (including a Silicon Lab for future detectors R&D).

a ~25 squared meter lab area will be dedicated only for the Silicon Lab.

The new building is expected to be ready in the middle of 2009. The lab room was designed to accommodate future installation of a clean room infrastructure.

** Lab Equipment:
fully equipped, computer monitored probe station.
The equipment is set up in a temporary lab for I/V, C/V measurements.

Tel-Aviv Uni Silicon Lab



Summary

- Laboratory infrastructure is created/improved/completed
- Testbeam equipment for sensor radiation hardness tests completed and used
- Testbeam equipment successfully operated in joint experiment with EUDET JRA1 pixel telescope
- VFCAL sensor test facilities are on schedule

Recent GaAs study