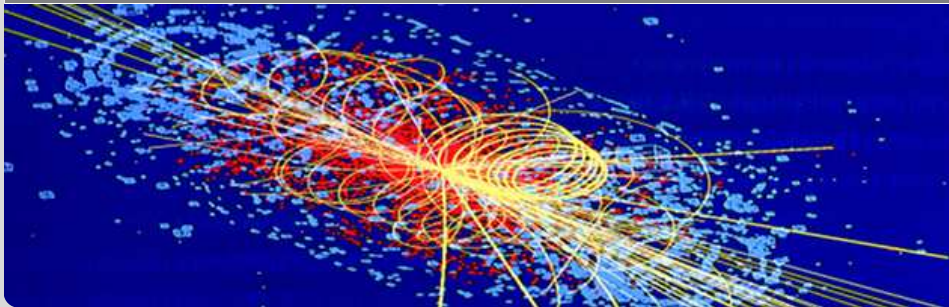


Status Teststations

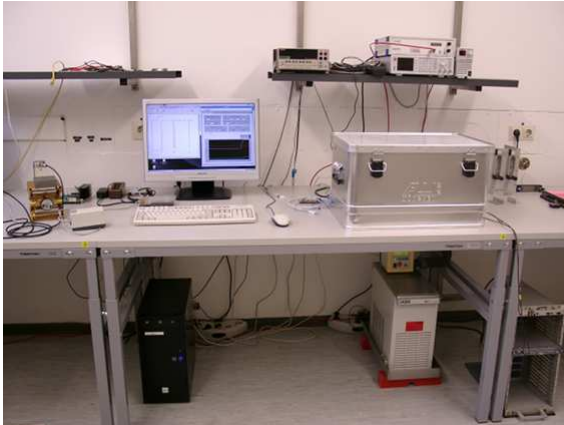
CMS Pixel Upgrade Phase 1 Monthly Meeting

Thomas Weiler, Stefan Heindl, Jan Hoss, Ulrich Husemann | February 13, 2012

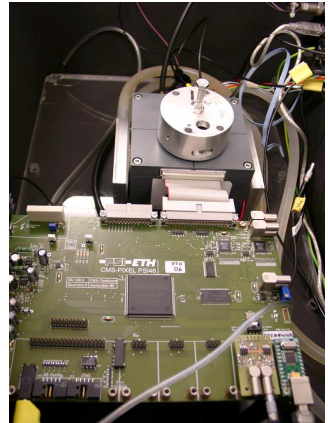
INSTITUT FÜR EXPERIMENTELLE KERNPHYSIK, KIT



- 1 Test Setups
- 2 Temperature Dependence
- 3 X-Ray Measurements
- 4 Summary and Outlook

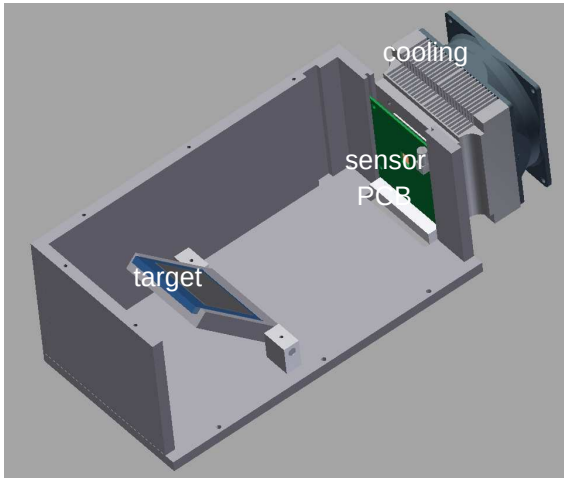


test setup for source measurements



view inside aluminum box

X-Ray Fluorescence Setup



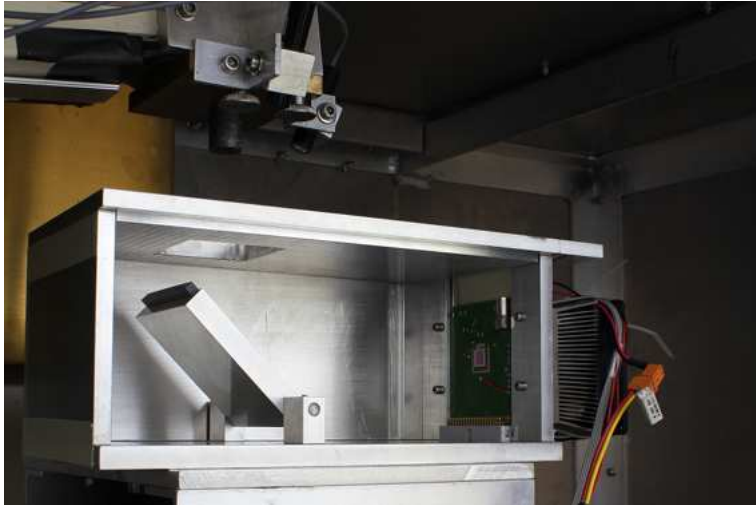
Tube characteristics

- accelerating voltage up to 60 kV
- current 2 mA to 33 mA
- anode material tungsten

Fluorescence target:

- Mo, Ag, In and Sn
- size 50 mm × 50 mm
- thickness 0.5 mm

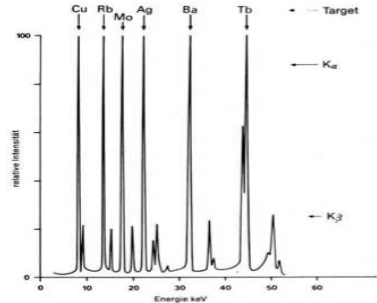
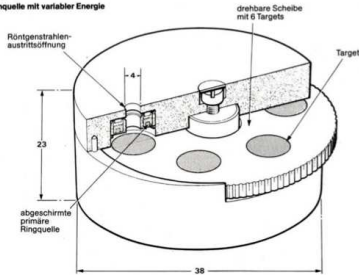
X-Ray Fluorescence Setup



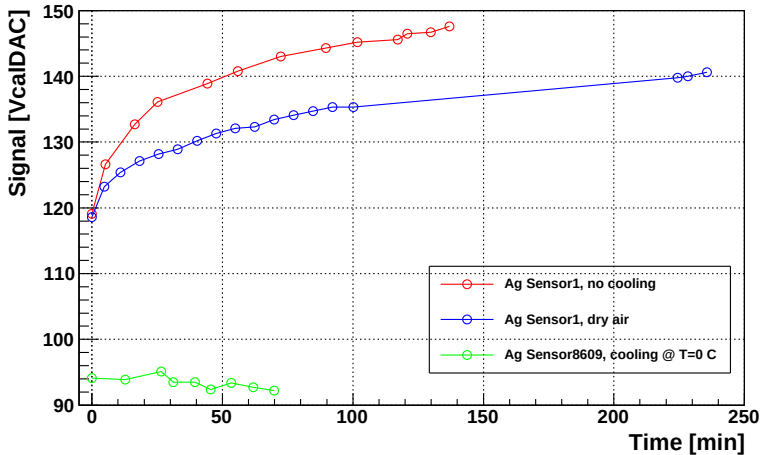
Am²⁴¹ for X-Ray Calibration

- Am²⁴¹ primary source with 6 inactive X-ray fluorescence targets:
(Cu (8.04 keV $\approx$ 2233e⁻), Rb (13.37 keV $\approx$ 3713e⁻), **Mo** (17.44 keV $\approx$ 4844e⁻),
Ag (22.10 keV $\approx$ 6138e⁻), **Ba** (32.06 keV $\approx$ 8905e⁻), Tb (44.23 keV $\approx$ 12286e⁻)

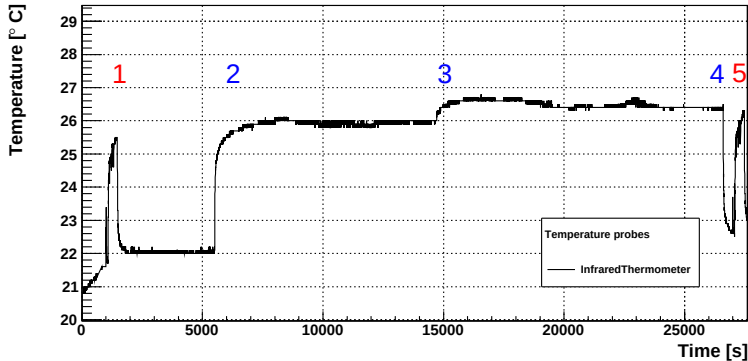
Americium-241
Röntgenstrahlenquelle mit variabler Energie



Temperature Dependence



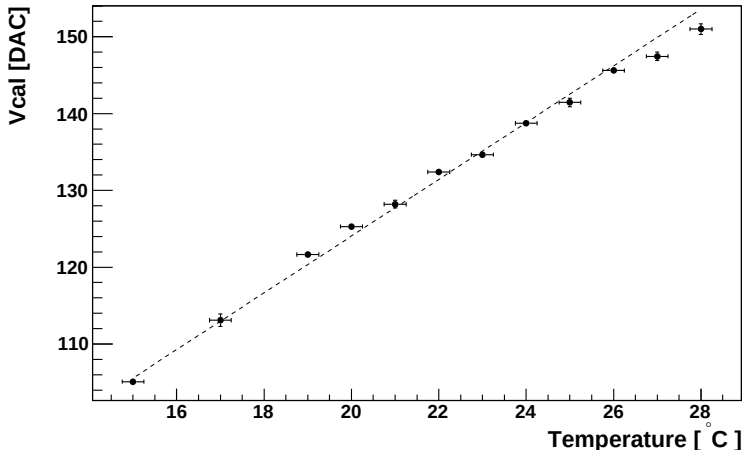
Temperature Dependence (ROC)



1, 5 - run standard tests (PreTest,...).

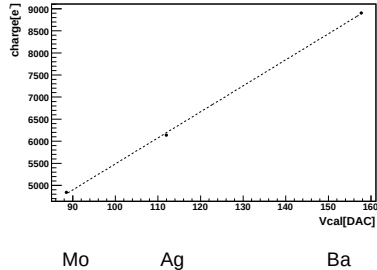
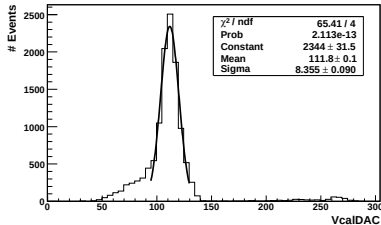
2 - started takeData, 3 - started run, 4 - exited takeData.

Temperature Dependence



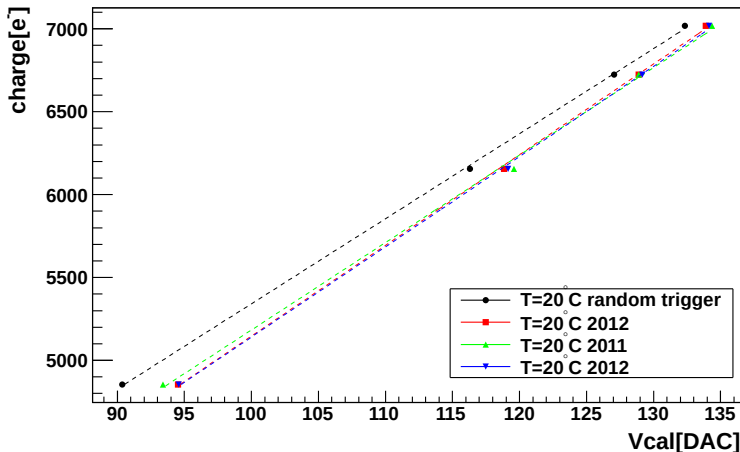
Module calibrated to 20 °C, slope 3.6 Vcal[DAC] / °C

Calibration via Spectrum

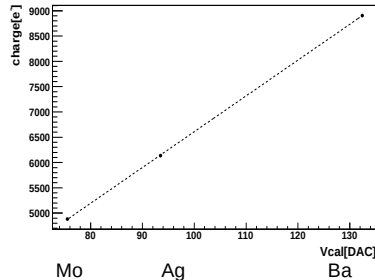
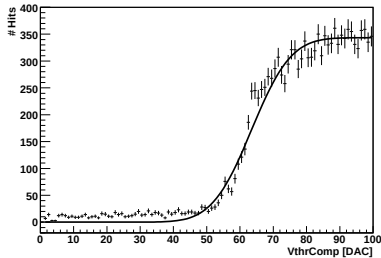


- Using takeData to measure spectrum, fit gaussian to peak position for different targets. Fit the slope of resulting line
- Result: $\approx 58.9 \text{ e}^- / \text{DAC}$

Calibration via Spectrum

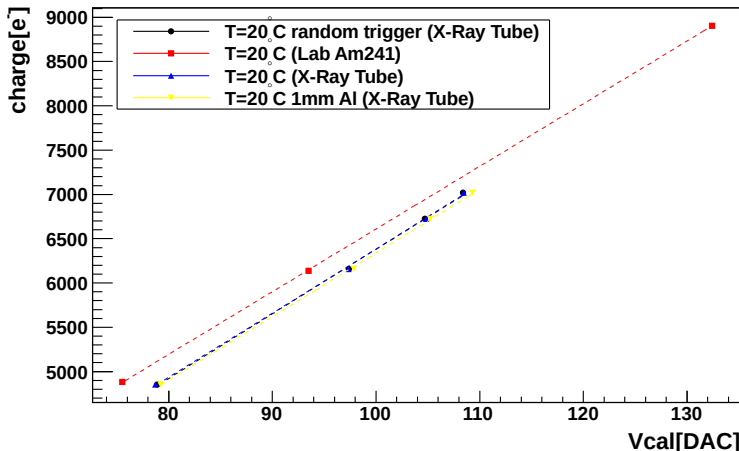


Slope: $51.3e^- / \text{Vcal}[\text{DAC}]$ $54.7e^- / \text{Vcal}[\text{DAC}]$ $52.7e^- / \text{Vcal}[\text{DAC}]$
 $54.4e^- / \text{Vcal}[\text{DAC}]$



- psi46expert x-ray test: threshold scan, resulting curve is fitted by error function, 50% point gives VthrComp, for each pixel Vcal scan is done, mean Vcal is plotted in right graph for different materials.
- Result: $\approx 70.7 \text{ e}^- / \text{DAC}$

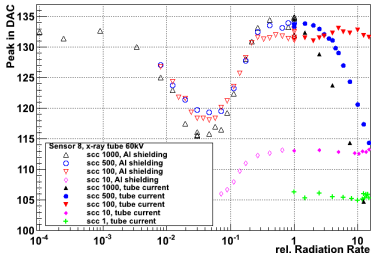
Calibration via VthrComp



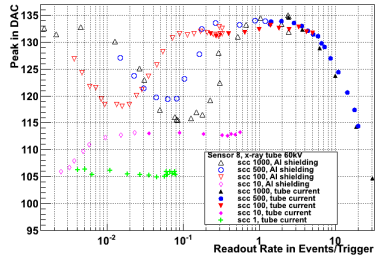
Slope: $73.0e^{-} / Vcal[DAC]$ $70.7e^{-} / Vcal[DAC]$ $72.3e^{-} / Vcal[DAC]$
 $71.8e^{-} / Vcal[DAC]$

Rate Dependence

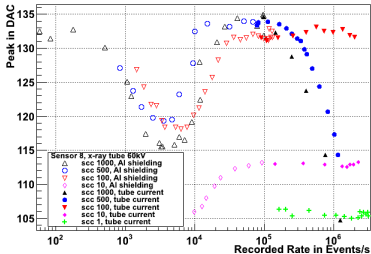
Peak Position vs Radiation Rate (T=20grad C, Vsf=150)



Peak Position vs Readout Rate (T=20grad C, Vsf=150)



Peak Position vs Recorded Rate (T=20grad C, Vsf=150)



- Setups for x-ray fluorescence and source measurements available
- Temperature control for stable signal is essential
- Calibration can be done with random trigger (x-ray tube only) → important for new ROC
- Cooling and cooling contact of x-ray fluorescence setup has to be improved to reach -20°C
- Calibrations for different temperature → need to find optimal Vsf DAC setting
- Rate measurements