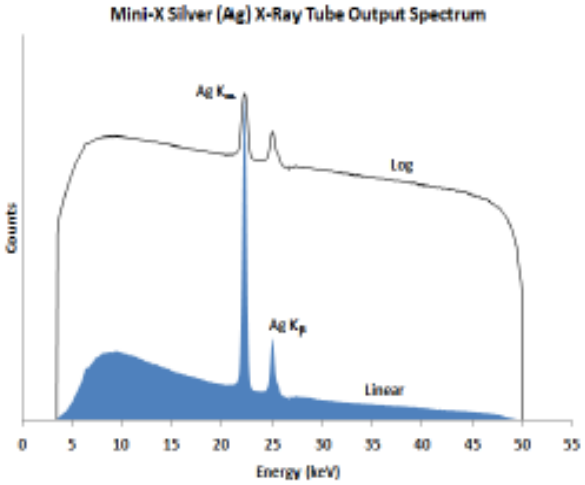
- X-Ray Calibration of digital irradiated Chips

  (Tobias Lapsien)

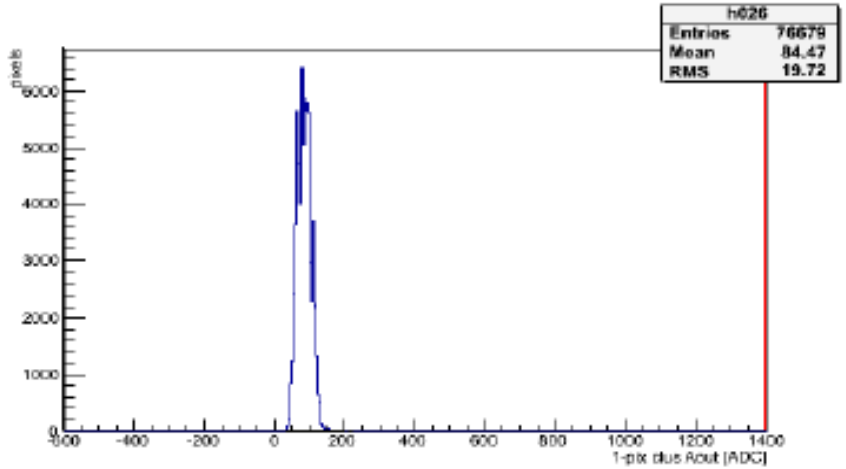
- IV/CV Measurements of the remaining Wafers

Matteo Centis Vignali, Erika Garutti, Johannes Haller, Malte Hoffmann, Tobias Lapsien, Stefan Mättig, Jennifer Sibille, Valentina Sola, Georg Steinbrück

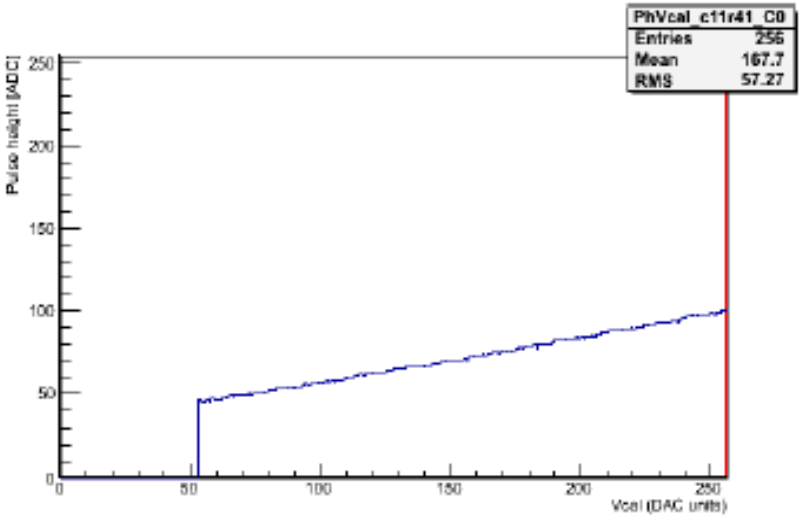
The Spectrum Method



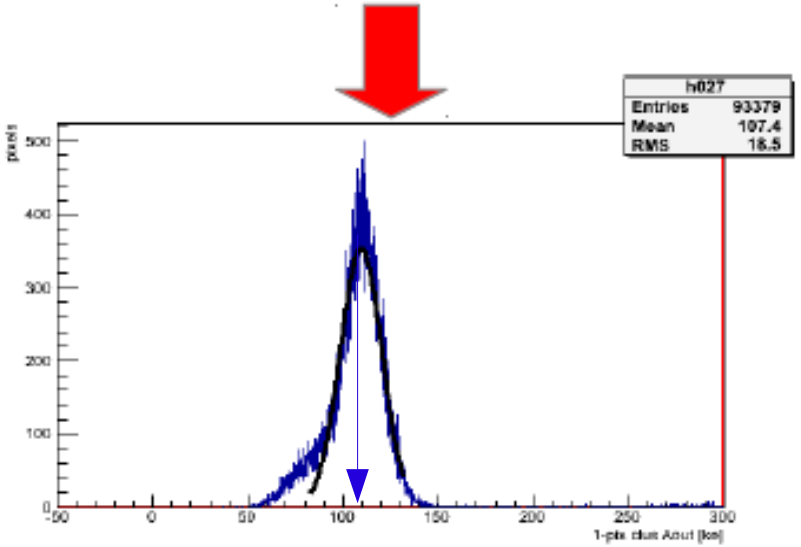
Choose specific energy with different targets



Measure ph-spectrum
in adc units

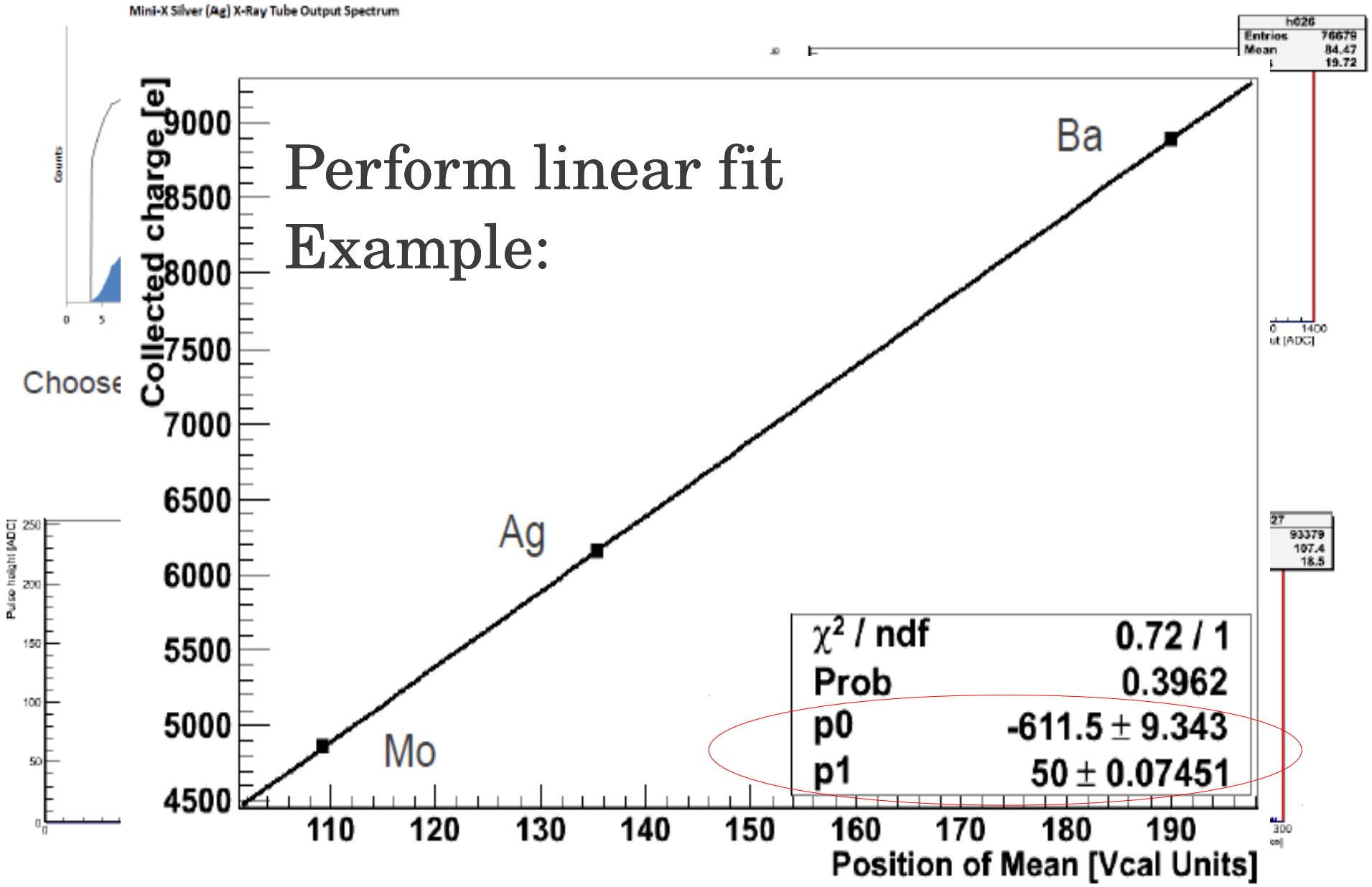


Do ph-calibration

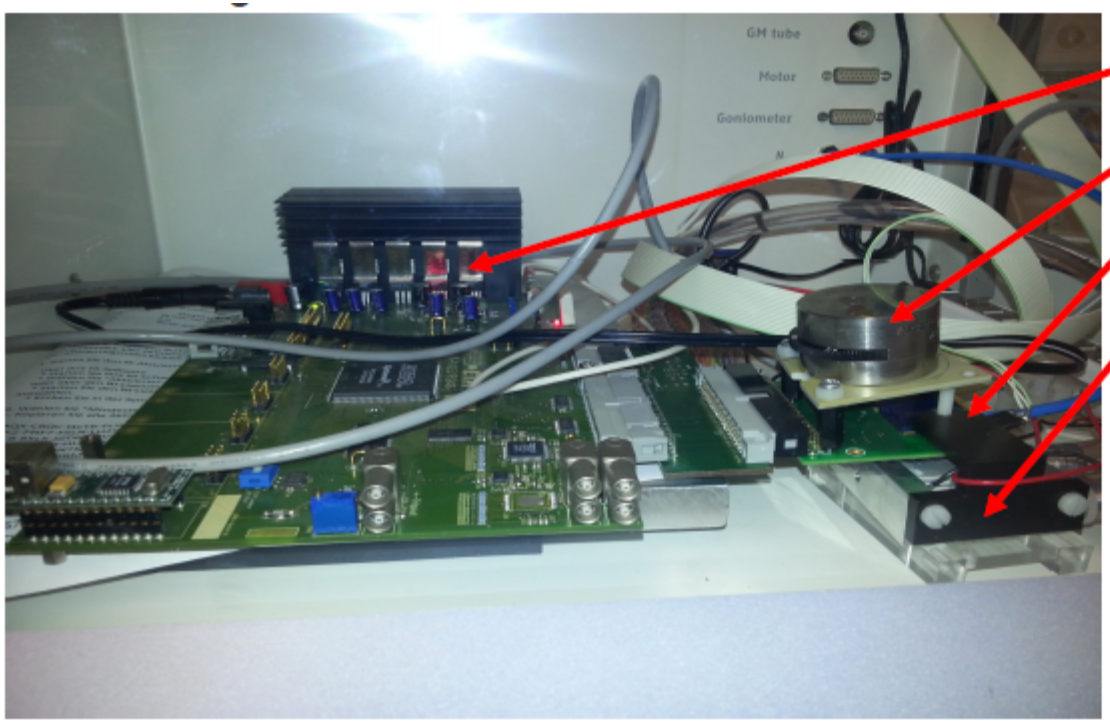


Get ph-distribution in vcal units

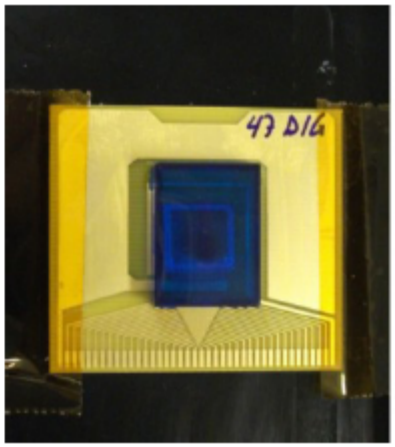
The Spectrum Method



Measurement Setup



Testboard
Variable X-ray source
Digital single chip
Cold block with peltiers



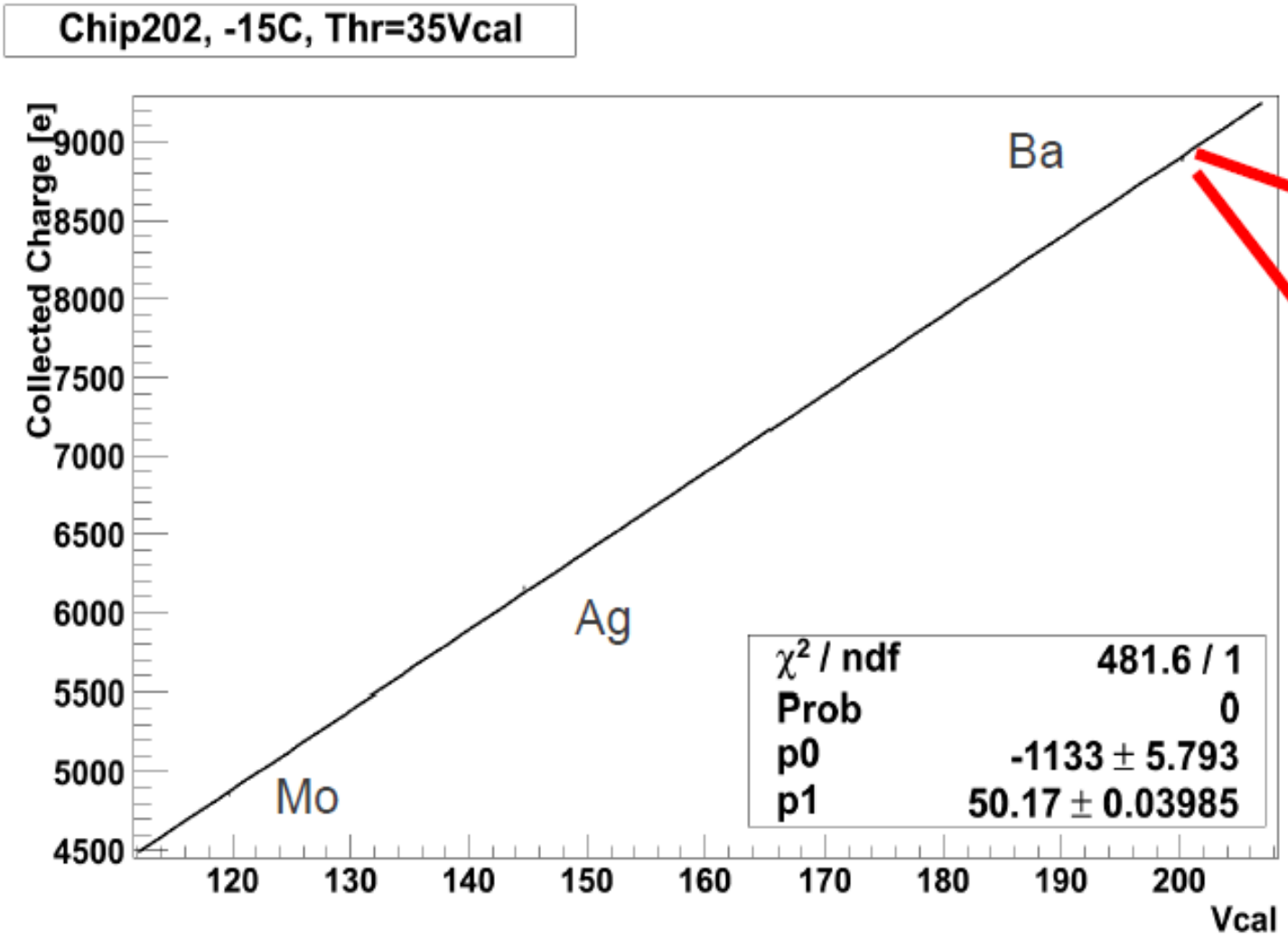
• Bias-voltage = 200V

• 3 targets were used:
Mo: 17.48 keV (4.9 ke in Si)
Ag: 22.16 keV (6.2 ke in Si)
Ba: 32.19 keV (8.9 ke in Si)

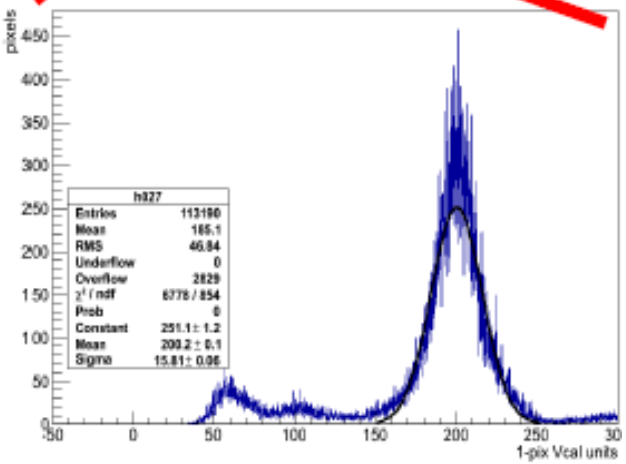
Chip 202 (0.9x10^14 p/cm^2; 3Mrad)
Calibrated at: -15° (Thr1= 35VCAL, Thr2= 50VCAL)
+15° (Thr1= 35VCAL)

Chip 203 (4x10^14 p/cm^2; 13Mrad)
Calibrated at: -15° (Thr1= 35VCAL)

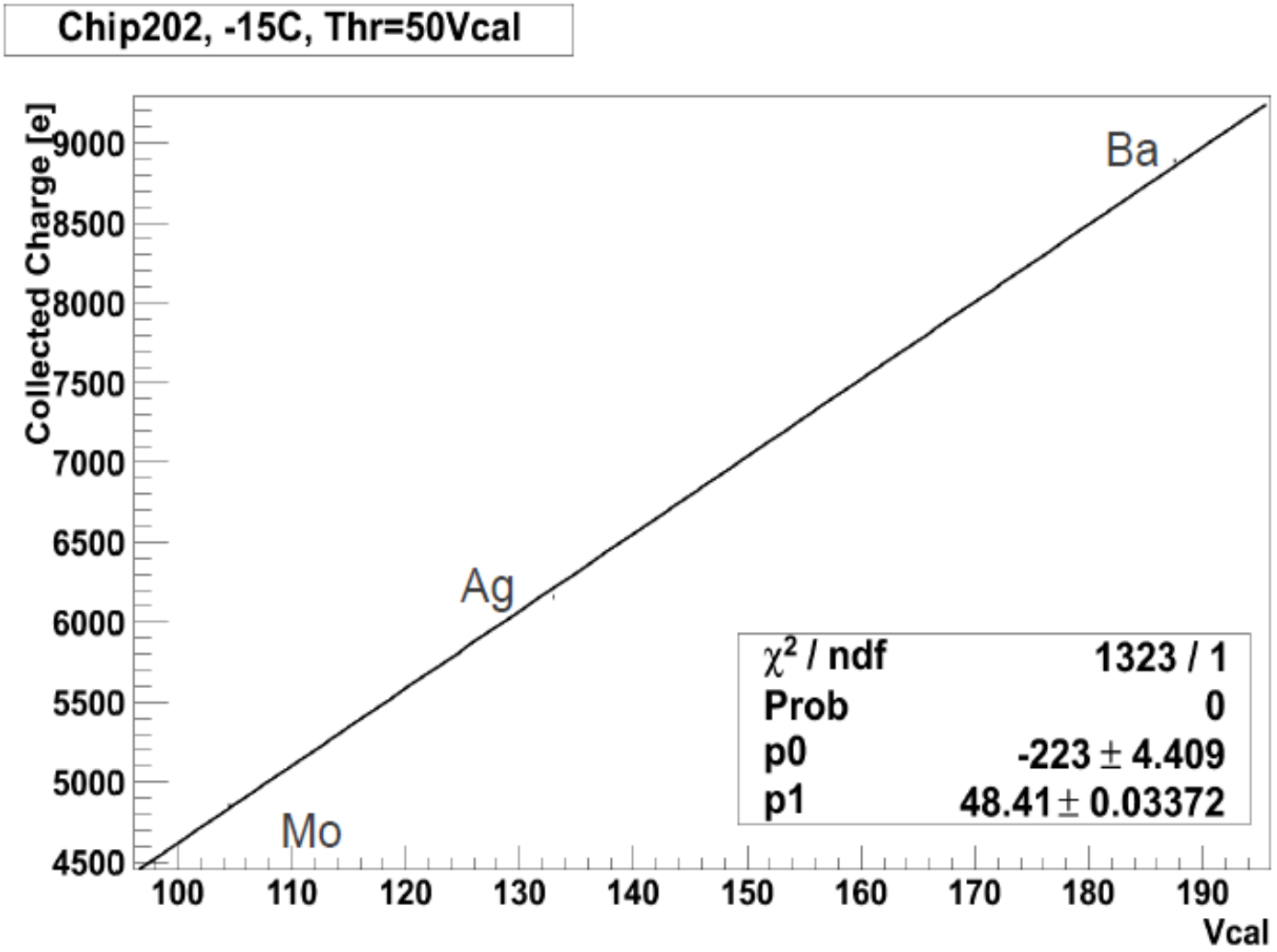
Chip 202: T=-15°, Thr = 35VCAL



- Calibration done with a threshold of 35Vcal
- Leakage current: 25uA

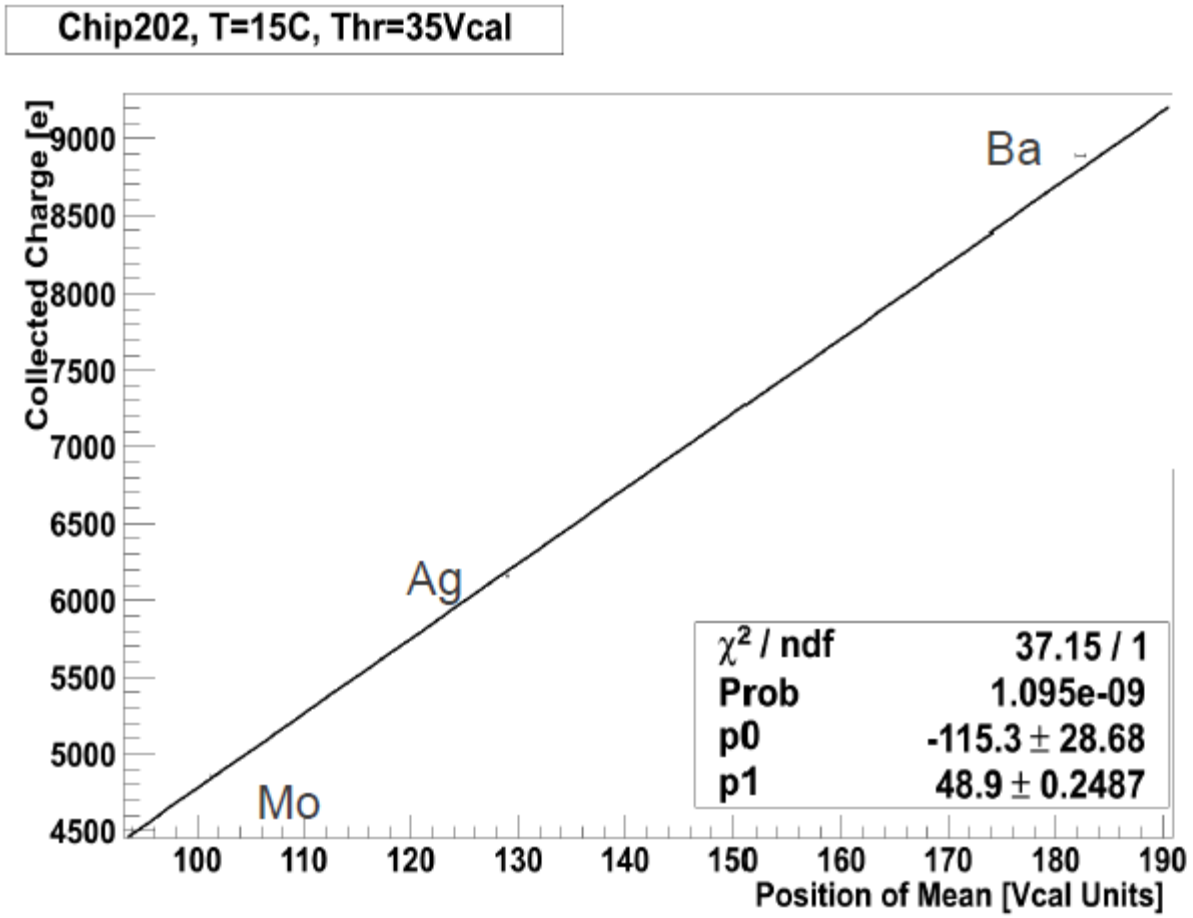


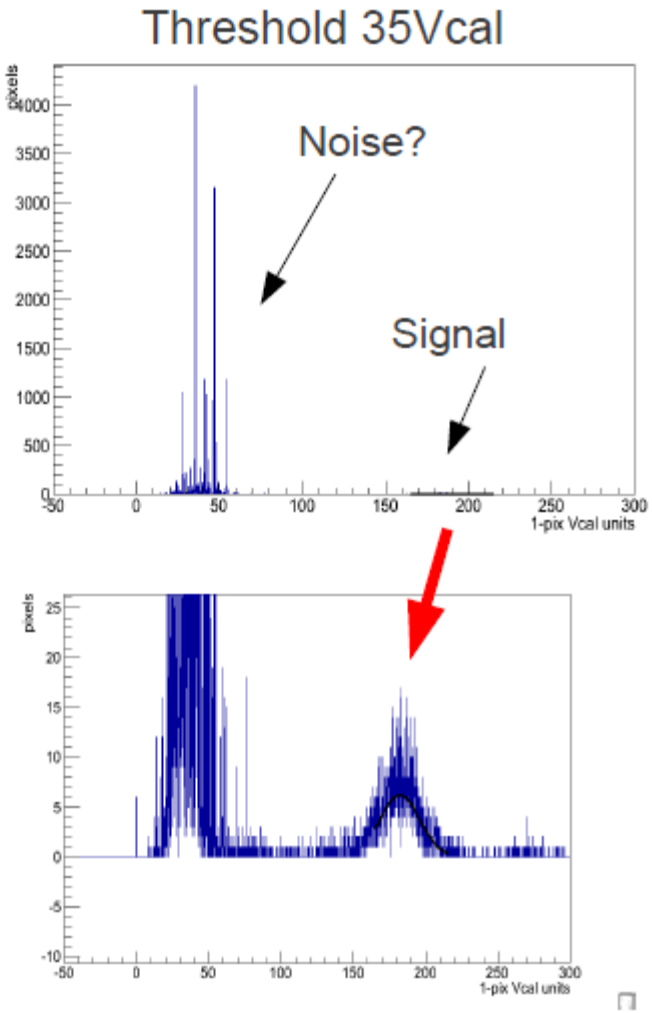
Chip 202: T=-15°, Thr= 50VCAL



- Calibration done with threshold of 50Vcal units
- Leakage current: 25uA

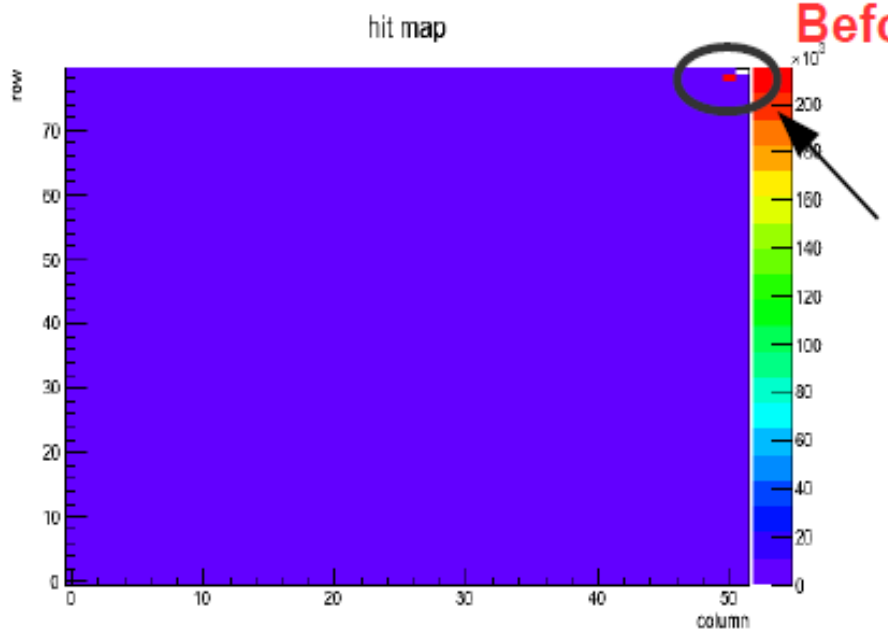
Chip 202: T=15°, Thr= 35VCAL





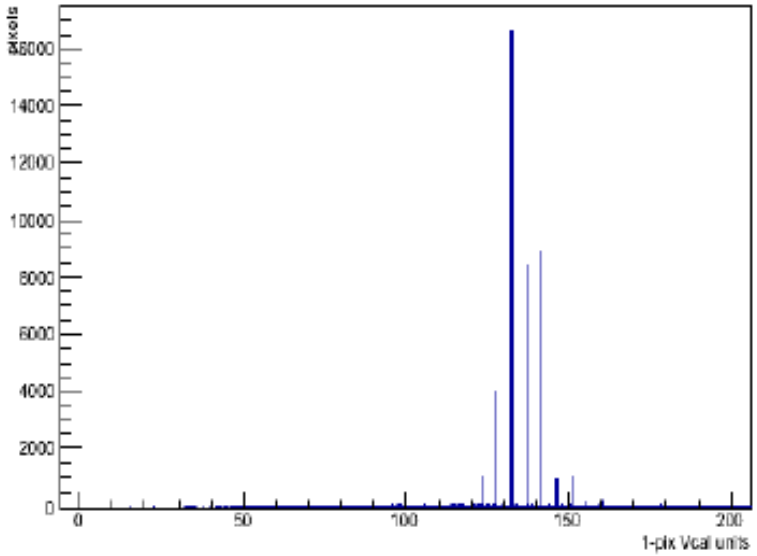
Leakage current much higher: 130uA

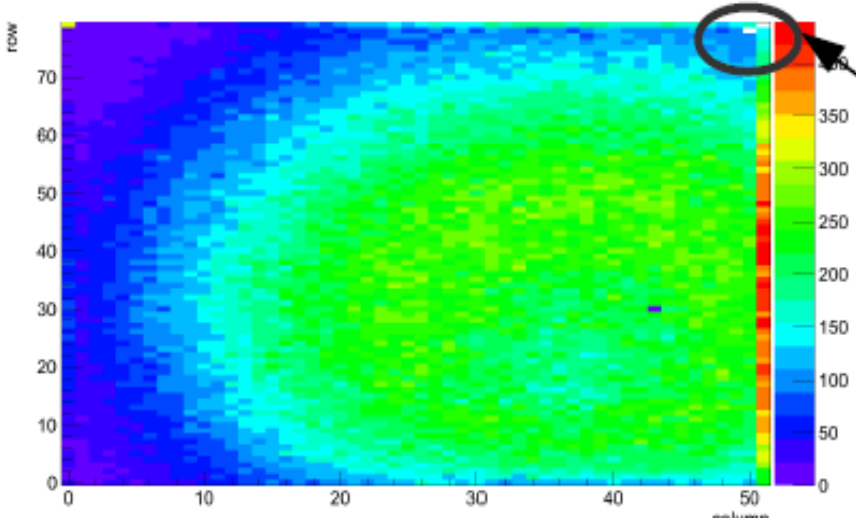
Chip 203: T=-15°, Thr= 35VCAL



Before masking

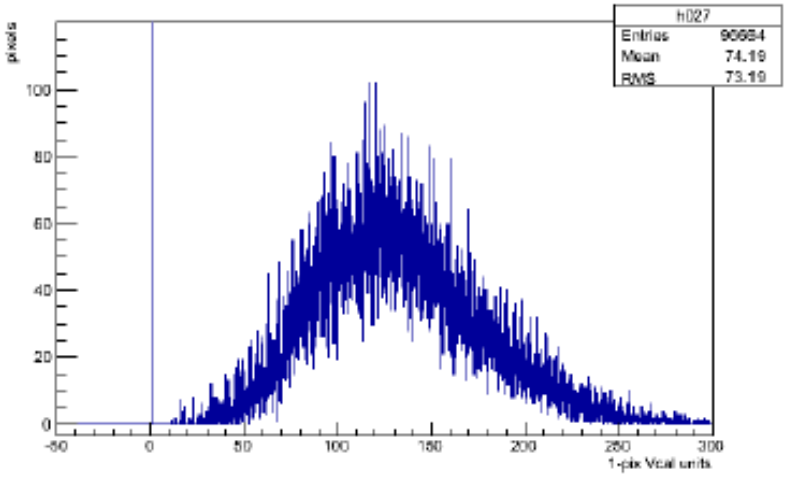
Noisy pixel



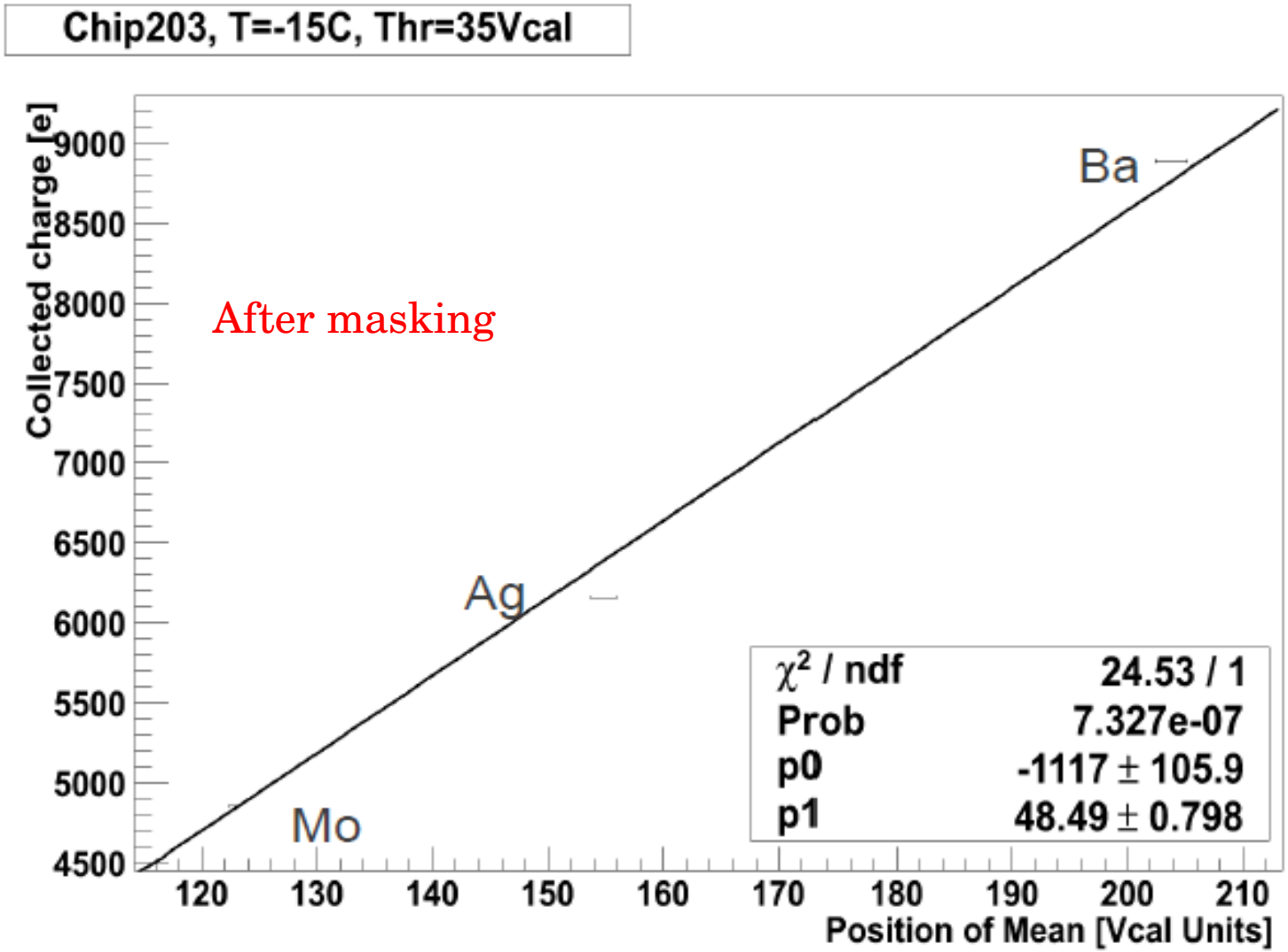


After masking

Masked pixel



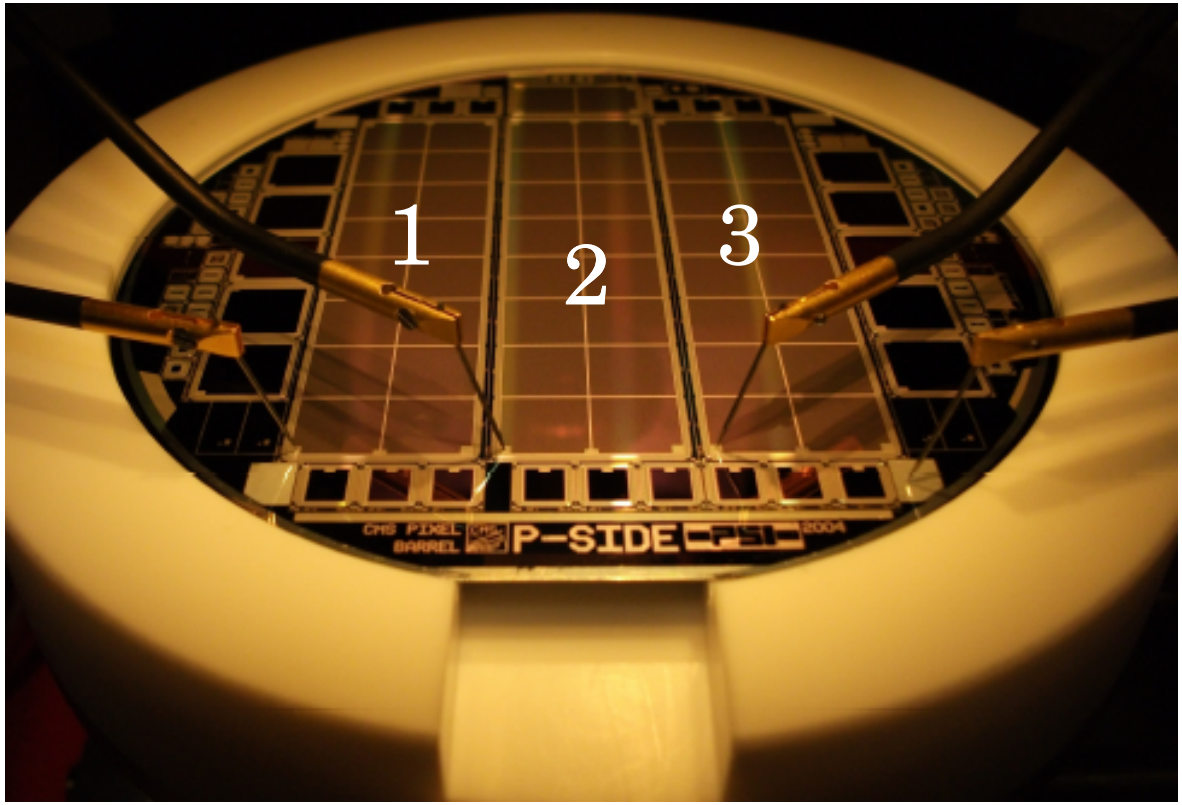
Chip 203: T=-15°, Thr= 35VCAL



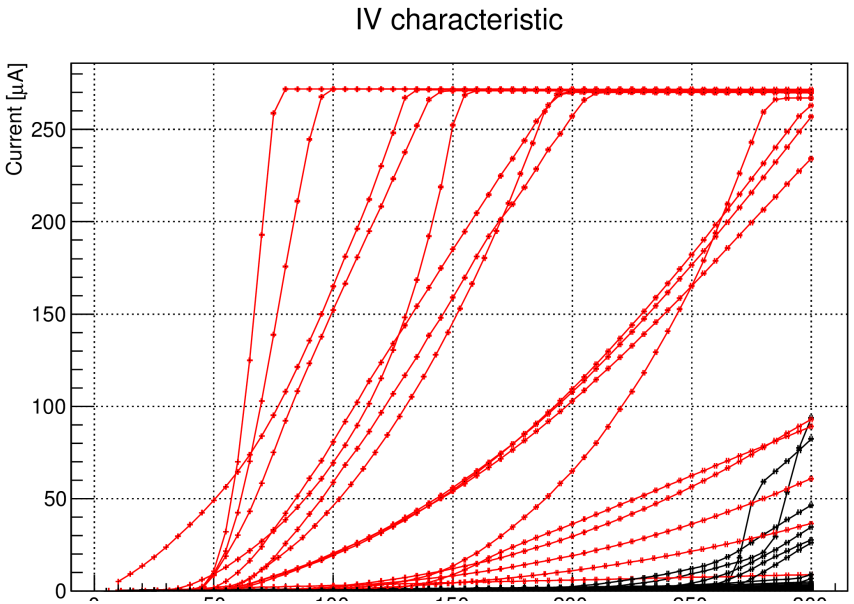
Leakage current: 700 µA

IV/CV Measurements of the remaining Wafers

2 Batches of 25 Wafers each

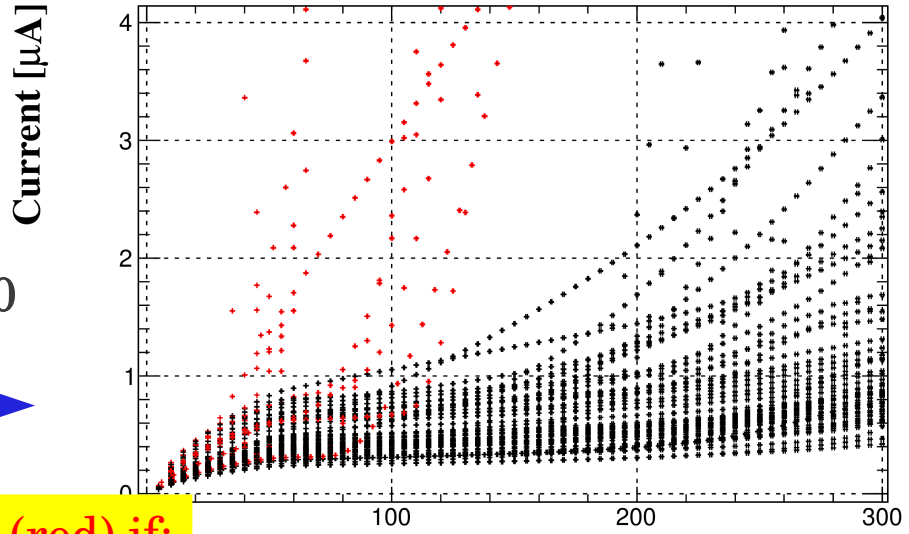


Current-Voltage (IV)

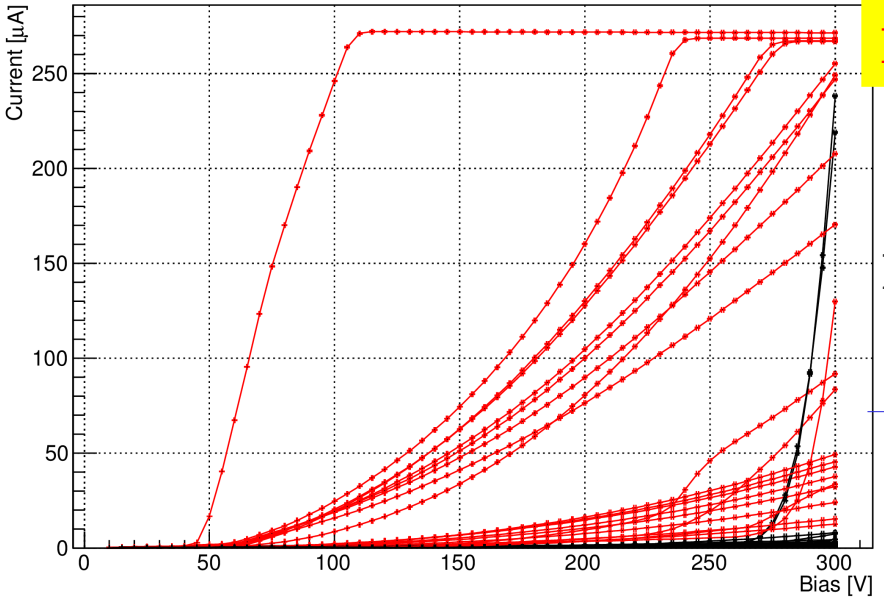


Batch: 322310

Zoom in

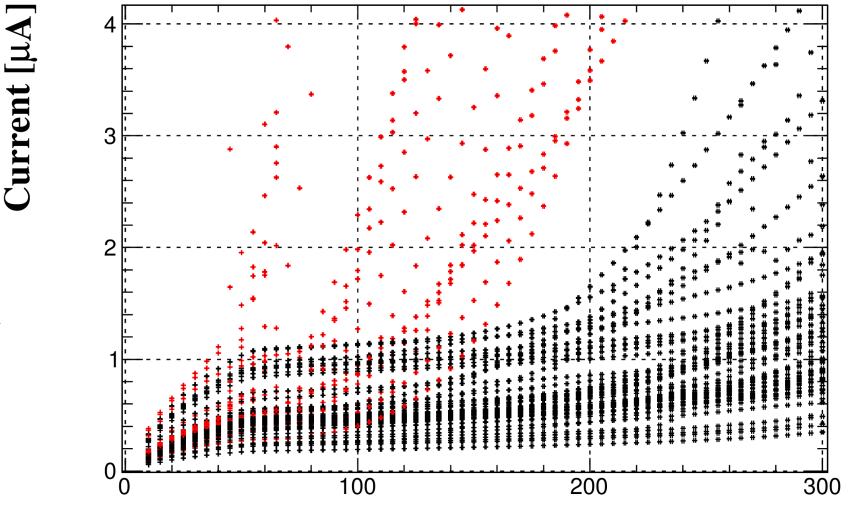


Bad Sensors (red) if:
I(150V) > 2 µA
I(150V)/I(100V) > 2

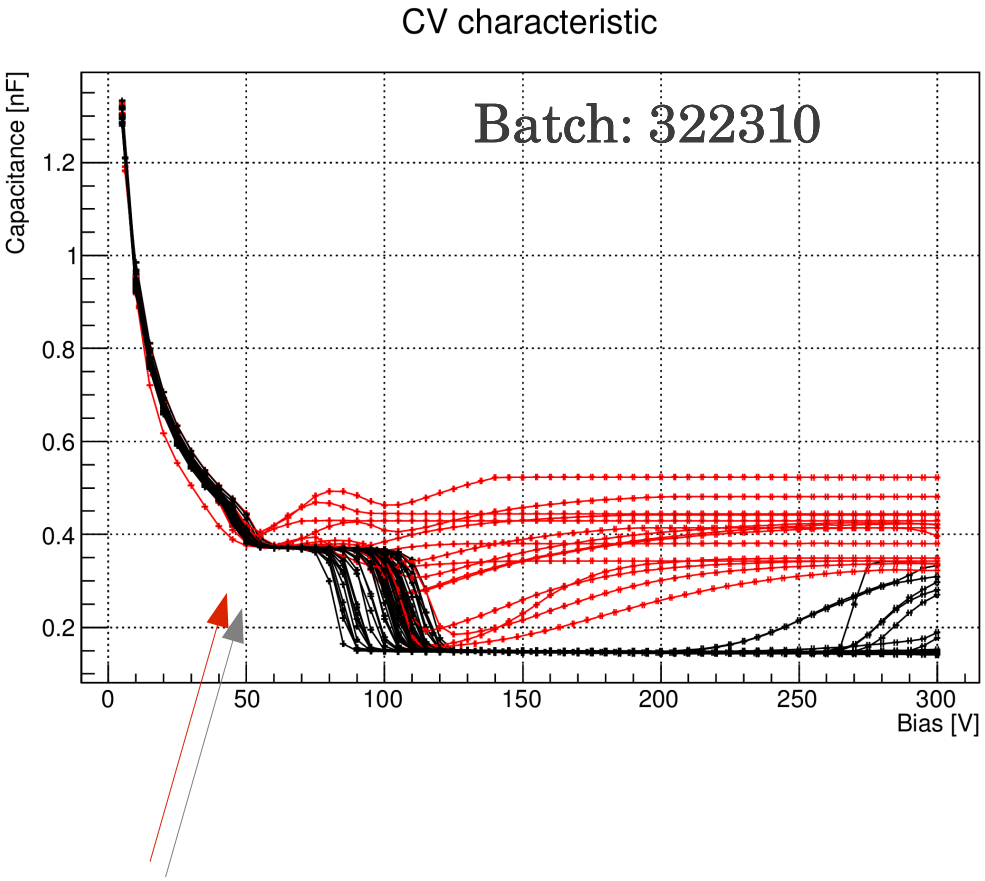


Batch: 322311

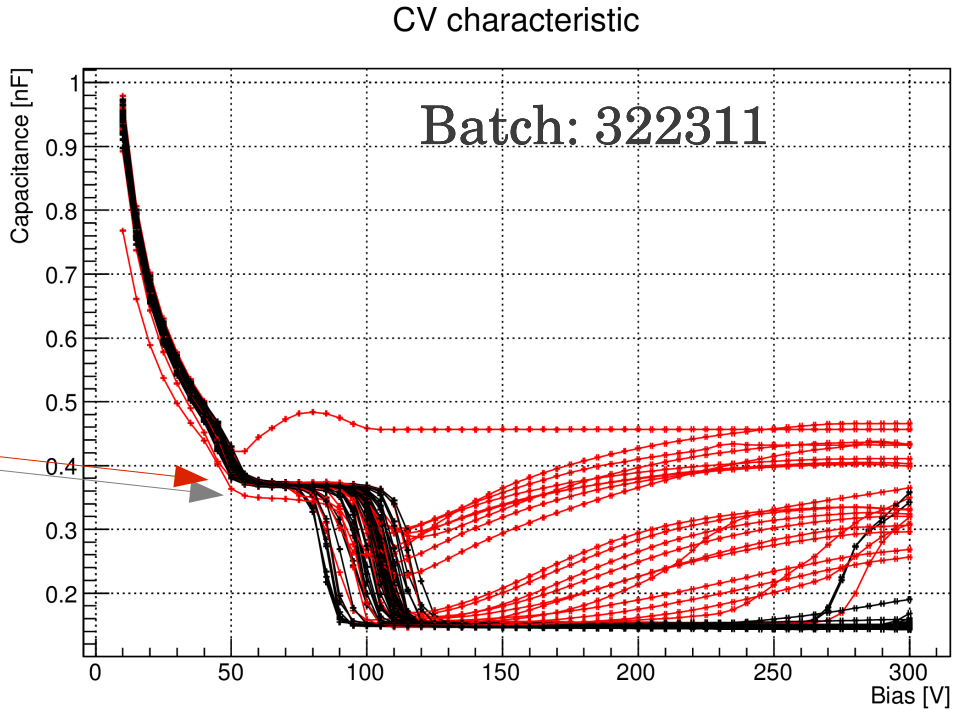
Zoom in



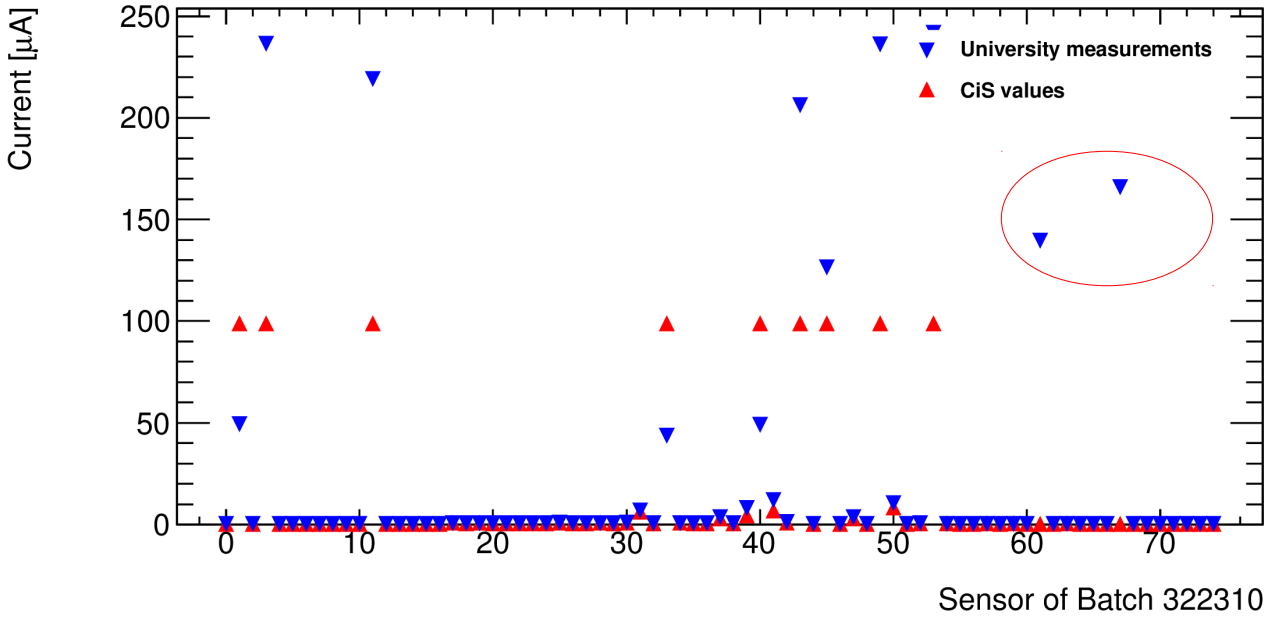
Capacitance-Voltage (CV)



Depletion Voltage ~ 50V

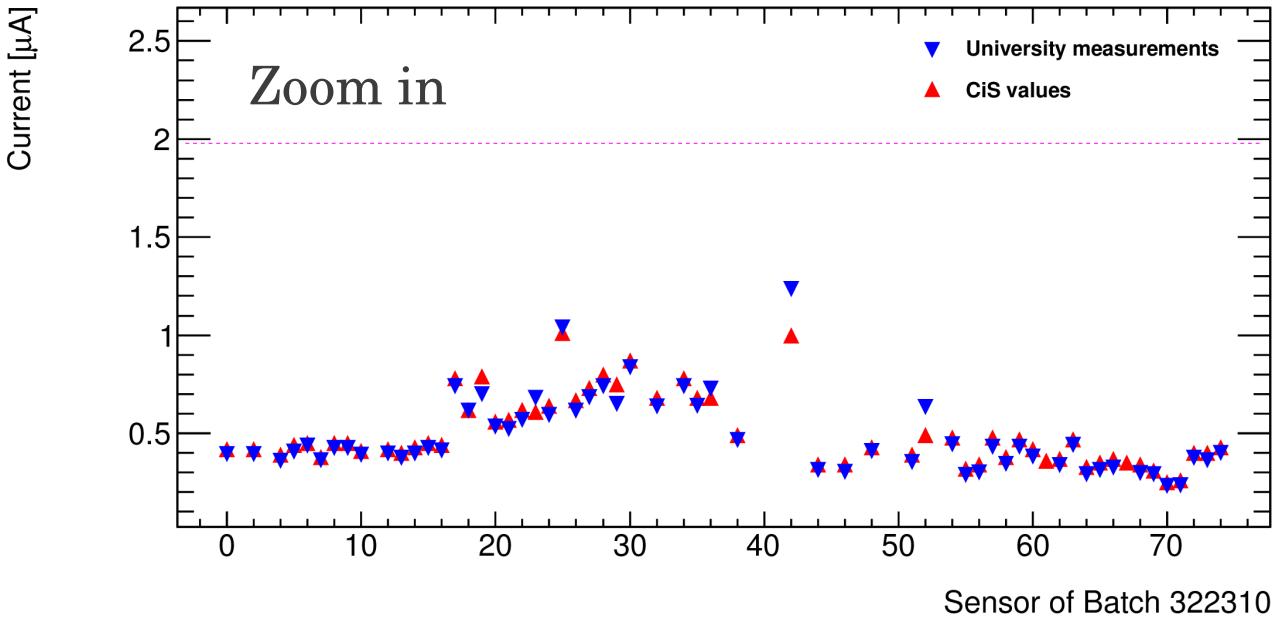


Comparisons with CiS (Batch: 322310)

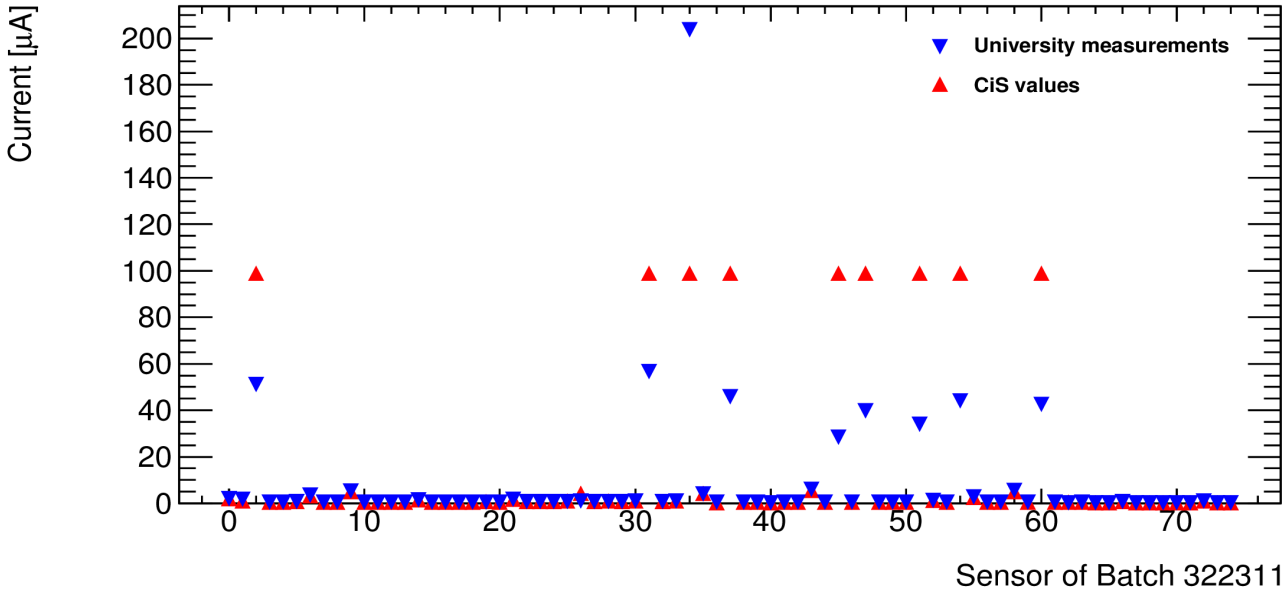


I[µA] measured at 150V scaled to T=20°

Bad Sensors if: I(150V) > 2 µA

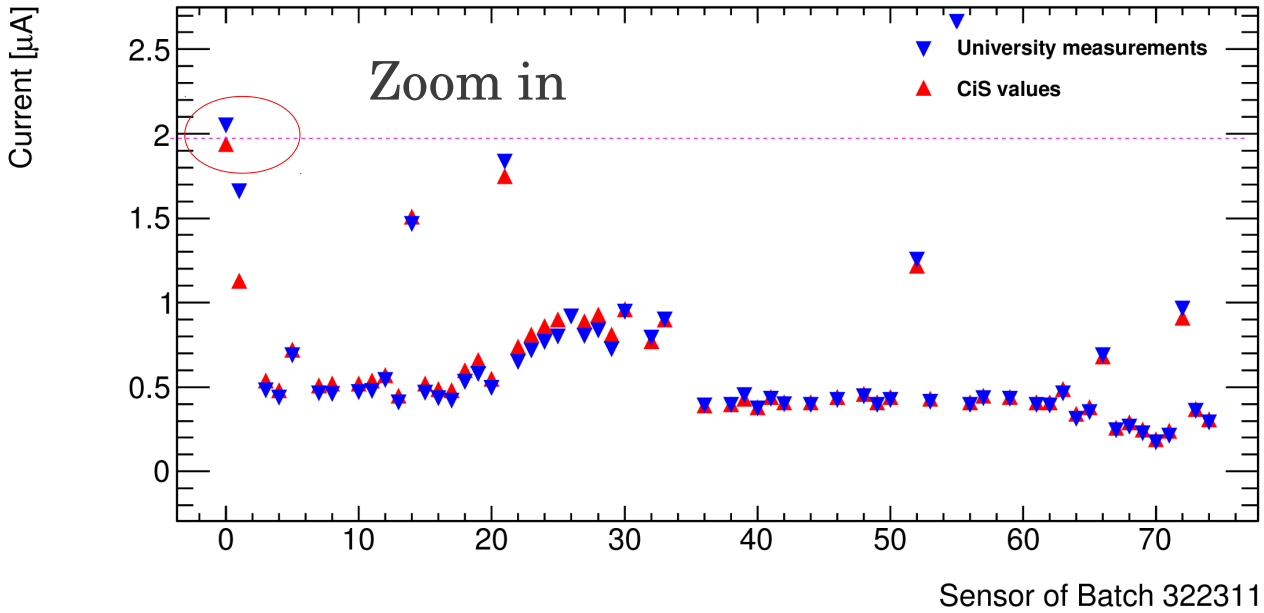


Comparisons with CiS (Batch: 322311)



I[µA] measured at 150V scaled to T=20°

Bad Sensors if: I(150V) > 2 µA



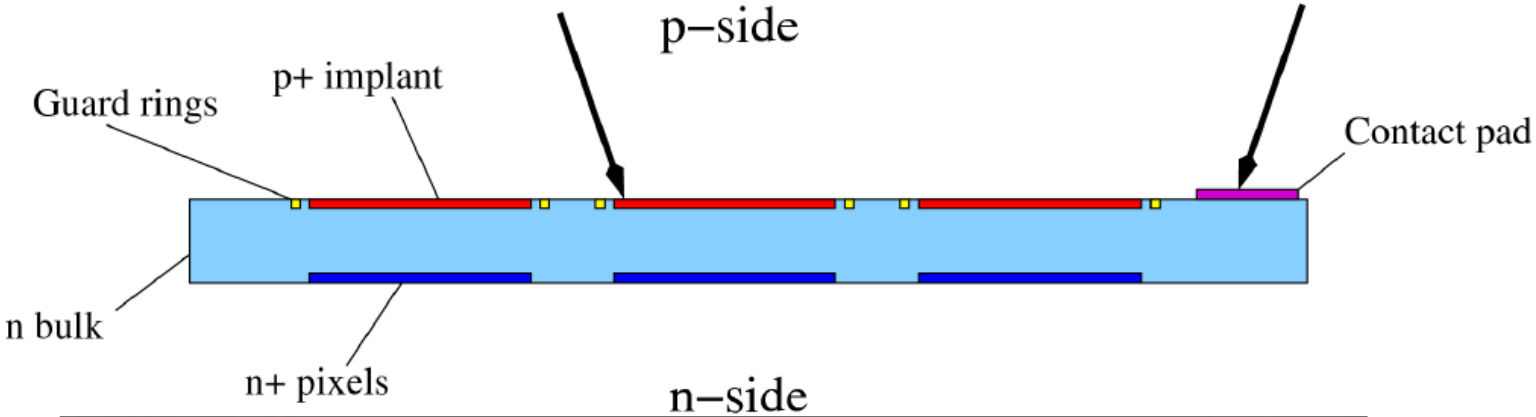
Conclusions

- Results from irradiated Chips are similar to un-irradiated Chip39 (~50e/VCAL)
- Deviations of ~3.5% in calibration at different threshold and temperature. Large differences in offset (p0) due to extrapolation.

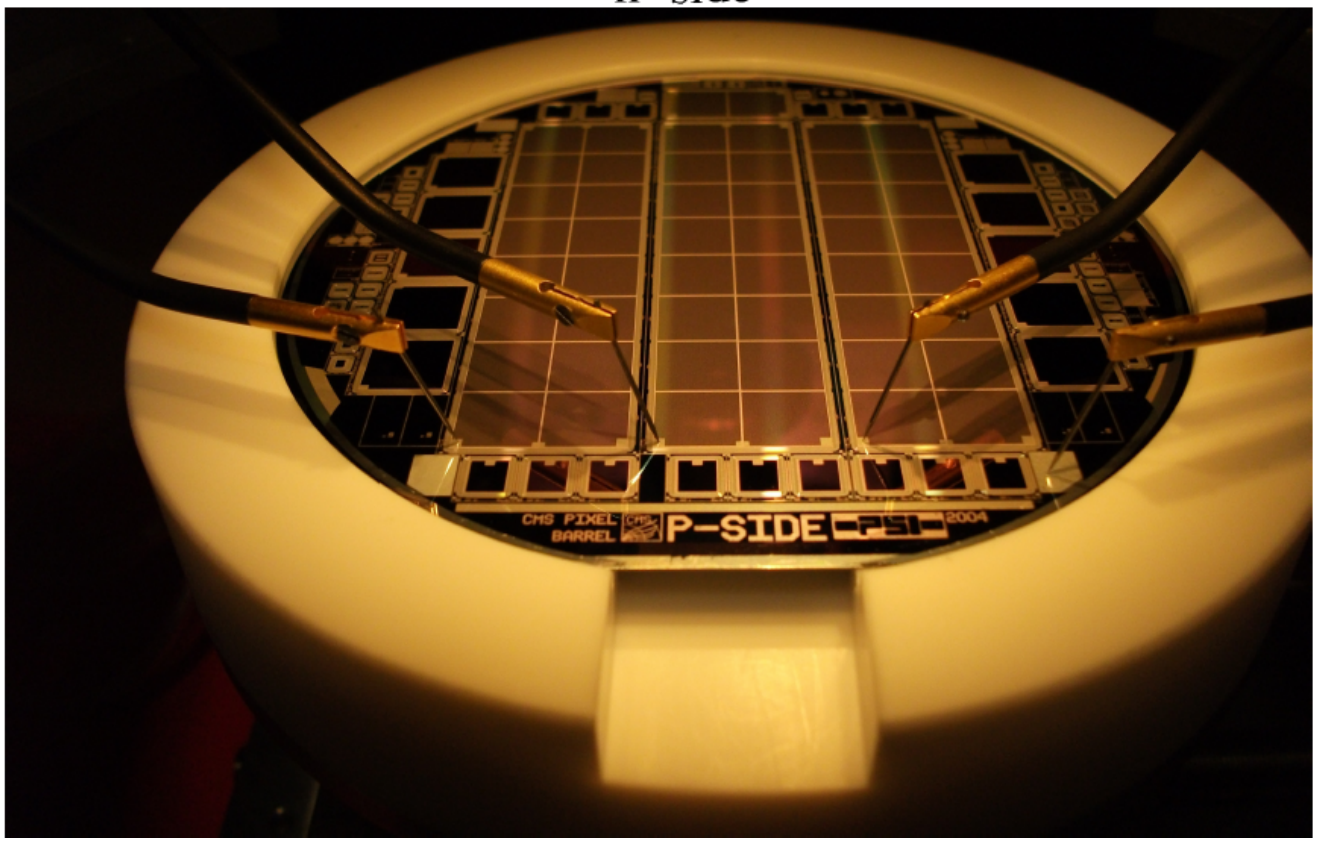
- Our IV/CV measurements are in good agreement with those of CiS
- All 150 Sensors have been measured → They are ready to be sent to PakTech

Backup

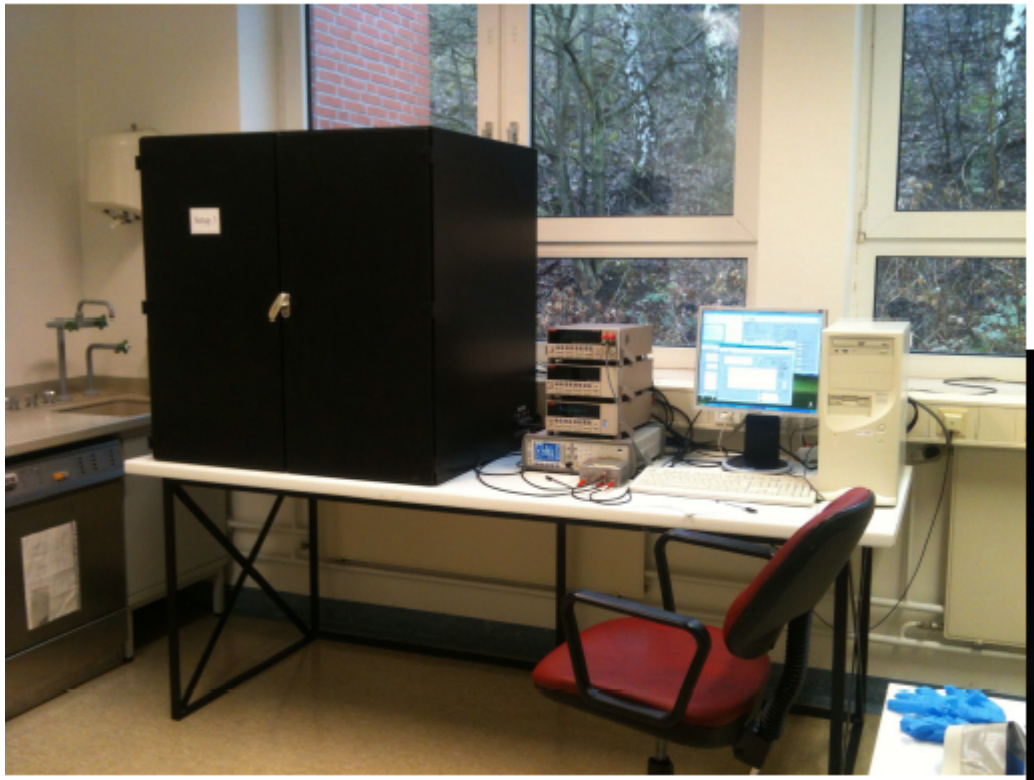
Measurement Setup



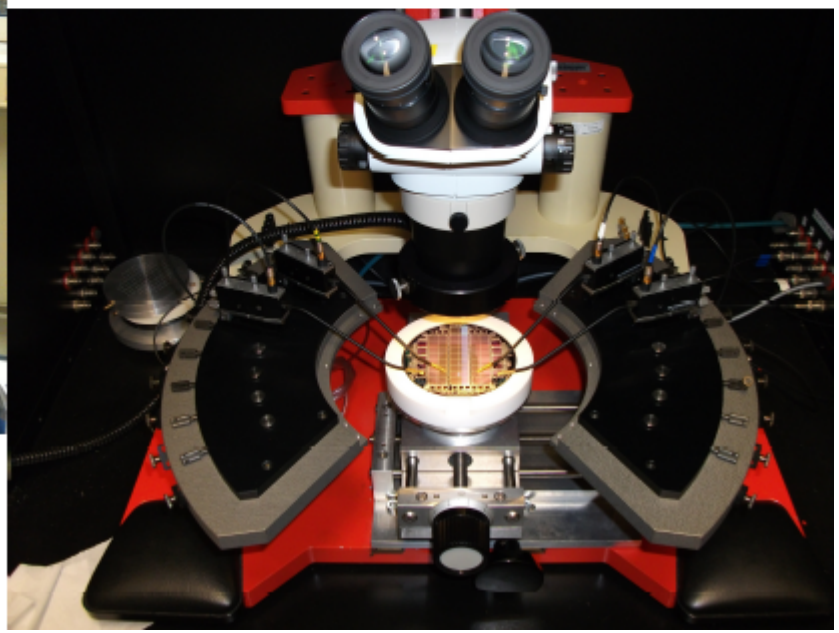
n–side

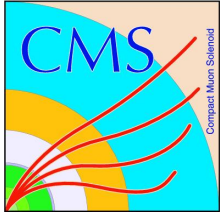


Measurement Setup



- Temperature sensor
- Picoammeter
- Bias source
- LCR meter
- Teflon chuck
- Microscope




CMS
Compact Muon Solenoid