Performance measurements on a new resistive mpgd

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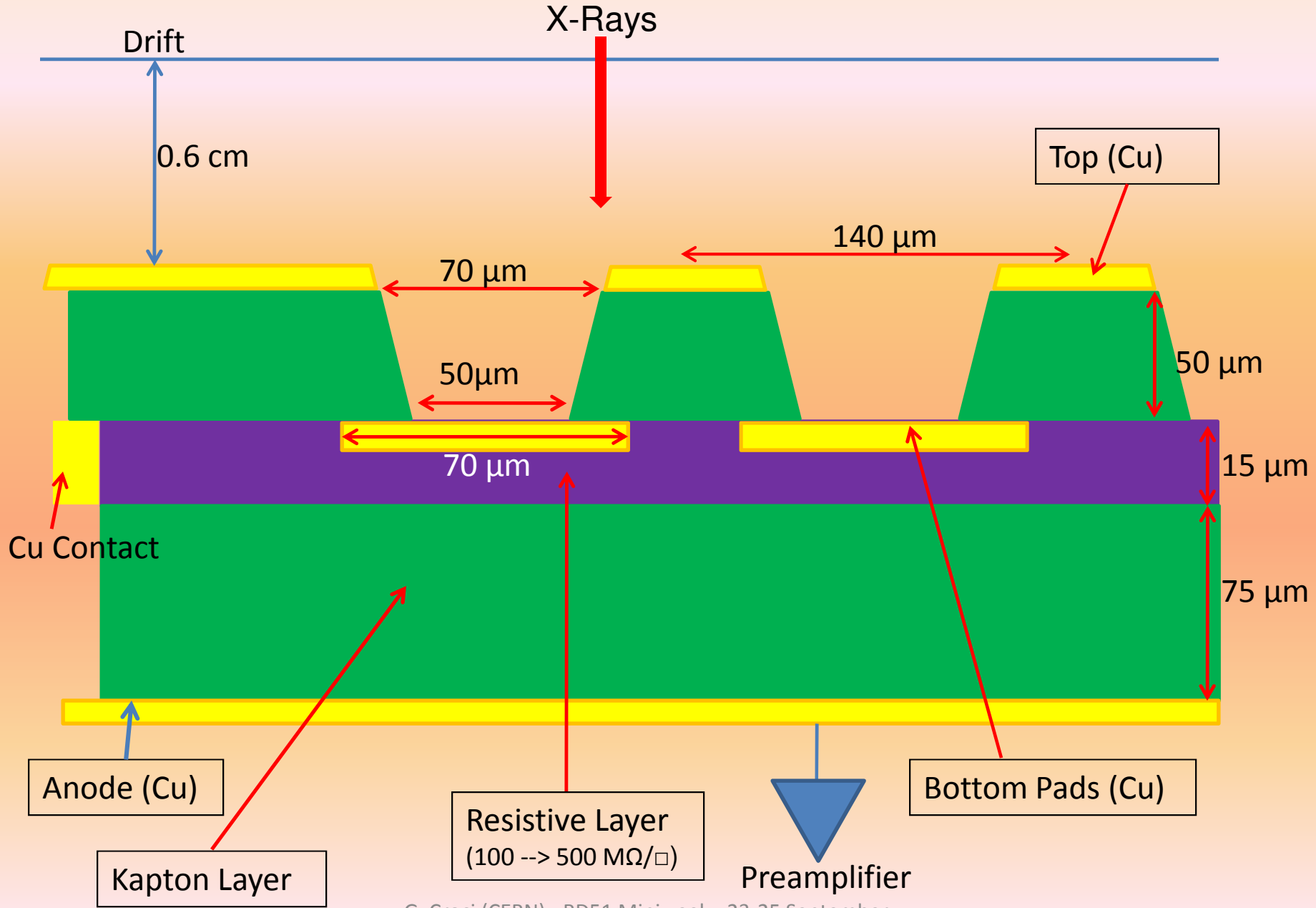
RD51 Mini-Week
23-25 September 2009

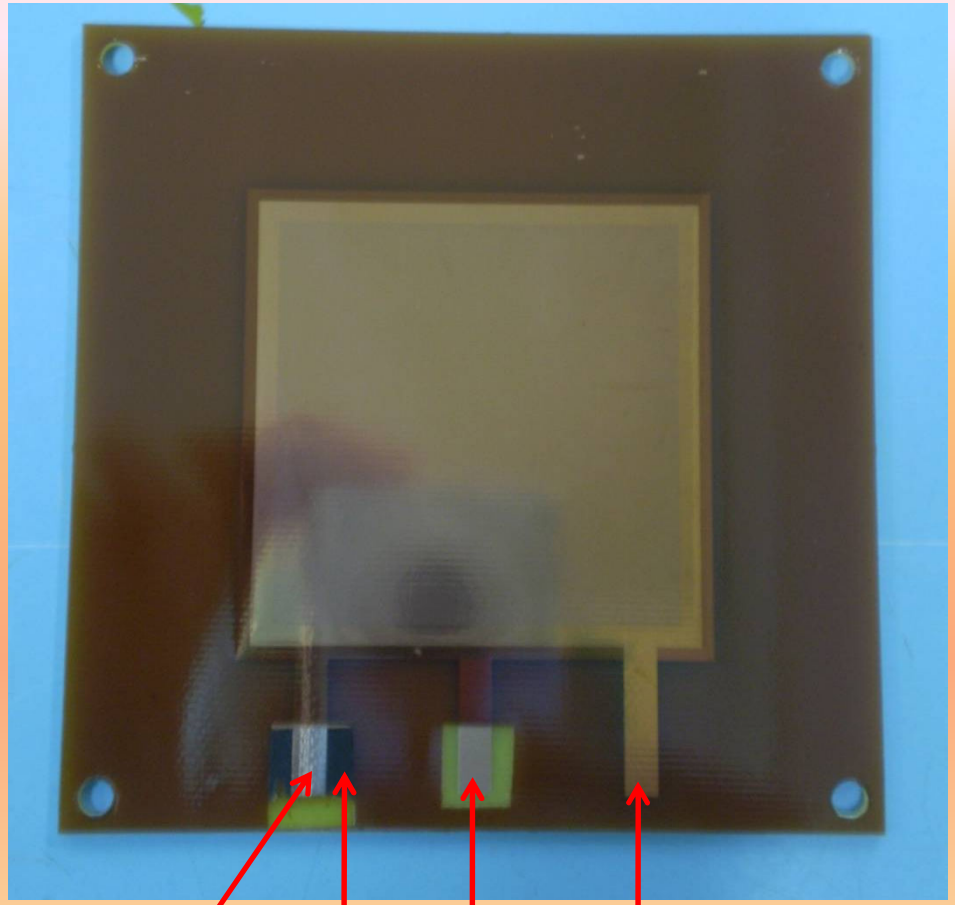
Outline

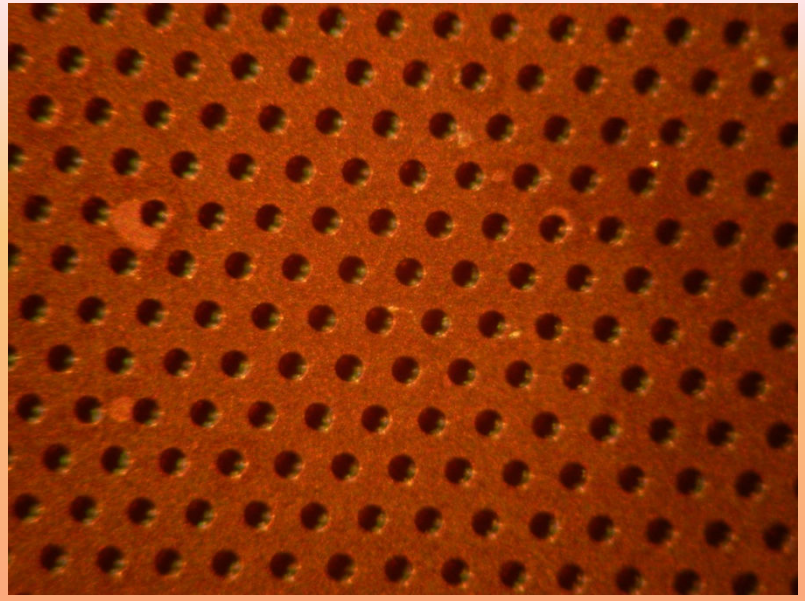
- Detector sketch and pictures
- Experimental setup
- Pulse height spectrum
- Gain and maximum gain measurement
- Gain space uniformity
- Drift field scan
- Rate Capability
- Gain time Stability

Resistive mpgd sketch



Resistive mpgd pictures



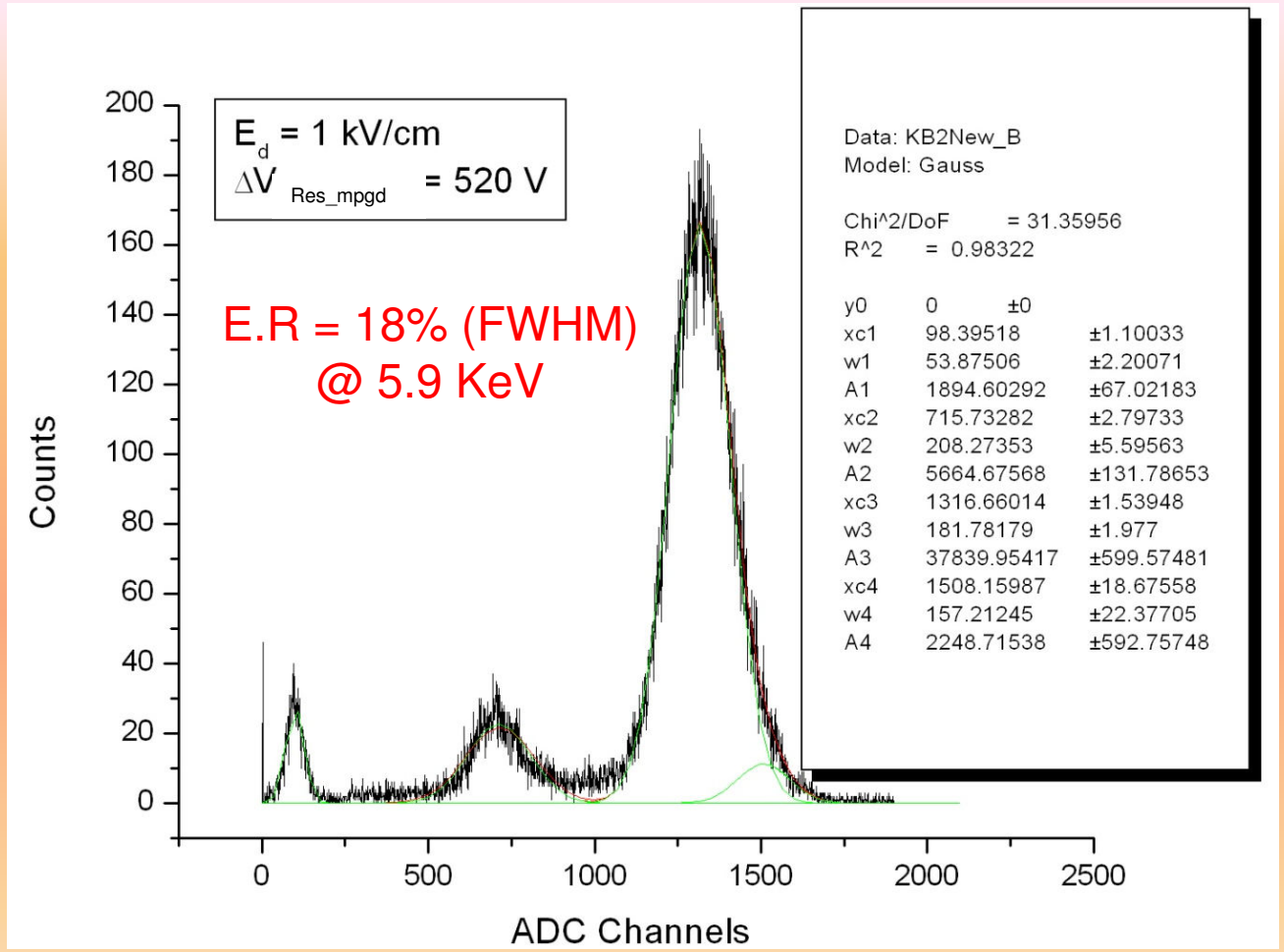


Experimental Setup

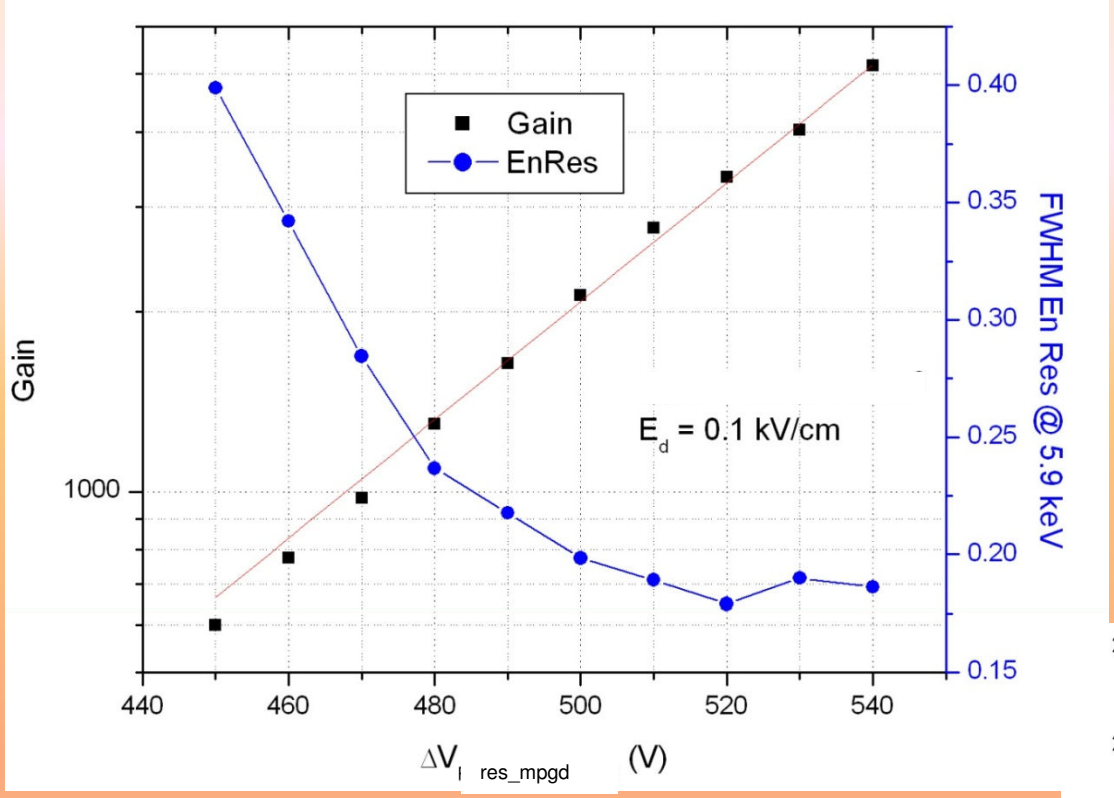
- Radioactive sources:
  - ^{55}Fe 5.9 KeV X-Rays source
  - 8.9 KeV Cu X-Rays collimated beam
- NIM Electronics
  - 142 IH Ortec preamplifier
  - 450 Ortec Research amplifier
- CAMAC Readout
- Keithely 6517A picoamperometer

- Pulse height measurements
  - Bottom grounded and signal read from the anode
- Current measurements
  - Anode grounded and current read from the bottom

Pulse Height Spectrum with ^{55}Fe Source



Voltage Scan: Maximum gain



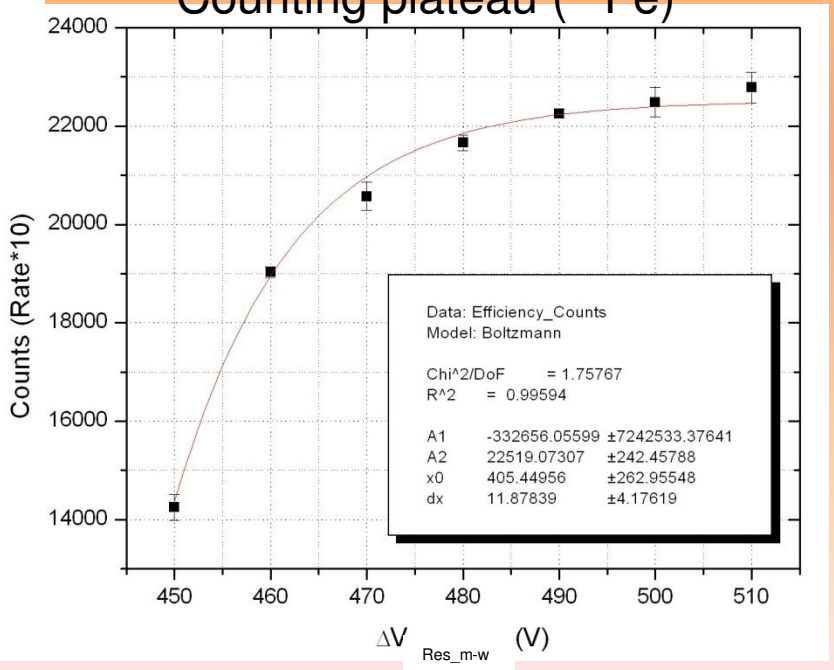
Scan made with Iron source acquiring the signal from the anode being the bottom grounded

Gain calibrated using Cu X-rays tube at the point V=500V grounding the anode and putting the keithley picoamperometer on the bottom

Very good energy resolution and Gain higher than single GEM

Maximum Gain of about 5000
(It can be underestimated due to the presence of the resistive layer !!!!!!)

Counting plateau (^{55}Fe)



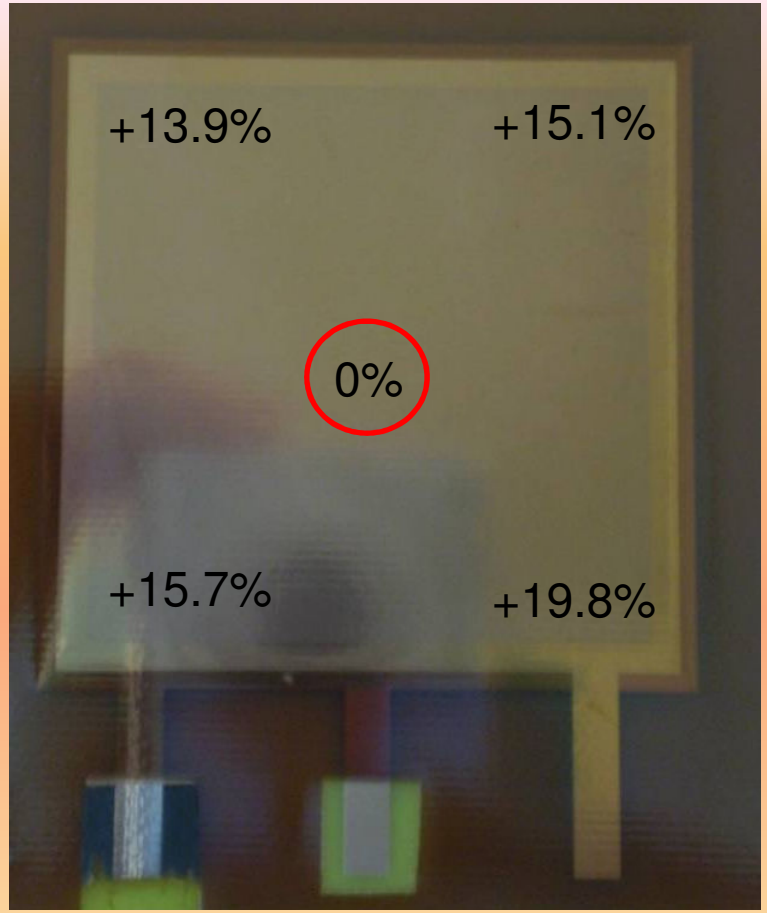
Gain Space Uniformity

We acquired PH spectra irradiating 5 different points in the active area of the chamber in order to test the gain uniformity

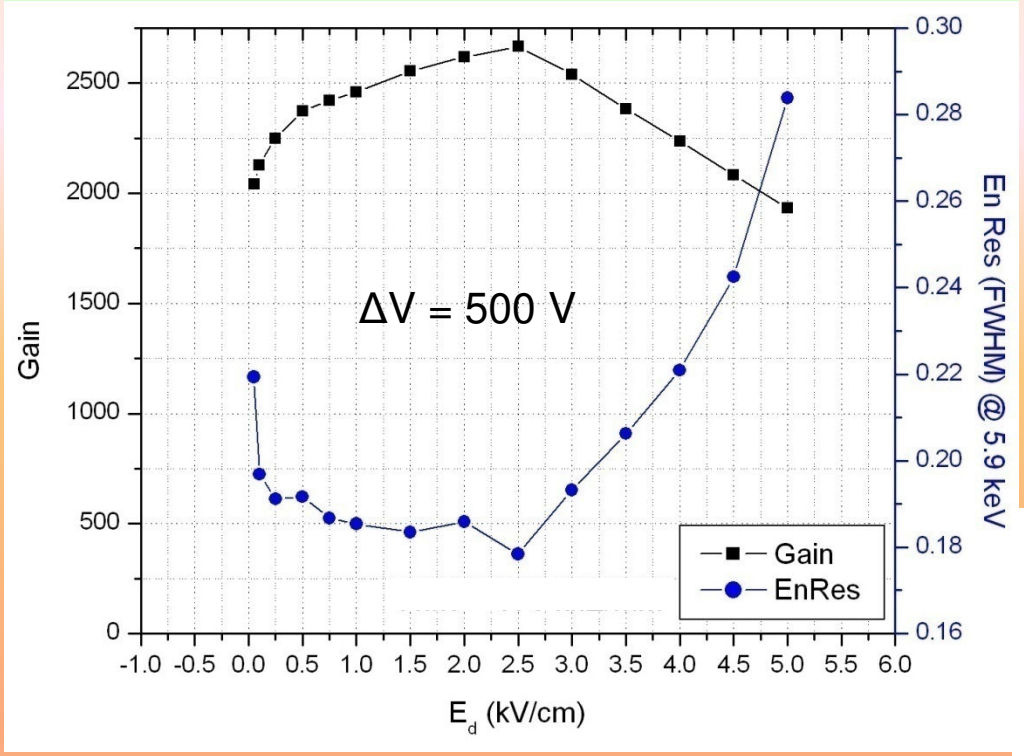
The percentages show the measurement of the gain variation with respect the centre (red circle)

The variation is not more than 20%.

The measurement was performed with $\Delta V_{Res\ mpgd} = 500V$ and $E_d = 0.1$ kV/cm

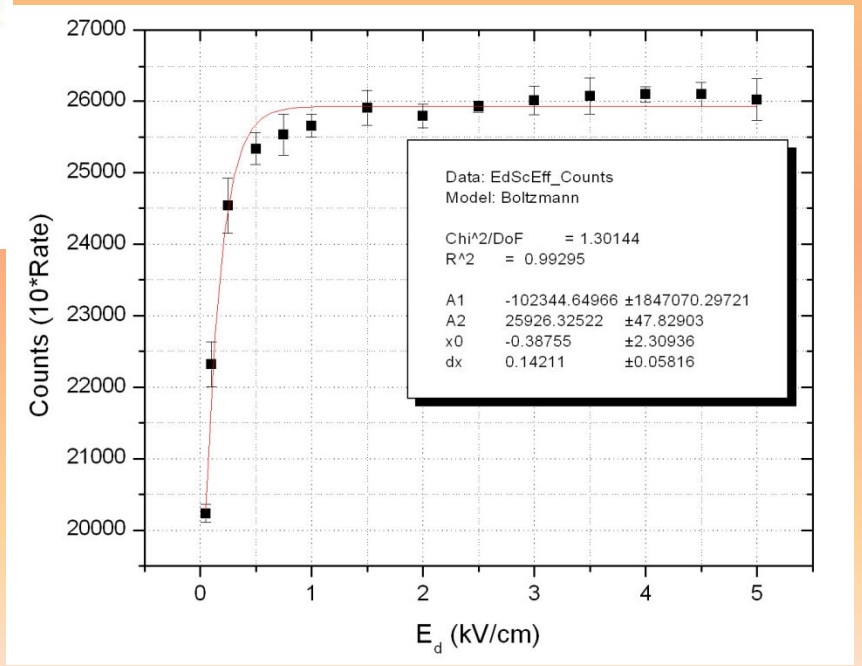


Drift Scan



The best transparency is reached at E_d = 2.5 kV/cm

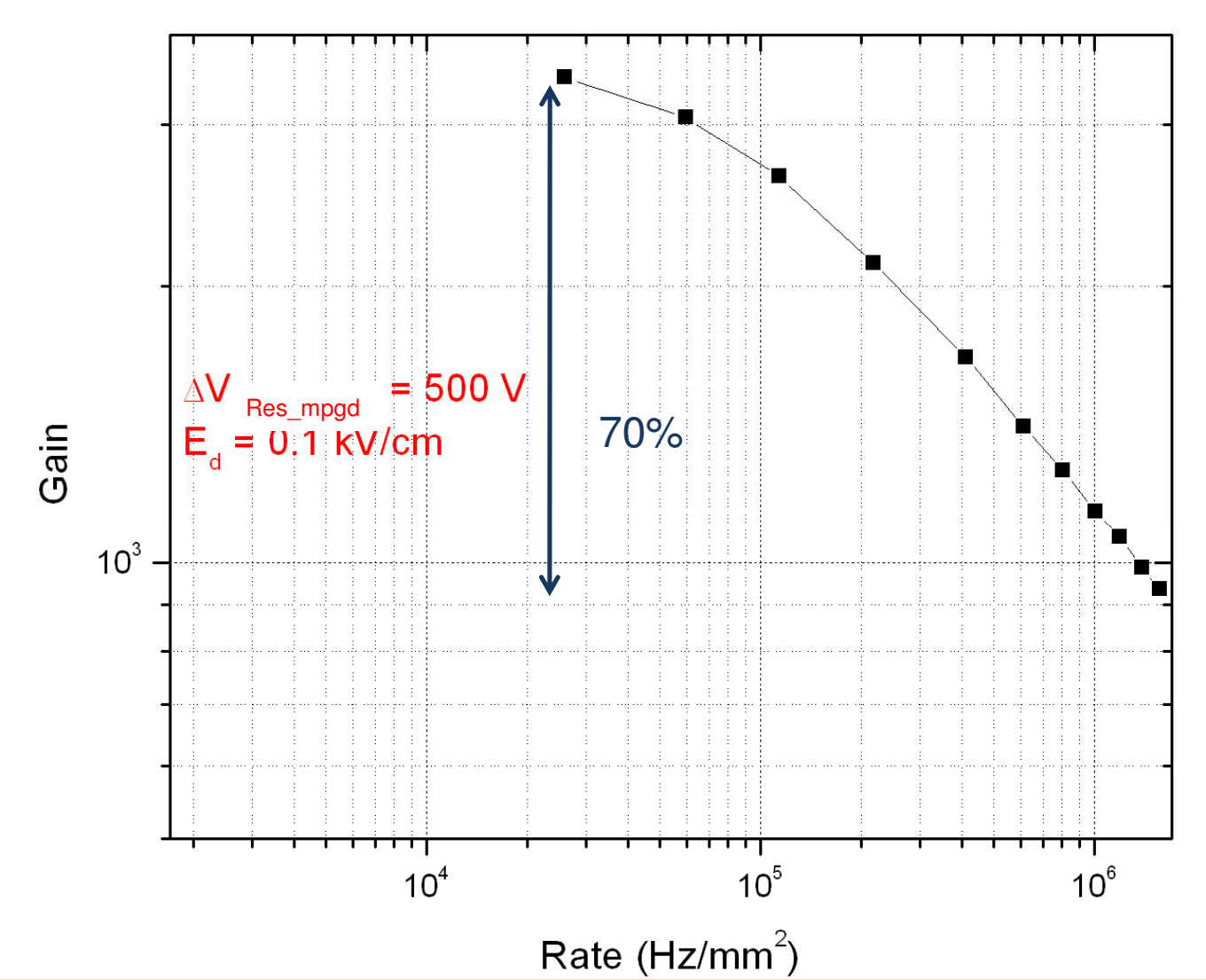
Counting Plateau (^{55}Fe)



Scan made with Iron source acquiring the signal from the anode being the bottom grounded

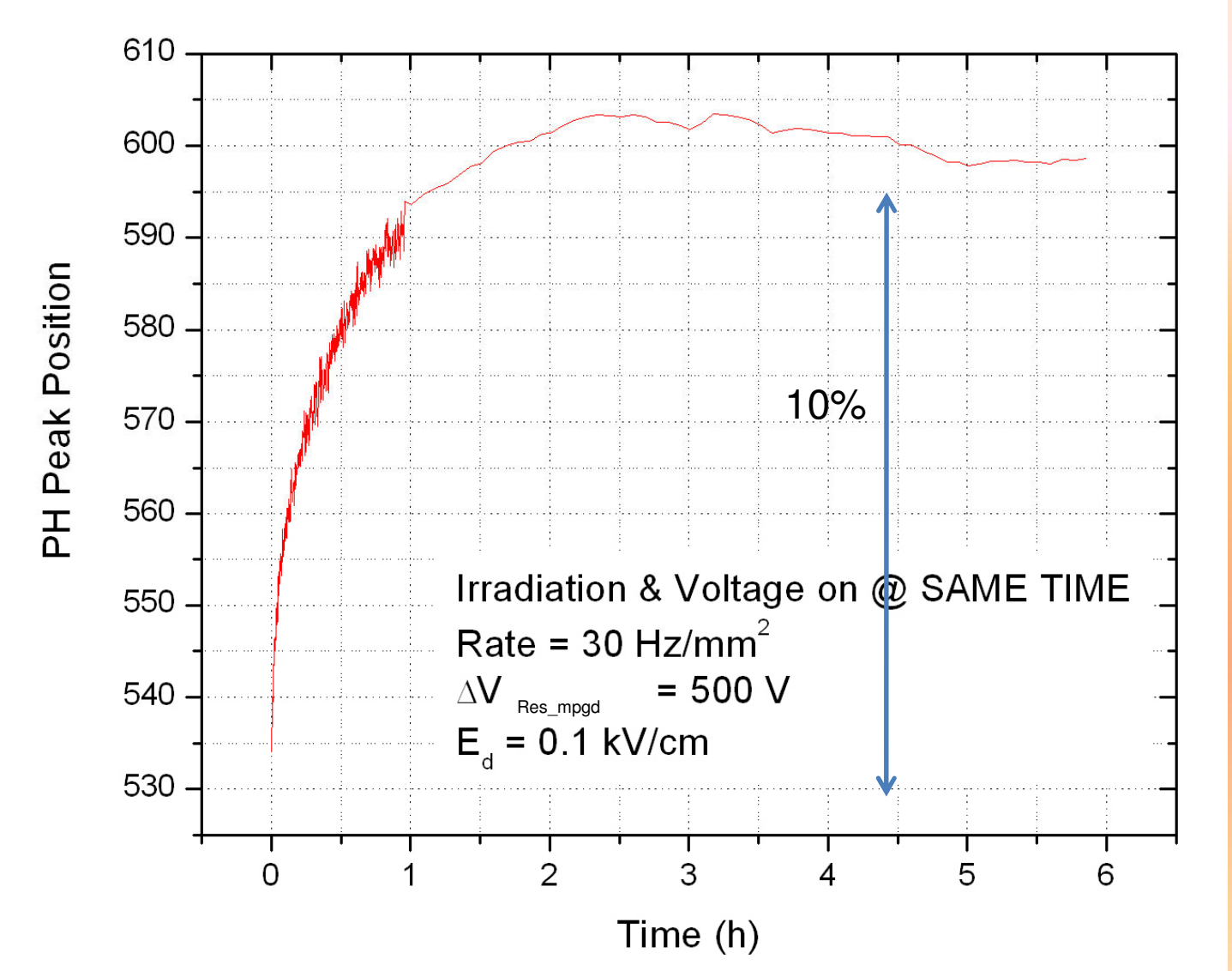
Gain calibrated using X-rays Cu tube at the point E_d=0.1 kV/cm grounding the anode and putting the keithley picoamperometer on the bottom

Rate Capability



70% gain drop form $2*10^4$ Hz/mm^2 up to $1*10^6$ Hz/mm^2 due to the very high resistivity of the resistive layer (100-500 MΩ/□)

Gain Time Stability



The detector was irradiated as soon as the set voltage on the drift and on the top electrode was reached. The gain variation in time is very similar to the gain variation of single GEM

Conclusions and plannings

- The energy resolution found is very promising (18% FWHM)
- Maximum Gain around 5000
- 20% space gain uniformity
- 10% gain variation in 2 h
- 70% gain drop from $2*10^4$ Hz/mm^2 up to $1*10^6$ Hz/mm^2
  → Rui is preparing a new detector with a resistivity around 1 MΩ/□.
- Need to perform maximum gain measurement in presence of highly ionizing particles (alpha particles)
- Need to better understand the potential drop in the holes due to the resistive layer.

Spare slides

Waveforms (E_d = 0.1 kV/cm)