Carbon Coated GEMs for TPC

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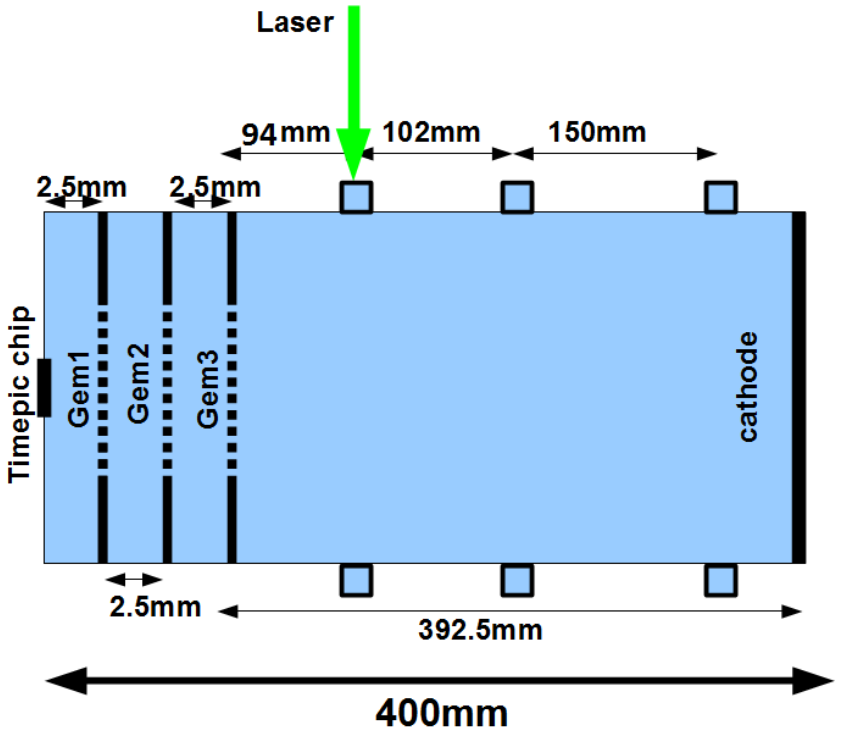
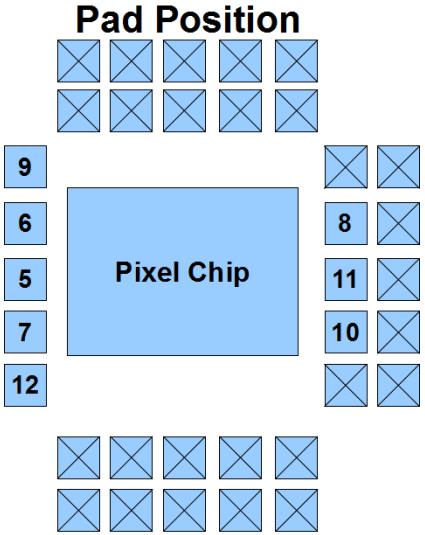
Time Projection Chamber at University of Siegen

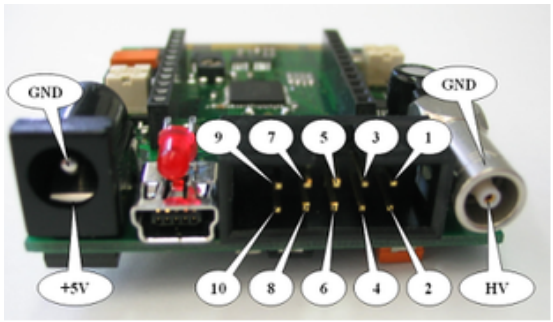
- Length of TPC: 400 mm
- Diameter: 270 mm
- 3 hexagonal GEMS from CERN (100×100 mm^2)
- Possibilities to ionize gas
  - UV laser
  - β-source (Sr-90)
  - Cosmic Muon
- 3 entry windows with different drift distances
- Argon-Carbondioxide (90:10 and 80:20)
- GEMs-Voltage: 340 - 380 V

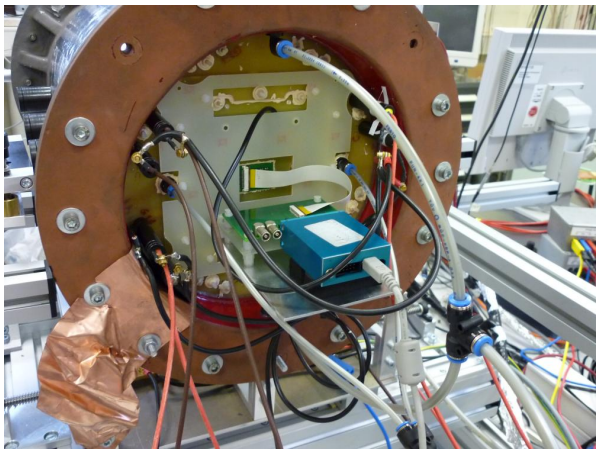


Readout System

- Combination of pad and pixel chip readout (TimePix chip)
- Pad size: $10 \times 4\,\mathrm{mm}^2$
- Connection of 8 pads to 8-channel-amplifier (designed at Uni Siegen)
- Readout of TimePix chip via USB interface



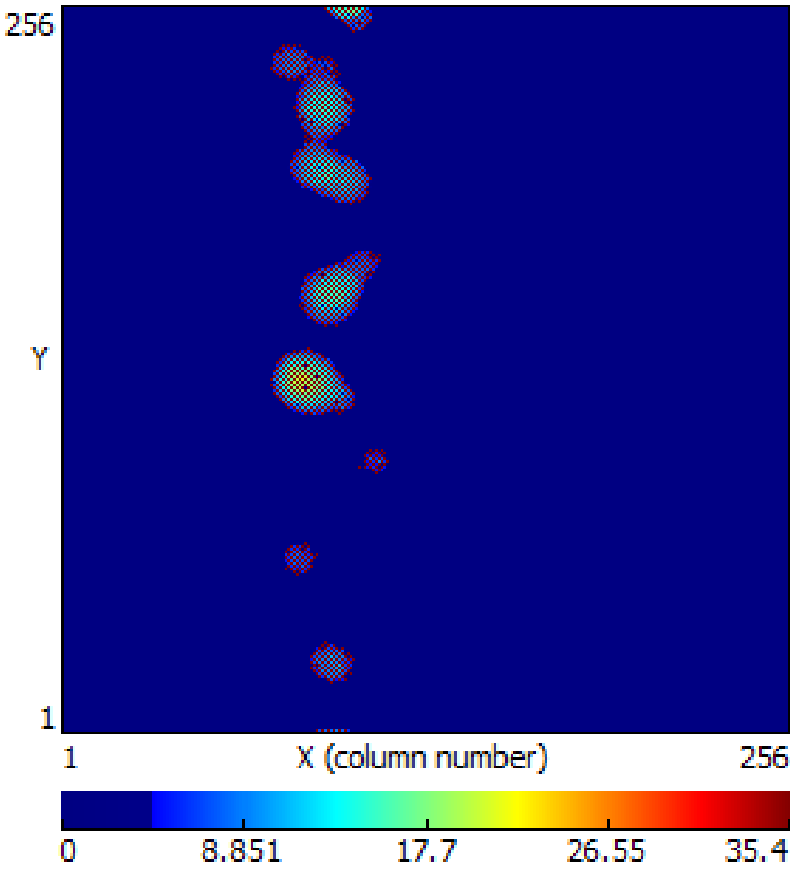




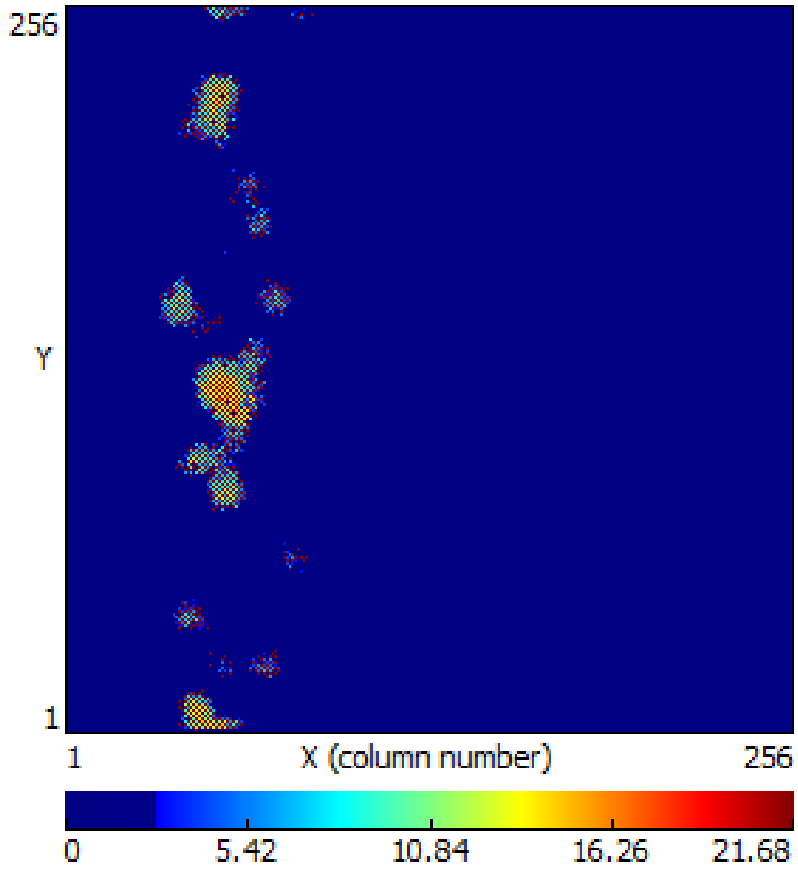
- Calibration is not possible with USB device
- New readout in collaboration with Uni Bonn

Software Preview

Sr90



Laser



Carbon Coated GEMs

Refering to previous analysis july 1998 :

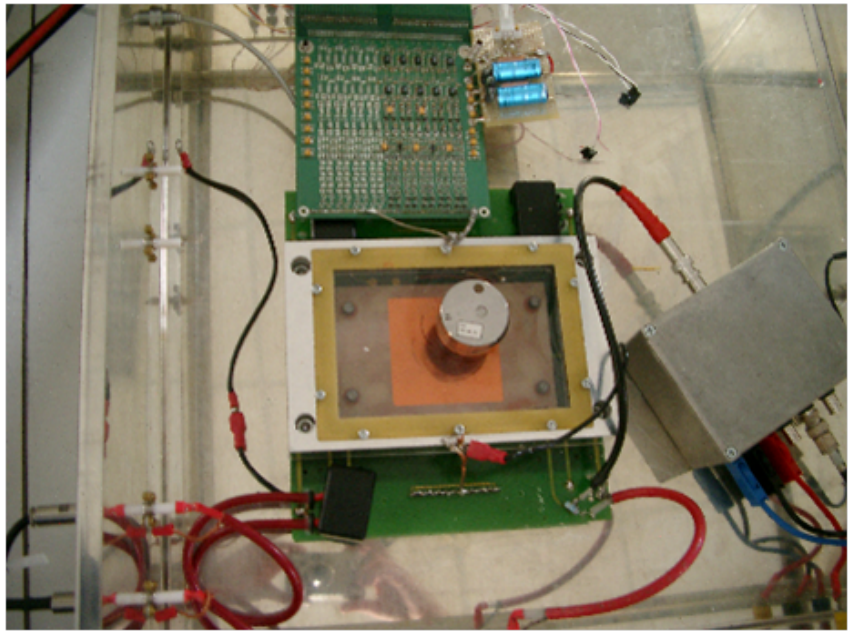
$\Rightarrow$ Reference paper: arXiv:physics/9807039v1 [physics.ins-det]

Advantages of Carbon Coated GEMs:

- Higher voltages possible (up to 650 V) $\rightarrow$ much higher gains can be achieved
- Less change in gain during time (time stabilized gain)
- Higher energy resolution
- Less change in resistance of GEMs during time

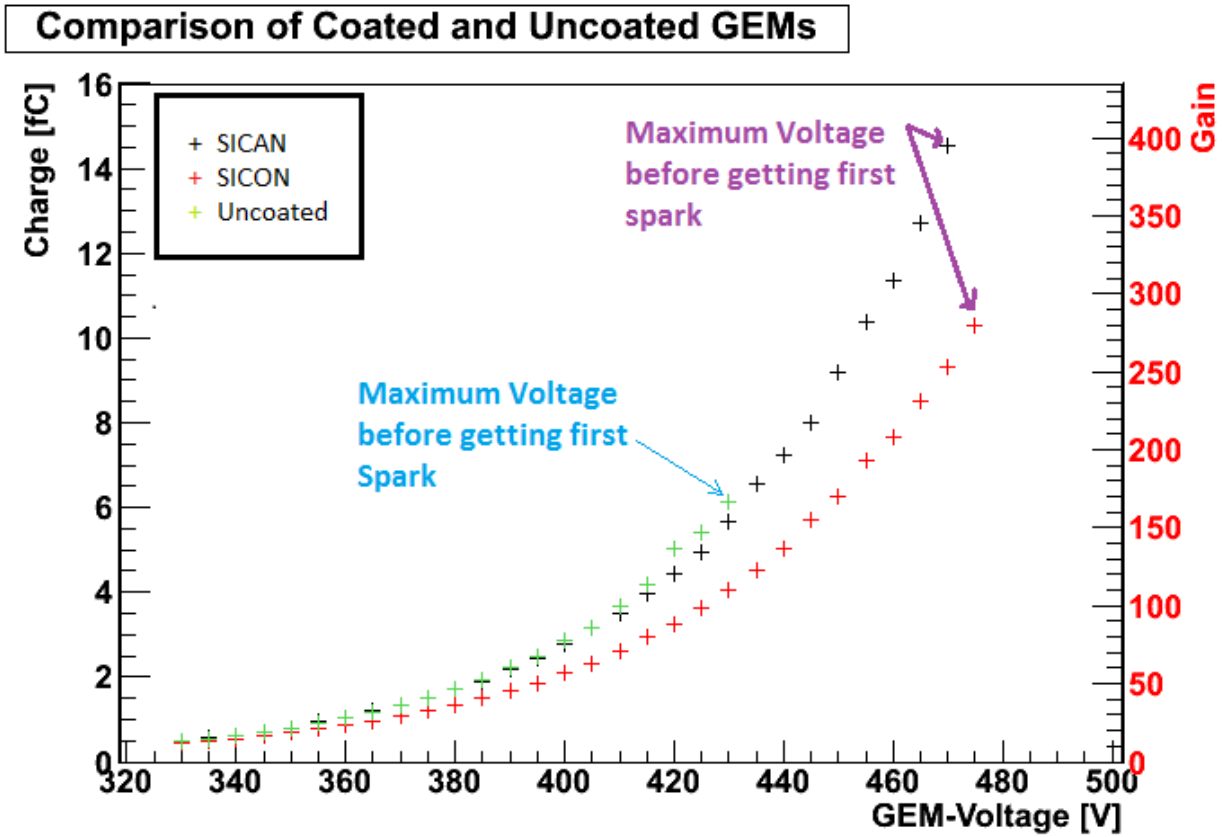
Experimental Setup of Small Prototype

- Drift Length: 5.4 mm
- GEM-Size: $50 \times 50\,\mathrm{mm}^2$ from CERN
- Ionization source: Fe55
- Gas: ArCO2 (80:20)
- GEM is coated with 0.1 μm thick Carbon layer over the whole surface
- GEM-Voltages: 330 V-500 V
- Drift Field: 50 V/mm
- Induction Field: 300 V/mm



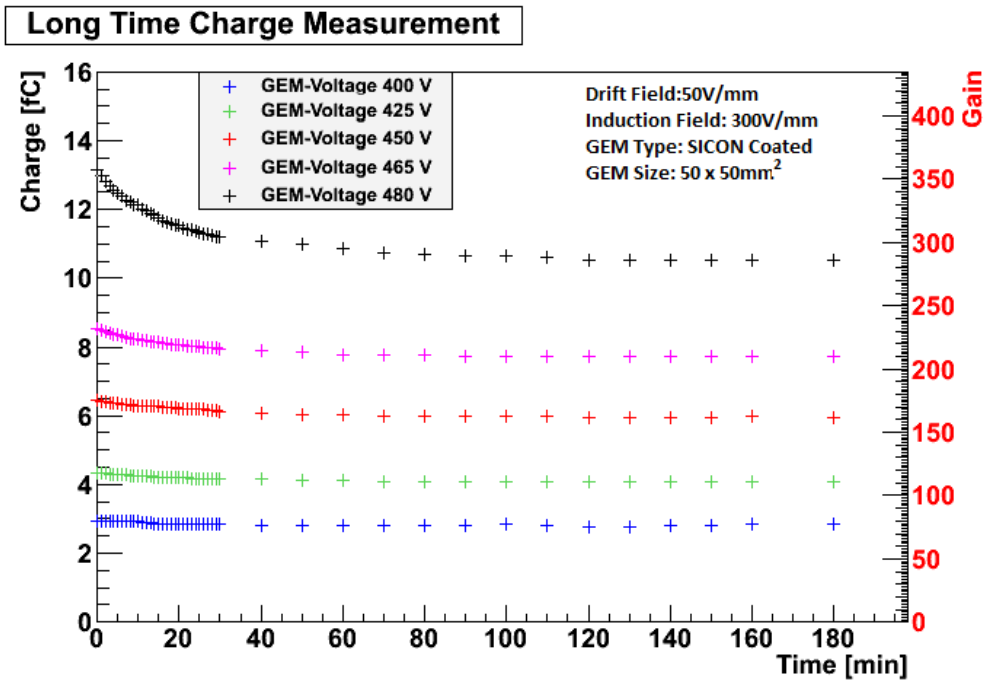
Measurements with 1 GEM

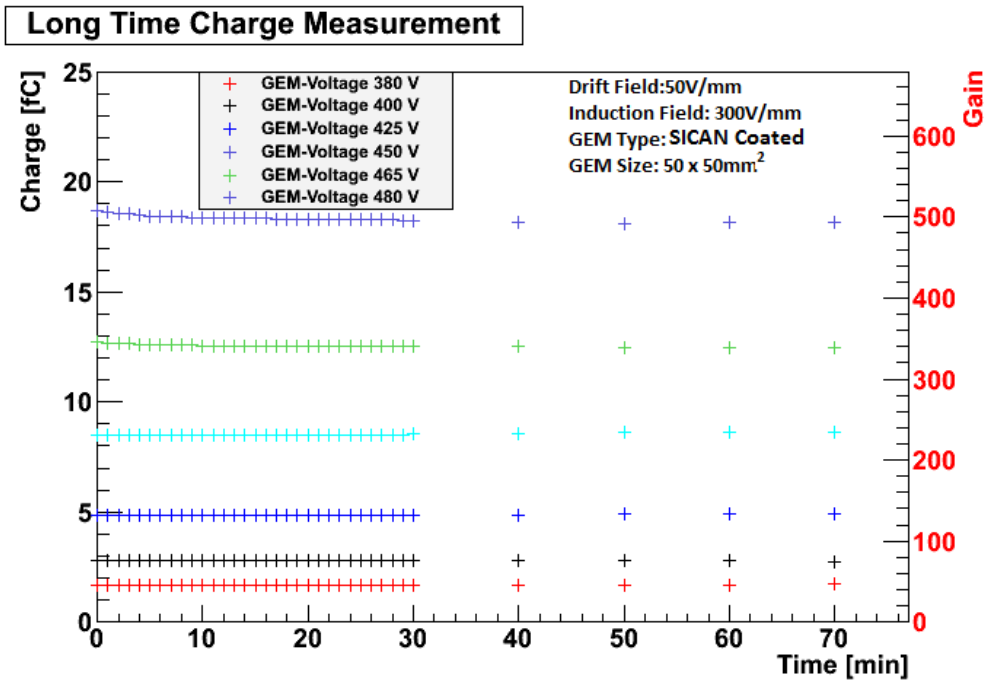
Comparison of SICON and SICAN Coating and Un-coated GEM



- GEMs with Carbon Coating having no single sparks up to 500 V
- Un-Coated GEMs having sparks after 430 V

Gain Stability





- Gain Stability Measurement with Un-Coated GEM is in progress

Backup Slides

Properties of SICON and SICAN

SICON and SICAN are Modified diamond like coating(DLC)

Layer-system of SICON (a-C:H:Si:O):

- Structure: Amorph
- Density: 1.3 - 1.5 g/cm^3
- Electrical Resistance: $>10^{10}\Omega$cm
- Dielectric Constant: 1-3 (a- C: H)
- Break down Voltage: 100 -200 V/μm
- Typical Thickness: 0.5 - 5 μ m

Layer-system of SICAN (a-C:H:Si):

- The conductivity of SICAN is little bit higher than SICON