

Experience with micromegas variants

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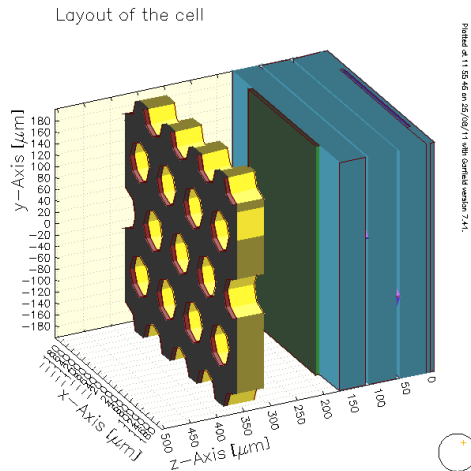
In collaboration with CERN/TE-MPE PCB workshop (Rui de Oliveira)

Motivation

- Simplify construction of large-area micromegas
 - Mesh stretching over large-area is possible but complicates the production process
 - Mesh HV insulation requires special attention, work intensive
 - Mesh segmentation is difficult to achieve, dead areas, labour intensive
- Two variants tried
 - Replace the mesh with a GEM foil
 - Connect the mesh to ground and the R strips to HV

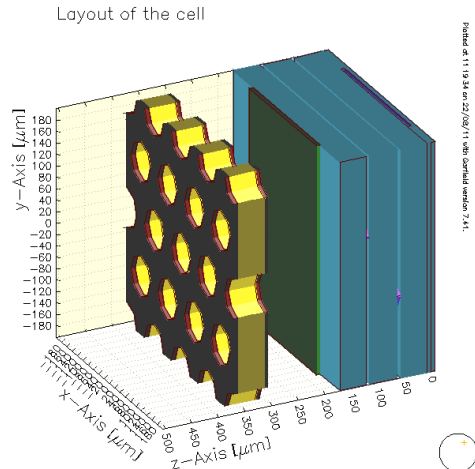
A. Replacing the mesh by a GEM foil

GEM is simply placed on 128 μm high pillars on the resistive strips
(first tried unsuccessfully to place a stripped GEM directly on R strips)



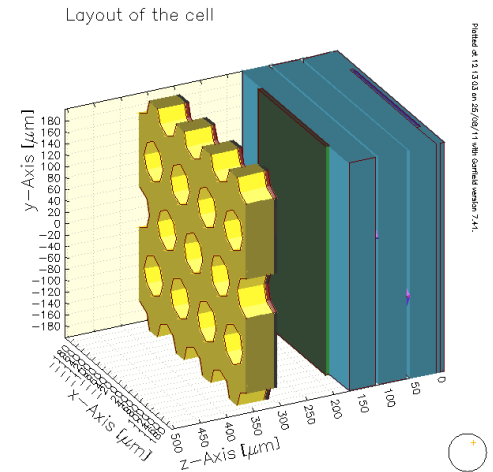
1. Stripped GEM foil (lower Cu layer removed)

- R19G, successfully used in test beam in July
- Works well, no striking difference to 19M (with micromesh)
- High rate looks OK
- Charge-up ??? not bad



2. Standard GEM foil

- Works similarly as R19G
- Did not find with this configuration a HV setting to profit from gain in GEM
- Fragile, sparks in GEM destroyed GEM

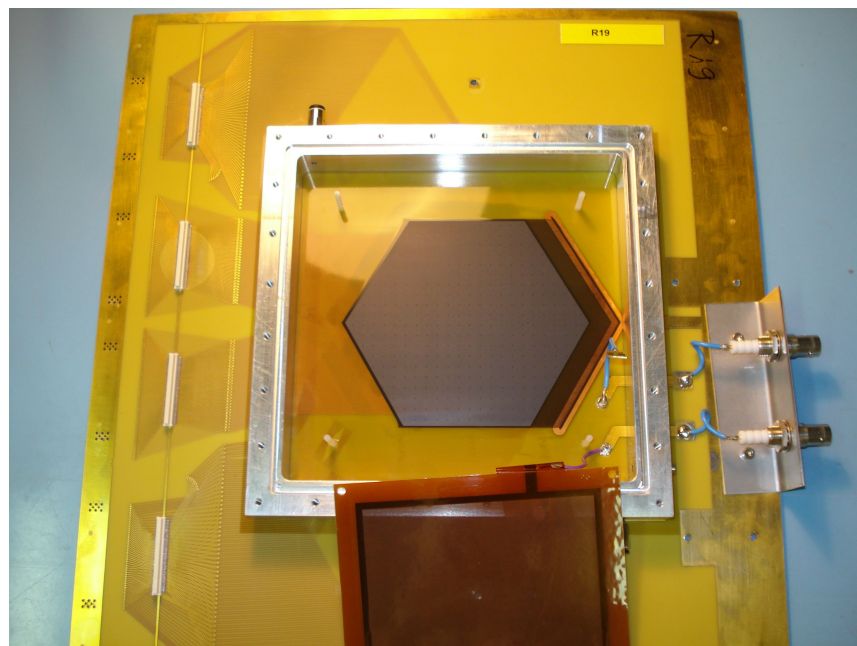
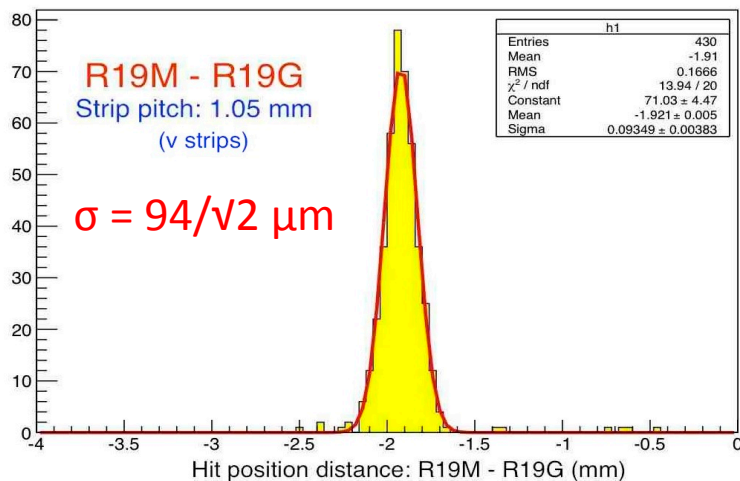
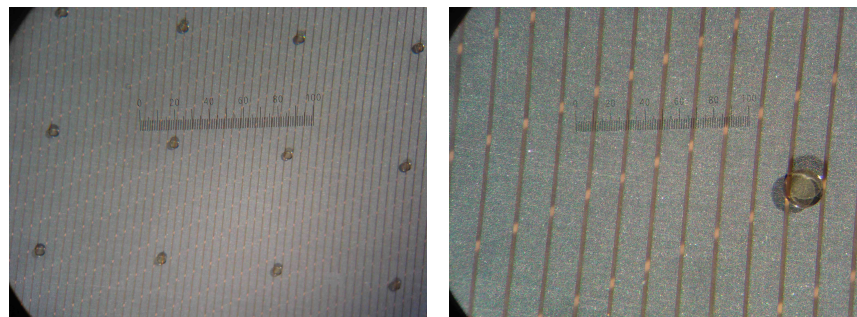


3. Stripped GEM foil (upper Cu layer removed)

- Did not find good operating point
- Works as MM but problems with GEM transparency

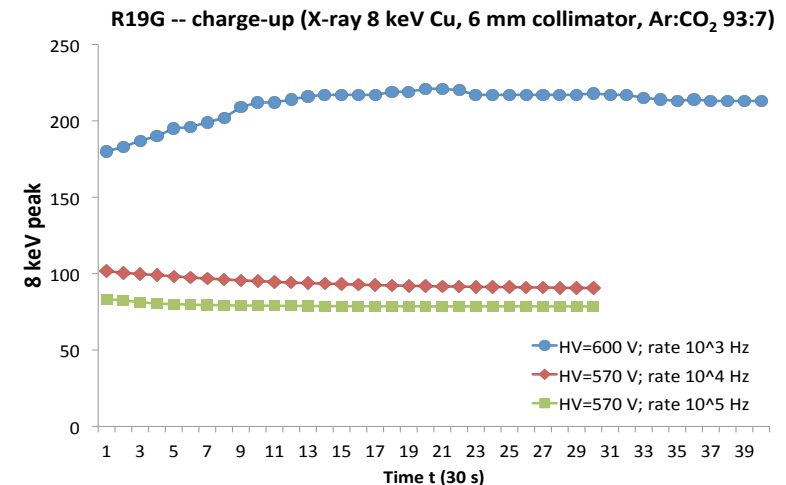
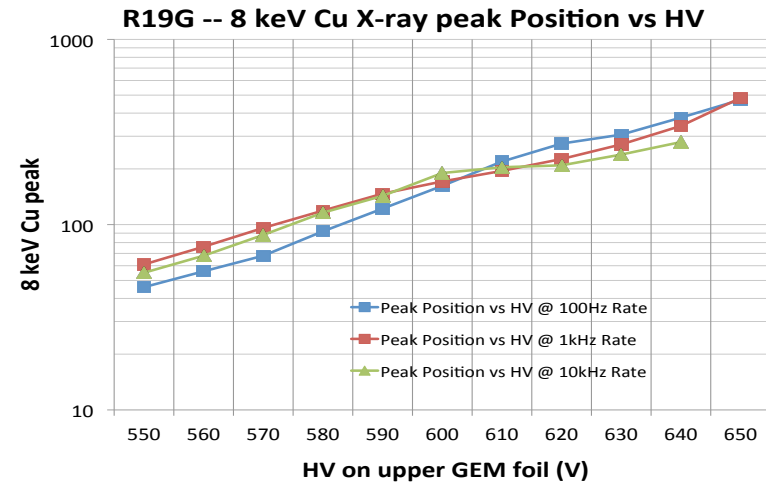
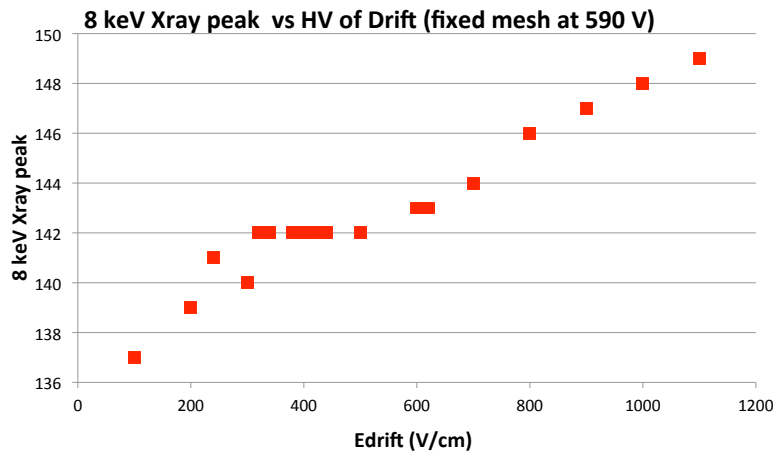
A.1 GEM with upper Cu layer only

- R19G has three readout strip layers (xuv); the GEM is placed on 128 μm high pillars
- R19G worked perfectly well during the July 2011 H6 test beam
 - Good charge spectra
 - Very nice resolution
- No striking difference to R19M with the same readout structure but a standard mesh



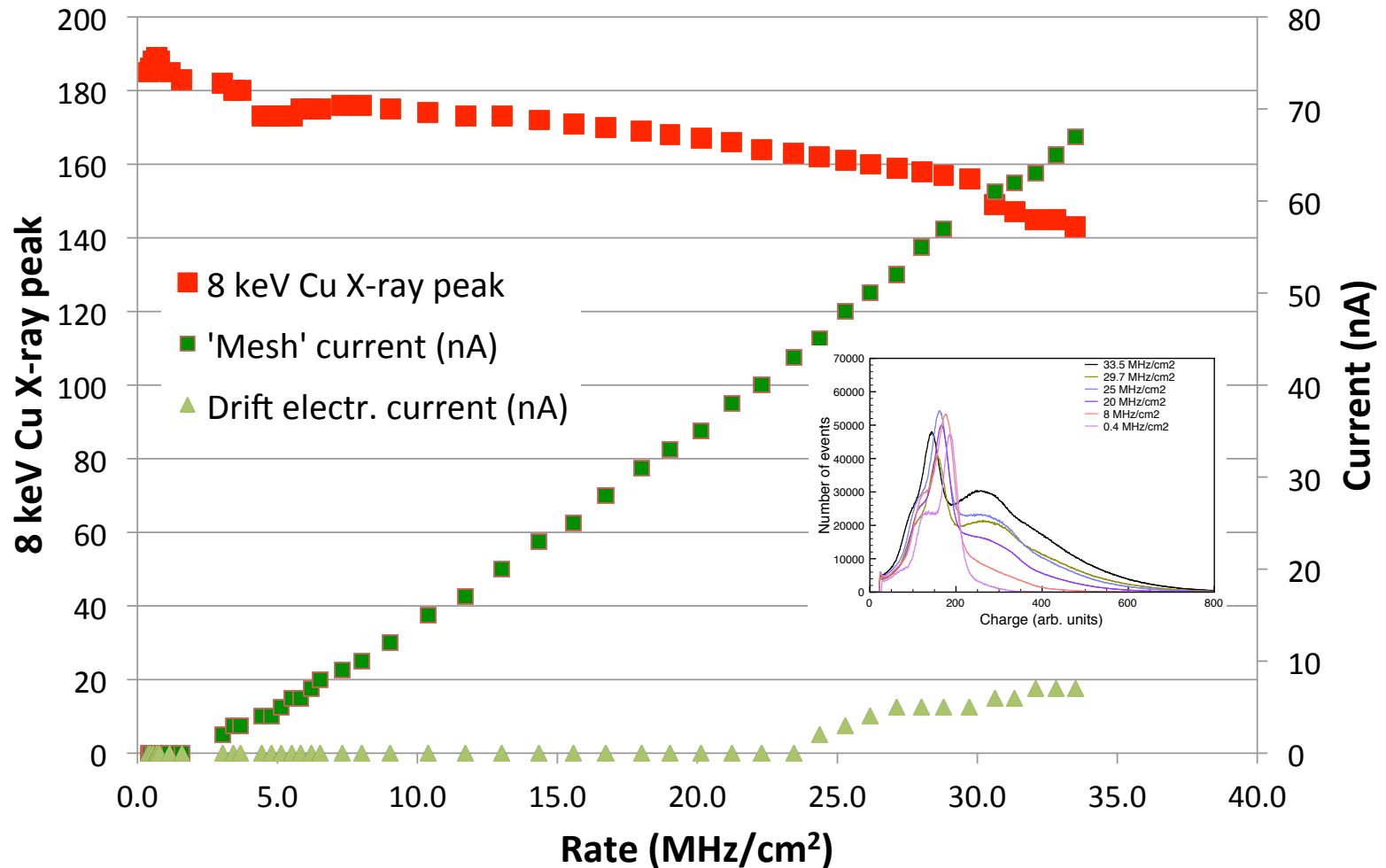
GEM with upper Cu layer II

- Gain curves show some indication of non-exponential behaviour
- Small rise of signal as function of drift field
- Charge-up:
 - Small rise of gain at low rate
 - Very small drop at high rate



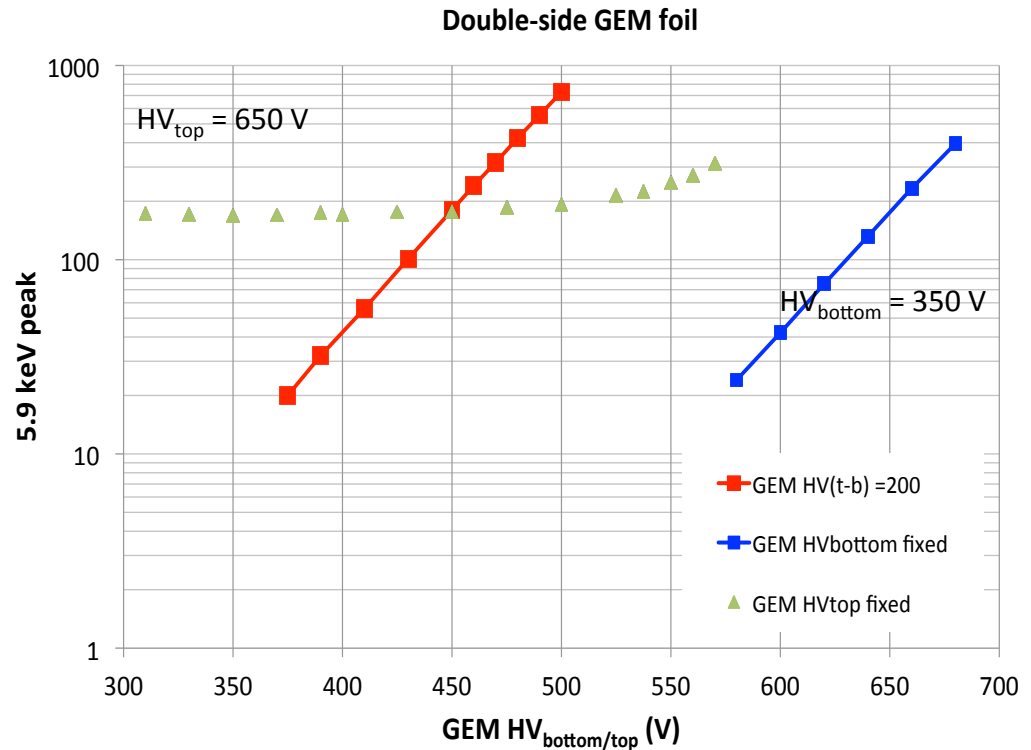
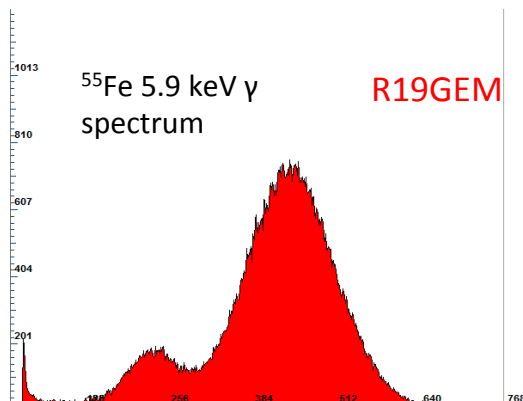
R19G rate study

R19G -- 8 keV Cu X-ray peak (Ar:CO₂ 93:7, HV = 570 V)



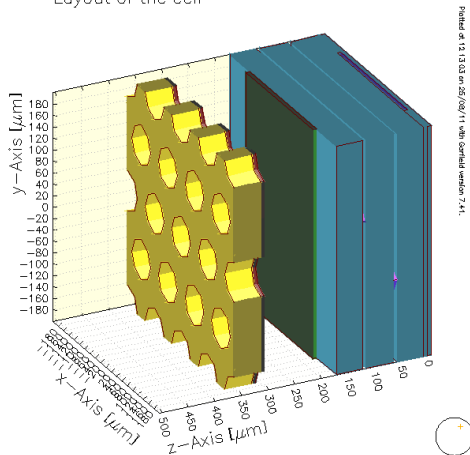
A.2 GEM with upper+lower Cu layer

- R19GEM works very similarly as R19G in MM mode
- Did not find with this configuration a HV setting to profit from gain in GEM
- Fragile, sparks in GEM destroyed GEM

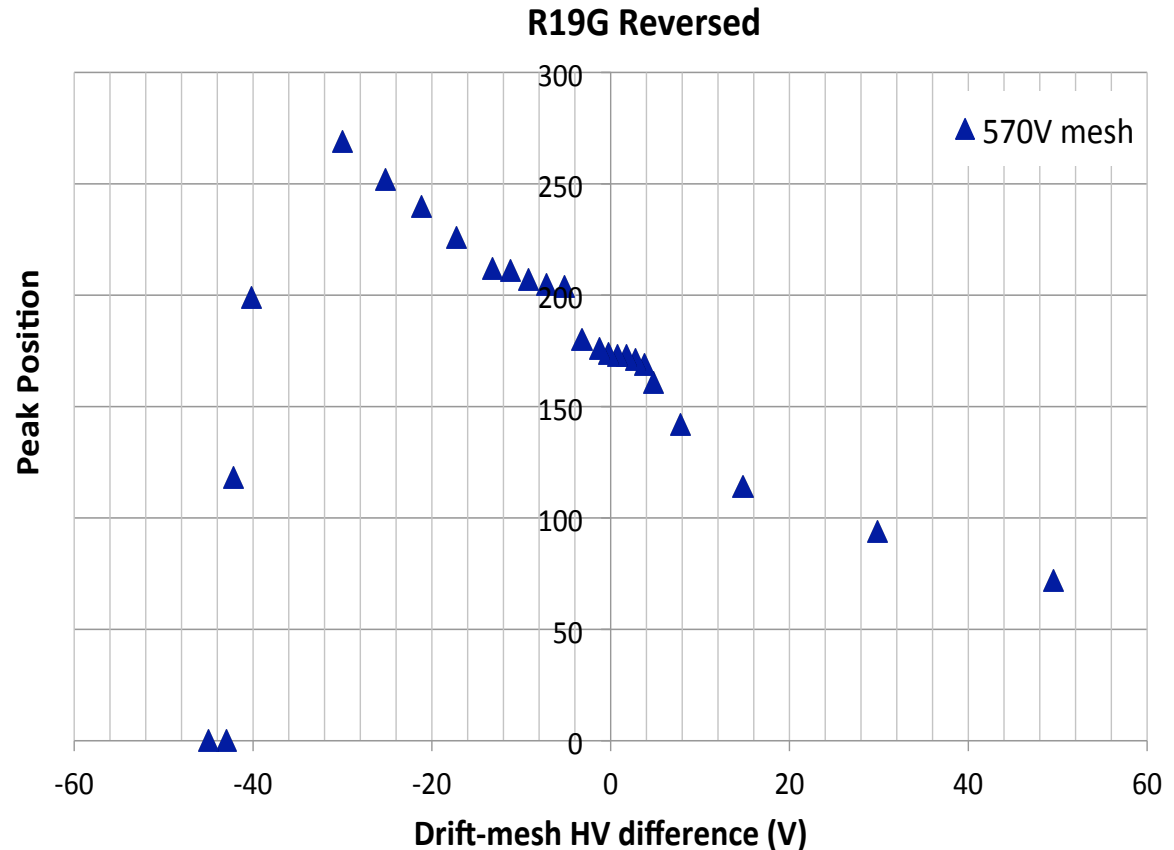


A.3 GEM with Cu on lower layer only

Layout of the cell

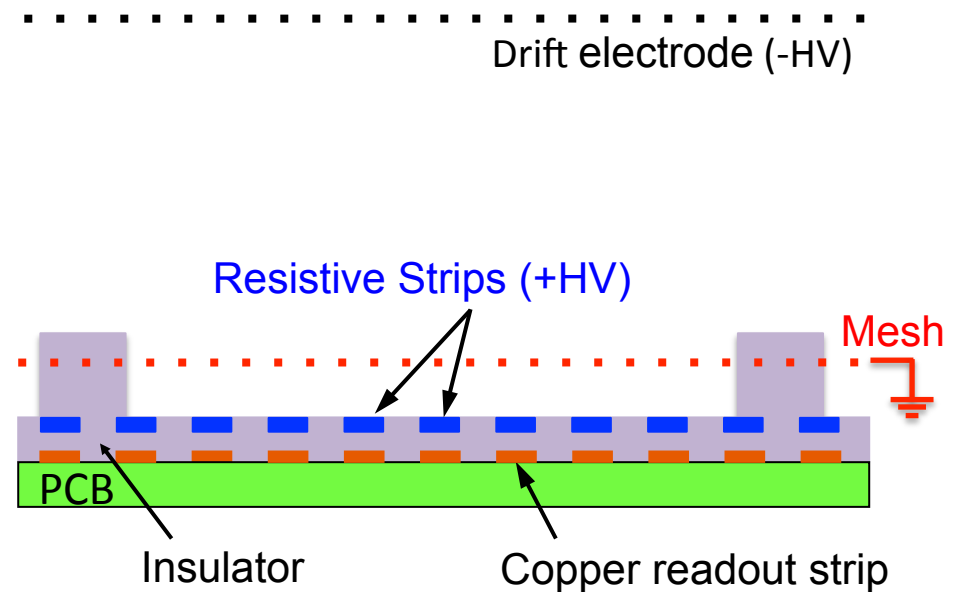


- Very low effective gain for normal drift and amplification field
- Bad resolution
- Starts separating main and escape peak for ^{55}Fe source data when drift field very low
- Approximately correct spectra at small negative drift voltages !?!



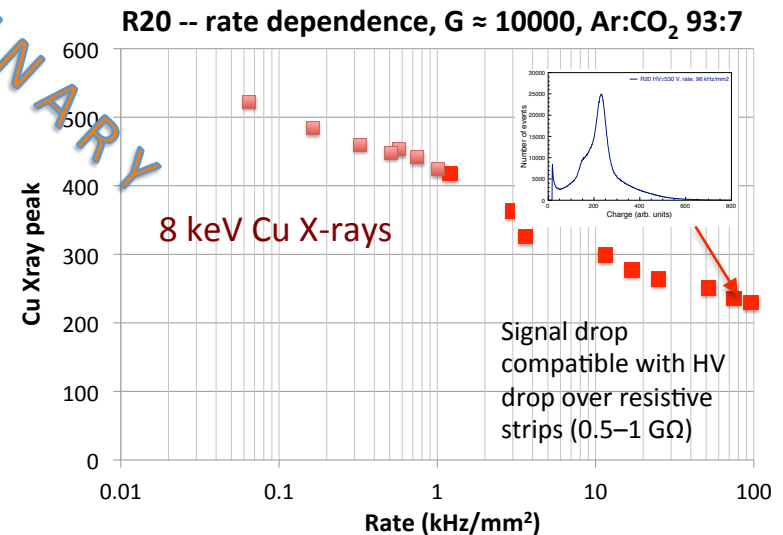
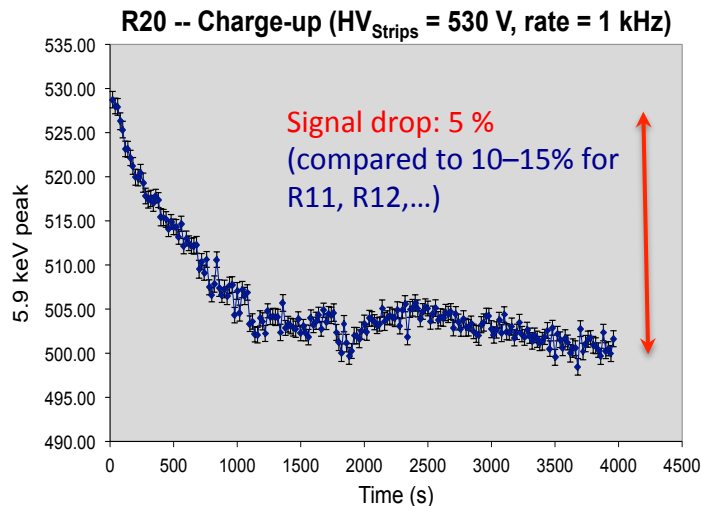
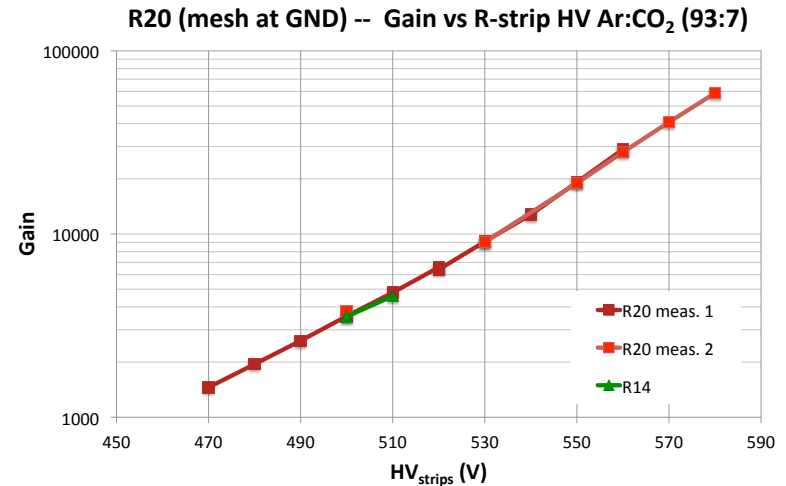
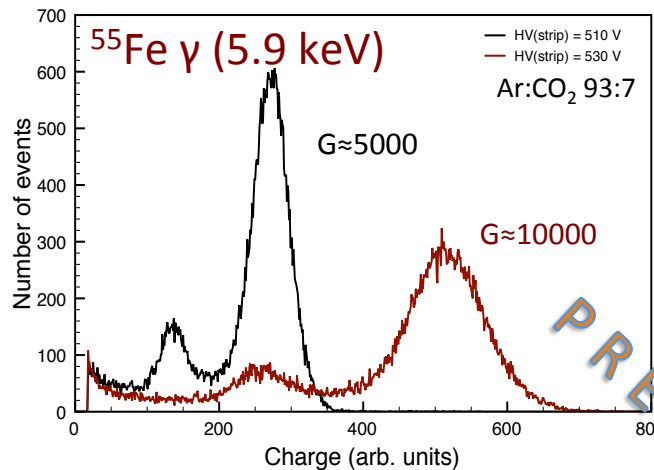
B. MM with mesh connected to GND

- Idea by A. Ochi 'Why not connect the R strips to HV and the mesh to ground?'
- R. de Oliveira built one for us (10 x 10 cm²) with x strips of 250 μ m pitch
- Chamber was ready mid of last week, results are brand-new and preliminary
- First results: Clean signals, good energy resolution
 - High gain
 - Little charge-up
 - Good high-rate performance



Looks very promising – may be the future

B. MM with mesh connected to GND II



Conclusions

- Replacing the micromesh by some other mesh-like structure may simplify dramatically the chamber construction
 - Stripped GEM with Cu electrode up works well
 - Stripped GEM with Cu electrode down is not working well
 - GEM with Cu electrode up & down works well, but fragile
 - Fully metallic electrode may be another option (Silvia dalla Torre)
- Inverting the HV and connecting the mesh to ground and HV to the resistive strips looks attractive but needs more studies to be conclusive

Thank you !

