GEM Detectors for SoLID

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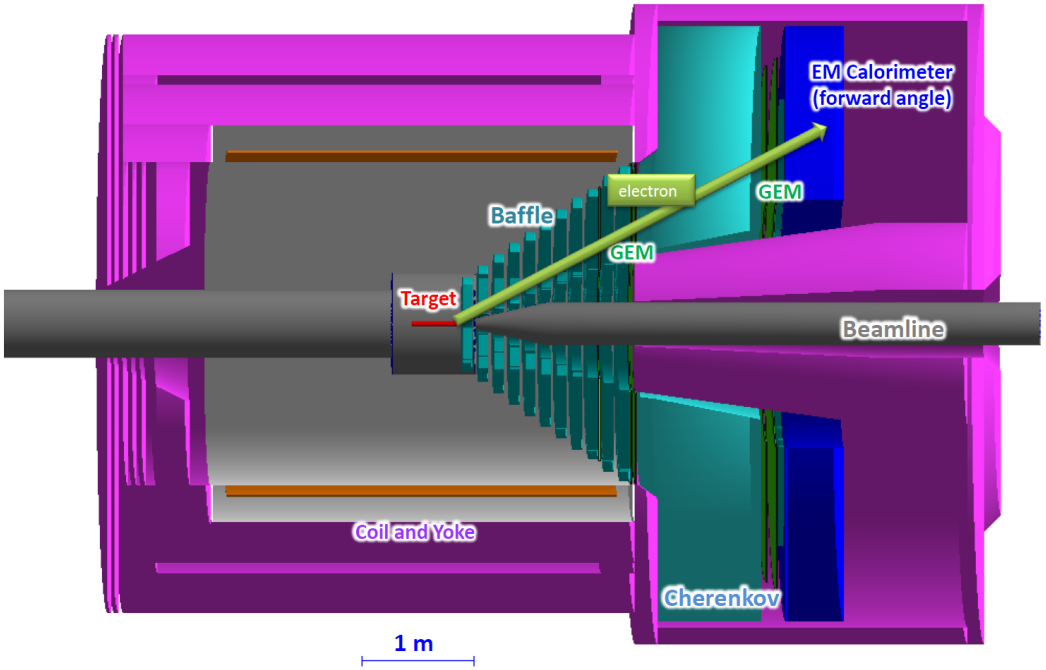
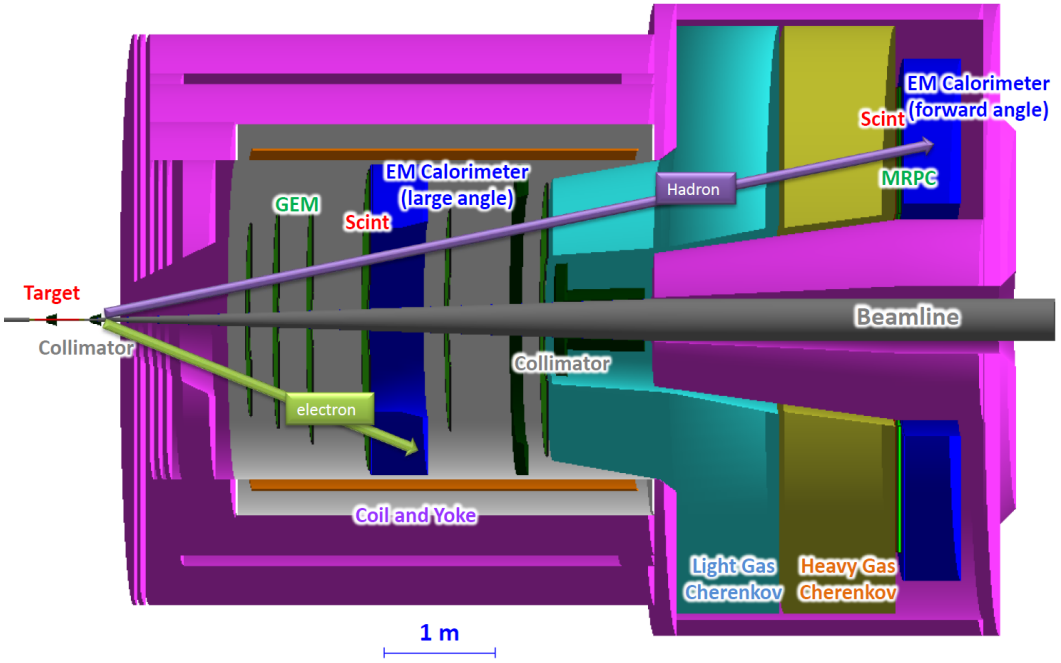
SoLID (PVDIS)



SoLID (SIDIS & J/ψ)

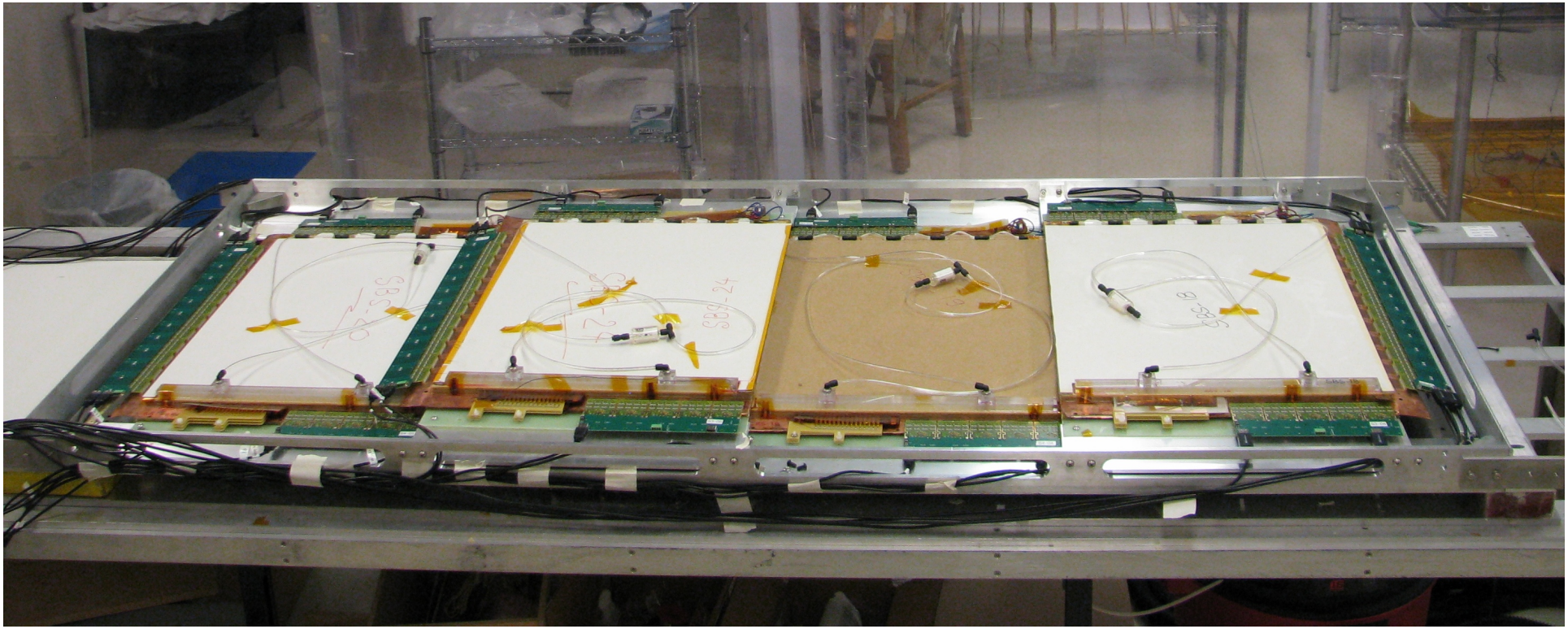


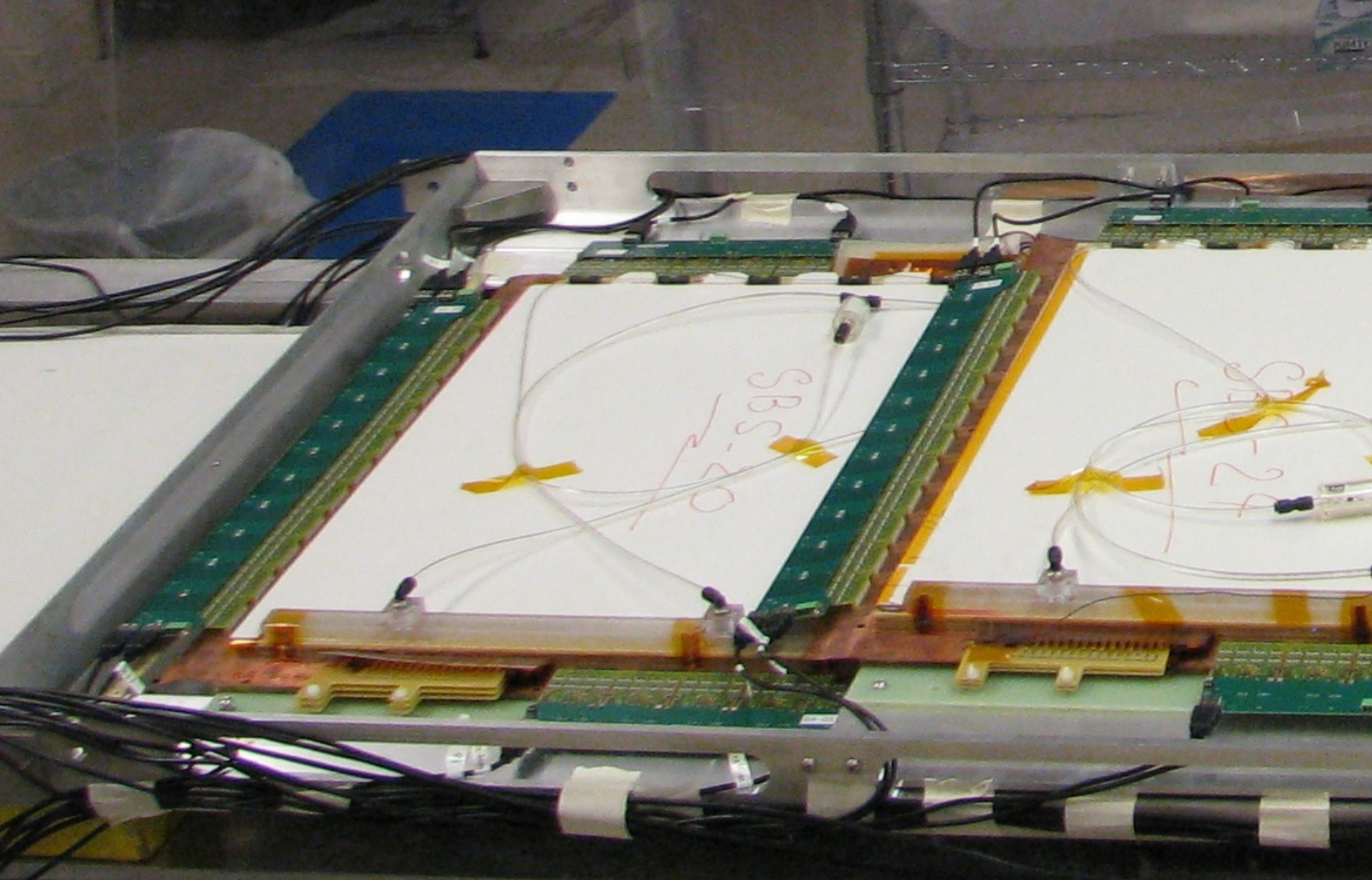
PVDIS GEM configuration

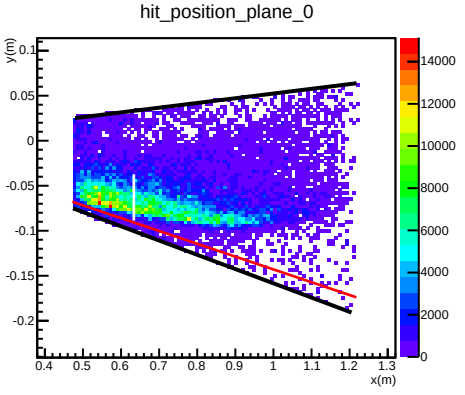
- Instrument five locations with GEMs:
- each module with a 12-degree angular width: need 1-2 cm for frame width: active angular width of a module limited to ~ 10-degrees.

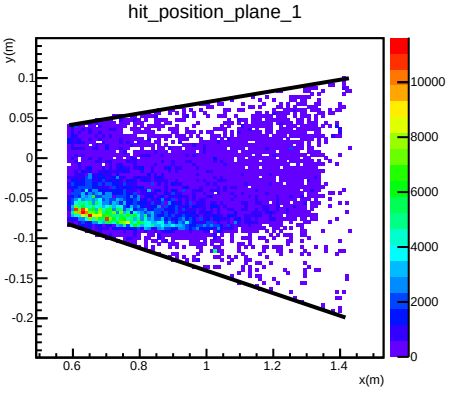
GEM Layer	Z(cm)	Rmin(cm)	Rmax(cm)	# Chan (.04/.06)	# Chan (.04/.04)
5	315	115	228	39773	59660
4	306	111	221	38552	57828
3	190	65	140	36633	36633
2	185.5	62	136	35587	35587
1	157.5	51	118	30877	30877
	Total			181422	220585

- are these outer radii reasonable ? We need about 17 cm from edge of active area t solenoid inner wall for electronics, cables, etc: can fit in between rails.
- Should max outer radius in barrel be 128 cm ? (145 -17 cm)
- For channels: .04/.06 is .04 mm pitch layers 1-3, .06 mm pitch layers 5 and 6.
- .04/.04 is 0.04 mm everywhere.
- segmenting hot channels in layer 1 adds 7.8 k more, 1 and 2 add 15.6 k more.






hit_position_plane_0
y(m)
x(m)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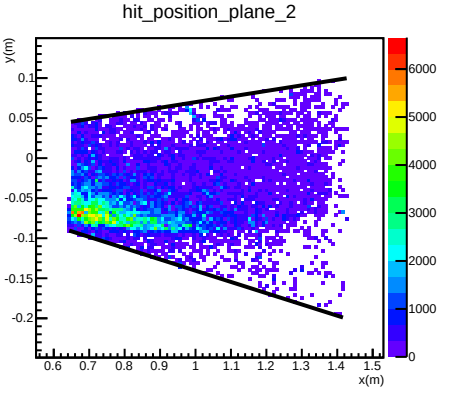
y(m)
x(m)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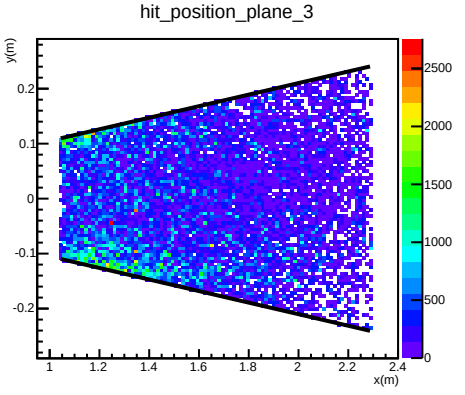
y(m)
x(m)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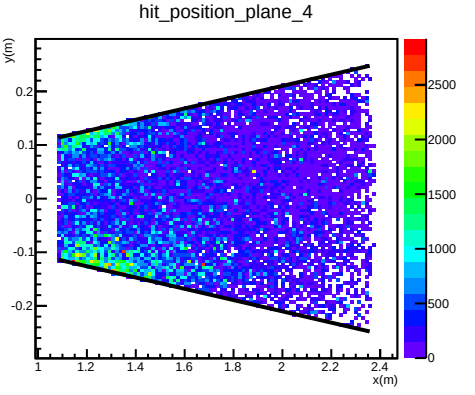
y(m)
x(m)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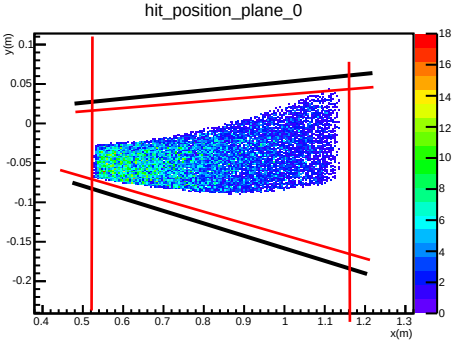
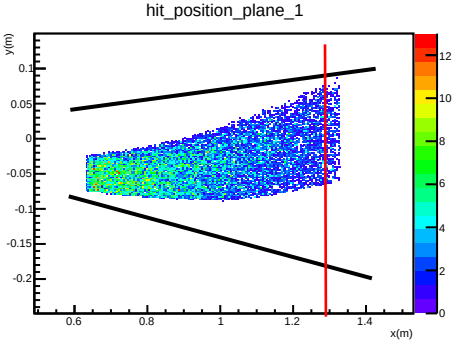
y(m)
x(m)


hit_position_plane_0
y(m)
x(m)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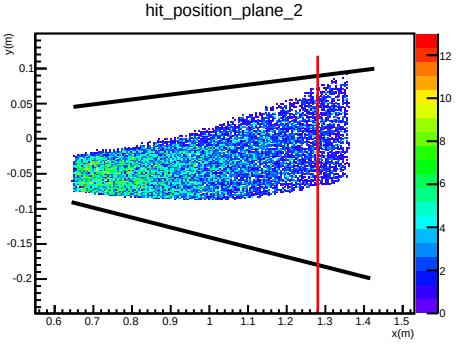
y(m)
x(m)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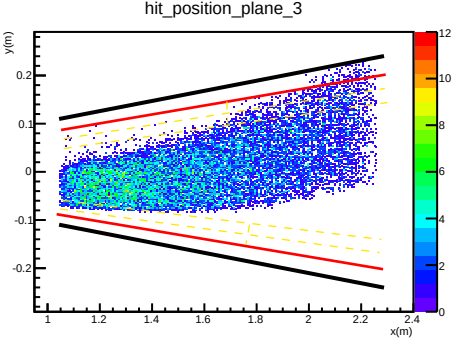
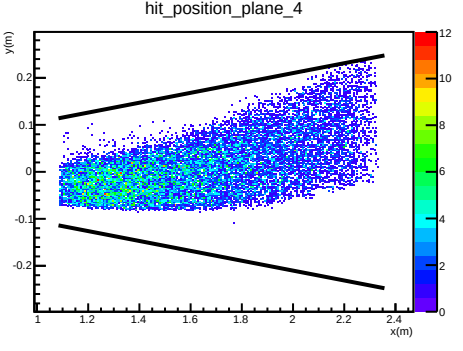
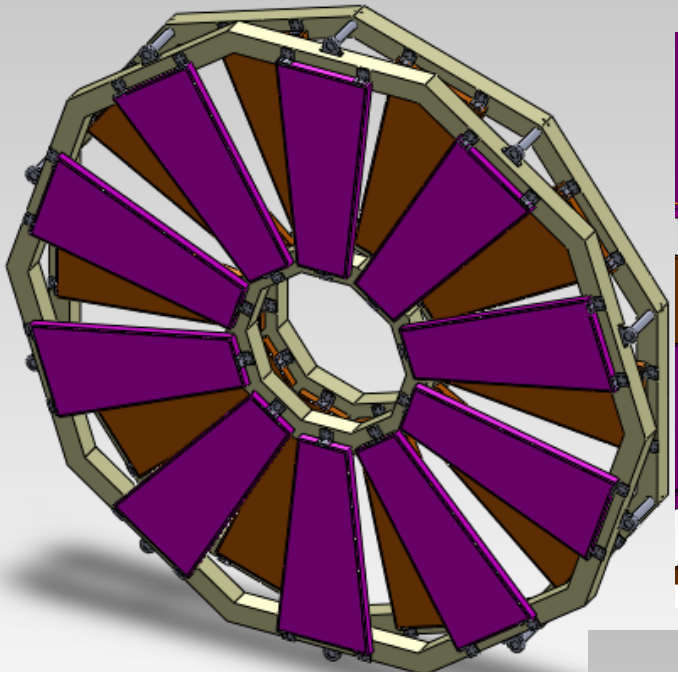
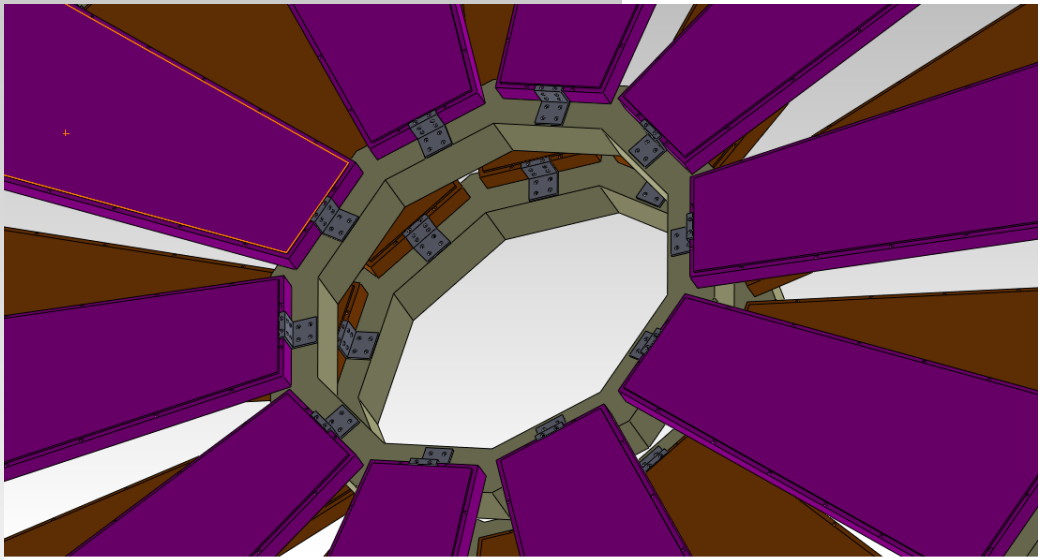
y(m)
x(m)


hit_position_plane_3
y(m)
x(m)

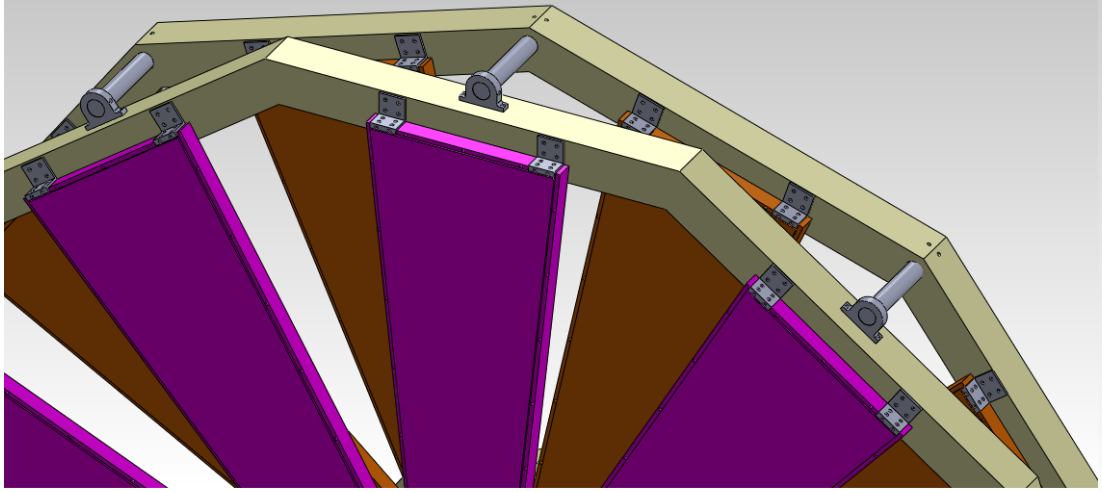

hit_position_plane_4
y(m)
x(m)

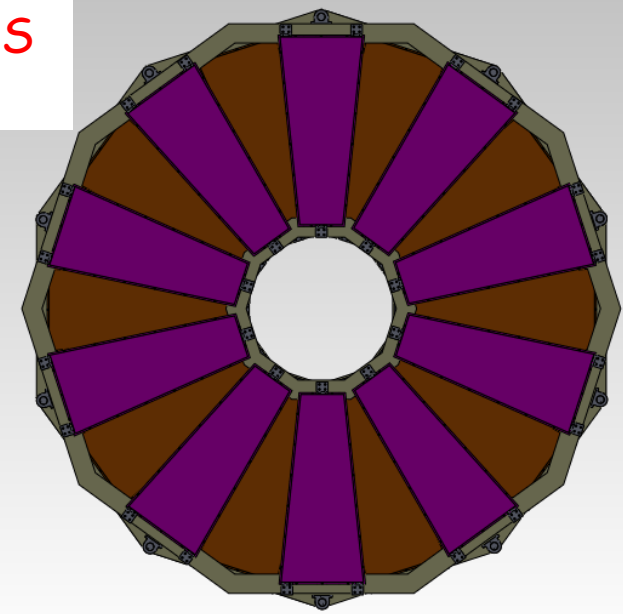
SIDIS GEM configuration





Has the effect of edges in active area of SIDIS been considered in sim ?





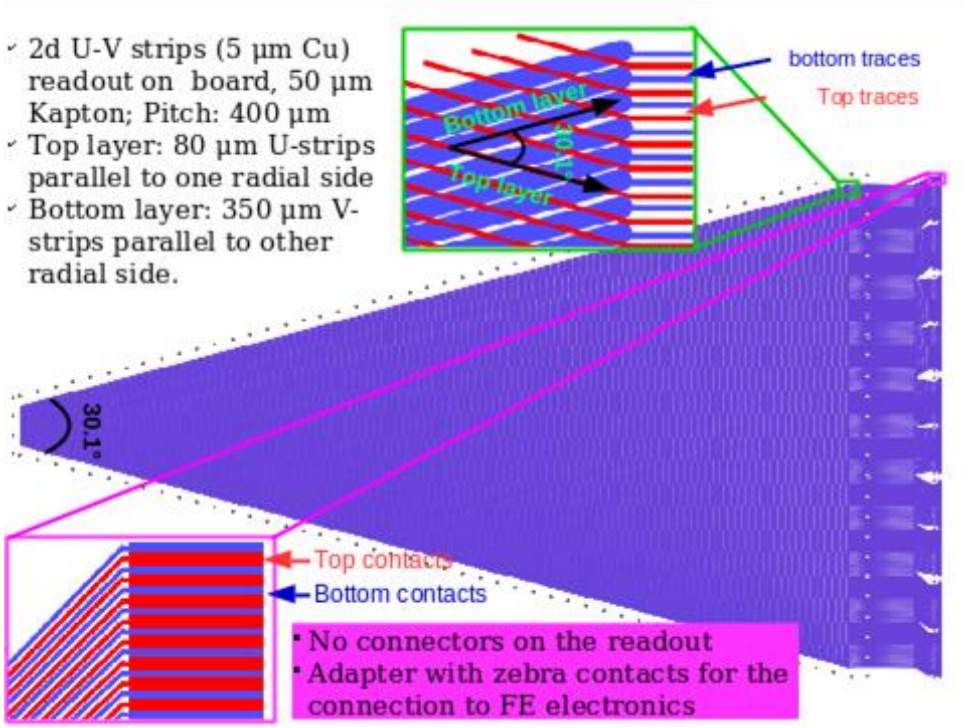
Cable estimate

- Layers 1-3, each module 6 HDMI cables, 1 SHV cable, 2 Gas lines: (all about 6 mm diameter)
  - 540 HDMI, 90 SHV, 180 Gas
- Layers 4 and 5: each module, 12 HDMI cables 1 SHV cable, 2 Gas lines: (all about 6 mm diameter)
  - 720 HDMI, 60 SHV, 120 Gas

New EIC R&D done by Kondo, directly applicable to SoLID

Common GEM foil design:

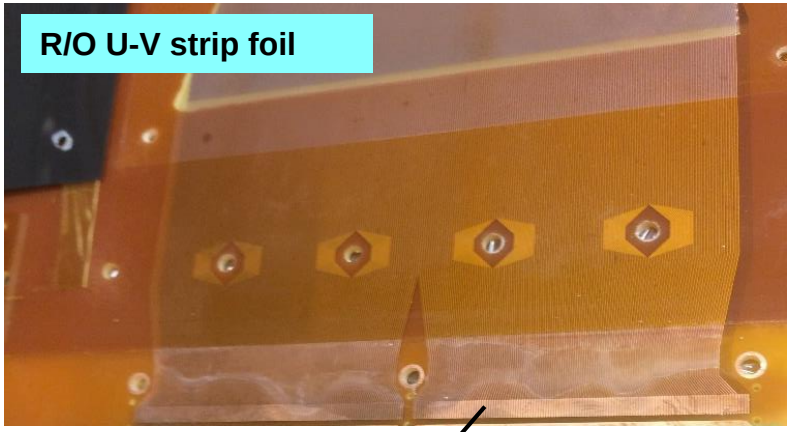
- ✓ (Univ. of Virginia, Florida Tech, and Temple U.)
- ✓ All connections (HV, gas flow structure and FE cards) are made on outer radius end.
- ✓ We received 4 common GEM foils from CERN



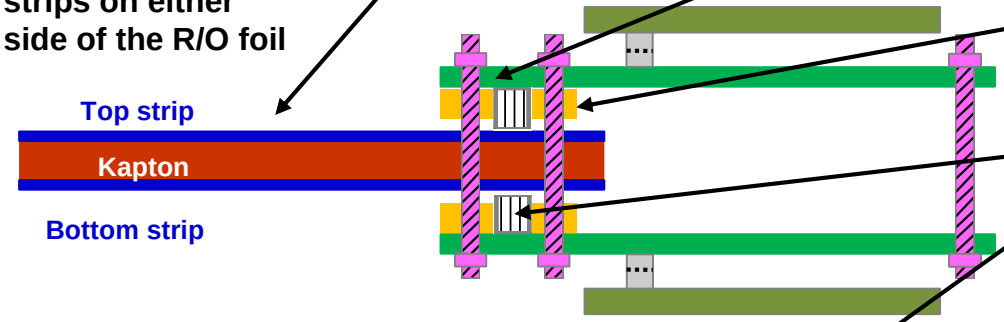
2D U-V strips readout (R/O)

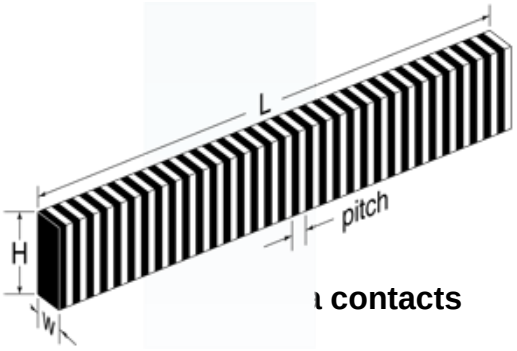
- ✓ Spatial resolution improvement
- ✓ No electronics on active area of the chamber
- ✓ No connectors or metallized vias on R/O
- ✓ Zebra connection for the FE electronics
- ✓ Zebra-Panasonic adapter board

Zebra Connection for EIC-FT GEM Readout

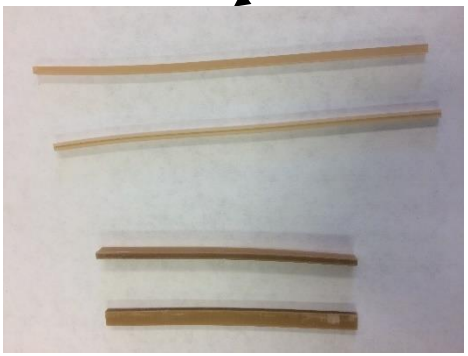


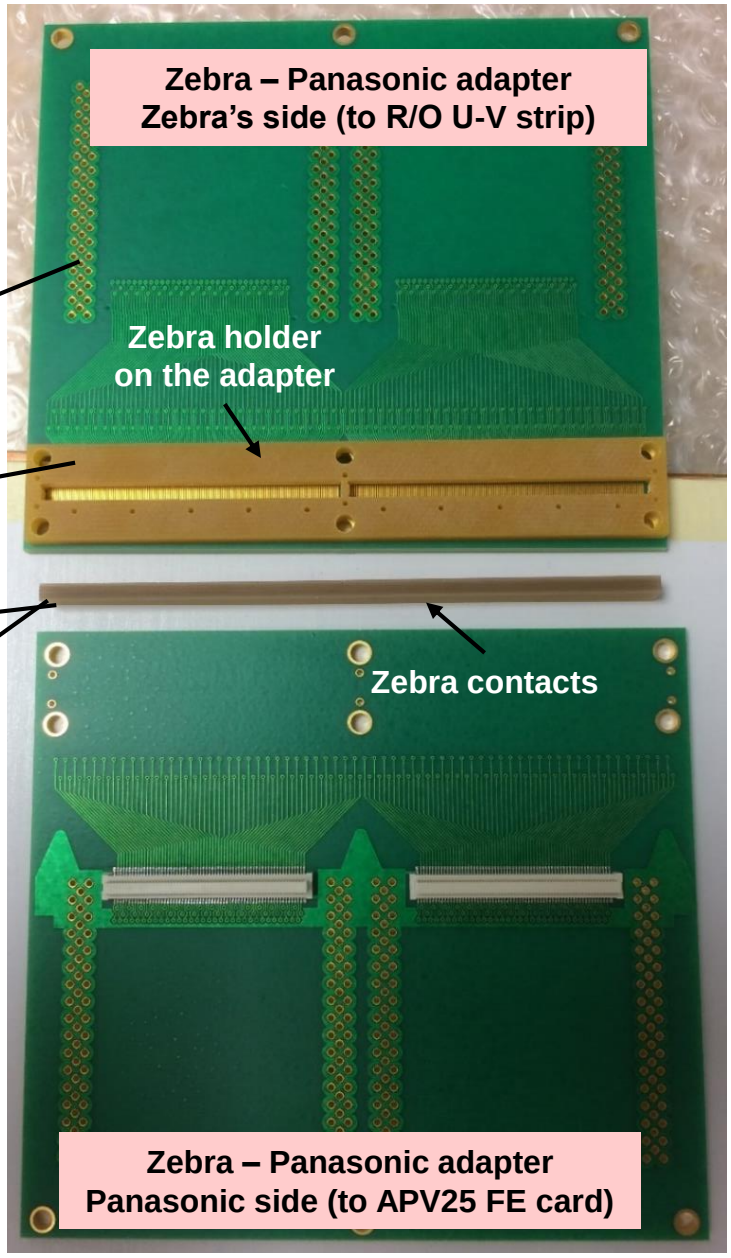
Contact of U and V strips on either side of the R/O foil





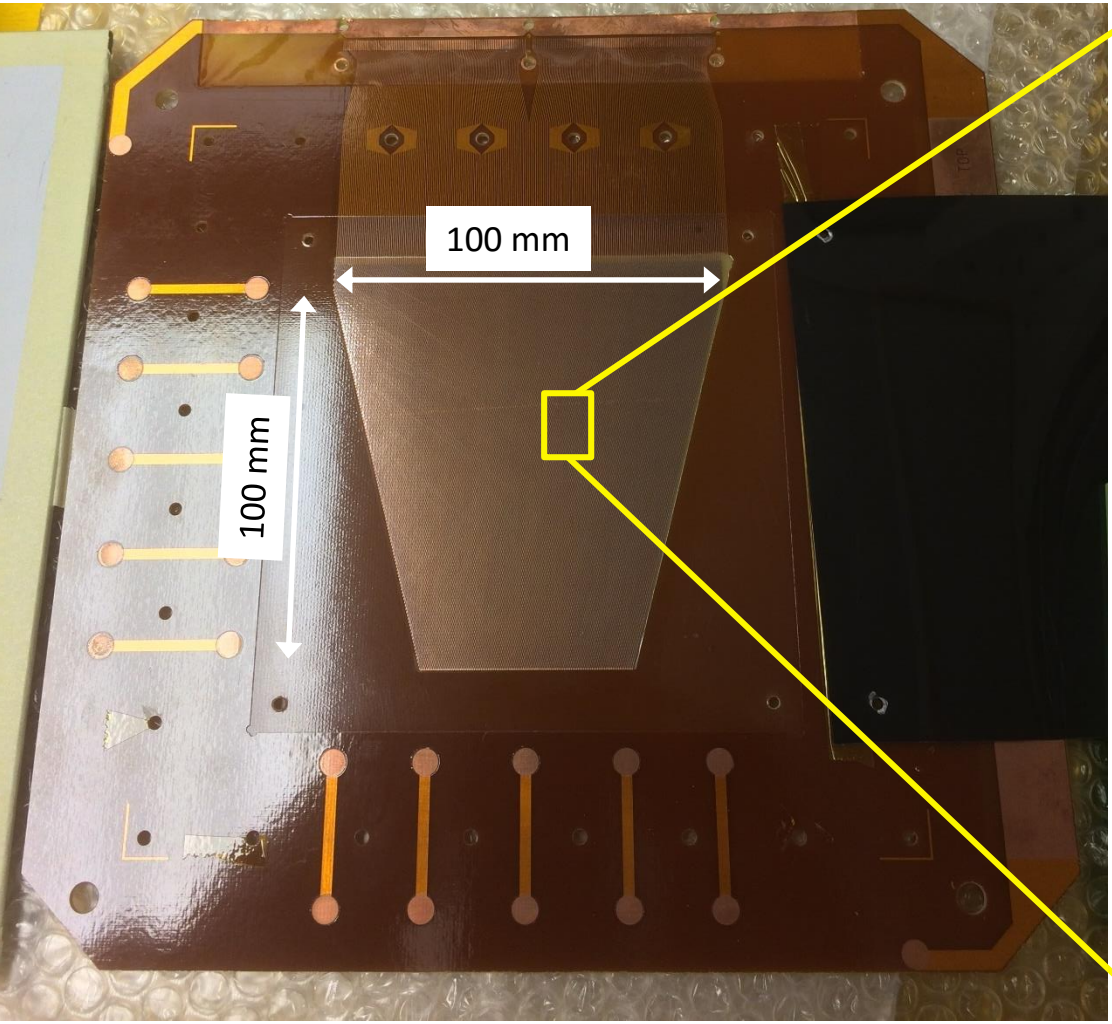
contacts

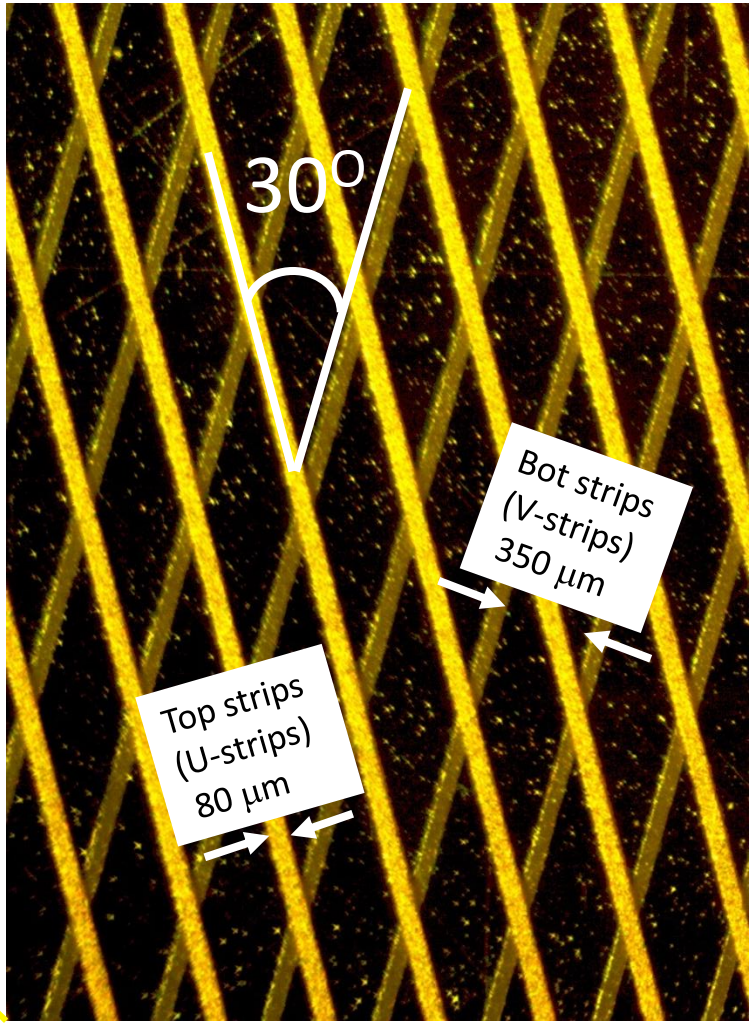




Small 2D U-V strips readout prototype

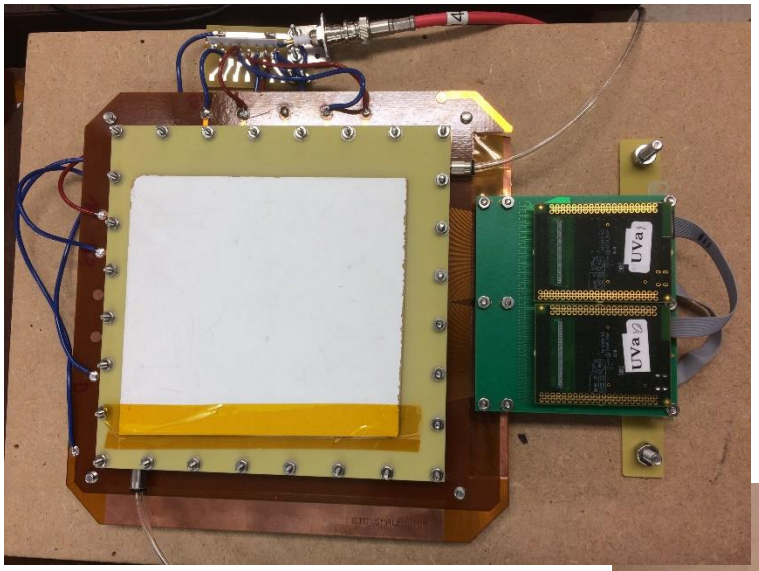
- 10 cm x 10 cm triple GEM,
- 2D flexible readout a la COMPASS with U-V strips,
- **double side zebra contact**



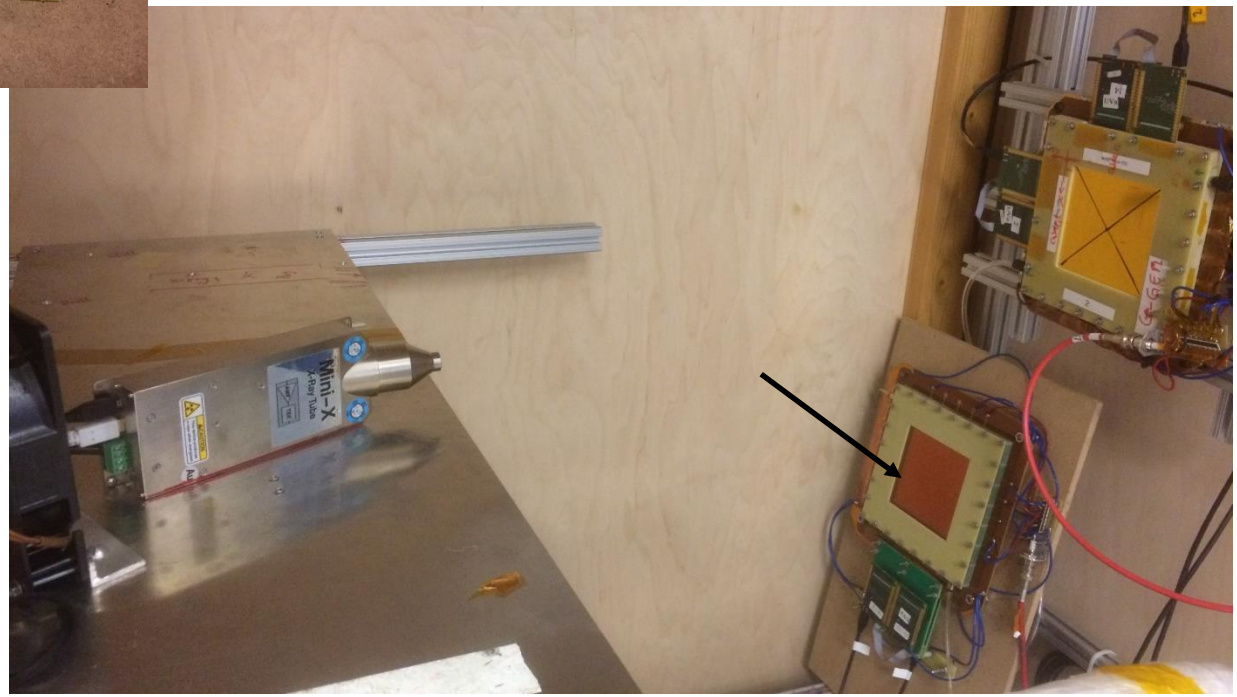


Characterization of U-V readout GEM proto with X-ray and Cosmic

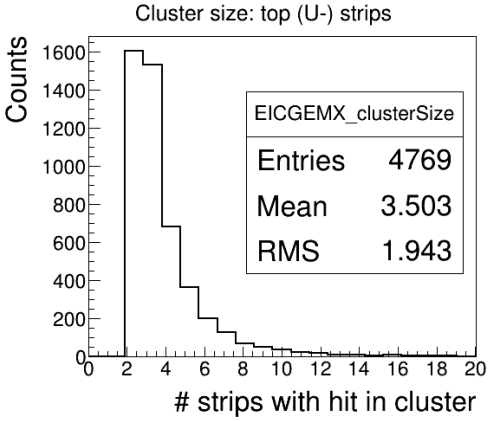
Cosmic



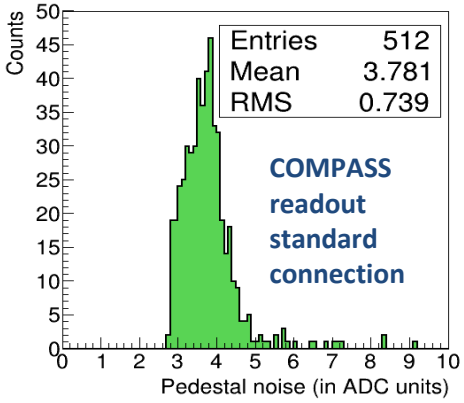
X-Ray box

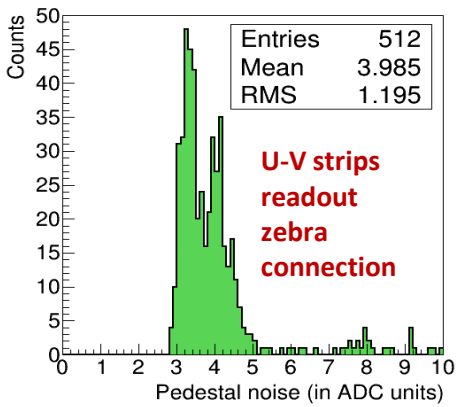


Characterization of U-V readout GEM proto with X-ray and Cosmic



Distribution of pedestal rms (noises) over 512 APV25 chs

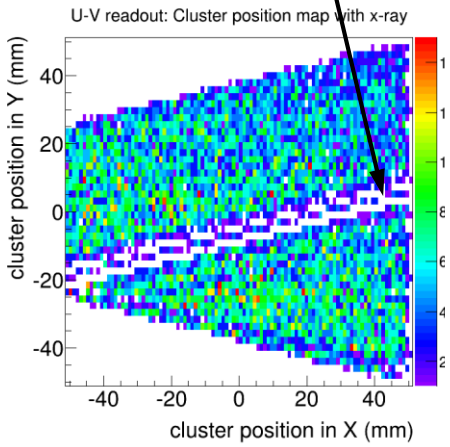


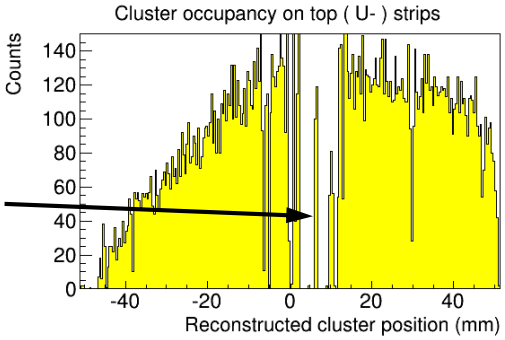


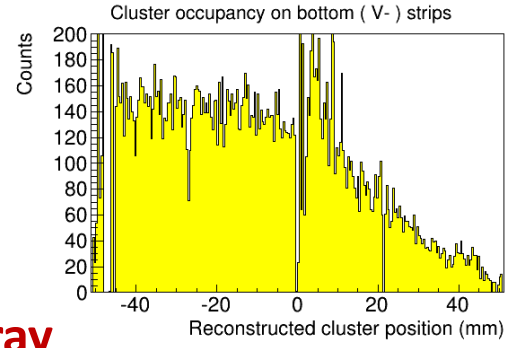
- Pedestal noise level comparable to standard COMPASS 2D readout
- No effect of the zebra connection on noise level

Cluster size > 3.5 ⇨ improvement in spatial resolution

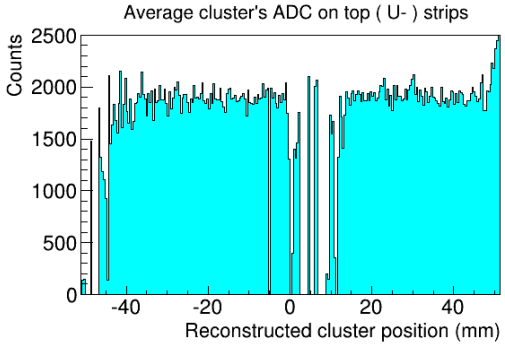
bad zebra contact

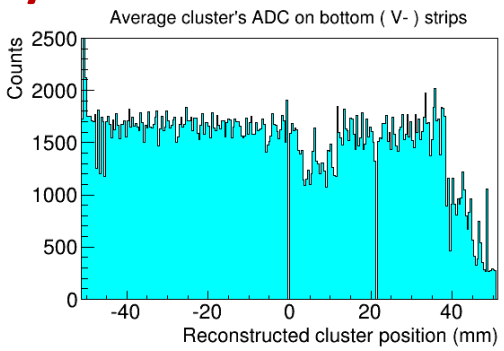






X-ray





Occupancy for U and V strips: Linear dependence with strip length is shown

Uniformity of the gain uniformity: (accumulated ADC / numbers of hits)