

GEMS (SBU)

- Klaus Dehmelt
- MOLLER Collaboration Meeting
- May 06, 2023



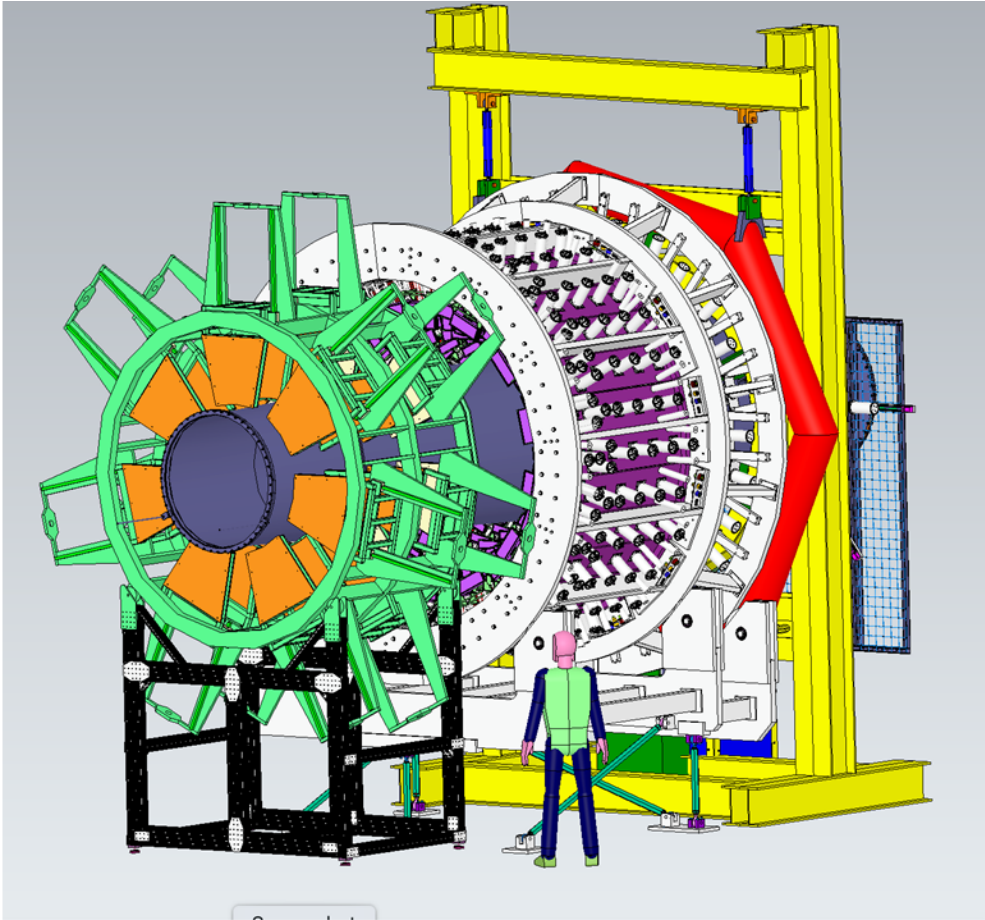
Stony Brook **University**

| The State University of New York

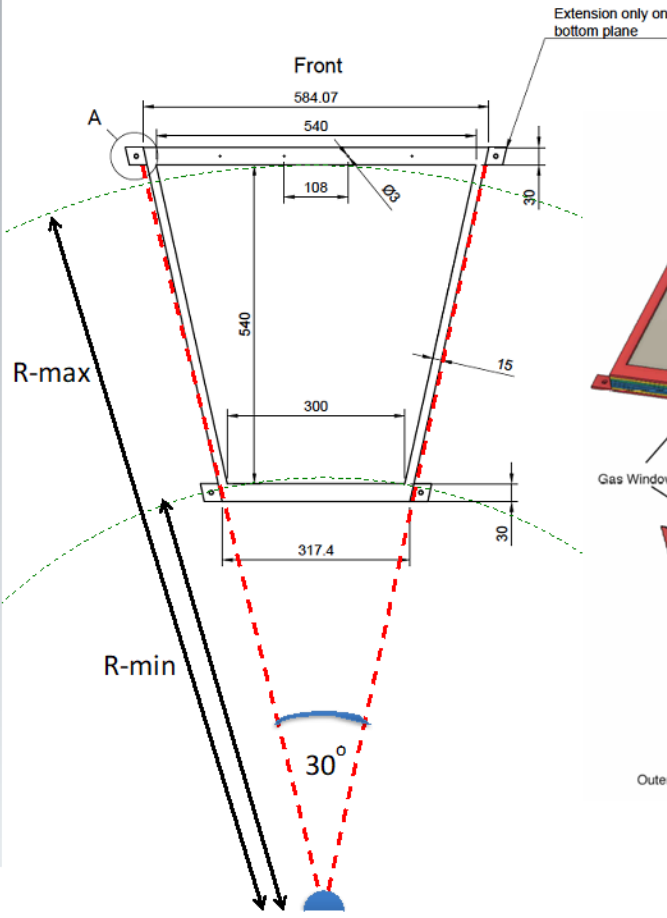
GEM TRACKER FOR MOLLER

- **Objective**
 - Produce 12 Coordinate GEM trackers for the MOLLER experiment
- **Team Members:**
 - Klaus Dehmelt
 - Prakhar Garg → moved on, searching for new hire
 - Brynna Moran
 - Zuhail Demiroglu
 - Wenliang (Bill) Li
 - James Shirk

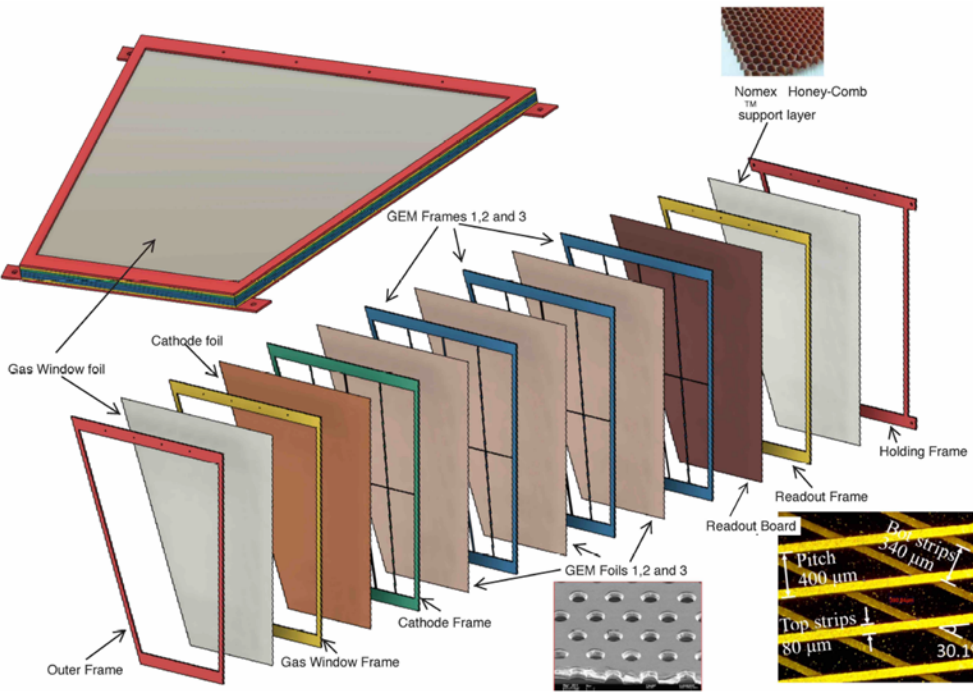
GEM TRACKER FOR MOLLER



4 GEM planes, located downstream of the two magnets

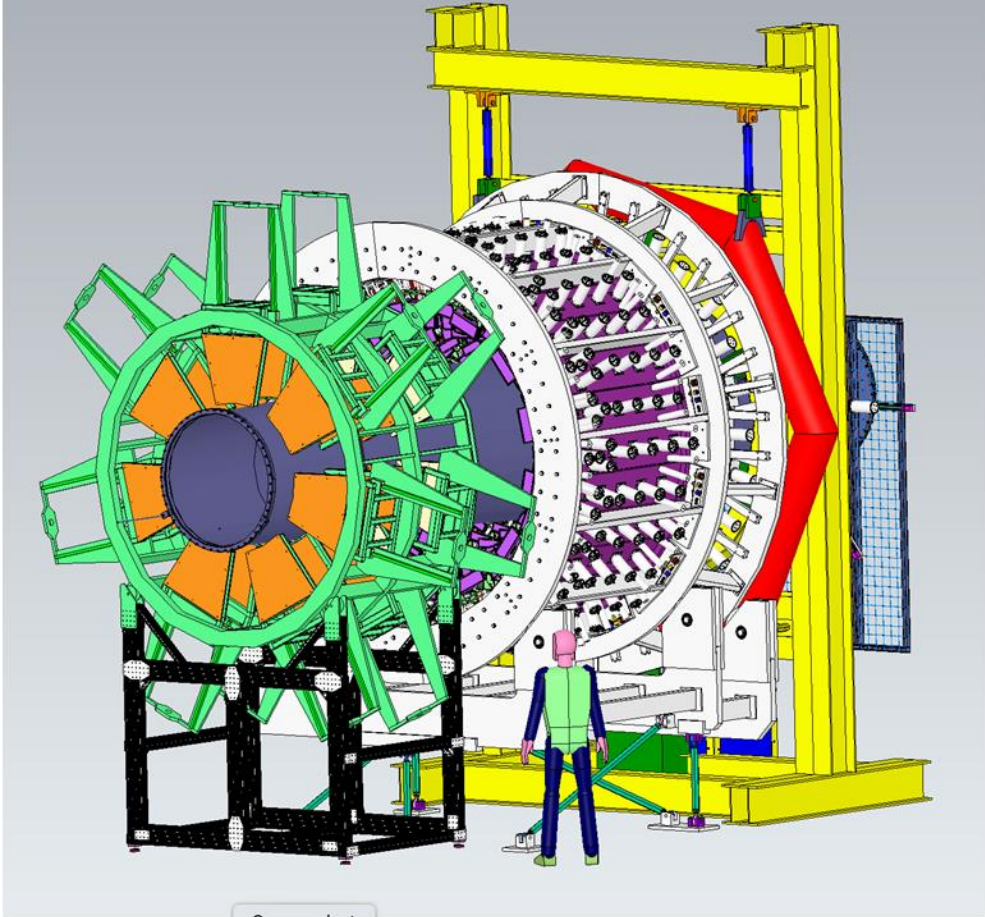


MOLLER GEM module as seen in the beam's eye view

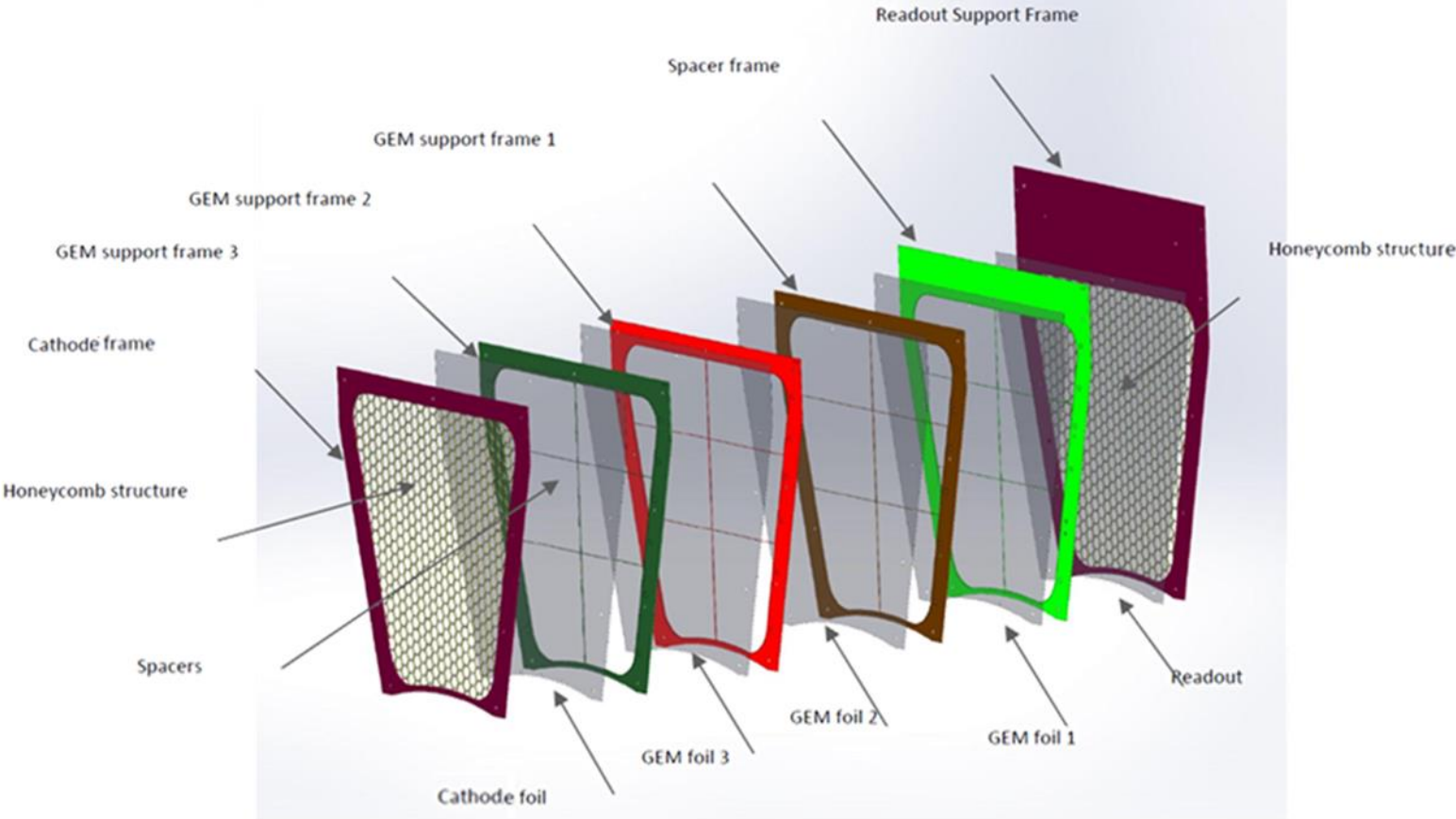


MOLLER GEM module: exploded view

GEM TRACKER FOR MOLLER



4 GEM planes, located downstream of the two magnets



MOLLER GEM module: exploded view

GEM TRACKER FOR MOLLER

- Four longitudinal positions – Ferris wheel + movable in ϕ and r

GEM	Distance from the Hall Center (mm)*		OR (mm) of Outer Photon Env. with target offset of 1 mm (a)	IR (OR) (mm) of present charged particles envelope	IR with 5mm clearance (mm) (b)	Gap (mm) available for frame, tolerance, and beam pipe (=b-a)	Existing Pipe OR (mm) from CAD
	remoll model	CAD model					
1	19280	19288.39	520	585 (1020)	580	60	518.5
2	19780	19788.39	530	610 (1050)	605	75	553.6
3	20194	20201.65	540	625 (1070)	620	80	572.8
4	20694	20701.65	552	645 (1115)	640	88	587.9

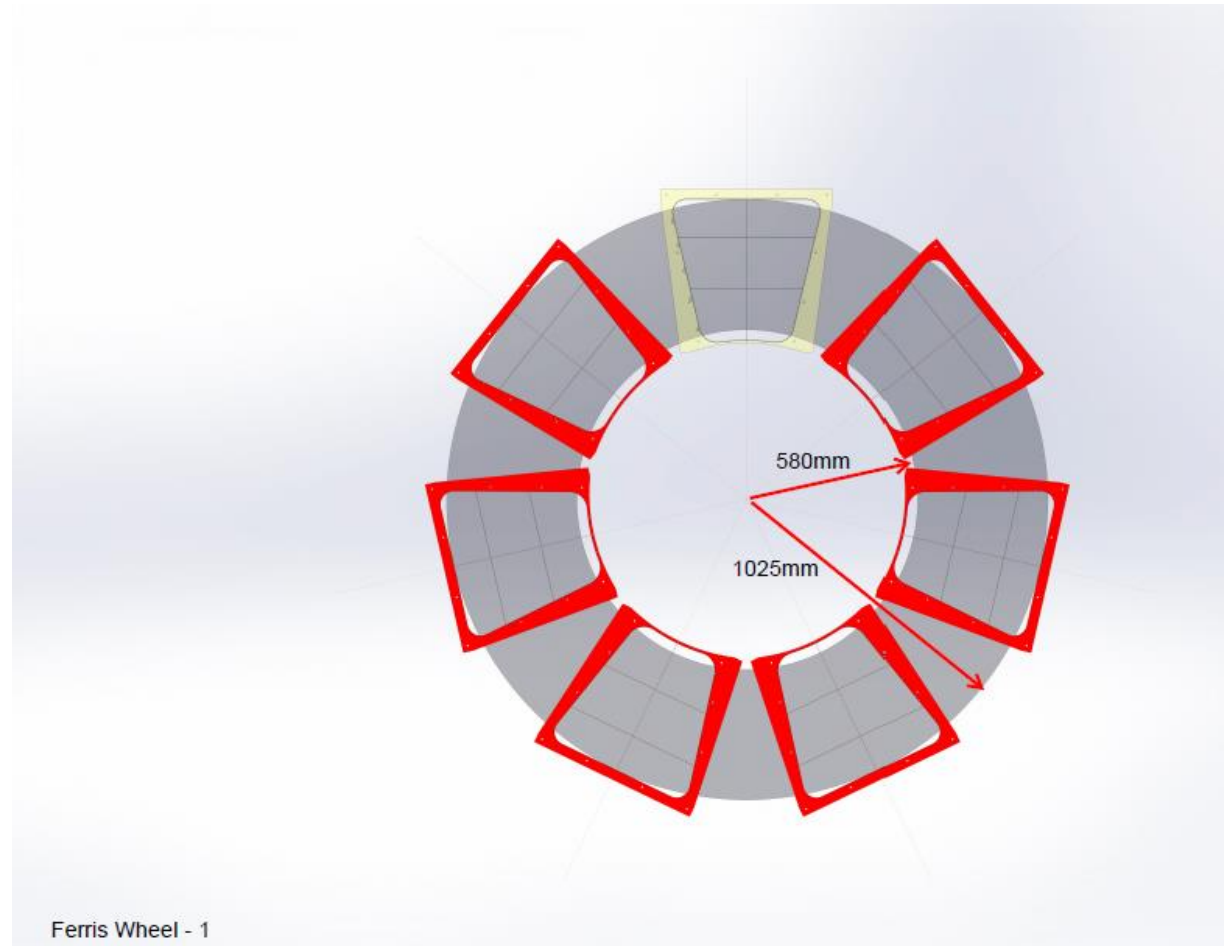
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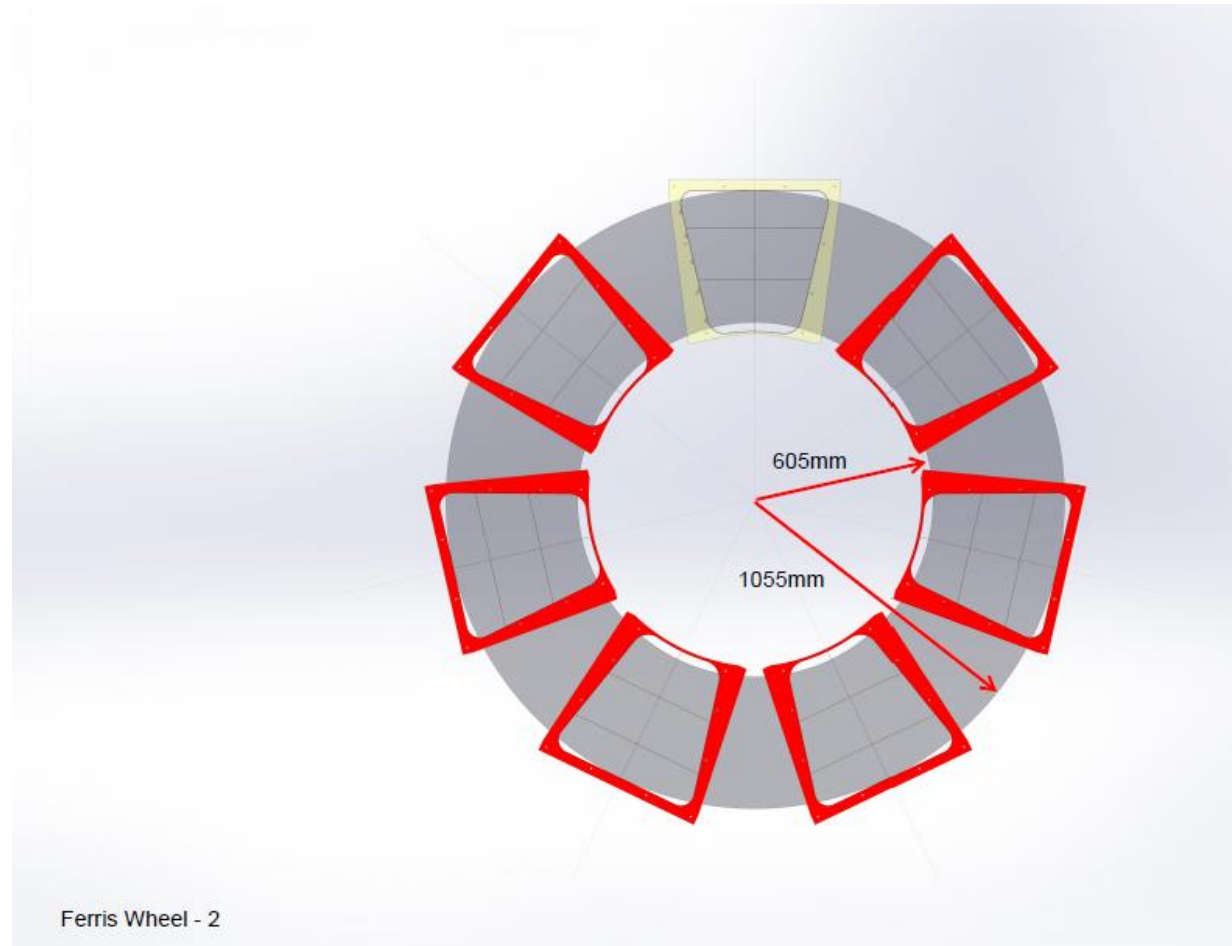
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3	20194	20203	540	1070	80	572.8
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One size fits all

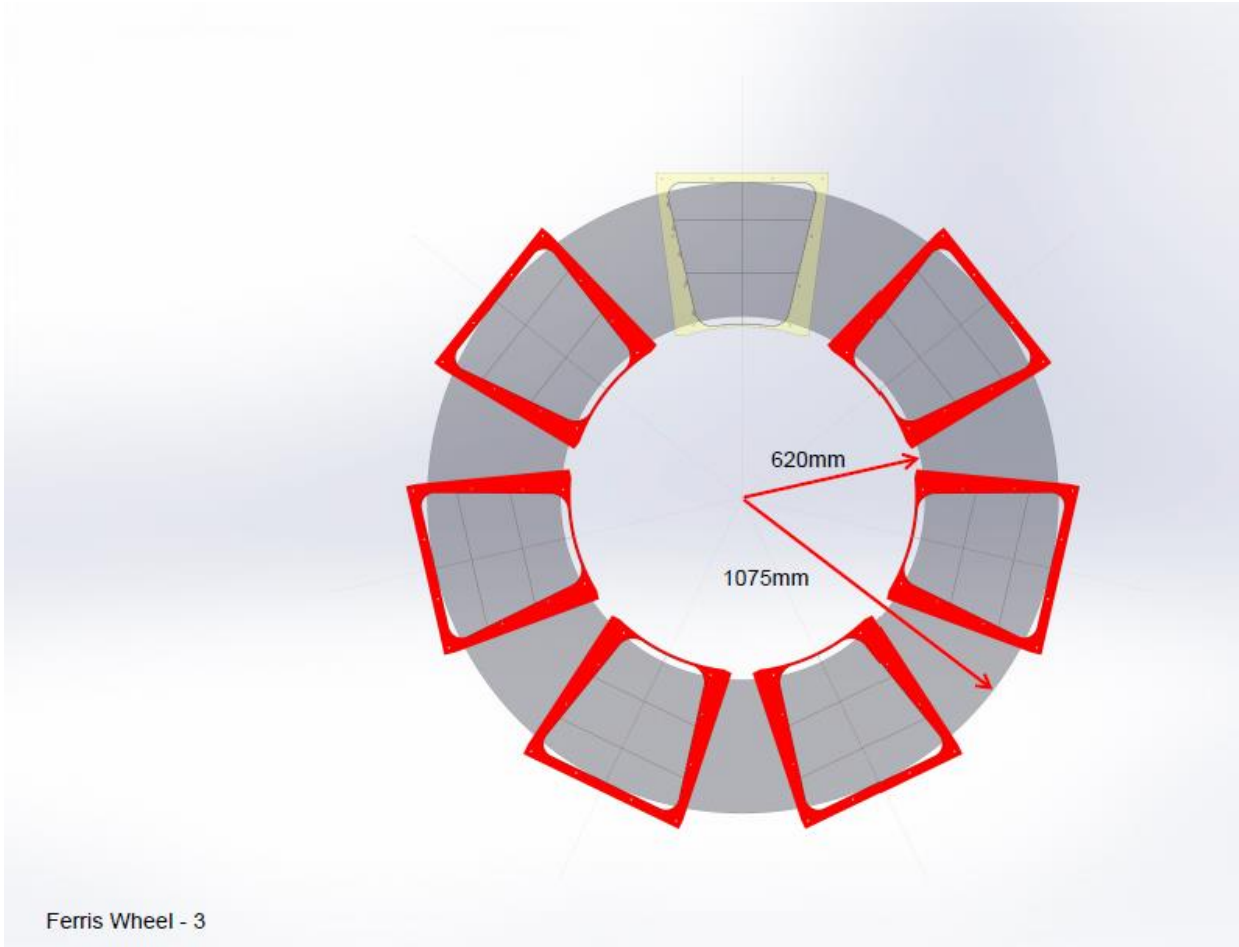
GEM TRACKER FOR MOLLER



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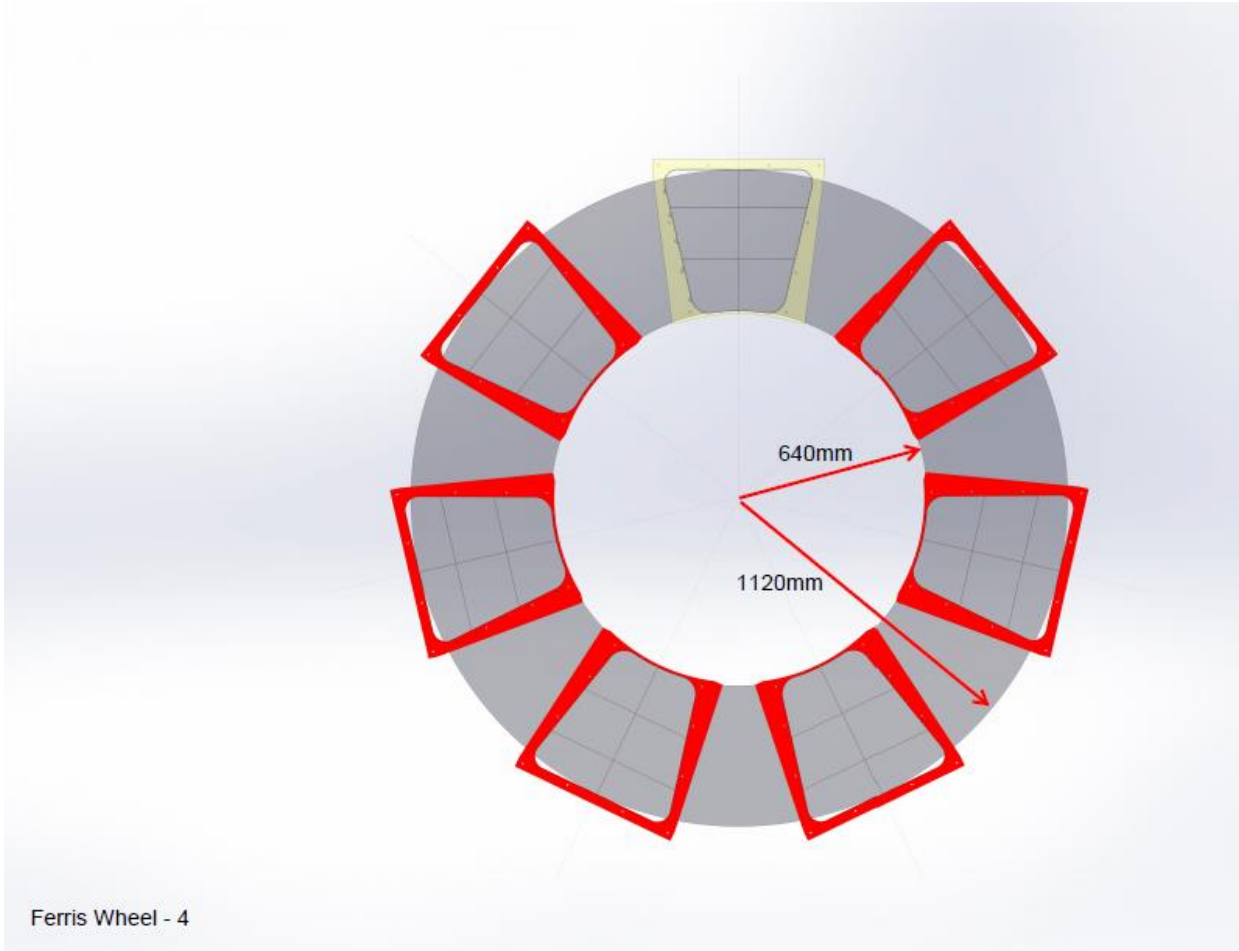


GEM TRACKER FOR MOLLER



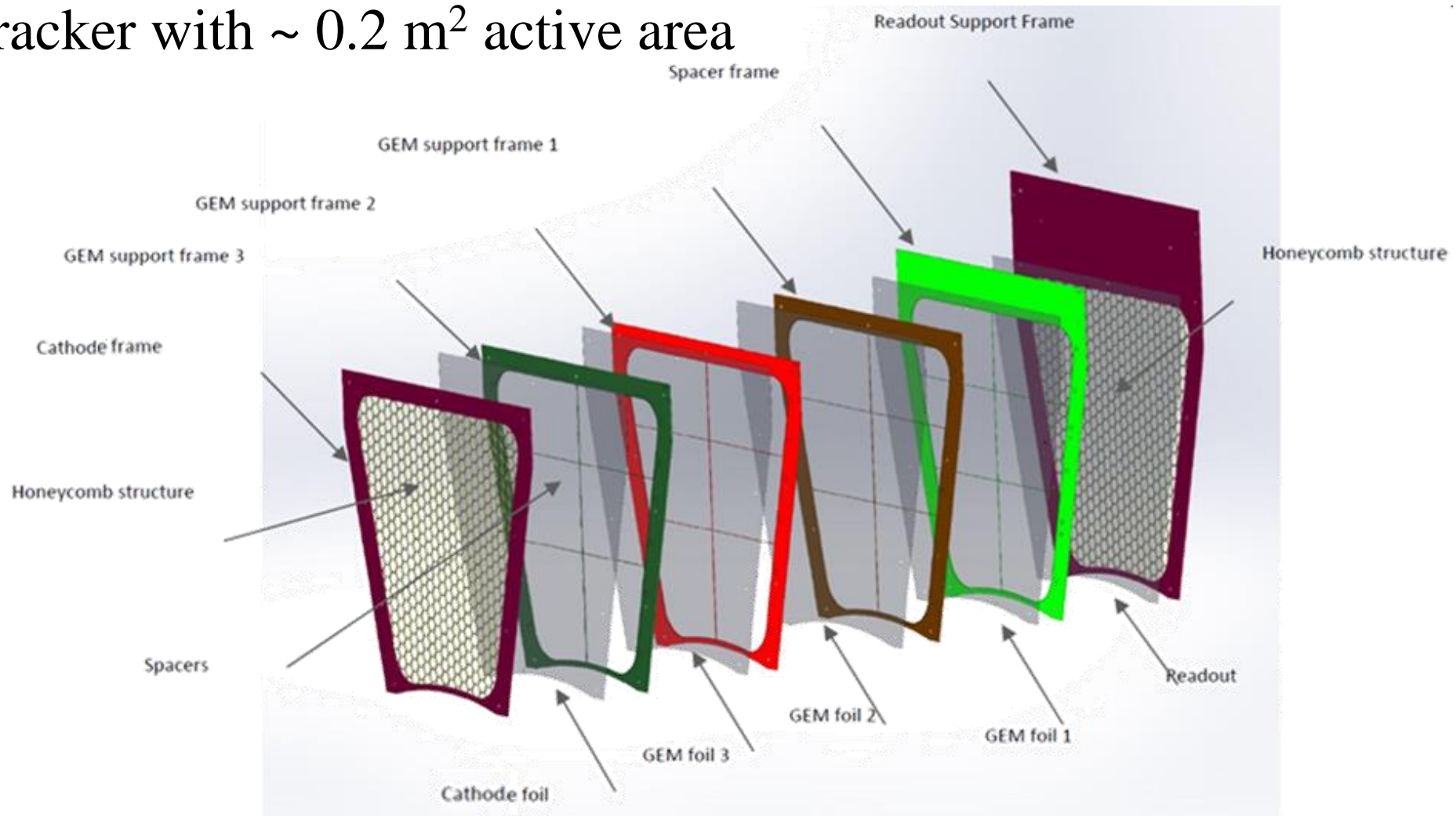
Ferris Wheel - 3

GEM TRACKER FOR MOLLER



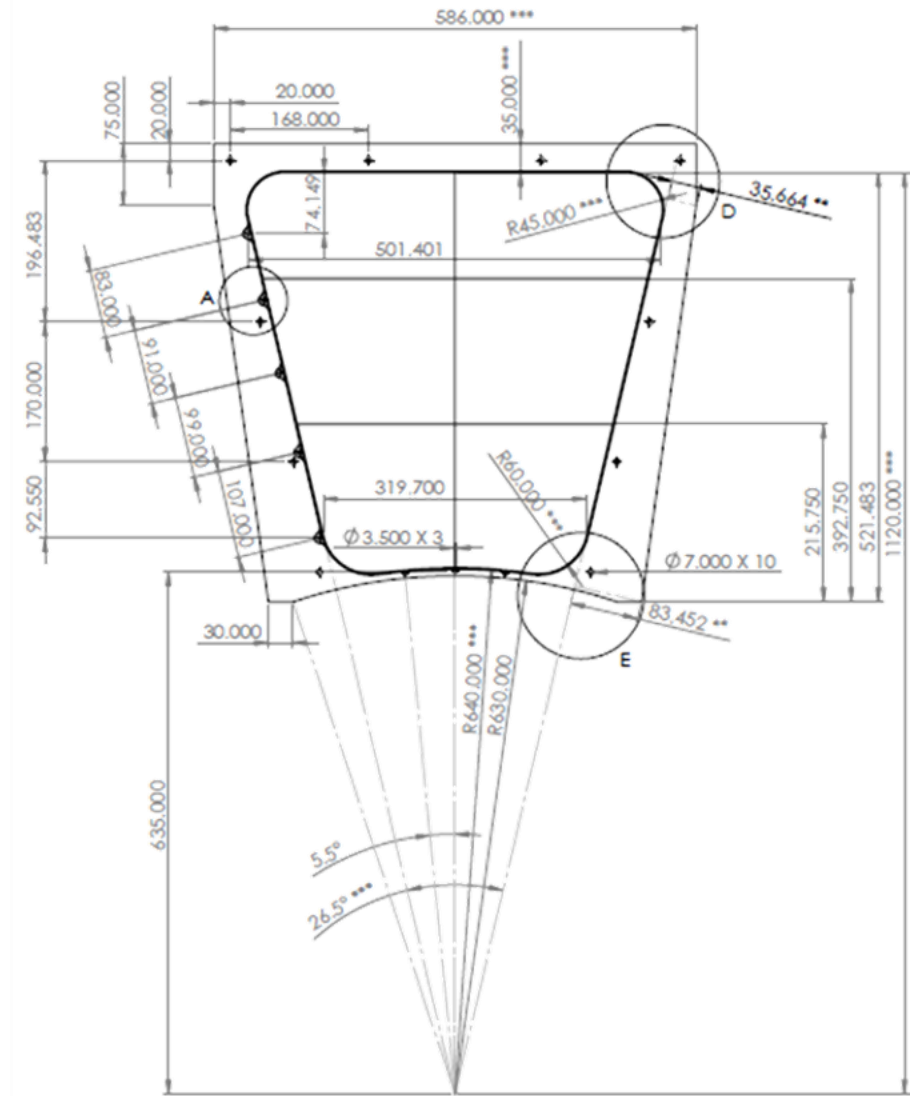
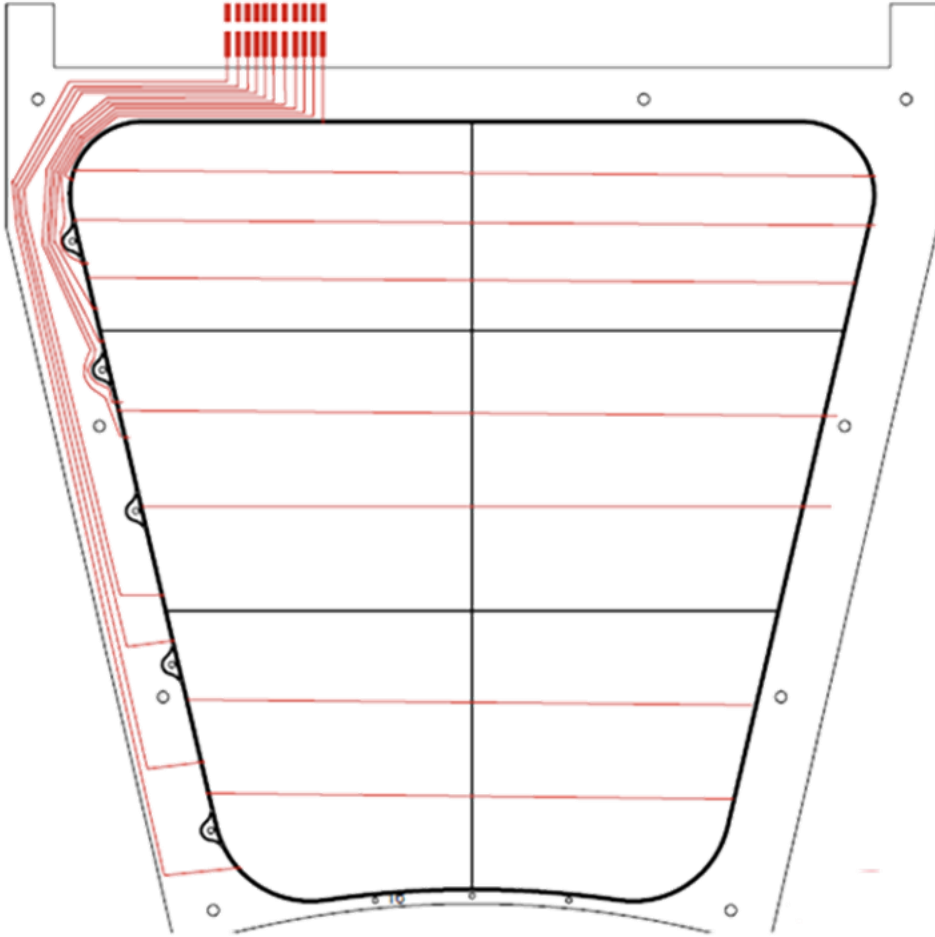
GEM TRACKER FOR MOLLER

- GEM tracker with $\sim 0.2 \text{ m}^2$ active area



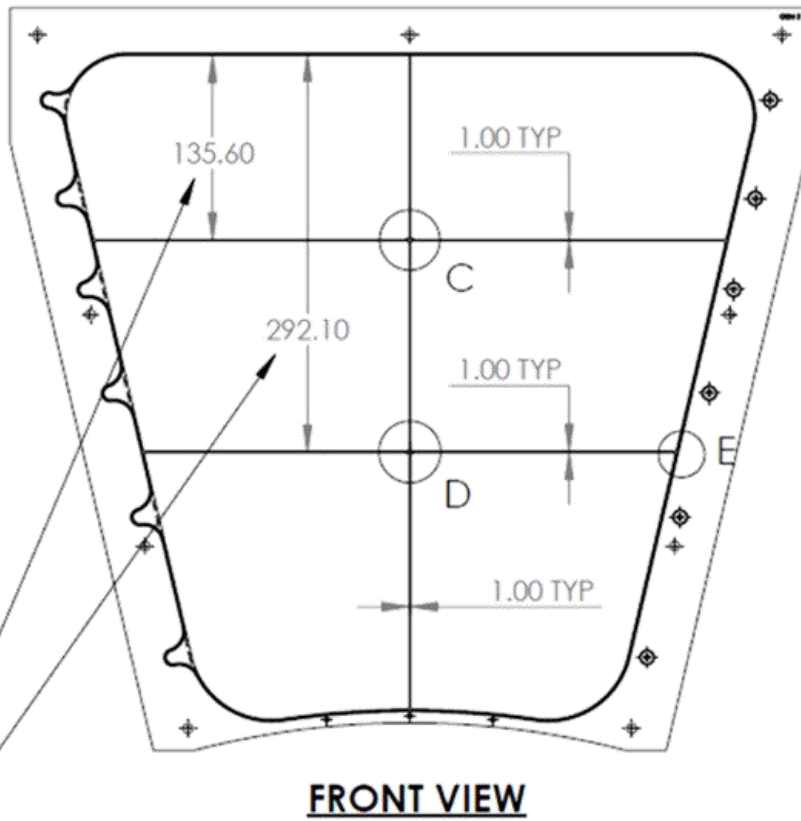
GEM TRACKER FOR MOLLER

- GEM tracker with $\sim 0.2 \text{ m}^2$ active area

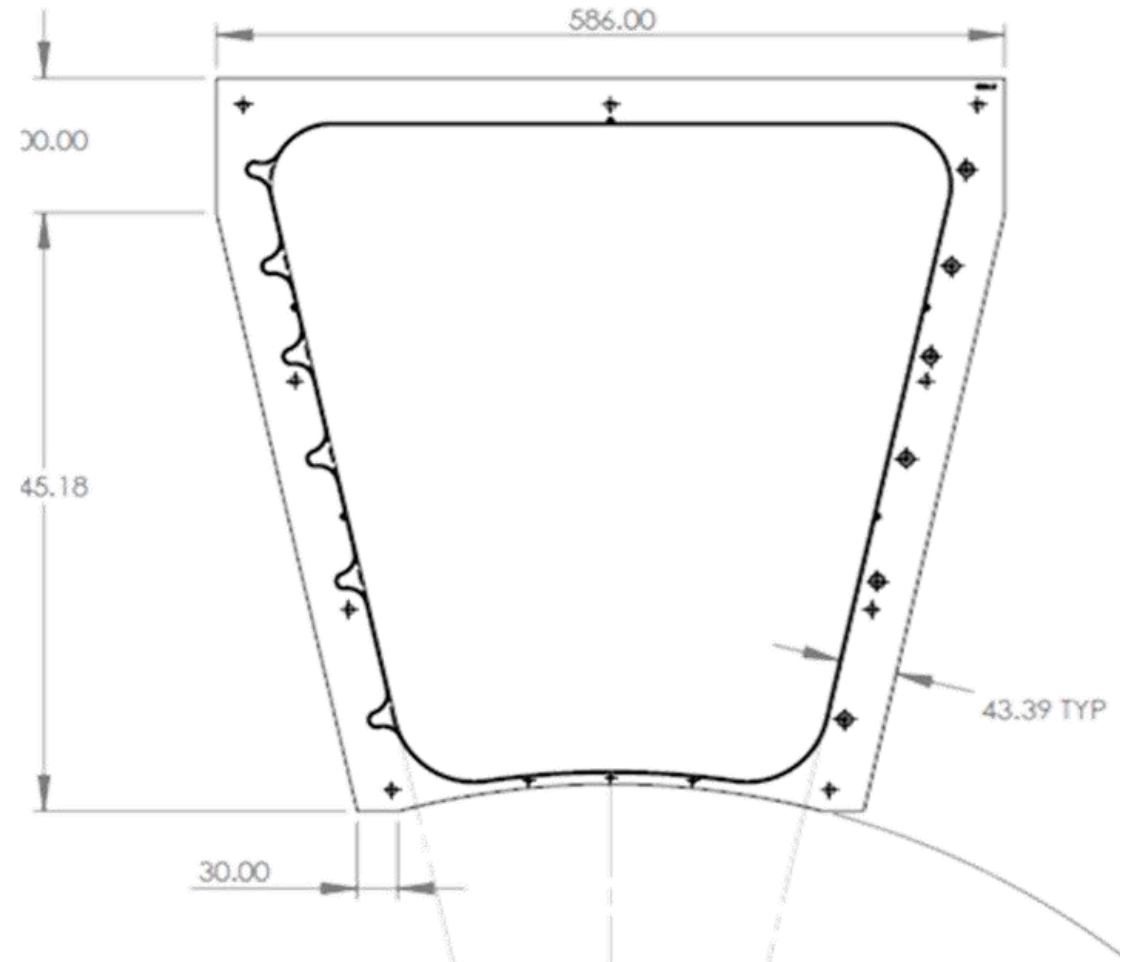


GEM TRACKER FOR MOLLER

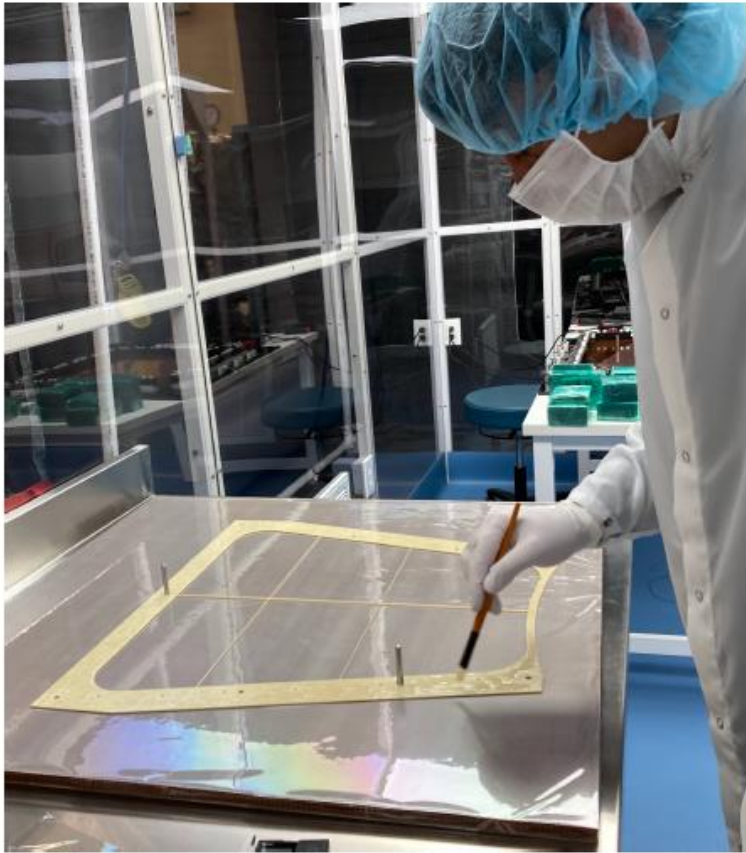
- Alternative designs → received quotes from different vendor



NOTE: THESE DIMENSIONS ARE FROM THE BOTTOM EDGE OF THE WINDOW TO THE MIDDLE OF THE SPACERS



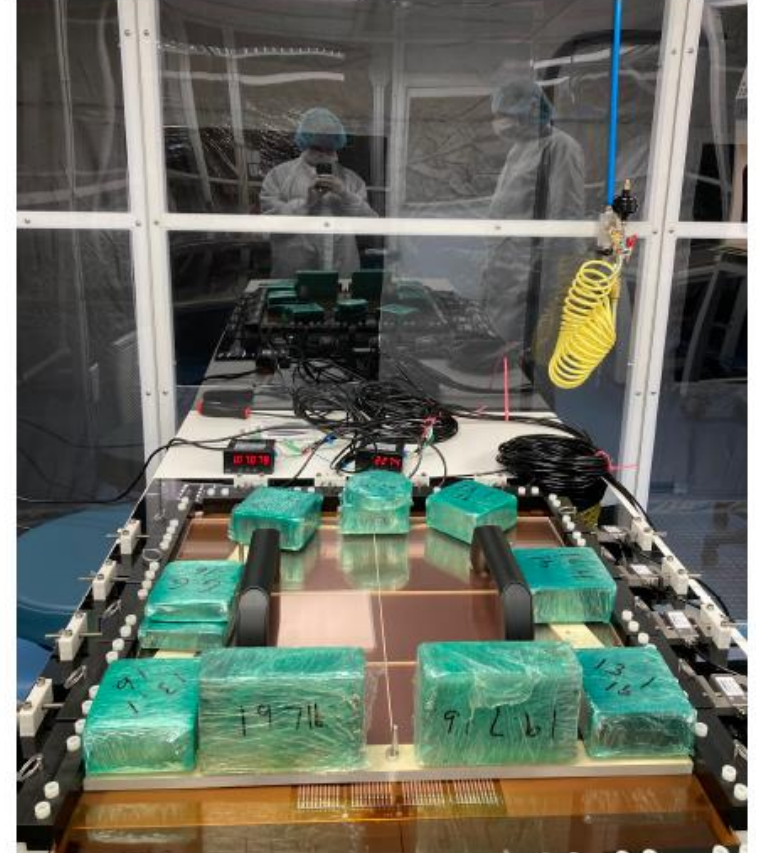
GEM TRACKER PRODUCTION @ SBU



Frame Painting with Epoxy



Frame on stretched GEM foil

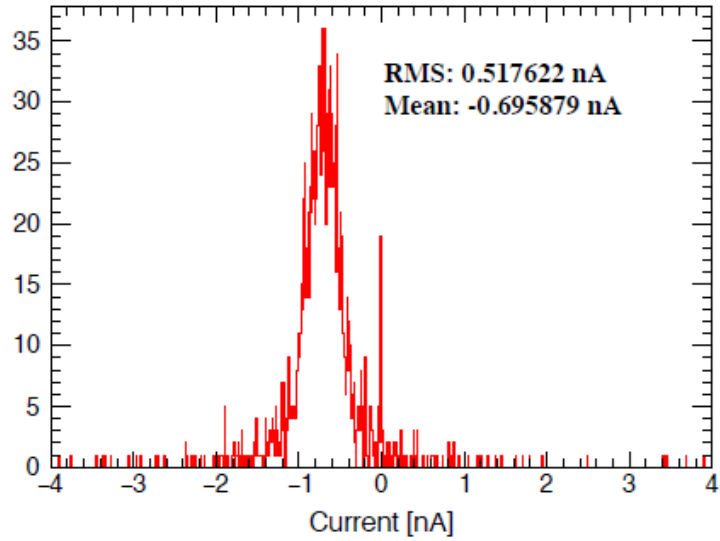


Epoxy Drying

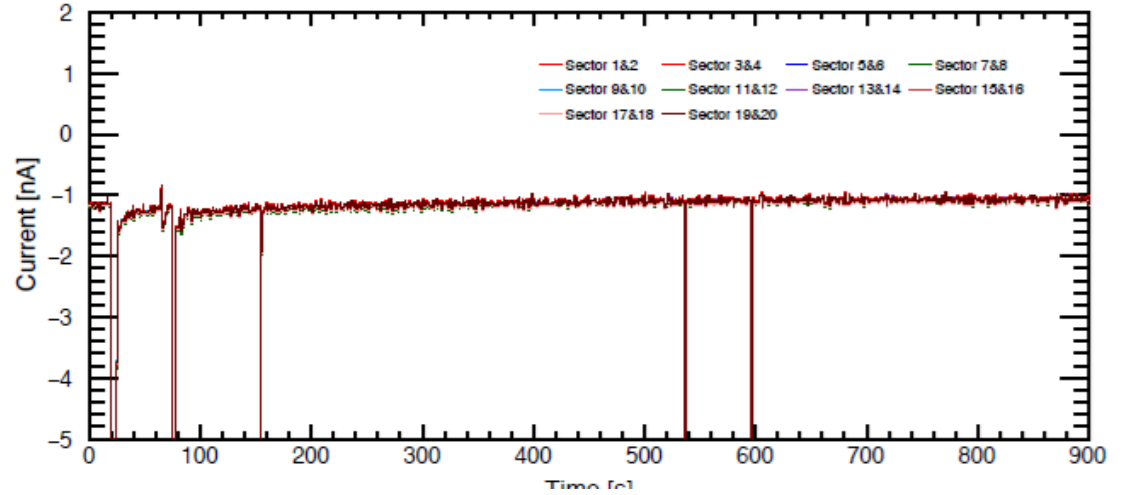
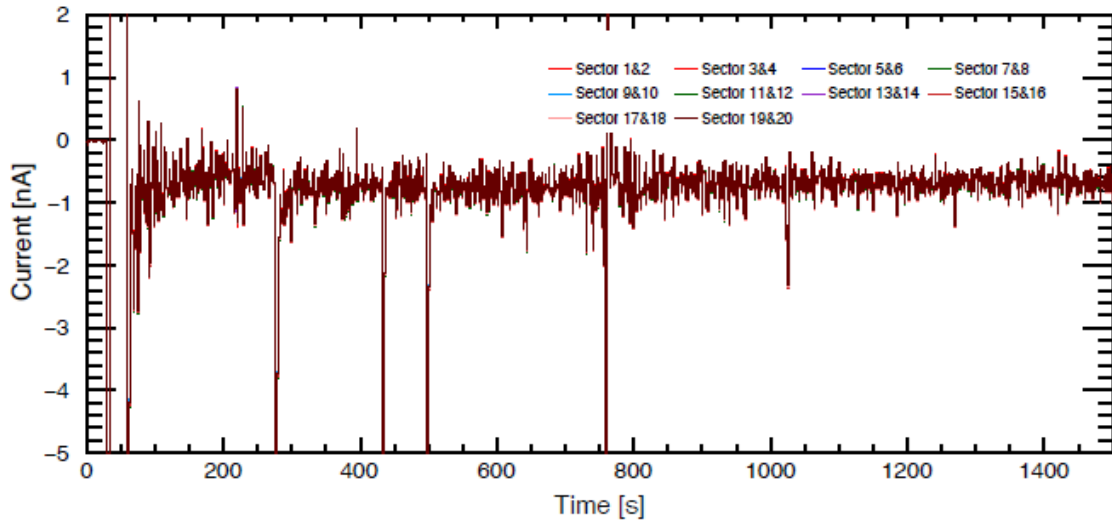
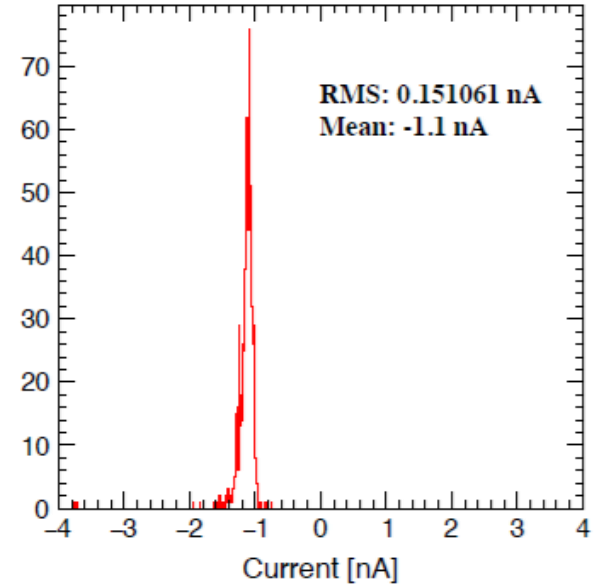
GEM TRACKER PRODUCTION @ SBU

GEM3 – 0.5 MΩ
N₂ @ 550V

Before Framing



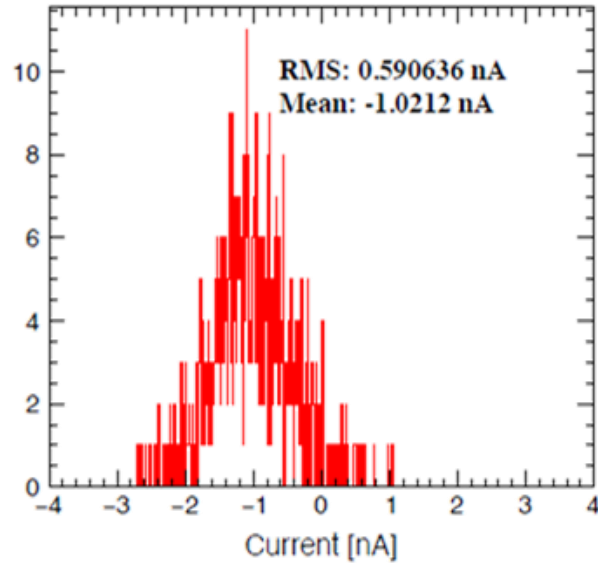
After Framing



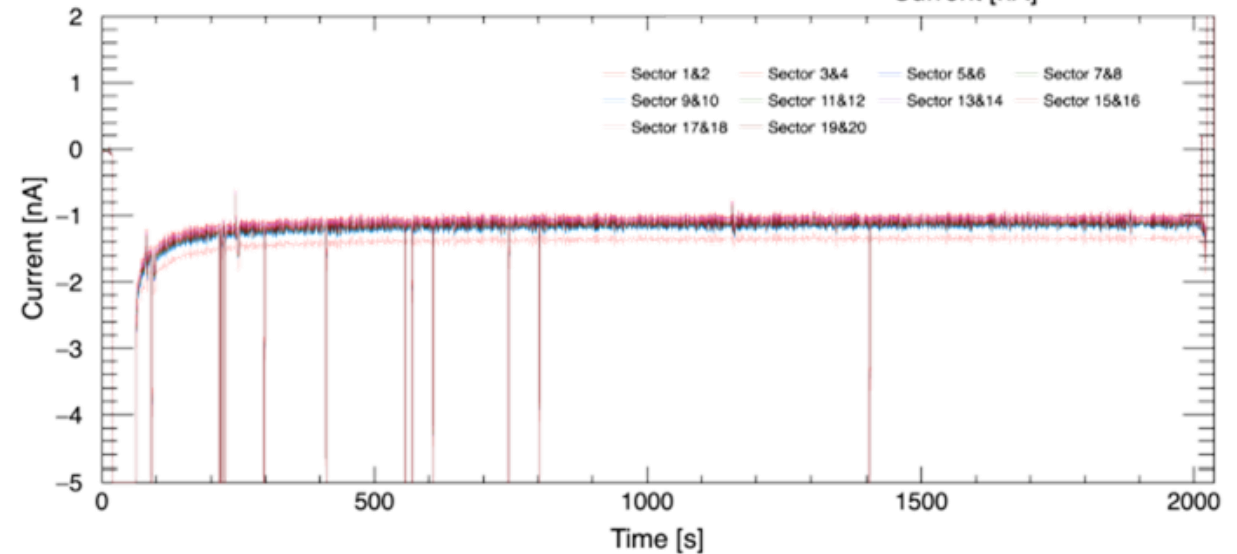
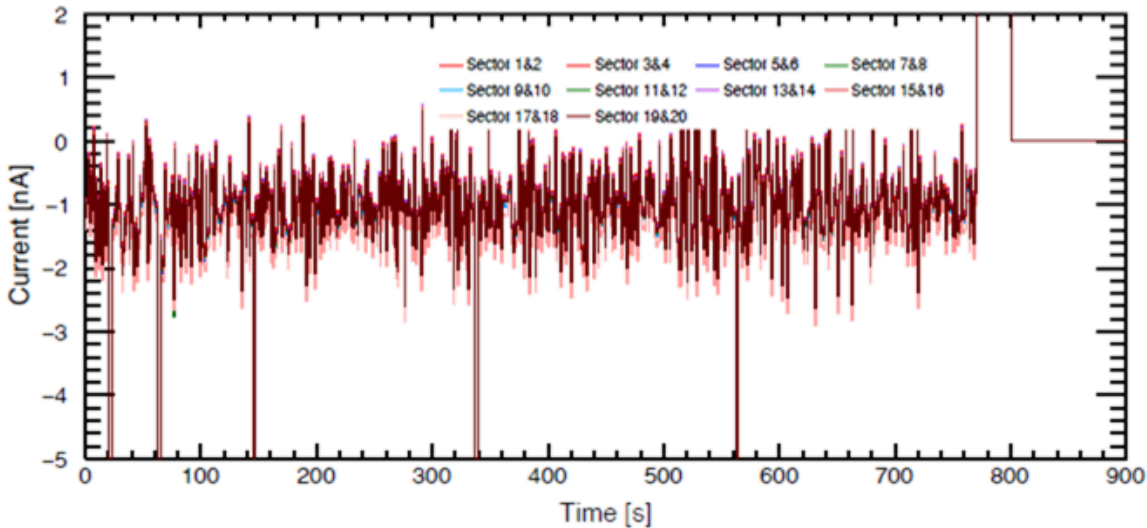
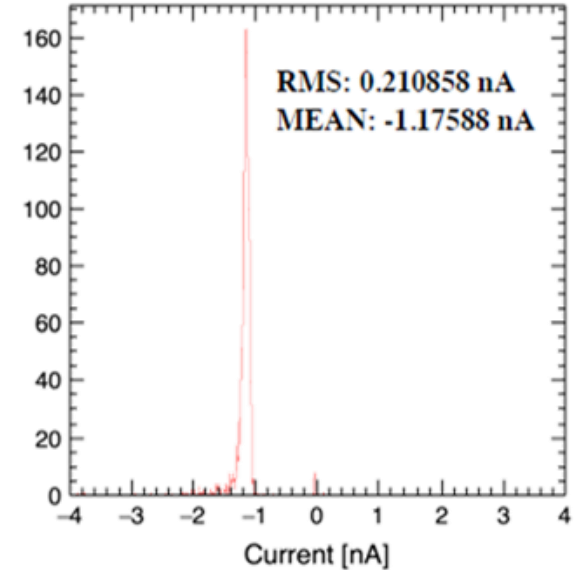
GEM TRACKER PRODUCTION @ SBU

GEM1/2 – 5 MΩ
N₂ @ 550V

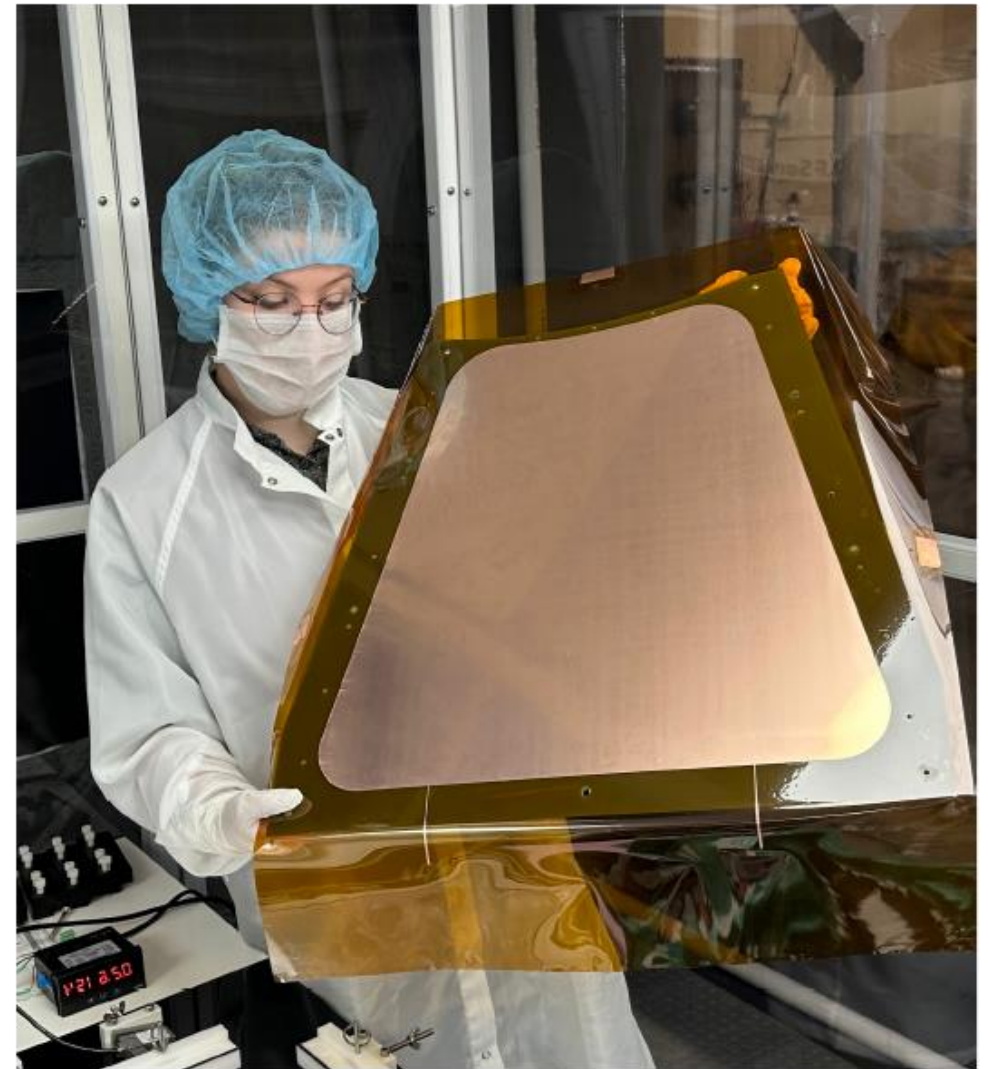
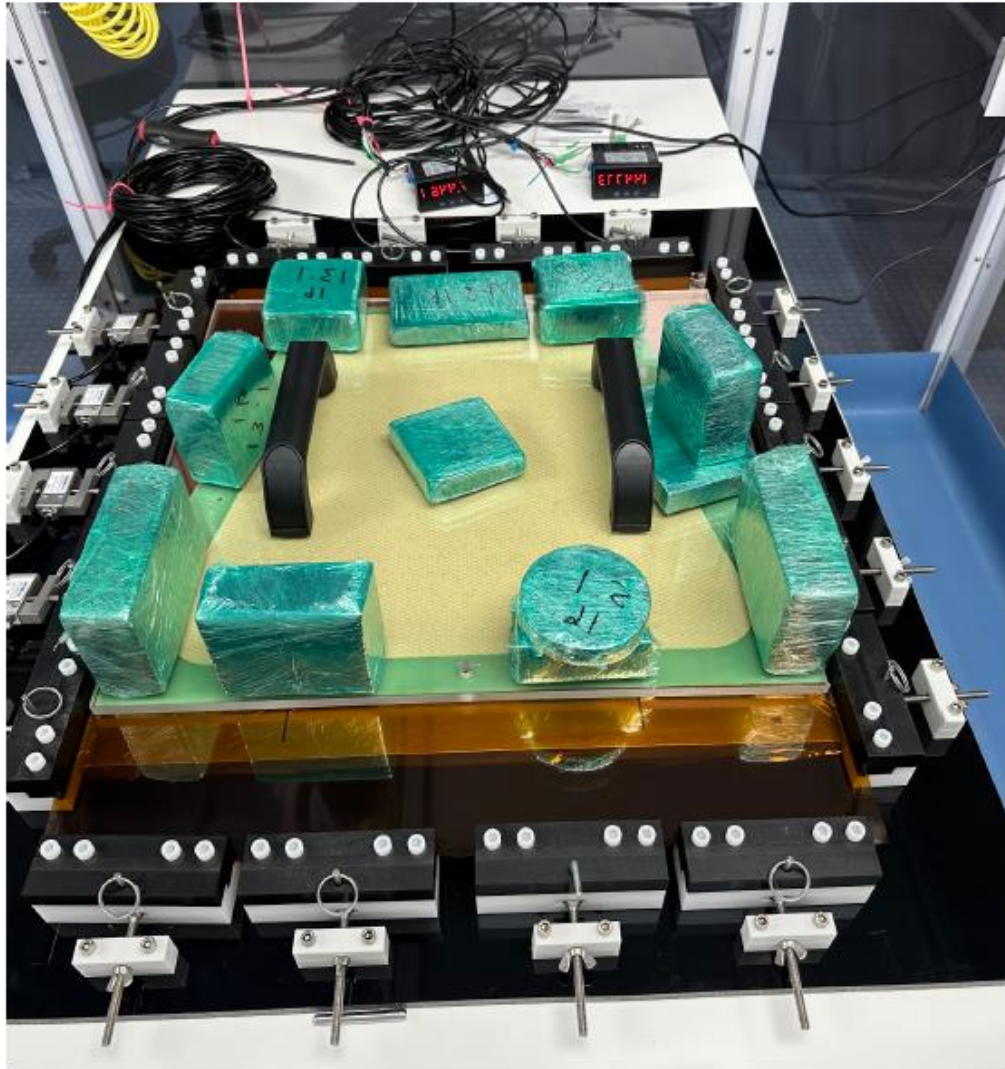
Before Framing



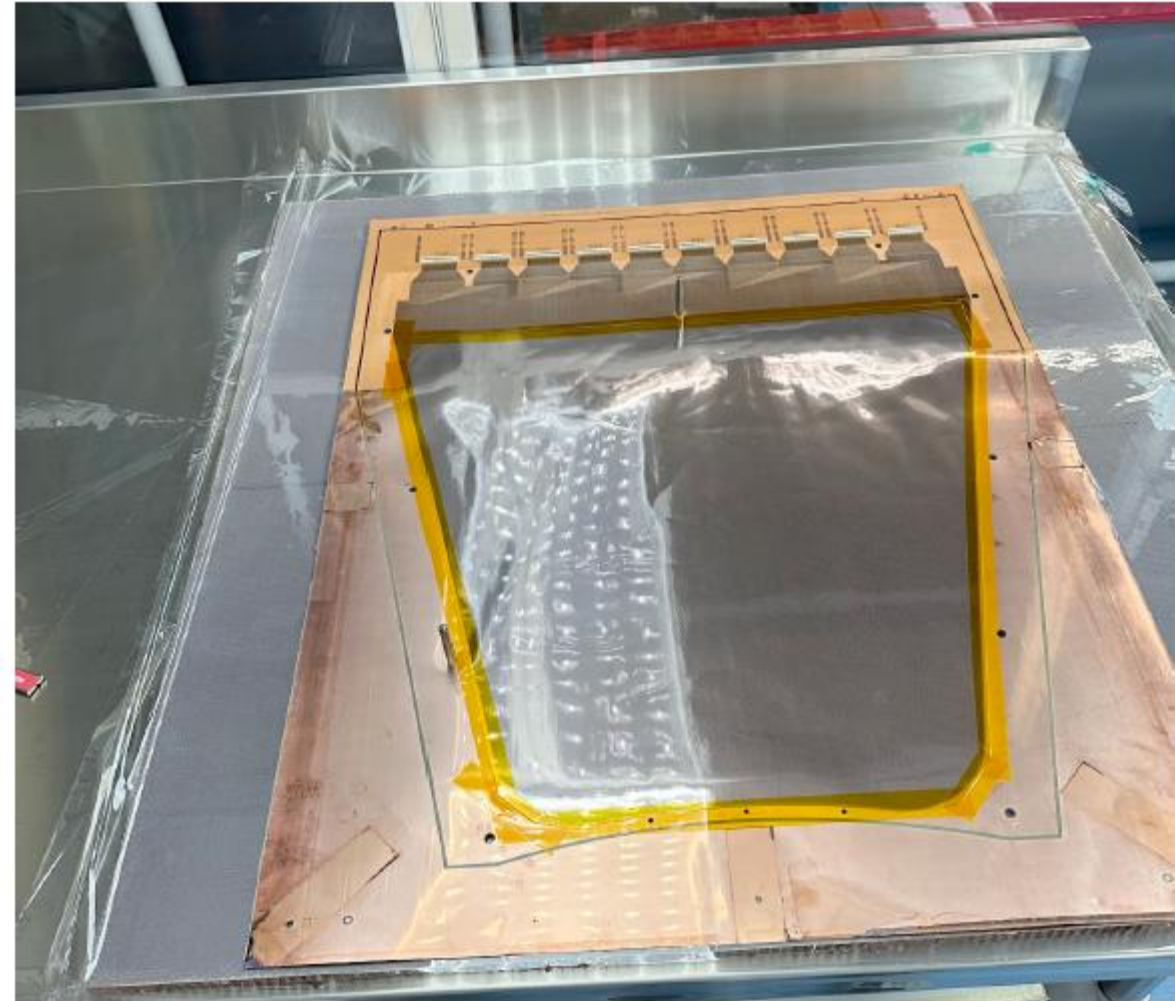
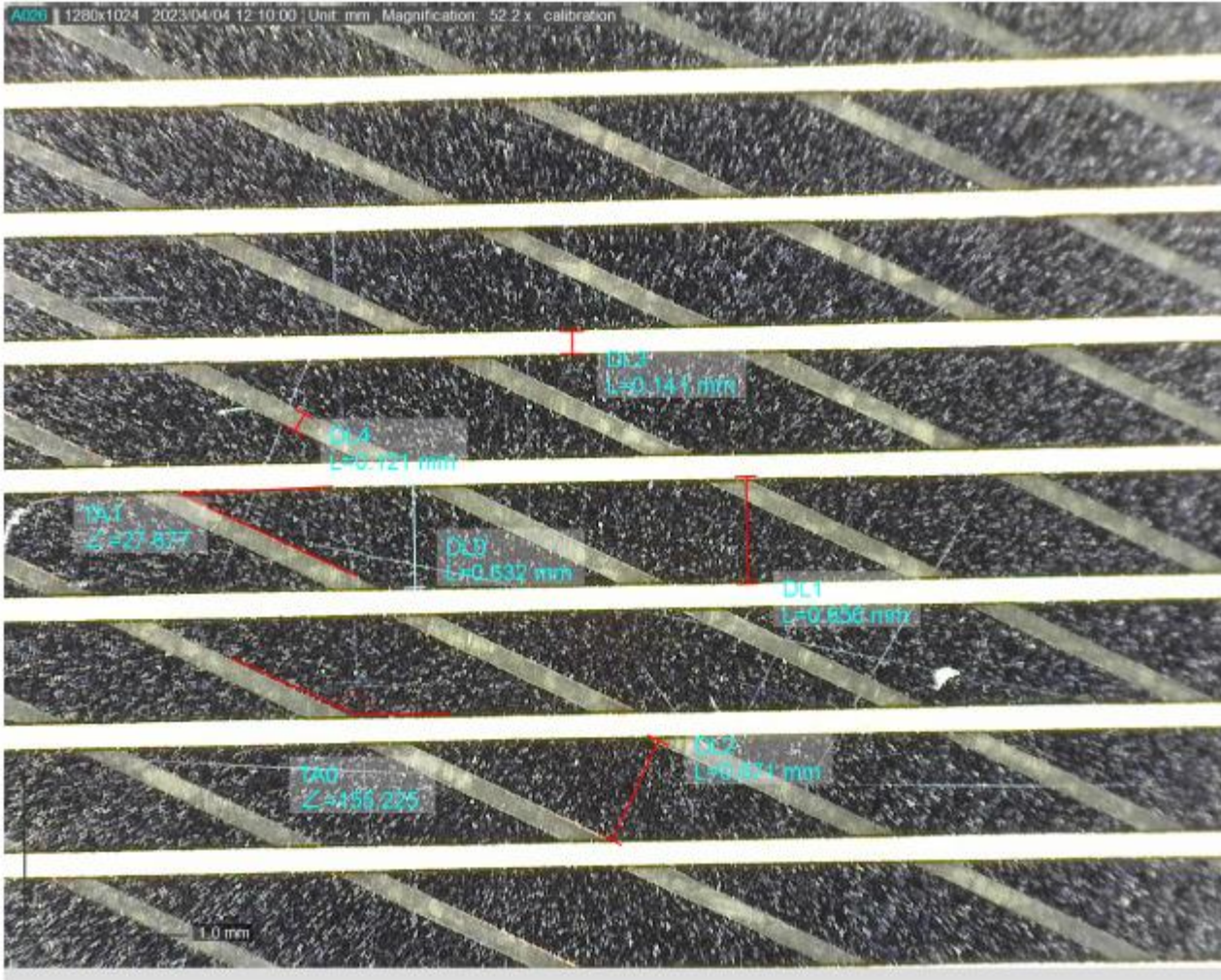
After Framing



GEM TRACKER PRODUCTION @ SBU

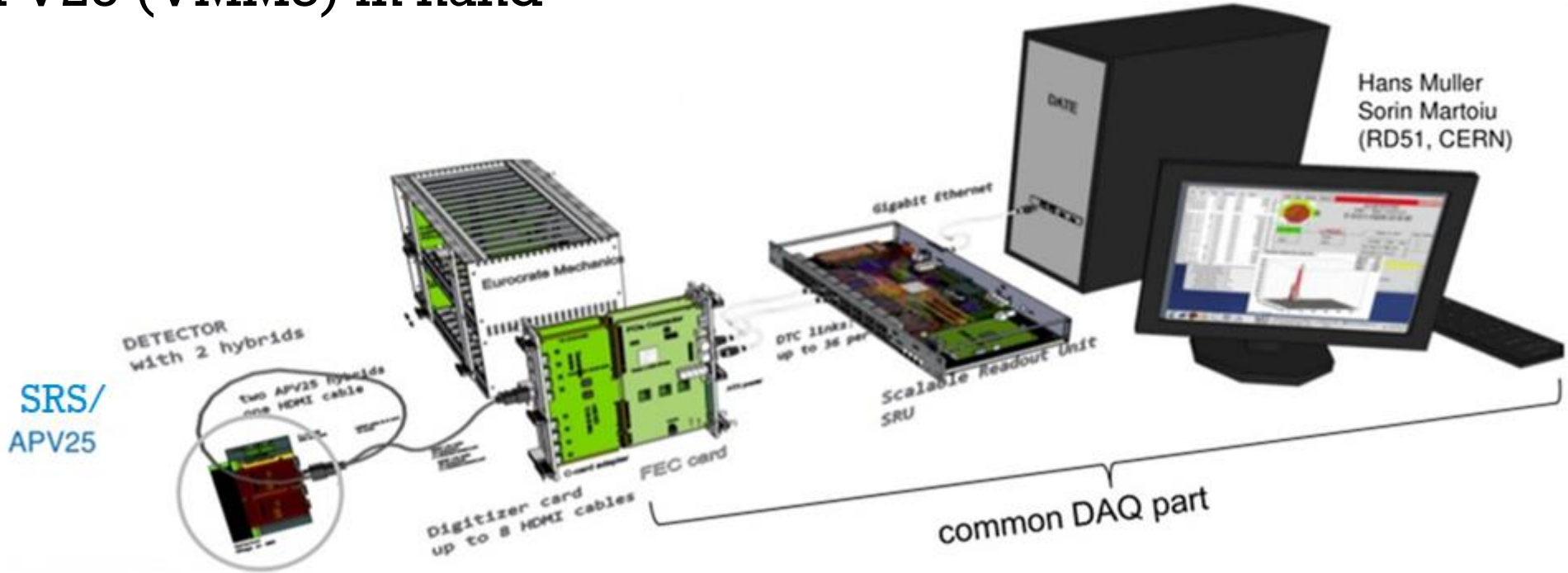


GEM TRACKER PRODUCTION @ SBU



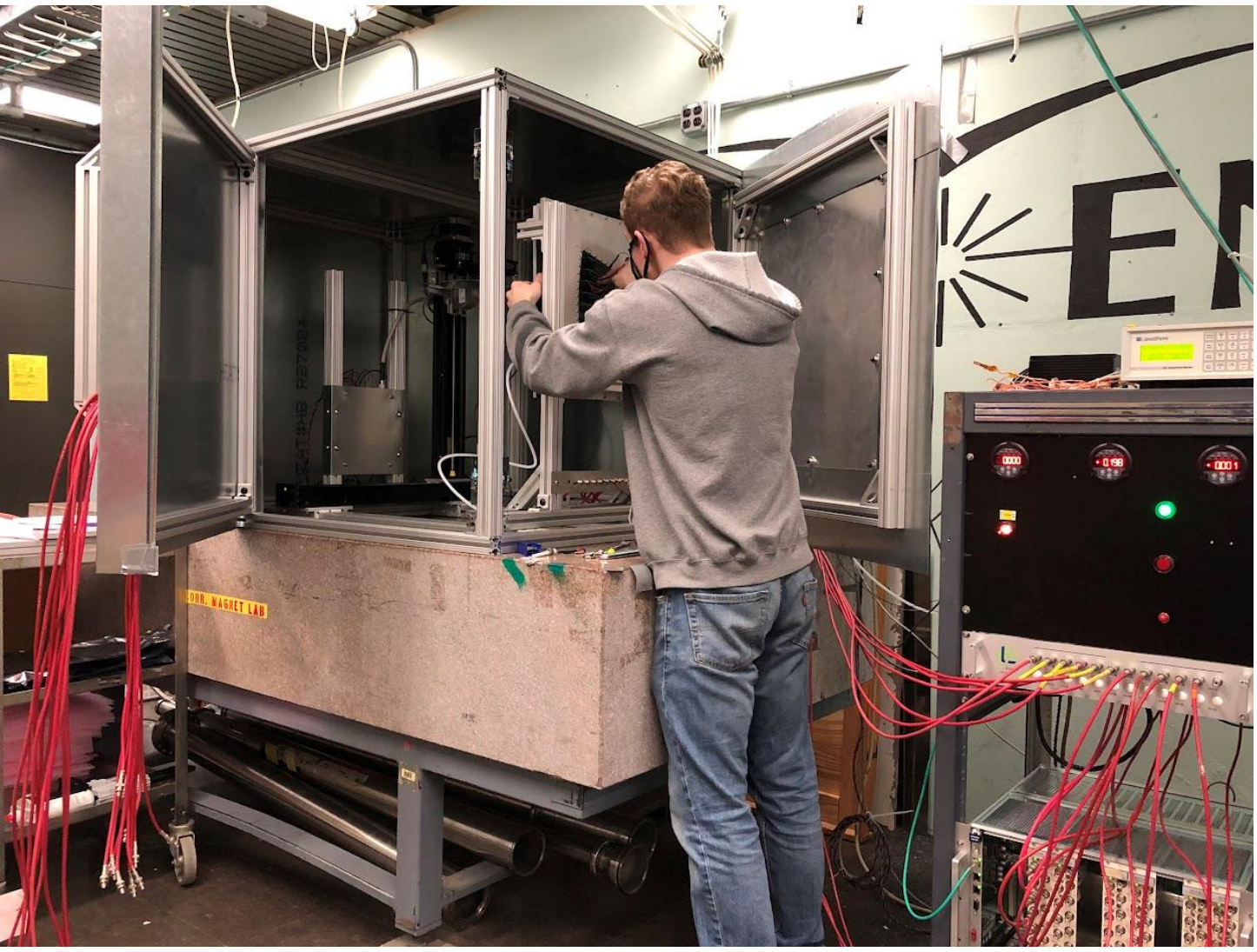
CHARACTERIZATION - READOUT

- SRS/APV25 (VMM3) in hand



- Plan is to get CODA system to SBU

CHARACTERIZATION – X-RAY



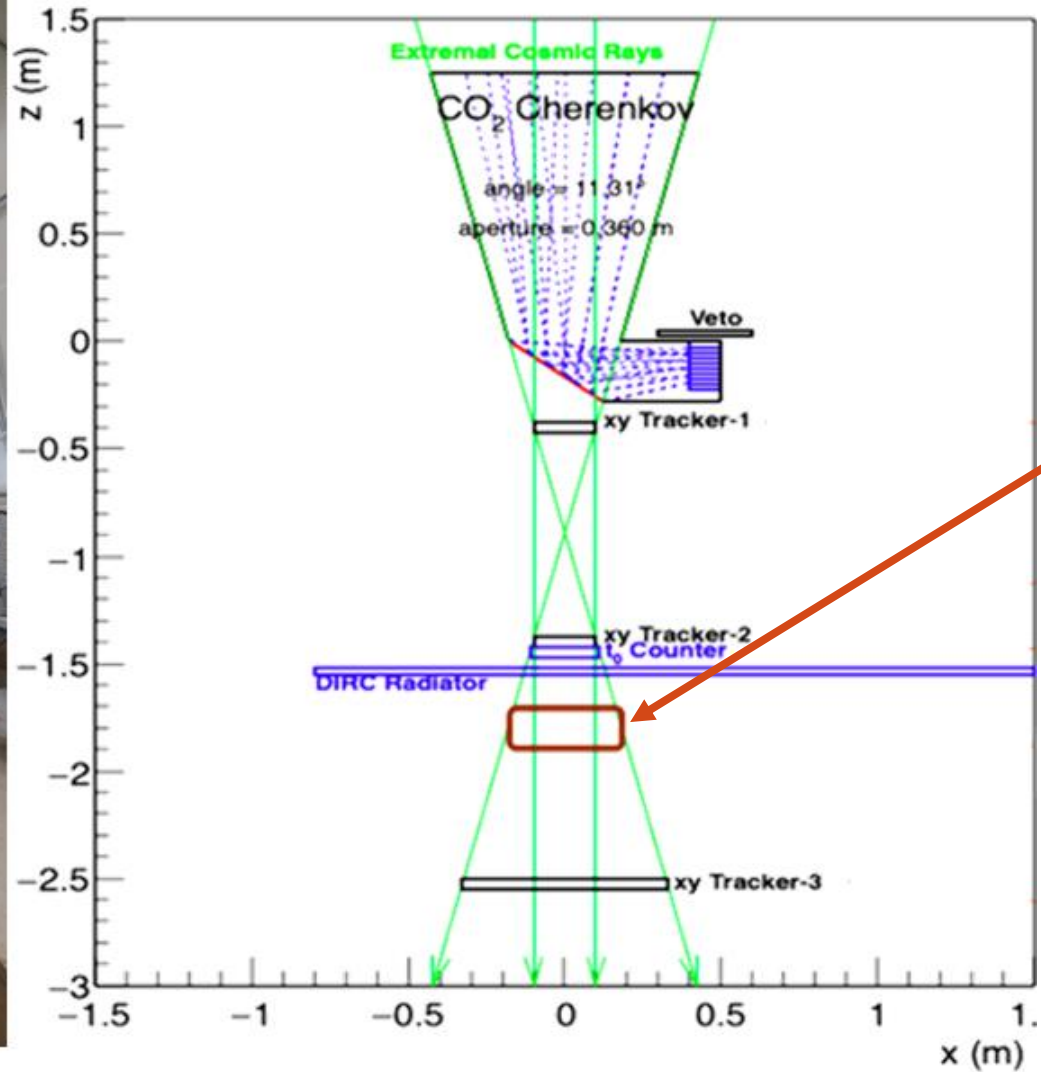
CHARACTERIZATION — X-RAY



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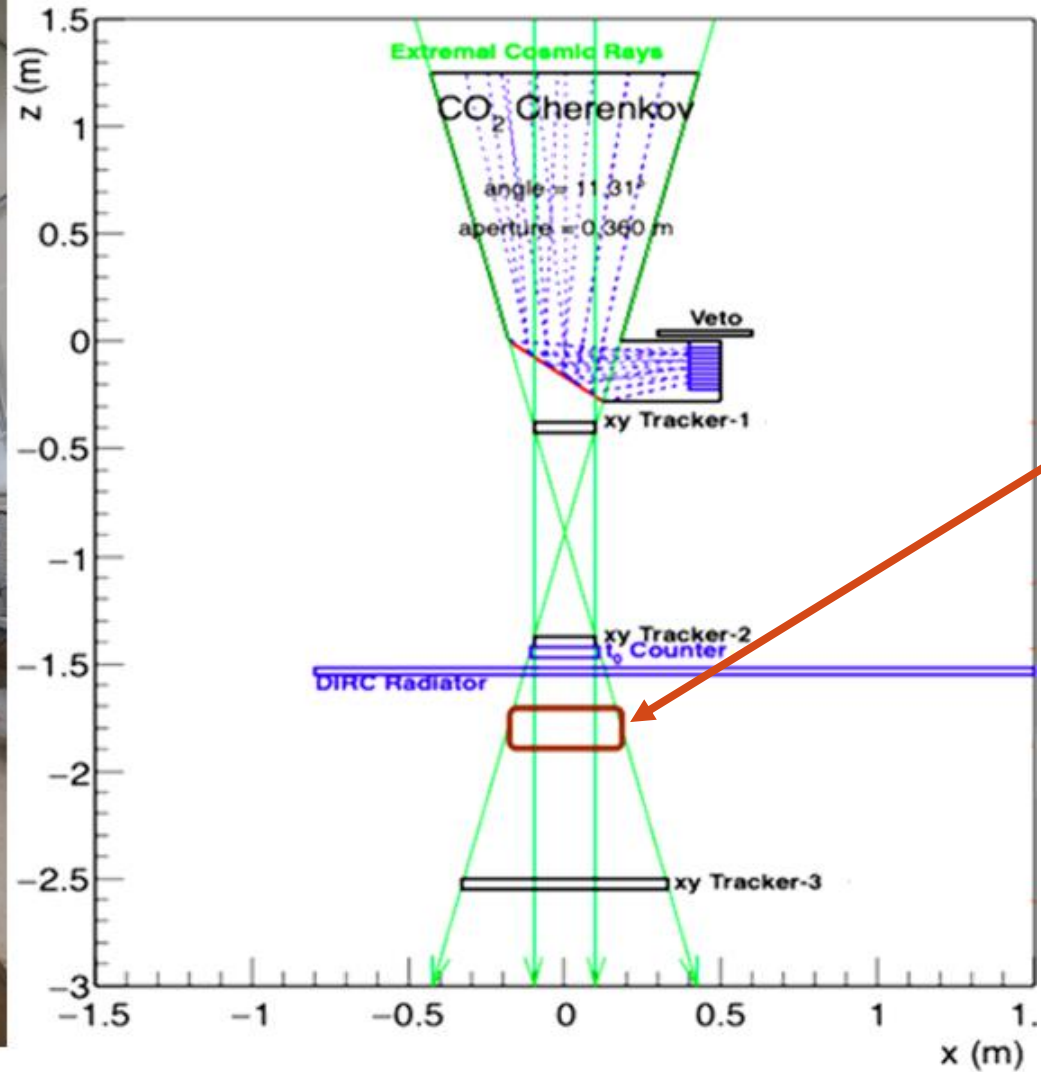


CHARACTERIZATION — COSMIC MUONS



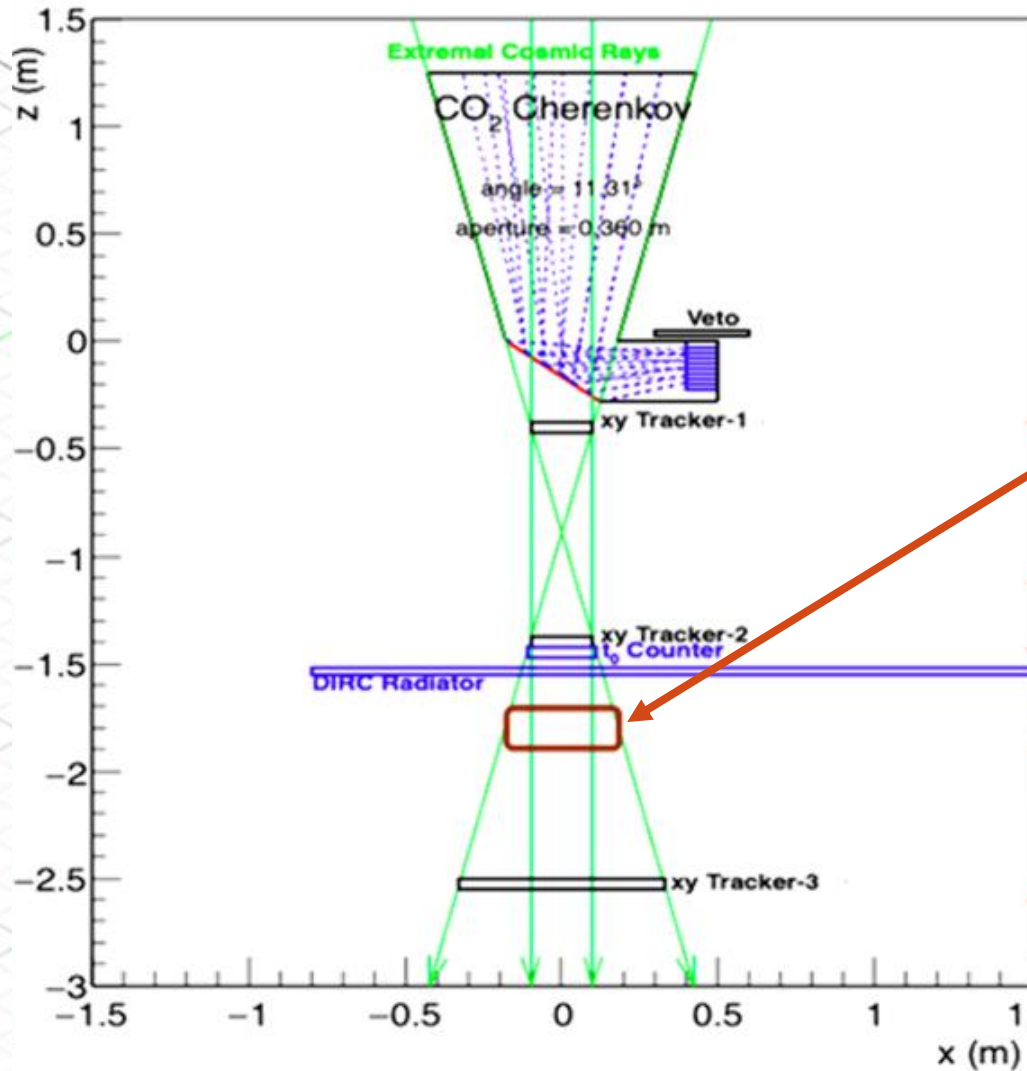
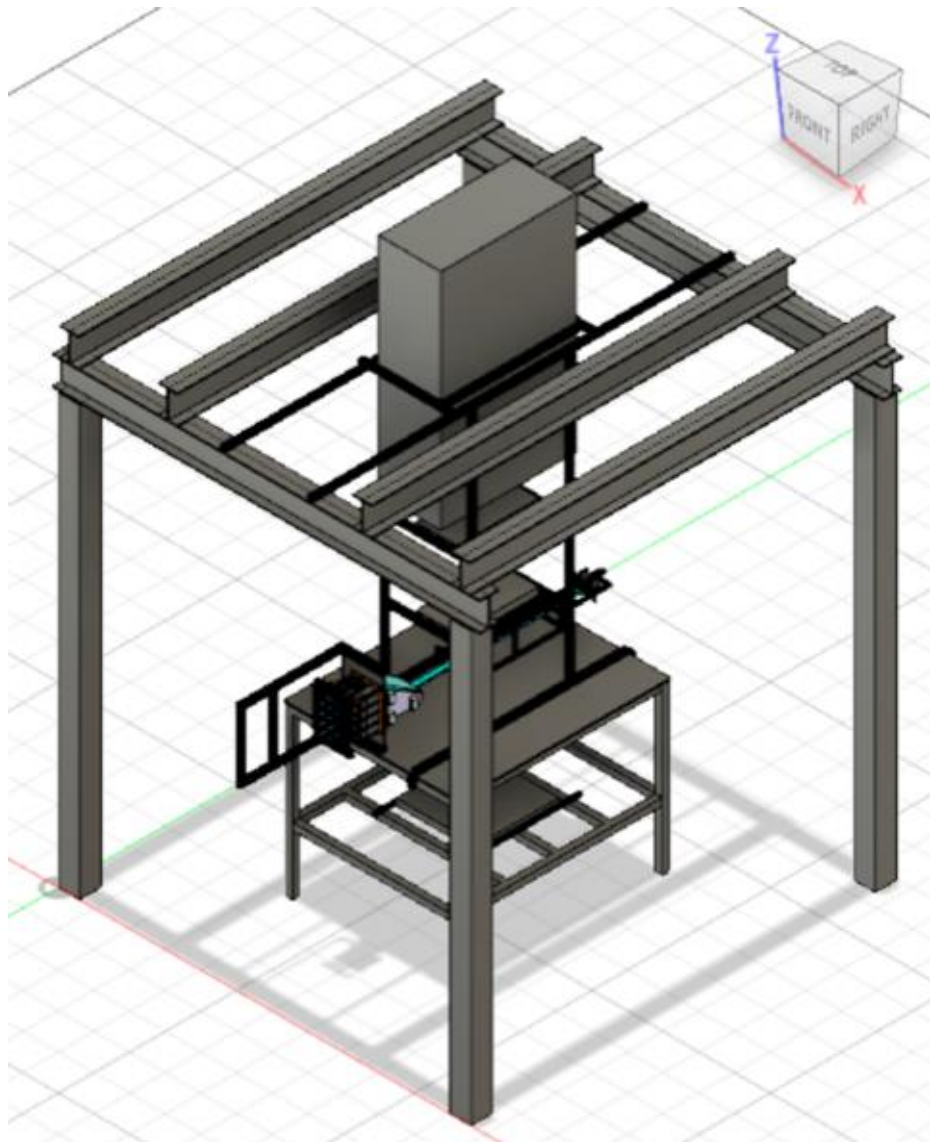
DUT:
MOLLER
GEM

CHARACTERIZATION — COSMIC MUONS



DUT:
MOLLER
GEM

CHARACTERIZATION — COSMIC MUONS



DUT:
MOLLER
GEM

SUMMARY (I)

- SBU is partnering with UVa toward Coordinate GEM tracker production
- SBU will produce
 - Two (three) engineering prototypes → opportunity: using them as final detectors
 - Pre-production prototype → opportunity: using it as final detector
 - 12 production trackers + yield spare
- 1st Engineering Prototype
 - Final assembly
 - X-Ray characterizing
 - Implementation into CRT setup
- 2nd (3rd) engineering prototype
 - Frame modifications

SUMMARY (II)

- Test beam effort
 - GEM DAQ test stand
 - Cosmic Ray Tagger setup at SBU
 - SPS test beam (NA60+ → Pb 150 GeV/nucleon) in October '23
- Pre-production prototype at the end of CY2023
- Production will start in early 2024 → after CD2/3 approval