MPGD ENDCAP Trackers (ECT) for ePIC

GEM–μRWELL technology

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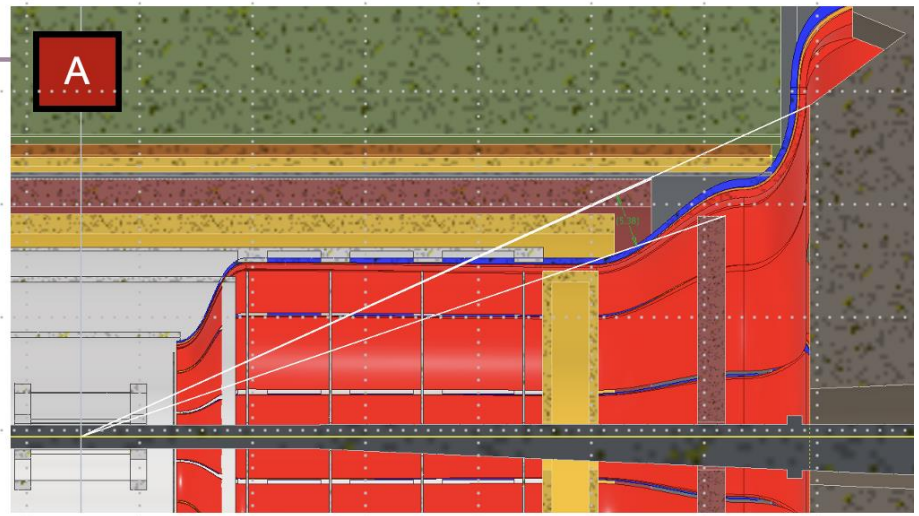
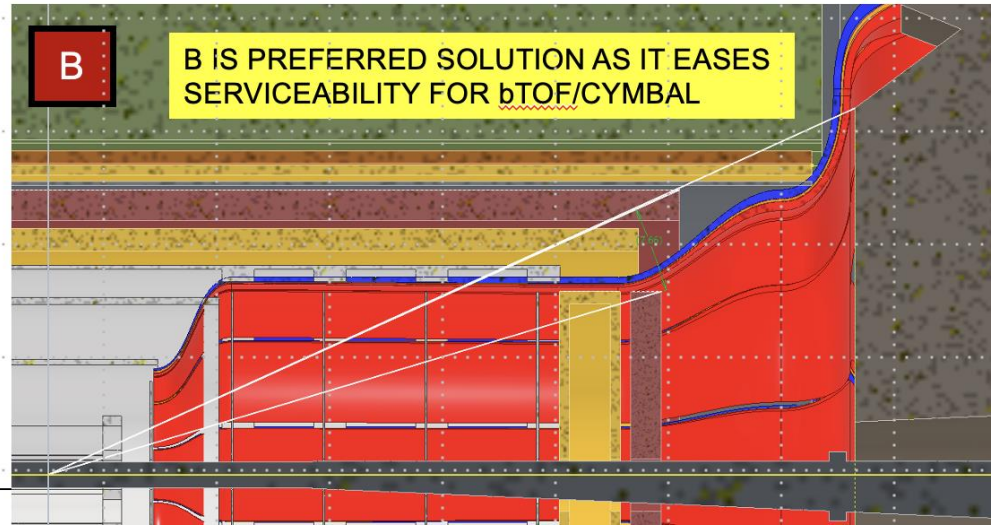
Electron-Ion Collider

The ePIC MPGD End Cap Tracker Envelope and Active Regions

Forward MPGD goes Backwards

- Requires moving the SVT disks towards IP. ToF will either be removable and supported by GST in option A or not removable and supported by the PST in option B.
- MPGD:
  - Inner Face Z: 1285mm
  - Thickness Z: 150mm
  - Outer Radius: 450mm
- A: ToF stays at current location
  - 5.4 deg ToF coverage angle
  - ToF Inner Face Z: 1675mm
  - ToF Thickness Z: 75mm
  - ToF Outer Radius: 600mm
- B: ToF is moved next to MPGD disks
  - 7.7 deg ToF coverage angle
  - ToF Inner Face Z: 1475mm
  - ToF Thickness Z: 75mm
  - ToF Outer Radius: 450mm





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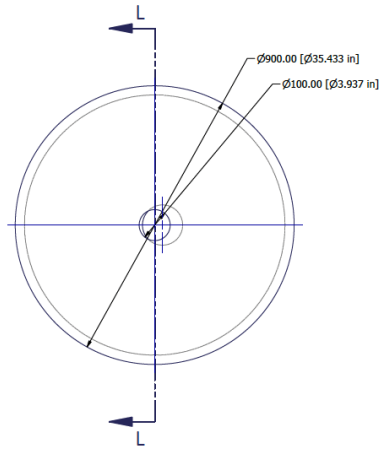
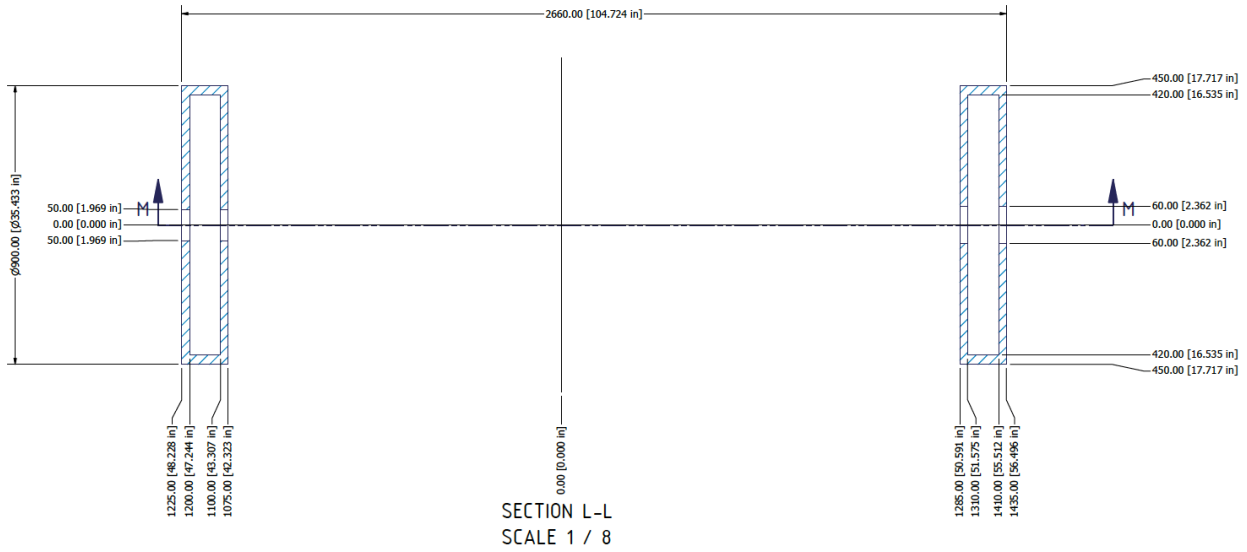
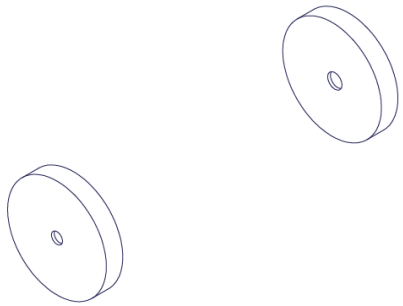
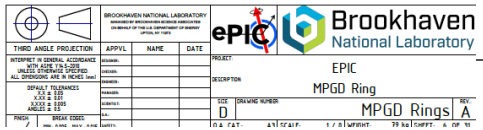




SECTION L-L
SCALE 1 / 8

SECTION M-M
SCALE 1 / 8





Both Lepton and Hadron disks have the same

Outer Diameter = 45 cm

Lepton ID = 5 cm

Hadron ID1 = 6 cm
Hadron ID2 = 9 cm

Zmin Hadron = 1285 mm

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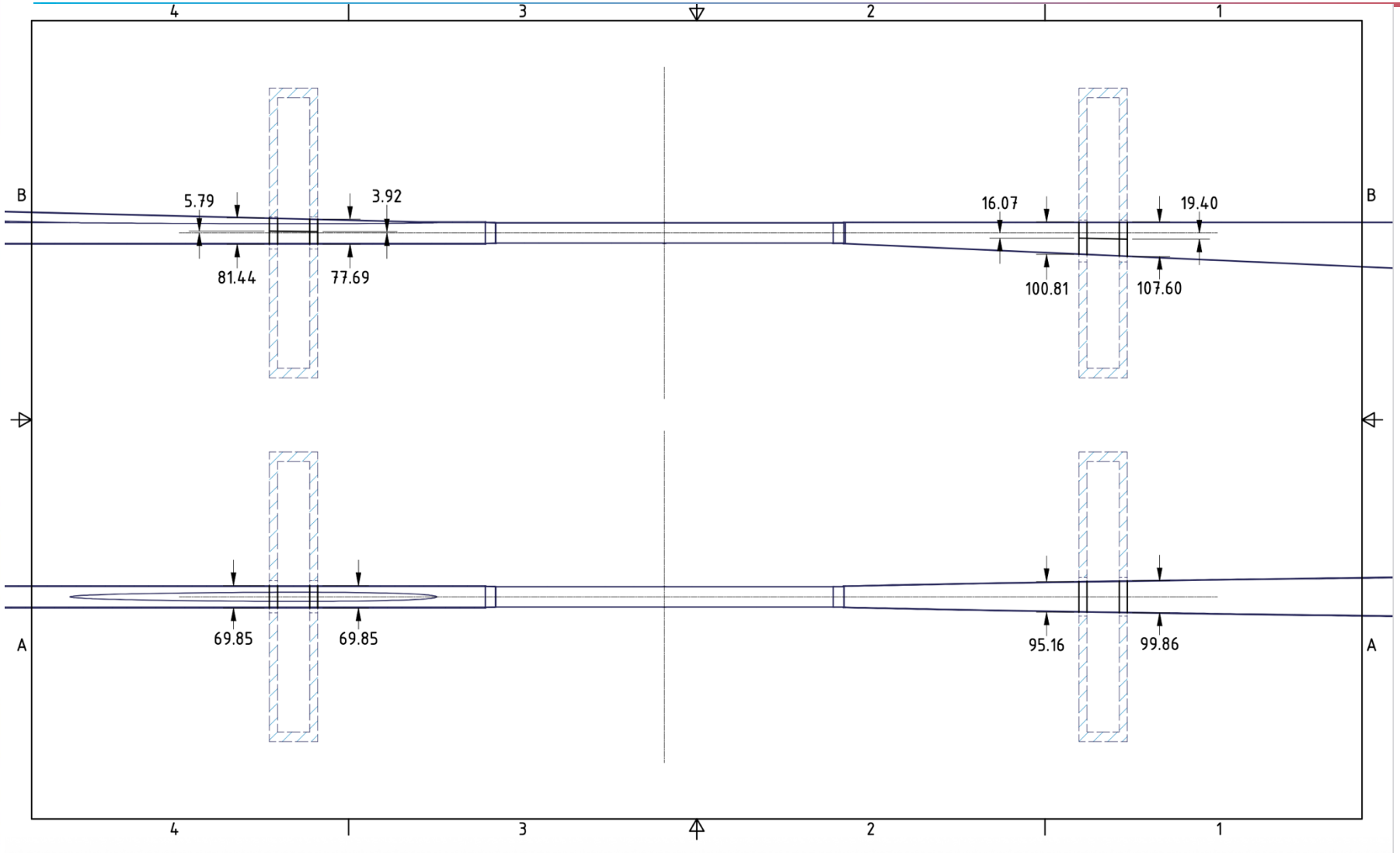

Lepton quadrant Internal radii of the active area

$$R=\frac{81.44}{2}+5.79+20=66.51\text{mm}$$

$$r=\frac{81.44}{2}-5.79+20=54.93\ \text{mm}$$

65 mm

Hadron quadrant Internal radii

$$R=\frac{107.60}{2}+19.40+20=93{,}2\ \text{mm}$$

$$r=\frac{107.60}{2}-19.40+20=54.4\ \text{mm}$$

95 mm

The ePIC MPGD End Cap Tracker Envelope and Active Regions

Previous estimations

Component	Z (cm)	Inner Active Reg. Radius (cm)	$\|\theta\|$ min (deg)	$\|\eta\|$ max	Outer Active Reg. Radius (cm)	$\|\theta\|$ max	$\|\eta\|$ min
HD MPGD 2	141	10.5	4.25	**3.29**	40	15.83	1.97
HD MPGD 1	128.5	10.5	4.68	**3.2**	40	17,29	1.88
LD MPGD 1	-107.5	6.5	3.46	3.5	40	20,4	1,71
LD MPGD 2	-120	6.5	3.1	3.6	40	18.43	1.81

Present estimations

Component	Z (cm)	Inner Active Reg. Radius (cm)	$\|\theta\|$ min (deg)	$\|\eta\|$ max	Outer Active Reg. Radius (cm)	$\|\theta\|$ max	$\|\eta\|$ min
HD MPGD 2	141	9.5	3,85	**3.39**	40	15.83	1.97
HD MPGD 1	128.5	9.5	4.23	**3.29**	40	17,29	1.88
LD MPGD 1	-107.5	6.5	3.46	3.5	40	20,4	1,71
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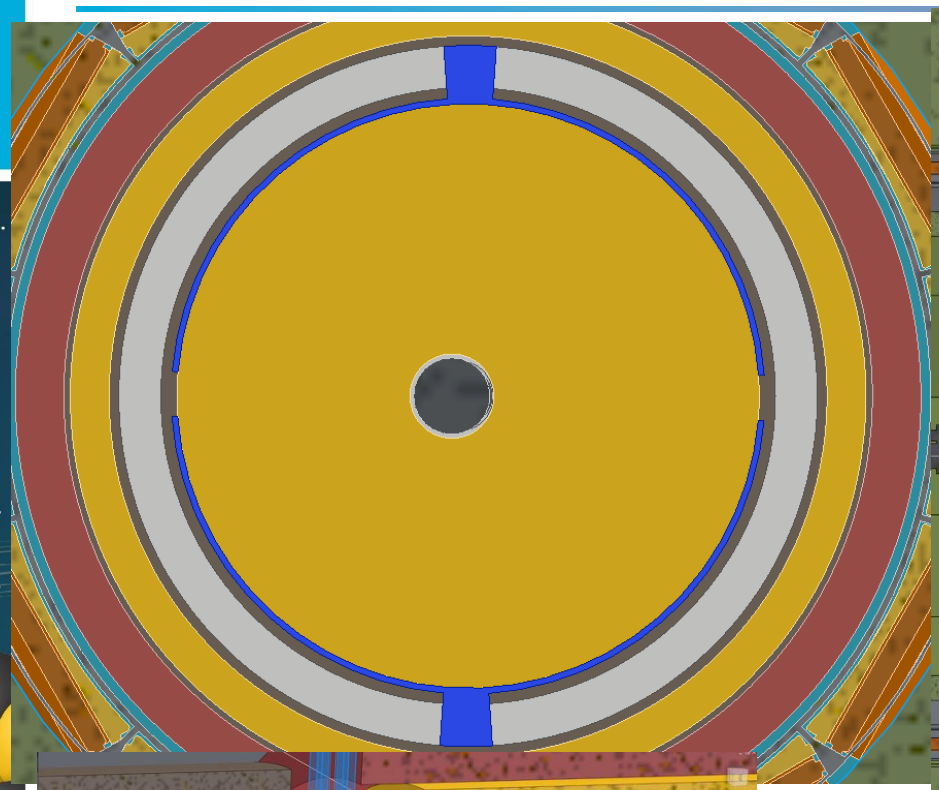
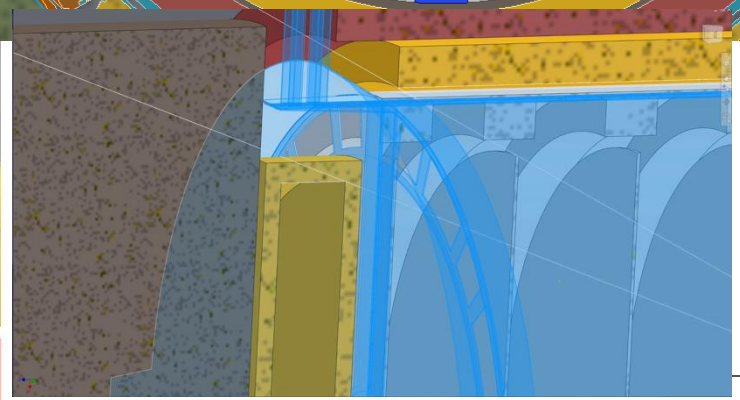
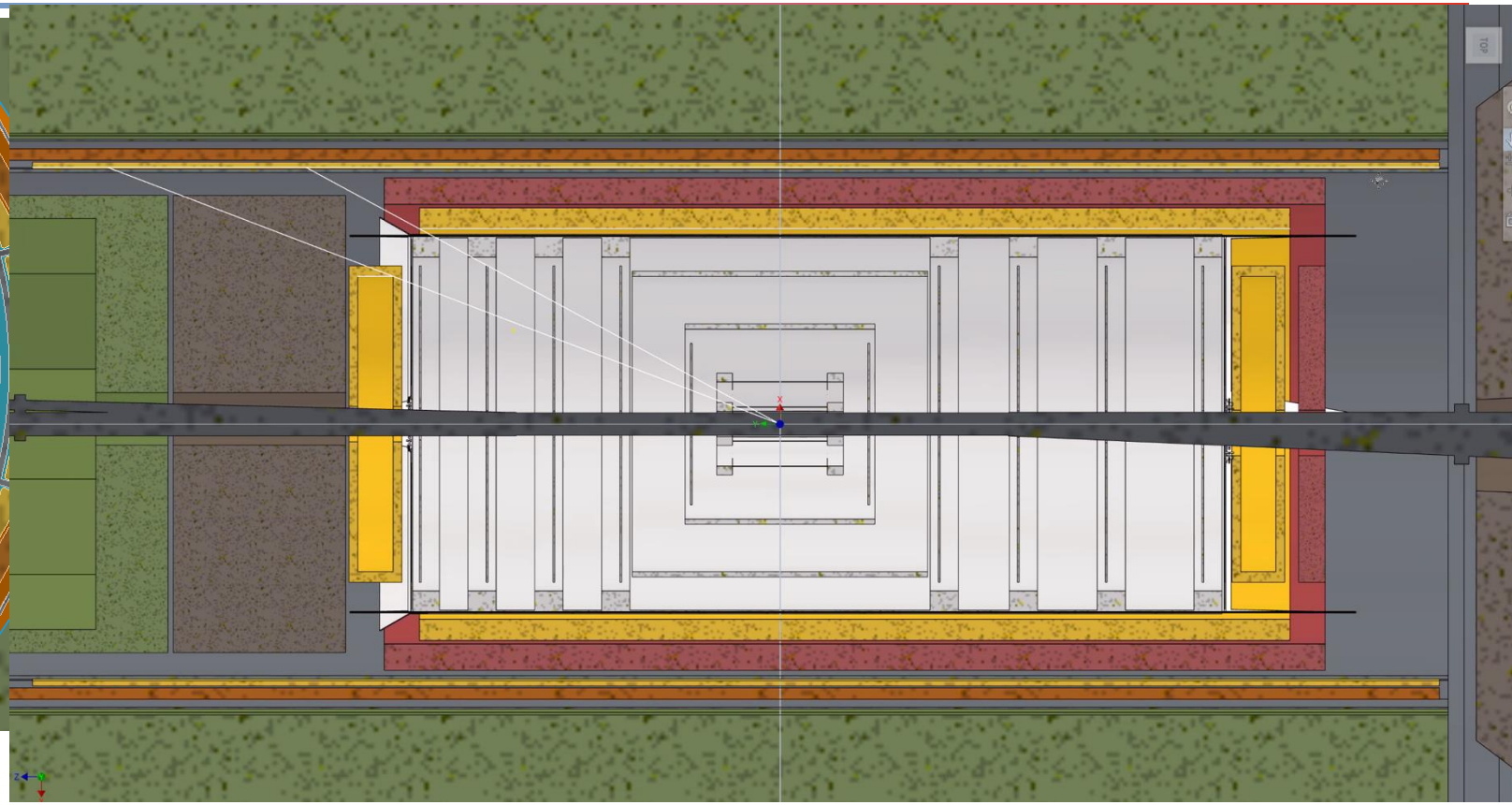
The ePIC MPGD End Cap Tracker Envelope and Active Regions







- Do the services need to come out transversely from the lepton side and longitudinally from the hadron side?
- Can we have 4 spaces for services at 90 degrees instead of two spaces at 180?

Electron-Ion Collider

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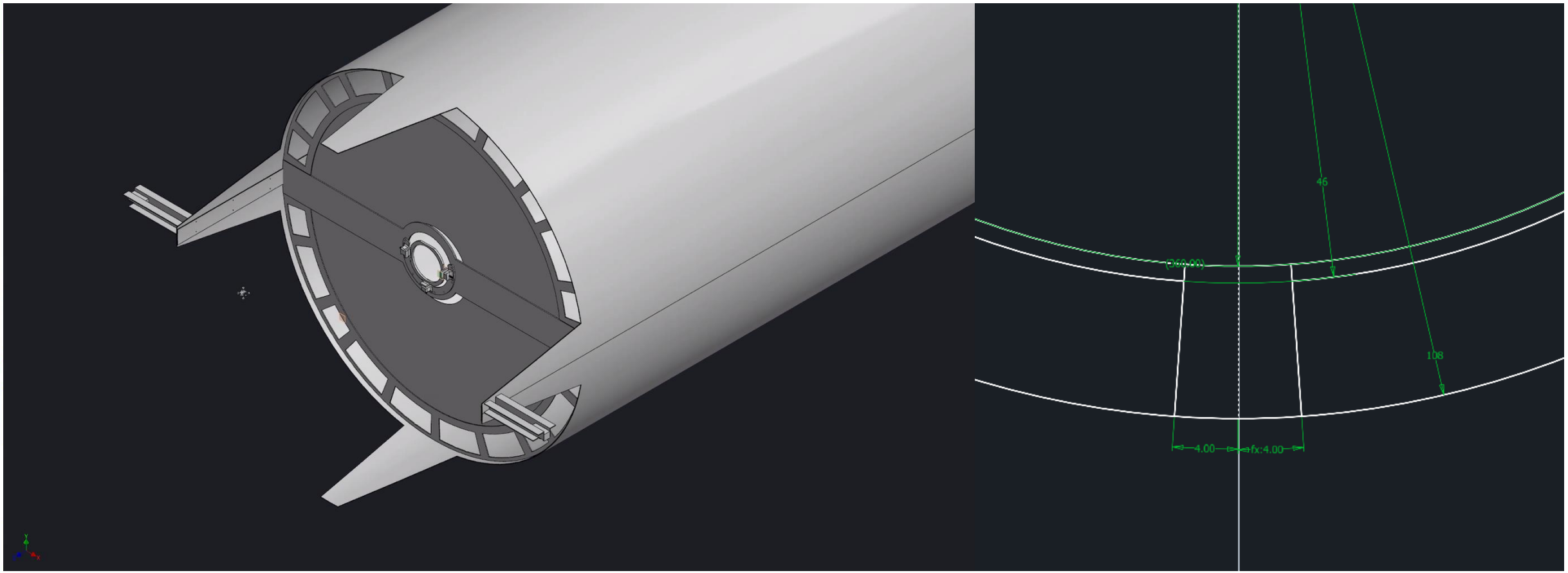
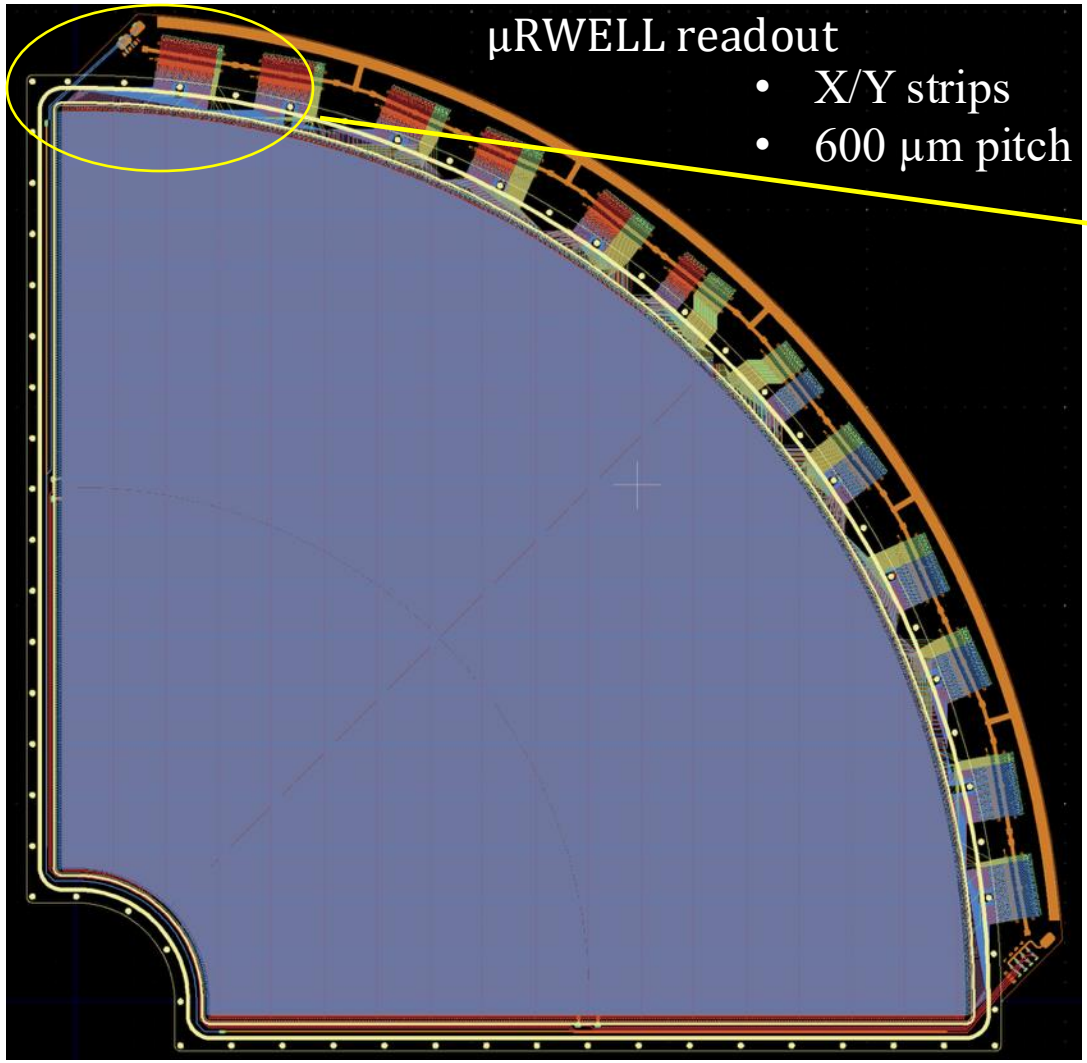
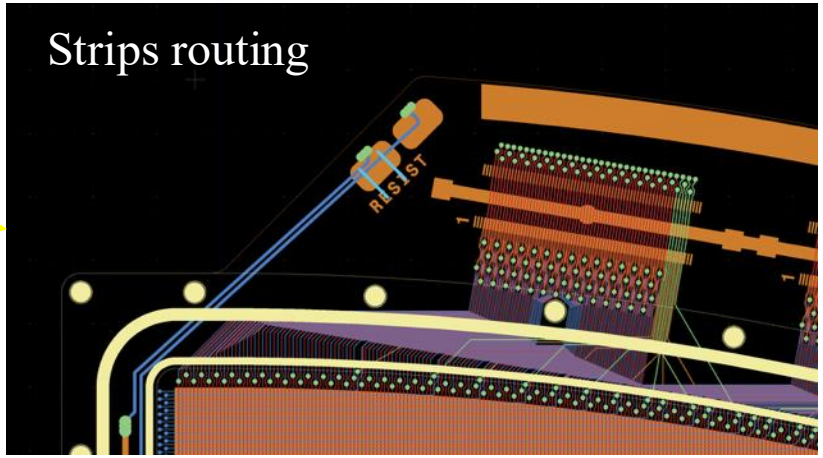


Are the lids in the way of the vertical spaces for the lepton side?

MPGD-ECT: PED Test Article Module

By Stefano Gramigna

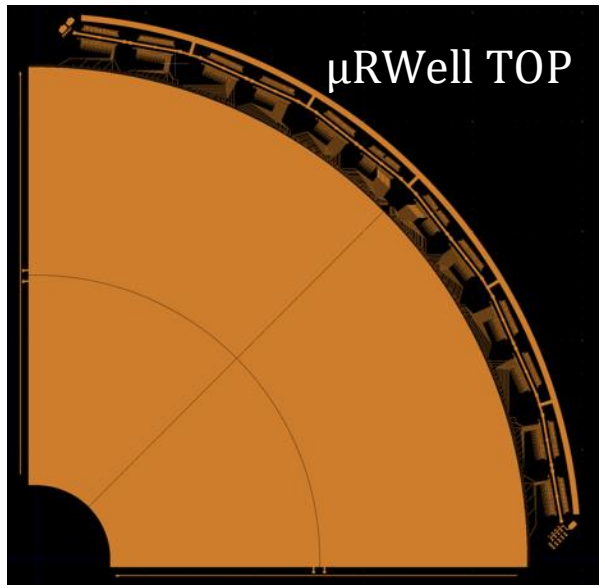


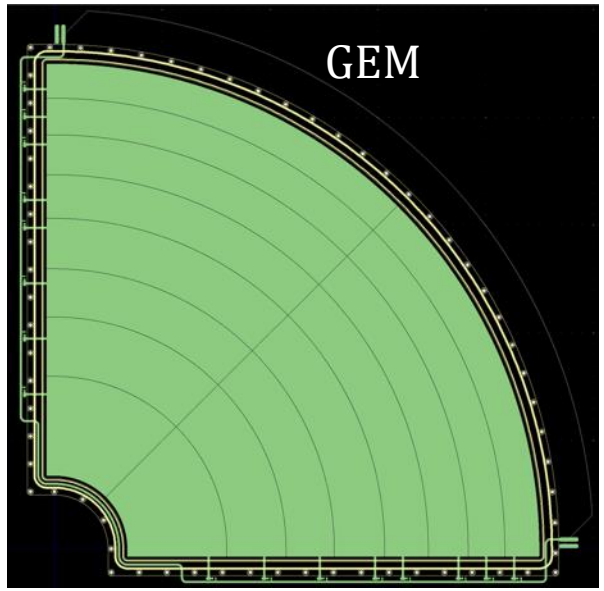


(X, Y) readout

→ no FEB in the active area

Detector delivery expected by Oct. 2025





GEM-µRWELL-ECT: Integration To do list

Send the required inner-radius & clearance numbers (per side) for the MPGD disks, reflecting the current beam-pipe profile and Z positions, and the beam-pipe clearance

- Revisit the definition of envelope for the disk and what part of the services are included in the envelope
- Confirm and share the service-space allocation for MPGD near the four attachment regions (both φ-span and available radial thickness/height), not just total cross-section percentages.
- Identify and propose patch-panel locations
- Coordinate with MPGD on cable-tray tie-ins at the four tabs; state how much of the shared window space can be reserved for MPGD trays.
- Recalculate layout/routing for the reduced-radius scenario: update from 6 → 5 front-end boards, ~625 µm pitch, and quantify impacts on single-hit resolution and acceptance/coverage
- Based on engineering inputs, specify any outer-radius access clearance needed for connector mating if not pre-cabled; if pre-cabling is required, state lead lengths and handling constraints.
- Provide an updated services table to the engineering group
- Since we need to consider the option of coupling the MPGD with PST, we need to understand the constraints on the services and maintenance of the disk

To answer some of these points from our end:

- Send the required inner-radius & clearance numbers (per side) for the MPGD disks, reflecting the current beam-pipe profile and Z positions, and the beam-pipe clearance
  - Attached is a drawing showing the beam pipe dimensions at the relevant locations.
- Revisit the definition of envelope for the disk and what part of the services are included in the envelope
  - I think this needs more discussion, but in this case, I would say the routing into bundles at 12 and 6 o'clock is part of the detector envelope and beyond that is not.
- Confirm and share the service-space allocation for MPGD near the four attachment regions (both φ-span and available radial thickness/height), not just total cross-section percentages.
  - Roland will reply shortly with some images/numbers which should help clarify this.
- Identify and propose patch-panel locations
  - I think we can look at having patch panels near the ends of the GST, but generally we don't have additional space near the detectors for patch panels that isn't in the detector envelope.
- Coordinate with MPGD on cable-tray tie-ins at the four tabs; state how much of the shared window space can be reserved for MPGD trays.
  - Roland's envelope includes the supports.
- Recalculate layout/routing for the reduced-radius scenario: update from 6 → 5 front-end boards, ~625 µm pitch, and quantify impacts on single-hit resolution and acceptance/coverage
  - To be answered by MPGD disk group.
- Based on engineering inputs, specify any outer-radius access clearance needed for connector mating if not pre-cabled; if pre-cabling is required, state lead lengths and handling constraints.
  - To be answered by MPGD disk group.
- Provide an updated services table to the engineering group
  - To be answered by MPGD disk group.
- Since we need to consider the option of coupling the MPGD with PST, we need to understand the constraints on the services and maintenance of the disk
  - To be answered by MPGD disk group.