SVT Working Meeting Dec 2025 Oxford
SVT simulation software status

- **IB –** update by Shujie Li 25.10
- **OB –** update Sam Henry, Athavan Ramalingam, Aditya Yalavatti 25.10

Sam Henry

SVT Inner Barrel

PR803 (Shujie Li, LBNL)

Until ePIC 25.08:
- 128 box shape per layer to approximate the cylinder
- No RSU structure
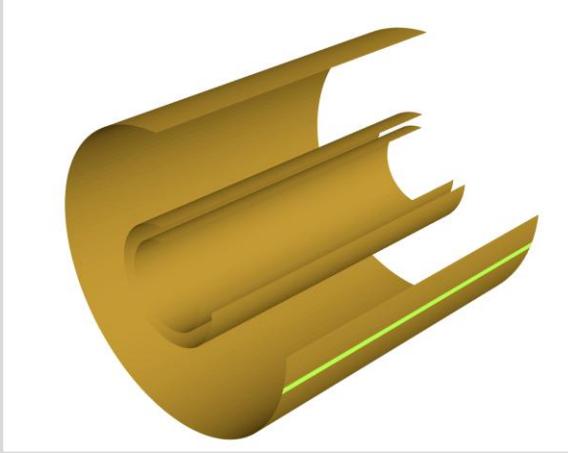
ePIC 25.10:
- Curved RSU sensor with inactive areas
- IB support structure and cables

Stp file of the design → simplified 2D CAD drawings → dd4hep geo description
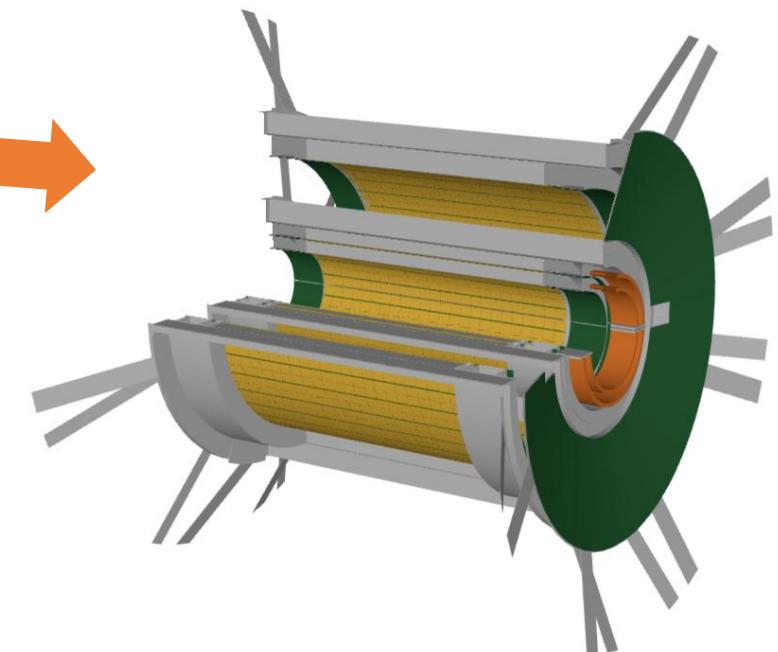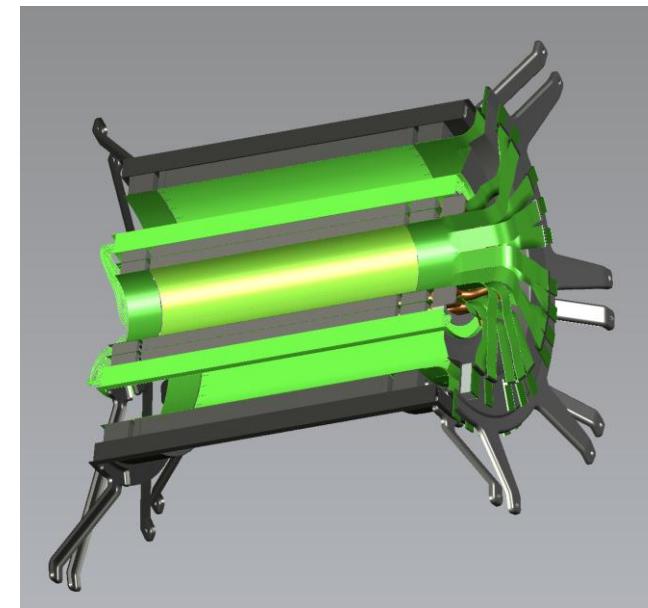
RSU in Simulation

Bottom half of the RSU:

biasing
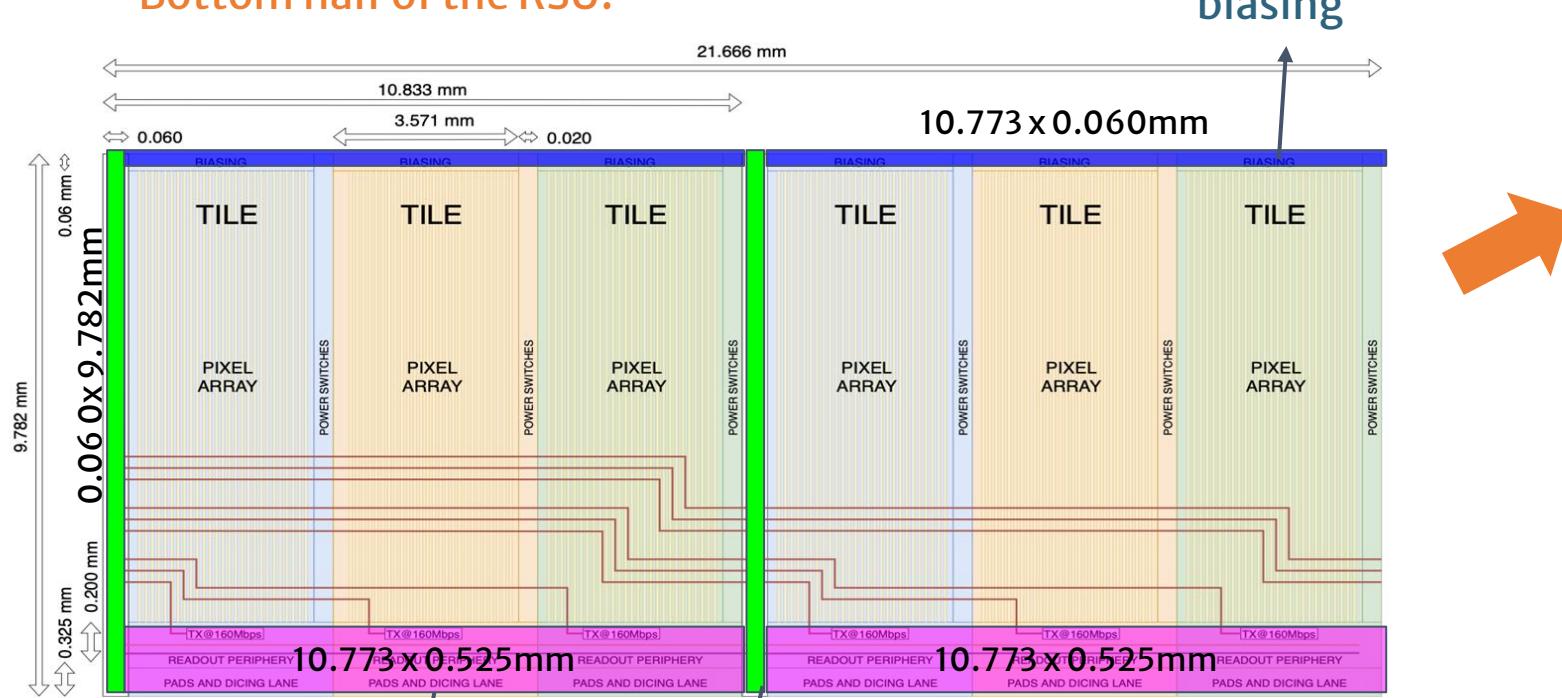
Figure 3.37: Architecture of the bottom half sensor unit (not to scale).

readout&dicing (may shrink in the actual design)

backbone

2x2 sections, 3 tiles/section:


Curved RSU in simulation:

3

Assemble the IB layer:

Drawing: Draft_Half_Asm_L0L1.pdf from R.Turrisi. See PR803 for details

IB	# of sensors	Rows per sensor	Total # of rows
L0	4	3	12
L1	4	4	16
L2	8	5	40

r=38mm, 50.3mm, 125.2mm

L0:

34   131.5   134.5   35   55

Cables not in simulation

Active area length = 12RSU/row = 26.6cm

FPC (digital + analog) = 2x100um of Aluminum

Combine and average FPC cables from L0 and L1 along the cone (see next page)

FPC (digital + analog+signal) = 3x100um of Aluminum
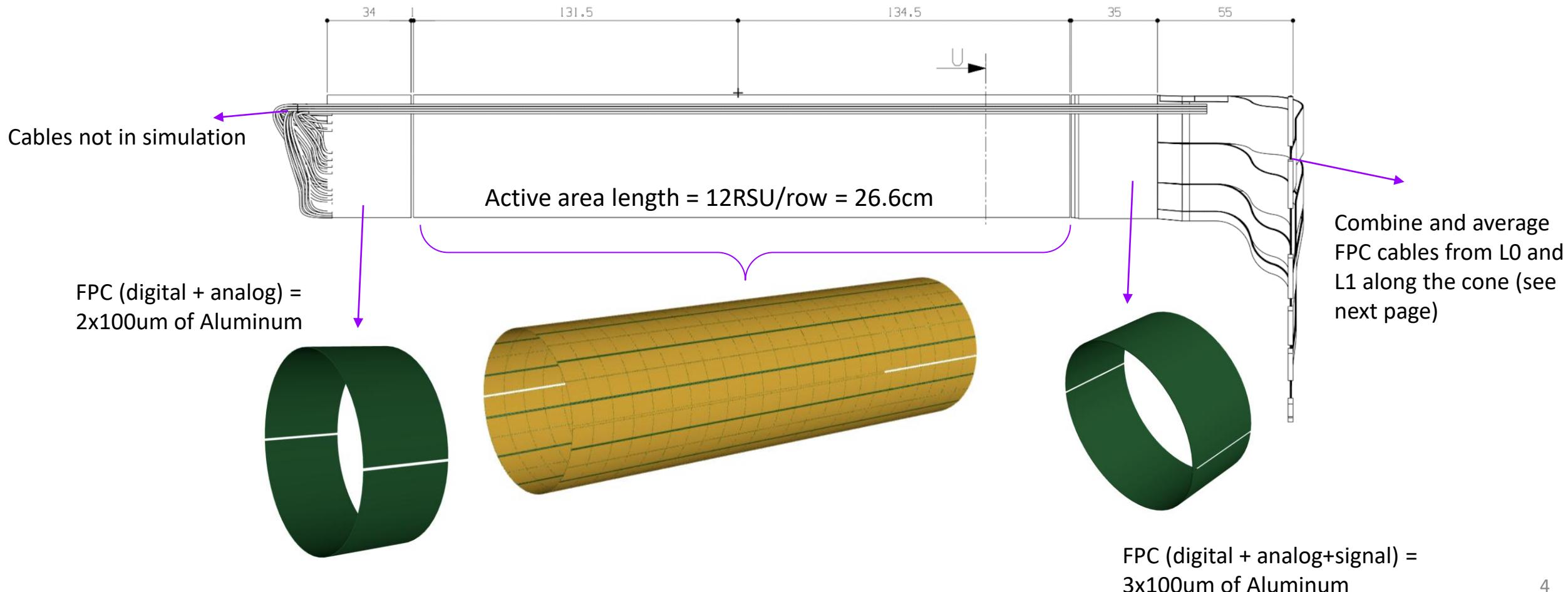
Build Mechanical structures with Simple TGeo Shapes
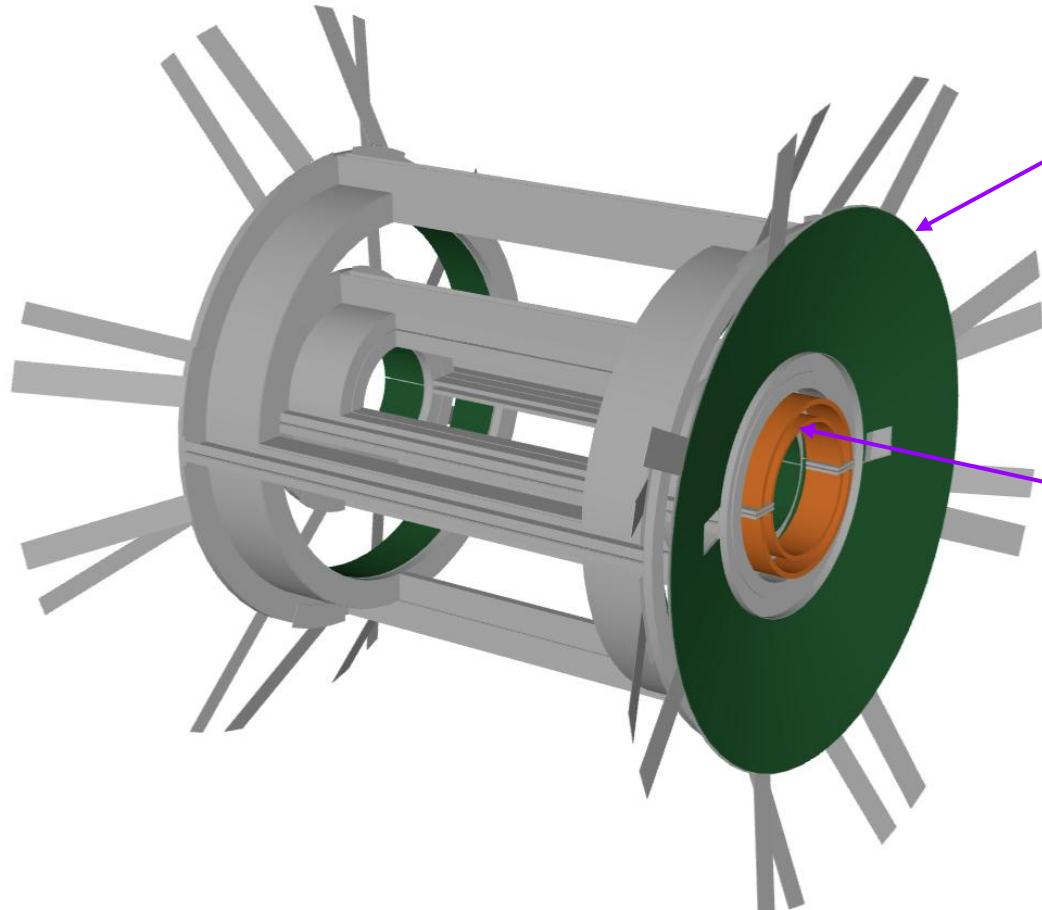
Distribute cables along the cone.
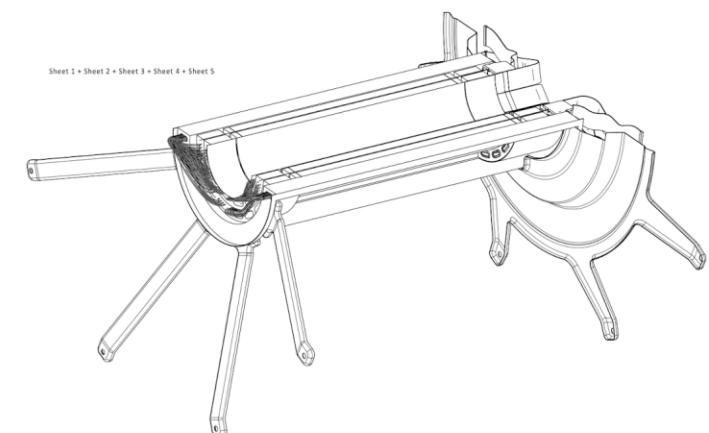
Approx. air tube connector as a ring
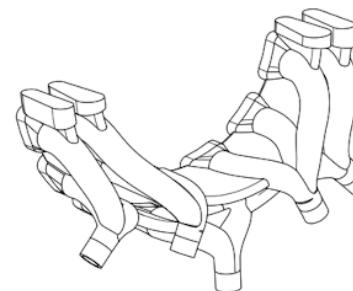
Material Scan

- **From stp file → GDML**
  Courtesy of R.Turrisi
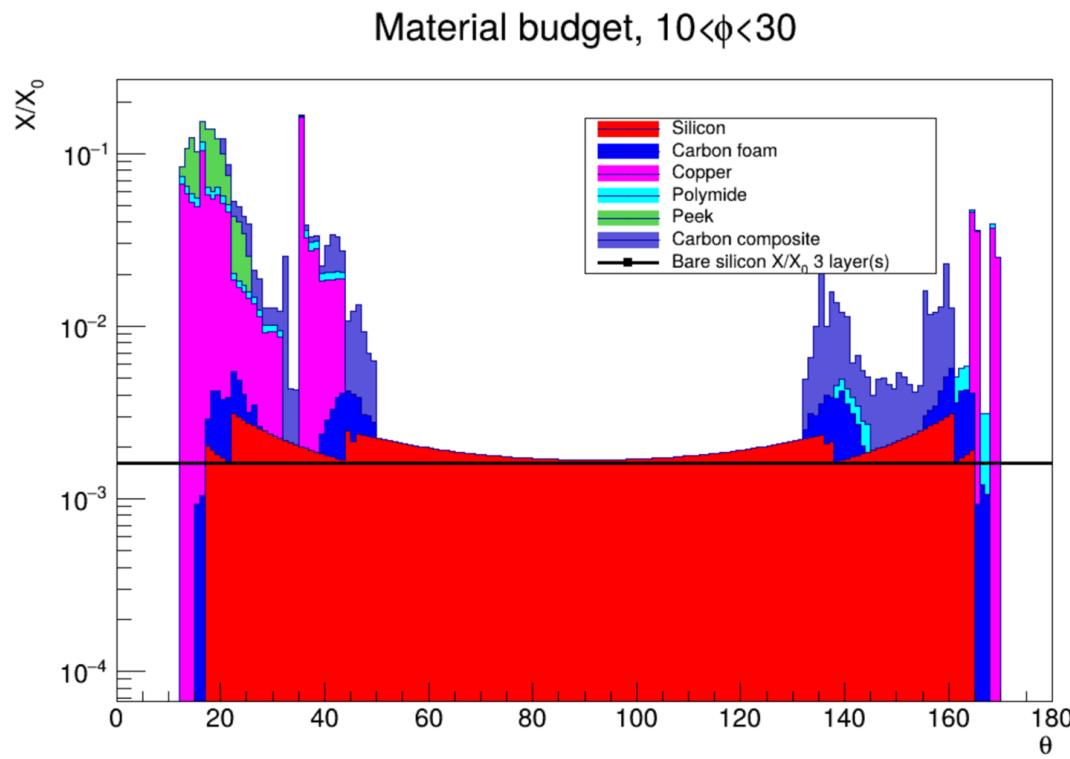
- **This simplified geometry for 28.10:**

Material budget, 10<φ<30

PST and Services

Provakar Datta (LBNL)

https://github.com/eic/epic/pull/1010
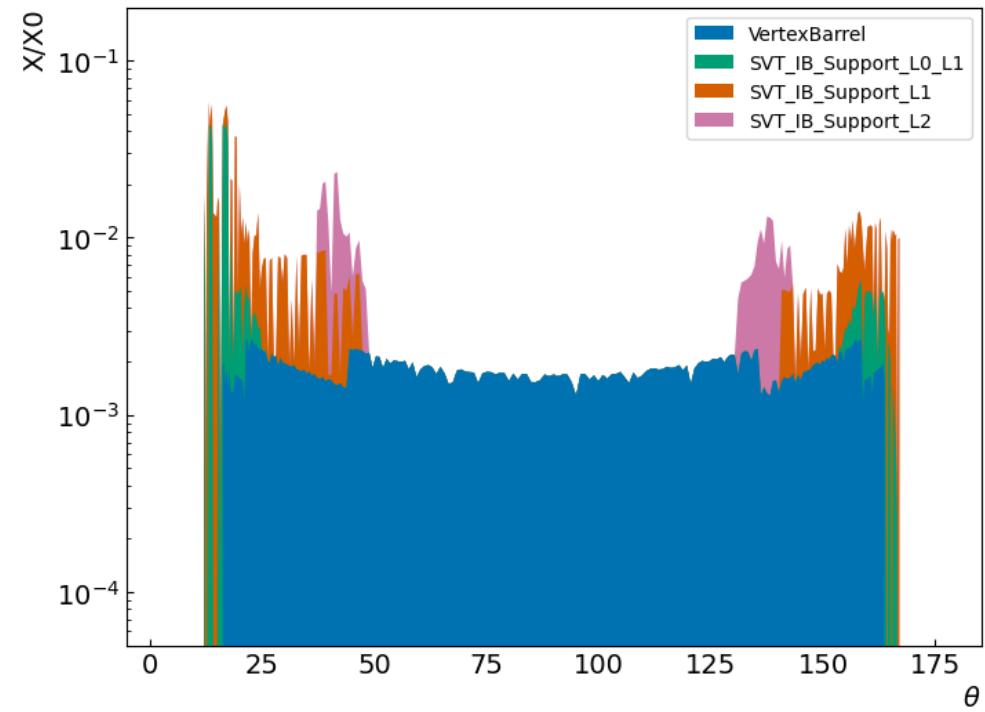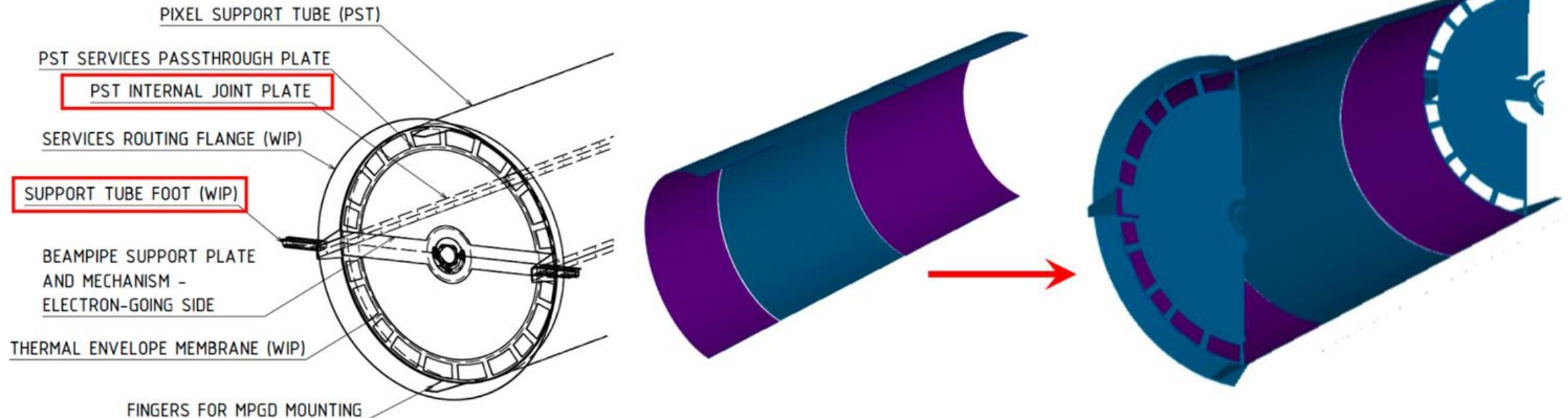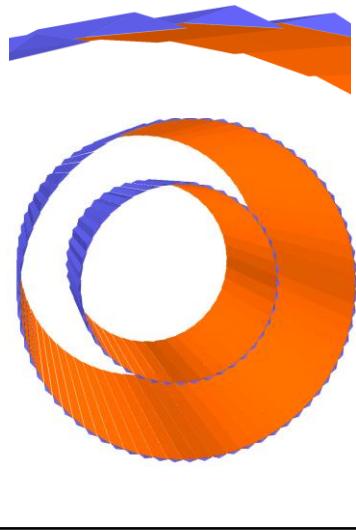
New simplified OB geometry epic 25.10

ePIC 25.08
Tilted staves

- Carbon fibre braces to reproduce peaks on material thickness scan
- Gap in active silicon to reproduce dead area
- Castellated stave arrangement (alternate staves at +6mm radius)

https://indico.bnl.gov/event/29542/#2-svt-ob-simulation-geometry-u

See Athavan's talk for full comparison

Active silicon layer with central gap

Kapton layer

Carbon fibre layer

Carbon fibre braces
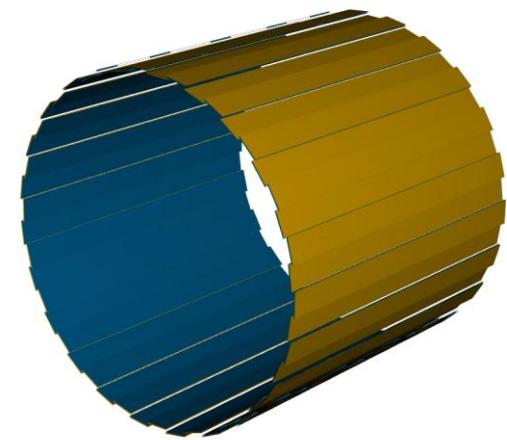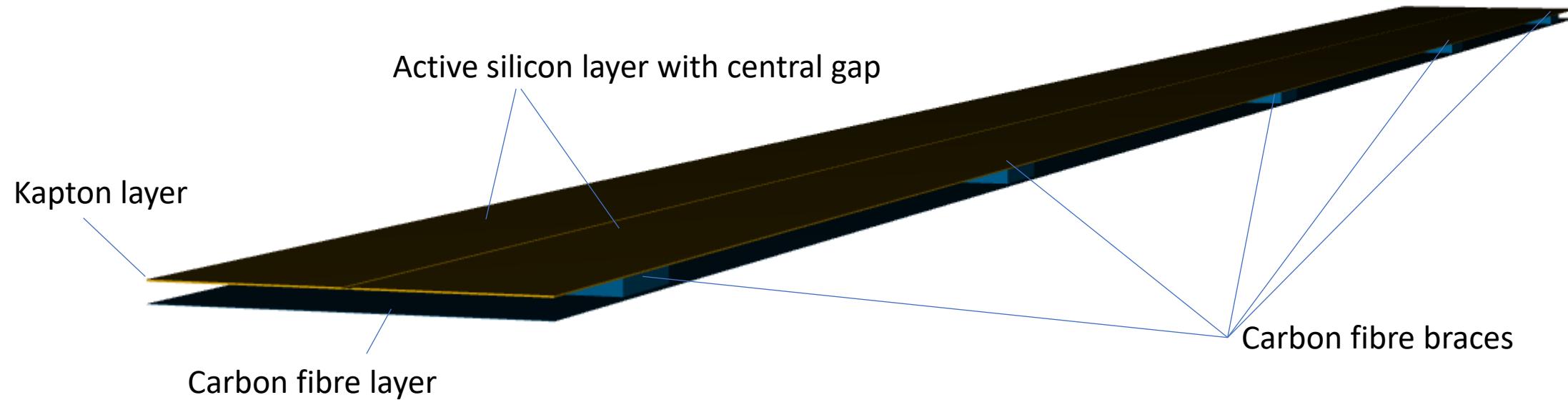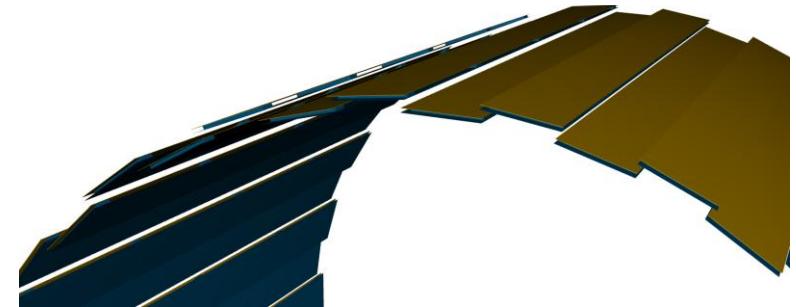
SVTOB_UK full CAD file geometry

- **Full CAD-file version –** SVTOB_UK: https://github.com/eic/epic/tree/SVTOB_UK
  - Previously reported bugs fixed; all material now included
  - Fully working with ddsim / geant4 - detailed hit maps and material thickness scans done for July design
  - Need updated CAD files
 - Not currently working with ACTS / eicrecon reconstruction software
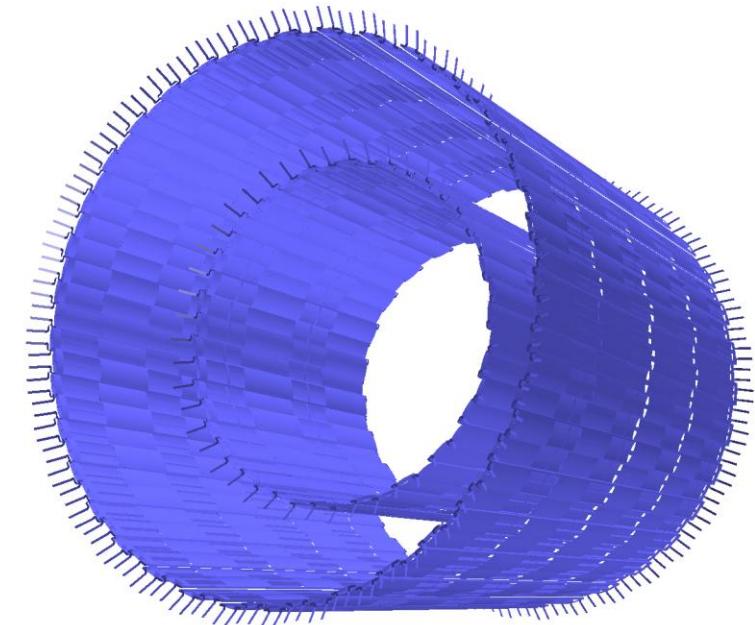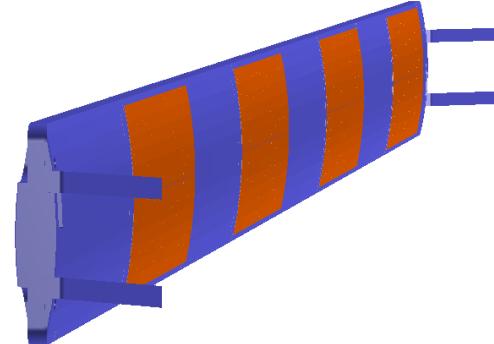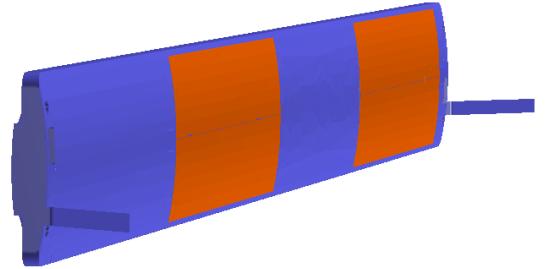
L3

flat_OB

July CAD

L4
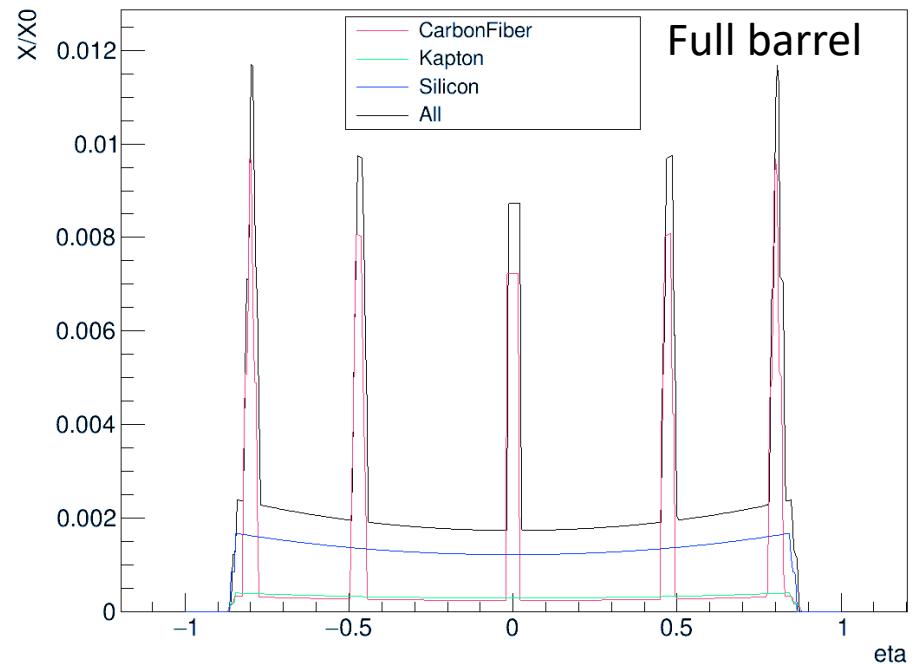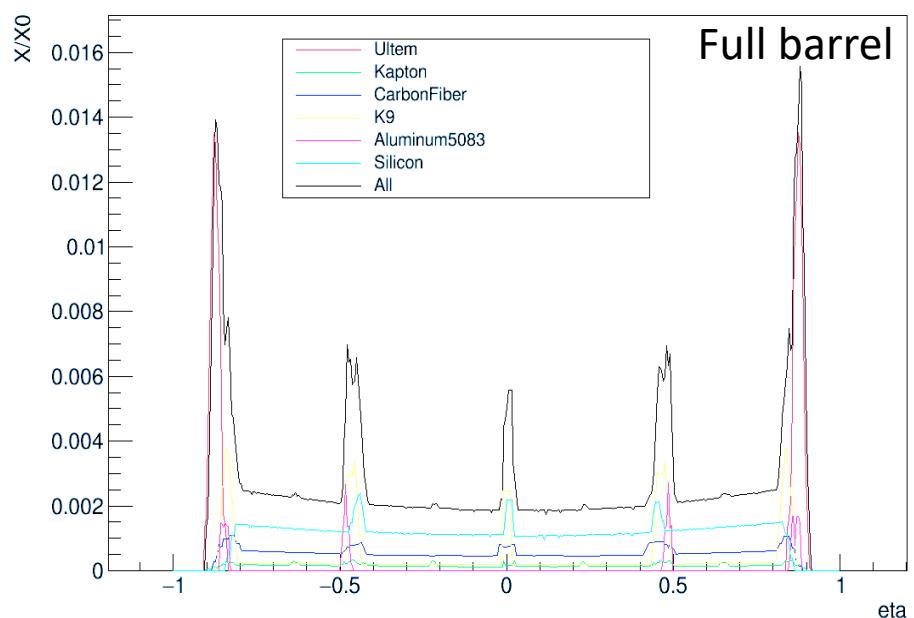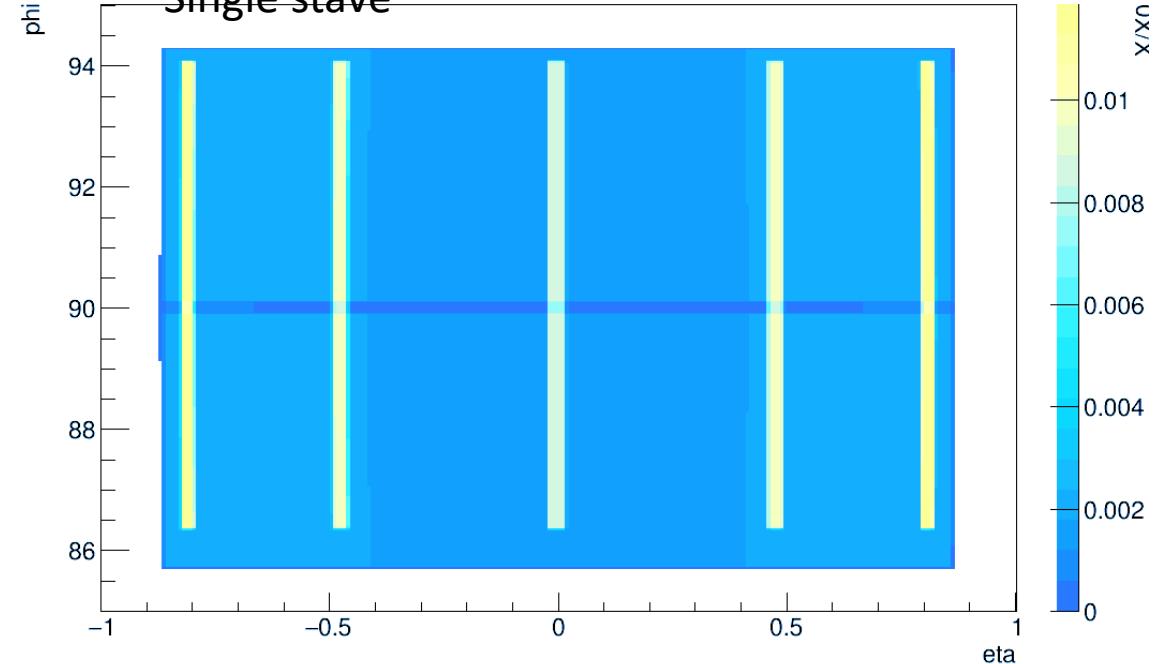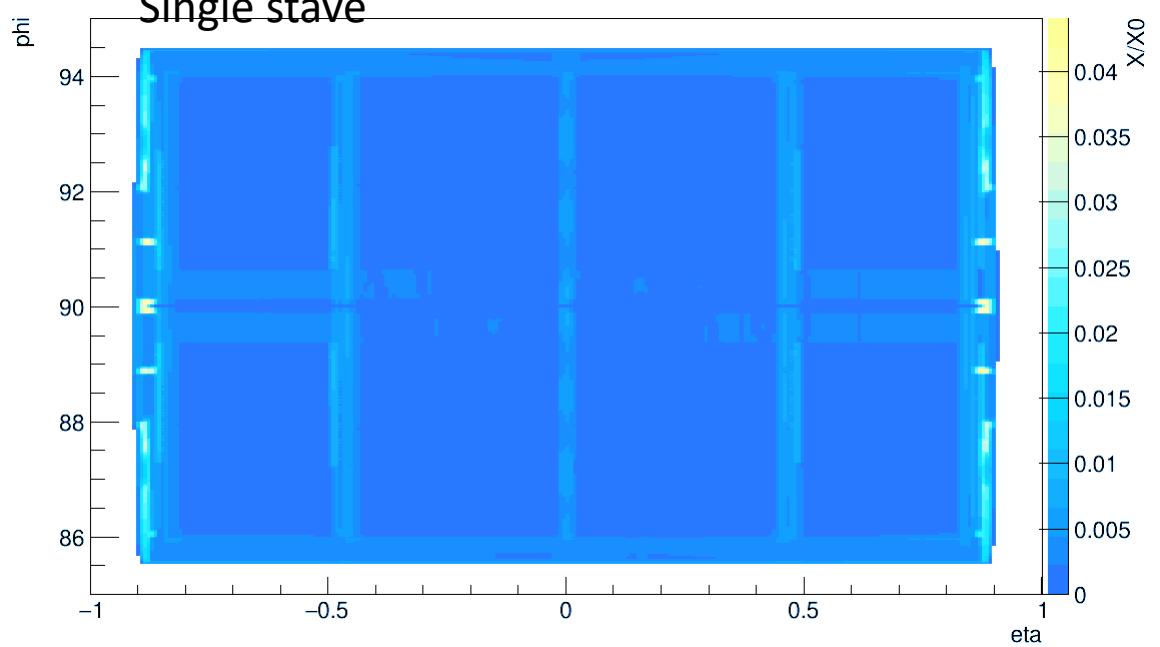
flat_OB
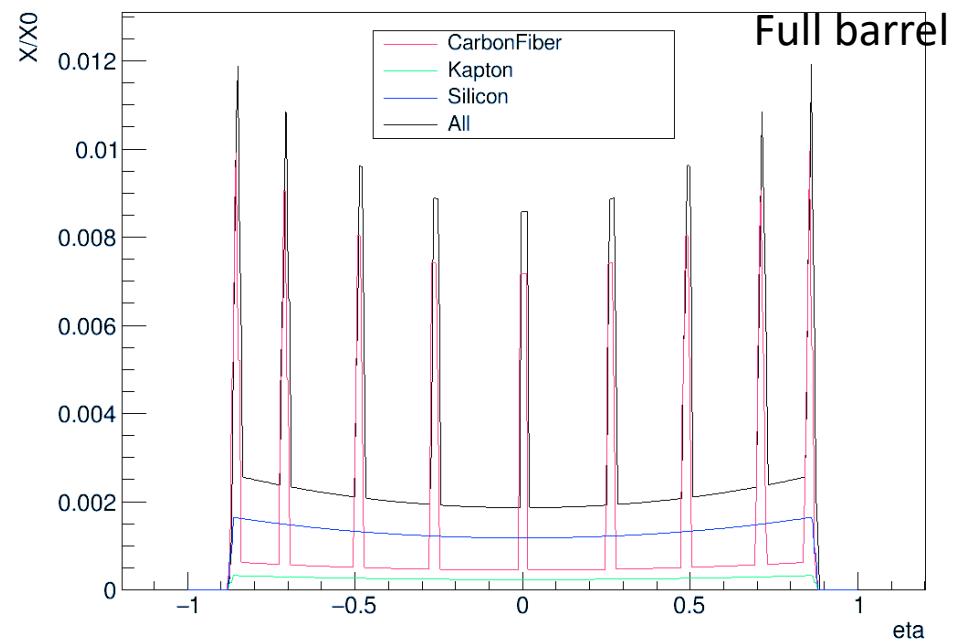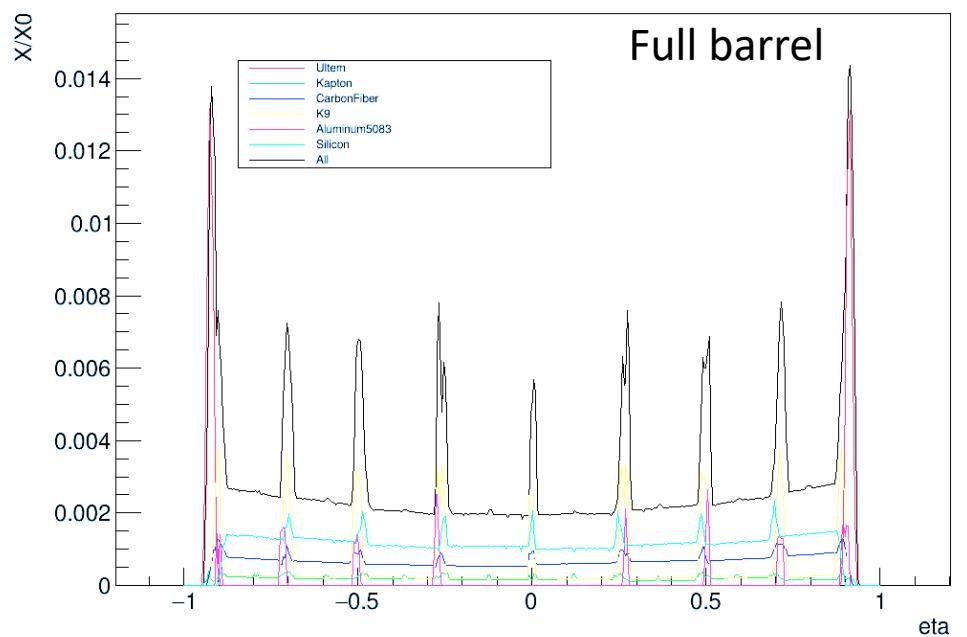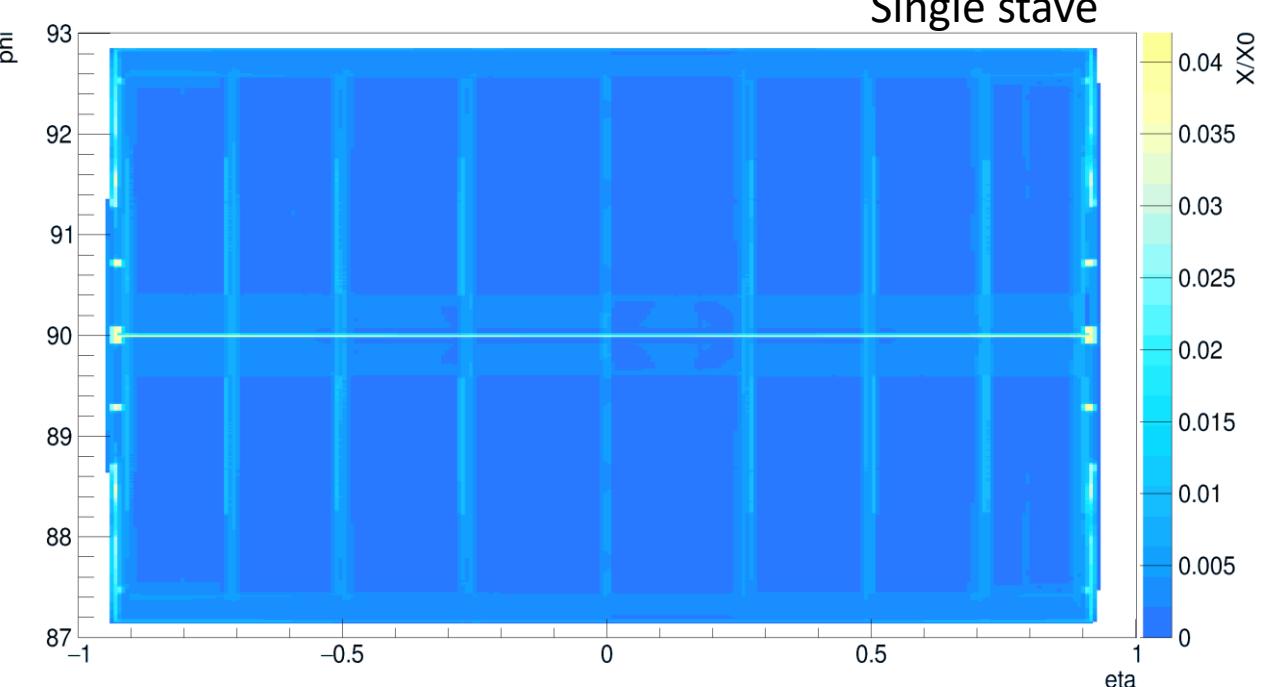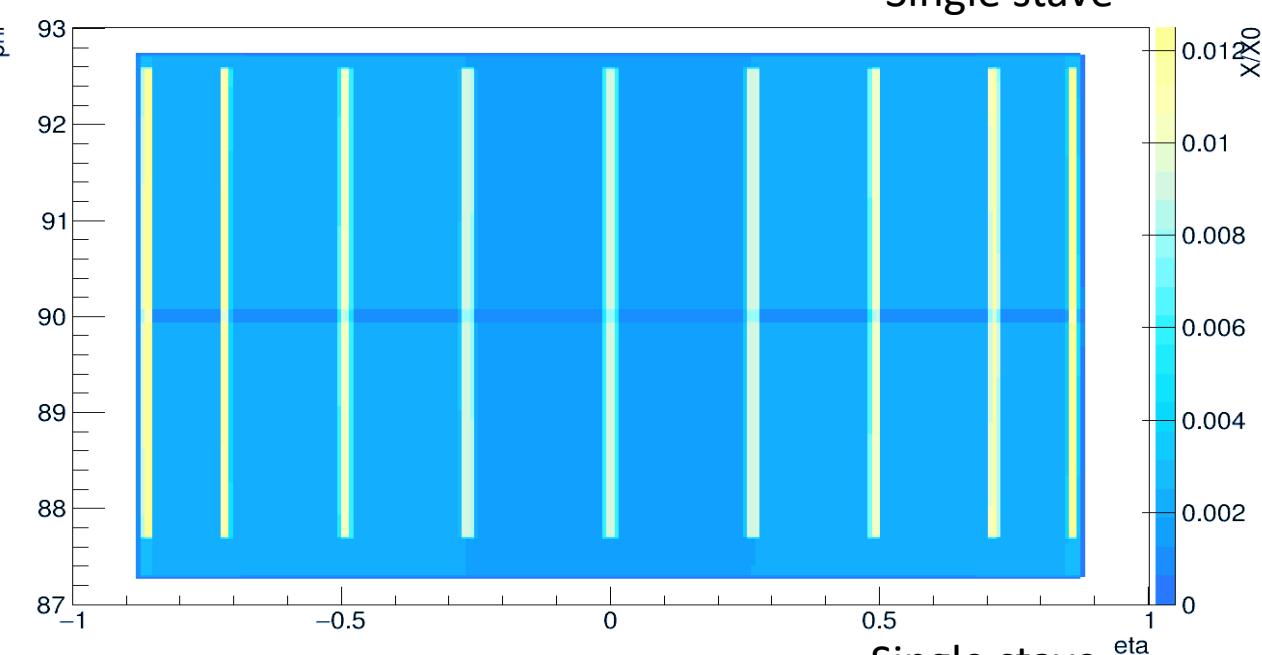
July CAD

Comparisons

L3
ePIC 25.10 / July CAD average ratio 0.98
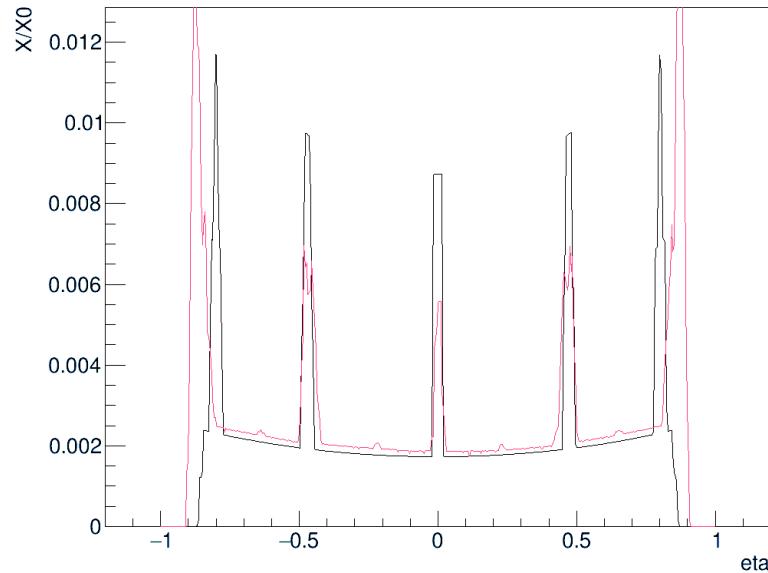
L4
ePIC 25.10 / July CAD average ratio 0.92
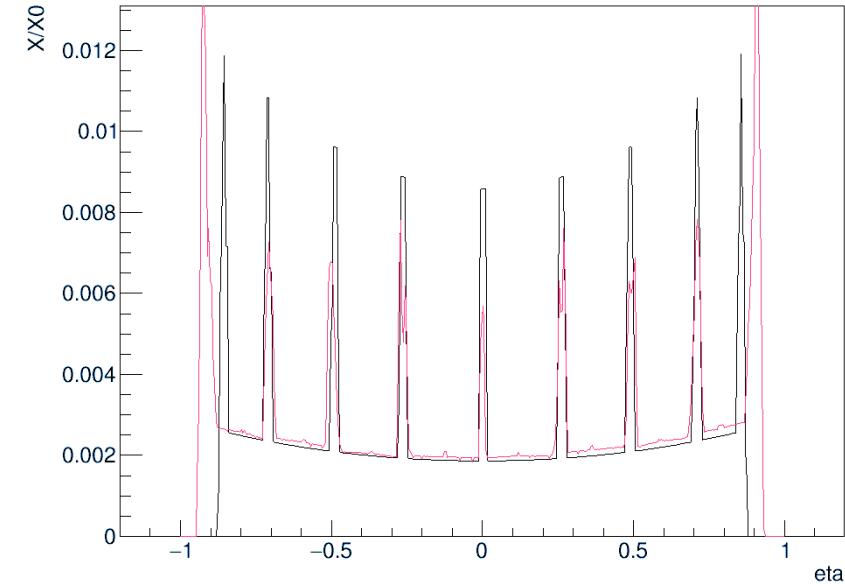
OB simulations – next steps

- **Curved_modular_OB:**

  https://github.com/eic/epic/tree/curved_modular_OB
  - Curved silicon surfaces modelled as N flat strips
  - Separate modules on top and bottom of staves
- **Next stage**
  - Hybrid geometry (curved modular active silicon + GDML passive structure)
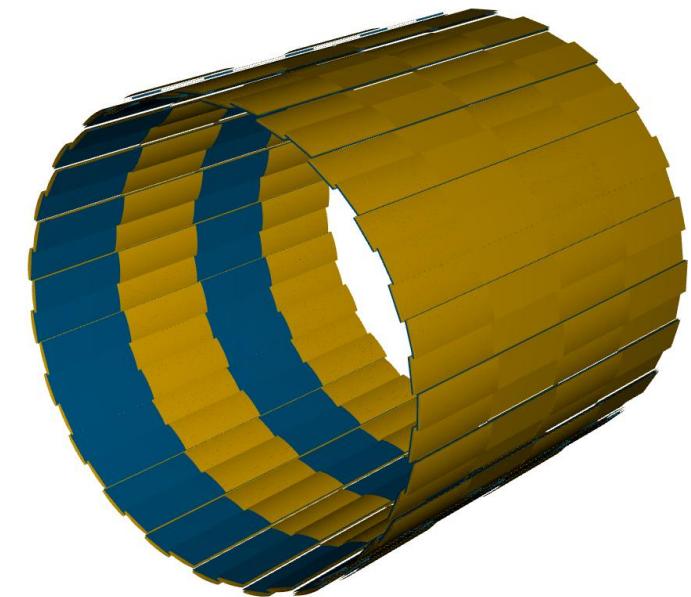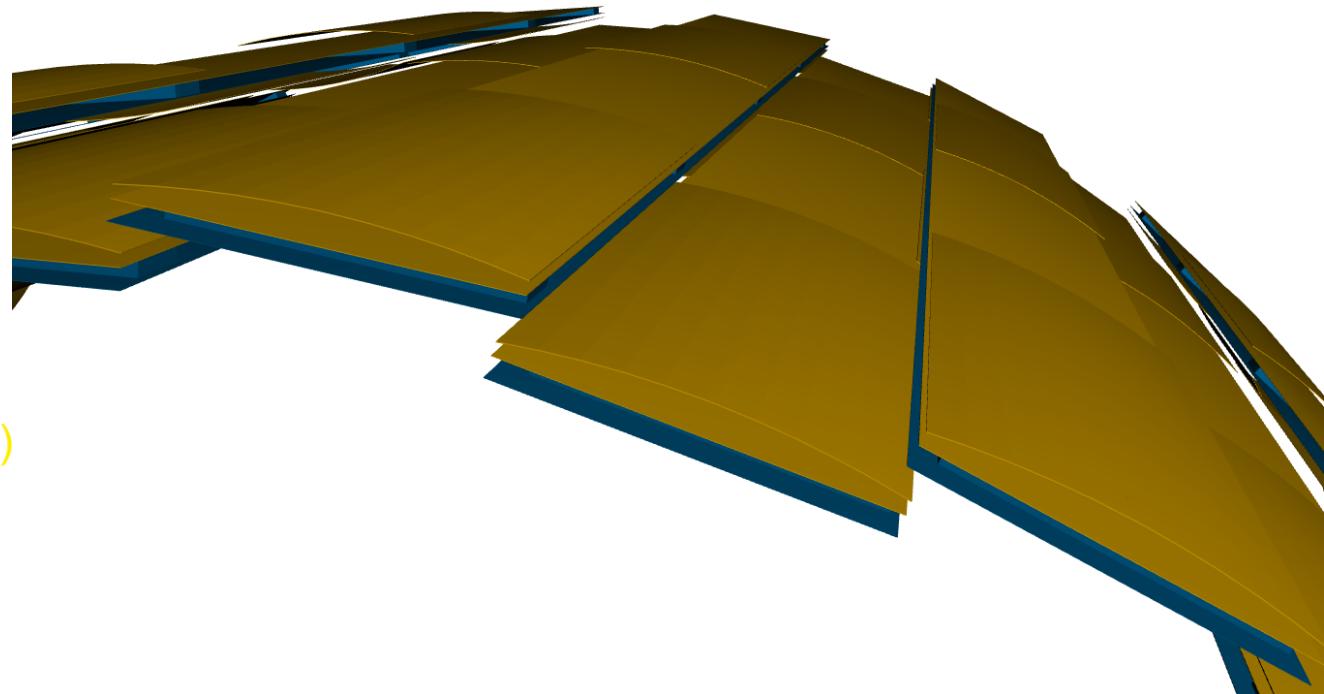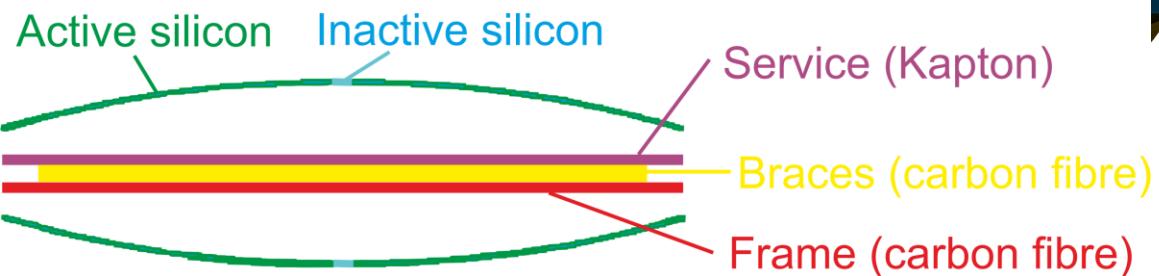
SVT Geometry change log

| Detector subsystem	Design (date, source, filename)	Simplified CAD (date, source, filename)	Simulation Description (date, github PR)	Assignee	Status	Note
IB	2025.07	2025.07	https://github.com/eic/epic/pull/803	Shujie Li	Merged.	will be in 25.10 simulation. The cone between L0 and L2 may need more work on the cable distribution.
OB		2025.09	https://github.com/eic/epic/pull/933	Sam, Athavan	Merged.	will be in 25.10 simulation.
Disks	LBL			Shujie	Paused. The current implementation of inner hole won't pass the latest volume overlap check.	
PST	Ben	2025.09	https://github.com/eic/epic/pull/961	Provakar/Shujie	Merged	The tube radius and length are updated. Waiting for some clarifications to move forward.
services	Ernst	calculation	https://github.com/eic/epic/pull/961	Provakar/Shujie	The total thickness in implemented as-is. Waiting for merge.	calculaton was done with r=50cm, which the previous cylinder has r=45cm, and the new PST design ahs r=54cm.
Cone	LBL					
PST	Ben	2025.09	https://github.com/eic/epic/pull/1010	Provakar	to be reviewed	added details in PST

Beam background rate study

For each time slice of 2us (1 merged event), mix 1 DIS signal event with beam background according to their calculated freq.

Event	signal	synrad	ebrems	etouschek	ecoloumb	p.b.gas
Event 1	🔴	○○○○	🔵			
Event 2	🔴	○○○○			🟡	🟣
Event 3	🔴	○○○		🟢		
Event 4	🔴	○○○	🔵			🟣
Event 5	🔴	○○○○	🔵			

18x275

Primary Particles

| rates in kHz	10x275 GeV	18x275 GeV
	2.5A@10kAhr	0.227A@10kAhr
DIS eA	/	/
electron Synchrotron Radiation	36608 MHz	3324 MHz
electron beam gas (Bremsstrahlung scatterings)	3177.25 kHz	316.94 kHz
electron beam gas (Coulomb losses,)	29 kHz	1.3 kHz
electron intrabeam (Touschek losses)	240 kHz	0.72 kHz
hadron beam gas	32.6kHz	22.5kHz
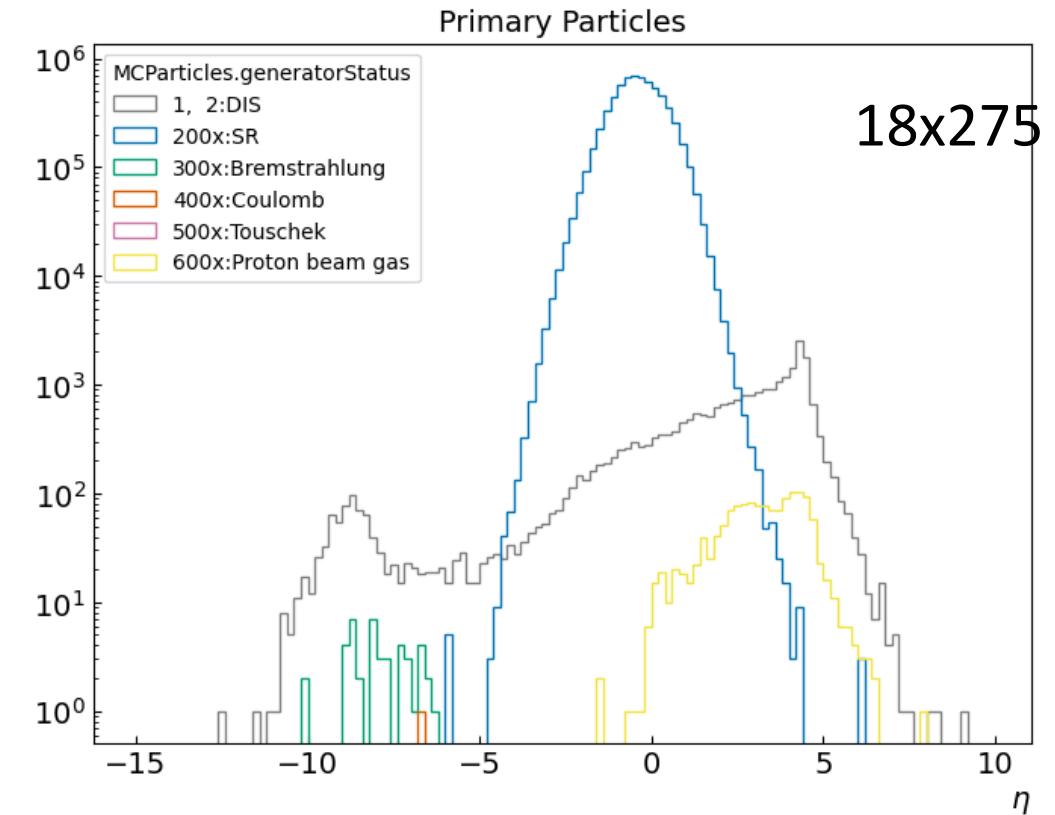
Beam background rate study

Hits from charged beam particles:
- → plot digitized hits (edep > 0.54 keV) for each SVT surface
  - ◆ Rphi v.s. Z on barrels
  - ◆ x v.s. y on disks
- → check number of hits per 2x2cm square (roughly size of one RSU), or 9.8x3.5mm (tile)
- → show result in **ms** (500 x 2us slices → kHz)

NO charge sharing algorithm

E-Disk 0: 18x275,max per RSU~700 k
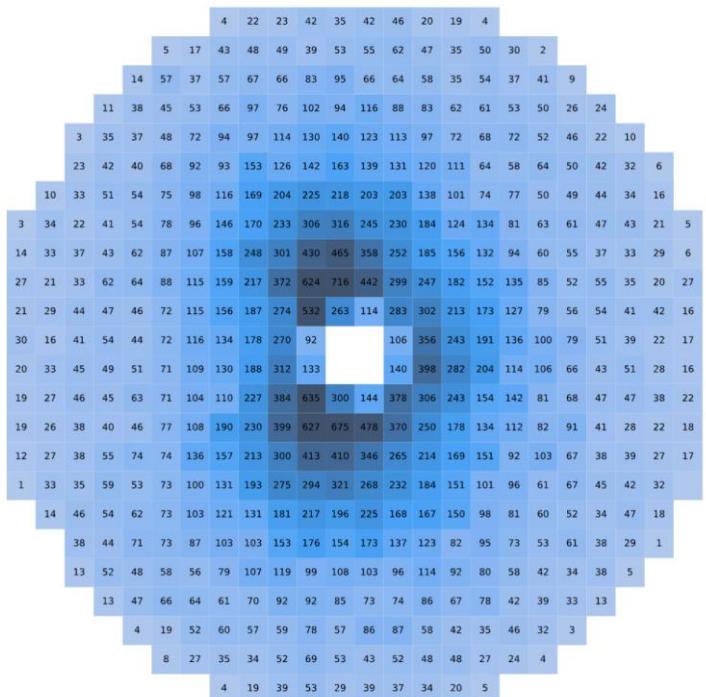
E-Disk 0: 10x275,max per RSU~7800
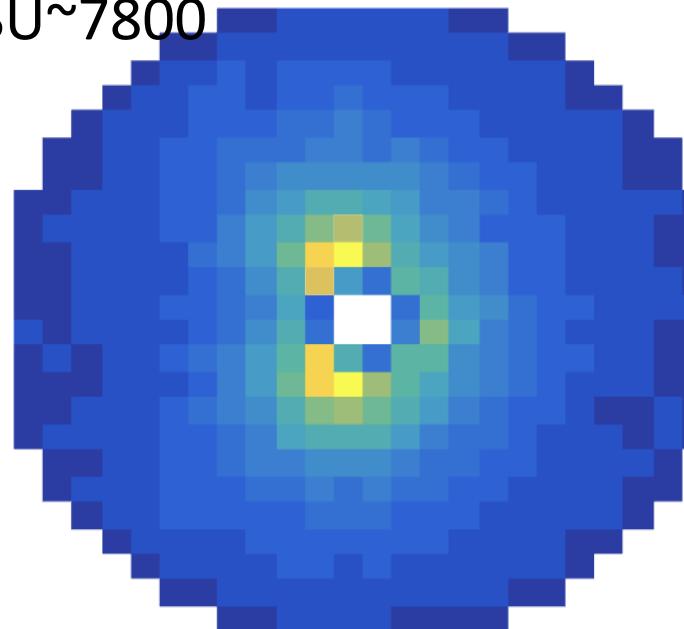
TBD:

Material map with OB update: https://eicweb.phy.anl.gov/EIC/detectors/athena/-/issues/153

Disk z position in corporate with forward MPGD https://github.com/eic/epic/pull/986

Potential L3 issue with ACTS