Some engineering challenges with the EPIC SVT design

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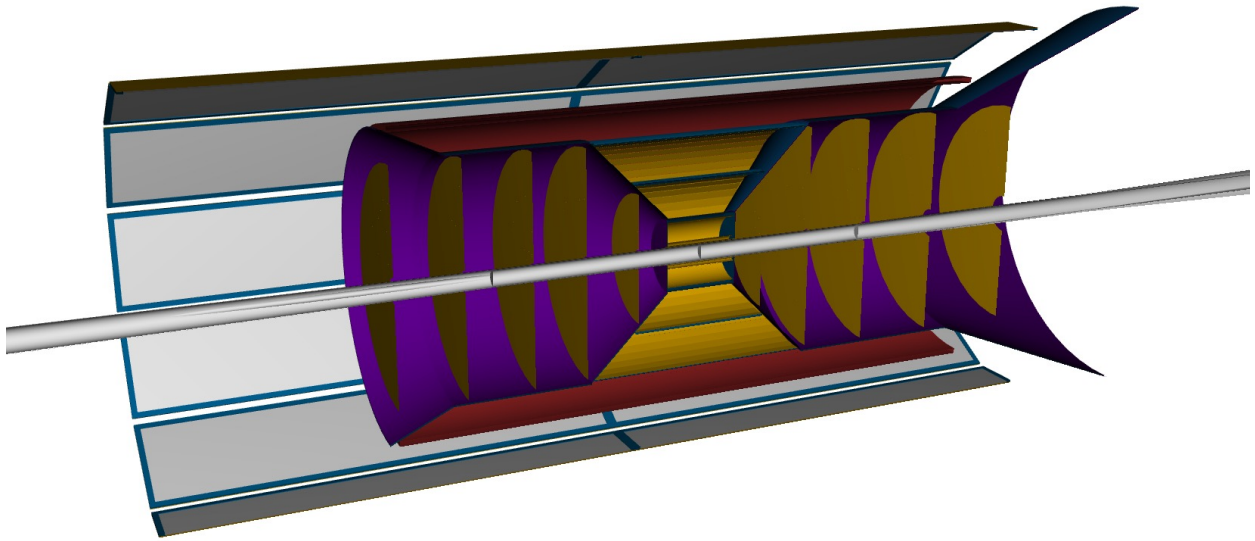
Current status

- EPIC SVT layout developed for the first simulation campaign
  - 5 barrel layers, 5 disks per side



Periphery not included

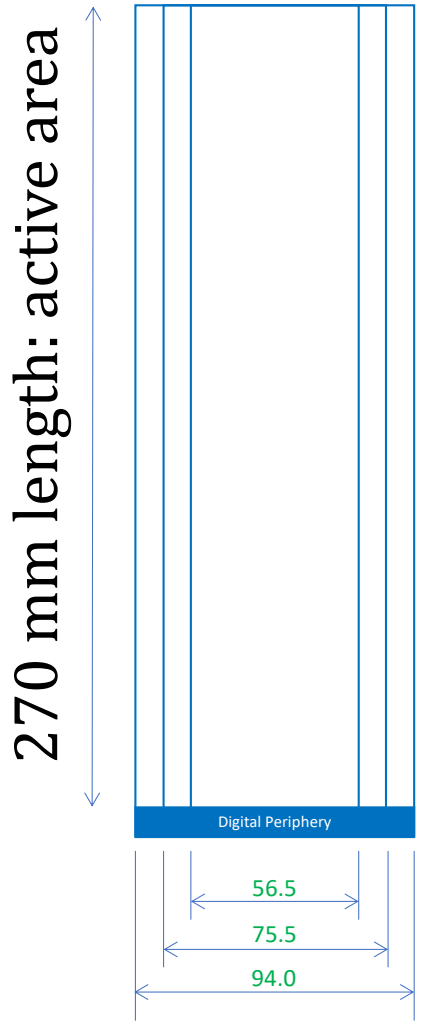
BARREL	r [mm]	l [mm]	X/X0 %
Layer 0	36	270	0.05
Layer 1	48	270	0.05
Layer 2	120	270	0.05
Layer 3	270	540	0.25
Layer 4	420	840	0.55

DISKS	+z [mm]	-z [mm]	X/X0 %
Disk 1	250	-250	0.24
Disk 2	450	-450	0.24
Disk 3	700	-650	0.24
Disk 4	1000	-900	0.24
Disk 5	1350	-1150	0.24

Goal: Minimize material, maximize acceptance

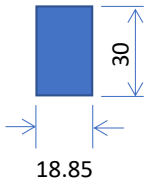
Stitched sizes

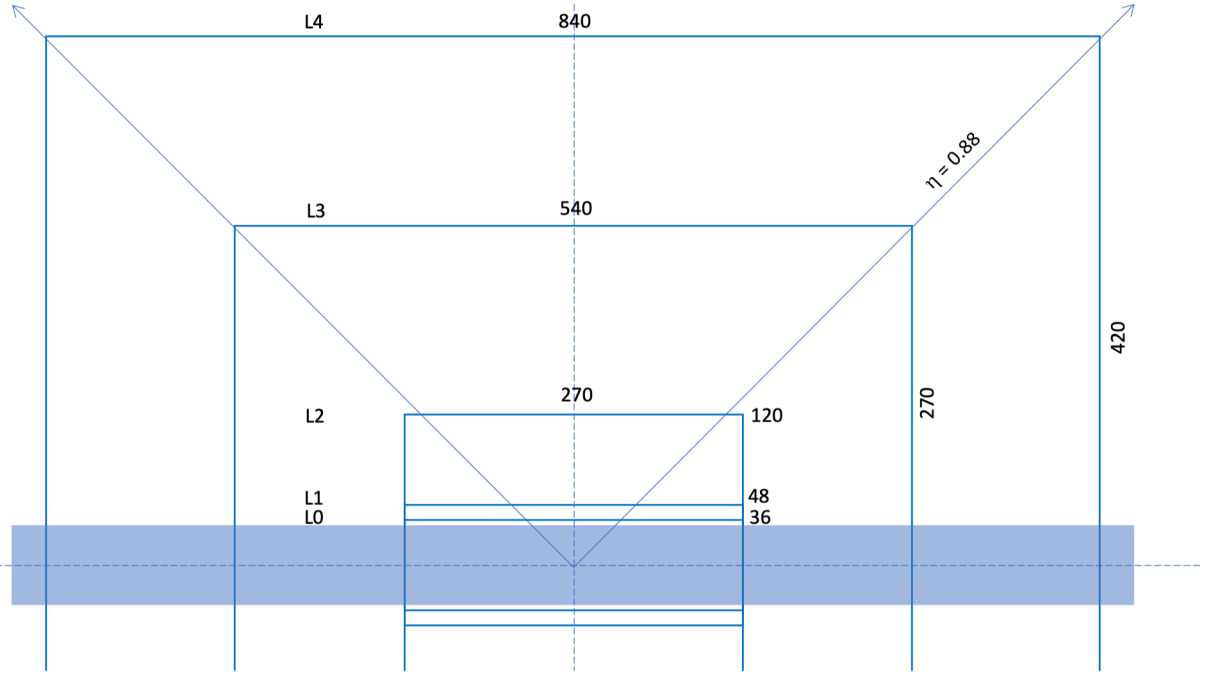
All layer lengths account only for active area



L0 = 4 x 56.5; R = 36
L1 = 4 x 75.5; R = 48
L2 = 8 X 94.0; R = 120

ePIC - SVT
Same 3 sensor formats:
L0 = 3 x 9 reticles
L1 = 4 x 9 reticles
L2 = 5 x 9 reticles
1 sensor per wafer
4 or 8 sensors per layer





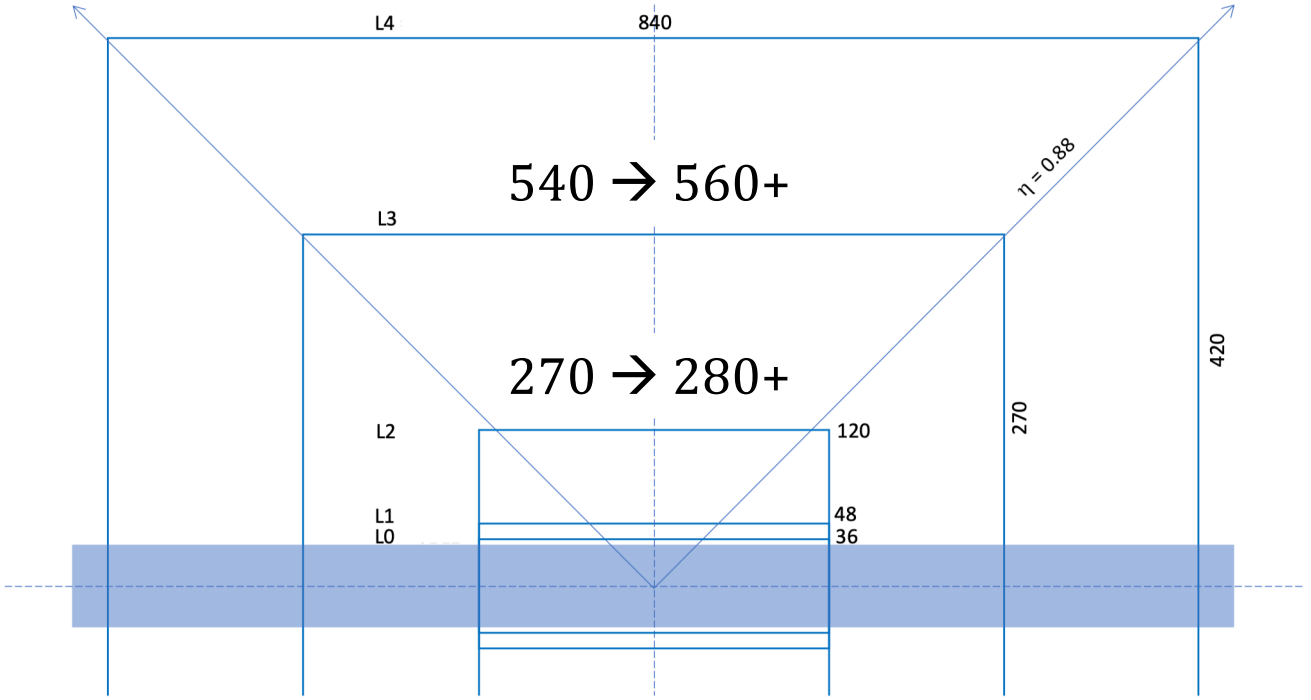
Note: radii and lengths work with a reticle size of 18.85 x 30.00 mm^2
Length of L0, L1 and L2 is made of one 270 mm sensor read out at ONE end
Length of L3 is made of two 270 mm sensors read out at BOTH ends
Length of L4 is made of four 210 mm sensors read out at BOTH ends

Digital periphery estimated at 10 mm

Figures by Peter Jones

Barrel layers

- Layers 0-2
  - Active area: 270 mm
  - Silicon size: ~280 mm
- Layer 3
  - Active area: 540 mm
  - Silicon size: ~560 mm (back-to-back length 9 sensors)
- Layer 4
  - Active area: 840 mm
  - Overlap sensors to avoid dead area



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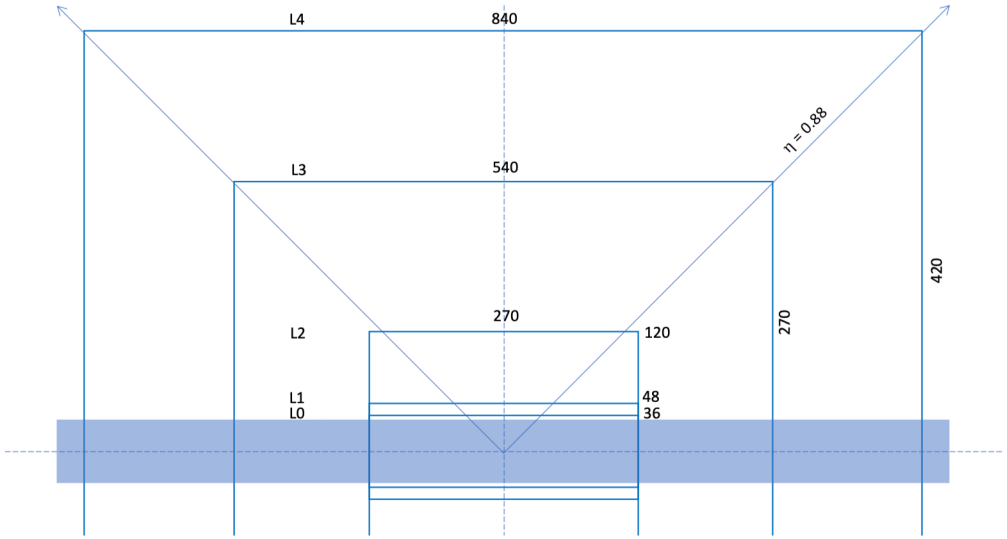
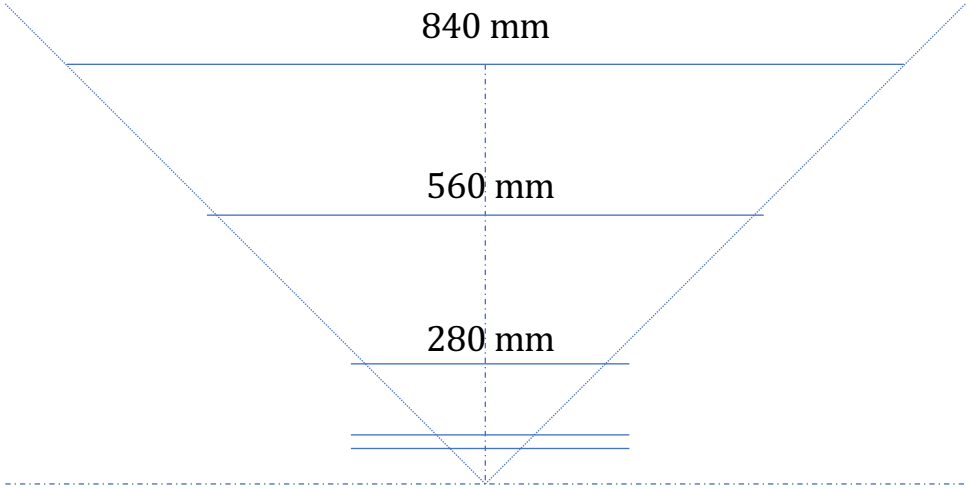
Periphery size estimated towards longer length

What does this mean for the geometry?



Only accounting for the periphery
No FPC included

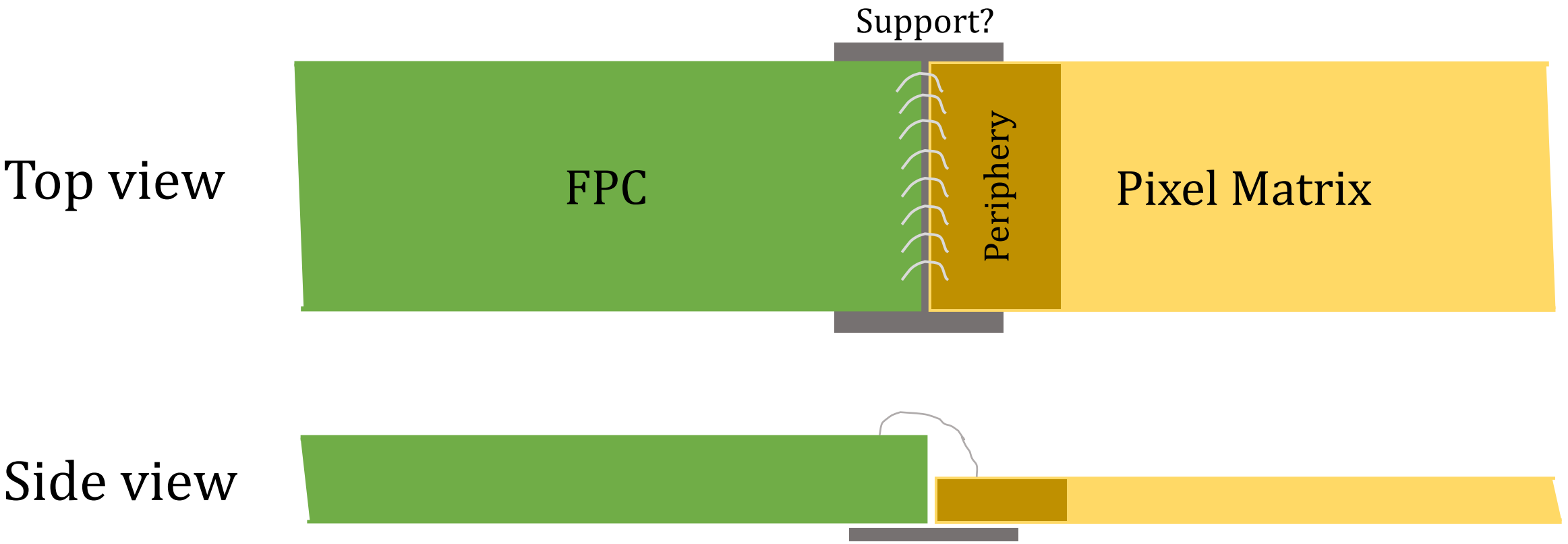
Projective cone unchanged



- Layers 0-2 not symmetric in z → periphery & FPC in forward direction
- Layer 3 is symmetric → periphery & FPC in both directions
- Layer 4 is symmetric → periphery & FPC along the sensor

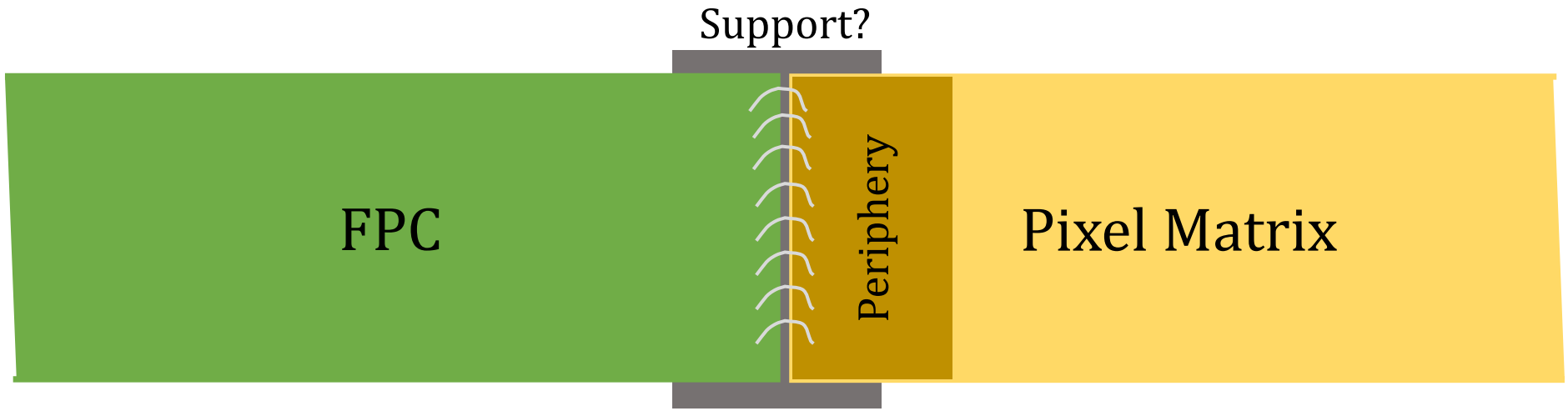
Stitched sensors – layers 0-2

Not to scale



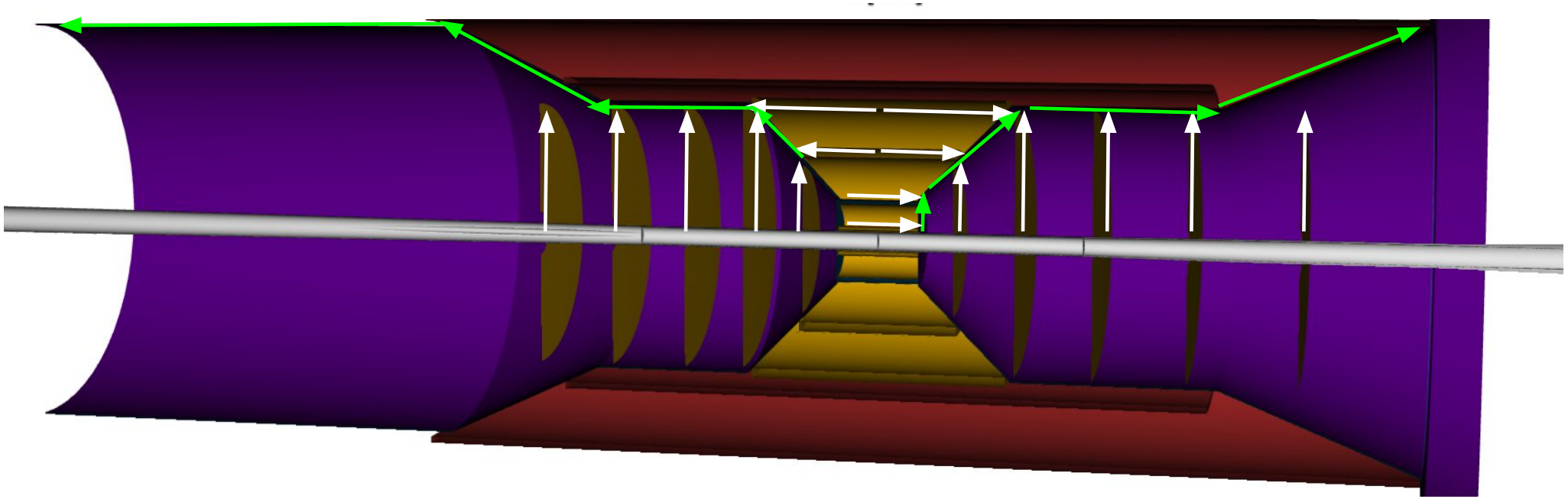
ALICE plan: FPC curved to the same radius as the sensor

Stitched sensors - some unknowns



- Size of periphery
- Periphery on both ends of sensor?
- Liquid cooling for the periphery?
- Length, thickness, type of support?
- Length, thickness, shape of FPC?
  - Bendability?

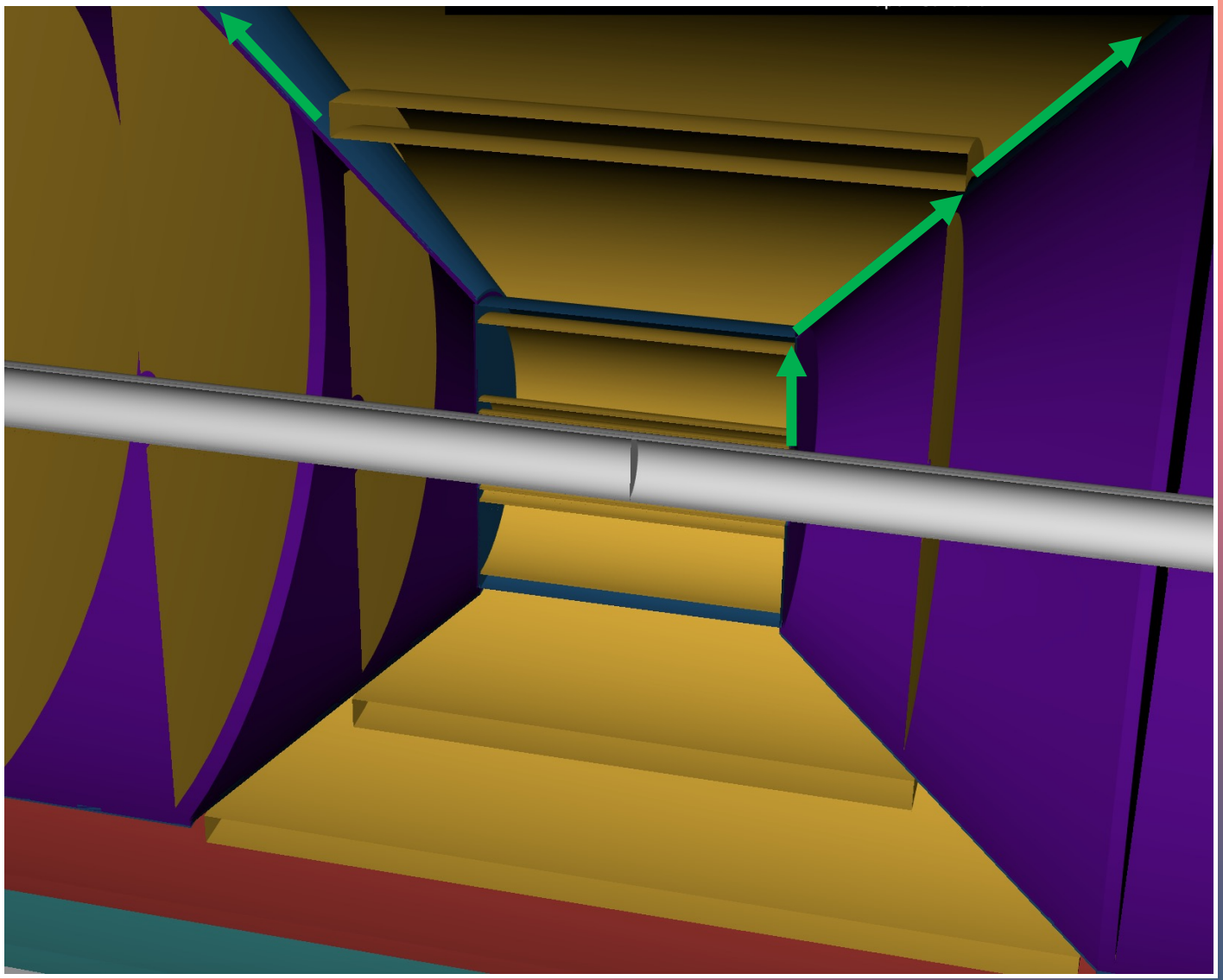
Barrel services



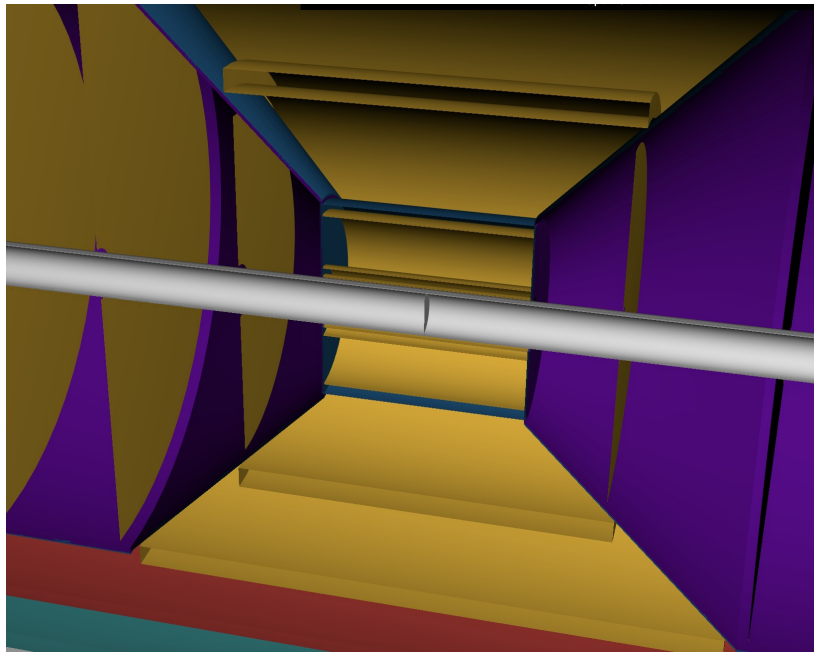
- In current design, services come directly out of active sensor area
- Up 90° from layers 0-2 and then projective (45°) from the inner layer support cylinder

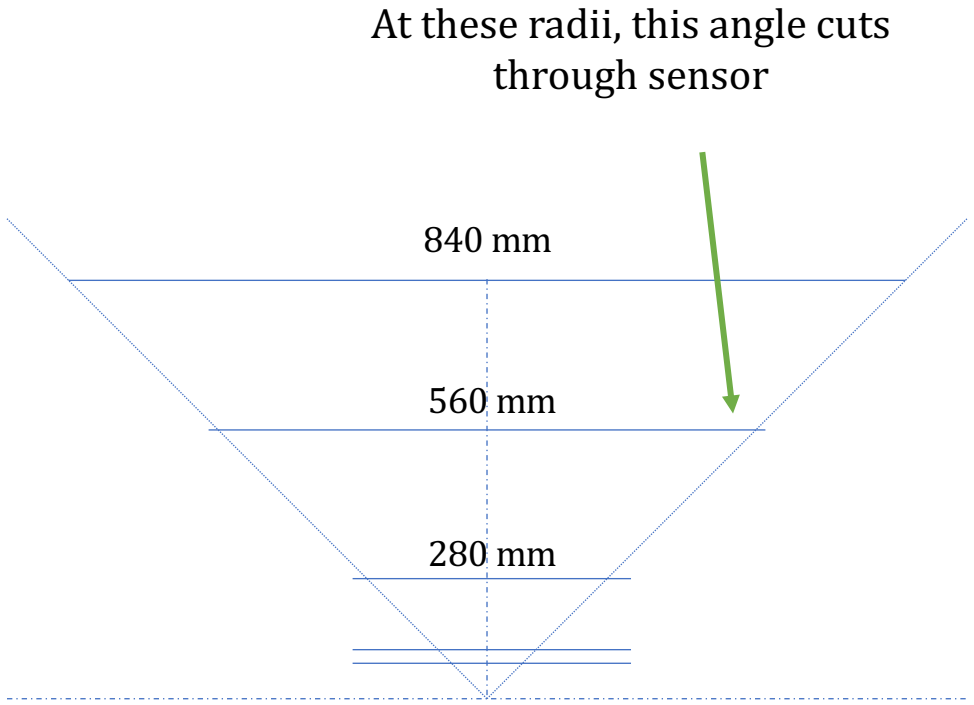
Services cont.

- Need space for periphery & FPC
- Sharp bend for the FPC in layers 0-2 is unlikely to be feasible
  - Steps?
- Patch panel?
- Periphery cooling?
- How do we direct the air for layers 0-2?



Service routing changes





- Layers 0-2: extend out to patch panel? Make a gradual bend for the FPC?
- Layer 3: extend out slightly for periphery & (likely) FPC extension? → will change the angle of the service cone. Change the r to keep the service cone angle?

Summary/Other

- Goal: Minimize material, maximize acceptance
  - Will need to divert from ALICE plans
- Layer 2 radius is much larger than ITS3 → do we need another support cylinder between layers 1 & 2?
- How do we direct air to layers 0-2? → not currently considered in material/support. Do we need to liquid cool the periphery?
- Actual sensor dimensions longer than shown in geometry → does that require a change in the radii?
- FPC connections need to be taken into account → what lengths? Can they be bent? Do they need additional support?