

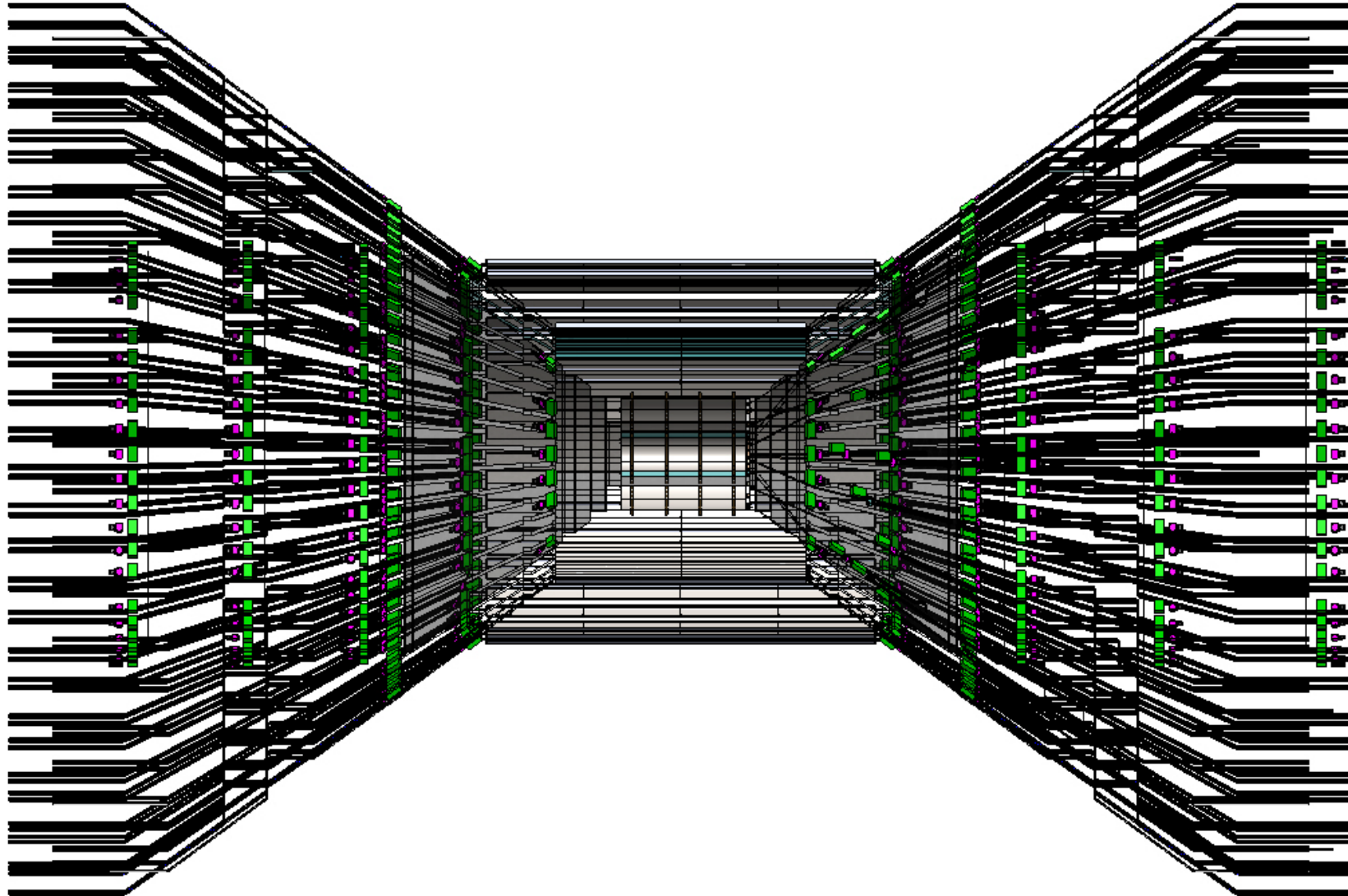
Update to EPICS vertex detector CAD model

Walter Sondheim, P-3

LANL

January 30th, 2023

Vertex detector; 3-barrel layers, 2-sagitta layers, 5 disks each side, based on the following parameters;



Overview of ePIC Tracking System

Francesco Bossù (CEA), Kondo Gnanvo (JLab), Laura Gonella (U. of Birmingham), Xuan Li (LANL).

On behalf of EIC ePIC Detector Tracking Working Group

ePIC Collaboration Meeting

Jefferson Lab, January 09 – 11, 2023

Barrel tracker: Current configuration

❖ Vertex layers:

- Radii of two innermost vertex layers optimised for beam pipe bake out (5 mm clearance) and ITS3 sensor size.
- 3rd vertex layer at $r = 120$ mm, **dual purpose vertexing & sagitta layer**, without increase in material (i.e. 0.05% X/X₀, bent layer).

❖ Sagitta layers:

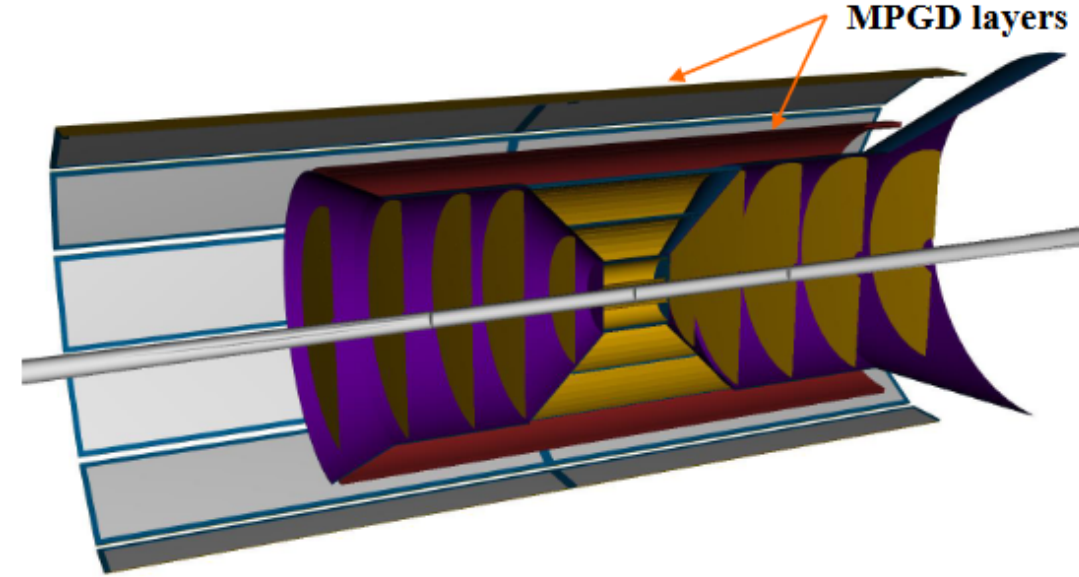
- Moved at larger radii to **increase lever arm with high precision measurements** to improved momentum resolution.
- Layer at 27 cm made two halves of 0.25% X/X₀.

❖ Cyl. Micromegas & AC-LGAD layers:

- Additional space point for pattern recognition / redundancy
- Ongoing geometry optimization

❖ μ RWELL planar layer behind hpDIRC

- Impact point and direction for the ring seeding of hpDIRC
- Additional space point for pattern recognition / redundancy
- Not be required if imaging calorimeter is used



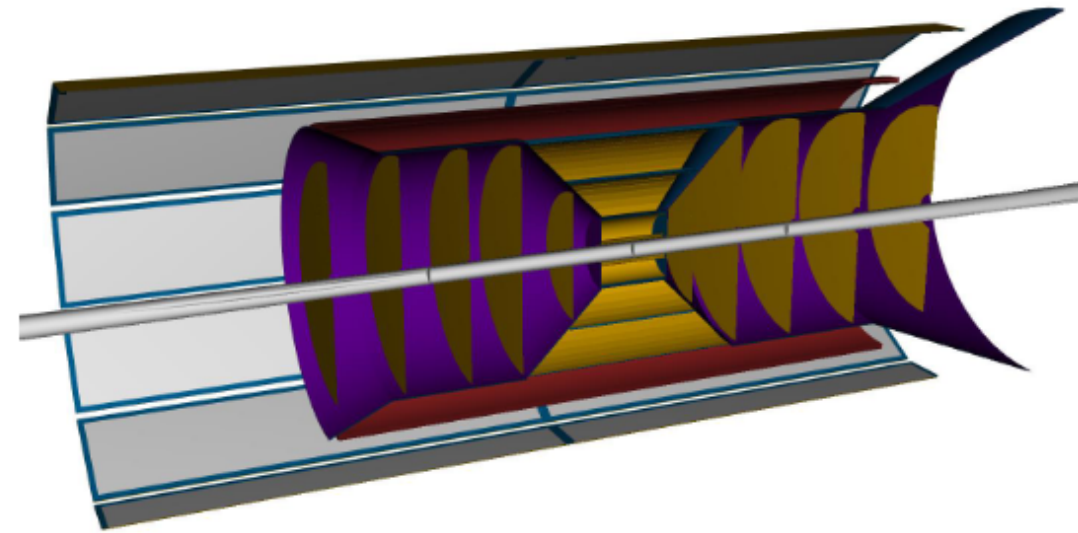
BARREL	r [mm]	l [mm]	X/X ₀ %
Si vertex layer 0	36	270	0.05
Si vertex layer 1	48	270	0.05
Si layer 2	120	270	0.05
Si sagitta layer 3	270	540	0.25
Si sagitta layer 4	420	840	0.55
Cyl. Micromegas layer	550	2300	0.5
AC-LGAD layer	640	2400	1.0
μ RWELL behind DIRC	730	3420	~1.0%

See talk by Stephen & Ernst at <https://indico.bnl.gov/event/16261/>

See talk by Laura & Ernst at <https://indico.bnl.gov/event/16582/> 5

ePIC end cap trackers: Current configuration

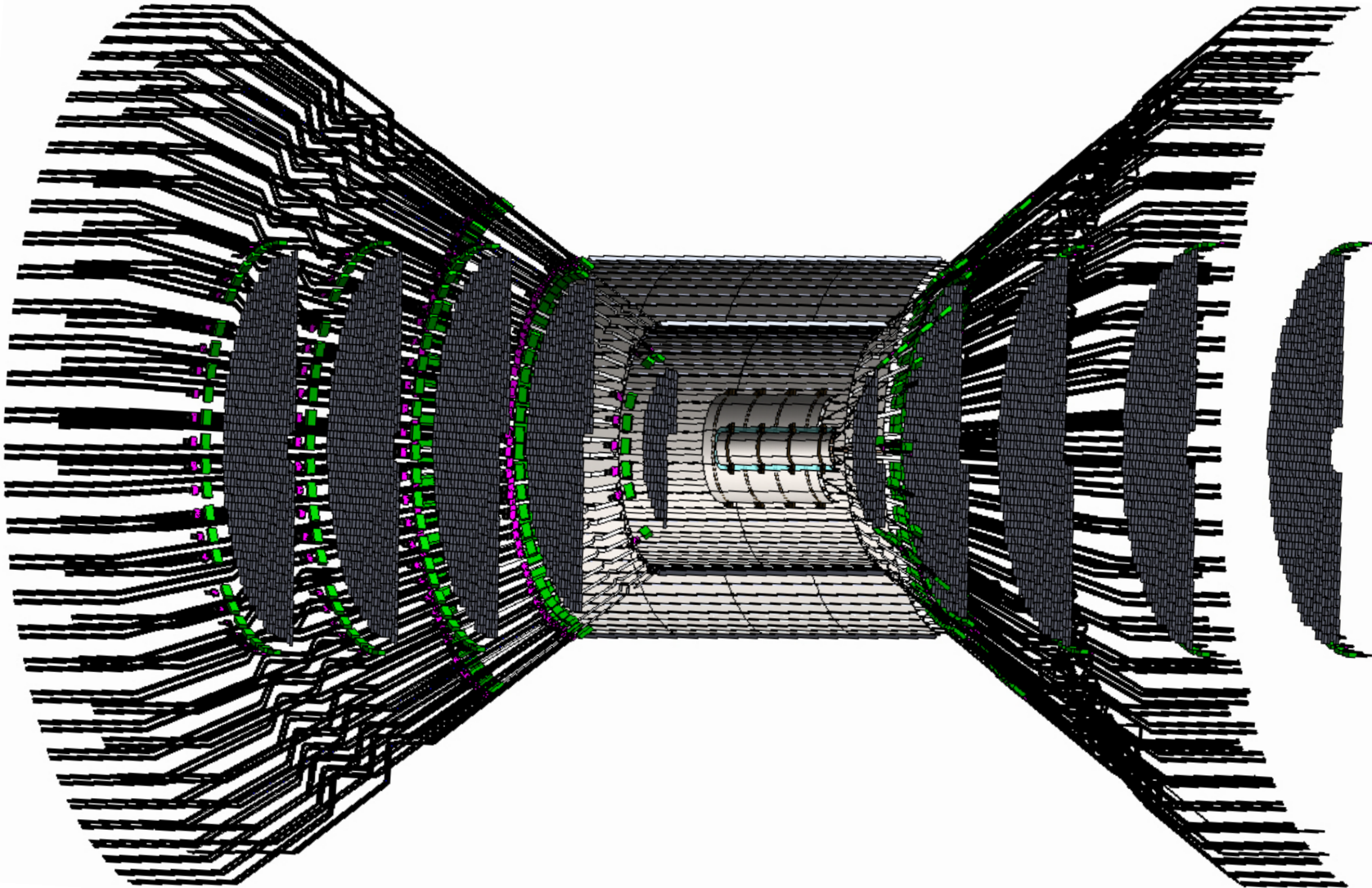
- ❖ Number of disks in the electron direction increased to **improve acceptance at high eta/increase number of points on track**.
 - At $|\eta| \geq 3$ in the electron going direction, hits on three disks only in reference detector. Insufficient considering noise and inefficiency.
- ❖ Use all available space in z to **increase lever arm**.
 - The table below show the current layout implemented in simulation. This is the envelop assuming the pRICH in the electron going direction. The disk design can be symmetric if the mRICH is used (i.e. envelop on electron side up to ~1350 mm).



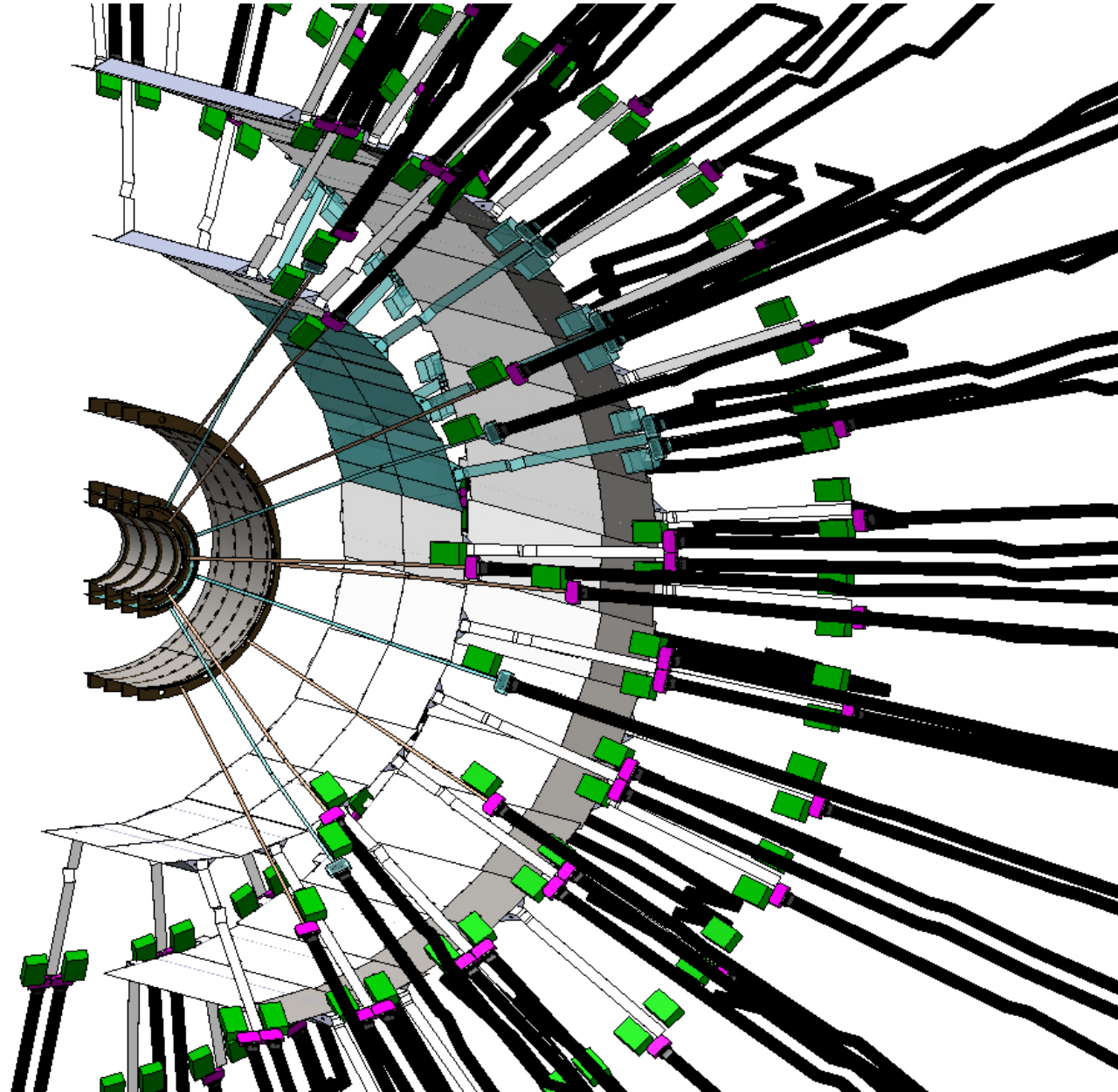
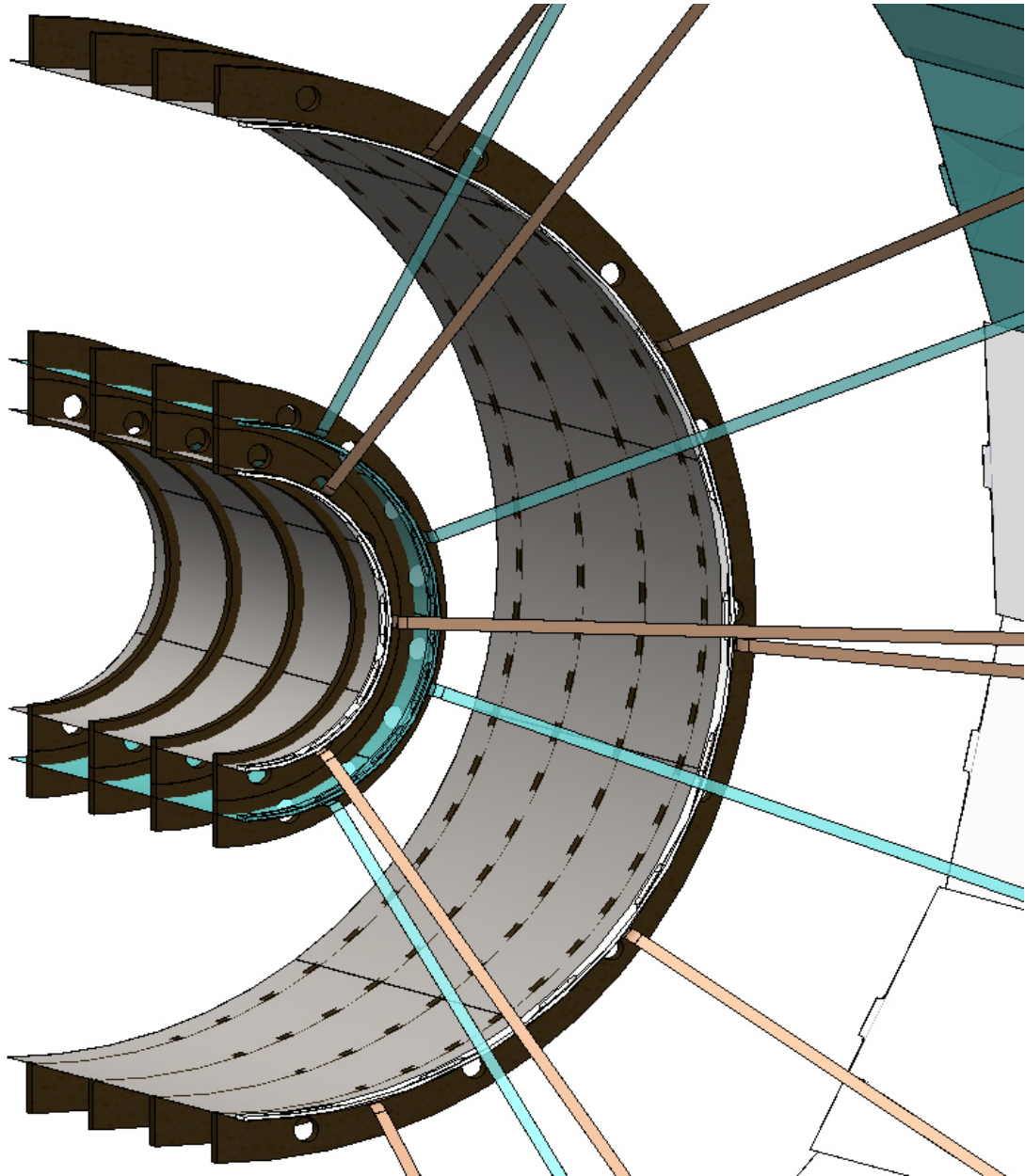
DISKS	+z [mm]	-z [mm]	X/X0 %
Disk 1	250	-250	0.24
Disk 2	450	-450	0.24
Disk 3	700	-650	0.24
Disk 4	1000	-900	0.24
Disk 5	1350	-1150	0.24

See talks by Ernst at <https://indico.bnl.gov/event/16582/> and <https://indico.bnl.gov/event/17348/>

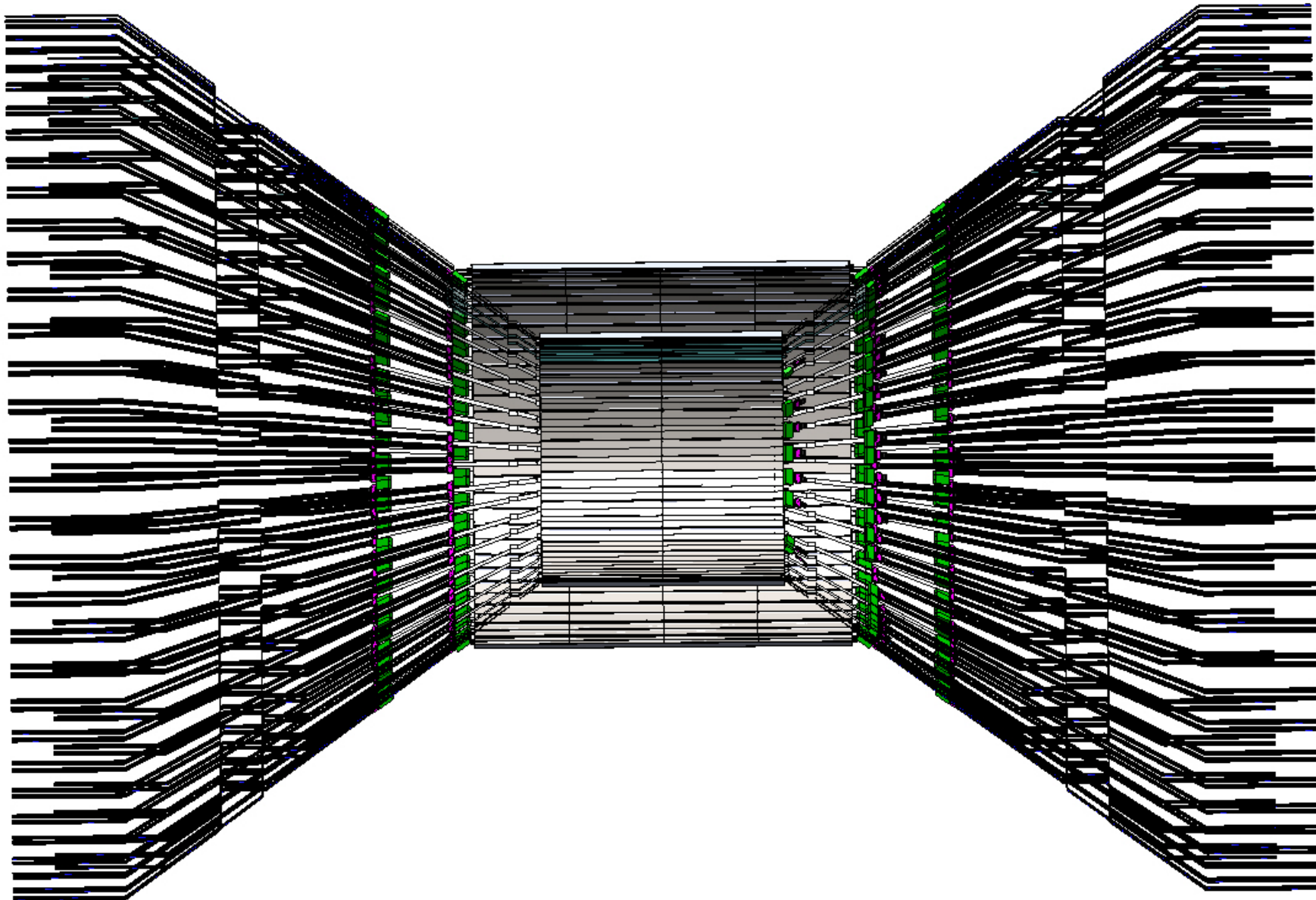
Vertex detector assembly – iso view, disks have no services; cables for read-out, cooling



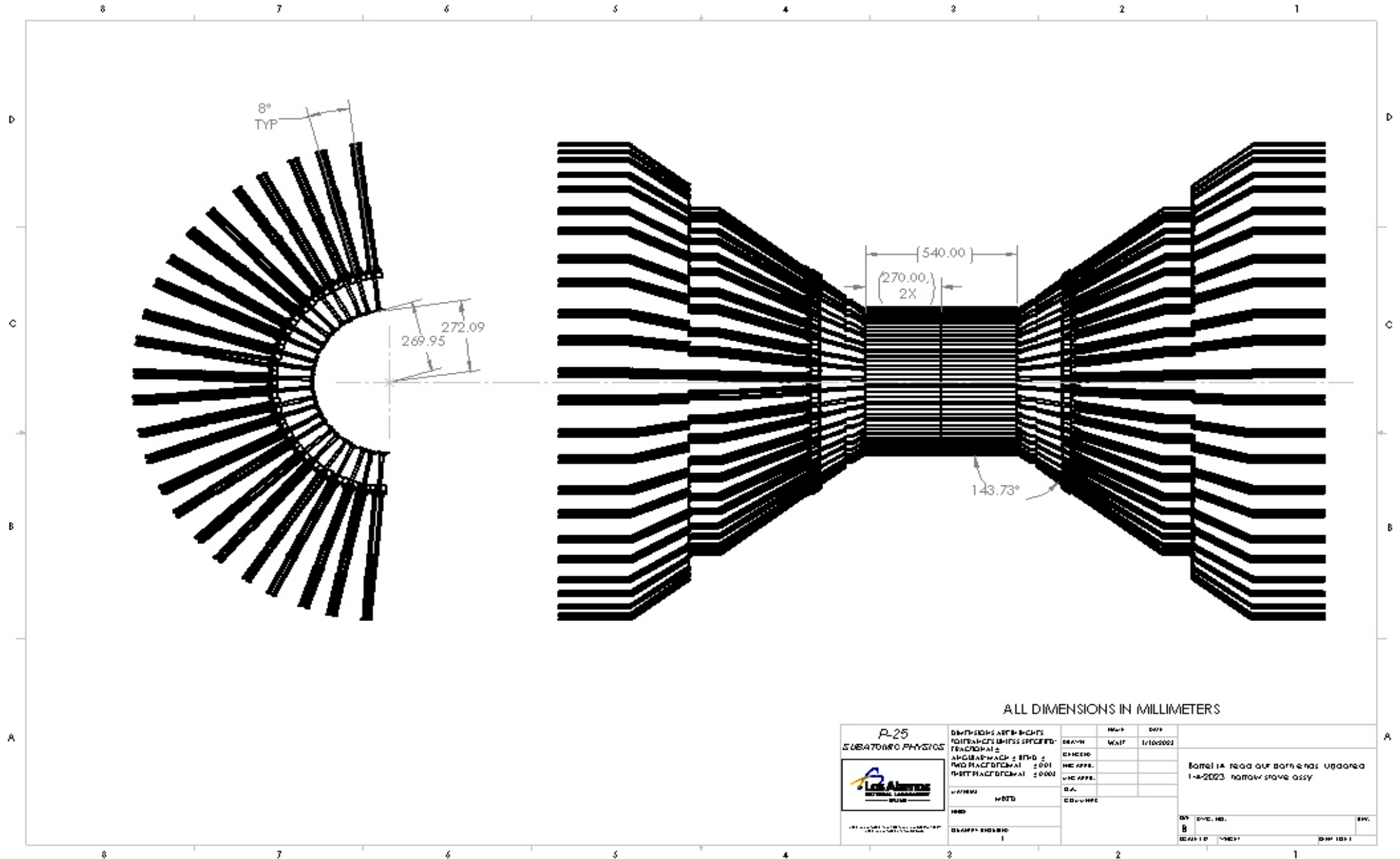
Section views, vertex only, vertex plus sagitta layers;



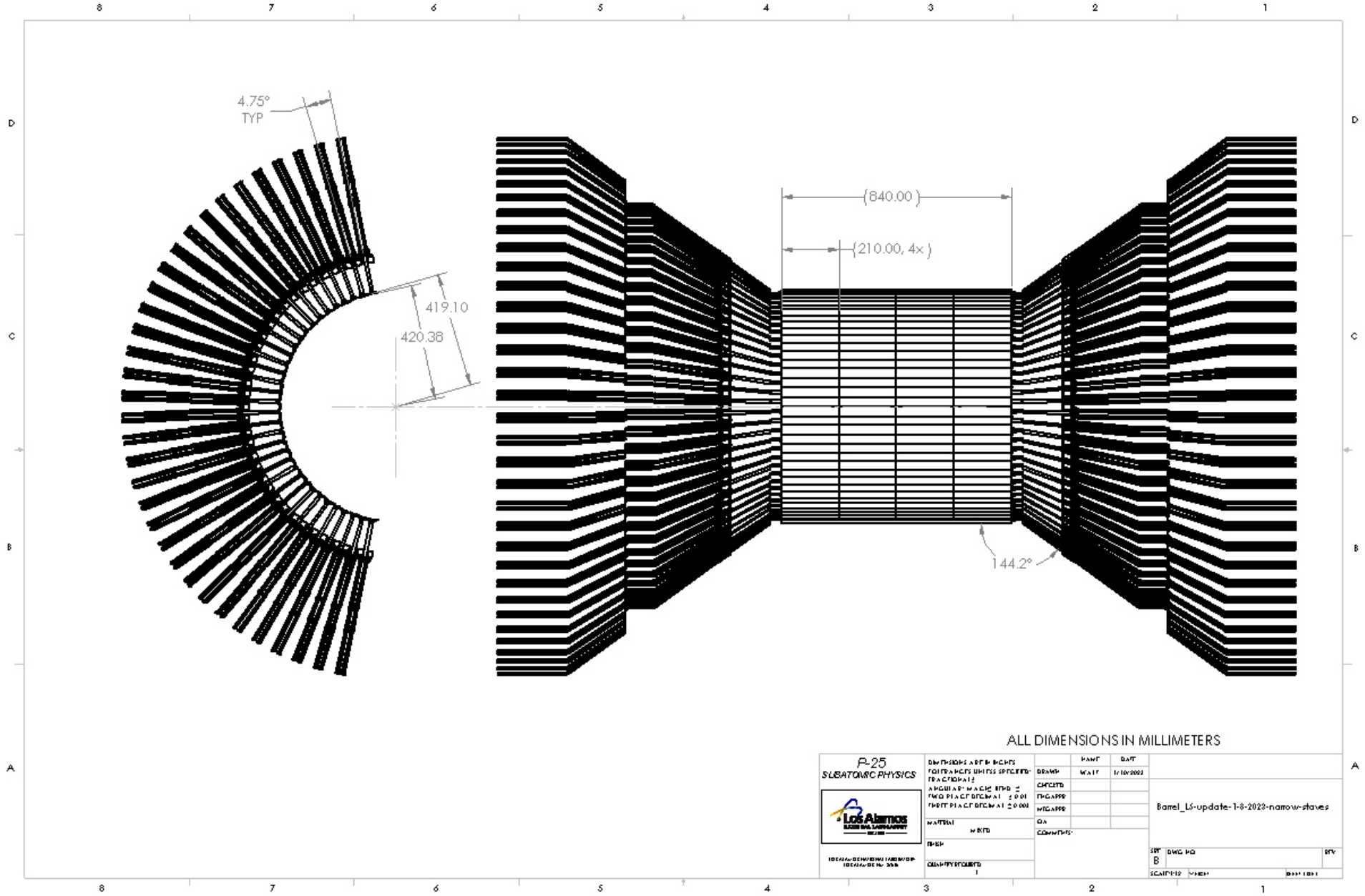
EPICS vertex detector sagitta layers 4 & 5



Mechanical drawing Sagita Layer 4;

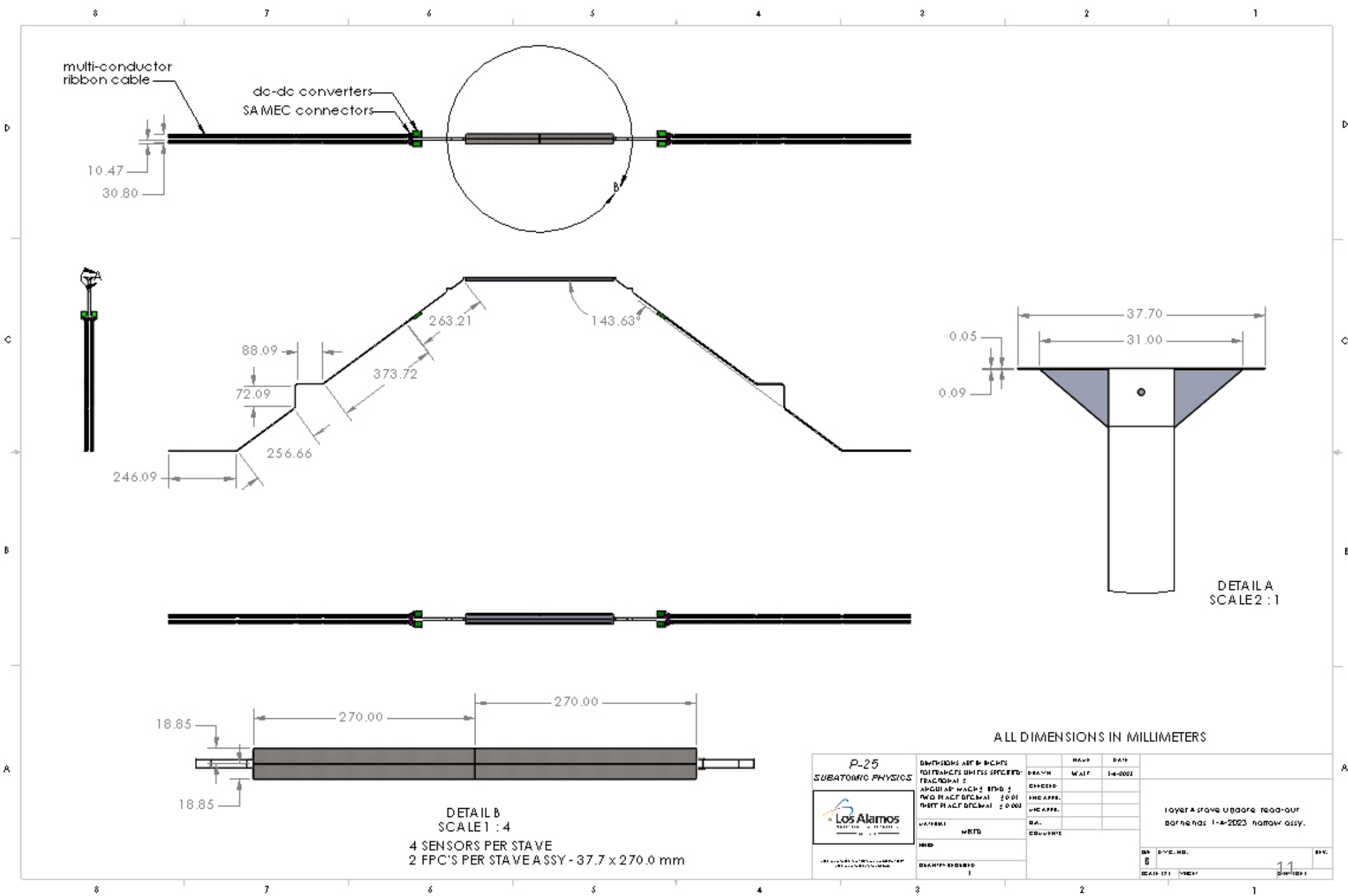


Mechanical drawing sagita layer 5



ALL DIMENSIONS IN MILLIMETERS

P-25 SUBATOMIC PHYSICS  <small>LOS ALAMOS NATIONAL LABORATORY 10240 SAN DIEGO AVENUE LOS ALAMOS, NM 87545</small>	DIMENSIONS ARE IN INCHES FOR FRANCHISE UNITS SPECIFIED FRACTIONS 1/2 ANGLES IN DEGREES 1/4 TWO PLACE DECIMAL 1/100 FIRST PLACE DECIMAL 1/1000	DRAWN CHECKED ENGINEER QA	NAME DATE 12/10/2023	Babel_LS-update-1-8-2023-narrow-staves
	MATERIAL FINISH QUALITY CONTROL	WEIGHT COMMENTS	DATE 12/10/2023	
	DWG NO SHEET NO	REV DATE	DATE 12/10/2023	
	SCALE	DRAWN BY CHECKED BY	DATE 12/10/2023	



multi-conductor ribbon cable

dc-dc converters
SA MEC connectors

10.47
30.80

246.09
256.66
72.09
88.09
373.72
263.21

143.63°

0.05
0.09
37.70
31.00

DETAIL A
SCALE 2 : 1

18.85
270.00
270.00
18.85

DETAIL B
SCALE 1 : 4
4 SENSORS PER STAVE
2 FPC'S PER STAVE ASSY - 37.7 x 270.0 mm

ALL DIMENSIONS IN MILLIMETERS

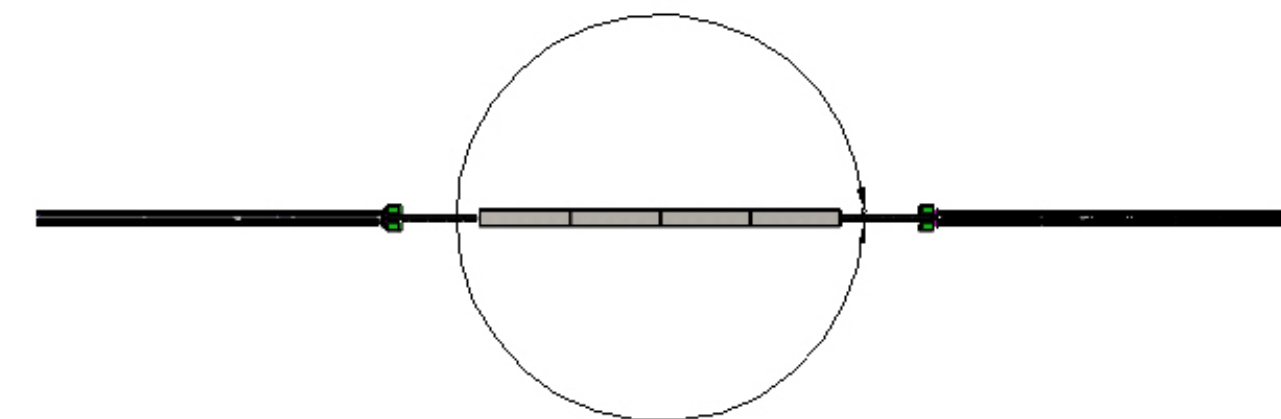
P-25 SUBATOMIC PHYSYS		DIMENSIONS ARE IN INCHES FRACTIONS UNLESS SPECIFIED DECIMALS ANGULAR TOLERANCES UNLESS SPECIFIED FRACTIONS DIMENSIONS UNLESS SPECIFIED DECIMALS	DRAWN CHECKED INCH APPR. METR APPR. QA EQUIPMENT	NAME DATE 14-0001	TOWER STAVE UPGRADE READ-OUT BORNE HAS 1-A-2023 narrow assy.
MATERIAL FINISH QUANTITY REQUIRED 1	WEIGHT	DRG. NO. 8	REV. 11		

1/30/2023

8 7 6 5 4 3 2 1

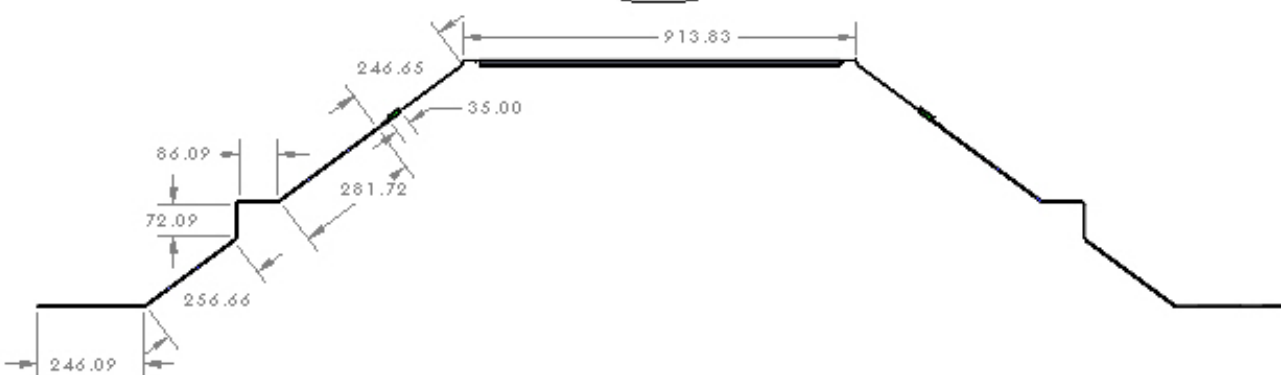
D

D



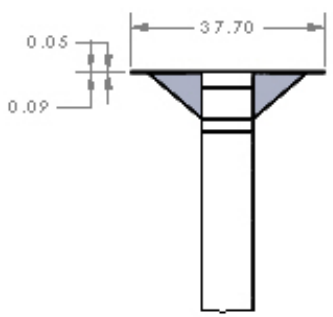
C

C



B

B

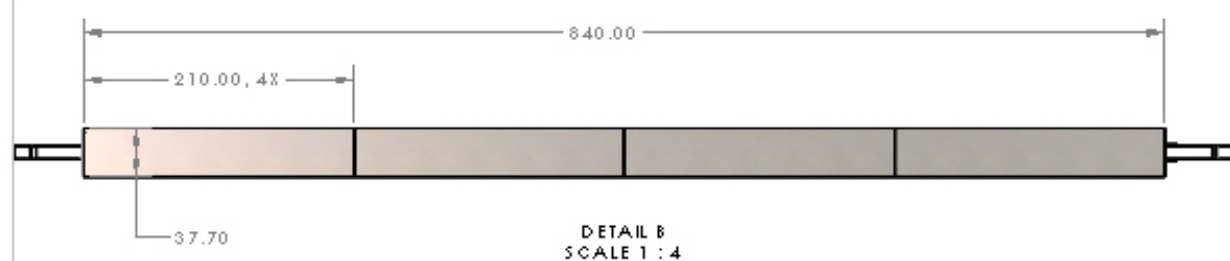


DETAIL A
SCALE 1 : 1



A

A



DETAIL B
SCALE 1 : 4

ALL DIMENSIONS IN MILLIMETERS

P-25
SUPERCONDUCTING PHYSICS

Los Alamos
NATIONAL LABORATORY

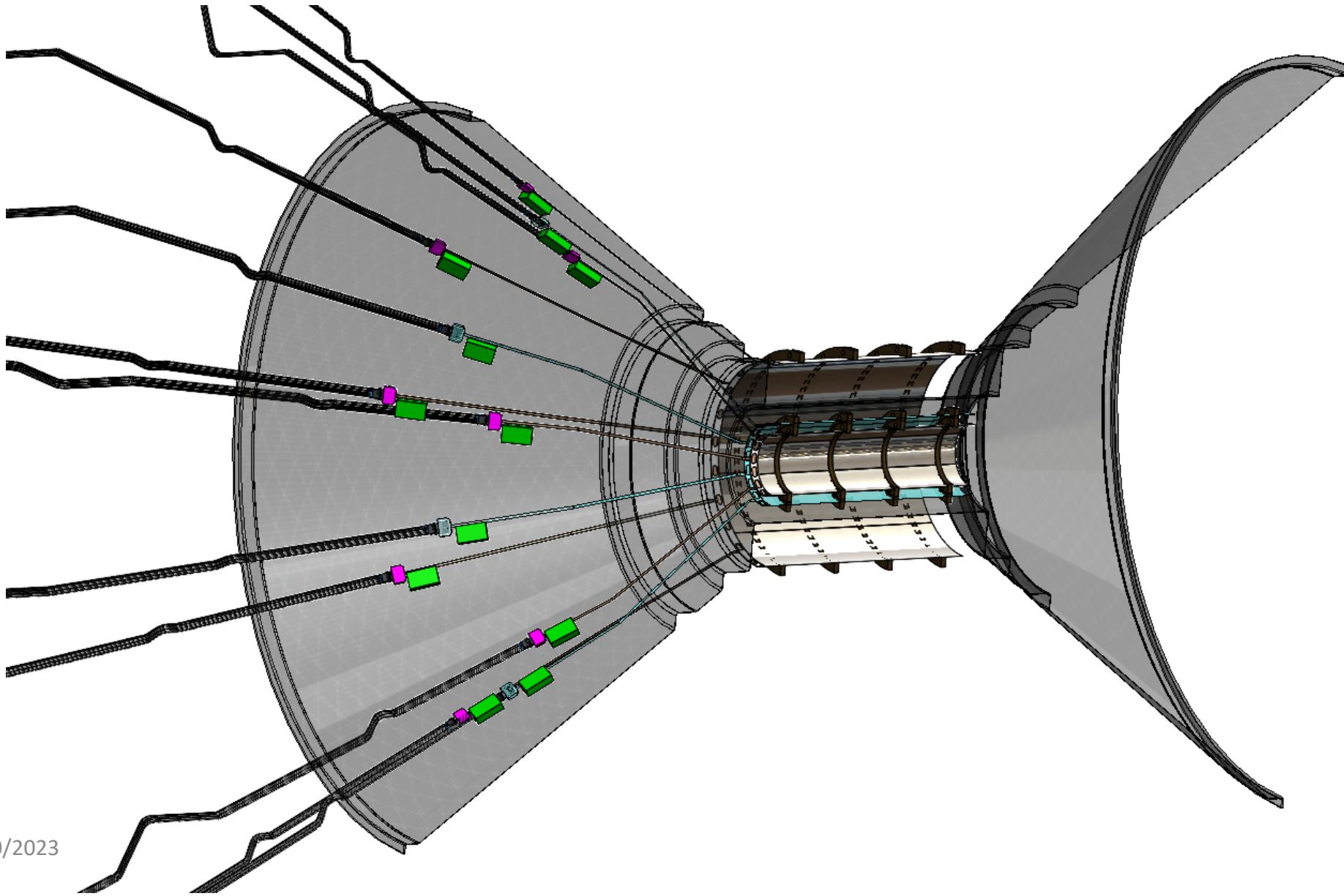
DRW	DATE	REV
DRW	1-1-2023	1
CHKD		
INSTR		
DATE		
BY		
CHKD		
DATE		

layer 3 show double ended lead-in 1-3-2023 narrow showassy	
BY	DATE
B	
CHKD	DATE

1/30/2023

8 7 6 5 4 3 2 1

EPICS vertex layers 1, 2 & 3, read-out one end;



EPICS vertex detector with EIC beampipe;

