

SiD VXD Geometry Update

Su Dong
SLAC

General Strategy

- The barrel + endcap layout is aimed at reducing the various effects at shallow entrance angles to a pure barrel geometry: effective material growth, sensitivity to radial alignment and Z spatial resolution degradation due to irreducible ionization fluctuation.
- General philosophy on material: Start from a known working detector (SLD VXD3) to make sure all parts are included. Reduction to material argued with real design changes.

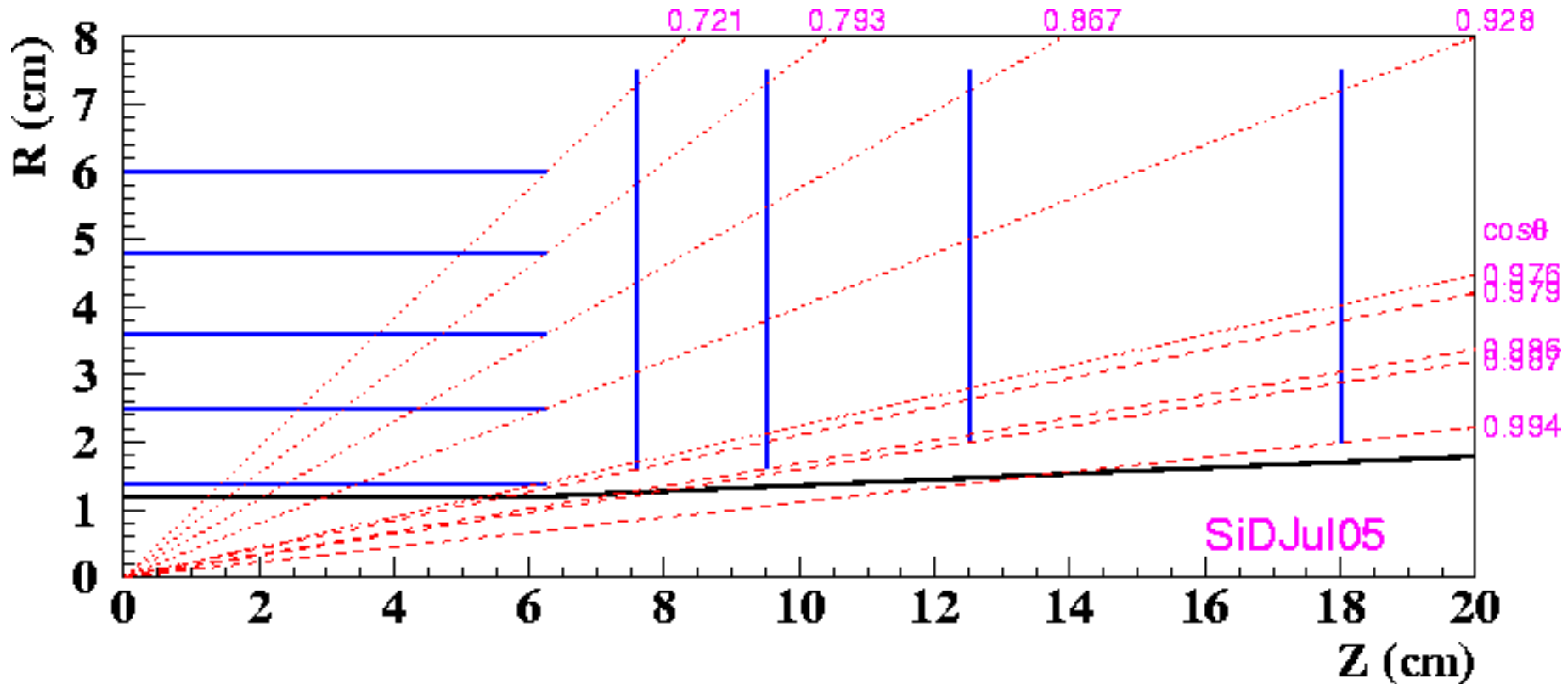
The geometry and material design are detailed on the SiD vertexing web page:

<http://www-sid.slac.stanford.edu/vertexing>

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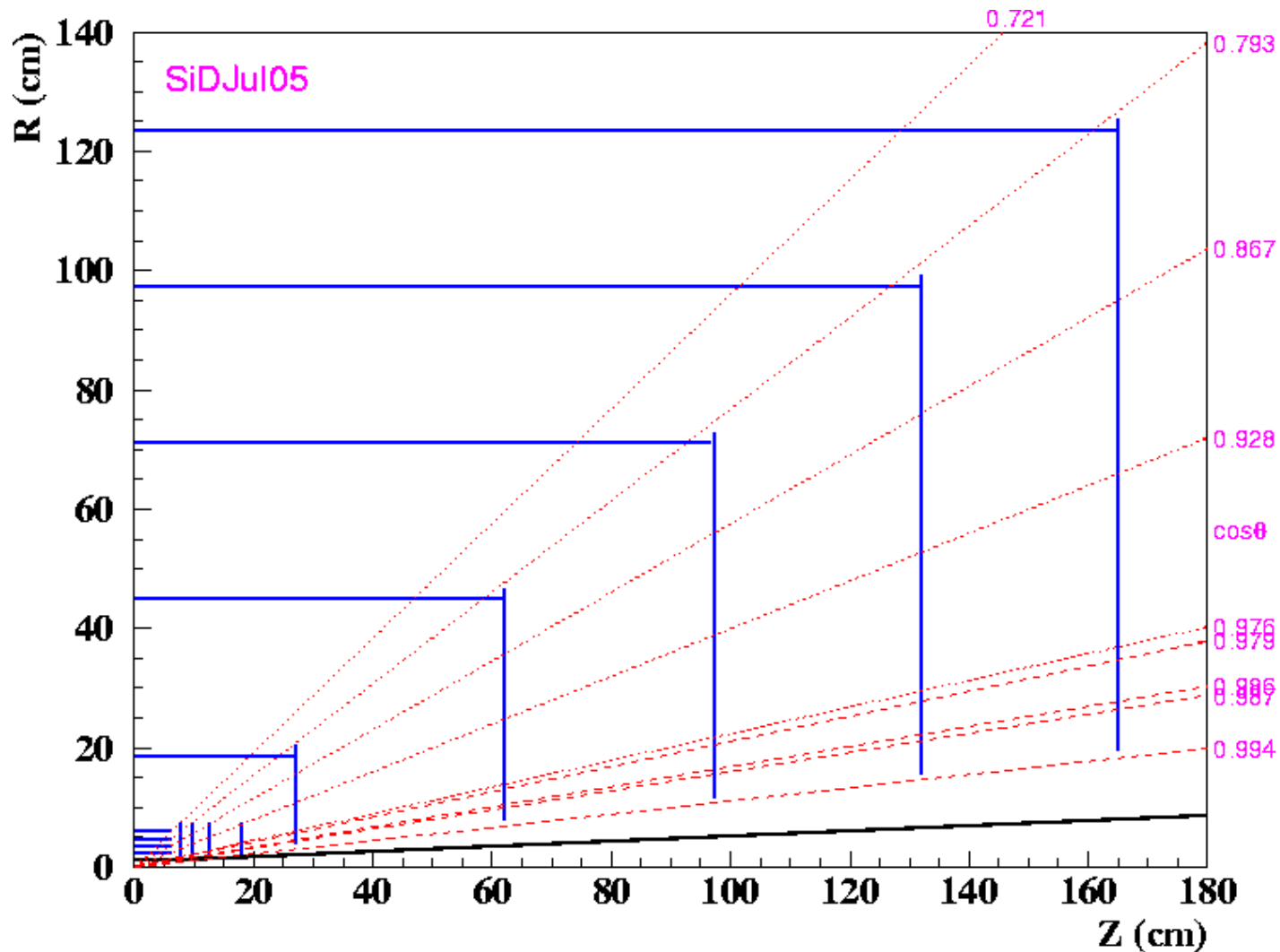
This is only the starting point !

Current SiD Geometry (SiDAug05)



Aimed to get good 5 hit coverage at all angles for self tracking
Many issues for $\cos\theta > 0.98$
Sensors are generic pixels of $20 \times 20 \times 20 \mu\text{m}^3$

Tracker+VXD matching



VXD geometry updates

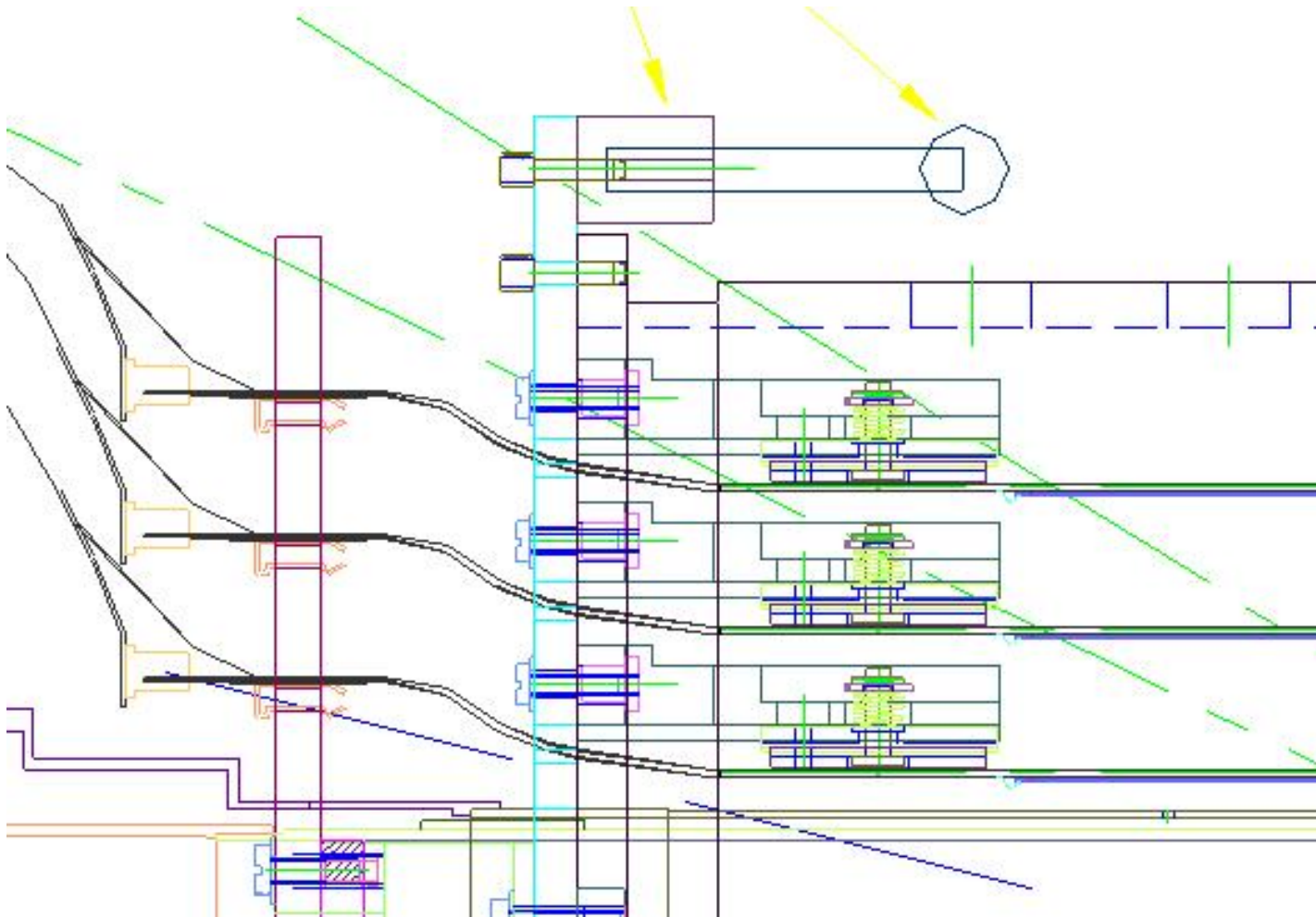
- Barrel layer 2,3 lowered by 1mm in radii
- All endcap discs moved out in Z
- All endcap discs outer radii 7.0->7.5cm for more robust endcap/barrel overlap
- Limit endcap disc inner radii to two types (1.6cm,2.0cm). Needed to increase inner radius to allow VXD services to connect to outside world.

VXD Barrel Material

	SLD VXD3	SiD VXD
Beampipe liner	Ti 50μm 0.14%	Ti 25μm 0.07%
Beampipe	Be 760μm 0.22%	Be 400μm 0.07%
Inner gas shell	Be 560μm 0.16%	(Note 1) 0
Ladder/layer	0.41%	0.11%
Outer gas shell	Be mesh 0.48%	0.28%
Cold N2 Gas	0.05%	0.05%
Cryostat coating	Al 500μm 0.58%	0.22%
Cryostat foam	Urethane 0.44%	NilFlam 0.12%

Note 1) Cooling gas can be brought in from two ends

SLD VXD3 endplate region



Endcap Region Material

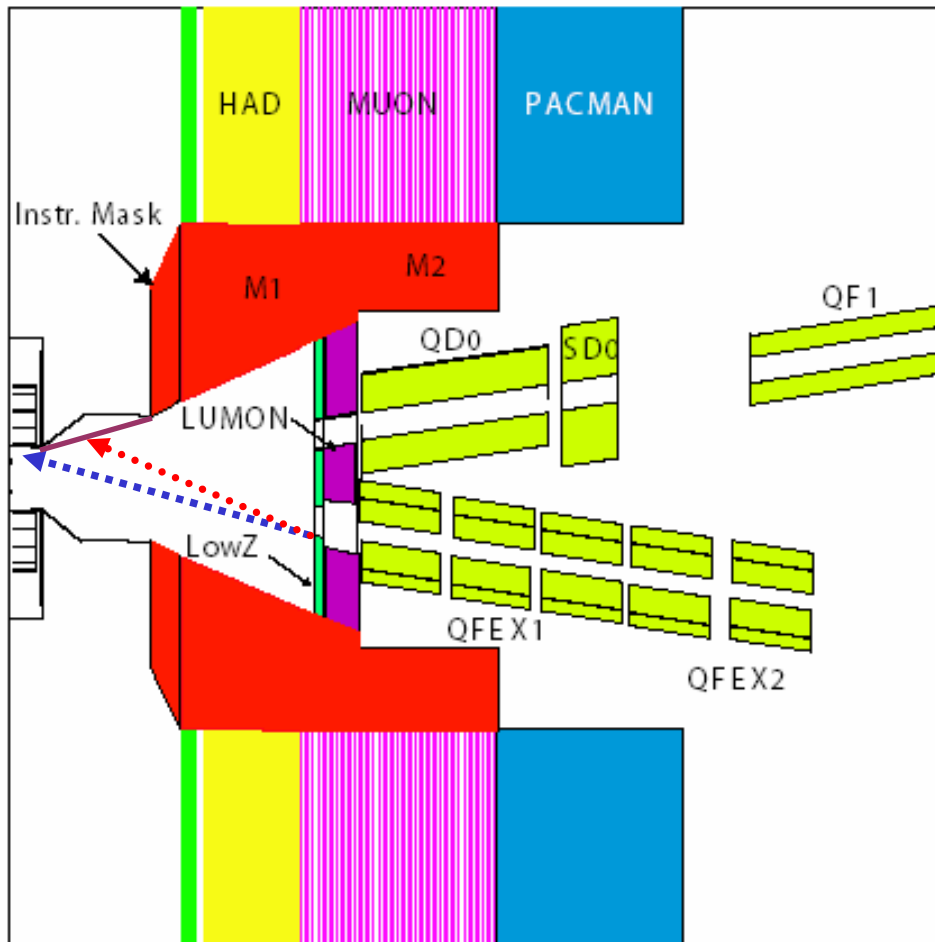
	SLD VXD3	SiD VXD
Barrel Endplate	Be/Fe/gap 3mm 1.5%	Composite ? 0.5%
Barrel support annulus	Be ~2.4%	1.0% ?
Ladder blocks	Al ₂ O ₃ (smeared) 3.0%	1.0% ?
Striplines	Kapton/Cu (face on) 0.5%	0.2%
Stripline clamp support	Be plate with holes ~1.0%	0
Stripline connectors	Hit it 0.4%; smear 0.14%	0
Cryostat	Foam 0.4%	0.4%

- What to replace the sliding blocks ?
- Readout can be replaced by optical system similar to ATLAS (T>-10C) with a very small transceiver and very thin fibers.
- Still needs power strips
- No need of clamp and connectors in active fiducial volume.

More Endcap materials

- The cone section of the beam pipe is 1mm Be and need to add some liner which should be x3 thicker than center.
- Add disc mechanical support placeholder: 1mm thick Be rings with 7mm radial width around outer and inner perimeters of the discs (absorbing the material for space frame rods linking these rings in these rings).
- A cone/cylinder of material just outside the coned section of beampipe for VXD fiber/strips/cooling material (~5% R.L. in radial direction).

Beam Line Related Issues



Main synchrotron back scatter source is expected to be the **beam hole edges** at $z=3.15\text{m}$

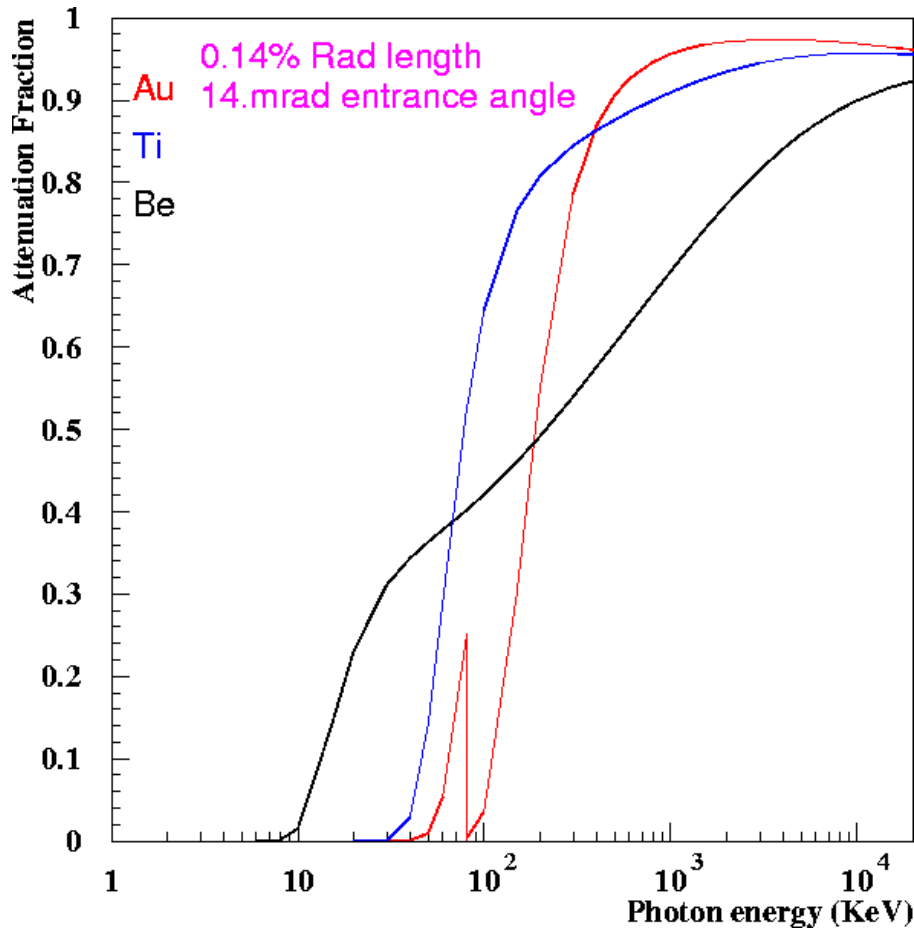
- Entrance angle to central barrel beampipe $\sim 14\text{mrad}$ (worst case)
- Entrance angle to coned section of beampipe $\sim 43\text{mrad}$ (need ~ 3 times thickness than central)

If beam crossing angle is 2mrad , entrance angle for central section can go down to $\sim 5\text{mrad}$ (~ 3 times thinner central liner)

How do VXD cables, cooling pipes etc. get out pass the M1 ? They present material in front of the instrumented M1 coverage.

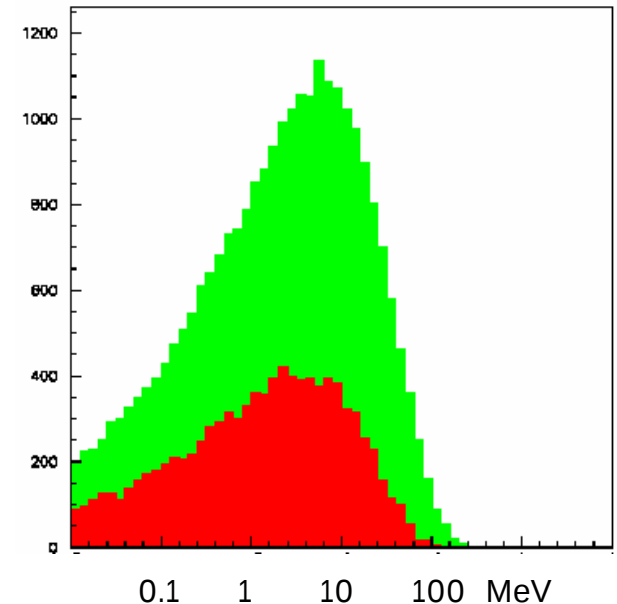
From Takashi Maruyama (LCWS05)
for 20mrad crossing angle

Beampipe Liner



Direct synchrotron

(backscatter spectrum to be calculated)



From Takashi Maruyama

Liners help taking out low energy synchrotrons, but is the attenuation adequate for high energy synchrotrons ?

Key Issues

- What mechanical realization could bring down the barrel endplate material (including power/signal cable routing) ? Warm sensors can make it much easier ? Alternative geometry (e.g. increased barrel length, or lamp shade?)
- What polar angle cutoff we should be aiming for ? Going beyond $\cos\theta=0.98$ require much more care on coned section of beam pipe: liner and Be thickness, endcap inner bore space and position of VXD services.
- Endcap disk support require more detailed sign.

Snowmass Activities and Goals

- VXD sensor and mechanical design discussions (**Tuesday Aug/23 1:30pm**). Brainstorm on major issues such as thin barrel endplate support.
- EMI pickup discussion and what to do for SLAC beam tests (**probably Friday Aug/19 morning or Monday Aug/22 morning**)
- Simulation training (**tutorial Wednesday Aug/17**). Start making tools to look at GEANT output.