Beamline and VXD Geometry

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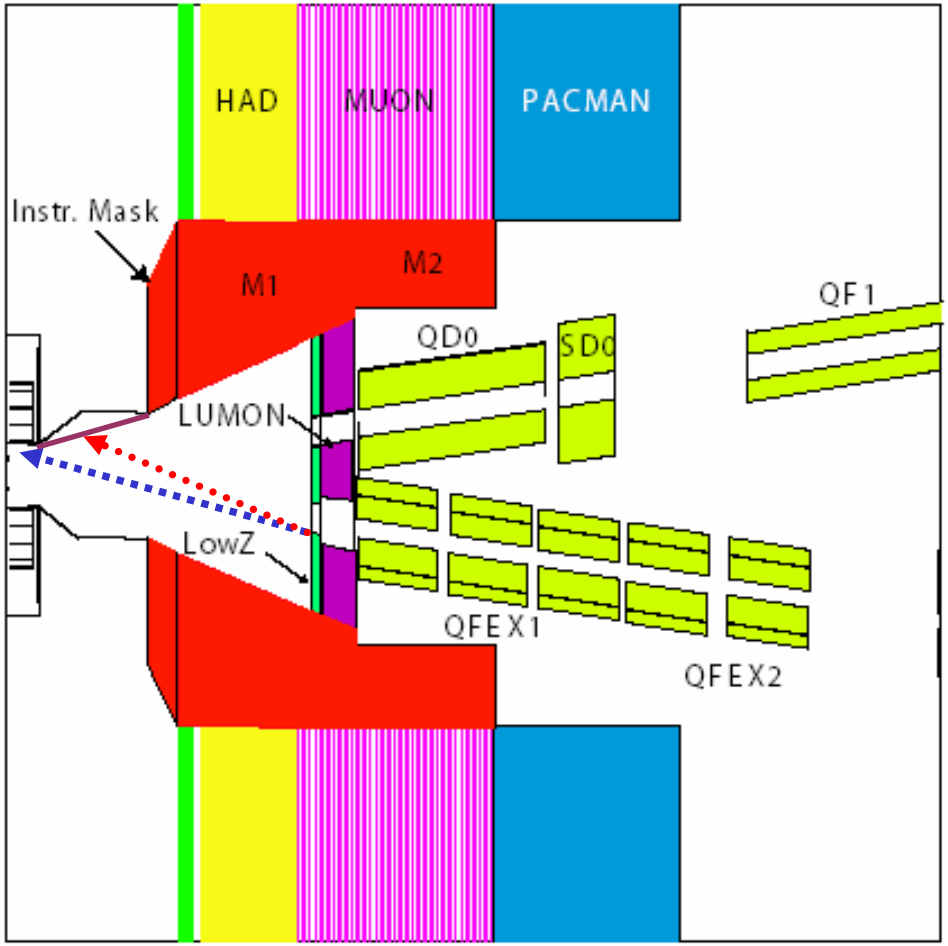
Beam Line Related Issues



From Takashi Maruyama (LCWS05) for 20mrad crossing angle

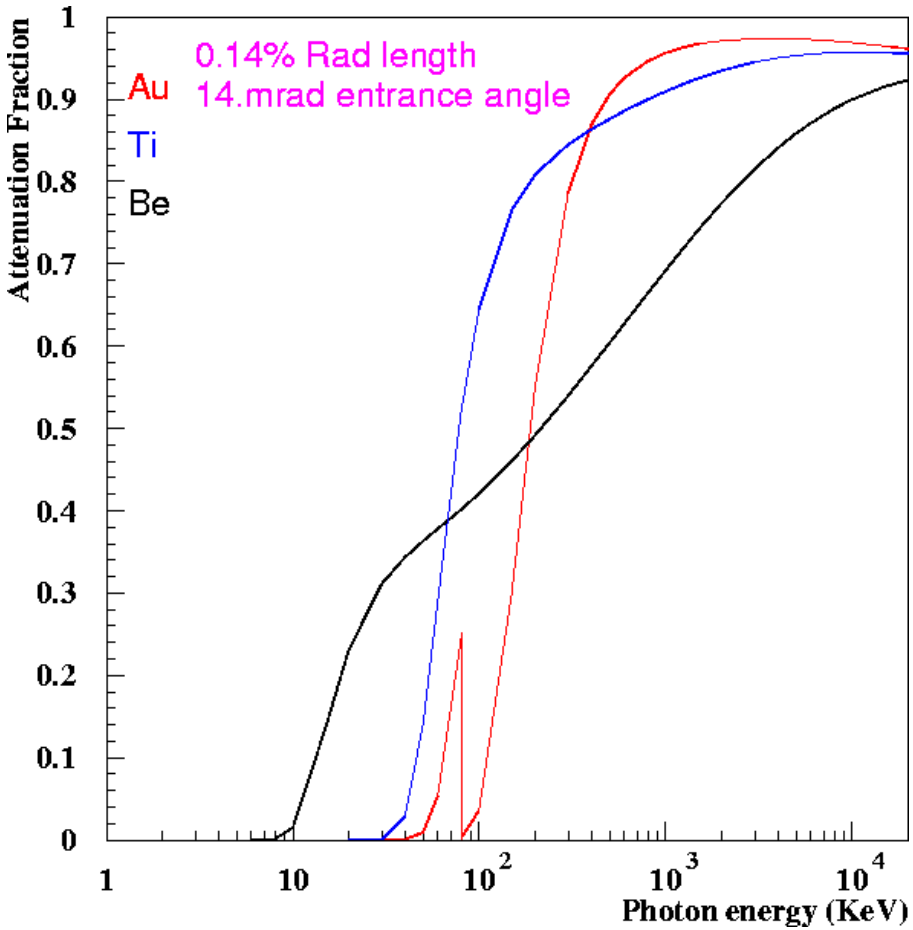
Main synchrotron back scatter source is expected to be the beam hole edges at z=3.15m

- Entrance angle to central barrel beampipe ~14mrad (worst case)
- Entrance angle to coned section of beampipe ~43mrad (need ~3 times thickness than central)

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

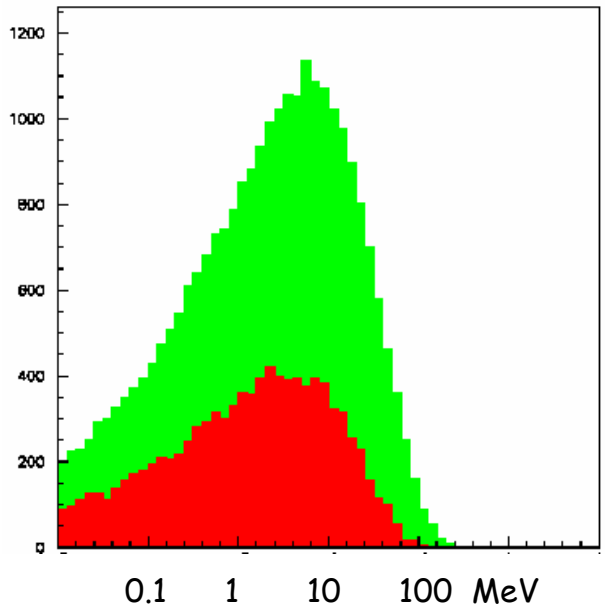
How do VXD cables, cooling pipes etc. get out pass the M1 ? They present material in front of the instrumented M1 coverage.

Beampipe Liner



Direct synchrotron

(backscatter spectrum to be calculated)



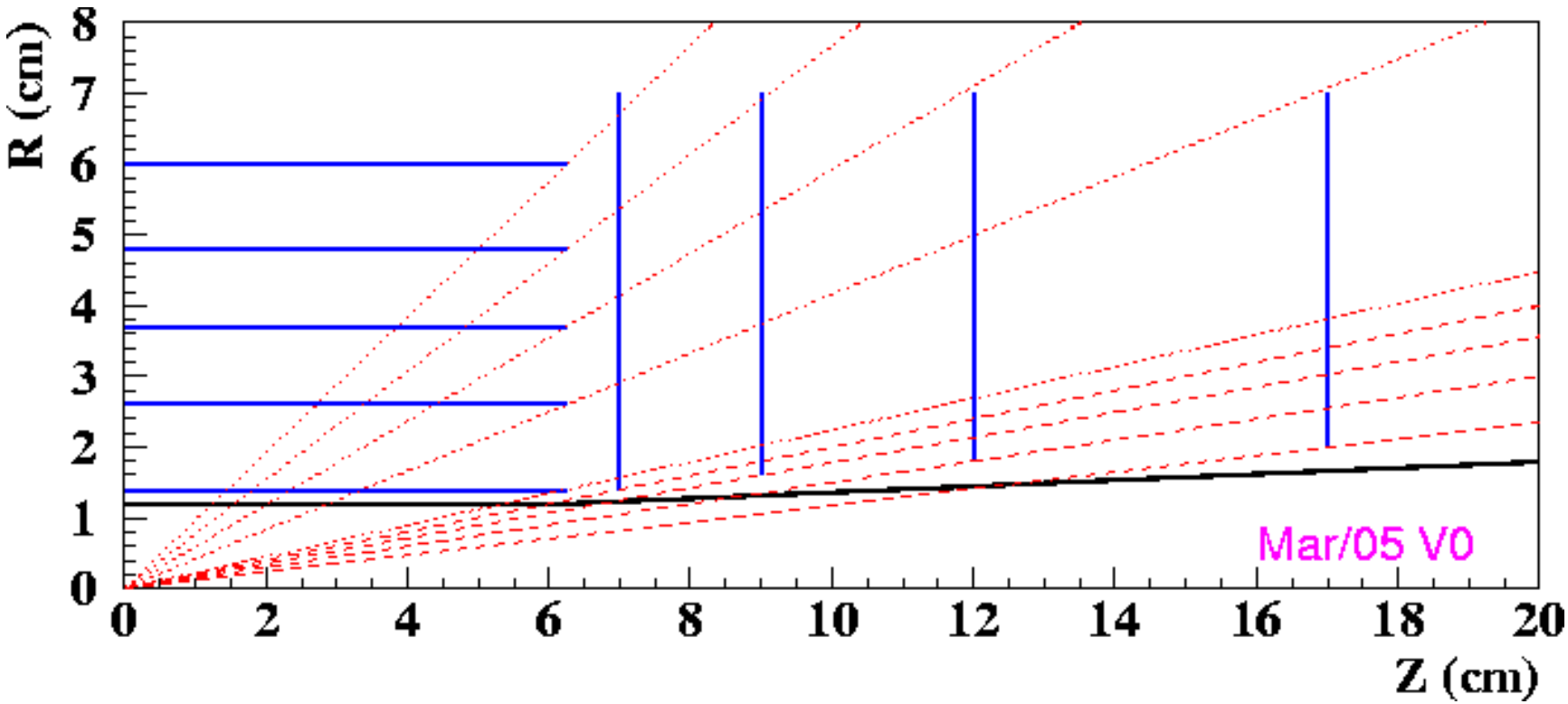
From Takashi Maruyama

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

Try to Converge on Geometry

- There are many detailed issues which need real design effort to demonstrate what we put in are reasonable and much optimization can be done with analyses.
- For now we need to get something established for the first batch of simulation so that we can look at the full GEANT simulation output immediately to exercise all down stream recon/analysis software.
- Some of the suggested modifications to follow are somewhat hand waving aimed to get some reasonable guesses in to get started and we shouldn't lose sights of the weak assumptions led to some of the current numbers. I think we could have another iteration of the baseline before Snowmass.

Current VXD geometry



Some issues:

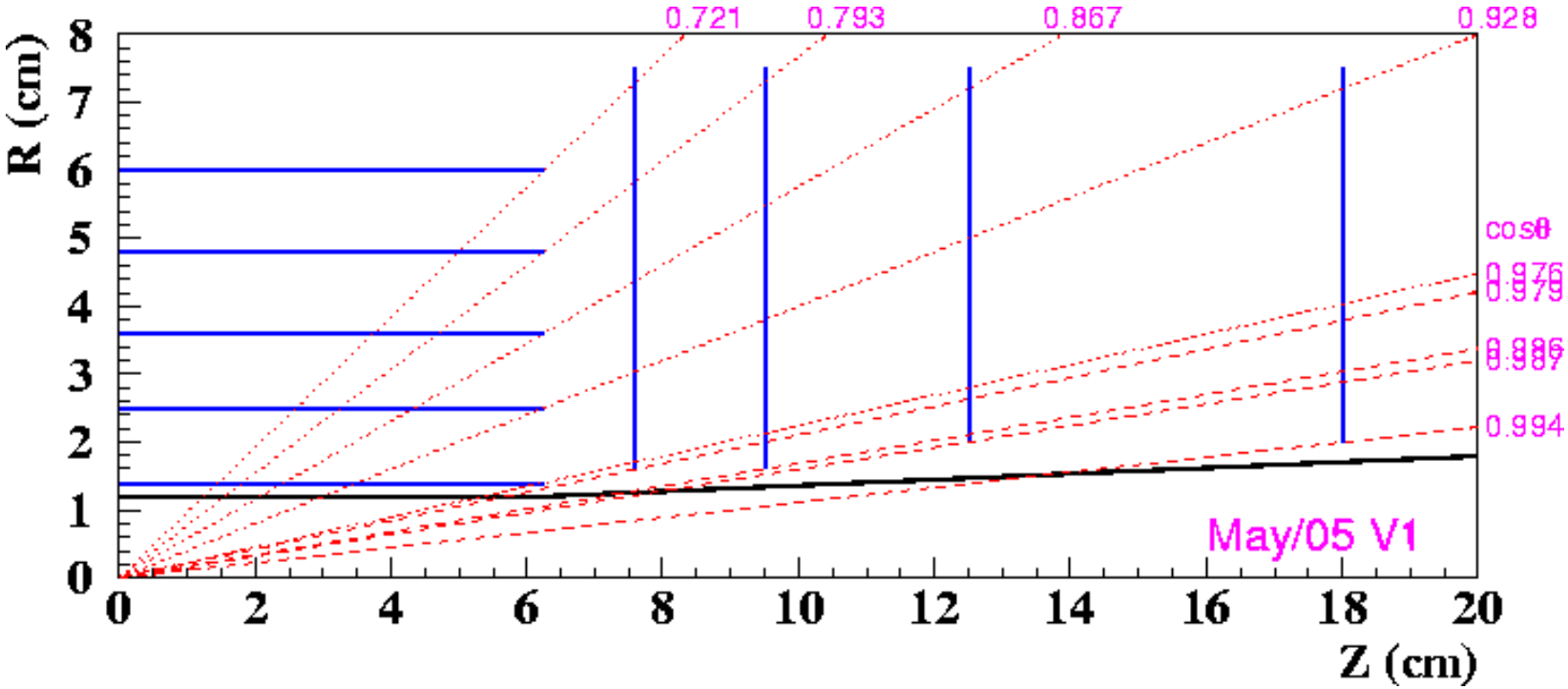
- First endcap plane too close to barrel ? (barrel cables)
- Need space (below disc 1 especially) near BP for cooling/cables.
- Inner cosθ matching not coherent (but no harm).

VXD endcap disc pixel layout

- A) Radial pixels with same ϕ coverage:
  - Clean readout toward inner bore
  - Ratio of pixel size outer/inner~4. Outer resolution degrade ?
- B) Rectangular barrel like modules stacking fan:
  - Same sensor module as barrel
  - Flexible in tuning inner/out radii
  - Readout all at inner bore.
  - Very difficult to stack with excessive inner overlap.
- C) Square constant size pixels, section into few rectangles
  - Simple pixel unit
  - Some readout nodes on outside can use traces wrap over to the back of the wafer to get to inner bore output ?
  - No seams between sections ?
- D) A few ring sections, pixel with same ϕ coverage within each ring section.
  - Advantage/disadvantage similar to c)

=> ***C) may be the most favorable ?***

Attempt to tune VXD geometry



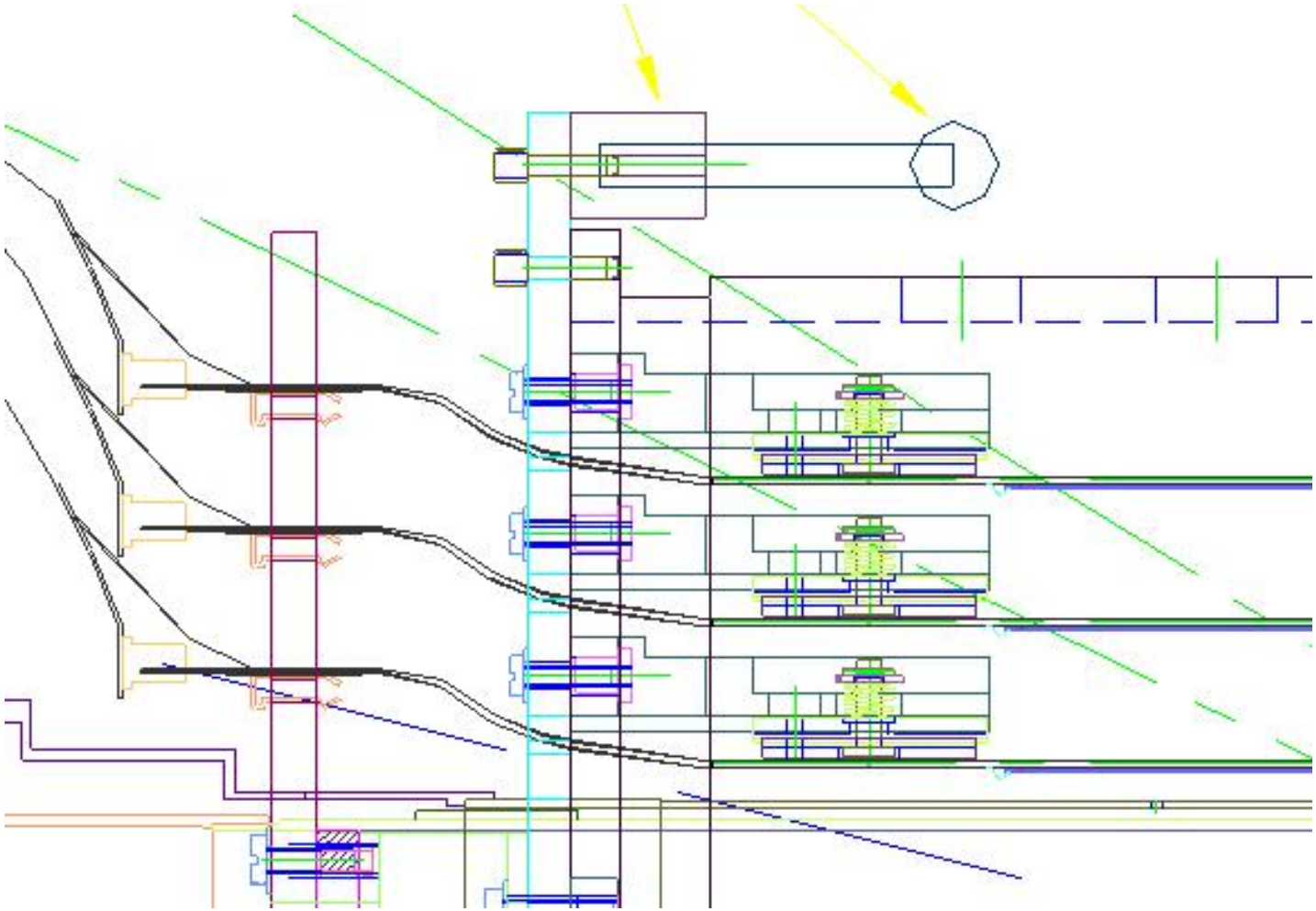
- Barrel layer 2,3 lowered by 1mm in radii
- All endcap discs moved out in Z
- All endcap discs outer radii 7.0->7.5cm
- Limit endcap disc inner radii to two types (1.6cm,2.0cm)

(Primary consideration was to relieve space and minimize differences between the discs).

VXD Barrel Material

	SLD VXD3		SiD VXD	
Beampipe liner	Ti 50μm	0.14%	Ti 50μm	0.14%
Beampipe	Be 760μm	0.22%	Be 250μm	0.07%
Inner gas shell	Be 560μm	0.16%	-	
Ladder/layer		0.41%		0.10%
Outer gas shell	Be mesh	0.48%		0.30%
Cold N2 Gas		0.05%		0.05%
Cryostat coating	Al 500μm	0.58%	-	
Cryostat foam	Urethane	0.44%	-	

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_2O_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%	-

- 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 beampipe is 1mm Be and need to add some liner which should be somewhat thicker than barrel cetral. **Say x2 -> 0.28%.**
- The endcap disc, assume Si+form support ~0.2% ?
- Add disc mechanical support, 2mm thick Be rings with 1cm 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 (not yet have an estimate).