MDI Interface Issues

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For

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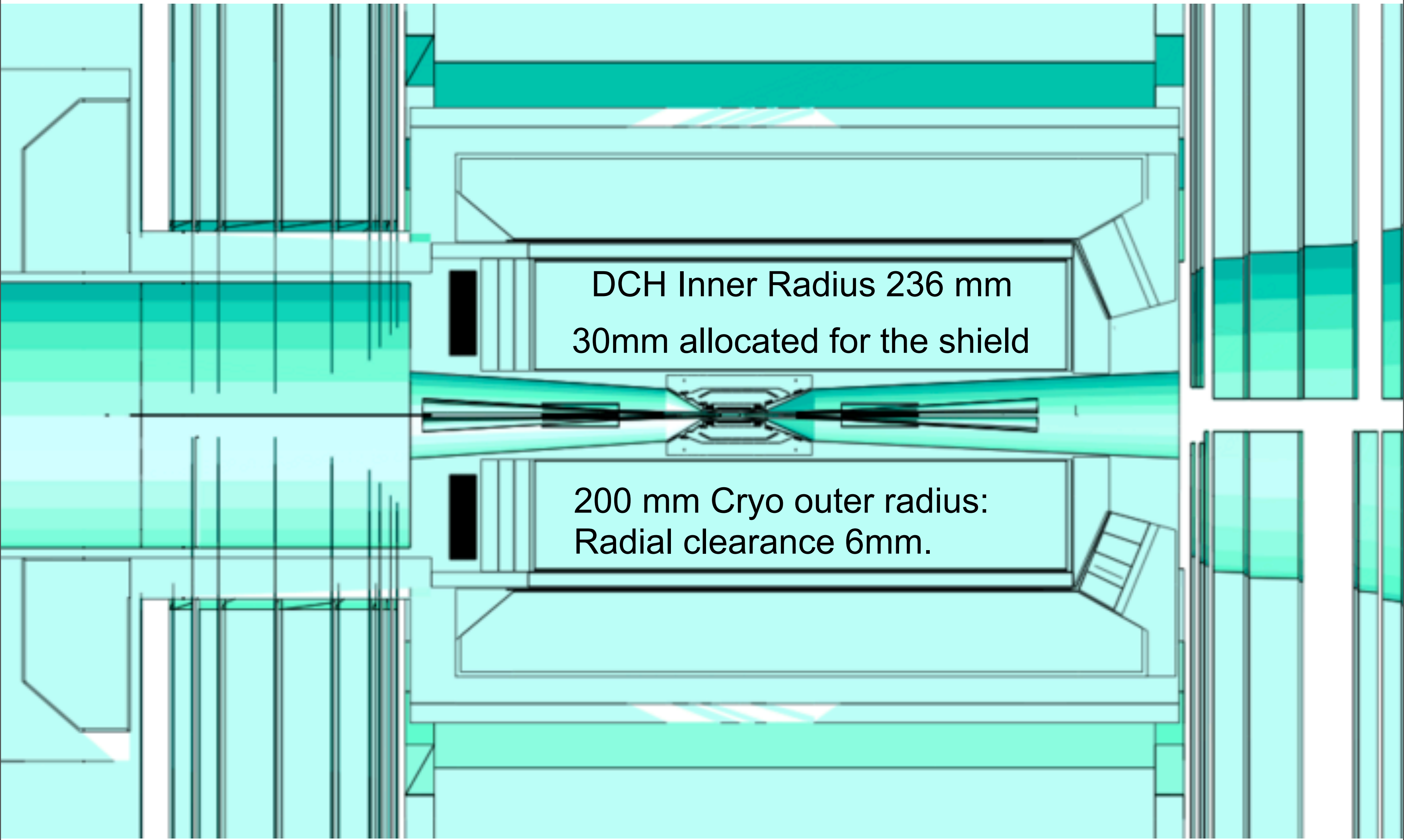
SuperB Workshop XIII
Elba, Italy
June 1-4, 2010

A List of Topics at the Interface

- **Physics beampipe**
  - Inside radius is 10 mm
  - As thin a Be wall as possible
    - Power absorbed by the Be pipe (next talk)
    - RF penetration if the pipe is too thin?

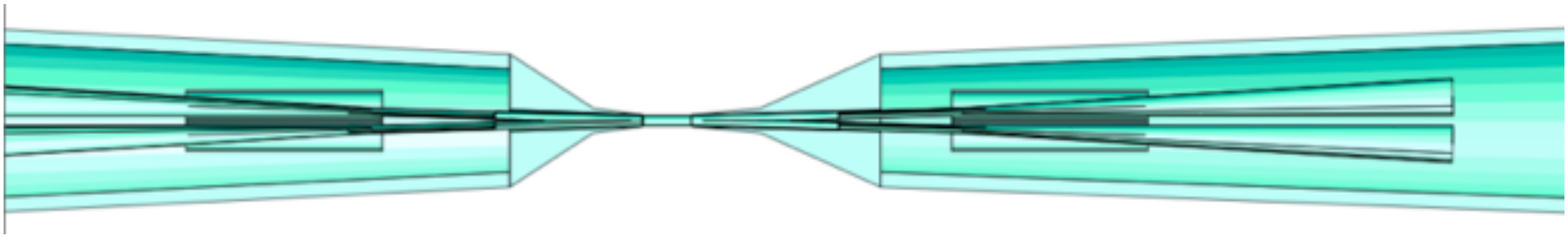
- **Angle of acceptance & Outer Radius**
  - 300 mrad is the demarcation line
  - Cryostat may end up close to that boundary (Shields?)
  - Presently assume that any detector hardware inside 300 mrad must be negotiated with machine (and vice versa)
    - This is out to some radius – presently Mike assumes ~20 cm.
  - We need some space down near the physics beampipe for a bellows and a flange pair
  - The SVT will want some space in this area as well

Mechanical Interface cut-away



Shields Issues

- The 3 cm thick tungsten shields are barely sufficient to protect the detector.

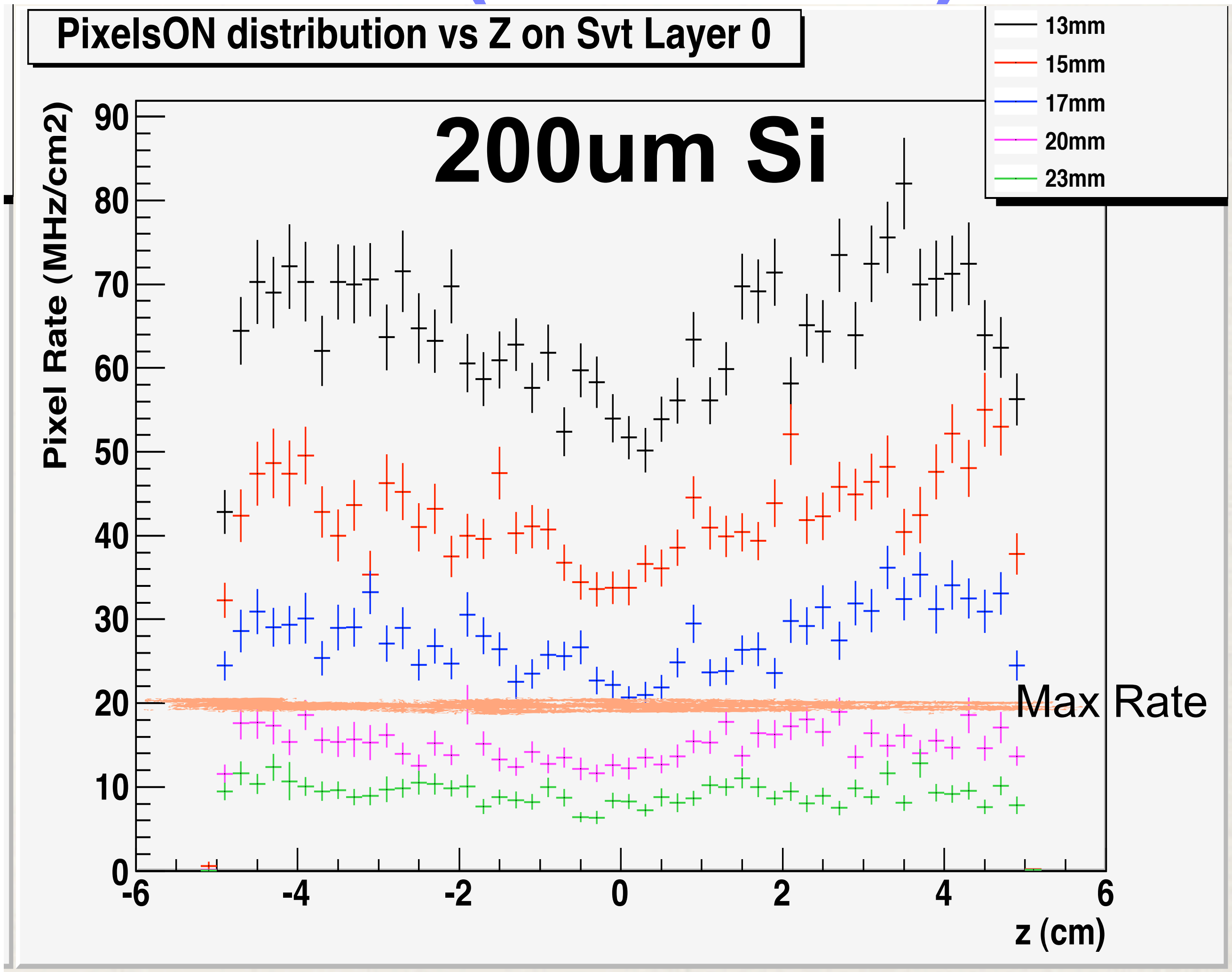


  - The Present shape of the shield model in Bruno is not compatible with John Cryo design
- These heavy shields cannot be supported by the detector, nor by the cryostat.
- Can they be the very support of the beam line? ENGINEERS, ENGINEERS...

IP issues, or: “Darling, where did you put the IP?”

- Tech board Caveat: with the reduced boost the optimal longitudinal IP position is slightly closer to the forward door (more symmetric detector).
  - Solenoid compensation
  - Door plugs, solenoidal field
- Mike caveat: IP sweat spot can be displaced by a few millimiters w.r.t. the nominal one
  - Eugenio concern: L0

L0 rate vs IP-L0 distance (R. Cenci)



How do we account for the IP transverse displacement?

- Transverse displacements order of 3 mm can be accounted in the factor 5 safety margin.
- Bigger transverse displacements led quickly the L0 baseline design in trouble.
- If machine people need to move around the IP up to a few mm from the inner beam pipe wall then detector people should be warned (and they will react).

Magnetic fields

- The air-core super-conducting quads will have an external field that might perturb the detector field
  - Tracking software people would prefer a constant B detector field.
- The same may be true for the compensating solenoids
  - The recent news from KEK (Oide-san) is that we must be more careful of the fringing fields of the compensating solenoids and the detector solenoids
  - This is especially true because the beams have a large crossing angle. The beams traveling with a large angle through the radial fringing field produces vertical emittance

More Topics

- **Quick access to the SVT and PM slices**
  - Presently working toward a rapid (few days) access to the SVT (and PM)
    - Cryostat design is already incorporating this
  - Flanges between the cryostats
    - More on this
- **Shared permanent magnets close to the IP**
  - Take up space
  - We want to maximize the probability of success of the accelerator
    - One way is to get focusing in as close as possible to the IP
    - No storage ring accelerator has tried to achieve the low beta* values we have at the IP

Have proposed removing these

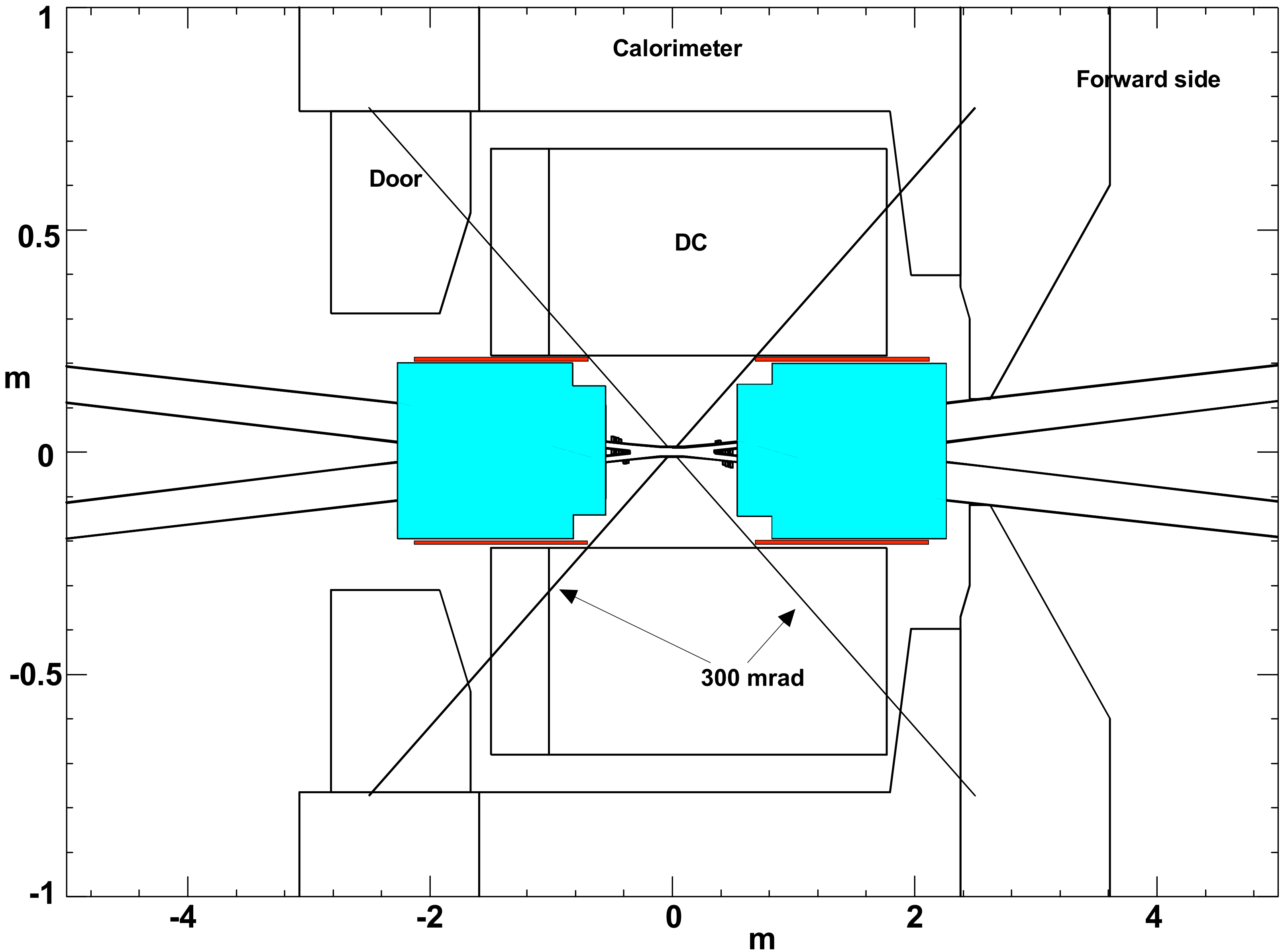
Magnetic fields (2)

- **With this potential of vertical emittance growth (which is the last thing we want) we need to cancel the detector fringing field as best we can**
  - Plan to redesign the compensation so that the compensating fringe field matches the detector fringe field at the outboard side of the cryostats
  - Then the compensation in toward the IP remains steady and just nullifies the detector field over QD0 and QF1
  - Fringe fields from the compensating solenoid near the IP are less troublesome because the beams are now much closer to the detector (and compensator) axis
  - We need the compensating solenoids then to be cylindrical and centered on the detector axis
  - Need to study this with the lattice people

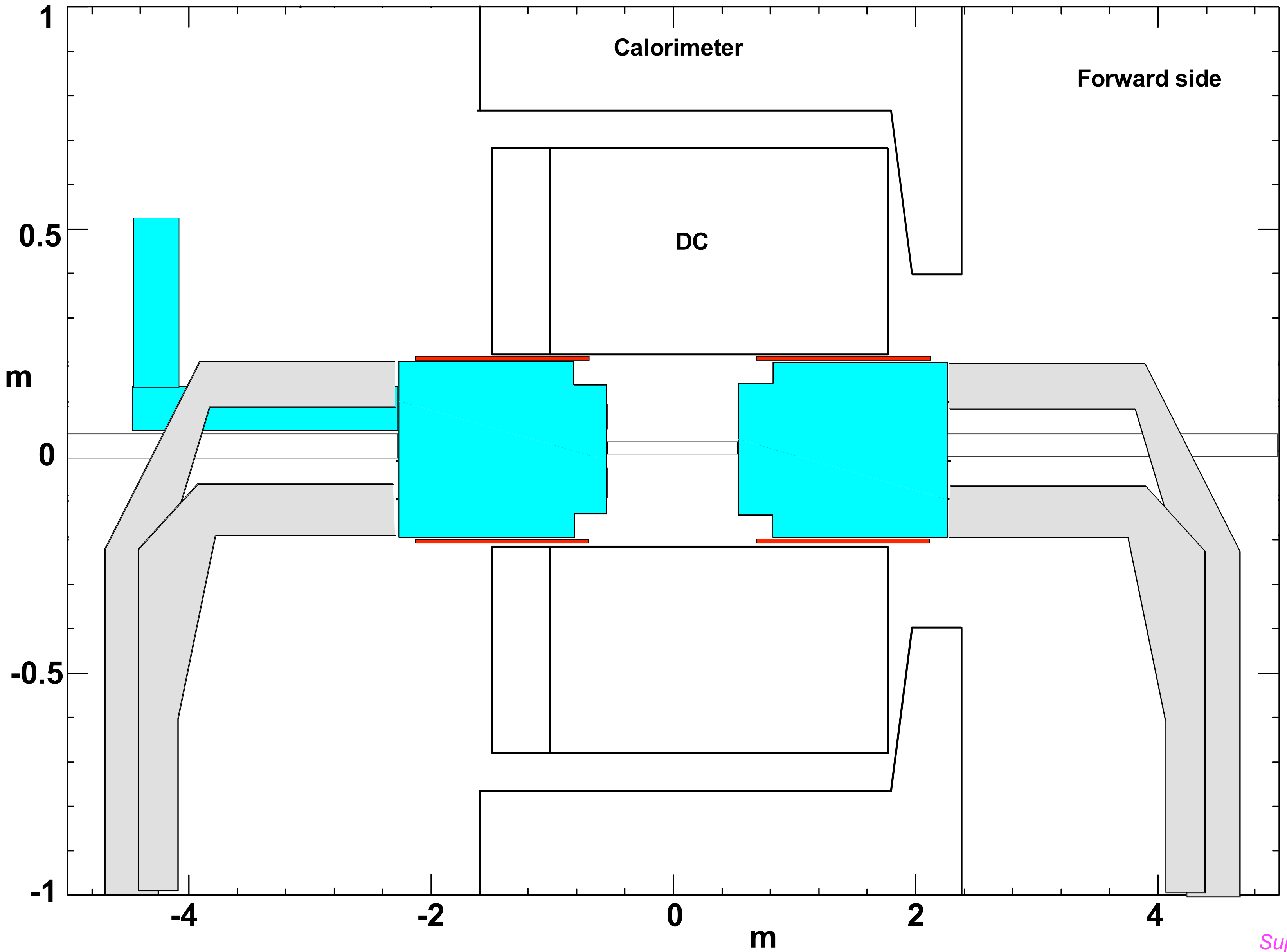
Still More Topics

- **Cryostat support**
  - We have to anchor the cryostats against the large expulsion forces of the detector field
  - Presently thinking of independently supporting the cryostats with large supports down to a rail system on the ground and tying the two supports together under the detector
  - Can we connect the cryostats together with carbon fiber rods?

Plan View



Cryostat Supports (side view)



Central chamber flanges

- In order to assemble the interaction region we need at least one vacuum joint between the cryostats (could be welded I suppose)

- We need two joints if we want to be able to change out the central chamber quickly and cleanly

- Conflat flange pairs make the best vacuum joint for high vacuum beam pipes

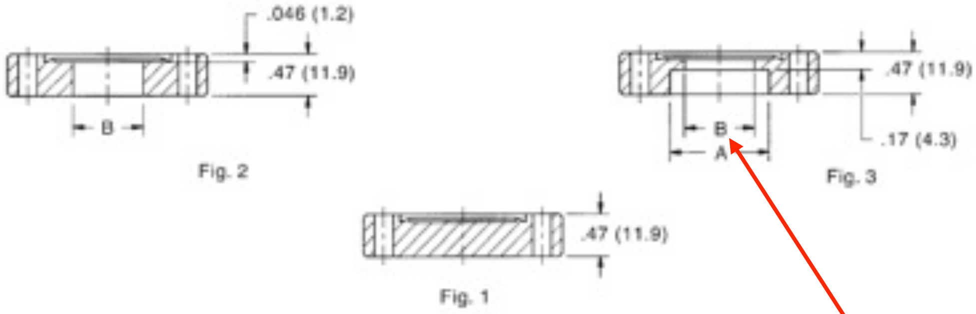
- The following shows the dimensions of a standard Conflat flange pair for a 20 mm diameter beam pipe

- In the IR drawing I have included space for a small bellows

Flange Drawing

2¹/₈ in. (NW25CF) Non-Rotatable

Outline Drawing



Thru holes: 4 holes .265 (6.7) dia. thru, eq. spaced on 1.625 (41.3) dia. B.C.
Tapped holes: 4 holes tapped 1/4-28 thru, eq. spaced on 1.625 (41.3) dia. B.C.

Dimensions: inches (millimeters)

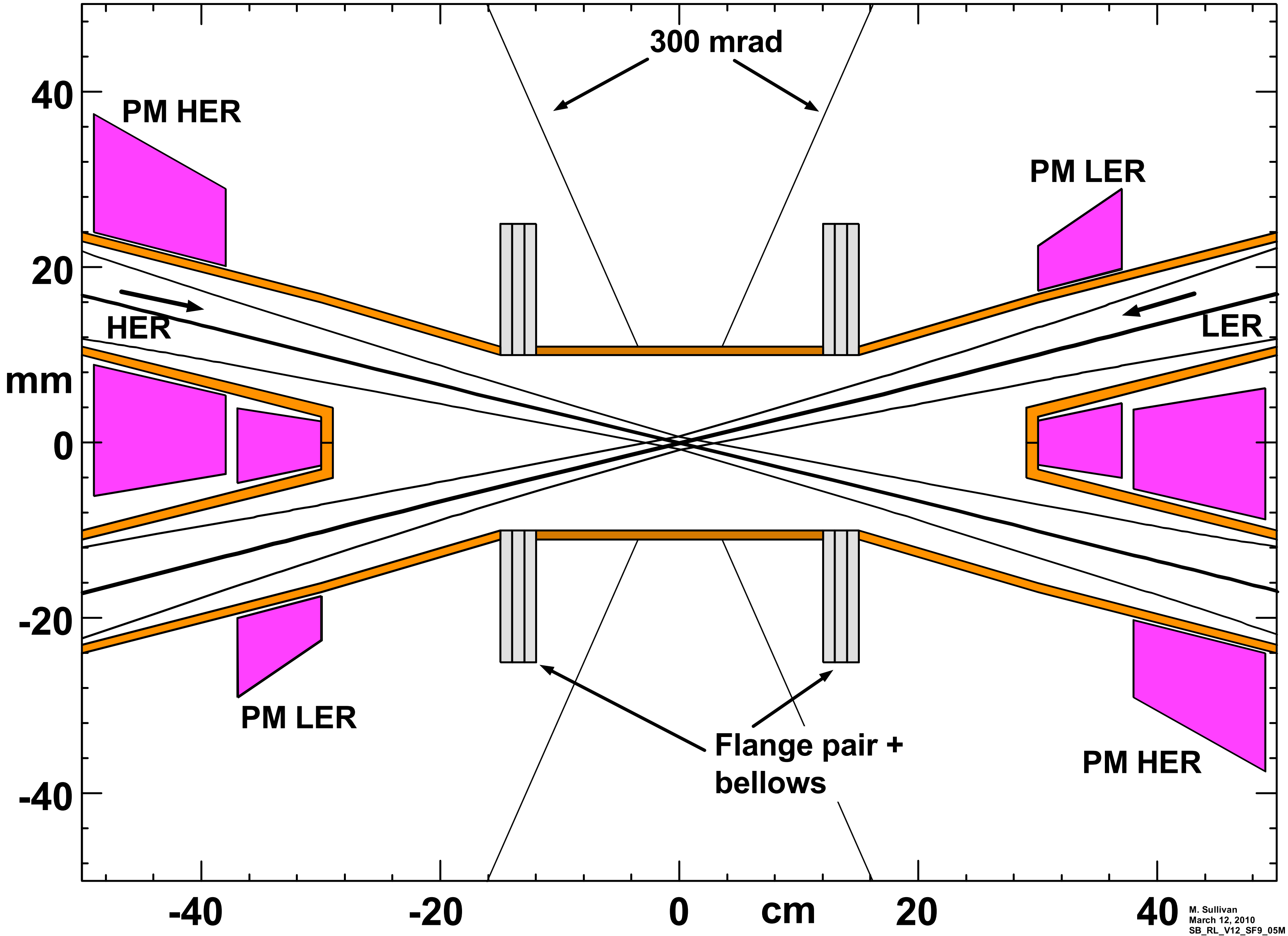
Ordering Information – 2¹/₈ in. Non-Rotatable Flanges

Type	304L SS Part Number	304 ESR SS Part Number	Fig. Number	Dimensions A in. (mm)	Dimensions B in. (mm)	Weight lbs (kg)
Non-Rotatable	F02120000NC4	F02120000NCE	1	–	–	0.5 (0.2)
	F02120025NC4	F02120025NCE	2	–	0.26 (6.48)	0.5 (0.2)
	F02120050NC4	F02120050NCE	2	–	0.51 (12.83)	0.5 (0.2)
	F02120075NC4	F02120075NCE	3	0.76 (19.30)	0.63 (15.86)	0.5 (0.2)
	F02120100NC4	F02120100NCE	3	1.01 (25.65)	0.88 (22.23)	0.5 (0.2)
Non-Rotatable Tapped	F02120000NT4	F02120000NTE	1	–	–	0.5 (0.2)
	F02120025NT4	F02120025NTE	2	–	0.26 (6.48)	0.5 (0.2)
	F02120050NT4	F02120050NTE	2	–	0.51 (12.83)	0.5 (0.2)
	F02120075NT4	F02120075NTE	3	0.76 (19.30)	0.63 (15.86)	0.5 (0.2)
	F02120100NT4	F02120100NTE	3	1.01 (25.65)	0.88 (22.23)	0.5 (0.2)

Accessories – 2¹/₈ in. Flanges

Description	Copper Part Number	Silver Plated Copper Part Number	Viton Part Number	Qty/Pkg	Weight lbs (kg)
Gaskets					
10-pack, individually sealed	FG0212CI	FG0212CIS	N/A	10	1.0 (0.5)
Package Set	N/A	N/A	FG0212VU	5	0.5 (0.2)
Gasket clip set	GC0275S	N/A	N/A	10	0.5 (0.2)

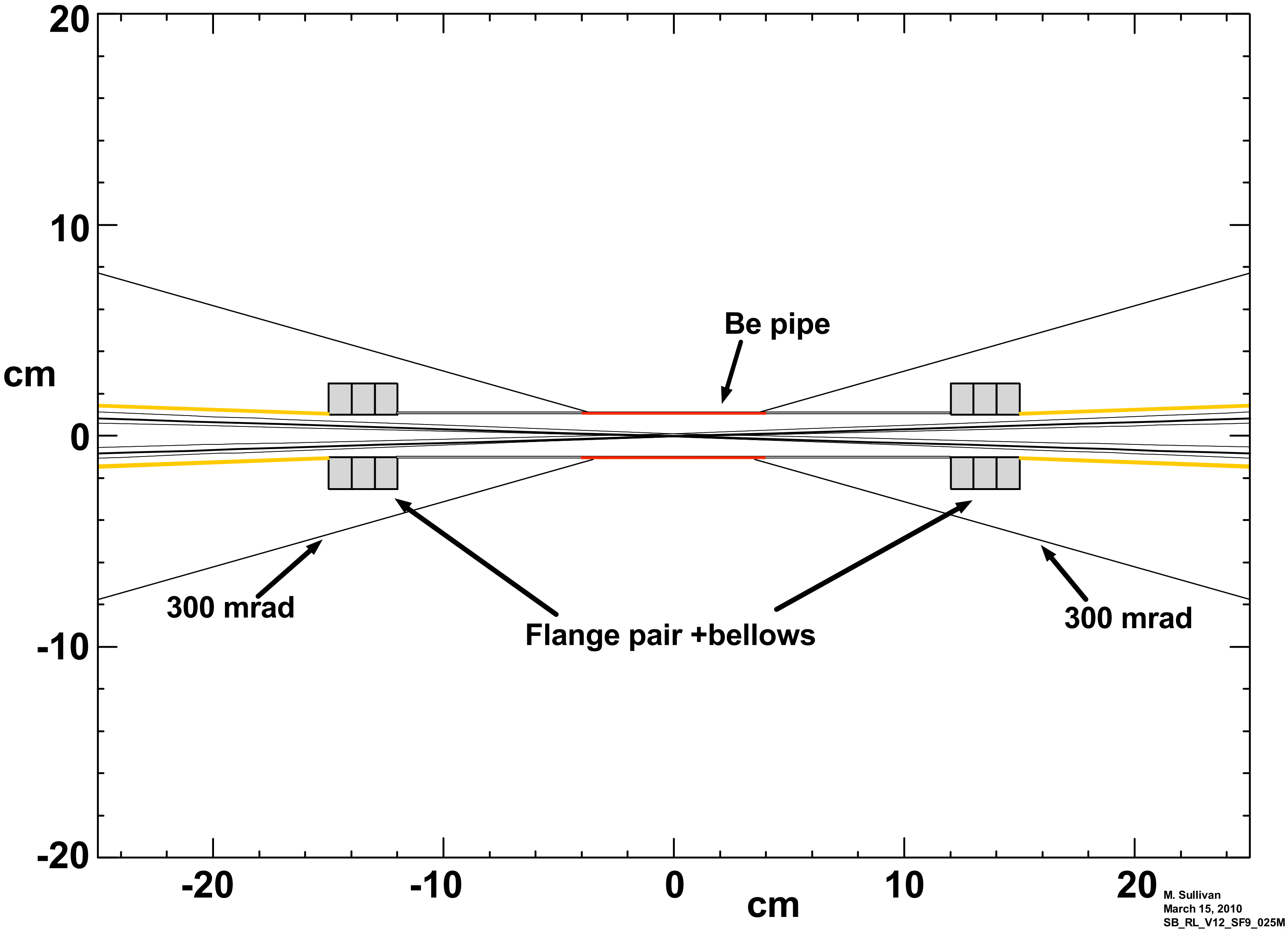
Central Chamber



Flange dimension details

- This is just a strawman design but it gives us an idea of what sort of space is needed to do this
  - Flange joint starts 12 cm from the IP
  - Two flanges (each 1 cm thick) plus 1 cm for a bellows (perhaps this could be smaller)
  - If we move this joint further away from the IP the beam pipe must become oval shaped in the flange joint
  - The end of the flange at 15 cm from the IP and with a 10 mm inside radius puts the beam pipe just 5 mm away from the center of the beam. This is presently the closest the beam pipe gets to the beam.
  - The outside radius of the flange pairs is 25 mm

Scaled Picture



General Summary

- We want to minimize the material for the Be beam pipe (see next presentation by Sasha)

- We should try to minimize the flange joint as much as possible but it cannot be much smaller than what we have in the strawman design (within a factor of two)

- To change the IP central chamber (perhaps a larger or smaller beam pipe radius) we need the vacuum flange connections
  - we might have layer zero mounted directly on the beam pipe and swap it out with the central chamber

- We will need to decouple the Be pipe from the cryostats. Bellows on either side.

- Presently the cryostats are independent of the detector