Vertexing issues

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SuperB WorkShop
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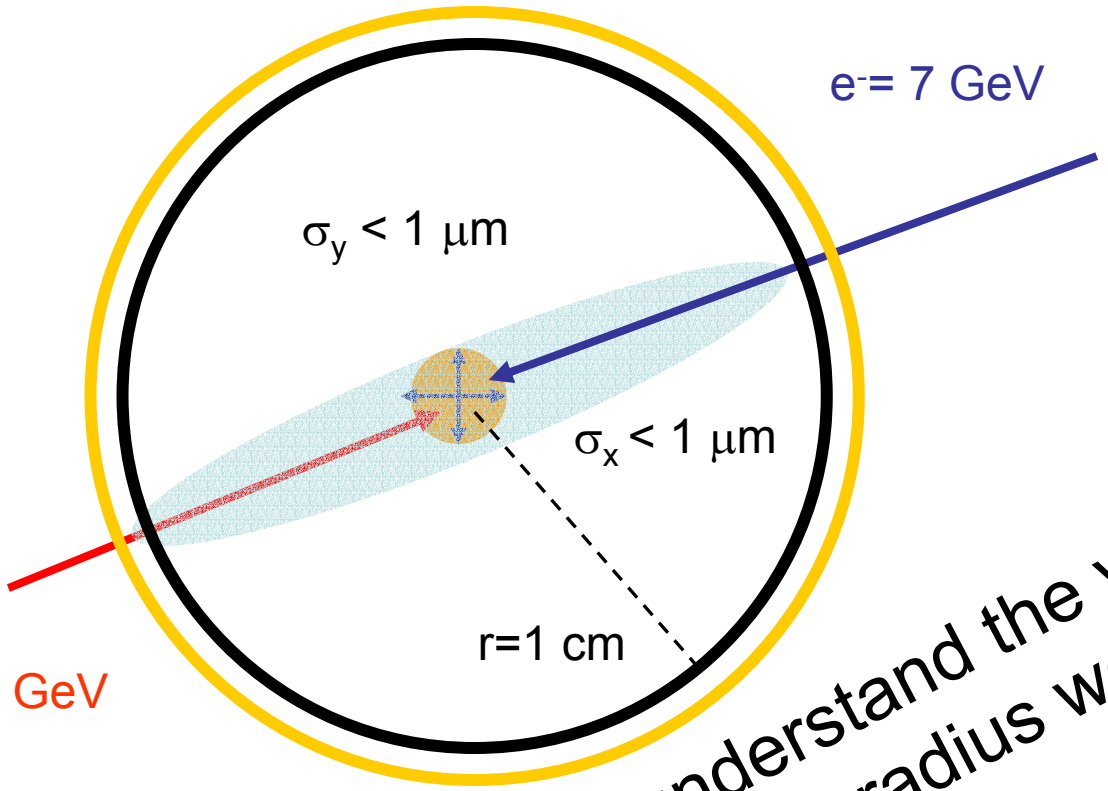
Interaction region SuperB

Not in scale



Need to understand the very limit of the beampipe radius we can afford.

0.03 cm thick Be beampipe

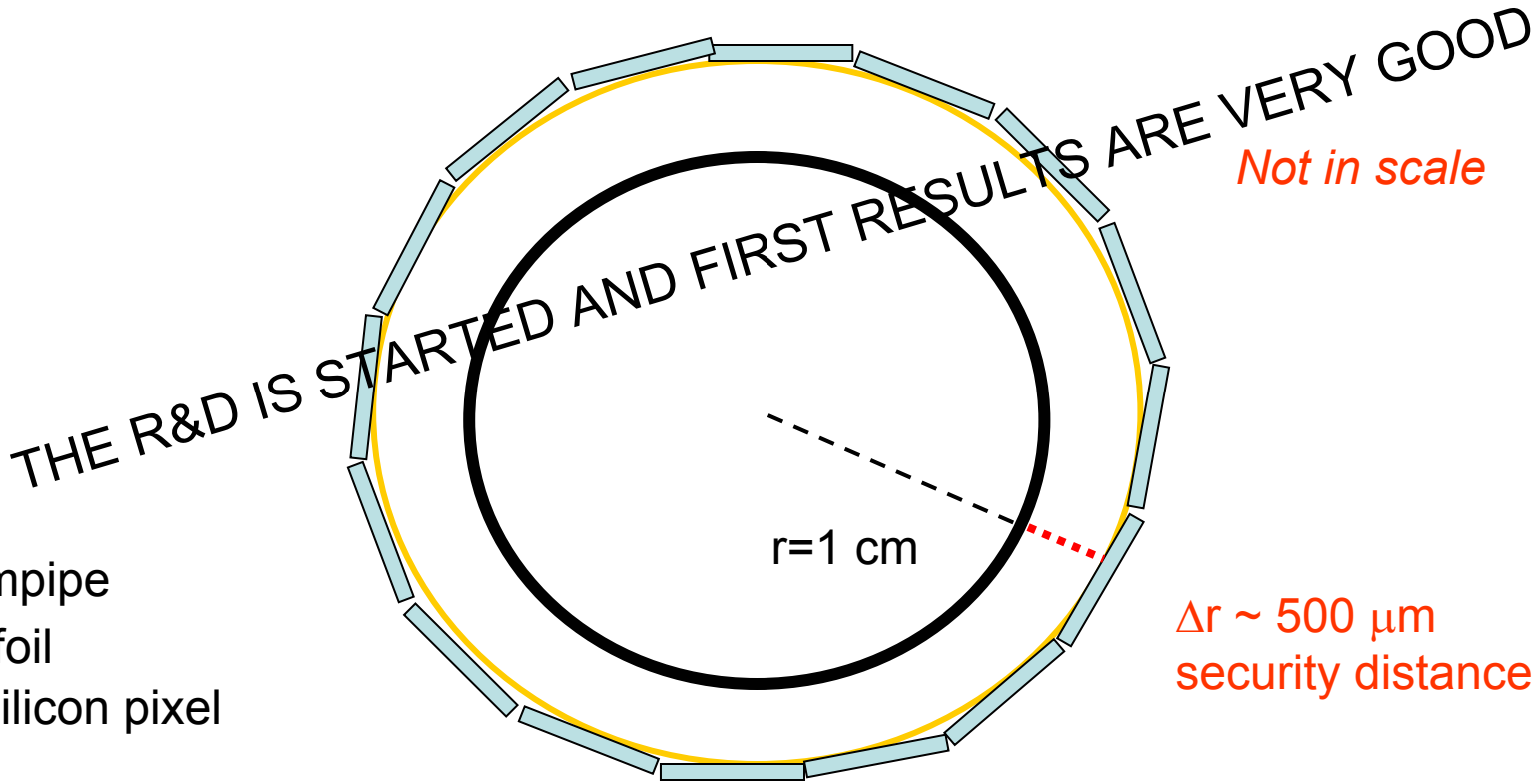
Au foil 5 μm thick

No cooling required in SuperB design “a la linear collider”

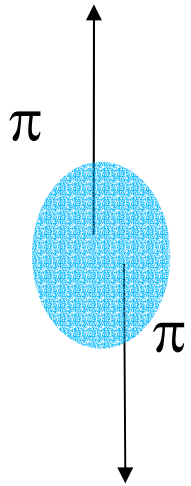
Layer0 design

New conceptual design for layer0

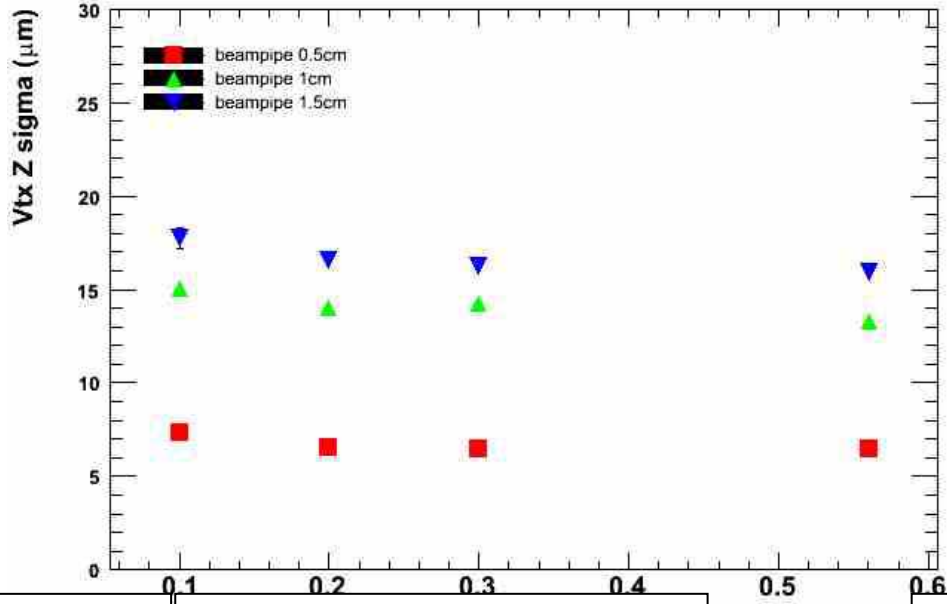
- Use kapton foil ~50 μm as support structure for the Si pixel
- Beam pipe radius set the radial distance for the layer0
- Rule of thumb: vertex resolution improves almost linearly with layer0 radial distance

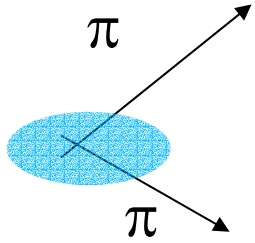


Reco Vertex Resolution



$\beta\gamma = 0.1$





$\beta\gamma = 0.56$

$$\sigma_{ms} \approx \frac{14}{P(MeV)} R_1 \sqrt{x/X_0}$$

$$\sigma_{res} \approx \sigma_0 \sqrt{1 + 2\left(\frac{R_1}{R_2 - R_1}\right)^2}$$

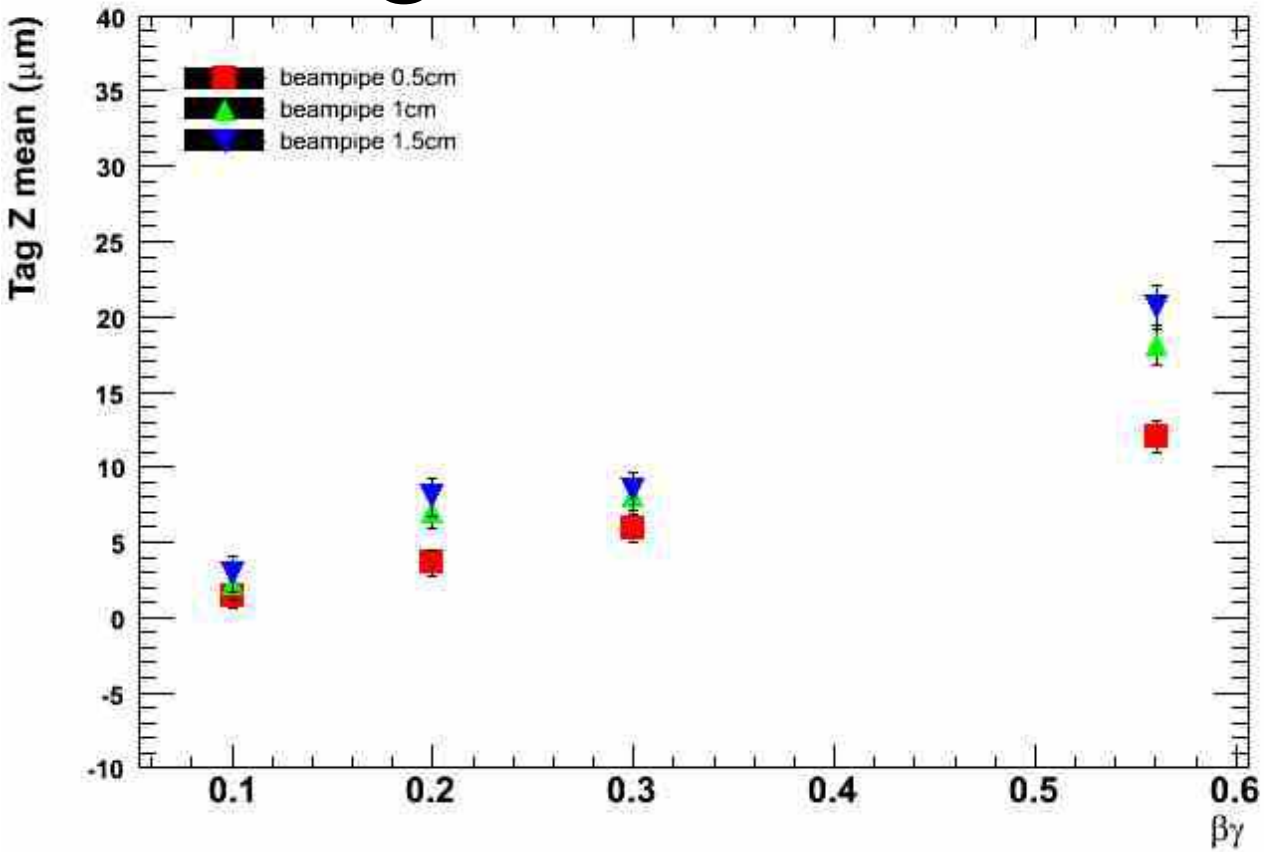
rule of thumb

I get $\sigma = \sigma_{ms} \oplus \sigma_{res} = 15.2 \mu m$

1 GeV tracks and 1cm configuration consistent with 15 μm from simulation.

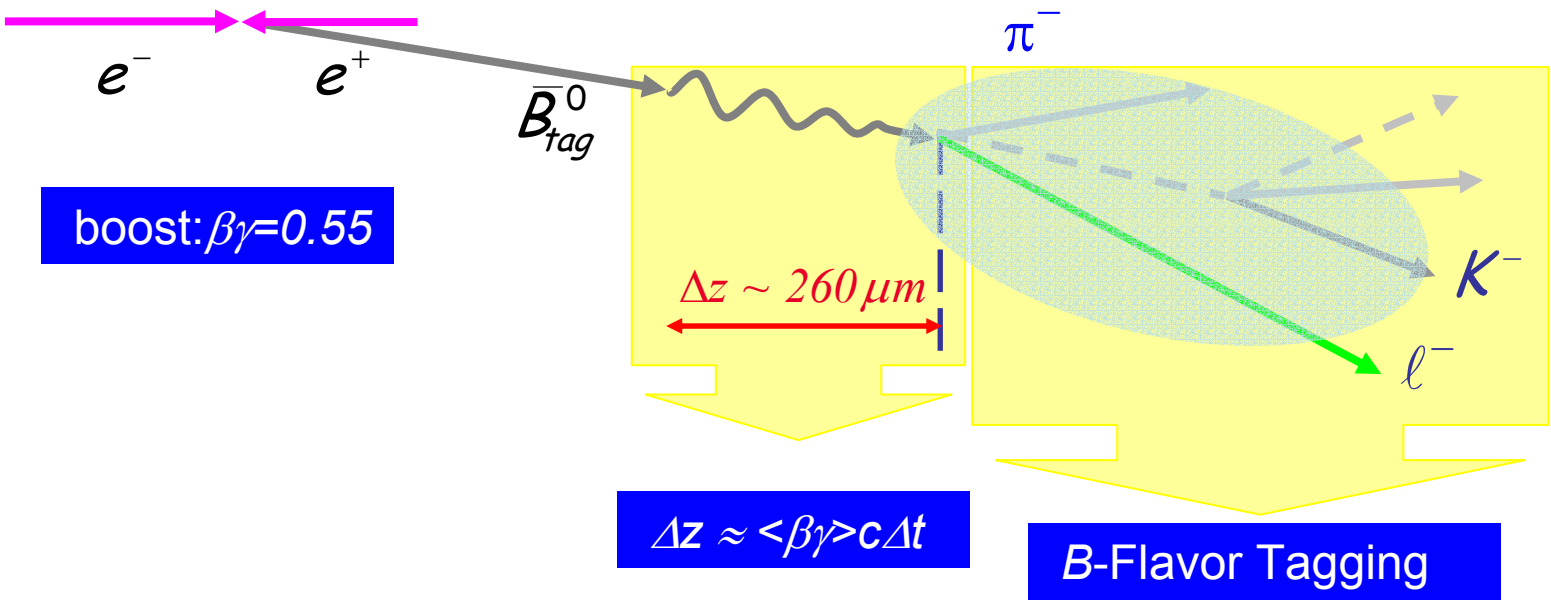
WHICH IS THE LIMIT ON THE INTRINSIC RESOLUTION WE CAN THINK ABOUT?
RESOLUTION ON HIT IS BETTER THAN PITCH/SQRT(12) (CLUSTERING)

Tag Vertex Bias



The tag-vertex starts from a pseudo-track determined from the B reco candidate which is better determined once you have better track parameters measurement. It avoids to misidentify the B vertex with the D vertex.

New tag vertex algorithm



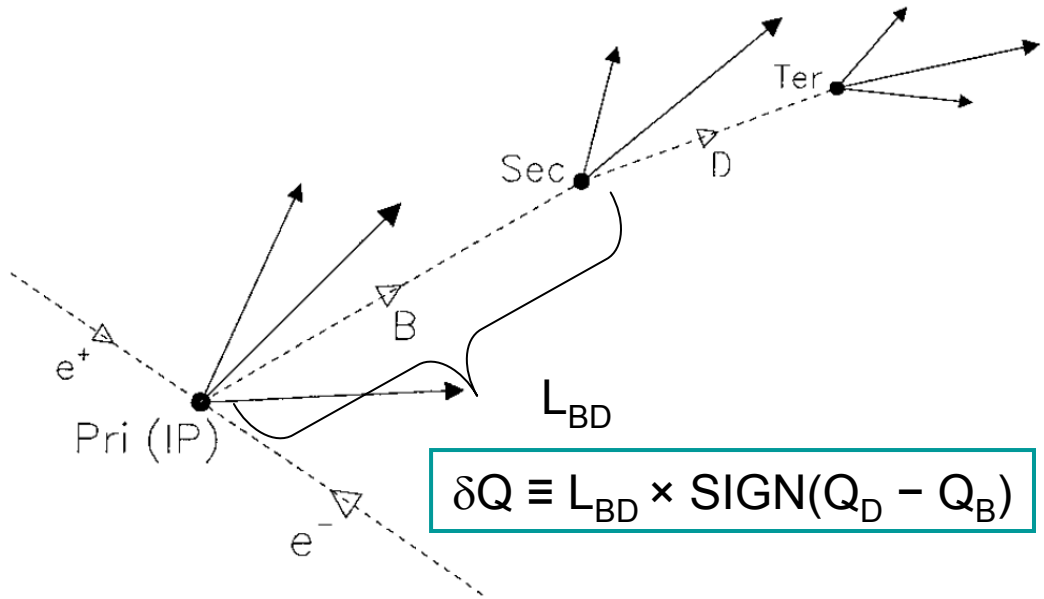
It is worth to investigate the possibility to reconstruct the secondary vertex of the B Tag (charm events) and evaluate the impact on the bkg rejection:

- uds events have no long live particles except K_s
- charm, tau events have no secondary vertex
- B events have secondary vertex

If it works a fisher discriminant to separate signal from continuum events should contain also vertex informations.

Benefits of better vertexing

- Better vertex determination not only impacts the time dependent measurements but all the analysis in general.
- The Δz helps rejecting continuum uds events.
- One can think about *"ad-hoc"* topological algorithm to further discriminate against combinatorial bkg.
- If you are able to separate the D vertex from the B vertex. You can determine the flavor of the tag B decay from the charge difference between the B and the D.
- SLD tagging "dipole based" (δQ) technique could be helpful. $\delta Q>0$ ($\delta Q<0$) means B0bar (B0).



$$\delta Q \equiv L_{BD} \times \mathrm{SIGN}(Q_D - Q_B)$$

- ***REDUCE BKG***
- ***IMPROVE TAGGING PERFORMANCES***