SuperB Drift Chamber overview

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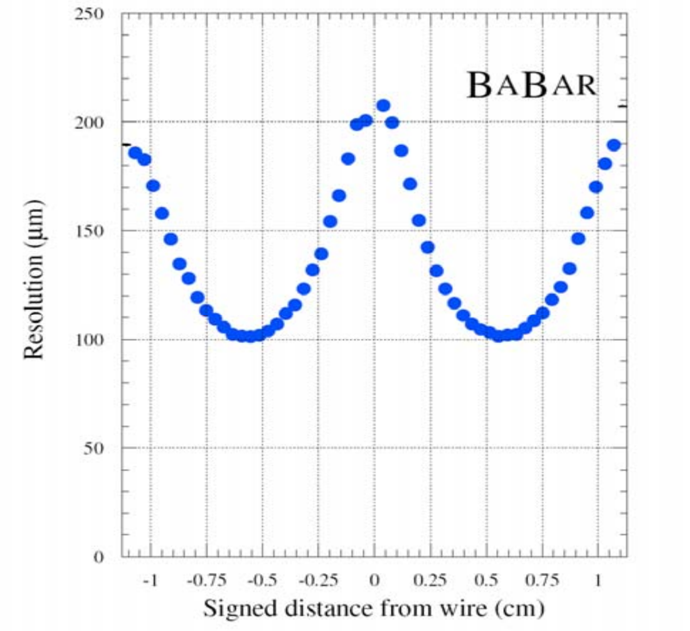
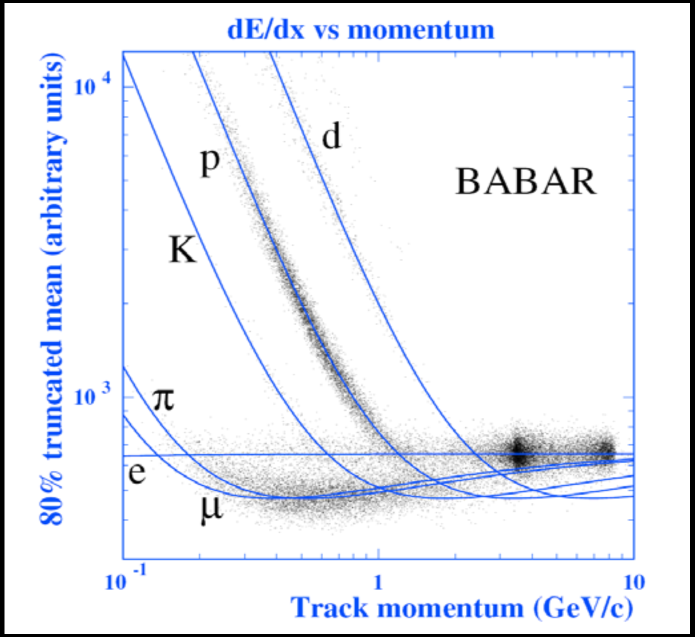
What we know

The BABAR DCH worked well for almost 10 years

- Hit and momentum resolution, tracking efficiency, *dE/dx* matched (or exceeded) design





- ~ no aging

What we want

I. A lighter structure, all in Carbon Fiber (CF)
   - because we know this can be done

II. A faster detector
   - because we know life will be tougher @ SuperB

III. Faster R.O. electronics
   - for the same reason

IV. Lighter FEE (including shielding & cooling)
   - because we may want to place detectors behind the DCH backward endplate now

I. Drift chamber mechanical structure

Total load due to tension of 27k wires in BABAR DCH is ~3.5 tons

- 12(24) mm thick Al endplates → 13(27)% X_0

3 Carbon Fiber options studied for the *SuperB* DCH

- Flat CF endplates
  - ✓ 20mm CF ($0.075X_0$), max deformation (d_{max}) ~1mm
- Spherical CF endplates (both concavities)
  - ✓ 4mm CF ($0.015X_0$), max deformation (d_{max}) <1mm
- Conic + spherical CF endplates
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Flat is ‘simple’, curved is stiffer

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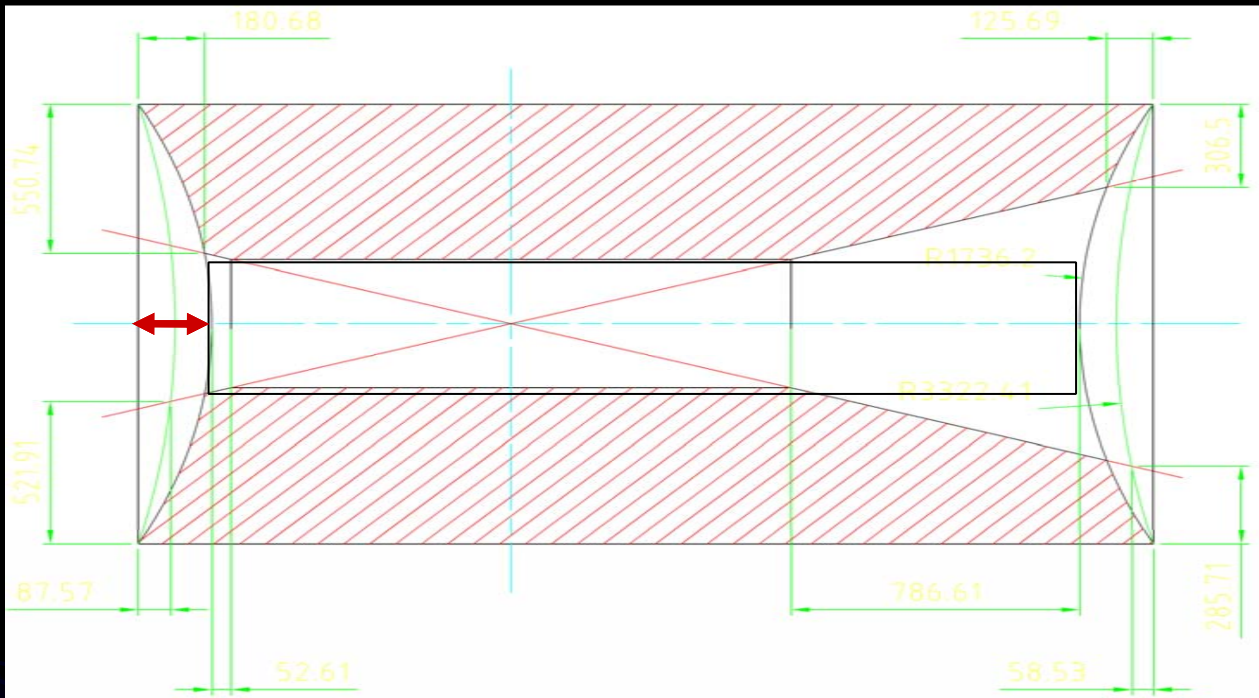
Spherical end-plates (concave)



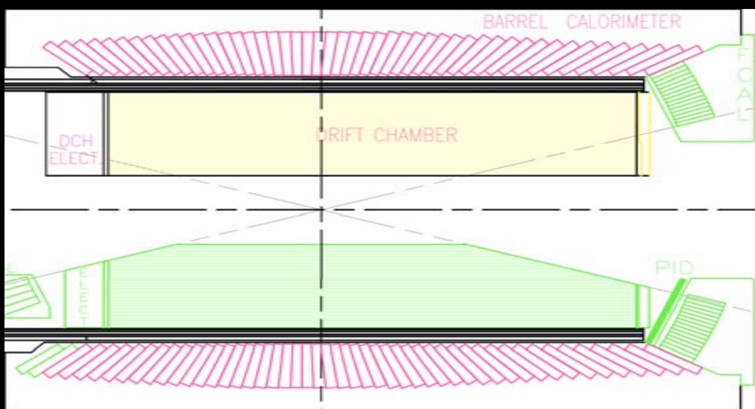
Thickness O(4mm), or *0.015* X_0

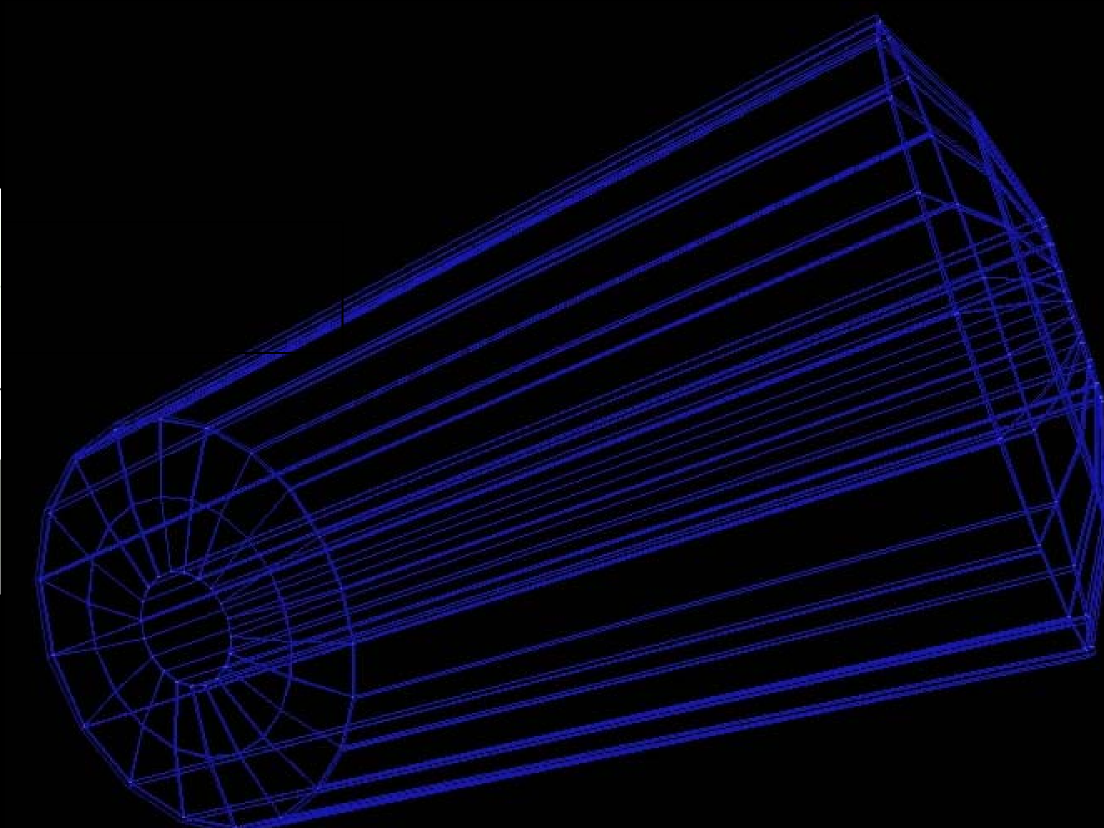
sagitta=200mm ➡ $d_{max200} \leq 0.5mm$

sagitta=100mm ➡ $d_{max100} \sim 2x d_{max200}$

Spherical end-plates (convex)

Convex shape could fit better
e.g. with forward PID device





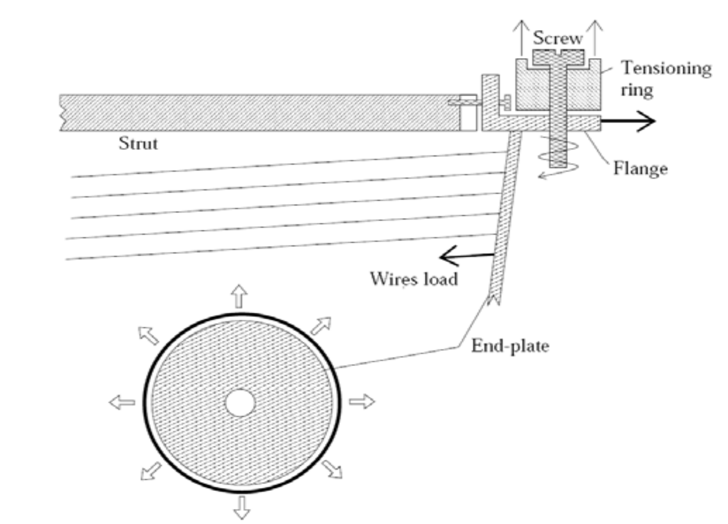
again, thickness O(4mm), or $0.015\ X_0$

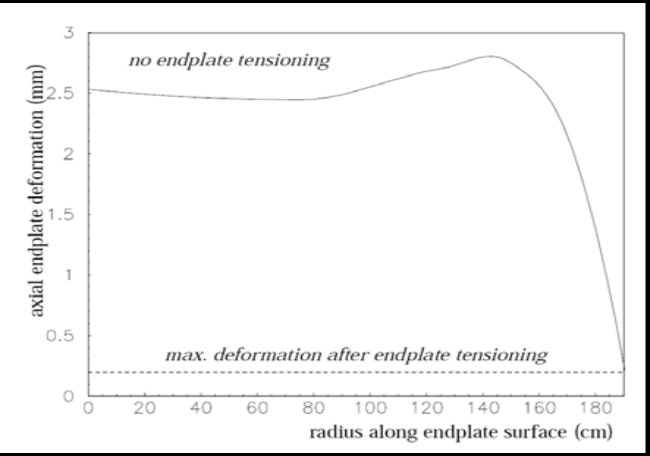
sagitta=200 mm ➡ $d_{max200} \leq 0.5mm$

sagitta=100 mm ➡ $d_{max100} \sim 2x d_{max200}$

Spherical EP concept proved in the KLOE DC

- R_{max} ~ 2m
- 52,140 wires
- total load ~ 3.5 tons
- EP thickness 9 mm
- Plate deformations recovered with CF "stiffening ring"
  - Given the smaller radius of the SuperB DCH, we can probably avoid this complication





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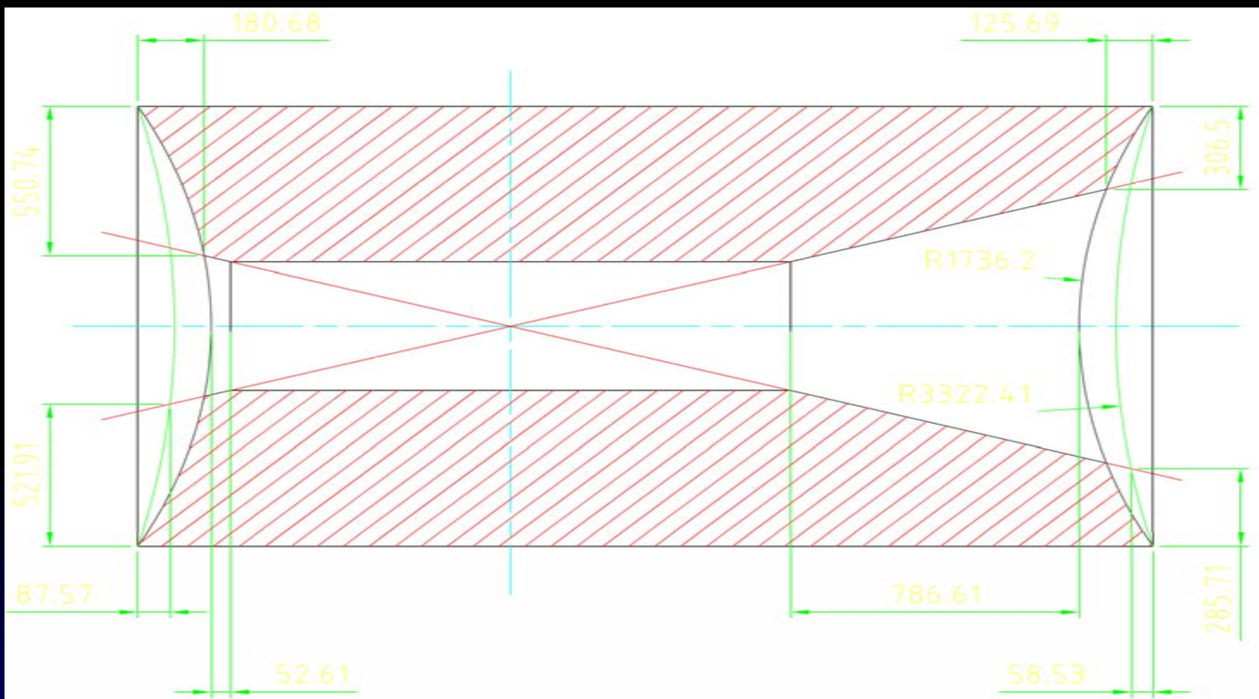
Option #3: conical end-plates

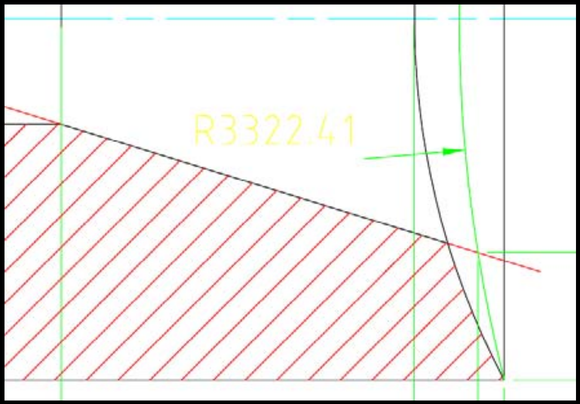
Expect high particle flux in forward direction. Conic-shaped EP's might help reducing occupancy in inner layers.



Thickness O(4mm), or *1.5%* X_0 (perp. to walls)

d_{max}~0.5mm

Option #3: conical end-plates (cont.)



- Besides the trickier structural analysis,conical endplates would pose several problems though:
  1) drilling the holes at a very small angle
  2) ensuring a flat seat for the feed-throughs
  3) stringing the wires in the conical section
  4) a lot of material seen by electrons tangential to the cone ⇨a lot of background produced
- None of the above (excluding 4), which needs careful investigation) looks unsurmountable, but we should be aware that conic end-plates are not exempt from issues.
- An alternative solution to this problem on talk #3 in this session.

Perspective: decisions to be taken before the TDR

- New cell structure
  - attack this problem with newly available simulation tools (next months)
  - test new cell and gas mixtures with prototypes (~1 year from now)
  - see next talk
- Define mechanical structure
  - simulation
  - Interplay with other detectors (length, offset, shape)
  - Once geometry outlined, make detailed FEA calculations
- Electronics design
  - Actual work starting next year
  - Understand requirements meanwhile
  - will be discussed during session on electronics on June 2nd