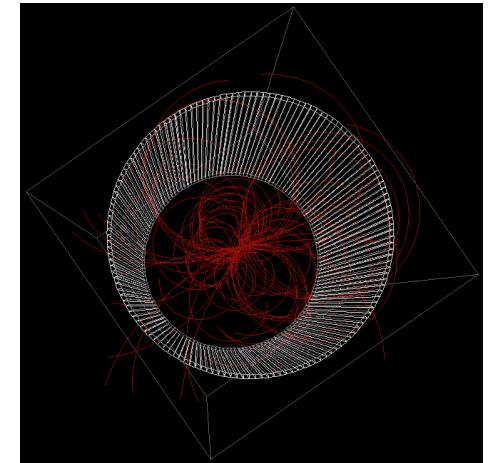


The BaBar design: Issues and alternatives

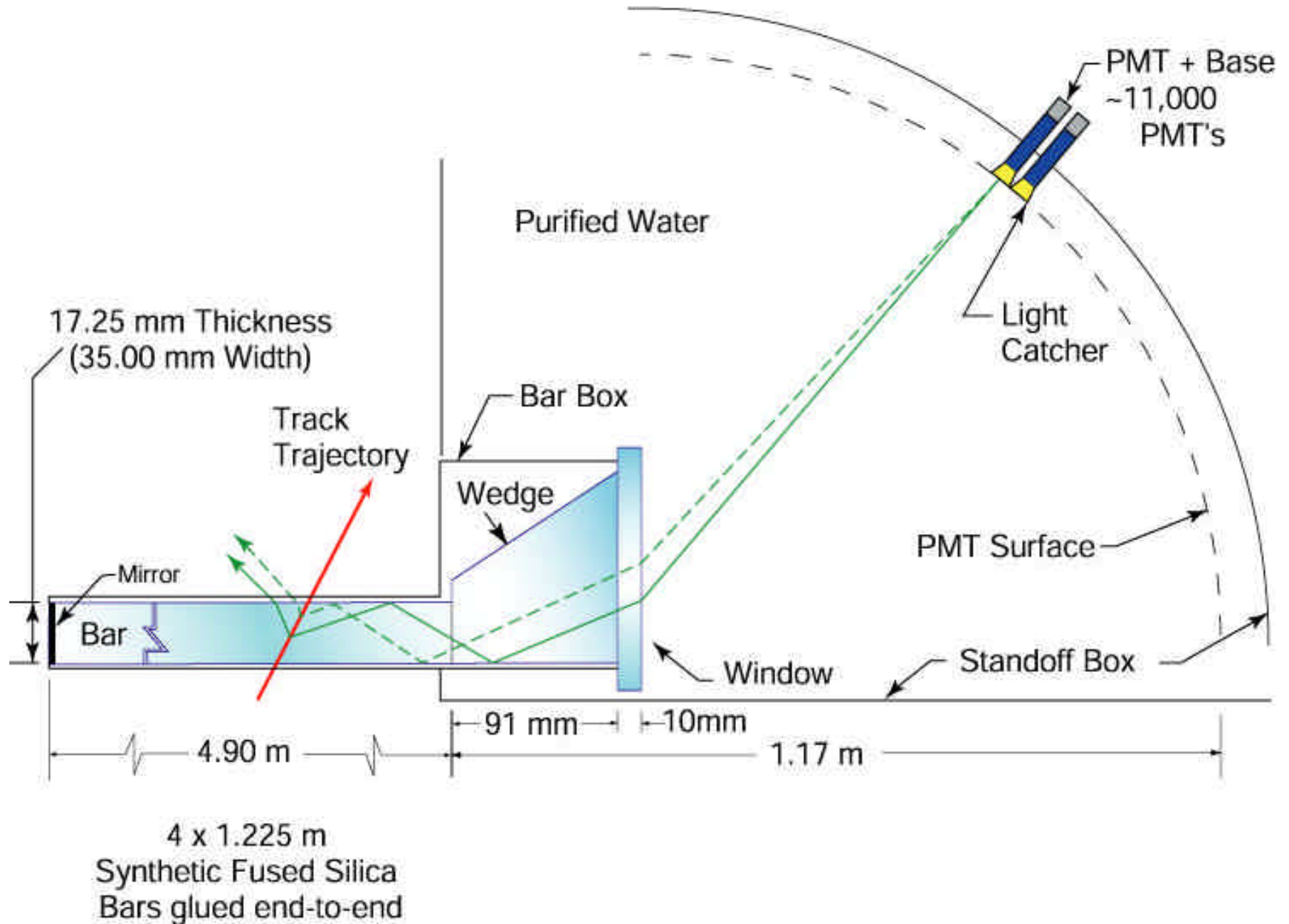
Alex Cerri



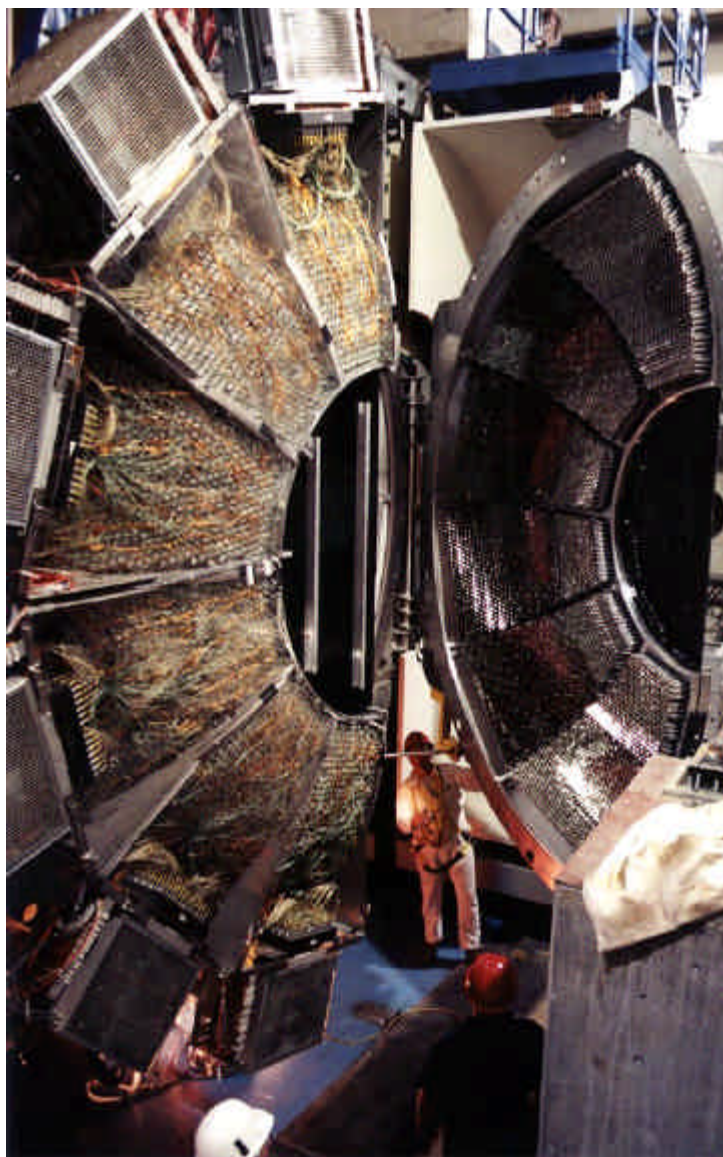
I ntroduction

- The BaBar design
- What (I) don't like in it
 - Some motivations
- What alternatives are there?
- Let's discuss!

DIRC

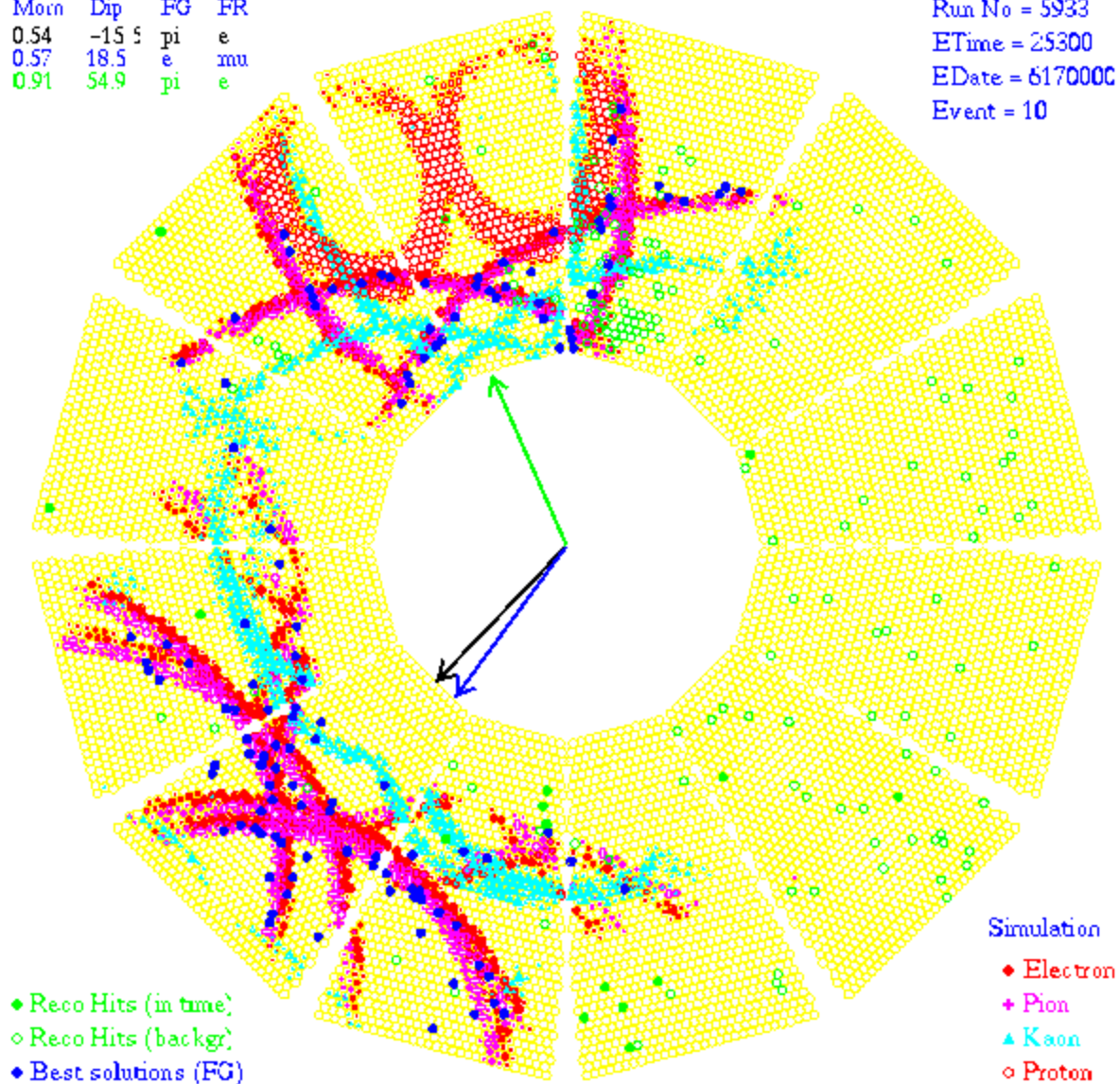


DI RC@BaBar



Moyn	Dip	FG	FR
0.54	-15.5	pi	e
0.57	18.5	e	mu
0.91	54.9	pi	e

Run No = 5933
 ETime = 25300
 EDate = 6170000
 Event = 10

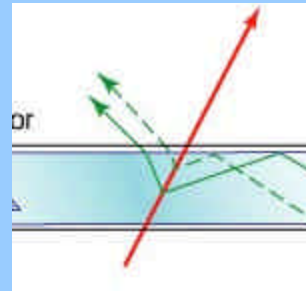


The BaBar DIRC @ CDF III?

Why being skeptical

- Is there a physics case strong enough? ← "Physics"
- PEPII is much cleaner than the Tevatron! ← "Technology"
- "Can we get through the door?" ← "Sociopolitical Blurb"
- ...in time? ← "Sociopolitical Blurb"
- Can we survive? ← "Sociopolitical Blurb"

- 144 bars
- $R=84$ cm
- 6000 Kg of water
- 16000 PMT
- Superb $K-\pi$ separation up to $O(5 \text{ GeV})$



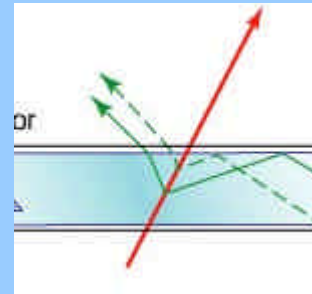
"Physics"

- Aim is mostly B physics (at least in my mind!)
- Two ingredients make a good HF experiment:
 - Particle Identification capabilities
 - Reconstruction of neutrals
- We have to address this question in parallel to everything else:
 - Can we give up O(1) yr of data taking, be back with a renewed detector and still be competitive?
(even with a stretched CDF II !)
- What we learned so far with CDF II :

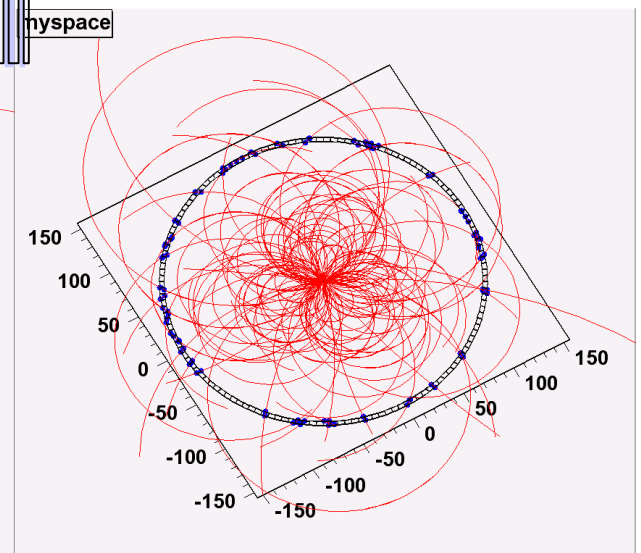
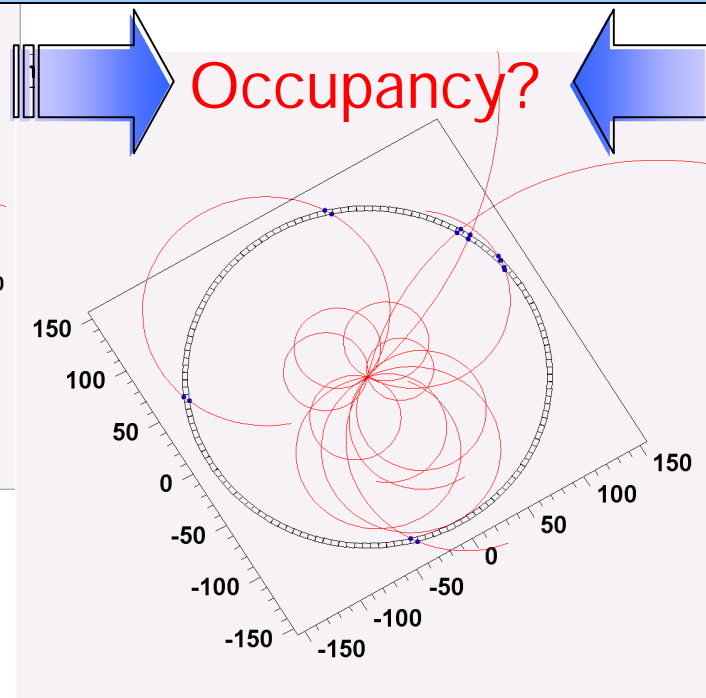
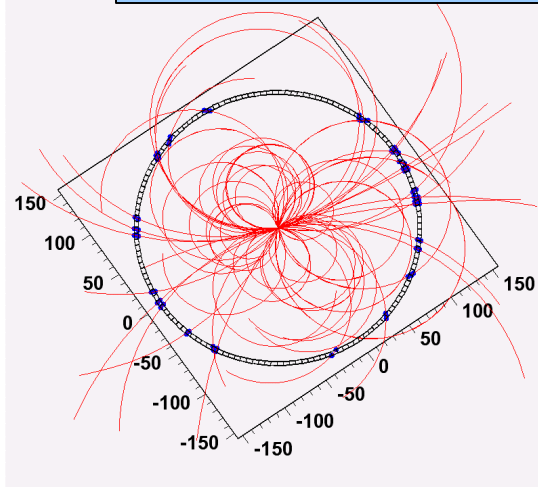
We cannot accept a PID device with $\epsilon \approx 50\%$ for B/D physics: no matter what the separation is it would be basically useless

The minimal CDF-centric DI RC

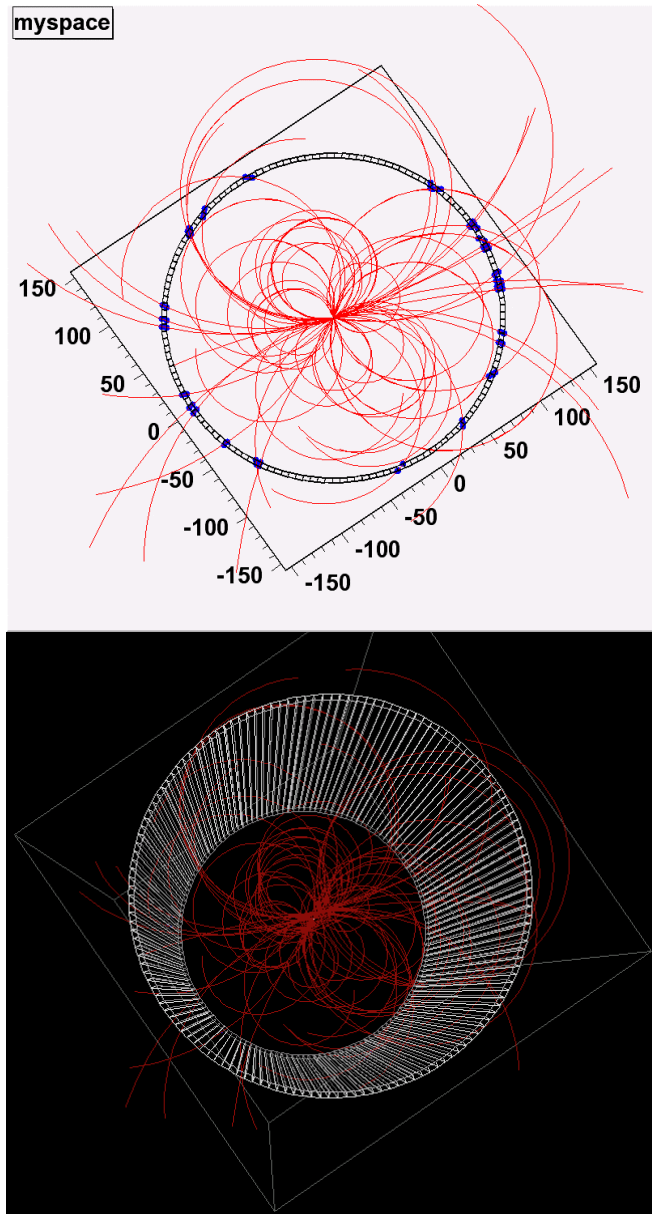
- >144 bars (but paying with light!)
- $R=140$ cm
- 6000+6000 Kg of water
- 15000+15000 PMT
- $O(300)$ reflections in the bar!



myspace



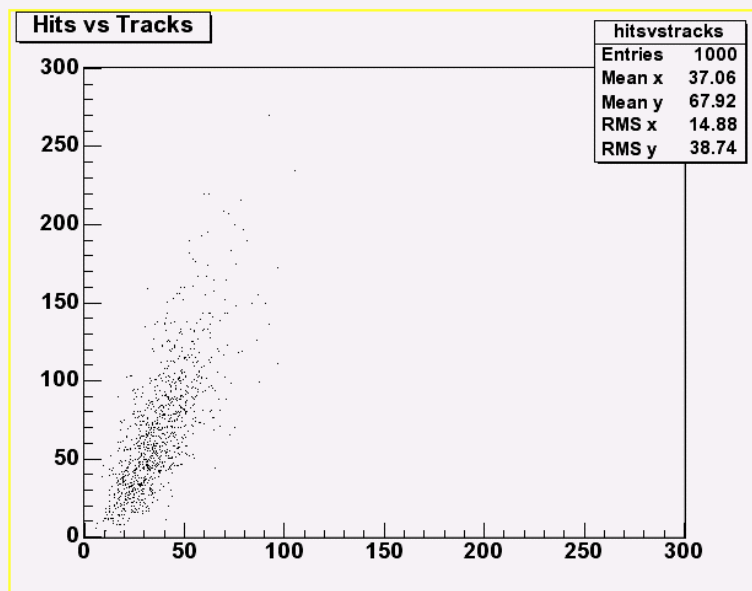
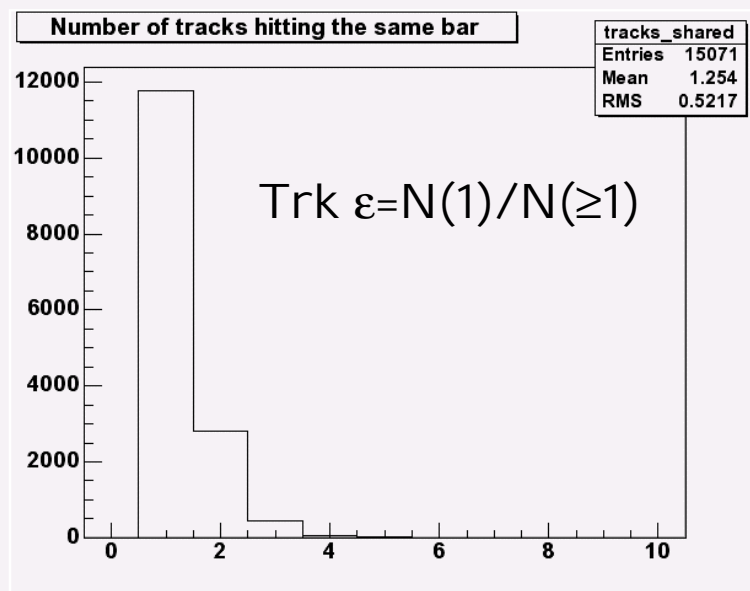
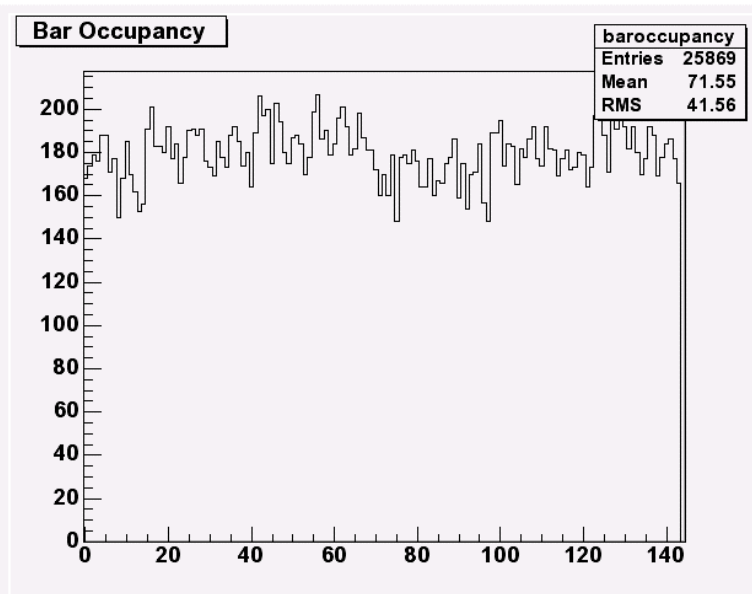
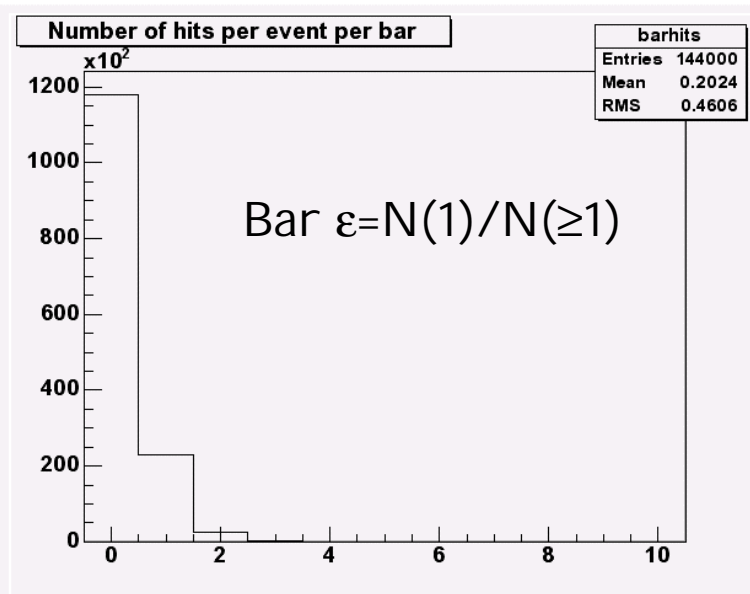
Occupancy



- Take tracks from real TTT events
- Extrapolate to hypothetical "DI RC" bars, sitting where the TOF sits
- Look at occupancy as a function of segmentation
- Compare with TOF observations to assess accuracy of projections

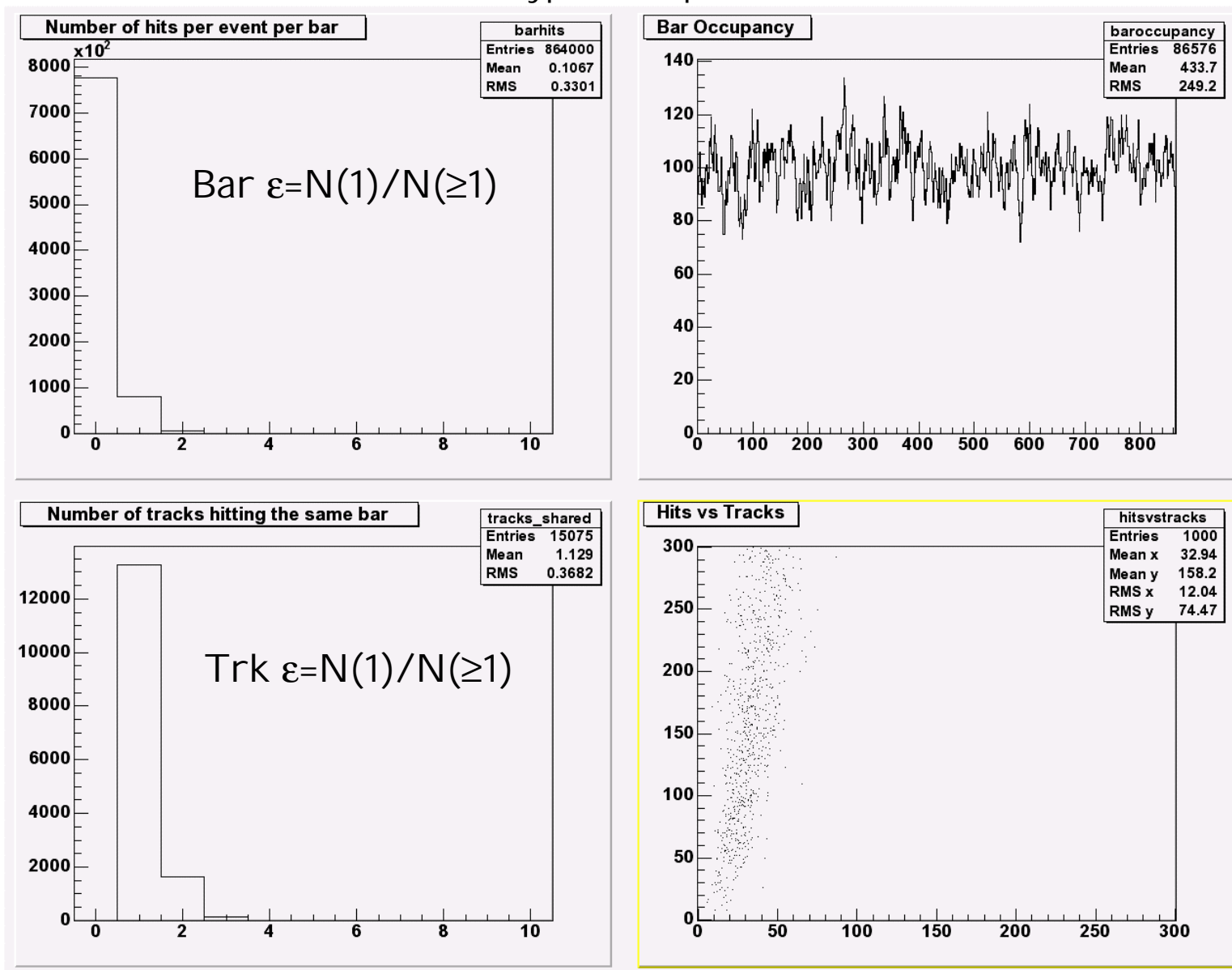
Occupancy

typical shapes



Occupancy

typical shapes

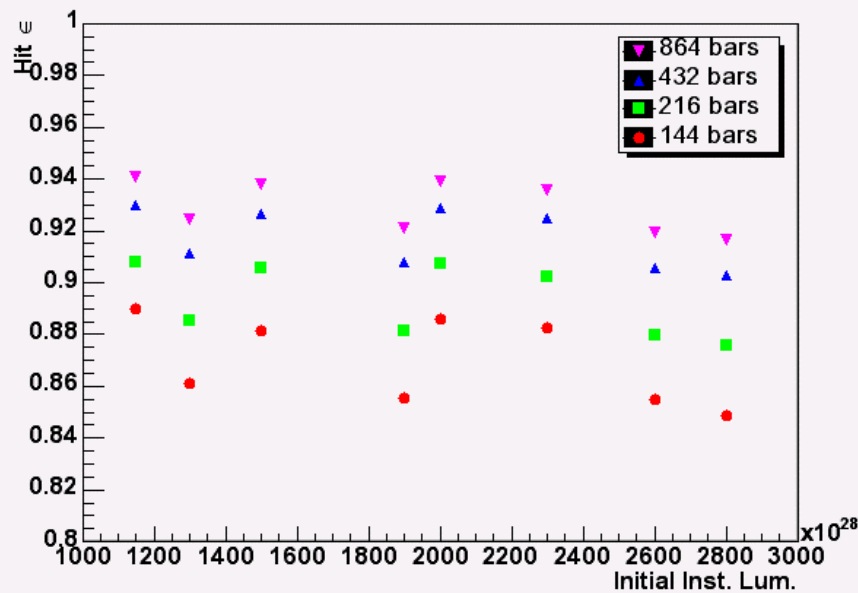


Luminosity & segmentation dependence

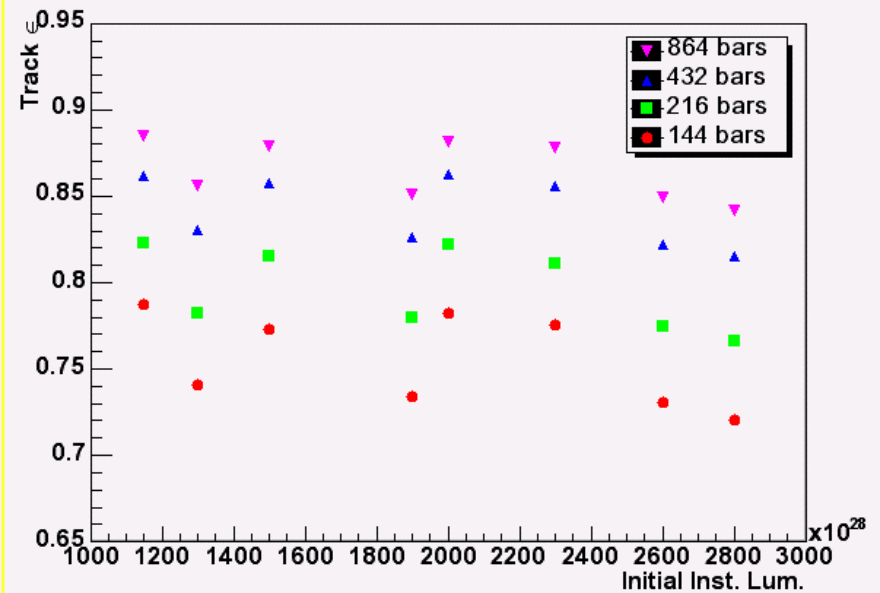
Run	InstLum 1E30	144		216		432		864	
		Bar %	Trk %	Bar %	Trk %	Bar %	Trk %	Bar %	Trk %
168774	20	88.6	78.2	90.7	82.2	92.9	86.2	93.9	88.1
168563	15	88.1	77.2	90.5	81.5	92.6	85.8	93.8	87.9
168089	23	88.2	77.5	90.2	81.1	92.5	85.6	93.5	87.8
167866	11	88.9	78.7	90.8	82.2	93	86.2	94.1	88.5
164274	28	84.9	72.1	87.6	76.6	90.3	81.5	91.6	84.2
164235	26	85.5	73	88	77.5	90.5	82.2	91.9	84.9
163958	13	86.1	74	88.5	78.2	91.1	83	92.4	85.6
163384	19	85.5	73.4	88.2	77.9	90.8	82.6	92.1	85

Luminosity & segmentation dependence

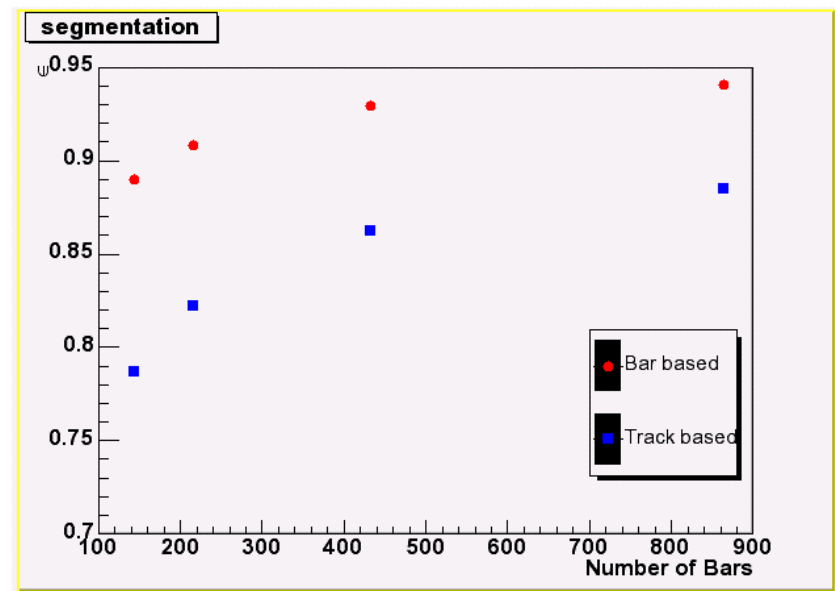
Bar $\epsilon = N(1)/N(\geq 1)$



Trk $\epsilon = N(1)/N(\geq 1)$



- Some luminosity dependent feature
- $4/5 \leftrightarrow 4/4$
- Clear segmentation-dependent effect



Plenty of things to be worked out

- Compare with TOF
- Multiple interactions
- Light yield?
- Background (backsplashes & similar)

?

Can we really setup 30K PMT and 12E6 gr of water in $O(1 \text{ year})$?

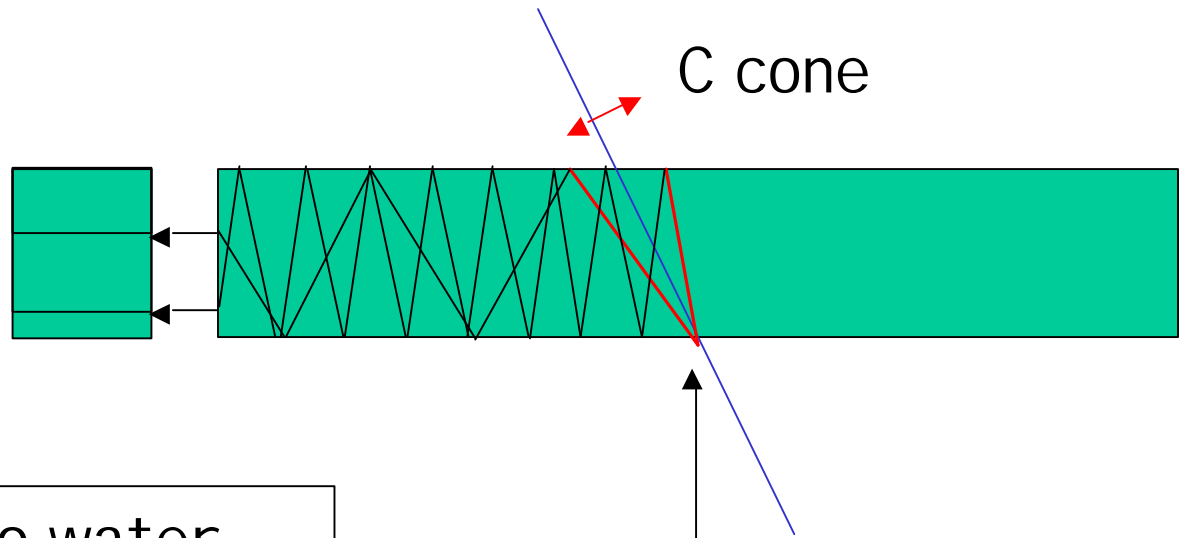
- Alternatives?
 - Drop the project? (lack of fantasy!)
 - Drop the water!
 - Less invasive procedure
- But remember: any alternative will have to be tested, re-tested and designed. This could be more time consuming than adapting the initial project?

Drop the water

- In the BaBar DIRC each bar is:
 - Optically connected to 12 neighbors
 - “Served” by virtually all the PMT in the detector
 - In practice ~1200 PMT [\rightarrow ~40x30]
- Would it be feasible to replace the water+PMT system with single-bar detectors and obtain similar or better performance?
- 30000 detectors \rightarrow O(500) detectors
- Same level of complication in the electronics
- Similar performances?

How?

"In principle" need only resolution in the radial direction! (and z from tracking)



Less channels, no water

BUT

certainly less powerful than fitting the circular profile of the C cone in a DIRC-like fashion

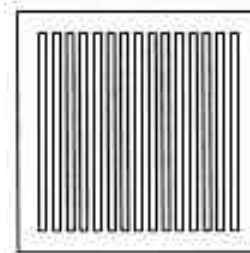
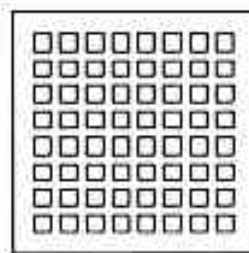
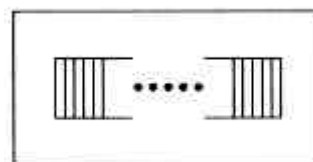
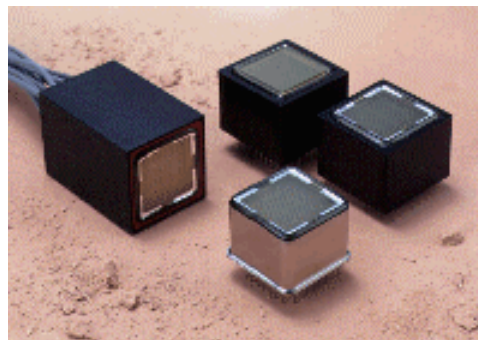
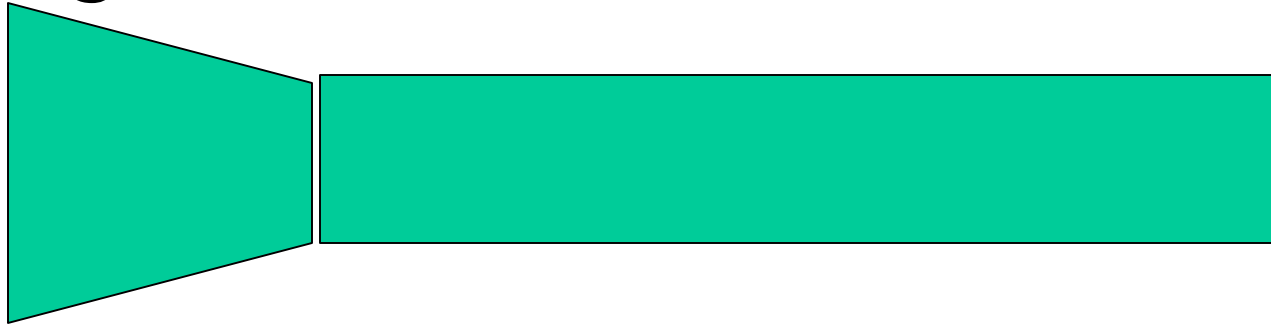
How much less?

Track z
from
tracking

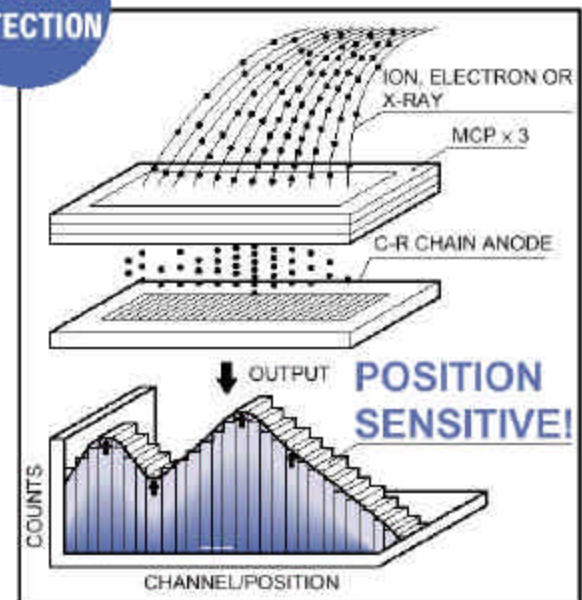
How well can the edge of the cone be focused?

Light readout alternatives:

?



POSITION
DETECTION



Conclusions

- We cannot sacrifice performances for time/costs
- We have tools and data to learn something more about the occupancy of a DI RC-like device
- The BaBar design cannot be used “as-is”
- Alternatives are possible but risky/time-consuming
- Let’s discuss, exchange ideas and roll up our sleeves!