2nd Frascati SuperB Workshop
Detector Summary

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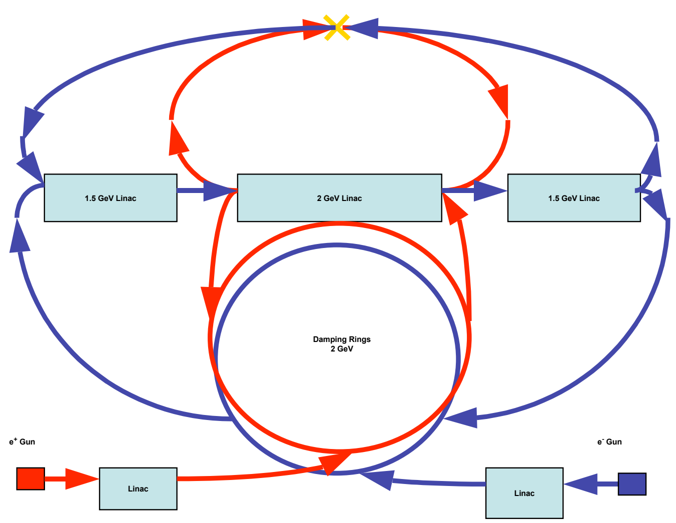
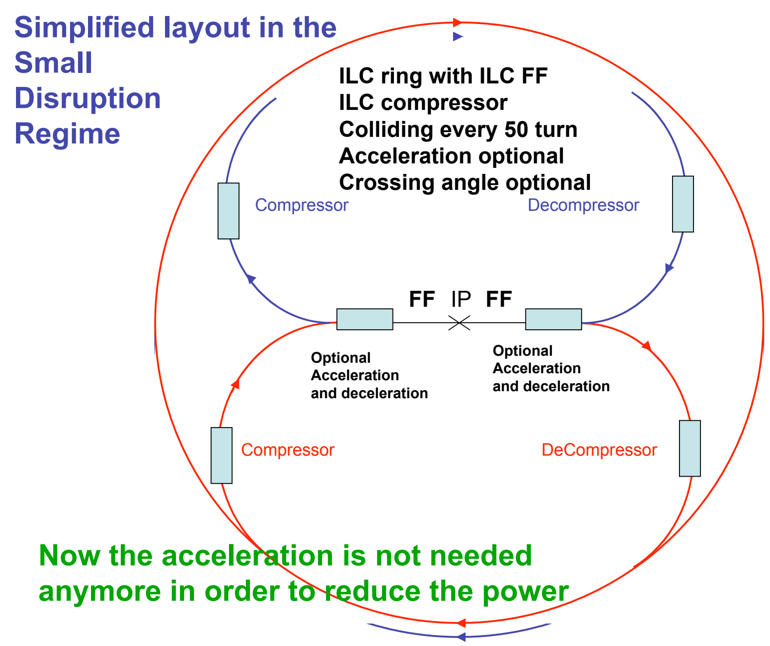
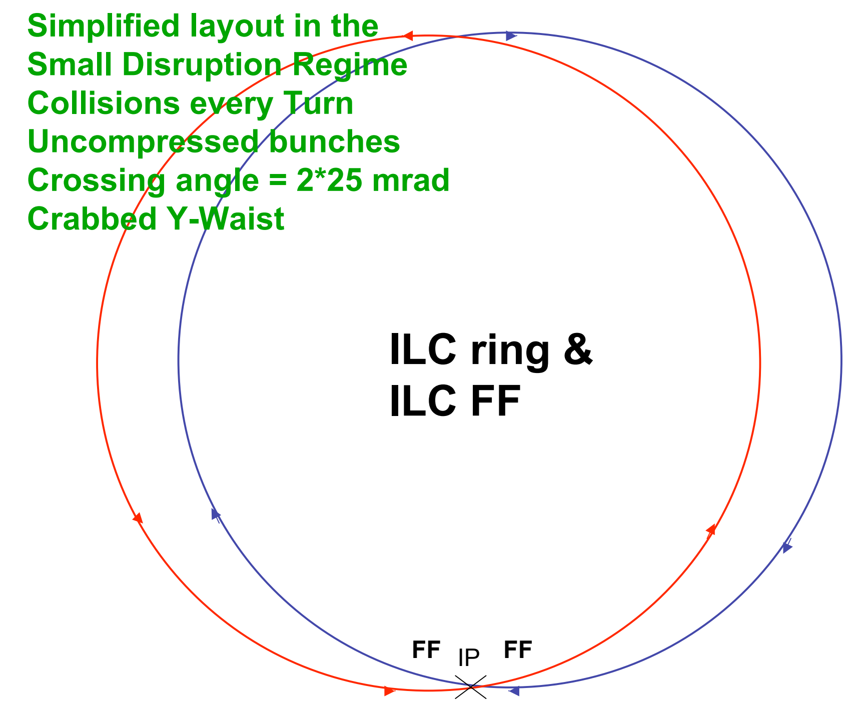
Detector Summary

- ✦ Critical Issues
  - Boost
  - Beampipe radius & cooling
  - Beam Background environment
- ✦ Physics Opportunities
  - Tau-Charm operation
  - B_s Production
  - Polarization
- ✦ Design Issues
  - Forward PID
  - Backward EMC & PID
  - Reuse of BABAR or BELLE
- ✦ Detector R&D

Critical Issues

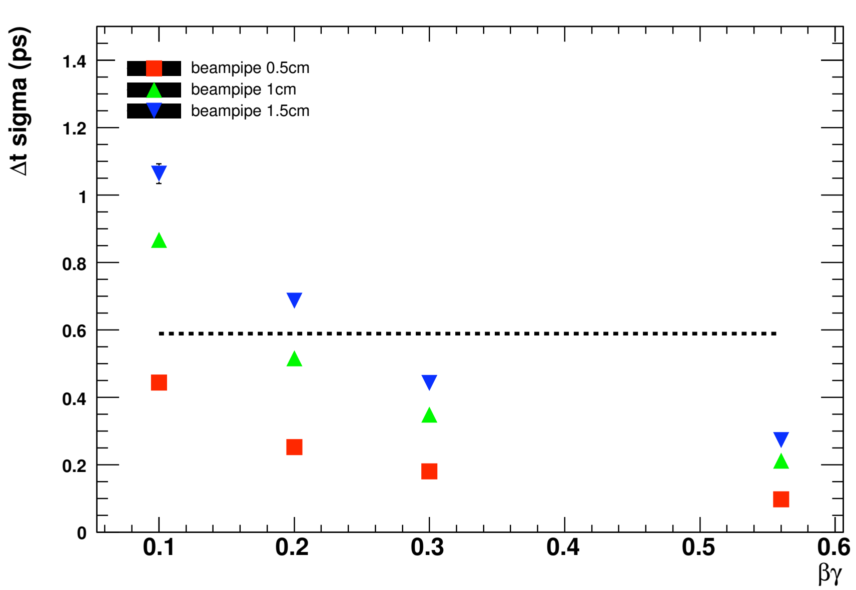






Currents few mA | Currents 10-100 mA | Currents 1-2 A

1) Beampipe Radius & Material?



Is a 1cm pipe without cooling realistic in any scenario?

With cooling, what is the minimum possible boost?

➡ need larger Boost than 7on4

Critical Issues (continued)

2)Boost? Some detector design decisions depend on the boost

3)Beam Background Environment?

Low currents ⟷ Higher currents

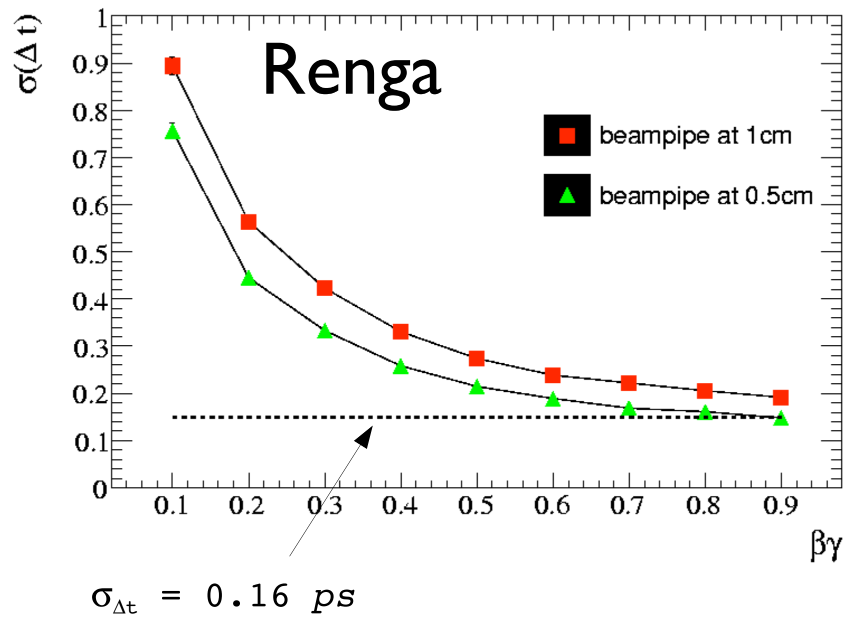
Occupancy limited Detector components

SVT inner layer
Tracker
Forward EMC
DIRC readout

Backgrounds above some threshold imply that all these detectors require new technology

New Physics Opportunities

B_s physics



time-dependent measurements?
not possible

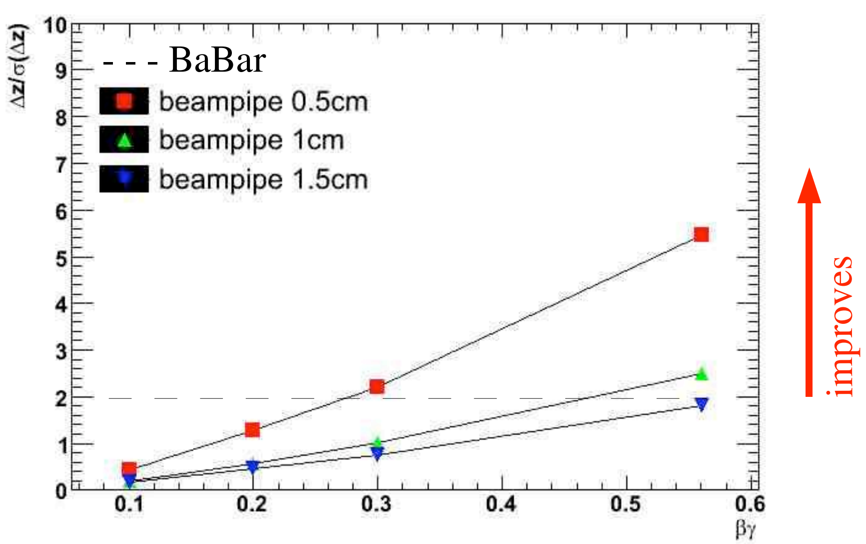
window of time-integrated measurements not possible at LHCb

Tau-Charm Energy

Neri

Ψ_{3770}

Assume σ(Tag)=σ(Vtx): low track multiplicity, no charm bias in Tag vtx



D lifetime 0.4 ps, for B it is 1.5 ps ⇒ Smaller Δz significance.
Layer0 at 0.5cm and reduction of the radial material is important.

with βγ Boost - CLEO-c type measurements plus time-dependence permits additional constraints on D mixing x and y

Physics Opportunities (continued)

Polarization and τ EDM and CP Violation

Paoloni & Hitlin

P-weighted Sensitivities ($10^7 \tau$ – pairs)

(a)

	c_{AB} (GeV^2)	$\sqrt{\langle O_1^2\rangle}$ (GeV^2)	$\lvert\delta\, \mathrm{Re} d_\tau^\gamma\rvert$ (e cm)
$\pi\pi$	1.72×10^3	3.46	2.61×10^{-19}
$\pi\rho$	1.34×10^3	2.38	1.68×10^{-19}
$\rho\rho$	7.62×10^2	1.48	1.33×10^{-19}

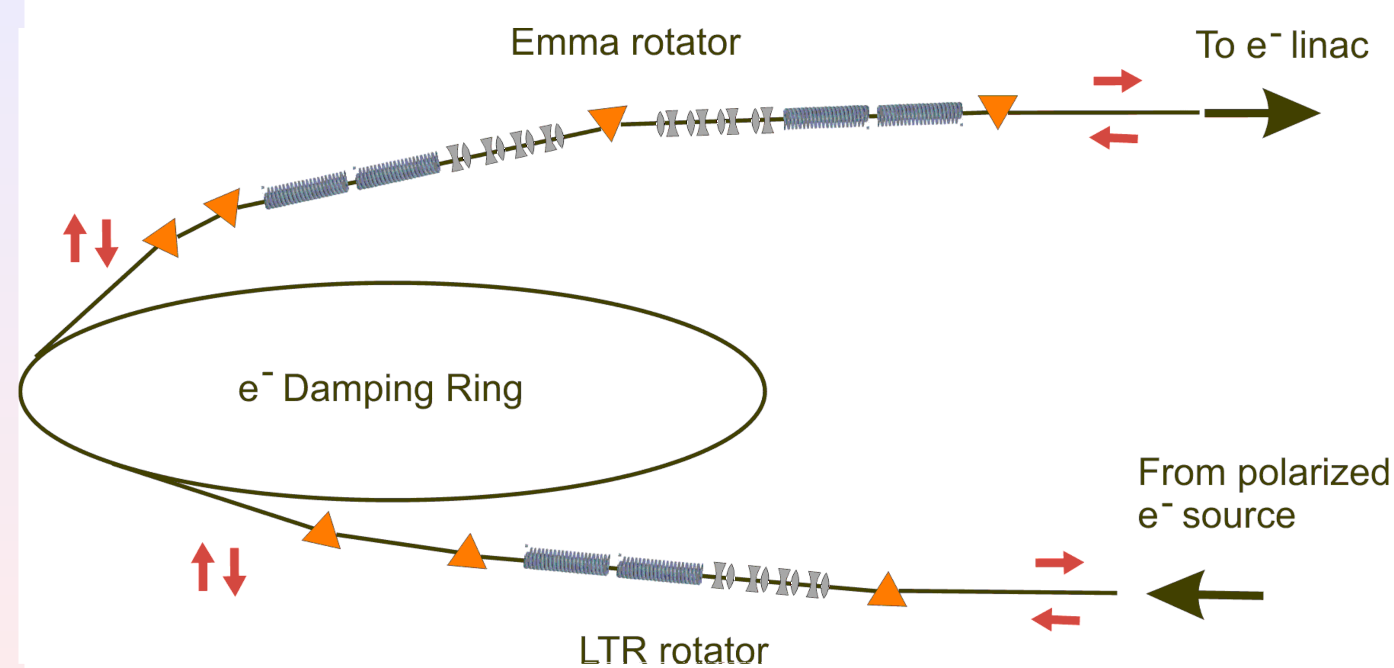
(b)

	c_{AB} (GeV)	$\sqrt{\langle O_2^2\rangle}$ (GeV)	$\lvert\delta\, \mathrm{Im} d_\tau^\gamma\rvert$ (e cm)
$\pi\pi$	2.49×10^{-1}	1.19	6.20×10^{-16}
$\pi\rho$	1.71×10^{-1}	1.28	7.03×10^{-16}
$\rho\rho$	9.35×10^{-2}	1.15	8.39×10^{-16}

$$c_{AB} \cdot \Re(d_\tau) = \frac{e}{\sqrt{s}} \left[\langle O_1 \rangle_P - \langle O_1 \rangle_{-P} \right]$$

- Most systematic effects should cancels in $\langle O_1 \rangle_P - \langle O_1 \rangle_{-P}$
- With a sample in excess of $10^{10} \tau$ pairs it seems possible to enter in the very high precision realm $d_\tau \sim 10^{-20} e\,\mathrm{cm}$

E. Paoloni (Università di PISA & INFN) LNF Mar. 2006 9 / 15

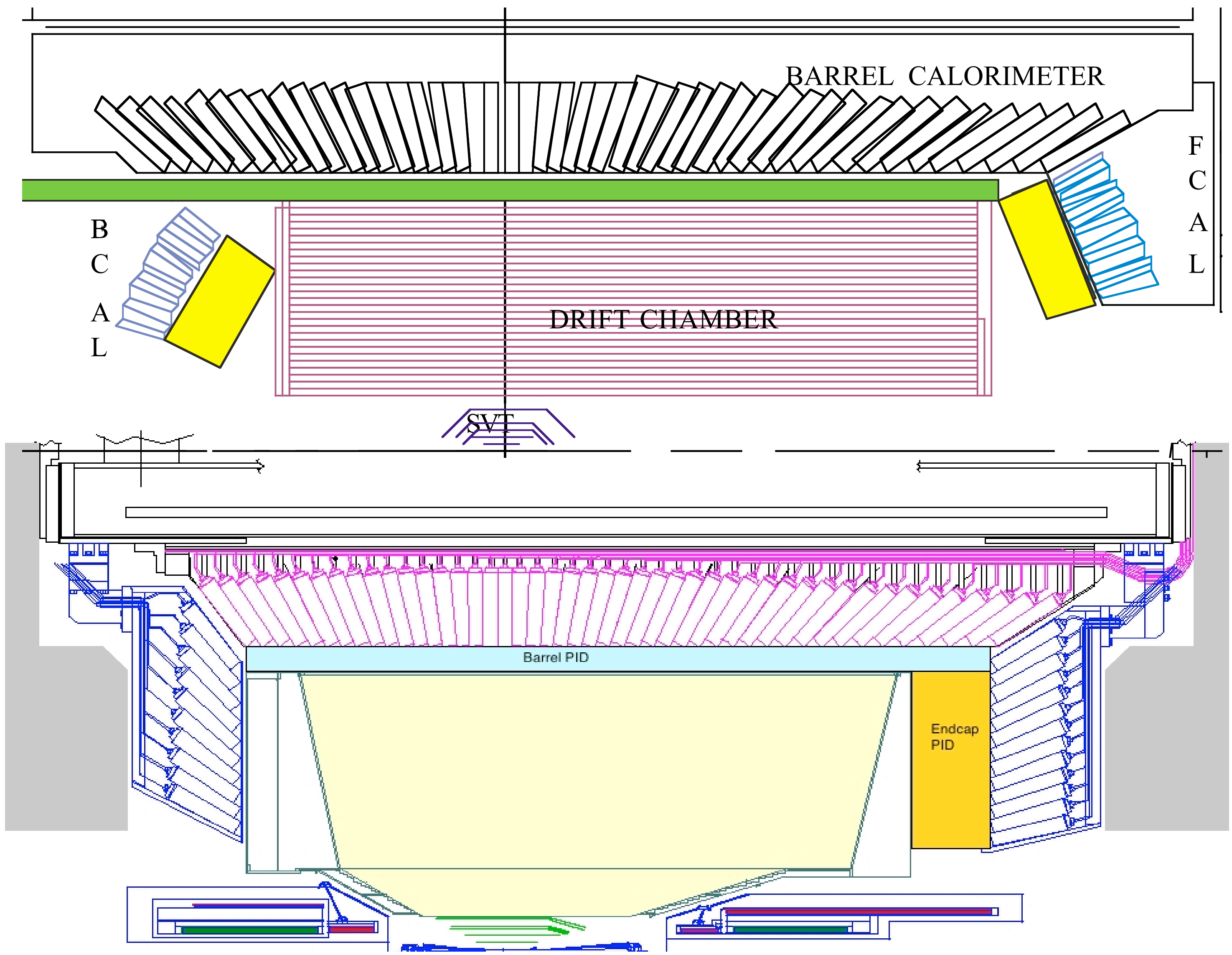


Polarization gains x10^3 in EDM, and perhaps x10-20 for CP Violation measurements

Does this Physics justify inclusion of Polarization?

Design Issues

Either BABAR or BELLE could be the basis of a SuperB detector



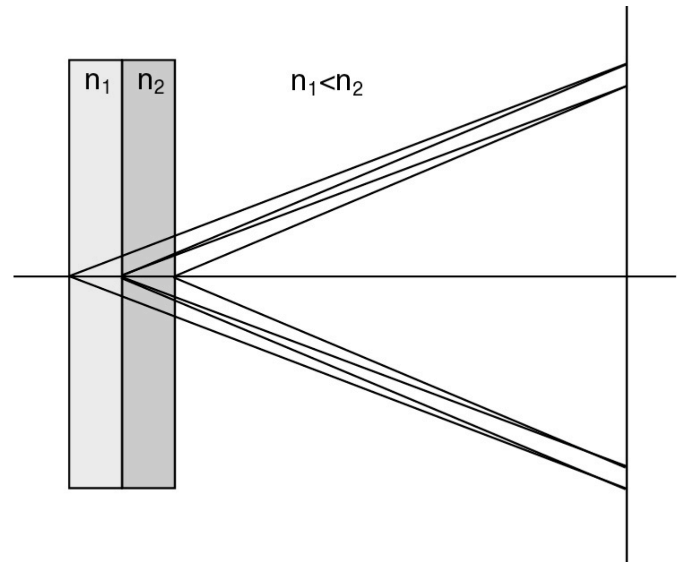
BELLE causes problem for DIRC

lower boost means backwards detectors more important

Detector R&D

Silicon R&D - MAPS pixels - Rizzo

forward PID



proximity focussing
Aerogel - Krizan

Focussing DIRC & new readout - Ratcliff

EMC Endcap occupancy - LYSO or LSO Hitlin

Trigger/DAQ - collision frequency

deadtimeless operation
Dubois-Felsmann

Conclusions & Limitations

Beampipe, Boost, Backgrounds

$\beta\gamma$=.45

BABAR-like background environment

current R&D consistent with limited detector technology updates, not high occupancy capability