



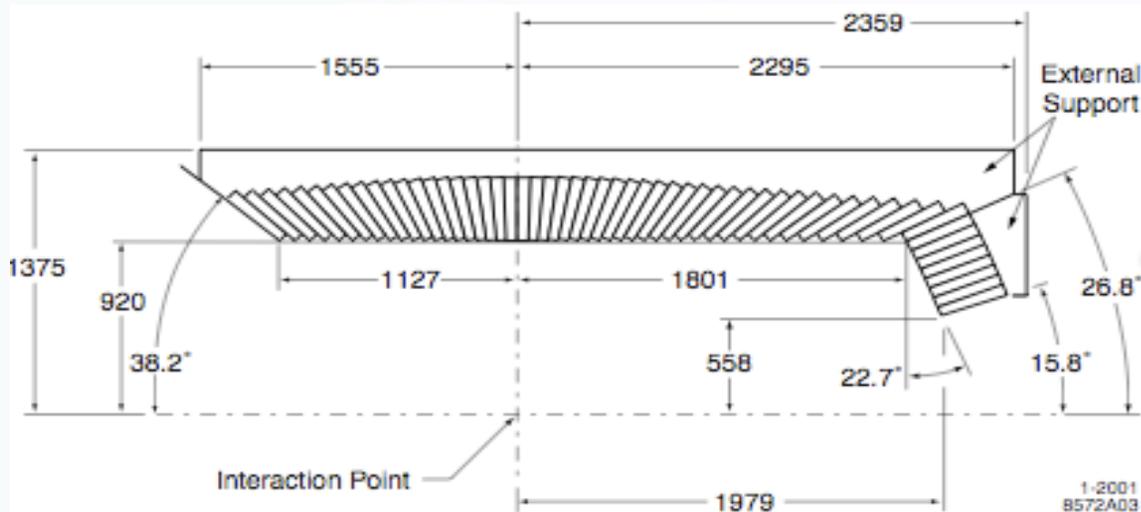
Babar/SuperB EMC-Barrel performance

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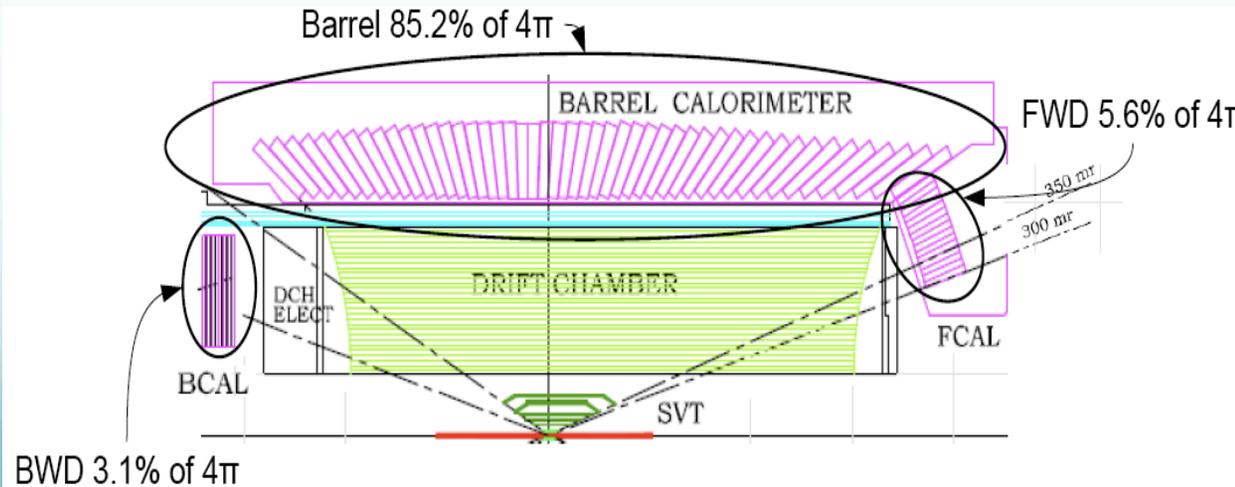
Outline

- TDR EMC barrel session (3-4 papers)—Kevin's pre-defined
 - Energy and position resolution;
 - Gamma-gamma mass resolution;
 - ~~Radiation Damage Effects;~~
 - Expected changes in performance at SuperB.
- Outline
 - Babar EMC;
 - Energy and position resolution;
 - Gamma-gamma mass resolution;
 - SuperB FastSim test (single photon, $B \rightarrow X_s \gamma$);
 - Expectation on SuperB.

Babar/SuperB EMC



← Babar
 Barrel-EMC 5760 CsI (TI)
 Crystals
 48 θ rings \times 120 crystals/
 rings



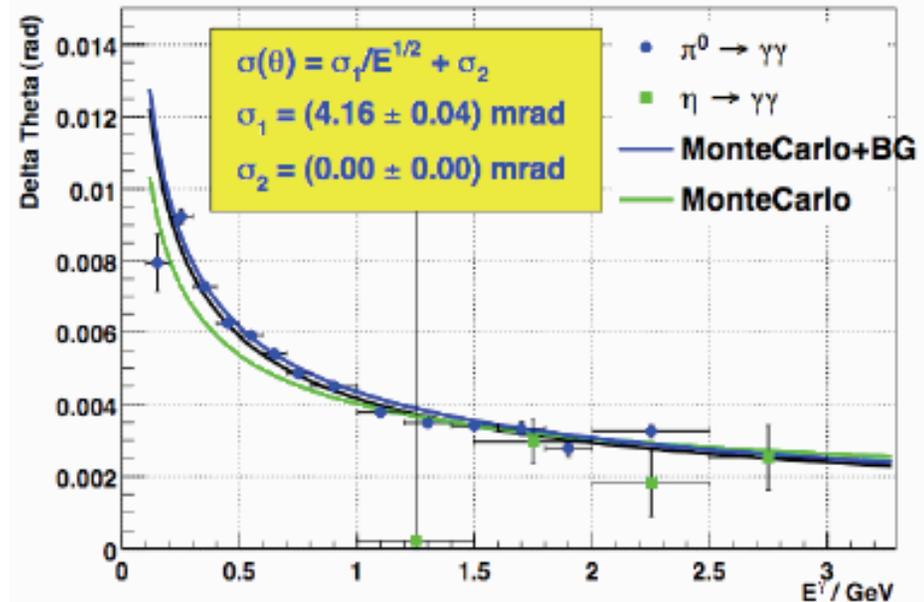
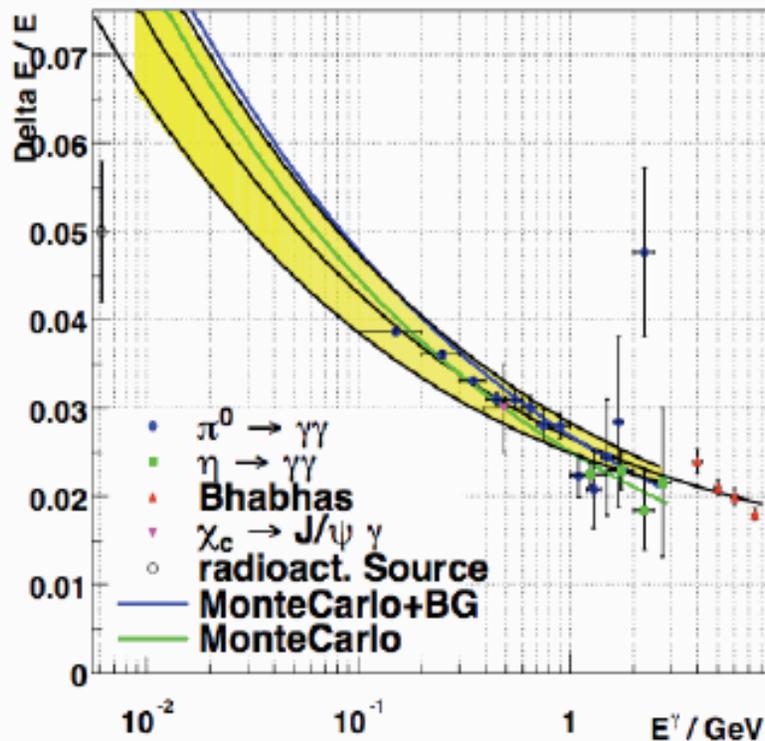
Reused for
 SuperB

Calorimeter Performance

- Energy Resolution:

$$\frac{\sigma_E}{E} = \frac{\sigma_1}{\sqrt[4]{E}} \oplus \sigma_2$$

- $\sigma_1 = (2.30 \pm 0.03 \pm 0.3)\%$
- $\sigma_2 = (1.35 \pm 0.08 \pm 0.2)\%$



- Angular Resolution:

$$\sigma(\theta) = \frac{\sigma_1}{\sqrt{E}} \oplus \sigma_2$$

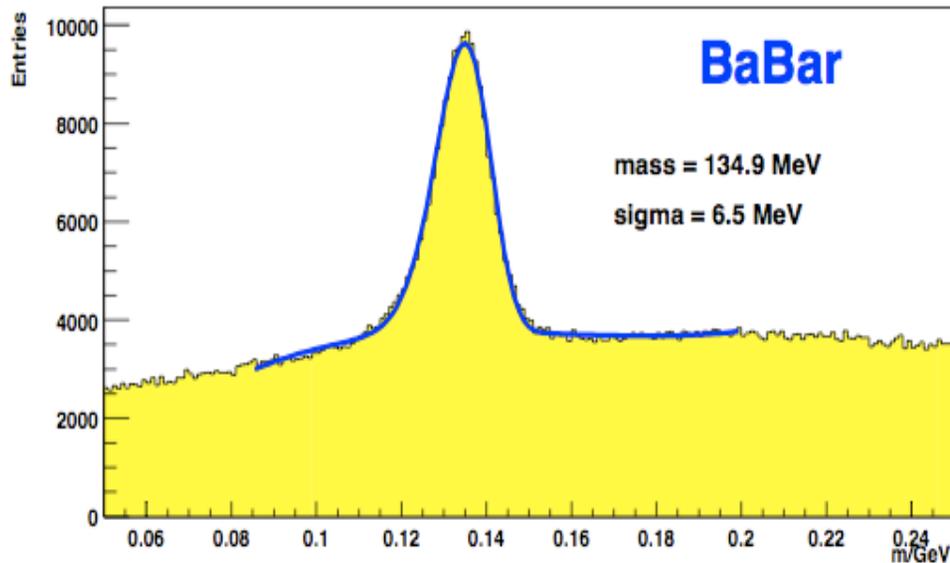
- $\sigma_1 = (4.16 \pm 0.04) \text{ mrad}$

2001 data, M. Kocian, Calor2002

A. Ruland, Calor2008

No significant difference in later runs

$m_{\gamma\gamma}$ resolution: Babar

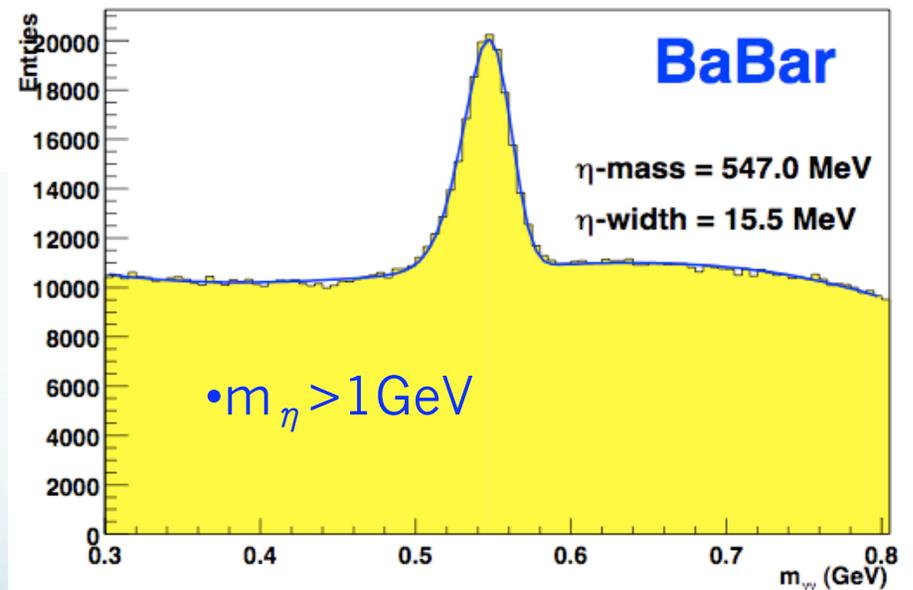


2 γ invariant mass from hadronic events

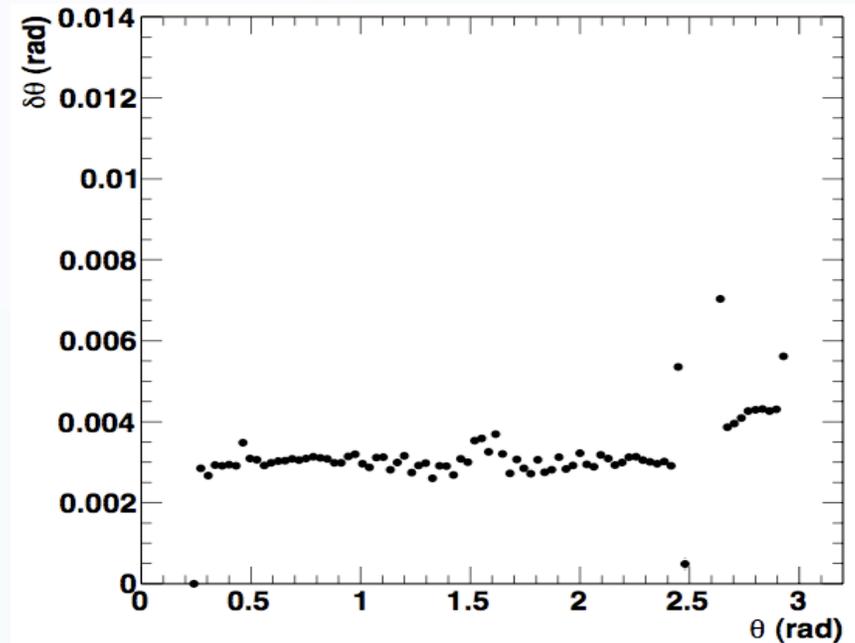
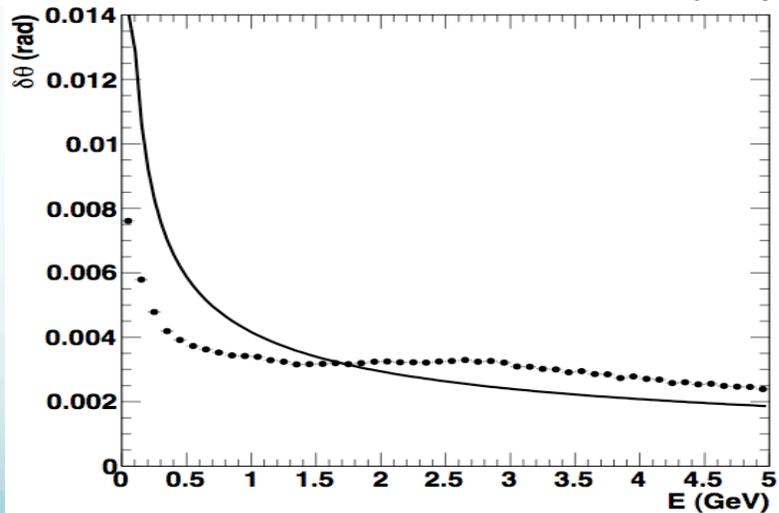
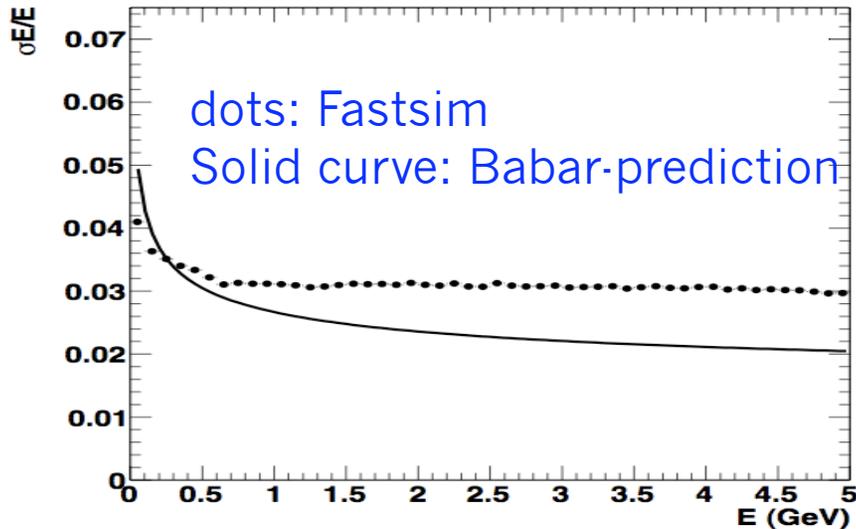
- $m_{\gamma} > 30$ MeV
- $m_{\pi} > 300$ MeV

2001 data, M. Kocian, Calor2002
A. Ruland, Calor2008
No significant difference in later runs

η Mass $E_{\gamma\gamma} > 1000$ MeV

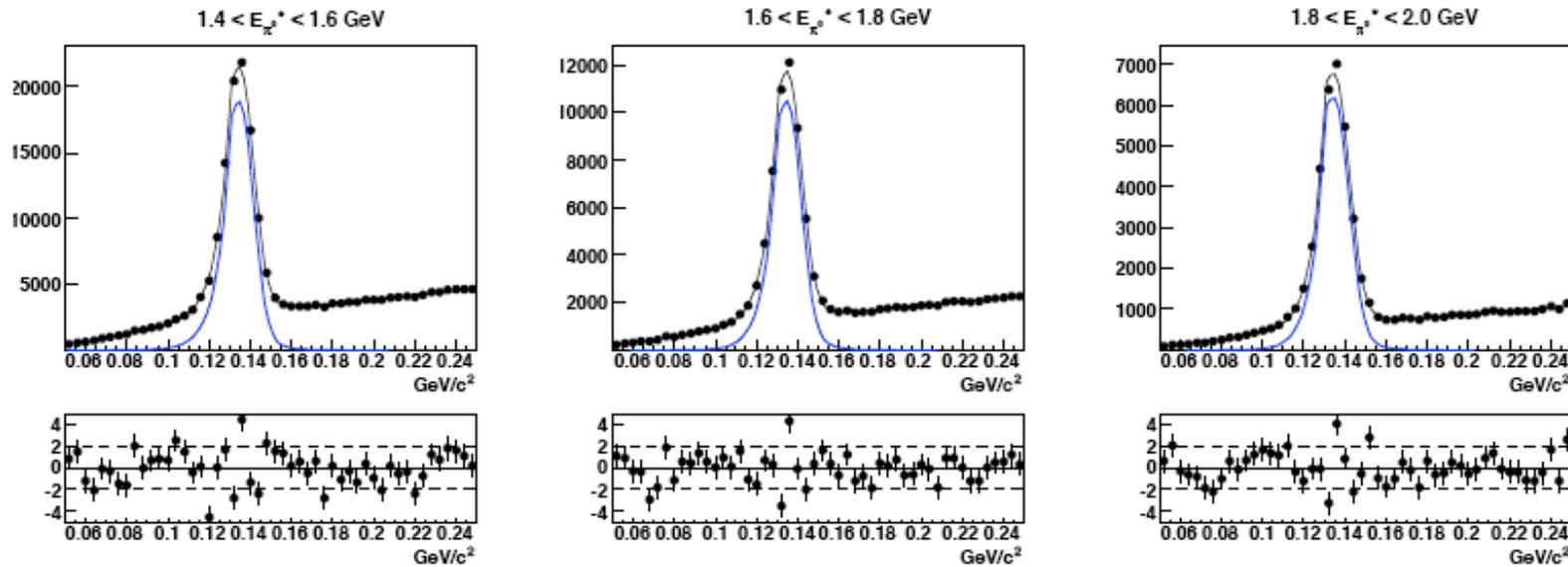


Single γ resolution: FastSim

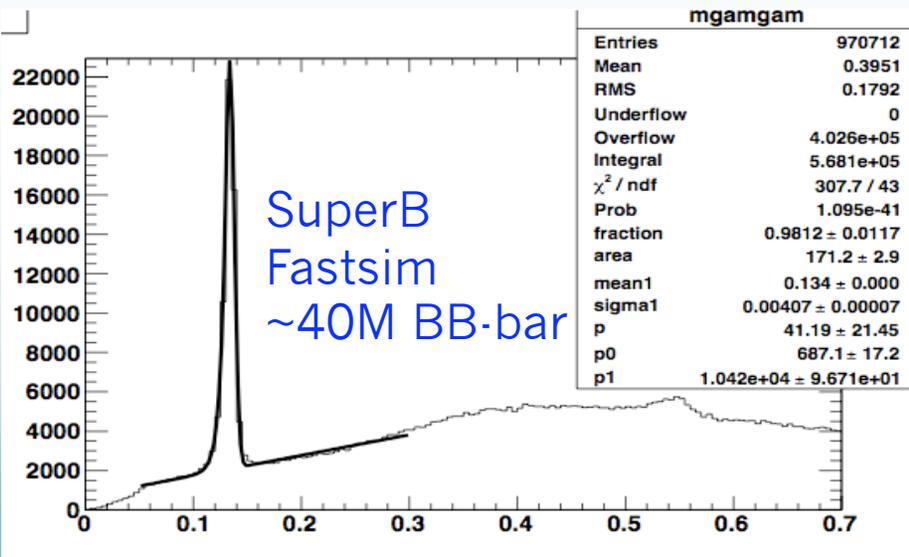


- FastSim –preliminary
2M γ 's
- Inconsistence,
more study needed.

$B \rightarrow X \pi^0$ --bg of $B \rightarrow X s \gamma$

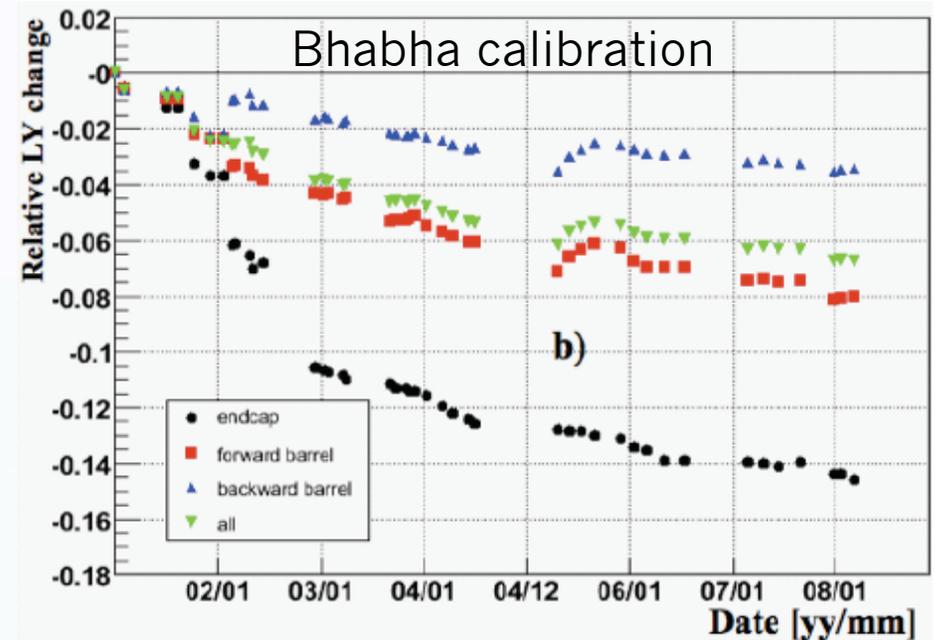
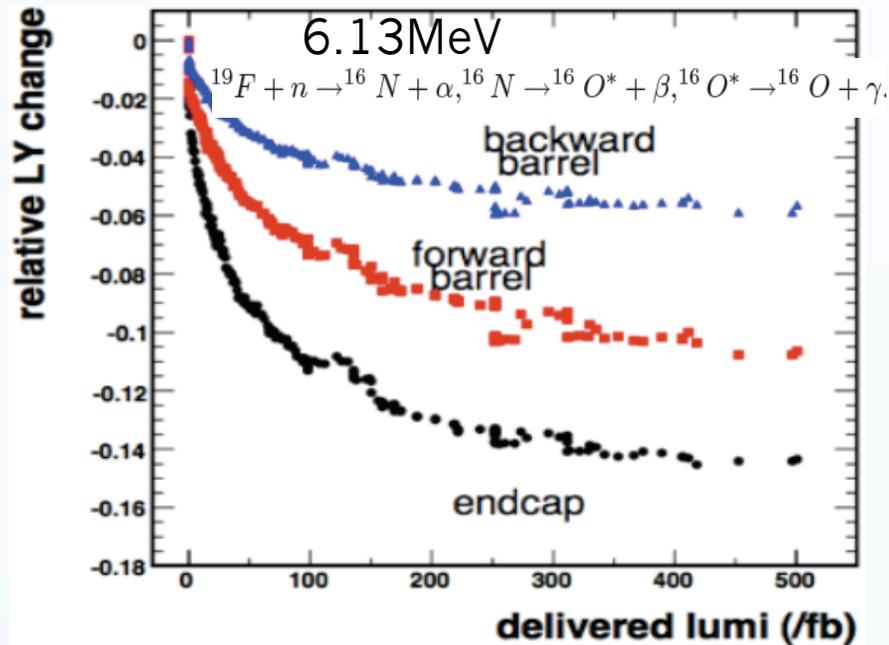


Babar
fully
inclusive



- Babar: 5.9-6.7 MeV;
- SuperB-FastSim
Same function, most
parameters fixed
~4 MeV

Expected performance @SuperB



- Babar barrel: total dose ~ 1 krad, $\sim 10\%$ Light yield loss, no measurable impact on performance, e.g. $\gamma\gamma$ resolution;
- SuperB: ~ 1 krad/year for SuperB; 10krad dose budget.
- Open question. Fastsim/Fullsim/Any suggestions?

Summary

- Energy and position resolution;
 - Gamma-gamma mass resolution;
 - Radiation Damage Effects on Radiation;
 - Expected changes in performance at SuperB.
-
- Ongoing..
 - Fastsim investigation (Full simulation?)
 - EMC performance expectation.



Backup

References

- Performance and calibration of the crystal calorimeter of the Babar detector, M. Kocian
SLAC-PUB-10170, 2002
- Performance and Operation of The Babar Calorimeter, A. M. Ruland, Calor2008
- Babar NIM paper
- Super-B Fastsim (preliminary)

Radiation damage in scintillating crystals

R.-Y. Zhu, NIM A413(1998)

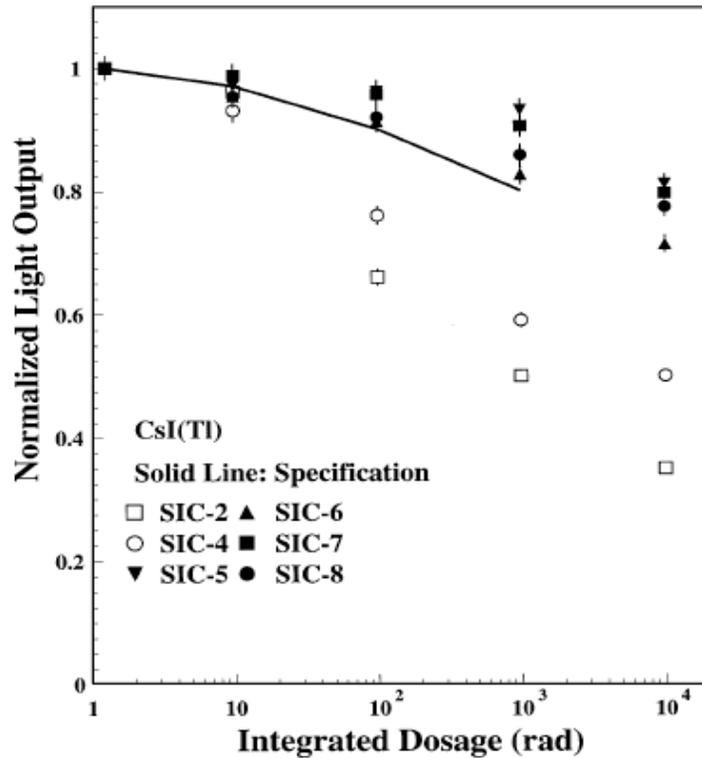


Fig. 12. The progress of CsI(Tl) radiation hardness is shown for full size (~ 30cm) CsI(Tl) samples from SIC together with the rad-hard specification of BaBar experiment.

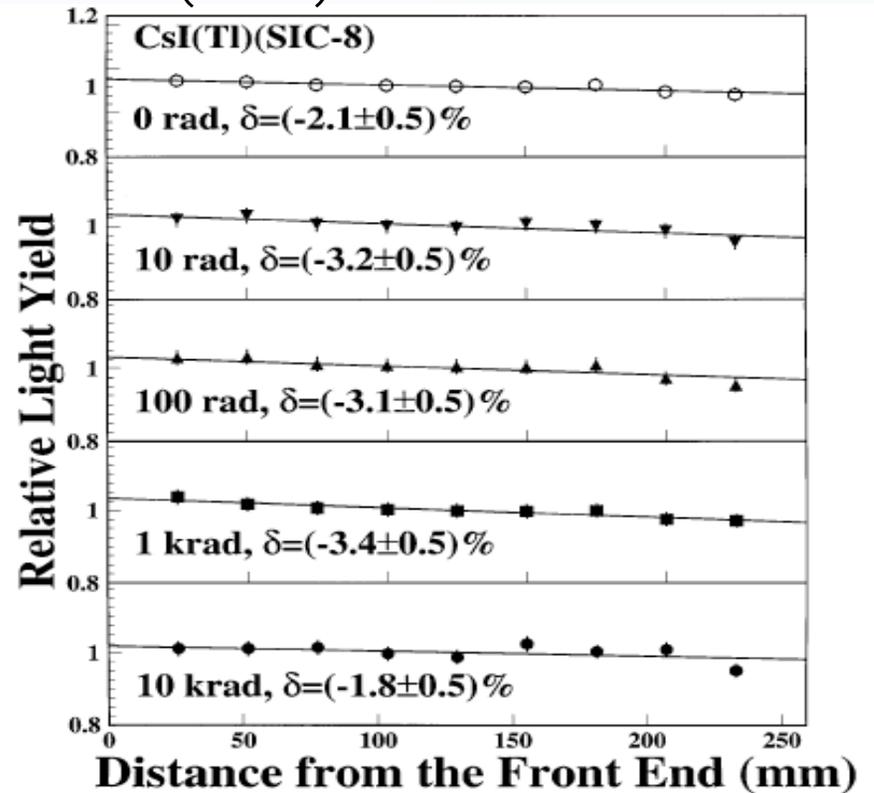


Fig. 5. The light response uniformities are shown as a function of integrated dose for a full size CsI(Tl) sample.