

# EMC Simulation Studies

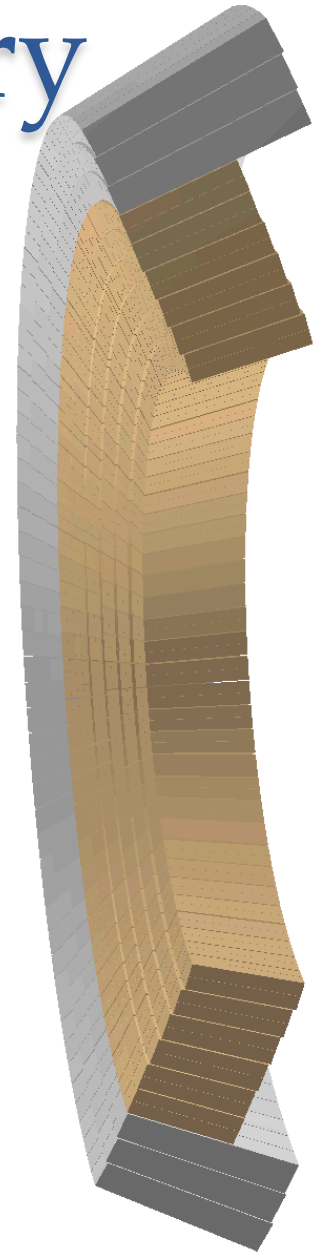
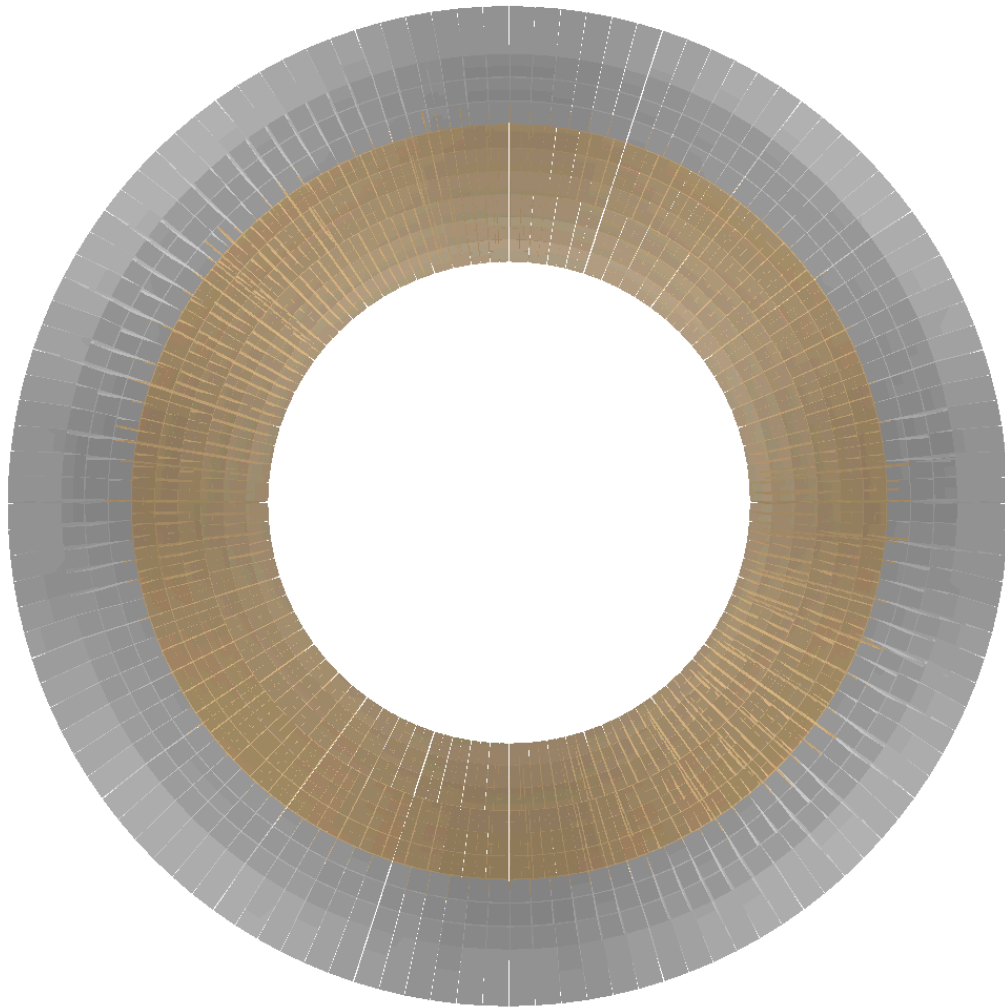
20/09/2012

Stefano Germani  
INFN PG – CNRS LAL

# Outline

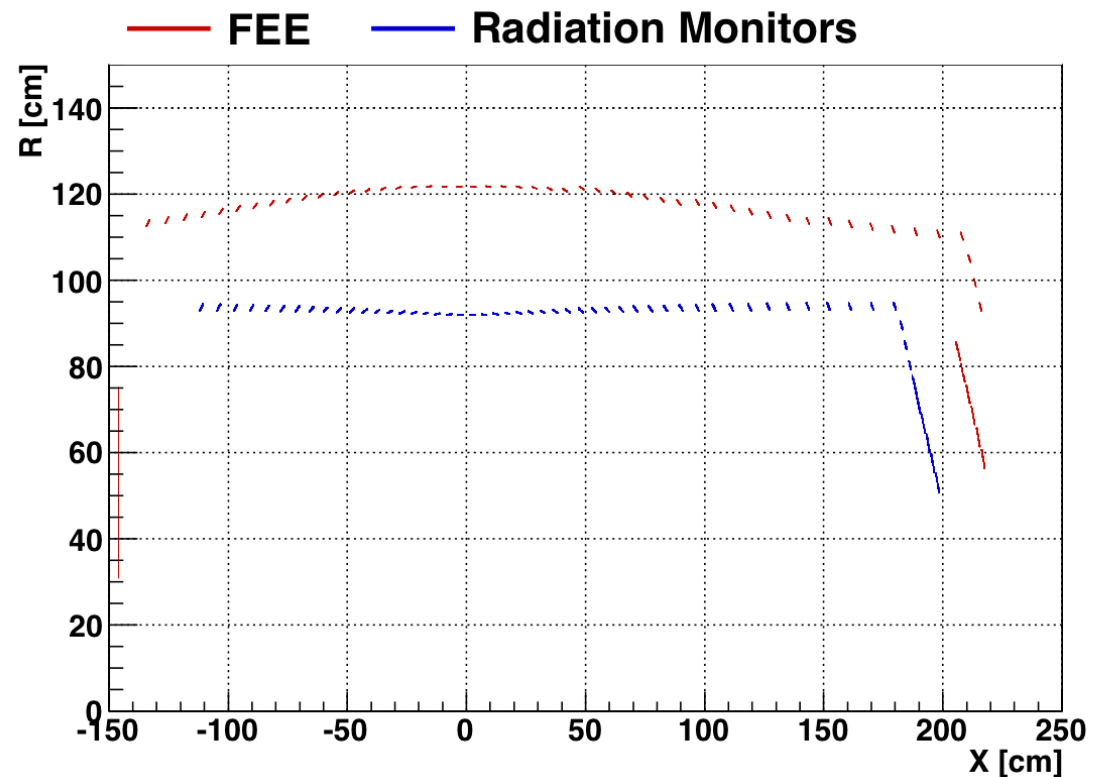
- Geometry and Simulation evolutions
- New Background production and Radiation Dose
- Hybrid endcap performance

# Hybrid Fwd Geometry



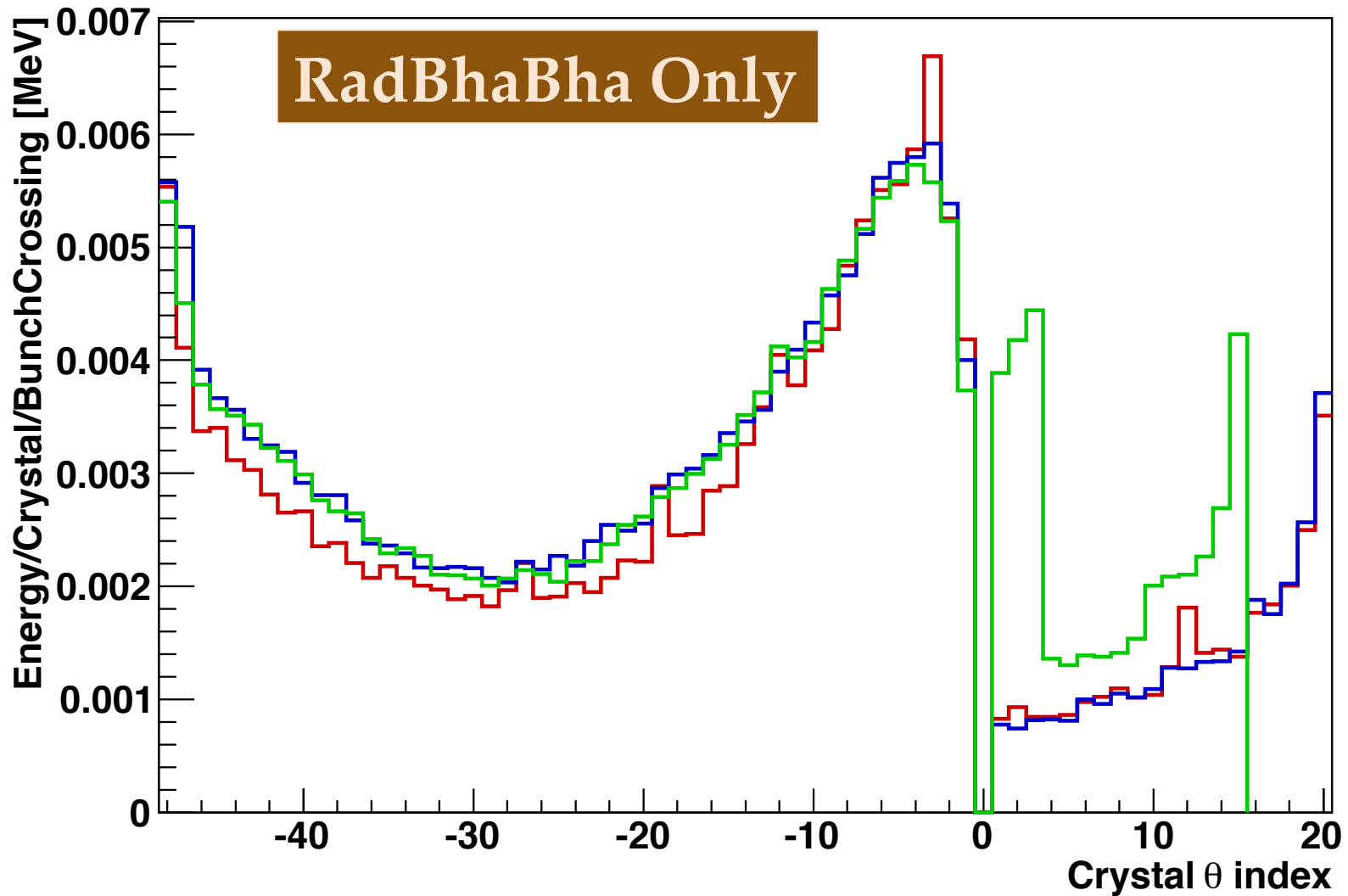
# Additional Volumes

- FEE Silicon on crystals back
  - It has been there for more than one year
- Radiation Monitor Silicon on crystals front
  - Added just for last production



# Quick look at the new Prod

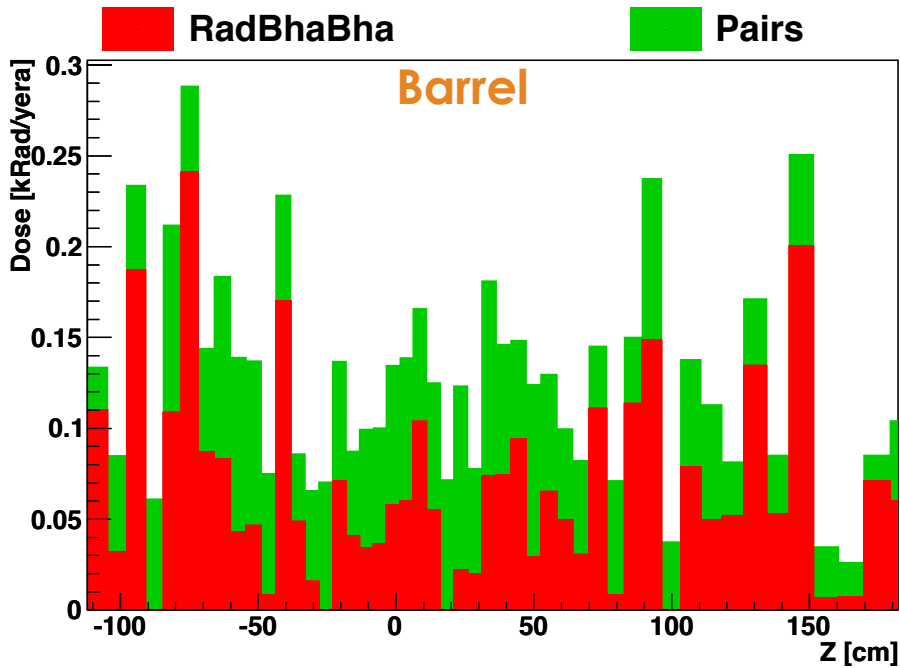
— Elba 2012 — Pisa 2012 — Pisa 2012 - Hybrid Fwd



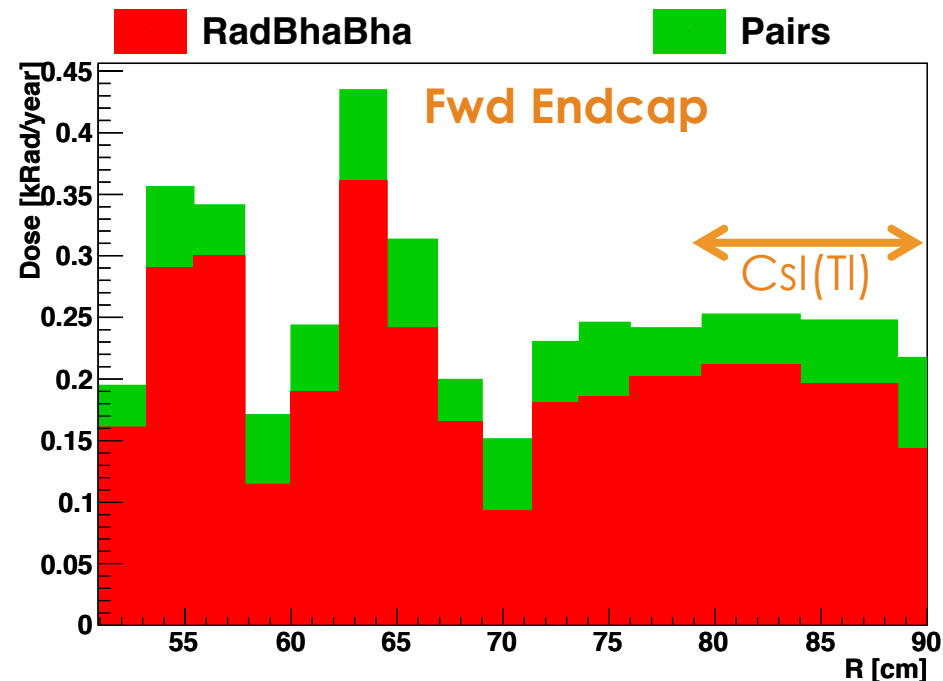
# Other backgrounds

- The last production (Pisa) also includes
  - Pairs
  - Touschek
  - Beam Gas
  - Synchrotron
- Synchrotron background has NO hits in the EMC
- Other backgrounds still to be analyzed in details

# Radiation Dose



- Use Radiation Monitors volumes to emulate radiation measurements from BaBar RadFETs
- Evaluate Dose/year vs Position



CsI crystal region for hybrid endcap has  $\sim 0.25$  kRad/year

# BaBar Calorimeter Slides ...

## Degradation of Calorimeter Performance at High Luminosities

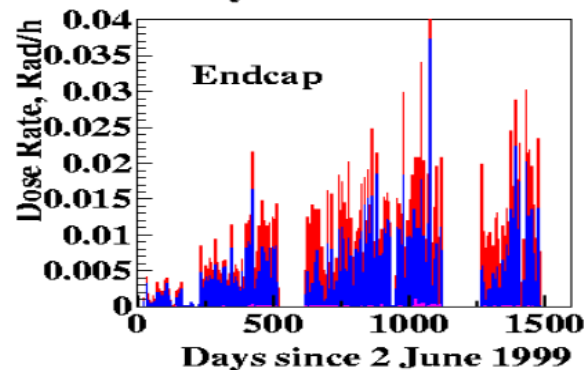
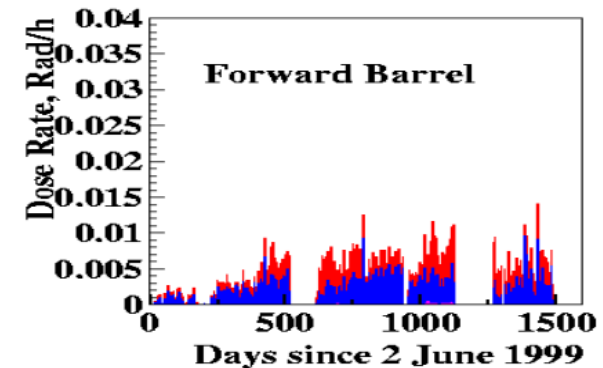
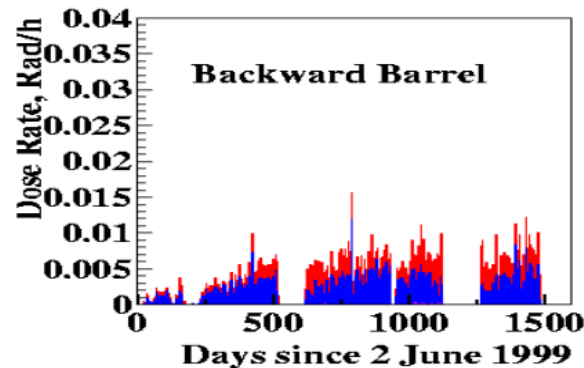
Martin Kocian

SLAC

Honolulu, 21 January 2004



## Dose Accumulation



Inject/tune  
Stable beams  
Injection Holding

T. Hryn'ova

Present dose rate is about 0.01 rad/h (from leakage currents)

⇒ At  $10^{36}$  the dose should be about 1 rad/h



# ...BaBar Calorimeter Slides

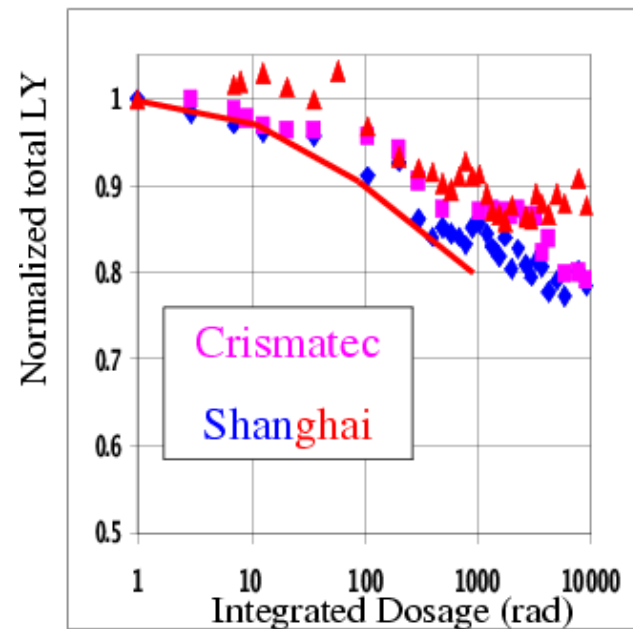
## Crystal Irradiation Experiment

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Crystal irradiation experiment by Tetiana Hryn'ova et al.

- Irradiated 16 CsI(Tl) crystals at 1-2 rad/h with  $^{60}\text{Co}$
- Integrated dose of 10,000 rad
- Measured total lightyield and uniformity
- Plot on the right shows lightyield vs dose for 3 crystals
- The red line indicates the original Babar specification
- The irradiation test is in good agreement with Babar data

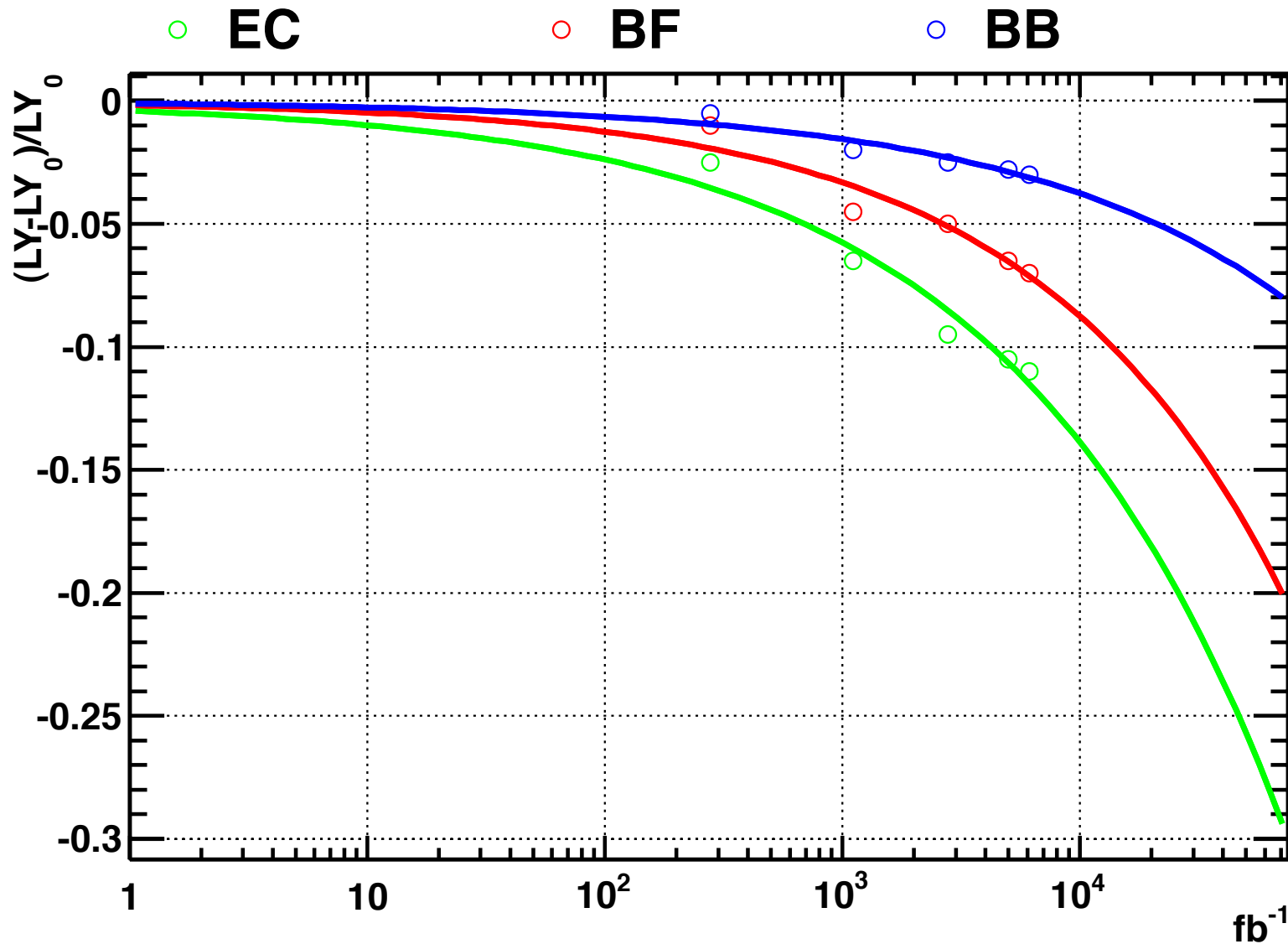
Typical Crystal Scanner crystals



# Dose Extrapolation

- BaBar
  - 1 Rad/h @ $10^{36}$  → 2.78 kRad/year
  - Radiation test reached 10 kRad → 75 % LY
- SuperB (Pairs+RadBhaBha)
  - Backward Barrel ~ 0.135 kRad/year
  - Central Barrel ~ 0.123 kRad/year
  - Forward Barrel ~ 0.116 kRad/year
  - Csl Endcap Part ~ 0.239 kRad/year
  
  - Used in extrapolation 0.25 kRad/year
  - 10 year running dose < BaBar radiation test (10 kRad)
- Extrapolation Plots
  - Use David Doll plots
  - Convert BaBar dose vs Integrated Luminosity in SuperB equivalent (~1/10)

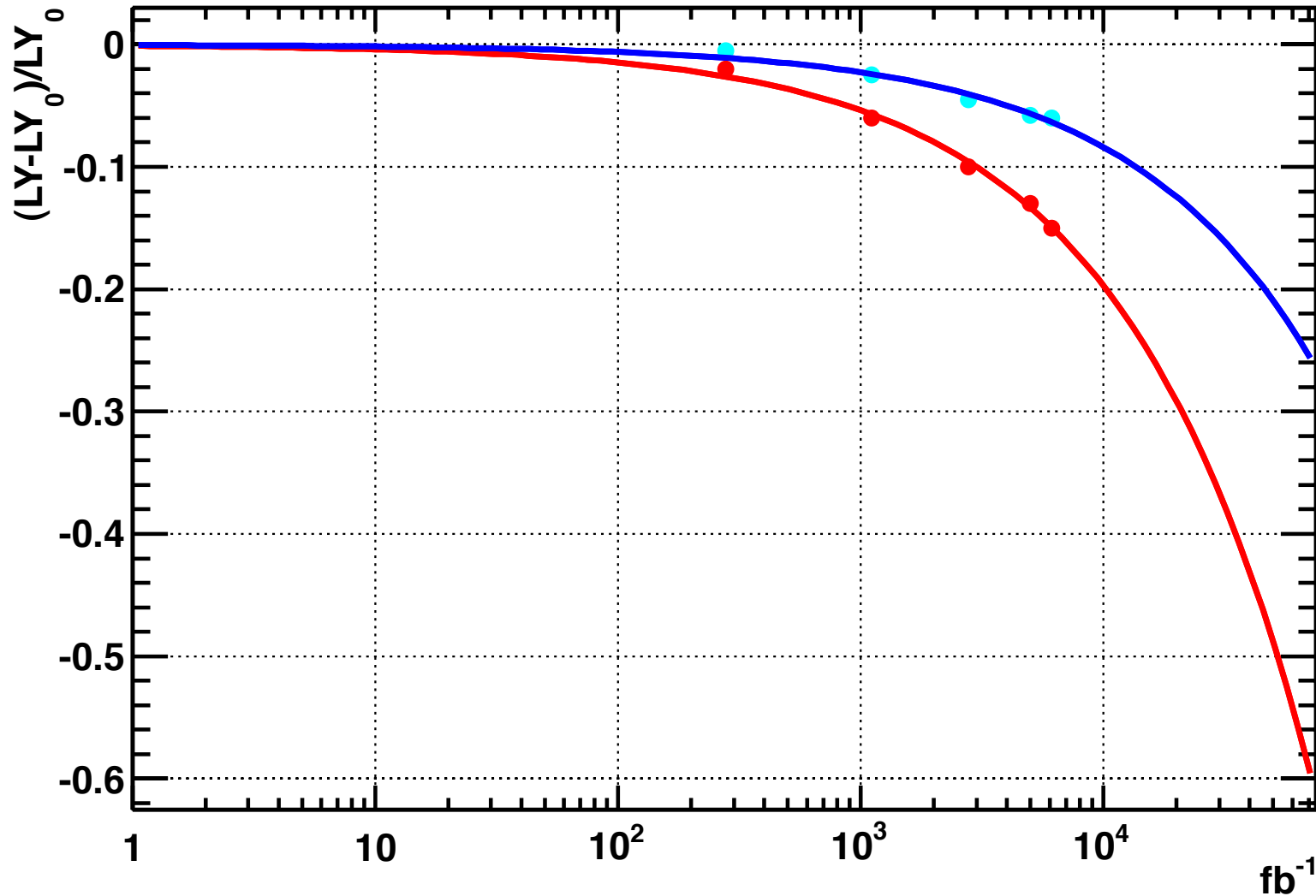
# Dose Extrapolation



# Dose Extrapolation

● **EC last**

● **FB first**

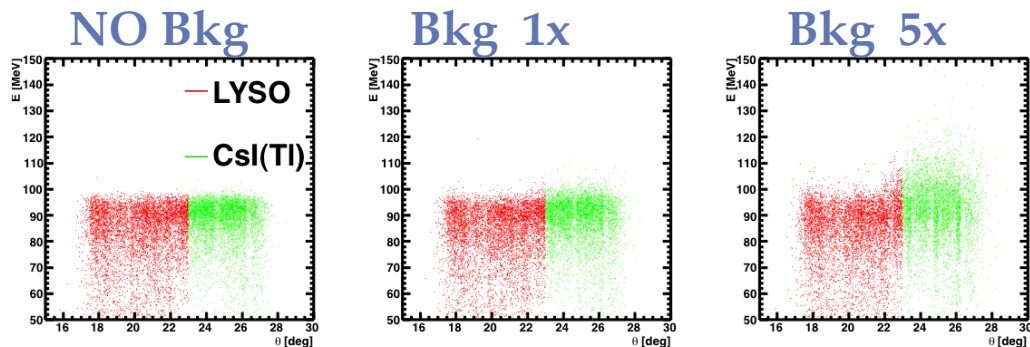


# Dose Conclusions

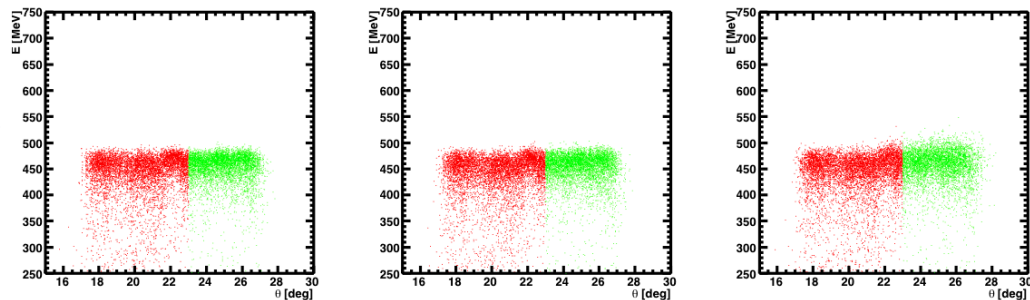
- SuperB seems to have 1/10 of Dose vs Integrated Luminosity wrt BaBar
- BaBar radiation test
  - 10 kRad > 10 SuperB years
  - -25% LY at 10 kRad
- BaBar data extrapolation
  - Not very solid
  - Worts loss for First Endcap ring : -60% LY @ 75 ab<sup>-1</sup>
- Need to include Touscheck and Beam Gas in dose evaluation
  - Expected to be marginal

# Hybrid Fwd -E vs Theta

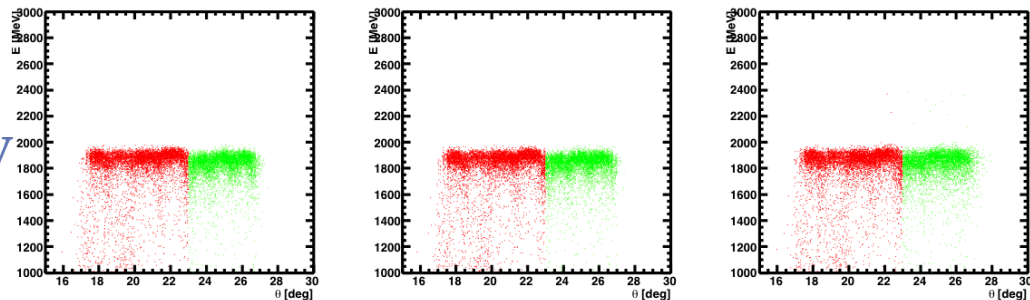
100 MeV



500 MeV



2000 MeV



- Different peak Energy
- Different peak shift with background
- Need (more) sophisticate intercalibration

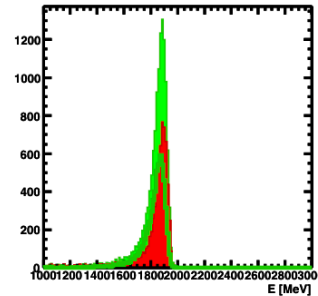
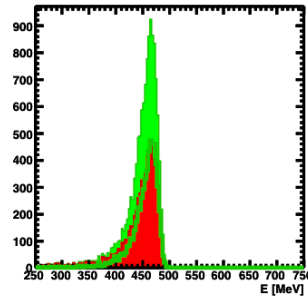
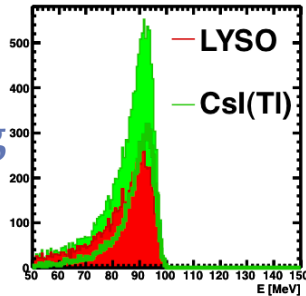
# Hybrid Fwd – Emeas

100 MeV

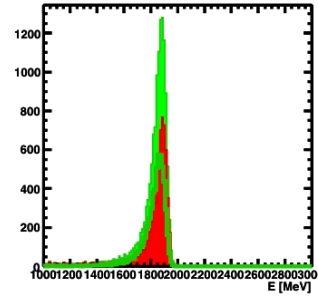
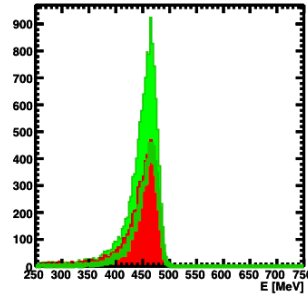
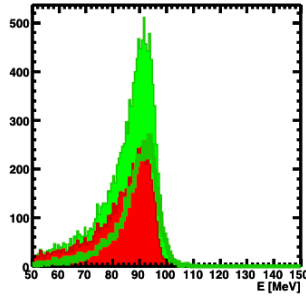
500 MeV

2000 MeV

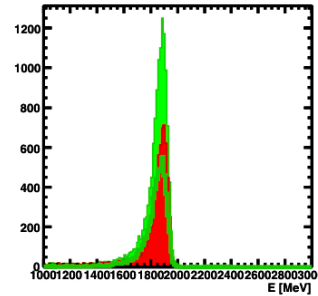
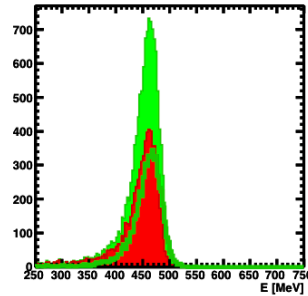
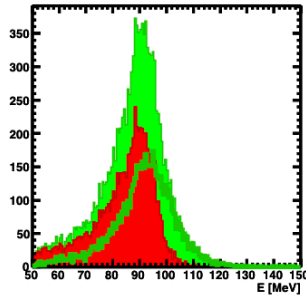
NO Bkg



Bkg 1x

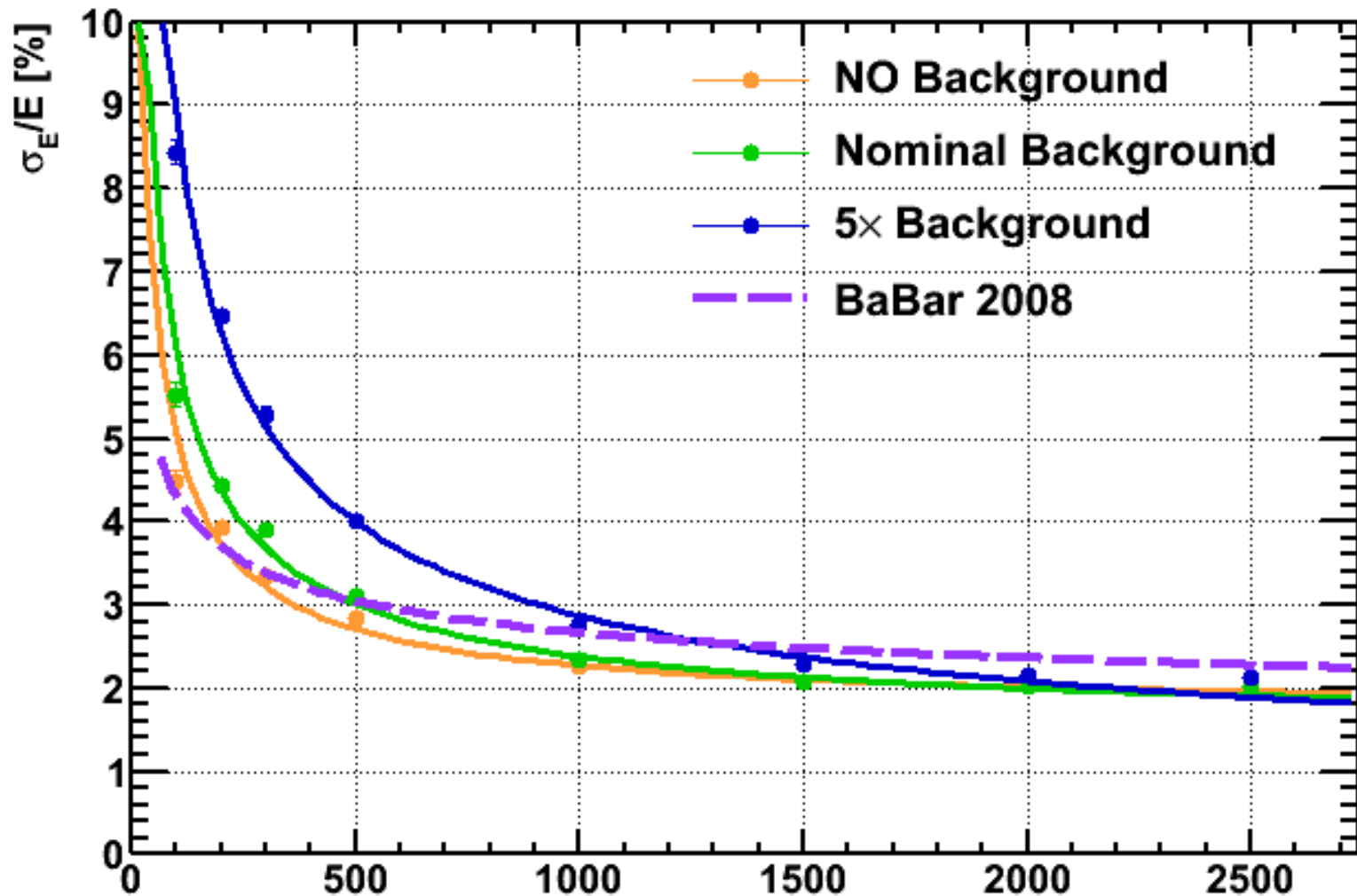


Bkg 5x



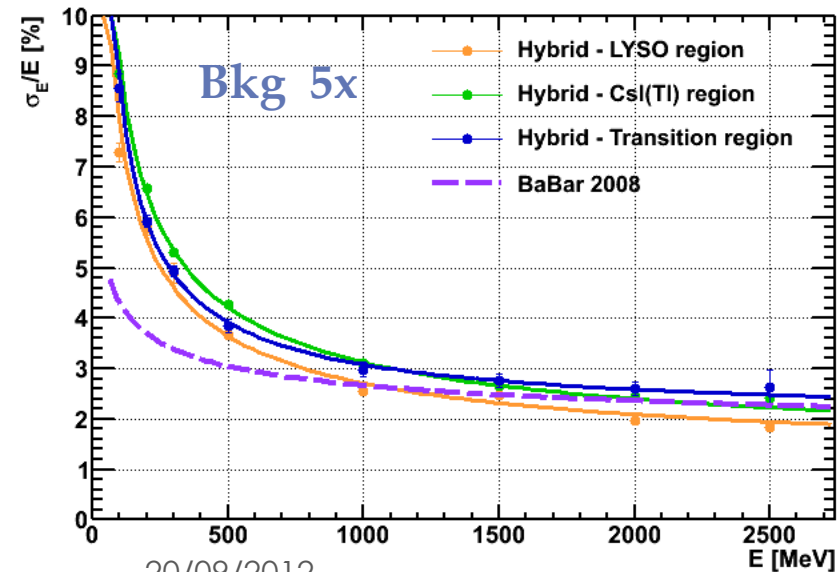
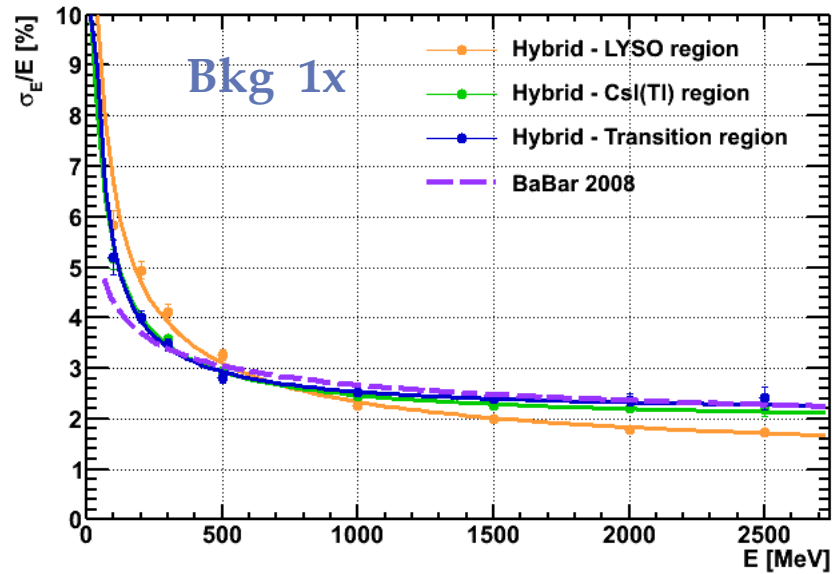
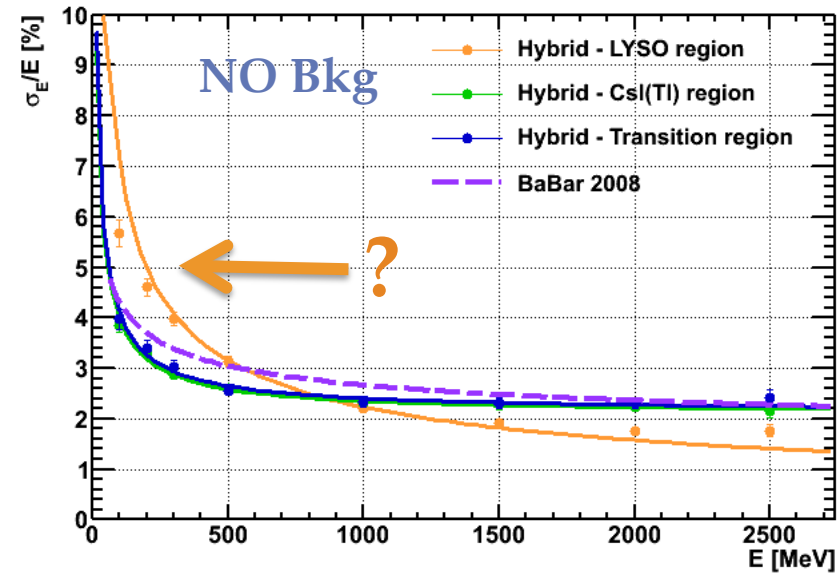
- Different peak Energy
- Different peak shift with background
- Need (more) sophisticate intercalibration

# Hybrid Fwd – Resolution





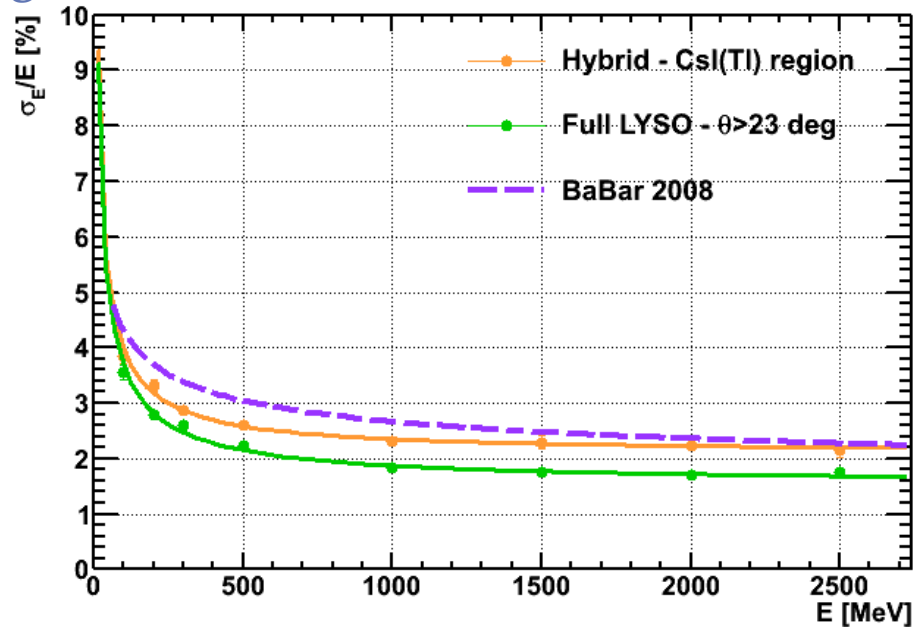
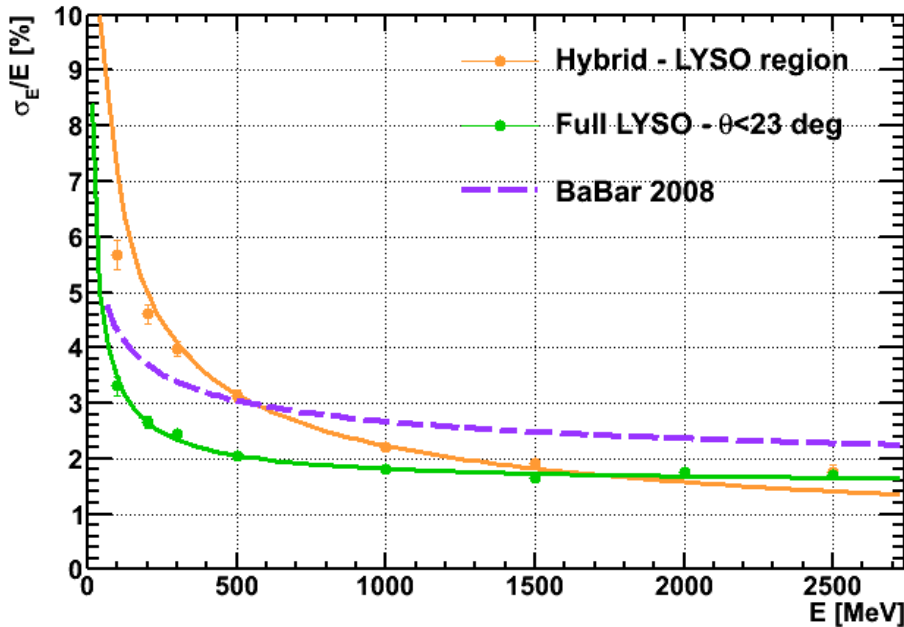
# Hybrid Fwd – $\sigma(E)$ vs Region



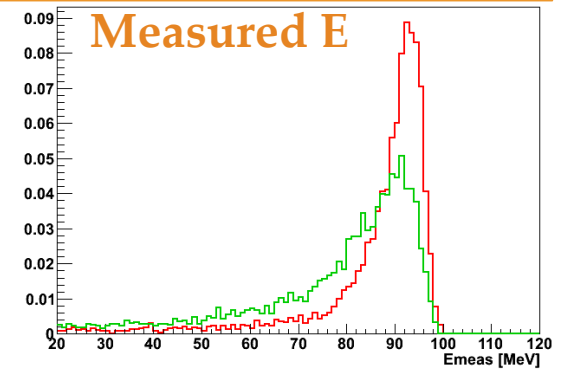
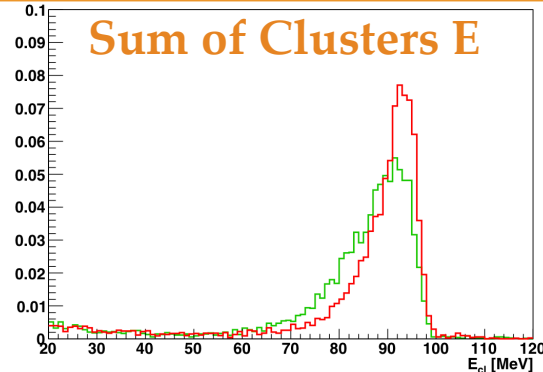
- LYSO region
  - shows strange resolution at low E
  - still almost insensitive to background
- Csl(Tl) region
  - Resolution flat at high E (leakage?)
- Transition
  - Performance similar to Csl(Tl)

# Hybrid vs Full LYSO Regions

NO Background

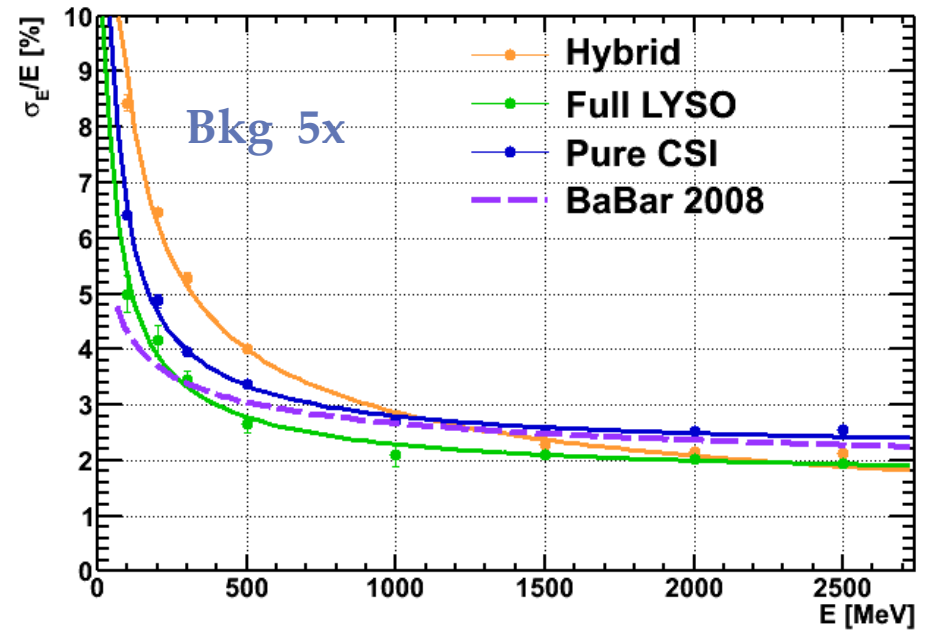
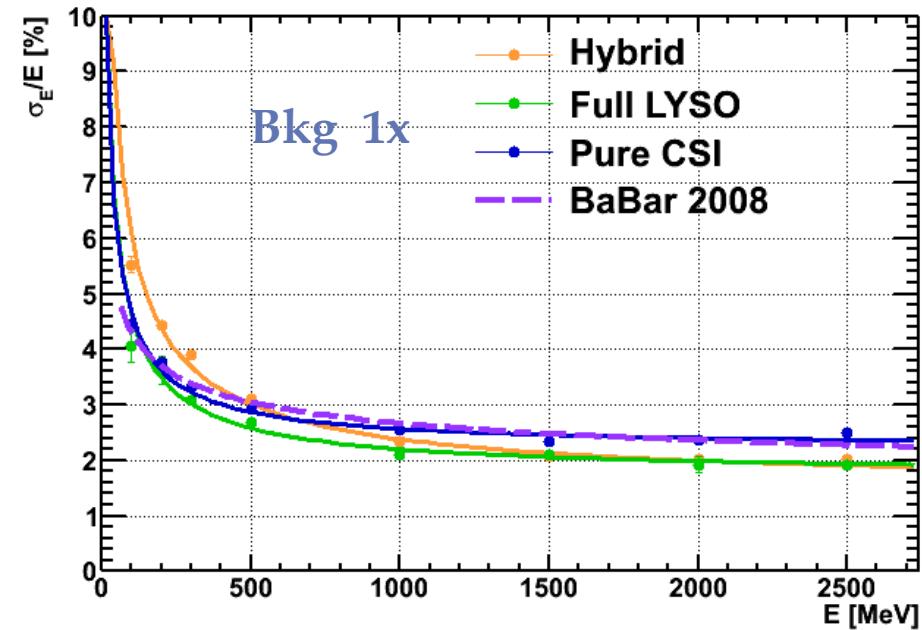


100 MeV NO Background – LYSO region



20/09/2012

# Fwd Options

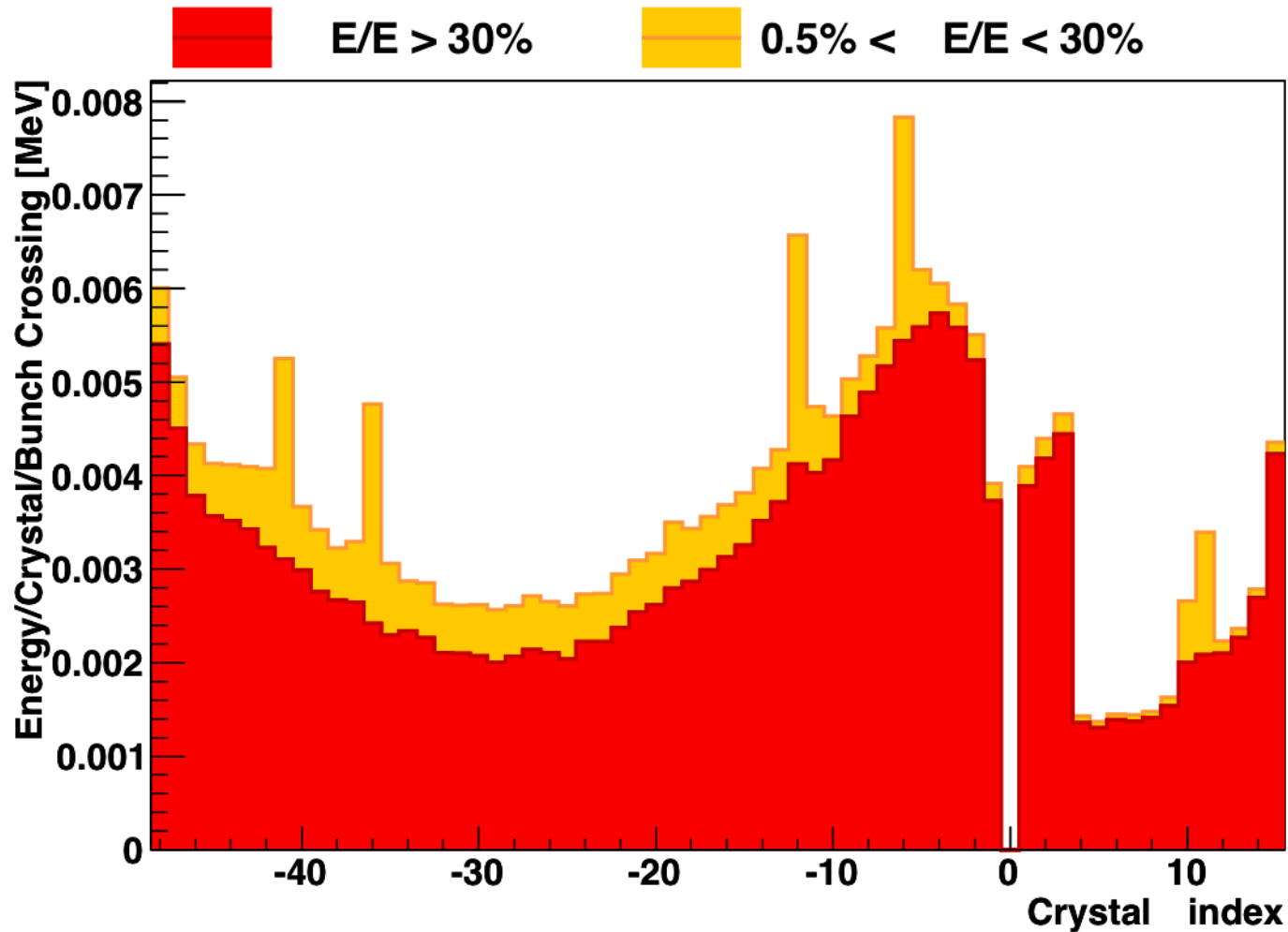


# Conclusions

- Radiation dose seems not to be too worrisome
- Hybrid endcap
  - LYSO region intrinsic performance to be understood
  - The transition seems not to have a large effect on the intrinsic resolution
  - Still sensitive to background levels

# BACKUP

# Background details ...



# Background details ...

