

# EMC Full Simulation Studies

EMC Session  
SuperB Collaboration Meeting  
La Biodola  
1/6/2012

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CNRS LAL  
INFN Perugia

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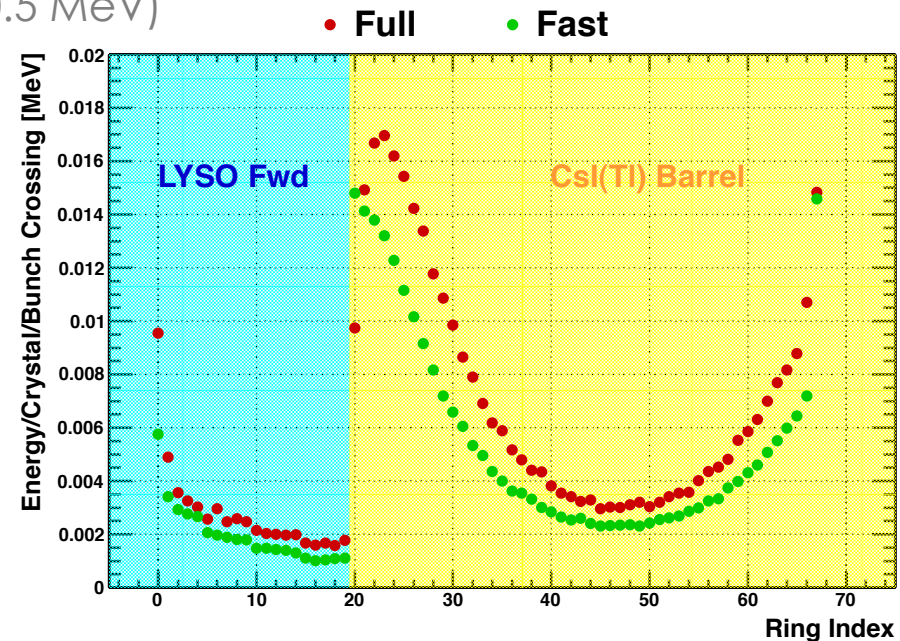
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# Outline

- Compare 3 and 4.5 cm shield with RadBhaBha
- Compare December 2011 (Frascati) and June 2011 (Elba) productions
- Barrel Resolution effects
  - Shield Thickness
  - Background Types
- Pure CsI Fwd Endcap

# Summary of Past Results

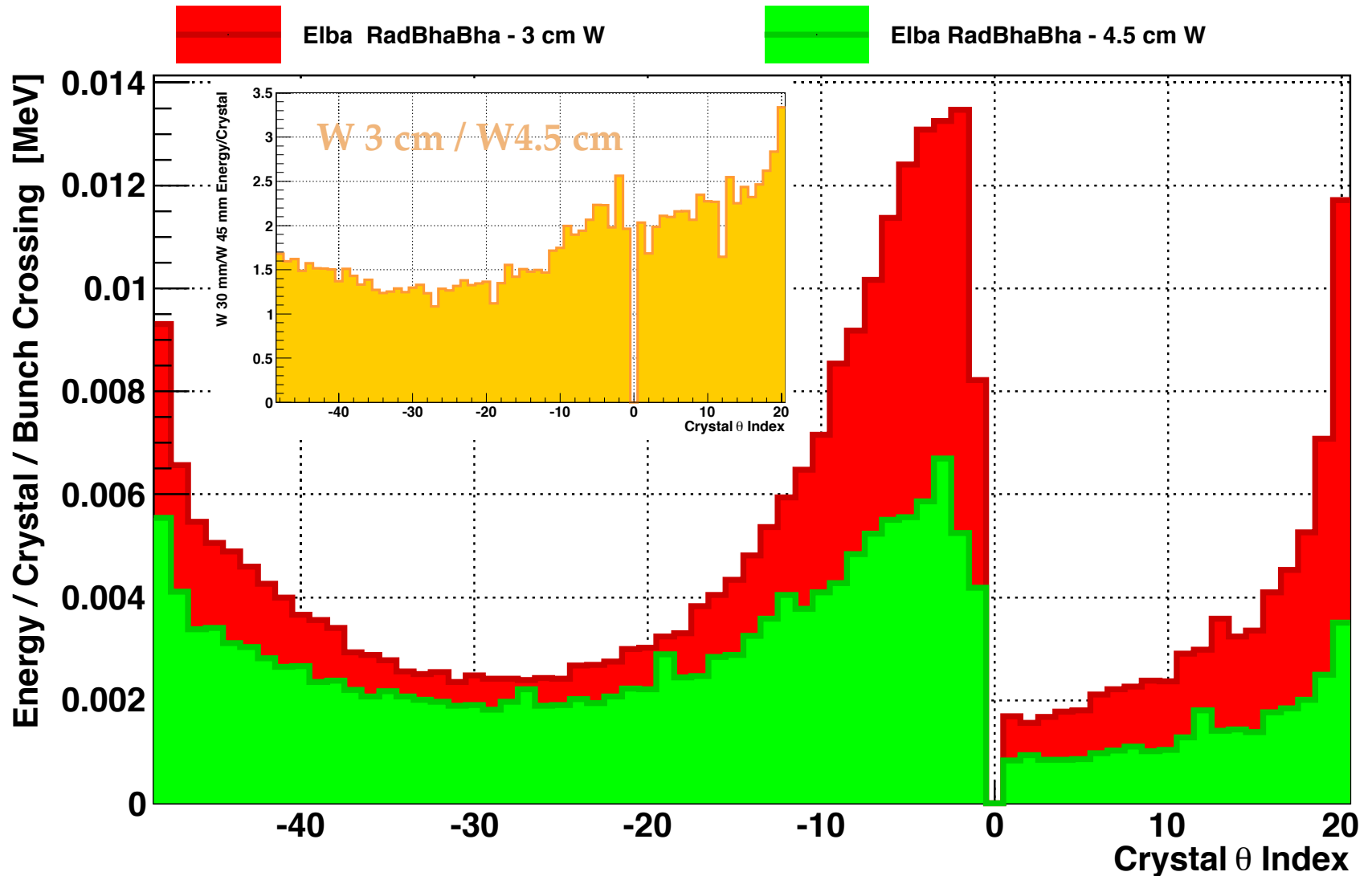
- Barrel
  - Energy resolution with NO Background similar to the BaBar one (2008)
  - Large Background impact on resolution with 140  $\mu$ s CSP + 500 ns Shaper
  - Large energy resolution dependence on the  $\theta$  angle
  - Significant performance improvement with 100 ns CSP + 500 ns Shaper (same noise level)
  - Small average effect on energy resolution adding Touschek background (Expect larger effects in Fwd and Bkd regions)
  - Noise scan recommends RMS < 1 MeV (0.5 MeV)
- Fwd Endcap
  - Similar performance for all simulated options with NO Background
  - LYSO OK even with x5 Background safety factor
- Full-Fast comparison
  - Improved agreement for Energy/Crystal from RadBhaBha



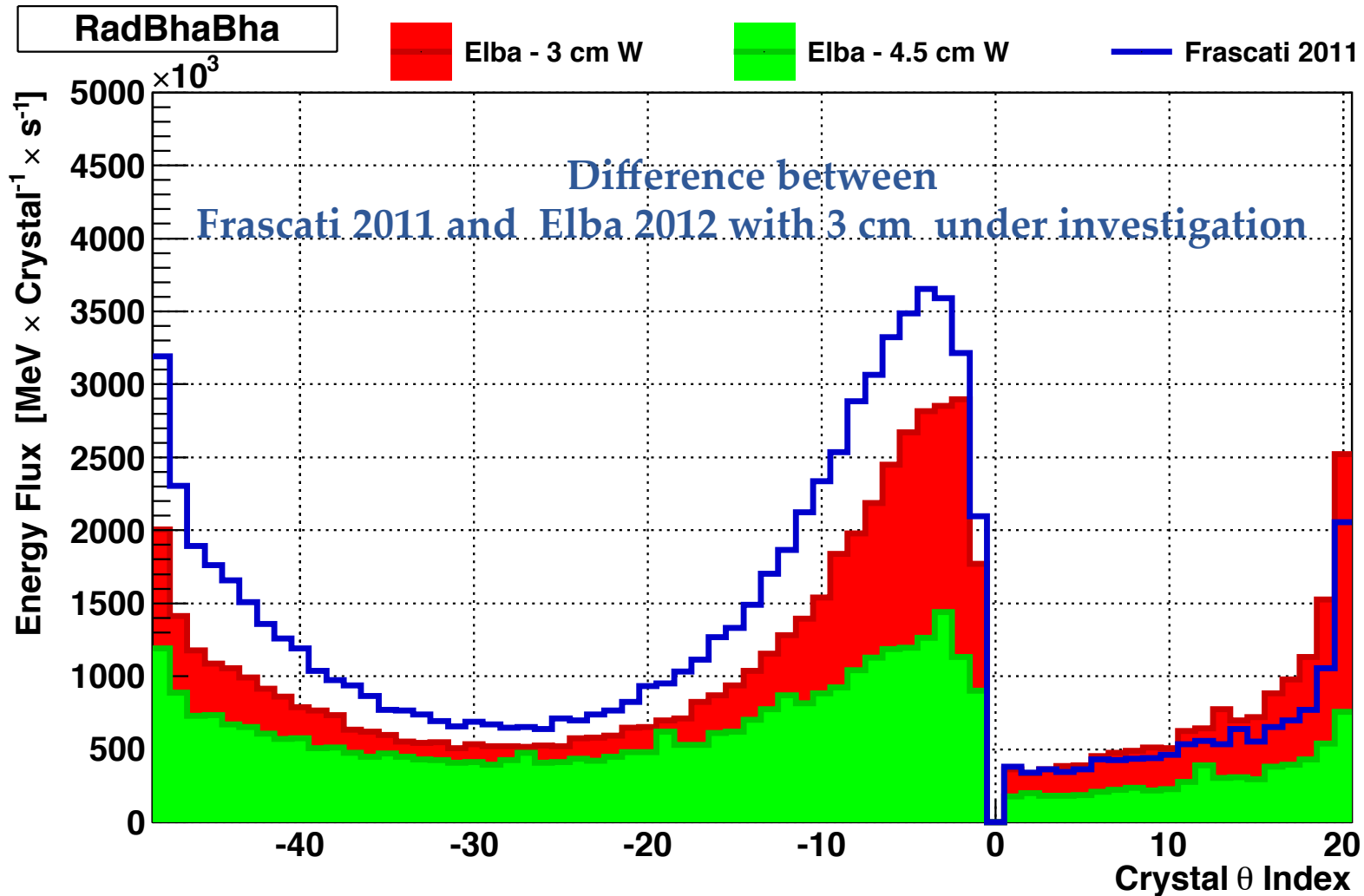
# Elba Bkg Productions

- RadBhaBha
  - 3 cm Shield
  - 4.5 cm Shield
  - 4.5 cm Shield Csl Fwd (EMC dedicated production)
- Touschek 4.5 cm shield
- Pairs 4.5 cm shield
- Beam Gas 4.5 cm shield

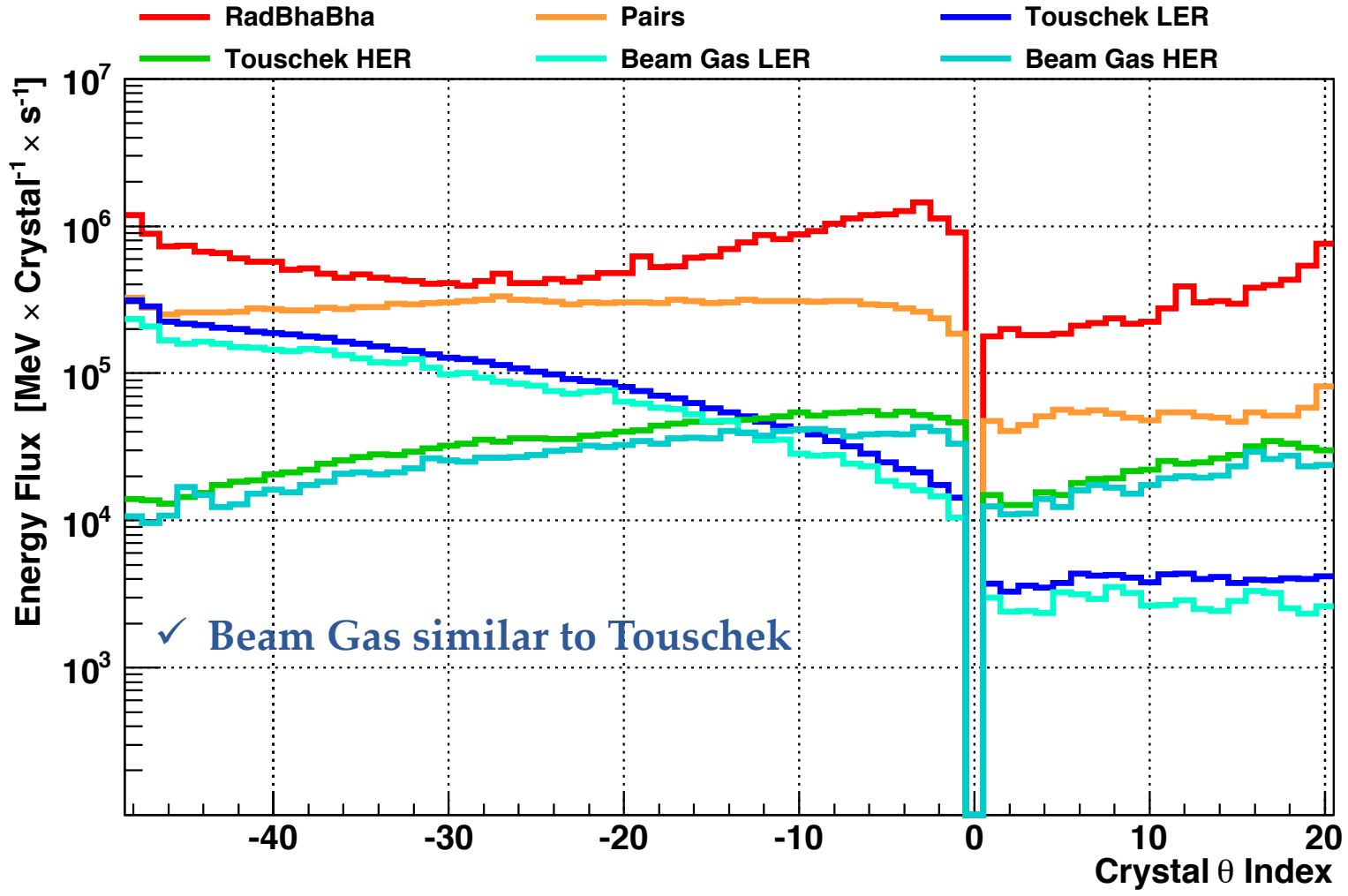
# Compare Shields



# Compare RadBhaBha Prods

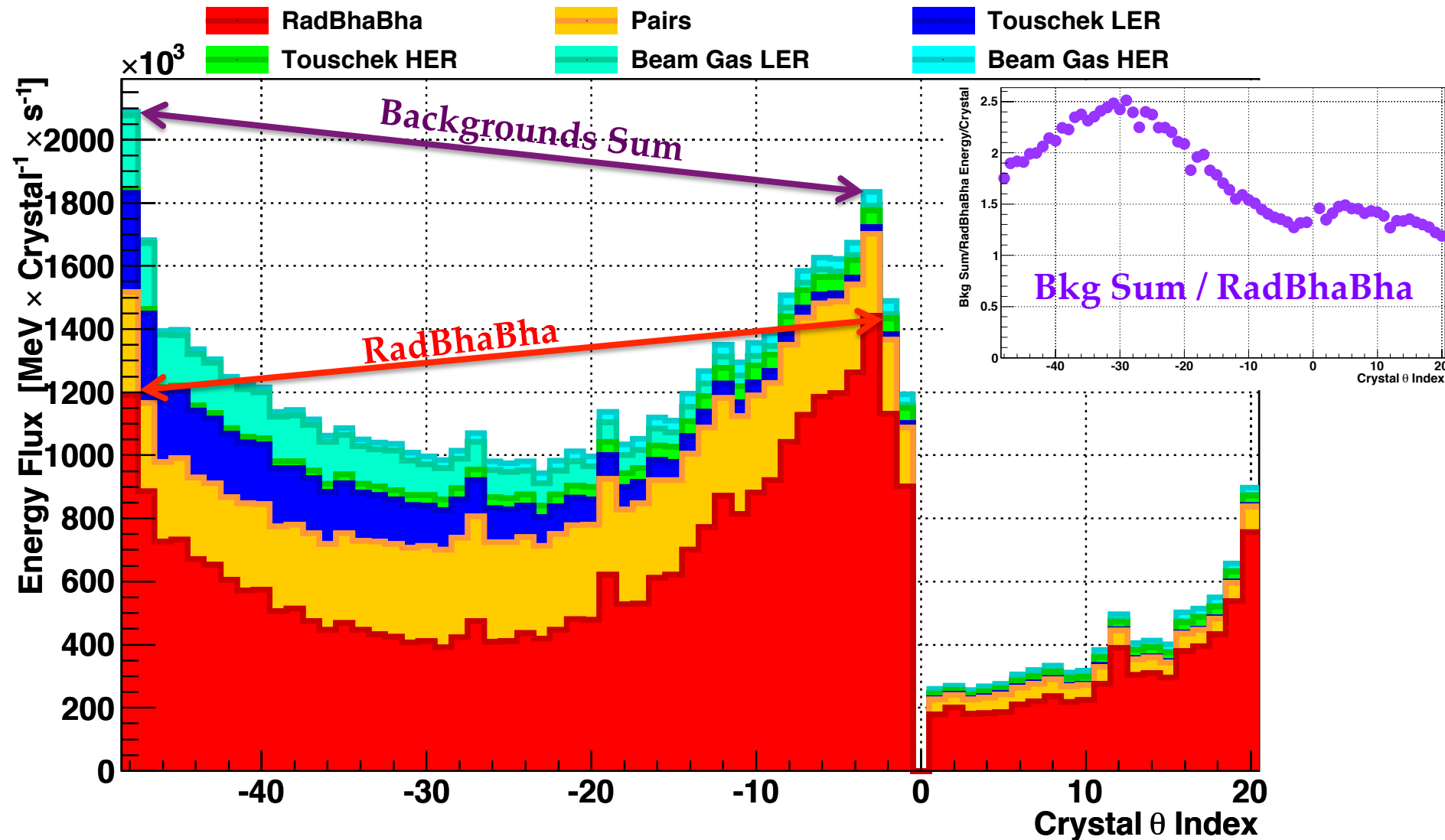


# Compare Backgrounds-45mm W



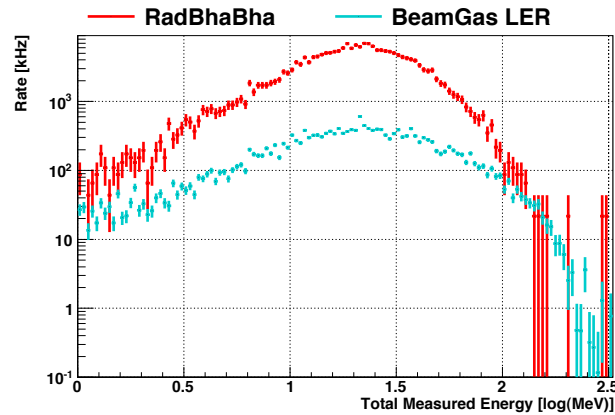
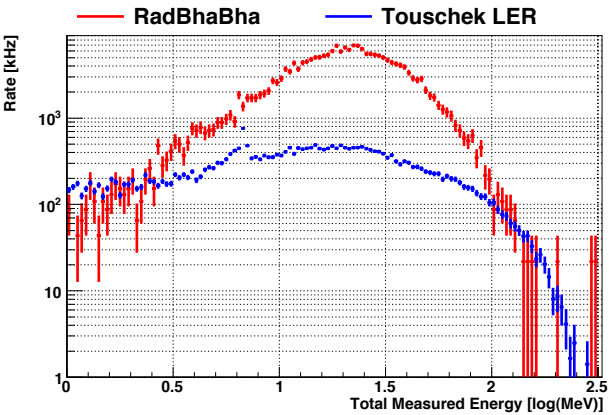
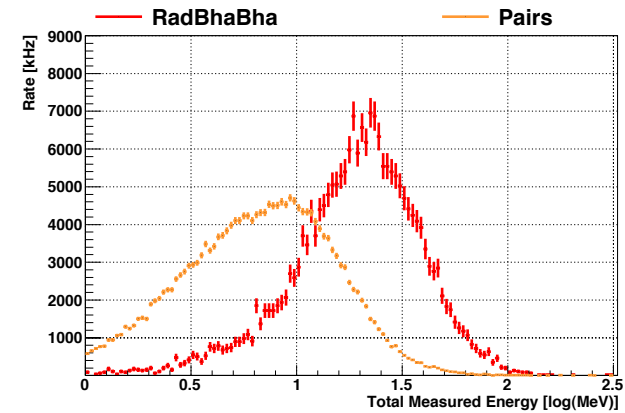
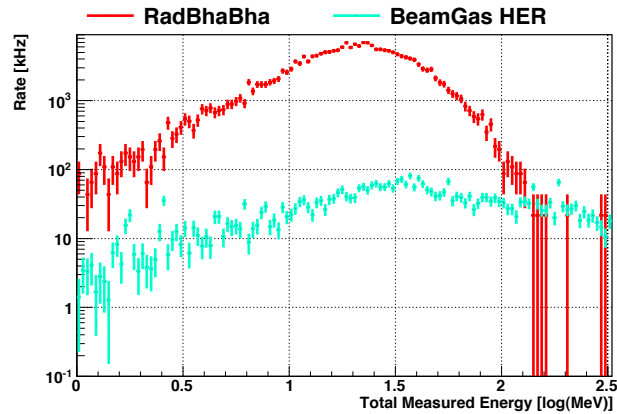
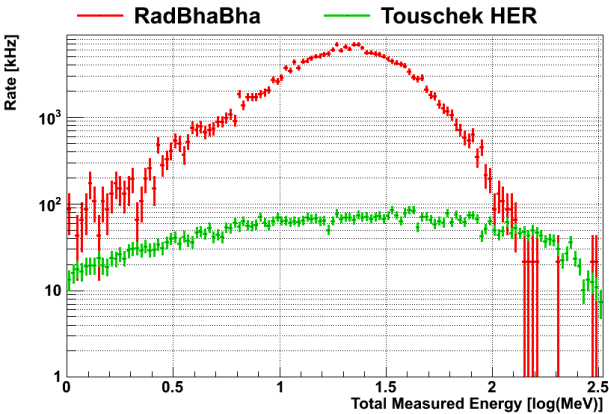
✓ Beam Gas similar to Touschek

# Sum of Bkgs - 45 mm W





# Total EMC Energy

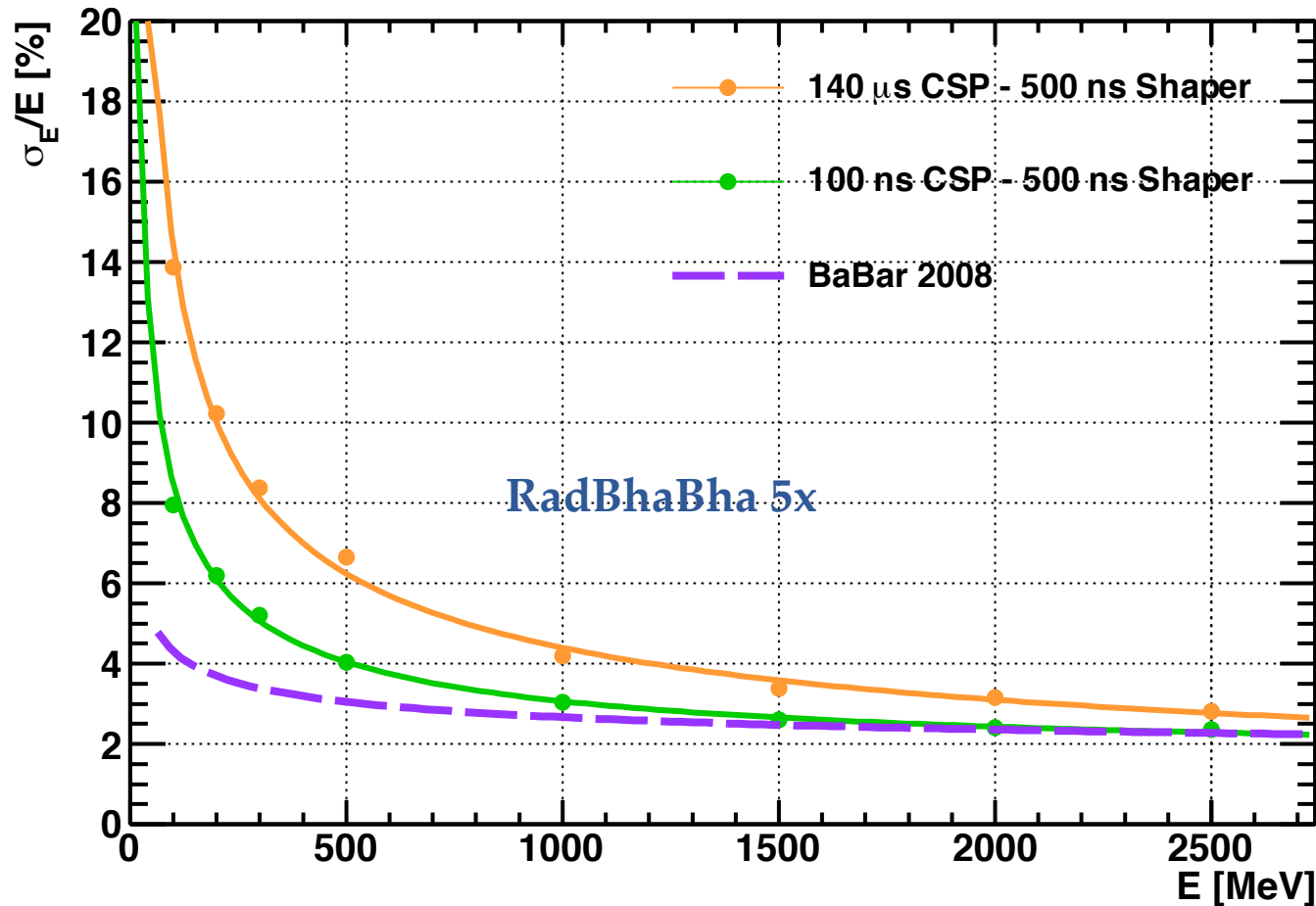


**Touschek and Beam Gas give significant high energy contribution in the EMC total Energy**

# Barrel Performance Simulation

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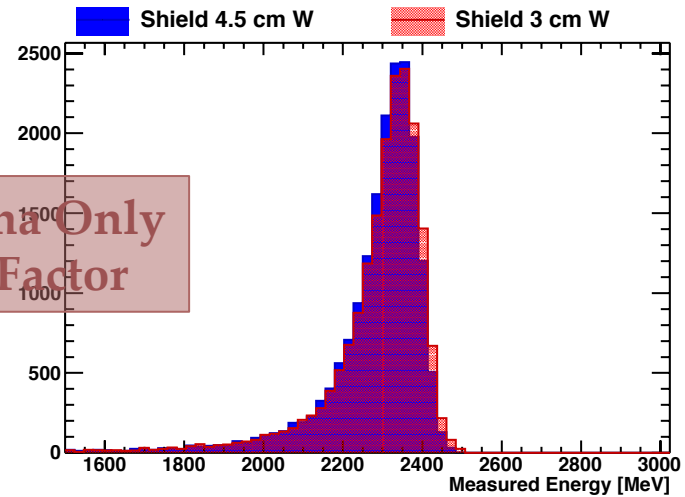
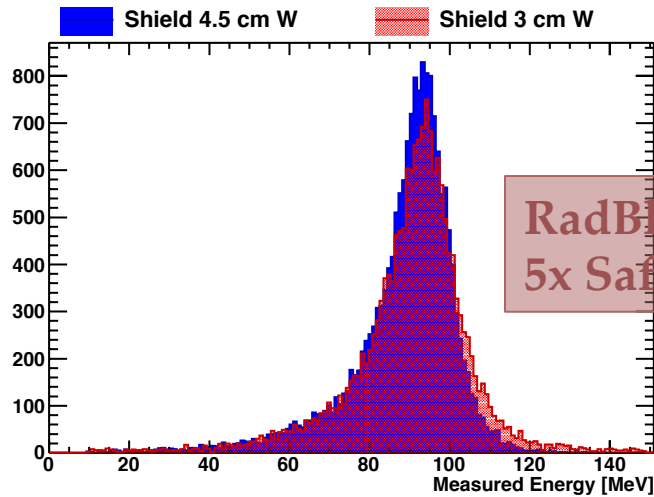
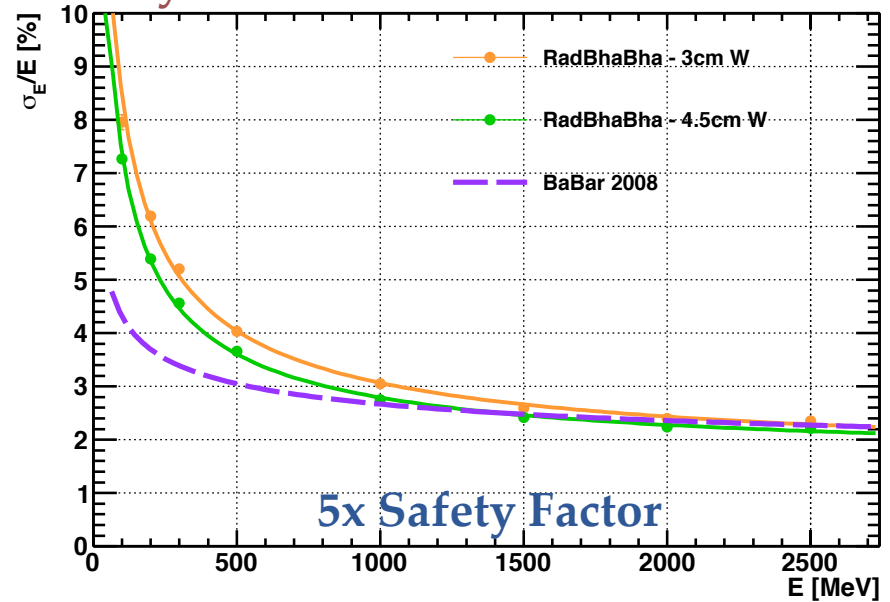
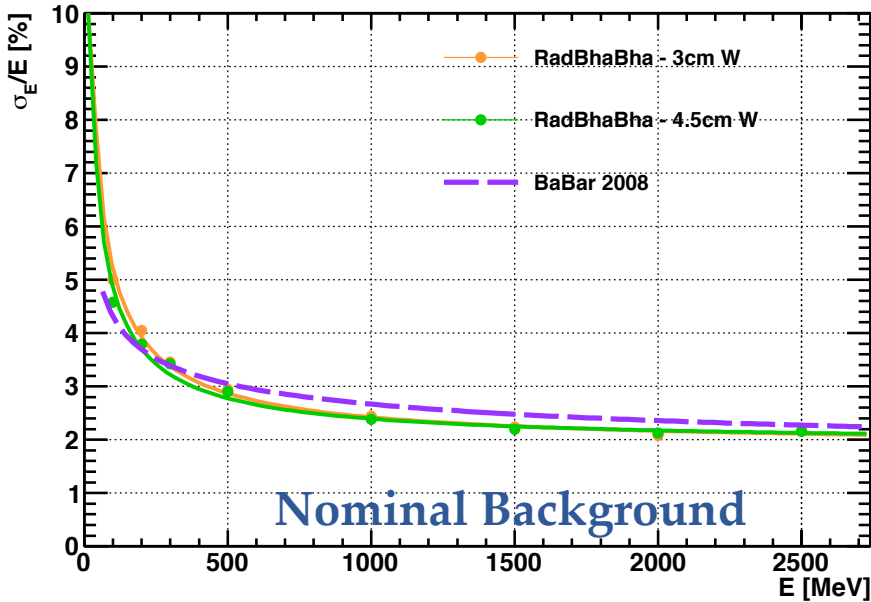
# Comapre CSP - 3cm W



From now on the 100 ns CSP 500 ns Shaper configuration will be used as the default one

# Barrel Resolution vs Shield

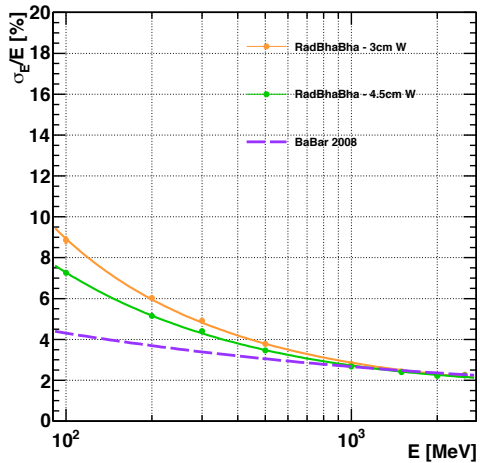
RadBhaBha Only



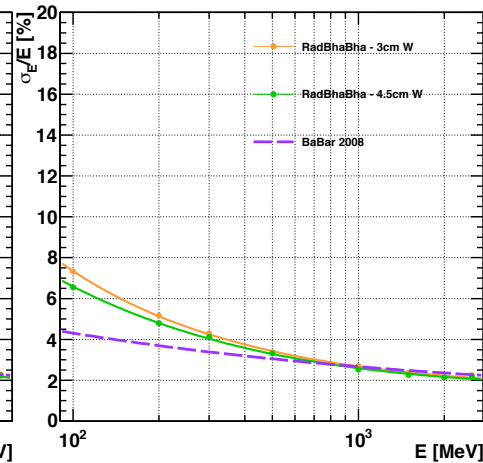
RadBhaBha Only  
5x Safety Factor

# Shield Effect vs Theta (x5)

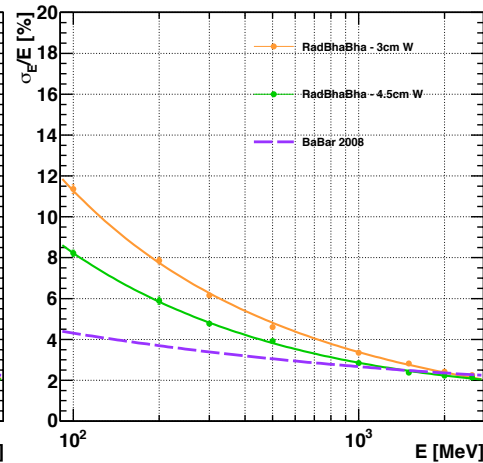
Theta 100-140



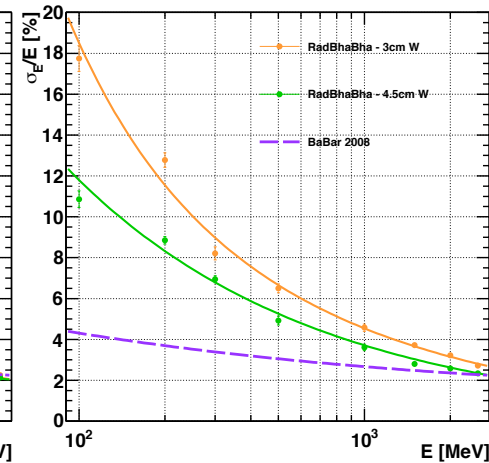
Theta 60-100



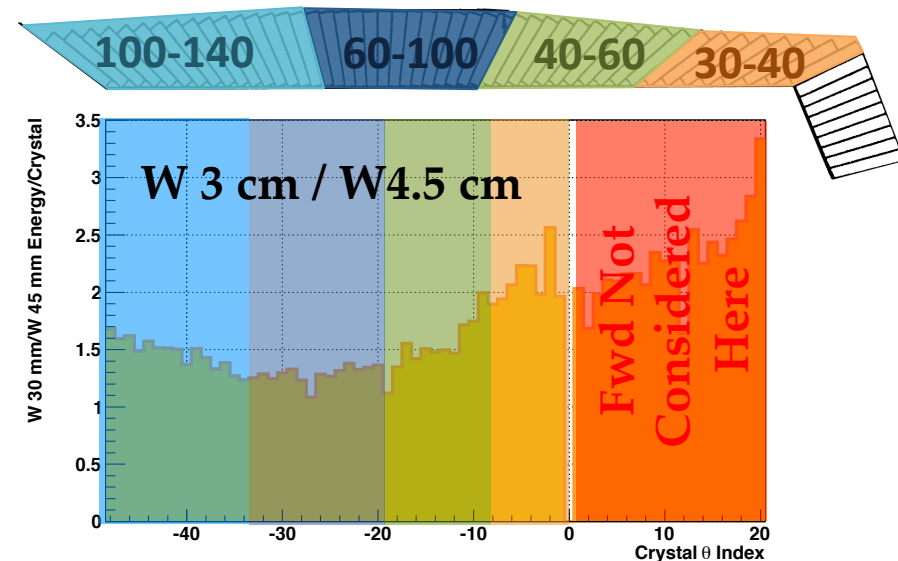
Theta 40-60



Theta 30-40

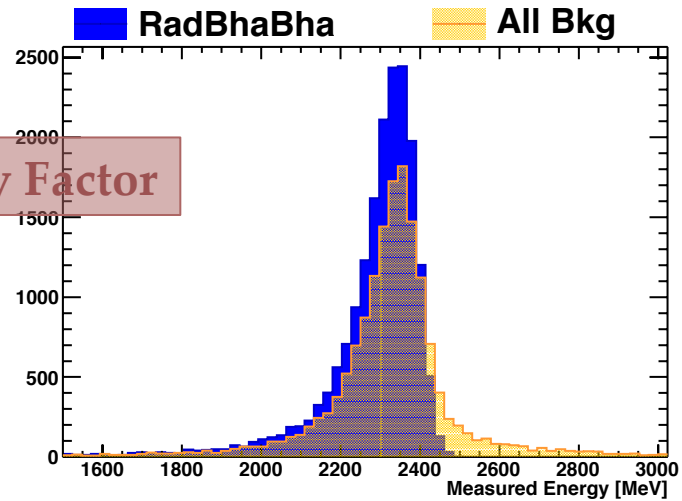
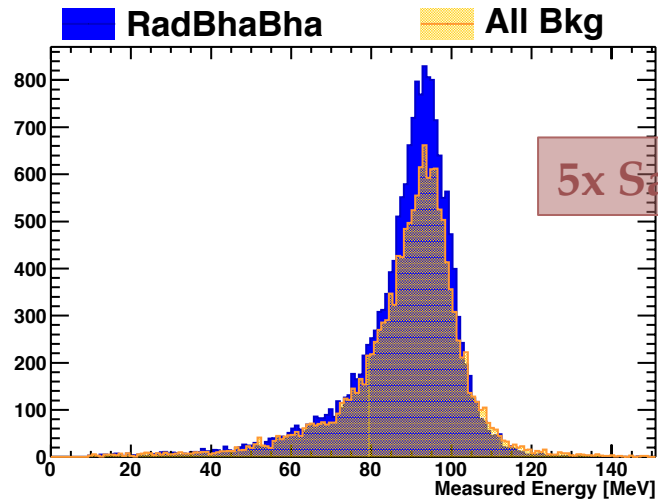
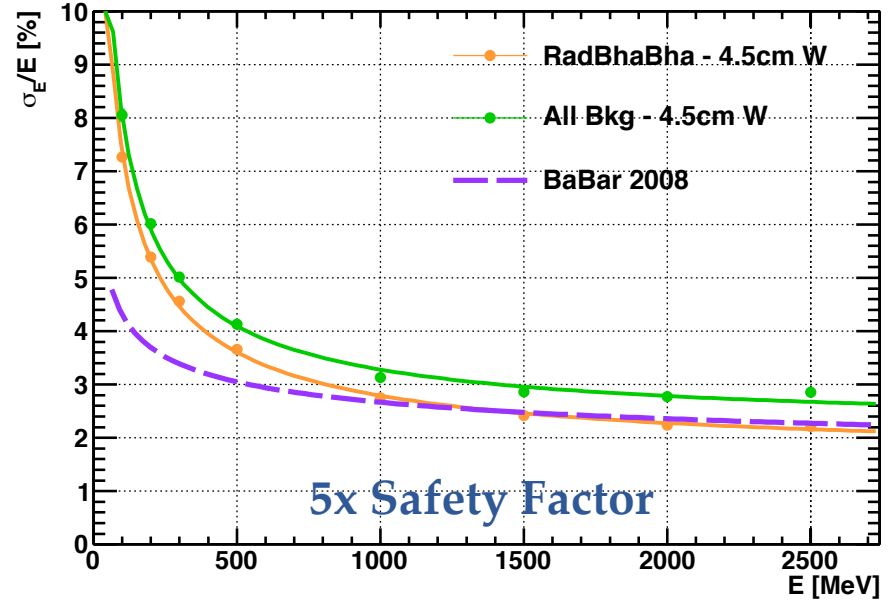
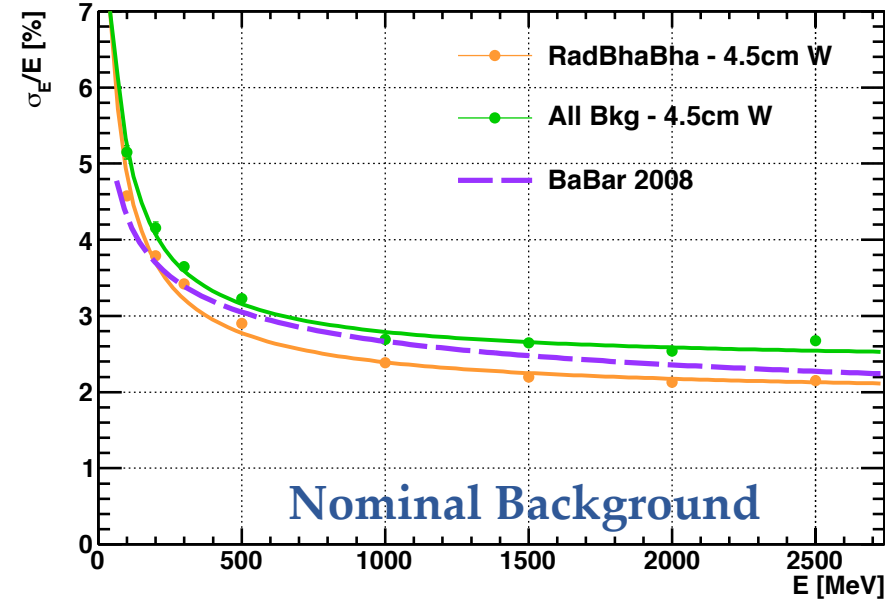


- ✓ Large performance improvement in fwd region
- ✓ Small effect in central barrel region
- ✓ More uniform Barrel performance across  $\theta$  angles



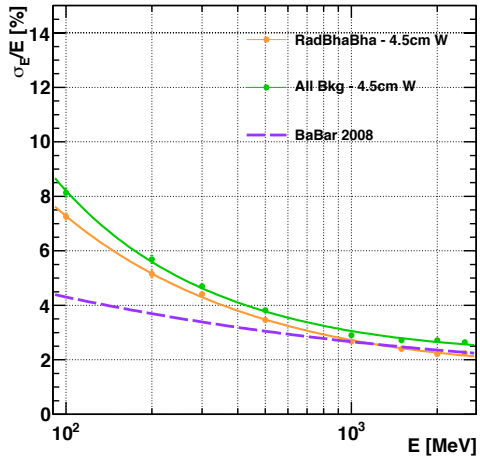
# Barrel vs Bkg

RadBhaBha + Pairs + Touschek + Beam Gas

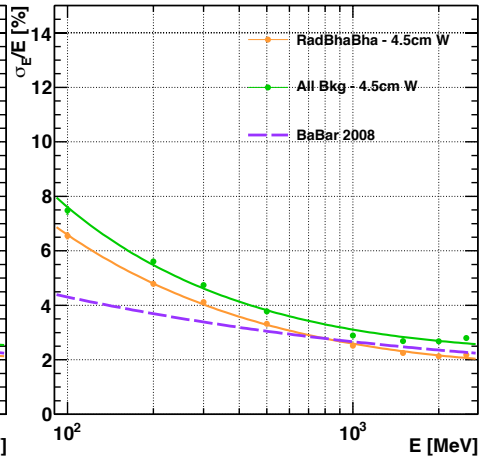


# Bkg Effect vs Theta (x5)

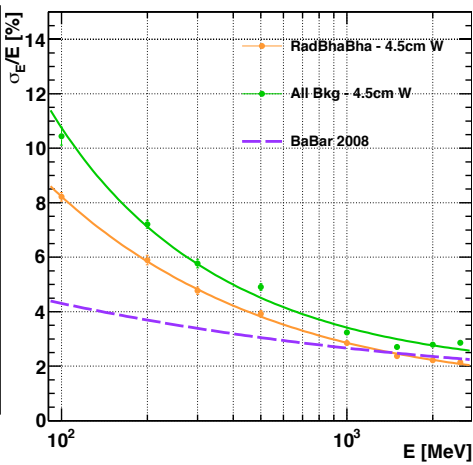
Theta 100-140



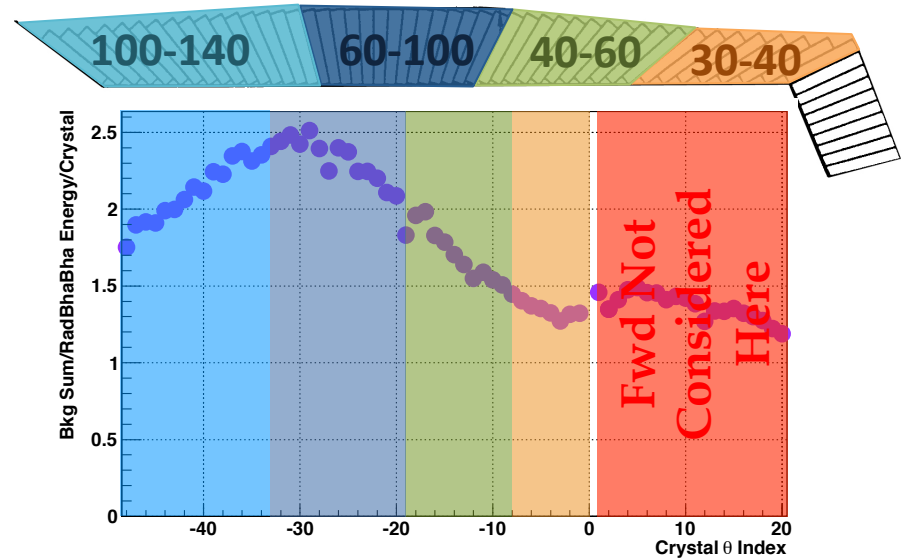
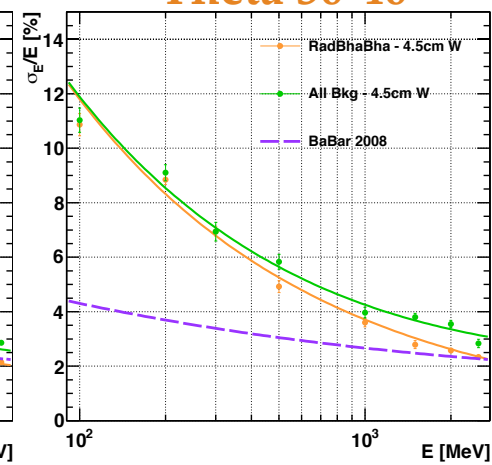
Theta 60-100



Theta 40-60



Theta 30-40

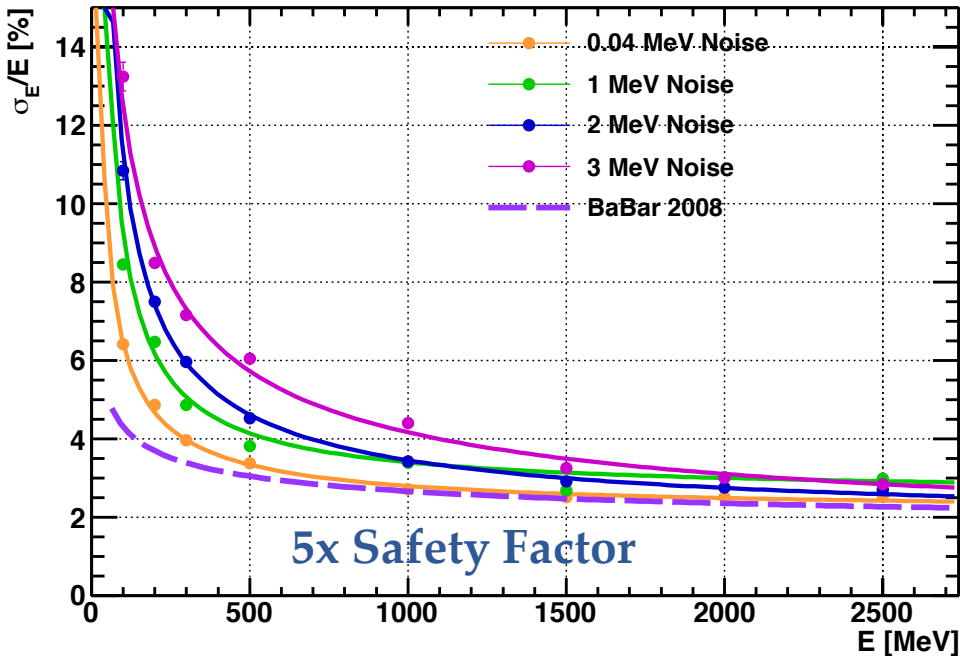
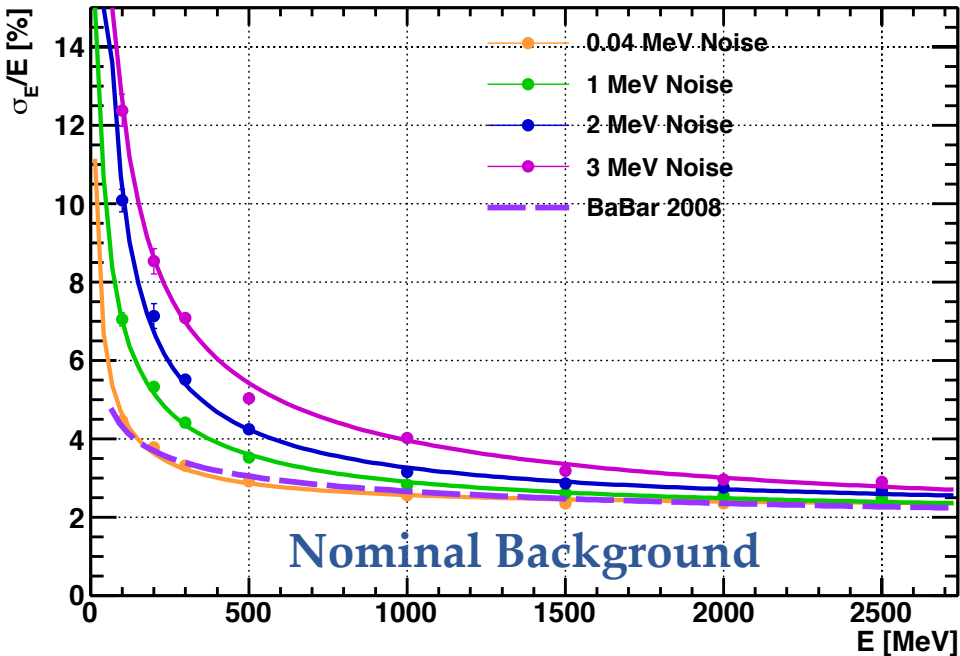


# Pure CSI Endcap Performance Simulation

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# Pure CsI Fwd Endcap



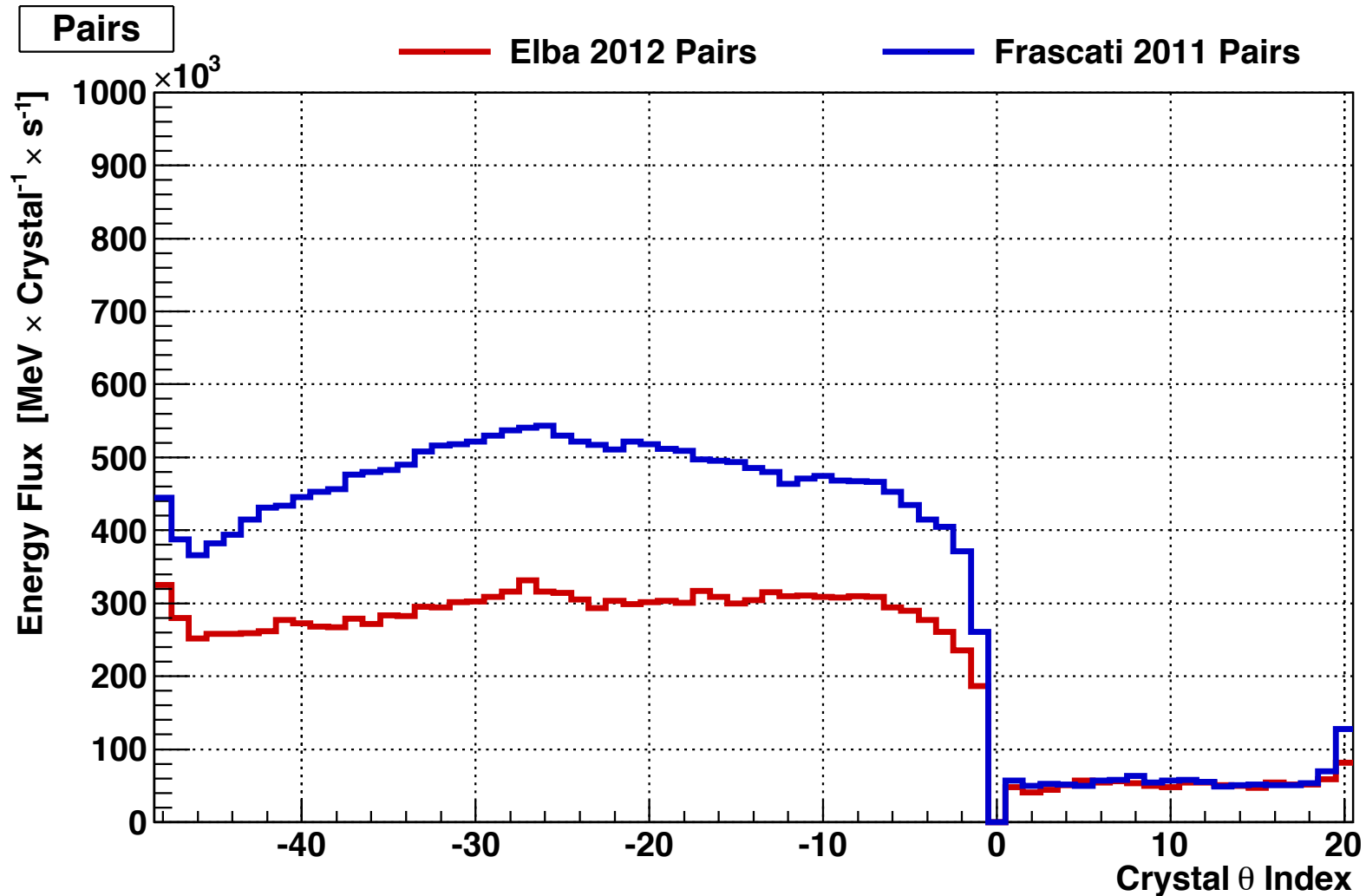
## RadBhaBha with 4.5 cm W Shield

- ✓ With negligible Noise effect good resolution even with x5 Background
- ✓ Large noise impact on resolution for RMS  $\geq 1$  MeV

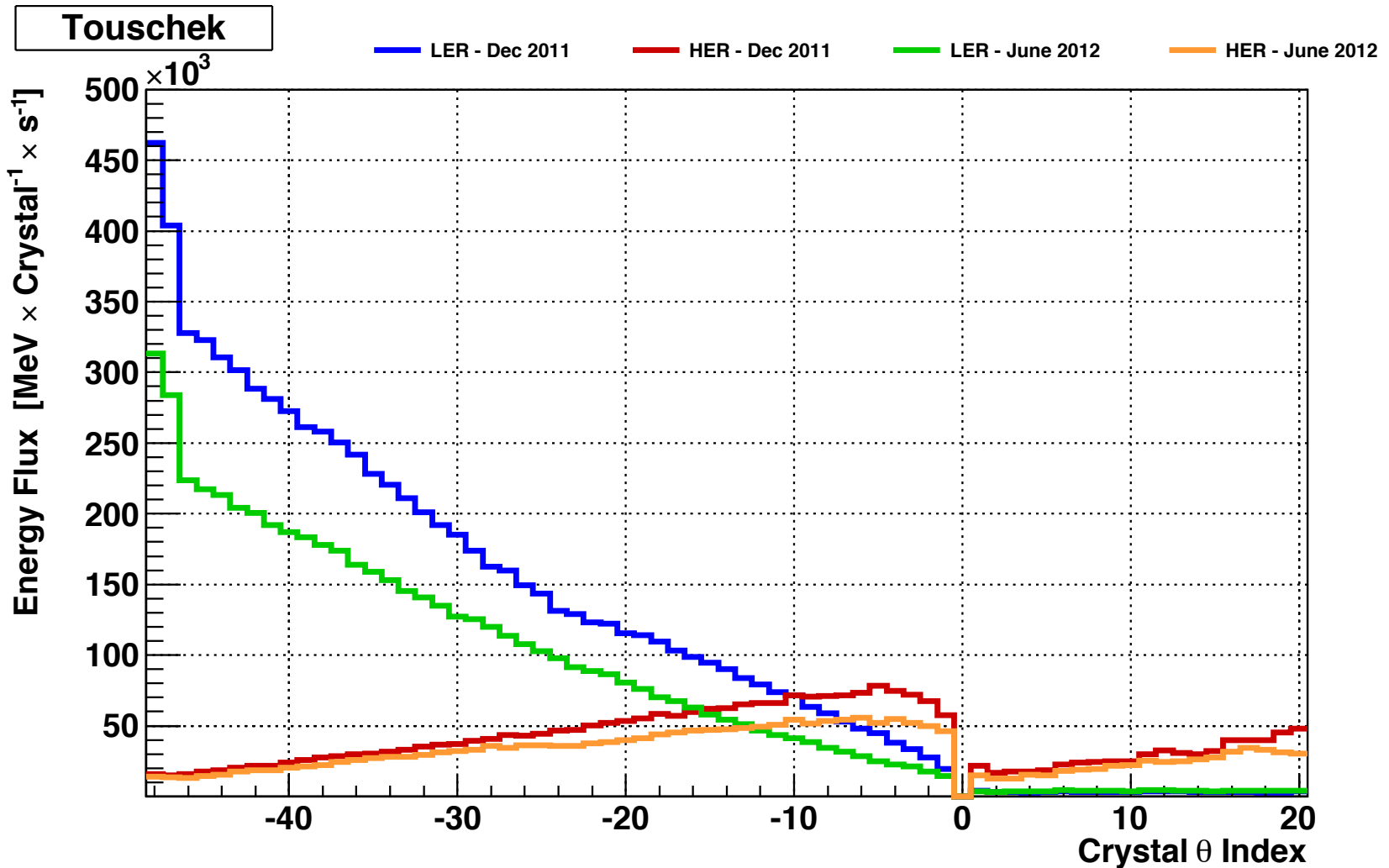
# Backup

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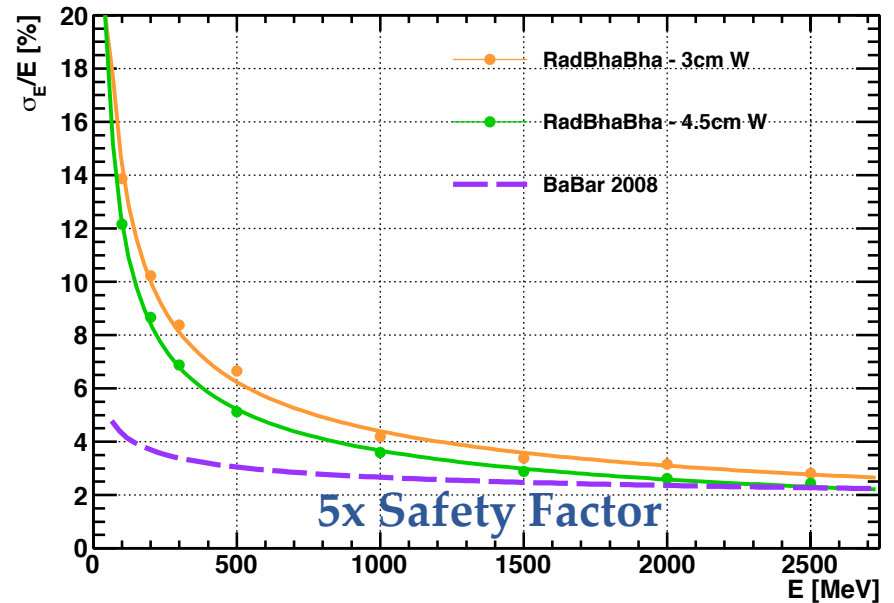
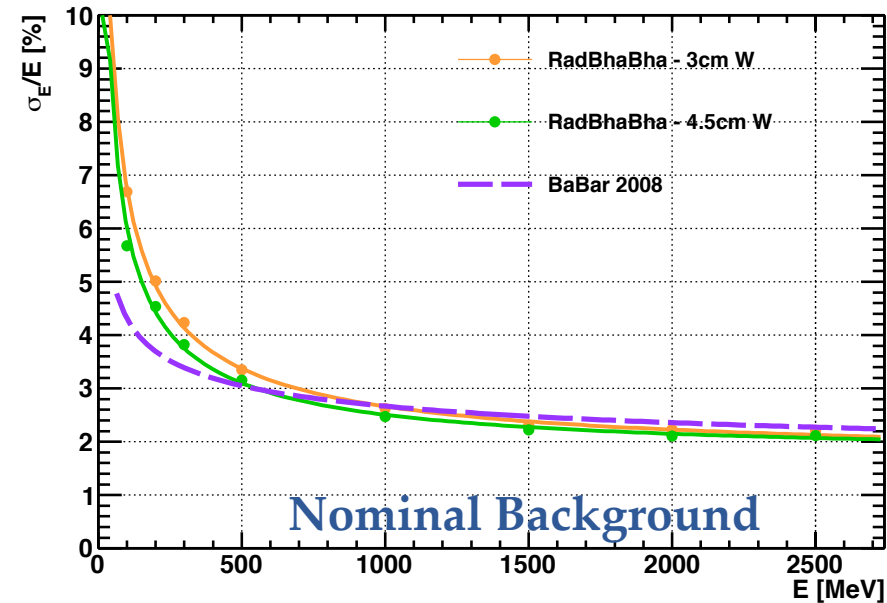
# Compare Pairs Productions



# Compare Touschek Prods



# CSP 140 $\mu\text{s}$ Barrel vs Shield



Elba June 2012 RadBhaBha production

# CSP 140 $\mu$ s Barrel vs Bkg

Elba June 2012 RadBhaBha + Pairs + Touschek + Beam Gas production

