EMC simulation:
effects of geometry options on energy resolution

PID + EMC joint meeting

LAL
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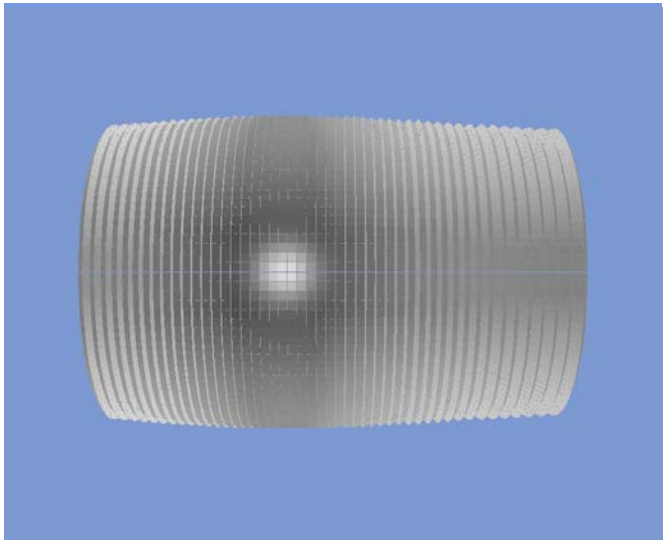
Outline

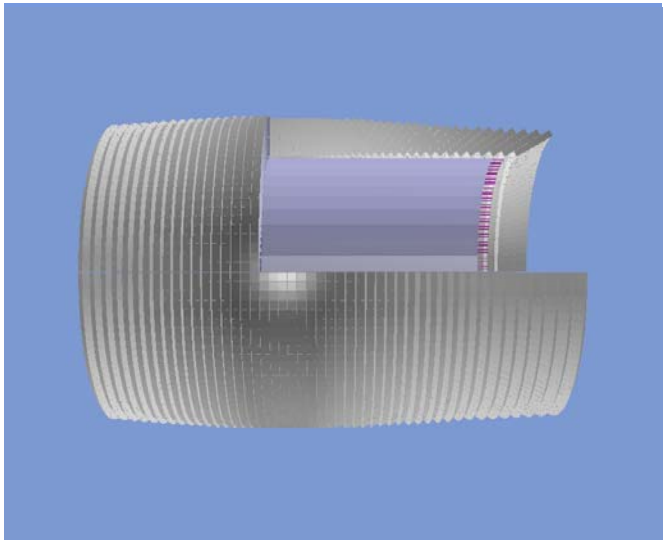
- SuperB EMC description and simulation
- Geometry options description
- Geometry options effect on EMC energy resolution
- Conclusions

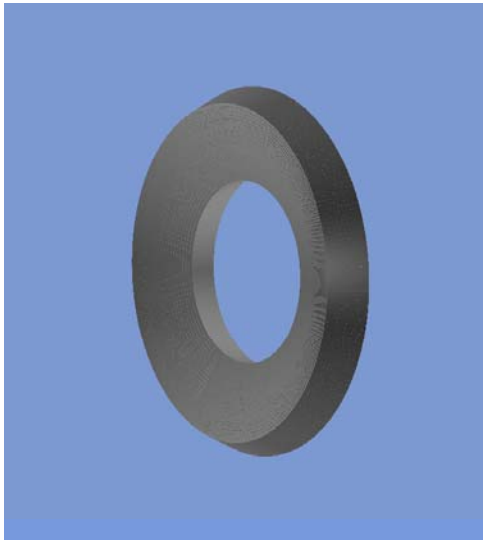
EMC Geometry: Introduction

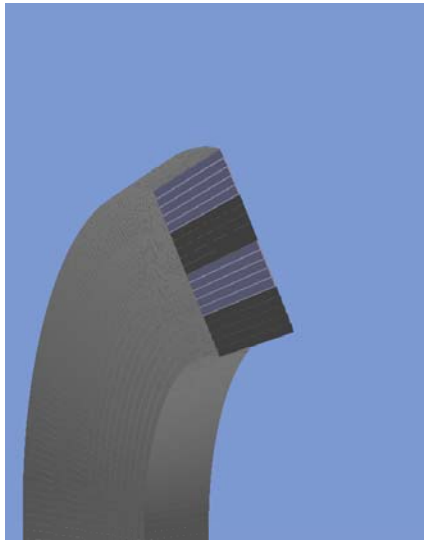
- SuperB will reuse BaBar Barrel Calorimeter
  - CsI crystals
    - thickness : ~32 cm
- Forward Endcap will be replaced using new crystals
  - L(Y)SO crystals
    - Thickness: 20 cm
- Difference between Barrel and Endcap thickness allows several geometry options
  - Front aligned Barrel + Endcap
  - Back aligned Barrel + Endcap
    - Leaves room for additional detectors (fwd PID)
- Fwd PID detector can be included even with front aligned Barrel + Endcap
  - Smaller DCH

EMC Barrel and Fwd Endcap Geometry

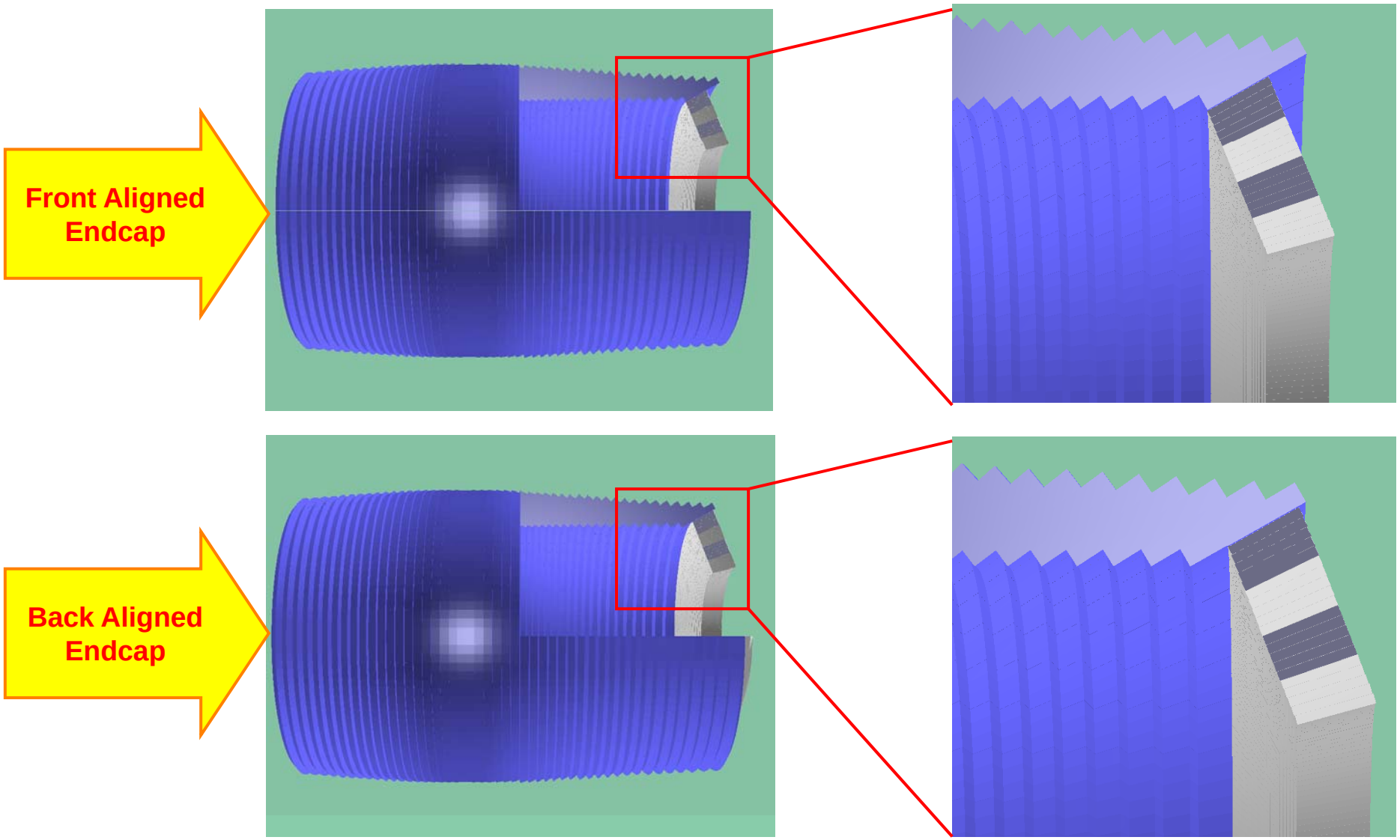




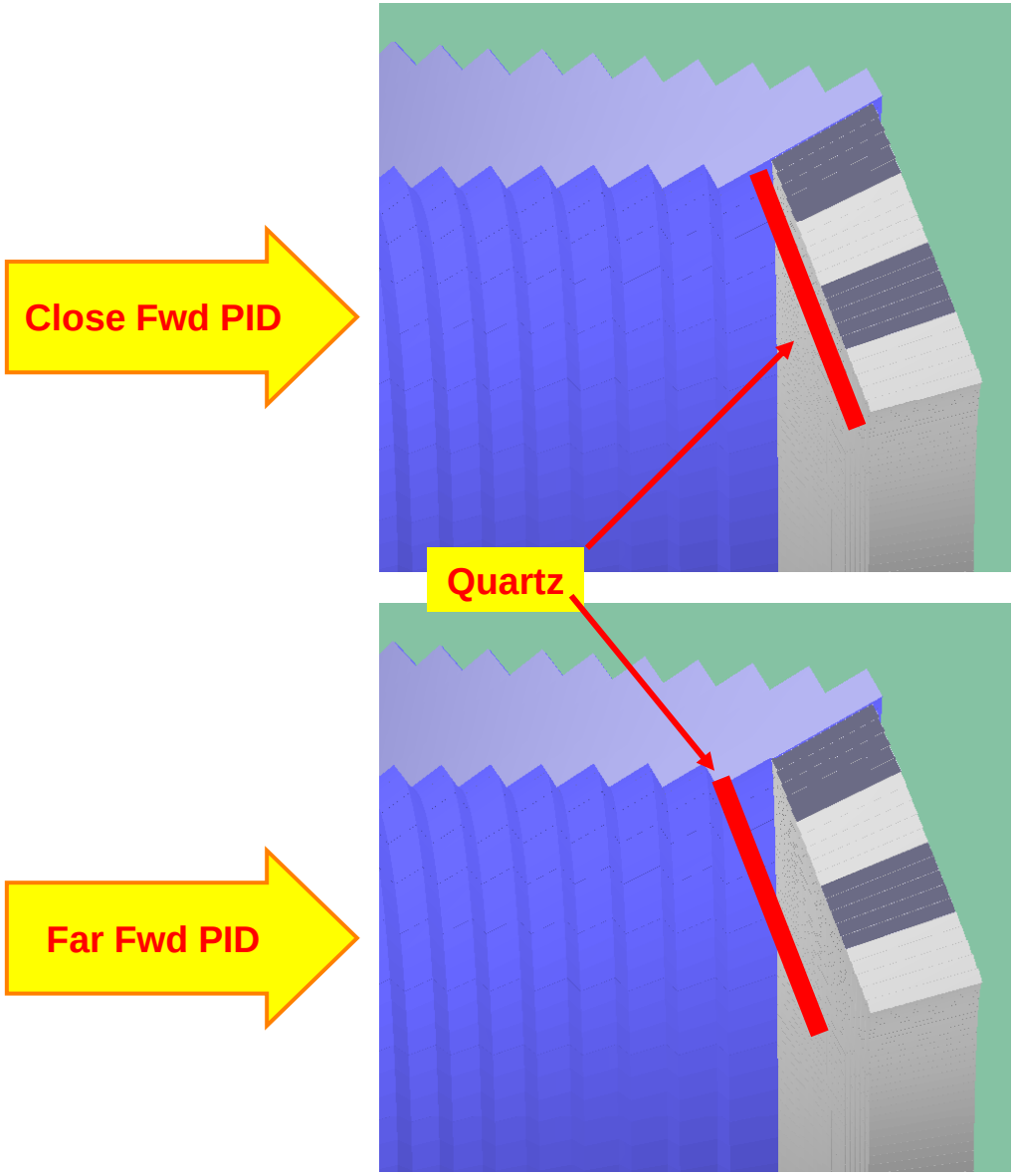




Barrel + Fwd Endcap alignement options



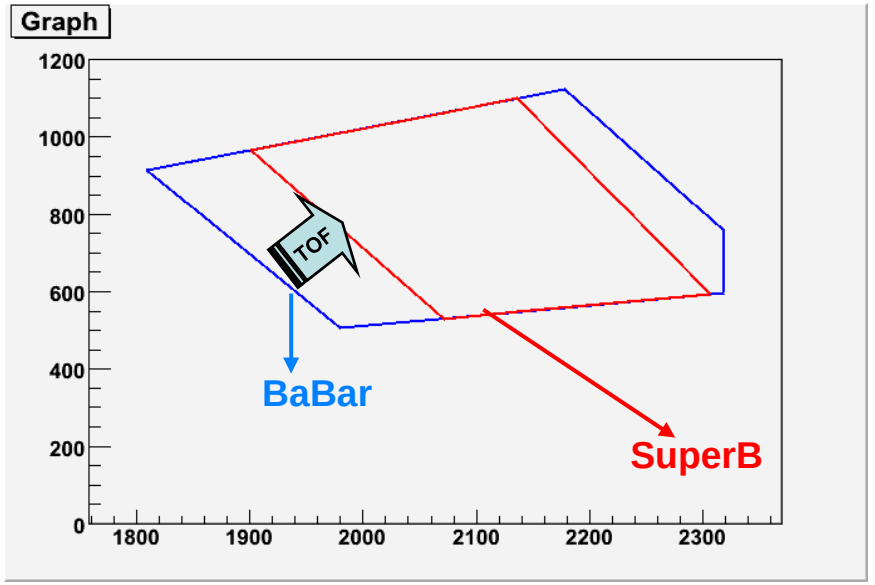
Forward PID simulated options

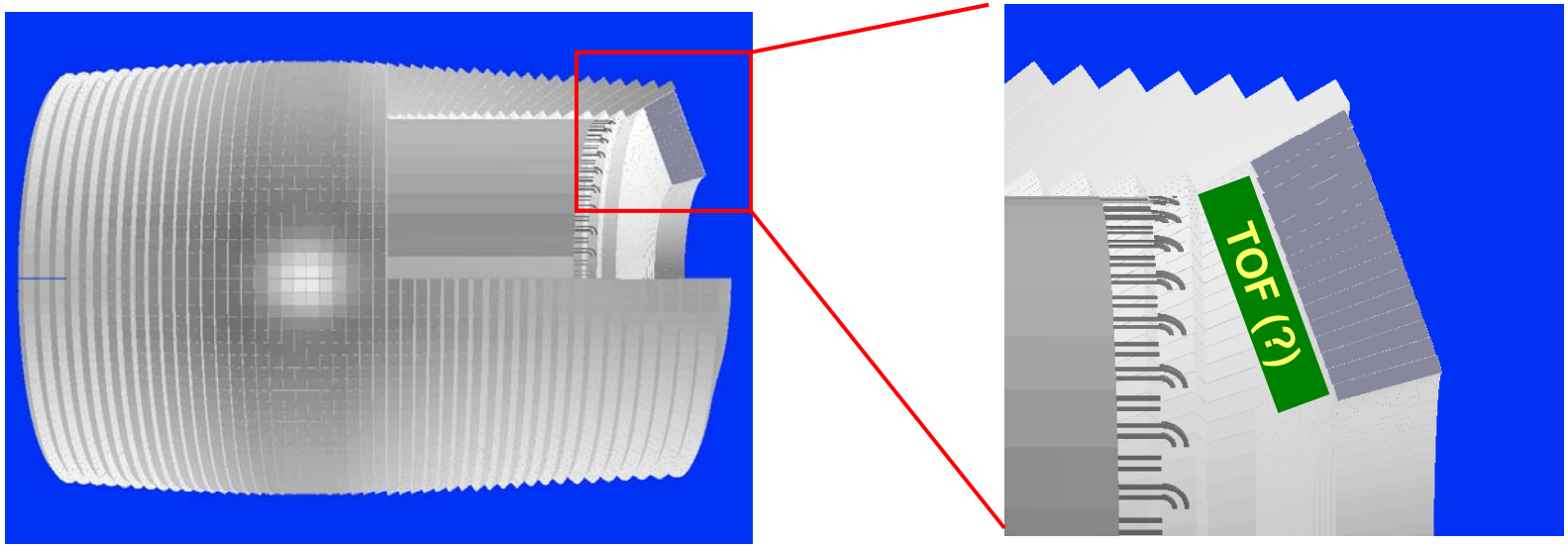


- Calorimeter with back aligned endcap
- Fwd PID simulated as pasiive material:
  - Variable thickness quartz layer
- Two option for PID positions:
  - Close to the Fwd Endcap surface
  - Far form the Fwd Endcap surface

Fwd ECAL Geometry Envelop

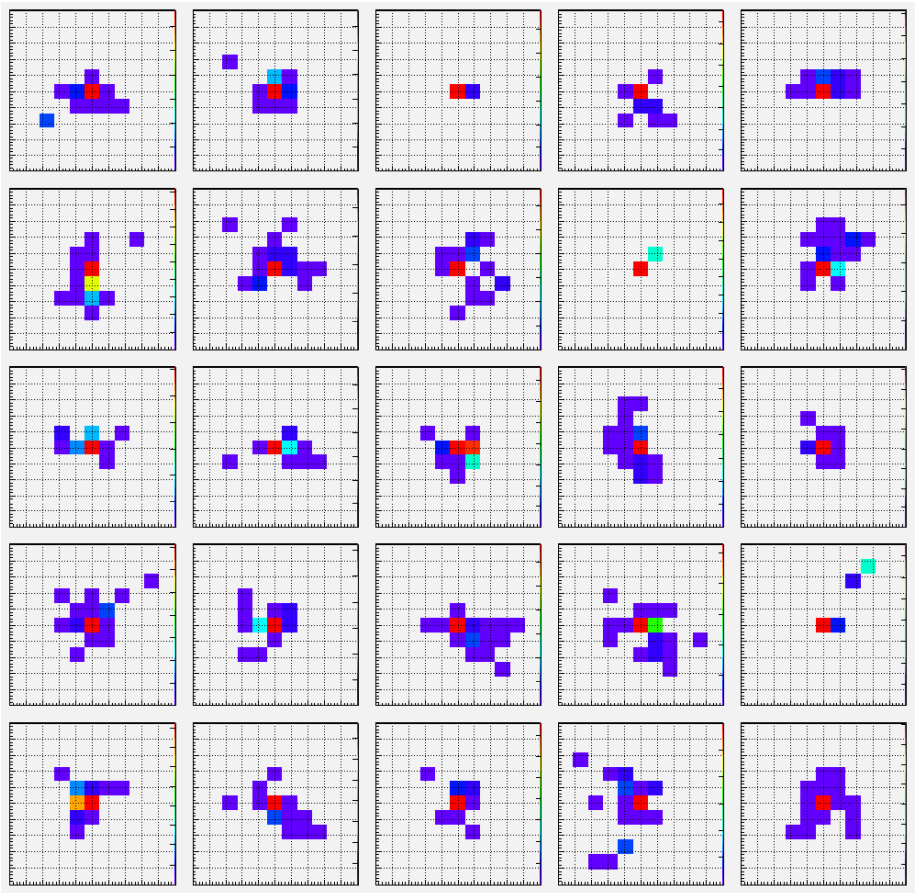
- Fill the same BaBar angular region but
  - leave space for TOF: ΔZ = (100 mm)*cos(22.7)
  - Xtals material : LSO (LYSO)
    - Xtal depth = 200 mm (~17.5 X_0)
- Barrlel-Endcap Transition region modeled according to M. Lebeau suggestion
  - 5 mm no-go zone (air)
  - 10 mm CF



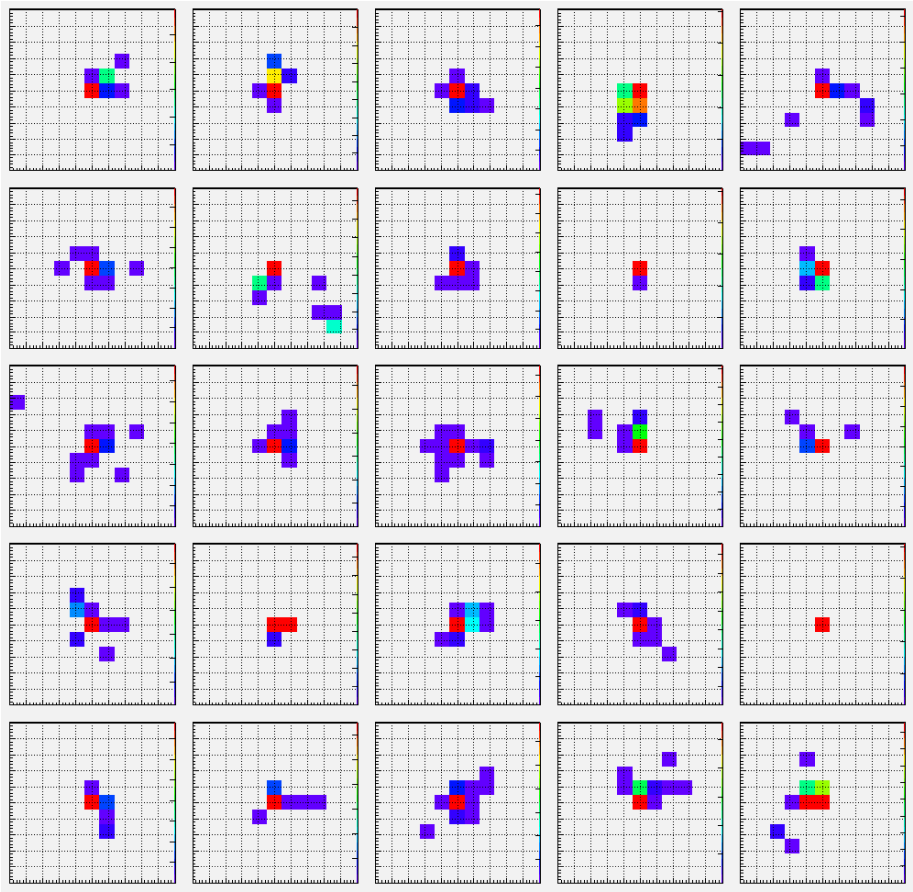


Clusters Fwd - Barrel 100 MeV

Fwd

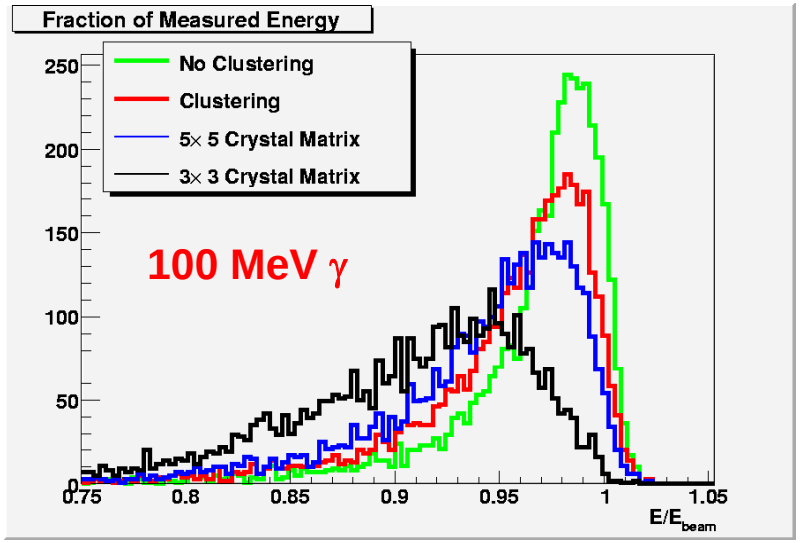


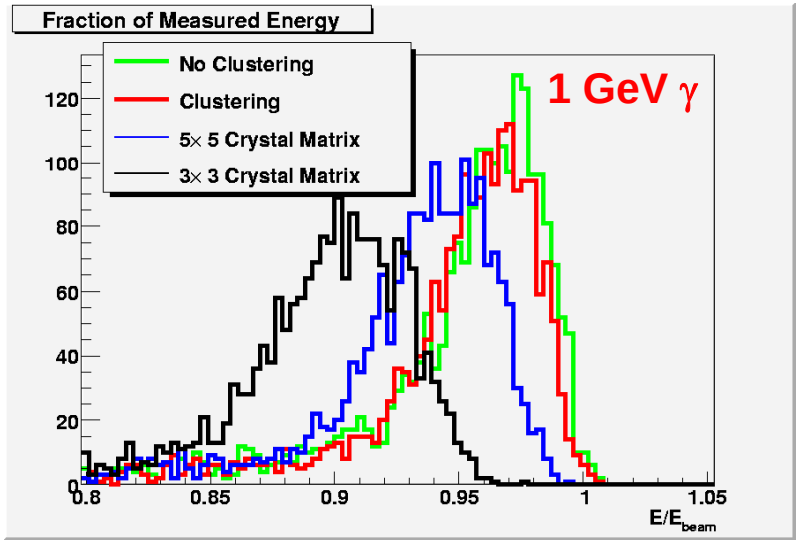
Barrel



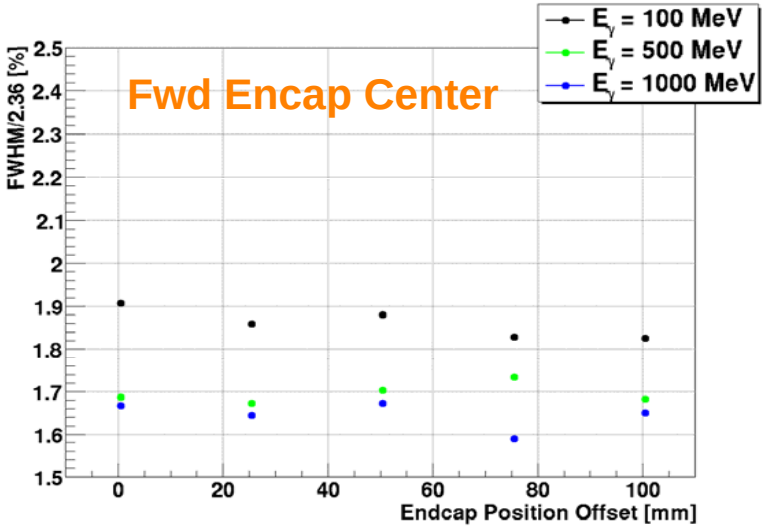
Clustering

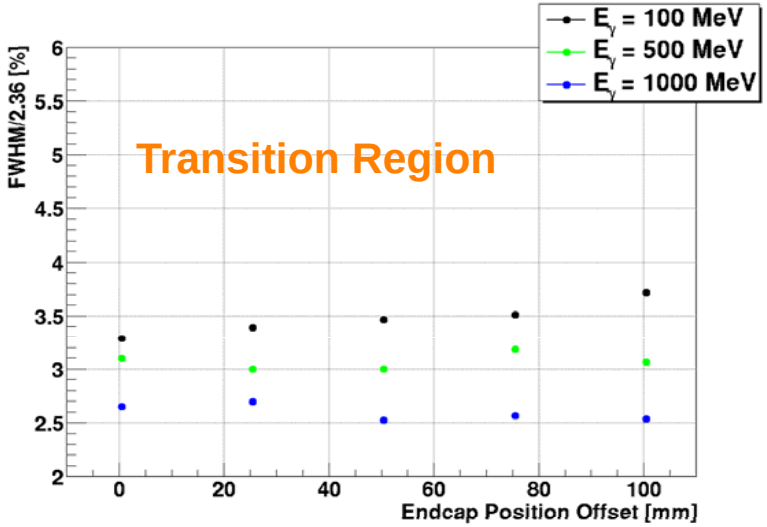
- No Clustering:
  - $E_{crystal}$ > 1 MeV
  - Same as slac meetiong
- Clustering :
  - Clustering algorithm as (supposed to be) in BaBar
  - Adapted for LSO
  - Not yet tuned or optimized
- 5 x 5 - 3 x 3 Matrix
  - Take maximum energy crystal and a matrix of crystal arount it



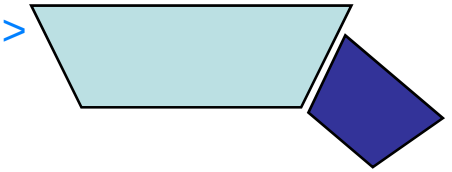


Energy Resolution vs Fwd Endcap Position

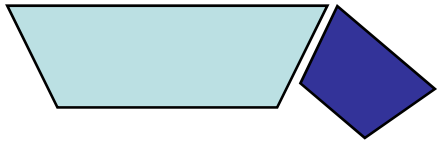




- Scan Energy resolution as a fuction of Forward Endcap position with respect to the Barrel
  - 0 mm Offest ->

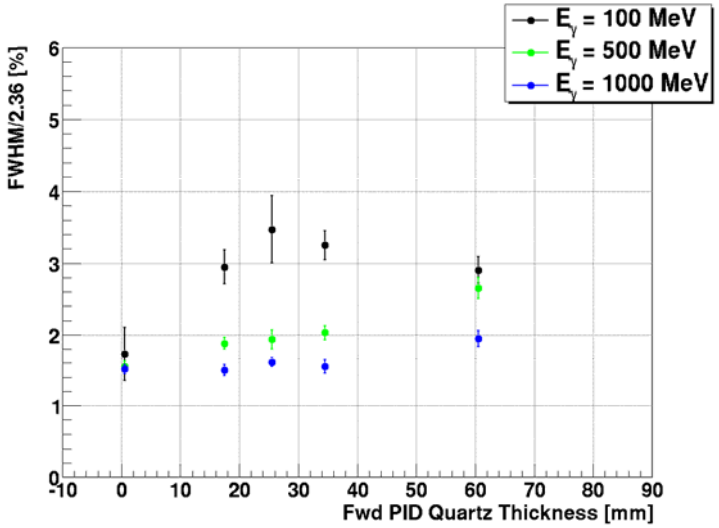


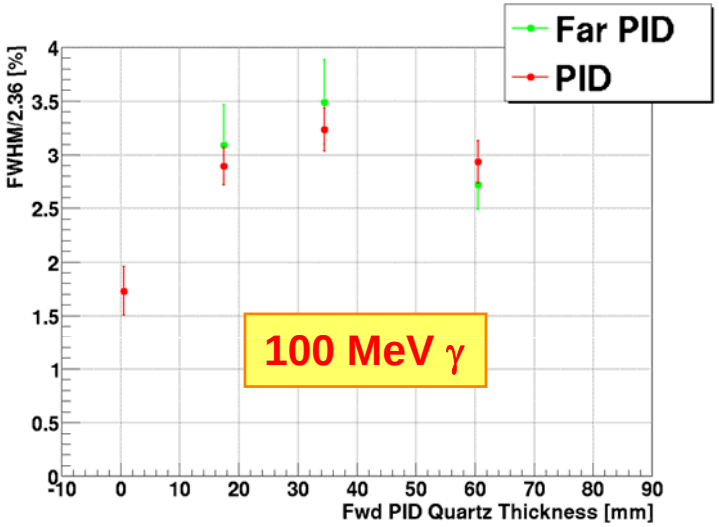
  - 100 mm Offset:



- The Endcap position seems to have an effect on the energy resolution close to the transition region at low energies

Eres vs Fwd PID thickness





- Adding the clustering algorithm the effect of the Forward PID material it is not negligible
- Larger impact on low energy resolution

Conclusions

- The position of the endcap wrt the barrel has some impact in the transition region
- The PID material seems to have a non negligible effect on the energy resolution
- PID material distance from ECAL seems to sligthly affect the energy resolution