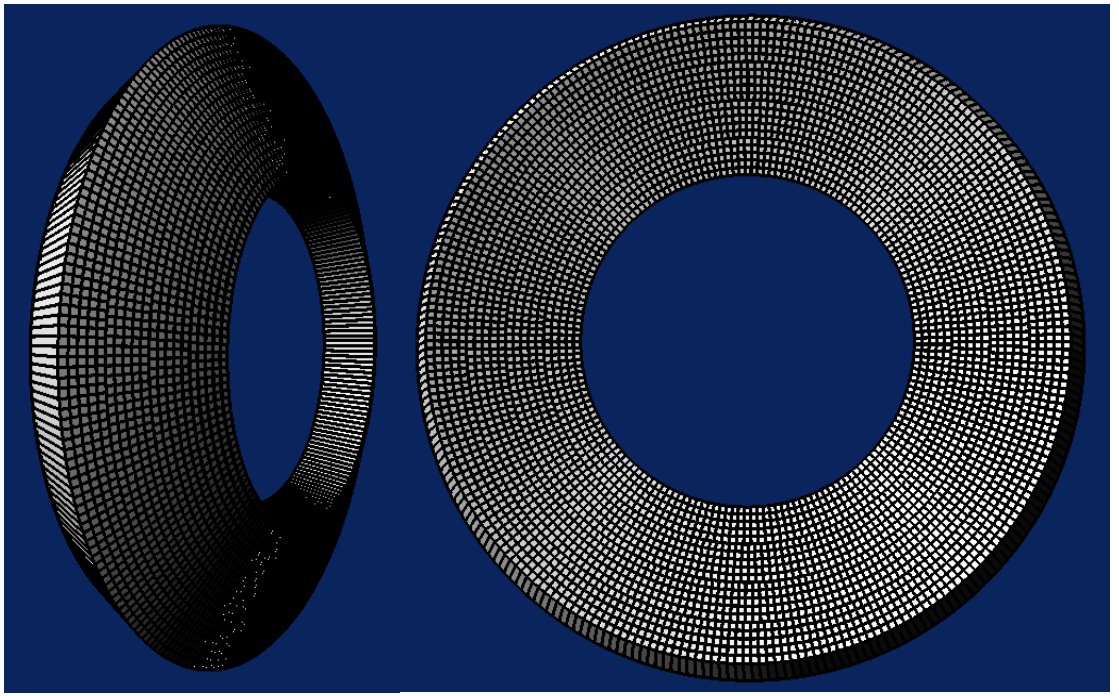
Fwd ECAL Geometry

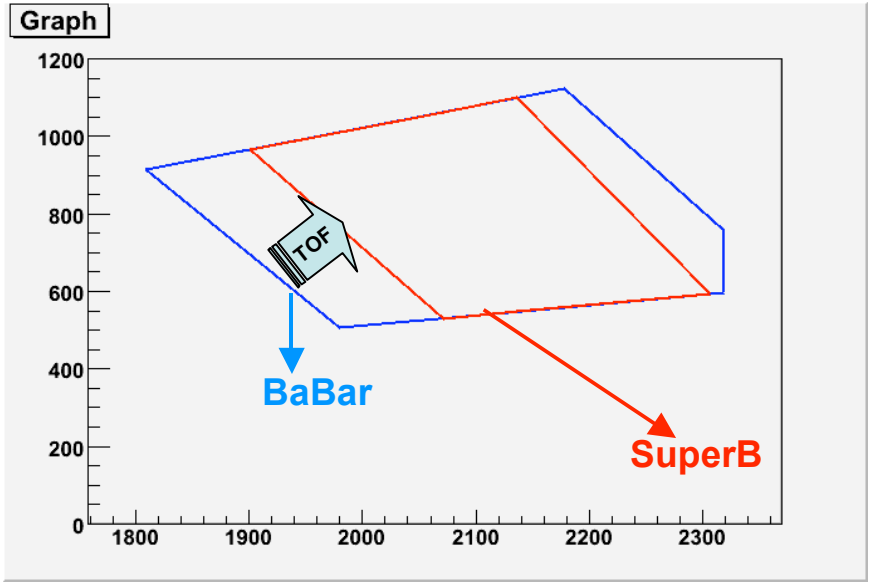
SuperB Computing Workshop
Frascati
16/12/08

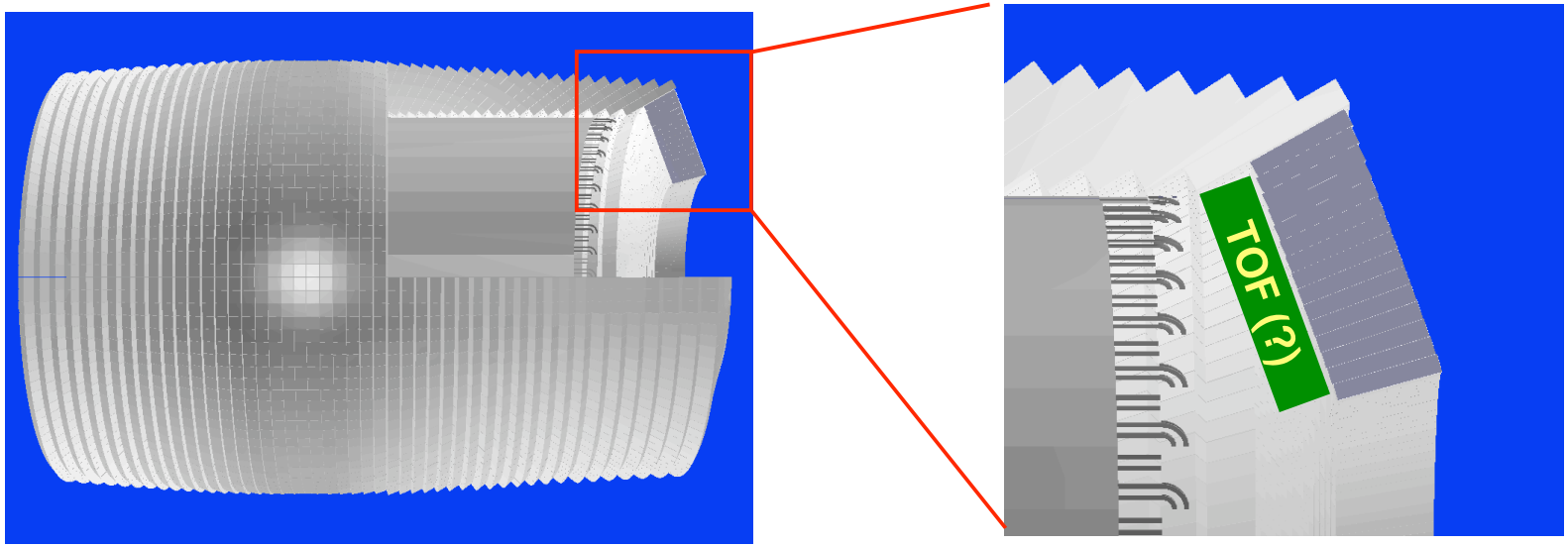


C. Cecchi - S. Germani
INFN Perugia

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)





Crystals Dimensions

LSO crystas

- depth: 20 cm ~17.5 X_0
- Crystas arranged in 20 rings within 5x5 modules

Ring	A	B	C	D	E	F
1	19.48	23.12	18.72	21.37	25.65	20.52
2	20.26	23.12	19.50	22.23	25.65	21.38
3	21.04	23.12	20.28	23.09	25.65	22.25
4	21.82	23.12	21.05	23.96	25.65	23.11
5	22.60	23.12	21.83	24.82	25.65	23.97
6	19.92	23.12	19.27	21.95	25.65	21.22
7	20.59	23.12	19.94	22.68	25.65	21.96
8	21.25	23.12	20.60	23.42	25.65	22.70
9	21.92	23.12	21.27	24.16	25.65	23.43
10	22.58	23.12	21.93	24.89	25.65	24.17
11	20.25	23.12	19.68	22.38	25.65	21.75
12	20.83	23.12	20.26	23.02	25.65	22.39
13	21.41	23.12	20.84	23.66	25.65	23.03
14	21.99	23.12	21.42	24.31	25.65	23.67
15	22.57	23.12	22.00	24.95	25.65	24.32
16	20.51	23.12	20.00	22.71	25.65	22.15
17	21.02	23.12	20.52	23.28	25.65	22.72
18	21.54	23.12	21.03	23.85	25.65	23.29
19	22.05	23.12	21.55	24.42	25.65	23.86
20	22.57	23.12	22.06	24.99	25.65	24.43

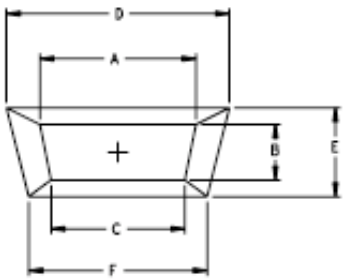
175 Xtals/Ring
35 Modules

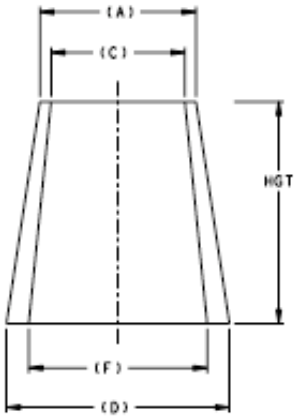
205 Xtals/Ring
41 Modules

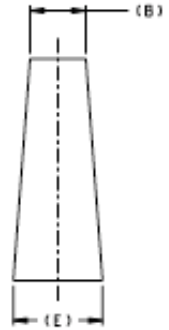
235 Xtals/Ring
45 Modules

265 Xtals/Ring
53 Modules

4400 Crystals

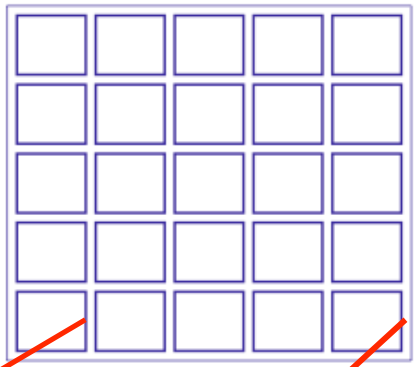


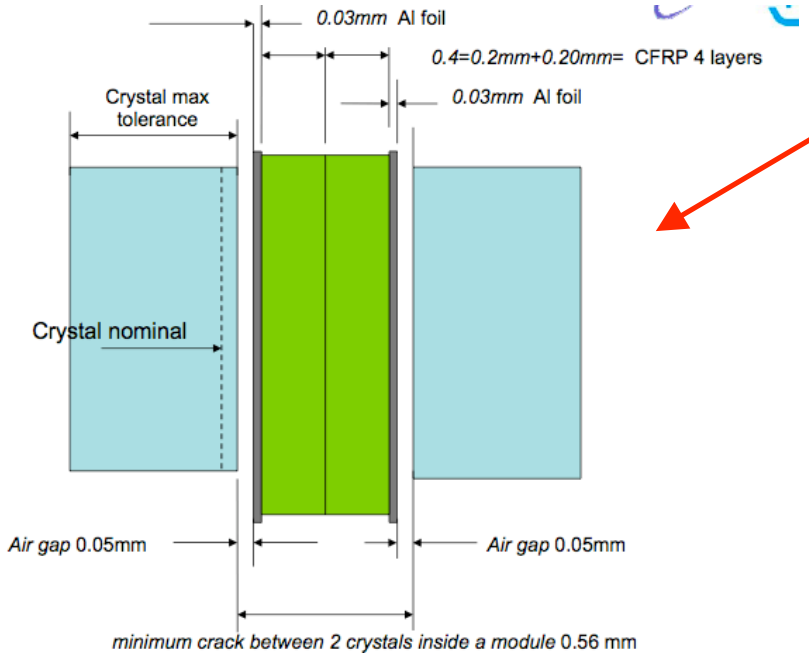


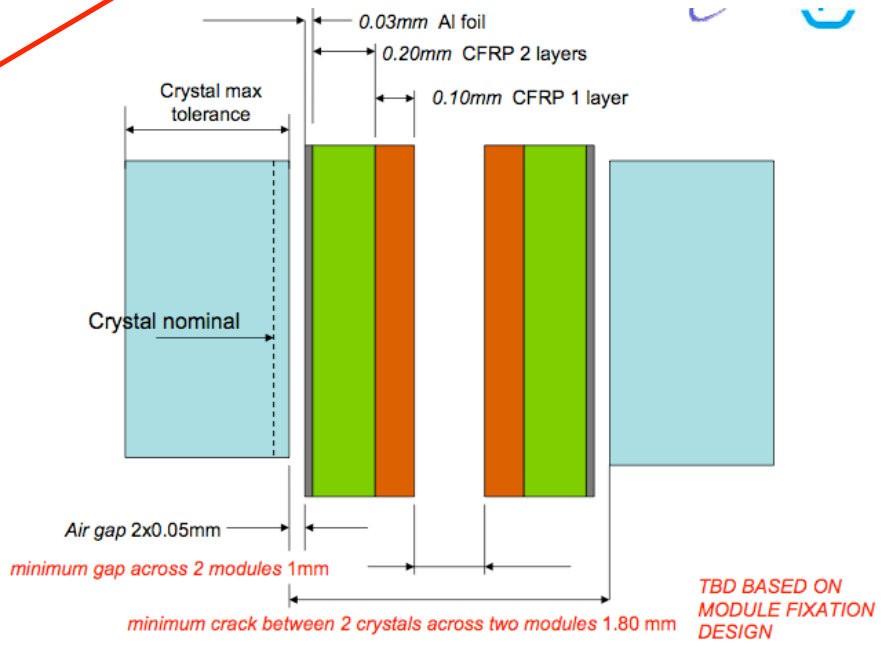


Dead material options

- Carbon Fiber reinforced plastic support structure
  - Naive version : almost no air gap between modules and crystals but (almost) correct CF thickness
  - Mechanical engineer version (C. Gargiulo INFN Roma1)
- Only optical isolation (tyvek) crystals holded from back face (to be investigated further)







G4 simulation

- **We did not succed in running Bruno on the PG farm**
  - **First problem: crash loading GDML files (no longer present)**
  - **Secon problem: errors and warnings when loading GDML files and no events in the output file.**

    Error example:

    >Bruno -m novis.mac -g newgeo2.gdml

    3.16659265358979303e*radian

    ----------^^G

    Evaluator : systax error

    error: systemId: /misc/data41/data/SuperB/G4Full/Bruno/newgeo2.gdml line: 396 column: 14

    Element 'physvol' is not valid for content model:'((materialref,solidref,((physvol|divisionvol|replicavol)|paramvol),loop),auxiliary)'

    >Bruno -m novis.mac -g SuperB.gdml

    error: systemId: /misc/data41/data/SuperB/G4Full/Bruno/EM1S.gdml line: 1029 column: 37

    Attribute 'vesion' is not declared for element 'setup'

    error: systemId: /misc/data41/data/SuperB/G4Full/Bruno/EM1S.gdml line: 1029 column: 37

    Required attribute 'version' was not provided

    error: systemId: /misc/data41/data/SuperB/G4Full/Bruno/EM1S.gdml line: 1032 column: 8

    Element 'materials' is not valid for content model: '((define,materials,solids,structure),setup)'

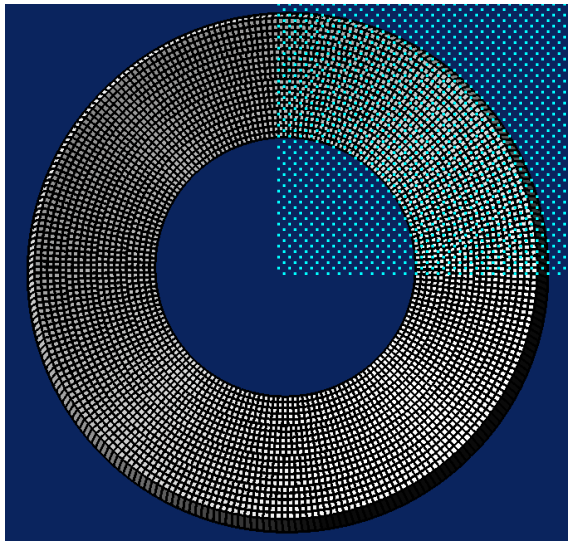
    Fatal error: systemId: line: 0 column: 0

    An exception occurred! Type:RuntimeException, Message:The primary document entity could not be opened. Id=/misc/data41/data/SuperB/G4Full/Bruno/SVT_L0_container.gdml

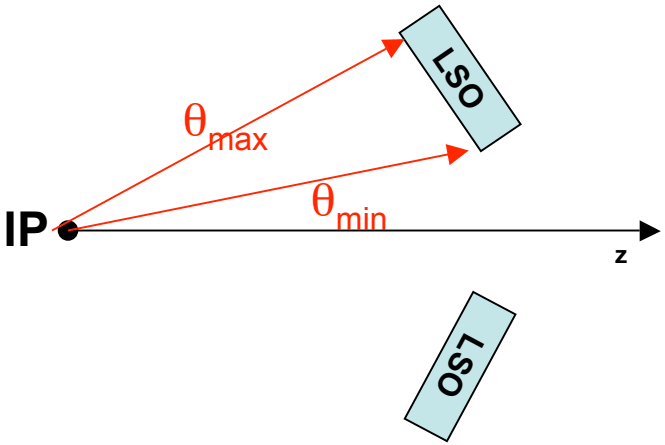
    error: systemId: /misc/data41/data/SuperB/G4Full/Bruno/final_focus_short.gdml line: 469 column: 14

- **We used a standalone G4 simulation to study the parametrisation for the Fast Simulation** (with some updates in the geometry)

Generated beams



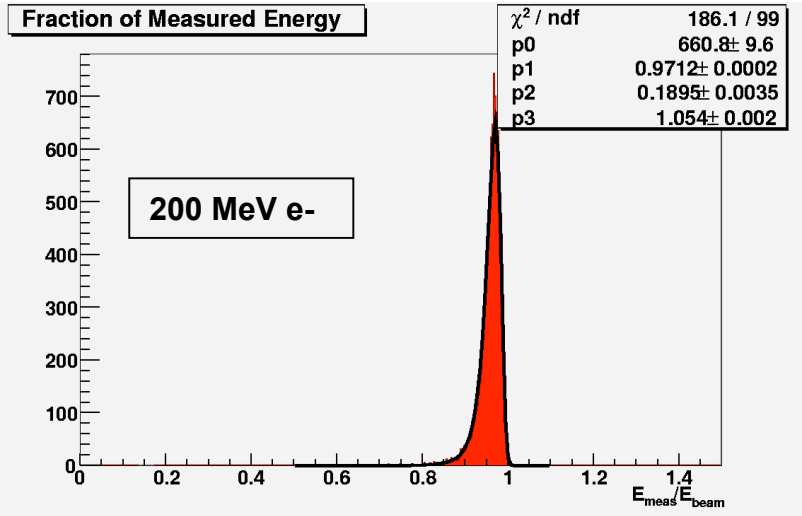
- Particles:
  - e- γ
- Energies:
  - 50, 100, 200, 350, 500, 750, 1000, 2000, 5000, 7000 MeV
- Surface:
  - Particles uniformely distribuited in one quandrant between θ_{min} - θ_{max}
- Primary vertex position:
  - Interaction point (x=y=z=0)



Energy Reconstruction

Algorithm:

1. Get Xtal deposited energy
2. Perform Poisson smearing with 8k pe/MeV
   - Value obtained by measurements in PG and Caltech
3. Assign 1% calibration error to crystals
   - Reconstruct with 8k±1% pe/MeV
4. Apply minimum energy cut for each xtal
   - 1 MeV to be tuned
5. Sum Xtal energy



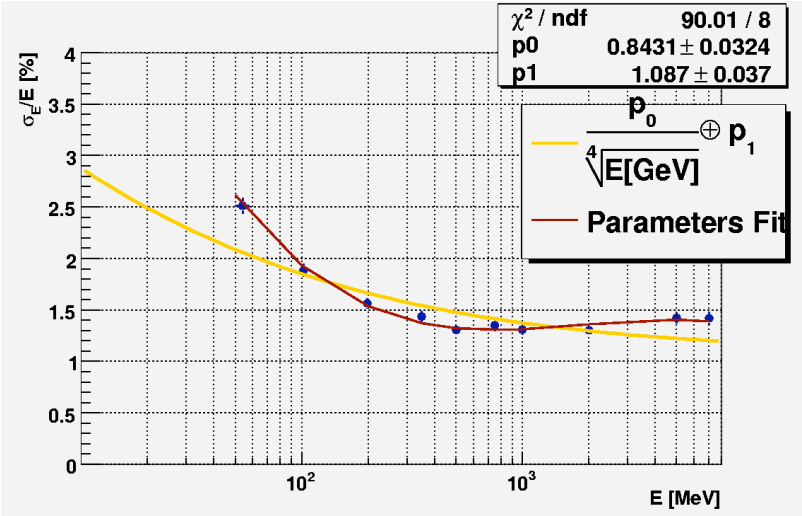
Comments:

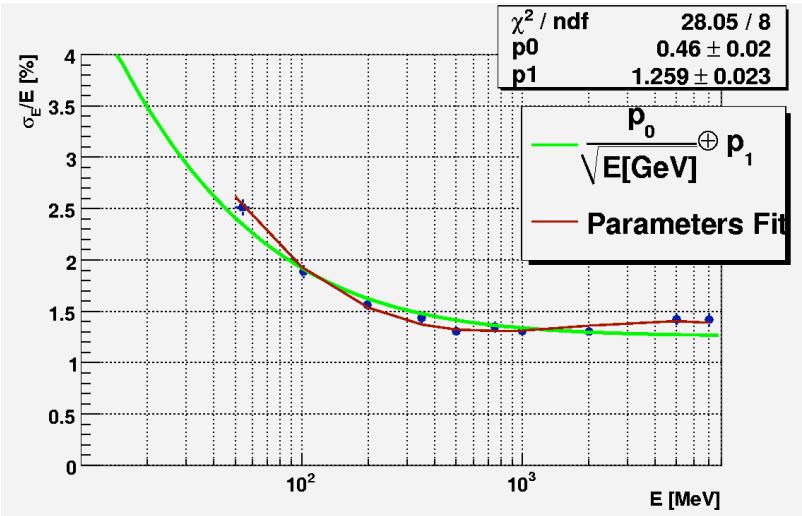
- All distributions have asymmetric low energy tails
  - Backsplash for low E particles
  - Forward leakege for high E particles
- Energy distributions fit with asymmetric Gauss function: $\sigma = \sigma(E)$
- Proposed parameterisation uses fit of p1,p2,p3 vs Energy

$$F(x) = P_0 e^{-\frac{(x-P_1)^2}{2[P_2(P_3-x)]^2}}$$

- P1 : most probable value (mpv)
- P2(P3-x) : running σ

Energy Resolution vs Energy: e-





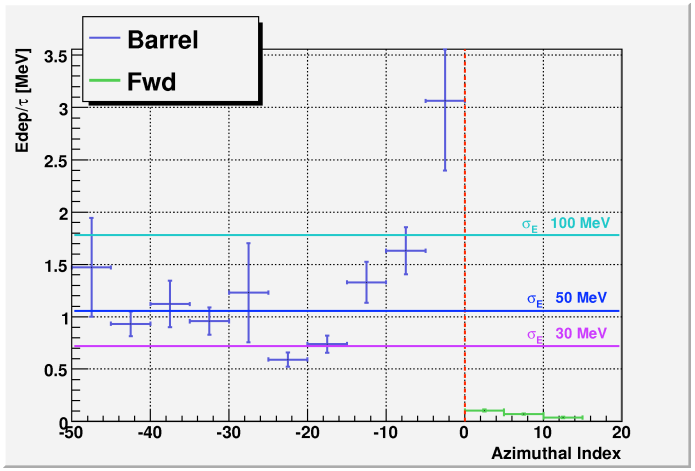
- To show the energy resolution use the running sigma value at the peak : σ(mpv)
  - Slightly underestimates the real distribution width
- Compare measured points with results from parameters fit
- Fit measured points with

$$\frac{\sigma(E)}{E} = \frac{p_0}{\sqrt[4]{E[GeV]}} \oplus p_1$$

$$\frac{\sigma(E)}{E} = \frac{p_0}{\sqrt{E[GeV]}} \oplus p_1$$

Conclusions and Plans

- Tuning on minimum energy cut and energy reconstruction need also background simulation



  - Need to be able to run Bruno correctly
  - Comparison between G4 full simulation with and without background
- Effect of different geometry options will be investigated in the next future