ECL::Software

Update on Simulations

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Italian ECL Meeting, 12th December 2014

Overview

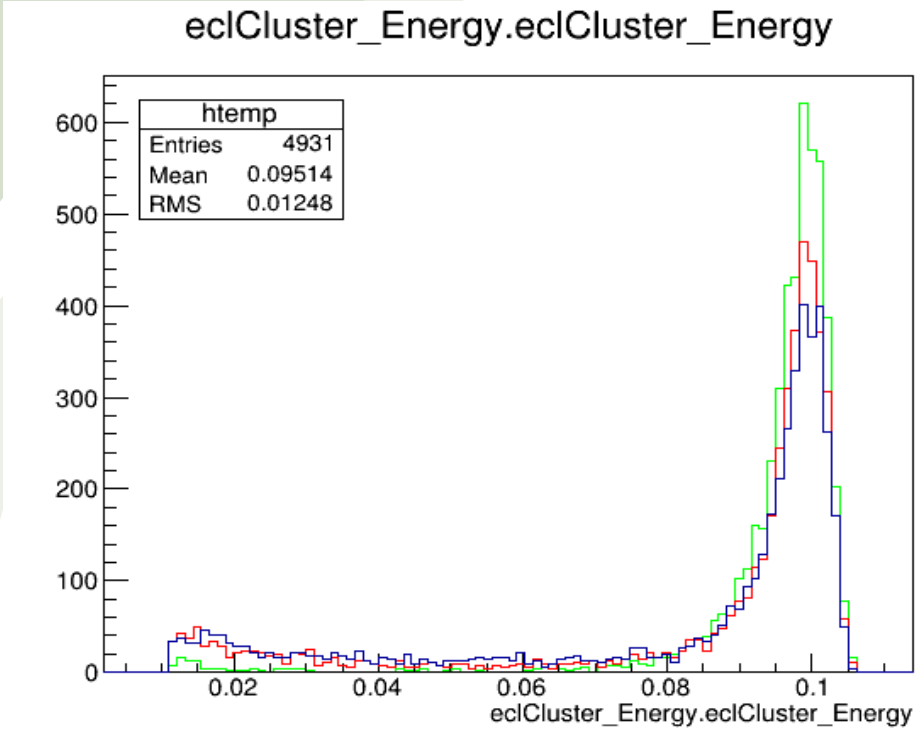
- *Upgrade oriented simulations started after November B2GM:*
  - *We had to develope our own tools to analyze stuff*
  - *Realitstic bkg simulation for ECL is available since short time (about 10 days, see M. Staric's talk at ECL meeting 28th November)*

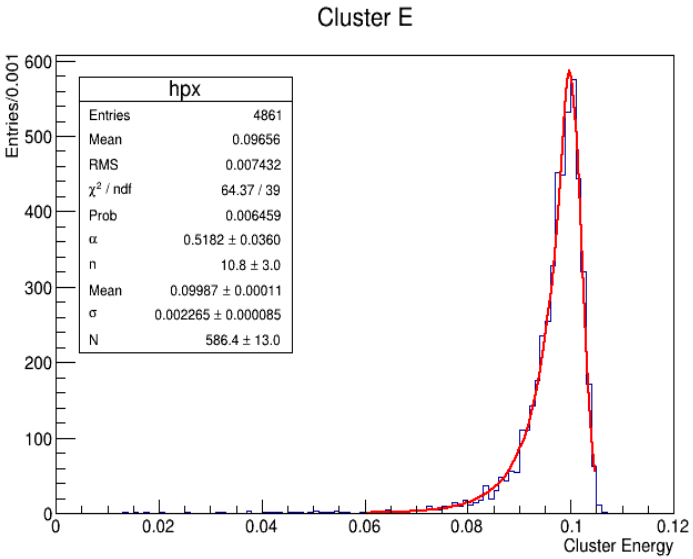
- *Intrinsic detector resolution and related effects:*
  - *Check for border effects and defined suitable region for FW studies*
  - *Energy scan of resolution function*
  - *Particular focus at 100MeV as benchmark for future studies*

- *Resolution in the presence of beam-backgrouns:*
  - *500MeV photons to define selection criteria*
  - *Study of resolution for 100MeV photons.. ongoing*

Intrinsic resolution studies

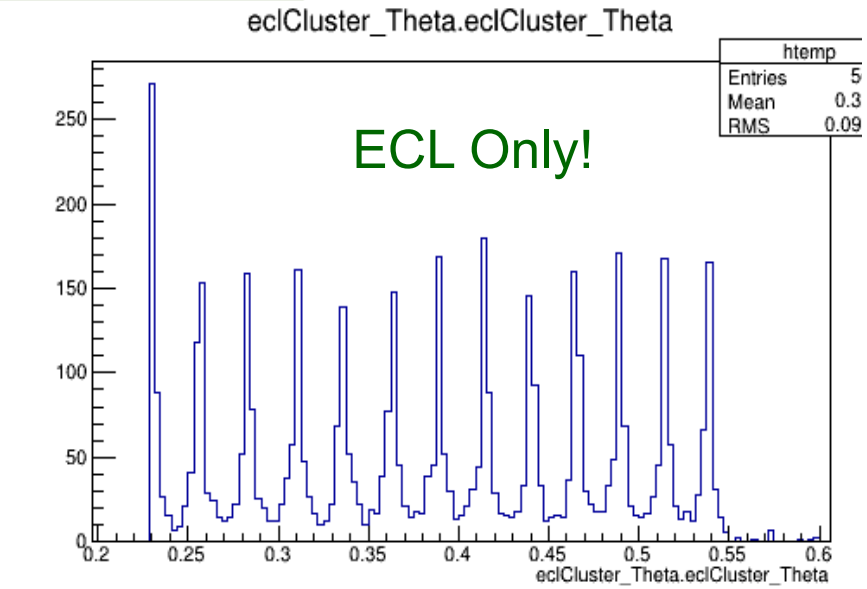
- *I started from nominal geometry using full FWD endcap*
- *Compared 3 different geometries:*
  - *ECL only (green)*
  - *Full detector without ARICH (as discussed at last B2GM) (red)*
  - *Full detector (blue)*
- *5000 events, single 100MeV photons from pGun*
- *No big effect of other subdetectors on resolution, rather on efficiency*

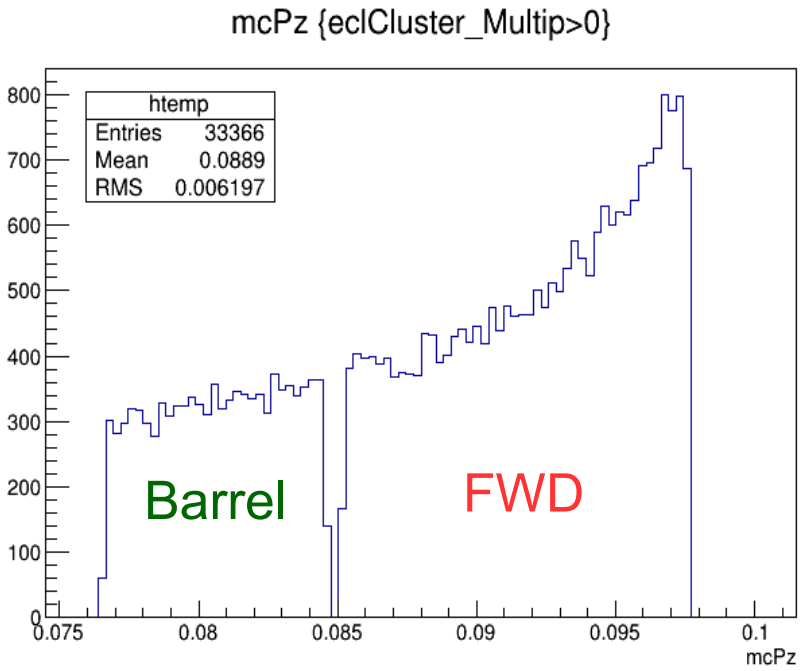




Intrinsic resolution remarks

- *The nominal geometry FWD (12.01° - 31.30°) and actual MC acceptance have observed to be different*
- *High loss of events (i.e. Clusters) close to the inner ring (actual MC acceptance is 12.4° - 31.35°)*
- *Other strange border effects obse*



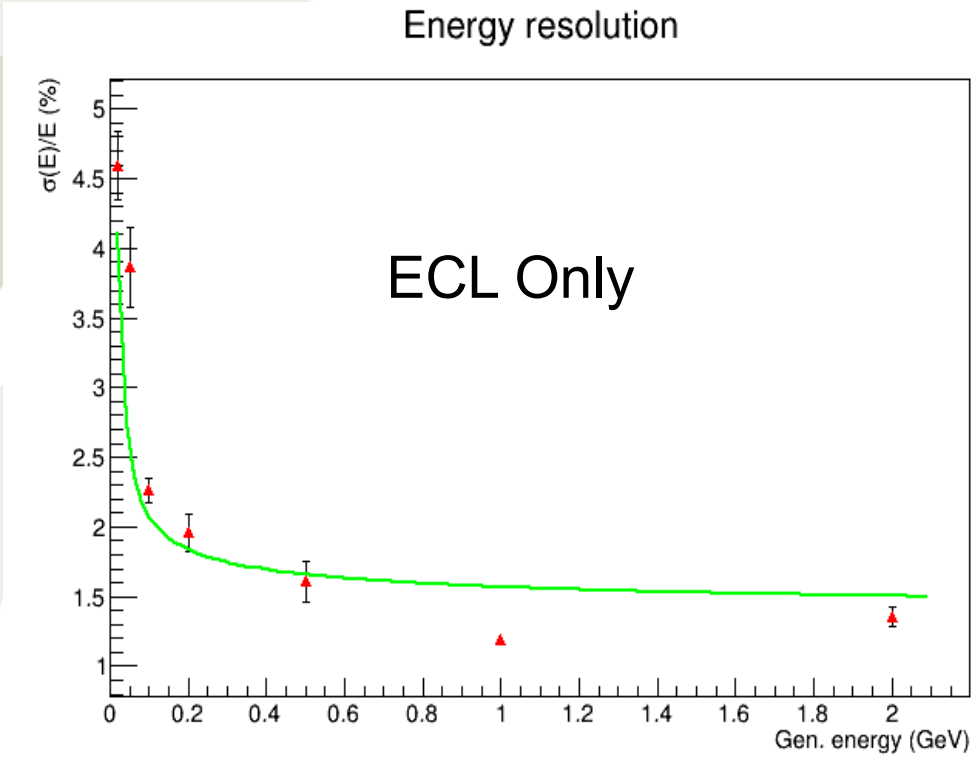


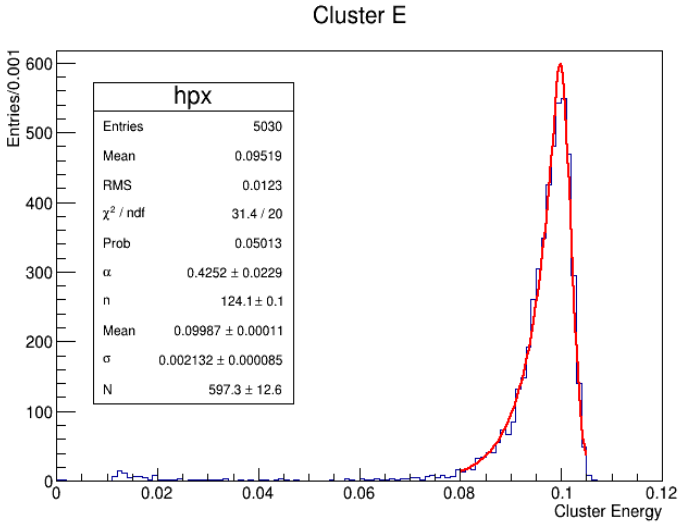
- *I decided to focus on a smaller ring 20° < theta < 24° FWD (3-4 fwd crystals) for further studies*

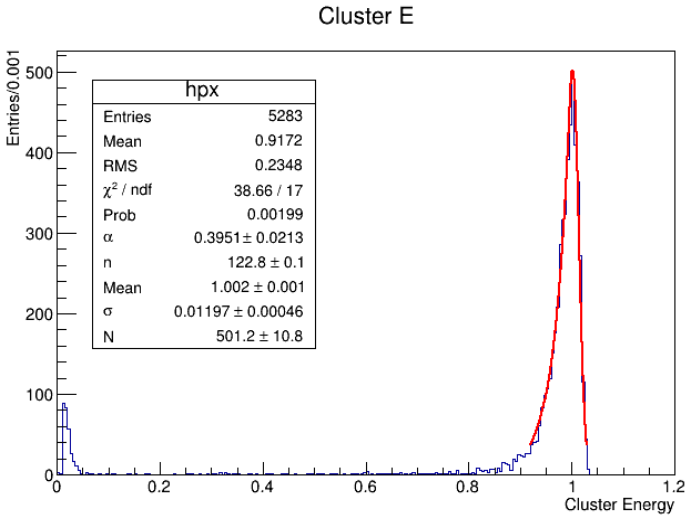
Energy resolution

- *Individual energies fitted with Crystal Ball function*
- *Energy range 20 MeV to 2 GeV, 5000 evts each*
- *Resolution function from TDR in green*

$$\frac{\sigma_E}{E} = \sqrt{\left(\frac{0.066\%}{E}\right)^2 + \left(\frac{0.81\%}{\sqrt[4]{E}}\right)^2 + (1.34\%)^2},$$

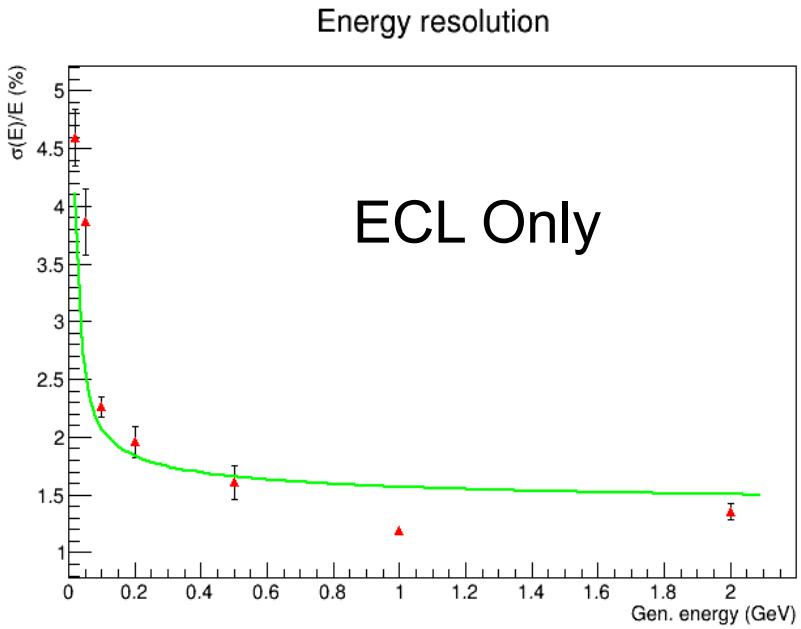


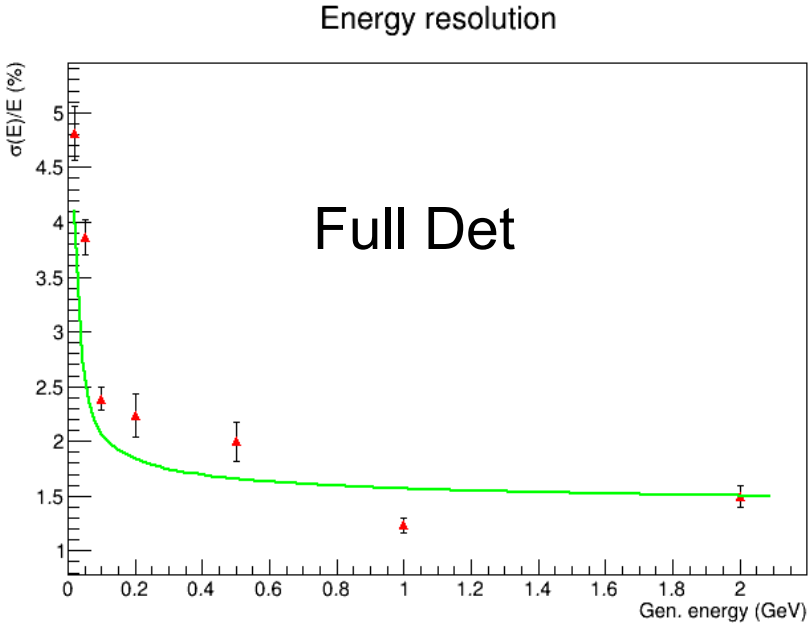


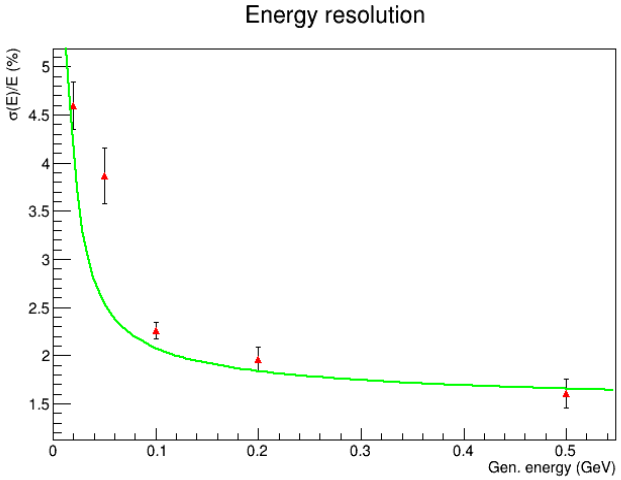


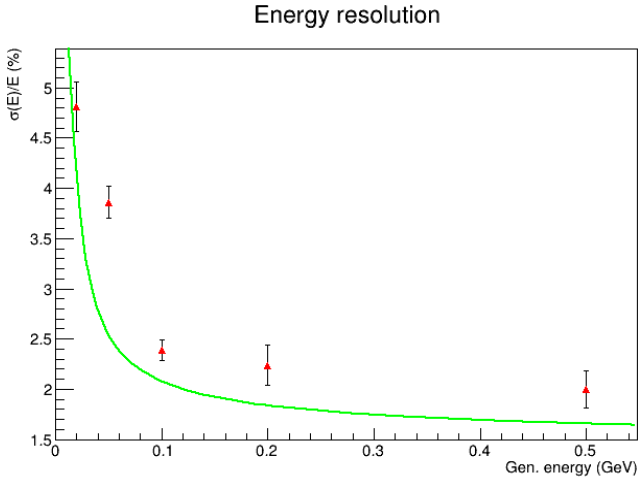
Energy resolution

- *Not really good agreement, seems to depend from ECL alone*



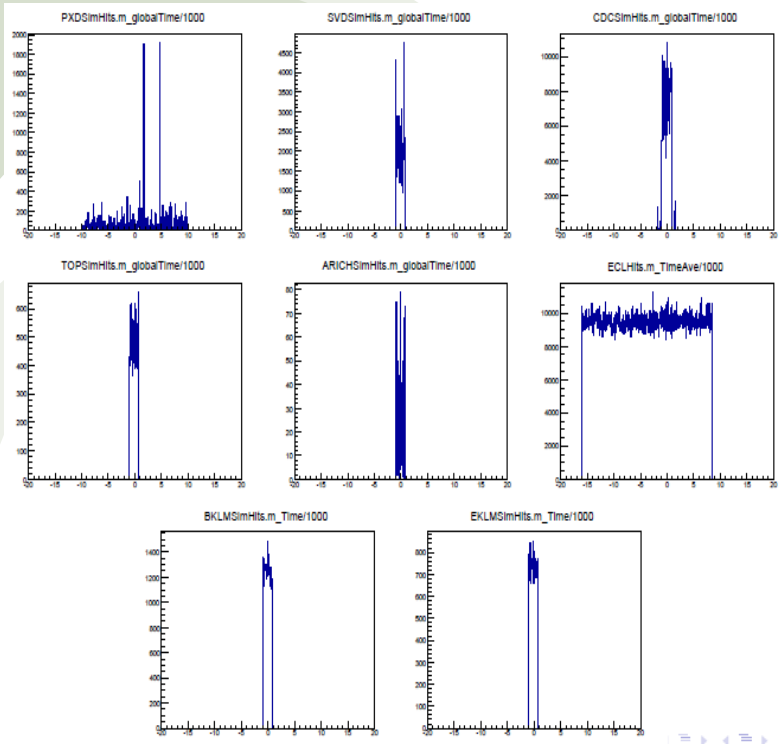


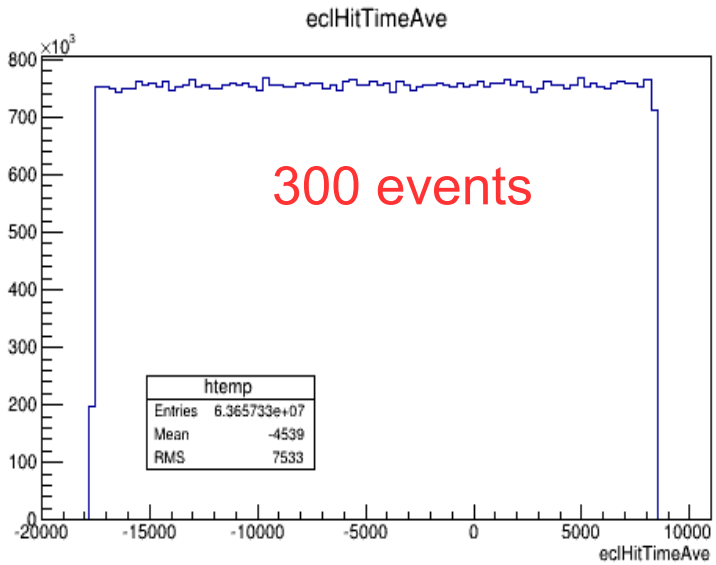




Background

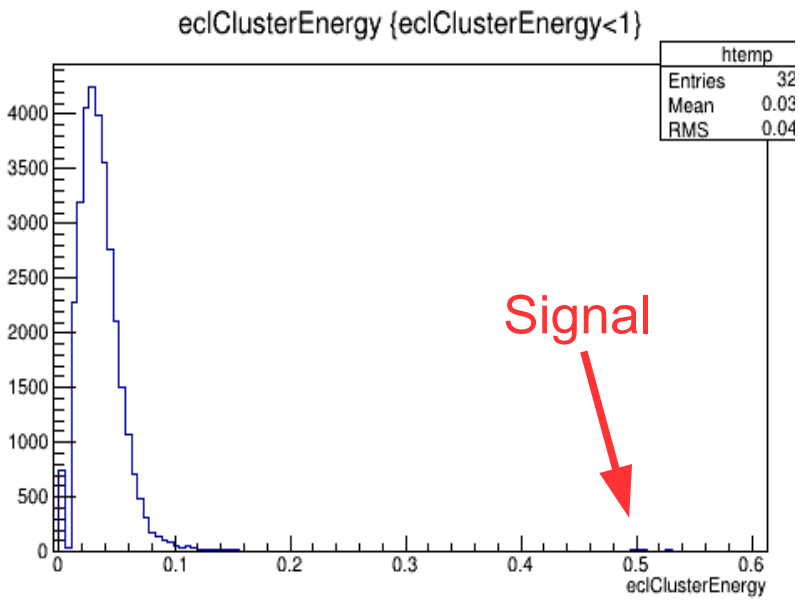
- *Background window has finally been fixed (-17.6, 8.5 us):*
  ADC clock = 508 MHz / (24 x 12) = 1.764 MHz ==> 567 ns/sample
  waveform fit → 15 samples = 8.504 us, pedestal fit → 16 samples = 9.071 us
  time window before 0 = 17.576 us, time window after 0 = waveform duration = 8.504 us
- *New bkg mixer released, allows different t windows for different subdets*
- *(Reminder: all detectors use -1, 0.8 us win., except ECL and PXD)*
- *Additional bkg files are available for ECL since about 1 week*

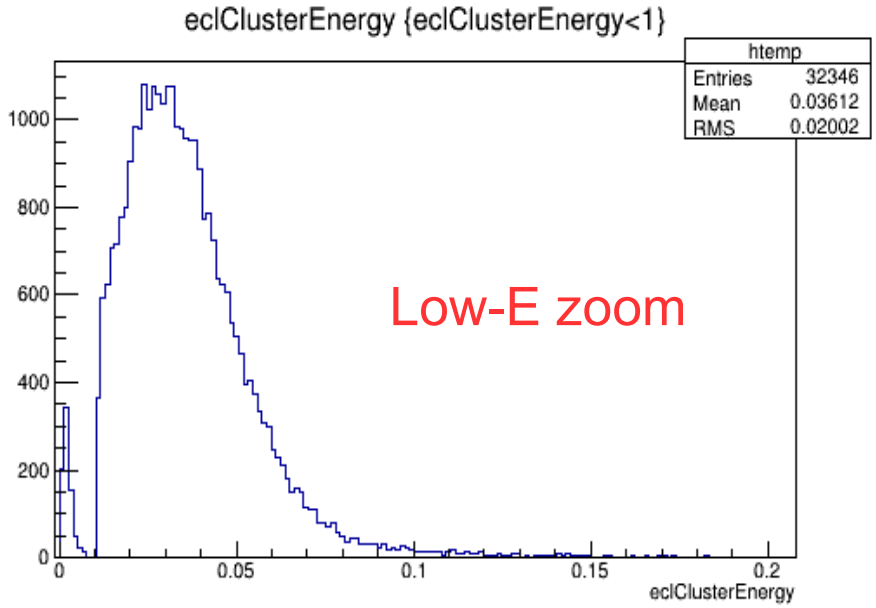




500 MeV photons

- *0.5GeV photons as benchmark for selection in presence of bkg*
- *198 events, single 0.5 GeV photon in 20° < theta < 24°*
- *32346 clusters, mostly low-E (but not only!)*

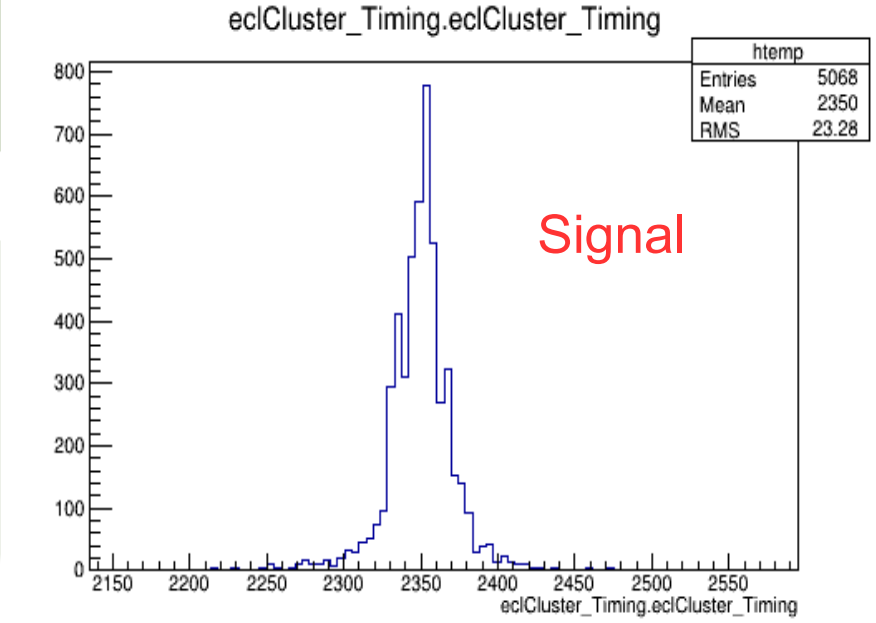


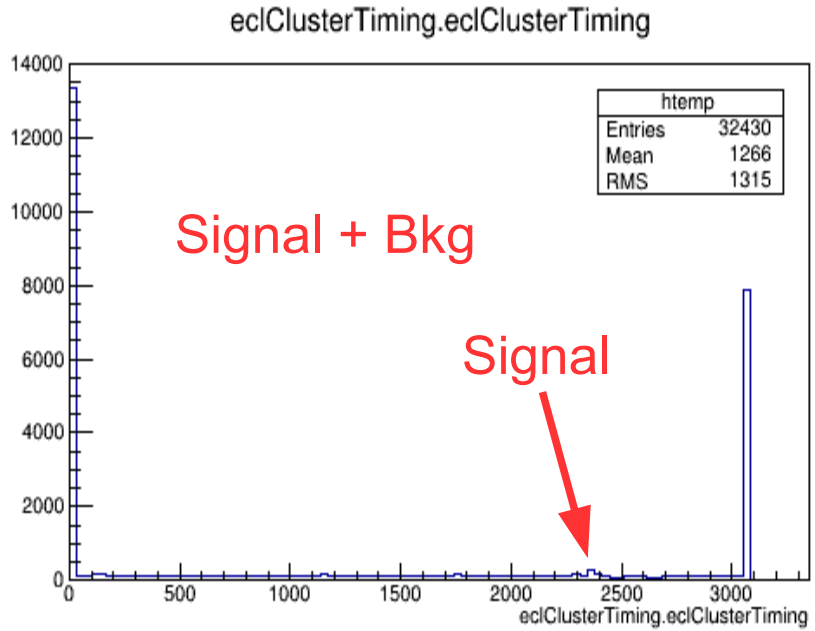


- *Tried to make an easy and clean selection: timing, E9oE25, minE*

About timing..

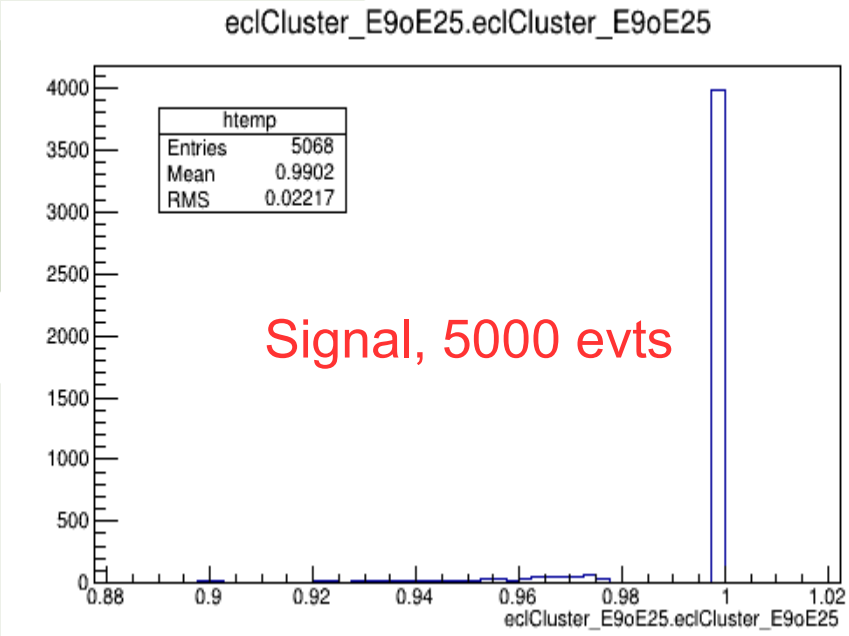
- *ECL digitizer clock rate is 1.76388 Mhz (=567 ns)$^{-1}$*
- *Actual event timing unit for ECL is 567/(96*16) ns (..don't ask me!)*
- *Cluster are accepted if they fall +-567 ns from trigger*
- *This corresponds to 3072 "ECL units" (or steps) ("ECL Unit" = 0.37 ns)*
- *Timing is expected to be good down to 10ns (RMS)*
- *Physics ECL time is peaked at 2350 "steps" (code bias)*
- *I decided to accept only events falling between 2300 and 2400 "steps"*

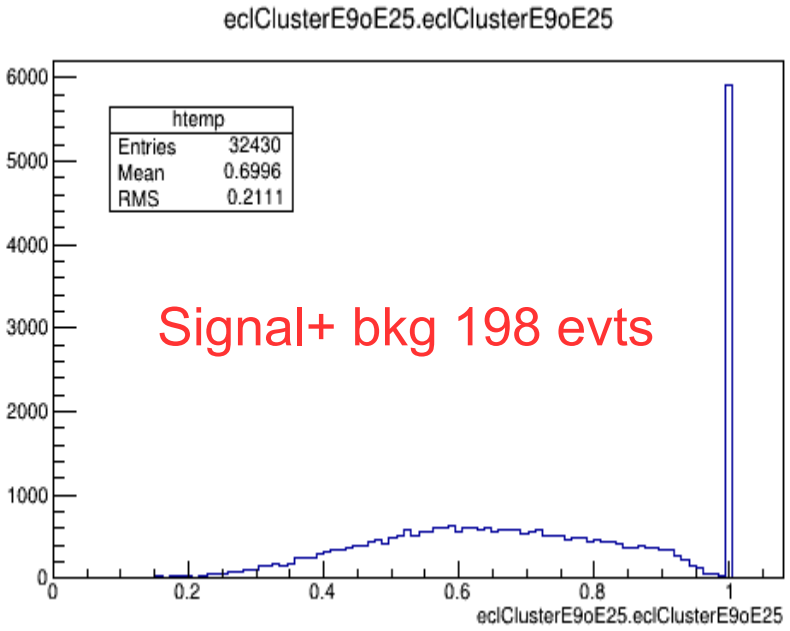




500 MeV photons

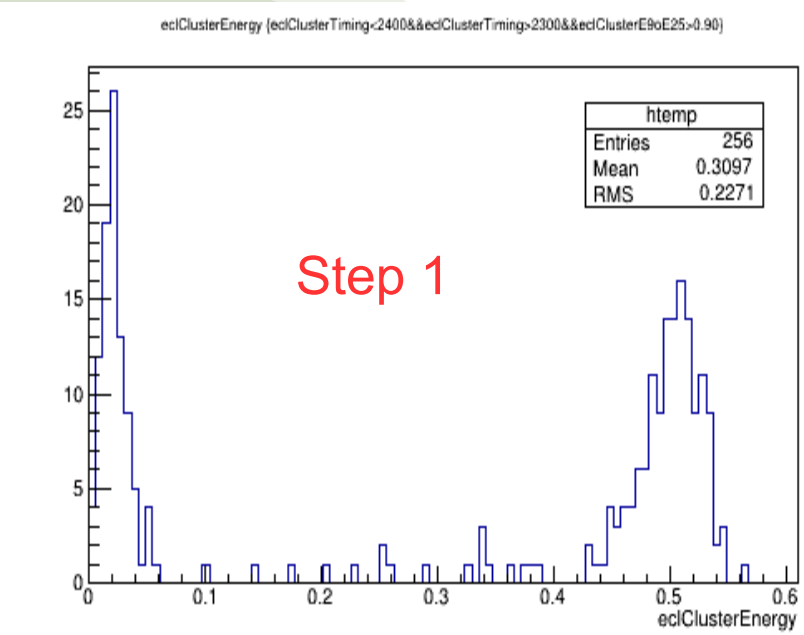
- *E9oE25 describes shower shape*
- *It's close to 1 for "good" photons while tends to be uniform for random (low-energy) beam-background*

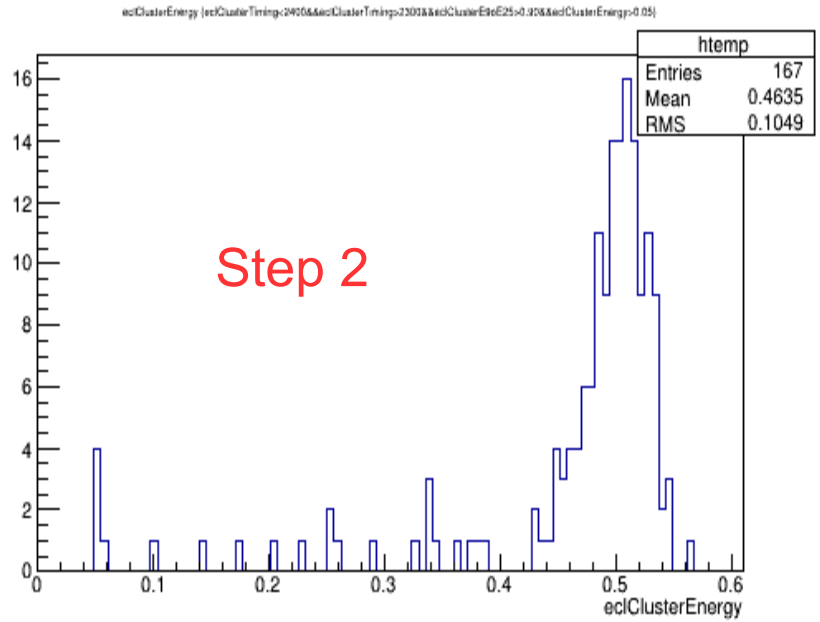




500 MeV photons

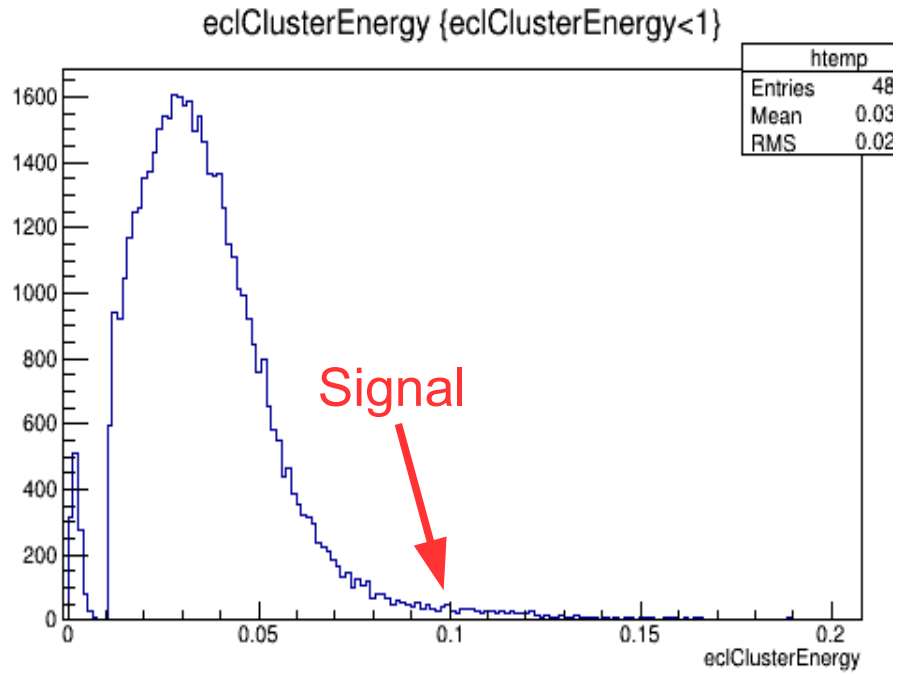
- *First sel step: 2300 < t < 2400 AND E9oE25 > 0.9*
- *Survive: 256 clusters, 162 associated to pGun photons*
- *Second sel step: E > 50 MeV (this was standard value for "good"-photons lis at BaBar)*
- *Survive 167 clusters, 161 signals →eff= 81%, purity= 96.4%*

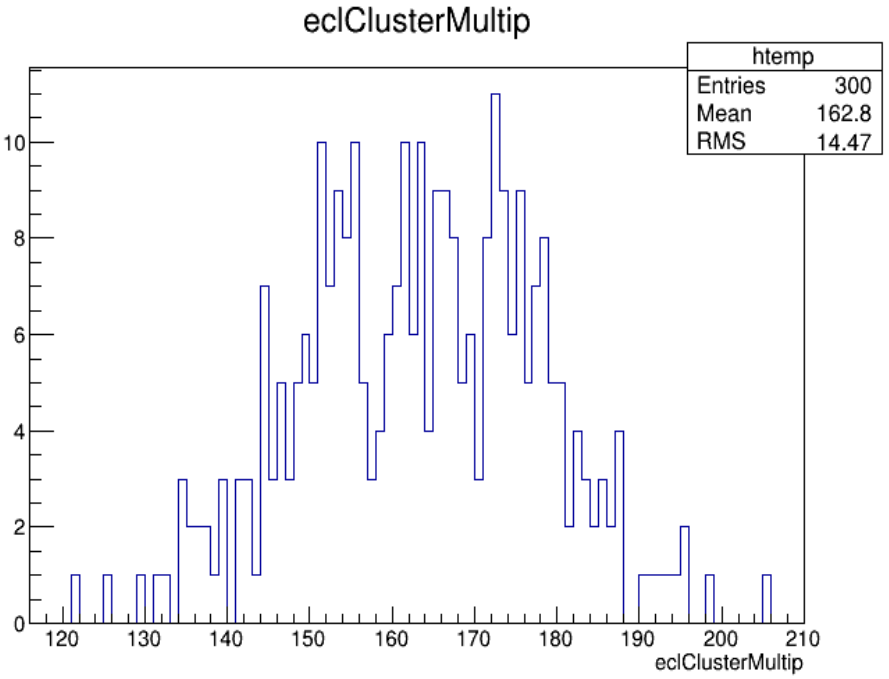




100 MeV photons

- *Now let's try with the difficult case*
- *300 events, single 0.1 GeV photon in 20° < theta < 24°*
- *Now signal is completely enveloped in bkg "tail"*

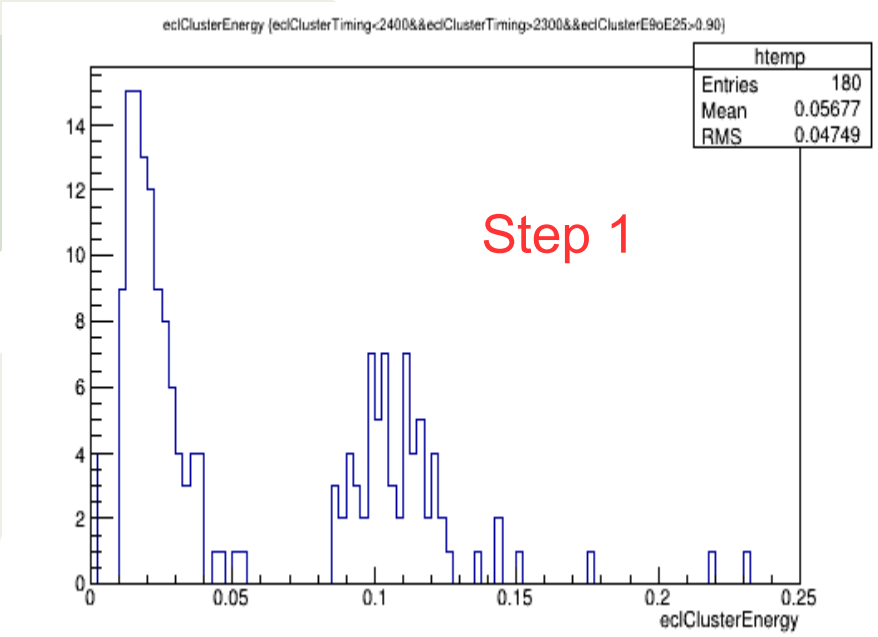


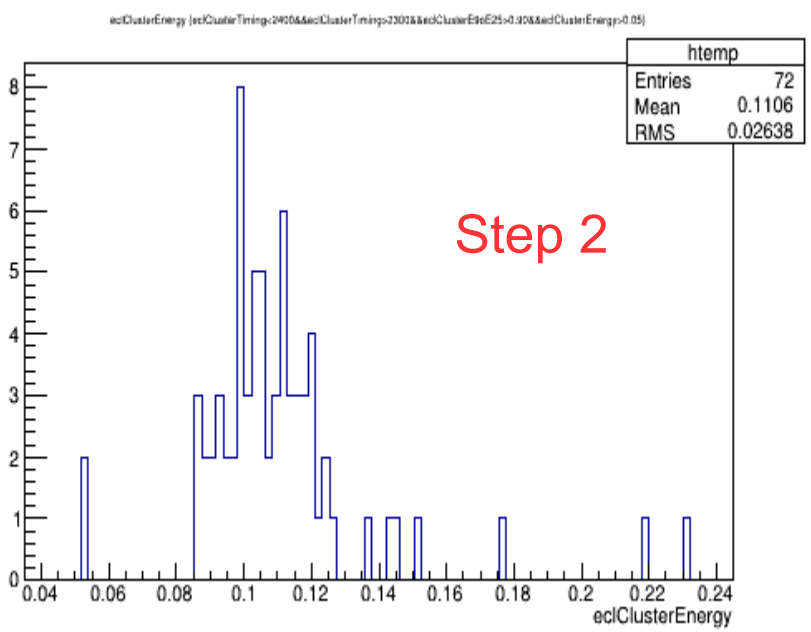


- *I used the same selection steps defined before*

100 MeV photons

- *First sel step: 2300 < t < 2400 AND E9oE25 > 0.9*
- *Survive: 180clusters, 71 associated to pGun photons*
- *Second sel step: E > 50 MeV*
- *Survive 72 clusters, 69 signals →eff= 23%, purity= 95.8%*



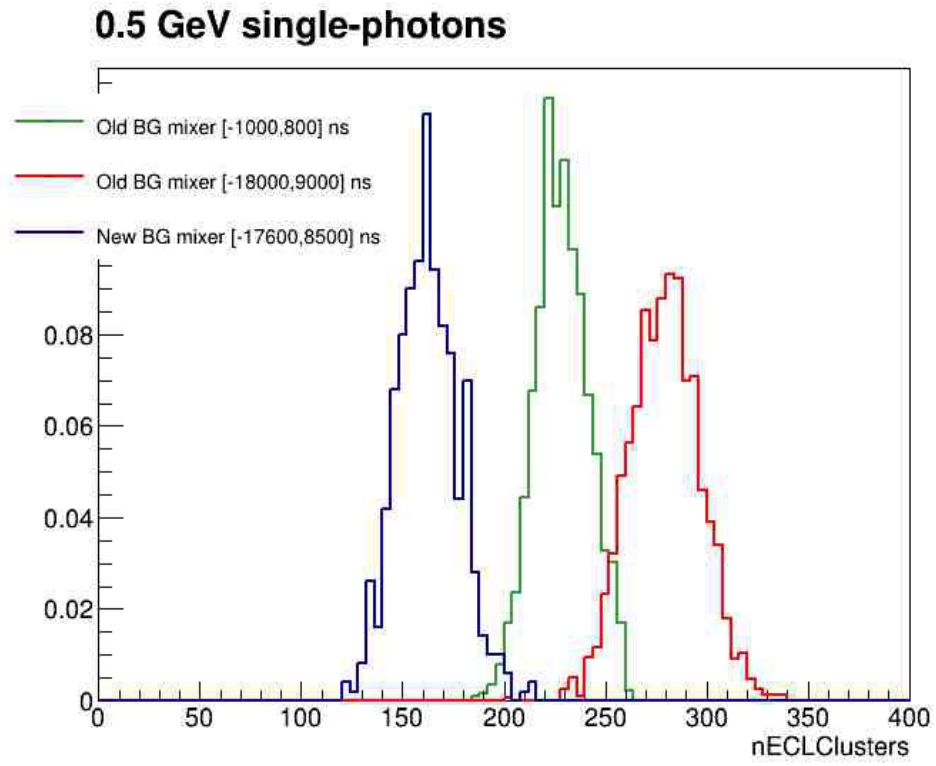


Background remarks

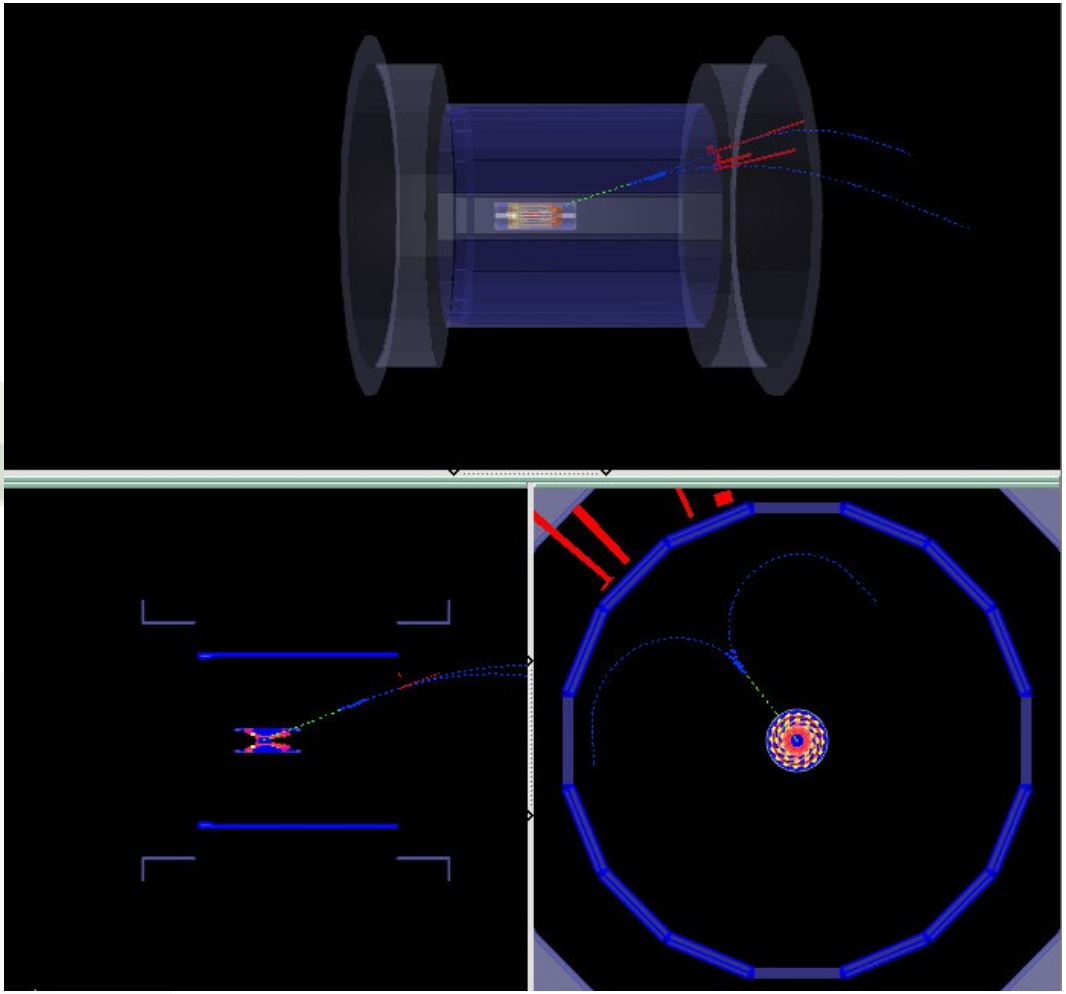
- *You may ask yourself (or have already asked me): why just few hundred events, why didn't you make a nice resolution fit in bkg case?*
- *Working offline (not KEK) with bkg, right now, is quite annoying:*
  - *the weight of 50 events is, on average, is 200Mb (single photon, no real physics event..)*
  - *Transfer rate from KEK to LNF is about 200Kb/s..*
  - *KEK and LNF both have login machines, that makes transferring files even more complicated*
  - *Limited storage area at LNF, and max file transfer size (about 200Mb)*

Background remarks (2)

- *There are some (significant) discrepancies between current and previous releases, the reason is not clear, we have ot investigate*
- *That's a crucial point: currently bkg people seems not to know enough about ECL and vice-versa → we need to address that*



Thanks!



Pair creation in the CDC