Resolutions and material budget

Elisa

Samples

- Code version: release-00-05-02/
- 50k events for each config and for each energy
- single photons generated with particle gun
- Energy: 100 MeV, 500 MeV
- FWD ECL acceptance (as in simulation config files): 'thetaParams': [12.398°, 31.62°] with uniform distribution

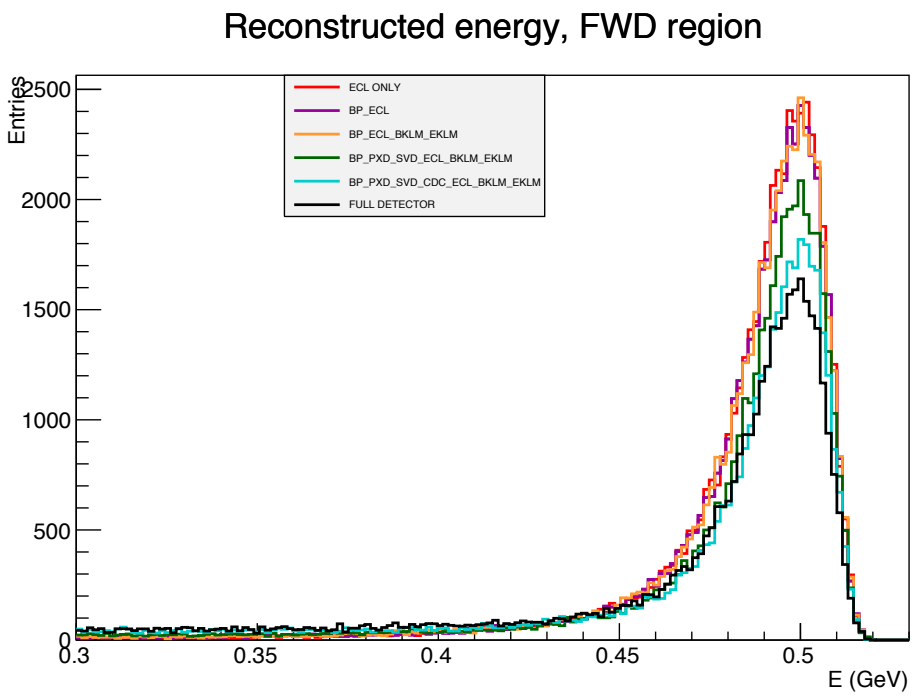
Configs

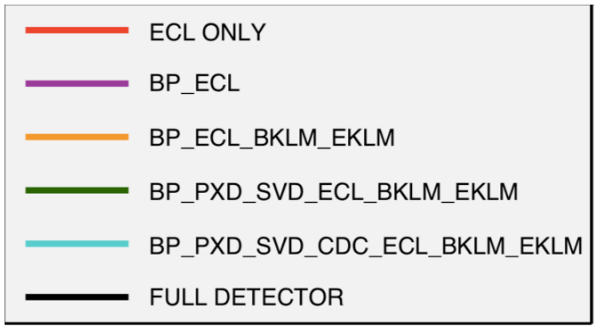
1. ECL ONLY
2. Beam Pipe + ECL (1 vs 2: beam pipe effect)
3. BP + ECL + BKLM + EKLM (2 vs 3: back-scattering effect)
4. BP + PXD + SVD + ECL + BKLM + EKLM (3 vs 4: vertex detectors effects)
5. BP + PXD + SVD + CDC+ ECL + BKLM + EKLM (4 vs 5: CDC effect)
6. FULL DETECTOR (5 vs 6: PID device effects)

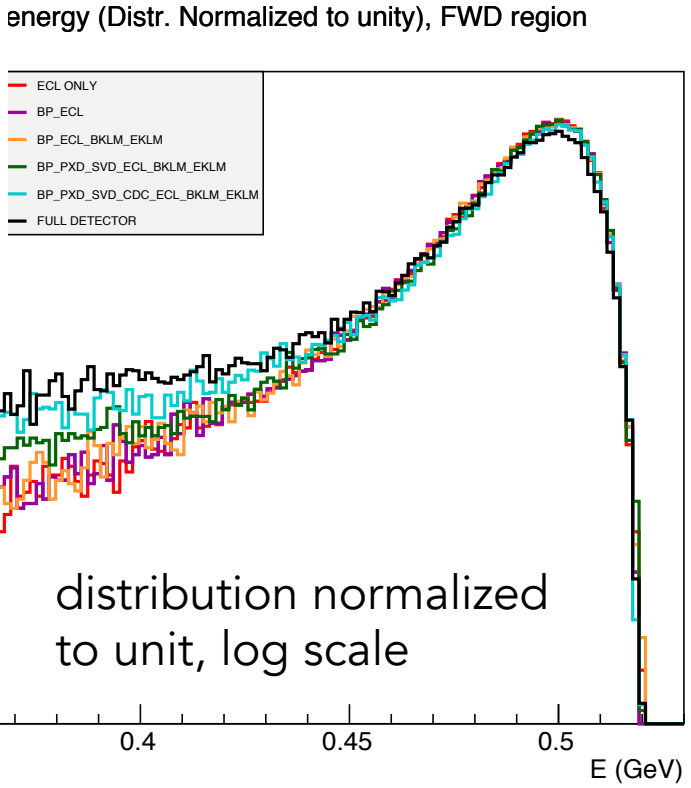
- [magnetic field always ON]

500 MeV

Reco'd energy distribution

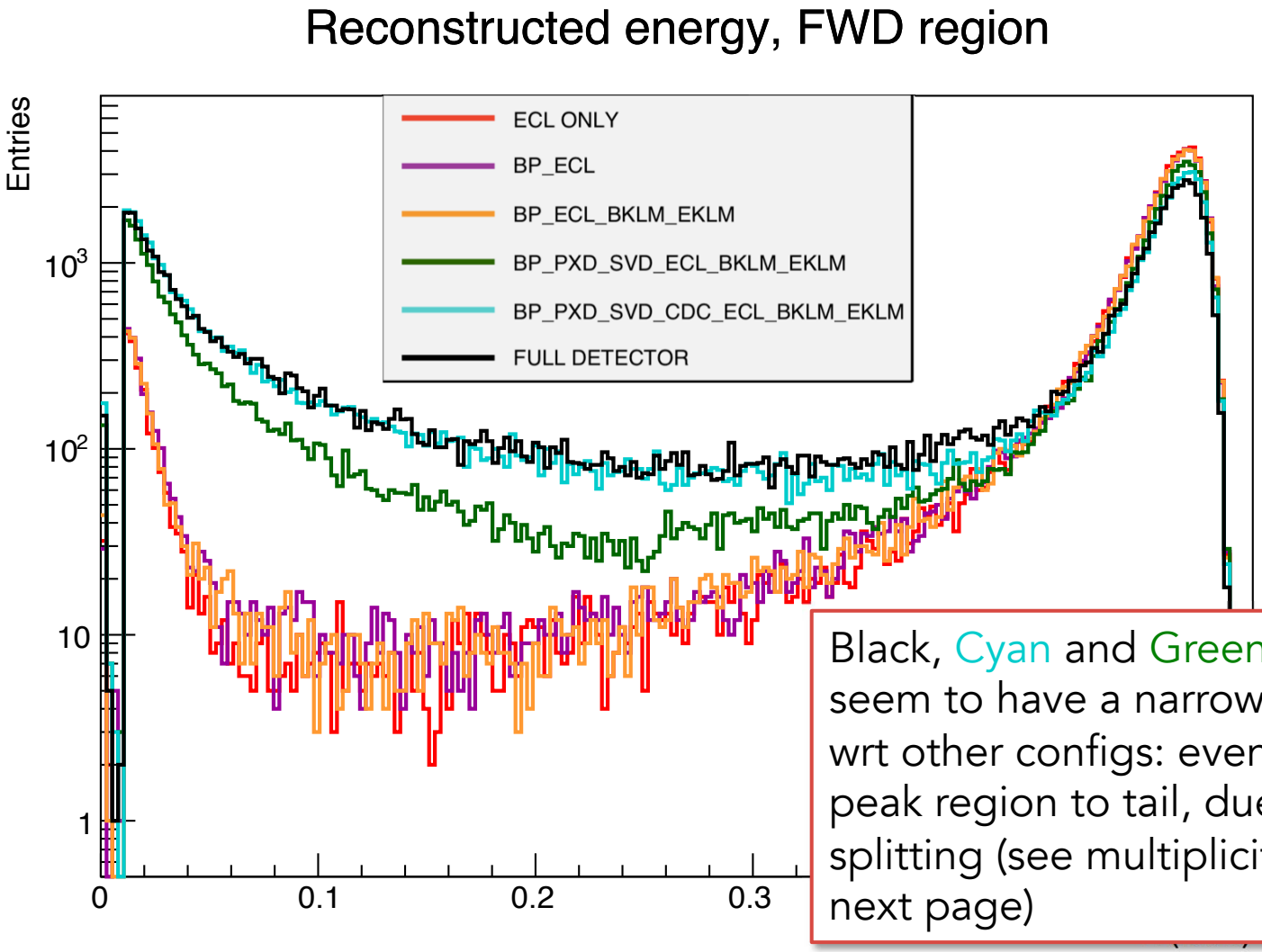






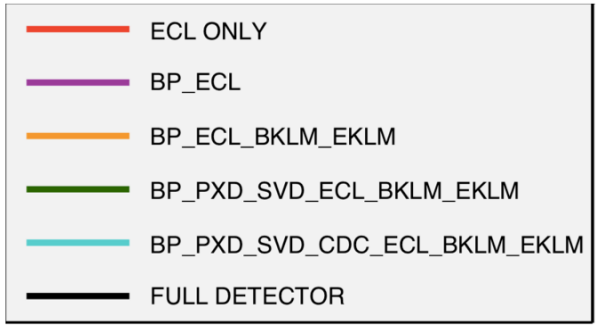
Largest effects when adding SVD+PXD and CDC

Reco'd energy distribution (II)

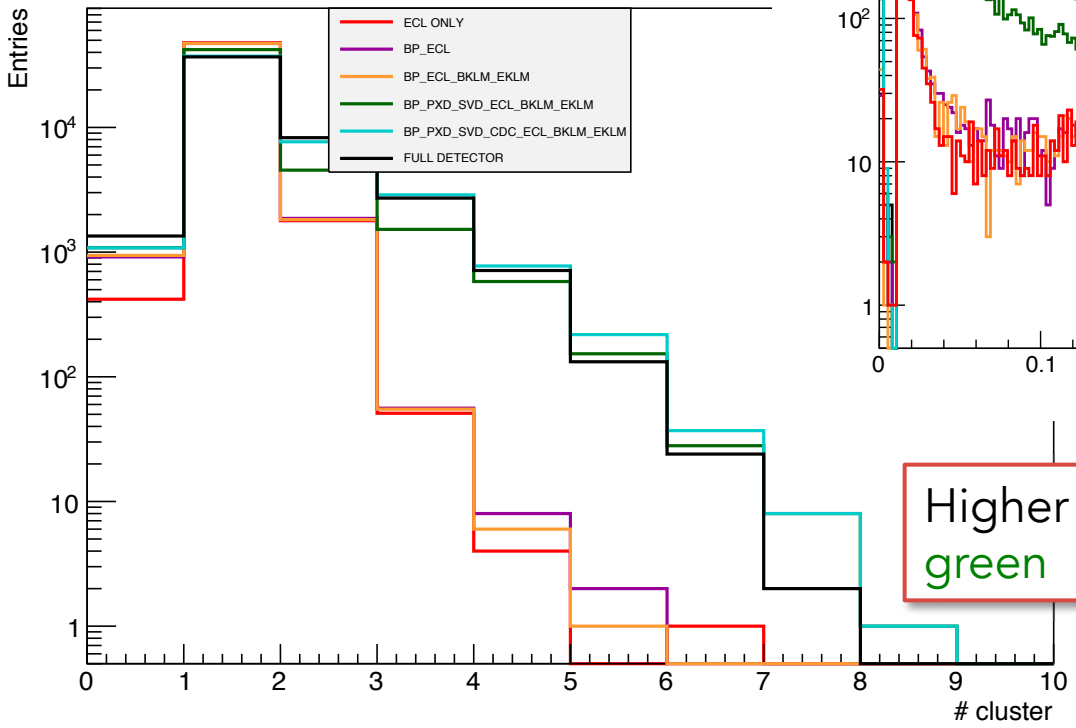


Black, Cyan and Green configs seem to have a narrower peak wrt other configs: events from peak region to tail, due to cluster splitting (see multiplicity plot in next page)

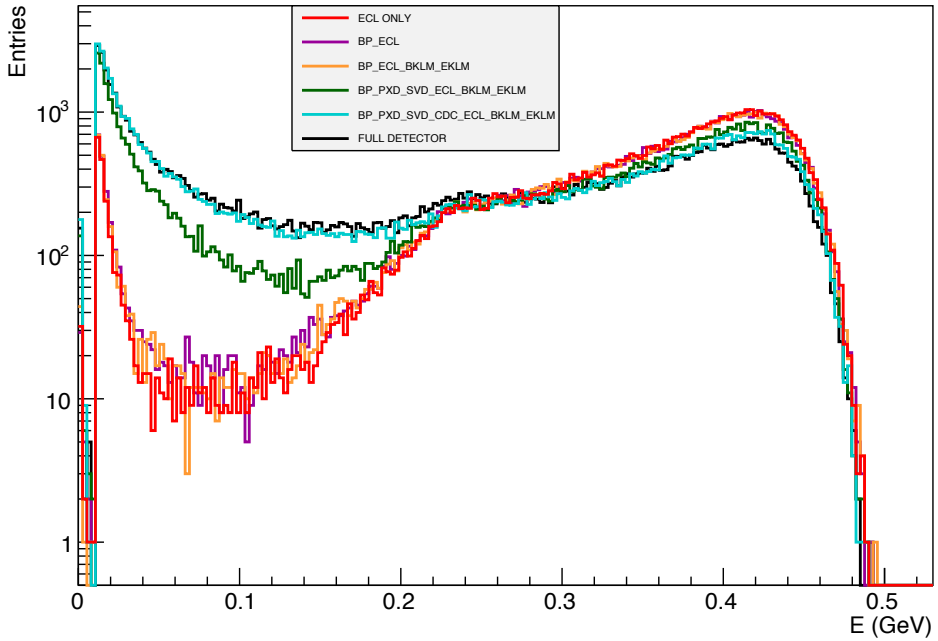
Multiplicity and Max energy deposit



Multiplicity, FWD regior



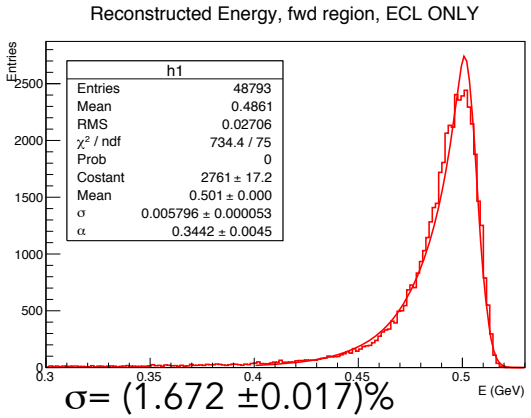
Highest energy deposit, FWD region



Higher multip for black, cyan and green

CB fits

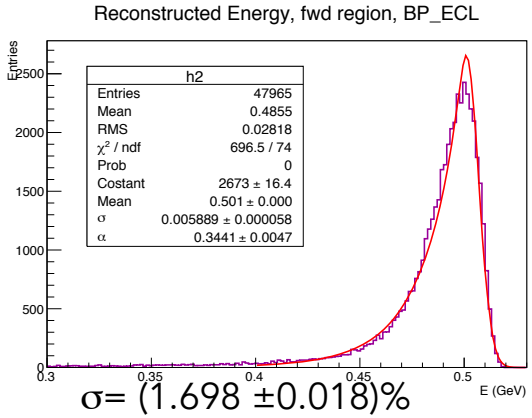
ECL ONLY



σ= (1.672 ±0.017)%

σ_{gauss} = (1.157 ±0.011)%

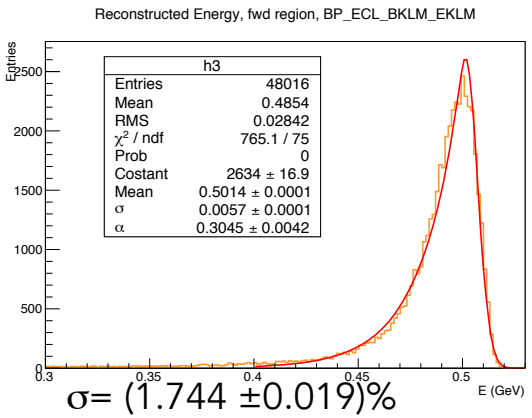
BP_ECL



σ= (1.698 ±0.018)%

σ_{gauss} = (1.175 ±0.011)%

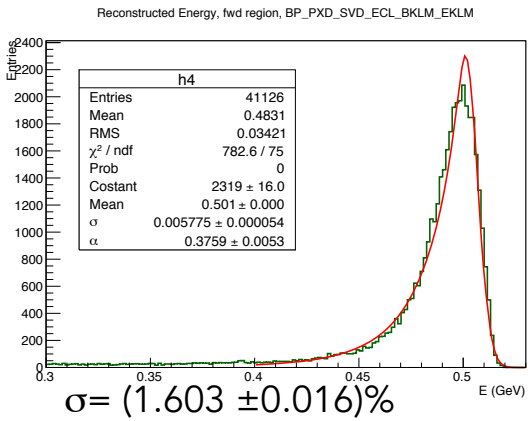
BP_ECL_BKLM_EKLM



σ= (1.744 ±0.019)%

σ_{gauss} = (1.137 ±0.011)%

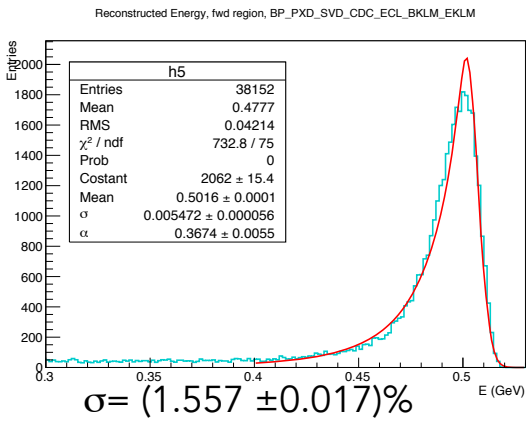
BP_PXD_SVD_ECL _BKLM_EKLM



σ= (1.603 ±0.016)%

σ_{gauss} = (1.152 ±0.011)%

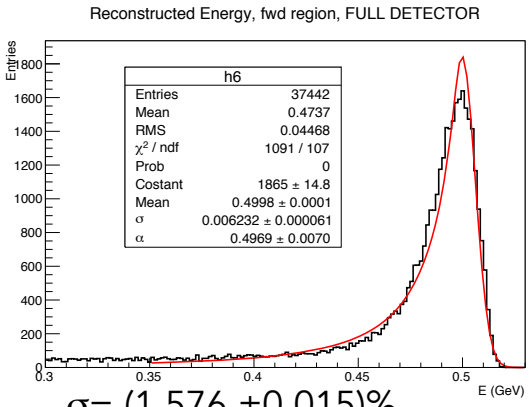
BP_PXD_SVD_CDC _ECL_BKLM_EKLM



σ= (1.557 ±0.017)%

σ_{gauss} = (1.091 ±0.011)%

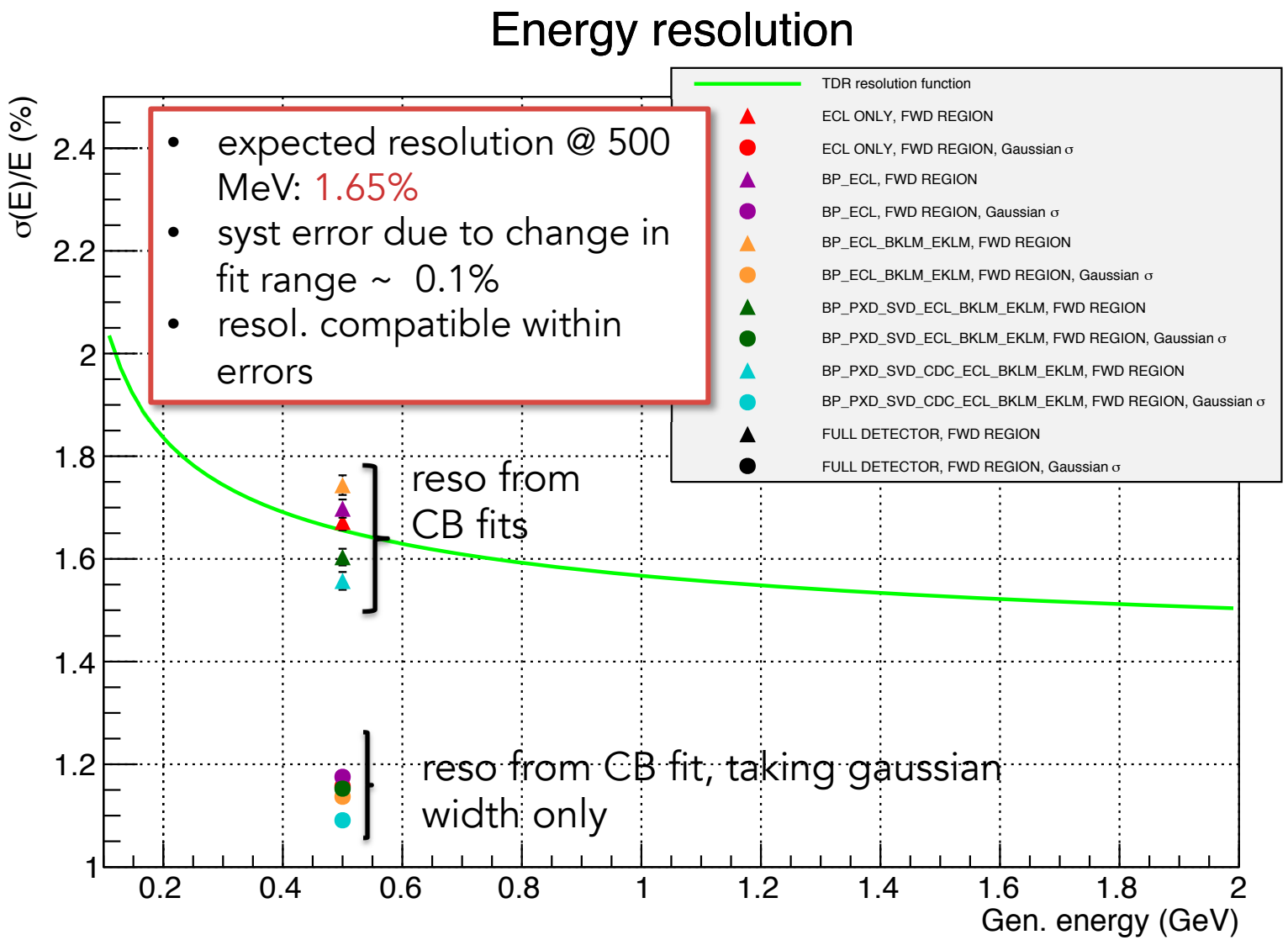
FULL_DETECTOR



σ= (1.576 ±0.015)%

σ_{gauss} = (1.247 ±0.012)%

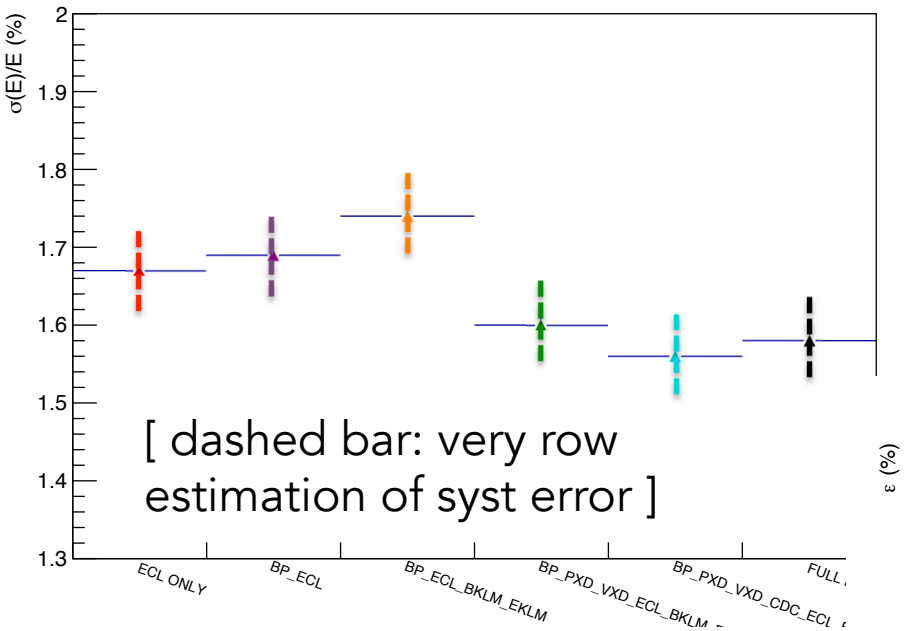
Resolutions



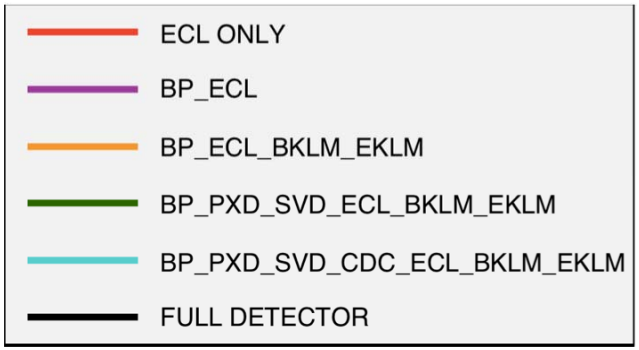
- expected resolution @ 500 MeV: 1.65%
- syst error due to change in fit range ~ 0.1%
- resol. compatible within errors

Resolution and efficieny summary

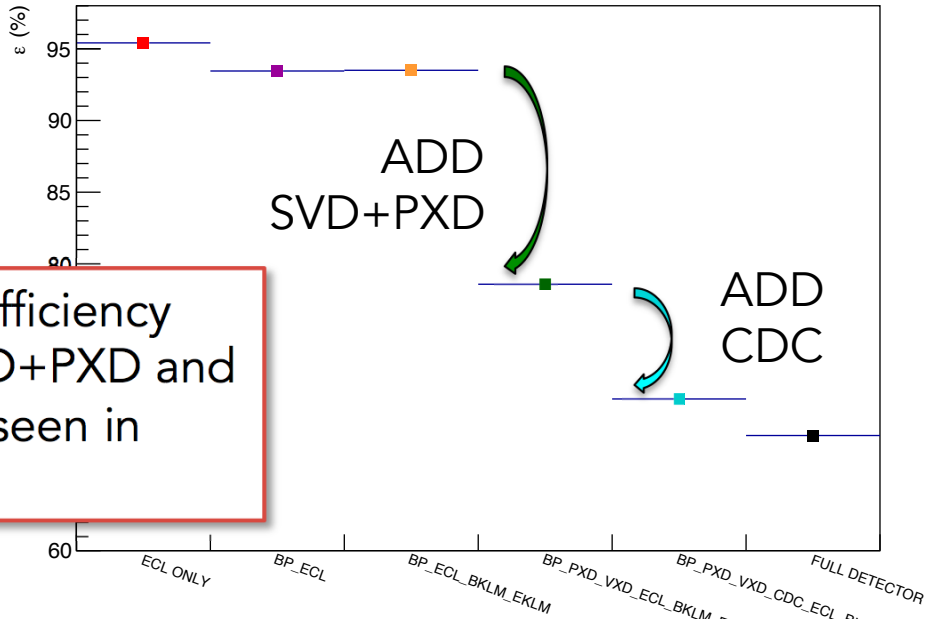
Resolution from CB fit



[dashed bar: very row estimation of syst error]

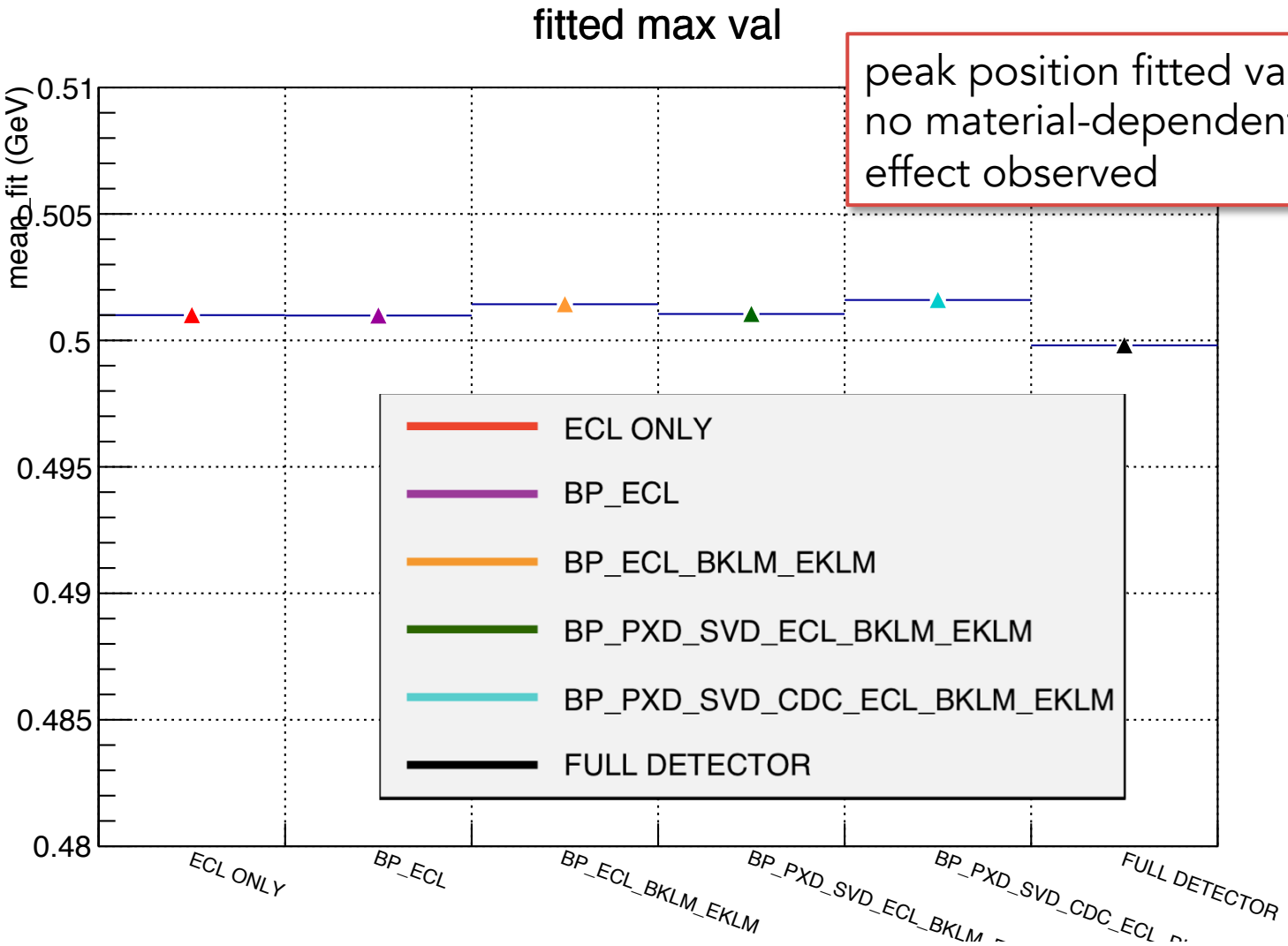


Efficiency (0.4-0.53 MeV range)



larger effect on efficiency when adding SVD+PXD and CDC (as already seen in previous studies)

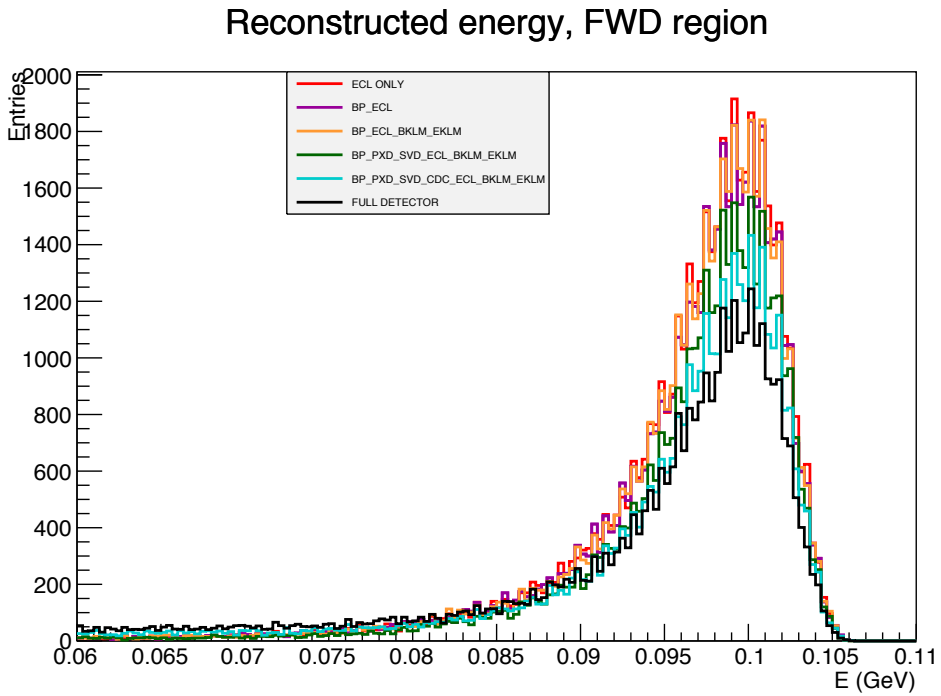
Peak position

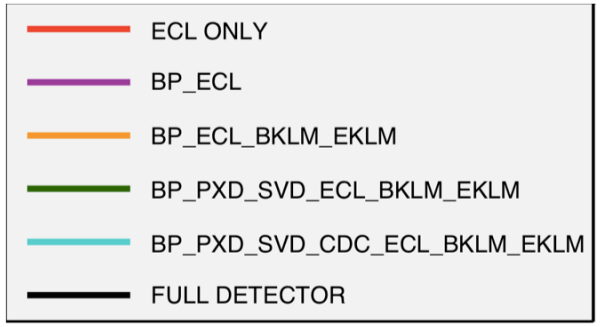


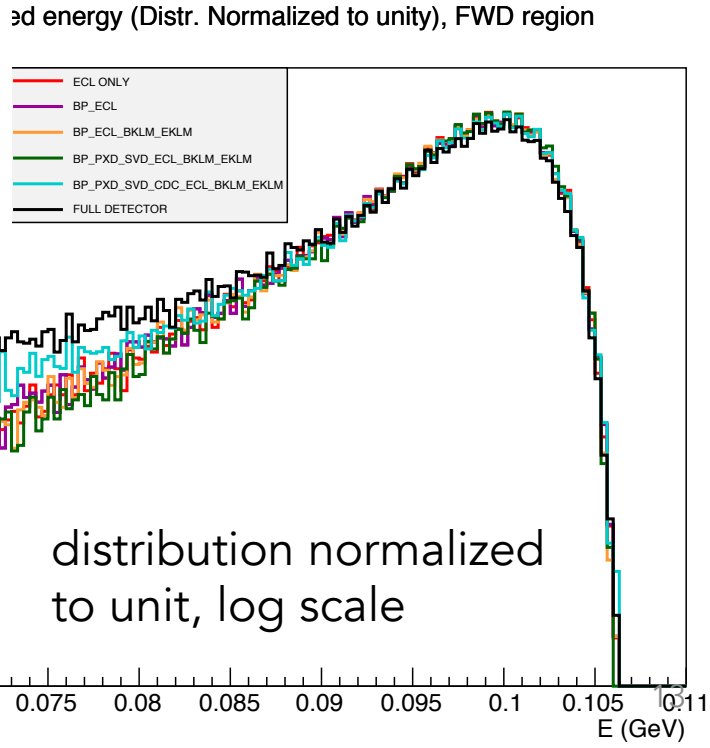
peak position fitted value, no material-dependent effect observed

100 MEV

Reco'd energy distribution





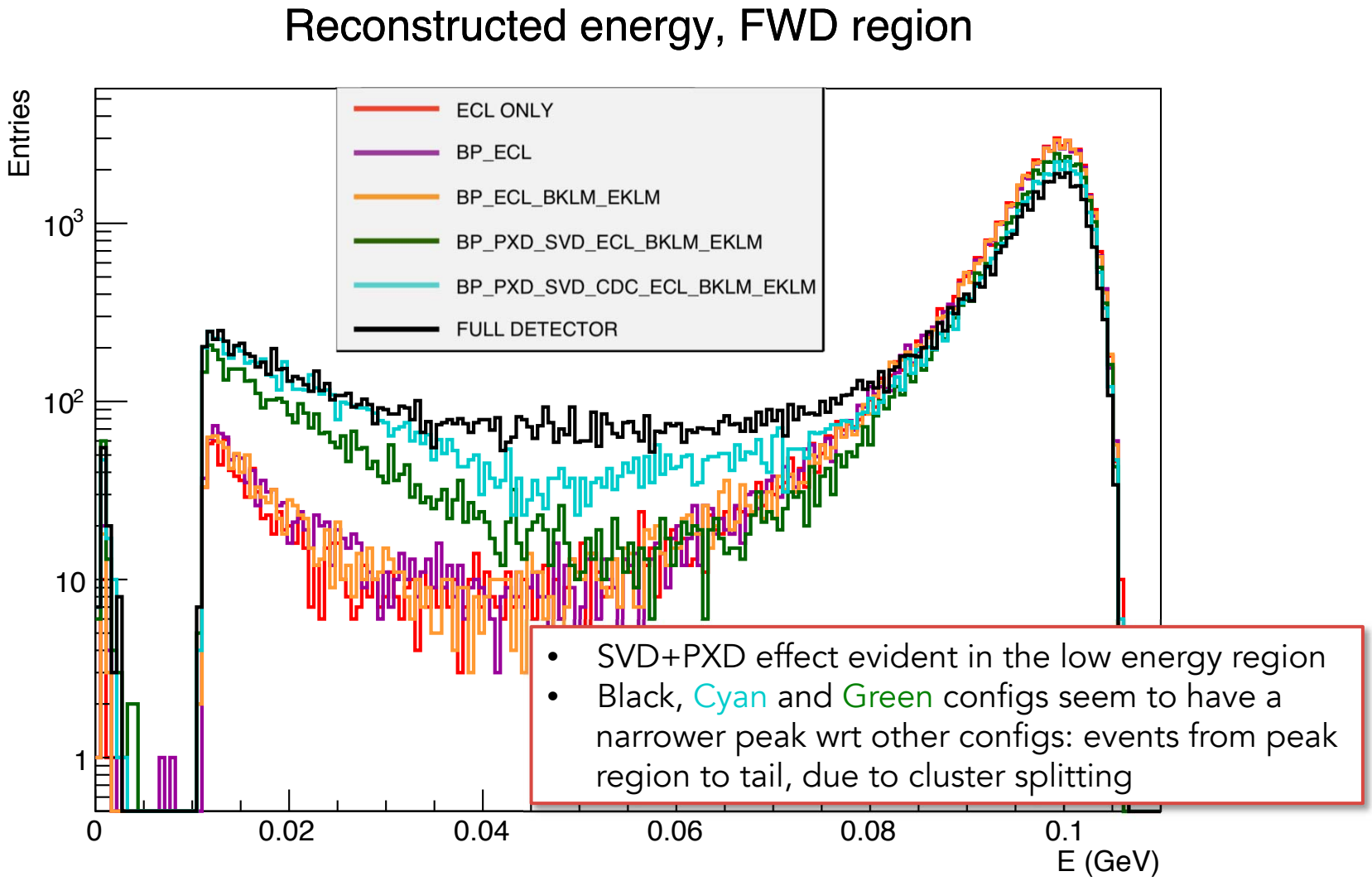


ADD CDC

distribution normalized to unit, log scale

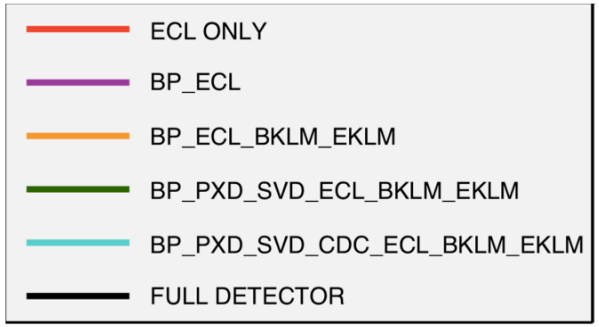
In the fit region, largest effects when adding CDC, SVD+PXD doesn't seem to have a big effect here

Reco'd energy distribution (II)

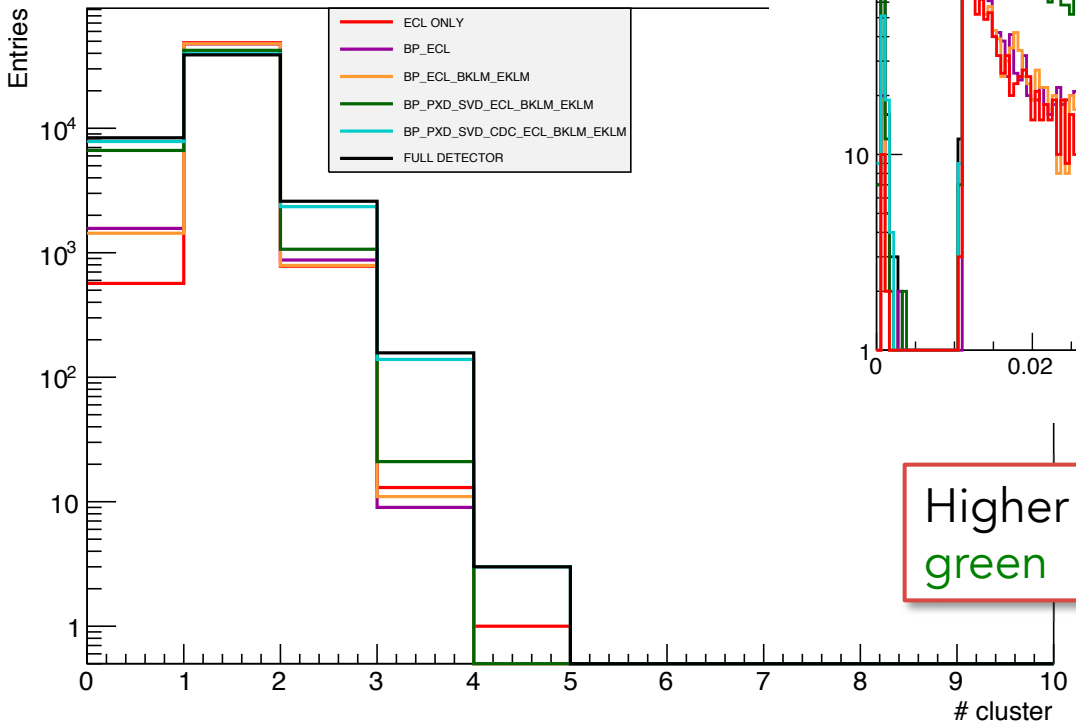


- SVD+PXD effect evident in the low energy region
- Black, Cyan and Green configs seem to have a narrower peak wrt other configs: events from peak region to tail, due to cluster splitting

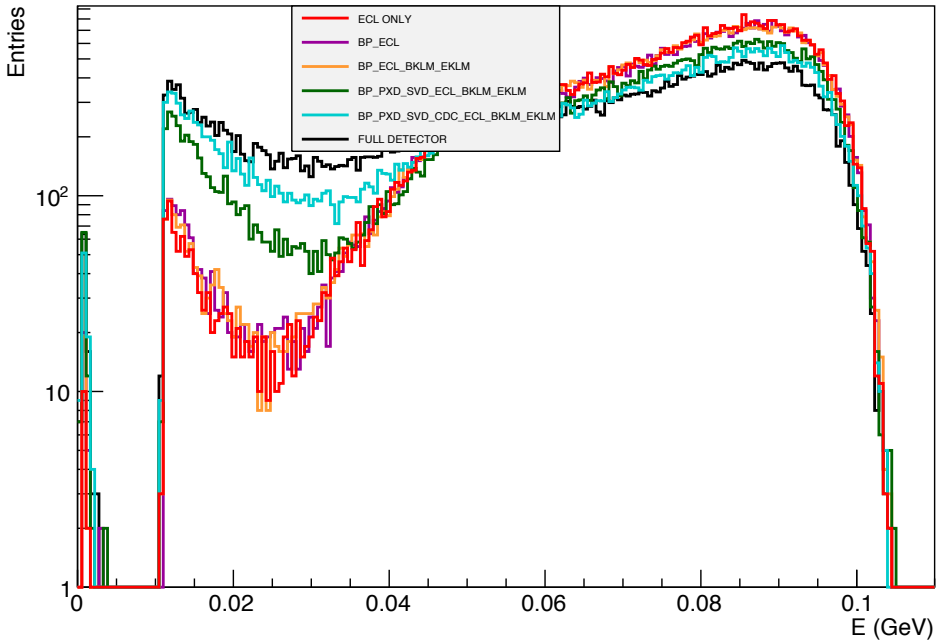
Multiplicity and Max energy deposit



Multiplicity, FWD regior



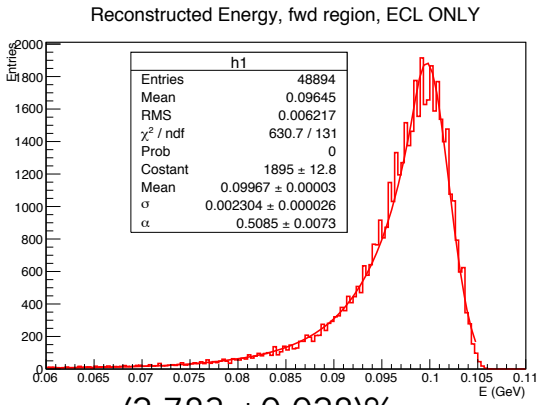
Highest energy deposit, FWD region



Higher multip for black, cyan and green

CB fits

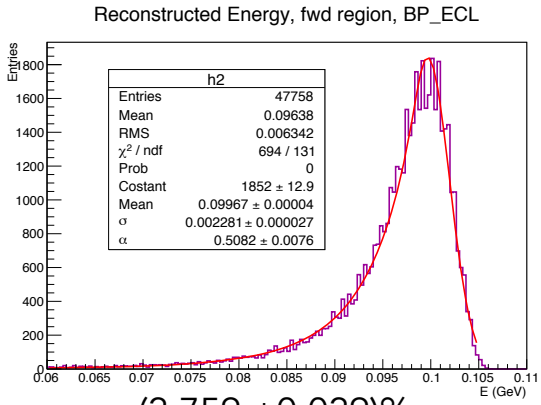
ECL ONLY



σ= (2.783 ±0.028)%

σ_{gauss} = (2.311 ±0.026)%

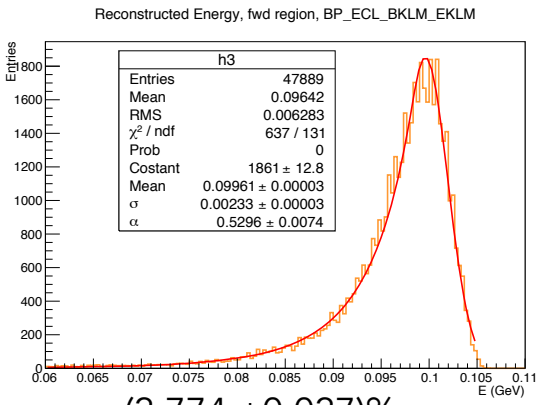
BP_ECL



σ= (2.759 ±0.029)%

σ_{gauss} = (2.288 ±0.027)%

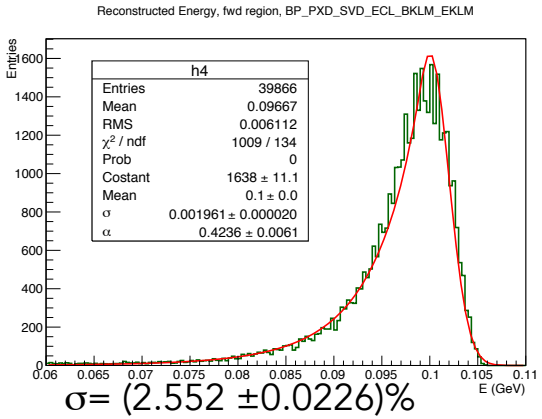
BP_ECL_BKLM_EKLM



σ= (2.774 ±0.027)%

σ_{gauss} = (2.339 ±0.026)%

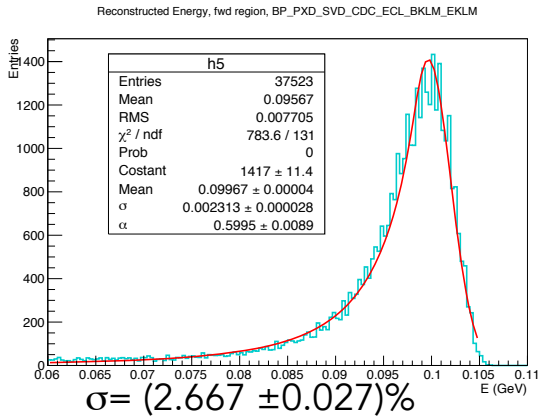
BP_PXD_SVD_ECL _BKLM_EKLM



σ= (2.552 ±0.0226)%

σ_{gauss} = (1.961 ±0.020)%

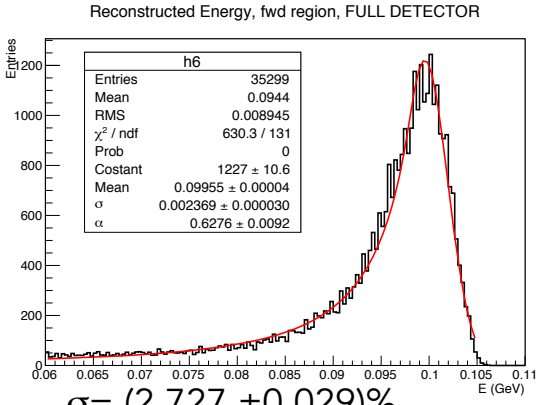
BP_PXD_SVD_CDC _ECL_BKLM_EKLM



σ= (2.667 ±0.027)%

σ_{gauss} = (2.321 ±0.028)%

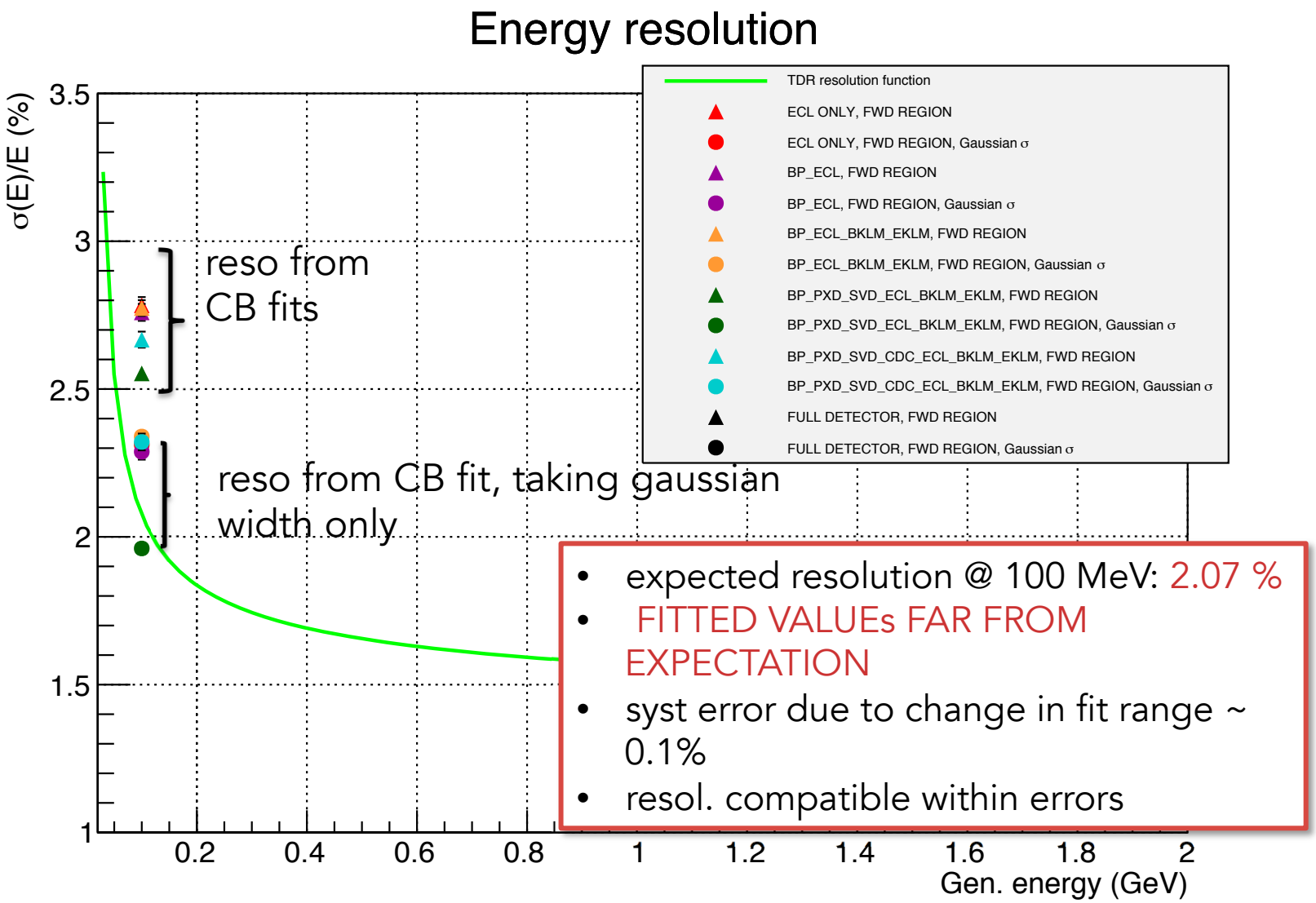
FULL_DETECTOR



σ= (2.727 ±0.029)%

σ_{gauss} = (2.379 ±0.031)%

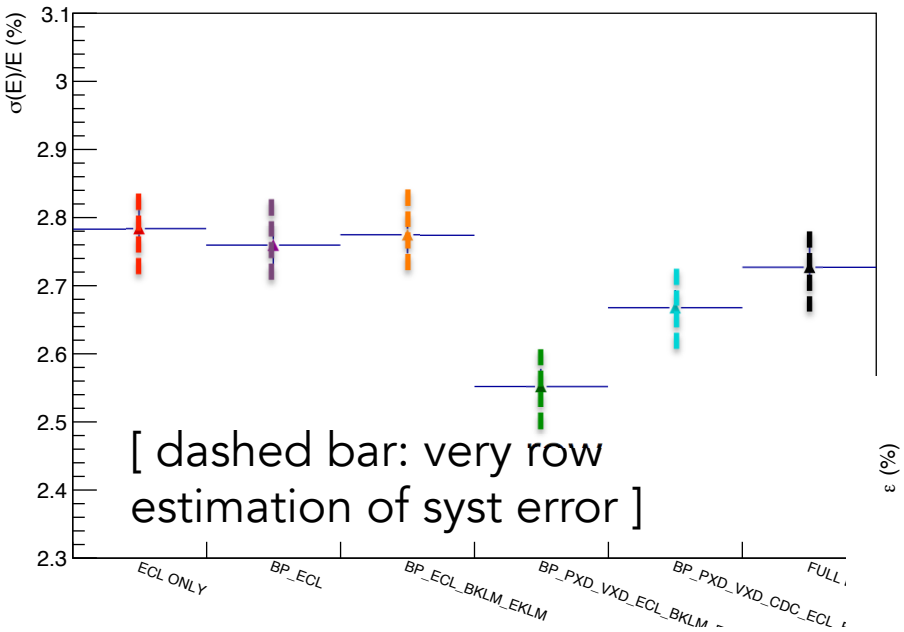
Resolutions

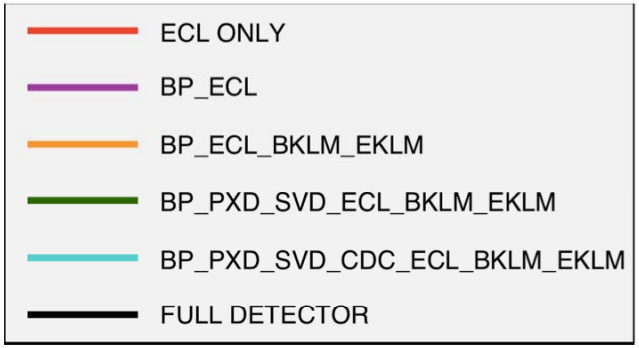


- expected resolution @ 100 MeV: 2.07 %
- FITTED VALUEs FAR FROM EXPECTATION
- syst error due to change in fit range ~ 0.1%
- resol. compatible within errors

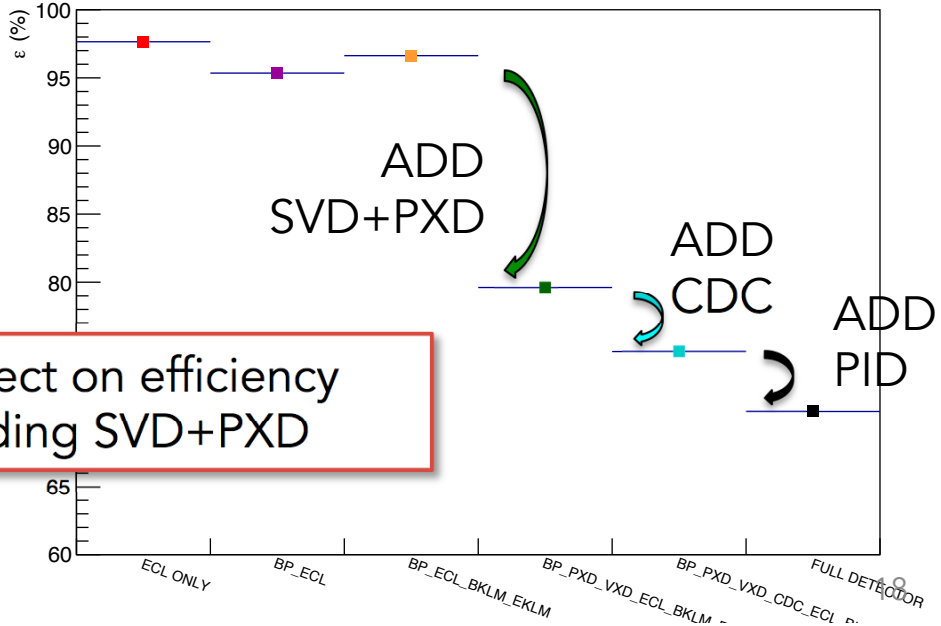
Resolution and efficiency summary

Resolution from CB fit



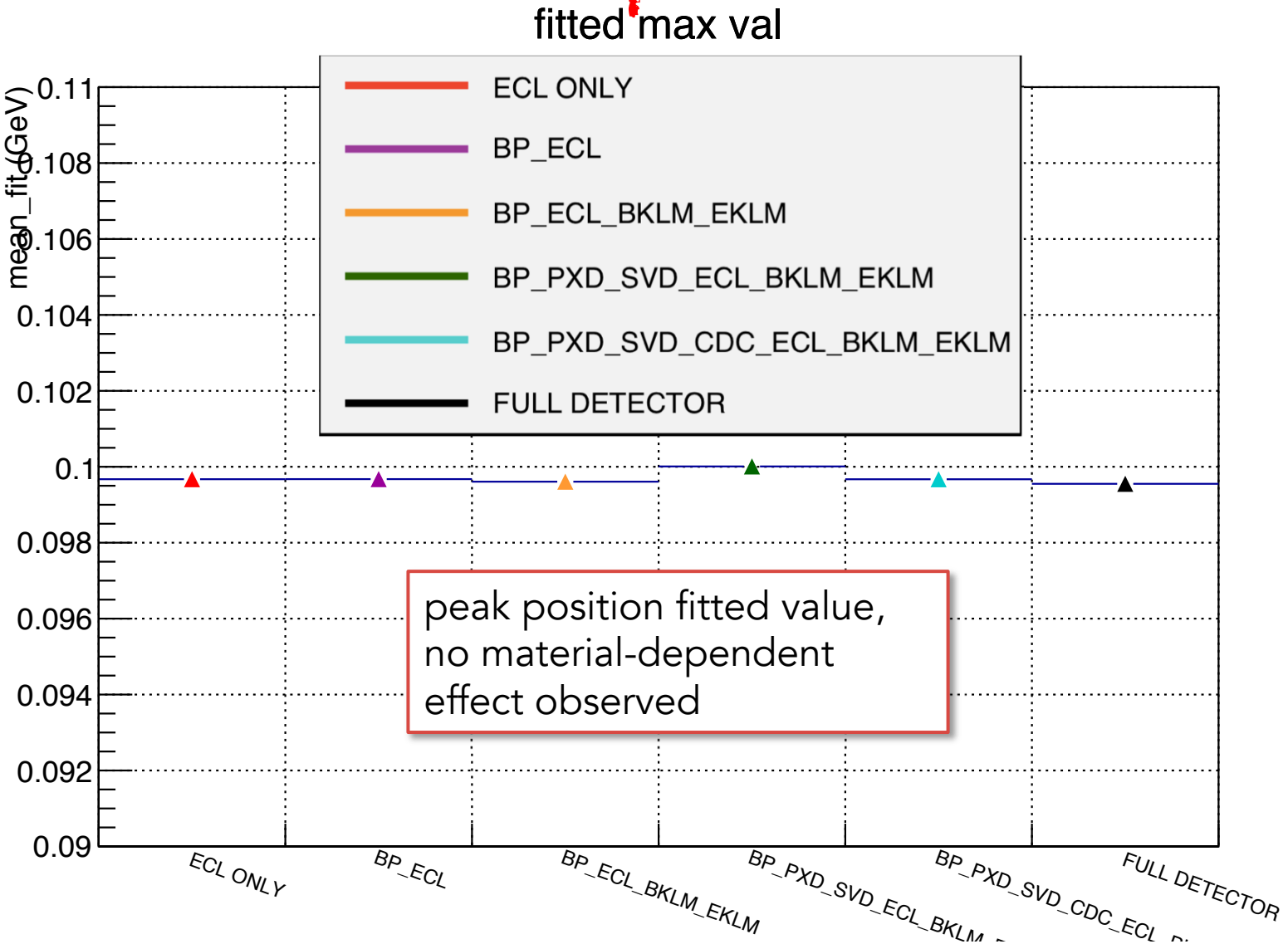


Efficiency (0.06-0.105 MeV range)



larger effect on efficiency when adding SVD+PXD

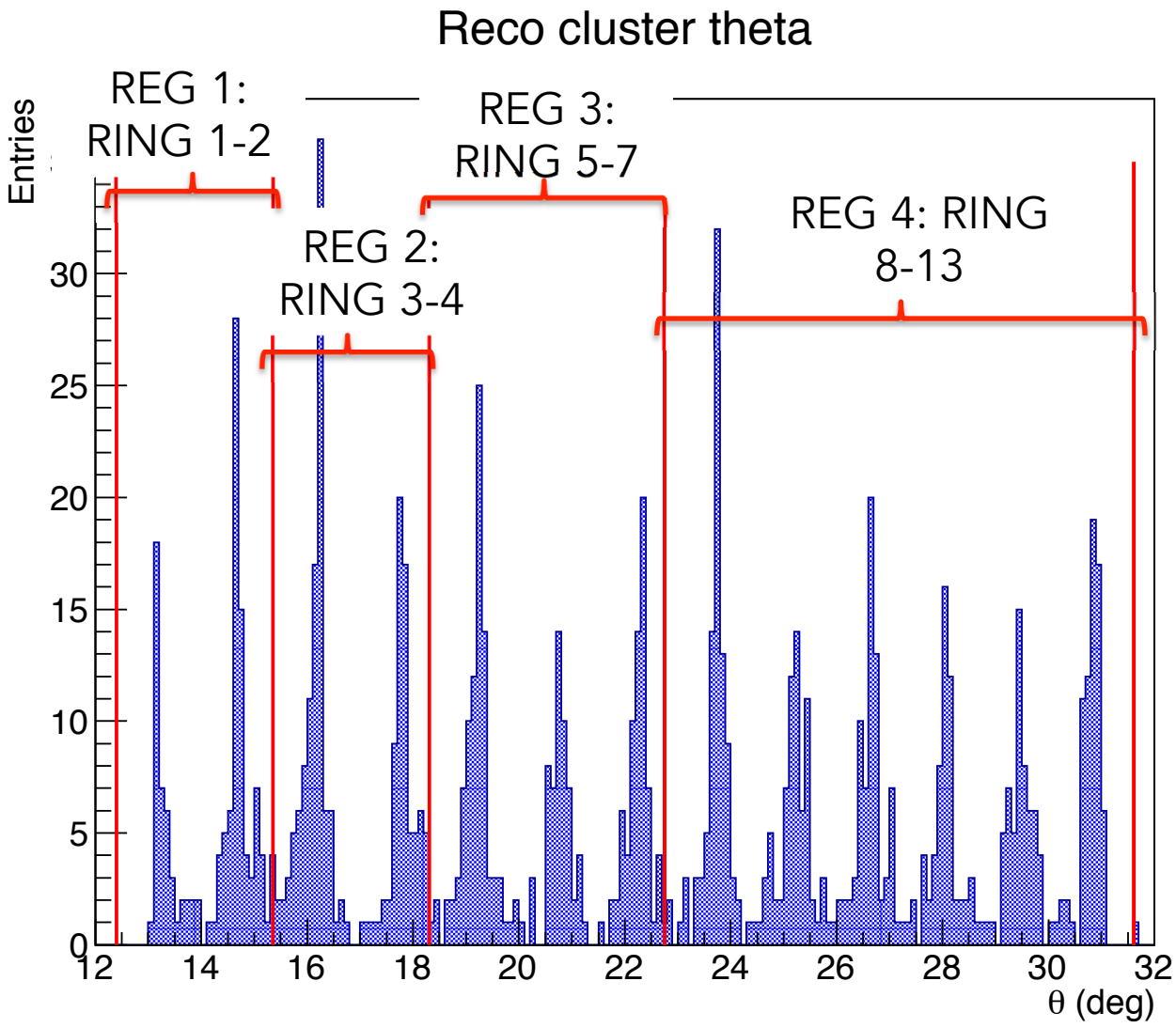
Peak position

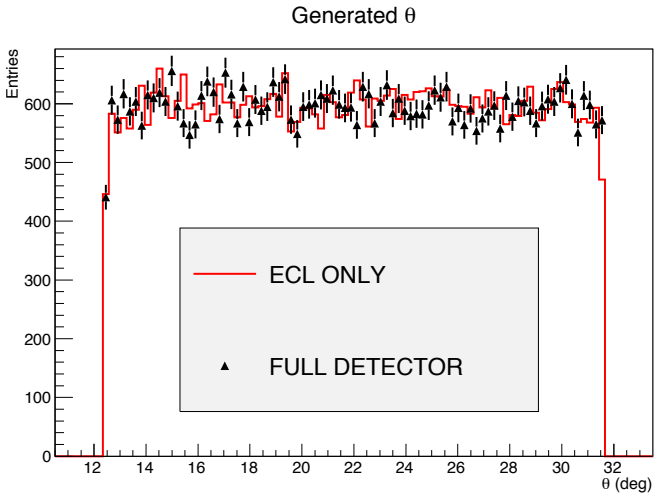


peak position fitted value, no material-dependent effect observed

DIVIDING FWD ECL IN SLICES

SELECTED SUB-REGIONS

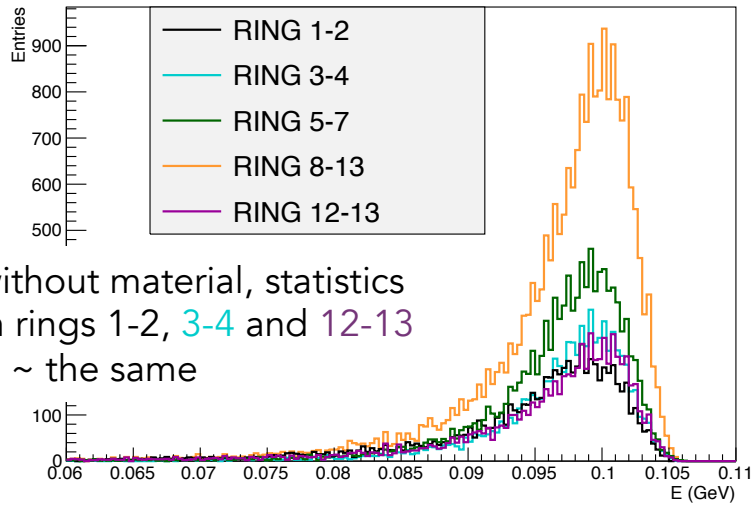




- events generated with 'thetaParams': [12.398°, 31.62°] with uniform distribution

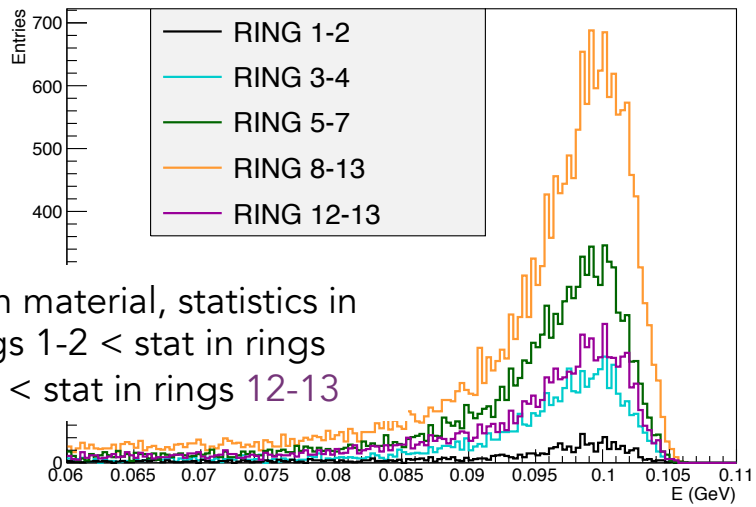
100 MeV (I)

ECL ONLY, Reconstructed Energy



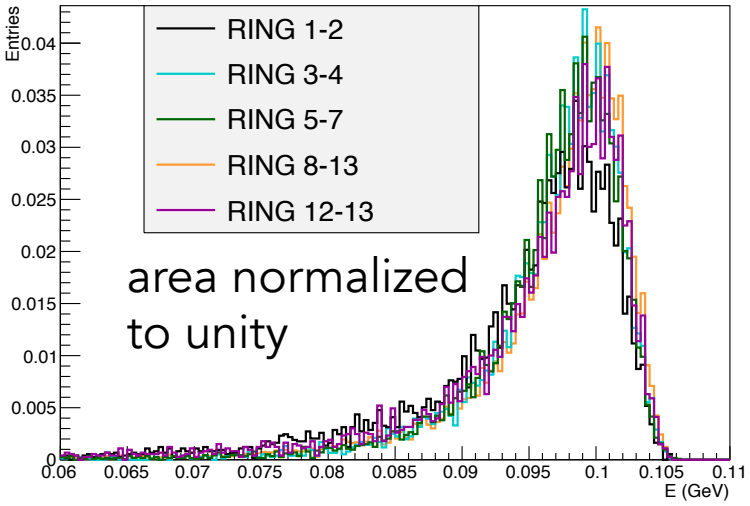
without material, statistics in rings 1-2, 3-4 and 12-13 is ~ the same

FULL DETECTOR, Reconstructed Energy



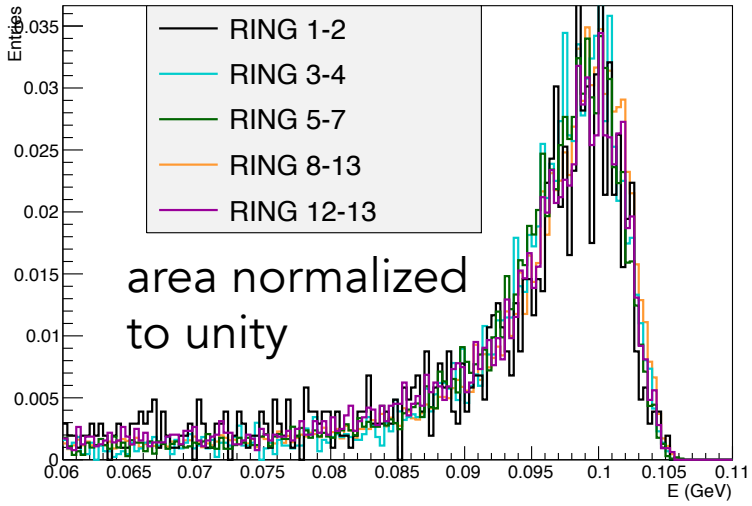
with material, statistics in rings 1-2 < stat in rings 3-4 < stat in rings 12-13

ECL ONLY, Reconstructed Energy



area normalized to unity

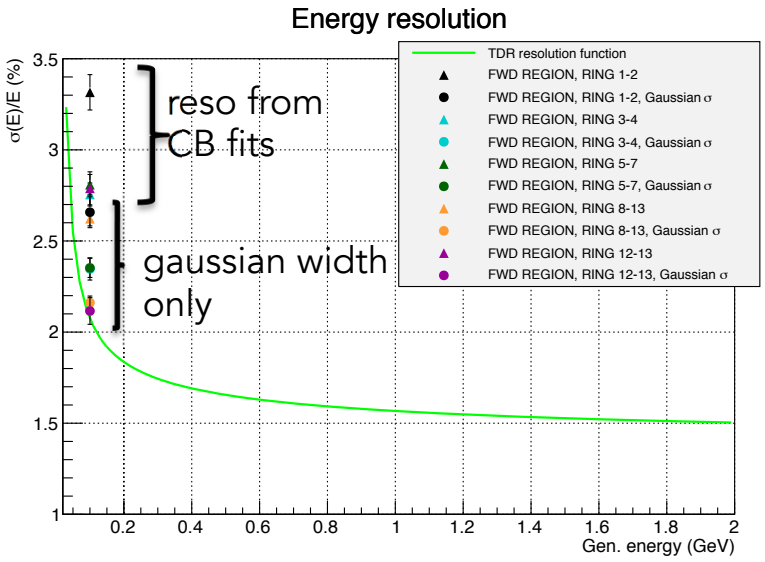
FULL DETECTOR, Reconstructed Energy



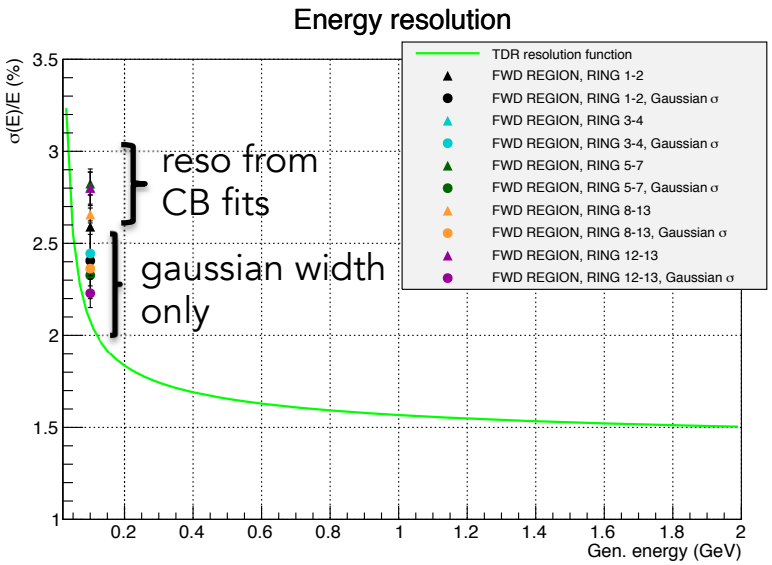
area normalized to unity

100 MeV (II)

- ECL ONLY



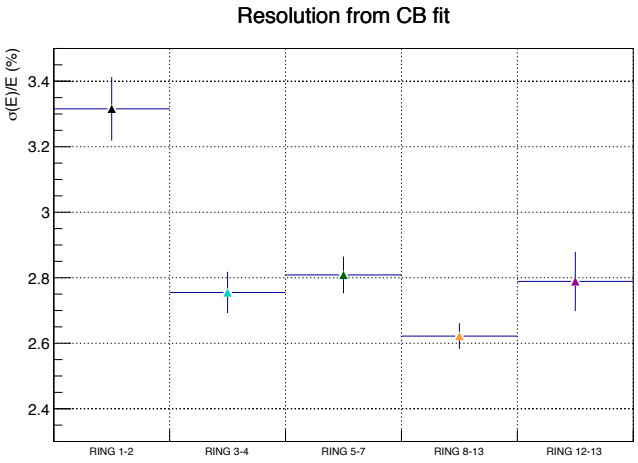
- FULL DETECTOR

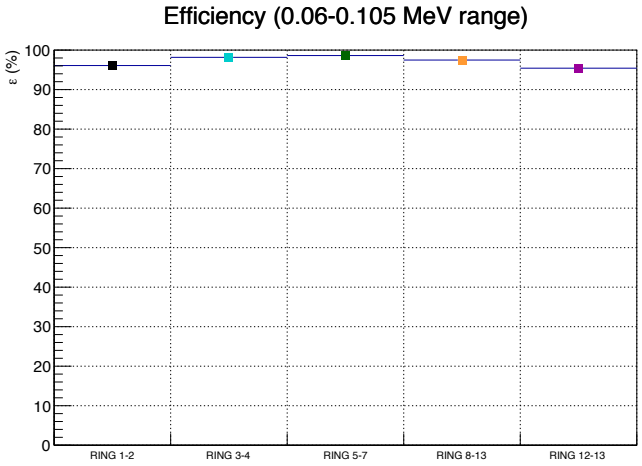


- resolution in ring 1-2, worse than in other regions
- fitted reso values far from expectation

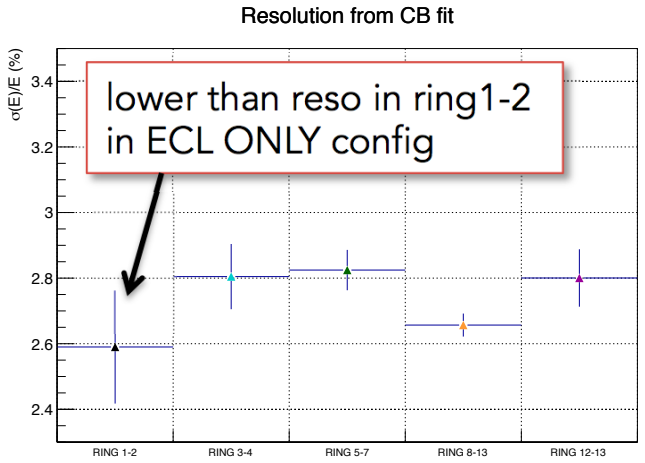
100 MeV (III)

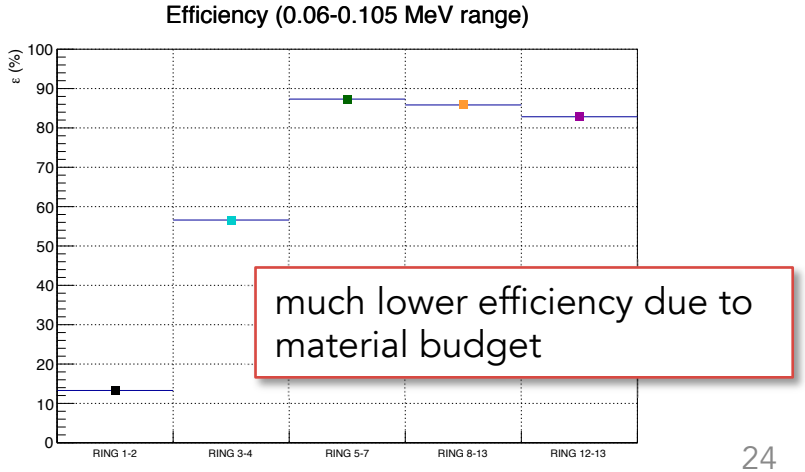
- ECL ONLY





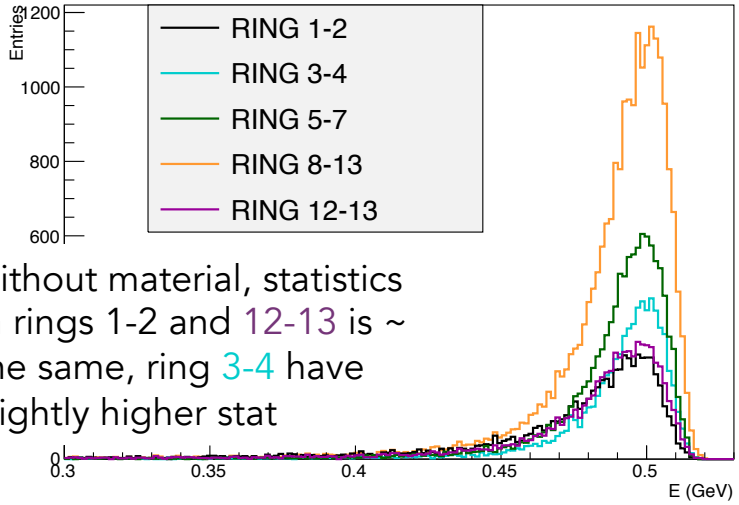
- FULL DETECTOR





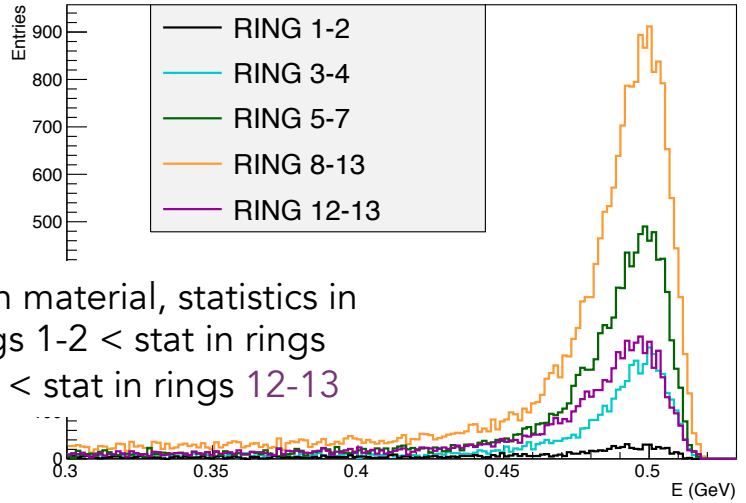
500 MeV (I)

ECL ONLY, Reconstructed Energy



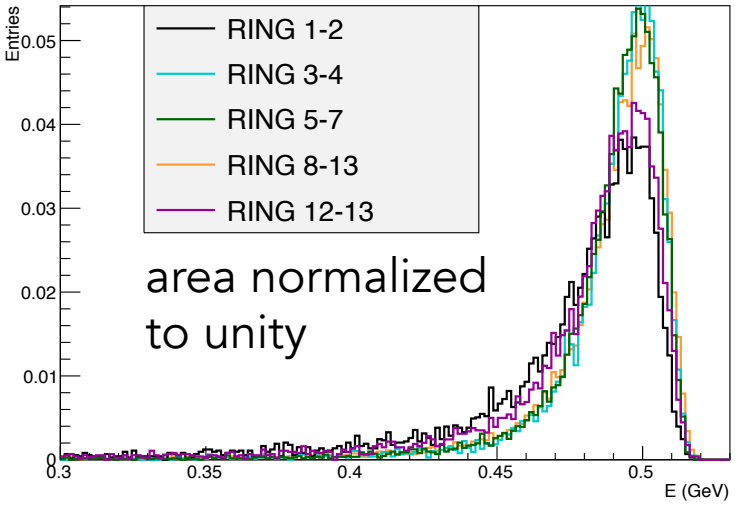
without material, statistics in rings 1-2 and 12-13 is ~ the same, ring 3-4 have slightly higher stat

FULL DETECTOR, Reconstructed Energy

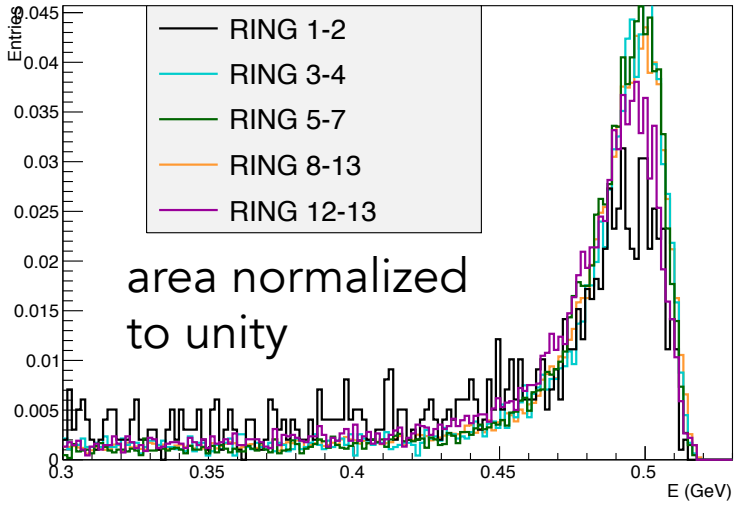


with material, statistics in rings 1-2 < stat in rings 3-4 < stat in rings 12-13

ECL ONLY, Reconstructed Energy

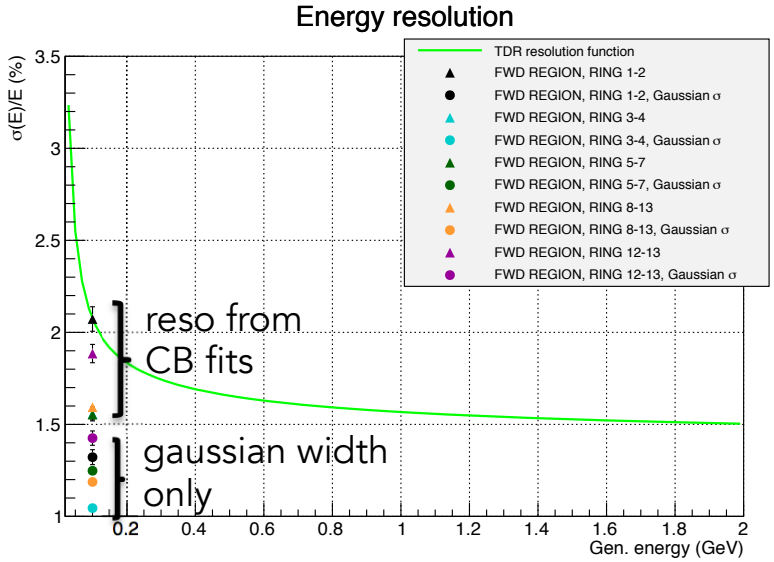


FULL DETECTOR, Reconstructed Energy

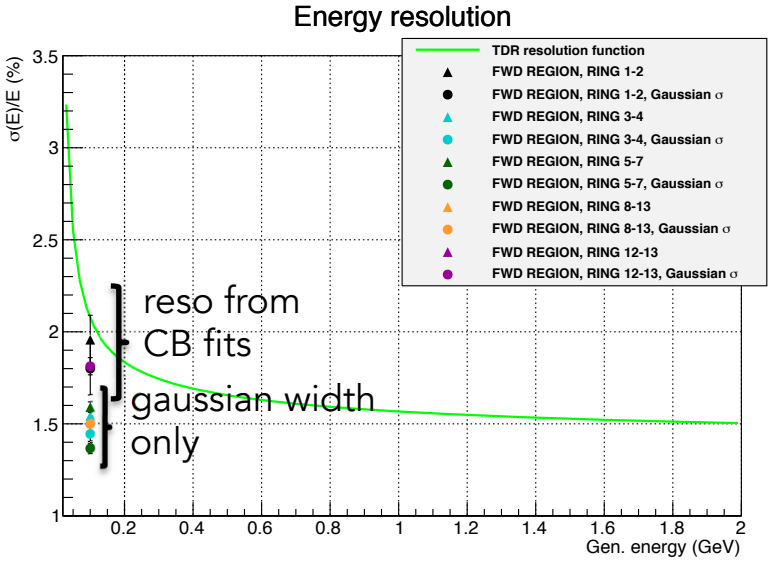


500 MeV (II)

- ECL ONLY



- FULL DETECTOR

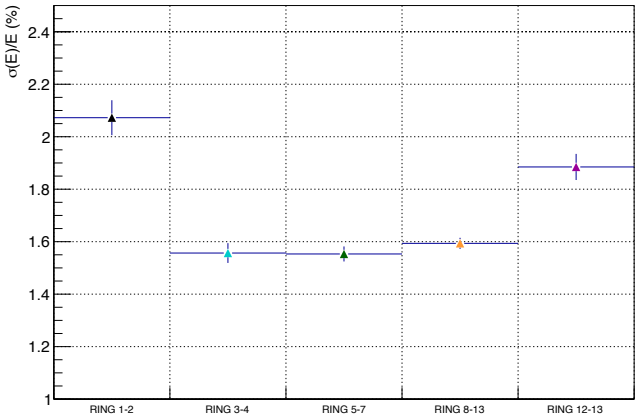


- resolution in ring 1-2, worse than in other regions
- fitted reso values ~ expectation

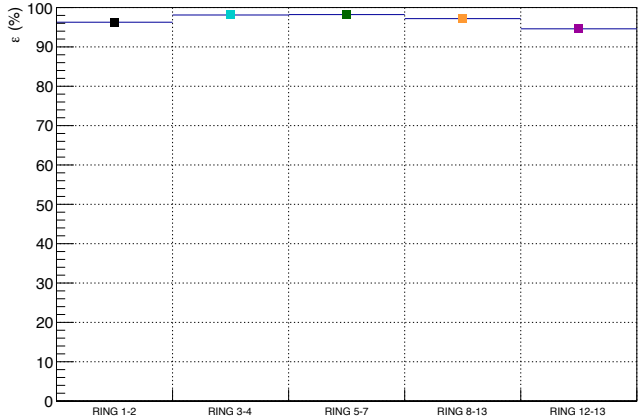
500 MeV (III)

- ECL ONLY

Resolution from CB fit

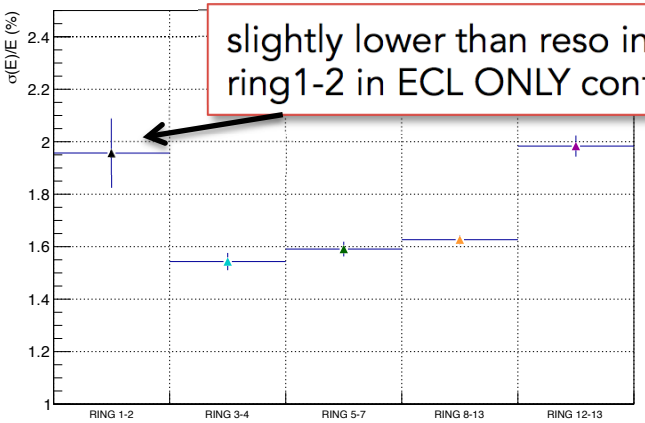


Efficiency (0.06-0.105 MeV range)



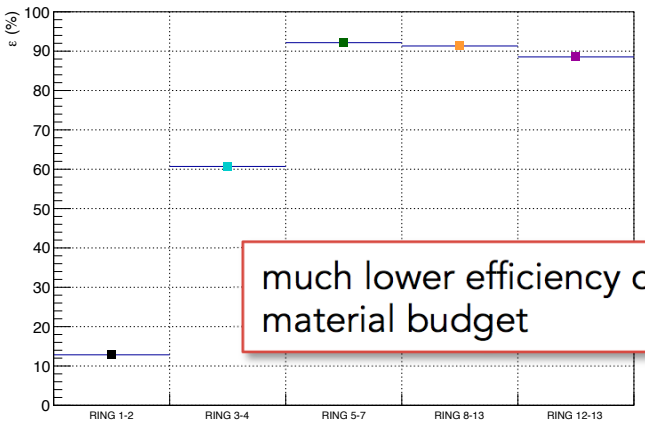
- FULL DETECTOR

Resolution from CB fit



slightly lower than reso in ring1-2 in ECL ONLY config

Efficiency (0.06-0.105 MeV range)



much lower efficiency due to material budget

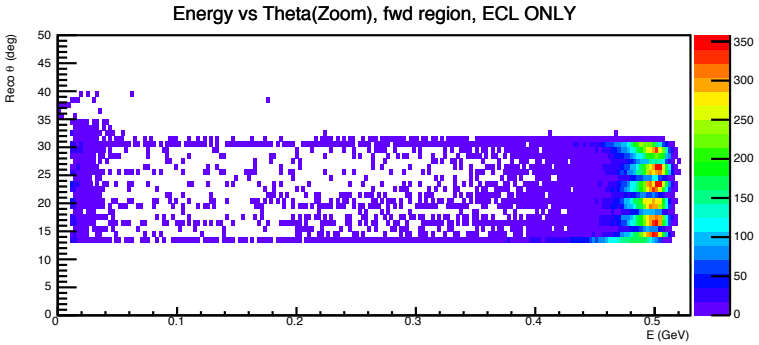
Conclusions

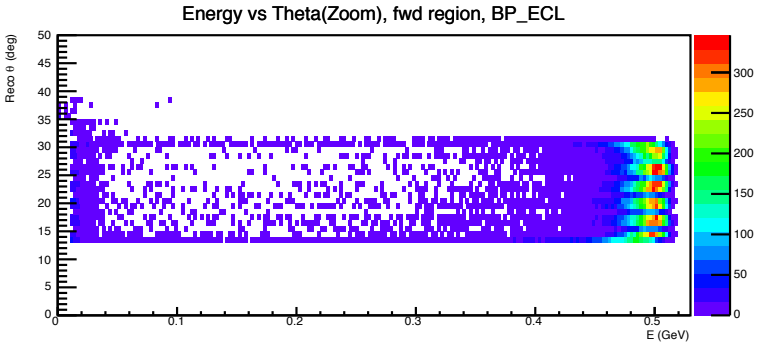
- Negligible material budget effect on resolution
  - adding SVD+PXD, CDC and PID cause cluster splitting
  - narrower energy distribution, lower efficiency in fit region
  - major effect in efficiency due to SCV+CDC
  - @ 500 MeV: fitted resol. compatible with expected
  - @ 100 MeV: fitted resol. FAR with expected

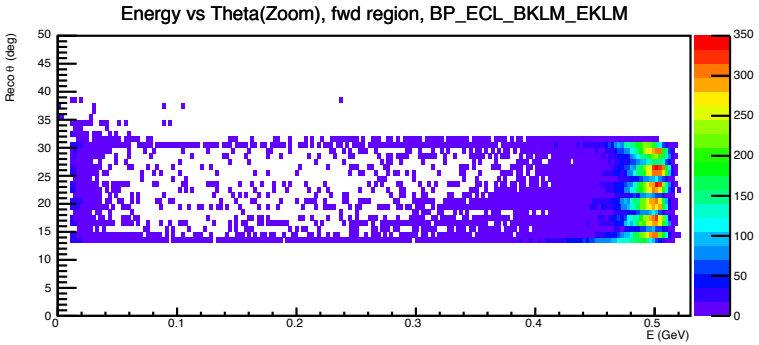
- Dividing FWD in slices:
  - @ 100 MeV: no difference between FWD ECL regions in terms on resolution (much lower efficiency in RING1-2)
  - @ 500 MeV: much worst resolution in RING1-2, also in ECL_ONLY config (much lower efficiency in RING1-2)

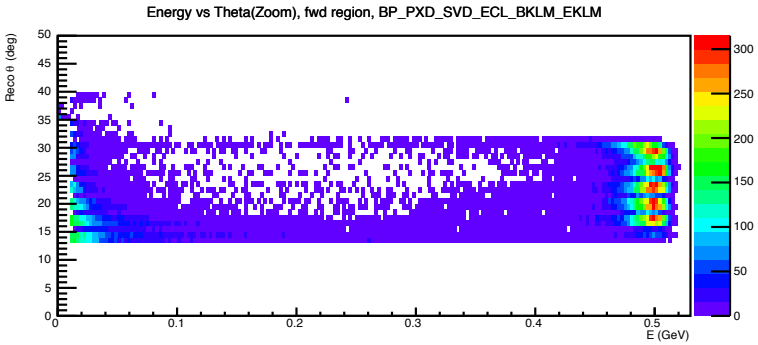
EXTRA-SLIDES

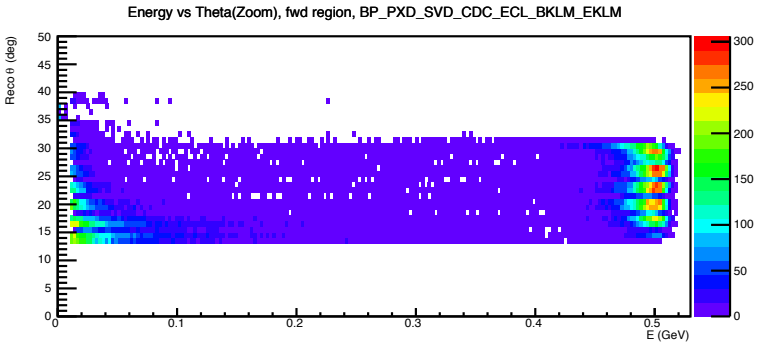
500 MeV: reco'd energy vs reco'd theta

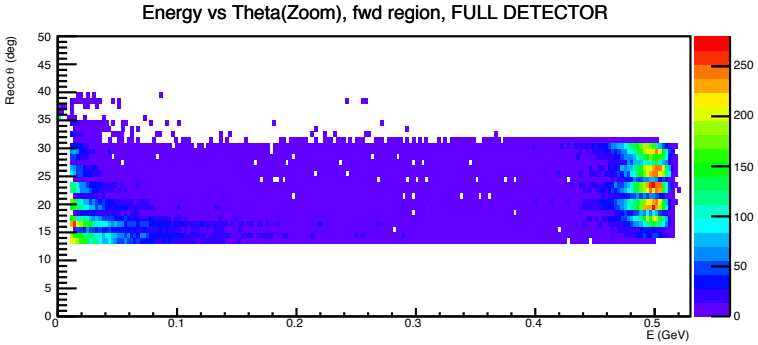




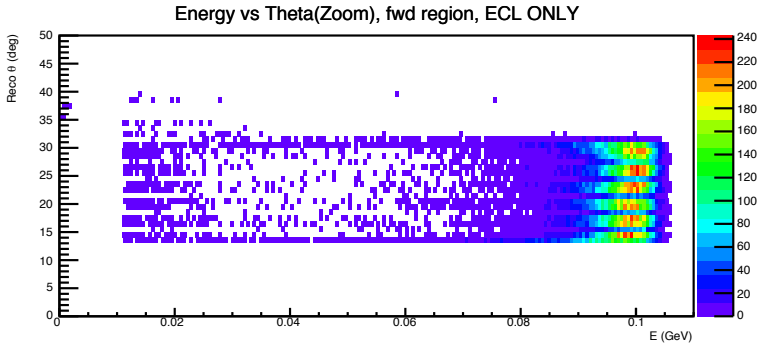


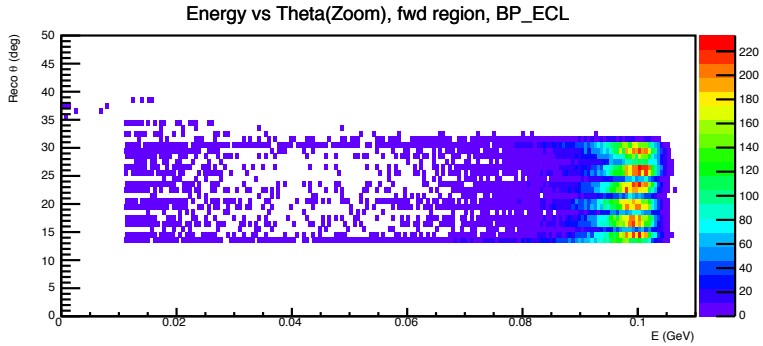


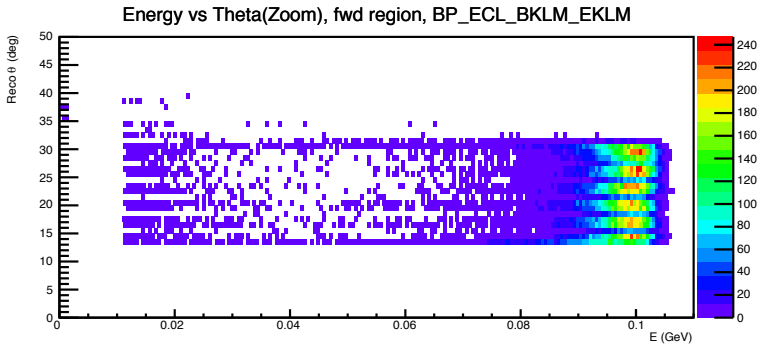


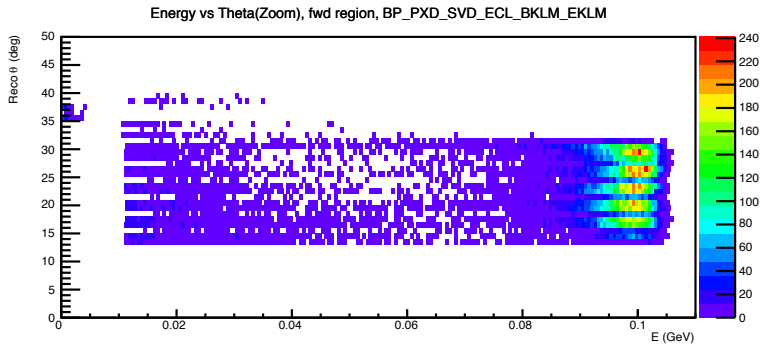


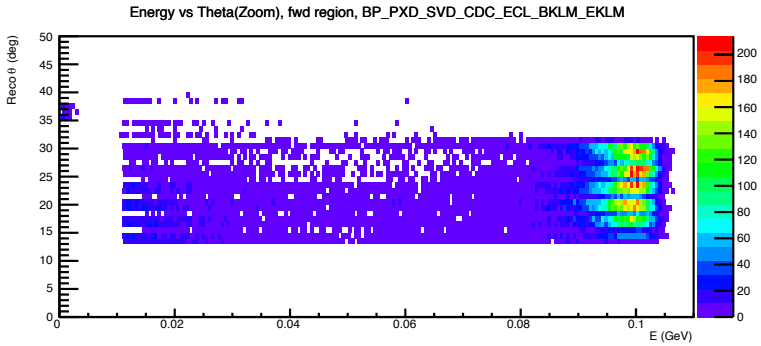
100 MeV: reco'd energy vs reco'd theta

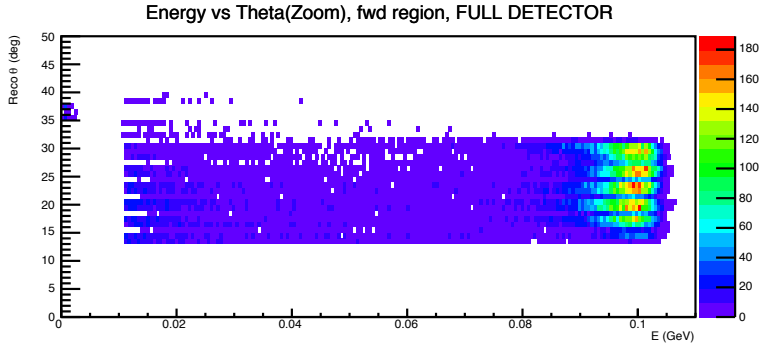






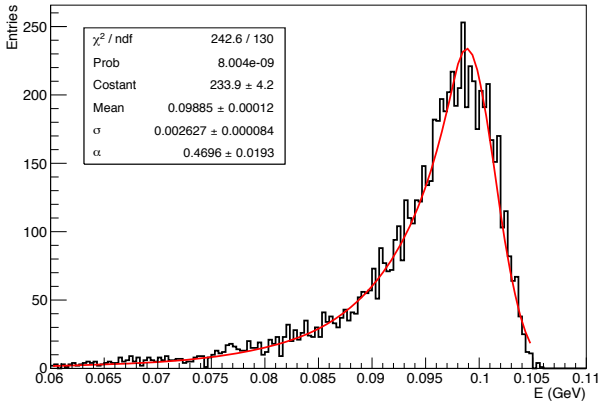




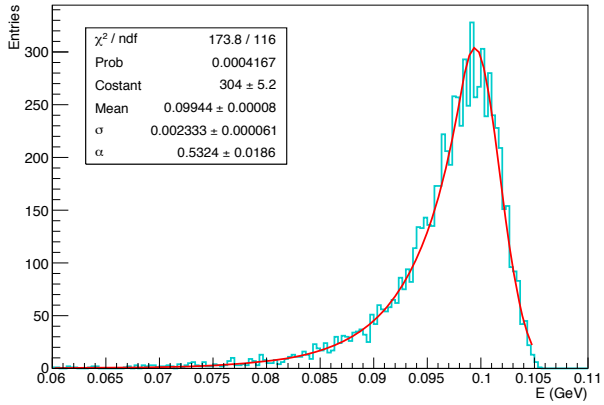


100 MeV, ECL ONLY

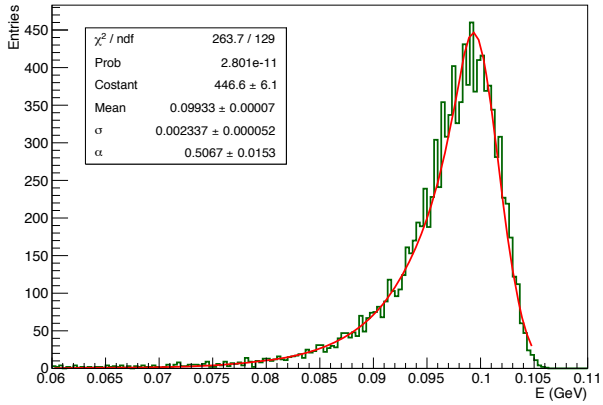
ECL ONLY, Reconstructed Energy, RING 1-2



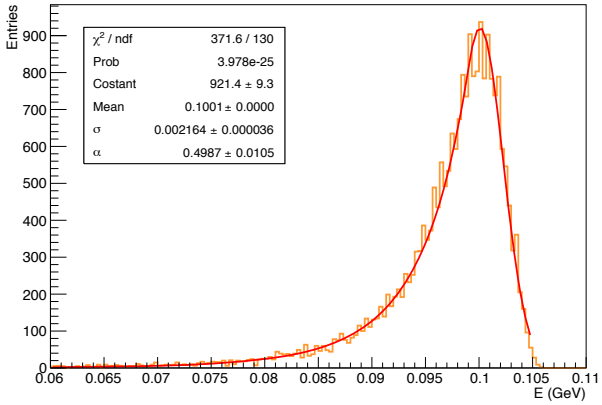
ECL ONLY, Reconstructed Energy, RING 3-4



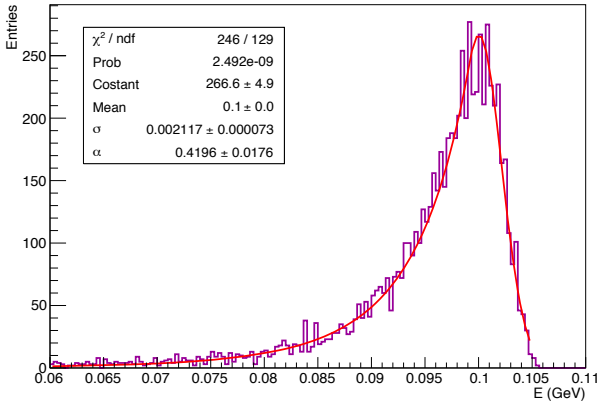
ECL ONLY, Reconstructed Energy, RING 5-7



ECL ONLY, Reconstructed Energy, RING 8-13

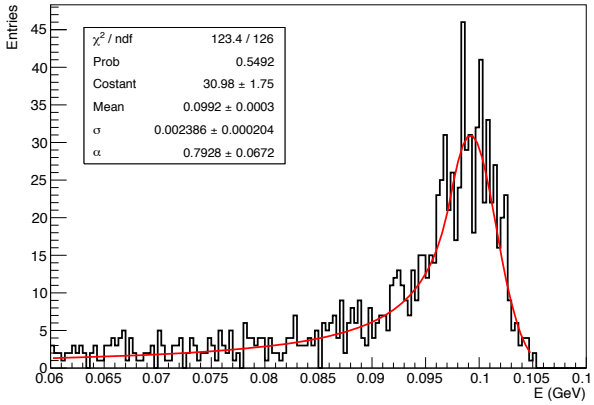


ECL ONLY, Reconstructed Energy, RING 12-13

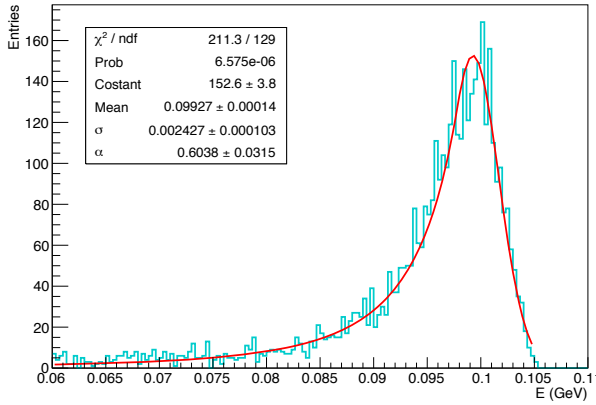


100 MeV, FULL DETECTOR

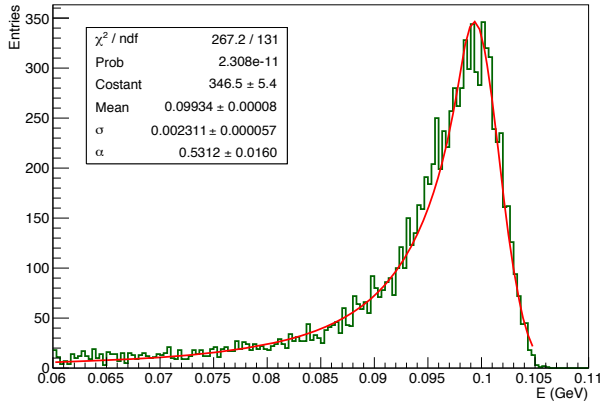
FULL DETECTOR, Reconstructed Energy, RING 1-2



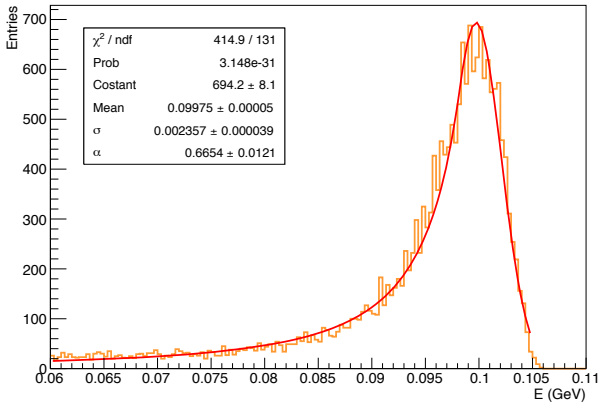
FULL DETECTOR, Reconstructed Energy, RING 3-4



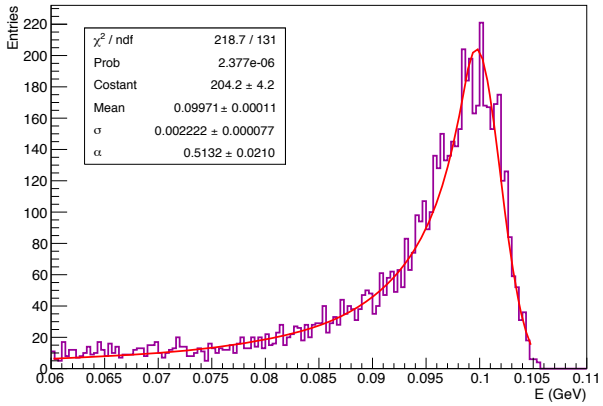
FULL DETECTOR, Reconstructed Energy, RING 5-7



FULL DETECTOR, Reconstructed Energy, RING 8-13

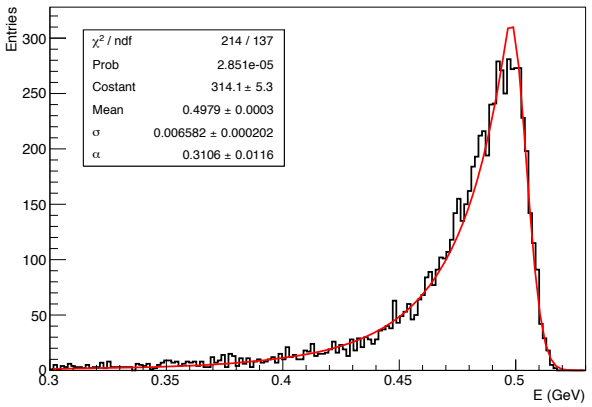


FULL DETECTOR, Reconstructed Energy, RING 12-13

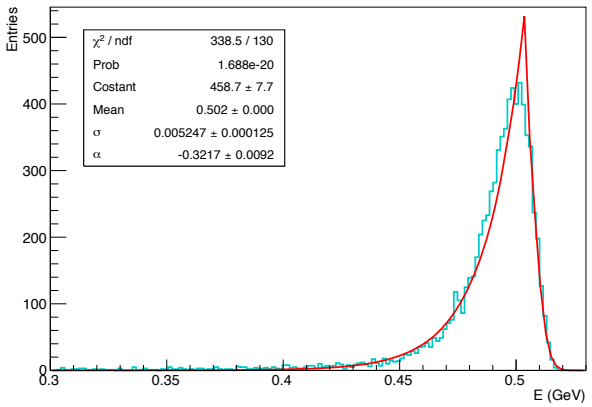


500 MeV, ECL ONLY

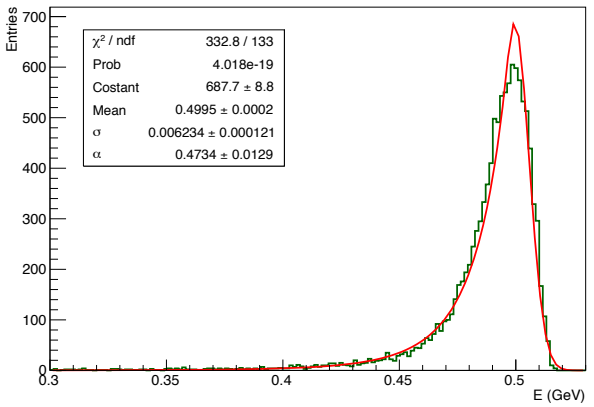
ECL ONLY, Reconstructed Energy, RING 1-2



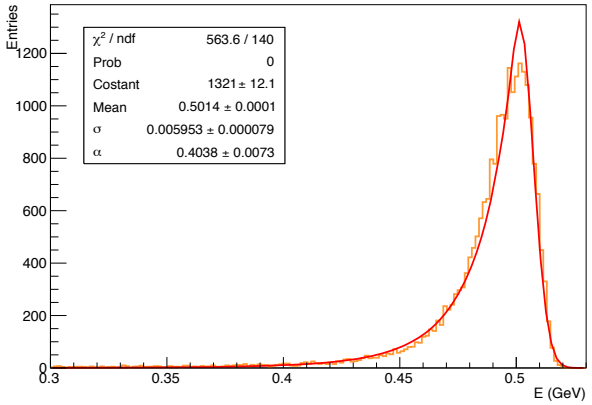
ECL ONLY, Reconstructed Energy, RING 3-4



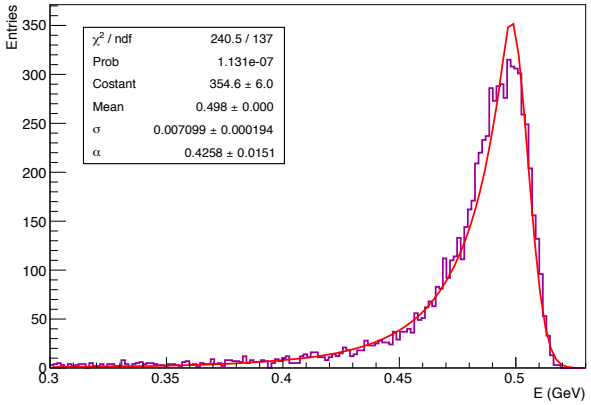
ECL ONLY, Reconstructed Energy, RING 5-7



ECL ONLY, Reconstructed Energy, RING 8-13

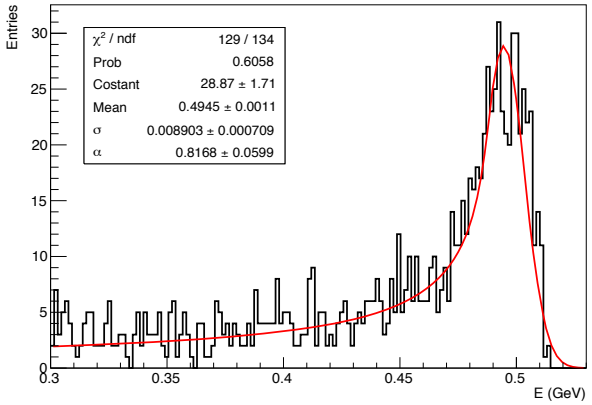


ECL ONLY, Reconstructed Energy, RING 12-13

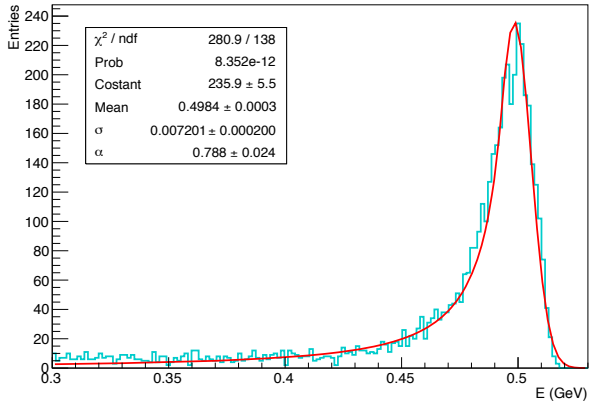


500 MeV, FULL DETECTOR

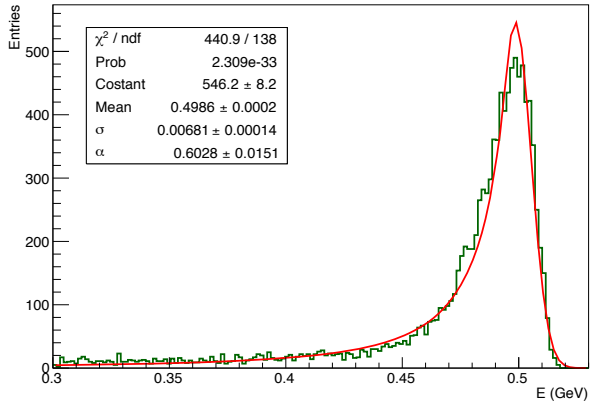
FULL DETECTOR, Reconstructed Energy, RING 1-2



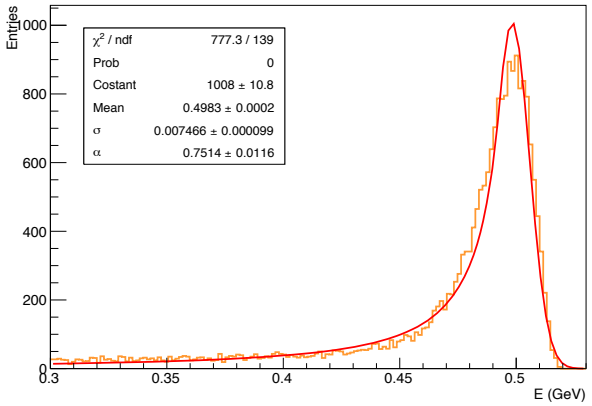
FULL DETECTOR, Reconstructed Energy, RING 3-4



FULL DETECTOR, Reconstructed Energy, RING 5-7



FULL DETECTOR, Reconstructed Energy, RING 8-13



FULL DETECTOR, Reconstructed Energy, RING 12-13