Electron reco in the backward EMCal: effect of the material on the way

A.Bazilevsky

ePIC Calorimetry Meeting

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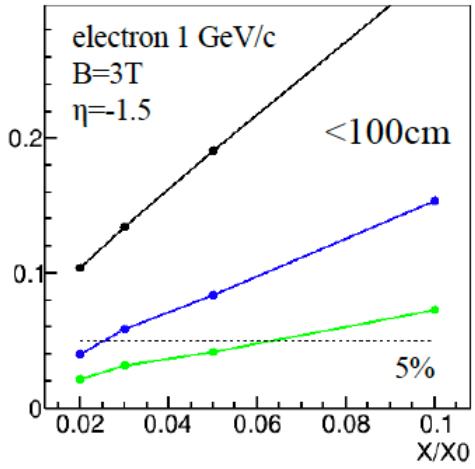
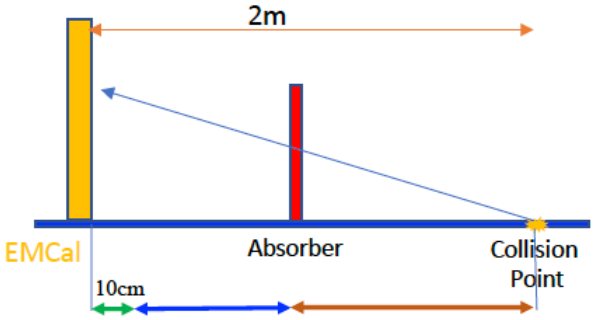
A few year ago conclusion

Effect of material on the way

The most extreme case:
Highest Bdl, lowest *e* momentum, close to coll. point

Efficiency loss (with 2σ cut) vs X/X_0





<50%X_0	<20%X_0	<(3-6)%X_0	Electron > 1GeV
<30%X_0	<10%X_0	<10%X_0	Photon > 0.1GeV

Exclusive requirements
(the whole effect assumed from one region)

e cluster energy

e cluster and rad γ energy from Ecl>50MeV

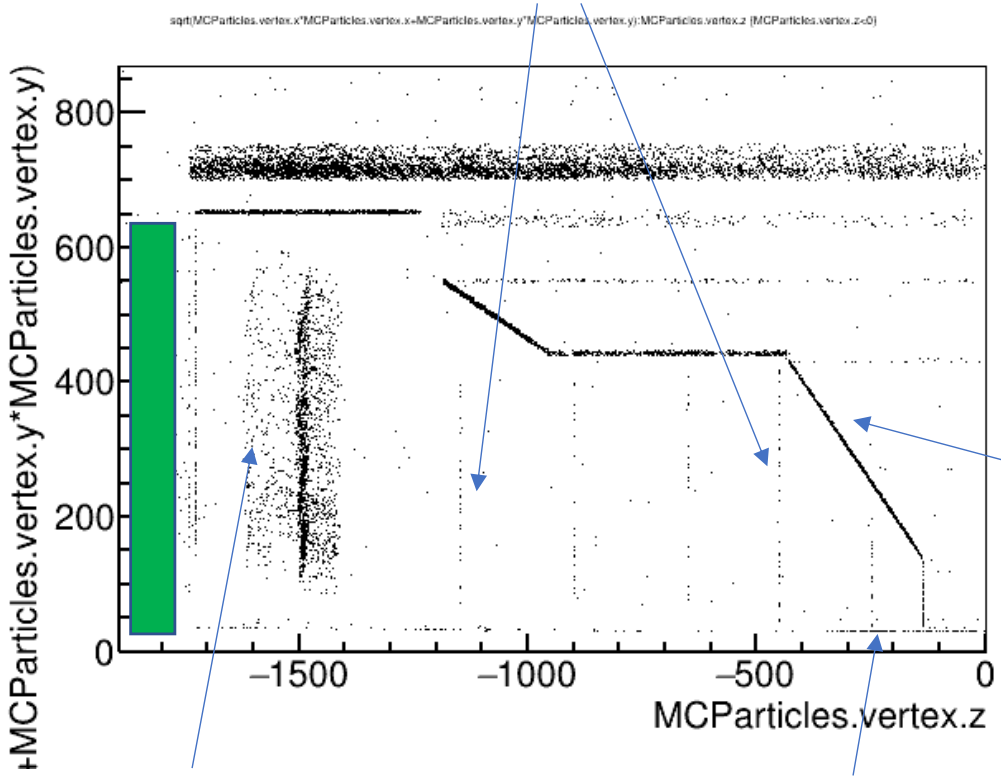
e cluster and rad γ energy from Ecl>50MeV and $\Delta\eta=\pm0.2$, $\Delta\varphi=\pm0.5$

The amount and localization of tolerable material formulated

The requirements are relaxed for B=1.7-2T

Material implementation in dd4hep-Brycecanyon

(z,r) position of photon conversion



Tracking disks (<1%)

bEMCal

Service/Cables
(out of bEMCal acceptance)

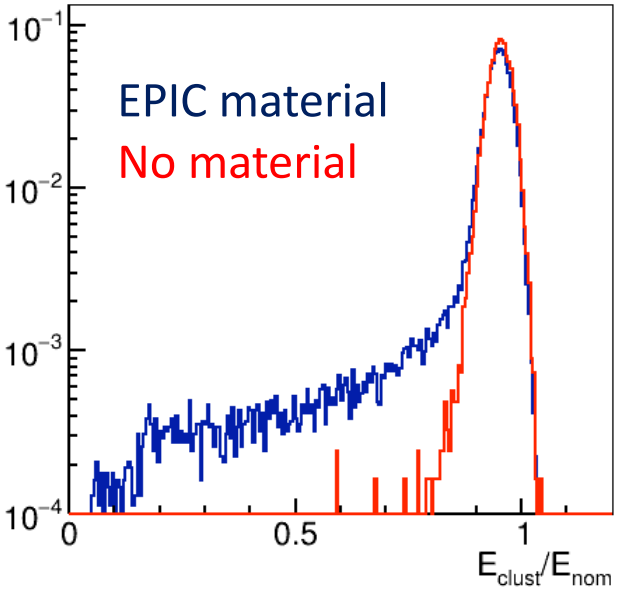
pfRich (~13% of X0)

Beam pipe
(1-3% in the bEMCal acceptance)

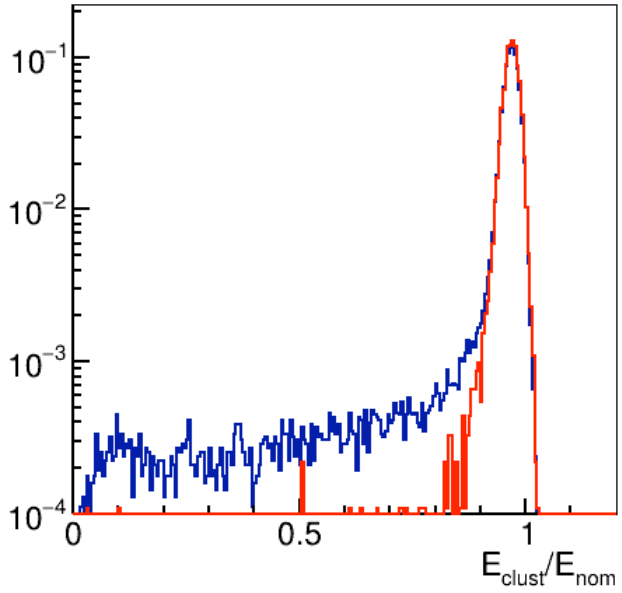
EMCal cluster from a single electron

Clusters associated with true track

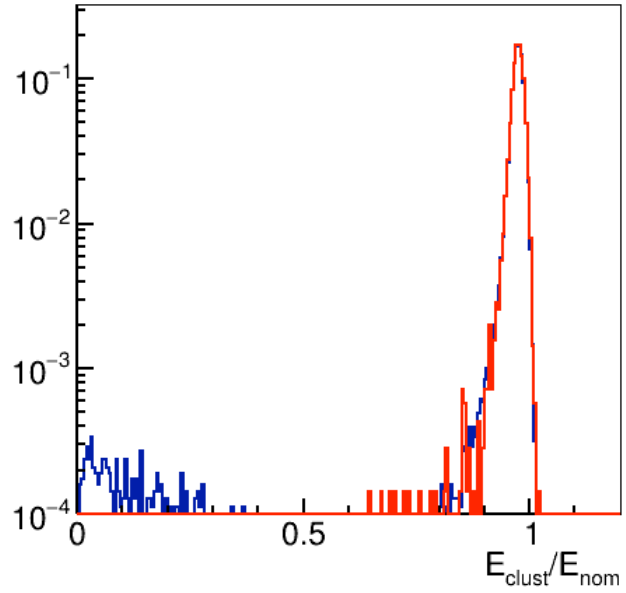
1 GeV



4 GeV



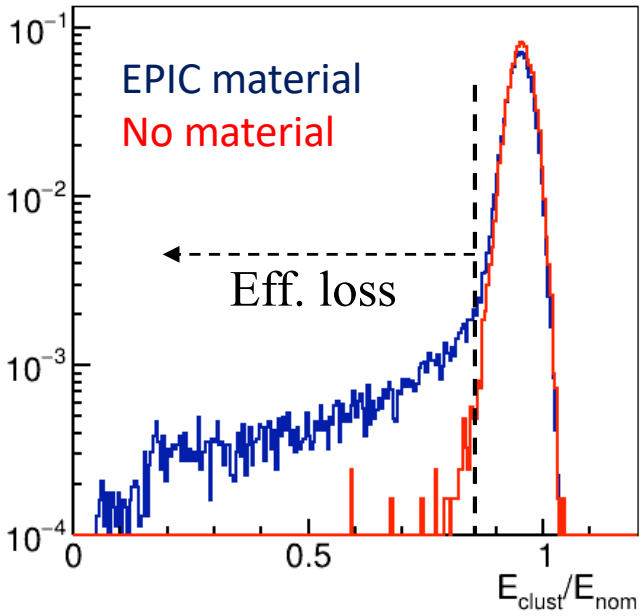
10 GeV

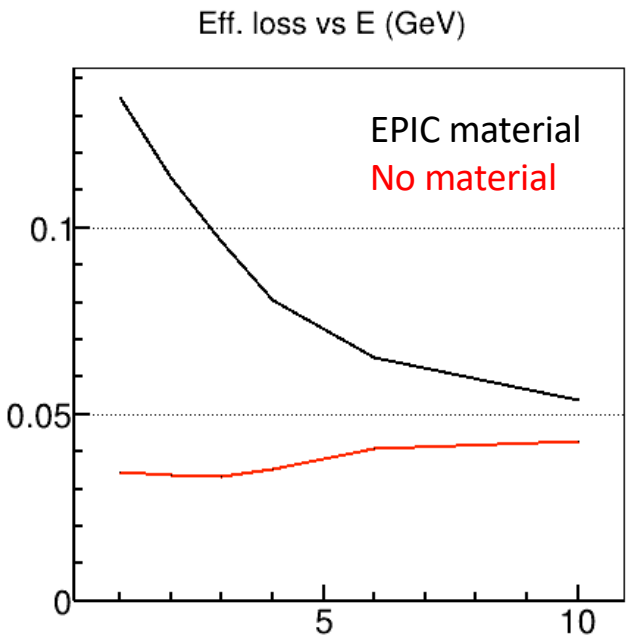


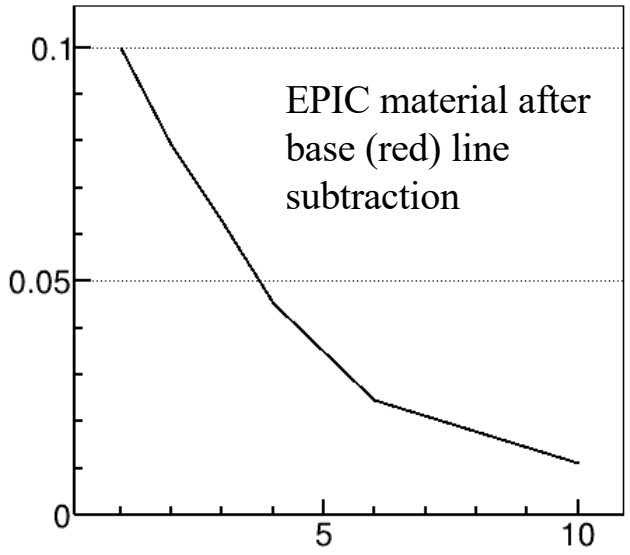
No effect on (~gaussian) peak width
Lower energy tails (the largest at lower energy)
No overall effect for high energy electrons (10 GeV)

Eff. loss

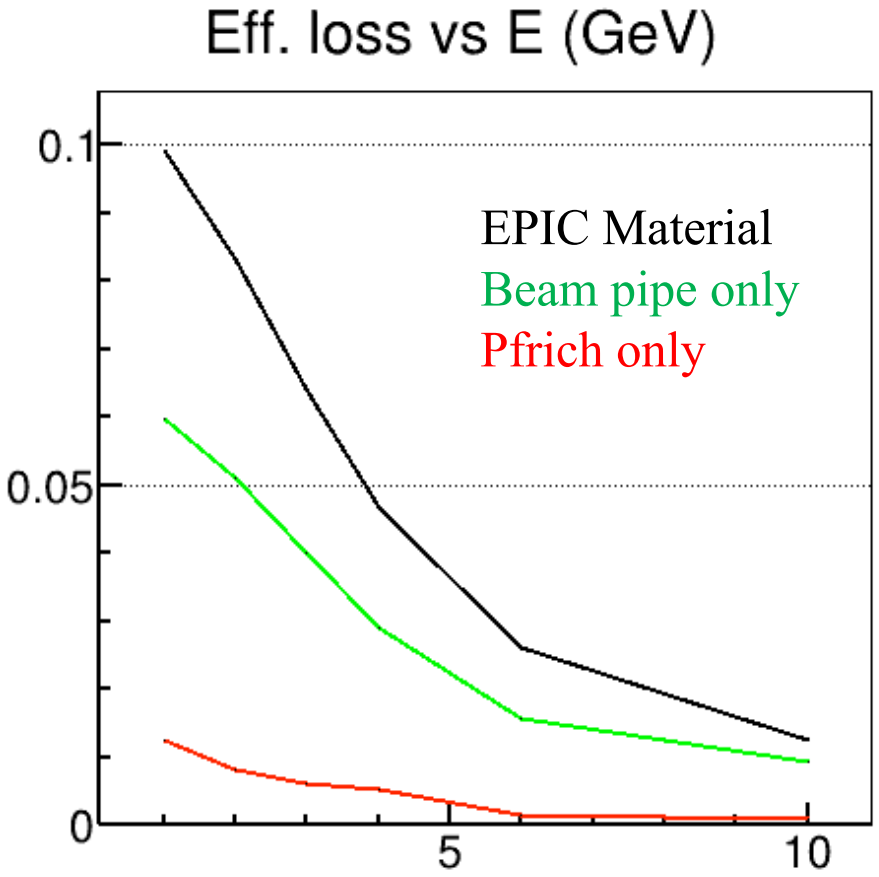
Efficiency loss:
fraction of counts at < (Mean - 2σ)







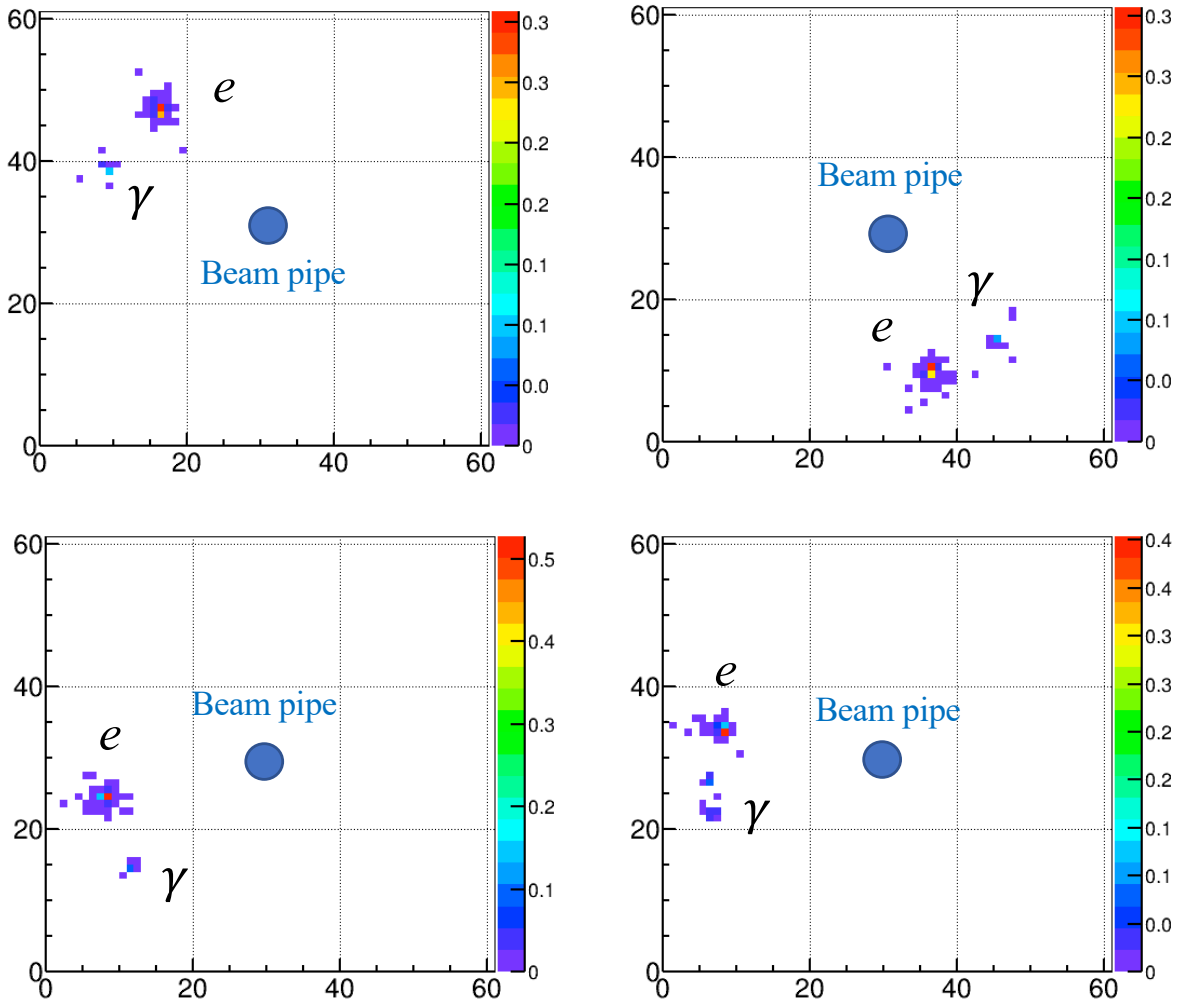
Eff. loss: contributors



The biggest effect from beam pipe

Small effect from Pfrich

Recover eff loss

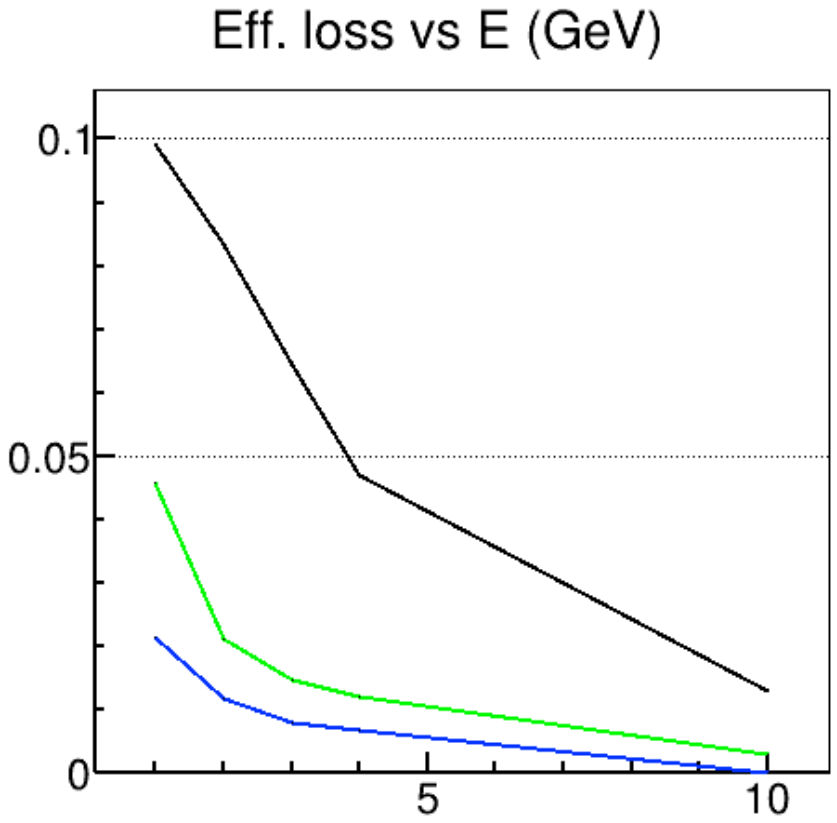


Radiated photons are not everywhere:

They prefer to be on the same arc (pseudo-rapidity) with parent electron, due to solenoidal magnetic field

=> Try to account radiated photon clusters when reconstructing electron energy in the EMCal

Recover eff loss



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e cluster and rad γ energy from Ecl>50MeV

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Summary

For electron reco in backward (PWO) EMCal in ePIC:

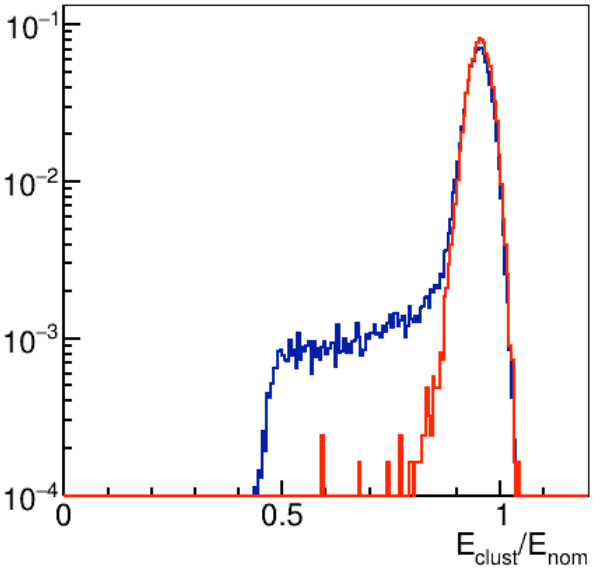
- The amount of material on the way looks acceptable
  - Biggest effect comes from beam pipe
  - The effect of the material associated with backward RICH detector (as now implemented in dd4hep) is small
- Efficiency loss due to material can be partially recovered with radiated photons reco
- When defining/optimizing the phase space to look for radiated photons
  - Need full DIS event simulation
  - Need to include backgrounds (beam-gas, synchrotron rad., etc)
- Algorithm development should include both EMCal and Tracking (and pf/mRICH?)

Backup

EMCal cluster from a single electron

Max cluster energy

1 GeV



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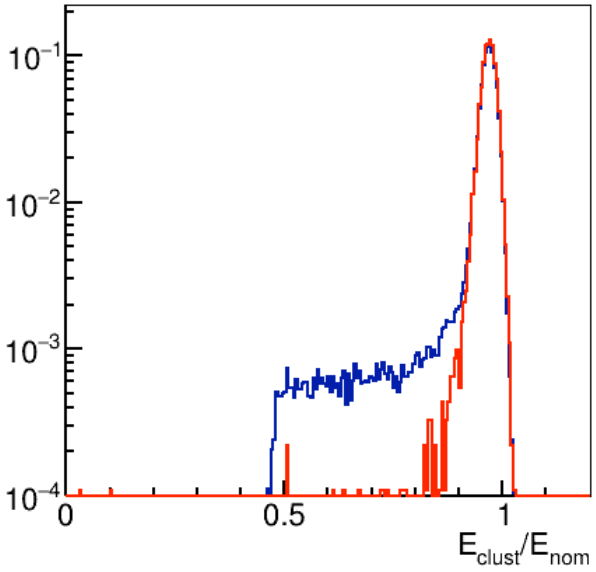
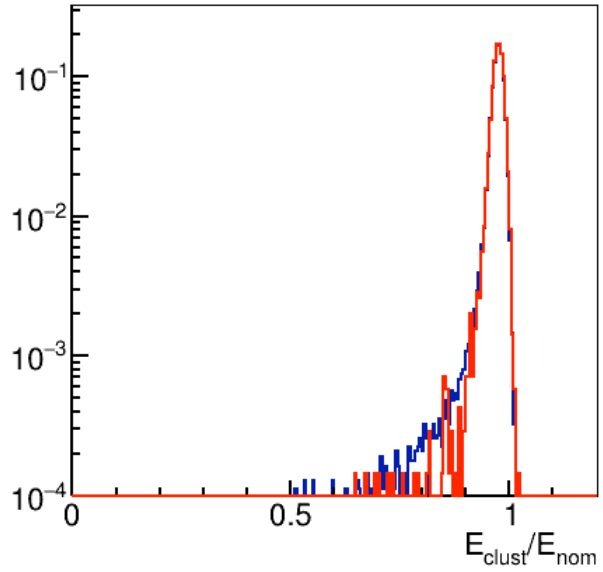


10 GeV



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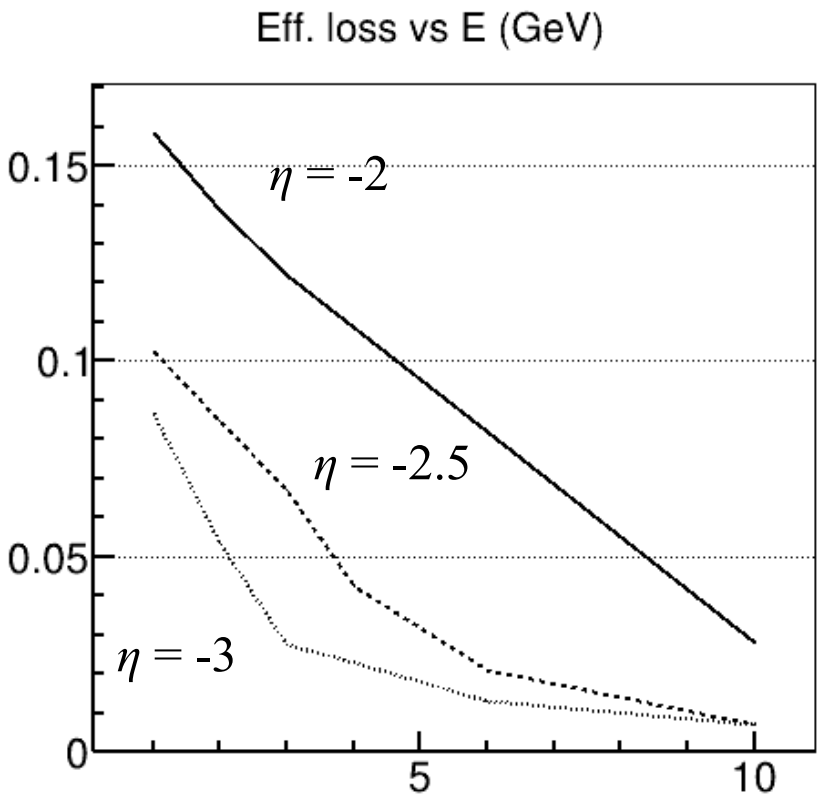
Versus eta



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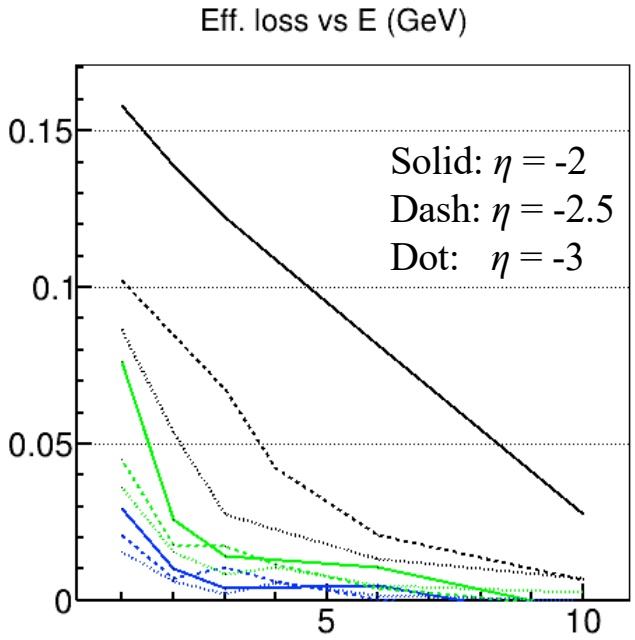

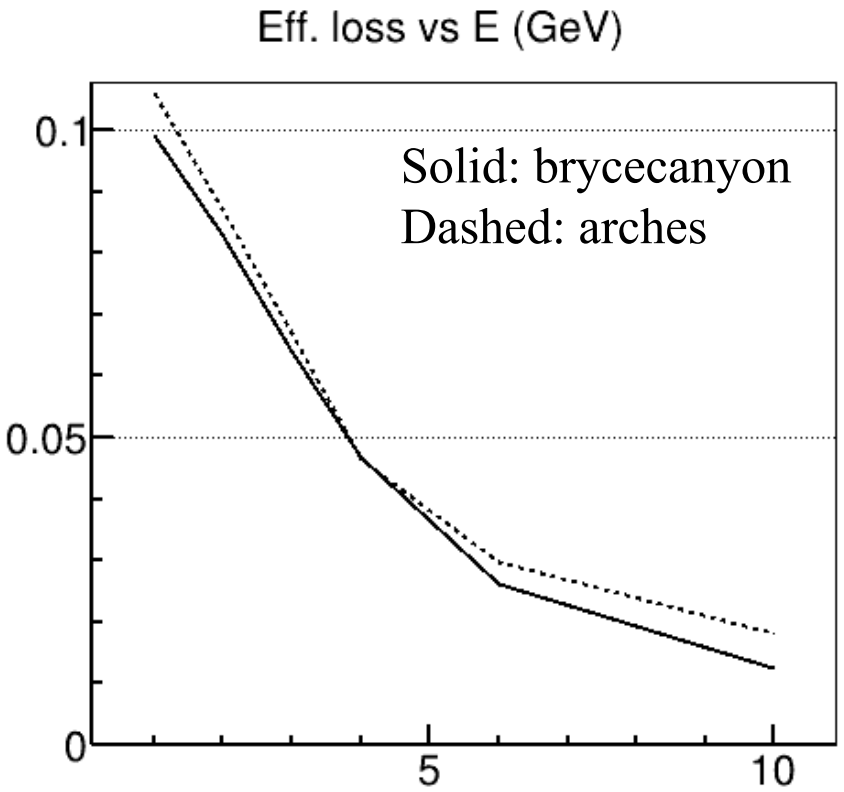
Eff. loss vs E (GeV)
0.1
0.05
0
5
10
Solid: brycecanyon
Dashed: arches