Longitudinal shower profile of the DESY and CERN testbeam data in the electromagnetic calorimeter

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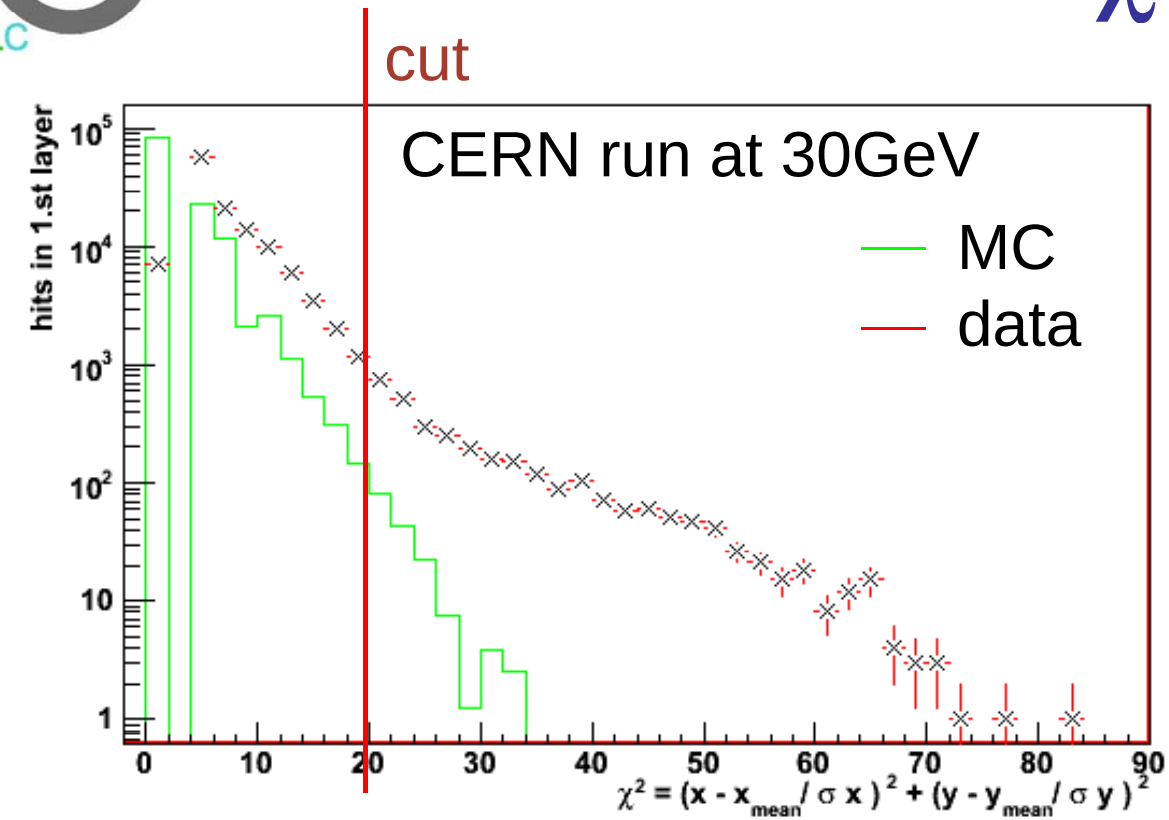
cuts/corrections currently used

- $E_{hit} > 0.6\ E_{MIP}$
- $0.5\ E_{beam} < E_{total} < 1.5\ E_{beam}$
- Cerenkov cut for CERN runs with combined e-/π beam
- cut on gaps in the detection layers
- @ first layer:

$$\chi^2 = (x-x_{mean}/\sigma_x)^2 + (y-y_{mean}/\sigma_y)^2 < 20$$

Motivation of $\chi 2$ cut

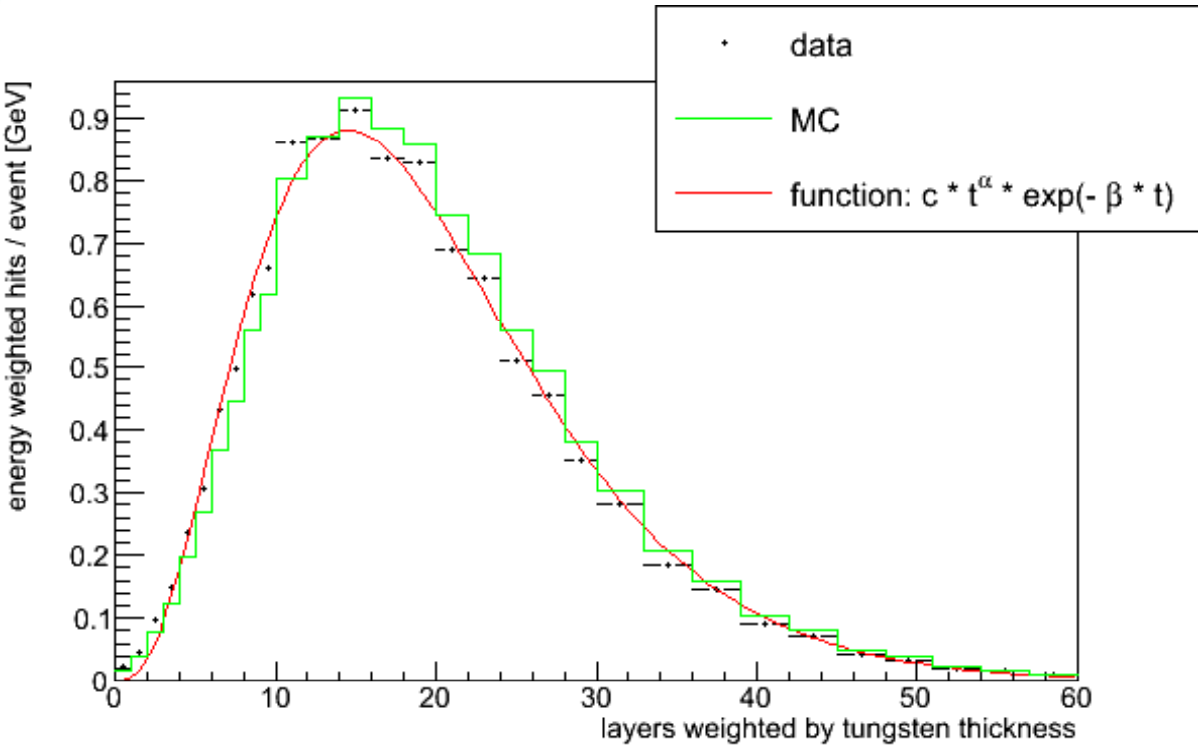


preshowering is shifting the longitudinal shower profile, cuts at the first layer likely to reduce this a bit

(though only cutting away small percentage of data)

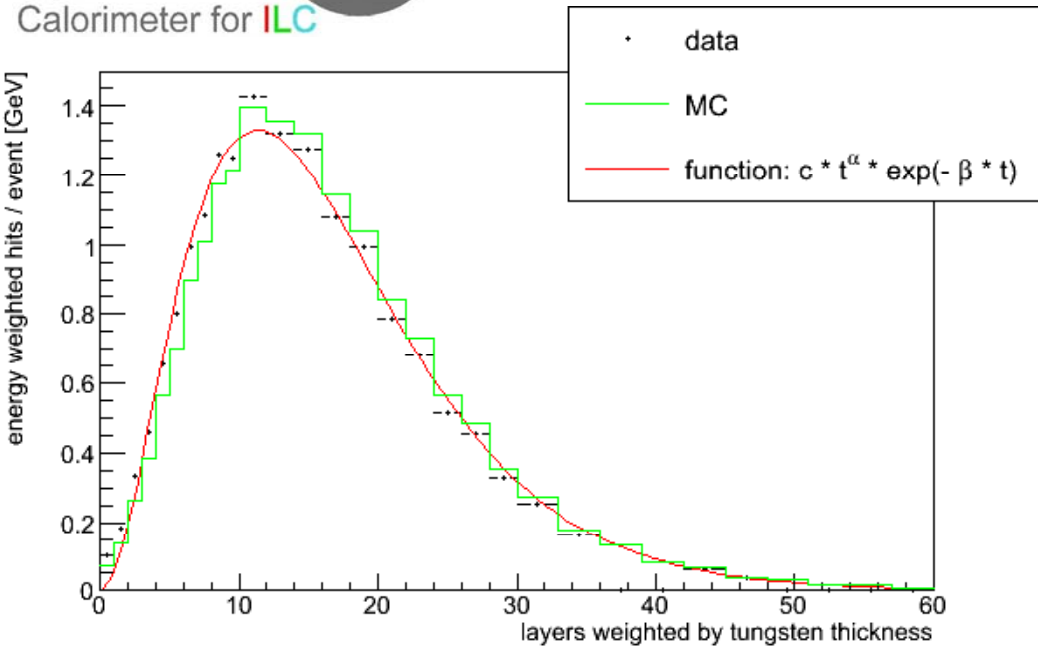
$$\chi^2 = (x-x_{mean}/\sigma_x)^2 + (y-y_{mean}/\sigma_y)^2 < 20$$

CERN: E_{beam}=20GeV

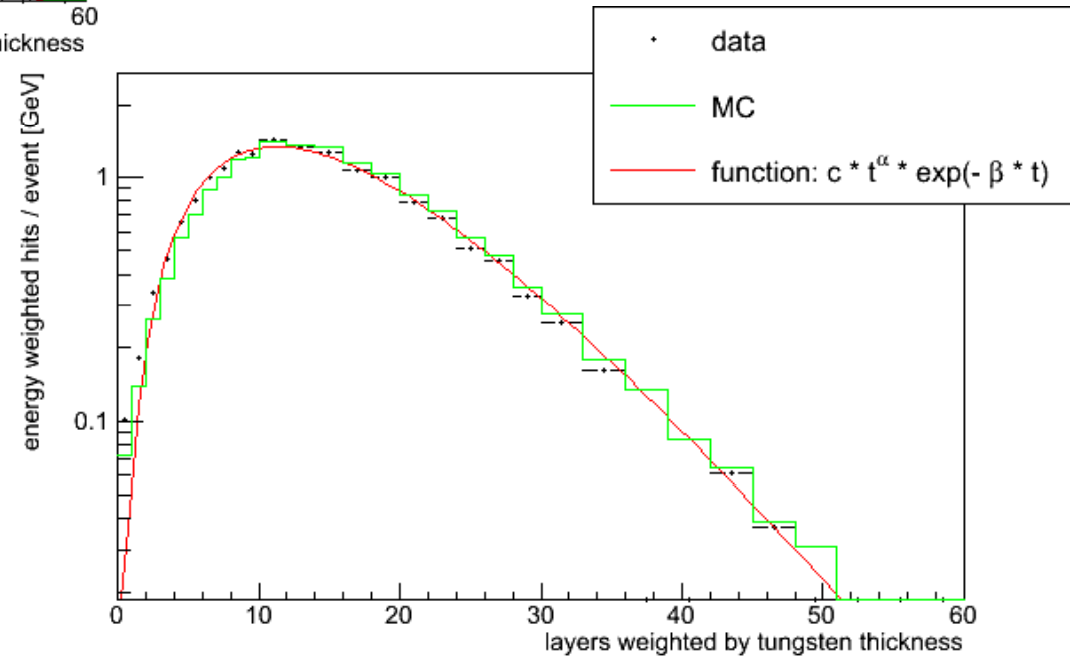


- MC prediction smaller than data before shower max and higher after shower max
- layer thickness 1-10:11-20:21-30 weighted by 1:2:3
- data well described by function

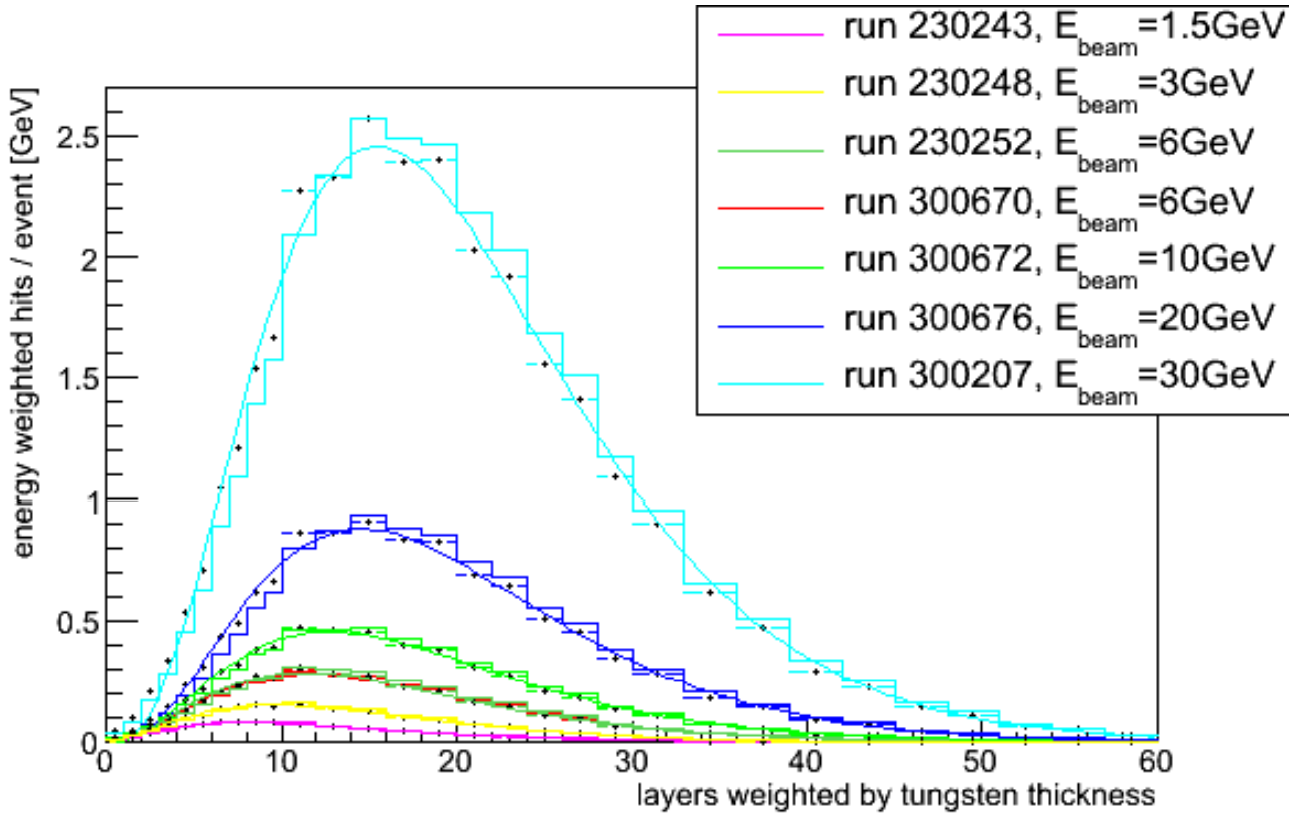
DESY: E_{beam}=6GeV



data in the downstream layers are well described though there are missing layers

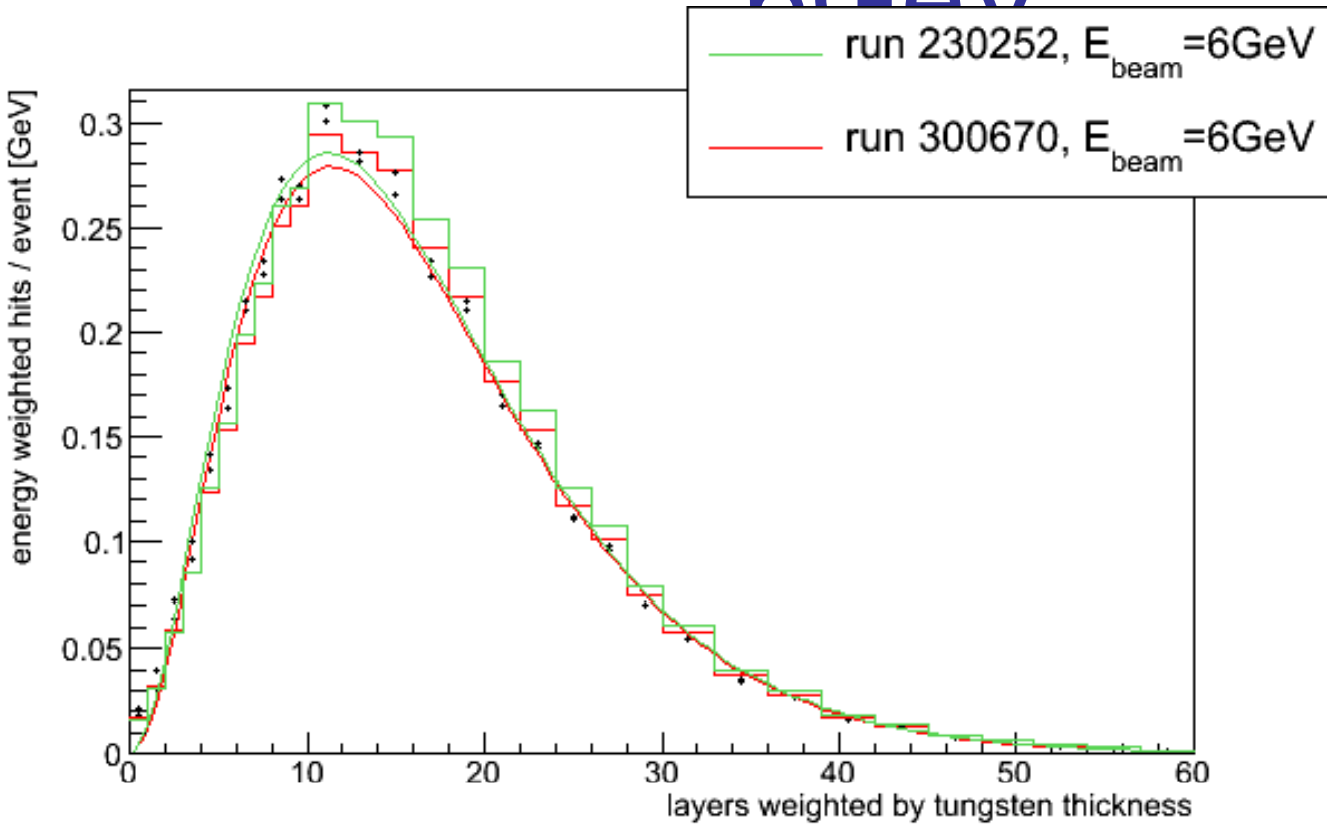


selected runs



- shower maximum increasing with increasing beam energy
- integral increasing due to increasing beam energy

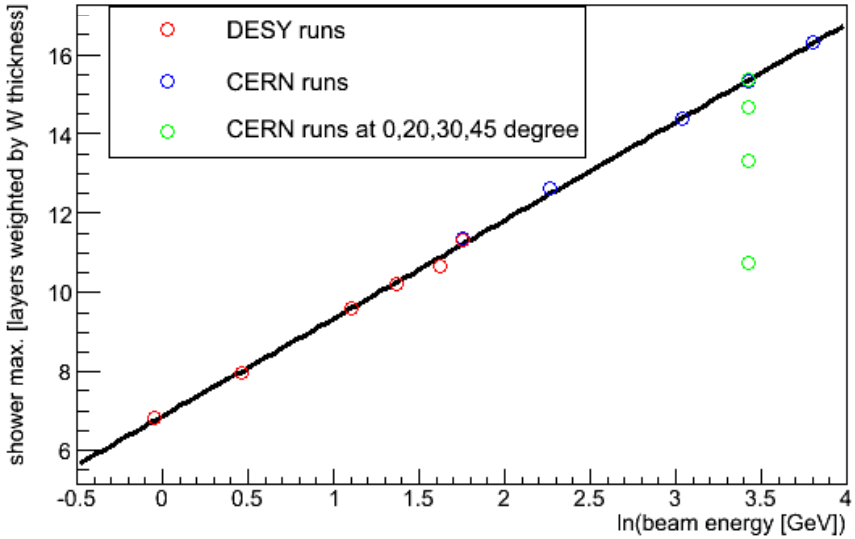
Comparison between CERN & DESY run at 6GeV



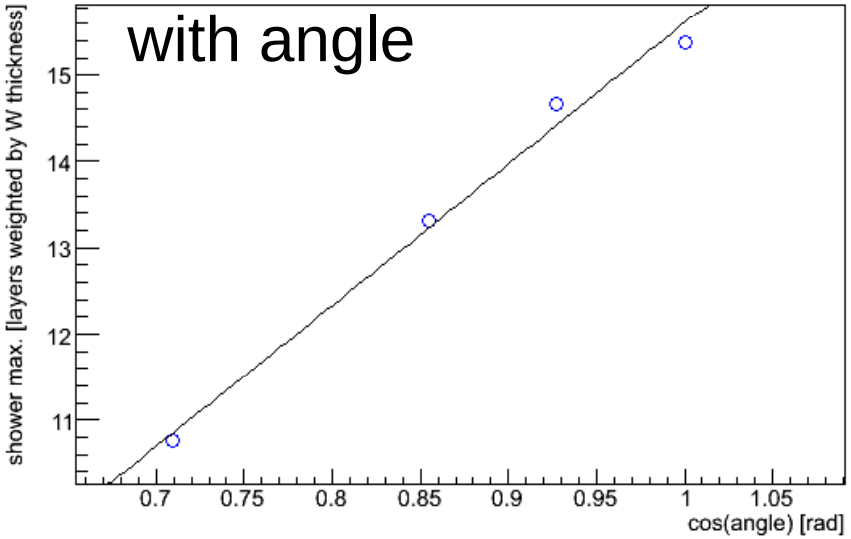
CERN and DESY data are well comparable

=> Use them in one plot for the subsequent analysis

shower maximum

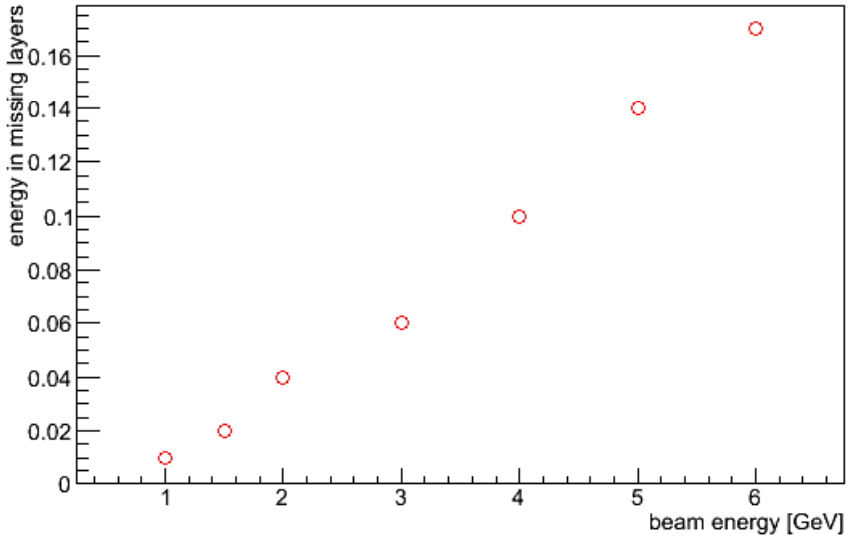


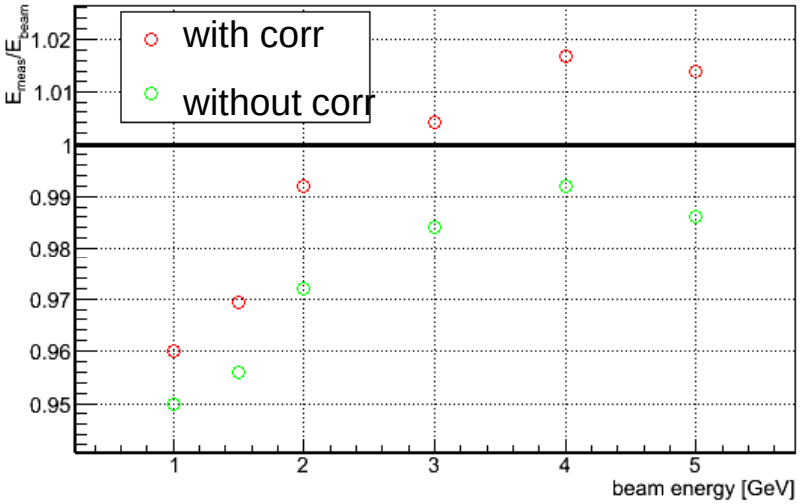
CERN runs at 30GeV with angle



- shower maximum increases with ln(Ebeam)
- for the angle shower max is proportional to increased distance in calo

estimate of energy in missing layers in DESY runs



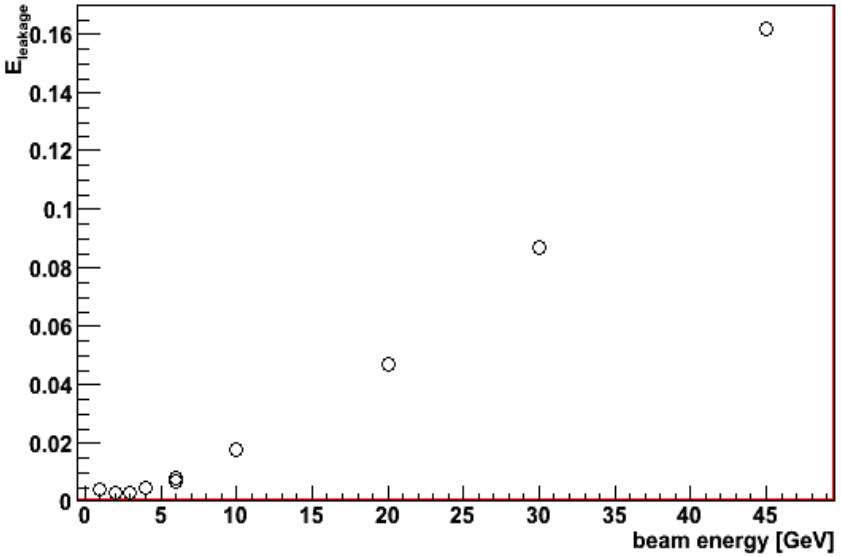


estimate from integral of the fitted parametrization over the missing layers

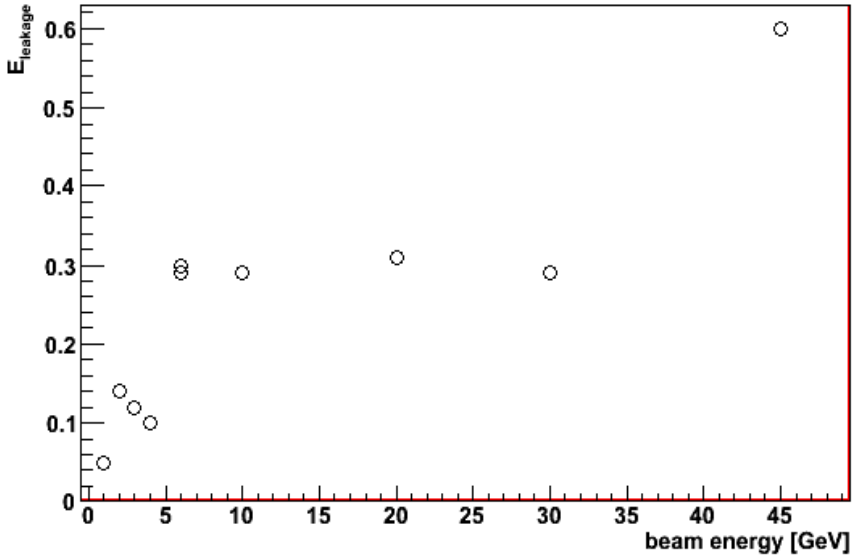
changes in the linearity plot of D. Ward if considering these estimates

leakage energy

leakage from fit integral from the end of the calo to inf



leakage from Ebeam-Emeas



Not a good prediction, still many questions:

- How exact is the beam energy?
- What does MC predict?
- How much energy is measured in the HCAL?
- Is there any inherent problem with the prediction?
- What happens at different angles?

conclusion

- longitudinal shower profile can be nicely fitted

- conclusions about the shower max and the energy in not-instrumented layers at DESY runs can be drawn

- there needs to be more thought put into the leakage energy though