MC models validation studies with pions in AHCAL

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CALICE analysis meeting

Background

- end of EUDET (EU funded project supporting CALICE & G4)
- requested final report on the "hadronic model validation" task

➔ write a paper in collaboration with the G4 group

!!! a big chance for CALICE to:

- combine results on MC models validation studies from:
  - ECAL pion paper (published)
  - Lars CAN-022 (already in CALICE repository)
  - Alex CAN-025 (accepted by CALICE)
- combine CALICE results with G4 models descriptions and expectations
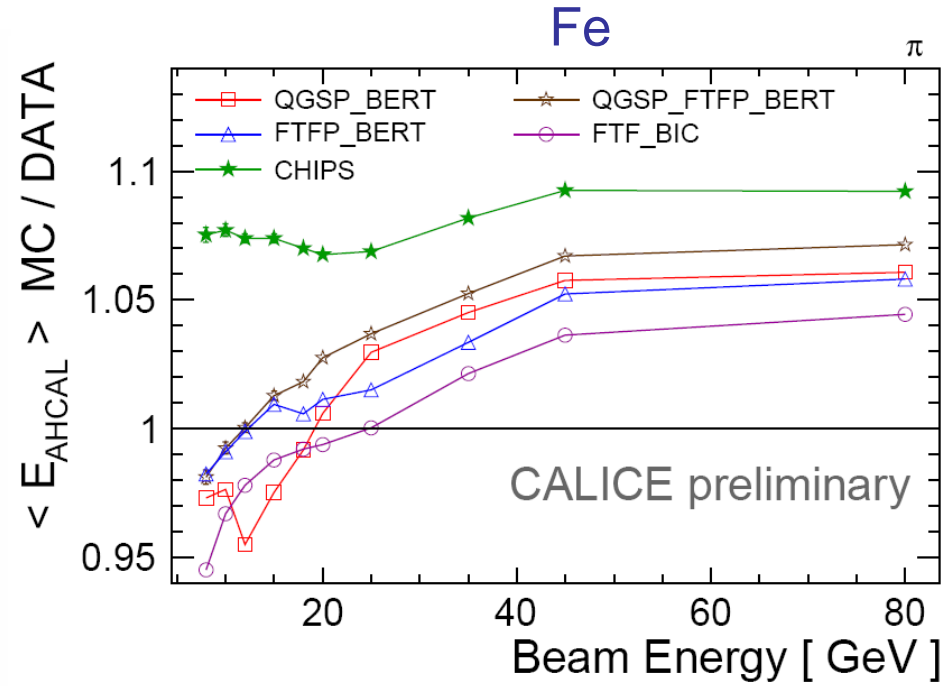
➔ EUDET report due end of 2010

Overview of the plots in the report

total visible energy in MC / data

W — Fe
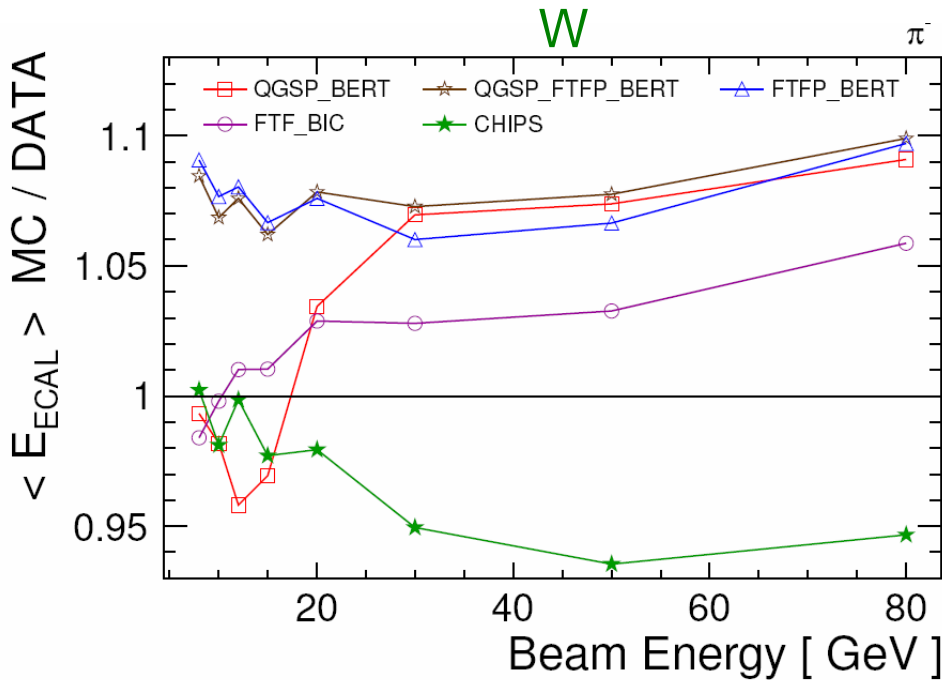
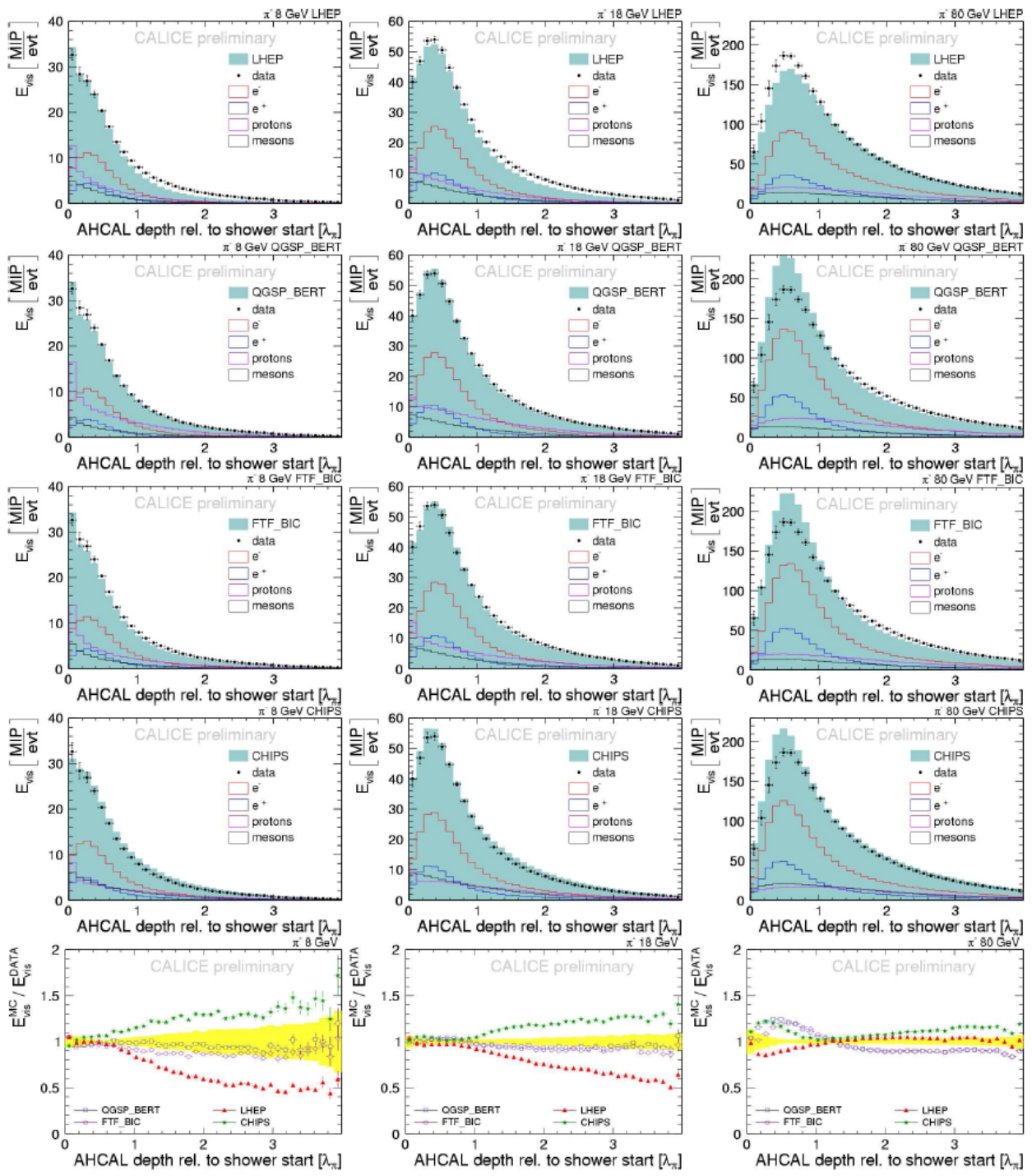large leakage in ECAL (~1λ)   shower almost contained in AHCAL

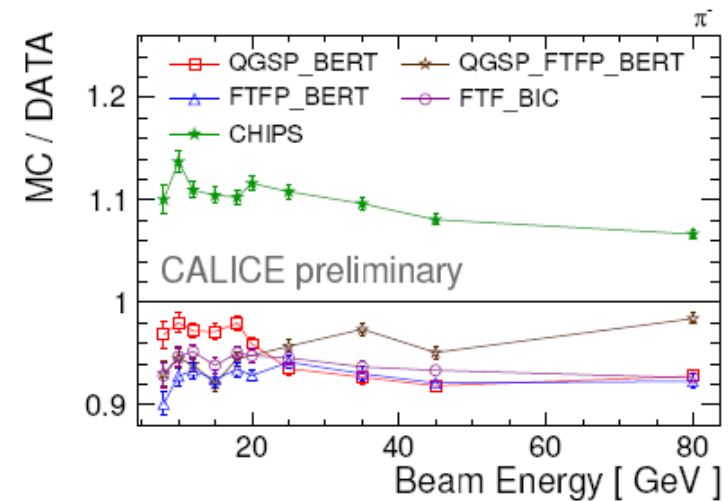FTFP_BERT not E dependent   CHIPS not E dependent
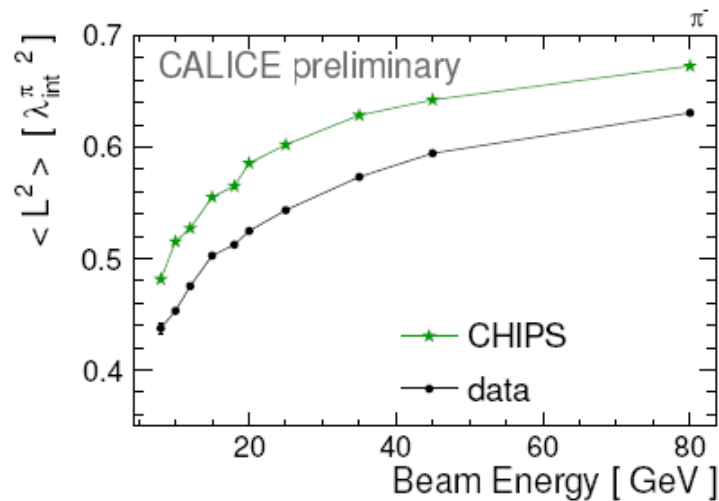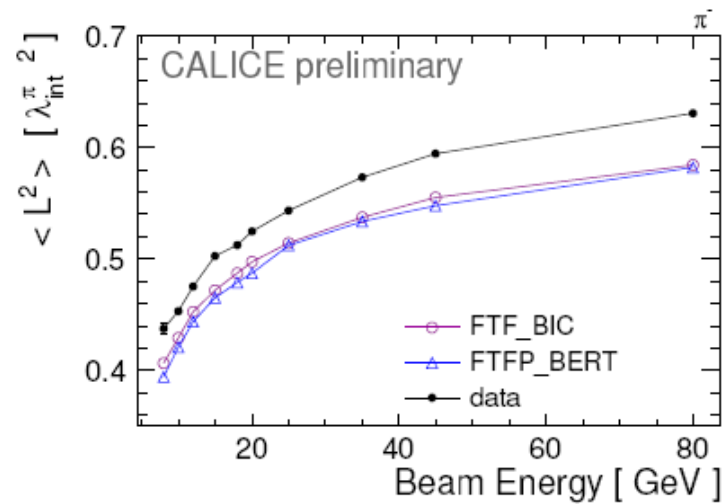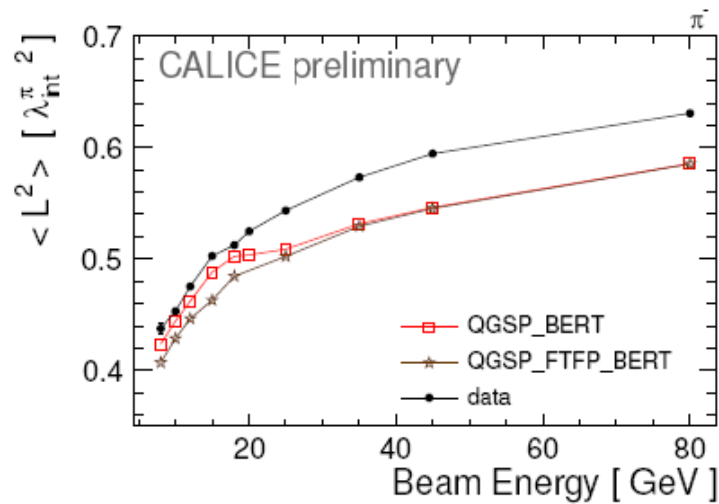
AHCAL longitudinal profiles

The position of the shower maximum is in general quite well simulated.

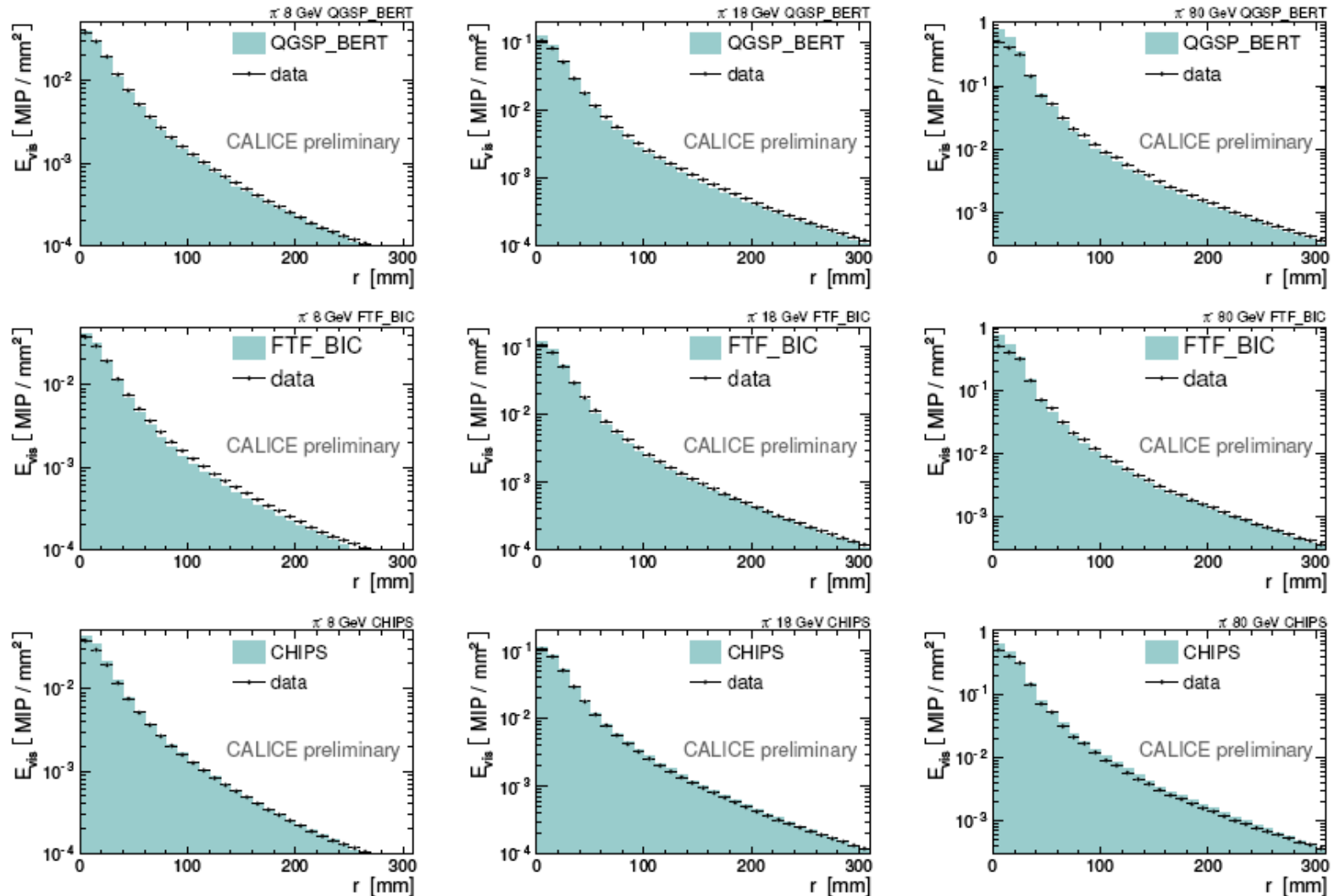All models except 267 CHIPS tend to underestimate the tails of the showers seen in data.
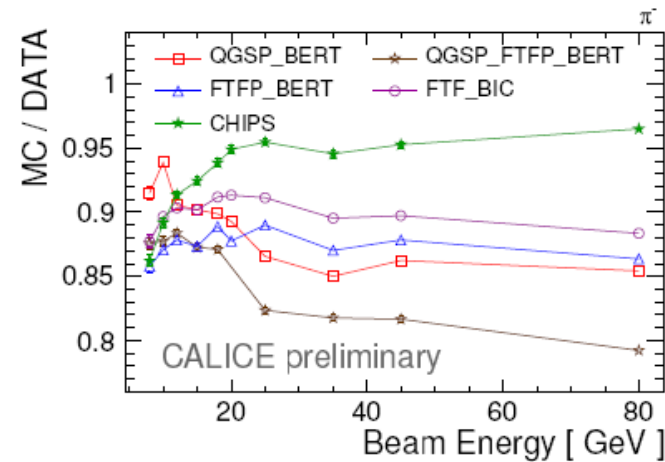
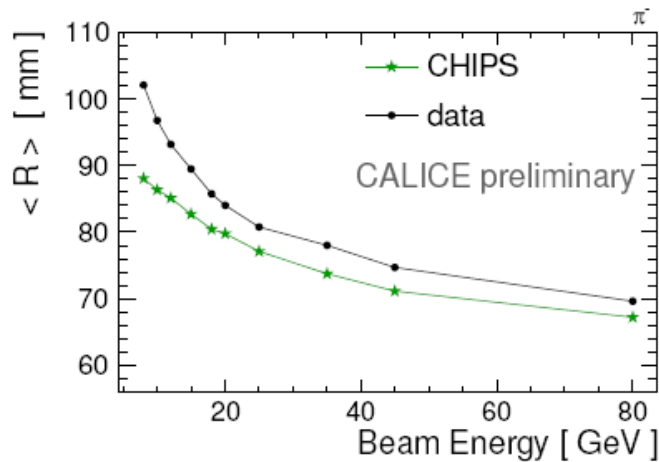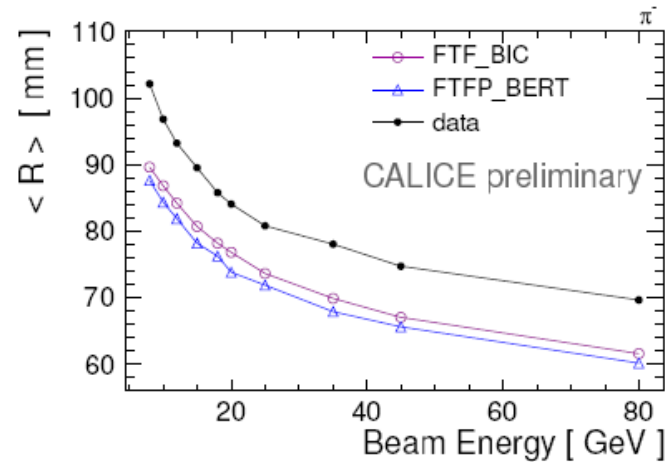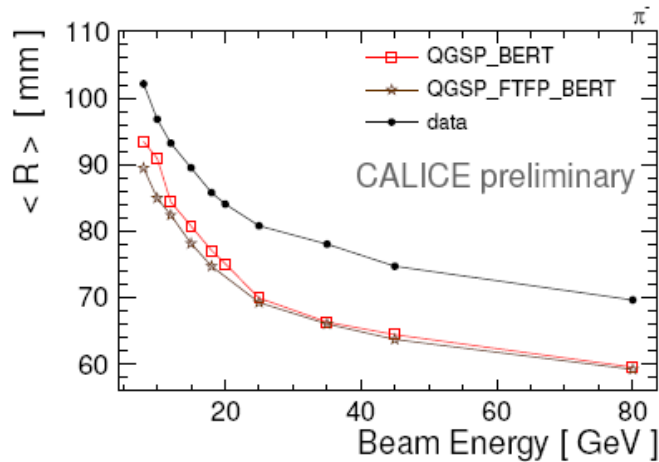The longer showers in CHIPS are expected

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AHCAL longitudinal second moment

AHCAL transverse shower profile
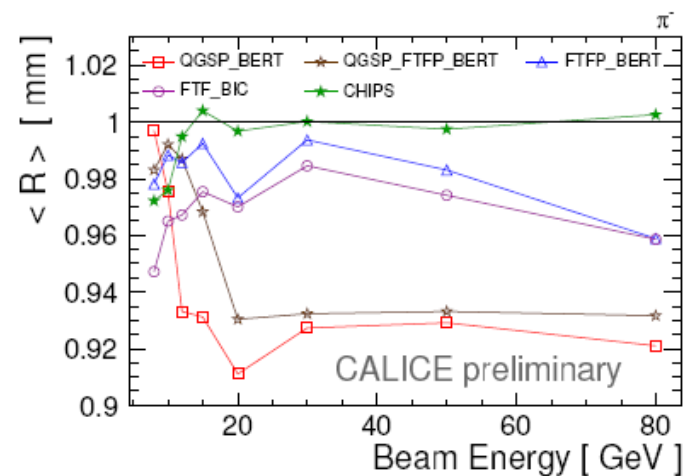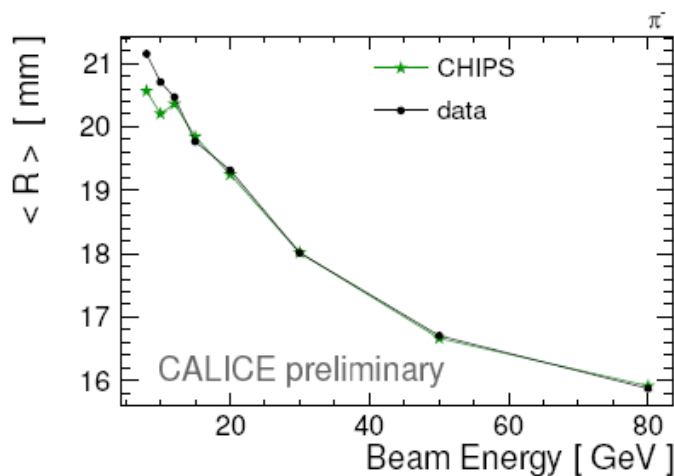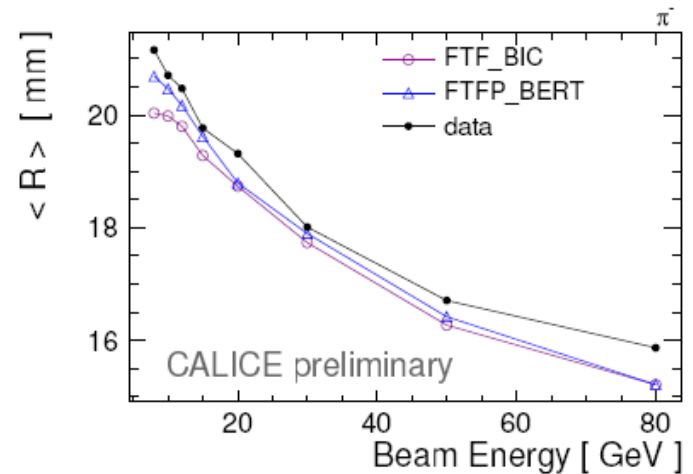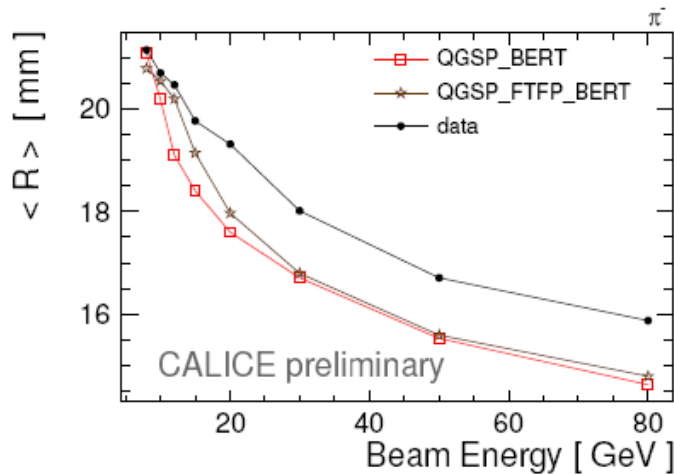
AHCAL mean shower radius

data possibly 5-10% too broad (instrumental effect also seen in EM analysis)
ratio to FTF_BIC not E dependent
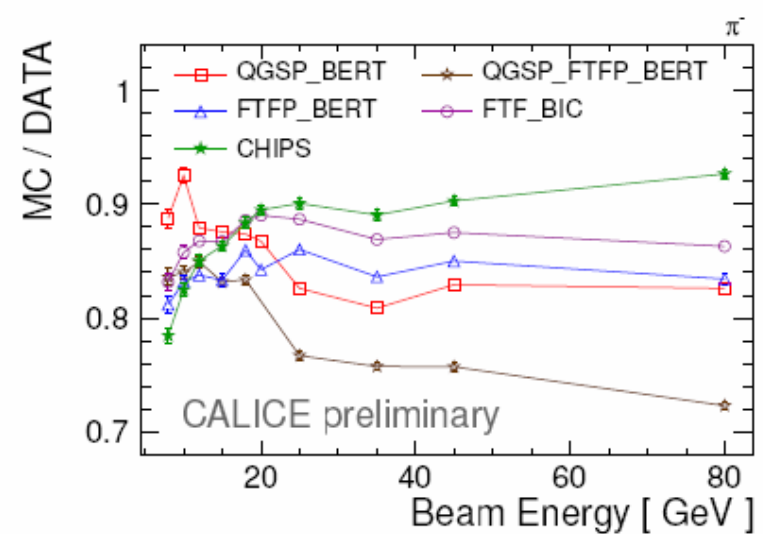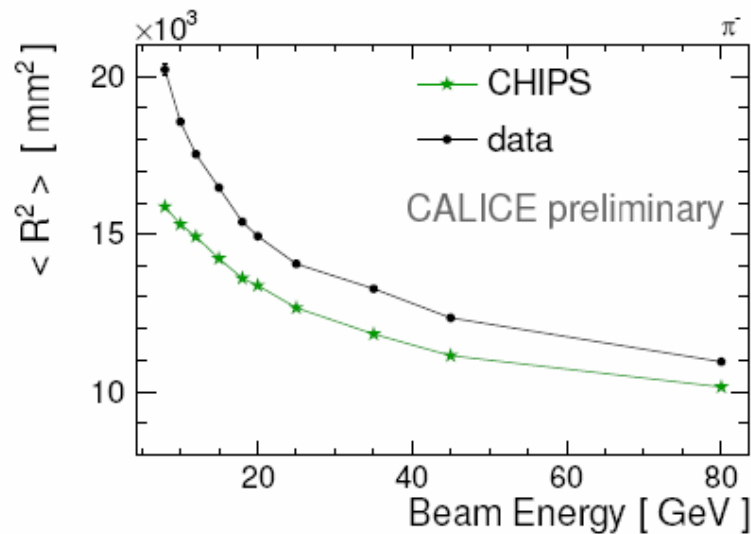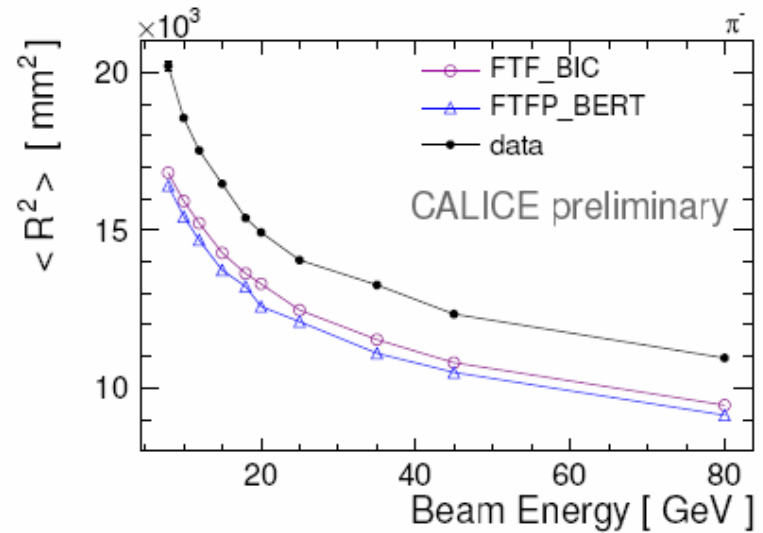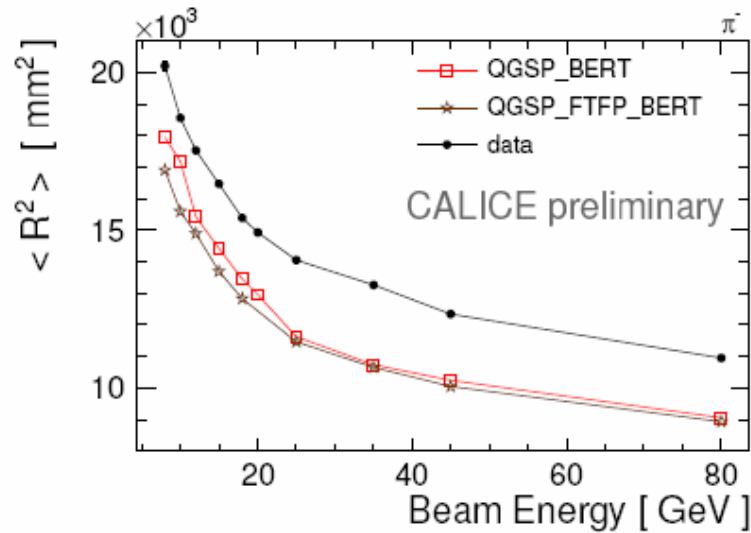CHIPS closes to data at E>18 GeV, but E dependent ratio
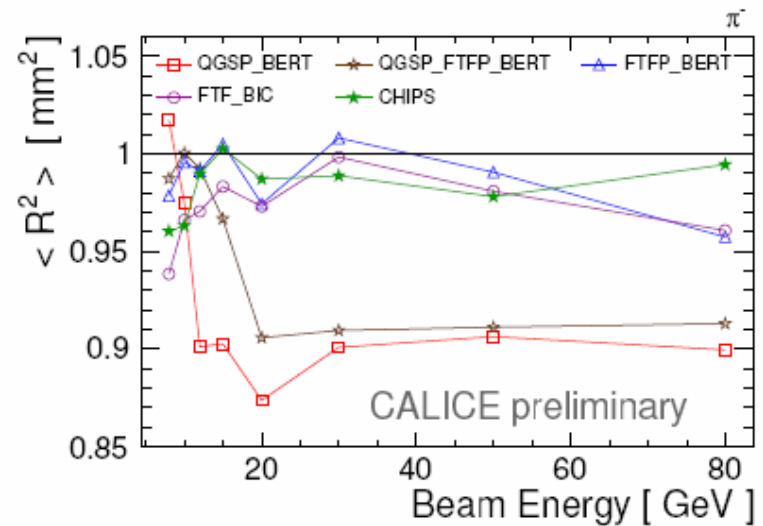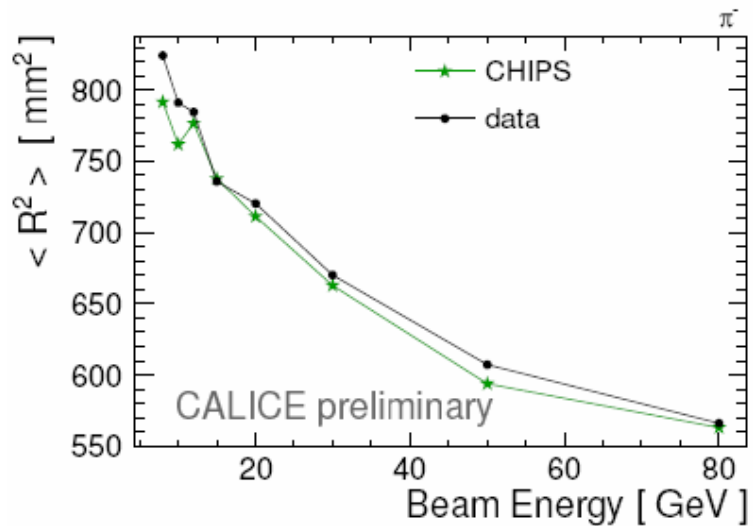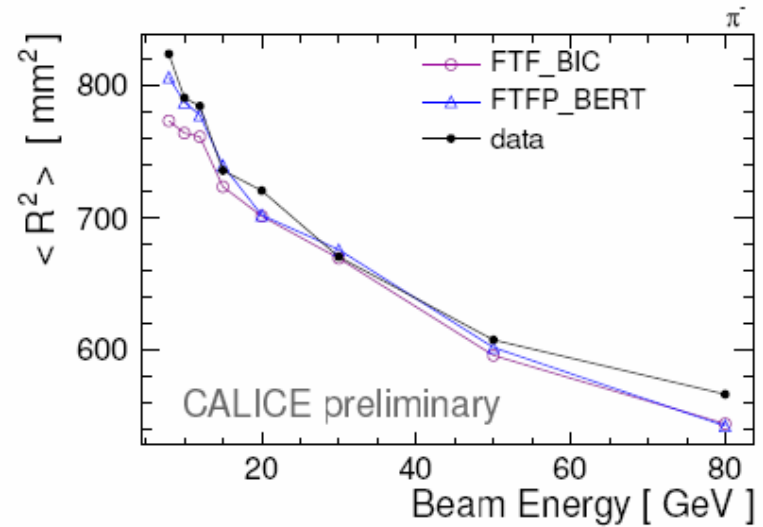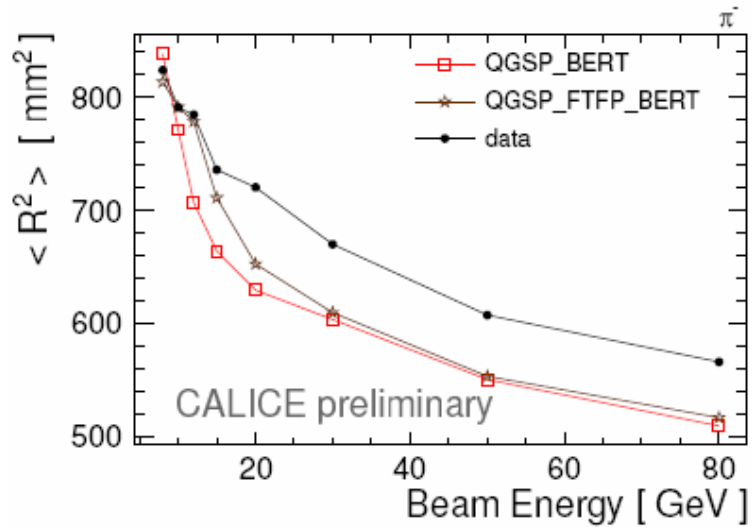
ECAL mean shower radius

CHIPS closes to data and no strong E dependent ratio
FTFP_BERT slightly better than FTF_BIC at low E

AHCAL transverse second moment
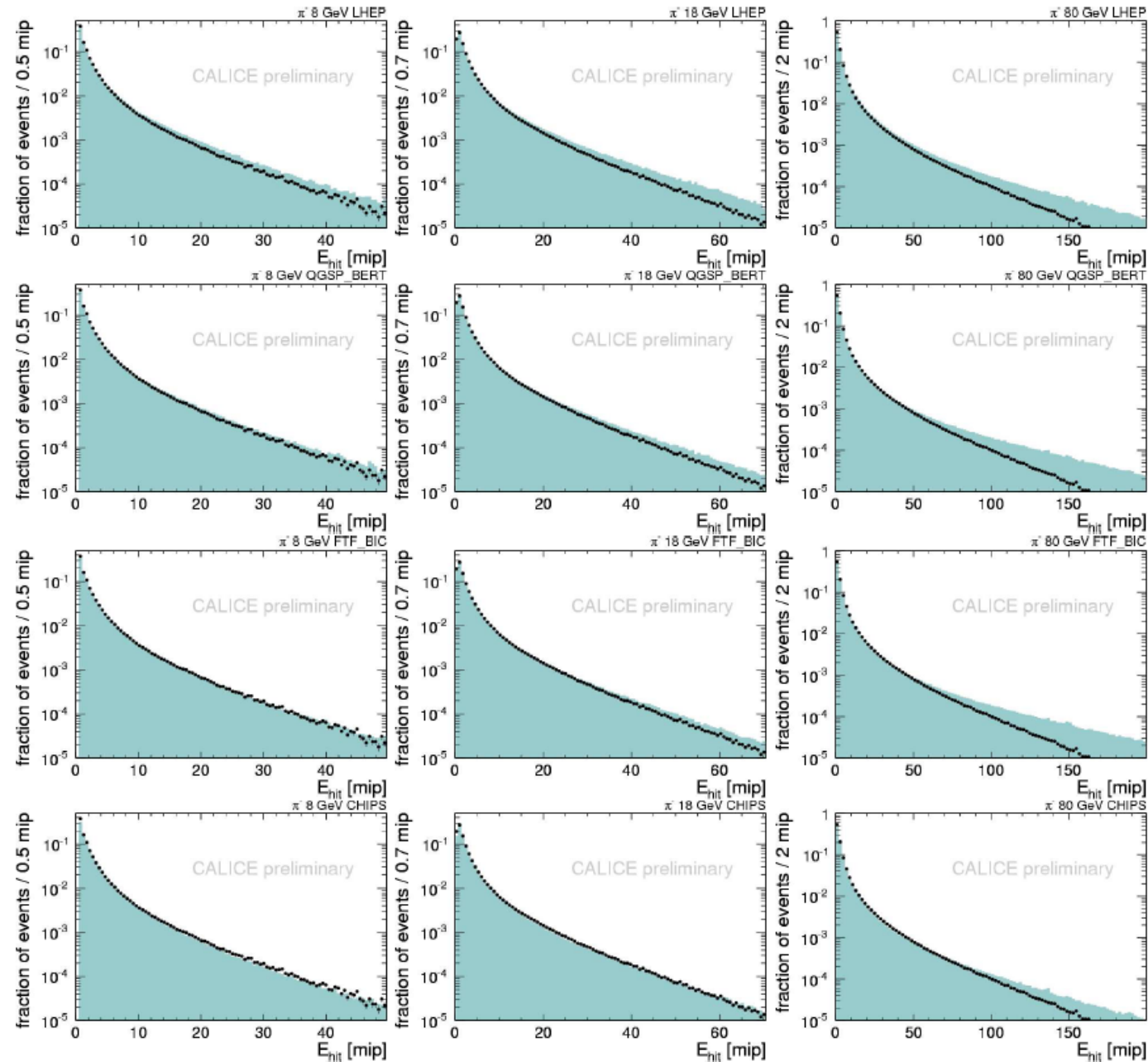
ECAL transverse second moment
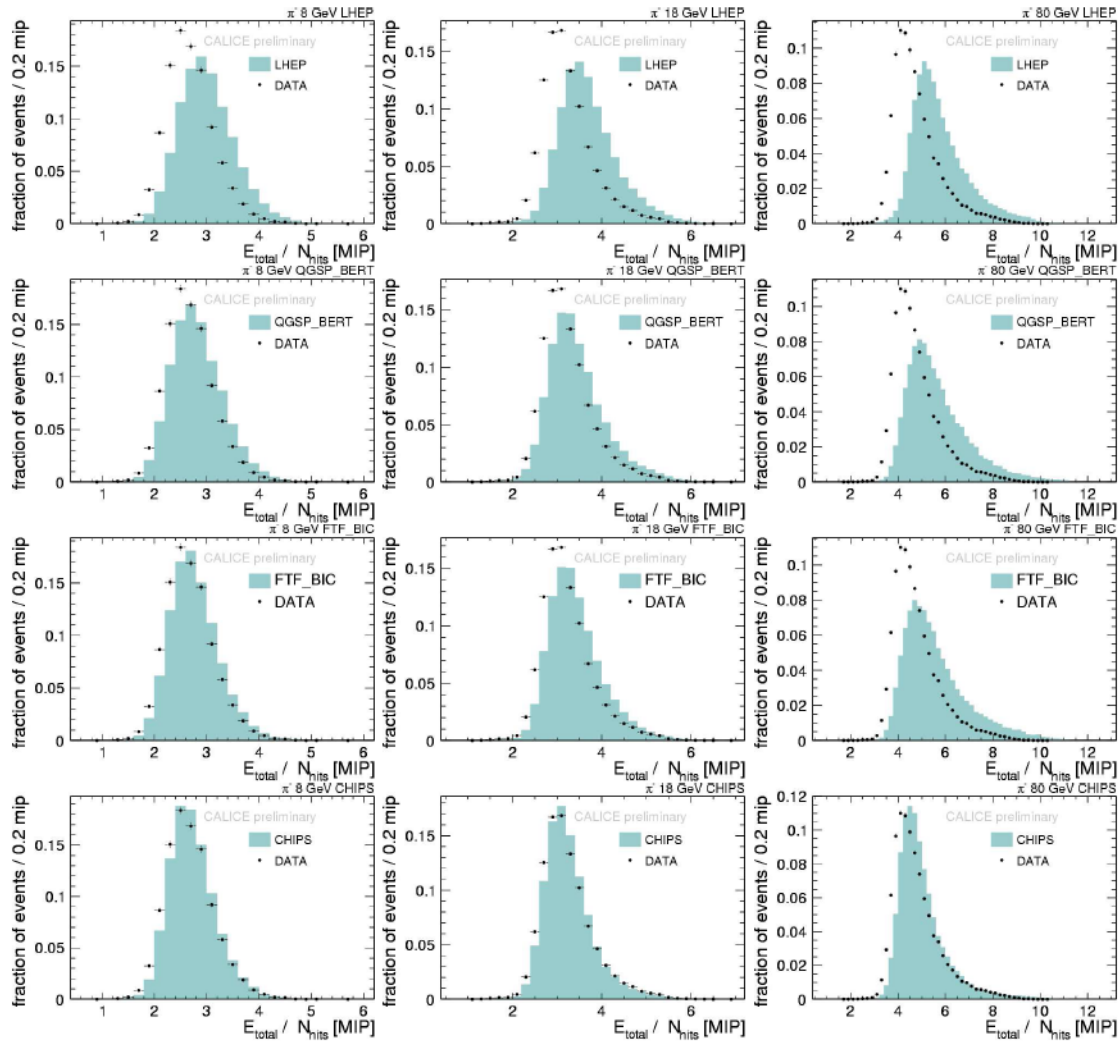
AHCAL energy hit spectra

provides a measurement of the energy density in the shower

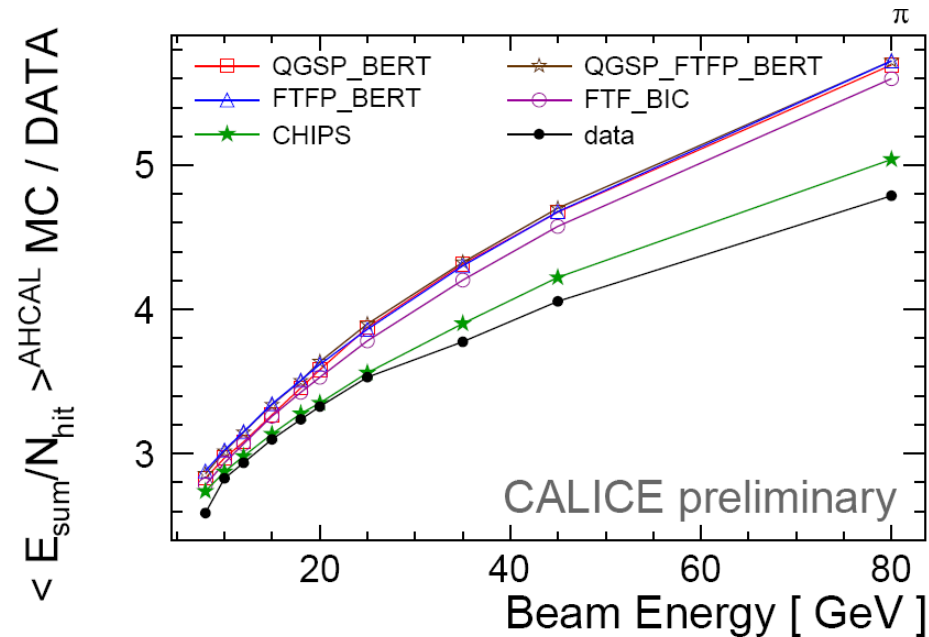useful to study whether MC models predict the same energy density as in data

this quantity could be related to the correct modelling of the EM fraction in the shower.

Energy per calorimeter cell (hit)
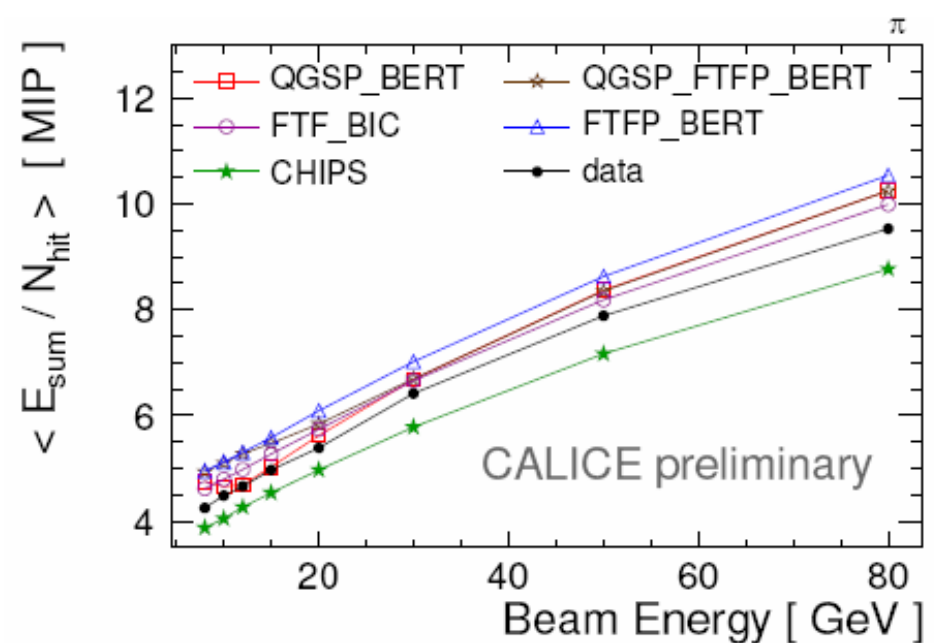
Energy per calorimeter cell (hit)

AHCAL average energy density per calorimeter cell:
~2.5 MIP/cell @ 8 GeV
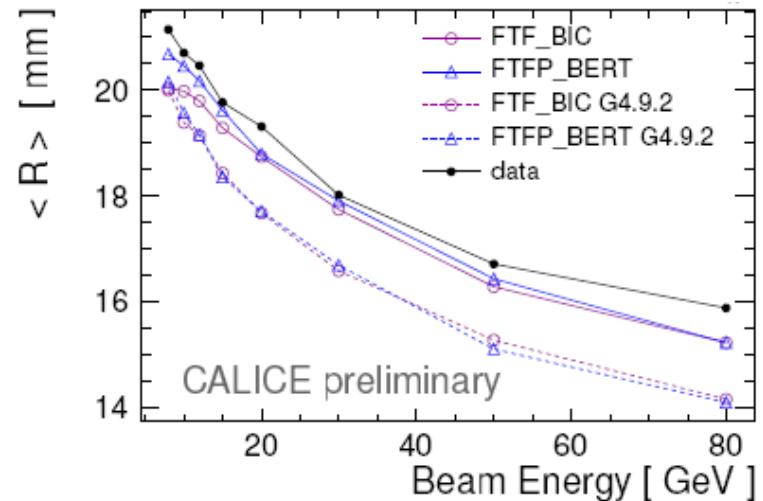~4.0 MIP/cell @ 80 GeV
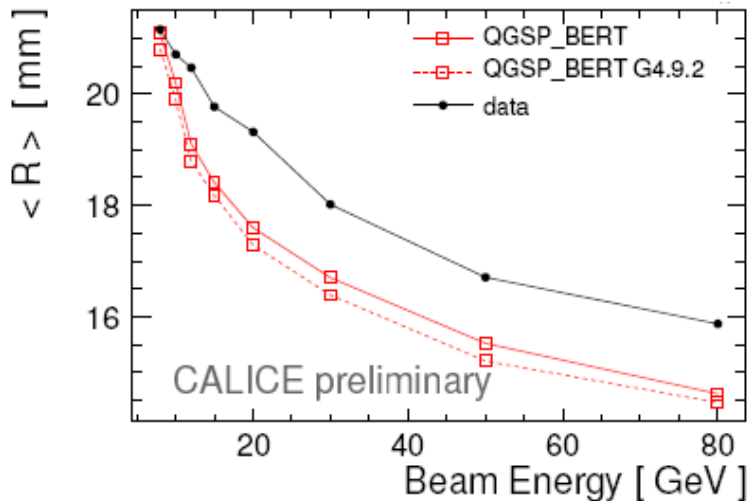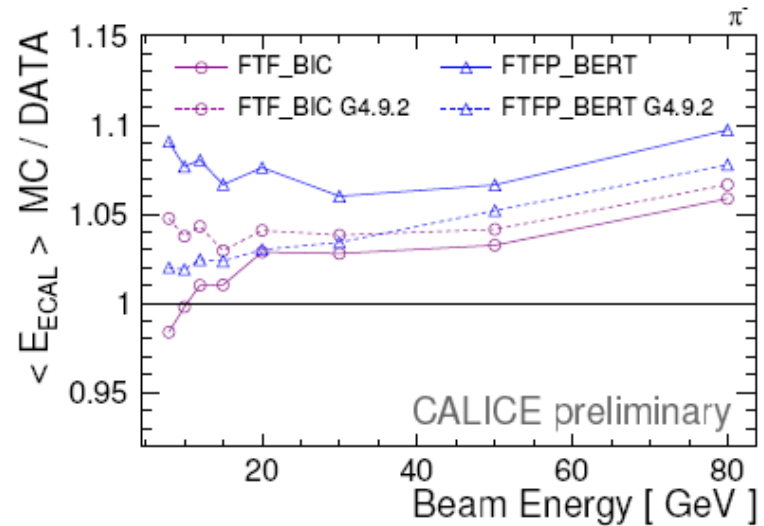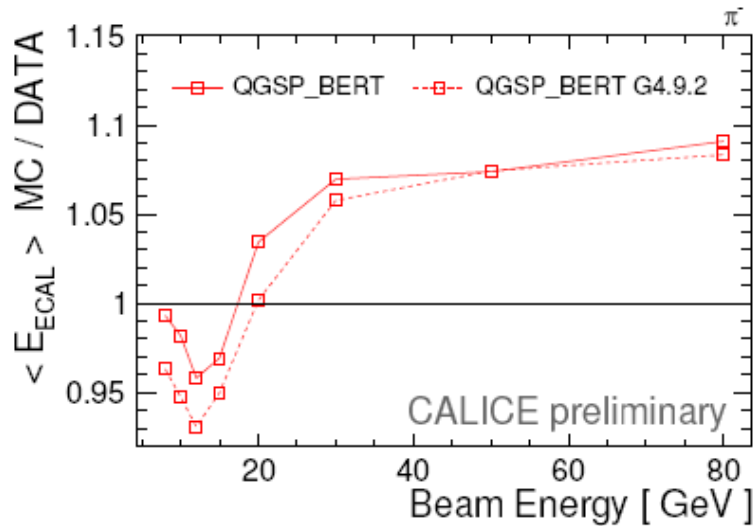➔ CHIPS agrees best with data

ECAL average energy density per calorimeter cell:
CHIPS lower than data
➔FTF_BIC best agreement

G4 9.2 vs 9.3

improvement in BERT linearity, BIC linearity worse
significant improved FTF transverse physics

Conclusions

- mostly consistent ECAL/AHCAL picture (where expected)

… but some differences (W vs Fe ?)

- CHIPS very promising on all observables
- FTF_BIC also doing good for most of observables

- difference between FTF_BIC and FTFP_BERT will become more evident with low E data from FNAL

- improvements in FTF and BERT from G4 9.2 to 9.3
- LHEP out
- next studies will need to compare phys. lists with _HP