

Transverse Profiles Analysis - Update -

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Overview

- 1 Reminder
- 2 Transverse Profiles in EM Showers
- 3 Conclusions



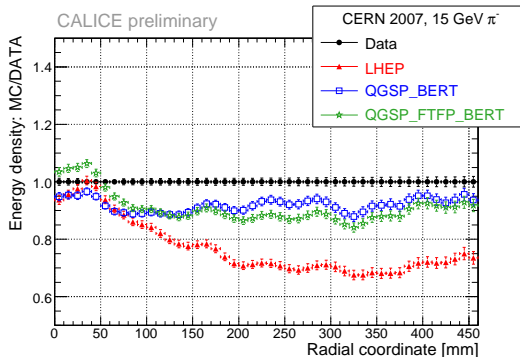
Reminder

- Profile done with respect to the track, i.e. axis of the shower:

$$\text{Radial coordinate} = \sqrt{(x_{\text{HCAL}} - x_{\text{track}})^2 + (y_{\text{HCAL}} - y_{\text{track}})^2}$$

- Results of **transverse profiles in hadron showers** presented in CAN-011-e

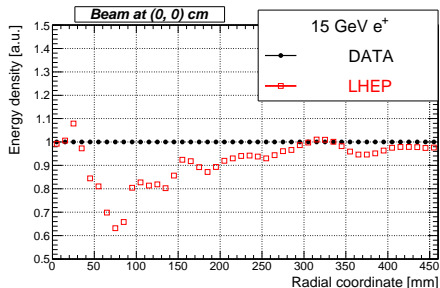
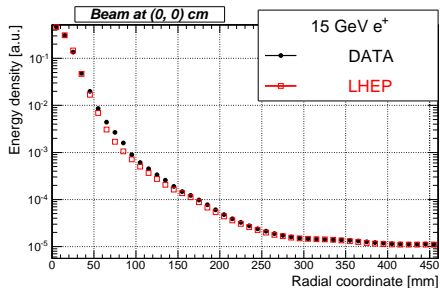
- Non-flat behaviour of MC/data ratio not explained



- In the following slides: concentrate on **electromagnetic showers** and check the situation there

Transverse Profiles in EM Showers

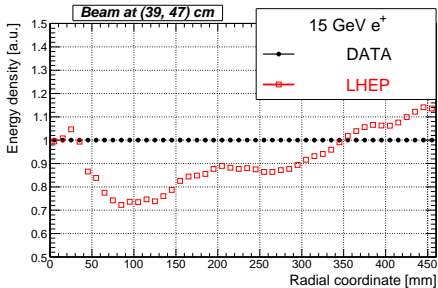
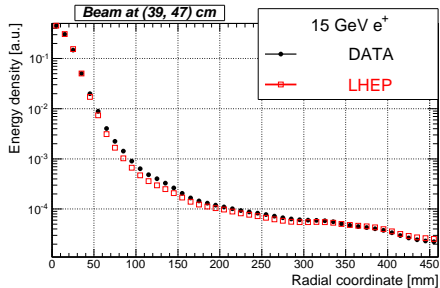
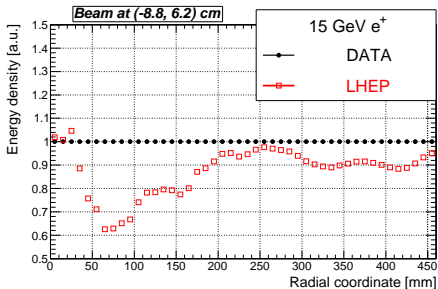
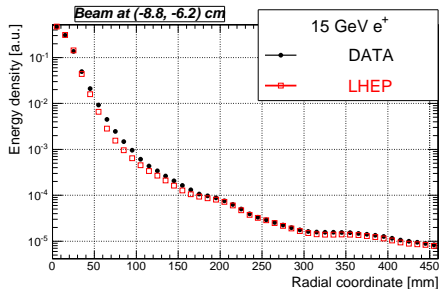
- Transverse profile ratio of MC/data for **positrons** also non-flat (but opposite direction compared to the pion case)
- Only LHEP shown, but QGSP_BERT similar



1) Detector Effects

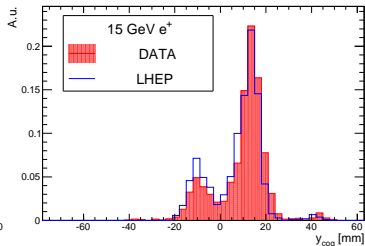
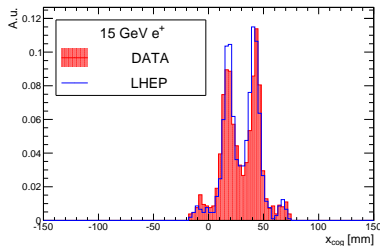
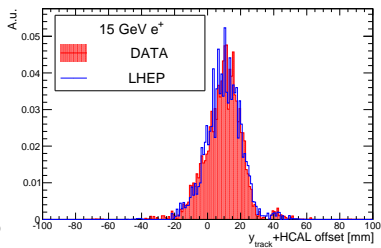
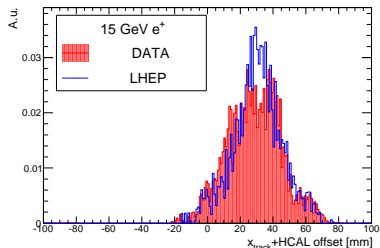
- Check for possible detector effects by comparing runs with beam at (0, 0) with beams at another position

1) Detector Effects - continued



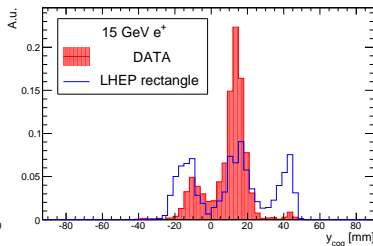
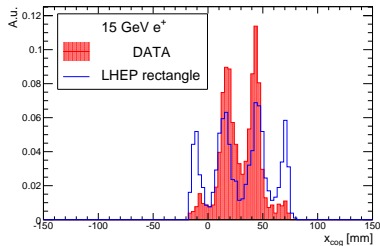
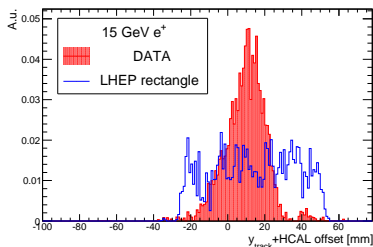
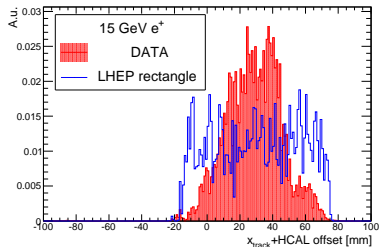
2) Shape of the Beam Profile

- Beam profile in Monte Carlo biased using information from experimental data (based on the GEANT4 **global particle source**)



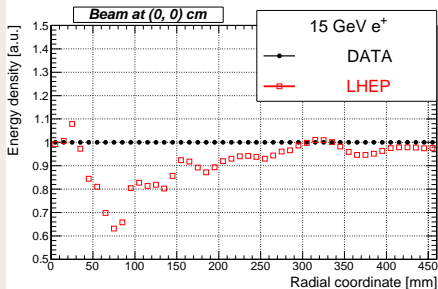
2) Shape of the Beam Profile - continued

- Default: beam profile in Monte Carlo just a simple **rectangle**

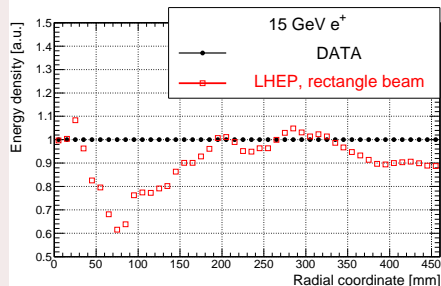


2) Shape of the Beam Profile - continued

Beam profile from data



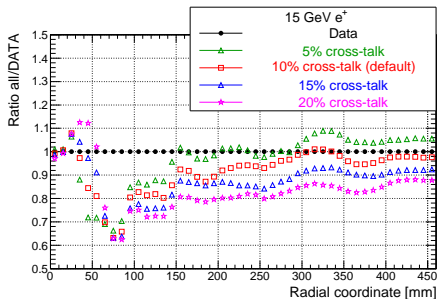
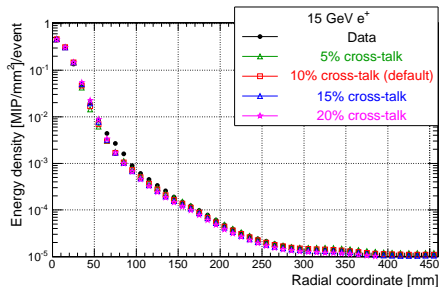
Beam profile just rectangle



- Shape of the beam profile has little impact on the drop seen between 5 and 10 cm

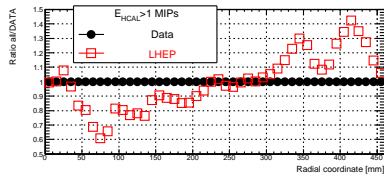
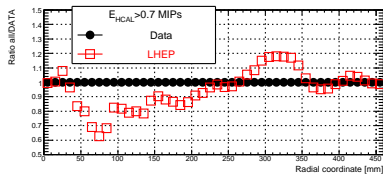
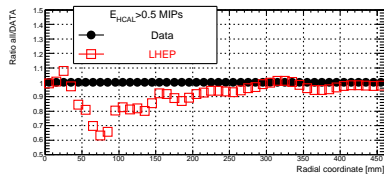
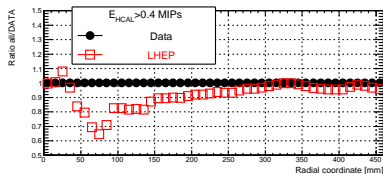
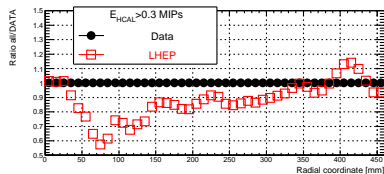
3) Effect of Cross-talk

- Light cross-talk between the AHCAL tiles introduced in digitisation
- Default: 10 % cross-talk, i.e. 2.5% of the energy of one tile goes into each of the 4 neighbouring tiles

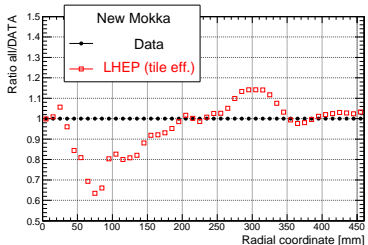
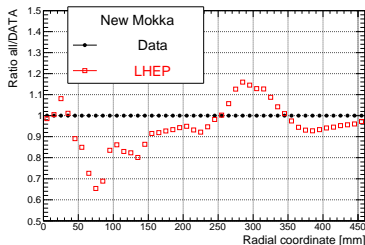
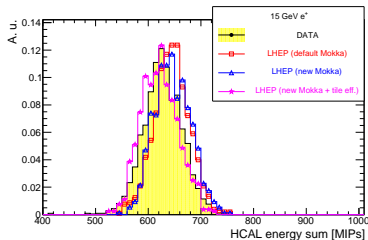
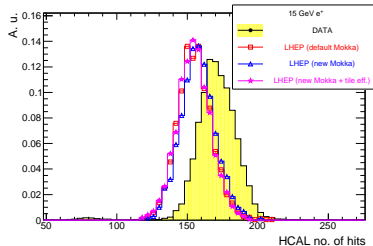


- Cross-talk value has minimal impact on the drop seen between 5 and 10 cm

4) Effect of the MIP Cut Value



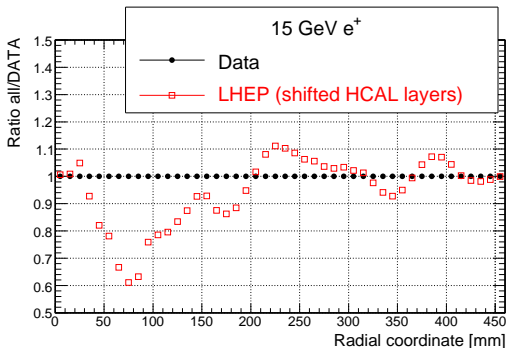
5) Effect of the Mokka Implementation - continued



- Drop between 5 and 10 cm present also for the new Mokka implementation...

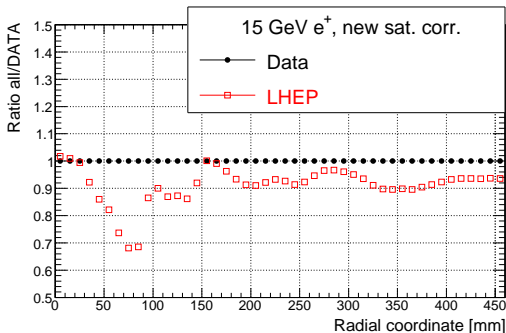
6) Shifted HCAL Layers

- Experiment: HCAL layers not perfectly aligned (spread of around 5 mm)
⇒ shift HCAL layers in Mokka, randomly, with a spread of 6 mm



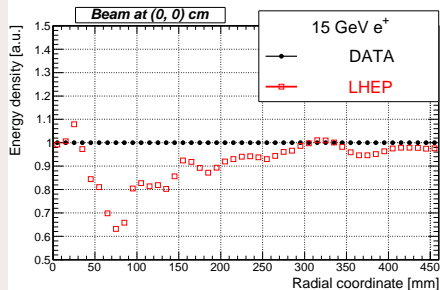
7) Saturation Correction

- New treatment of saturation correction (double exponential fit of saturation curve)

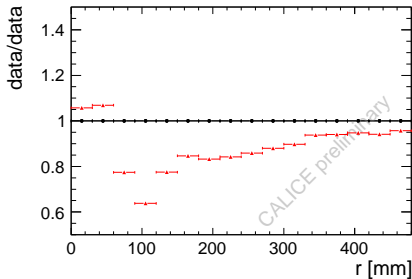


8) Software Used to Calculate the Transverse Energy Density

Angela:



Beni:



- The software does not cause the drop
- Mistake/feature most probably in the files itself (digitisation, calibration?)

Conclusions

- Transverse profiles with e^+ in AHCAL
- Different studies done to identify source of non-flat behaviour of MC/data ratio:
 - detector effects (due to active tile)
 - shape of the beam profile
 - cross-talk effect
 - MIP cut
 - Mokka implementation
 - alignment of AHCAL layers
 - treatment of saturation correction (many thanks to Niels)
 - software used to measure transverse energy density (thanks to Beni)
- Unfortunately no response yet
- Any ideas/suggestions/critics are welcome