

Transverse Profiles Analysis - Update -

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Overview

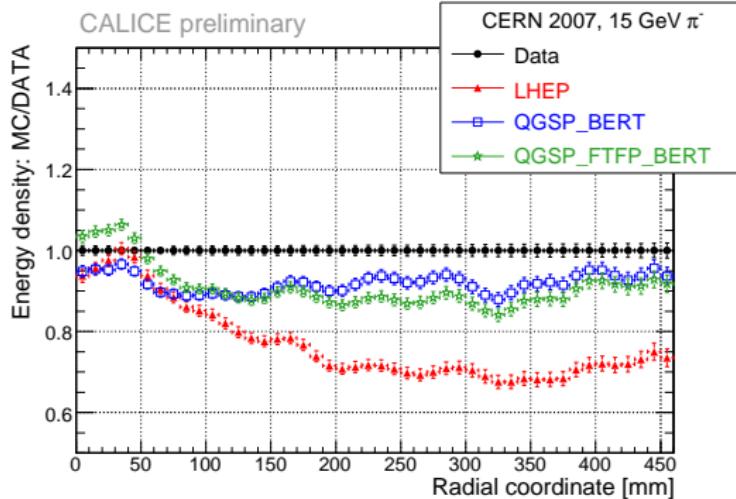
- 1 Reminder
- 2 Transverse Profiles in EM Showers
- 3 Conclusions



Reminder

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

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

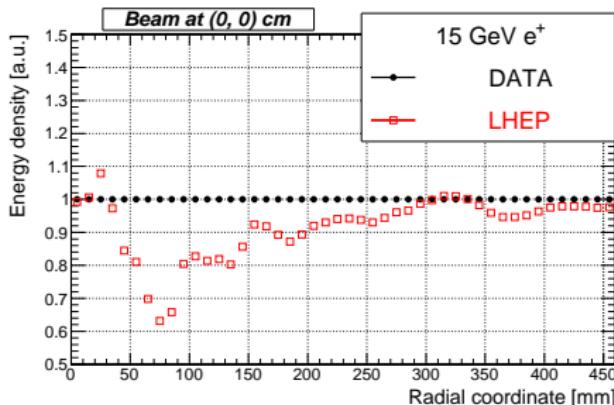
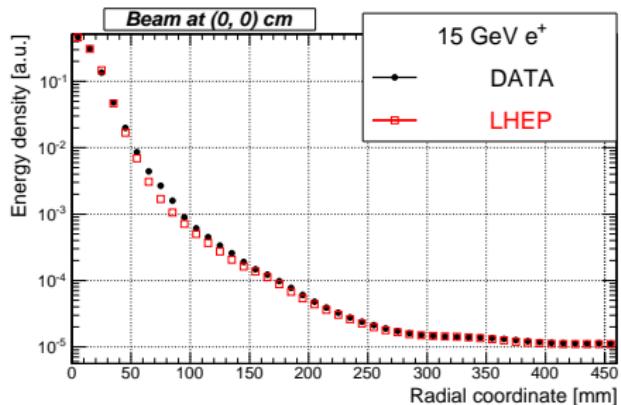


- Results of **transverse profiles in hadron showers** presented in CAN-011-e
- Non-flat behaviour of MC/data ratio not explained

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

Transverse Profiles in EM Showers

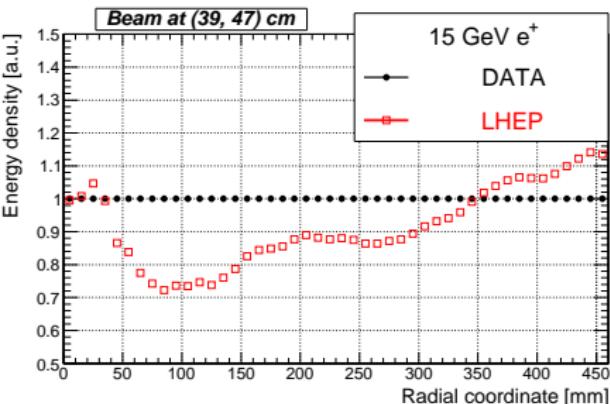
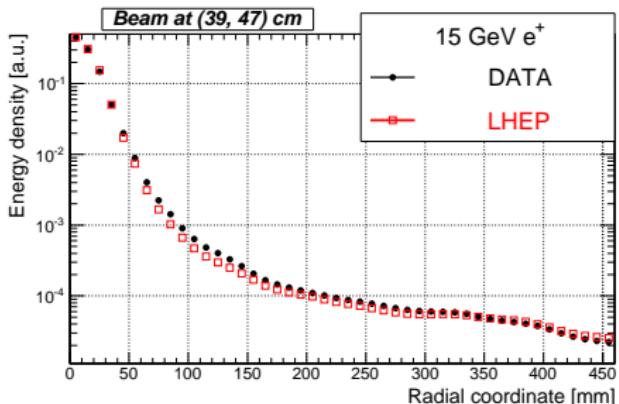
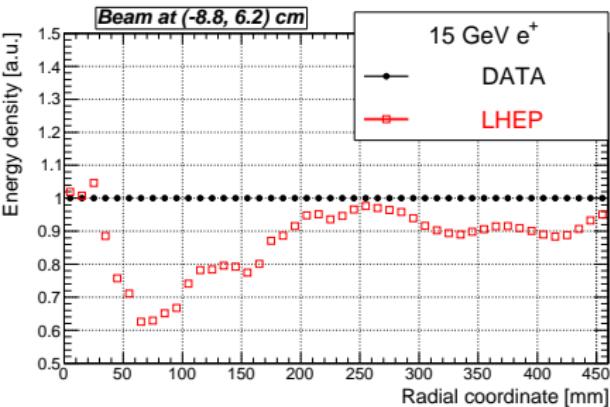
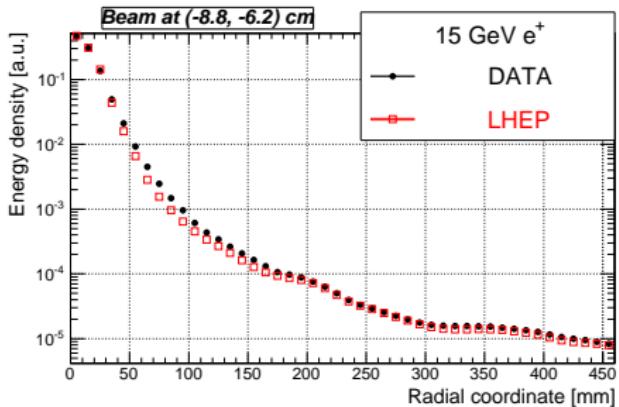
- Transverse profile ratio of MC/data for **positrons** also non-flat (but opposite direction compared to the pion case)
- Only LHEP shown, but QGSP_BERT similar



1) Detector Effects

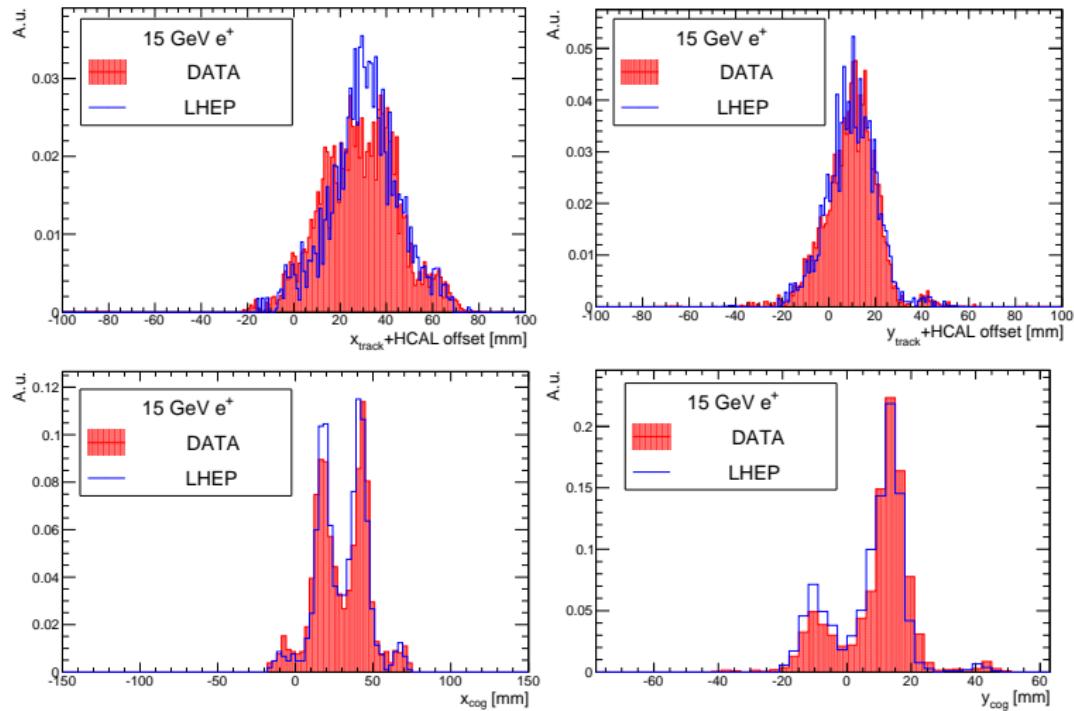
- Check for possible detector effects by comparing runs with beam at (0, 0) with beams at another position

1) Detector Effects - continued



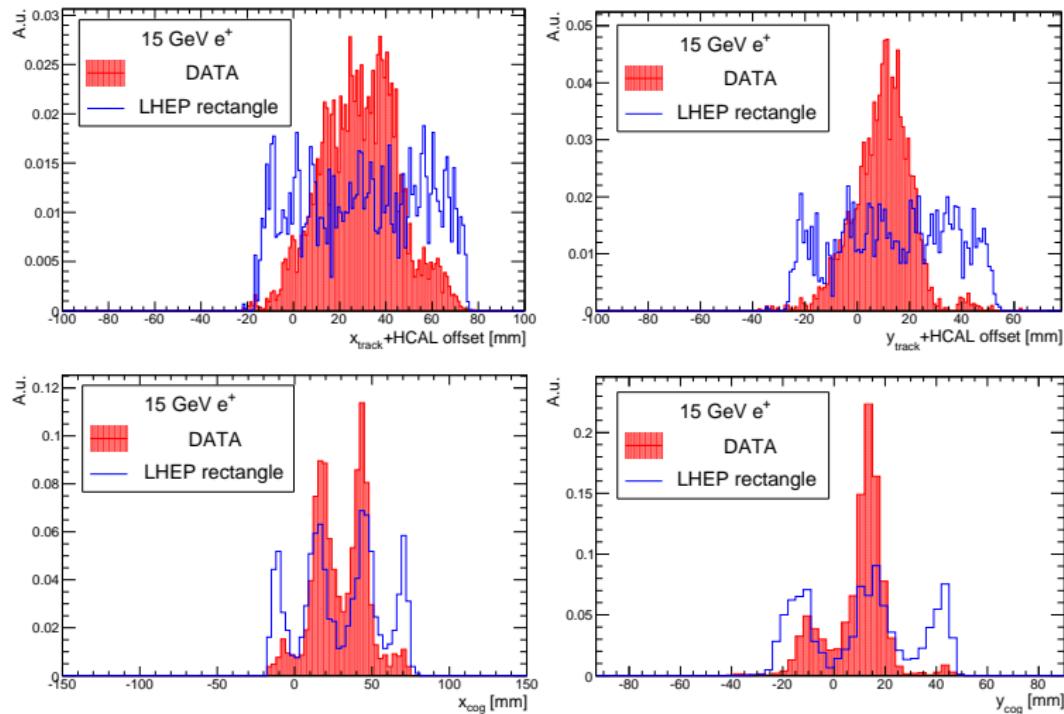
2) Shape of the Beam Profile

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



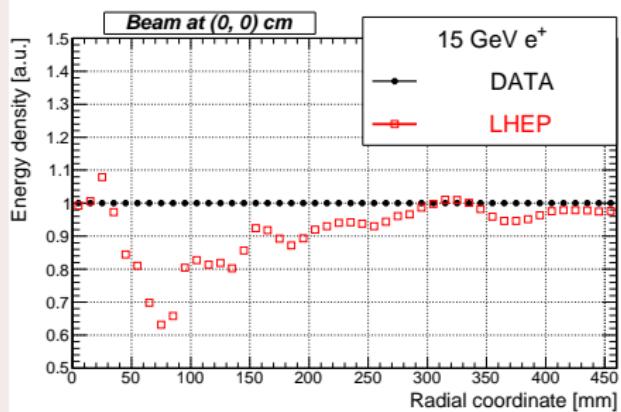
2) Shape of the Beam Profile - continued

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

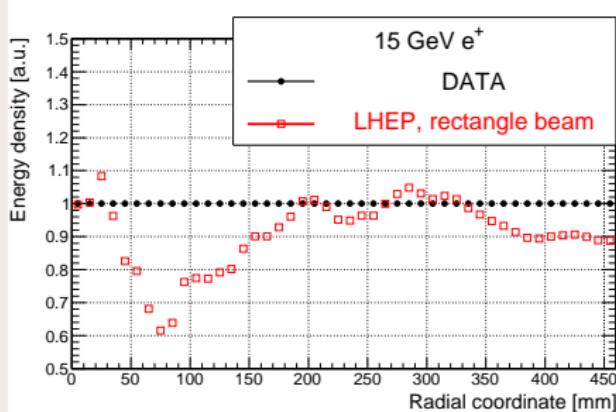


2) Shape of the Beam Profile - continued

Beam profile from data



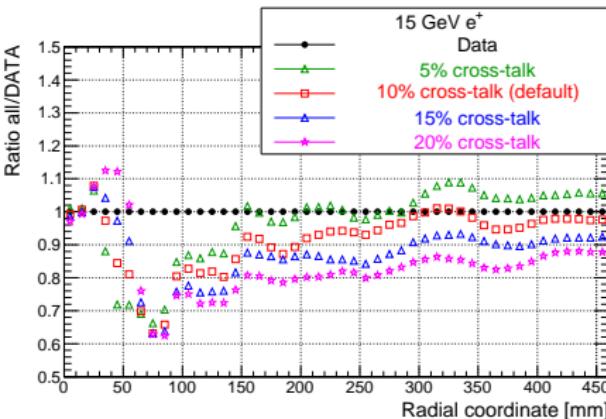
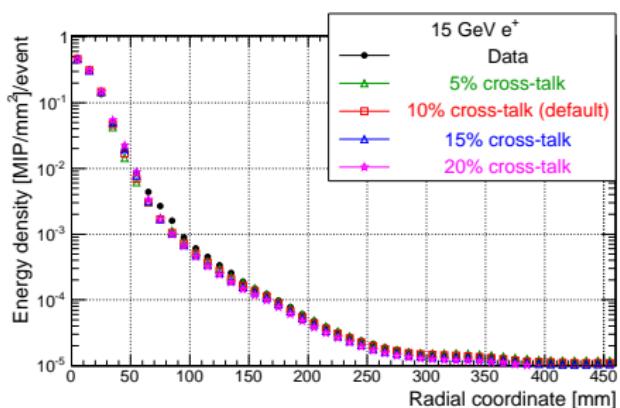
Beam profile just rectangle



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

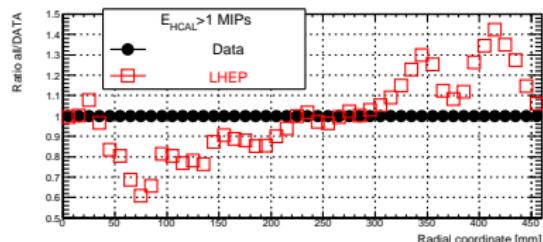
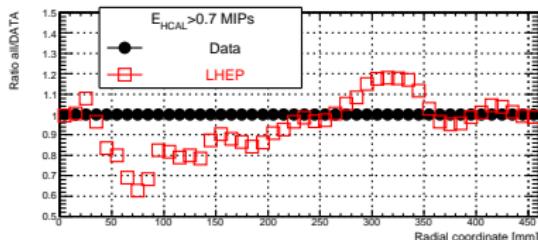
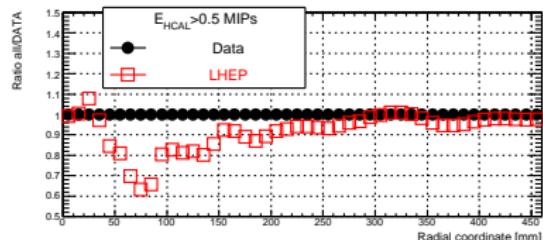
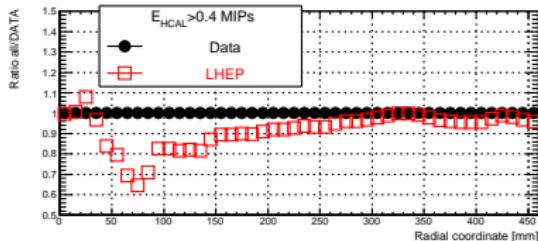
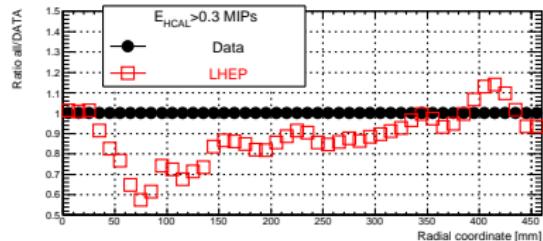
3) Effect of Cross-talk

- 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

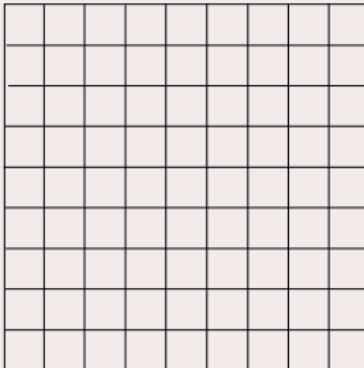
4) Effect of the MIP Cut Value



5) Effect of the Mokka Implementation

Default Mokka:

- 900 virtual cells, $1 \times 1 \text{ cm}^2$ each
- Grouped in larger cells during digitisation

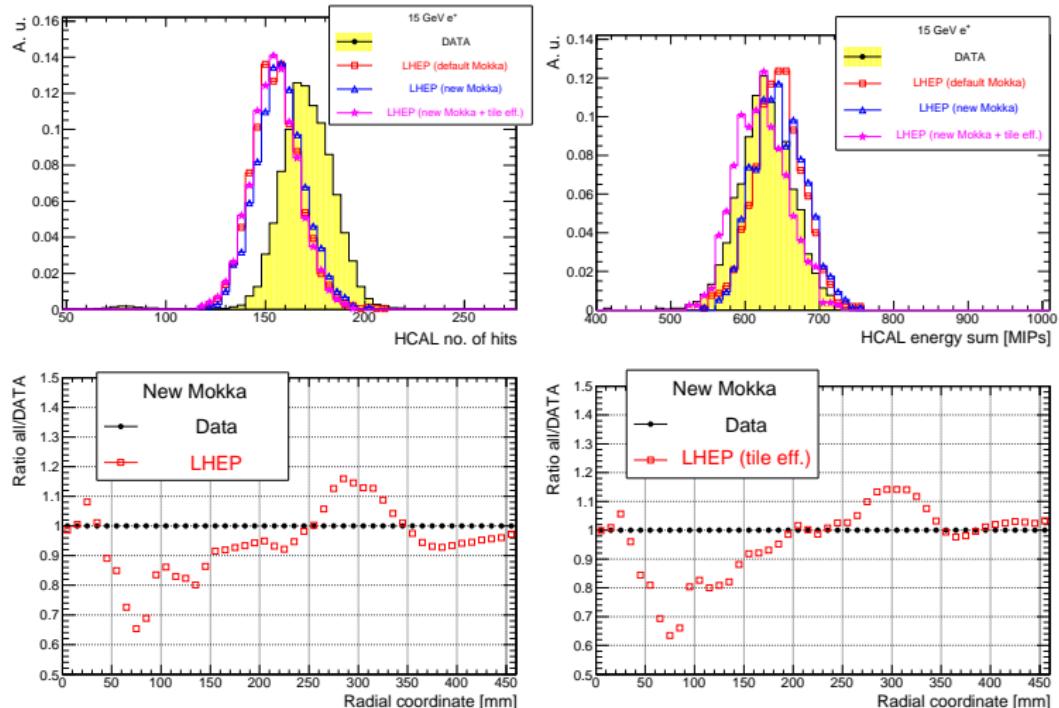


New Mokka:

- Separate volumes for each $3 \times 3 \text{ cm}^2$, $6 \times 6 \text{ cm}^2$ and $12 \times 12 \text{ cm}^2$ cells
- *New Mokka + tile efficiency*: simulated tile inefficiency (i.e. hits close to the margin of the tiles deposit only approx 80% of their energy)

		13/79	25/79	37/79	49/79	61/79							
		13/73	19/73	25/73	31/73	37/73	43/73	49/73	55/73	61/73	67/73	73/73	79/67
1/61	1/61	13/67	19/67	25/67	31/67	37/67	43/67	49/67	55/67	61/67	67/67	73/67	79/55
	1/49	13/61	19/61	25/61	31/61	37/61	43/61	49/61	55/61	61/61	67/61	73/61	79/43
1/49	1/49	13/55	19/55	25/55	31/55	37/55	43/55	49/55	55/55	61/55	67/55	73/55	79/31
	1/49	13/49	19/49	25/49	31/49	37/49	43/49	49/49	55/49	61/49	67/49	73/49	79/19
1/37	1/37	13/43	19/43	25/43	31/43	37/43	43/43	49/43	55/43	61/43	67/43	73/43	79/13
	1/37	13/37	19/37	25/37	31/37	37/37	43/37	49/37	55/37	61/37	67/37	73/37	79/13
1/25	1/25	13/31	19/31	25/31	31/31	37/31	43/31	49/31	55/31	61/31	67/31	73/31	79/13
	1/25	13/25	19/25	25/25	31/25	37/25	43/25	49/25	55/25	61/25	67/25	73/25	79/13
1/13	1/13	13/19	19/19	25/19	31/19	37/19	43/19	49/19	55/19	61/19	67/19	73/19	79/13
	1/13	13/13	19/13	25/13	31/13	37/13	43/13	49/13	55/13	61/13	67/13	73/13	79/13
		19/1	31/1	43/1	55/1	67/1							

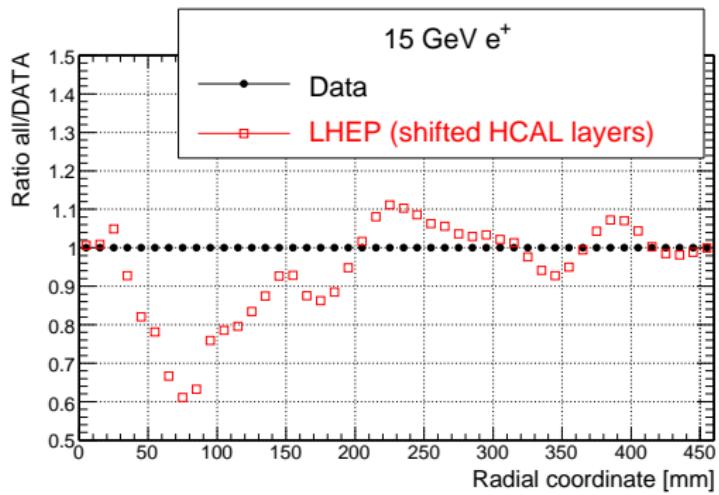
5) Effect of the Mokka Implementation - continued



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

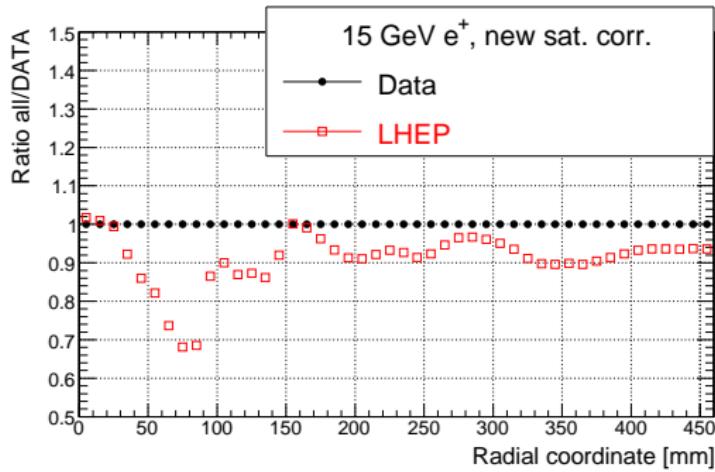
6) Shifted HCAL Layers

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



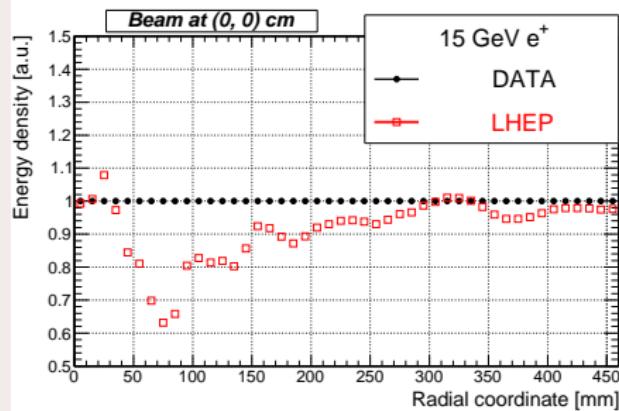
7) Saturation Correction

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

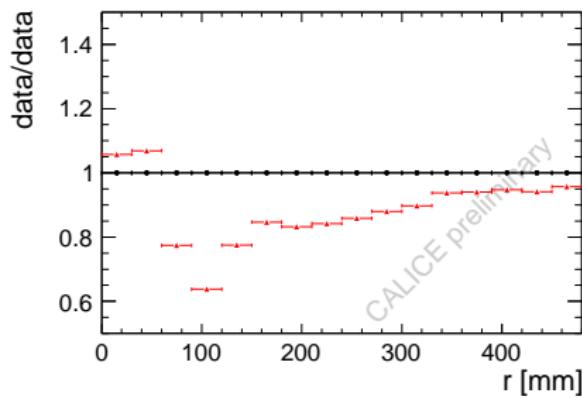


8) Software Used to Calculate the Transverse Energy Density

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