

# Transverse Profiles Analysis

**Angela Lucaci-Timoce**

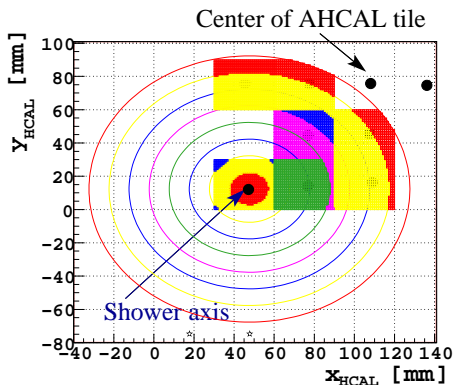


# Transverse Profiles: Reminder

- Get the shower axis based on TBTrack
- Look in rings centered at the shower axis
- Sum up the energy in each ring, weighted by the fraction of the tile area in the specific ring
- Divide by the ring area  
⇒ **energy density vs radial coordinate:**

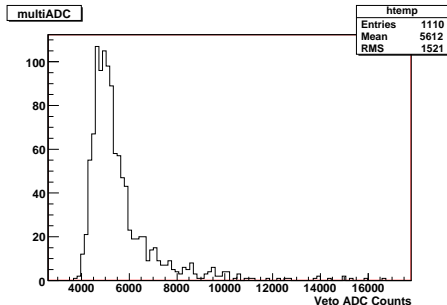
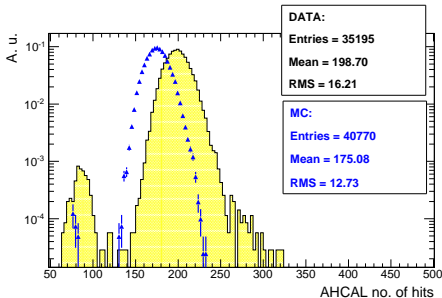
$$R = \sqrt{(x_i - x_{track})^2 + (y_i - y_{track})^2}$$

⇒ **transverse profiles**

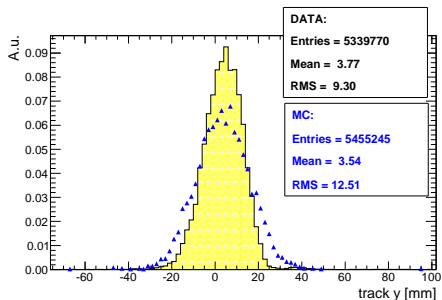
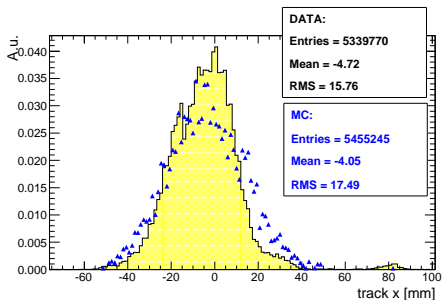
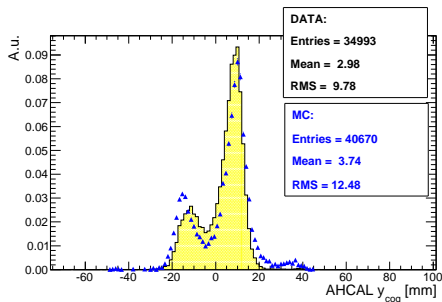
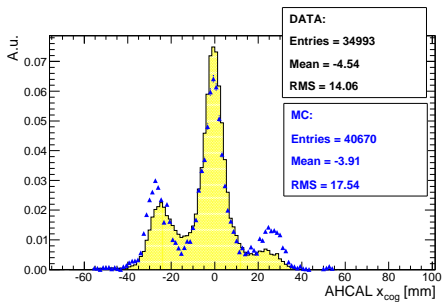


# Event Selection: $e^+$

- Run 350137,  $e^+$ , 20 GeV, CERN 2007
- Monte Carlo: QGSP\_BERT
- Use of new AHCAL reconstruction and digitisation
- Events starting to shower in AHCAL:  
 $N_{\text{AHCAL hits}} > 100$
- Remove multiparticle events with the help of the veto counter
- Purity 99.9%  
( $\text{multiADC} < 7296$ )

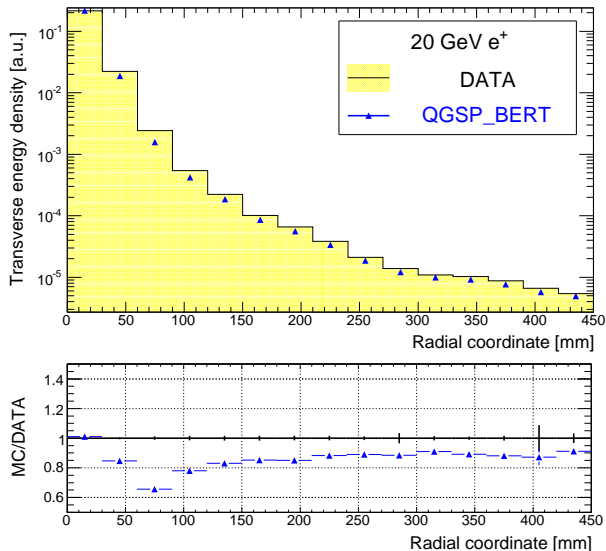


# Control Plots: $e^+$



# Transverse Profile: $e^+$

- The same dip at around 7 cm, as before, but less pronounced

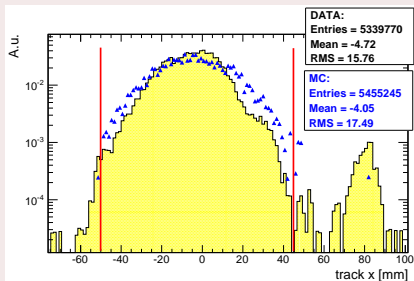


# Tracks Cut

- Scintillator counters:  $10 \times 10 \text{ cm}^2$
- Tracks outside are unphysical

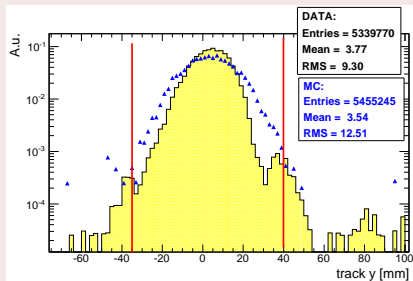
## Track x

$$-50 \text{ mm} < x_{\text{track}} < 45 \text{ mm}$$



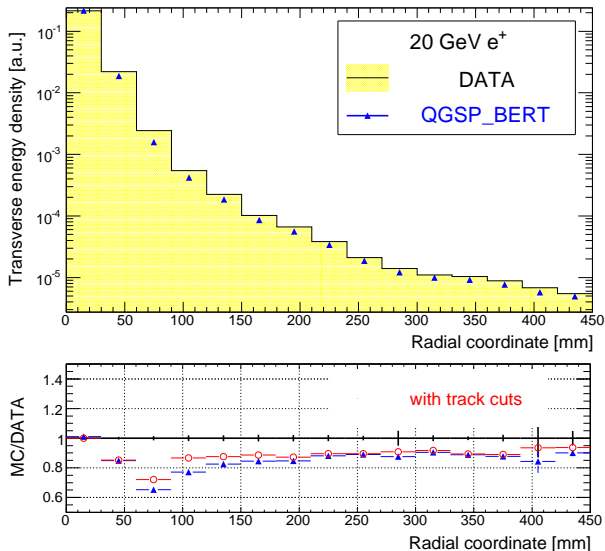
## Track y

$$-35 \text{ mm} < y_{\text{track}} < 40 \text{ mm}$$



# $e^+$ Transverse Profile with Track Cuts

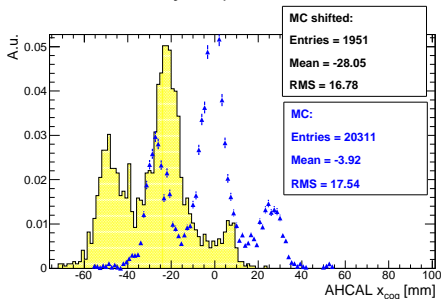
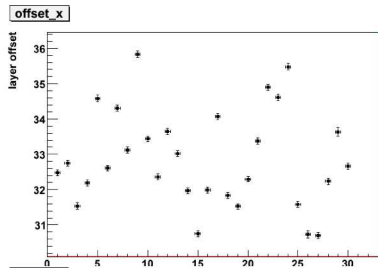
- Removing problematic tracks improves the situation a little bit
- Applying more stringent cuts on the tracks does not help anymore



# $e^+$ : Shifted AHCAL Layers

- Method developed by Niels Meyer to measure shifts of the AHCAL layers based on muon runs
- Example: shifts in  $x$  of around 33 mm, with spread of approximately 3 mm

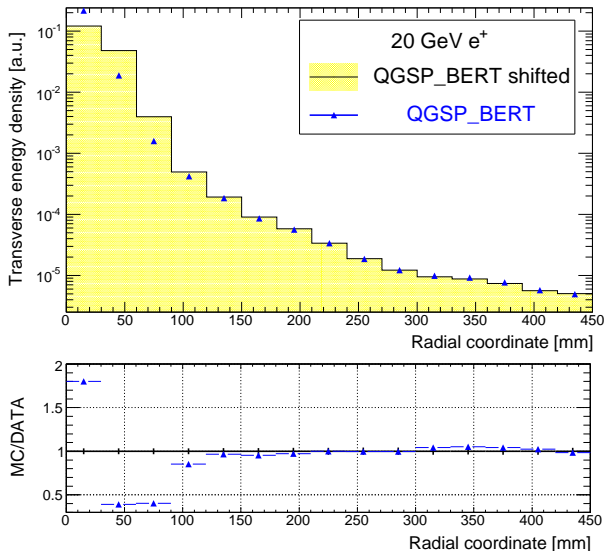
- Monte Carlo: shift the first 7 AHCAL layers with  $Gaus(mean = 33 \text{ mm}, spread = 3 \text{ mm})$ , no shift in  $y$
- Compare shifted Monte Carlo (i.e. "data") with default Monte Carlo (perfect alignment of the AHCAL layers)





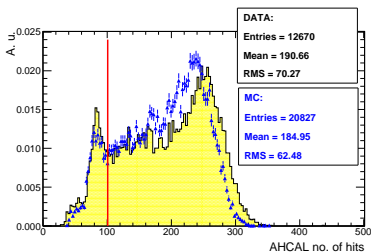
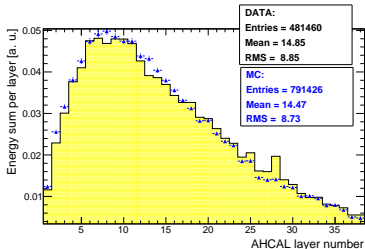
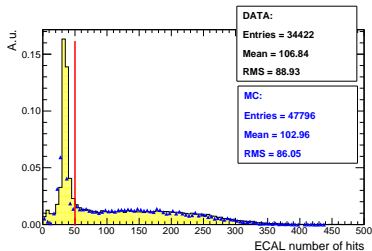
# $e^+$ Transverse Profile with Shifted AHCAL Layers

- Shifted AHCAL layers induce similar dip
- But such strong misalignment would be visible in comparing  $x/y_{cog}$  from data and Monte Carlo
- Some other hidden effect?

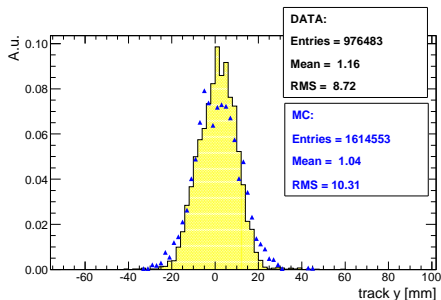
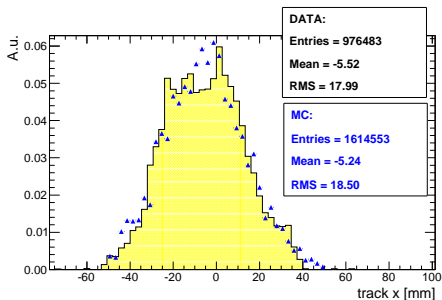
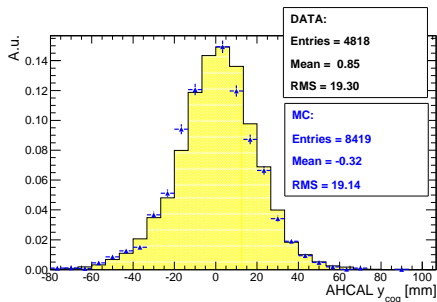
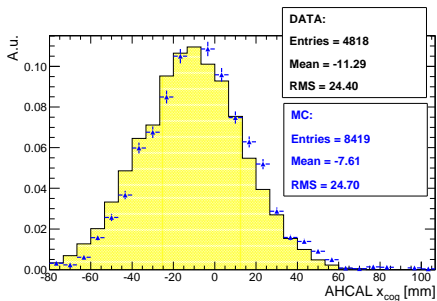


# Pion Sample: Event Selection

- Run 330770,  
20 GeV  $\pi^-$
  - Shower starting in  
AHCAL:  
 $N_{ECAL\ hits} < 50$
  - Muon rejection:  
 $N_{AHCAL\ hits} > 100$
- One problematic layer (28), but it should have little influence on the transverse profile

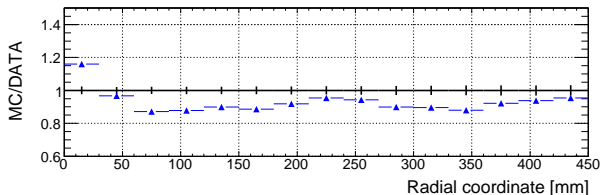
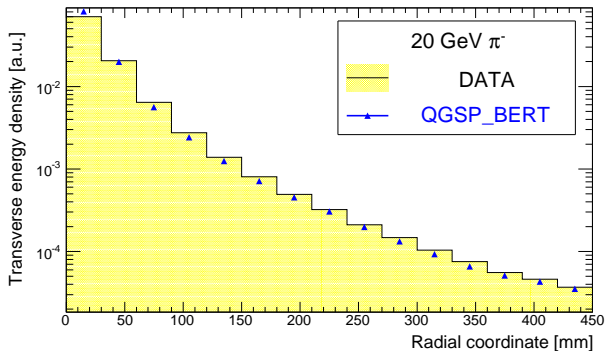


# Pion Sample: Control Plots



# Transverse Profile: $\pi^-$

- Still some not understood structure



# Conclusions

- Transverse profiles for 20 GeV positrons and pions presented, in the new AHCAL reconstruction and digitisation framework
- Not understood dip observed in the DATA/MC ratio (present also in Marina's and Beni's analysis)
- Unfortunately still open questions...

Thank you