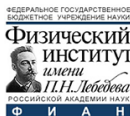


Update of comparison PP vs. noPP mode for May 2018 test beam data

Marina Chadeeva

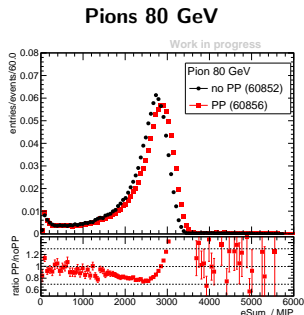
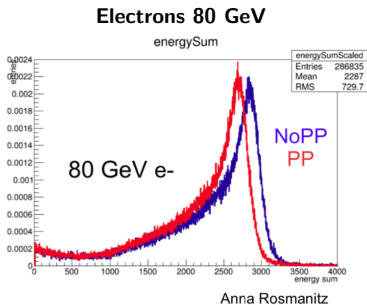
LPI, MEPHI

- 1 Data samples and conditions
- 2 Crosscheck for no PP mode
- 3 Crosscheck for PP mode



Reminder: motivation

- Observed shift of the energy sum for PP regime wrt that without PP for electrons and pions: preliminary studies [Anna, AHCAL weekly, June 2018]
- Shifts in MIP calibration reported by Daniel [AHCAL weekly, September 11, 2018]
- Pions from May 2018 TB data: good agreement for 10,20,40 GeV and discrepancy for 80 GeV (one run at 80 GeV in PP mode only) [CALICE Collaboration meeting at CERN, 2019]



Shift in opposite directions, one run only for pion comparison: further crosscheck required

Data samples and selection

Data samples from May 2018

- **80 GeV pion runs** with and w/o PP (marked as "good")
 - **no PP (different dates): 60696, 60714, 60852**
 - **PP (same date): 60856, 60857**, two runs only at 80 GeV in PP mode
- Observables: **energy sum** without clustering and longitudinal profiles
- **Muon-like** events from pion runs to check mip calibration

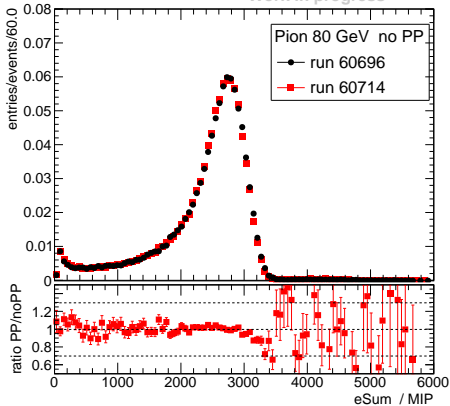
Software

- Standard reconstruction with the latest CALICE software version 01-07-01 as of September 2019 (**many thanks to Vladimir Bocharnikov**)
- Particle ID using Vladimir's processor for two categories:
 - hadron events
 - muon-like events
- Shower start finder inherited from the previous prototype analyses - no additional tuning

no PP regime: runs from different dates (I)

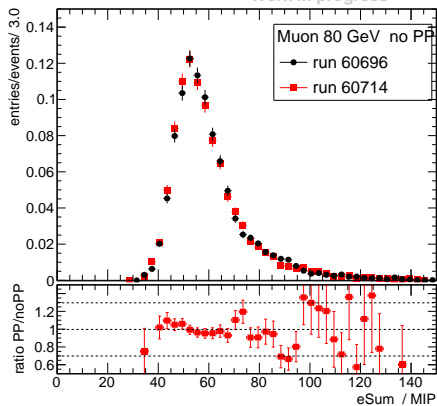
Pion 80 GeV

Work in progress



Muon-like from 80 GeV hadron run

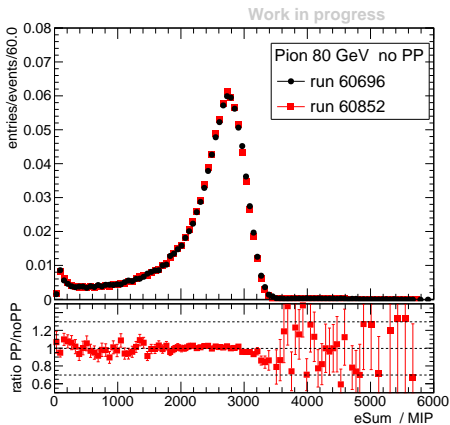
Work in progress



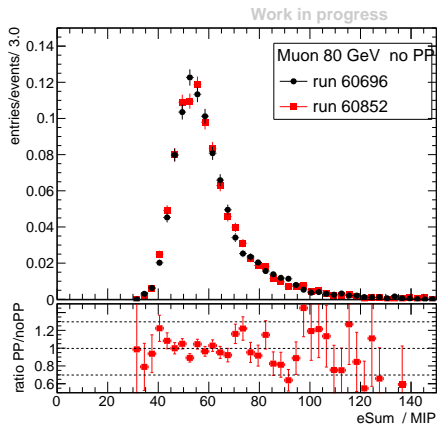
Good agreement for both pions and muons.
Late showering hadrons in the left shoulder

no PP regime: runs from different dates (II)

Pion 80 GeV



Muon-like from 80 GeV hadron run



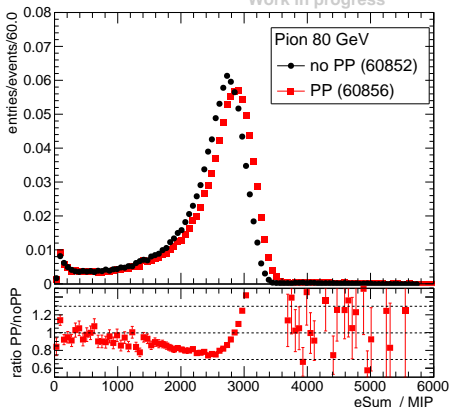
Good agreement for both pions and muons.
Late showering hadrons in the left shoulder

PP mode (run 60856) versus no PP mode

Run 060856 marked as "good", it is the first one after switching to PP mode.

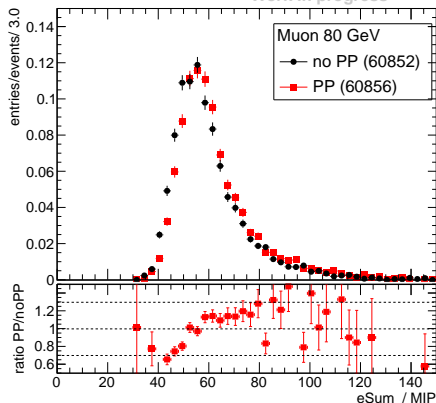
Pion 80 GeV

Work in progress



Muon-like from 80 GeV hadron run

Work in progress



The noted shift of $\sim 5\%$ in energy scale was corrected for the next run.

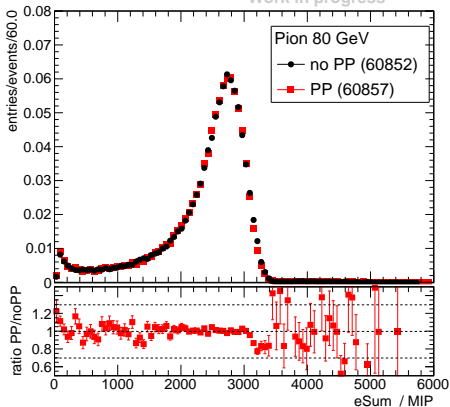
PP mode (run 60857) versus no PP mode

Run 060857, no "good" mark,

the comment says "shifted eSum distribution, rechecked after new calibration".

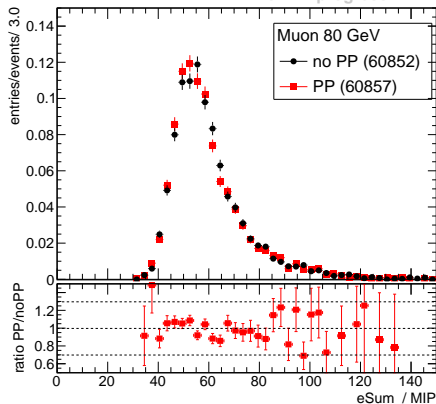
Pion 80 GeV

Work in progress



Muon-like from 80 GeV hadron run

Work in progress



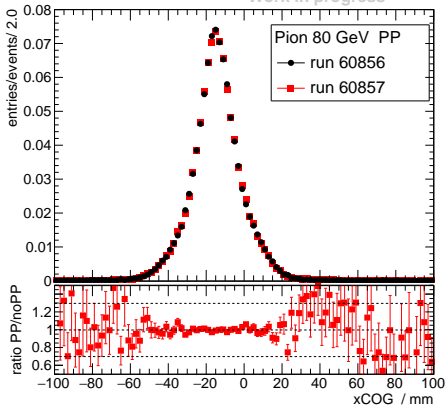
Much better agreement between PP and no PP modes after recalibration.

Crosscheck: beam position for hadron events

Hadron events, 80 GeV hadron runs in PP mode

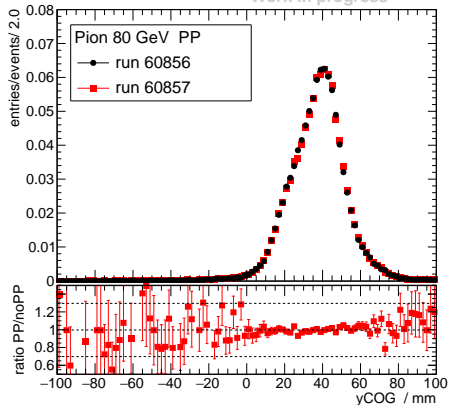
xCOG

Work in progress



yCOG

Work in progress

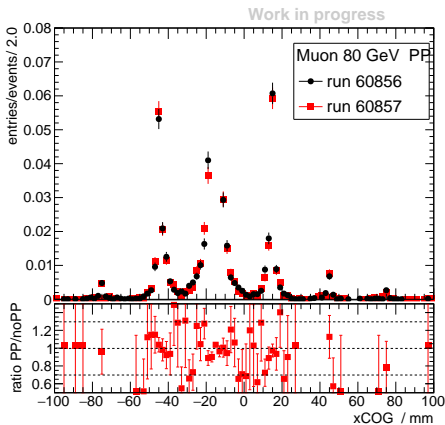


Good agreement of beam position in two runs.
Very close to the beam position in no PP mode.

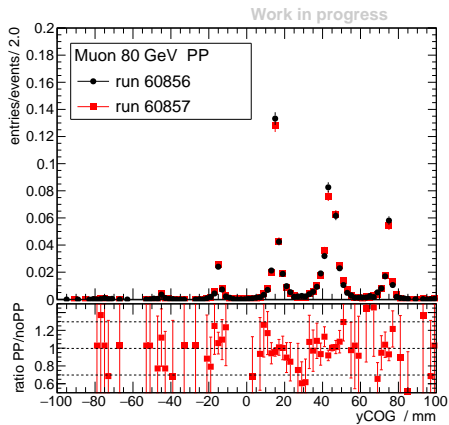
Crosscheck: beam position for muon-like events

Muon-like events, 80 GeV hadron runs in PP mode

xCOG



yCOG



Good agreement of beam position in two runs.

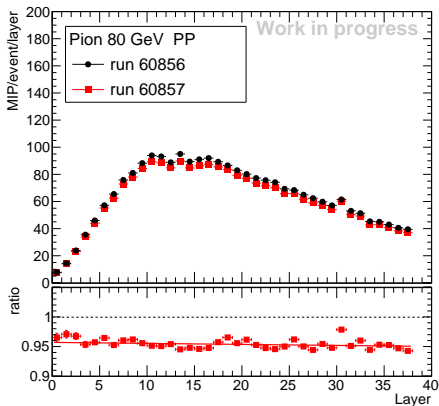
Crosscheck: longitudinal profiles from calorimeter front

Run 60856: switching to PP mode, before recalibration

Run 60857: after recalibration

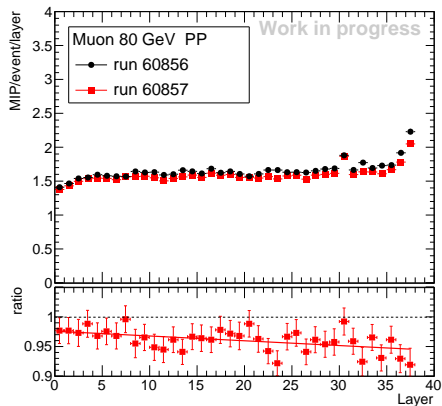
Pion 80 GeV

Lng profile from calo front



Muon from 80 GeV hadron run

Lng profile from calo front



Slow trend: increasing difference with increasing layer number, more pronounced for muons.

Summary

Test beam data for comparison and crosscheck

- Negative pions at 80 GeV from May 2018 TB data, with and w/o power pulsing
- Standard CALICE software for reconstruction + particle ID by Vladimir
- Comparison of energy sum

Conclusions

- **Crosscheck confirmed a stability of calorimeter response during May 2018 data taking period for both pion showers and at the mip level.**
- Run 60857 marked as "recalibrated" shows much better agreement with no PP mode than run 60856 marked as "good".

Questions

- What was the reason of energy scale shift and on-fly recalibration after switching to PP mode for run 60856? Was the recalibration layer-wise?
N.B.: No other mentions of such behaviour in the run list (at least for good runs).
- Could the additional "offline" corrections on top of mip calibration in the data base cure the scale for good (but shifted) run 60856?
- Do we need additional data quality control / certification for physics analyses? For instance, for data-MC comparison.

Backup slides

Data samples

May 2018, pion runs **with** and w/o PP, marked as "good" in the list

Energy / GeV	w/o PP	with PP
10	60646	60653
20	60711	60877
40	60712	60872
80	60696	60856

Hits and amplitudes

- number of hits, number of isolated hits
- energy sum, mean hit energy
- hit energy spectra

Shower shape

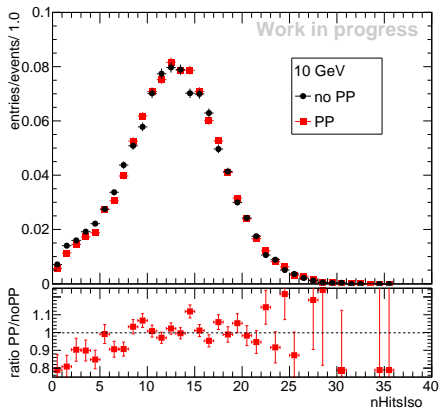
- shower radius wrt centre of gravity in XY plane: $R = \frac{\sum_{i=1}^N e_i \cdot r_i}{\sum_{i=1}^N e_i}$,
 N – number of hits, r_i - radial distance of hit e_i from CoG
- longitudinal centre of gravity: $z_{COG_{front/start}} = \frac{\sum_{i=1}^N e_i \cdot (z_i - z_{front/start})}{\sum_{i=1}^N e_i}$,
 z_i – z coordinate of hit e_i , $z_{front/start}$ – position of calorimeter front or shower start

Shower profiles

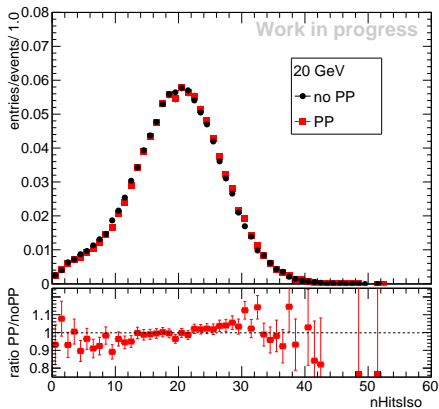
- longitudinal profile from calorimeter front face
- longitudinal profile from shower start

N.B.: No event selection by shower start is applied.

Pion 10 GeV

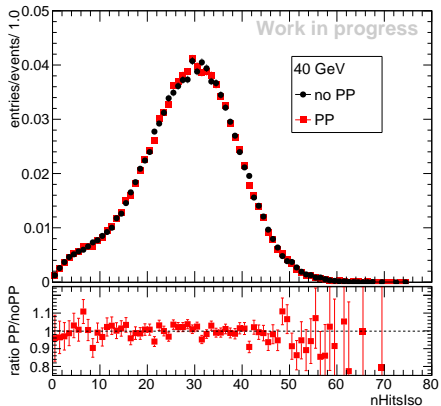


Pion 20 GeV

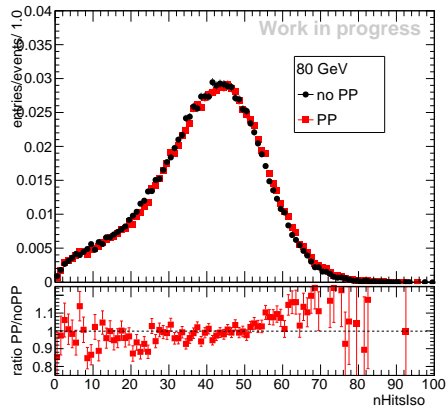


Differences in number of isolated hits are within uncertainties.

Pion 40 GeV



Pion 80 GeV



Differences in number of isolated hits between **PP** and noPP regime are within uncertainties.