Pion Data Quality Checks

Erik Buhmann[1], Erika Garutti

Universität Hamburg
DER FORSCHUNG | DER LEHRE | DER BILDUNG

Bundesministerium
für Bildung
und Forschung

CALICE
Calorimeter for ILC

Friedrich Naumann
STIFTUNG FÜR DIE FREIHEIT

[1] eMail: erik.buhmann@desy.de

Links

Run list:
https://docs.google.com/spreadsheets/d/1nZiltumo3yqxcxpDWMMRuEHWBUFrsaTvkxp_ODQGBf0/edit?usp=sharing

All plots created for this talk can be downloaded here:
https://wolke.physnet.uni-hamburg.de/index.php/s/pof3IvprxnihD7G

Paths to root macros:

/nfs/dust/ilc/user/buhmae/tokyoWorkshop/macros_PionQuality

May & June run list

[Click here to access run list google sheet]

Thanks to all the shifters for filling in the list!!
(If you notice mistakes, please report and amend)

- How to use the list:
  - Filter for *'standard'* run (those runs the shifters considered as taken with correct settings)
  - Filter for particle type, beam energy, PP or no_PP
- Now: How to proceed with the list?
  - .tsv in stash?
  - Table in Confluence?
  - Other ideas? Preferably an option that makes it easy to filter the list

Pion data quality check

Checking all pion ‘standard runs’ (according to run list) for outliers

Creating lists:

- *“Good”* runs: ?
- *“Need-to-check”* runs: ?

All plots only for May data so far

→ current reco files: /nfs/dust/ilc/group/flchcal/AHCAL_Testbeam_SPS_May2018/reco_rootfiles/

June plots did not make sense yet as calibrations constants are off for tail catcher and Tokyo Module

Pion data quality check

Checking all pion ‘standard runs’ (according to run list) for outliers

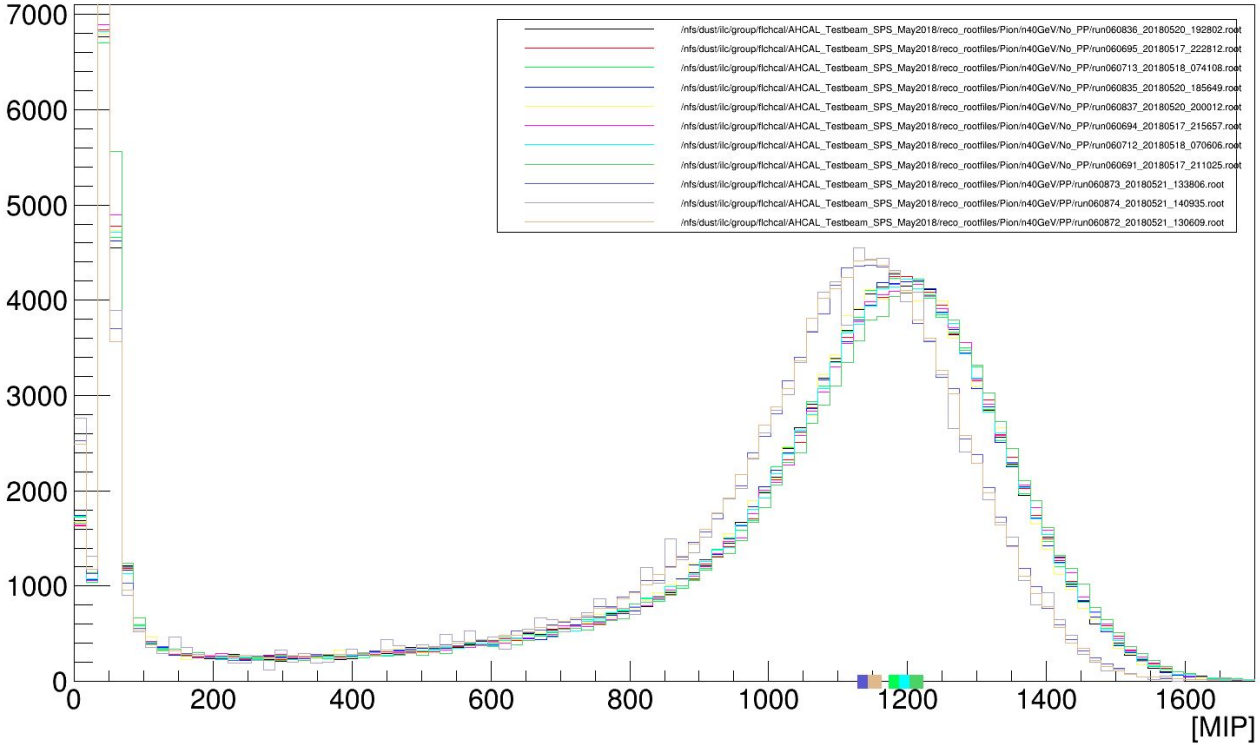
Looked at:

- Energy Sum
- nHits
- Center of Gravity in X & Y
- Ratio nPions vs nMuons based on energy cut @ 200 MIP

Root macros to create all plots can be found here:

/nfs/dust/ilc/user/buhmae/tokyoWorkshop/macros_PionQuality/

Energy sum histograms 40 GeV



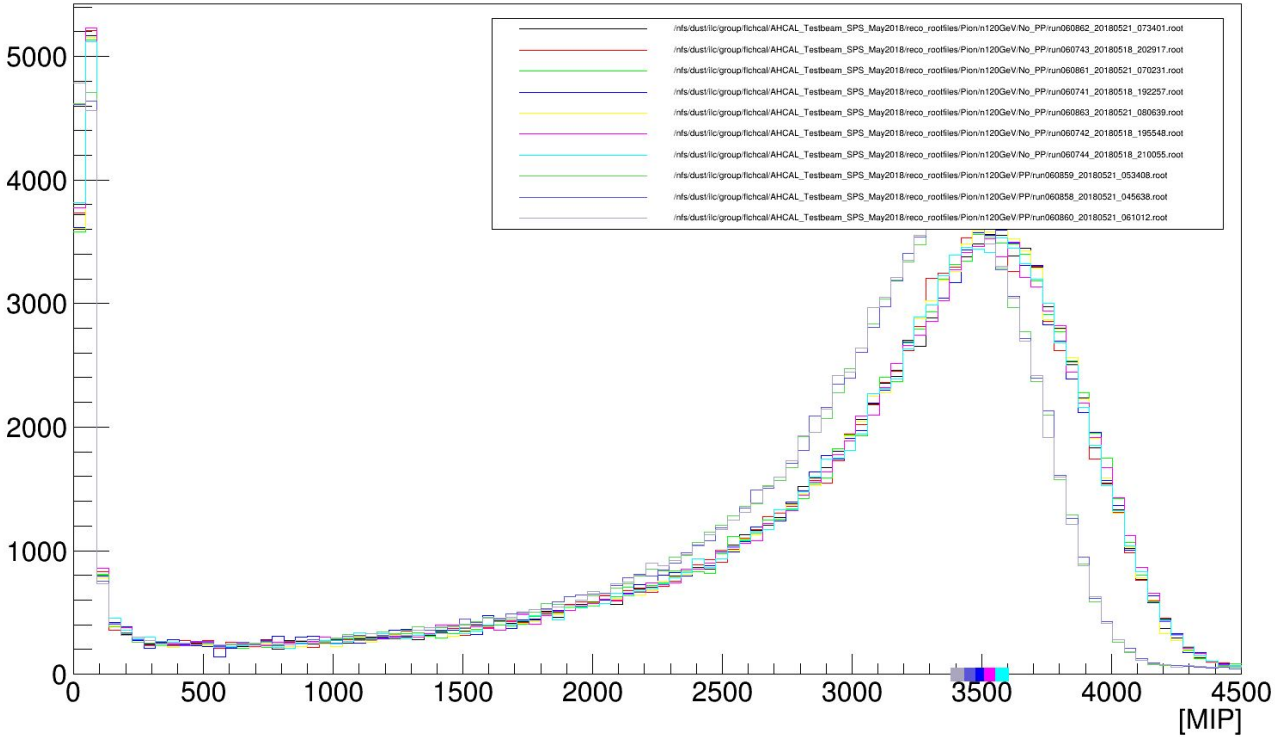
Normed histograms of energy sums of each 40 GeV run

Binning = 100
(for all histograms)

Marked bin with peak position for comparison

Systematic difference between PP & No_PP ?

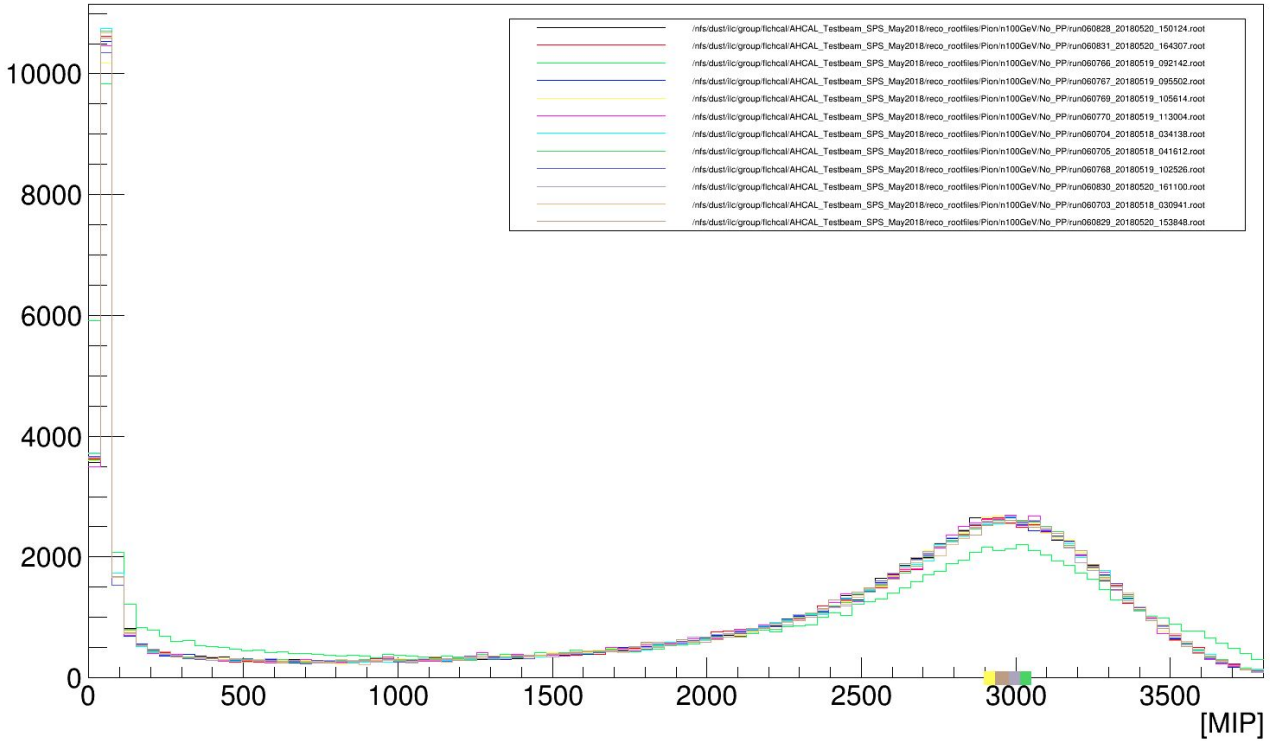
Energy sum histograms 120 GeV



Similar distributions for 120 GeV and 160 GeV

Distribution shift between PP and No_PP mode

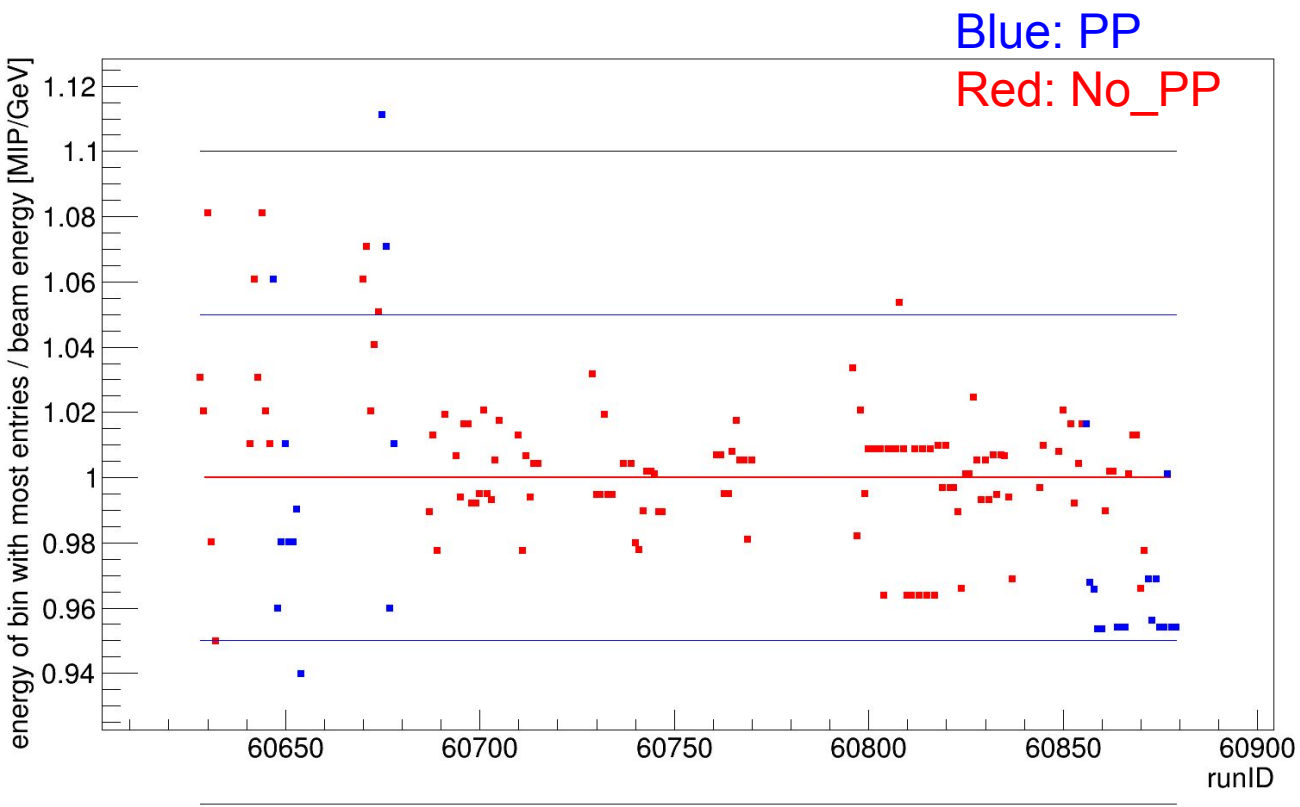
Energy sum histograms 100 GeV



Clear outlier:

Run 60766
(missing absorber according to eLog)

E_sum peaks vs Run ID

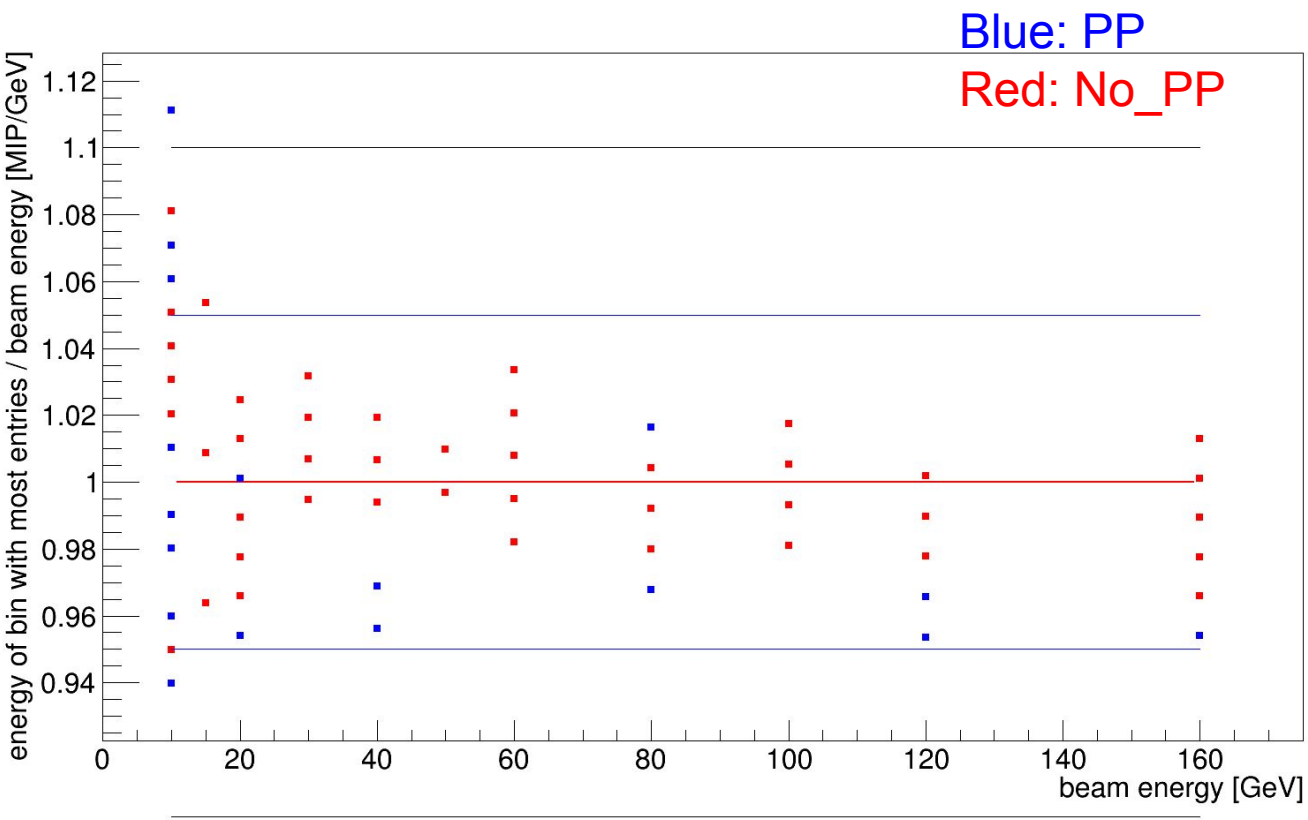


E_sum peak / beam energy
→ Detektor response surprisingly linear (!)

Checking time dependence with Run ID

Few outlier off > 5%,
just one off > 10%

E_sum peaks vs beam energy



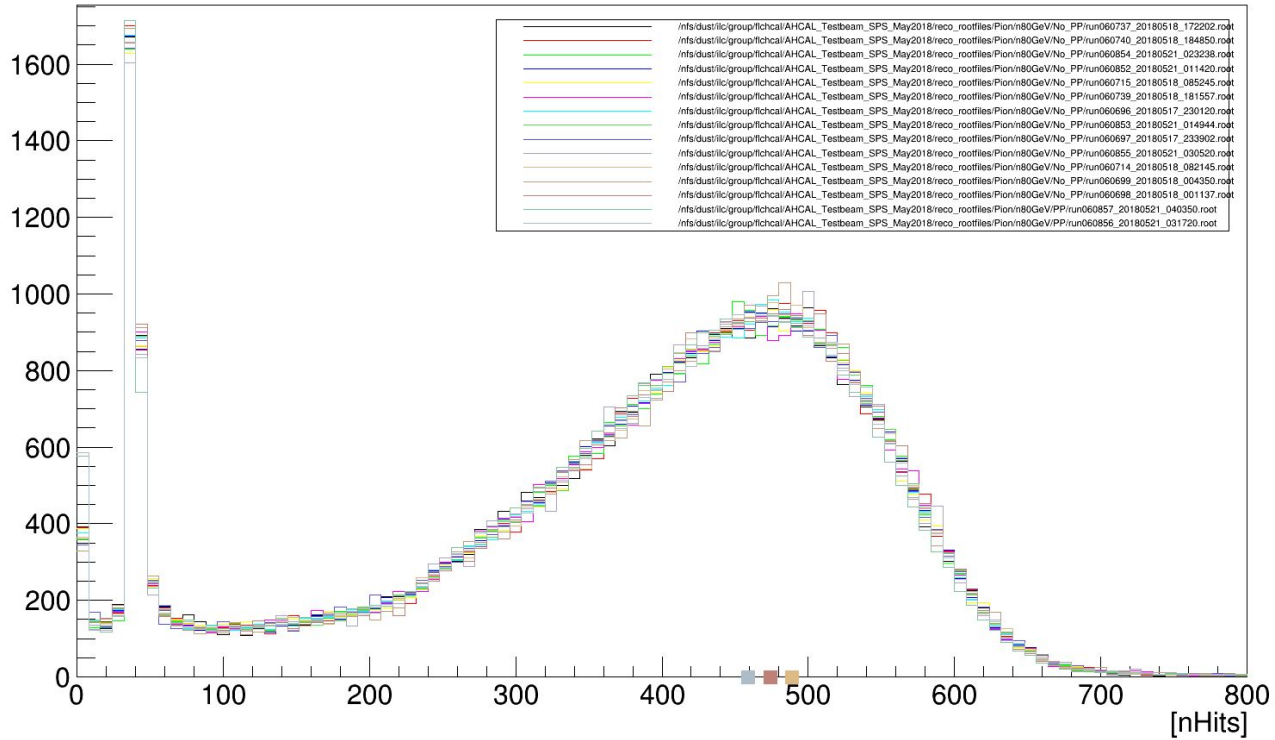
Same representation, now sorted by beam energy

(!) markers are overlaid, for full story look at this plot and the former one

All peak position within 5% (except 10 GeV)

Systematic peak shift PP vs no_PP? At high energies? (needs to be investigated)

nHits histograms
80 GeV



Normalized histograms of all 80 GeV runs

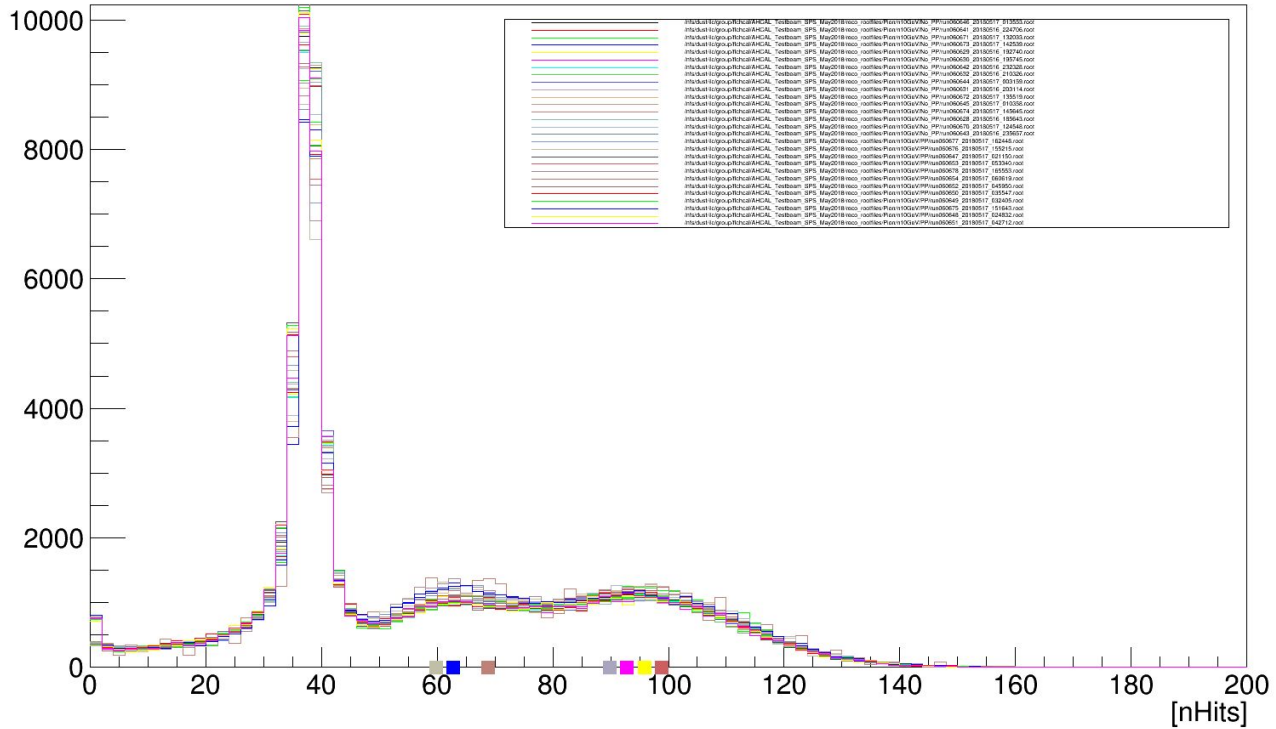
Marked bin with peak position for comparison

All energies look similar (except 10 GeV and 100 GeV)

No systematic difference between PP and No_PP visible

Binning = 100
(for peak bin with 1000 entries)

nHits histograms
10 GeV

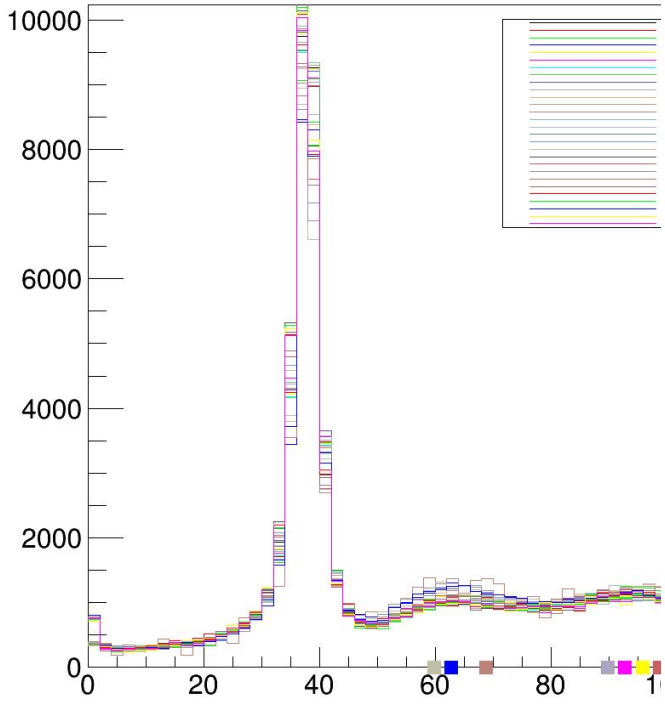


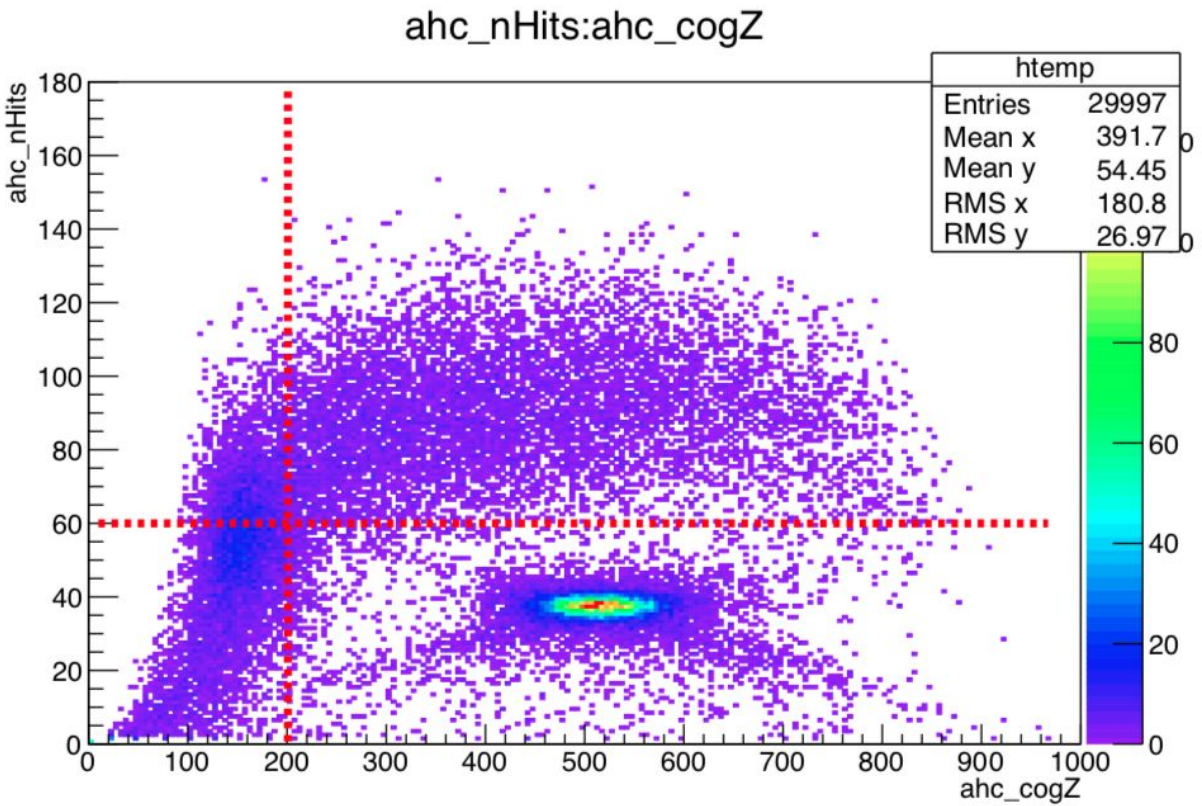
Large electron contamination

Was known already during the testbeam

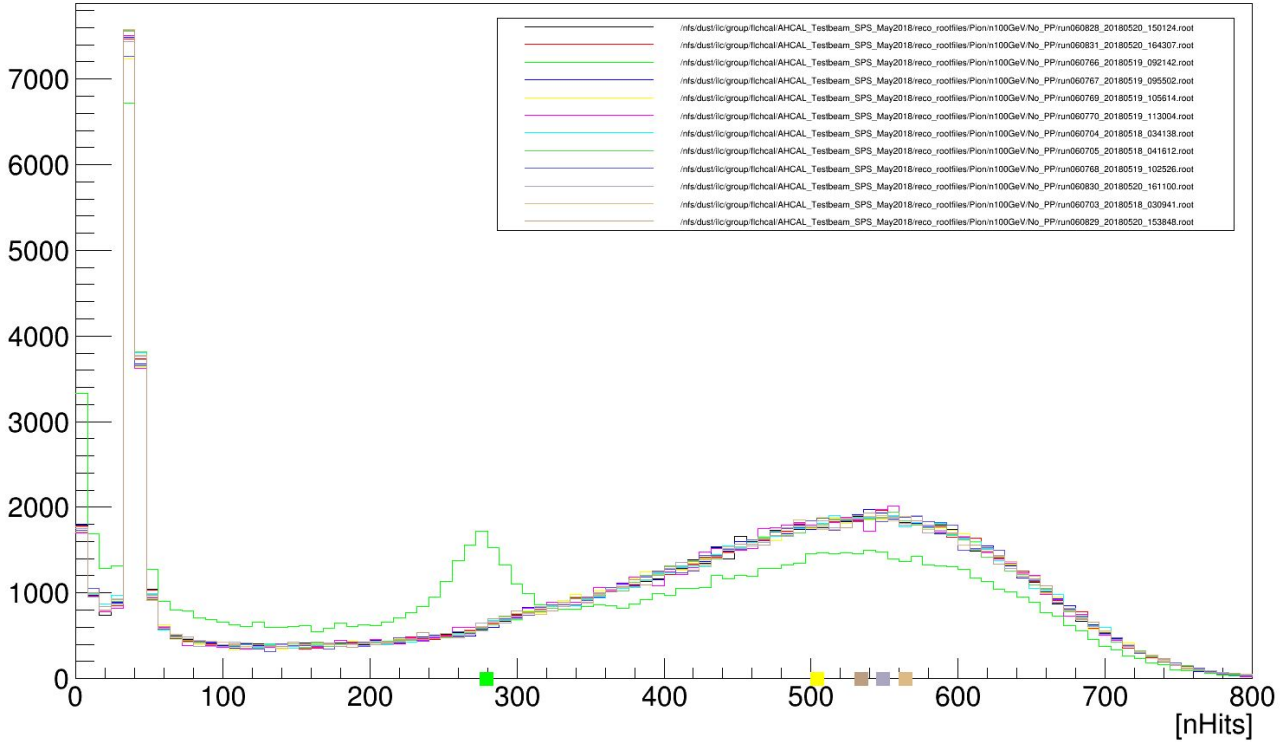
See plot from the eLog:

nHits histograms
10 GeV



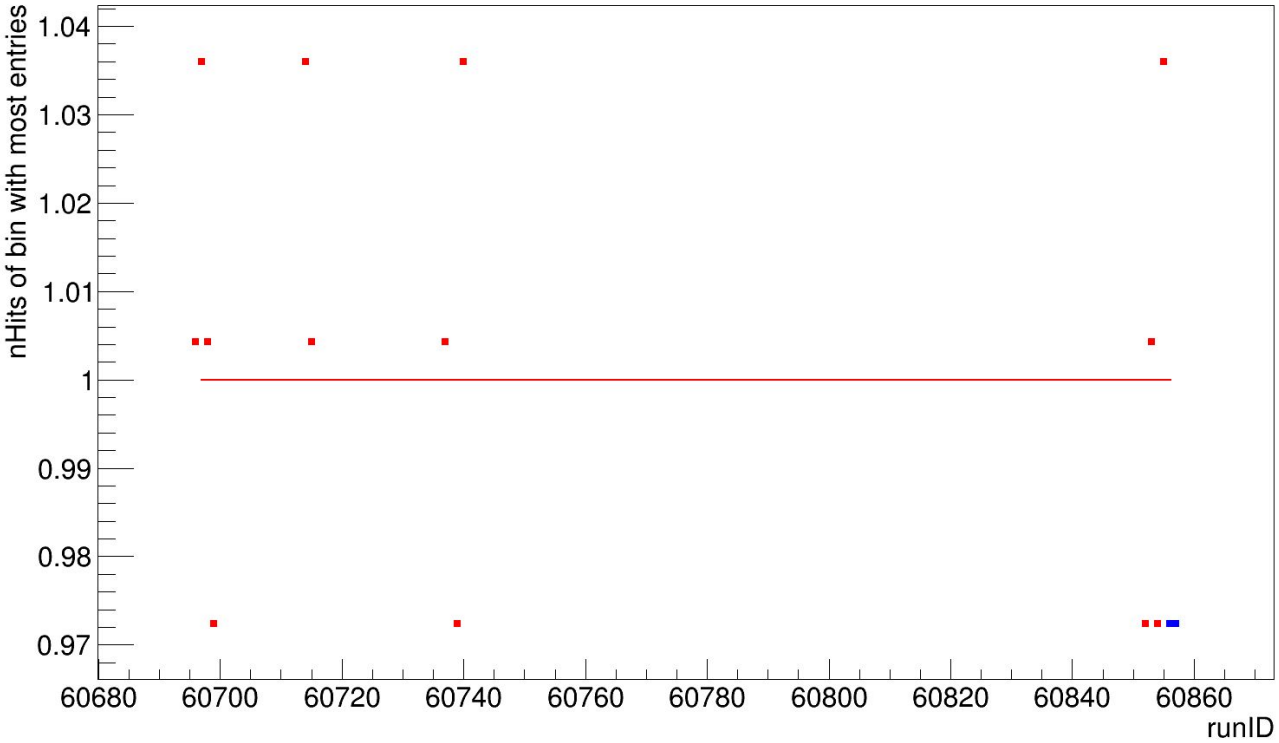


nHits histograms
100 GeV



Already noticed this run in the energy sum histograms

nHit peak bin vs run ID
80 GeV

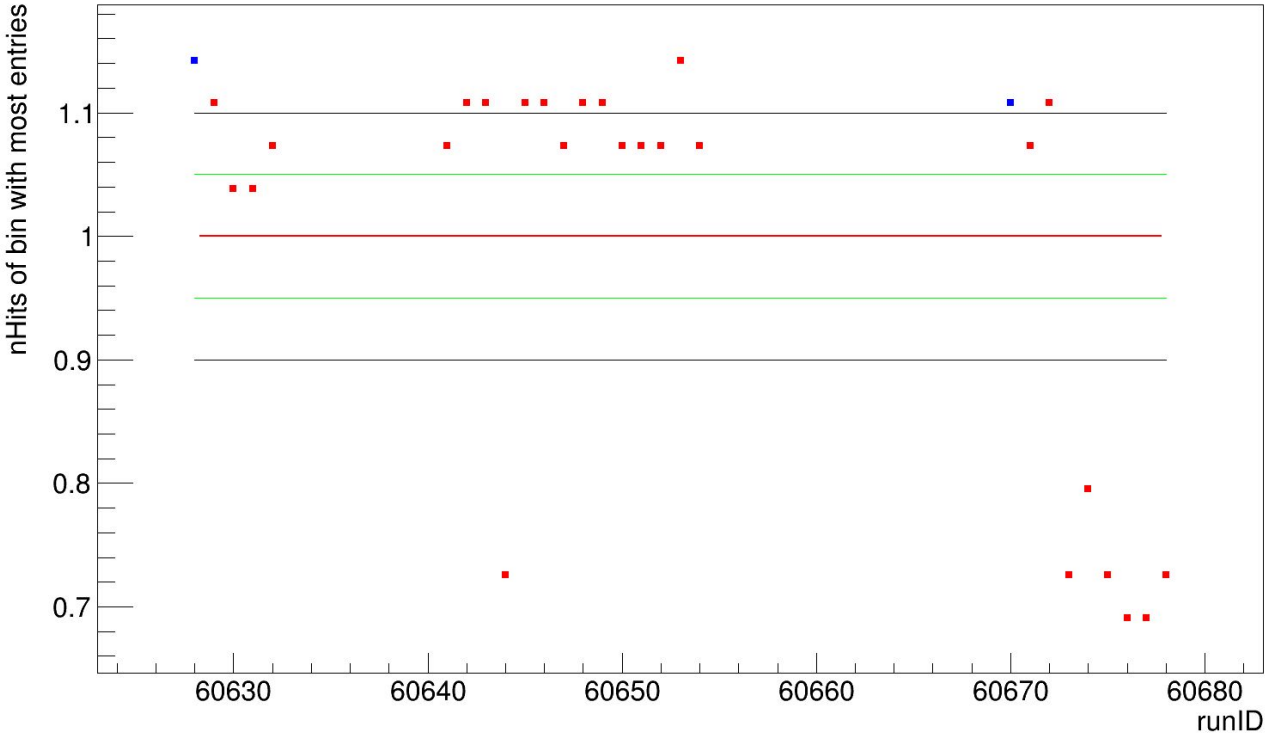


Distribution of peak bin positions for runs of single energy

Most peaks within 5%, all peaks within 10%

(except 10 GeV and the one 100 GeV run)

nHit peak bin vs run ID
10 GeV

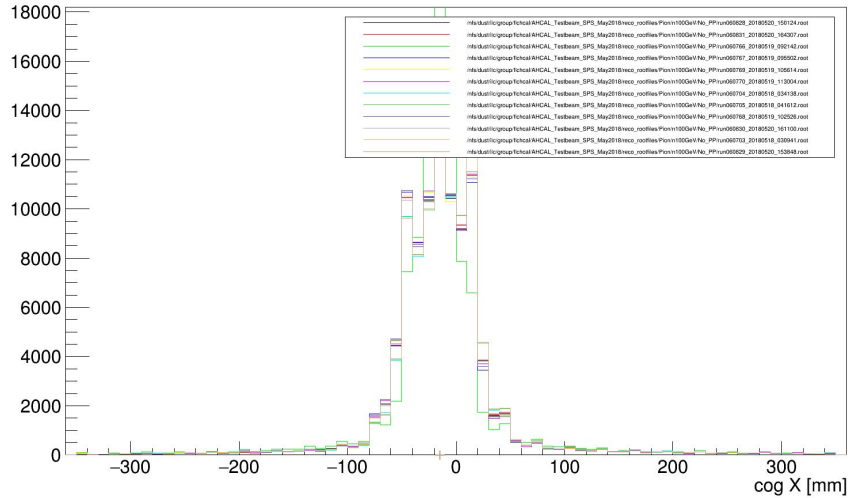


We see here the wide spread due to the electron contamination

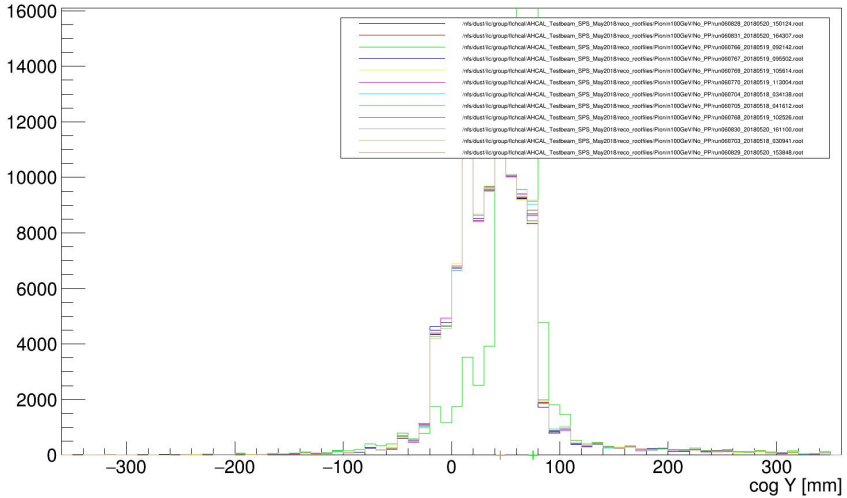
→ Quality criteria should take exception for our 10 GeV pions into account

Center of Gravity Plots

X-axis



Y-axis



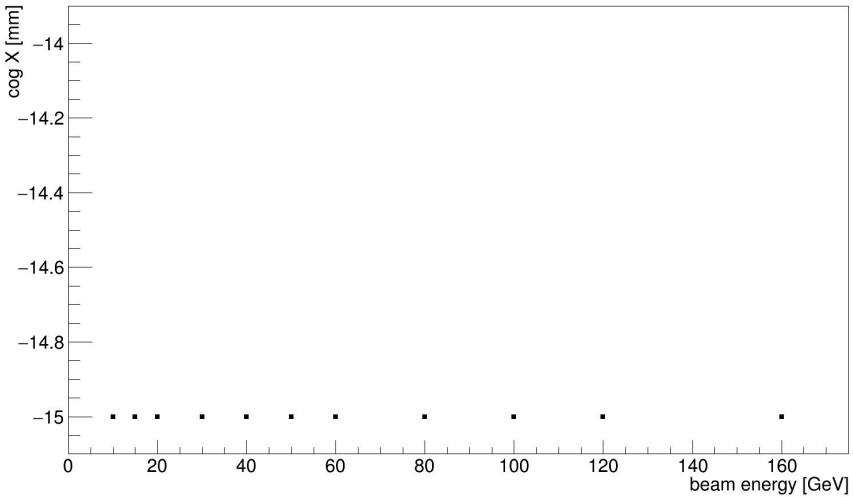
Beam was well centered for all runs

(Y-axis outliers because of Muons - except the ‘special’ 100 GeV run)

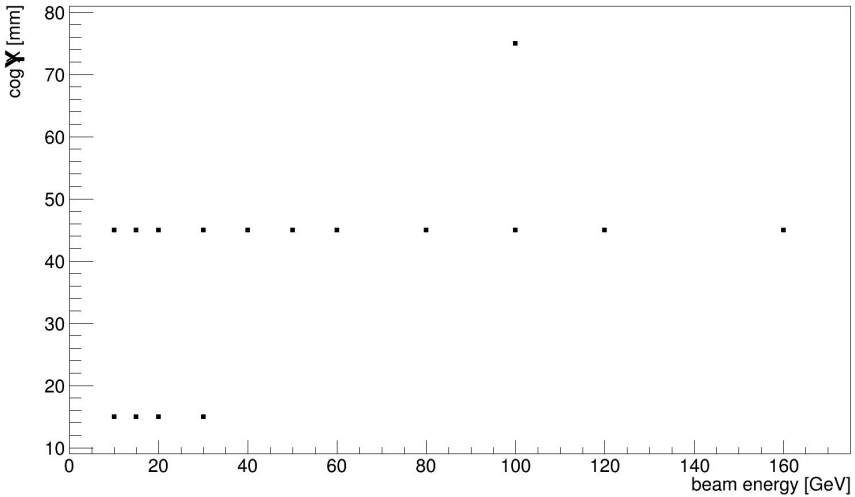
(1 cm binning)

Center of Gravity Plots

X-axis



Y-axis



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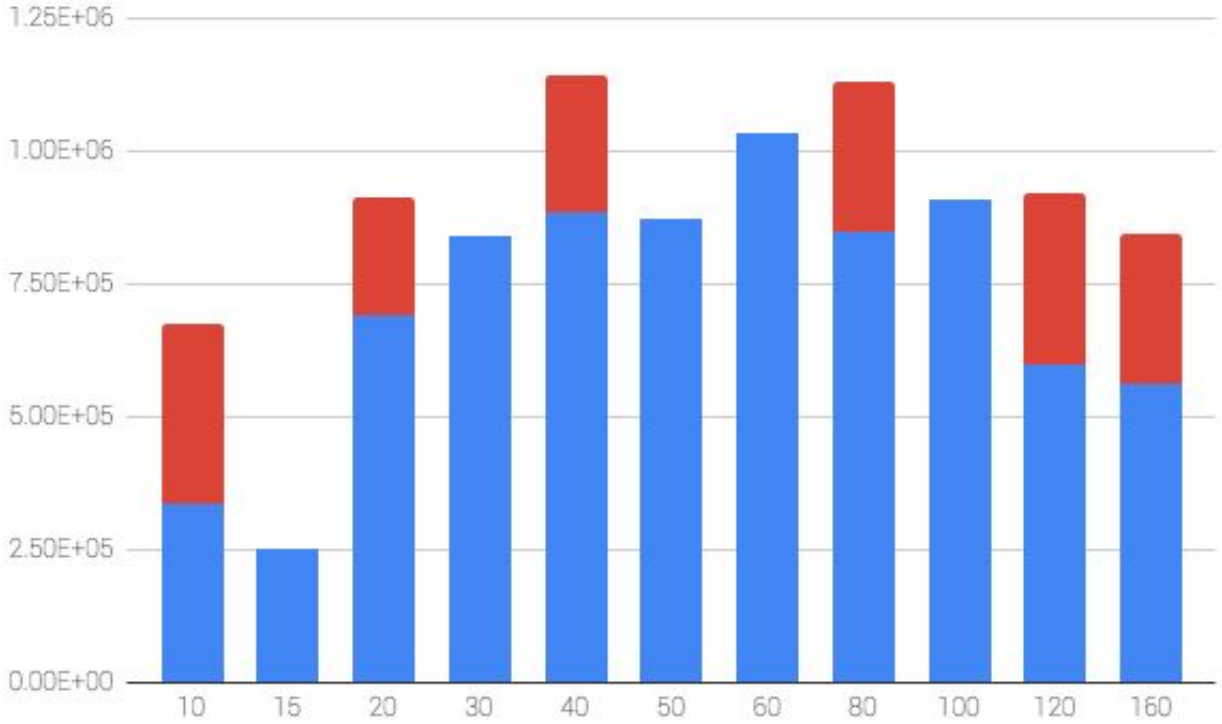
Pion Candidates (cut: eSum > 200 MIP)



Blue: No_PP

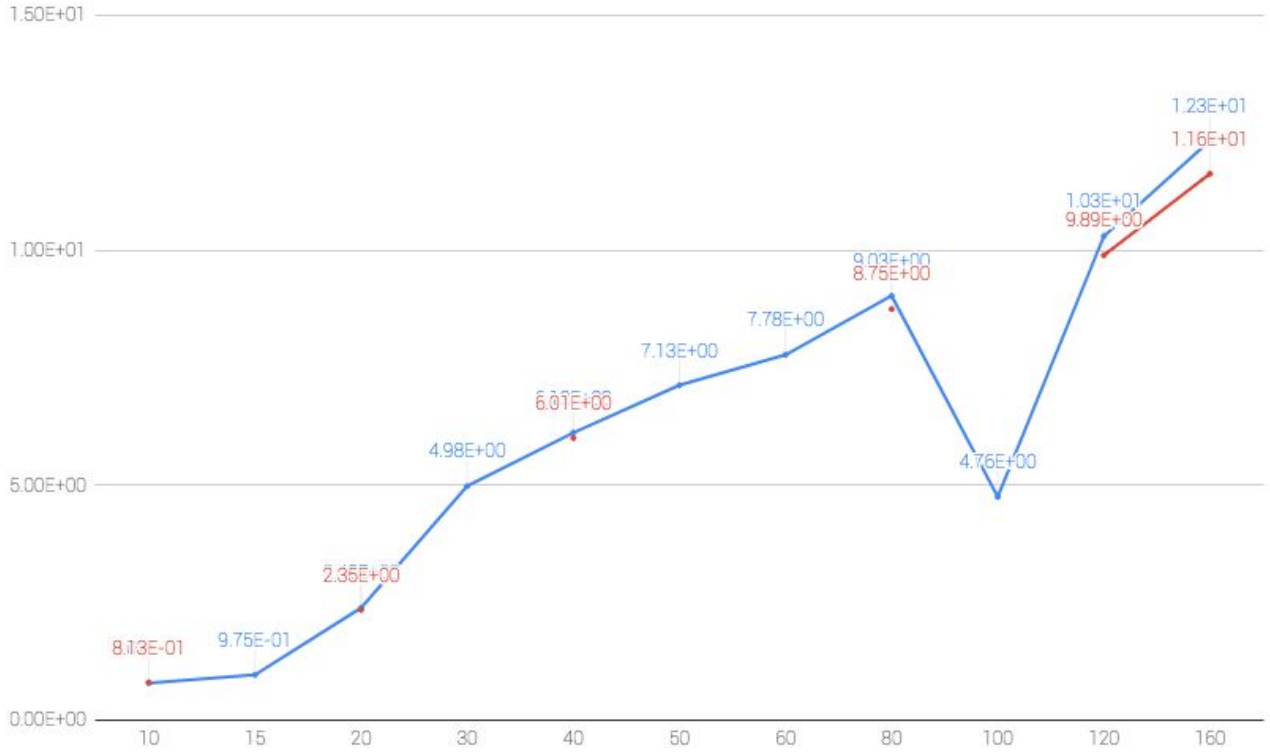
Red: PP

Based on very simple energy cut

Expect less pions for analysis
→ Vladimir's Particle ID

\+ June Pion data (only with PP)

‘Pion’ / ‘Muon’ Ratio



Blue: No_PP

Red: PP

Do we understand this behavior?

100 GeV raises concern: Checked used beam file → XCHV.021.133 wide open!

Tail at low energy in the E_sum in comparison to other 60 / 60 /120 GeV

Summary: “Good run” criteria

Proposal:

- eSum peak bin within 5 % of each other (same energy)
  - Except 10 GeV, \bc of large e- contamination
- nHit peak bin within 5 % of each other (same energy)

Open for discussion!

Afterwards:

- New column in run list with flag ‘good run’ or flag ‘need-to-check run’
- Document criterias for ‘good run’ on confluence

Outlook

- Fix criteria for ‘good runs’
  - Document on confluence
- Add quality flag in run list
- ‘Need-to-check’ runs need to be investigated
  - + Comparison between PP and No_PP mode
- Quality check for June pion data
  - Box-and-whisker plots might be helpful
- Quality check for electron data (& muon data?)
- Move run list away from Google sheet

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Thank you!

Bonus slides

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All No_PP runs in May
Noticeable tail at low energies for 100 GeV

CALICE Calorimeter for ILC