

Pion production momentum

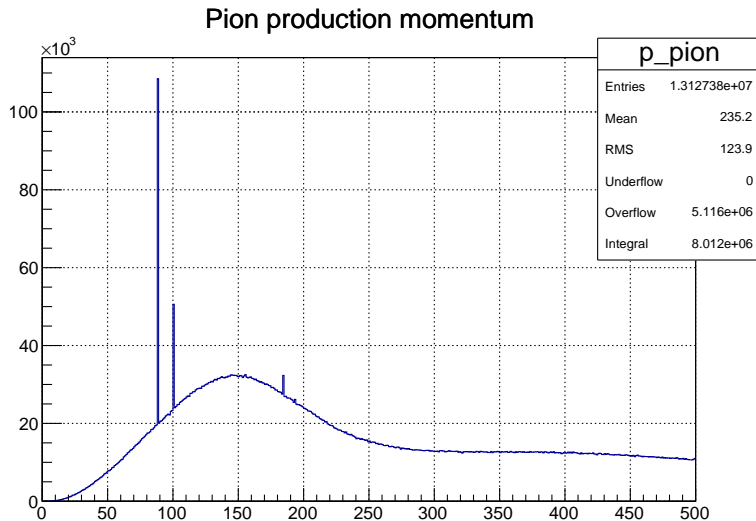
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Introduction

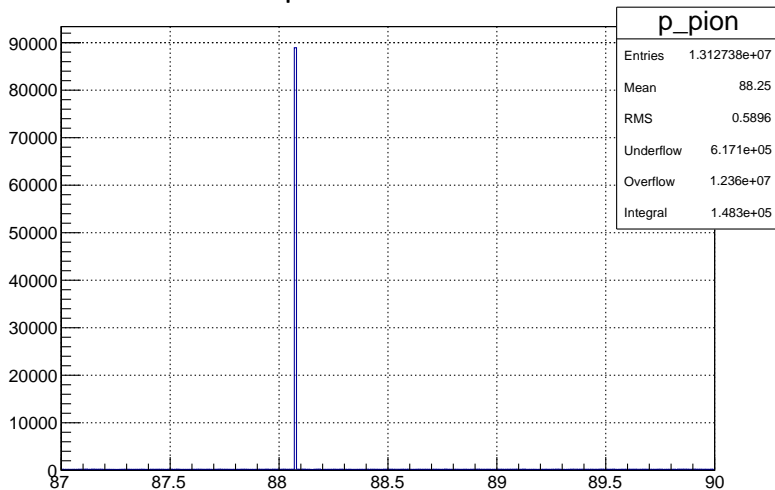
- ▶ This is a follow up on the anomaly that I first saw in the Kevin's talk [docdb-21875](#)(v2): the peaks in the pion momentum distribution on page 16.
- ▶ I looked at the default (ShieldingM) physics list and QGSP_BERT using Offline v7_2_0, both have the peaks. All plots in this talk are for QGSP_BERT.

Production momentum of π^- for 10M POT



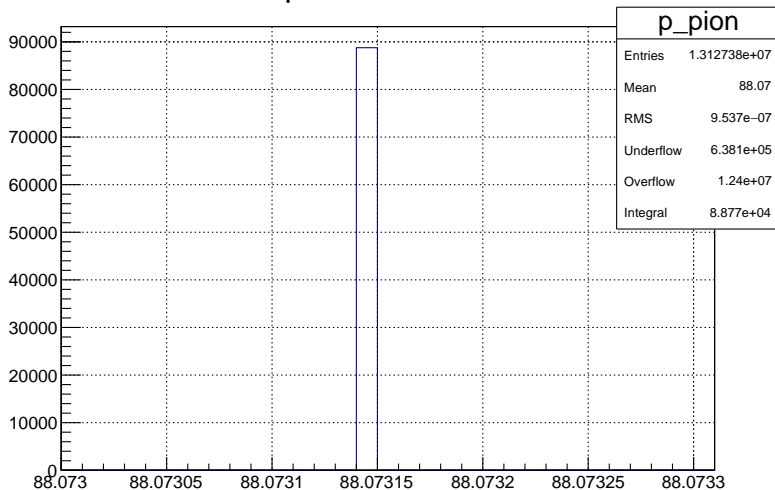
Production momentum of π^- zoom

Pion production momentum



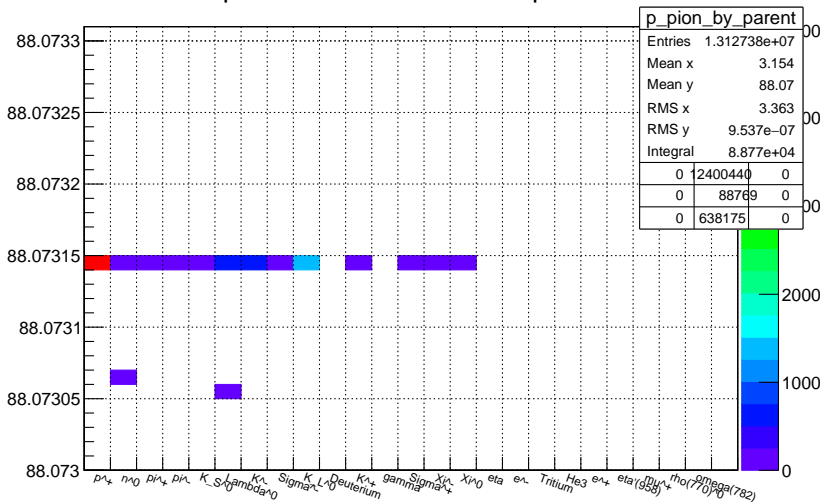
Production momentum of π^- more zoom

Pion production momentum



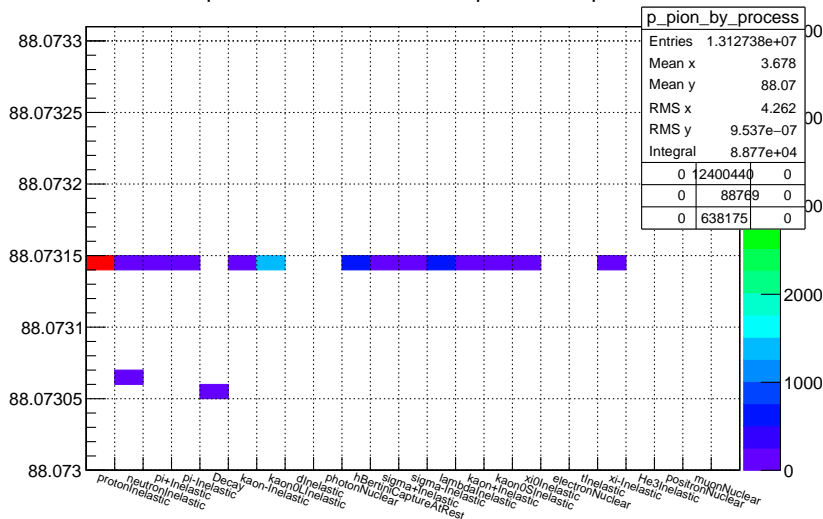
Production momentum of π^- vs parent name

Pion production momentum vs parent PID



Production momentum of π^- vs creation code

Pion production momentum vs production process



Summary

- ▶ There are unphysical monoenergetic lines in the pion production momentum.
- ▶ Not tied to a particular parent particle or process code.
- ▶ About 2 negative pions per 1000 POT are in the mono-lines.
- ▶ Simulated datasets are on tape and analysis code in git for everyone to look.

EXTRA SLIDE: Simulated datasets

- ▶ 10M events with the default (ShieldingM) physics list:
`sim.gandr.pionMmomentumSim.Offline720.art`
- ▶ 10M with QGSP_BERT:
`sim.gandr.pionMmomentumSim.QGSP_BERT_720.art`
- ▶ Simulation writes out all pions and most other secondaries — no filtering on muon stop
- ▶ EM, protons and neutrons below 100 MeV kE are killed
- ▶ Full detail in fcl datasets, identifiable via SAM — the “parent” of the data file. E.g. (all one line or follow the link)

<https://samweb.fnal.gov:8483/sam/mu2e/api/files/name/>

`sim.gandr.pionMmomentumSim.Offline720.000001_00000000.art/metadata`

then use `mu2eDatasetFileList` on the identified fcl dataset.