STOPPING PROTONS ANALYSIS

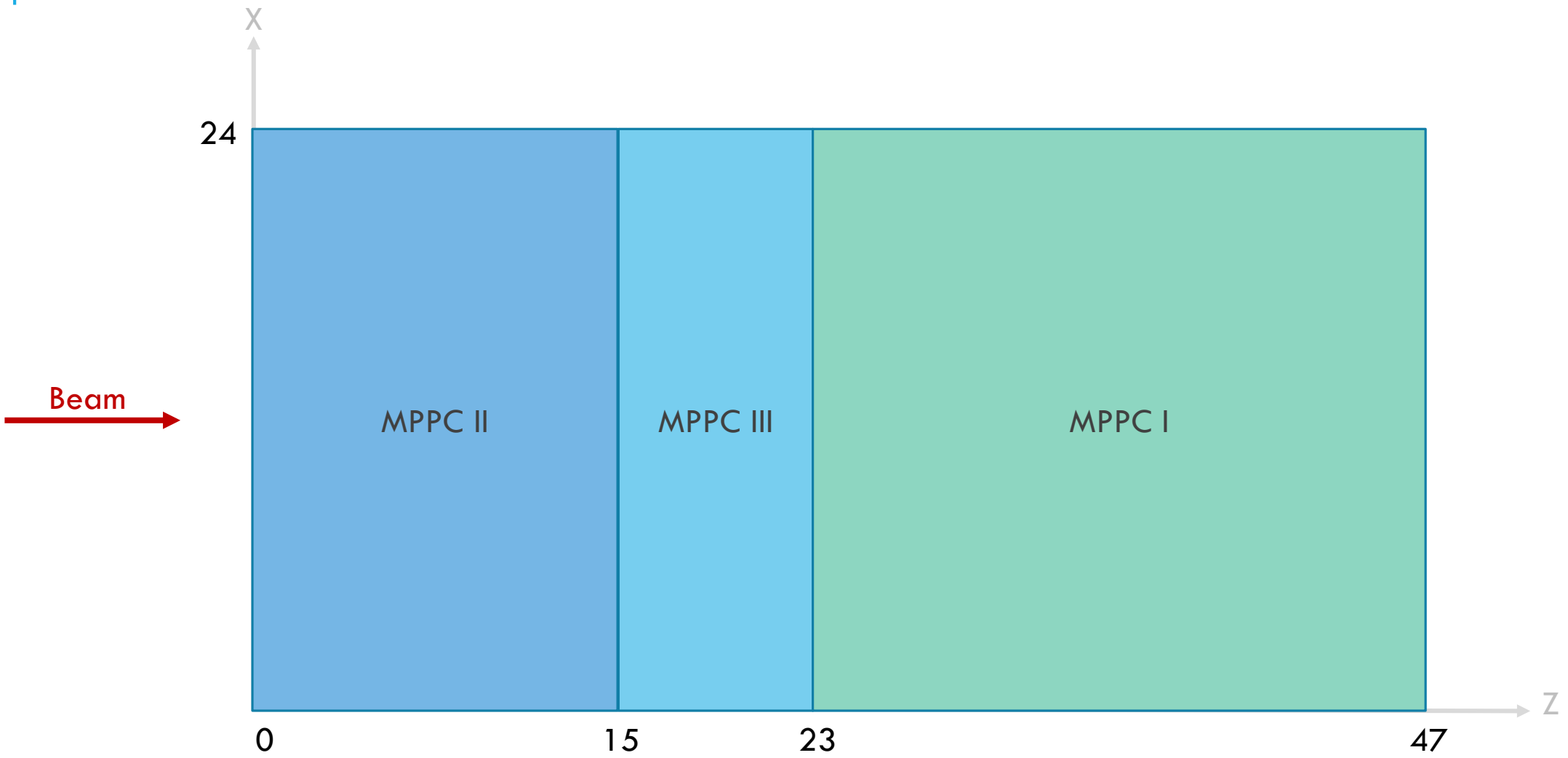
GOAL

To study stopping protons in the SuperFGD using data from the Aug/Sep test beam, analyzing where protons stop in the detector.

By considering the three types of MPPCs separately, build a distribution of the energy deposited in the last cell the proton reaches.

Use the shape of the distribution to check whether there is a saturation effect.

MPPCS IN THE DETECTOR



STEPS

1. dE/dx
2. Event Selection.
3. Treat MPPCs separately.
4. Obtain relative dE/dx from end point of each event.
5. Build histogram for energy deposited in the last cell.

DATA SAMPLE

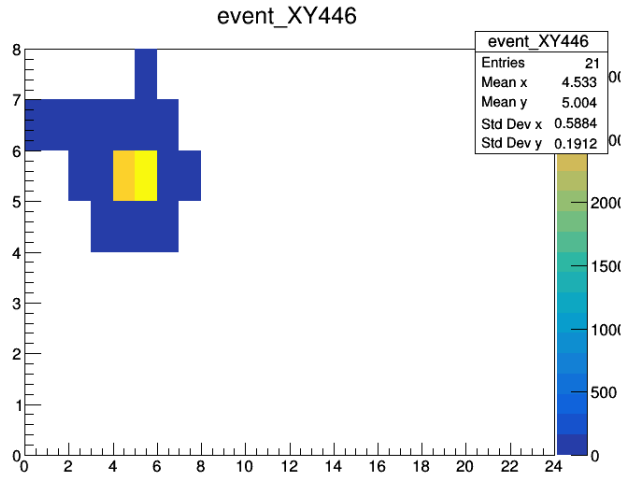
0.8 GeV/c Protons.

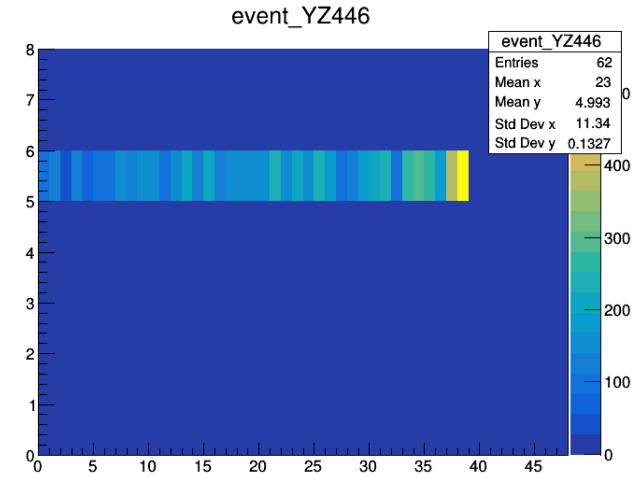
Magnet ON, 135 A.

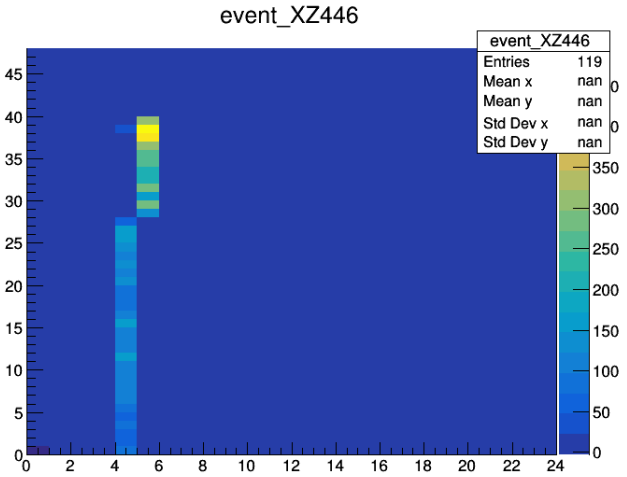
Default HG, default LG (55, 55).

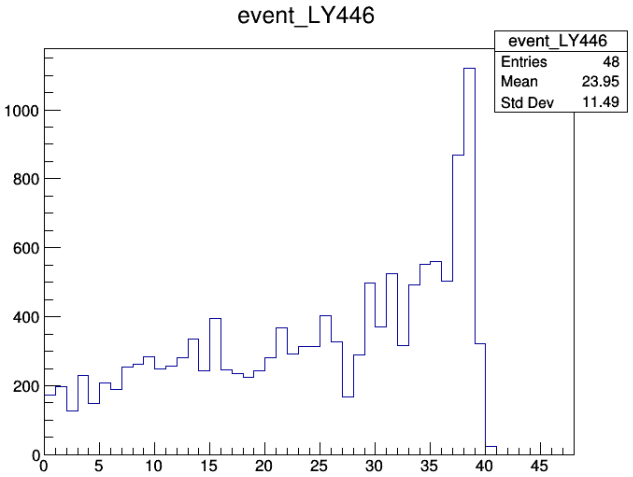
Proton trigger ON.

1. ENERGY DEPOSITION









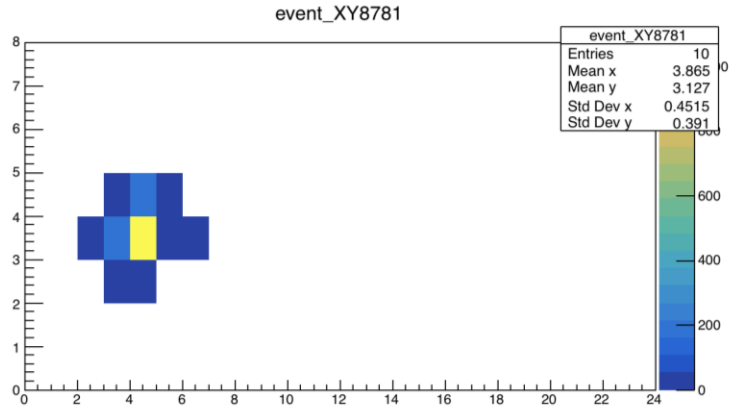
Code by Sasha

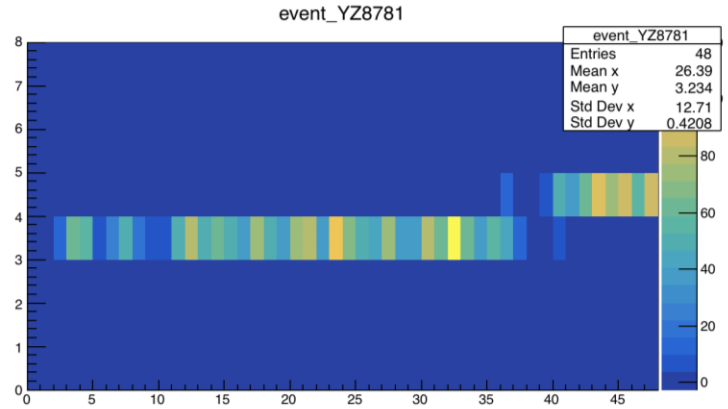
2. EVENT SELECTION

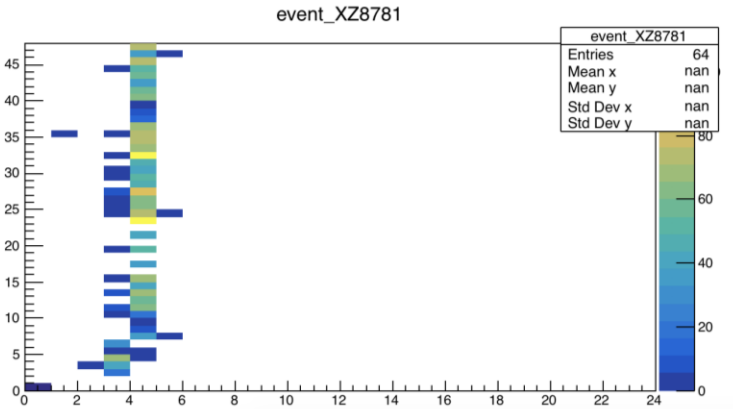
Need to consider different event scenarios.

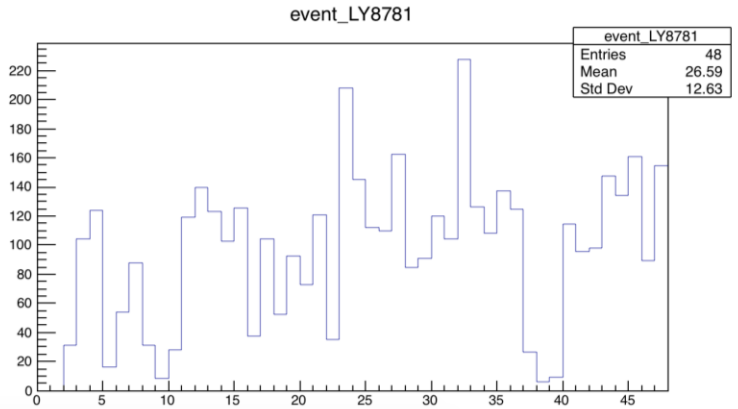
Which to include, which to discard.

NO STOP



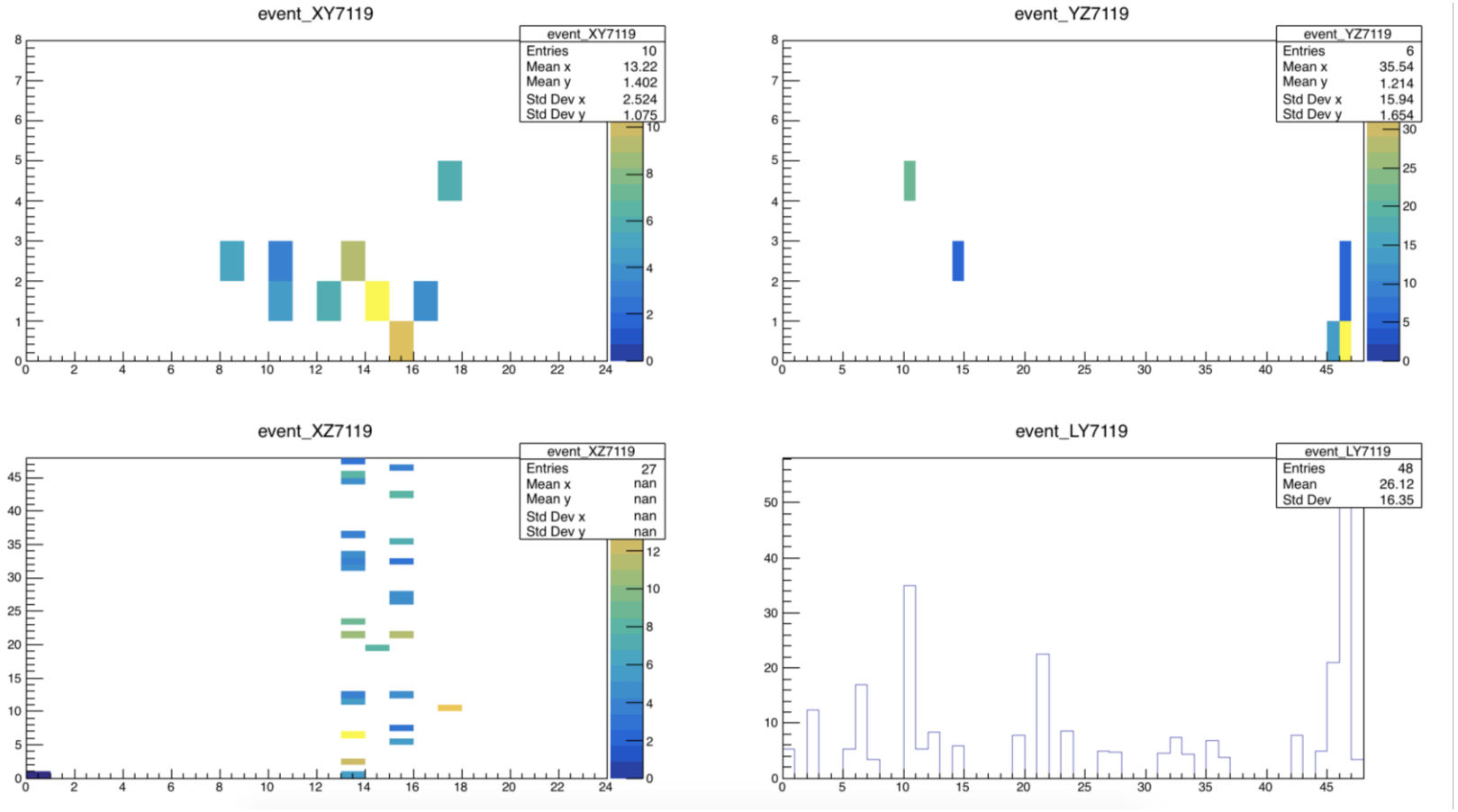






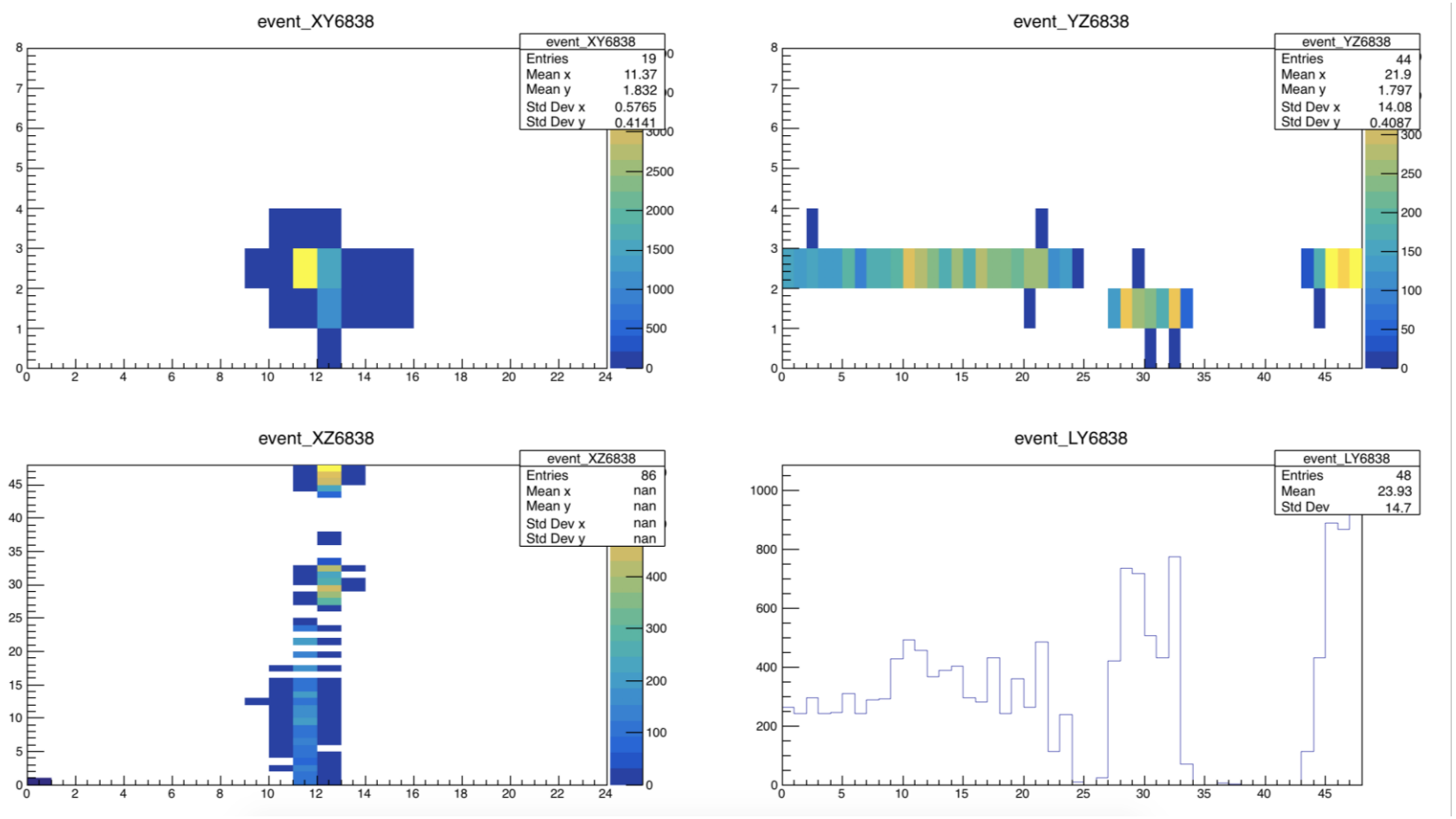
Cut: No energy deposited in last layer (Z=47)

MEANINGLESS EVENTS



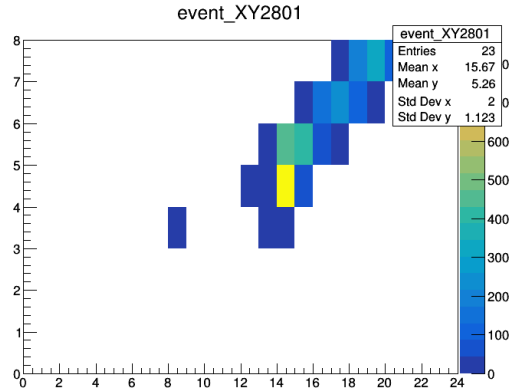
Cut: Energy deposited at the peak > 250 p.e.

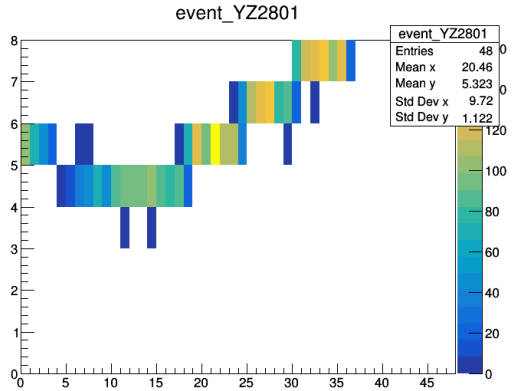
DISCONTINUITIES

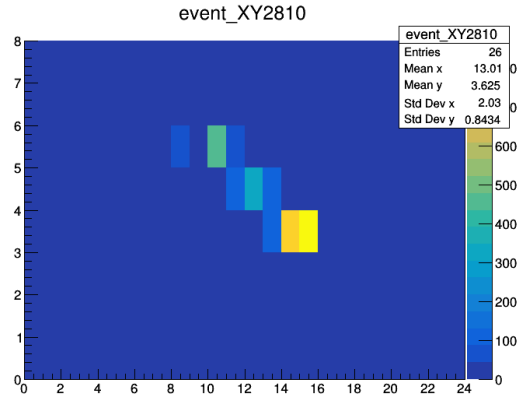


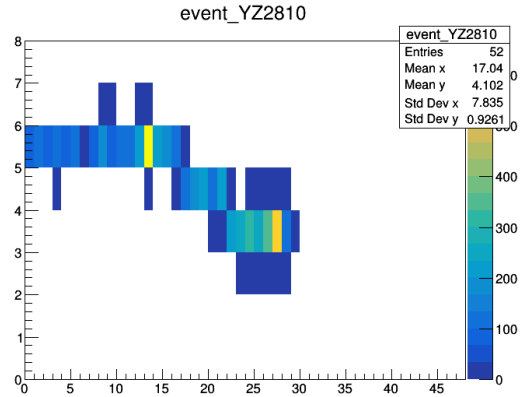
Cut: Before the peak, max number of allowed layers with ZERO deposited energy is 2.

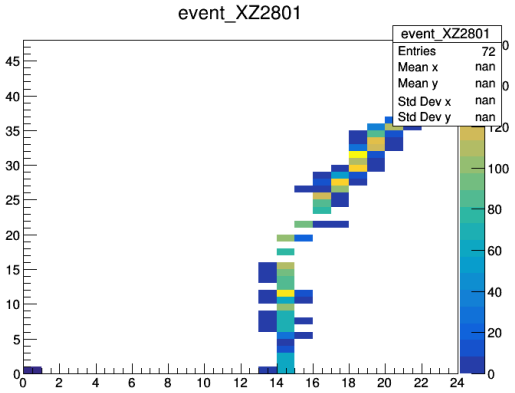
SCATTERINGS, SOMETIMES LEAVING THE DETECTOR?

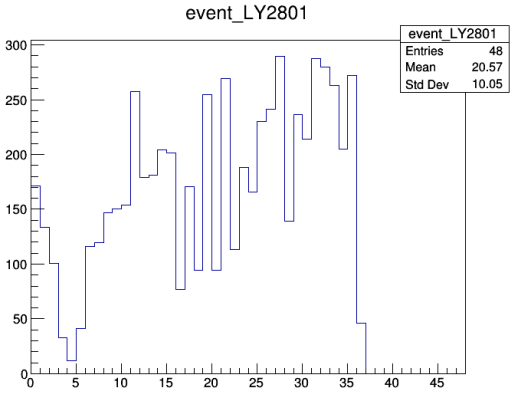


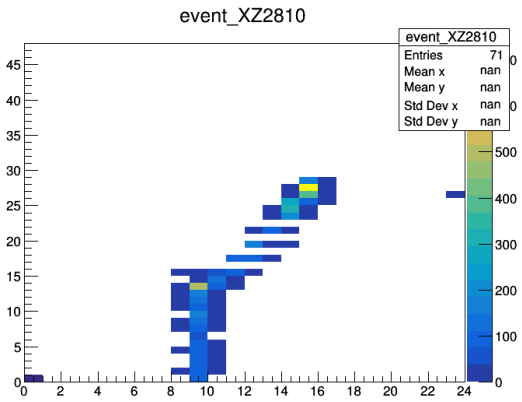


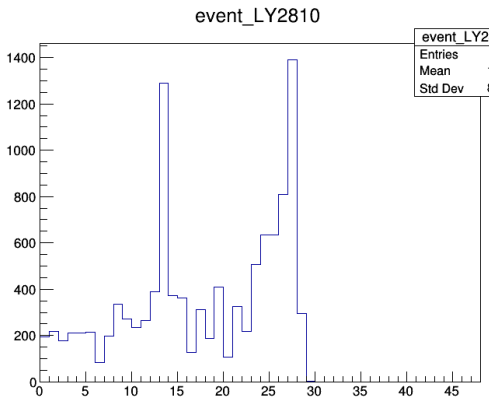






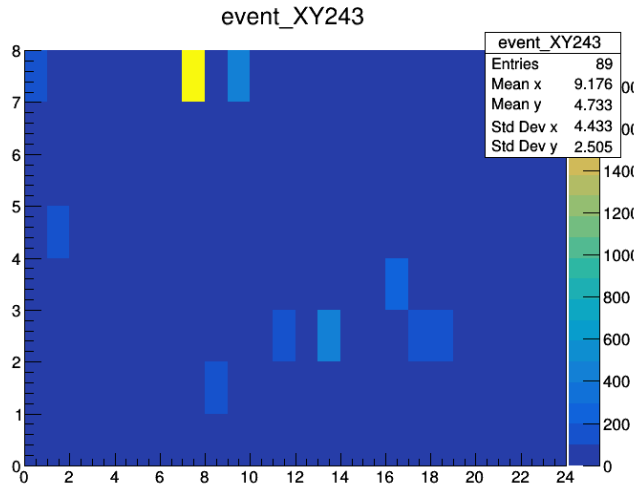


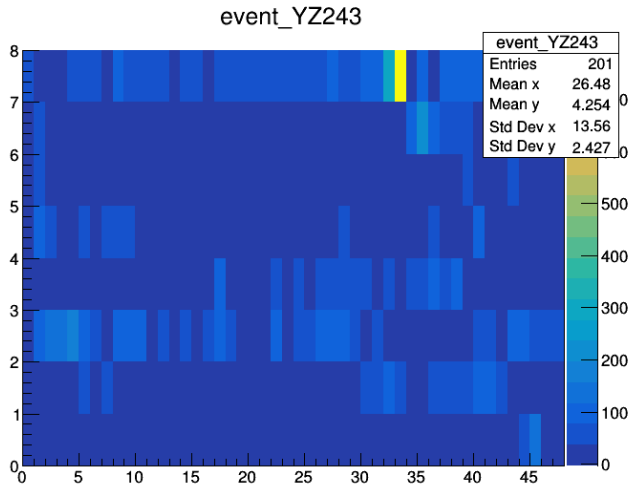


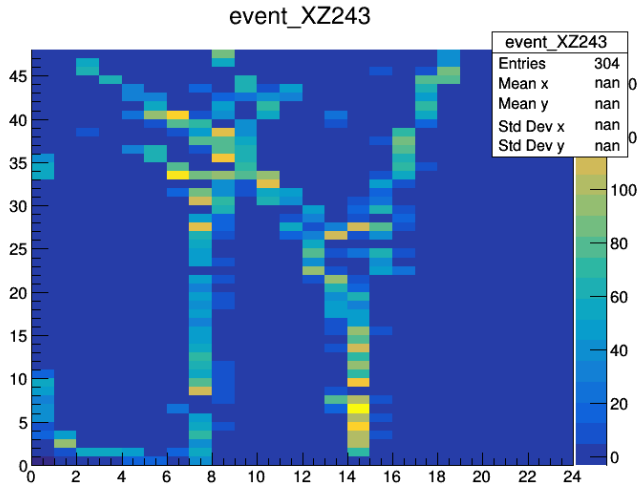


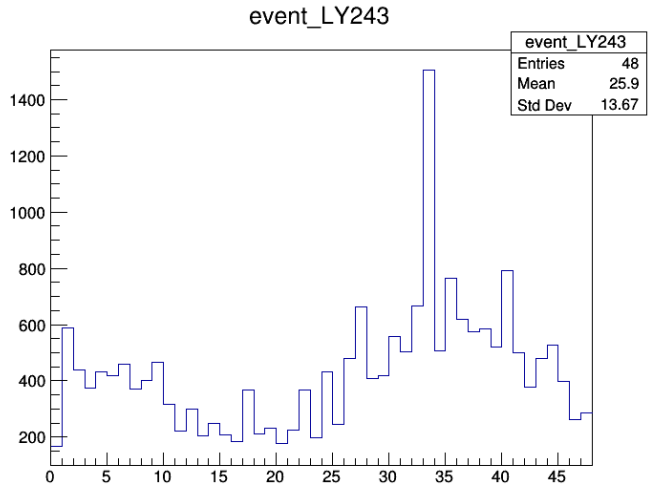
Cut: For the front (XY) view, stdDevX and stdDevY both < 1.0

MULTIPLE TRACKS







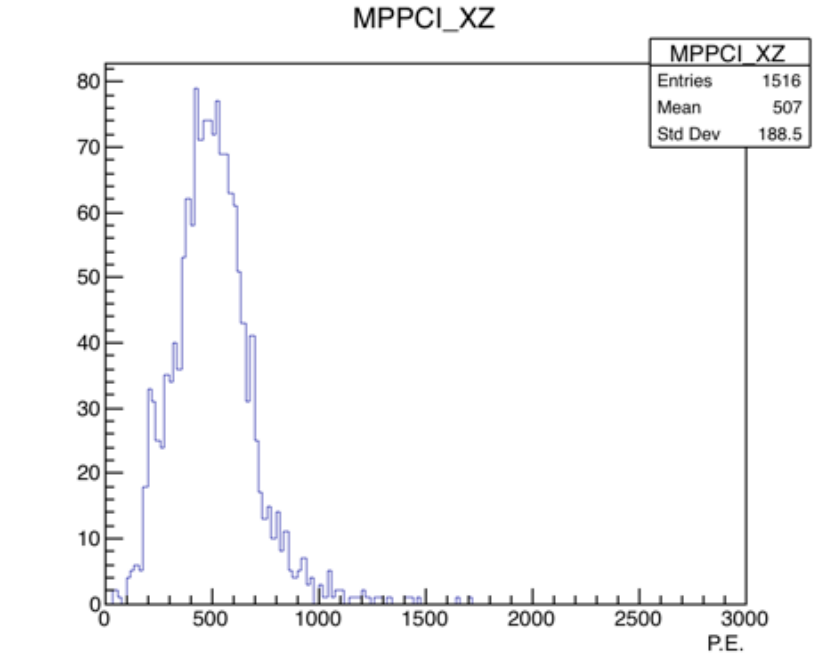


Eliminated by previous cut.

FIRST ROUND OF APPLIED CUTS

- Energy deposited at the peak > 250 p.e.
- No energy deposited in last layer (Z=47)
- Before the peak, max number of allowed layers with ZERO deposited energy is 2.
- For the front (XY) view, stdDevX and stdDevY both < 1.0

From 4525 Events → 1908 Events (42% left)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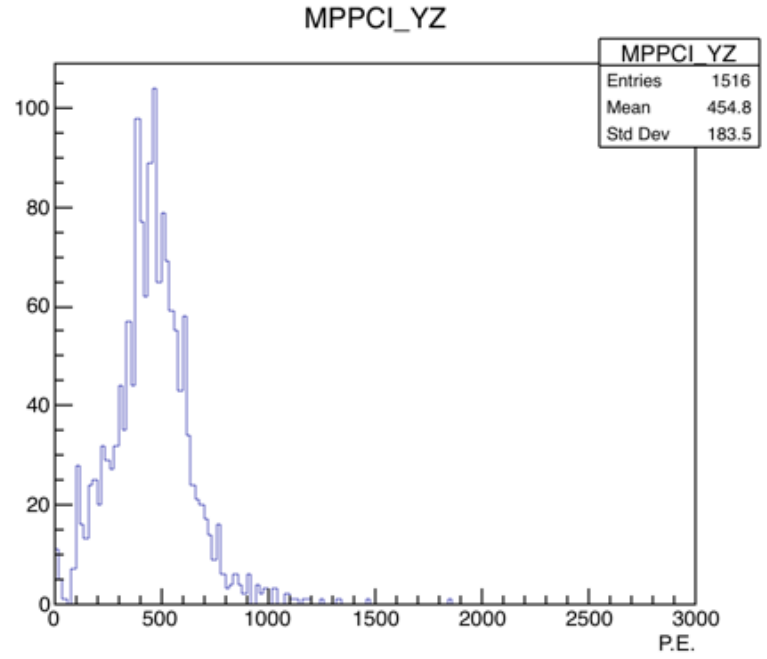
Entries 1516
Mean 507
Std Dev 188.5
P.E.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Std Dev 183.5
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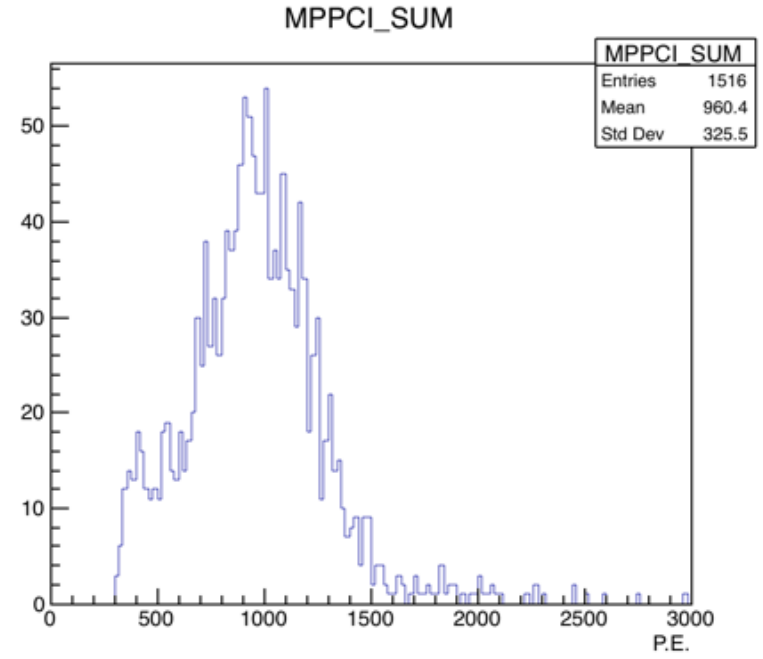
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Entries 1516
Mean 960.4
Std Dev 325.5
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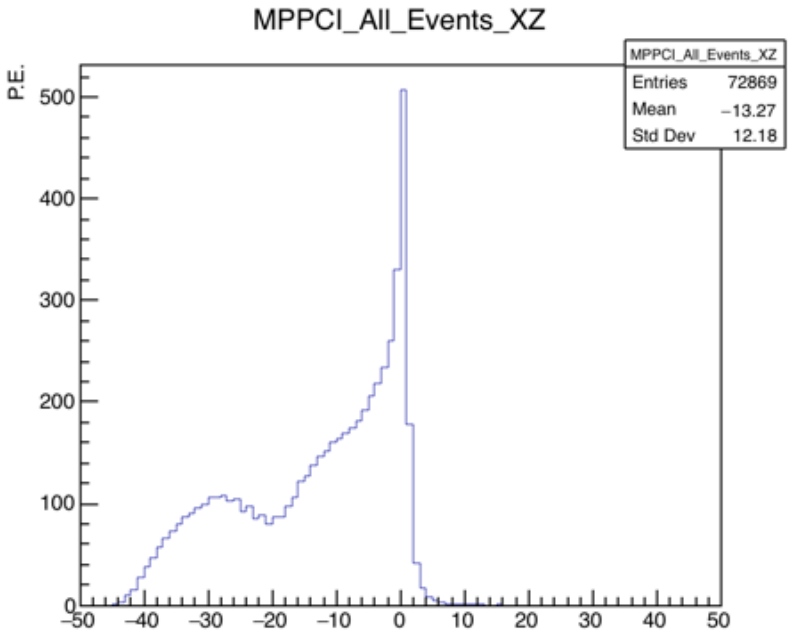
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Mean −13.27
Std Dev 12.18
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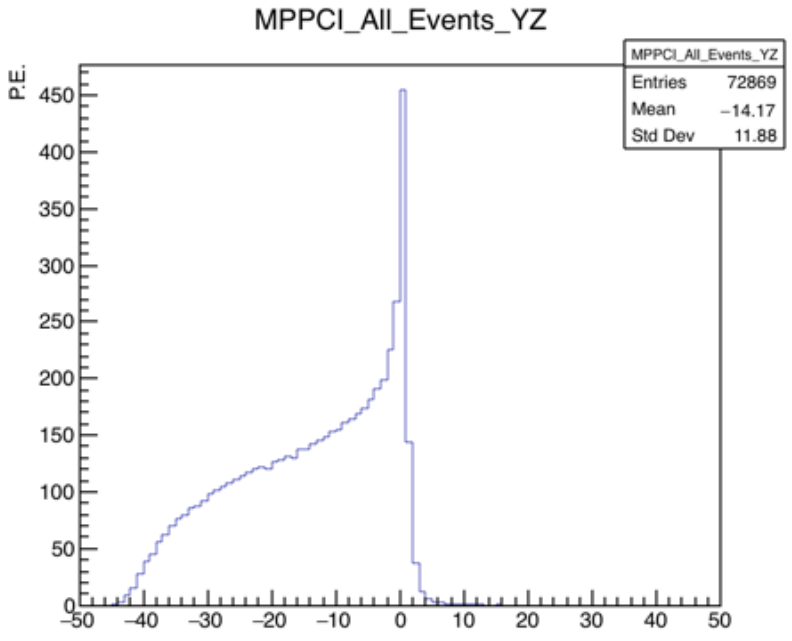
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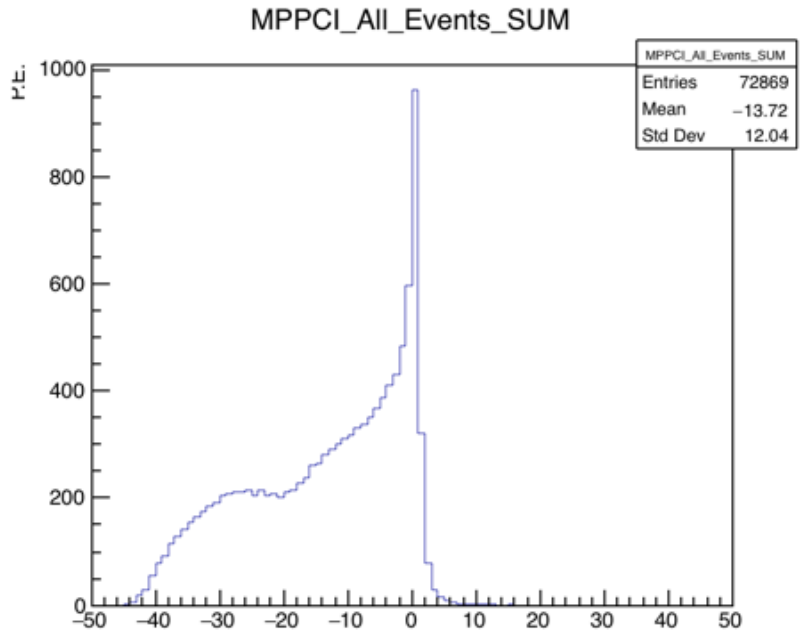
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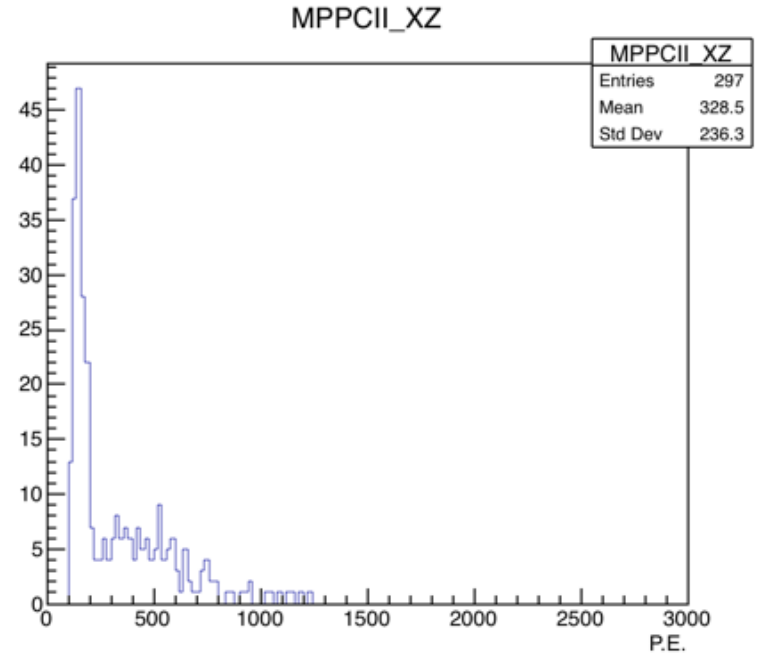
Std Dev 12.04
P.E.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Entries 297
Mean 328.5
Std Dev 236.3
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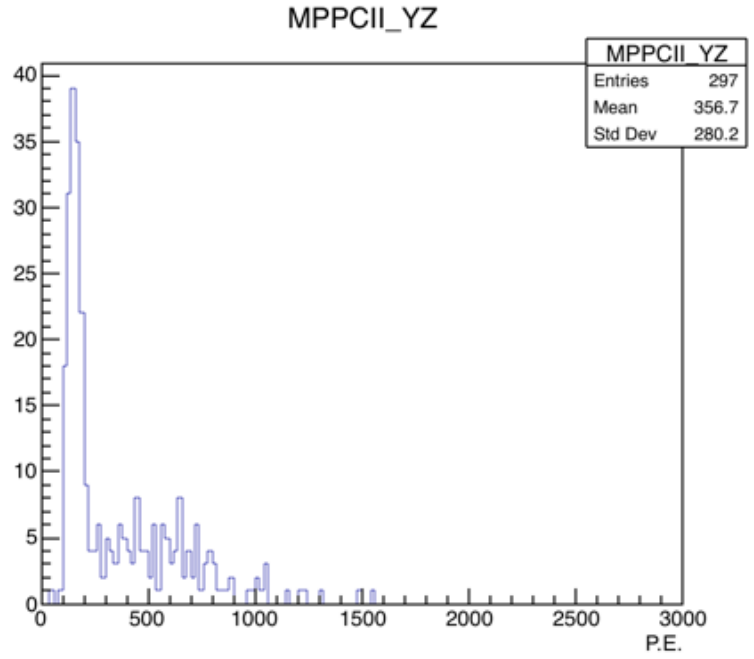
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Std Dev 280.2
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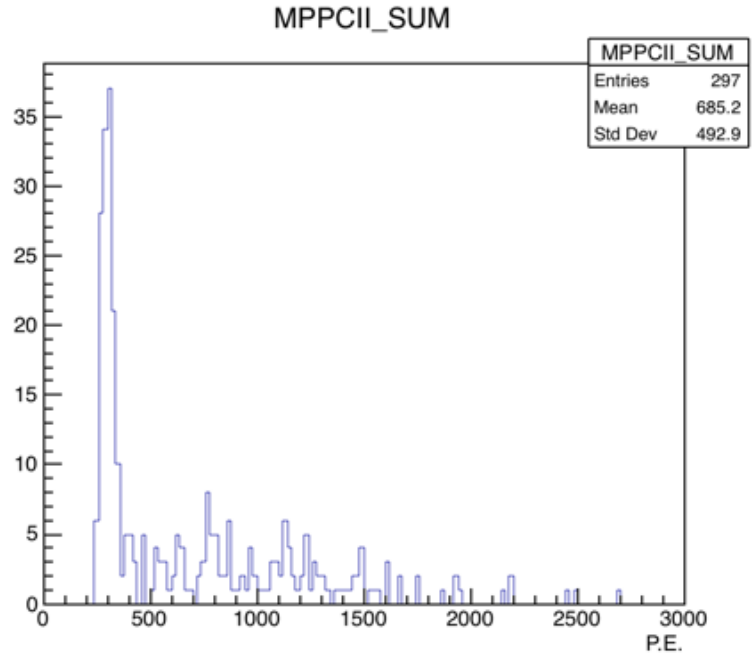
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Mean 685.2
Std Dev 492.9
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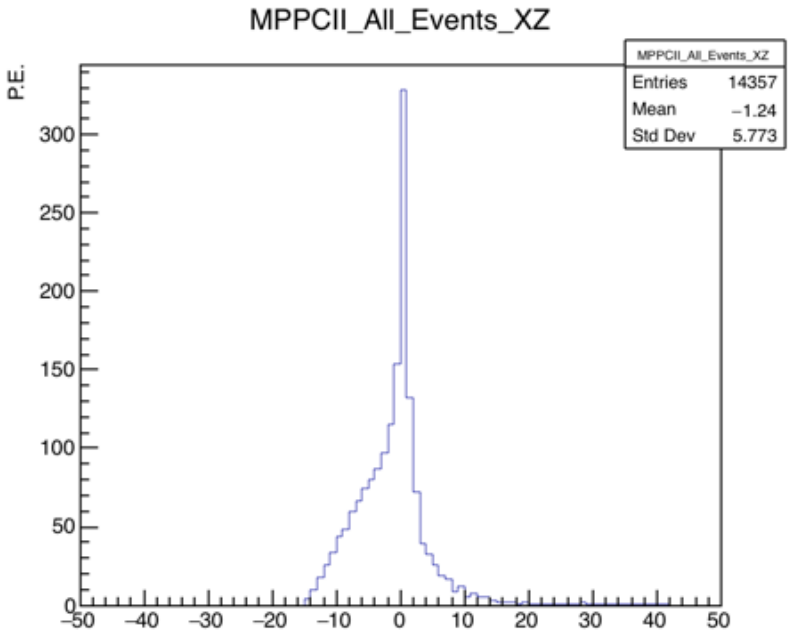
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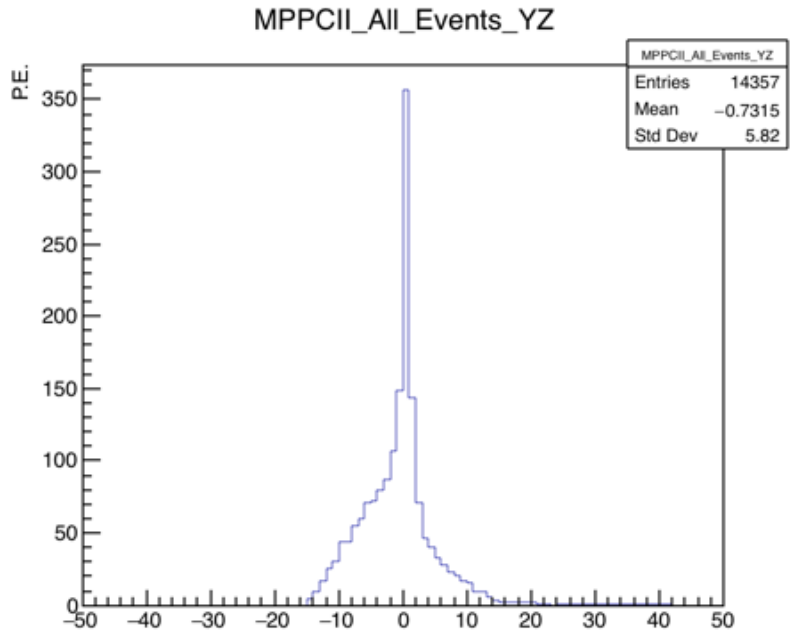
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Std Dev 5.82
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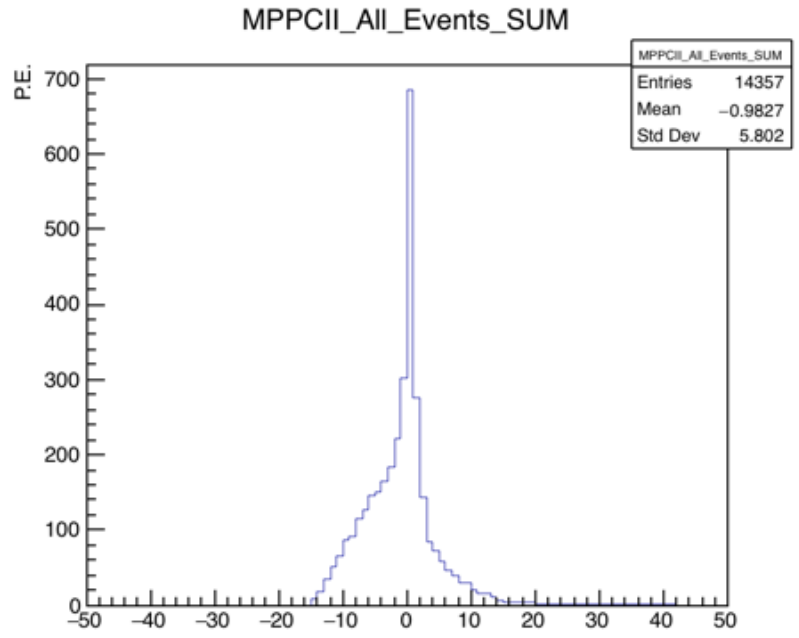
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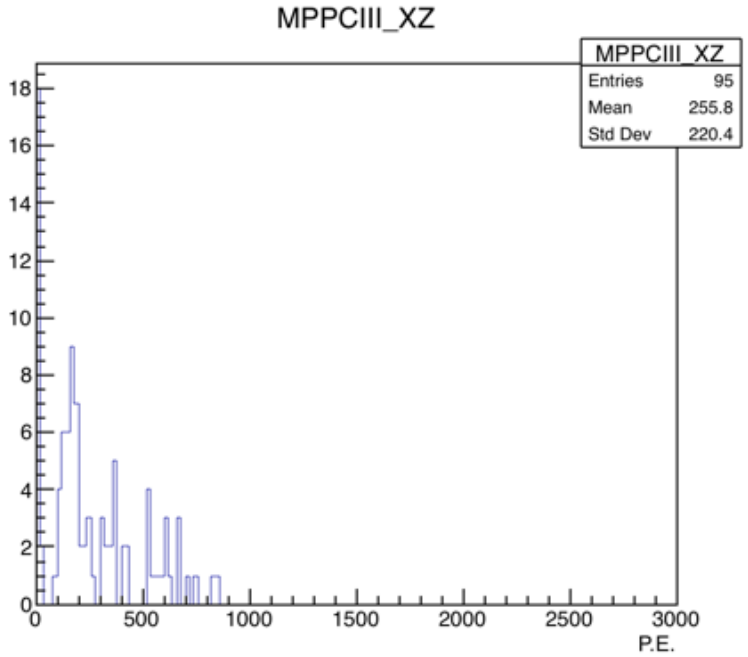
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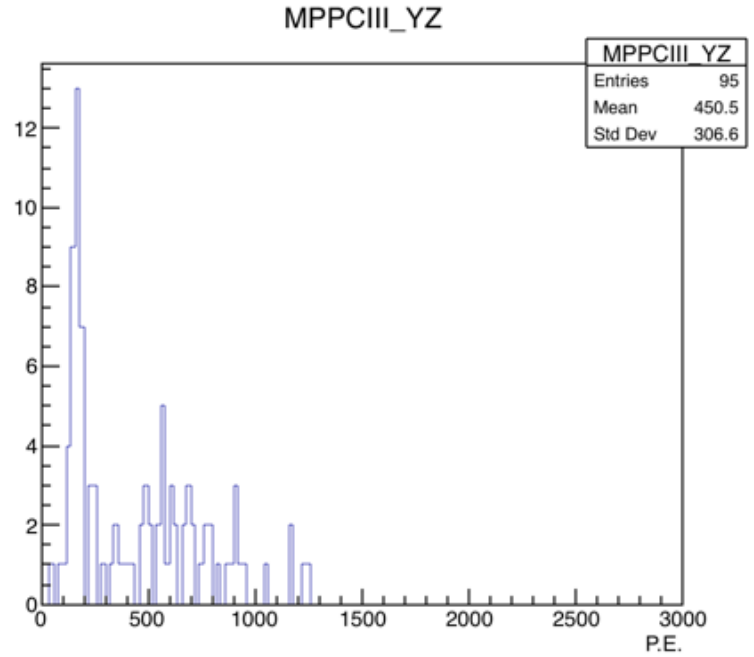
Mean 255.8
Std Dev 220.4
P.E.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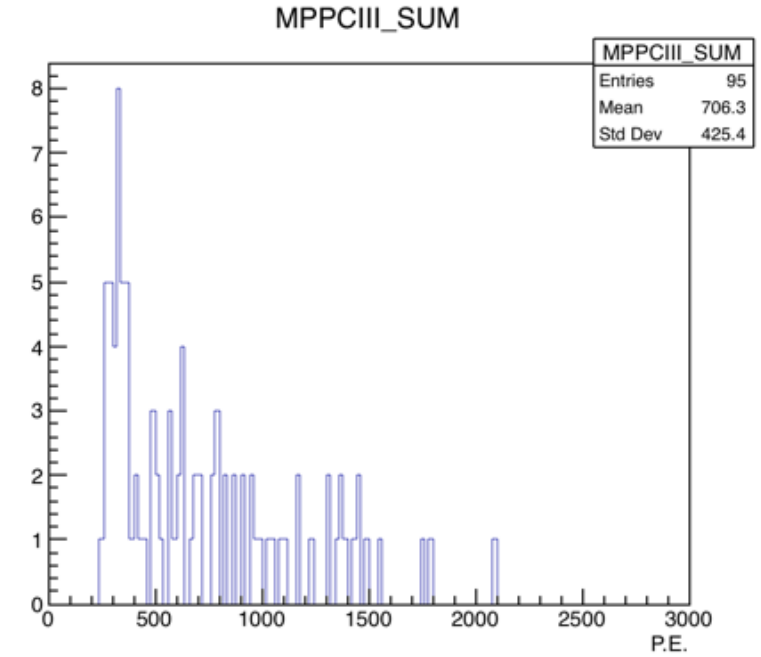
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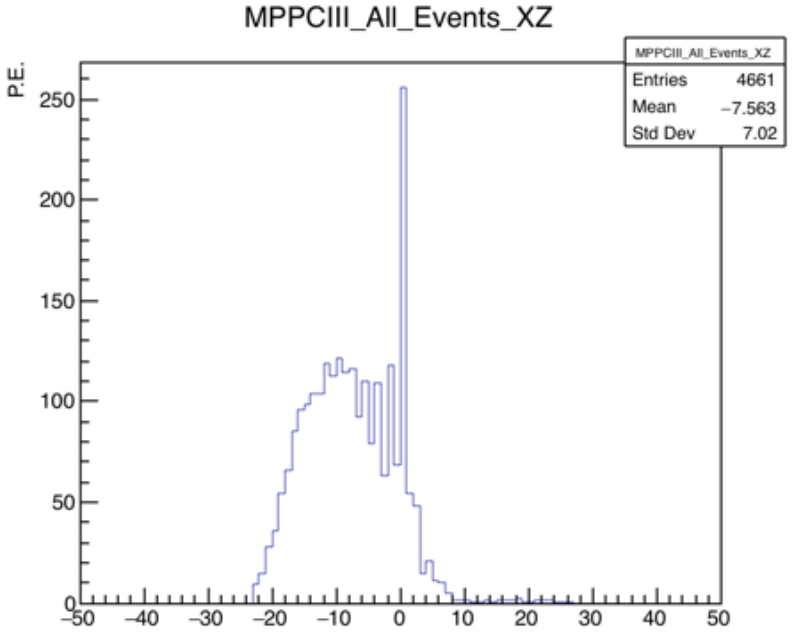
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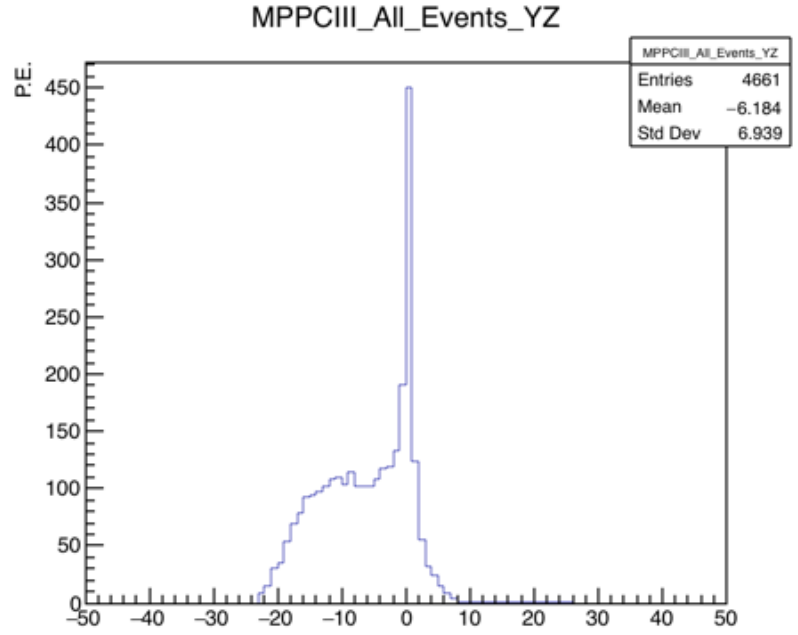
Std Dev 7.02
P.E.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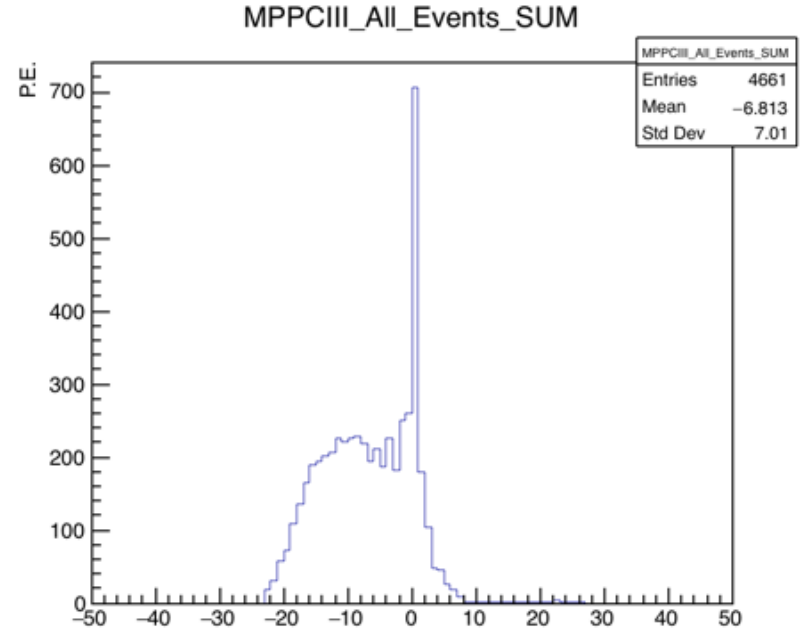
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Entries 4661
Mean −6.813
Std Dev 7.01
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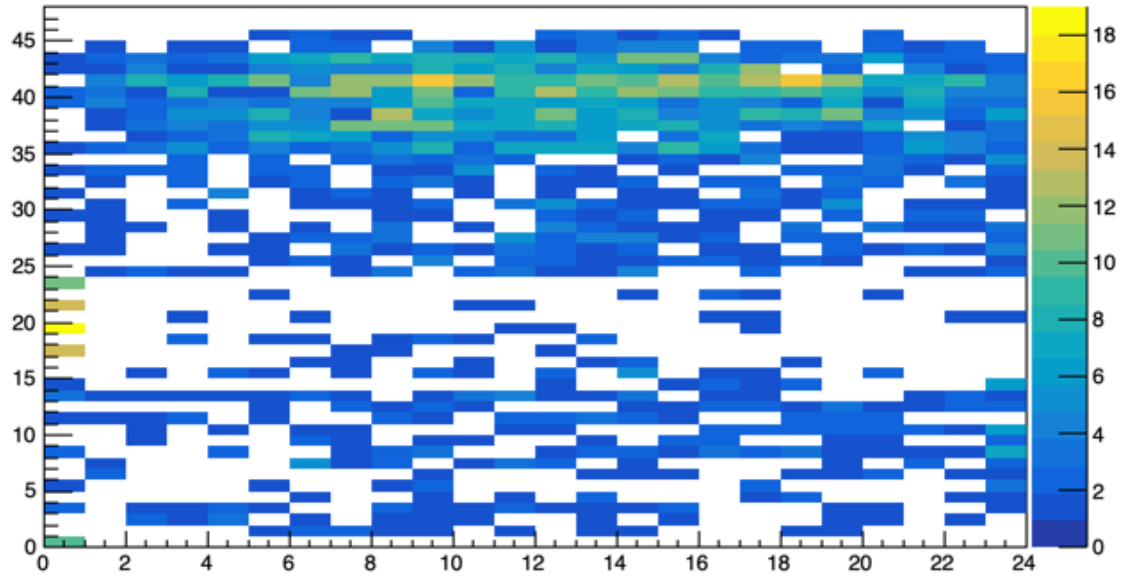
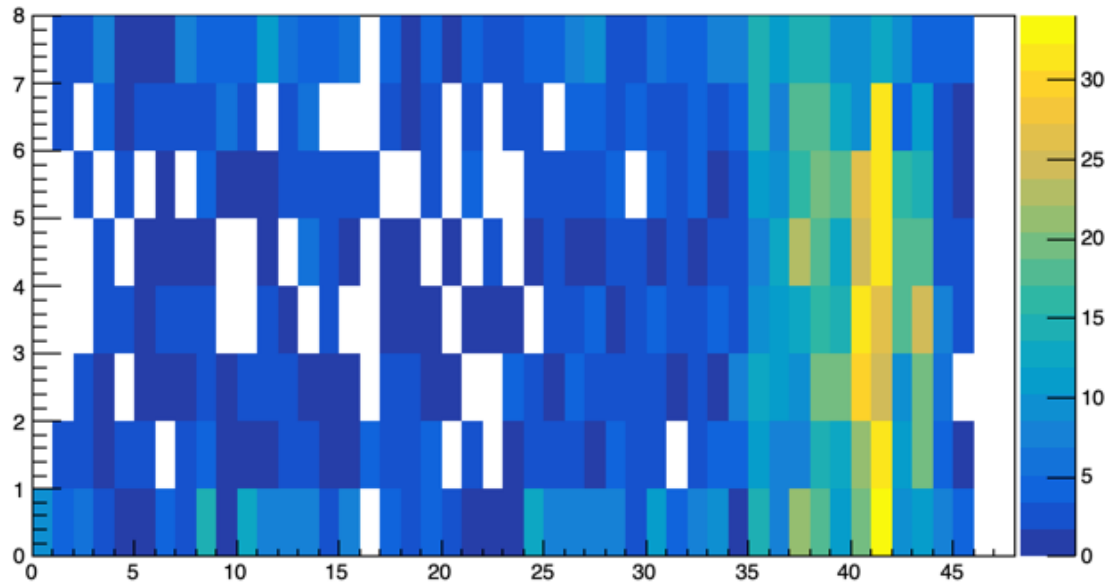
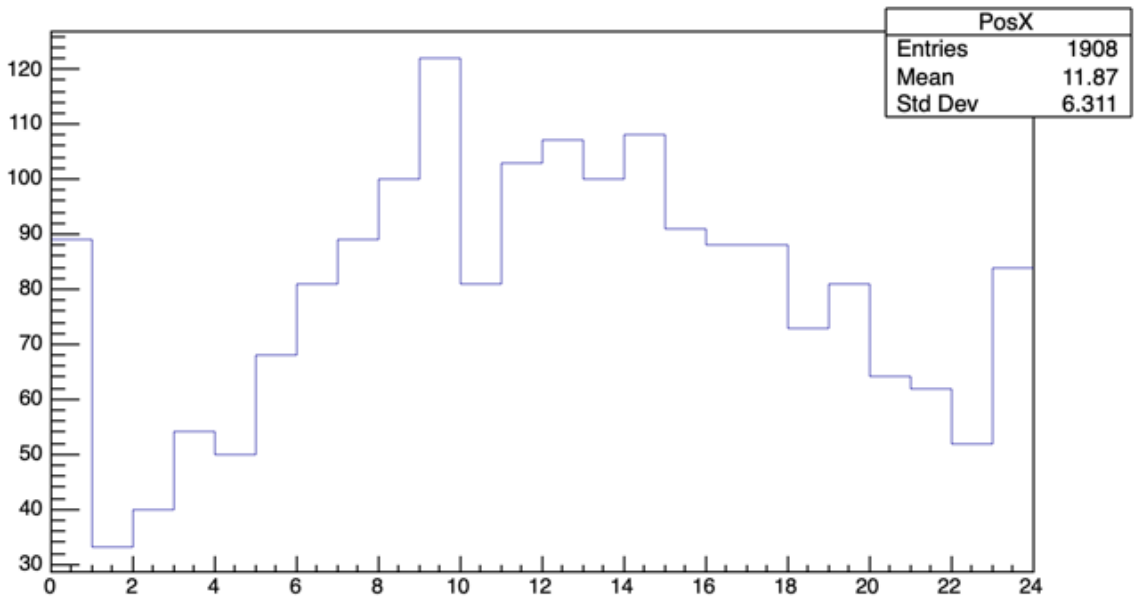
PosXZ



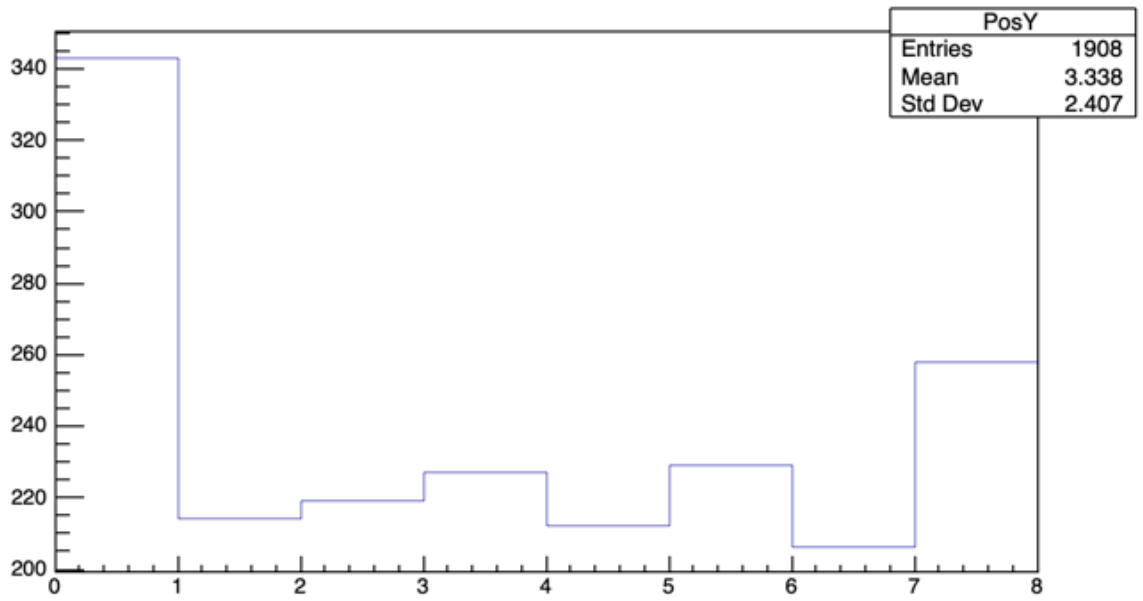
PosYZ



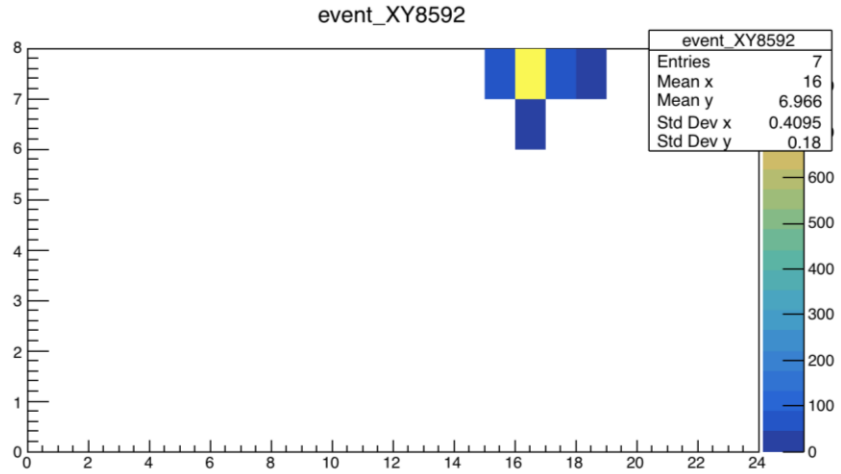
PosX

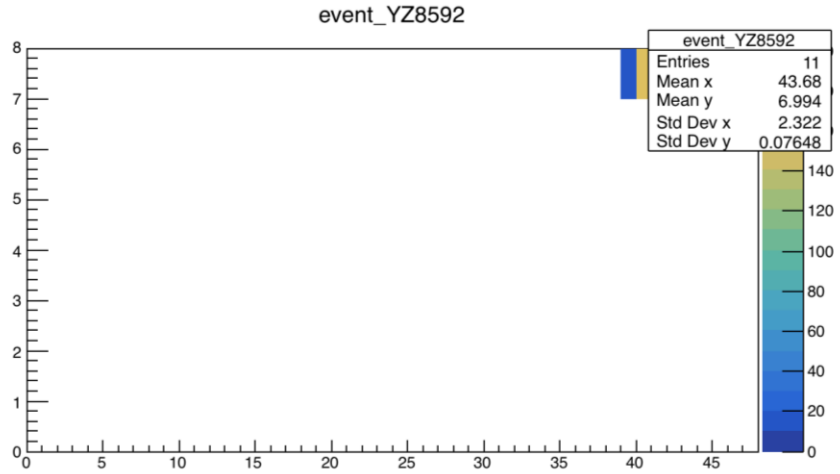


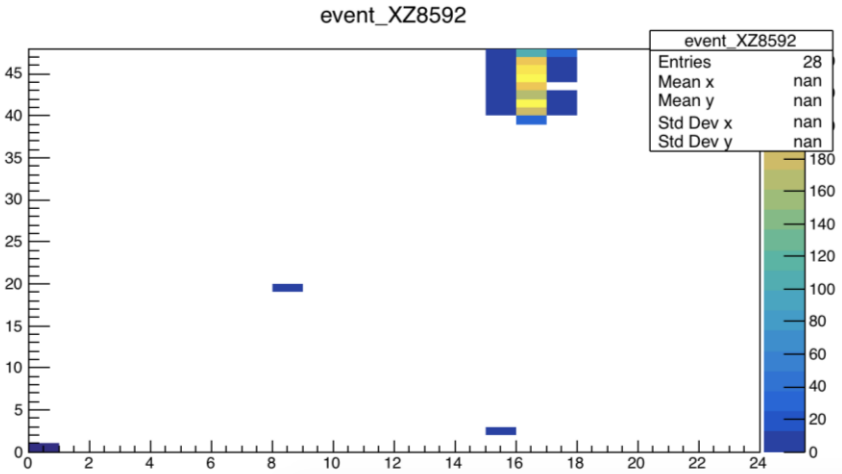
PosY

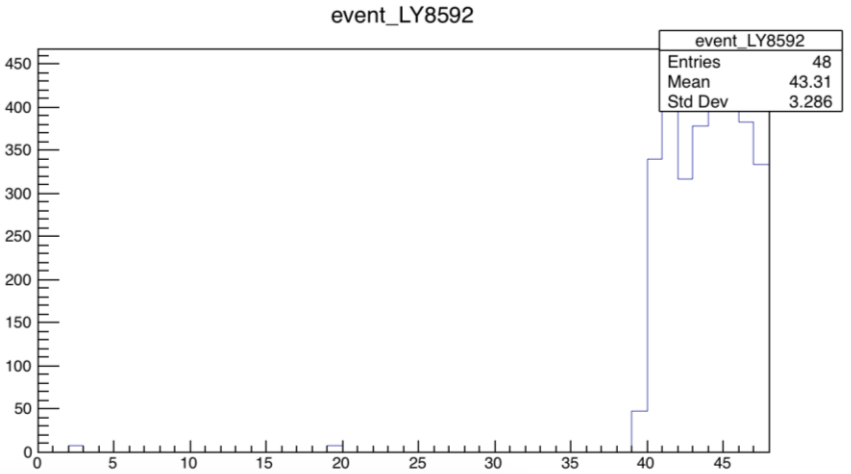


EVENTS AT THE SIDES OF THE DETECTOR

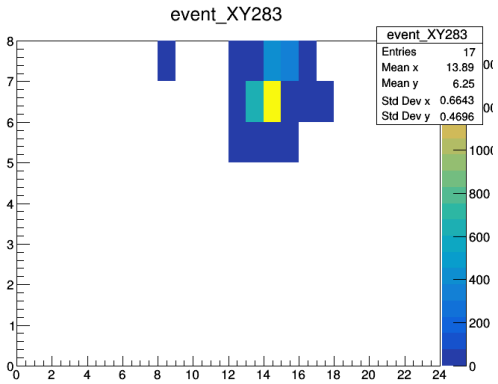


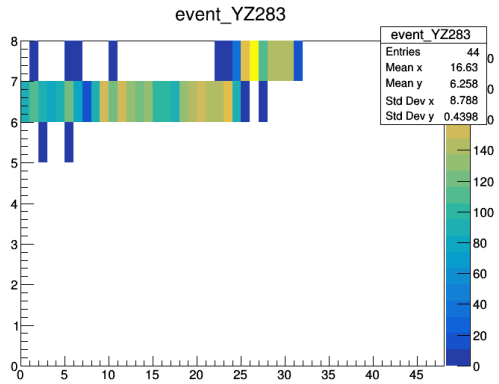


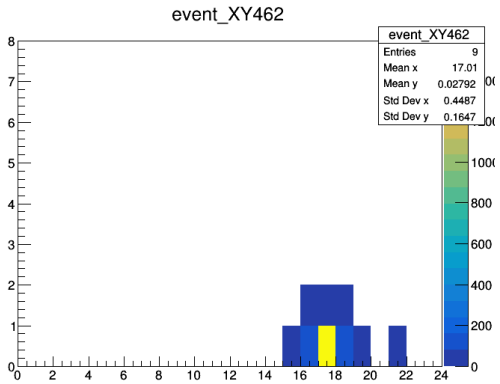


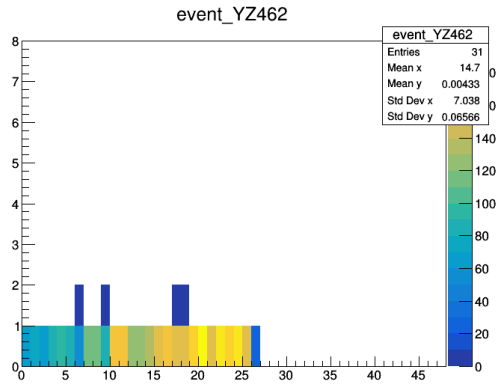


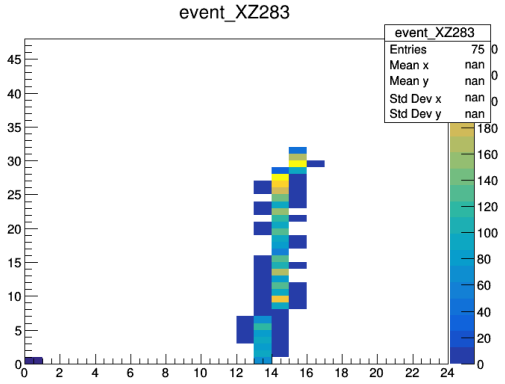
EVENTS THAT MAY HAVE ESCAPED THE DETECTOR

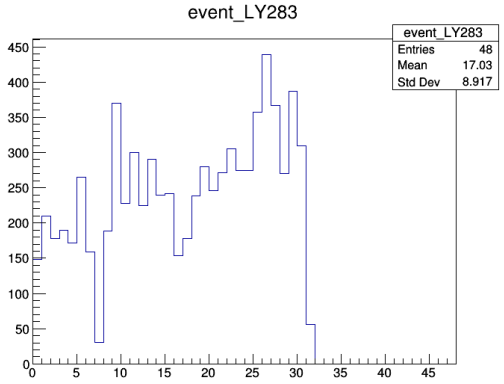


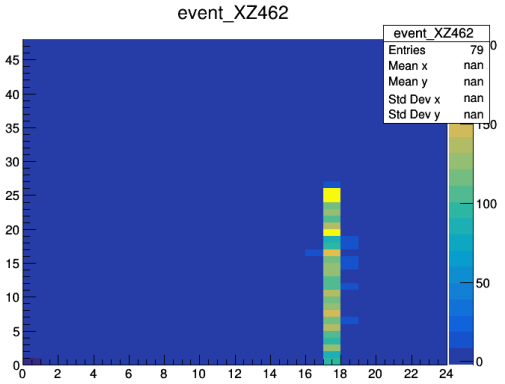


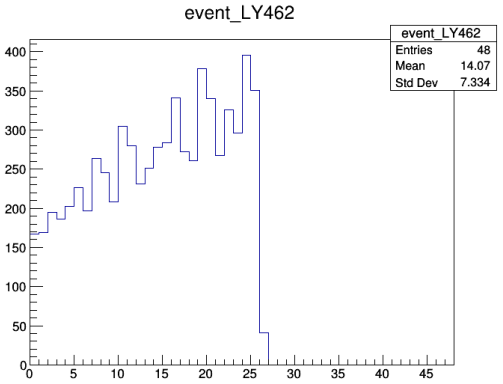












Low energy deposition

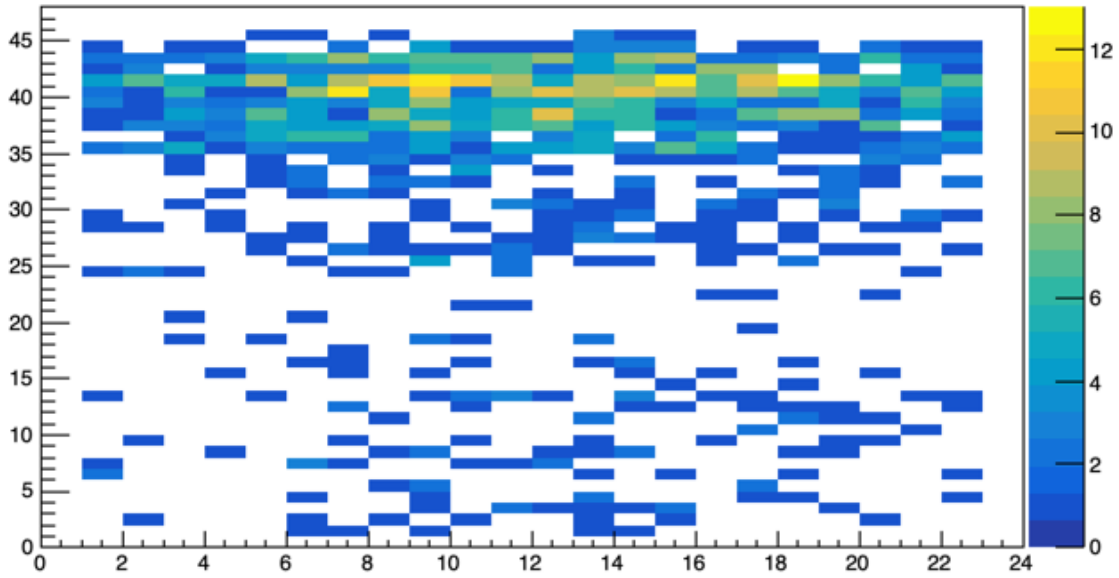
CUTS TO ELIMINATE EVENTS

XatMax != 0 or 23

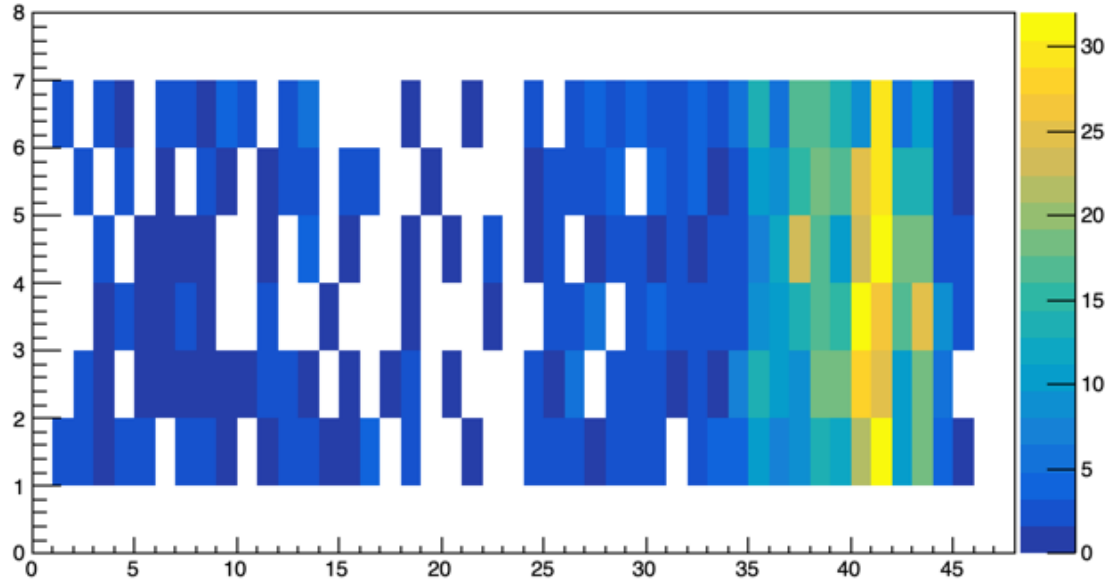
YatMax != 0 or 7

1908 events → 1199 events (37% lost)

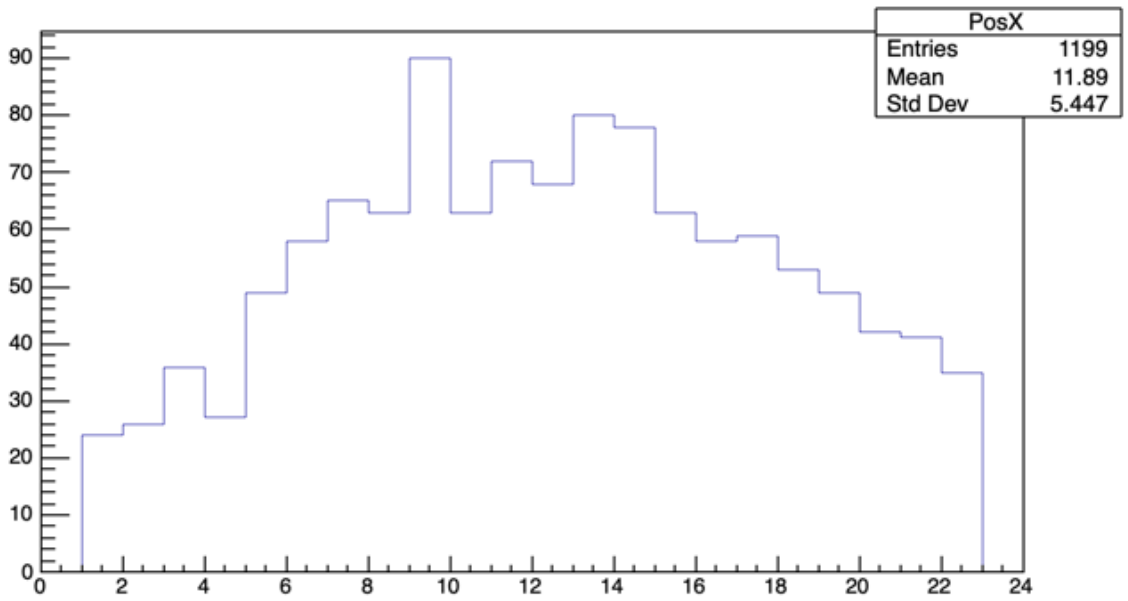
PosXZ



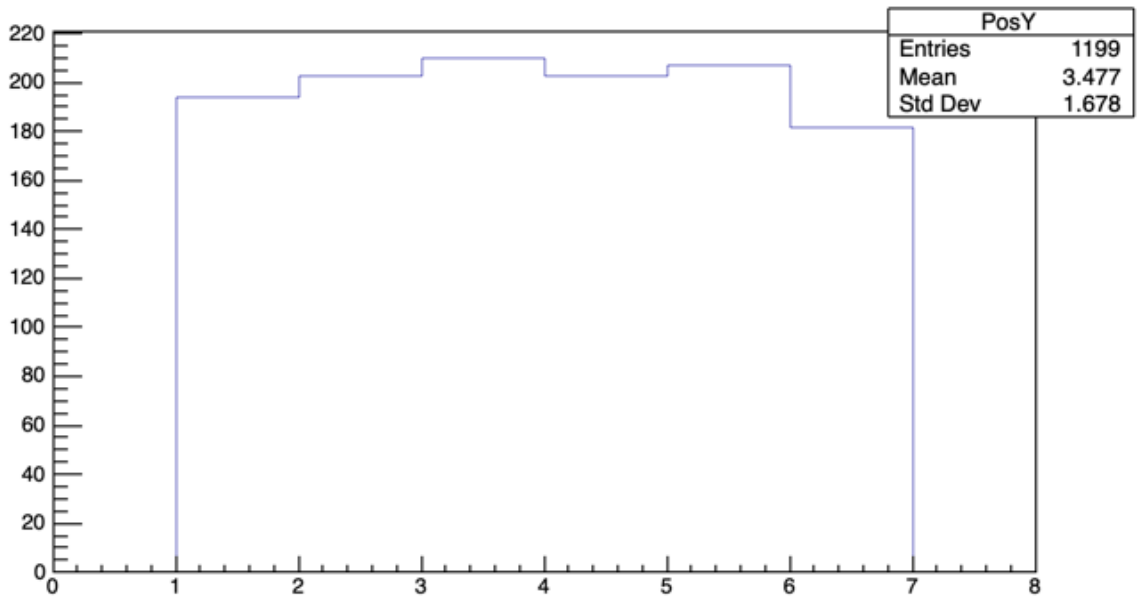
PosYZ

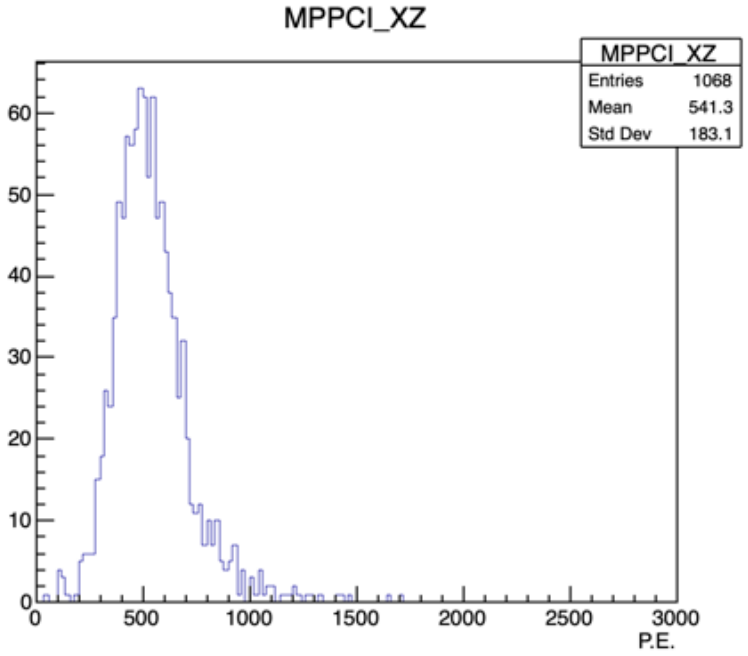


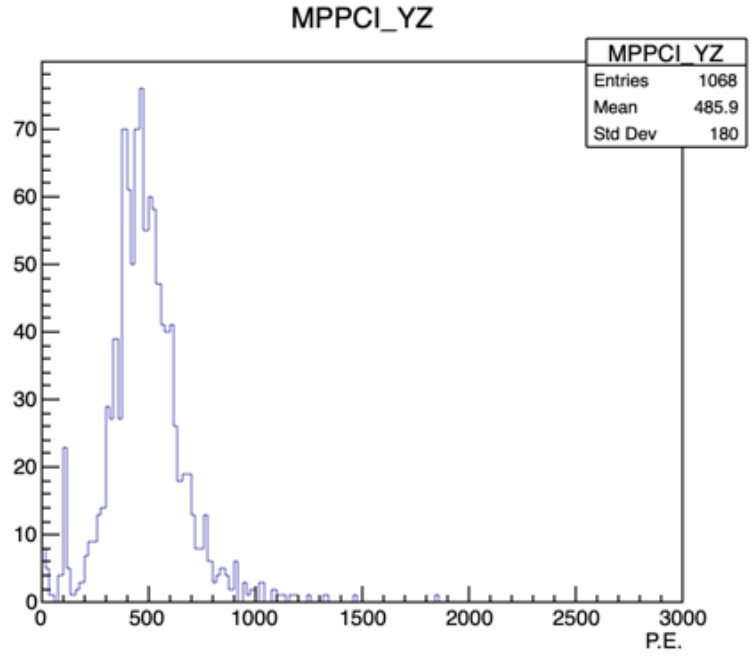
PosX

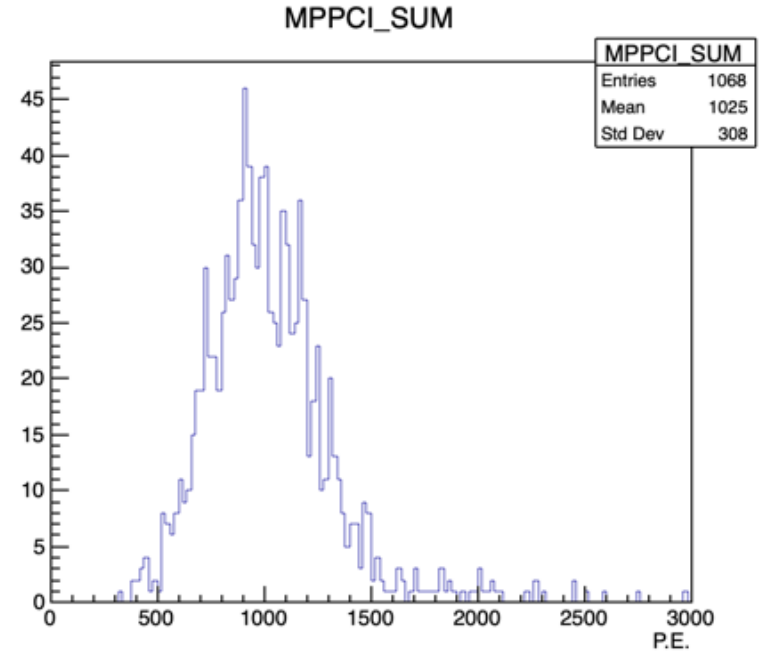


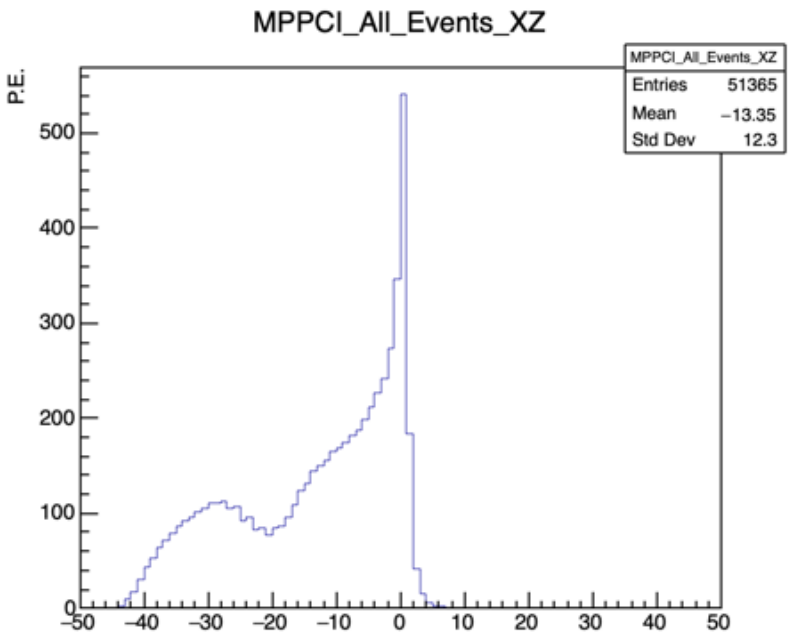
PosY

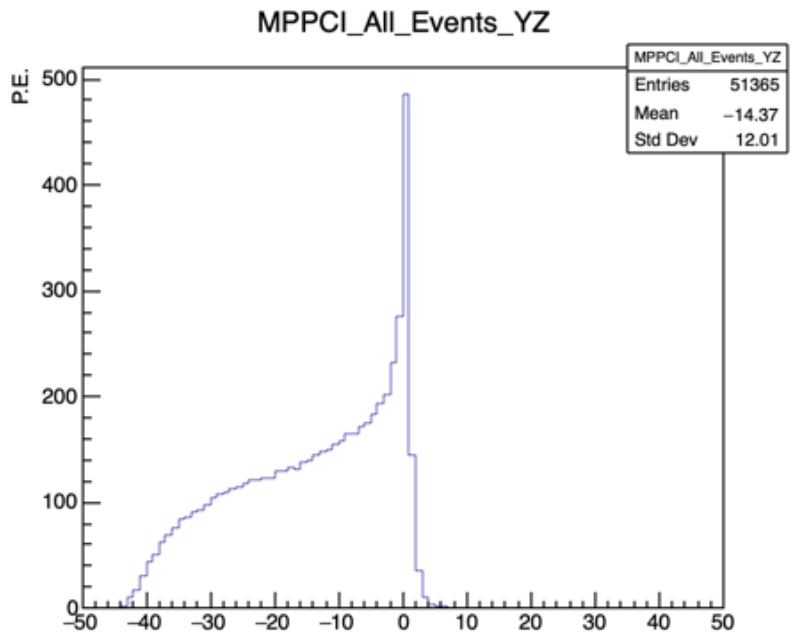


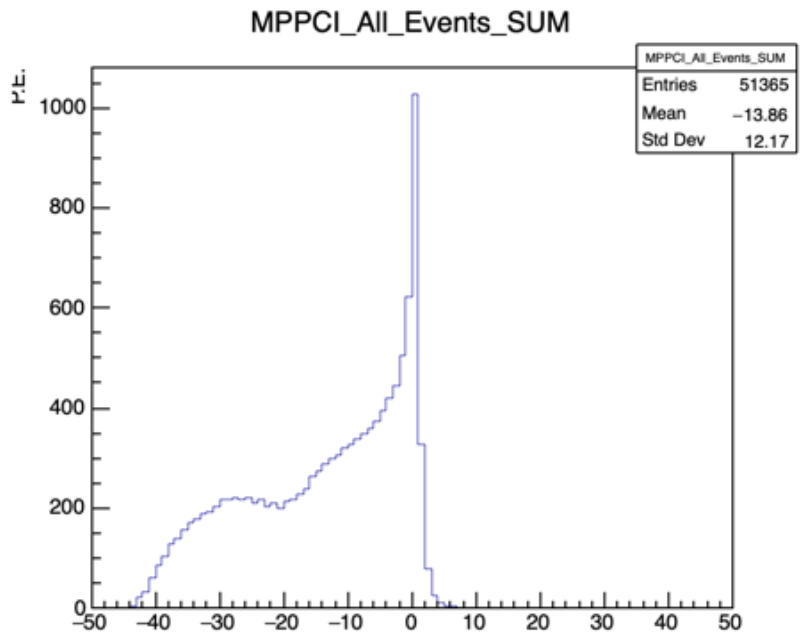

MPPCI_XZ
MPPCI_XZ
Entries 1068
Mean 541.3
Std Dev 183.1
P.E.

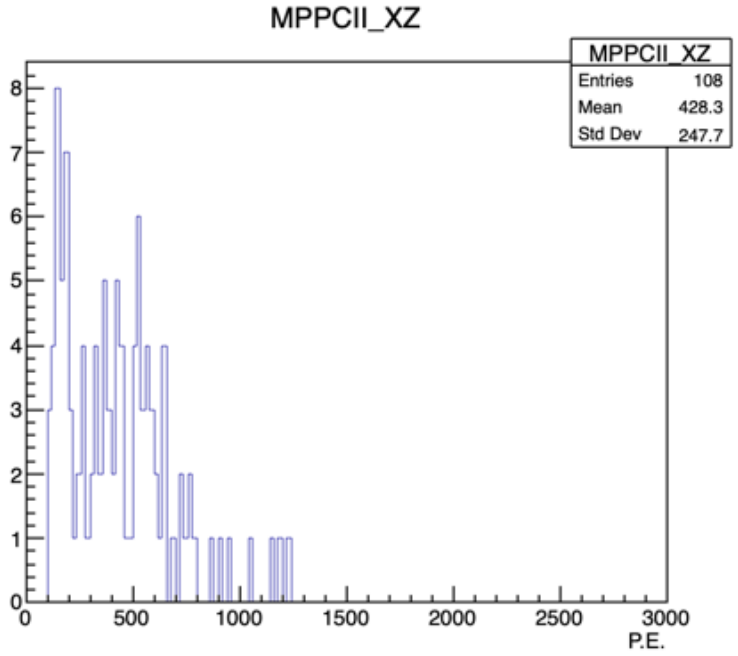

MPPCI_YZ
MPPCI_YZ
Entries 1068
Mean 485.9
Std Dev 180
P.E.

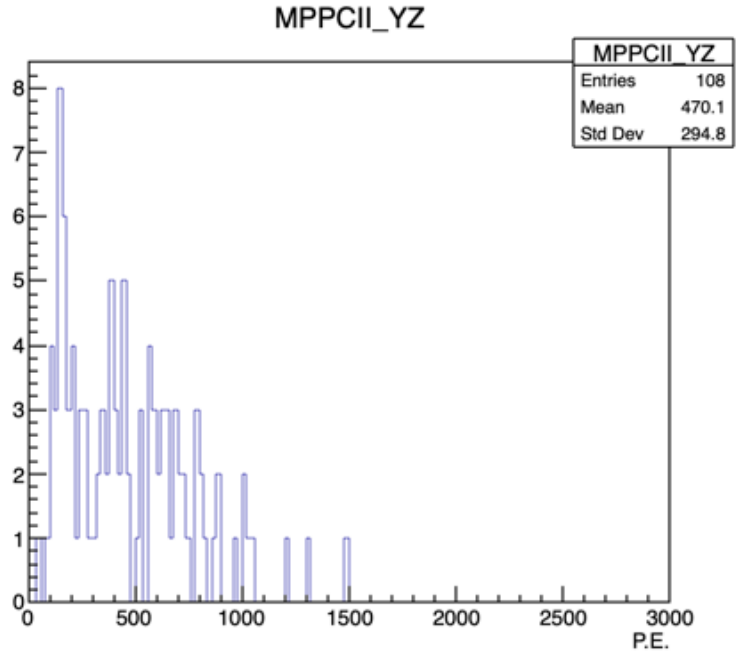

MPPCI_SUM
MPPCI_SUM
Entries 1068
Mean 1025
Std Dev 308
P.E.

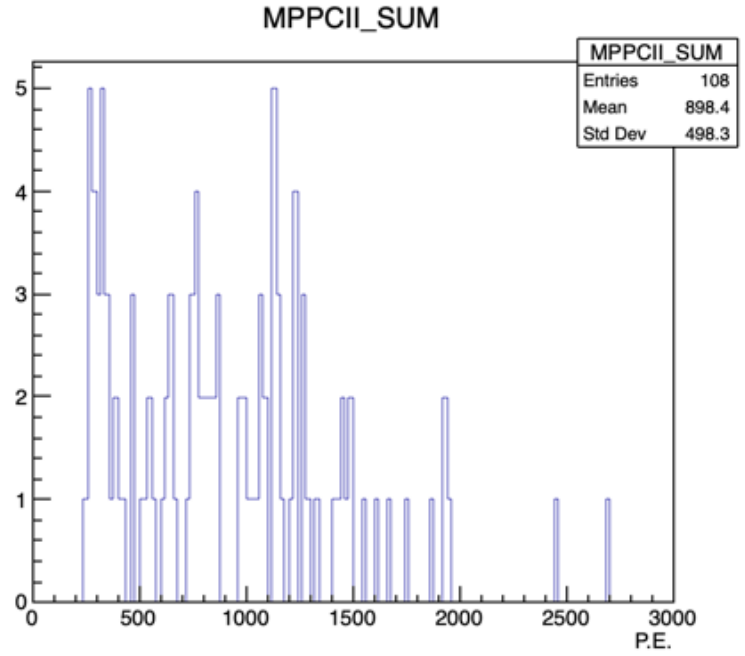

MPPCI_All_Events_XZ
MPPCI_All_Events_XZ
Entries 51365
Mean −13.35
Std Dev 12.3
P.E.

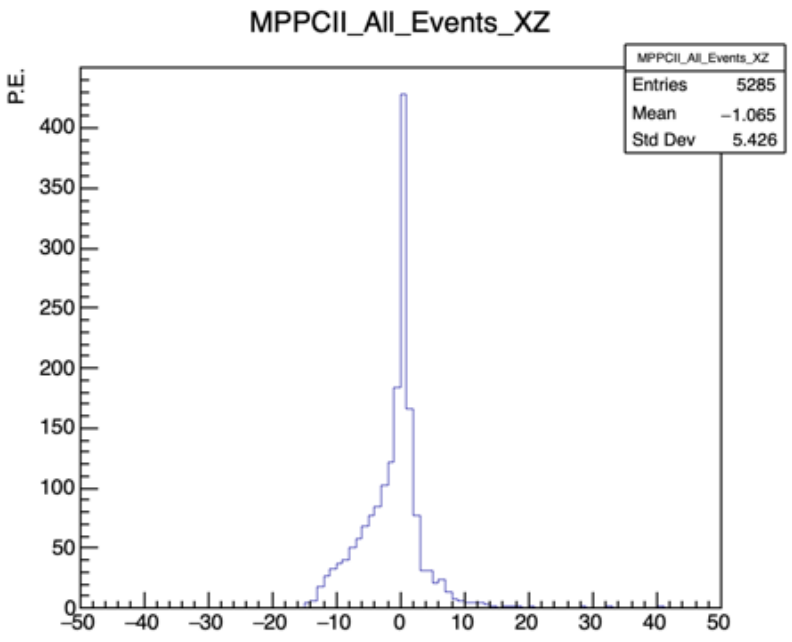

MPPCI_All_Events_YZ
MPPCI_All_Events_YZ
Entries 51365
Mean −14.37
Std Dev 12.01
P.E.

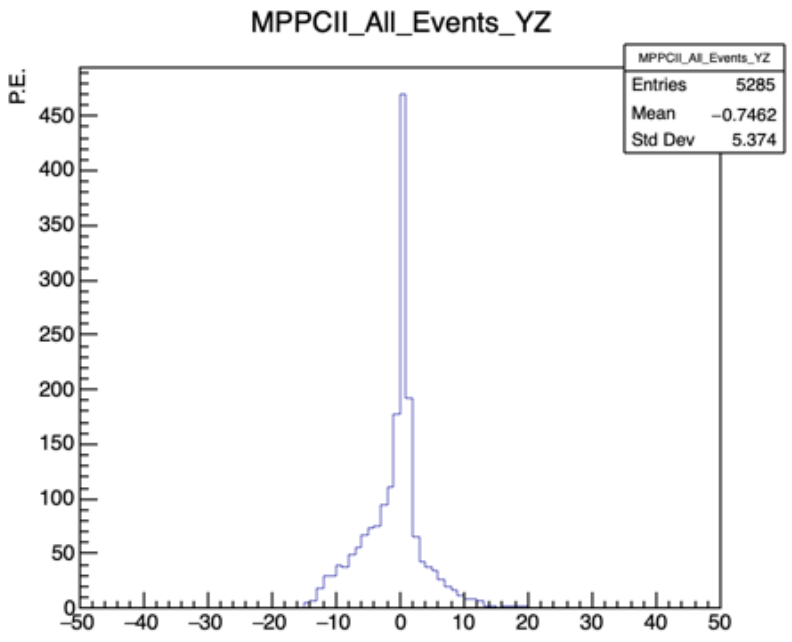

MPPCI_All_Events_SUM
MPPCI_All_Events_SUM
Entries 51365
Mean −13.86
Std Dev 12.17

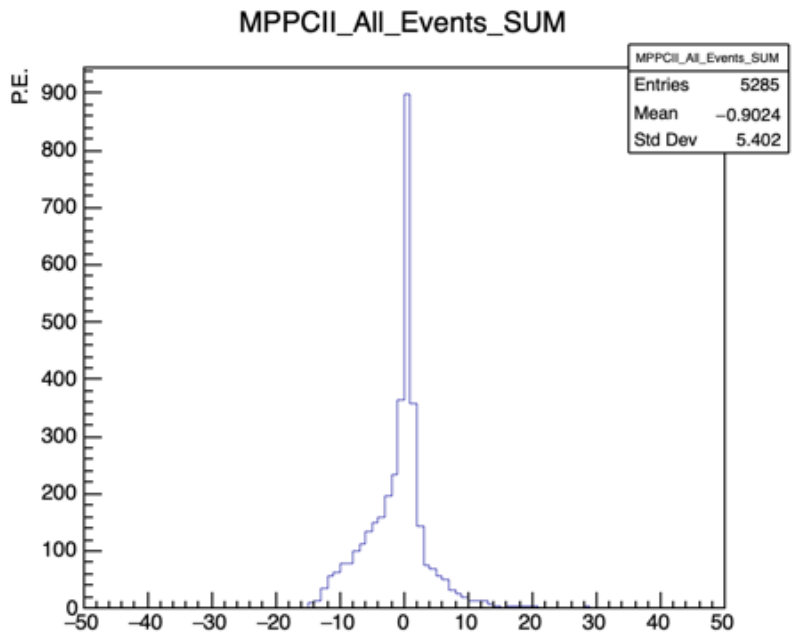

MPPCII_XZ
MPPCII_XZ
Entries 108
Mean 428.3
Std Dev 247.7
P.E.

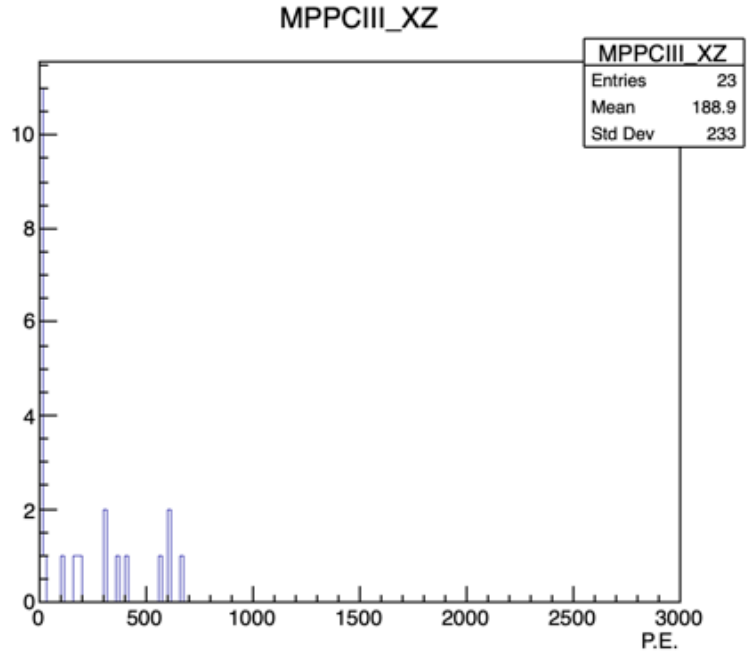

MPPCII_YZ
MPPCII_YZ
Entries 108
Mean 470.1
Std Dev 294.8
P.E.

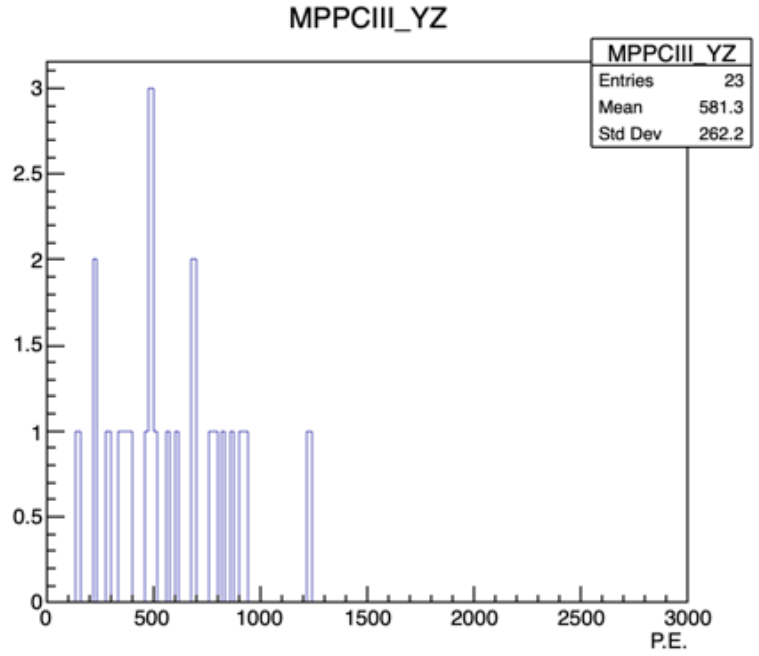

MPPCII_SUM
MPPCII_SUM
Entries 108
Mean 898.4
Std Dev 498.3
P.E.

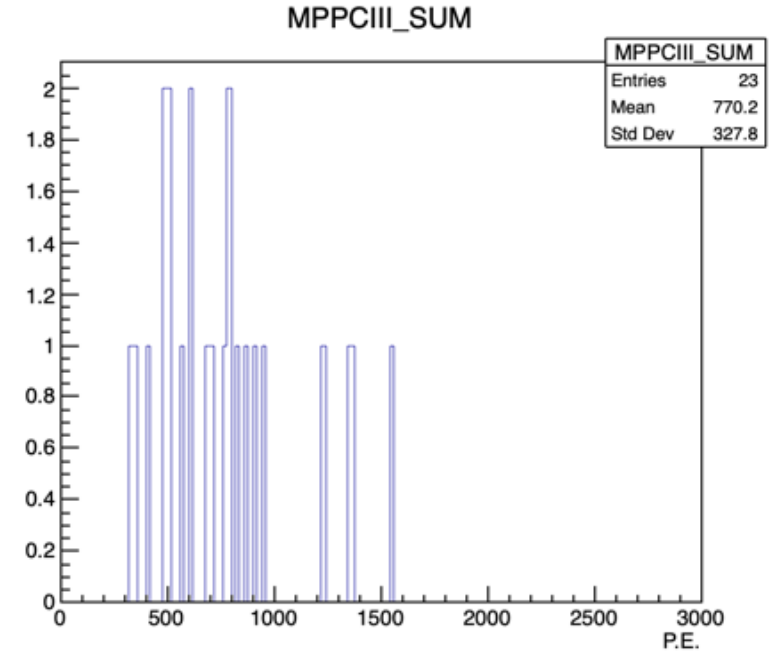

MPPCII_All_Events_XZ
MPPCII_All_Events_XZ
Entries 5285
Mean −1.065
Std Dev 5.426
P.E.

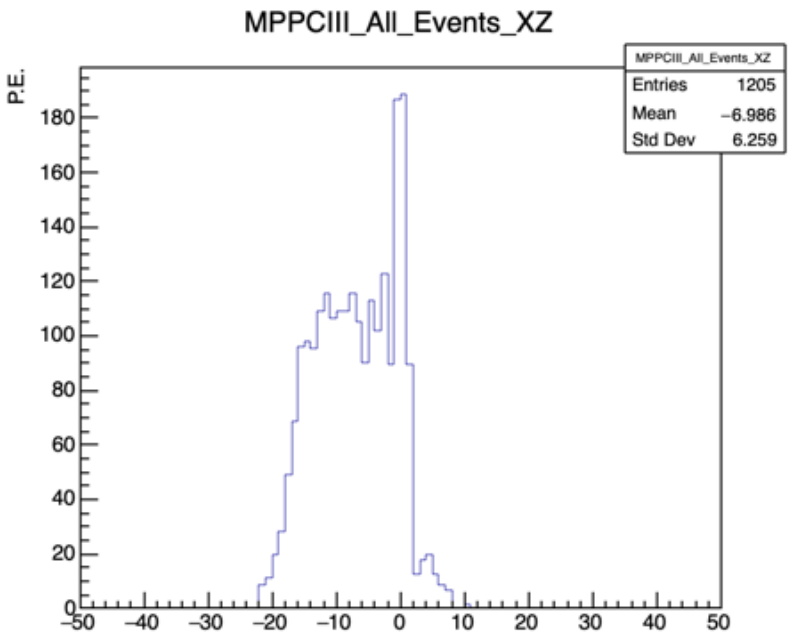

MPPCII_All_Events_YZ
MPPCII_All_Events_YZ
Entries 5285
Mean −0.7462
Std Dev 5.374
P.E.

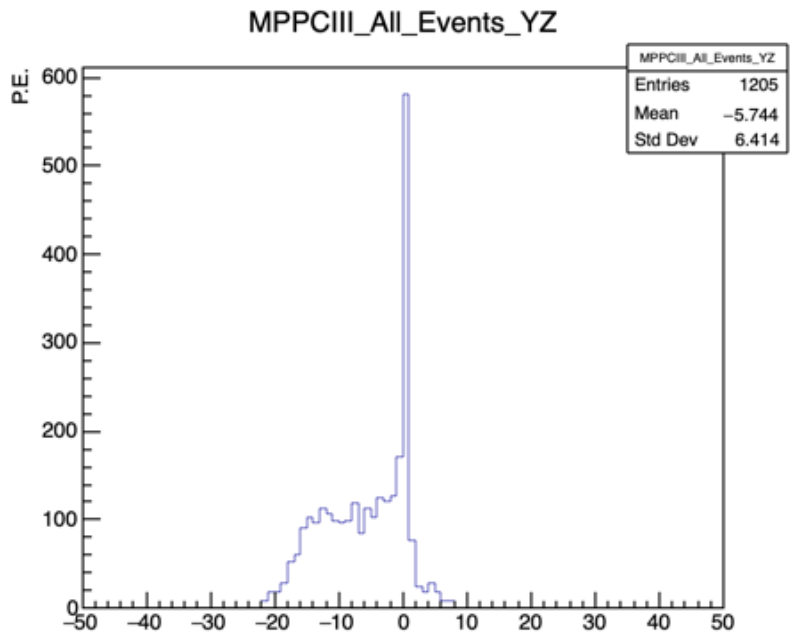

MPPCII_All_Events_SUM
MPPCII_All_Events_SUM
Entries 5285
Mean −0.9024
Std Dev 5.402
P.E.

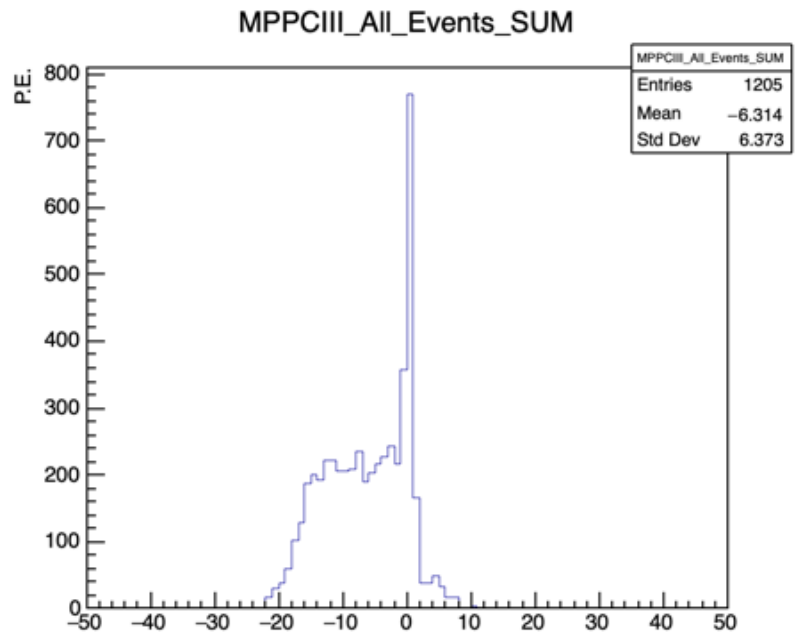

MPPCIII_XZ
MPPCIII_XZ
Entries 23
Mean 188.9
Std Dev 233
P.E.


MPPCIII_YZ
MPPCIII_YZ
Entries 23
Mean 581.3
Std Dev 262.2
P.E.


MPPCIII_SUM
MPPCIII_SUM
Entries 23
Mean 770.2
Std Dev 327.8
P.E.


MPPCIII_All_Events_XZ
MPPCIII_All_Events_XZ
Entries 1205
Mean −6.986
Std Dev 6.259
P.E.


MPPCIII_All_Events_YZ
MPPCIII_All_Events_YZ
Entries 1205
Mean −5.744
Std Dev 6.414
P.E.


MPPCIII_All_Events_SUM
MPPCIII_All_Events_SUM
Entries 1205
Mean −6.314
Std Dev 6.373
P.E.

NEXT

- Take a sample with 0.5 GeV/c protons to get more events stopping in the first half of the detector.
  → more statistics for MPPCII and MPPCIII
- Do the ADC → p.e conversion outside the Stopping Proton code then test the code with the new branches.