Beam analysis
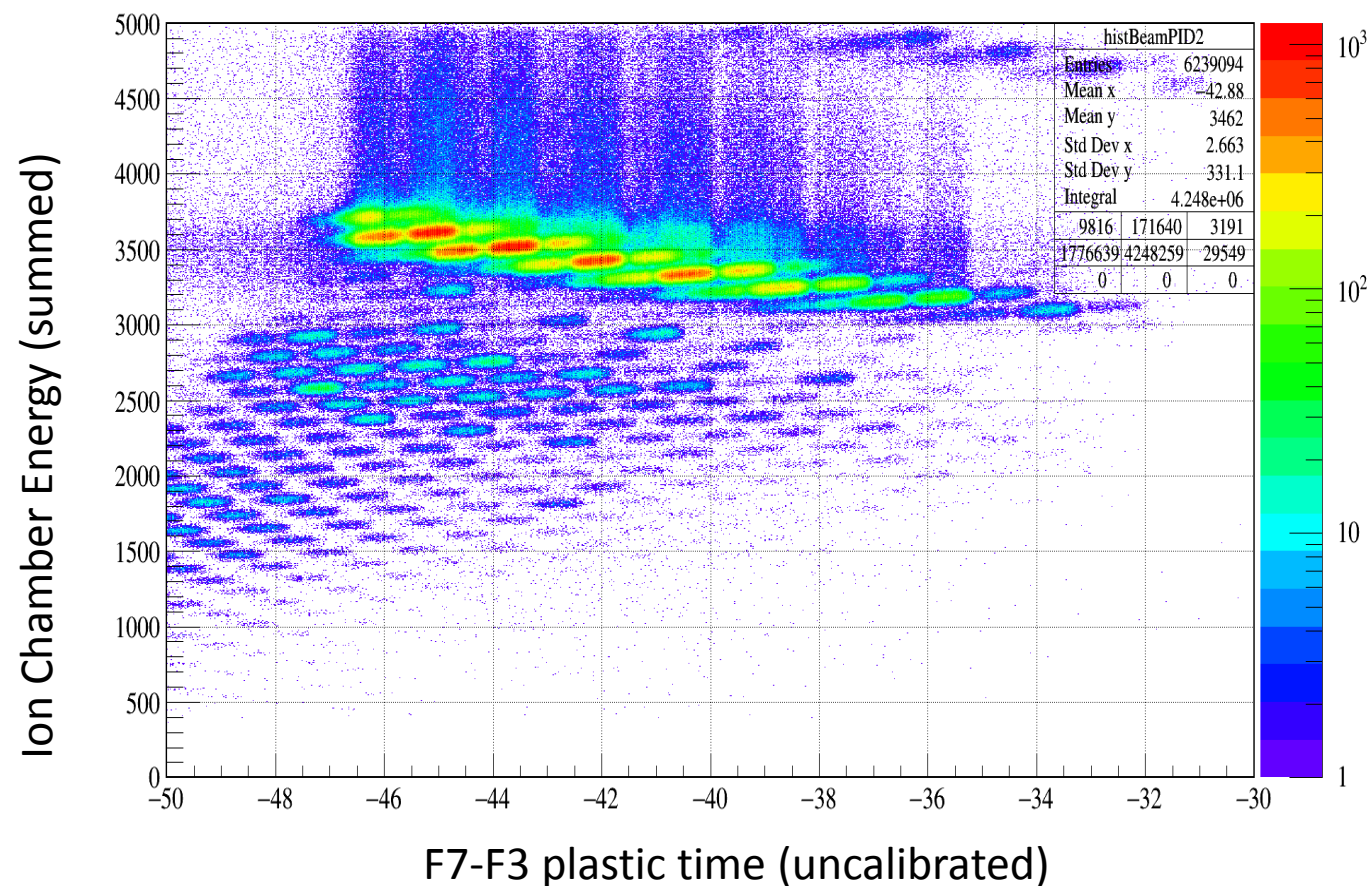
SπRIT Collaboration meeting

26 March 2017

Supplementary materials

Raw PID – IC energy/beta

- TOF from relative F3, F7 plastic scintillators

- Flight path length corrected by PPAC detectors

- Energy from Ion Chamber (IC)

Ion Chamber Energy (summed)

F7-F3 plastic time (uncalibrated)

histBeamPID2	
Entries	6239094
Mean x	−42.88
Mean y	3462
Std Dev x	2.663
Std Dev y	331.1
Integral	4.248e+06

9816	171640	3191
1776639	4248259	29549
0	0	0

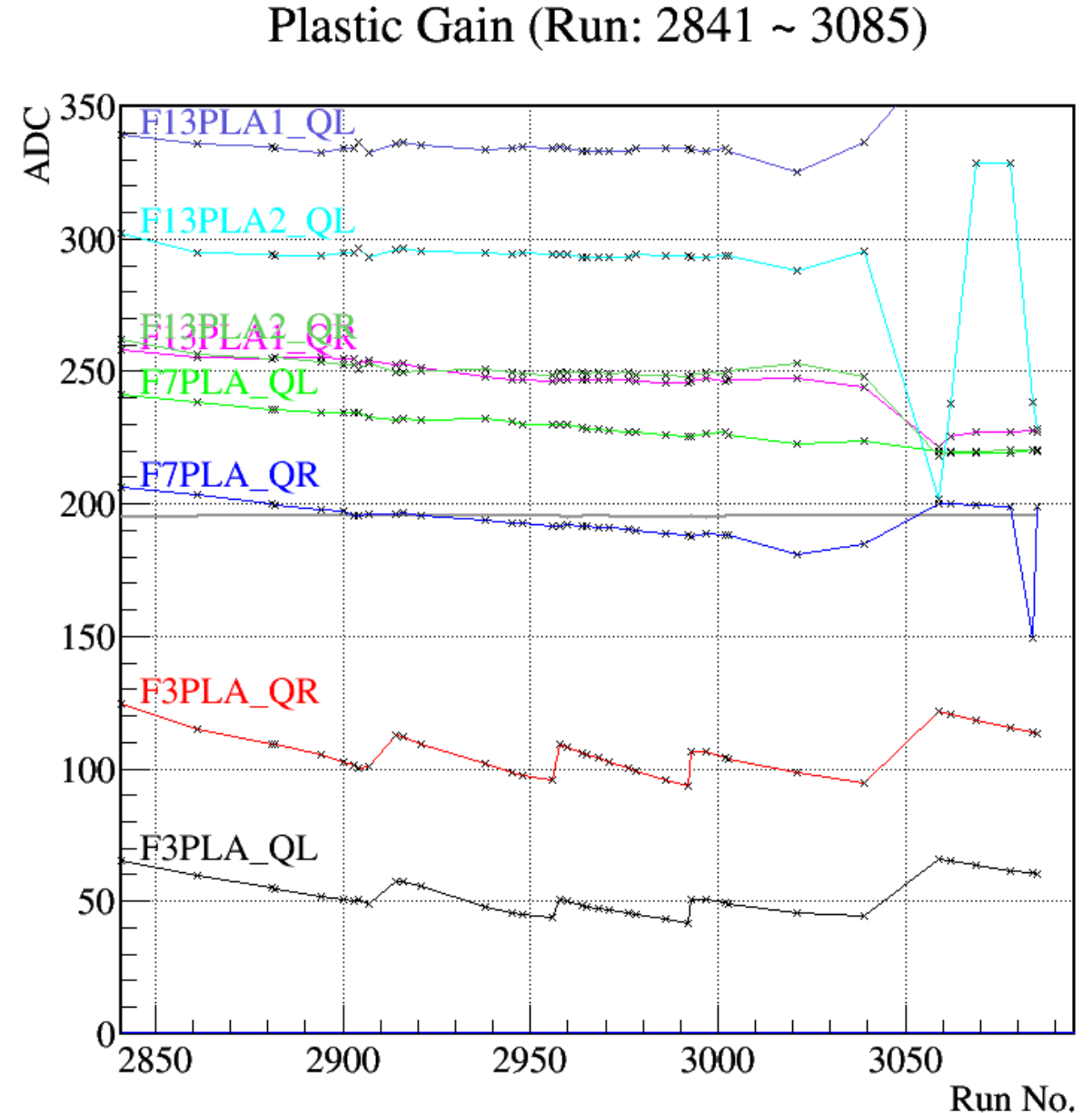N. Fukuda et al. NIM B 317 (2013) pp. 323-332

Macro: drawRawPID.C

Intro to Fukuda san's paper

- TOF from relative F3, F7 plastic scintillators

- Flight path length corrected by PPAC detectors

- Energy from Ion Chamber (IC)

N. Fukuda et al. NIM B 317 (2013) pp. 323-332
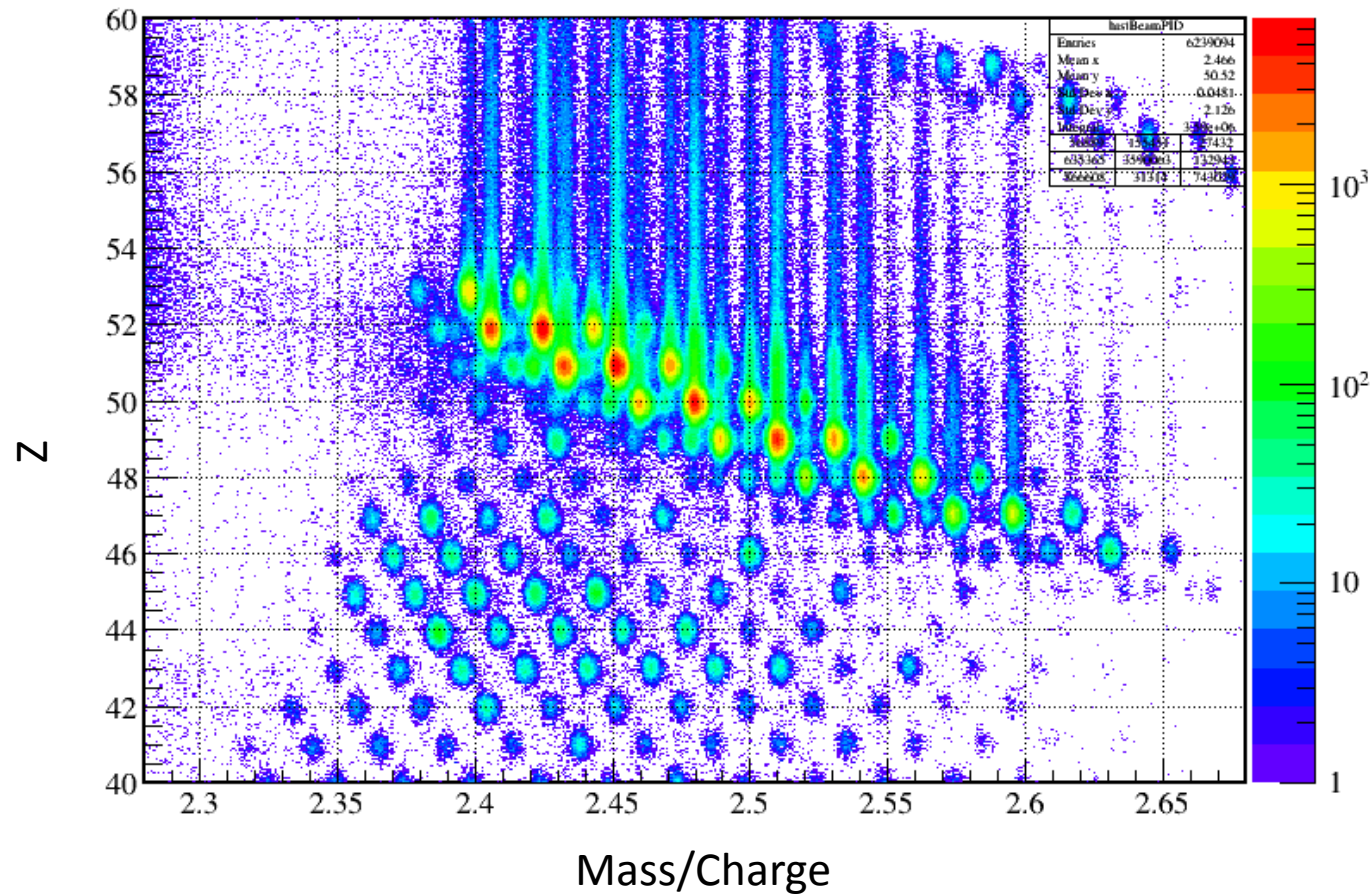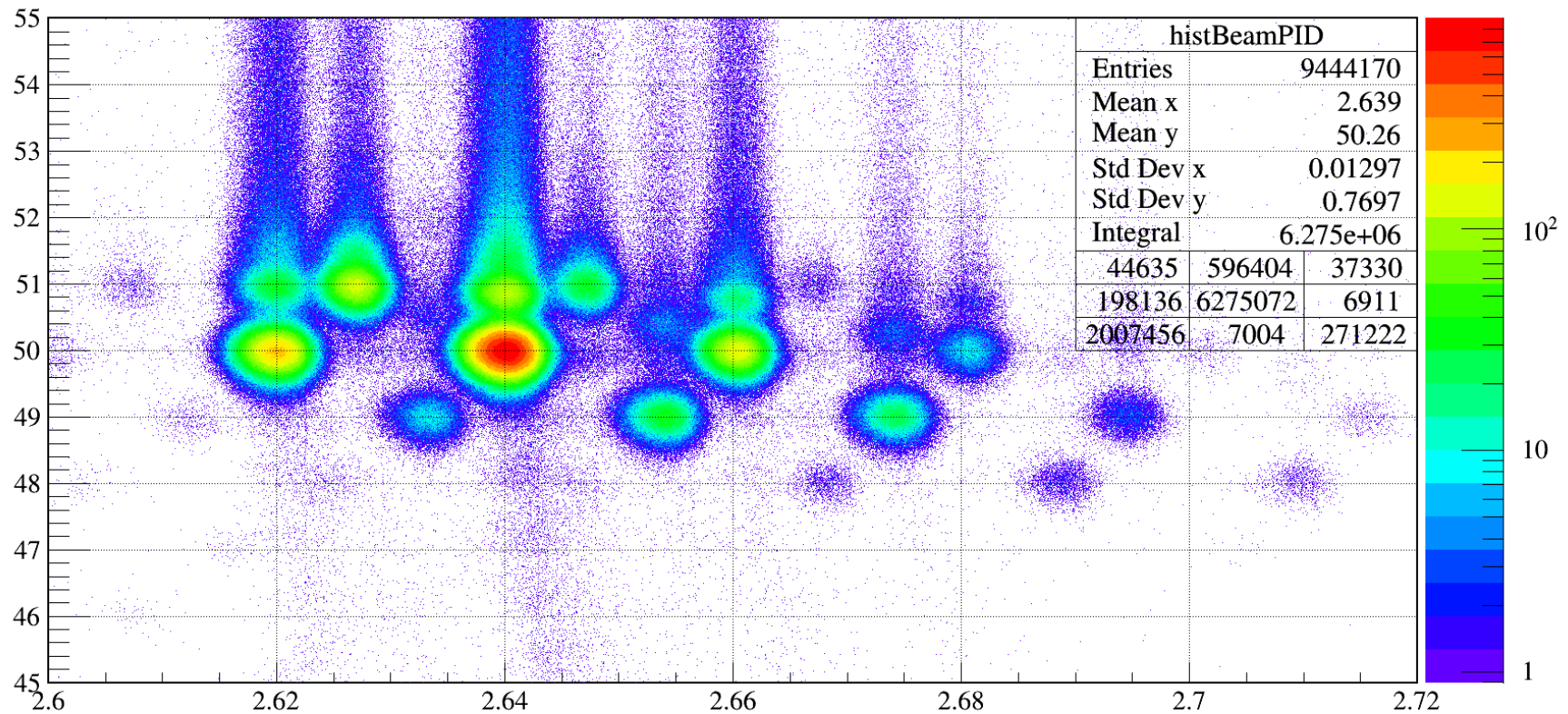
Macro: drawRawPID.C

TOF offset calibration

- Relative timing between F3, F7 affected by plastic degradation
- Two options: use an average, or correct the offset for each run

Plastic Gain (Run: 2841 ~ 3085)

From online analysis

Averaged by plastic setting

histBeamPID		
Entries		9444170
Mean x		2.639
Mean y		50.26
Std Dev x		0.01297
Std Dev y		0.7697
Integral		6.275e+06
44635	596404	37330
198136	6275072	6911
2007456	7004	271222

Fri Aug 26 09:35:35 2016

Macro: drawPID.C

Run by run

histBeamPID

Entries		9444170
Mean x		2.639
Mean y		50.26
Std Dev x		0.01297
Std Dev y		0.7697
Integral		6.28e+06
44414	596899	36411
185093	6280496	6807
2020033	7030	266987
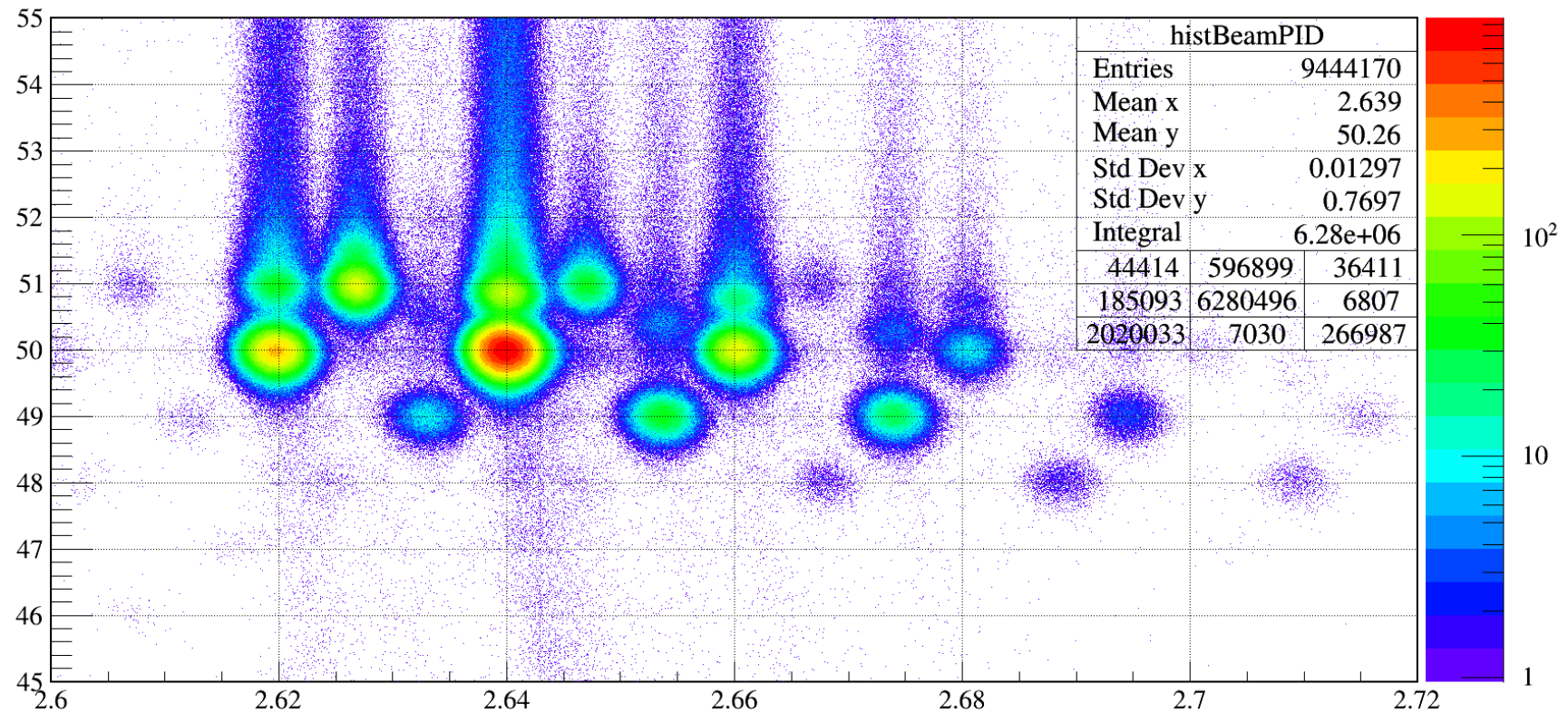
Fri Aug 26 09:37:10 2016

Macro: aoqByRun.C,drawPID.C

IC calibration: 4 parameters in configuration file

- Two linear fits. First linear fit:

- Fit ADC channels in Ion Chamber to MeV lost (using different beam species):
  ICMeVSqSum=ch2mev_0+ch2mev_1*ADCSqSum

- Requires PID is mostly in the correct position to use ICfitting1.C macro

Macro: ICfitting1.C

IC calibration

- Fit Ion Chamber energy peaks to corresponding Z

- Z=zcoef_1+zcoef_0*f(beta, ICMeVSqSum)
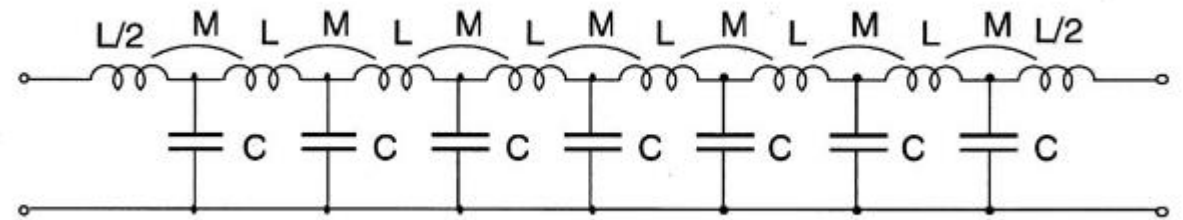
- Note that coef_0,1 are switched from ch2mev_0,1

Macro: ICCalib.C / CalibSpectrum.C
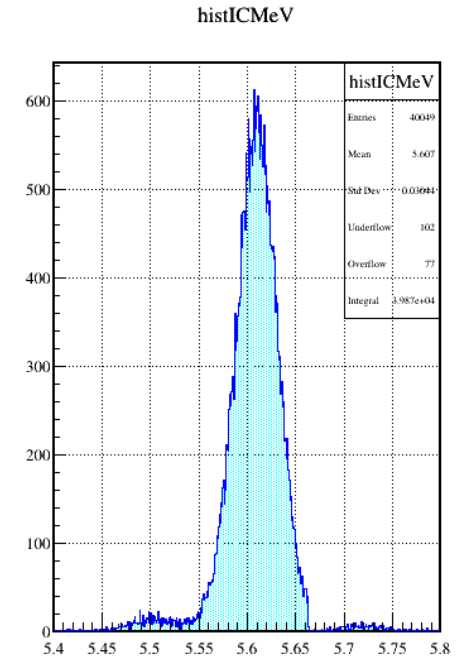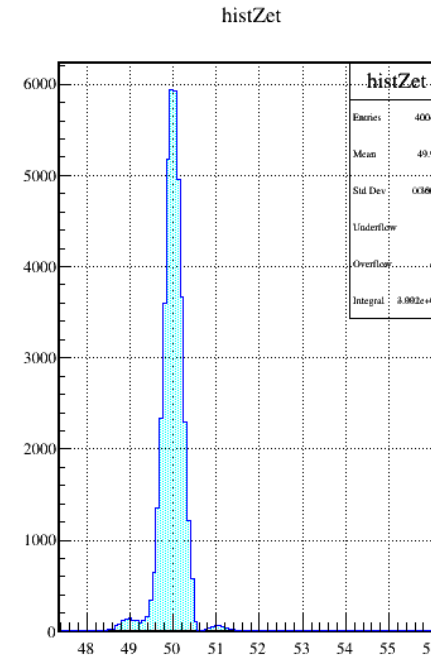
PPAC TSUM calibration

- Due to delay line readout of PPAC detectors, TSUM should be constant

- TSUM_X = TX1+TX2

- TSUM_Y = TY1+TY2

- For missing TX1/TX2 or TY1/TY2, can still reconstruct the PPAC position (using patch in TArtCalibPPAC.cc)
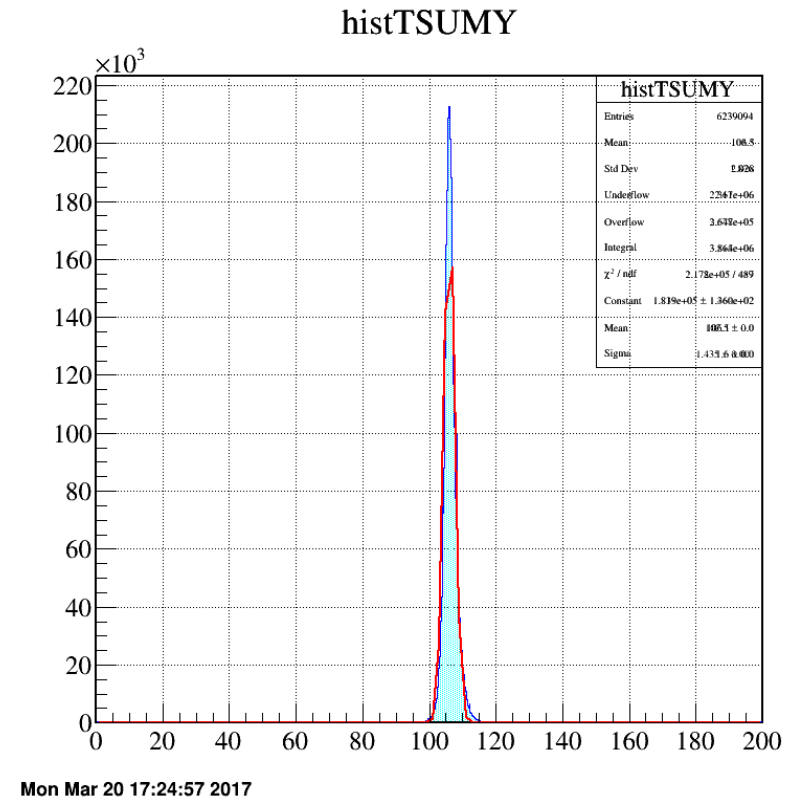
Macro: makeTSUM.C

H. Kumagai et al. https://arxiv.org/abs/1311.0215

Effect of applying cuts

- For each cut, show The PID before applying cut and after

Starting PID (calibrated) run 3062

Plastic cuts

(124Sn, all runs)

F13.1 correlation

Position from relative charge

Position from relative time

Macro: PlasticCorr.C
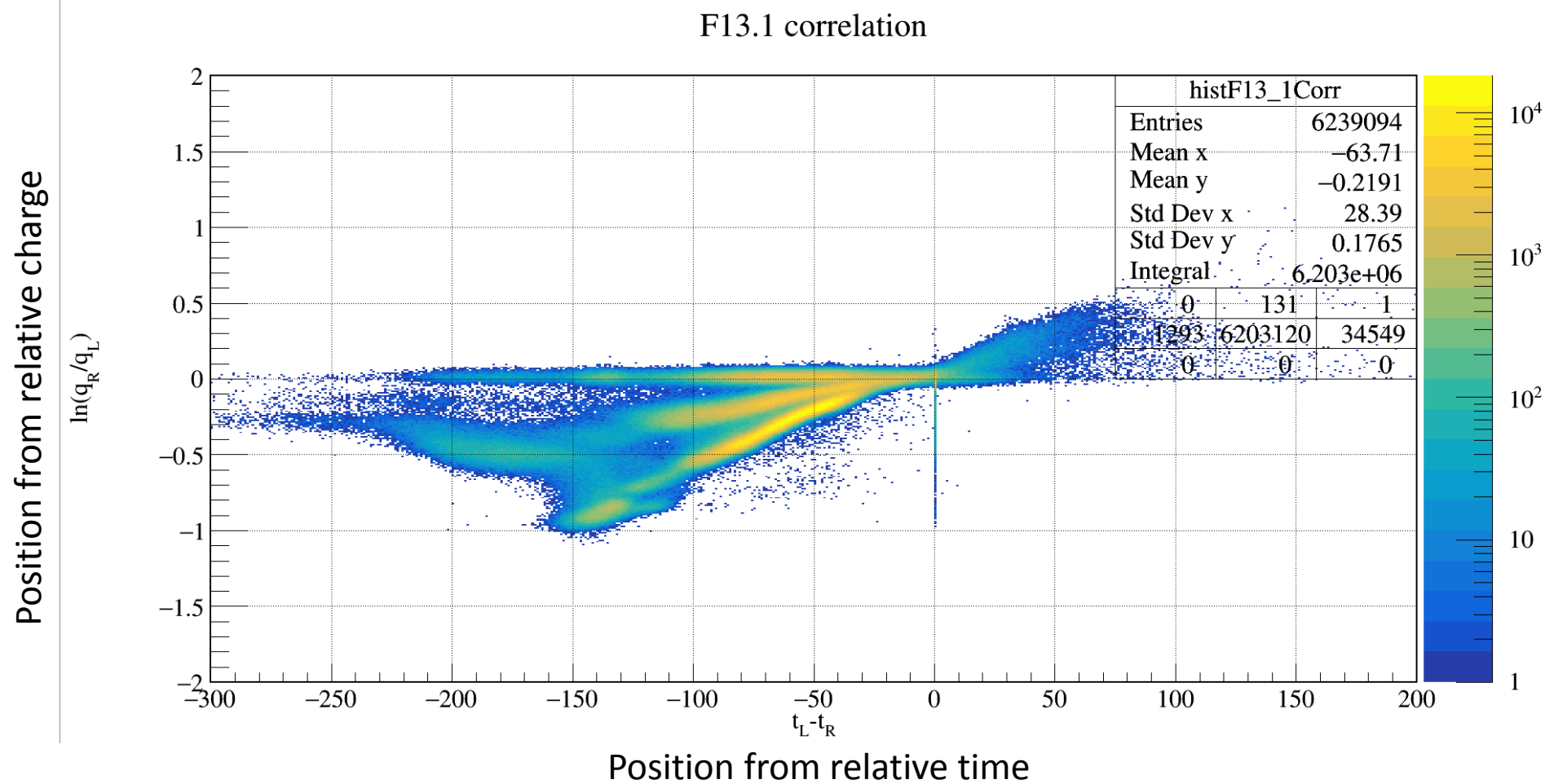
Plastic cuts

1. Good
2. Low PPAC hits
3. Beam runs
4. Non-correlated
5. Beam spot on BL side of plastic

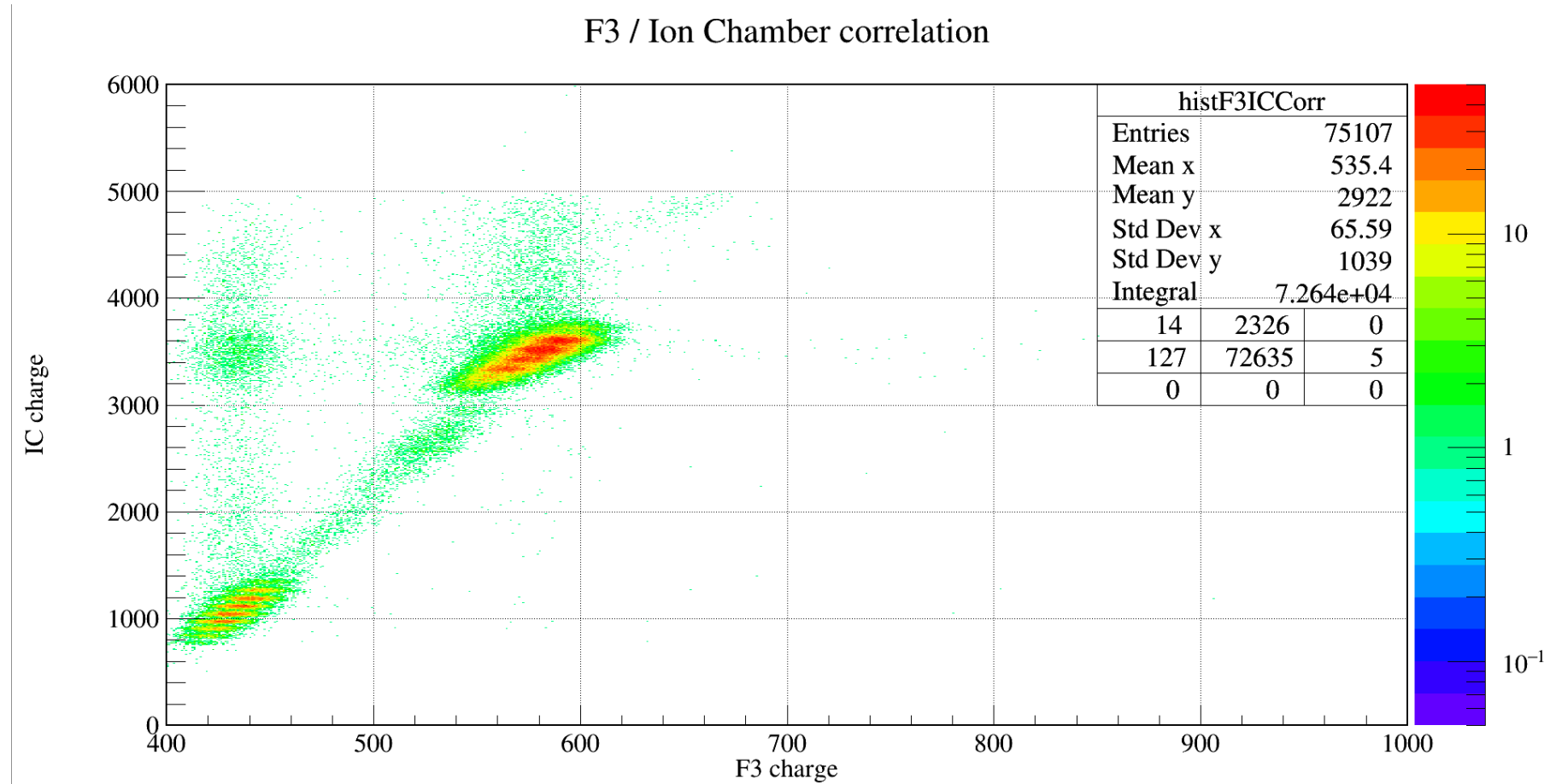Need to use a different cut for beam run! Different cuts for different beams!

(124Sn, all runs)
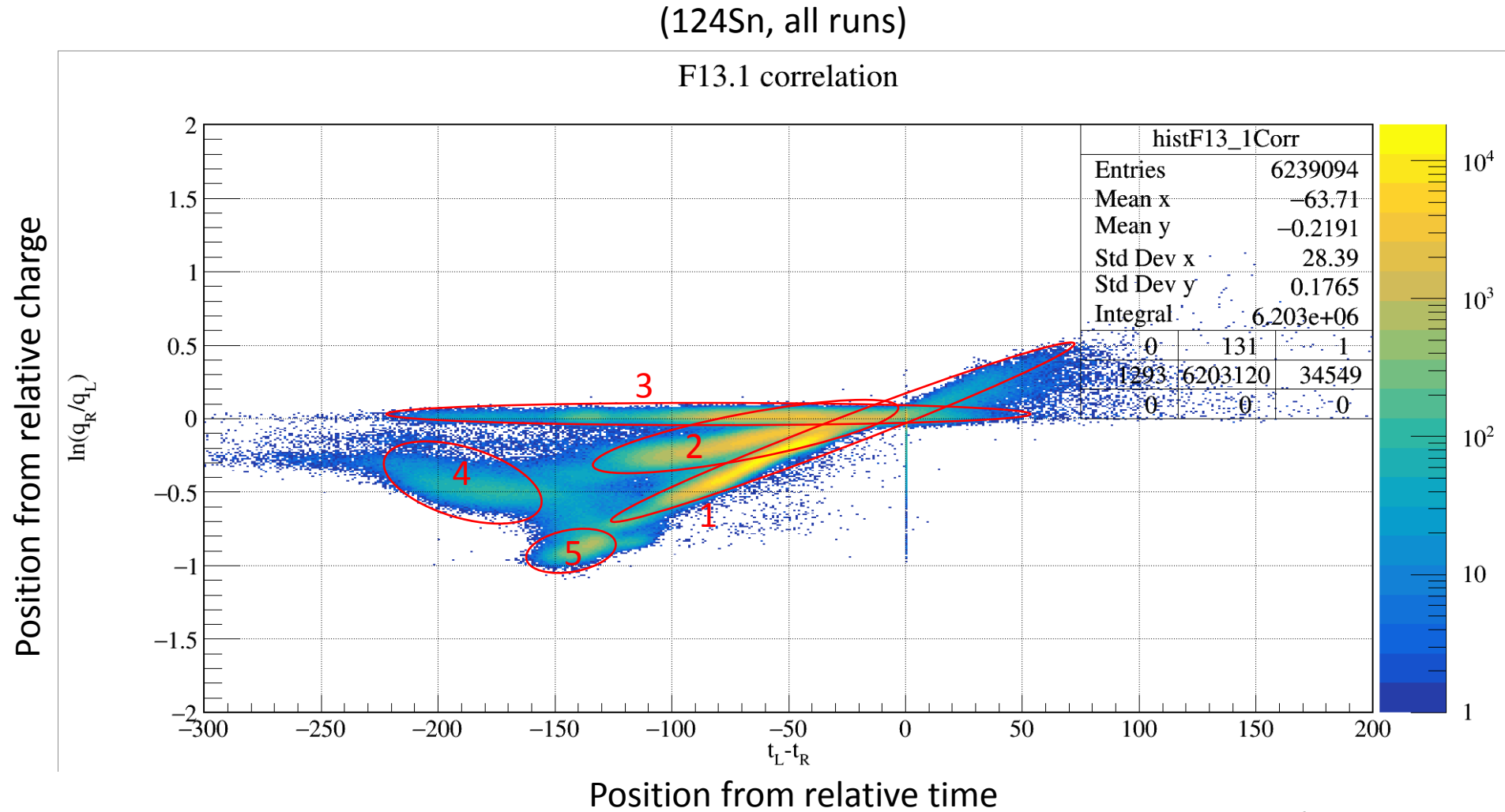
Macro: PlasticCorr.C

PPAC hit cuts

- Number of PPAC signals present indicates problems
- >64 indicates pileup
- <50 has poor reconstruction

Number of total hits in PPAC

Macro: PPAChits.C / RIDFtoBeamROOT.cpp

IC v PlaQ cut

F3 / Ion Chamber correlation
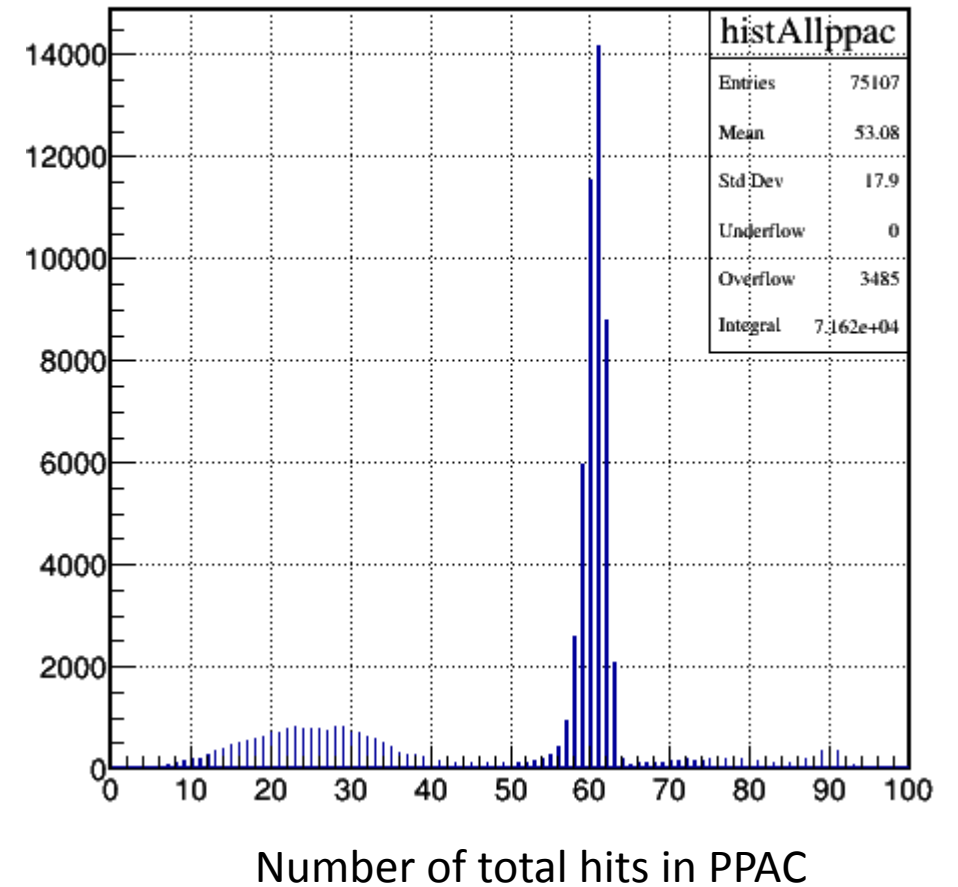
Macro: ICplCorr.C

Energy loss: getting to F7/8

- For each beam, take β extracted from sample run for the isotope we are interested in, calculate energy.

- Use BigRIPS estimate for E78 to determine kinetic energy loss before STQ/BDC detectors. Apply percent change in kinetic energy to each event.

Custom class: TBeamEnergy

Energy loss: through magnetic projection

- LISE++ used to determine dE/dx for each material after F7/F8 drift as a function of % of kinetic energy lost

- Integrate energy loss with position change for final BDC projection

- Choose an end "z" to stop projection

Custom class: TBDCProjection

BDC information

- Angle, position from straight line projection through BDC detectors

- Magnetic field information used after the Z position of BDC2 to project to various points downstream (target, active veto, etc.)

Custom class: TBDCProjection
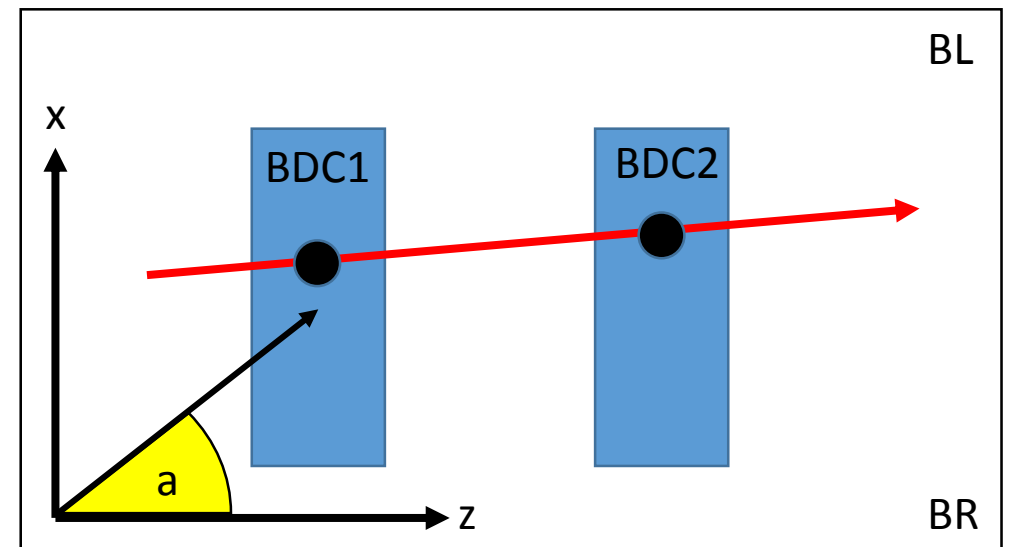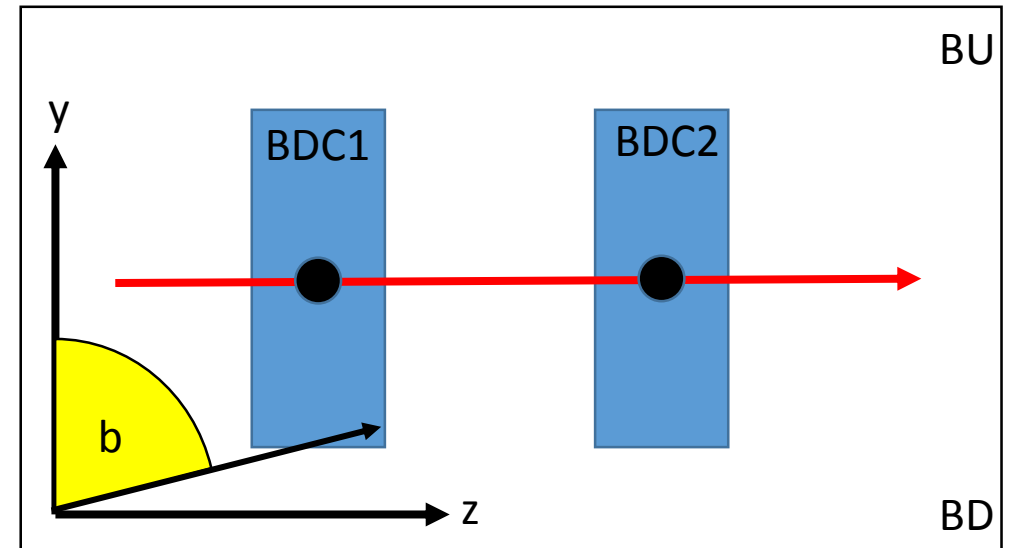
Magnetic projection: results

- Use beam run (3055, 124Sn)
- Project to start of pad plane
- Project to end of pad plane
- Compare to clusters in first and last row of TPC

- Include PGM correction for BDC
- Assume perfectly aligned TPC (no PGM correction)

Macro: Vertex comparison macro requires SpiRITROOT and ANAROOT. A beta macro available on request

Pad plane start

Mean: - 0.8377

Mean: - 0.0005
(manually corrected)

Macro: Vertex comparison macro requires SpiRITROOT and ANAROOT. A beta macro available on request
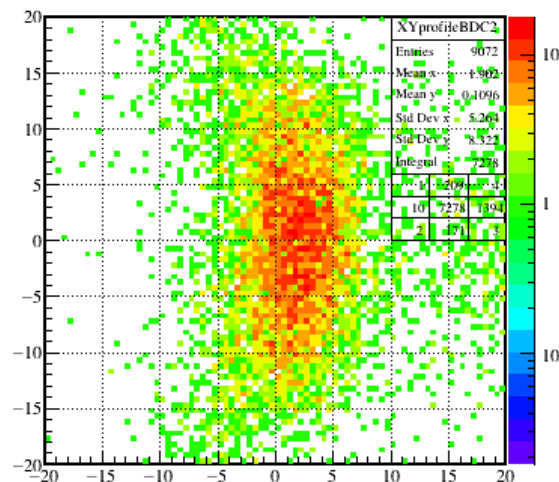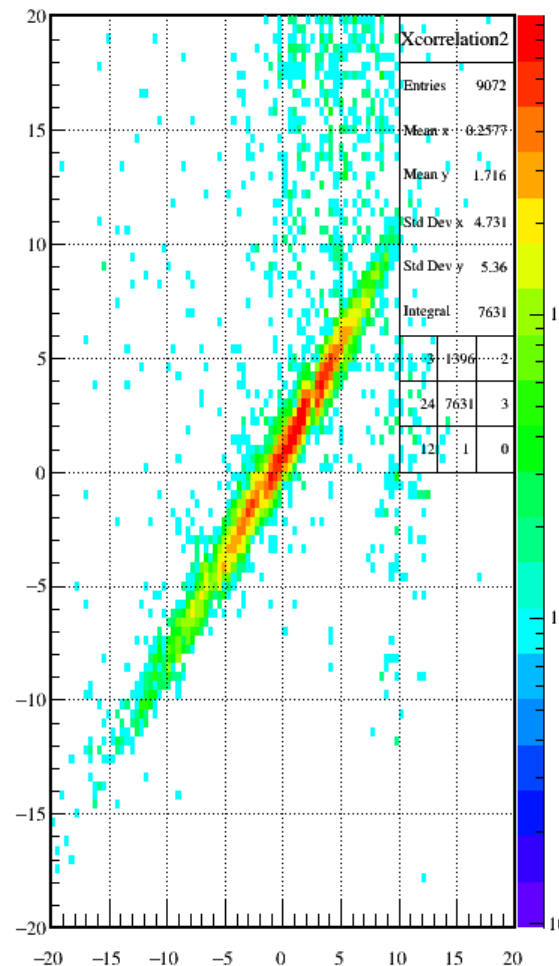
Pad plane end

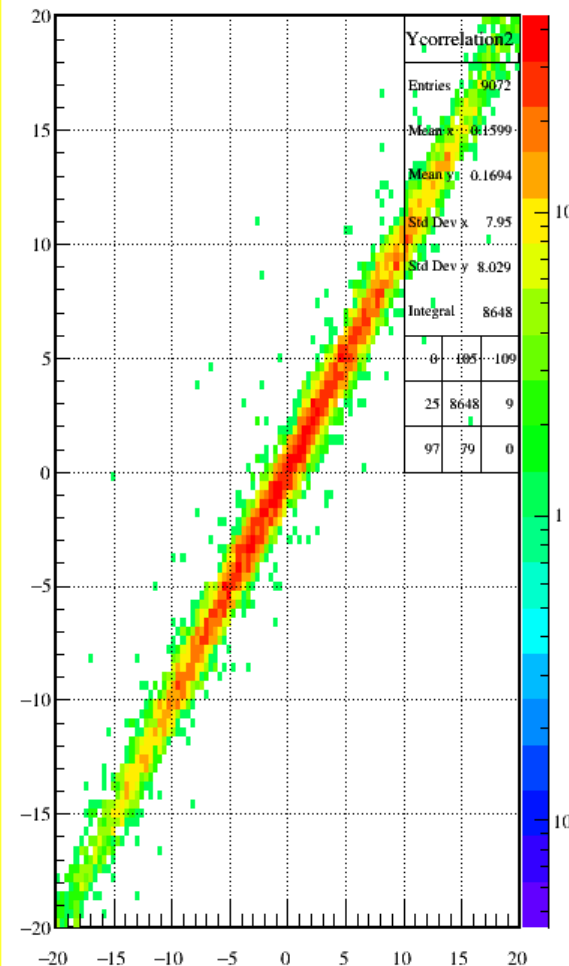beam profile reconstructed from TPC, end of pad plane

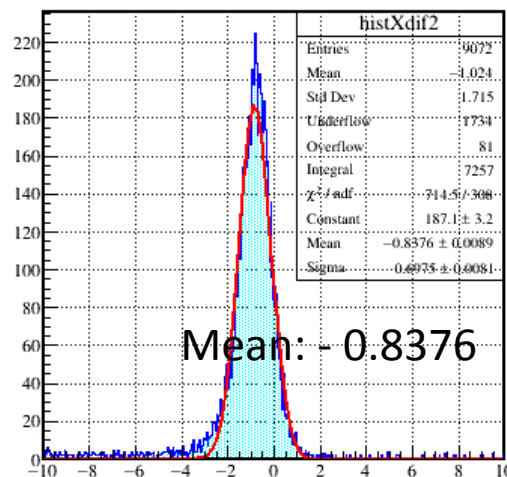beam profile reconstructed from BDC, end of pad plane
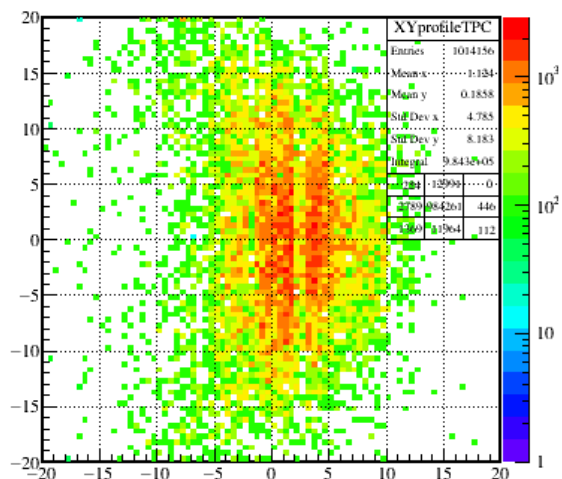
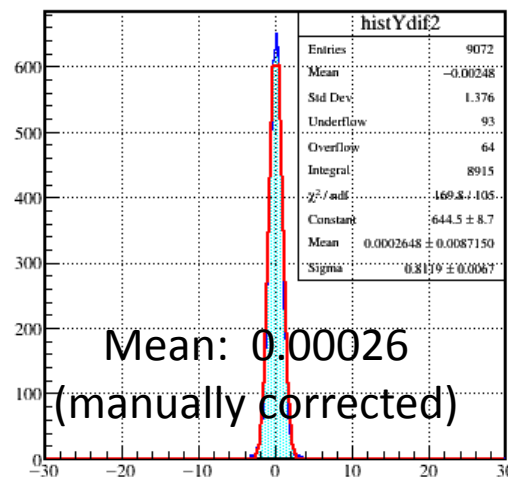x correlation end pad plane: TPC(mm): BDC (mm)

y correlation end pad plane: TPC(mm): BDC (mm)
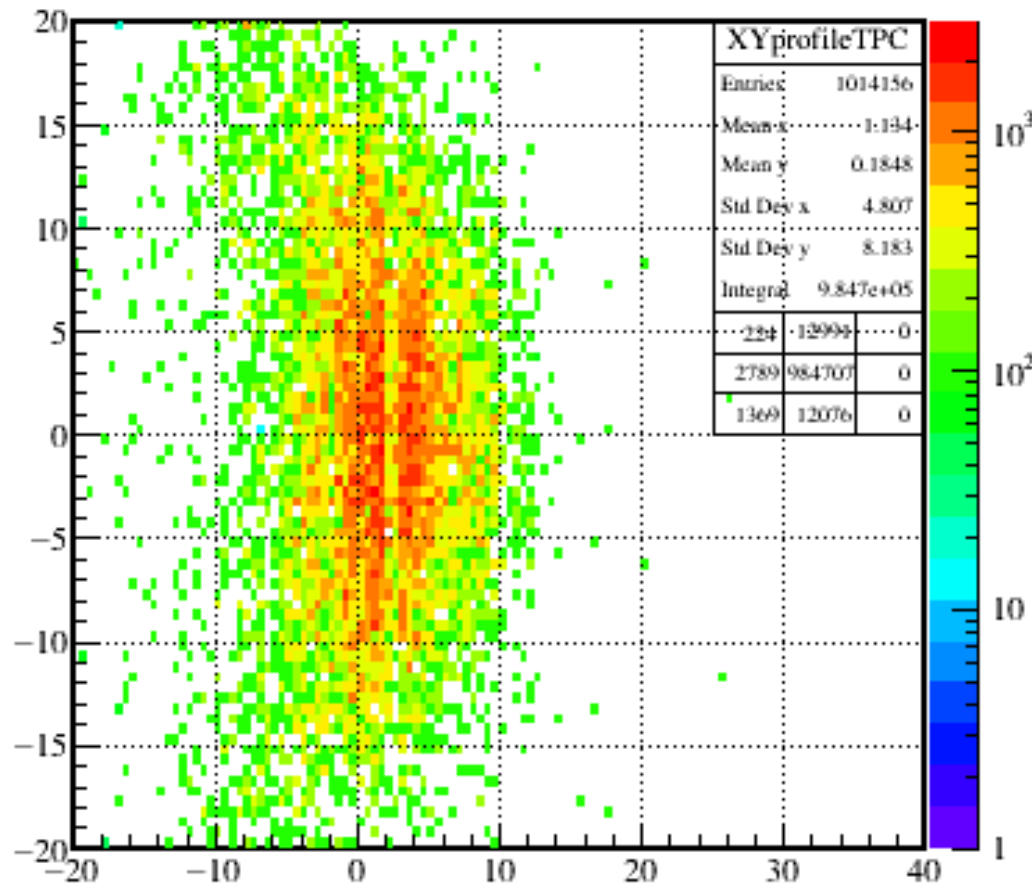
end pad plane X - BDC projection X

Tend pad plane Y - BDC projection X Y

Mean: - 0.8376

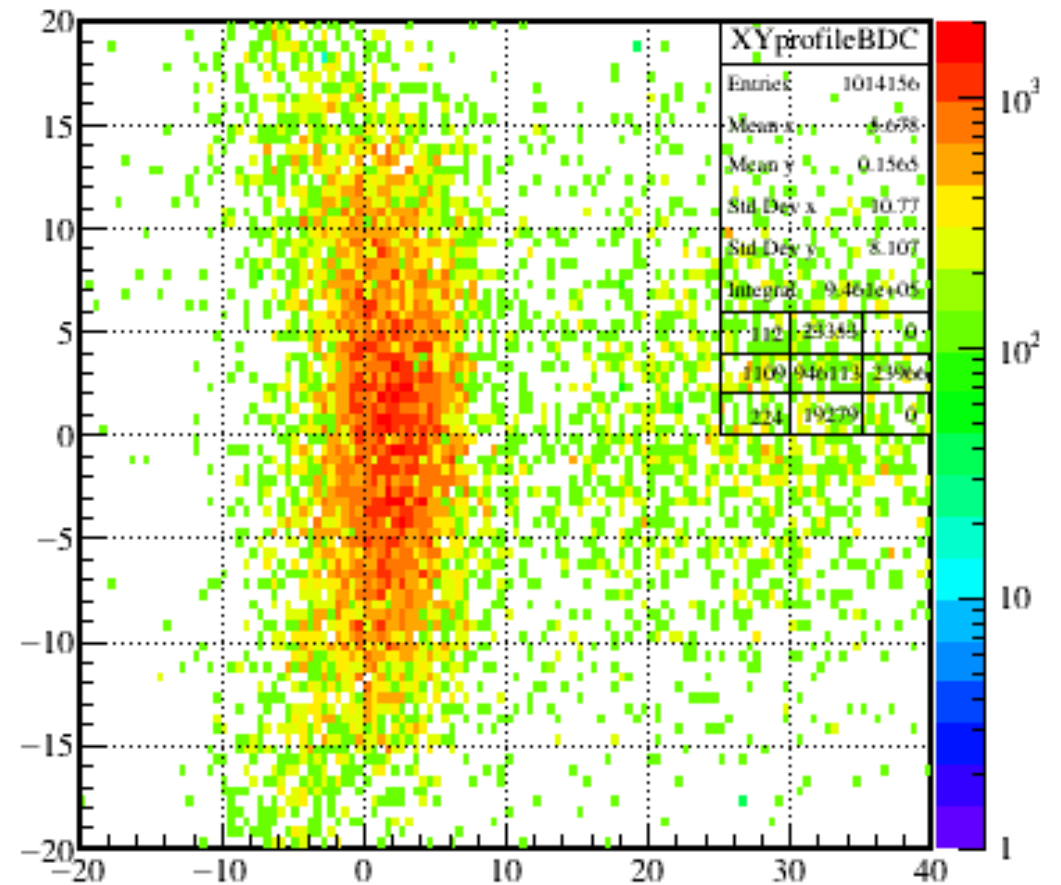Mean: 0.00026
(manually corrected)

Macro: Vertex comparison macro requires SpiRITROOT and ANAROOT. A beta macro available on request

Closeup - profile

beam profile reconstructed from TPC
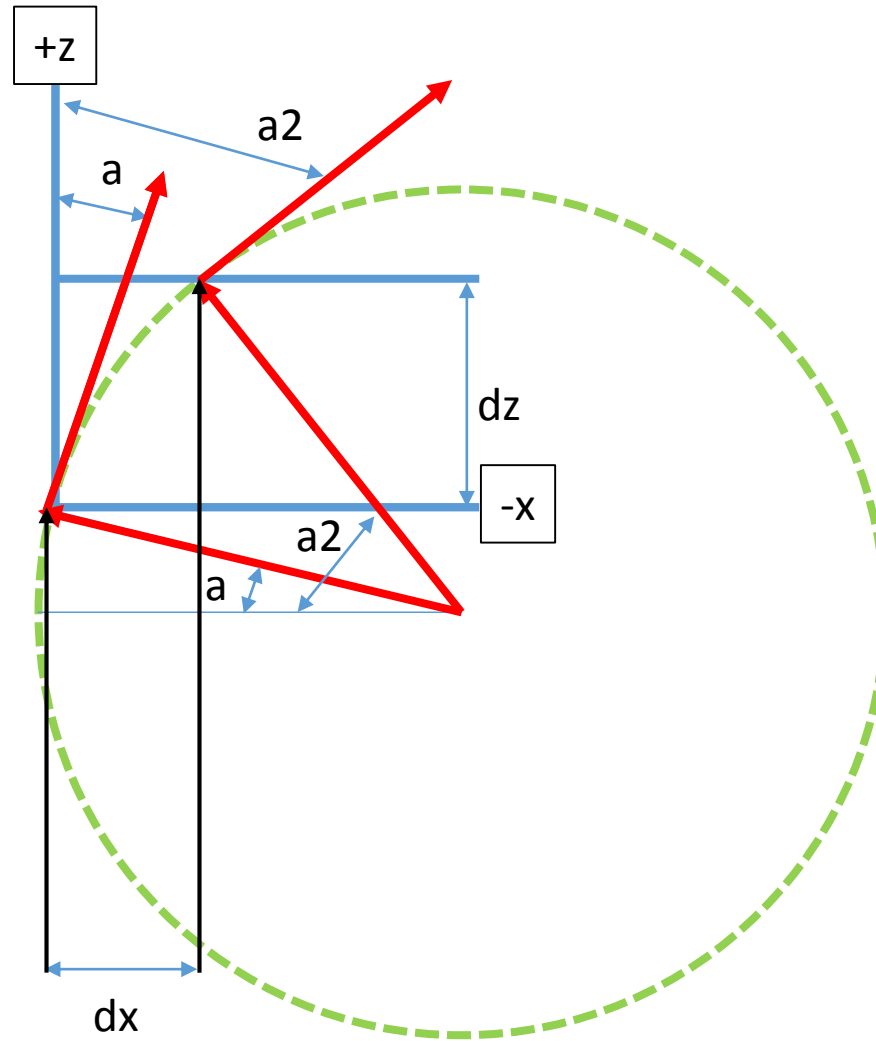
beam profile reconstructed from BDC

Macro: Vertex comparison macro requires SpiRITROOT and ANAROOT. A beta macro available on request
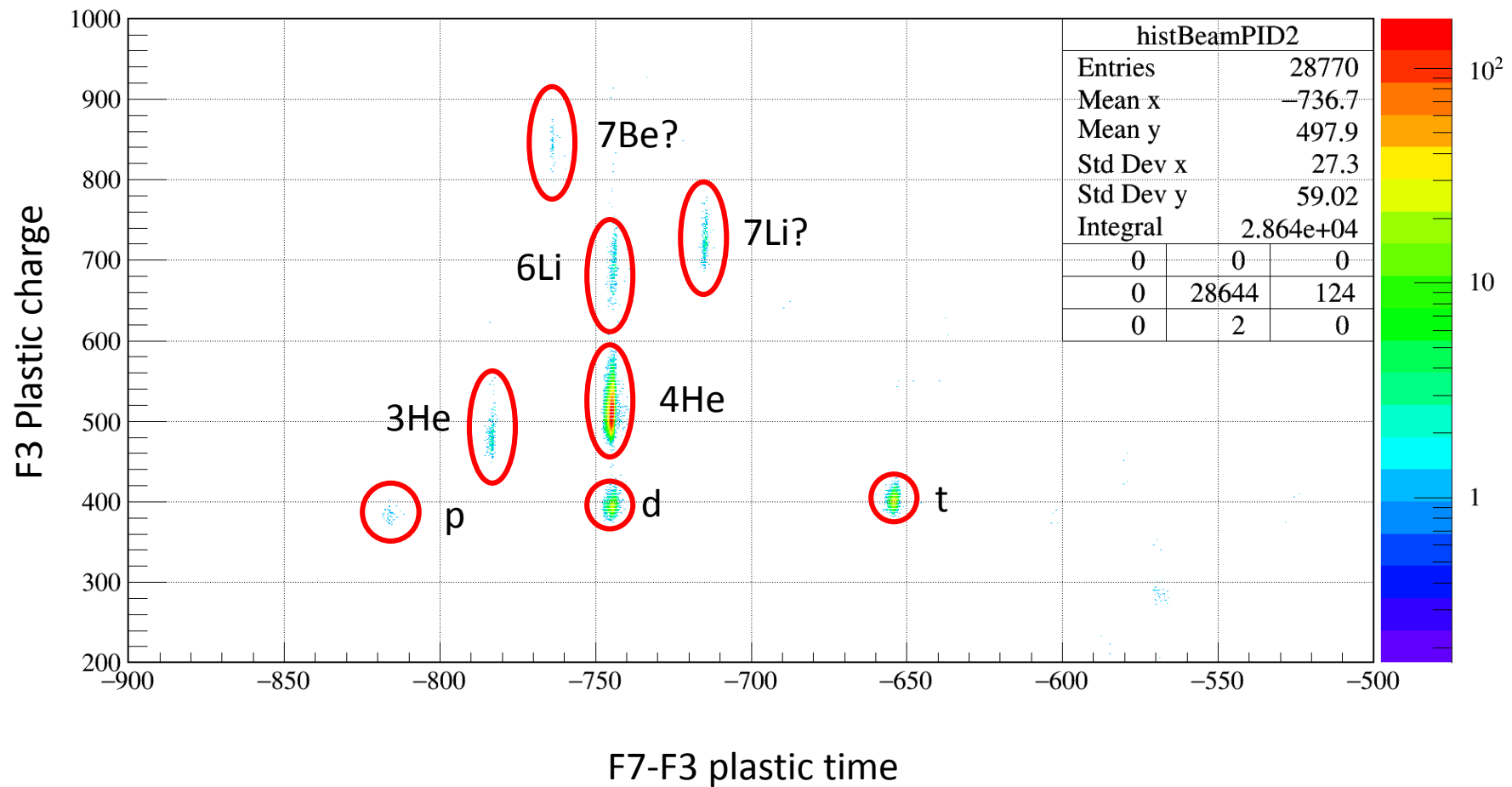
Acknowledgements

Extra slides

Angular inclusion

Same problem, with a different origin for circle
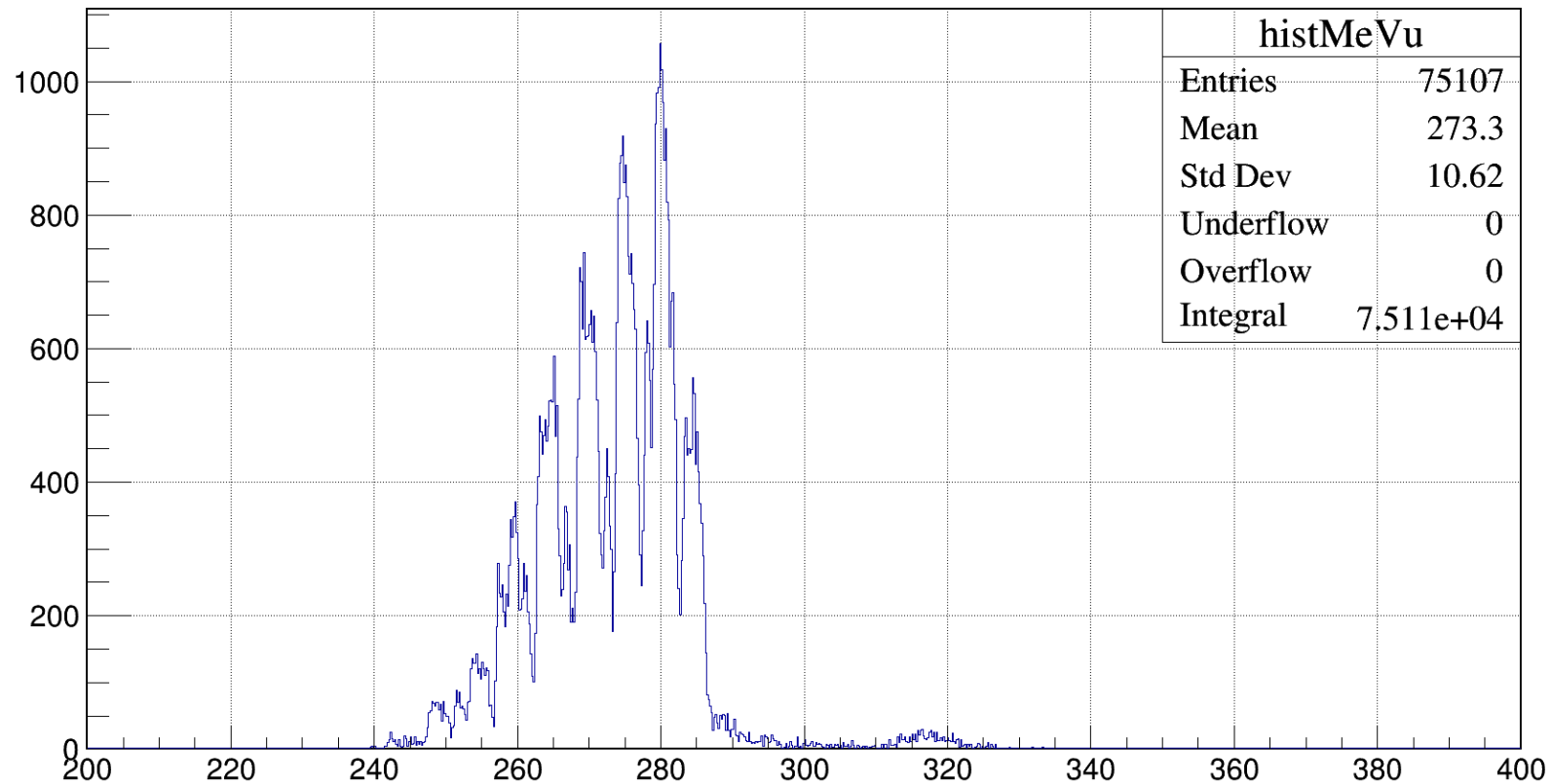
$a2 = asin((dz + \rho*sin(a))/\rho)$

$dx = \rho*[cos(a2) - cos(a)]$

Custom class: TBDCProjection

Cocktail beam (Raw PID)

Beam Energy mid target (124 Sn & contaminants)

Beam Energy mid target (only 124 Sn)

histMeVu	
Entries	4958
Mean	269.8
Std Dev	0.9618
Underflow	0
Overflow	0
Integral	4958