

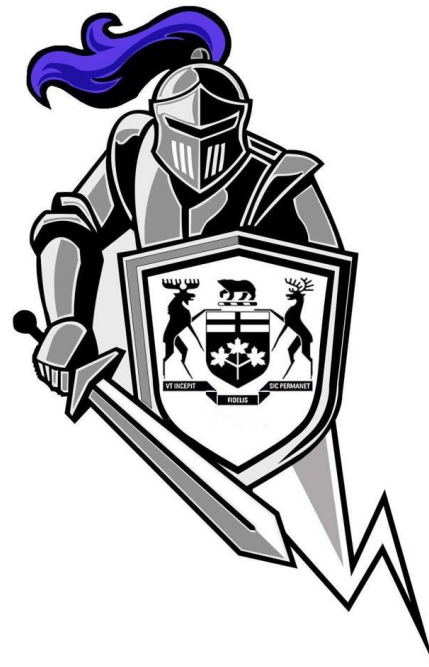
ANALYSIS RESULTS

Charging Cavaliers
Beamline for Schools - CERN



TOPICS TO DISCUSS

- Introduction
- Micromegas
- Fractionally charged particles detector and trigger
- Conclusion
- Summary of each beam day





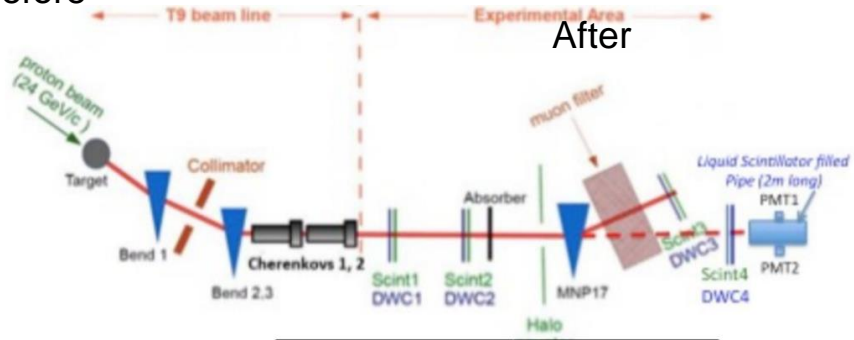
INTRODUCTION (II)

- Our aim at the beginning
 - Observe and measure light emitted by a liquid scintillator when interacting with various particles, including fractionally charged particles.

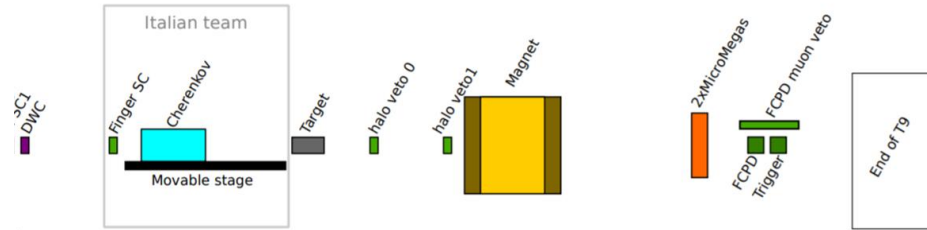
INTRODUCTION (III)

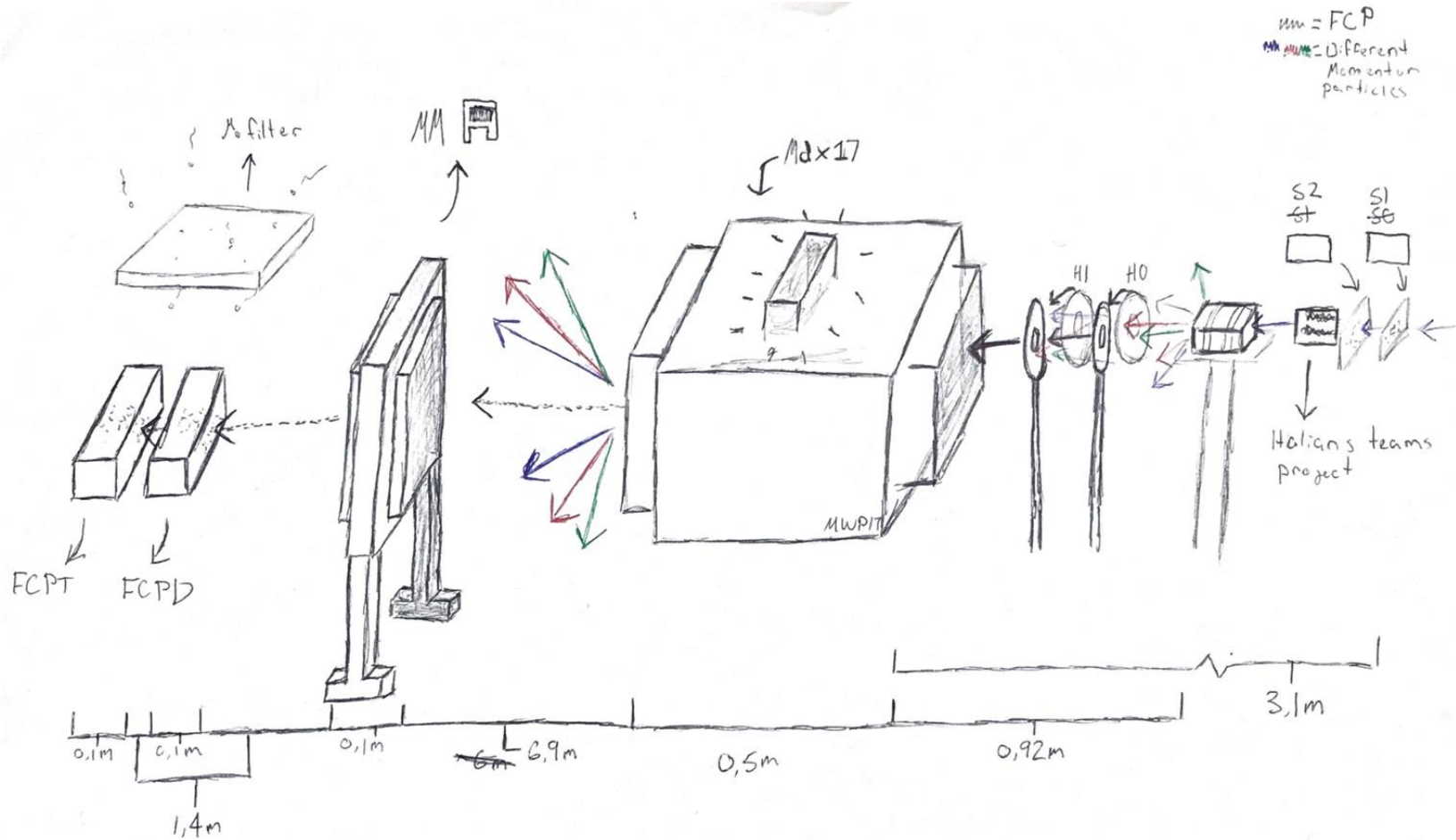
- What has changed?
 - Due to time constraints we have swapped out the liquid scintillator for a plastic one.

Before



After







INTRODUCTION (IV)

- Method
 - Calibration
 - Trial and error.
- Type of analysis we're going to be doing
 - Root
 - Formulas
 - Bending Radius:

$$B = \frac{P}{qB}$$



INTRODUCTION (V)

- Graphs (histo, plot, bar)
- Functions (Gaussian distribution)



Day 1: September 24th

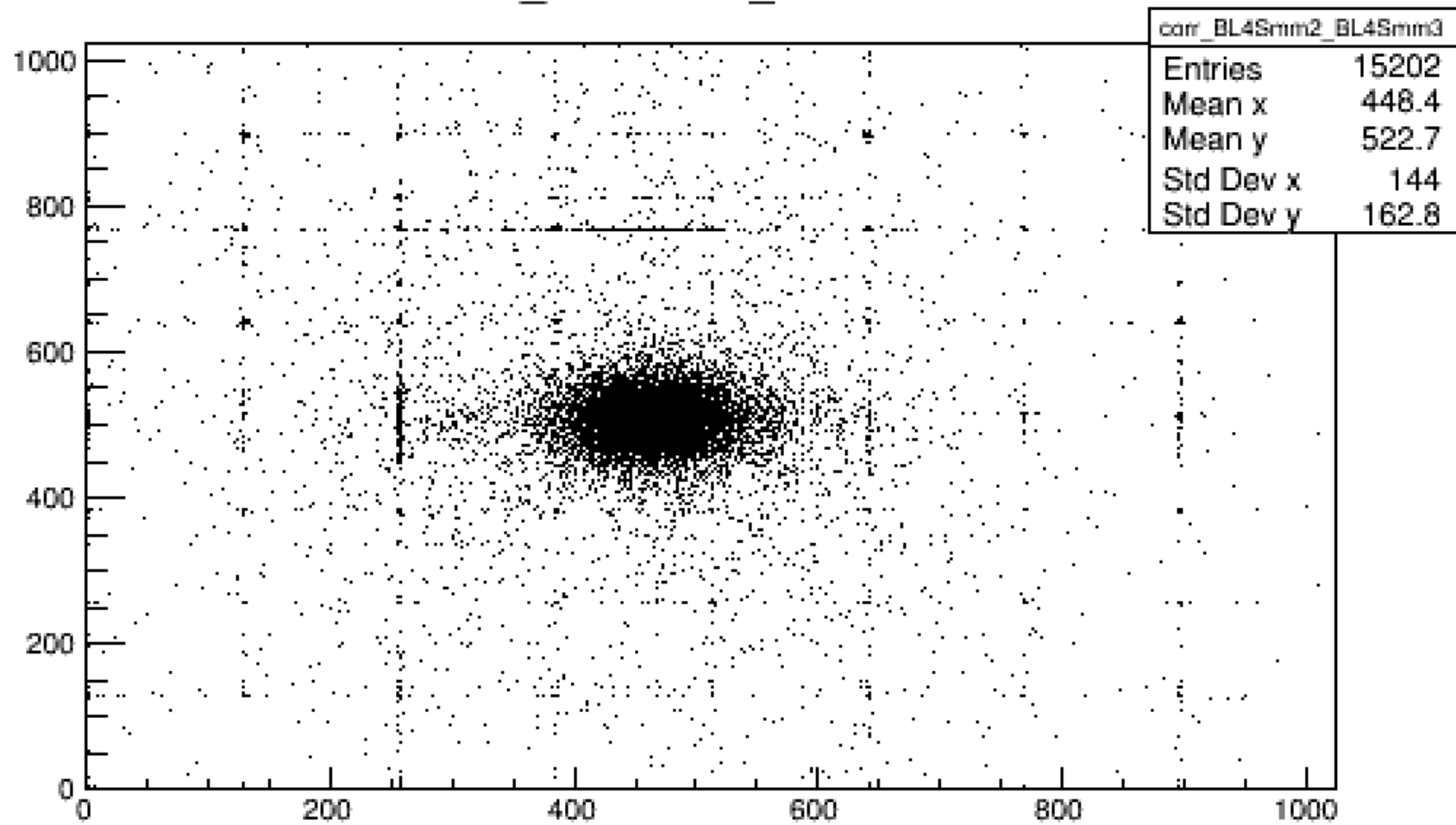
- Took measurements (Magnet dimensions and size, distance from magnet to Micromegas, etc.)
- Launched our first run for the Micromegas but noticed many problems that caused us to abort the test
- We started noticing scattering from the distance between the halo scintillators and the Micromegas (No hole was being found)
- Also had many problems with the Micromegas (Such as dead strips)



Day 2: September 25th

- Collimators were adjusted many times as the beam appeared to not be as focused as it needed to be.
- Upon conducting more tests, we confirmed that we had our first concentrated beam (1506332137)

corr_BL4Smm2_BL4Smm3

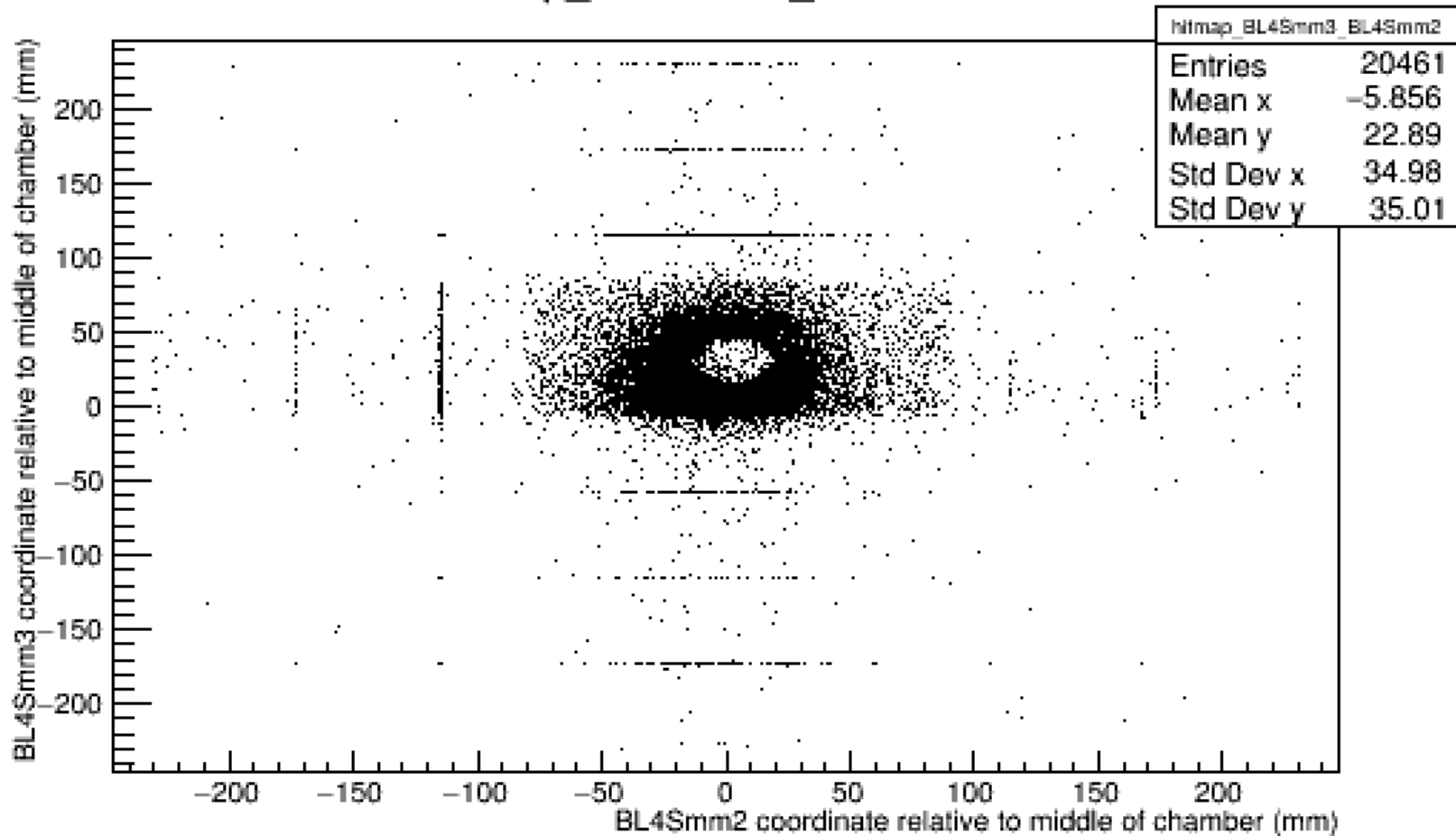




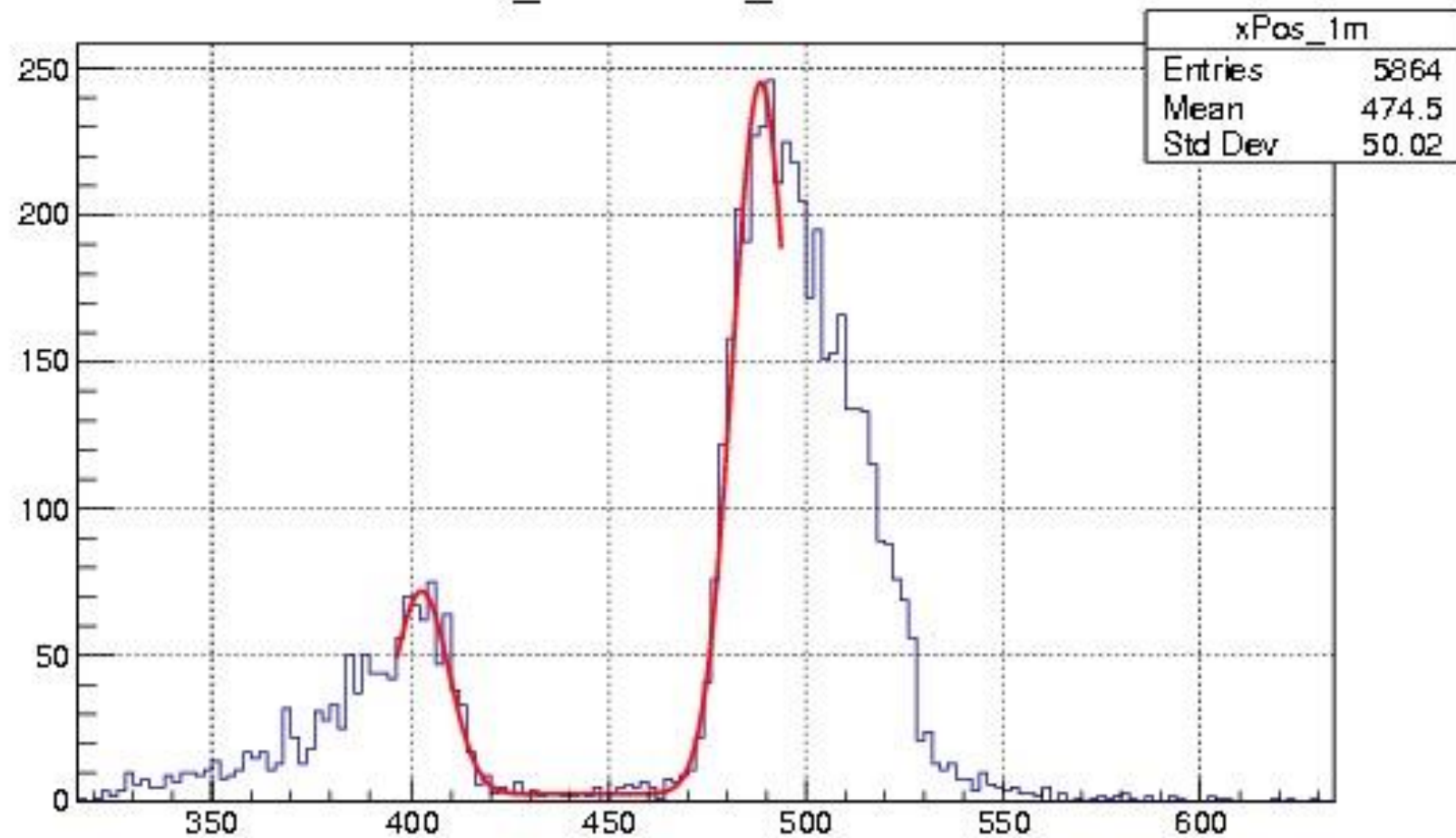
Day 2: September 25th (Cont.)

-As stated yesterday, there was a lot of scattering, so scintillators were moved to get accurate reading and make sure scintillator works. (Donut)(1506361504)(moving it forward yielded bigger beams than further)

hitmap_BL4Smm3_BL4Smm2



corr_BL4Smm2_BL4Smm3

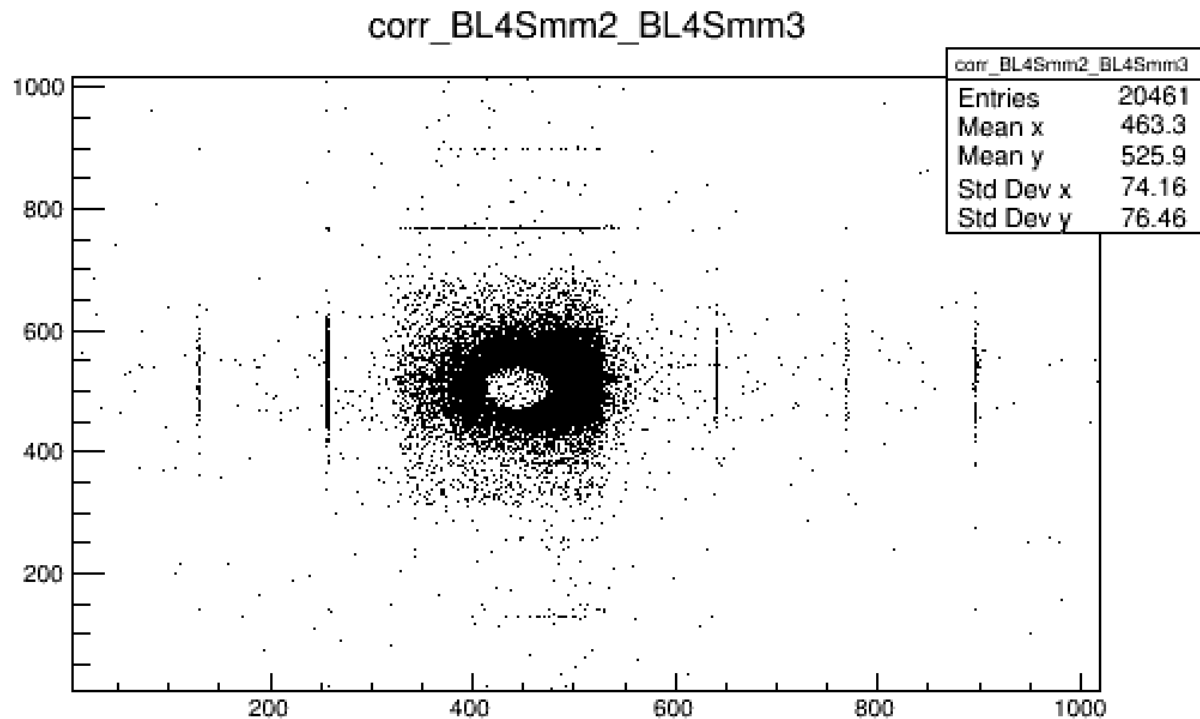




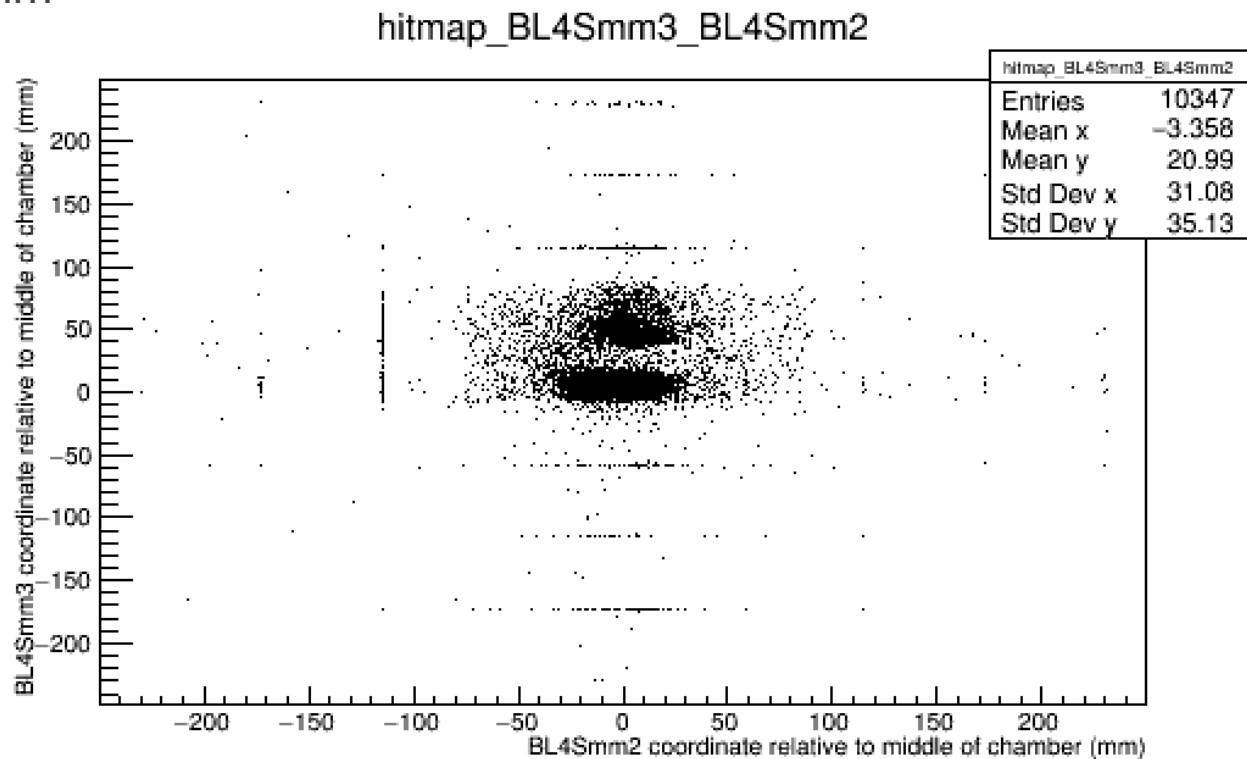
Day 3: September 26th

- [19:30] Aligned halo 1 with the magnet and halo 0 using laser Added delays (by adjusting nims) to halo 0 and 1, approximately 10-15 ns, Activated them as vetos

Halo 0; 1 metres from Micromegas: Diameter of Hole, ~ 29mm



Halo 0; 3 metres from Micromegas (10 000 hits) Diameter of Hole,
~ . 23mm





Day 3: September 26th

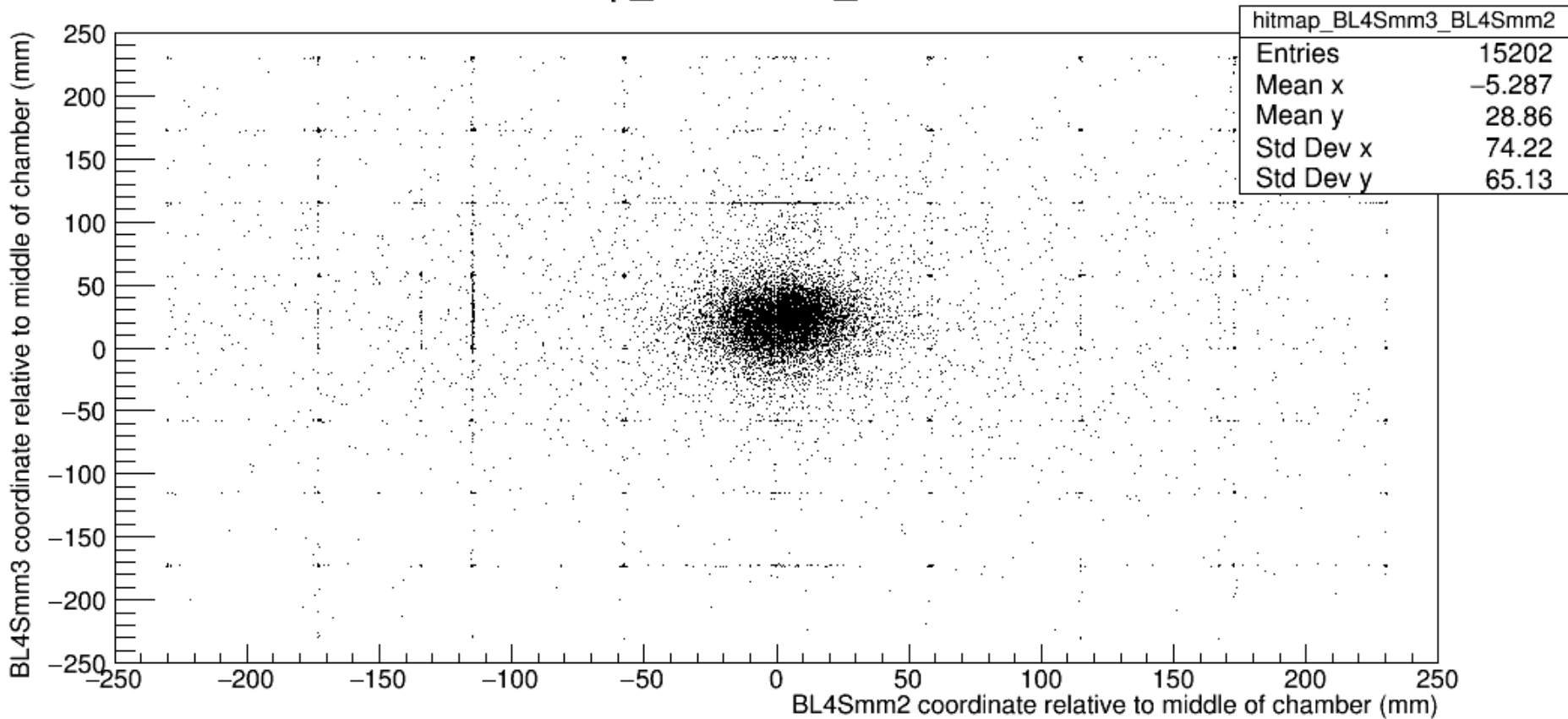
Magnetic Deviation

-We calculated the magnet deviation to ensure that the measure of $B = 1.04\text{T}$ is correct

-This was calculated by using different

+0A at -10GeV

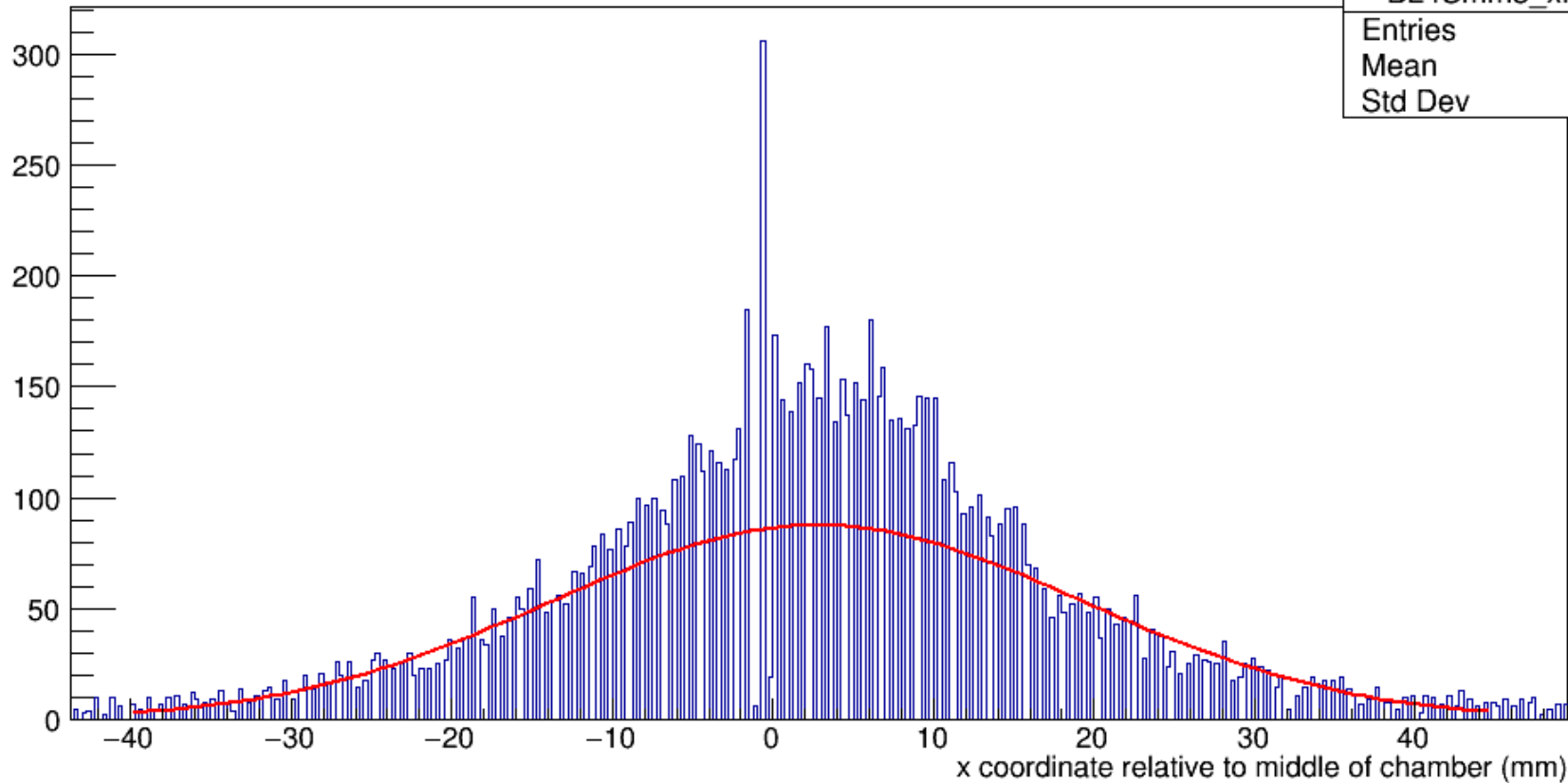
hitmap_BL4Smm3_BL4Smm2



+0A at -10GeV

BL4Smm3 x coordinate

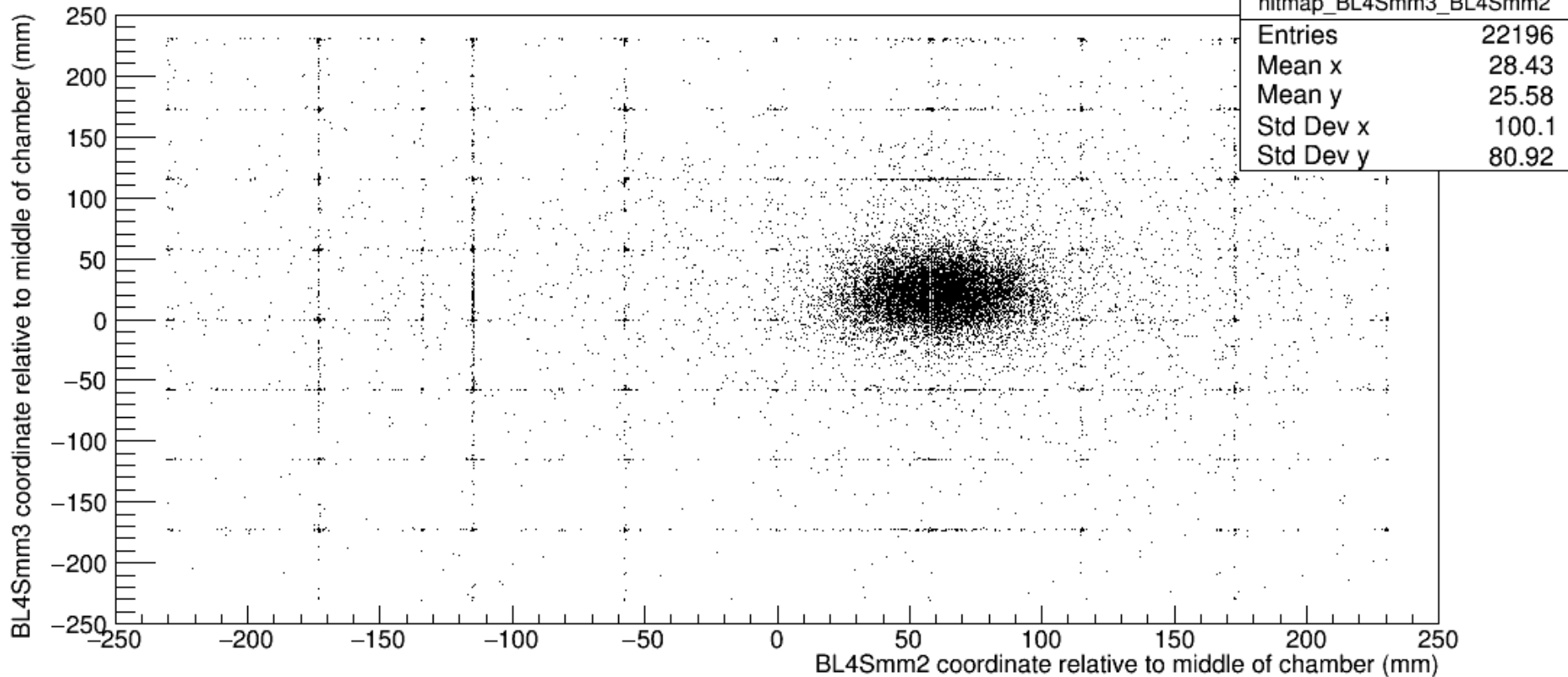
events



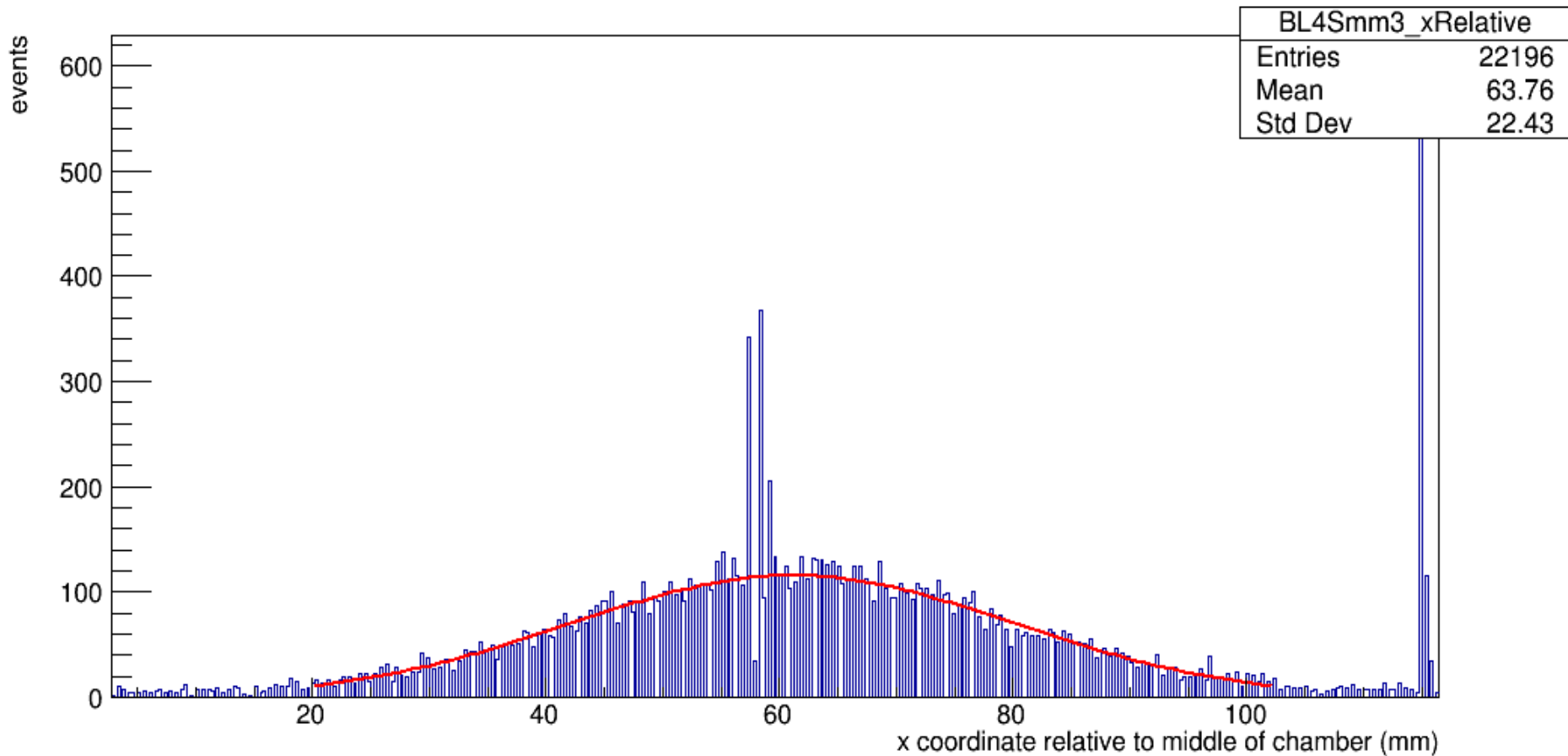
BL4Smm3_xRelative	
Entries	15202
Mean	2.558
Std Dev	15.26

+120A at -10 GeV the spray of particles is +10 cm to the right

hitmap_BL4Smm3_BL4Smm2

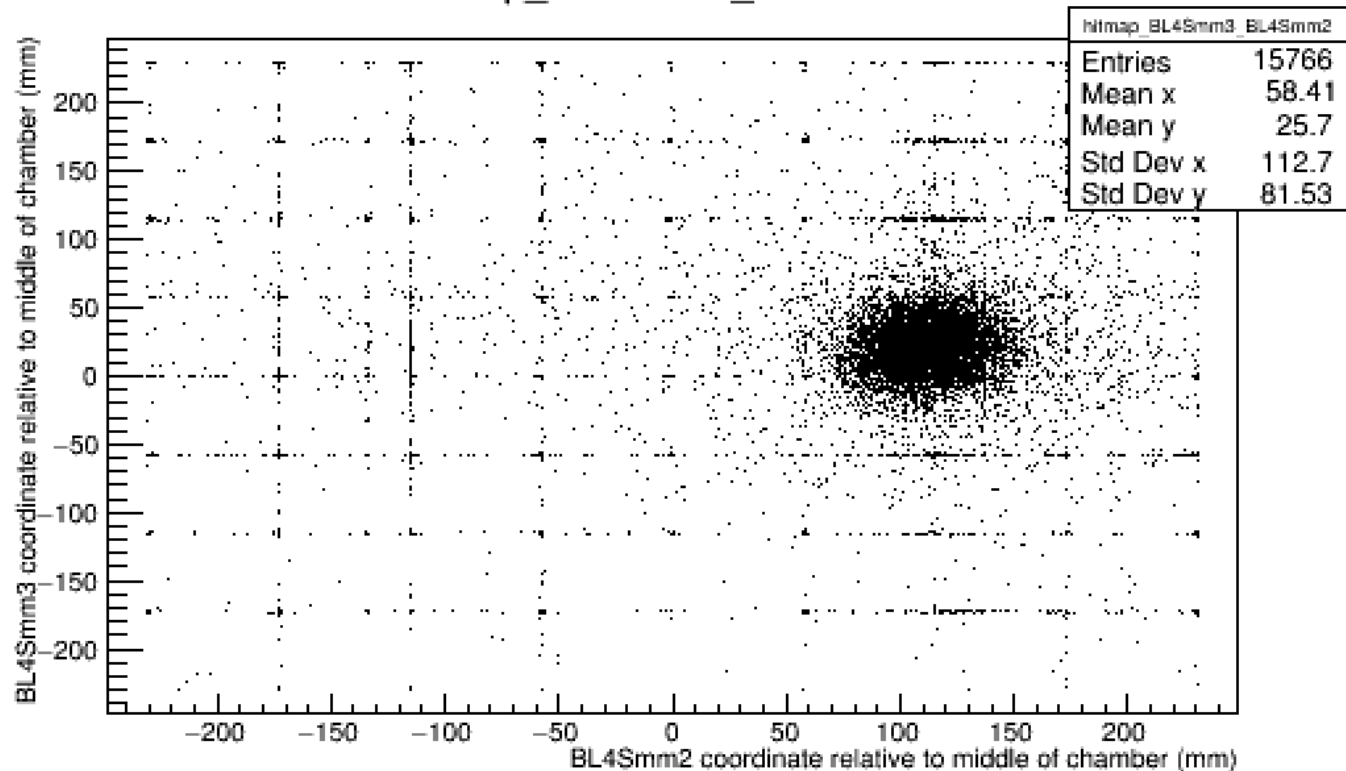


+120A at -10 GeV the spray of particles is +10 cm to the right
BL4Smm3 x coordinate



+240A -10GeV

hitmap_BL4Smm3_BL4Smm2



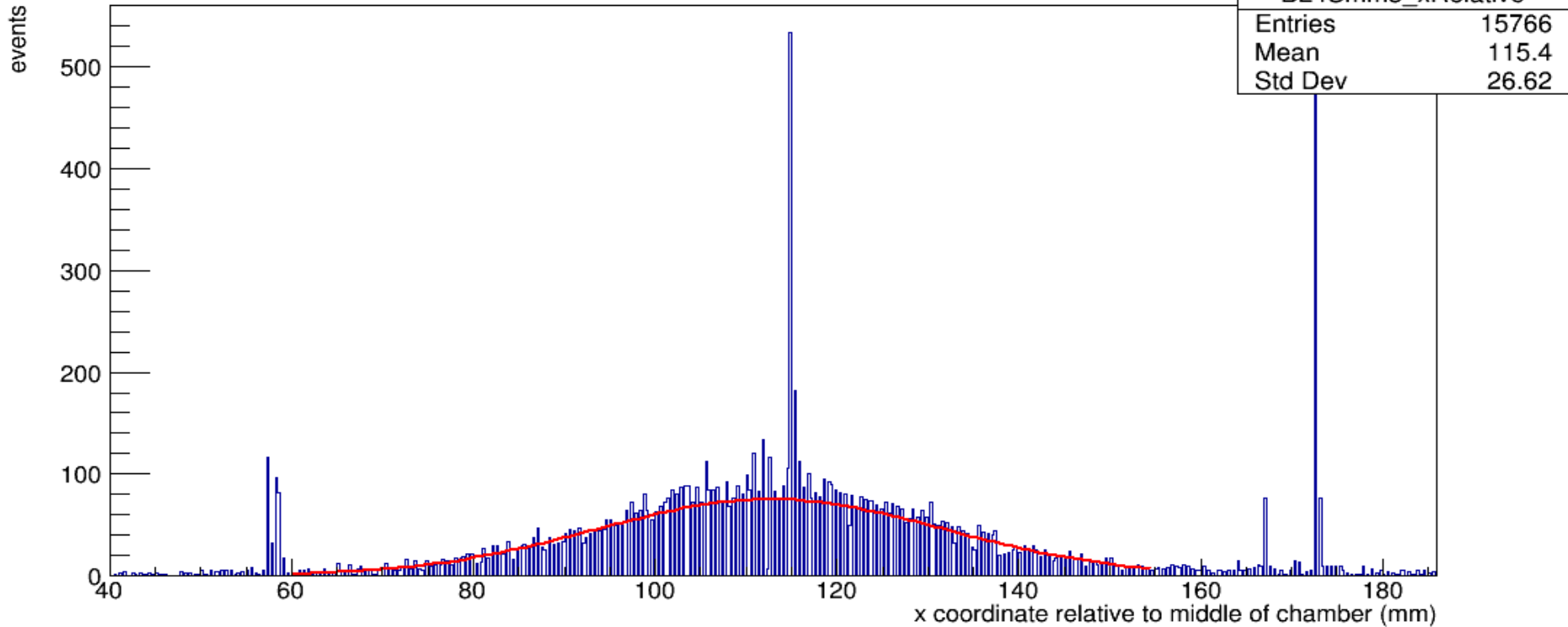
Mean = 112.796mm

Sigma = 19.4359



+240A -10GeV

BL4Smm3 x coordinate





Day 3 : September 26th

Calculations

At 240A and -10GeV, we have concluded that the maximum intensity of the magnet is 1.04 tesla.

At 120A and -10GeV, this was reassured by the fact that it halved at around 0.554 tesla.

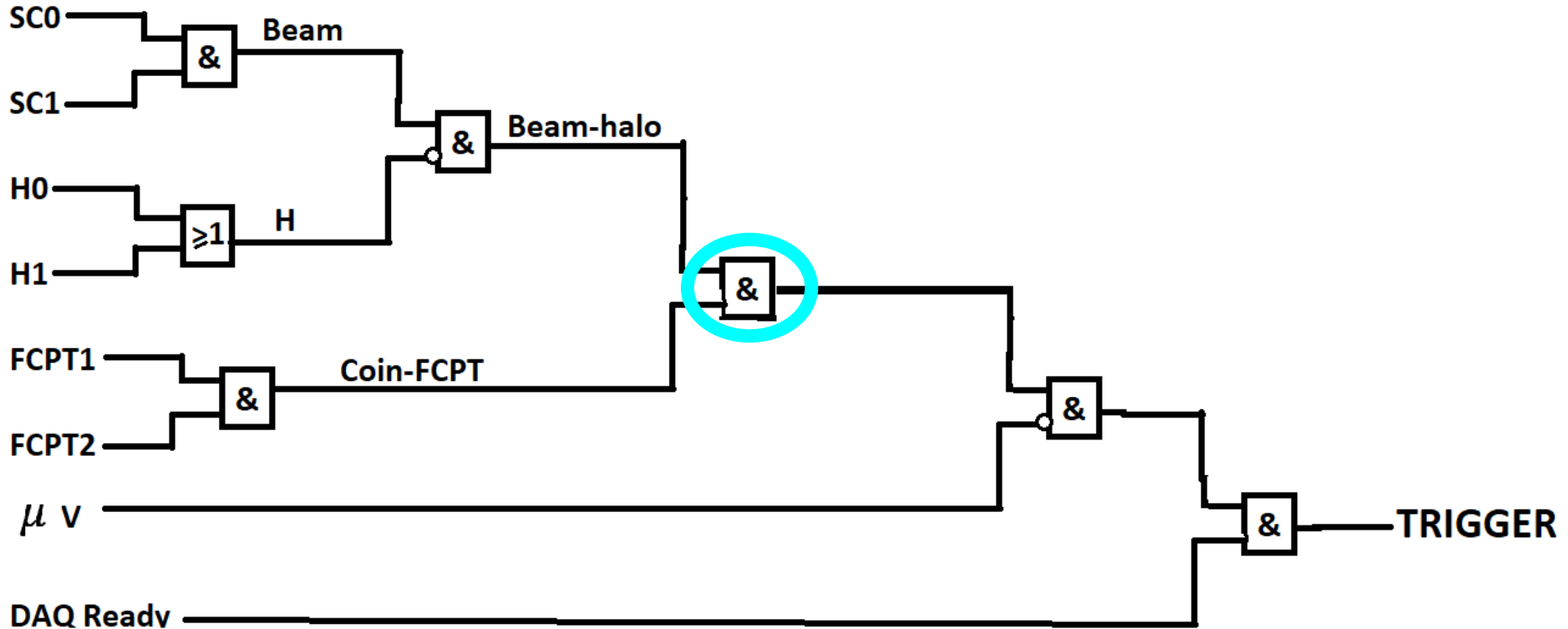


Day 4: September 27th

No beam :(



Day 5: September 28th





Day 5: September 28th

7 runs with magnet off, no target, both stoppers out (except run 7), Coincidence made between Beam, T1 and T2 and veto made with both halo scintillators

- **Run 3** : error (loose cable)
- **Run 5**: vertical collimator distance increased (more particles per spill) beam size bigger than usual (~ 1.5), double peak (weird noise we don't understand overlaps)
- **Run 6**: Positive Beam, beam size smaller than usual (~ 2), QDC values too low
- **Run 7: Muon calibration run** Positive Beam, one blocker in



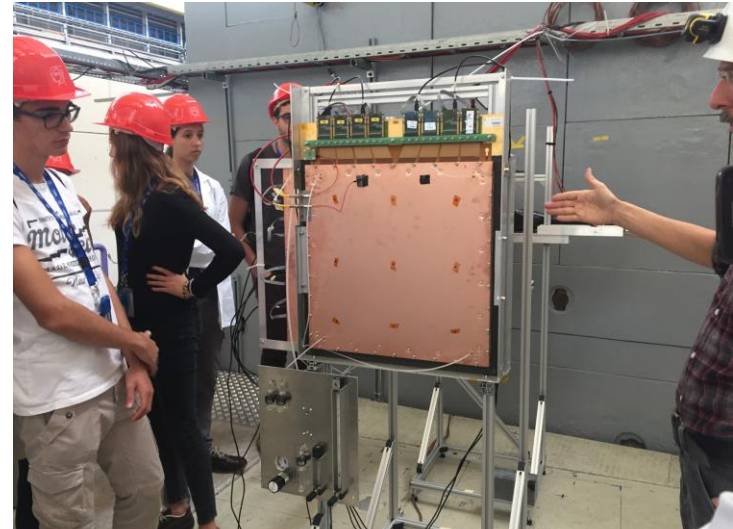
Day 6: September 29th

Started beam, encountered errors (as per the norm)

Diagnosed the problem - MicroMegas current above where it should have been

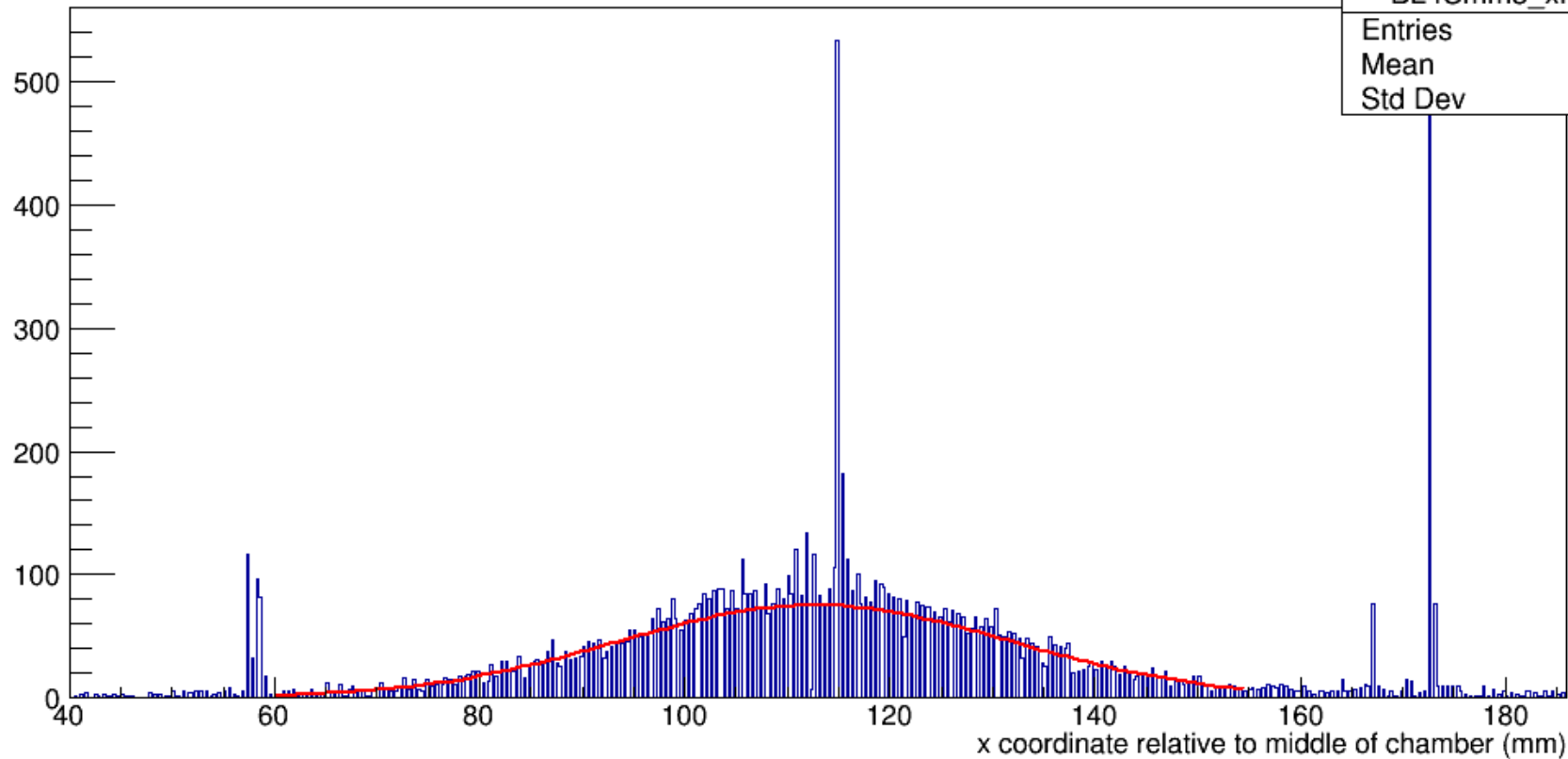
Having thin mesh & high voltage causes problems, overheating and such

Resorted to turning off MicroMega's affected channels



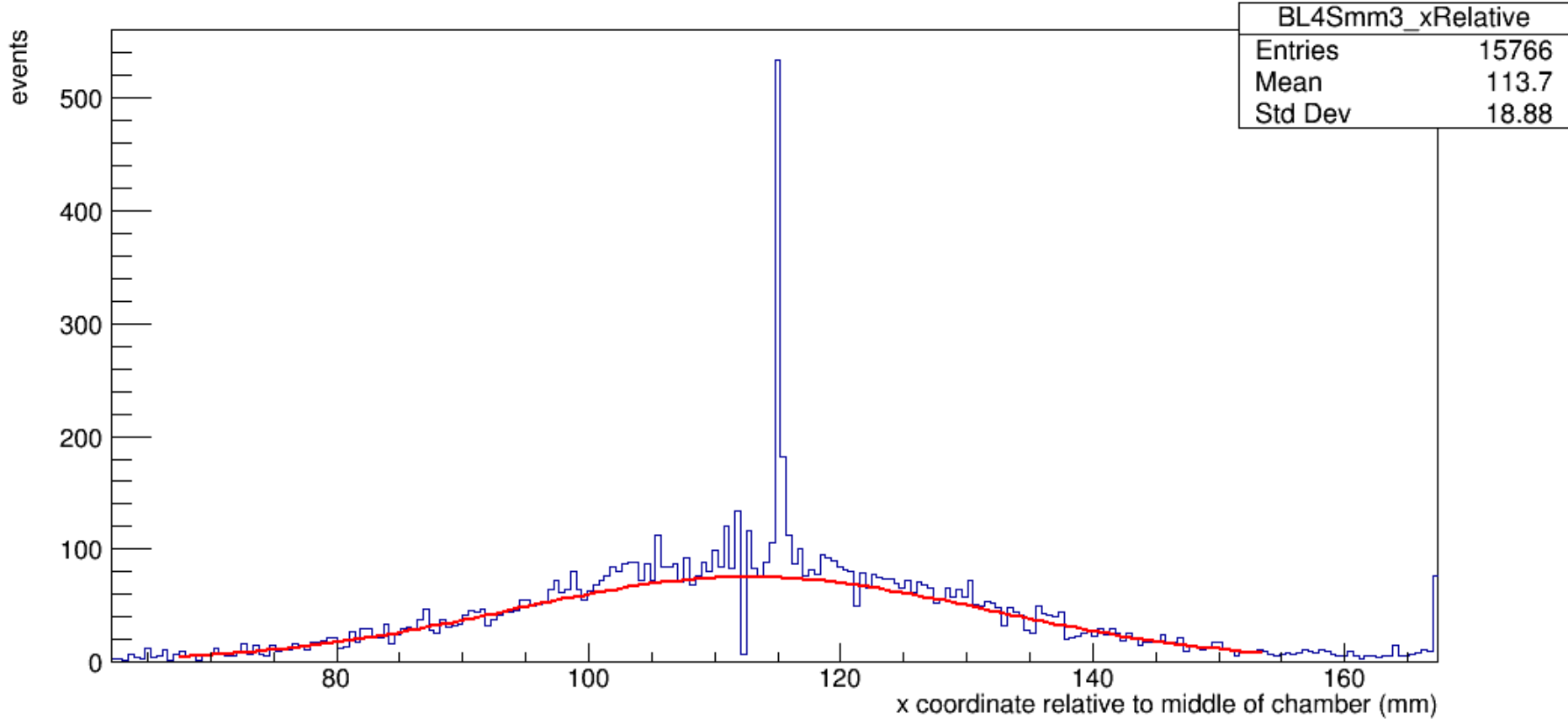
BL4Smm3 x coordinate

events



BL4Smm3_xRelative	
Entries	15766
Mean	115.4
Std Dev	26.62

BL4Smm3 x coordinate





VIP meeting!

Introduced to ambassadors from all over the world

-Italy, Netherlands, Canada!

Director of CERN's accelerators, members of Departments of Physics from various universities, CERN's past director, Rolf Heuer, and many others

Working around MicroMegas problem

Vertical MicroMega swapped out

-not the solution to every problem (of course)

Calibrated delays in order for the muon veto and the FCDP/FCPT to coincide

Halo scintillators were found to be running at low efficiency





Learning ROOT

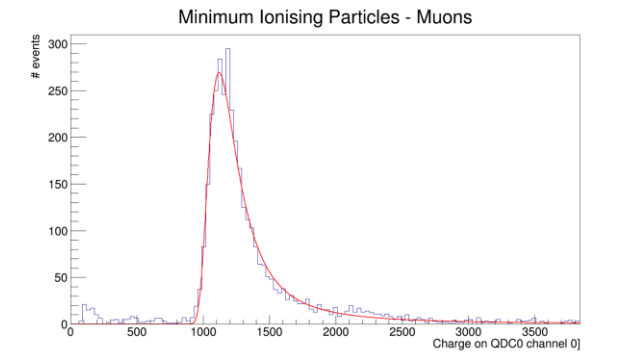
Some lessons with Bane and the other volunteers to familiarize us with the software

We can access our data without help!



Day 7: September 30th

- changed beam -10 to +10 GeV/c
- we've moved the FCPD and the FCPT 6cm, but the wrong side...
- move the other way 12 cm (get out the fully charge particles)
- Ask a question to Bane about special relativity
 - STILL NOT SATISFIED WITH THE ANSWER





Day 8: October 1st

- Change the ADC to QDC
- **statistics, statistics, statistics!**

What we have learned





CONCLUSION

- Our next steps

THANK YOU!!

