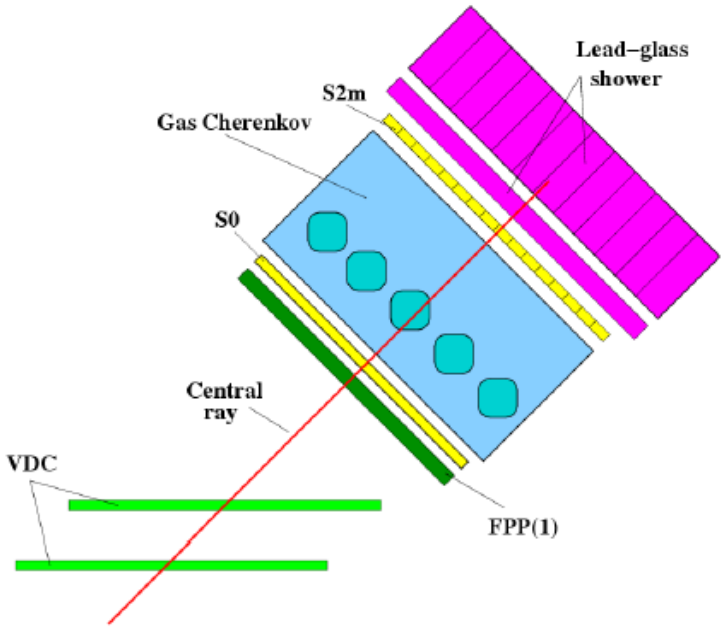
Status of the High Resolution Spectrometers (HRS)

Barak Schmookler

HRS Detector Configuration

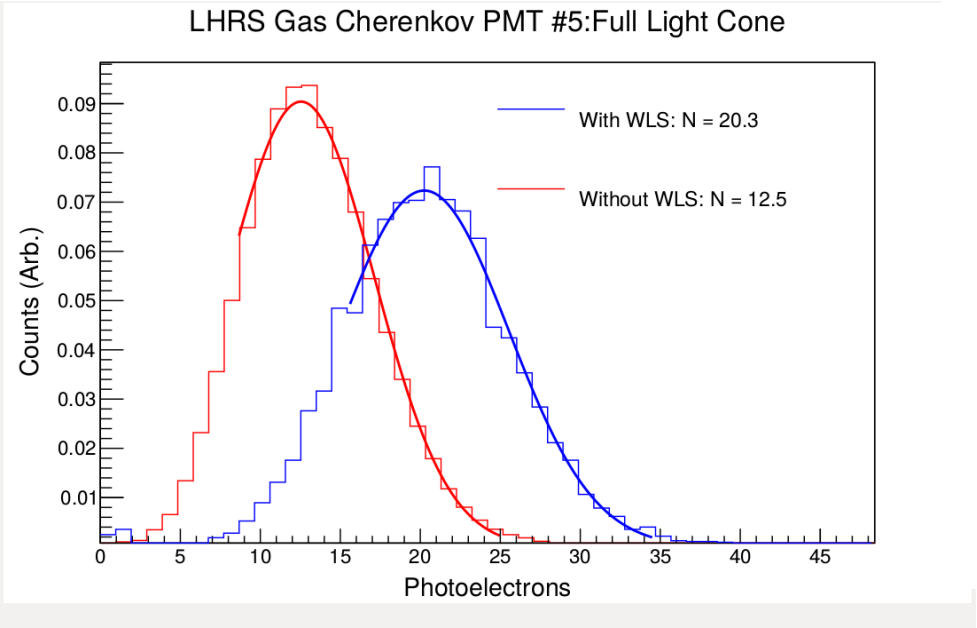
- Two VDCs at focal plane for tracking
- Straw Chamber as an auxiliary tracking chamber
- Hodoscopes S0 and S2m as primary trigger detectors
- Particle ID:
  - Cherenkov Counter
  - Lead-Glass Calorimeter

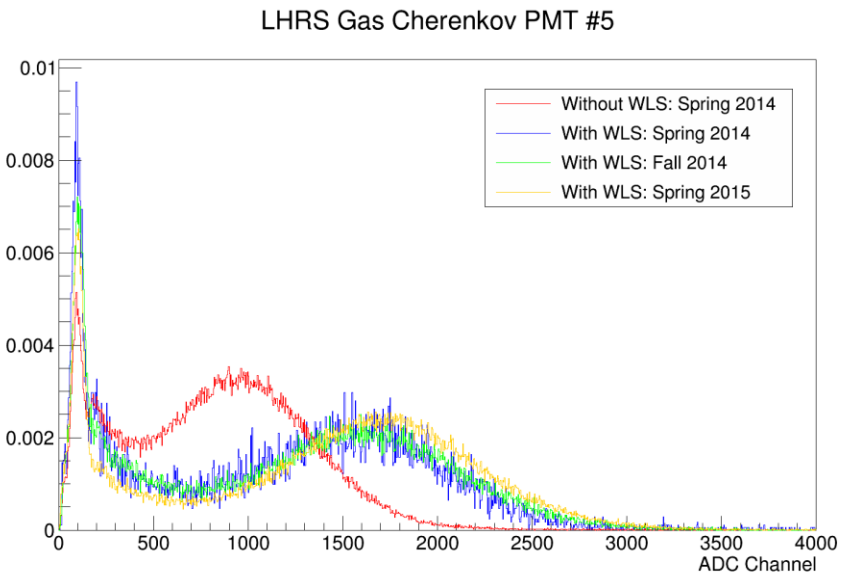


HRS Detector Stack

Gas Cherenkov Detector

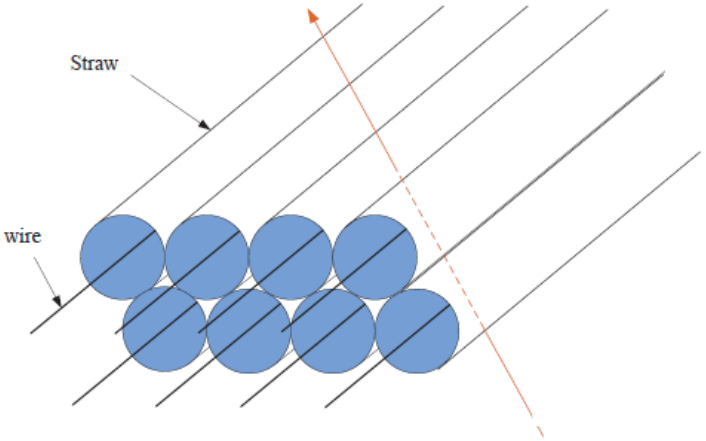
- All 20 PMTs are covered with wavelength-shifting (WLS) paint
- The effect of WLS paint was tested in Spring 2014.
- A 50+% increase in #p.e. was observed (results in *K. Allada et al.,* NIM **A** 782 (2015) 87)
- Typically ~15 p.e. were detected in GC after application of WLS paint
- No time dependence observed on the #p.e. yield with WLS for over a period of ~ 1 year

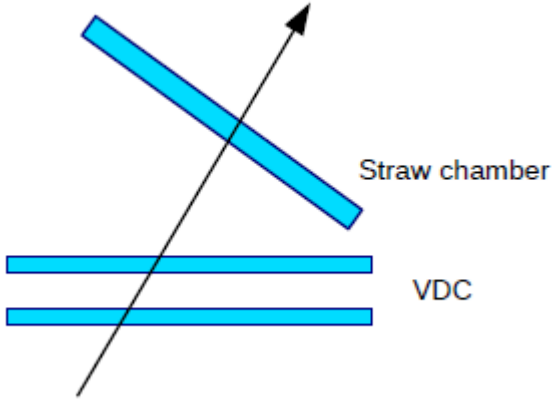




Straw Chamber

- One Straw Chamber installed in each HRS
- 3 U and 3 V planes
- U-V angle: 45^{o} to horizontal
- 170 straws per plane
- Wire spacing: 1.095 cm
- Help resolve ambiguous tracks from VDC
- Determine VDC efficiency



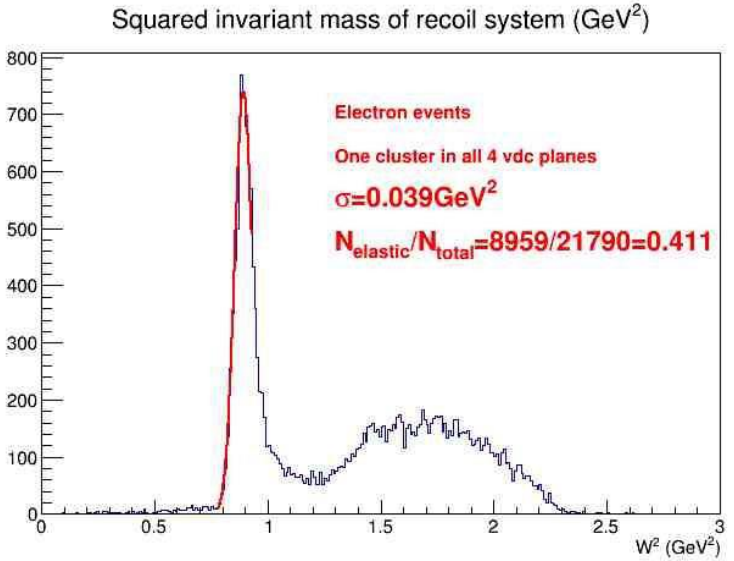


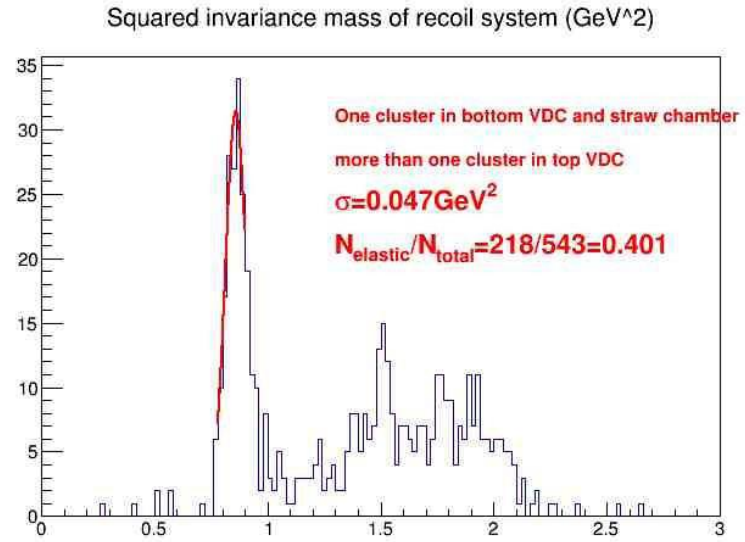
Tracking with Straw Chamber

Analysis of multi-cluster events in VDC:

- Select events with one cluster in bottom VDC and straw chambers but more than one clusters in top VDC
- Reconstruct track using clusters in bottom VDC and straw chambers (disregarding clusters in top VDC)
- Reconstructed track is then used to calculate target and kinematic variables
- Fraction of one cluster events in VDC:

$N_{single}/N_{total} = 0.914$

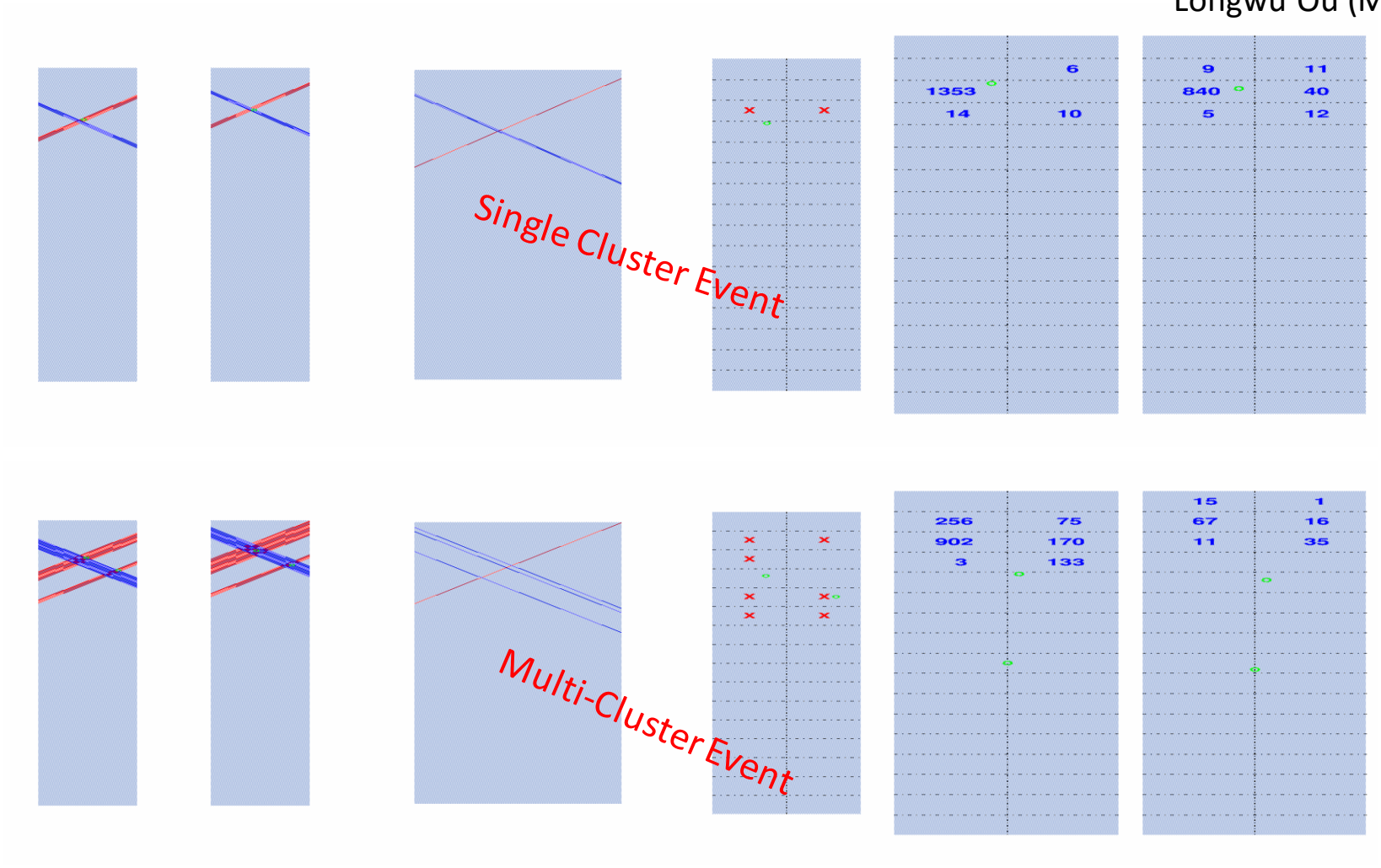




Longwu Ou (MIT)

Event Display

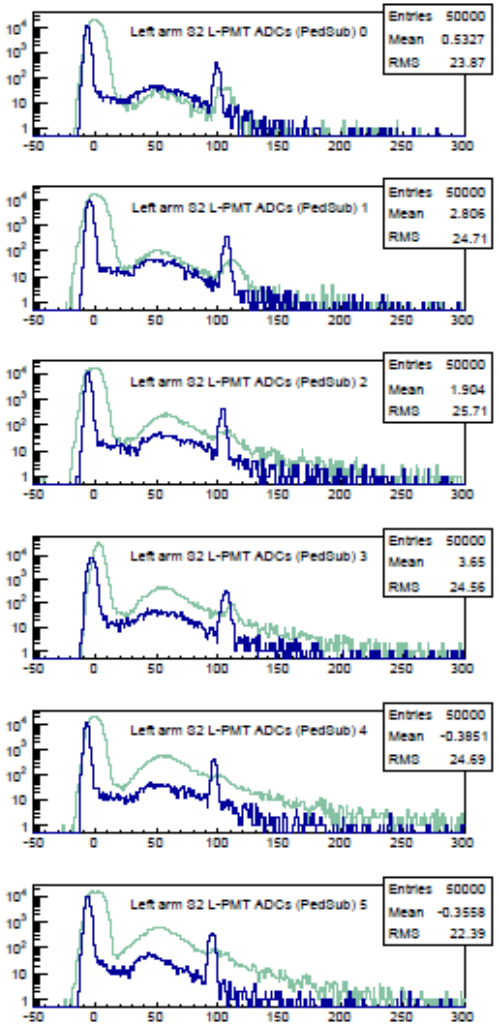
Longwu Ou (MIT)



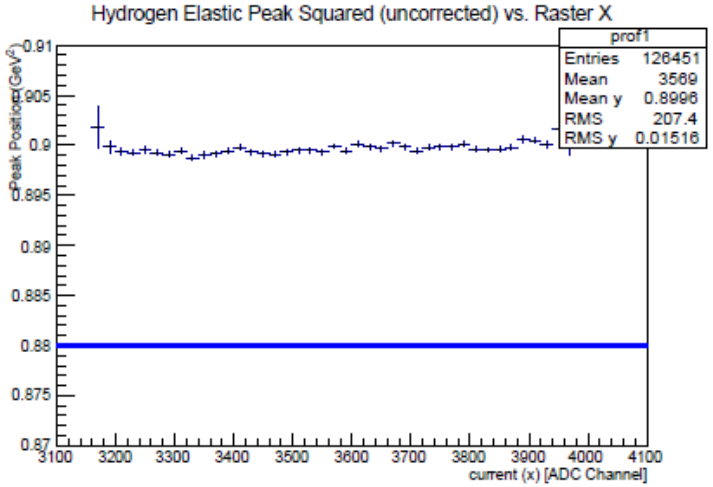
Some Other Things

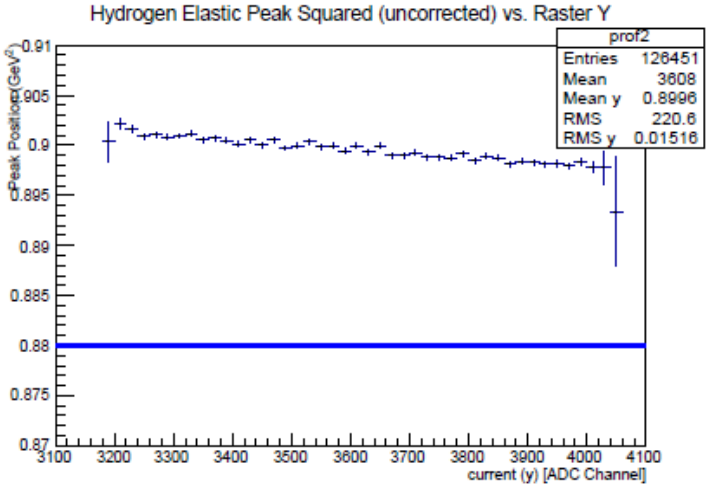
- New ADC Filters have been designed and installed on both spectrometers
- An Electronic Dead-time Monitoring (EDTM) system has been installed on the Left HRS
- A 16 Channel Flash-ADC has been installed on the Left HRS
- Additional information has been added to the online analysis GUI
- New software tools have been developed to analyze new two-raster system

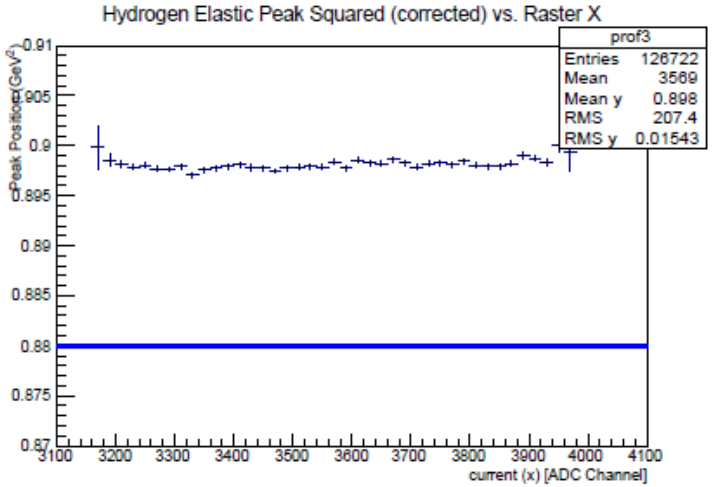
New ADC Filters

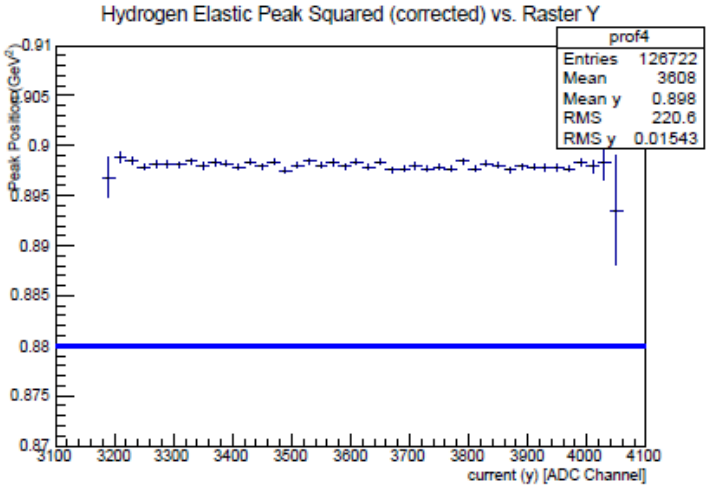


Raster Corrections

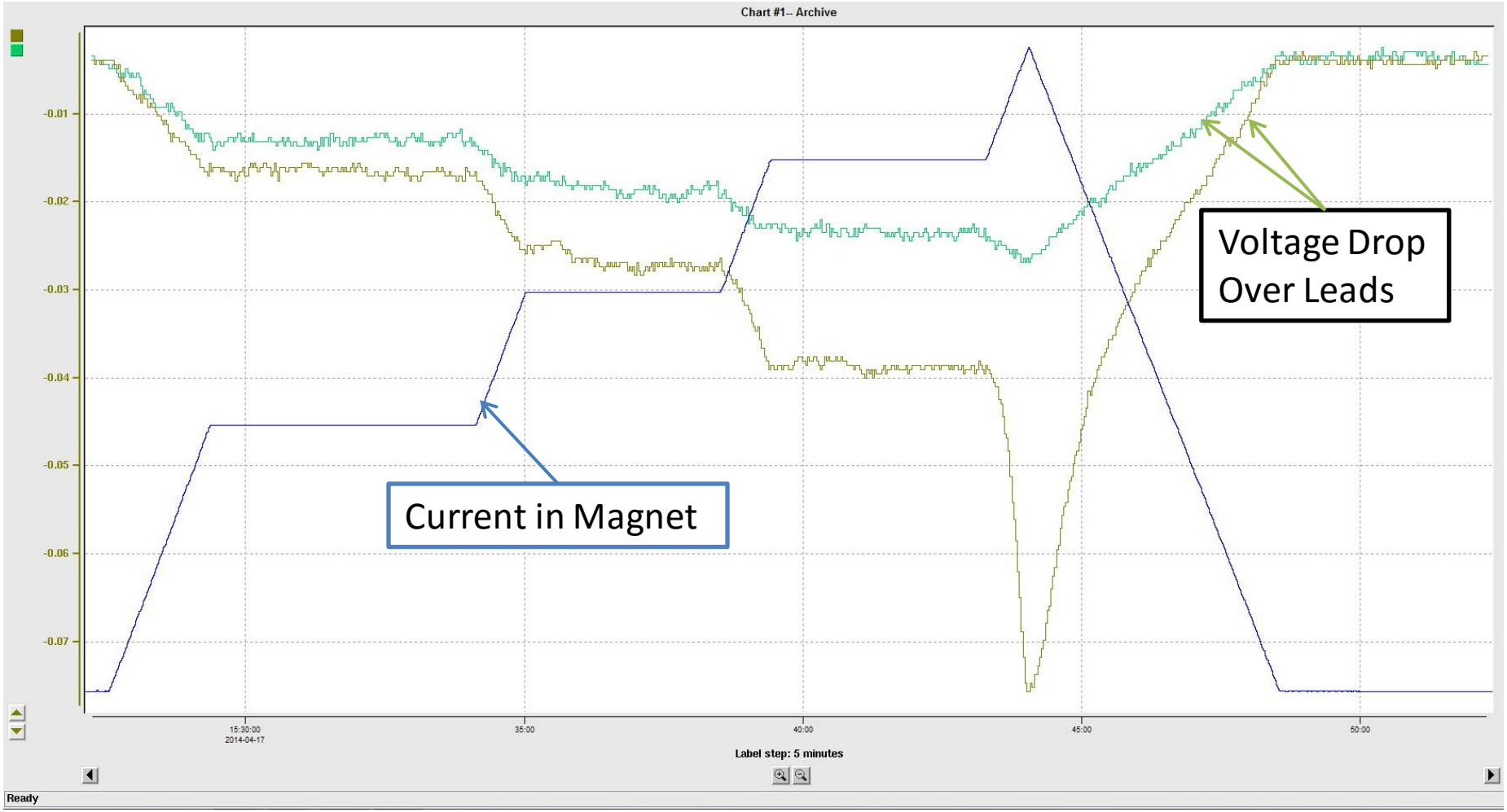








RHRS Q1: Voltage Across Leads

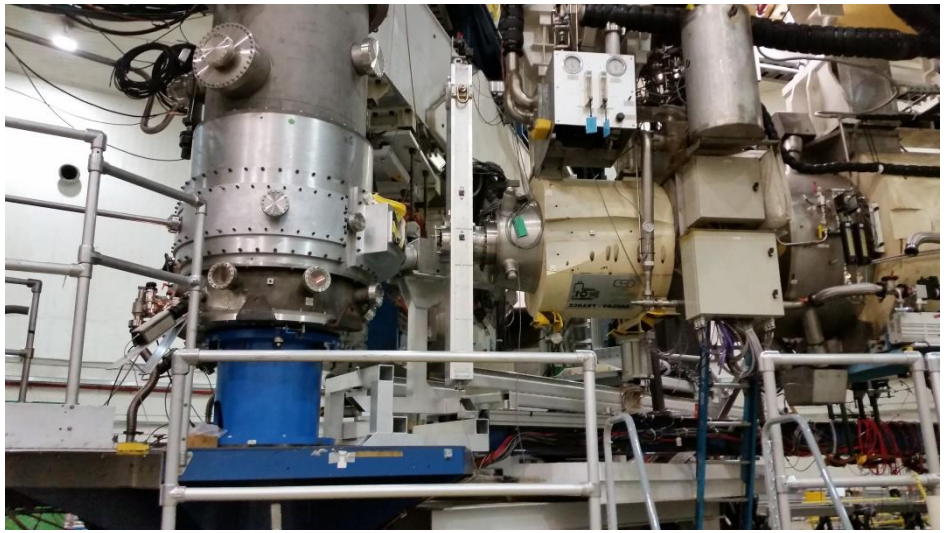


The SOS Spectrometer

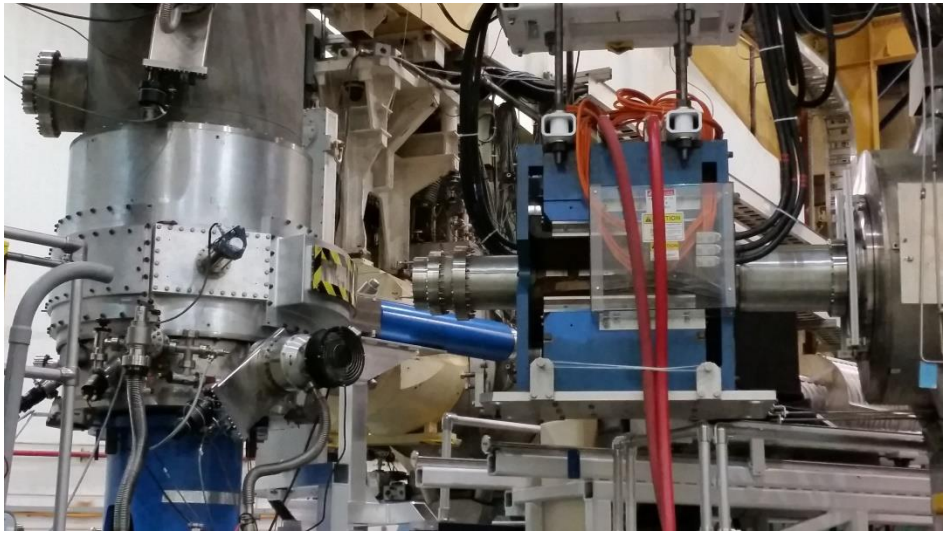
- The SOS spectrometer, located in Hall C, had a QD~~Đ~~ design. The spectrometer operated up to a momentum of ~1.75 GeV/c.
- The SOS quad has a radius of 12.8 cm (Q1 radius = 15 cm). It has a magnet length of 70 cm (Q1 length = 94 cm).It was operated to a maximum pole-tip field of ~1 T in the spectrometer. The pole tips are planes, rather than curves.
- The dipoles, which shared the same iron yoke, limited the spectrometer momentum.
- So, the quad was not operated at its maximum potential current/field.

Current HRS

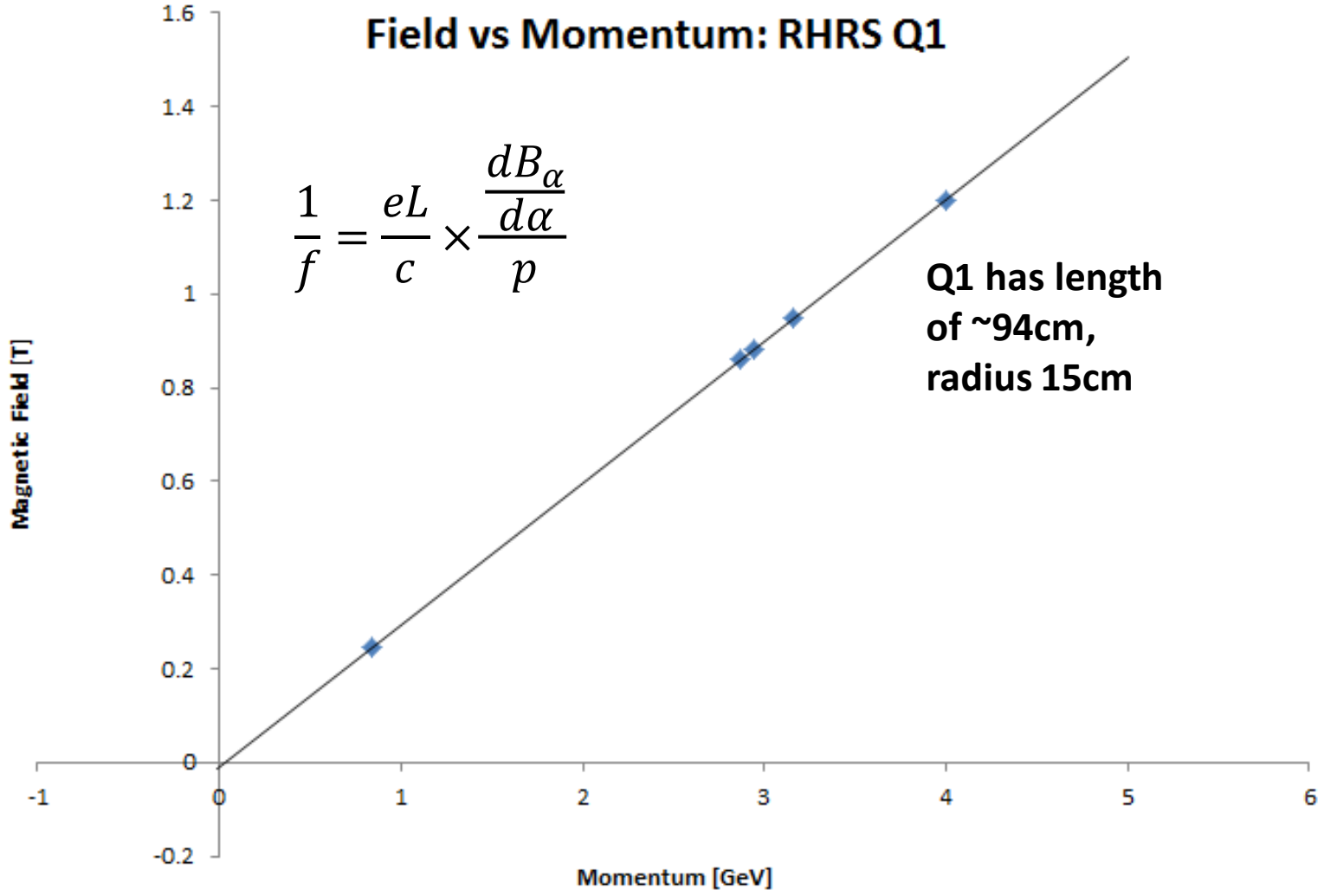
Left HRS



Right HRS



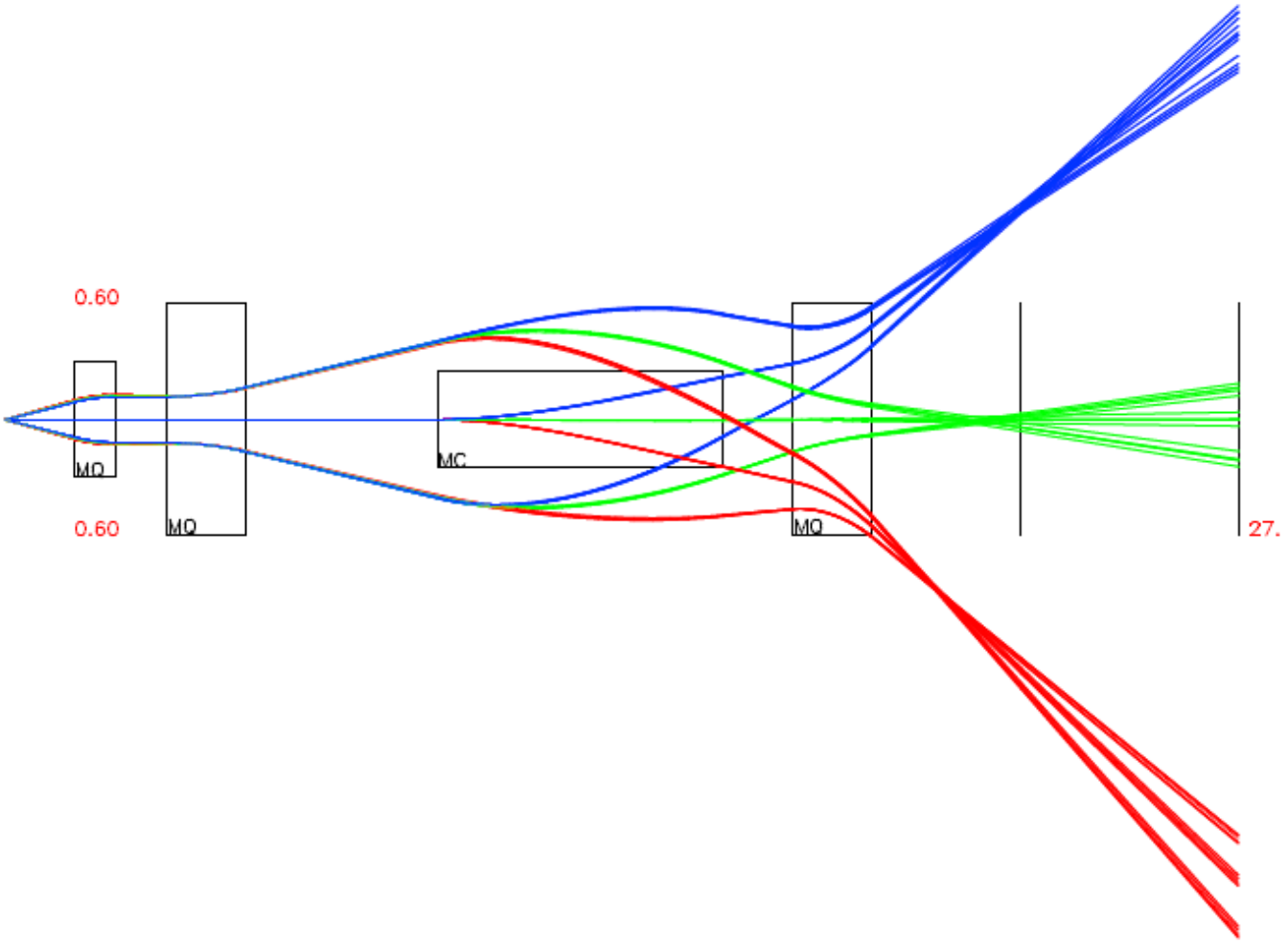
Tune for Q1 in RHRS



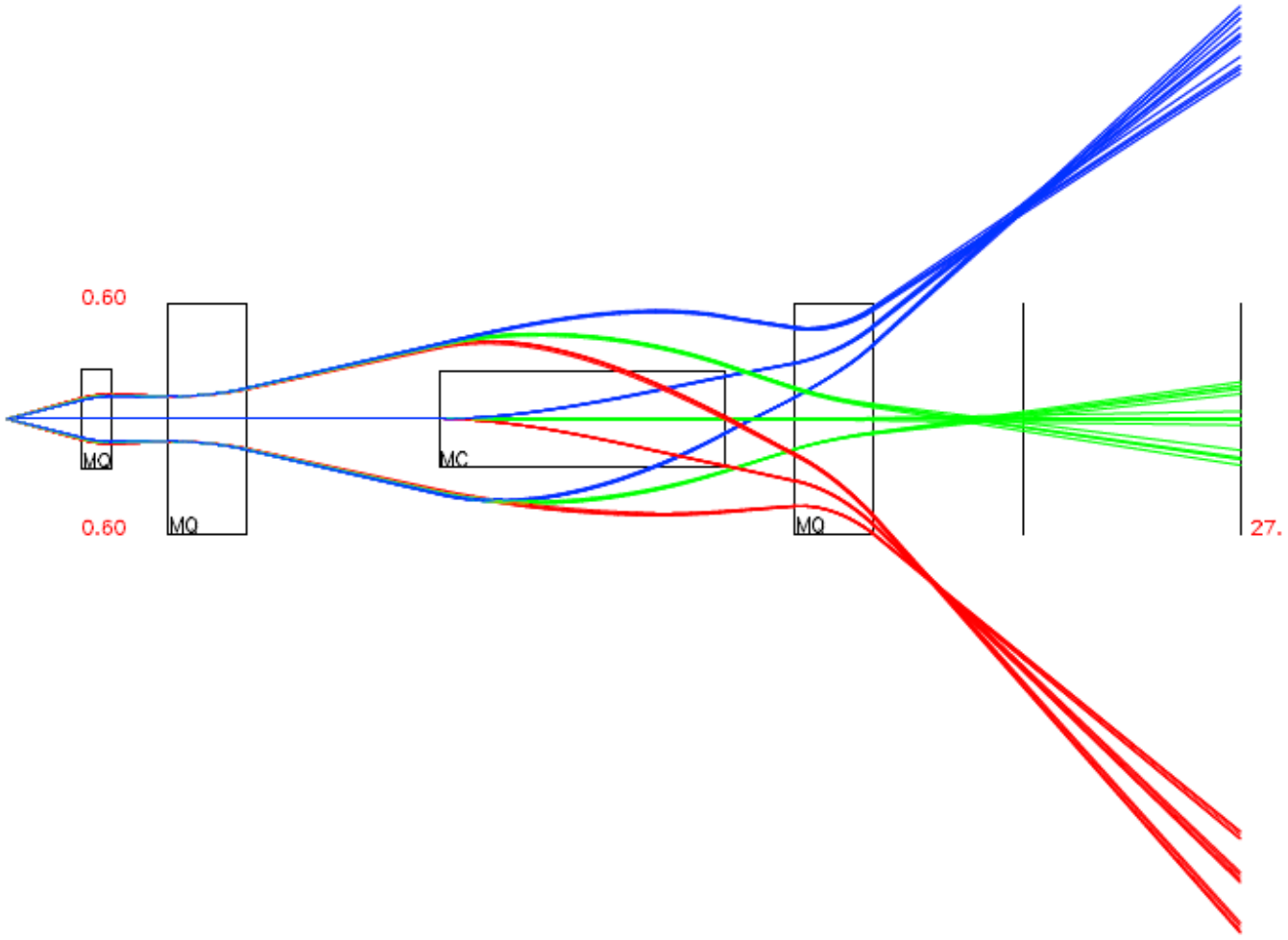
Simulation Studies

- Used the program COSY Infinity to study effect of replacing Q1 with the SOS Quad
- Generate transport and reconstruction matrices were then placed into SIMC for acceptance (and other) studies
- The SOS quad was placed with its center at the same location as Q1's, and the focal length was matched

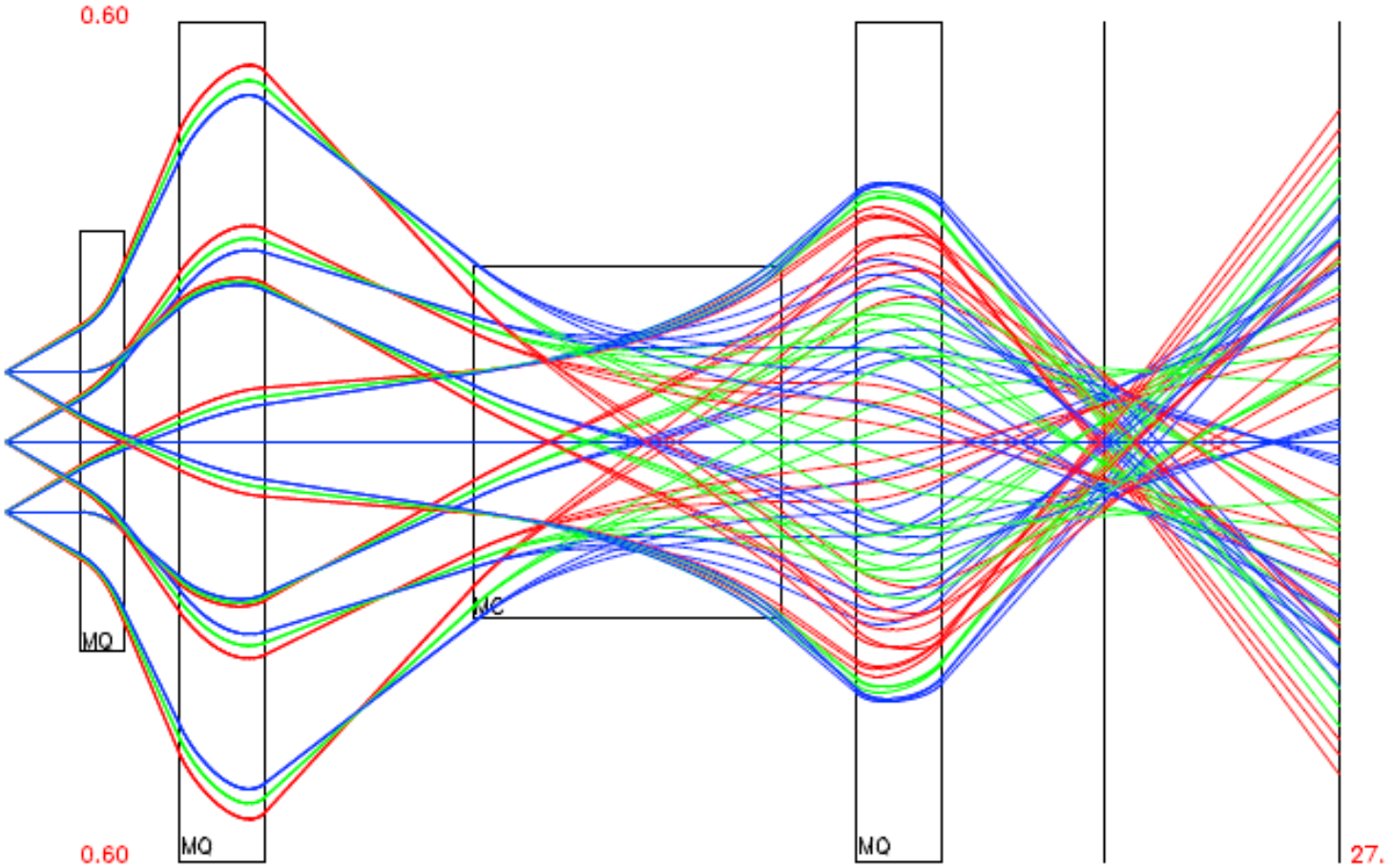
Normal HRS (Bend Plane)



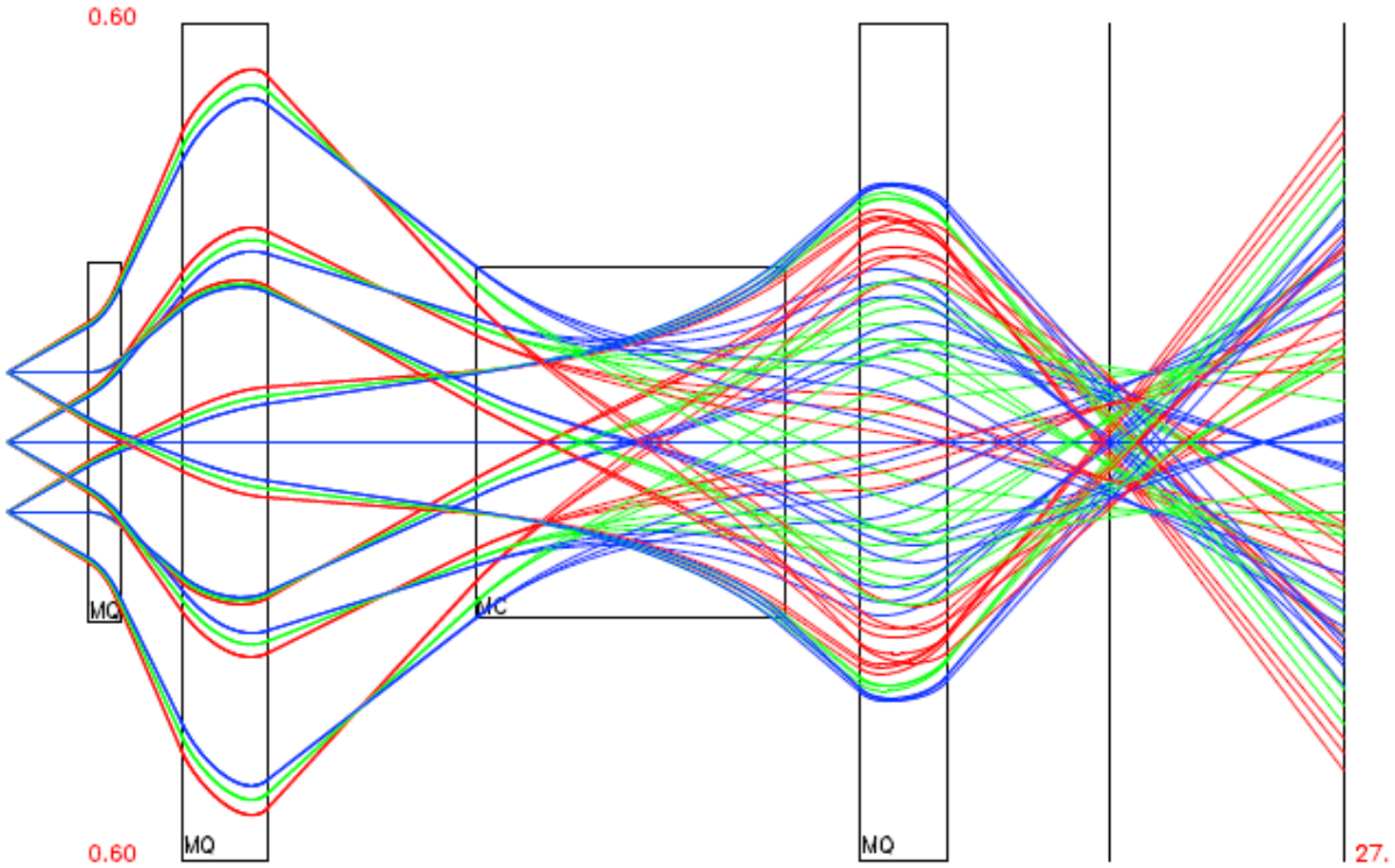
Modified HRS (Bend Plane)



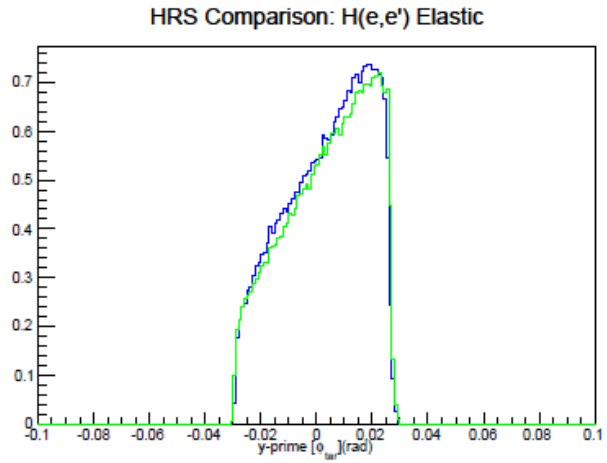
Normal HRS (Non-Bend Plane)

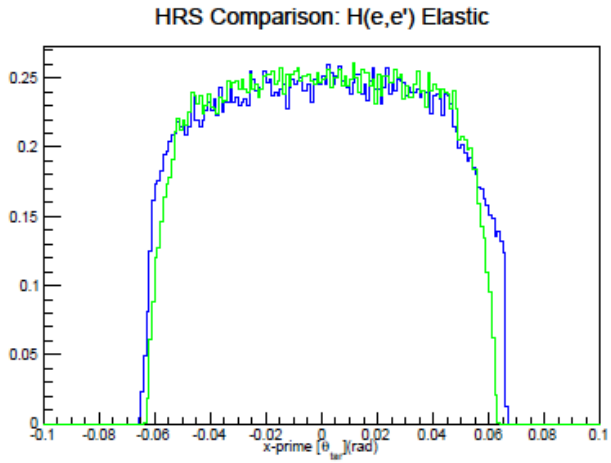


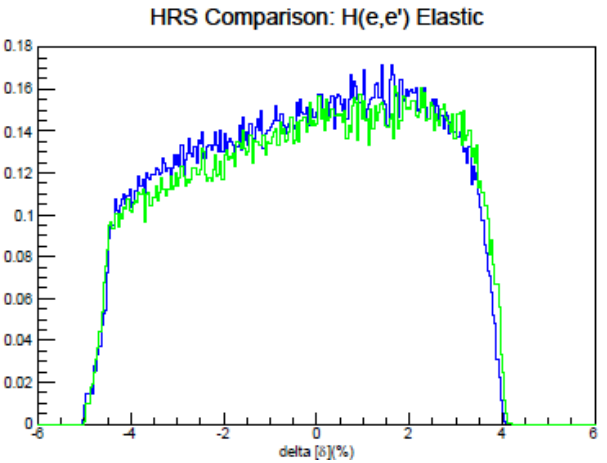
Modified HRS (Non-Bend Plane)

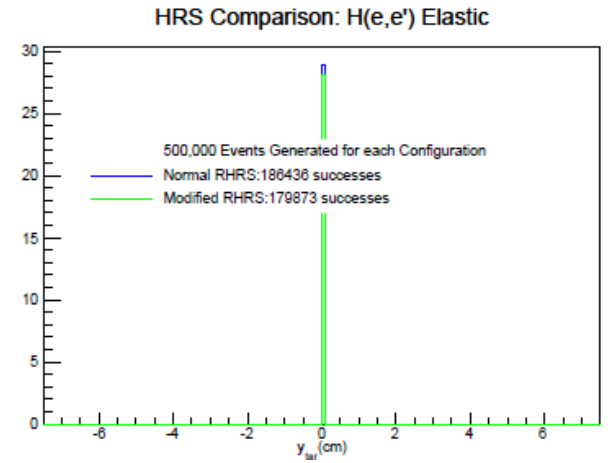


Acceptance Comparison (Y_tar = 0 cm)

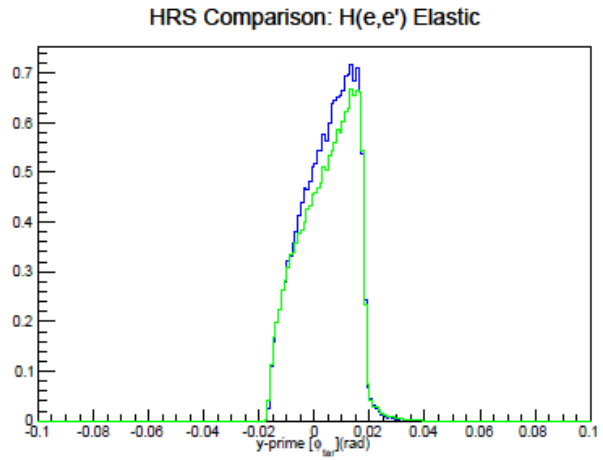


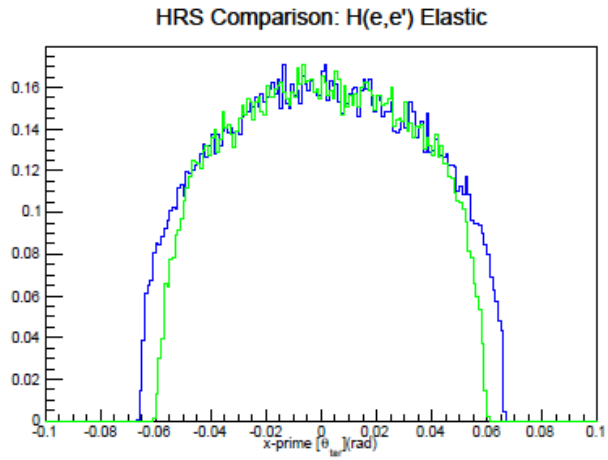


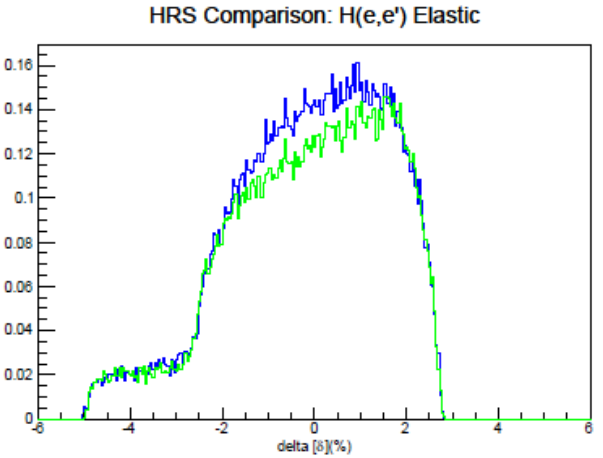


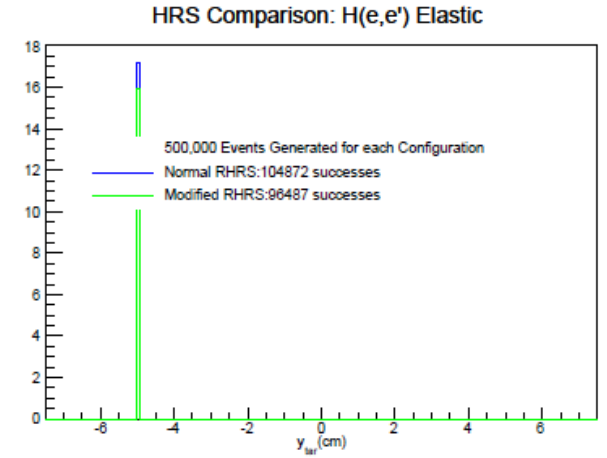


Acceptance Comparison (Y_tar = -5 cm)

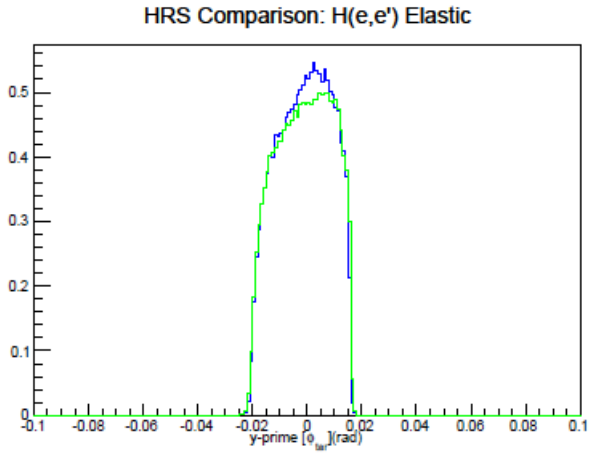


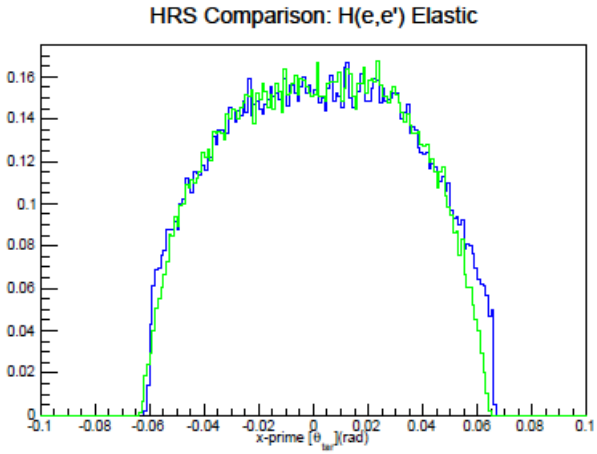


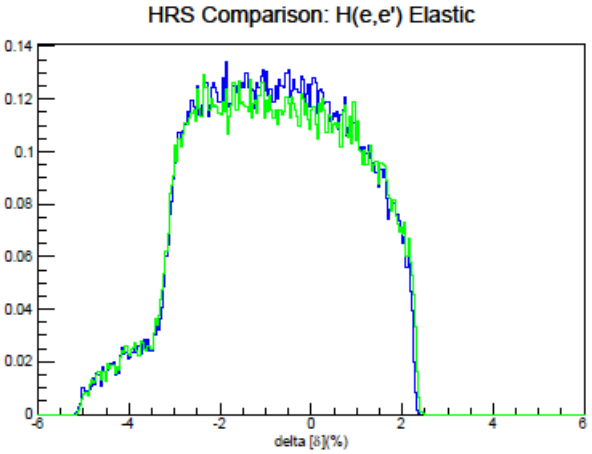


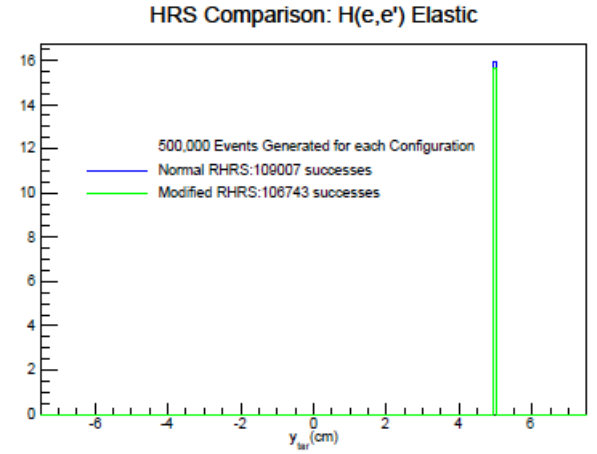


Acceptance Comparison (Y_tar = +5cm)

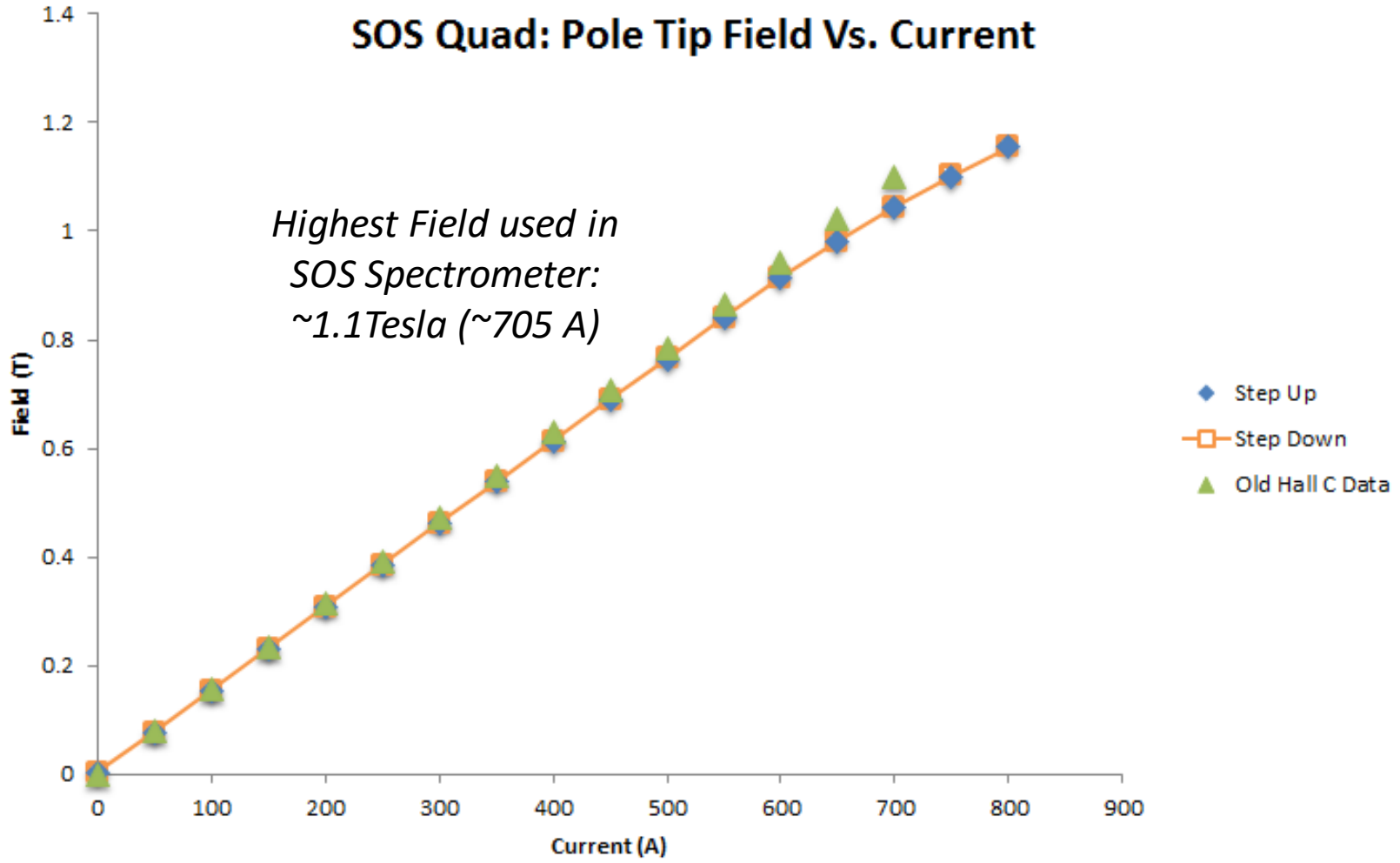








Pole-Tip Field vs Current in SOS Quad



Initial Guess to Match Q1 Focal length

- Want to scale pole-tip field up at:

  3300 Gauss/GeV

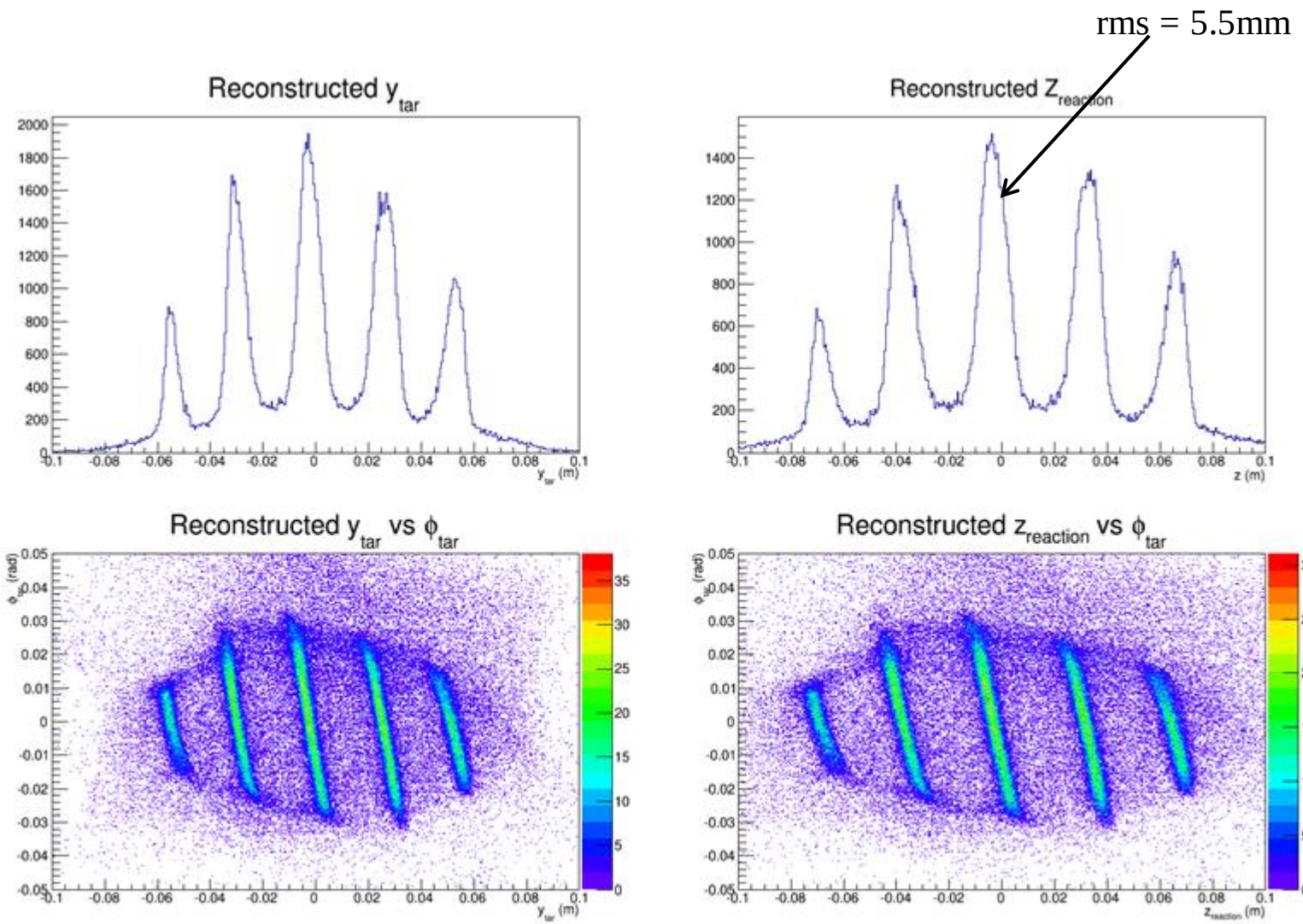
- We measured B vs. I with hall probe:

  15.5 Gauss/Amp

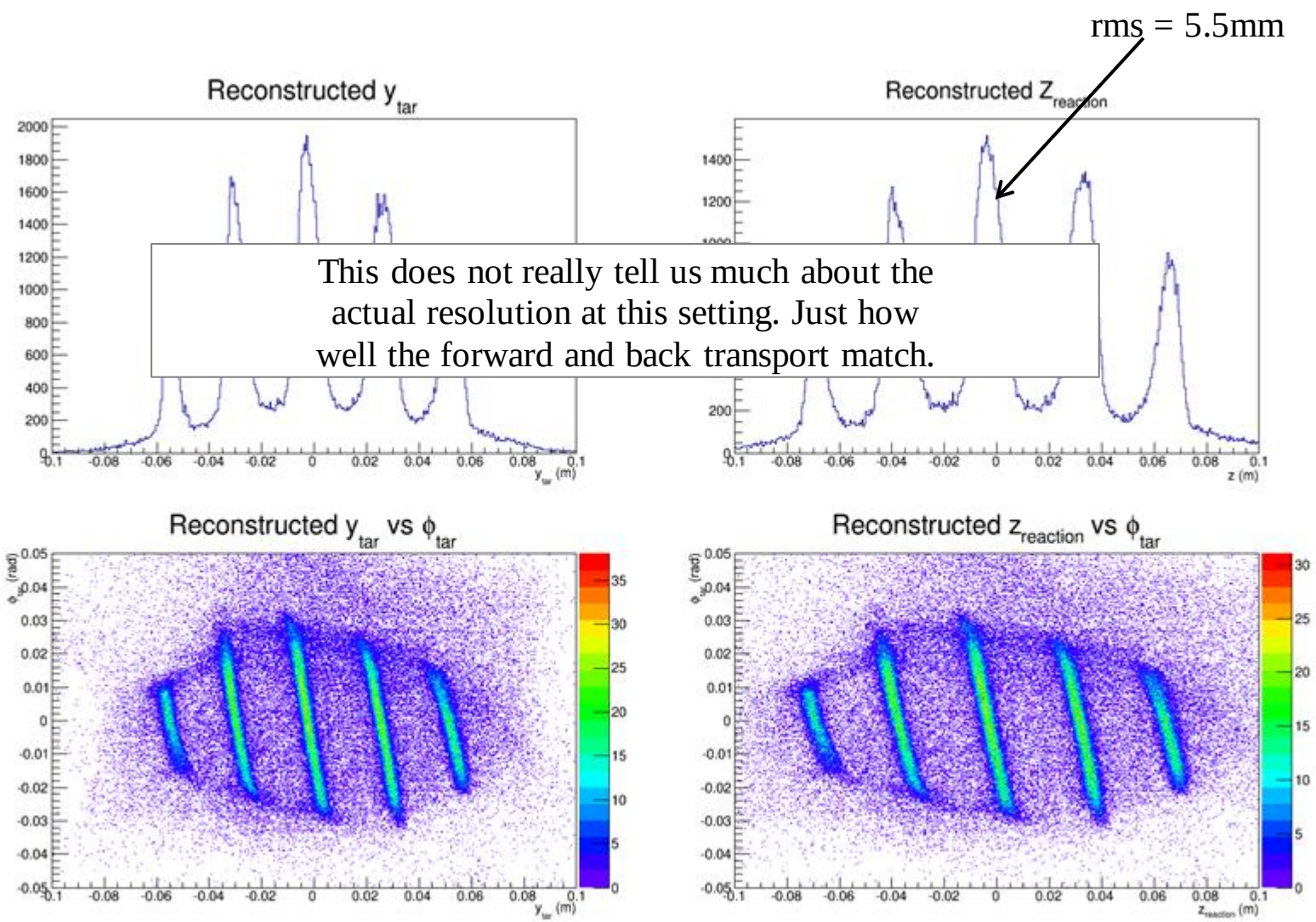
- Thus we want to scale at current at:

  213 Amp/GeV

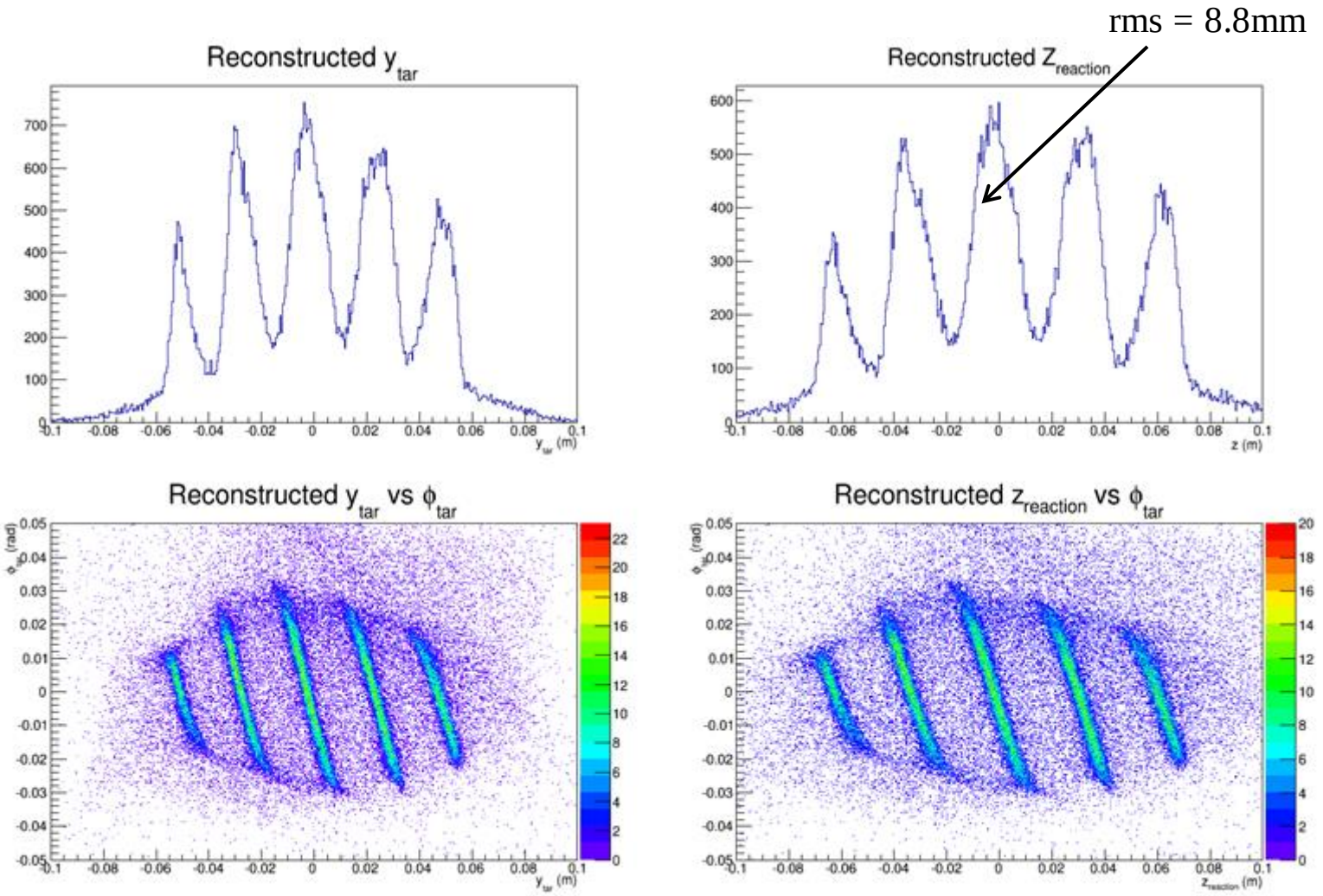
Data with Optics Target: Initial Guess



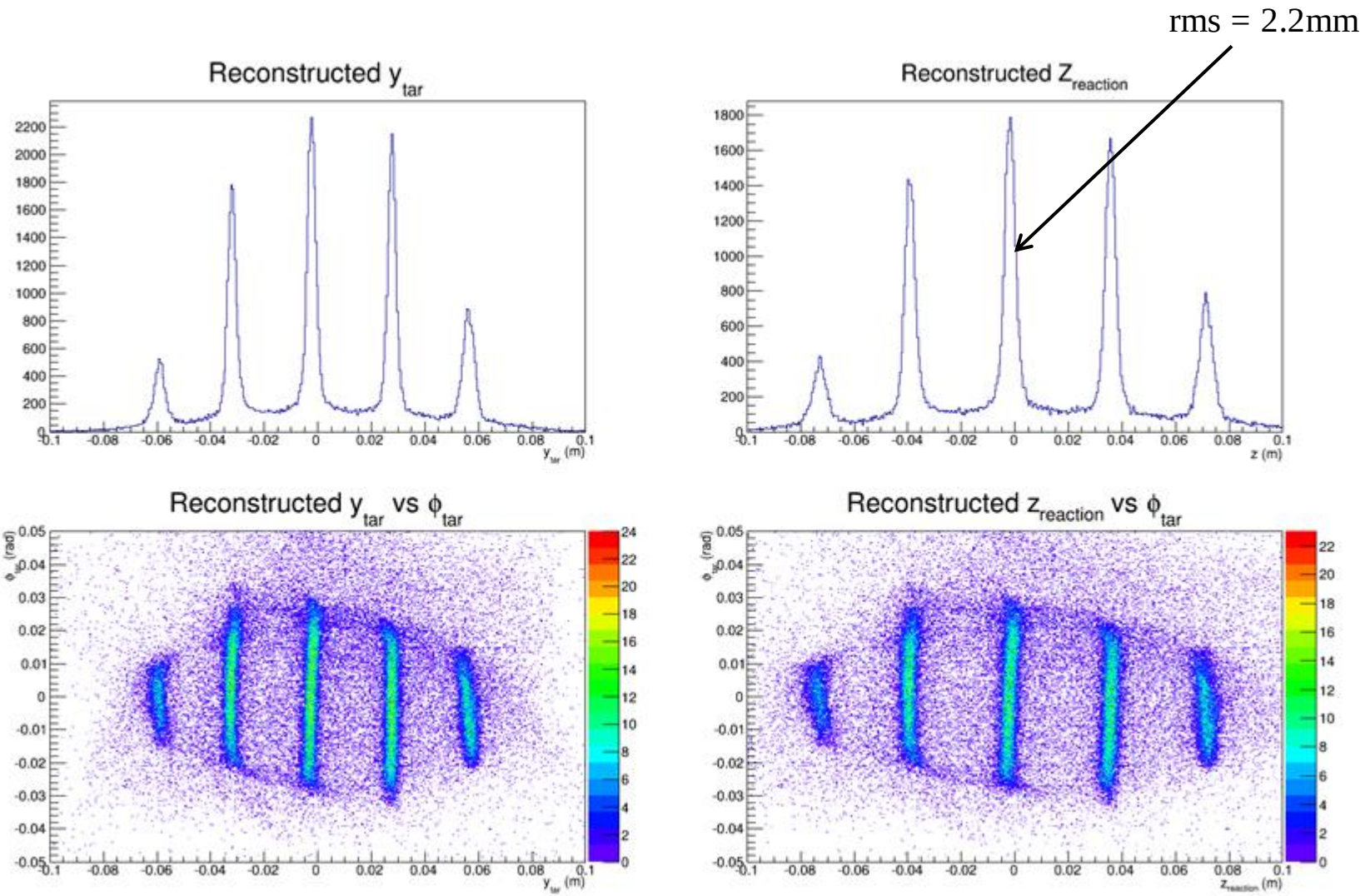
Data with Optics Target: Initial Guess



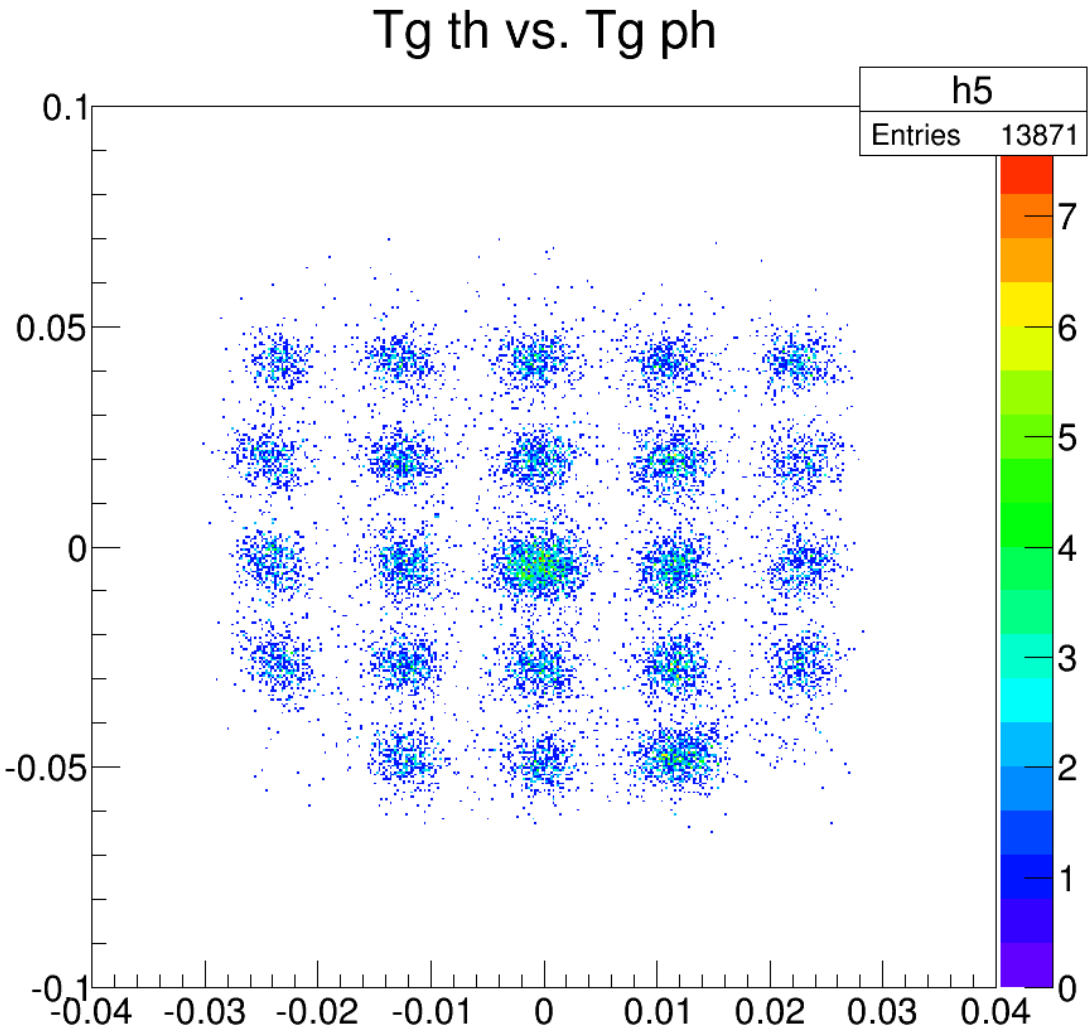
Data with Optics Target: +10%



Data with Optics Target: -5%



Sieve Pattern before Optics Optimization



Questions ?