Summary of the HMS Optics

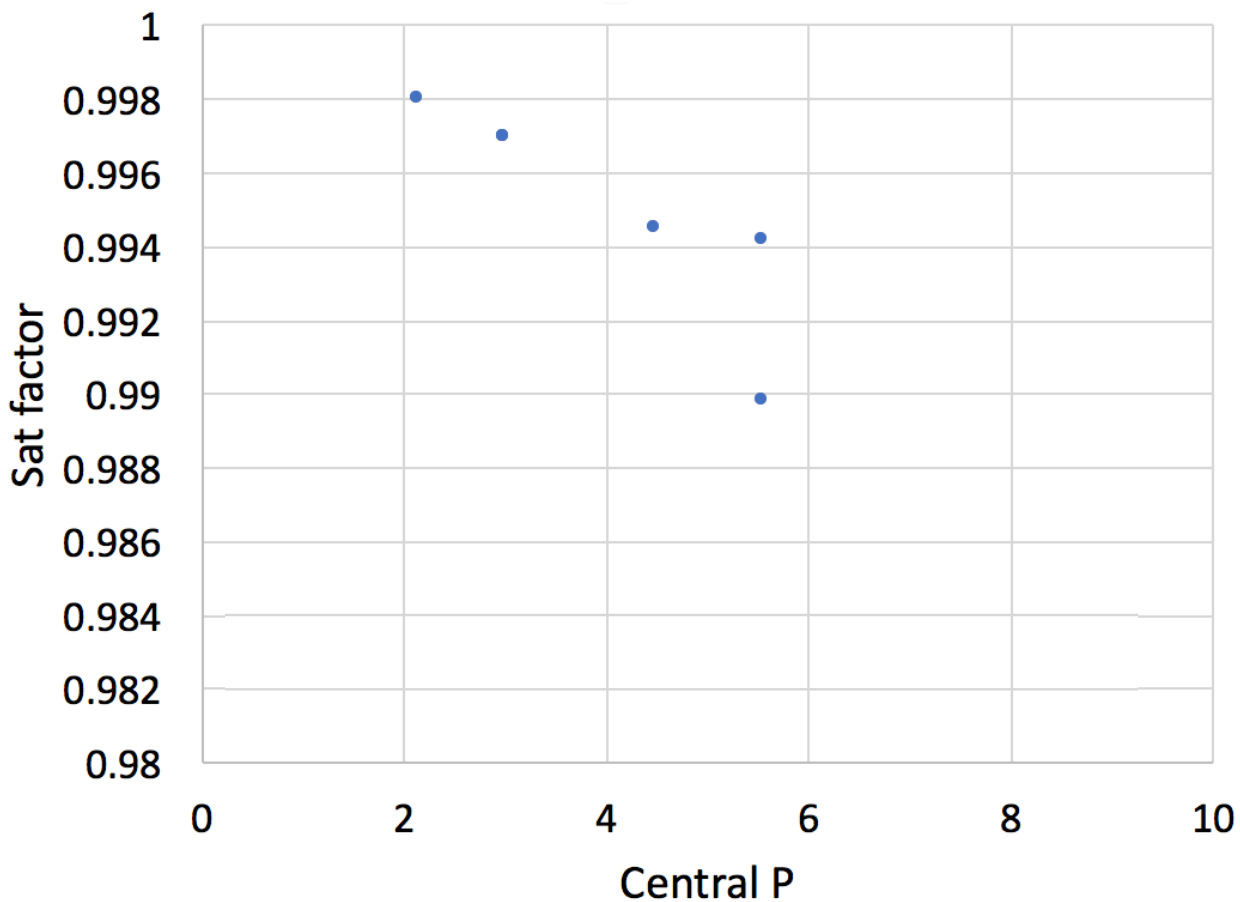
- Studied saturation effects looking at yptar vs zvertex (probably not the full picture)
- W offset in hydrogen elastics gives dipole saturation

30 Sep 2018

From the Color Transparency experiment H(e,e'p):

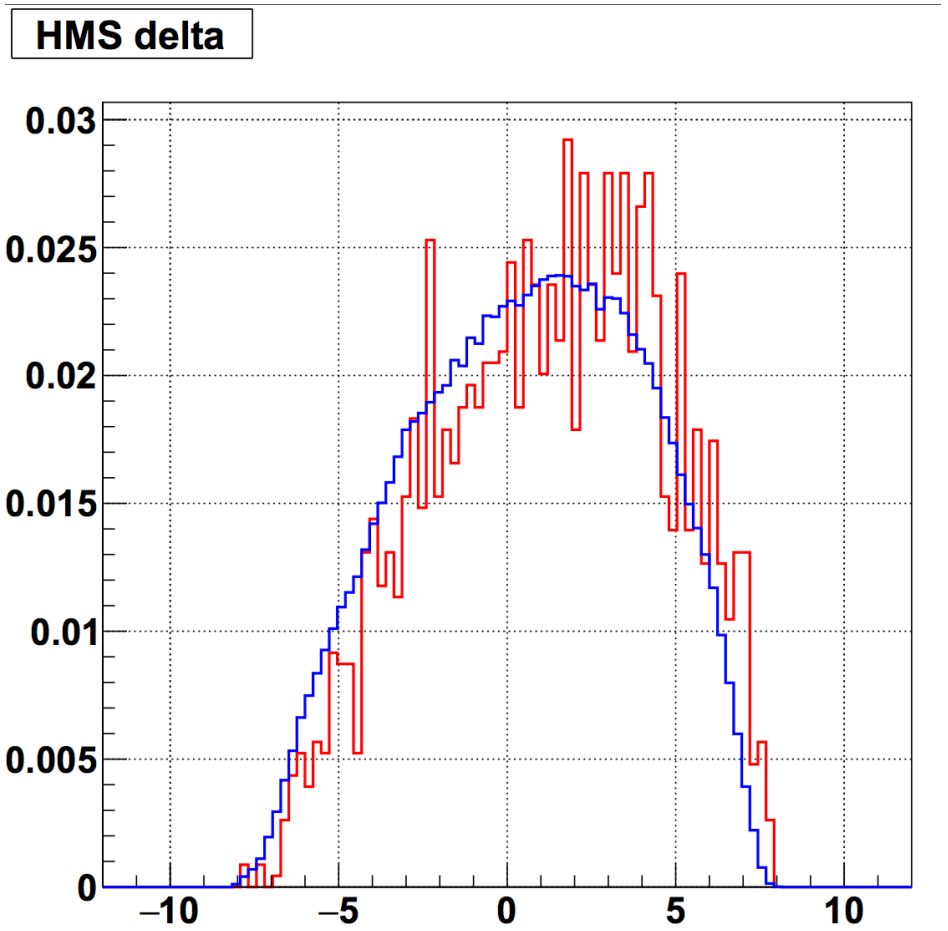
	HMS angle [deg]	HMS central P [GeV/c]
6.4 GeV beam	45.1	2.131
10.6 GeV beam	23.2	5.539
	28.5	4.478
	39.3	2.982

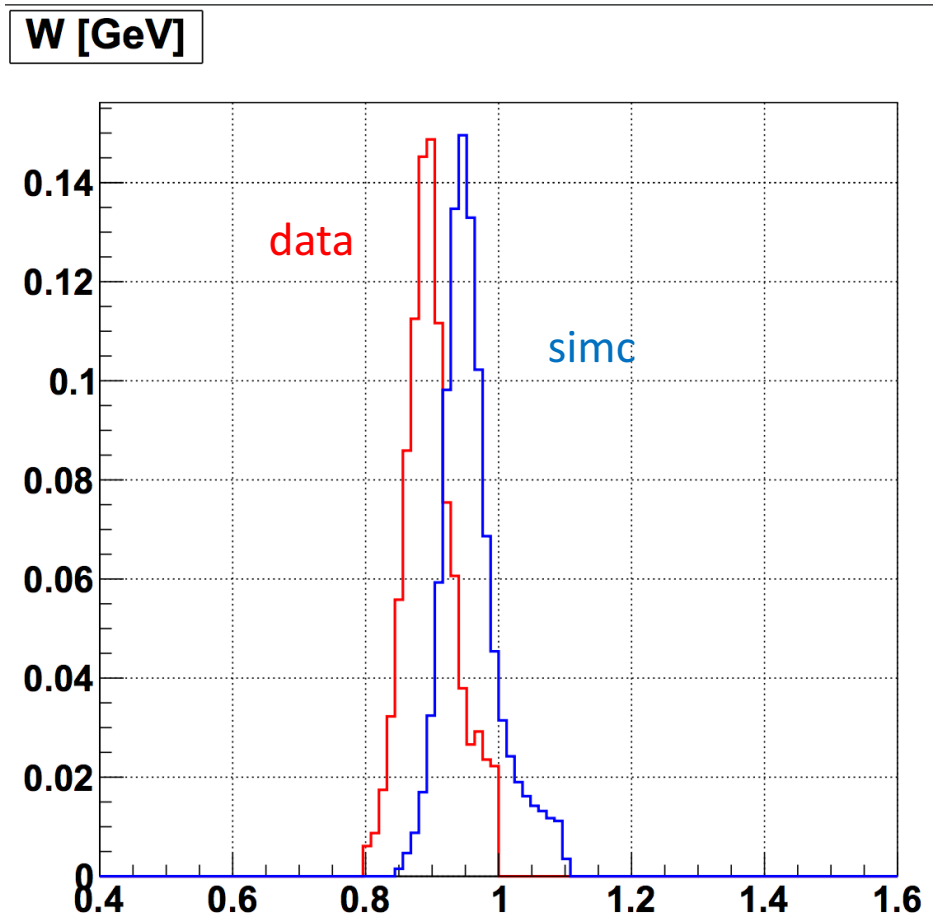
Matching the W peak from MC and data:



Consistently low by 0.3% in the dipole P setting (even after angle considerations)

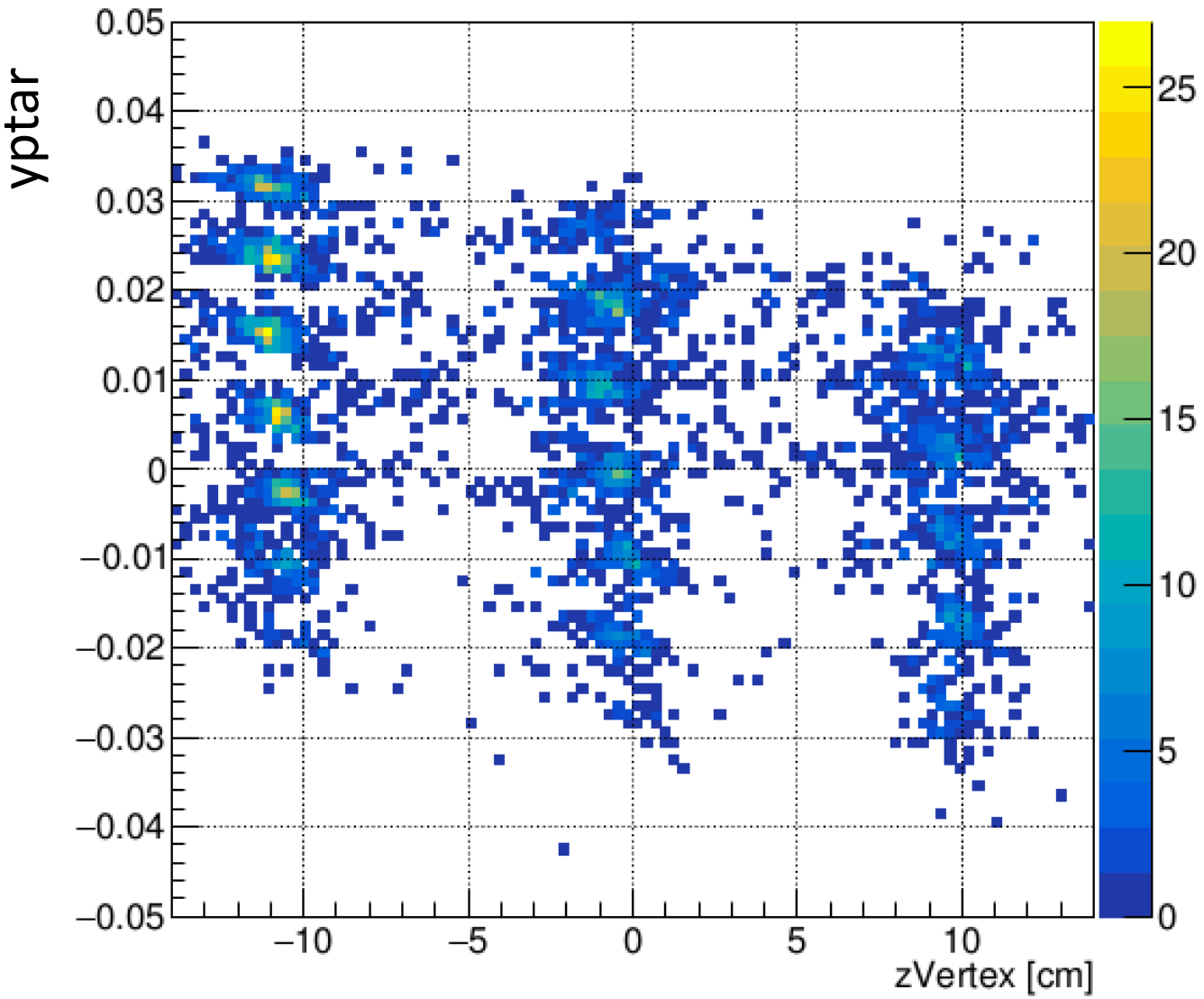
HMS at -5.3 (from this singles run this week):





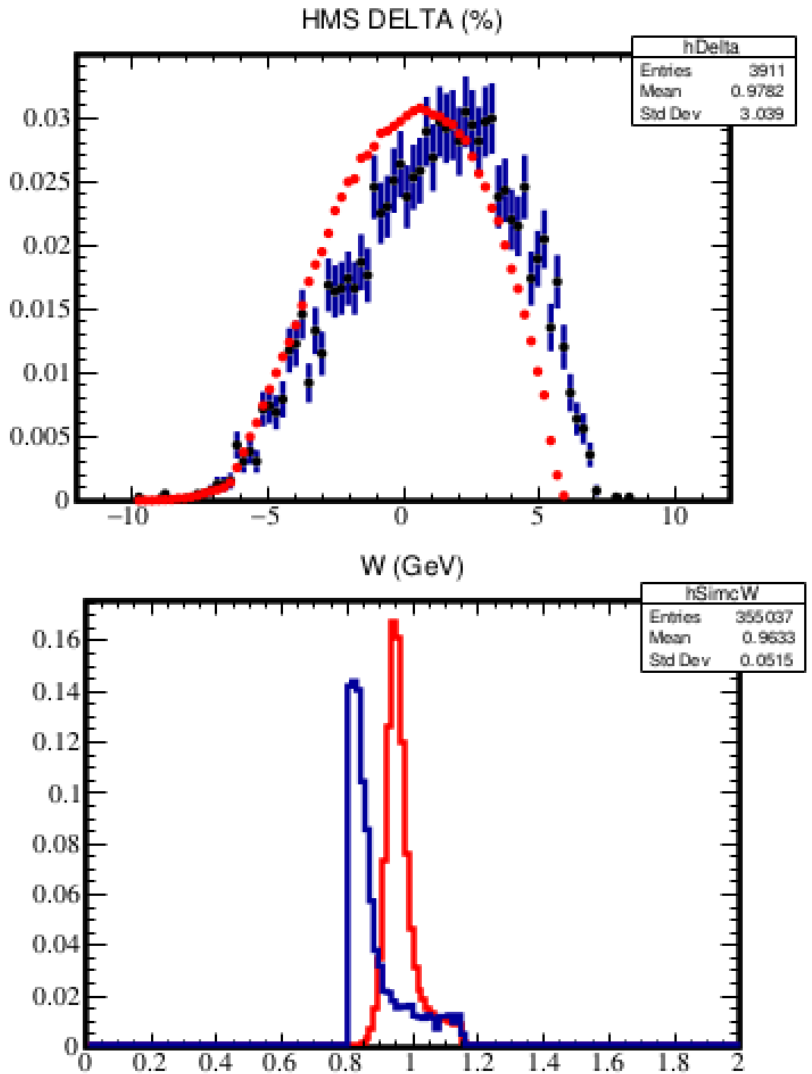
- Momentum setting appears low by approximately 50 MeV (0.45%).
- Consistent with CT H(e,e'p) runs at -5.5 GeV (low by ~0.5%). Also optics at -2.1 GeV appears low by approximately 21 MeV (or 0.3%).

Run 2102, -5.5 GeV, dipole x1.004 (April 2018):



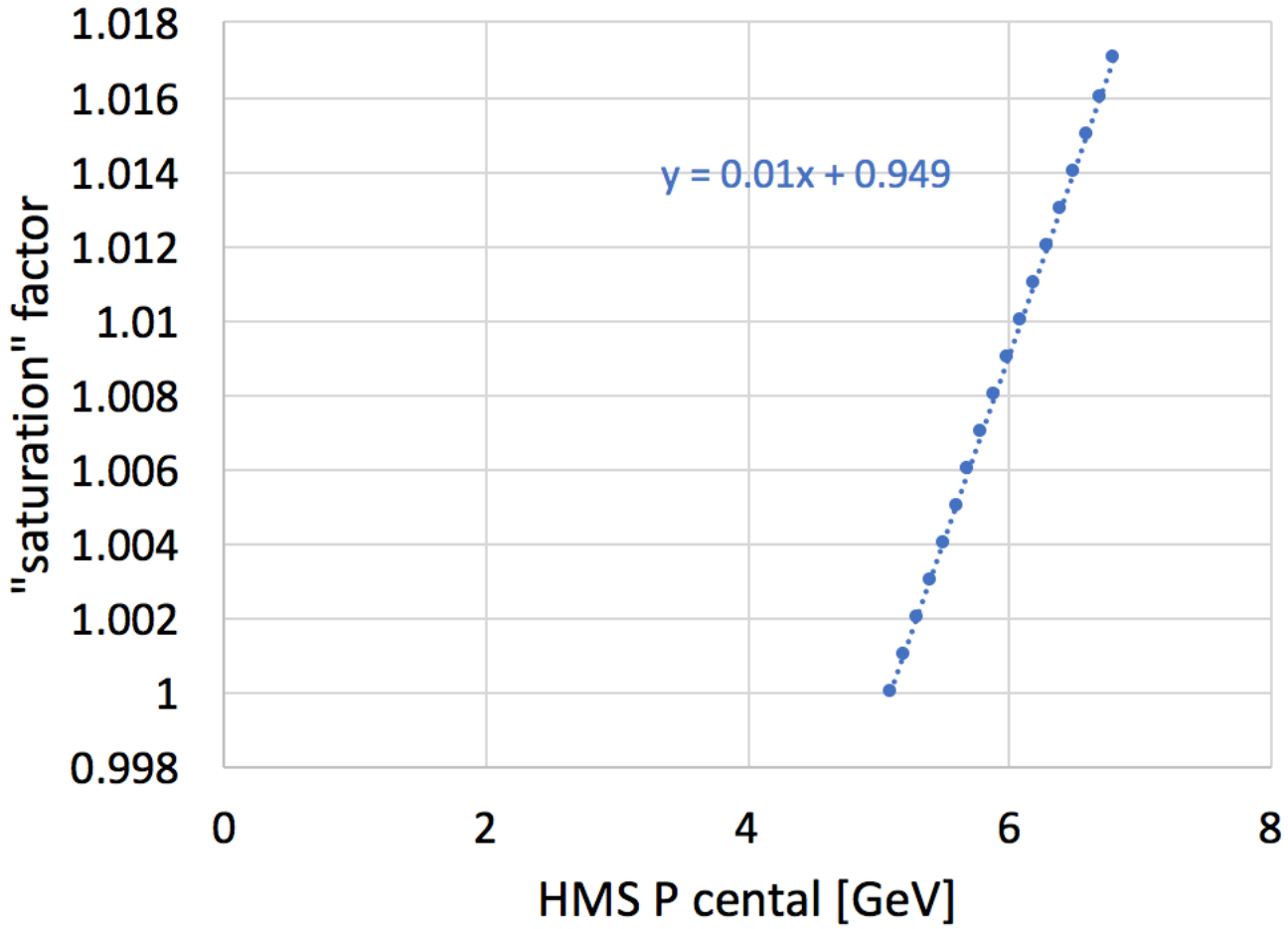
Increasing the dipole, rotates this plot CCW
Decreasing the dipole, rotates this plot CW

While yptar vs zvertex looks ok, the HMS dipole reconstructed W is still off.



5.5 GeV H(e,e'p) setting from CT

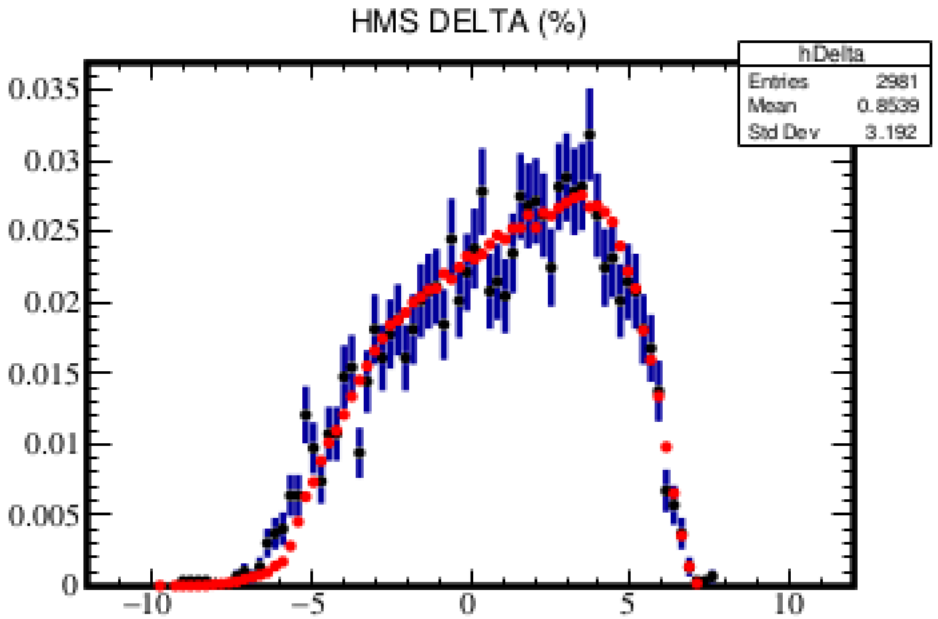
From the April studies of HMS from 5-5.9 GeV, using yptar vs z vertex rotation, determined a saturation correction (currently in field17 setting program, at 5.1 GeV and above):

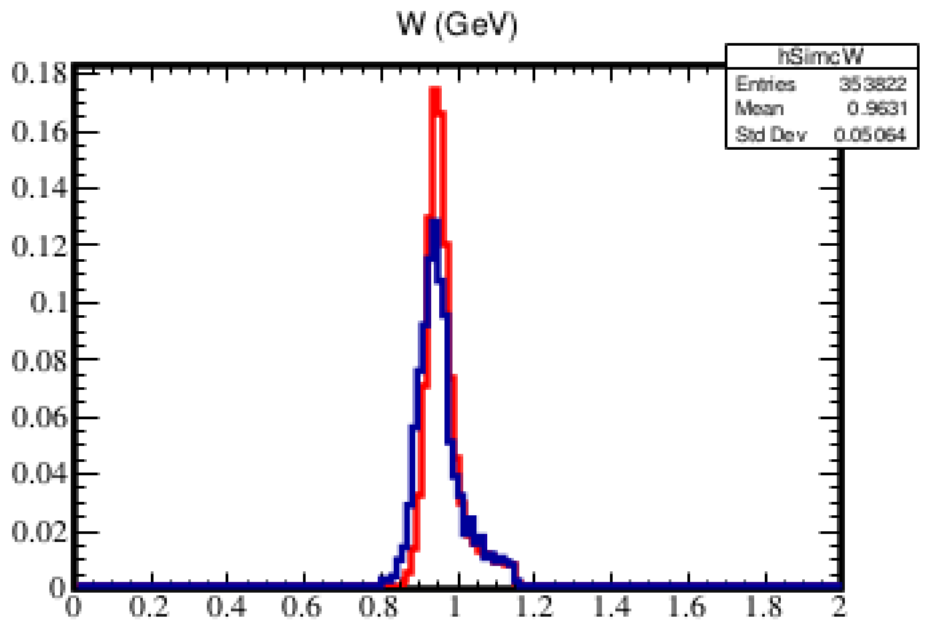


The problem is that even with correct rotation (yptar vs z vertex), we still have some W offset.

- W offset is driven by the dipole setting, central P
- Rotation can also be corrected by quads
- HMS quads have cubic order corrections to Q1 and Q2 magnets in momentum regimes we care about.

Color transparency 5.5 GeV setting, HMS + 0.55% saturation correction:



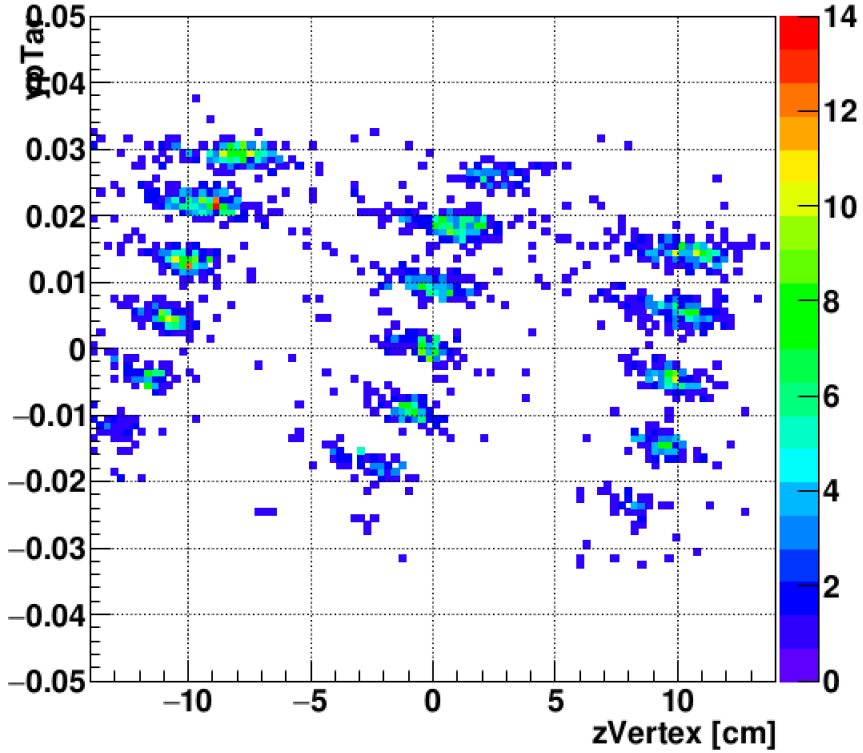


Fully corrects the W/delta offsets

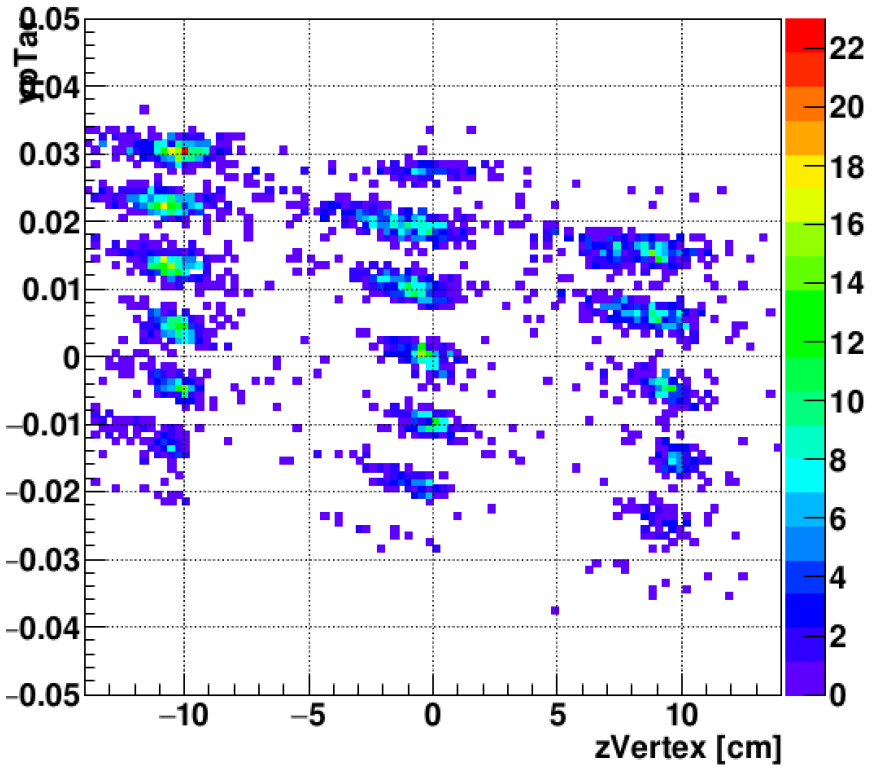
Over rotates yptar vs zvertex

Is this compensated for by a quad? Q1? Q2? Only sieve data can tell us…

Run 4766, -6.6 GeV, all quads nominal (sat from field17 only)



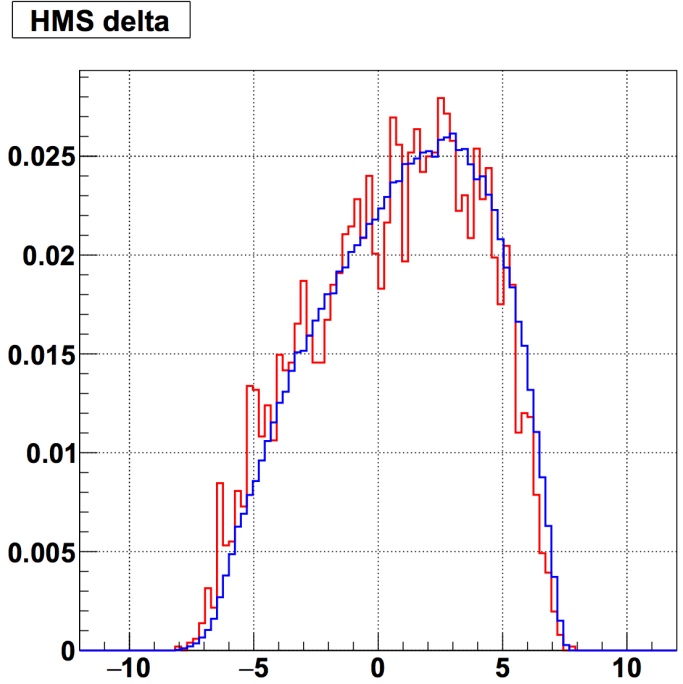
Run 4773, -6.6 GeV, Q1x1.004, Dx1.006

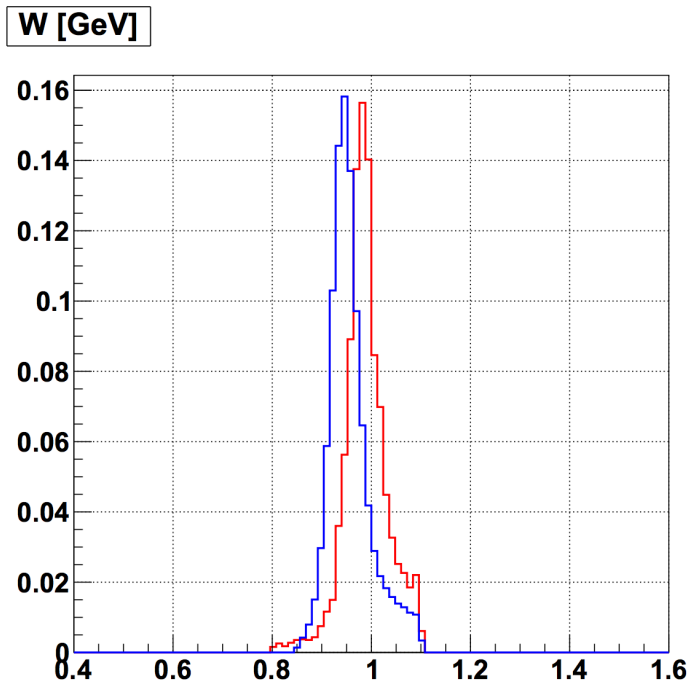


Rotation is strongly correlated to dipole

Quads can focus/de-focus, rotate yptar, distort the sieve patterns (this is what we studied with the carbon sieve data)

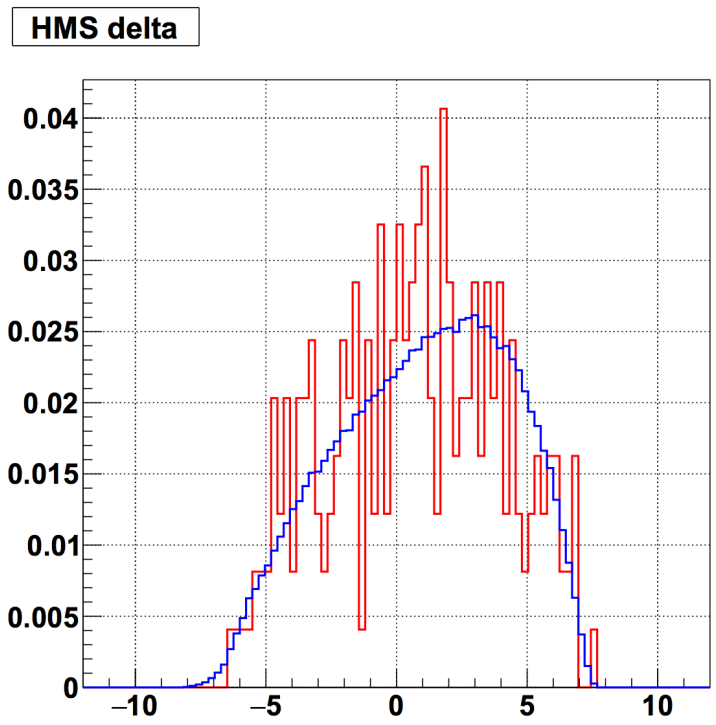
W tells us if the dipole central P is set correctly

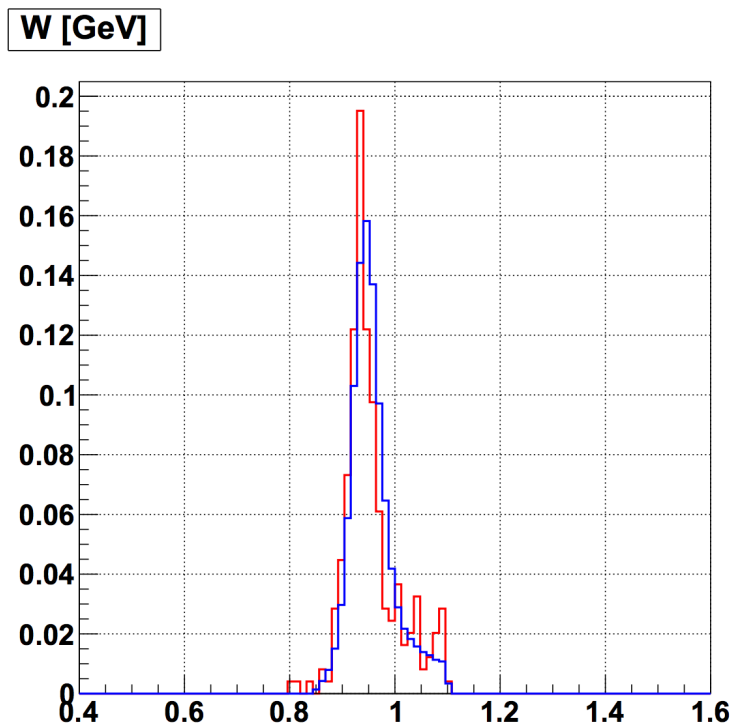




HMS at -6.6 GeV:

- top: dipole with nominal saturation from field17





- bottom: dipole x1.002 on top of saturation from field17

We are off in the lower momentum, so if we want optics to be the same, we should be off here too!

Summary:

- W shows us that yptar vs z vertex is not the full picture
- Q1 and Q2 are possibly over compensating and correcting this distribution and the sieve, causing us to still see offsets in the W
- To keep the optics the same, we have the nominal correction in the field17 program, but the yptar vs z vertex at high momentum indicates we are missing something somewhere…