LHRS Analysis for d_2^n

Acceptance and Systematic Errors

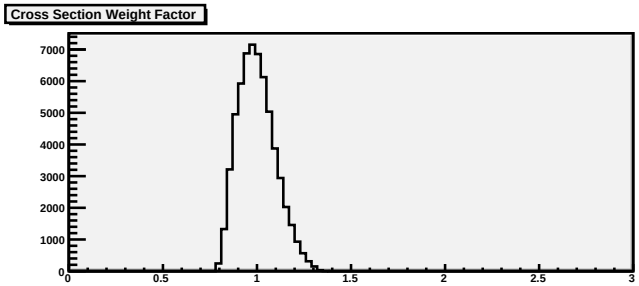
D. Flay

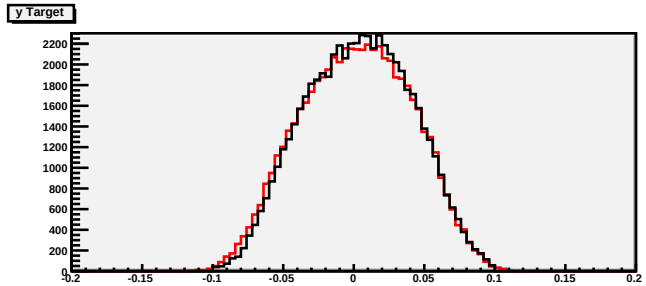
5/19/11

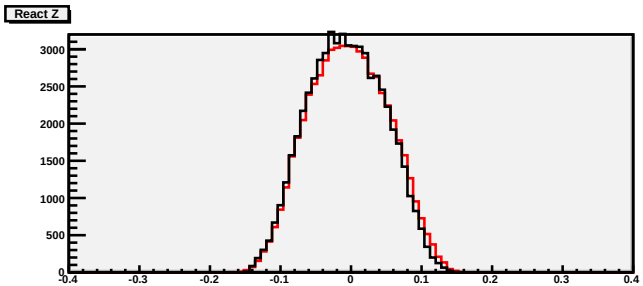
Outline

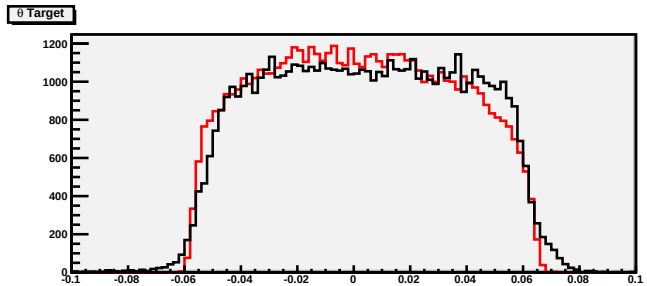
Momentum Dependence (1)

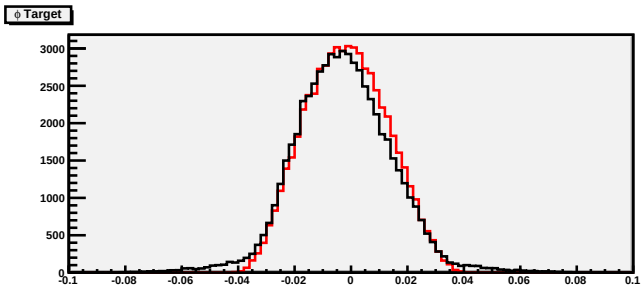
Target Variables at p = 600 MeV, 4-pass

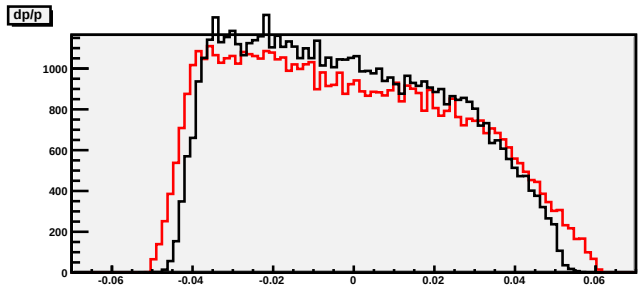






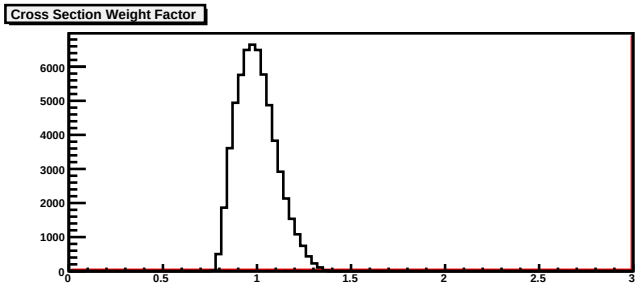


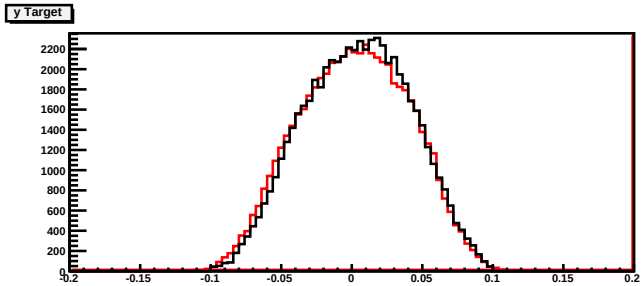


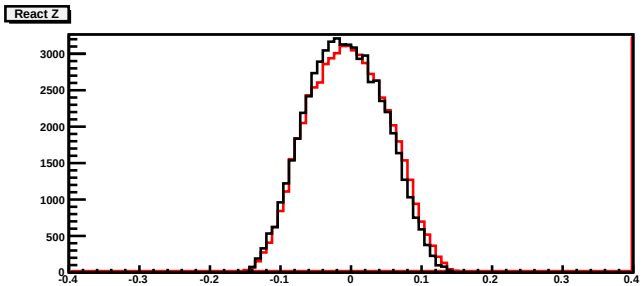


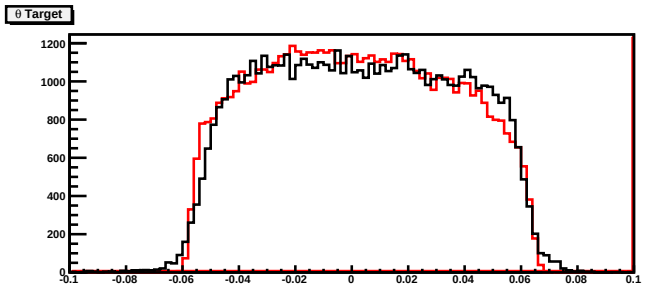
Momentum Dependence (2)

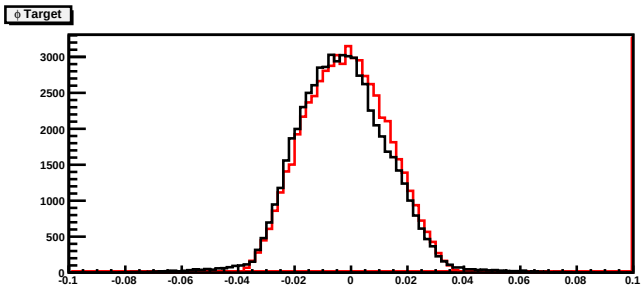
Target Variables at p = 800 MeV, 4-pass

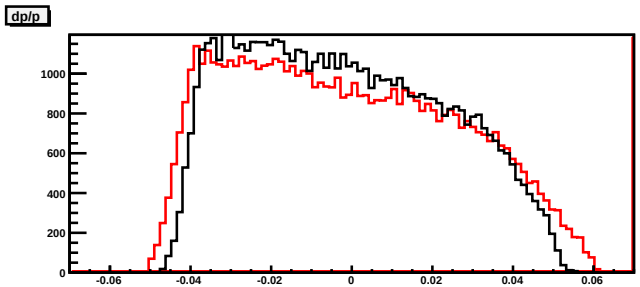






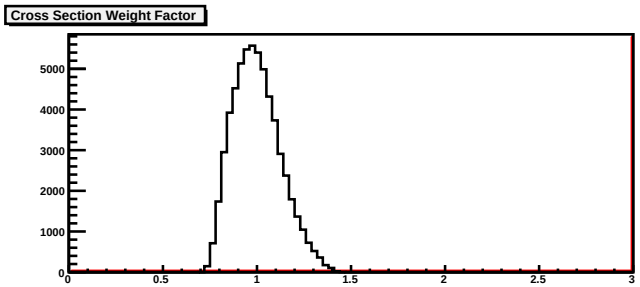


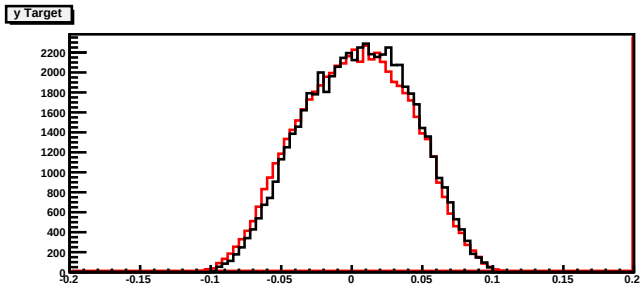


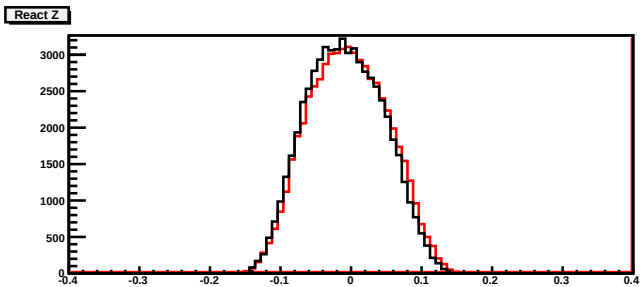


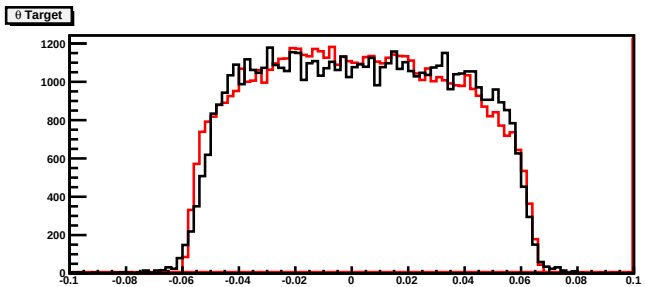
Momentum Dependence (3)

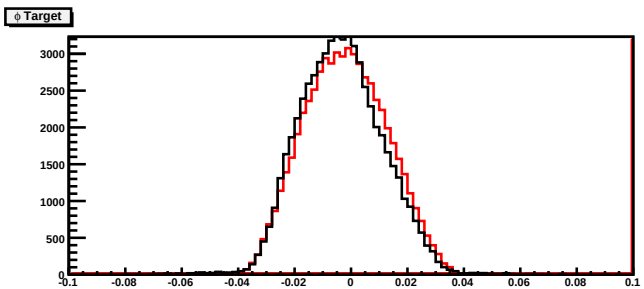
Target Variables at p = 1120 MeV, 4-pass

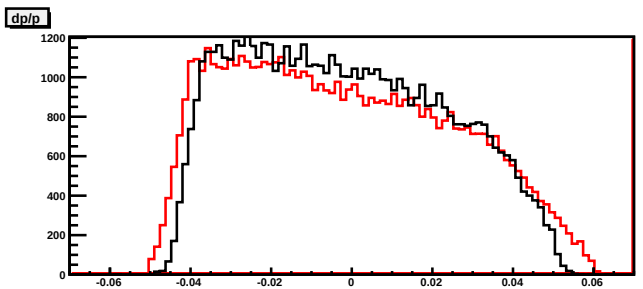






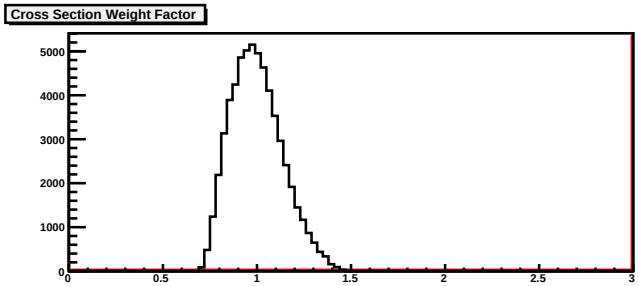


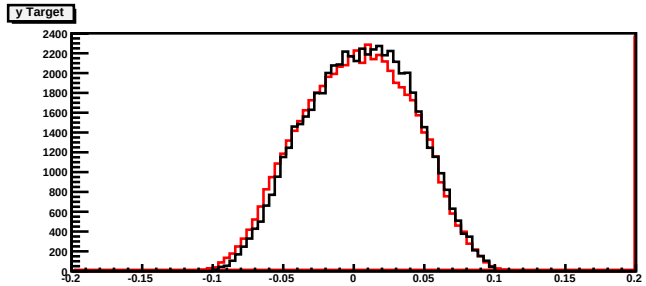


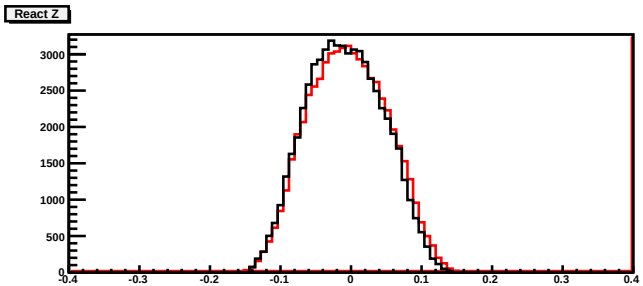


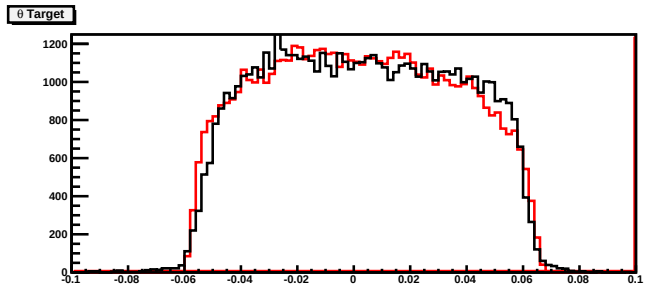
Momentum Dependence (4)

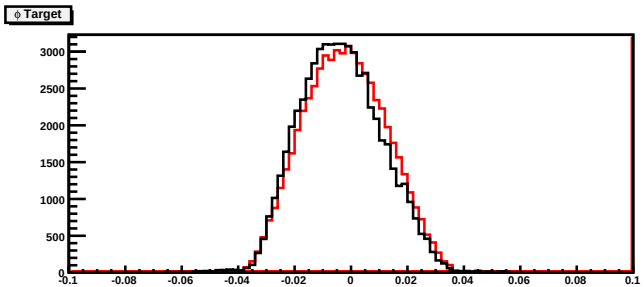
Target Variables at p = 1190 MeV, 4-pass

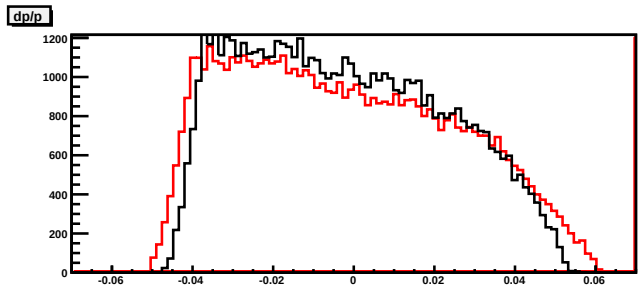






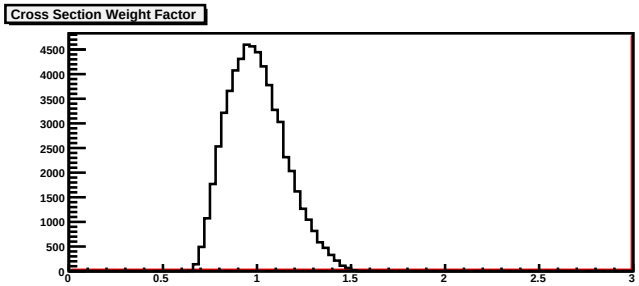


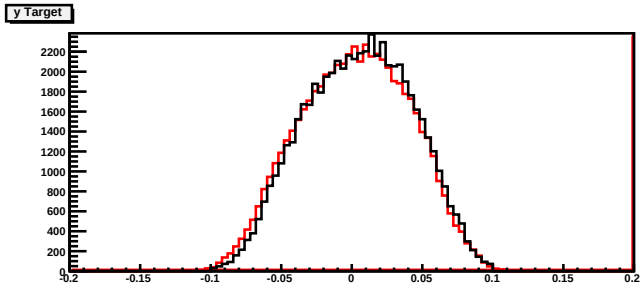


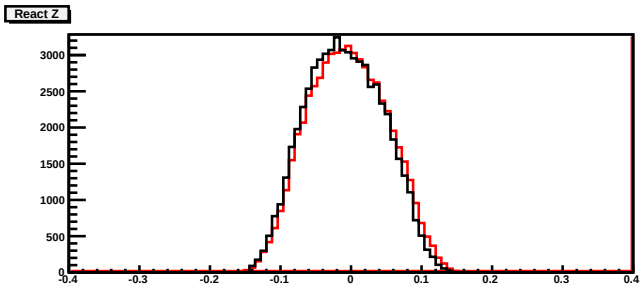


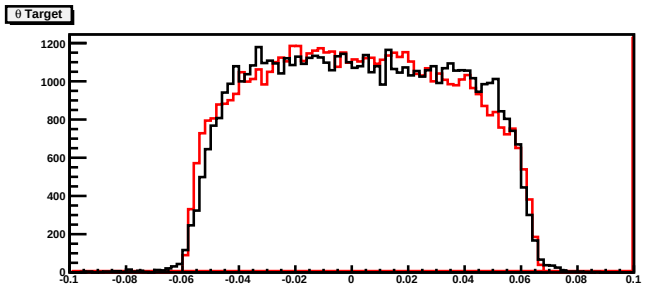
Momentum Dependence (5)

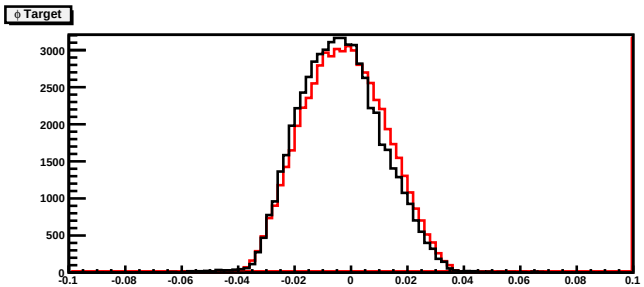
Target Variables at p = 1260 MeV, 4-pass

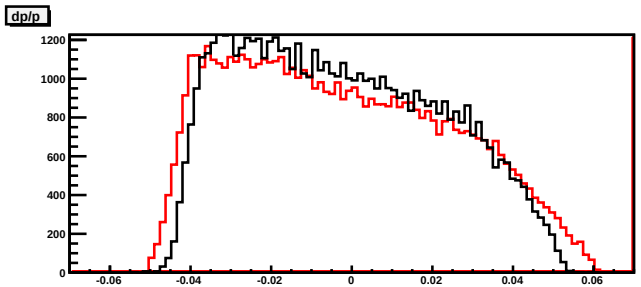






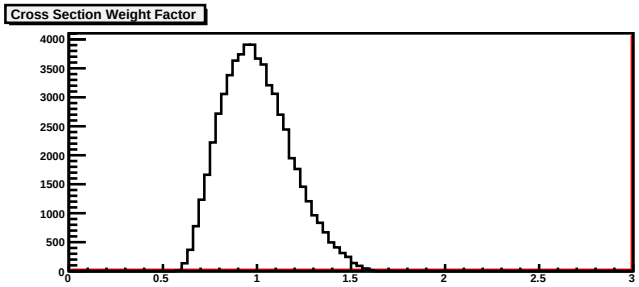


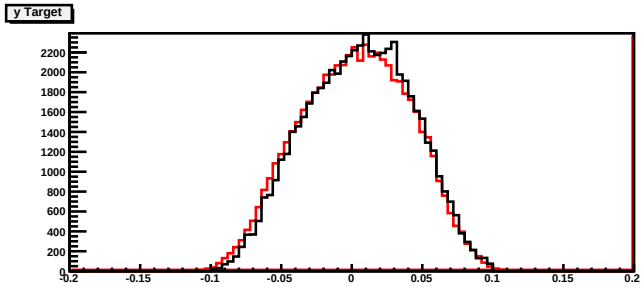


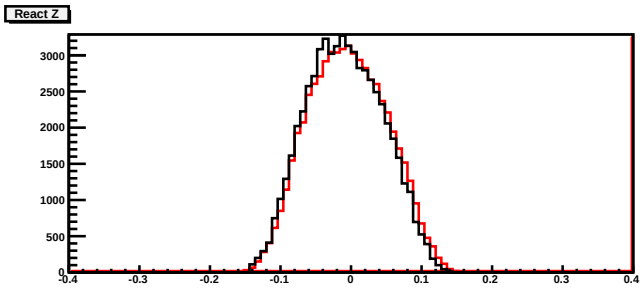


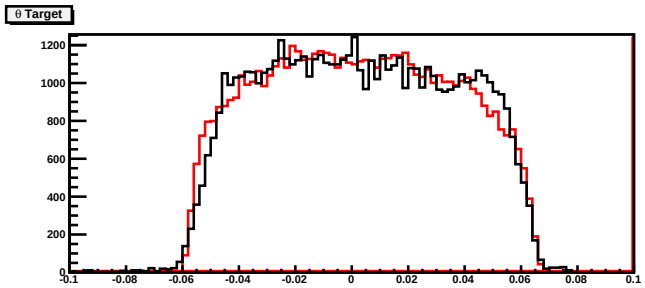
Momentum Dependence (6)

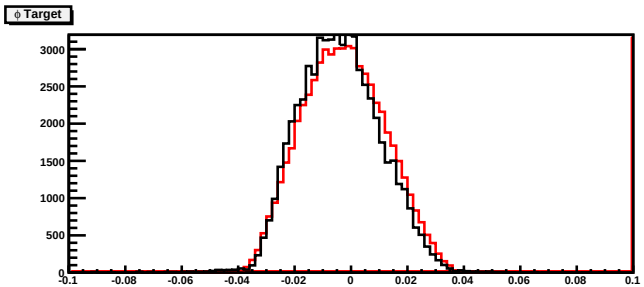
Target Variables at p = 1340 MeV, 4-pass

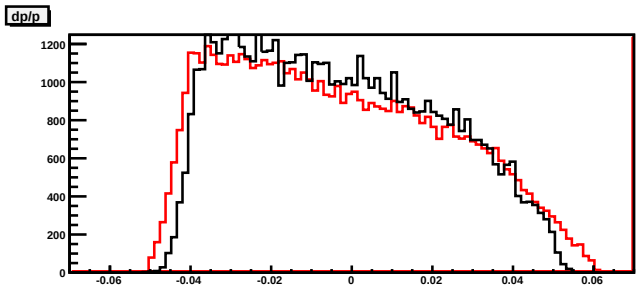






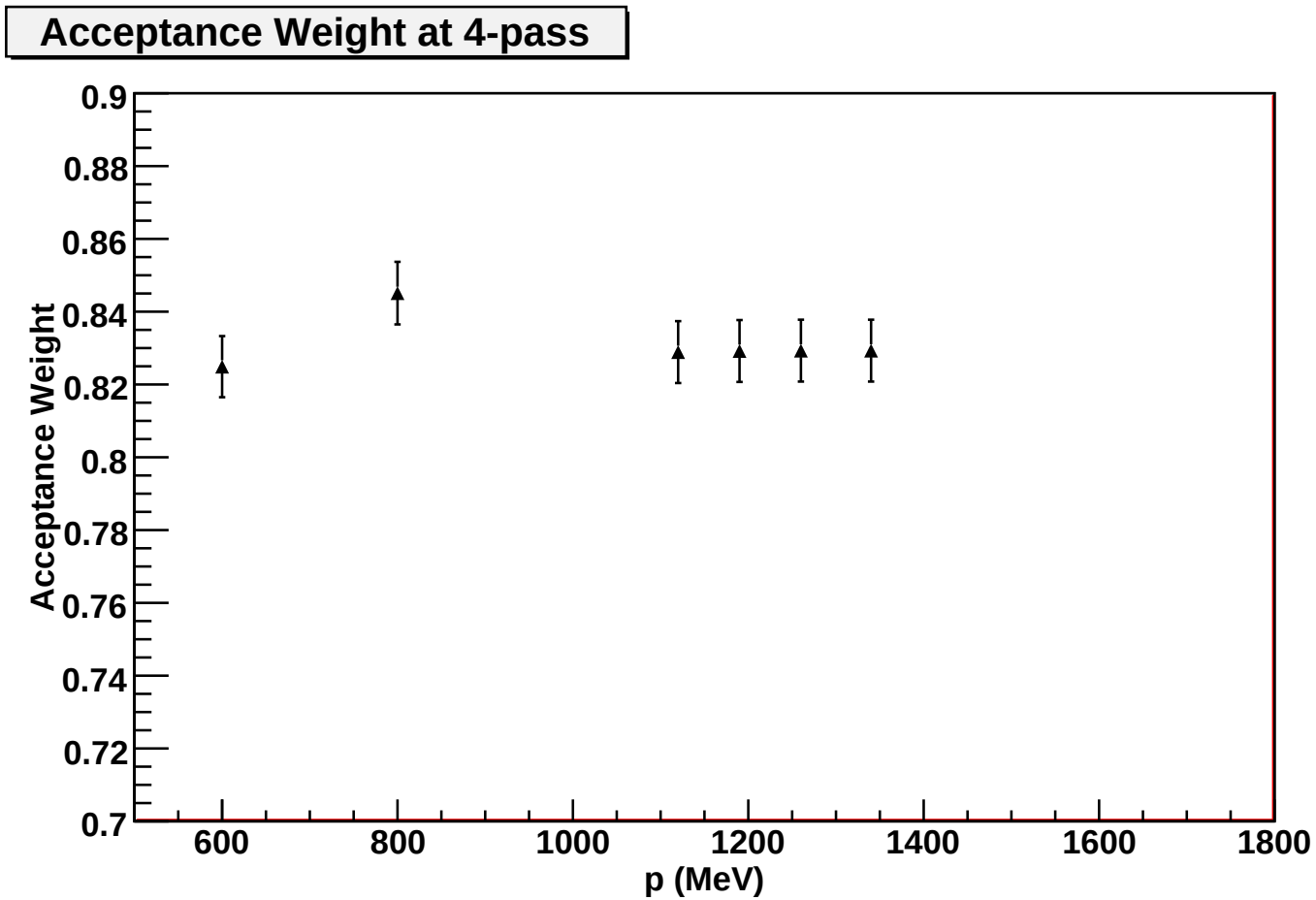






Momentum Dependence (7)

4-pass Results (So Far)



VDC One Track (1)
Inefficiency of the VDCs

- For each event, the VDC software reconstructs up to four tracks.
- Typically, the 'good events' will have one track associated with them; however, some good events could possibly end up with more than one track
  - Motivation for calculating the one-track efficiency
- Therefore, we take the zero- and multi-track events as the inefficiency of the VDCs.
  - The (calculated) efficiency of the zero- and multi-track cuts is our systematic error

VDC One Track (2)
Sample Calculation (for Good Electrons)

$p = 0.60$ GeV, $E = 4.73$ GeV		
# of Tracks	# of Events	ε (%)
0	20	0.036 ± 0.008
1	56004	99.282 ± 0.592
2	377	0.668 ± 0.035
3	8	0.014 ± 0.005
4	0	0.000 ± 0.000

- Errors shown are statistical
- Total inefficiency $= 0.036 + 0.668 + 0.014 = 0.718\%$
  - Safe estimate: $\sim 1.44\%$

VDC One Track (3)

Systematic Errors for All Kinematic Bins

VDC Systematic Error		
p (GeV)	E (GeV)	δ_{syst} (%)
0.60	4.73	1.44
0.60	5.89	1.32
0.70	5.89	1.43
0.80	4.73	1.58
0.90	5.89	1.41
1.12	4.73	1.69
1.13	5.89	1.54
1.19	4.73	1.91
1.20	5.89	1.57
1.26	4.73	1.84
1.27	5.89	1.66
1.34	4.73	1.95
1.34	5.89	2.05
1.42	4.73	1.62
1.42	5.89	2.38
1.51	4.73	1.79
1.51	5.89	1.66
1.60	4.73	2.09
1.60	5.89	2.34
1.70	5.89	2.76

T3 Trigger (1)
Inefficiency of T3: The T4 Trigger

- Recall the T3 trigger definition: Logical AND between S1 and S2m – good electrons should always satisfy this requirement
  - The T4 trigger shows the inefficiency of the T3 trigger: Logical AND between either S1 or S2m and the gas Čerenkov – it's possible a good electron creates a T4 some percentage of the time
- We can take the efficiency of the T4 trigger as the systematic error for the T3 trigger
- Example result at $p = 0.60\ \mathrm{GeV}$, $E = 4.73\ \mathrm{GeV}$:

$$\begin{aligned} \varepsilon_{T3} &= 99.969\% \\ \varepsilon_{T4} &= 0.031\% \end{aligned}$$

- Safe estimate: $\sim 0.062\%$

T3 Trigger (2)
Systematic Errors for All Kinematic Bins

T3 Trigger Systematic Error		
p (GeV)	E (GeV)	δ_{syst} (%)
0.60	4.73	0.062
0.60	5.89	0.074
0.70	5.89	0.090
0.80	4.73	0.106
0.90	5.89	0.098
1.12	4.73	0.082
1.13	5.89	0.130
1.19	4.73	0.104
1.20	5.89	0.042
1.26	4.73	0.036
1.27	5.89	0.108
1.34	4.73	0.100
1.34	5.89	0.074
1.42	4.73	0.088
1.42	5.89	0.104
1.51	4.73	0.096
1.51	5.89	0.114
1.60	4.73	0.076
1.60	5.89	0.096
1.70	5.89	0.112

Summary

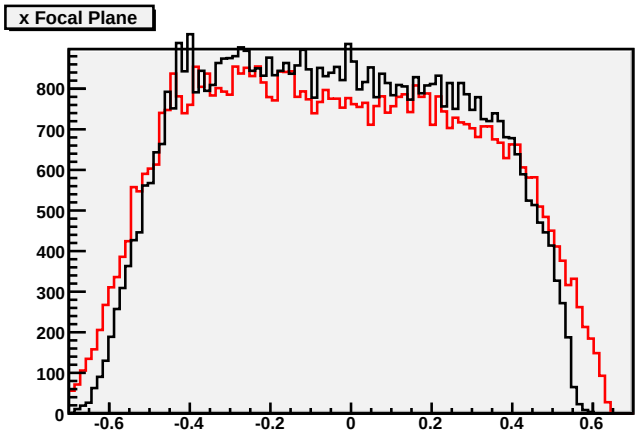
- Acceptance:
  - Looks consistent across the whole kinematic range at 4-pass
    - Need to double-check $p = 800\ \mathrm{GeV}$ input parameters (beam x and y widths) against data
- Systematic errors:
  - VDC: estimates are at the 1–2% level for all kinematic bins
  - T3 trigger: estimates are at the 0.1% level for all kinematic bins

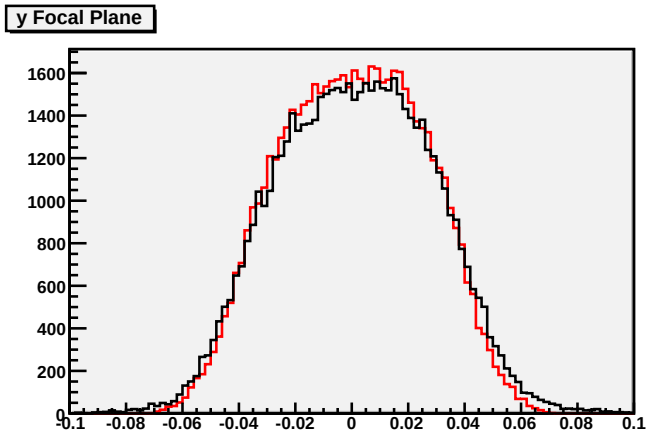
What's Next?

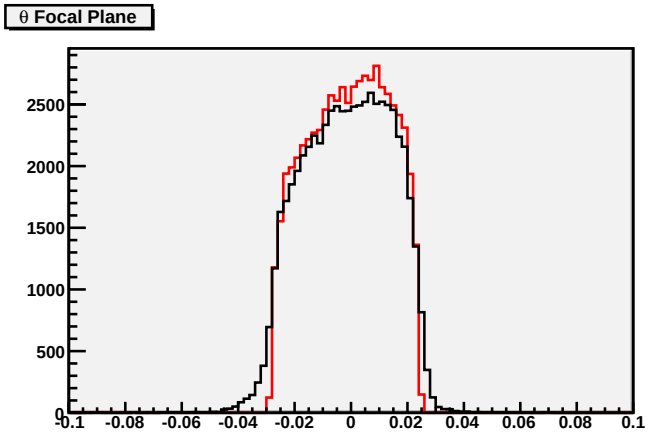
- Acceptance:
  - Keep running SAMC for each kinematic bin
- Cross Section:
  - Carbon runs are ready – what about the target density (?)
  - Gather appropriate world ^{3}He data to compare to our results
  - Start tweaking QFS and thinking about radiative corrections
- Systematic Errors:
  - Charge
  - Deadtime (livetime)
  - SAMC

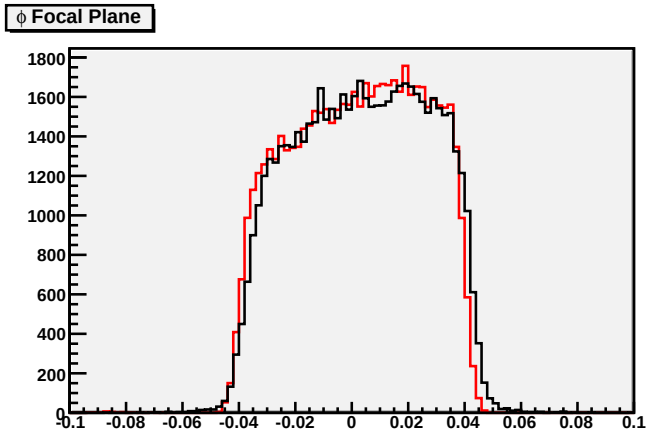
Appendix: Momentum Dependence (1)

Focal Plane Variables at p = 600 MeV, 4-pass



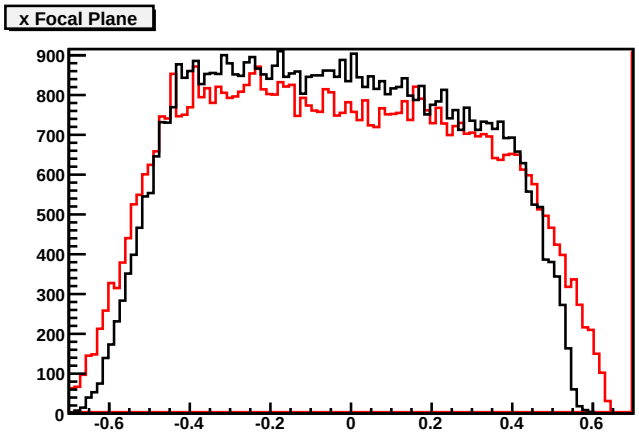


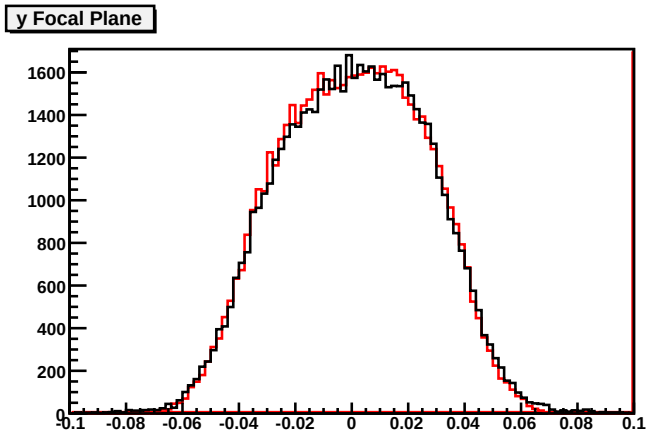


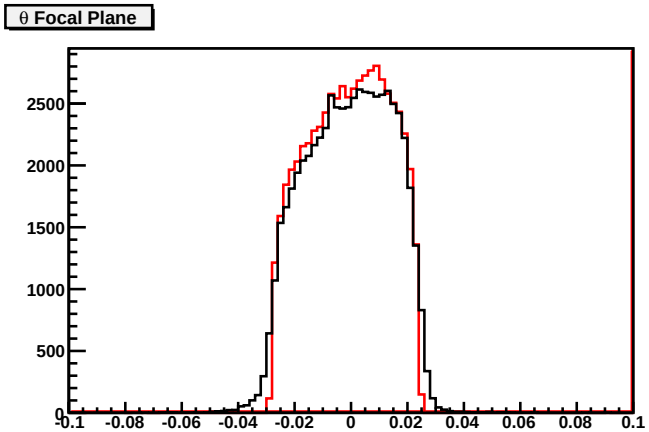


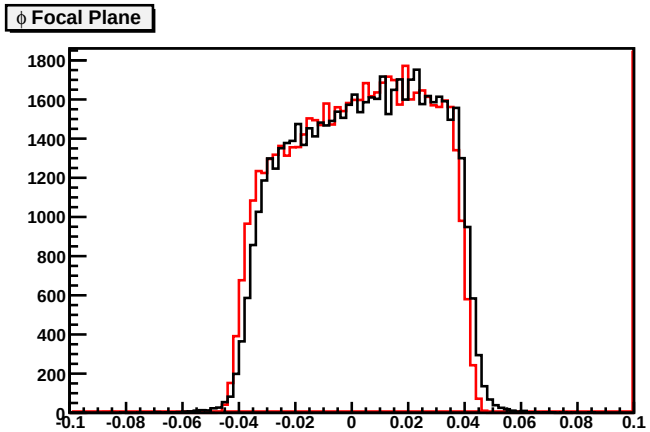
Appendix: Momentum Dependence (2)

Focal Plane Variables at p = 800 MeV, 4-pass



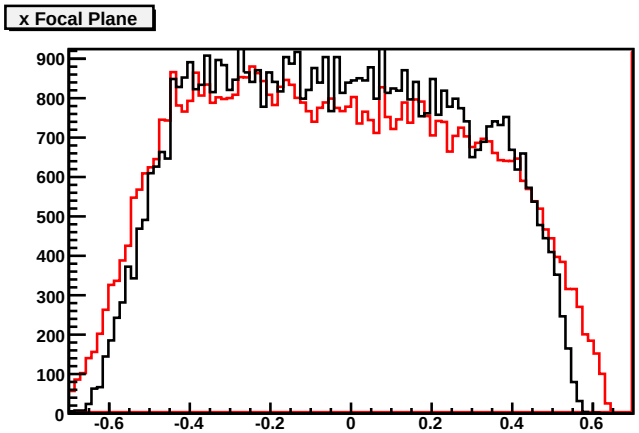


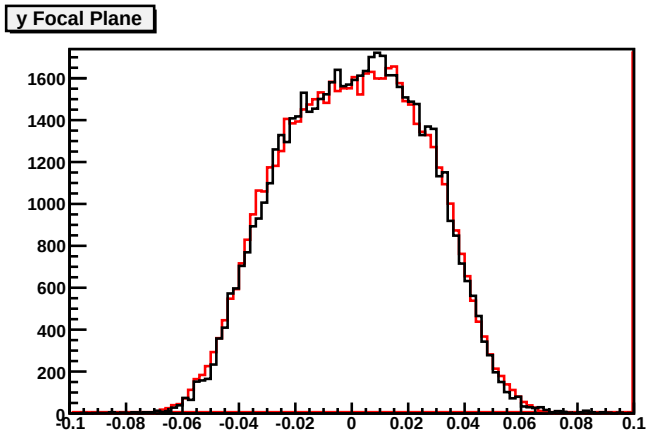


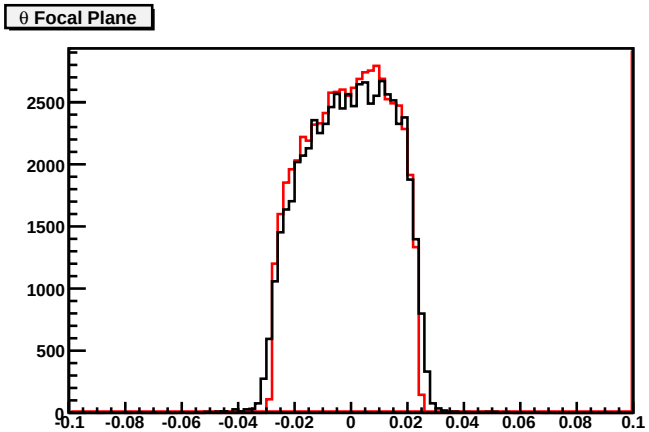


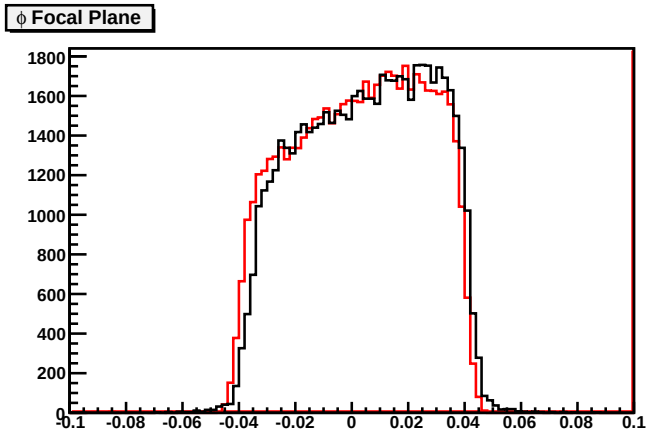
Appendix: Momentum Dependence (3)

Focal Plane Variables at p = 1120 MeV, 4-pass



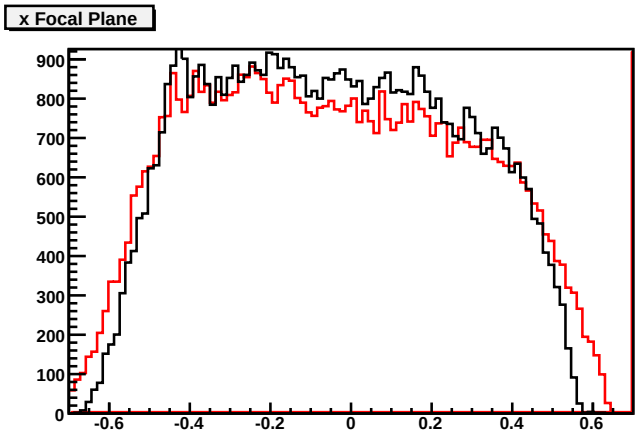


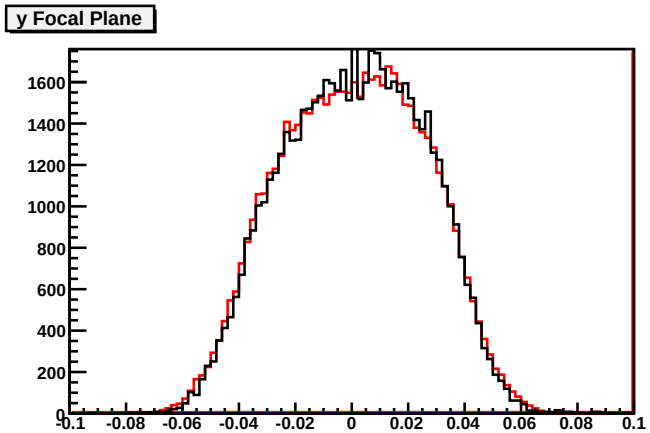


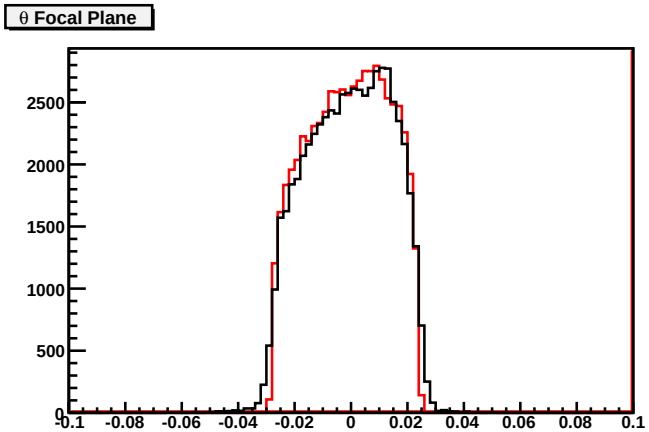


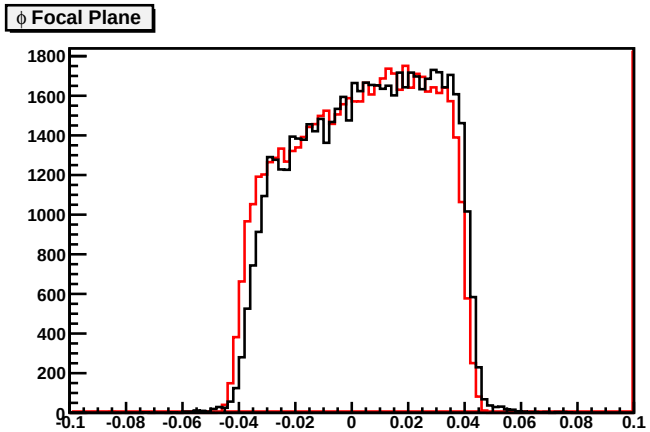
Appendix: Momentum Dependence (4)

Focal Plane Variables at p = 1190 MeV, 4-pass



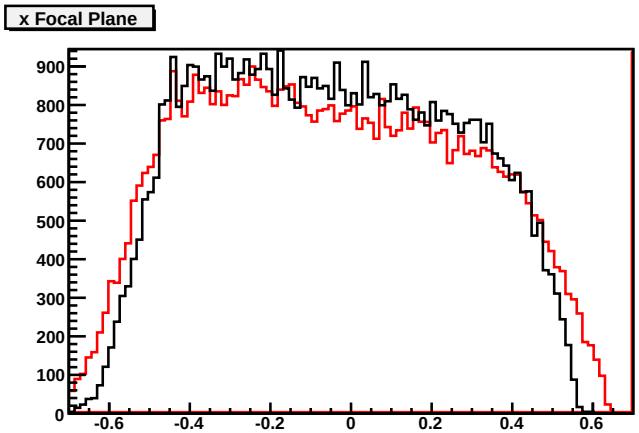


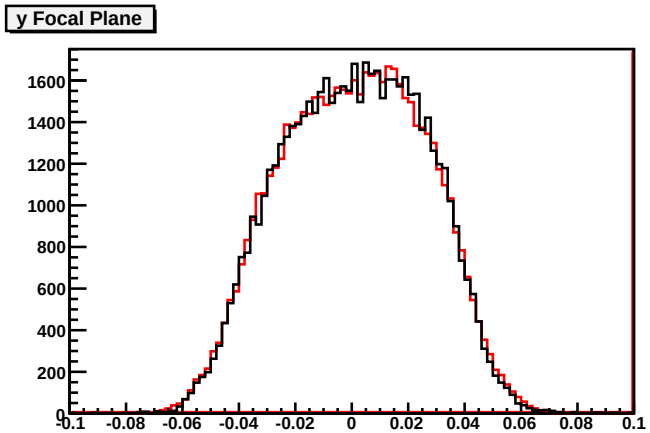


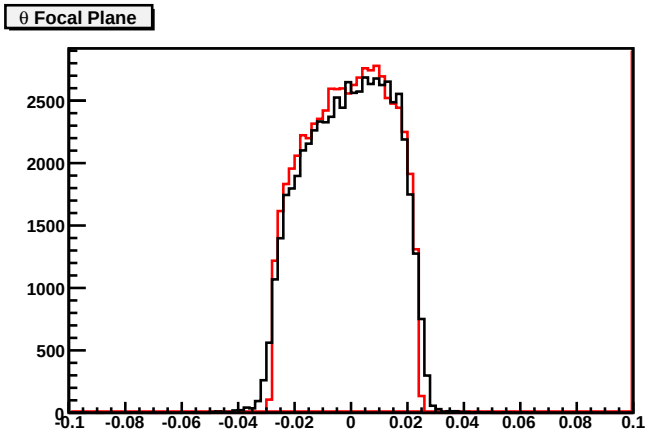


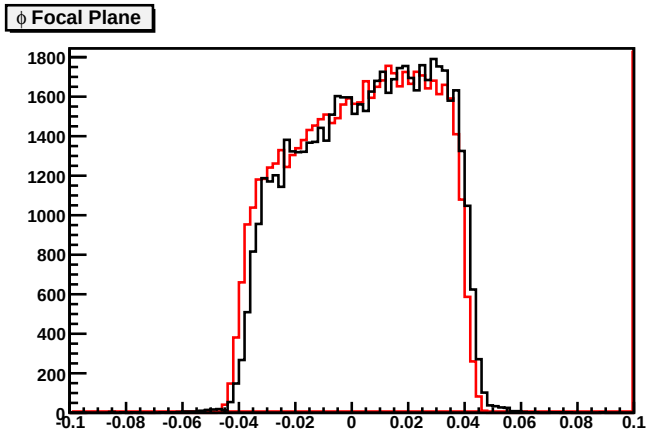
Appendix: Momentum Dependence (5)

Focal Plane Variables at p = 1260 MeV, 4-pass









Appendix: Momentum Dependence (6)

Focal Plane Variables at p = 1340 MeV, 4-pass