Work Summary

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Cross section extraction

- $Yield = \frac{N_s^i * prescale}{N_e * LT * \epsilon_{eff}}$
- i: ith bin
- N_s^i: number of scattered electrons in ith bin
- N_e: total number of electrons in the beam
- ϵ_{eff}: total efficiency, including detection efficiency, cut efficiency
- LT: live time

Beam Charge

- BCM Calibration (Completed by Shujie and Mike)
  - Unser Calibration
    - Pass a wire with a known current through the Unser over a given range in currents(3μA-25μA), and then determine the gain and offset of the Unser
  - Use Unser as a reference to calibrate BCMs
    - Only signals from unew and dnew are used in this experiment
- Results

Run#	730	731	739	740	747	748	755	756	763
unew	2542.07	2622.68	2675.35	3933.96	2715.18	2661.95	2443.41	2618.53	2887.96
dnew	2512.14	2650.65	2642.61	4046.64	2783.02	2741.85	2432.18	2587.74	2873.71
average	2527.11	2636.67	2658.98	3990.3	2749.1	2701.9	2437.80	2603.14	2880.84
Stat err(%)	1.99	1.95	1.94	1.58	1.91	1.92	2.03	1.96	1.86

- $Stat\ err = \frac{(\sqrt{unew}+\sqrt{dnew})/2}{\text{average}}$

Live time

- Percentage of trigger events being recorded to the total trigger events
  - $LT = \frac{\#events\,recorded * prescale}{\#events\,sent\,to\,DAQ}$
- Results

Run#	730	731	739	740	747	748	755	756	763
recorded	276217	272537	271609	412528	275643	276838	290804	275101	272858
prescale	5	15	12	10	9	7	5	5	5
total	1404670	4155140	3310050	4191340	2516110	1989050	1479850	1400900	1387940
Live time	0.98321	0.983854	0.98467	0.98424	0.98596	0.974269	0.982543	0.981869	0.982958
Stat err(%)	0.022	0.012	0.014	0.012	0.015	0.023	0.022	0.023	0.022

- Wilson score Interval
  - $LT = \frac{1}{1+\frac{1}{n}z^2}[p + \frac{1}{2n}z^2 \pm z\sqrt{(\frac{1}{n}p(1-p) + \frac{1}{4n^2}z^2)}]$ for a 95% confidence level, z=1.96

Trigger Efficiency

- T3 : (S0&&S2) && (GC||PR)
- The detection efficiency of GC and PR are both 100%, so trigger efficiency is (S0&&S2) efficiency
- Calculate S0&&S2 efficiency
  - Select sample events
    - T5 (S0||S2) && (GC||PR)
    - Single track
    - Acceptance cuts
    - PID cuts
  - $\epsilon = \frac{\#events\ have\ signal\ on\ both\ S0\ and\ S2}{\#sample\ events}$
- Results

Run#	730	731	739	740	747	748	755	756	763
Trigger eff	0.9990	0.9986	0.9991	0.9985	0.9991	0.9989	0.9996	0.9994	0.9989
Stat err(%)	0.073	0.070	0.066	0.062	0.064	0.069	0.048	0.055	0.070

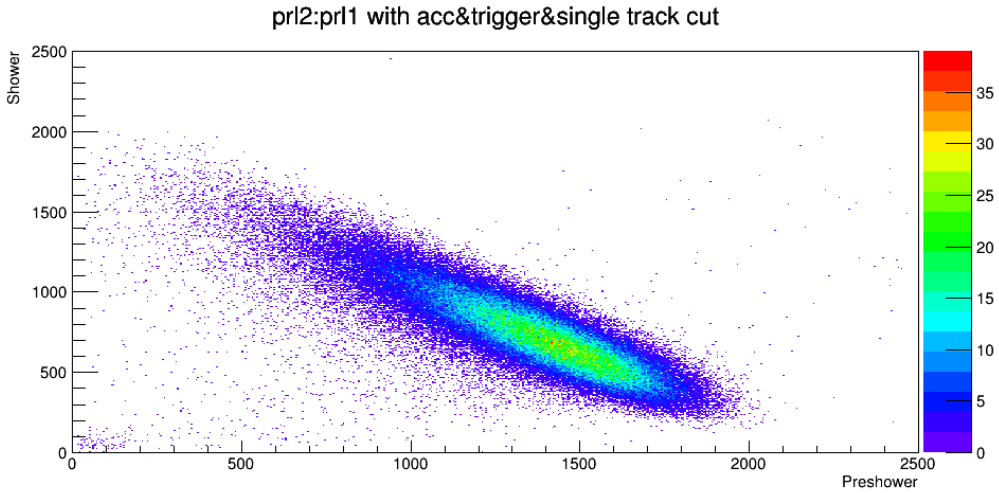
VDC one track Efficiency

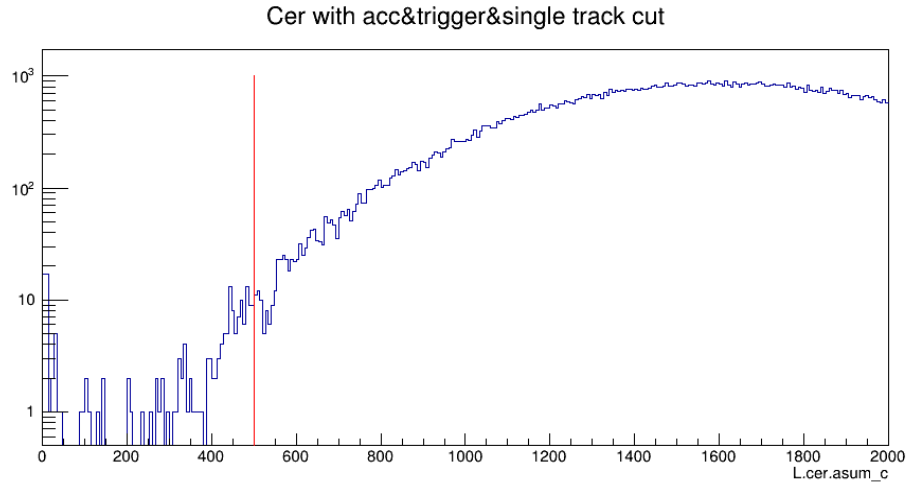
- Select Sample events
  - T3 (S0&&S2)&&(GC||PR)
  - Acceptance cuts
  - PID cuts
- $\epsilon = \frac{\#single\ track\ events}{\#sample\ events}$
- Results

Run#	730	731	739	740	747	748	755	756	763
VDC eff	0.9921	0.9840	0.9846	0.9877	0.9888	0.9899	0.9910	0.9914	0.9919
Stat err(%)	0.049	0.059	0.062	0.045	0.052	0.049	0.046	0.046	0.045

Cerenkov Cut Efficiency

- Little pion contamination
- Set cer cut at 500
- Select Sample events
  - T3 (S0&&S2)&&(GC||PR)
  - Single track
  - Acceptance cuts
  - Calorimeter cut
- $\epsilon = \frac{\#events\ with\ cer>500}{\#sample\ events}$
- Results

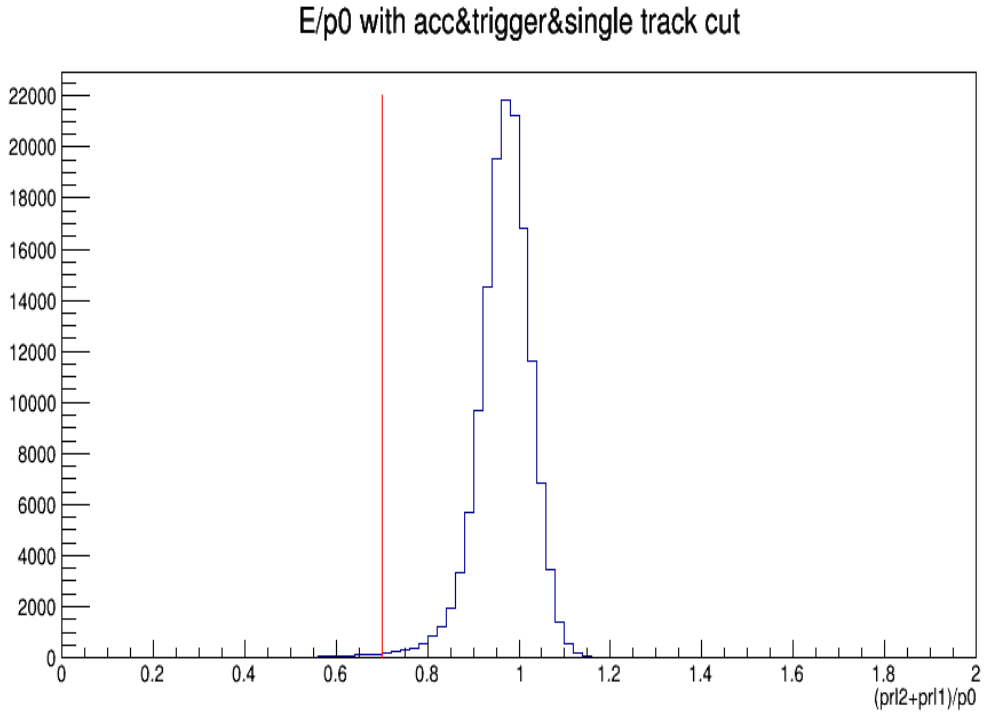




Run#	730	731	739	740	747	748	755	756	763
Cer cut eff	0.9990	0.9986	0.9981	0.9987	0.9987	0.9983	0.9982	0.9981	0.9980
Stat err(%)	0.035	0.035	0.046	0.032	0.038	0.048	0.045	0.048	0.051

Calorimeter Cut Efficiency

- Set cut as E/p0 > 0.7
- Select Sample events
  - T3 (S0&&S2)&&(GC||PR)
  - Single track
  - Acceptance cuts
  - Cer>800
- $\epsilon = \frac{\#events\ with\ E/p0>0.7}{\#sample\ events}$
- Results



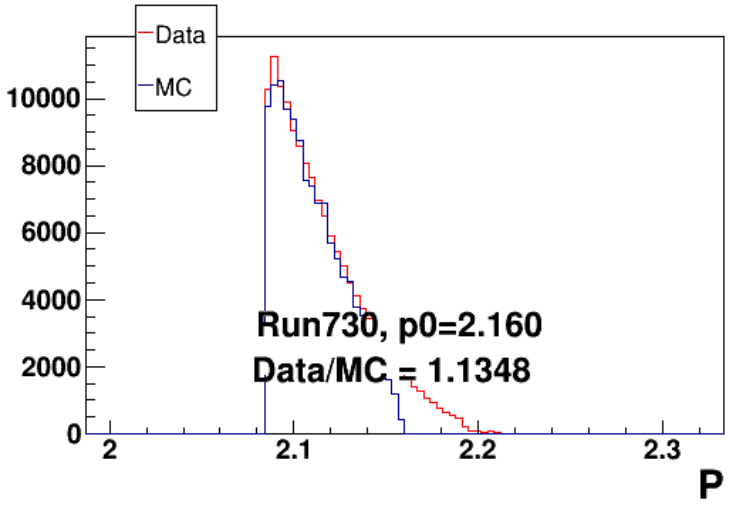
Run#	730	731	739	740	747	748	755	756	763
Calo cut eff	0.9943	0.9953	0.9952	0.9950	0.9954	0.9952	0.9953	0.9947	0.9947
Stat err(%)	0.040	0.033	0.036	0.029	0.034	0.035	0.034	0.037	0.037

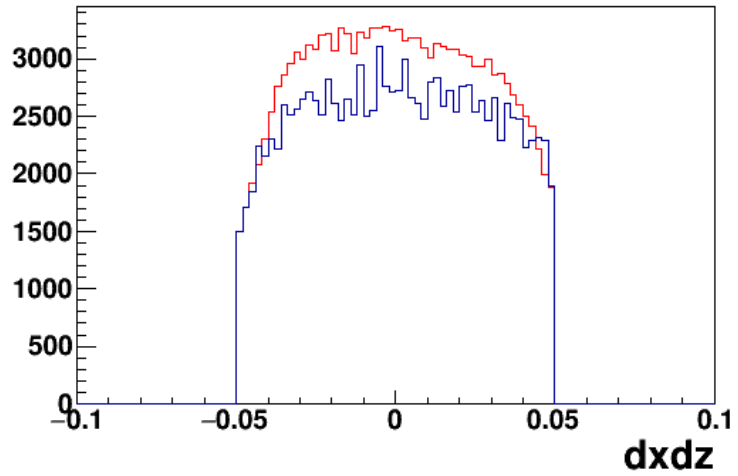
Total statistical error

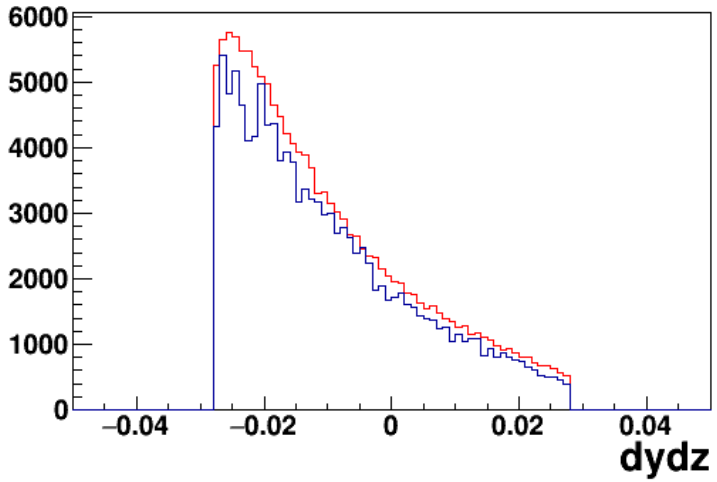
Run#	730	731	739	740	747	748	755	756	763
Stat err(%)	1.993	1.953	1.943	1.582	1.913	1.923	2.032	1.962	1.863

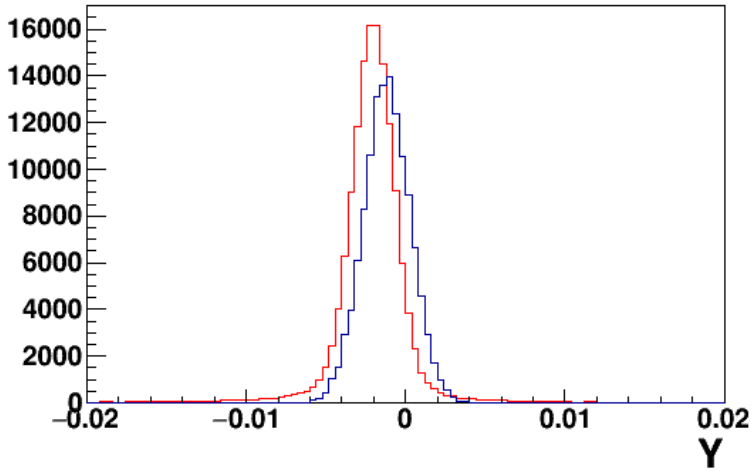
Statistical error from the number of scattered electrons in each bin is not included

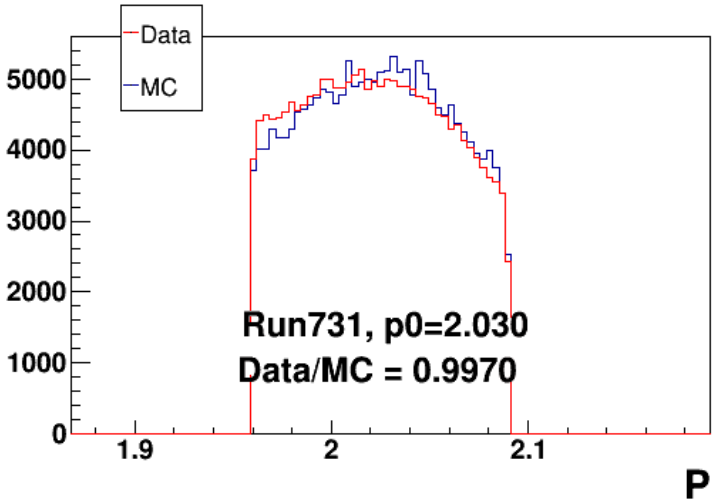
Simulation Results







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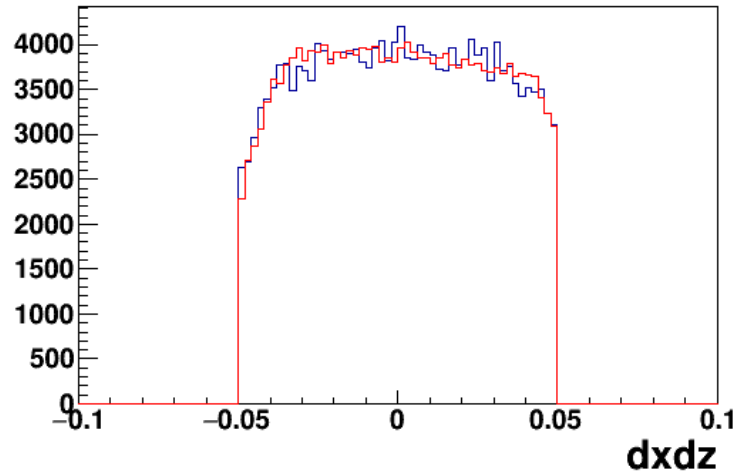
P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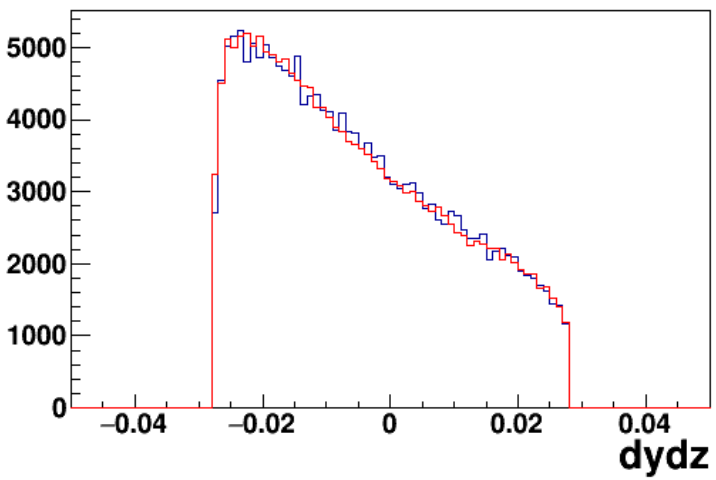
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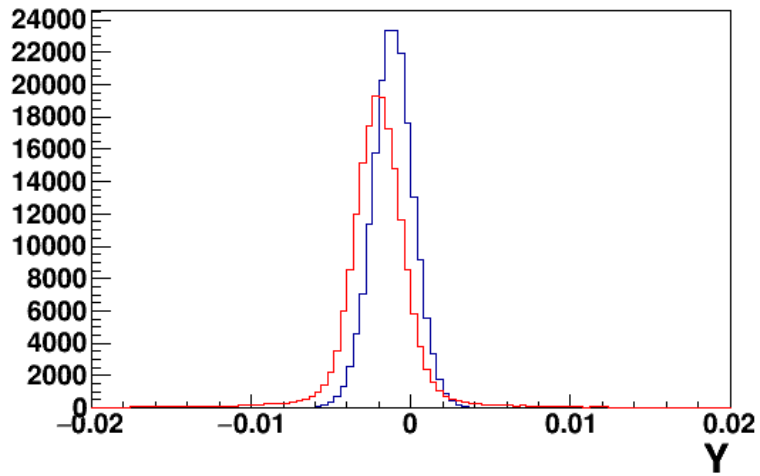
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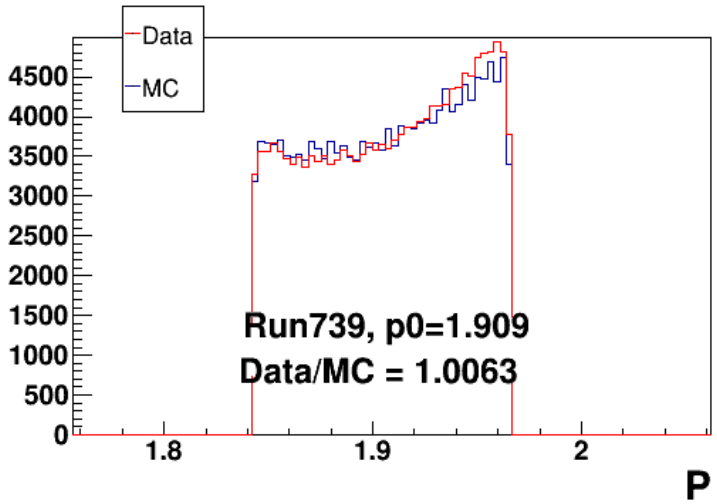
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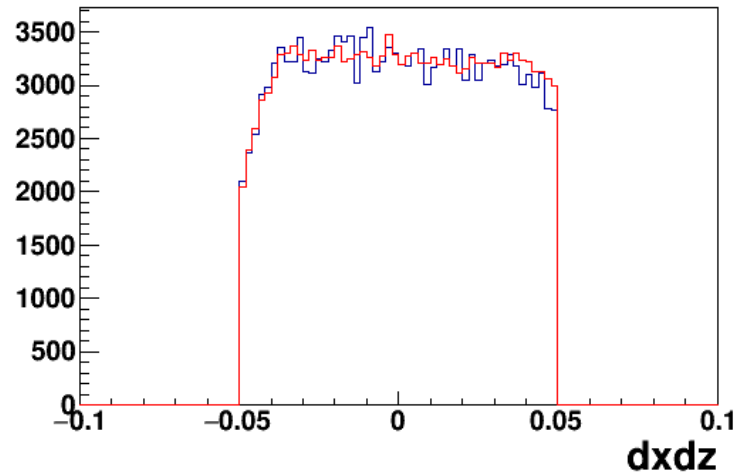
P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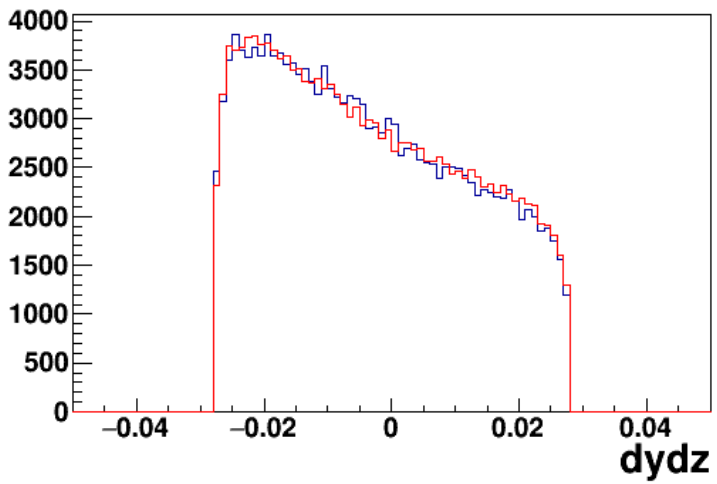
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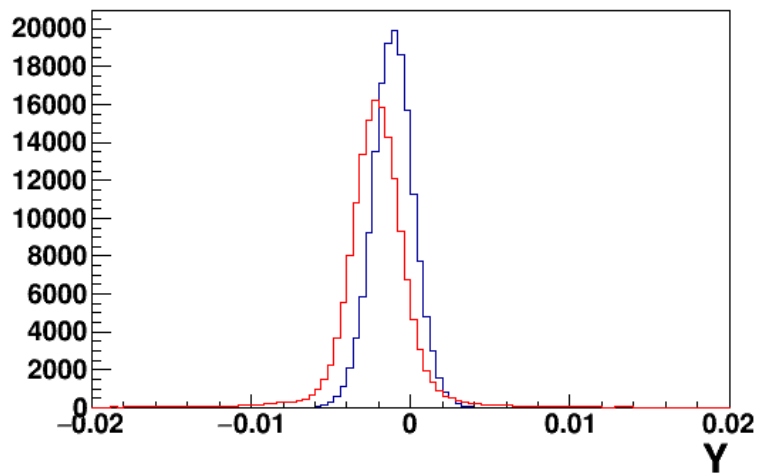
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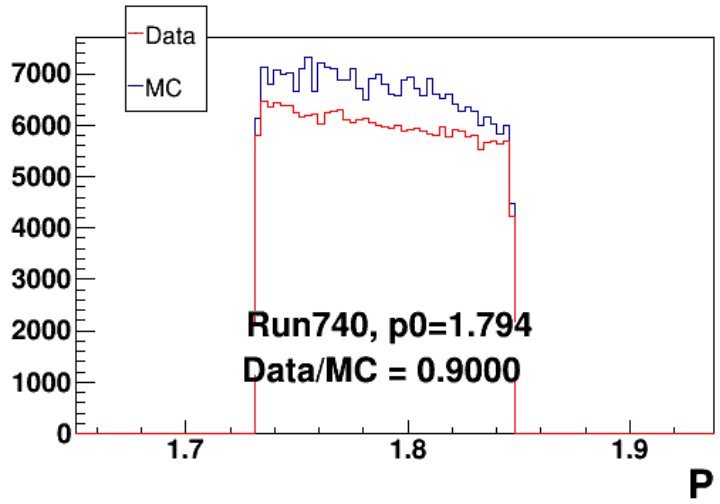
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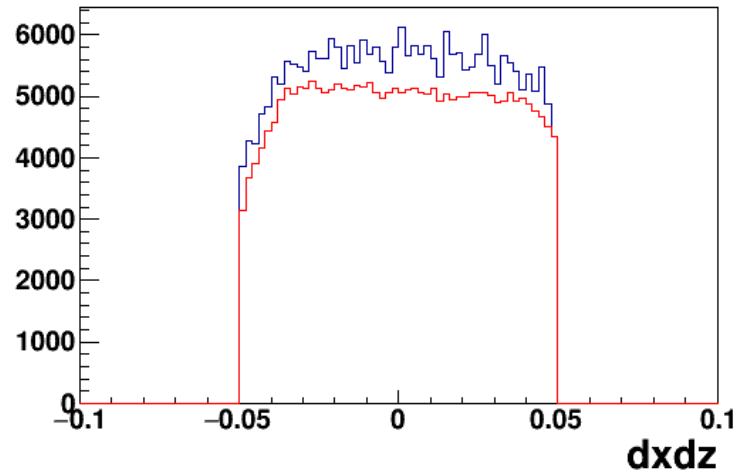
4000
3000
2000
1000
0
1.7
1.8
1.9
P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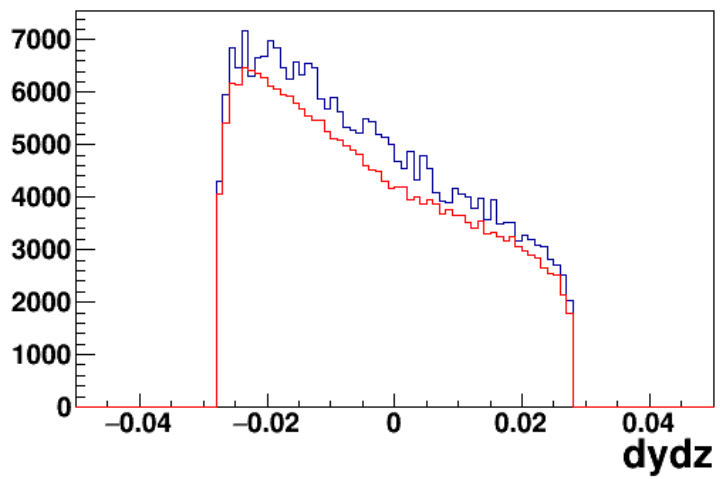
5000
4000
3000
2000
1000
0
−0.1
−0.05
0
0.05
0.1
dxdz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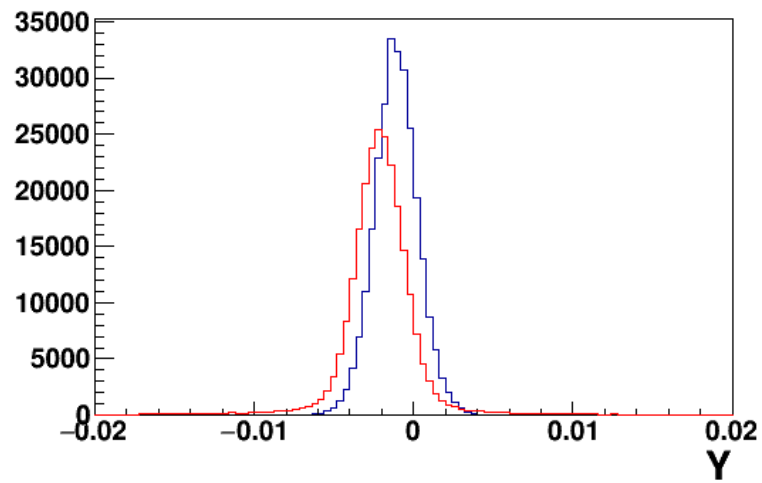
6000
5000
4000
3000
2000
1000
0
−0.04
−0.02
0
0.02
0.04
dydz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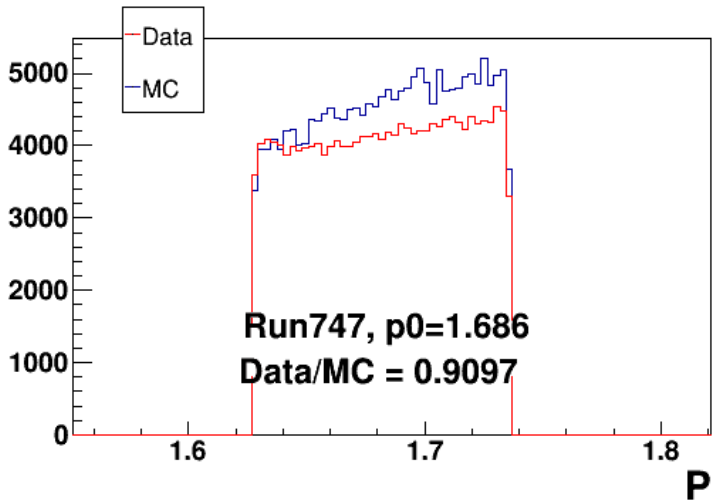
25000
20000
15000
10000
5000
0
−0.02
−0.01
0
0.01
0.02
Y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3000
2000
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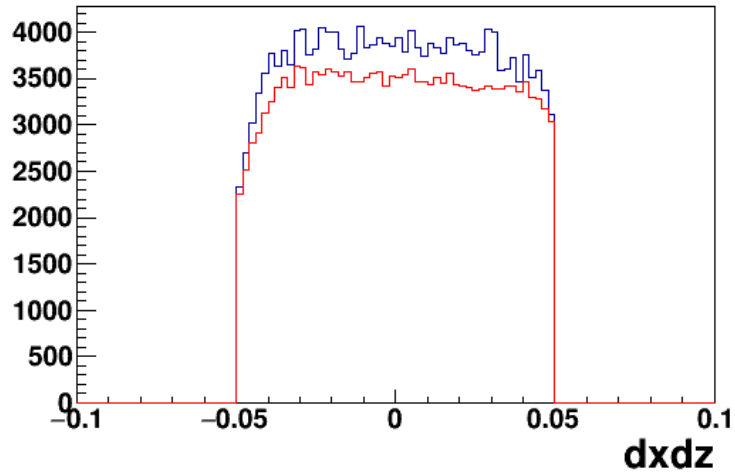
1.6
1.7
1.8
P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2500
2000
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500
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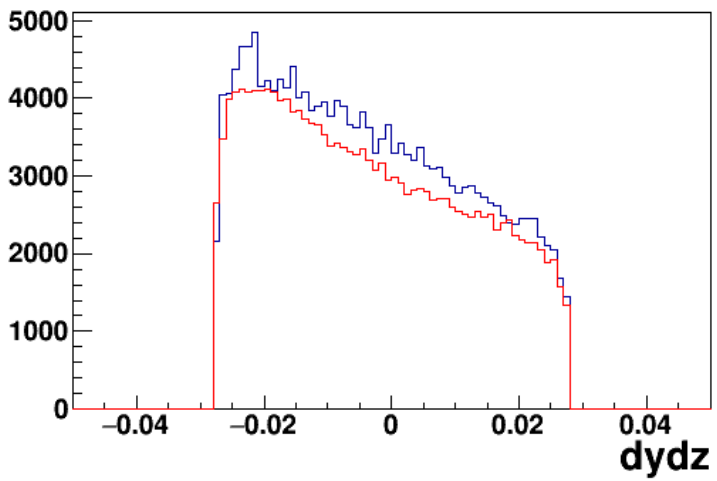
0.05
0.1
dxdz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1000
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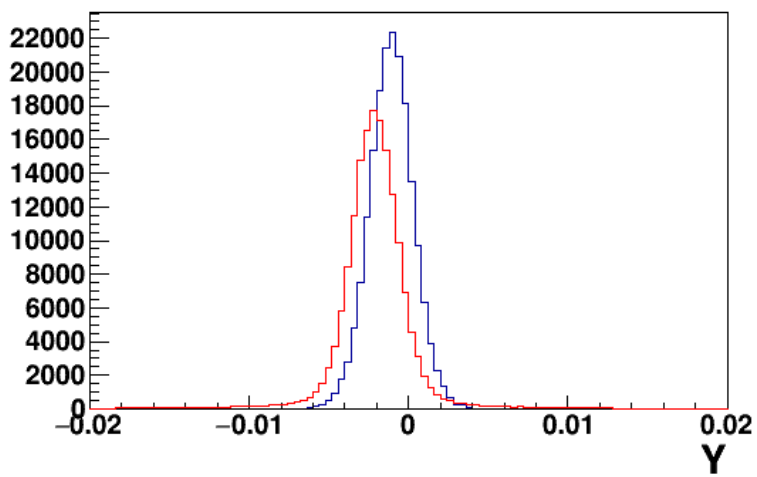
−0.02
0
0.02
0.04
dydz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6000
4000
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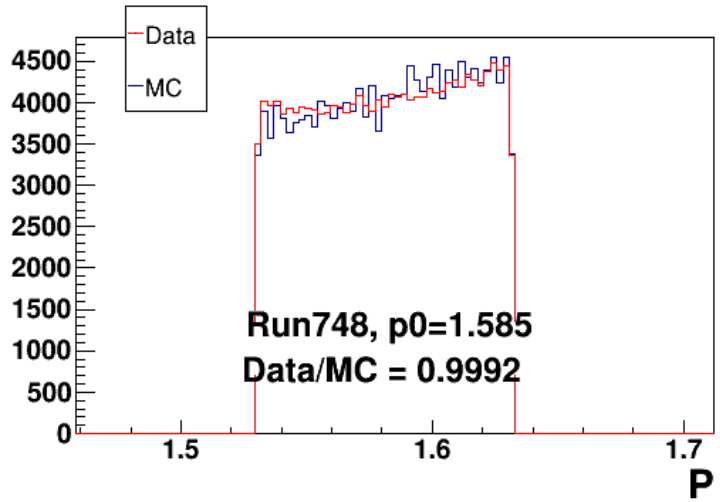
−0.01
0
0.01
0.02
Y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Run748, p0=1.585
Data/MC = 0.9992
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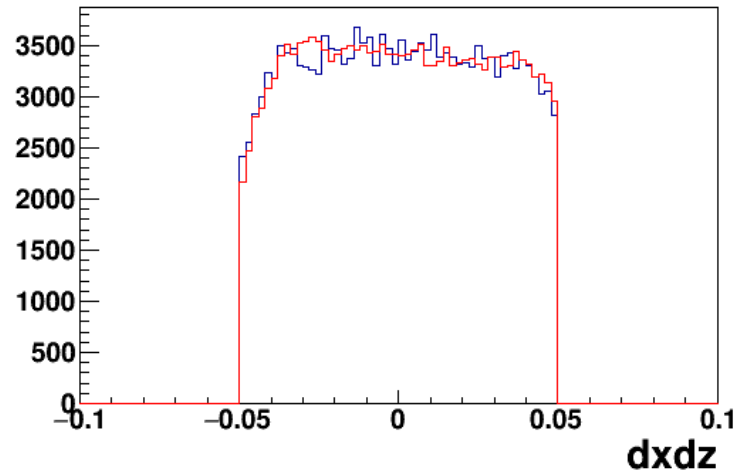
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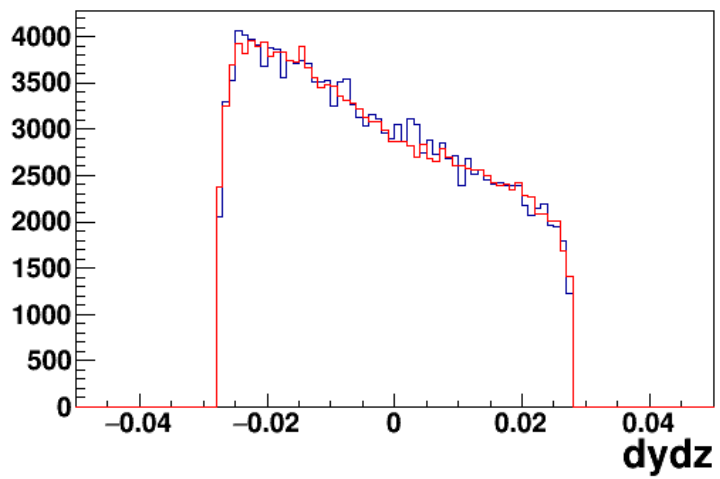
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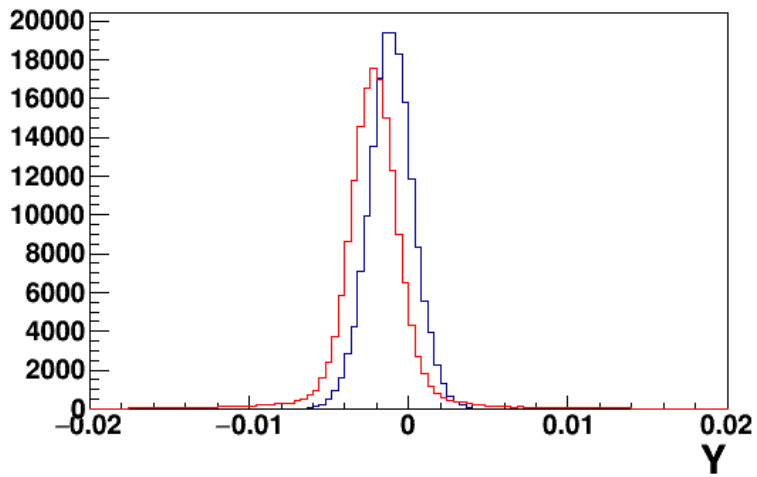
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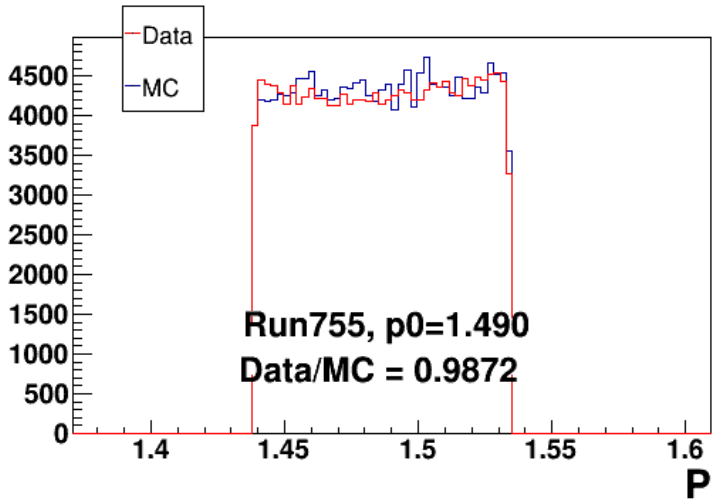
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Run755, p0=1.490
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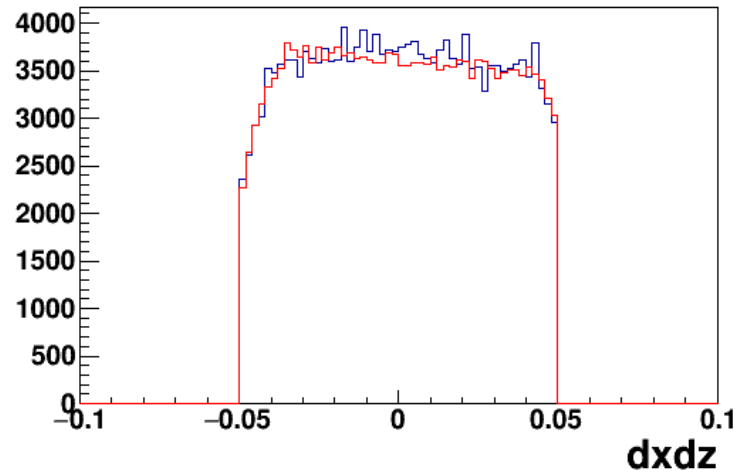
P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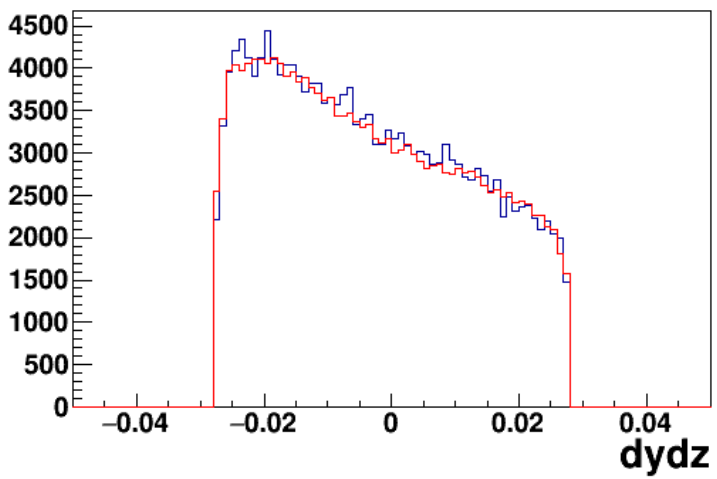
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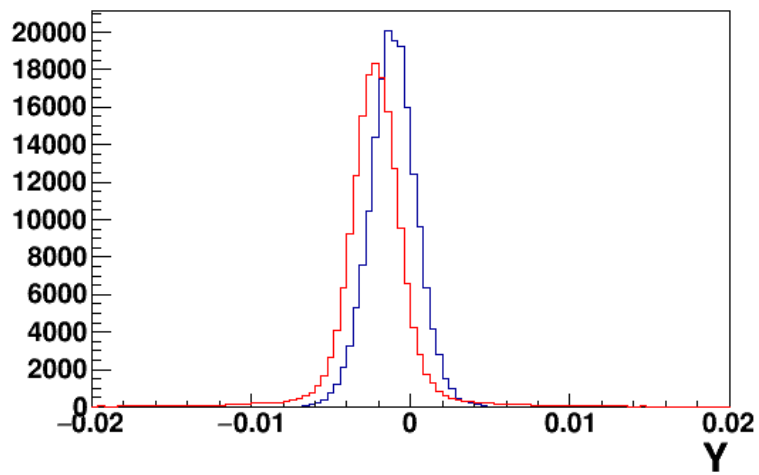
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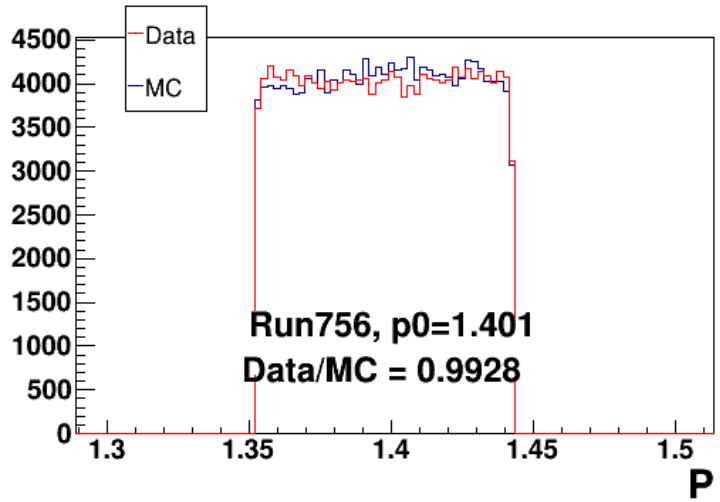
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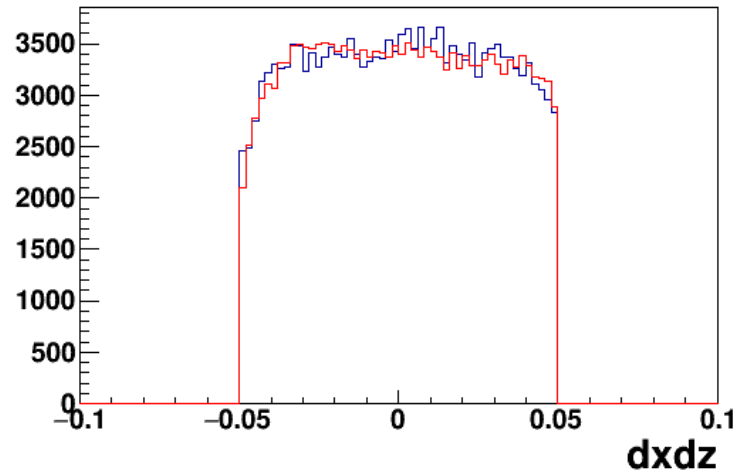
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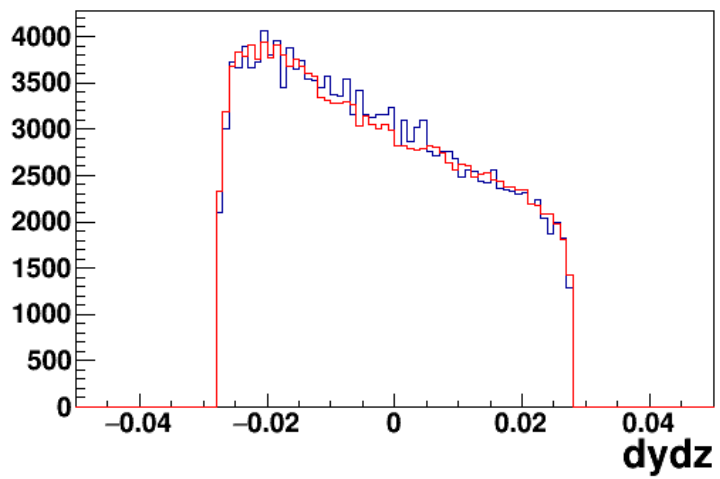
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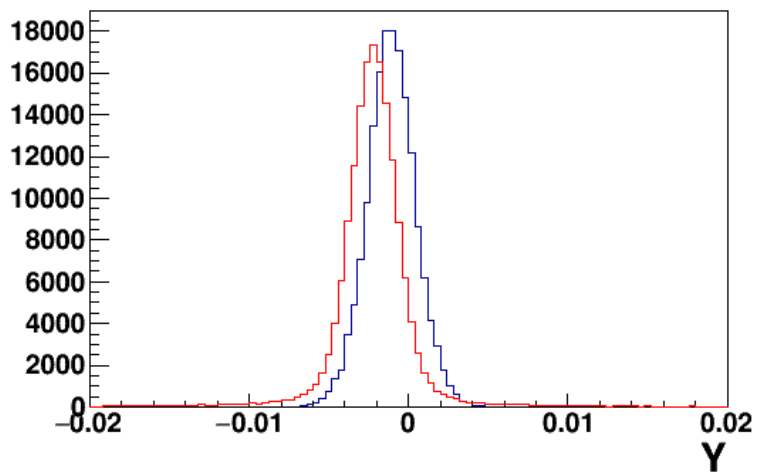
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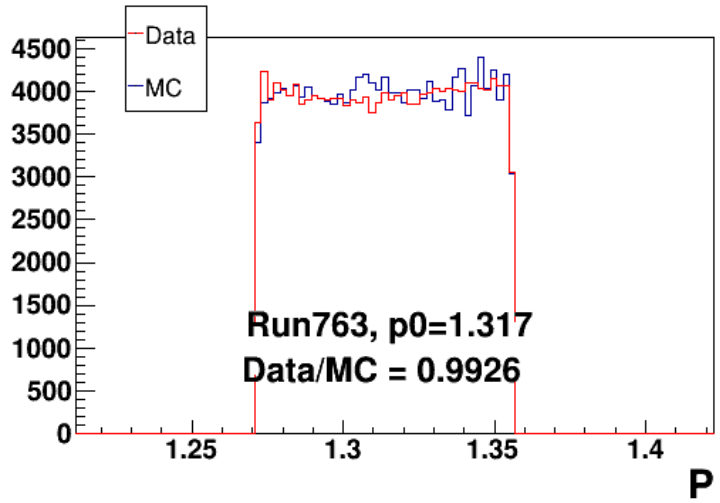
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Run763, p0=1.317
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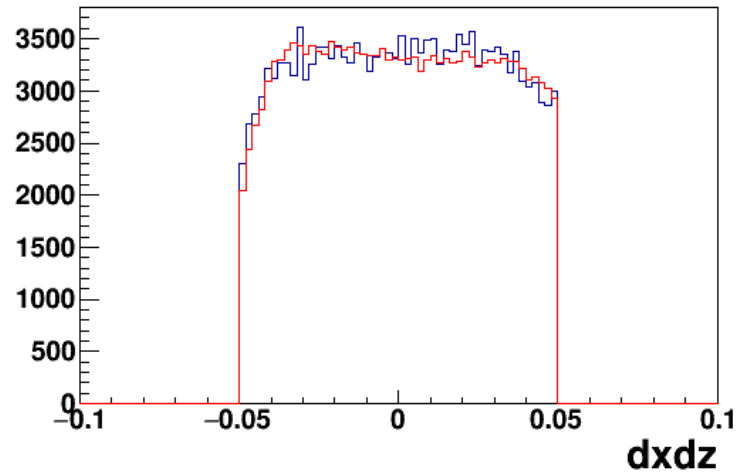
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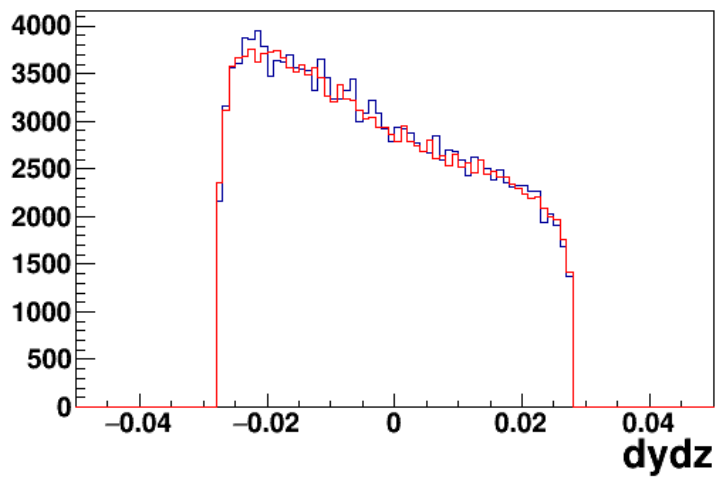
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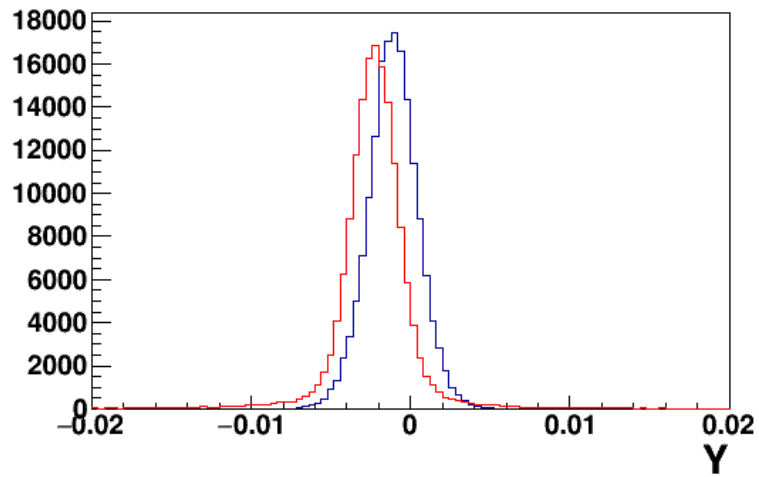
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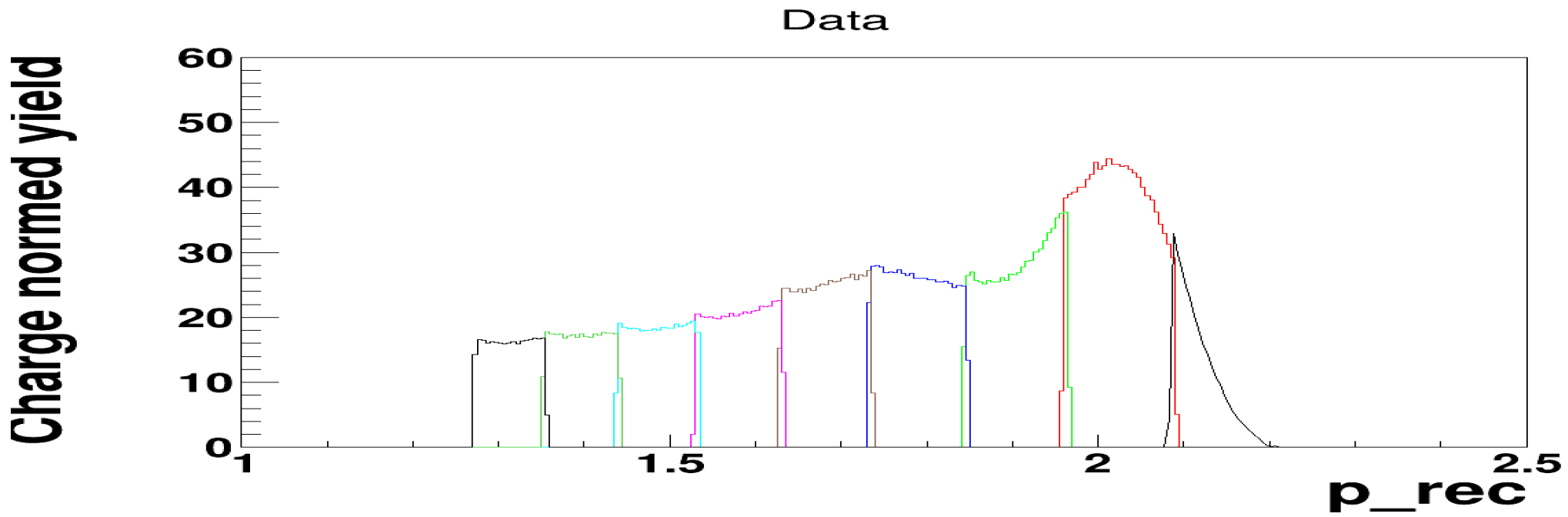
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Charge normed yield
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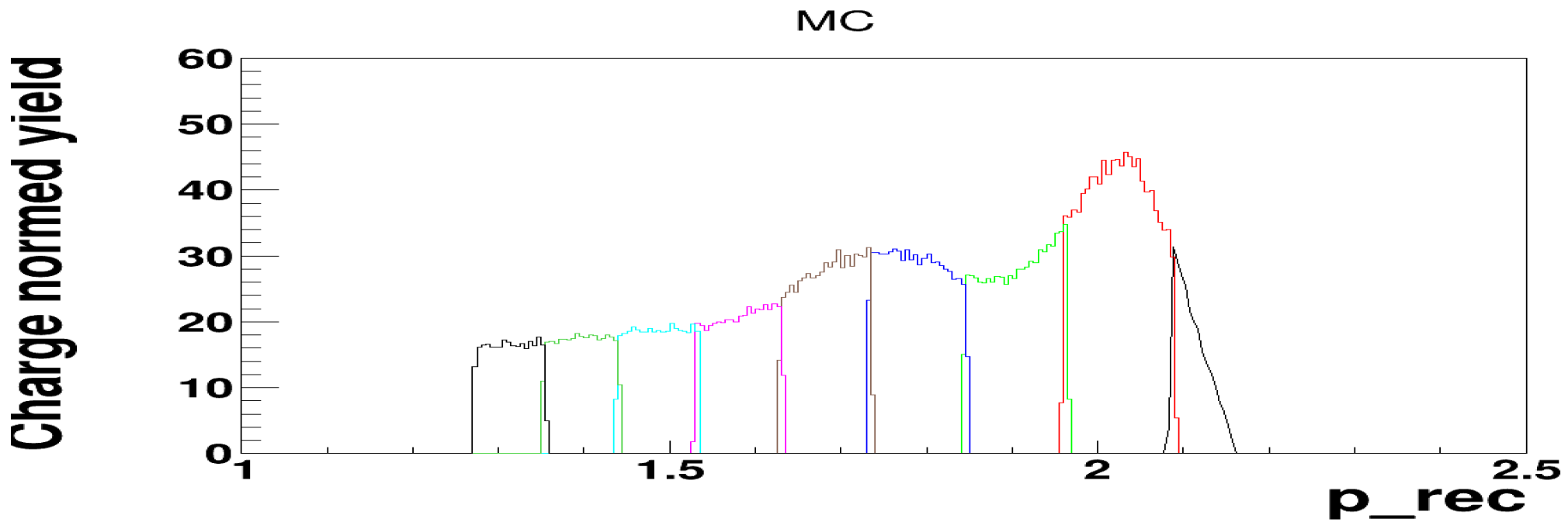
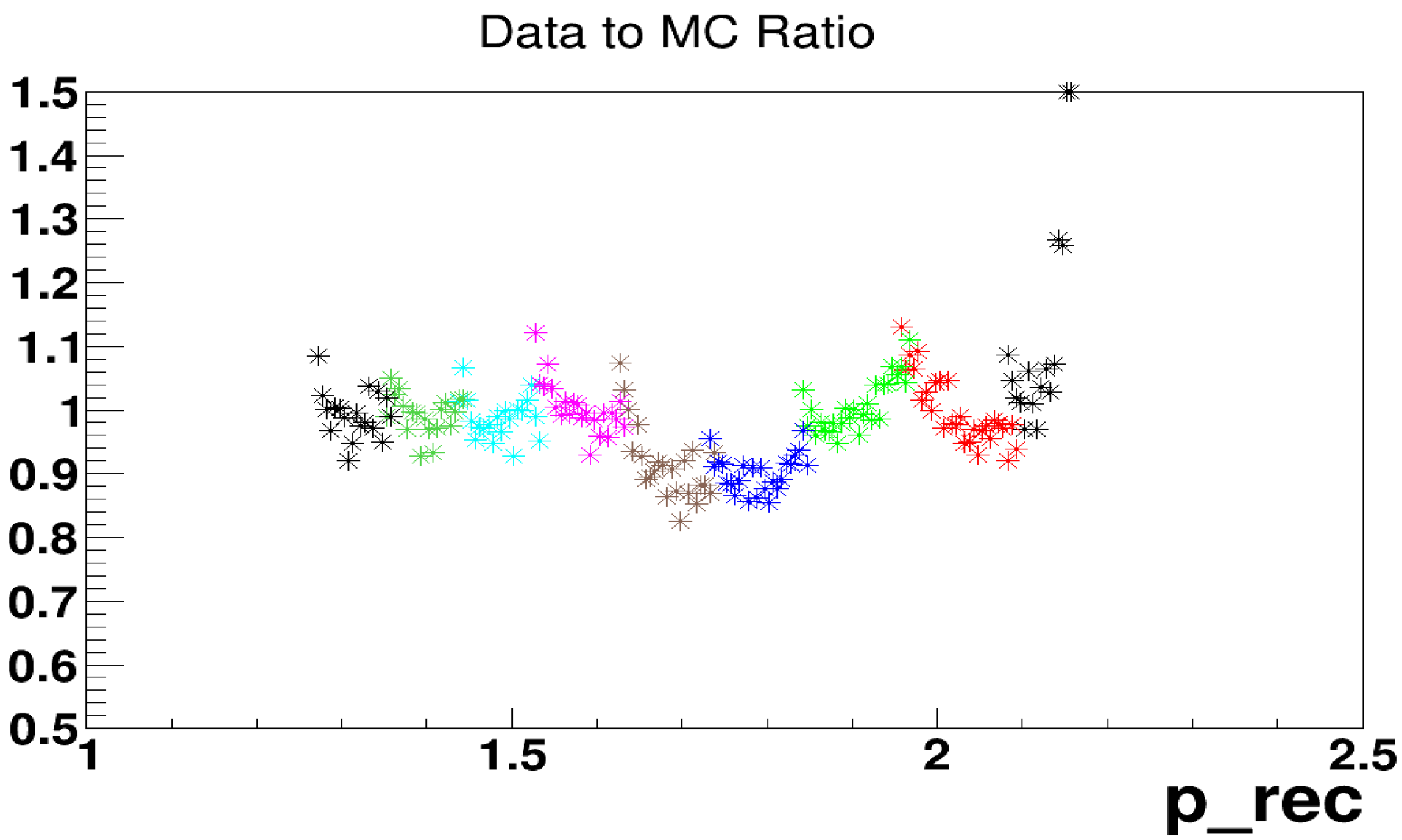
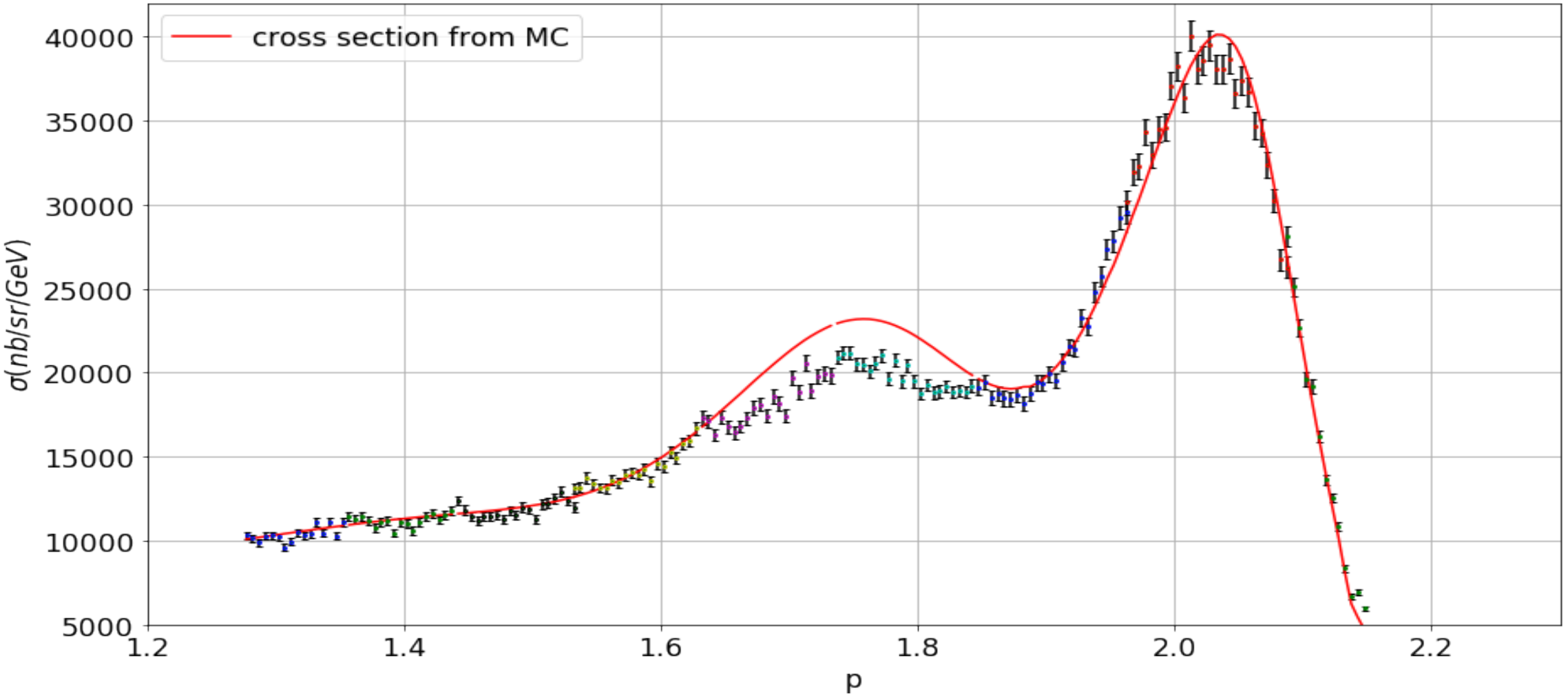
50
40
30
20
10
0
1
1.5
2
2.5
p_rec


MC
Charge normed yield
60
50
40
30
20
10
0
1
1.5
2
2.5
p_rec


Data to MC Ratio
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
1
1.5
2
2.5
p_rec

Comparison between data and MC



Systematic errors

- Acceptance cuts
- Cerenkov cut efficiency
- Calorimeter cut efficiency
- Target thickness
- Beam x offset
- Beam y offset
- Spectrometer x offset
- Spectrometer y offset
- Beam charge

❖Raster half-width x,y

❖Beam Energy

Systematic error from acceptance cuts run730 total=2.028%

Cuts on dp/p, th, phi	Ntotal_mc	N_mc	N_data	N_cor=N_data/(N_mc/Ntotal_mc)	Err(%)=(N_cor-298896)/298896
[-0.035,0.03], [-0.05,0.05], [-0.028,0.028]	263382	125468	142386	298896	0
[-0.0352,0.03], [-0.05,0.05], [-0.028,0.028]	263382	126996	143907	298454	-0.1479
[-0.0348,0.03], [-0.05,0.05], [-0.028,0.028]	263382	115735	131479	299211	0.1054
[-0.035,0.0298], [-0.05,0.05], [-0.028,0.028]	263382	124611	141317	298692	-0.0683
[-0.035,0.0302], [-0.05,0.05], [-0.028,0.028]	263382	125836	143174	299671	0.2593
[-0.035,0.03], [-0.052,0.05], [-0.028,0.028]	263382	124058	140838	299007	0.0371
[-0.035,0.03], [-0.048,0.05], [-0.028,0.028]	263382	125468	142386	298896	0
[-0.035,0.03], [-0.05,0.048], [-0.028,0.028]	263382	125468	142386	298896	0
[-0.035,0.03], [-0.05,0.052], [-0.028,0.028]	263382	126701	143456	298212	-0.2288
[-0.035,0.03], [-0.05,0.05], [-0.03,0.028]	263382	123971	140885	299317	0.1409
[-0.035,0.03], [-0.05,0.05], [-0.026,0.028]	263382	123576	140506	299466	0.1907
[-0.035,0.03], [-0.05,0.05], [-0.028,0.026]	263382	127150	144175	298648	-0.083
[-0.035,0.03], [-0.05,0.05], [-0.028,0.03]	263382	127910	148020	304791	1.9723

Run731 total=0.905%

Cuts on dp/p, th, phi	Ntotal_mc	N_mc	N_data	N_cor=N_data/(N_mc/Ntotal_mc)	Err(%)=(N_cor-268432)/268432
[-0.035,0.03], [-0.05,0.05], [-0.028,0.028]	269238	185013	184459	268432	0
[-0.0352,0.03], [-0.05,0.05], [-0.028,0.028]	269238	185500	185022	268544	0.0417
[-0.0348,0.03], [-0.05,0.05], [-0.028,0.028]	269238	177751	176722	267679	-0.2805
[-0.035,0.0298], [-0.05,0.05], [-0.028,0.028]	269238	182418	181856	268409	-0.0086
[-0.035,0.0302], [-0.05,0.05], [-0.028,0.028]	269238	185822	185895	269344	0.3398
[-0.035,0.03], [-0.052,0.05], [-0.028,0.028]	269238	184504	183876	268322	-0.041
[-0.035,0.03], [-0.048,0.05], [-0.028,0.028]	269238	184576	184033	268446	0.0052
[-0.035,0.03], [-0.05,0.048], [-0.028,0.028]	269238	185332	184834	268515	0.0309
[-0.035,0.03], [-0.05,0.052], [-0.028,0.028]	269238	187201	186244	267862	-0.2123
[-0.035,0.03], [-0.05,0.05], [-0.03,0.028]	269238	182387	182177	268928	0.1848
[-0.035,0.03], [-0.05,0.05], [-0.026,0.028]	269238	181907	181374	268449	0.0063
[-0.035,0.03], [-0.05,0.05], [-0.028,0.026]	269238	187881	187380	268520	0.0328
[-0.035,0.03], [-0.05,0.05], [-0.028,0.03]	269238	186298	187105	270404	0.7346

Run739 total=0.839%

Cuts on dp/p, th, phi	Ntotal_mc	N_mc	N_data	N_cor=N_data/(N_mc/Ntotal_mc)	Err(%)=(N_cor-277509)/277509
[-0.035,0.03], [-0.05,0.05], [-0.028,0.028]	275767	157386	158380	277509	0
[-0.0352,0.03], [-0.05,0.05], [-0.028,0.028]	275767	157900	158848	277423	-0.031
[-0.0348,0.03], [-0.05,0.05], [-0.028,0.028]	275767	151740	152819	277728	0.0789
[-0.035,0.0298], [-0.05,0.05], [-0.028,0.028]	275767	154634	155491	277295	-0.0771
[-0.035,0.0302], [-0.05,0.05], [-0.028,0.028]	275767	158174	159859	278705	0.431
[-0.035,0.03], [-0.052,0.05], [-0.028,0.028]	275767	156952	157946	277513	0.0014
[-0.035,0.03], [-0.048,0.05], [-0.028,0.028]	275767	156839	157787	277434	-0.027
[-0.035,0.03], [-0.05,0.048], [-0.028,0.028]	275767	158025	159002	277472	-0.0133
[-0.035,0.03], [-0.05,0.052], [-0.028,0.028]	275767	159364	160091	277025	-0.1744
[-0.035,0.03], [-0.05,0.05], [-0.03,0.028]	275767	155287	156333	277625	0.0418
[-0.035,0.03], [-0.05,0.05], [-0.026,0.028]	275767	154625	155385	277122	-0.1395
[-0.035,0.03], [-0.05,0.05], [-0.028,0.026]	275767	159821	161192	278133	0.2249
[-0.035,0.03], [-0.05,0.05], [-0.028,0.03]	275767	158369	160381	279270	0.6346

Run740 total=0.970%

Cuts on dp/p, th, phi	Ntotal_mc	N_mc	N_data	N_cor=N_data/(N_mc/Ntotal_mc)	Err(%)=(N_cor-398042)/398042
[-0.035,0.03], [-0.05,0.05], [-0.028,0.028]	442271	271778	244599	398042	0
[-0.0352,0.03], [-0.05,0.05], [-0.028,0.028]	442271	272628	245440	398165	0.0309
[-0.0348,0.03], [-0.05,0.05], [-0.028,0.028]	442271	261494	235120	397664	-0.095
[-0.035,0.0298], [-0.05,0.05], [-0.028,0.028]	442271	267250	240651	398252	0.0528
[-0.035,0.0302], [-0.05,0.05], [-0.028,0.028]	442271	273211	246917	399707	0.4183
[-0.035,0.03], [-0.052,0.05], [-0.028,0.028]	442271	270930	243739	397884	-0.0397
[-0.035,0.03], [-0.048,0.05], [-0.028,0.028]	442271	270986	243916	398091	0.0123
[-0.035,0.03], [-0.05,0.048], [-0.028,0.028]	442271	272611	245306	397973	-0.0173
[-0.035,0.03], [-0.05,0.052], [-0.028,0.028]	442271	274975	247074	397395	-0.1625
[-0.035,0.03], [-0.05,0.05], [-0.03,0.028]	442271	267919	241461	398595	0.1389
[-0.035,0.03], [-0.05,0.05], [-0.026,0.028]	442271	267445	240266	397325	-0.1801
[-0.035,0.03], [-0.05,0.05], [-0.028,0.026]	442271	275757	248680	398844	0.2015
[-0.035,0.03], [-0.05,0.05], [-0.028,0.03]	442271	273725	248310	401207	0.7951

Run747 total=0.905%

Cuts on dp/p, th, phi	Ntotal_mc	N_mc	N_data	N_cor=N_data/(N_mc/Ntotal_mc)	Err(%)=(N_cor-277424)/277424
[-0.035,0.03], [-0.05,0.05], [-0.028,0.028]	304951	185802	169030	277424	0
[-0.0352,0.03], [-0.05,0.05], [-0.028,0.028]	304951	186323	169533	277471	0.0169
[-0.0348,0.03], [-0.05,0.05], [-0.028,0.028]	304951	179597	162906	276610	-0.2934
[-0.035,0.0298], [-0.05,0.05], [-0.028,0.028]	304951	182673	166116	277311	-0.0407
[-0.035,0.0302], [-0.05,0.05], [-0.028,0.028]	304951	186733	170685	278743	0.4754
[-0.035,0.03], [-0.052,0.05], [-0.028,0.028]	304951	185341	168514	277265	-0.0573
[-0.035,0.03], [-0.048,0.05], [-0.028,0.028]	304951	185259	168472	277318	-0.0382
[-0.035,0.03], [-0.05,0.048], [-0.028,0.028]	304951	186403	169604	277468	0.0159
[-0.035,0.03], [-0.05,0.052], [-0.028,0.028]	304951	187984	170752	276997	-0.1539
[-0.035,0.03], [-0.05,0.05], [-0.03,0.028]	304951	183478	166778	277195	-0.0825
[-0.035,0.03], [-0.05,0.05], [-0.026,0.028]	304951	182690	165987	277070	-0.1276
[-0.035,0.03], [-0.05,0.05], [-0.028,0.026]	304951	188817	171980	277758	0.1204
[-0.035,0.03], [-0.05,0.05], [-0.028,0.03]	304951	187042	171285	279261	0.6622

Run748 total=0.836%

Cuts on dp/p, th, phi	Ntotal_mc	N_mc	N_data	N_cor=N_data/(N_mc/Ntotal_mc)	Err(%)=(N_cor-278079)/278079
[-0.035,0.03], [-0.05,0.05], [-0.028,0.028]	278304	165893	165759	278079	0
[-0.0352,0.03], [-0.05,0.05], [-0.028,0.028]	278304	166362	166247	278112	0.0119
[-0.0348,0.03], [-0.05,0.05], [-0.028,0.028]	278304	160552	160132	277576	-0.1809
[-0.035,0.0298], [-0.05,0.05], [-0.028,0.028]	278304	162870	162659	277943	-0.0489
[-0.035,0.0302], [-0.05,0.05], [-0.028,0.028]	278304	166884	167497	279326	0.4484
[-0.035,0.03], [-0.052,0.05], [-0.028,0.028]	278304	165455	165281	278011	-0.0245
[-0.035,0.03], [-0.048,0.05], [-0.028,0.028]	278304	165326	165197	278087	0.0029
[-0.035,0.03], [-0.05,0.048], [-0.028,0.028]	278304	166442	166306	278077	-0.0007
[-0.035,0.03], [-0.05,0.052], [-0.028,0.028]	278304	167914	167487	277596	-0.1737
[-0.035,0.03], [-0.05,0.05], [-0.03,0.028]	278304	163476	163598	278512	0.1557
[-0.035,0.03], [-0.05,0.05], [-0.026,0.028]	278304	163072	162801	277842	-0.0852
[-0.035,0.03], [-0.05,0.05], [-0.028,0.026]	278304	168473	168545	278423	0.1237
[-0.035,0.03], [-0.05,0.05], [-0.028,0.03]	278304	166980	167880	279804	0.6203

Run755 total=0.764%

Cuts on dp/p, th, phi	Ntotal_mc	N_mc	N_data	N_cor=N_data/(N_mc/Ntotal_mc)	Err(%)=(N_cor-290313)/290313
[-0.035,0.03], [-0.05,0.05], [-0.028,0.028]	294071	177099	174836	290313	0
[-0.0352,0.03], [-0.05,0.05], [-0.028,0.028]	294071	177627	175349	290300	-0.0045
[-0.0348,0.03], [-0.05,0.05], [-0.028,0.028]	294071	171556	168883	289489	-0.2838
[-0.035,0.0298], [-0.05,0.05], [-0.028,0.028]	294071	173626	171456	290396	0.0286
[-0.035,0.0302], [-0.05,0.05], [-0.028,0.028]	294071	178123	176617	291585	0.4381
[-0.035,0.03], [-0.052,0.05], [-0.028,0.028]	294071	176552	174250	290237	-0.0262
[-0.035,0.03], [-0.048,0.05], [-0.028,0.028]	294071	176481	174316	290463	0.0517
[-0.035,0.03], [-0.05,0.048], [-0.028,0.028]	294071	177653	175385	290317	0.0014
[-0.035,0.03], [-0.05,0.052], [-0.028,0.028]	294071	179239	176618	289771	-0.1867
[-0.035,0.03], [-0.05,0.05], [-0.03,0.028]	294071	174744	172563	290401	0.0303
[-0.035,0.03], [-0.05,0.05], [-0.026,0.028]	294071	174144	171806	290123	-0.0654
[-0.035,0.03], [-0.05,0.05], [-0.028,0.026]	294071	179879	177774	290630	0.1092
[-0.035,0.03], [-0.05,0.05], [-0.028,0.03]	294071	178485	177093	291778	0.5046

Run756 total=0.852%

Cuts on dp/p, th, phi	Ntotal_mc	N_mc	N_data	N_cor=N_data/(N_mc/Ntotal_mc)	Err(%)=(N_cor-272400)/272400
[-0.035,0.03], [-0.05,0.05], [-0.028,0.028]	274380	165757	164561	272400	0
[-0.0352,0.03], [-0.05,0.05], [-0.028,0.028]	274380	166280	165095	272425	0.0092
[-0.0348,0.03], [-0.05,0.05], [-0.028,0.028]	274380	160660	159043	271618	-0.2871
[-0.035,0.0298], [-0.05,0.05], [-0.028,0.028]	274380	162643	161333	272170	-0.0844
[-0.035,0.0302], [-0.05,0.05], [-0.028,0.028]	274380	166846	166314	273505	0.4057
[-0.035,0.03], [-0.052,0.05], [-0.028,0.028]	274380	165208	163989	272355	-0.0165
[-0.035,0.03], [-0.048,0.05], [-0.028,0.028]	274380	165220	164083	272492	0.0338
[-0.035,0.03], [-0.05,0.048], [-0.028,0.028]	274380	166320	165064	272308	-0.0338
[-0.035,0.03], [-0.05,0.052], [-0.028,0.028]	274380	167794	166266	271881	-0.1905
[-0.035,0.03], [-0.05,0.05], [-0.03,0.028]	274380	163299	162460	272970	0.2093
[-0.035,0.03], [-0.05,0.05], [-0.026,0.028]	274380	162919	161673	272282	-0.0433
[-0.035,0.03], [-0.05,0.05], [-0.028,0.026]	274380	168333	167290	272680	0.1028
[-0.035,0.03], [-0.05,0.05], [-0.028,0.03]	274380	166949	166762	274073	0.6142

Run763 total=0.802%

Cuts on dp/p, th, phi	Ntotal_mc	N_mc	N_data	N_cor=N_data/(N_mc/Ntotal_mc)	Err(%)=(N_cor-268793)/268793
[-0.035,0.03], [-0.05,0.05], [-0.028,0.028]	270804	162837	161628	268793	0
[-0.0352,0.03], [-0.05,0.05], [-0.028,0.028]	270804	163319	162154	268872	0.0294
[-0.0348,0.03], [-0.05,0.05], [-0.028,0.028]	270804	157525	156161	268459	-0.1243
[-0.035,0.0298], [-0.05,0.05], [-0.028,0.028]	270804	159775	158462	268579	-0.0796
[-0.035,0.0302], [-0.05,0.05], [-0.028,0.028]	270804	163881	163473	270130	0.4974
[-0.035,0.03], [-0.052,0.05], [-0.028,0.028]	270804	162362	161101	268701	-0.0342
[-0.035,0.03], [-0.048,0.05], [-0.028,0.028]	270804	162267	161095	268848	0.0205
[-0.035,0.03], [-0.05,0.048], [-0.028,0.028]	270804	163334	162117	268786	-0.0026
[-0.035,0.03], [-0.05,0.052], [-0.028,0.028]	270804	164841	163399	268435	-0.1332
[-0.035,0.03], [-0.05,0.05], [-0.03,0.028]	270804	160534	159588	269208	0.1544
[-0.035,0.03], [-0.05,0.05], [-0.026,0.028]	270804	159842	158703	268874	0.0301
[-0.035,0.03], [-0.05,0.05], [-0.028,0.026]	270804	165348	164360	269186	0.1462
[-0.035,0.03], [-0.05,0.05], [-0.028,0.03]	270804	163995	163680	270284	0.5547

Systematic error from cer cut efficiency

Run#	Eff0 % (cer>500)	Eff1 %(cer>475)	Eff2 %(cer>525)	(Eff1-Eff0)/E0%	(Eff2-Eff0)/E0%	Total%
730	99.896	99.913	99.873	0.017	-0.022	0.028
731	99.863	99.885	99.832	0.023	-0.030	0.038
739	99.811	99.837	99.774	0.026	-0.037	0.045
740	99.867	99.891	99.832	0.024	-0.035	0.043
747	99.875	99.886	99.845	0.011	-0.030	0.032
748	99.831	99.867	99.789	0.036	-0.042	0.055
755	99.817	99.843	99.782	0.026	-0.035	0.044
756	99.812	99.855	99.767	0.043	-0.045	0.062
763	99.805	99.824	99.750	0.019	-0.055	0.058

Systematic error from calorimeter cut efficiency

Run#	Eff0 % (E/p0>0.7)	Eff1 %(E/p0>0.65)	Eff2%(E/p0>0.75)	(Eff1-Eff0)/Eff0%	(Eff2-Eff0)/Eff0%	Total%
730	99.429	99.630	99.039	0.203	-0.392	0.441
731	99.525	99.704	99.228	0.180	-0.299	0.348
739	99.524	99.676	99.221	0.152	-0.305	0.341
740	99.502	99.682	99.188	0.181	-0.315	0.364
747	99.541	99.716	99.278	0.176	-0.264	0.318
748	99.523	99.686	99.215	0.164	-0.309	0.350
755	99.526	99.688	99.235	0.163	-0.292	0.335
756	99.471	99.634	99.188	0.163	-0.285	0.328
763	99.466	99.626	99.167	0.161	-0.301	0.341

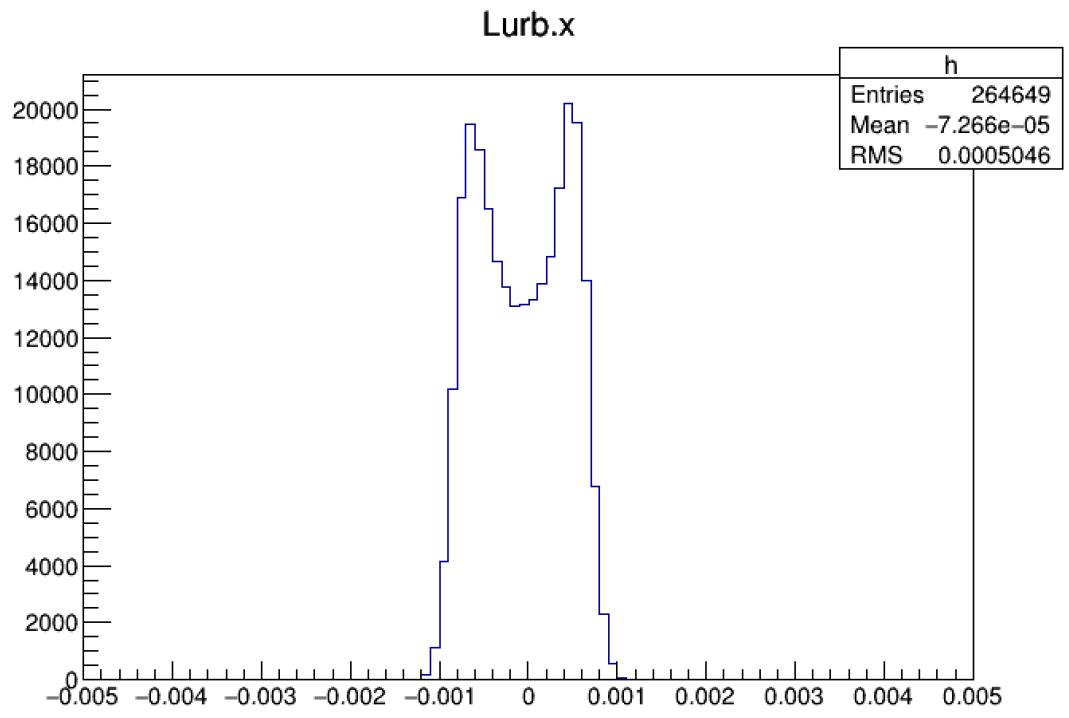
Systematic error from target thickness

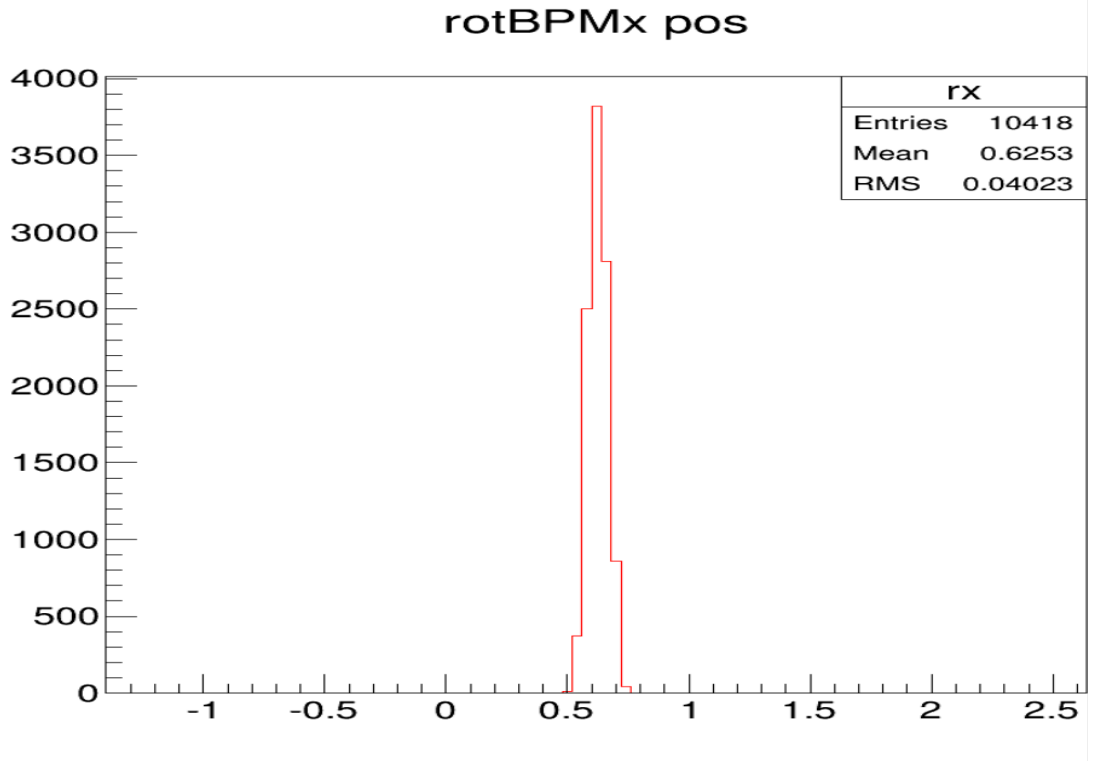
Run#	Thick=0.07556	Thick=0.07583	Difference(%)	Thick=0.07529	Difference(%)	Total(%)
730	125468	122914	-2.036	123260	-1.760	2.691
731	185013	185669	0.355	184673	-0.184	0.399
739	157386	157922	0.341	158638	0.795	0.865
740	271778	272134	0.131	275624	1.415	1.421
747	185802	184334	-0.790	185412	-0.210	0.817
748	165897	166997	0.663	166704	0.486	0.822
755	177094	173545	-2.004	174297	-1.579	2.552
756	165757	168114	1.422	166606	0.512	1.511
763	162837	163233	0.243	162426	-0.252	0.350

C	0.167 ± 0.0006	C (99.95%)

Systematic error from Beam x offset

- Read the beam center from the plot
- Take σ as the error





- The plot on the right is from Jason's slides.

Systematic error from Beam x offset

Run#	X off=-0.0075	X off=-0.0035	Difference(%)	X off=-0.0115	Difference(%)	Total(%)
730	125468	122372	-2.468	125797	0.262	2.481
731	185013	185482	0.253	185560	0.296	0.389
739	157386	157817	0.274	158531	0.728	0.777
740	271778	275776	1.471	274829	1.123	1.850
747	185802	185313	-0.263	184374	-0.769	0.812
748	165897	166474	0.348	167434	0.926	0.990
755	177094	174078	-1.703	174055	-1.716	2.418
756	165757	165538	-0.132	165234	-0.316	0.342
763	162837	162915	0.048	163361	0.322	0.325

Systematic error from Beam y offset

Run#	Y off=0.118	Y off=0.113	Difference(%)	Y off=0.123	Difference(%)	Total(%)
730	125468	124374	-0.872	125797	0.262	0.911
731	185013	186175	0.628	185560	0.296	0.694
739	157386	158120	0.466	158531	0.728	0.864
740	271778	273684	0.701	274829	1.123	1.324
747	185802	183983	-0.979	184374	-0.769	1.245
748	165897	165085	-0.489	167434	0.926	1.048
755	177094	173815	-1.852	174055	-1.716	2.524
756	165757	165899	0.086	165234	-0.316	0.327
763	162837	164028	0.731	163361	0.322	0.799

Systematic error from Spectrometer x offset

Run#	X off=0.122	X off=0.1225	Difference(%)	X off=0.1215	Difference(%)	Total(%)
730	125468	124591	-0.699	124054	-1.127	1.326
731	185013	185649	0.344	185299	0.155	0.377
739	157386	158576	0.756	158543	0.735	1.055
740	271778	274958	1.170	274517	1.008	1.544
747	185802	184065	-0.935	183166	-1.419	1.699
748	165897	168690	1.684	165986	0.054	1.684
755	177094	173891	-1.809	174904	-1.237	2.191
756	165757	166111	0.214	165736	-0.013	0.214
763	162837	162802	-0.021	164349	0.929	0.929

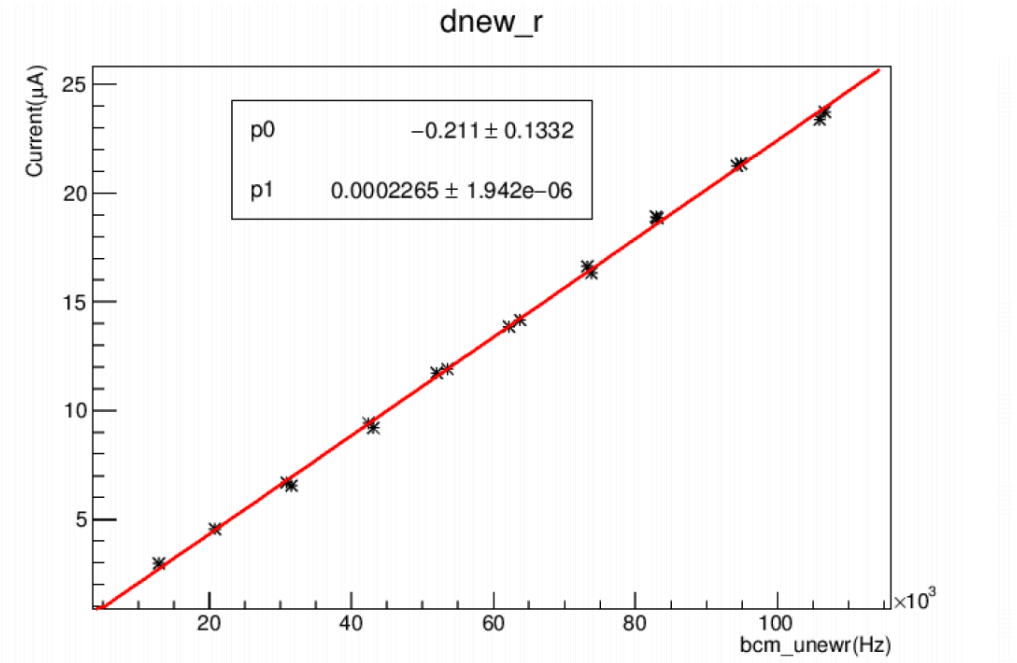
The central ray of the spectrometer is at -15.541 degrees
The central ray is missing the defined target center by -0.98 [mm] Upstream
and -1.22 mm vertically [positive value is up]

Systematic error from Spectrometer y offset

Run#	Y off=0.098	Y off=0.0985	Difference(%)	Y off=0.0975	Difference(%)	Total(%)
730	125468	125581	0.090	124537	-0.742	0.747
731	185013	184643	-0.200	186610	0.863	0.886
739	157386	157722	0.213	157806	0.267	0.342
740	271778	275362	1.319	275232	1.271	1.831
747	185802	185803	0.001	183793	-1.081	1.081
748	165897	164977	-0.555	167086	0.717	0.906
755	177094	174381	-1.532	175485	-0.909	1.781
756	165757	166552	0.480	167086	0.802	0.934
763	162837	163023	0.114	163926	0.669	0.678

Systematic error from Beam Charge

- A systematic error of 1% was assigned to this calculation based on the stability of the gain on the BCM



Total systematic error

Run#	730	731	739	740	747	748	755	756	763
Sys err(%)	4.674	1.913	2.270	3.874	2.975	2.870	5.329	2.294	1.988

Thank you!