

MCS in LH_2 , Field-off



Outline

- Alignment developments
 - Determining the required rotation per set of data/MC
 - Comparing scattering behaviour in data/MC w.r.t. rotations
- TOF distribution modeling
 - Particle IDs in TOF10 fitting sample
 - Pion TOF distr. "fast" tail

TOF distribution modeling



- ▶ TOF10 modeling for contamination estimation
- ▶ The simplest case will be considered first
 - ▶ MC Truth time at TOF0,1
 - ▶ No decays,
 - ▶ TOF0,1 single reconstructed SPs
- ▶ Effects such as decays & detector smearing will be introduced later
- ▶ A leading edge of pions is observed in MC,
 - ▶ My code is the first suspect, but so far no errors were found
 - ▶ ID and number of particles are being examined

θ_X Particle species with single SPs



170 MeV/c, Empty

TOF0

GEANT4 PID	Number
-13	252026
-11	134897
11	36
22	246
211	302918
2212	7

TOF1

GEANT4 PID	Number
-211	1
-13	315450
-11	126581
11	935
22	10306
211	236473
2112	87
2212	297

TOF2

GEANT4 PID	Number
-13	243795
-11	99456
11	918
22	36424
211	309460
2112	68
2212	9

170 MeV/c, Full

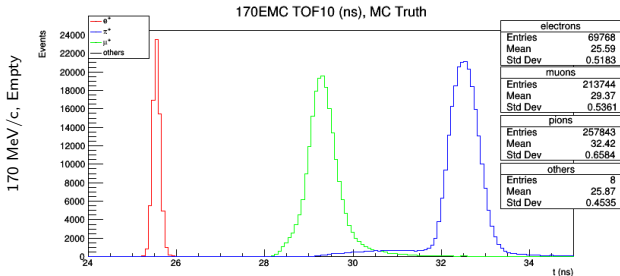
GEANT4 PID	Number
-13	242229
-11	129415
11	36
22	225
211	290867
2212	4

GEANT4 PID	Number
-13	303051
-11	121516
11	909
22	9826
211	227084
2112	99
2212	291

GEANT4 PID	Number
-13	233732
-11	96747
11	912
22	33521
211	297827
2112	34
2212	3

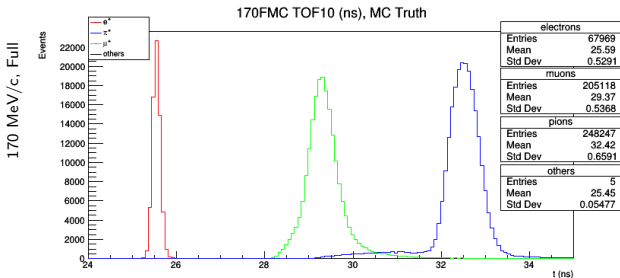
* muons (+/-13), pions(+/-211), electrons (+/-11), protons (+/-2212), neutrons (2112), π^0 (33) other mesons 11,22,33..

TOF distributions



Selection:

- ▶ Single SP in TOF0,1
- ▶ Same PID at TOF0, TOF1



Parameter definitions

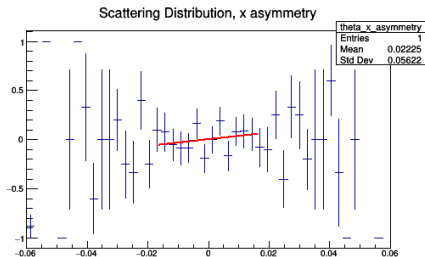
- Skewness:

$$\frac{\sum_1^N (Y_i - \bar{Y})^3 / N}{s^3}$$

- Excess Kurtosis:

$$\frac{\sum_1^N (Y_i - \bar{Y})^4 / N}{s^4} - 3$$

- Asymmetry: Gradient of line fit to the asymmetry of θ



- Mean US-DS Residuals:

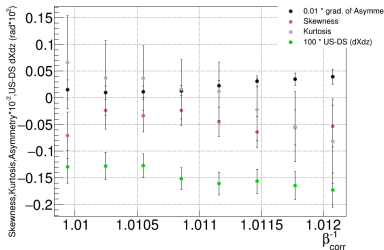
$$dX(Y)/dz_{US} - dX(Y)/dz_{DS}$$

Scanning TOF selection, 200MeV/c Full



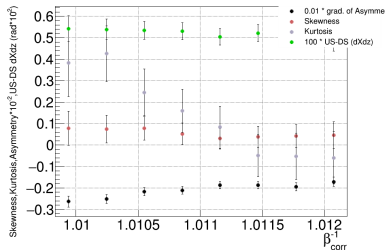
Data

Scanning tof sel., examining θ_x

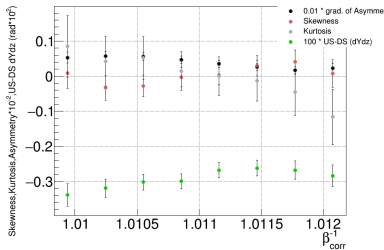


MC

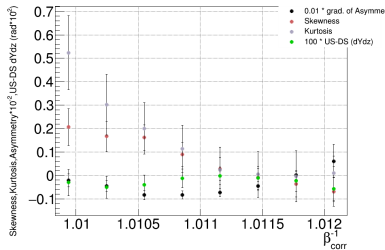
Scanning tof sel., examining θ_x



Scanning tof sel., examining θ_y



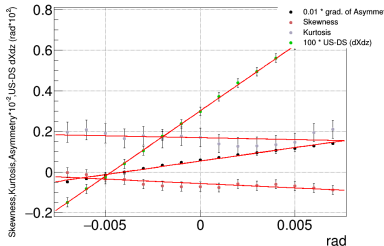
Scanning tof sel., examining θ_y



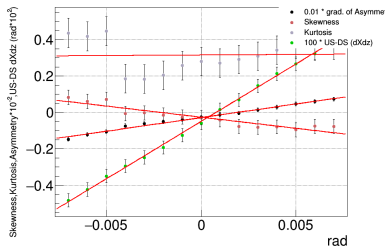
US track rotations, 200MeV/c Full



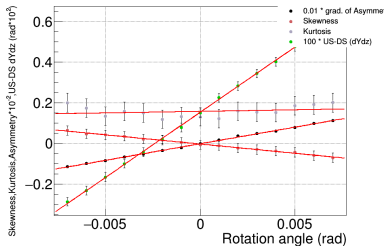
Data
 Rotating dXdz, examining θ_y



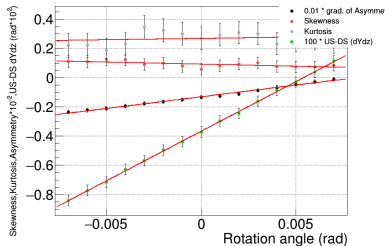
MC
 Rotating dXdz, examining θ_y



Rotating dYdz, examining θ_x



Rotating dYdz, examining θ_x





Columns 2,3 show the required rotation to get a zero offset in terms of that variable. Column 4 is the average of the previous two. Column 5-6 show the value of that variable when the column 4 correction is applied.

$$\theta_y$$

Set	Rot. Asymmetry	Rot. DS-US residual	Average	Skewness at cor.	Kurtosis at cor.
200FD	-0.00133264	-0.00352508	-0.00242886	0.0293027	0.485686
170ED	-0.00238715	-0.00385591	-0.00312153	-0.0152993	0.616278
240ED	-0.00238223	-0.00355106	-0.00296664	-0.0365675	1.8068
170FD	-0.0040369	-0.00467968	-0.00435829	-0.0398351	0.175767
200ED	-0.00164073	-0.00320552	-0.00242313	-0.037539	1.54067
240FD	-0.00166231	-0.00335459	-0.00250845	-0.00873356	0.749968

$$\theta_x$$

Set	Rot. Asymmetry	Rot. DS-US residual	Average	Skewness at cor.	Kurtosis at cor.
200FD	-0.000630672	-0.00171523	-0.00117295	-0.0193509	0.420866
170ED	-0.000283196	-0.00186127	-0.00107223	-0.0194105	0.779585
240ED	3.17077e-05	-0.0016251	-0.000796696	0.00244223	1.64699
170FD	0.000106347	-0.00238866	-0.00114116	-0.00443292	0.15728
200ED	7.95861e-05	-0.00116413	-0.000542274	-0.102453	1.40298
240FD	-0.000106427	-0.00159698	-0.000851705	-0.0658005	0.755826



*Columns 2,3 show the required rotation to get a zero offset in terms of that variable. Column 4 is the average of the previous two. Column 5-6 show the value of that variable when the column 4 correction is applied.

$$\theta_y$$

Set	Rot. Asymmetry	Rot. DS-US residual	Average	Skewness at cor.	Kurtosis at cor.
200FMC	0.0013874	-0.000278522	0.000554437	0.0392365	0.752895
170FMC	0.00187149	0.000773402	0.00132244	-0.0487085	0.316342
240FMC	0.00130028	-0.000271174	0.000514551	0.0126073	1.51387
200EMC	0.000462529	-0.000442748	9.89085e-06	-0.168963	1.66096
240EMC	0.000906057	-0.000576094	0.000164982	0.142234	2.15474
170EMC	0.000580846	-0.000722811	-7.09826e-05	-0.0646052	1.09663

$$\theta_x$$

Set	Rot. Asymmetry	Rot. DS-US residual	Average	Skewness at cor.	Kurtosis at cor.
200FMC	0.007	0.00634841	0.0066742	-0.049762	0.617104
170FMC	0.007	0.00539605	0.00619803	0.0718401	0.280329
240FMC	0.007	0.00630408	0.00665204	-0.0578901	1.2143
200EMC	0.007	0.00600837	0.00650418	-0.0174854	1.47538
240EMC	0.007	0.00594556	0.00647278	0.12619	1.99329
170EMC	0.007	0.00614014	0.00657007	-0.215013	1.54742