



Pion-LT Meeting

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HEEP Study

PionLT Experiment

Beam Energy (GeV)	Setting (HeePCoin - 9)	Run Numbers
5.986	HMS_p = -3.271, HMS_theta = 29.170, SHMS_p = 3.493, SHMS_theta = 27.495	13058, 13059, 13061, 13062, 13128
6.395 (s1)	HMS_p = -4.752, HMS_theta = 18.595, SHMS_p = 2.412, SHMS_theta = 37.970	16277 – 16279
6.395 (s2)	HMS_p = -4.391, HMS_theta = 21.095, SHMS_p = 2.792, SHMS_theta = 34.470	16280 – 16282
6.395 (s3)	HMS_p = -3.014, HMS_theta = 33.350, SHMS_p = 4.220, SHMS_theta = 23.115	16512 - 16517
7.937	HMS_p = -3.280, HMS_theta = 33.645, SHMS_p = 5.512, SHMS_theta = 19.265	14589 - 14600
8.479	HMS_p = -5.587, HMS_theta = 19.560, SHMS_p = 3.731, SHMS_theta = 30.020	16162 – 16165
9.177	HMS_p = -3.738, HMS_theta = 31.645, SHMS_p = 6.265, SHMS_theta = 18.125	11867 - 11879
9.876	HMS_p = -5.366, HMS_theta = 23.050, SHMS_p = 5.422, SHMS_theta = 23.050	13164 - 13169
10.549	HMS_p = -5.878, HMS_theta = 21.670, SHMS_p = 5.539, SHMS_theta = 23.110	14986 - 14993

- Cuts for HeeP data.

HMS Cuts (Electrons)

$$-8 < H_gtr_dp < 8$$

$$-0.08 < H_gtr_th < 0.08$$

$$-0.045 < H_gtr_ph < 0.045$$

$$HMS_Cal_etottracknorm > 0.7$$

$$H_Cer_npeSum > 1.5$$

SHMS Cuts (Protons)

$$-10 < P_gtr_dp < 20$$

$$-0.06 < P_gtr_th < 0.06$$

$$-0.04 < P_gtr_ph < 0.04$$

Ctime_epCoinTime_ROC1 – Prompt Peak

- Cuts for HeeP SIMC.

HMS Cuts (Electrons)

$$-8 < hsdelta < 8$$

$$-0.08 < hsxpfp < 0.08$$

$$-0.045 < hsyfp < 0.045$$

SHMS Cuts (Protons)

$$-10 < ssdelta < 20$$

$$-0.06 < ssxpfp < 0.06$$

$$-0.04 < ssypfp < 0.04$$

- Global In-Plane Offset from Garth:

Global In-Plane Offsets – Momentum and Energy offsets in 0.1% unit, Angle offset in mrad unit

dthe	1.2000	dpe	-0.1000	dthp	1.7000	dpp	-0.2000		
BE	5984.8	6394.7s1	6394.7s2	6394.7s3	7937.6	8478.6	9171.3	9876.9	10546.8
dE	-0.6000	-0.6000	-0.6000	-0.6000	-0.5000	-0.5000	-0.6000	-0.7000	-0.0000

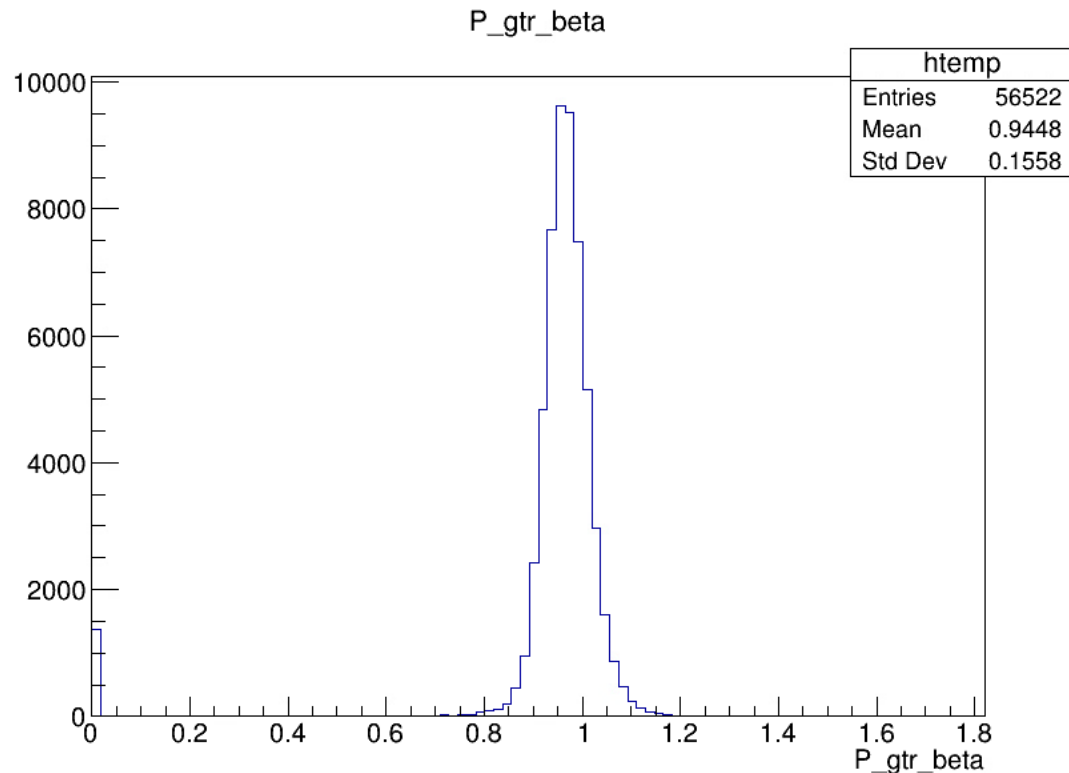
- Implemented energy, momentum and angle offset with positive sign on both DATA and SIMC.
- Implemented Out-of-plane offsets to DATA (**HMS = +0.00196rad** and **SHMS = -0.000082rad**).

HEEP Study

PionLT Experiment

Beam Energy (GeV)	Year	Run Numbers	Data/SIMC Ratio (Without MMP Cut)	Data/SIMC Ratio (with MMP Cut < 0.1)	Data/SIMC Ratio (with MMP Cut < 0.1) & SHMS_Hodo_3/4_EFF = 0.99
5.986	2021	13058 – 13062, 13128	1.055 +/- 0.005	0.999 +/- 0.004	0.995 +/- 0.005
6.395 (s1)	2022	16277 – 16279	1.083 +/- 0.004	1.004 +/- 0.004	1.000 +/- 0.004 (Used actual value)
6.395 (s2)	2022	16280 – 16282	0.944 +/- 0.004	0.862 +/- 0.004	0.858 +/- 0.004
6.395 (s3)	2022	16512 - 16517	1.095 +/- 0.007	1.053 +/- 0.006	1.017 +/- 0.007 (no dummy run)
7.937	2021	14589 - 14600	1.114 +/- 0.009	1.062 +/- 0.008	1.002 +/- 0.008
8.479	2022	16162 – 16165	1.136 +/- 0.007	1.030 +/- 0.007	1.011 +/- 0.007
9.177	2021	11867 - 11879	1.258 +/- 0.014	1.170 +/- 0.013	1.027 +/- 0.014
9.876	2021	13164 - 13169	1.146 +/- 0.013	1.043 +/- 0.011	1.025 +/- 0.012
10.549	2022	14986 - 14993	1.224 +/- 0.011	1.097 +/- 0.010	1.021 +/- 0.010

- Looked at SHMS Beta plot – **No Need to Apply beta cut.**
- Found Some zero bin entries.
- Placed cut “> 0.2” to check the effect:
- Ratios dropped by “~ 2%”.
- Will rerun all beam energies with same cut to see the effect.



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Data/SIMC ratio hdelta = 0.971 +/- 0.005  
Data/SIMC ratio pdelta = 0.971 +/- 0.005  
Data/SIMC ratio hxptar = 0.971 +/- 0.005  
Data/SIMC ratio hyptar = 0.971 +/- 0.005  
Data/SIMC ratio pxptar = 0.971 +/- 0.005  
Data/SIMC ratio pyptar = 0.971 +/- 0.005  
Data/SIMC ratio hxpfp = 0.971 +/- 0.005  
Data/SIMC ratio hypfp = 0.971 +/- 0.005  
Data/SIMC ratio pxpfp = 0.971 +/- 0.005  
Data/SIMC ratio pypfp = 0.971 +/- 0.005  
Data/SIMC ratio pmiss_x = 0.971 +/- 0.005  
Data/SIMC ratio pmiss_y = 0.971 +/- 0.005  
Data/SIMC ratio pmiss_z = 0.971 +/- 0.005  
Data/SIMC ratio pmiss = 0.971 +/- 0.005  
Data/SIMC ratio emiss = 0.971 +/- 0.005  
Data/SIMC ratio W = 0.971 +/- 0.005  
Data/SIMC ratio MMP = 0.971 +/- 0.005  
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- Made HeePCoin comparison plots and calculated Data/SIMC Ratio.
- Calculated errors in ratios properly.
- SIMC and Data is normalized.

$$\textit{Effective charge} = \textit{Charge} \times \textit{Tracking Eff} \times \textit{Detector Eff} \times \textit{Hodo}^{\frac{3}{4}} \textit{Eff} \times \textit{EDTM Live Time} \times \textit{Boiling Corr}$$

- In data normalization, Following quantities are included:
 - **Charge (run-by-run)**
 - **Tracking Efficiencies (HMS and SHMS run-by-run)**
 - **Detector Efficiencies (HMS Cer and HMS Cal run-by-run)**
 - **Hodo $\frac{3}{4}$ Efficiencies (HMS and SHMS run-by-run)**
 - **EDTM Live Time (run-by-run)**
 - **Dummy Target Thickness Correction Applied – (3.527 +/- 0.227 - PionLT)**
 - **Richard's Boiling Correction Applied (-0.0007899) - From Richard**

In progress:

- SHMS $\frac{3}{4}$ Hodo Efficiency - Mark.
- Optics files for High momentum settings - Christine.
- Proton absorption correction – Nacer.
- Will start working on the SHMS pion PID and detector efficiencies.