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# HEEP Studies

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# HEEP Study

PionLT Experiment

Beam Energy (GeV)	Setting (HeePCoin - 9)	Run Numbers
9.177	HMS_p = -3.738, HMS_theta = 31.645, SHMS_p = 6.265, SHMS_theta = 18.125	11846 - 11879
5.986	HMS_p = -3.271, HMS_theta = 29.170, SHMS_p = 3.493, SHMS_theta = 27.495	13058 - 13062, 13128
9.876	HMS_p = -5.366, HMS_theta = 23.050, SHMS_p = 5.422, SHMS_theta = 23.050	13164 - 13169
7.937	HMS_p = -3.280, HMS_theta = 33.645, SHMS_p = 5.512, SHMS_theta = 19.265	14589 - 14600
10.549	HMS_p = -5.878, HMS_theta = 21.670, SHMS_p = 5.539, SHMS_theta = 23.110	14986 - 14993
8.479	HMS_p = -5.587, HMS_theta = 19.560, SHMS_p = 3.731, SHMS_theta = 30.020	16162 - 16165
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

- 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)

$$-10 < ssdelta < 20$$

$$-0.06 < ssxpfp < 0.06$$

$$-0.04 < ssyfp < 0.04$$

- Updated beam energy values from Mark's wiki page ([https://hallcweb.jlab.org/wiki/index.php/Table\\_of\\_12\\_GeV\\_Beam\\_Energy\\_Measurements](https://hallcweb.jlab.org/wiki/index.php/Table_of_12_GeV_Beam_Energy_Measurements)).
- Updated Beam energy values as given below:

Beam Energy Value (BE)	Sync Rad	Corrected Beam Energy Value (BE - Sync Rad)
9.172705 +/- 0.00374	0.0014	9.171305
5.984792 +/- 0.00299	0.0	5.984792
9.878901 +/- 0.00395	0.0020	9.876901
7.937662 +/- 0.00342	0.0	7.937555
7.937448 +/- 0.00342	0.0	-
10.549355 +/- 0.0041371	0.0026	10.546755
8.478619 +/- 0.003554	0.0	8.478619
6.394701 +/- 0.003055	0.0	6.394701

- Old Global In-Plane Offsets (from Garth):

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

<b>dthe</b>	1.0000	<b>dpe</b>	0.6000	<b>dthp</b>	1.5000	<b>dpp</b>	0.3000			
<b>BE</b>	5984.8	6394.7s1	6394.7s2	6394.7s3	7937.0	8478.6	9172.7	9878.9	10549.4	
<b>dE</b>	0.1000	0.1000	0.1000	0.1000	0.2000	0.2000	0.1000	0.0000	0.6000	
<b>chisq</b>	596.005	4.647	110.743	34.658	36.869	35.301	42.526	21.573	72.909	236.780

- New Global In-Plane Offset (from Garth):

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

<b>dthe</b>	1.2000	<b>dpe</b>	-0.1000	<b>dthp</b>	1.6000	<b>dpp</b>	-0.1000			
<b>BE</b>	5984.8	6394.7s1	6394.7s2	6394.7s3	7937.6	8478.6	9171.3	9876.9	10546.8	
<b>dE</b>	-0.5000	-0.5000	-0.5000	-0.5000	-0.4000	-0.4000	-0.5000	-0.6000	-0.0000	
<b>chisq</b>	561.363	4.574	105.191	32.276	34.279	38.182	35.719	19.292	73.033	218.817

- Made HeeP comparison plots of other variables (delta, target, focal plane)
- SIMC is normalized.
- Data is normalized (BCM calibrations are not correct)

$$\textit{Effective charge} = \frac{1}{\textit{Charge} \times \textit{Tracking Eff} \times \textit{Detector Eff} \times \textit{EDTM}}$$

- In data normalization, **charge and tracking efficiencies** (HMS & SHMS – run by run) are included so far.
- Out of plane offsets Finalized (Got **+1.90mr for HMS** and **-0.07mr for SHMS**).
- Implementing in plane offsets in kinematics and param files.

### **In progress:**

- Working on detector efficiencies (HMS Cherenkov and HMS Calorimeter).
- Working on in plane offset study.