HEEP Studies

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HEEP Study

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

HEEP Study

- 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 < hsypfp< 0.045

SHMS Cuts (Protons)
-10 < ssdelta< 20
-0.06 < ssxpfp< 0.06
-0.04 < ssypfp< 0.04

HEEP Study

- **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 to both DATA and SIMC.
- Implemented Out-of-plane offsets to DATA (**HMS = +0.0019rad and SHMS = -0.00005rad**).

HEEP Study

- **Corrected Beam Energy values after Global Offsets (implemented with negative sign):**

Beam Energy (GeV)	Global Offset (0.1%)	Global Offset Value	Corrected Beam Energy (GeV)
5.984792	-0.6000	-0.003590882	**5.981201125**
6.394701	-0.6000	-0.003836821	**6.390864179**
7.937555	-0.5000	-0.003968785	**7.933586223**
8.478619	-0.5000	-0.00423931	**8.474379691**
9.171305	-0.6000	-0.005502783	**9.165802217**
9.876901	-0.7000	-0.006913836	**9.869987169**
10.546755	0.0000	0	**10.546755**

- **Global Angle Offsets:**
- Offset on HMS_theta = 1.2000mrad and equal to **+0.0012rad** for all beam energies.
- Offset on SHMS_theta = 1.6000mrad and equal to **+0.0017rad** for all beam energies.

HEEP Study

- **Global Momentum Offsets with negative sign:**

Corrected Beam Energy (GeV)	HMS_p (GeV/c)	HMS_p Offset (1%)	HMS_p Offset Value (GeV/c)	HMS_p Value (GeV/c)	SHMS_p (GeV/c)	SHMS_p Offset (1%)	SHMS_p Offset Value (GeV/c)	SHMS_p Value (GeV/c)
5.981812	-3.271	-0.01	**0.0003271**	**3.2706729**	3.493	-0.02	**-0.0006986**	**3.4923014**
6.391504_s1	-4.752	-0.01	**0.0004752**	**4.7515248**	2.412	-0.02	**-0.0004824**	**2.4115176**
6.391504_s2	-4.391	-0.01	**0.0004391**	**4.3905609**	2.792	-0.02	**-0.0005584**	**2.7914416**
6.391504_s3	-3.014	-0.01	**0.0003014**	**3.0136986**	4.220	-0.02	**-0.0008440**	**4.2191560**
7.934395	-3.283	-0.01	**0.0003283**	**3.2826717**	5.512	-0.02	**-0.0011024**	**5.5108976**
8.475228	-5.587	-0.01	**0.0005587**	**5.5864413**	3.731	-0.02	**-0.0007462**	**3.7302538**
9.166719	-3.738	-0.01	**0.0003738**	**3.7376262**	6.265	-0.02	**-0.0012530**	**6.2637470**
9.870982	-5.366	-0.01	**0.0005366**	**5.3654634**	5.422	-0.02	**-0.0010844**	**5.4209156**
10.546755	-5.878	-0.01	**0.0005878**	**5.8774122**	5.530	-0.02	**-0.0011060**	**5.5288940**

HEEP Study

- **Corrected Beam Energy values after Global Offsets (implemented with positive sign):**

Beam Energy (GeV)	Global Offset (0.1%)	Global Offset Value	Corrected Beam Energy (GeV)
5.984792	0.6000	0.003590882	**5.988382875**
6.394701	0.6000	0.003836821	**6.398537821**
7.937555	0.5000	0.003968785	**7.941523778**
8.478619	0.5000	0.00423931	**8.48285831**
9.171305	0.6000	0.005502783	**9.176807783**
9.876901	0.7000	0.006913836	**9.883814831**
10.546755	0.0000	0	**10.546755**

- **Global Angle Offsets:**
- Offset on HMS_theta = 1.2000mrad and equal to **+0.0012rad** for all beam energies.
- Offset on SHMS_theta = 1.6000mrad and equal to **+0.0017rad** for all beam energies.

HEEP Study

- **Global Momentum Offsets with positive sign:**

Corrected Beam Energy (GeV)	HMS_p (GeV/c)	HMS_p Offset (1%)	HMS_p Offset Value (GeV/c)	HMS_p Value (GeV/c)	SHMS_p (GeV/c)	SHMS_p Offset (1%)	SHMS_p Offset Value (GeV/c)	SHMS_p Value (GeV/c)
5.981812	-3.271	0.01	**0.0003271**	**3.2713271**	3.493	-0.02	**-0.0006986**	**3.4936986**
6.391504_s1	-4.752	0.01	**0.0004752**	**4.7524752**	2.412	-0.02	**-0.0004824**	**2.4124824**
6.391504_s2	-4.391	0.01	**0.0004391**	**4.3914391**	2.792	-0.02	**-0.0005584**	**2.7925584**
6.391504_s3	-3.014	0.01	**0.0003014**	**3.0143014**	4.220	-0.02	**-0.0008440**	**4.2208440**
7.934395	-3.283	0.01	**0.0003283**	**3.2833283**	5.512	-0.02	**-0.0011024**	**5.5131024**
8.475228	-5.587	0.01	**0.0005587**	**5.5875587**	3.731	-0.02	**-0.0007462**	**3.7317462**
9.166719	-3.738	0.01	**0.0003738**	**3.7383738**	6.265	-0.02	**-0.0012530**	**6.2662530**
9.870982	-5.366	0.01	**0.0005366**	**5.3665366**	5.422	-0.02	**-0.0010844**	**5.4230844**
10.546755	-5.878	0.01	**0.0005878**	**5.8785878**	5.530	-0.02	**-0.0011060**	**5.5311060**

HEEP Study

- In first study, applied In-plane momentum and In-plane energy offsets in four different combinations.

Combinations	In-Plane Energy Offset	In-Plane Momentum Offset	In-Plane Angle Offset (kept fixed)
1st	**-ve sign**	**-ve sign**	+ve sign
2nd	**-ve sign**	**+ve sign**	+ve sign
3rd	**+ve sign**	**-ve sign**	+ve sign
4th	**+ve sign**	**+ve sign**	+ve sign

- In second study, applied in-plane angles offsets in two different combinations.

Combinations	In-Plane Energy Offset	In-Plane Momentum Offset	In-Plane Angle Offset
1st	+ve sign	+ve sign	**+ve sign**
2nd	+ve sign	+ve sign	**-ve sign**

HEEP Study

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

$$Effective\ charge = \frac{1}{Charge \times Tracking\ Eff \times Detector\ Eff \times Hodo\frac{3}{4}Eff \times EDTM\ Live\ Time \times Boiling\ Corr.}$$

- 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 ¾ Efficiencies (HMS and SHMS run-by-run)**
- **Conclusion – momentum and energy offsets in positive sign giving good results.**

In progress:

- Testing out-of-plane angle offsets. – check 10GeV distributions.
- Will Try to use Richard's boiling correction on this data and calculate the ratios.