Optics Calibration for e’p
(Round 1)

Shujie Li
05.29.2018

HRS Optics matrix:

Reconstruct target variables (scattering angle and momentum) from focal plane variables (detected tracking and energy)

Assume x_tg is 0, then correct for the offset.

$$\begin{bmatrix} \delta \\ \theta \\ y \\ \phi \end{bmatrix}_{tg} = \begin{bmatrix} \langle \delta|x \rangle & \langle \delta|\theta \rangle & 0 & 0 \\ \langle \theta|x \rangle & \langle \theta|\theta \rangle & 0 & 0 \\ 0 & 0 & \langle y|y \rangle & \langle y|\phi \rangle \\ 0 & 0 & \langle \phi|y \rangle & \langle \phi|\phi \rangle \end{bmatrix} \begin{bmatrix} x \\ \theta \\ y \\ \phi \end{bmatrix}_{fp.}$$

want

known

Optics Calibration:

- Find the mapping between focal plane and target variables (minimization)
  - Y_tg : fixed by multifoils
  - Theta, phi: fixed by sieve pattern
  - Delta: fixed by (quasi) elastic scattering

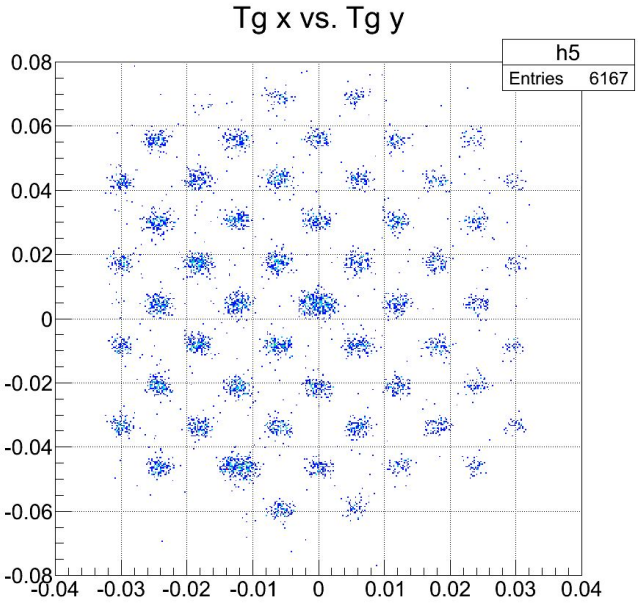
$$\begin{bmatrix} \delta \\ \theta \\ y \\ \phi \end{bmatrix}_{tg} = \begin{bmatrix} \langle \delta|x\rangle & \langle \delta|\theta\rangle & 0 & 0 \\ \langle \theta|x\rangle & \langle \theta|\theta\rangle & 0 & 0 \\ 0 & 0 & \langle y|y\rangle & \langle y|\phi\rangle \\ 0 & 0 & \langle \phi|y\rangle & \langle \phi|\phi\rangle \end{bmatrix} \begin{bmatrix} x \\ \theta \\ y \\ \phi \end{bmatrix}_{fp.}$$

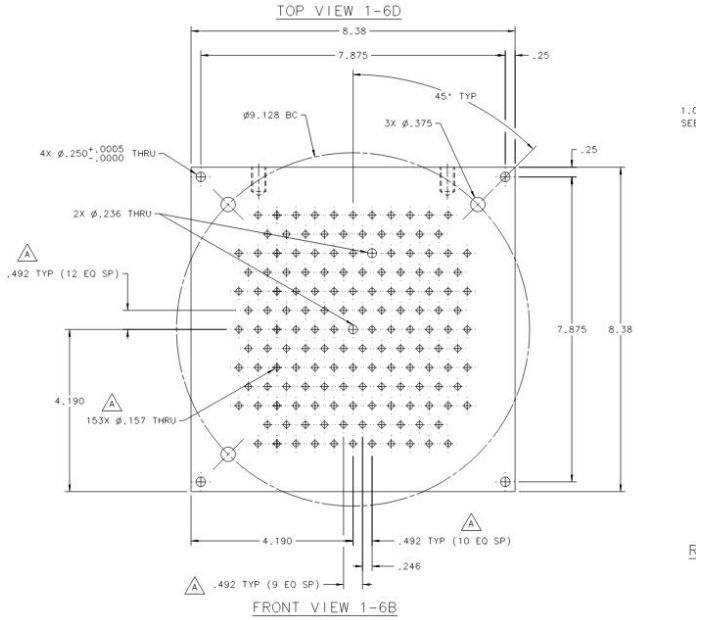
want known

LHRS Sieve Runs:

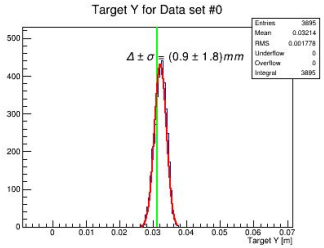
- Marathon runs 2335 - 2340
- momentum=3.57 GeV, Q1 current = 770.34 A
- Target = 11 optics foils separated by 2.5 cm each
- From Rey's target offset study:
  - The central optics foil is at vertex z = 3 mm
- From survey A1855:
  - Angle = 17.578
  - Misspointing is - 2.08 mm (target y), 1.38 mm (target x)

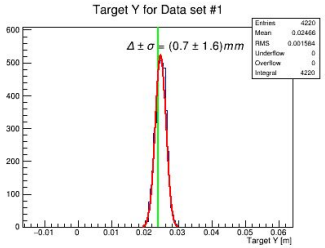
Sieve:

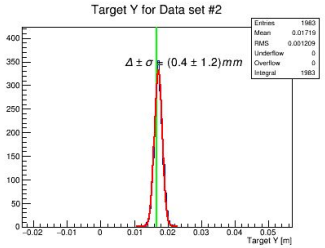

Tg x vs. Tg y
h5
Entries 6167
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.04 -0.03 -0.02 -0.01 0 0.01 0.02 0.03 0.04

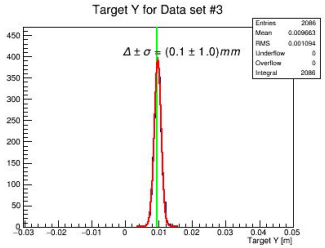

TOP VIEW 1-6D
8.38
7.875
.25
45° TYP
ø9.128 BC
3X ø.375
4X ø.250 +.0005 -.0000 THRU
.25
2X ø.236 THRU
.492 TYP (12 EQ SP)
7.875
8.38
4.190
153X ø.157 THRU
4.190
.492 TYP (10 EQ SP)
.246
.492 TYP (9 EQ SP)
FRONT VIEW 1-6B

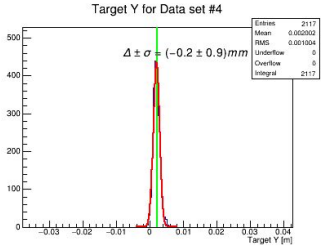
LHRS Y_tg with current tritium DB

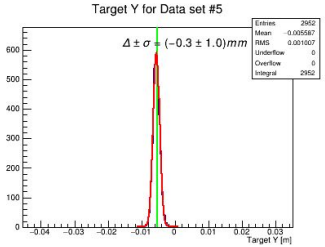


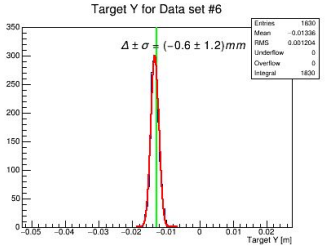


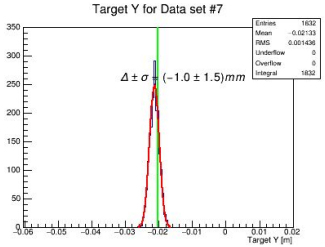


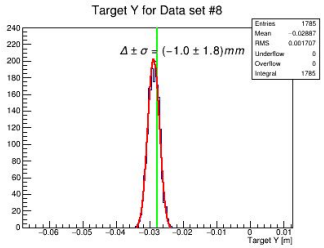


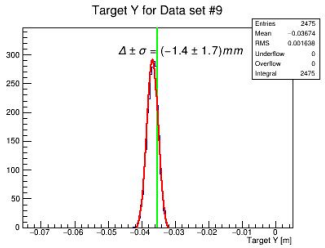


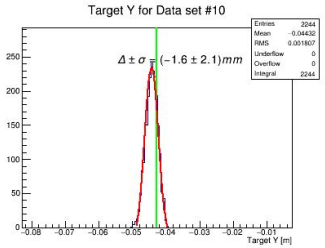




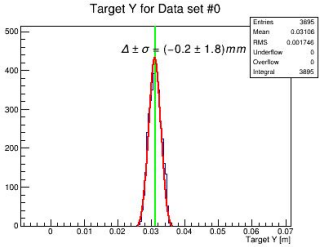


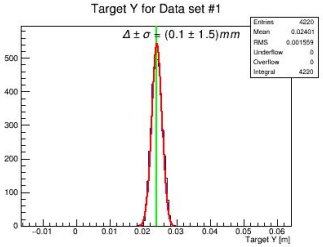


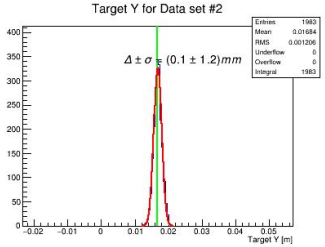


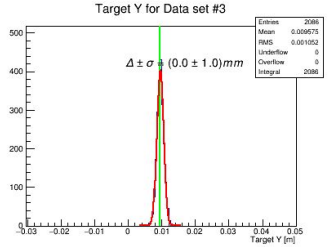


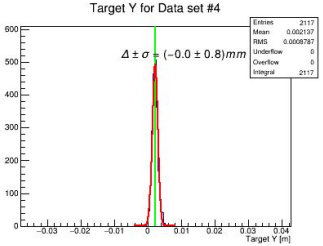
LHRS Y_tg refitted

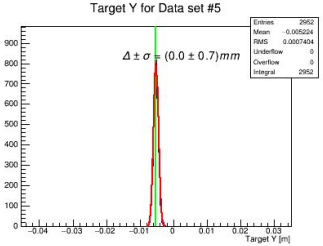


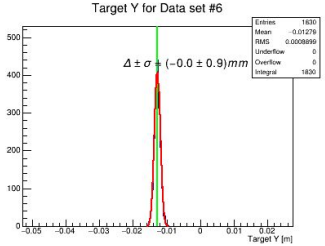


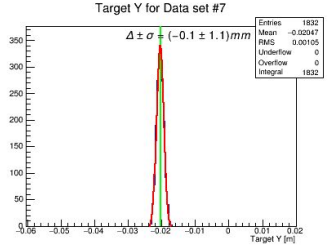


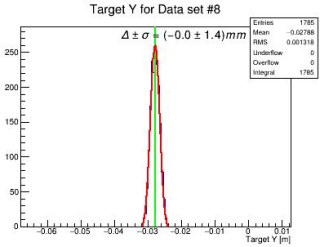


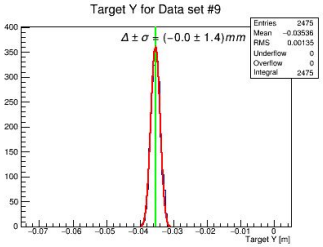


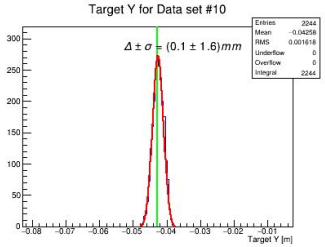




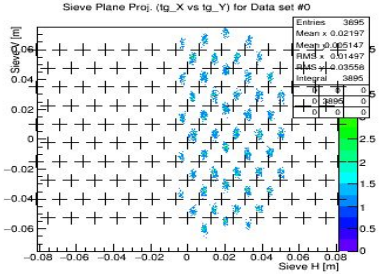


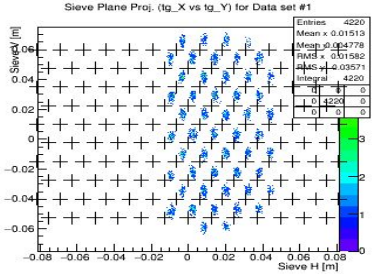


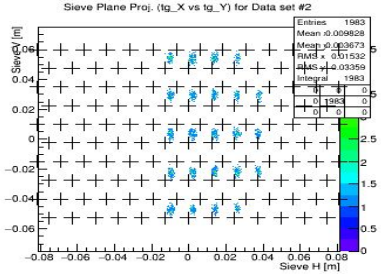


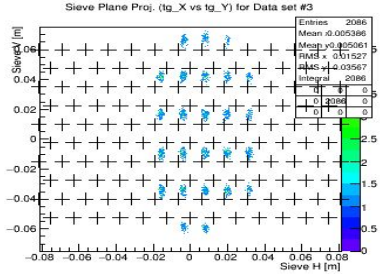


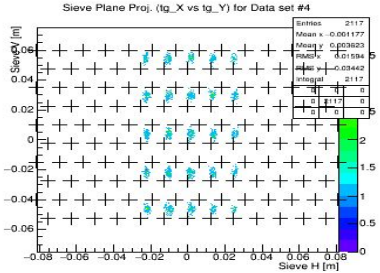
LHRS theta-phi with current tritium_db

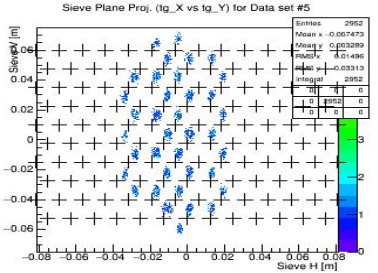


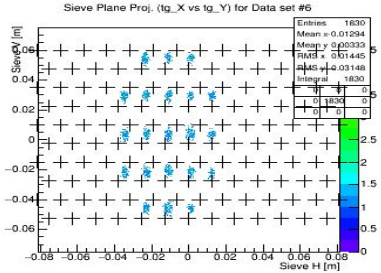


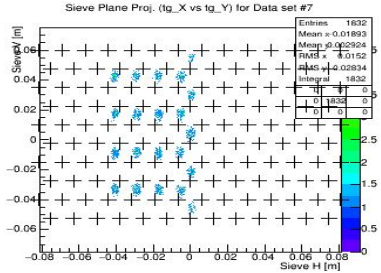


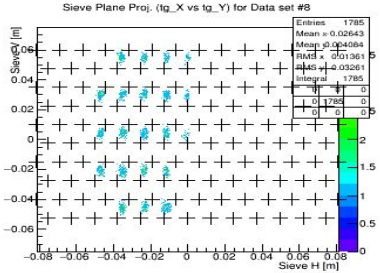


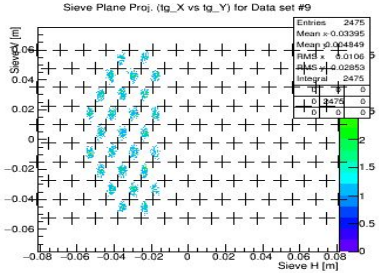


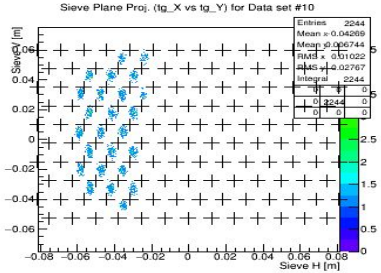




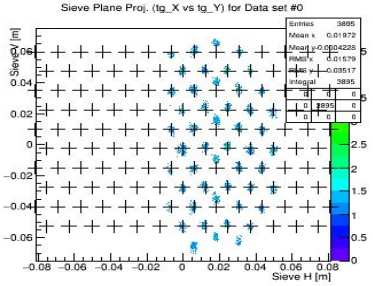


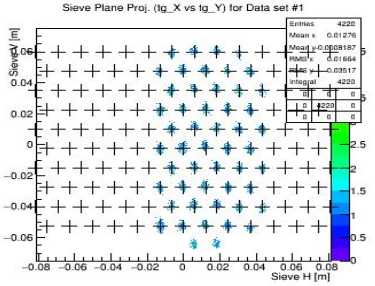


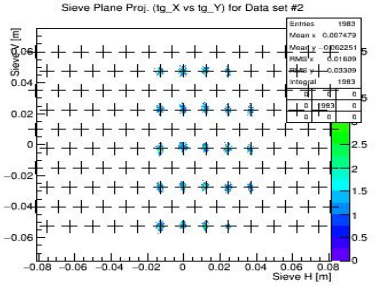


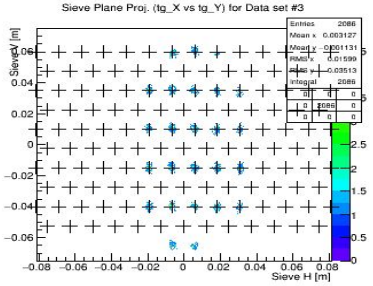


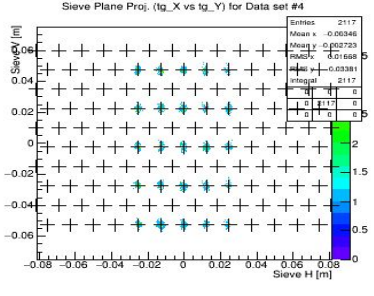
LHRS theta-phi refitted

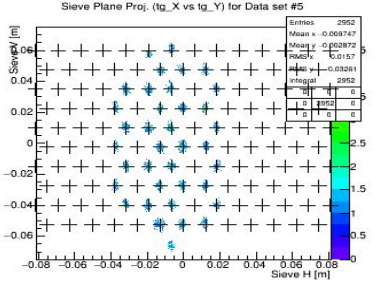


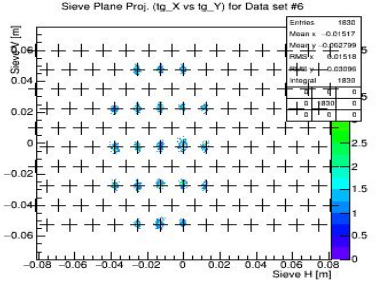


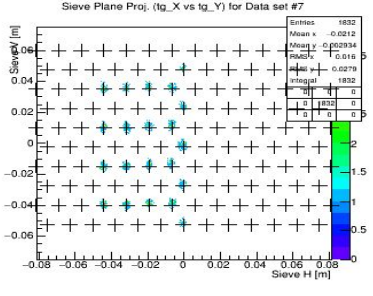


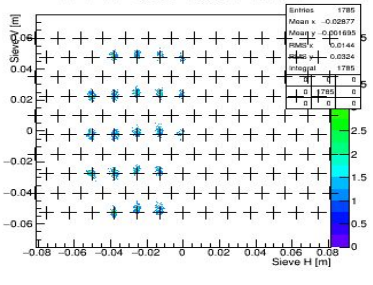


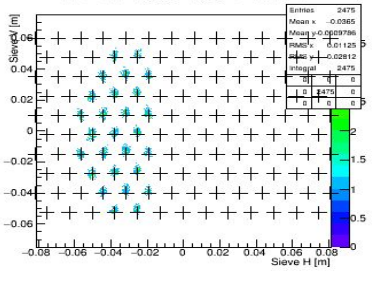


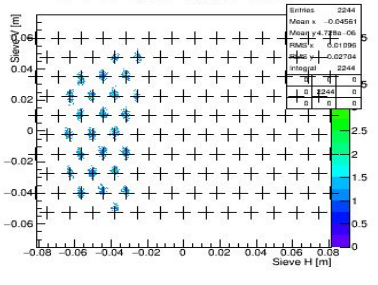




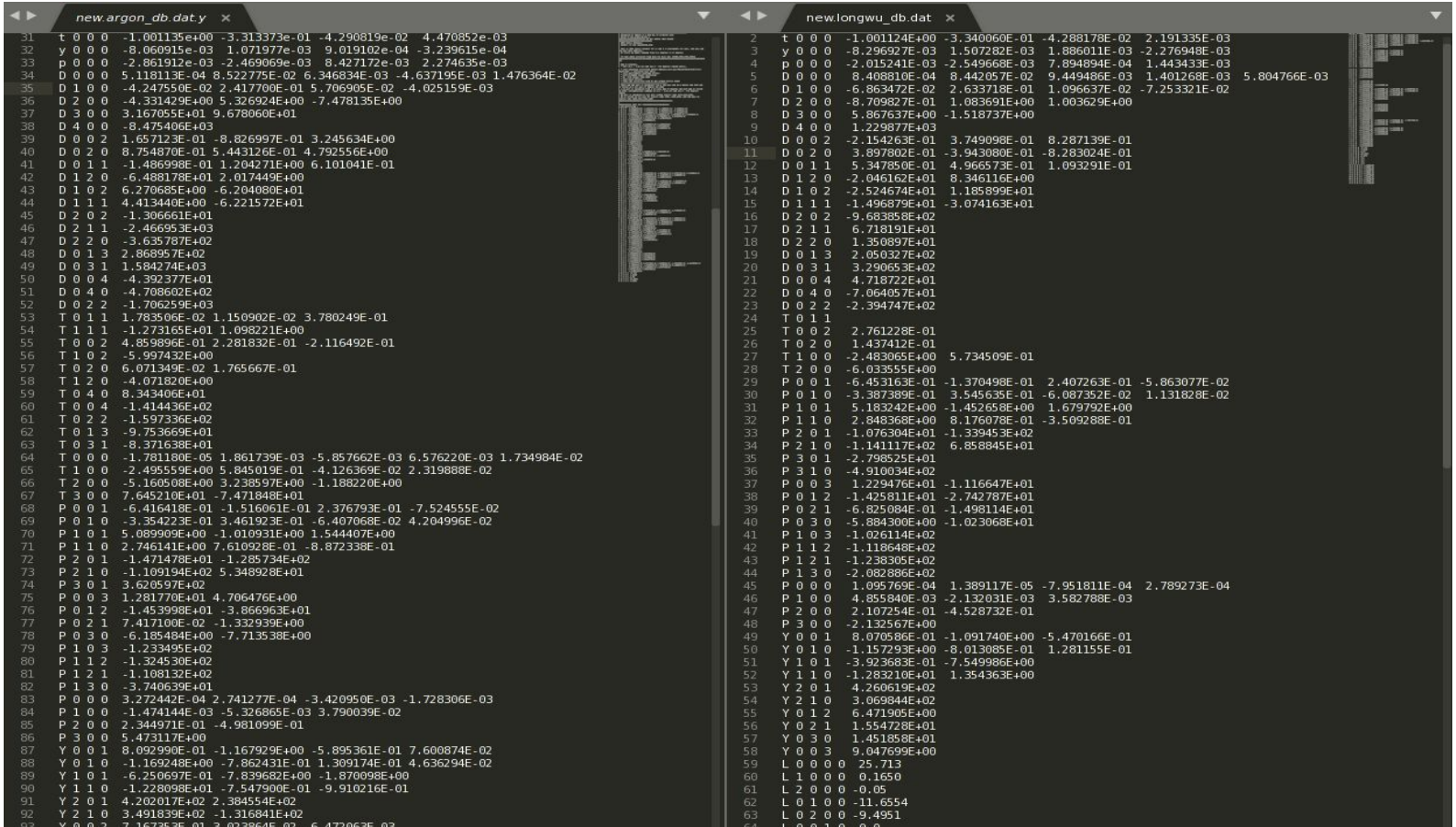








Lower Order Optics from GMp



Thanks Eric, Longwu, Thir, Dien for useful discussions.