# Optics For HAPPEX

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December 2, 2005
HAPPEX Group Meeting

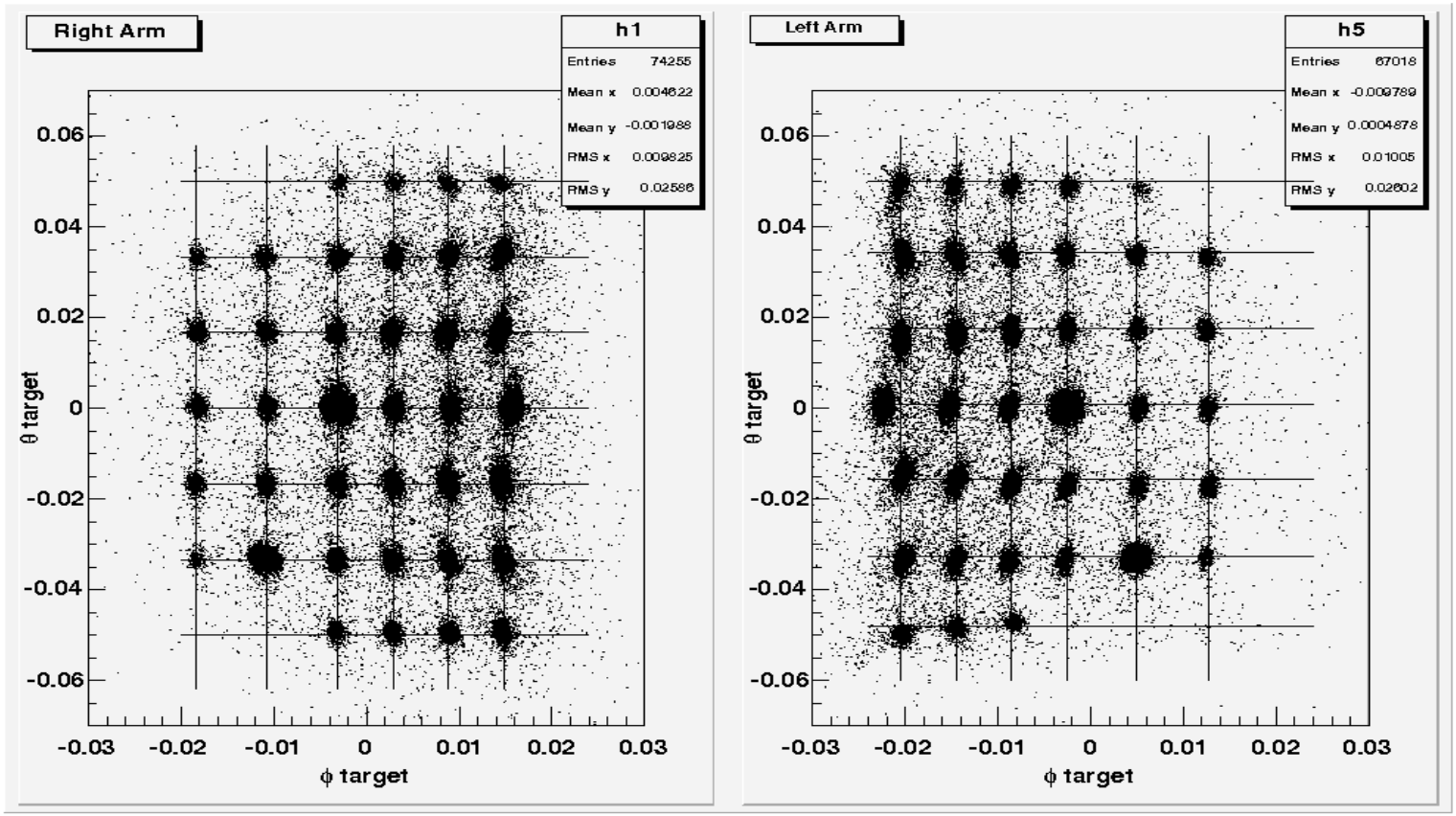
# Spectrometer Matrix Elements

- The optics database provides a link between the focal plane elements x, y, θ, and ϕ with the target variables y, θ, ϕ and δ momentum. Like this for y:

$$y_{tg} = \sum_{j,k,l} \sum_{i=0}^{m} C_i^{Y_{jkl}} x_{fp}^i \theta_{fp}^j y_{fp}^k \phi_{fp}^l$$

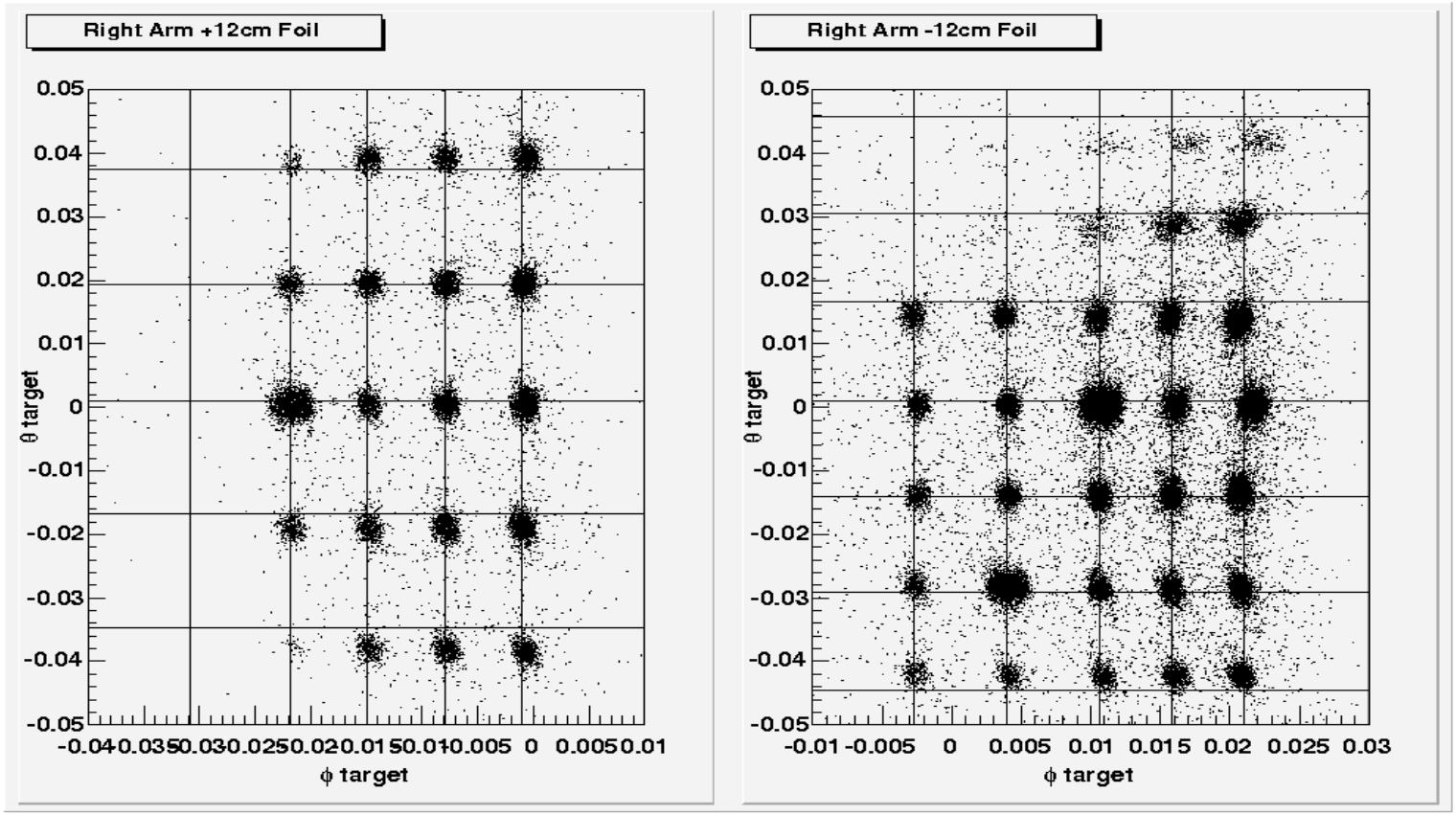
- The database was optimized for y, θ, and ϕ. In the sweeper off configuration.
- The code uses $\chi^2$ minimization based upon getting the average position of each hole closest to the correct $x_{sieve}$, $y_{sieve}$, and $z_{react}$.
- Two targets were used: a single foil $^{12}C$ target, and a two foil 24 cm separated $^{12}C$ target.
- Using the 92 holes seen with the Left-HRS the 54 θ parameters, 65 ϕ parameters, and 53 Y parameters were optimized.

# Left and Right Central Foil



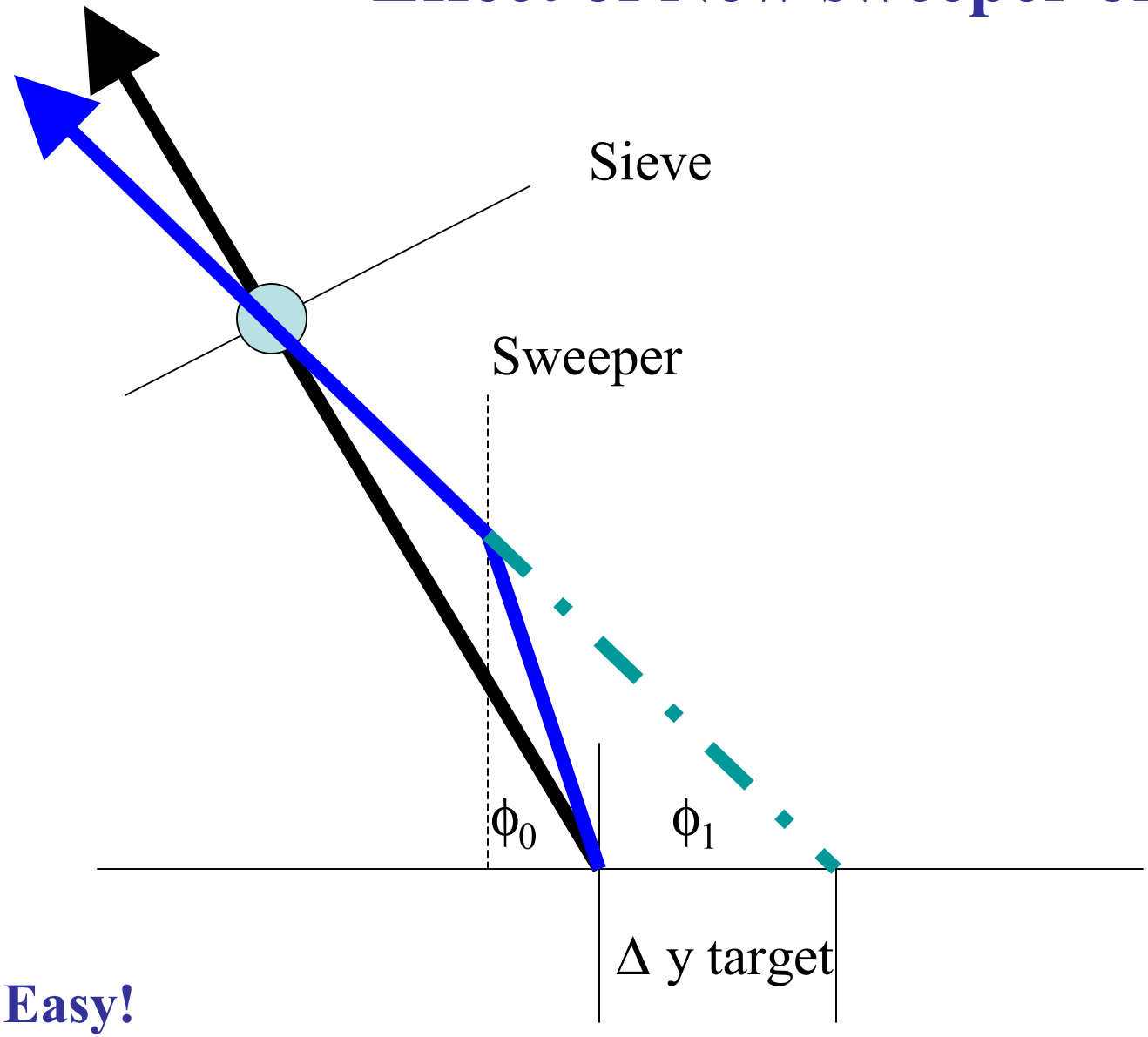

- Database Optimized without sweeper.

# Right Arm Extended Target



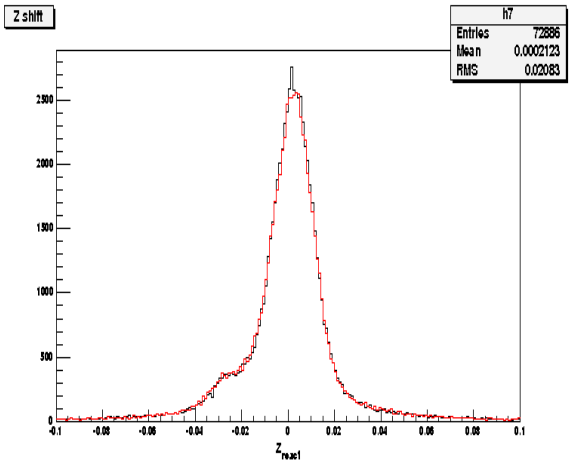

- Database Optimized without sweeper.

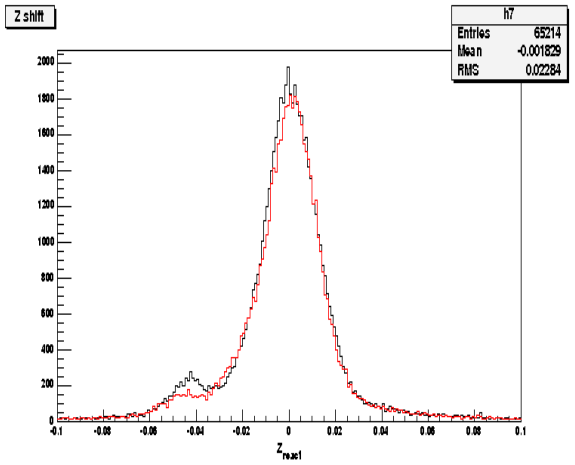
# Effect of New sweeper on optics

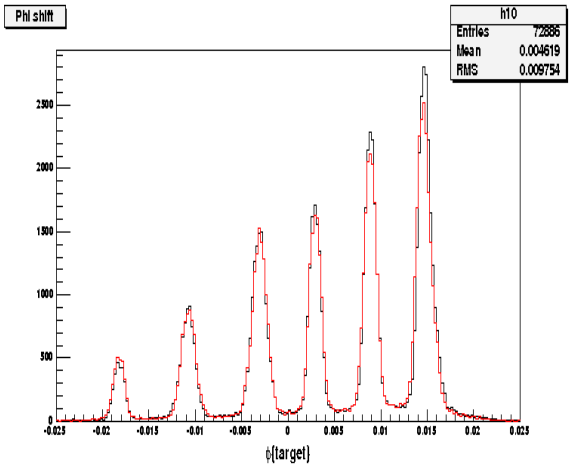


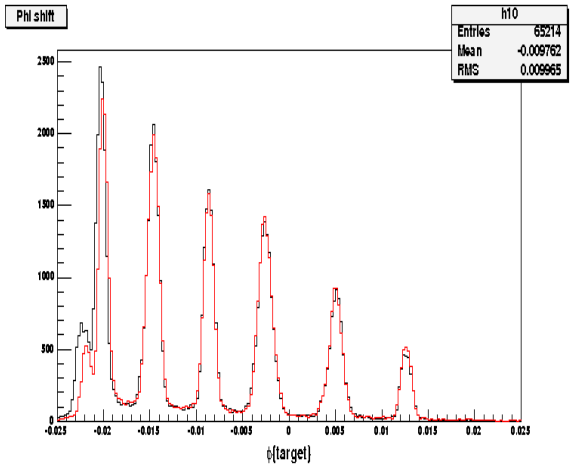

**Not Easy!**

# Central Foil Shifts



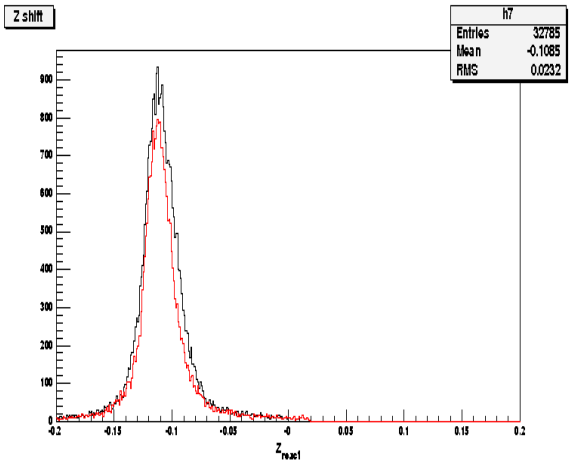



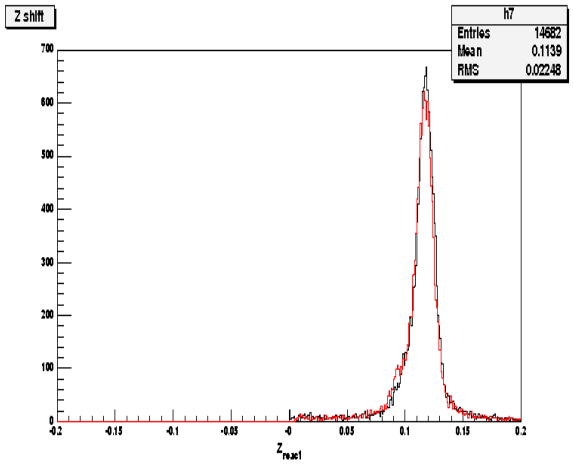



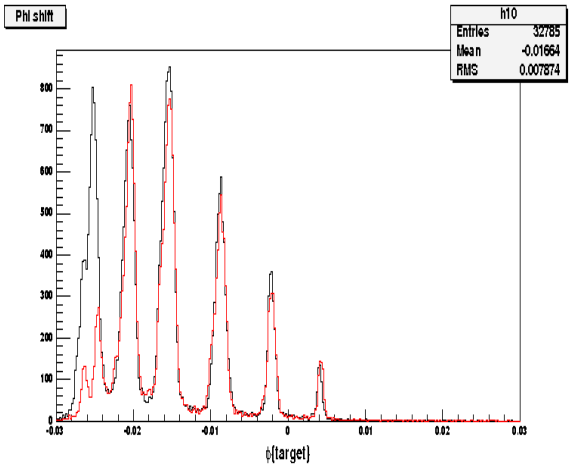



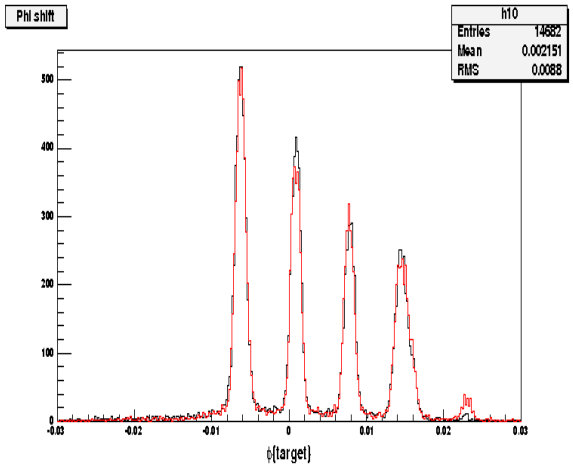

- Right Arm Shift = 1.9mrad
- Left Arm Shift = 1.8mrad

# Left Arm Extended Target Shifts



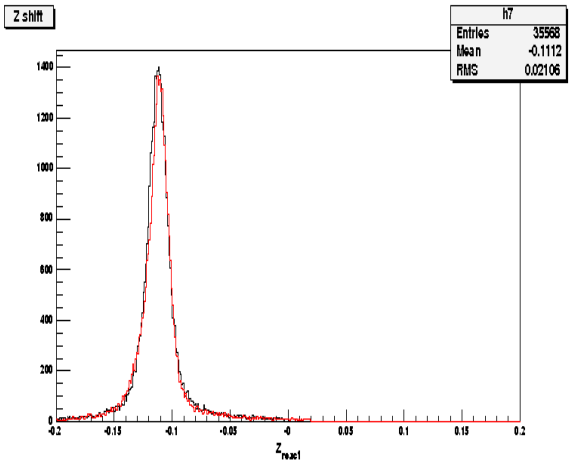



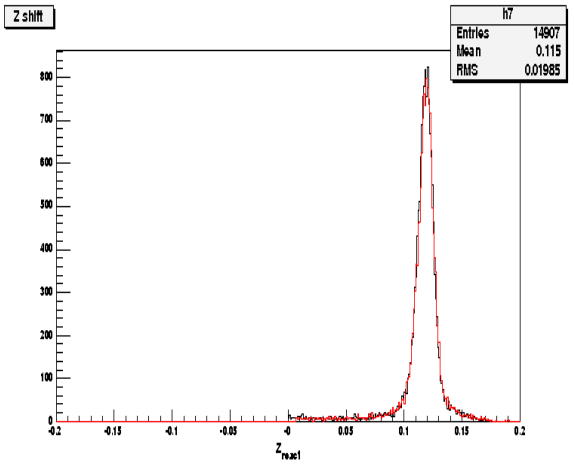



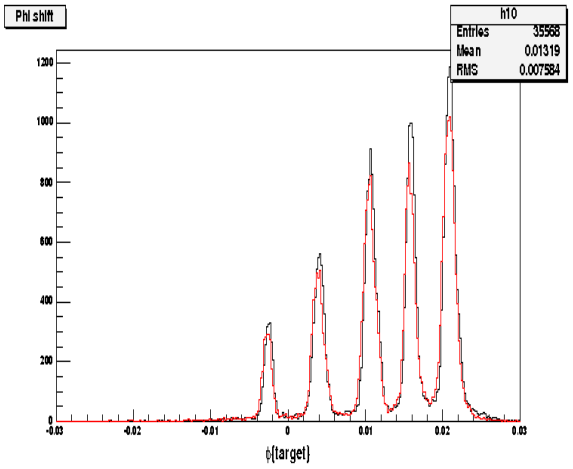



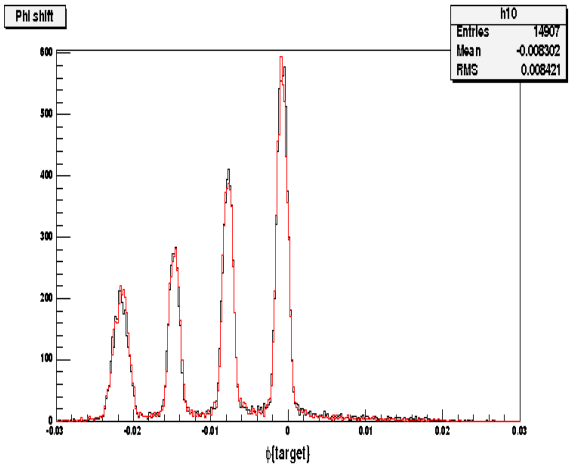

- Left Z=-12cm Shift = 2.1mrad
- Left Z=+12cm Arm Shift = 1.1mrad

# Right Arm Extended Target Shifts




- Right Z=-12cm Shift = 2.3mrad
- Right Z=+12cm Arm Shift = 1.1mrad

# What's left?

- Optimize with the sweeper and Rob's setting.
- Correct for the beam not being at (0,0) in the
- Optimize code.
- Scale the HAPPEX-H angle and reoptimize.

- The He database will be done by Christmas.
- The H database I hope to be done by Christmas, if not then early January.