Analysis Update

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g2p collaboration meeting

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Overview

- Completed work
  - Analyzer database file
    - Organized and generated the correct file
    - Wiki page describes how the information was obtained
    - Thanks to Chao and Ryan for their contributions
  - HRS optics
    - LHRS/RHRS straight through optics
    - LHRS 1.7 GeV, 2.5T transverse, worst septum optics
    - They have been updated by Chao later with latest bpm information and corrections
  - Central scattering angle measurement

- Ongoing work
  - Acceptance

Central Scattering Angle Measurement

- Central scattering angle is defined as the angle between the line connecting target center and sieve center and the ideal beam line
- Reference for scattering angle analysis
  - optics angle calibration
- Two methods to measure this angle
  - Survey
  - Pointing

Survey

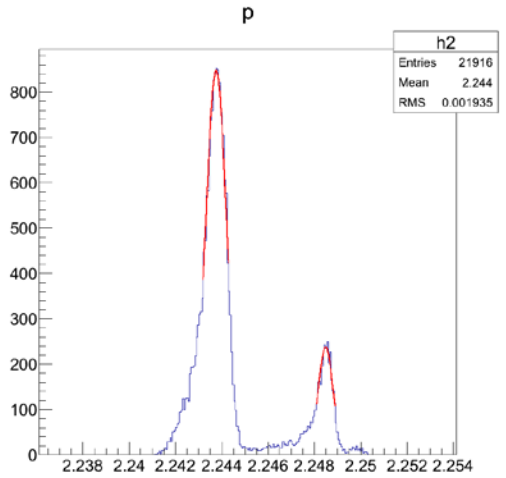
- Uncertainties from survey measurements and target location

Quantity	Uncertainty
Sieve x, y	0.5mm
Sieve z	1mm
Target z	1.5mm

- Results

Arm	Survey values (rad)
LHRS	0.1007 ± 0.0007
RHRS	0.1009 ± 0.0007

Pointing



- Elastic scattering off a target of mass M

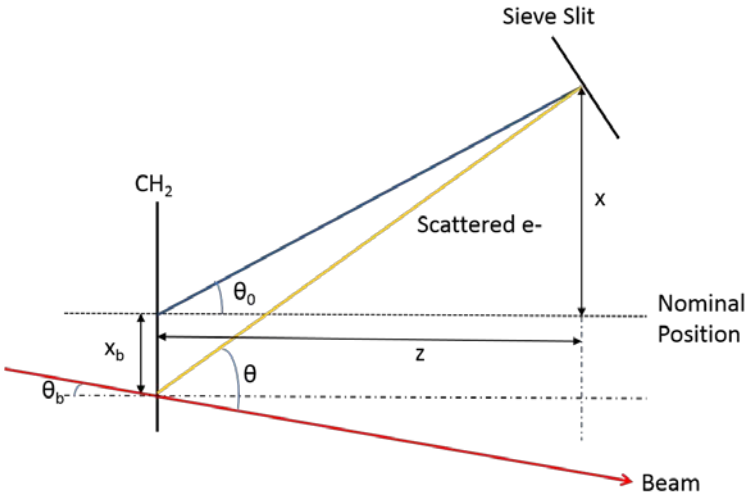
$$E' = \frac{E - E_{loss}}{1 + \frac{E - E_{loss}}{M}(1 - \cos\theta)} - E'_{loss}$$

- Use the difference in E' between two nuclei

$$\triangle E' = E'_1 - E'_2 = \frac{E - E_{1loss}}{1 + \frac{E - E_{1loss}}{M1}(1 - \cos\theta)} - \frac{E - E_{2loss}}{1 + \frac{E - E_{2loss}}{M2}(1 - \cos\theta)} - (E'_{1loss} - E'_{2loss})$$

- Carbon foil in LHe and CH_2 targets were used in g2p

Pointing



Quantity	Uncertainty
Sieve x, y	0.5mm
Sieve z	1mm
Target z	1.5mm
Beam x_b	1.5mm
Beam θ_b	1.5mr

- θ obtained from the pointing calculation
- To convert θ to θ_0, the uncertainty is involved with $(\theta-\theta_0)$ is 2.4mr
- Already larger than survey uncertainty (0.7mr)
- Does not work here

- Survey provides more accurate results
- Tech note for details

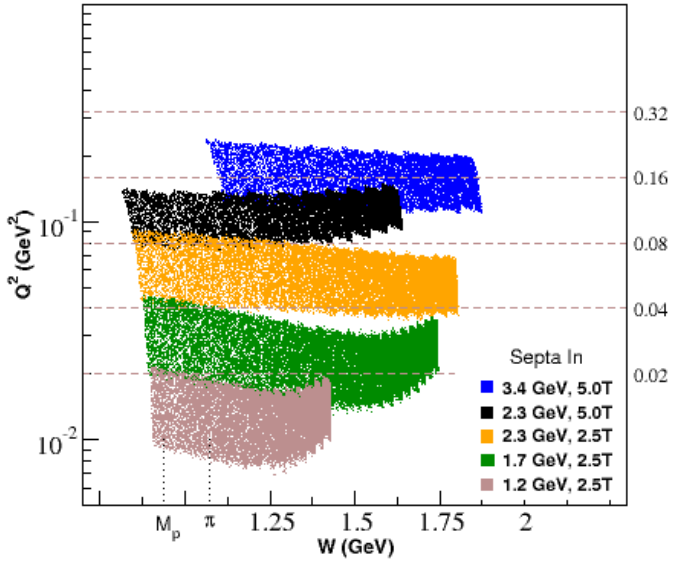
Acceptance

- Unpolarized cross section
- $\frac{d\sigma^{raw}}{d\Omega d\mathrm{E}'} = \frac{N \cdot ps \cdot RC}{Q/q \cdot N_{tg} LT \cdot \epsilon_{det}} \frac{Acc}{\Delta\Omega \Delta\mathrm{E}'}$
- Use Monte-Carlo simulation to study Acc
- $\frac{Acc}{\Delta\Omega \Delta\mathrm{E}'} = \frac{1}{\Delta\Omega^{MC} \Delta\mathrm{E}'^{MC}} \frac{N_{simu}^{MC}}{N_{acc}^{MC}}$

Method

- Generate transport functions to describe trajectories (Snake)
  - Forward/backward between target and focal plane
  - Forward to multiple end-planes along the trajectories to define apertures
- Transport functions compiled into simulation package (g2psim)

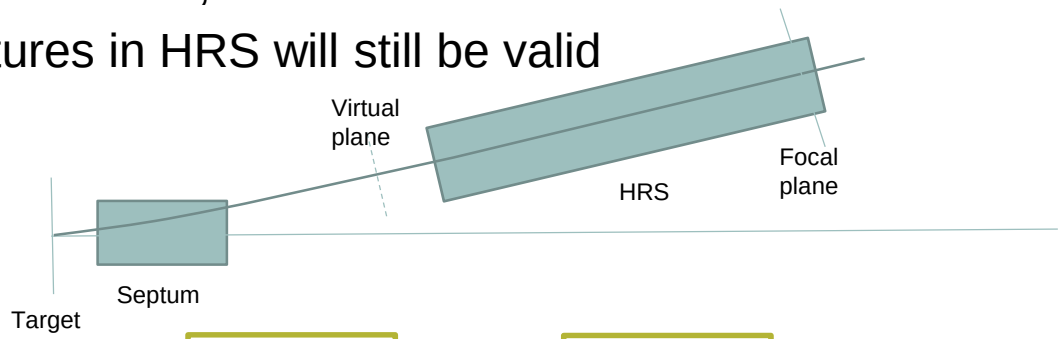
Transport Functions

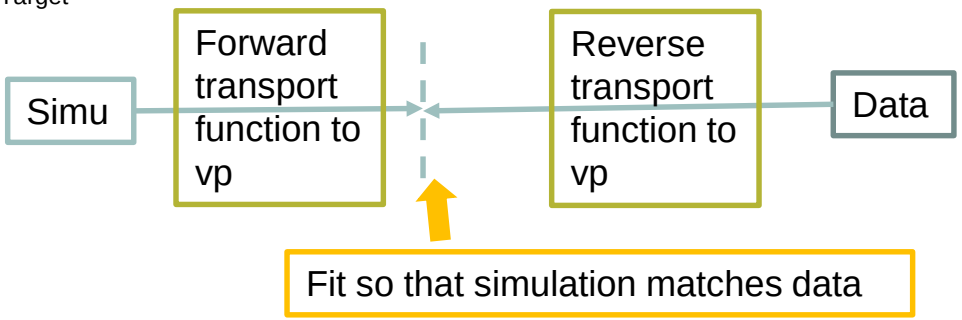


Septum	Production data	Transport function package
484816 good	2.3GeV, 2.5T, p0=2.228GeV	Ready to use
403216 bad	2.3GeV, 2.5T, all other p0 settings	No straight-thru data to compare, will work on it later
400016 very bad	3.4GeV, 5T 2.3GeV, 5T 1.7GeV, 2.5T 1.2GeV, 2.5T	Ready to use

Corrections to Transport Functions

- Goal: match focal plane data
- Method: divide transport functions into two parts
  - Target -> virtual plane + virtual pane -> focal plane
  - Septum is new, while HRS is standard
  - Apertures in HRS will still be valid



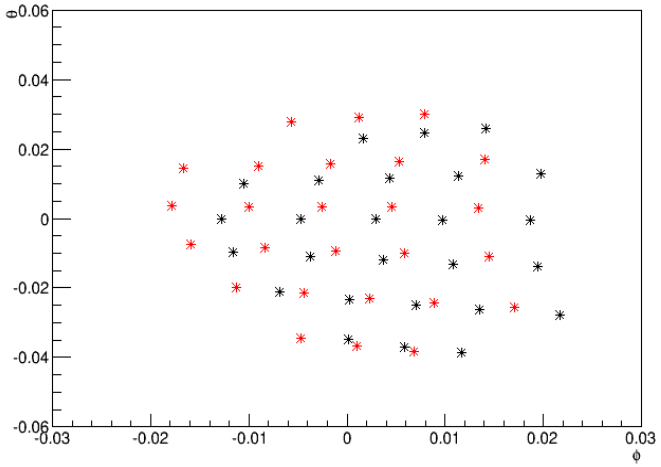


Result:

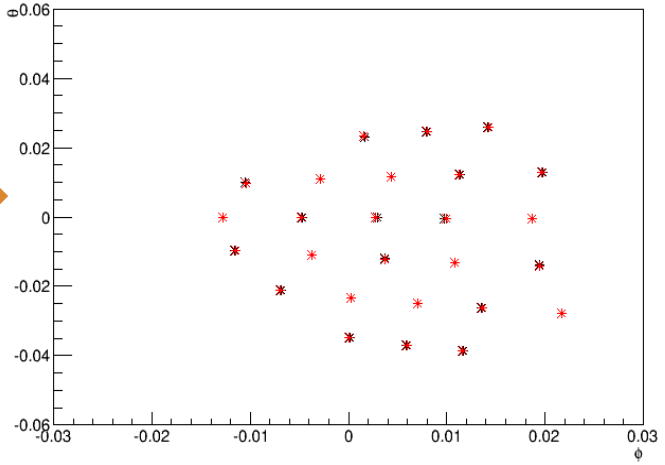
Virtual Plane Fit

θ vs φ

Original



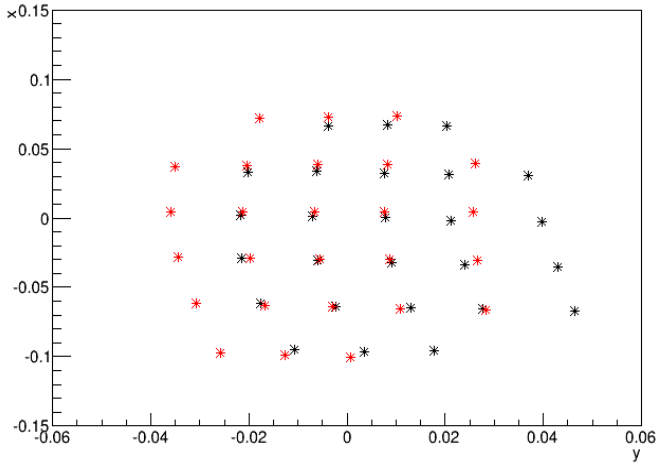
Fit result



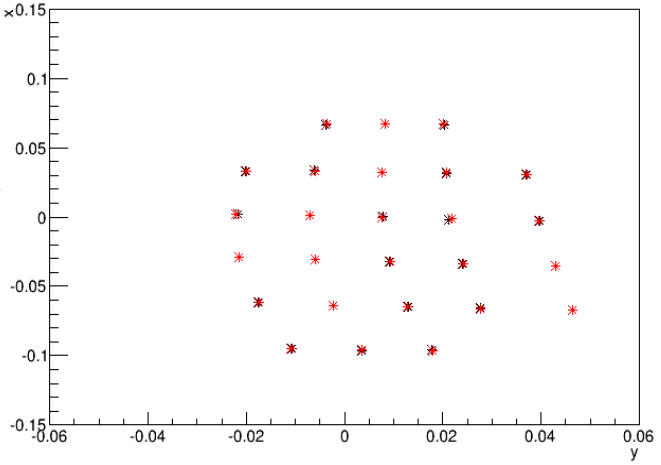
Data
Simulation

x vs y

Original



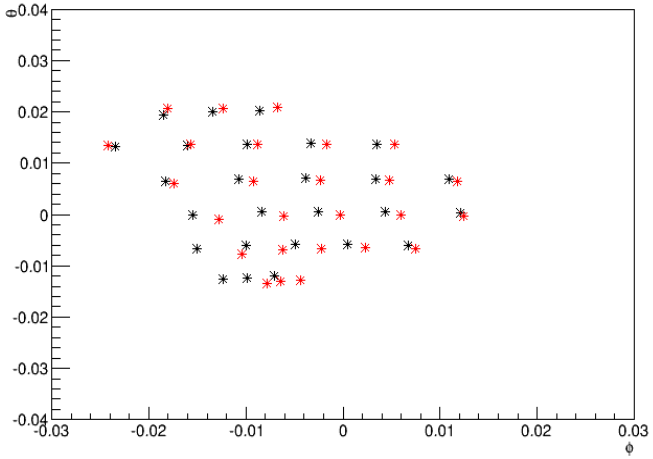
Fit result



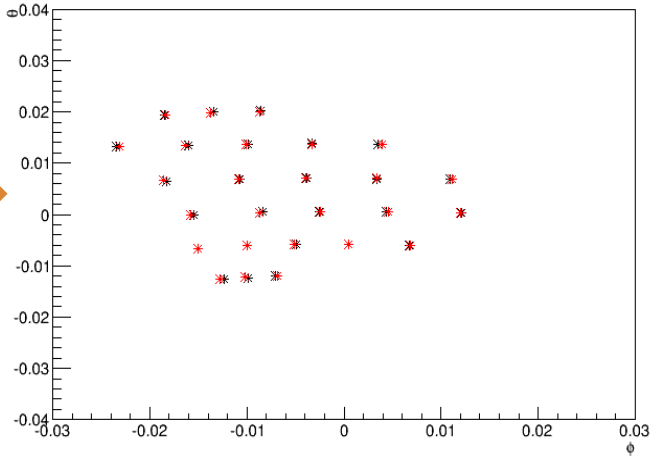
Focal Plane Comparison

θ vs φ

Original



After correction @ fp



Data
Simulation

x vs y

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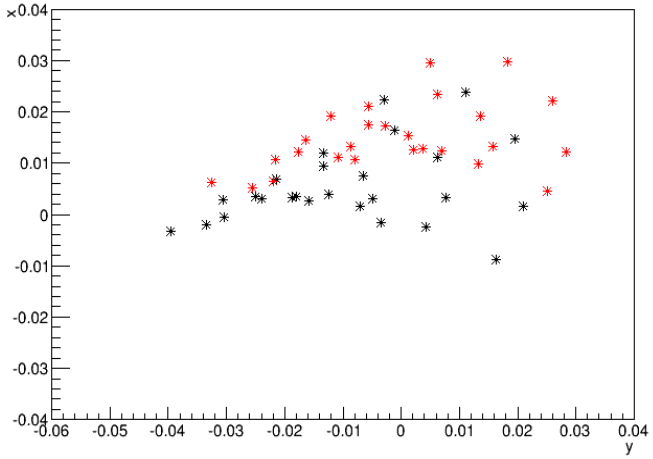

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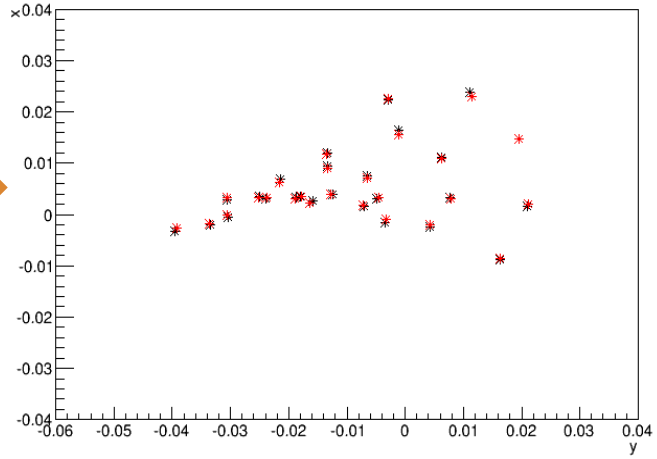
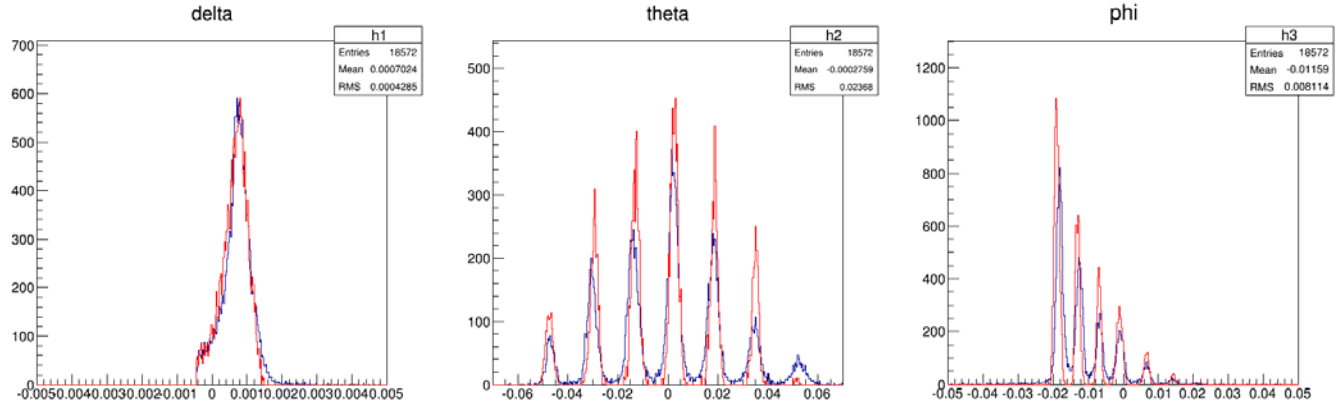


Acceptance

- Distribution comparisons at target plane

Straight through optics run



Apply corrected transport functions

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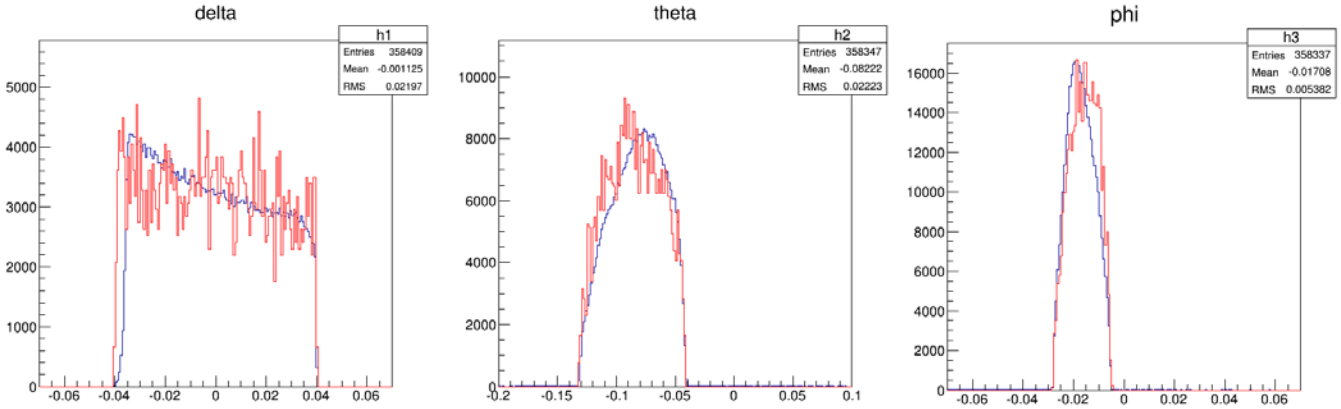
1.706 GeV, 2.5T, transverse, dilution run, empty target



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Plan for Graduation

- Short term plan
  - Acceptance (1-2 months ?)
    - Update with energy loss model (when completed)
    - Update with new transport functions
    - Repeat the correction procedures for worse septum situations
    - Go through other settings
- Long term plan
  - Analysis of thesis topic
- Plan to graduate in May, 2015