Analysis Workshop Summary

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Jefferson Lab

Hall A Collaboration Meeting
June 13, 2008

http://hallaweb.jlab.org/data_reduc/AnaWork2008/

Outline

1. Software Progress
   - Podd (C++ Analyzer)
   - BigBite Track Reconstruction
   - Tools
2. Experiment Reports
   - Experiment Reports: E02-013 (GEn)
   - E05-110 (Coulomb Sum Rule)
   - E06-007 (Pb(e,e'p))
   - E97-110 (small angle GDH)
   - E05-103 (low E gamma-d)
   - E03-101 (gamma-pp)
3. General Issues

Podd 1.5: Status

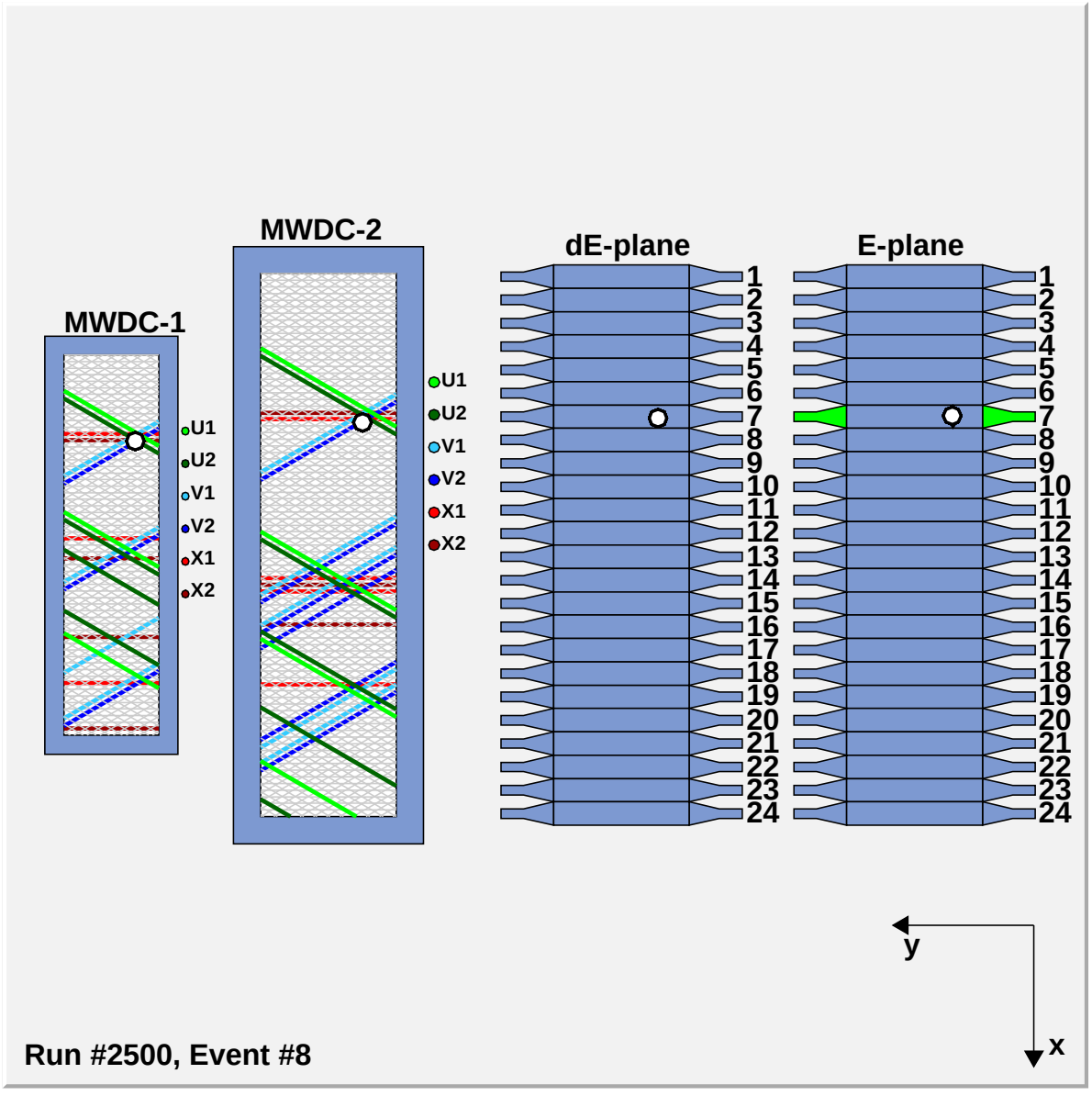
- Expanded database capabilities (arrays, strings)
- Extended detector maps (reference channels)
- Restructured helicity classes
- Bugfixes (split runs, formulas, output)
- Performance improvements (output)
- Support for ROOT 5.18

Well-working “beta” version in CVS now, on Web in mid-June

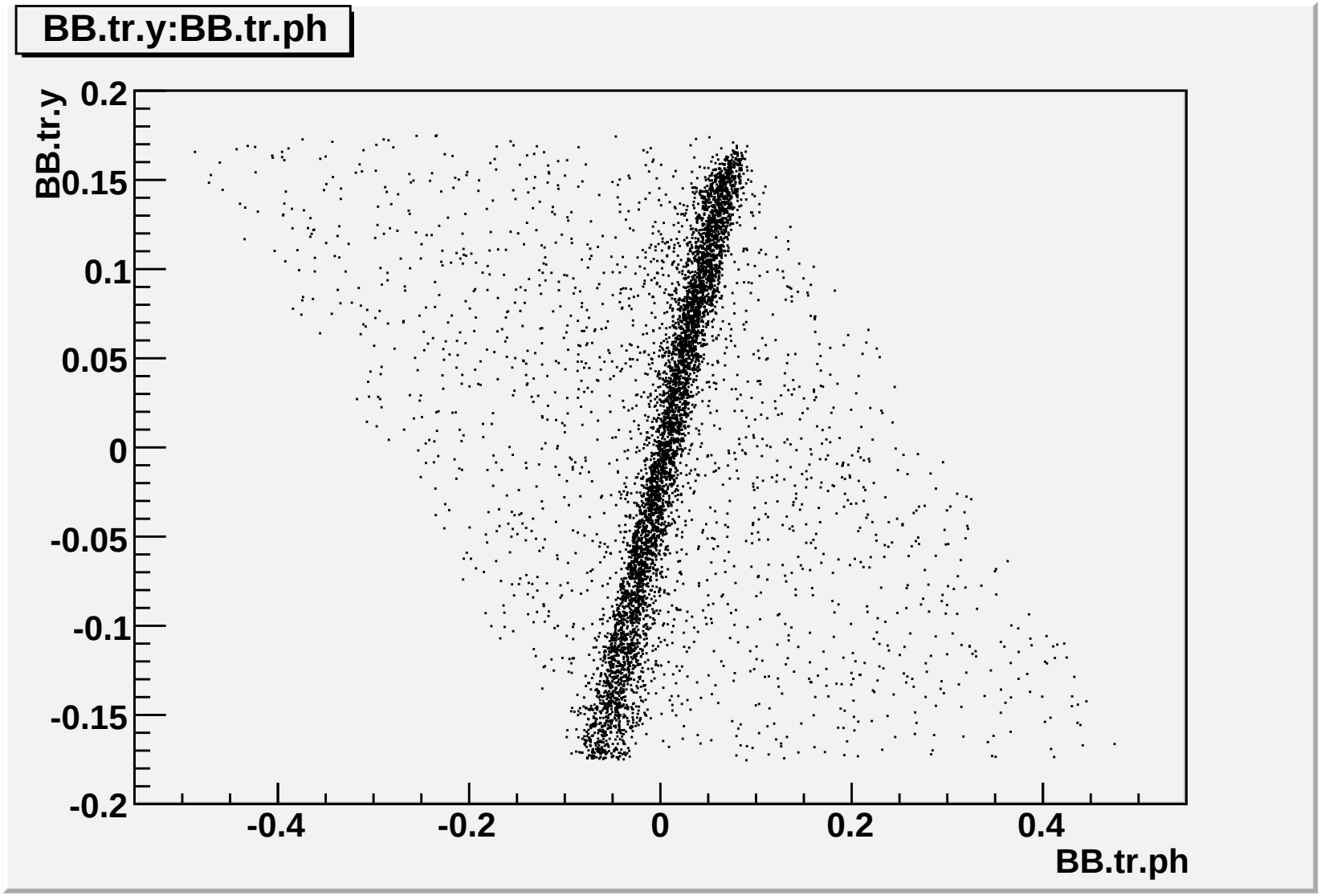
BigBite Tracking: Status

- Finished tracking code in January–April: Five new algorithms in addition to TreeSearch!
- Tested and debugged with G_E^n and E04-007 data. Works reasonably well.
- 12-chamber BigBite configuration not well suited for TreeSearch, while 15-chamber G_E^n configuration is.
- Event display (Miha Mihovilovic)
- Preliminary target reconstruction (Jin Huang)
- Still to do
  - Verification with Monte Carlo and against old G_E^n code
  - Precision target reconstruction
  - Shower/scintillator cut
  - Higher order corrections ($\cos\theta$, timing, etc.)

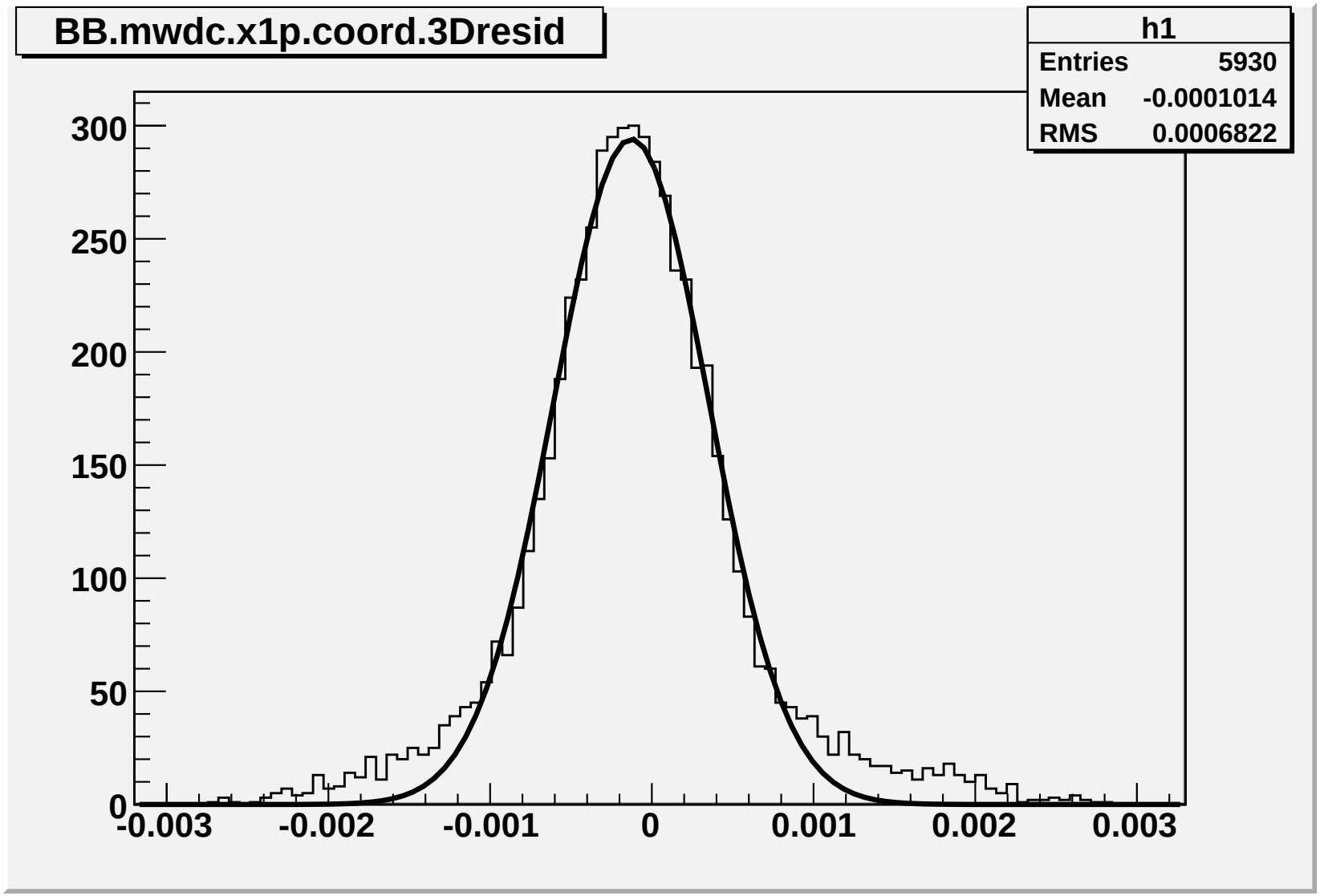
Event Display: Planar View (E04-007)



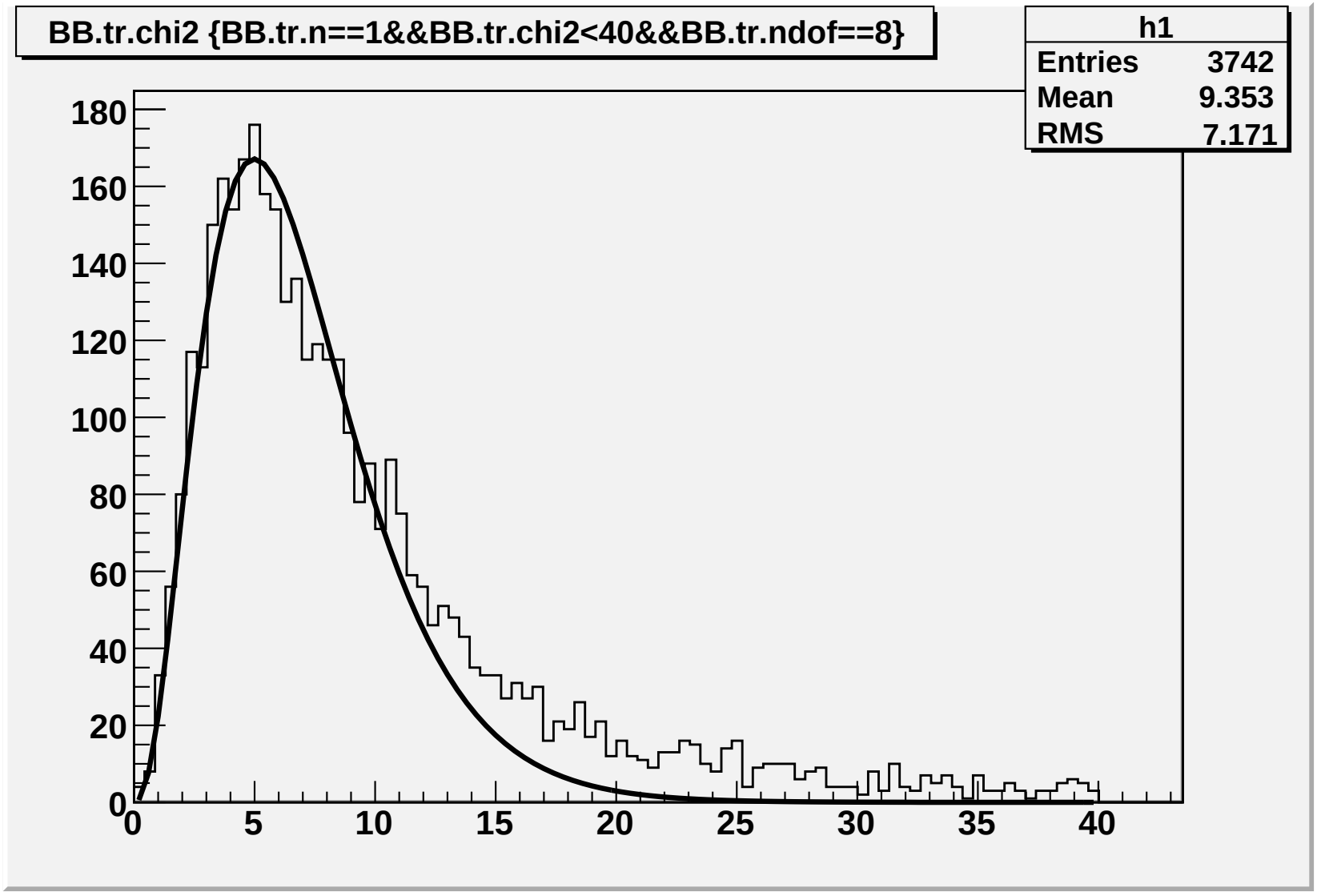
Track y vs phi (NB: approx. point target)



Hit position residuals



Track χ^2


BB.tr.chi2 {BB.tr.n==1&&BB.tr.chi2<40&&BB.tr.ndof==8}
h1
Entries 3742
Mean 9.353
RMS 7.171
180
160
140
120
100
80
60
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20
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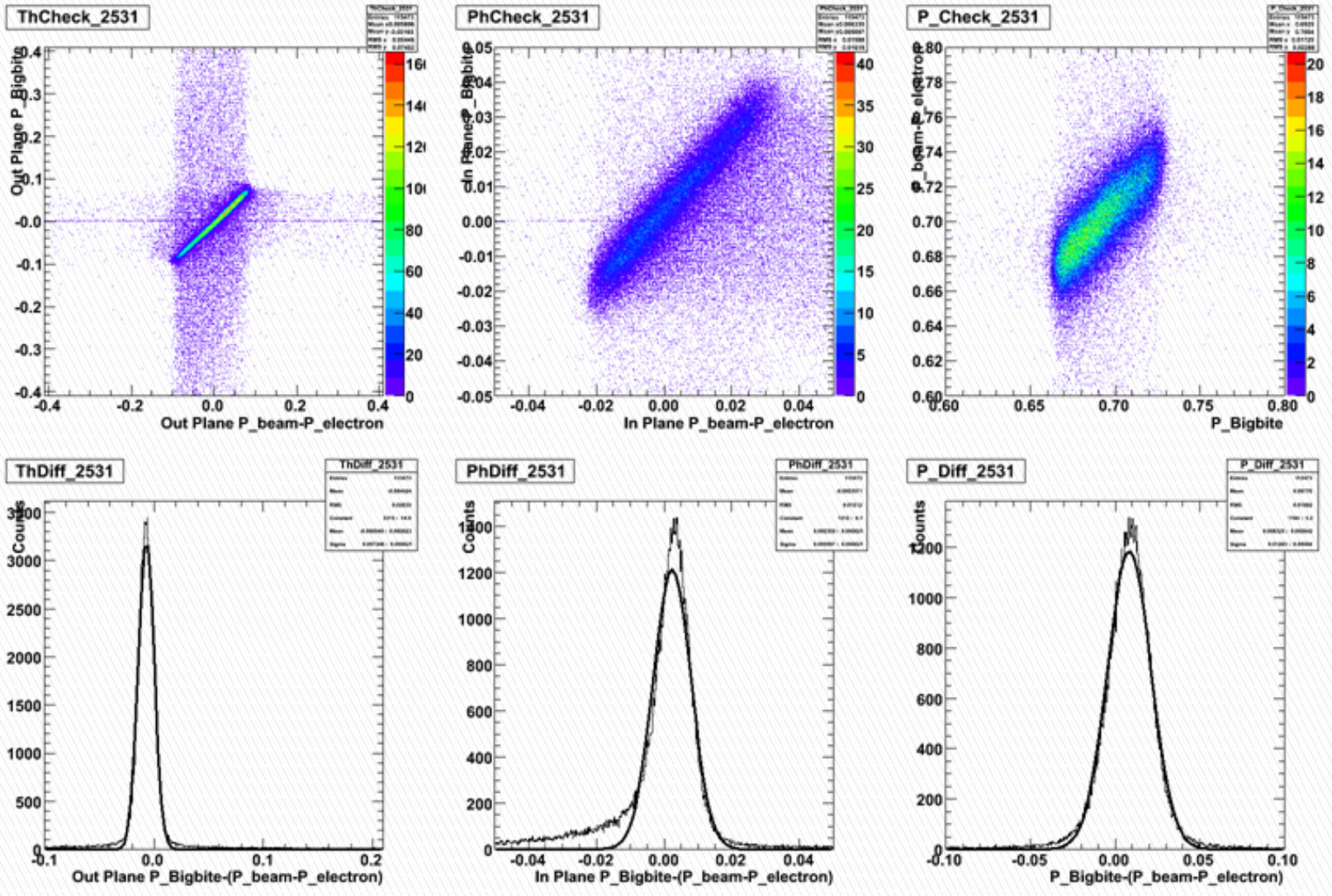


Elastic e-p scattering with BigBite coil @ ~400A

Online System

- Replay Script System (Jin Huang)
  - Generic analysis scripts — largely reusable
  - Maintenance by experiment expert(s), used by shift crew
  - Built-in checks & automation
- BigBiteLib: collection of BigBite software (Jin)
  `http://www.jlab.org/~jinhuang/BigBiteDoc/`
- Podd database files
  - Daily CVS backup (B. Moffit)
  - Automatic update of `db_run.dat` (V. Sulkosky)
- OnlineGUI (B. Moffit):
  `http://www.jlab.org/~moffit/onlineGUI/`
- Example scripts available for download (Jin)
  `http://www.jlab.org/~jinhuang/Meeting/2008.06.12%20Analyzer%20Workshop/Scripts/`

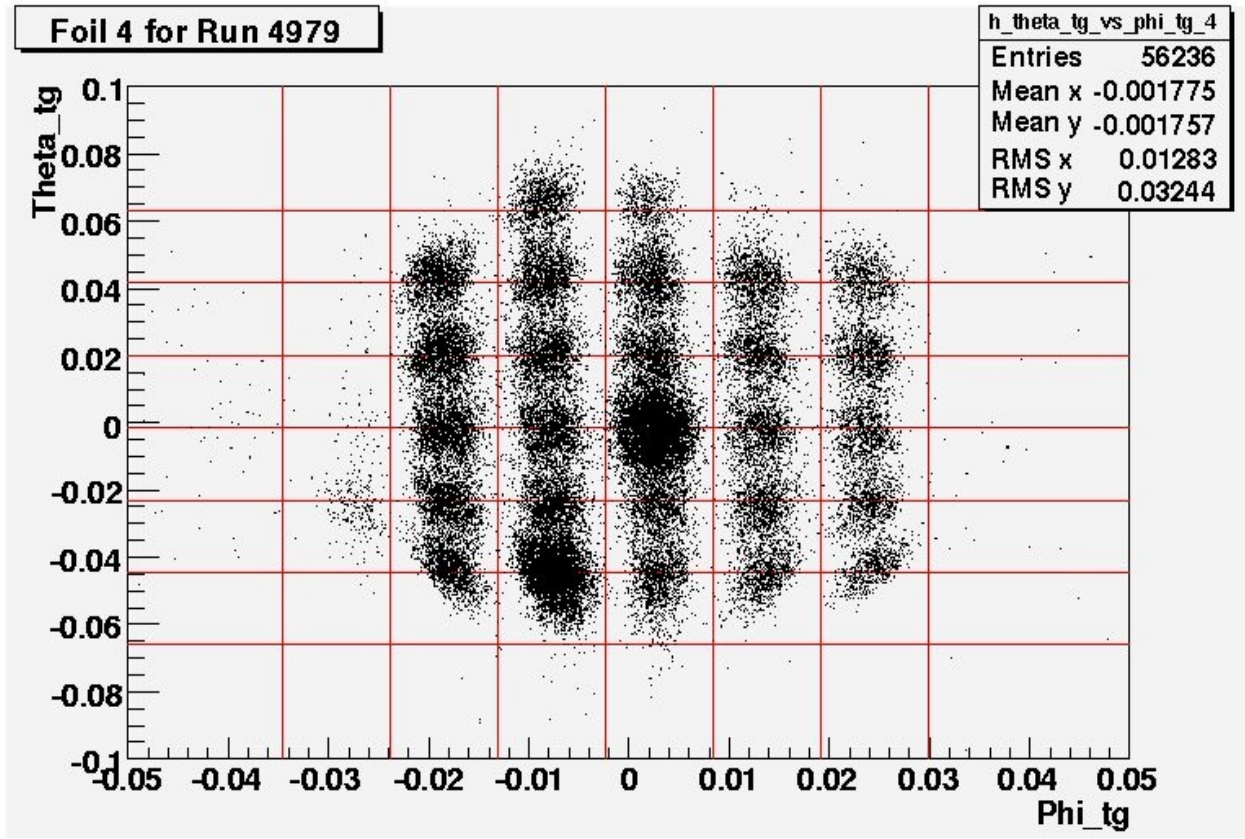
E02-013: Polarized 3He(e,e'n) Analysis

- $Q^2 = 3.5$ GeV^2 QE event selection (resolution-limited)
- π production Monte Carlo
- Dilution factors
- Charge ID in neutron detector
- Better statistics (event selection, tracking)

E05-110: CSR Cross-Section Analysis

- Optics
- NaI calibration
- Target boiling study
- Beam energy calibration

0.4 GeV Problem



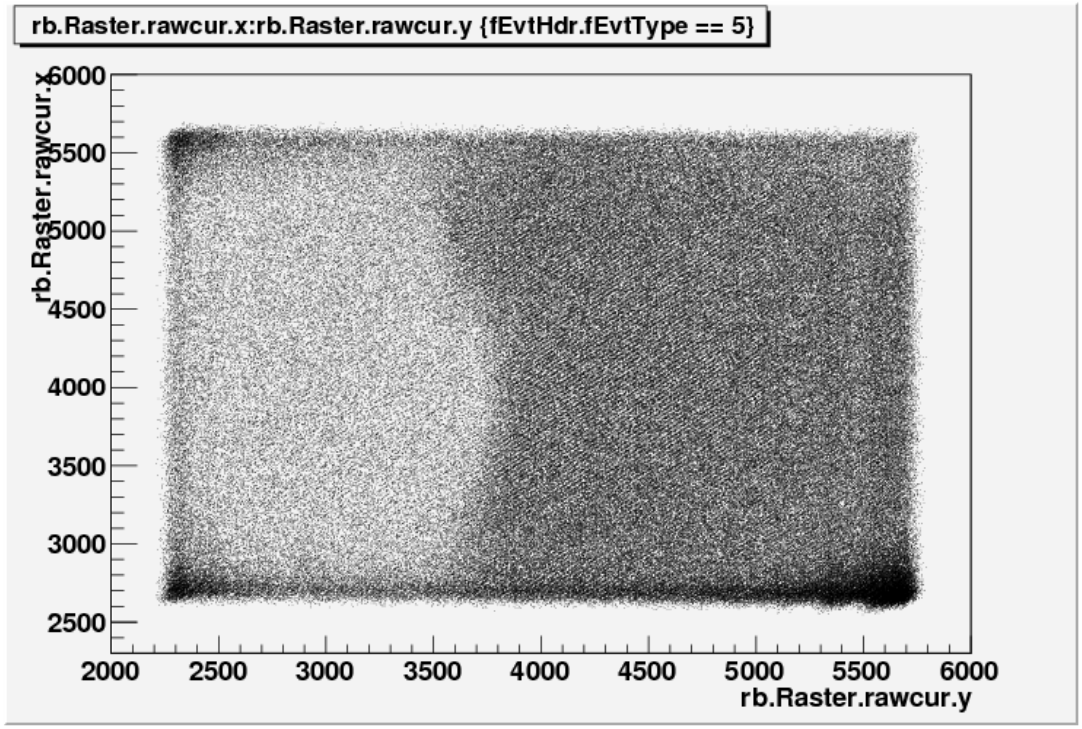
With elastic peak cut

E06-007 (Pb(e,e'p))

- Optics, esp. raster correction
- Q_{eff} of displaced BeO target
- GEANT Monte Carlo

Effective Charge (Q_{eff})

^{209}Bi target, unfortunately, slipped of its frame



E97-110: VDC Multi-Track Analysis

Study of two-track events using shower

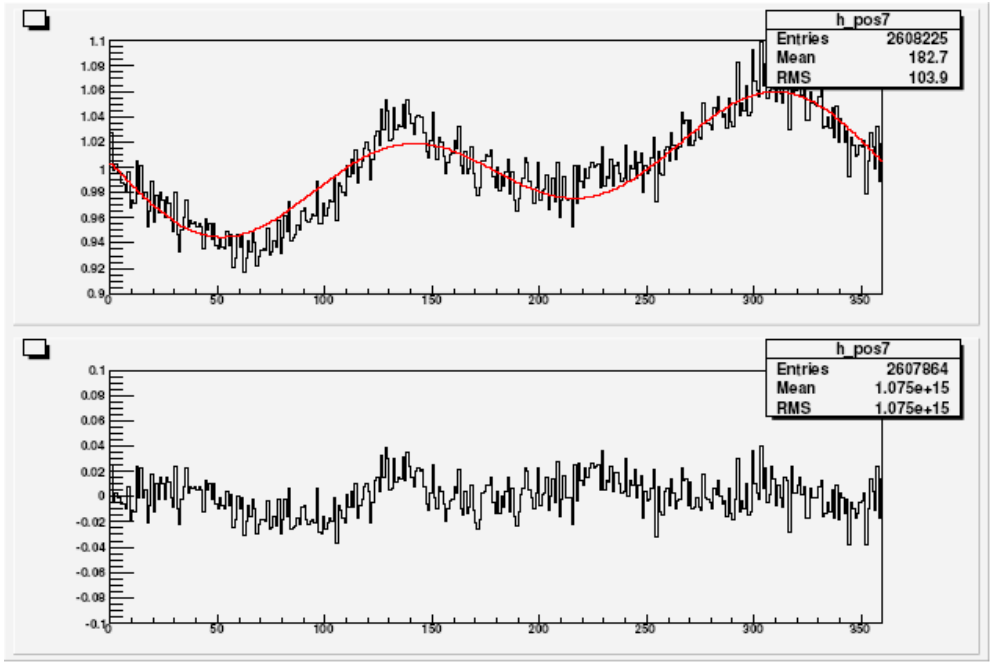
Conclusions

- For $0.8 < \frac{E_{1st}}{p} < 1.1$ and $\frac{E_{2nd}}{p} < 0.9$, 40% - 50% of events are good
- For $0.8 < \frac{E_{2nd}}{p} < 1.1$ and $\frac{E_{1st}}{p} < 0.9$, 10% - 20% of events are good
- For $0.95 < \frac{E_{1st}}{E_{2nd}} < 1.05$ and $0.9 < \frac{E1}{p} < 1.1$, 10% of events are good
- For the standard low Q^2 GDH cut, $0.8 < \frac{E}{p} < 1.1$ cut on two-tracks events, nearly 70% of two-tracks events can be added into good events when we calculate the cross section - not very sensitive to kinematics

E05-103: FPP False Asymmetry Parametrization

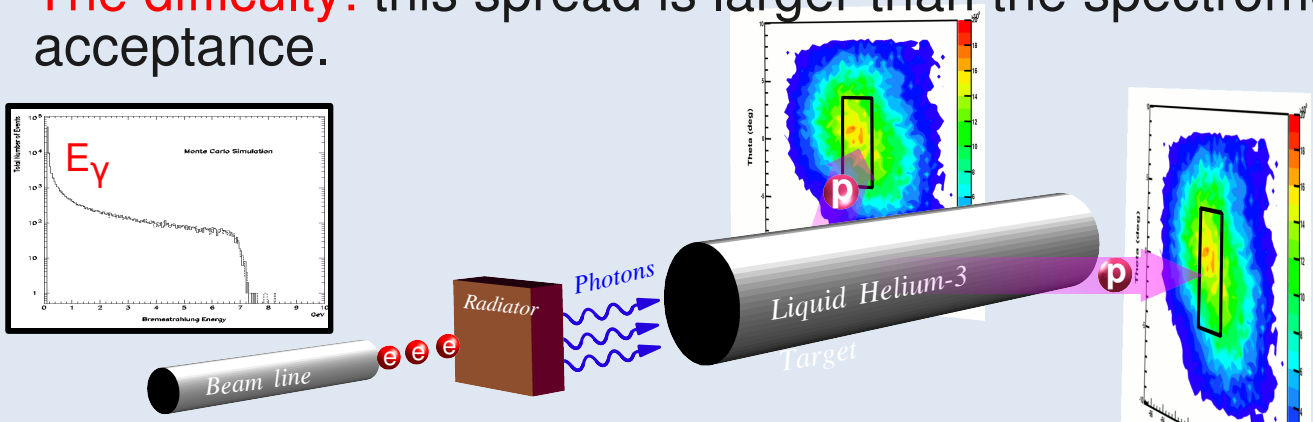
Result of Parameterization

Results of parameterization shown below as a function of ϕ_{fpp}. Top plot is helicity sum of elastic data for $0.015 < \delta_p < 0.025$, along with the instrumental asymmetry parameterization plotted for dp = 0.02. Bottom plot shows helicity sum subtracted by polynomial fit, resulting a flat distribution centered at zero.



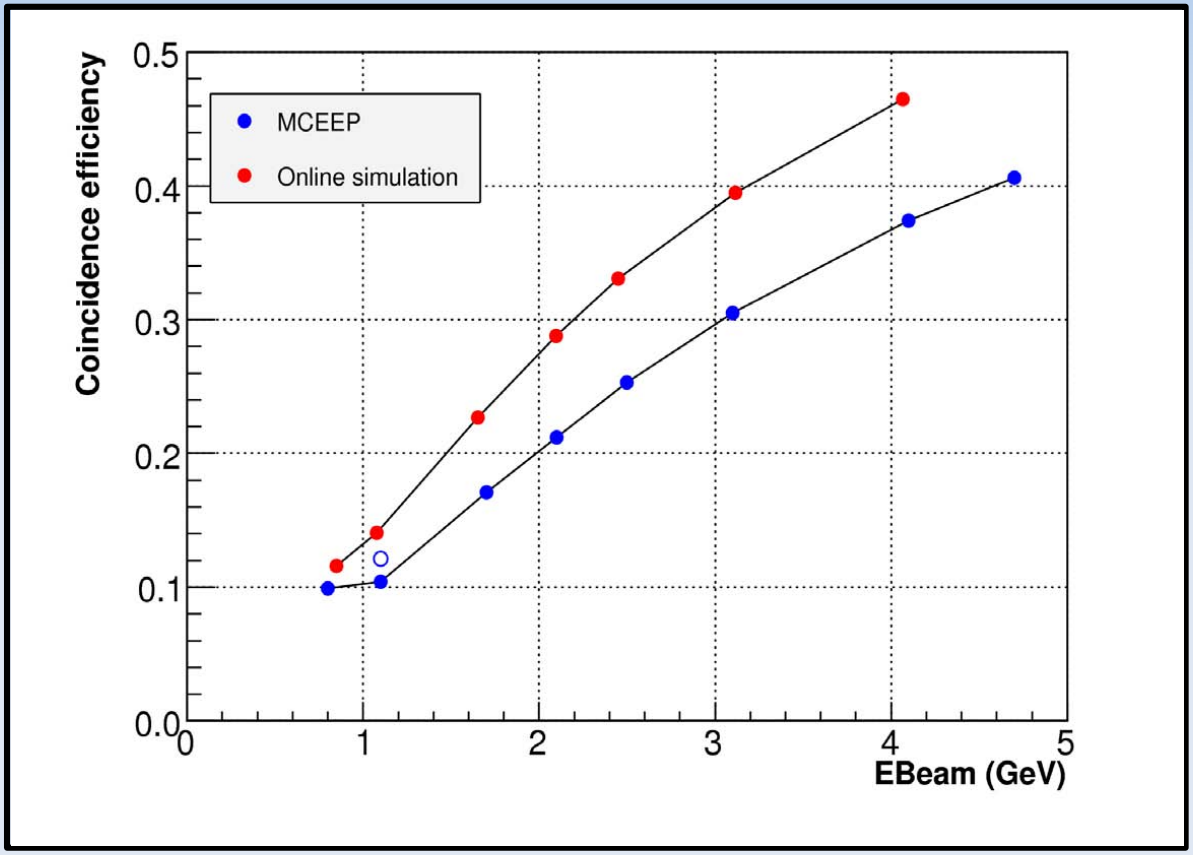
Coincidence efficiency calculation

- We set the spectrometers to detect events in which two protons emerged in coincidence. The edge of the HRS acceptance is set to detect a pair at rest disintegrated in 90^{o} c.m. from a photon with $E\gamma=E_{Beam}$.
- The fermi motion of the proton pair and the $E\gamma$ spectrum results in a spread of the phase-space distribution of the outgoing protons.
- The difficulty: this spread is larger than the spectrometers acceptance.



Coincidence efficiency calculation

- Results



General Issues

- Workshop Format
  - At every collboration meeting
  - Presentations from every active experiment (ca. 75% success rate this time)
- Monte Carlo Workshop: try at next collaboration meeting
- Communication
  - Wiki or similar with examples, mini-tutorials etc. — to do
  - halog-style log? roottalk-style mailing list?
- Software Development
  - About 2 man-years of projects (none are critical)
  - Need manpower, volunteers

Example Software Development Projects

- Write documentation (esp. User's Guide)
- Improve performance of `THaOutput`
- Improve VDC track reconstruction (multitrack handling)
- Improve shower cluster analysis
- Write EPICS fitter (time evolution of slow control data)
- Implement abstract database interface with SQL & file-based backends
- Convert Podd to `TTimeStamp` to handle timezones correctly
- Implement multi-threading

Volunteers welcome