Analysis Workshop Summary

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Jefferson Lab

Hall A Collaboration Meeting
December 15, 2009

http://hallaweb.jlab.org/data_reduc/AnaWork2009/

Outline

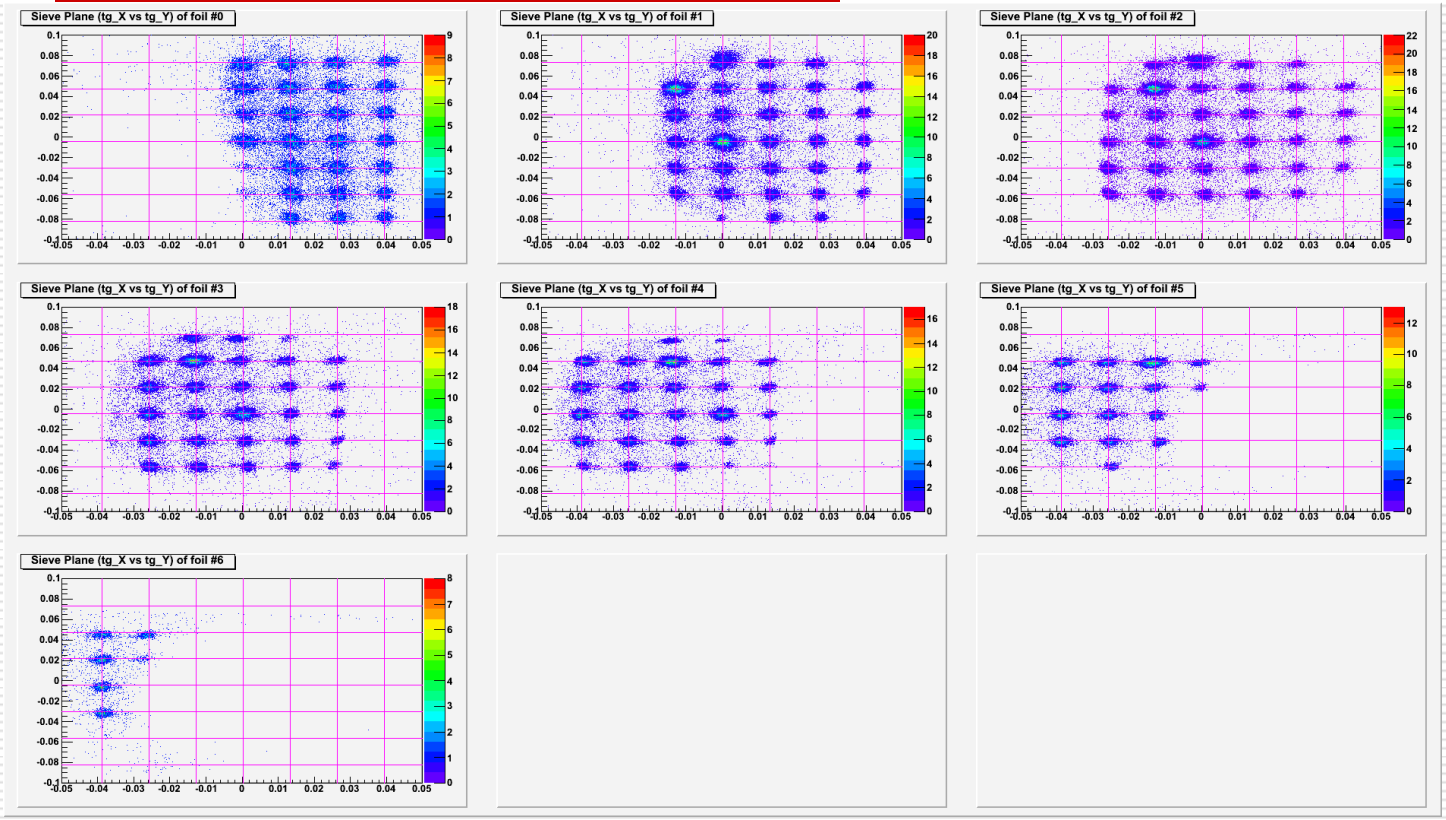
Podd (C++ Analyzer) Status

- 2006 vintage: version 1.4.12 ▸ release notes
  - Stable production code
  - Still used by some older experiments
  - Contains backports of most version 1.5 bugfixes
- 2008 vintage: version 1.5.12 ▸ release notes
  - Stable production code
  - Used by current experiments (2008–)
  - Required for new BigBite tracking software ▸ web
  - Recommended for all new development
- Podd 1.6: expected 2010

Home page: http://hallaweb.jlab.org/root/

HRS Optics Optimization I (Ge Jin)

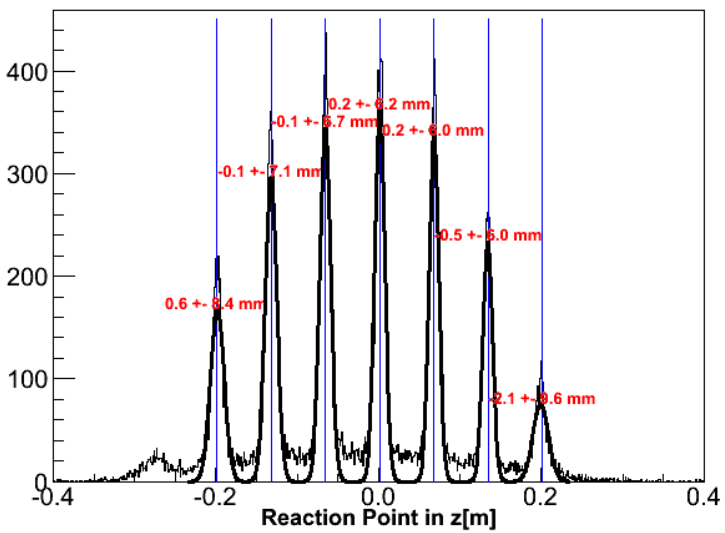
Sieve reconstruction from a multi-carbon foil target



HRS Optics Optimization II (Ge Jin)

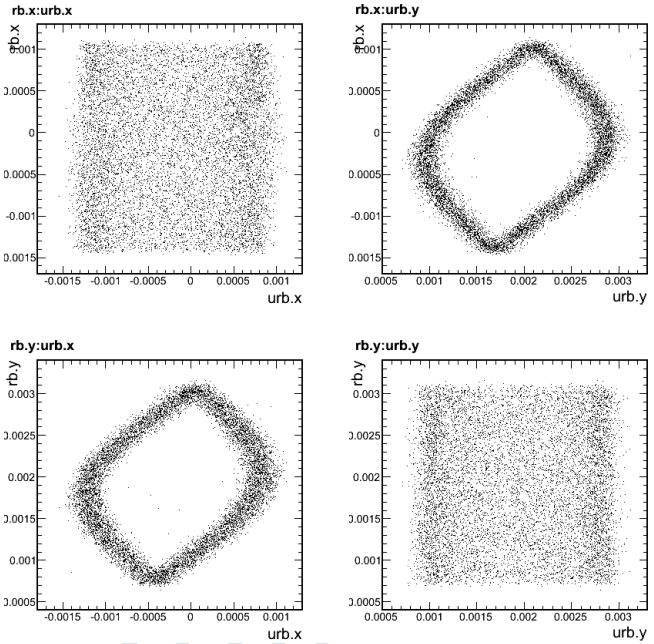
Target y (reaction point z) calibration

- 7-carbon foil target to cover 40 cm range
- Reconstruction error ~.5 mm, resolution ~6 mm



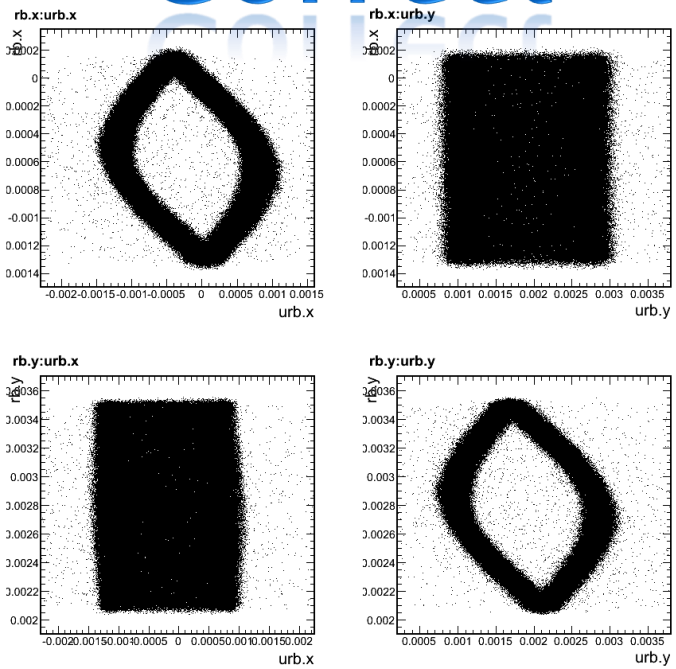
Raster Corrections (Jin Huang)

Identifying the problem / Raster BPM correlation



X Wrong

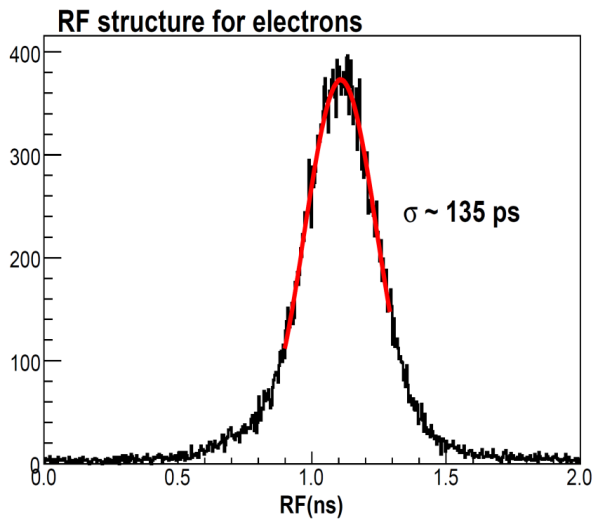
Correct

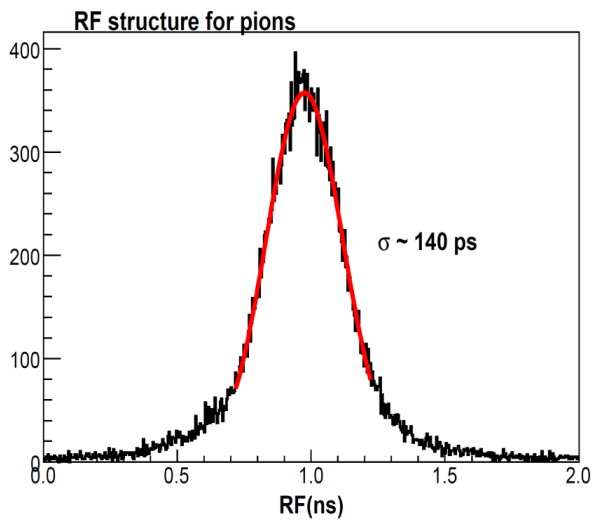


BigBite Coincidence Timing Analysis I (Jin Huang)

LHRS single arm final
by Chiranjib Dutta

- Reached a 1σ resolution ≤140ps
- Checked with RF Structure $\mathrm{RF\ Time}_{\mathrm{Spectrometer}} - t_{\mathrm{RF}}$

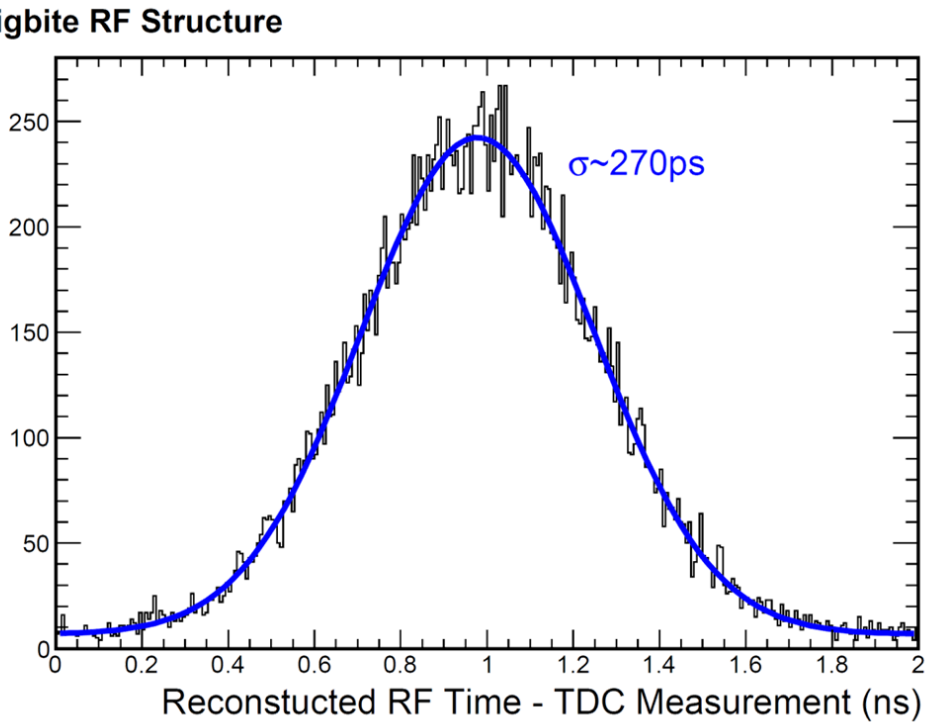




BigBite Coincidence Timing Analysis II (Jin Huang)

BigBite single arm final

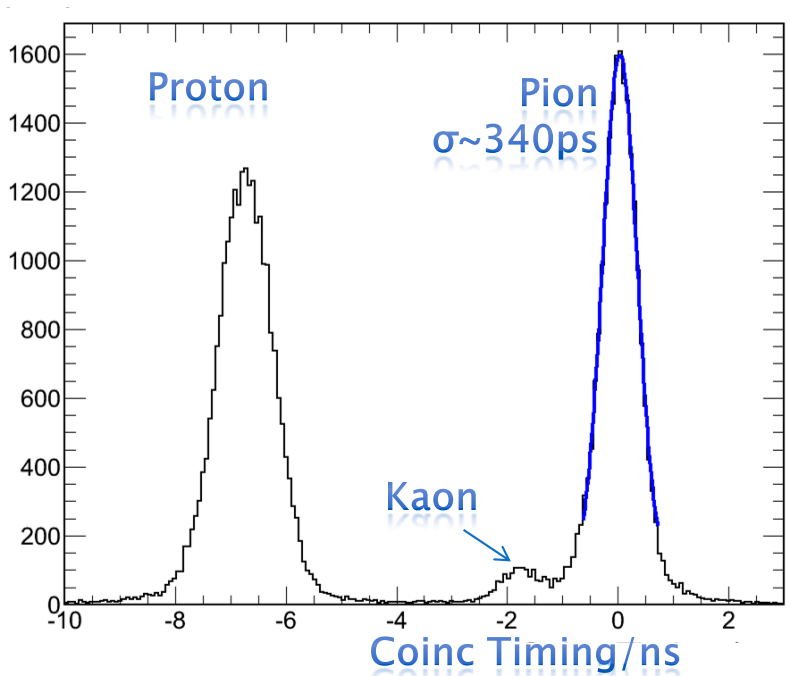
- Final electron timing resolution reached σ~270ps



BigBite Coincidence Timing Analysis III (Jin Huang)

Combing -> CT

- Difference between two single arm trigger is measured by high res. TDC
- Compiling All Pieces:
  - σ~340ps
  - Random Coinc Rej. 100:1
  - Pion Rej. from Kaon >25:1
  - Also for (e,γhadron) σ~400ps



Transversity Data Quality Checks (Chiranjib Dutta)

Transversity Data Management / Quality Checks

BigBite Data Quality/Stability

Calorimeter degradation/ correction

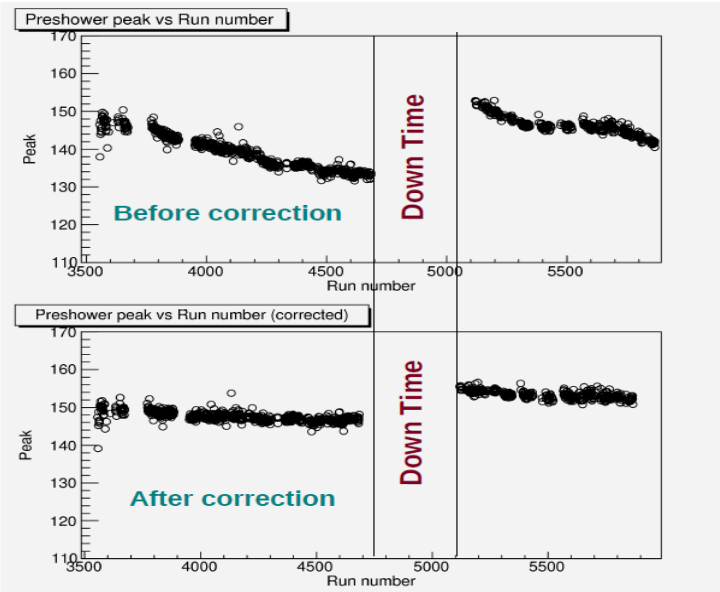


Figure: Preshower peak

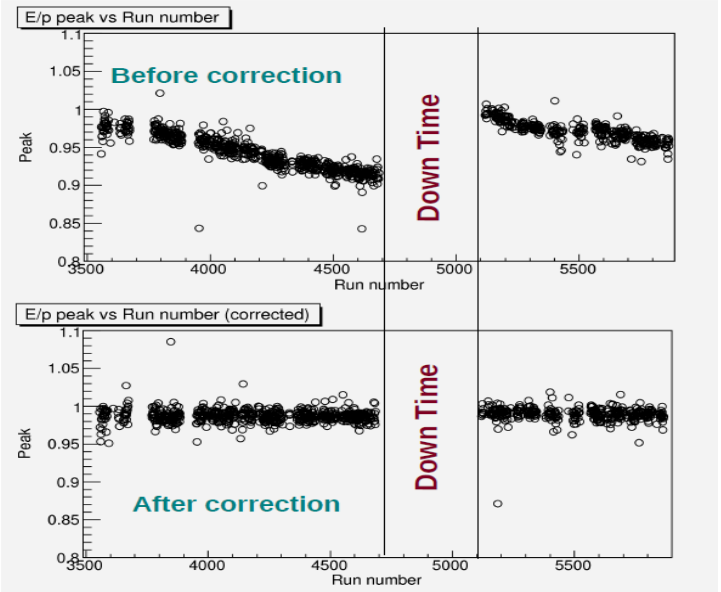


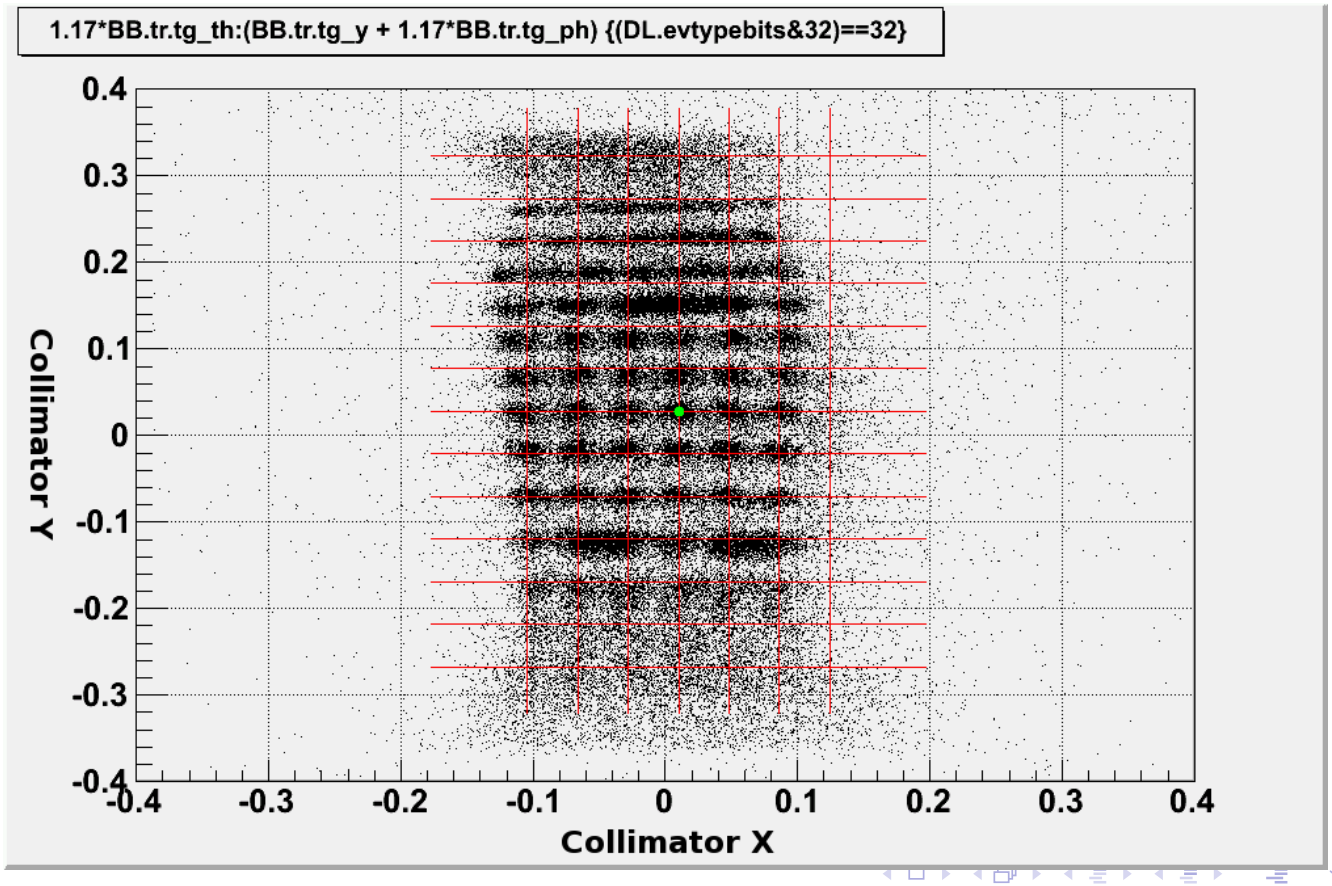
Figure: Shower $\frac{E}{P}$

BigBite Optics Optimization (Miha Mihovilovič)

Sieve slit #2

A lot of work still needs to be done

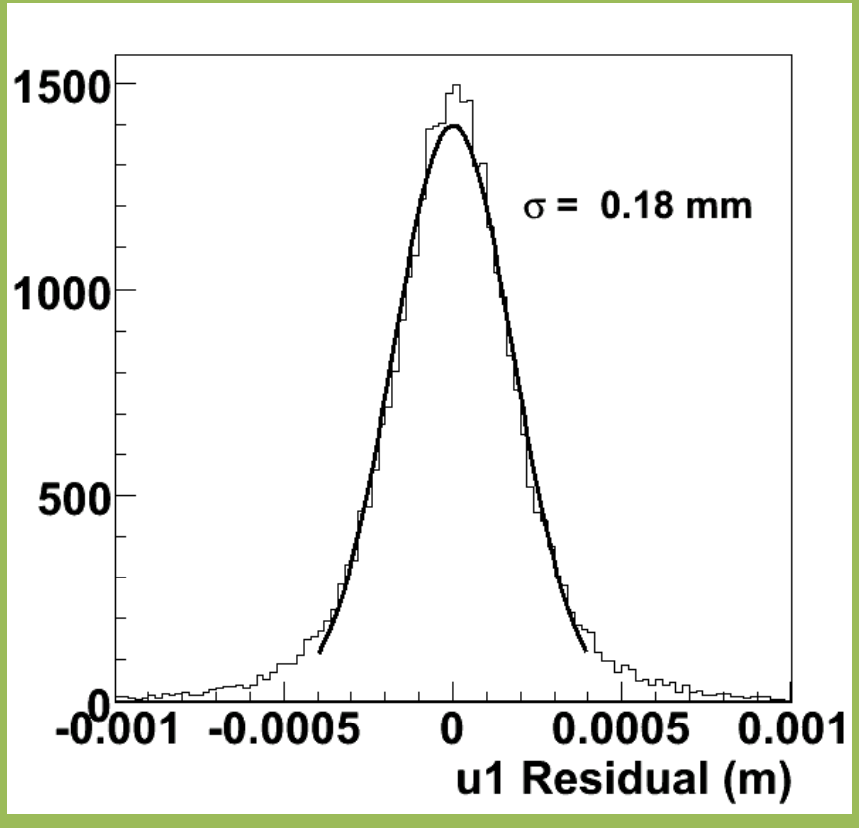
Comparison of reconstructed hole positions with true positions



BigBite Wire Chamber Calib. & Tracking (Xin Qian)

Results After Calibration

- Before Iteration procedure of off-line calibration, the σ of the residual peak is about 440 μm.
- Now: < 200 μm.



BigBite Wire Chamber Calib. & Tracking (Xin Qian)

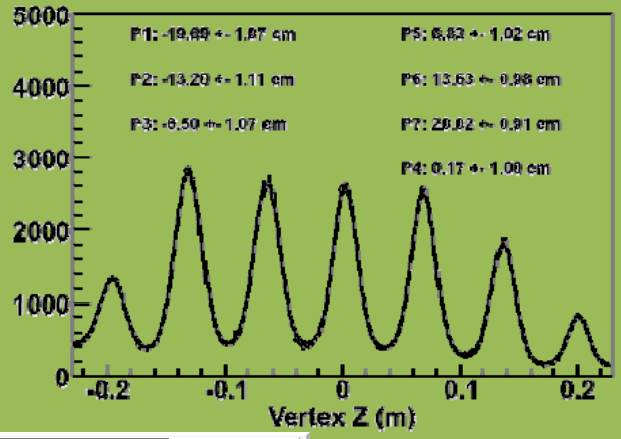
Experience with Tracking

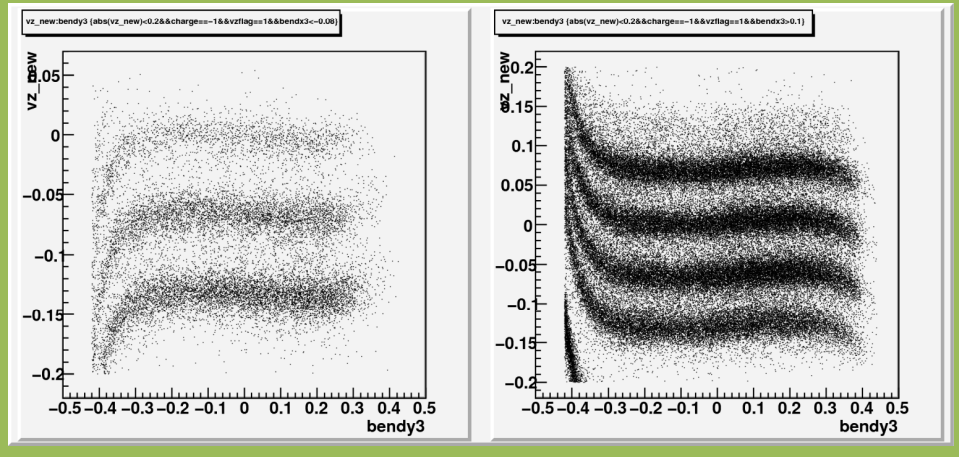
- 1st pass optics run @ 1 uA (hydrogen elastic kinematics):
  - preshower > 150 MeV and total energy > 700 MeV
  - Require three set of 5/6 planes
  - Chi2/ndof < 2.4
  - About 86.5% of the events have tracks (lower bound)
- Chamber hitting efficiency is about 96%, thus the theoretical tracking efficiency is about (0.96^6+6.*0.96^5*0.04)^3 = 93.5 %
  - The chamber HVs were increased during production run to increase the hitting efficiency.
- The Tracking Monte-Carlo with the same software gives about 95% software tracking efficiency assuming 100% hitting efficiency with current setup.
  - 98% were obtained if the middle chamber is really in the middle point of chamber-1 and chamber-3.

BigBite Wire Chamber Calib. & Tracking (Xin Qian)

Vertex Reconstruction

- Vertex: average 0.72 cm through the entire momentum coverage.
- Also show the edge effects
- Acceptance cut to avoid the extreme regions



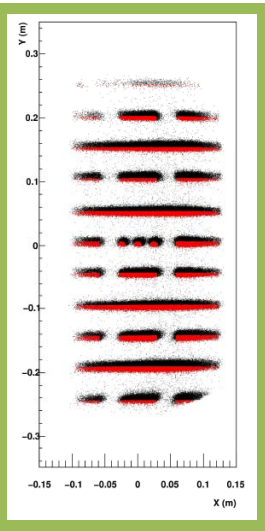


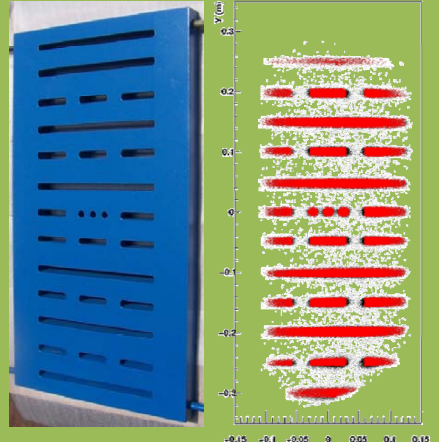
BigBite Wire Chamber Calib. & Tracking (Xin Qian)

Angles Reconstruction

- With vertex figured out, just connect the vertex position with the hit point in the middle plane, we get all the angles.
- The angles reconstruction is checked with the sieve pattern.
- Smaller corrections are added.

• First order is already very good.
• The final resolution is estimated as angle: < 10 mrad



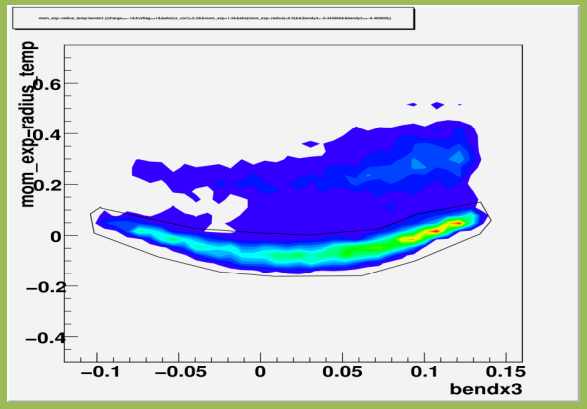


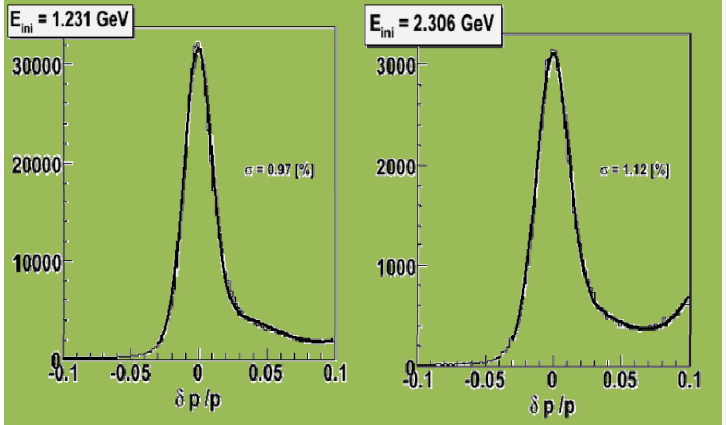
BigBite Sieve Slit

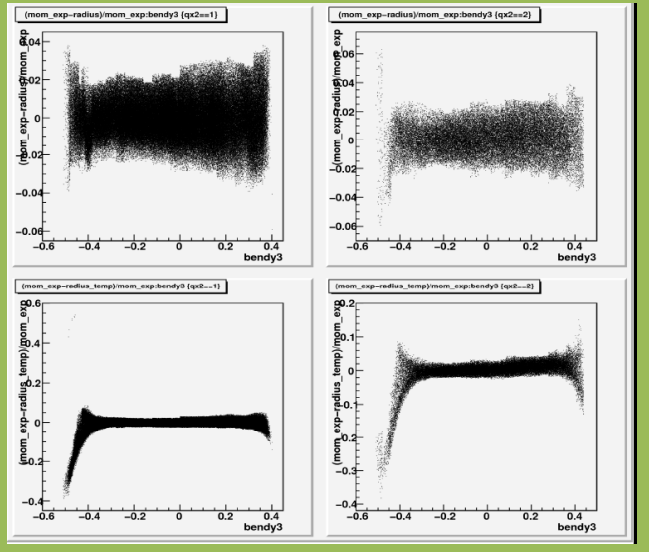
BigBite Wire Chamber Calib. & Tracking (Xin Qian)

Momentum Reconstruction

- Edge effects
- Resolution:
  - Momentum: 1%

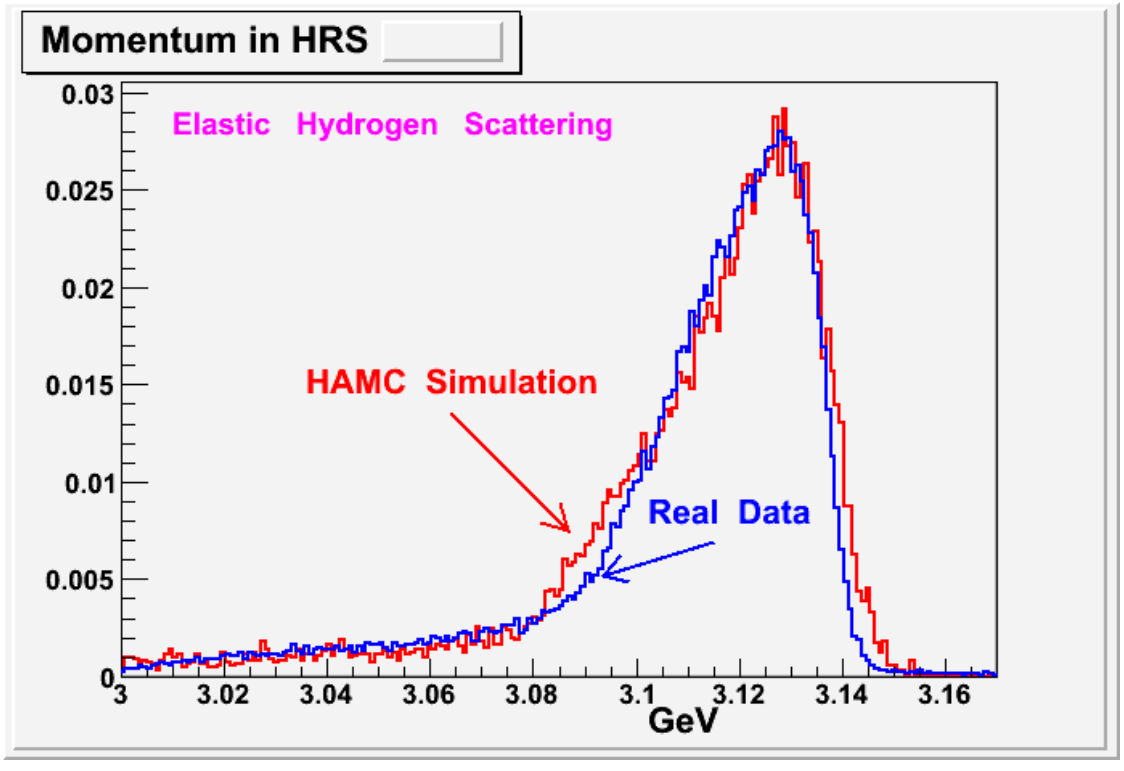






HAMC: Hall A Monte Carlo (Bob Michaels)

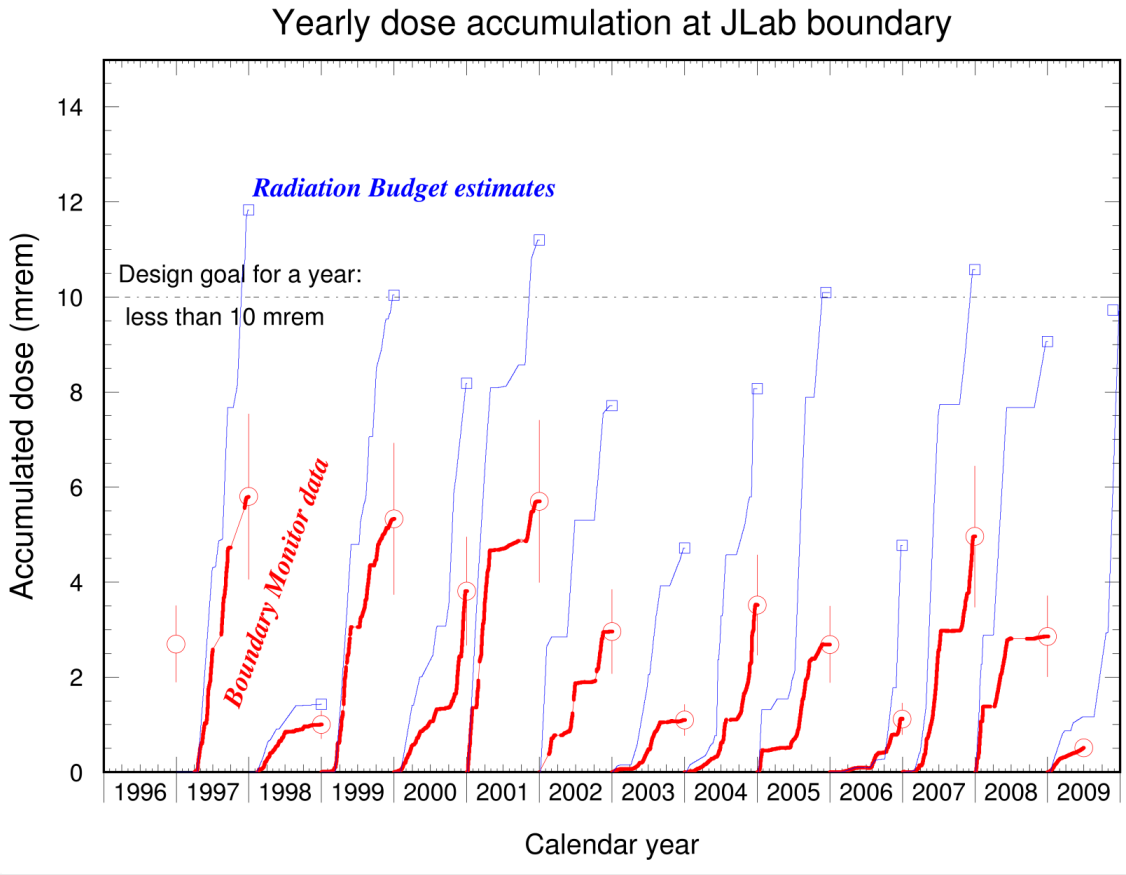
Does HAMC work ? **Yes, well enough for our goals.**



A problem: ***Radiative tail*** *out to high loss is underestimated. Use "effective target" size to adjust (reduce) predicted rates.*

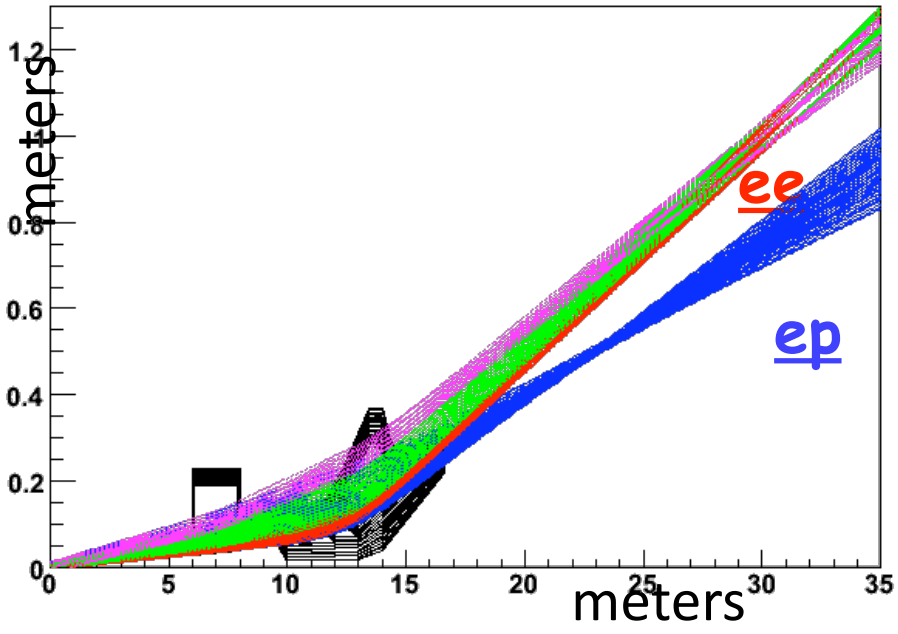
Radiation Budget & Background (Pavel Degtiarenko)

Radiation Budgeting Reports



Simulation of 12 GeV Møller Experiment (Mark Dalton)

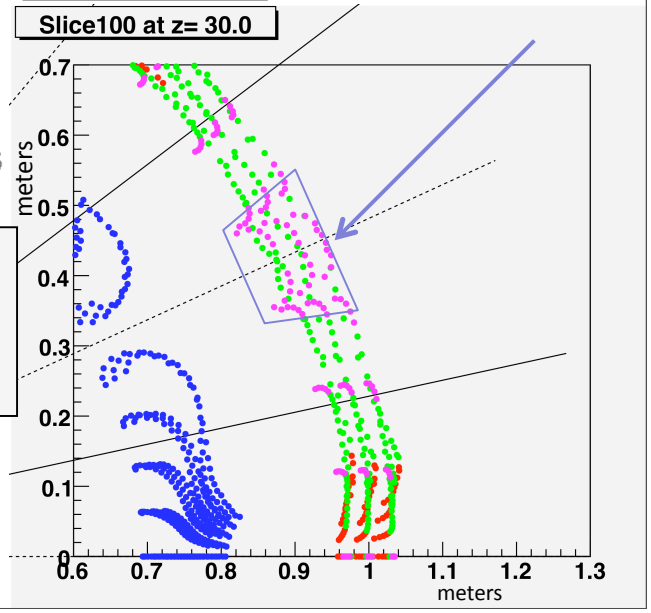
Toroid design concept



- More complicated magnet geometry used to control integral Bdl without extensive defocusing
- Pre-bender magnet pushes highest angle tracks above high field region, and focuses other tracks

Focus at ~32.5 meters

Overlap between neighboring sectors

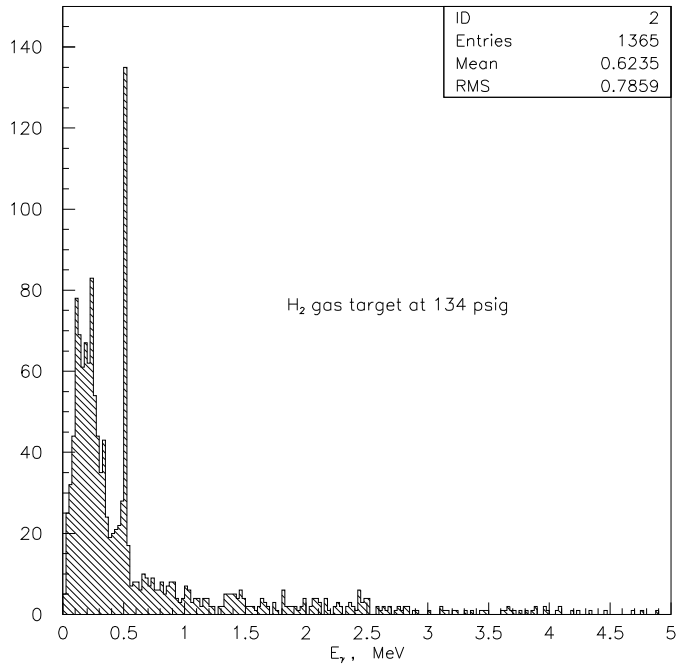


- ep
- ee, 60°-75°
- ee, 75°-105°
- ee, 105°-120°

1.5 meter target, full range of theta and phi

Slide: K Paschke

Gamma Backgr. in Transversity (Vladimir Nelyubin)



SIMC Overview I (Dave Gaskell)

What is SIMC?

SIMC is the standard Hall C Monte Carlo for coincidence reactions (similar to MCEEP) → written in FORTRAN (now gfortran compatible …)

Features:

→ Optics (COSY) and "aperture checking" Monte Carlos of spectrometers
[HMS, SOS, SHMS, HRS's, BigCal,…]

→ Includes radiative effects, multiple scattering, ionization energy loss, particle decay

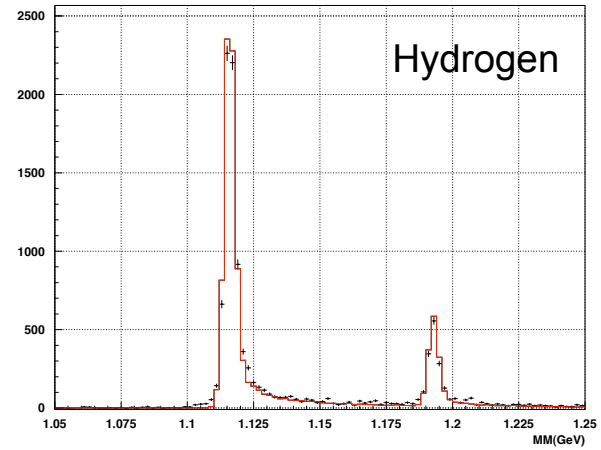
→ Simple prescriptions available for FSIs, Coulomb Corrections, etc.

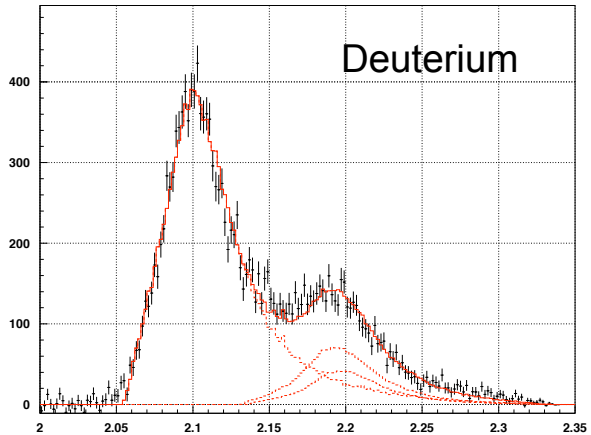
Reactions implemented:

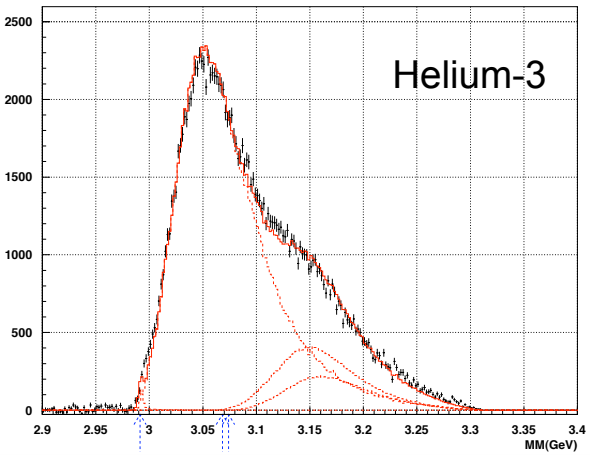
1. Elastic and quasielastic → H(e,e'p), A(e,e'p)
2. Exclusive pion production
   → H(e,e'π^+)n, A(e,e'$\pi^{+/-}$) [quasifree or coherent]
3. Kaon electroproduction → H(e,e'K^+)Λ,Σ, A(e,e'$K^{+/-}$)
4. H(e,e'$\pi^{+/-}$)X, D(e,e'$\pi^{+/-}$)X [semi-inclusive]
5. H(e,e'$K^{+/-}$)X, D(e,e'$K^{+/-}$)X [semi-inclusive]
6. H(e,e'$\rho\rightarrow\pi^+\pi^-$)p, D(e,e'$\rho\rightarrow\pi^+\pi^-$) [diffractive ρ]

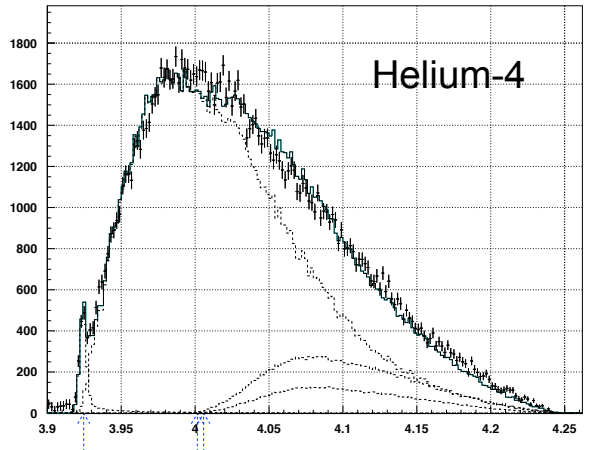
SIMC Overview II (Dave Gaskell)

Kaon Electroproduction









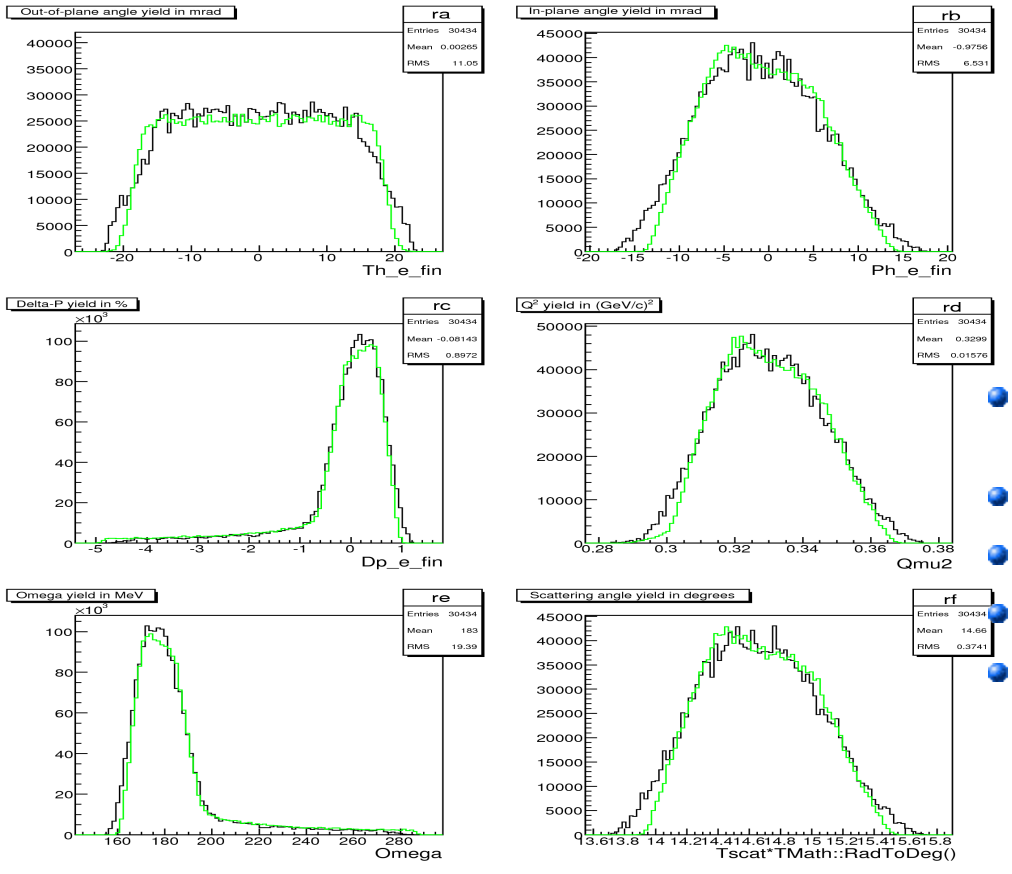
Includes:

1. Radiative corrections
2. Spectral function
3. FSI
4. Kaon decay

Only norm. of each peak fit to data

SIMC–MCEEP Comparison (Peter Monaghan)

Radiation ON



SIMC
MCEEP

- Small collimator model - 10 x 20 mr^2
- Disagreement at edges
- Spectrometer models?
- Aperture tests?
- Radiation models?

Discussion Points

- Collect Monte Carlo experience (Web, wiki)
- JLab-relevant physics in GEANT4?
  - Join GEANT4 collaboration?
  - Local effort?