PREx(Lead (^{208}**Pb**) **R**adius **Ex**periment)

Zafar Ahmed
Syracuse University

Physics of PREx

- Parity violating elastic scattering to measure the neutron distribution in lead at energy 1 GeV.

- Z^0 mainly couples to Neutrons $\mathbf{F_N \, (Q^2)}$ and Physics asymmetry is given by

$$A = \frac{\left(\dfrac{d\sigma}{d\Omega}\right)_R - \left(\dfrac{d\sigma}{d\Omega}\right)_L}{\left(\dfrac{d\sigma}{d\Omega}\right)_R + \left(\dfrac{d\sigma}{d\Omega}\right)_L} = \frac{G_F Q^2}{2\pi \, \alpha\sqrt{2}} \left[1 - 4\sin^2\theta_W - \frac{F_N \, (Q^2)}{F_P(Q^2)} \right] \quad \sim 0.65$$

Parity Violating Asymmetry

$$\sigma \approx \left| \gamma + Z^0 \right|^2$$
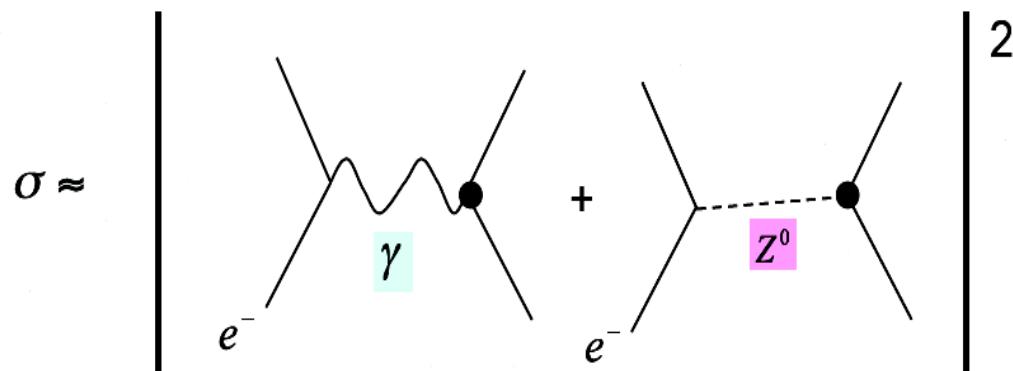
PREx applications:

Nuclear Physics

Neutron Stars

Atomic Parity Violation

PREx Region After Target
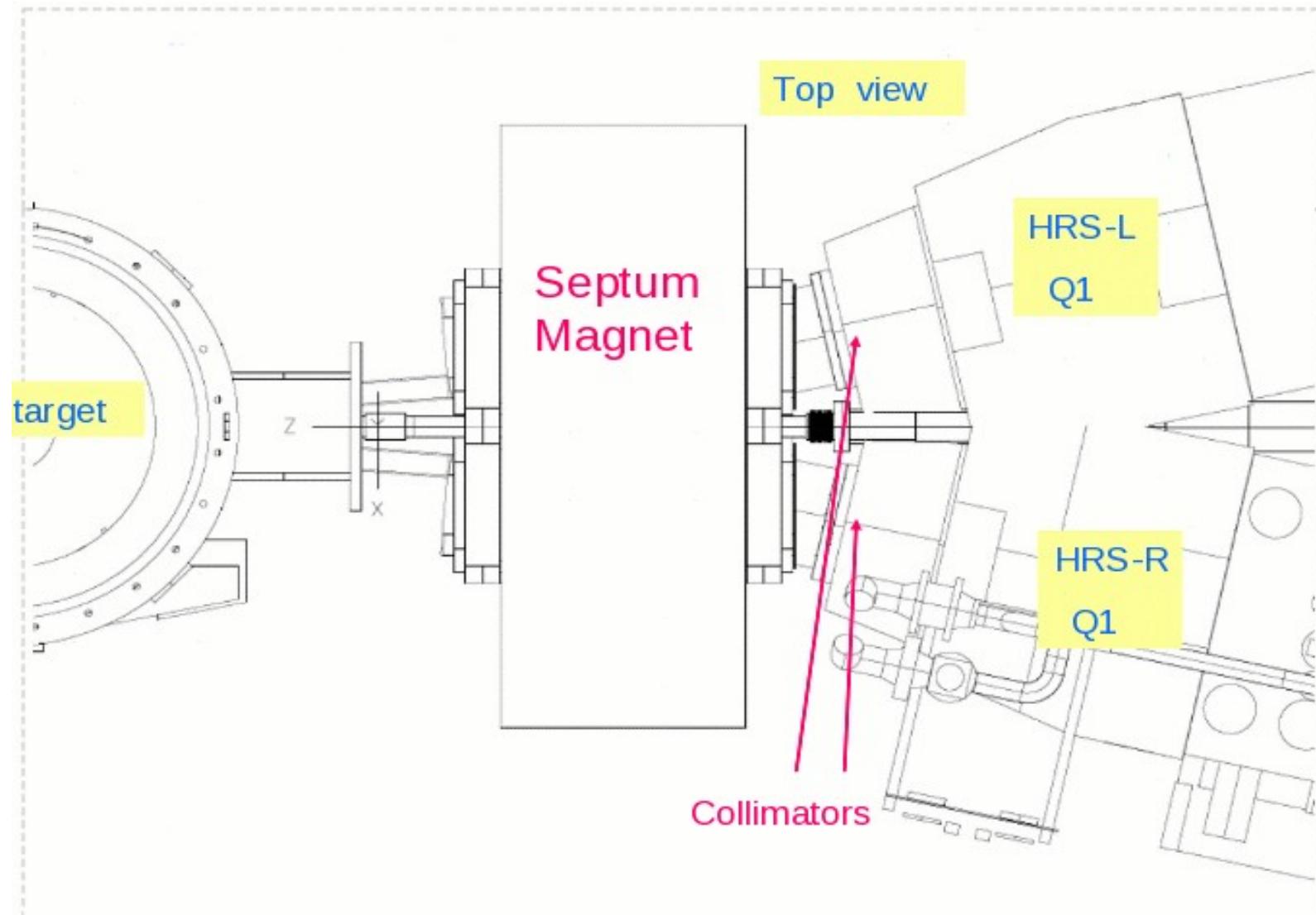
A quick time line of PREx

- PREx ran from March 19 to June 20, 2010.

- First 30 % of the data has large systematics and requires substantial corrections.

- Slug 16 to slug 40 is good Lead production data.

- We got 20% of the required statistics.

Problems while running the PREx

- Radiation degrading the vacuum seals in the scattering chambers and the controls systems for the HRS.

- Pockels cell ringing systematics.

- Septum magnet was running at 5% low current.

Angle distribution of the data

Left: MC for the original acceptance of PREx.

Right: MC with a cut on the scattering angle to mimic the low septum current.
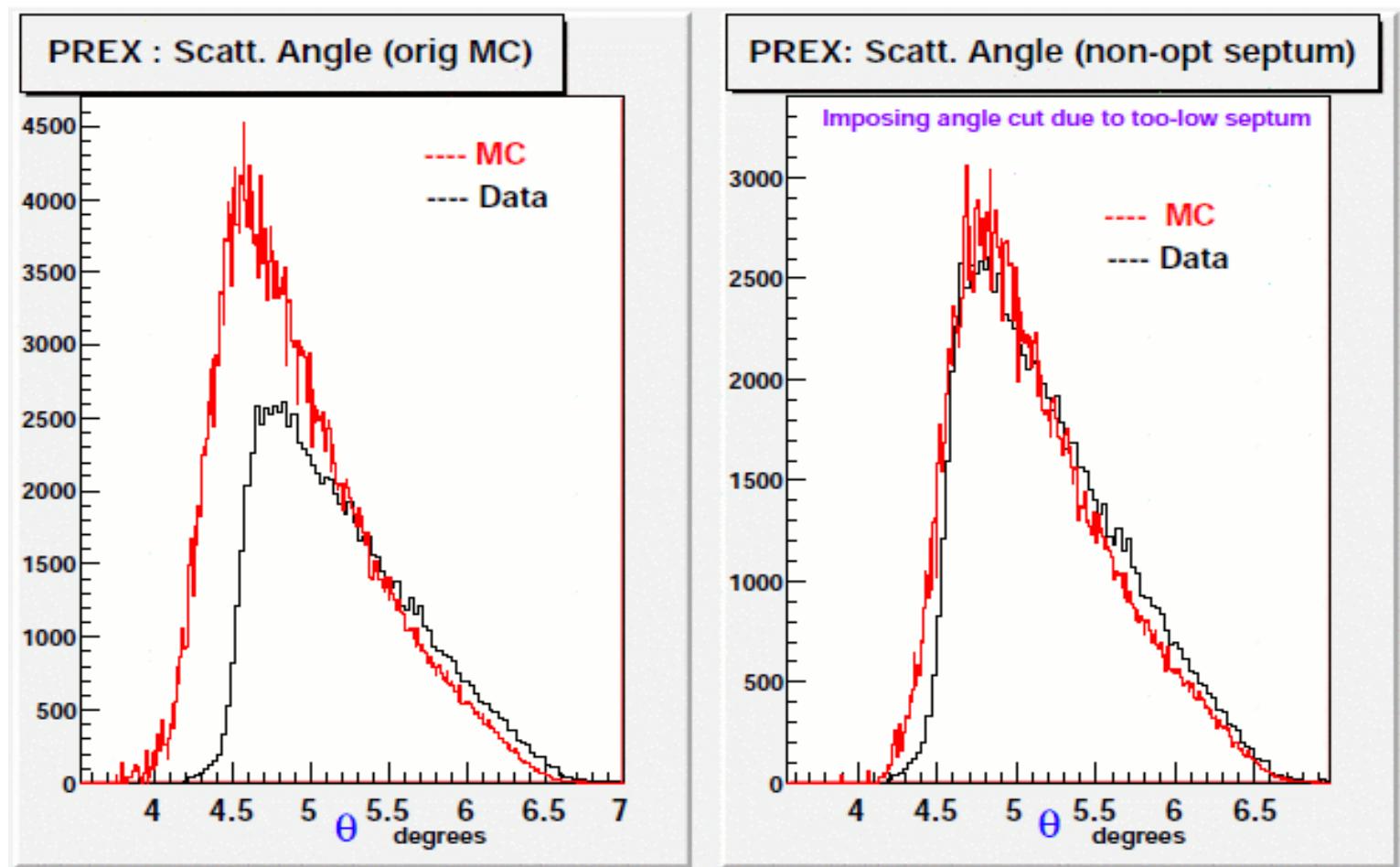
# Scaled and blinded asymmetry

- Arbitrarily normalized to 1.0 (~ ppm).
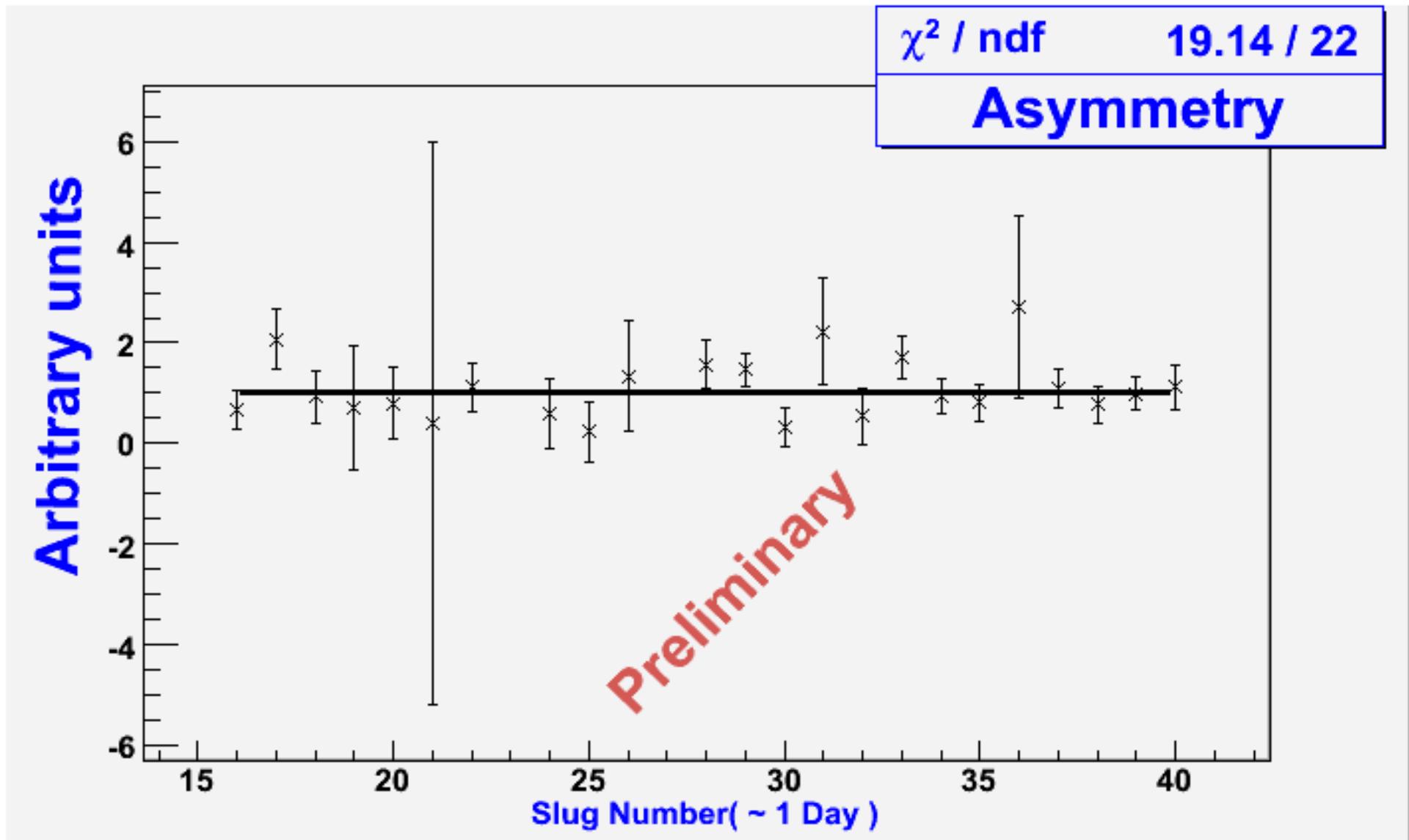
Blinded Raw asymmetry

- Raw asymmetry for wien × ihwp = +1. Half of our good production data.(There are two ways to flip the sign: Wien and insertable half-wave plate, so the product of the two gives the overall sign.)
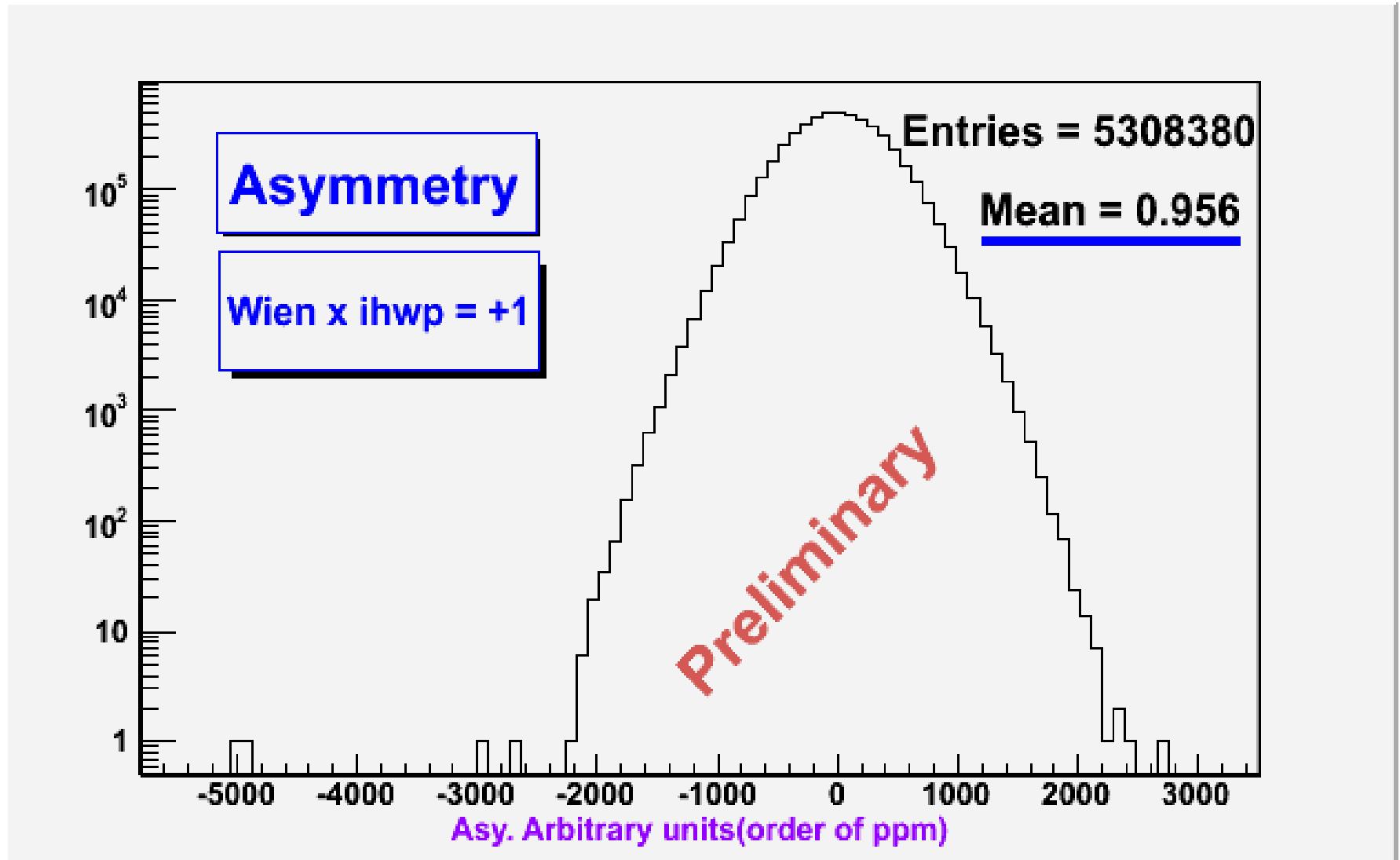
Blinded Raw asymmetry

- Raw asymmetry for wien × ihwp = -1. The other half of our good production data.
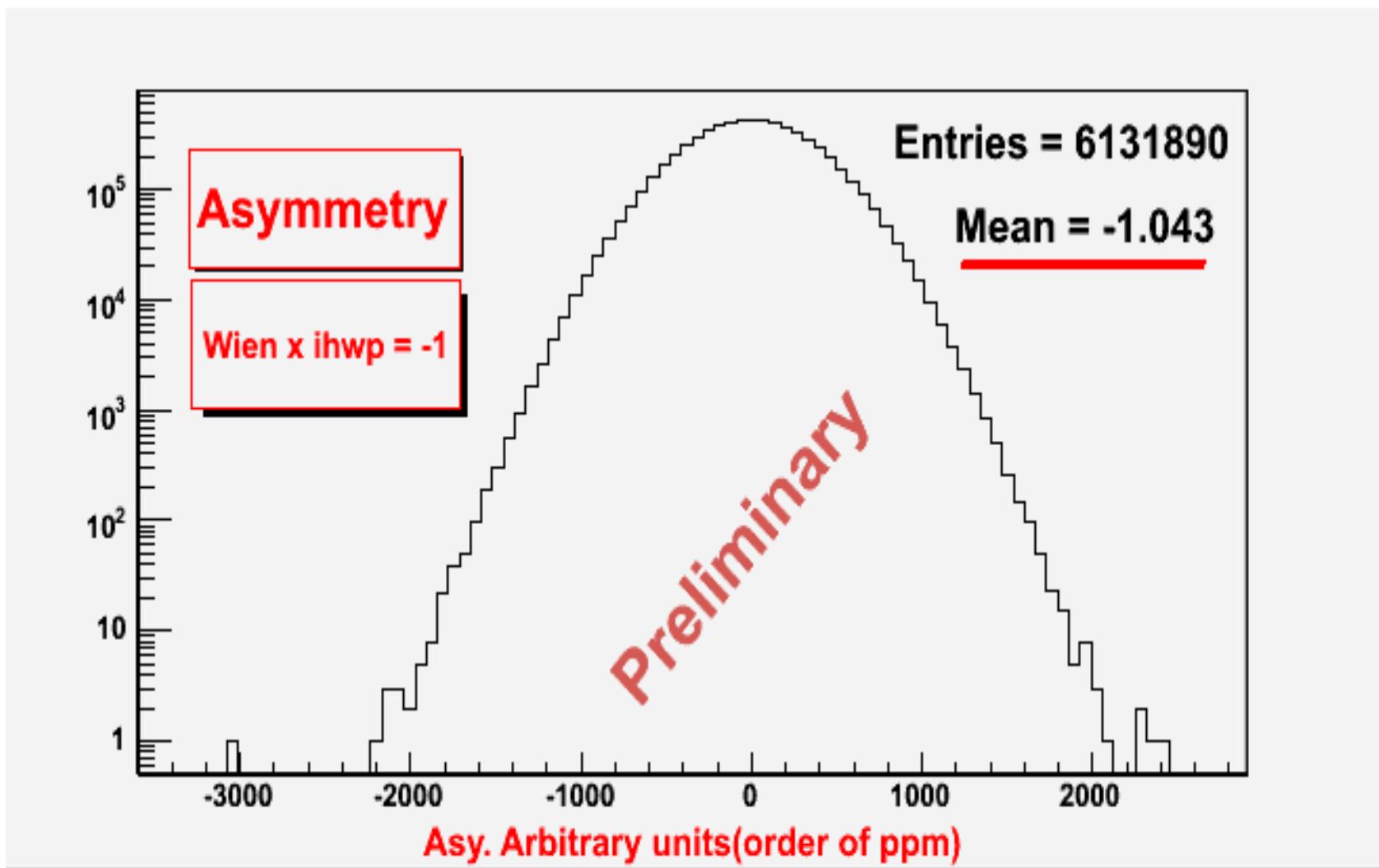
Helicity correlated charge asymmetry vs. Slug no.
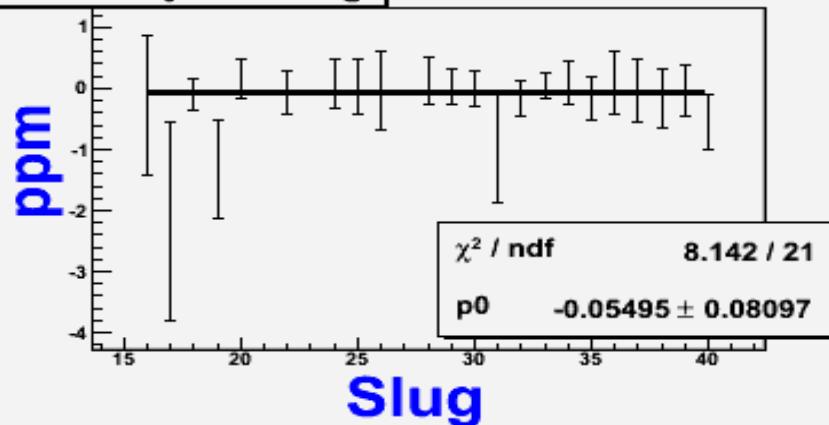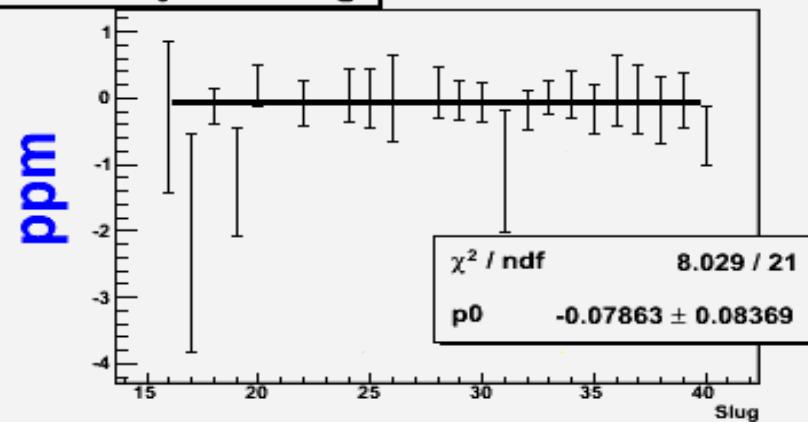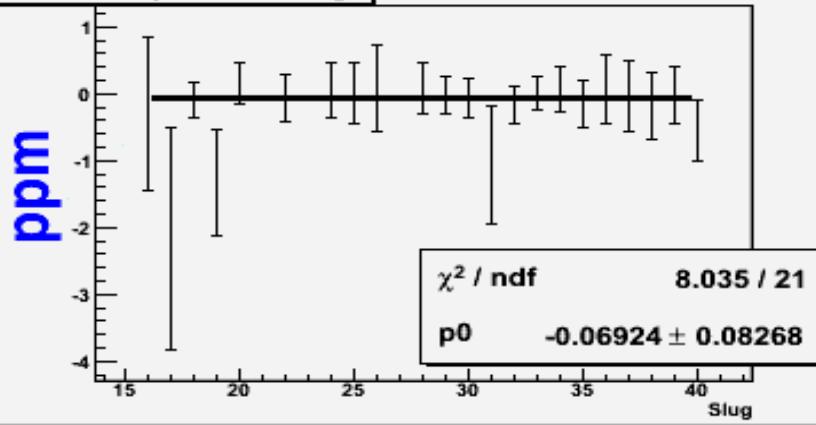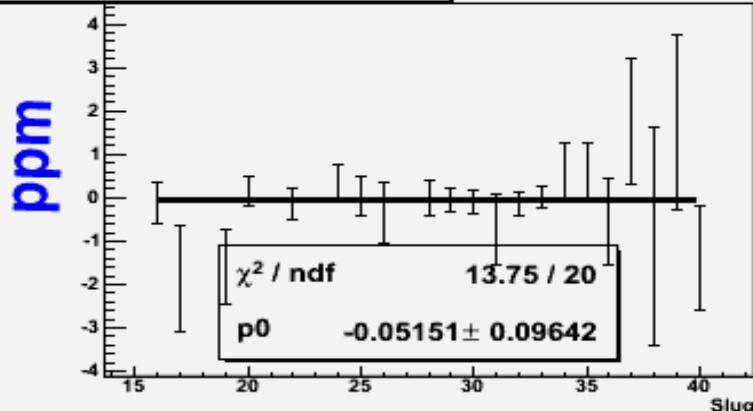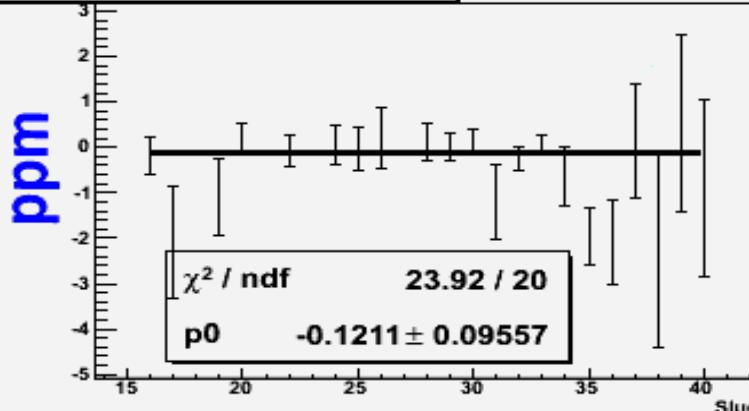
Helicity correlated position diff vs. slug no.
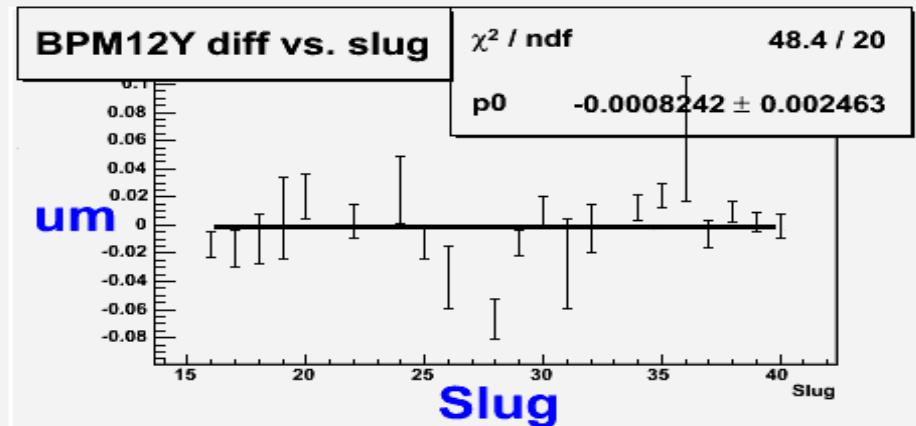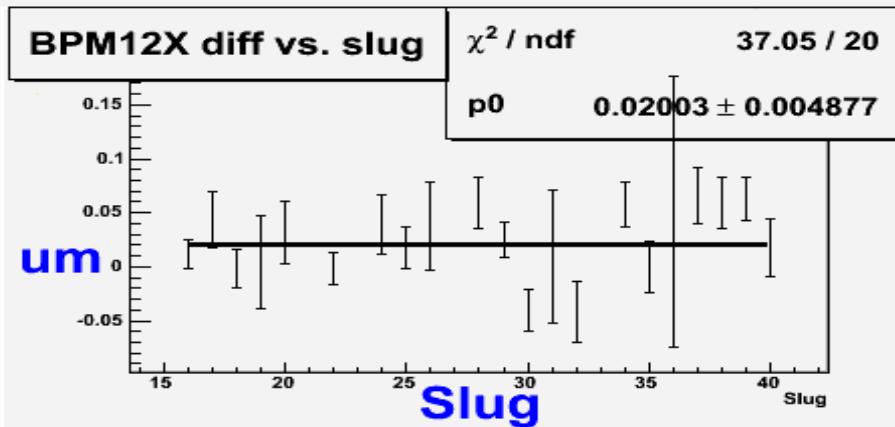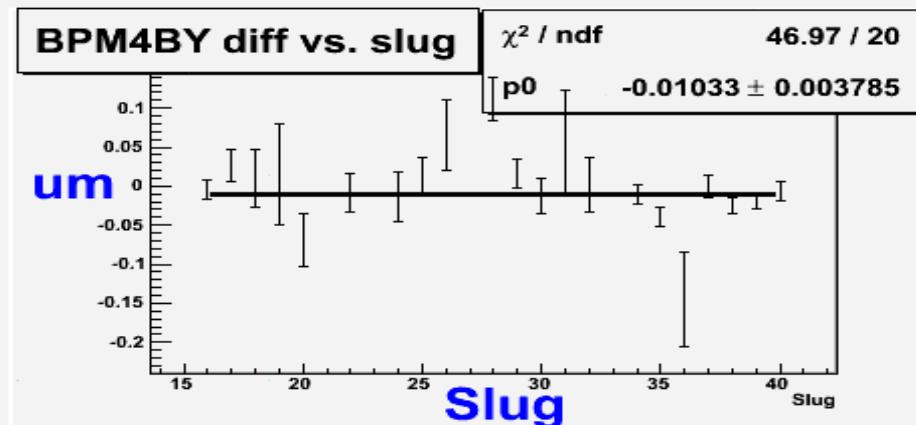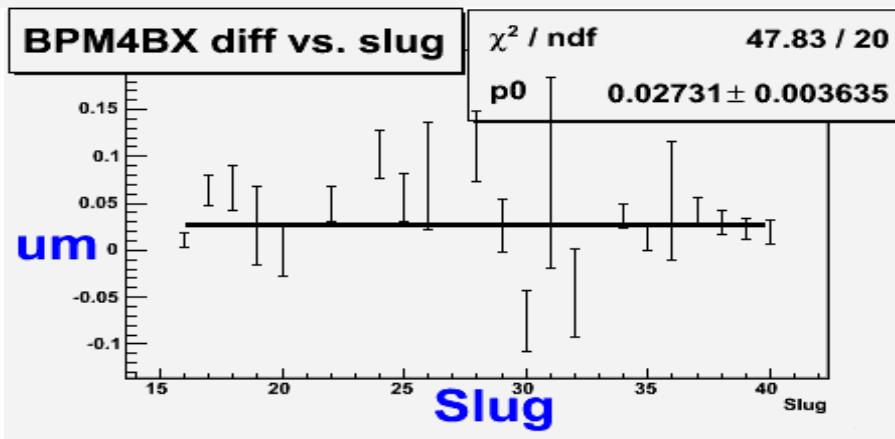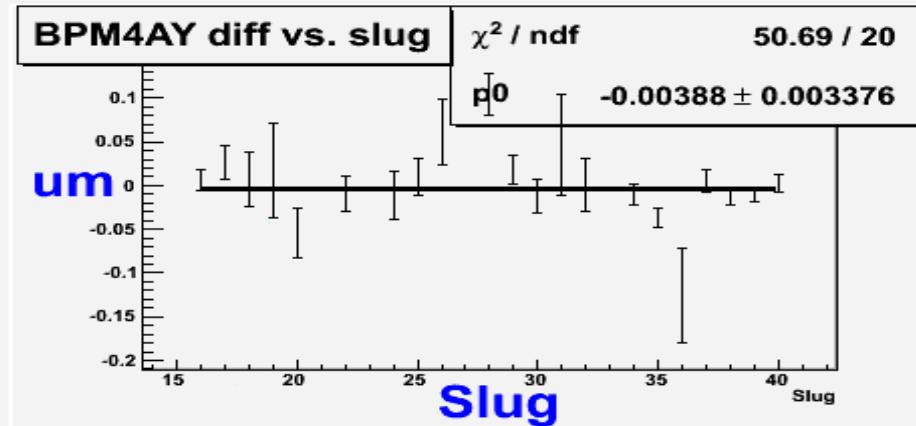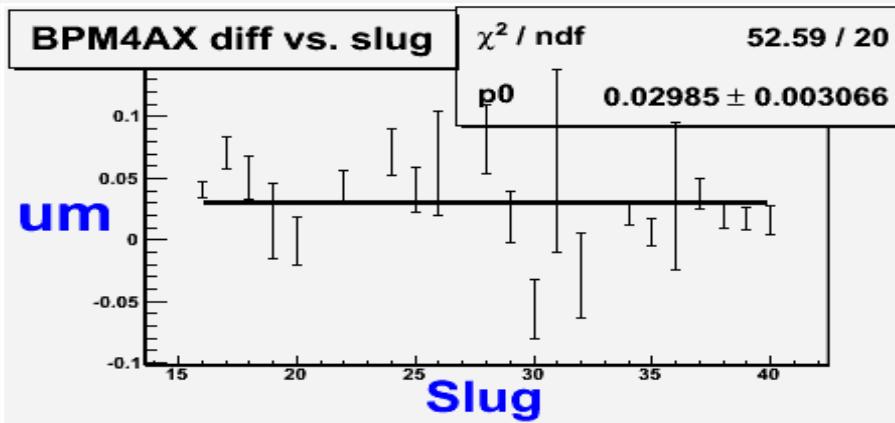
PREx Students

- Abdurahim Rakhman Compton green laser cavity.

- Jon Wexler parity analysis.

- Kiad optics and Q^2.

- Zafar Ahmed Moller polarimeter & raw analysis.

Conclusions

- Progress on Data Analysis:
  1) Run list and cut list is finalized.

  2) Preliminary analysis results are close to expectation

  3) Two independent analysis are in progress.

  4) Normalization factors: Q^2 and Polarimetery work is in progress.

  5) Plan to unblind in spring 2011.

- Future of PREx: Next talk by Krishna Kumar.