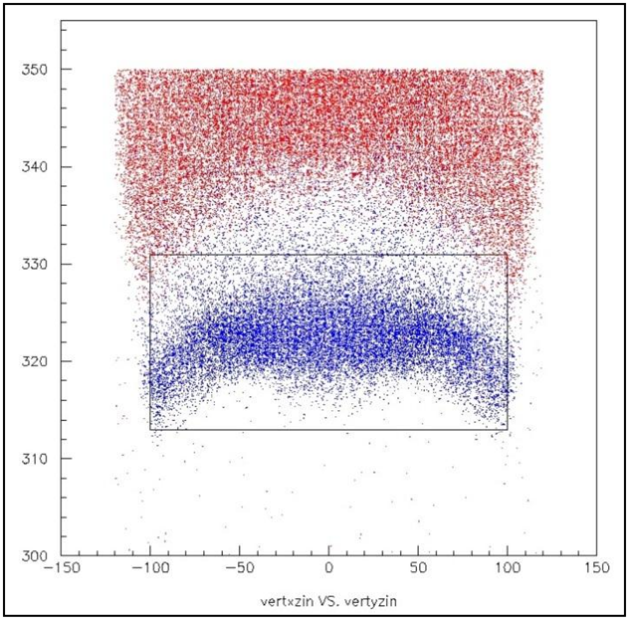
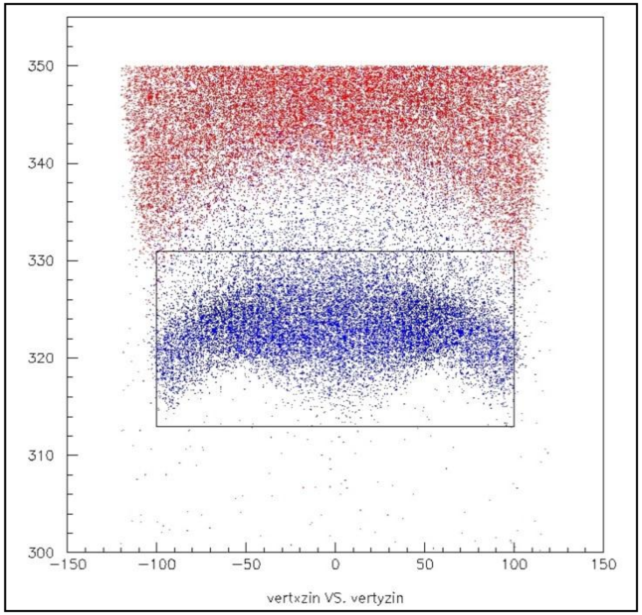
I. Large phase space of possible changes
   A. Field (strength, coil position and profile)
   B. Collimator location, orientation, size
   C. Choice of Primary collimator
   D. Detector location, orientation, size

II. Large phase space of relevant properties
   A. Moller rate and asymmetry
   B. Elastic ep rate and asymmetry
   C. Inelastic rate and asymmetry
   D. Transverse asymmetry
   E. Neutral/other background rates/asymmetries
   F. Ability to measure backgrounds (the uncertainty is what's important)
      1. Separation between Moller and ep peaks
      2. Profile of inelastics in the various regions
      3. Degree of cancellation of transverse (F/B rate, detector symmetry)
      4. Time to measure asymmetry of backgrounds (not just rate)
   G. Beam Properties (location of primary collimator)

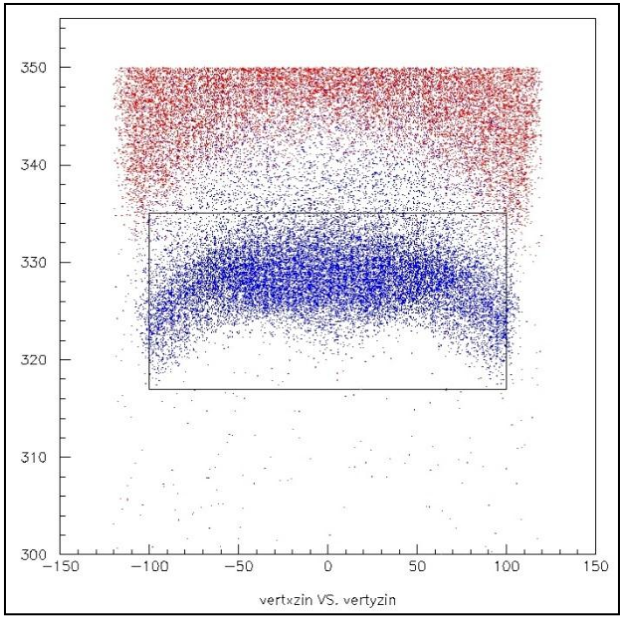
new map comparisons



Old map, BFIL 1.00.



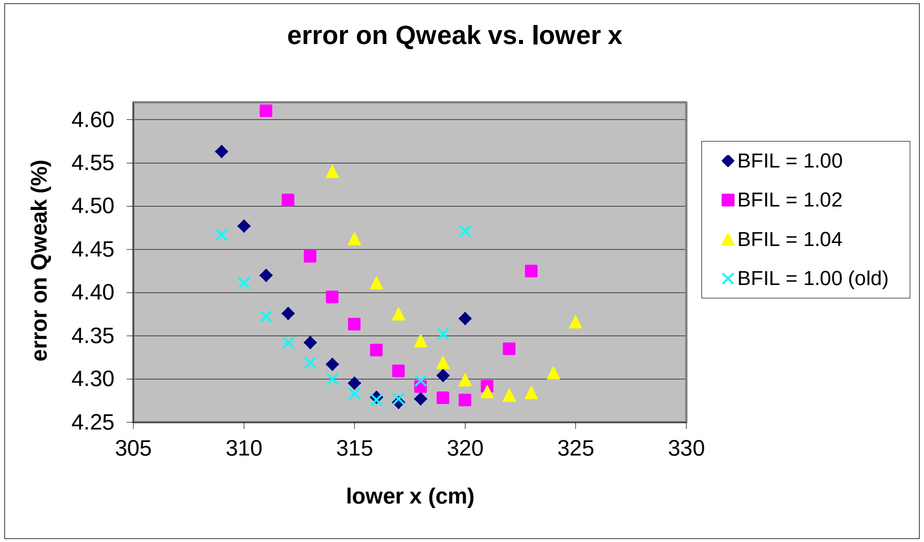
New map, BFIL 1.00.

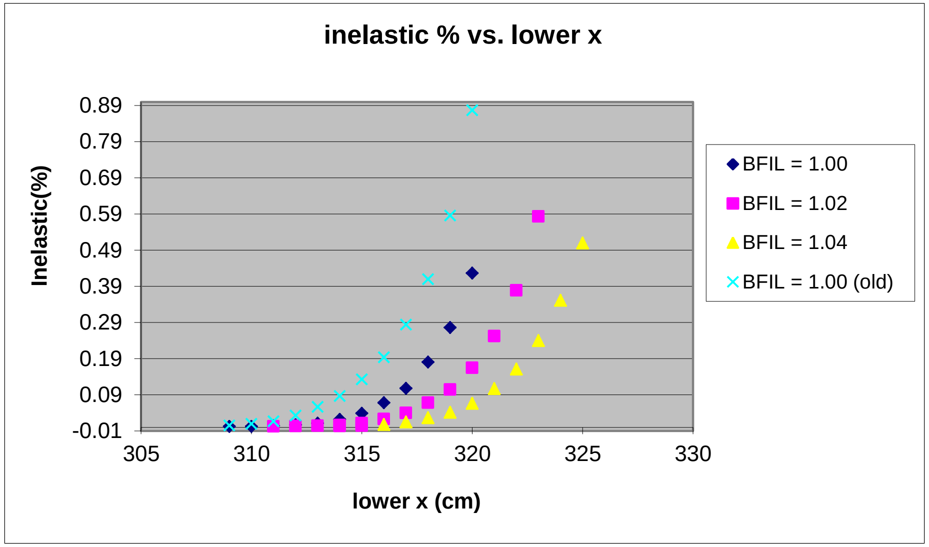


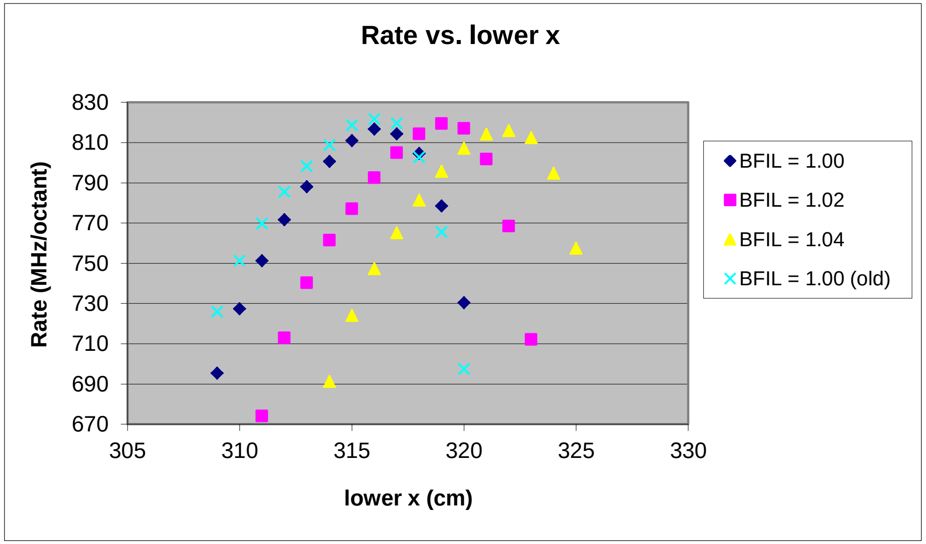
New map, BFIL 1.04.

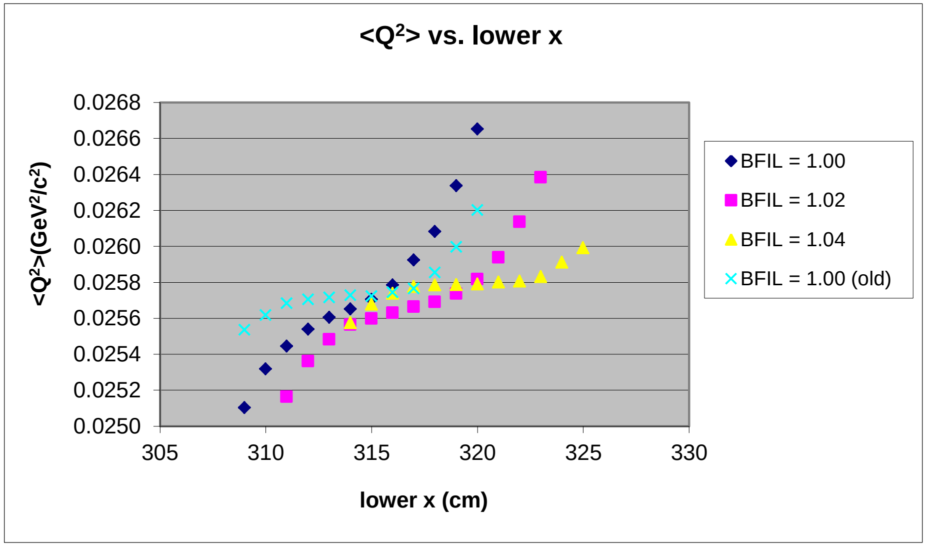
Blue – Elastic electrons
Red – Inelastic Electrons

new map comparisons









collimator tilt studies

removed “cleanup” collimators

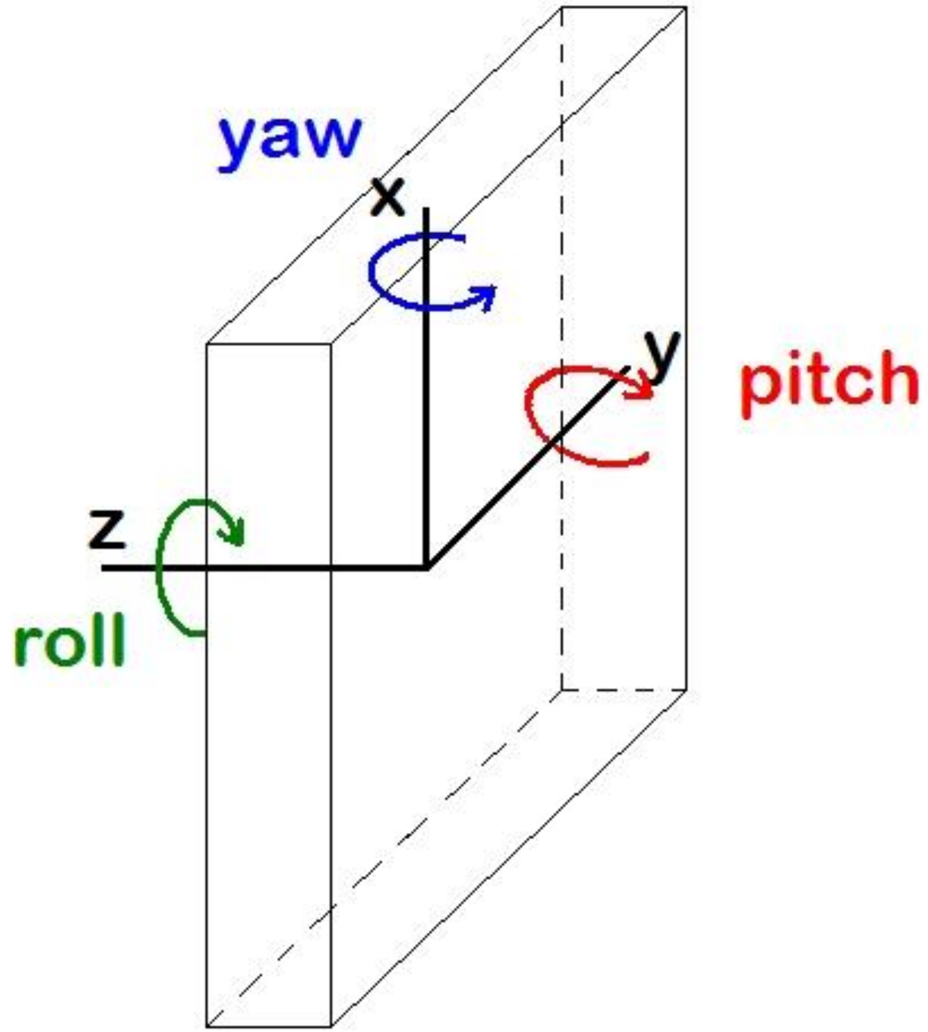
no beamline, new map BFIL 1.00

did not move the quartz bar
(lower edge 315cm)

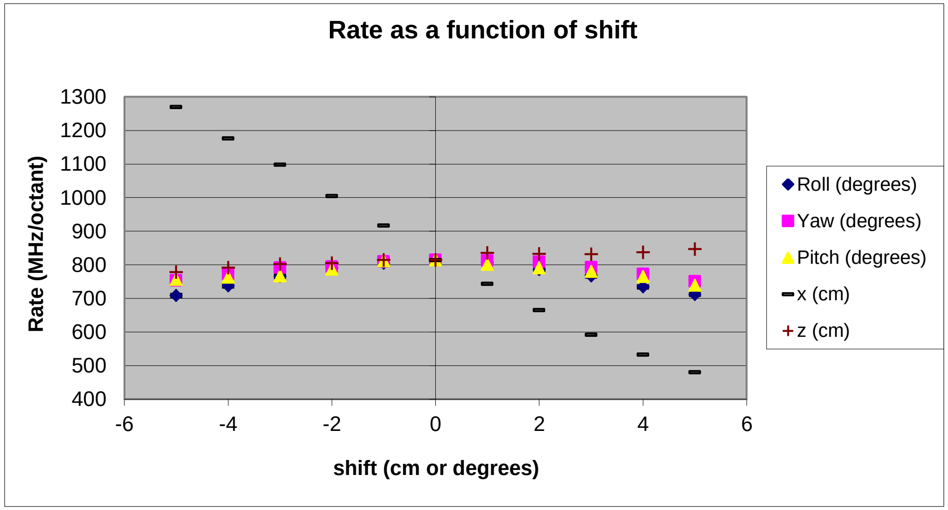
for pitch, roll and yaw ±5º

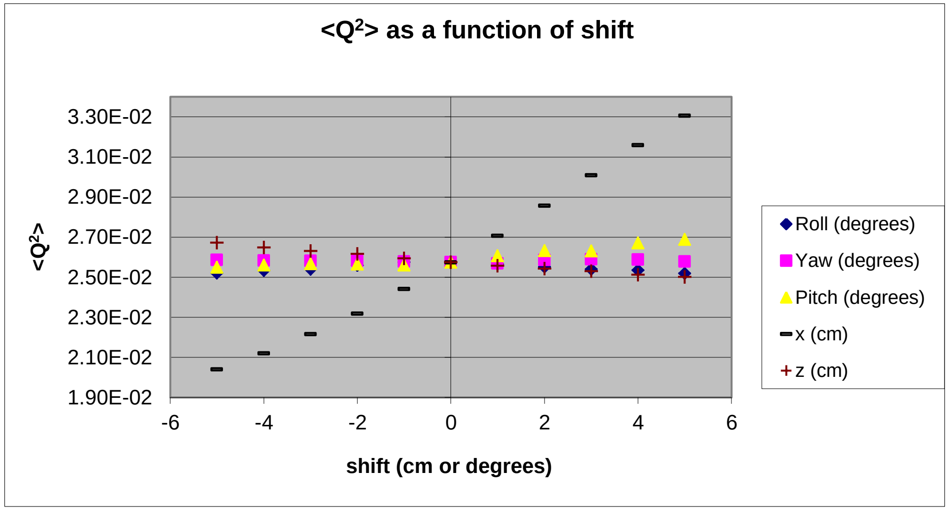
for x, z ±5 cm

Also assumed all plots were linear,
though some obviously aren’t

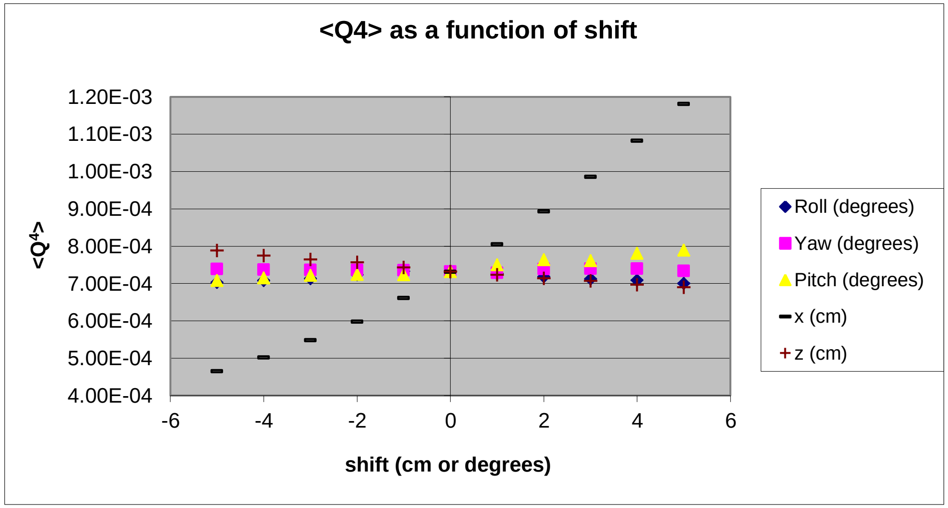


collimator tilt studies





par	$\frac{1}{R}\frac{\partial R}{\partial par}$	$\frac{1}{Q^2}\frac{\partial Q^2}{\partial par}$	$\frac{1}{Q^4}\frac{\partial Q^4}{\partial par}$
roll (º)	-0.0275	-0.0039	-0.0096
yaw (º)	-0.0161	-0.0008	0.0014
pitch (º)	-0.0005	0.0039	0.0001
x (cm)	-0.0993	0.0505	0.0956
z (cm)	0.0077	-0.0078	-0.0137



Measured Asymmetry:

$$A_m = \frac{N_{-1} - N_{+1}}{N_{+1} + N_{-1}}$$

solving for variance on the measured asymmetry gives:

$$\delta A_m = \frac{\sqrt{1 - A^2}}{\sqrt{N}} \approx \frac{1}{\sqrt{N}}$$

The asymmetry due to moller events, based on the measured asymmetry, is:

$$A_e = \frac{A_m N - A_p N_p}{N_e} = \frac{A_m - A_p D}{1 - D}$$

where:

$$D = \frac{N_p}{N_e + N_p}$$

Figure of Merit:

$$\left(\frac{\delta Q_w^e}{Q_w^e}\right)^2 = \left(\frac{\delta A_e}{A_e}\right)^2 = \left(\frac{1}{1-D}\frac{\delta A_m}{A_e}\right)^2 + \left(\frac{D}{1-D}\frac{\delta A_p}{A_e}\right)^2$$

Where the first part is a statistical contribution and the second is systematic due to the e-p backgrounds.