BigBite Analysis

5.89 GeV Cut Acceptance and N2 Densities

Matthew Posik

[1]Temple University
Philadelphia, PA 19122

03/08/2012

Outline

Threshold Change Locations

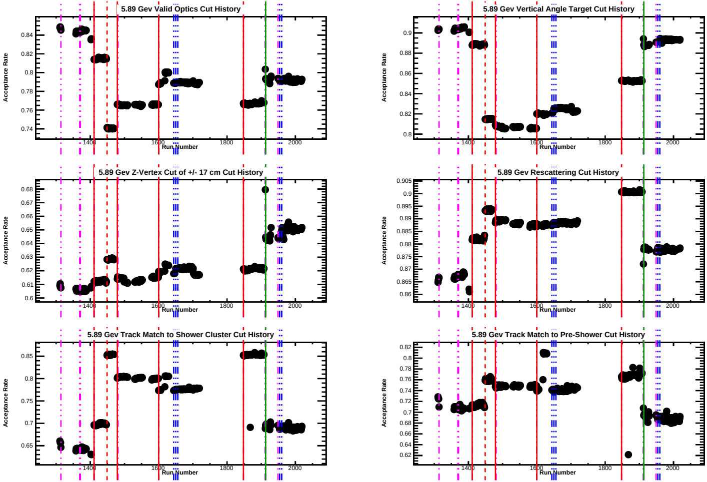
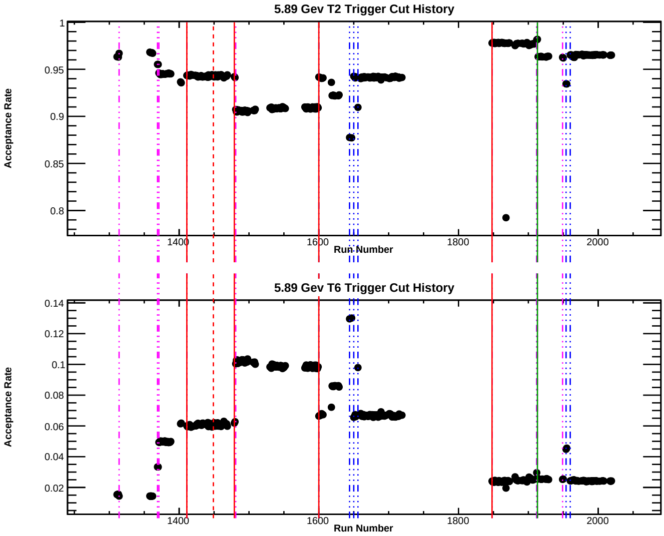


Figure: Location of shower (red solid lines) and pre-shower (green solid line) threshold changes, T2 (blue dash-dot) and T6 (magenta dash-dot) pre-scale changes for various cuts. The red dashed line shows a shower threshold change when the summing mod. was fixed.

Trigger Pre-Scale Change Locations



Cut Acceptance Summary

- Most of the cut acceptance structure is correlated with trigger threshold changes
- Pre-scale changes don't seem to cause much structure on most of the cuts (exception the trigger cuts)

Run	Beam Energy (GeV)	Temp (°C)	Pressure (psig)	Pressure (amg)
2055	4.74	42.0	116	7.71
1529	5.89	41.7	22	2.17
1696	5.89	42.0	100	6.77
1894	5.89	41.8	-	-
1923	5.89	41.6	113	7.54
1962	5.89	41.9	120	7.95

Table: Nitrogen reference cell densities for some 5.89 GeV runs.

Extracting EPR Polarization

$$P_{^3\mathrm{He}} = \frac{\Delta\nu_{EPR}}{\frac{2}{3}\mu_0 \frac{d\nu_{EPR}}{dB} \kappa_0 \mu_{^3\mathrm{He}} n_{pc}} \tag{1}$$

- $\Delta\nu_{EPR}$: EPR frequency shift
- μ_0: Vacuum permeability
- $\frac{d\nu_{EPR}}{dB}$: Derivative frequency with respect to field, from atomic physics experiments
- κ_0: Constant from atomic physics experiments
- n_{pc}: ^{3}He pumping chamber density
- $\mu_{^3\mathrm{He}}$: Magnetic moment of ^{3}He

EPR Spectrum

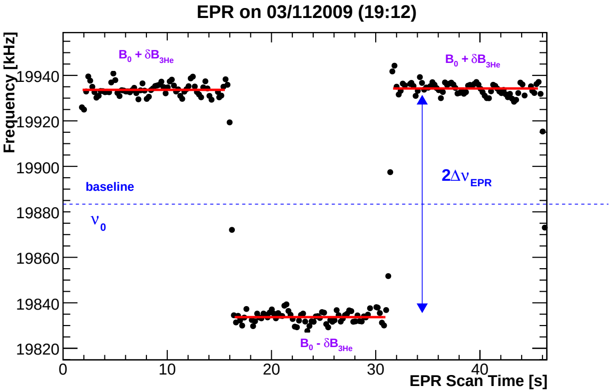


Figure: EPR measurement spectrum.

Uncertainty on EPR Polarization

Parameter	Uncertainty (%)	Source
$n_p c$	1.88	pumping chamber
$\Delta\nu_{EPR}$	0.5	Fit
κ_0	2.79	See paper
Total	3.40	

Table: Longitudinal EPR Polarization

Parameter	Uncertainty (%)	Source
$n_p c$	1.85	pumping chamber
$\Delta\nu_{EPR}$	0.5	Fit
κ_0	2.97	See paper
Total	3.54	

Table: Transverse EPR Polarization

EPR Polarization Results: Modern κ_0

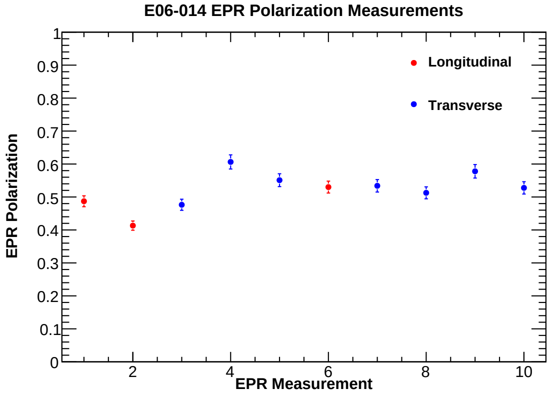


Figure: EPR polarizations using the more recent value of κ_0^{39K}. For the first 3 EPR measurements, only 2/3 COMET lasers were functional. For the measurement 1 and 3, 2 COMETs and 1 FAP laser was used. For the second measurement, only 2 COMET lasers were used. This is why the first 3 EPR measurements are low.

EPR Polarization Results (Modern κ_0 Value)

Date	Direction	Alkali	Polarization (%)	Constant	Datafile
02/07/2009	Longitudinal	K	48.71	-	EPR_AFP_20090207_2015
02/07/2009	Longitudinal	K	41.32	-	EPR_AFP_20090207_2056
02/09/2009	Transverse	K	47.64	-	EPR_AFP_20090209_1652
02/17/2009	Transverse	K	60.64	-	EPR_AFP_20090217_0940
02/17/2009	Transverse	K	55.10	-	EPR_AFP_20090217_0947
02/23/2009	Longitudinal	K	53.00	-	EPR_AFP_20090223_1022
03/11/2009	Transverse	K	53.39	-	EPR_AFP_20090311_1907
03/11/2009	Transverse	K	51.26	-	EPR_AFP_20090311_1912
03/16/2009	Transverse	K	57.79	-	EPR_AFP_20090316_1007
03/16/2009	Transverse	K	52.77	-	EPR_AFP_20090316_1042

Table: Summary of EPR measurements taken during E06-014, using modern κ_0).

Target Summary

- EPR polarizations are for pumping chamber, but we want target chamber polarizations
- Apply polarization diffusion model to get target polarizations
  - This depends on transfer tube geometry and polarization life times (spin relaxations ect.)
  - We do not currently have the transfer tube geometry: Yawei will measure for us.
  - We did not do a life time measurement on Samantha cell:
    - Yi suggested using live times from transversity cells
    - UVA website also has some live time information, but no uncertainties
    - Try to estimate error by comparing transversity cell life times measured at UVA and at JLab
- Start looking into water cell calibrations

What’s Next

- Look more into in-plane angle shift
- Finish live time calculations
- Implement live-times and new densities into 5-pass N2 runs for dilution correction
- Finish pion asymmetries
- Begin looking into water cell calibration