

BigBite Analysis

Live-Time Asymmetry, EPR Calibration and Pumping Chamber
Polarization

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Outline

- 1 Live-Times
- 2 NMR Interpolation
- 3 EPR Calibration

5.89 GeV Live Times

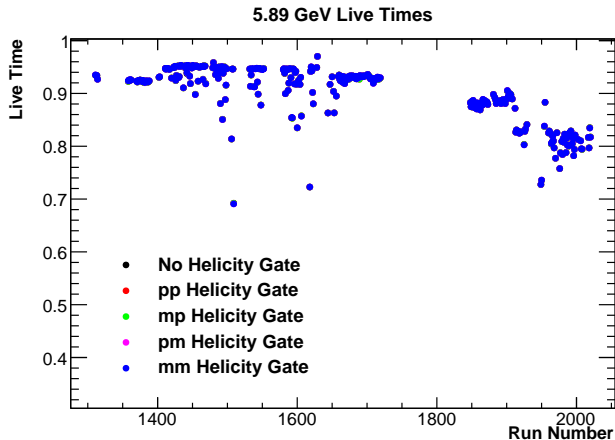


Figure: 5.89 GeV live times (no beam trip cuts applied).

5.89 GeV Live Time Asymmetry

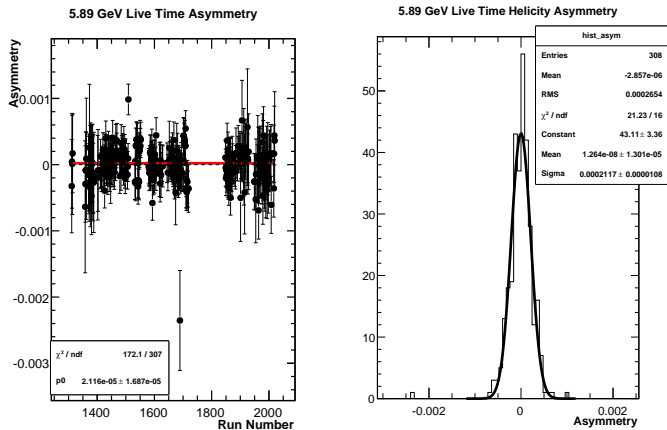


Figure: 5.89 GeV live time asymmetry (no beam trip cuts applied). Average asymmetry $\sim 10^{-5}$

4.74 GeV Live Times

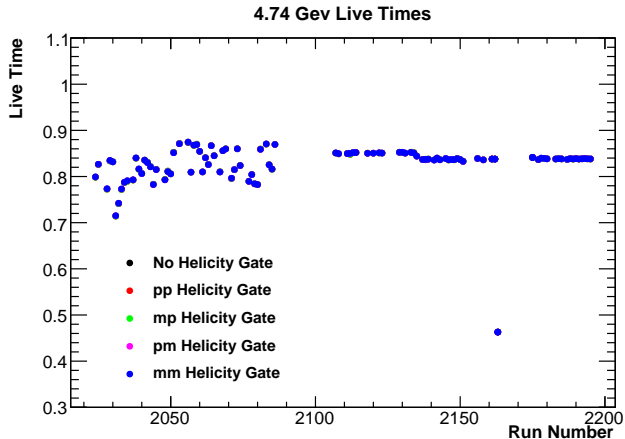


Figure: 4.74 GeV live times (no beam trip cuts applied).

4.74 GeV Live Time Asymmetry

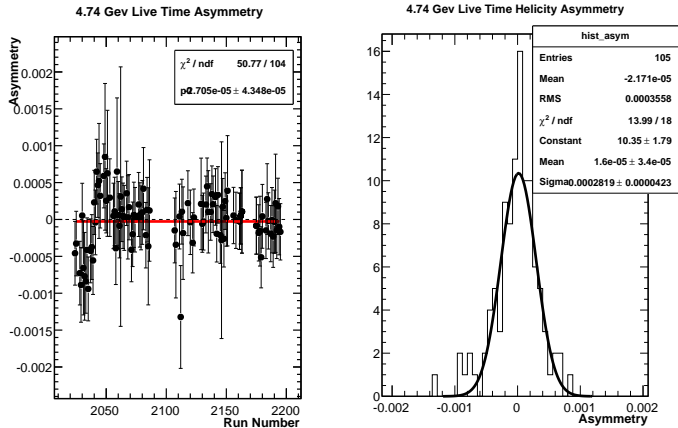


Figure: 4.74 GeV live time asymmetry (no beam trip cuts applied). Average asymmetry $\sim 10^{-5}$

NMR Interpolation Fits

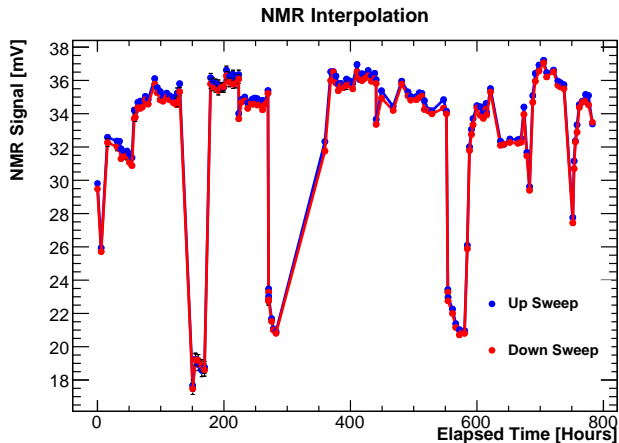


Figure: Linear Fits to NMR measurements.

Production Run NMR

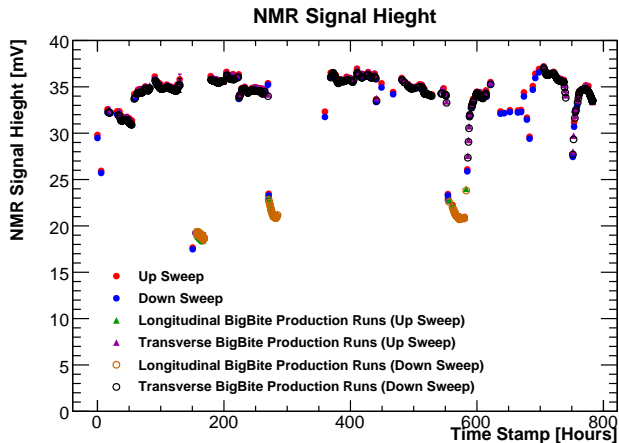


Figure: Production Runs using NMR interpolation.

EPR Calibration

- 1 EPR Polarization measured in the **pumping chamber** gives **absolute ^3He polarization**, P_{EPR}
- 2 NMR measurements in the **target chamber** were taken at the same time as EPR
- 3 NMR signal, S_{NMR} , **does not** give an **absolute polarization** need to calibrate with EPR polarization
- 4 Can apply calibration constant, C_{EPR} , to all NMR measurements to get ^3He polarization

$$C_{EPR} = \frac{P_{EPR}}{S_{NMR}}$$

EPR Polarization

See talk from [03/08/2012](#) for more information

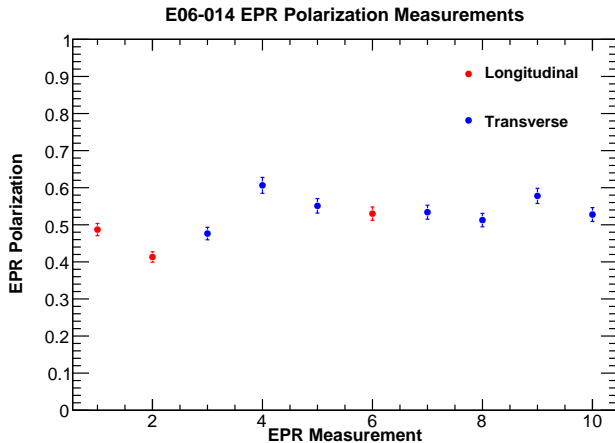


Figure: EPR polarizations using the more recent value of κ_0^{39K} . For the first 3 EPR measurements, only 2/3 COMET lasers were functional. For the measurement 1 and 3, 2 COMETs and 1 FAP laser was used. For the second measurement, only 2 COMET lasers were used. This is why the first 3 EPR measurements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

NMR Calibration Fit

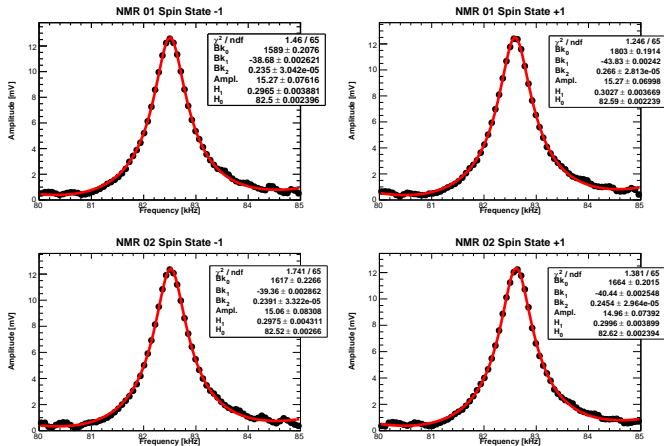


Figure: NMR signal fit during EPR measurement 20090207_2015. As the spin state is flipped the NMR amplitude decreases.

Calibration Constant C_{EPR}

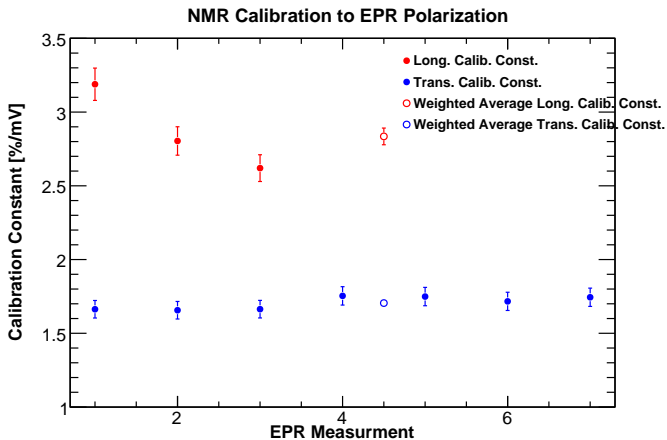


Figure: EPR calibration constant as a function of EPR measurement are shown in solid circles. Open circles are weighted mean of the calibration constants for a given target spin orientation.

EPR Calibration Results (Modern κ_0 Value)

Date	Target Spin	P_{EPR} (%)	δP_{EPR} (%)	S_{NMR} (mV)	δS_{NMR} (%)	C_{EPR} (%/mV)	δC_{EPR} (%)
02/07	L	48.71	3.400	15.275	0.499	3.189	3.436
02/07	L	41.32	3.400	14.734	0.515	2.804	3.439
02/09	T	47.64	3.540	28.645	0.481	1.663	3.573
02/17	T	60.64	3.540	36.609	0.600	1.656	3.591
02/17	T	55.10	3.540	33.122	0.534	1.664	3.580
02/23	L	53.00	3.400	20.231	0.655	2.620	3.463
03/11	T	53.39	3.540	30.446	0.315	1.754	3.554
03/11	T	51.26	3.540	29.310	0.350	1.749	3.557
03/16	T	57.79	3.540	33.669	0.641	1.717	3.598
03/16	T	52.77	3.540	30.253	0.326	1.744	3.555
Weighted Avg.	L					2.835	2.000
Weighted Avg.	T					1.705	1.351

Table: Summary of values that went into calibrating the NMR using the EPR polarization.

Pumping Chamber Polarization

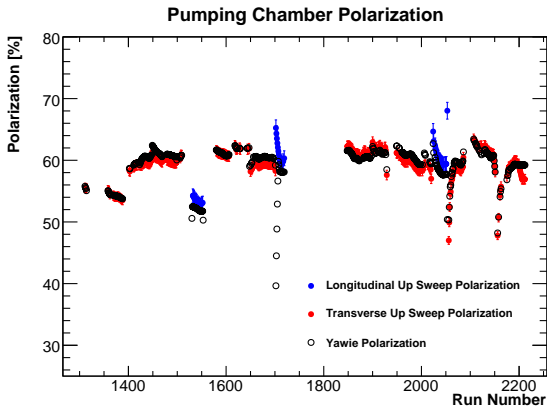


Figure: Pumping chamber polarization calculated from EPR calibration constant, C_{EPR} . And applied to interpolated NMR production run amplitudes.

To Do

- Form working polarization diffusion model to apply to pumping chamber polarization
- Begin looking again into asymmetry radiative corrections

Beam Trip Live Time Effect

T2 scaler count goes flat during beam trips. Does not contribute much to live time calculation.

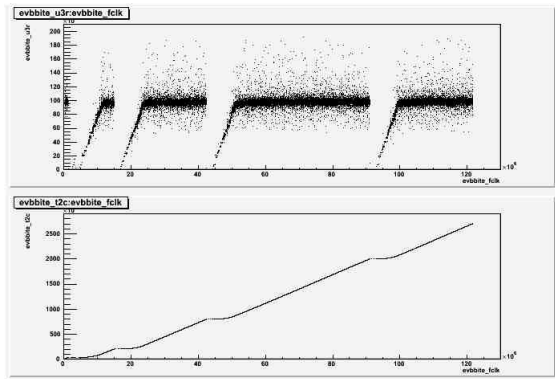


Figure: Current rate vs fast clock (top plot). T2 count vs fast clock (bottom plot).