2.464 GeV Elastic Calibration Simulations

Garth Huber

University of Regina, Regina, SK, S4S 0A2, Canada

June 7, 2007

By the time of SANE's run, the 5-pass beam energy could be as high as 6.06 GeV. This is a check of the corresponding 2-pass elastic calibrations at 2.464 GeV.

At 2.464 GeV, the $\theta_p = \theta_{e'}$ kinematic point moves forward by nearly a degree from what it was at 2.317 GeV. Thus, the coil obstruction will cause some shadowing at the edges of the scan, whereas 2.317 GeV is a near-optimal energy in several respects. Nonetheless, it is still possible to find kinematics where the shadowing effect is minimized. In comparison to the 2.317 GeV simulations, the scattered electron energy is about 70 MeV higher, so the vertical deflection is a little less and the calorimeter calibration coverage is correspondingly reduced. Because of the Q^2 values are about 0.14 GeV^2 higher, the coincidence rates are slightly lower than at 2.317 GeV, and the scan should take about 4.2 days of beam (at 60% data-taking efficiency), versus the 3.3 days projected for this purpose in the PAC31 study. Thus, we might have to reduce the collected statistics slightly from the original 400 count/cell target.

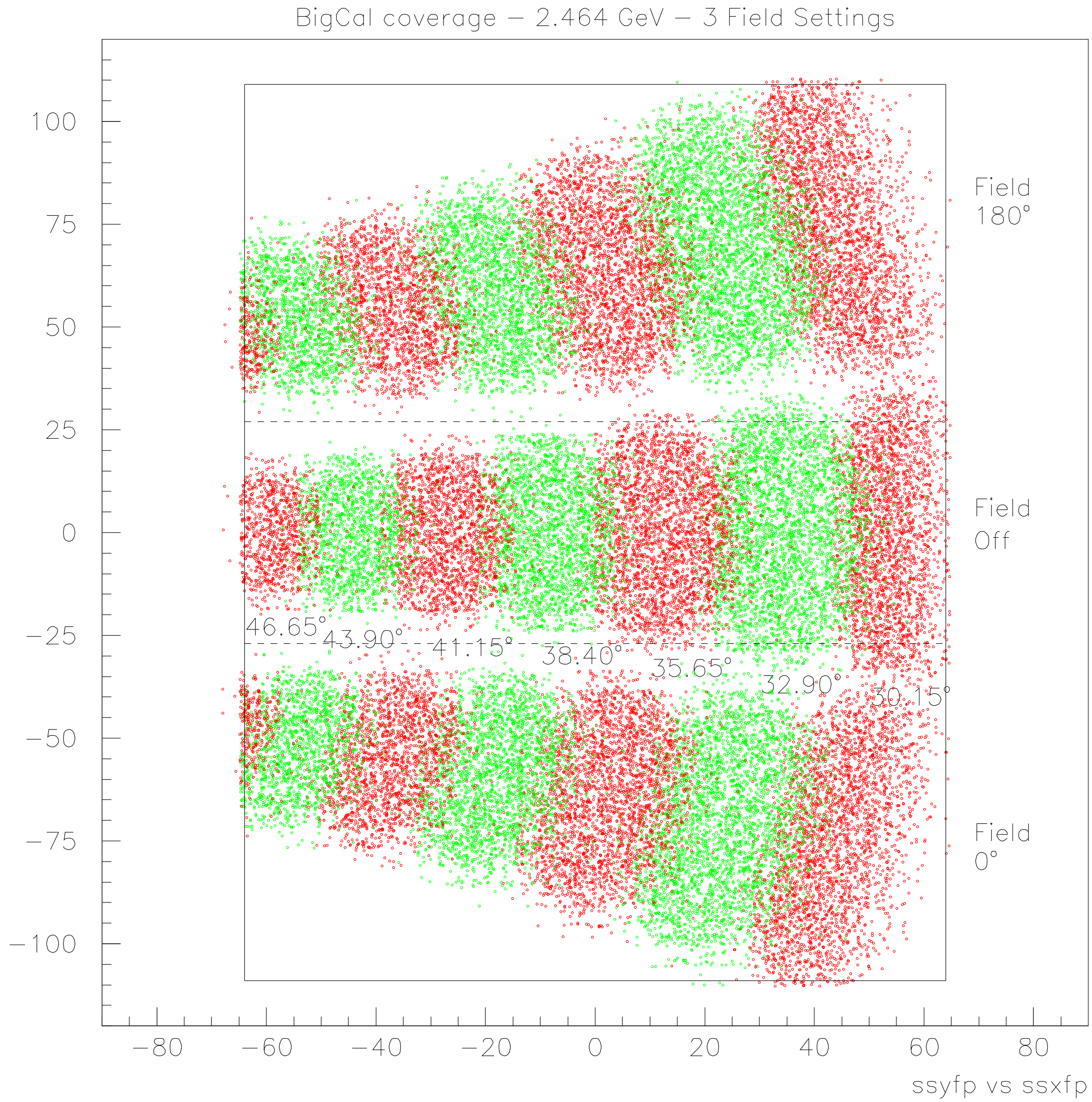

FIG. 1: Simulated locations of electron hits across the calorimeter for the various HMS (proton) angle settings and target field orientations listed in Table I. BETA is set at an angle of 40^o and 320 cm from the target throughout. The effect of the target coil obstruction is clearly seen for the settings on the right edge of the plot. Please note that the calorimeter 'focal plane' coordinates are reversed from the physical geometry, i.e. the $+x$-axis (vertical scale) points downwards, and the $+y$-axis (horizontal scale) points to the left.

2.464 GeV $e+p$ elastics										
$E_{e'}$	$\theta_{e'}$	Q^2	θ_p	p_p	Counts/cell/hr			Beam time (hrs)		
(GeV)	(deg)	(GeV^2)	(deg)	(GeV)	0^o Field	180^o Field	Field Off	0^o Field	180^o Field	Field Off
1.85	29	1.16	46.65	1.24	810	810	2150	0.5	0.5	0.2
1.76	32	1.32	43.90	1.35	1490	1440	1550	0.3	0.3	0.3
1.67	35	1.49	41.15	1.46	830	830	880	0.5	0.5	0.5
1.57	38	1.67	38.40	1.57	450	450	480	0.9	0.9	0.9
1.47	42	1.86	35.65	1.69	250	250	260	1.6	1.6	1.6
1.36	46	2.07	32.90	1.81	120	120	120	3.3	3.3	3.3
1.25	51	2.27	30.15	1.93	37	37	42	5.4*	5.4*	4.8*
Half-Field Rates										
1.85	29	1.16	46.65	1.24	1950	1930		0.2	0.2	
1.76	32	1.32	43.90	1.35	1540	1490		0.3	0.3	
1.67	35	1.49	41.15	1.46	880	860		0.5	0.5	
1.57	38	1.67	38.40	1.57	480	460		0.9	0.9	
1.47	42	1.86	35.65	1.69	250	260		1.6	1.6	
1.36	46	2.07	32.90	1.81	120	125		3.3	3.3	
1.25	51	2.27	30.15	1.93	40	40		5.0*	5.0*	
Total Time (100% efficiency)								24	24	12

TABLE I: Elastic scattering kinematics and projected BETA+HMS coincidence rates as determined from a SIMC simulation including the effect of the 5.1 T target magnetic field, the beam slow raster, etc. The proton is detected in the HMS and the scattered electron is in BETA, which is positioned at 40^o and 320 cm from the target throughout. The rates are per hour per 4×4 cm^2 cell assuming a beam current of 1 μA and the 3 cm target. * indicates that 200 counts per cell is used in the time computation, instead of 400 counts.

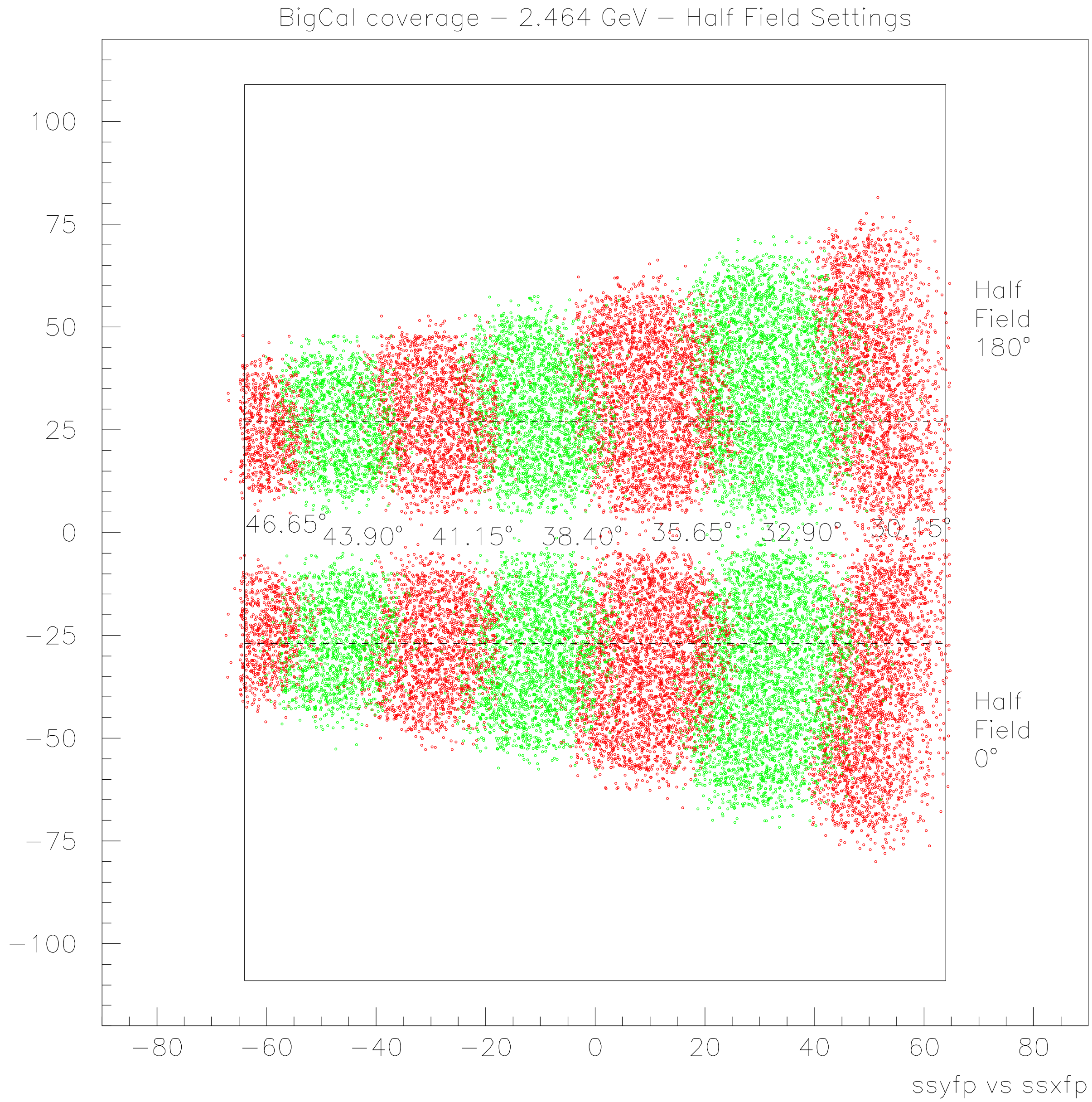

FIG. 2: Simulated locations of electron hits across the calorimeter for the half-field settings listed in Table I. BETA is set at an angle of 40^o and 320 cm from the target throughout.