

High Precision Electron Beam Polarization Measurement With Compton Polarimetry at Jlab Hall A

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A Compton polarimeter, based on a Fabry-Perot cavity that amplifies the laser light scattering the electron beam, has been built in 1998 at JLAB hall A.

In 2000, the Compton polarimeter has measured the beam polarization for the so called "N-Delta" and "Gep" experiments. During these runs, more than 400 polarization measurements have been taken with a typical absolute uncertainty of 1.4% during 40 mn data taking and polarization variations of the beam have been monitored with a relative uncertainty of 1%.

These unprecedented results at this range of electron beam energy and intensity (4.5 GeV, 40 μ A) have been achievable thanks to the use of a scattered electron detector that allows to determine the response function of the scattered photon calorimeter, and which provides an alternative and independent analysis method. A special attention has been brought also to the reduction of the major sources of false asymmetries (such as the lock of the vertical position of the electron beam). A careful study of all the sources of systematic errors (experimental asymmetry, analysing power and photon polarization) have led to a typical systematic uncertainty, for one run, of 1.1%. For the first time at JLAB, the polarization difference between the two helicity states of the electron beam has been measured and found to be compatible with zero at the level of 0.3%.