The OLYMPUS Experiment

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Abstract

OLYMPUS was designed to measure the cross section ratio of positron-proton to electron-proton elastic scattering, with the goal of determining the contribution of two-photon exchange to elastic scattering. Two-photon exchange might resolve the discrepancy between measurements of the proton's form factor ratio $\mu_p G_E^p/G_M^p$ made using polarization techniques and those made in unpolarized experiments. To make this determination, OLYMPUS operated on the DORIS storage ring at DESY, alternating beteen electron and positron beams at 2.01 GeV incident on an internal hydrogen gas target. The experiment used a toroidal magnetic spectrometer instrumented with drift chambers and time of flight detectors to measure rates for elastic scattering over the polar angular range of approximately 25°–75°. A symmetric Møller / Bhabha calorimeter at 1.29° and telescopes of GEM and MWPC detectors at 12° served as luminosity monitors. A total luminosity of approximately 4.4 fb^{-1} was collected over two running periods in 2012. This paper provides