

# The OLYMPUS Experiment

## Hard Two-Photon Contribution to Elastic Lepton-Proton Scattering

### **Abstract**

The OLYMPUS experiment, the final experiment at the DORIS storage ring at DESY, measured the positron-proton to electron-proton elastic cross section ratio,  $R_{2\gamma}$ , a direct measure of the hard two-photon exchange (TPE) to the elastic cross section. TPE is assumed to be the cause of the discrepancy in the recent proton form factor ratio measurements. OLYMPUS collected data in 2012, alternatively scattering electron and positron beams from an internal, windowless, hydrogen gas target. The detector consisted of a toroidal magnetic spectrometer instrumented with drift chambers, a system of time-of-flight scintillation counters, and a redundant set of luminosity monitors. Radiative effects were taken into account for the extraction of  $R_{2\gamma}$ . The results, for a wide range of virtual photon polarization  $0.456 < \varepsilon < 0.978$ , are smaller than hadronic two-photon exchange calculations predict, but are consistent with a phenomenological model.