Photoproduction of ω Mesons off Protons with Linearly Polarized Photons

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Abstract

The photoproduction of ω mesons off protons will be used to study baryon resonances and t-exchange processes in the center-of-mass energy regime of 1.73 to 2.24 GeV. In baryon spectroscopy, the ωN channel is expected to be a significant branch for the decay of baryon resonances carrying the isospin $I = \frac{1}{2}$. t-channel exchange contributions can only be disentangled by use of a linearly polarized photon beam. The measurement will employ a linearly polarized beam of photons produced by the approved Coherent Bremsstrahlung Facility to measure the beam asymmetry and the spin density matrix elements of the three-pion decay of the ω. The spin density matrix elements and polarization asymmetry of the ω decay will be extracted as functions of the center-of-mass energy $\sqrt{s}$ and the ω production angle θ_{cm} in the center-of-mass frame. These measurements will expedite the search for baryon resonance contributions and will provide new physics information on diffractive, t- and u-channel processes. The proposed experiment will probe the lower energy region ($1.2 < \mathrm{E}_\gamma < 1.6$ GeV) with an average photon polarization of 65% by using a 4 GeV electron beam. A second run with a 6 GeV electron beam will permit measurements in the energy regime $1.5 < \mathrm{E}_\gamma < 2.2$ GeV with an average photon polarization of 80%. The 100 MeV overlap will allow for cross checking and comparing the results of the two runs. We propose to collect data in parallel with and contiguous to the already approved experiments E94-109 and E98-109, which are scheduled for the $\gamma 8$ CLAS running period.