

Abstract

Vector meson production from a proton target is very useful in probing the structures of nucleon and nucleon resonances. It has been suggested that some of the double polarization observables in the case of ϕ mesons are extremely sensitive to the strange quark content of the proton, and polarization observables are essential for identifying the so-called “missing resonances” in ω production. We propose to measure the recoil proton polarization from electroproduction of ϕ and ω mesons with a longitudinally polarized electron beam and a liquid hydrogen target. The scattered electrons and recoil protons will be detected in coincidence, and ϕ and ω mesons will be identified by a missing mass technique. The recoil proton polarizations from ϕ production will be measured at an invariant mass of 2.15 GeV and a $|Q^2| = 0.135$ (GeV/c)². The recoil proton polarization from ω production will be measured at two sets of kinematic settings: $W = 2.15$ GeV, $|Q^2| = 0.135$ (GeV/c)²; and $W = 2.0$ GeV and $|Q^2| = 0.177$ (GeV/c)². In addition to the recoil proton polarization measurement, differential cross sections will be measured as a function of t and Q^2 . These cross section data will help to address issues related to the theoretical uncertainty in interpreting the polarization data. The total beam time requested for this experiment is 25 days.

I. INTRODUCTION

The discovery of the underlying quark structure of the nucleon from deep-inelastic scattering (DIS) of electrons from protons in the 1960s motivated the construction of new, powerful electron and photon facilities, where the main scientific thrust has been understanding the detailed structure of nucleon and baryon resonances in terms of quark and gluon degrees of freedom in QCD. The advent of polarized beams, polarized targets and recoil polarimeters has opened up new windows of opportunity in probing the structure of matter with polarization observables at these new facilities.

One of the very intriguing questions in probing the structure of the nucleon is that strange sea quarks seem to play a non-negligible role in both the static and dynamic properties of the nucleon. The possible evidence for this statement come from different experiments ranging from high energy polarized DIS measurements of polarized leptons scattering off polarized nucleon targets, to low energy pion-nucleon scattering. These experiments measured different matrix elements, and different model dependences were unavoidably involved in extracting information on the strange quark property in nucleon.

The idea of looking for hidden strangeness in the nucleon, *i.e.* for $s\bar{s}$ pairs in the quark sea directly, originally proposed by Henley *et al.* [1], is to measure the amplitude for the direct knockout of such a pair in the form of a ϕ meson which is known to be nearly pure $s\bar{s}$. More recent calculations [2] have shown that double polarization observables might be very useful in identifying the direct knock-out of $s\bar{s}$ pairs from proton from other mechanisms. Furthermore, it is also suggested [3] very recently that accurate information on the