Testing the Limits of the Single Particle Model in ^{16}O(e, e'p): An Update to E89-003

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We propose to measure the cross section, R_{lt}, and A_{lt} for the $^{16}\mathrm{O}(e, e'p)$ reaction with higher precision and to much higher missing momentum and missing energy than in E89-003. We will perform this measurement at the same energy and momentum transfer ($Q^2 = 0.8$ (GeV/c)^2 and $\omega = 0.445$ GeV). This experiment will take advantage of the Hall A high-precision spectrometers and the self-normalizing waterfall target; accurate, modern, relativistic $(e, e'p)$ theory; and observables sensitive to specific physical parameters. We will compare our results to theoretical predictions in order to determine:

(i) the limits of validity of the single-particle model of valence proton knockout;

(ii) the effects of relativity and spinor distortion on valence proton knockout using the diffractive character of the A_{lt} asymmetry;

(iii) the bound-state wave function and spectroscopic factors for valence knockout; and

(iv) the longitudinal component of the higher missing energy (two-nucleon knockout) cross section (through the R_{lt} response function), including the predicted two-nucleon knockout correlation ridge.

To compensate for the lower cross sections at higher missing momenta, we will increase the beam energy and the luminosity over those used for E89-003. This proposal is an update to E89-003, which has time remaining. We are requesting 31 days of beamtime to perform these measurements.