

Abstract Submitted  
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**Precision Measurement of Spectrometer Angles for Hall A Parity Violating Experiments** KIADTISAK SAENBOONRUANG, University of Virginia — Jefferson Lab Hall A High Resolution Spectrometer (HRS) pair provides high momentum resolution at the  $10^{-4}$  level and high angular precision at the level of 0.1-0.2 mrad level. However, in order to meet the experimental requirements, the spectrometer central angle ( $\theta_0$ ) must also be well known. Although  $\theta_0$  can be reasonably measured by performing a spectrometer survey, the survey uncertainty can be as large as 0.8 mrad. This uncertainty is unacceptable for very forward angle experiments such as PREX (87.3 mrad). We used an alternate experimental method to determine  $\theta_0$  with higher accuracy. This method uses electrons elastically scattered off nuclei with different masses; it is based on the dependence of angle and energy of elastic scattered electrons on the nuclear mass. In the case of HAPPEX-III and PREX experiments, we used elastic scattering off Hydrogen ( $^1H$ ) and Oxygen ( $^{16}O$ ) nuclei in a water-cell target. The energy loss corrections cancel in the difference. Multiple measurements of the  $^1H$  and  $^{16}O$  energy difference were made using different central momenta of the spectrometer to improve the accuracy and to establish the systematic uncertainty. We used our method to determine  $\theta_0$  for the PREX (HAPPEX-III) experiment with an accuracy of 0.4 (0.5) mrad. The resulting uncertainty in  $Q^2$  is 0.9% (0.4%) for PREX (HAPPEX-III), within the 1% accuracy required.

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