Critical Tasks for PREX

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1 Introduction

Below are the tasks that are critical for the timely completion of PREX

1. Compton Polarimeter

   (a) Manpower for the laser, etc. Syracuse is planning to provide a postdoc for this issue. Additional help is needed.

   (b) Integrating Compton. The present plan is to use a continuous FACD system. It is essential that we identify the hardware and get it operating in time to test it with G_{En}.

   (c) Detection crystal. We must that we can get a response with nonlinearities accurately characterized. A GEANT simulation is the first step. The results will help us evaluate how serious the problem is and what the next steps should be.

2. Septum Magnet: We need a warm septum magnet. We plan to fund this with a MRI to the NSF led by a consortium consisting of Smith College and Syracuse for on the order of $200k. The iron should be shielded so that pole-tip scattering does not contribute to a false asymmetry.

3. Achieve 100 ppm noise for one window pair. The basic plan is to use new ADC's and the LUMI with a carbon target as a full system test. A key intermediate step is to get the PMT pedestal noise small and also test the PMT electronics with a battery. One problem is the unavoidable ground loop with the HV. Should we use a battery system? We need to develop a detailed plan and schedule that includes times

when Hall A is available for LUMI tests with high current and a thick target. We also need a schedule for the 18-bit ADC's.

4. High field Moller polarimeter. Both the overall plan and the hardware need need to be specified and a schedule developed.

5. Angle measurement. Since the Q^2 is much lower than it was for HAPPEX II, the issues are different. We need a homogeneous target with both H and a heavier nucleus. Since we need to run at very low current anyway, a hydrocarbon target might work. A specific plan is needed.

6. Detector. The resolution of the HAPPEX II detector and the new quartz detectors were too wide. We need to evaluate the problem, develop an improved design, and test it.

7. BCM, BPM agreement. It is important to show that redundant monitors give the same answer. The cavity BPM's and the striplines appear to serve this purpose. The BPM data from the HAPPEX II run need to be evaluated in this light.

8. Pole tip Scattering: Monte Carlo. The small size of the Pb detector should make us less sensitive to pole tip scattering, etc. However, a realistic Monte Carlo would help better evaluate this and other important issues.

9. Linearity. New limits on linearity need to be established. PMT's are presumable, but we need better tests. Incorporating the Los Alamos vacuum diodes and electronics into our tests seems to be a good solution.

10. Beam asymmetry: The beam transverse polarization asymmetry asymmetry is about 10 times the parity asymmetry. The implications of this need to be worked out. The L-R asymmetry in the apparatus provides a measure of the vertical polarization. Careful alignment of the Wein filter seems to be the best way to control the horizontal polarization.

11. Can we be more quantitative in limiting systematics due to beam spot size?

12. The sensitivity of our data to R_n varies over the acceptance. For Hydrogen, the corrections for this effect are small and under control. How

much worse is the problem for Pb? Evaluating the effects for ^{4}He might serve as a good test case.

13. Procure isotopically pure ^{208}Pb.

14. Radiation issues:

    (a) Will radiation damage power supplies, etc. in the hall?

    (b) Can we add shielding near the target to reduce the problems with neutron radiation?

15. We should add a second stripline where there is significant dispersion to serve as an independent energy monitor.

16. A cavity-only regression should be done for the HAPPEX II data as a test of the cavity monitors.

17. Full optics calculations should be done.