PREX/CREX
Readiness Review Comments

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Committee

1. Ed Folts (observer)
2. Arne Freyberger (beam)
3. Javier Gomez (observer)
4. Dave Mack (chair)
5. Chris Keith (target)
6. Todd Kujawa (EHS&Q/electrical)
7. Bert Manzlak (EHS&Q)
8. Jack Segal (power supply)
9. Pavel Degtiarenko (radiation)
10. Mark Wiseman (septum)

1. What is the operational status of the equipment? What are the completion/commissioning schedule and tasks?

The major designs are preliminary. The experimenters have conceptual designs for the target system and shielding ready to be developed into a coherent system. No completion/commissioning schedule was presented.

2. Is the 48Ca target geometry optimized for background suppression? Are local shielding and machine protection systems required to minimize detector background in place? Have the proper measures been taken to protect the 48Ca target from oxidation?

The existing Ca-48 target, tilted 45° from the beam axis, appears to be sufficient for the successful completion of the CREX program. Target impurities have been considered and shown not be a problem. Studies at the University of Manitoba on the characterization and removal of the oxide layer from the calcium surface should continue and be incorporated into the target's preparation. Further thought must be given as to protecting the target from oxidation during and after the experiment (see comments below).

Yes, based on previous experience using a Pb target. Detector backgrounds from Ca may be different.

Transfer under oil should prevent oxidation under normal conditions.

3. Have the proper measures to protect the 208Pb target from melting been taken?
Have measures been taken and defined to prevent and monitor density fluctuations?

No. The collaboration anticipates some lead targets will melt, but based on PREX-I experience, a sufficient number (10) will be installed on the target ladder to ensure the successful completion of PREX-II.

During PREX-I, the experimenters demonstrated that precision synching of the FR to the reversal frequency made the density fluctuations negligible in the helicity correlated asymmetry.

4. The septum magnet will be operated at higher current density during CREx. Has the safe and efficient magnet operation at this current density been satisfactorily addressed by the collaboration? Is the water-cooling system adequate for the high current?

Not yet. While the gap-shimmed, 3-coil septum appears (optically) to be a viable solution for both PREX and CREX with existing power supplies, additional testing is recommended to check that available pressure drops in Hall A can produce the recommended flow rate. Powered tests may be useful.

Apparently not. A detailed LCW estimate should be presented for the entire experiment.

5. Does the operation of the septum magnet produce any residual field along the beam line? If it does, has its effect on beam transport been evaluated and shielded properly?

The septum does not produce a significant dipole field, but saturation of the magnetic shield inside the septum produces a residual quadrupole field which magnifies the beam spot on the dump face. The experimenters should

i. Check that the magnified beam spot is safe for beam dump operation, and

ii. Investigate the effect of the HRS Q1 fringe fields on potential beam deflection

or develop mitigation procedures.

6. Have the EHS&Q considerations been properly included in the design of the equipment?

While the collaboration appears to be on track in this matter, the designs were not at a stage were the details could be evaluated and should be covered in later design reviews. Some examples of progress include:

i. Features such as the shared target chamber, and the collimator “coffin”, which will reduce radiation exposure to workers.
ii. The collaboration has identified and designated qualified design authorities for some equipment.
iii. The Hall A Lead Engineer demonstrated awareness of the EH&S engineering expectations and requirements.

7. Are the anticipated beam characteristics (parity quality, general stability …) expected to be within the required specification to perform these experiments?

The beam quality is likely to meet the PREX-II requirements as they have been previously met. Measurements made during Spring 2016 support similar parity quality beam to the 6 GeV era.

8. Are the radiation levels expected to be generated in the hall acceptable? I.e. has the impact of the radiation generated in the hall equipment and infrastructure been properly calculated and mitigated? This includes:

o The scattering chamber

o The beam-line downstream of the scattering chamber

o The instrumentations (electronics, ...)

The Collaboration did a good job in evaluating radiation environment in the PREX-II/CREX experiments and has developed conceptual measures to mitigate the expected high prompt dose rates in the critical areas in the Hall, down to acceptable levels. The calculations are validated/benchmarked against other calculations and against experimental data from previous comparable experiments. The conclusions look quite reliable. The next iteration of the radiation calculations will be needed when the engineering design of the targets and the interaction region is finalized.

Based on the conceptual shielding design, radiation doses to equipment inside Hall A are acceptable, however the site boundary dose is approaching the limit *even assuming no Hall C operation* (primarily due to CREX running). To increase the confidence that the site boundary dose in a given calendar year will not be exceeded, the collaboration should implement their idea of installing additional shielding over the 48Ca target to reduce sky-shine.

9. Are the responsibilities for carrying out each job identified, and are the manpower and other resources necessary to complete them on time in place?

The responsibilities are reasonably identified for this stage of the experiment. Some amount of design and engineering time is needed in the near term to take the overall experimental set up to a more concrete level so that design concepts can be finalized. These resources are not “in place”.

10. Has the equipment ownership, maintenance and control been defined during beam operations?

This was not as well defined as it could be but there is still time to develop this prior to the experiment.

11. Are the specific documentation and procedures to operate safely and efficiently the equipment, in place and adequate? This includes demonstrated readiness for full rate capability and expedient analysis of the data.

The collaboration is clearly aware of the EHS documentation expectations. However, not all specific documentation and procedures are in place and adequate. Place-holders exist which is appropriate for this stage. Responsibilities need to be assigned. Time is more than adequate to bring these to completion.