Basic Beam Requirements: Qweak Spring 2010 Commissioning Run

A detailed commissioning and run plan is under development by the collaboration for the Spring 2010 run. What follows is a general summary of the collaborations goals and basics beam requirements for the upcoming first run of the Qweak experiment. After the spring 2010 commissioning run the collaboration and laboratory will be in a much better position to generate a detailed set of achievable beam requirements and detailed run plan for the Fall 2010-Sping 2010 production run.

The three major goals for spring 2010 Qweak commissioning run

1) Determine the performance characteristics of each major Qweak sub-system, the accelerator, beamline, polarimeters and polarized injector. Specifically, the commissioning of sub-systems with an eye on determining what will require modification, upgrade, or repair during the summer 2010 down.

2) Perfecting the methodology and procedures to conduct the later production running.

3) Taking ~3 weeks of production beam during the spring 2010 run in order to perform a ~25% measurement of Q^p_{Weak}.

Requirements and beam conditions necessary to accomplish the above stated goals

The collaboration fully recognizes that our experiment, the accelerator and polarized injector will not likely turn on with ideal/final operating characteristics. Therefore, we will be somewhat flexible with respect to accommodating the needs of the other experiments during approximately the 1st half of the spring 2010 commissioning run.

However, during the 2nd half of the spring run we request as stable as possible parity quality beam (see Qweak proposal for detailed specs), with high beam current, fully longitudinal polarization and nominal 1.160-1.165 GeV beam energy. This is required in order to obtain the data necessary for a 25% measurement of Q^p_{Weak} to be used as thesis material for the collaboration's first generation of graduate students. Note: In the 1160-1165 MeV range our FOM is flat so if this flexibility is required to improve the polarization in the other Halls we have no issue. However, looking towards the later production running we would like to keep if possible the same energy between the two 6 month production runs and certainly not change energy within a production run.

We request that the polarized injector and accelerator be operational with acceptable trip rate (<10 hour) and low beam halo. We desire the double Wien slow flip and rapid 1 ms helicity reversal capability during this period. We require true 100% longitudinal beam and must have control over adjustments to keep it that way if/when it drifts. Specifically, Qweak requests the 1 ms quad pattern (non-line locked) helicity reversal scheme during the majority of our spring 2010 commissioning run. We prefer that the settling time gate

be no longer than ~80 micro-seconds. We plan to use oversampling techniques to determine the effective target boiling noise suppression (common mode rejection) at slower reversal rates. However, we would like several dedicated days to allow for the direct measurements of the beam residuals with other reversal patterns and rates. Note: Unless measurements during the spring run change our plans the laboratory should assume we will be doing our production running at this higher (1 ms) reversal rate. We will also, require several dedicated days of running with transverse polarized beam.

We will need to have the energy lock on and essentially all the standard fast feedback loops in the accelerator operational. We will also need the "slow" DC position and angle lock operational on our target. This is in addition to all our custom helicity correlated injector feedback loops and our Hall C line and beam energy (small) modulation systems. We will be running at various currents between 100 pA to 1 na (tracking runs) with up to 150 μA (180 μA if feasible) during the target tests and planned 25% measurement of Q^{p}_{Weak}. We would also like the capability to get so called "beat frequency" chopped beam in order to conduct time-of-flight studies of backgrounds. These runs will be of short duration and will likely average between 10 nA and 100 nA peak beam current. Chopped beam is a "strong like" rather than a "must have" capability for the spring run.

We understand that there will need to be dedicated injector/accelerator time required to debug these features/systems during which we will have limited control over what beam is delivered to Hall C. We request that the source group let us know how much of the spring run will be required for these activities in order for us to fold it into our final run plan.