Hall A Halo Monitor Specifications Document

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Overview:

The halo monitor proposed for Hall A uses much of the same apparatus that fulfilled a similar purpose during the Qweak run in Hall C. This document provides specifications on the specific target needed for Hall A and details on the running modes to define the conditions for the FSD/ADC module for the fast shutdown logic.

The halo monitor consists of a thin aluminum target with two holes (one rectangular, one round) mounted in place of the usual "fork" in a standard superharp drive mechanism. The superharp mechanism is oriented to drive the target into the beam vertically. There is no horizontal motion capability. The assembly used for this purpose during the Qweak run in Hall C (including the Qweak halo target) is currently installed in Hall A just downstream of the fast raster magnets. Downstream of the halo target is an array of scattered radiation monitors consisting of lucite and scintillator mounted to phototubes. These detectors and their data acquisition systems are maintained by Hall A staff and users and are not discussed further in this document. The scaler count rate output of these monitors are provided via EPICS variables.

Target:

The halo target should be the same as the attached drawing in all respects **EXCEPT** for these modifications:

- The top hole should be rectangular with dimensions of 6 mm vertically and 16 mm horizontally. The center of the rectangle should be at the same place as the center of the square in the existing drawing.
- The bottom hole should be circular with a diameter of 8 mm with its center being at the same place as the circle in the existing drawing.

These two modifications are shown laid on top of the existing drawing in Figure 1.

The reasoning for these two choices is as follows: Since we have no horizontal motion, we can't guarantee the beam will be centered in the horizontal direction. The rectangular hole allows us to measure any halo in the vertical direction (after finding the center in that direction with the actual beam) to within 3 mm of the main beamspot. If the beam center horizontally is reasonably well (within 1 mm) coincident with our target, then the circular hole could be used a well.

Desired running modes to define the logic in the FSD/ADC module

The following are the running modes we would want to operate this device in:

- **Regular running modes:** Several allowed programmable target positions where beam can be run at full current with FSD occurring upon any target motion. These positions would assume that the beam is on a well-defined trajectory that is controlled with some sort of slow lock system. So one input to this box would presumably be a signal indicating that the slow lock system is engaged.
    - Target out: target fully retracted from beam
    - Position 1: vertical position of the rectangular hole (determined from calibration at low beam current)
    - Position 2: vertical position of the circular hole (determined from calibration at low beam current)

- **Special calibration mode:** In this mode the FSD would be masked and target motion would be allowed at very low beam currents (we used 10 nA or less in Qweak). This mode is necessary for two reasons:
    - Calibration of the halo monitor detectors: This is done by moving the target so the low current beam is fully on the aluminum.
    - "Beam-based" alignment: By scanning the target vertically with low current beam, the vertical positions corresponding to the set points for "Position 1" and "Position 2" above can be determined for the nominal beam trajectory that the slow lock system is set to.

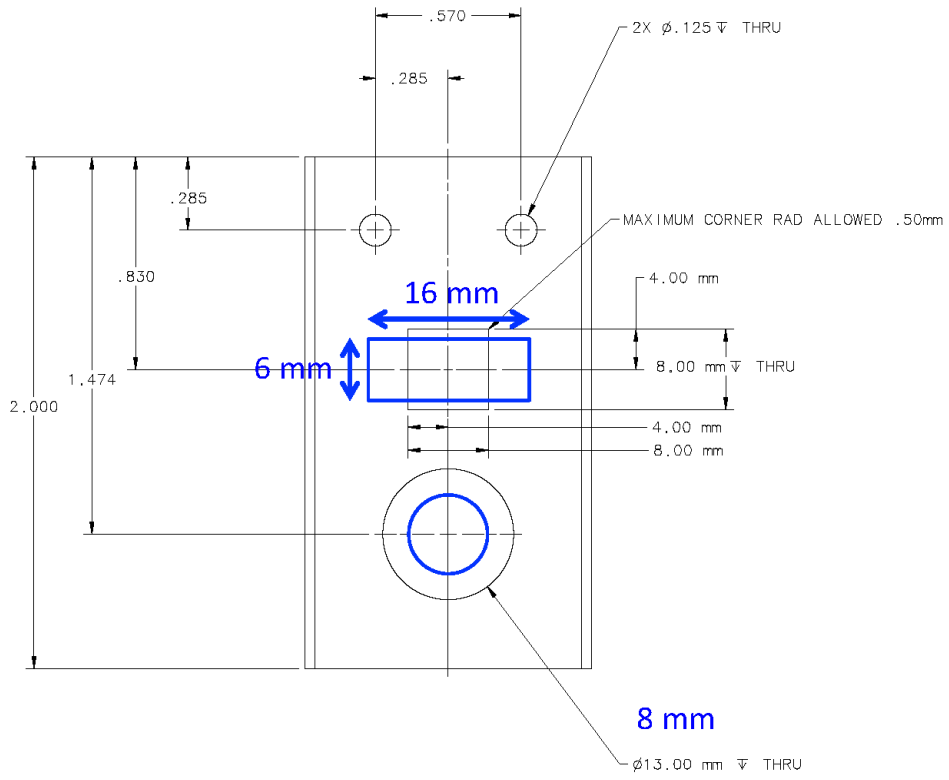

Figure 1: Schematic of desired hole sizes and locations for Hall A Halo Target; all other dimensions, hole locations, and materials choices remain the same.