Test Plan for FDC Prototype Studies in a Magnetic Field

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The Forward Drift Chamber (FDC) system for the GlueX experiment in Hall D will be operated in the strong magnetic field provided by the 2.2 T GlueX superconducting solenoid. We will perform studies of the FDC small-scale prototype chamber performance in a magnetic field so that we can understand the performance issues and calibrations required, and quantify the impact of the magnetic field on the chamber resolution. We will employ the old pair spectrometer magnet in the downstream alcove in Hall B. We will require minor assistance from the Hall B technical staff during set-up and break-down of the test set up.

Installation Work:

- Install electronics racks, gas handling system, and gas bottles in the Hall B downstream alcove.

  This will require the assistance of the Hall-B crew to transport our electronics racks, gas handling system, and gas bottles from the Test Lab to Hall B and to crane the equipment into the alcove.

- Install the small-scale FDC prototype inside the magnet gap.

  This work will be performed after the magnet refurbishment, checkout, and field mapping required as part of Hall B experiment E07-009 (Stepanyan et al.)

  This may require mounting the prototype on aluminum structural components so that we can slide the prototype into the gap and will also serve to fix the position of the chamber in the magnet.

- Install trigger scintillators above and below the magnet.

  We need to make sure that the magnetic field in the vicinity of our PMTs is low enough (<5 G) so that the tubes will operate. If the field is too large, we will have to come up with a suitable shielding scheme.

- Install tracking detectors (8 IUCF MWDCs) above and below the magnet to define an external track. Alignment of each stack of 4 chambers and the prototype will be performed.

- Install low voltage distribution system for pre-amplifier boards for all chambers.

- String gas lines to all chambers.
- Install ribbon, high voltage, and coaxial cables between alcove and the electronics racks.

  Insure all chamber grounds are tied to the common electronics ground.

  Look at chamber signals on a scope. If there are noise or humidity problems, we will nitrogen over the electronics boards.
- Make sure that the data acquisition system runs and we can access the DAQ computer from outside Hall B.
- We will trigger the readout on cosmic rays for all planned studies. We will require 1 week for setting up the electronics and optimizing the chamber performance in Hall B before the data runs begin.

Test Plan:

After installation of the FDC prototype chamber, we will put up appropriate signage to warn people of the dangers and hazards. We will complete a TSOP for the work and have it posted in the Hall. We would prefer that access to the downstream alcove (behind the shielding wall) be restricted while the tests are ongoing. Our test plan will require roughly 1 week to perform electronics checkout and to calibrate and align the external tracking chambers and the FDC prototype in situ. Once our calibrations are complete, the main part of our test plan is to take data runs with the following field settings on the pair spectrometer magnet: 0 T, 0.5 T, 1.0 T, 1.4 T. Each setting will require roughly 5 days of acquisition time for a total of 25 days (5 days for calibrations and 20 days for data runs). We will also study different gas mixtures to confirm the expected behavior of the Lorentz effect due to different Argon/CO_2 ratios.

Tentative order:

- Zero-field checkout with 40% Ar/60% CO_2 (includes calibrations of time-to-distance function and geometry parameters for all chambers).
- Run at maximum field (1.4 T) with 40% Ar/60% CO_2.
- Run at maximum field (1.4 T) with 60% Ar/40% CO_2.
- Run at 1.0 T with 40% Ar/60% CO_2.
- Run at 0.5 T with 40% Ar/60% CO_2.
- Run at maximum field with other gas mixtures if time remaining.

Break Down:

After the test period is completed, we will require assistance from the Hall B crew to crane down the electronics racks and gas equipment to the floor and to transport the equipment back to the Test Lab.