Beam diagnostic stations for the TAMUTRAP beamlines

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The goal of the upcoming TAMUTRAP facility is to measure the beta-neutrino correlation parameter of $T = 2$ superallowed beta-delayed proton emitters by observing the shape of the distribution of the resulting proton energy spectrum. The low energy radioactive ion beam (RIB) necessary for this experiment will be extracted from the T-REX gas catcher and transported through a multi-RFQ (Radio Frequency Quadrupole) Paul Trap cooler/buncher to the TAMUTRAP Penning trap facility. As development of the TAMUTRAP experiment continues, it will become important to determine the beam profile and position and to obtain an idea of the transverse emittance of the ion beam at various stages in the beam line. To this end, a beam diagnostics station based on a wedge-shaped micro-channel plate (MCP) detector with a phosphor screen for obtaining position information has been designed, and is currently in testing. Planned locations for these stations are shown in Fig. 1.

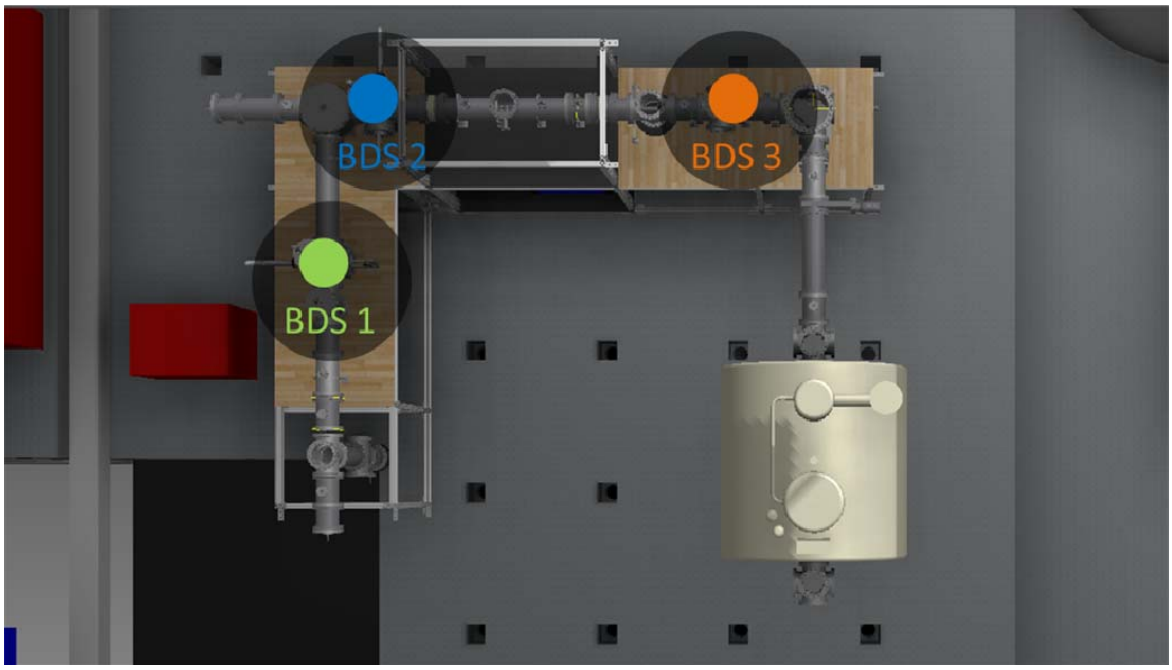

FIG. 1. Planned locations for the Beam Diagnostic Stations (BDS).

A Beam Imaging Solutions BOS-40-IW MCP detector (see Fig. 2) makes up the heart of the diagnostic station, and can provide a timing signal from the included metal anode or position information via the phosphor screen. This position information is recorded by a UEye camera for analysis. Transverse emittance measurements are planned to be performed by using this detector in conjunction with a pepper pot mask (right side of Fig. 2) placed upstream in the path of the beam. By calculating the separation of the resulting spots in the pattern on the phosphor and comparing these to the known pattern on the mask, the emittance can be deduced. Software has been written to perform these calculations in

LabView, and is currently being finalized. Additionally, longitudinal emittance will be calculated via timing information from the metalized anode of the MCP. A Faraday cup is also included in the beam diagnostic station for simple efficiency measurements and higher current tests. The entire system has been fabricated, and should be operational and fully tested within the upcoming months

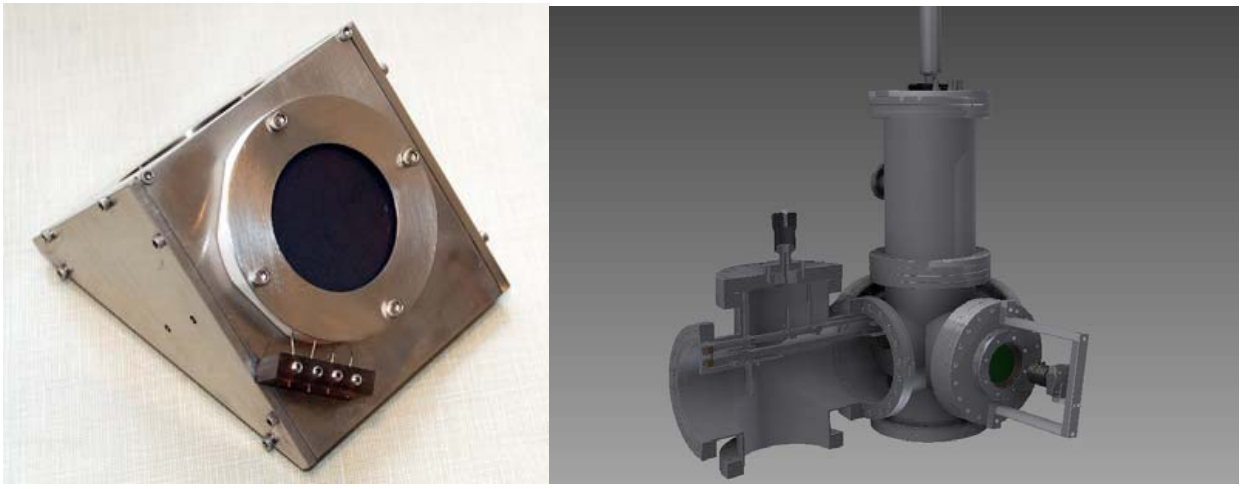

FIG. 2. The Beam Imaging Solutions BOS-40-IW multi-channel plate detector (left) and design of the beam profile and emittance measurement diagnostic station (right).