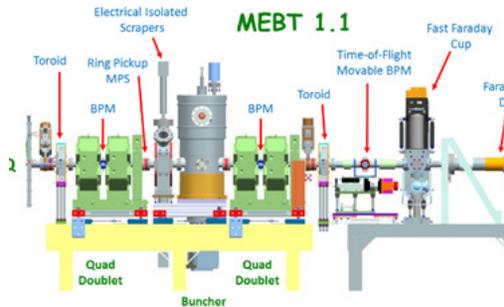


BEAM POSITION MONITORING SYSTEM FOR THE PIP-II INJECTOR TEST ACCELERATOR

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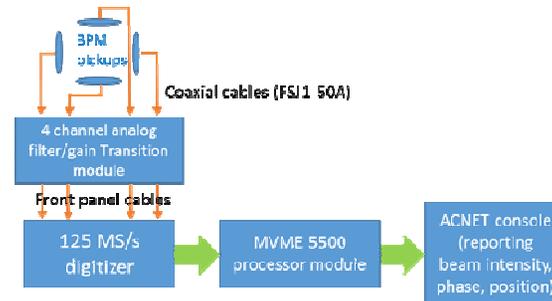
Abstract

The Proton Improvement Plan II (PIP-II) injector test accelerator is an integrated systems test for the front-end of a proposed continuous-wave (CW) compatible, pulsed H-superconducting RF linac. This linac is part of Fermilab's PIP-II upgrade. This injector test accelerator will help minimize the technical risk elements for PIP-II and validate the concept of the front-end. Major goals of the injector accelerator are to test a CW RFQ and H- source, a bunch-by-bunch Medium-Energy Beam Transport (MEBT) beam chopper and stable beam acceleration through low-energy superconducting cavities. Operation and characterization of this injector places stringent demands on the types and performance of the accelerator beam diagnostics. A beam position monitor (BPM) system has been developed for this application and early commissioning measurements have been taken of beam transport through the beamline.



Layout showing location of BPMs in the MEBT beamline

A BPM system is required for providing transverse position, relative intensity, and relative phase measurements for the MEBT linac. A 4-button BPM system is implemented to provide such measurements.



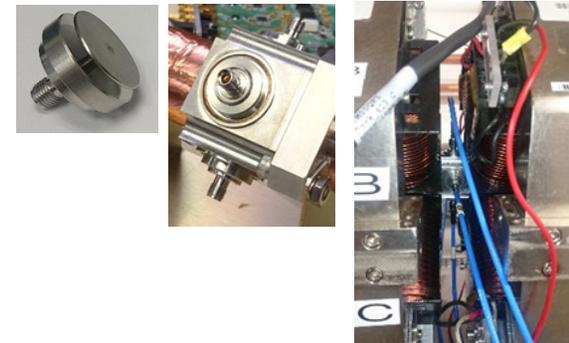
BPM System Block Diagram

All electronics will fit within one rack. Analog transition boards and digitizers modules are in-house custom designs which allow for flexibility, low-cost and compact designs.

The design relies on using the 162.5 MHz bunch frequency and isolating this component with a bandpass filter. The signal is then digitized and processed. The BPM pickups are characterized to know the relationship between beam location and differences between signal levels seen at the pick-ups.

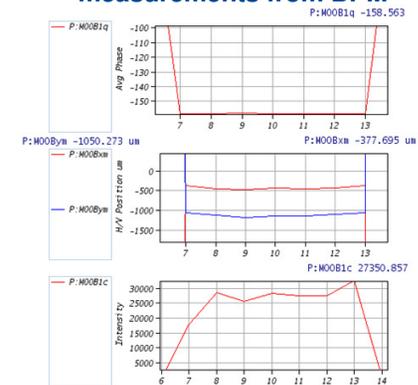


BPM Electronics Rack



Beam Position Monitor Button Pick-ups – Higher levels of assembly, left to right

Phase, position and intensity measurements from BPM



Measurements made are seen to have low variation. Measurement below shows around 60 μm of variation (left). BPM intensity (right) tracks with toroid current readings.

