

1 nA Beam Position Monitor

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Abstract. A new BPM system, based on resonant cavities, has been developed for measuring the transverse position of very low-intensity electron beams delivered to Experimental Hall B at the Continuous Electron Beam Accelerator Facility (CEBAF) in Newport News, VA. The system requirements called for measuring down to 1 nA with a 100 μm resolution. The actual system is much better: it can measure down to 100 pA at the 100 μm required resolution. A 100 pA beam yields about 1 electron per bunch. Each 1 nA BPM utilizes three resonant RF cavities to determine the position of the beam: one cavity sensitive to X position, a second cavity sensitive to Y position, and a third cavity which measures intensity. The position cavities operate at room temperature in a dipole type mode at 1497 MHz and contain internal field perturbing rods in an arrangement similar to that of the CEBAF rf Separator cavities. The position cavities are electron beam welded assemblies made of copper plated stainless steel. The RF output signal from each cavity is processed using a down-converter and a DSP based commercial lock-in amplifier operating at 100 kHz. The lock-in amplifiers connect to the EPICS control system via an IEEE 488 bus. System features under development include intensity and position modulation measurement capabilities. This paper provides measured performance results and an updated overview of the installed and operational 1 nA BPM system.

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