

Wire Scanner for High Intensity Beam Profile Diagnostics *

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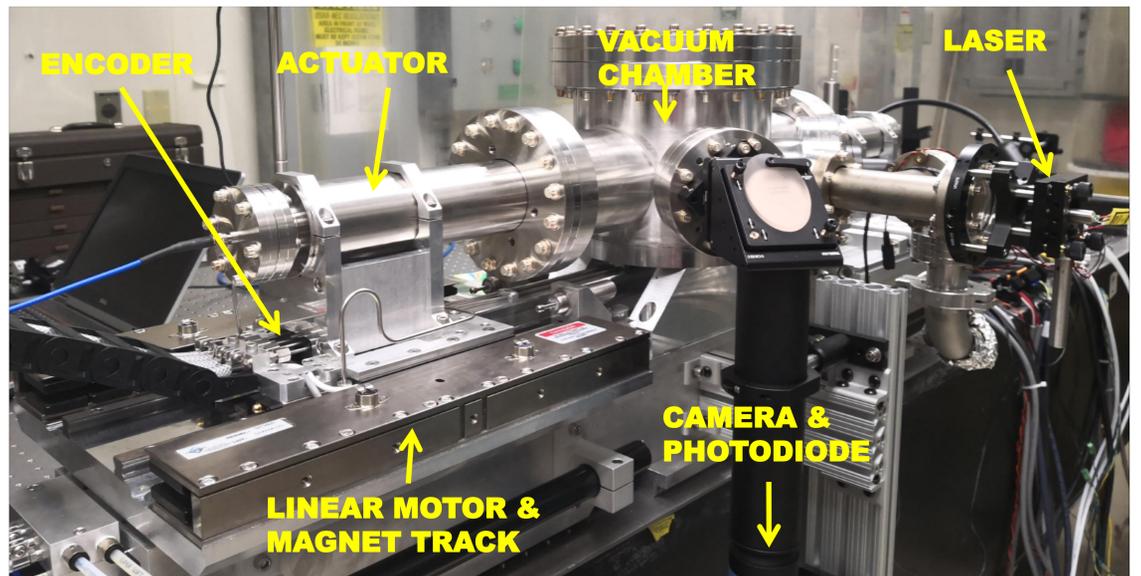
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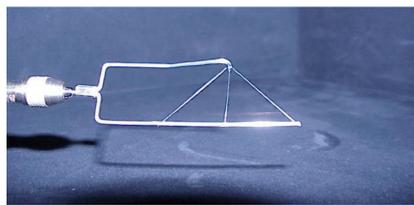


Abstract

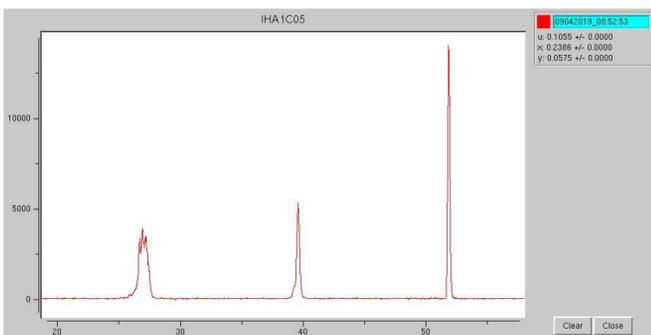
A control and data acquisition system of a high speed wire scanner is developed for high intensity beam profile diagnostics. The control system of the wire scanner includes two IOCs, a Soft IOC and a VME IOC. The Soft IOC connects with an Aerotech Ensemble motor drive through EPCIS motor record and controls the movement of the wire scanner. An Electrical Input card samples the real-time position of the wire through an incremental encoder, and generates a pulse to synchronize a VME ADC data acquisition card, which digitizes and samples the beam-induced signal after pre-amplification. A VME Relay Output card is installed to control the Brake Solenoid and Actuator Solenoid. All the VME I/O cards are installed on one VME crate and controlled by the VME IOC. The system configuration and software of the wire scanner are under development.



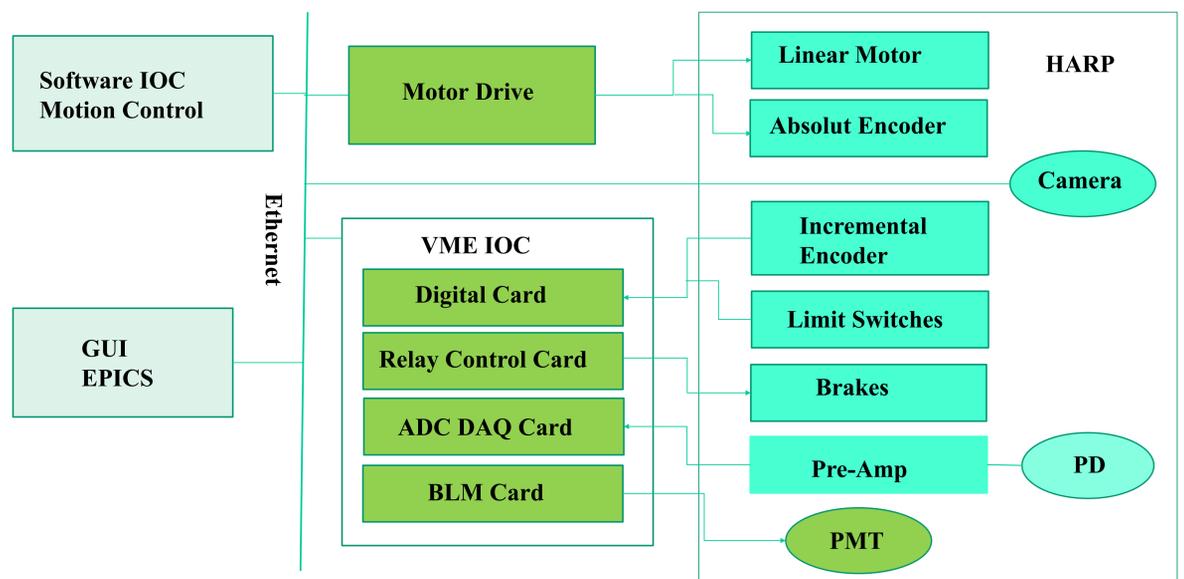
The Picture of the RadiBeam Wire Scanner



Harp is a beam profile measurement device that consists of a vertical thin wire and two orthogonal thin wires. When it passes in a controlled manner through the electron beam, a beam-induced current is generated as a function of the wire position.

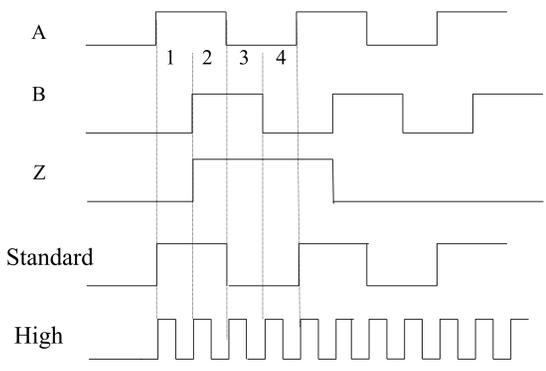


A typical Accelerator harp scan with "humps" produced by three wire. Motor Speed 1.0 mm/sec, Position 15 -70 mm.

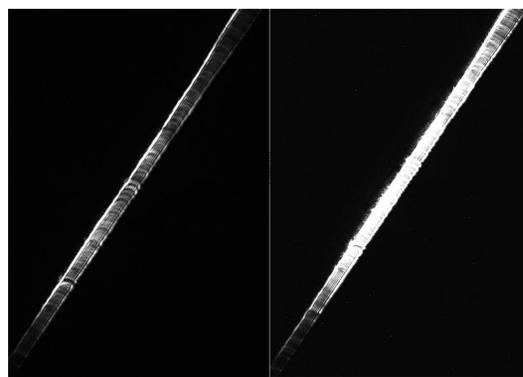


The Block Diagram of the Wire Scanner System

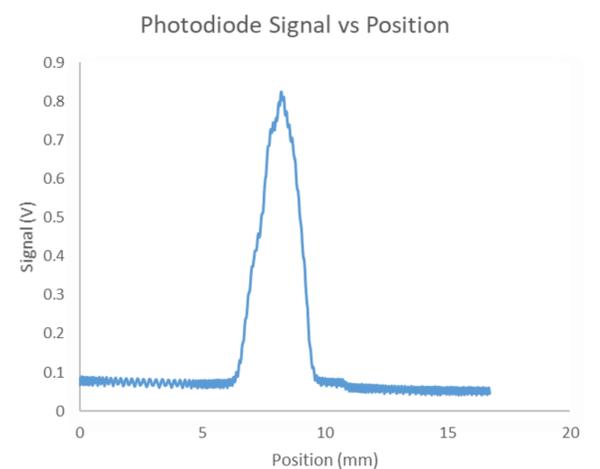
Laser Beam is Applied to Simulate the Electron Beam



Incremental Encoder measures the position. Wave Pulses A,B, Z from the Incremental Encoder. Output pulses: Standard – Single Evaluation
High Accuracy – Quadruple Evaluation



Images of the wire with reflected light taken by a CCD Camera when the wire is passing through a laser beam.



The reflected laser beam profile measured with a photodiode at a motor speed 50 mm/sec. The vertical axis is the signal of photodiode after pre-amplifier, and the horizontal axis is the position of the wire.

CONCLUSIONS

A high-speed control and data acquisition system for the RadiBeam wire scanner has been developed for high intensity beam profile diagnostics. The motor drive has been extensively tested with different parameters. The high-power Aerotech Ensemble HPe was chosen to drive the wire scanner. The software package that controls the motor drive and other I/O interfaces has been implemented in the EPICS control system. The hardware for device control and data sampling has been configured to provide multiple harp operations, such as a Super harp and a PMT harp. Initial results have been achieved on the 45° wire by using a laser beam to simulate the electrons and fitting the photodiode signal and the wire position to a Gaussian distribution. The next step is to install the wire scanner in the LERF and CEBAF beam lines at Jefferson Lab for high intensity beam testing. Before installing the wire scanner in a real beam, more testing of the hardware and software need to be performed.



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