

Fermi National Accelerator Laboratory LDRD Project Data Sheet - FY15

Project ID: FNAL-LDRD-2015-021

Project title: Transverse and Longitudinal Profile Diagnostics for H- Beams using Fiber Lasers and Synchronous Detection

Principal investigator: Victor Scarpine

Project description: (short description and explanation of cutting edge, high-risk, high-potential science or engineering)

The proposal is to test the concept of a combined transverse and longitudinal H- beam profiling instrument utilizing a low-power, high rep-rate fiber laser with optical fiber transport to the accelerator and synchronous signal detection. The expected small photo-disassociation signal will be detected through a narrow-band synchronous detection of a modulated laser pulse train. In addition, we propose to test the concept of acquiring these beam profiles by measuring the reduction in H- beam current.

Tie to Mission: (explain the project's relevance or anticipated benefits to Fermilab's and DOE's missions)

Beam diagnostics often lead to improvements in accelerator performance. The proposal is a novel approach for making non-invasive measurements of the beam profile for an H- beam relevant for the PIP-I, PXIE, PIP-II, and IOTA accelerator projects or proposed projects at Fermilab and elsewhere in the DOE complex where H- beams are used. The approach has advantages over conventional techniques with regards to safety, reduced beamline space, and increased measurement sensitivity.

Previous year's accomplishments: (as applicable)

The laser design was modified and a new quotation for the laser system was required and the purchase order was placed late in FY17 for laser delivery in FY18. The infrastructure (non-LDRD) for deploying the laser on the PIXIE beamline is also almost done. The project has been descoped to the design work and improvements and procurement with the custom laser for this application.

Work proposed for current fiscal year and anticipated / desired results:

The project is further descoped from original plans where the demonstration will be made in the vertical plane only and other measurements with new funds beyond LDRD to be sought. Receiving the laser and beginning commissioning will be the tasks to be completed before the project is closed.

Project funding profile: (costs, budgets, projected budgets, and total)

Prior year(s) costs	FY15	FY16	FY17	FY18	Total
N/A	33,382	33,961	17,085	160,000	244,428

Project Start Data: 2/1/2015 (est)

Total Approved Project funds: \$ 464,700