

# 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 is complete and a quotation for the laser system is in-hand so that a purchase can be made early in FY17. Design of infrastructure including a laser hut on the PIXIE beamline is also almost done. Modeling of the required magnetic field to capture the electron stripped from the H- beam has been done.

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

The project is descoped from original plans where the demonstration will be made in the vertical plane only. This will reduce the overall cost of the project. Actual measurements and demonstrations are still a desired outcome but will be subject to priorities of the PIXIE beamline.

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

Prior year(s) costs	FY15	FY16	FY17	Total
N/A	37672	33961	245000	316,663

Project Start Data: 2/1/2015 (est) Total Approved Project funds: \$ 464,700