

**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) FY15, not applicable

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

The proposed work for the project for FY15 will be to design and begin to develop the required laser system. The work will include the purchase of a fiber laser amplifier, design, procurement, and assembly of vacuum hardware and optics and electronics to characterize and test in an optics lab. If successful, the project will be ready to move to beamline testing with a goal of the construction and operation of a R&D profiling instrument that can study low-power photo-disassociation signals and laser and instrumentation systematic issues, as well as make initial beam profile measurements.

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

<b>Prior year(s) costs</b>	<b>FY15</b>	<b>FY16</b>	<b>FY17</b>	<b>Total</b>
N/A	194.3K	270.4K	--	464.7K