

**Fermi National Accelerator Laboratory
LDRD Project Data Sheet - FY17**

Project ID: FNAL-LDRD-2017-027

Project title: Silicon precision timing detectors for minimum ionizing particles

Principal investigator: Artur Apresyan and Lindsey Gray

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

We plan to develop over two years the technology that achieves the level of 20-30 psec for single minimum ionizing particle detection, and implement it in a "large system" detector, comprised of around 30 individual readout channels. This detector will be placed in the Fermilab Test Beam Facility (FTBF), as part of permanent installation. As such, the outcome of this project will provide a facility enhancement for FTBF, as well as a technology demonstrator for future experiments.

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

The importance of advances in fast-timing technologies was highlighted in the Coordinating Panel for Advanced Detectors (CPAD) report [1], and marked as a priority in the 2013 Snowmass report [2]. Silicon precision timing is a new line of research with applications in both calorimetry as well as our interest in timing of single minimum ionizing particles. Among many advantages of the silicon based MIP timing solutions are their high radiation tolerance, capability to operate in high magnetic field, fine-pixelated devices, fast signal response, no need for vacuum-sealed devices (as in MCPs), and small material budget in collider detectors.

Previous year's accomplishments: (as applicable)

N/A

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

For the first phase of the project, the objective is the construction of single channel detector components capable of high precision timing measurements at the level of 20-30 psec. PIs will start by studying and optimizing the currently available high resolution detectors, using bench setups and the beams at FTBF facility, to characterize these devices, and working with the RD50 collaboration to achieve the timing resolution needed for future experiments.

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

Prior year(s) costs	FY17	FY18	FY19	Total
N/A	145,786.45	283,053.69	100,000	528,840.14

Project Start Data: 3/01/2017

Total Approved Project funds: \$ 528,840.14