Fermi National Accelerator Laboratory
LDRD Project Data Sheet - FY16

Project ID: FNAL-LDRD-2016-001
Project title: Beam Precision Time Profile Monitor
Principal investigator: Eric Prebys / Andrei Gaponenko

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

This LDRD project will attempt to measure the fraction of beam that falls outside the nominal RF bunch with sensitivity of at least 10^{-5}, which is a regime where computer simulations are not necessarily predictive. The longitudinal tails have implications for beam and acceleration efficiency. The proposed technique uses a statistical method with a charge telescope monitors beam scattering off an existing wire/foil in the beam line. The accurate measuring comes from integrating over many bunches and then compared with simulation.

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

High Energy Physics (HEP) experiments often rely on precise knowledge of the beam halo both longitudinally and transversely. Out of time beam can also be lost causing activation. This project, if successful, will allow for a new technique to make measurements that will validate computer models of these beam effects, to a new level of precision that will enable beam line optimizations.

Previous year's accomplishments: (as applicable) The four-detector arm was assembled and installed in the test beam and then installed in the Recycler. A 16-channel data acquisition system was assembled and data was taken on 53 MHz bunches in the Recycler. Test beam results were very encouraging. The measurements in the recycler demonstrated the principle but there were some issues with trigger timing.

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

The project is nearing completion and some additional measurements are expected to be completed when beam gets re-established before the end of the calendar year.

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

Prior year(s) costs	FY16	FY17	FY18	Total
N/A	69,559	100,135	25,000	194,694

Project Start Data: 1/01/2016   Total Approved Project funds: $ 238,682