

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

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) One arm of the four-arm device has been constructed and operated in a test beam using a digital oscilloscope. A new crate of DAQ electronics is being commissioned for the full device. There is an area for the device to be installed in the MI/Recycler area and work will begin during the shutdown.

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

The project will be to construct the charge telescope using an aluminum frame that allows for the mounting of photomultiplier tubes. Quartz radiators will be used to produce light from the halo beam particles. The apparatus will be flexible and will initially be employed in the Fermilab Recycler to perform the measurements and to allows for comparisons to computer modeling of beam tails. The deliverables include the device and measurements such that conference and other publications of the findings can be made.

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

Prior year(s) costs	FY16	FY17	FY18	Total
N/A	69,558.74	122,814	--	192,373

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