

Fermi National Accelerator Laboratory

LDRD Project Data Sheet - FY15

Project ID: FNAL-LDRD-2015-020

Project title: Off-the-Shelf Data Acquisition System

Principal investigator: Ryan Rivera

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

Define and evaluate a low-cost, scalable data acquisition (DAQ) system architecture based on commercial technology being developed for the emerging “Internet of Things” (IoT). This approach connects intelligent front-end digitizers directly to a standard network which is used for data acquisition, event building, detector controls, online and offline data storage/processing, and control room interfaces. The system is scalable from a few MBytes/sec to hundreds of GBytes/sec using inexpensive commodity networking equipment and interface modules.

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

A wide range of experiments and test beam studies rely on data acquisition systems that in the past were often based upon relatively expensive and short-lived technologies. As experiments are reluctant to subsidize the development of niche standards, an off-the-shelf DAQ enabled by the IoT has the potential to satisfy the requirements of a large range of experiments and studies at a very modest cost.

Previous year’s accomplishments: (as applicable)

A number of software tasks have been completing including evaluation of web server infrastructure, developing a generic UDP receiver framework for artdaq, developing a web interface infrastructure. Several proof-of-concepts have been demonstrated such as compatibility with Fermilab passwords, widgets in JavaScript, and a website interface. A number of hardware tasks have been completed. Ethernet FPGA code has been added to various interfaces. The performance of the low-end candidate has been characterized. The mid and high-end candidates for evaluation have been selected. Several proof-of-concepts have been demonstrated including 100 Mbps data with the low-end board, the creation of an arbitrary digital waveform generator, power over Ethernet, a monitor of temperature, voltage, and current. Faster data rates (1Gbps) has been demonstrated with higher-end candidate boards.

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

The next set of work will be to specify a timing/synchronization system. Also, the mid and high-end boards will be characterized. This should result in a full off-the-shelf DAQ chain that can be installed in the test beam area and exercised with users who will provide feedback for further refinements.

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

Prior year(s) costs	FY15 through 8/15	FY16 budgeted	FY17 budgeted	Total
N/A	244124	173730	150000	567,854

Project Start Data: 2/1/2015 (est) Total Approved Project funds: \$ 589,660