Fermi National Accelerator Laboratory
LDRD Project Data Sheet – FY21

Project ID: FNAL-LDRD-2021-007

Project title: Breaking the Big Data Bottleneck and Meeting the Real-time Constraints of Multi-messenger Astronomy in DUNE and LSST with Computational Storage and Machine Learning

Principal investigator: Michael Wang

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

DUNE needs to sift through ~120 TB of LArTPC data to detect supernova neutrino burst (SNB) candidates and quickly disseminate reliable information on them over an alert network. LSST's goal is to execute its prompt processing pipeline to generate and transmit ~10k transient alerts to brokers within 1-2 minutes of shutter closure. Both DUNE and LSST face serious challenges in accomplishing these goals due to severe bandwidth limitations imposed by the data buses and interconnects employed in traditional computer architectures. Instead of forcing data through these bottlenecks to reach the computing elements, we propose to address these challenges by using emerging technologies like computational storage to embed the processing in or close to the data itself.

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

A successful proof-of-concept will provide a big boost to Fermilab's flagship experiment, DUNE, in its ability to carry out one of its major physics goals of studying SNBs from nearby core-collapse supernovae. It will allow Fermilab to play a leading role in LSST by leveraging its big-data computing expertise acquired over decades spent conducting major cosmological surveys. The valuable knowledge gained in applying promising emerging technologies like in-storage computing will, without a doubt, contribute to DOE's goal of maintaining U.S. leadership in science, technology, and innovation.

Previous year's accomplishments: (as applicable) N/A

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

Develop and test algorithms for identifying SNBs and determining directional information. Identify and acquire suitable hardware and begin implementing algorithms.

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

Prior year(s) costs	FY21	FY22	Total
N/A	$36,650	$201,953	$283,603

Project Start Data: 3/1/2021 Total Approved Project funds: $465,366