Fermi National Accelerator Laboratory
LDRD Project Data Sheet - FY18

Project ID: FNAL-LDRD-2018-025
Project title: Towards a Quantum Computing Science Center at Fermilab
Principal investigator: Panagiotis Spentzouris

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

This proposal will provide the foundation to create a world-class HEP Quantum Computing Science Center at Fermilab. We will identify and develop potential quantum algorithms for HEP and make plans for a quantum computing user facility giving HEP users access to external quantum computing resources starting with, but not limited to those at the Google quantum computing facility.

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

Quantum Computing (QC) has recently been established as a high priority strategic direction of the Department of Energy Office of Science. This priority is seen as a way to address ever-increasing computing demands in the post-Moore's law era. The first generation of quantum computers, soon to be deployed in production, will soon achieve capabilities for certain problems that exceed the largest existing supercomputers.

Previous year's accomplishments: (as applicable)

N/A

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

For this proposal, we will form a partnership with Google and utilize it to make QC available and accessible to our user community. QC is directly applicable to Fermilab science areas such as Quantum Field Theory, high dimensional optimization problems, and solving large scale partial differential equations. Our goal is to introduce QC programing using the familiar paradigm of hybrid computing. For this, a software layer needs to be developed to interface into Google's QC emerging cloud service. A list of candidate applications for QC prototyping will be made.

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

Prior year(s) costs	FY18 ½	FY19	FY20	FY21 ½	Total
N/A	150,000	300,000	300,000	200,000	950,000

Project Start Data: 3/15/2018 Total Approved Project funds: $ 950,000