

Fermi National Accelerator Laboratory LDRD Project Data Sheet - FY16

Project ID: FNAL-LDRD-2016-008

Project title: Novel Methods for High Performance Superconducting Coating on Copper

Principal investigator: Genfa Wu

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

The project will develop approaches to put superconducting coatings on less expensive cavity substrates preserving the performance compared with cavities composed entirely of superconducting material. To improve previous coating processes, an emphasis to have larger crystal sizes and higher deposition energies so that the thickness of the coating film is increased. The process of High Power Impulsive Magnetron Sputtering (HiPIMS) is chosen as the starting point to develop the new processes.

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

Requirements for Fermilab future high intensity beam accelerators such as PIP-3 require advances in performance along with development towards lower cost compared with currently available technologies. Other future accelerators based upon superconducting RF cavities would also potentially benefit consistent with Fermilab being a steward of advanced accelerator technologies.

Previous year's accomplishments: (as applicable) Work has begun on the HiPIMS system design including a pulser system designed by a JLAB collaborator. A new opportunity to provide coatings using ECR deposition with a JLAB system being moved to Fermilab looks promising.

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

The work will be to develop the HiPIMS processes, addressing known technical challenges, in order to achieve the high performance coatings. The first year work plan includes the initial steps of designing and procuring a HiPIMS system. This will continue into the 2nd year where the system will be used to produce coated samples to develop the processing recipes. The final year will focus on establishing the coating system by coating cavities and measuring cavity performance. The ECR system will be pursued if it's associated R&D can fit within the budget constraints and if there are no disadvantages for its use in accelerator cavities.

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

Prior year(s) costs	FY16	FY17	FY18	Total
N/A	97,993.09	409,500	479,807	987,300

Project Start Date: 4/01/2016 Total Approved Project funds: \$ 987,300