

Fermi National Accelerator Laboratory LDRD Project Data Sheet - FY15

Project ID: FNAL-LDRD-2015-029

Project title: Nb₃Sn superconducting RF cavities to reach gradients up to 90MV/m and enable 4.2K operation of accelerators

Principal investigator: Sam Posen/Alexander Romanenko

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

This proposal seeks to advance Nb₃Sn superconducting RF (SRF) cavities towards performance measurements of gradients up to 90MV/m and 4.2K operation. The work will be to identify and correct a cavity surface defect in otherwise very promising recent research at Cornell University and to develop an optimized production-ready Nb₃Sn layer forming technique.

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

Future accelerators based upon SRF cavities hold tremendous promise but cost considerations are tied to the achievable gradient and other operational parameters. If successful, the research would represent another breakthrough in SRF making such future accelerators much less expensive for a given desired energy.

Previous year's accomplishments: (as applicable)

A coating chamber / furnace has most of its design completed. Finishing the design and completing the procurement of required parts should be complete by the end of the calendar year. There is a plan for acquiring a klystron. The plan should be executed pending accelerator and technical division policies. A Nb₃Sn cavity has been cut out to allow for testing and making microscopic studies. These will continue along with HF rinse studies throughout the rest of the calendar year,

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

If the current work is successful, the furnace insert will be manufactured and commissioned and the optimization of the deposition process will be studied towards the manufacture of a 1-cell cavity with performance better than reported ones. The last year of the project will be to further improvements towards the production of a 9-cell Nb₃Sn cavity with gradient and Q outperforming bulk Nb cavities.

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

Prior year(s) costs	FY15 through 8/15	FY16 budgeted	FY17 budgeted	Total
N/A	88925	384641	586491	1,060,057

Project Start Data: 2/1/2015 (est) Total Approved Project funds: \$ 1,297,987