

**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: 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) FY15, not applicable

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

The proposal will work in the first year to establish a better limit on the superheating field of Nb₃Sn and to determine the nature of the gradient-limiting defects. Work will be directed towards developing a furnace insert for Nb₃Sn vapor diffusion based upon the design at Cornell. It is noted that much of the work will be carried out by a new Fermilab hire, Sam Posen (Co-I), who has performed prior SRF work at Cornell. If 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 final year will be 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	FY16	FY17	Total
N/A	326856	484641	486491	1297987