

**Fermi National Accelerator Laboratory
LDRD Project Data Sheet - FY14**

Project ID: FNAL-LDRD-2014-012

Project title: Development of HTS Based Rapid-Cycling Accelerator Magnets

Principal investigator: Henryk Piekarz

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

The goal is design, fabricate, and test a short-sample rapid-cycling superconducting accelerator magnet using a novel combined core and cable design made from high temperature superconductor, HTS. The rapid-cycling magnet will be coupled to a 500 Hz ringing mode power supply and a 20 Hz white circuit power supply to achieve 2000 T/s and 20 T/s ramp capabilities. This unique design will overcome limitations with normal conducting rapid-cycling magnets due to eddy currents and magnetic hysteresis and potentially pave the way for extended capabilities in ramp rate, lower power, and more stable operation of these magnets.

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

Rapid-cycling magnets are a critical component of many particle accelerator systems including fast-cycling synchrotrons such as the Booster, Main Injector, and FAIR. A key limitation in achieving high beam intensities is the high field ramp rate and successful R&D in this area would provide extended capabilities for possible new magnet components at Fermilab and at other facilities within DOE.

Previous year's accomplishments: (as applicable) FY14, not applicable

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

The project proposes to design the magnetic core and procure a test core during the first year of funding. This work includes the design of a window-frame core with high quality field to serve as reference to other designs. A C-shape core design will be explored to produce a high quality magnet gap field and "field-free" conductor space. The HTS power cables and their arrangements within the magnetic core will be also designed. The effect of magnetic force due to rapid cycling will be investigated. A 1.8T of a window-frame core and 5mm gap will be designed for the rapid-cycling tests.

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

Prior year(s) costs	FY14 (3 mo)	FY15	FY16	FY17 (9 mo)	Total
N/A	16000	157057	366295	345668	885020