

**Fermi National Accelerator Laboratory
LDRD Project Data Sheet - FY18**

Project ID: FNAL-LDRD-2018-037

Project title: Development of 10 kilogram Skipper Charge Coupled Device (CCD) experiments

Principal investigator: Juan Estrada

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

The work proposed here has the goal of demonstrating the scalability of the skipper-CCD technology for the development of 10 kg scale experiments. The final phase of the project involves development the compact cryogenic vacuum vessel to accommodate 200 Multi CCD Modules, MCMs, corresponding to approximately 10 kg of active mass.

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

Detectors with 10eV threshold are proposed as a new tool for miniaturized neutrino experiments using Coherent Elastic Neutrino Nucleus Scattering (CENNS) and other low threshold applications. A massive detector would enable projects with unprecedented reach in efforts looking for new physics in the low energy neutrino sector, short baseline neutrino oscillation experiments and low mass direct dark matter searches. This CCD technology has been identified as a potential tool for the detection of plutonium breeding blankets in nuclear reactors – possibly relevant for the verification of the “U.S. – Russia Plutonium Management Disposition Agreement”.

Previous year’s accomplishments: (as applicable)

N/A

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

The initial phase is for the development of an individual skipper-CCD module (with 1k x 6k skipper-CCD sensor) with a cold electronics (CE) circuit on the package to integrate and digitize the CCD signal as shown in Fig. 3. The CE will consist on discrete components on a circuit printed on Si and epoxied to a skipper-CCD.

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

Prior year(s) costs	FY18 ½	FY19	FY20	FY21 ½	Total
N/A	60,000	226,561	149,886	86995	523,442

Project Start Data: 3/15/2018

Total Approved Project funds: \$ 523,442