

**Fermi National Accelerator Laboratory  
LDRD Project Data Sheet - FY17**

**Project ID:** FNAL-LDRD-2017-028

**Project title:** Increasing the photon detector light efficiency in a liquid argon detector by an order of magnitude

**Principal investigator:** Gustavo Cancelo

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

This proposal seeks to achieve a photon detection efficiency higher than 1% in LAr scintillating detectors using a novel light trapper and active ganging structure of silicon photo-multiplier devices (SiPMs).

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

The photon detection efficiency is a key parameter that determines the degree of science to be obtained by a liquid argon detector. This R&D will look at a novel option to improve the photon detection light efficiency compared with baseline technologies selected for the DUNE project. If the high efficiency can be demonstrated, there can be improvements in selecting non-beam events for proton decay and supernova.

**Previous year's accomplishments:** (as applicable)

N/A

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

The first year will focus on a proof of principle of the two methods, the ARAPUCA, light trapper, concept and the active ganging of SiPMs. As a first step both techniques can be proved independently. Both techniques will be tested in LAr facilities with cosmic rays and radioactive sources. The deliverables will be a measure of the efficiency in the detection and performance of the SiPM detectors using active electronics in LAr. The experiments will be complemented by a simulation effort and data analysis. Results will be disseminated as shown below in the next section.

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

<b>Prior year(s) costs</b>	<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>Total</b>
N/A	100,000	200,000	100,000	400,000

Project Start Data: 3/01/2017

Total Approved Project funds: \$ 400,000