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Features and performances of the DUNE Far Detectors photon detection system

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The Photon Detection System (PDS) of the first two DUNE far detectors (FD1 and FD2) is composed of 6000 and 672 photon detection units respectively, named X-Arapuca.

The PDS will complement and boost the DUNE LArTPC for the detection of non beam events: the prompt light detection will enable the trigger and the calorimetry of the supernova neutrinos, and improve the vertex reconstruction of the beam ones.

The FD1 PDS is placed behind the anode planes of the LArTPC, while the FD2 PDS is located on the cathodic plane, biased at 320 kV, therefore leading to extra challenges for both the power and the readout of the X-Arapuca device.

The X-Arapuca is a photon trap with two light downshifting stages, where light is collected to SiPMs by a large area Wavelength Shifting light guide. It is an assembly of several components, whose grade and coupling determines its Photon Detection Efficiency (PDE), and consequently the PDS sensitivity of the DUNE physics reaches.

We will present the FD1 and FD2 PDS and discuss their individual features, with a special focus on the photon collector components and on the performances achieved by the X-Arapuca units measured in laboratory and in the CERN facility at the Neutrino Platform, where the small scale prototypes of both PDS are being tested. We will also present the possible changes to the baseline design of both FD1 and FD2 X-Arapuca that will allow to further enhance their PDE.

The FD1 and FD2 scale 1:20 prototypes at the NP04 and NP02 CERN neutrino platform instrumented with the baseline versions of the X-Arapuca will be operated with Liquid Argon in the first semester of 2024.

Collaboration

DUNE

Role of Submitter

I am the presenter

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