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Enhancing the LAr VUV Light Collectors of the DUNE Photon Detection System and of low background LAr based experiments.

martedì 18 giugno 2024 17:30 (2 ore)

The Photon Detection System (PDS) of the first two DUNE far detectors, FD1 and FD2, is composed of large area photon detection units named X-Arapuca; they embed large area PMMA based wavelength shifting lightguides and dichroic filters custom developed and produced for the LAr environment.
The PDS will complement and boost the calorimetry of the LArTPC, enable the detection of non beam events such as supernova neutrino bursts, and improve the vertex reconstruction of the beam.
The X-Arapuca is a photon trap with two down-shifting stages, driving photons to SiPMs where they are eventually collected. 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 reach.
An experimental study is presented showing how specific changes to the baseline components of both the FD1 and the FD2 X-Arapuca enhances its PDE, hence the DUNE PDS sensitivity. The impact of each of the X-Arapuca main components is quantified.
New characterization at cryogenic temperatures of the absorbance, photo-luminescence and light emission time profile of the VUV sensitive fluors (pTP, BBT) will be presented: they are at the basis of the LAr Photon Detection Systems for DUNE and can be employed in low background LAr experiments.
The features and the radiocontaminant budget of the large area PMMA based down-shifting lightguides are presented and discussed. These lightguides can be directly coated with VUV sensitive fluors employing dip-coating and wire bar coating techniques.
These technologies are also relevant for the DUNE FD3 and low background experiments, such as LEGEND-1000, where WLS lightguides of similar shape and size are being considered.

Poster prize

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