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Characterization of low-energy argon recoils with the ReD experiment

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The Recoil Directionality project (ReD) within the Global Argon Dark Matter Collaboration aims to characterize the response of a liquid argon (LAr) dual-phase Time Projection Chamber (TPC) to neutron-induced nuclear recoils and to measure the charge yield for low-energy recoils. The charge yield is a critical parameter for the experiments searching for dark matter in the form of low-mass WIMPs and measurements in Ar below 10 keV are scarce in the literature. This project will cover the gap down to 2 keV.

The TPC is irradiated by neutrons produced by an intense 252 Cf fission source in order to produce Ar recoils in the energy range of interest. The energy of the nuclear recoils produced within the TPC by (n,n') scattering is determined by detecting the outgoing neutrons by a dedicated neutron spectrometer made of 18 plastic scintillators. The kinetic energy of neutrons interacting in the TPC is evaluated event-by-event by measuring the time of flight between a BaF $_2$ detector located close to the 252 Cf source, which tags the primary fission event by detecting the accompanying radiation, and the neutron spectrometer. Data with the 252 Cf source are being taken during the Winter of 2023 at the INFN Sezione di Catania. The experiment will be complemented by calibrations with low-energy internal sources of 83m Kr and 37 Ar diffused inside the TPC.

In this contribution, we describe the experimental setup and the preliminary results from data analysis.

Submitted on behalf of a Collaboration?

Yes

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