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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 $^{83\text{m}}\text{Kr}$ 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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