

FEB

SiPM

SiPM

The Recoil Directionality (ReD) experiment Simone Sanfilippo on behalf of the ReD Working Group Università di Roma Tre - INFN Sezione di Roma Tre (<u>simone.sanfilippo@roma3.infn.it</u>)

Motivation

- Sideral variation of WIMP wind from Cygnus, results in a substantial anisotropy in nuclear recoils
- Ratio of horizontal WIMP induced Ar recoils to vertical ones, varies by a factor of ten over the day \bullet
- **Unlikely** for the background to mimic the directional signal \bullet
- A dark matter detector with directional capability would provide a smoking gun for a possible discovery

Recoil Directionality in Liquid Argon

Case 2: Less Recombination

Cryogenic system and TPC Performance





DARKSIDE

- 5x5x6 cm dual-phase LAr **TPC**:
 - Acrylic with 3M Reflector +

Columnar recombination

may display a sensitivity to the angle between nuclear recoil direction Θ_{R} and drift field E in a LAr TPC:

> • Scintillation (S1) and ionization (S2) signals expected to depend on E and $\theta_{\rm R}$.

The experimental setup at LNS and first data analysis





- Main goal: irradiate a small LAr TPC with neutrons and produce recoil parallel or orthogonal wrt the E field in order to probe the **directionality of nuclear recoil** in liquid argon
 - Recoiled neutrons detected on an array of nine per 3-inches Liquid Scintillator (Lsci) neutron detectors
- How: neutron beam is produced at INFN Laboratori Nazionali del Sud (LNS) in Catania by the 15 MV **Tandem** via the **p(⁷Li,⁷Be)n** reaction



9000

10000

E (ADC ch.)

p(⁷Li,⁷Be)n @ 28 MeV ⁷Li

• tag ⁷Be @ 5 deg to select monochromatic **neutrons** with **E** ~ 7 MeV at the TPC angle (~ 22 deg)

- 24 x 1 cm² FBK SiPM with 24ch readout on the TOP of the TPC
 - **Readout board made by INFN-NA**, with the collaboration of INFN-BO and LNGS
- 24 x 1 cm⁻ FBK SiPM with 4ch readout on the **BOTTOM** of the TPC
- ²⁴¹Am source (59.5 keV):
 - **Total light yield** accounting for Cross Talk and After Pulse in the SiPM at null field **8.3 phe/keVee**



- TPB coating
- New SiPMs light readout at cryogenic temperatures:
 - key test for future **DarkSide-Proto and DarkSide-20k detectors**



- Calibration with ^{83m}Kr (41.5 keV)



8000

7000

 Inelastic scattering and random bkg under control





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S2 Yield (PE/keV