Finanziato dall'Unione europea NextGenerationEU
Ministero dell'Università e della Ricerca
Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA
INFN

RED AND RED+

L. Pandola

INFN LNS

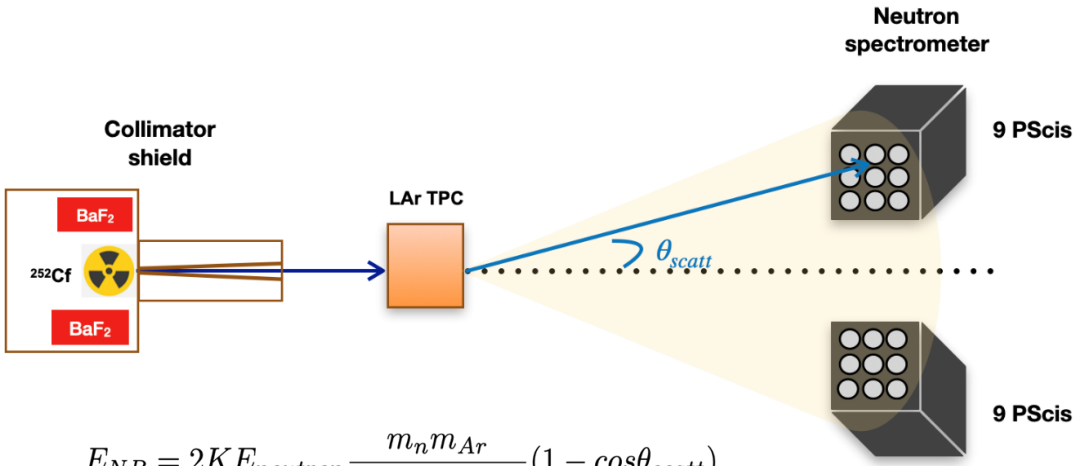
LNS Users Committee

September 30th, 2024

ReD and ReD+

- **Main goal**: characterization of the response of a dual-phase Argon Time Projection Chamber to low-energy (≤ 1 keV) nuclear recoils
- **Physics background**: direct search for Dark Matter, as low-mass WIMPs, O(few GeV)
  - Relevant for **DarkSide-20k** (under construction @LNGS)

- **Layout**: irradiate the TPC with neutrons and detect the scattered neutrons by plastic scintillators
  - **Two-body kinematics**
  - Neutrons from ^{252}Cf (1-10 MeV) or DD gun (2.4 MeV)



$$E_{NR} = 2KE_{neutron}\frac{m_n m_{Ar}}{(m_n + m_{Ar})^2}(1 - cos\theta_{scatt})$$

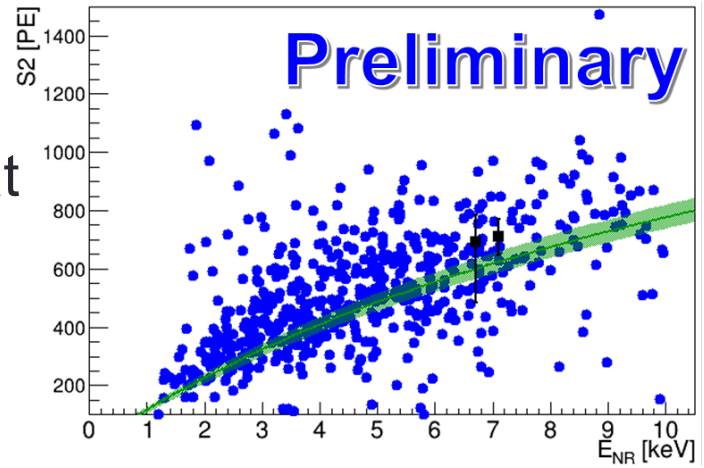
Time of flight

Fixed by geometry

ReD+

Finanziato dall'Unione europea NextGenerationEU
Ministero dell'Università e della Ricerca
Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA
INFN

- **ReD project** (as a branch of DarkSide-20k) completed in 2023 at the INFN Catania
  - Sensitivity down to **2 keV (achieved)**



- **ReD+**, funded as a 2-year **PRIN project** at LNS (Oct23-Oct25)
  - Extend coverage **down to 0.5 keV** using the same approach (^{252}Cf source) but optimized components
  - Use the lessons learnt from ReD
- After: irradiate the same TPC with **2.4-MeV mono-energetic** neutrons from a **DD generator**
  - Further extend **down to 0.2 keV**
  - Joint project with University of Sao Paulo
  - Delivered to USP in June 2024: it will be commissioned and shipped to LNS

FAPESP