

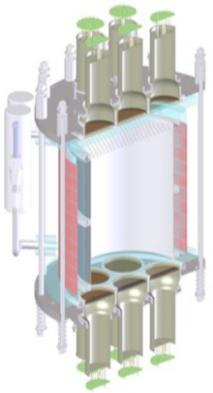


DarkSide @INFNCT

Richieste 2026



The DarkSide program

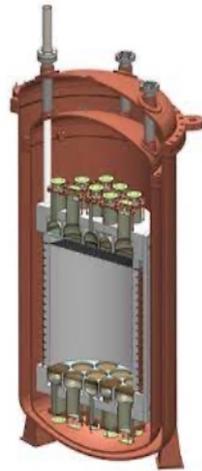


DarkSide-10

10 kg Ar



 2011 - 2013

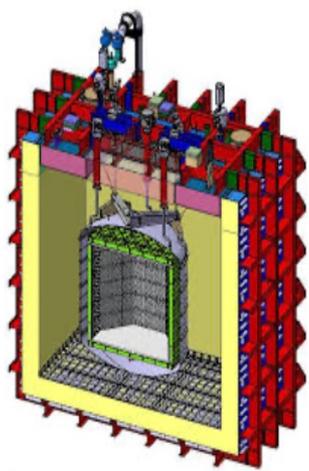


DarkSide-50

50 kg Ar



 2015 - 2019



DarkSide-20k

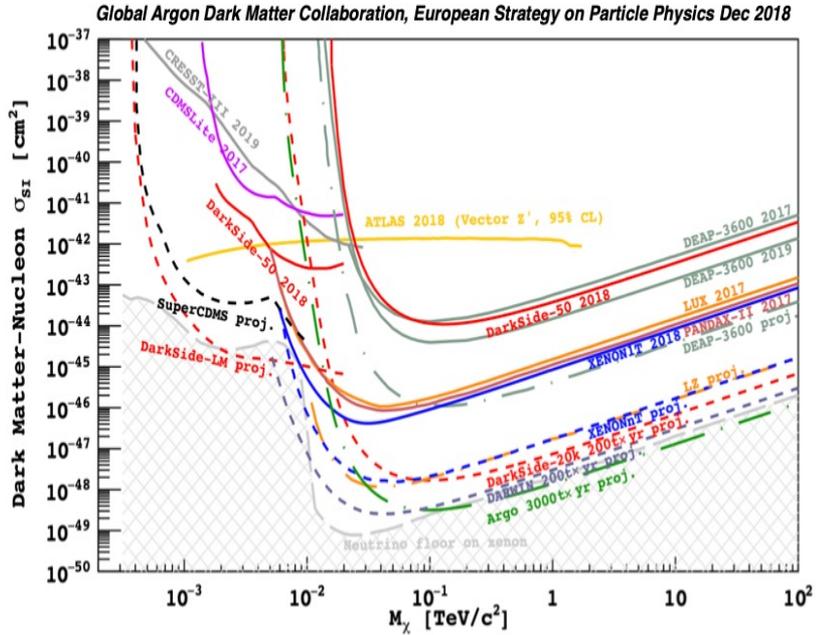
50 t Ar (20 t fiducial)



 2026 - ...

Under construction
@ INFN - LNGS

- DarkSide-20k : Near-future goal of *Global Argon Dark Matter Collaboration* [see talk by Andrea Zani]
- Liquid Argon TPC in dual phase
- Push sensitivity down to neutrino fog



Completato ReD e avviato ReD+

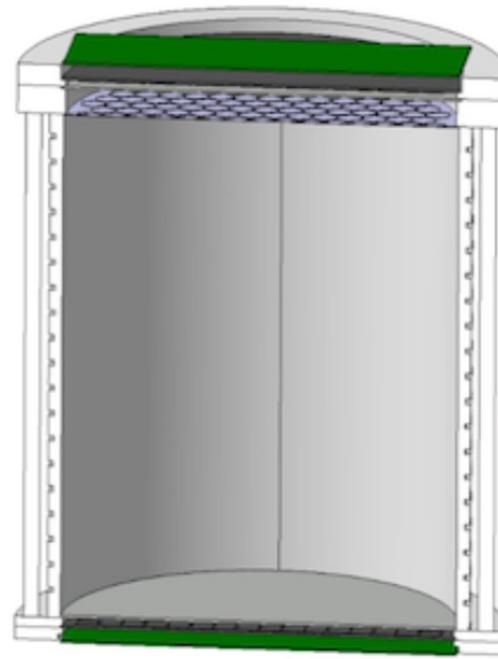
Al di fuori dei finanziamenti INFN è stato approvato un PRIN 2022:

ReD+, a low-energy characterization for low-mass Dark Matter searches with Argon

Future perspectives: ReD+, to cover down to 0.4 keV_{nr}

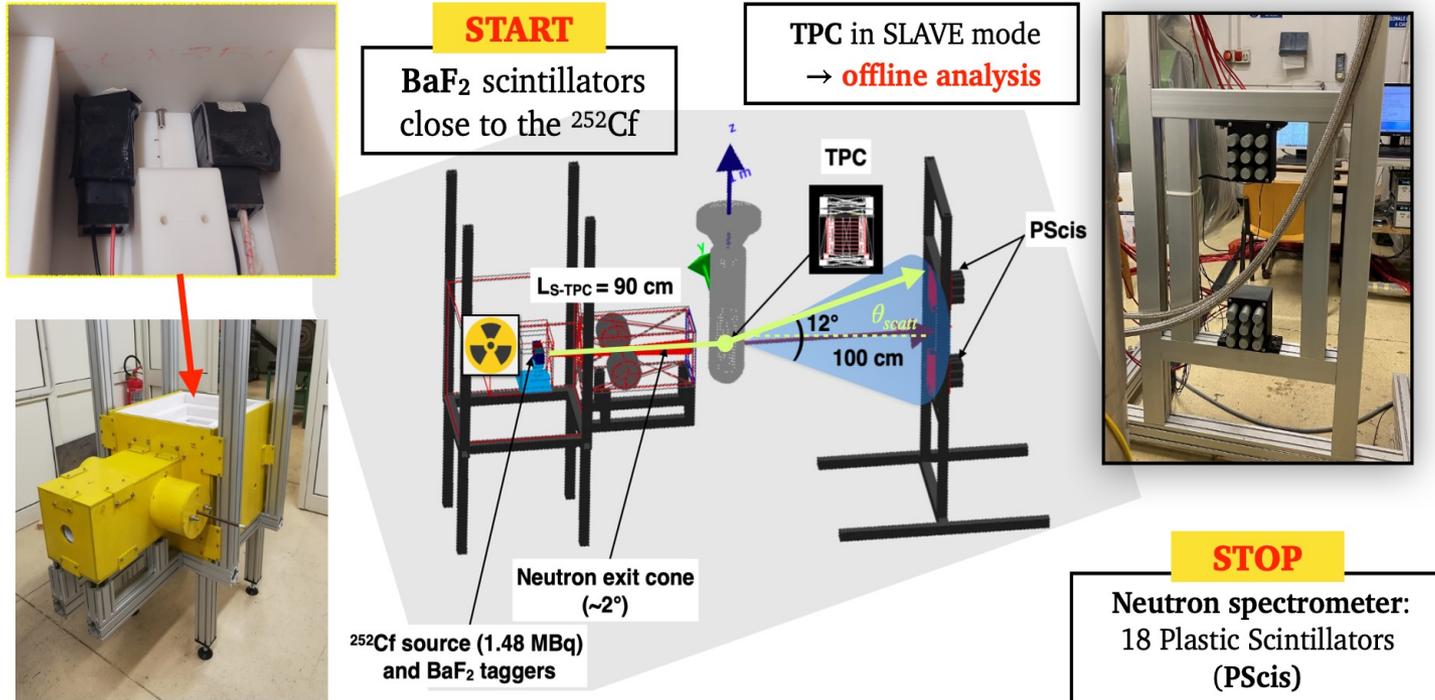


TPC exterior



TPC interior

Trasferimento del Laboratorio ReD da INFNCT a LNS

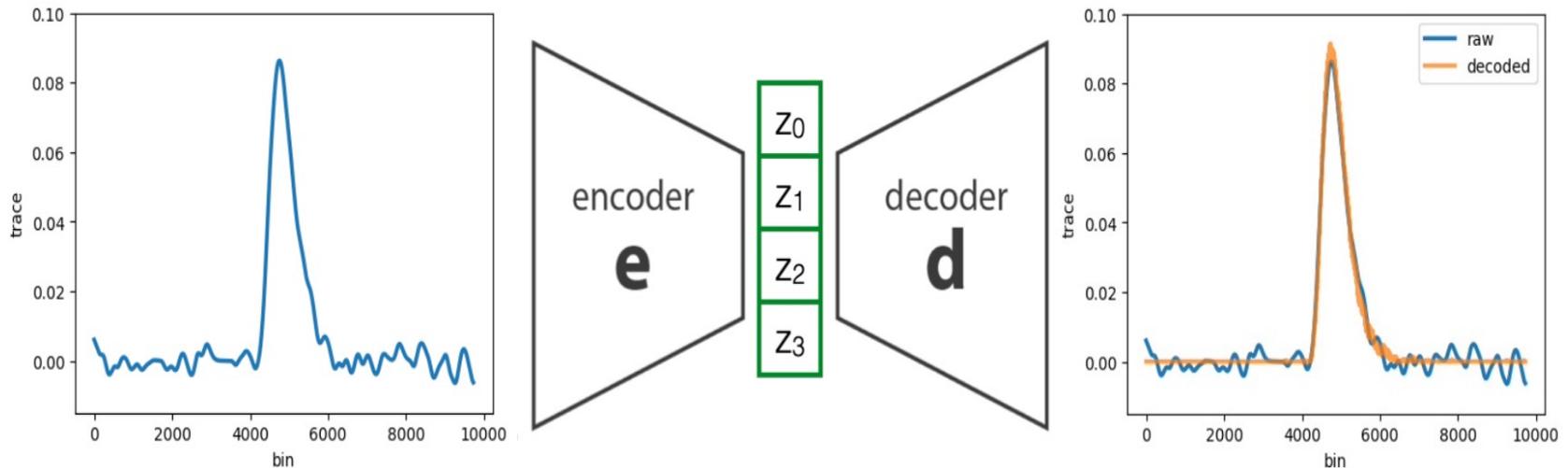


Incremento della attivita' della sorgente, Ampliamento della schermatura della sorgente di Cf232 , raddoppio del numero di PMT della parete a tempo di volo, incremento del volume della TPC

Convolutional AutoEncoders and their application

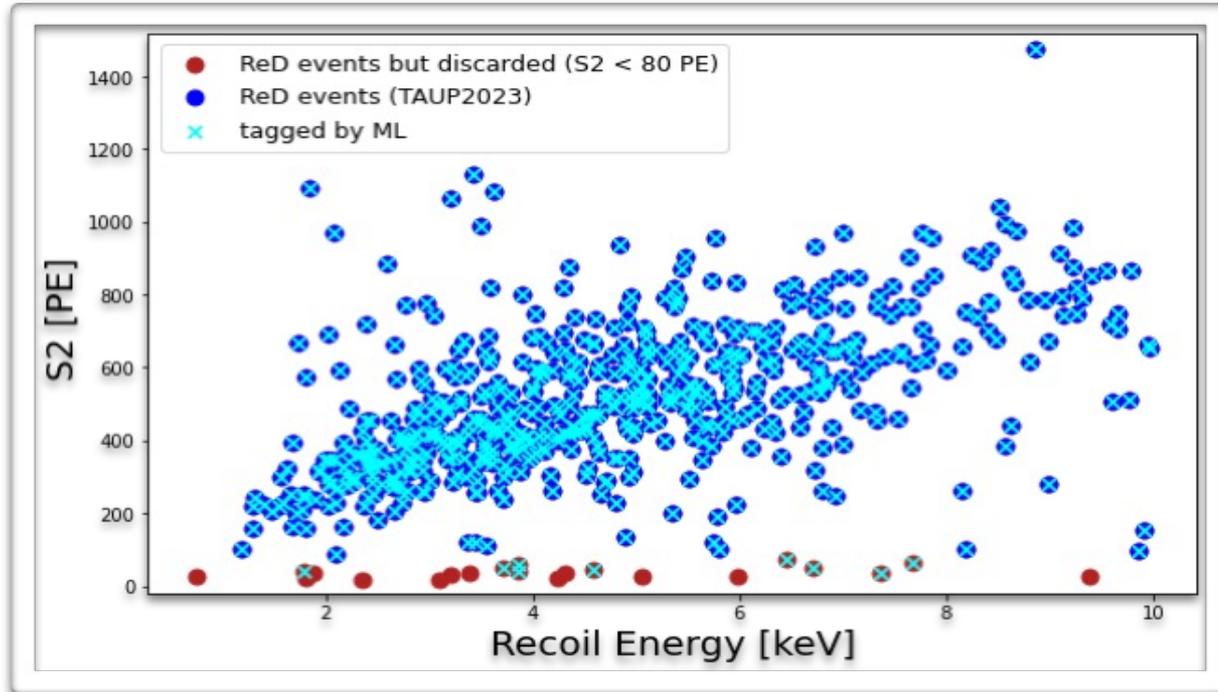
Self-supervised neural network architecture where data are compressed into a low dimensionality *latent space*, then reconstructed minimizing differences between original and output.

Implicitly highlighting features of a dataset, while disregarding noise and redundancies



- **input:** time series (~ 10,000 bins) resembling waveforms measured by the ReD TPC
- **architecture:** 3 Conv1D + avg. pooling layers, followed by 1 flattened dense layer (*details in backup*)
- **4-dimensional latent space** (i.e. each trace is compacted into only 4 values, named z_i)

Confronto dei risultati ML e non ML



Grande sforzo fatto nel primo semestre per evolvere il nostro approccio machine learning da convolution autoencoder verso variational autoencoder, in cui i parametri dello spazio latente compresso sono governati attraverso distribuzioni di probabilita gaussiane

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Ampliamento dati con passaggio dai valori totali di luce raccolta nell'intera camera RED ai singoli valori di ogni SiPM

Conferenze ultimo anno

- N.Pino 'Data-driven identification of light signals from low-energy recoils in a LAr TPC using self-supervised machine learning' **15th International Workshop on the Identification of Dark Matter 2024** Jul 8-12 2024 L'Aquila (Italy)
- G.A. Anastasi "The Spoke 2 of the ICSC National Centre, with a focus on deep learning applications in astroparticle physics and satellite imagery" **213th CRIS-MAC**, Trapani, 17-21 June 2024
- N.Pino 'Characterization of light signal in the Liquid Argon TPC of the ReD experiment' **9th edition of the Roma International Conference on AstroParticle Physics (RICAP)** 23–27 Sept 2024

Composizione e percentuali 2026

Sebastiano Albergo	60%	PO Responsabile locale
Gioacchino Anastasi	0%	RTDA HPC
Marzio De Napoli	70%	RTDB (INFN)
Sebastiana Puglia	80%	RTDA
Alessia Tricomi	10%	PO
Paul Zakhary	100%	AR

Contributo tecnico da

Elettronica **0.5 mu**

Tecnologie avanzate **1mu**

Officina **2mu**

Impegni di attività nel 2026

- Implementazione analisi Machine Learning ReD&DS-50
- Attività su PROTO e test beam
- Collegata (extra INFN) attività su PRIN ReD+

RICHIESTE 2026

Consumo	Metabolismo	2. k€
Missioni	- Meeting di collaborazione	3. k€
	- Partecipazione a test beam	3.0
	- Turni test PROTO Napoli	5.0