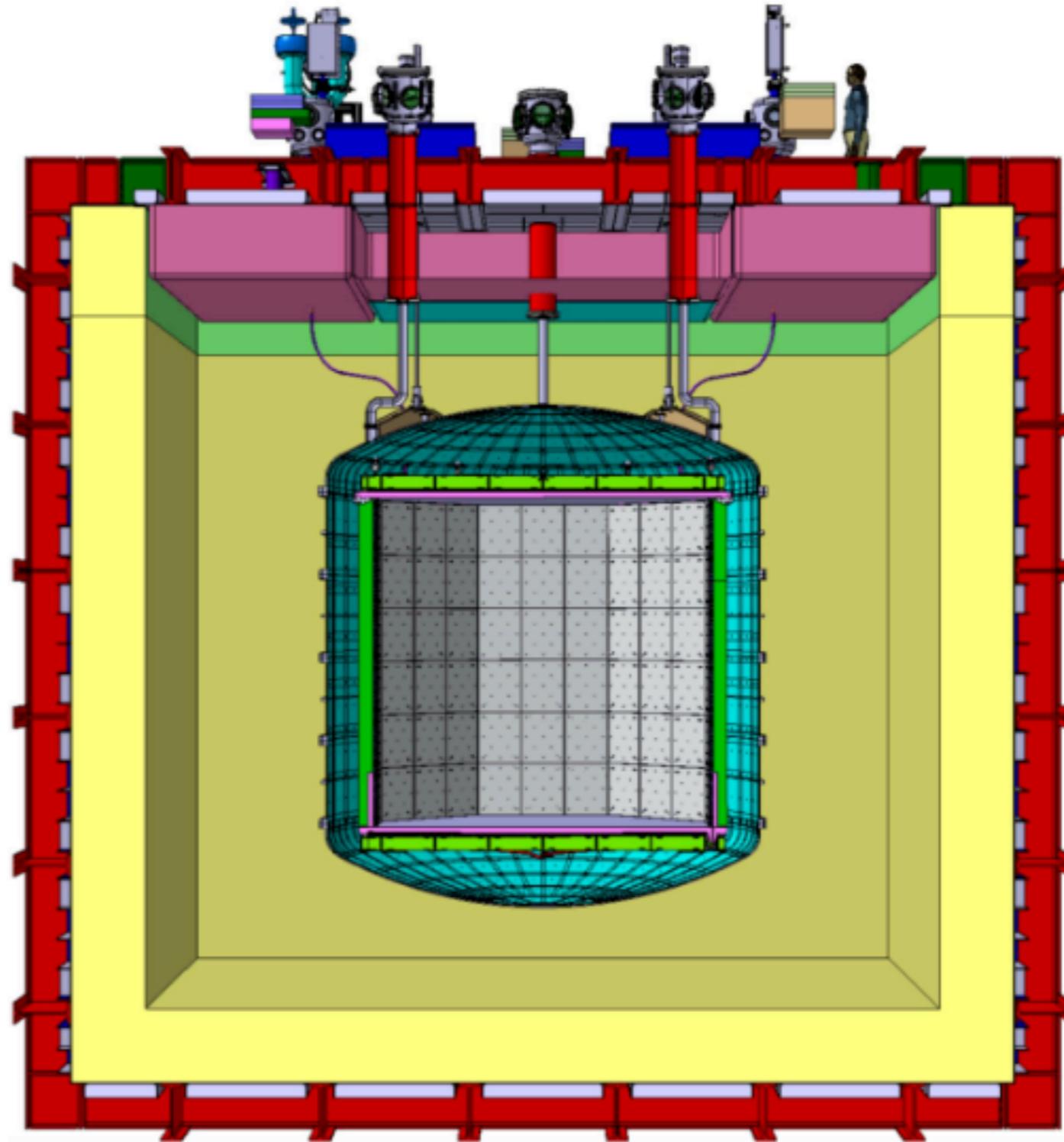


# DarkSide-20k

*by the Global Dark Matter Argon Collaboration*



# Searching for Dark Matter with Liquid Argon

## Direct DM detection *is challenging*:

### - Large mass

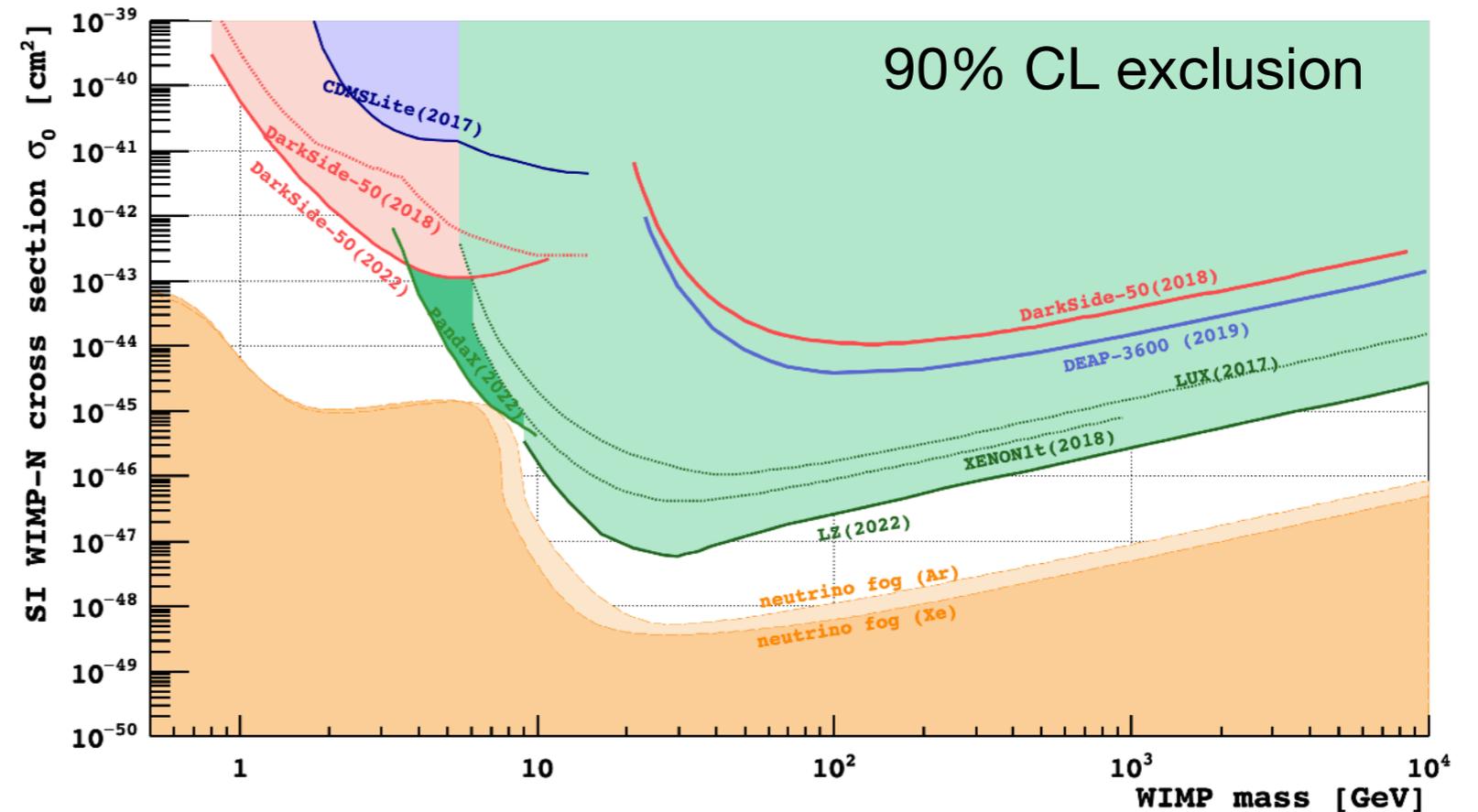
(~ 1 event/tonne/yr  
@  $10^{-47}$  cm<sup>2</sup> in noble liquids)

### - Low energy threshold

( $E < 100$  keV)

### - Background suppression

Deep underground  
Passive/active shielding  
ER background discrimination  
...

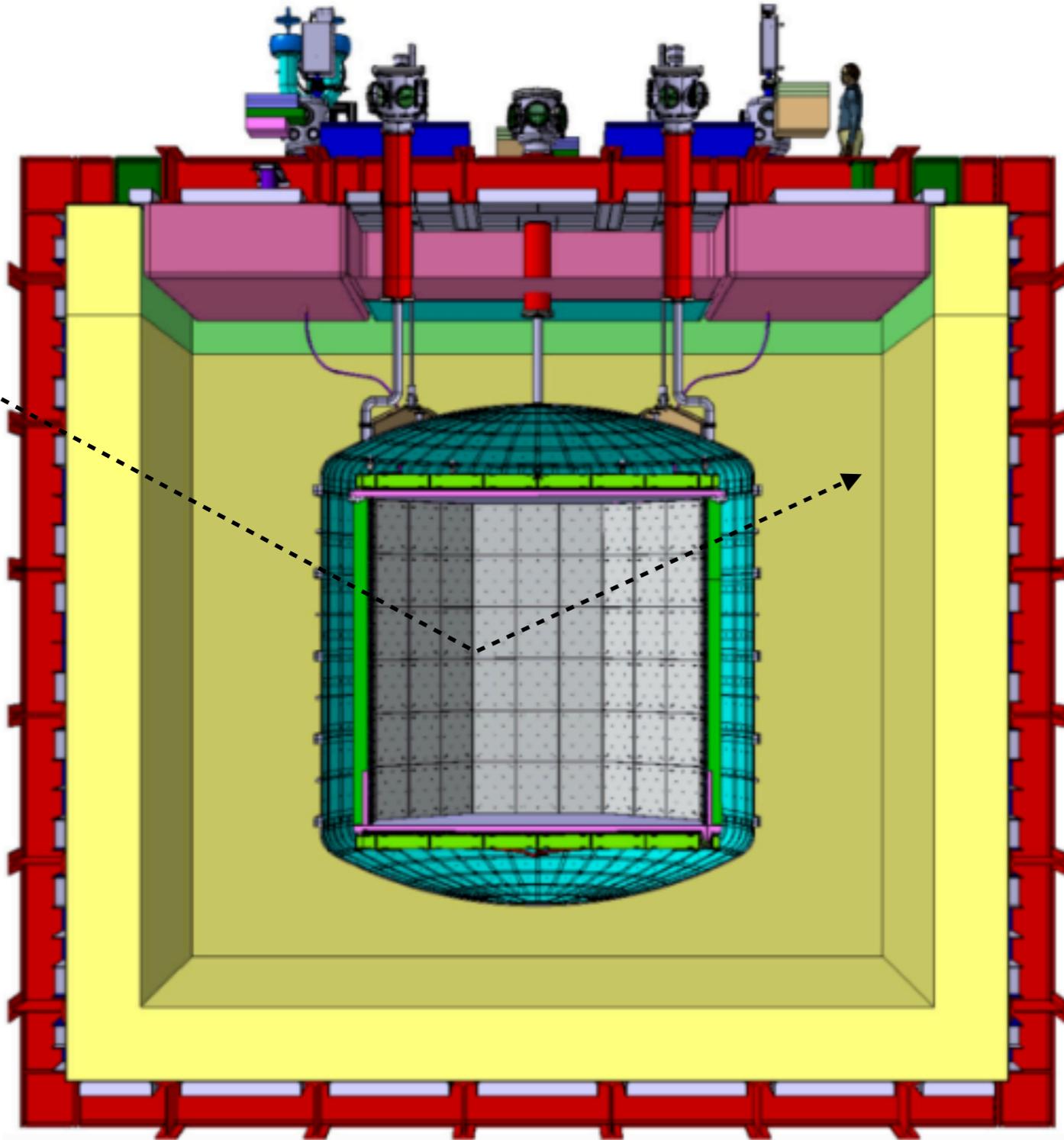


## Liquid Argon is a suitable target:

- can be made very (radio)pure → argon from underground
- large ionization/scintillation yields ( $W \sim 20$  eV)  
→ high collection efficiency (light and charge)
- $> 10^9$  ER recoil background discrimination  
→ pulse shape discrimination (timing)

# DarkSide-20k

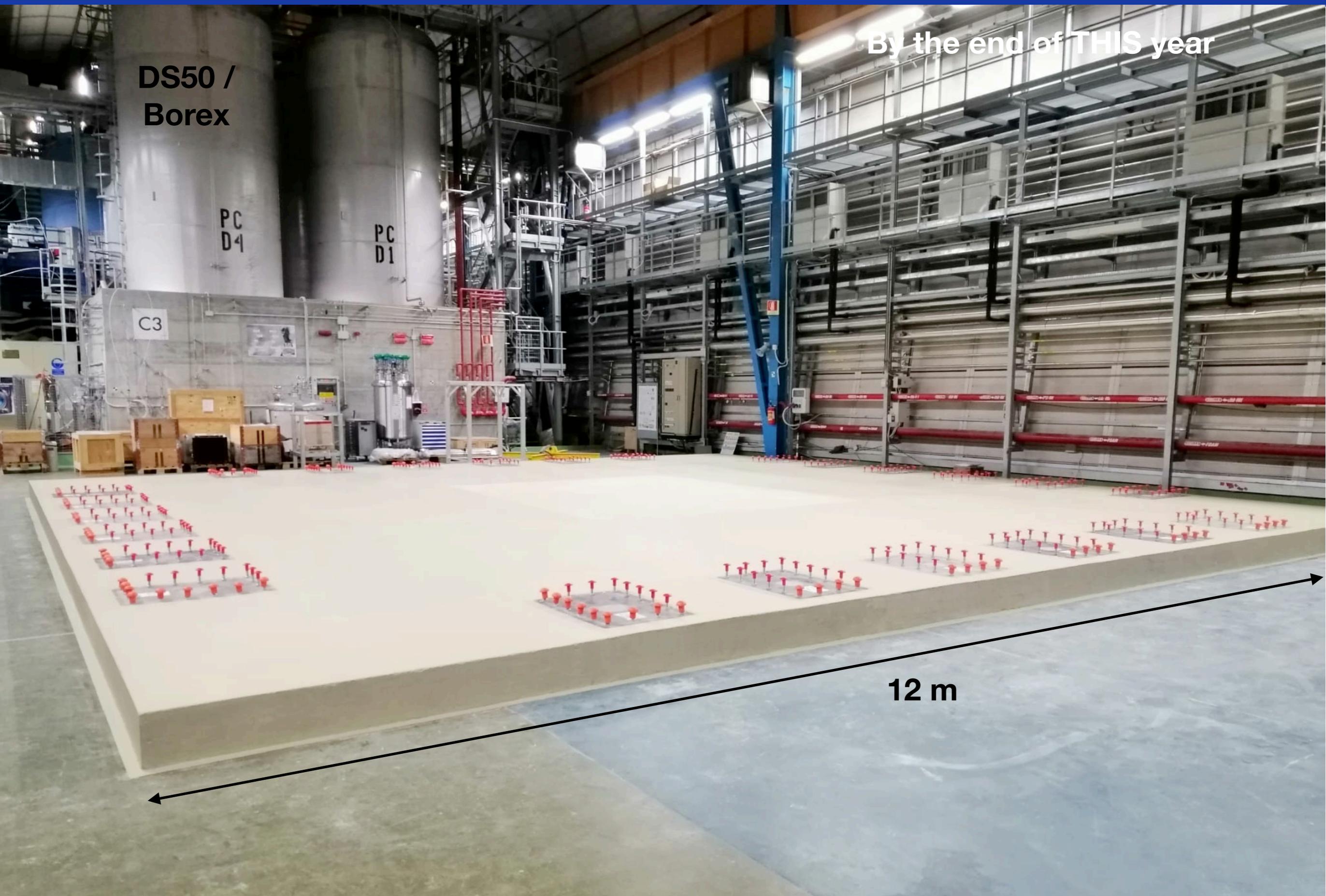
by the Global Dark Matter Argon Collaboration



- To be installed in Hall C at LNGS
- Hosted inside a 700 t AAr LAr bath, in a cryostat *à la* ProtoDUNE
- **Target: 50 t of Argon from Underground as WIMP target**
- **Veto: 35 t UAr + custom developed Gd-PMMA**, optimized for radiogenic neutrons
- **Novel readout system for the scintillation light**, based on grouped SiPM arrays ( $> 25 \text{ m}^2$ )



# Where are we?



DS50 /  
Borex

PC  
D4

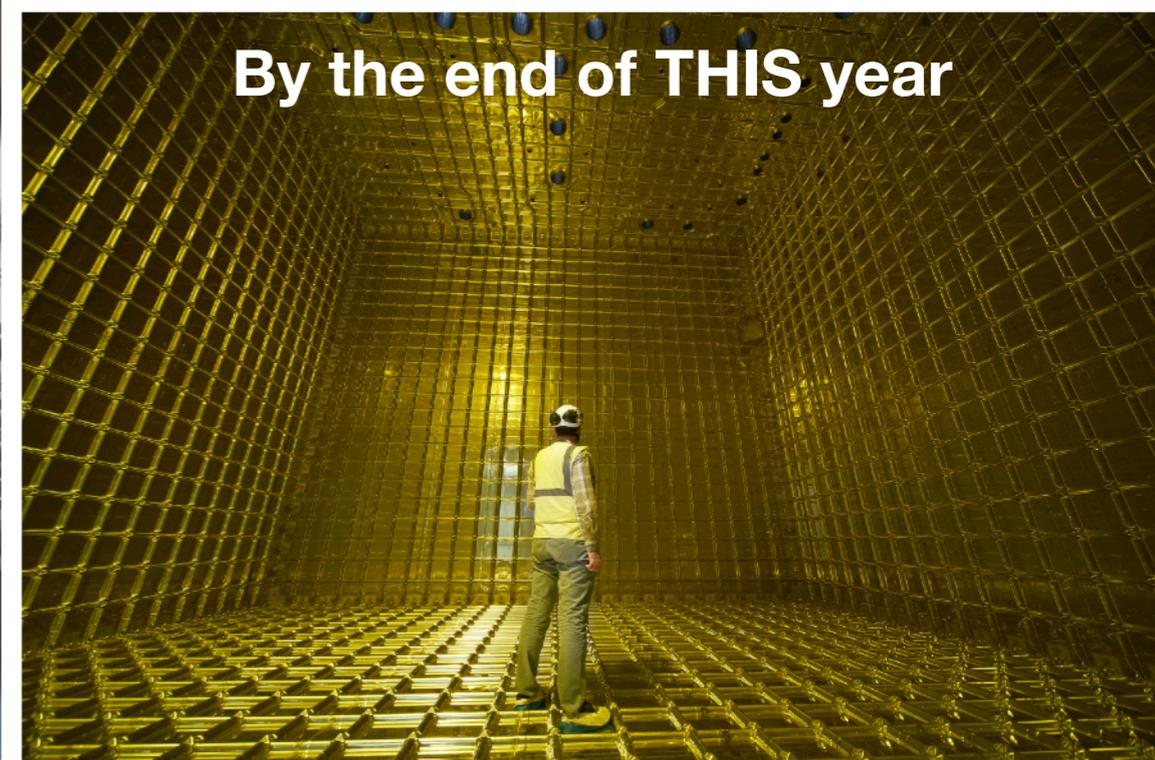
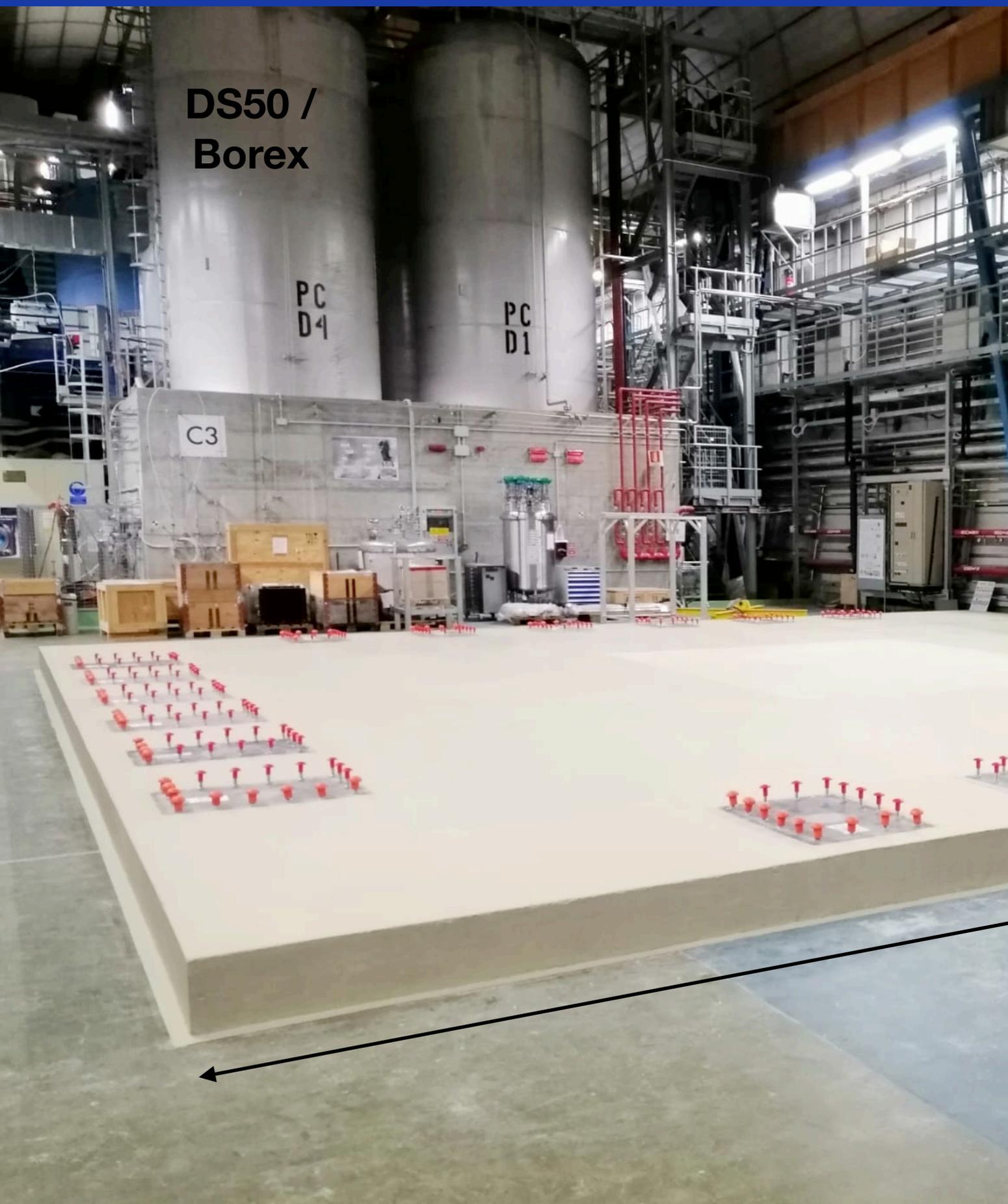
PC  
D1

C3

By the end of THIS year

12 m

# Where are we?



# The DarkSide PhotoElectronics

Goal: **detect single photons** from scintillation in liquid argon

—> **Asish and Priyanka's theses**

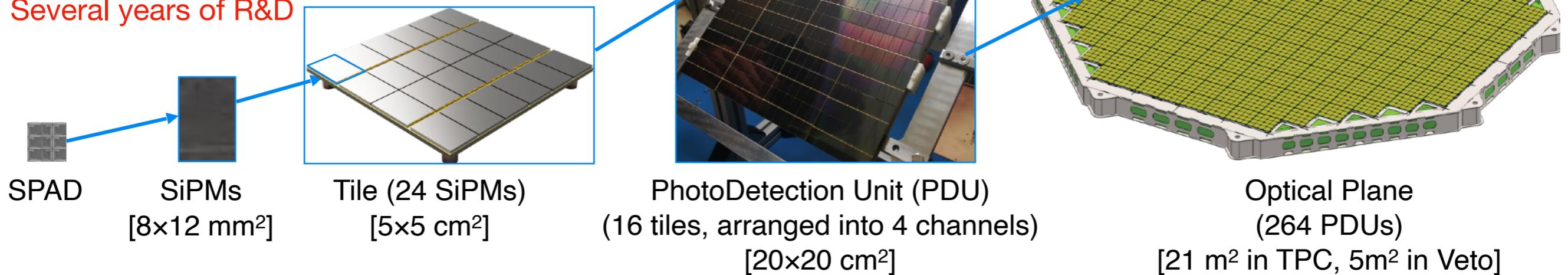
Photo-detection efficiency > 40% at 77K

Dark count rate < 0.01 Hz/mm<sup>2</sup> at 77 K

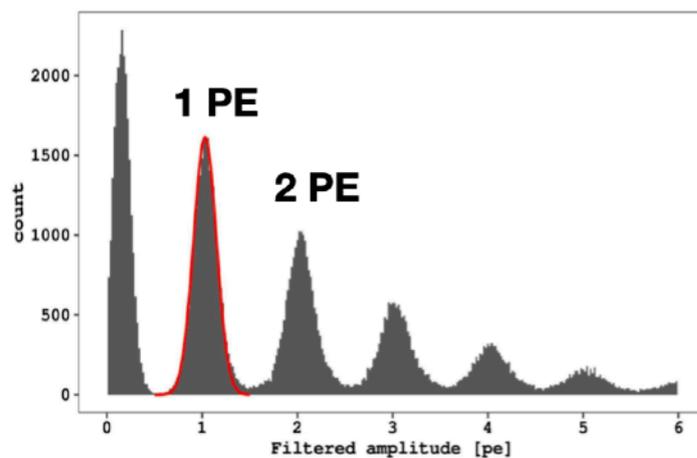
Signal to Noise Ratio > 8

Time resolution < 10 ns

Several years of R&D



Nuova Officina Assergi (**NOA**) facility, recently **started operations**



Excellent single photo-electron resolution



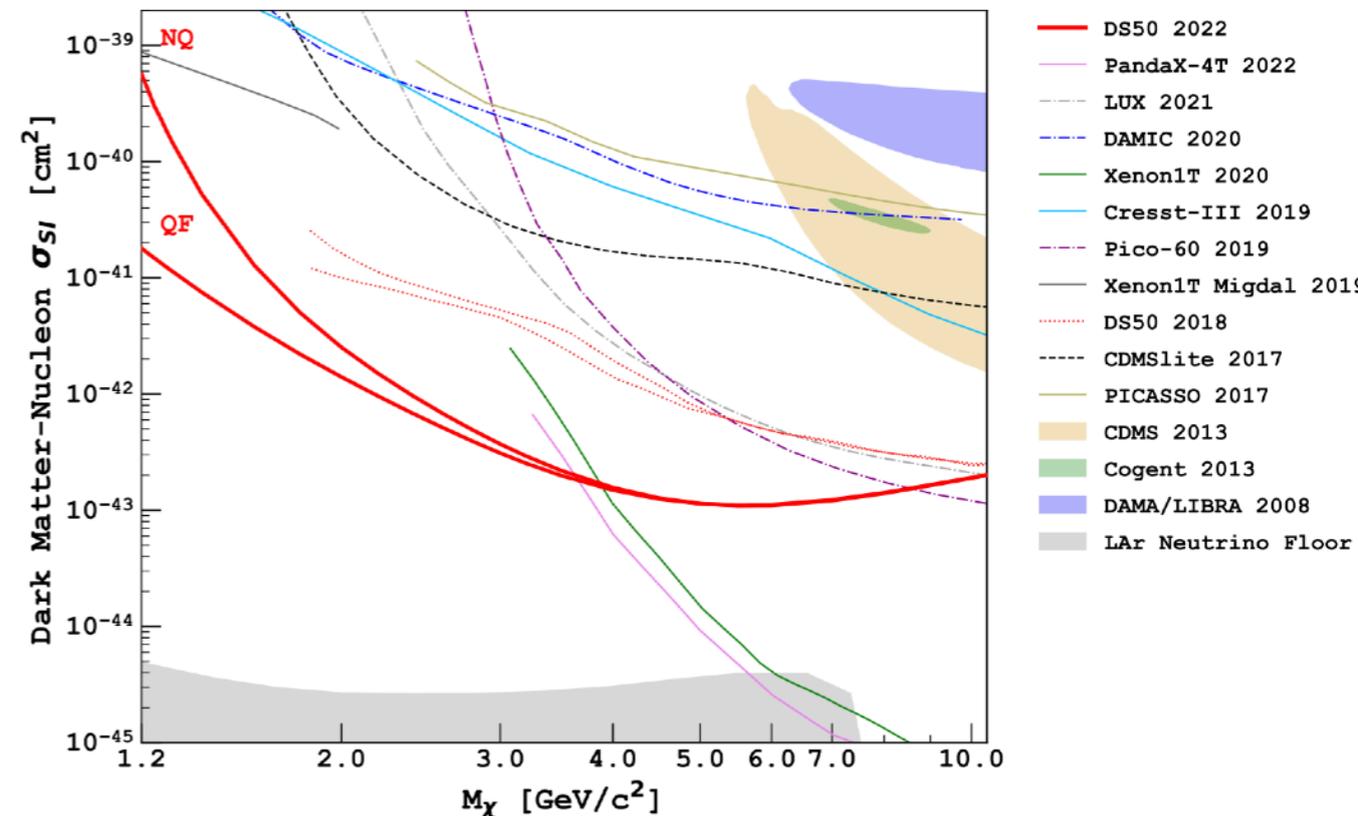
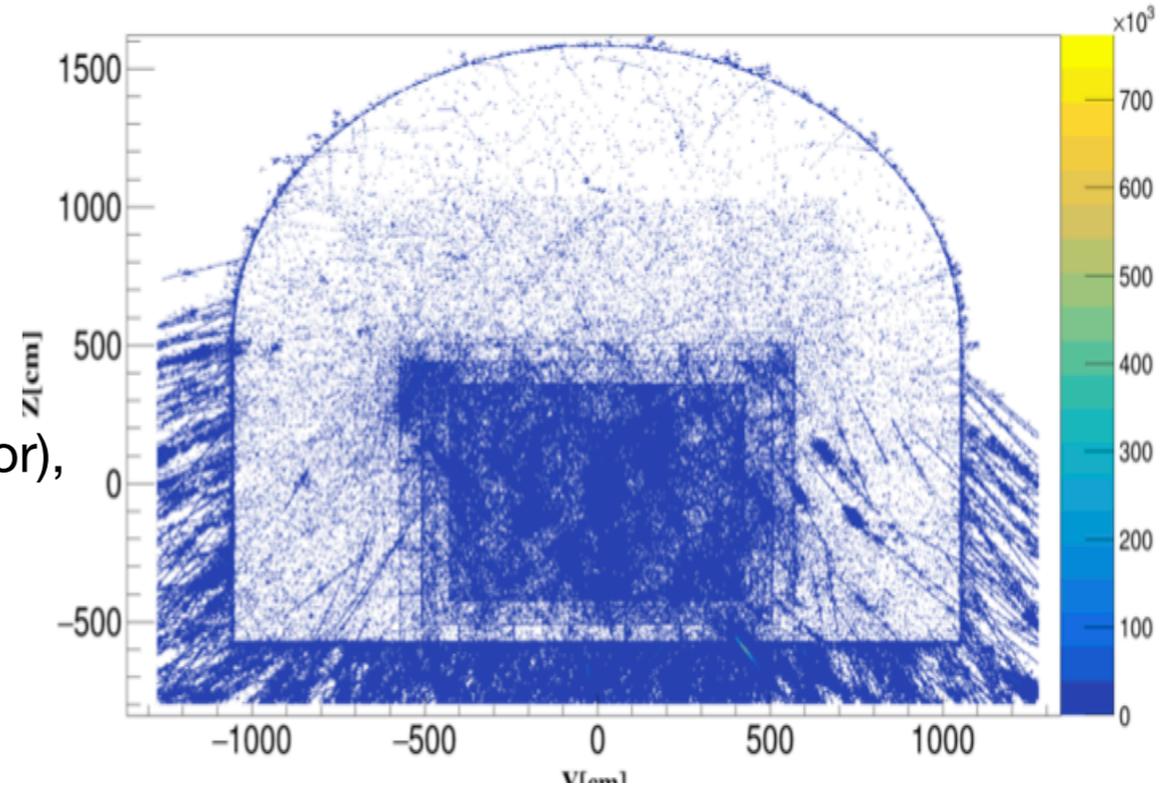
—> Teena's theses

## OFFLINE

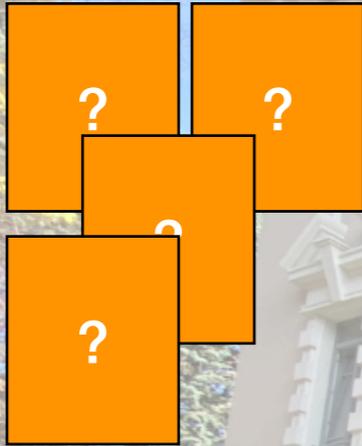
- Background estimates (NR and ER)
  - from the detector materials, the Hall C, cosmic rays
- novel SiPM response characteristics and intrinsic noise
- prototype analysis and reconstruction algorithm
- analysis of the data from prototypes
- analysis of the DarkSide-50 data (a successful predecessor), 2 PRL and 2 PRD published in Feb/March
- + ..... much more .....

## DAQ

- determine the optimal format for the data:
  - minimize data stream: Peta-Byte / yr of data written to disk ( 🤪 )
  - avoid loss of information (performance)
- install DAQ prototype by mid '24



# DarkSide in L'Aquila



## GSSI

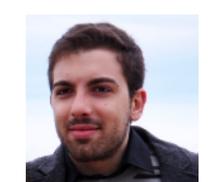
- > **Offline** (2.5)
- > **DAQ** (1.5)
- > **NOA** (1)
- > **UAr cryogenics** (1)  
(arriving at LNGS soon)



+ others



—> **NOA**



—> **Power Supply  
R&D**

