

# DarkSide-LowMass: requirements at Boulby

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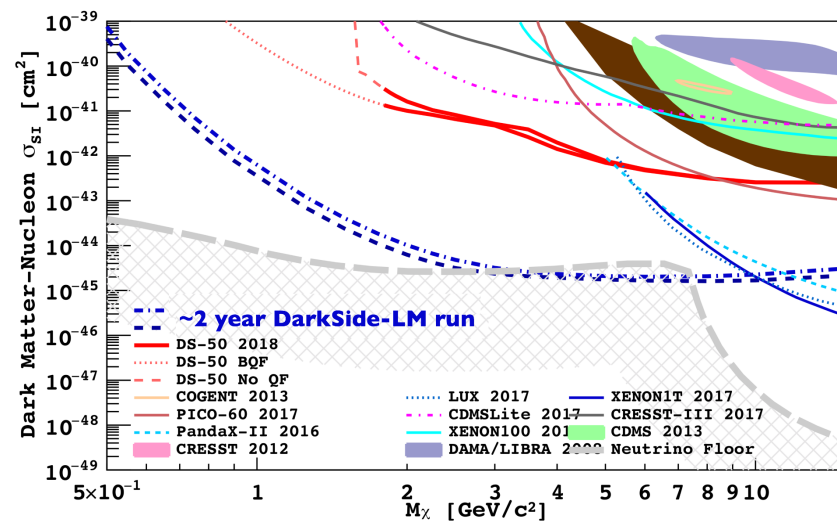
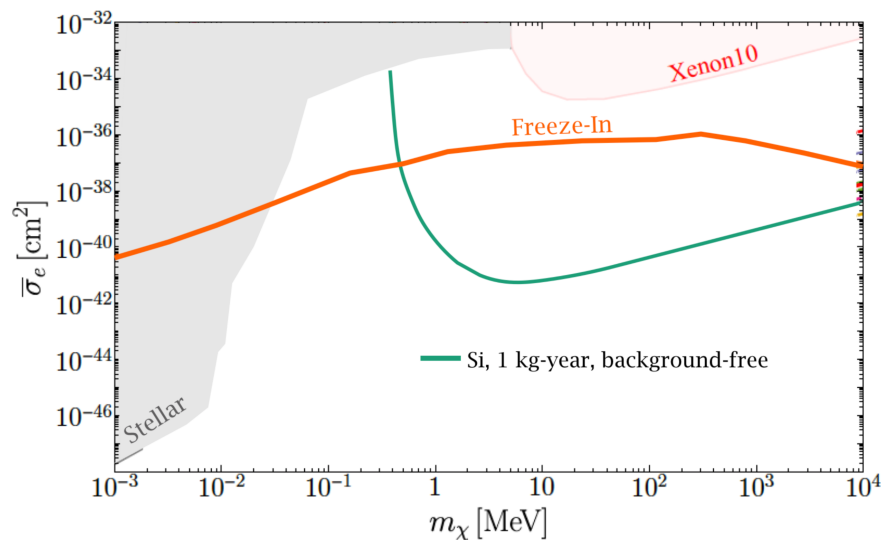
*on behalf of the DarkSide-UK community*

Boulby Underground Laboratory Development Feasibility Meeting

March 12<sup>th</sup> 2021

## DarkSide-LowMass is a 1 tonne scale LAr TPC direct dark matter detection experiment, with possibility to be sited at Boulby

- Presented overview at previous meeting: <https://indico.kcl.ac.uk/event/I54/>
- Project world-leading sensitivity to very low mass WIMPs (keV – 10 GeV)
- Potential to explore coherent-elastic neutrino-nucleus scattering
- Platform for deployment of radiopure silicon photosensor development in UK
  - Industrial links with e2v and FBK for joint R&D and technology transfer



- Discussed opportunistic use of AIT-WATCHMAN in 2026+ (cost saving)
- How about a standalone DarkSide-LowMass at Boulby?

## Timescales

- Decoupling from AIT-WATCHMAN removes hard restriction of 2026+
- Much earlier likely limited by technological developments and tensioning of resources against commissioning of DarkSide-20k (start 2023)

## Depth:

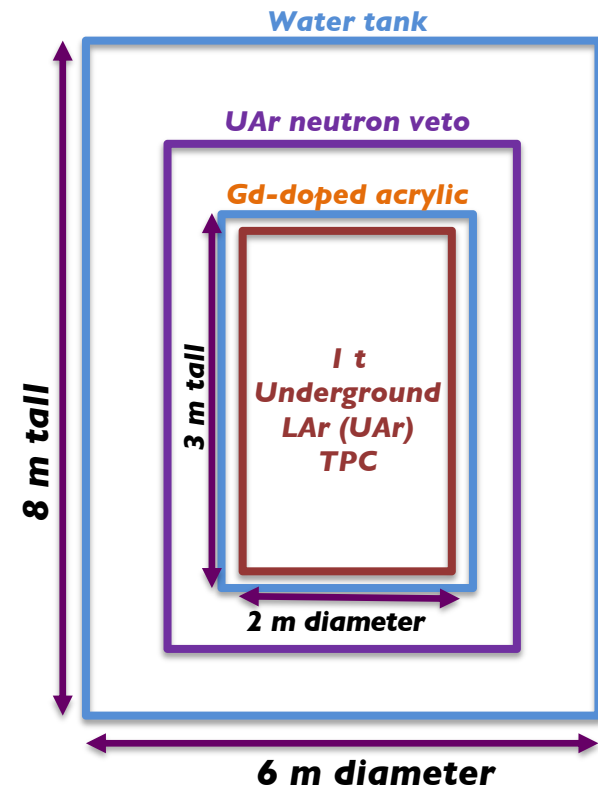
With neutron veto, 1.1 km depth sufficient for control of external backgrounds

## Experiment geometry:

To be independent of AIT-WATCHMAN, need dedicated neutron veto surrounding LAr TPC

- **1 t SiPM instrumented TPC (UAr)**
- **Instrumented neutron veto:**
  - Gd-doped acrylic panels
  - Large UAr veto volume
- **Water tank for neutron moderation**

Total size: 6 m (dia.) x 8 m (height)



## Experiment geometry:

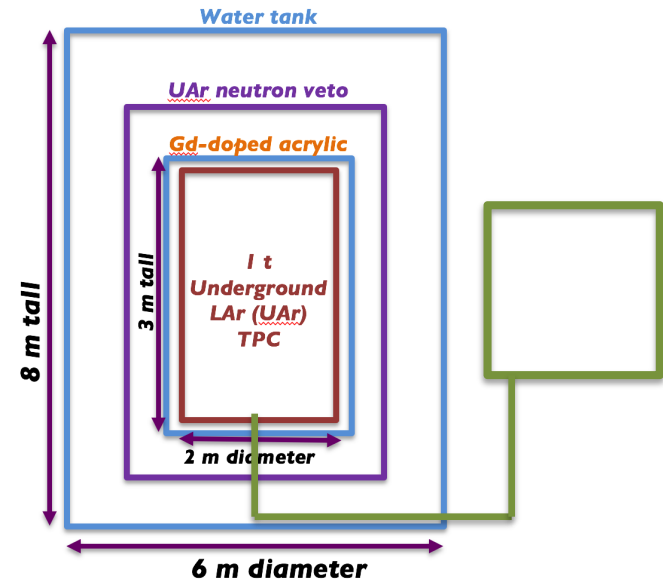
- Require storage cryostat for UAr next to DarkSide-LowMass in case of faults (Capture of UAr)
- No exact sizing now, but 'small' relative to DarkSide-LowMass volume with shielding

## Safety:

- WATCHMAN-free design involves no chemical hazards (Gd captured in acrylic)

## Assembly:

- No notable clearance above experiment needed
- Experiment can be constructed in place: water tank acting as temporary clean room for construction, with photodetector assembly at the surface



## Clean room requirements

- Clean room at surface to build photosensor planes
  - *Planes ~ 0.5 sqm so transport not anticipated to be an issue*
- Clean room underground (~4m x 3m) with Radon abatement at 100 mBq/m<sup>3</sup>

## Power requirements

- Requirements for electronics ~0.2 kW
- Cryogenic system for stable argon temperature needs would need more study to be determined (difficult to scale from current experiments: DS20k ~5 kW)

## Computing

- Basing on DarkSide-50 DAQ requirements:
  - ~10 TB front-end storage as temporary buffer underground
  - 1000 TB of disk space above ground for short- and long-term data storage
  - High-throughput connection to GridPP for replication / analysis
  - (+ likely some local computing staff to maintain)