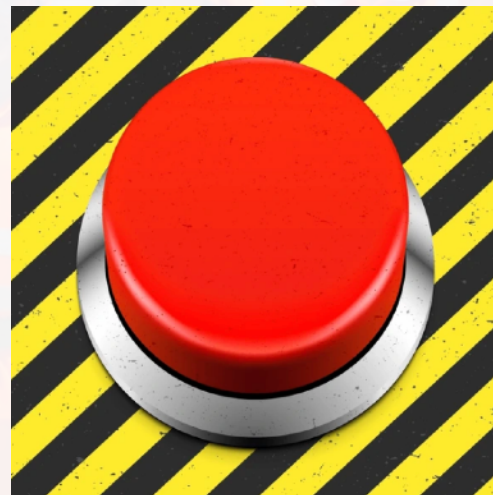
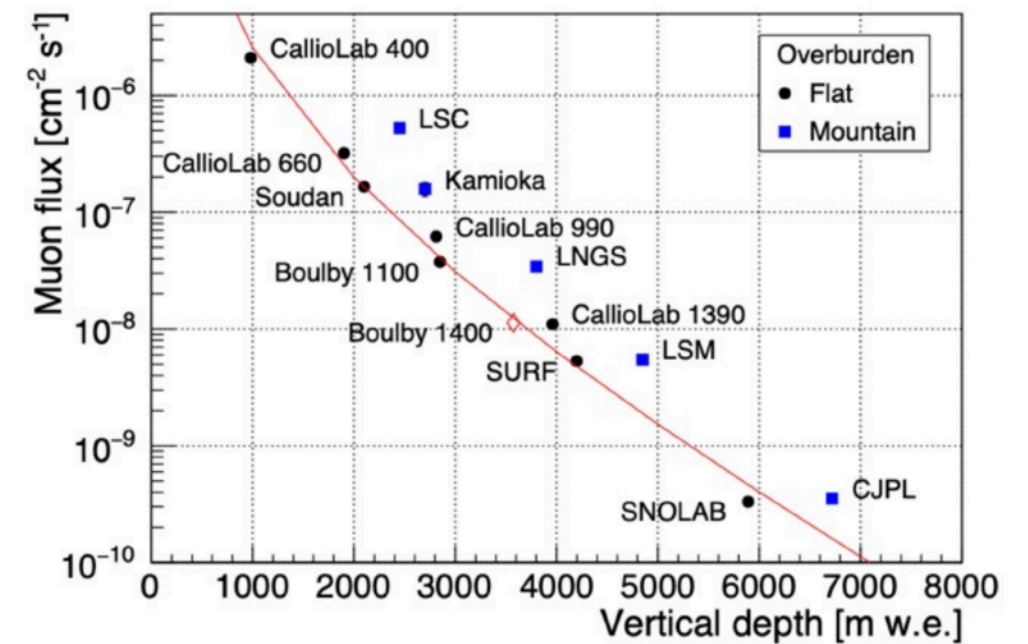
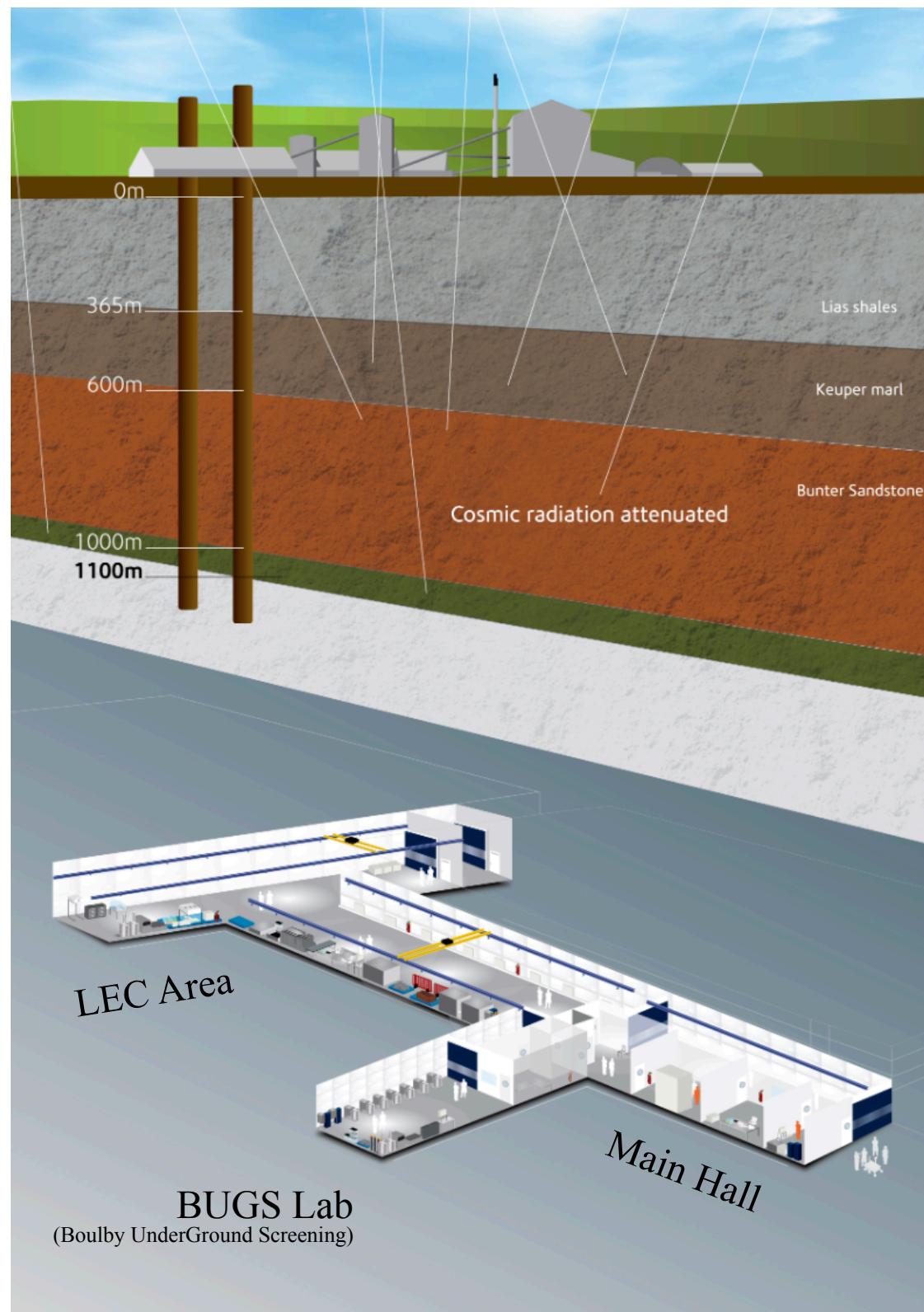


BUTTON

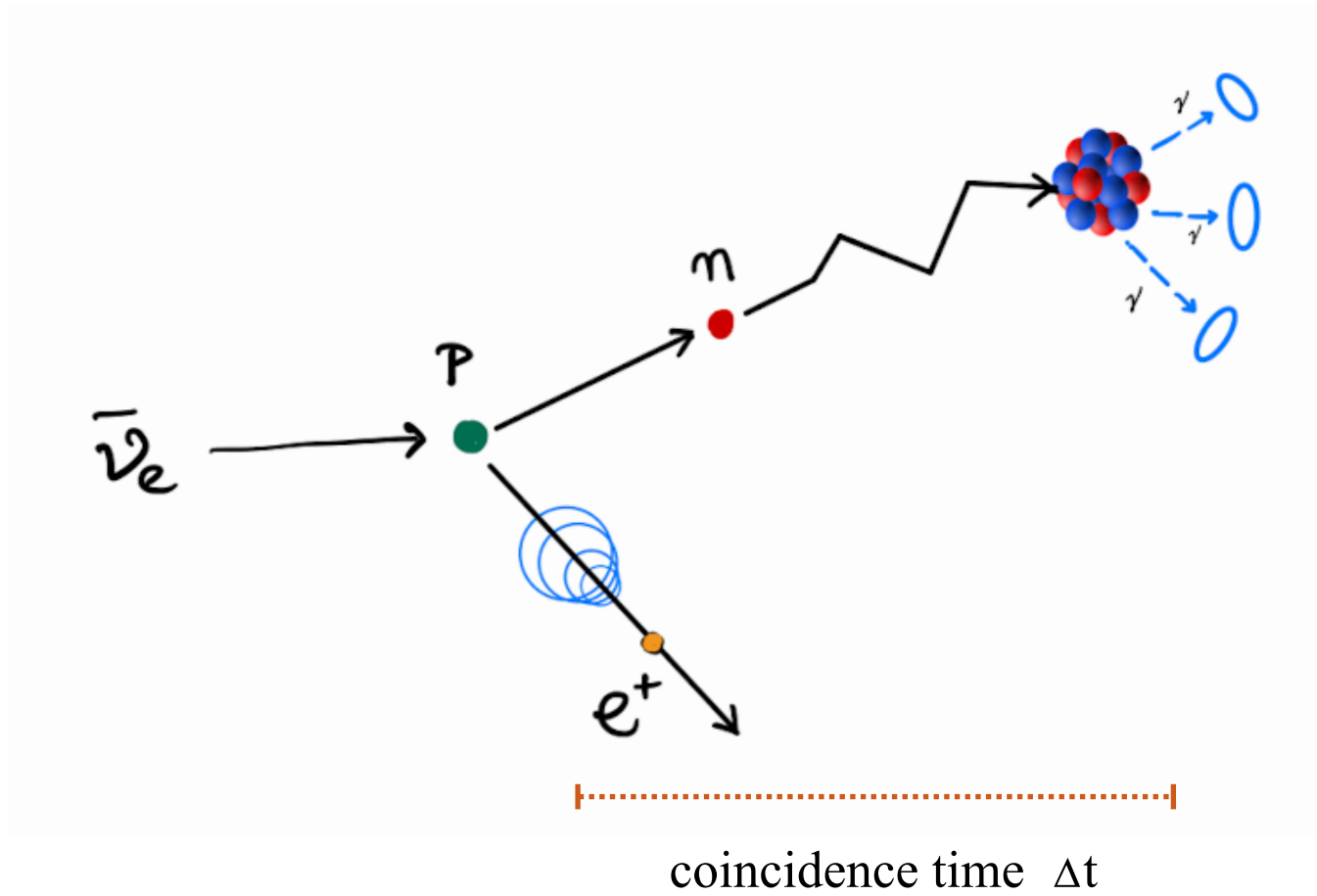


the Boulby underground test facility (polyhalite/potash mine)



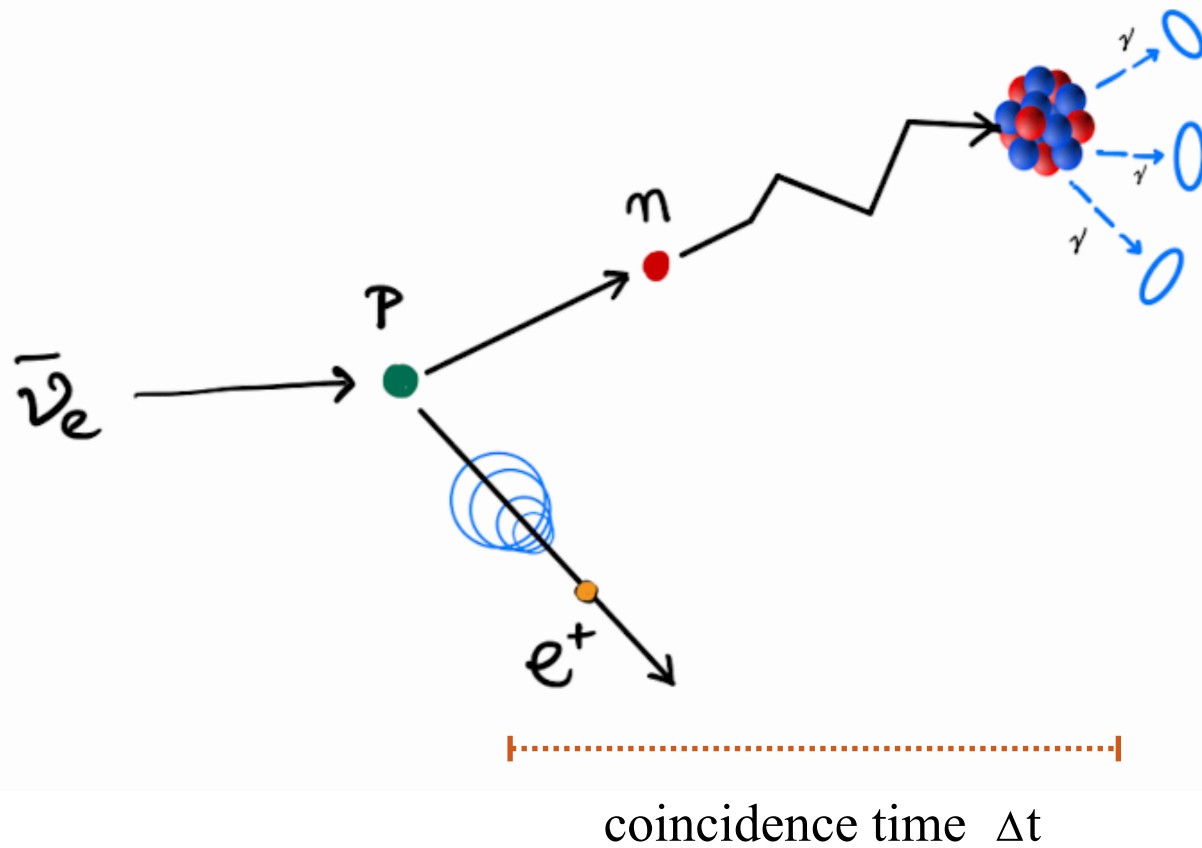
- Muon flux reduced by 10^{-6} at 1.1 km
- Low Radon level: 3 Bq/m^3 .

- Detection process: Inverse Beta Decay (IBD)



- Pure water (hydrogen) : $\Delta t = \sim 200 \mu\text{s}$ (1-2 MeV)
- Gd-loaded water: $\Delta t = \sim 20 \mu\text{s}$ (~ 8 MeV)

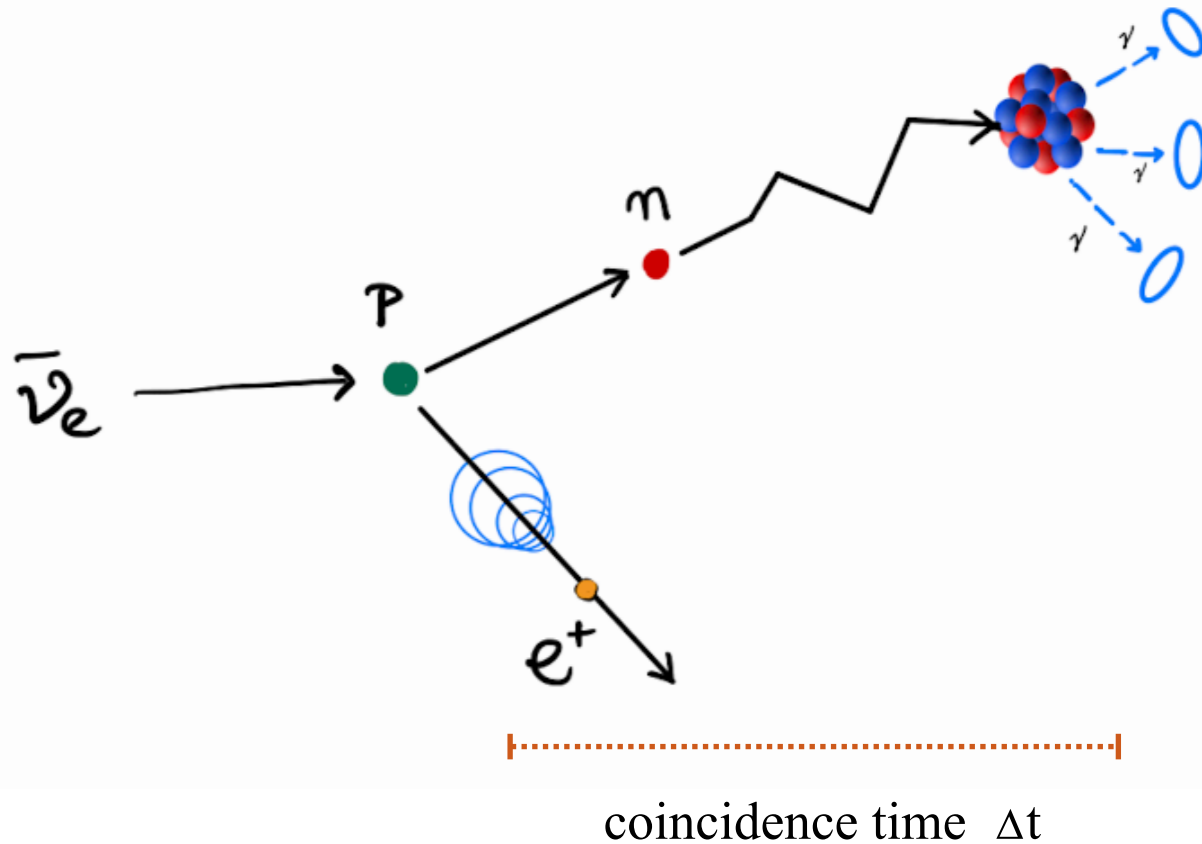
- Detection process: Inverse Beta Decay (IBD)



- Pure water (hydrogen) : $\Delta t = \sim 200 \mu\text{s}$ (1-2 MeV)
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Neutrons from outside are
one of the main backgrounds for this process

- Detection process: Inverse Beta Decay (IBD)



- Pure water (hydrogen) : $\Delta t = \sim 200 \mu\text{s}$ (1-2 MeV)
- Gd-loaded water: $\Delta t = \sim 20 \mu\text{s}$ (~ 8 MeV)

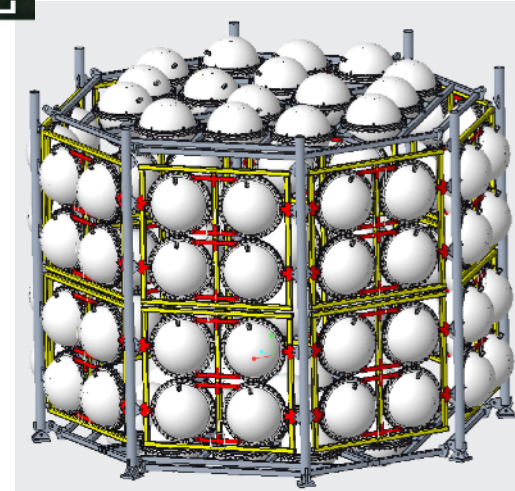
Direct Dark Matter Search

- Even more critical for direct dark matter search
- Neutron mimics nuclear recoil (NR) for WIMP scattering of target (dual-phase Xe TPC) nuclei
- An efficient 'veto detector' will lower the neutron background
- The neutron detection technology is same for Neutrino/Dark matter

Detecting antineutrino at BUTTON



Hartlepool reactor ~ 25 km \Rightarrow kilo-tonne neutrino detector
but the detector technology needs to be demonstrated



The Boulby Underground Technology Testbed for Observing Neutrinos (BUTTON)

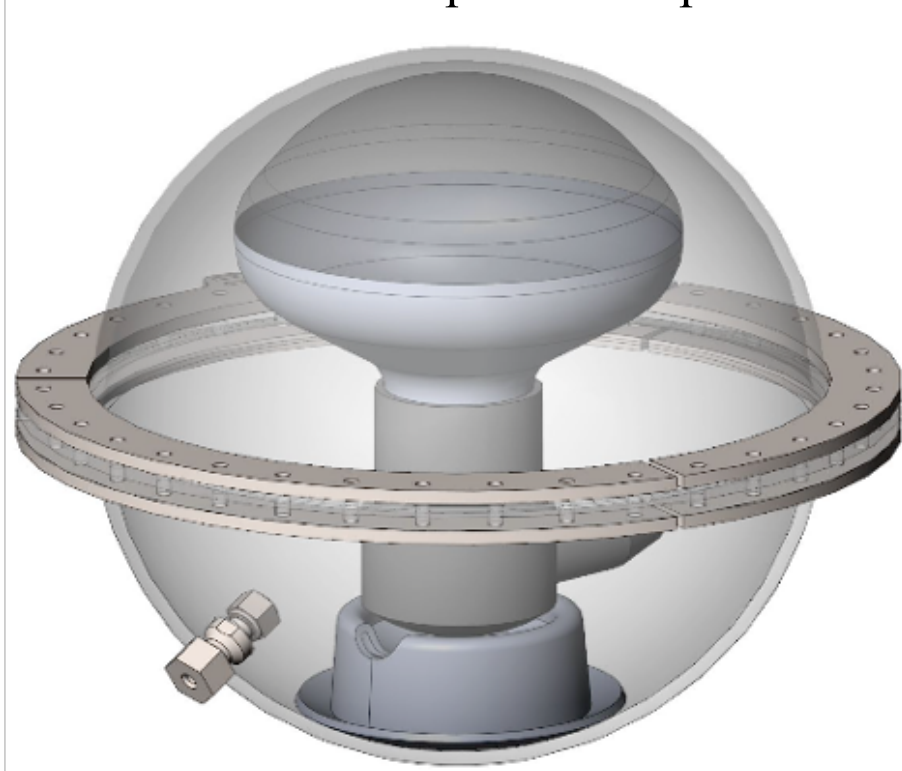
- 30 tonne water/hybrid detector
- 96 PMT,
- Water, Liquid Scintillator (LS)
- Water-based Liquid Scintillator (WbLS)
- Gd loading (water and WbLS)
- Large Area Picosecond Photo Detector (LAPPD)



The optical detector development for BUTTON is led by the University of Edinburgh



10 inch Hamamatsu R7081 photomultiplier tube (PMT)

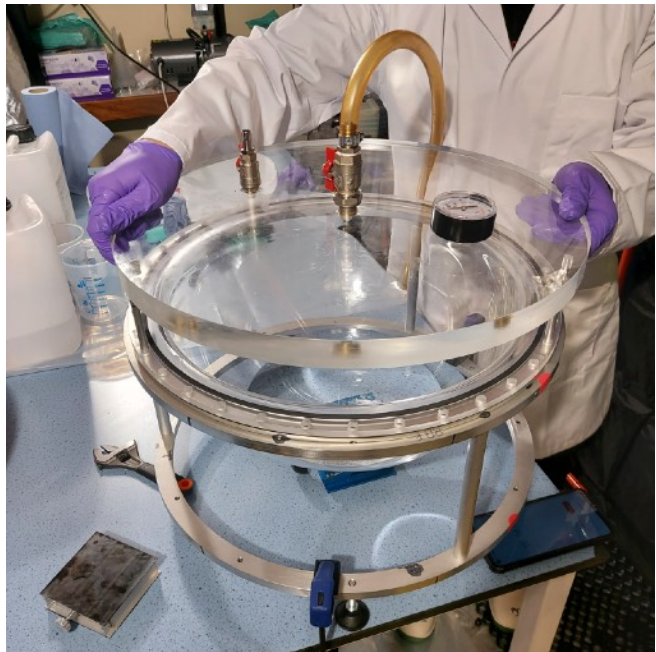
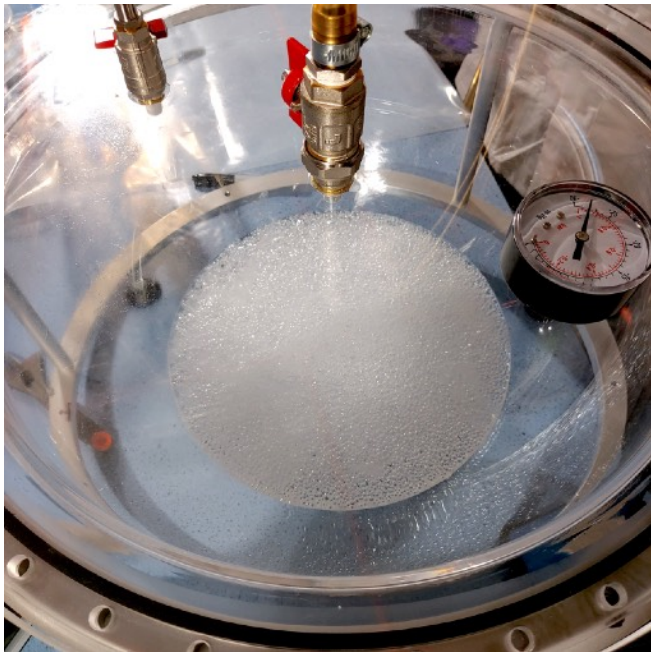
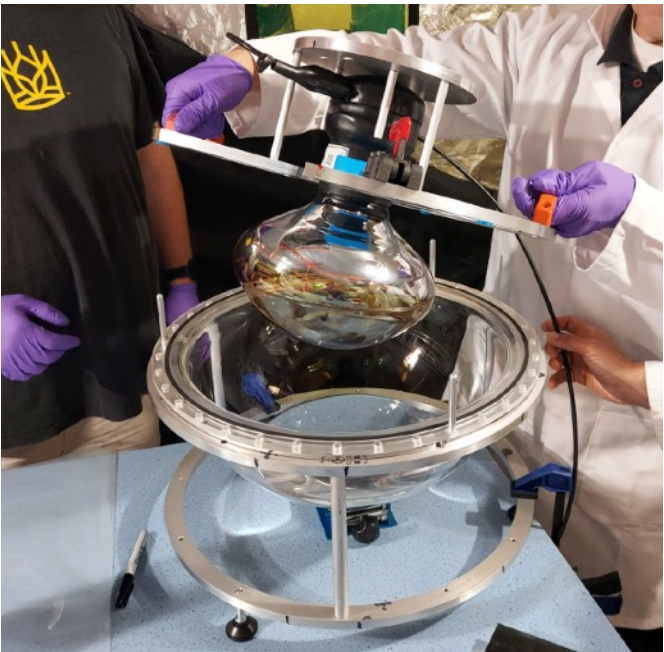
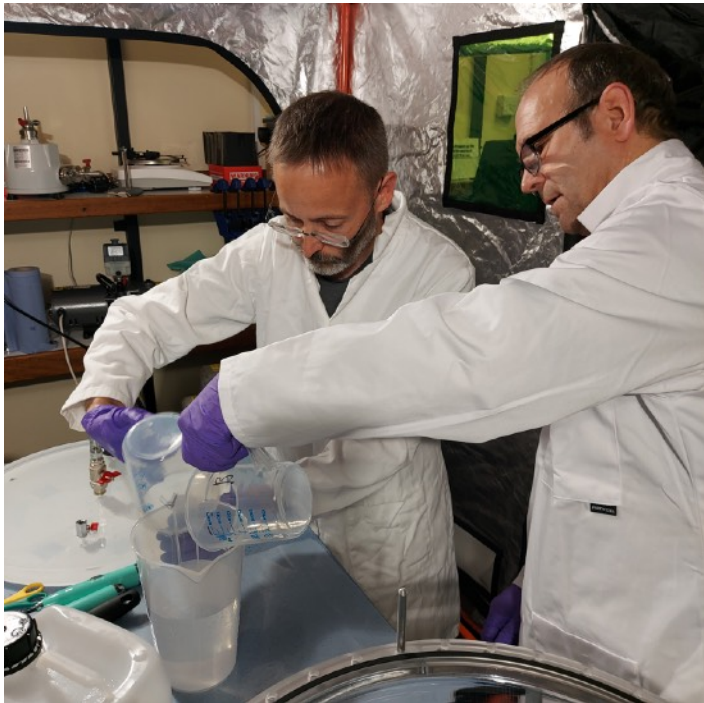
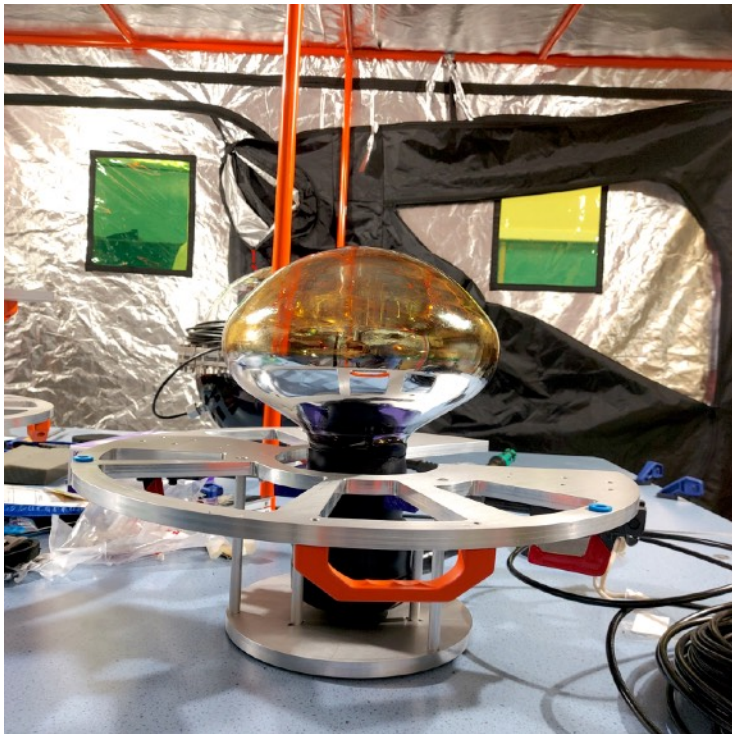


Water-tight acrylic housing



A BUTTON optical module

R&D and construction work at the University of Edinburgh



You all are welcome to visit our lab to see a real BUTTON optical module

(dbhatta2@ed.ac.uk)

Installation in Boulby, led by Edinburgh:



Summary:

- **We led the construction of BUTTON. It's now being commissioned in Boulby.**
- **It will be fully operational in a few months.**
- **Boulby is planning to host a kilo-tonne and XLZD.**
- **Successful operation of BUTTON for next 5 years is absolutely critical to build any neutrino and dark matter detector in the UK.**

Thank you !