THE LZ EXPERIMENT

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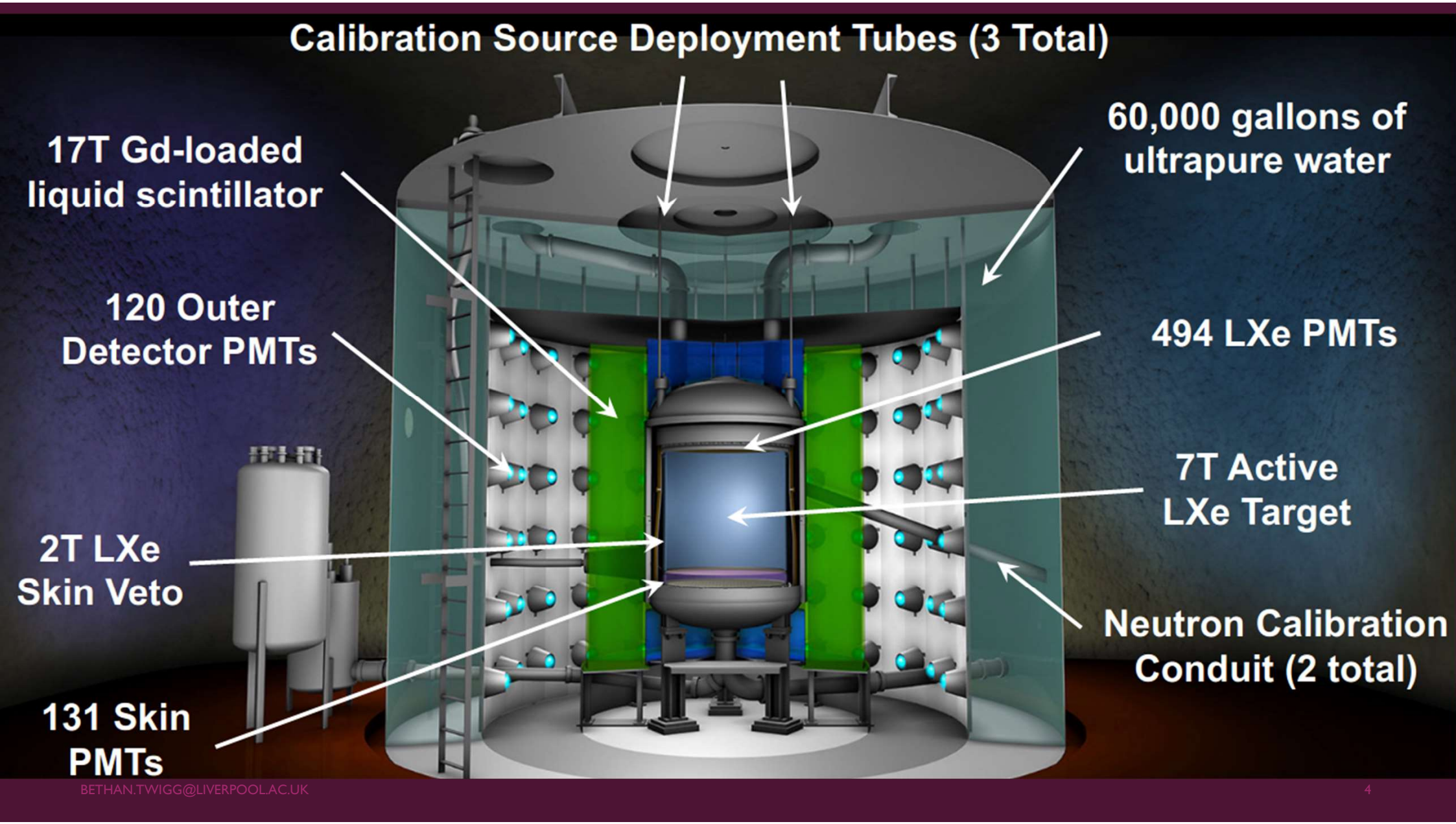
LZ – LUX ZEPLIN

- Large Underground Xenon, ZonEd Proportional scintillation in Liquid Noble gases
- Duel Phase liquid Zenon time projection chamber (TPC) detector + Liquid Scintillator Outer detector (OD)
- Planning On LZ started in 2012
- Data taking started in late 2021 ,currently in run 3 and data taking is planned to run till 2028, with a total of 5 runs
- Around 250 scientists and engineers from around 39 different institutions are part of the LZ collaboration

WHAT IS PLANED FOR ME TO DO

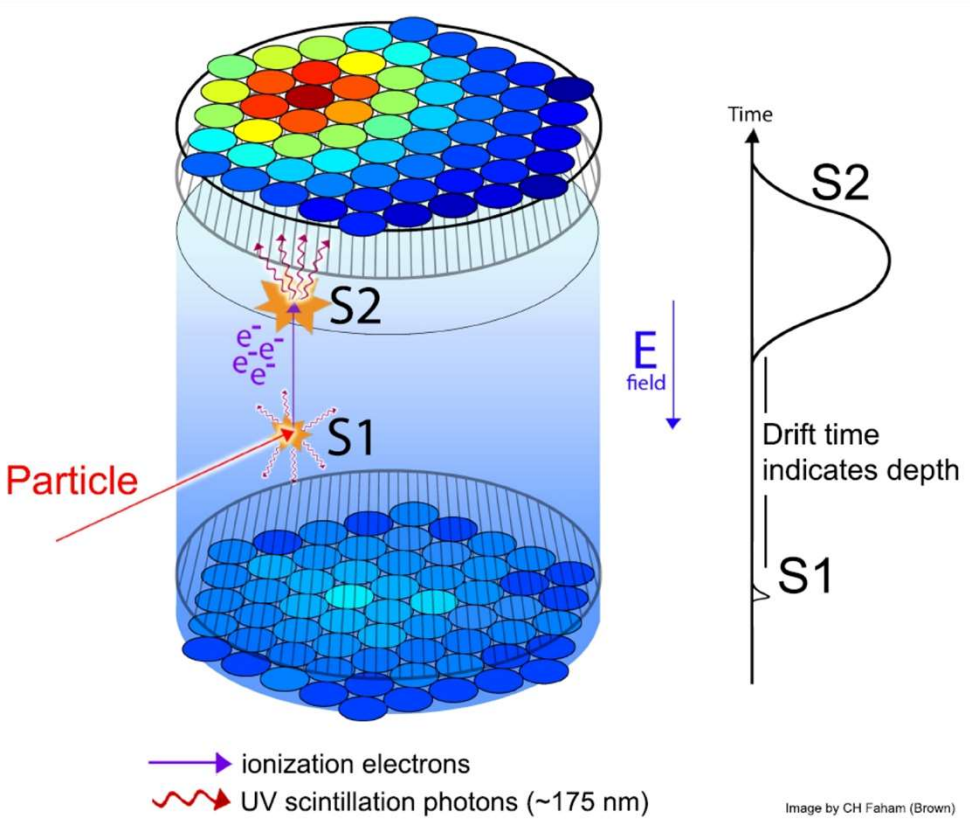
- Improve signal reconstruction In LZ:
  - Compare PMT output before and after electronic enhancement
  - Identify timing and number of optical photons detected
  - Could this improvement help us identify the multiplicity of gamma events in the Outer Detector?
  - Possible implementations of ML

- XLZD (Xenon, LZ and Darwin) Hardware/R&D:
  - Detector design: using Geant4 simulations - developing position reconstruction algorithms to maximise neutron tagging efficiency in the OD
  - Hardware: helping to build and use a testbed at Liverpool to characterise different OD media


Calibration Source Deployment Tubes (3 Total)
17T Gd-loaded liquid scintillator
60,000 gallons of ultrapure water
120 Outer Detector PMTs
494 LXe PMTs
7T Active LXe Target
2T LXe Skin Veto
Neutron Calibration Conduit (2 total)
131 Skin PMTs

DARK MATER SIGNAL: NUCLEAR RECOILS

- Dark Matter will hit the Xe nucleus and produce a Nuclear Recoil (NRs) which can be detected by an S1 and consecutive S2 signal.
- S1 are Prompt signals
- S2 are Delayed Electroluminescence
- Electron Recoils (ERs) also produce S1 and S2 signals
- NR's and ER's can be distinguished via the ratio of the S1 and S2 signals



THANK YOU !!

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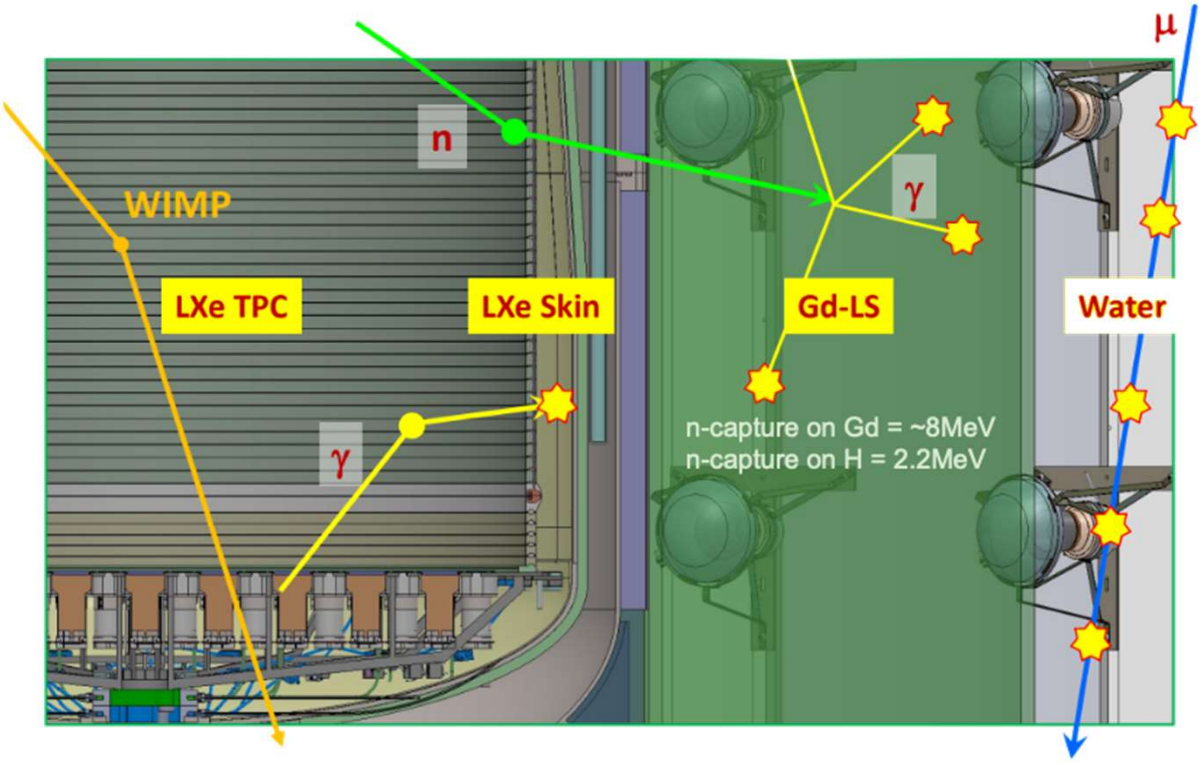
EXTRA: THE SKIN AND OUTER DETECTOR (OD)



The Outer Detector (OD):

- 17 tones of Gd-loaded liquid scintillator (120 8" PMTs)
- Tags and veto's neutron scatters detected in the skin or TPC.
- After a scatter, the neutron slows down and is captured most likely by the Gd nuclei in OD.
- Neutron capture in OD emits gamma rays of a total of approx. 8MeV these are then detected by the PMT's
- When a scatter and gamma capture are found to coincide, the event is tagged, and NR signal is vetoed