

AM-OTech: A large scale LiquidO-based neutrino detector for reactor monitoring

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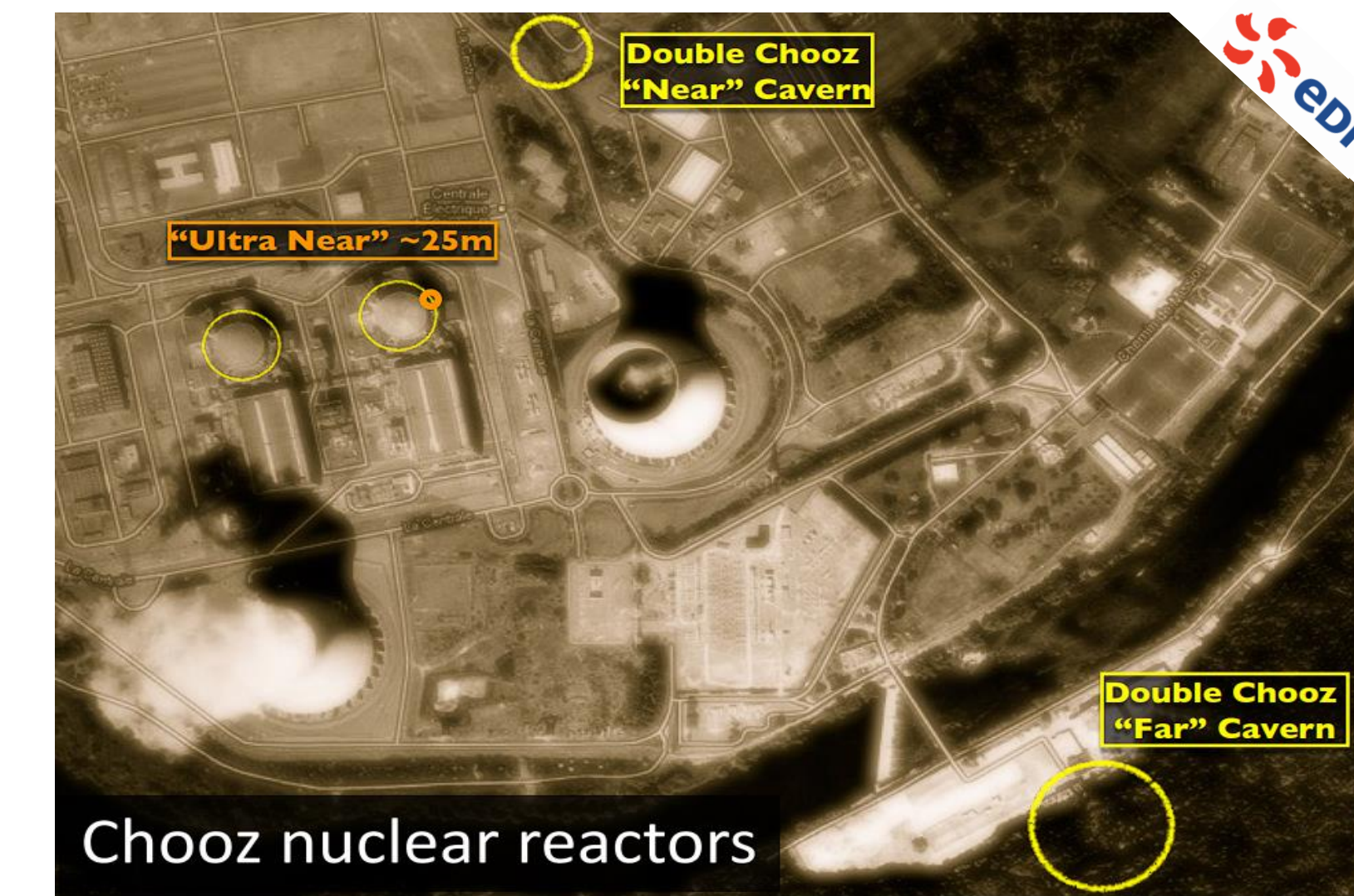
Introduction

AntiMatter-OTech (AM-OTech) is a project funded by the European Innovation Council (EIC) and UK Research and Innovation (UKRI) with the goal of building the world's first large scale LiquidO based neutrino detector for reactor monitoring. The detector will be situated at the EDF Chooz-B nuclear reactor site located in France.

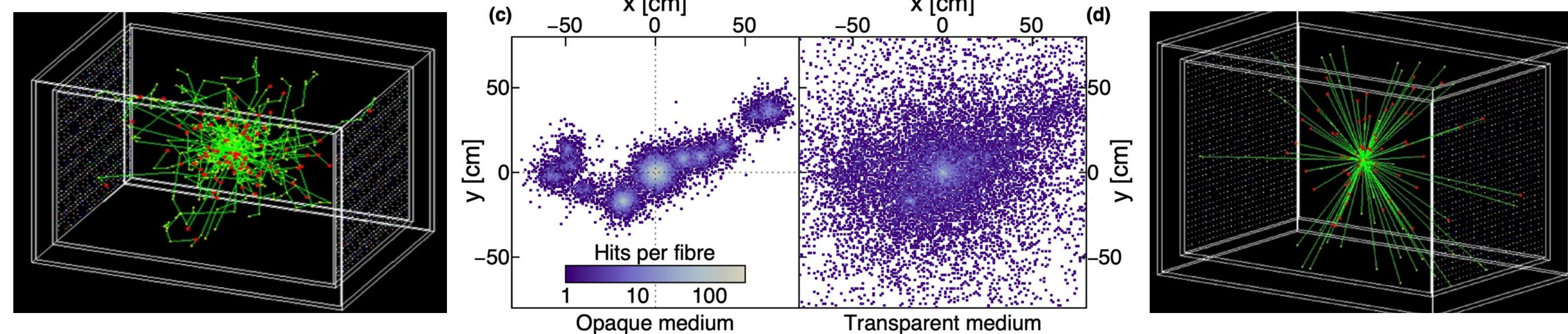
LiquidO is a new and emerging technology relying on the use of opaque liquid scintillators to offer better particle identification, background rejection and vertex reconstruction. With the help of LiquidO, AM-OTech aims to achieve high precision antineutrino flux measurements (uncertainties < 1%) for real-time reactor monitoring.

AM-OTech: Nuclear Reactor Monitoring with LiquidO

Electron antineutrinos ($\bar{\nu}_e$) are produced during the β -decay of nuclear fission products. Nuclear reactors emit a high flux of $\bar{\nu}_e$, proportional to the fission rate. Accurate measurements of the $\bar{\nu}_e$ flux will thus reveal information about the real-time state of an active reactor.



LiquidO: Opaque Liquid Scintillators

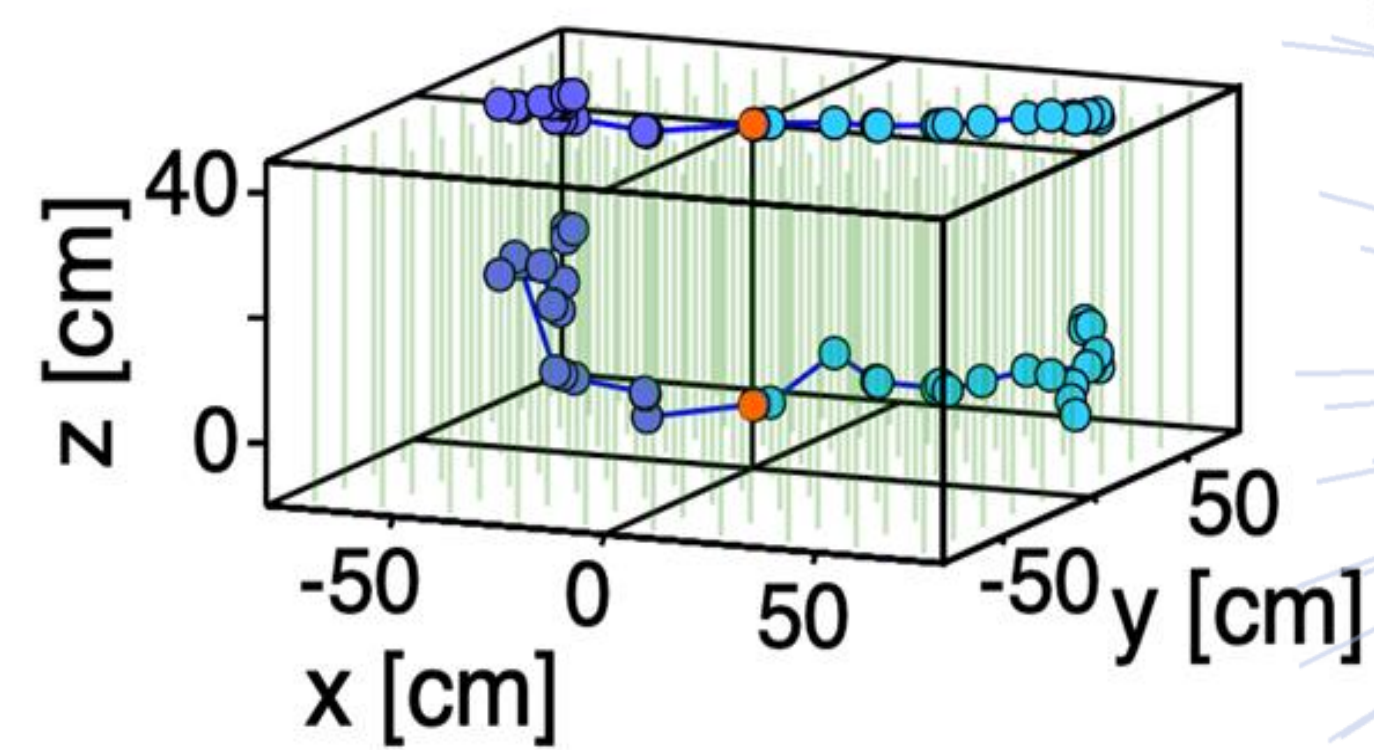


LiquidO Technology

Opaque scintillator

- Short scattering length (~mm)
- Long absorption length (~m)

⇒ Stochastic light confinement



Today's Technology

Transparent scintillator

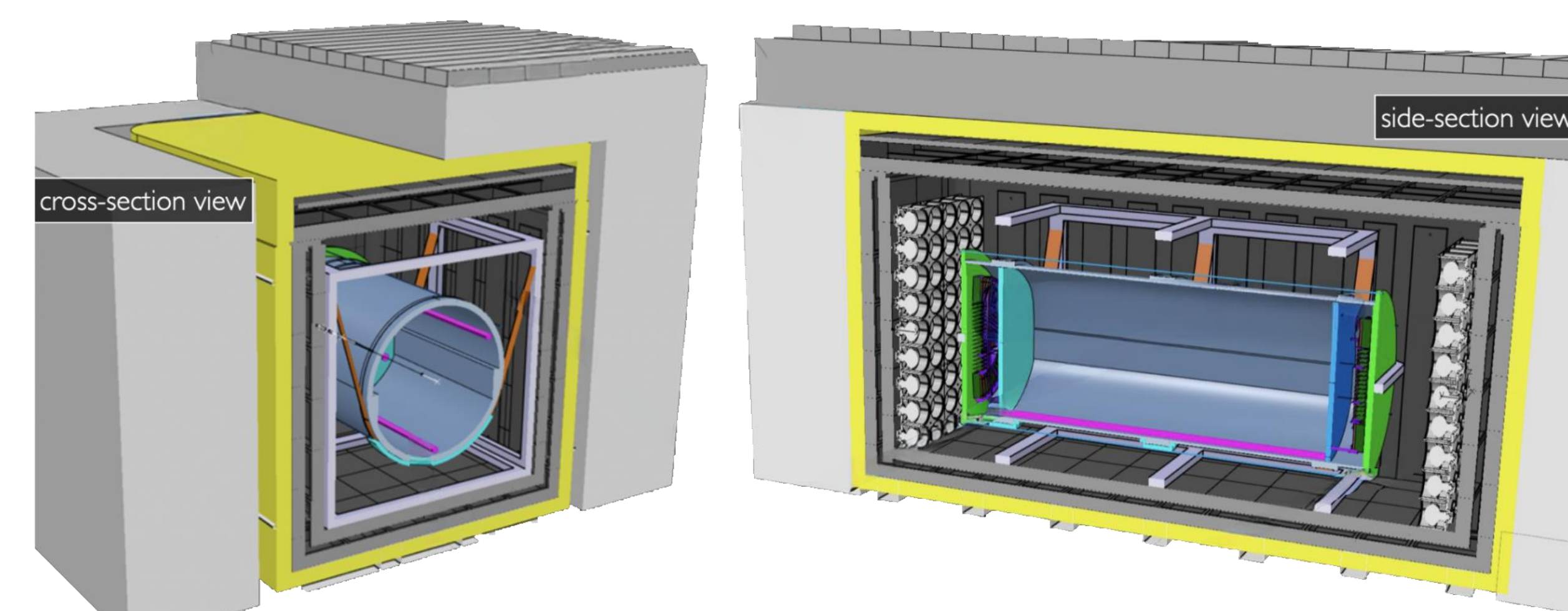
- Long scattering length
- Long absorption length

⇒ Topology lost unless physically segmented

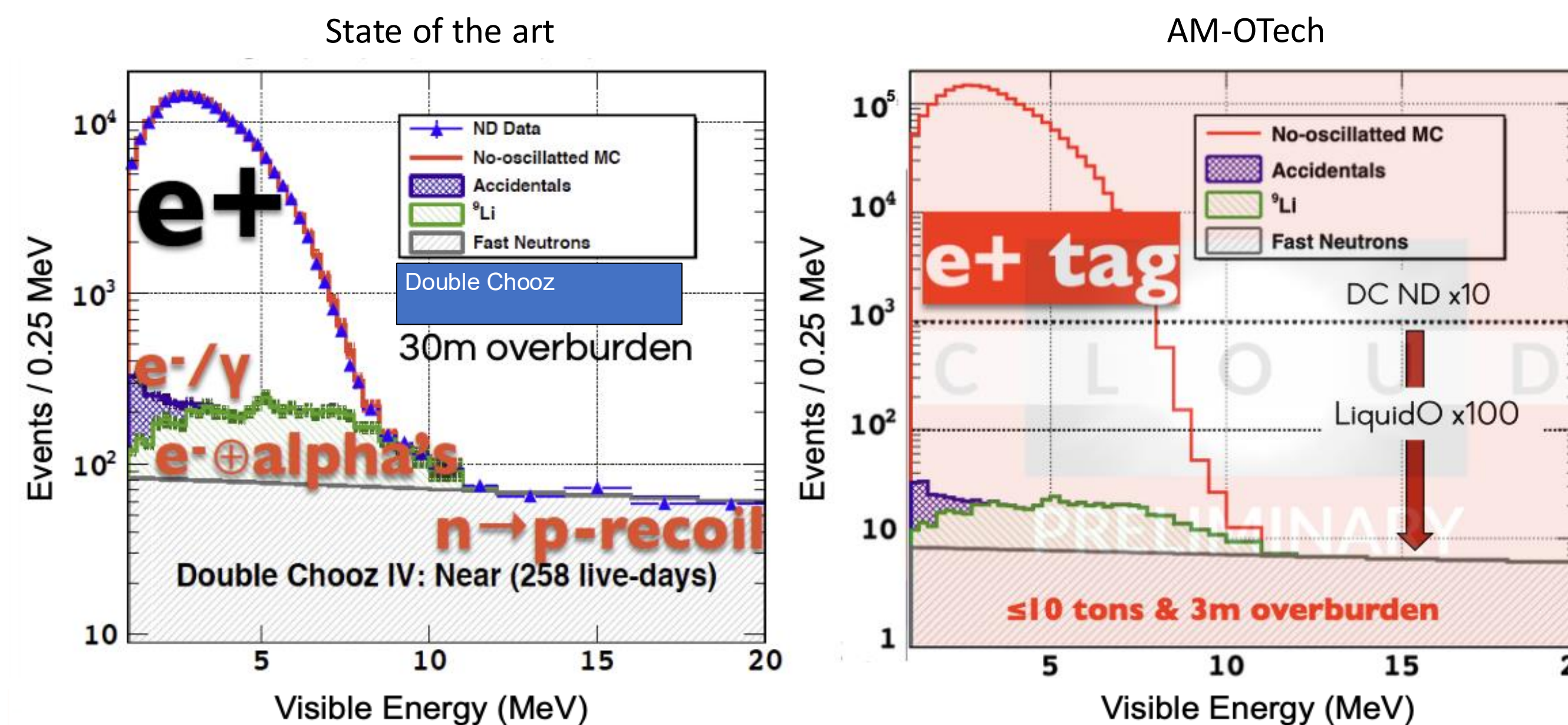
LiquidO seeks to improve $\bar{\nu}_e$ detection efficiency and provide better background control through:

- Confinement of light into "light balls" around each ionization point
- Discrimination of individual e^+ , e^- and γ events at 1MeV scale
- A self-segmented detector (no dead material)

Signal (Inverse Beta Decay): $\bar{\nu}_e + p \rightarrow e^+ + n$



- 5-10 tons of opaque liquid scintillator
- 10,000 WLS fibres
- 20,000 SiPMs
- 1.8m diameter
- >200 PE/MeV light yield



- 10,000 $\bar{\nu}_e$ interactions/day
- S/BG >100 (Reactor ON)
- S/BG >1 (Reactor OFF)
- Reactor neutrino flux (<1%)
- Reactor ON-OFF transition