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Building Tiny LArTPC to Measure Low Energy Events

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DUNE (Deep Underground Neutrino Experiment) :

- The detectors are in
 - Fermi National Accelerator Laboratory, Batavia, Illinois
 - Sanford Underground Research Facility, Lead, South Dakota
- Objective
 - Accelerator neutrino
 - Neutrino oscillations
 - Supernova neutrino

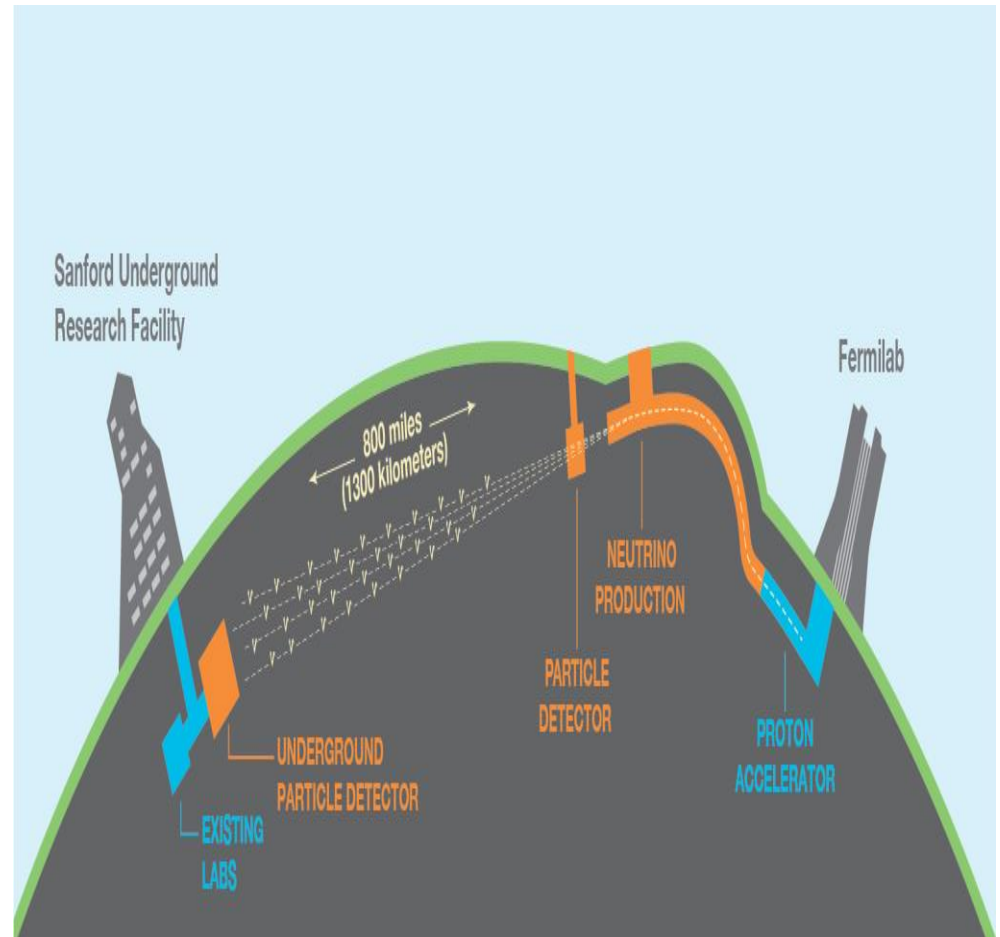


Fig 1: Operational Diagram of DUNE
([Source](#))

LArTPC (Liquid Argon Time Projection Chamber) :

- An incoming neutrino interacts with an Ar nucleus which results in **Ar ions & Charged particle/s**
- Energy and trajectory are measured by ionization signal
- Time is measured through scintillation light

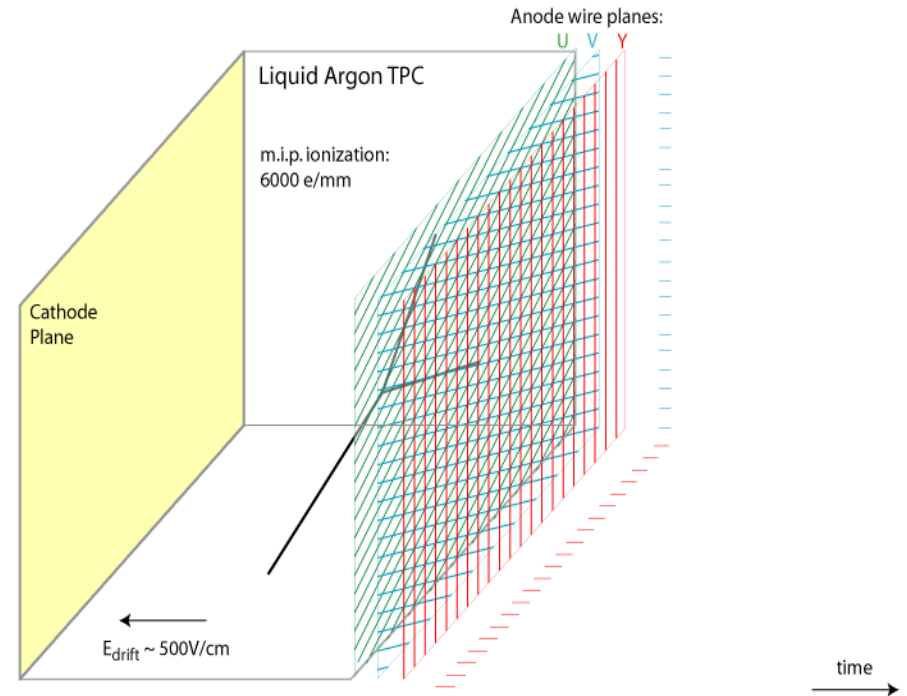


Fig 2: Scientific Diagram of the LArTPC
([Source](#))

Objective: Low Energy in LArTPC

- Energy measurement will need to combine the light and charge measurements
- Light is collected with very low efficiency
- Propose adding **photosensitive dopants** to convert some of the scintillation to light

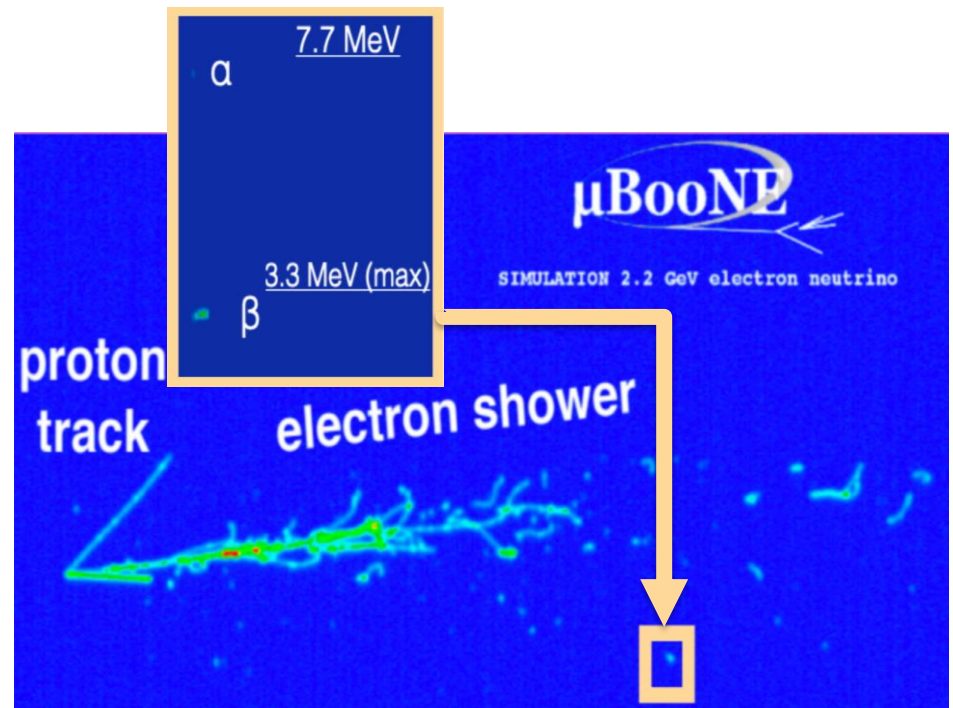


Fig 3 : MicroBoone Simulation (Source: Stolen from Fernanda Psihas)

Objective : LArTPC Test Stand

- TPC is deployed in Balance in PAB
- Measure the energy of low energy events in LArTPCs
 - Background/cosmic data
 - Radioactive source
 - Photosensitive dopants
 - Analyze the data



Fig 5 : Blanche Cryostast ([Source](#))

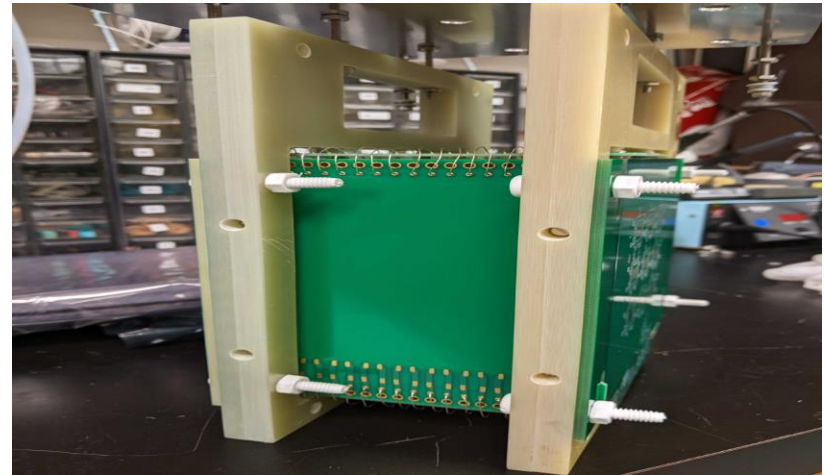


Fig 3 : Completed Tiny LArTPC (Source: LArPix documentation)

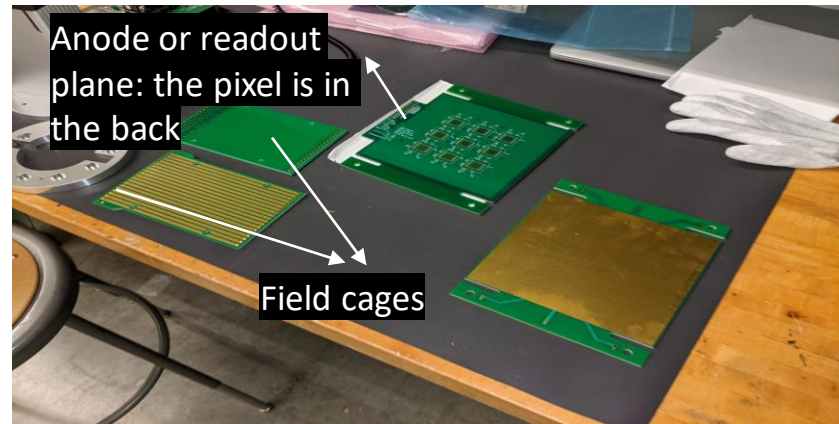


Fig 4: Components Tiny LArTPC (Source: LArPix documentation)

Progress

- ✓ Developing Technical Scope of Work & Preparing work area in PAB
- ✓ Familiarize with background
 - ✓ Neutrino Detection
 - ✓ LArTPC
 - ✓ Low Energy Signal
- ✓ Learning/Reviewing software tools
 - ✓ Bash Basics
 - ✓ C++ & Root
 - ✓ Python & Matplotlib
- Creating mechanical designs to support TPC in cryostat

