Reconstruction techniques in MicroBooNE

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MicroBooNE is a Liquid Argon Time Projection Chamber (LArTPC) neutrino detector at Fermilab

It began collecting neutrino data in October 2015

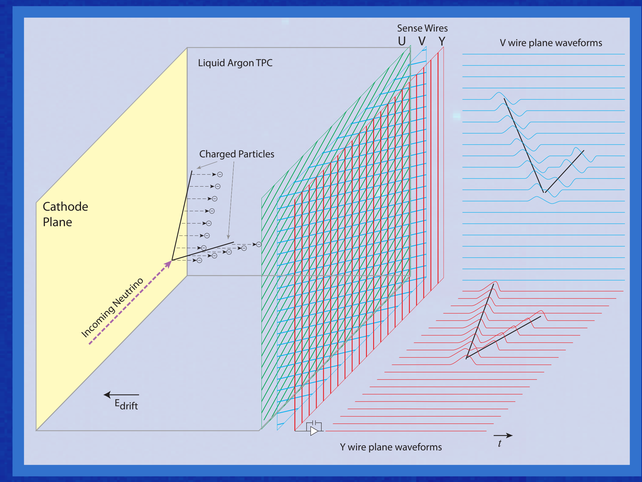
It aims to explore the low-energy excess in the ν_e spectrum reported by MiniBooNE as well as perform v-Ar cross-section measurements

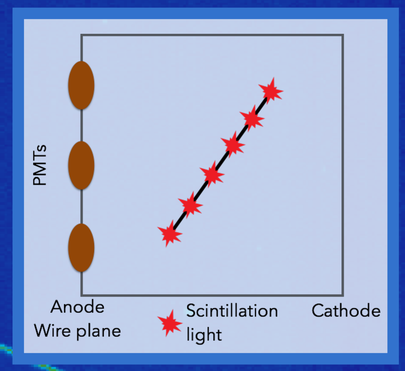
MicroBooNE's physics program also encompasses searches for supernova and proton decay

Is located on axis in the Booster Neutrino Beam Line, 470m downstream from the neutrino production target

The BNB delivers a beam of predominantly muon neutrinos with energies peaking at 700 MeV

MicroBooNE is also located about 600 m downstream from the NuMI neutrino production target



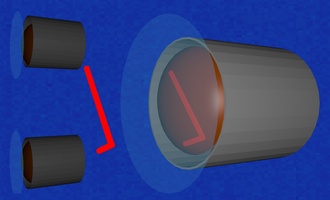


Charged particles leave trails of ionisation electrons that are transported under the influence of a uniform electric field.

Particles also create prompt scintillation photons: 32 photomultiplier tubes are located directly behind the anode planes, immersed in the liquid argon.

The image shows a neutrino candidate event recorded on October 23, 2015

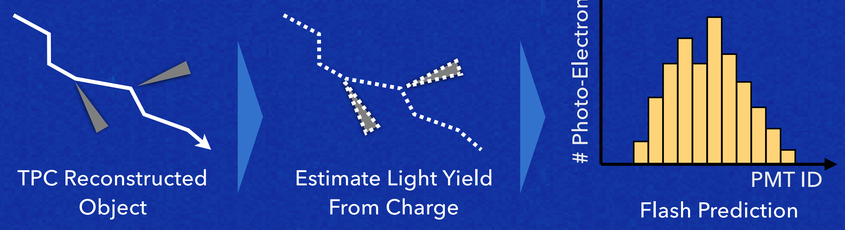
Flash to track matching



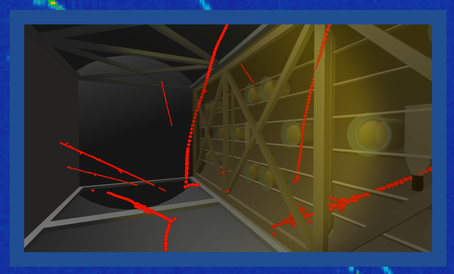
Flash: group of scintillation light in time collected from different PMTs

Flash-to-track matching: the attempt to pair flashes with their corresponding tracks from TPC readout

The track to light matching is crucial
- to the mitigation of the high cosmic rate,
- to identify the neutrino interaction,
- to provide the time (t_0) for each TPC interaction.

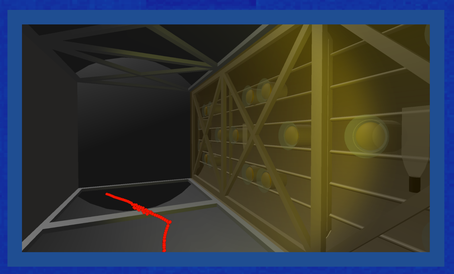


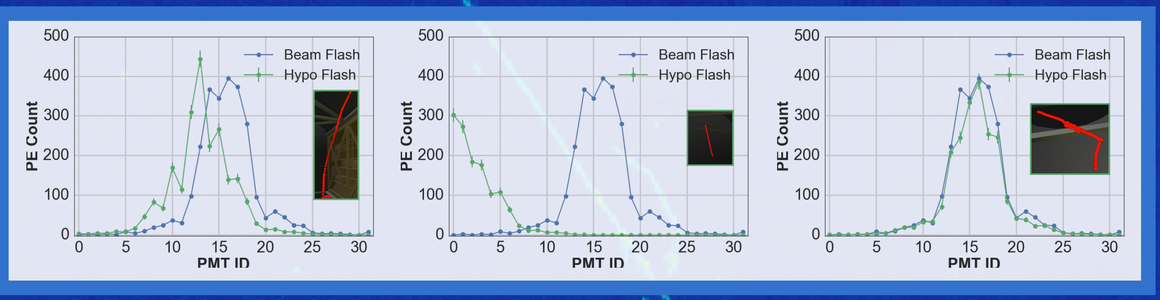
Inside of the MicroBooNE TPC, red dots are reconstructed 3D hits from Event 2919, Run 5153, recorded on February 26th, 2016



After removing hits related to through going tracks and hits not in time with the beam

After removing hits related to tracks not compatible with the beam flash





- The reconstructed **beam flash** is selected (using time information)
- For each reconstructed track, a **flash hypothesis** is made
- If the hypothesis is highly incompatible with the beam flash, the track is rejected