

Liquid Argon Time Projection Chamber Projects at Fermilab

Mike Kirby

CS Liaisons Meeting

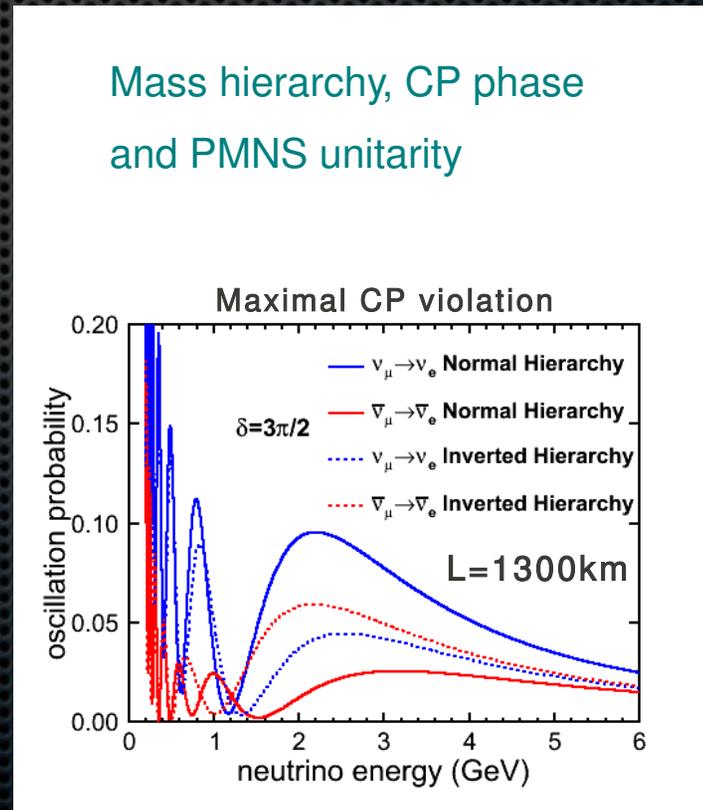
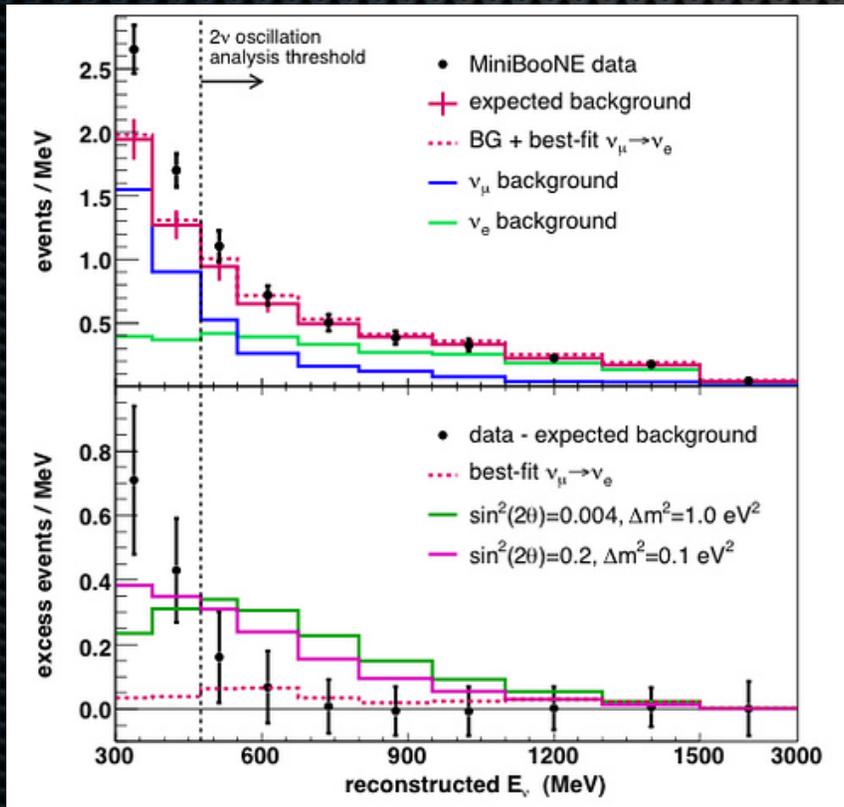
July 24, 2013

LAr ν -Physics at FNAL

μ BooNE

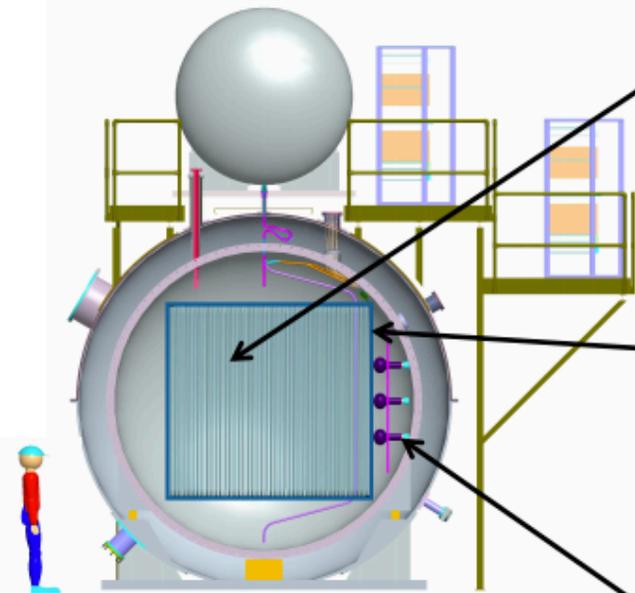
investigating miniBooNE low energy excess, ν x-sec & osc

Long Baseline Neutrino Experiment

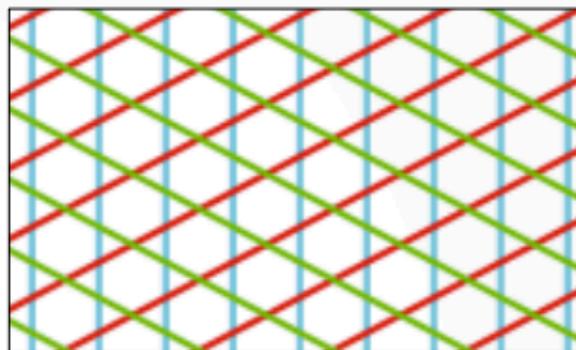


LArTPC

Liquid Argon Time Projection Chamber



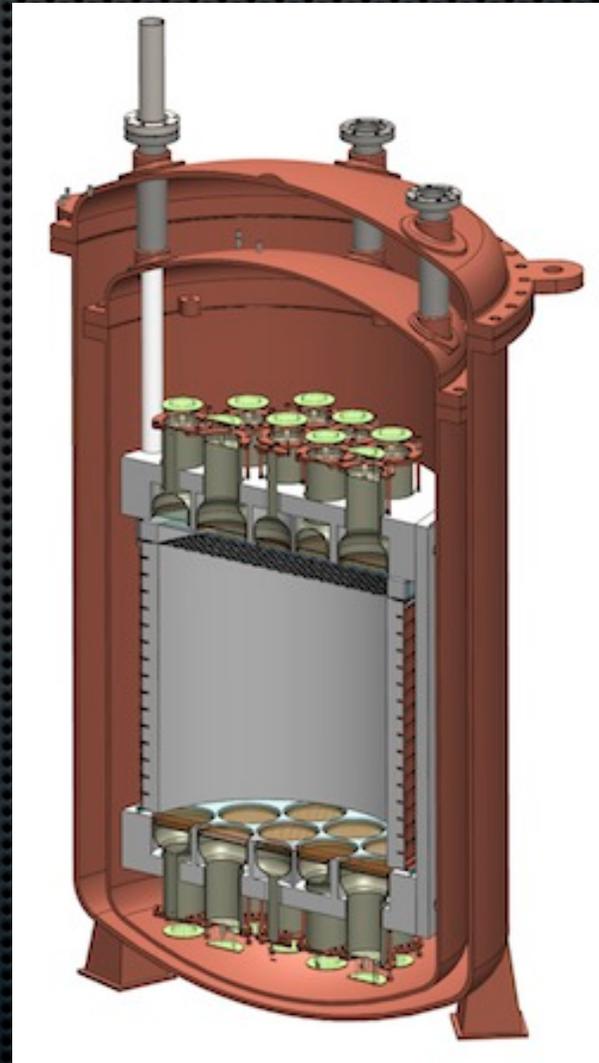
- Detector volume is filled with 170 tons of LAr
- Charged particle tracks ionize Ar atoms in the detector
- Electric field in the detector causes ionization electrons drift towards three wire planes (vertical, $\pm 60^\circ$ from vertical)
- 32 PMTs also detect scintillation light from neutrino and cosmic ray events
- PMTs provide information about the timing of the event



Orientation of wire planes
(wire spacing = 3mm)

Also, separate from LAr dark matter searches...

- ✦ DarkSide 50
- ✦ dual phase detector
- ✦ not situated in a neutrino beam
- ✦ still a time projection chamber, but much different resolution characteristics



Motivation

Your typical neutrino event

Incoming neutrino

Flavor: unknown

Energy: unknown

Outgoing lepton

Flavor ID:

CC vs NC

μ^+ vs μ^- , e vs γ , τ ?

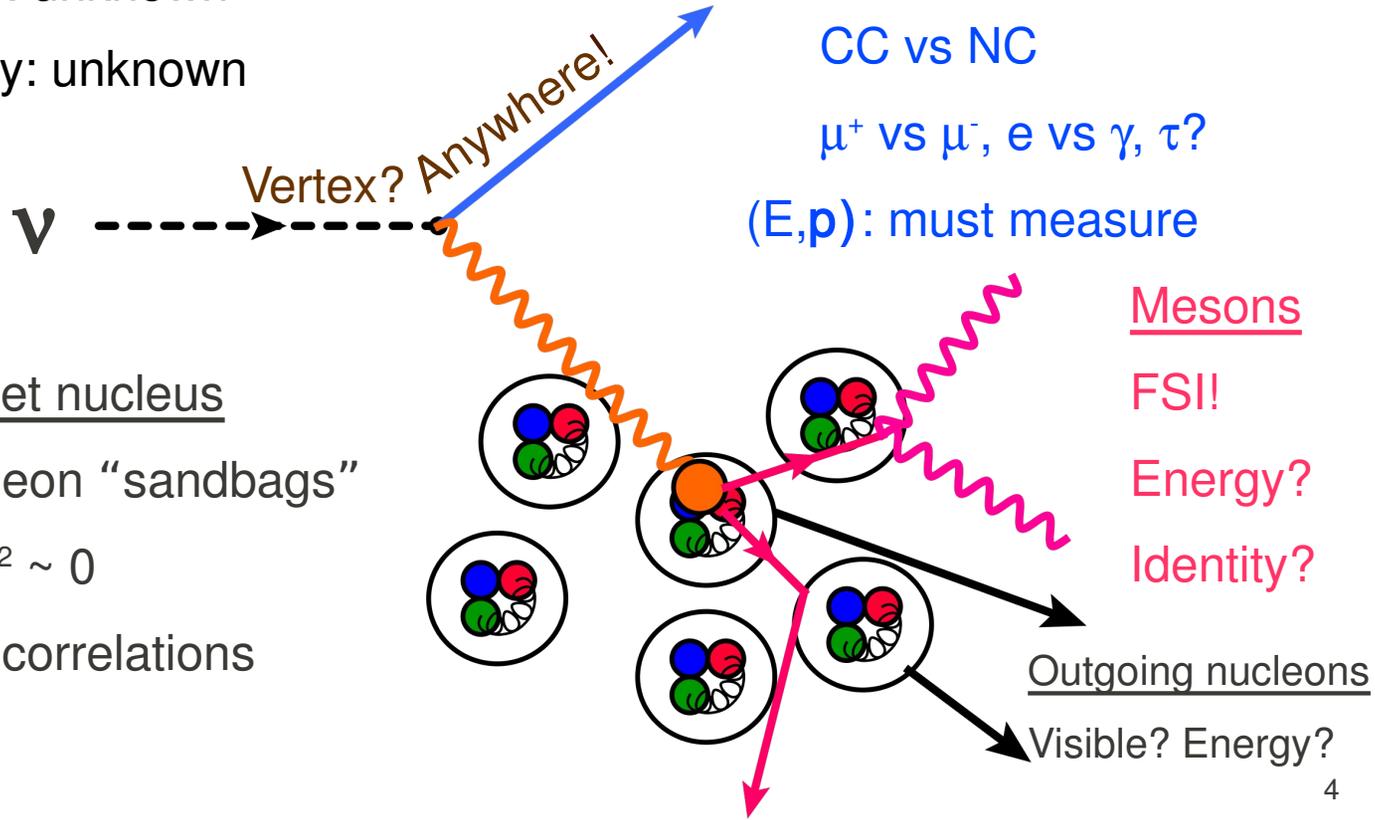
(E,p): must measure

Target nucleus

Nucleon "sandbags"

at $Q^2 \sim 0$

N N correlations



Mesons

FSI!

Energy?

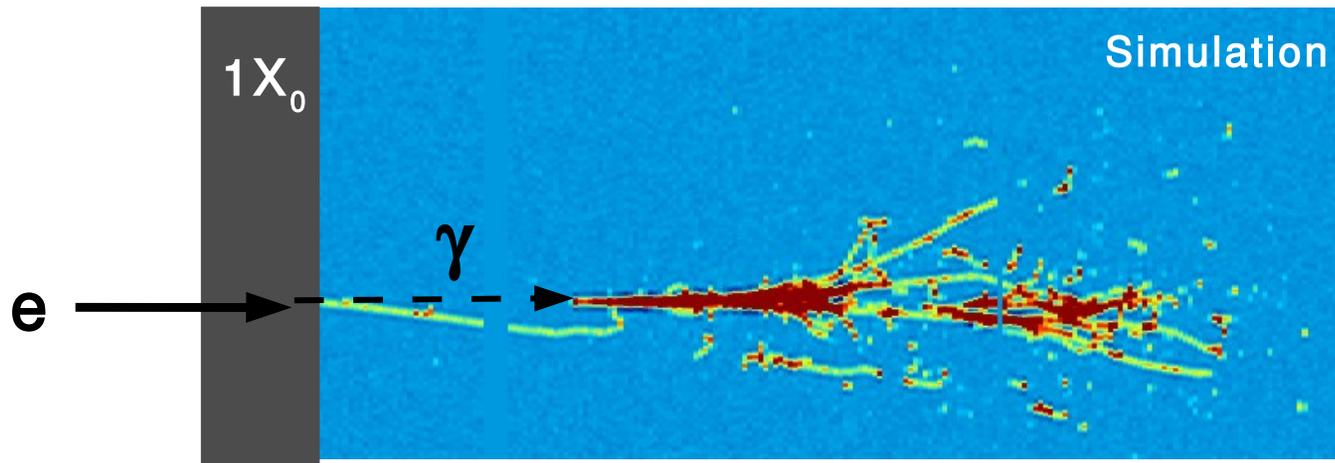
Identity?

Outgoing nucleons

Visible? Energy?

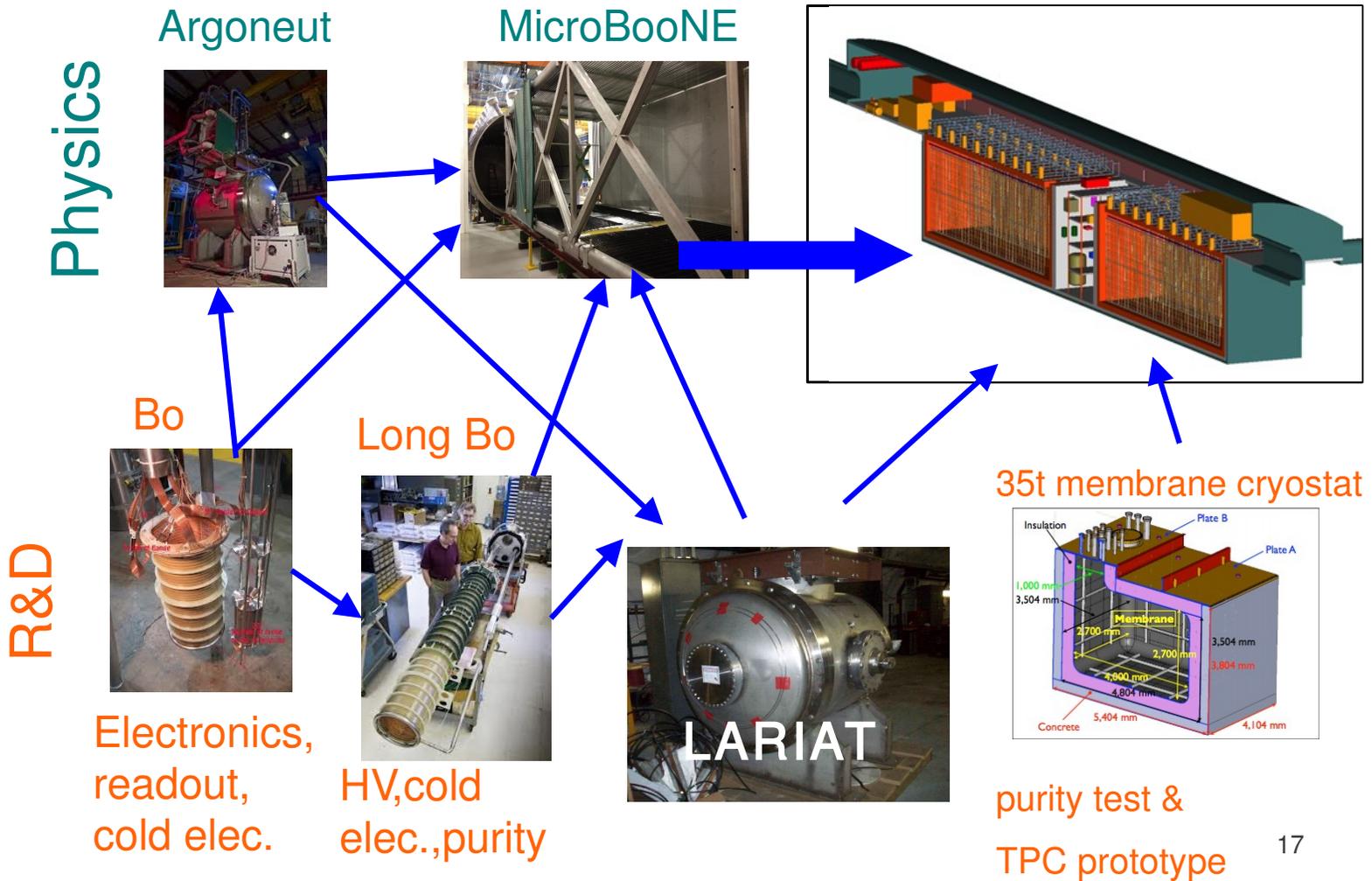
Particle identification

electron vs photon discrimination



Bremsstrahlung from upstream radiator plate
Tagged with incoming electron PID in beamline
+ deviated track + gap.

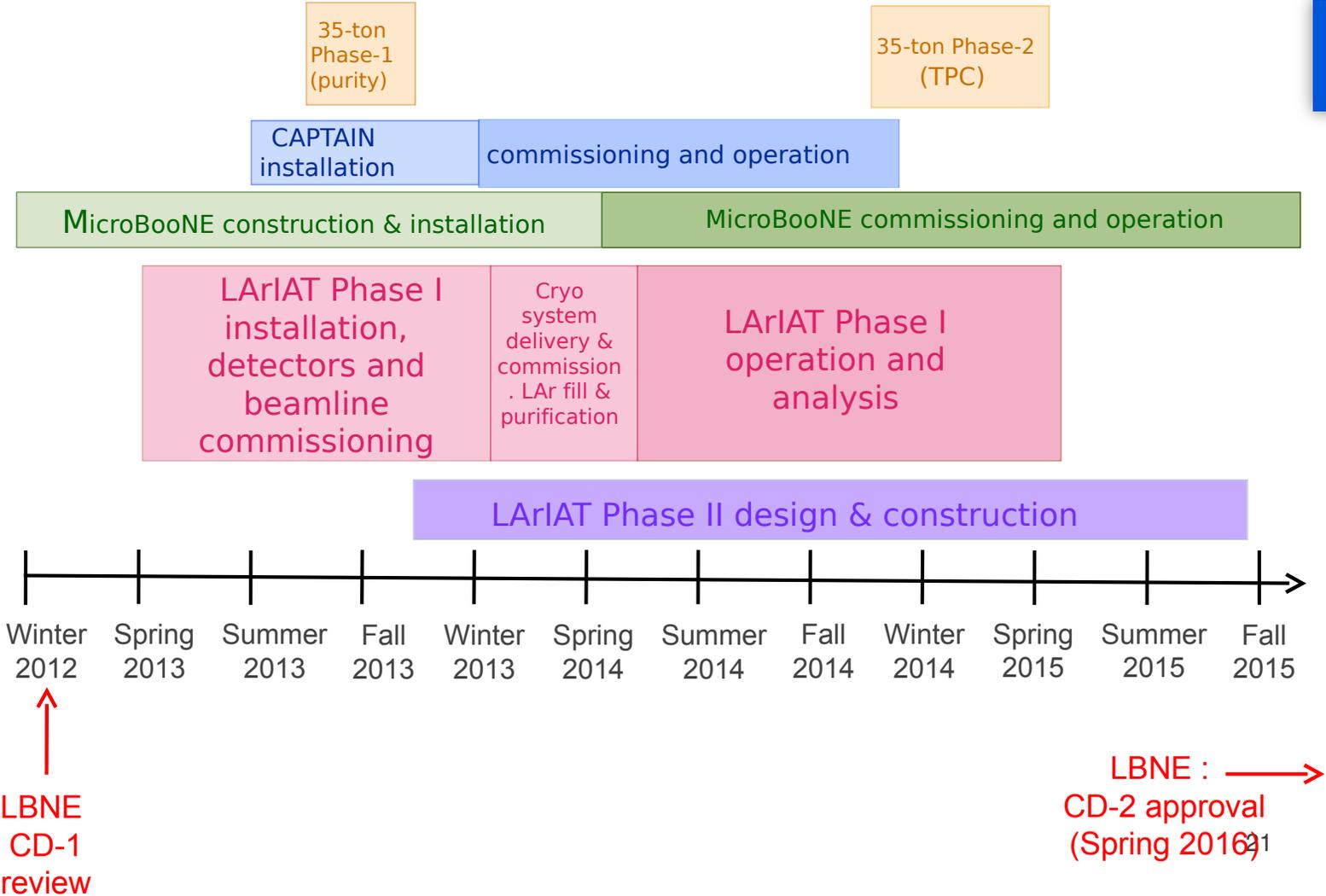
Working toward LBNE



Slide from Mike Kordosky

LAr R&D Timeline

LAr1
2018



Slide from Mike Kordosky