



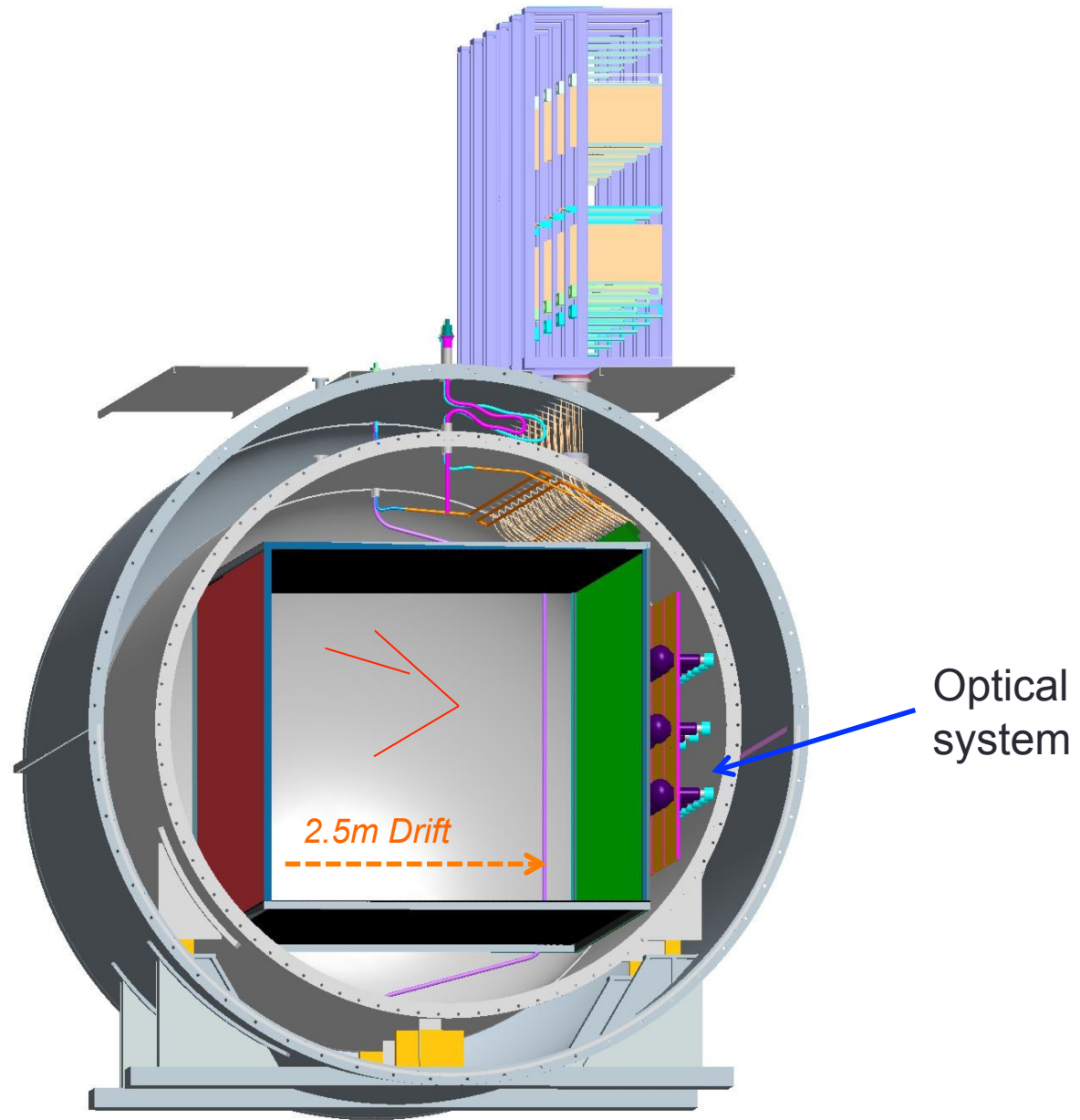
THE MICROBOONE EXPERIMENT

Fermilab All Experimenters Meeting

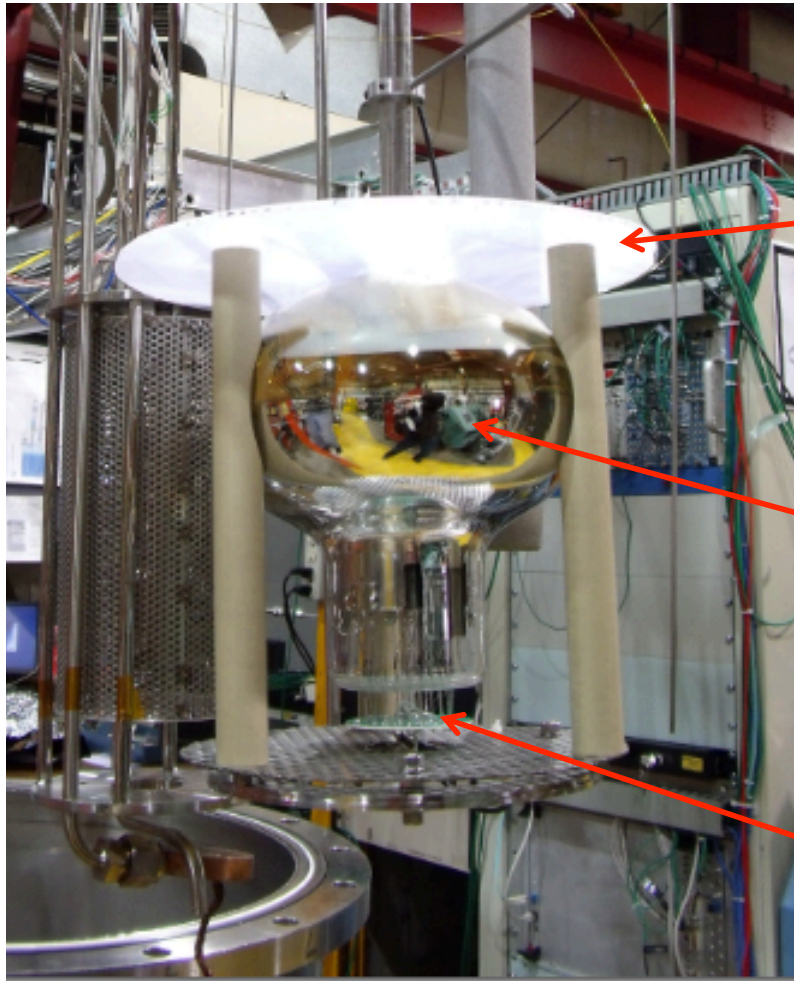
Ben Jones, MIT, 08/12/13

This Talk

- There continues to be outstanding progress on MicroBooNE construction by every subgroup, on every system.
- Today I will tell you about two main areas:
 - **Focus 1:** Status of the photon detection system
 - **Focus 2:** Readiness of analysis tools



Detector Elements

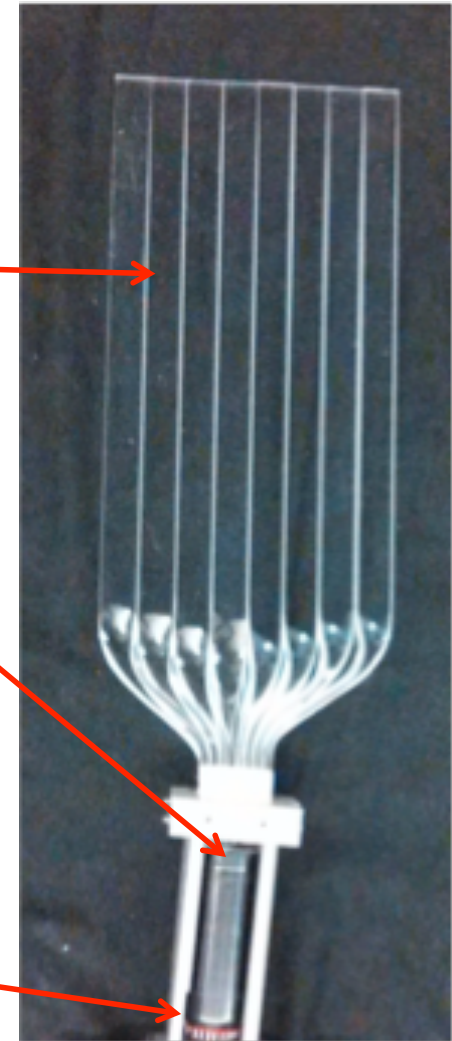


***Cryogenic PMT Assembly
(main system for physics)***

Wavelength
shifter (TPB)

Cryogenic
PMT

Cryogenic
base
electronics



***Paddle Detector
(long term test for LBNE)***

Optical System Mounting

PMT mount production line

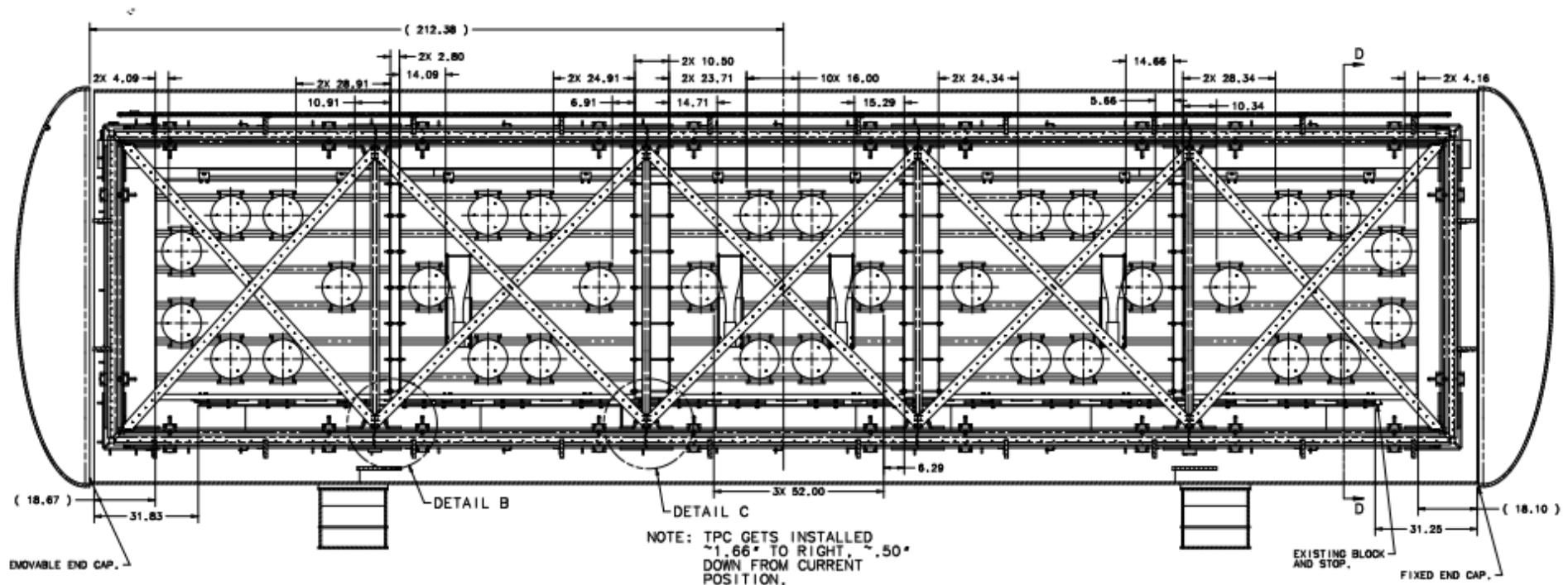


*32x mounted 8" PMTs
now ready for installation*



Geometrical Arrangement

- 32 x cryogenic photomultiplier tube assemblies
- 4 x prototype paddle detectors



R. Reinert

Test Installation

All five racks installed and removed, one prototype of each component connected + installed, full cable routing to all PMT positions from feedthrough



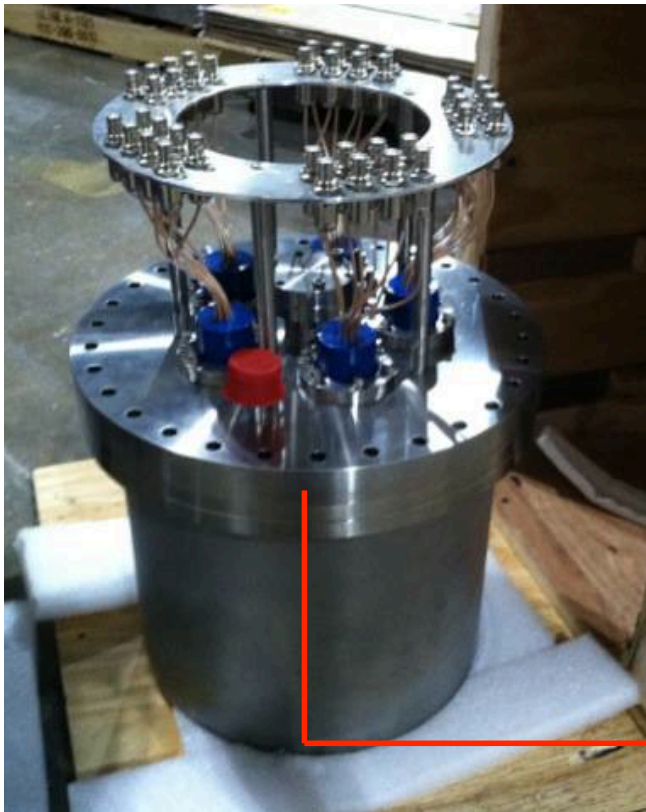
Installation

PMT flange with epoxy potted feedthroughs and patch panel has now arrived from BNL.

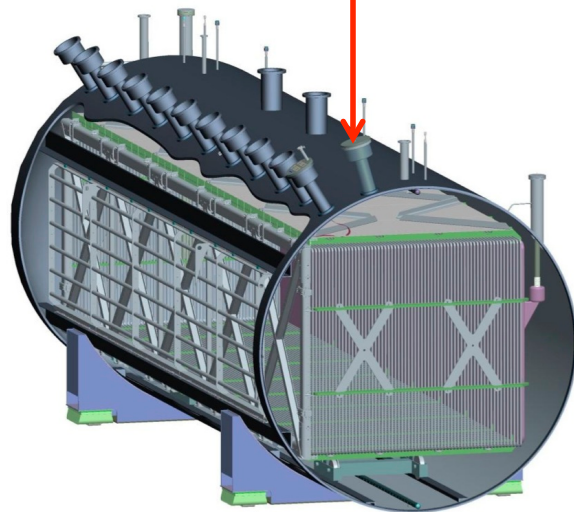
Installation of the PMT system will be taking place over the next 3-4 weeks.

This is the first detector system to be installed into the MicroBooNE cryostat

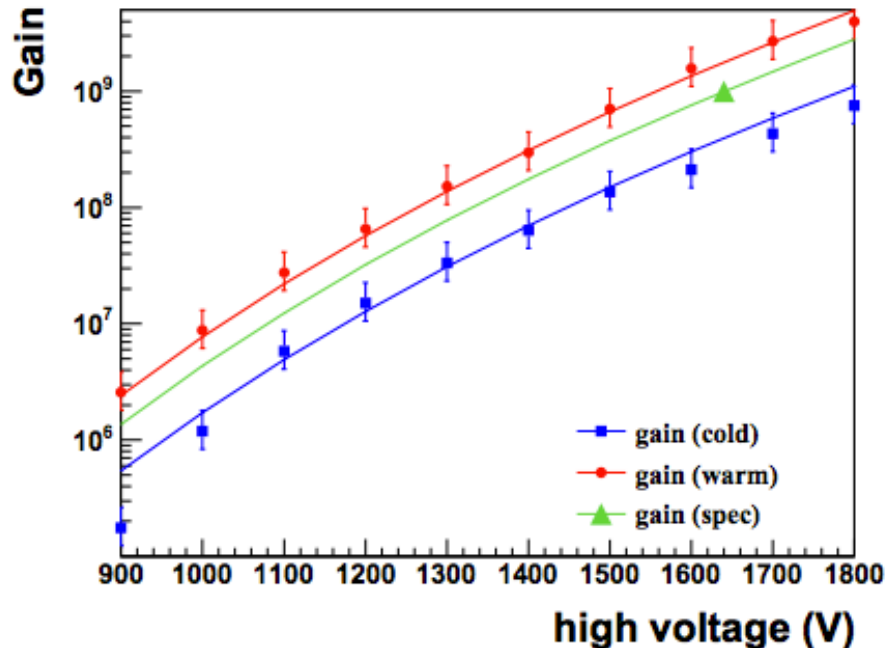
TPC roll-in will follow in September - October.



Final outstanding part of optical system now delivered!



Warm and Cold PMT Characterization



Every PMT for MicroBooNE has been characterized both warm and in liquid nitrogen

A many month project, performed in an open-dewar test stand at the Proton Assembly Building

JINST technical report published just a few days ago...

Journal of Instrumentation > Volume 8 > July 2013

T Briese et al/ 2013 JINST 8 T07005 doi:10.1088/1748-0221/8/07/T07005

Testing of cryogenic photomultiplier tubes for the MicroBooNE experiment

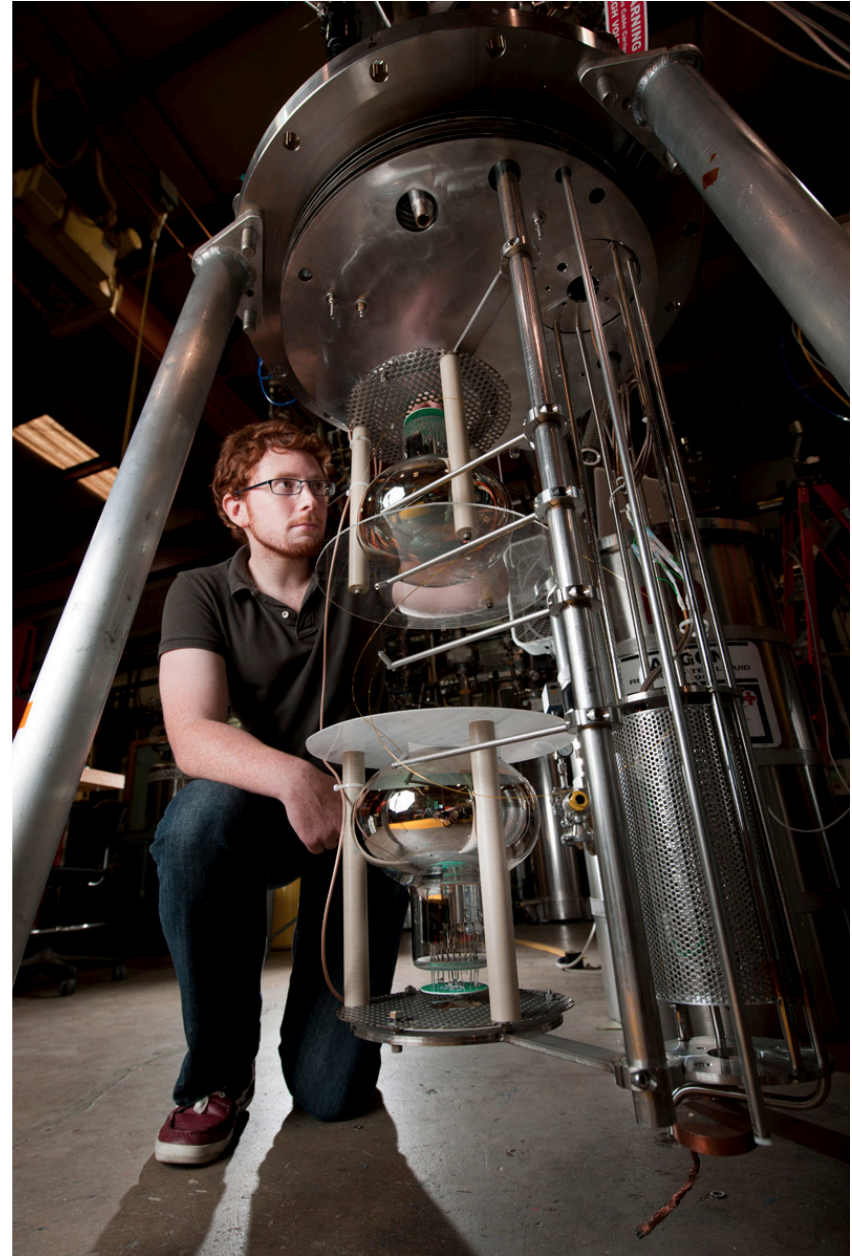
FREE ARTICLE

T Briese^d, L Bugel^b, J M Conrad^b, M Fournier^d, C Ignarra^b, B J P Jones^b, T Katori^b, R Navarrete-Perez^c, P Nienaber^d, T McDonald^d, B Musolf^e, A Prakash^b, E Shockley^d, T Smidt^b, K Swanson^a and M Toups^b

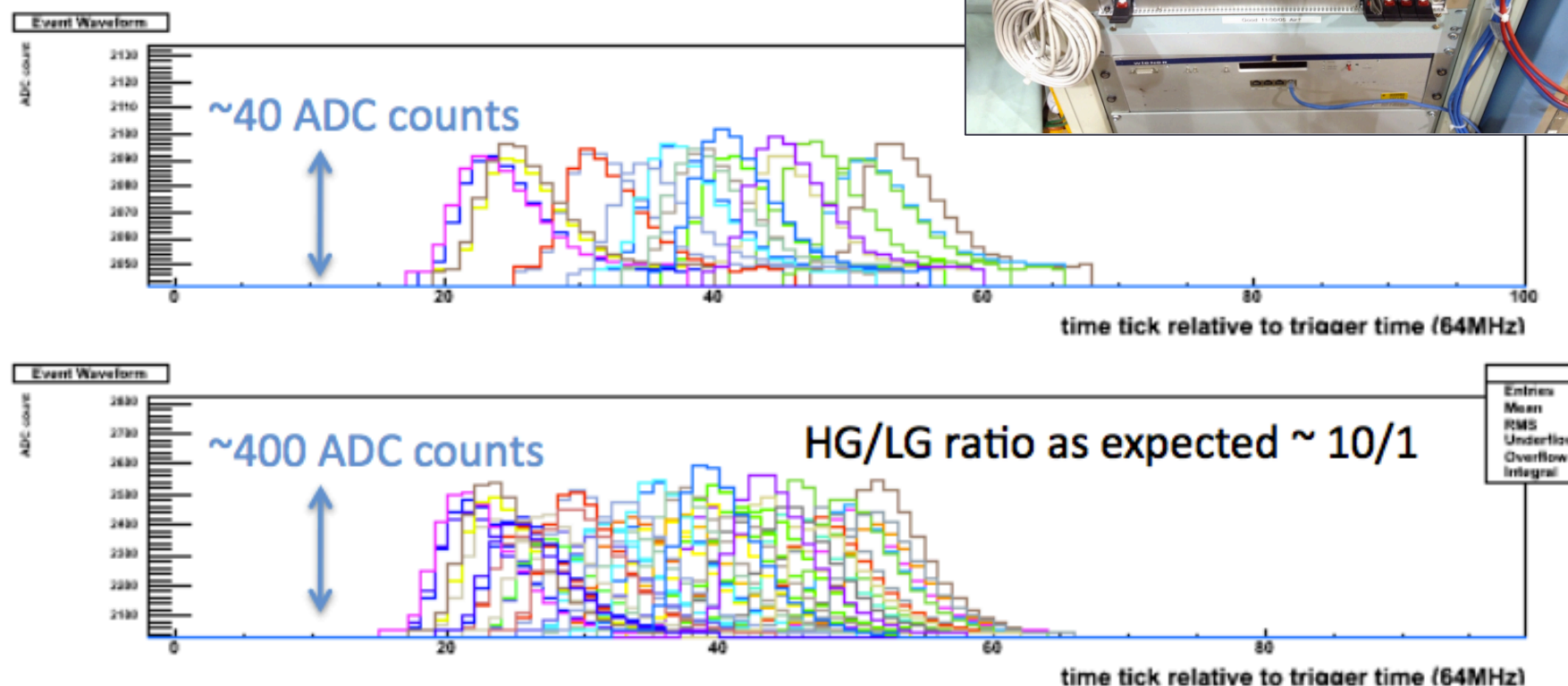
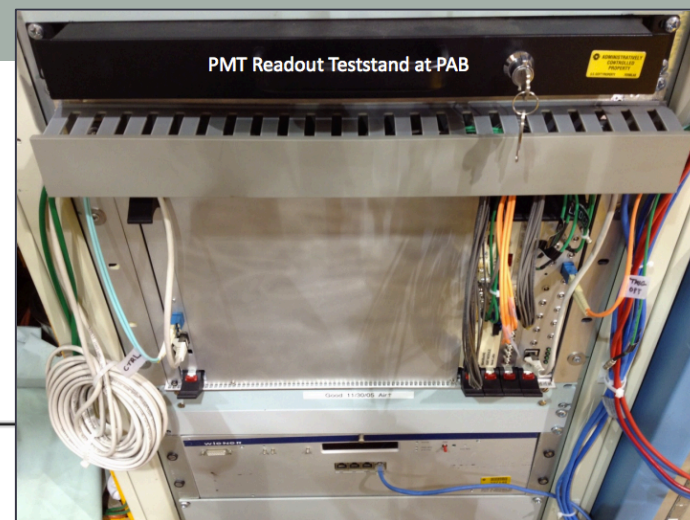
Bo VST

- Bo Vertical Slice Test exercises one slice of the MicroBooNE optical system including:
 - *Cryogenic photomultiplier tubes*
 - *Base electronics*
 - *Wavelength shifting plate*
 - *High voltage system + interlocks*
 - *Cables and splitters*
 - *Readout electronics*
 - *Cryostat feedthrough*
 - *Trace impurity monitors*
 - *Etc...*
- Also responsible for several standalone R&D publications

Impossible without the help of Stephen Pordes and the excellent PAB techs



PMT Electronics @ VST



Signals read out through high and low gain splitter channels, and fed into LArSoft through entire MicroBooNE PMT readout electronics chain. Now iterating towards a full understanding of the readout + trigger system and digitization routines.

MicroBooNE optical system publications

Journal of Instrumentation > Volume 8 > July 2013

B J P Jones *et al* 2013 *JINST* **8** P07011 doi:10.1088/1748-0221/8/07/P07011

A measurement of the absorption of liquid argon scintillation light by dissolved nitrogen at the part-per-million level

FREE ARTICLE

B J P Jones, C S Chiu, J M Conrad, C M Ignarra, T Katori and M Toups

Journal of Instrumentation > Volume 8 > July 2013

T Brieser *et al* 2013 *JINST* **8** T07005 doi:10.1088/1748-0221/8/07/T07005

Testing of cryogenic photomultiplier tubes for the MicroBooNE experiment

FREE ARTICLE

T Brieser^d, L Bugel^b, J M Conrad^b, M Fournier^d, C Ignarra^b, B J P Jones^b, T Katori^b, R Navarrete-Perez^c, P Nienaber^d, T McDonald^d, B Musolf^e, A Prakash^b, E Shockley^d, T Smidt^b, K Swanson^a and M Toups^b

Journal of Instrumentation > Volume 8 > January 2013

B J P Jones *et al* 2013 *JINST* **8** P01013 doi:10.1088/1748-0221/8/01/P01013

Photodegradation mechanisms of tetraphenyl butadiene coatings for liquid argon detectors

B J P Jones^a, J K VanGemert^b, J M Conrad^a and A Pla-Dalmau^b

Journal of Instrumentation > Volume 7 > July 2012

C S Chiu *et al* 2012 *JINST* **7** P07007 doi:10.1088/1748-0221/7/07/P07007

Environmental effects on TPB wavelength-shifting coatings

C S Chiu, C Ignarra, L Bugel, H Chen, J M Conrad, B J P Jones, T Katori and I Moulton

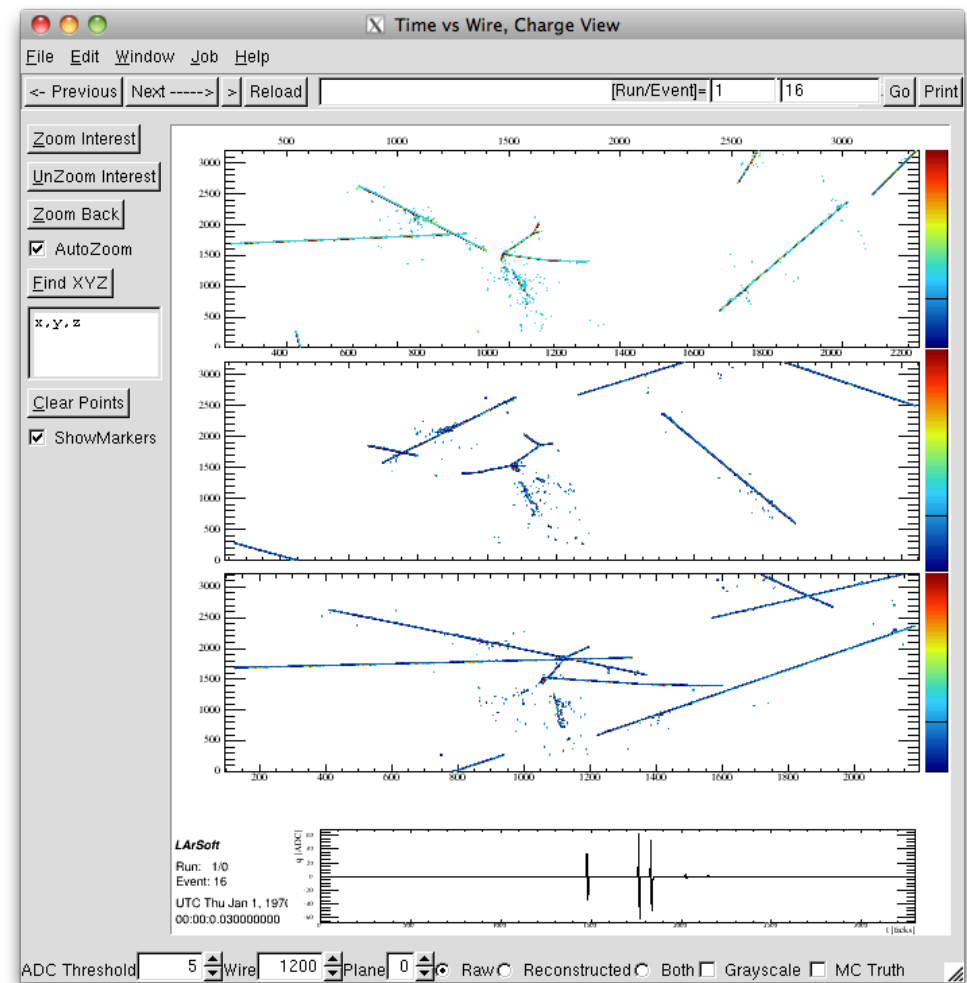
+ one more submitted to JINST this week, and a NIM paper on paddles!

Analysis Tools Readiness

A “typical” neutrino + overlaid cosmic event

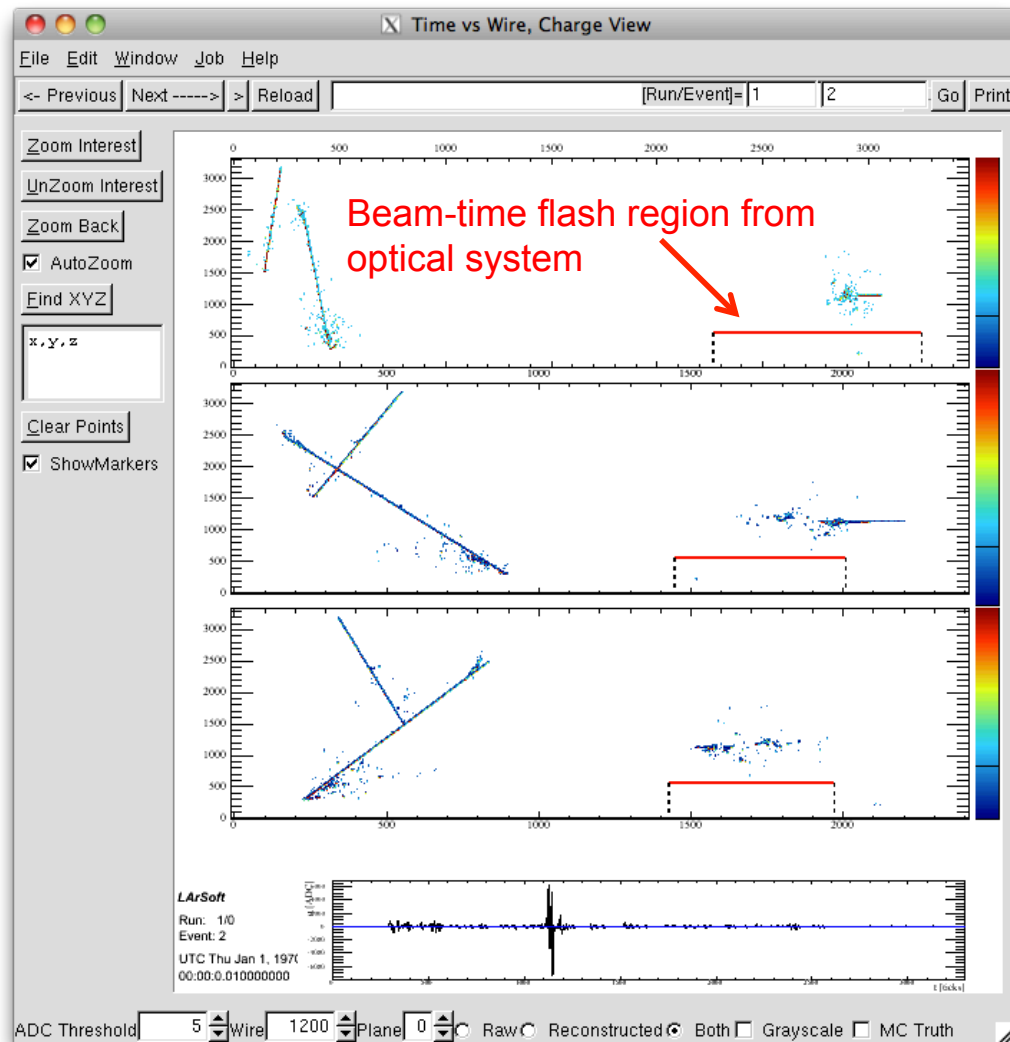
- LArTPCs provide an unprecedented level of detail for studying neutrinos
- Due to the long drift time, large surface based LArTPCs require an unprecedented level of background rejection
- As such, LArTPC reconstruction + cosmic rejection represents a major challenge for the technology

Ongoing hard work from the entire LArSoft development team, including recently added CD support headed up by Rick Sneider

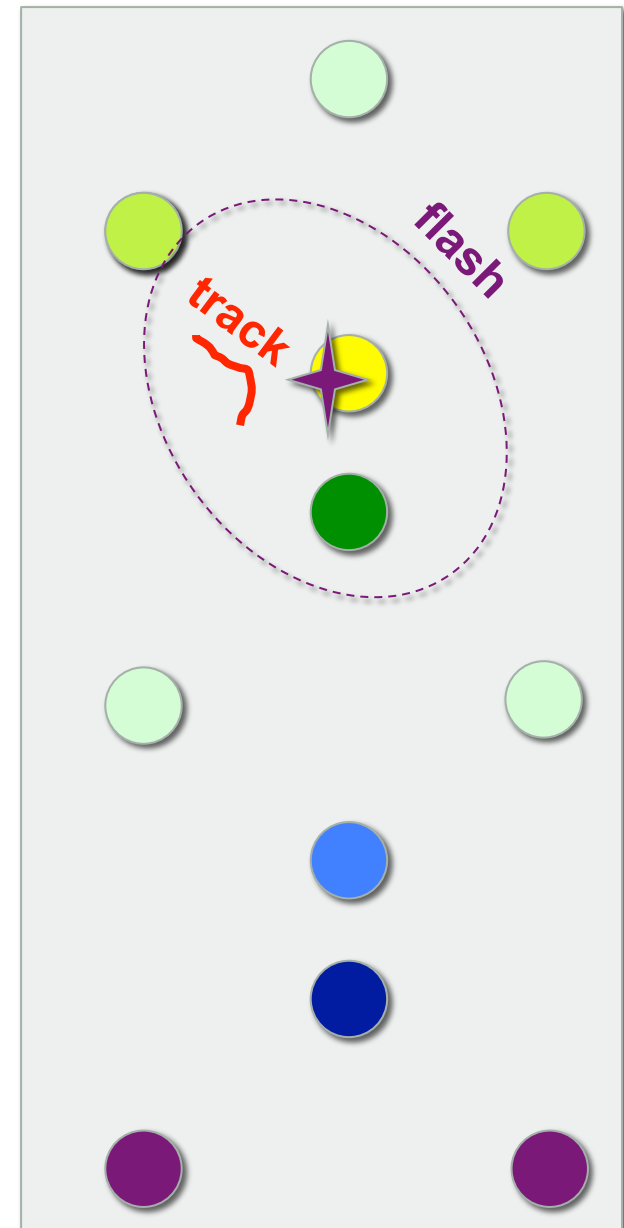


Matching to Optical Data

MicroBooNE Flash Finder (BJPJ)

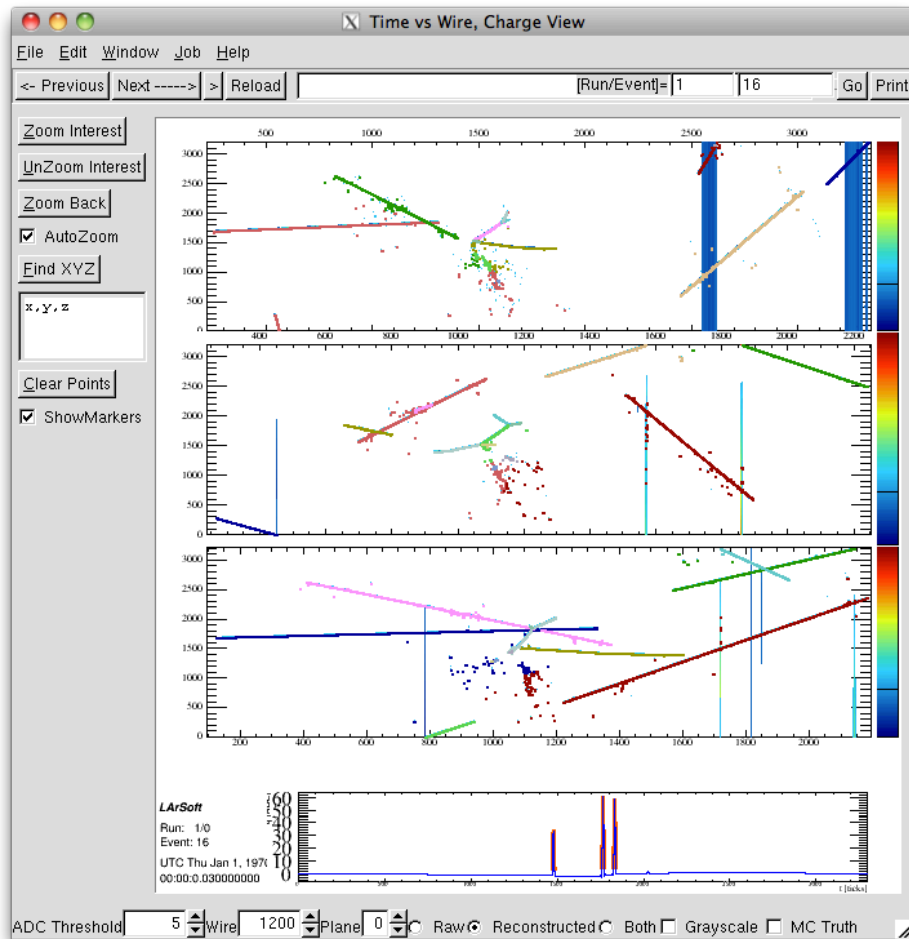


Likelihood based flash -> track matching algorithms are now approaching completion.

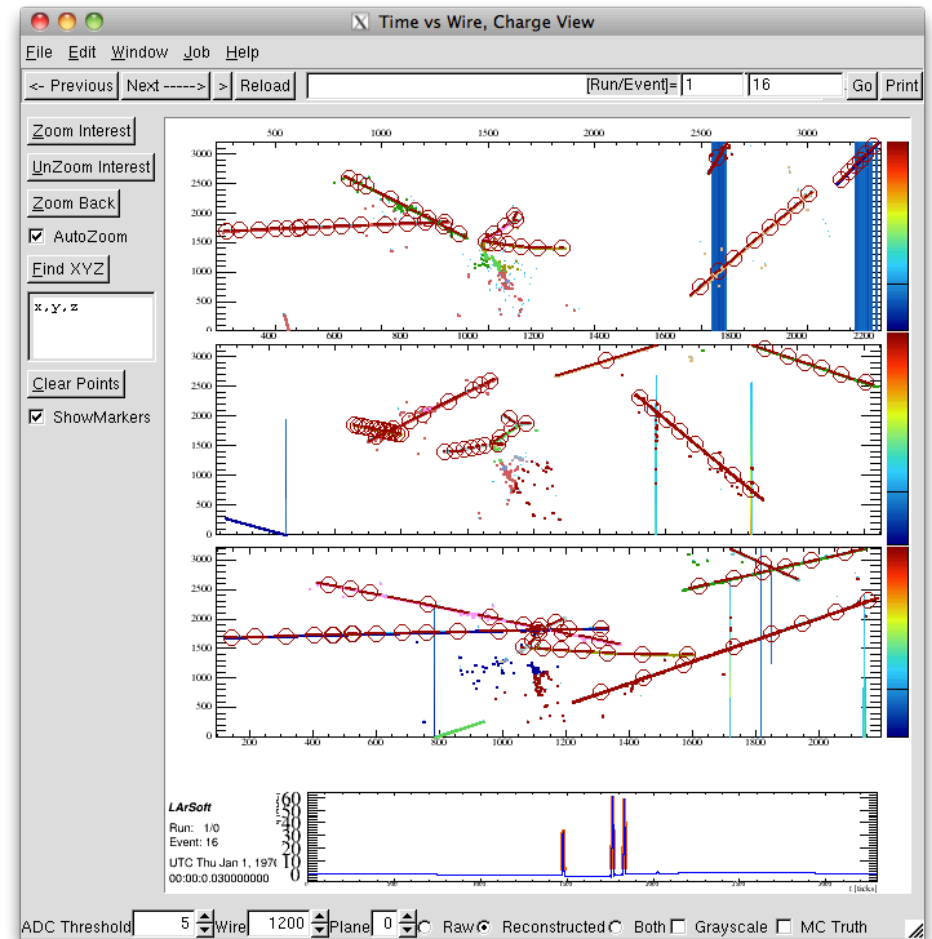


Pattern Finding and Tracking

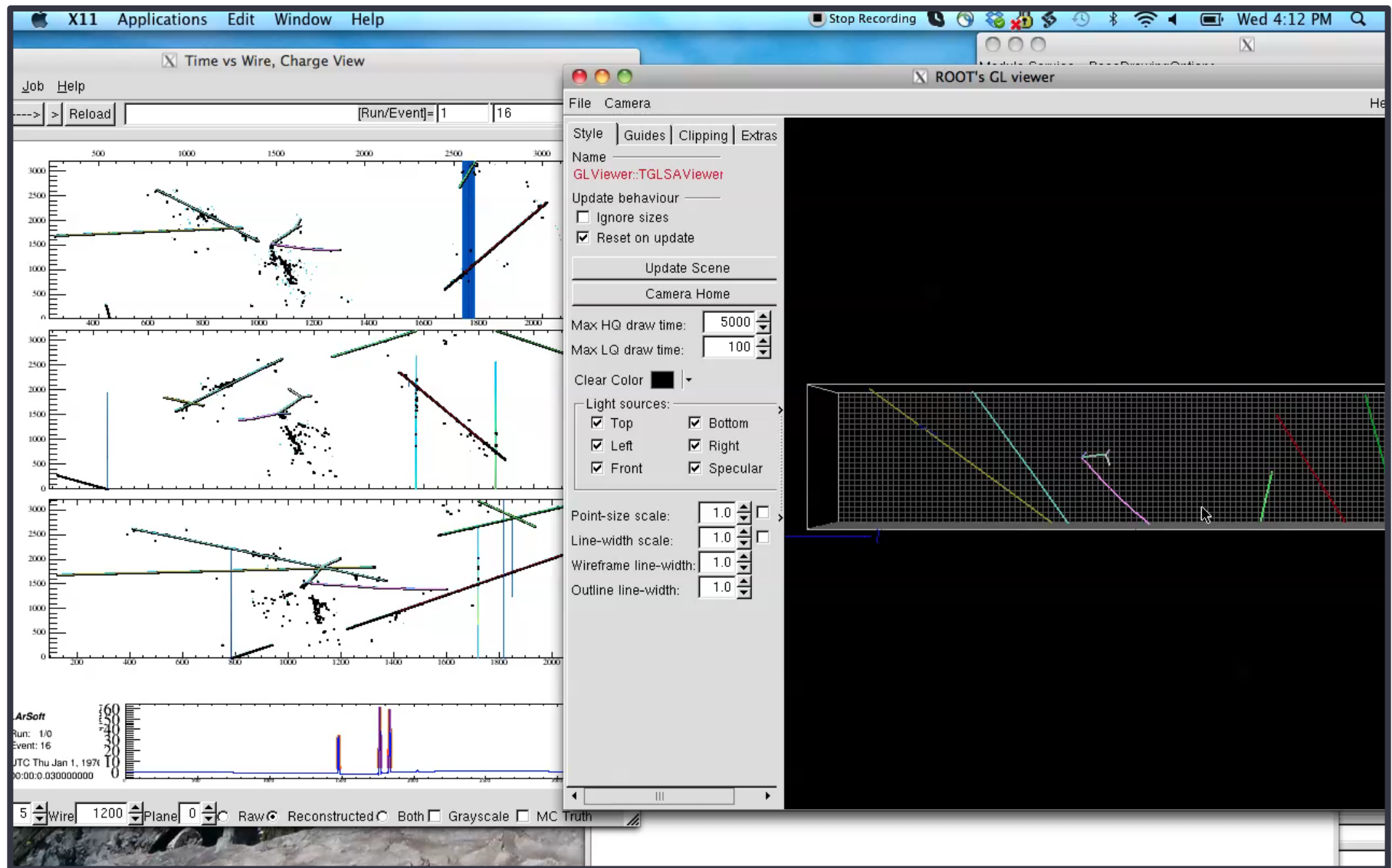
2D Fuzzy clustering (B Carls)



3D Track seeding (BJPJ)



2D Fuzzy Clustering (B. Carls) + 3D Seed Finding + Bezier tracking + Bezier vertexing (BJPJ)



Readiness for Data

- This is the first demonstration of fully automated 3D track reconstruction applied to a multi-ton scale, surface based LArTPC detector, with realistically simulated events + background.
- We are preparing to start testing and tuning our simulation and reconstruction tools on cosmic rays very soon after the detector becomes operational
- MicroBooNE has a driven and enthusiastic workforce of postdocs and graduate students, who are pushing a very aggressive cosmic-ray based commissioning plan.
- We expect to be ready and hungry for protons very soon after the first argon fill.

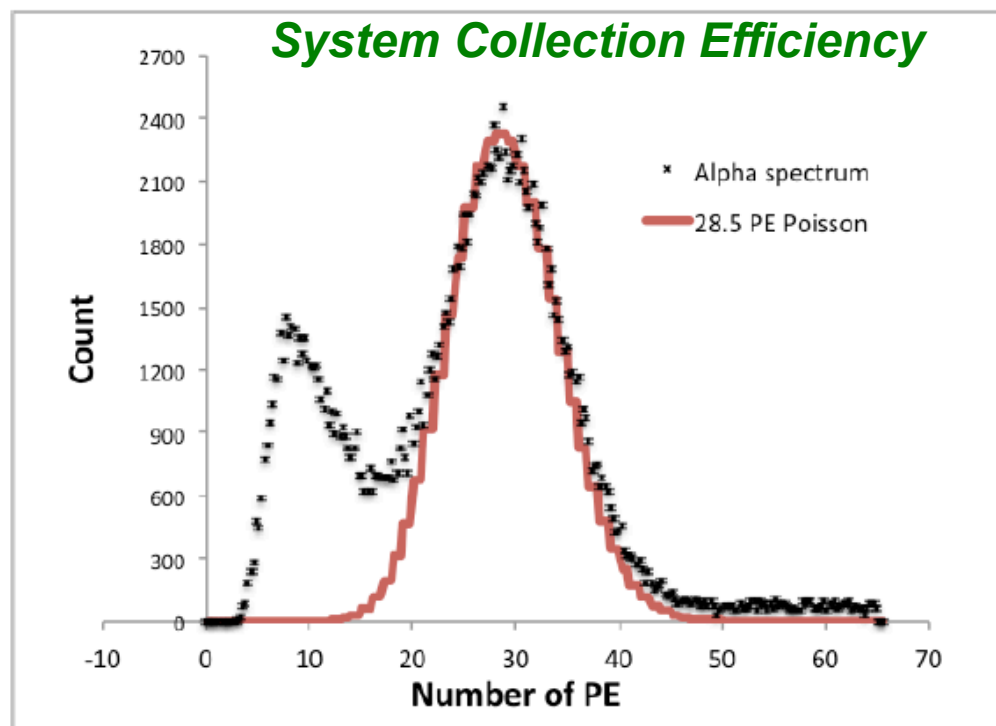
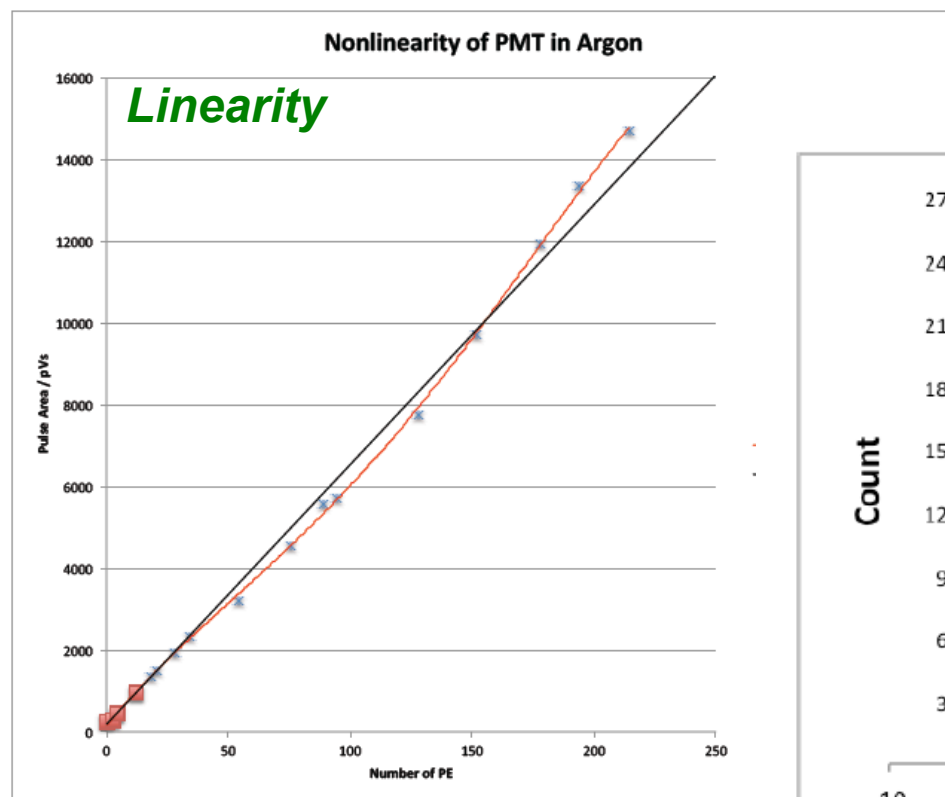
Thanks For Your Attention!





Backups

Vertical Slice Test Results



+ Many more important system characterizations