

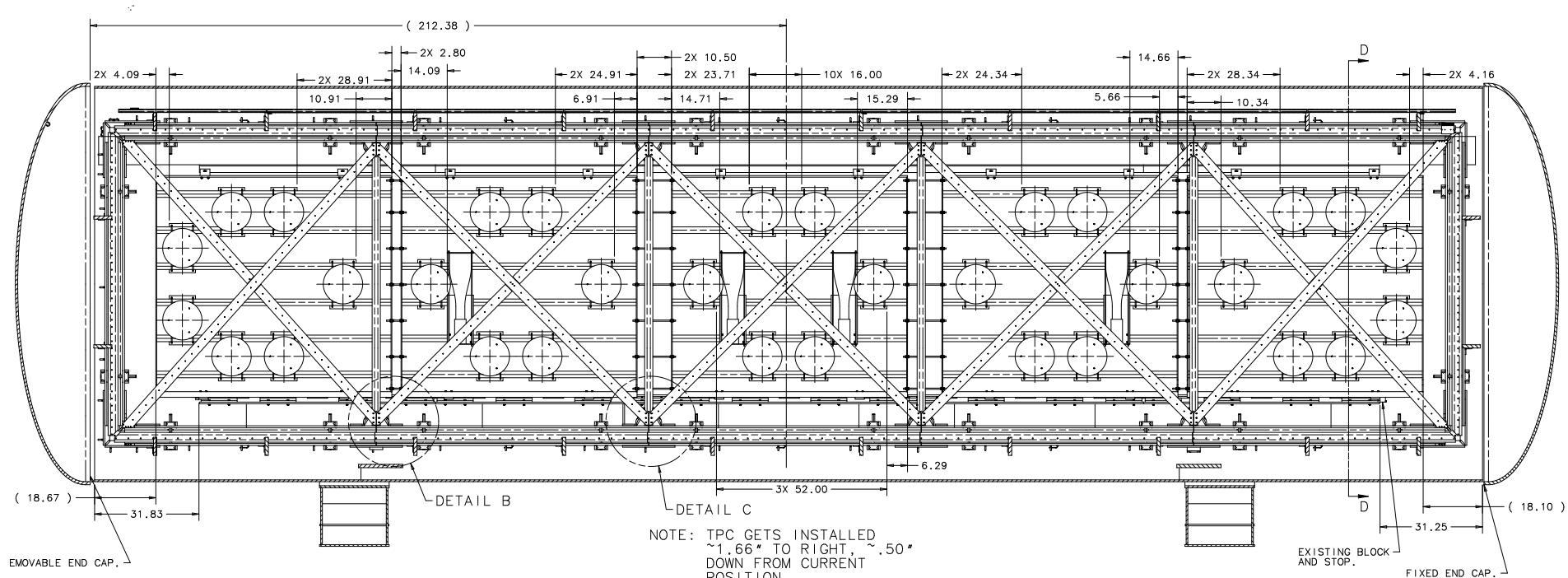
PMT Paddle Proposal to the μ BooNE Technical Board

M. Toups, on behalf of the PMT group
06/23/13



What is the “PMT Paddle Proposal”?

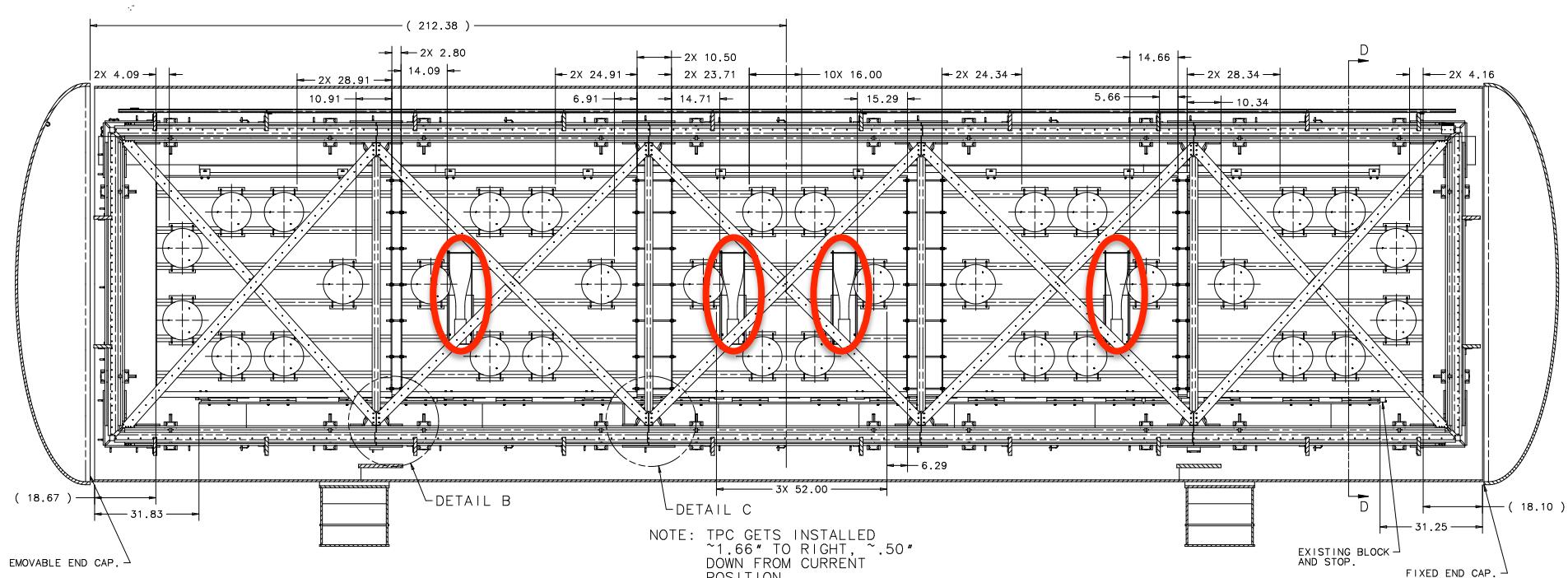
To install 4 TPB-coated adiabatic light guides coupled to 4 cryogenic 2" PMTs in MicroBooNE:



R. Reinert

What is the “PMT Paddle Proposal”?

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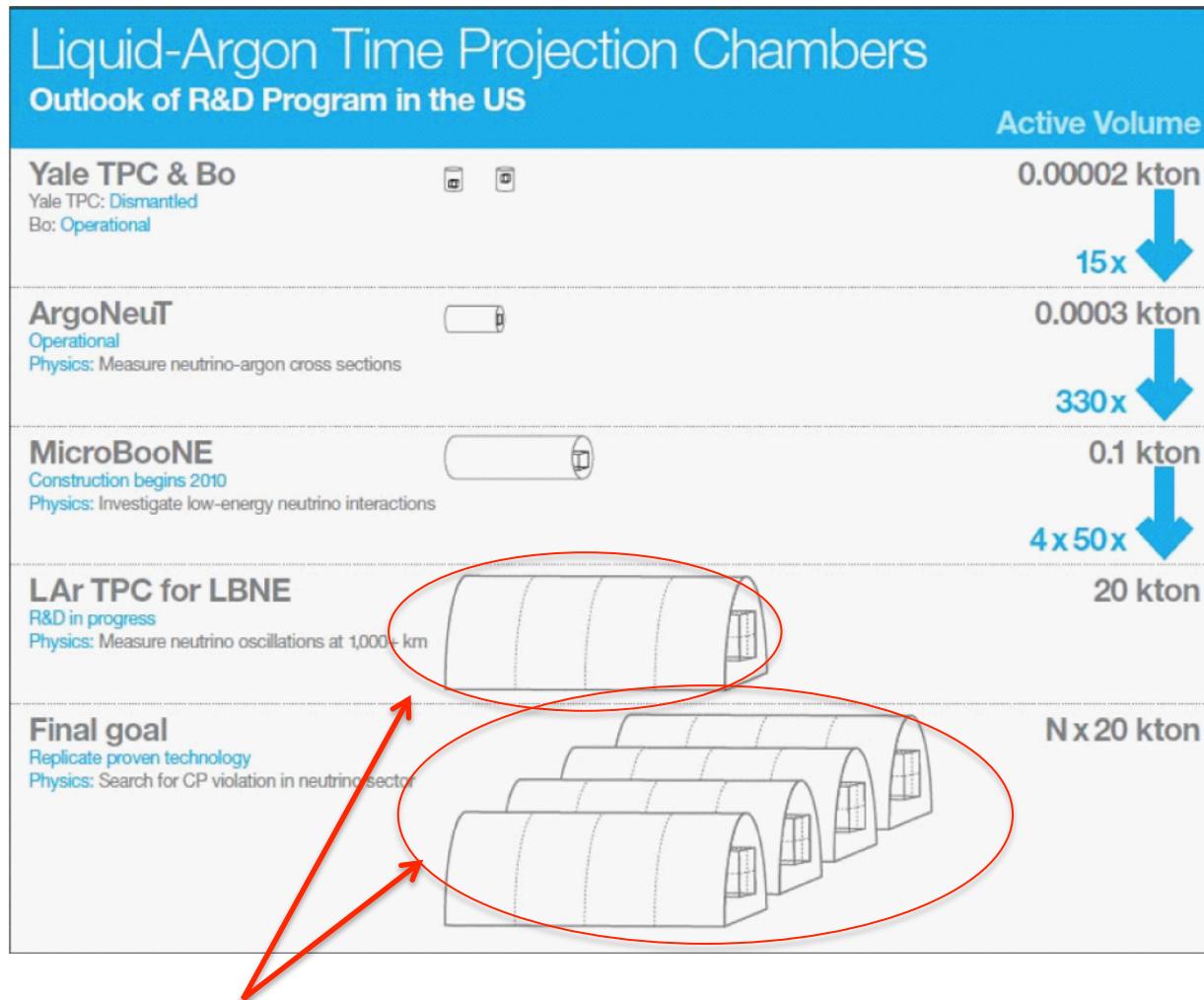
R. Reinert

What is the “PMT Paddle Proposal”?

To install 4 TPB-coated adiabatic light guides coupled to 4 cryogenic 2" PMTs in MicroBooNE:

- PMT HV, cables, feedthroughs, and electronics all designed with 8 spare channels
 - Propose to use 4 of these for PMT paddles
- See DocDBs 2496, 2495, and 2426

Why?



Light guide detectors under serious consideration for these

----- Original Message -----

Subject:prototype LBNE photon detectors in MicroBooNE

Date:Wed, 5 Jun 2013 12:11:35 -0400

From:Stuart Mufson <mufson@astro.indiana.edu>

To:Janet Conrad <conrad@mit.edu>

Hi Janet,

Thank you for hosting the LIDINE2013 Conference last week at Fermilab. Bringing together the international experts in scintillation light generated in liquid noble gasses was a great learning experience. I came away with a better appreciation of how our work here at IU fits into the larger picture.

I was particularly intrigued by Christina's, Teppei's, and Ben's talks on the work going on in your lab. I think your idea to mount prototype LBNE-type photon detectors in MicroBooNE is an excellent one. As the manager for the LBNE photon detector system, I would very much like to encourage all prototyping activities. The baseline design we are developing at IU is far from a proven concept. The fiber readout (CSU) design and commercially made light guide paddles (LBNL) are no further along in development than your MIT design, probably less. The fact that your system has already been prototyped and costs nothing to deploy, and the fact that it has almost no impact on MicroBooNE seems to make the choice to deploy it almost a no-brainer.

I emphasize that your work is important because there really is no design yet for the LBNE photon detectors. Installing your PDs in MicroBooNE would provide valuable information on how they stack up against the other prototypes currently being studied in a large LAr volume.

Regards,

Stuart

Readiness For Installation

- All needed materials are at FNAL
 - Paddles have already been coated
 - Paddle mounts have been cleaned and assembled
- Paddle installation was tested during “dry run”



Technical Board Charge for Paddle Proposal

1. From a technical standpoint, are there any negative impacts on the detector performance from installation and operation of the paddle system? Are there any failure modes of the paddle system which could incur a negative impact on the detector performance both in the short term (6 months) and long term (3+ years)?
2. Is there any cost or schedule impact on the project and/or collaboration from installation and operation of the system?
3. Will the addition of the system produce publishable results?

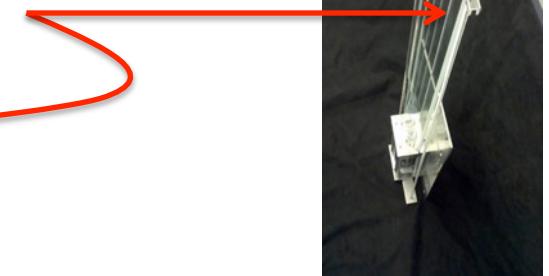
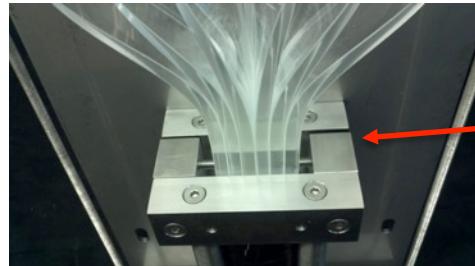
B. Flemming

Technical Risks

- TPB-coated acrylic and polycarbonate tested in the Materials Test Stand (DocDB-2618)
 - Acceptable results in liquid phase



- PMT paddles cryo-cycled dozens of times at MIT
- Mounts restrain paddle at both ends



Impact on Schedule and Cost?

- PMT paddles are ready for installation
 - No appreciable impact on PMT installation schedule
- PMT paddle installation timed during “dry run”
 - PMT paddle installation time very short compared to time required to install and place PMT rack itself
- No additional cost to experiment to install and operate
 - There are no procurement costs for this system

Publishable Results

- Demonstration of lightguides for LArTPCs is publishable:



Demonstration of a lightguide detector for liquid argon TPCs

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ABSTRACT

We report demonstration of light detection in liquid argon using an acrylic lightguide detector system. This opens the opportunity for development of an inexpensive, large-area light collection system for large liquid argon time projection chambers. The guides are constructed of acrylic with TPB embedded in a surface coating with a matching index of refraction. We study the response to early scintillation light produced by a 5.3 MeV α . We measure coating responses from 7 to 8 PE on average, compared to an ideal expectation of 10 PE on average. We estimate the attenuation length of light along the lightguide bar to be greater than 0.5 m. The coating response and the attenuation length can be improved. As a benchmark of the present capability, we show a 30 paddle design meets the requirement of the MicroBooNE Experiment, which is efficient triggering on 40 MeV protons produced by neutrino neutral current elastic scatters.

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- In particular, side-by-side comparisons of the PMT paddles and μ BooNE 8" PMT assemblies will be of interest
- Also, MIT has a strong track record for data-driven senior theses

Thank you

