



Large-Area WLS development Status

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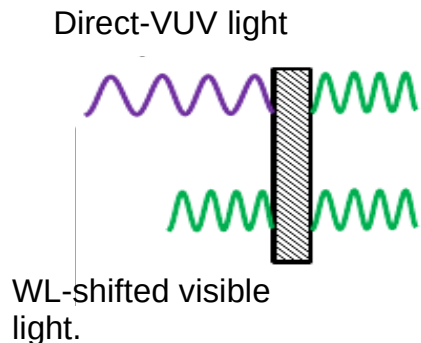
- Lots of (exciting) activity ongoing – expect new results soon.
- Here I will present overview of why we care and recent progress.



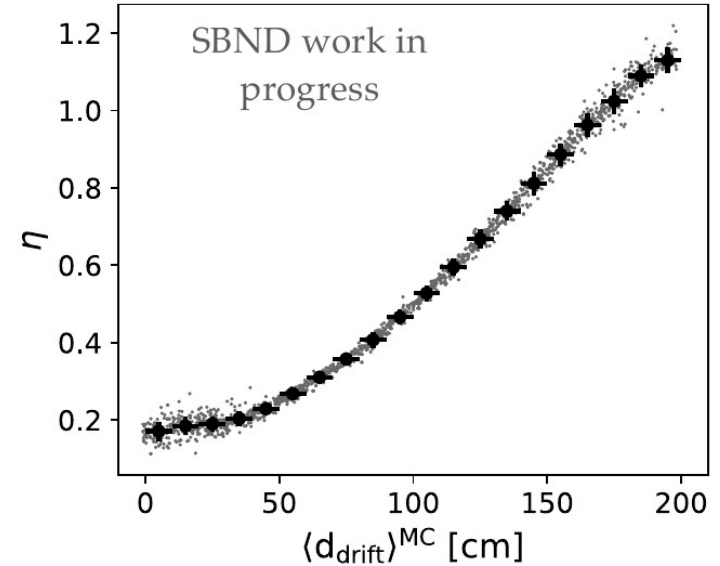
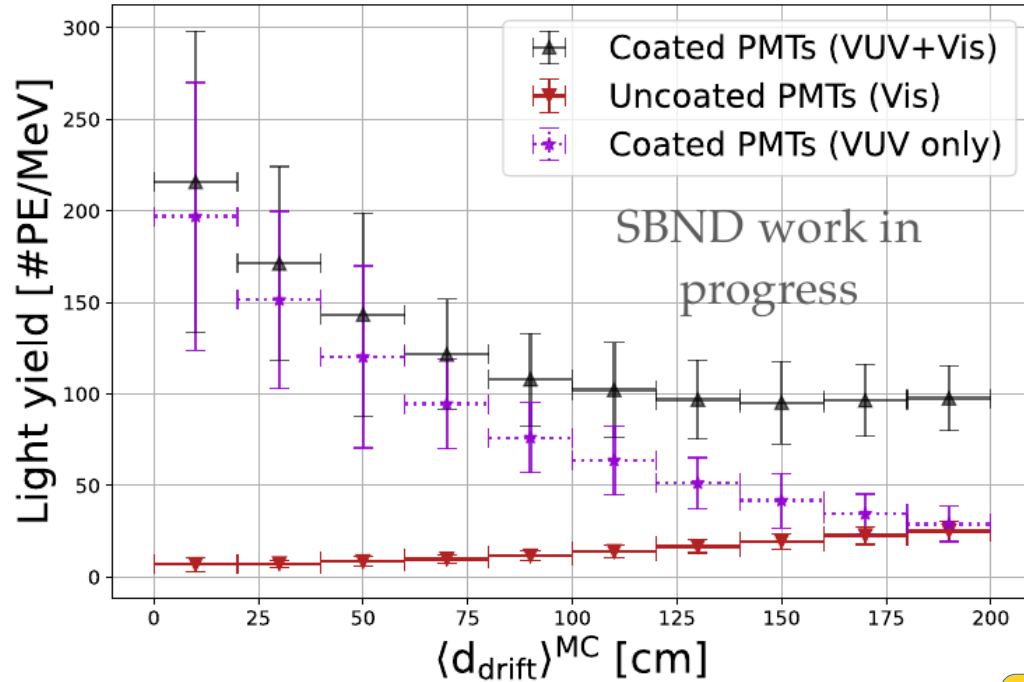
Large-Scale WLS Surfaces

- Wavelength-shifter covered reflector foils installed on the CPA (or field-cage) can enhance the light collection efficiency in large LAr neutrino detectors.
- Would improve uniformity (useful for triggering), timing and ~~potentially~~ enable x-position resolution with light.
- Part of task 9.4 is to find an applicable solution for future neutrino LArTPCs, e.g. DUNE.

- LAr VUV light is absorbed by most materials – light impinging on walls is lost.
- Covering the surfaces with reflective foils covered with a wavelength-shifter compound recovers this light.
- To profit from this, the sensitive detectors need to be sensitive to visible light as well as VUV.
- Most probable WLS to consider are:
 - TPB: known and used in large scale projects.
 - PEN: a new idea that would simplify engineering.
- Ideally, need an efficient and durable solution.



Example applications



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Questions we can ask

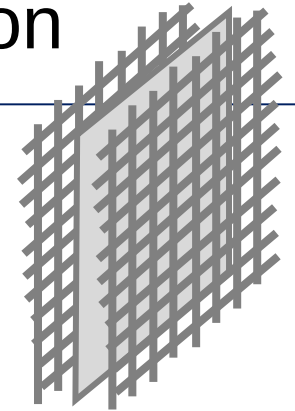
- How do large-area WLS surfaces perform in a neutrino detector?
 - SBND at Fermilab is turning on as we speak!
- PEN as an alternative to TPB:
 - How does it perform at large scales?
- Understanding TPB film surface behaviour.
 - Can we explain/understand measurements hinting at TPB detachment?

SBND turning on

- SBND will run with TPB-coated reflector foils on the cathode.
- 38m² of area on double sided plates.
- Detector is full of liquid argon as of last week – purification ongoing.
- First tasks will be to monitor performance of the system in situ!
- Paper on performance of MC is in collaboration review (CIEMAT contribution)



Mesh



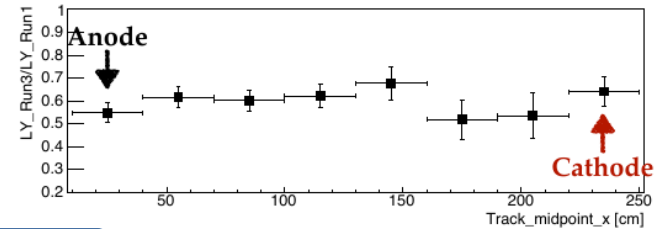
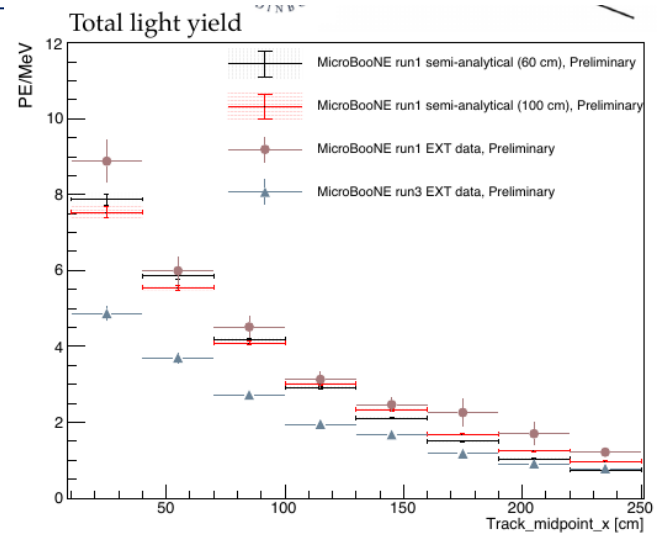
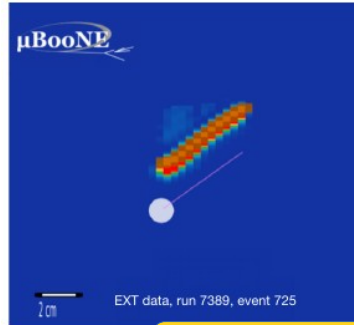
Mesh

Foil plates



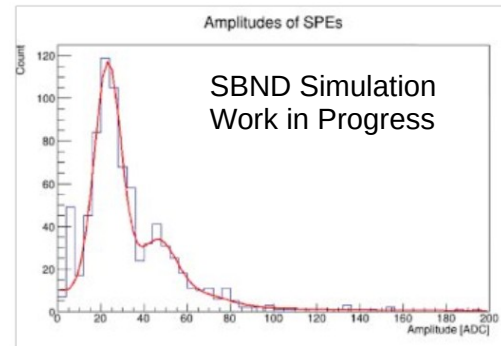
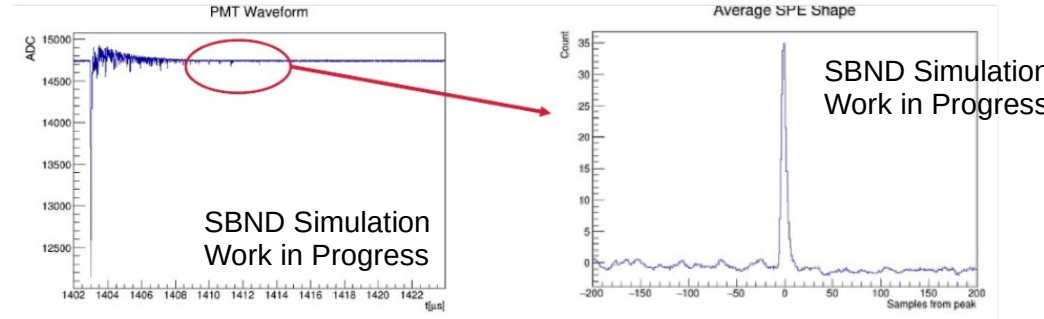
Measuring LY

- Methods developed with MicroBooNE:
- Using isolated proton events, Michel electrons or whole muon tracks.
- Proton publication coming soon.



SBND PMT Gain calibration

- First ste: calibrate PMTs on single PEs from argon scintillation.
- Demonstrated on MC, soon to look at data.



PEN tests at CERN

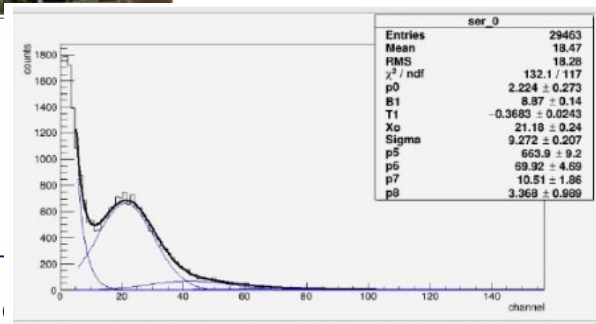
- A dedicated test has been performed at the CERN neutrino platform test facility to measure the performance of large-area PEN sheets as a WLS
- 19 days of data acquired



feedthrough connectors for LED, PMT and SiPM power and signal, and capacitance probe



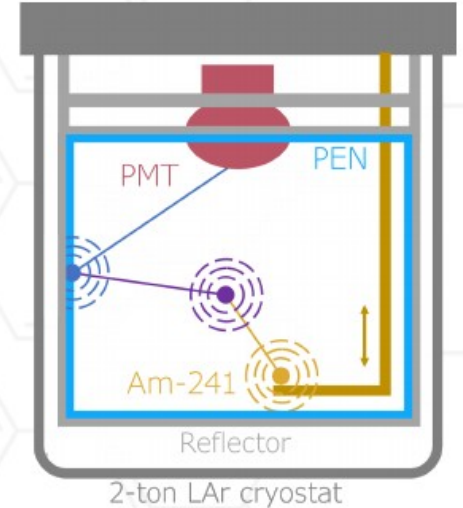
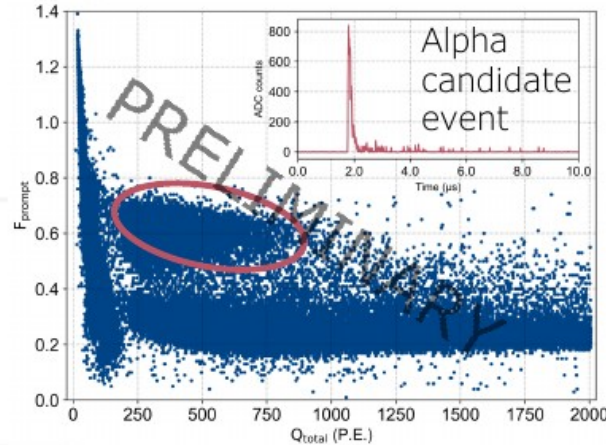
PMT



Preliminary results

- Demonstrated operation of large-area WLS.
- Analysis to determine precise efficiency is ongoing.

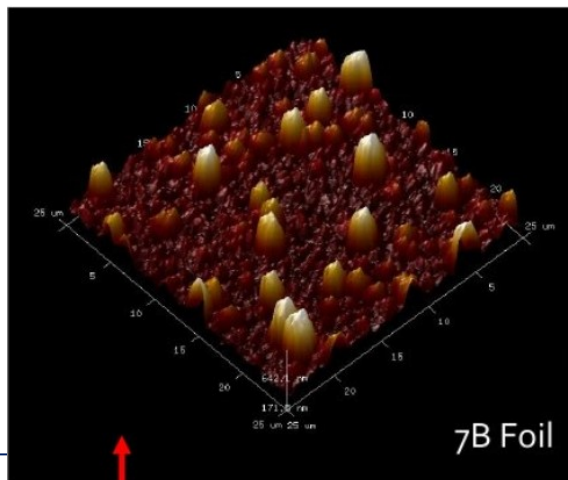
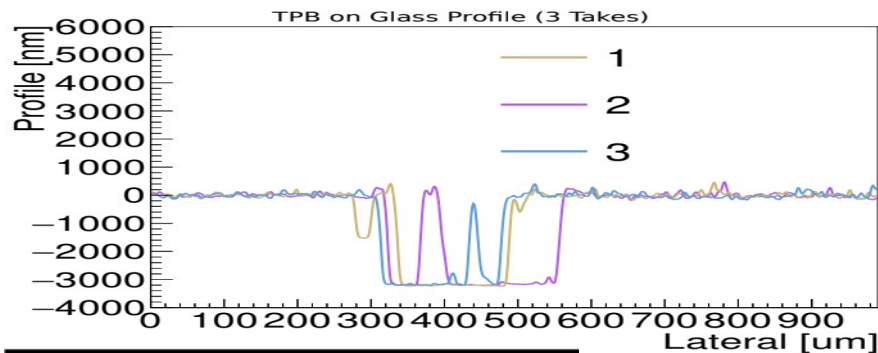
- Validate light yield & light yield stability
- 4 m² of ESR+PEN Q53 25 μm



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TPB film surface studies

- TPB deposited via Low-Temperature Evaporation.
- Working on setting up infrastructure with liquid argon to test long-term soaking effects.



Conclusions

- Large-area WLS-coated surfaces can enhance performance of LArTPC neutrino detectors.
- We are about to obtain data from SBND – largest WLS-coated surface to date.
- Analysis from smaller prototype at CERN ongoing
- Studies of TPB-film performance planned for summer.