Contributions of Liverpool researchers to SBND and Mu2E and secondment plan

INTENSE mid-term review, 28 November 2022

UNIVERSITY OF LIVERPOOL

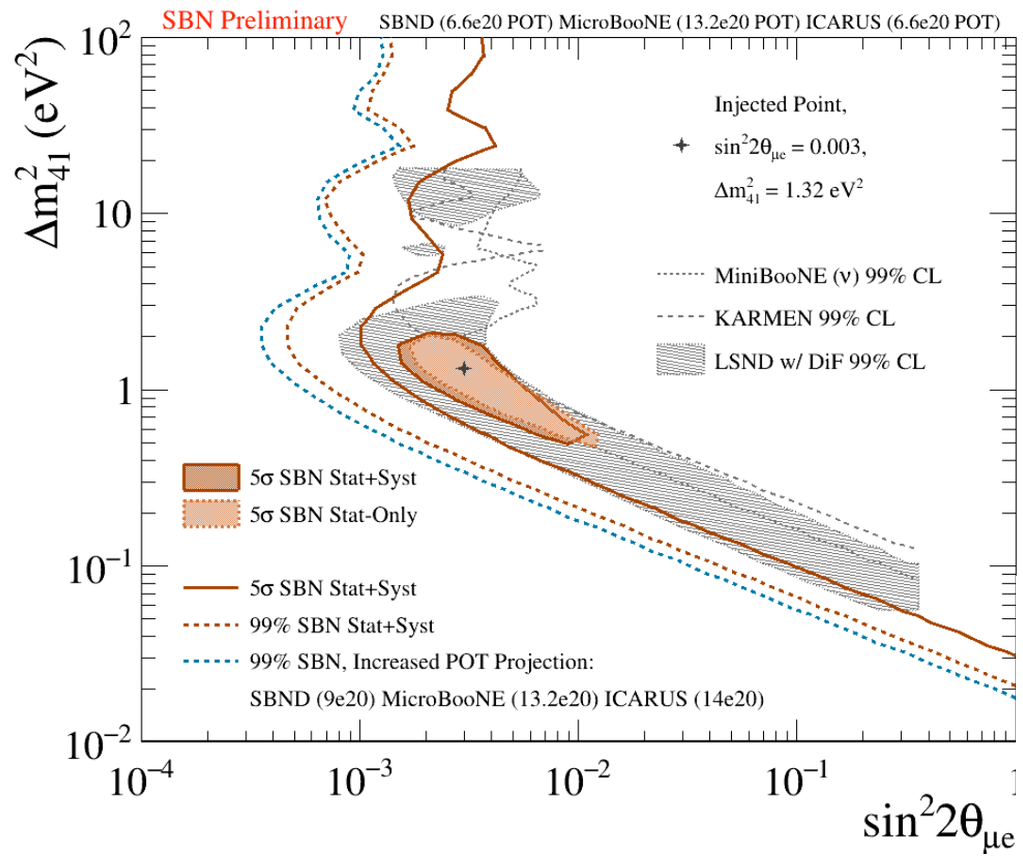
Liverpool contributions to SBND

Liverpool is a founding institution of SBND, with important roles in detector construction and physics studies

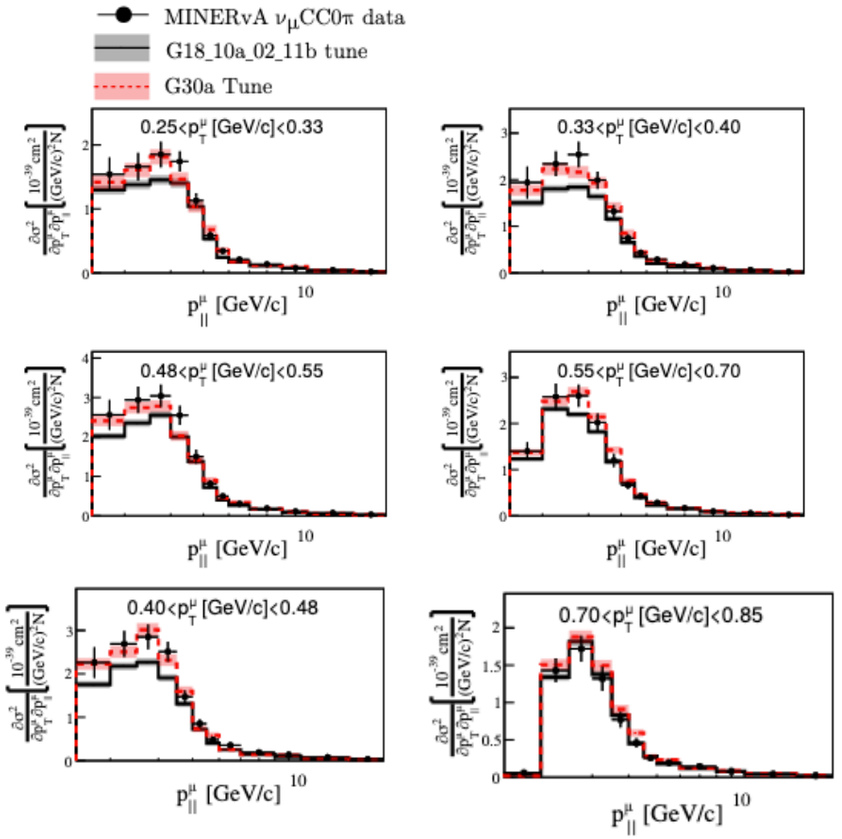
Prof. Costas Andreopoulos is Physics co-Coordinator of SBND and member of the SBND Executive Committee.
He is also the coordinator and lead author of the ***GENIE*** neutrino interaction simulation used by all Fermilab experiments, and the coordinator and lead author of the ***VALOR*** oscillation analysis (previously developed for T2K) used by SBND.

Dr. Marco Roda is SBND Simulation and Calibration WG co-Coordinator.
He a lead author of ***GENIE***, and developed the corresponding global analysis that informs the nominal simulation model for SBND.

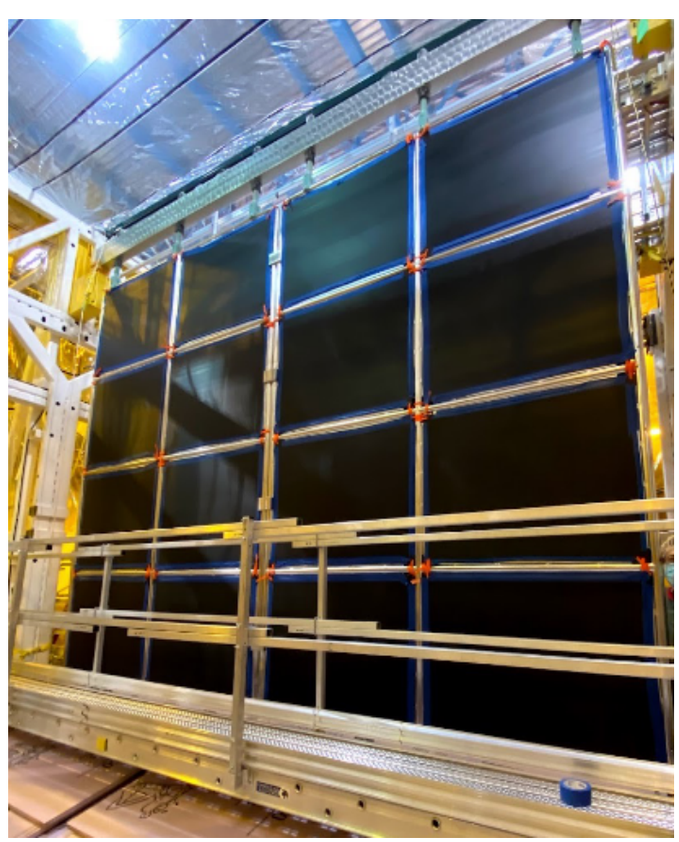
Dr. Kostas Mavrokoridis was the SBND L2 TPC Manager and had a crucial role in the management of the design and construction of four Anode Plane Assemblies (APAs), field cage, Cathode Plane Assemblies (CPAs) and high-voltage feed-through. The CPAs were constructed at Liverpool. **Dr. David Payne** (L3 CPA Manager) performed metrology flatness measurements of the CPA and has led its assembly at FNAL.



SBN electron-neutrino appearance sensitivity calculation using VALOR (https://valor.pp.rl.ac.uk)



Recent GENIE (http://www.genie-mc.org) tuning campaigns (arXiv:2206.11050, arXiv:2106.05884, arXiv:2104.09179) Inform the nominal SBND predictions



Liverpool-built SBND CPA at FNAL

Planned secondments of Liverpool SBND researchers

Prof. Costas Andreopoulos (2 weeks in 2023, 2 weeks in 2024)

Coordination of first SBND cross-section analyses, and development of SBND inputs (systematic constraints, extrapolated spectra at ICARUS location) to the joint SBN analysis.

Dr. Marco Roda (2 weeks in 2023, 2 weeks in 2024)

Coordination of SBND neutrino interaction modelling and tuning activities.

Dr. David Payne (8 months in 2023 + 4 months in 2024) [*]

Play a crucial role in SBND commissioning and operations (Significant previous experience with LArTPC construction, and as run coordinator for the T2K near detector.)
Payne will be the most senior SBND UK physicist based at FNAL.

9 months of secondments in 2023
5 months of secondments in 2024

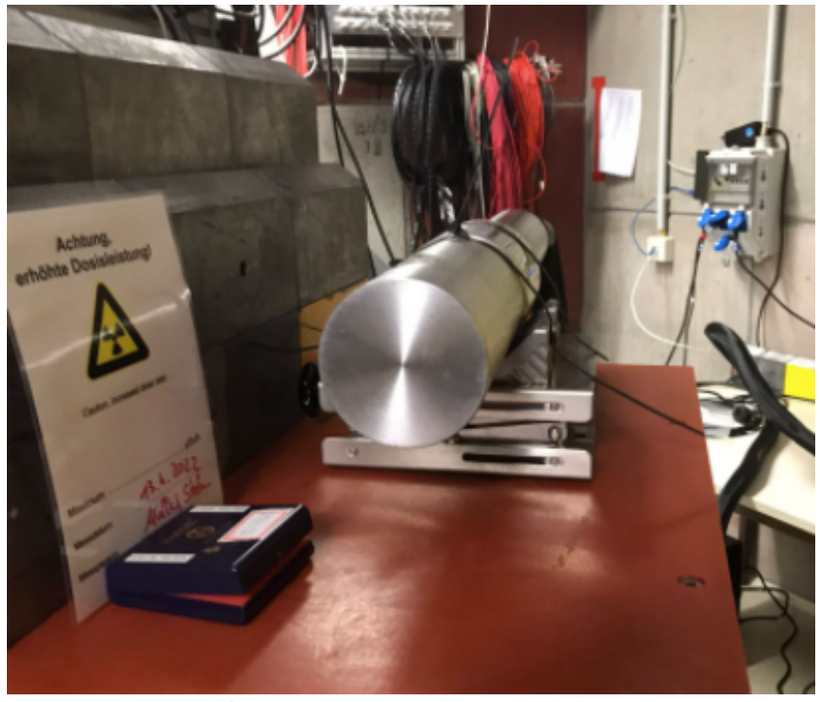
[*] 12-month secondment funded by INTENSE, part of a planned 18-month long-term attachment to FNAL

Liverpool contributions to Mu2E

Liverpool delivers the High Purity Germanium (HPGe) detectors for the Stopping Target Monitor (STM).

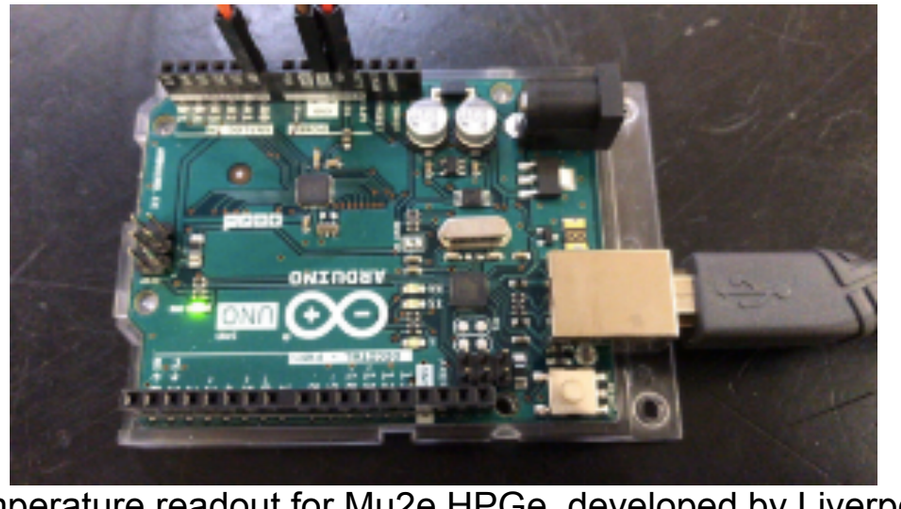
Also, Liverpool researchers are:

- Working on fast online tracking algorithms;
- Developing simulations of the particle composition and momentum profile of the beam;
- Developing a background subtraction algorithm for the STM;
- Perform R&D towards the Mu2E-II detector upgrades.

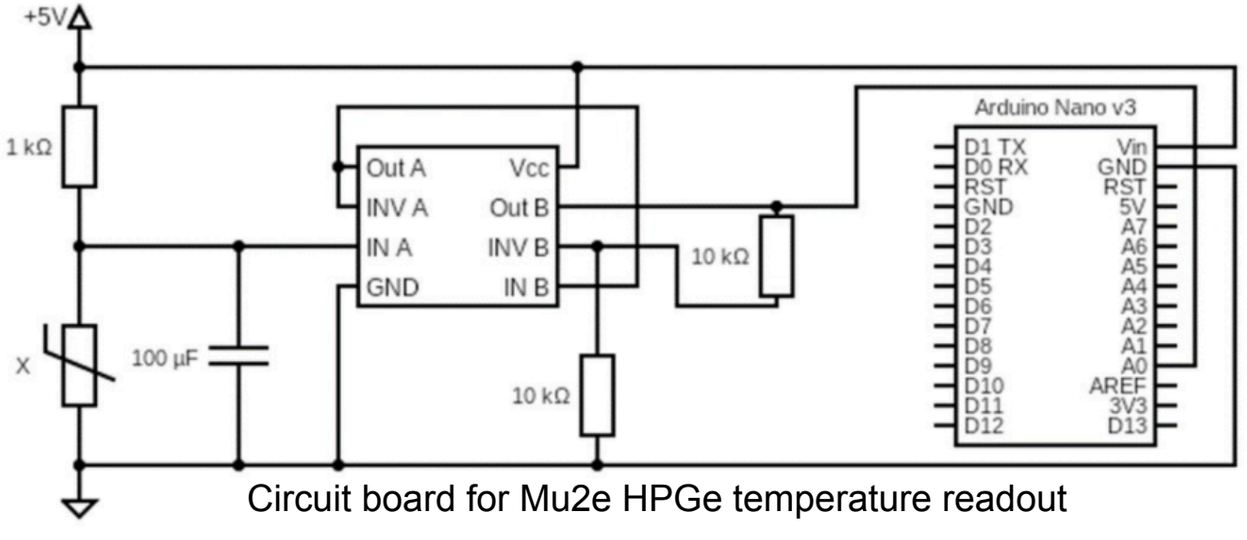


Mu2e HPGe detector at HZDR test beam

The HpGe Detector in the testing labs at Liverpool



Temperature readout for Mu2e HPGe, developed by Liverpool



Circuit board for Mu2e HPGe temperature readout

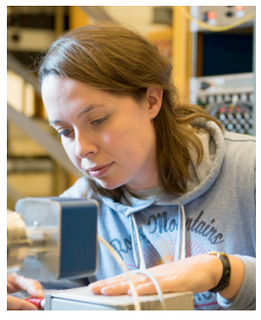
Planned secondments of Liverpool Mu2E researchers

Dr. Joe Price (8 weeks in 2023)
HPGe installation to main hall

Professor Laura Harkness-Brennan (4 weeks in 2023)
HPGe installation to main hall

8 months
of secondments
in 2023

Dr. Dan Judson (4 weeks in 2023)
HPGe installation to main hall



Dr. Saskia Charity (12 weeks in 2023)
Integration of the HPGe temperature read out with Mu2e slow control,
and installation of HPGe into main hall

Professor Themis Bowcock (4 weeks in 2023)
Support dedicated low energy EDM run using FNAL ring.