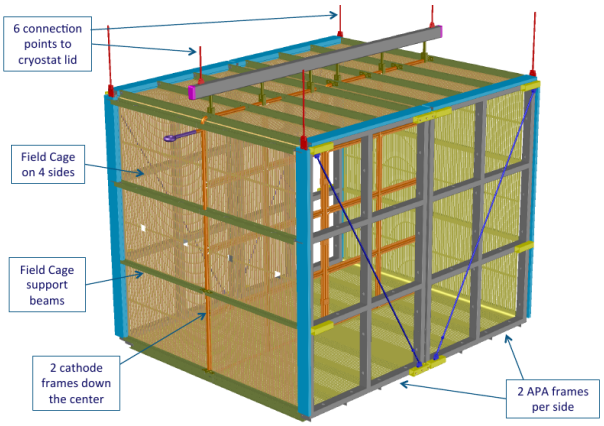
SBND TPC development and construction

Nicola McConkey

Short Baseline Near Detector (SBND) is a Liquid Argon Time Projection Chamber (LAr TPC) which will operate in the Booster Neutrino Beam (BNB) at Fermilab, at a distance of 110 m from the target. The 112 tonne active volume detector will make precision measurements of the neutrino interaction cross section in argon, as well as forming the near detector for the short-baseline neutrino (SBN) programme at Fermilab. In combination with the MicroBooNE and ICARUS-T600 detectors, this experiment provides a powerful opportunity to understand observed neutrino anomalies, and has the potential to make precision measurements of oscillations to sterile states, and has the potential to settle the question of the existence of the sterile neutrino.

The Fermilab Intensity Frontier Fellowship will enable me to play a significant role in the construction and assembly of the LAr TPC which forms the core of this experiment. My involvement will be in four key areas. The first 6 months will be spent at University of Sheffield, working on detector component construction, and development of the TPC assembly process. The latter 6 months will be based at Fermilab, preparing the TPC assembly space, and being directly involved in the initial assembly stages.

The SBND TPC, as shown below, will have a $5\,\mathrm{m} \times 4\,\mathrm{m} \times 4\,\mathrm{m}$ active volume, with two 2 m drift regions. The charge is drifted from a central cathode (CPA), to wire readout planes at either end of the detector. These readout planes each consist of two coupled Anode Plane Assemblies (APAs).



An APA consists of a steel frame of dimensions $2.5\,\mathrm{m} \times 4\,\mathrm{m} \times 0.15\,\mathrm{m}$, which supports three wire readout planes; a vertical collection plane (Y), and two induction planes (U,V) at $\pm 60°$ angles to the vertical. In order to minimize the cost of the readout electronics, each APA has cold readout electronics on two edges only. The U wires of each APA are electrically connected via flexible jumper connections at the adjoining edges. The V wires are similarly connected.

The four APA frames for the SBND project will be manufactured in Sheffield, and I will continue to play the role of the interface to the project for the engineers building the frame. This will allow me to interact and liase with the engineers working on the project to ensure the timely completion of the components to the standard required.

In parallel with my involvement with the APA frame construction in Sheffield, I will be involved with testing of the assembly procedure for the APA sub-assemblies, which constitute the wire planes. The detector assembly process and tooling has been outlined as part of the design stage, and further work will take place to finalise and test this, using prototype APA frames which are being manufactured at University of Chicago.

The final assembly of the TPC will take place at Fermilab, in the D0 Assembly Building. It is intended to spend the months prior to that setting up the assembly facility, and procuring the tooling required for the assembly. I anticipate being based at Fermilab to be directly involved in this process.

The detector assembly will begin with the APA sub-assembly. The initial stages of the detector assembly are the ones which are most relevant to my involvement to date, and the completion of these tasks will fall within the timescale of this fellowship.