
MicroBooNE/SBN

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In a nutshell

- MicroBooNE is investigating the MiniBooNE anomaly
 - Look for an excess of low energy electrons
 - Look for an excess of low energy photons
 - Also, cross section measurements
- SBN will search for sterile neutrinos
 - Look for a changing spectrum across 3 baselines
 - Also, cross section measurements
 - Also, exotic searches for new physics (dark matter, etc)
- All use LArTPC technology, \sim GeV beam energy

How is SBN different to others?

- Argon target
 - We need **calculations on argon!**
- Low energy
 - Need estimates at a **few hundred MeV**
- Fine granularity
 - Models need to predict **low energy particles**

MicroBooNE-specific concerns

These are also concerns for SBN!!!

- What is the ν_{μ} / ν_e cross section ratio?
 - What if one requires a proton (to reject cosmics more easily)?
 - What if this proton threshold is higher/lower?
- What is the single-photon production rate?
 - We have very little to go on – one model in GENIE, no neutrino data to use
 - Luis has a model which we're looking at – getting it in GENIE would be best
 - Efficiency estimation needs a model we believe – do we believe our model?
 - In SBN these are backgrounds to some exotic searches

Energy Reconstruction

- If SBN is to draw acceptance/rejection contours for sterile neutrinos, we need to correlate observables with true neutrino energy
- Particles below our threshold, or those that are invisible (neutrons), need to be accounted for
 - We're looking for oscillation signatures at a few hundred MeV. Best possible proton threshold is $\sim 20\text{MeV}$ – 5-10% of the neutrino energy.

Final state interactions

- Pion absorption and charge exchange really matter
- Protons close to threshold losing energy will fall below threshold
- Can e-Ar exclusive data be used? (probably)
- Better way to estimate uncertainties?
 - Reweighting is hard, re-simulating is hard for a different reason

All needs to be on argon!

Radiative effects

- Same concerns as everyone else
- LArTPC **might** have the resolution to observe radiated photons collinear with the muon? No promises though...
- **Argon target** – how do these effects scale with A/Z ?

Need more models

- NC-MEC
 - We have one model, the empirical MEC model
 - There is a CC analogue, and it isn't very good at predicting our data
- Single photon production
- Can lattice QCD do better?
 - Error estimation in particular

What can we do with our own data?

- SBN will have lots of data...
- Are there measurements we can make that constrain pieces we can't measure?
 - Or, that will help other experiments?
- Example:
 - Measure final state protons, infer final state neutrons?

Does your MC predict this?

