MiniBooNE-DM (R.L. Cooper on behalf of the MiniBooNE-DM Collaboration)
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Experimental Setup In 2014, the MiniBooNE-DM collaboration completed a beam dump run at the Fermilab Booster Neutrino Beamline (BNB) in order to search for accelerator-produced, sub-GeV dark matter. The BNB 8 GeV-proton beam was steered around the neutrino production target to a steel beamstop 50 m downstream. This suppresses neutrino production by almost a factor 50 because neutrino scatters are backgrounds to the dark matter search. The dark matter then passes through 487 m of dirt between the beam stop and the 800-ton MiniBooNE detector. The dirt stops all typical beam backgrounds (e.g., muons, neutrons, etc.).

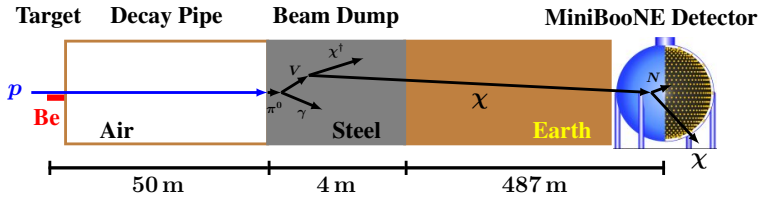

Figure 1: Beamline and detector setup.

Current Results A total of 1.86×10^{20} protons were delivered to the beam dump. A first analysis of dark matter-nucleon elastic scattering has recently been completed (arXiv:1702.02688 [hep-ex]). We found no excess of dark matter events above background in this search which is systematics-limited. A significant reduction of the overall uncertainty was achieved by simultaneously fitting the beam off-target dark matter signal with three additional samples because there is significant correlation of systematic errors between these samples. The final confidence limit is shown in the figure below.

Future Work The MiniBooNE-DM collaboration is currently working on the dark matter-electron elastic scattering channel and an inelastic interaction that proceeds through a Δ resonance decaying to a neutral pion. The neutral pion has a characteristic final state of two electron tracks from the pair of photons converting in the detector. Both of these channels show enhanced sensitivity relative to the nucleon elastic scattering channel. Furthermore, the BNB consists of a number of narrow RF bunches spaced by 19 ns. Because the dark matter travels nearly 500 m at subluminal speeds, it is possible to analyze the timing distribution of events between RF bunches to further constrain more massive dark matter.

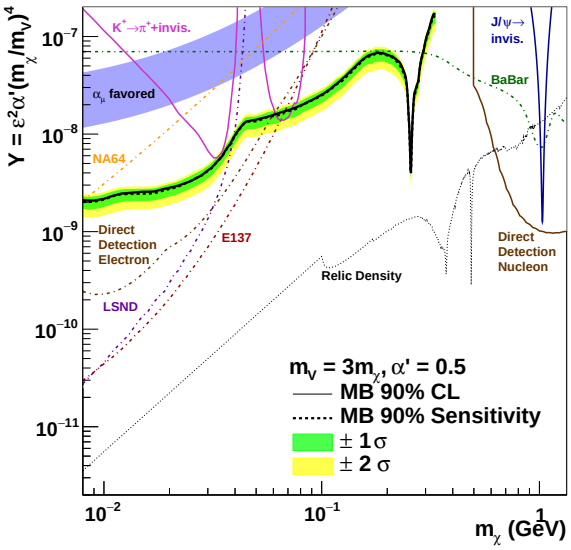

Figure 2: Dark matter-nucleon confidence limit.