May 2014 MicroBooNE Quarterly Report

1. Cosmic-Ray Tagging (Wes Ketchum)

The Monte Carlo simulations include cosmic-ray overlay events, as shown in Figure 1. Work has begun on an algorithm to quickly identify tracks in MicroBooNE that are associated with cosmic ray background and not to signal neutrino events. The general idea is to match tracks to phototube hits and to use the fast phototube timing to tag tracks that are out of time with respect to the 1.6μs beam spill. More specifically, the algorithm looks for events with a phototube flash during the beam spill and assumes that a given track is associated with the flash. The algorithm then tags the track if the flash hypothesis is inconsistent with the actual phototube flash. Figure 2 shows a preliminary Monte Carlo simulation of cosmic-ray tracks and a neutrino-induced track. The cosmic-ray tracks are tagged as inconsistent. Additional algorithms can identify cosmic-ray tracks that enter and exit the TPC, and those that are inconsistent in drift-time with neutrino interactions. Work is moving forward in evaluating the rejection and misidentification rates of these algorithms.

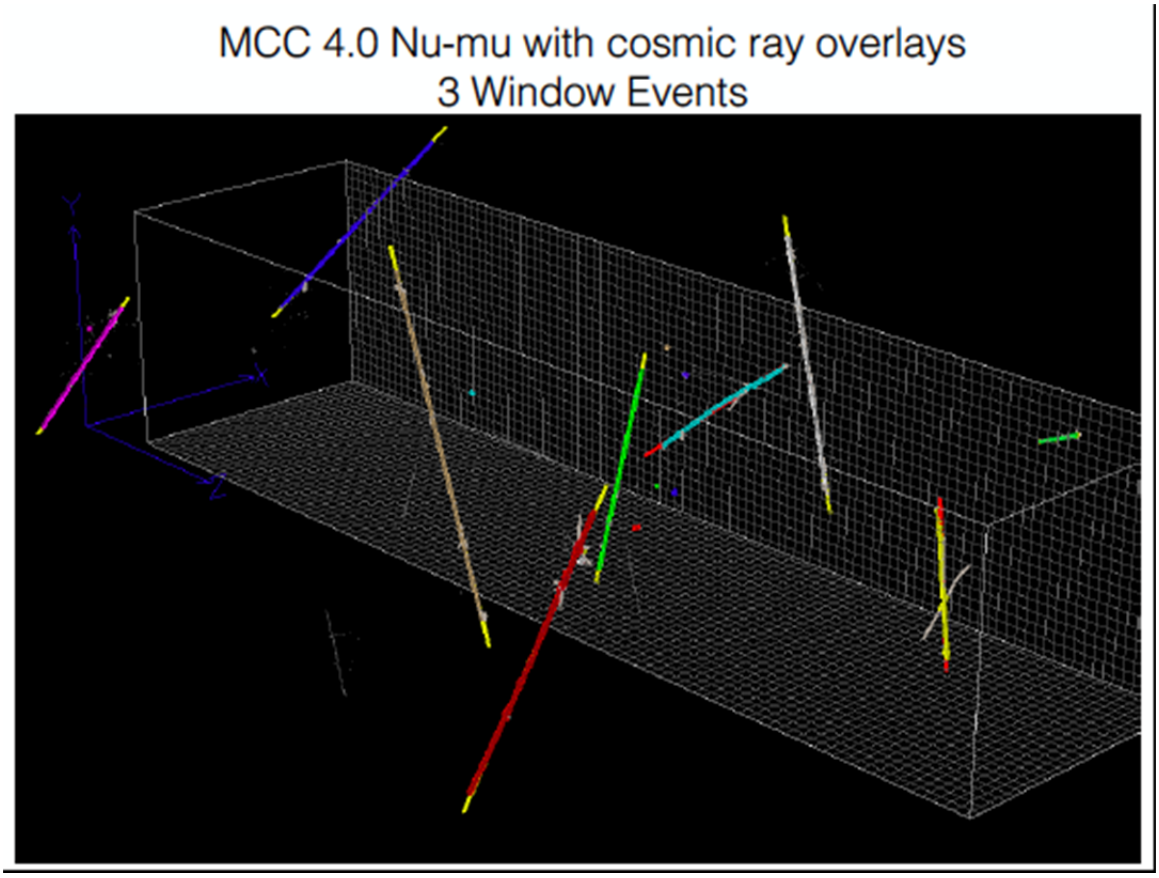

Figure 1: Monte Carlo simulations include cosmic-ray overlay events.

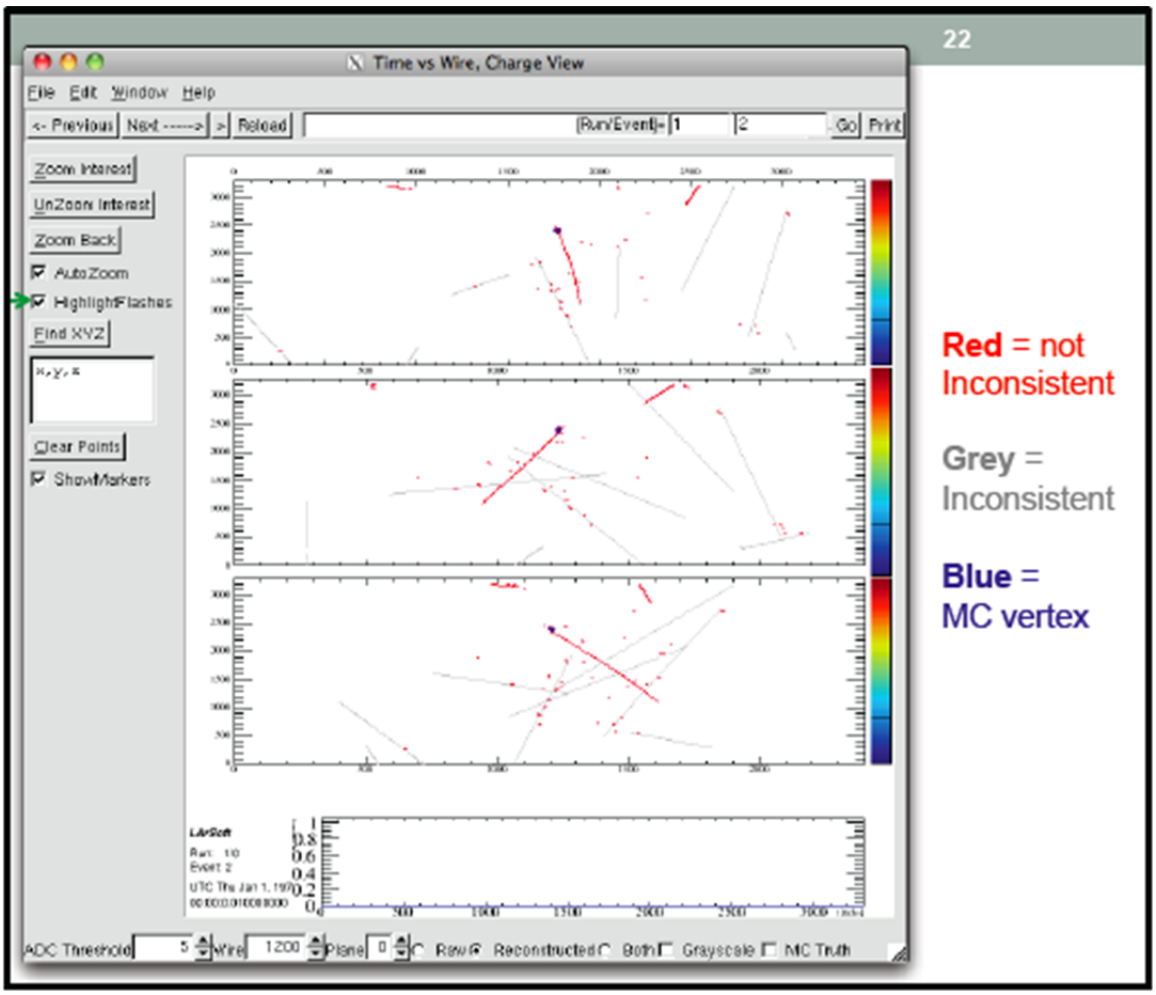

Figure 2: A preliminary Monte Carlo simulation of cosmic-rays tracks and a neutrino-induced track. The cosmic-ray tracks are tagged as inconsistent.

2. Calibration Test of MicroBooNE Electronics (Wes Ketchum)

A calibration test of the MicroBooNE electronics and DAQ system has been completed successfully. Figure 3 shows the image of a 50μs waveform that was recorded during the calibration test. The two peaks correspond to the rising and falling edges of the waveform.

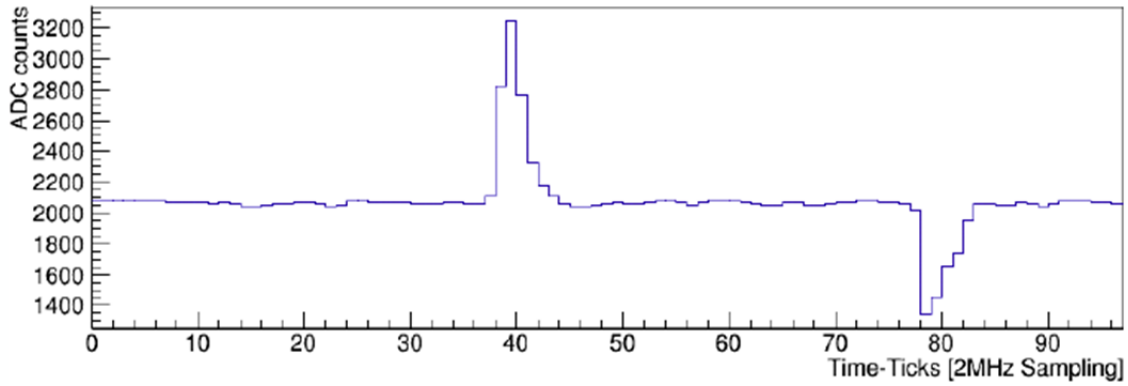

Figure 3: The image of a 50μs waveform that was recorded during the calibration test.

3. Event Reconstruction (Wes Ketchum)

There has been good progress on the reconstruction of neutrino events. Figure 4 shows the event reconstruction of a simulated charged-current event. After a 2D reconstruction in each plane, objects are matched among planes to form 3D charged-particle tracks and electromagnetic showers. The deposited charge is converted to energy, and particles are identified from dE/dx versus range.

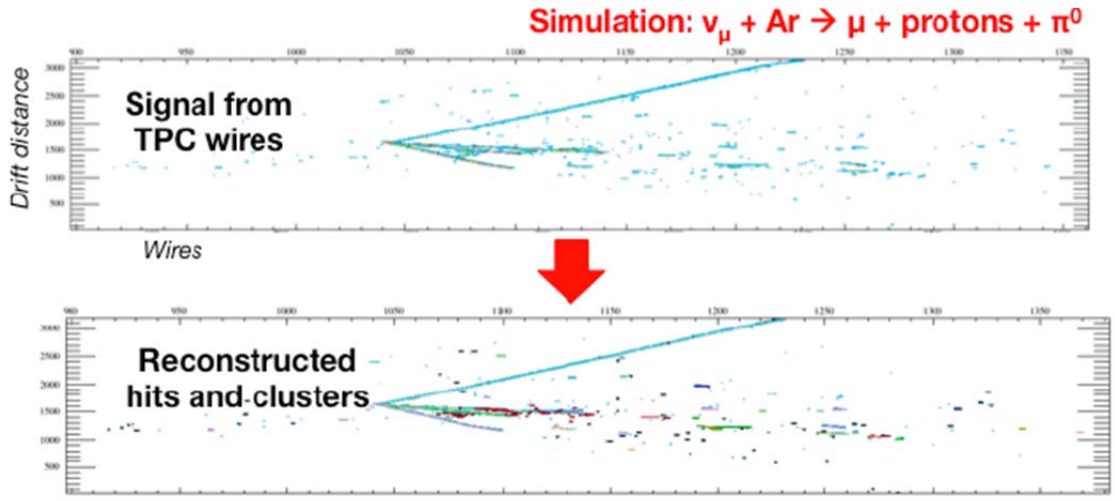

Figure 4: The event reconstruction of a simulated charged-current event.