MiniBooNE mineral oil tests at IUCF

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The MiniBooNE detector contains 800 tons of "pure" mineral oil with no scintillating additives. However, the MiniBooNE mineral oil does scintillate at a low level. A program of tests was performed by the IUCF neutrino group using the 200 MeV (kinetic energy) proton beam from the RERP facility. This beam is ideal for these tests as the protons are highly ionizing yet below the Cerenkov threshold in mineral oil.

The apparatus for these tests consisted of a high-gain PMT (Burle-8850 12-stage Quantacon) capable of single-photoelectron sensitivity immersed in small (~200ml) sample of mineral oil. The sample holder was surrounded by trigger scintillators for protons. This apparatus was placed in the IUCF RERP proton beam and exposed to ~10-50KHz of protons. We measured the absolute light output and the time distribution of the light emitted from the mineral oil due to proton tracks. We measured 4.7±0.7 photoelectrons emitted per MeV of energy loss from a 200MeV proton track with a characteristic emission time of 18.6±1.0 ns. The data are summarized in Fig. 1. MiniBooNE is using these numbers in the event reconstruction and sim simulation algorithms.

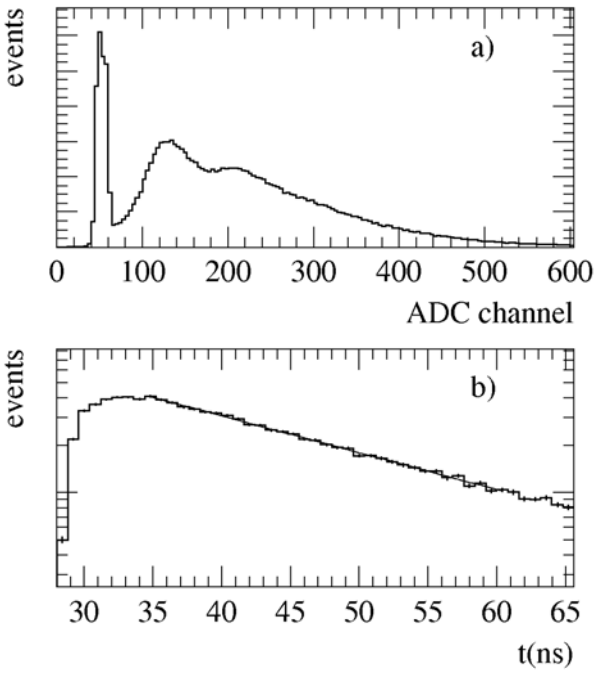

Figure 1*: ADC a) and time b) distributions of light emitted from a MiniBooNE oil sample in tests performed at IUCF with 200 MeV protons. The pedestal, first, and second photoelectron peaks are visible in the ADC distribution. A fit to this distribution determines the average number of photoelectrons detected. The time distribution fits well to a single exponential of width* τ*=18.6±1.0 ns.*

Another test of the MiniBooNE mineral has recently been performed at IUCF - again using 200 MeV protons. To fully understand light propagation in the MiniBooNE detector, one must know the wavelength spectrum of the emitted light in the scintillation process. We built a device consisting of a recirculating oil sample (to avoid radiation damage) viewed by a fiber routed to a spectrometer. The spectrometer recorded the wavelength spectrum of the emitted scintillation light from a few nA current of 200 MeV protons. Preliminary results show (see Fig. 2) that this method will allow for a complete characterization of scintillation in the MiniBooNE mineral oil.

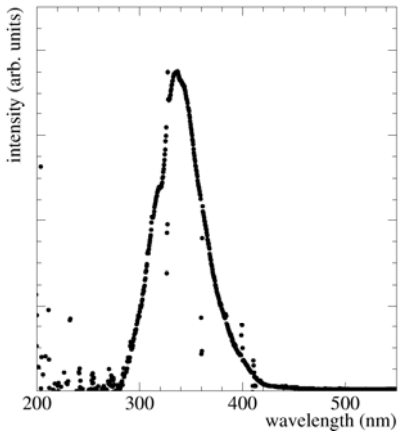

Figure 2*: Preliminary results from the measurement of the wavelength spectrum of scintillation light in the MiniBooNE mineral oil conducted in the IUCF 200 MeV proton beam.*