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R&D of water-based liquid scintillator as a reactor anti-neutrino detector

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Neutrino energy measurement is very important not only for a neutrino oscillation experiment but for a nuclear reactor monitor requested by IAEA (International Atomic Energy Agency) as one of their safeguards against misuse of nuclear technology and nuclear materials. The requirements for the reactor monitor are to be nonflammable and nonvolatile. As such a detector, we are developping a water-based liquid scintillator.
One of the problems of a water-based scintillator is that
it is difficult to get enough light yield bucause most of the known luminescent agents are difficult to dissolve in water. We tried to dissolve a liminescent agent in water with sevarel surfactants and measured the light yield varying concentrations of the liminescent agent and surfactants. The scintillators are contained in a vial (4cm diameter and 6cm height) and the light yield is measured using compton edge electrons by gamma-rays from a cobalt 60. We used a blue LED for light yield calibration. As one of the results, we got about 30 photo-electrons for a scintillator consisting of water, PPO (luminescent agent), Bis-MSB (wavelength shifter), and sodium dodecylsulfate (surfactant).
Neutrino interactions are identified by a well-known coincidence of a prompt positron signal followed by a delayed neutron capture by
gadlinium. In addition to the light yield measurement described previously, we will report about development of the gadlinium-loaded water-based liquid scintillator.

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