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Measuring directionality in double-beta decay and neutrino interactions with kiloton-scale scintillation detectors ANDREY ELAGIN[1], University of Chicago, CHRISTOPH ABERLE, University of California, Los Angeles, HENRY FRISCH, MATTHEW WETSTEIN, University of Chicago, LINDLEY WINSLOW, University of California, Los Angeles — We present initial studies of a technique for separating scintillation and Cherenkov light in a large liquid scintillator detector in order to reconstruct directionality for electrons with energies typical of neutrino-electron scattering (5 MeV) and double-beta decay (2.1 MeV and 1.4 MeV). On average scintillation light is delayed with respect to the direct Cherenkov light due to chromatic dispersion and and the finite time of the scintillation processes; early light thus contains directional information. Using a GEANT4 simulation of a 6.5m-radius spherical detector with 100% coverage of photodetectors having transit-time-spread (TTS) of 100 ps, we have shown that a time cut on the early light is effective at isolating the directional light, improving the ratio of Cherenkov to scintillation light from 0.02 to 0.63 for 5 MeV electrons originating at the detector center. This ratio is degraded by a factor of 2.5 if typical photomultipliers with TTS=1000 ps are used. The ratio for TTS=100 ps can be further improved by a factor of 1.6 by using red-enhanced photocathodes, or by 1.4 by using narrow-emission scintillators.

[1]APS membership is being renewed.

Andrey Elagin
elagin@hep.uchicago.edu
University of Chicago

[X] Prefer Oral Session
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