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Cherenkov light separation in organic liquid scintillator for neutrino detection

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Organic liquid scintillator are one of the most exploited detection medium for neutrino detection in the past years, especially for low energy ($\sim$ MeV). Although these media have a very good light yield, allowing to perform a good energy spectroscopy of the incoming particle, organic liquid scintillator lost the information of the particle direction due to the isotropy of the scintillation light.
To overcome this limitation, in the past years a huge effort by the liquid scintillator community has been started trying to combine liquid scintillator with Cherenkov detectors. In particular, Cherenkov radiation is emitted when a charged particle have a speed higher then the light speed in the medium. This radiation is usually emitted in neutrino-electron elastic scattering at the MeV energies due to the high refractive index of these media (~ 1.5), but it is overcame by the scintillation light which usually is a factor 100 more. The mixing of this two techniques will be the next step forward in neutrino dection, in particular for neutrino pointing and for $0\nu\beta\beta$ decay search, which can profit by exploiting the direction of the interaction to increase the signal over background ratio.
In this poster, I will first introduce the Milano Liquid Scintillator facility, called SHELDON (Separation of cHErenkov Light for Directionality Of Neutrinos), developed to fully characterize standard liquid scintillators but also novel liquids, like water based liquid scintillator (WbLS) or slow liquid scintillator (SLS). I will focus more the high resolution (~ 0.4 ns) time profile apparatus devoted to measure fluorescence and Cherenkov time profiles. Then I will present the optical separation technique which allow to enhance the Cherenkov contribution by exploiting bandpass filters, that could be exploit by next generation neutrino experiments.

Collaboration you are representing

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