Study of a Potential Third Time Component of Light in Liquid Argon

written by
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Submitted to the Department of Physics of ETH Zürich
in partial fulfillment of the requirements for the degree of
Master of Science in Physics

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September 19, 2016

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Fermi National Accelerator Laboratory,
September 19, 2016

Abstract

I describe here my Master's Thesis work, done in the Proton Assembly Building (PAB) at Fermi National Acceleration Laboratory, USA. My first task was to prepare and build an experiment for testing the new Hamamatsu Vacuum Ultra Violet (VUV) Multi Pixel Photon Counters (MPPC) in Liquid Argon (LAr). The test gave succeful results and an average amplified response of the MPPCs was obtained. The second part consisted in building an experiment for testing a hypotethical third intermediate component of scintillation light in Liquid Argon. The experiment, conducted in LAr, measured the distributions of time differences between scintillation photons produced by an alpha source and measured by a VUV MPPC close to the source and two other MPPCs 65 cm away. One of those MPPC measured direct scintillation photons while the other measured waveshifted photons by a Tetra Phenyl Butadiene (TPB) coated plate. At the end of the data anaylsis we were not able to definitively confirm or refute the existence of a third time component fitting the data. Reasons and possible future steps are discussed.