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Advanced plastic scintillation detectors for low-background experiments

Many international low-background experiments are showing increasing interest in the use of different plastic scintillation detectors. Based on our experience in the field of quality improvement of the polystyrene (PS) based plastic scintillation detectors [1,2], this work is focusing on a further enhancement of the scintillator light output and the associated energy resolution crucial for the detection of a very rare processes. To produce PS scintillators from liquid styrene various stabilization additives and conditions of polymerization process are commonly used. These factors, i.e. stabilization additives and atmospheric oxygen, have a negative impact on above mentioned optical properties of the scintillation detectors. Within this study, several samples under different conditions, e.g. concentration of luminescent and stabilization additives; air and inert atmosphere, were prepared and tested using a unique tunable electron spectrometer providing a monoenergetic electron beam ranging from 200 keV to 1.4 MeV [3].

[1] R. Hodák et al., AIP Conference Proceedings 1672 (2015) 130003

[2] A.S. Barabash et al., Nuclear Inst. and Methods in Physics Research, A 868 (2017) 98–108

[3] C. Marquet et al., Journal of Instrumentation 10 (2015) P09008

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