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Comparative studies of plastic scintillator strips with high technical attenuation length for the total-body J-PET scanner

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Plastic scintillators are used in many applications connected with advanced medical devices, for example in novel multiphoton J-PET scanners with positronium imaging capability [1, 2], and in plastic scintillation dosimetry [3].

In the first part of the lecture, results from measurements of transparency of commercially available plastic scintillators will be presented [4]. Purpose of the research is to select the best type of scintillator for the total-body J-PET scanner construction. Emission spectra, transmission spectra and technical attenuation length (TAL) values of six types of plastic scintillators with dimensions 6 mm × 24 mm × 1000 mm will be discussed. General purpose, blue-emitting plastic scintillators with low attenuation of visible light were tested: polyvinyl toluene-based BC-408, EJ-200, RP-408 and polystyrene-based Epic, SP32 and UPS-923A. The emission spectra of the investigated scintillators have maxima ranging from 420 nm to 429 nm. The BC-408 and EJ-200 scintillators have the highest transmittance values of about 90% at the maximum emission wavelength (measured through a 6 mm thick scintillator) and the highest TAL values up to about 200 cm, allowing building of long modules for total-body J-PET scanner.

In the second part of the talk, results from the research of blue- and green-emitting polystyrene-based plastic scintillators for scintillation dosimetry applications will be presented [5]. Anthracene, coumarin and perylene fluorescent dyes were used as wavelength shifters [6]. Emission maxima of manufactured green-emitting polystyrene scintillators are in range from 484 to 525 nm. The concentrations of the BPBD ultraviolet dye and Solvent Green 5 green fluorescent dye, influence the light output, rise and fall times, and the emission spectra of the scintillator samples.

References:

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