WHAT CAN WE LEARN DETECTING GAMMA RAYS EMITTED IN HADRON THERAPY?

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The main focus of experiment Gamma-CCB is investigation of gamma emission in experiments modelling the course of hadron therapy. First measurements were performed in Cyclotron Centre Bronowice in Cracow, using phantoms made of graphite and PMMA polymer. Gamma quanta were registered with the use of HP Ge detectors with anti-Compton shielding located at 90° and at 60° polar laboratory angle, and proton beam of 70 MeV energy. A novel target setup was proposed, which made possible simultaneous measurements in two modes: one integrating over the whole proton path in the target, the other enabling registration of gamma quanta produced only on a certain depth in the phantom. Obtained results were analysed with regards to the intensity of the two prominent spectral lines corresponding to the $^{12}C_{4.44\rightarrow g.s.}$ and $^{16}O_{6.13\rightarrow g.s.}$ transitions. Strong correlation with the Bragg peak position in the investigated materials was observed, confirming the usefulness of the technique *e.g.* in future applications for quality assurance in hadron therapy. Experimental results were also confronted with model calculations based on the TALYS program. Data from the differential measurements were also analysed with regards to the shape of the4.4 MeV carbon line. In order to reproduce the its shape at different energies, a number of model calculations were performed, each with different assumptions regarding the angular distributions for the two stages of the reaction occurring in the material: excitation of carbon nuclei by the incident protons and deexcitation of the excited state. Comparison of experimental data and the theoretical model allowed to determine parameters of the angular distribution of the $^{12}C_{4.44\rightarrow g.s.}$ transition.

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