

Construction and tests of an in-beam PET-like detector for hadrontherapy beam ballistic control.

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We present the electronics, the construction and the first results obtained with a detector, called LAPD for Large Area Pixelized Detector. The LAPD is dedicated to the beam ballistic control in the context of hadrontherapy, using in-beam and real time detection of secondary particles emitted during the irradiation of the patient. These particles could be high energy photons (γ prompt), or charged particles like protons, or 511 keV γ -ray photons from the annihilation of a positron issued from the β^+ emitters induced in the patient tissues along the beam path. The LAPD detector focuses on these 511 keV γ and is similar to a conventional PET (Positron Emission Tomography) camera. Nevertheless, there are some specific constraints, compared to conventional PET, to take into account when trying to use 511 keV γ from positron annihilations for the ballistic control in hadrontherapy, such as the low β^+ activity, the short lives isotopes, the isotope diffusion through the patient tissues, and the large γ prompt background. Specific electronics based on Switch Capacitor Array (DRS 4) for the digitization and on the μ TCA standard for the data acquisition system have been developed in order to acquire data with a minimum dead time. This detector has been partially tested in beam at HIT, and has also been characterized using FDG sources at the cancer therapy center of Clermont-Ferrand, and some preliminary results will be shown.

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