Real time spectrometer for thermal neutrons from radiotherapic accelerators

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Abstract

Radiotherapy accelerators can produce high energy photon beams for deep tumour treatments. Photons with energies greater than 8 MeV produce neutrons via photoproduction. The PHONES (PHOto NEutron Source) project is developing a neutron moderator to use the photoproduced neutrons for BNCT (Boron Neutron Capture Therapy) in hospital environments. In this framework we are developing a real time spectrometer for thermal neutrons exploiting the bunch structure of the beam. Since the beam is produced by a linear accelerator, particles are sent to the patient in bunches with a rate of 150-300 Hz depending on the beam type and energy.

The neutron spectrum is usually measured with integrating detectors such as bubble dosimeters or TLDs, which integrate over a time interval and an energy one. We are developing a scintillator detector to measure the neutron spectrum real time in the interval between bunches, that is in the thermal region. The signals from the scintillator are discriminated and sampled by a dedicated clock in a Cyclone II FPGA by Altera, thus obtaining the neutron time of flight spectrum. The physical process in ordinary plastic scintillators is neutron capture by H with a subsequent γ emission. The measured TOF spectrum has been compared with a BF_3 counter one.

The final detector will consist in a segmented boron doped scintillator, readout by multianode PMTs. A dedicated simulation with MCNP is being developed to extract the energy spectrum from the TOF one.

The paper will present the results of the single channel measurements and the comparison with the simulation.

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