

Innovative accelerator based neutron source for neutron capture therapy

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Innovative accelerator source of epithermal neutrons for the hospital-based boron neutron capture therapy was proposed [1] and presented [2, 3]. A beam of negative hydrogen ions is injected into electrostatic vacuum insulation tandem accelerator VITA. After stripping the ions inside the high voltage electrode, a proton beam is accelerated to double voltage of electrode. Kinematically collimated neutrons are produced via near-threshold ${}^7\text{Li}(p,n){}^7\text{Be}$ reaction at proton energy of 1.915 MeV. Current of tens of milliamperes allows to provide therapeutical beams with treatment times of tens of minutes.

In this report, status of project realization is presented. Results of experiments and simulations are also presented. Design features of facility components are discussed. Dc beam of negative hydrogen ions was obtained at test desk. Focusing optic system was optimized numerically and manufactured. Charge-exchange target was chosen and prepared for use. Experiments on study of high voltage durability of vacuum gap with large square electrodes were finished on 0.6 MeV tandem accelerator. 2.5 MeV vacuum insulation tandem accelerator is under construction now. Sectionized rectifier with operating voltage of 1.25 MV was constructed. The possibility of 0.1 % stabilization of proton energy was proposed. Various lithium neutron production targets have been developed. Stationary thin lithium neutron production target with liquid metal heat-carrier was made. Thermal mode of the target was investigated under powerful electron beam. Problems of ${}^7\text{Be}$ isotope accumulation and radiation blistering were considered. At proton energy of 2.5 MeV the neutron beam production for NCT use after moderation was also considered.

Demo neutron source in a radiation shielding bunker basing on accelerator developed is under construction now. Completion of demo neutron source is planed within next 2.5 years.

1. B. Bayanov *et al.*, Nucl. Instr. and Meth. in Phys. Res. A 413 (1998) 397-426.
2. B. Bayanov *et al.*, Proc. 9 Intern. Symp. on NCT, October 2-6, 2000, Osaka, Japan, p. 249.
3. Y. Belchenko *et al.*, Research and Development in Neutron Capture Therapy, W. Sauerwein, R. Moss, A. Wittig, Editors. 2002, Monduzzi Editore, p. 293.