14th International Congress

Neutron Capture Therapy → *New Challenges*

Progamme & Abstracts

International Society for Neutron Capture Therapy

"Centro Cultural Borges"

October 25-29, 2010

Buenos Aires, Argentina

Parallel Session 3
Accelerator Neutron Sources and physics 1 (AC-1) - Room B

factor of around 0.7. This normalization factor was caused by the differences in neutron yields at the beryllium target between actual data and evaluated cross-section of ENDF/B-VII used for simulation.

In conclusion, it was found from the experimental results that the intensity of epithermal neutron flux at the center of gamma-ray shield was 1.2×10^{9} cm^{-2} s^{-1} under the proton beam condition of 1 mA. This value was about twice larger than the reactor-based epithermal neutron source of Kyoto University Research Reactor that was used for 275 clinical trials. It is desirable to use C-BENS for a clinical trial soon.

5:50 PM

BINP accelerator based epithermal neutron source

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Introduction: In 1998, an original source of epithermal neutrons was conceived based on a tandem accelerator with vacuum insulation, suitable for a widespread use of BNCT in clinical practice. It is intended to generate neutrons with the threshold $^{7}Li(p,n)^{7}Be$ reaction by bombarding a lithium target with a 2 – 2.5 MeV, 10 mA proton beam. It is world-recognized that the best reaction to form the epithermal neutron beam is the $^{7}Li(p,n)^{7}Be$ reaction: neutron production is high, and the neutron spectrum is relatively soft. However, the mechanical, chemical, and thermal properties of lithium metal prevented it from being a candidate for a target.

The construction of the proposed source started in 2003 at BINP, and in 2007, the stable proton beam with the required energy and a current of 2.7 mA was obtained. High monochromaticity and the stability of the proton beam energy were achieved in the accelerator. This allowed us to obtain near-threshold neutron generation, which is attractive due to a directed neutron flow and low background radiation. By now, all problems of a lithium target have been solved, namely i) the effective cooling was implemented to keep the lithium layer solid in order to prevent the propagation of ^{7}Be radioactive isotope, ii) the controlled evaporation of a thin lithium layer was used to reduce accompanying gamma radiation, iii) substrate materials as resistant to blistering as possible were found. In 2008, the target was assembled and neutron generation was performed.

Results and discussion: Now, the facility is being upgraded to increase the proton beam current, and to provide sustained stable neutron generation for *in vitro* investigations. The facility was equipped with beam position diagnostics, which allowed us to study and optimize the proton beam transport and sweeping. The manufacture of a new low energy beam transport line and a new stripping target are now close to be finished. An original solution for implementing the time-of-flight technique with continuous proton beam is proposed, and the time-of-flight diagnostics are assembled. To solve the problem of target activation by Be-7 isotopes, a protective subsurface container for holding and temporary storage of activated targets was proposed and made. For the near-threshold neutron generation mode, which was so attractive at the beginning of the study due to low activation of the facility and the target, a solution was found providing the density of epithermal neutron beam of 3×10^{8} cm^{-2} s^{-1} at an acceptably small flux of fast and thermal neutrons at the proton beam energy of 1.9 MeV and a current of 10 mA. Changes in the proton beam energy and the moderator make it possible to form the neutron flux with different features including higher density, and to select the optimal one for BNCT. Achievement stable neutron generation will provide the organization of the Shared Center to develop the BNCT technique.