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Research Progress of High Repetition Frequency and Ultrashort Pulse Neutron Source Based on 3 MeV Proton Accelerator

The high repetition rate and short pulse neutron source based on 3 MeV proton accelerator has the characteristics of high single pulse neutron number, narrow pulse width (nanosecond level), wide neutron spectrum coverage and high repetition frequency (40 kHz). The neutron source is mainly composed of 100 mA ECR ion source, low energy transmission line (LEBT),100 mA continuous wave RFQ, medium energy transmission line (MEBT),330 kW continuous wave power source and high current and strong neutron target station. The ECR ion source can generate 110 mA, 80 keV proton beam; LEBT is used to match the beam parameters of the ion source to RFQ, and the 110 mA DC proton beam can be chopped into 40 kHz, 100 ns wide macropulses by using a slow beamformer; RFQ is used to accelerate the high-frequency macro pulse proton beam to 3 MeV, and to generate a dozen micropulses with a distance of 6ns and a pulse width of 1ns, each of which is larger than 1 E10 p/pulse. MEBT is used to match the beam parameters of RFQ to the neutron target station, and a single micropulse in the macro-pulse cluster is selected by using a fast chopper, so that the generated 40 kHz and 1ns micro-pulses are incident to the neutron target station; the neutron target station is used to produce 40 kHz and 1ns pulsed neutrons with a yield of more than 1E9 n/s and a neutron spectrum range of 0.1 ˜ 1.2 MeV, and three beams are planned on the neutron target station. Slow neutron and fast neutron experiments. The performance index of the device is very special, reaching the international advanced level, and the neutron with high energy resolution can be obtained at close range, which is an ideal platform for studying the neutron-related technology. Based on its high-quality, high-intensity neutron beam and proton beam, the basic fields of fast neutron physics, neutron (proton) photography, anti-nuclear reinforcement, nuclear data, nuclear detection technology and so on can be studied. Currently, the development of ECR ion source, LEBT, RFQ, MEBT and neutron target station is under way, and construction of the device is expected to be completed by the end of this year.

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