The Conceptual design of the Neutron target station for the KOMAC pulsed neutron source

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Korea multi-purpose Accelerator Complex (KOMAC) have a plan to construct the compact pulsed neutron source, which is tasked to generated the short pulse neutron through the 160 MeV protons onto the tungsten target. The KOMAC neutron facility is the exotic facility which provide the short pulse neutron beam(less than 1 μsec) through the EBIS SC ion source, compare to other compact pulse neutron source. The conceptual design of the neutron target station for the compact pulsed neutron source will be discussed.

I. Introduction

The compact neutron source at Korea multi-purpose Accelerator Complex (KOMAC) is the first pulsed neutron source in the South Korea. Most of the compact neutron source provides the long pulsed neutron beam, which compensate for the intrinsic low neutron intensity. The KOMAC pulsed neutron source are designed to provide the sub-micro second neutron beam by using the EBIS-SC(superconducting electron beam ion source) ion source and could provide the high intensity neutron beam by high energy proton irradiation. The KOMAC proton linac could provide 100 MeV proton beam at now. Through the future upgrade of linac, the maximum 160 MeV proton beam will provided by super-conducting accelerating cavity.

II. Production yield and the energy spectrum

1 kW proton beam is delivered on the tungsten target, the target thickness is 20 mm (the 160 MeV proton range in tungsten is 17.9 mm calculated by SRIM2008 [1]). The spallation reaction in tungsten target produce the fast neutron, the calculated energy spectrum of the leakage neutron from the target shows the just below 1 MeV neutrons are pre-dominant, which is typical the energy spectrum of the spallation neutron source [2]. The production yield is 0.37 neutrons per the incident proton, which calculated by FLUKA (version 2011.2c.5) [3].

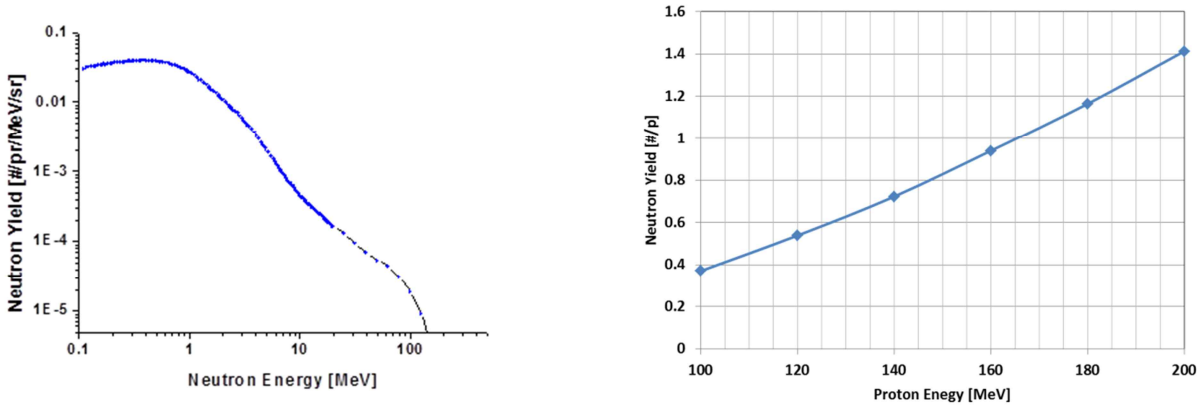

Fig.1. the calculated neutron energy spectrum and production yield.

III. Target-Moderator-Reflector configuration

The neutron target stations are design to produce the thermal to epi-thermal and the short pulse neutrons. The light water moderator selected for the thermal neutron production and For the short moderation time, the material of reflector was selected by light water. The conceptual design parameters are described as Table 1.

TABLE I. TMR Design parameter

	Material	Dimension
Target	Tungsten	Diameter: 80mm Thickness: 20 mm
Moderator	Light water	Thickness : 60 mm Area : 120 mm × 120 mm
Reflector	Light water	Radius : 250 mm
De-coupler(poison)	Cadmium	Thickness : 2 mm
Vacuum chamber	Aluminum alloy	-

IV. CONCLUSIONS

The compact pulsed neutron facility at KOMAC will provide the short pulse and high intensity neutron beam through the 160 MeV protons onto the tungsten target. In this paper, the conceptual design parameters of the neutron target station are described.

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