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The Preliminary Design of the Neutron Production Target for the KOMAC Pulsed Neutron Source

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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 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 0.939 neutrons per the incident proton, which calculated by FLUKA (version 2011.2c.5) [3].

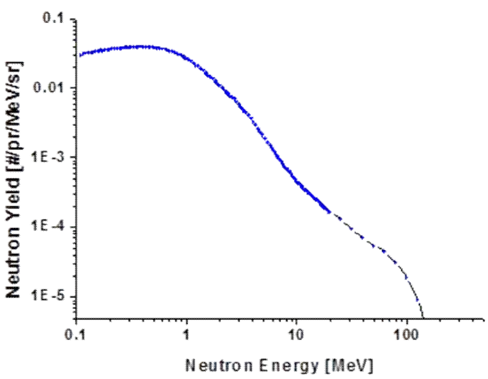

Fig. 1. The energy spectrum of the leakage neutron from the target.

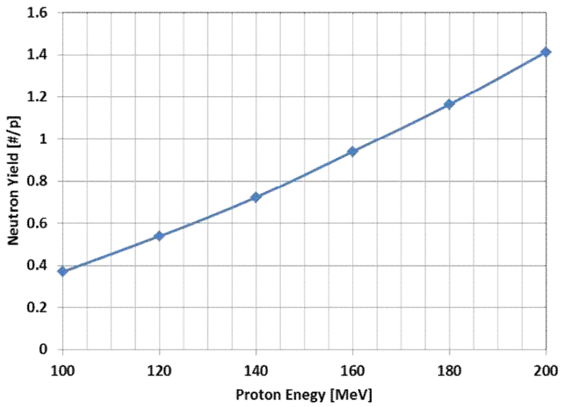

Fig. 2. The total neutron yield as a function of the incident proton energy.

III. The concept of Target-Moderator-Reflector

1. The optimization of target radius

The number of leakage-neutrons from the cylindrical target depends on the target radius [4]. Figure 3 shows the neutron yield as a function of the target radius. The number of neutron increase according to target radius increase. And then, the numbers of neutron begin to decrease with increasing radius. Thus , the radius of tungsten target was determined to 40 mm.

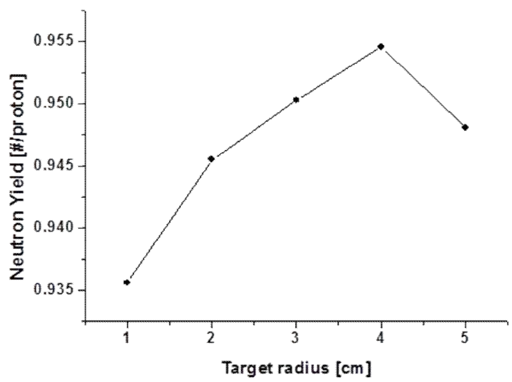

Fig. 3. The total neutron yield as a function of the target radius (proton energy was 160 MeV)

2. TMR 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 1. 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. SUMMARY

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

Acknowledgment

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