*Proc. 3rd J-PARC Symposium (J-PARC2019)*
JPS Conf. Proc. **33**, 011097 (2021)
https://doi.org/10.7566/JPSCP.33.011097

# A Two-Dimensional Scintillation Neutron Detector for TAKUMI Diffractometer in J-PARC MLF

Tatsuya NAKAMURA[1*], Takuro KAWASAKI[1], Kentaro TOH[1], Stefanus HARJO[1], Kaoru SAKASAI[1], and Kazuya AIZAWA[1]

[1]J-PARC Center, Japan Atomic Energy Agency, Naka, Tokai, Ibaraki 319 1195, Japan

*E-mail: nakamura.tatsuya@jaea.go.jp

(Received January 10, 2020)

Large area, two-dimensional scintillation neutron detectors were developed for TAKUMI engineering neutron diffractometer at the Materials and Life Science Experimental Facility, Japan Proton Accelerator Research Complex. The detector was made based on a scintillator/wavelength shifting fiber technology. The detectors have neutron-sensitive area of 320 × 320 mm with a pixel size of 5 × 5 mm, which is about 1.56-fold larger than the original SENJU detector. The thicknesses of the $^{6}$Li:ZnS(Ag) scintillator screens were selected to 0.3 mm for both the front and rear scintillator screens. The detectors which are equipped with new discriminator electronics decreased a required PMT voltage to 86% of the maximum rating of the multi anode PMT (type H8804, Hamamatsu, JAPAN). The produced three detectors exhibit detection efficiencies of 40~48% for 2-Å neutron. The detectors have count uniformities to 6% (1σ). These detectors have been installed to the TAKUMI diffractometer at the scattering angle 2θ of 157 degree and in service since 2017.

**KEYWORDS:** Scintillator detector, position-sensitive neutron detector, wavelength-shifting fiber, TAKUMI diffractometer

## 1. Introduction

TAKUMI is a time-of-flight neutron diffractometer installed in the BL19 at the Materials and Life Science Experimental Facility (MLF), Japan Proton Accelerator Research Complex (J-PARC) [1]. In the original detector configuration, the linear position-sensitive neutron detectors have been installed to cover the scattering angle of ±90 degree with the linear spatial resolution of 3 mm [2]. This neutron instrument has been used mainly in the study of engineering materials since its first acceptance of the neutron beam in 2008.

Implementation of two-dimensional neutron detectors to the instrument increases its research capability. For example, two-dimensional detection of Debye-Scherrer rings enables studies on a texture within single crystal-like samples, coarse-grained samples, etc. These researches can be done more efficiently by using two-dimensional neutron detectors. Moreover, the detectors can produce data with a higher time-of-flight resolution than that with the original detectors when they are configured at a larger scattering angle. Unfortunately, the present detectors installed in TAKUMI have no capability to detect neutrons in two dimensions, thus a new position-sensitive detector is required [2].

In this paper, we present our two-dimensional scintillation neutron detectors