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Development of Neutron Guides in HANARO

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1. Introduction

The cold neutron guide systems, as a part of the cold neutron research facilities in HANARO, have been being developed since 2003. Until early 2008, the beam port assigned for the cold neutron (CN) has been used for an 8-m SANS instrument without a neutron guide. All the hardware for the CN beam line will be replaced with a completely new system composed of neutron guides, an in-pile plug, a primary shutter, shielding blocks, and vacuum systems. This paper summarizes the technical status of the development for the cold neutron guide and the related systems that are mostly ready for an installation from 2008.

2. Neutron Guide System

The cross section and layout had been optimally decided through many discussions between users with advice from international experts. Three kinds of glass materials were selected with optimum lengths as shown in figure 1 by considering their lifetime, shielding, maintainability and cost as well.

There are important mechanical structures or components which affect the efficiency of the neutron at the final destinations; scattering instruments in the guide hall. The final goal of these mechanical items is to achieve an accurate alignment of the neutron guides. The in-pile plug is the shielding plug including the first five guides in the beam port with a helium charge. We developed the in-pile plug assembly and the special tools not only for the replacement of the plug assembly but also for the alignment or replacement of the guide cassette under a high radiation.

The primary shutter includes a rotational drum to open or close all the beams together at the downstream of the in-pile plug. The drive system of the primary shutter controls the position of the drum accurately to meet an alignment accuracy of $5x10^{-5}$ radian for the guides. The out-of pile guides, with a separate vacuum system from the primary shutter, continue and divide into 7 beam guides. These guides are supported by a support system composed of two pillars, one I-beam and 2-8 adjusting frames. To avoid any stress by a temperature change or the uneven bolt torques during the installation or operation, we always applied the concept of a '3-points support' between the floor and the pillar, the pillar and the I-beam, the adjusting frame and the guide.

For the alignment work to meet the high accuracy requirement with in a limited time and space under the radiation field, we prepared a laser tracker system and accessories including various target holders on the floor and walls to be mounted in the reactor hall and the guide hall. The first alignment data will be used for the replacement of the guides and monitoring of any change of the alignment in future.

There are removable shielding blocks around the primary shutter and out-of-pile guides. There have been many case studies for the shielding design to optimize the space, the structural integrity under seismic conditions, the replaceability, the manufacturability and the cost. Finally it became a layer of the borated polyethylene, heavy concrete with a density of 3.4 and a thick steel plate sequentially layered from the inside.

The installation and alignment work are to be interfaced with many other works at the site. Therefore it is necessary to prepare well-arranged working procedures and schedule to complete the site work within the schedule. All the technical steps for the installation and alignment were set-up from the design with discussion among designers, supervisors and international experts.

3. Conclusions

All the key components for the neutron guide system are ready for installation with verification tests to install in Hanaro from May 2008.

When the installation of the whole guide systems is completed, we are sure that the package for the neutron guide system can be localized.

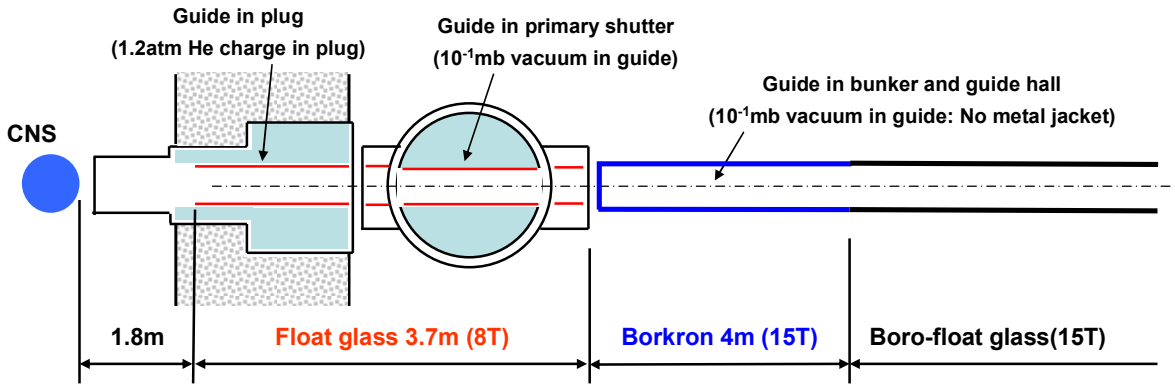

Fig. 1 Guide Selection for Hanaro

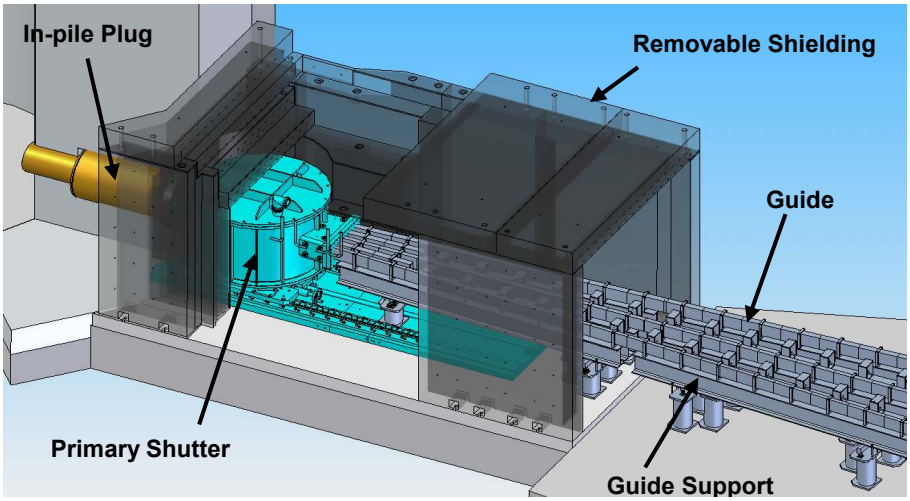

Fig 2. Neutron Guide System