Integrated User Interface for Utilization of Research Reactor

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1. Introduction

Radioisotope production is one of the main fields of technology used for research reactors. The target is irradiated in the reactor core to produce Mo-99. The operator at the top of the pool uses a long handling tool to handle targets in the pool. The target is bound to the tool and the operator remotely inserts the target into the core. A crane hoist is used to move the handling tool in the horizontal and vertical directions. A target loading device can be used for loading or unloading of the target.

There are some difficulties in the handling of the target in the pool. First, the operating procedures and equipment used are different depending on the type of radioisotope. Equipment such as handling tools and rigs vary according to the type of radioisotope. Each equipment is stored in a designated location in the pool. The location of the irradiation hole, the loading procedure, and the irradiation time depend on the type of radioisotope. The operation procedure differs according to the type of operation. For example, there are procedures for loading in the reactor core for irradiation of the target, retrieval and cooling. The skill of a worker may have a great influence on efficiency due to such various types of work and the location of equipment. Secondly, it is difficult to check the loading stage of the target. In order to prevent falling of the target during loading, working procedure should be prepared with proper stages and a limited loading speed. It is necessary to check the target loading stage and loading speed to avoid human error due to long working time.

In this work, an integrated user interface concept for utilization of research reactors is introduced. This conceptual interface integrates information of work in the reactor pool and displays the integrated information for workers.

2. Interface Concept

The integrated user interface displays information related to the operation in the research reactor pool for radioisotope production. The interface receive position and speed data from transport devices such as a crane hoist and target loading devices when performing target irradiation and cooling work. It provides the operation status as visualized information to the worker. The integrated user interface consists of a display device and a control panel.

2.1 Display Device

Display layouts are shown in Figs. 1-5. The operator can choose the work type and work status in this view. The display device shows information and screen layout according to the selected work type. Figure 1 shows a display layout of pool for horizontal transport. Position and speed of the crane hoist are indicated on the schematic plan view of the reactor pool and facilities. Storage position of handling tools, rig racks, and other facilities are also indicated on the plan view. Work type and work status can be chosen by operator in this view. Path of the handling tool and target is indicated in the horizontal or vertical view when the work type is selected. The display layout of pool for vertical transport is shown in Fig. 2. Current position and speed of the target or the end tip of the handling tool in the vertical direction are easily checked on this view.

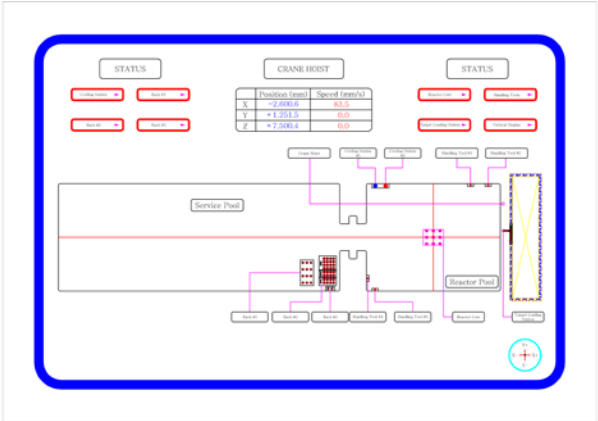

Fig. 1. Display layout of pool for horizontal transport

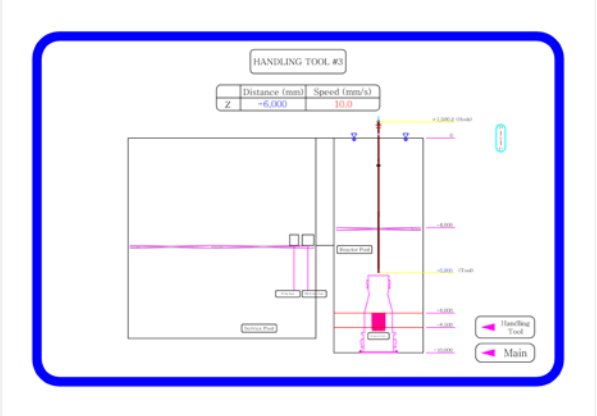

Fig. 2. Display layout of pool for vertical transport

Path of the handling tool and target is indicated on a schematic vertical section of the reactor as shown in Fig. 3 when the target moves inside the reactor. The current loading stage of the target is indicated depending on the radioisotope type.

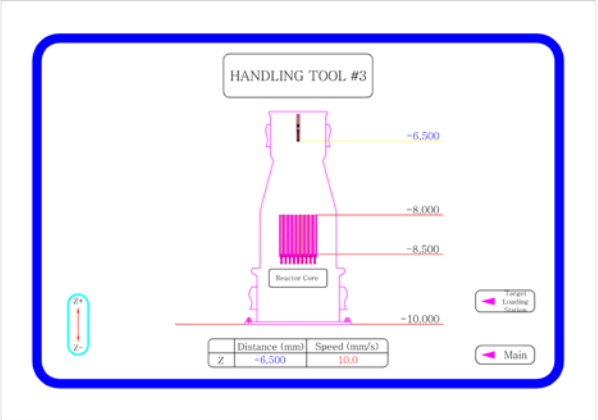

Fig. 3. Display layout of reactor for vertical target loading

Work status is shown in different view when the status is selected from the menu. Horizontal position of each irradiation location is indicated in the schematic plan view of irradiation hole as shown in Fig. 4. Irradiation time for each irradiation hole can be indicated in the same view. Storage status of rigs in the rack is checked as shown in Fig. 5.

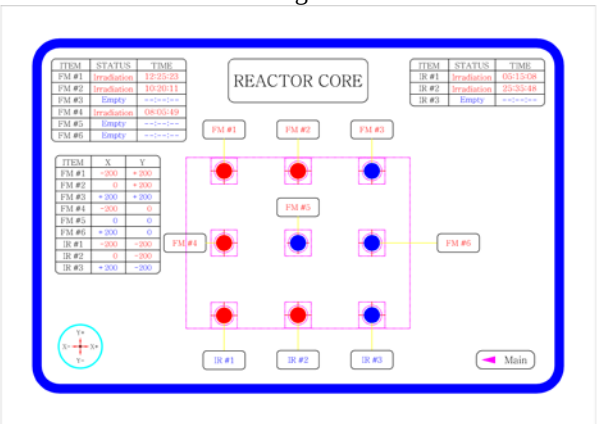

Fig. 4. Display layout of irradiation holes for target loading

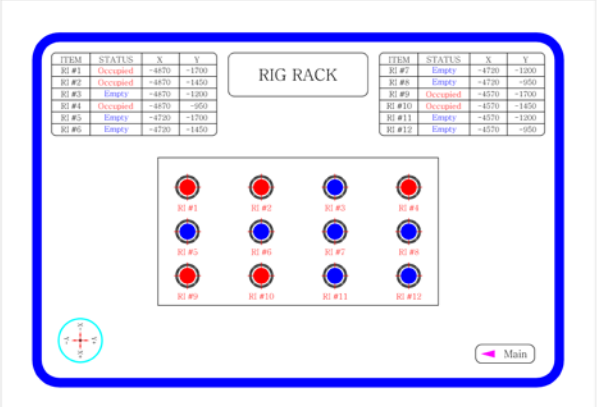

Fig. 5. Display layout of rig rack for storing rig

2.2 Control Panel

The display device and the control panel are installed on the operation bridge. The control panel is connected with the control panels of crane hoist and target loading device to receive position and speed data. The power for the device is supplied from the operation bridge.

3. Conclusion

The integrated user interface visually displays information related to radioisotope production in the research reactor pool. Visualized information increases the efficiency of radioisotope handling work and helps to prevent accidents induced by human error. It can be applied to the research reactor currently in use without major changes of other facilities. In addition, it can be used as a visualized operation manual, which helps education of operators or visitors.

Acknowledgements

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