Improvements of the RIBF control system

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We report on two improvements of the RIBF control system. One is the completion of update of an aged controller, DIM,[1] used in the RILAC control system, while the other is an improvement of the alarm system to support stable beam delivery during a long-term experiment.

In the RIBF control system, various types of old and new controllers are mixed for interfacing with each controlled object used in the RIBF accelerator complex. Because the supply of many parts used in these old controllers has been terminated, we have been successively replacing the old controllers with new ones every year. Especially, the DIM module, an in-house controller developed for beam diagnostic equipment, vacuum systems and magnet power supplies in our old facility, is the oldest controller in the RIBF control system. Hence, we have been replacing DIM with N-DIM[2], an in-house controller newly developed as a successor to DIM in 2003. As a result, most of the DIMs have been updated to N-DIMs up to last year. However, we found a problem in the data acquisition of the program used in the N-DIM system last year. After refurbishment of the program and repeated operation tests, we confirmed the normal operation of N-DIMs early in this year. Subsequently, we updated the remaining DIMs used for controlling the magnet power supplies of the RILAC accelerator complex to N-DIMs this summer. Consequently, the update of all the DIMs in the RILAC control system was completed, which results in a reduction of the number of the CAMAC crate controllers used in RIBF from 6 to 5. The model of the CAMAC crate controller in use[3] is not available commercially now and we should terminate its operation with DIM as soon as possible. N-DIM, when used as a controller of magnet power supplies, needs a slightly longer response time than DIM, even after recent updates of the program handling procedures of post-monitoring and the analysis of the network packet of N-DIM this year. We have not completely overcome the response-speed problem, and further improvements are needed.

The second improvement is related to hardware protection under high-intensity operations of the RIBF accelerator complex frequently performed in the past few years. Because the present typical beam intensity causes heat loads much higher than the allowable values for components used in the accelerators, malfunction and hardware troubles of the control system may seriously damage the hardware. Therefore, the malfunction of equipment should be detected as soon as possible, and when a problem occurs during an experiment, the operator is required to fix its cause and, if possible, remove it immediately. Therefore, we have started to upgrade the existing alarm system, which covers only some components of the ion source. We newly installed a distributed alarm system, the Best Ever Alarm System Toolkit (BEAST)[4] based on the Control System Studio (CSS)[5] platform. The BEAST was chosen taking into account the future extension of the CSS at the RIBF control system instead of upgrading the existing Alarm Handler[6]. As the first step of the alarm system upgrade, the vacuum status of the entire RIBF accelerator complex, including the status of vacuum pumps, gate valves, and vacuum pressures, was registered in the BEAST. The BEAST outputs a warning signal when the opening-closing status of a valve changes, a vacuum pump stops, or a change of vacuum pressure higher than its pre-determined limit is detected. In addition, the difference between the set and read-back value of the excitation currents of all the magnet power supplies of the RIBF accelerator complex was registered in the BEAST. The BEAST outputs a warning signal when the ratio of the read-back current value to the set value is less than 50%. We registered approximately 700 signals in the BEAST, and its test operation was started in April 2016. Toward more efficient operation, we are now investigating how to set the optimal alarm criterion patterns for each experiment in the BEAST. Since there are 65 beam operation patterns with different combinations of ion sources, accelerators, and experimental vaults, it is necessary to activate signals relevant to the experiment of running at a particular time.

References

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