The Sonix+ software package is the main software for control of instruments on the BR2 reactor. It was created in the early 1990s for a high-resolution neutron spectrometer (beam 6A IBR-2). Later, the complex was transferred to other devices, including those located outside the FLNP. Since then, the complex has been installed on more than 20 devices, including 14 in FLNP and 7 in other centers. The Sonix+ was created simultaneously with the popular Tango and Epics systems. A similar problem generates a similar solution, so the fundamental ideas in these approaches are more or less the same:

- single control computer is enough to control the instrument. There are some additional tools for servicing rare exceptions;
- the universal approach to the graphical user interface has been proposed and successfully implemented.

Recent changes to Sonix+

Code refactoring
Code refactoring is the process of restructuring a program without changing its external behavior, i.e., functionality for the user. The refactored version of the complex was successfully tested in October 2021 on the NERA device, similar versions were prepared for other instruments. To do this:
- DAQ modules have been adapted;
- data formats for event mode data and histograms have been changed;
- data converters and GUIs for manual conversion event mode data to histogram have been prepared;
- SpectraViewer visualization program has been also adapted.

Customize to work with event-mode data
The use of DAQ DeLiDAQ-2 controllers and CAEN digitizer N6730 with the absence of hardware histogramming on the IBR-2 instruments required adapting the complex to work with data in the form of a list of events (so-called “event-mode” or “list-mode”) data and transferring a number of DAQ servicing modules to 64-bit address space. To do this:
- convert DAQ architecture to “list mode”
- eliminate outdated modules
- data processing based on 64-bit architecture
- improve code refactoring.

New SpectraViewer
The SpectraViewer is completely redesigned to optimize its code and improve its performance. It is also transferred to 64-bit address space to work with event-mode data.

Websonix: Features and Real Requirements
The system is designed to remote supervising the experiment with a web browser. It consists of a website on one of the central FLNP servers and the corresponding software on the control computers.

To reduce a response time in the new version, the previous protocol for communication with sequential processing of requests has been replaced.

The new protocol is implemented using the PyChannel Messaging Service.

PyChannel Messaging Service
The PyChannel messaging service is designed to communicate between the control computer and external server. It has been adapted for communication of 32-bit Sonix+ kernel modules with a 64-bit GUI.

Conclusion
The refactored version of the complex was successfully tested in October 2021 on the NERA device, similar versions were prepared for all other IBR-2 devices. It has been prepared for all instruments. The initial version of event-mode data processing was implemented and tested with the data of real measurements. This solution meets current needs, but will be improved, if users will formulate new requirements.

The Repository software refinement and its integration with the Journal system will also be continued.

References
2. G. Frank Laboratory of Neutron Physics, Joint Institute for Nuclear Research, 141980 Dubna, Moscow Region, Russia.
3. E-mail: skirillov@jinr.ru

The history of concept and module composition

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