

Theme: «Scientific and methodological research and developments for condensed matter investigations with IBR-2 neutron beams» for 2021-2025

Project: Construction of a wide-aperture backscattering detector (BSD) for the HRFD diffractometer (proposed for implementation at JINR in 2021-2023).

Review

The High-Resolution Fourier Diffractometer (HRFD) developed in the framework of collaboration between FLNP JINR (Dubna), PNPI (Gatchina) and VTT (Espoo, Finland) has been operating at the IBR-2 reactor already more than 20 years. During its use, the diffractometer has proved to be a world-class instrument with its unique features and world-class key parameters. However, in order to remain at the present level and adapt to the new requirements related primarily to the need to study new classes of increasingly complex compounds and materials created in recent years and to be ready for the tasks that will be stated in the future, an essential modernization of the diffractometer is of great necessity. In 2016 a new mirror neutron guide and fast Fourier chopper were put into operation and previously there had been a complete replacement in the data acquisition and experiment control electronics. During 2018 - 2020, the project "Development of a wide-aperture backscattering detector (BSD) for the HRFD diffractometer" was successfully implemented. A new version of backscattering detectors has been developed, which will allow to increase the solid angle by a factor approximately 12 times to 2.0 sr. as compared to the existing detector. The detector efficiency range via the scattering angle interval becomes 59% -96% and on average it increases to 85%. Such an increase in efficiency, together with an aperture increased to 2 sr. will bring the backscattering detector to a completely new level. The key points of implementation of the project in 2018-2020 were the development of the technical design of the Backscattering Detector (BSD) for HRFD and adaptation of the existing manufacturing technology of scintillation detectors for BSD. The proposed configuration using combined electronic-geometric focusing is absolutely original and has no analogues.

As a result of implementation of the project "Development of a wide-aperture backscattering detector (BSD) for the HRFD diffractometer", everything is ready to the full extent for the manufacture of the detector with 11 detector sectors and a data acquisition and accumulation system with software, at which the new project "Construction of a wide-aperture backscattering detector (BSD) for the HRFD diffractometer" is aimed, proposed for implementation at JINR in 2021–2023. The technical feasibility of implementation of the project within the specified time frames is well-justified. The proposed schedule and the necessary resources required for the implementation of the project are reasonable and in the case

of regular funding of the stages, the project should be successfully implemented. The requested financial resources correspond to the project tasks. The project is completely provided with appropriate human resources at JINR. Experienced and highly qualified specialists are involved in the implementation of the project. Significant partner companies and equipment suppliers have been selected.

In conclusion, I fully support the implementation of the project "Construction of a wide-aperture backscattering detector (BSD) for the HRFD diffractometer" in the presented form. The estimates show that the solution of these problems will allow an approximately two- to three-fold increase in the number of conducted experiments, substantially improve the accuracy of the obtained structural information, as well as significantly enhance the capabilities of the diffractometer in performing experiments under various external conditions on the sample. The scientific significance of the project is undeniable. The implementation of the project will make a great contribution to the development of the experimental base for carrying out research of the condensed matter at the IBR-2 beams.

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