Referee report

on the project "Development of a wide-aperture backscattering detector (BSD) for the HRFD diffractometer"

The goal of the project is development and creation of a new detector for the high resolution Fourier diffractometer to be used at the pulse reactor IBR-2.

Neutron high resolution Fourier diffractometers are indispensable instruments for precision analysis of polycrystalline structure, study of phase transitions in poly- and monocrystals, determination of residual internal stress in volumetric samples. HRFD, made in JINR in 1995 and so far working at IBR-2, is one of the world best by its resolution ($\Delta d/d \approx 0.001$). However, many parts of this device are obsolete and have to be replaced. Moreover, the detector aperture is not large; hence, rather long expositions are necessary in order to collect the required statistics, thereby limiting the number of the diffractometer users. Therefore, development of a new detector for the high resolution Fourier diffractometer at IBR-2 is an actual issue.

The proposed project aims at creation of a new detector for HRFD, which will have the following advantages compared with the existing one:

i) essentially larger solid angle (gain of 12.5 times, up to 2.0 sr);
ii) replacement of the lithium glass scintillators by scintillation screens from ZnS(Ag)/^{6}LiF. The ZnS scintillator has such merits as extremely low sensitivity to gamma-quanta (thus decreasing the measurement background), and a large light output;
iii) using of modern electronics and data acquisition system.

The calculation results of the geometrical parameters of the detector rings and detector efficiency are presented in the project, and the geometrical contribution into the full diffractometer resolution is estimated. It is demonstrated that the contribution into resolution coming from the scintillation screen thickness and the sample dimension is very small, being almost an order of magnitude less than the tolerable one.

It is worth to mention that the practical building of such a detector is a complicated designing and engineering task because it requires both the thorough development work and high precision of the mechanical detail manufacturing, while the element dimensions are up to 2 meters. Nevertheless, the experience of the participants and capabilities of the workshop make it possible to rely on successful solving of this task.

Within 3 years of the project realization, it is not planned to finish creation of the new detector for the diffractometer completely, but all procedures will be developed, and all mechanical details and electronics will be produced. Also there will be tested the completed sector of the device which will be then replicated until the full-scale detector construction. Therefore, it seems important to involve young scientists in this project.

The goal of the proposed project and method of its realization deserve full acceptance. The requested resources are reasonable, but strongly uneven distribution of the resources over the years, to my opinion, is not a necessity.

Concluding, I would like to mention that realization of this project would give to JINR a new device, at the best world level, which for sure will be in a great demand not only from the JINR researchers but also from external, including foreign organizations.

I recommend to approve the project "Development of a wide-aperture backscattering detector (BSD) for the HRFD diffractometer" with first priority.

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