Report of the Reviewer on the proposal for the new Project

"Development of an inelastic neutron scattering spectrometer in inverse geometry at the IBR 2 reactor". Theme: « Studies of functional materials and nanosystems using neutron scattering»

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Inelastic neutron scattering is one of the most demanded methods for studying the atomic and magnetic dynamics of condensed matter in all leading neutron centres. For example, the suite of neutron spectrometers on ISIS pulsed neutron source (UK) includes 8 spectrometers, which makes up 30% of the total number of instruments available. A similar ratio take place on SNS (USA) and KENS (Japan).

In the preamble the authors presented a deep and comprehensive analysis of scientific problems that require neutron spectroscopic research at present and in the future of condensed matter science. This justifies the need to develop a spectroscopic experimental base and prospective requirements for it, taking into account the spectral characteristics and duration of the neutron pulse of the IBR-2M reactor.

The existing NERA spectrometer at IBR 2 was built for almost 30 years ago. Over the past years, numerous upgrades of this spectrometer have been carried out, so two years ago a 25m focusing neutron guide was installed, which gave a gain in neutron flux density of more than three times, and, in fact, the modernization potential of NERA has now been practically exhausted. Although the NERA spectrometer is currently a source of high-quality scientific results, it is largely a device of the last century, where, for example, outdated neutron optics and a somewhat outdated arrangement of energy analysers are used, which significantly limits the spectrometer luminosity. Therefore, the need to build a new inverse geometry spectrometer seems extremely necessary.

The experience gained over the years of operation and modernization of the NERA spectrometer allows the authors of the project to formulate optimal requirements for a new generation spectrometer. The proposed scheme of a new instrument is undoubtedly an innovative solution giving a big gain in intensity compared to the existing NERA spectrometer.

The planned spectrometer will be equipped with the most modern neutron optics manufactured by SwissNeutronics, which will focus a neutron beam from a size of 15x20cm2 at the input of a neutron guide to a size of 3x3cm2 at the sample location,

that will give a 10 times gain in flux density compared to NERA, and this is without taking into account the quality of the new neutron guide that will undoubtedly increase this ratio. The secondary spectrometer will also have an original design, allowing to have a large crystal area of highly oriented pyrolytic graphite (HOPG) analysers. It will exceed the HOPG area by NERA by 18 times and, accordingly, the luminosity on the new instrument will increase significantly. Thus, due to neutron optics of the primary spectrometer and a significantly larger analyser crystal area, the total gain in the luminosity of the new spectrometer will be more than 180 times.

The pulse shaping chopper planned to be installed on a new spectrometer at a distance of 2.6 m from the moderator surface will make it possible to control the pulse width and thus choose the energy resolution, which is essential for high energy transfers.

All this will make the new spectrometer a flexible and highly effective instrument for neutron spectroscopy, which allows working with samples weighing tens of milligrams, significantly reduces the measurement time, and makes it possible to carry out parametric measurements.

The Project will be realized at the Department of Neutron Scattering Investigations of Condensed Matter of FLNP. The Department personnel are well known among the international neutron scattering community for their long standing experience in the field of the considered activities, supported by high quality publications, conference presentations.

Finally, I recommend realization of these activities at JINR and endorsing the opening of the new project "**Development of an inelastic neutron scattering spectrometer in inverse geometry at the IBR 2 reactor"** in the frames of the theme "Investigations of Functional Materials and Nanosystems by Neutron Scattering Methods".

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