Referee's report on the project
"The JINR Multifunctional Information and Computing Complex (MICC) continuation"

The rapid development of information technologies and new user requirements stimulate the development of all MICC components and platforms. The uppermost feature of the project is the need to ensure almost 100% reliability and availability in a 24x7x365 mode. The JINR computer infrastructure consists of numerous computing components and IT-technologies to solve JINR current tasks, from theoretical studies to experimental data processing, storage and analysis. They are the IT-ecosystem for the NICA project (BM@N, MPD, SPD), Tier1 of the CMS experiment at JINR, Tier2/CICC providing support to experiments at the LHC (ATLAS, ALICE, CMS), FAIR (CBM, PANDA) and other large-scale experiments as well as support to users of the JINR Laboratories and the JINR Member States (MPD/NICA, BESIII, LRB, FLNR, DLNP, BLTP, FLNP, VBLHEP); the integrated cloud environment of the JINR Member States for support of JINR users and experiments (NICA, ALICE, BESIII, NOvA, Daya Bay, JUNO, etc.); the HybriLIT platform with the GOVORUN supercomputer as a major resource for high-performance hybrid computing.

The continuation of the MICC project being the JINR basic facility is aimed to modernization and development of main hardware and software components of the computing complex, creation of a modern software platform designed to develop methods and algorithms of machine/deep learning (ML/DL) for encompassing a wide range of tasks.

In frame of the MICC modernization it is planned the following:

1. Development and improvement of the JINR telecommunication and network infrastructure.
2. Stage-by-stage modernization of the JINR MICC engineering infrastructure.
3. Modernization and development of the IT-infrastructure for the NICA project.
4. Expansion of the performance and capacity of storage systems of Tier1 data processing center for the CMS experiment.
5. Modernization and development of the resources being part of Tier-2/CICC integral component which provides support for the experiments using the grid environment and cooperating with physical groups in JINR as well as for non-grid JINR users and its Member States (MPD/NICA, BESIII, LRB, FLNR, DLNP, BLTP, LNP).
6. Extension of the cloud component in order to enlarge a range of services provided to users as well as to create an integrated cloud environment for the experiments of JINR (NICA, ALICE, BESIII, NOvA, Daya Bay, JUNO, etc.) and its Member States using the containerization technology.
7. Enlargement of the HybriLIT heterogeneous platform with the GOVORUN supercomputer.
8. Significant extension of the MICC components to meet requirements of neutrino experiments.
9. Development of a unified system for computing resource management aimed to big data processing.
10. Development of a unified data management system for all MICC components (JINR data lake).

The above-planned work on the modernization and further expansion of the MICC resources is driven by the rapid development of information technologies and new requirements of the experiments conducted at JINR and with the JINR participation. Multi-

functionality, scalability and high performance, a reliable data storage system, information security and a customized software environment for different user groups are the main requirements, which the MICC should meet as a modern scientific computing complex.

It is noteworthy that the part of work, mainly on the experiments at the LHC, is carried out in frame of the WLCG (Worldwide LHC Computing Grid) project. JINR computing resources and storage systems are integrated in the grid environment and provide processing, storage and analysis of data from the LHC experiments. A full-scale WLCG Tier1 site for the CMS experiment at the LHC plays a special role in this infrastructure. The importance of developing, upgrading and expanding the computing performance and data storage systems of this center is dictated by the research program of the CMS experiment, in which JINR physicists take an active part. The fact of the creation and support of the work of the JINR Tier1 site demonstrates a high qualification level of the JINR LIT staff ensuring the functioning of this MICC component. There are only seven similar CMS centers in the world, and the JINR site is regularly ranked as a second in the amount of processed events showing almost 100% level of availability and reliability.

The work on the creation of the joint cloud environment with the JINR Member States was carried out by the authors of the project at its first stage. The GOVORUN supercomputer commissioned in March 2018 is successfully functioning for users.

The work performed at the first stage of the MICC project is presented in the project report. The list of publications for 2017-2019 is attached.

The scientific relevance of the project is beyond doubt, since it is determined not only by the publications of the project authors, but also by the scientific results of experiments and users obtained during computing on the MICC resources. The intellectual contribution of the authors of the project to its implementation and modernization is evident.

JINR LIT has technical capacities for the project realization within the indicated time.

The requested financial resources are adequate to the planned work and correspond to the tendency of financing the work on IT-infrastructure at the first stage of the MICC implementation.

The project group of authors consists of specialists of high qualification, which is proved by a long-standing experience of the successful work in the WLCG project, as well as by the effective introduction of a new equipment in a short period of time as, for e example, the GOVORUN supercomputer.

The project definitely deserves support and continuation until 2023 with the first priority.

N.Russakovich
Chief Researcher, JINR