Referee report on the project for the JINR participation in the **Compressed Baryonic Matter** experiment during 2021-2025.

Compressed Baryonic Matter (CBM) experiment at SIS100 at FAIR (Germany) will perform the investigations in heavy ions collisions at the highest baryonic densities (as high as 8-10 times normal nuclear density) and at relatively moderate temperatures, where the transition from the ordinary nuclear matter to quark-gluon plasma is expected. This QCD -phase diagram part studies makes CBM experiment very complimentary for those performed at ALICE, ATLAS and CMS at LHC as well as at STAR and PHENIX at RHIC where low densities and high temperatures are mostly available.

CBM detector will able to detect and select the secondaries with unprecedented statistics including rare probes like D-mesons, charmonia, cascade hyperons and anti-hyperons, double hypernuclei, di- electrons and di- muons, which can provide the information on the first stage of nuclear interaction at SIS100 energies. These studies, therefore, are complimentary to the measurements performed during Beam Energy Scan (BES) -II at STAR, at NA61, at HADES and planned at BM@N and MPD.

In 2021-2025 the CBM collaboration will construct the minimal start version of the detector consisting of superconducting dipole magnet, silicon pixel vertex detector, silicon tracker system, ring imaging cherenkov counter, muon detector, transition radiation detector, time-of-flight based on resistive plate chambers, projectile spectator detector, infrastructure and high performance free-streaming data acquisition system. Apart for this, so called CBM Phase0 program is proposed for 2021-2023 which includes the participation of CBM physicists in eTOF project at STAR for BES-II program at BNL, in RICH project at HADES at GSI, in silicon tracker at BM@N at JINR. Moreover, mini-CBM setup which includes prototypes of almost all the detector systems is prepared at GSI to check the feasibility of the synchronization, data acquisition and slow control systems as well as to take data on the hyperon production.

JINR has already participated actively in the previous stages of the CBM project and has made remarkable contribution in its development. The JINR group designed the superconducting dipole magnet, which is a key part of the CBM setup. The technical design report on the superconducting dipole magnet has been prepared and approved at FAIR. The magnet will provide good momentum particle resolution with an accuracy at a level of 1%. The JINR team has designed, developed and tested several straw tracker prototypes and has made a corresponding contribution into the muon detector technical design report. LIT team took part in the data simulation, processing and analysis aimed to the optimization of the CBM detectors and global tracking procedure. LIT team has also contributed to physics program and relevant software like artificial neural networks, cellular automata and present-day methods and tools for the experimental data analysis. In physics JINR

focuses on the charmonia production in heavy ion and proton induced reaction, on the nuclear fragments and light hyper-nuclei production , on high transverse momenta pion spectra etc.

During the CBM Construction phase in 2021-2025, when the detector should be assembled and commissioned, JINR will perform the expertise of the CBM superconducting dipole magnet by the independent magnetic field and stresses calculations and will participate in the facility acceptance tests and magnet commissioning. JINR will continue further development of the software methods and algorithms for simulations, processing and analysis of the experimental data for CBM and mini-CBM. JINR will participate in the physics program for heavy ion collisions such as charmonia production in di-electron and di-muon channels, light nuclei fragments production, hard processes with high transverse momenta. JINR will continue to participate in R&D of the gaseous, silicon and segmented scintillation detectors.

CBM project is included in the 7-years plan for the development of JINR and in the perspective plan until 2030 y. Note that JINR participation in CBM allowed to bring significant amount of the additional resources via Germany-Russia Road Map into NICA due to close cooperation of CBM and BM@N/MPD in silicon trackers and software.

I would like to stress that JINR participation is crucial for successful development of the CBM experiment during 2021-2025. JINR team makes an important contribution to the development, construction and commissioning of the CBM detector subsystems, in the development of the software for the simulation and global tracking, in the preparation of the physics data analysis.

The requested from JINR budget resources are reasonable. The experience obtained by JINR scientists and engineers during their participation in the CBM experiment is very useful for realization of the NICA program at JINR.

Therefore, I strongly recommend PAC to support the participation of JINR team in the CBM project with highest priority for 2021-2025 yy.

Prof. V.A. Bednyakov
E-mail: bedny@jinr.ru