Referee report on the extension of the project:
«Deep underwater muon and neutrino detector on Lake Baikal»
for the years 2019-2021

The subject of neutrino astronomy is a well established and motivated research topic. Given the unique features of neutrino as a very weakly interacting particle, the neutrino fluxes from astrophysical objects should provide complementary information in addition to the conventional astronomy methods. This was understood since long but the real breakthrough has happened recently when the first experimental observation of astrophysical neutrino candidate events was announced by the IceCube experiment. Those results confirmed that a km3 volume detectors are already sensitive to detect such events and this became very important for the Baikal project, which by that time had a very well developed detector technology, proven at a smaller volume prototypes.

The full scale Baikal-GVD neutrino telescope project has a goal of constructing by the year 2023 of 14 clusters with 288 Optical Moodules (OM) each with the total effective volume of ~0.7 km3. In the timescale of this ambitious project a number of milestones has been set and some of them were reached already. Namely, the preparatory phase of this project has concluded in 2015 by the deployment of a first (demonstration) cluster «Dubna» with 192 OMs. In 2017 the second cluster was added and it is expected that by the year 2020 the array will contain 8 clusters covering an effective volume of ~0.4 km3. This will already open a possibility for very interesting measurements, especially taking into account that:

a) Baikal-GVD has a unique angular resolution, which is important for the search of local high energy neutrino sources in our Galaxy and
b) It is situated in the Northern Hemisphere complementing South Pole IceCube experiment measurements and providing better sensitivity to the Galactic center.

Apart from the main goal, the Lake Baikal detector can be used for searches of some dark matter candidates, magnetic monopoles and other exotic particles. The detector infrastructure also allows to perform environmental studies at Lake Baikal.

The JINR team is playing an essential role in materialization of those ambitious plans. It is responsible for several key detector constructions, software and physics analysis. The present team composition looks adequate for the current project goals but a constant attention should be paid to enforce it, especially, in the area of data processing and physics analysis. In particular, good understanding of the detector performance for muon tracks and cascades is a prerequisite for obtaining any physics results. Equally important is to develop efficient monitoring of the detector components behavior and data quality.

Operation of the present detector infrastructure and deployment of new strings provide an important information on the reliability of chosen technical decisions. This information should be carefully analyzed and, if necessary, used as a feedback for corrections. With the future increase of the detector volume those things may accumulate and it is important to be prepared for that and foresee an adequate JINR team and Collaboration enlargement. In this process further involvement of the Institutes from JINR member states is of the high priority.

In conclusion, Baikal-GVD is a well motivated and developed project with the strong JINR participation. The requested resources and timelines of the project are well understood and reliable. I recommend extension of this project at JINR for the years 2019-2021.

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