

Referee report on the Project Borexino/DarkSide (JINR participation)

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The report given to the Program Advisory Committee of JINR on 31 January 2018 outlines the proposal submitted by JINR neutrino physics researchers to continue their activities within the Borexino and Dark Side experiments at the Gran Sasso Laboratory in Italy.

This request of continuation goes beyond the previous proposal (2015-2018), which was focused on the Phase II Borexino run and on the initial setting up of the DarkSide-50 detector. As it is well known, the Borexino experiment at the Gran Sasso Laboratory is running with the scientific objective of precision measurements of the solar neutrino flux with an effective energy threshold of about 1 MeV. Solar ^7Be neutrinos can be detected with a very small uncertainty. Improved experimental conditions on high radio-purity allowed carrying on real-time measurement of pp neutrinos, hence obtaining important science results in the last few years.

Among the future goals, one expects a measurement of CNO neutrinos and an improved detection of geo-neutrinos, in addition to the measurement with an intense Ce antineutrino source for a very short baseline ancillary experiment (SOX). About DarkSide dark matter experiment, data taking is continuing for the prototype and design studies are in progress for the future 20 ton detector.

As far as the JINR group interests are concerned we can mention the data analysis, in particular that concerning geo-neutrinos, the pp neutrino flux measurement, and the work related to the SOX project. For DarkSide they intend to join the data analysis effort and measure the features of the ^{39}Ar component. For the 20 ton detector the JINR group is involved in the Monte Carlo simulation (notably for the SiPM). As far as the hardware contributions, the proposed activities of the Dubna group concern the development and production of the 220 magnetic shielding of the PMTs for the muon veto for the DarkSide 20k experiment.

As also mentioned in the SWAT analysis the referee sees serious risks for the SOX activities, mostly in relation to the availability of the intense source and to the related authorizations.

In relation to the planned activities of the group, the referee report given in 15 June 2015 stated: “In this perspective, it will be desirable that the JINR group takes clear analysis

responsibilities on crucial topics with well-identified leadership roles.” This issue should be better developed in the open presentation, making the specific JINR group contributions in the last period more evident, with emphasis on young researchers and leadership positions. The most notable hardware contribution of the group to the experiment is the rather early effort for the PMT test facility.

These discussions will have also impact on the definition of the future work (2018-2021). Moreover, the referee is concerned by the consistence of the group: 9 people with 4.5 FTs, no one at 100% and only one student, who regrettably is working only at 50%. Last but not least, the referee considers that the participation in the project has a relatively low profile (see also the financial requests), not matching the large interest in the physics program and the potential scientific outcome. One should probably discuss if for such a project a more visible and stronger JINR contribution should be envisioned or, on the contrary, a limited participation in a few specific research subjects.



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