Review of the **DANSS** project

(Detector of the reactor AntiNeutrino based on Solid state plastic Scintillator)

proposed for extension to 2019-2021

under the JINR research theme 03-2-1100 2010/2018

"Non accelerator neutrino physics and astrophysics"

It is proposed to exploit the detector of the reactor antineutrino based on the hydrocarbon plastic scintillator doped with gadolinium – **DANSS** – created in the previous project period. Antineutrino induces so-called inverse beta-decay (IBD) of the hydrocarbon proton, and then the products of IBD (positron and neutron) are detected with the scintillator. Highly segmented detector structure improves the signature of the IBD significantly. As the spectrometer does not contain inflammable liquids, it may be located close to the reactor core without problems. Under this condition, the detector is able to detect about 5000 IBD-events per day. In 2016-2017 the detector was pushed to operation and some preliminary results demonstrate its good characteristics.

At the moment, the detector is used to search for the short-range neutrino oscillations to the fourth sterile type. Due to a special lifting gear, the DANSS of all existing similar detectors would be probably one of the best suited for the job. Authors should continue their measurements in the next three years in order to realize this advantage. At the same time, it would be very important to widen the range of the reactor-detector distances which allows to extend the sensitivity to the lower values of the oscillation parameter Δm^2_{new}.

From the positron energy it is possible to reconstruct the initial neutrino spectrum which, in its turn, differs for different fissionable species. As a result, any changes in the isotopic composition of the reactor fuel (including the ^{235}U burn-off and ^{239}Pu turn-out) could be monitored in the real-time mode, which is especially important for the nonproliferation programs. These works should be continued as well.

Parallel to the DANSS exploitation, the group is developing a new device – S-cube detector which is smaller and cheaper but has better resolution and efficiency. This new detector could be easier replicated and used for the reactor tomography in future.

All the technical aspects of the project have been thoroughly considered and elaborated, optimal solutions found. Numerous tests performed in a JINR lab and under a $3GW_{th}$ reactor of the Kalinin nuclear power plant as well as one-year operation of DANSS have demonstrated reliability of the chosen concept. Authors have great experience in the field of neutrino physics, in particular – in the low-background measurements searching for 2β-decay and neutrino magnetic moment (NEMO, TGV, GERDA and GEMMA experiments). I have no doubts that the goals of the project could be reached successfully as well.

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