

Referee Report on DANSS Prolongation and construction of DANSS -2
by Hans H. Gutbrod, January 2021

The collaboration has presented its plans for the coming next three years, pointing out the ongoing work and physics analysis with DANSS and its development of an improved DANSS-2 detector. In 2023-2024, data will be taken by the DANSS-2 spectrometer with much better resolution than DANSS. The data-analysis is expected to allow expanding the region of the tested phase space of oscillations into a sterile neutrino and, most importantly, reaching the signal region in the NEUTRINO-4 experiment $\sin^2(2\theta_{14}) \sim 0.25$, $\Delta m_{14}^2 \sim 7 \text{ eV}^2$. Verification of this signal is indeed an important scientific problem in modern fundamental physics.

The proposed improvement of the detector design looks very reasonable and promising. The new scintillation material should help if it is produced in a quality as specified. The wavelength shifting fibres should be of state of the art.

However, the use of the existing set-up of old DANSS should be evaluated in more detail, if it is really the best way to achieve the Physics goals.

- a) The proposal states: *The output from four SiPMs on one side of the strip will be combined into one channel to keep the same number of channels in the DAQ.* Is it prudent to stay with the present DACQ system or would it be better to read out the SiPMs individually and add their signals later after thorough calibration?
- b) As discussed in 2019, the group wanted to enable the set-up to change the distance of the detector in the range from 5 – to 18 m to the reactor core. In the motivation slide of the present proposal, the group talks about 5-20 m. This is not in agreement with the statement in slide 7: *“The detector is built on a movable platform. Data are taken at 3 distances 10.9m (Up), 11.9m (Middle), and 12.9 m (Down) from the reactor (center to center), changed sequentially 3 times per week.”* From the reactor layout, it looks impossible to achieve positions closer than the achieved 10.9 m. Larger distances could be achieved by going down one floor onto the tram level. I would like to see the group explaining the physics impact by the geometrical limitations to the 10.9 to 12.9m region.

I am recommending the proposal for funding as proposed and would like to ask the team to present in the meeting in the coming week the answers to my questions and also what is still open from my referee report of January 2019.

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