1a. Goals of the experiment

Initial goal of the **DANSS** project started in 2010 was to develop and create a detector of the reactor antineutrino and then explore it in order to monitor industrial power reactors. After the "Reactor Anomaly" claimed in 2011, one more goal has appeared – search for short-range neutrino oscillation to a sterile state. Within the previous period of the project realization, the unique neutrino spectrometer **DANSS** has been built and started to operation at Kalinin Nuclear Power Plant (KNPP, Russia) in 2016. Some features of the detector make it free of numerous disadvantages being inherent in similar devices: absence of dangerous liquids, extremely high neutrino flux, good shielding against cosmic rays, high segmentation of the detector body, on-line variation of the distance from the core within 10.7 – 12.7 m. The latter property allows us to investigate short-range neutrino oscillation in a model-independent way. Today, the limits produced with **DANSS** are the strongest in the world.

Parallel to a regular data taking with the **DANSS** spectrometer, few additional goals are set for the nearest future:

1. accumulate statistics enough to widen the sensitivity region of the oscillation parameter values in the range of $\sin^2(2\theta_{new}) \approx 0.01$ with $\Delta m^2_{new} \approx (0.1 – 5.0)\ eV^2$;
2. investigate detailed dependence of the neutrino spectrum from the reactor power and the fuel composition during 2-3 full reactor campaigns (one campaign takes 18 months);
3. make necessary steps towards measurement of the neutrino spectra at shorter and longer distances (5–18 m) from the point-like reactor SM3 at the NIIAR (in collaboration with **NEOS** and **Neutrino4**);
4. develop and create two new smaller and simpler neutrino detectors **S^3** (***S-cube***) with improved parameters to be exploited at the Kalinin NPP (RU) and Temelin NPP (CZ).

1b. Place of the DANSS between competitive projects

The **DANSS** project is the only one using movable segmented neutrino detector close to an industrial power reactor. Only **NEOS** detector operates under similar conditions, but it is not segmented, uses liquid scintillator and therefore (by safety reasons) is located at a twice longer distance – 27 m. Being unmovable, the **NEOS** can produce only model-dependent results. The other competitive projects (**PROSPECT**, **SoLid**, **STEREO** and **Neutrino4**) use segmented liquid scintillator and are located near small low-power research reactors. Only **Neutrino4** is in a real operation producing physical results, the rest three are at the starting/tuning stage now.

2a. Contribution of the JINR group

Most of the DANSS hardware (70-80%) was developed and produced in JINR, purchased by JINR or payed by JINR: slow-control system (^{3}He neutron detectors, NaI gamma-detectors, etc.), all mechanical structure with lifting system, 2500 scintillator strips, WLS fibers, 50 PMTs, 2500 SiPMs, polyethylene neutron shielding, copper gamma-shielding, active muon veto, PMT acquisition electronics (5 crates + 5 PC).

The JINR team played the leading role in all stages of the spectrometer mounting under the Reactor #4 of the KNPP. Operation of the **DANSS** detector is driven by 2 JINR physicists who present at KNPP (Tver region, 285 km from Dubna) permanently on a basis of one-week shifts.

Development and creation of two **S-cube** detectors is done by the JINR physicists in collaboration with ÚTEF ČVUT (Prague, Czechia).

Participation of JINR in the **Neutrino4** project consists in production of the muon veto system, assistance in the logistic (transportation of the **NEOS** LS from Korea to Russia), as well as some R&D. Taking into account significant progress and former results of **Neutrino4**, our participation in this project (namely, in its next version – **Neutrino6**) could be intensified significantly next years.

2b. Responsibility of the JINR group in the collaboration management

As the **DANSS** project was initiated by the JINR and ITEP, we follow the 50:50 parity in the collaboration management.

On the other hand, **S-cube** neutrino detector was initiated by the JINR and ÚTEF ČVUT. Being the members of JINR, both Prague and Dubna physicists participate in these works within the JINR research theme 03-2-1100-2010/2018 "Non-Accelarator Neutrino Physics and Astrophysics".

As was mentioned above, the JINR participation in the **Neutrino4** is quite limited (at least, today). So, we do not pretend to any management role there. The situation could be changed if we decide to participate more intensively in the **Neutrino6** (next generation of the project).

3. Plans

In the next project period (years 2019-2021) the JINR group will work in following directions:

- Perform neutrino diagnostics of the reactor (measure $E\nu$-spectrum as a function of the campaign time) with the **DANSS** spectrometer.
- Create two new neutrino detectors **S**^{3} ***(S-cube)*** and start it to operation.
- Depending on the situation, take more active part in upgrade of the **Neutrino4** detector.
- Continue searching for short-range neutrino oscillations (measure $E\nu$-spectrum as a function of the distance) with the existing **DANSS** spectrometer and with a new detector being under creation now within the **Neutrino4/Neutrino6** project in NIIAR (Dimitrovgrad).

4. Publications:

1. **"DANSS: Detector of the reactor AntiNeutrino based on Solid Scintillator"**, I.Alekseev et al., JINST **11** (2016) no.11, P11011;
   DOI: 10.1088/1748-0221/11/11/P11011; arXiv:1606.02896 [physics.ins-det]
   Detailed description of the DANSS detector – construction, parameters, estimated sensitivity, etc. (JINR authors: 20 of 31; JINR corresponding author)
2. **"DANSS Neutrino Spectrometer: Detector Calibration, Response Stability, and Light Yield"**, I Alekseev et al., Physics of Particles and Nuclei Letters **15** (2018) 272–283; *DOI: 10.1134/S1547477118030020*
   Description of the data analysis procedure (JINR authors: 7 of 16; JINR corresponding author)
3. **"Search for sterile neutrinos at the DANSS experiment"**, I Alekseev et al., Phys.Lett. **B787** (2018) 56-63*; DOI: 10.1016/j.physletb.2018.10.038*; arXiv:1804.04046 [hep-ex]
   Presentation of the first preliminary results (JINR authors: 20 of 31, ITEP corresponding author)

5. PhD theses:

Two theses (V.Belov, I.Zhitnikov) are in preparation, both devoted to the DANSS construction, operation, data analysis and physical results. The titles are not fixed yet; the theses are expected to be completed within 2019.

Talks

In **DANSS** presentations we follow the 50:50 parity with ITEP colleagues – both for **6a** and **6b**.

6a

1. V. Egorov, **"Detection of reactor neutrinos with DANSS: results of one-year operation"**, talk at XXVIII International Conference on Neutrino Physics and Astrophysics (**Neutrino 2018**), Heidelberg, Germany, 4-9 June 2018; DOI: 10.5281/zenodo.1286986

6b

1. Yu. Shitov, **"Status of the DANSS project: in pursuit of a light sterile neutrino"**, talk at 15th International Conference on Topics in Astroparticle and Underground Physics, (**TAUP2017**), 24 - 28 July 2017, Sudbury, ON, Canada.
2. I. Zhitnikov, **"Status of the DANSS experiment"**, talk at International Session-Conference of the Section of Nuclear Physics of the Physical Sciences Department of the Russian Academy of Sciences "Physics of fundamental interactions" dedicated to 50th anniversary of Baksan Neutrino Observatory, June 6-8, 2017, Nalchik, Russia.
3. M. Shirchenko, N. Scrobova, **"Searches for sterile neutrinos at the DANSS experiment"**, talk at The International Workshop on Particle Physics at Neutron Sources (**PPNS-2018**), 24-26 May 2018, LPSC, Grenoble, France.
4. M. Shirchenko, **"Search for sterile neutrino in DANSS experiment"**, talk at The 6th Symposium on Neutrinos and Dark Matter in Nuclear Physics (**NDM-2018**). 29 June - 4 July 2018. IBS HQ, Daejeon, Korea
5. V. Belov, **"Actual status of the DANSS project"**, talk at The Int. Conf. New Trends in High-Energy Physics (**NTiHEP-2018**), Budva, Becici, Montenegro 24 - 30 September, 2018.
6. V. Belov, **"Actual status of the DANSS project"**, talk at the LXVIII International conference **NUCLEUS 2018**, July 2 – 6 2018, Voronezh, Russia
7. V. Egorov, **"Sterile neutrinos: Latest results from reactors with focus on DANSS results"**, talk at the 8th edition of the Very Large Volume Neutrino Telescopes Workshop (**VLVnT-2018**) 2 – 4 October 2018, Dubna, Russia.
8. Yu. Shitov, **"Status of the DANSS"**, talk at The 14th International Workshop on Applied Antineutrino Physics (**AAP-2018**), 10-11 October 2018, Livermore, California, USA.

Non-JINR physicists have presented our common results at approximately similar number of conferences/workshops.

7. Group size, composition and budget.

7a. Estimation of JINR human resources

Size of the JINR group is not fixed because the same physicists participate in several experiments performed inside the same Department, very often using the same equipment end techniques, so that their activity (especially, that of technician staff) is distributed over the projects irregularly in time – depending on necessity.

The DLNP JINR participants: continuation of works with the **DANSS** detector (regular shifts, maintenance, data analysis); development, creation and exploitation of the **S^3** detector at KNPP (*R&D*, mounting, electronics, data analysis); specific *R&D* dedicated to the liquid scintillators which could be used in **Neutrino6** and other neutrino detectors (NOvA, JUNO, DayaBay, etc.).

Neutrino spectrometer:			**DANSS**				**S^3 (#2)**				
JINR staff member			type of activity								
Name (*the young persons are marked with color*)	*Position*	*% of participation*	*Maintenance*	*Regular shifts*	*Data analysis*	*MC simulations*	*R&D*	*Mounting*	*ACQ electronics*	*Data analysis*	*MC simulations*
V.V. Belov	jun.	100	+	+	+		+	+	+	+	
V.B. Brudanin	dep.	10	*Management of all works*								
V.G. Egorov	sect.	100	*Management and participation in all works*								
M.V. Fomina	jun.	100			+	+	+	+		+	+
S.V. Kazartcev	jun.	100	+	+			+	+	+	+	
A.S. Kuznetsov	ing.	100	+	+		+	+	+	+	+	+
D.V. Medvedev	sci.	30	+	+				+	+		
A.G. Olshevsky	dep.	5	*Management of some works*								
I.E. Rozova	jun.	50			+		+	+	+		
N.S. Rumyantseva	jun.	30			+		+	+	+		
Ye.A. Shevchik	ing.	30	+	+			+	+	+	+	
M.V. Shirchenko	sci.	50	+	+			+	+	+		
Yu.A. Shitov	sen.	50			+	+	+	+	+		+
I.V. Zhitnikov	jun.	100	+	+	+	+	+	+	+	+	+
D.R. Zinatulina	jun.	50					+	+	+		

7b. No changes are expected.

7c. The JINR group budget

Expenditures, resources, financing sources		Costs (k$) Resource Require-ments	Proposals of the Labora-tory on the distribution of finances and resources		
			1st yr	2nd yr	3rd yr
Expenditures	Materials for the **S3** detector (scintillators, PMTs,WLS fibers, Pb and CHB shielding, mechanics)	211	151	60	0
	Components and materials for R&D (optic glue, cables, connectors, instruments, etc.)	25	10	10	5

		Scint. counters for muon veto of the new spectrometer at NIIAR	130	65	65	0
		Electronics for the **S3** detector (VME- and NIM-crates and devices, PC and additional hard disks for data)	34	20	12	2
		Total	**400**	**246**	**147**	**7**
esRequired	urStandard	Resources of – Laboratory design bureau – Laboratory experimental workshop	300 600	100 200	100 200	100 200
Financing sources	Budgetary	Budget expenditures including foreign-currency resources.	**400**	**246**	**147**	**7**
	esExternal s	Contributions by collaborators. Grants.	0	0	0	0