



# **New service in HybriLIT ecosystem**

**Shushanik Torosyan**  
on behalf of the team

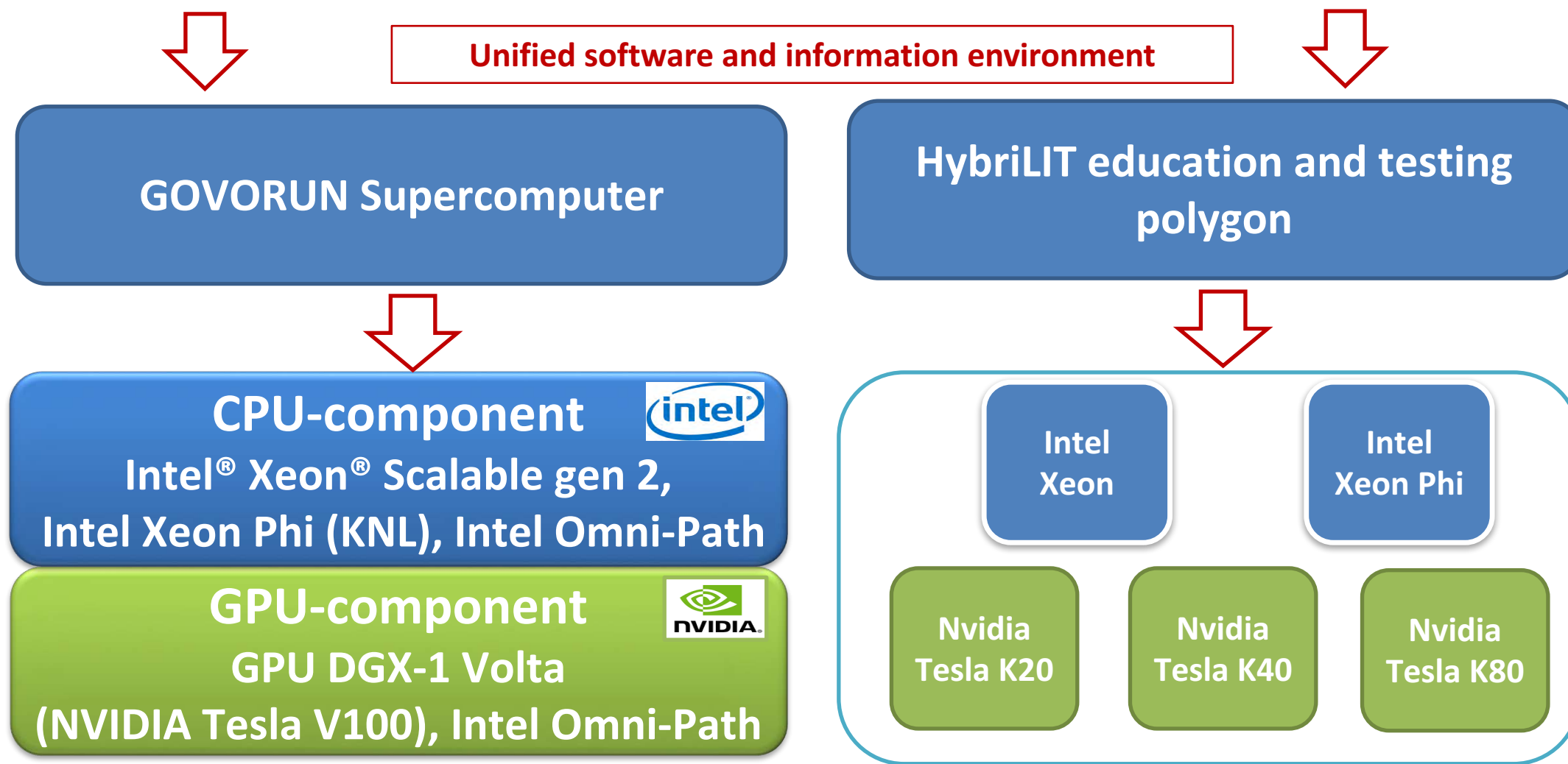
**Alushta-2021**

**June 8–15**

**Laboratory of Information Technologies**



## HYBRILIT HETEROGENEOUS COMPUTING PLATFORM





# High-performance data processing and storage system on the GOVORUN supercomputer



**Virtual Institute for I/O**

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## IO 500

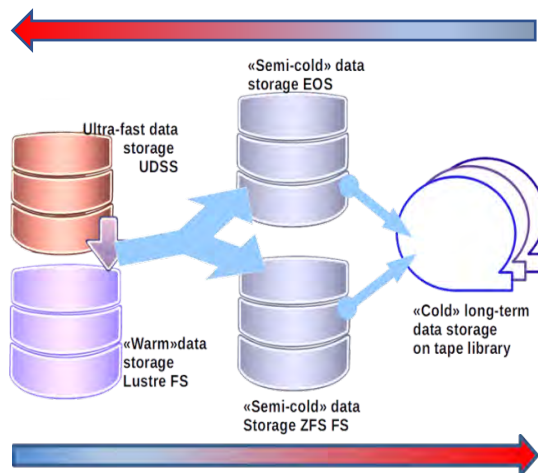
This is the official list from ISC-HPC 2018. The list shows the best result for a given combination of system/institution/filesystem.

#	Information						io500		
	system	institution	filesystem	storage vendor	client nodes	data	score	bw	md
								GiB/s	kIOP/s
1	Oakforest-PACS	JCAHPC	IME	DDN	2048	zip	137.78	560.10	33.89
2	ShaheenII	KAUST	DataWarp	Cray	1024	zip	77.37	496.81	12.05
3	ShaheenII	KAUST	Lustre	Cray	1000		41.00*	54.17	31.03*
4	JURON	JSC	BeeGFS	ThinkparQ	8		35.77*	14.24	89.81*
5	Mistral	DKRZ	Lustre2	Seagate	100		32.15	22.77	45.39
6	Sonasad	IBM	Spectrum Scale	IBM	10	zip	24.24	4.57	128.61
7	Seislab	Fraunhofer	BeeGFS	ThinkparQ	24		16.96	5.13	56.14
8	Mistral	DKRZ	Lustre1	Seagate	100	zip	15.47	12.68	18.88
9	Govorun	Joint Institute for Nuclear Research	Lustre	RSC	24	zip	12.08	3.34	43.65
10	EMSL Cascade	PNNL	Lustre		126		11.12	4.88	25.33
11	Serrano	SNL	Spectrum Scale	IBM	16		4.25*	0.65	27.98*
12	Jasmin/Lotus	STFC	PanFS	Panasas	64	zip	2.33	0.26	20.93

Values with \* indicate that a value for the computation was missing.

Further lists with more data

## Velocity of data processing



## Volume of data storage

The Govorun supercomputer ranks 17th in the current edition of the IO500 list (July 2020) and is the first in terms of data processing speed among Russian supercomputers. The second fastest Russian supercomputer "Polytechnic - RSK Tornado", located in SPbPU, takes 22nd place in the IO500 list. At the same time, it should be noted that the most powerful Russian supercomputers Kristofari and Lomonosov-2 are not included in this list, and the supercomputer "Polytechnic - RSK Tornado" takes 5th place in the TOP50 rating.

#	Institution	System	io500		
			Score	BW GiB/s	MD kIOP/s
1	Intel	Wolf	1792.98	371.67	8649.57
2	WekaIO	WekaIO on AWS	938.95	174.74	5045.33
3	TACC	Frontera	763.80	78.31	7449.56
4	Argonne National Laboratory	Presque	537.31	108.19	2668.57
5	National Supercomputing Center in Changsha	Tianhe-2E	453.68	209.43	982.78
17	JINR	Govorun	90.87	35.61	231.88
22	SPbPU	Polytechnic RSC Tornado	64.29	21.56	191.73

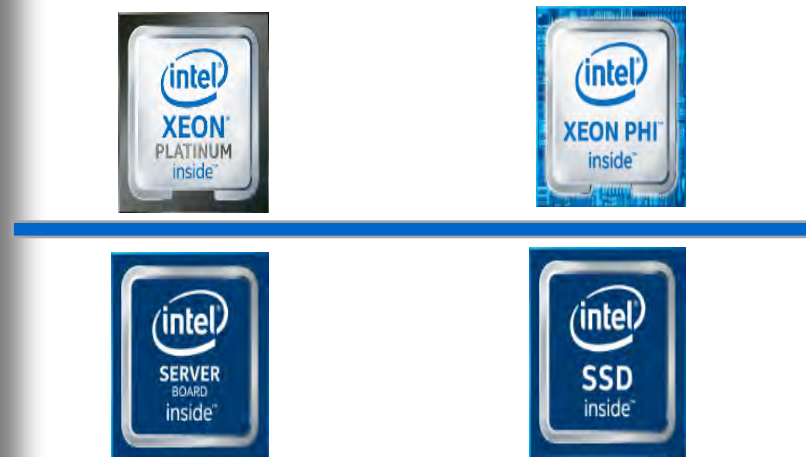
# Upgrade of the «Govorun» supercomputer



In November 2019, a presentation and a demonstration of the modernized “Govorun” supercomputer took place at LIT.



First modification, 2018:  
Total peak performance:  
1 PFlops for single precision  
500 TFlops for double precision



Number of computing cores:

1440 → 4224

Capacity of UDSS:

120 TB → 288 TB

Data input/output rate:

56 GB/s → 300 GB/s



**#10 in Top50**

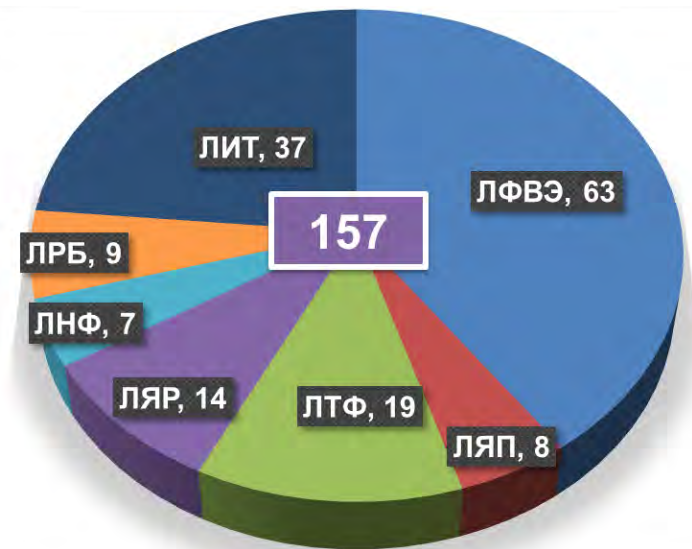
Second modification, 2019:  
Total peak performance:  
1.7 PFlops for single precision  
860 TFlops for double precision

# GOVORUN for the tasks of JINR

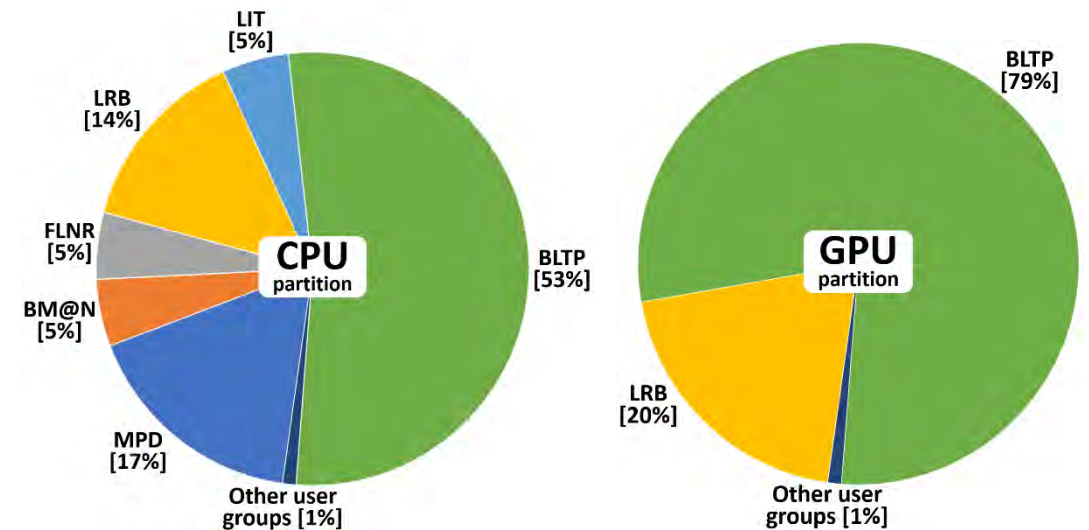


The resources of the Govorun supercomputer are used by scientific groups from all the JINR laboratories within the framework of **25 topics of the JINR Topical Plan** for solving a wide range of problems both in the field of theoretical physics and for modeling and processing experimental data.

**LHEP**: 1065, 1066, 1087, 1088, 1097, 1107, 1108;  
**BLTP**: 1117, 1135, 1137, 1138; **DLNP**: 1099, 1100, 1123;  
**FLNP**: 1105, 1121, 1122, 1128; **FLNR**: 1129, 1130, 1131;  
**LIT**: 1118, 1119; **LRB**: 1077.



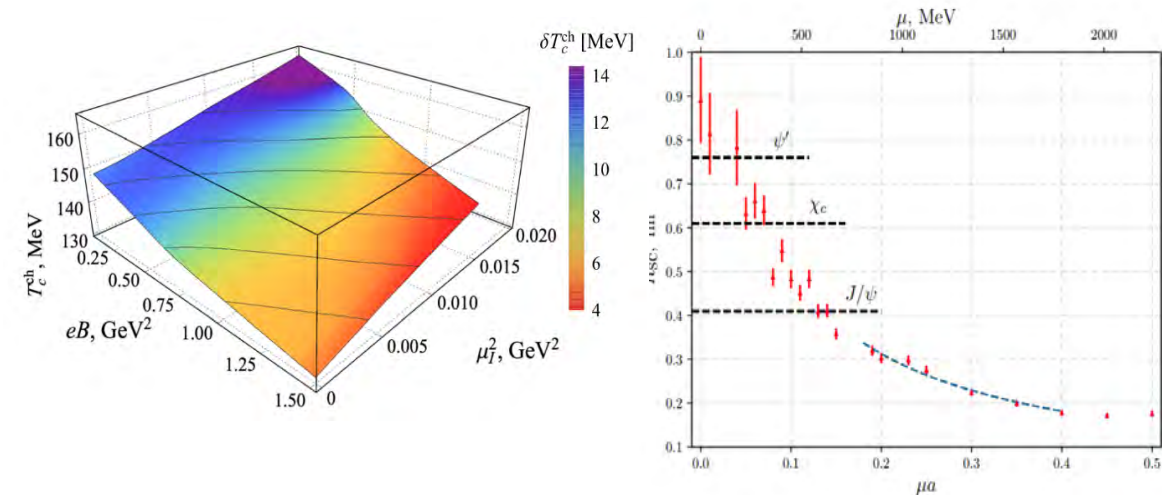
Distribution of users by laboratories



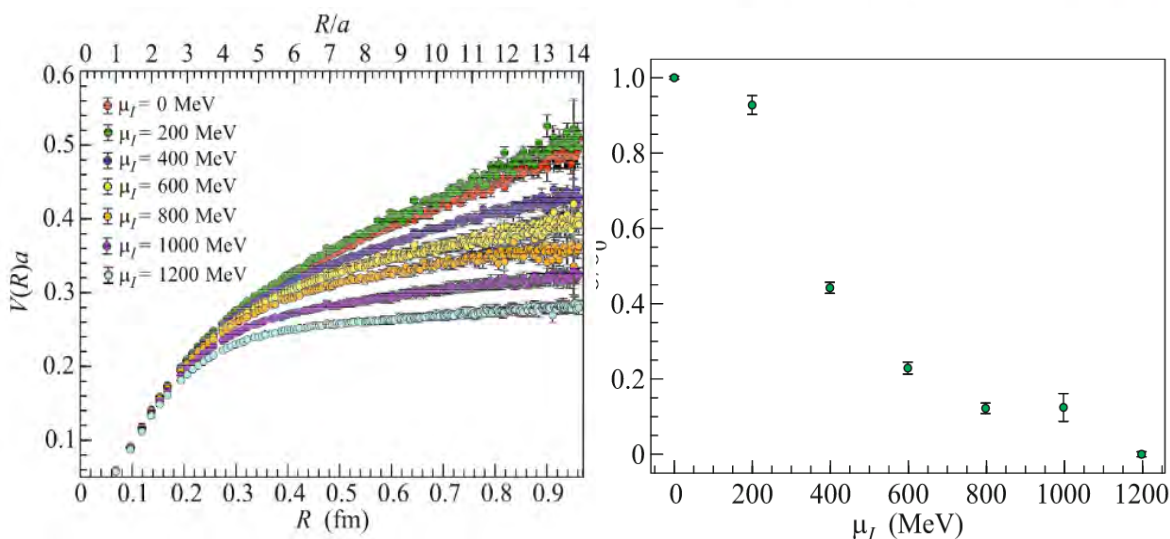
Distribution of resources according to the user groups

Research results obtained using supercomputer resources in 2020 are presented in **65** publications.



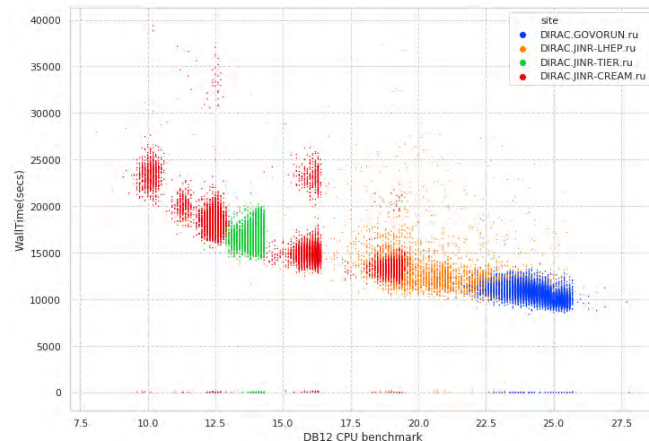
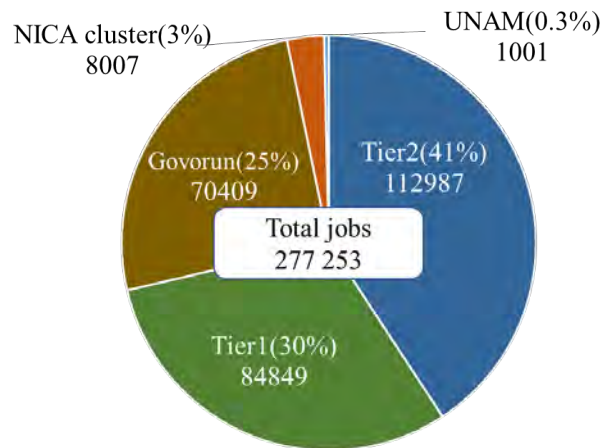
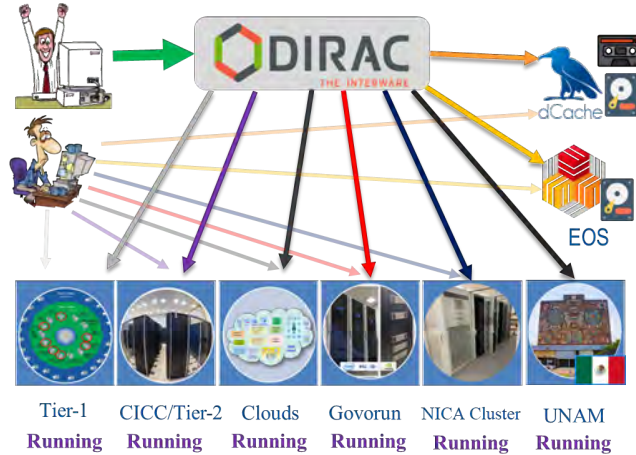
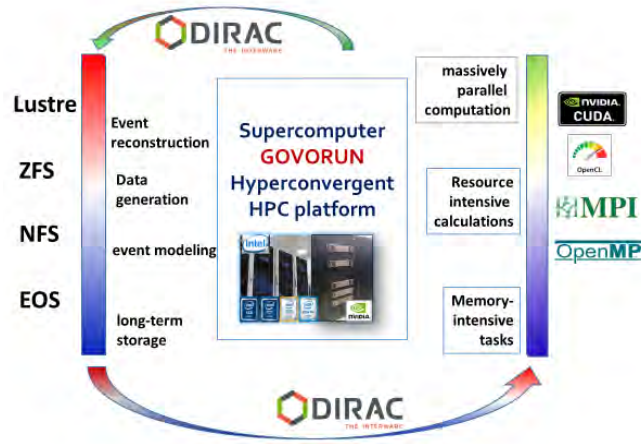


The resources of the SC "Govorun" were used to study the properties of quantum chromodynamics (QCD) and Dirac semimetals in the tight-binding mode under extreme external conditions using lattice modeling. Such a study requires inversion of large matrices, which is performed on video cards (GPU), as well as massive parallel CPU computations to implement the quantum Monte Carlo method.



## Publications:

1. V. V. Braguta, M. N. Chernodub, A. Yu. Kotov, A. V. Molochkov, and A. A. Nikolaev, Phys. Rev. D 100 (2019), 114503, DOI: 10.1103/PhysRevD.100.114503, arXiv:1909.09547
2. V.V. Braguta , A.Yu. Kotov, A.A. Nikolaev, JETP Lett. 110 (2019) no.1, 1-4, DOI: 10.1134/S0021364019130083 (Письма ЖЭТФ, 110 (2019) no.1, 3-6)
3. N. Astrakhantsev, V. Bornyakov, V. Braguta, E.M. Ilgenfritz, A.Y. Kotov, A. Nikolaev, A. Rothkopf, PoS Confinement2018 (2019), 154, DOI: 10.22323/1.336.0154
4. V. V. Braguta, M. I. Katsnelson, A. Yu. Kotov, and A. M. Trunin, Phys.Rev. B100 (2019), 085117, DOI: 10.1103/PhysRevB.100.085117 , e-Print: arXiv:1904.07003
5. N. Yu. Astrakhantsev, V. G. Bornyakov, V. V. Braguta, E.-M. Ilgenfritz, A. Yu. Kotov, A. A. Nikolaev, A. Rothkopf, JHEP 1905 (2019) 171, DOI: 10.1007/JHEP05(2019)171,e-Print: arXiv:1808.06466
6. <https://arxiv.org/abs/1902.09325>
7. <http://arxiv.org/abs/1910.08516>



To solve the problems of mass modeling and reconstruction of the data for the NICA MPD experiment, the resources of the Govorun supercomputer (SC) of the Laboratory of Information Technologies (LIT) are actively used. The practice of using various computing resources of JINR and other institutes of the MPD collaboration has shown that at the moment **the most effective is the use of computing resources on the SC "Govorun"**.

The unique setup of the Govorun SC equipment, which includes a super-fast data access system and computational nodes with a large amount of RAM (3 TB per node), made it possible to process the same number of events on almost half the number of computational cores as on other available computing resources.

Global recognition of tracks among the noises is carried out immediately over the entire picture of the event. The GraphNet program is based on the use of graph neural networks for tracking. An event is represented as a graph with counts as nodes, and then this graph is inverted into a linear orggraph, when the edges are represented by nodes and the nodes of the original graph are represented by edges. In this case, information about the curvature of track segments is embedded in the edges of the graph, which simplifies the recognition of tracks in the sea of fakes and noises.

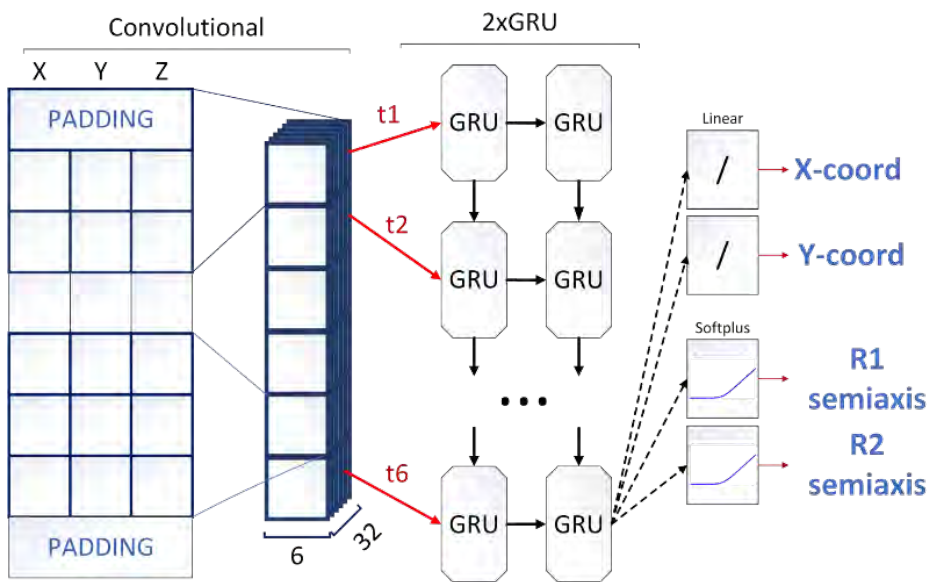
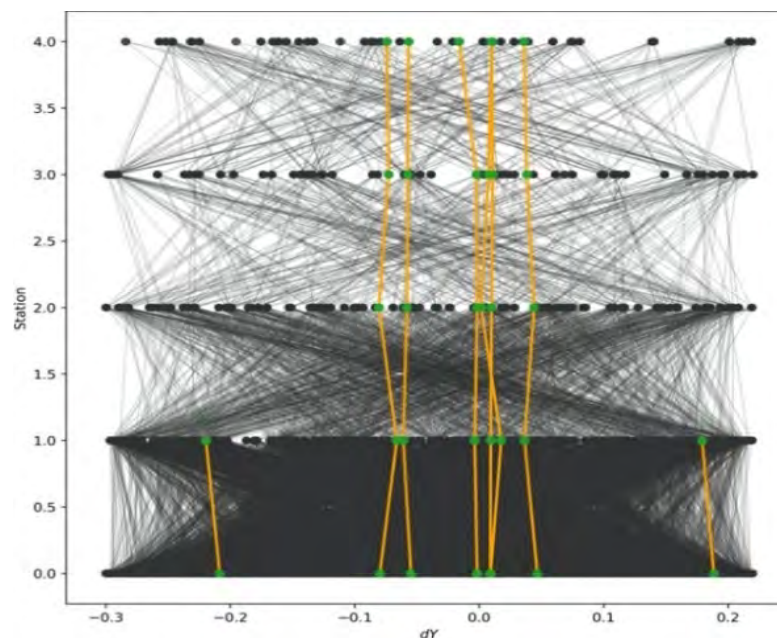


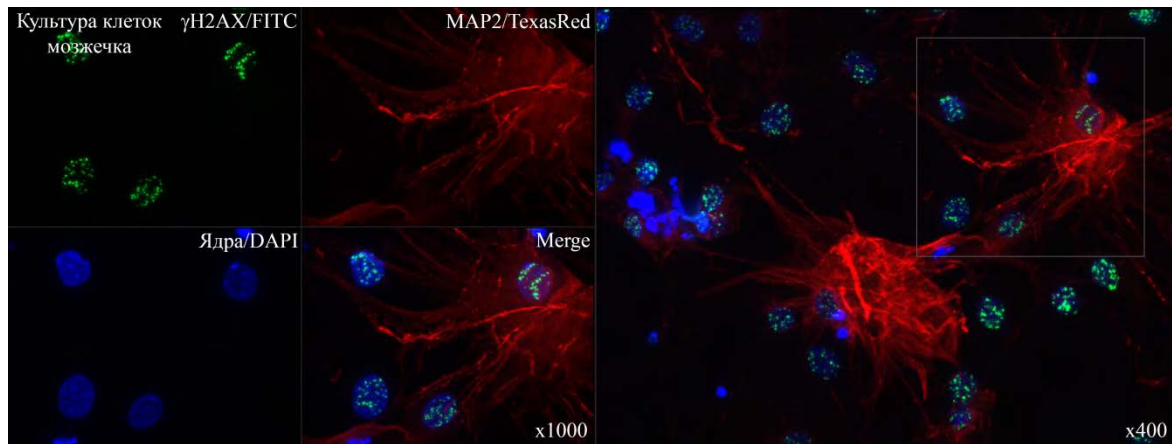
Схема нейросети TrackNETv2







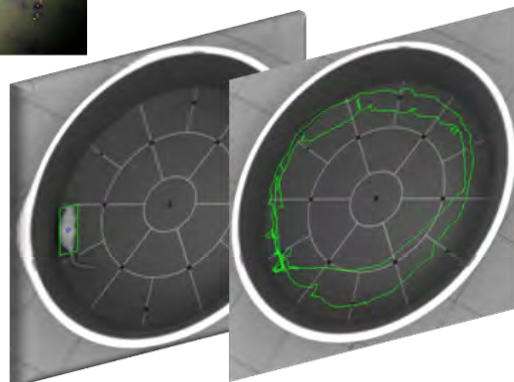
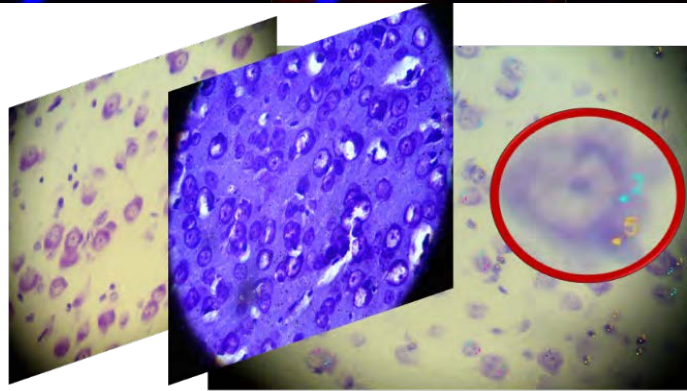
# Information system for radiobiology tasks (MLIT and LRB project)



**This project by MLIT and LRB** is aimed at development of information system for experimental data storage and analysis of changes in the central nervous system of mammals based on molecular, pathomorphological and behavioral changes in the mammalian brain when exposed to ionizing radiation and other factors.

**This information system allows:**

- To accelerate and simplify the work with experimental data for various groups of researchers
- to simplify and accelerate the diagnosis of pathologies of the central nervous system, and in a particular case, the development of effective methods of prevention and protection against ionizing radiation.

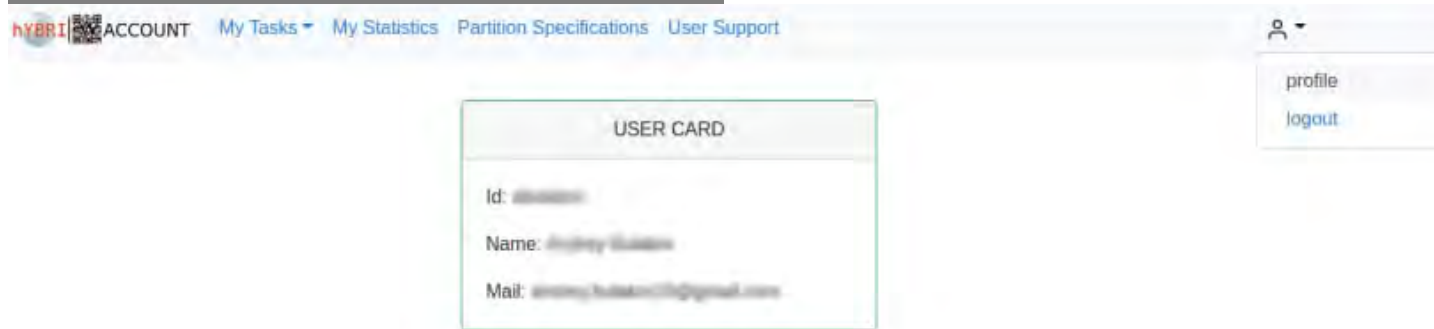


*Research is being held at the resources of theHybriLIT JINR  
heterogeneous platform*

# HybriLIT: User Account



- Increasing number of users arises the need to develop a special service aimed at containing the main info about the system
- A service that allows to work in the browser instead of using several services and save time
- Information amount is too high and too distributed among other services
- Different teams of users cannot be fully supported



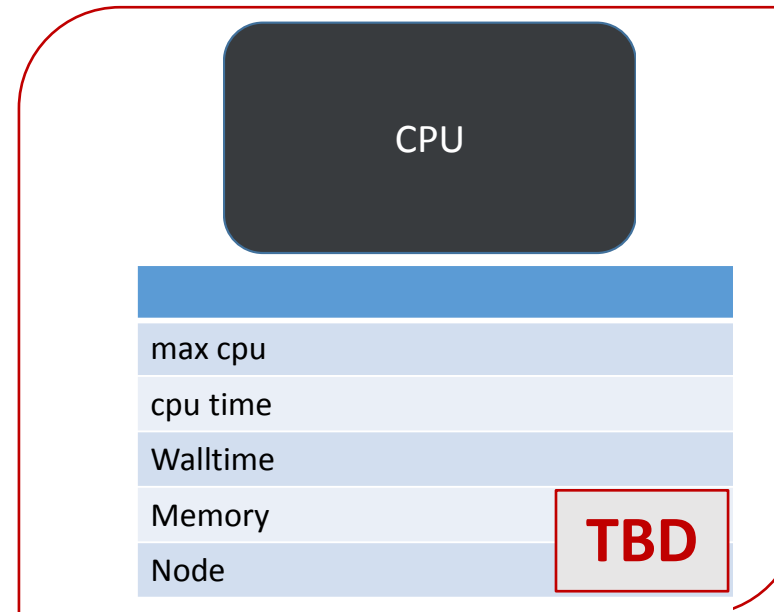
# HybriLIT: User Account



## 1. User Tasks:

JOBID	PARTITION	NAME	USER	DATE AND TIME START	DATE AND TIME END
114737	dgx	run.sh	...	Nov 04 2020, 21:42:41	Nov 05 2020, 6:15:28
114736	dgx	run.sh	...	Nov 04 2020, 21:39:47	Nov 04 2020, 21:39:51
114735	dgx	run.sh	...	Nov 04 2020, 21:38:04	Nov 04 2020, 21:38:05
114634	dgx	run.sh	...	Nov 04 2020, 21:33:26	Nov 04 2020, 22:39:25
114633	dgx	run.sh	...	Nov 04 2020, 21:29:47	Nov 04 2020, 21:29:48
114623	dgx	run.sh	...	Nov 04 2020, 21:25:40	Nov 04 2020, 21:29:05
114531	dgx	run.sh	...	Nov 04 2020, 21:16:44	Nov 04 2020, 21:25:17
111830	dgx	run.sh	...	Nov 04 2020, 15:48:04	Nov 04 2020, 15:52:47
111728	dgx	run.sh	...	Nov 04 2020, 15:39:18	Nov 04 2020, 15:40:58
111719	dgx	run.sh	...	Nov 04 2020, 15:34:29	Nov 04 2020, 15:38:53

## 2. Partition specs:



User can checkout their tasks with different “status” which include:

- *running*
- *pending*
- *completed*
- *suspended*

1

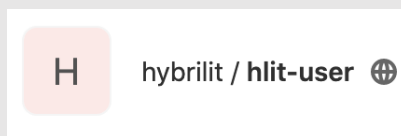
User can checkout their tasks history for a period of time (e.g. 7 days as shown here).

This helps users to keep track of their own activity and have basic statistics.

1

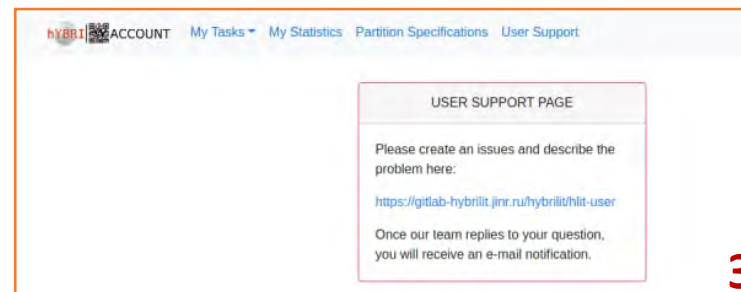
## 3. User Support

User Support page re-directs you to the Gitlab project:



where users can report their problem or request help.

3



3





***Thank you for attention!***

**HETEROGENEOUS PLATFORM HYBRILIT IN LIT JINR:**

**<http://hlit.jinr.ru>**