

Supercomputer GOVORUN a year later

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Network infrastructure 3 x 100 Gb/sec

Grid infrastructure - Tier1-center for CMS

- Tier2-center for all LHC experiments

Cloud infrastructure uniting the clouds of the JINR Member States

✓ Supercomputer «GOVORUN»

✓ Advanced storage system

Current CPU-component



RSC Tornado nodes based on Intel[®] Xeon Phi[™]:

• Intel[®] Xeon Phi[™] 7190 processors (72 cores)

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- Intel[®] Server Board S7200AP
- Intel[®] SSD DC S3520 (SATA, M.2)
- 96GB DDR4 2400 GHz RAM
- Intel[®] Omni-Path 100 Gb/s adapter







RSC Tornado nodes based on Intel[®] Xeon[®] Scalable:

- Intel[®] Xeon[®] Gold 6154 processors (18 cores)
- Intel[®] Server Board S2600BP
- Intel[®] SSD DC S3520 (SATA, M.2), 2 x Intel
 [®] SSD DC P4511 (NVMe, M.2) 1TB
- 192GB DDR4 2666 GHz
- Intel[®] Omni-Path 100 Gb/s adapter

Multi-level management software RSC BasIS

Current GPU-component

NVIDIA DGX-1 The world's most powerful supercomputer for AI

8x Tesla V100 with NVLink interconnect60 TFlops double precision120 TFlops single precisionUnique energy efficiency 3.2 kW

Full stack deep learning software preinstalled Replaces 400 traditional dual CPU servers on DL applications

Monitoring systems



High reliability

RSC

High availability and fail-safe operation are provided by an innovative system of control and monitoring of separate nodes and the entire cluster system

Software stack «RSC BasIS» for multi-level system management

Monitoring systems

				CPU				
id	name	cores	load	sys	user	nice	iowait	idle
1	n02p001	72	61.79	0%	100 %	0 %	0 %	0 %
2	n02p002	72	42	9.9 %	48.5 %	0 %	0 %	41.6 %
3	n02p003	72	62.77	0 %	100 %	0 %	0 %	0 %
4	n02p004	72	61.86	0 %	100 %	0 %	0 %	0 %
5	n02p005	72	62.09	0 %	100 %	0 %	0 %	0 %
6	n02p006	72	62.8	0 %	100 %	0 %	0 %	0 %
7	n02p007	72	62.02	0 %	100 %	0 %	0 %	0 %
8	n02p008	72	61.33	0 %	100 %	0 %	0 %	0 %
9	n02p009	72	62.17	0 %	100 %	0 %	0 %	0 %
10	n02p010	72	60.78	0 %	100 %	0 %	0.%	0 %
11	n02p011	72	61.79	0 %	100 %	0 %	0 %	0 %
12	n02p012	72	0	0 %	0 %	0 %	0 %	100 %
13	n02p013	72	72.07	0.1 %	100 %	0 %	0 %	0 %
14	n02p014	72	72.12	0.1 %	99.9 %	0 %	0 %	0 %

Stat-hlit: https://home-hlit.jinr.ru/#/

litMon: https://litmon.jinr.ru

dgx

14,65%

knl

24,79%

dgx knl skylake

Время

skylake

60.56%

Over 72 000 tasks (NICA – over 40 000)

Heterogeneous platform "HybriLIT"

Unified software and information environment

HLIT-VDI – Virtual desktops system

Surface: Magnetic flux density norm (T) -1 -1 0

VDI by citrix

Magnetic field distribution at median plane of the magnet

Superconducting magnet SC200 designed for medical application

Computational mesh

Computing in High Energy and Nuclear Physics

NICA computing challenge

QCD phase diagram

Simulations

GOVORUN

MPD experiment

Events reconstruction

Physics analysis

ML Tracks Reconstruction BM@N

Machine learning algorithms bring a lot of potential to the tracks reconstruction problem due to their capability to learn effective representations of high-dimensional data through training, and to parallelize on HPC architectures.

Input data for the first step algorithm were simulated by GEANT in MPDRoot framework for the real BM@N configuration.

G.Ososkov et al. Deep learning for tracking NEC-2017

Simulation data

True found track
Ghost track

White dots are both hits and fakes.

Efficiency 97,5%

Optimization problem for the heat equation towards improvement of the "temperature gates" characteristics

Govorun Supercomputer

A hybrid algorithm MPI+OpenMP has been developed for solving optimization problem for nonlinear unsteady heat equation. The optimization problem has been formulated in order to improve design of the so-called "temperature gates" technique for the pulse injection (in the millisecond range) of working gases into the multiply charged ion source ionization chamber.

The work has been done in collaboration with colleagues from VBLHEP and IEP SAS (Kosice, Slovakia)

A. Ayriyan, J. Busa Jr., H. Grigorian, E. E. Donets. Solving the Optimization Problem for Designing a Pulsed Cryogenic Cell. // Physics of Particles and Nuclei Letters, vol. 16(3), pp. 300-309 (2019) A. Ayriyan and J. Busa Jr. Parallel Algorithm for Numerical Solution of Heat Equation in Complex Cylindrical Domain // RUDN Journal. Series MIPh, vol. 27 (accepted to print in 2019)

Proposed GOVORUN system extension

Hyper-converged system allows to use all Storage nodes as computing ones in parallel with store/retrieve data. This will add 230 TFlops to GOVORUN system, almost doubling the CPU part performance.

Thanks for your attention! Please, your questions ...