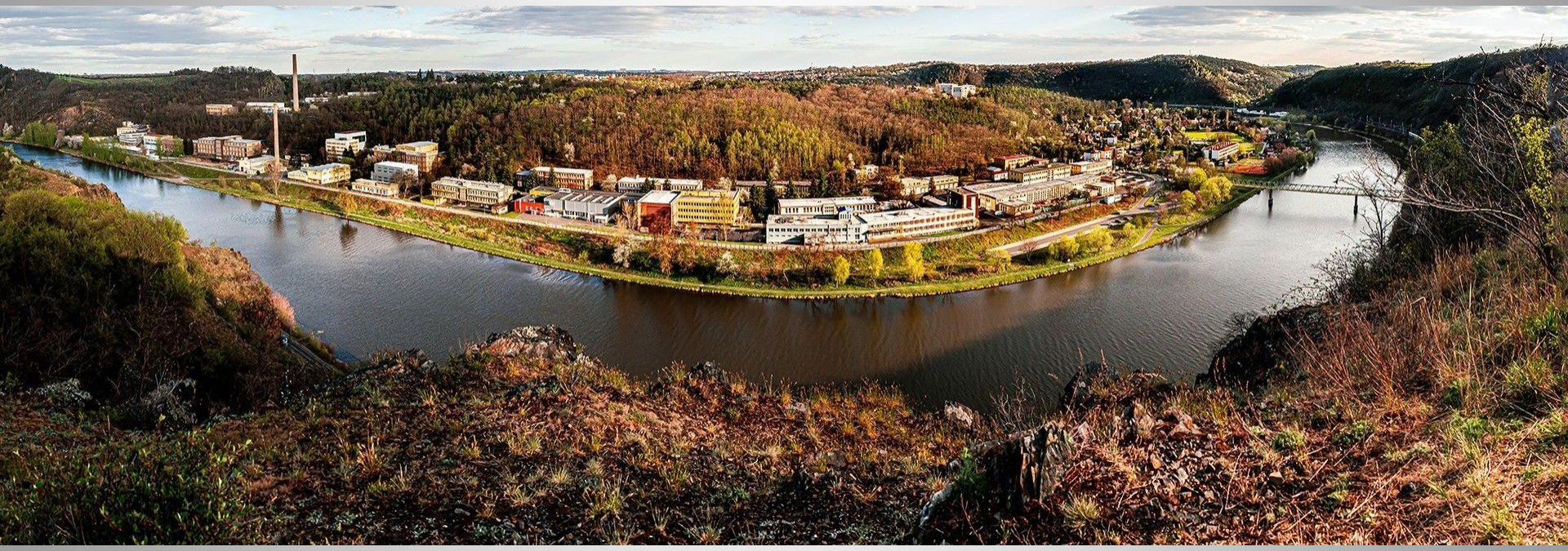
Nuclear Physics Institute CAS and its role in the WLCG computing in the Czech Republic



Dagmar Adamova
HTCondor Workshop Autumn 2025

NUCLEAR PHYSICS INSTITUTE
The Czech Academy of Sciences

The basics

- The Nuclear Physics Institute (NPI) of the Czech Academy of Sciences (CAS) conducts research across a broad spectrum of nuclear and particle physics, both experimental and theoretical as well as applied.
    - Basic research in nuclear physics and related disciplines
    - Use of nuclear methods in interdisciplinary and applied research
- Pa2rticipation in large-scale international projects:
- ***ALICE@CERN, STAR@RHIC and ePIC@EIC, KATRIN@Karlsruhe, HADES@GSI, CBM@FAIR***
- ***ESS ERIC (European Social Survey European Research Infrastructure)***
- ***SPIRAL2@GANIL***
- A number of local experimental facilities
- ***NPI has seven scientific departments covering the research areas listed above.***

CANAM/RAMSES

- One of the local research facilities is ***CANAM***:

  Center of Accelerators and Nuclear Analytical Methods

  and its extension ***RAMSES: Ultra-trace isotope research in social and environmental studies using accelerator mass spectrometry (AMS).***

- 3 major research laboratories:
- Laboratory of Cyclotrons and Fast Neutron Generators (LC&FNG), operating U-120M and TR-24
- Laboratory of Tandetron (LT) operating accelerator Tandetron 4130 MC
- Neutron Physics Laboratory (NPL) providing facilities at the reactor LVR-15.

CANAM/RAMSES

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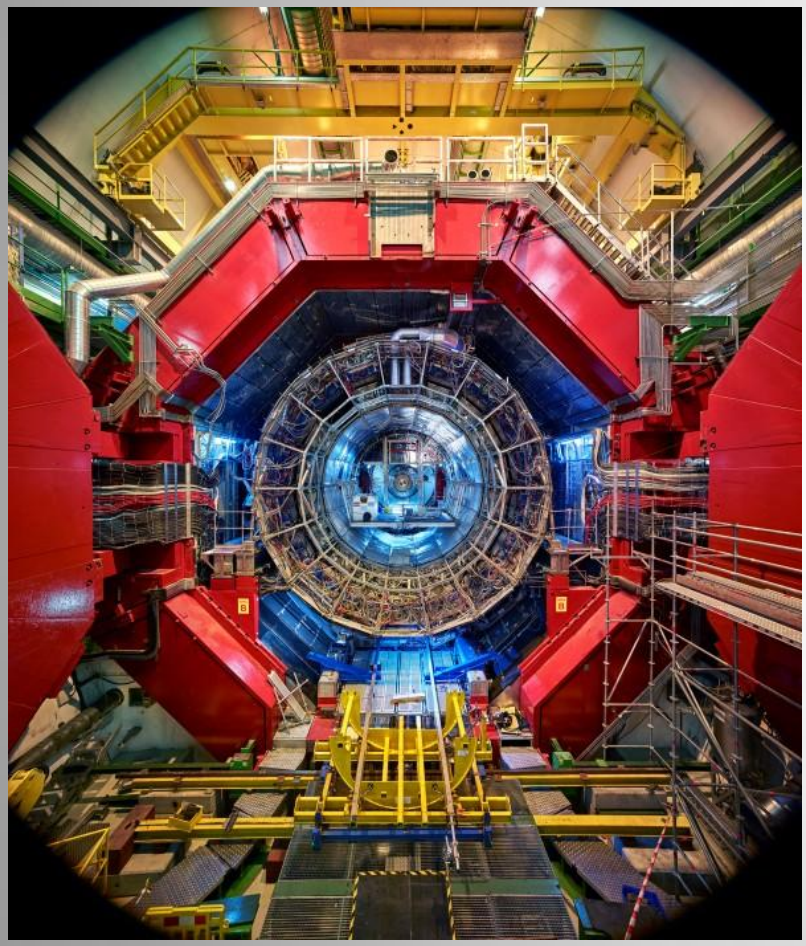
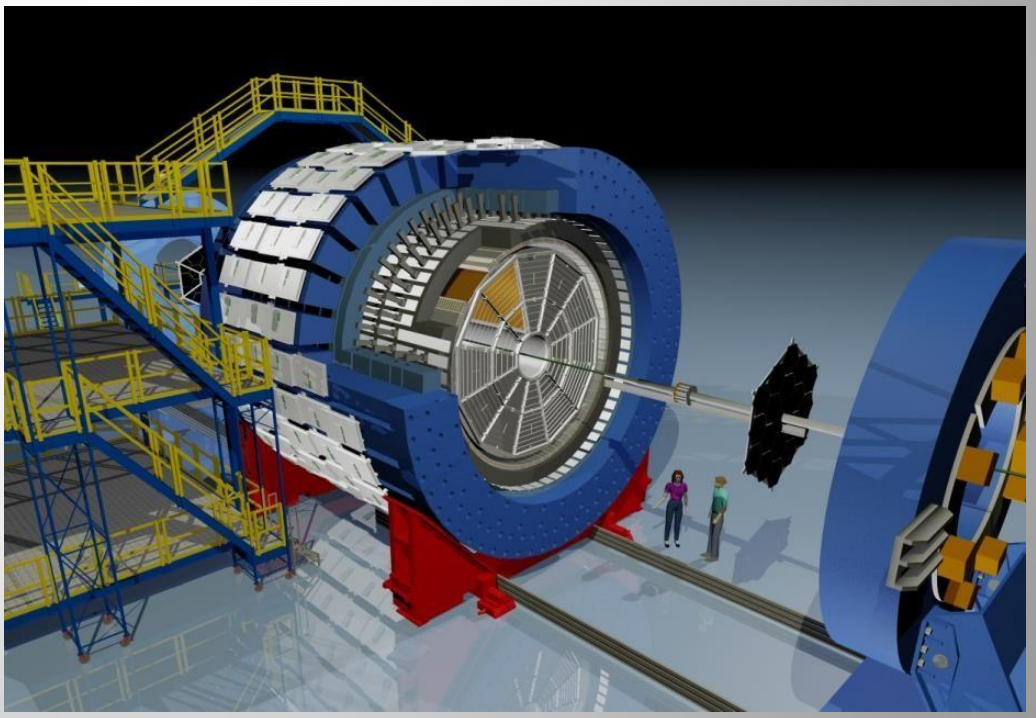
Department of Heavy Ion Physics

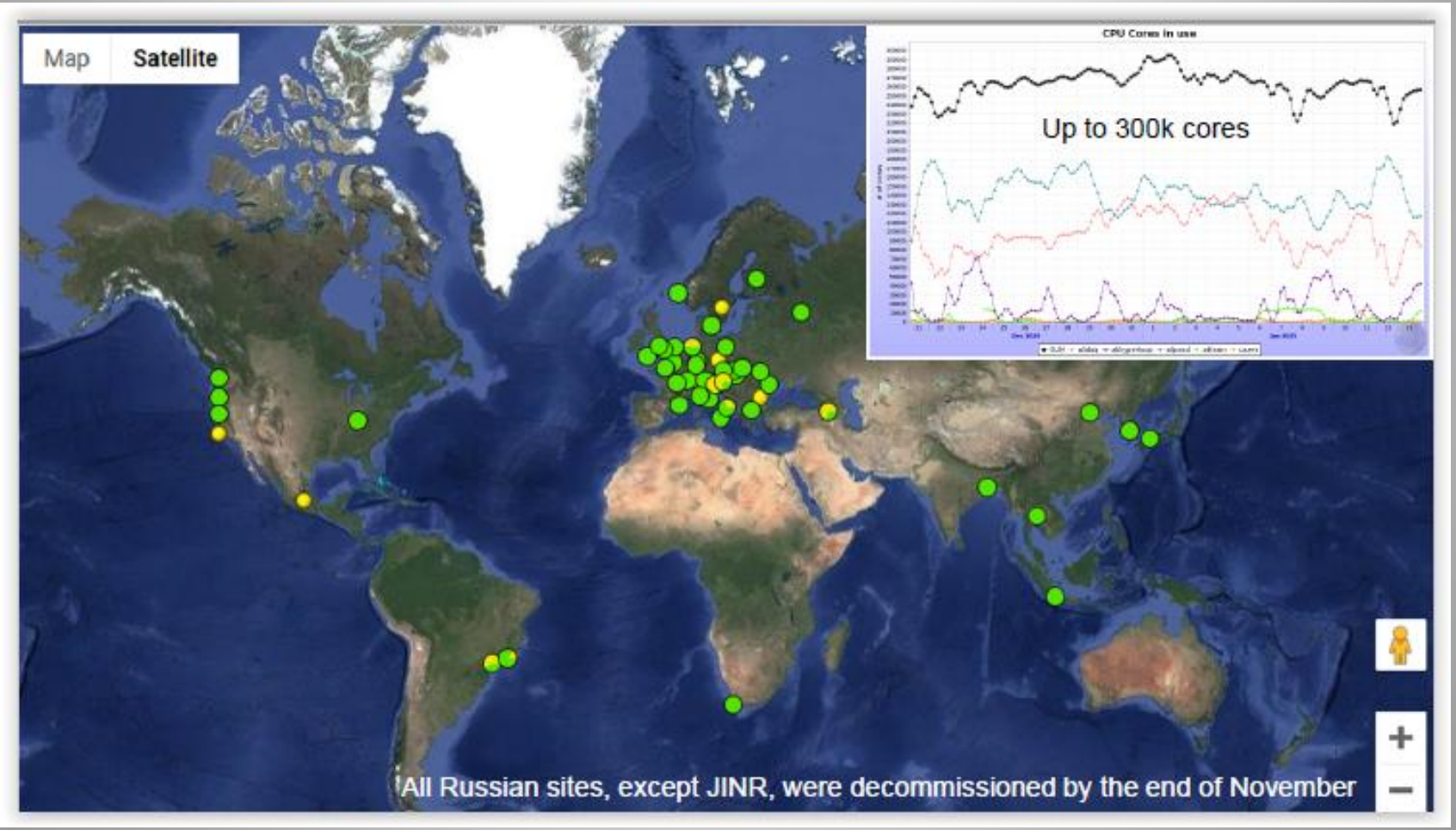


Scientists and students involved mainly
in three big international projects:
ALICE@CERN, STAR@RHIC *and* ***ePIC@EIC***



Computing for ALICE in the Czech Republic: driven by the ALICE group @ NPI

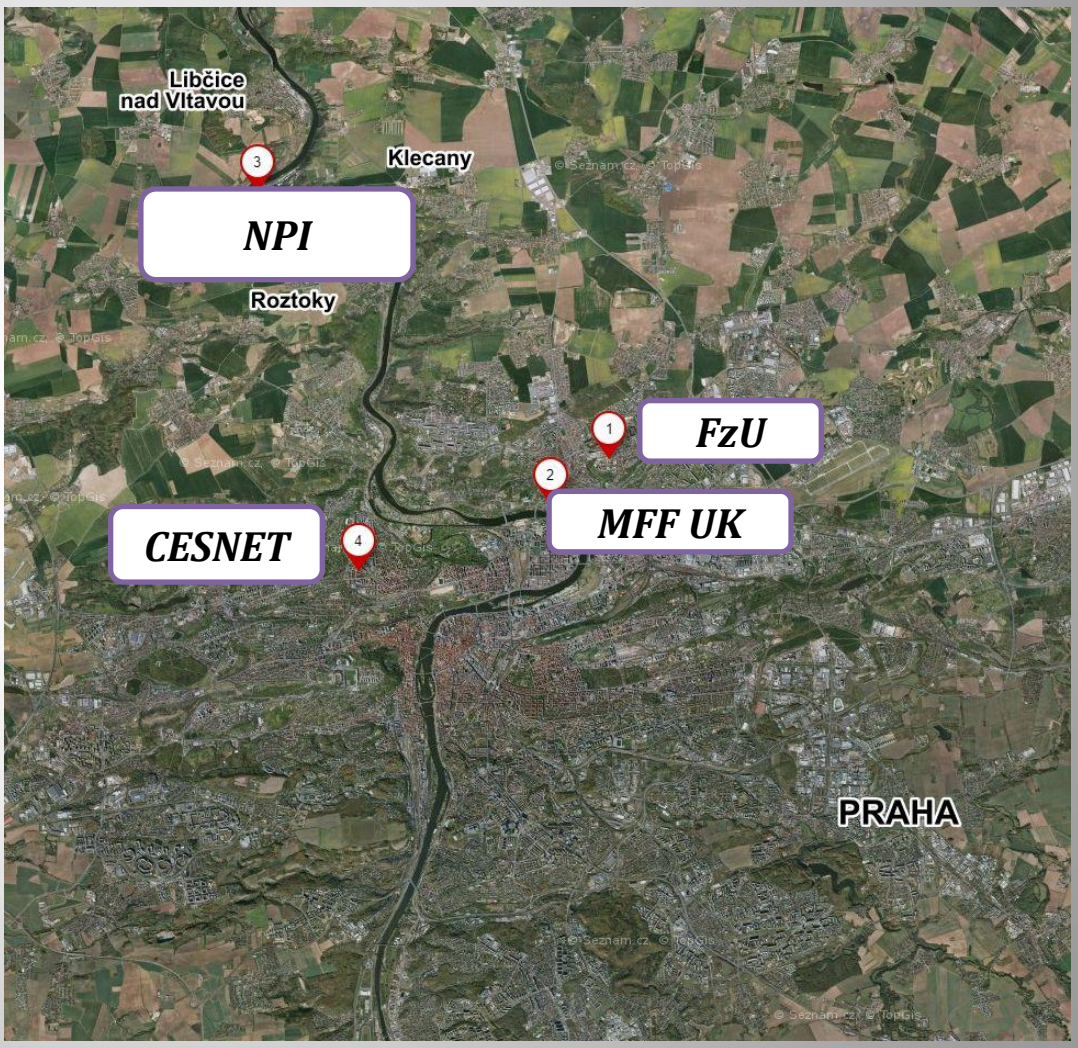
- Executed as a part of the operations of the Czech WLCG Tier-2 site praguelcg2
- Delivering CPU and disk resources in quantities required by the ALICE Constitution and M&O-A



Czech Republic Tier-2 center - geographical layout

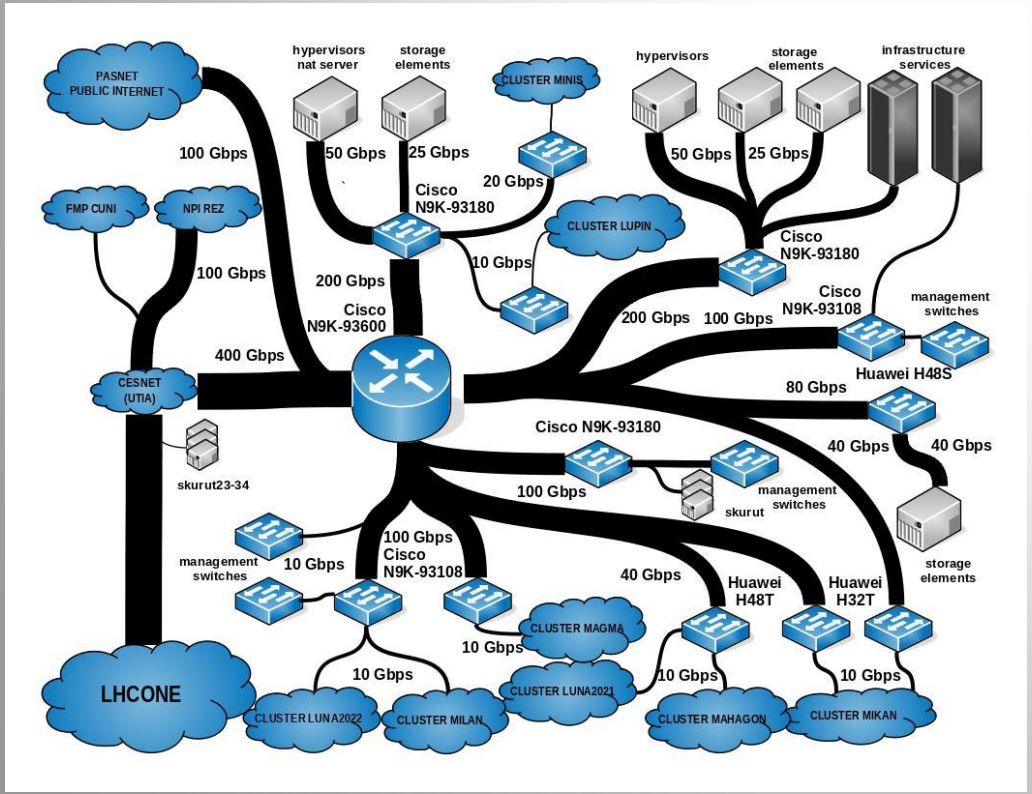
WLCG Tier-2 site praguelcg2

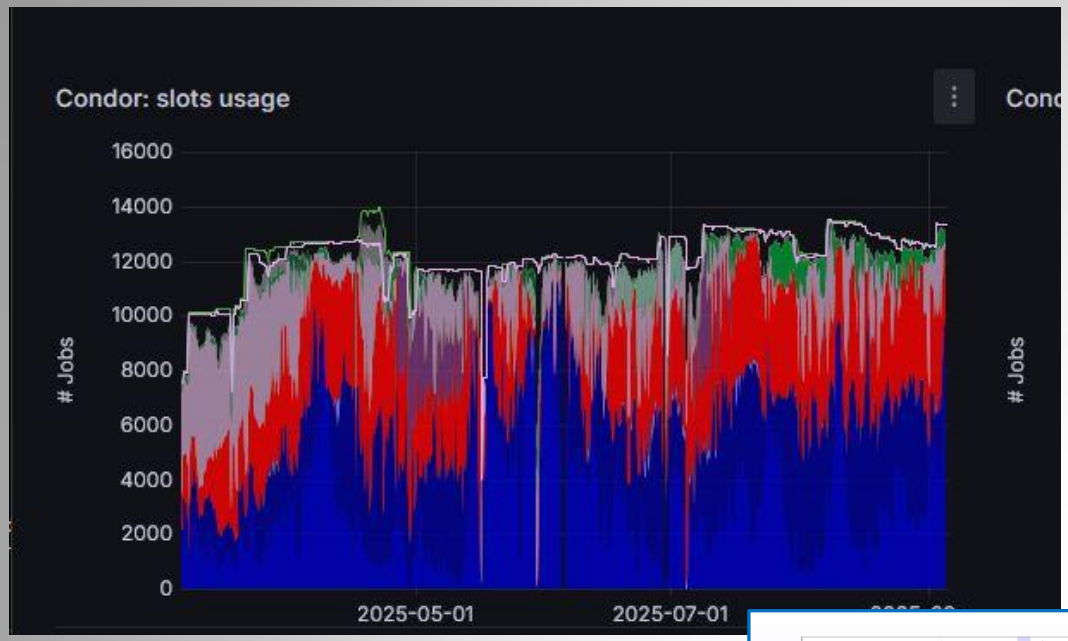
- Distributed resources
- **Several clusters under one HTCondor LRMS**: ~13500 jobslots (~6000 physical cores)
- Most of the resources are installed at the Institute of Physics (FzU) (current workshop venue)
- ***Disk servers dedicated to ALICE operate at the NPI (currently 5.3 PB)***
- There is a dedicated network link of 100 Gb/s between the cluster at NPI and a CESNET router close to FZU



praguelcg2 main facility@ FzU

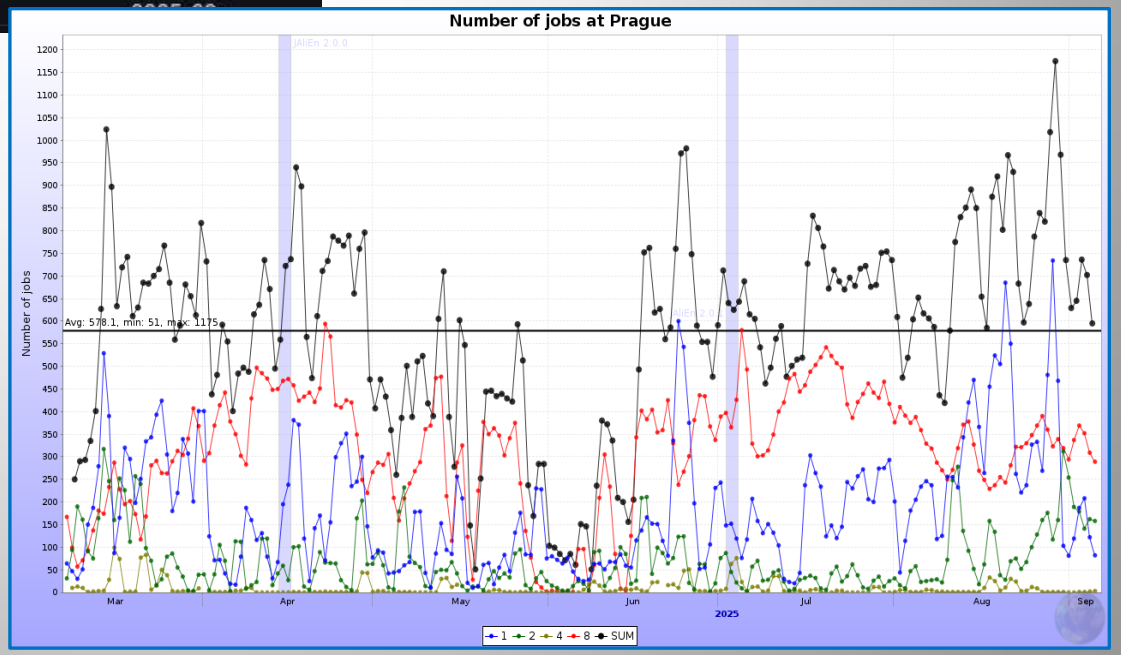
- ***all the CPU servers executing ALICE jobs operate here***
- 1 batch system (HTCondor)
- 2 main WLCG VOs: ALICE, ATLAS, also Auger, CTA, Fermilab, NOVA
- ~ 13500 job slots on site
- ~ 8 PB on disk storage (dCache, NFS)





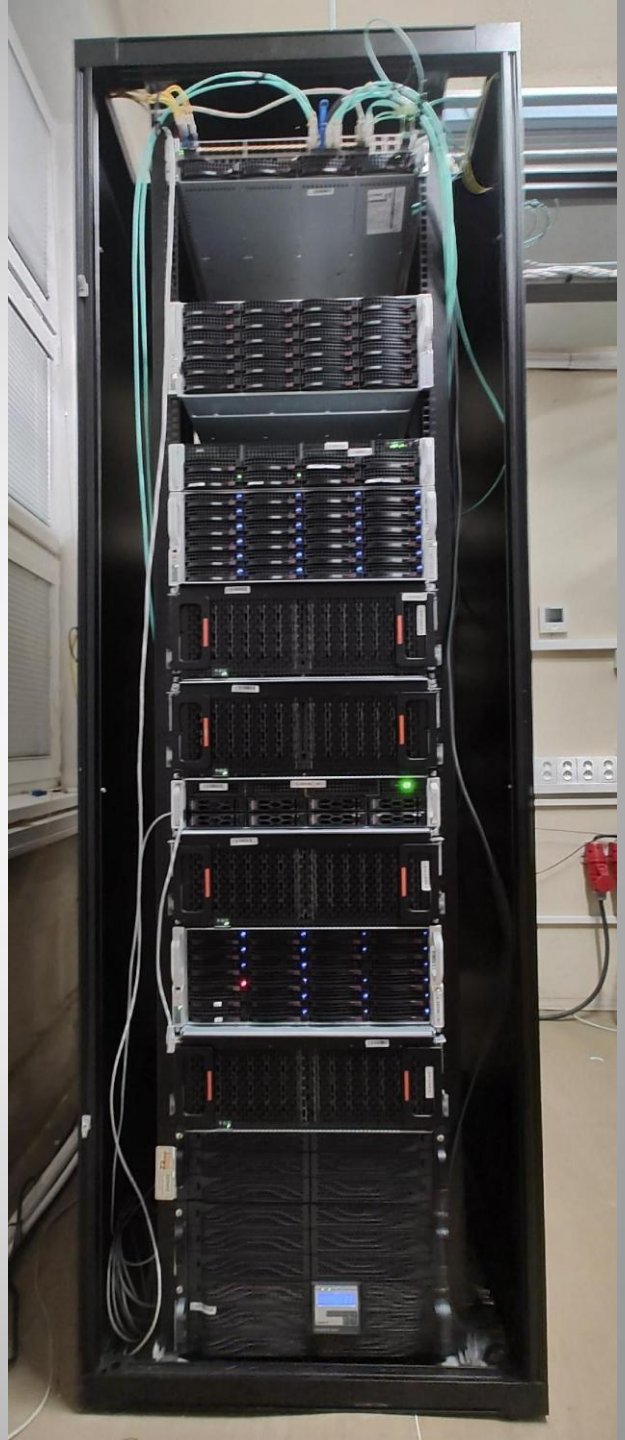
Running jobs profile
during last 6 months,
by the local Grafana monitoring
at the central site @ FZU.
ALICE: Avg. ~ 3000
Max .~ 8000

ALICE multicore running jobs profile during last 6 months, by the ALICE MonALISA monitoring.
8 core: Avg.315, Max. 905
1 core: Avg. 185, Max. 2977



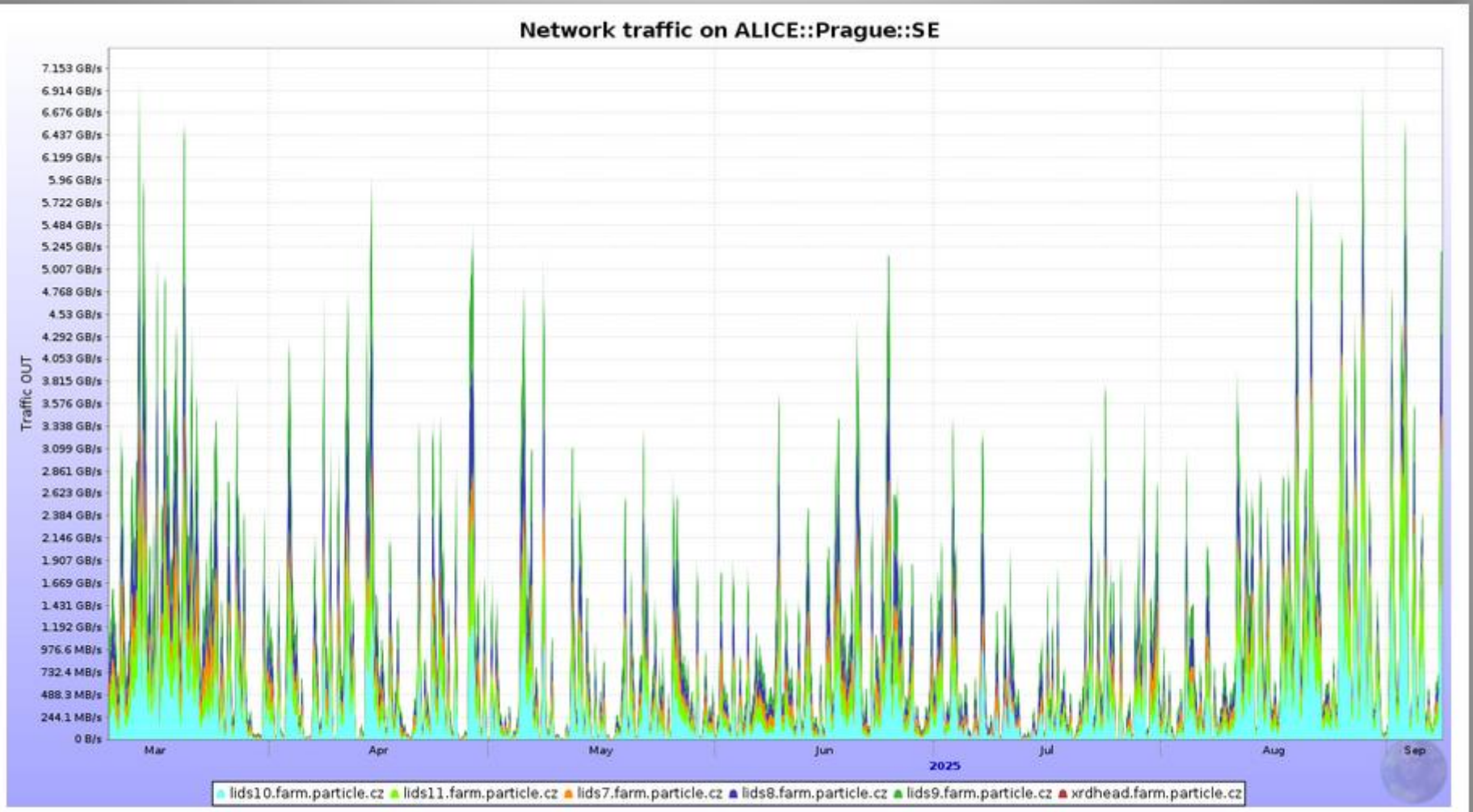
Disk storage cluster dedicated to ALICE operates at the Dept. of HIP @ NPI

-Current status: 5 storage servers
with the total net capacity of ~ 5.3 PB
-The last upgrade performed in June 2025
-Most of the ALICE storage hardware was purchased with the money provided by the NPI and CAS



Traffic on the ALICE storage cluster @ NPI in the last 6 months

5 storage servers - total net capacity 5.3 PB
Total download from the cluster in the last 6 months: 18.67 PB

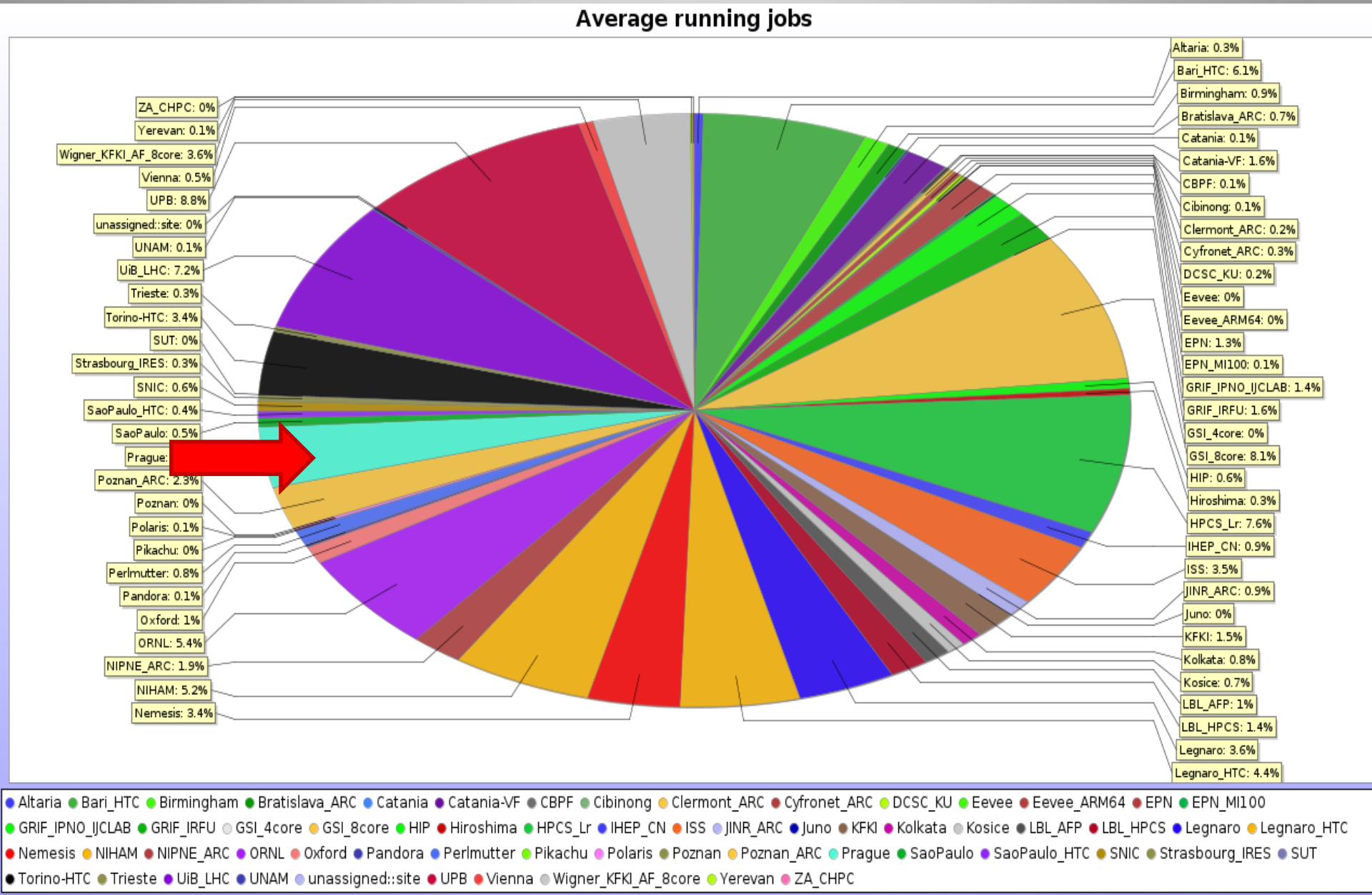


Data flow IN/OUT executed by ALICE storage cluster @ NPI

- Data traffic IN and OUT of our ALICE storage cluster @ NPI, ***last 5 weeks***
- Max OUT: 91.6 Gb/s, Max IN : 44.8 Gb/s
- Total data transfer 6.85 PB

Prague CPU delivery - ALICE Tier-2 share: 03/2025 – 08/2025, 3.3%

In excess of what is requested



Concluding remarks

- NPI CAS covers a broad spectrum of nuclear and particle physics - experimental, theoretical, and applied.

- Department of Heavy Ion Physics participates in the computing support of the ALICE experiment at the LHC:

-- utilizing and operating the resources of the Czech Tier-2 center,
-- ensuring continuous processing of ALICE jobs (now mostly 8-core jobs),
-- providing 5.3 PB of disk space for ALICE data.

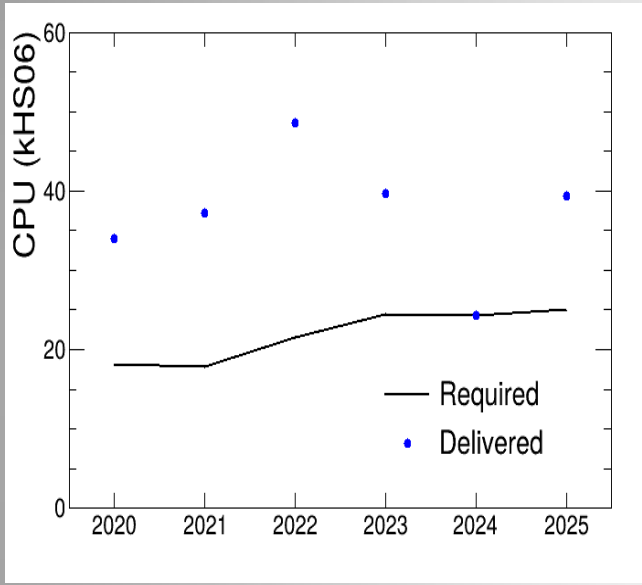
- Despite ongoing financial constraints, we have consistently met our commitments in delivering computing resources and services and remain committed to supporting ALICE with the required resources in the coming years.

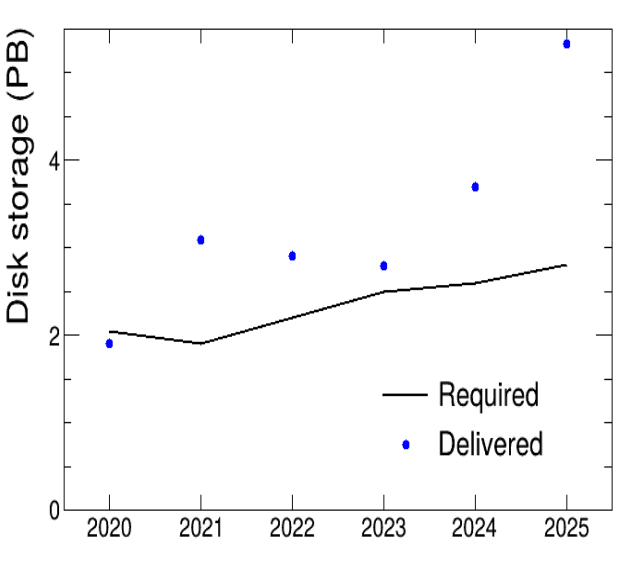
backup

Computing for ALICE

Manpower: 1 scientist (D. Adamová 0.8 FTE)

Management and monitoring of
- data processing @ WLCG Tier-2 center at Institute of Physics
- storage provided by the clusters @ NPI





- 2022: new server rack cabinets installed + new UPS units with bigger capaciroom 0.5 MCZK from NPI
- 2023: new air conditioning of the NPI server
- Nov 2023: capacity of the link NPI – IoP increased to 100 Gb/s
- 2024 installed additional 1.32 PB disk server capacity
- Oct 2024 finished call for additional 0.6 PB & CPU
- June 205” disk capacity increased to net 5.3 PB