# Belle II Update

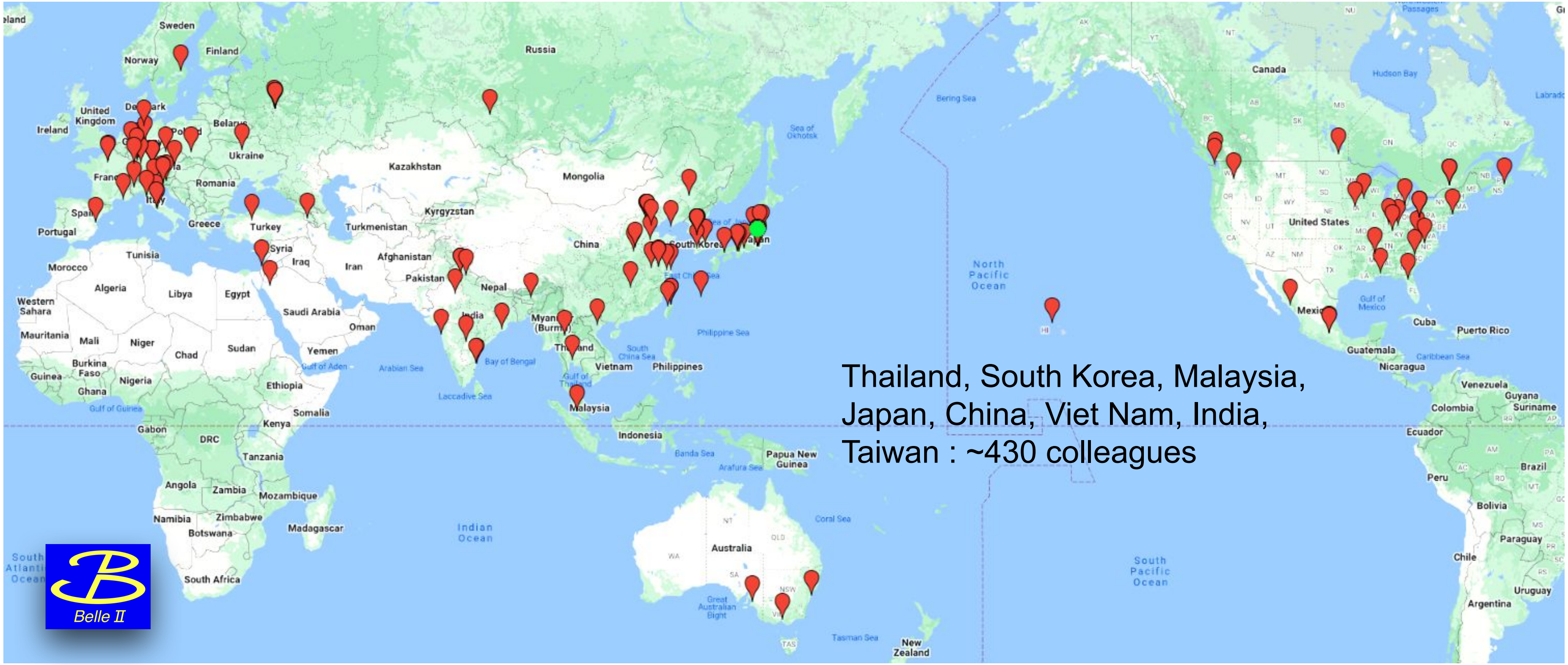
LHCOPN-LHCONE meeting #55
Karlsruhe - DE

Dr. Silvio Pardi

8 October 2025

# The Belle II Experiment

Over 1100 physicists and engineers from 122 institutions in 27 countries

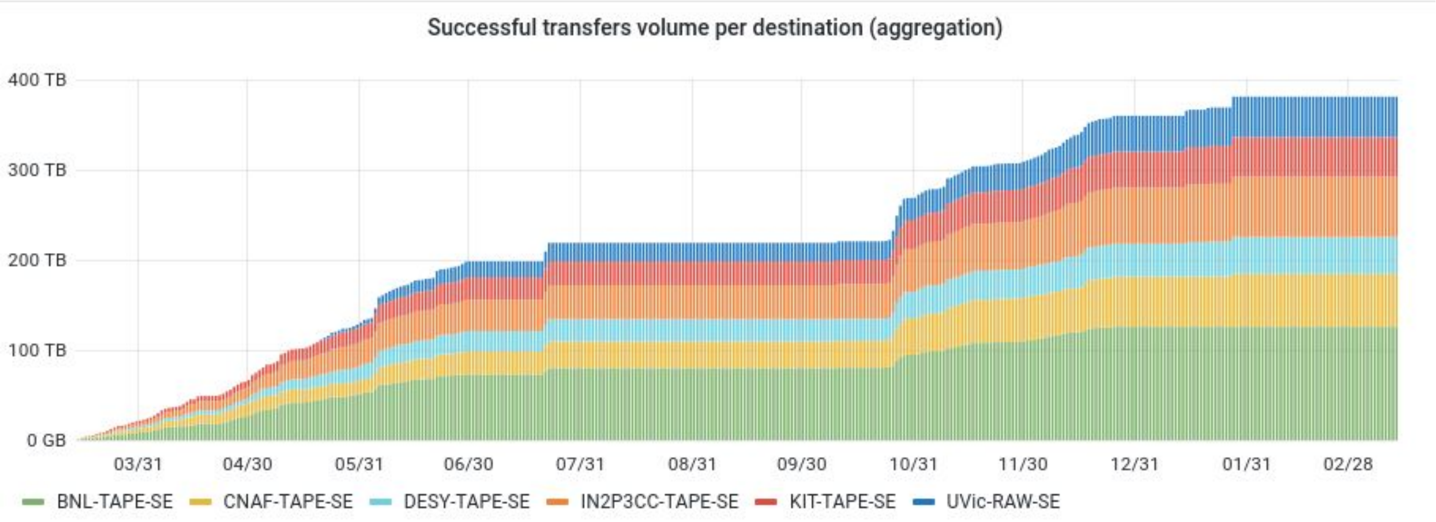


# Belle II Status

Run 2 started in Feb. 2024.

Data taking is going to be resumed after a shutdown. Physics run expected in November 2025

About 150 fb-1 (~400 TB) accumulated since the start of run 2.



# Site Report 2025 - Pledged Resources

- 31 sites providing pledged resources.
- 29 grid storages
- 5 Tape systems

Several sites providing pledged resources also offer opportunistic CPU.

In addition there are 16 sites providing only opportunistic CPU.

| TYPE | Resource provided | Pledged for 2025 JFY |
|---|---|---|
| CPU Pledge | 450 kHS23* | 247kHS23 |
| DISK | 23.3 PB | 19.3 PB |
| TAPE | 13.0 PB | 11.8 PB |

**450 kHSF23 corresponding to 32.5 kjobslots**

*Including local resources and calibration

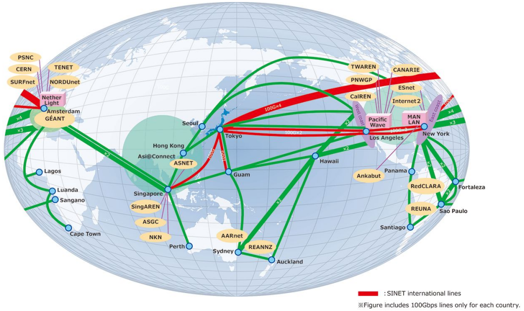
| TYPE | Resource provided |
|---|---|
| CPU | 52.4 kHS23 |
| DISK | 1.485 PB |

Specific Resource for calibration in KEK and BNL

# Belle II Network: Main Pillars

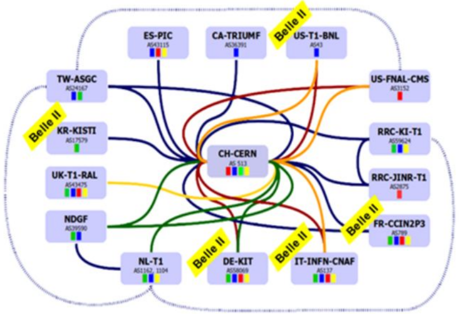
## SINET6 (Science Information Network) links

https://www.sinet.ad.jp/en/news_en/sinet6-upgraded-japan-amsterdam-lines-to-400gbps-april-1-2024



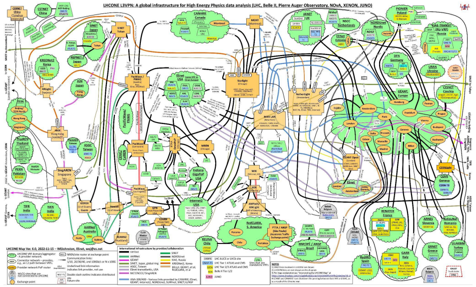

Japanese NREN

## LHCOPN Optical infrastructure that can be used without jeopardizing resources




Belle II traffic between WLCG T1s

## LHCONE L3 VPN



# MultiONE

**Belle II sites connected to LHCONE**

https://twiki.cern.ch/twiki/bin/view/LHCONE/MultiOneBGPcommunities

The activity requires a work site side and NREN side.

Currently, 17 of the 24 Belle II sites connected to LHCONE are seen publishing BGP communities.

| #Belle II Sites | RC Site | BGP Communities |
|---|---|---|
| 1 | INFN-FRASCATI | ATLAS, BelleII, LHCb |
| 1 | IN2P3-CC | ALICE, ATLAS, BelleII, CMS, DUNE, ILC, JUNO, LHCb, NOvA, Pierre, XENON |
| 1 | GRIF | ALICE, ATLAS, BelleII, CMS, DUNE, ILC, JUNO, LHCb, NOvA, Pierre, XENON, perfSONAR |
| 1 | INFN-T1 | ALICE, ATLAS, BelleII, CMS, DUNE, JUNO, LHCb, Pierre, XENON |
| 2 | FZK-LCG2 | ALICE, ATLAS, BelleII, CMS, LHCb |
| 1 | praguelcg2 | ALICE, ATLAS, DUNE, NOvA, BelleII, Pierre |
| 1 | IN2P3-IRES | ALICE, BelleII, CMS, ILC, JUNO, perfSONAR |
| 1 | INFN-LNL-2 | ALICE, BelleII, CMS, LHCb, perfSONAR |
| 2 | CA-UVic-Cloud | ATLAS, BelleII |
| 1 | DESY-HH | ATLAS, BelleII, CMS |
| 1 | INFN-NAPOLI-ATLAS | ATLAS, BelleII, CMS, LHCb, Pierre, perfSONAR |
| 1 | BNL-ATLAS | ATLAS, BelleII, DUNE |
| 2 | ARNES | ATLAS, BelleII, LHCONE, Pierre, perfSONAR |
| 1 | JP-KEK-CRC-02 | perfSONAR, BelleII, ILC |

N.B. Network Prefix are kept from CRIC. To double check that belle II resources are configured on the proper subnet.

# IPv6 Service status

- Almost all central services are IPv6 compliant and configured in dual stack.
- Setup of IPv6 on Condition DB ongoing.
- A testing cluster IPv6 only setup in Napoli for testing.

From site report

- 26 Storage endpoints configured in dual stack as of 29 pledged SE
- 23 Sites reported that WNs are configured in dual stack as of 47
    - 18 Site with pledged resources as of 31
    - 5 Sites providing only opportunistic resources as of 16

# IPv4 removal from LHCOPN to BNL

On September 2nd, 2025, IPv4 was removed from the BNL and FNAL LHCOPN links.
From the Belle II perspective, this change affects the following traffic flows:

BNL ↔ KIT
BNL ↔ CNAF

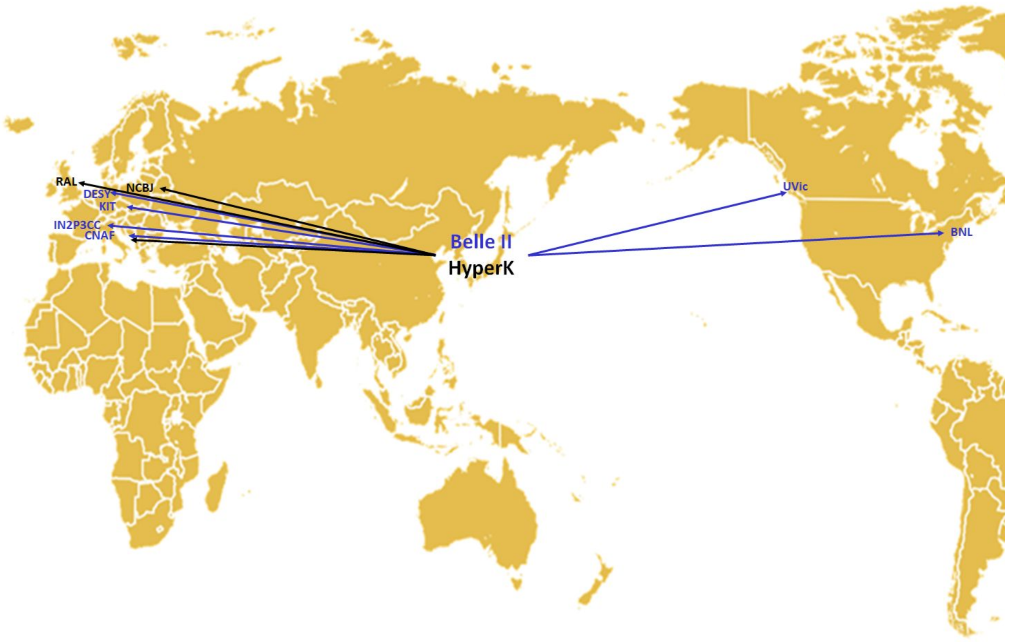
Since the storage systems at KIT and CNAF are dual-stack, the only traffic expected to be rerouted is between CNAF worker nodes (IPv4-only) and the BNL storage element (SE).

No specific issues have been observed. IPv4 traffic has been successfully rerouted via LHCONE, as expected.

```
From a WN IPv4 Only at CNAF
[root@cn-leo-200 ~]# tracepathblrucio.sdcc.bnl.gov
1?: [LOCALHOST] pmtu 2042
1: 172.16.150.130 0.348ms
1: 172.16.150.130 0.421ms
2: 193.204.219.248 0.901ms
3: no reply
4: garr-lhcone-gw.gen.ch.geant.net5.347ms
5: 62.40.126.201 12.589ms
6: no reply
7: eqxam3-cr6--eqxld8-bb-c.igp.es.net99.618ms asymm 15
8: eqxld8-cr6--bost-bb-a.igp.es.net97.099ms asymm 14
9: newy32aoa-cr6--bnl725-bb-a.igp.es.net99.717ms asymm 11
10: no reply
11: no reply`
```

```
From a dual stack node in CNAF
[spardi@ui-tier1 TPC2021]$ tracepath blrucio.sdcc.bnl.gov
1?: [LOCALHOST]                          0.006ms pmtu 9000
1:  gw1-192.cr.cnaf.infn.it                           0.289ms
1:  gw2-192.cr.cnaf.infn.it                           0.249ms
2:  l773-e-rjup1-2-lhcopn-ue26.cern.ch               10.099ms
3:  l773-e-rjup1-2-lhcopn-tl1.cern.ch                10.174ms asymm
4:  fddd:7d33:c9b4:ff::26                            96.167ms
5:  fddd:7d33:c9b4:ff::26                            96.165ms asymm
6:  no reply
7:  no reply
```

# Belle II and Hyper-K in DC27

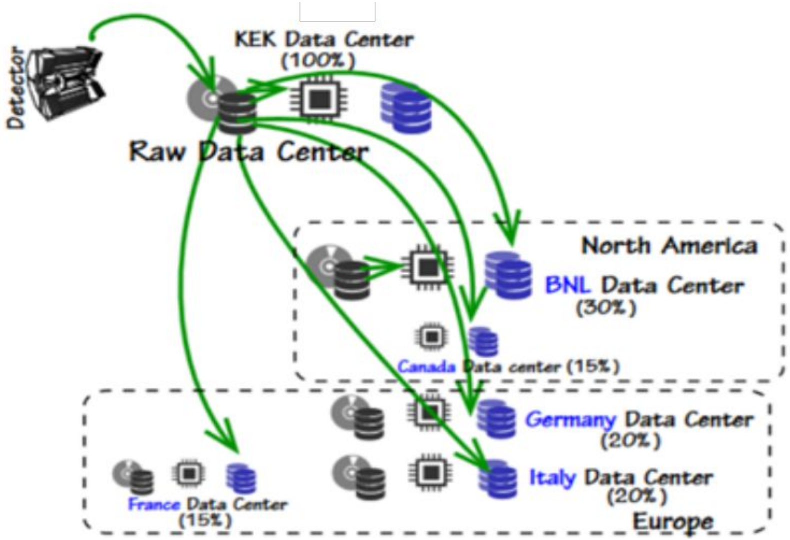



In the context of JENNIFER3 EU project BelleII/Hyper-K plan to organize a joint data challenge session try to join together the WLCG DC27.

This will involve the usage of common network links connecting Japan vs the European sites of Belle II and Hyper-K, concurrently with the traffic generated by LHC experiments.

It should be a loosely coupled joint activities, i.e. we don’t need to use any common service just organize the transfer in the same time windows and sharing results.

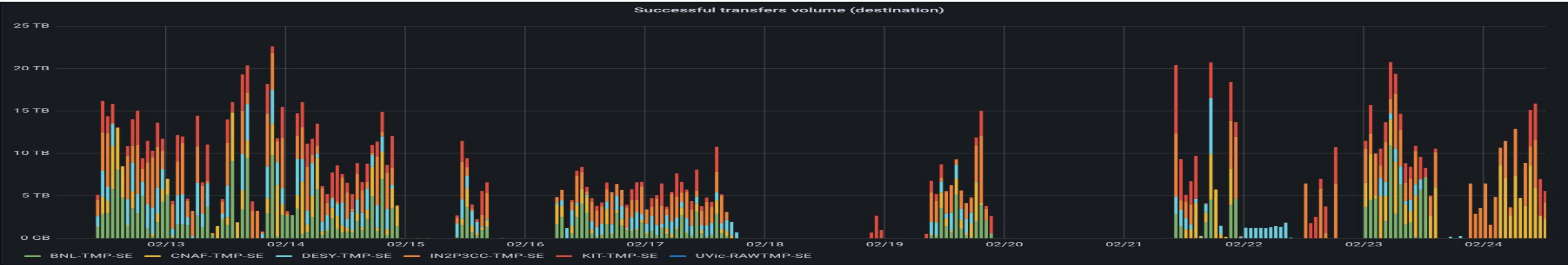
# Belle II in the latest WLCG DC24




Belle II joined the latest WLCG Data Challenge 2024 creating a synthetic traffic from KEK vs our RAW Data Centers in EU and USA.

Tools and protocols used

- FTS
- RUCIO
- Davs protocol
- X509 authentication



# Change for Belle II since latest DC24

New KEKCC in place Network Connection Upgrade to 100G to LHCONE, 20G General Internet

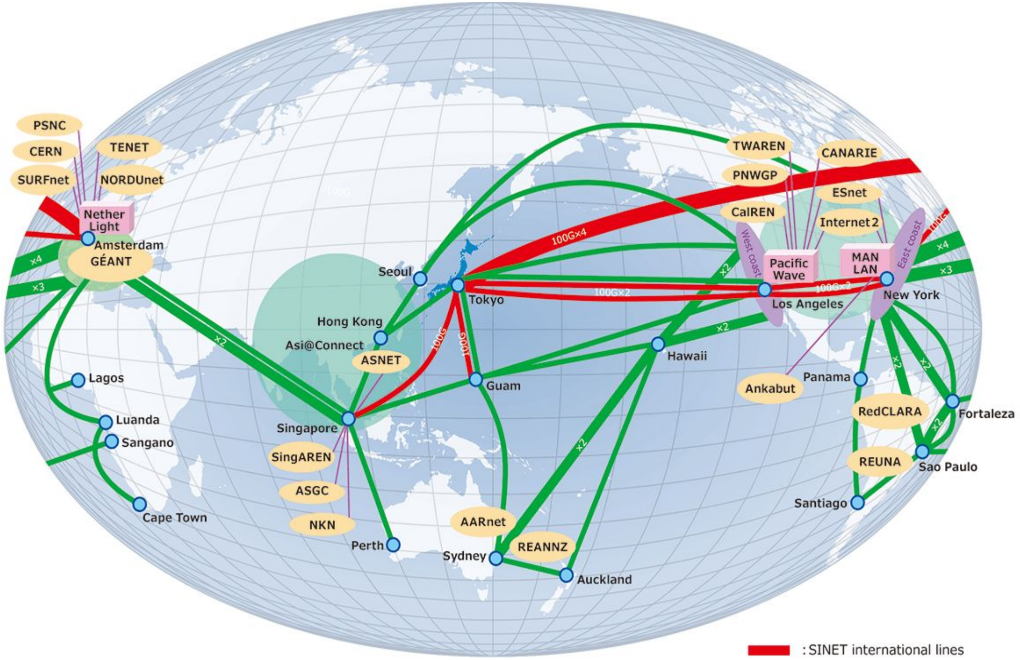
New International links from Japan to EU and USA (Sinet6)

Several network update in key sites

IPv4 removed from LHCOPN links at BNL

More experience accumulated with token.

https://www.sinet.ad.jp/en/news_en/sinet6-upgraded-japan-amsterdam-lines-to-400gbps-april-1-2024




: SINET international lines

※Figure includes 100Gbps lines only for each country.

# Possible idea for Belle II test for DC27

Last time exercice transfer from KEK to RAW-DCs simulating a scenario of high luminosity.

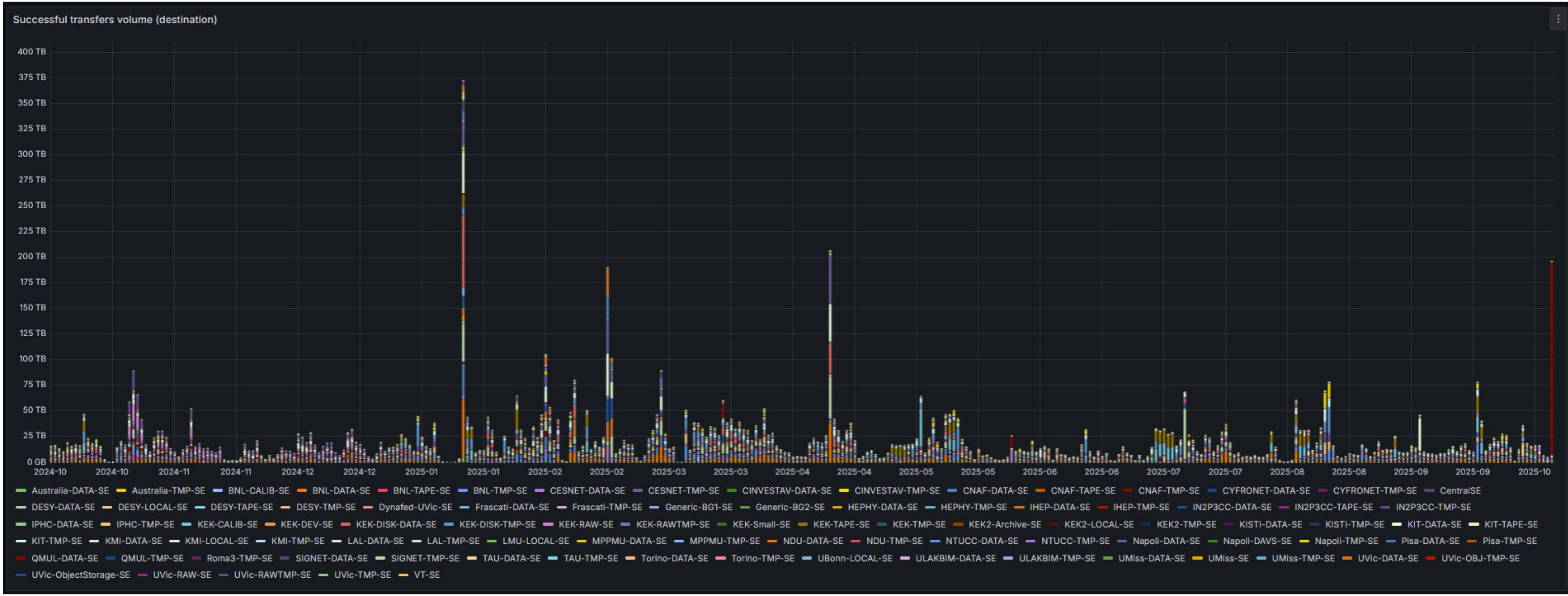
As of today we have around 11 sites that could be interested to participate (including RAW-DCs BNL, CNAF, DESY, KIT, CC-IN2P3, UVic)

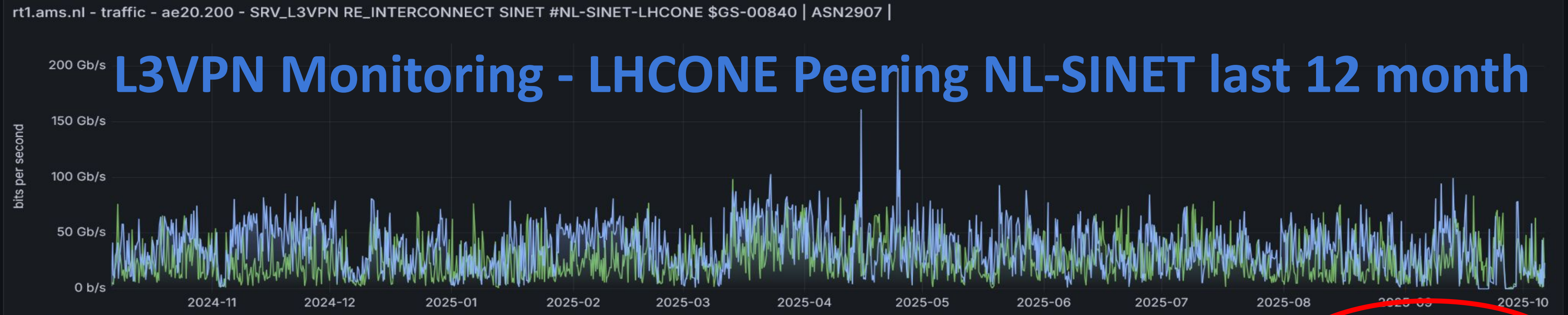
Possible ideas:

- Test transfers from KEK to RAW-DCs again to stress the new network path of Sinet6
- Full matrix test among the available sites (SE to SE)
- Testing Token authentication
- Testing full IPv6 stack from RUCIO/FTS/SEs

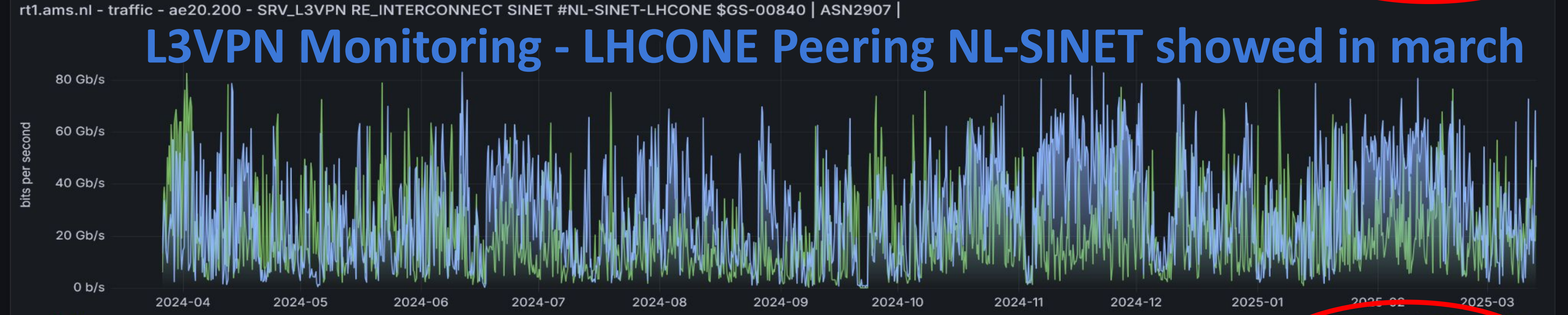
A mini-Data Challenge could be organized in 2026

# Belle II transfers volume last year activity






| Name | Mean | Last * | Max |
|---|---|---|---|
| Ingress Traffic | 26.4 Gb/s | 9.52 Gb/s | 98.4 Gb/s |
| Ingress 95th Percentile | 19.6 Gb/s | 19.6 Gb/s | 19.6 Gb/s |
| Egress Traffic | 36.9 Gb/s | 23.4 Gb/s | 198 Gb/s |
| Egress 95th Percentile | 35.0 Gb/s | 35.0 Gb/s | 35.0 Gb/s |




| Name | Mean | Last * | Max |
|---|---|---|---|
| Ingress Traffic | 21.3 Gb/s | 28.1 Gb/s | 82.7 Gb/s |
| Ingress 95th Percentile | 16.9 Gb/s | 16.9 Gb/s | 16.9 Gb/s |
| Egress Traffic | 30.3 Gb/s | 46.8 Gb/s | 85.6 Gb/s |
| Egress 95th Percentile | 27.8 Gb/s | 27.8 Gb/s | 27.8 Gb/s |

# Conclusions

Belle II is going to restart data taking with physics run expected in November 2025

The experiment is increasing IPv6 support at sites level and on central services.

Belle II is preparing for WLCG Data Challenge 2027 in coordination with HyperK experiment.

A Mini-Data Challenge could be organized in 2026

# Thank you

# MultiONE Monitor

```
06/10/2024  18:20.12  /home/mobaxterm/LHCONE  ./communities.sh INFN-NAPOLI-ATLAS 4
CHECK COMMUNITIES OF 90.147.67.0/24
                Communities: 137:5 137:6 20965:155 61339:2 61339:3 61339:4 61339:6 61339:11 61339:60001 target:137:5
                Communities: 137:5 137:6 2603:2112 20965:155 61339:2 61339:3 61339:4 61339:6 61339:11 61339:60001 target:137:5 target:2603:434300001 target:20965:111
                Communities: 137:5 137:6 57484:137 61339:2 61339:3 61339:4 61339:6 61339:11 61339:60001 target:137:5
                Communities: 61339:2 61339:3 61339:4 61339:6 61339:11 61339:60001 64805:13
✓

06/10/2024  18:20.19  /home/mobaxterm/LHCONE  ./communities.sh INFN-NAPOLI-ATLAS 6
CHECK COMMUNITIES OF 2001:760:422a:137::/64
                Communities: 137:5 137:6 20965:155 61339:2 61339:3 61339:4 61339:6 61339:11 61339:60001 target:137:5
                Communities: 137:5 137:6 2603:2112 20965:155 61339:2 61339:3 61339:4 61339:6 61339:11 61339:60001 target:137:5 target:2603:434300001 target:20965:111
                Communities: 137:5 137:6 57484:137 61339:2 61339:3 61339:4 61339:6 61339:11 61339:60001 target:137:5
                Communities: 61339:2 61339:3 61339:4 61339:6 61339:11 61339:60001 64805:13
✓
```