



Joint Institute for Nuclear Research

# CTA Evaluation at JINR

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# Tape Storages at JINR

- 3 Tape Libraries
  - IBM TS3500 - 5961x2.5 TB tapes – LTO6, 12 drives (160 MB/s)
  - IBM TS4500 - 4500x20 TB 3592-JE tapes, 12 TS1160 drives (400 MB/s)
  - IBM TS3200 (Testbed) - 45x1.5 TB tapes, 4 drives (140 MB/s)
- EOS/CTA
  - TS3500 and TS4500
  - 432 TB all-flash buffer (6 servers)
- dCache/Enstore
  - TS4500
  - 2.65 PB HDD-based buffer (16 servers)
- Testbed
  - IBM TS3200
  - 4 drives (140 MB/s), 45x1.5 TB tapes

TS3500

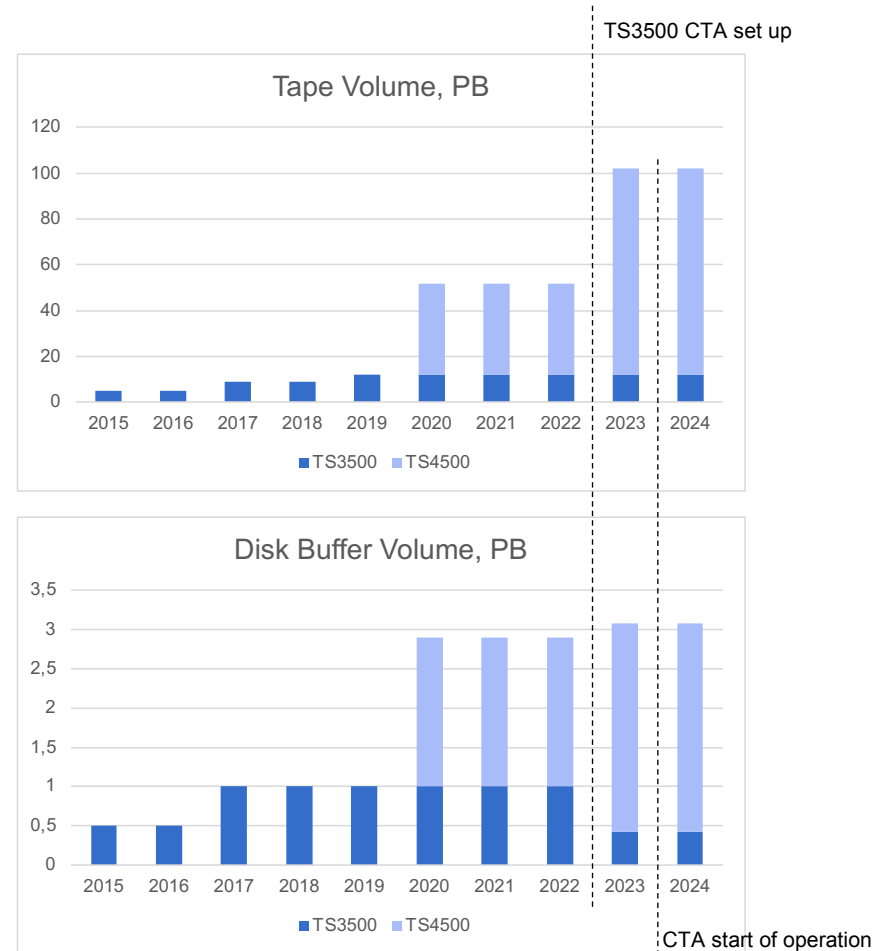


TS4500



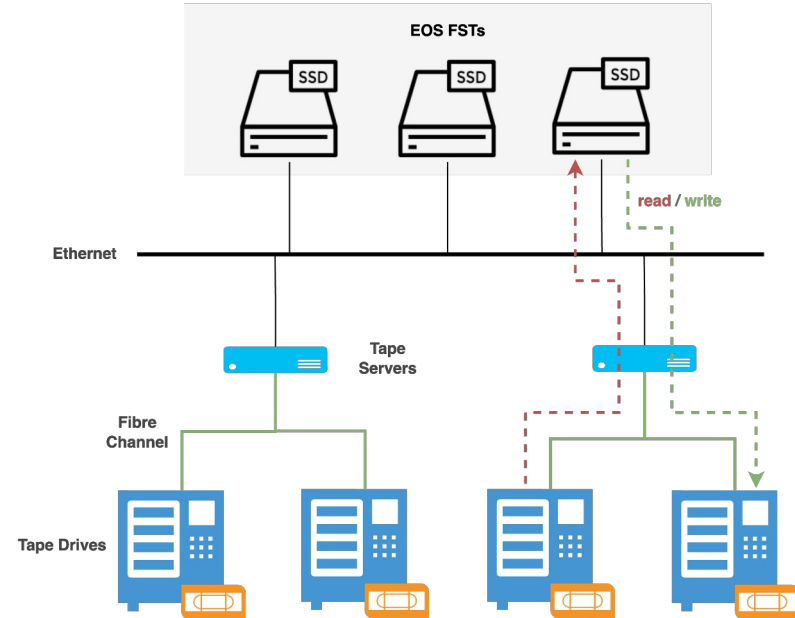
# Currently Operating Libraries Timeline

- TS3500 in operation since 2015
  - Powered by Enstore till the end of 2023
  - CTA now
  - Changed HDD buffer to all-flash
- TS4500 in operation since 2021
  - Used by both dCache/Enstore and EOS/CTA
- TS3500 → TS4500 data migration
  - Took 365 days to finish (April 2020 – April 2021)
  - ~8 PB and ~3M files transferred
  - Only 3 files lost during migration



# EOS-CTA Configuration Overview

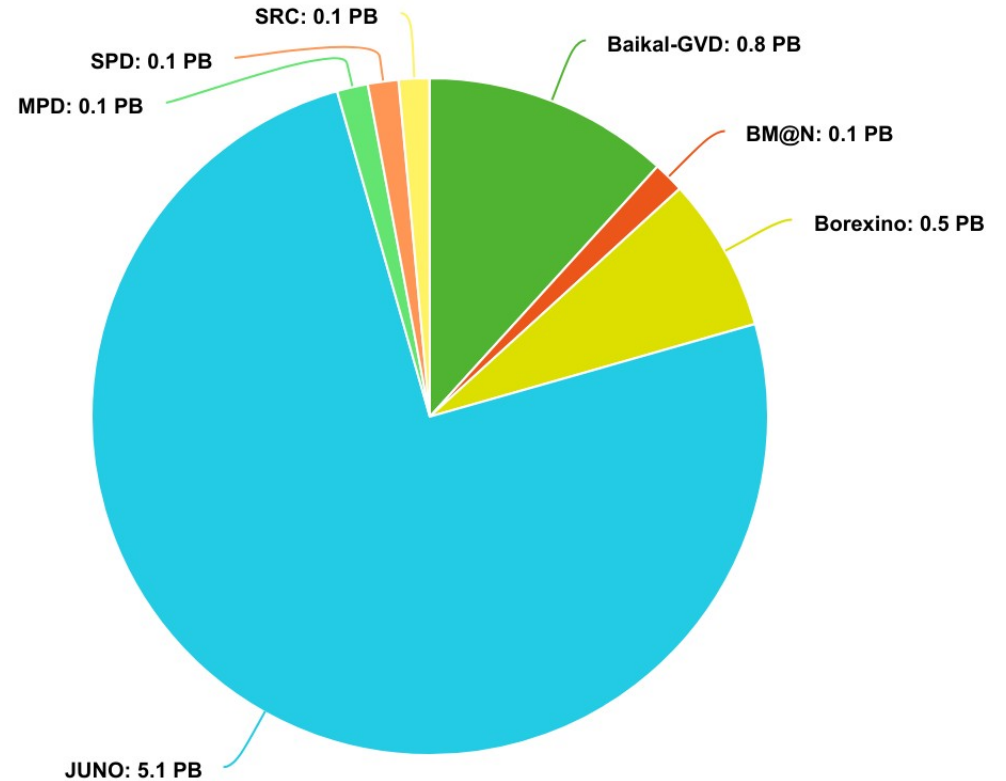
- In operation since Autumn 2023
- Uses both TS3500 and TS4500
- All-flash disk cache based on EOS
- Standard EOS configuration
  - Active-passive HA for MGM/MQ
  - RAFT HA for QuarkDB
  - Replica layout, 1 replica
- Software
  - Scientific Linux 7 everywhere
  - EOS 5.1.9
  - CTA 5.10
  - Postgres 14.0



	CPU	Memory	Disk	Network
6 x Tape servers	2 x Xeon Gold 6126, 40 cores	128 GB	2 x 480 GB SSD (RAID1)	2 x 16 Gb/s FC, 40 Gb/s Ethernet
2 x Tape servers	1 x EPYC 7443P, 24 cores	128 GB	2 x 480 GB SSD (RAID1)	2 x 16 Gb/s FC, 40 Gb/s Ethernet
6 x EOS FST servers	2 x Xeon Gold 6348, 56 cores	256 GB	480 GB SSD (RAID1), 9 x 7.68 TB NVMe	100 Gb/s Ethernet

# CTA Usage

- CMS data is kept in Enstore
- Experiments on Nuclotron-based Ion Collider Facility (NICA):
  - BM@N
  - MPD
  - SPD
  - SRC
- Neutrino experiments:
  - Baikal-GVD
  - JUNO
  - Borexino
- Non-experimental data (backups, etc)



# Humidity Issues

- Plot shows relative humidity (RH) in one of the cold aisle with near to constant temperature (~17 C)
- TS4500 triggers tape alert when RH goes out the allowable RH 20 – 50% range
  - TS4500 continues functioning
  - CTA blocks write operations
- We are working on improving environment conditions
- Meanwhile, it would be great if there was a way to make CTA ignore tape alerts

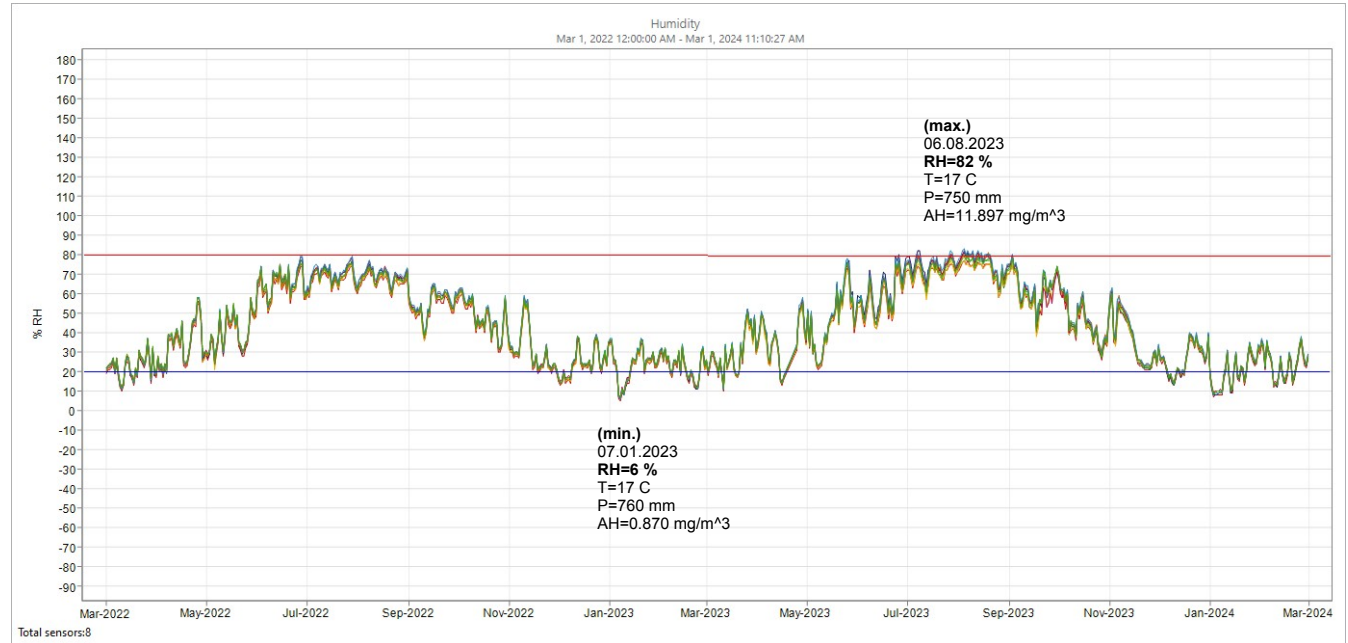


Table 1-20 Equipment environment specifications for the TS4500 tape library

Product operation					Product power off			
Dry-bulb temperature <sup>a</sup>		Relative Humidity (Non-condensing)		Maximum Wet-bulb temp.	Maximum elevation	Dry-bulb temp.	Relative humidity (% RH)	Maximum Wet-bulb temp.
Allowable	Recommended	Allowable (% RH)	Recommended (% RH)					
16 - 32°C	16 - 25°C	20 - 80%	20 - 50%	26°C	3050 m	5 - 45°C	5 - 80%	28°C

a. Derate maximum dry-bulb temperature 1°C/300 m (1.8°F/984 ft.) above 900 m (2 953 ft.).

# Tape Library Monitoring

- Environmental conditions control
- Visual control to track manually triggered operations and fallen tapes
- Software
  - Grafana
  - Prometheus
  - MariaDB
- Hardware
  - Raspberry Pi 3
  - DHT22 and BME280 Sensors
  - POE IP Camera
  - USB camera connected via Pi3



# Tape Future at JINR

- We are considering 3 scenarios in context of Enstore discontinuation
  - Move from dCache/Enstore to EOS/CTA completely
  - Continue operating both configurations
  - Evaluate other disk-tapes configurations: EOS/Enstore and dCache/CTA
- We have already started porting Enstore to Python 3 and consider taking over its support



# Conclusions

- Currently, it is too early to make any conclusions about EOS/CTA
- The only issue so far is TapeAlert flag treatment by CTA, we are interested in implementing a CTA option to ignore it
- We haven't given up on Enstore, there's light at the end of the tunnel
- We'll continue operating both dCache/Enstore and EOS/CTA for some time
- Move to new OS due to SL 7 EOL (presumably AlmaLinux 9)

# Thanks!

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