



EOS Service @ CERN

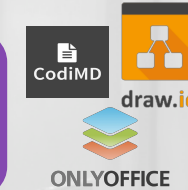
Maria Arsuaga-Rios IT-ST-PDS



EOS Service @ CERN



General purpose services

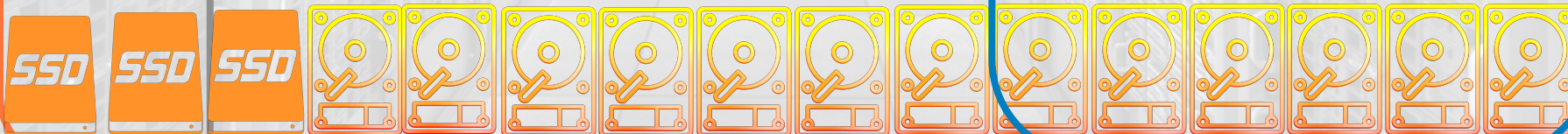


Physics services



Tape services

CERN
Tape Archive



EOS Service @ CERN



EOS instances

Cernbox: 9
(5 homes + 3 projects + 1 media)

Physics: 9
(6 LHC, 3 non-LHC)

CTA: 8
(4 LHC, 2 non-LHC, 1 backup, 1 internal repack)

QA/PPS:
(1 cernbox, 2 eos-physics, 1 ctapps)

1257 (+65%)
Storage Nodes

51986 (+32%)
Disks

4 LHC:
500 SSDs + 800 spinners for ~5PB
of spinners based storage

- 400 JBODS x 24 disks x 14TB = 134.4PB
- ALICEO2 R&D 192 JBODS x 24 disks x 14TB = 64.5PB

QA/PPS:
(1 cernbox, 2 eos-physics, 1 ctapps)

2 PB

12 PB

40 PB

150 PB

270 PB

340 PB

396 PB

+ 200PB

+ 80PB

550 PB

~18PB
retirement

26.4PB
Drained

Wigner
rump down

Maria Arsuaga-Rios IT-ST-PDS

2010

2012

2014

2016

2018

2020

2021

2022 3



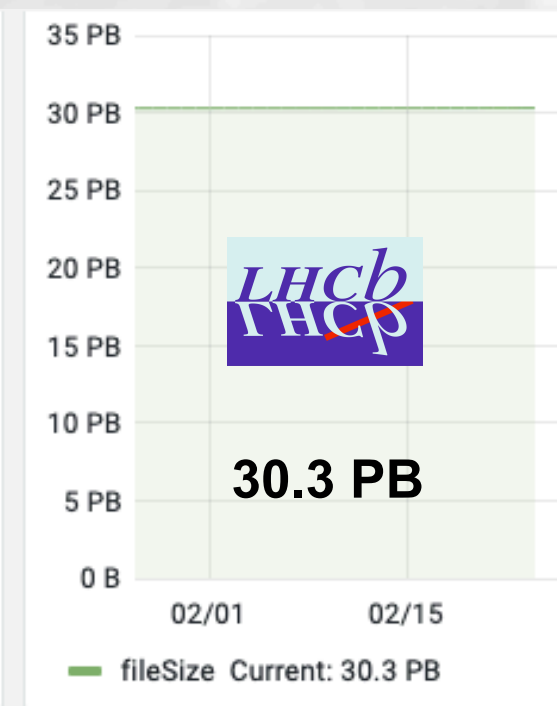
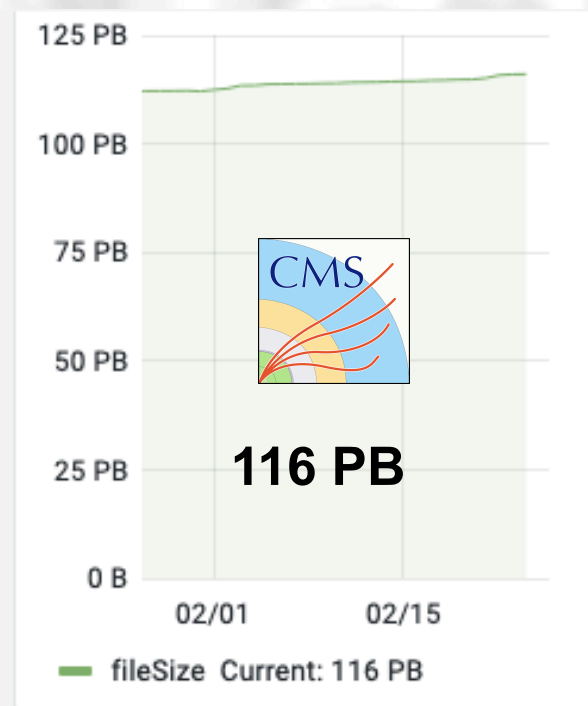
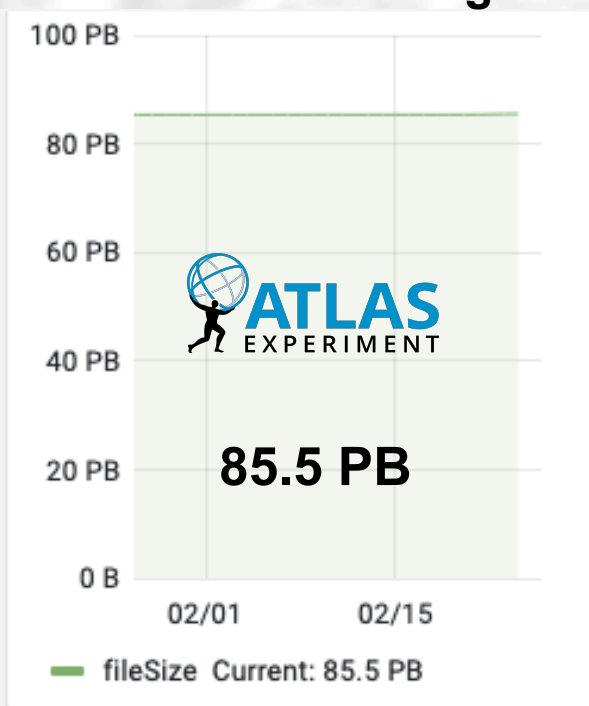
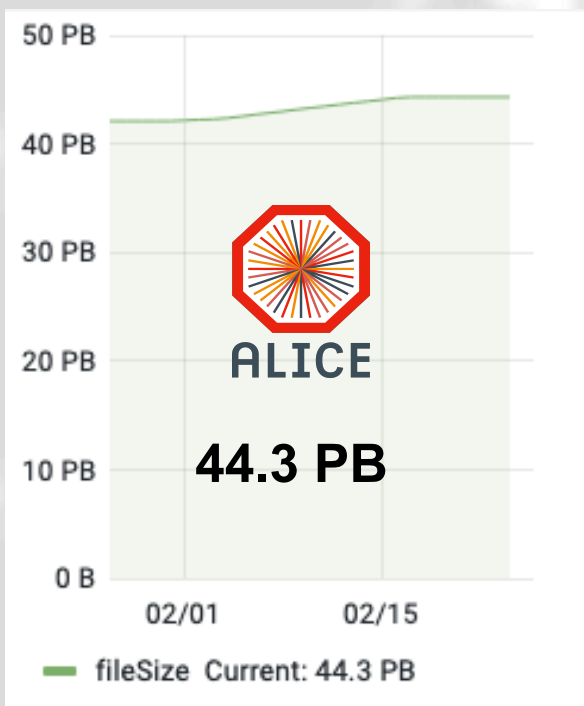
Tape Storage Capabilities



CERN
Tape Archive

The primary purpose of CTA is to provide reliable, long-term archival storage of the custodial copy of the data from all of the physics experiments at CERN.

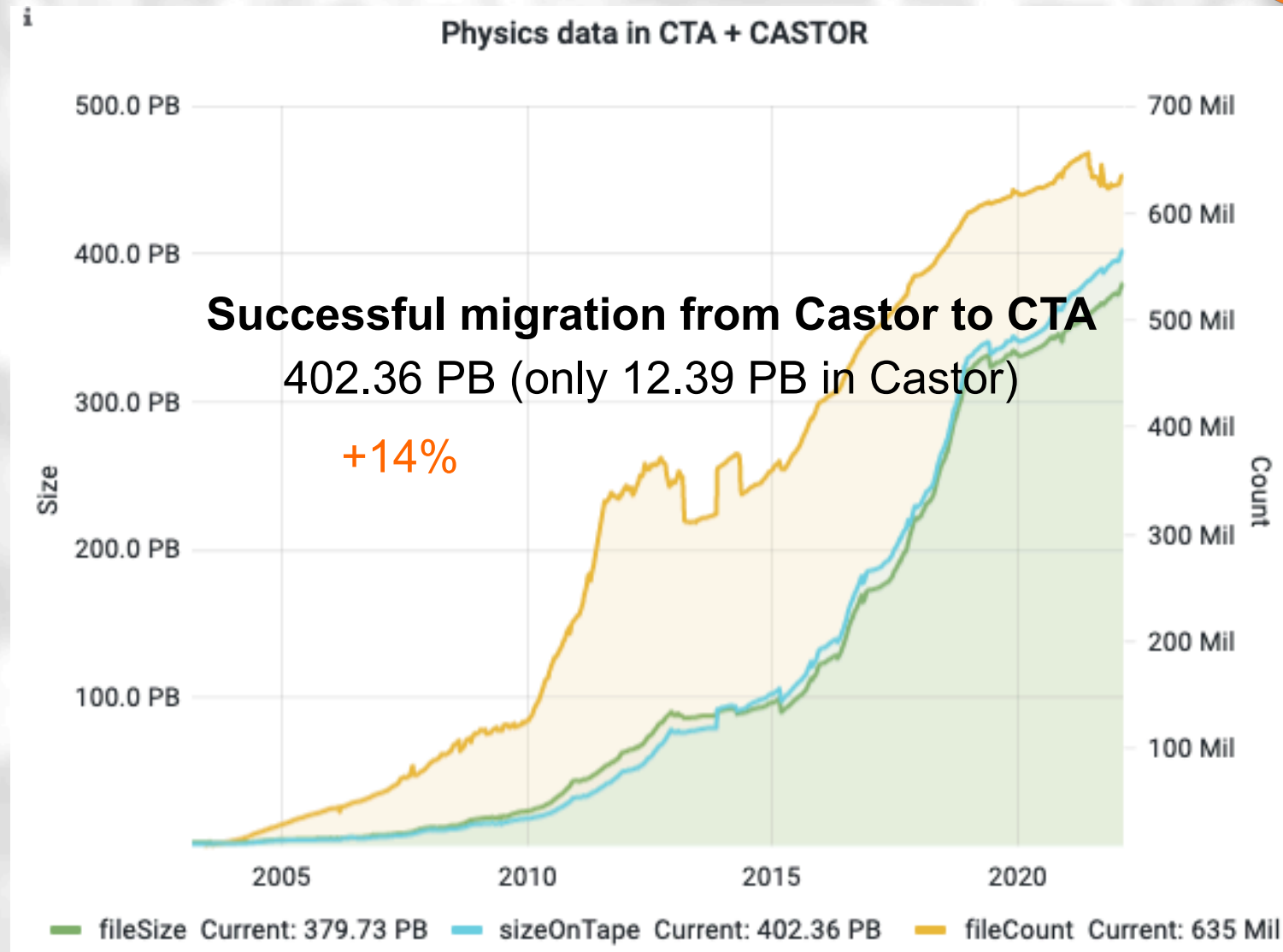
Successful migration from Castor to CTA



Tape Storage Capabilities



CERN
Tape Archive



General purpose services



9

Instances

Homes, Projects and Media



2.02 Bill

Number of Files

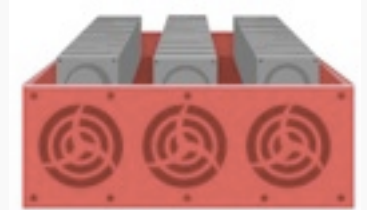
+24%



220 Mil

Number of Directories

+30%



29.08 PB

Total Space

+9%



Backup in a different technology

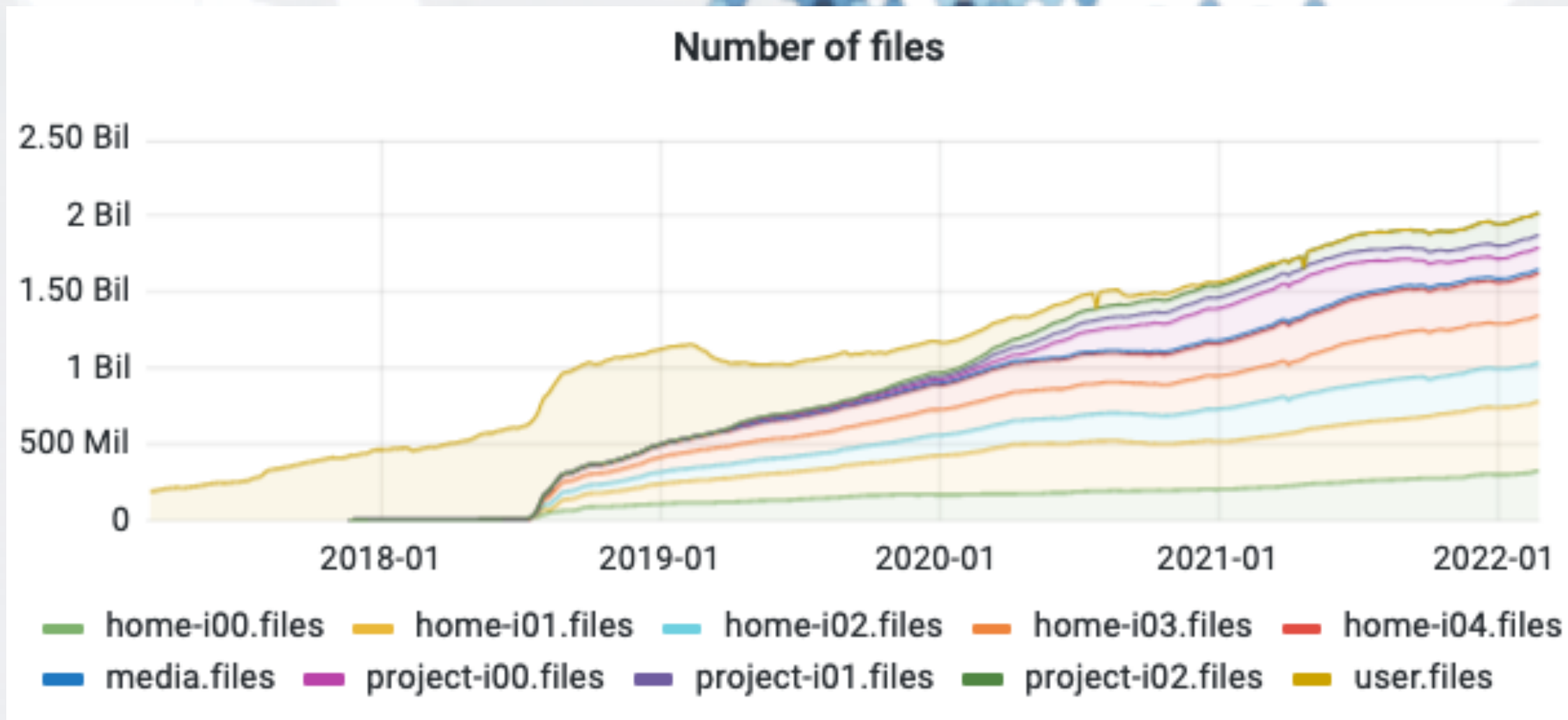


RESTIC



Maria Arsuaga-Rios IT-ST-PDS

General purpose services



EOS for Physics: Numbers



6 + 3

Instances



2.67 Bill

Number of Files

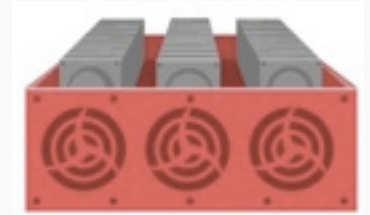
+8%



215 Mil

Number of Directories

+13%



514.84 PB

Total Space

+75%

	Total space	Used space	Number of files
ATLAS	94.02 PB	72.43 PB	255 Mil
CMS	72.65 PB	53.47 PB	149 Mil
ALICE	93.63 PB	63.32 PB	690 Mil
LHCb	51.75 PB	14.81 PB	893 Mil
non-LHC	84.66 PB	56.60 PB	390 Mil
ALICEO2	90.57 PB	35.35 PB	219 Mil
TOTAL	487.28 PB	295.98 PB	2596 Mil

Production: ALICE, ALICEO2, ATLAS, CMS, LHCb, and Non-LHC

Dedicated: AMS, ALICEDAQ, EULAKE

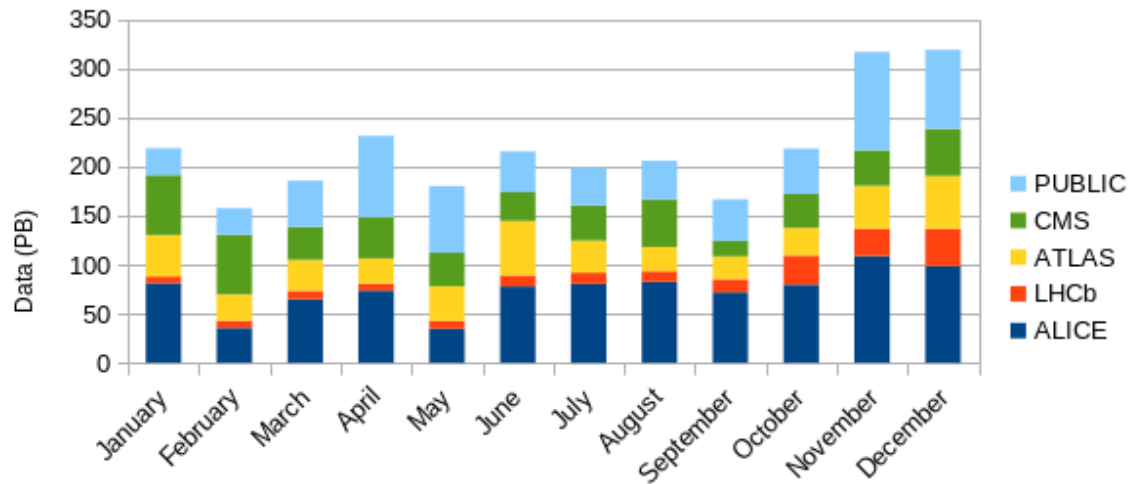
Testing/Internal: Pilot, PPs, Backup (not included in the numbers)

EOS for Physics: Activity

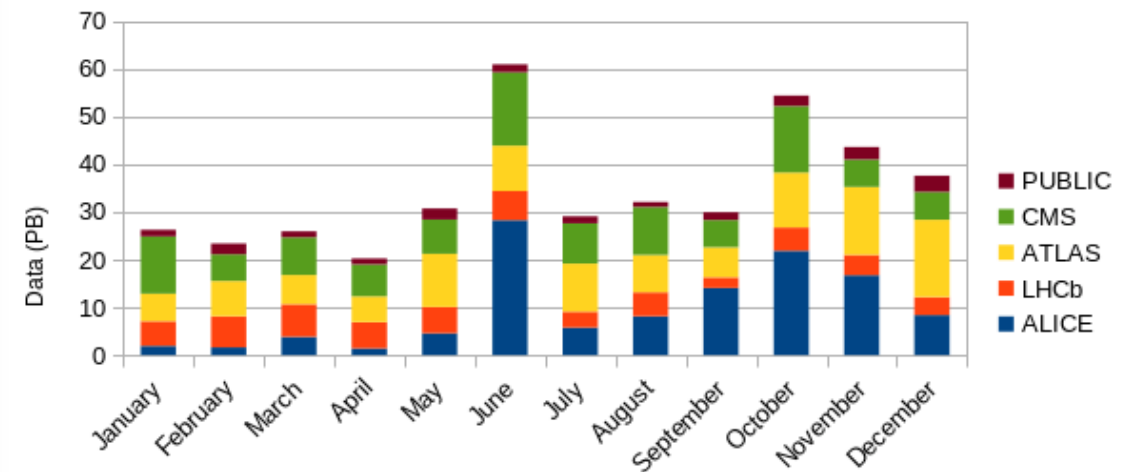


EOS served 2.6 ExaBytes of data from the physics instances
and 0.5 ExaBytes received

Amount of data read in 2021



Amount of data written in 2021



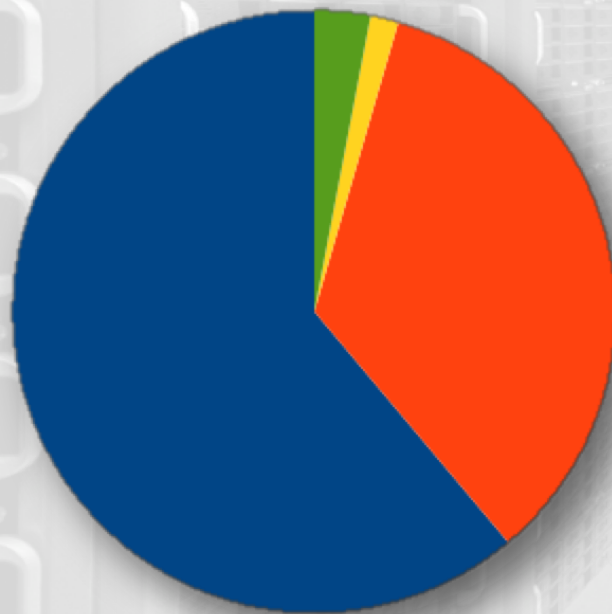
EOS for Physics: Activity



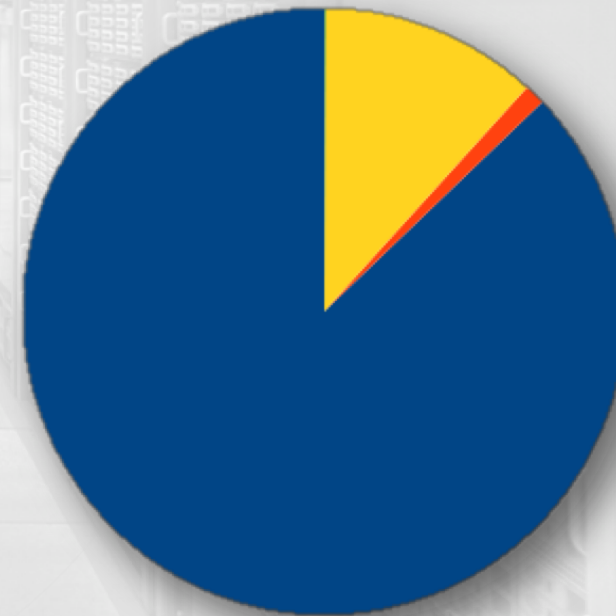
Most used protocol for reads: XrootD or via mounted filesystems (FUSE)

Most used protocol for writes: XrootD followed by GridFTP

Total reads per protocol



Total writes per protocol



■ XROOTD
■ FUSE
■ GRIDFTP
■ HTTP

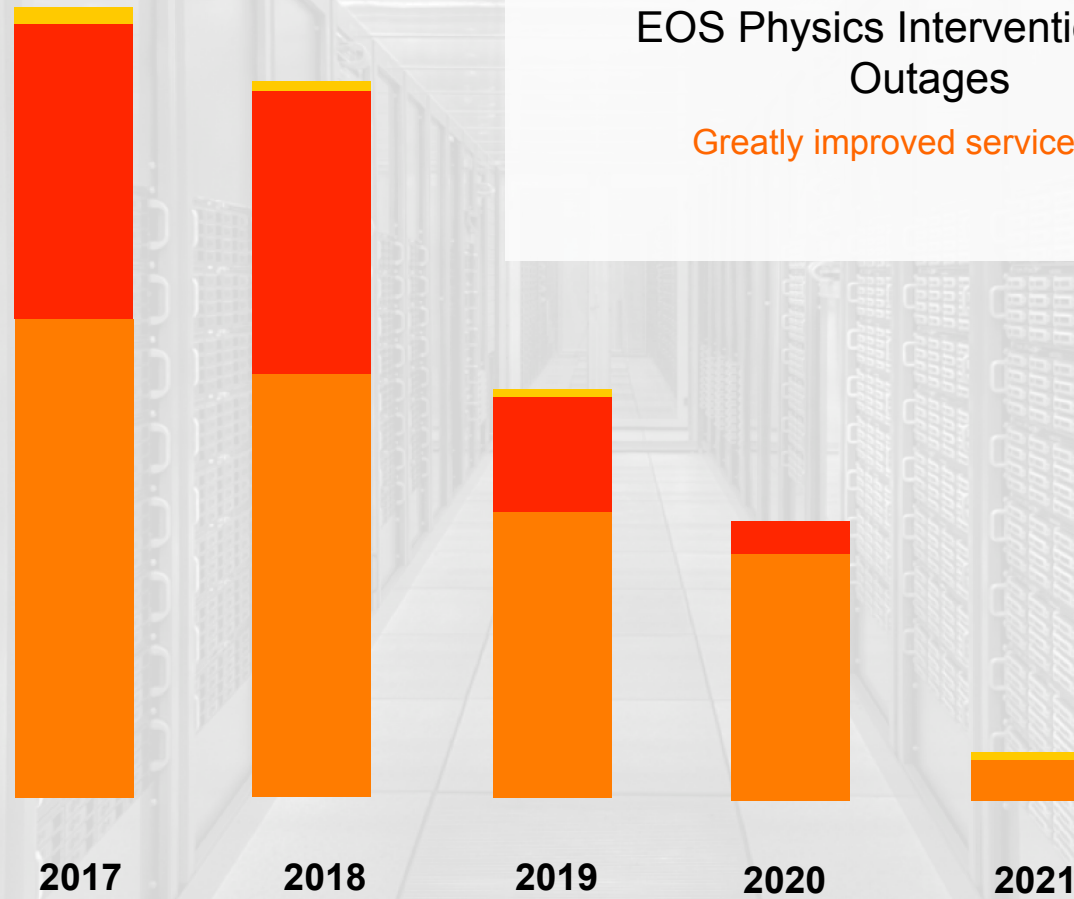
EOS for Physics: Availability EOS

11 days -

Total duration (sum)

EOS Physics Interventions and Outages

Greatly improved service availability



 Degraded
 Down
 No impact

EOS for Physics: Service Operations



- Continuous improvements of instance monitoring and alerting

- The durability project: less risks for data stored on EOS, faster draining process

- More in-depth testing of new EOS releases in pre-production
 - Creation of new test instances (EOSPILOT, EOSHOMECANARY)
 - Pre-production, experiments testing majority of their work flows on EOSPILOT instance (CMS Tier-0)



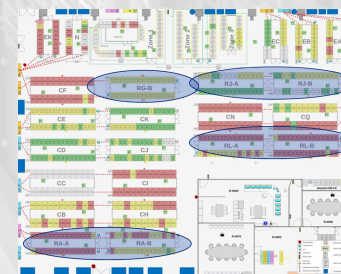
Run 3 Preparations

- Great participation (4LHC)
- Objectives achieved (+ some improvements foreseen)
- No interferences observed
- Plans ahead ☺

Allow external analysis:

- Inject transfers log data for experiment analysis (Fluent Bit)
- Implemented resource accounting together with IT/CM
- EOS quota monitor

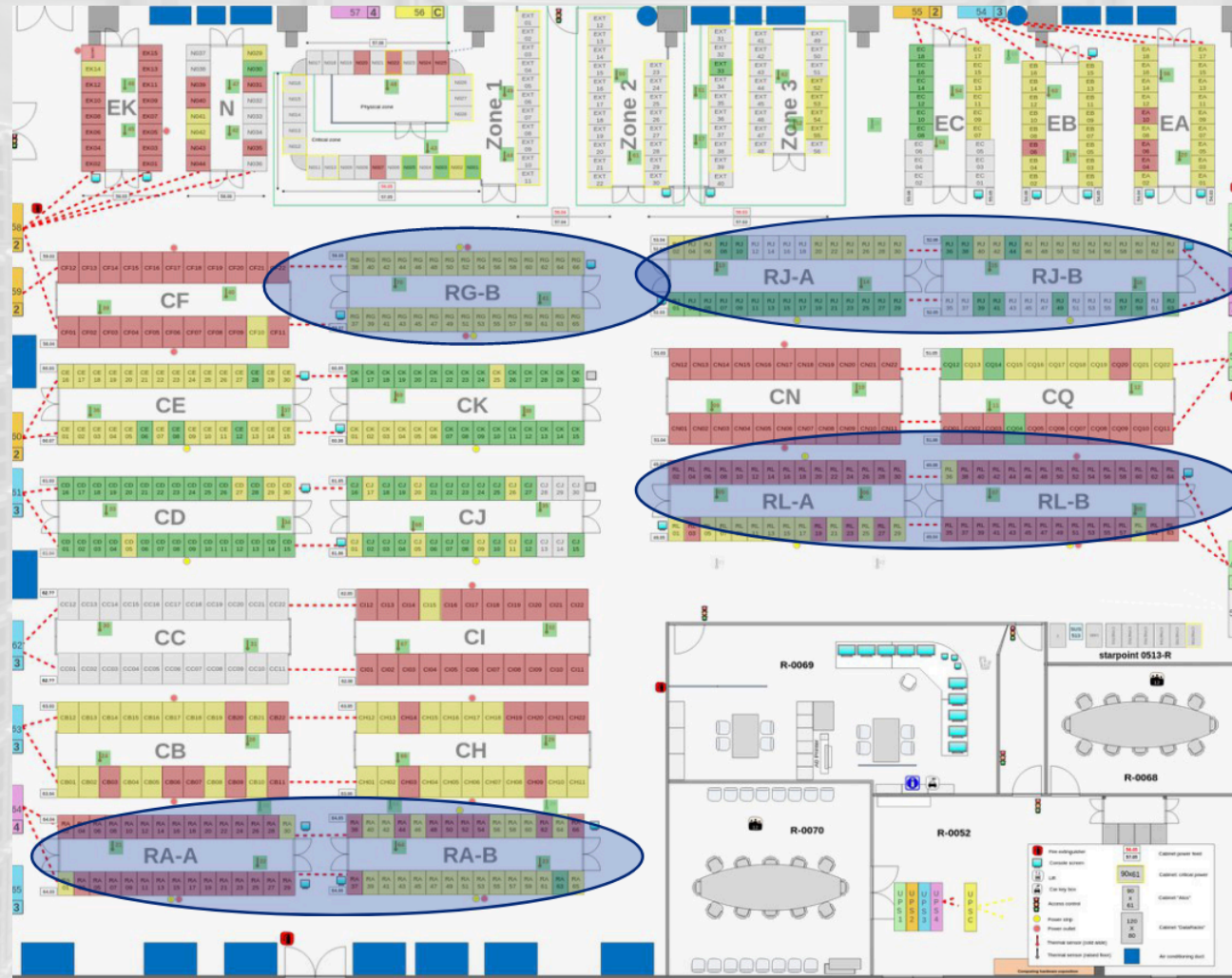
Continuous HW life-cycle management



EOS for Physics: Service Operations



Continuous HW life-cycle management



Maria Arsuaga-Rios IT-ST-PDS

Main Challenges 2022

EOS 5 in high availability mode

- EOS5 deployed on all Physics instances
- High availability mode enabled in all Physics instances

- Expand erasure coding where possible (Already used in ALICEO2, AMS02 and R&D in EOSCMS)
- Understand, test, and act upon the OS changes

Increasing resource usage efficiency

- Final Commissioning with RUN 3 Hardware
- Streamline the Best Effort support

Readiness for RUN3