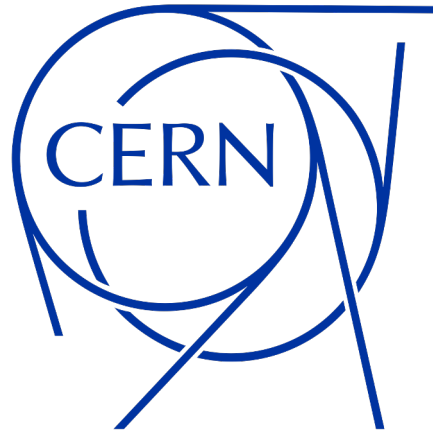




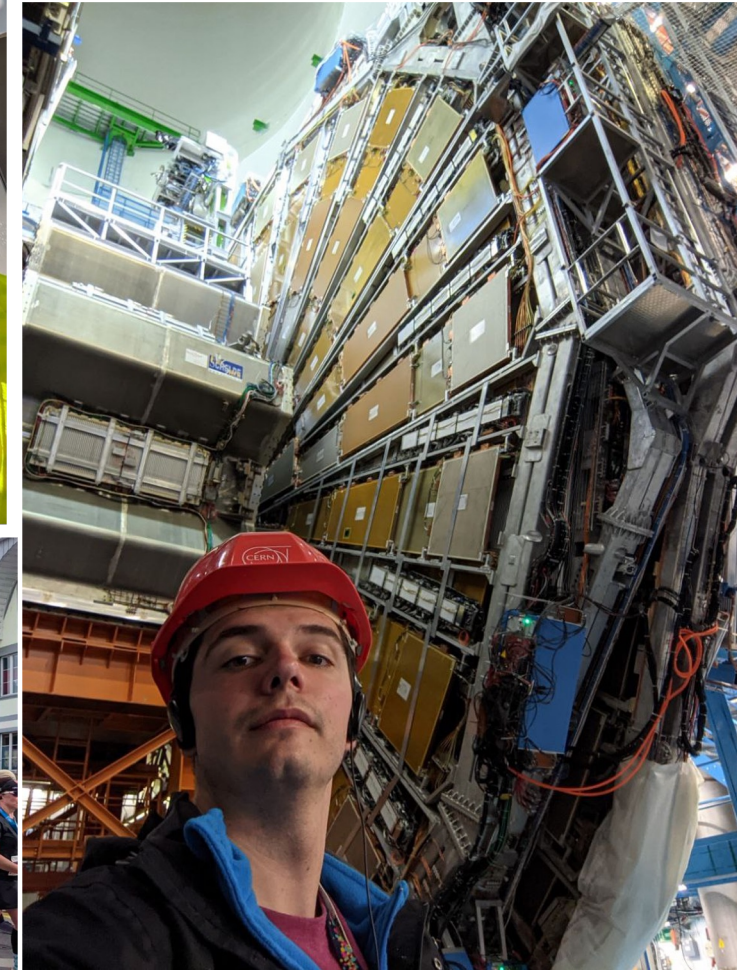
Colliders and Codebases: What CERN can teach you about Innovation and Software

Cristian Schuszter, PhD

23 September 2025

\$ whoami

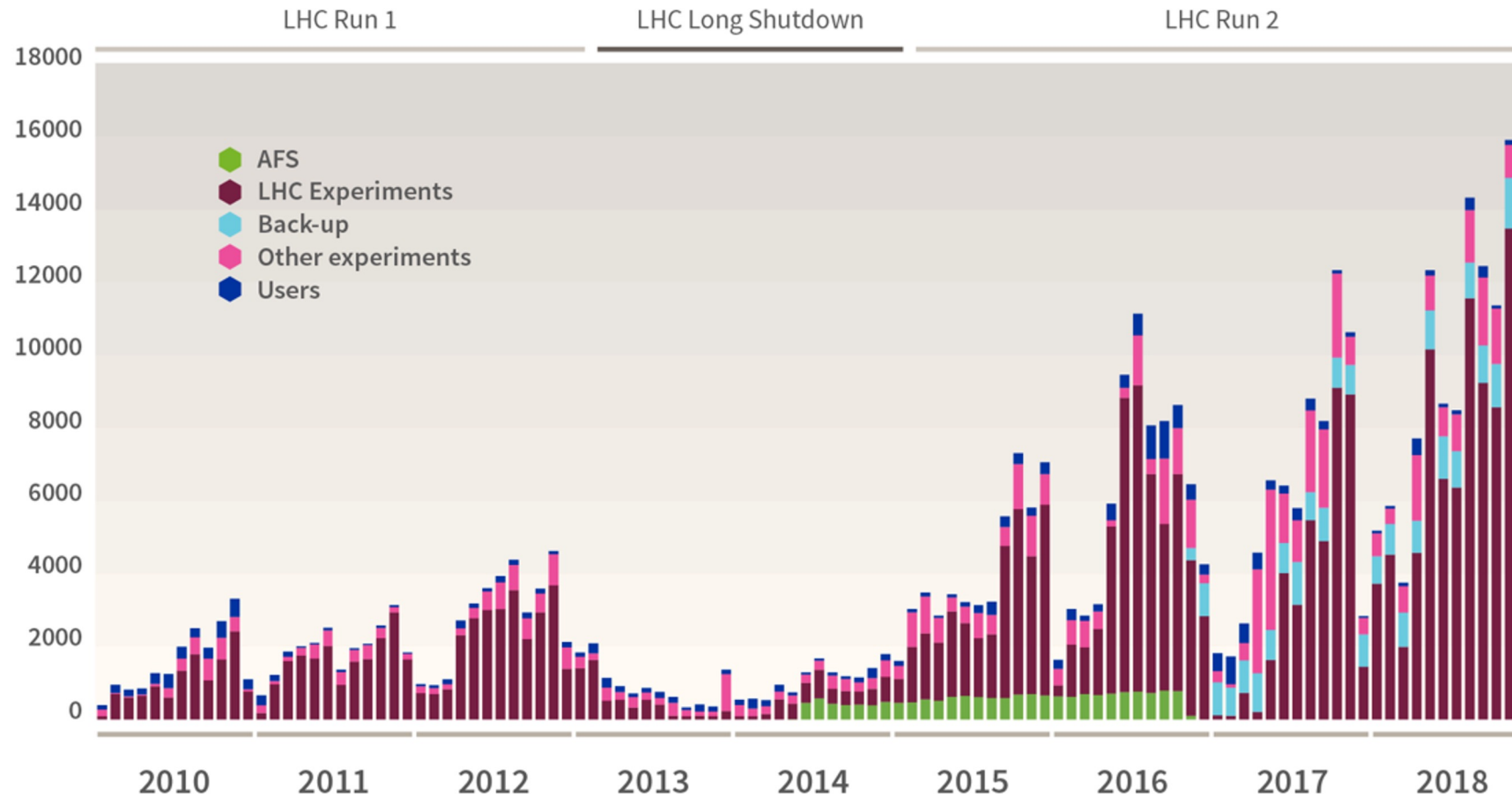
- **Cristian Schusztter**
- **Staff Software Engineer @ CERN**
- **Solution Architect**
- **Been around for ~ 8 years**
 - computer security
 - SSO team
 - now working on “business computing”
- **Previously:**
 - various U.S. startups
 - working on data engineering topics
- **CERN guide in my spare time**
 - do pass by!



Putting things in scale



Putting things in scale

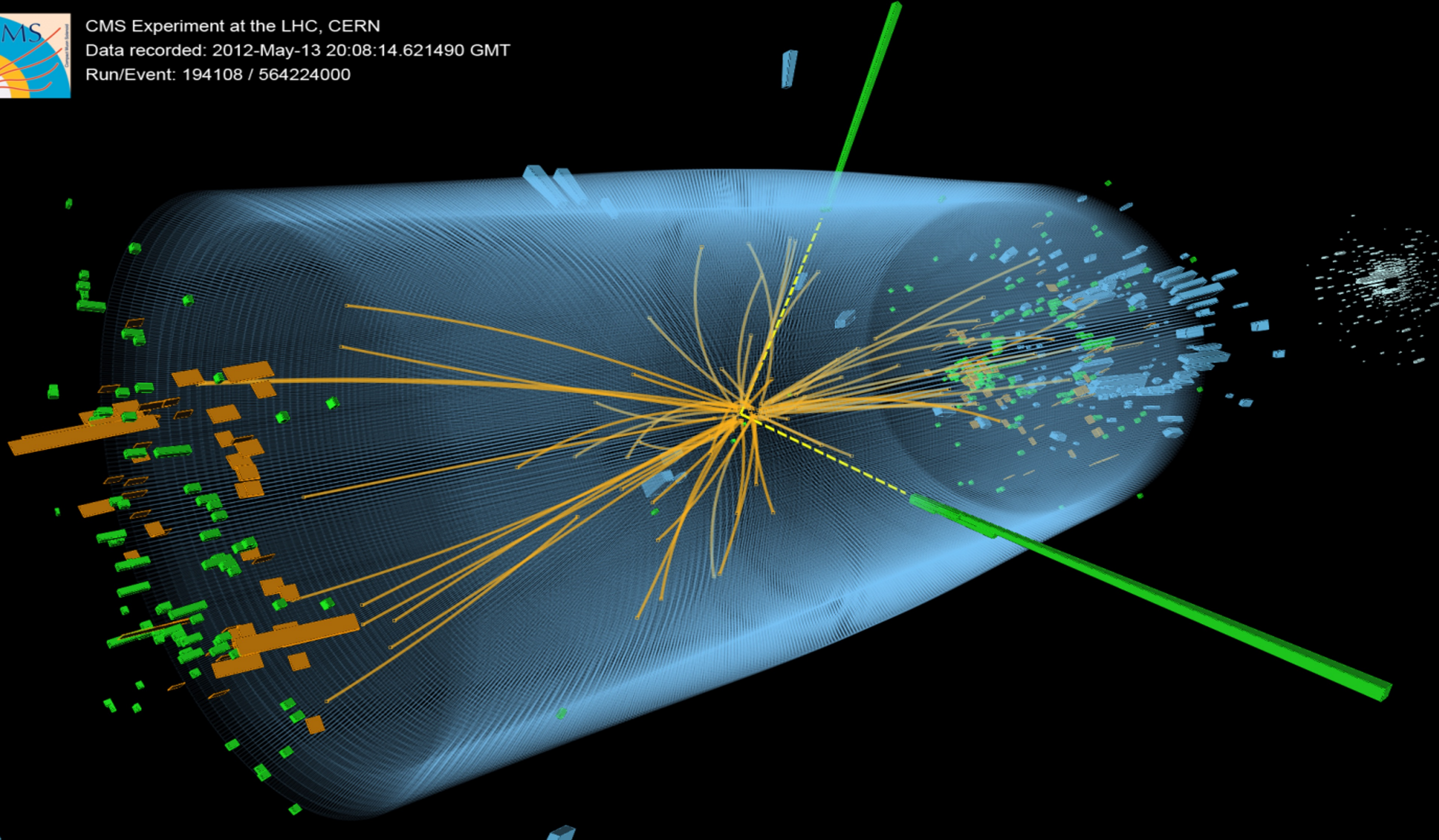


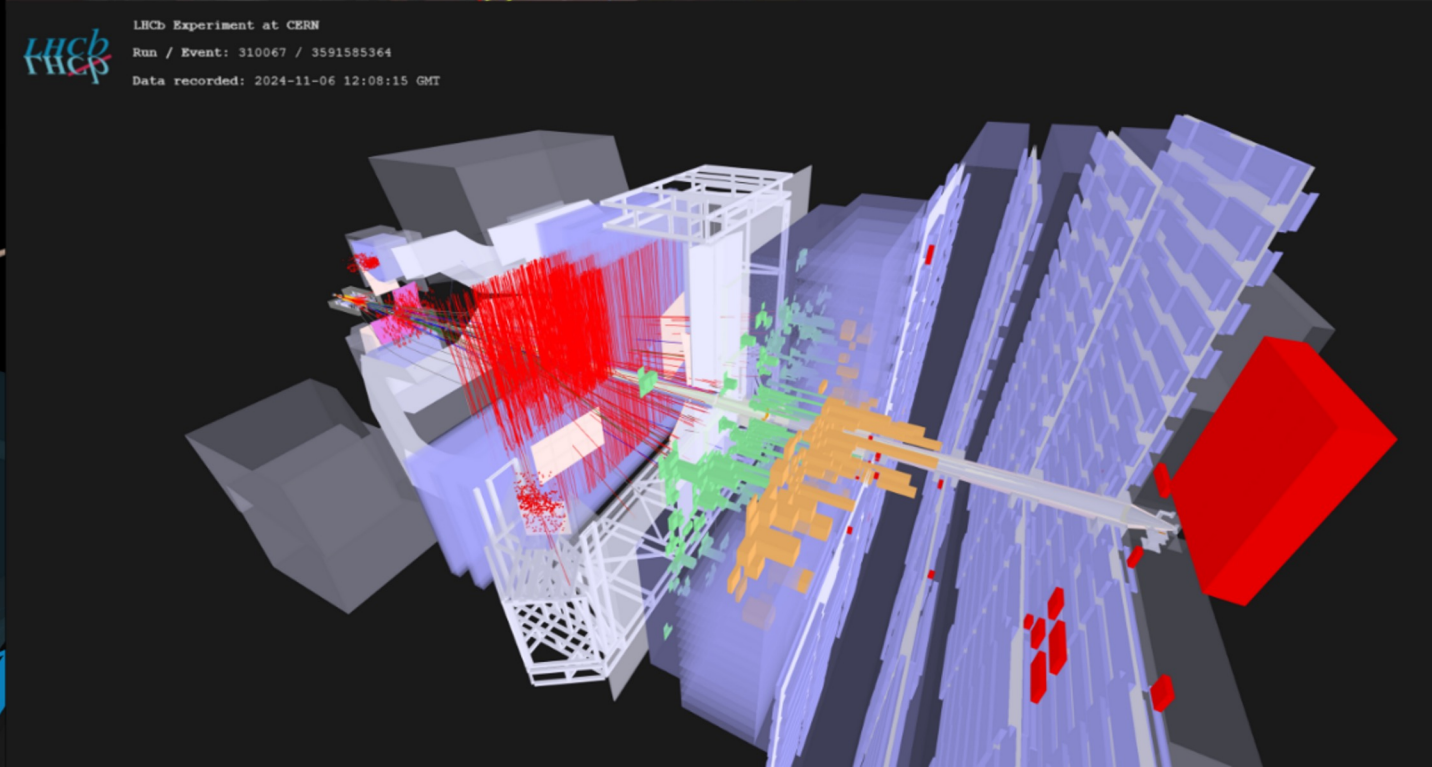
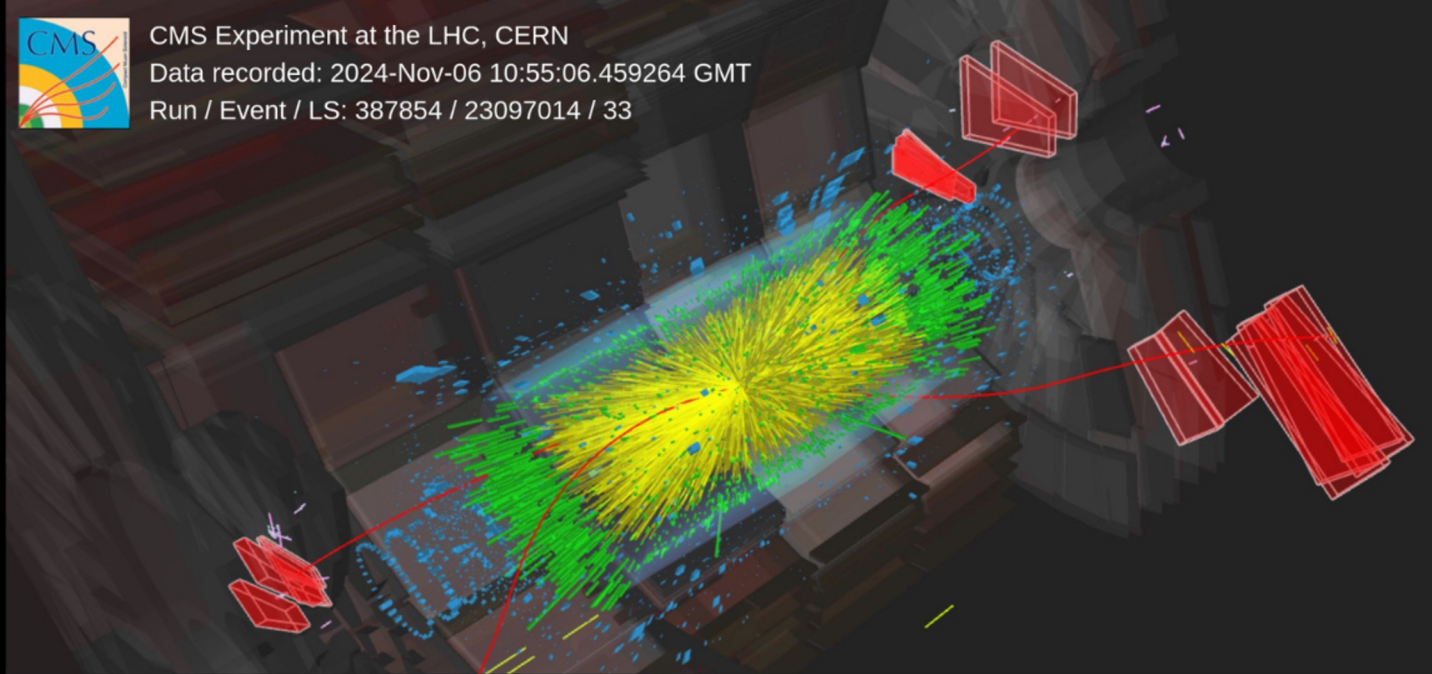
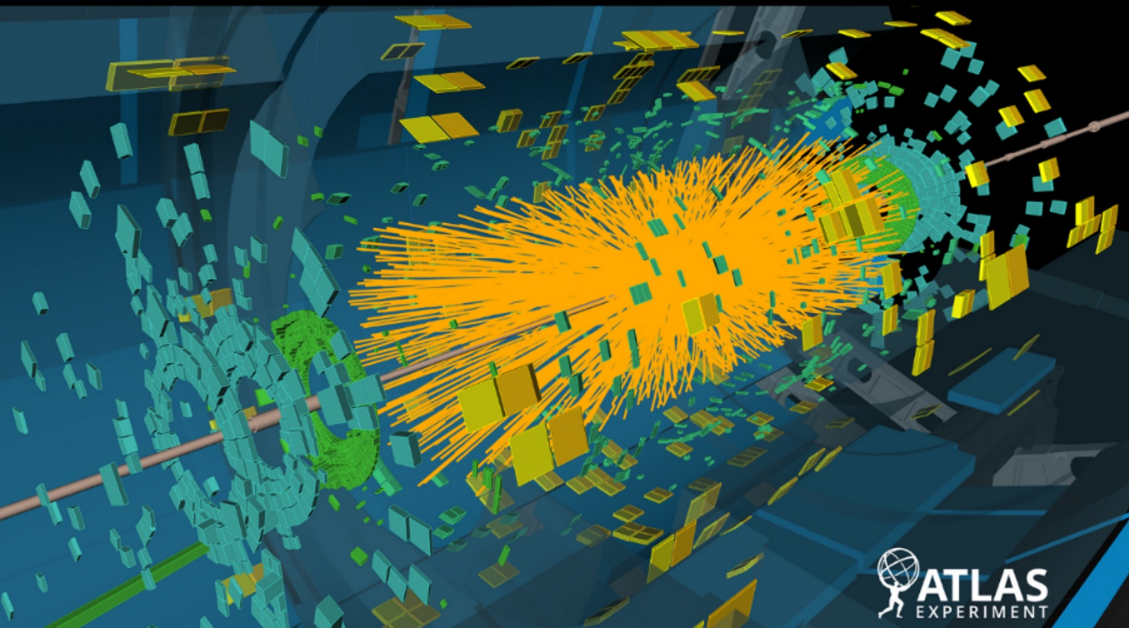
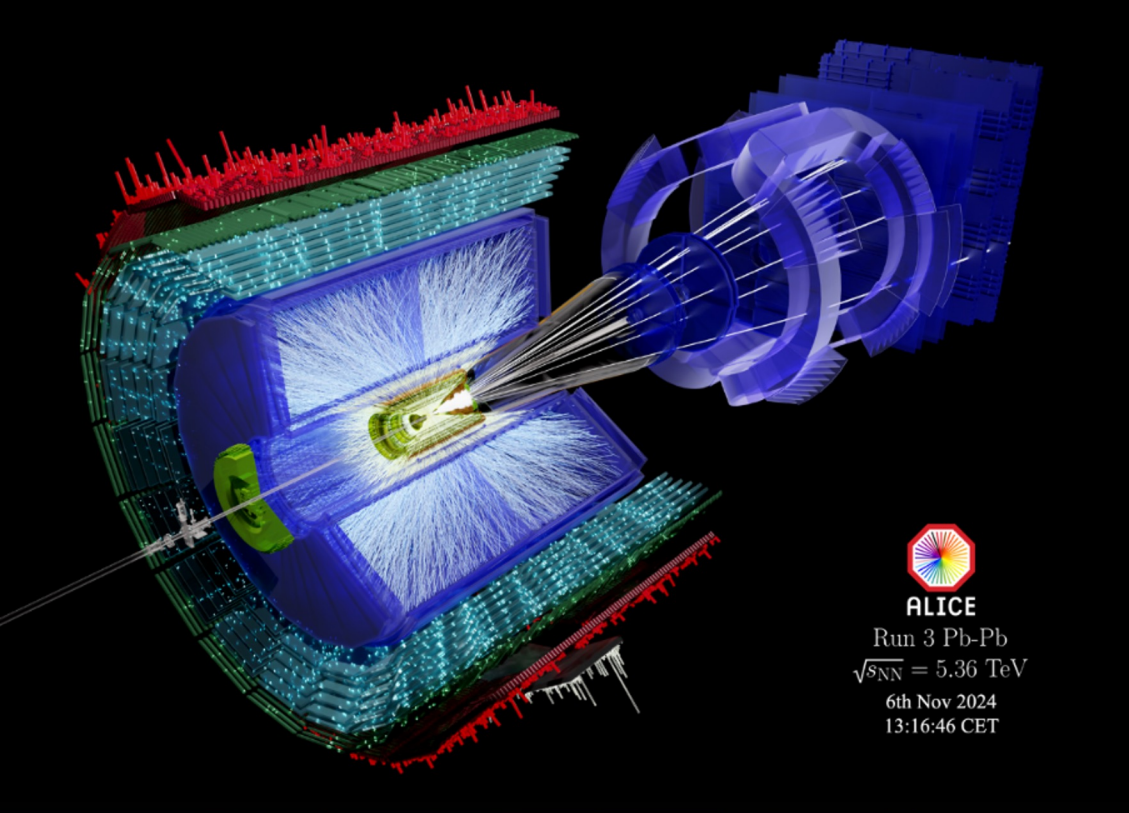


CMS Experiment at the LHC, CERN

Data recorded: 2012-May-13 20:08:14.621490 GMT

Run/Event: 194108 / 564224000

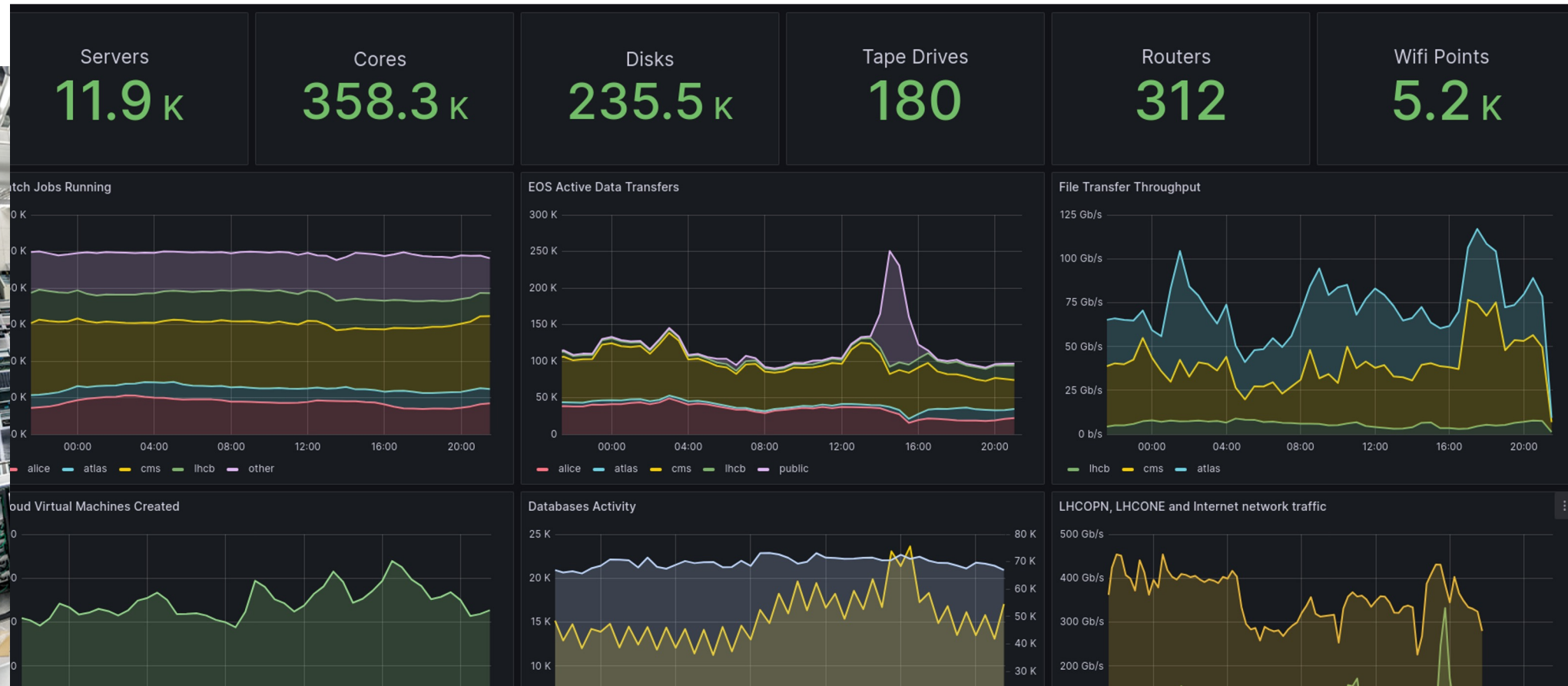
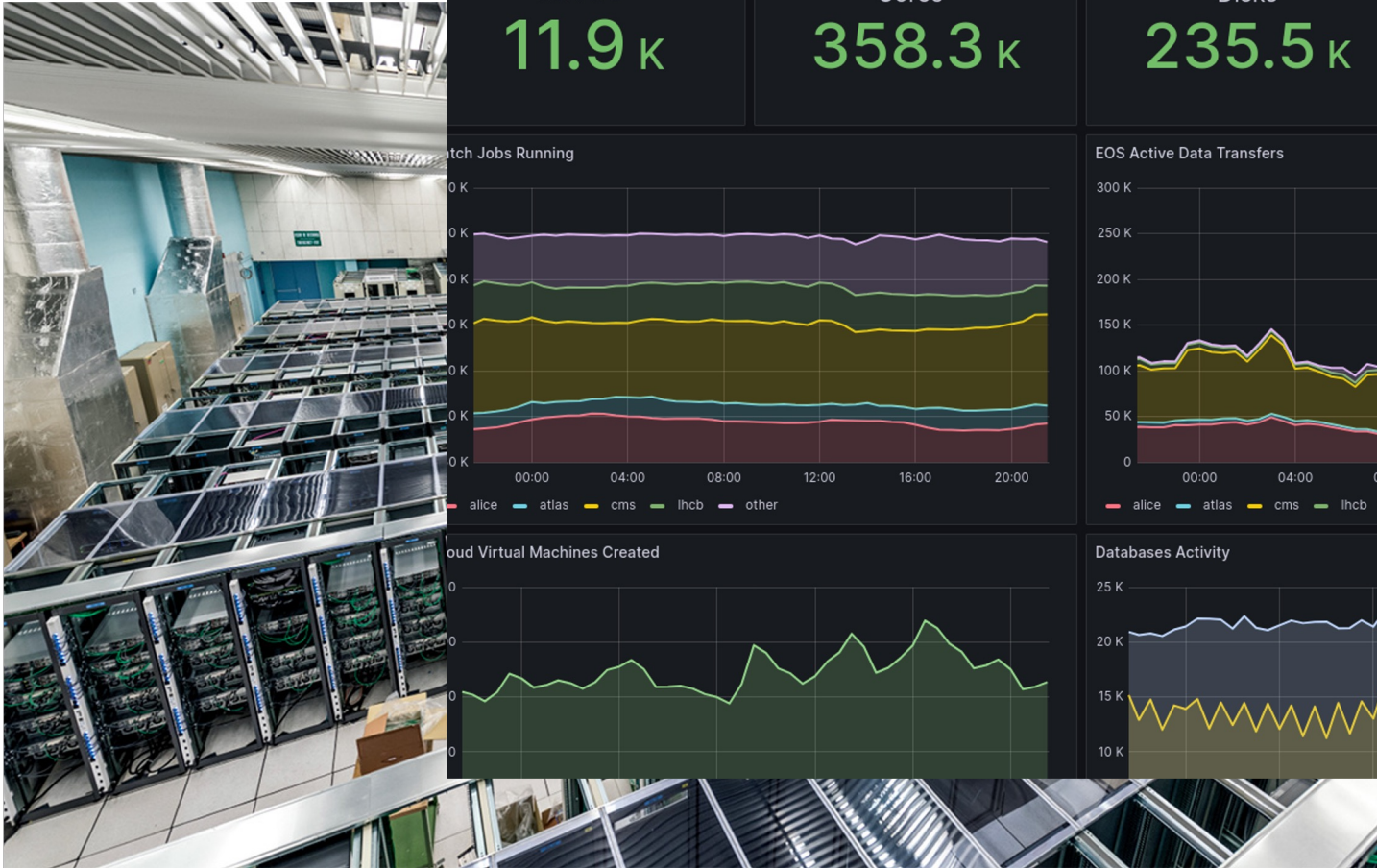




CERN storage and computing power

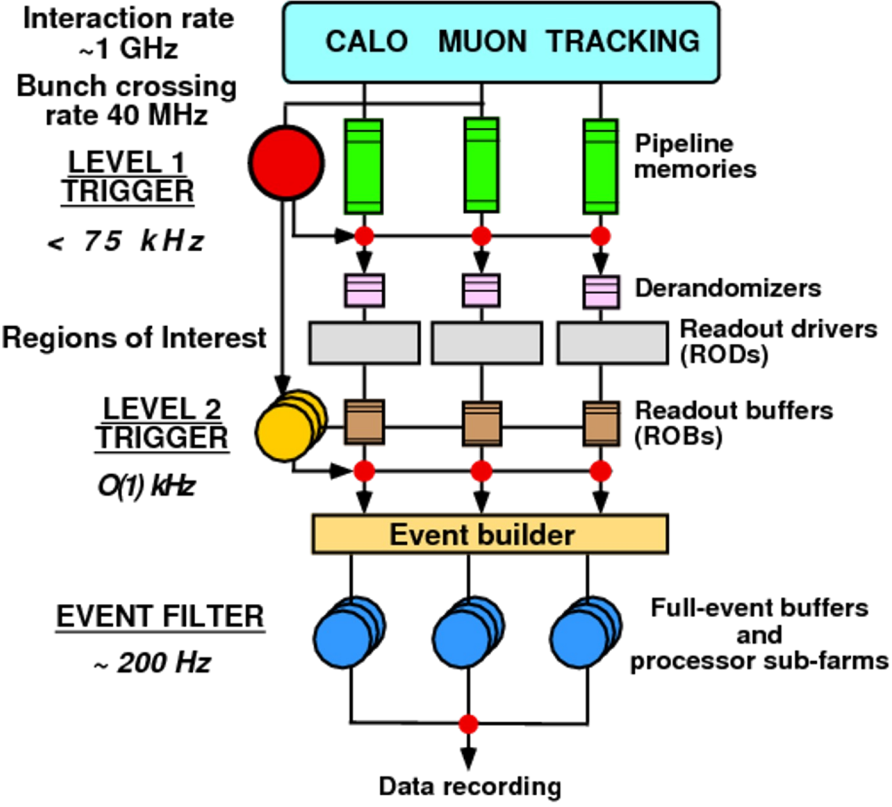


CERN storage and computing power



[1] <https://monit-grafana-open.cern.ch/d/000000884/it-overview?orgId=16>

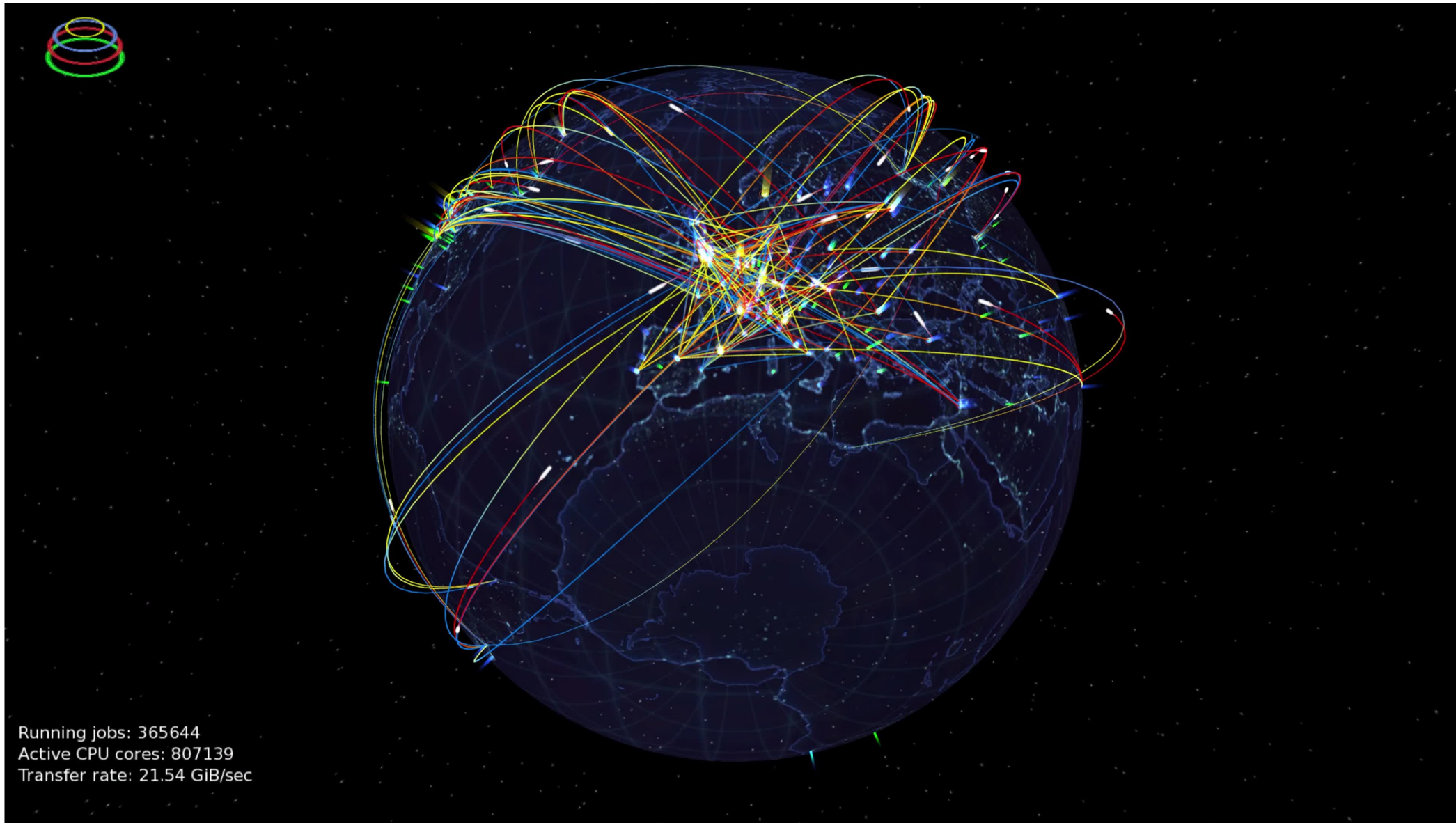
Event reconstruction



LHCb portable data centre $\sim 2 \text{ MWh}$



Physics data
at global scale



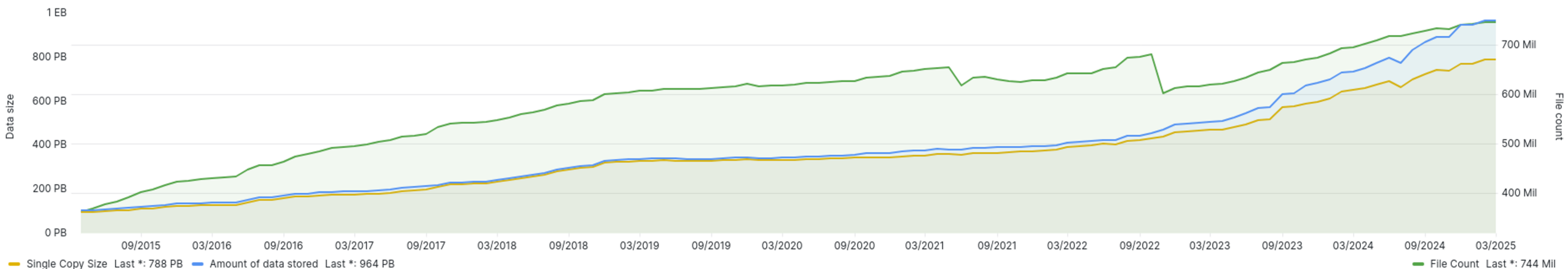
Almost at the Exabyte mark

Home > Dashboards > CERN Tape Namespace

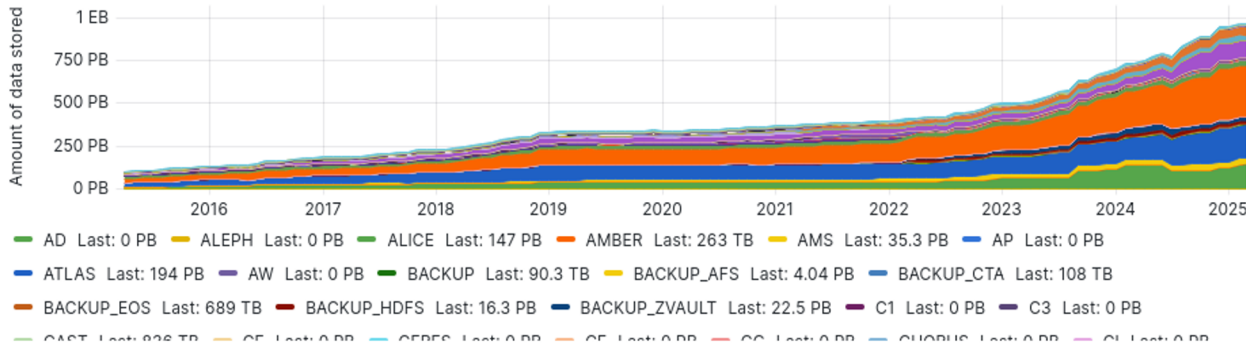
Last 10 years

VO All LHC Experiments All resolution 1mo

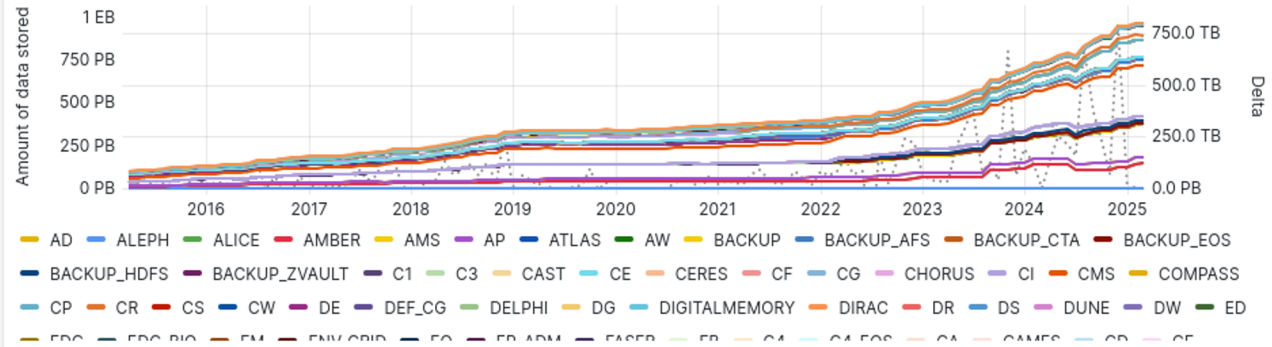
Total physics data on Tape



Data grouped by VO or experiment



Size on tape, delta



A constantly changing machine

Selected dates: 09-04-2018 and 21-09-2025

LHC Ring

Validity: 24-11-2003 - Endless

Machine
LHC

☐ Expert name on hover

☐ Asset name

☐ Optic dimensions

☒ Default height

☒ Hierarchy level: 4

☒ 5

☒ 6

☒ 7

☒ Names level: 4

☐ 5

☐ 6

☐ 7

☒ Region colors

Classes

BI BLM

BI BPM COLD

BI BPM MEASURING POINTS

BI BPM WARM

COLD MASSES LQ

COLLIMATORS

CORRECTORS

DFBX

LQ

MAD HCORRECTOR

MAD VCORRECTOR

MULTIPOLES

QUADRUPOLES

SOLENOIDS

VACUUM BEAM SCREENS

VACUUM CHAMBERS

VACUUM FLANGES

VACUUM GAUGES

VACUUM INSTRUMENTED PUMPING ST

VACUUM MODULES

VACUUM PUMPS

VACUUM SECTOR VALVES

VACUUM SUBASSEMBLIES AND PARTS

VACUUM VALVES

☒ All classes

Positions

☒ DCUM range

☐ Functional position range

☐ Region range

DCUM start*
-1

DCUM end*
50

Update

Sequences

B1

B2

E

I

LHCBLM

VAC E

VAC I

☒ All sequences

Reset Filters

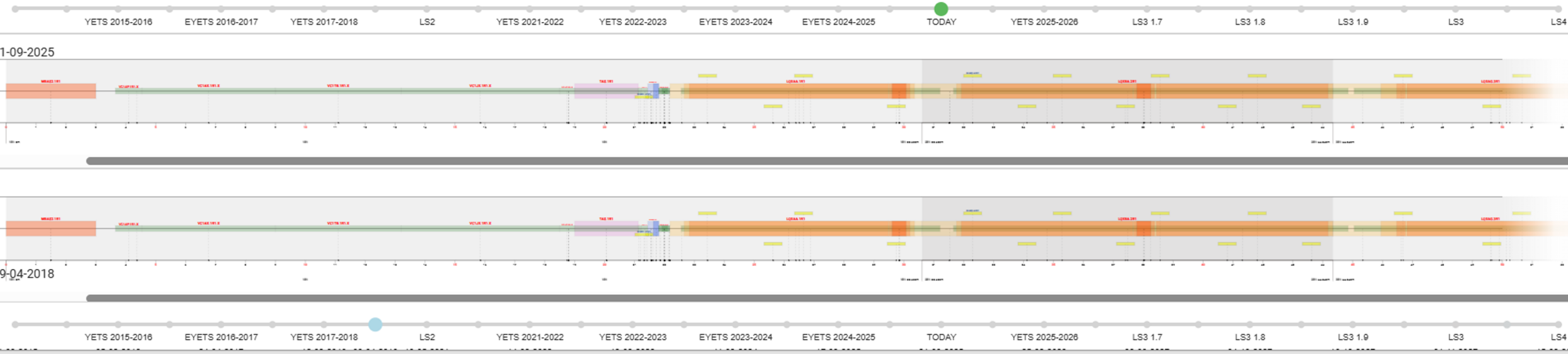
Align Zoom/Position

☒ Zoom/pan with a mouse

☒ Common scroll

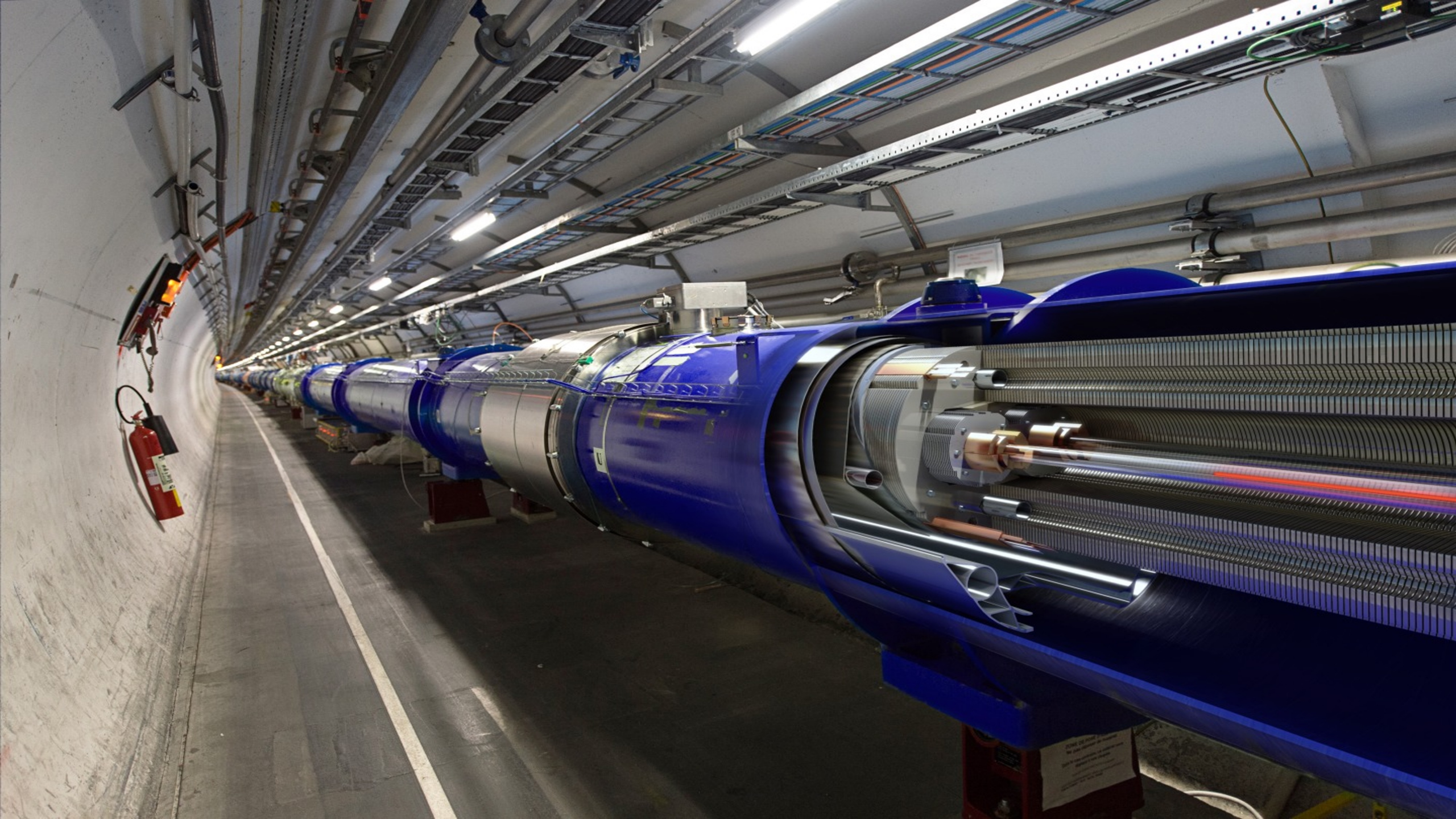
Switch to Side View

Single layout view



A constantly changing machine

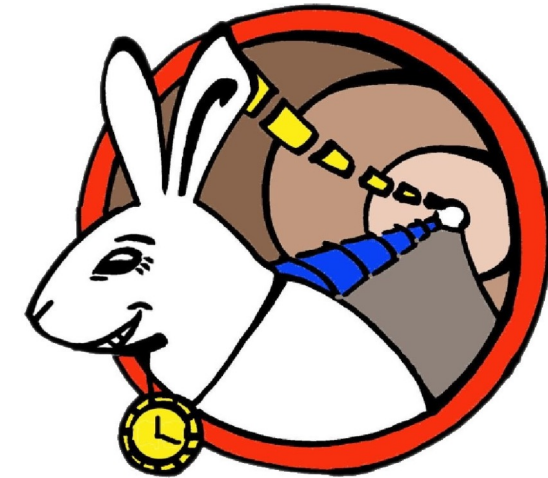
CERN ELP ALARM TiopAll MASKED (19) ALARM MAP										Filter ("/" to focus) SEARCH 16:22:45 18 / 807 EMATLI	
v. 1.0.7											
ID	Building	Site	Safety zone	Fault member	Fault family	Point description	Prio.	Masked until ↓	Masked on	Configuration	
185871	117/R-001	MEY	19	YSALC-00956	ACCE_GENERALE_MEY	ACCES LAISSE OUVERT	1	11-Mar-2021 16:30:00	Today 16:21:05	TiopAll	
10467149	BM4 (994)	POINT_4_SPS		EMD412_SLASH_M4	EXTRACTABLEBREAKERWITHEARTH	Interlock EIS 1	0	11-Mar-2021 16:30:00	Today 16:18:45	TiopAll	
10467153	BM4 (994)	POINT_4_SPS		EMD412_SLASH_M4	EXTRACTABLEBREAKERWITHEARTH	Declenchement	0	11-Mar-2021 16:30:00	Today 16:18:45	TiopAll	
10467201	BM4 (994)	POINT_4_SPS		EMD412_SLASH_M4	EXTRACTABLEBREAKERWITHEARTH	Ordre ext. declenchement disjoncteur	0	11-Mar-2021 16:30:00	Today 16:18:45	TiopAll	
138869	UJ56 (2537)	L05		UAUQ-01557	THER_VENT_LHC	DEFAULT GENERAL	2	11-Mar-2021 16:30:00	Today 16:18:45	TiopAll	
198327	890/R-001 (PD544)	PRE	9	YSALC-01234	ACCE_GENERALE_PRE	ACCES LAISSE OUVERT	1	11-Mar-2021 16:30:00	Today 16:21:05	TiopAll	
169897	866/R-203 (BL3)	PRE		YSPOR-0035975	ACCE_GENERALE_PRE	ACCES LAISSE OUVERT	1	11-Mar-2021 16:30:00	Today 16:21:05	TiopAll	
198121	887/R-254 (HNA910)	PRE	9	YSALC-01173	ACCE_GENERALE_PRE	ACCES LAISSE OUVERT	1	11-Mar-2021 16:30:00	Today 16:21:05	TiopAll	
170721	BC/R-001 (874)	PRE	13	YSALC-01426	ACCE_GENERALE_PRE	ACCES LAISSE OUVERT	1	11-Mar-2021 16:30:00	Today 16:21:05	TiopAll	
186558	771/R-201	PRE	10	YSALC-00785	ACCE_GENERALE_PRE	ACCES LAISSE OUVERT	1	11-Mar-2021 16:30:00	Today 16:21:05	TiopAll	
139639	UXC55/1 (3525)	L05		FCUL-00019_SILICON2	EAU_FLUOROCARB_LHC	DEFAULT GENERAL INST	0	11-Mar-2021 16:30:00	Today 16:21:05	TiopAll	
202747	BA20 (869)	SPS		FDED-00011_130	EAU_DEMI_SPS	DEFAULT PROCESS CIRC	2	11-Mar-2021 16:30:00	Today 16:21:05	TiopAll	
197052	6045/R-203	L08	8	YSPOR-0041927	ACCE_GENERALE_LHC	ACCES LAISSE OUVERT	1	11-Mar-2021 16:30:00	Today 16:21:05	TiopAll	
101462	355 (ME6)	AIM	28	FQSTR-00024_AIMANT_N1	EAU_PRIM_PS	[?] DEFAULT NIVEAU BAS TOUR DE REFROIDISSEMENT	2	Today 16:30:00	Today 15:20:59	TiopAll	
110998	SMI2/R (3191)	L01	34	UAVC-00001	THER_VENT_LHC	[?] ARRET EQUIPEMENT	2	Today 16:30:00	Today 15:20:59	TiopAll	
178561	SX8/R-003 (2885)	L08	8	YSALC-00787	ACCE_GENERALE_LHC	ACCES LAISSE OUVERT	1	Next activation	Today 16:18:11	TiopAll	
170247	867/R-256 (HM0)	PRE		YSALC-00488	ACCE_GENERALE_PRE	ACCES LAISSE OUVERT	1	Next activation	Today 16:18:11	TiopAll	
195776	107 (ME15K)	MEY	26	YSALC-01088	ACCE_GENERALE_MEY	ACCES LAISSE OUVERT	1	Next activation	Today 16:18:11	TiopAll	
177001	SUI8 (3880)	SPS		UUW1-00124	THER_VENT_SPS	DEFAULT MAJEUR CENTRALE TRAITEMENT D AIR UUW1 124	2	Next activation	Today 15:20:38	TiopAll	



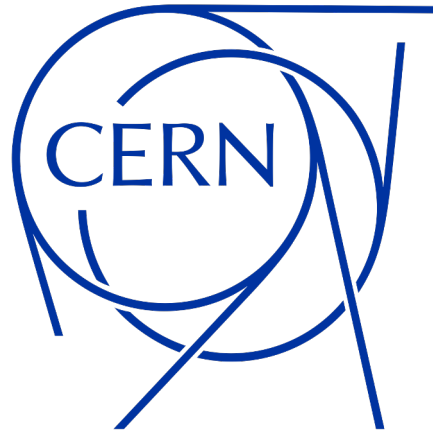
White Rabbit, a CERN-born technology, sets a new global standard

The Institute of Electrical and Electronics Engineers has incorporated the White Rabbit technology into its industry standard, maximising its adoption by industry and other partners in their pursuit to build innovative solutions for world challenges

26 JUNE, 2020 | By Marzena Lapka





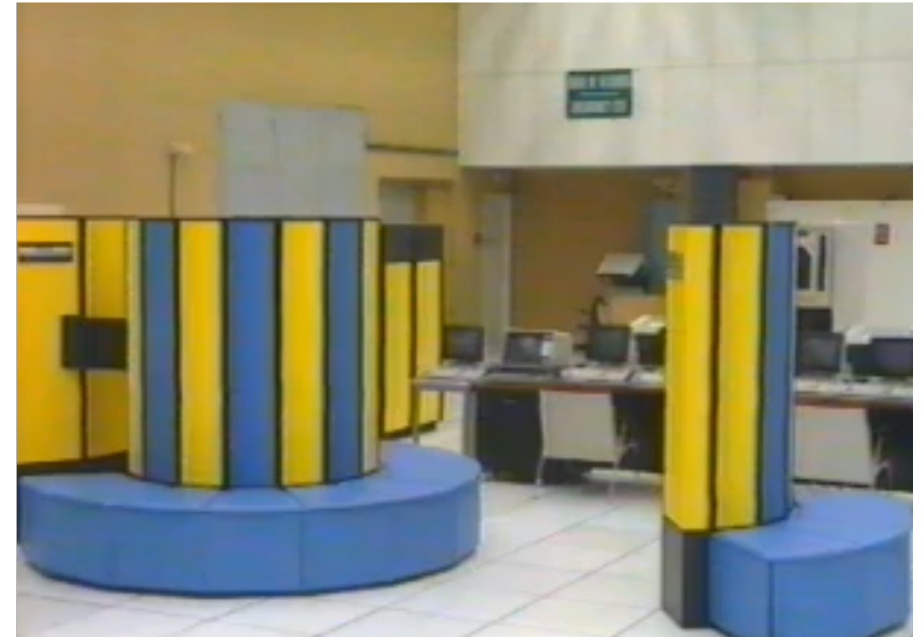
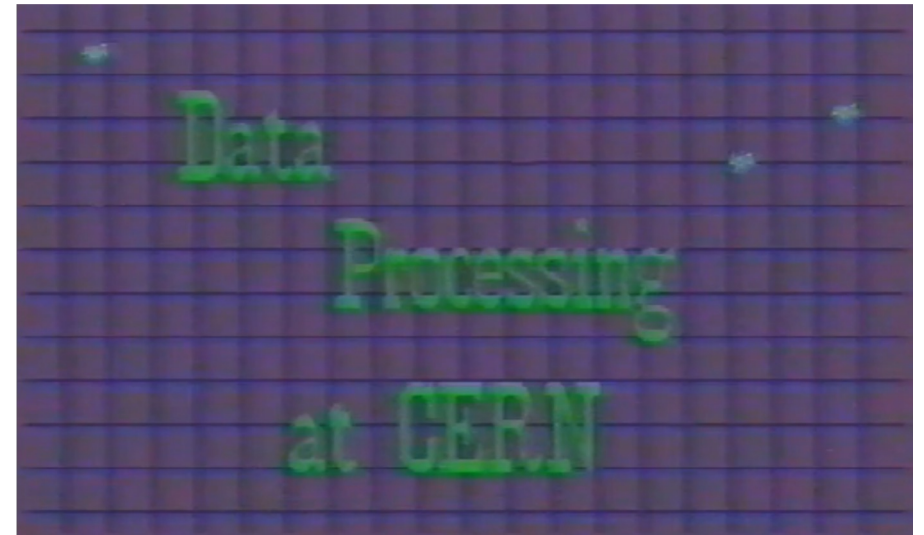


How did we get here?

CERN's first computer - 1958



Innovation through need



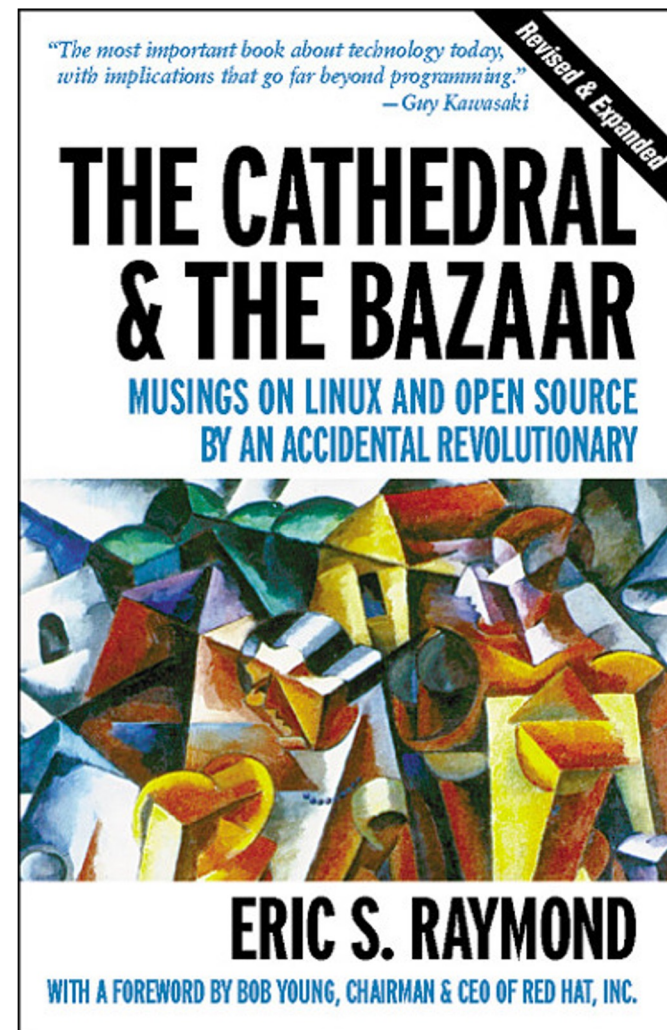
Collaboration is not optional

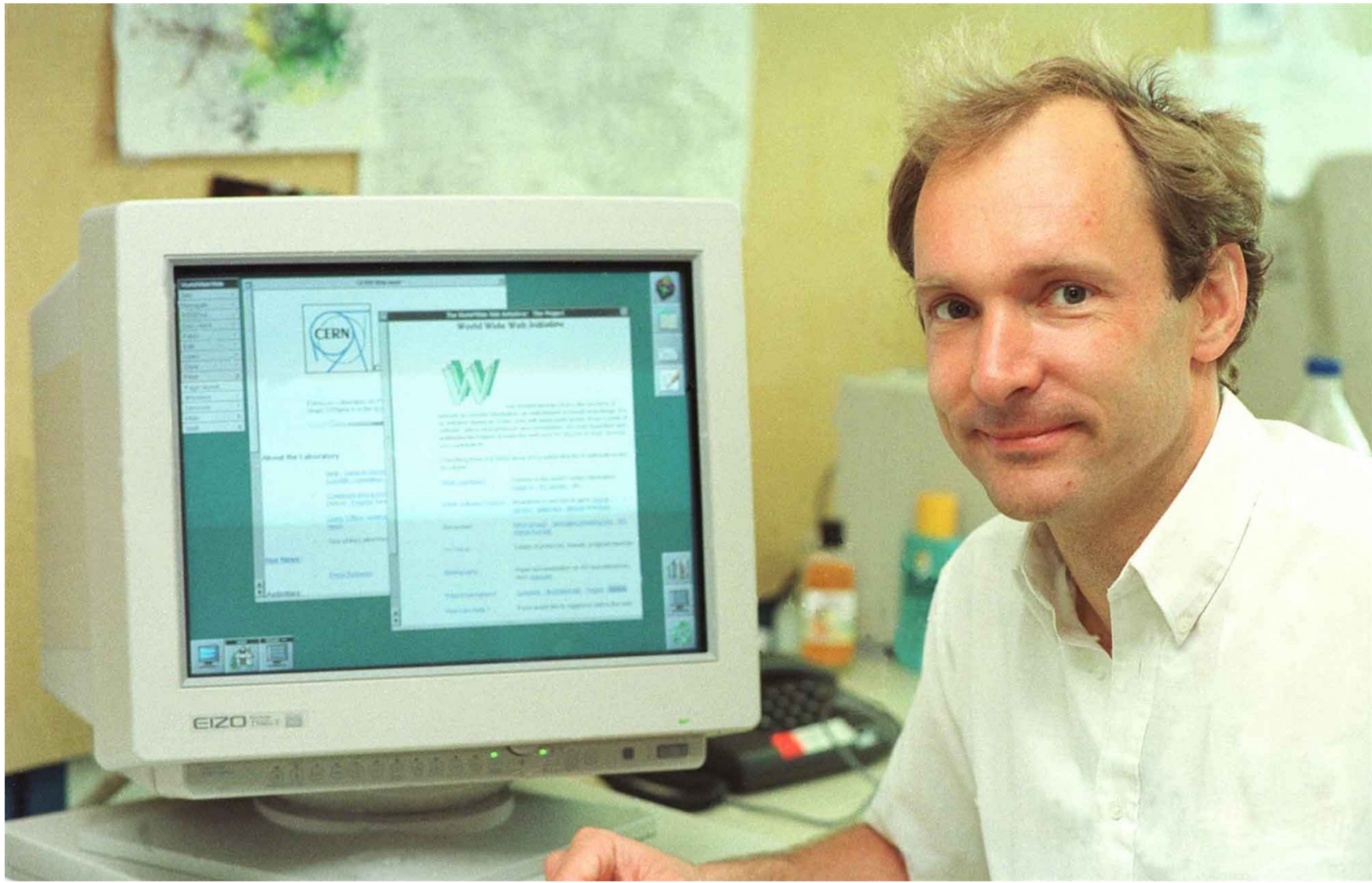
CERN is a wonderful organisation. It involves several thousand people, many of them very creative, all working toward common goals. Although they are nominally organised into a hierarchical management structure, this does not constrain the way people will communicate, and share information, equipment and software across groups.

The actual observed working structure of the organisation is a multiply connected “web” whose interconnections evolve with time. In this environment, a new person arriving, or someone taking on a new task, is normally given a few hints as to who would be useful people to talk to. Information about what facilities exist and how to find out about them travels in the corridor gossip and occasional newsletters, and the details about what is required to be done spread in a similar way. All things considered, the result is remarkably successful, despite occasional misunderstandings and duplicated effort.

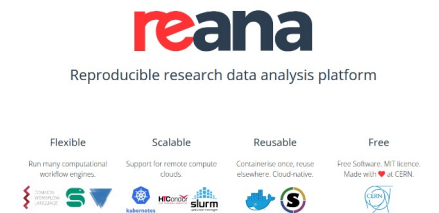
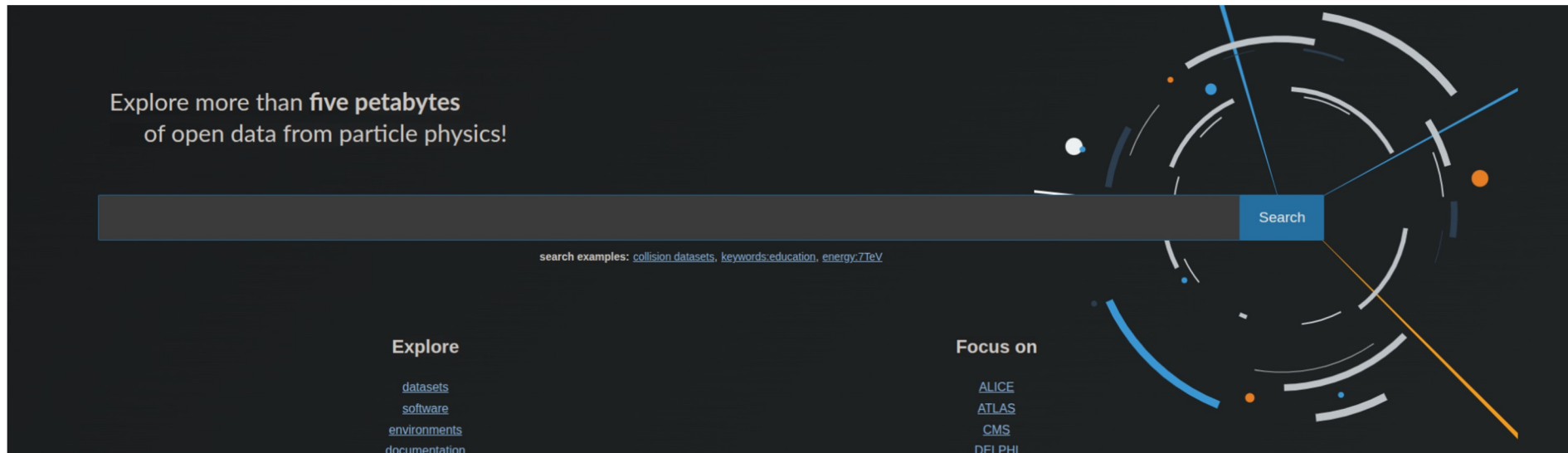
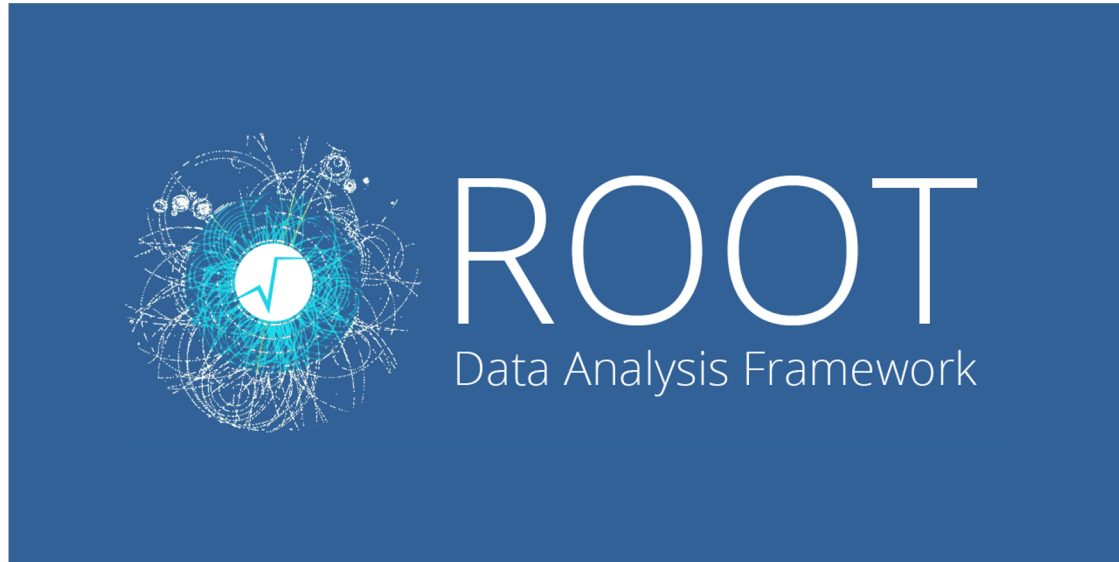
A problem, however, is the high turnover of people. When two years is a typical length of stay, information is constantly being lost. The introduction of the new people demands a fair amount of their time and that of others before they have any idea of what goes on. The technical details of past projects are sometimes lost forever, or only recovered after a detective investigation in an emergency. Often, the information has been recorded, it just cannot be found.

<https://cds.cern.ch/record/369245/files/dd-89-001.pdf>





CERN <3 open source / data



Innovation through stability



Last update: November 24

Material Request - Netscape

File Edit View Go Communicator Help

Bookmarks Netsite: <https://edh.cern.ch/Document/MAG>

Material Request Clone Pr.View Catalog Delay? Lines Save Send Help

Fields with asterisks (*) are obligatory and must be filled in.

General Description: Experimental Equipment ?

Requestor *: Derek MATHIESON (AS-IDS) ?

Delivery Location *: 5-5-006 ?

Requested Delivery Date: 07.06.2000 ?

Delivery Comments: ?

Budget Code *: 16152 ?

Total: SFr. 398.00

Pos	Qty ?	Unit	SCEM ?	Comments	Subtotal
1	1	pc	59.70.20.410.0	ARGON P.+GIFT REGUL.300bar/16l Item in stock, you will be served within 1 working day.	214.00
2	1	pc	59.70.50.220.9	ST.OXYGEN REGULATOR 300/20 bar Item in stock, you will be served within 1 working day.	184.00
3					
4					
Total: SFr. 398.00					

Document: Done



11261052 - Material Request

[Sign Document](#)[Save](#)[Cancel](#)[Attach](#)[Document options](#)

Created by [Ioan Cristian SCHUSZTER \(FAP-BC-ENG\)](#) Tel: 66240 on 21.09.2025 17:12 (Last modified on 21.09.2025 17:12)

General Information

General Description: HP ELITE 800 G9 TOWER ?

[Requestor *](#): Ioan Cristian SCHUSZTER (FAP-BC-ENG) ?

[Budget Code *](#): 71852 ?

[Stores - Terms and conditions](#)

Delivery Details

☐ ? Click and Collect

[Delivery Location *](#): 58-R-002 BI ?

[Requested Delivery Date](#): 23.09.2025 ?

Delivery Comments: ?

Total: CHF 635.00

Order items from:

 CERN Stores	 FARNELL Electronic Components	 RADIO SPARES Electronic Components	 BOSSARD Fasteners	 SFS Tooling	 DISTRELEC IT accessories	 LYRECO Office Supplies	 ART COMPUTER Apple Products	 SFS FASTENERS Fasteners	 DIGI-KEY Electronic Components
 MOUSER Electronic Components	 SONEPAR Industrial Supplies	 PROLIANS Industrial Supplies	 MABEO Industrial Supplies	 MANUTAN Tooling	 ALLECTRA Vacuum connecting components	 WAGO Electrical components	 DANOFFICE PC Products	 MIB IT infrastructure	 MARKIT PC Products

Order Lines

Pos.	Quantity	Unit	SCEM	Comment	Value
1	1	=1.00	PC	80.01.01.026.5	635.00
HP ELITE 800 G9 TOWER					

GXEBS Dépôt Incoterms Mode de transport Etape

Gestion des échanges | Gestion des liens | Gestion du colisage | Ges. intervenants | Ges. docs échange | Génération cdes log.

Echange ☒ Mnémonique Date d'échange ☒ Dépôt ☒

Expéditeur

Fax

E-mail

Gestionnaire

Interlocuteur

Pays d'origine

Incoterms ☒

Expédition/réception

Traitements

Destinataire

Etape ☒ Creation

Informations générales

Mat. danger

Fragile Assurance Montant

Emballage Propriété

Info. complémentaires

Colisage

Nombre de colis Volume (m3)

Poids net Poids brut

Distribution interne

Paramètre ASSSXEBS - Microsoft Internet Explorer provid...

Valeur	Intitulé	Etat
N	Pas d'assurance	A
O	Assurance	A
T	Traite	A

GXEBS
Gestion des échanges de biens et services

Gestion des échanges
Gestion des liens
Gestion du colisage
Ges. intervenants
Ges. docs échange
Histo. étps échanges

Gestion des échanges de biens et services

Echange
EM
EDH
Mnémonique
Date d'échange
06/05/2002

Echange
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EDH
Mnémonique
Date d'échange
*06/05/2002
Dépôt
*MEYRIN
Reception MEYRIN

Expéditeur
CERN
CERN
MEYRIN
CERN Site de Meyrin
CERN - CH-1211-GENEVE 23
Fax
E-mail
Gestionnaire
1572
UFI
Interlocuteur

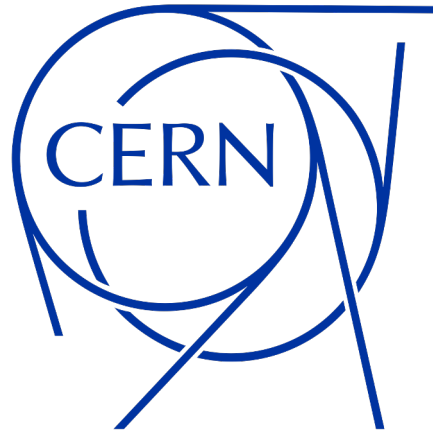
Destinataire
EDH-99
HEWLETT-PACKARD-REPA
9703
Silostrasse 1
HEWLETT-PACKARD-REPAIR-CENTRE - CH-5606-DINTIKON
Fax
056 616 71 22
Téléphone
0800 55 53 53
E-mail
Gestionnaire
UFI
Interlocuteur

Pays d'origine
CH
SUISSE
Incoterms
*EXW
EX WORKS
Destination
MEYRIN
Expédition/réception
Etat
Actif
Inactif
Supprimé
Pays provenance
CH
SUISSE
Mode de transport
PS
Poste CH
Etape
*37
Prod.docs
03/05/2002

Fragile
O
Assurance
T
Montant
3 500,00
Matières dangereuses
N
Traçabilité
Emballage
N
Propriété
C
Prop. CERN
Distribution interne
E
Informations complémentaires

Colisage
Nombre de colis
1
Poids net
2,50
Poids brut
3,30
Volume (m3)
0,02
Traitements

Mode saisie
Ligne : 9 / 19
Personnalisé



Where to next?

HL-LHC coming soon

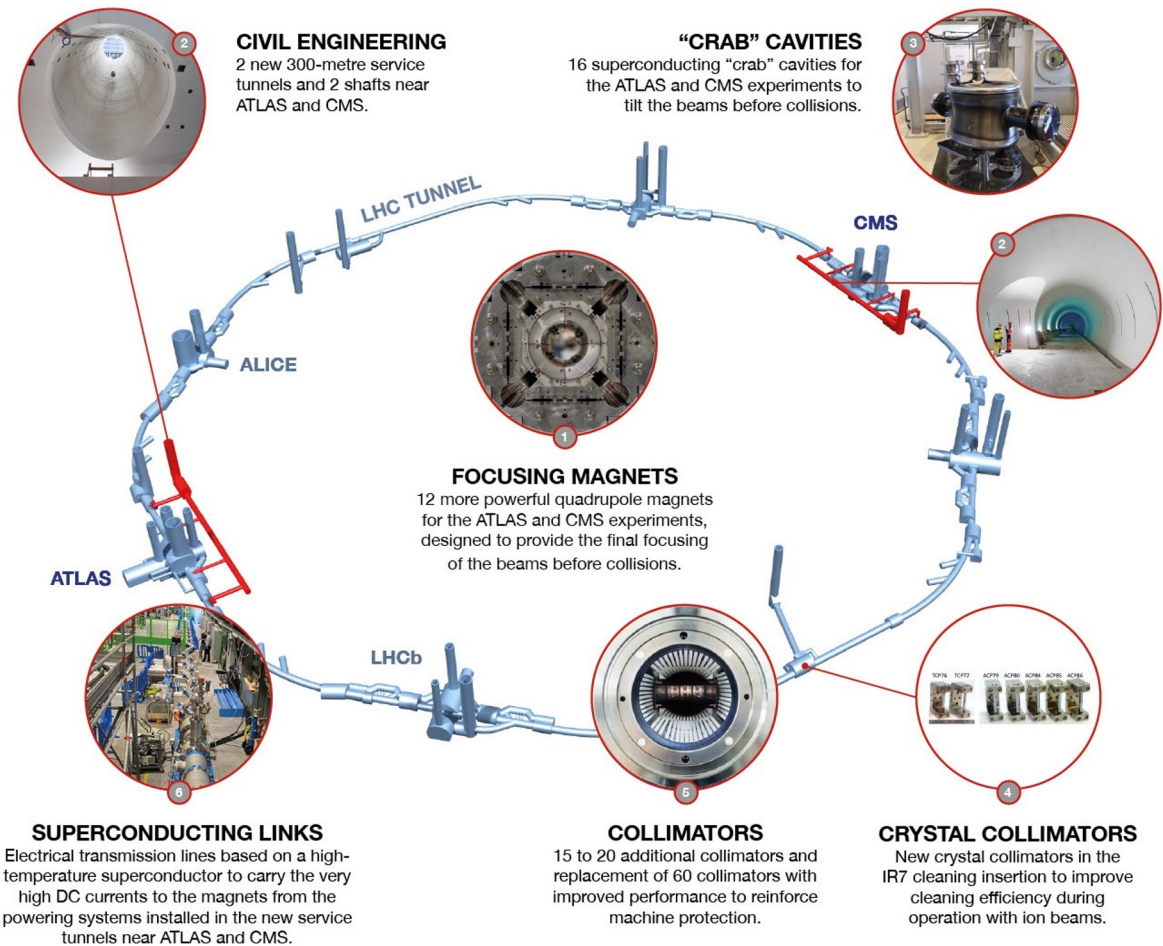


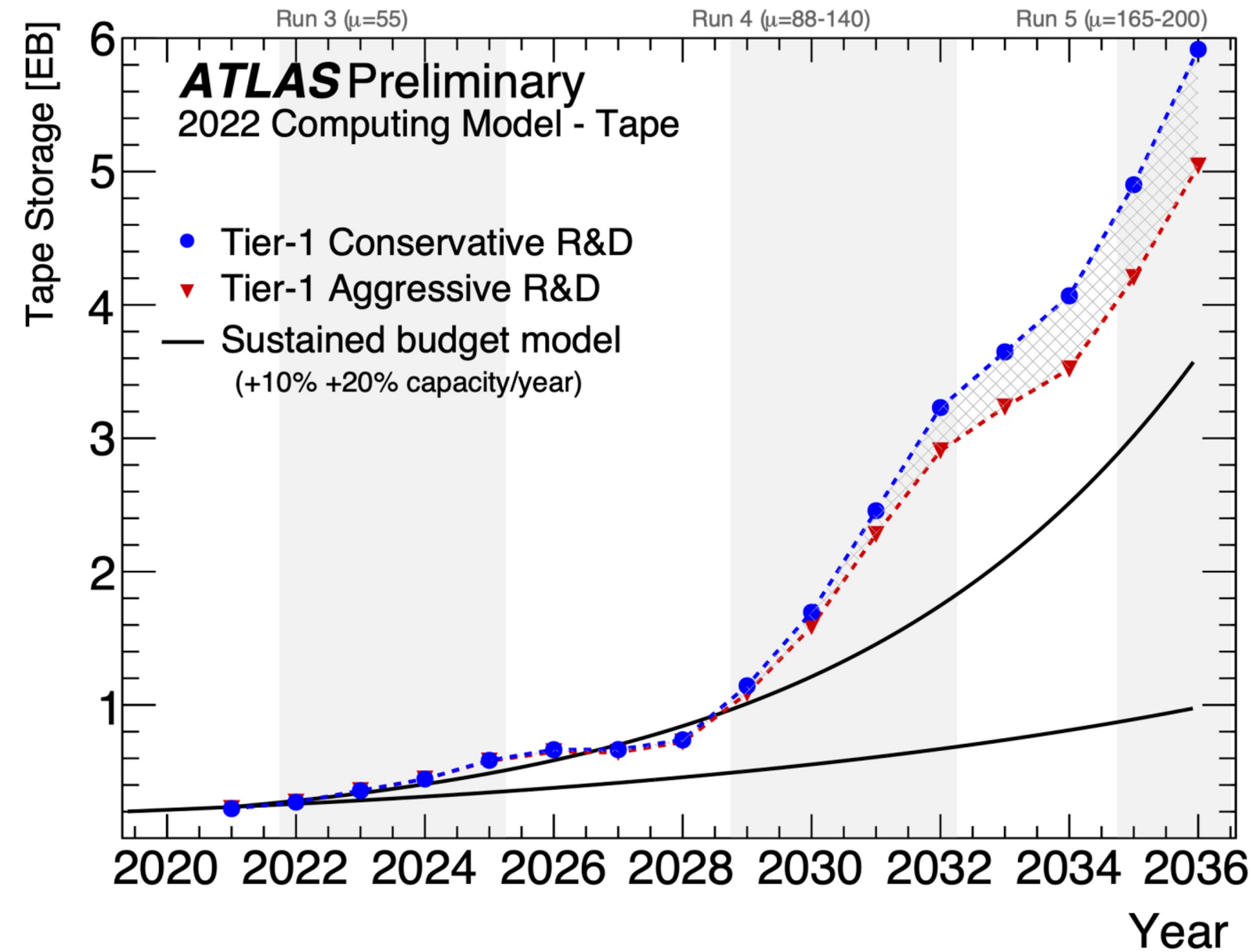
YETS 22/23

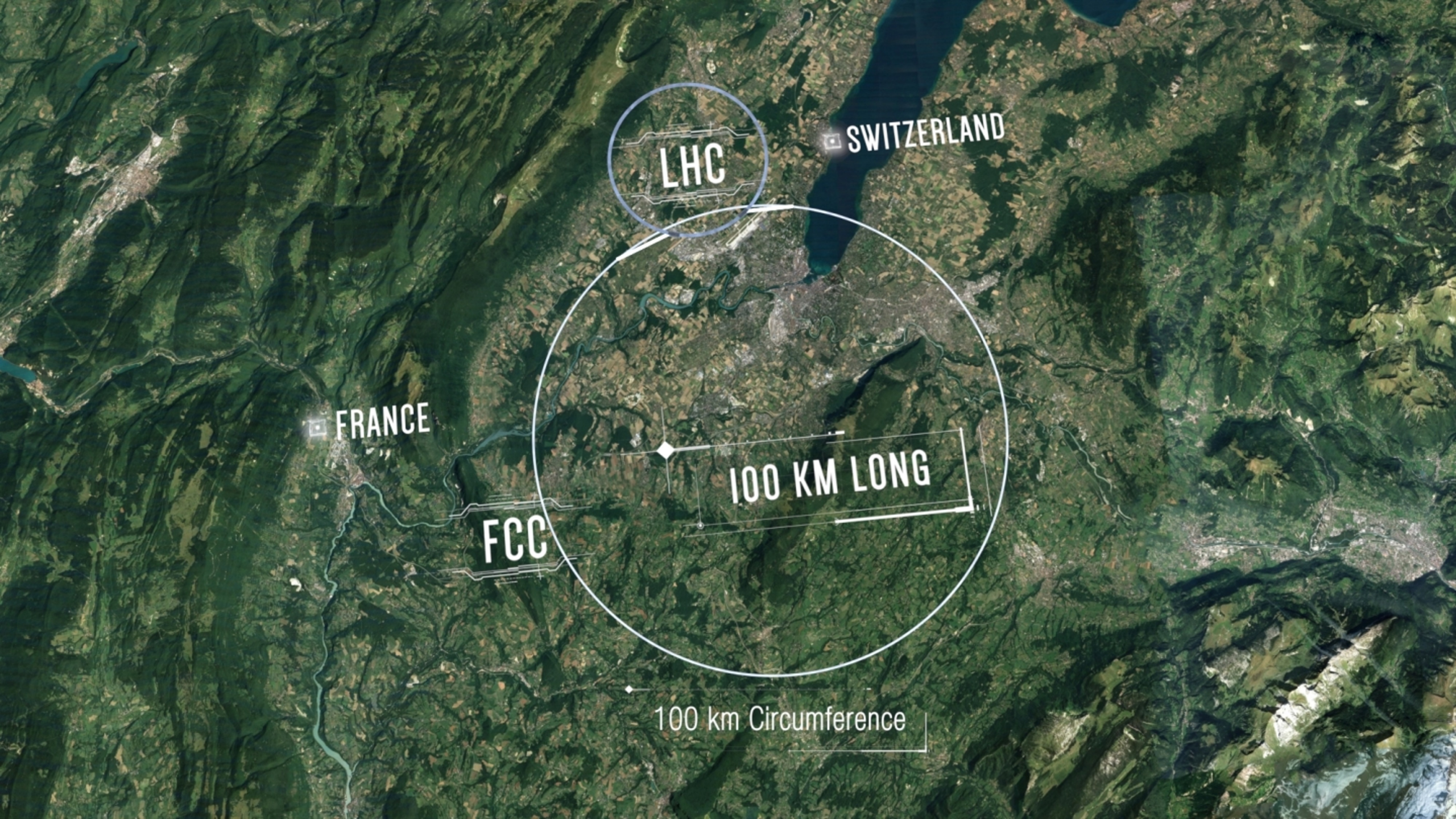
YETS 23/24

EYETS 24/25

LS3 (shifted by 1 year and extended to 3 years)







LHC

SWITZERLAND

FRANCE

FCC

100 KM LONG

100 km Circumference

CERN Quantum Technology Initiative

Accelerating Quantum Technology Research and Applications

CERN in numbers

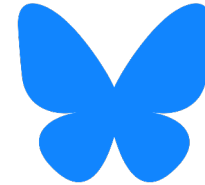
- Around **12,000** researchers from ~ 70 countries
- LHC operations produce around 13 petabytes raw data / **month**
- **40 Mhz** data-rates at the detector levels
 - HL-LHC upgrade issues - 10x increased data rates
 - <https://home.cern/press/2022/HL-LHC>
- Large scale storage and analysis of all the various data produced on site.

Q&A?

Presentation



<https://cern.ch/devconf-zurich-25>



@cschuszter.bsky.social



@cschuszter

cristian.schuszter@cern.ch



home.cern