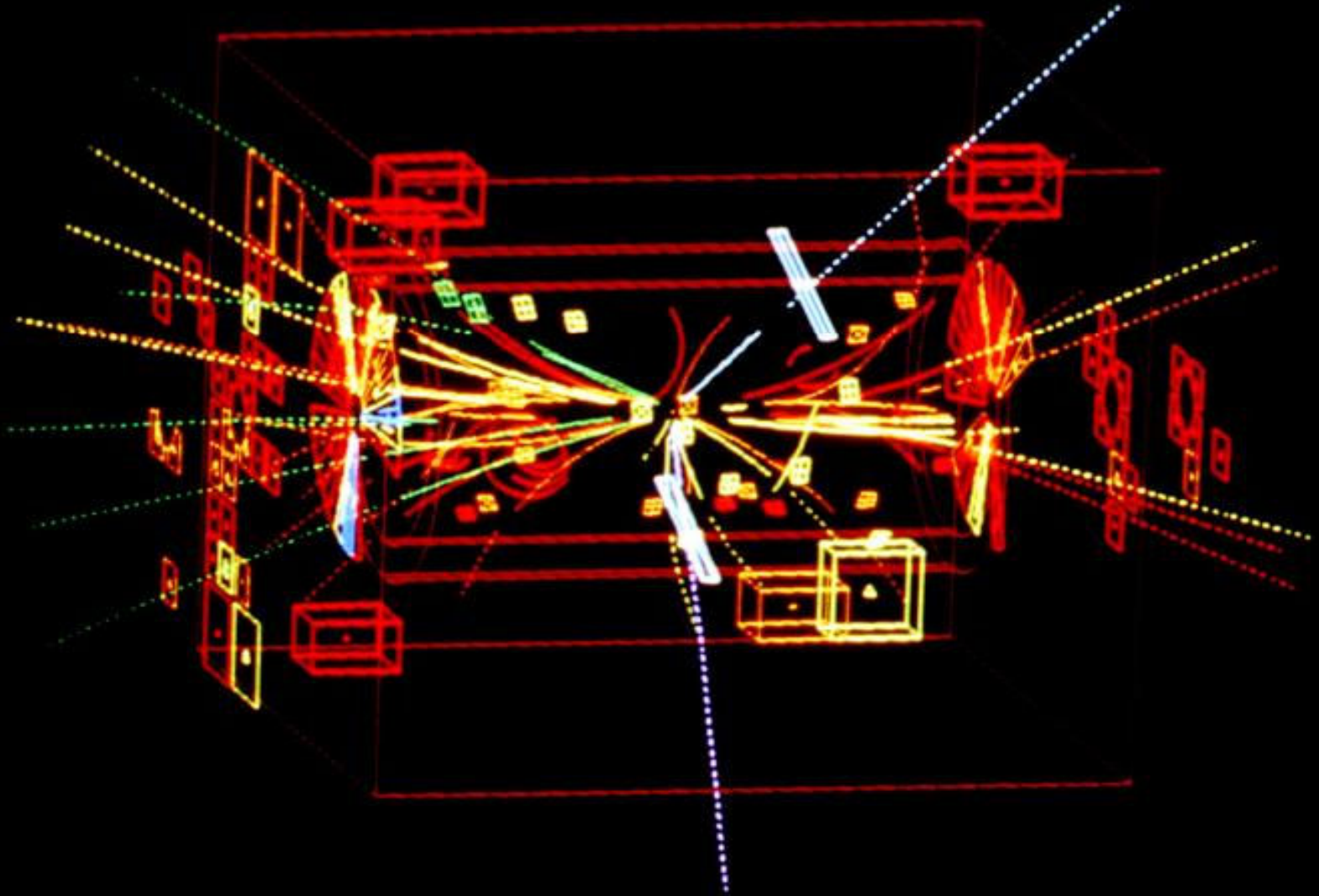
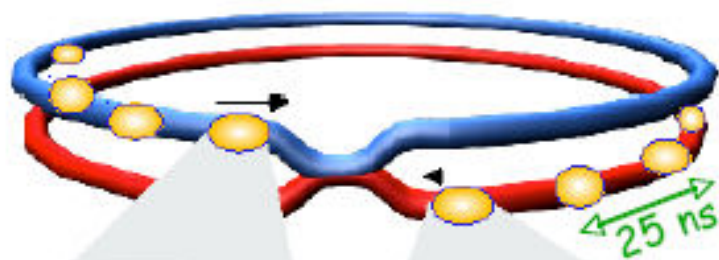


LHC experiments starting with the p-pbar community in 1986



Collisions at LHC



Proton-Proton

Protons/bunch	10^{11}
Beam energy	7 TeV (7×10^{12} eV)
Luminosity	10^{34} cm ⁻² s ⁻¹

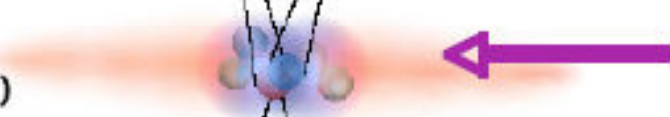
Bunch



Proton



Parton
(quark, gluon)



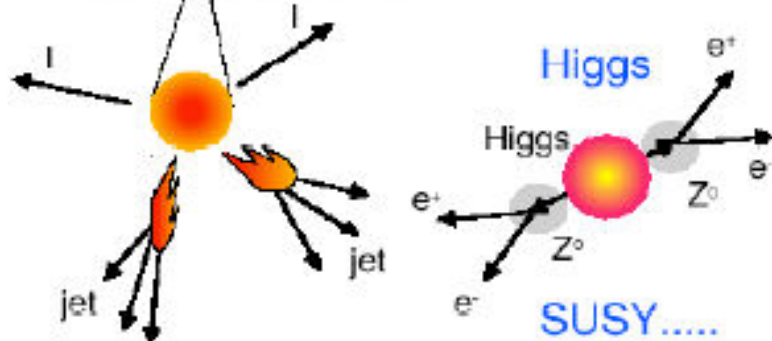
Event rate in ATLAS :

$N = L \times \sigma (pp) \approx 10^9$ interactions/s

Mostly soft (low p_T) events

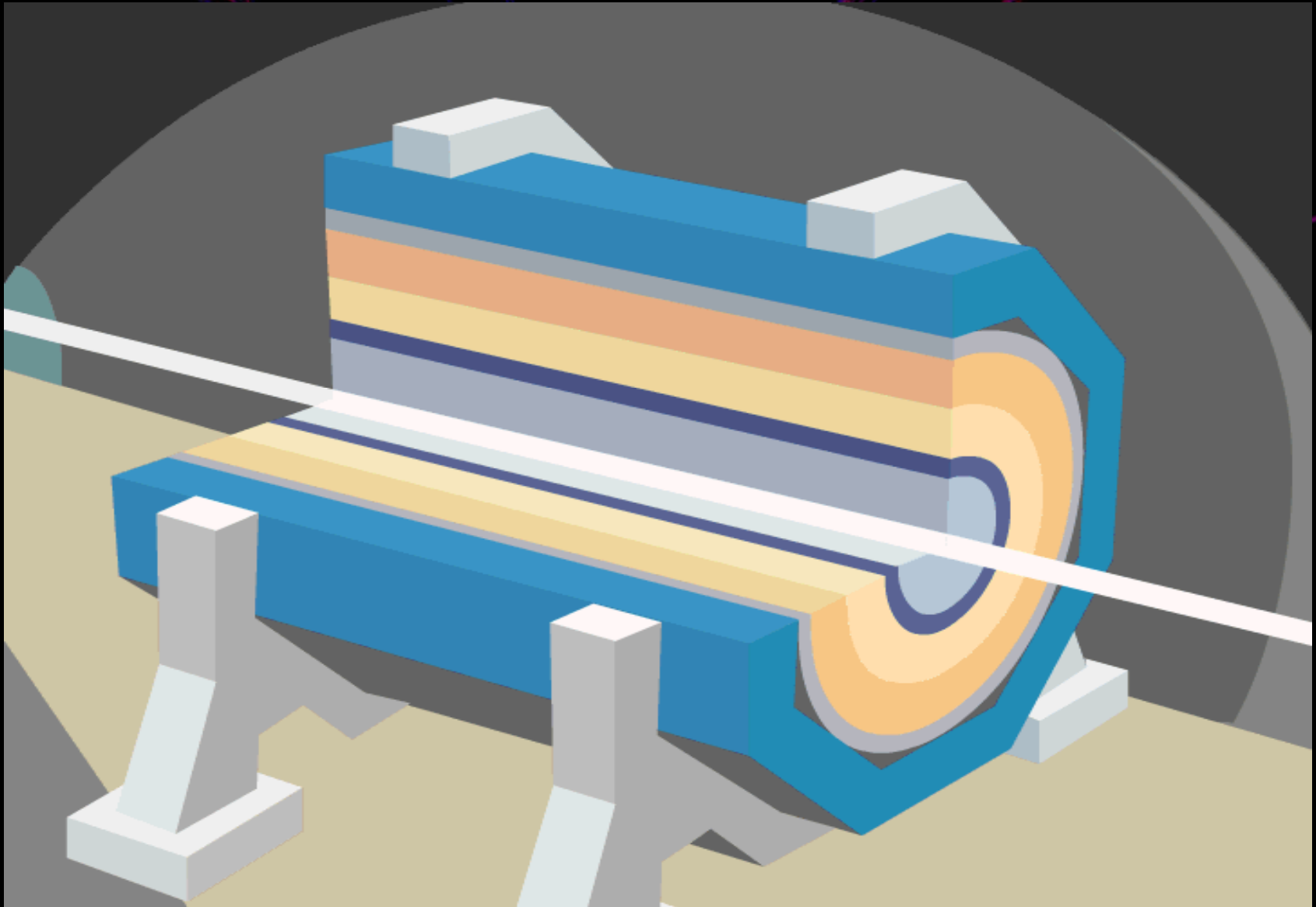
Interesting hard (high- p_T) events are rare

Particle

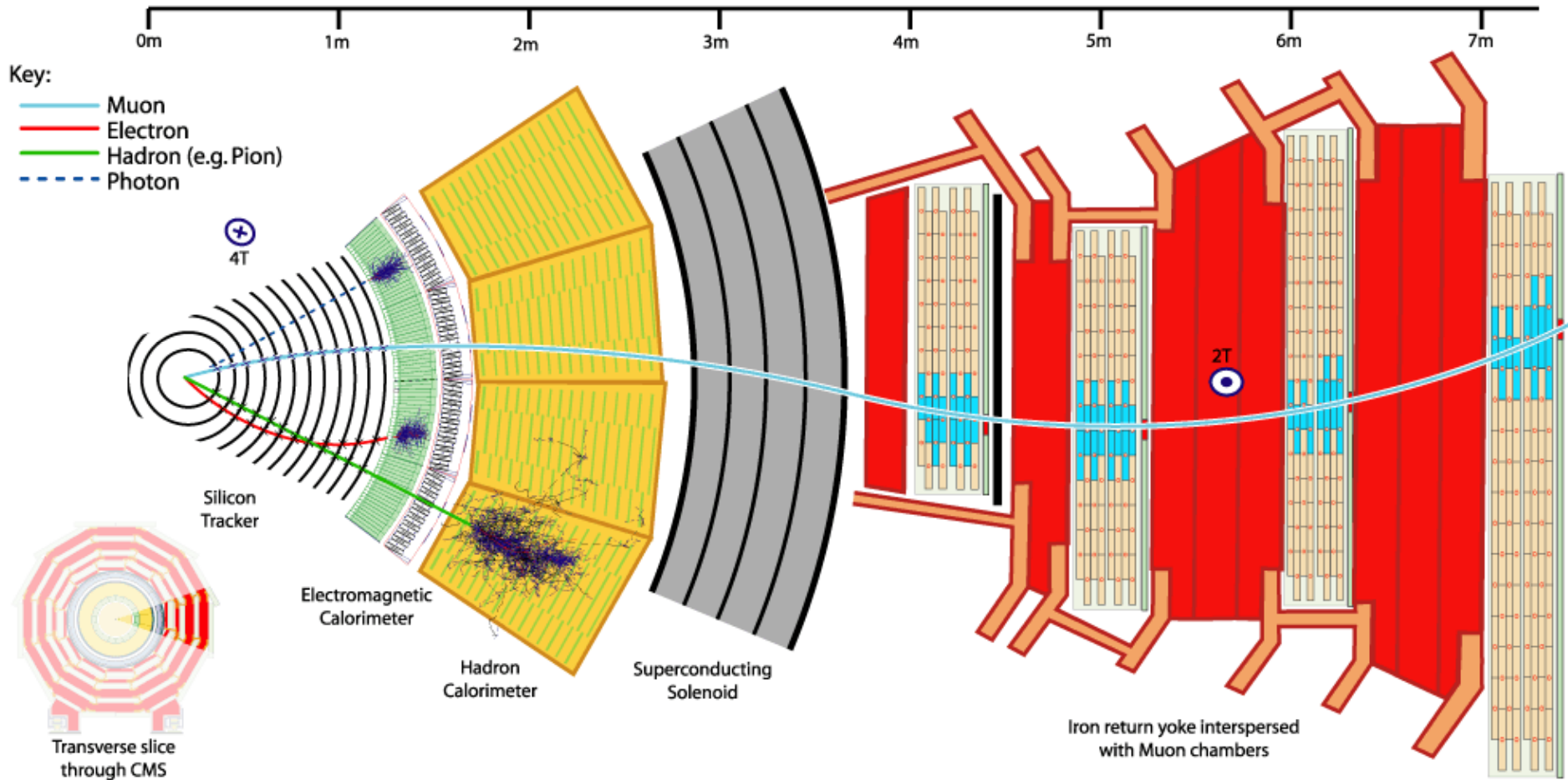


**Selection of 1 in
10,000,000,000,000**

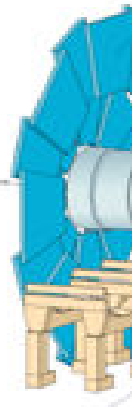
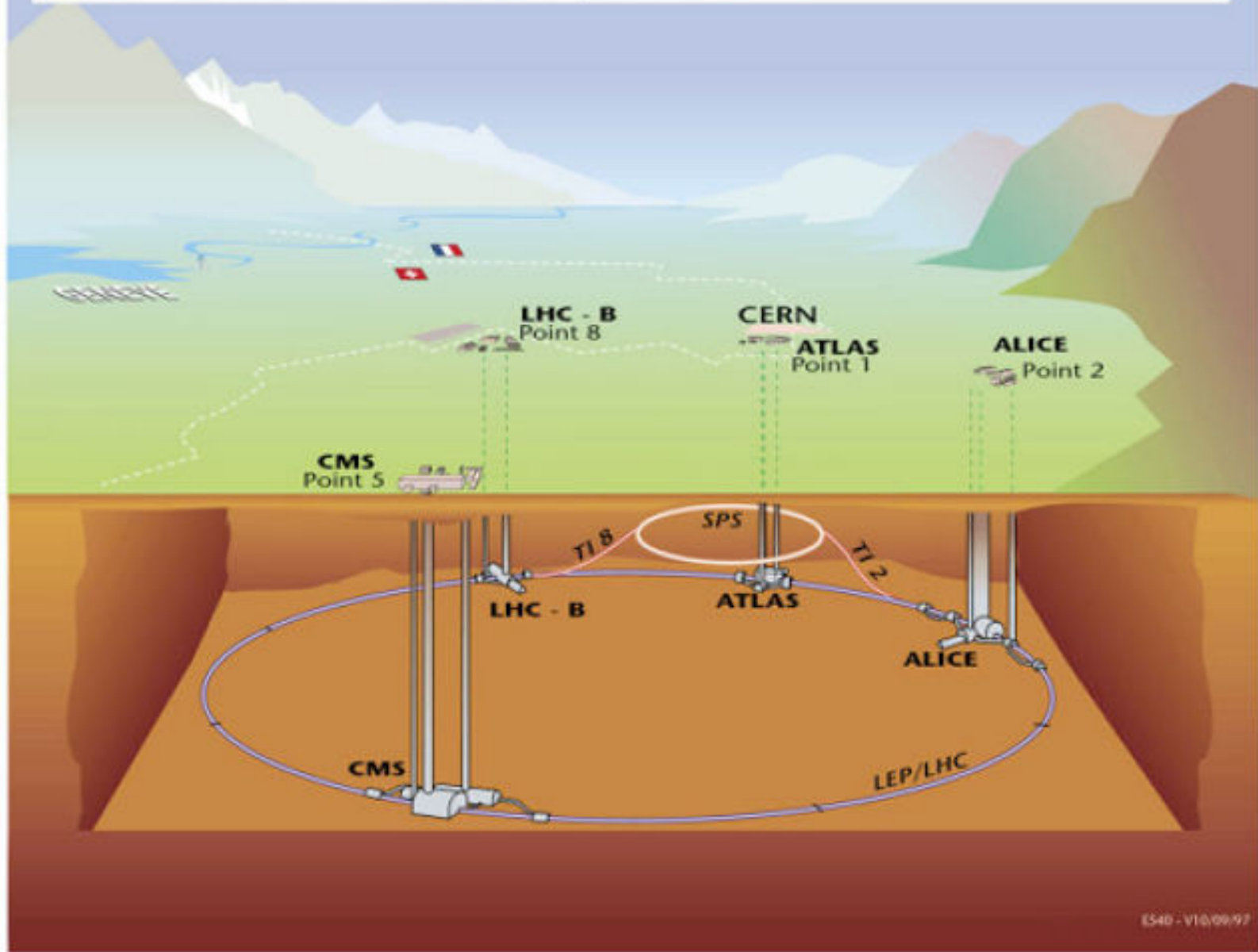
Observe the collisions



CMS



Overall view of the LHC experiments.



Barrel Toroid

Tin Project Chamber

L3 Magnet

or
netic

ter

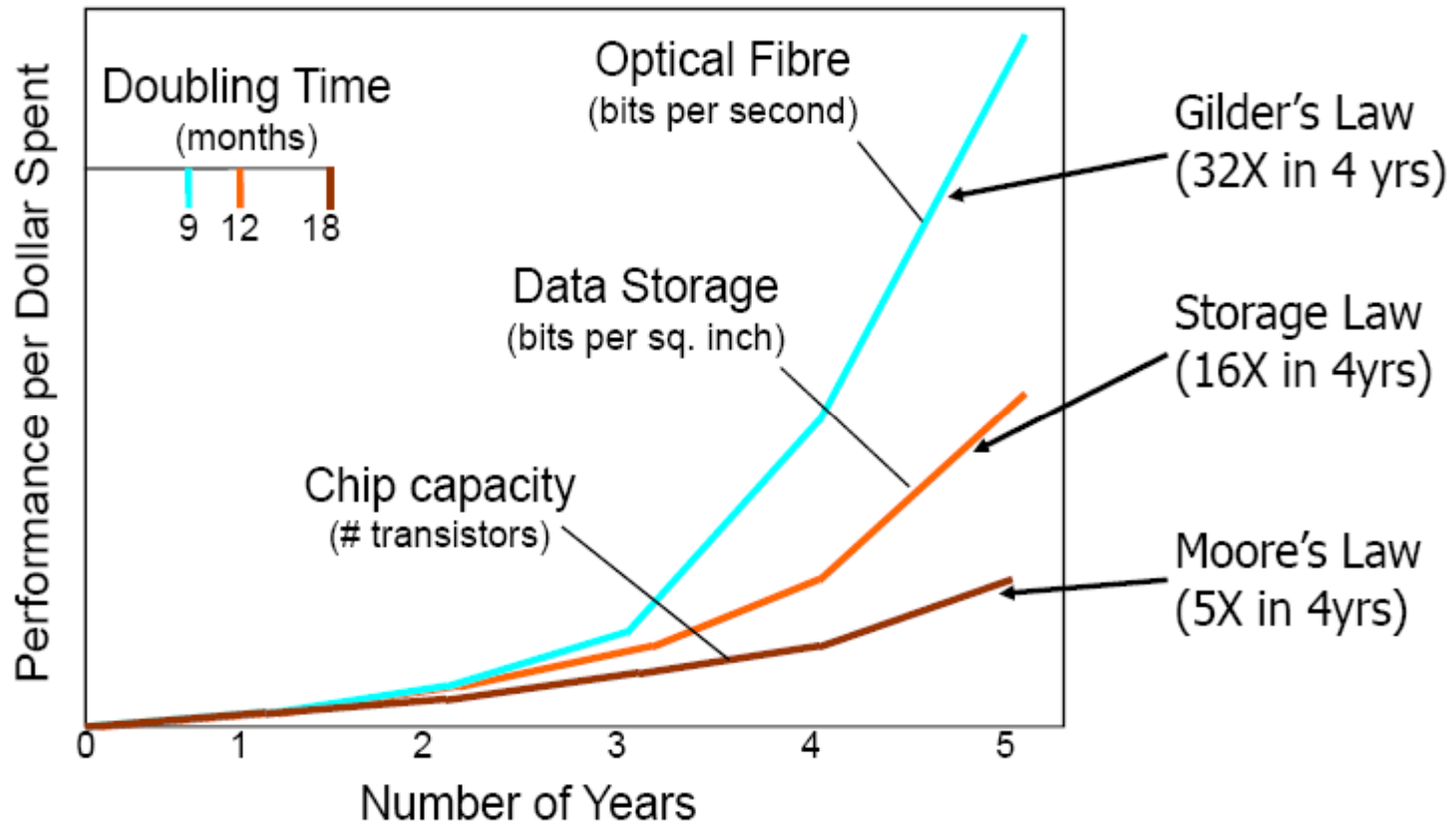
cting

-B



Example: Technologies' watch

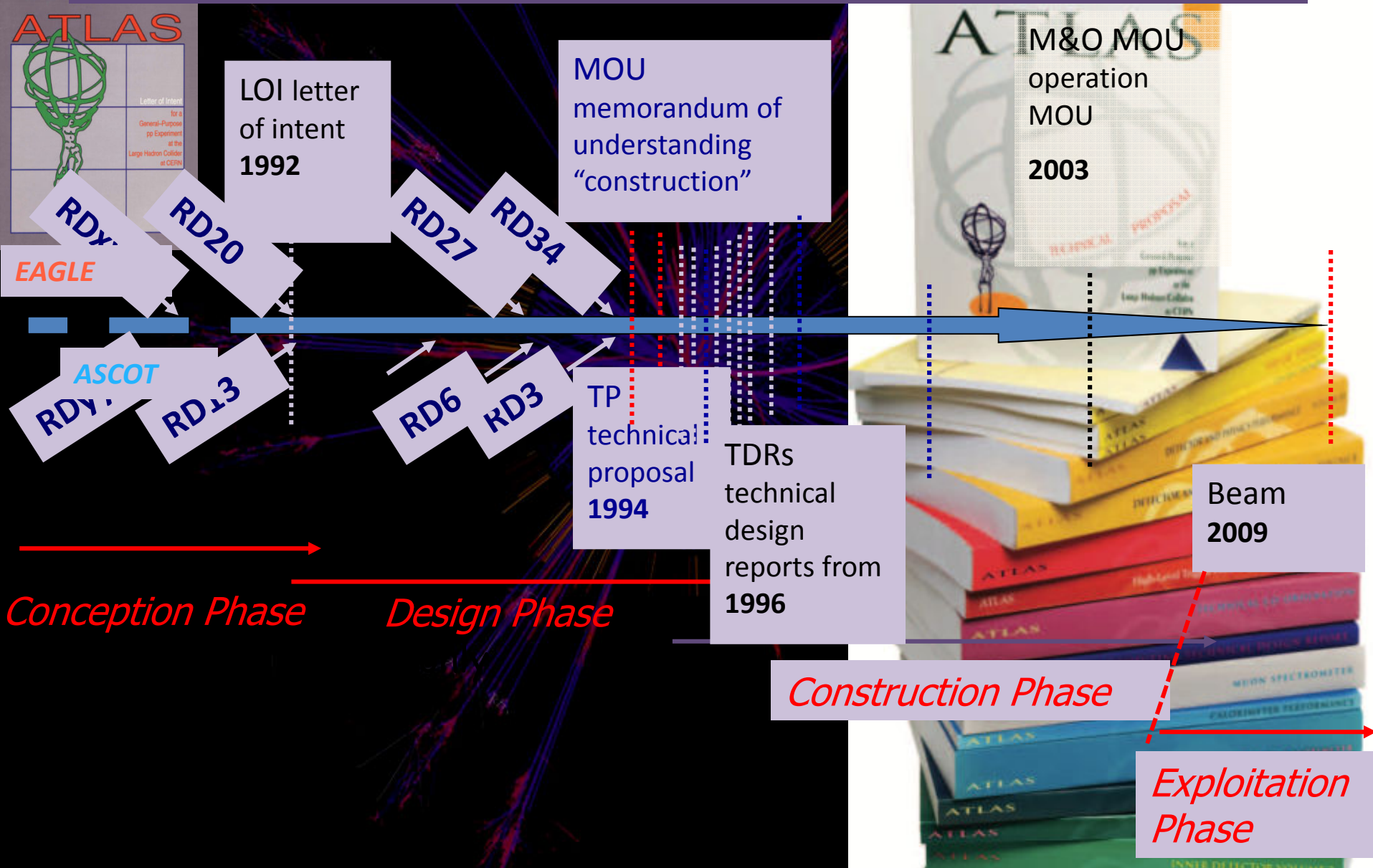
Exponential Growth



Triumph of Light – *Scientific American*. George Stix, January 2001



Maximum use of everybody's knowledge



Collaboration Board
(Chair: K. Jon-And
Deputy: G. Herten)

**ATLAS
Plenary Meeting**

**Resources Review
Board**

**CB Chair Advisory
Group**

Spokesperson
(F. Gianotti
2 Deputies)

***ATLAS Organization
January 2009***

**Technical
Coordinator**
(M. Nessi)

**Resources
Coordinator**
(M. Nordberg)

Executive Board

Inner Detector
(L. Rossi)

Tile Calorimeter
(B. Stanek)

Magnet System
(H. ten Kate)

**Electronics
Coordination**
(P. Farthouat)

**Trigger
Coordination**
(N. Ellis)

**Data Prep.
Coordination**
(C. Guyot)

**Additional
Members**
(T. Kobayashi,
M. Tuts, A. Zaitsev)

LAr Calorimeter
(I. Wingarter-Seez)

**Muon
Instrumentation**
(L. Pontecorvo)

Trigger/DAQ
(C. Bee,
L. Mapelli)

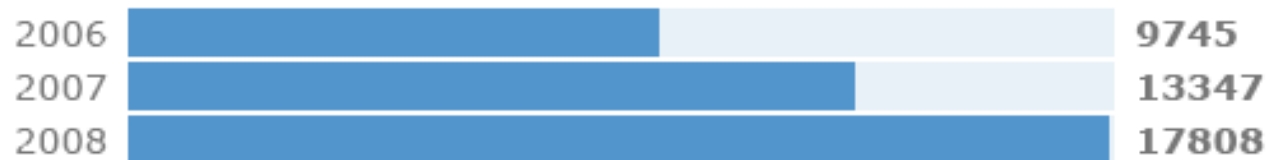
**Commissioning/
Run Coordinator**
(T. Wengler)

**Computing
Coordination**
(D. Barberis,
D. Quarrie)

**Physics
Coordination**
(D. Charlton)

Last years' ATLAS meetings

Scheduled meetings



Recorded contributions to those meeting



"Virtual" international big science laboratory
Funded, supervised by ~50 funding agencies



37 Countries

169 Institutions

2800 Scientific Authors

(1850 with a PhD)

1200 Technical persons

Thousands of industrial relations

ATLAS Collaboration

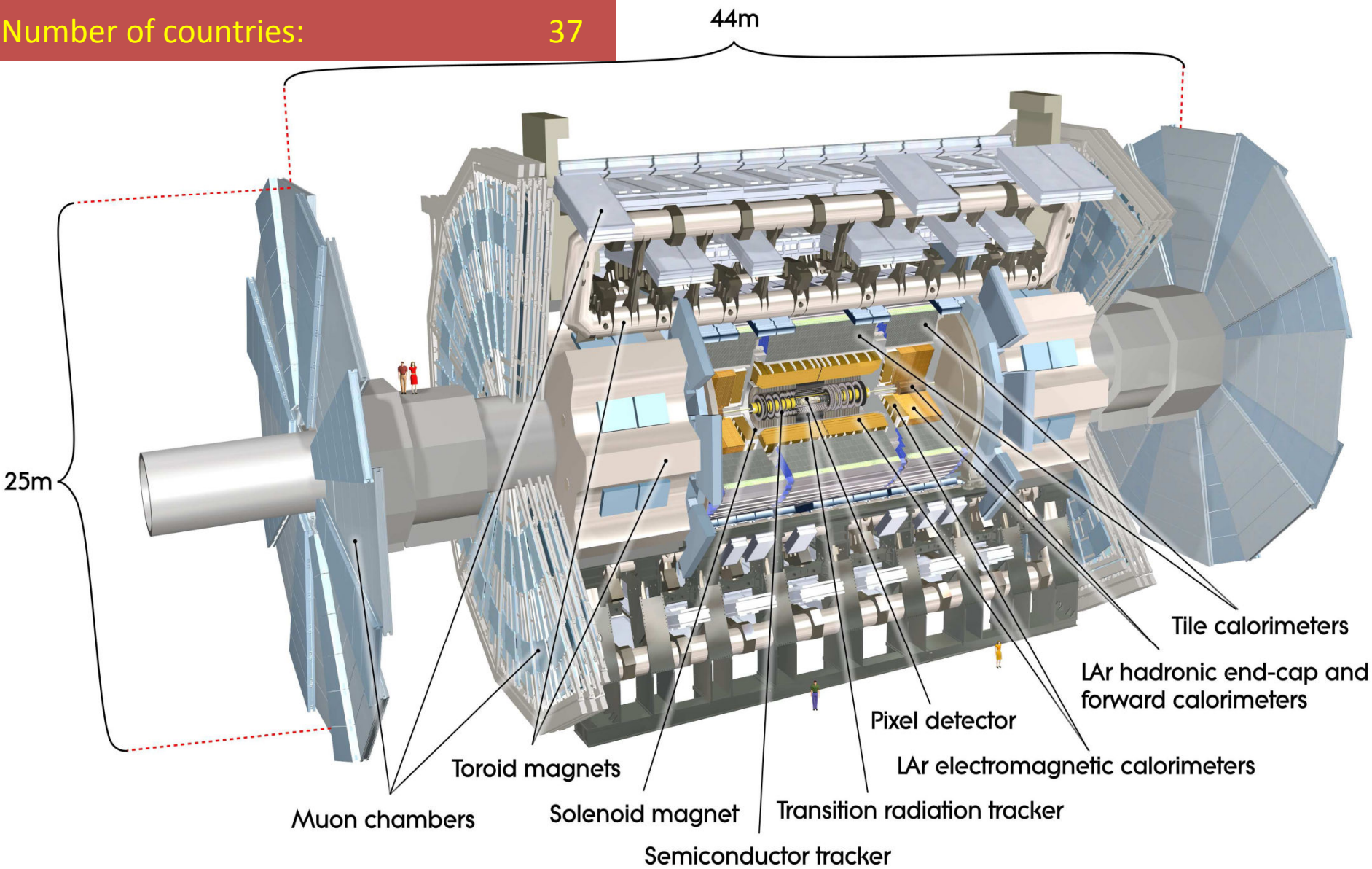


Number of scientists: 2100

Number of institutes: 167

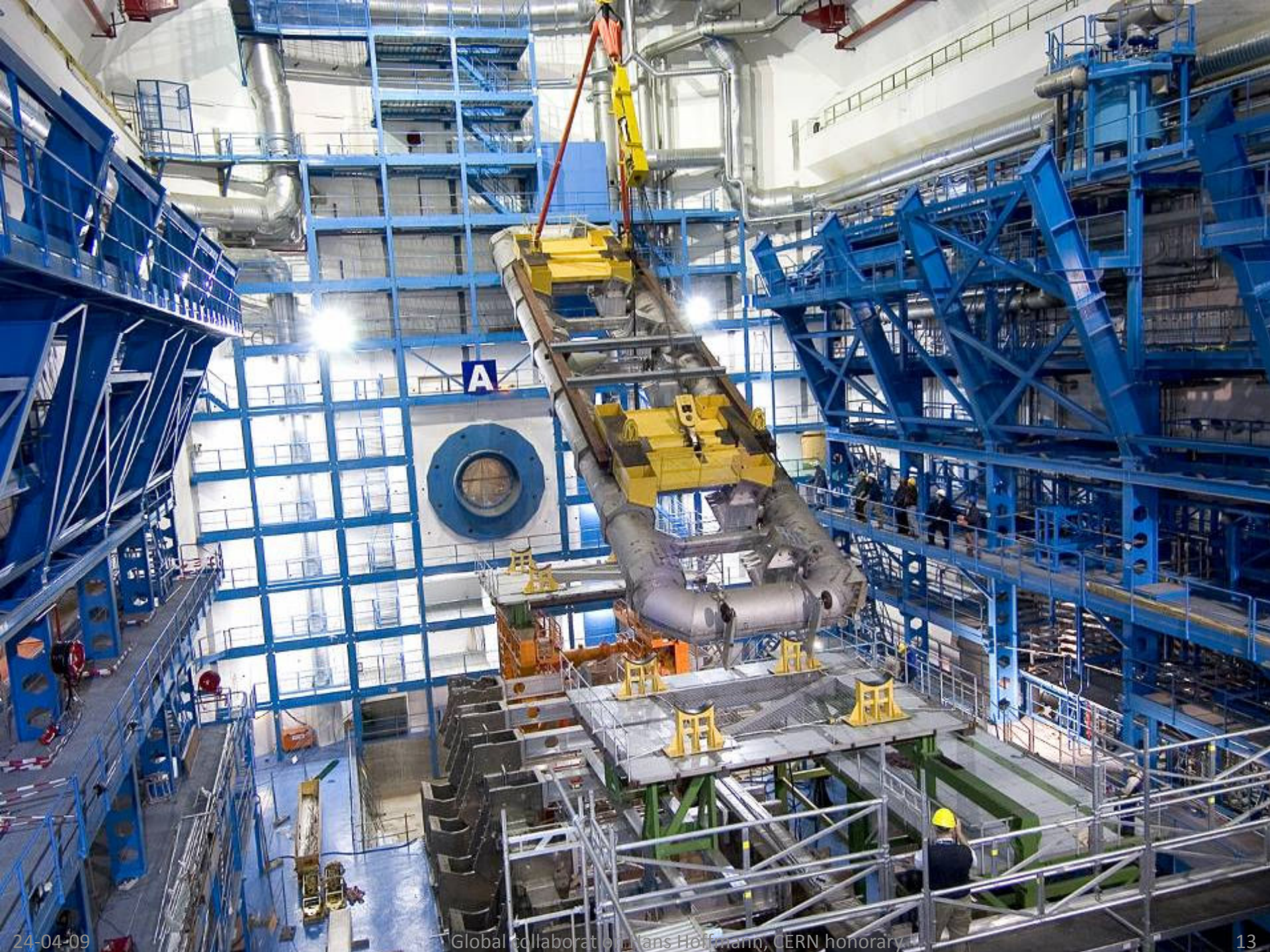
Number of countries: 37

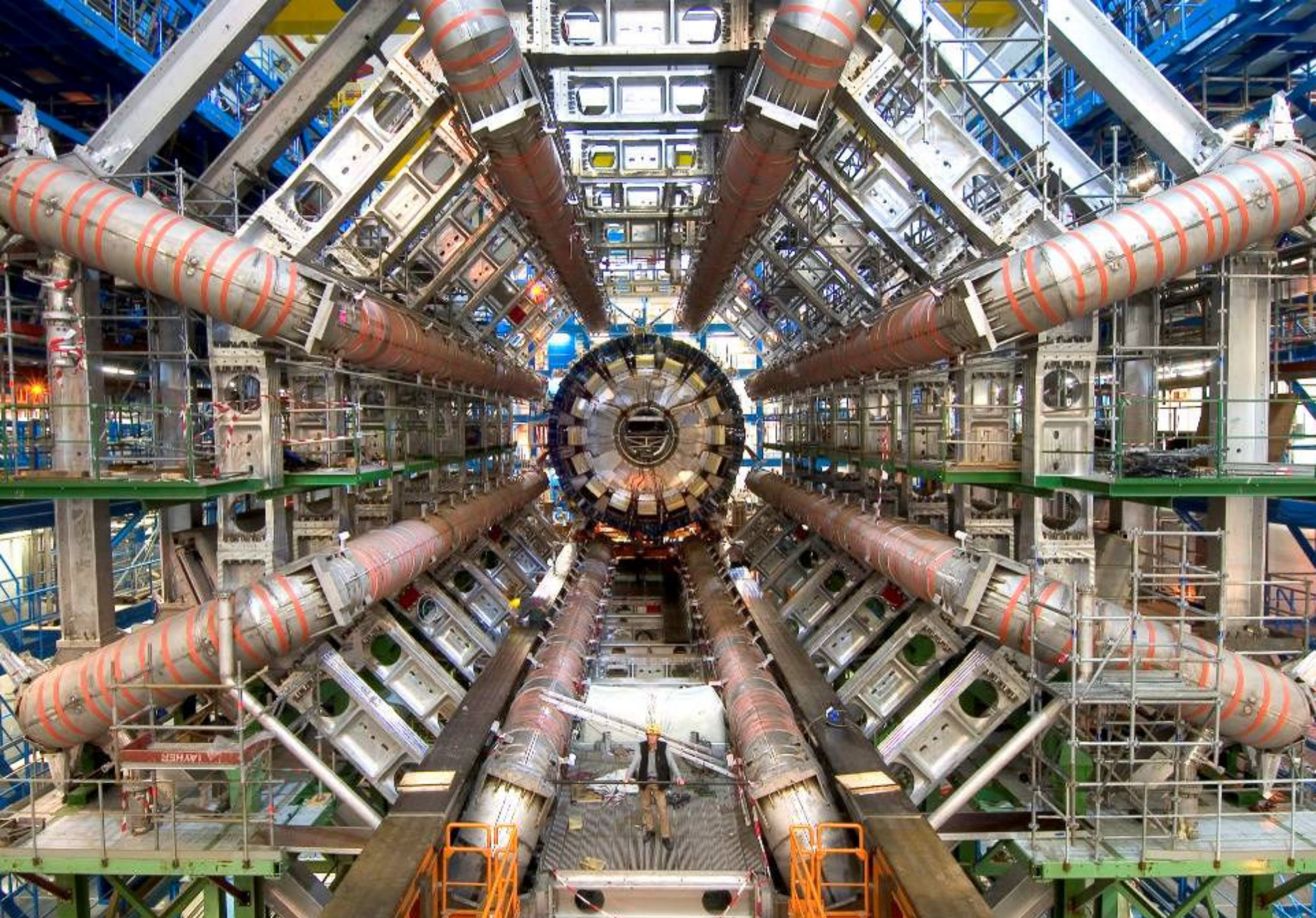
ATLAS (Spokesperson Fabiola Gianotti)





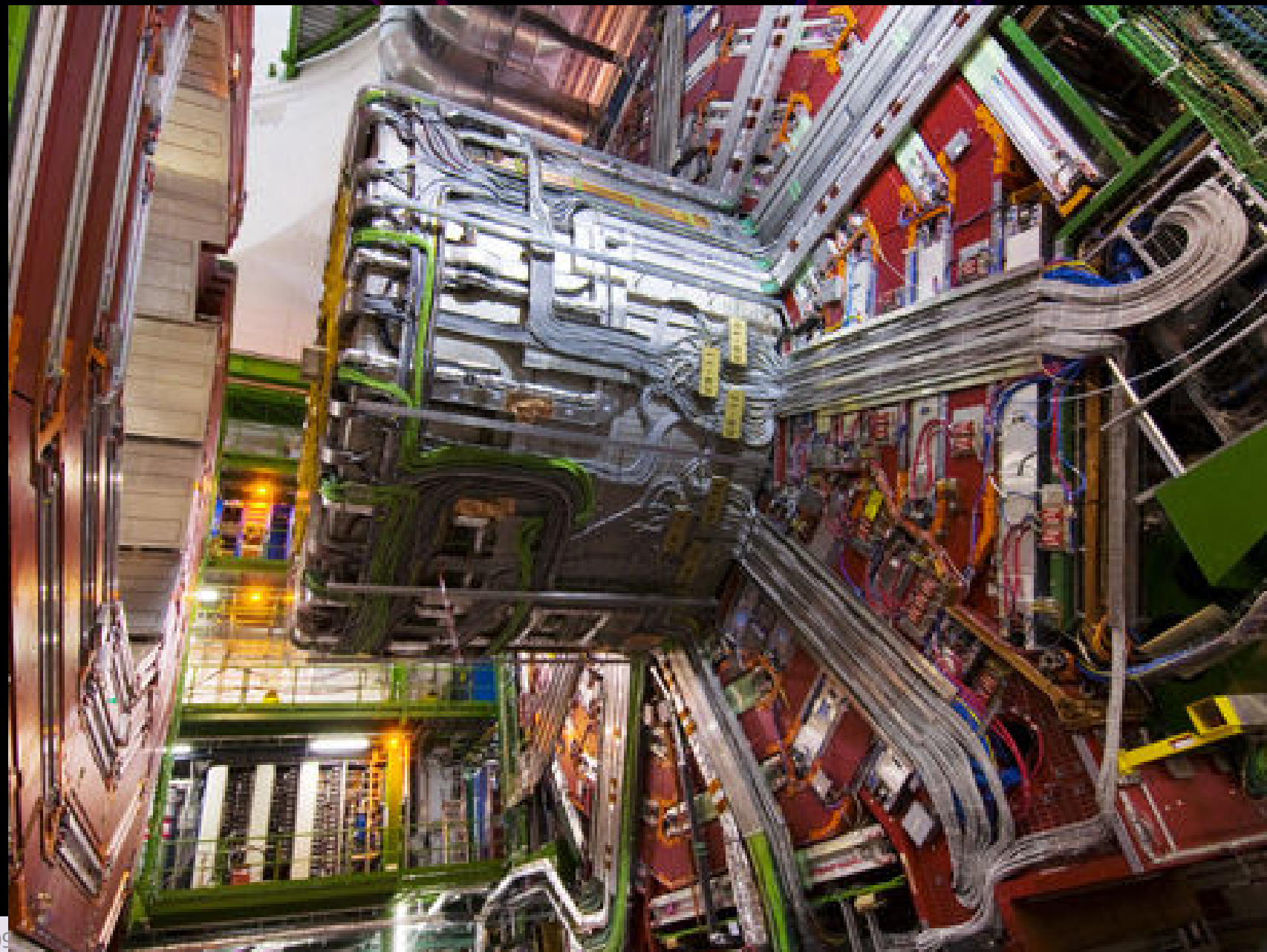
The ATLAS Cavern

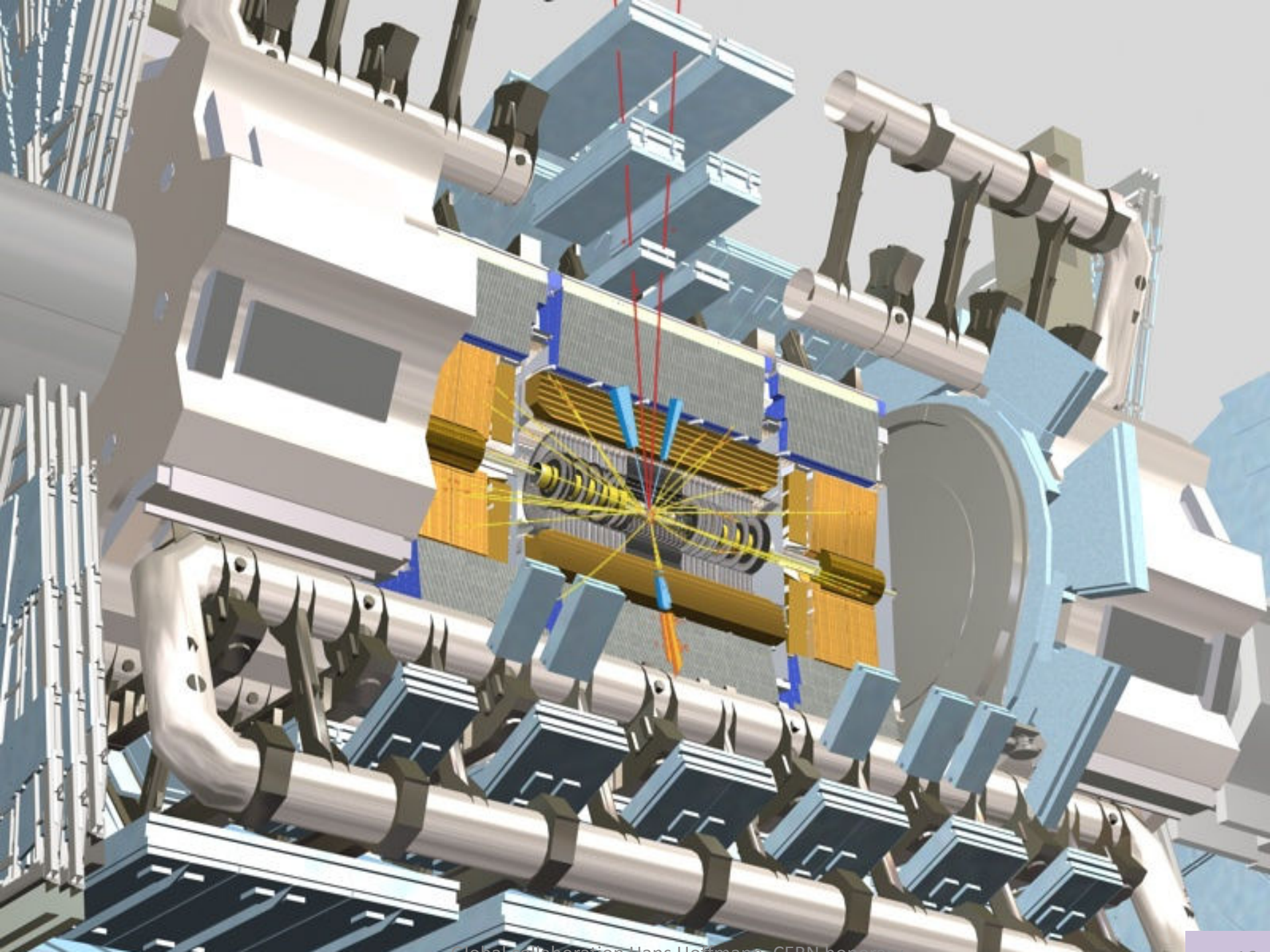


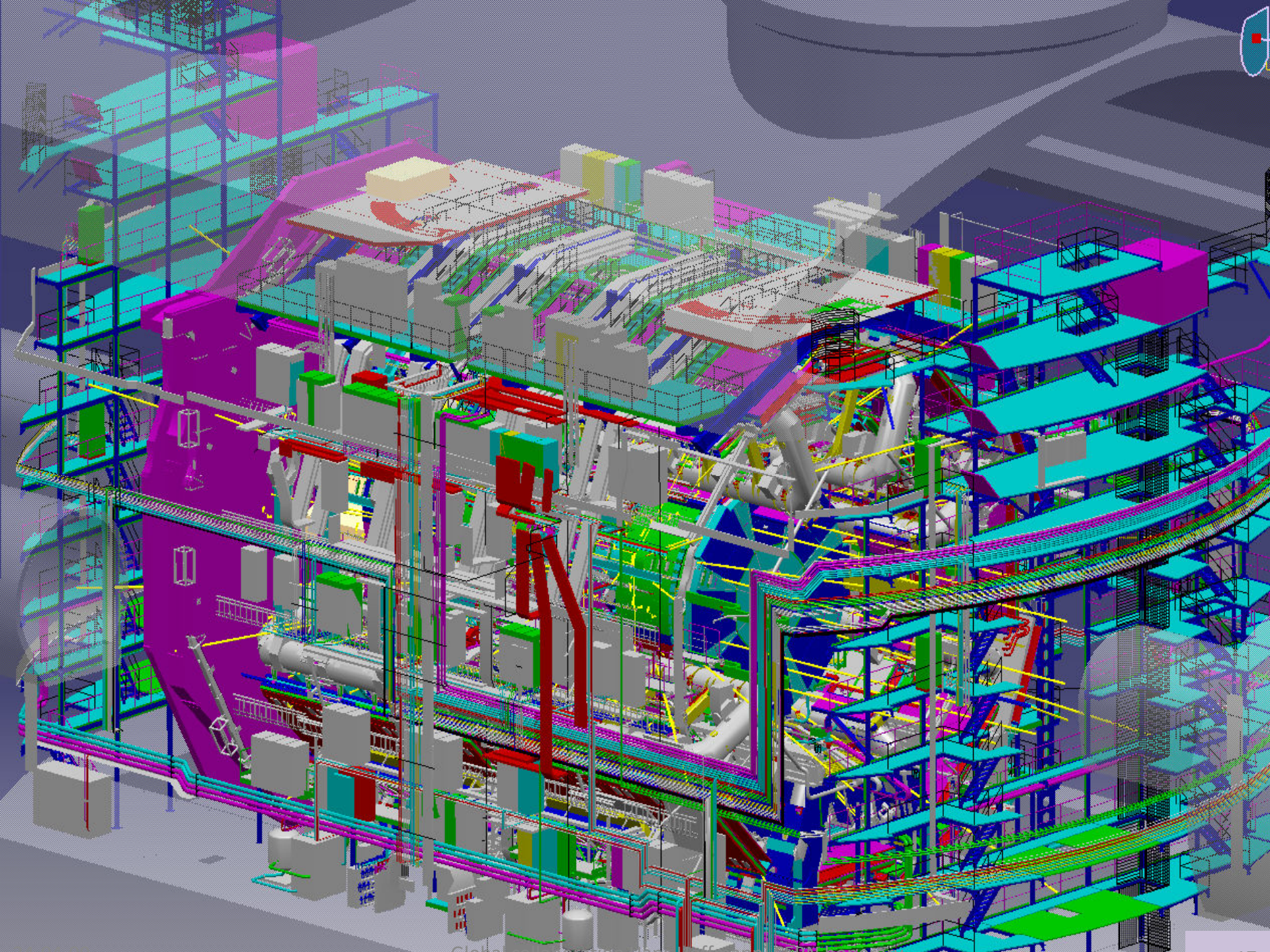


The ATLAS Cavern

Assembly CMS







Tracker



B

EM calorimeter 80 000 xtals, lead tungsten oxide, 80% metal: transparent



Trigger and Dataflow

40 MHz

μ s

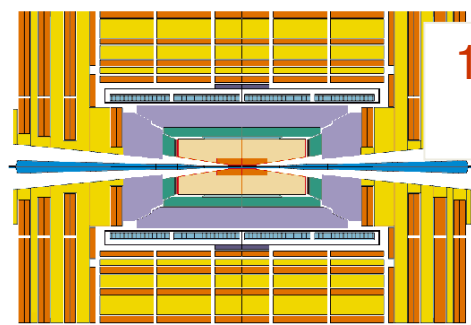
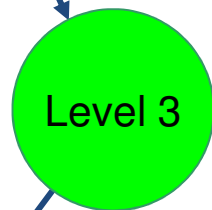
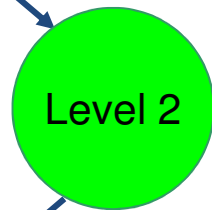
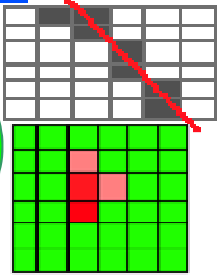
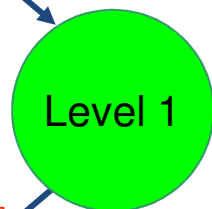
100 kHz

ms

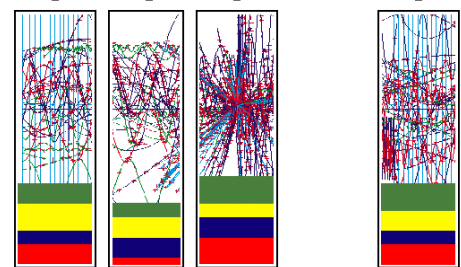
1 kHz

sec

100 Hz

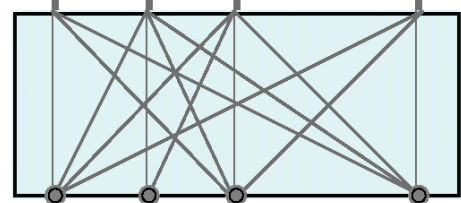


16 Million channels
3 Gigacell buffers

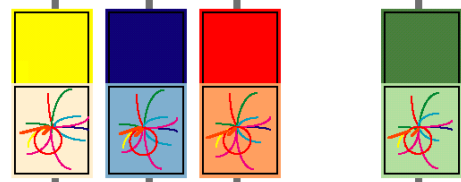


Read Out Buffers
200 Gigabytes

1000 Gigabit/s

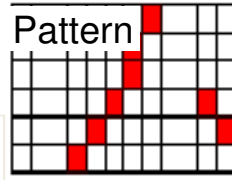
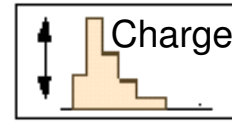
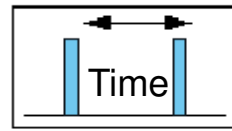


100 Gigabit/s

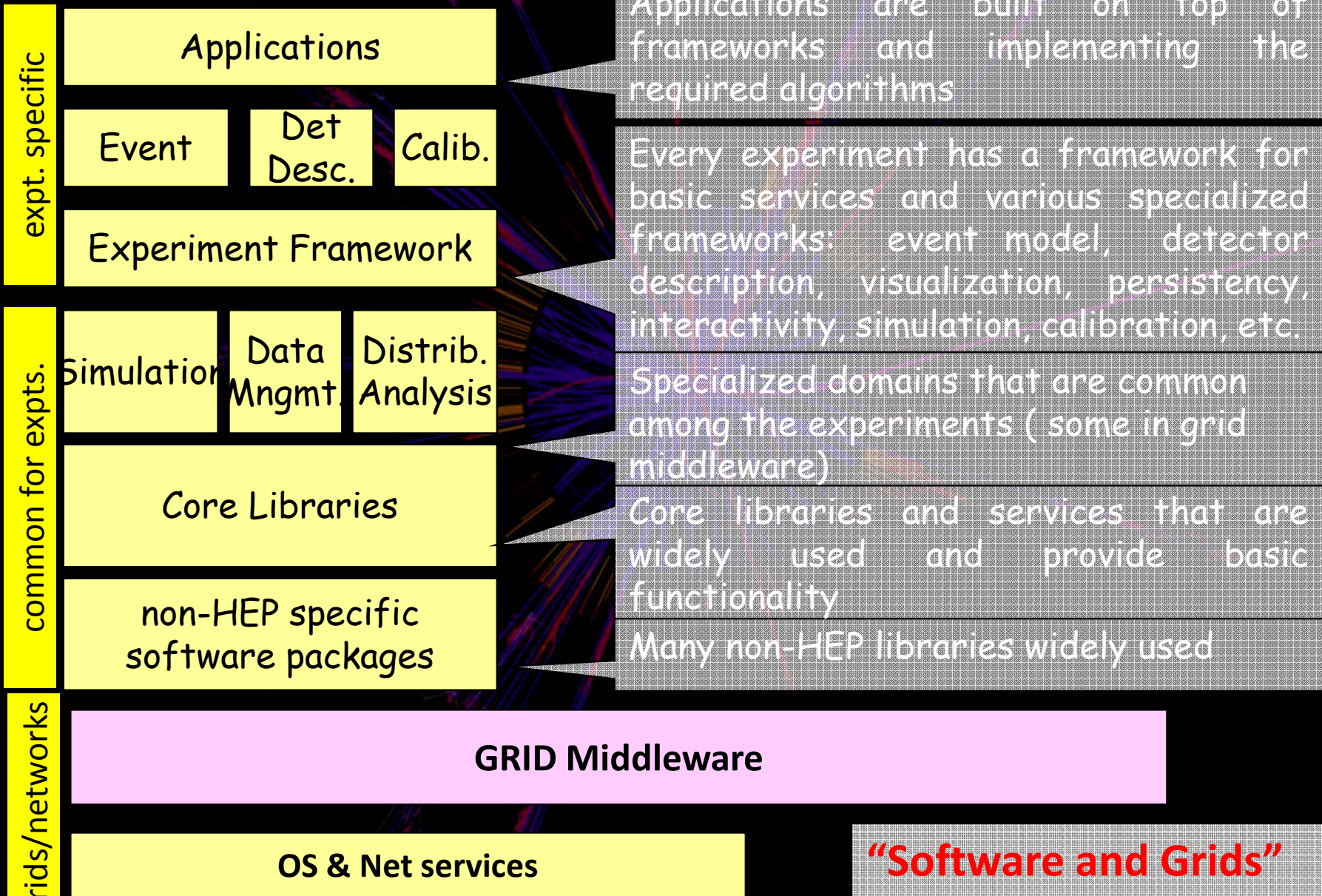


Permanent Storage

1 Petabyte/y

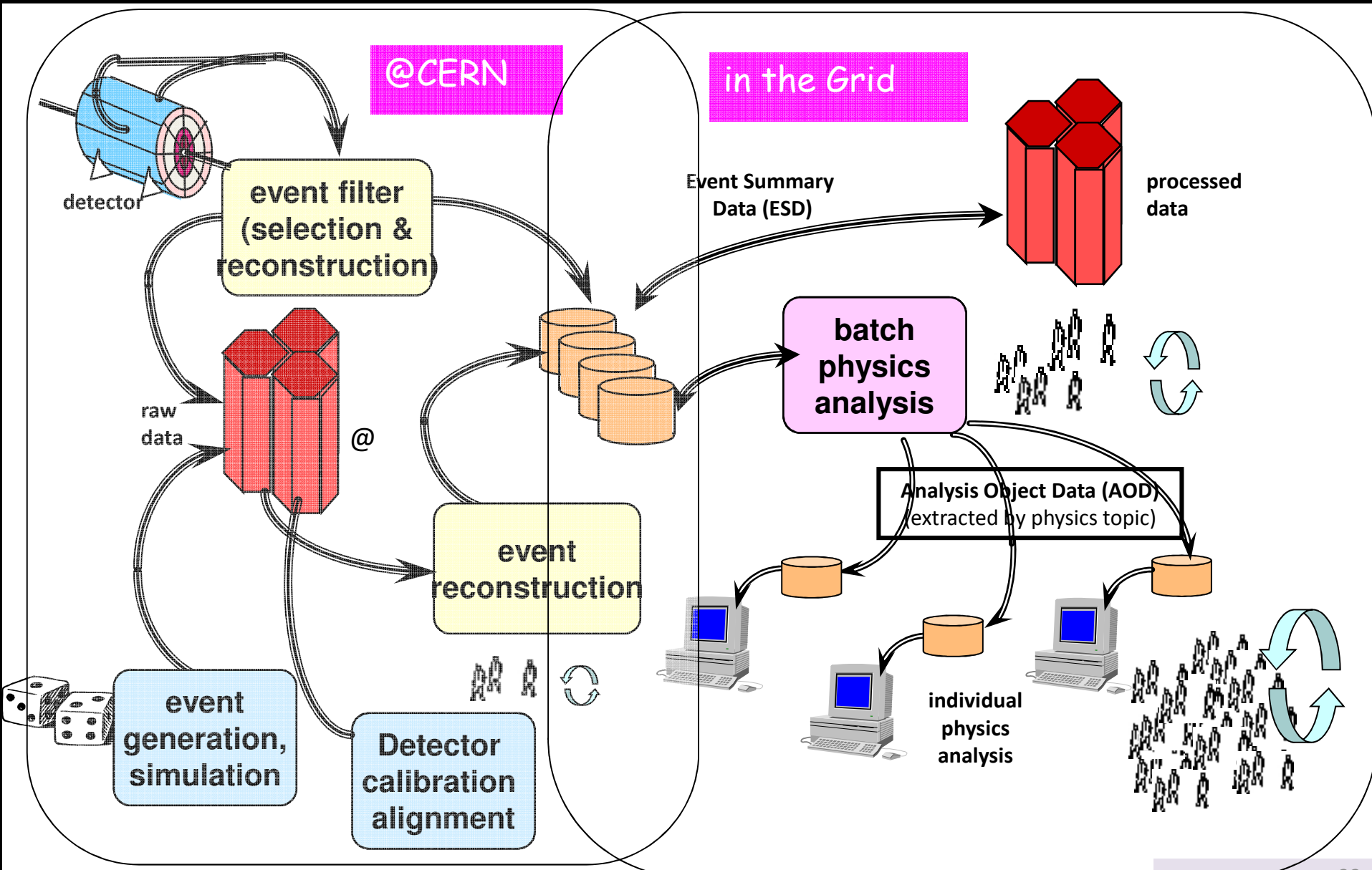


Software structure/layers

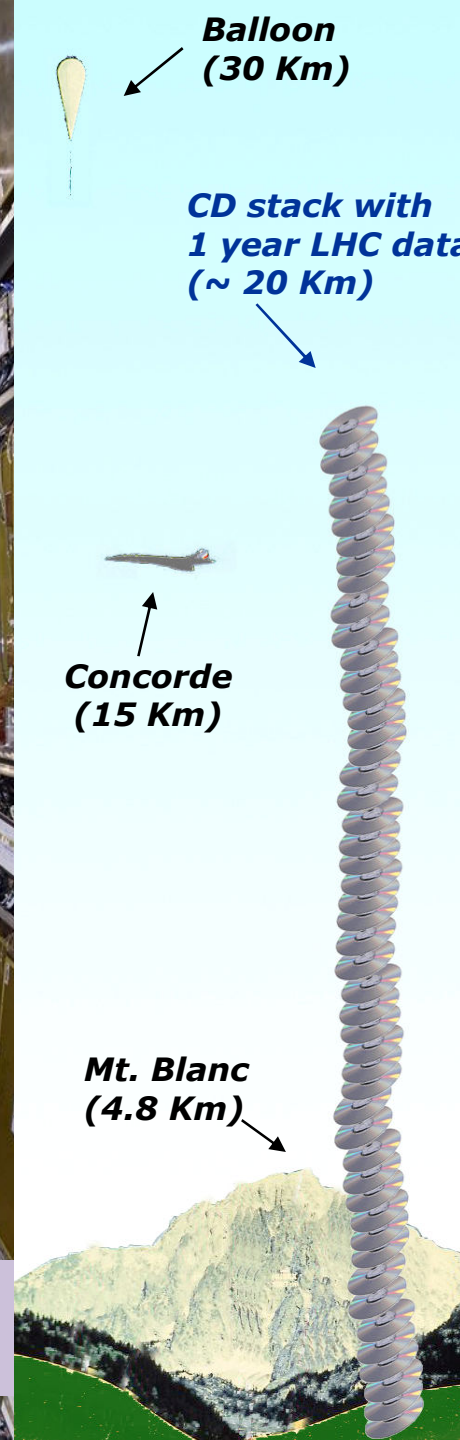
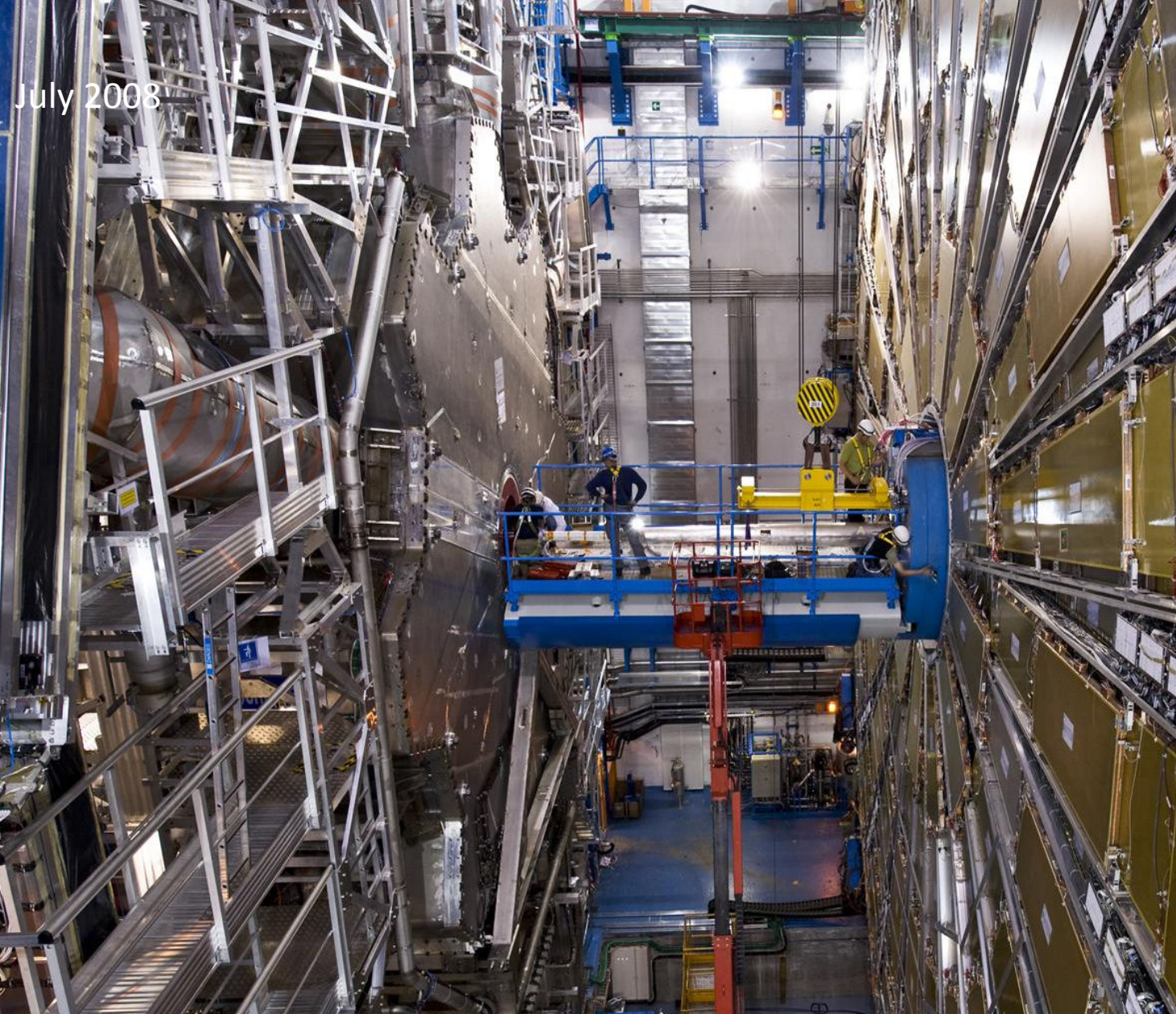


“Software and Grids”

What to do with the data?



July 2008



**Balloon
(30 Km)**

**CD stack with
1 year LHC data
(~ 20 Km)**

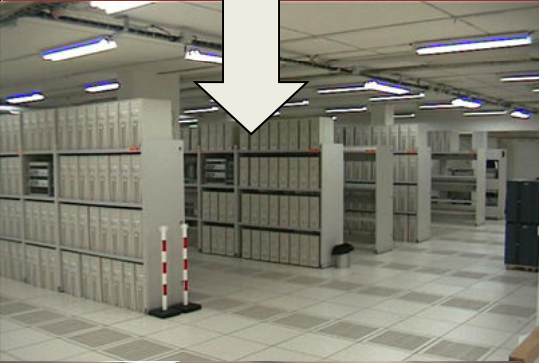
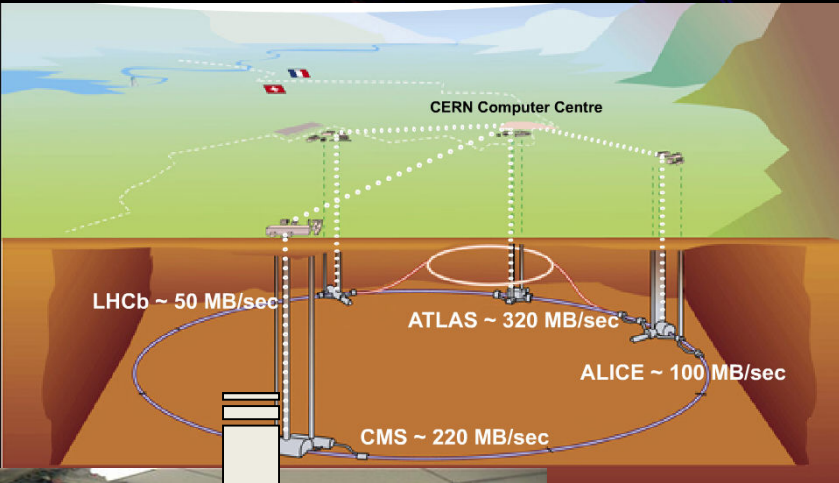
**Concorde
(15 Km)**

**Mt. Blanc
(4.8 Km)**

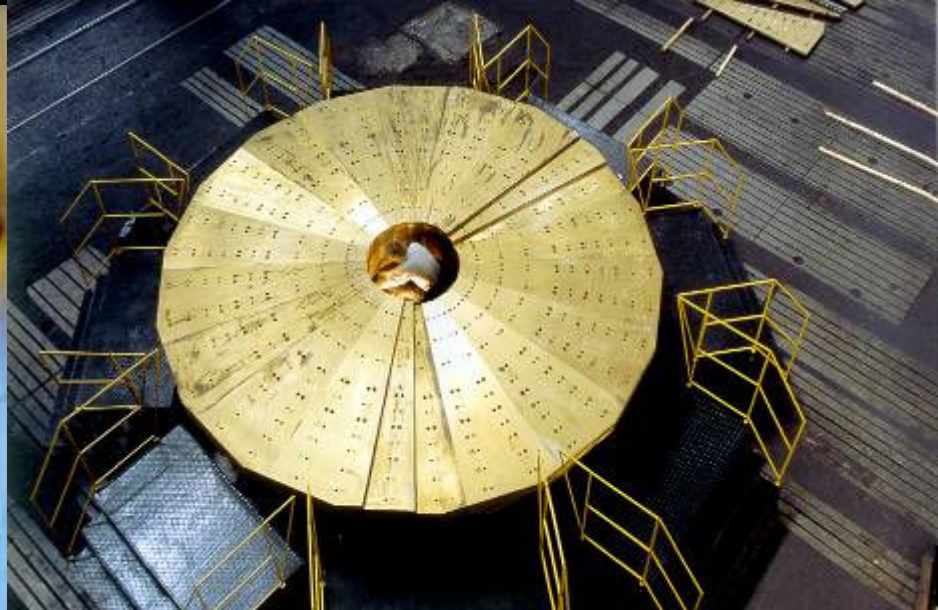
"Digital camera", 150 M pixels, observing: 10^9 frames/s,
recording selected frames: 200/s, ~1 GB/s recorded volume

Computing

GRID the size of the planet!



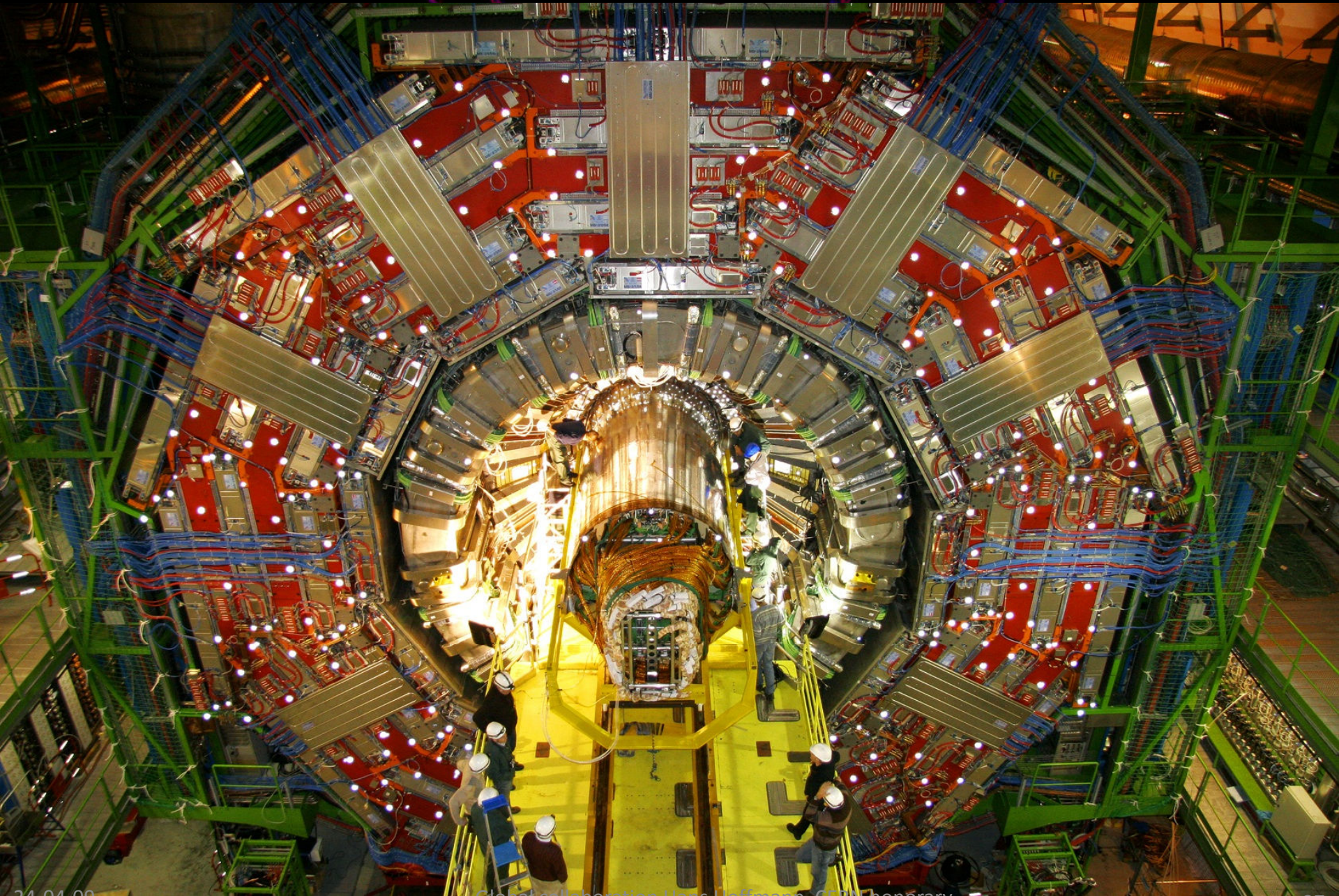
International cooperation: Russian workers converting shells to CMS detector parts



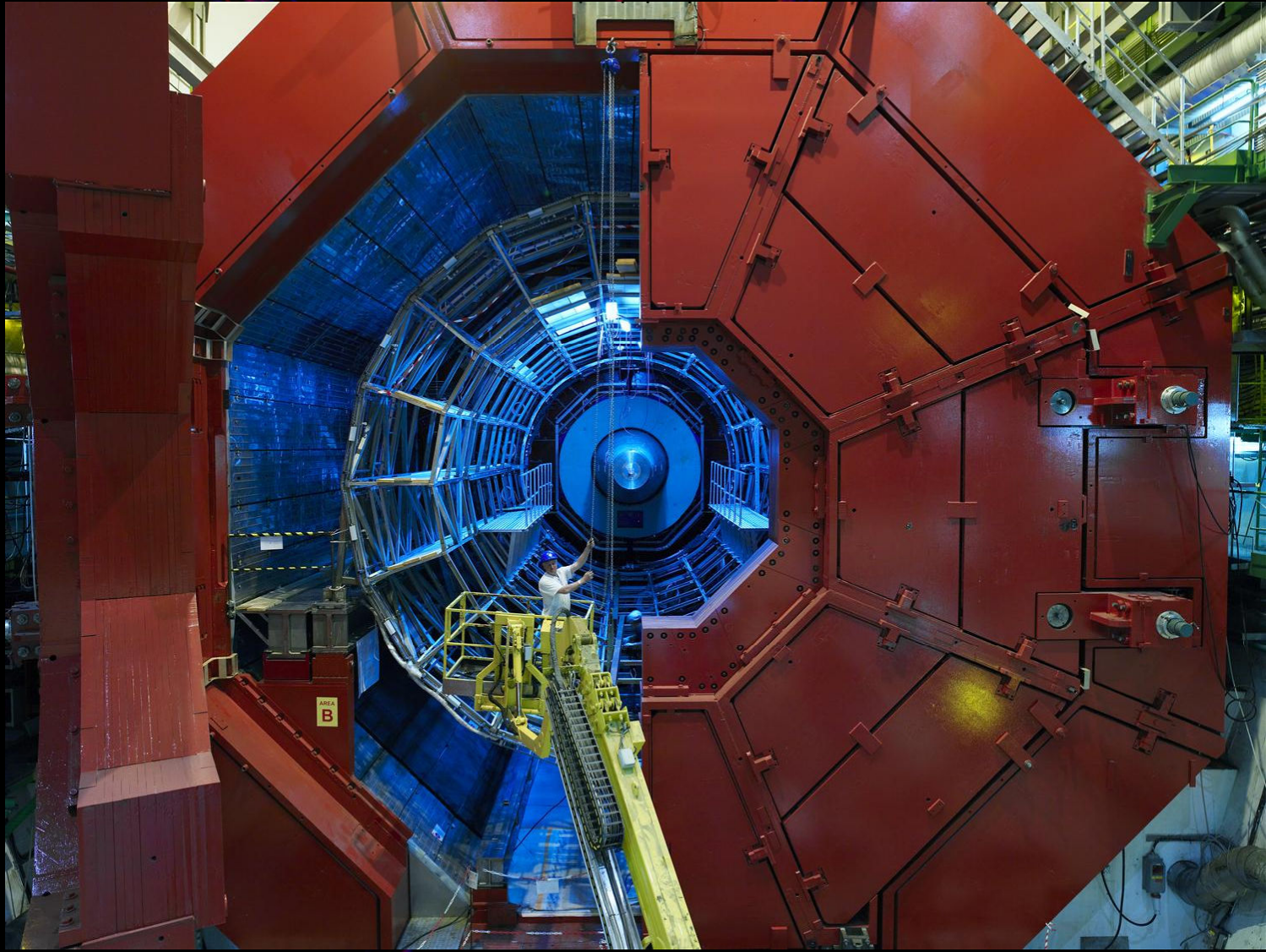
Contribution from Pakistan



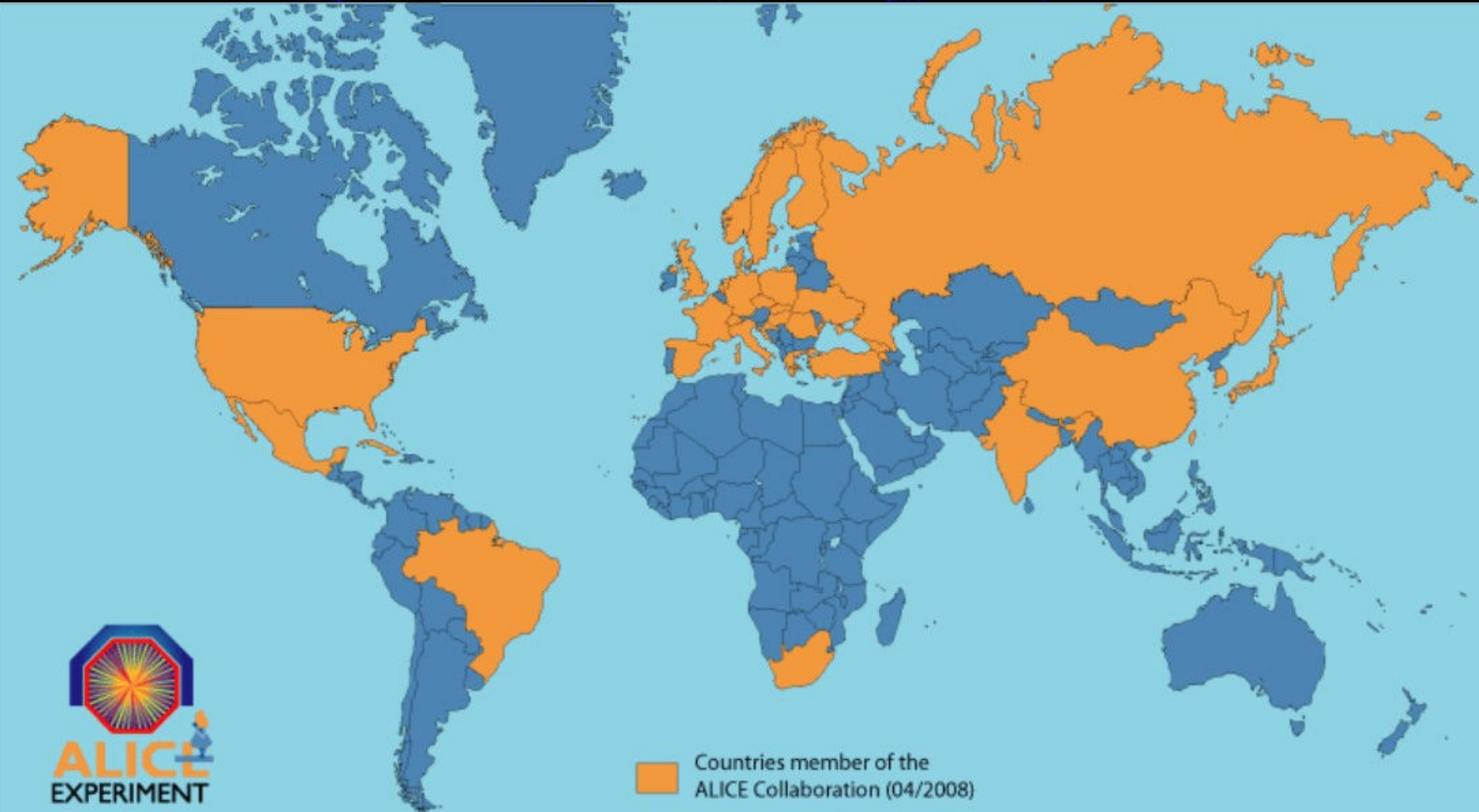
CMS



ALICE: an ultra-sensitive eye on the Universe: Quark-gluon plasma?



31 countries, 109 institutes, 1000
scientific/technical participants



LHCb: an asymmetrical perspective



What is the Grid?

The **World Wide Web** provides seamless access to information that is stored in many millions of different geographical locations

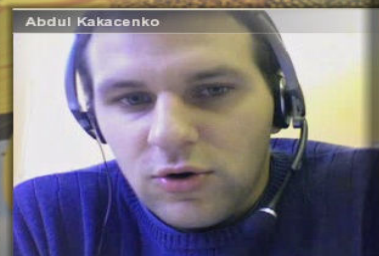
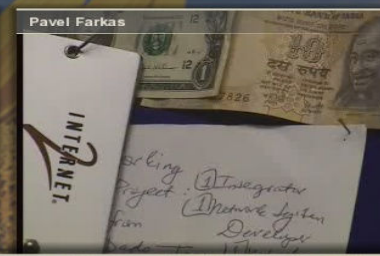
In contrast, the **Grid** is an emerging infrastructure that provides seamless access to computing power, software and data; distributed over the globe

enabling CERN users to work from home as if at CERN



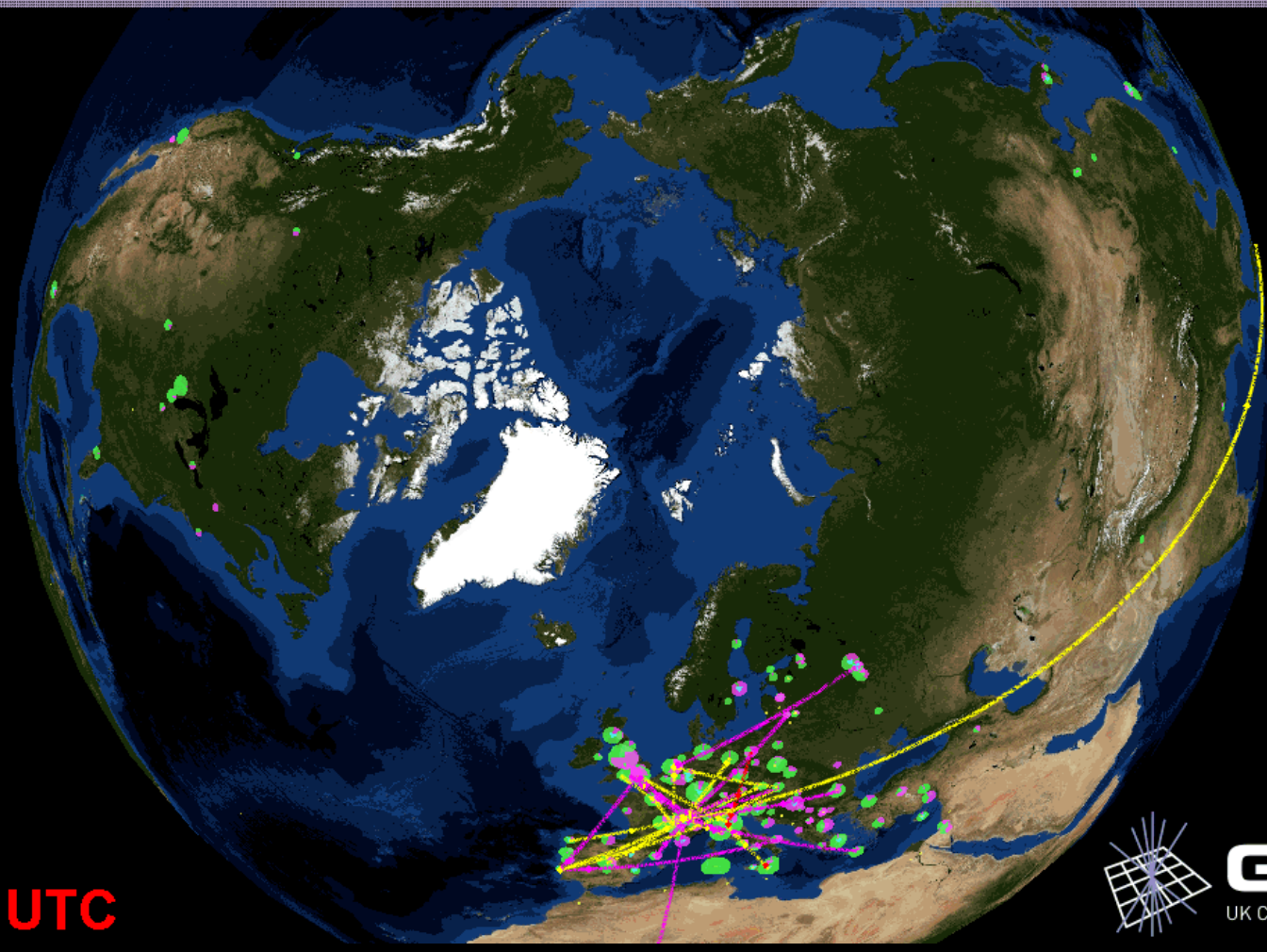


The Collaboration Network



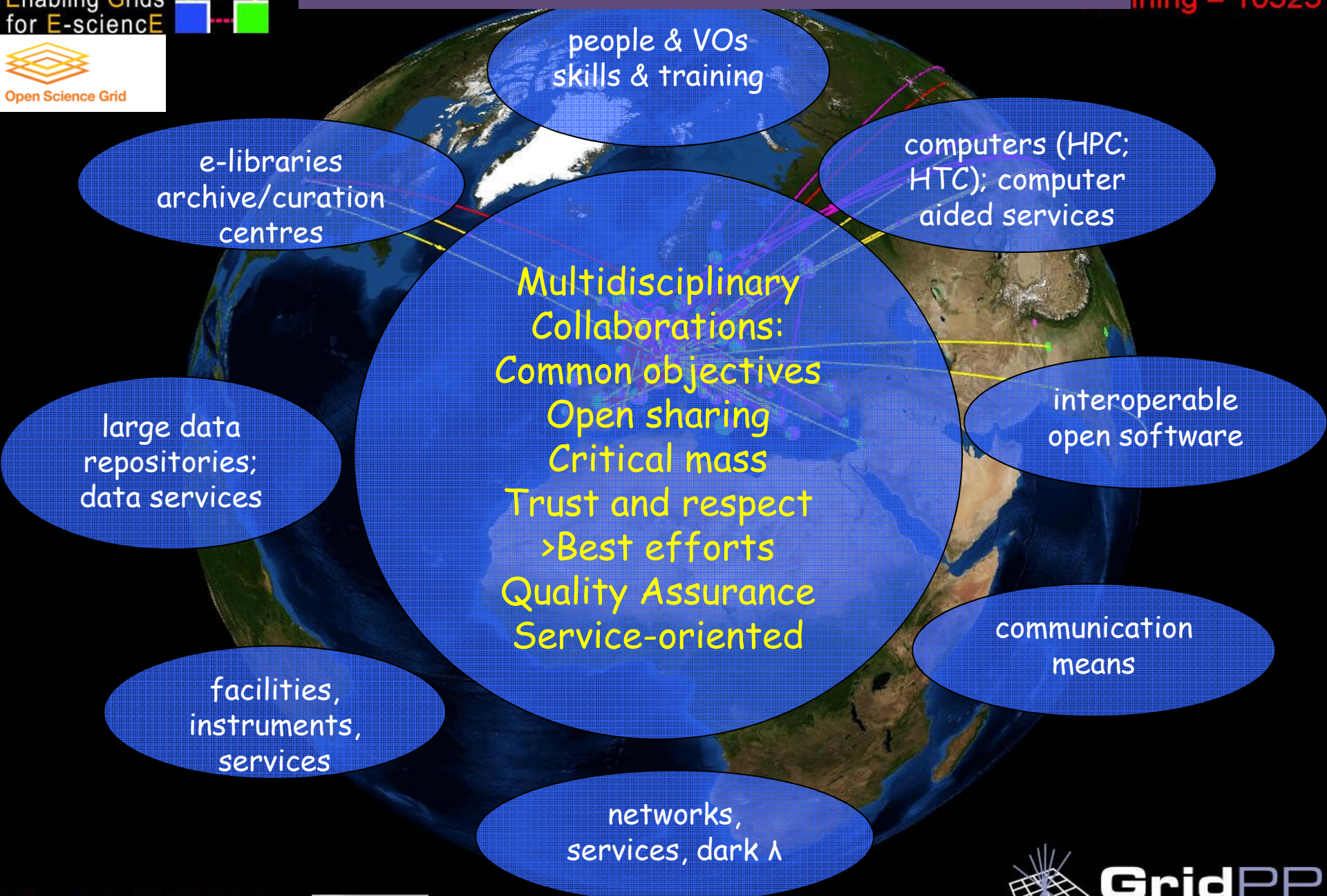
Provide equal access to the data, software,
compute power. . to all participating scientists

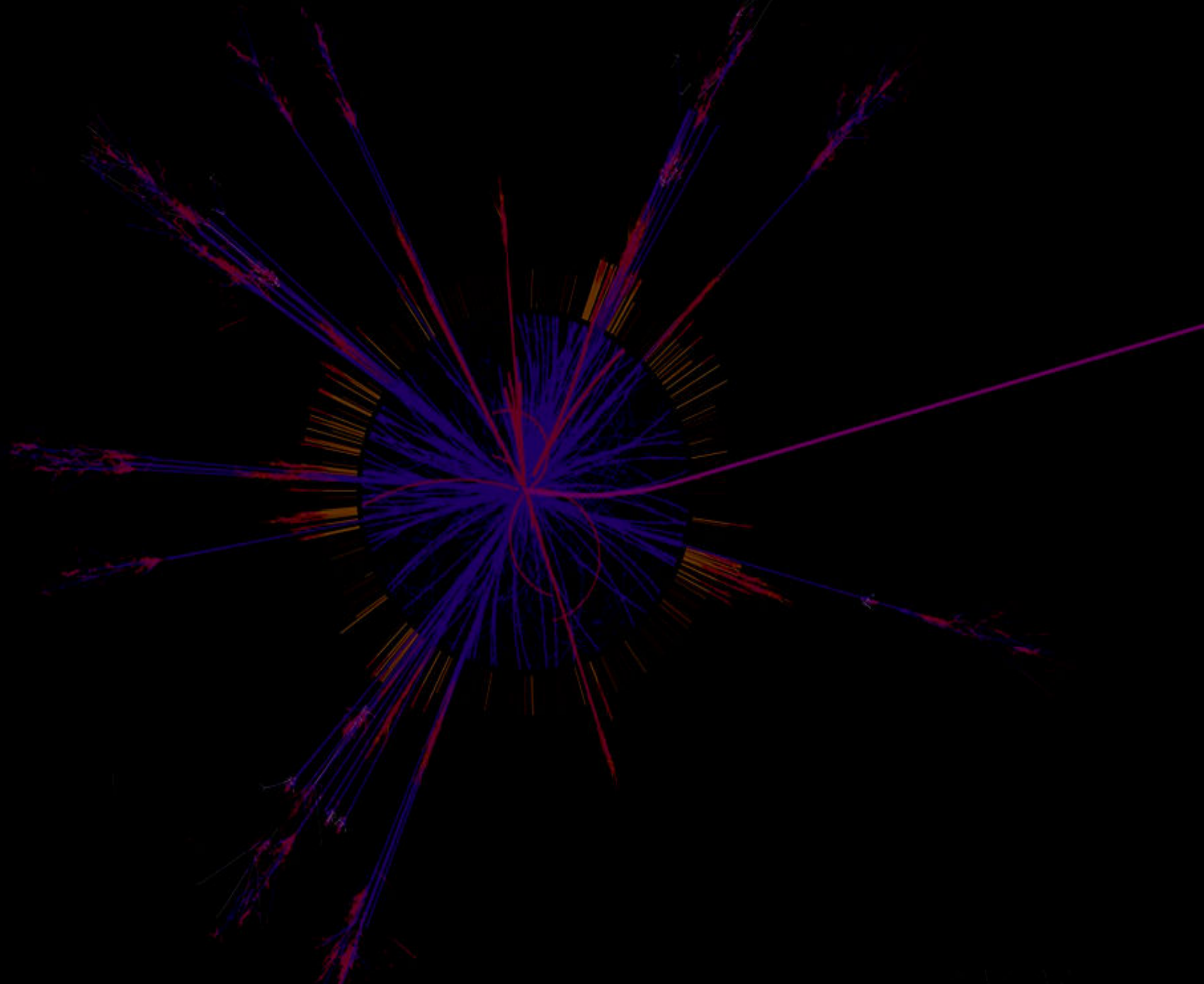
539
Running = 25374



21:13:50 UTC

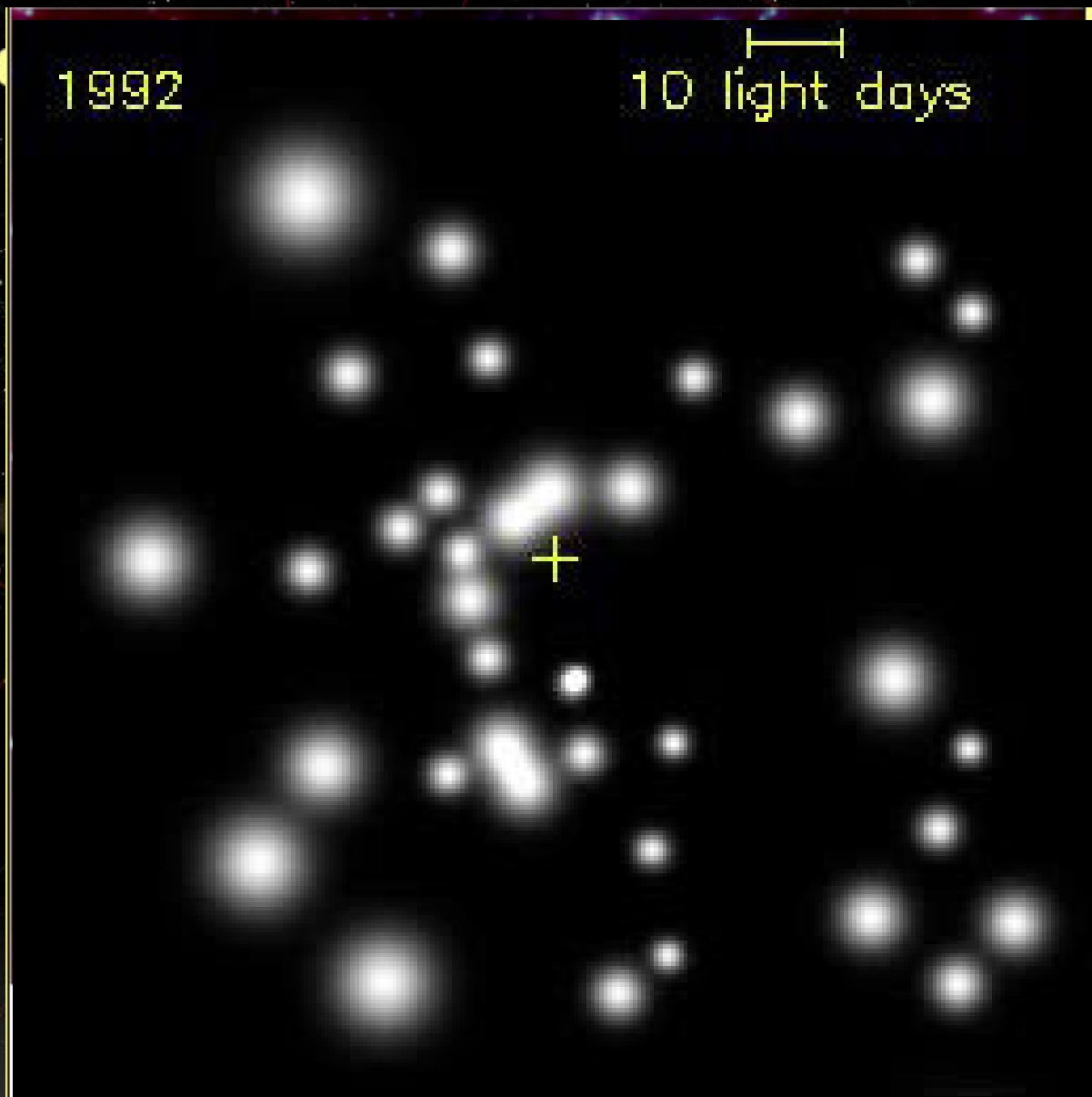
"e-Science is about more than networks, Grids, High Performance Computing...; e-science is about global collaboration in key areas of science and the next generation of infrastructure that will enable it." John Taylor, Director Research Councils, UK, 2000





Bernex, 22 mars 2007, 04h30, direction SE

Le Centre de



Black hole of $3.5 \cdot 10^6$
solar masses

Distance to Centre Galaxy
28 000 light years



