

E2E circuits for the WLCG

A "user" experience

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LHC

The **Large Hadron Collider** is a particle accelerator

- It collides beams of protons at an energy of 14 TeV
- It operates at about -270°C , just above absolute zero of temperature.
- It has a circumference of 27km, is located 100m underground.
- It has four major detectors: ALICE, ATLAS, CMS, LHCb

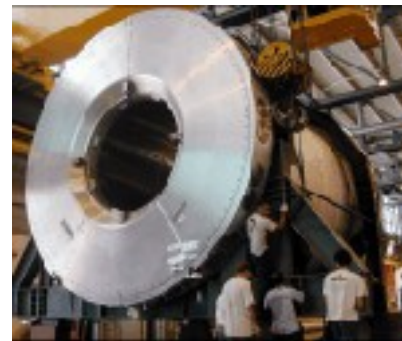
CMS



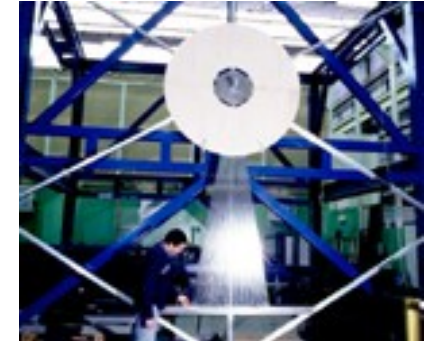
LHCb



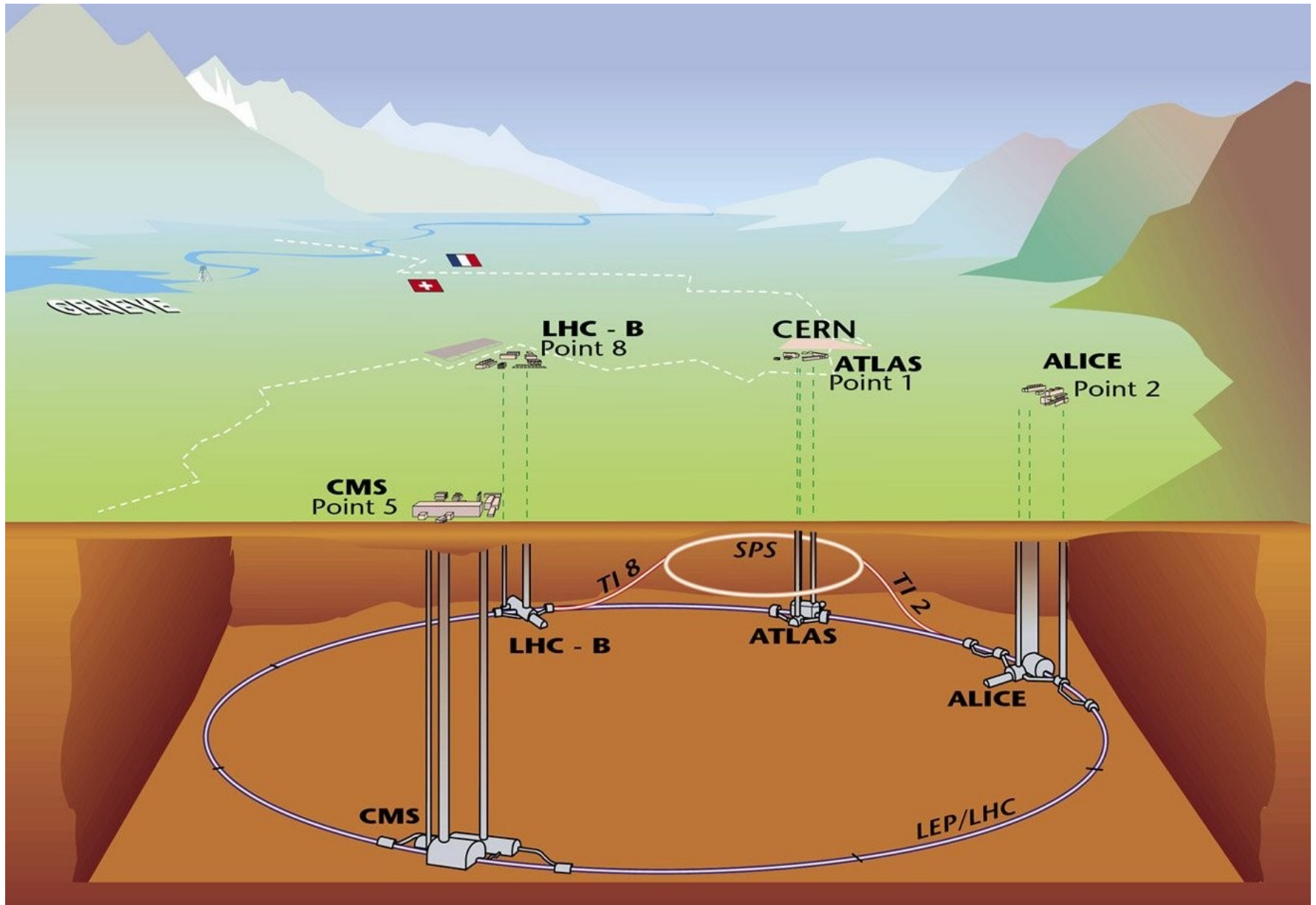
ATLAS



ALICE

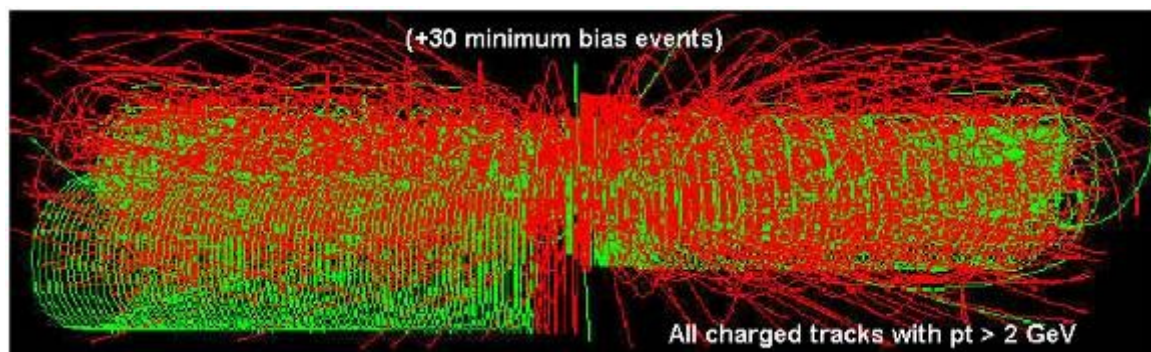


LHC

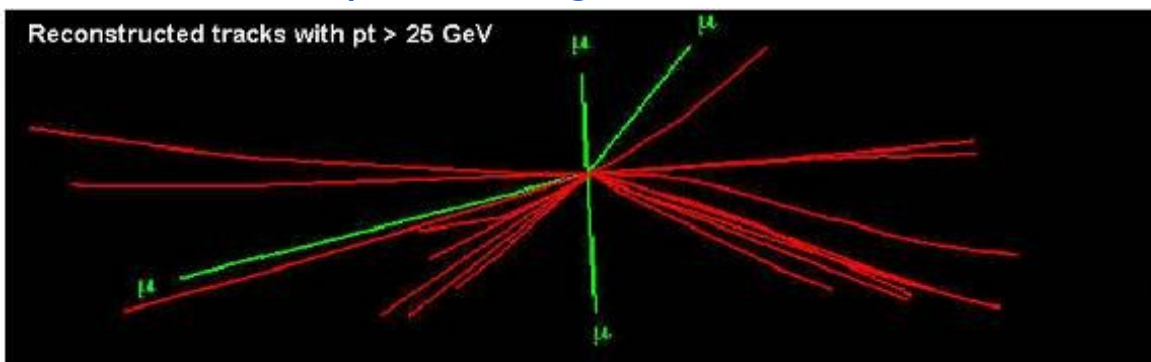


Data analysis

Look for characteristic pattern. Take an event...



.. and look for the particle "signature"



- 40 million collisions per second

- After filtering, 100 collisions of interest per second

- A Megabyte of data digitised for each collision
= recording rate of 0.1 Gigabytes/sec

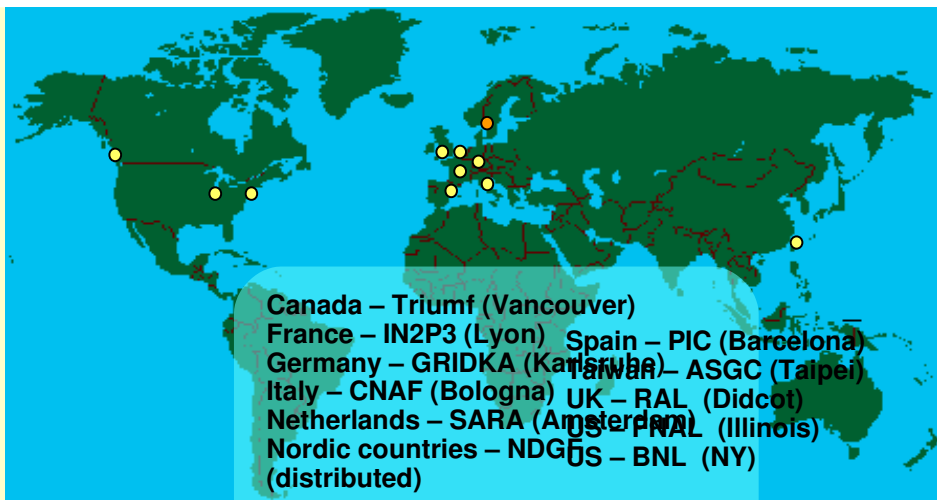
- 10^{10} collisions recorded each year

= 10 Petabytes/year of data

WLCG: Worldwide LHC Computing Grid

Tier-0: The accelerator centre:

- data acquisition and initial processing
- long-term data storage
- distribution of data to the Tier-1 centres



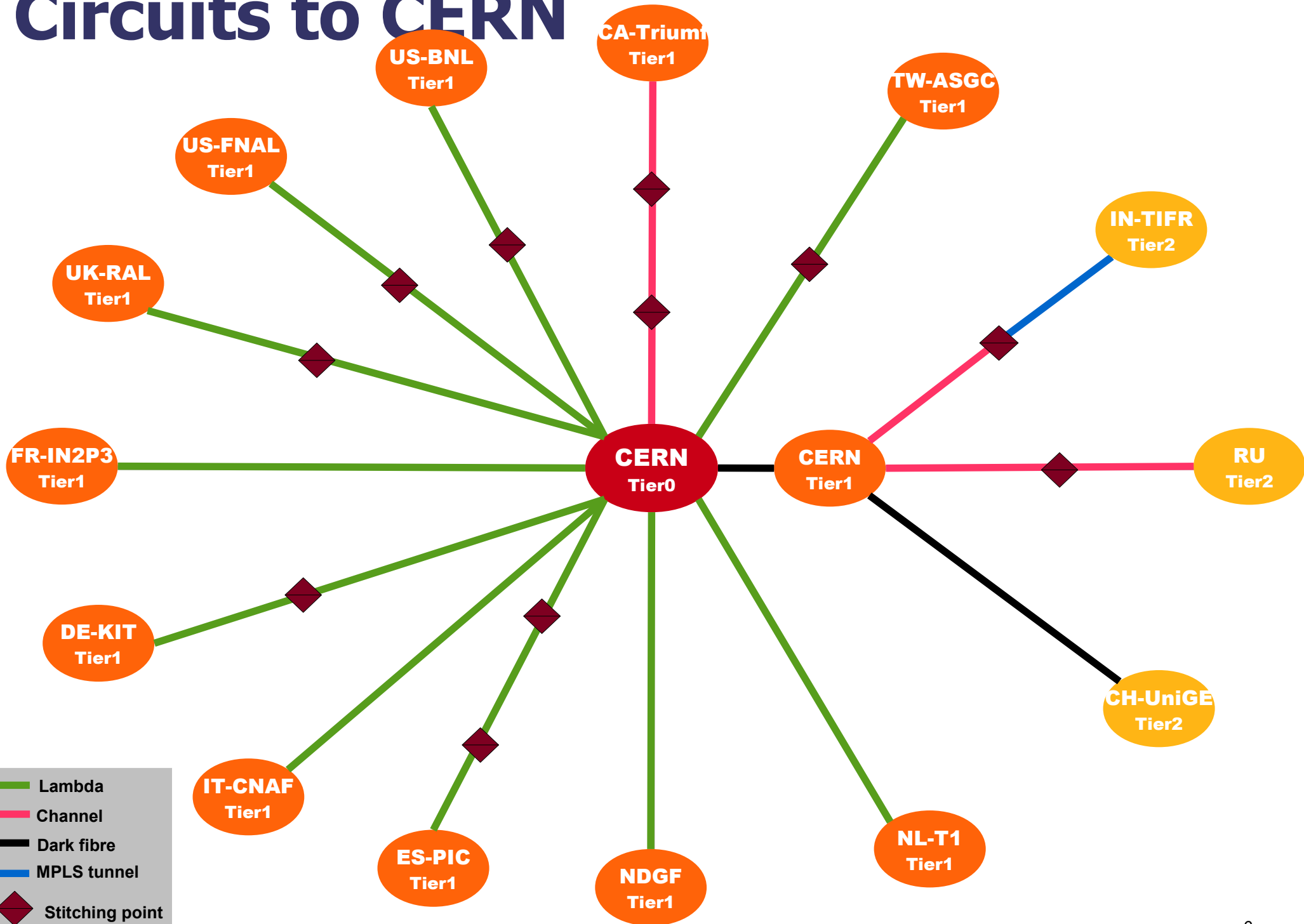
Tier-1s: data analysis and distribution

- managed mass storage
- grid enabled data services
- heavy data analysis

Tier-2s: ~130 centres in 35 countries

- end users analysis (where the discovers are made)
- simulations

Circuits to CERN



Circuits Types

Single lambda

Multiple stitched lambdas

Channel

Multiple stitched channels

Channel and MPLS tunnel

Circuits Requirements

Permanent

1Gbps (T2-T1) to 10Gbps (T1-T0)

Ethernet

Circuits Purchasing

More segments (i.e. providers), more paperwork

Commercial providers stricter with specifications

Circuits Providers

Geant2, USLHCnet

NRENs

Commercial ISPs

Circuits Provisioning

More segments (i.e. providers), more time

**NRENs more flexible in fixing stitching problems
(optic types, fibre connectors...)**

Circuits Utilization

Always connected to the external boundaries of the two organizations.

All traffic somehow firewalled.

BGP routing between the two parts.

Circuits Operations

So far so good:

- Not very difficult to spot a faulty segment**
- More difficult when issue on the stitching fibre (no man's land)**
- It helps to have L3 device to insert at the stitching point**

Conclusion

The evil is in the detail

Questions?