

# Making the Invisible visible, and the Impossible possible

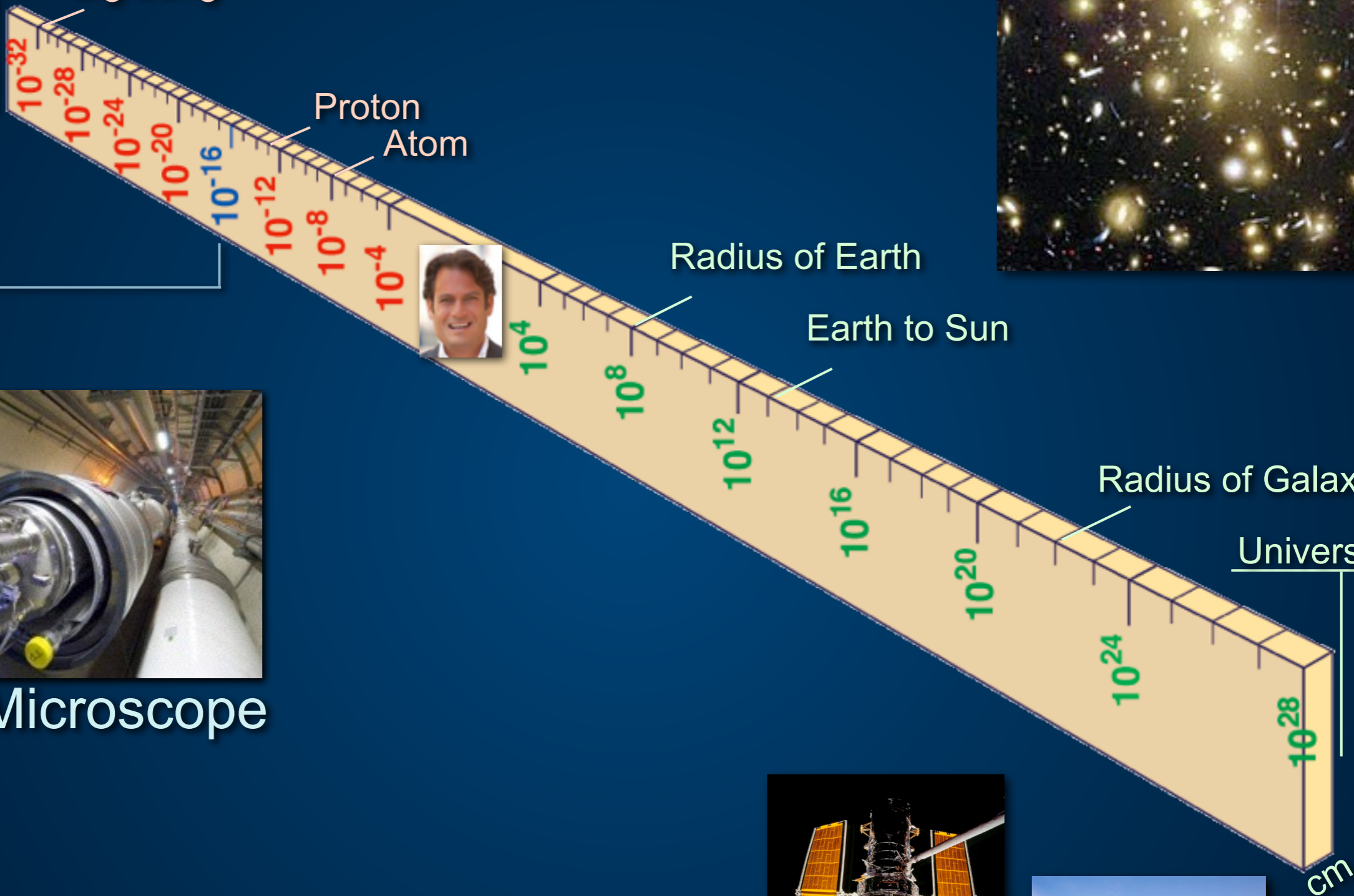


*accelerating science and innovation*

Prof. Günther Dissertori  
ETH Zurich

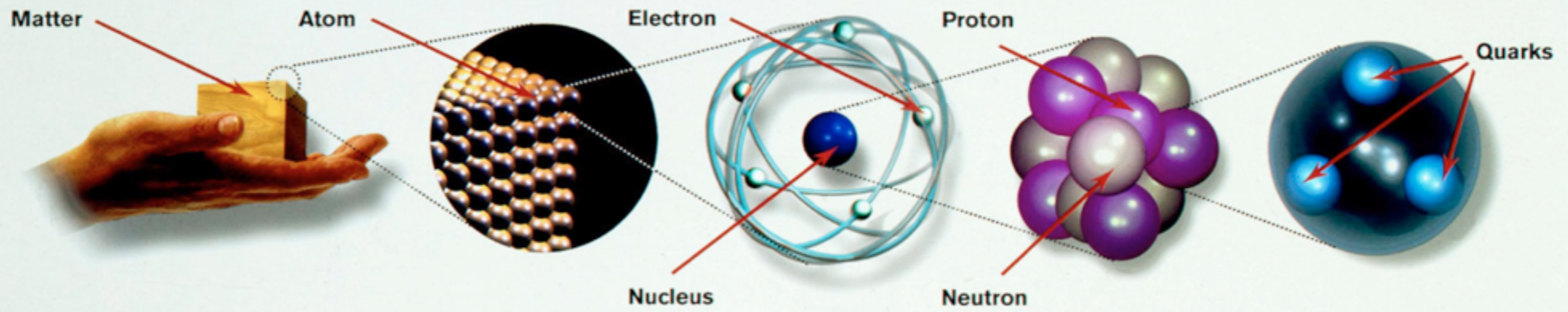


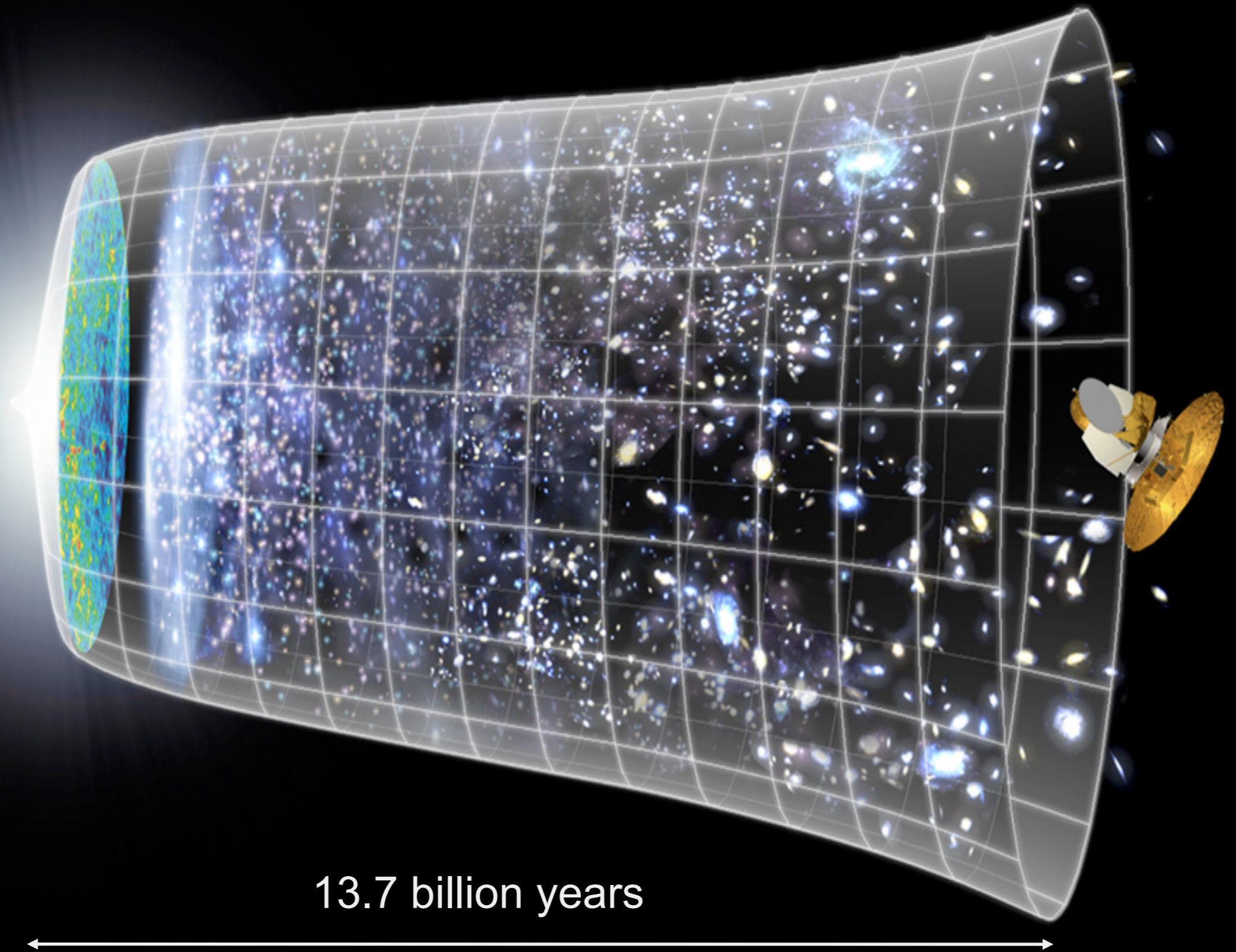
Big Bang



Super-Microscope



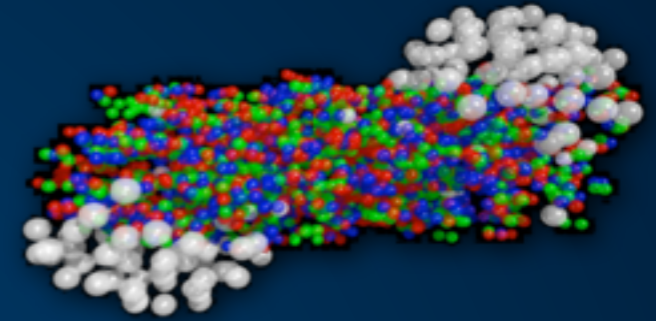




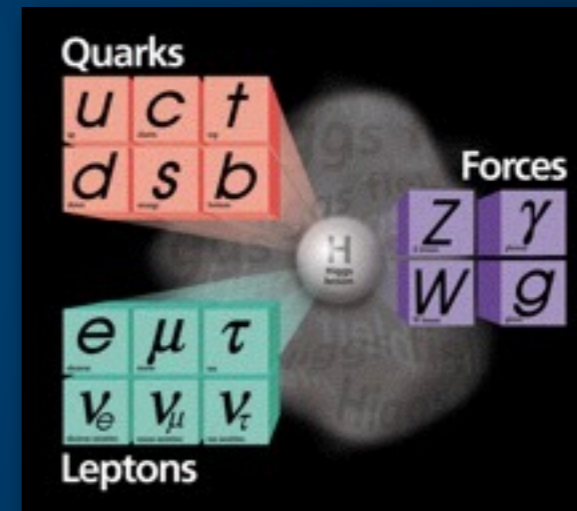
13.7 billion years

# Big Open Questions

- what happened shortly after the **Big Bang**



- properties of the newly discovered **Higgs Boson**, other new particles?



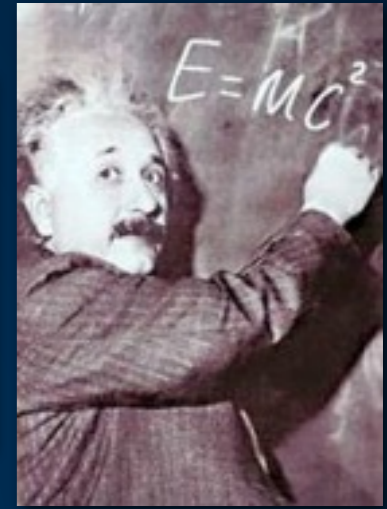
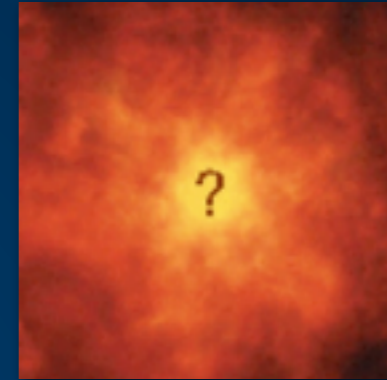
- what is **Dark Matter** ?



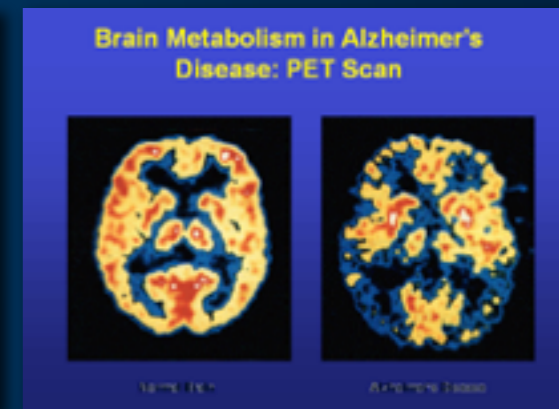


# CERN's Mission

● Push the **frontiers of knowledge**



● Develop **new technologies**



● Train the **scientists and engineers** of tomorrow

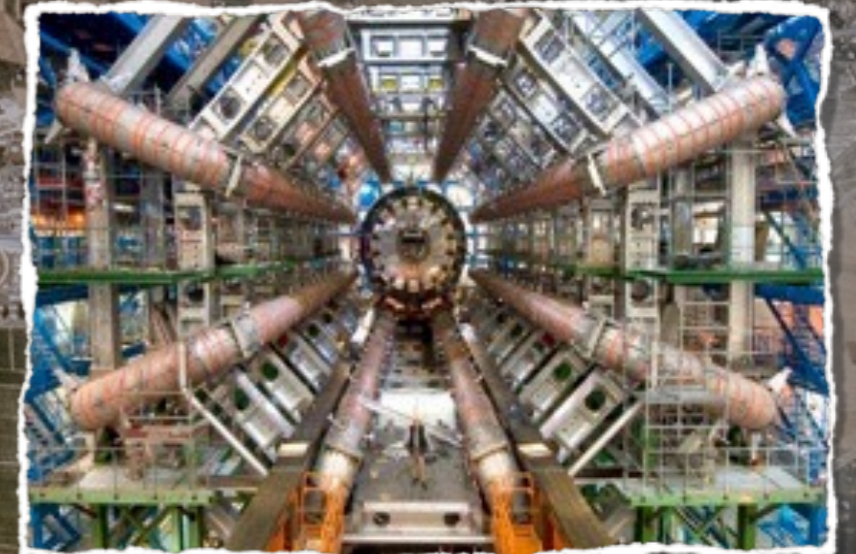


● Unite **people**



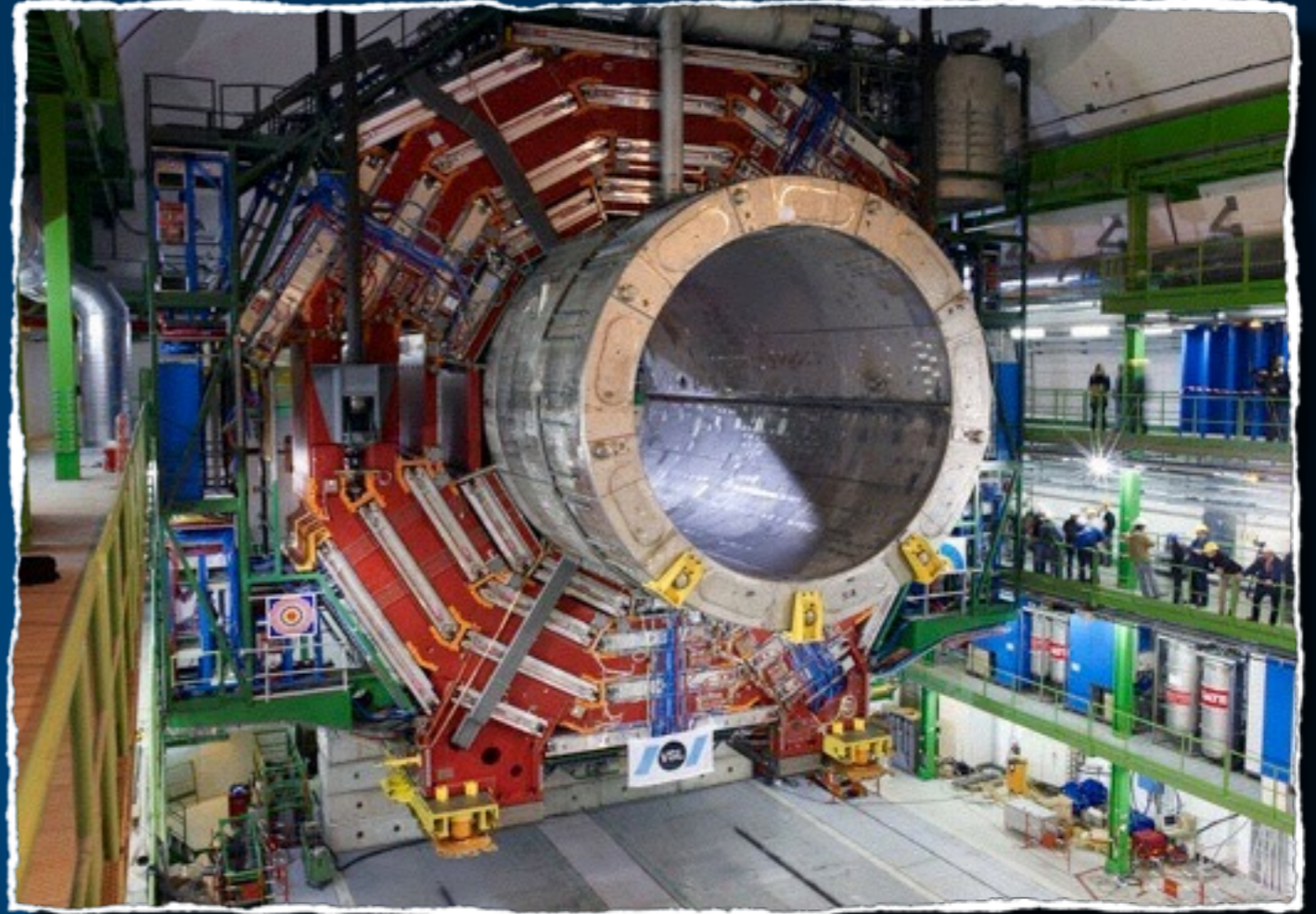
# The Large Hadron Collider

One of the largest, global, scientific projects ever

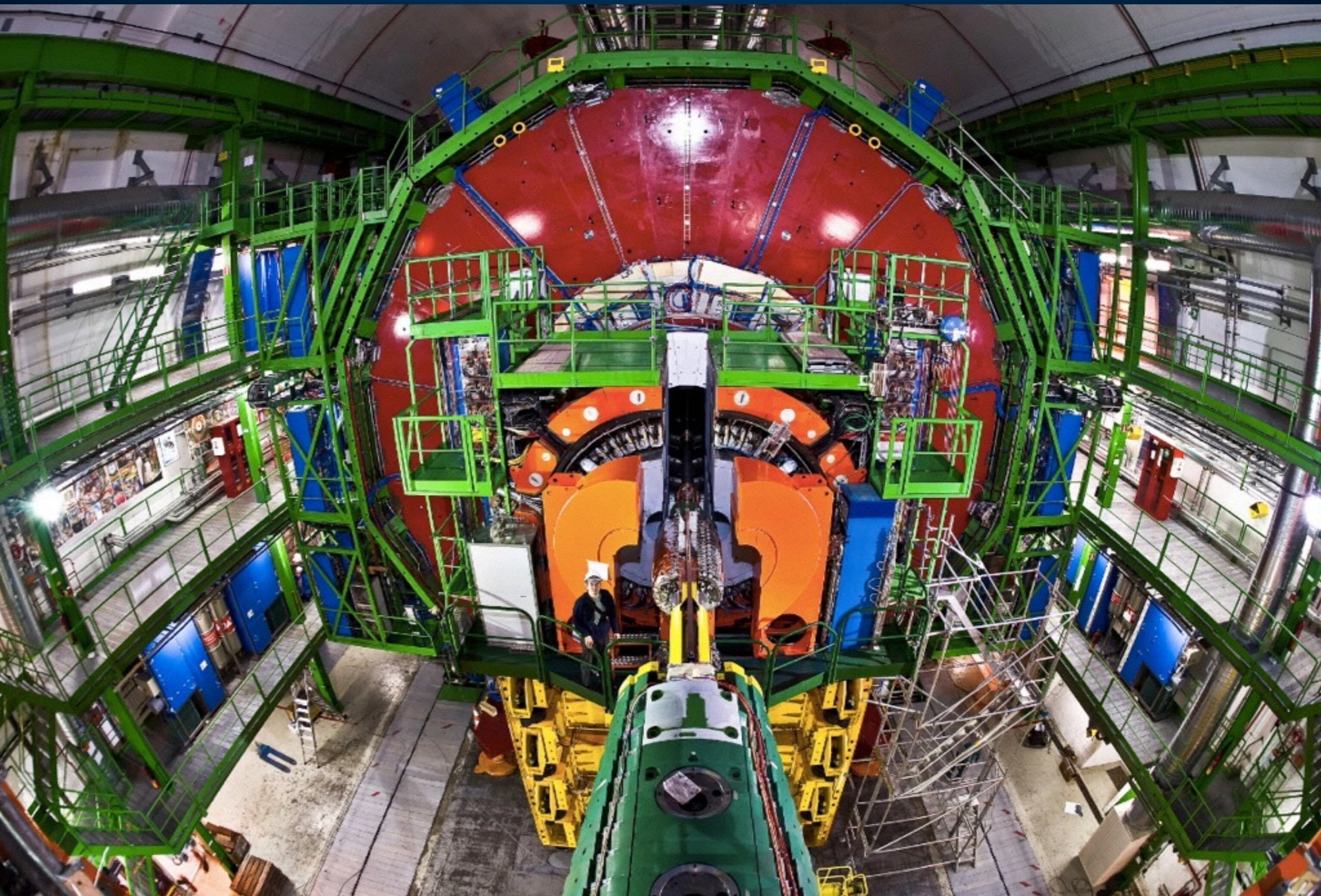


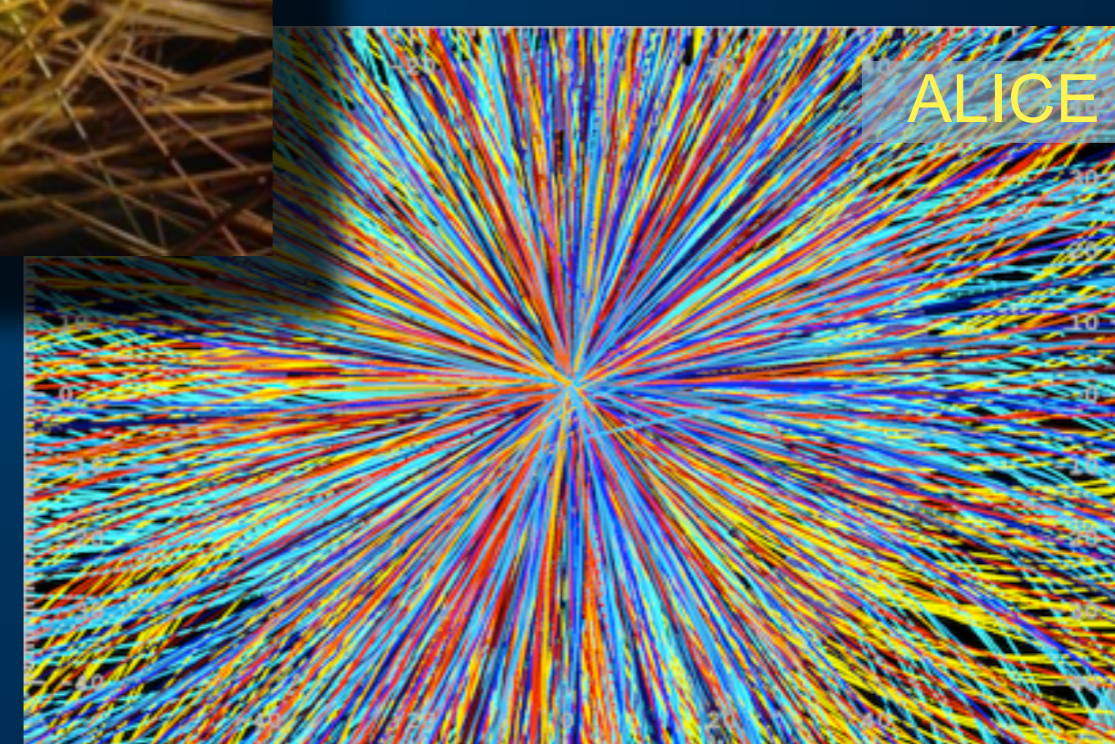
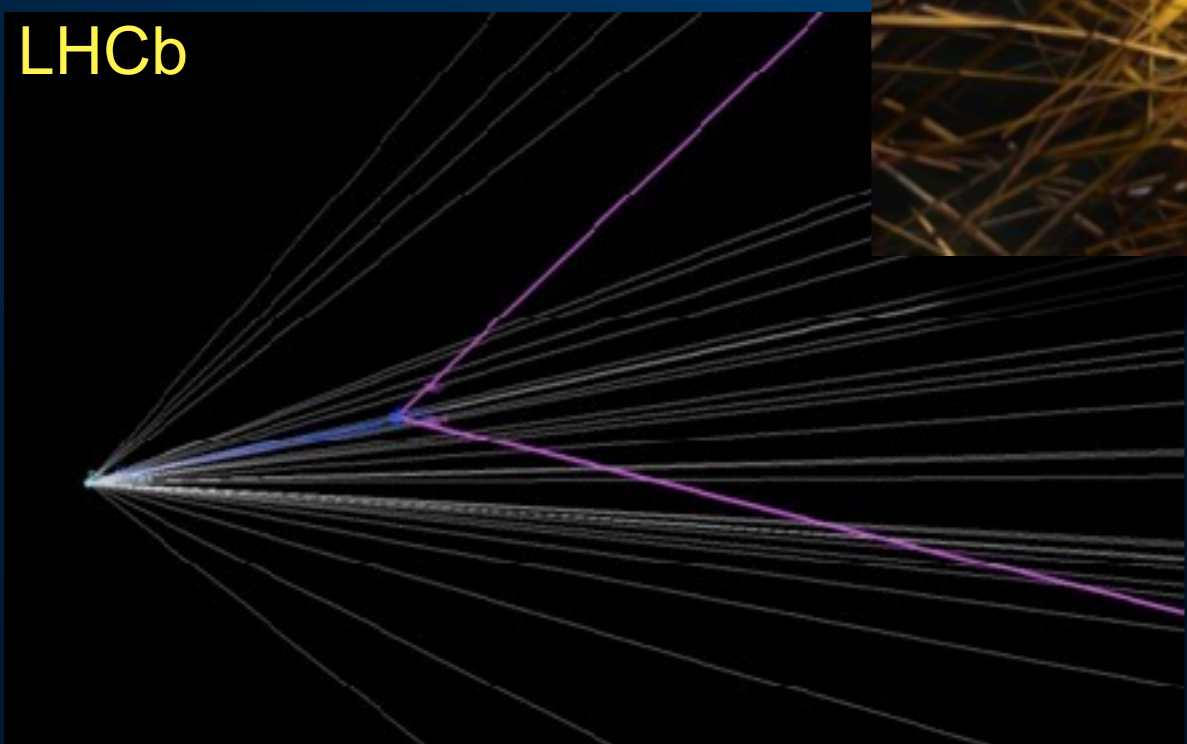
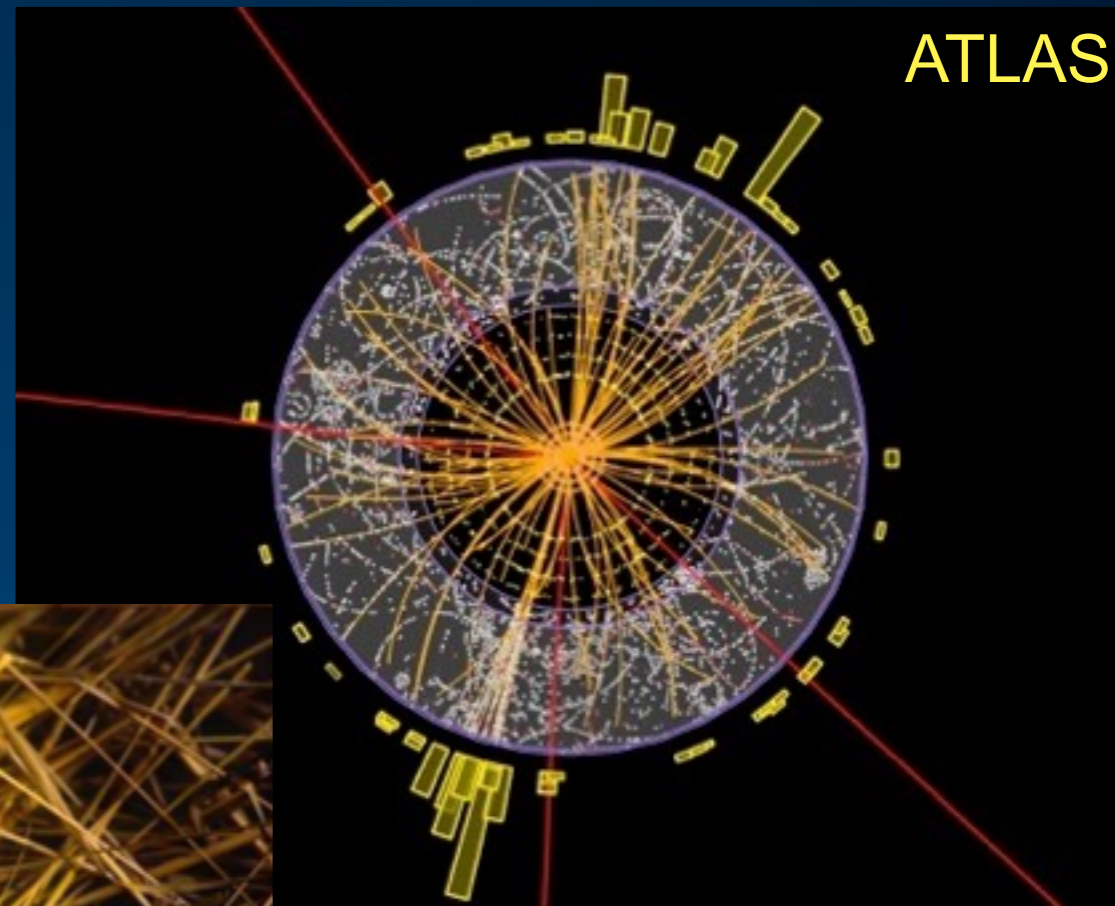
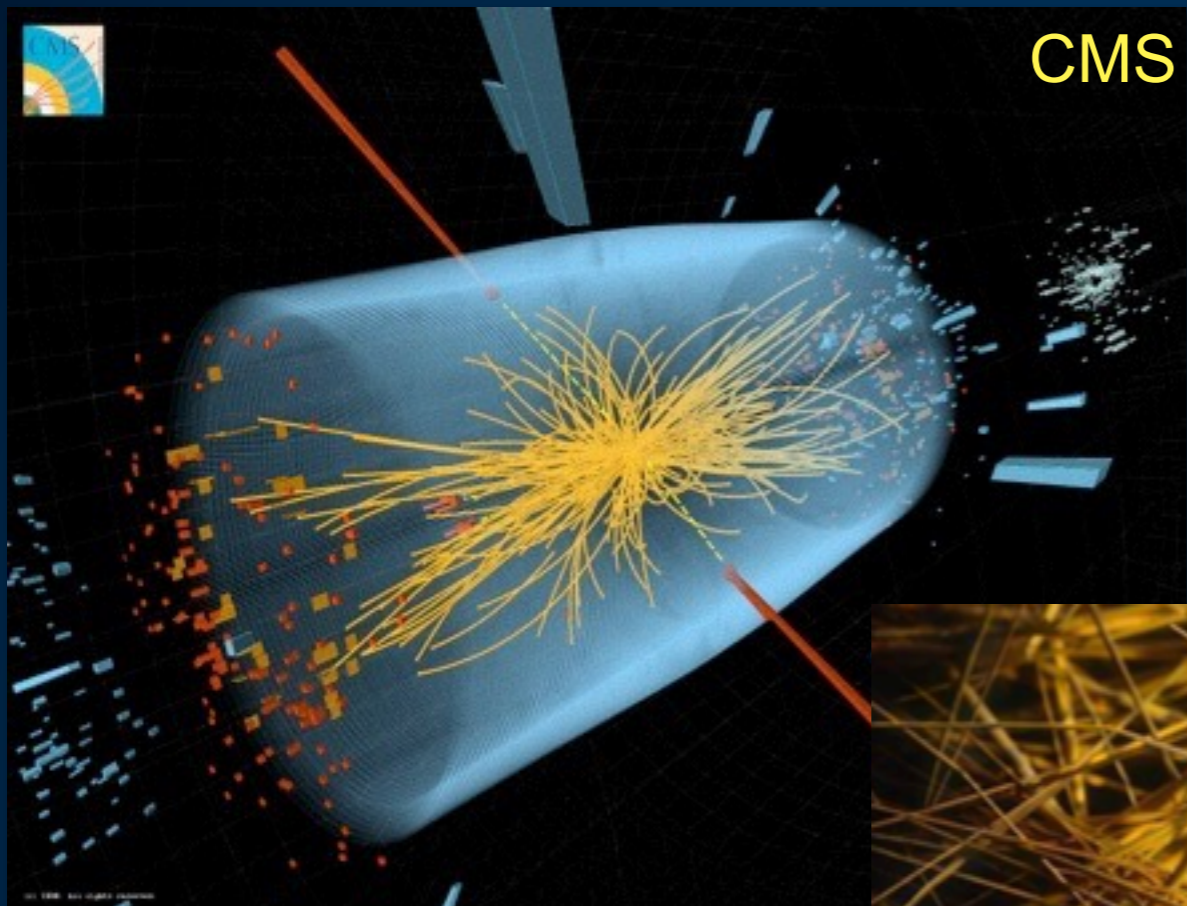






lowering of the heaviest element  
~ 2000 tons  
~ 5 Jumbo Jets



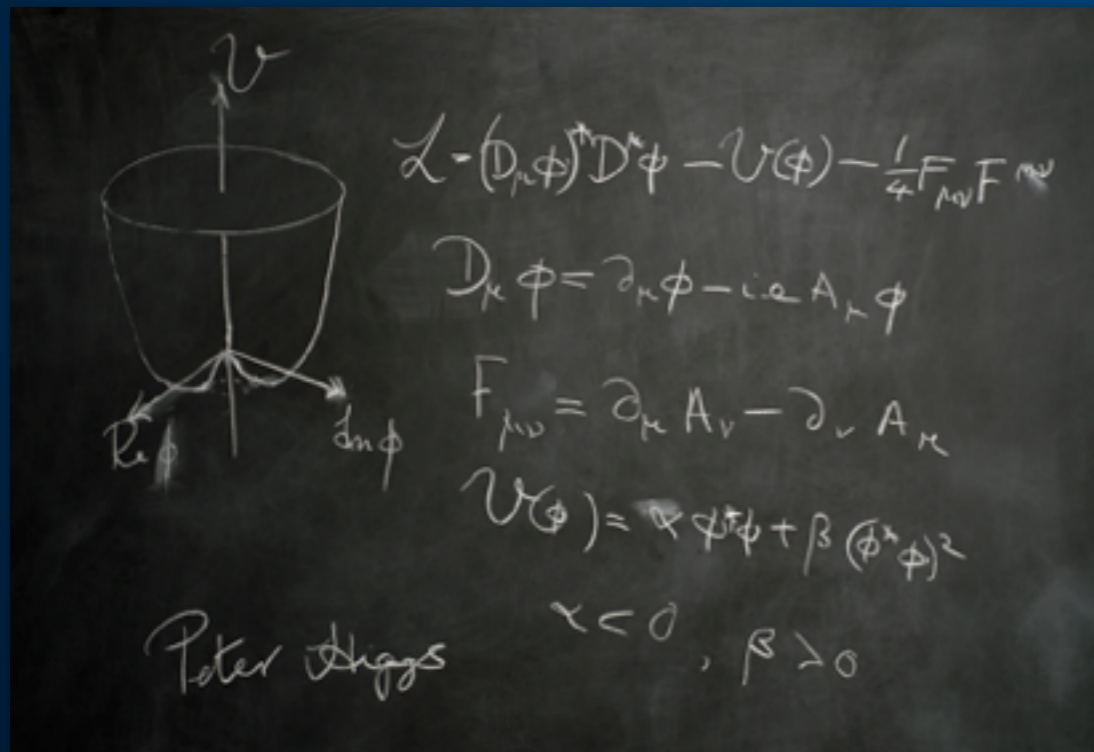




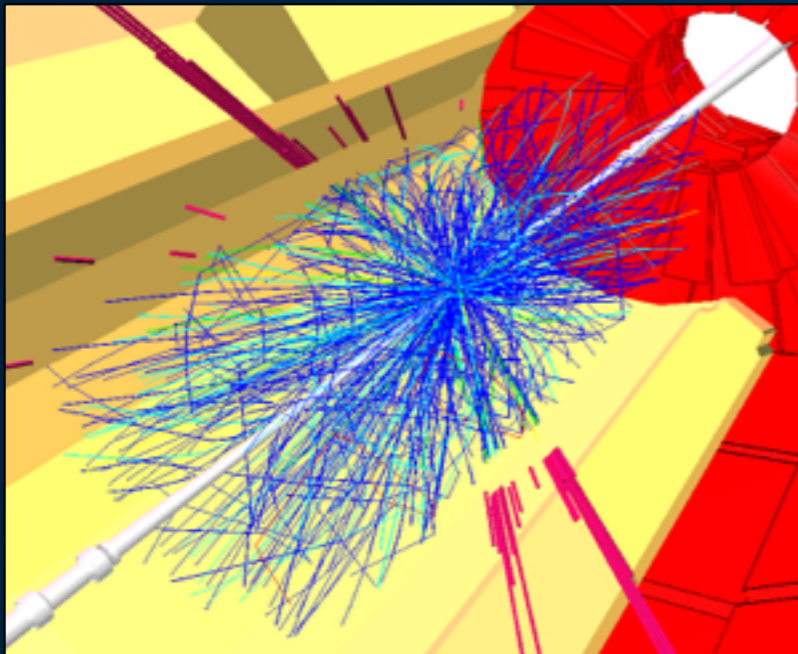


Prof. F. Englert and Prof. P. Higgs

Nobel Prize in Physics, 2013



# a lot of data.....



~ 100 million readout channels

a digital image 40 million times a second

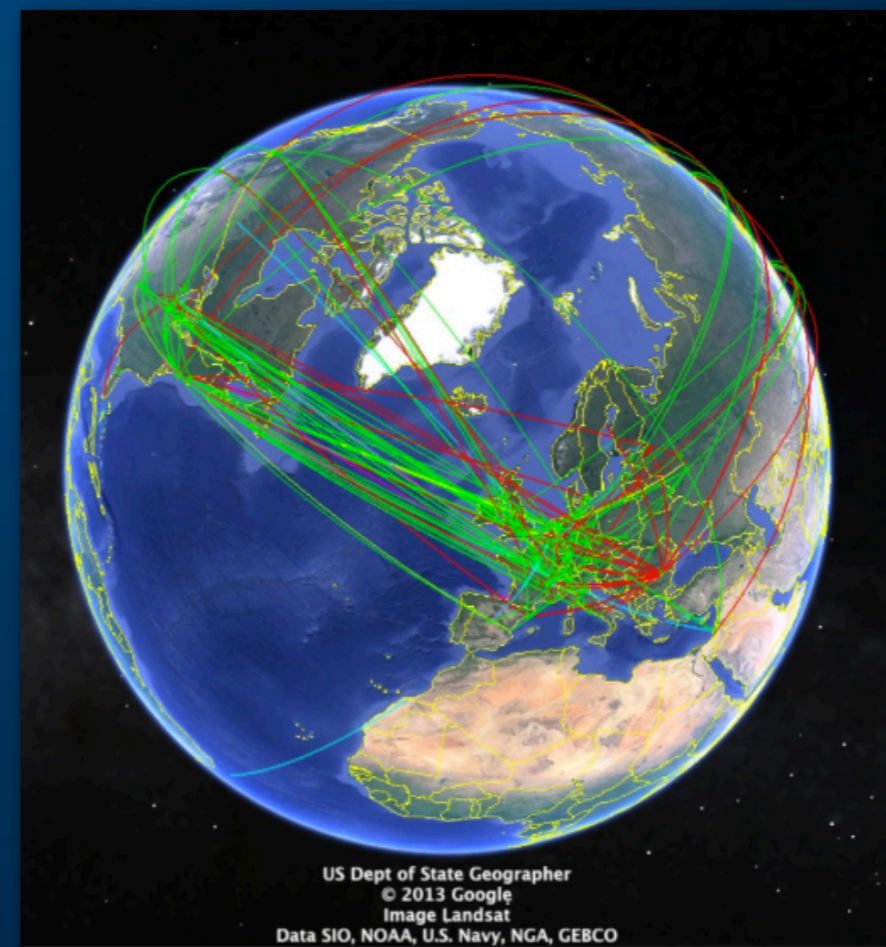
all experiments together ~3 GB/sec

data volume per year ~25 Petabytes

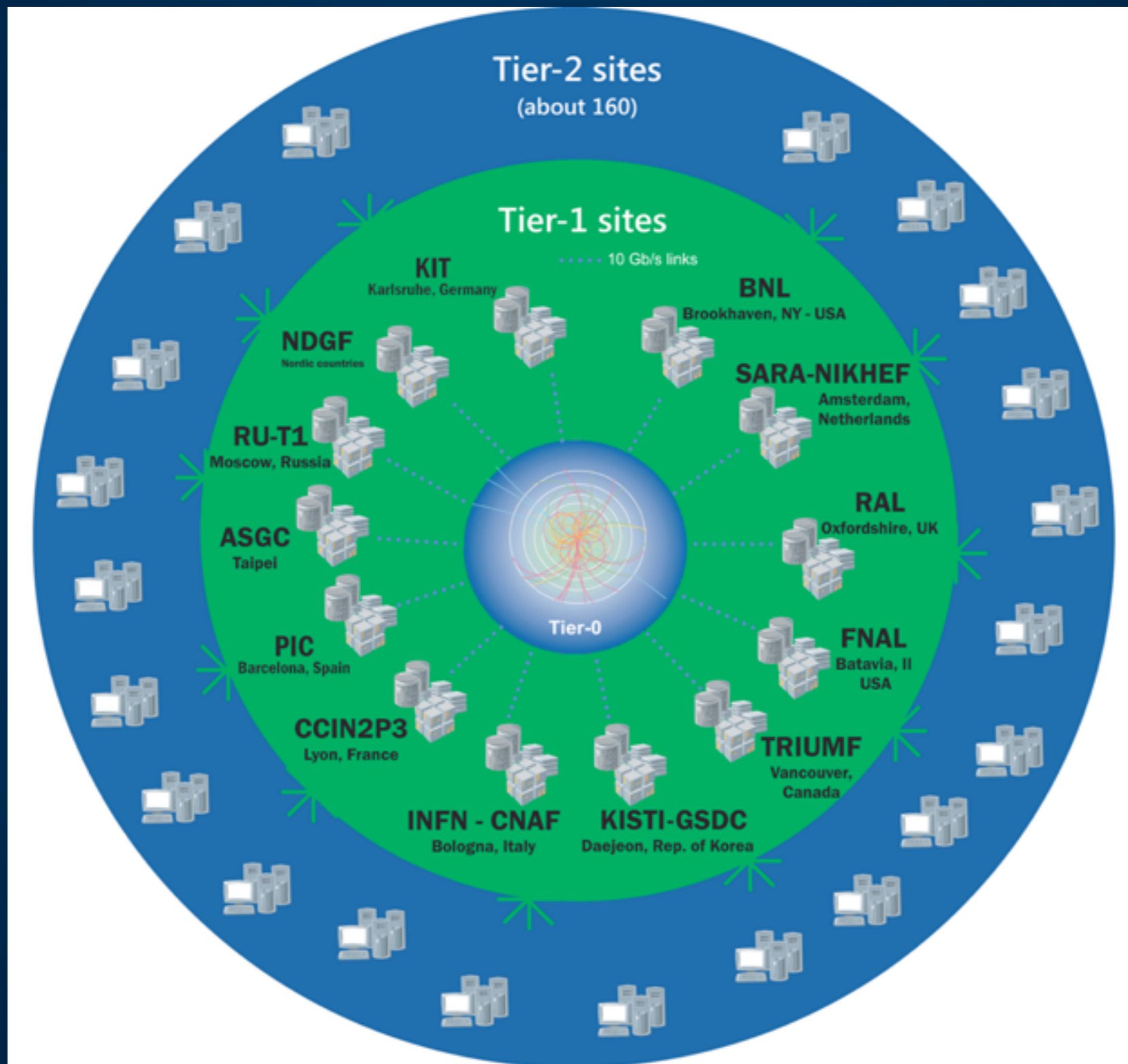
## Grid Computing



~ 140 computing centres in ~ 40 countries



# WLCG: World-Wide LHC Computing Grid



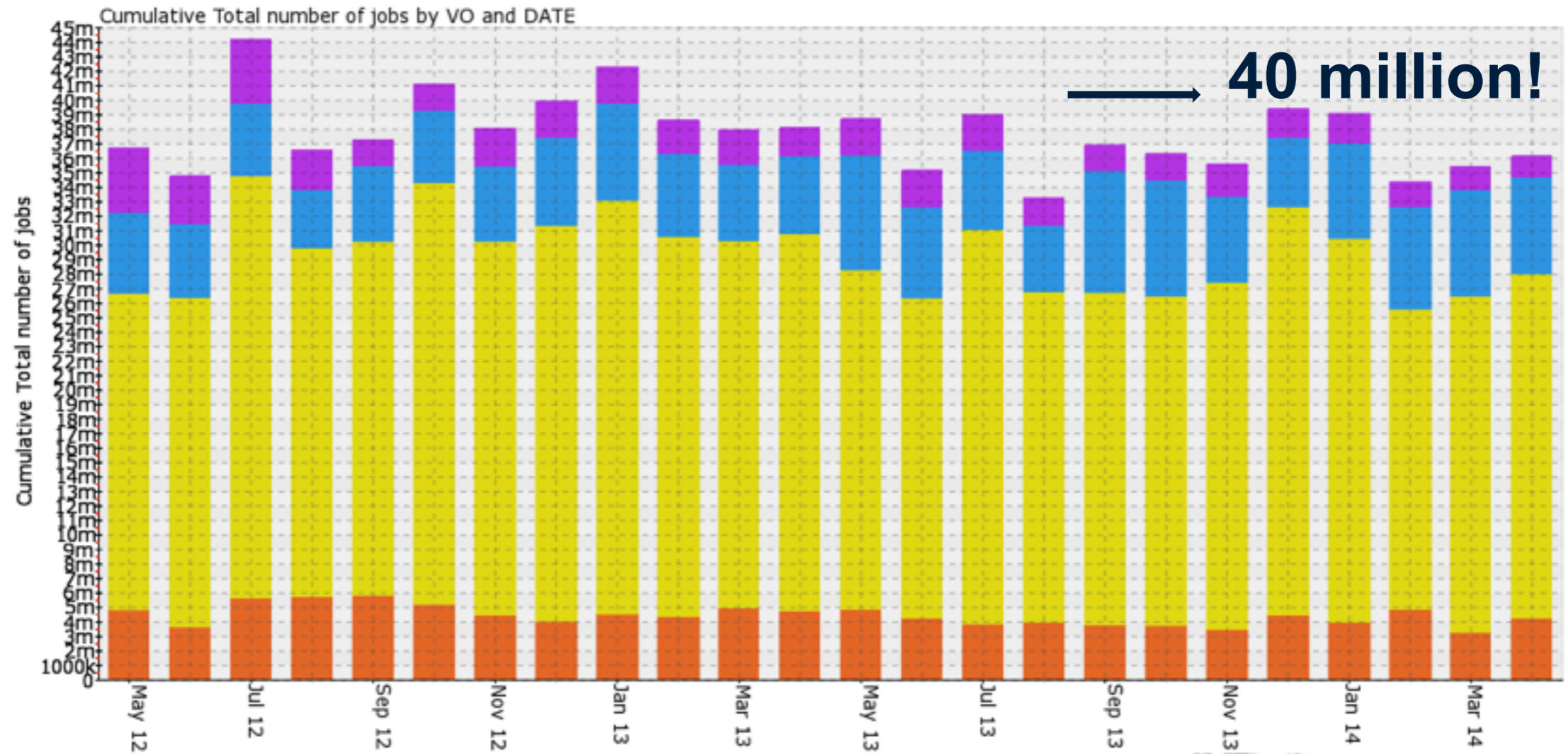
Transfer Experiments->Tape/Disks: Peaks of 6.6 GB/s

# Data mining, across the “hay stacks”

Chart showing the Cumulative Total number of jobs grouped by VO and DATE (only information about LHC VOs is returned).

Developed by CESGA EGI View: / njobs / 20125-2014:4 / VO-DATE / lhc (x) / ACCBAR-LIN / i

2014-05-18 14:59



Jobs/month, run by LHC collaborations

- and many more years (and data) to come!
- only ~ 1% of all expected data collected so far



# Follow technology developments : **openlab**



## Partners



## Contributors



## Associates



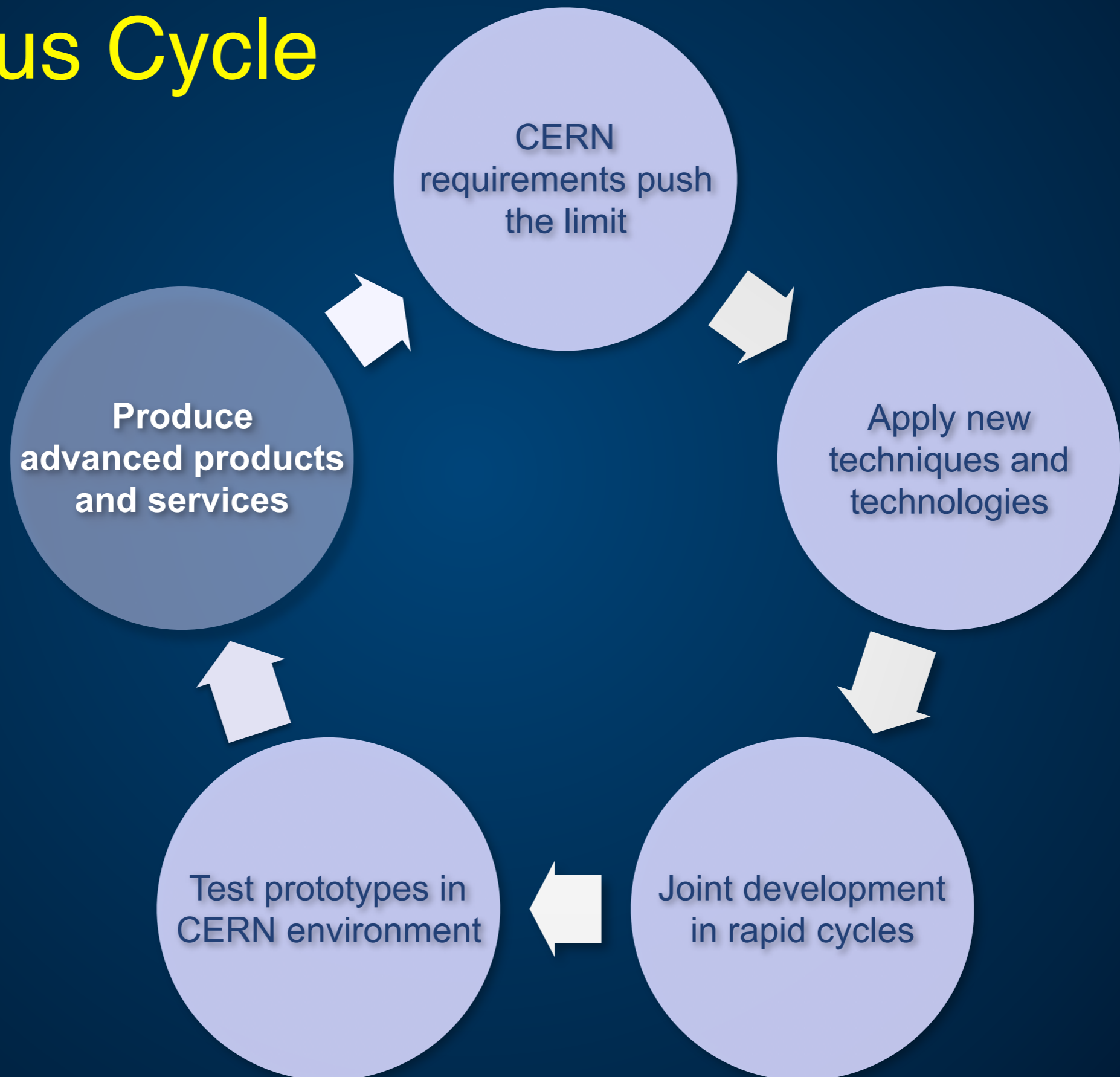
- science – industry partnership to drive innovation
- over a decade of success
- Evaluate state-of-the-art technologies in a challenging environment and improve them:  
**“ you make it, we break it ”**
- Test in a research environment today what will be used in many business sectors tomorrow
- Train next generation of engineers/employees

## **Domains (a few examples):**

- Automation and control
- Data storage architectures
- Data analytics
- Security, networks, connectivity

**The cloud** : becoming an important topic

# Public - Private partnership: a Virtuous Cycle



**What for?**

# Example: World Wide Web



*interesting, but vague...*

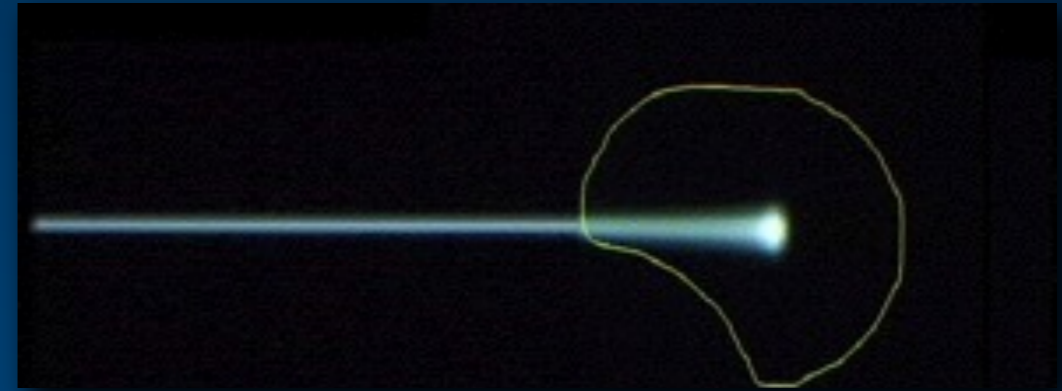


[www.cern.ch](http://www.cern.ch)

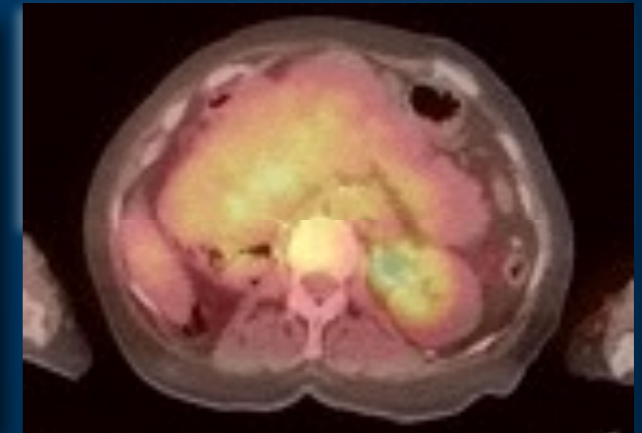
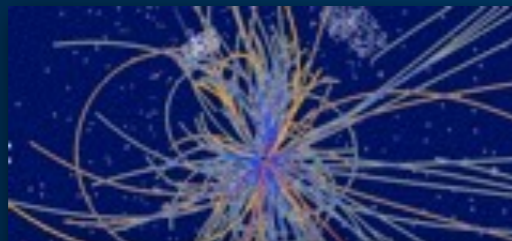
developed ~25 years ago:  
not foreseen that it would revolutionize the way we communicate

# Example: Medical Applications

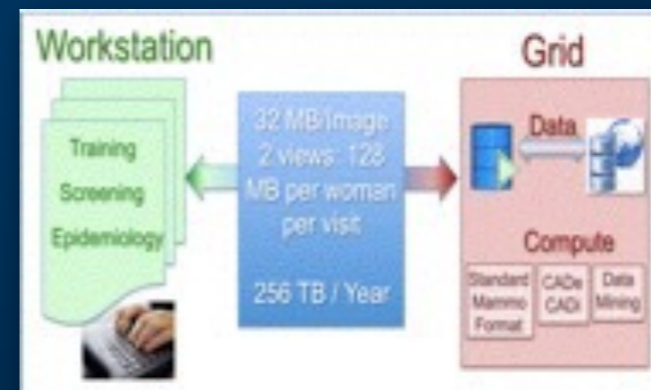
Particle beams from accelerators to fight cancer



Particle detector technologies for (bio-) medical imaging

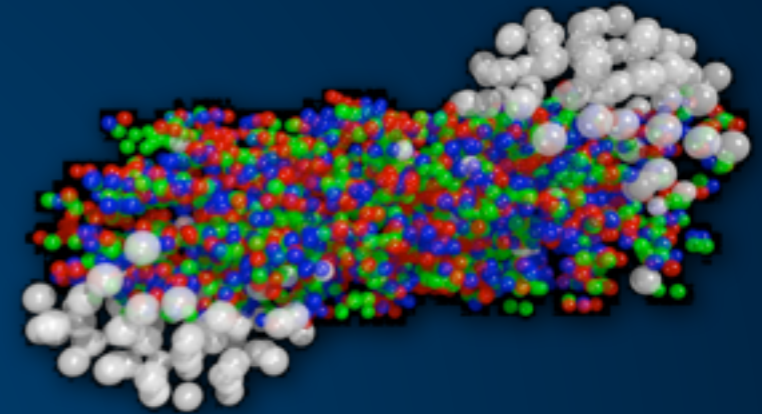


Grid technology for medical data administration and analysis



# A few more thoughts...

- more atoms in your fingertip than stars in the Universe



- we are made of 13 billion years old building blocks

- we are made of star dust

