

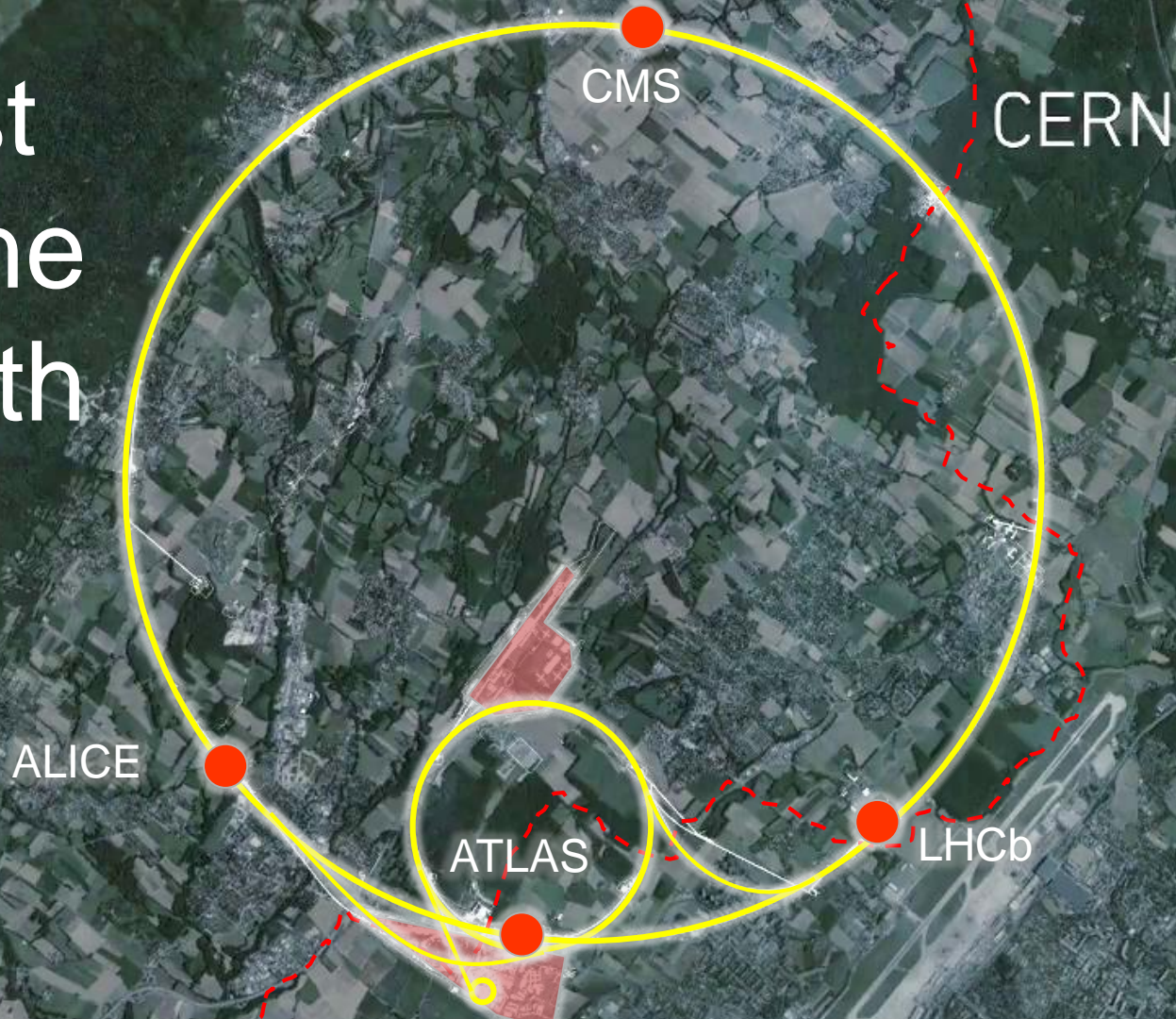


OpenStack at CERN

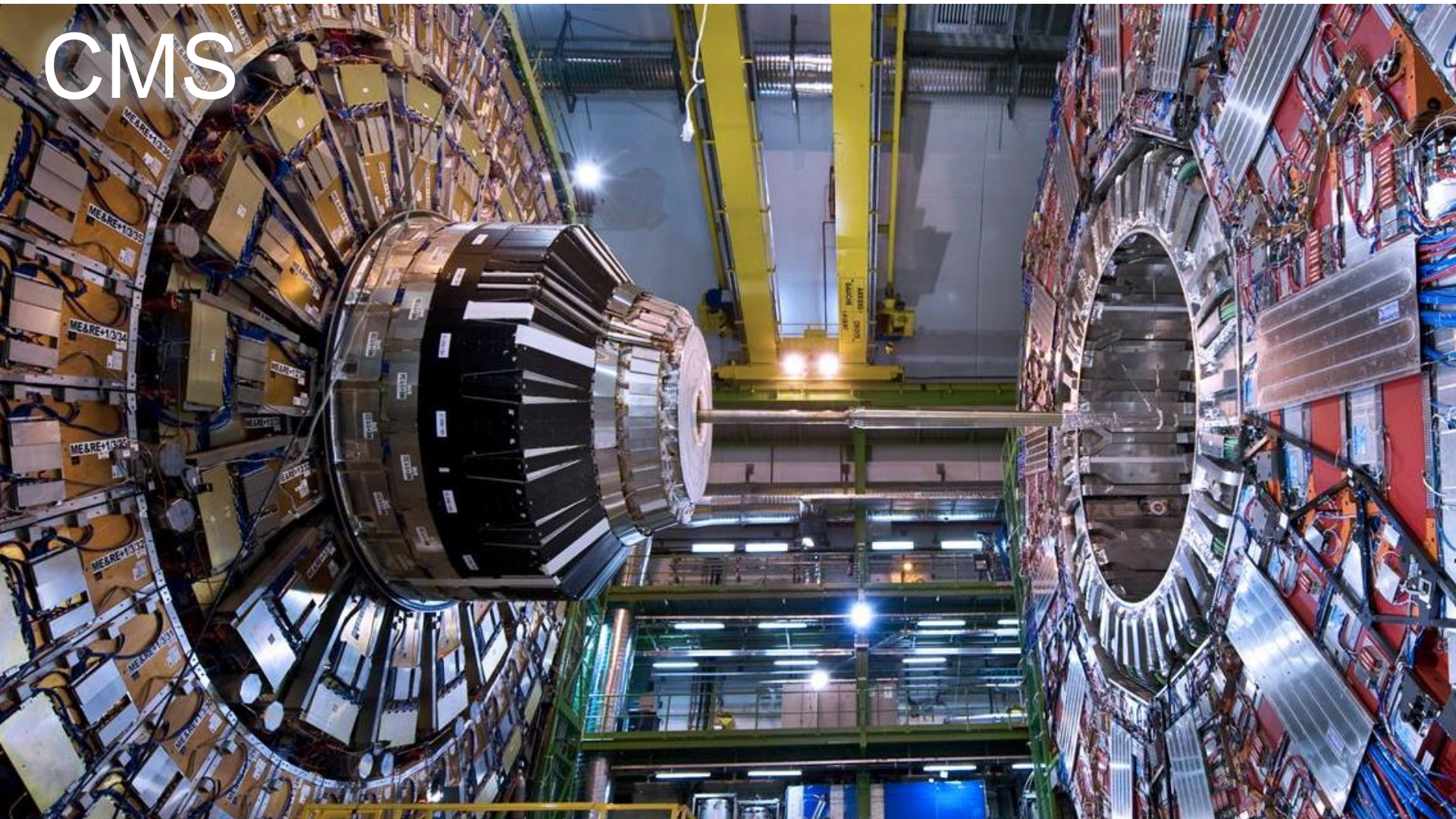
Barcelona Summit 2016



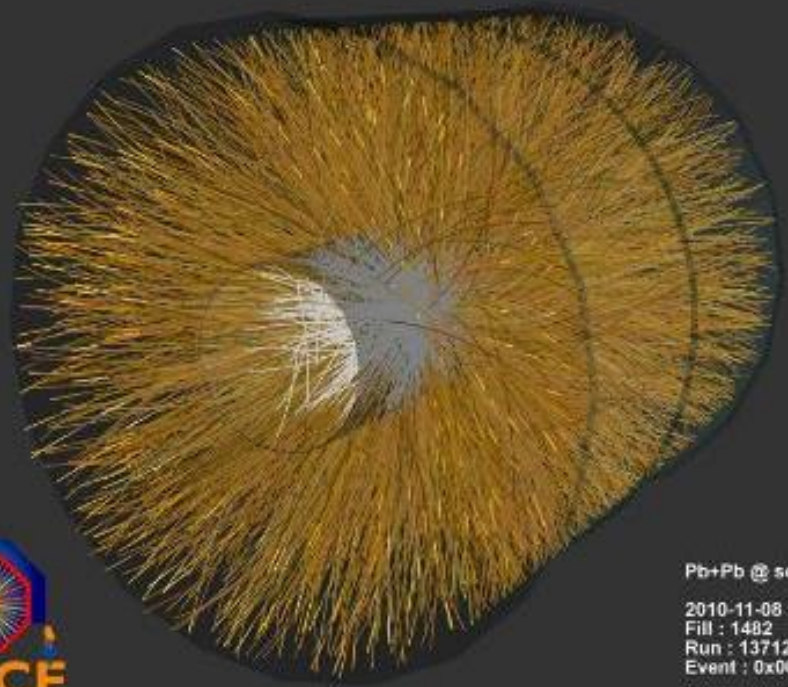
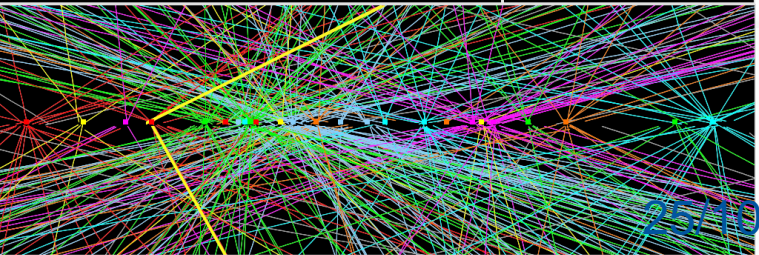
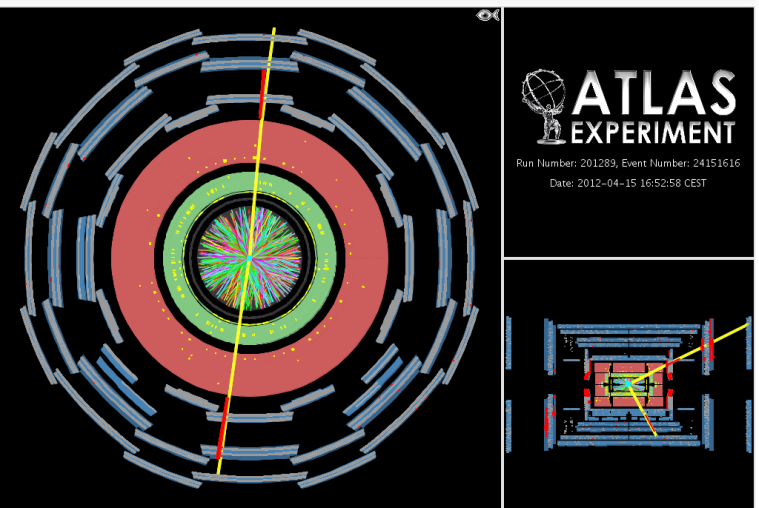
Largest machine on Earth



CMS

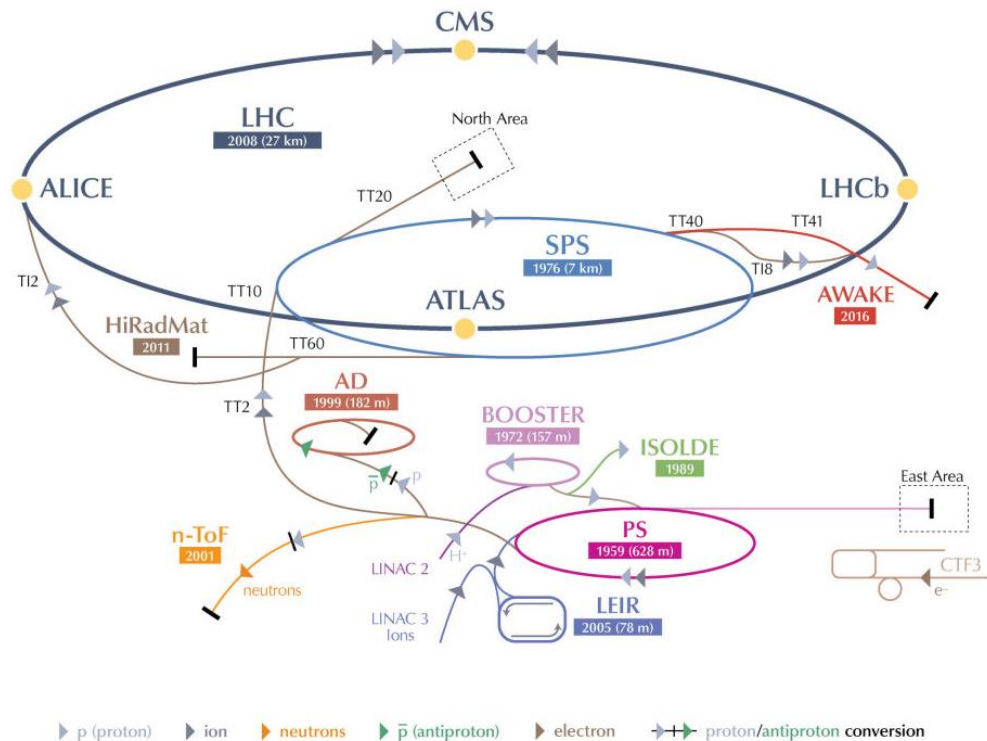


1 Billion Collisions/s



Pb+Pb @ sqrt(s) = 2.76 ATeV
2010-11-08 11:30:46
Fill : 1482
Run : 137124
Event : 0x00000000D3BBE693

CERN's Accelerator Complex



LHC Large Hadron Collider SPS Super Proton Synchrotron PS Proton Synchrotron

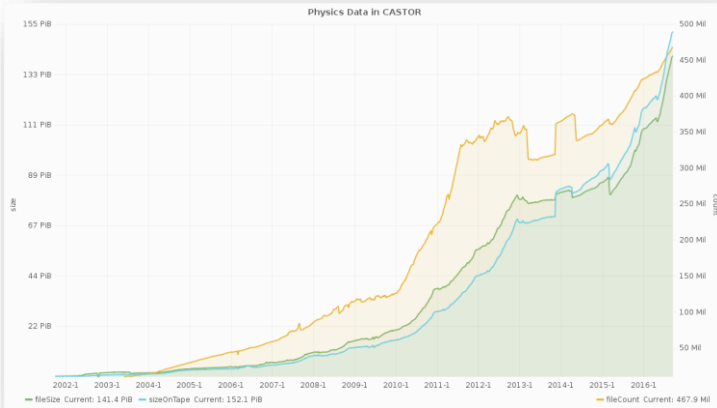
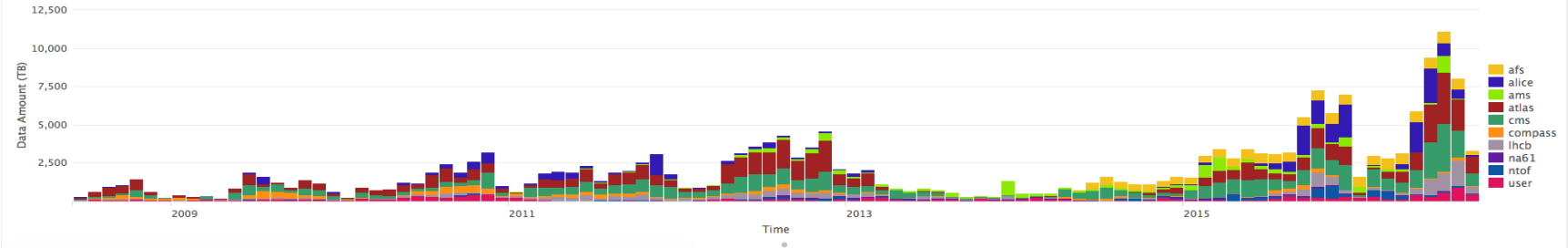
AD Antiproton Decelerator CTF3 Clic Test Facility AWAKE Advanced WAKEfield Experiment ISOLDE Isotope Separator OnLine Facility

LEIR Low Energy Ion Ring LINAC LINear ACcelerator n-ToF Neutrons Time Of Flight HiRadMat High-Radiation to Materials



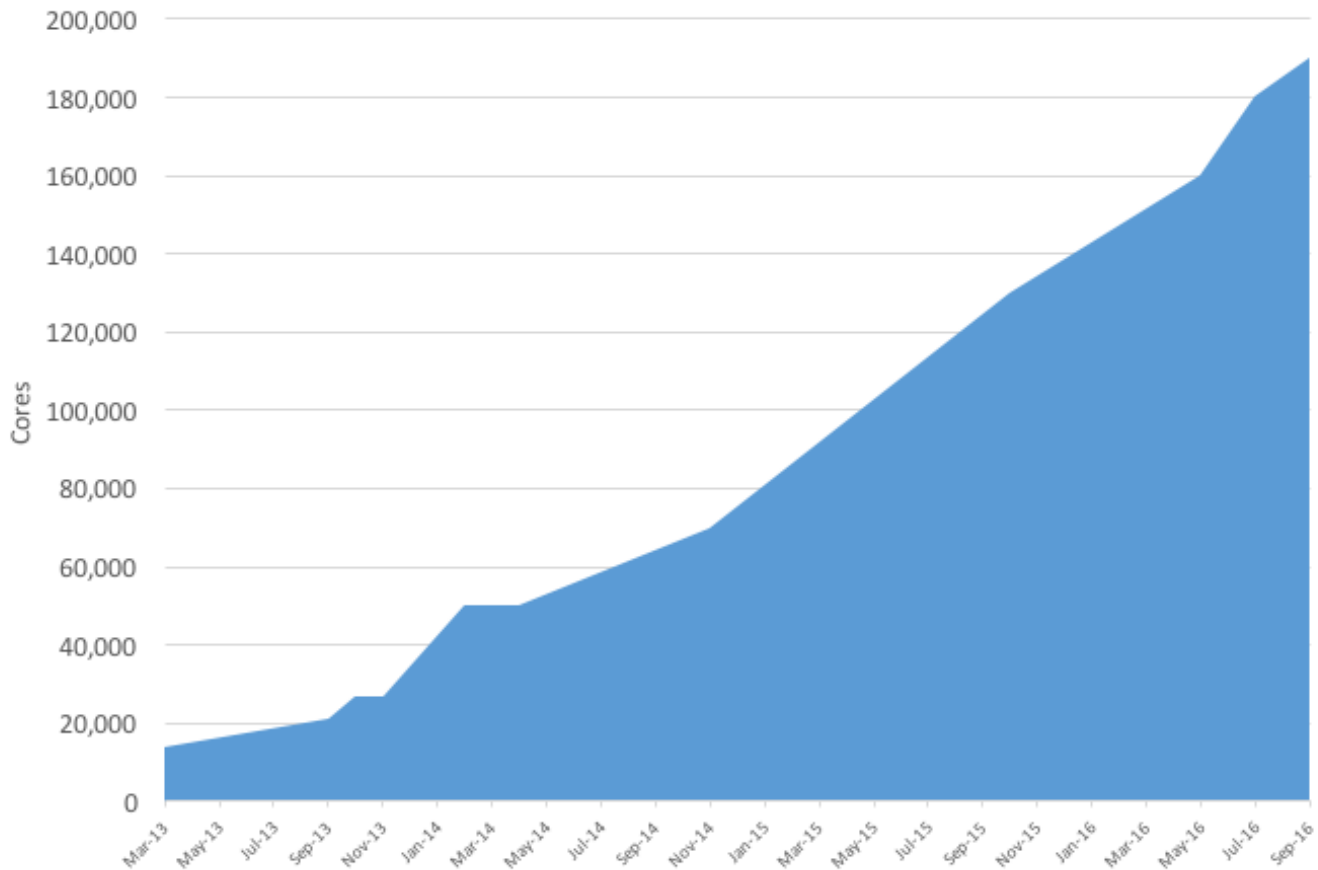
2016 : A lot of physics

Transferred Data Amount per Virtual Organization for WRITE Requests



- ~160 PB stored on tape at CERN
- June-Aug 2016 recorded >0.5 PB / day
- Outlook is for 60x compute increase by 2023 but the budget outlook for servers and people is flat

CERN IT OpenStack Cloud Evolution



- >190K cores in production under OpenStack
- >90% of CERN compute resources are virtualised
- >5,000 VMs migrated from old hardware in 2016
- >100K cores to be added in the next 6 months

Containers on Clouds



For the user

- Interactive
- Dynamic

For IT - Magnum

- Secure
- Managed
- Integrated
- Scalable

There will be many disruptive technologies within this framework

Higgs decay to two photons

The Standard Model predicted the decay of the [Higgs bosons](#) into photons. The process is depicted by the diagrams below:

(a) (b) (c)

At the [Large Hadron Collider](#), this process has been measured. This figure shows how an Higgs boson decay looks in the CMS detector.

This ROOTbook illustrates a simplified fitting procedure aiming to identify the peak due to the Higgs boson decay over the exponentially falling background.

Importing input data into a ROOT file

First of all we import the input data, here simplistically stored into a text file, into a [ROOT file](#).

```
In [1]: TTree tree("HiggsTree", "The tree cont");
auto nevt = tree.ReadFile("Hgg.txt", "x");
if (nevt <= 0) {
```

Hybrid Clouds for Science

- LHC workloads on public clouds?



SOFTLAYER[®]
an IBM Company

Microsoft Azure

 **DARZ**
Daten sind wertvoller als Geld


ClouData

 **rackspace**
the #1 managed cloud company

iNNOVO
CLOUD

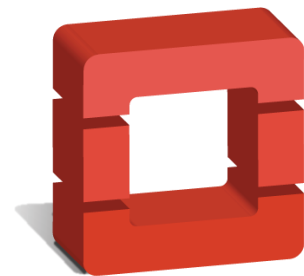
CLOUD & HEAT

 **ULTIMUM**
TECHNOLOGIES

•• **T** •• **Systems** •

Atos

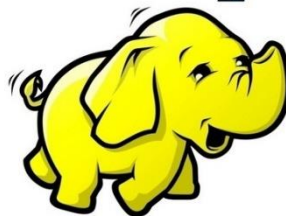
Thanks for your help!



FOREMAN



RUNDECK



Jenkins

For Further Information



CERN home page is at <http://home.cern/>

Technical details on the CERN cloud at <http://openstack-in-production.blogspot.fr>

Custom CERN code is at <https://github.com/cernops>

Scientific Working Group at https://wiki.openstack.org/wiki/Scientific_working_group

CERN OpenStack story from OpenStack Paris 2014 at <https://www.youtube.com/watch?v=7k3VnWXOjP4>

Helix Nebula details at <http://www.helix-nebula.eu/>