



SC12

Salt Lake City, Utah

Conference Dates:
November 10-16, 2012

Exhibition Dates:
November 12-15, 2012

IEEE
computer
society



Association for
Computing Machinery

Infrastructure Clouds for Science and Education: ATLAS High Energy Physics on the Cloud

Patrick Armstrong

University of Chicago

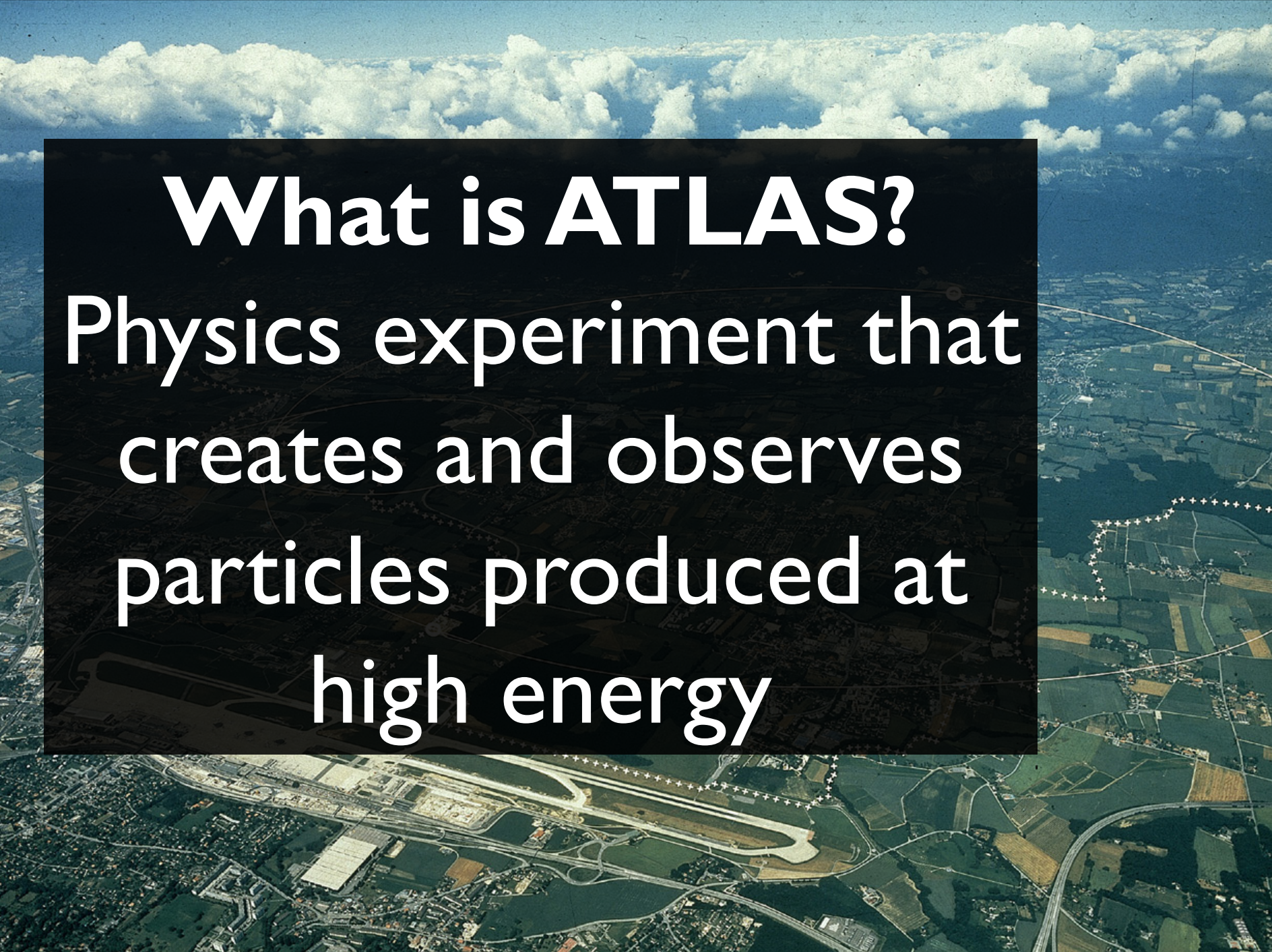


The ATLAS Experiment

One of the particle physics
experiments at the
Large Hadron Collider (LHC)
in Geneva

What is ATLAS?

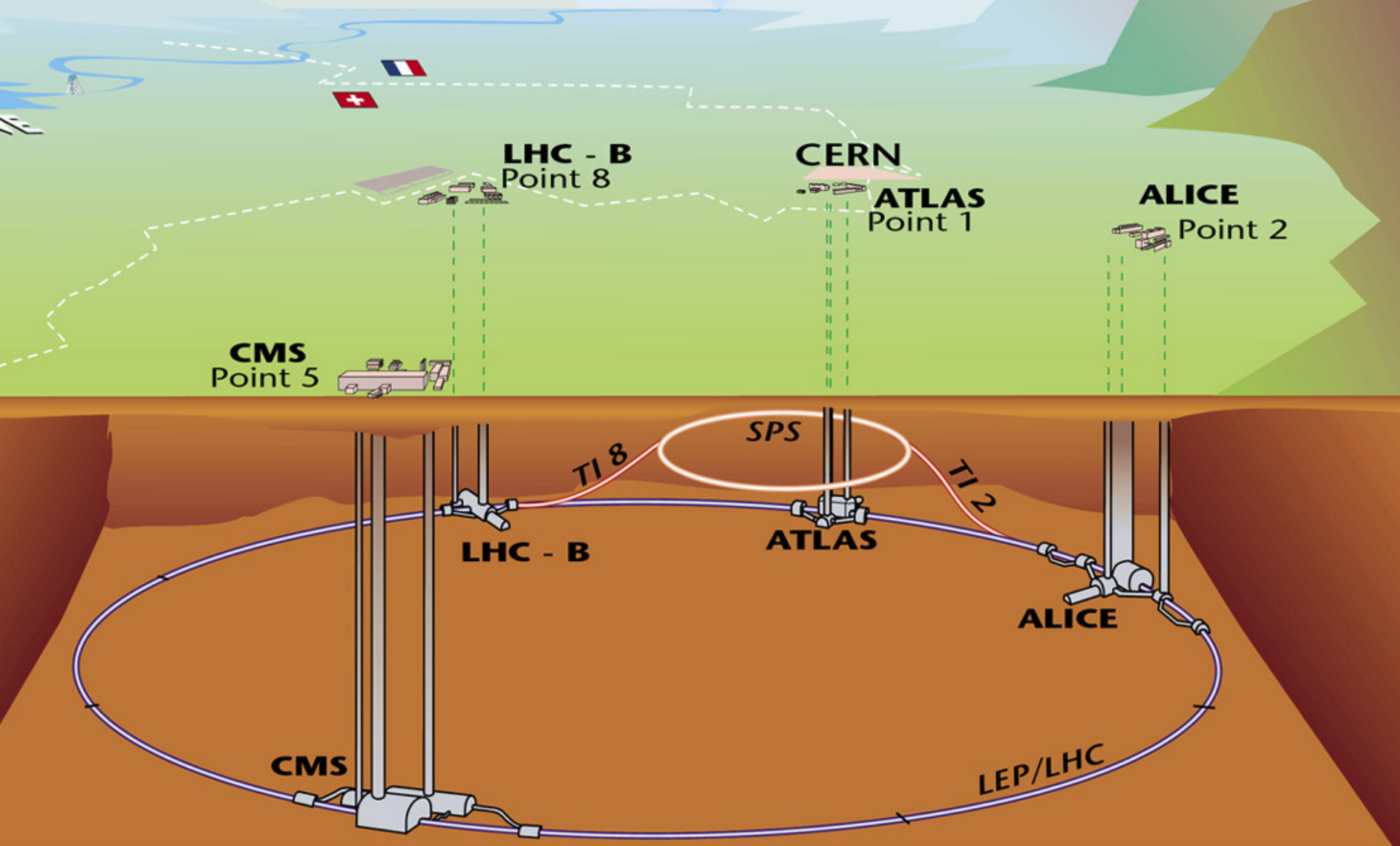
Physics experiment that
creates and observes
particles produced at
high energy



The Accelerator:

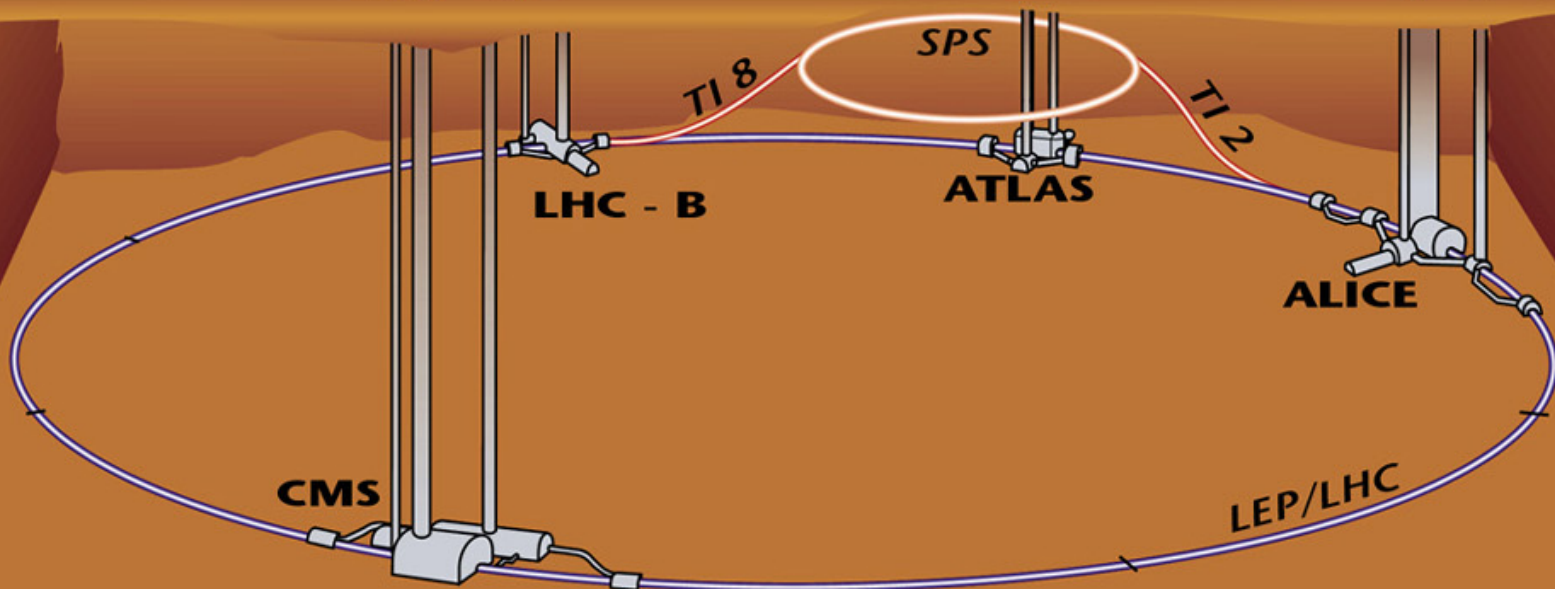


The Accelerator:

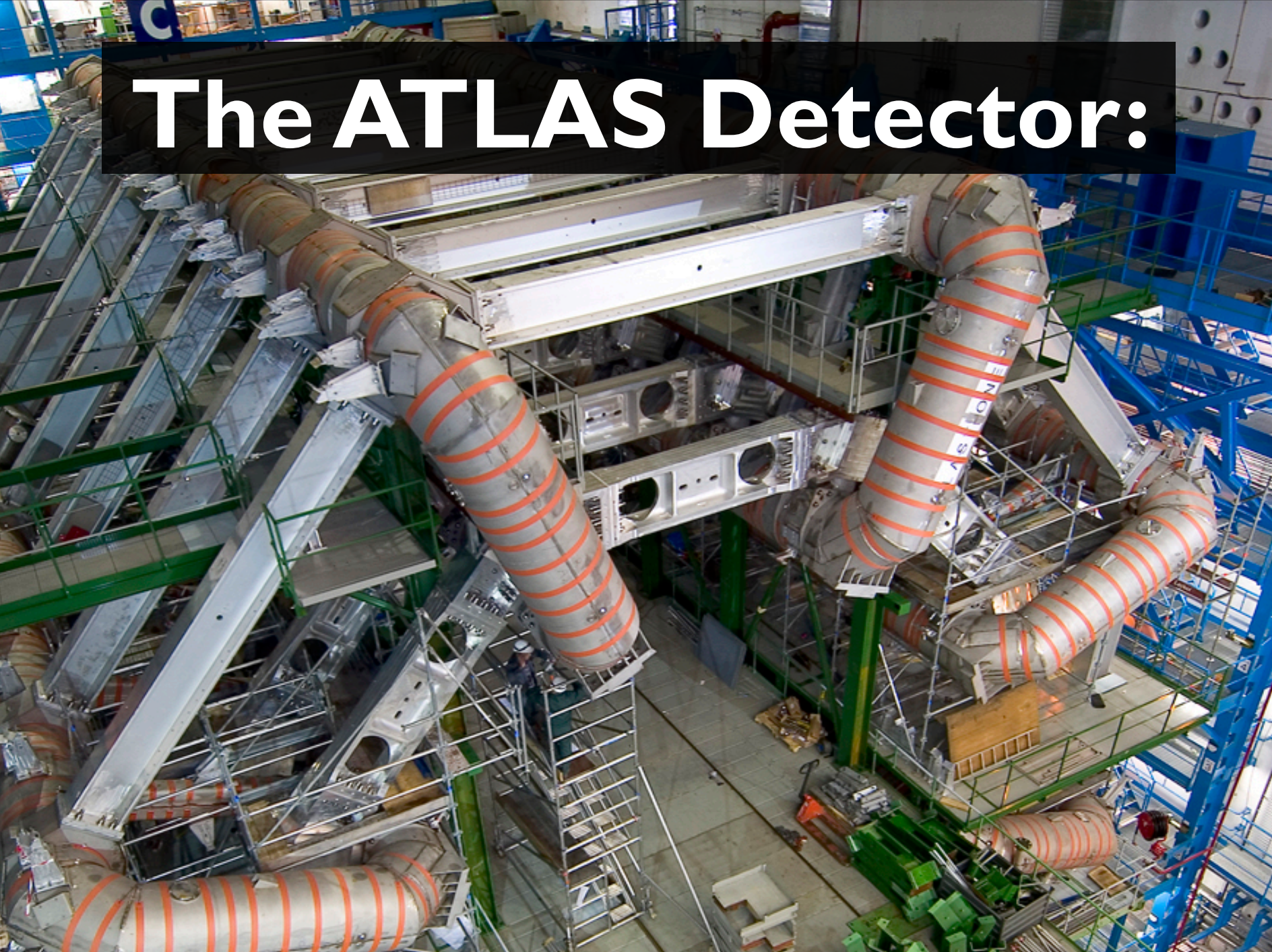


The Accelerator:

Particles are accelerated at high energy, and are collided in the detector



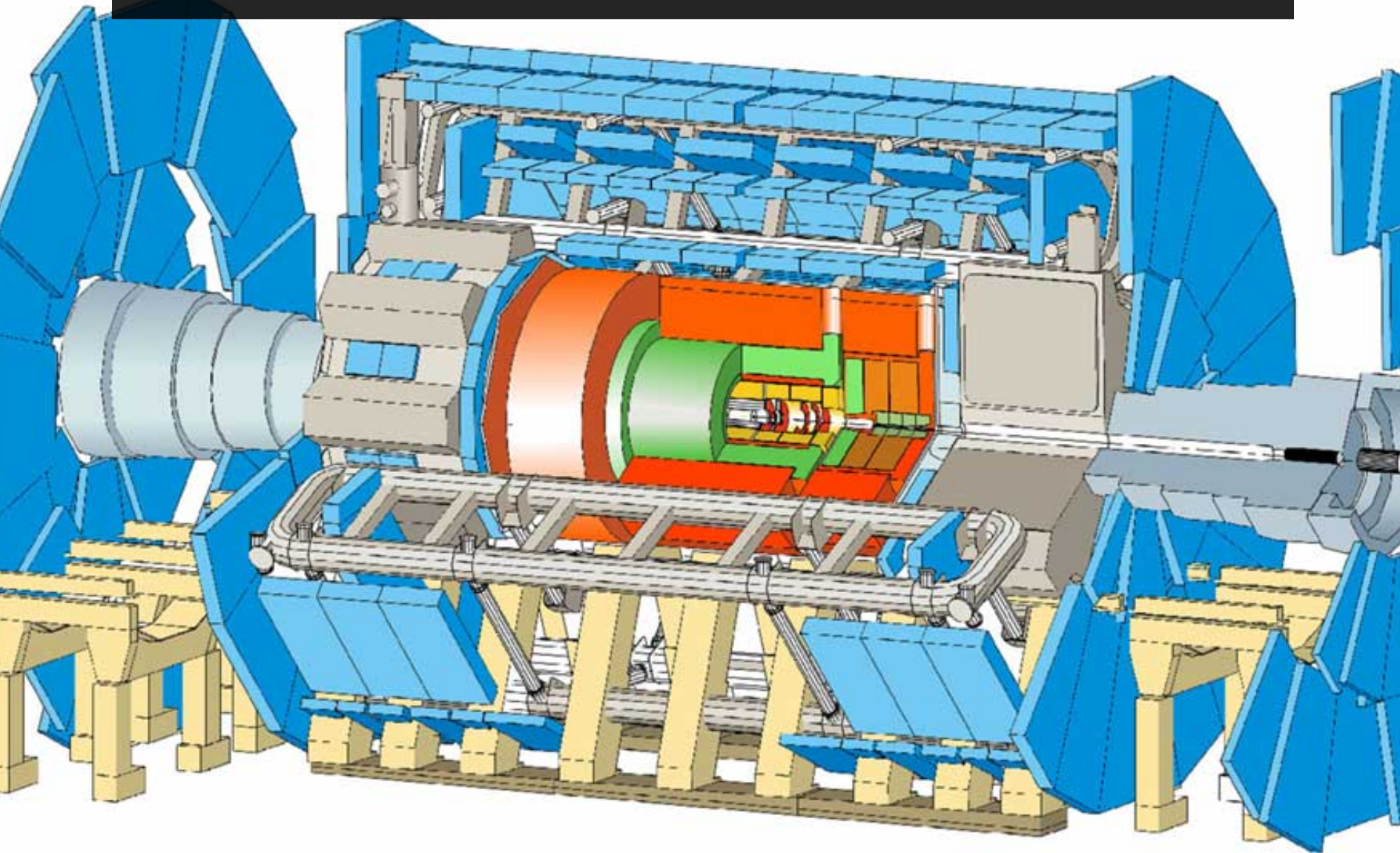
The ATLAS Detector:





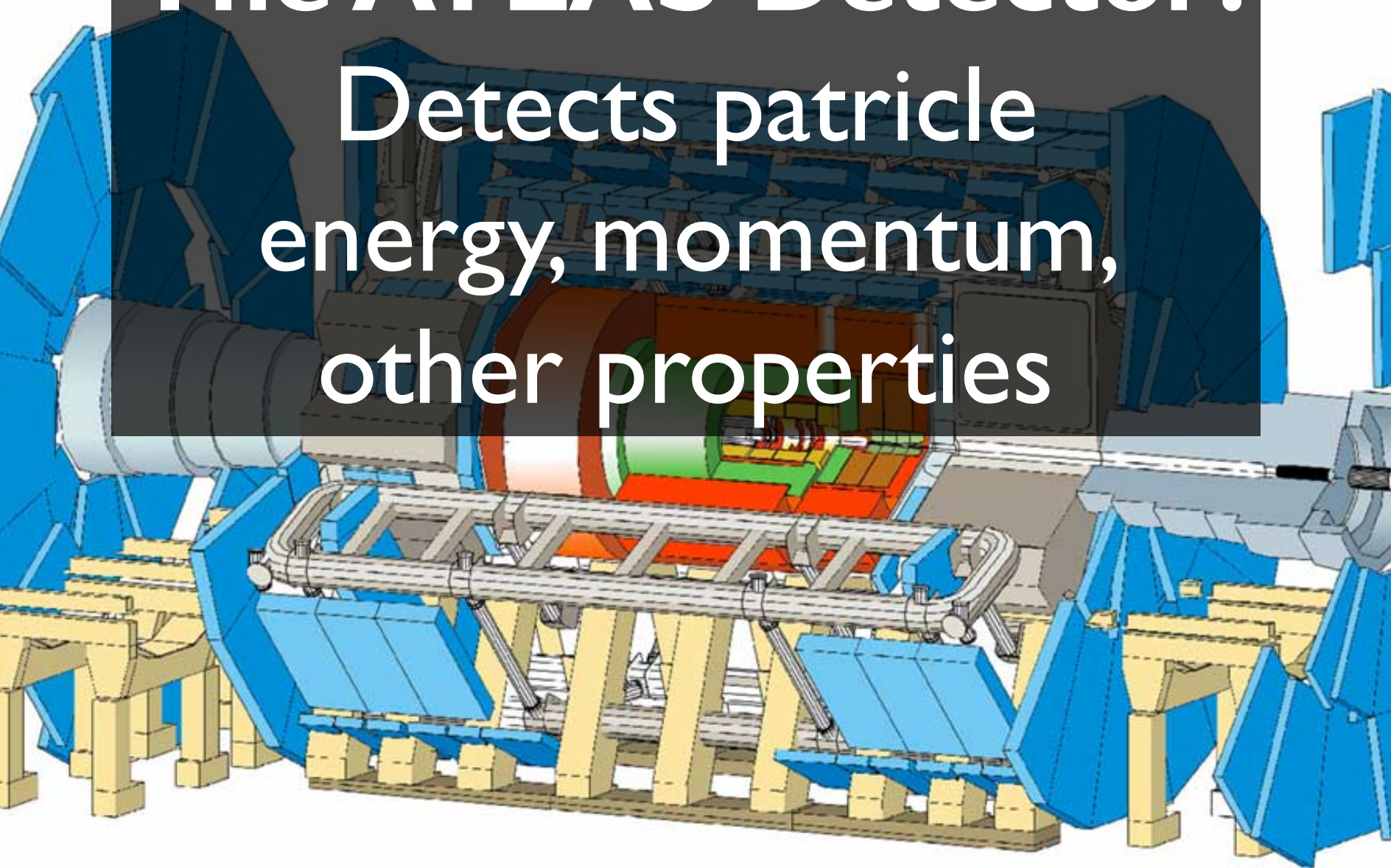
The ATLAS Detector:
Detects different particles
produced by collision
with a broad range of
energies.

The ATLAS Detector:



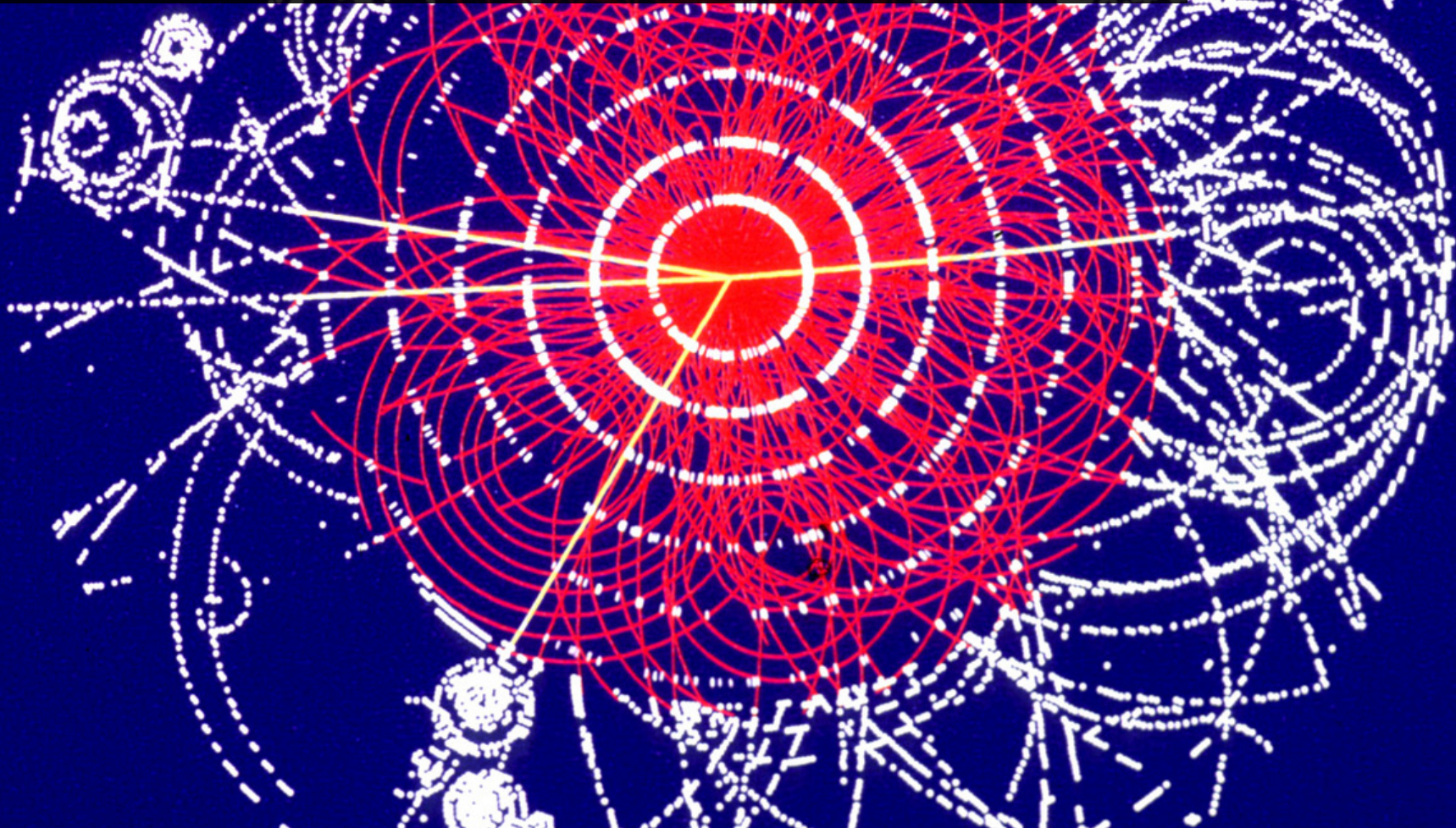
The ATLAS Detector:

Detects particle
energy, momentum,
other properties



Collision:

Particles after collision



Collision: In the detector



Results



Higgs search
update 04.07.2012



Higgs search
update 04.07.2012



Sergio BERTOLUCCI
Director for Research
& Scientific Computing



Fabiola GIANOTTI
ATLAS Spokesperson



Rolf HEUER
CERN Director-General



Joe INCANDELA
CMS Spokesperson



Stephen MYERS
Director for Accelerators
& Technology



Results:

“CERN experiments observe particle
consistent with long-sought
Higgs boson”



Computing:

More than 200,000 processing cores
and 150 petabytes of disk space,
distributed across 34 countries



WLCG

Worldwide LHC Computing Grid

Computing:

Tier-0: CERN, primary data storage

Tier-1: analysis, reconstruction, storage

Tier-2: analysis, production, reconstruction

Tier-3: Local researcher analysis



WLCG

Worldwide LHC Computing Grid

Cloud: Tier-3 and CernVM

Tier-3 analysis uses the CernVM to ease use and installation of software used in the experiment.

Deployed on cloud sites, and local PCs:



Cloud: Tier-3 and CernVM

Users have access to much more powerful machines for analysis than they would on their laptop, with minimal extra sysadmin burden



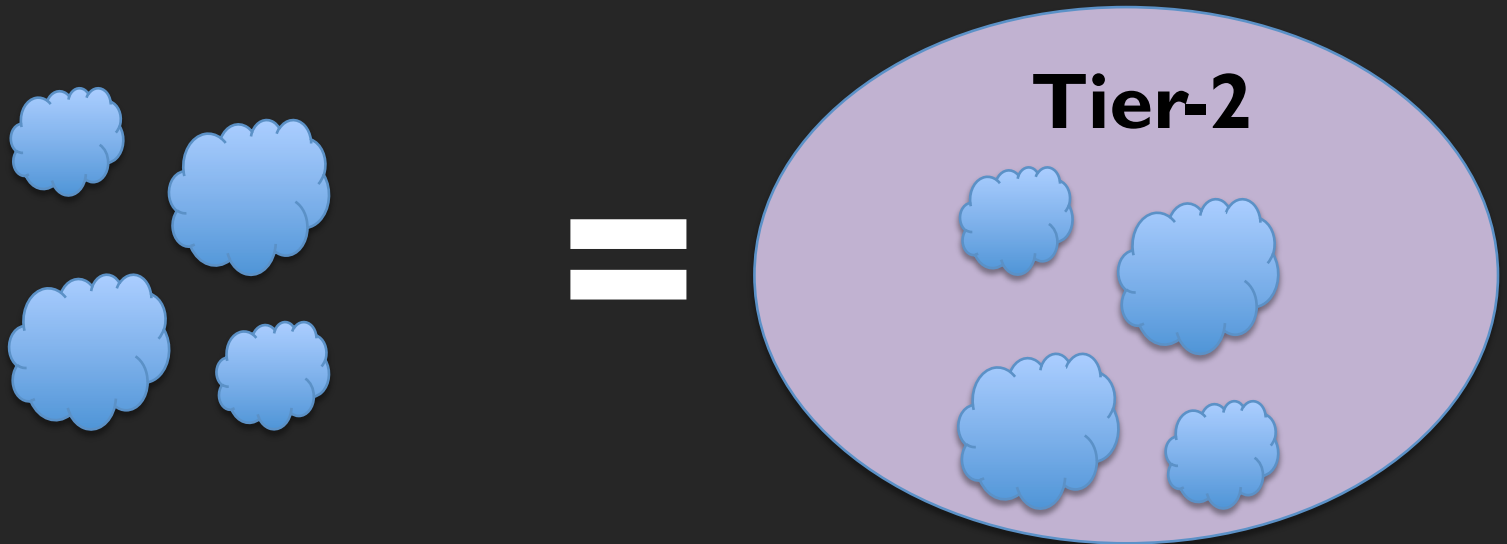
Cloud: Tier-2

“Hefty infrastructure” requiring significant effort and expertise.

How can smaller resources
(~100 cores) participate?

Cloud:Tier-2

Set up a virtual Tier-2 site that includes many cloud resources.



Why?

Scale up when there is
a higher demand for
simulation production.

Production is requested
by researchers.

How?

ATLAS jobs are submitted
to a Condor queue, and
Cloud Scheduler starts
CernVM instances in response.

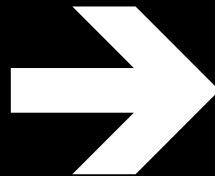
How?

Researcher creates a
Simulation job



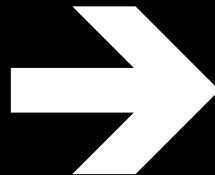
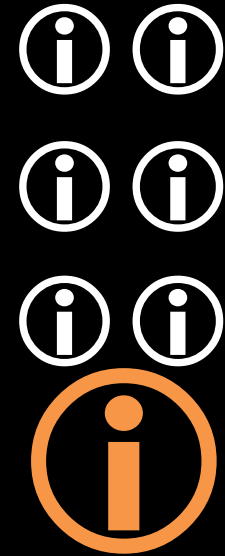
How?

Submits it to a queue



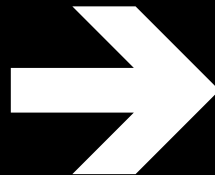
How?

Cloud Scheduler starts a VM



How?

...which runs the simulation.



How?

The result goes to researcher



How?

The VM is shut down



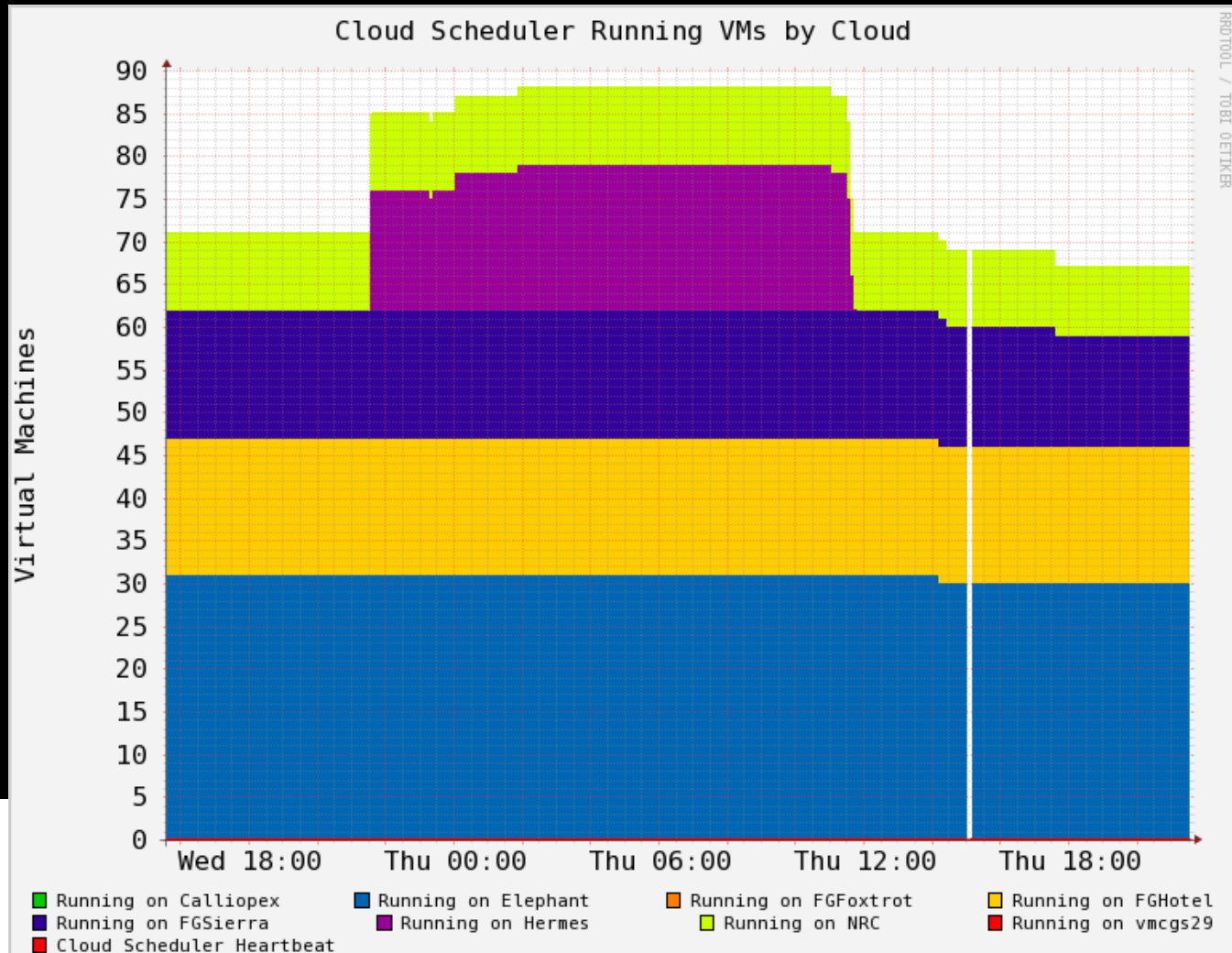
How?

The VM is shut down

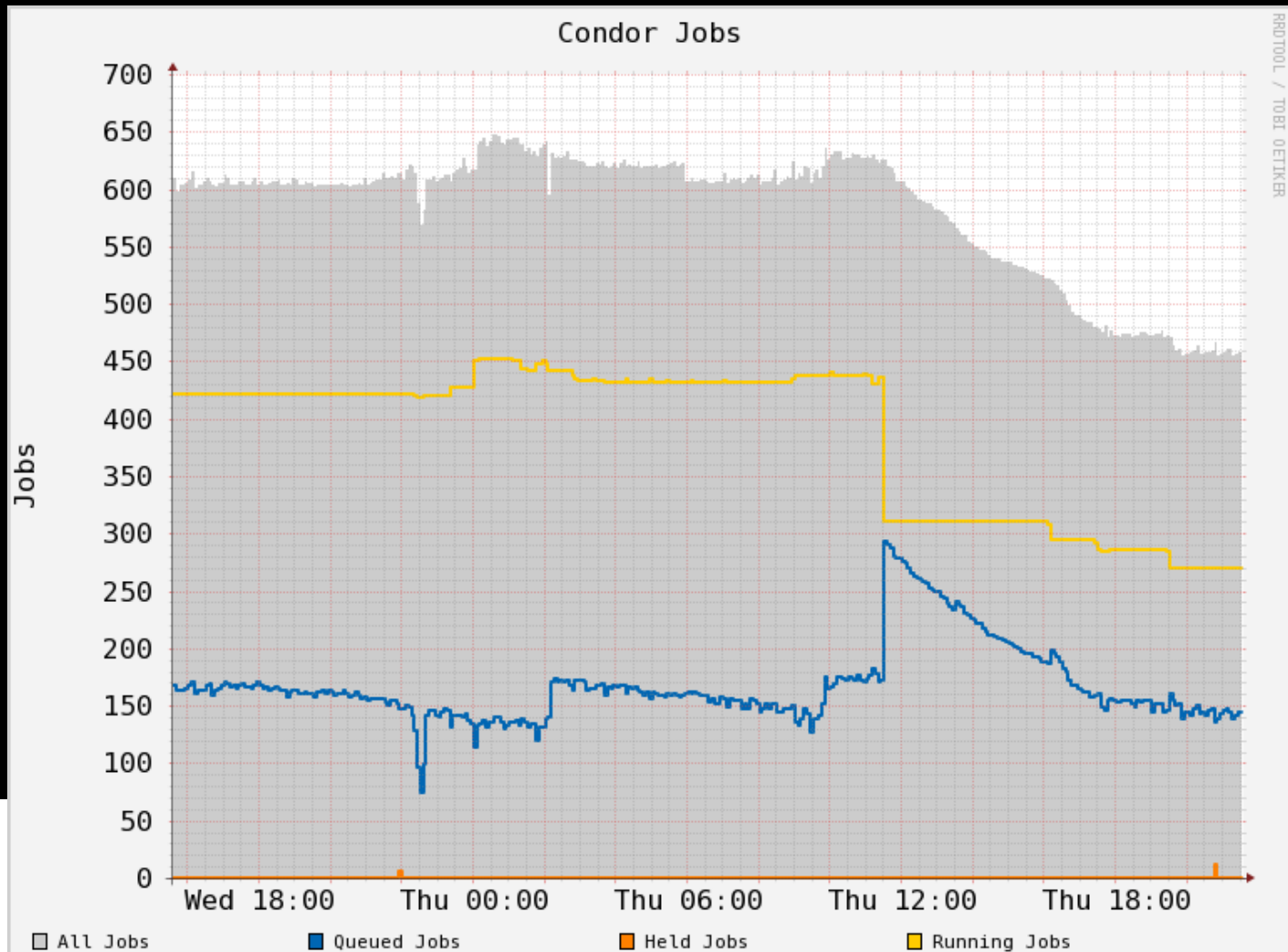


In Practice:

(8 core VMs)



In Practice: (jobs)



In Practice:

A virtual resource made
of a variety of resources
can be as effective as a
single site

More Details:

Randall Sobie (rsobie@uvic.ca)

heprc.phys.uvic.ca

cloudscheduler.org

atlas.ch

wlcg.web.cern.ch