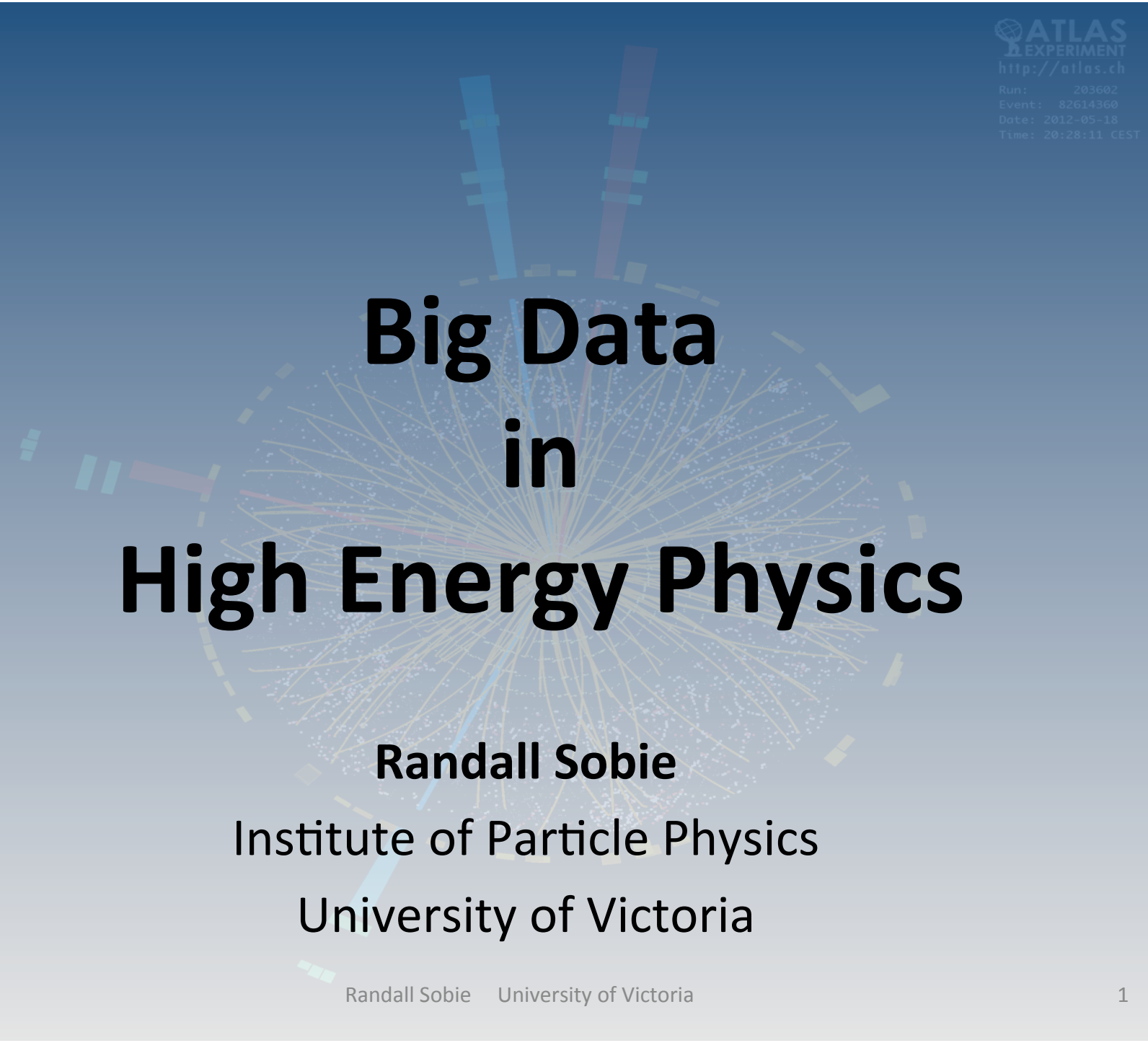


Big Data in High Energy Physics

Randall Sobie

Institute of Particle Physics

University of Victoria

High Energy Physics

(Particle Physics)

The area of physics that studies the fundamental particles of nature and their interactions.

Accelerators

SLAC Linear Accelerator

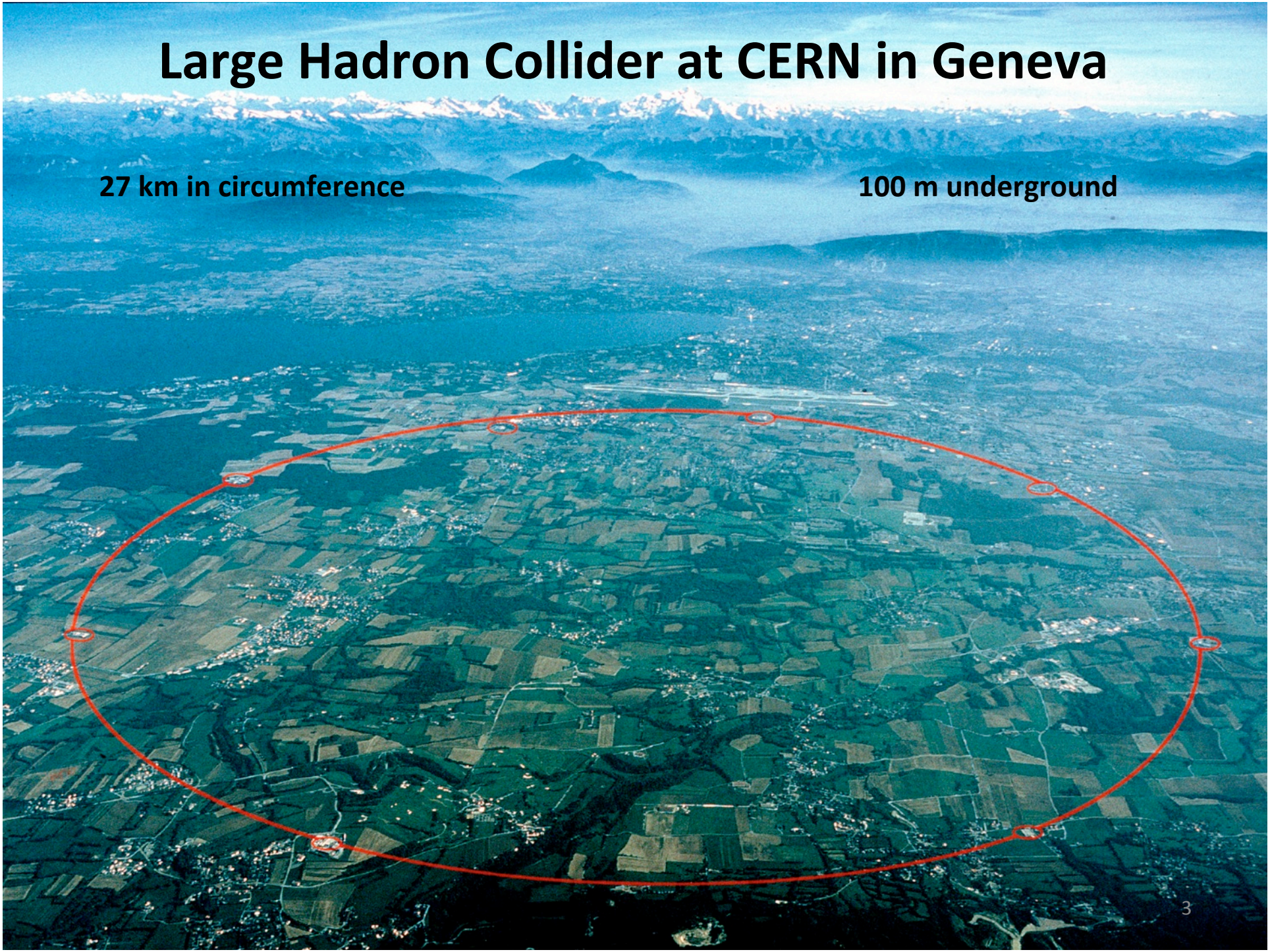
Underground labs

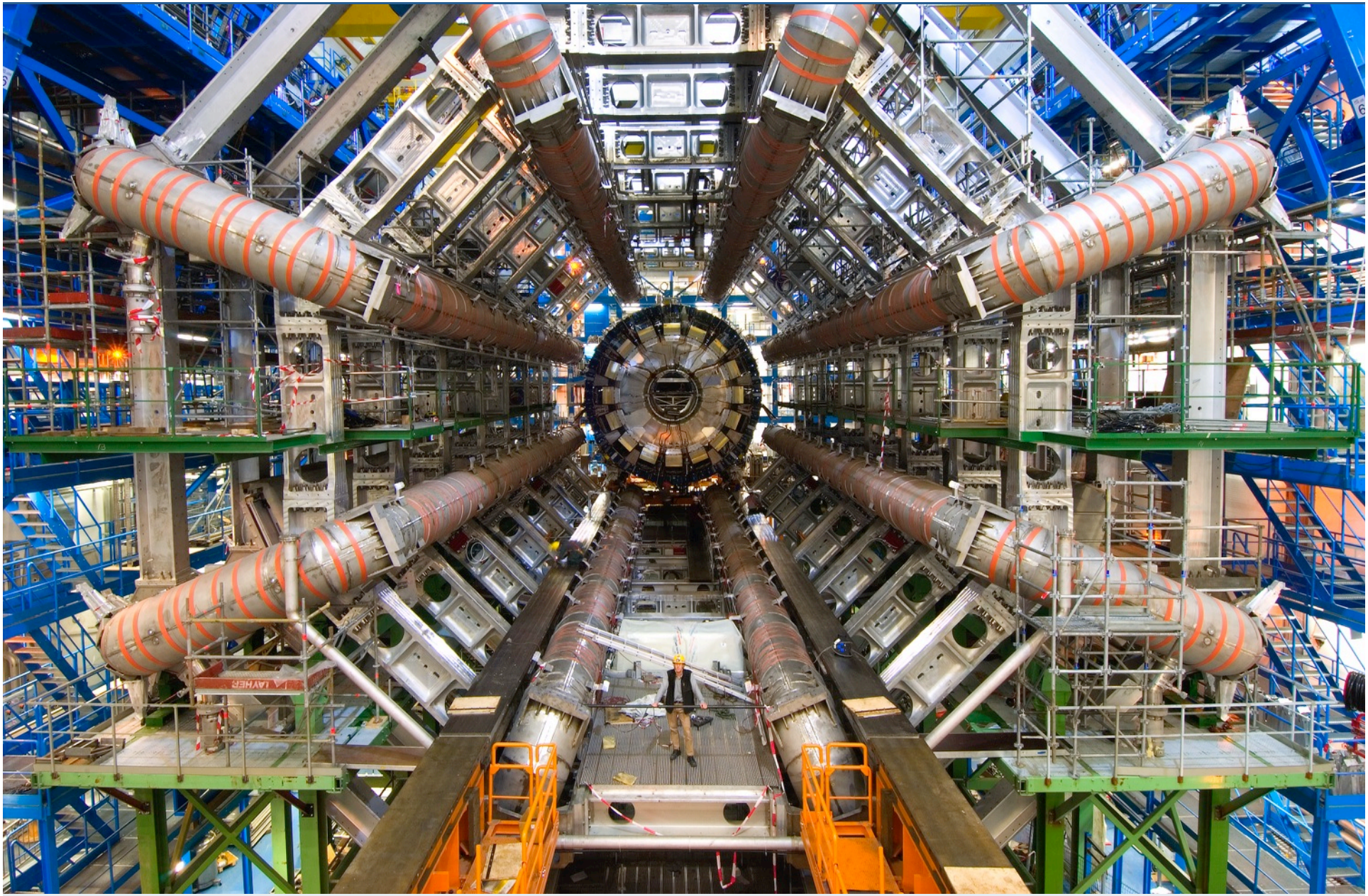
Sudbury Solar Neutrino Detector

Orbiting labs

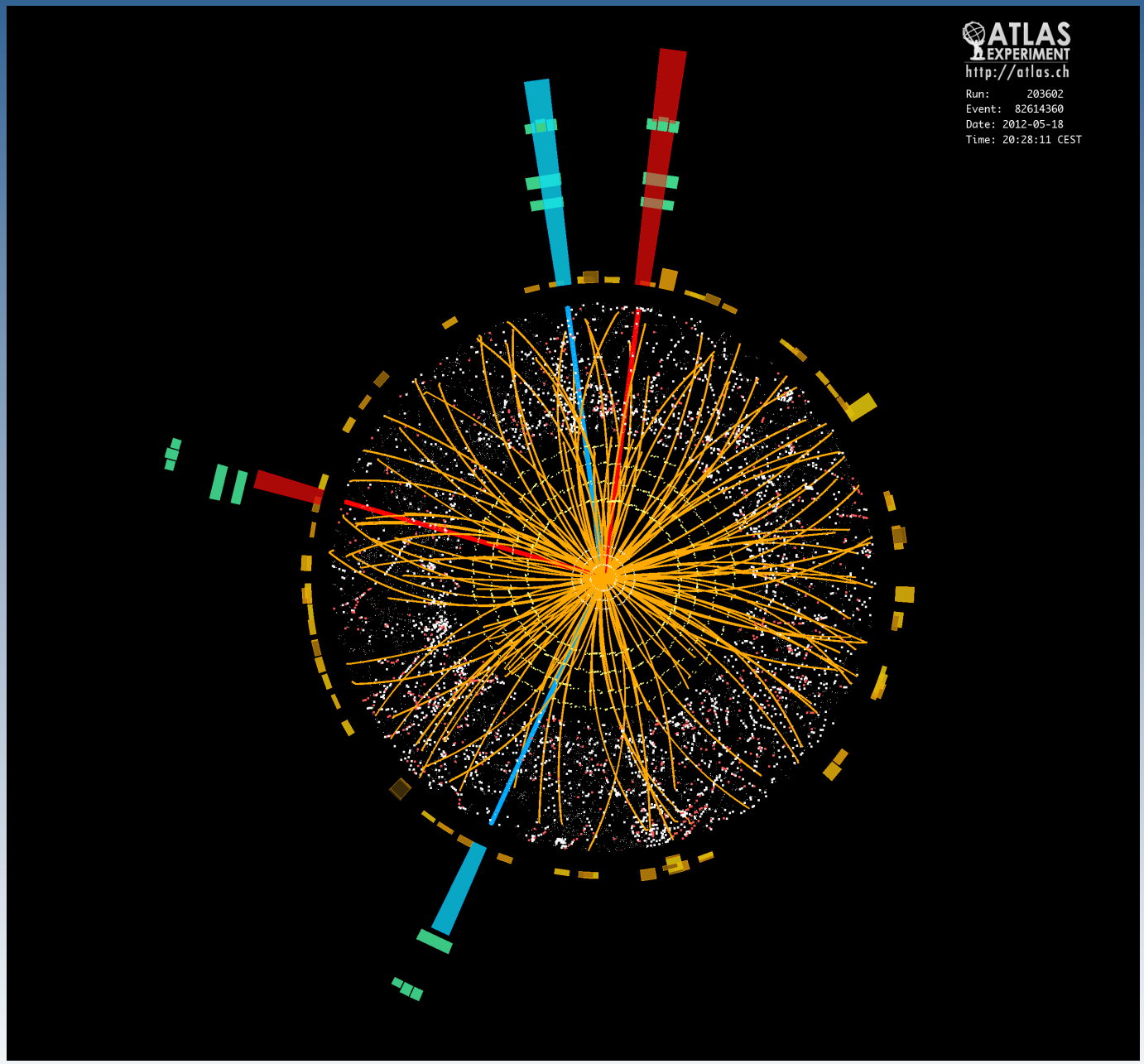
Alpha Magnetic Spectrometer
Space Station

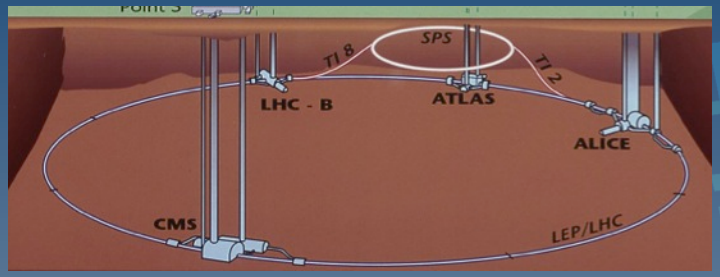
Large Hadron Collider at CERN in Geneva



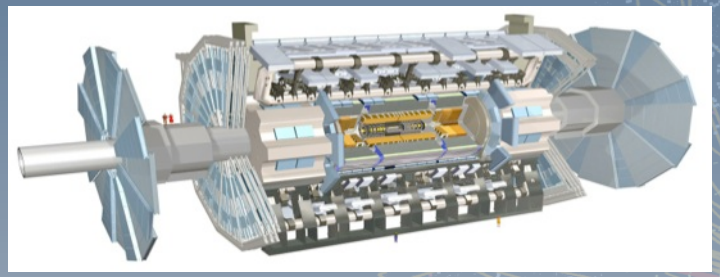


ATLAS detector during construction in 2005


ATLAS
EXPERIMENT
http://atlas.ch
Run: 203602
Event: 82614360
Date: 2012-05-18
Time: 20:28:11 CEST



40 million collisions per second

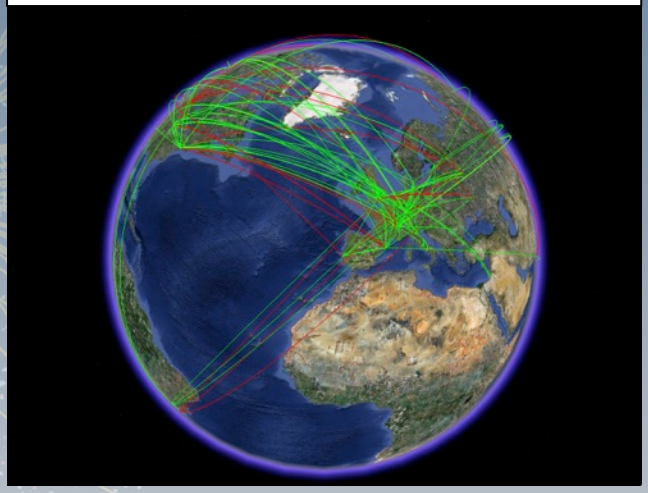


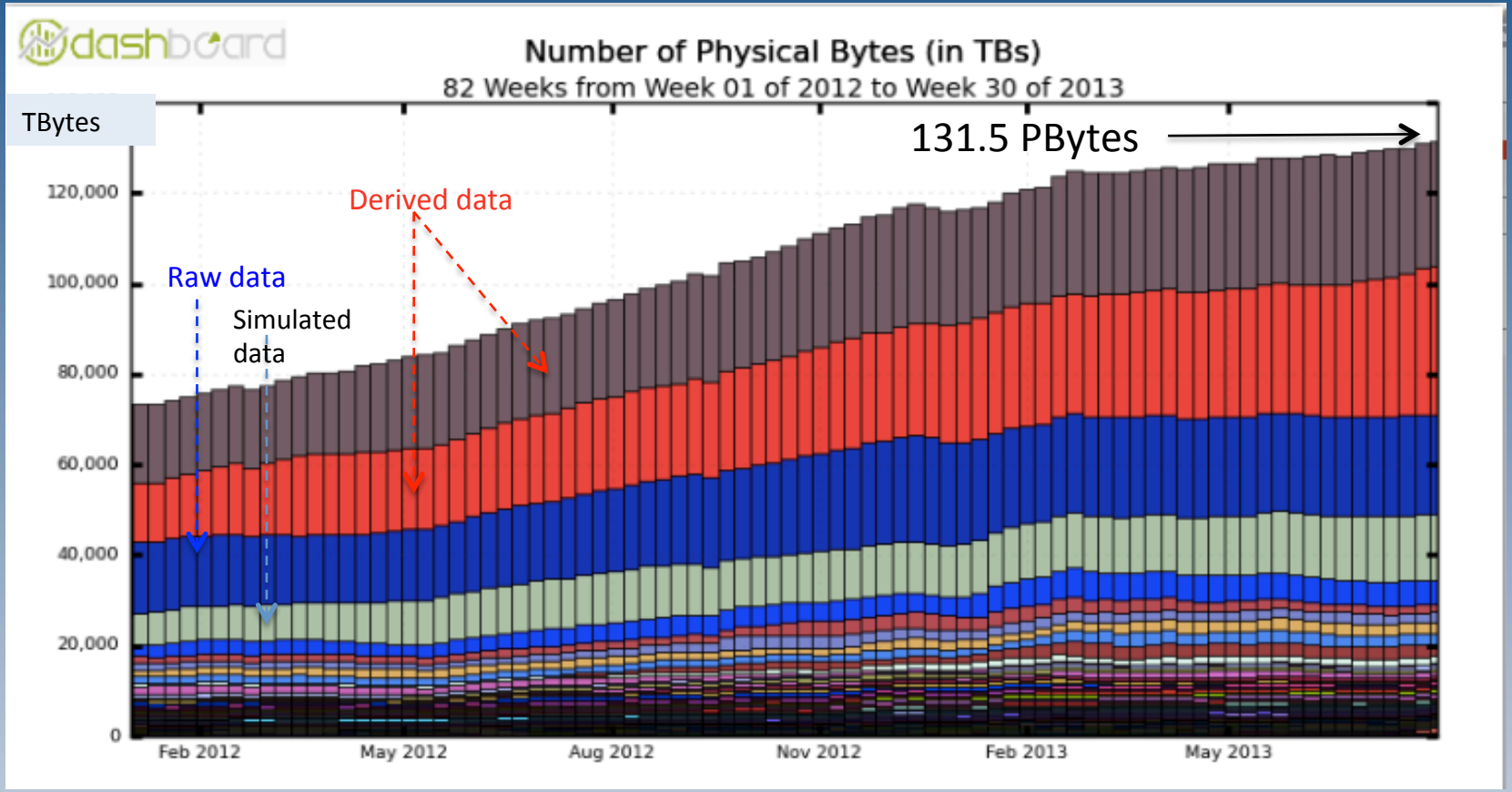
100,000 collisions selected

200 events per second

WLCG Computing Grid
CERN Tier 0
10 Tier1 sites
60+ Tier2 sites

140 PB data





Raw data is distributed to 10 *Tier 1* centres around the world

TRIUMF Laboratory in Vancouver is the Canadian ATLAS Tier 1 centre

Other samples distributed to ~60 *Tier-2* centre

McGill, Toronto, SFU and Victoria host T2 centres

Analysis jobs are sent to T2 centre that hosts the data

Big Data requires very high speed networks

HEPnet Canada

Responsible for national and international networks in for Canadian Subatomic Physics community

5G lightpath from Vancouver-Geneva

10G VPN for global LHC traffic

HEP is 50% of the Canadian research traffic

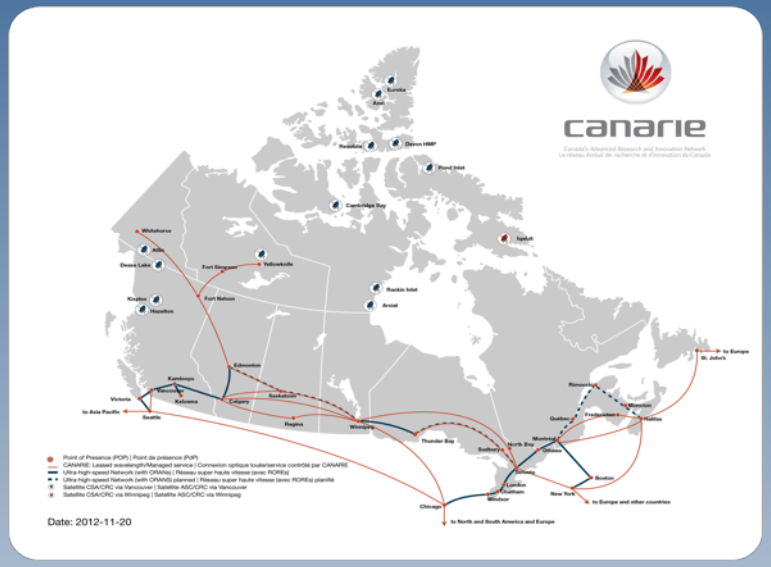
Testing 100G transatlantic link

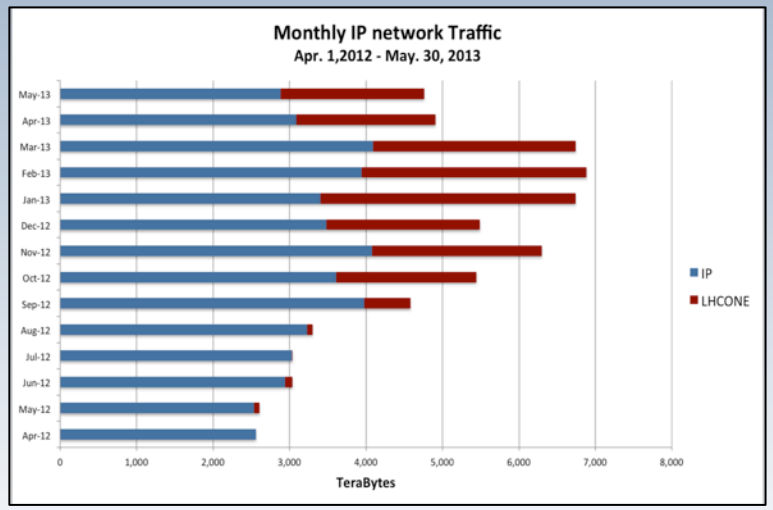
High-speed network demo projects

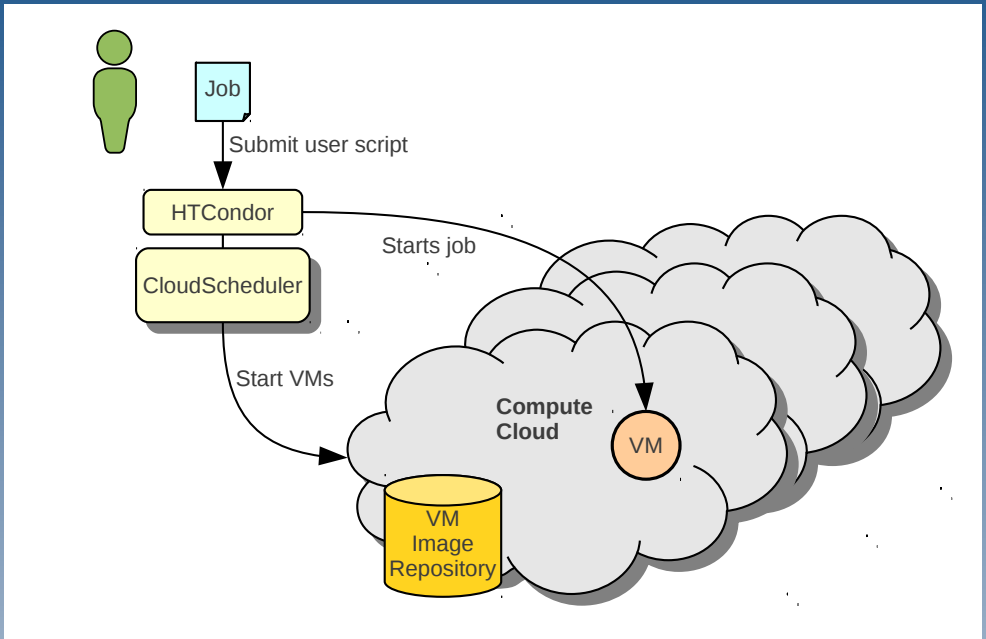
Set WAN world records

Exploring Software Define Networks (SDN)

Application controls the network







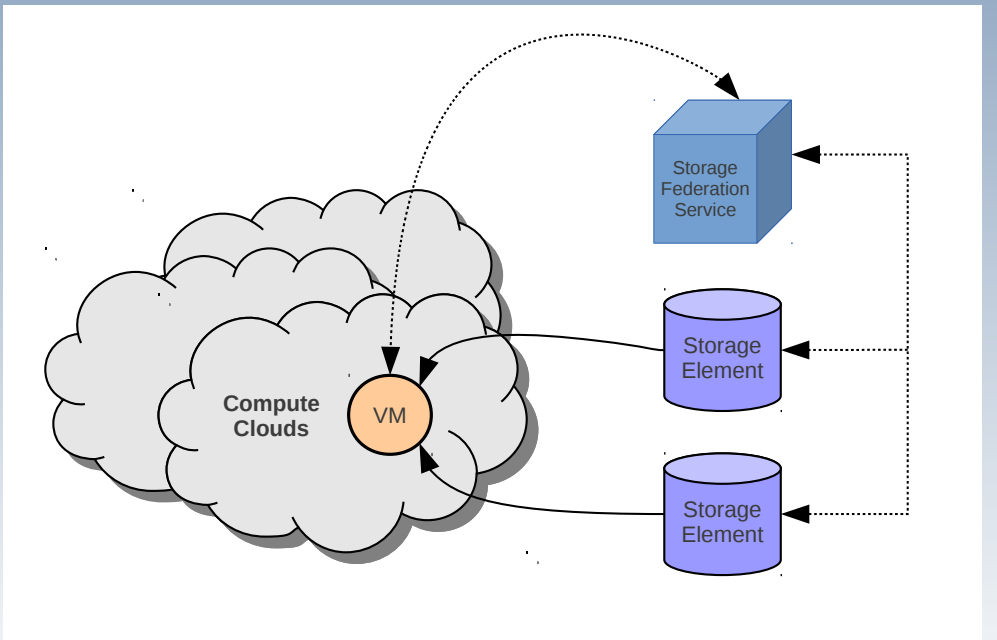
Batch cloud computing

Using 30 clouds in 3 continents

Workloads in excess of 2000 jobs for ATLAS and BelleII experiments

Storage federations

VM queries SF service to get reference to nearest storage element with a copy of the file



Big Data help us understand our universe

This requires world-class networks and fast storage facilities
Multi-100G networks is changing our computing models

Migrating to an on-demand model using computing clouds and federated storage

The New York Times **Science** July 4, 2012

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ENVIRONMENT SPACE & COSMOS

Physicists Find Elusive Particle Seen as Key to Universe

Pool photo by Denis Balibouse

Scientists in Geneva on Wednesday applauded the discovery of a subatomic particle that looks like the Higgs boson.