

High Energy Physics Applications on Grid

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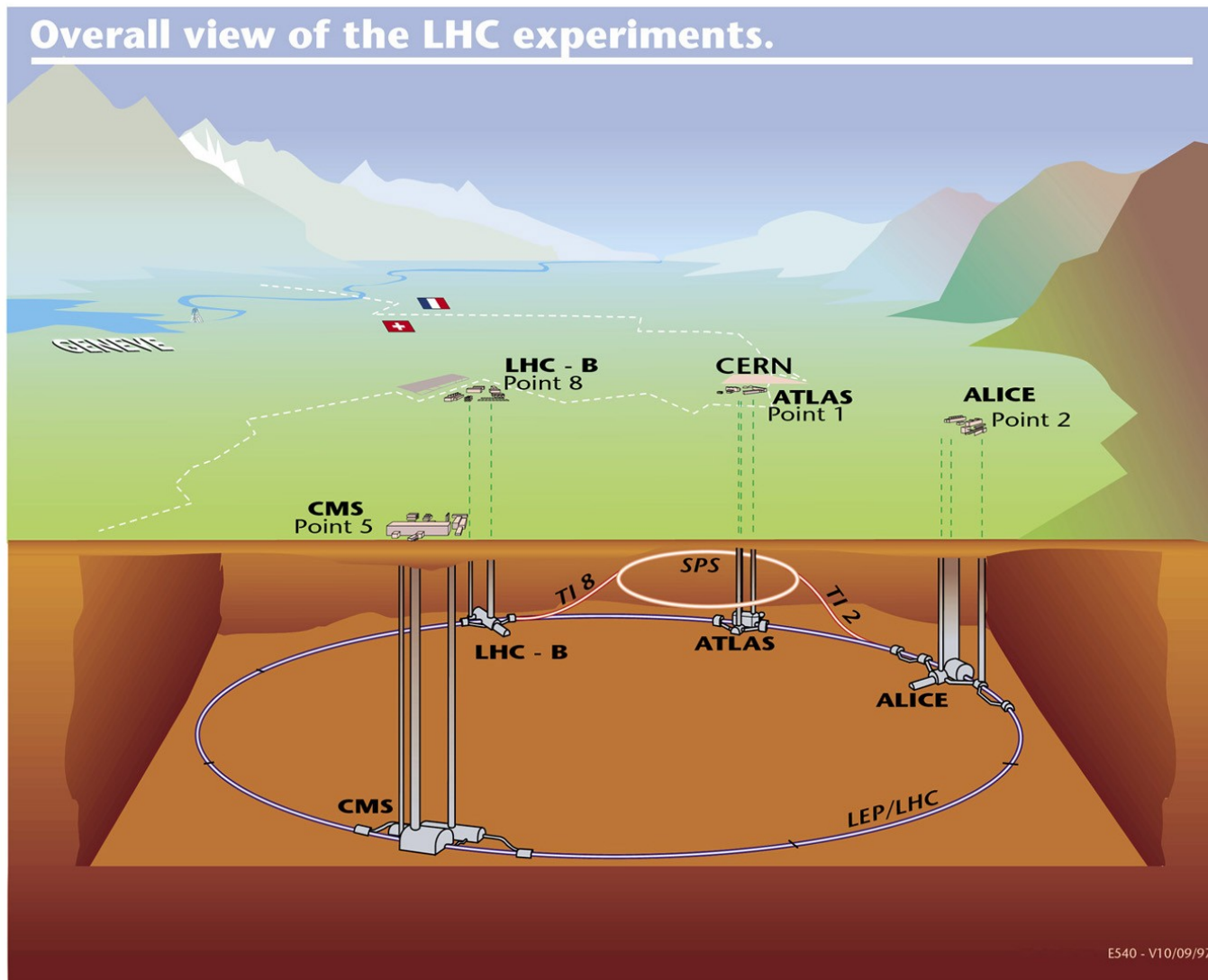
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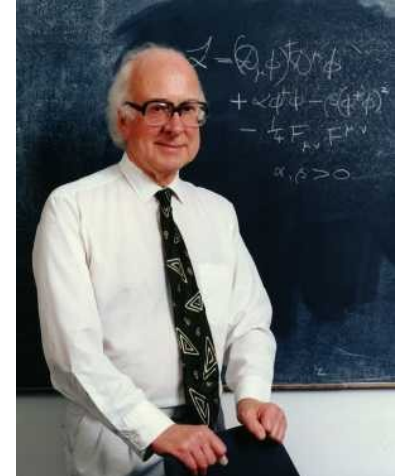
CERN



LHC – Large Hadron Collider

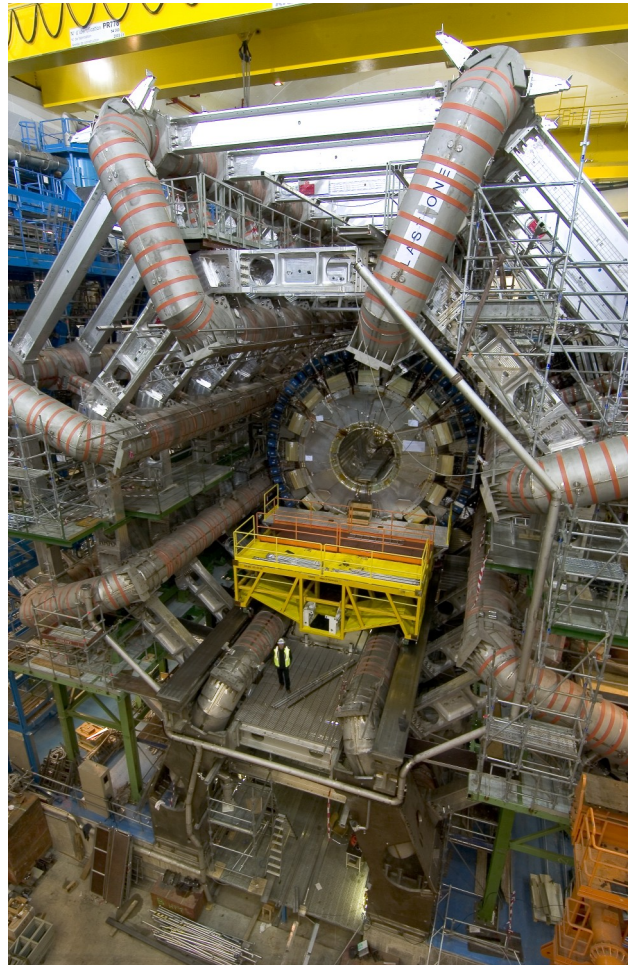


Physics at LHC

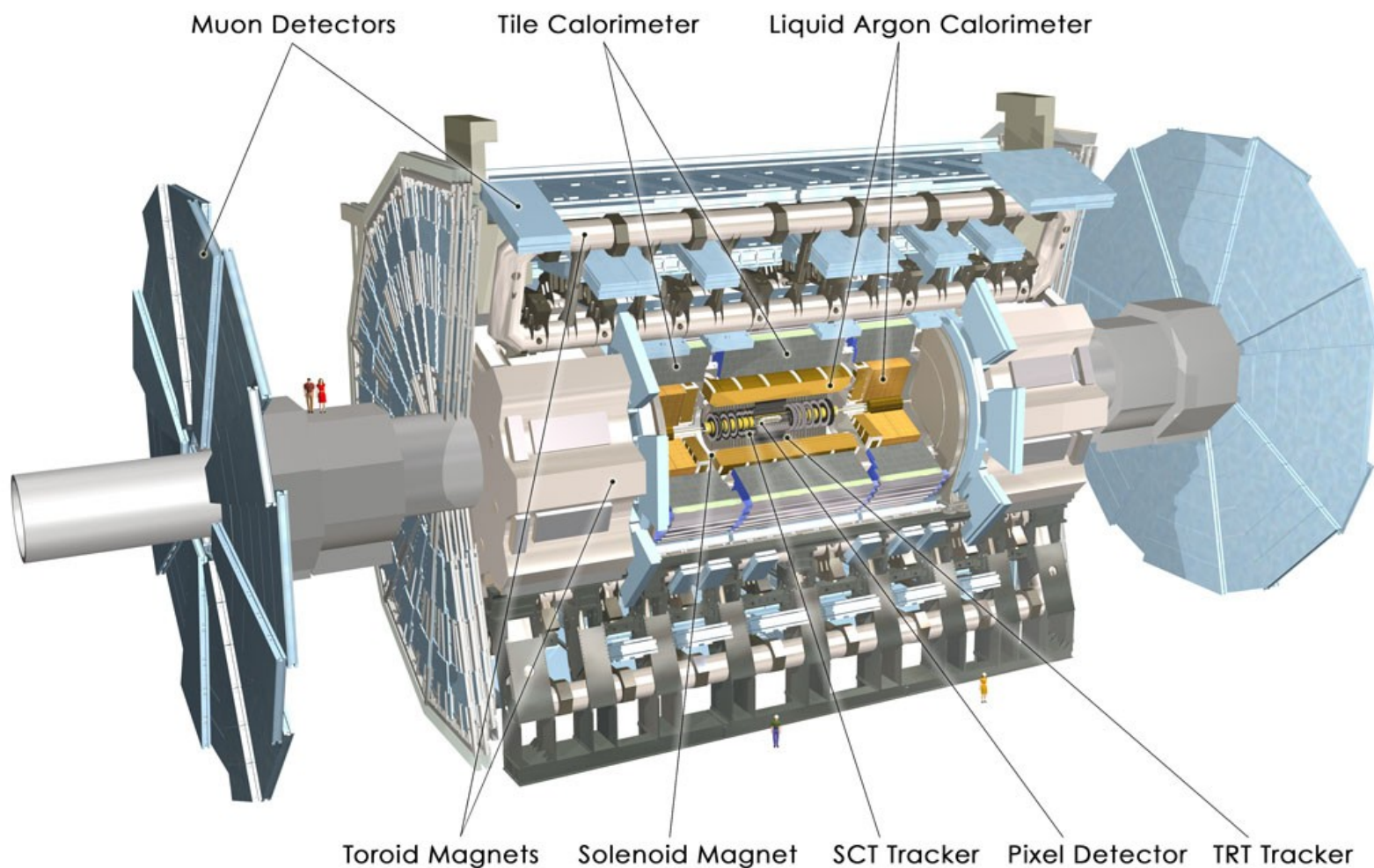


- Searching for new particles, e.g.
 - The Higgs boson
 - The only particle in the standard model (SM) whose existence has not been verified experimentally
 - Supersymmetric particles
 - Predicted by extensions to the standard model
- Precision measurements of SM parameters
- B physics, top physics, quark gluon plasma, ...

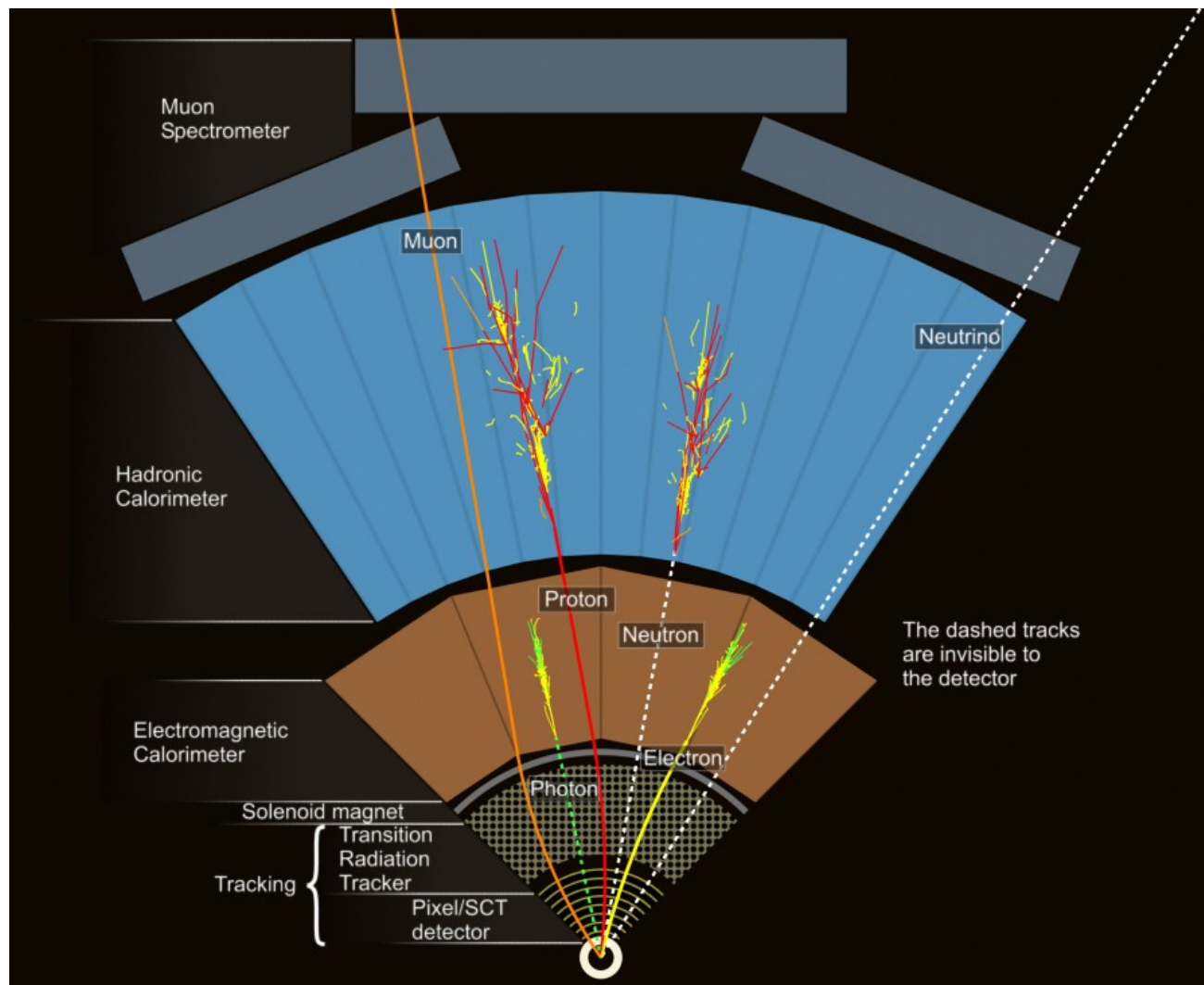
ATLAS under construction



ATLAS Subdetectors



ATLAS Subdetectors



Data Acquisition in ATLAS

- A bunch of protons collides with another bunch every 25 ns – 40 MHz
- The ATLAS detector has 10^8 readout channels
- Very efficient selection criteria are required:
 - A collision where a Higgs boson is created and decays to 2 photons happens 1 time in 10^{23}

Data reduction in 3 steps

- Level 1: hardware implemented
 - Reduces 40 MHz to appr. 40 kHz, decision in 2.5 μ s
- Level 2: analyses “regions of interest” (appr. 2%)
 - Reduces to appr. 2 kHz
- Event filter: reconstruction using all data
 - Reduces to appr. 200 Hz
 - Raw data per stored event: 1.6 MB

Processing of data

- Raw Data (RAW): 1.6 MB/event
- Event Summary Data (ESD): 500 kB/event
- Analysis Object Data (AOD): 100 kB/event
- First processing RAW → ESD → AOD takes place at CERN
- 10^7 events/day, $2 \cdot 10^9$ events per year

Distribution of ATLAS Computing

- The necessary computing resources are not available at a single location
- External computing and storage resources must be used to a large extent
- To manage the available resources various grid solutions are used

Data & Service Challenges

- In preparation for the start of data acquisition in 2007 ATLAS has performed various tests
 - Data challenges
 - Generation and processing of simulated data using various external computing resources
 - Service challenges
 - Test of data transfer capacity from CERN to external computing centres

Summary

- LHC will start at CERN in 2007
- The analysis of the collected data and the creation of the necessary simulated data require vast computing and storage resources
- Must make use of resources at different locations
- The available resources are handled using grid technologies