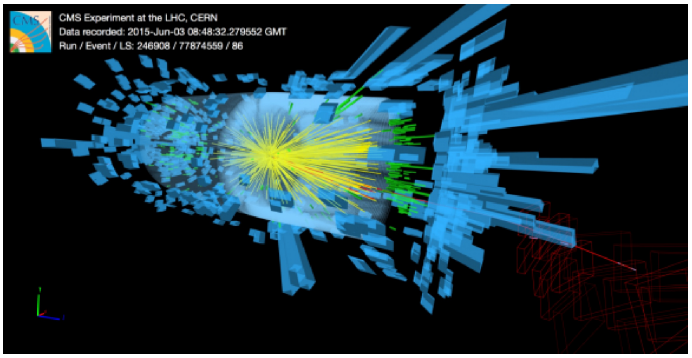
The Large Hadron Collider is back in business

Following a $150 million overhaul a new research season has begun for the Large Hadron Collider at CERN (LHC) in Switzerland. After 2 years of repair work and improvements the facility started to collect data again. Operators in the CERN control room guided two stable beams of protons – particles found within all atoms – around the LHC before slamming them into one another at designated points. Energetic smash-ups like these will let physicists in the coming years explore the tiny parts that make up the atoms from which our world and universe are made.

Situated 100 metres beneath tranquil countryside on the Franco-Swiss border, the LHC is a 27-km underground ring. **It's the world's largest and most powerful atom smasher, the largest and most complex experimental facility ever built, and the largest single machine in the world.**

The LHC's first run was from 2010 to 2013. **That first run resulted, among other things, in the discovery of the long-sought Higgs Boson — also known as the "God Particle"** – a sub-atomic particle predicted by a theory in physics known as the Standard Model. The Higgs Boson explains how the universe gets its mass.

The new and improved LHC is operating at much higher energies than were achieved during its first run. **Test collisions have been carried out at the energy of 13 trillion electron volts (TeV), up from a high mark of 8 TeV achieved during the machine's first run.**

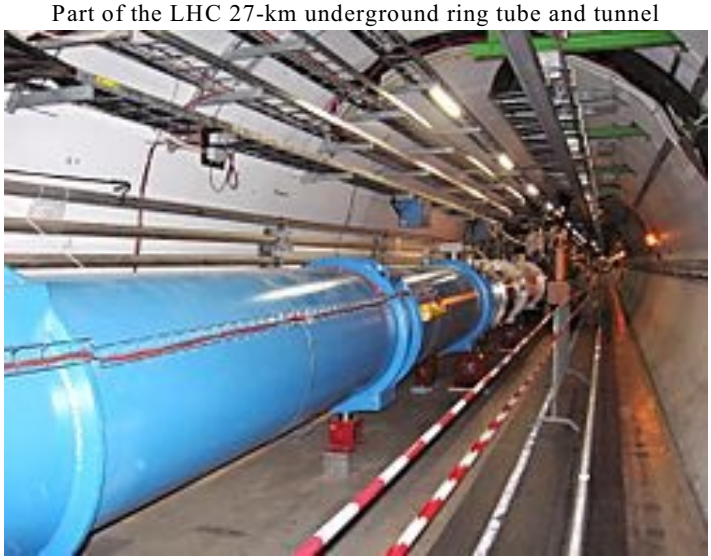


Collisions seen within the LHC today – June 3, 2015

With run 2 starting today, physicists have the ambition to further explore the Standard Model and even to find evidence of new physics phenomena beyond its boundaries, **which could explain remaining mysteries such as dark matter, believed to make up about a quarter of the universe, or nature's apparent preference for matter over antimatter, without which we would not exist.** The LHC will now run round the clock for the next three years.

Over the two-year shutdown, the four large experiments ALICE, ATLAS, CMS and LHCb also went through an important programme of maintenance and improvements in preparation for the new energy frontier. The collisions we are seeing today indicate that the work done in the past two years to prepare and improve our detector has been successful and marks the beginning of a new era of exploration of the secrets of nature. The successful restart of physics data-taking, with all systems in great shape to collect, process and analyse the new data quickly, is a testament to the commitment and immense hard work of the many people during the long shutdown. Excitement is building as we are starting to delve into the new data to see what nature has in store for us at these new unexplored energies. It will allow follow ups on puzzles from run-1 studies, and to probe with higher sensitivity the difference in behaviour between matter and antimatter. Proton-proton collisions will provide essential reference data for the run with heavy-ion beams foreseen for the end of the year, in which the LHC will provide both higher energy and luminosity as compared to run 1. This will allow to extend the exploration of the intriguing signals that have emerged from Run 1.

Part of the LHC 27-km underground ring tube and tunnel



In addition to these large collaborations, three new smaller experiments – TOTEM, LHCf and MoEDAL – will be among those searching for new physics at the energy frontier of 13 TeV5.