First physics from the Large Hadron Collider's CMS detector

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Dr Matthew Ryan from Imperial College London viewing the heart of the CMS experiment. Credit: STFC

(PhysOrg.com) -- Scientists working on the CMS experiment at the CERN LHC have just published results of the first analysis of data from the highest energy particle collisions ever carried out, bringing us another step closer to answering some of the most fundamental questions about our Universe. The results appear in the *Journal of High Energy Physics* (JHEP).

“Our findings provide the first information on the characteristics of charged particle production in this new energy range,” says Prof. Guido Tonelli, Spokesperson of the CMS experiment, “The results confirm previous measurements, and expectations for the new energy regime. They are important to help us modelling the experimental backgrounds for future measurements at even higher energies.”

The LHC provided first collisions in late November 2009, after about 20 years of extremely challenging design and construction work for both the accelerator and the experiments. About three weeks later, protons were accelerated for the first time in the LHC itself to an energy of 1.18 TeV/beam, the highest energy yet attained in accelerators. Around one hundred thousand collisions were recorded by the four LHC experiments at this energy.

CMS is one of two so-called general-purpose experiments which look into the unknown and search for new physics. It is designed to see a wide range of particles and phenomena produced in the LHC’s high-energy collisions and will help to answer questions such as: What is the Universe really made of and what forces act within it? And what gives everything substance? It will also measure the properties of previously discovered particles with unprecedented precision, and be on the lookout for completely new, unpredicted phenomena. Such research not only increases our understanding but may eventually spark new technologies that change the world we live in.

UK institutes involved in CMS (Bristol University, Brunel University, Imperial College and Rutherford Appleton Laboratory) played major roles in the design and construction of the experiment and Prof T. Virdee of Imperial College was also the CMS Spokesperson for several years leading up to first operation.

The first published measurements by CMS depend on the charged

particle tracking detector, using silicon pixel and microstrip sensors. The radiation-hard electronics of the microstrip tracker were designed in a collaboration between Imperial College, Rutherford Appleton Laboratory and CERN. Prof. G. Hall, UK-CMS Spokesperson, notes “It is fantastic to see how well the CMS silicon tracker performs, and how rapidly it has met our design goals.” Prof. T. Virdee, the former Spokesperson, comments that “After two decades from conception to completion of construction, this publication marks the true start of an equally long phase of the extraction of science from CMS, widely expected to be revolutionary”.

Following the 2009 run there was a technical stop to prepare the LHC for accelerating protons to an energy of 3.5 TeV/beam. Beams will soon start circulating again and a long run, lasting some eighteen months, will begin at the end of February. This should enable the experiments to accumulate enough data to explore new territory in all areas where new physics is expected.

More information: Paper: arxiv.org/abs/1002.0621

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