

Physicists Analyse the Time Immediately After the Big Bang

Posted on Wednesday 13th June 2007

Physicists from the University of Birmingham are to start uncovering the mysteries of the universe by measuring particle collisions under conditions that would have existed less than a millionth of a second after the Big Bang.

At CERN (the European Laboratory for Particle Physics) in Geneva in an underground tunnel of 27 kilometres that runs underneath the French/Swiss border, Birmingham scientists are playing key roles in large international collaborations which will examine these particle collisions at two specially built detectors, called ALICE and ATLAS.

In this cutting edge project, researchers from Birmingham's School of Physics and Astronomy have designed and built sophisticated electronics (trigger electronics) that will help select the important particle collisions – the collisions that are selected by these triggers will help scientists to concentrate on the data most likely to yield new discoveries.

The ATLAS experiment, one of the largest scientific collaborative projects with 1800 physicists from 34 countries, will explore the fundamental nature of matter and the basic forces that shape the universe by searching for new information in head on collisions of protons of very high energy. The electronic boards built at Birmingham have been designed and constructed to make a fast decision – in less than a millionth of a second – on which proton-proton collisions to record.

The ALICE detector, where Birmingham is the only UK university involved, will study collisions between lead nuclei as well as protons. This experiment will recreate the conditions a millionth of a second after the Big Bang when the universe consisted of a dense and hot state of matter called a quark-gluon plasma which then cooled to form ordinary matter. The trigger system designed and built at Birmingham will allow scientists to select the collisions of importance and record them for analysis.

Professor Peter Watkins head of the particle physics group, in the School of Physics and Astronomy, and member of the ATLAS collaboration says, 'Birmingham's role in the project is very special. We are expecting 1000 million collisions a second but even with the fastest computers we can only record 200 of these per second. We, therefore, need to select the right collisions to record and analyse. Our job was to build key components of the trigger to make a very fast decision - within a millionth of a second - about which collisions to record. This is particularly important, because if we miss some new exciting physics, we can't go back in time and recover that collision.'

Dr David Evans from the University's School of Physics and Astronomy, who is the ALICE UK project leader, says, 'We collide the nuclei of lead atoms at almost the speed of light. These high energy collisions create sub atomic fireballs, which mirror conditions that existed a millionth of a second after the big bang. These fireballs only exist for an instant in time before dissolving into thousands of particles.'

He continues, 'The Birmingham group is responsible for the design, construction and delivery of the central trigger processor, which is effectively the electronic brain of the detector. It receives signals from various sub-detectors and sensors and makes an initial decision within a tenth of a millionth of a second about whether to record data.'

This has already been built and is currently being installed at CERN where science operations are due to begin in Spring 2008.'

Ends

Notes to Editors

1. Research TV - Note to Broadcast Media: Moving footage/interviews are available free of charge as a package to broadcast media via Research TV, due for streaming via APTN on Tuesday 12 June from 12.15-12.30 GMT (KHC check time of feed). Contact <http://www.Research-TV.com> for details / to request footage.

3. The UK subscription to CERN is paid by the Science and Technology Facilities Council (STFC) who also provide funding to University research groups to participate in large scale science projects such as the Large Hadron Collider. For further details see <http://www.scitech.ac.uk> (<http://www.scitech.ac.uk/>)

The University of Birmingham is one of 22 UK institutes involved in the Large Hadron Collider.

4. Images of the LHC and the Birmingham scientists involved are available from Gill Ormrod in the Science and Technology Facilities Council Press Office. Tel: 01793 442012. Mobile: 0781 8013509. Email: gill.ormrod@stfc.ac.uk (<http://www.newscentre.bham.ac.uk/press/2007/06/gill.ormrod@stfc.ac.uk>)

For further information

Kate Chapple, Press officer, University of Birmingham, tel 0121 414 2772 or 07789 921164.

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