Mini Big Bangs - UK scientists gear up for first lead particle collisions at the LHC

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Birmingham physicists working at CERN's Large Hadron Collider (LHC) in Switzerland are gearing up to study a piece of the Universe as it would have been just moments after the Big Bang.

The LHC's ALICE experiment, with UK work funded by the Science and Technology Facilities Council (STFC), will later this week study the result of accelerating and smashing together lead nuclei at the highest possible energies, generating incredibly hot and dense sub-atomic fireballs to recreate the fundamental particles that existed in the first few microseconds after the Big Bang.

Scientists from the University of Birmingham's School of Physics and Astronomy are playing a key role in this new phase of the LHC's programme which comes after seven months of successfully colliding protons at high energies.

'We will be creating the highest temperatures and densities ever produced in an experiment in these mini Big Bangs', said Dr David Evans from the University of Birmingham. 'Although the tiny fireballs will only exist for a fleeting moment (less than a trillionth of a trillionth of a second) the temperatures will reach over ten trillion degrees, a million times hotter than the centre of the Sun.'

'This will allow us to make and study a tiny piece of what the universe was made of just a millionth of a second after the Big Bang', Dr. Evans added. 'At the temperatures generated even protons and neutrons, which make up the nuclei of atoms, will melt resulting in a hot dense soup of quarks and gluons known as a Quark-Gluon Plasma. By studying this quark-gluon plasma physicists hope to learn more about the strong force, one of the four fundamental forces of nature, which not only binds the nuclei of atoms together but is responsible for 98% of their mass. We are all really looking forward to these first collisions which will be created in a safe, controlled environment. If all goes well we could even see some new discoveries before the end of next year.'

The 10,000 ton ALICE experiment has been specifically designed to study the extreme conditions produced in these lead collisions. ALICE is one of the four main experiments at the LHC designed to study the physics from ultra-high energy proton-proton and lead-lead interactions.

Whilst the conditions created in the LHC detector will be a world record for manmade experiments and represent a great achievement for science and engineering, they pose no threat. More energetic particle reactions occur regularly throughout the Universe, including in the upper atmosphere of the Earth itself.

Notes to editors

Further updates will be available on the CERN website: **http://public.web.cern.ch/public/ (http://public.web.cern.ch/public/)**

Images
Images and an animation can be downloaded from: **http://epweb2.ph.bham.ac.uk/user/evans/lead2010/ (http://epweb2.ph.bham.ac.uk/user/evans/lead2010/)** . When using these images, please credit: CERN

Further information about the ALICE Experiment
Physicists working on the ALICE experiment will study the properties, still largely unknown, of the state of matter called a quark-gluon plasma. This will help them understand more about the strong force and how it governs matter; the nature of the confinement of quarks – why quarks are confined in matter, such as protons; and how the strong force generates 98% of the mass of protons and neutrons.

The collisions will be recreated in a safe, controlled environment. Although the LHC is by far the most powerful man-made particle accelerator ever built, there are much more powerful, naturally occurring particle accelerators in the universe. Cosmic rays in our atmosphere produce much higher energy collisions and have been doing so since long before mankind existed.

The ALICE Collaboration consists of around 1000 physicists and engineers from about 90 institutes in 30 countries. The UK forms a relatively small part of ALICE, consisting of eight physicists and engineers and seven PhD students from the University of Birmingham, but plays a vital role being responsible for the design and construction of the central trigger electronics (the ALICE Brain) and corresponding software. In addition, the UK group is making an important contribution to the analysis of ALICE data.

ALICE utilises state-of-the-art technology including high precision systems for the detection and tracking of subatomic particles, ultra-miniaturised systems for the processing of electronic signals, and a worldwide distribution network of the computing resources for data analysis (the GRID). Many of these technological developments have direct implications to everyday life such as medical imaging, microelectronics and information technology.

For further information
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