UK news from CERN

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Calibrating ALICE and LHCb

The LHC won't start operating until Spring 2015, but two experiments have already captured their first data.

Excitement in the LHCb control room – Collaboration Spokesperson Guy Wilkinson (Oxford) along with the shift leader, run coordinator and sub-detector experts, keeps a close eye on the data acquisition computer screens © CERN/LHCb

Last weekend, as part of the preparations for restarting the LHC, accelerator operators tested the transfer lines between the Super Proton Synchrotron (SPS) and LHC. The tests were used to check the control systems, beam instrumentation and transfer line alignment. The team also performed the first optics measurements and examined the beam trajectory.

Although a 21.6 tonne beam dump made of graphite, aluminium and copper absorbed the accelerated particles and prevented the SPS protons from entering the LHC, secondary muons produced by the beam hitting the stopper allowed LHCb and ALICE to do some useful calibrations.

The precise timing of each beam dump allowed the experiments to tune their detectors and triggers to the LHC clock. In LHCb, the data will also be used to check the alignment of the different sub-detectors with respect to each other.

This was the first time that the transfer lines had seen beams in more than a year, and the first opportunity to test the LHC's operation system. The LHC operators successfully commissioned the LHC's injection and ejection magnets, all without beam in the machine itself – an important milestone in the preparations for the restart of the LHC in 2015.

Steering technology into medicine

When Steve Myers retired as CERN's Director of Accelerators and Technology in 2013, there was no question about what he would do next; Steve took on a new role - Head of Medical Applications. His mission is to take the engineering and technology developed to help us find out more about the origins of our Universe and apply them to medical challenges that are much closer to home.

The aim is for CERN to become an important facilitator of medical physics in Europe. There

Science & Technology Facilities Council

60 YEARS CERN

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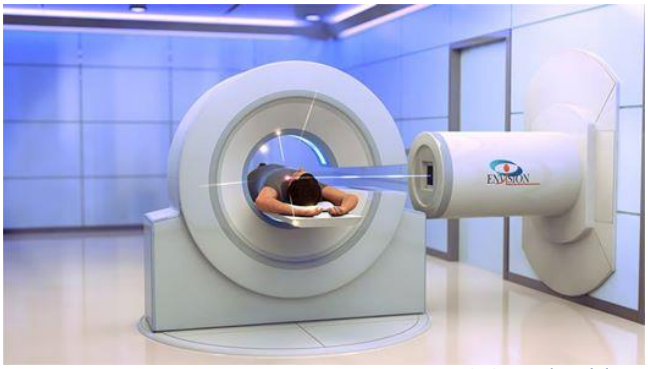
are plans to develop a CERN bio-medical facility using the LEIR storage ring called OPENMED (suitably adapted with external funding) and to increase the use of the ISOLDE nuclear physics facility to develop isotopes for clinical trials (MEDICIS).



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Building effective networks with other institutes and organisations around the world is critical – as with every other area of research, funding is limited and needs to be spent in the best way to bring effective new diagnostic tools and treatments to patients as quickly as possible.

Last week saw the first meeting of the International Strategy Group for Medical Applications. The group draws its membership from hospitals and research institutes in Asia, America and Europe with specialists in imaging and radiobiology working alongside oncologists and physicists.

The UK is represented by Kevin Prise (QUB), with Bleddyn Jones (Oxford) as Scientific Secretary.

Bleddyn is a rare example of a hands-on clinician with an active research programme in radiobiological modelling. One of his particular interests is in modelling relative biological effectiveness (RBE) – the effect on biological tissues of ionizing radiation from different types of particle beams. The aim is to maximise the energy delivered to the tumour that you wish to destroy whilst reducing the biological effects due to radiation given to the healthy tissue that surrounds it.

Radiobiologist Kevin is based at the Centre for Cancer Research & Cell Biology at Queen's University Belfast, working on new models for the application of advanced radiotherapy approaches in cancer patients. He has longstanding expertise in understanding the effects of ions in biological models which will be essential for the development of the next generation ion-based clinical facilities.

"The models that we use at the moment are based on classic experiments from the 1960s," explains Bleddyn, "they're elegant, wonderful and descriptive, but they don't give parameters for specific tissue types such as the brain or spinal cord. We've got the gist of the story but we need much more detail to make particle beam therapy more effective and safer to the patient."

For Bleddyn, this is where CERN can really make a difference. Bleddyn would like to see the rigorous standards of particle physics applied to radiobiology. "We need to understand the effects of ionizing radiation on different tissues within the human body, taking account radiation intensity as well as dose. That needs to be carried out in one laboratory under standardised conditions using a range of human cells exposed to megavoltage photons and positively charged particles."

That's where LEIR, CERN's low energy ion ring comes in. It is currently used for around two months every year to provide lead ions for the LHC. For the remaining 10 months, it could become the focus for an international project to produce tissue-specific data that will establish the parameters for using proton beams to treat complex tumours.

Alongside a testing programme, Bleddyn would also like to see CERN become an international centre for particle therapy data with every clinician involved in in this type of treatment contributing to OPENMED, a global database with information about their patients, technical details about the beam used to treat them, and the outcomes. Particle beam therapy is still a relatively uncommon treatment and no single country can pool sufficient information to move the body of radiobiology knowledge forward.

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Kevin agrees, “There is an urgent need for international collaborative projects like OPENMED which will provide access to state-of-the-art research facilities and data. These are essential for us to test hypotheses that will ultimately make particle beam therapy more effective for patients around the world. I’ll be focussing on how OPENMED should be developed and delivered for the benefit of the whole scientific community.”

The big question is whether CERN should be doing this kind of research. Bleddyn is in no doubt, “Louis Pasteur said that ‘There are no such things as applied sciences, only applications of science.’ You could argue that it is the core responsibility of particle physics to apply its science to medicine, but it needs to be in a truly inter-disciplinary setting where there is a clear connection to the patient.”

For Kevin, the latest developments are simply the next step in a series of technology transfer activities that have been taking place at CERN for many years. “The pioneering early work done on PET imaging, which is now routinely in clinical use around the world, was delivered from CERN research and the underpinning accelerator technologies devised for the ion-beam clinical facilities in CNAO (Pavia) and MedAustron (Austria) were developed from the CERN Proton Ion Medical Machine Study (PIMMS).

“This is a great opportunity to continue to bring significant added value from all that CERN has built over the last 60 years.”

Beamline for Schools is back

In 2015, CERN will once again be making a fully equipped beamline available for schools. Beam time will be allocated to the one or more teams that win the 2015 beamline for schools competition.

The competition is open to high-school students aged 16 or older, in teams of up to 30 students, nine of whom would – if their team wins – come to CERN to run their experiments.

Teams may be from a single school, or a number of schools working together.

Physicist Cenk Yidril introduces the 2014 winners to the T9 beamline © CERN

Just like teams of real scientists, each school team must submit a proposal for the experiment that it would like to carry out. The proposals will be reviewed by a committee of CERN scientists, with the shortlist being sent on to the committee that validates all proposals for experiments at the laboratory’s SPS and PS accelerators.

Competition was fierce in 2014 but that shouldn’t deter teams from UK schools. Peter Watkins (Birmingham) is the UK representative on the International Particle Physics Outreach Group and the national contact for the competition, “If you’re planning to take part, why not get in touch with me or with the particle physics department at your local university – we will try to answer your questions about Particle Physics experiments and beamlines which should help you to improve your proposal.”

The first step is to register your team and tell CERN why you think you should win time to conduct your experiments on the beamline. Registration closes at midnight CET on 31 January 2015.

The second step involves submitting a two-part proposal: a written proposal and a 1-minute video about your proposed experiment. The deadline for submitting the experiment proposals is midnight CET on 31 March 2015.

For more information about how to apply and to read about the winning teams from 2014 take a look at the beamline for schools website.

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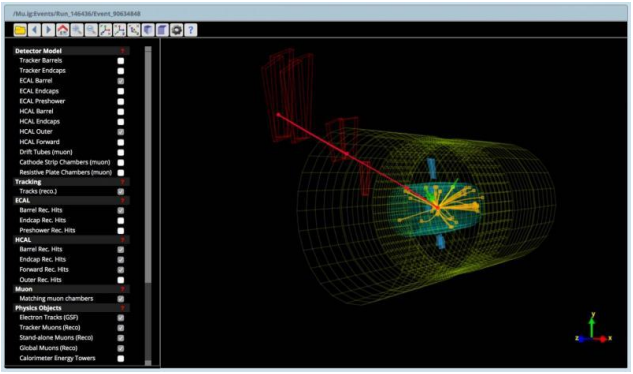
LHC data – what will you find?

For the first time, data from real collision events produced by LHC experiments is available to everyone!



The web-based CMS event display, accessible through the CERN Open Data Portal, shows a proton collision event recorded by the CMS detector © CMS/Open Data Portal)

Whether your interest is education or research, you can download tools and data to carry out your own analyses of data from ALICE, ATLAS, CMS and LHCb via CERN's Open Data Portal. There are simple analysis tools which will help you visualise collision events or view histograms, but if you want more of a challenge, you can develop your own analysis tools. Since the launch of the Open Data Portal on 20 November, the opportunity to look at real data is proving popular - an online community is already developing where citizen scientists can share and compare results.

Bazinga!

Top of UKNFC's Christmas list this year is the Mini Big Bang Theory Lego set.

© Alatariel/GlenBricker

The set was proposed by Alatariel and GlenBricker as part of the Lego Ideas initiative, and achieved the 10,000 votes required to take it to the next stage of Lego's review process in record time.

This is the second success for Alatariel (alias Ellen Kooijman, a Dutch geochemist with a passion for Lego). Her determination to see more female Lego role models has led to the equally excellent Research Institute. Featuring a paleaontologist (with dinosaur skeleton!), astronomer and chemist, it is available online or from any good toy shop.

© Lego

The price, final design and release dates for the Mini Big Bang Theory set are yet to be confirmed but UKNFC doesn't mind getting such a cool Christmas present a little late.

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Diary dates

CERN Council – 8-12 December
A world a particle in Liverpool - until 8 January
Particle physics community meeting – 1 April
CERN Council - 16-19 March

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