UK news from CERN

Issue 32: 5 November 2013

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Collider opens in London

The LHC is coming to London. OK, so not exactly, but a fantastic new exhibition called 'Collider' opens on 13 November at the Science Museum. With lots of input from CERN and sponsorship from STFC, the exhibition will give visitors an insight into LHC research and life at CERN.

Concept design for inside the LHC © Science Museum/Nissen Richards Studio

Planning first started in early 2011, well before the discovery of the Higgs boson, and Emma Sanders has led the project for CERN, facilitating fact-finding visits for the Science Museum and bringing together a unique collection of exhibits. "The museum team wanted to meet as many people as possible – from the LHC machine and experiments, but also the infrastructure and services including the staff of restaurant 1, which they quickly understood was one of the key environments here at CERN."

This is not an 'objects in display cases' exhibition. "Particle physics is a tough subject for museums," says Alison Boyle, Deputy Keeper of Science and Medicine at the Science Museum, "the scientific concepts are way beyond most visitors' prior knowledge, and the technology is unfamiliar and often baffling at first glance. The LHC's extremes of scale - from the enormous machinery to the subatomic world - are not very suited to displaying in glass showcases!"

And so the team developing the exhibition has included two Olivier Award winners; playwright Michael Wynne and video designer Finn Ross have created a theatrical experience that will transport visitors from the museum to the heart of CERN. It won't just look like CERN, it will feel like it too.

Whilst the scientific goals that drive CERN, and the engineering that enables them, are the cornerstones of the exhibition, there's a strong focus on the people.

"When the Science Museum team first came to CERN, they were expecting to be awed by the kit that we have," says Emma, "they were, but actually, it was the people that impressed them the most – the variety of languages and cultures, but also the enthusiasm, creativity and spirit of collaboration. Having accompanied the exhibition since its beginnings I'm looking forward to seeing it for real. I know about the

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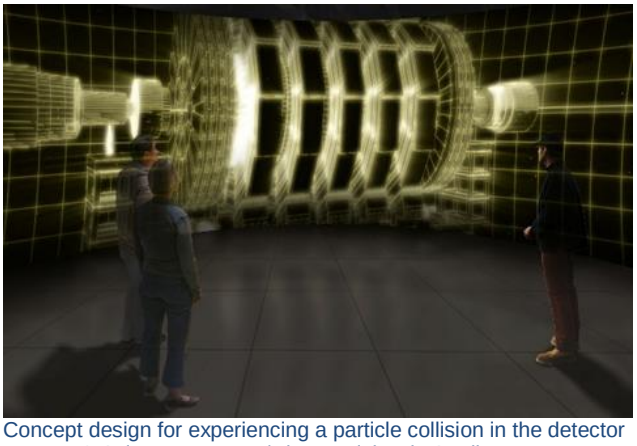
content, but I'm hoping to be just as wowed as everyone else to see for myself."

LHCb researcher, Harry Cliff (Cambridge) has also been working on the exhibition. Harry is the Science Museum's Fellow of Modern Science, "I think CERN staff and users could get a lot out of the exhibition - not that I expect they'll learn much physics, but I think they may get an insight into how CERN appears to an outside visitor.



Concept design for experiencing a particle collision in the detector cavern. © Science Museum/Nissen Richards Studio

"We've really tried to recreate the atmosphere and feel of CERN and there will certainly be quite a few familiar locations and faces, some probably quite surprising!" says Harry. "There's even a life-scale recreation of my office corridor in building 2 - complete with ancient conference posters and silly cartoons (especially "Wanted, Schrodinger's Cat, Dead and Alive").

"I hope people will be surprised and charmed by the look and feel of the exhibition - it's a very long way away from a standard museum show. It'll be a much more visceral experience, with the sights, sounds and even smells of CERN. It is also an exhibition full of people, including a great cast of real CERN engineers and physicists, who really help to recreate a sense of community at CERN."

It's unusual for CERN to provide so much help to a single institution. However, the exhibition will eventually go on an international tour and many of the items that left CERN as real components will return transformed into more engaging exhibits which will take their place in CERN's own exhibition spaces.

See the Science Museum website for more information.

See it for free!

If you have a CERN access card, take it with you and you can visit the Collider exhibition for free!

Cryogenic hotspot

The cream of the UK cryogenics community gets together at an annual Cryogenic Cluster Day. Held at the STFC Rutherford Appleton Laboratory, it's a dynamic mix of seminars, industry developments, the latest research, a trade show and, of course, networking. The UK is an international leader in both cryogenic research and its application, and the Cluster Day is increasingly attracting international delegates, including colleagues from CERN.

Vladimir Datskov, Glyn Kirby and Antonella Chiuchiolo from CERN took part in the event and presented a poster explaining how their work is being used to test prototype magnets that may be used in future upgrades of the LHC. The ground-breaking research has looked at how to achieve precise temperature measurements in the harshest environments – with huge mechanical stresses, high levels of radiation, voltages up to 5kV, rapid temperature fluctuation (1.8-300K in 0.6 second), ultra high vacuum conditions and fast changing magnetic fields (0-12T in 0.6s).

The CERN team used a tiny component manufactured by Oxfordshire-based specialists, Temati. The company has been supplying CERN for nine years, with its highly sensitive carbon ceramic sensors (CCS) being used in a number of different experiments. Over that time, they have demonstrated that the small sensor is not only very accurate, but it is also very robust and offers the long term stability needed for many CERN projects.

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Testing the CCS

© CERN

The CCS is mounted on a thermalisation pad - a thin piece of plastic plated with gold and copper. "There is a relationship between resistance and temperature which we exploit for the sensor," explains Temati's Paul Ryan, "but it's no good having the best sensor if you don't have an equally good thermalisation pad."

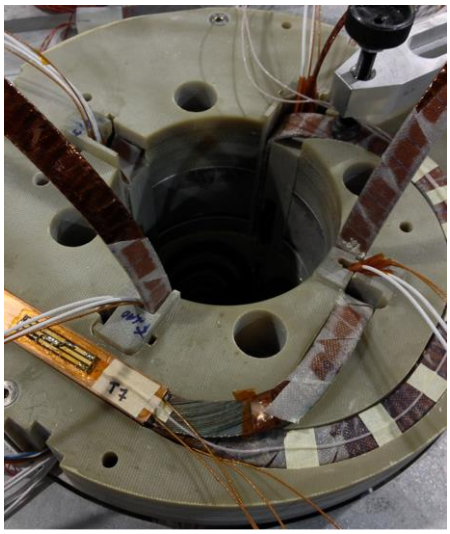
In fact the combination of CCS and thermalisation pad enabled the CERN team to measure temperature changes within 5 milliseconds – that's the same amount of time that it takes for a bee to flap its wings.

"These sensors are faster than anything else that we've tried," says Glyn Kirby. "We need exceptionally precise instruments for testing prototype magnets for future projects."

Putting these prototype magnets through their paces in a controlled way includes seeing how the magnet reacts to the superconductor converting to a normal conducting state – called a quench. This happens when the operating conditions for the superconductor are lost - possibly due to a rapid temperature change caused by energy being deposited in the magnet - and liquid helium in the magnet converts to gas, spreading the temperature change throughout the magnet.

"We've monitored the quench velocity through the superconducting cables by placing temperature sensors on either side of the cable, but only heating the cable from one side," explains Glyn. "The sensors are so fast that we've observed a very interesting effect for the first time; on the side of the cable facing the heater, the temperature rises as you would expect, but on the other side, the temperature initially falls. This takes place within a time frame of only 2-3 milliseconds. We've never observed it before and we're still working out why this is happening."

For a small company, working with CERN has had tangible benefits for Temati. "Our relationship with CERN has definitely helped us gain orders with new companies," says Paul. "After Glyn and his colleagues first presented their paper at a conference in Boston in July, there has been lots of interest in our CCS. We've had a number of enquiries, some of which have already led to firm orders."



CCS sensor mounted on superconducting cable with thermalisation pad

© CERN

The next Cryogenic Cluster Day will be on 19 September 2014 and you can register your interest now.

New friends for ALICE

UK presence in the ALICE collaboration has been strengthened with the addition of the University of Liverpool. There are now four institutes representing the UK; the universities of Birmingham and Liverpool, and the STFC Daresbury and Rutherford Appleton Laboratories.

Joining a long established collaboration is a slightly daunting experience but Marielle Chartier, who leads the Liverpool ALICE group,

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says she and her colleagues have been warmly welcomed into the fold.

Marielle is a nuclear physicist but joining a high-energy physics experiment at the LHC is not as surprising as it might seem, "I've spent the last seven years working on heavy ion collisions at lower energies, doing fixed target experiments using the heavy ion beams at GSI Helmholtz Institute in Germany and RIKEN in Japan to study the equation of state of dense asymmetric nuclear matter. Using ALICE, I'll be exploring the phase diagram of strongly interacting matter at lower densities and much higher temperatures."

Marielle's group is particularly interested in heavy flavour physics and especially the open charm. Charm quarks are ideal probes for investigating the Quark Gluon Plasma created during heavy ion collisions in ALICE; they are formed in the very early stage of the heavy ion collisions and propagate in the hot and dense matter before they aggregate to form hadron particles. They experience the complete heavy ion collision history.

It's a small team – just Marielle, two post docs and a PhD student - but she hopes the team will grow as they become more involved with ALICE, "We'll be drawing on the considerable expertise of the Liverpool Nuclear Physics group", explains Marielle. "The Physics Department at Liverpool is giving us lots of support and we have a lot to offer ALICE."

People news

Early Career Award

Kara Lynch has been awarded the 2013 Institute of Physics Nuclear Physics Group's Early Career Award.

Following her degree at the University of York, Kara joined the CERN Doctoral Student programme with the University of Manchester, working on the CRIS beamline in the ISOLDE nuclear physics facility. Her research focussed on developing the technique of collinear resonance ionization spectroscopy to make sensitive measurements of the nuclear structure of francium, one of the rarest and least understood elements. The experiment featured in UKNFC5.

Kara and colleagues working through the night in summer 2012 to collect measurements of francium © Kieran Flanagan

Speaking about her award, Kara says, "The past three years working at ISOLDE has been a fun and inspiring time, and this is a testament to all the support and encouragement I have received from my supervisor and the CRIS collaboration. I am delighted to have received this award."

Having successfully completed her PhD, Kara has recently started her first post-doc position with KU Leuven, one of the main collaborators on the CRIS beamline along with the University of Manchester.

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Diary dates

UK@CERN industry event – 7-8 November
Collider exhibition opens – 13 November
Public Engagement Symposium – 25 November
CERN Council – 9 – 13 December

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