THE INDEPENDENT ON SUNDAY

Tim Lott: If this is the end of the road, there must be a rainbow...

Cern experiment: Machine switched on. No Big Bang. It works

The world watched and waited for the greatest experiment in history to begin. Impressive though it was, it was also a bit like booting up a sulky PC, says Andy McSmith who was at Cern

Thursday, 11 September 2008

All was quiet at the moment when the greatest scientific experiment in history was scheduled to begin, at 9.30am Swiss time yesterday. No bands, no flags, no cheerleaders – only a silence so heavy and awed that even the 300 journalists stopped talking.

AP

Cern scientists gather to watch the traces of the first protons in the Large Hadron Collider during switch-on

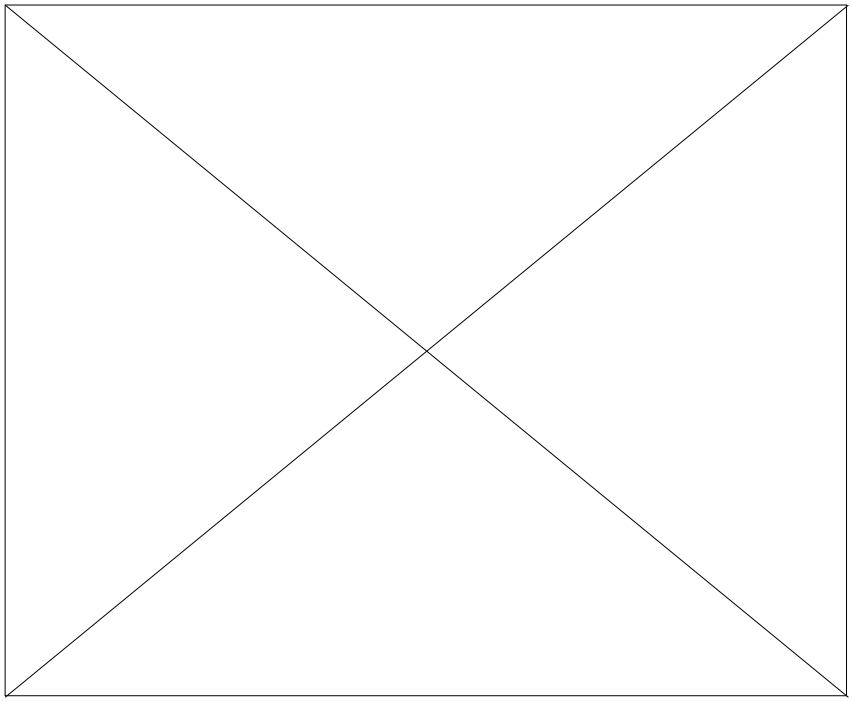
A machine that has taken 13 years to design and build, at a cost approaching £5bn, and which will advance the frontiers of science was switched on for the first time.

Absolutely nothing happened. This was bad enough for those who were doing live broadcasts, who were supposed to capture breathlessly the excitement of the moment. The project leader at the European Organisation for Nuclear Research (Cern), Lyndon Evans, must have wished a black hole would pop out of his machine and swallow him up. There he was, with his new kit, 6,000 scientists and technicians on hand to operate it, a microphone clipped on his shirt to pick up any swear words he might mutter as the world waited – and the machine was not working.

"Five, four, three, two, one... nothing," Dr Evans said, in a nervous attempt at humour. The reputation of European science hung by a thread for nearly four minutes, until at last the computer screen at the control centre said something had happened. There was a round of applause from everyone present.

"It's not like trying to start your home computer," the press relations woman said later. "It's much, much more complicated."

Footage of the reaction to the beginning of the experiment



I disagree. It was exactly like trying to start your home computer. As any Luddite knows, a home computer can detect the moment when it is really important that it should work perfectly, and that is when it develops a glitch. Yesterday was the biggest day in European science for decades. It was the start of the most expensive scientific experiment in history. It was also the biggest PR exercise ever mounted by Europe's scientific community. It was vital nothing went wrong.

One small indicator of the uniqueness of the occasion was that Cern staff abandoned the usual standards of scruffiness associated with advanced science. Dr Evans, a miner's son from south Wales, was dressed in a shirt and jeans. His normal work clothes are a T-shirt and shorts.

The glitch was caused by a cryogenic problem, cryogenics being the science of producing low temperatures. The temperature inside the Large Hadron Collider (LHC), the particle accelerator built by Cern, is about as close to absolute zero as it is possible to get. It is colder than outer space. Around its 27km underground tunnel there are 6,500 magnets, with enough power to cause protons fired into the LHC to accelerate to more than 99.99 per cent of the speed of light. If one of those thousands of magnets is 1C warmer than it should be, or 1mm out of position, it could wreck the experiment.

Engineers discovered on Monday night that there was something wrong, and worked frantically to put it right. The night shift on Tuesday discovered more problems. But when the scientists assembled at 9am yesterday, they were briefed that all was now OK. Then came those four doom-laden moments, when it looked as if something else had gone horribly wrong.

At last, a beam of protons – hydrogen atoms stripped of their electrons – began its slow progress around the 27km circuit. It was halted at eight points to ensure that it was moving in a perfect path. At point six, it appeared that the beam would have to be dumped and the experiment started afresh, because it was oscillating, but the problem was corrected, and at 10.26am, there was a noisy standing ovation as the beam arrived back where it had begun, having completed a 27km circuit in less than an hour.

There are two tubes in the LHC tunnel that are race tracks for protons. In the first, the beam travelled clockwise. The next task was to send another beam anticlockwise around the other tube. That one got back to base at around 3pm to another jubilant ovation. And that was that for day one in the life of the Large Hadron Collider – a good day's work, even though all it has proved is that the machine works.

"This is only the start of the commissioning process. It could take years to fully commission," said R□diger

Schmidt, the scientist in charge of hardware commissioning. There is still a long wait for answers to the big mysteries of the universe, such as why some particles have mass when others don't, what is "dark matter", and are there more than three dimensions to the universe?

When it is up and running, the LHC will fire beams of protons in opposite direction around the two tubes. They intersect at four points, which is where the energy-laden protons will smash together, replicating the conditions that existed less than a nanosecond after the Big Bang. Above each intersection is a research status where computers will read the data from the collisions. The complex is so vast that visitors need a passport to move from one research centre to another across the Swiss-French border.

The LHC is not the world's first particle accelerator, but it is the most powerful, by a factor of about seven. In the US, a plan to build one of this magnitude was abandoned because of the cost.

Europe is the world leader in experimental particle physics. Discoveries made in the LHC, which would be impossible anywhere else, could mean Nobel prizes for the British physicists Stephen Hawking and Peter Higgs if their theories turn out to be correct. But Professor Jordan Nash, of Imperial College London, who will help analyse LHC's data said: "It's not about prizes. All of us do it out of fundamental curiosity about how the universe works. We have done all the easy stuff over the last 2,000 years. To push further takes a hugely complex apparatus. What we are going to learn is what nature consists of, not what we think it consists of."

The man who devoted 35 years to making it happen

John Ellis joined Cern in 1973 as 27-year-old theoretical physicist, and has been working there ever since. Yesterday marked the culmination of his life's work. He marked it by wearing a T-shirt displaying the mathematical formula for a Higgs boson, the elusive sub-atomic particle that scientists have hunted for decades.

What does this day mean to you and to science?

It's the biggest event at Cern since I have been there, without question. I have been here when we have started up previous particle accelerators, but there was nothing on this scale. The hopes are riding so high. Previously when people have started a new accelerator it has always been in the quiet of their laboratory, but we have had the world's press here, and I don't know how many millions of people have followed it on television or on the web.

Do you expect to find a Higgs boson, or "God particle", that would explain why some particles have mass, but others have none? What would be more exciting: to find it, or not find it?

I expect that it will find one. I am sure that it will either find a Higgs boson or prove that it doesn't exist, though it may take years to do so. If it turns out that there is no Higgs boson, that will be the more exciting discovery because it will mean we have all been barking up the wrong tree for 44 years, and we will have to put our thinking caps back on.

Do you expect to find supersymmetrical particles, proving dark matter exists?

I think it's more likely than not. It would be really negligent of nature not to exploit supersymmetry.

Will the experiment create black holes?

It might, but there will be zero risk. Mother Earth has performed this same experiment at least 100,000 times, and we are still here.

Do you expect it to prove the existence of a fourth dimensions, or more?

Possibly. It would be very exciting if that were to happen, but the arguments are not as strong as in the case of supersymmetry.

What will this experiment do for Mr and Mrs Ordinary?

Ever since recorded history people have between wanting to understand the universe around them. This is a basic human urge, and it's useful. Nobody thought Einstein's Theory of Relativity had a use when it was first expounded, but you can't operate a satnav without it. I don't know what the LHC is going to find – how can you know? – but it's going to be useful.

Andy McSmith

What does it all mean – in 35 words

Today is the most exciting day of my life at Cern so far, but I expect more excitement when the LHC starts discovering things. Maybe the Higgs boson? Maybe supersymmetry? Maybe black holes? Who knows?

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