

# X-ray tests: Night at the collider

November 26 2013

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Gunter Kniesche prepares to X-ray a section of the Large Hadron Collider.  
Credit: CERN

When night falls over Geneva and technicians, engineers and physicists finish their work in the Large Hadron Collider tunnel to go home, Gunter Kniesche and his colleagues take the helm. They are non-destructive testers – a team of experts who X-ray components such as connections, bellows and pipes to check that they meet the required quality standards.

X-raying isn't straightforward in the LHC tunnel. Twenty-seven kilometres of collider, consisting of more than a thousand interconnected 15-metre magnets and acceleration sections, cannot be brought to the surface for tests. But many thousands of tests are needed during the current long shutdown (LS1), for example of the newly repaired and shunted connections between magnets, welds, pipes and cooling bellows.

At 7pm, the non-destructive testers don their safety equipment and go underground with their mobile X-ray source. Because this source consists of the radioactive element selenium 75, no other work can be carried out in the tunnel at the same time. This is why the X-ray testers come at night. On rickety LHC bikes, with 10-kilo mobile X-ray source in tow, they cycle up to three kilometres to the point where their expertise is needed.

"This kind of life isn't for everybody," says Kniesche, who originally comes from Dresden in Germany but has worked in Geneva and at CERN for a Swiss contractor company for more than 10 years. He is one of seven experts for non-destructive testing at CERN. "I like it though."

It takes roughly half an hour to X-ray a magnet interconnect and digital X-ray images are immediately checked against design requirements.

"The decision whether something needs to be opened and fixed is taken by the CERN experts, not by us. We just supply them with the data they need to take this decision," says Kniesche. Every image is saved to a detailed digital database.

One important checking point is the compensators for the cooling system. During LHC operation two small helium leaks were detected, and during the warming up for LS1 five more were found. X-ray images soon showed heavily deformed compensators. A compensator is a sort of bellow that makes up for differences in size when material contracts because of the extremely low temperatures in the LHC. One particular weld had not been up to the job and the compensator more or less collapsed upon itself. Now, every single compensator is X-rayed to detect faulty bellows and potential future problems.

The X-ray shift ends at around 4am and LS1 activities resume. Until the end of the long shutdown Kniesche and his colleagues will spend many more nights in the tunnel, inspecting thousands of interconnects and mountains of other components.

Provided by CERN

Citation: X-ray tests: Night at the collider (2013, November 26) retrieved 26 April 2024 from <https://phys.org/news/2013-11-x-ray-night-collider.html>

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