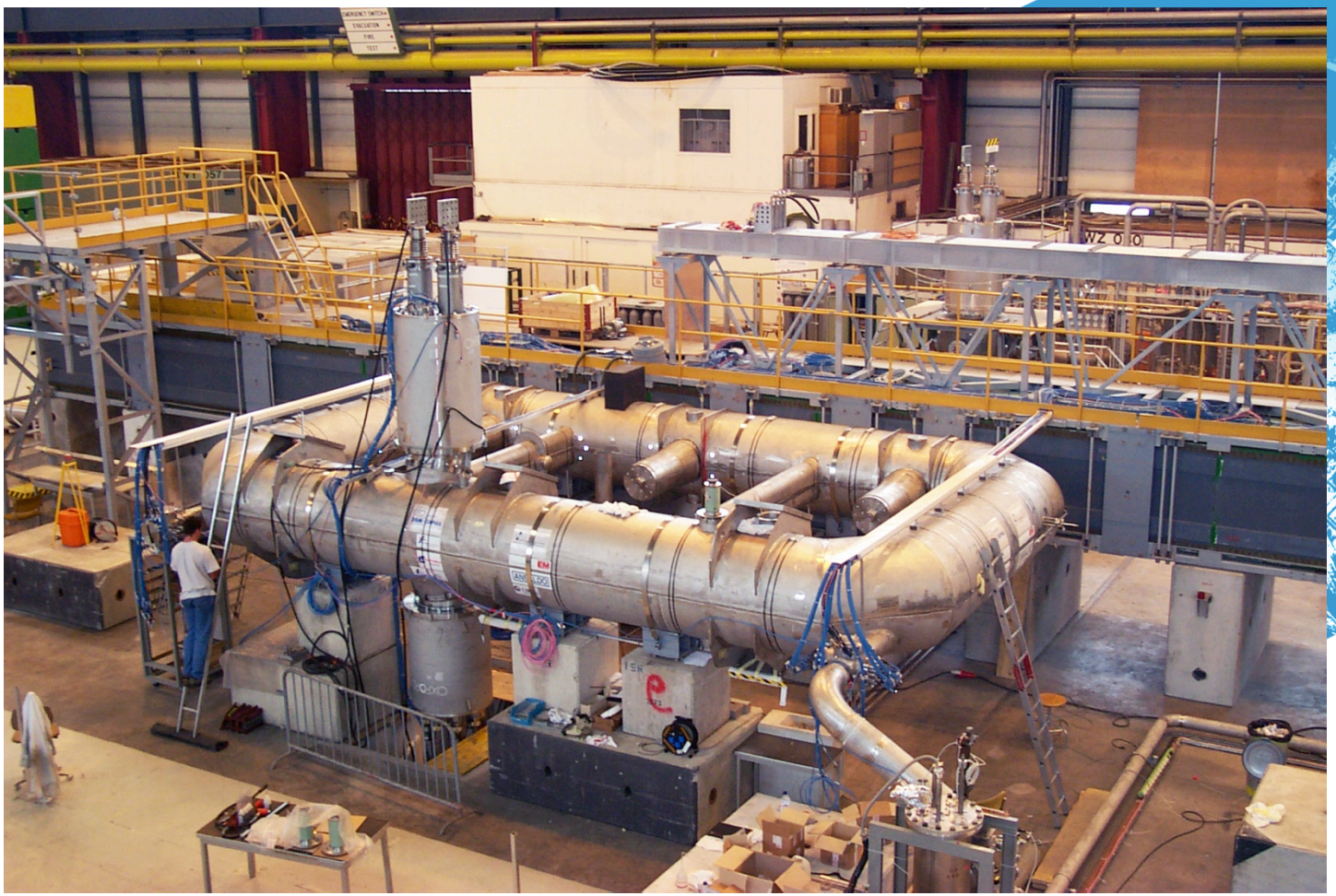
# *The ATLAS B0 Toroid Model Coil*



ATLAS
Mapping the secrets of the universe

ATLAS EXPERIMENT

## Why, when?

It was around 1995, 1996. The ATLAS technical proposal was published in December 1994 but the Toroid project was not approved yet [the 4 ATLAS magnet system TDR were published in 1997]. The coil conductor properties had been successfully tested: cooling down to 4 K, current ramping up and induced magnetic field. Everything was fine… but on a 1m long setup, which would fit on a table. Would the construction technique proposed be proper for a 25m x 5m magnet? The magnet team felt that they had to get started, and that the experience gained would speed up ATLAS construction. A special project was created and financially sponsored by CEA, INFN and CERN together, called "the B0". Shorter in length, but fully representative in terms of cross section, it was a "learning on the job" demonstrator, setup to shorten the construction time of the full ATLAS magnet.

## To mimic ATLAS environment: the magnetic mirror

In principle the ATLAS toroid is an air coil, one can predict very precisely the field map. In reality, ATLAS contains stainless steel structures and some iron, which distort the field heavily. A second feature to be studied is the effect of forces induced on each coil by others and detector elements, the tile calorimeter in particular. The resulting force is radial and about 1400 tons.

Both effects were accounted for through a metallic wall – called magnetic mirror – build next to the inner side of the B0.

All together, the field probes and measurement system developed by CERN, Saclay and Nikhef finally worked very well. In 2005 a new and "validation" campaign of the improved setup was proposed, this time on one of the current ATLAS toroid "BT8".

On the B0 the magnet bending due to its weight and length was too small to be measured, but on the final ATLAS coil elements it is measurable – small but measurable – and taken into account. All 8 coils eventually went through the same test.

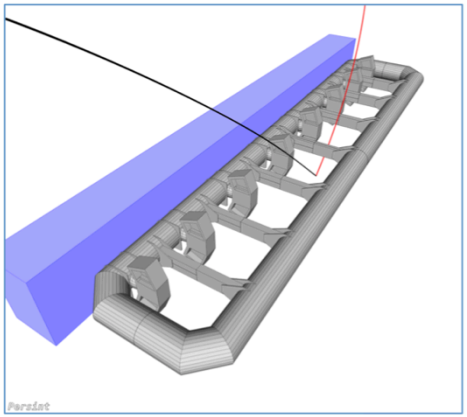


Image caption: trajectory of two muons of opposite charge, and momentum of 3 GeV. The magnetic mirror is drawn in blue.

## Fitting the magnet shape and position

A precise magnetic field map, rapidly and repeatedly accessible by the reconstruction programs, is needed to measure the momentum of muons in ATLAS. Establishing this map requires a precise knowledge of the coils position and deformation… within the cryostats. This is determined by using 1840 sensors, equipped with 3 Hall probes measuring the 3 components of the field. Placed on the MDT chambers or the cryostats, these sensors provide the measurement needed to fit the position of each coil element, and then calculate the magnetic field everywhere in the Muon System, with a precision of 1 mT.