

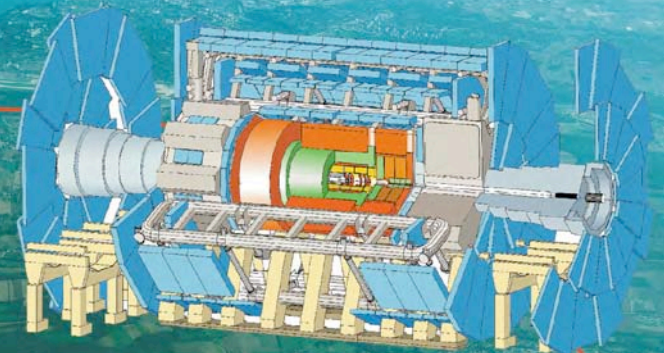
# ATLAS

## The ATLAS Experiment

ATLAS is one of four major experiments that will enter new territory in the exploration of matter, energy, space and time when the Large Hadron Collider begins operation at CERN.

Designed to find out why the Universe is like it is today, ATLAS will probe more deeply into matter than ever before and explore new fundamental processes.

Unlocking Nature's secrets by investigating particle collisions with ATLAS will be an unprecedented scientific and technological challenge. The ATLAS experiment is being conducted by a collaboration of scientists from 34 countries around the world. The detector they are building is not only complex but also very big – it will be the largest-volume detector ever constructed for particle physics.





The ATLAS detector consists of four major components:

### ATLAS and the LHC

ATLAS will observe dramatic head-on collisions of pairs of protons whose total energy is 14 TeV. The protons will be accelerated to these high energies by the Large Hadron Collider (LHC) – an underground accelerator ring 27km in circumference. The LHC is filled with superconducting magnets to steer and focus the protons in beams that repeatedly circle the ring. The ambitious experimental programme of ATLAS will shed light on many unanswered questions about the origins of matter and the fundamental forces of nature.

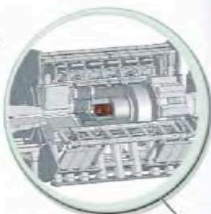
### The particle collisions

Measuring 46m long and 25m high, the ATLAS detector is the largest and one of the most elaborate particle physics experiments ever designed. The head-on collisions of protons at its centre leave debris that will reveal new particles and new processes in the interior of matter.

Various layers of the detector will track the trajectories of the charged particles and measure the energies of most charged and neutral particles. The curvature of particle tracks in the magnetic field will allow the momentum and electric charges to be determined. Out of nearly 1000 million collisions each second, only a few will have the special characteristics that might lead to new discoveries. The trigger system selects such events for recording and avoids storing immense amounts of unnecessary information.

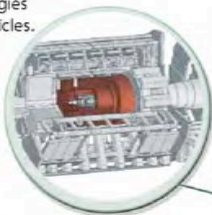
#### Inner Detector

Measures the momentum of each charged particle.



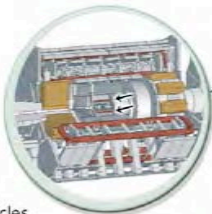
#### Calorimeter

Measures the energies carried by the particles.



#### Muon Spectrometer

Identifies and measures the momenta of muons.



#### Magnet System

Bends charged particles for momentum measurement. Arrows point to the solenoid magnet. The larger objects are toroid magnets.

# Detector

# ATLAS Physics

The particles from a collision event leave tracks and deposit energy in the detector. This is a bird's-eye perspective of how an event would look in the detector (the radial proportions are distorted).

## The unknown

ATLAS brings experimental physics into new territory. Most exciting is the completely unknown surprise – new processes and particles that would change our understanding of energy and matter and of the basic forces that have shaped our universe since the beginning of time. Are there, for example, extra dimensions of space or mini-black holes?

## Dark matter

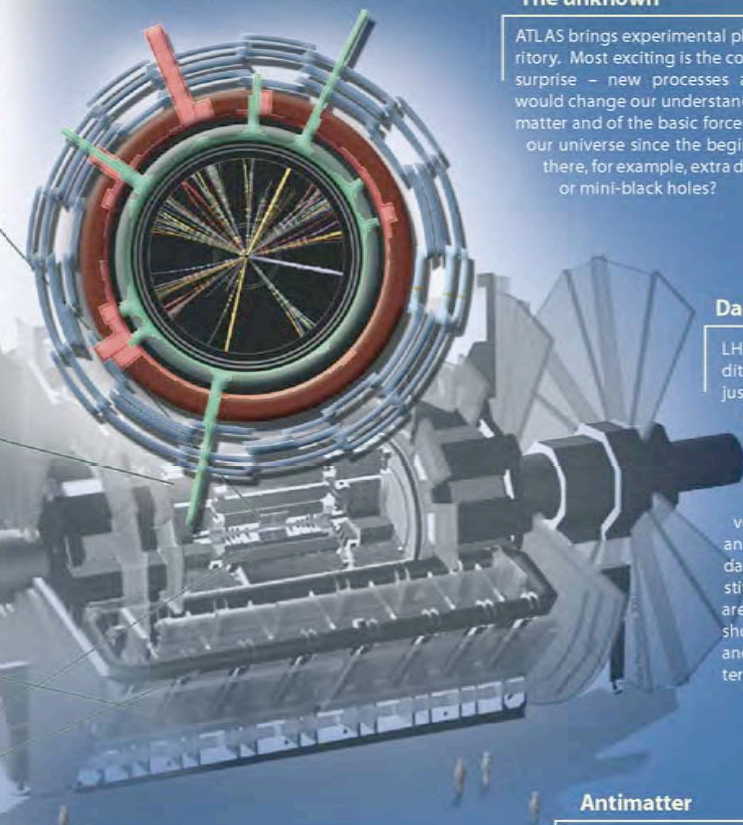
LHC will recreate the conditions of the universe just after the Big Bang to understand why the universe is like it is today. It will investigate why the matter of the universe is dominated by an unknown type called dark matter. If the constituents of dark matter are new particles, ATLAS should discover them and elucidate the mystery of dark matter.

## Mass

Why do fundamental particles have such different masses? Two of the greatest mysteries are how particles gain mass and how mass and energy are related. To explain these mysteries, theories predict a new particle, the Higgs particle. If this particle exists, ATLAS will discover it and provide great insight into the problem of masses.

## Antimatter

At the very beginning of the universe, equal amounts of matter and antimatter existed. If matter and antimatter were exact mirror images of each other, they would have completely annihilated to leave only energy. But why was some of the matter left over to create galaxies, the solar system with our beautiful planet, and us? ATLAS will explore the tiny difference that exists between matter and antimatter.



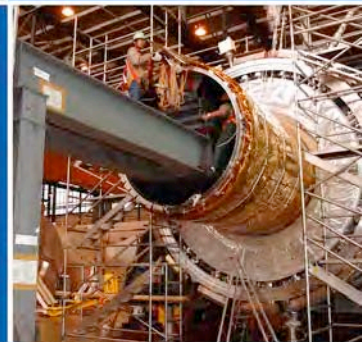
## The world of ATLAS

The 1800 scientists from 150 universities and laboratories collaborating on ATLAS represent 34 countries and all the world's populated continents. In 2007 the first LHC proton beams will collide in the centre of ATLAS and for the next 10-15 years a huge amount of data will be collected and analysed in universities and laboratories all over the world.

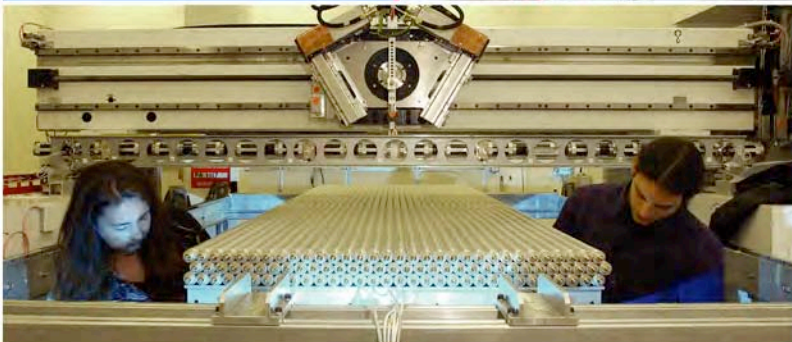
Scientists and engineers come from all over the world to work on ATLAS (right)



Inserting the superconducting solenoid magnet into the barrel cryostat of the electromagnetic calorimeter (below)



Muon chambers for the outer layers of ATLAS undergo quality control checks (left)



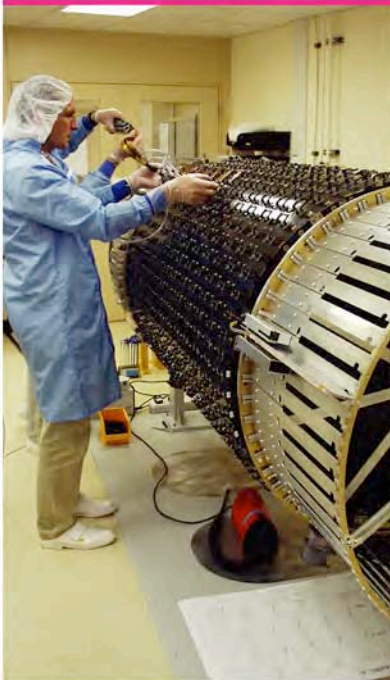
The large international ATLAS collaboration provides a powerful environment for exploration in particle physics. It succeeds by splitting its work into separate projects in which smaller working groups can make substantial contributions. Components come to CERN from all over the world to be integrated in the giant detector.

Members of the team preparing the straw detectors that pinpoint the tracks of particles (left)



The first section of the hadron calorimeter installed in the ATLAS cavern (below)

Assembly of the Semiconductor Tracker (left)



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The vast amount of data from the proton collisions will be used to study a wide variety of research topics, by scientists and students in their home institutions. Some 400 students worldwide are participating in ATLAS, constructing the detector and preparing for collection and analysis of the data.

<http://atlas.ch> The ATLAS website contains further information on the organization, the detector, the physics, the LHC and the participating university and laboratory groups.

