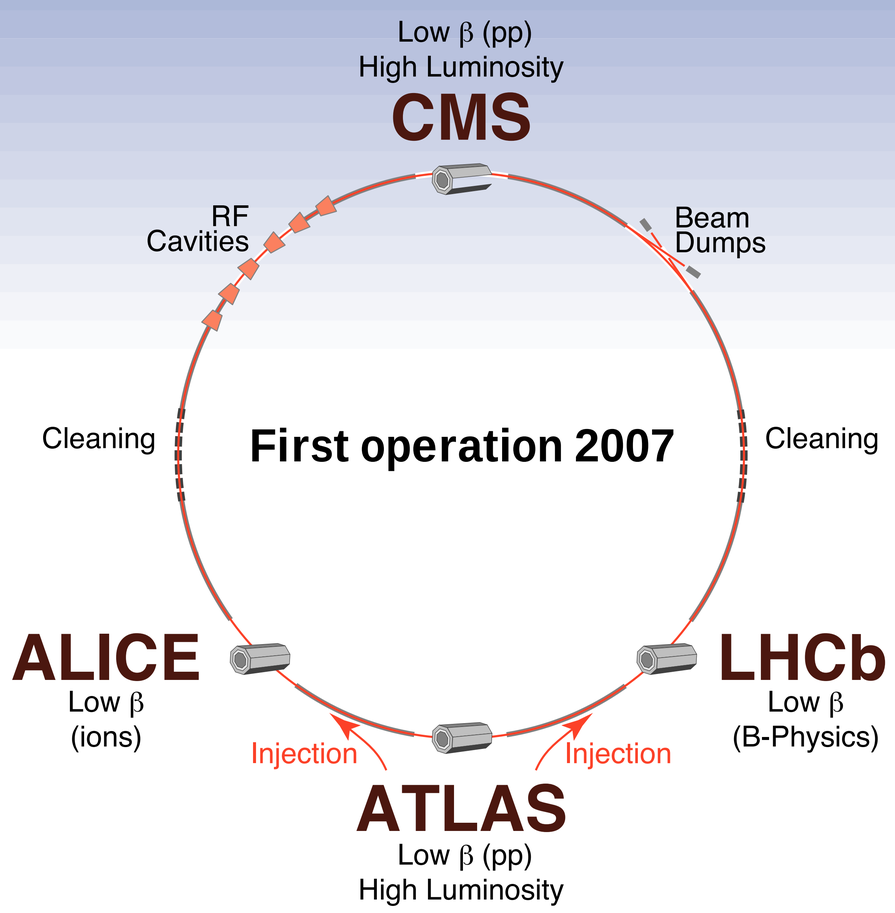
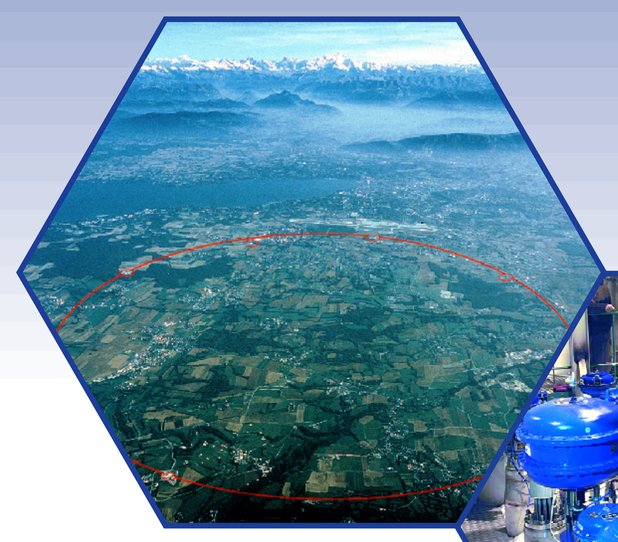
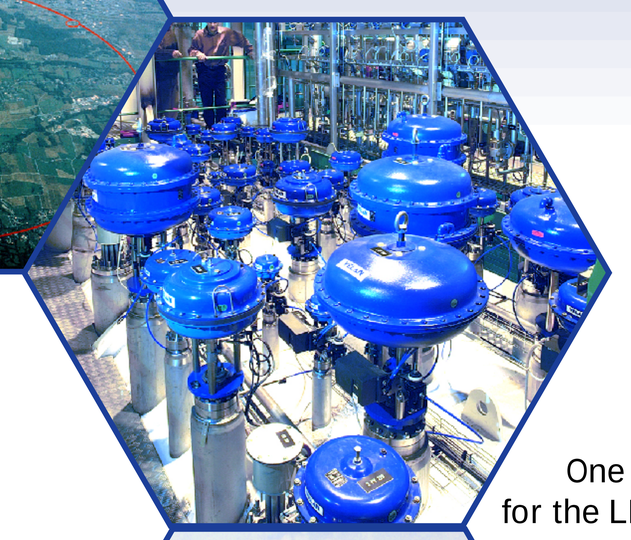
LHC - the world's most powerful particle accelerator

Particle accelerators are the machines that make all this research possible. Over the years, CERN has built up the world's most versatile complex of particle accelerators. In 2007, this is set to be joined by the most ambitious accelerator to date, the Large Hadron Collider (LHC). The LHC will enable the study of proton-proton and ion-ion collisions. CERN's existing chain of injectors (LINAC, booster, PS, SPS) will provide the necessary particles.



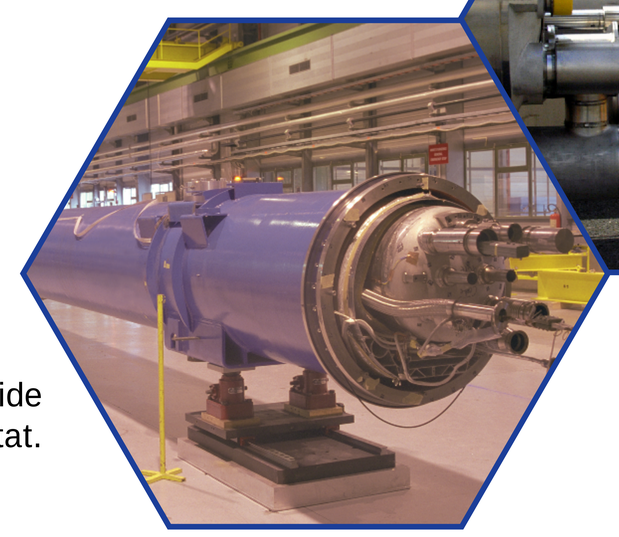


CERN from the air.
The red circle marks the position of the LHC tunnel, 100 metres underground.
In the background are lake Geneva and the Alps.



One of four new cold boxes for the LHC's cryogenic system.

Cold masses for LHC dipole masses awaiting assembly into their cryostats at CERN.



A dipole inside its cryostat.

Performance parameters

Energy	TeV	7.0
Dipole field	T	8.3
Coil aperture	mm	56
Distance between apertures	mm	194
Luminosity	$cm^{-2}s^{-1}$	10^{34}
Beam-beam parameter		0.0036
Injection energy	GeV	450
Circulating current / beam	mA	582
Bunch spacing	ns	25
Bunches per beam		2808
Particles per bunch		10^{11}
Stored beam energy	MJ	366
Normalized transverse emittance	μm.rad	3.75
r.m.s. bunch length	m	0.077
β-values at I.P. in collision	m	0.55
Full crossing angle	μrad	285
Vacuum beam lifetime	h	84
Luminosity lifetime	h	13.9
Energy loss per turn	keV	7
Critical photon energy	eV	44.1
Total radiated power per beam	kW	3.8

(General LHC parameters version 3.0. Nominal proton performance parameters version 3.0)

The LHC superconducting magnets will generate the highest magnetic fields ever reached in an accelerator of this scale. The dipoles and quadrupoles will be interconnected so as to form a continuous cryogenic "pipe" installed in the 27 km-long LHC tunnel with a separate cryogenic distribution line. The superconducting RF accelerating cavities, along with the beam cleaning and beam dump systems, will complete the machine.