# CAST – CERN Axion Solar Telescope

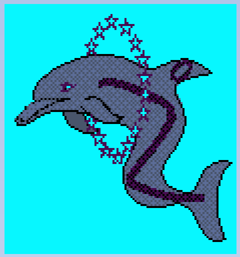

**The CERN Axion Solar Telescope (CAST)** aims to shed light on a 30 year old riddle of particle physics by detecting axions originating from the 15 million degree plasma in the Sun's core.
The conversion efficiency for axions increases as the square of the product of the transverse magnetic field component and its length. This makes a 9 tesla, 10 m LHC prototype dipole magnet with two straight beam pipes ideal for the task, giving a conversion efficiency exceeding that of the two earlier telescopes by a factor of almost 100. CAST's LHC magnet is mounted on a platform with ± 8° vertical movement, allowing for observation of the Sun for 1.5 h at both sunrise and sunset. The horizontal range of ± 40° encompasses nearly the full azimuthal movement of the Sun during the year. The time the Sun is not reachable is devoted to background measurements. At both ends of the magnet, three different detectors are searching for X-rays coming from axion conversions in the magnet when it is pointing to the Sun. As X-ray detectors CAST utilizes:  an X-ray mirror telescope in combination with a CCD camera, a MICROMEGAS, a TPC
The X-ray focusing system and Micromegas are looking for sunrise axions, while the TPC is occupying both bores on the other end and is waiting for sunset axions.
The operation of the CAST experiment is foreseen to go in two phases: **Phase I** (**completed!**): during 2003 and 2004 the experiment operated with vacuum inside the magnet pipes and explored axion mass range up to 0.02 eV. 2003 data have been analyzed. **Phase II** (**running**): in order to extend CAST sensitivity to higher axion rest masses, magnet pipes are filled with a gas (in 2005-2006 with $^{4}He$ and in 2007 and on with $^{3}He$).

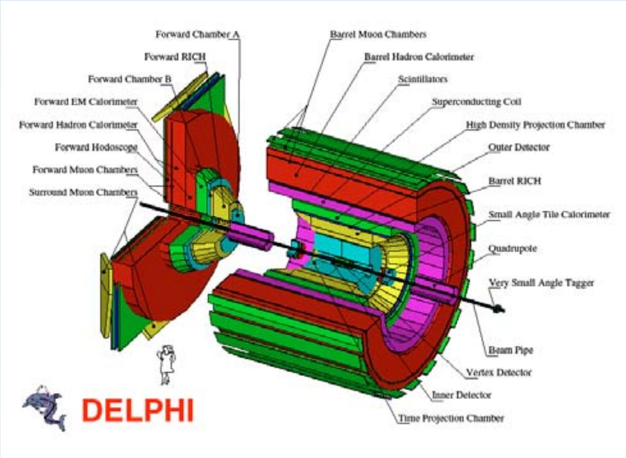
CAST is making an important step in solar axion searches:
the sensitivity of the experiment is comparable with the limit imposed by astrophisical considerations,
in Phase II, CAST is able to enter into the region which is especially favoured by axion models, for the first time for a laboratory experiment.

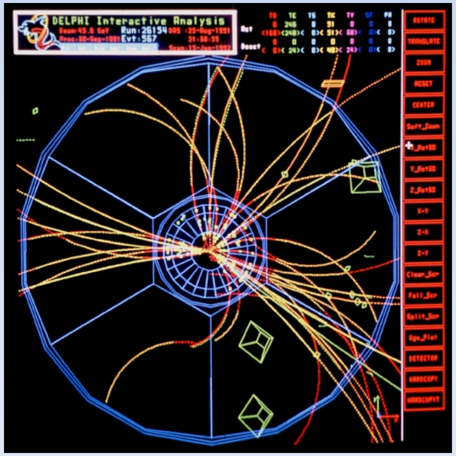
# DELPHI
# Experiment DEtector with Lepton, Photon and Hadron Identification

The operation of the LEP collider at CERN started in August 1989 opening a new chapter in the history of particle physics. With a circumference of 27 km, LEP is the largest accelerator yet built. LEP stopped in november 2000, but the analysis of data is still going on, with the possibility of discovering new physics phenomena.

**DELPHI** was an advanced detector. As well as having high precision and 'granularity', it has the specific ability, using the Ring Imaging Cherenkov technique, to differentiate between all the various secondary charged particles. It also has an advanced silicon detector providing very precise tracking, principally in order to detect very short lived particles by extrapolating the tracks back towards the interaction point. Design and construction of the DELPHI detector took 7 years; data have been taken every year for 12 years.






# LHC Cryogenics

LHC superconducting magnets are sited in 1.9 K baths of superfluid helium at atmospheric pressure. These baths are cooled by low-pressure saturated superfluid helium flowing in heat-exchanger tubes distributed along the string of magnets.
The cooling of the LHC is produced by eight large cryogenic plants – one per sector - installed in five cryogenic islands. Each plant is able to produce up to 600 kW at 80 K with LN2 precooling, up to an equivalent capacity of 18 kW at 4.5 K as well as up to 2.4 kW at 1.8 K. The cooling of the huge sector mass of 4600 tons from room temperature down to 1.9 K and the filling of the magnet with up to 15 tons of helium mainly in superfluid state are performed in few weeks and consume 1250 tons of liquid nitrogen.

# LOCATION OF POINT 8