L3

The detector is a multi-layered cylindrical set of different devices, each of them measuring physical quantities relevant to the reconstruction of the collision under study. Starting from the centre, close to the pipe where electrons and positrons circulate and collide, we first find the Silicon strip Microvertex Detector (SMD) and the Time Expansion Chamber (TEC). These two sub-detectors trace the paths of charged particles produced in the collision. One also gathers information about the momentum (a quantity related to mass and energy) of the particles by measuring their deflection in the magnetic field present in the detector. The three main outer layers are the electro-magnetic calorimeter (also called BGO because it's made of Bismuth Germanium Oxide), the hadronic calorimeter (HCAL) and the muon detector.

Schematic view of the detector :

Calorimeters are dense and stop most particles, measuring their energy. A set of scintillation counters is placed between the electro-magnetic and hadronic calorimeters: one of their functions is to help in recognising and rejecting signals coming from cosmic ray muons, very highly energetic particles which come from the space and can disturb the measurement.

The outermost layer contains the magnet (the largest in the world: about the same weight of the Eiffel tower!) which generates inside the detector a magnetic field about 10000 times the average field on the surface of the Earth . This field deflects the charged particles which cross it and the curvature of this deflection is a way of reconstructing the energy of the particles.

Another important part of the detector are the two luminosity monitors, placed along the beam on both sides of the interaction point. They measure the "luminosity" of the beam, which is a way of quantifying the rate of interactions produced.

The muon chamber, visible in the picture, is particularly designed to detect muons, which pass through the inner calorimeters with a very small loss of energy.

The electro-magnetic calorimeter (left) and the hadronic calorimeter (above) are seen here during assembly.

Electrons leave most of their energy in the electro-magnetic calorimeter, where also photons (X-rays) are detected. Unlike electrons, photons do not have a charge and therefore they do not trace their path in the time expansion chamber. Hadrons (such as protons and pions) deposit their energy mainly in the hadronic calorimeter, usually being stopped there. Muons have a very small interaction with the calorimeters and so they can reach the muon chamber where they are finally detected.

All the information relative to a collision event is recorded on computers: the event itself can then be reconstructed by means of sophisticated software and visualised in a picture showing the paths followed by the particles and the energies deposited by them.