

# LHC magnets

Preparations for the LHC proton collider to be built in CERN's LEP tunnel continue to make good progress. In particular development work for the high field superconducting magnets to guide the almost 8 TeV proton beams through the 'tight' curve of the 27-kilometre ring are proceeding well, while the magnet designs and lattice configuration are evolving in the light of ongoing experience. At the Evian LHC Experiments meeting, this progress was covered by Giorgio Brianti.

The magnet configuration now foresees more evenly distributed correction coils, and longer bending magnets - three 13.6-metre dipoles rather than four 10-metre ones - per 50-metre half-cell. This means that 'only' 1152 dipoles, rather than 1600, would be needed to fill the ring.

This new configuration gives an increased beam energy of 0.81 TeV per Tesla, rather than 0.77 as in the original 'Pink Book' Design Study, so that the required 7.7 TeV proton beams (15.4 TeV collision energy)

can be guided using 9.5 Tesla fields instead of the 10 T originally foreseen. This increases the margin between operating and maximum fields and makes the design more comfortable.

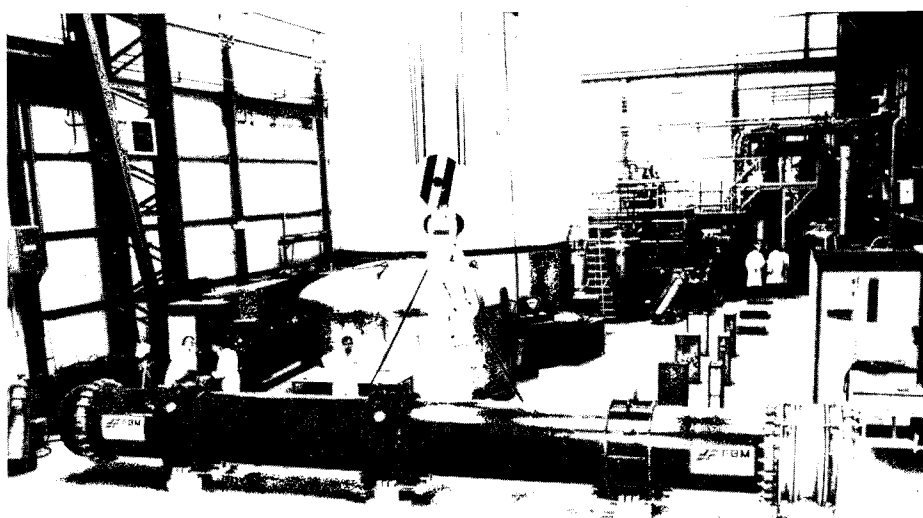
Progress with model and prototype magnets is promising. Short (1-metre) models have attained 10 Tesla or thereabouts, and important progress has been made in understanding where and why quenches occur. A 'full length' (according to the original design) 10-metre prototype has been put through its paces at the French Saclay Laboratory. This dipole has a full LHC configuration, with twin beam apertures inside a single magnetic assembly (the 'two-in-one' design), but to obtain an initial rapid result uses the same coils as the HERA superconducting proton ring at DESY, Hamburg, which have a bore of 75mm instead of the 50mm of the LHC design.

Cooled to 4.4K, these coils behave like those in HERA, but when taken down to the 1.9K levels foreseen for

LHC cryogenics, the current increases from 6600 to 9500 A, and after only a few quenches, demonstrating that the two-in-one design does not adversely affect performance. The field reached was 8.3 Tesla.

Five 10-metre dipoles of this design, with real LHC coils, have been ordered. Four of these will be used next year for an above-ground 'string test' of the LHC magnet lattice which is seen as an important milestone.

However to study closely the behaviour in the 10 T region, more one-metre models and ten-metre prototypes are being built to explore other design alternatives, such as separate collars for the two beam channels to reduce mechanical stresses.



The first 10-metre prototype LHC magnet has performed well in cryogenic tests at the French Saclay Laboratory. After 6600 A currents at 4.4K, the current increased to 9500 A with the coils cooled down to the 1.9K levels foreseen for LHC working, and after only a few quenches, demonstrating that the two-in-one design does not adversely affect performance. The field reached was 8.3 Tesla.

(Photo Saclay)