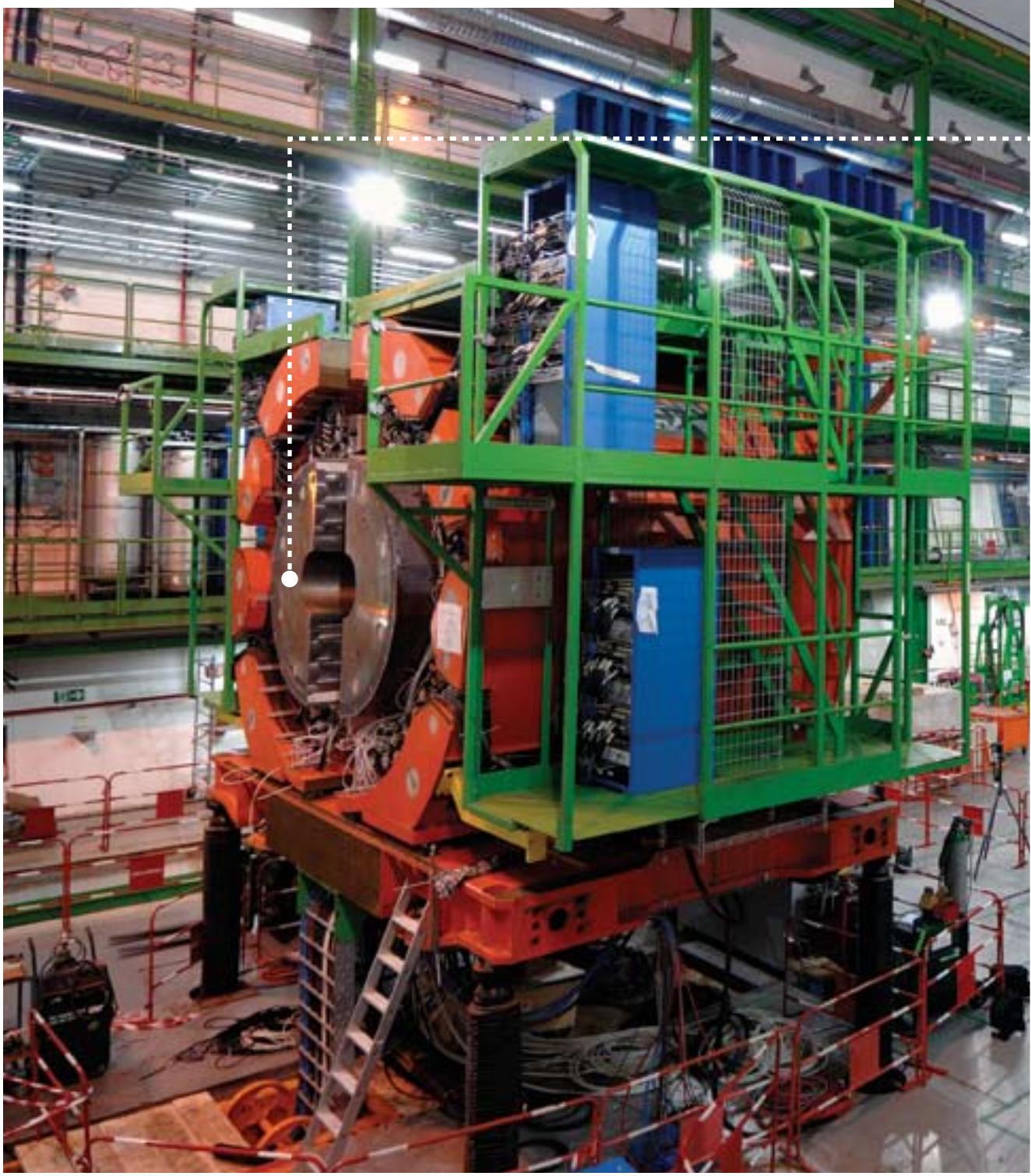
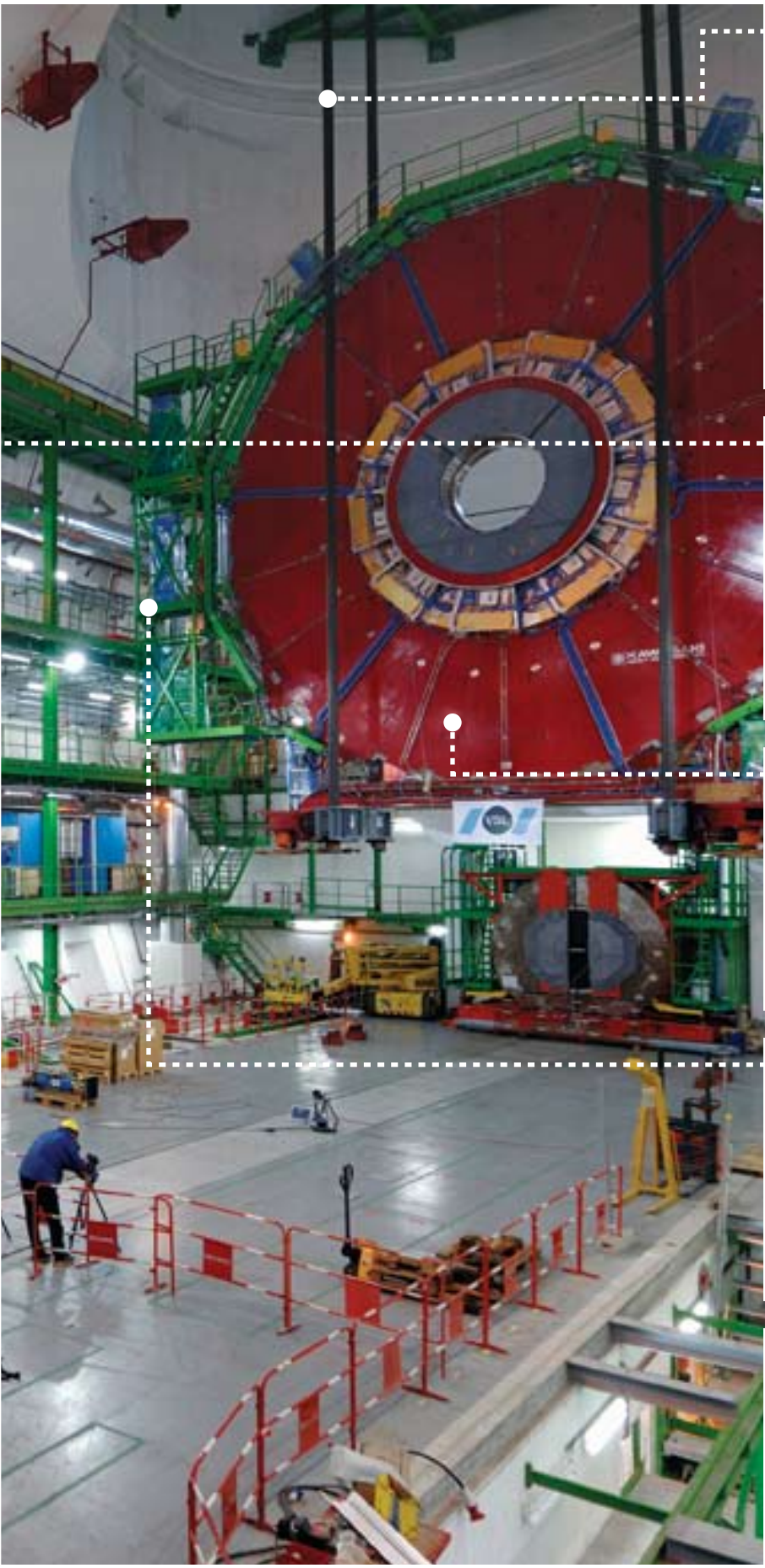
The Compact Muon Solenoid

(CMS) detector is one of the two general purpose particle detectors being constructed at CERN's Large Hadron Collider (LHC) outside Geneva, Switzerland. The conceptual design of CMS started taking shape 16 years ago with physicists trying to work out how to build such a large detector and install it underground.

Building on his previous experience with the installation of the L3 detector at the Large Electron Positron (LEP) collider, the CMS technical coordinator Alain Hervé decided that building large objects on the surface and transferring them completed to the underground area was the clear way to go. This modular concept also minimizes the time required to access, uncable, dismount, remount, recable, and recommission detector subsystems during shutdown periods.





1 The basic modular design of CMS was finalized in the summer of 1992. The design incorporated 15 large elements that could each be built on the surface and lowered 100 meters underground by a gantry crane, albeit one that could lift 2500 tons via four enormous cable bundles. Over the past few years these pieces have been assembled at CERN from elements built by physicists, engineers, and technicians at the 155 institutions of the CMS collaboration. All pieces undergo detailed tests before they are lowered underground.

2 Following extensive tests of the gantry crane, the first pieces to be lowered into the cavern were the two Hadronic Forward calorimeters, or "HFs". These 300-ton objects are made from steel embedded with quartz fibers that emit Čerenkov light when particles pass through them faster than light can. The light produced provides an estimation of the energy of particles traveling through the HFs.

3 The first of six endcap disks (three on each side of the CMS detector) was lowered into the cavern in November 2006. This solid steel disk forms part of the magnet return yoke and is equipped on both sides with muon detectors. It is around 16 meters in diameter, about a half-meter thick, and weighs about 400 tons.

4 The green superstructure attached to the disk will house electronics for a part of the detector that registers muons (heavy relatives of the electron). Moving the superstructure is an exciting task: during the ten-hour journey underground the clearance between the disks and the shaft walls is just 20 centimeters!

The remaining endcap disks and the five barrel "rings" (weighing up to 2000 tons) will all be lowered by the middle of 2007, shortly followed by the lowering, installation, and commissioning of the inner detectors to be ready for the LHC startup.

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Photo: CERN