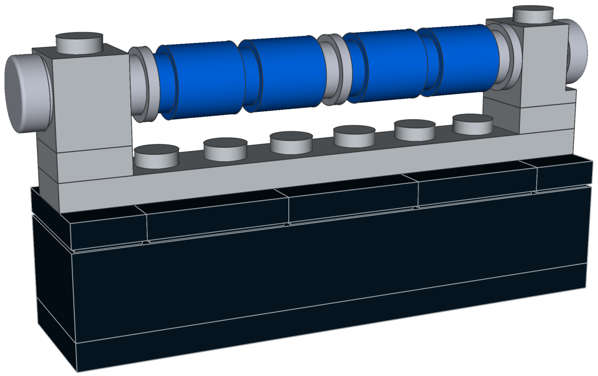
Large Hadron Collider Magnet

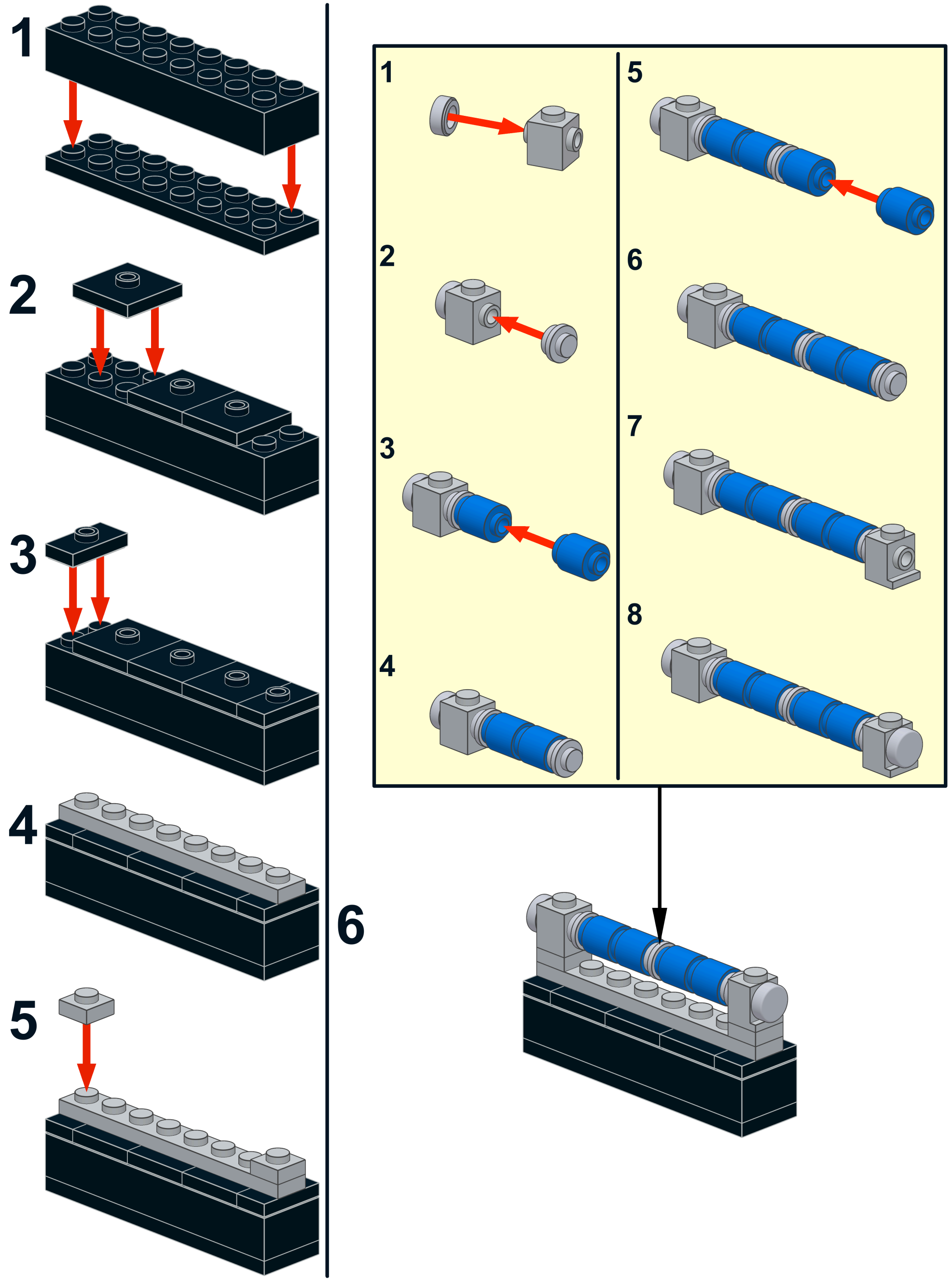
Model Designed by Nathan Readioff



The Large Hadron Collider at CERN is the largest and most powerful particle accelerator in the world, consisting of a 27km circumference ring of superconducting magnets in a tunnel beneath the French-Swiss border. It accelerates two separate beams of protons up to almost the speed of light while they repeatedly circle the ring in opposite directions. Each beam travels in a steel pipe holding an ultra-high vacuum, comparable to the interplanetary void, in order to stop the protons from bouncing off stray molecules from the air and losing energy.

The accelerator uses 1232 dipole magnets, each measuring 15 metres long and weighing 35 tonnes, to steer the beams around the ring. An additional 392 quadrupole magnets, each around 3-4 metres long, are used to squeeze the beams and focus them into a series of tightly packed proton bunches. All the main magnets are made from a niobium-titanium alloy and cooled by liquid helium to -271.25°C, a temperature slightly colder than outer space, so that they become superconducting. This causes all electrical resistance to disappear, allowing the magnet coils to carry much higher currents than normal and generate intense magnetic fields over 100,000 times stronger than that of the Earth.

Special insertion magnets squeeze each beam down to a diameter of around 64 micrometers, about the width of a human hair, and the beams are then nudged to pass through each other in the centres of four huge detectors - ALICE, ATLAS, CMS and LHCb. Individual protons from each beam collide head-on and are smashed apart, producing a host of new particles. Hundreds of millions of such proton collisions occur each second, while the beams circulate for hours at a time. The detectors continuously observe the particle debris of each collision, and physicists search for rare and unusual particles that will help unlock the mysteries of the Universe.



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