Particle Accelerators

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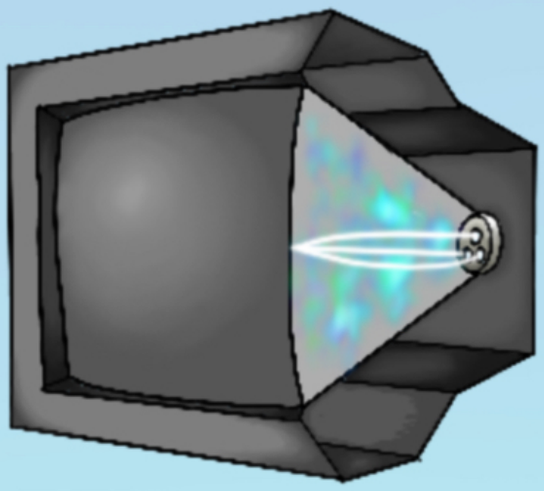
Throughout history many ***physics experiments*** *have been performed, some of them with* ***machines*** *that end up being* ***useful*** *for our* ***daily life****, such as* ***particle accelerators.***

The particle accelerators are machines that ***accelerate charged particles*** *to high velocities by* ***electromagnetic fields****. Particles are usually accelerated to* ***collide*** *them with each other.*

2 *There are two types of particles accelerators,* ***linear*** *and* ***circular.***

Linear particle accelerators are widely used in ***medicine*** *and* ***industry.*** *For example,* ***old televisions*** *worked with a small particle accelerator inside them that produced* ***electron beams.***



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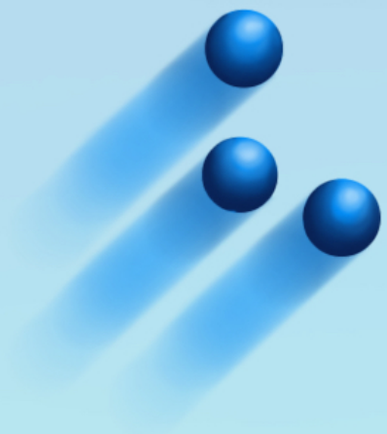
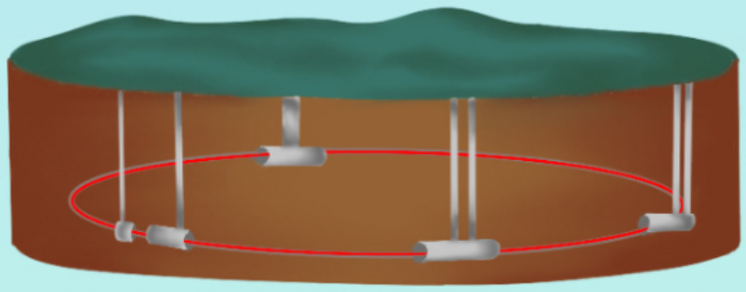
For physical research, particle accelerators are used to ***collide particles*** *and study the* ***products*** *that are generated in these collisions. Many scientific organizations have developed particle accelerators and these have been* ***very important*** *for* ***discoveries*** *such as* ***Higgs Boson.***



4 ***CERN****(European Organization for Nuclear Research) is currently the most important organization for* ***particle physics research.***

It was founded in 1954 by the union of ***12 European countries*** *and it has participated in important* ***discoveries*** *and* ***inventions.***

5 *At CERNs facilities is located the* ***biggest particle accelerator*** *of the entire world, the* ***LHC****(Large Hadron Collider).*



LHC has a ***27km*** *circumference, it's located on the* ***French-Swiss*** *border and it's 100m underground.* ***Protons*** *and* ***lead ions*** *collide in the LHC.*

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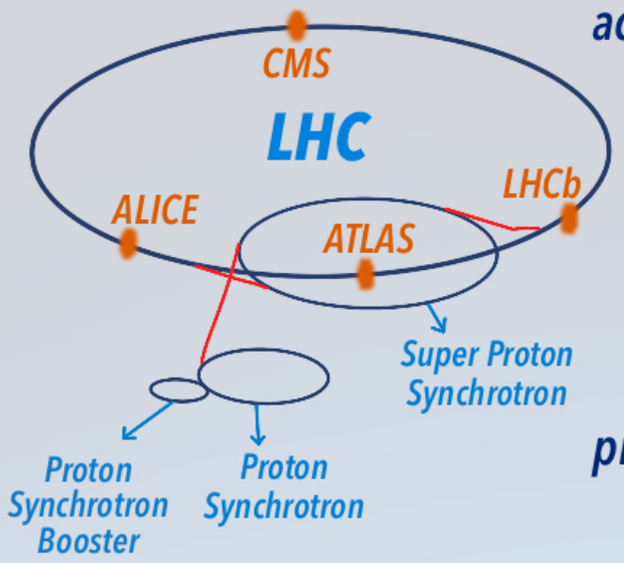

*For the particles to be accelerated in the largest ring, **protons** must be first created, then its **energy** must be **increased** in a series of accelerators before protons are **injected** into the **main ring.***

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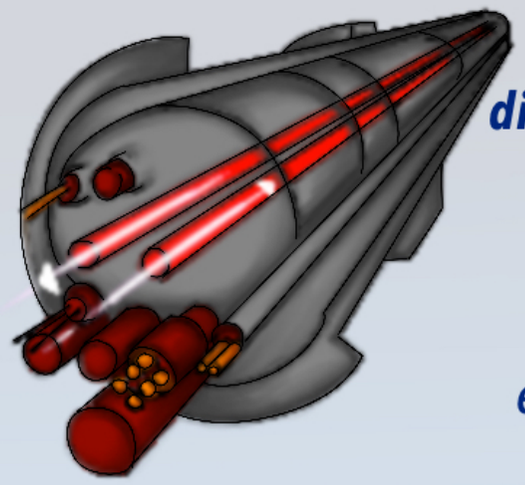

*Protons are accelerated in **two ducts** in **opposite directions,** these ducts cross at 4 points, where the protons collide, in these points are located the experiments **ALICE, ATLAS, CMS** and **LHCb.***

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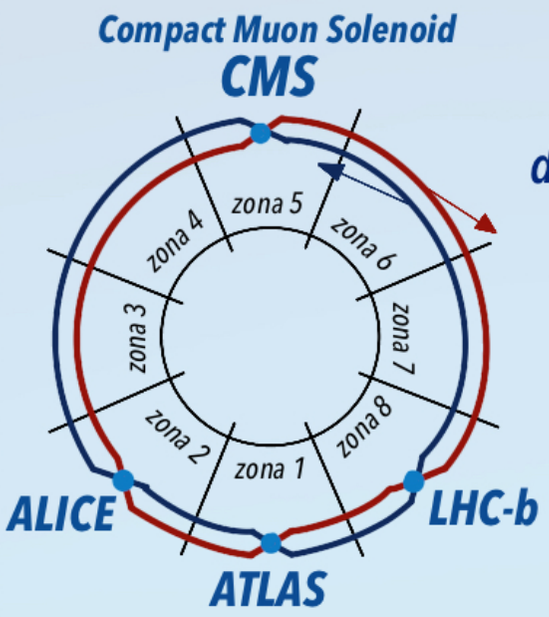

*The **CMS(Compact Muon Solenoid)** is the **heaviest** detector of the LHC and one of the largest. The main goal of CMS is to search for new physics. CMS is designed to **measure** the **energy** and **momentum** of the **particles** created in the collisions.*

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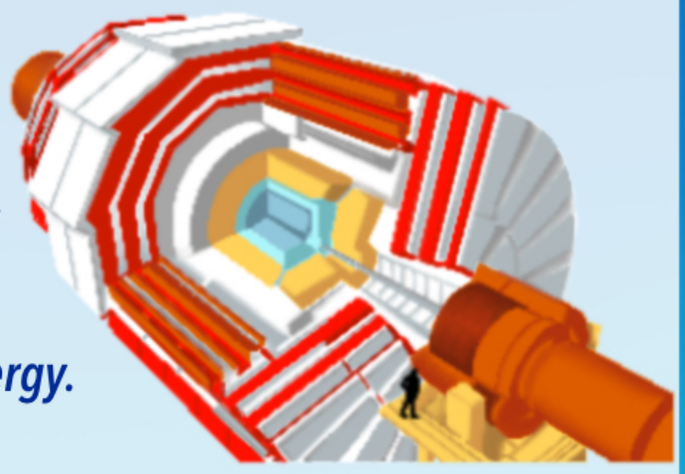
*The CMS has several parts, first a **tracker system** that reconstructs the tracks of the particles created in the collision, then, an **electromagnetic calorimeter** that stops **photons** and **electrons,** and measures their energy.*



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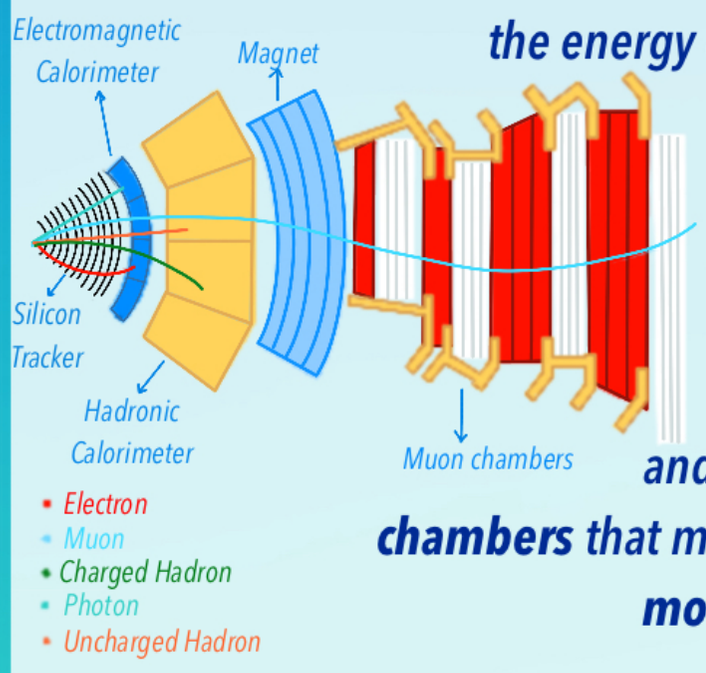
*Then there's a **hadronic calorimeter** that measures the energy of the hadrons(Particles formed by quarks); then there's a large **magnet** that bends the paths of the charged particles, and finally there are **muon chambers** that measures the **charge** and **momentum** of the muons.*



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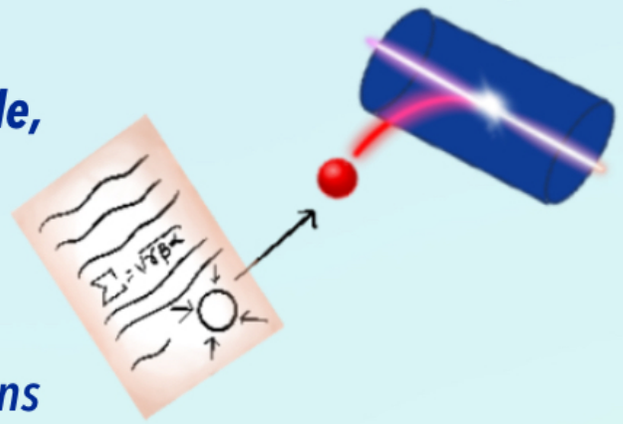
*With the **LHC** and **CMS,** searches are made for different particles that have been **theoretically predicted,** such as **dark matter particle,** that has several **candidates** that **could be detected** in particles collisions at the LHC.*



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