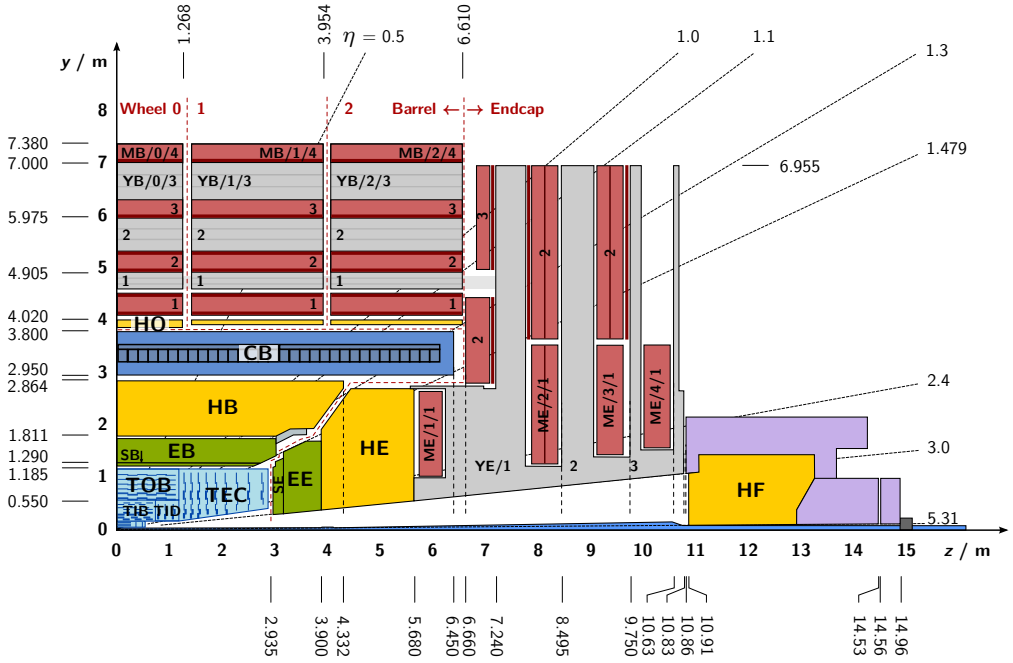


Figure 3.6: Cross section of one quadrant of the CMS detector in the $y$-$z$-plane. The different detector subsystems and their size are indicated: The tracking system (light blue), the electromagnetic calorimeter (green), the hadronic calorimeter (yellow), the superconducting solenoid (dark blue) and the muon chambers (red) [43].

### Electromagnetic Calorimeter

The electromagnetic calorimeter (ECAL) measures the energies of photons and electrons. It is the second innermost subdetector, located just outside the tracking system and only 1.3 m away from the interaction point.

Electrons and photons create an electromagnetic shower, effects like pair production and bremsstrahlung lead to a cascade of photons and electrons. Their energy is deposited in the calorimeter material via Compton scattering or the photoelectric effect. The ECAL material scintillates, the resulting photons are caught by avalanche photodiodes and converted into digital signals. The particle energy can be estimated as it is proportional to the number of registered scintillation photons.

The ECAL is made of lead tungstate ($PbWO_4$) crystals because of several reasons: This material has a low scintillation time as 80% of photons are emitted within 25 ns, half the time between two bunch crossings. Also, the short radiation length of 0.89 cm allows for a compact design, with the ECAL fitting inside the magnet coil.

75 848 crystals are arranged in two components, the barrel (EB) and the endcap (EE) sections. These sections cover the rapidity ranges $0 < |\eta| < 1.479$ and $1.553 < |\eta| < 3.0$, respectively. A preshower detector is installed in front of the endcaps to distinguish isolated photons from pion decays. The ECAL can be seen in Figure 3.6, coloured in green, between the tracking system and the hadronic calorimeter.