An Interview with Prof. Barbara CLERBAUX

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Could you tell us about your university career?

I am working in the field of particle physics, which studies the elementary blocks of matter and the fundamental interactions between them. This requires large infrastructure, typically particle accelerators. The particles (electrons or protons) are accelerated and are colliding at various interaction points where complex detectors are located. Researchers study the particles in the final state created by the interactions.



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During my career, I participated in four large experiments. I did my PhD (1994-1998) at the ULB studying the structure of the proton in the framework of the H1 experiment at DESY (an electron-proton collider located in Hamburg, Germany). I then moved to CERN in Geneva for a postdoctoral research stay within the ALEPH collaboration at the LEP (Large Electron Positron) collider. I analyzed the ALEPH data searching for new particles predicted by the supersymmetry theory. These particles were not observed, and strong bounds were put on their masses and on parameters relevant to this theory.

In 2002, back at ULB at the IIHE, I started my permanent FNRS position, joining this time the CMS experiment at the Large Hadron Collider (LHC) at CERN and later the JUNO experiment in construction in China.

Could you tell us more about the IIHE?

The Inter-university Institute for High Energies (IIHE) (ULB-VUB) combines the experimental particle and astroparticle research groups from both Brussels universities, ULB and VUB. Created in 1972, it has about 100 physicists, engineers, IT, and support staff contributing to world-leading international experiments probing the universe at the largest and smallest scales, such as CMS, IceCube, RNO-G, AUGER, JUNO, and Solid experiments.

In addition, it has a strong R&D division based on detector development, data acquisition systems, and electronics. The IIHE deployed a large computing cluster that supports the processing of the vast amount of data produced by the experiments. I've been running this institute since October 2021.

What is the CMS Experiment?

CMS is a 15-meter diameter experiment consisting of a series of shells of complementary detectors that surround the LHC beam collision point. The IIHE, together with its Belgian colleagues from UAntwerpen, UCLouvain, and UGent, was responsible for the construction of part of the tracker detector. The proton beams are accelerated at high energies and collide at the center of the detector.

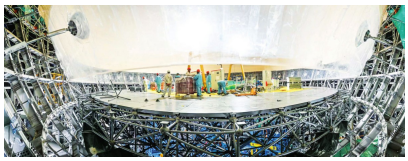
The most famous achievement of the CMS experiment is the discovery of the Brout-Englert-Higgs boson in 2012. At the IIHE, the CMS group is active in key research domains: precise measurements of the standard model particles, study of the Brout-Englert-Higgs boson, search for new particles, and dark matter signatures.

Right now, the IIHE is actively participating in the upgrade of the CMS tracker detector. This upgrade is necessary in order to gather data at higher rates during the high-luminosity LHC (HL-LHC phase 2 upgrade), planned to start in 2030. A total of 1,600 silicon modules with on-detector data processing capability are being built and tested at the IIHE in a 120 m^2 clean room.

What about the JUNO experiment?

In construction in China, this experiment will consist of a 35-meter diameter acrylic sphere filled with 20 kton of liquid scintillator and instrumented by 18,000 large photomultiplier tubes (PMT). The aim is to study the elusive neutrino particles (with very small masses and oscillations among their three flavours) and to measure some of their parameters with sub-percent level precision.

The IIHE was responsible for the design, test, and construction of the backend cards for the electronics readout system. The group is also involved in various sensitivity studies using simulation data. The start of the JUNO data collection is expected in summer 2025.



© ULB - Central sphere of the JUNO detector in construction