**Abstract**

CERN is the world's largest particle physics laboratory, housing multiple accelerators that rely heavily on magnetic coils. These coils are integral to the generation of powerful magnetic fields essential for particle accelerator experiments, detectors, and other equipment. At CERN, a range of magnetic coils are utilized, many of which are custom-made and located in various research facilities both above and below ground. However, these magnetic coils include epoxy resins, making them susceptible to fire hazards. Given the unique nature of CERN, a thorough engineering approach is required for fire safety design. Therefore, understanding the flammability characteristics of the epoxy resin used in magnetic coils is therefore crucial for ensuring proper fire safety measures at CERN.

The focus of this thesis is to investigate and gain a deeper understanding of the fire risk and fire behaviour associated with the epoxy resins used in magnetic coils at CERN that operate at ambient temperatures. In the first part of the thesis, the key factors that impact the flammability of epoxy resins and composites have been identified and their effects are well understood. Literature shows that the mechanical properties of epoxy resins can degrade due to radiation and aging, which represents a potential ignition source.

The second section of the thesis involves conducting four standardized tests on three representative epoxy resins used at CERN. Two of the epoxy resins are from magnetic coils that have been exposed to radiation environments for a considerable amount of time. These tests include micro-combustion calorimetry, cone calorimetry, lateral ignition and flame spread testing, and thermogravimetric analysis combined with Fourier transform infrared spectroscopy. The tests evaluate the ignition behavior, fire spread behavior, and flammability properties of the epoxy resins.