The upgrade of the CERN Proton Synchrotron Booster transfer line magnets

Abstract
The Proton-Synchrotron Booster (PSB), in operation since 1972, is the first of several pre-injectors in the way to the Large Hadron Collider (LHC) located at the European Organization for Nuclear Research (CERN) in Geneva, Switzerland.

The PSB was installed as part of the CERN Proton-Synchrotron (PS) upgrade in order to achieve higher beam intensity, where it first accelerated protons up to an energy of 800 MeV. By 1988, the PSB was capable of providing 1 GeV protons to the PS. After which in 1999, in preparation for LHC operations it was upgraded to 1.4 GeV. Finally during the Second Long Shutdown between LHC operations (LS2) which is currently underway, it is undergoing a latest upgrade to 2 GeV in order to ease the injection of high intensity and high brilliance beams into the PS, and thus help removing bottlenecks in the LHC injector chain. Along with the upgrade to 2 GeV, the connection of the new LINAC 4 to the PSB is also taking place. Replacing the 50 MeV LINAC 2, the LINAC 4 will accelerate negative hydrogen ions (H⁻, consisting of a hydrogen atom with an additional electron) to 160 MeV which when arriving at the PSB will be stripped of the electrons.

Largely untouched during decades of operation, many of the magnets in the existing transfer lines from the new LINAC 4 to the PSB, and the PSB to the PS will be upgraded as they no longer meet the increased requirements due to the two energy increases. Other magnets have come to the ‘end of life’ or will be changed to minimize and harmonize the number of magnet and power converter families in use and thus reduce the number of spares required.