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Designing a synchrotron - a real life example

Friday 4 October 2024 12:10 (1 hour)

This lecture's goal is to review several aspects of beam dynamics applied to the design and operation of an existing synchrotron. Our choice is the CERN Super Proton Synchrotron (SPS) whose enormous versatility has been demonstrated since its design and operation. It has served as high energy synchrotron serving fixed target experiments (West Area, North Area, CNGS, HIRADMAT), collider of protons and anti-protons (allowing the W and Z bosons discovery in 1983), accelerator of electrons and positrons for injection into the Large Electron-Positron (LEP) Collider, accelerator of protons and ions for the Large Hadron Collider (LHC), or even for extracting protons towards a plasma wakefield acceleration experiment (AWAKE). In this respect, the choice of the SPS basic parameters are reviewed such as energy, bending field and circumference, its optics design for arcs and insertions, the manipulation of transition energy, collective effects, namely instabilities, space-charge and e-cloud but also electron/positron beam dynamics (equilibrium beam properties, energy loss per turn, damping times).

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