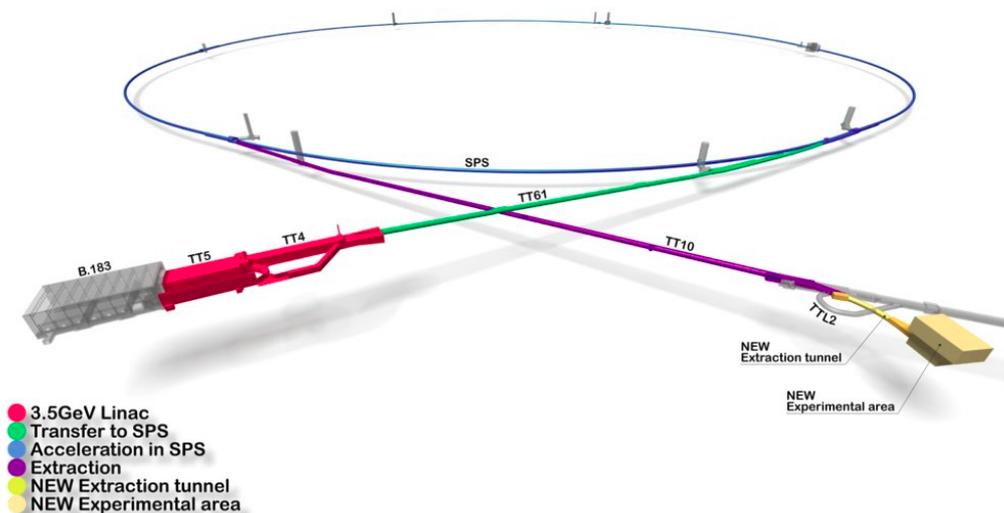


A primary electron beam facility at CERN — eSPS

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Abstract:

The design of a primary electron beam facility at CERN will be described. It re-enables the Super Proton Synchrotron (SPS) as an electron accelerator, and leverages the development invested in Compact Linear Collider (CLIC) technology for its injector and as an accelerator research and development infrastructure. This would be a facility relevant for several of the key priorities in the 2020 update of the European Strategy for Particle Physics, such as an electron-positron Higgs factory, accelerator R&D, dark sector physics, and neutrino physics. In addition, it could serve experiments in nuclear physics.

The electron beam delivered by this facility would provide access to light dark matter production significantly beyond the targets predicted by a thermal dark matter origin, and for the nature of dark matter particles that are not accessible by direct detection experiments. It would also enable electro-nuclear measurements crucial for precise modelling the energy dependence of neutrino-nucleus interactions, which is needed to precisely measure neutrino oscillations as a function of energy.

The facility is a natural next step in the development of X-band high-gradient acceleration technology as pursued within the CLIC collaboration. The facility also allows studies of a number of components and phenomena for a future electron-positron Higgs and electroweak factory as the first stage of a next circular collider at CERN, and its cavities in the SPS would be the same type as foreseen for such a future collider. Its X-band injector linac would become a facility with multi-GeV drive bunches and truly independent electron witness bunches for plasma wakefield acceleration. A second phase capable to deliver positron witness bunches would make it a complete facility for plasma wakefield collider studies and studies of positron production.