Hilary Term 2021 Seminars

Report of Contributions

https://indico.cern.ch/e/1030179

Contribution ID: **1** Type: **not specified**

The eSPS facility at CERN

Thursday 21 January 2021 16:15 (1 hour)

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. It's 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.

Presenter: STAPNES, Steinar (CERN)

Contribution ID: **2** Type: **not specified**

The FCC-ee Higgs and Electroweak Factory

Thursday 28 January 2021 16:15 (1 hour)

The Future Circular Collider (FCC) integrated project consists, in a first stage, of an energy- and luminosity-frontier electron-positron collider, FCC-ee. The FCC-ee is a precision instrument to study the Z, W, and Higgs boson, and the top quark, and offers unprecedented sensitivity to signs of new physics. Its beam parameters are limited by several, partly new effects, such as beamstrahlung in collision, a coherent beam-beam instability with large crossing angle, the available top-up injection rate, and instabilities related to the large ring circumference. The FCC-ee should also be designed with maximum energy-efficiency, regarding hardware, operational scenarios, and parameters. In a second stage, most of the FCC-ee infrastructure could be reused for a subsequent hadron collider, FCC-hh, which shall provide proton-proton collisions at a centre-of-mass energy of 100 TeV. In this seminar, I will present selected highlights and key accelerator challenges from the FCC-ee design, near-term study targets, and the longer-term FCC schedule.

Presenter: ZIMMERMANN, Frank (CERN)

Contribution ID: **3** Type: **not specified**

The International Linear Collider

Thursday 4 February 2021 16:15 (1 hour)

The International Linear Collider (ILC) is an electron–positron collider with a total length of around 20 km for a Higgs factory (a centre-of-mass energy of 250 GeV). Key technologies at ILC are superconducting RF (SRF) acceleration at main linacs and nano-beam technology at the interaction point (IP).
Prior to the actual construction, a four-year period of preparation (under ILC Pre-Lab, an international preparatory body) would be necessary. International development team (IDT) was established on August, 2020 and IDT has been working for the organization design of the ILC Pre-Lab. Based on international agreements, the Pre-Lab will start its operation and complete the necessary preparation to start the construction. The construction would take around 10 years and the experiments could be conducted for twenty years.

Presenter: MICHIZONO, Shinichiro

Contribution ID: **4** Type: **not specified**

Superconducting Magnets: An Enabling Technology for Physics Research and Society

Thursday 11 February 2021 16:15 (1 hour)

Fundamental science has nurtured superconducting magnet technology for a long time in order to explore the high energy regime. The discovery of the long-awaited Higgs boson at CERN's Large Hadron Collider, based on thousands of powerful superconducting magnets, is maybe the most famous outcome. However, technologies that are only possible due to the invention of large superconducting magnets, such as magnetic resonance imaging (MRI) scanners, have made important impacts on our lives. The quest for even higher magnetic fields, necessary for the next generation energy frontier colliders, is generating a vigorous effort toward the 20 tesla dipole field frontier (doubling the LHC range). New materials are being engineered, like rare earth and iron-based superconductors to build the magnets from. In addition new paradigms for coil technology are being tested, for example, conductor windings with no electrical insulation. In the meanwhile, magnet designers are exploring new magnet topology to take advantage of new superconductors and new technologies. The talk will illustrate the recent achievement in this domain and discuss the possible reverberation on society.

Presenter: ROSSI, Lucio (Università degli Studi e INFN Milano (IT))

Contribution ID: **5** Type: **not specified**

The SuperKEKB Collider

Thursday 18 February 2021 16:15 (1 hour)

SuperKEKB is an asymmetric energy collider, colliding a 4 GeV positron beam with a 7 GeV electron beam at the KEK Tsukuba campus. It has been built to search for new physics beyond the standard model of the particle physics in the B meson regime. The SuperKEKB collider has been designed to achieve a luminosity that is more than an order of magnitude higher than the KEKB collider. It achieves this by employing a nano-beam scheme originally proposed by P. Raimondi for the SuperB collider. In this talk, the key architecture of the upgrade from KEKB to SuperKEKB will be shown, as well as the challenges currently faced by researchers in order to achieve higher luminosities.

Presenter: TOBIYAMA, Makoto (KEK)

Contribution ID: **6** Type: **not specified**

Physics vs. Cancer: What are the Hot Topics in Particle Therapy Accelerator Development?

Thursday 25 February 2021 16:15 (1 hour)

The presentation provides an overview over the recent developments in the field of accelerators and beamlines for proton, ion and high-energy electron therapy. It describes the rising use of the superconducting technology, in particular to its application to the gantry magnets. The advantages and disadvantages of the superconducting technology use are discussed in regards to both proton and ion beam therapy systems. This includes the delineation of the new treatment modalities enabled by the use of superconducting magnets. Furthermore, the principle of FLASH therapy with electron and proton beams is introduced and its challenges in regards to dose distribution, beam stability and dosimetry are discussed. As a conclusion, the outlook for the potential solutions is presented.

Presenter: GERBERSHAGEN, Alexander (CERN)

Contribution ID: **7** Type: **not specified**

Upgrade of the ISIS Facility

Thursday 4 March 2021 16:15 (1 hour)

The ISIS Neutron and Muon Source accelerators have been studied, improved and refined over many years, but recently a feasibility study was launched to explore ISIS-II, the next generation source for the UK. The aim is to refocus facility upgrades in light of the advent of the European Spallation Source (ESS) in Sweden and new forecast scenarios for neutron and muon provision in Europe.

A working group was set up consisting of ISIS experts on accelerators, targets, neutronics, instrument science, detectors and engineering, to reflect the ambition of a full facility upgrade, not simply an accelerator upgrade. This working group has produced a comprehensive roadmap for the feasibility and design studies and associated R&D to enable a fully informed decision on the optimal proton driver and target system architecture to build a Megawatt-class short pulse neutron and muon facility on the Harwell campus with the best balance of technical capability and lifetime cost —'ISIS-II'. This could either be a stand-alone facility, or make use of existing ISIS infrastructure.

This challenging and ambitious project aims to gather enough detailed knowledge to enable a decision by 2027 and start construction by 2030 on a machine that will support the international research community for decades to come.

Presenter: Dr THOMASON, John (STFC-RAL)

Contribution ID: **8** Type: **not specified**

Student Design Project: The eSPS at CERN

Thursday 11 March 2021 16:15 (1 hour)

The aim of this year's JAI student project is to prepare a design of the primary electron beam for the electron-Super Proton Synchrotron (eSPS) at CERN. The facility re-enables the SPS as an electron accelerator, and leverages the development invested in the Compact Linear Collider (CLIC) technology for its injector and accelerator R&D infrastructure.

The SPS has, in the past, accelerated electrons and positrons from 3.5 GeV to 22 GeV when it was used as the injector to the Large Electron Positron (LEP) collider. It is now proposed to use the SPS simultaneously as an accelerator and as a very long pulse stretcher to provide an electron beam to a new experimental area. The electron injector would be a 3.5 GeV compact high-gradient linac based on CLIC technology injecting pulses into the SPS. The beam would then be accelerated to 16 GeV, using an 800 MHz superconducting radiofrequency (RF) system, similar to what is needed for the future electron-positron Future Circular Collider (FCC-ee). The electrons would then be extracted at 16 GeV using a slow resonant extraction. The extracted beam will be transported to a new experimental area where the particle detectors will be located.

The student work concerns the eSPS and the investigation of this new electron beam facility, focusing on the general lay-out, the lattice design and the choice of magnets & magnet design for the transfer line from the 3.5. GeV compact linac to the SPS, and the design of the RF system in the SPS.

Presenter: GRADUATE STUDENTS, JAI (JAI)