

**UK Accelerator Institutes  
Seminar Series Autumn 2021  
(Session 2)**

**Report of Contributions**

Contribution ID: 1

Type: **not specified**

## The CHUV-CERN Collaboration on a High-energy Electron FLASH Therapy Facility

*Thursday, 14 October 2021 16:15 (1 hour)*

A very hot topic in radiation oncology is the so-called FLASH therapy, which involves delivering an entire radiation treatment in a few hundred milliseconds or less. This fast delivery can reduce toxicity to healthy tissue while maintaining tumour control, thus expanding the parameter space for treatment. The effect has been observed in experiments and clinical translation is now underway. As part of this effort, Lausanne Hospital (CHUV) and CERN have formed a collaboration to design and build a clinical FLASH-capable facility for treatment of large, deep-seated tumours using high-energy, 100 MeV-range, electrons accelerated with electron linac technology developed by the CLIC linear collider study.

**Presenter:** WUENSCH, Walter (CERN)

Contribution ID: 2

Type: **not specified**

## Quantum Beams (aka single electron/photon physics)

*Thursday, 21 October 2021 16:15 (1 hour)*

Charged particle beams in accelerators behave classically in general, with quantum effects, if any, being negligible. Radiation from a charged particle beam, however, can be analyzed for its statistical properties in terms of 'incoherent' or 'coherent' states of light in classical, semiclassical and quantum regimes. The physics can become important in particle beam collisions at very high energies and high intensities (e.g. 'beamsstrahlung' limitations in electron-positron collisions), but more importantly at very low intensities of a few charged particles and photons (e.g. a single electron or a single photon). Understanding single photon/electron classical, semiclassical and quantum statistical dynamics can be useful in such processes as 'optical stochastic cooling' etc.

I will give a general introduction to the subject and limited results from experiments to date. I will also touch upon quantum aspects of 'Atomic Beams' and 'Cavity Electrodynamics' in search of the 'dark' sector the vacuum.

**Presenter:** Prof. CHATTOPADHYAY, Swapan (Director Emeritus, Cockcroft Institute)

Contribution ID: 3

Type: **not specified**

## The PIP-II Project at Fermilab

*Thursday, 28 October 2021 16:15 (1 hour)*

The Proton Improvement Plan II (PIP-II) project is an essential upgrade to Fermilab's particle accelerator complex to enable the world's most intense neutrino beam for LBNF/DUNE and a broad particle physics programme for many decades to come. PIP-II will deliver 1.2 MW of proton beam power from the Main Injector, upgradeable to multi-MW capability.

The central element of PIP-II is an 800 MeV linac, which comprises a room temperature front-end followed by an SRF accelerator. The front-end was constructed and operated with beam in the PIP-II Injector Test facility (PIP2IT). The SRF accelerator consists of five different types of cavities/cryomodules, including Half Wave Resonators (HWR), Single Spoke and elliptical resonators operating at state-of-the-art parameters. The first two PIP-II cryomodules, HWR and Single Spoke Resonator 1 (SSR1), have accelerated beam to 17 MeV in PIP2IT.

PIP-II is the first U.S. accelerator project that will be constructed with significant contributions from international partners, including India, Italy, France, United Kingdom and Poland. The project is baselined, and conventional facilities construction is underway. The project will be completed in 2028.

**Presenter:** MERMINGA, Lia (Fermilab)

Contribution ID: 4

Type: **not specified**

## **The CERN Next Ion Medical Machine Study: Towards a Next Generation of Accelerators for Ion Therapy of Cancer**

*Wednesday, 3 November 2021 16:15 (1 hour)*

Cancer therapy with beams of particles heavier than protons has several advantages with respect to conventional radiation therapy but is presently provided in only a few facilities, primarily because of the size and cost of the accelerator. To make this advanced form of therapy accessible to a larger fraction of the population, CERN has recently started a wide collaborative study based on its large experience in accelerator technology. Its goals are to identify and develop technologies that will improve the accelerator, integrating at the same time innovative delivery techniques like FLASH therapy. After reviewing the opportunities provided by ion therapy, the speaker will present an overview of various accelerator designs and technologies and will introduce some ongoing European initiatives to build a next generation ion therapy system.

***PLEASE NOTE EXCEPTIONAL DAY OF SEMINAR***

**Presenter:** VRETENAR, Maurizio (CERN)

Contribution ID: 5

Type: **not specified**

## Layout, Goals and Construction Status of the International Accelerator Facility FAIR

*Thursday, 11 November 2021 16:15 (1 hour)*

After its completion, the Facility for Antiproton and Ion Research, FAIR GmbH, is expected to be the leading nuclear physics laboratory in Europe. The central research instrument of FAIR is a new accelerator complex, which is presently being constructed east of GSI-Helmholtzzentrum für Schwerionenforschung GmbH in Darmstadt. The FAIR accelerators are served by the existing accelerators of GSI, which are, in parallel to the construction of FAIR, upgraded for operation as injectors and boosters. Four scientific pillars are the foundation of the physics programme at FAIR: a) the NUclear STructure and Reactions programme (NUSTAR), b) the Atomic, Plasma Physics and Applications (APPA) programme, c) the Compressed Baryonic Matter programme (CBM) and d) the hadron structure and dynamics programme (PANDA). The civil construction of the buildings and tunnels for the so-called modularised start version (MSV) is progressing fast. The construction of the underground SIS100 synchrotron tunnel is completed and the construction of the on-ground buildings in the construction area South is well advanced. The accelerator facility comprises a large number of machines, structured in different sub-projects. With SIS100, Super-FRS, p-linac and pbar separator, CR, HESR and the HEBT system, seven different accelerator systems are under construction in parallel. Meanwhile, a large amount of the accelerator components have been built and accepted and are stored in dedicated storage areas. A major fraction of these components are delivered as in-kind contributions by the FAIR shareholders. The present reference project schedule is targeted towards a completion of the overall facility in 2026.

**Presenter:** SPILLER, Peter-Jurgen

Contribution ID: 6

Type: **not specified**

## Superconducting RF at CERN: Past Achievements and Future Challenges

*Thursday, 18 November 2021 16:15 (1 hour)*

Superconducting RF (SC-RF) science and technology is at the heart of modern particle accelerators. At CERN, superconducting cavities were used extensively for the LEP2 collider in the 1990's. The particularity of LEP cavities lies in the innovative technology, which had been proposed and developed at CERN, of using thin niobium films deposited on copper substrates to produce the resonators. The same technology was adopted for the much less demanding RF system of the LHC, and, later on, for the superconducting booster of the ISOLDE radioactive beam facility, which was built for the HIE-ISOLDE project. Conventional manufacturing from bulk niobium, instead, was the choice for the crab cavities which will be an essential part of the HL-LHC presently under construction. Looking forward, the FCC study, and in particular the lepton machines, will rely heavily on SC-RF, and a vast R&D programme is ongoing to address the technical issues and assess the overall feasibility of the required SC-RF systems. After a brief introduction on SC-RF basics, I will describe the SC-RF aspects of the projects mentioned above, with particular emphasis on the developments of the Nb-Cu technology.

**Presenter:** VENTURINI DELSOLARO, Walter (CERN)

Contribution ID: 7

Type: **not specified**

## **The European XFEL –An X-ray laser driven by the world's largest superconducting accelerator**

*Thursday, 25 November 2021 16:15 (1 hour)*

The European XFEL in Hamburg, Germany, started operation about 5 years ago, after almost 25 years filled with technology development, funding preparations, civil construction and installation. This talk will highlight some of the key developments and milestones and give an update of the operational achievements and present-day unique features of both the accelerator and the SASE free electron lasers.

**Presenter:** DECKING, Winni



Contribution ID: 8

Type: **not specified**

## Challenges in Beam Instrumentation and Diagnostics

*Thursday, 2 December 2021 16:15 (1 hour)*

CERN operates a large accelerator complex that serves a diverse experimental physics programme. The beam instrumentation group designs, builds and maintains all the instruments that characterise the beam properties across the whole complex. This talk will guide you through a selection of the most recent devices that are used daily by the operators to tune the beams. It will also present the main R&D activities carried out in our group to be able to meet the challenging needs of CERN's future projects.

**Presenter:** LEFEVRE, Thibaut (CERN)