UK Accelerator Institutes Seminar Series Spring 2021 (Session 1)

Report of Contributions

https://indico.cern.ch/e/1030794

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

Building the European Spallation Source Accelerator

Thursday, 29 April 2021 16:15 (1 hour)

Abstract: The European Spallation Source (ESS), currently under construction in Lund, Sweden, is the world's most powerful linear accelerator (linac) driving a neutron spallation source, with an ultimate beam average power of 5 MW at 2 GeV. The linac accelerates a proton beam of 62.5 mA peak current at 4 % duty cycle (2.86 ms at 14 Hz). The accelerator uses a normal conducting front-end bringing the beam energy to 90 MeV, beyond that the acceleration up to 2 GeV is performed using superconducting structures. The accelerator is built by a European collaboration consisting of 23 European institutes delivering in-kind contributions of most hardware but also of services for installation and testing. More than half of the original 510 M€ for the accelerator budget being in form of in-kind contributions. In this talk, I will give a short introduction to the science planned for ESS, give an overview of the status of the ESS accelerator and comment on the challenges the accelerator collaboration has encountered and how we are together addressing these challenges.

Presenter: Dr LINDROOS, Mats (ESS - European Spallation Source (SE))

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

The Diamond-II Upgrade Project

Thursday, 6 May 2021 16:15 (1 hour)

Diamond Light Source is the UK's national synchrotron radiation facility, commissioned in 2006 and welcoming its external first users in 2007. The number of operating beamlines has grown steadily over time from the initial complement of 7 up to the present value of 35. This has only been possible by making several modifications to the structure of the storage ring, such as the 'mini-beta' insertions, the 'double-double bend achromat'(DDBA) cell replacement and the 'missing-sextupole' modification.

In parallel with developments at Diamond, there has been a step-change in the design and ultimate performance of storage ring-based light sources worldwide. The latest generation of facilities are based around the multi-bend achromat concept, which are able to produce 1-2 orders of magnitude increase in the photon beam brightness. This was first demonstrated by the MAX-IV light source in Sweden, but was quickly followed by many other new facility and upgrade proposals. Within this context, Diamond is in the process of producing the Technical Design Report for a replacement storage ring that merges the ESRF-EBS design with the Diamond DDBA concept.

This talk will provide an initial introduction to the Diamond facility before moving on to present the Diamond-II upgrade project. The concept and underlying principles of the replacement ring design will be described before concluding with an overview of the technological choices.

Presenter: Dr MARTIN, Ian (Diamond Light Source)

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

The Laser-hybrid Accelerator for Radiobiological Applications (LhARA)

Thursday, 13 May 2021 16:15 (1 hour)

The 'Laser-hybrid Accelerator for Radiobiological Applications', LhARA, is conceived as a novel, uniquely flexible facility dedicated to the study of radiobiology. The technologies that will be demonstrated in LhARA have the potential to allow particle-beam therapy to be delivered in a completely new regime, combining a variety of ion species in a single treatment fraction and exploiting ultra-high dose rates. LhARA will be a hybrid accelerator system in which laser interactions drive the creation of a large flux of protons or light ions that are captured using a plasma lens and formed into a beam. The laser-hybrid approach will allow the exploration of the vast "terra incognita"of the mechanisms by which the biological response is modulated by the physical characteristics of the beam. I will describe outline the state of the art in laser- driven ion acceleration, describe the motivation for LhARA, present the status of its development, and summarise the programme upon which the LhARA collaboration has embarked to drive a step-change in clinical capability.

Presenter: Prof. LONG, Kenneth Richard (Imperial College (GB))

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

The Future Circular Collider Hadron-Hadron Collider (FCC-hh)

Thursday, 20 May 2021 16:15 (1 hour)

The Future Circular Collider (FCC) integrated study is preparing the long-term future of CERN with the study of two rings to be housed in a common tunnel, following the successful scheme of the LEP and LHC rings. In this seminar, I will present the status and aims of the on-going studies for the FCC-hh, together with the technological and accelerator physics challenges.

Presenter: Dr GIOVANNOZZI, Massimo (CERN)

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

The Electron-Ion Collider (EIC) - Accelerator Design Overview

Thursday, 27 May 2021 16:15 (1 hour)

The Electron-Ion Collider (EIC) will be the machine that will unlock the secrets of the strongest force in Nature. It will collide spin-polarised beams of electrons and ions, in order to study the properties of nuclear matter in detail via deep inelastic scattering. The EIC science case was developed by a large international community. In 2012 a White Paper was published, proposing the development and building of the EIC accelerator, and in 2015 the US DOE Nuclear Science Advisory Committee (NSAC) named the construction of an electron–ion collider one of the top priorities for the near future in nuclear physics. In 2018 the National Academies of Sciences, Engineering, and Medicine made an independent assessment of the EIC science, and strongly confirmed recommendation for its construction. Moreover, the National Academies stressed that creating EIC will push forward not only nuclear physics, but also the accelerator science and technology. In 2020 it was announced by DOE that the EIC will be built at Brookhaven National Laboratory (BNL), that BNL and Jefferson Lab will be the leading labs to realise the EIC, and that international partners are invited to join the EIC collaboration. In this lecture, following a brief overview of the EIC science case and of the EIC project, we will discuss the key elements of the EIC accelerator design.

Presenter: Prof. SERYI, Andrei (Jefferson Lab)

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

AWAKE: Accelerating Electrons to GeVs in a Proton Driven Plasma Wakefield Experiment

Thursday, 3 June 2021 16:15 (1 hour)

AWAKE is an accelerator R&D experiment to demonstrate for the first time ever, plasma wakefield acceleration of electrons in wakefields driven by a proton bunch and, in the future, take advantage of the large energy store in the proton bunch to reach very high energy gain in a single plasma.
The AWAKE Run 1 experiment finished successfully its proof-of-concept program by observing the strong modulation of high-energy proton bunches in plasma; the results represent the first ever demonstration of strong plasma wakes generated by proton beams. In addition, AWAKE demonstrated for the first time the acceleration of externally injected electrons to multi-GeV energy levels in the proton driven plasma wakefields, a result published in Nature in August 2018.
AWAKE Run 2 starts in 2021 and aims to achieve high-charge bunches of electrons accelerated to high energy (˜10 GeV) while maintaining beam quality and showing that the process is scalable. By the end of Run 2 AWAKE should be in the position to use that scheme for first particle physics applications.
The principle of the AWAKE experiment is described. The experimental results of AWAKE Run 1 and the experimental program of AWAKE Run 2 are shown. First applications of this acceleration scheme are presented.

Presenter: Dr GSCHWENDTNER, Edda (CERN)

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

Thoughts for Dynamic Systems

Thursday, 10 June 2021 16:15 (1 hour)

Our team's activities centre around dynamic systems, predominantly for scientific inquiry. Our interest is in the physics-informed construction and use of digital twins in real-time control systems. Why? Our complex systems can have millions of process variables, change over time, and the subsystems can influence one another. Further, on top of controlling these systems as understanding of nomalies/prognostics (e.g. a component failing) we also want to analyse in near real-time, for example, in one immediate project funded by EPSCoR, the materials properties of what the tool is probing. We are active users of the Argonne Leadership Computing Facility (ALCF) and are establishing our real-time connection between one of these analytical tool systems for both control and analysis. We will be soon deploying an edge-computing-based sub-system digital twin at the Facility for Rare Isotope Beams (FRIB) supported by the DOE SBIR programme in Nuclear Physics. Scaling and realisation of deep-learning aided digital twins on cloud and HPC systems. Here, I will present a few examples of aspects of these dynamic systems, including, an ion-based quantum information science (QIS) system, particle accelerators, and the precise formation of a 2-CubeSats satellite system. In this way, we hope to share our activities thus far and find synergies with others in the community to mutually enhance our goals in the deployment of digital twins.

Primary author: Dr BIEDRON, Sandra (University of New Mexico)

Presenter: Dr BIEDRON, Sandra (University of New Mexico)

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

First measurement of the positive muon magnetic anomaly from the Muon g-2 Experiment at Fermilab

Thursday, 17 June 2021 16:15 (1 hour)

The Fermilab Muon g-2 Collaboration has recently released its first measurement of the positive muon magnetic anomaly with a precision of 0.46 ppm. This measurement is consistent with the previous measurement made at Brookhaven National Laboratory, where there is a 4.2 standard deviation difference between the Standard Model prediction recommended by the Muon g-2 Theory Initiative and the combined first Fermilab and final BNL measurements. This difference hints at the possibility of physics beyond the Standard Model. This talk will give an overview of the Muon g-2 Experiment and the first measurement of the muon anomaly at Fermilab.

Presenter: Dr CRNKOVIC, Jason (Brookhaven National Laboratory)