John Adams Institute for Accelerator Science

UNIVERSITY OF OXFORD

Accelerator Design Studies on the eSPS Electron Beam Facility at CERN

JAI Student Design Project

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JAI Seminar – Hilary Term 2021
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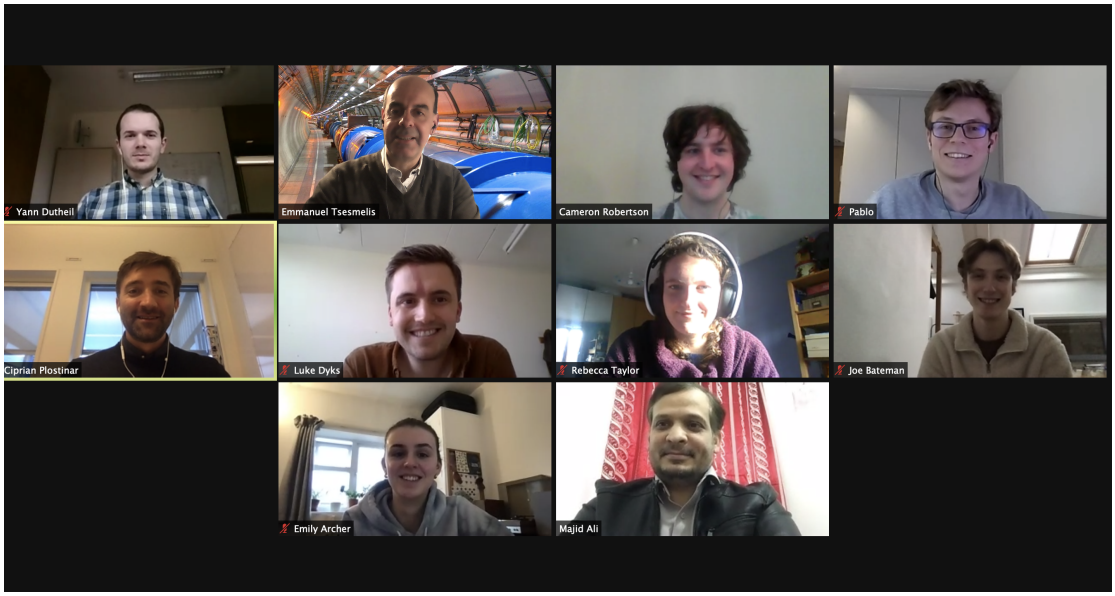

The aim of this year's JAI student project is to prepare a design of the primary electron beam for the electron-Super Proton Synchrotron (*eSPS*) at CERN. The facility re-enables the *SPS* as an electron accelerator, and leverages the development invested in the Compact Linear Collider (*CLIC)* technology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