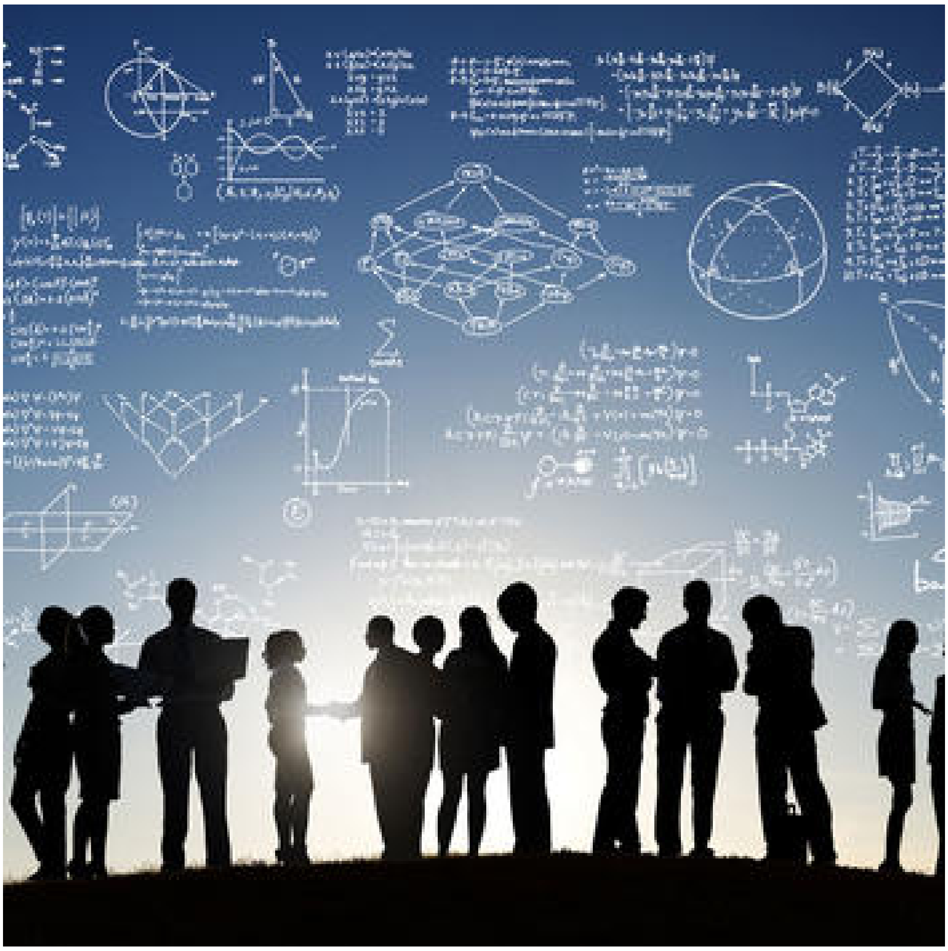
IOP Particle Accelerators and Beams Group Annual Meeting 2021



Report of Abstracts

https://indico.cern.ch/e/PABG2021

Abstract ID : **13**

Jitter Analysis of High-Power Laser Guiding in a HOFI Waveguide

Content

Statistical analysis of the guiding results from a 100 mm plasma waveguide generated using the Gemini laser. Presented work demonstrates a number of different focal spot tracking techniques used to identify the laser focus and determined its size. Using this the Author creates a model to determine the theoretical guiding success rate based upon the jitter and compares this to the experimental result.

Primary authors: JONES, Harry (University of Liverpool, Cockcroft Institute); Dr REID, Lewis (University Of Liverpool, Cockcroft Institute); Mr PICKSLEY, Alex (University of Oxford, John Adams Institute); Dr ALEJO, Aaron (University of Oxford, John Adams Institute); Dr COWLEY, James (University of Oxford, John Adams Institute); Dr JONNERBY, Jakob (University of Oxford, John Adams Institute); Ms ROSS, Aimee (University of Oxford, John Adams Institute); Dr HOLLOWAY, James (University of Oxford, John Adams Institute); Dr WALCZAK, Roman (University of Oxford, John Adams Institute); Mr FEDER, Linus (University of Maryland); Dr BOURGEOIS, Nicolas (Central Laser Facility, Rutherford Appleton Laboratory); Dr HOOKER, Chris (Central Laser Facility, Rutherford Appleton Laboratory); Dr HAWKES, Steve (Central Laser Facility, Rutherford Appleton Laboratory); Dr CORNER, Laura (University of Liverpool, Cockcroft Institute); Prof. MILCHBERG, Howard (University of Maryland); Prof. HOOKER, Simon (University of Oxford, John Adams Institute)

Presenter: JONES, Harry (University of Liverpool, Cockcroft Institute)

Track Classification: Annual Meeting

Status: SUBMITTED

Submitted by **JONES, Harry** on **Friday 12 March 2021**

Abstract ID : **15**

Multi-objective optimization of RF accelerating structures

Content

With the release of various integrated software packages and improved parallelization, there has been a renewed interest in applying multi-objective optimization methods to complex RF structure design. These methods provide a way to find optimal solutions in the presence of trade-offs between multiple conflicting objectives, which is often the case in radio frequency cavity design. The application of multi-objective genetic algorithms (MOGA's) to RF cavity design is explored and the trade-offs between the cavity key quantities of interest (QoIs), including peak fields, shunt impedance, coupling factor and modified Poynting vector are investigated. Finally, results of the optimization of a generic cavity using these techniques are presented using several visualization methods, showing the power of this approach.

Primary author: SMITH, Samuel (Lancaster University)

Co-author: BURT, Graeme Campbell (Lancaster University (GB))

Presenter: SMITH, Samuel (Lancaster University)

Track Classification: Annual Meeting

Status: SUBMITTED

Submitted by **SMITH, Samuel** on **Monday 15 March 2021**

Abstract ID : **16**

Prediction and clustering of longitudinal phase space images and machine parameters using Neural Networks and K-means algorithm

Content

Machine learning algorithms were used for image and parameter recognition and generation with the aim to optimise the CLARA facility using start-to-end simulation data. Convolutional and fully connected neural networks were trained using TensorFlow-Keras for different instances, with examples including predicting longitudinal phase space (LPS) images with machine parameters as input and FEL parameter prediction (e.g. pulse energy) from LPS images. The K-means clustering algorithm was used to cluster the LPS images to highlight the patterns within the data. Machine learning techniques can enhance the way large amounts of data are processed and analysed and so have great potential for application in accelerator science R&D.

Primary authors: Ms MAHESHWARI, Minerva (Science and Technology Facilities Council); Dr DUNNING, David (Science and Technology Facilities Council); Dr POLLARD, Amelia (Science and Technology Facilities Council); Dr JONES, James (Science and Technology Facilities Council); Mr KING, Matthew (Science and Technology Facilities Council); Ms KOCKELBERGH, Hannah (Science and Technology Facilities Council)

Presenter: Ms MAHESHWARI, Minerva (Science and Technology Facilities Council)

Track Classification: Annual Meeting

Status: SUBMITTED

Submitted by **MAHESHWARI, Minerva** on **Wednesday 24 March 2021**

Abstract ID : **17**

Preserving Bright Electron Beams: Distorted CSR Wakes and CSR Cancellation

Content

Low emittance is a desirable property of accelerator beams, as it leads to brighter FEL x-rays, and higher luminosity colliders, for this reason it is important to preserve and limit its growth. However, CSR can lead to emittance growth, and while there are some methods of CSR cancellation, these methods may be less effective when the CSR kicks are distorted. In an attempt to understand why CSR kicks become distorted, we compare CSR kicks generated when the slice longitudinal Twiss parameters are constant, to CSR kicks generated with non-uniform slice Twiss values.

Primary author: DIXON, Adam (University of Liverpool)

Presenter: DIXON, Adam (University of Liverpool)

Status: SUBMITTED

Submitted by **DIXON, Adam** on **Monday 29 March 2021**

Abstract ID : **18**

Simulating Electron Diffraction for Development of a Relativistic Ultrafast Electron Diffraction Facility

Content

Electron diffraction is a method which can be used to study the small-scale internal structure of materials, based on the distances between its different crystalline planes. This can be expanded to investigate structural changes within a sample over time, by using an ultrashort (fs timescale) electron bunch. RUEDI is a future MeV-scale electron diffraction facility capable of producing time-resolved diffraction patterns to observe dynamic processes within the sample.
In order to investigate and optimise the electron beam properties required to produce a high-quality diffraction pattern, this process can be simulated using particle tracking codes.
Different methods for simulating electron diffraction have been considered. A GPT (General Particle Tracer) custom element is being developed to be used for simulating the diffraction process, producing diffraction patterns that can be displayed graphically, and their quality can be quantified using Matlab. The effect of space-charge on the diffraction pattern is shown.
Future work will be required to use this element to simulate electron diffraction from other samples with different beam energies, and even possibly single crystals. Once finalised, this element, along with the ring analysis techniques, will be used to optimise the beamline. It will also be used in conjunction with simulations of different bunching techniques, which are required to obtain ultrashort bunches for time resolved electron diffraction.

Primary author: HALL, Lydia (STFC, ASTeC)

Co-author: MCKENZIE, Julian (STFC, ASTeC)

Presenter: HALL, Lydia (STFC, ASTeC)

Track Classification: Annual Meeting

Status: SUBMITTED

Submitted by **HALL, Lydia** on **Thursday 01 April 2021**