EUROPEAN NETWORK FOR NOVEL ACCELERATORS

EuroNNAc4

NPACT supported by EU via I-FAST

Contribution ID: **33** Type: **Poster**

Surrogate modelling of laser-plasma acceleration

Wednesday, 21 September 2022 19:15 (1 hour)

Laser-plasma acceleration (LPA) promises compact sources of high-brightness electron beams for science and industry. However, transforming LPA into a technology to drive real-world applications remains a challenge. Machine learning techniques could prove decisive in further understanding and improving the performance of these machines. Here, we discuss the application of supervised learning to create surrogate models of the LPA process at LUX. Using simulated and experimental data, we train artificial neural networks to predict the electron beam quality as a function of the drive laser properties. Of the many potential applications of such models, we emphasize their use to study the influence of laser fluctuations on the electron beam stability.

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Session Classification: Poster Session