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Surrogate Modeling of Laser-Plasma Acceleration

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.

Primary author: KIRCHEN, Manuel (MLS (Laser fuer Plasmabeschleunigung))

Co-authors: JALAS, Soeren (UNI/EXP (Uni Hamburg, Institut fur Experimentalphysik)); BROGREN, Frida (MLS (Laser fuer Plasmabeschleunigung)); MAIER, Andreas (MLS (Laser fuer Plasmabeschleunigung))

Presenter: KIRCHEN, Manuel (MLS (Laser fuer Plasmabeschleunigung))

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