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ML-driven Automated Tuning of XFEL for Various Experiments and User-specific Requirements at SACLA

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To satisfy recent complex requirements from XFEL applications, an automated tuning tool has been developed and regularly used for daily XFEL operations at SACLA. In a ring-based synchrotron radiation facility, an electron beam with identical characteristics is provided to many user beamlines. In contrast, in a linear accelerator-based XFEL facility with multiple beamlines, the electron beams should be properly tailored by varying energies and longitudinal distributions to meet simultaneously different experimental requirements of each beamline. In addition, since the requirements change every few days alongside the users, efficient and prompt accelerator tuning is crucially important. To address this challenge, we have developed an automated tuning system based on Bayesian optimization, and it can optimize performance indicators, which encompasses not only a central wavelength and a pulse energy, but also a spectral shape and a transverse laser profile, and so largely facilitates the delivery of XFELs that mostly meet the stringent requirements set by experimental users. This presentation will report our recent efforts and results in daily XFEL tuning at SACLA utilizing the tool.

Footnotes

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