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Optimization of Beam Quality Along the Second Hard X-ray Beamline at PAL-XFEL: A Study Using the Simplex Method and Bayesian Optimization

Thursday, November 14, 2024 1:00 PM (1h 30m)

The Pohang Accelerator Laboratory X-ray Free Electron Laser (PAL-XFEL) generates an electron beam with high peak current and low emittance, achieving an energy of up to 11 GeV. From this electron beam, hard X-rays are produced, covering a photon energy range from 2.2 keV to 15 keV. Recently, a second hard X-ray beamline, known as the HX2 beamline, has been proposed. To ensure that the HX2 beamline does not spatially overlap with the existing HX1 beamline, a dog-leg beam transport line is being considered. It is essential to carefully design the dog-leg to preserve key beam parameters, such as transverse emittance, during beam transport.

To achieve this goal, we focus on optimizing the beamline using numerical algorithms and particle tracking simulations. In this study, we utilized the simplex method, a standard feature in the Elegant simulation software, alongside Bayesian Optimization (BO) for the optimization process. BO is particularly useful for complex optimization problems, especially when dealing with limited data. We anticipate that BO will be an effective optimization method due to the many parameters and intensive computations involved in our simulation. Finally, by comparing the results of these two methods, we will highlight the advantages of BO in handling complex optimization tasks.

Paper submission Plan

Best Presentation

Yes

Contribution track

ICABU WG2. Beam Physics, Diagnostics & Novel Techniques

Primary author: Mr JANG, Won (University of Seoul)

Co-authors: Dr KIM, Seongyeol (Pohang Accelerator Laboratory, POSTECH); Prof. CHUNG, Moses (POSTECH)

Presenter: Mr JANG, Won (University of Seoul)

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