

Studies on high repetition rate operation of SACLA with X-band normal conducting accelerator

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The X-ray free-electron laser facility SACLA generates X-ray SASE up to 20 keV in a compact 700 m long machine using a low-emittance thermal cathode electron gun, a high-field C-band normal-conducting 8 GeV linac and short-period in-vacuum undulators. The next upgrade plan for SACLA is to increase the repetition rate of the accelerator, which is currently 60 Hz, by one order of magnitude to 1 kHz maintaining the performance of the current SASE and electricity usage. Challenge is how to achieve high repetition operation without increasing the electric power consumption, which allows to reuse the same accelerator building, electrical plant, and cooling water system. To improve the power efficiency, we choose X-band as the radio frequency of the main accelerator instead of current C-band. A basic design and optimization of the accelerator are undergoing. As a testbed, we plan to introduce an X-band transverse deflector cavity to measure the temporal distribution of the electron beam downstream of the undulator. The development of equipment such as RF sources, pulse compressors, dummy loads, low-level RF control, which are common to the systems for high repetition, has also begun. We will report the design and the status of developments.

Footnotes

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