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Electron Bunch Spacing with Extreme Laser Heating for FEL improvement at PAL-XFEL*

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All XFEL machines utilize multiple magnetic Bunch Compressors (BC) for e-bunch compression. Since the non-linear energy chirp among bunch slices, current peaks occur in the head and tail of bunches, which generate collective effects spoiling the core slices. To remove current peaks, collimators at BCs are used to collimate head and tail slices in FEL machines operating at an approximate hundred Hz. However, the electron collimation is impractical to implement in MHz machines due to heat and radiation issues. Therefore, we study to suppress the current peaks in the head and tail with extreme laser heating. The energy spread of bunch slices is significantly increased by the high-power IR laser in a Laser Heater (LH). The collective effects from head and tail slices are almost disappeared by diluting these slices with intense dual laser pulses in the LH. In this paper, we present the bunch spacing with extreme laser heating in simulations and experiments. Also, we present the FEL improvement achieved through this bunch spacing.

Footnotes

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Author: YANG, Haeryong (Pohang Accelerator Laboratory)

Co-authors: SHIM, Chi Hyun (Pohang Accelerator Laboratory); NAM, Inhyuk (Pohang Accelerator Laboratory); CHO, MyungHoon (Pohang Accelerator Laboratory)

Presenter: YANG, Haeryong (Pohang Accelerator Laboratory)

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