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Harmonic generation with homeopathic seeding at FERMI

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The use of an external laser to initialize the FEL process at the harmonics of the laser has been demonstrated to be very efficient for improving the FEL performance. Thanks to the external seeding FEL can reach saturation in a shorted undulator compared to SASE FELs, but also gain in terms of FEL spectral brightness and stability. An efficient harmonic conversion in the FEL process requires powerful laser pulses that are not compatible with new generation of linear accelerators and FELs aiming at MHz repetition rate. The limit can be overcome with the use of a self-amplification of the laser pulse before the FEL harmonic generation. This scheme, also known as OK-HGHG, has been previously studied and the principle experimentally demonstrated. In this work, conducted at the FERMI FEL-1, we have performed a detailed characterization of the FEL performance in the OK-HGHG configuration. Our studies clearly show the benefits allowing to reduce the seed power by 3 orders of magnitude but also highlights some possible issues related to the microbunching amplification. Results are reported together with a discussion on implication on future seeded FELs.

Footnotes

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