# OUTPUT BANDWIDTH EFFECTS IN SEEDED, HARMONIC CASCADE FELS

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## Abstract

A number of laboratories are studying and/or proposing seeded Harmonic Cascade (HC) FELs as a means both to reach soft x-ray output wavelengths and to provide a degree of longitudinal coherence much greater than that normally possible with SASE devices. While theoretically the output bandwidth of a HC FEL can approach the transform limit given a high quality input seed of reasonable power, there appear to be a number of practical considerations that in many cases can increase the output bandwidth many-fold. In particular, designs that employ dispersive sections following modulator sections in order to increase the amount of coherent harmonic microbunching, can be very sensitive to temporal variations in the electron beam energy, resulting in an output wavelength chirp. Unwanted microbunching induced by the combination of longitudinal space charge instability growth in the linac and CSR in compression sections also can lead to variations in the output radiation phase and amplitude, thus increasing the bandwidth. We give some semi-analytical results for the predicted bandwidth increase for HC configurations and also some detailed numerical simulation results.[1]

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