Simulations predict that the lower frequency branch can hamper amplification of the other branch and, thus, can lead to the spectral gaps.
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A Compact High-Brightness Hard X-Ray Light Source

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The use of hard x-ray radiation as an analytical research tool is wide spread and is used to address scientific, technical as well as societal problems. The availability of compact hard x-ray sources will significantly boost the applications that use this type of radiation. We propose a novel high-brightness and compact hard x-ray source that is based on Compton backscattering of photons produced by an FEL. The system we envision consists of an energy recovering, superconducting X-band RF accelerator capable of generating approximately 50 MeV electrons in two passes through the accelerator. These high-energy electrons are used to drive a high-Q FEL oscillator equipped with a ring resonator with no outcoupling. The photons produced in the ring cavity will backscatter from the intermediate-energy (approximately 25 MeV) electrons. We will discuss the overall system and then focus on the performance of the FEL which is driven by a low peak current, high repetition rate (6 GHz) electron beam. Given the photon flux produced by the FEL, we estimate the brightness of the hard x-rays and discuss the effect of electron beam quality on the performance of the source.