Effect of Energy-Phase Correlation on the Coherent Emission from an RF Modulated Electron Beam*, A. DORIA, G.P. GALLERANO, E. GIOVENALE, S. LETARDI**, G. MESSINA, C. RONSIVALLE, A. VIGNATI, ENEA - In the design of electron accelerators for Free Electron Lasers, the manipulation of the particle distribution in the phase space can play a crucial role to realize high efficiency generators of coherent radiation in the mm-wave and far-infrared regions and at even shorter wavelengths. An RF modulated electron beam passing through a magnetic undulator emits coherent radiation at harmonics of the RF with a phase which depends on the electron drift velocity. At long wavelengths a proper energy ramping of the electrons during the bunch can be exploited to lock in phase the field radiated by the individual electrons, resulting in a significant enhancement of the coherent emission. The feasibility of a device suitable for a systematic investigation of energy-phase correlation effects is presented in this paper together with a comparison between the theoretical model and computer simulations. We also describe the preliminary design of an accelerating structure composed of a beta-graded self-focusing RF linac operating at 3 GHz followed by a "Phase-Matching Section" controlled in phase and amplitude with respect to the main linac section. The accelerator will drive a compact high efficiency mm-wave generator.

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