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Evidence of intrabeam scattering in high brightness electron linacs

So far, IBS has not been observed in single pass electron accelerators because charge density orders of magnitude higher than in storage rings would be needed. We show that such density is now available at high brightness electron linacs for free-electron lasers (FELs).We report measurements of the beam energy spread in the FERMI linac in the presence of the microbunching instability, which are consistent with a revisited IBS model for single pass systems. We criticaly review experimental and numerical results in the literature in the light of most recent understanding of IBS-dominated dynamics, including a systematic characterization of the FERMI seeded FEL brilliance vs. electron beam optics, benchmarked with an IBS-MBI semi-analytical model. We also show that neglecting the hereby demonstrated effect of IBS in the parameter range typical of seeded VUV and soft x-ray FELs, results in too conservative a facility design, or failure to realise the accessible potential performance.

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