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Beam Dynamics of the MeV Microscopy Line of RUEDI

RUEDI is a proposed Relativistic Ultrafast Electron Diffraction and Imaging facility for the UK. It will deliver single-shot time-resolved imaging with MeV electrons, as well as ultrafast electron diffraction at 10 fs timescales. The few-MeV-scale imaging and microscopy line aims to deliver high charge (up to 10^8 electrons), ultra-low emittance electron bunches to a 10μm sample with minimal energy spread and transverse divergence, aiming for imaging resolutions at the 10nm scale. The physical layout of the imaging beamline will be discussed, along with a multi-dimensional study of the beam dynamics of the proposed design. The extreme requirements on the injector specification, and the limitations inherent in such systems, will be investigated, and potential upgrade paths explored in terms of both imaging resolution and technological feasibility.

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