SIMULATION OF 2D POINT SPREAD FUNCTION DOMINATED BEAM PROFILE IMAGES BASED ON BACKWARD TRANSITION RADIATION FROM THE TILTED TARGET

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Transverse beam profile diagnostics in electron accelerators is usually based on direct imaging of a beam spot via visible radiation (transition or synchrotron radiation). In this case, the fundamental resolution limit is determined by radiation diffraction in the optical system. A method to achieve a resolution beyond the diffraction limit is to perform point spread function (PSF) dominated imaging, i.e. the recorded image is dominated by the resolution function of a point source (single electron). With knowledge of the PSF, the true image (beam spot) can be reconstructed. In the case of classical backward transition radiation imaging however, the radiation is emitted from the surface of a tilted screen, and a part of the image will be out of focus. While this de-focusing influence can usually be neglected, it was observed already in the case of sub-micron beam size measurements. This paper presents a model to calculate PSF-dominated beam profile images based on backward transition radiation from a tilted screen surface, taking into account the influence of de-focusing.

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