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Wake-field in an array of metallic posts: Possible application for beam position monitoring

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Abstract

It is proposed to use an array of metallic posts as a beam position monitor (BPM). The structure consists of a set of $N \times N$ metallic vertical posts bounded from above and below by two horizontal metallic plates. The beam position offset from the symmetry axis is determined by measuring the *backward radiation* emitted by the beam as it traverses the array. The suggested BPM's position resolution is dominated by the thermal noise level and the shot noise level of the detectors measuring the radiation whereas the time resolution is dominated by their operation frequencies. In the optical regime and for ultra-relativistic beams the time resolution is of order of 10 ps i.e. at least two orders of magnitude higher than the common time resolution in stripline BPM. Utilizing the state of the art optical detectors the position resolution of such a BPM may reach the level of a few nanometers which is one order of magnitude better than the common position resolution of existing systems.

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