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Dealing with thermionic emission in wire scanners based on secondary electron emission

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Measuring transverse beam profiles using thin wires is a very successful and widely used method. The signal is generated either by measuring scattered particles outside of the vacuum chamber or by measuring the current of the secondary electrons emitted from the wire. In high-brightness accelerators, the heating of the wire induced by the direct beam interaction or by coupling to RF fields can lead to the thermionic emission of electrons, which disturbs the measurement. The spectra of the electrons are different, but they overlap, therefore the typically used method of biasing the wire only partly reinstates the original beam profile. This study investigates the mixing of current signals from both phenomena and tries to address the question of the optimal bias voltage and potential reconstruction of the original beam profile. The estimations are compared to measurements performed on high-brightness beams of PSI HIPA machines.

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Footnotes

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