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Virtual diagnostics for longitudinal phase space imaging

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For any linear accelerator, a thorough understanding of the Longitudinal Phase Space (LPS) of the beam is a great advantage. At the synchrotron light source MAX IV the two storage rings are injected with electrons using a 3 GeV linear accelerator, which also serves to provide beam for a short pulse facility (SPF). A newly commissioned Transverse Deflecting Cavity (TDC) is used to reconstruct the full LPS in a separate branch in the SPF after the second bunch compressor. This diagnostic performs a destructive measurement to extract the LPS and can not be used simultaneously with the beamline in the other branch in the SPF. In this paper we present a new virtual diagnostics which utilizes machine learning methods to extract the LPS information from other, non-destructive signals in the MAX IV linac. This involves simulations of the linac including the TDC response, as well as the collection of real data from the new TDC, for use in training artificial neural networks to predict the full LPS.

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Footnotes

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Yes

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