Virtual diagnostics for high brightness particle accelerators

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Virtual diagnostics are computational tools which predict the output of measurement devices. They are especially useful when they predict the output of intercepting diagnostics which otherwise affect the ability to simultaneously measure e-beam properties and use the beams for experiments. In this talk I will report on the application of machine learning-based virtual diagnostics for predicting the longitudinal phase space (LPS) of high brightness beams. I will discuss the use of such ML-diagnostic for prediction as well as to tune accelerator settings to generate desired LPS profiles. Finally, I will discuss recent work in using ML based surrogate modeling and optimization applicable for emittance minimization in linacs and storage rings.