ML based longitudinal phase space prediction of accelerators

C. Emma, A. Edelen, M.J. Hogan, B. O'Shea, G. White, V. Yakimenko

ML at SLAC workshop

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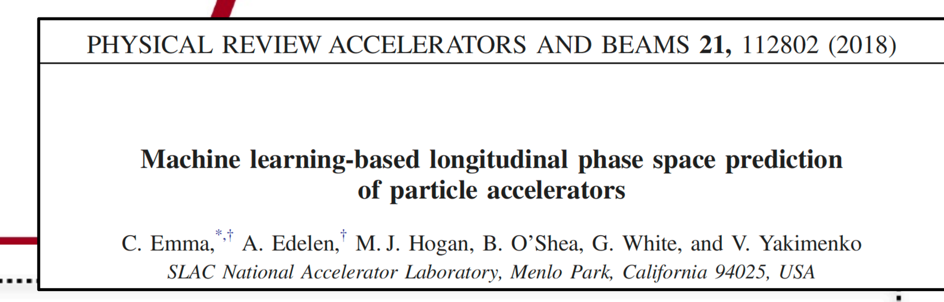
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Machine learning-based longitudinal phase space prediction of particle accelerators

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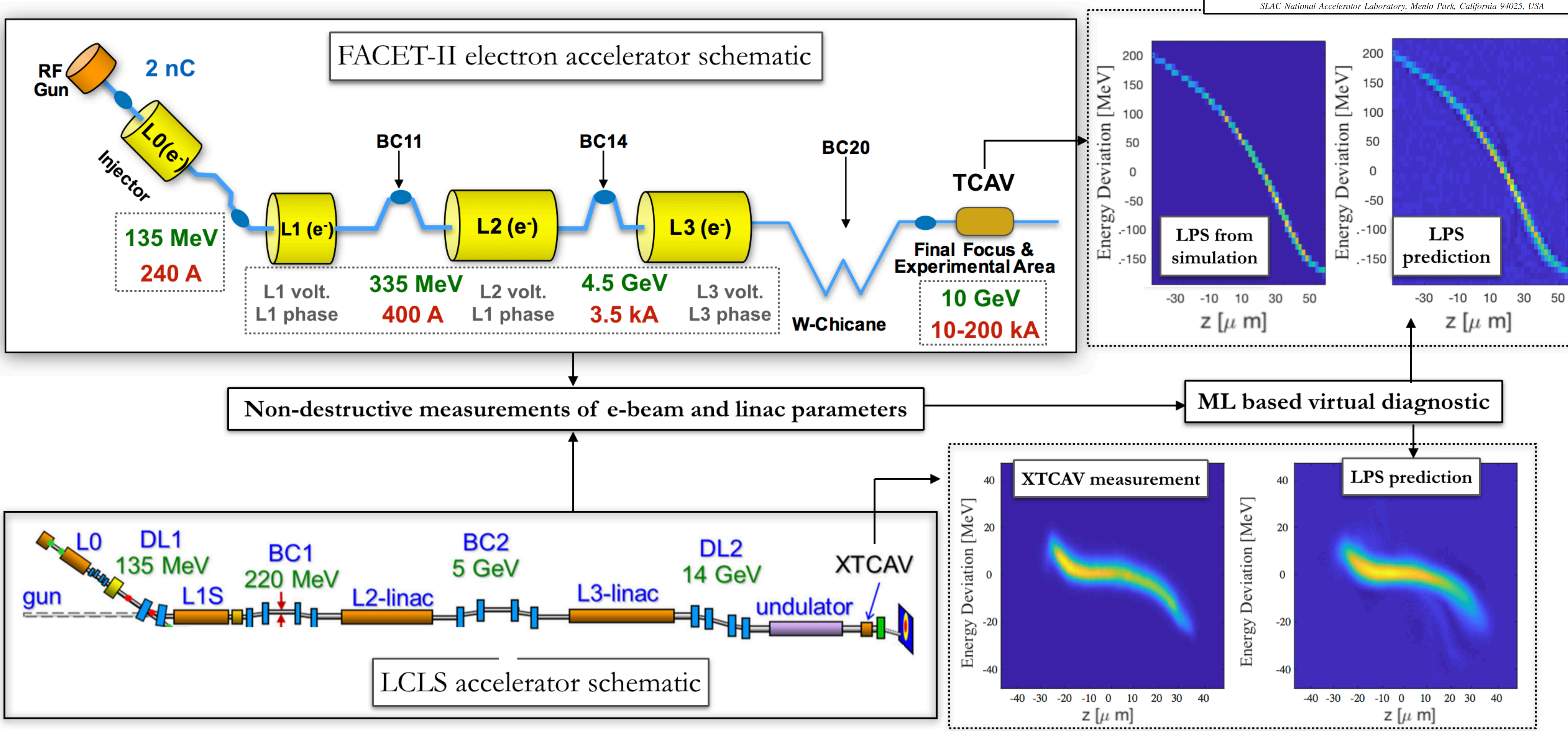

Project goals	Work Plan	Conclusions/Open Questions
• **Implement a single-shot, ML-based virtual diagnostic which predicts the LPS of the e-beam for PWFA experiments.** • **Use a ML model with a conventional optimizer to customize the LPS at the IP for different experiments.** • **Use a ML-based control policy to maintain the LPS in a fixed state during experiments in the presence of machine drifts.**	• Train ML model using non-destructive accelerator inputs and TCAV images to predict LPS distribution. • Acquire different LPS images by scanning key accelerator parameters (e.g. linac phases, compression settings). • Use linac *and* e-beam diagnostics as inputs. Determine which diagnostics are most critical to prediction accuracy.	• **The predictive model works under tested conditions for LCLS and FACET-II.** • **What is the long term accuracy of the trained model?** • **How robust is this model against e.g. machine drifts? Does it need to be re-trained to account for them? If so, how often?** • **Can you augment datasets with machine *and* simulation data to predict LPS beyond resolution of the TCAV?**

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