

# A Cylindrical Spectral Variational Algorithm for Beam-Plasma Interactions

Stephen Webb<sup>1</sup>

<sup>1</sup>*RadiaSoft LLC, USA*

Operating a plasma wakefield accelerator driven end user facility, such as a free-electron laser, will require operation at much higher repetition rates ( $\sim$ kHz) than current experiments test ( $<$ Hz). Understanding the relaxation kinetics of the wake is critical to understanding the loading effects of a high average power accelerator.

To probe this regime computationally requires variational kinetic algorithms with low particle noise, excellent numerical dispersion for electromagnetic waves, and respect for phase space dynamics over many hundreds of plasma oscillations. We present this algorithm, its present state in a production code, and future plans for the code.