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Wake Field and Trapped Resonant Mode Calculations for the BioXAS in-Vacuum Undulator

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The Canadian Light Source 2.9 GeV electron synchrotron storage ring circulates 220 mA of beam current distributed over 265 bunches. These bunches travel through several in-vacuum undulators, large magnet arrays housed in tapered vacuum chambers with a complex internal geometry. The electrons traveling through these vacuum chambers carry electromagnetic fields whose distribution is determined by the geometry and material properties of the boundary. Electromagnetic wake fields are induced when the electron travel through a boundary condition transition. The wake fields of a lead particle can perturb the position and momentum of following particles or they may excite long lived but undesirable resonant modes in cavity-like vacuum chambers. Either case may drive beam instabilities. We have modeled these trapped modes with finite difference time domain codes. The results of these simulations, including the frequency and amplitude of these modes, are predicted in this report.

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