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Longitudinal dynamic analysis for Project X LINACs

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The longitudinal dynamic analysis for Project X is very challenging. Project X has 2 LINACs with warm and cold sections, one CW and one pulsed RF LINAC. The CW LINAC has cavities operating at 3 or 4 RF frequencies, high loaded Qs of up to 3 10^7 and 20Hz bandwidths.

The 3 to 8 GeV LINAC has ILC type 1.3 GHz cavities with a gradient amplitude of 25 MV/m. 13 RF Stations: 2 cryomodules with 8 cavities/cryomodule for a total of 16 cavities/RF-ST. Total Energy gain ~5 GeV. Beam current of 1 mA or 2 mA. Beam phase: -10 degrees. Minimum RF pulse of 4.3 ms flattop but also 20 to 30 ms are being considered and Qload in the order of 1e7.

This work analyzes and simulates the longitudinal dynamics in the presence of major disturbances such as Lorentz force detuning, microphonics, beam loading, beam phase, etc.

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