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Electron cloud measurements in Fermilab booster

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Fermilab Booster synchrotron requires an intensity upgrade from 4.5×10^{12} to 6.5×10^{12} protons per pulse as a part of Fermilab's Proton Improvement Plan-II (PIP-II). One of the factors which may limit the high-intensity performance is the fast transverse instabilities caused by electron cloud effects. According to the experience in the Recycler, the electron cloud gradually builds up over multiple turns inside the combined function magnets and can reach final intensities orders of magnitude greater than in a pure dipole. Since the Booster synchrotron also incorporates combined function magnets, it is important to measure the presence of electron cloud. The effect of the electron cloud was investigated using two different methods: measuring bunch-by-bunch tune shift by changing the bunch train structure at different intensities and propagating a microwave carrier signal through the beampipe and analyzing the phase modulation of the signal. This paper presents the results of the two methods and corresponding simulation results conducted using PyELOUD software.

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Footnotes

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Yes

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