Abstract Submitted
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Theory of Harmonic Generation on a Traveling Wave Tube[1] C.F. DONG, P. ZHANG, D. CHERNIN[2], Y.Y. LAU, D.H. SIMON, P. WONG, G. GREENING, R.M. GILGENBACH, U. Michigan — In a klystron, charge overtaking of electrons leads to an infinity of AC current. The harmonic content therein has been calculated accurately, with or without space charge effects [1]. This paper extends the klystron theory [1, 2] to a traveling wave tube (TWT). We calculate the harmonic content on the beam current on a TWT that results from an input signal of a single frequency. We assume that the electron motion is described by linear theory, which is generally accurate over 85 percent of the tube length. These linear orbits may lead to charge overtaking and therefore harmonic generation, as in a klystron. We calculate the buildup of harmonic content as a function of distance from the input, and compare these analytic results with the CHRISTINE code [3]. Reasonable agreement was found. A dimensionless "bunching parameter" for TWT, X = sqrt[(Pi/Pb)/C], is identified, which characterizes the harmonic content in the AC current, where Pi is the input power of the signal, Pb is the DC beam power, and C is Pierce's gain parameter.

[1] C. B. Wilsen, et al., IEEE Trans. Plasma Sci. 30, 1176 (2002).
[2] Y. Y. Lau, et al., IEEE Trans. Plasma Sci. 28, 959 (2000).
[3] T. M. Antonsen and B. Levush, IEEE Trans. Plasma Sci. 26,774 (1998).

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