On the bandwidth of a short traveling wave tube

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We analyze the bandwidth of a short traveling wave tube. When no beam is present the
bandwidth is proportional to the group velocity and inversely proportional to the total length
of the system. The bandwidth of the gain factor, the imaginary part of the wave vector, is
mainly determined by the beam current. However, regardless of the current intensity, the gain
factor is identically zero for frequencies which, in the empty structure, correspond to phase
velocities larger than the speed of light. The bandwidth of a short amplifier, is narrowed
relative to the "cold" bandwidth by the same amount the amplitude of the growing wave
increases, provided that the frequency and the current allow the growing wave to be dominant.
This relation is verified with experimental data and good agreement is found.