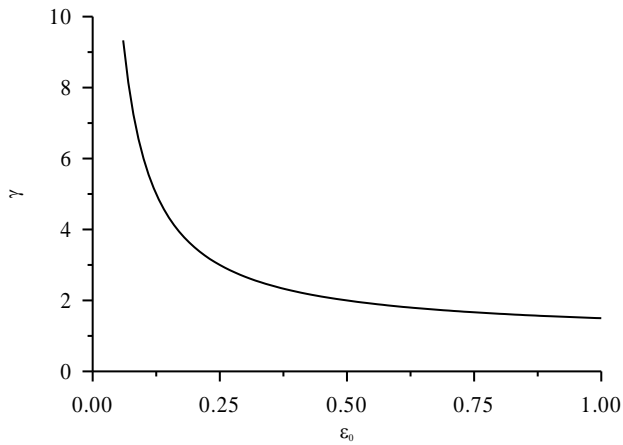




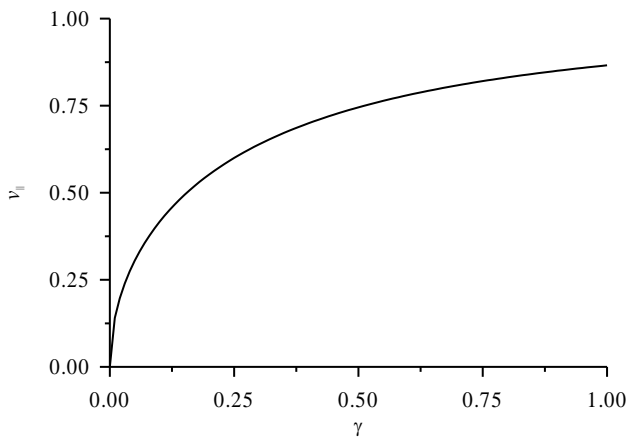


The Figure 4 and 5 show dependence of relative electron energy on accelerating potential difference  $U$  and rest energy  $\varepsilon_0$ . These figures show linear increasing and hyperbolic decreasing of the considered relative electron energy. Both dependences are enough natural.

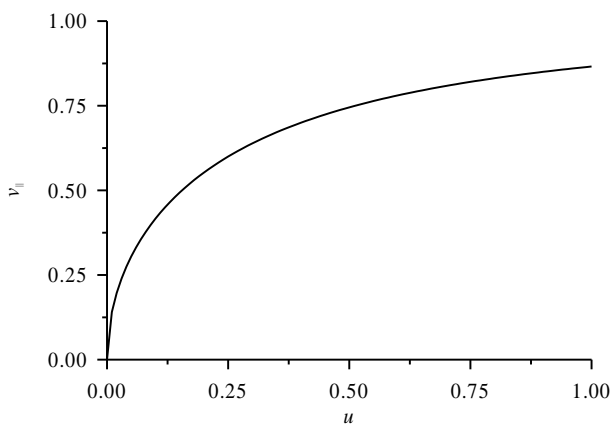


**Figure 5.** Dependence of relative electron energy  $\gamma$  on rest energy  $\varepsilon_0$

Velocity  $v_{||}$  increases with increasing of the above relative electron energy  $\gamma$  (see Figure 6). Analogous dependence could be found as a function of the energy on relative changing in energy under the action of field  $u$  (see Figure 7).

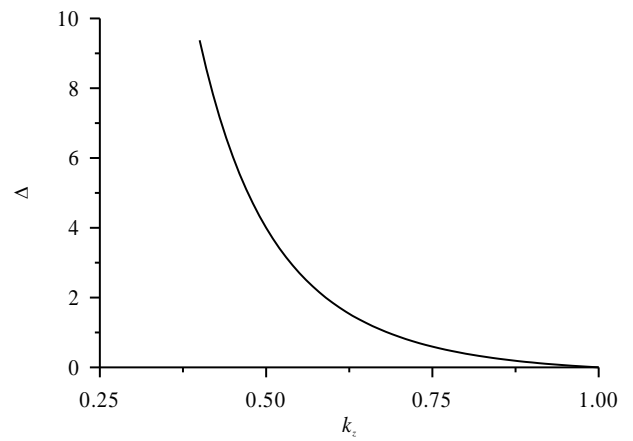


**Figure 6.** Dependence of velocity  $v_{||}$  on relative electron energy  $\gamma$

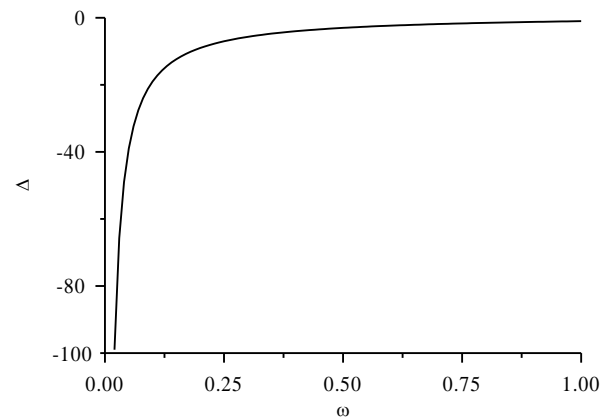


**Figure 7.** Dependence of velocity  $v_{||}$  on relative changing in energy under the action of field  $u$

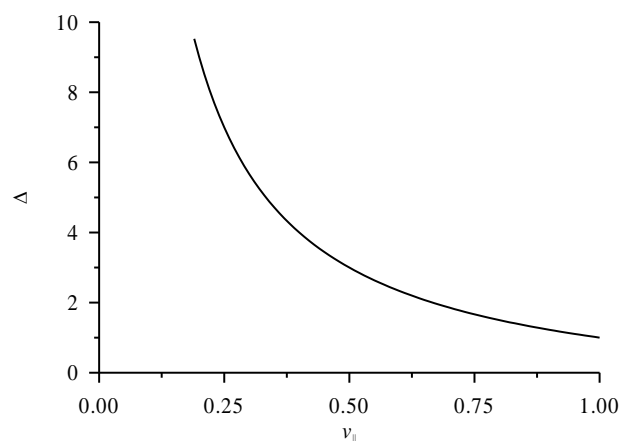
Dimensionless detuning of the synchronism  $\Delta$  decreasing at absolute value with increasing of wave number  $k_z$  (see Figure 8), leads to the constant value with increasing of frequency  $\omega$  (see Figure 9), decreasing at absolute value with decreasing of velocity  $v_{||}$  (see Figure 10).



**Figure 8.** Dependence of dimensionless detuning of the synchronism  $\Delta$  on wave number  $k_z$

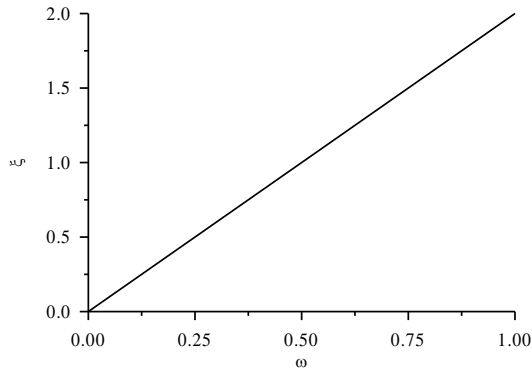


**Figure 9.** Dependence of dimensionless detuning of the synchronism  $\Delta$  on frequency  $\omega$

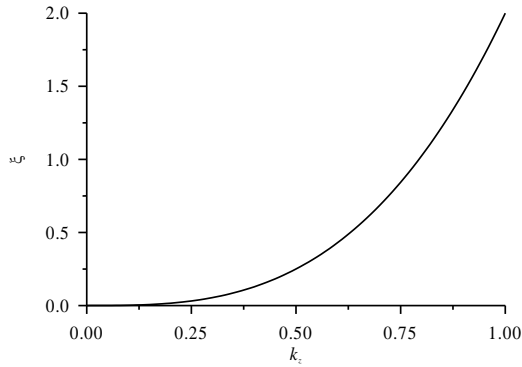


**Figure 10.** Dependence of dimensionless detuning of the synchronism  $\Delta$  on velocity  $v_{||}$

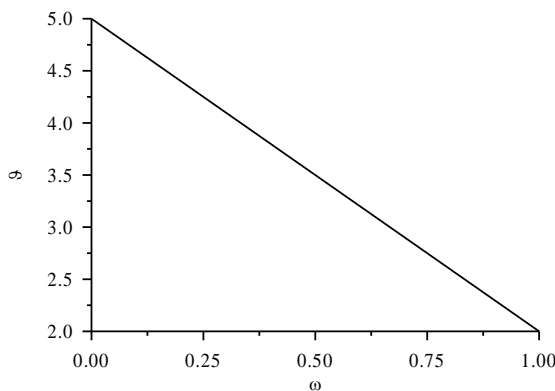
Dimensionless length  $\xi$  increases with increasing of frequency  $\omega$  became also unlimited with linear increasing (see Figure 11) and with cubic nonlinearity as function of wave number  $k_z$  (see Figure 12).



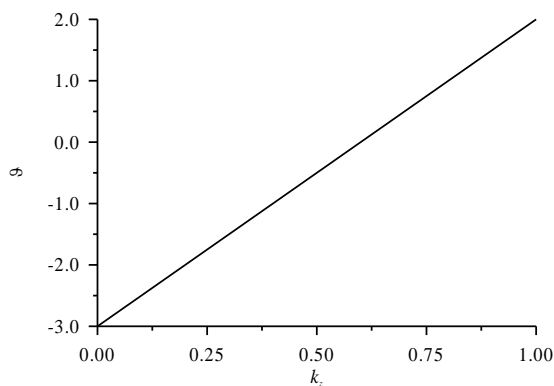
**Figure 11.** Dependence of dimensionless length  $\xi$  on frequency  $\omega$



**Figure 12.** Dependence of dimensionless length  $\xi$  on wave number  $k_z$



**Figure 13.** Dependence of phase of electrons  $\varphi$  on frequency  $\omega$



**Figure 14.** Dependence of phase of electrons  $\varphi$  on wave number  $k_z$

Phase of the considered electrons with respect to the radio-frequency field  $\vartheta$  has linear increasing with increasing of wave number  $k_z$  (see Figure 12) and linear increasing with increasing of frequency  $\omega$  (see Figure 13).

#### 4. CONCLUSION

In this paper we introduce an analytical approach for analysis of operating regimes of traveling wave tube type O. Based on this approach we analyzed the energy transfer of the considered tube. Based on this analysis we formulate conditions to increase efficiency of this traveling wave tube. For example, efficiency of traveling wave tube could be increased with increasing of energy of electromagnetic field. Efficiency of this tube also depends on its length. But this dependence is nonmonotonous and has a single maximal value.

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