



Iranian Journal of Physics Research, Vol. 23, No. 4, 2024
DOI: 10.47176/ijpr.23.4.11634

Investigation of the beam loading effects in a constant-impedance traveling wave acceleration tube

R Kavusiomid ^{1*}, S Z Kalantari ¹, Sh Sanayehajari ², and F Ghasemi ²

1. Department of Physics, Isfahan University of Technology, Isfahan 841568311, Iran

2. Physics and Accelerators School, Nuclear Science and Technology Research Institute, AEOI, Tehran, Iran

E-mail: r.kavusiomid@ph.iut.ac.ir

(Received 17 January 2023 ; in final form 30 August 2023)

Abstract

In a high- power acceleration structure, the friction factor is a limiting parameter and affects the energy gain of the particles. Beam can to excite acceleration modes and higher-order. The beam effects in the excitation of acceleration modes are known as beam loading. In this article, the beam loading effect for a constant impedance traveling wave accelerating tube in S band is simulated by CST software. The results are compared with the theoretical relation obtained from energy conservation. The main purpose of this article is to validate the theoretical relationship and investigate the effects of beam loading in constant impedance acceleration structures. The comparison of the results shows a good match between the simulation and the theoretical relationship. On the other hand, it can be claimed that the beam -loading effects cannot be compensated by changing the radio frequency design. The results of this study will be used to design a high-powered accelerator with an energy of 30 MeV and an average power of 30 kW in the S-band.

Keywords: energy gain, acceleration modes, beam loading, traveling wave accelerating, S-band

For full article, refer to the Persian section