Design of ESS-Bilbao RFQ Linear Accelerator

J. L. Muñoz[1], D. de Cos[1], Igor Madariaga[1], I. Bustinduy[1]

[1]ESS-Bilbao, Bilbao, Spain

Abstract

The design of a RFQ (Radio Frequency Quadrupole) linear accelerator cavity using COMSOL Multiphysics is presented. This is a challenging multiscale problem. ESS-Bilbao RFQ [1] accelerator is a 3 m long copper cavity with relevant geometric features in the range of the tens of microns. In this paper, the different steps in the design process are described in detail. The cavity design starts with the definition of the vane modulation; from it the geometry is built in COMSOL geometry modeler or imported from external CADS. Electrostatic simulations are carried out to compute the accelerating field and the surface fields in the copper vane tips. Radiofrequency eigenvalue simulations are then used for designing the 2D cross section of the resonator, and then in 3D for the whole cavity length, including the input and output sections. The electromagnetic design is finished with the study of the frequency tuning of the cavity by simulations means. Finally, the cavity copper walls are heated by the electric losses a coupling between RF and thermo-mechanical physics is used to define the cooling strategy and to control the cavity deformation. After several years of development, the design process for this device in ESS-Bilbao has finished successfully and fabrication is launched.

Reference

1 ESS-Bilbao web page http://www.essbilbao.org

Figures used in the abstract

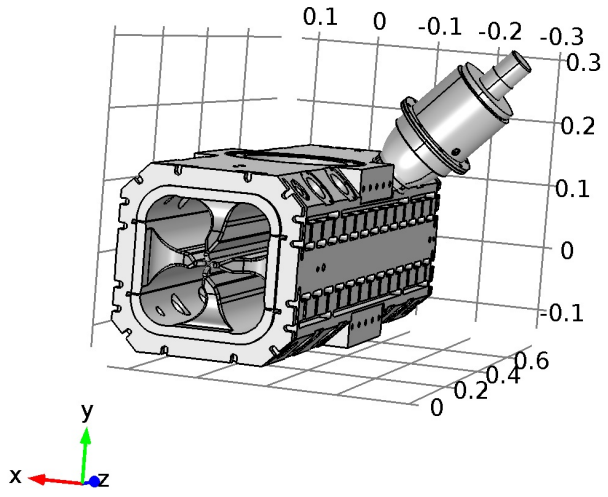

Figure 1: CAD model of first segment of the RFQ with coupler

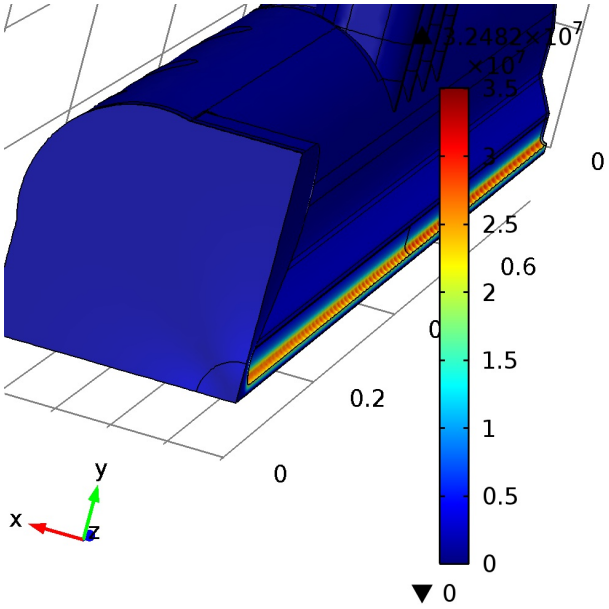

Figure 2: Electric field in an RF eigenvalue simulation of a quarter of first segment.

Figure 3

Figure 4