

Optimization of Cavity Shape for C-Band Accelerating Structure

The baseline design for the CEPC linac has been established at 30 GeV, employing S-band and C-band normal-conducting accelerating structures (AS). From 1.1 GeV to 30 GeV after the damping ring, there are 235 sets of C-band units with pulse compressors. A C-band high-power test bench will be established in Huairou Park at IHEP.

This study concentrated on optimizing cavity shape for a C-band accelerating structure to get a significant rise in shunt impedance while minimizing a low normalized surface electric field (E_s/E_0). Various cavity geometries and iris configurations were modeled and analyzed using Superfish, and the results were compared. Upon evaluating multiple designs, an elliptical racetrack-type pillbox cavity with an elliptical iris was determined to be the most reasonable design, offering improved field distribution and increased RF efficiency.

A further parametric analysis of iris thickness was conducted for improved accuracy. Based on its reasonable balance between shunt impedance and E_s/E_0 , an ideal thickness (t) of 4 mm is taken into consideration. The consistency of the outcomes was then verified by the optimized design in CST Studio Suite.

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