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Trapped mode and wakefield evaluation of bellows for 197 MHz superconducting crab cavities

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Stainless steel bellows are used to connect the 197 MHz superconducting crab cavities, to compensate for the cavity displacement due to cryogenic temperature changes. The impedance of the bellows should be evaluated for both wakefield effects and the potential high order trapped modes. In the nominal bellows one longitudinal trapped mode was found at 2252 MHz, located between two nearby harmonic frequency lines in the beam spectrum for the 0.7 A average current with 290 proton bunches. Mechanical simulations were performed to evaluate the compressed, extended, and transversely deformed states of the bellows. The trapped modes in all configurations remained well confined within the two harmonic frequencies. The ohmic losses of the trapped modes are calculated accounting for the mechanical and electrical conductivity at both 4 K and room temperature. The differences were found to be negligible, indicating that the bellows can also be used in the cold-to-warm transition between the crab cavity and the beam pipe. A preliminary short-range wakefield was calculated as a basis for subsequent long-range wakefield analysis.

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Yes

Footnotes

Funding Agency

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