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Resistive wall impedance calculations and effects of NEG coated insertion device vacuum pipes for the PF-HLS ring

Wednesday 4 June 2025 16:00 (2 hours)

I show analytical expressions of the longitudinal and transverse impedances of a two-layered circular pipe and their practical expressions at high frequencies derived by using asymptotic expansions of the Bessel functions. These expressions are applied to resistive-wall impedance calculations of NEG-coated insertion-device (ID) pipes for the PF-HLS ring*, which is proposed as a 2.5/5.0 GeV energy switchable ring and can simultaneously provide synchrotron light pulses emitted by electron bunches stored in the ring and by extremely short electron bunches (50 fs in length) injected from the superconducting linac. Both real and imaginary parts of the impedances rise up in high frequency regions depending on the NEG coating thickness. The heating powers of the ID pipes are calculated from the real parts of the longitudinal impedances for the stored electron beam and for the short electron bunches injected from the superconducting linac. The kick factors and the coherent betatron tune shifts due to the ID pipes are calculated from the imaginary parts of the transverse impedances for the stored electron beam. These dependences on the NEG-coating thickness are shown in this presentation.

Footnotes

*K. Harada et al., J. Synchrotron Rad. 29, 118-124(2022).

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