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Pressure profile simulation for the vacuum system in the SPS-II storage ring

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The vacuum system for the Siam Photon Source II (SPS-II) is optimized through a hybrid simulation methodology that integrates one-dimensional (1D) pressure profile calculations with three-dimensional (3D) test-particle Monte Carlo (TPMC) simulations using Molflow+.
In the initial phase, nitrogen-equivalent pressure simulations establish baseline parameters for pump placement, system configuration, and conductance optimization. The 1D approach provides a computationally efficient framework for estimating pressure profiles, incorporating pumping speeds, outgassing rates, and conductance, enabling informed design adjustments. The 3D simulations extend this analysis by incorporating gas-specific characteristics, modeling outgassing rates and pumping speeds for multiple species to better represent operational conditions.
A detailed comparison between nitrogen-equivalent and gas-specific 3D simulations highlights the influence of molecular dynamics and conductance variations on pressure distributions. This integrated simulation framework delivers a robust and cost-effective approach for achieving the ultra-high vacuum conditions essential for synchrotron storage ring performance.

Footnotes

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