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Simulating Pressure Profiles for the Free-Electron Laser Photoemission Gun Using Molflow+ [1] DIEGO SONG, Wesleyan University, CARLOS HERNANDEZ-GARCIA, Thomas Jefferson National Accelerator Facility — The Jefferson Lab Free Electron Laser (FEL) generates tunable laser light by passing a relativistic electron beam generated in a high-voltage DC electron gun with a semiconducting photocathode through a magnetic undulator. The electron gun is in stringent vacuum conditions in order to guarantee photocathode longevity. Considering an upgrade of the electron gun, this project consists of simulating pressure profiles to determine if the novel design meets the electron gun vacuum requirements. The method of simulation employs the software Molflow+, developed by R. Kersevan at the Organisation Européene pour la Recherche Nucléaire (CERN), which uses the test-particle Monte Carlo method to simulate molecular flows in 3D structures. Pressure is obtained along specified chamber axes. Results are then compared to measured pressure values from the existing gun for validation. Outgassing rates, surface area, and pressure were found to be proportionally related. The simulations indicate that the upgrade gun vacuum chamber requires more pumping compared to its predecessor, while it holds similar vacuum conditions. The ability to simulate pressure profiles through tools like Molflow+, allows researchers to optimize vacuum systems during the engineering process.

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