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Characterization and Performance of the NSCL's Large Volume Linear Gas Cell

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Beam thermalization plays a pivotal role in the ability of projectile fragmentation facilities to produce low-energy ion beams. The National Superconducting Cyclotron Laboratory (NSCL) employs a beam thermalization technique that involves first passing high-energy beams through solid degraders to remove the bulk of the beam's kinetic energy. The remaining kinetic energy is then dissipated through collisions with buffer gas atoms of a large volume linear gas cell that was constructed at Argonne National Lab (ANL). A series of initial commissioning experiments for the gas cell were conducted using 76Ga beams produced at approximately 90 MeV/u in the A1900. The fast beams were delivered to the gas cell in a new momentum compression beam line and the range distributions, extraction efficiency as well as the overall efficiency of the system were measured as a function of the incident intensity. The data were compared to predictions from the LISE++ code [1], stopping and range of ions in matter (SRIM) [2], and then particle-in-cell (PIC) calculations [3] of the space charge produced by the stopping were used in SIMION calculations [4] of the ion migration in the cell. The calculated efficiencies have been completed and generally agree with the observed behavior of the gas cell. Both the experimental and simulated results for the linear gas cell's performance will be presented and discussed.

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