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Beam Thermalization in a Large Gas Catcher

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Thermalization in a buffer gas provides a method to transform fast exotic beams produced by projectile fragmentation at the National Superconducting Cyclotron Laboratory (NSCL) into low-energy beams. The process includes slowing down the fast exotic beams in solid degraders combined with momentum compression and removing the remaining of kinetic energy by collisions with the buffer gas [1]. The beam thermalization area at the NSCL was reconfigured to accommodate two new momentum compression beam lines, a large Radio-frequency (RF) gas catcher constructed by Argonne National Lab [2] and a low-energy beam transport system. A large variety of exotic isotopes produced by the A1900 fragment separator was thermalized in the 1.2 m long gas catcher filled with helium at ~100 mbar. The ions were guided to an extraction nozzle with a combination of electrostatic and RF potentials and ejected by the gas flow. A novel RF ion guide was used for low-velocity transport of the ions into ultrahigh vacuum [3]. Finally, the ions were modestly accelerated for transport to various experiments. Twelve fragments ranging from 14O to 76Ga were used to study the thermalization process in the gas catcher. The combined stopping and extraction efficiencies were measured varying from 0.05% to 40% depending on the study case. The operational status of the beam thermalization area and gas catcher characterization results will be presented.

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[1] L. Weissman et al. , Nucl. Phys. A 746 (2004) 655.
[2] G. Savard, J. Phys. Conf. Ser. 312 (2011) 052004.
[3] B. Barquest, https://publications.nscl.msu.edu/thesis/Barquest2014_369.pdf

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