

## Heavy Ion Guide Gas Handling System: Calculations and Execution

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A heavy ion guide (HIG) is a part of the T-REX upgrade project at the Cyclotron Institute. In the HIG, radioactive nuclei will be produced in heavy ion induced reactions and will be separated from the primary beam and other unwanted reaction products. Separated ions will slow down in an aluminum degrader, losing most of their energy, before stopping inside the gas catcher. In order to collect a variety of ions, it is desired to know the effects of the aluminum degrader thickness and helium gas pressure on the gas catcher's ability to stop ions. The effect of pressure can be calculated using energy loss simulations with SRIM software. SRIM simulations were done using the following ions: Ca-50 at 10 MeV/u, 12 MeV/u, and 14 MeV/u; Ni-68 at 10 MeV/u; and Si-24 at 14 MeV/u; at gas pressures ranging from 100 to 500 mbar. Data was gathered on the average ion energy that could be stopped, the aluminum thickness required for ions to reach this energy, and the energy/space distributions of ions within the gas catcher. The results show that higher pressures can handle more energy and require less aluminum than lower pressures. Furthermore, pressure was shown to have a significant effect on the ion distributions within the gas catcher, with higher pressures resulting in a greater mean and smaller standard deviation. Present simulations will be used as the starting point for in-beam measurements. Design and programming of the digitally controlled interface for the gas handling system was also done.

### References

- [1] Savard, G. (2011). Large radio-frequency gas catchers and the production of radioactive nuclear beams. *Journal of Physics: Conference Series*, 312, 1-9. doi: 10.1088/1742-6596/312/5/052004
- [2] Ziegler, J. F., Ziegler, M. D., & Biersack, J. P. (2010). SRIM – The stopping and range of ions in matter (2010). *Nuclear Instruments and Methods in Physics Research B*, 268, 1818-1823. doi: 10.1016/j.nimb.2010.02.091