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# Progress of TITAN's Cooler Penning Trap for Highly Charged Ions

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The Penning trap cyclotron frequency is proportional to the charge state, q, so therefore measuring the larger frequencies of highly charged ions (HCIs) yields a corresponding increase in the precision of mass measurements. This was demonstrated in the mass measurement of the superallowed β-emitter 74Rb8+[1]. The process of charge breeding HCIs, however, introduces a large energy spread into the ion bunch which decreases the trapping efficiency and the precision of the mass measurement as the ions probe a larger and more inhomogeneous magnetic field. The TITAN experiment [2] at TRIUMF in Vancouver has begun commissioning a Cooler Penning Trap (CPET) with the goal of sympathetically cooling HCIs generated in an electron beam ion trap (EBIT) via interactions with other trapped, charged particles.

CPET was designed with the option of using a room temperature electron plasma, H+, or He2+ ions as a cooling medium, and simulations of cooling behavior have been run for each [3]. The initial program focuses on electrons and CPET's current status with respect to trapped electron plasma will be discussed. Already, CPET has demonstrated the trapping of a self-cooling, room temperature plasma for several minutes[4]. Technical details of the effort to create nested traps that capture both positively charged HCIs and a negatively charged electron plasma in such a way that the two interact and remain confined will also be discussed.

[1] S. Ettenauer, et al, PRL 107 (2011) 272501.
[2] J. Dilling, NIMB 204 (2003) 492.
[3] Z. Ke, et al, Hyperfine Interact. 173, 103 (2007).
[4] U. Chowdhury, et al,Proc. XII Int. Symp. ELECTRON BEAM ION SOURCES TRAPS, 120–123 (2015).

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