K. Dietrich[1,2], J. Dilling[1,3], O. Kester[1,4], I. Mukul[1], A.A. Kwiatkowski[1,4]

[1]TRIUMF
[2]Heidelberg University
[3]University of British Columbia
[4]University of Victoria

New electron gun for the TITAN-EBIT

High-precision mass measurements of radioactive ions are critical to understanding nuclear structure and tests of fundamental symmetries. Penning traps are widely used for mass spectroscopy with the lowest uncertainty and they can reach a precision of dm/m~1*10^(-9) with radioactive ion beams. This precision can be further improved by using highly charged ions (HCI) because the precision directly depends on the ions' charge state q. These HCIs can be created with charge breeding inside an Electron Beam Ion Trap (EBIT) where high electron current densities are used to knock out electrons of the trapped ions via electron impact ionization. This boost in measurement precision has been successfully demonstrated at the TITAN facility at TRIUMF, the sole Penning trap mass spectrometer with access to radioactive HCI.

At TITAN, the EBIT high voltage has recently been upgraded to allow 65 keV electron beams. To better take advantage of the higher energies, we are upgrading the electron gun of the EBIT to achieve higher current densities and therefore shorter breeding times.
To optimize the design, the electron beam properties were simulated using the Field Precision Trak software. With modifications to the electromagnetic optics, a lower heat load on the bucking coil can be achieved, which makes the system more reliable. For maximal experimental flexibility, three cathode sizes were simulated over a range of beam energies. Furthermore the geometry and design are also simpler to facility routine maintenance.
We will present the results of our simulations and the new design. The new electron gun will enable us to better perform high-precision mass measurements of nuclides with short half lives as well as extend our research program using in-EBIT nuclear decay spectroscopy.