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## Improvement of the Efficiency and Beam Quality of the TRIUMF Charge State Booster (CSB)

An Electron Cyclotron Resonance Ion Source is used as the charge state booster at the Isotope Separator and Accelerator facility of TRIUMF. Since its commissioning in 2010, the modified 14.5 GHz PHOENIX booster has been used to charge breed radioactive ions ranging from potassium to erbium operating in single-frequency heating mode. Under this regime, the efficiency of the booster was measured up to 6 %. The rf system of the source was recently upgraded to implement the two-frequency heating, and initial results showed significant improvement in the efficiency of the source. Another point of improvement that is being addressed is the extraction system and beam transport. The quadrupole scan technique using the thick lens approach has been developed to measure the emittance of the booster and, the overall system of the source is currently being optimized in preparation for the detailed investigation of the effect of the two-frequency heating on the outputs of the booster.

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