Real-time Optimization of an Ion Optical Beamline\textsuperscript{1} ZACHARY SCHILLACI, MATTHEW AMTHOR, Bucknell University, DAVE MORRISSEY, National Superconducting Cyclotron Laboratory, MAURICIO PORTILLO, Facility for Rare Isotope Beams, STEFAN SCHWARZ, MATHIAS STEINER, CHANDANA SUMITHRARACHCHI, National Superconducting Cyclotron Laboratory —

We have developed an experimental approach to automatically adjust multiple electrostatic and/or magnetic elements on an ion optical beamline, while analyzing the profile of the beam on a detector at the image point, until an optimal tune is found. This approach dramatically simplifies beamline tuning, thus allowing more efficient use of experimental equipment; ensures a more optimal tune is found, providing a more focused beam spot without a significant loss of beam transmission; and will allow the development of specialized optical tunes based on the needs of any given experiment. The approach was tested directly on the D-Line at the National Superconducting Cyclotron Laboratory at Michigan State University in several real-time optimization runs. The initial experiments demonstrate the ability of the optimizer to focus the beam while preserving transmission, ultimately halving $\sigma_\text{x}$ and $\sigma_\text{y}$ of the beam spot within a one-hour optimization run relative to that produced through a manual tweak of a model based tune. With further research we plan to generalize the approach to work on any given beamline, including particularly for higher order tunes of fragment separators.

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