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Diagnostic requirements and methodology for the ARIEL High Resolution Separator

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The ARIEL High Resolution Separator at TRIUMF is designed to have a mass resolving power of 20000 for an accepted emittance of 3μm x 6μm. Two 90° dipoles serve as the separating elements, with multipole correction between them to improve the preservation of emittance. At the entrance and exit, the ion beam envelope is magnified by quadrupoles to ease mechanical requirements of the slits which define the beam and separate species at the exit. The primary diagnostics for evaluating beam quality are emittance scanners at the entrance and exit of the separator, as well as scanning slits to provide the beam profile. To ensure acceptable transmission, these diagnostics must provide sufficient detail to confirm properly tuned beam optics, as well as information about unavoidable aberrations which must be mitigated to achieve the design acceptance. Here we discuss the precision required of the diagnostics, strategies for how to achieve it, and methods by which they are used to improve the quality of separation.

Email address

rschick-martin@triumf.ca

Supervisor's Name

Thomas Planche

Supervisor's email

tplanche@triumf.ca

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Primary author: SCHICK-MARTIN, Riley (TRIUMF)

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