

Source Section Development and Ion Source Testing at the Tennessee Tech Ion Beam Lab

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The Ion Beam Lab at Tennessee Technological University is a facility under development that emphasizes hands-on undergraduate involvement in every aspect of the work done. It will eventually be used for experiments in hyperfine structure measurements. This work focuses on the development of the ion source and ion optics section, where ions are generated at high voltage, shaped into a beam, and directed further down the beamline. Producing a usable beam from this section requires the operation of several supporting systems, which include: a high vacuum infrastructure capable of maintain a low pressure environment on the order of 10^{-6} Torr, a high voltage platform (up to 15kV) with effective ground isolation and electrical systems to extract and accelerate ions, and beam optics components, including a custom-designed quadrupole deflector, to steer the beam and maintain collimation. These supporting systems were developed and commissioned over two summer projects. SIMION simulations for the beam optics components as well as the custom-designed components were made to understand the ion trajectories prior to the fabrication of the instruments.

With this infrastructure in place, two ion sources were prepared for testing. The first is a commercially available thermionic ion gun selected for its well-characterized behavior. The second is a laser ablation ion source designed and developed by undergraduates. The design, the control algorithm, and results from the initial beam will be presented.