1^+-n^+ ECR Ion Source Development Test Stand

The purpose of the 1^+-n^+ test stand at Texas A&M is to study the systematics of using an ECR ion source to boost the charge states of singly charged ions extracted from another ion source capable of producing only low charge states. The ultimate goal is to relate the charge-boosting of ions of stable species to possible charge-boosting of ions of radioactive species extracted from the diverse, low-charge-state ion sources being developed for radioactive ion beams. ECR1, an ECRIS using 6.4 GHz microwave excitation, will be compared with ECR2, an ECRIS using either 14.5 GHz microwave excitation or a combination of 14.5 and 11 GHz microwave excitation. The study will focus on finding out the important parameters for efficiency of conversion to high-charge states and hold-up times in the ECRIS for light to heavy ions. Theses parameters studied will include the emittance and brightness of the input beam, the magnitude of the magnetic field of the ECRIS, and the frequency and multiplicity of microwave injection.

Both ECR sources have had problems recently, and this combined with the fact that one source must be in constant use with the cyclotron has affected progress. These problems are being addressed, and charge-boosting experiments will begin soon. The problems with the sources have been as follows:

1. The performance of ECR1 had degraded due to a worsening defect in one of its permanent magnet hexapole bars. This bar was recently replaced with a newly assembled one.
2. Each source has used a long magnetic solenoid lens to create its first focus. The solenoid for ECR1 takes up space along the beam-line that is needed for the 1^+ injection, and also, due to its length, this solenoid is inefficient in focusing the total beam from an ECRIS. Two shorter Glaser lenses have been constructed and they will soon replace the solenoids.
3. The ECR2 ion source has not performed up to expectations because of what has been determined to be a small water leak into its plasma chamber. The area and cause of the leak have been identified, and both a quick repair and a new plasma-chamber design are being worked on.

Meanwhile a SIMION beam-tracing study has been carried out at ANL on the behavior of the singly charged beam through the magnetic field mirror

along the axis of ECR1 and through deceleration elements into the source. This has aided in the design of a scheme to incorporate a biased ring at the injection end of the source. This ring will act as the final deceleration electrode as well as take the place of the biased disk that is routinely used to amplify the performance of ECR1.

Expenditures on the test stand to this date are:

1. TWT 500 watt amplifier for 11 to 13 GHz	$40,036.03
2. Controller for TWT amplifier	3,036.35
3. Two motorized, bellows-sealed vacuum feedthroughs	2,673.40
4. Picoammeter	1,196.00
5. Gas-control valve	1,088.00
6. Computer	2,277.46
7. Alkali ion gun incl. various ion sources & voltage supply	13,665.81
8. Turbo pump w/ starter, mech. pump & vacuum gauges	16,360.86
Total	$80,333.91

Items that remain to be purchased include a dipole magnet for beam selection and a variable oscillator for the TWTA.