

The charge-breeding ECR ion source

D. P. May and W. D. Cornelius¹

¹*Scientific Solutions, San Diego, California*

Before radioactive ions can be injected into the K500 cyclotron, they must have the proper charge-state for acceleration. The boosting of a singly charged ion to higher charge-states is termed “charge breeding”. The ECR ion source (CB-ECRIS) that will be devoted to charge breeding the radioactive ions produced by the ion guides was delivered in August. It was designed and built by Scientific Solutions of San Diego, California with a Phase I and a Phase II Small Business Innovative Research grant from the U.S. Department of Energy. The Cyclotron Institute is supplying the axial-coil power supplies, the vacuum pumps and the 14.5 GHz transmitter for the source.

The source was designed to enable a minimum of contamination and a high degree of efficiency. The efficiency in injection is made possible by an open path through the injection plate and by external electrostatic Einzel lenses. The efficiency of capture and charge breeding is provided for by high magnetic containment fields and the plasma-chamber cooling protection that allows high microwave power input. Two large coils supply the axial mirror magnetic field, and a surrounding Halbach type hexapole, assembled with Nd-Fe-B permanent magnets, provides the radial mirror field. The plasma chamber is formed by a water-cooled aluminum liner. The source is of medium volume and will operate at 14.5 GHz with the possibility of adding a lower second frequency later.

Scientific Solutions assembled the ion source in October. After pumping on the source the vacuum achieved on both the injection and extraction end was in the middle 10^{-8} torr range. CB-ECRIS will be commissioned after the transmitter and remaining axial-coil power supply are delivered and the analysis line is assembled.