ECR2 Ion Source Upgrade

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Introduction

The design for the upgrade to the ECR2 ion source has been presented in the two previous progress reports. In January the major task of assembling the permanent magnet hexapole was completed. In February the plasma-chamber/hexapole was inserted through the yoke and axial coils, the extraction and injection ends were mounted and the vacuum connections made. Also, some previously existing misalignment of the ECR2 injection line was corrected. On February 28 the axial field was turned on, and the 6.4 GHZ transmitter was turned on. A few days later the 14.5 GHz transmitter was turned on. The initial performance of the source has been promising, but several problems remain.

Assembling the Hexapole

Using the POISSON code FORCE, it was estimated that the magnetic force on each of the 23 in. long hexapole bars as they are moved radially and symmetrically into their slots builds up to a maximum of 920 lbs. directed radially inward. In actual assembly, the three north pole bars were brought symmetrically into their slots first, then the south pole bars. Since the three like poles repel one another, this procedure was seen as having less risk even though the inward force on the three south poles was higher (1320 lbs.) than it would have been for symmetric assembly. In order to handle such a force, each bar was assembled using a specially fabricated stainless steel strap that surrounded the bar (fig. 1). Stainless steel pins connected opposite sides of the strap through holes drilled in the permanent magnets. Each strap was drilled and tapped at each end for four stainless steel screws. These were used to fasten each bar to the assembly device (fig. 2). In addition, each holder was constructed of soft steel to provide a more uniform holding force.

After the bars were secured in their slots, the plasma-chamber/hexapole was encased in a stainless steel sheath and then Teflon shrink tubing. The field strength at the inner wall was measured with a Hall probe. The measurement