Plans for new ECR4 ion source

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Introduction

A new electron-cyclotron-resonance source (ECRIS), designated ECR4, is being designed as a supplement to the ECR1 ion source currently injecting the K500 cyclotron. The new source will use 6.4 GHz microwave heating and its design will incorporate the successful magnetic field structure of ECR1.

Ion Source Design

The magnetic fields for ECR4 were optimized using the POISSON-SUPERFISH software. The specifications for the NdFeB permanent magnets in the hexapole structure, including the residual magnetization (B_r), coercivity (H_c) and dimensions were determined via the PANDIRA tool of the software (Fig. 1). The yoke and coil geometry was determined using the POISSON tool (Fig. 2). This hexapole structure for ECR4 is almost identical to that of ECR1, with the exception of somewhat higher B_r and H_c for ECR4. The yoke-coil structure was simplified from ECR1 so that only seven identical coils are incorporated; no steel connects the two ends of the yoke; and the injection-end, steel plug is shorter. This optimization is possible because the ideal magnetic field profile was retrofitted to ECR1 which uses a nine-coil (eight identical and one larger) yoke structure.

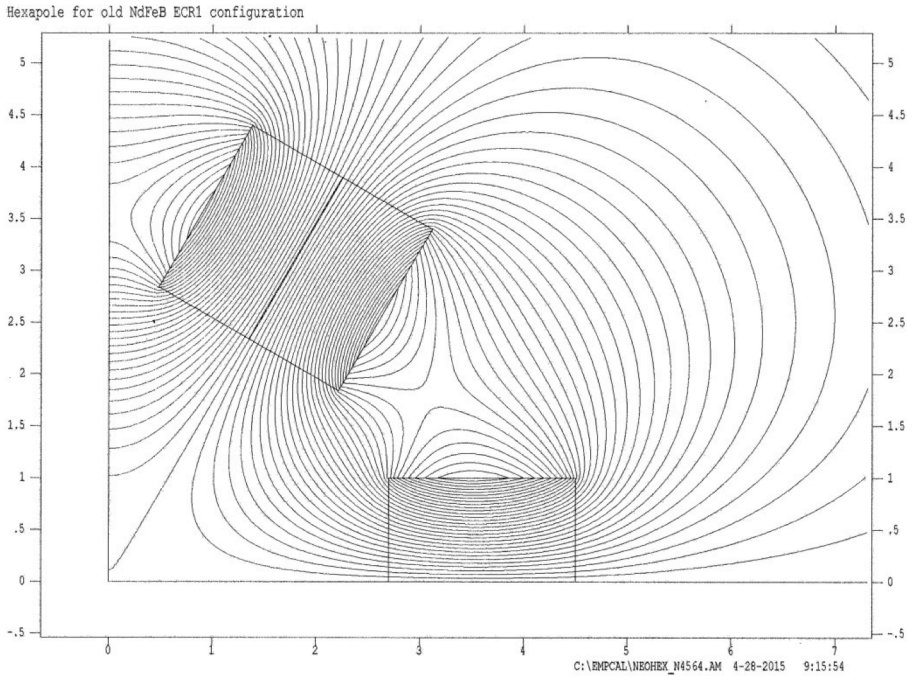

FIG. 1. PANDIRA simulation of the hexapole design.

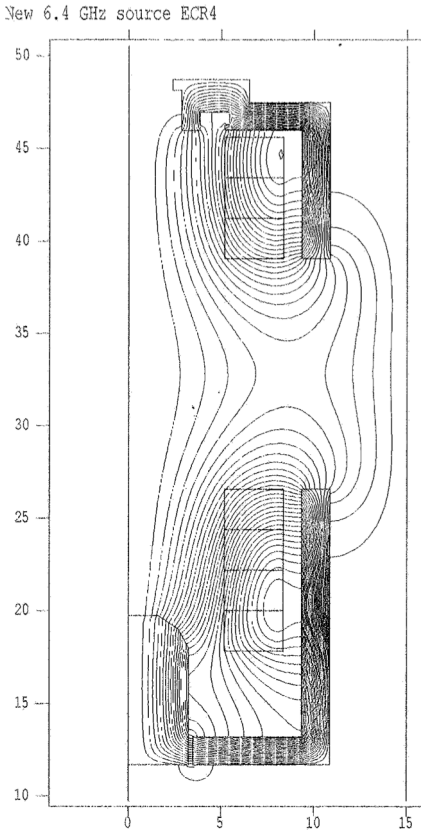

FIG. 2. POISSON simulation of the steel yoke and coil assembly.

Plans

The mechanical drawings for ECR4 are currently being made. The plasma chamber will feature more water-cooling for the permanent magnets. The source will also accommodate studies of the ECR plasma that relate to the beam properties, including charge-state distribution, stability and emittance. These studies will include x-ray spectroscopy of the plasma and will constitute a thesis project for L. E. Henderson.