Augmented Tune/Match Circuits for High Performance Dual Nuclear Transmission Line Resonators

Erickson, M.G. (Gainesville VA); Elumalai, M. (UF, AMRIS)

Introduction

Much progress was made on the dual nuclear coils. Shop access problems delayed progress, but both surface coil and volume coil are nearly complete.

Results and Discussion

1) A double nuclear surface coil was constructed from two rectangular pieces of dual sided copper clad Rexolite 1422. Each piece measures 5 x 7 cm x 0.23 cm (nominal) The inner diameter of each loop is 2 cm. The conductive trace of each loop is 5 mm in diameter. Each loop is continuous with a balanced stripline, with stripline extending 5 cm beyond the loop on either end. Identical copper traces were routed into each piece, and a 3 mm gap was routed into the ground plane of each piece at the virtual ground point for each coil. One member of the pair shall be tuned to carbon 13, and the other to proton. The two coils were stacked on top of each other in pancake fashion, with nylon washers providing 5 mm of vertical spacing between the two. Connectors for the hybrid termination stubs were fabricated from silver plated Anderson Power Pole connectors. Each connector was flattened in a hydraulic press, then crimped on to the center conductor of the HF-290 cables. A test set up assembled around a high performance current balun was used to determine the proper length of the termination lines. Hybrid stubs were adjusted to give virtual short at the midpoint of each loop. This approach was also used for the volume coil.

2) A double nuclear volume coil was constructed by dispersing 8 1.8 cm x 12 cm x 0.24 cm strips of copper clad Rexolite 1422 strips around a 7 cm OD polycarbonate tube in circumferential fashion, with axial interval of 45 degrees between each. An outer polycarbonate tube of 10.8 cm OD lined with copper shielding stock made up the Faraday enclosure. This outer tube was supported by two polycarbonate outer support rings.
   The Rexolite pieces were made by stripping 1 side of the cladding off of a double clad piece. The stripping operation caused bowing in each piece. This problem was solved by carefully bending each piece into approximate straightness in a vise. Next, each piece was clamped between two polished aluminum blocks, and subjected to several -20 C freeze/thaw cycles. Straightened pieces were supported in place on the polycarbonate tube with two polycarbonate retaining rings. As before, modified Anderson connectors were used for electrical connection. Electrical testing followed along the lines of the surface coil.

Conclusion

The design has proved out as planned. The electrical test set up proved mission critical to this project. Both coils will be complete and ready for magnet testing 2015 when tune/match boxes are fabricated. Shunt notch filters will be incorporated into each tune/match box.

Acknowledgements

AMRIS facility and NHMFL Users Program