Abstract Submitted
for the DNP11 Meeting of
The American Physical Society

Construction of Specialty Guide Field Coils Using an Industrial Robotic Arm[1] WILLIAM BERRY, CHRISTOPHER CRAWFORD, MARIO FUGAL, ELISE MARTIN, DANIEL WAGNER, ROBERT MILBURN, University of Kentucky — Many contemporary nuclear physics experiments require precise control of the magnetic field within key regions of the experimental apparatus. The nEDM experiment, for instance, requires uniform guide fields (produced by guide field coils) to transport neutron spin polarization from the polarizer to the measurement cell. Guide field coils in general are subject to tight geometrical constraints, and must not produce any external fields which would affect the results of the experiment. In order to produce a satisfactory coil in light of these constraints, a systematic design technique is needed. We introduce the magnetic scalar potential technique, which calculates the exact coil windings required on a specified boundary to produce any desired field distribution inside that satisfies Maxwell's equations. Realizing the designs produced by this technique introduces an additional difficulty: winding many turns according to the exact calculated paths. This is addressed by "printing" our coils onto a copper-plated G10 form using a calibrated robot arm and spindle, resulting in a 3-d printed circuit board. To correct for deviations in the actual shape of the form, we use a laser displacement sensor to capture the actual geometry as input into the calculation of the windings.

[1]Supported in part by NSF grant PHY-0855584.

William Berry
University of Kentucky

Date submitted: 01 Jul 2011 Electronic form version 1.4