

Multi-Coil Shimming System for an Electropermanent Magnet MRI System

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PURPOSE/INTRODUCTION

MRI systems require high magnetic field homogeneity in the Field of View (FoV) to obtain a good quality image. In this work, the design and implementation of active multi-coil shimming system [1] based on a bi-planar array is presented.

SUBJECTS AND METHODS

A low cost and compact MRI system based on an electropermanent magnet (EPM) array to generate the main magnetic field [2] is being developing see Fig.1a. A shimming system is necessary to obtain homogeneity of at least 10ppm in the Field of View (FoV).The shim coils must be to create a magnetic field (MF) as high as 4 mT at a distance of 75mm away from their faces.

RESULTS

A multichannel system based on an array of 10 planar coils has been chosen to design the shimming system. This system is composed by two PCBs each containing 5 Planar Coils (see Fig.1b) placed each around the FoV. For the coil design a fingerprint pattern was chosen. Each coil has an outer diameter of 50mm (16 turns) and there is composed of 8 layers and connected in series. For the power supply and control of the shimming system, an in-house system was built (see Figs.1c-d) with each coil can be powered up to 40 W and independently controlled. A driver board controls up to 20 channels independently and is powered by LCM600 power supply [3]. The communication with the PC is performed with a USB-i²C adapter. A more detailed description of the control system can be found in [4]. Before manufacturing the shimming array, a system formed by two coils was built and characterized with a magnetic test bench available in the i3M (Fig.1e). Fig.1f shows the MF profile for this proof system using a current $I=7A$.

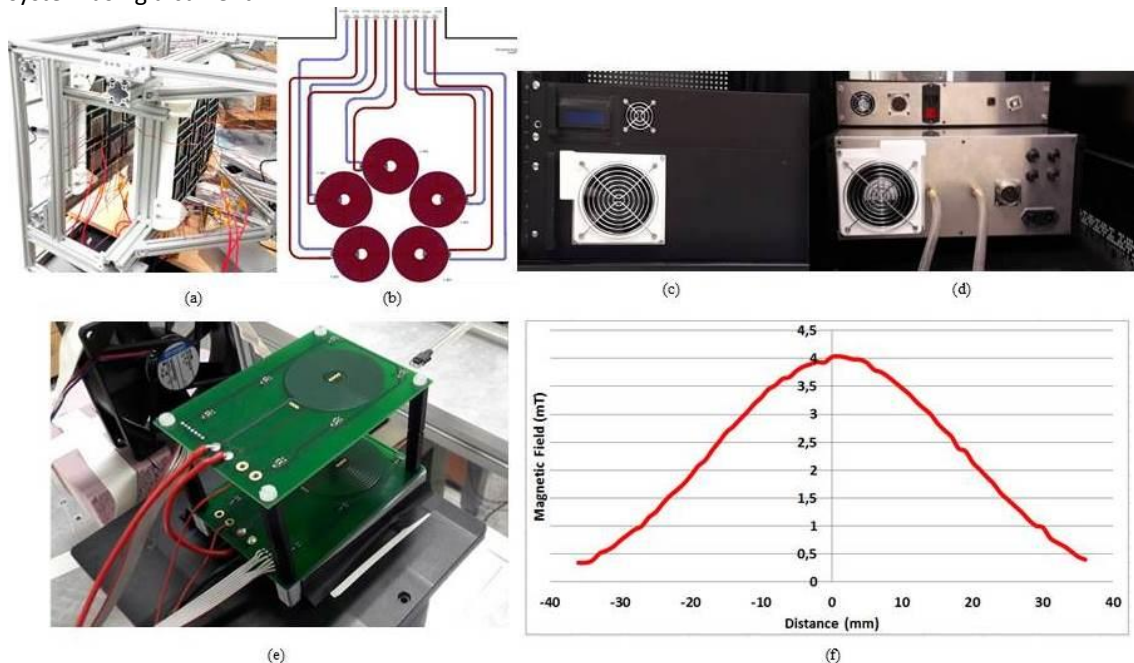


Figure 1: (a) Electropermanent Magnet System. (b) Shim coil array Board. (c) Front and (d) back view of the shimming power module. (e) Coil Test and (f) magnetic field profile measurements.

DISCUSSION/CONCLUSION

A shimming System composed by a 10 coils array (fingerprint pattern) is being built to increase the homogeneity of the magnetic field for an electropermanent magnet MRI system. Experimental MF field up to 4mT is obtained just measuring a two coils system using the desired current ($I=7A$). Considering

the preliminary results, the proposed shimming system will be able to obtain a 10ppm homogeneity in the FoV.

REFERENCES

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