A permanent magnet system for neutron spin analyzers optimized with the EMS software

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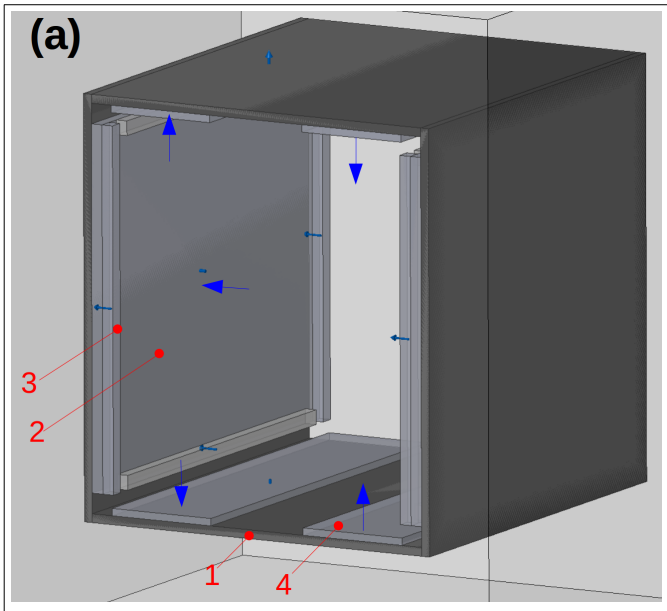
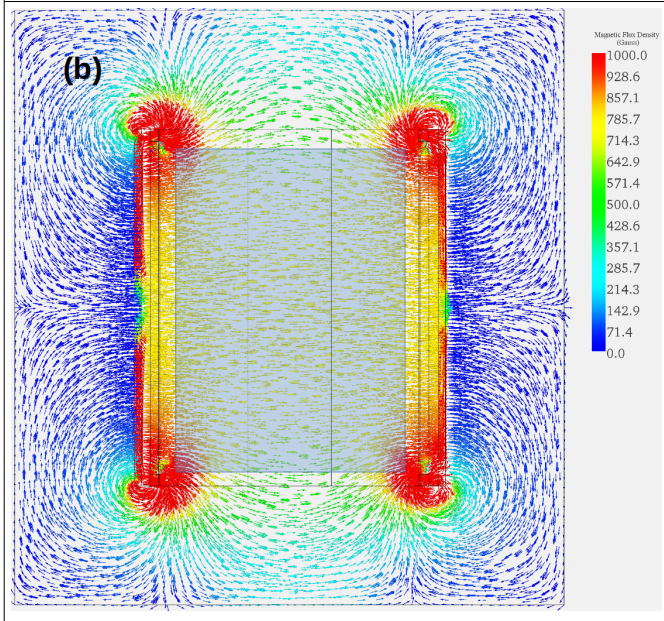


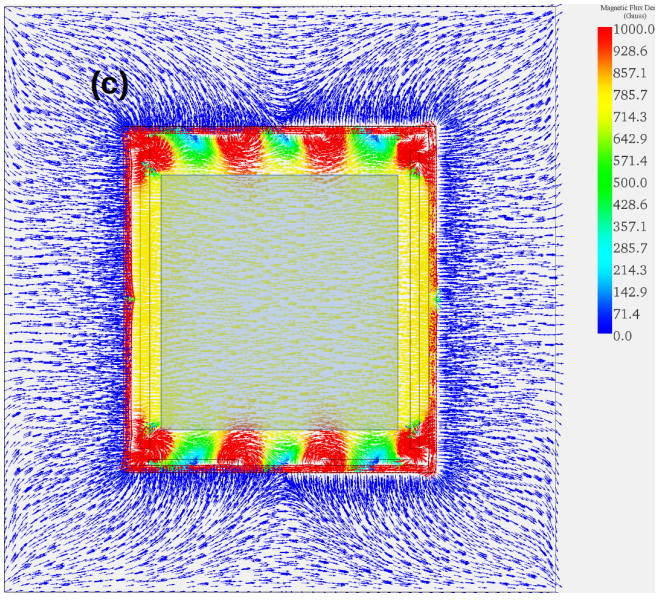
Figure 1

(a) Yoke with NdFeB permanent magnets. (1): Soft-iron box (ARMCO, 6 mm), outer dimensions 260x290x300 mm^3 (width x height x length). (2-4): NdFeB magnets, thickness 8 mm (2,3), and 5 mm (4). The blue arrows indicate the magnetization direction.

(b) Flux density B in the horizontal symmetry plane, the gray area 200x250 mm^2 shows the size of the mirror.

(c) B in the vertical symmetry plane. The gray area 200x250 mm shows the size of the entrance window. The scale is in Gauss.





We report on the design of a yoke with permanent magnets to generate a uniform field of ~700Gs in a volume of 200x200x250 mm^3. The purpose of this field is to magnetize thin ferromagnetic mirrors, iron-silicon hetero-structures on glass substrates, for neutron polarization analysis. The mirrors are aligned parallel to the horizontal plane, such that the magnetic field lies in the mirror plane. Field components perpendicular to this plane disturb

the polarization efficiency of the mirrors. Basic requirements are minimized vertical field components, small outer dimensions of the device, low weight, and small external stray fields. The EMS software was very helpful to optimize the arrangement of the permanent magnets. The final model and the flux density calculated with EMS is shown in Fig. 1 The evolution of our model with varying homogeneity and field strength is shown in Fig. 2 (a-c).

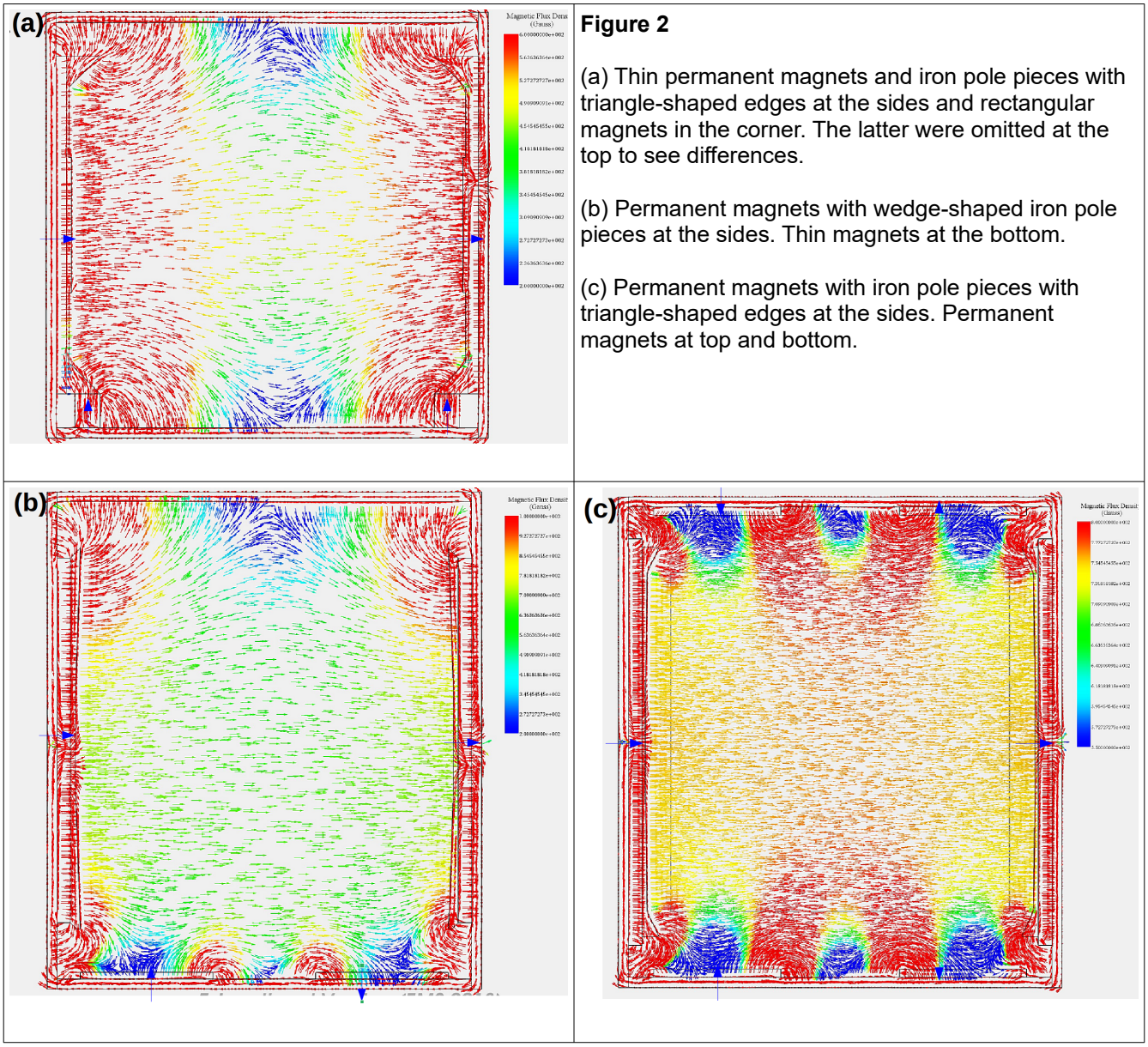


Figure 2

(a) Thin permanent magnets and iron pole pieces with triangle-shaped edges at the sides and rectangular magnets in the corner. The latter were omitted at the top to see differences.

(b) Permanent magnets with wedge-shaped iron pole pieces at the sides. Thin magnets at the bottom.

(c) Permanent magnets with iron pole pieces with triangle-shaped edges at the sides. Permanent magnets at top and bottom.

Comments

+ The EMS software is well integrated into SolidWorks. The work-flow is similar to other simulation packages. EMS is easy to handle for users familiar with SolidWorks. We like the software and will buy a license for the MLZ.

+ The support by the service was fast and competent.