**Force acting on a magnetic cloak placed in magnetic field**

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Magnetic cloak → advanced magnetic shield that does not affect external magnetic field.

We use coaxial arrangement of superconducting and ferromagnetic cylinders.

Magnetic invisibility → negligible force in non-uniform magnetic field (?)

numerical model in 3D and experimental verification

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**Experimental setup**

Superconducting cylinder
6 layers from 12 mm wide SuperPower SCS12050-AP tape (Ic ~400 A), wound in the same direction with overlapping,

\[ D_{in} = 45.2 \text{ mm}, \ \text{thickness} = 0.6 \text{ mm}, \ \text{length} = 145 \text{ mm} \]

Ferromagnetic cylinder
\( \text{Li}_{0.575}\text{Zn}_{0.4}\text{Fe}_{0.55}\text{O}_{4} \) ferrite powder with grain size below 80 \( \mu \text{m} \) mixed with the epoxy resin (Epoxy 1200 with the hardener P11)

\[ D_{in} = 50 \text{ mm}, \ \text{thickness} = 12.75 \text{ mm}, \ \text{length} = 150 \text{ mm} \]

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**Results**

Experimental measurements were taken using the Force meter EMS20-50N.

Numerical simulations
Relative magnetic permeability of ferromagnetic material.

Superconducting part was simulated as the tube, which value of relative magnetic permeability was 0.0045.

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**Conclusions**

Simplified 3d model shows good prediction of the magnetic cloak behavior in non-uniform magnetic field, generated by the real magnet.

Presented model do not consider hysteresis of both used materials and non-linear properties of superconductor which critical current depends on magnitude and direction of the applied magnetic field.