

Active magnetic shielding

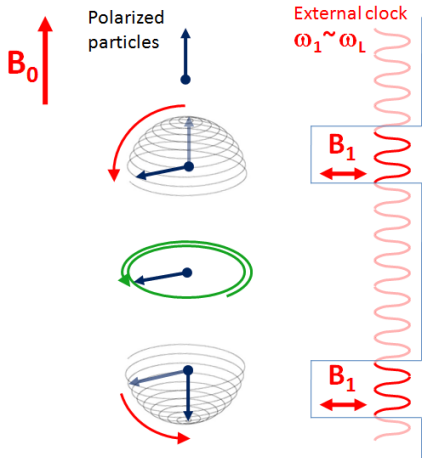
Grzegorz Wyszyński

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25th January 2013

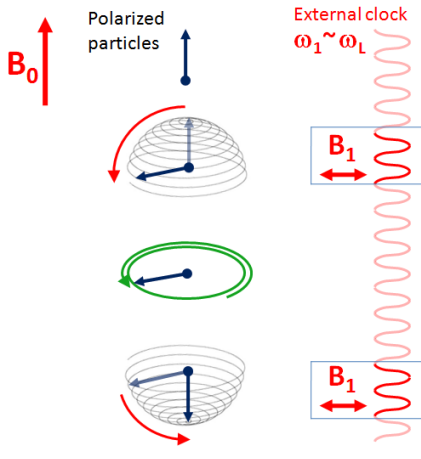
Ramsey method of oscillating fields



$$h\nu_{\uparrow\uparrow} = |2\mu B + 2dE|$$

$$h\nu_{\downarrow\downarrow} = |2\mu B - 2dE|$$

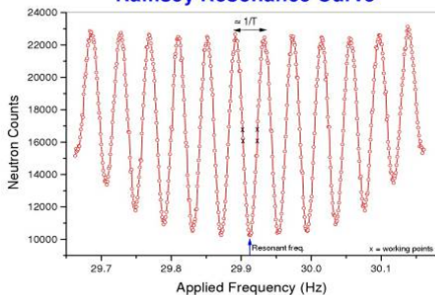
Ramsey method of oscillating fields



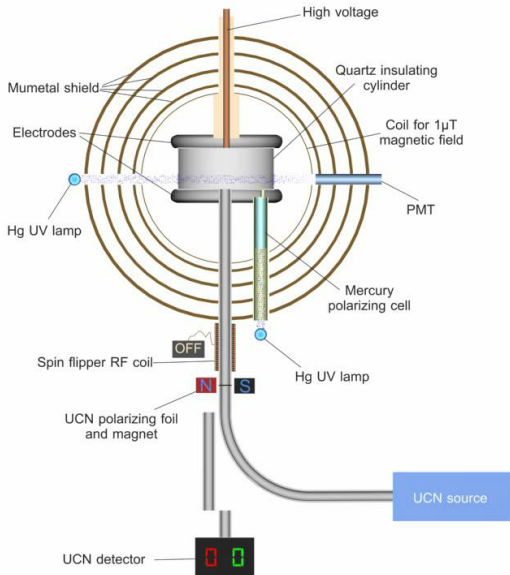
$$h\nu_{\uparrow\uparrow} = |2\mu B + 2dE|$$

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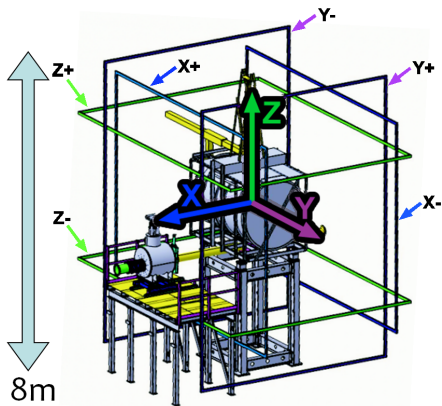
Ramsey Resonance Curve



nEDM apparatus



Surrounding Field Compensation (SFC)



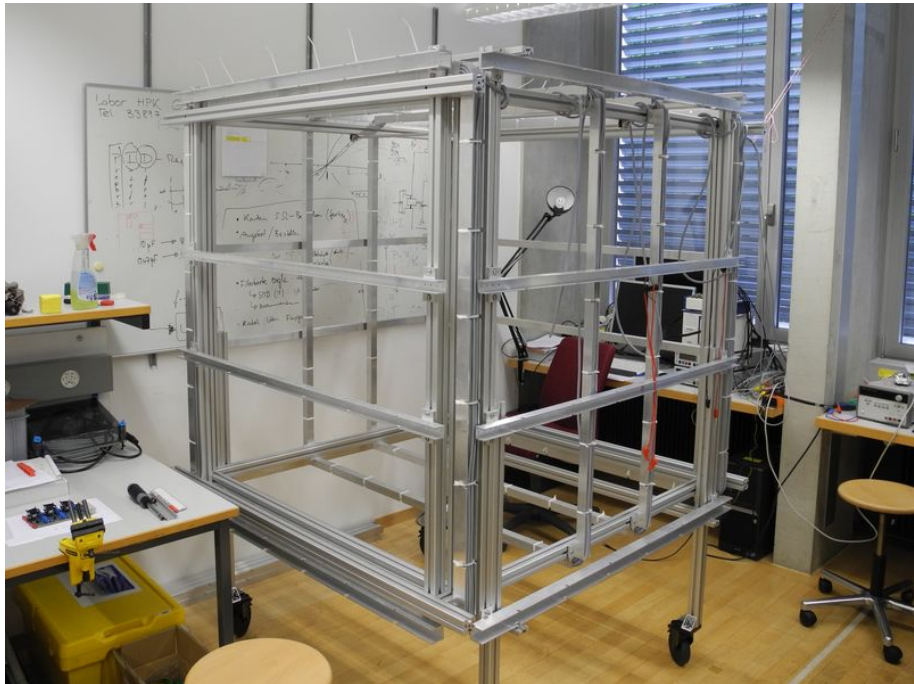
- Three square-Helmholtz coil pairs connected to Software calculating currents based on readouts from vector Fluxgate magnetometers



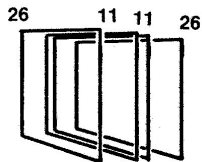
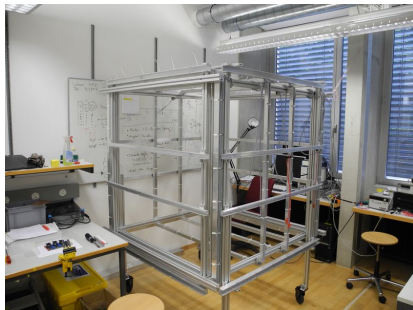
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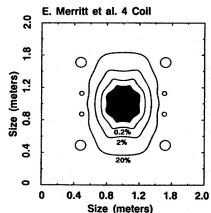
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"Coil cage"



E. Merritt et al. 4 Coil

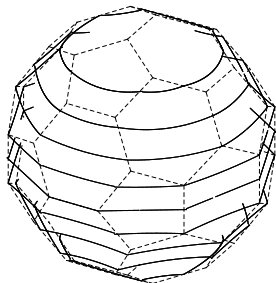


Drawings from: Kirschvink, J. L. (1992), Uniform magnetic fields and double-wrapped coil systems: Improved techniques for the design of bioelectromagnetic experiments. *Bioelectromagnetics*, 13: 401–411

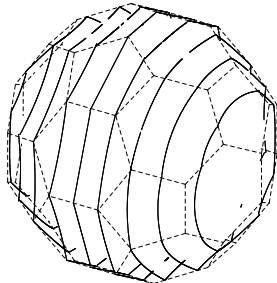
Second idea - orthogonal set of coils



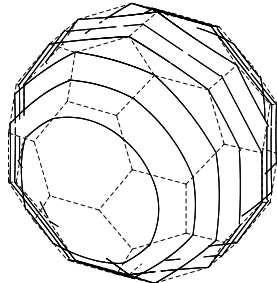
Φ_{10}



$\Re(\Phi_{11})$



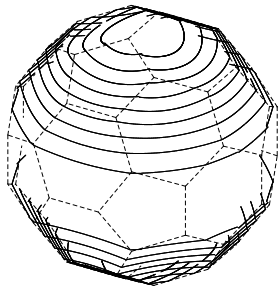
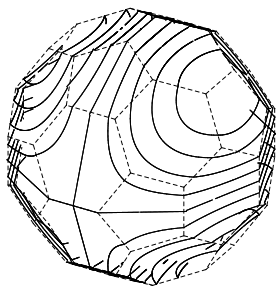
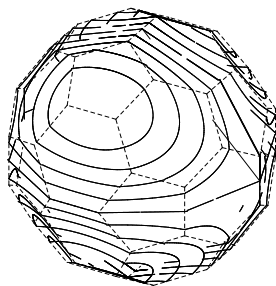
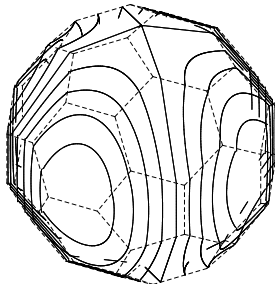
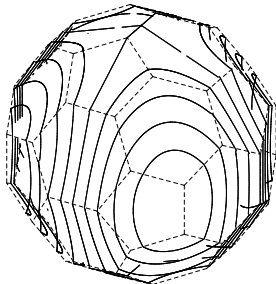
$\Im(\Phi_{11})$

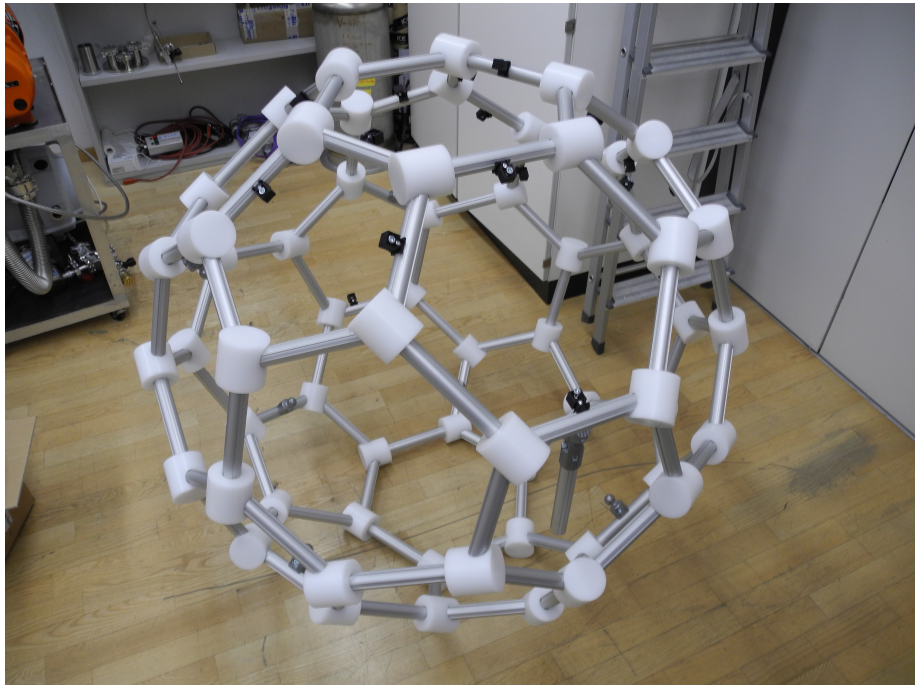


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Φ_{20}  $\mathcal{R}(\Phi_{21})$  $\mathcal{S}(\Phi_{21})$  $\mathcal{R}(\Phi_{22})$  $\mathcal{S}(\Phi_{22})$ 



Work done so far

- Small coil cage prototype is built and will be examined
- Football supporting structure has been built

Future

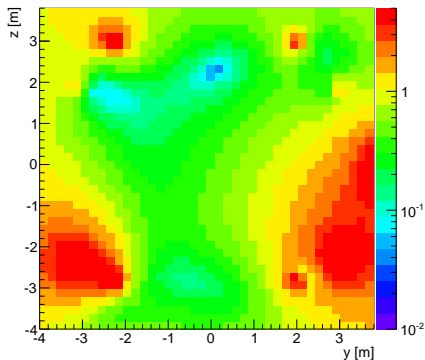
- Finish the construction - wires for football structure and mounting of sensors
- Test both configurations, find optimal sensor positions and optimal current determination algorithm
- Build the bigger setup



Simulation with $r_{sensors} = 3$ m and $n_{sensors} = 7$

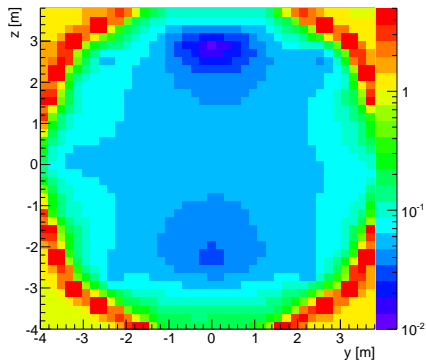


Relative difference, $x=0.000000$, SFC



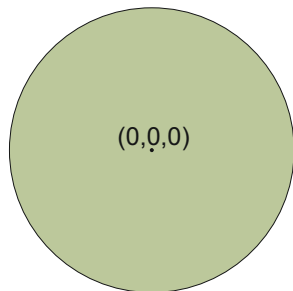
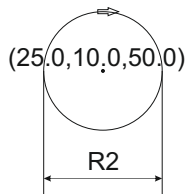
SFC system

Relative difference, $x=0.000000$



Football-like system

Setup for simulation



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Position of sensors - spherical coordinates



nr	θ	φ
1	0	0
2	π	0
3	0	$\pi/2$
4	0	$3\pi/2$
5	$\pi/2$	0
6	$\pi/2$	π
7	$\pi/3$	$\pi/4$



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