

Animation of dipole configurations discussed in Ingo Rieberg and Peter Blumner, *Ansys® approach to creating homogeneous fields with finite-size magnets*. Phys. Rev. Applied 23, 064029 (2025). <https://doi.org/10.1103/PhysRevApplied.23.064029>

Configurations:

- ☐ $H_r \alpha$
- ☐ H_α
- ☐ f_α
- ☒ f_α
- ☐ $H_2 \alpha$
- ☐ H_α
- ☐ H_α

3d view options:

- ☐ r_e
- ☐ r_a
- ☐ r_r
- ☐ stp
- ☒ 3D
- ☐ xy
- ☐ xz
- ☐ yz

add-on:

- ☒ flat
- ☒ \vec{m}
- ☒ axes
- ☒ shell

field coord:

- ☒ B_x
- ☐ B_y
- ☐ B_z

Parameters:

- N_{dip} : 16
- focus: 0.576
- distance: 1.153
- twist: 0
- size: 0.010
- R : 0.035

Field Distribution:

K_y : 0.71

K_z : 0.01

K_x : -0.72

Field Strength:

B_x (mT)

B_y (mT)

B_z (mT)

Field Strength Scale:

0.0 to 40 mT

Field Strength Legend:

- ☒ None
- ☐ shape
- ☐ $f(N)$
- ☐ STL

Field Strength Legend:

- ☒ GUI_{ring}
- ☐ pri_{ax}
- ☐ art_{pra}
- ☐ GUI_{clu}

Field Strength Legend:

- ☐ Ti
- ☐ Fo
- ☐ QR

1. Configurations

The naming is adapted from:

- Physical Review Applied: (<https://doi.org/10.1103/9nnk-jytn>)

- Choosing the magnet shape with the second RadioButton:
 - **dip**: a point dipole. All lengths are then given in units of the ring radius R .
 - **sph**: A sphere of finite size (as determined by the sliders, in meter).
 - **cub**: a cube of finite size (as determined by the sliders, in meter).
- Configuration Sliders:
 - **N_{dip}** : Number of magnets in a ring
 - **focus**: the focal length (in units of R)
 - **distance**: The distance (in units of R) between ring in stacked configurations
 - **twist**: twist angle in degree (for stacked configurations)
 - **size**: the diameter (in meters) for a sphere, and the edge length for a cube
 - **R** : the radius of the magnet centers (in meters).

2. 3D View Options

Set specific viewing angles for the upper-left 3D plot.

- To rotate the rings, use the top three rotation buttons.
- To stop the rotation, press the "stp" button.

3. Add-On Checks

Enable additional plot elements via the checkboxes:

- **flat**: Displays the magnetic field within planes. If checked, the "hz" slider adjusts the height of that plane.
- **m**: indicates the direction of the moment with an arrow.
- **axs**: shows the axes.
- **shell**: indicates the shape (rod, sphere, or cube)

4. Field Component

Choose which magnetic field component to display:

- x, y, or z

5. Pop-Ups

Optional overlays are:

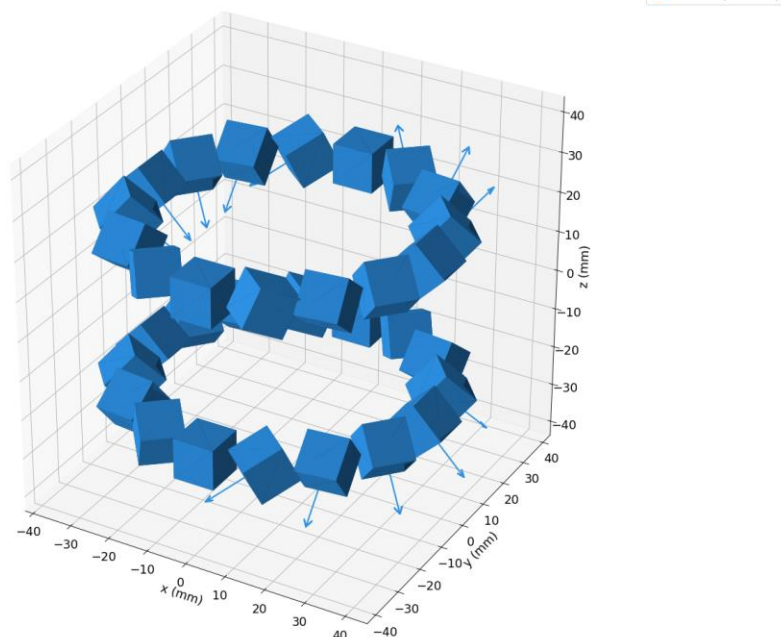
- Ti: The title (useful for a presentation, editable within the script).
- Fo: Display the formula showing the field's power-law deviation from the center value.
- QR: A QR code for quick access to this software.

6. External Links

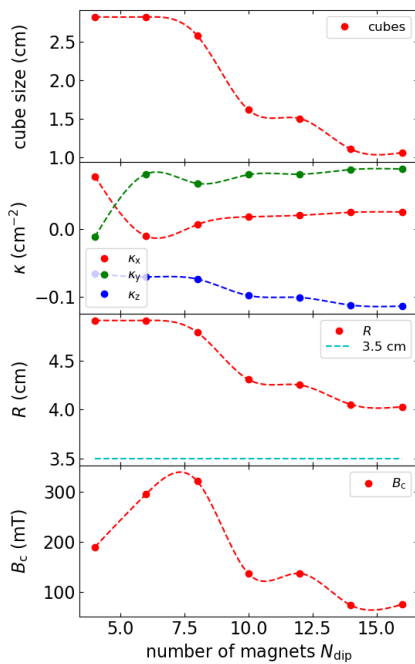
- **GUI_{ring}**: The source code of this GUI.
- **art_{pra}**: The article explaining theoretical and experimental background.
- **pri_{arx}**: The preprint for that article.
- **GUI_{clu}**: A related interactive tool for exploring general dipole clusters.

7. Additional Figures

- **shape**:
Show the cluster as a 3d magpylib-plot.

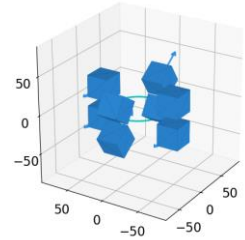
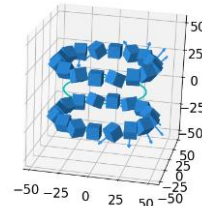


- f(N):**

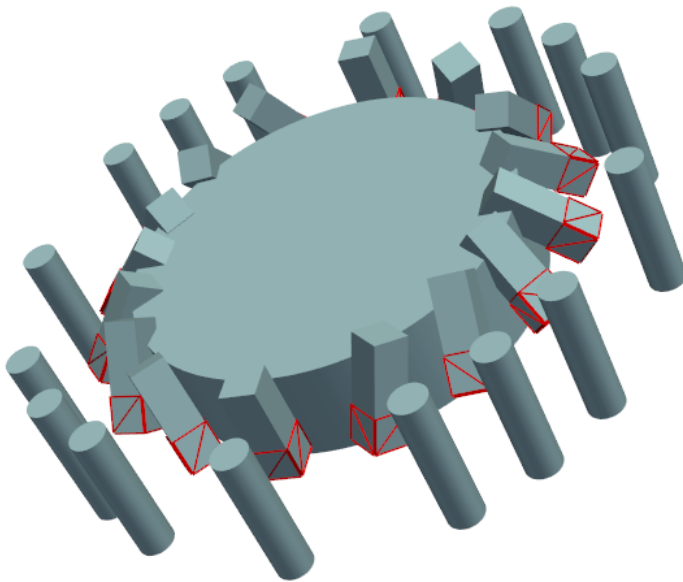


The field strength and the curvature as a function of the number of magnets (a focused sandwich configuration is chosen for this example). The inner diameter (cyan) is chosen by the **R-slider** (which is the radius of the magnet centers in the plot described above). For a given magnet number, the size is then chosen as large as possible, with a spacing of at least 1 mm between the cubes.

The plots on the right hand side illustrate the first (4 per ring) and the last (16 per ring) number of cubes considered here.



- STL:**



Generates an STL-file as a help for 3d-printing of the corresponding magnet holder. You see the negative part of the magnet support here. The red lines indicate the position of the cubes.