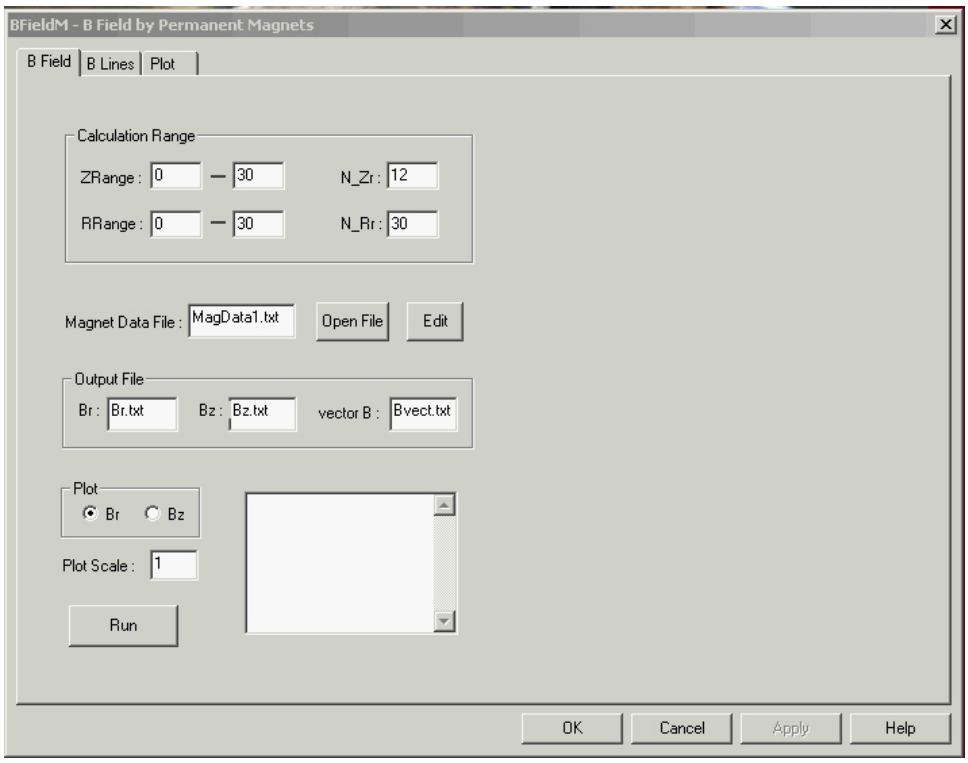
Instructions for BFieldM program

A. Installation

BFieldMSetup.exe will install the program in a directory which you name. *All results will be put into this directory*; this cannot be changed. The results will be overwritten on the next calculation unless you move them into a data directory. The program has not been corrected for inconsistencies, so you must watch out for its peculiarities.

B. Numerical B-field data

To calculate the B-field numerically, click on the first tab. This appears:



ZRange is the range of calculation in cm. However, if set for 0-30, for instance, the output will be from -30 to +30. You have to delete the negative *z*'s in Excel if they are not needed. However, the RRange will always be for positive *r*, even if you set it for -30 to +30. N_Zr and N_Rr are the number of points computed within the range of *z* or *r*, respectively. These are not arbitrary. Only convenient integral numbers will be accepted by the program (without telling you). Click on RUN. Do not click on OK; that will close the program!

The input file (Data File) is a text file *.txt. The default input file is MagData1.txt. You have to paste your own input file here. We will show later how to write it. You can then change it with Edit, which opens it in Notepad.

The output files are Br.txt, Bz.txt, and Bvect.txt. The last one allows you to draw vectors of the B-field, but it is not very useful. The most useful file is Bz.txt. Open this file in Excel. Choose Fixed Width, then Finish. The result will look like this (next page). The first column gives *z* in cm, and the first row gives *r* in cm. Delete the negative *z* lines if not needed. The field is given in Gauss when the permeability is given in the input file.

z| r	0	1	2	3	4
-10	-1.6195	-1.5861	-1.4838	-1.3058	-1.0412
-9	-2.6392	-2.6098	-2.5189	-2.3584	-2.1141
-8	-3.7745	-3.7525	-3.6837	-3.5592	-3.3628
-7	-4.9955	-4.9847	-4.9497	-4.8818	-4.7653
-6	-6.2575	-6.2614	-6.2712	-6.2801	-6.2758
-5	-7.5023	-7.5235	-7.5864	-7.688	-7.822
-4	-8.6613	-8.701	-8.8208	-9.0224	-9.3085
-3	-9.6621	-9.7194	-9.8934	-10.191	-10.625
-2	-10.436	-10.507	-10.727	-11.105	-11.663
-1	-10.925	-11.006	-11.255	-11.687	-12.327
0	-11.092	-11.177	-11.436	-11.886	-12.556
1	-10.925	-11.006	-11.255	-11.687	-12.327
2	-10.436	-10.507	-10.727	-11.105	-11.663
3	-9.6621	-9.7194	-9.8934	-10.191	-10.625
4	-8.6613	-8.701	-8.8208	-9.0224	-9.3085
5	-7.5023	-7.5235	-7.5864	-7.688	-7.822
6	-6.2575	-6.2614	-6.2712	-6.2801	-6.2758
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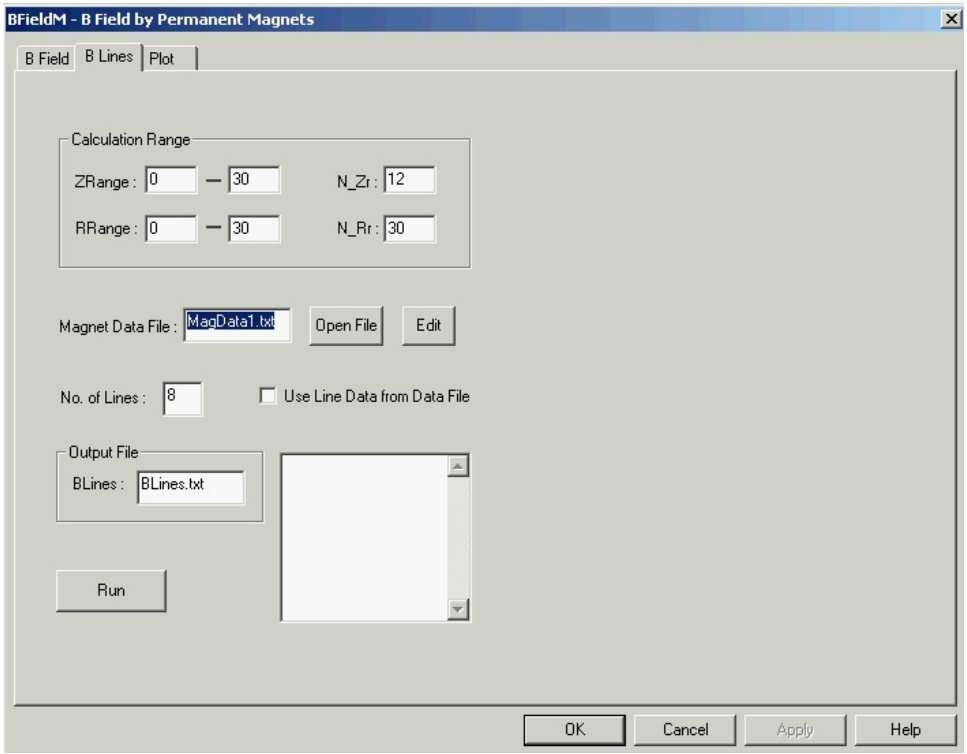
9	-2.6392	-2.6098	-2.5189	-2.3584	-2.1141
10	-1.6195	-1.5861	-1.4838	-1.3058	-1.0412

C. Computation of field lines

Clicking on the tab Blines opens this interface:

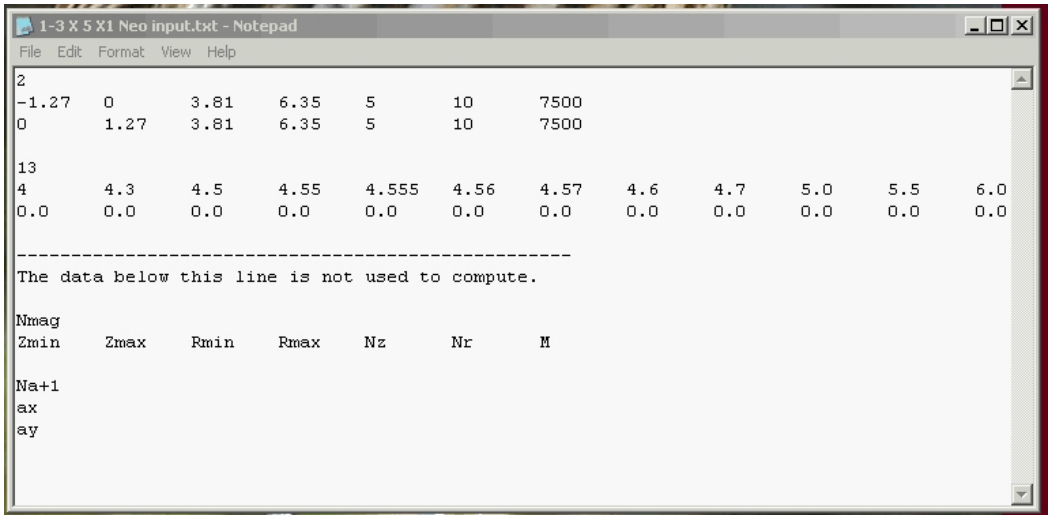


The Z and R ranges and the input file have to be re-entered. They are not carried over from the Bfield tab. The result comes out in two columns in the Blines.txt file; these are the *x* and *y* coordinates of each point on each line. All the data are in the first two columns. The data for each line is separated from the previous one by "next" on one line. To get this into convenient form, you have to move the x, y pairs into different columns.

The tab Plot will show a plot of the lines for positive and negative *z*, including blocks indicating the positions of the magnets. The default number of lines is 8, but you can set any number. However, for the best presentation, you can choose which lines to plot. This is done in writing the input (Data) file. In that case, check the box Use Line Data from Data File.

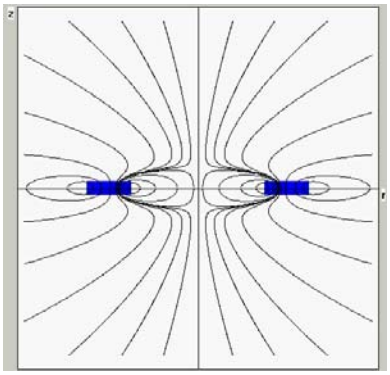
D. The input file

The input file for one NeFeB ring magnet with ID = 3 in., OD = 5 in., and thickness 1 in. looks like this:



The explanation is given below the line. The first line, Nmag, is the number of magnets. Note that we want z = 0 to be the midplane of the magnet, so we divide it up into two magnets, each ½ in. thick, with no space in between. Thus, the first line, Nmag, is 2. The second line has Zmin = –1.27 cm and Zmax = 0. This is the lower ½ in. The third line gives the upper half. In the next two columns, the inside and outside radii, Rmin and Rmax, are given in cm. The next two columns give Nz and Nr, which is the number of segments the magnet is divided into in the *z* and *r* directions for computation. The last column is the permeability. This is best found by fitting the computed field with the value measured with a gaussmeter.

The lower part of the file above the line specifies the lines to be plotted. The "13" is the number of lines plus 1. The two lines below give the x and y coordinates of the starting point of each line. Most of these are inside the magnet, so a small change in position may give a big difference in the line. It takes a lot of experimentation to get conveniently spaced lines. Fortunately, you can see the result immediately in Plot, and can edit the input file. Be sure to name and save the input file.



The program will generate plots like this one if the lines are chosen carefully. The diagram cannot be copied directly; any changes to the desktop will destroy the plot. To copy it, you must have a program that can capture part of the screen.