

NOTES ON CODE VERSIONS AND FILENAMES ...February 2024 Version ...

SUPPLEMENTARY DOCUMENT TO PHD THESIS OF BEN JONES,

“Study of Broken Symmetries in Electrodynamics with Specific Case Study on the Mechanical Antenna”.

FILENAME:

Mechtenna-c-2-face-ANGLES-MAG03-B2B-COMPAQ.cpp

TO DISPLAY 3D IMAGE OF MAGNETIC FIELD PATTERN IN THE RECTANGLE
NEAR THE ELECTRET

NOT NEEDED ... lines 877 - 982 ... CAN REMOVE FROM COMPILATION USING
/* */

OR CAN PUT INTO COMPILATION by Removal of /* */

ALSO SET BOOLEANS near lines 100-101, to display the 3D image

bool Multiple_Angles = false;

bool MAG03_display = false;

SET LOOK-AT around LINE 200. Toggle between

gluLookAt(-300 , -300 , 270, 0, 0, 0, 0,0,1); (oblique angle) , to display the 3D image
AND

gluLookAt(..... xy-plane only) to display the two-dimensional graphs

gluLookAt(0, 0,10, 0, 0, 0, 0,1,0); is for xy plane to display Graphs, see OpenGL Reference on “gluLookAt” for more information

TO DISPLAY FIELDS AT SENSORS AS FUNCTION OF ANGLE

bool Multiple_Angles = true;

bool MAG03_display = true;

Remember one must include the VECTOR header file (also on GITHUB).

MAGNETIC FIELD INDICATORS IN RECTANGLE NEAR ELECTRET THICK ELECTRET (thickness increased compared with later runs) AT FIXED ANGLE

lines 115, 116: Electret thickness in metres:
variable h (height in metres)

h = .004 (large value to make Cuboid easier to see) for Figures 6.3 and 6.6
h = .000250 (Bickford's value, thin square electret) for later Figures

To remove Field Indicators within xy-plane, comment out lines 474 - 542 with /* ... */

Mechtenna-c-2-face-ANGLES-MAG03-B2B-COMPAQ.cpp

bool Multiple_Angles = false;

bool MAG03_display = false;

change VIEW ... use oblique angle, not view along negative-z axis

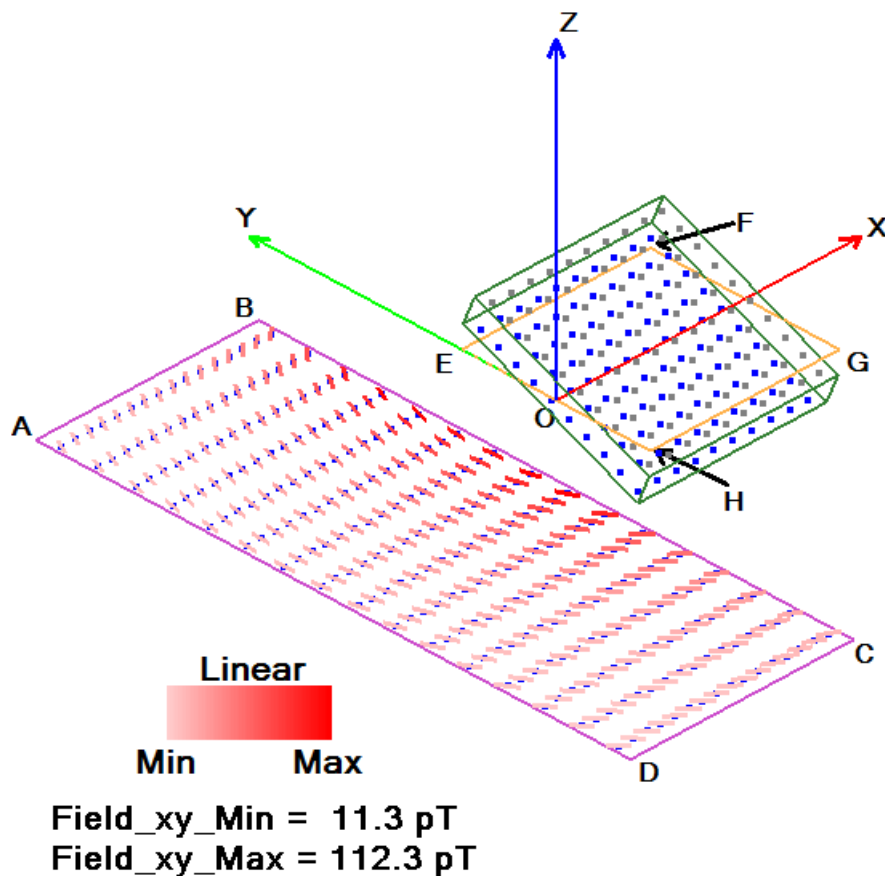


Figure 6.3, page 127

VELOCITY VECTORS; LINE SEGMENTS EMANATING FROM POINT CHARGES **Mechtenna-c-2-face-ANGLES-MAG03-B2B-COMPAQ.cpp**

To have program draw Velocity Vectors,
make lines 434-474 ACTIVE (remove /* */)

Comment out lines 434-474 to remove drawing Velocity Vectors

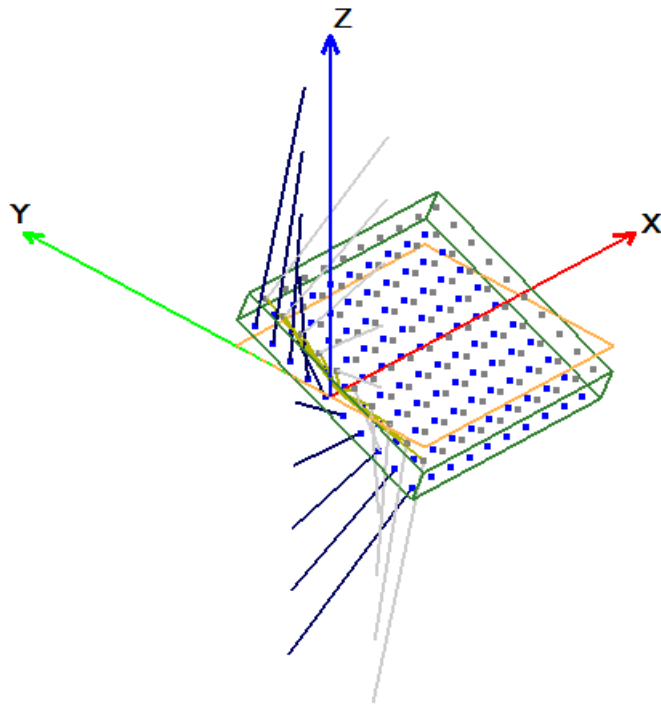


Figure 6.6, page 131

MAGNETIC FIELD INDICATORS IN RECTANGLE NEAR ELECTRET ELECTRET AT FIXED ANGLE , THIN ELECTRET

Mechtenna-c-2-face-ANGLES-MAG03-B2B-COMPAQ.cpp

bool Multiple_Angles = false;

bool MAG03_display = false;

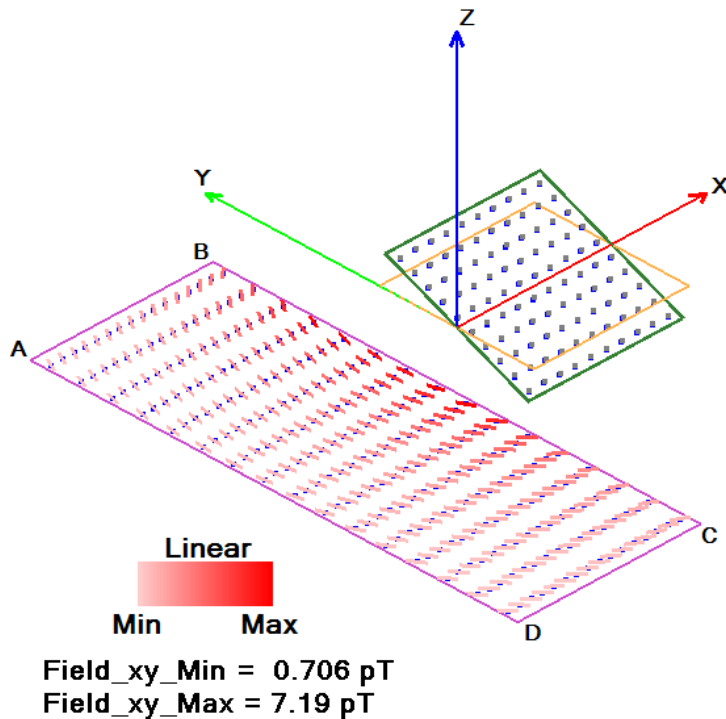


Figure 6.8 page 133

lines 115, 116: Electret thickness in metres:

variable h (height in metres)

THIS TIME AND FOR SUBSEQUENT IMAGES USE

h = .000250 (Bickford's value in metres, thin square electret)

SIMULATION CODE WITH MAG-03 INSTRUMENT SENSORS ALSO SIMULATED
FIELD FOR SPINNING ELECTRET AT ONE ANGLE

Mechtenna-C-2-face-ANGLES-MAG03-B-z1gap.cpp

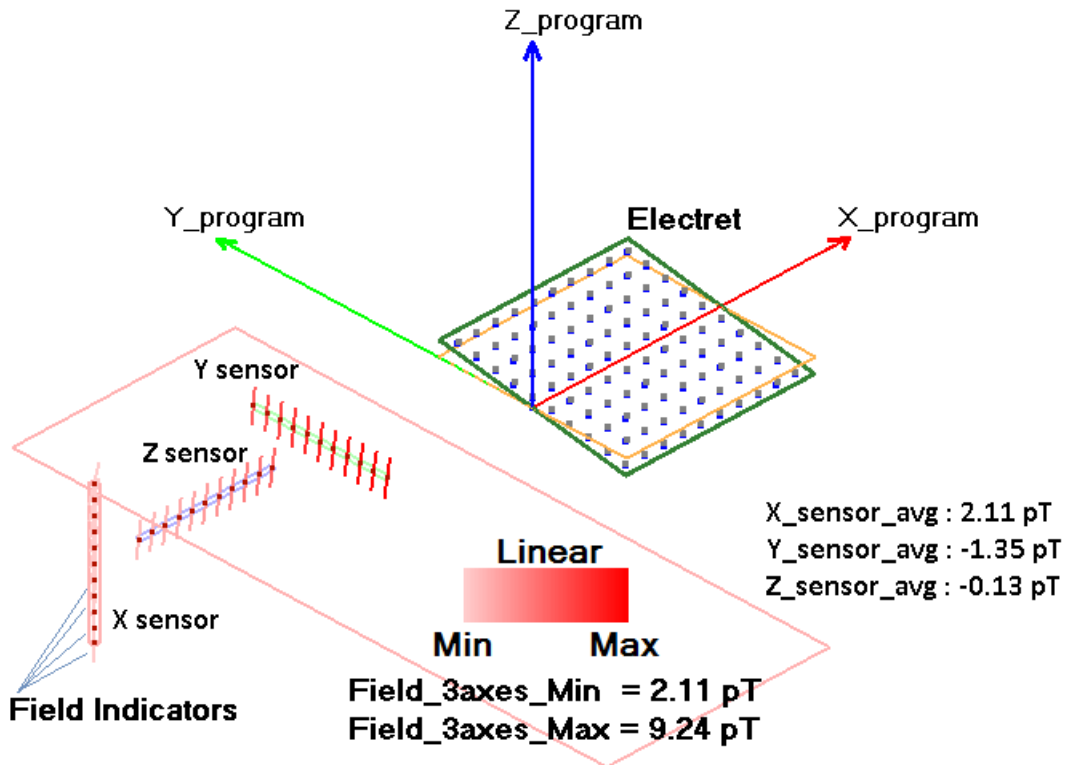


Figure 6.19

BOOLEAN VARIABLE SETTINGS NEEDED ARE:

```
bool Multiple_Angles = false;  
bool MAG03_display = true;  
bool multiple_z1_gap = false;
```

SENSOR YZX FIELD VALUES AS FUNCTION OF ANGLE

Mechtenna-c-2-face-ANGLES-MAG03-B2B-COMPAQ.cpp

bool Multiple_Angles = true;

bool MAG03_display = true;

change VIEW ... view of xy plane only, not oblique angle (see earlier page)

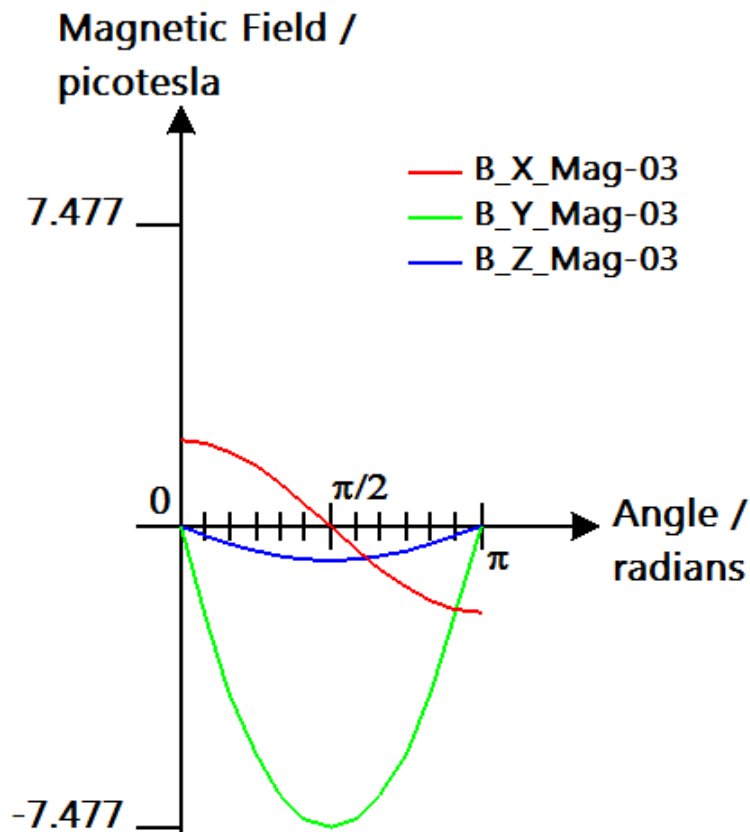


Figure 6.20 page 146

MAGNETIC FIELD AS FUNCTION OF DISTANCE TO SENSOR ELEMENTS

Mechtenna-C-2-face-ANGLES-MAG03-B-z1gap.cpp

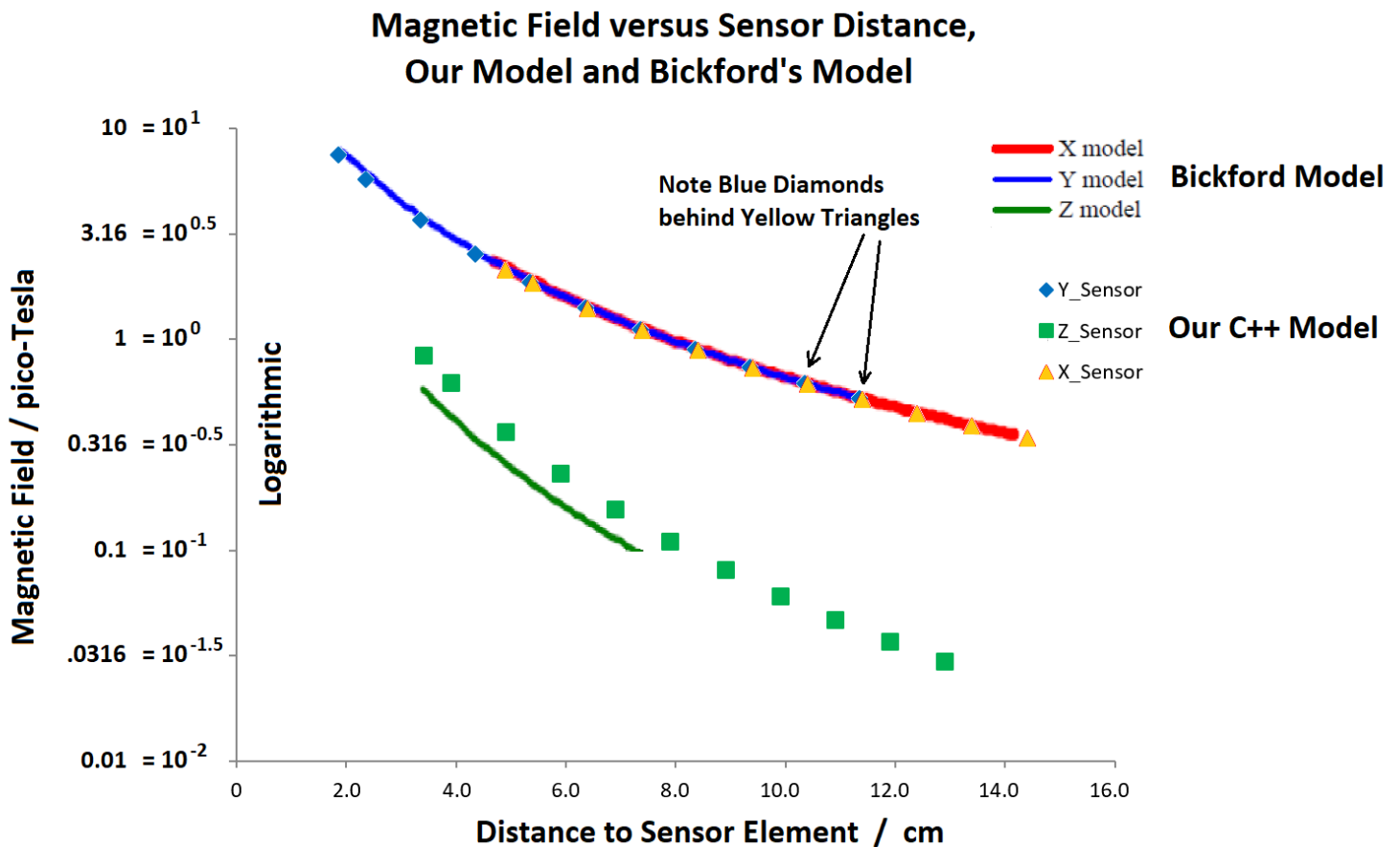


Figure 6.22 page 150

BOOLEAN VARIABLE SETTINGS NEEDED ARE:

```
bool Multiple_Angles = true;
bool MAG03_display = true;
bool multiple_z1_gap = true;
```

Program will output a comma-separated (csv) data file with filename

file-4-output.csv

To make the graphical image in Figure 6.22, this *csv* file was first imported into Microsoft Excel, then additional columns in the Excel Worksheet were made to calculate the logarithms of the picotesla values for the field strengths, and then Excel's graph plotting feature was used. Next, the plot was scaled appropriately then overlayed on the image taken from Bickford's presentation.

SIMULATION OF EQUIVALENT PERPENDICULAR COILS - PLOT OF MAGNETIC FIELD PATTERN FROM TWO PERPENDICULAR SQUARE LOOPS

Mechtenna-c-2-face-ANGLES-MAG03-B2B-2-wire-loop-phases.cpp

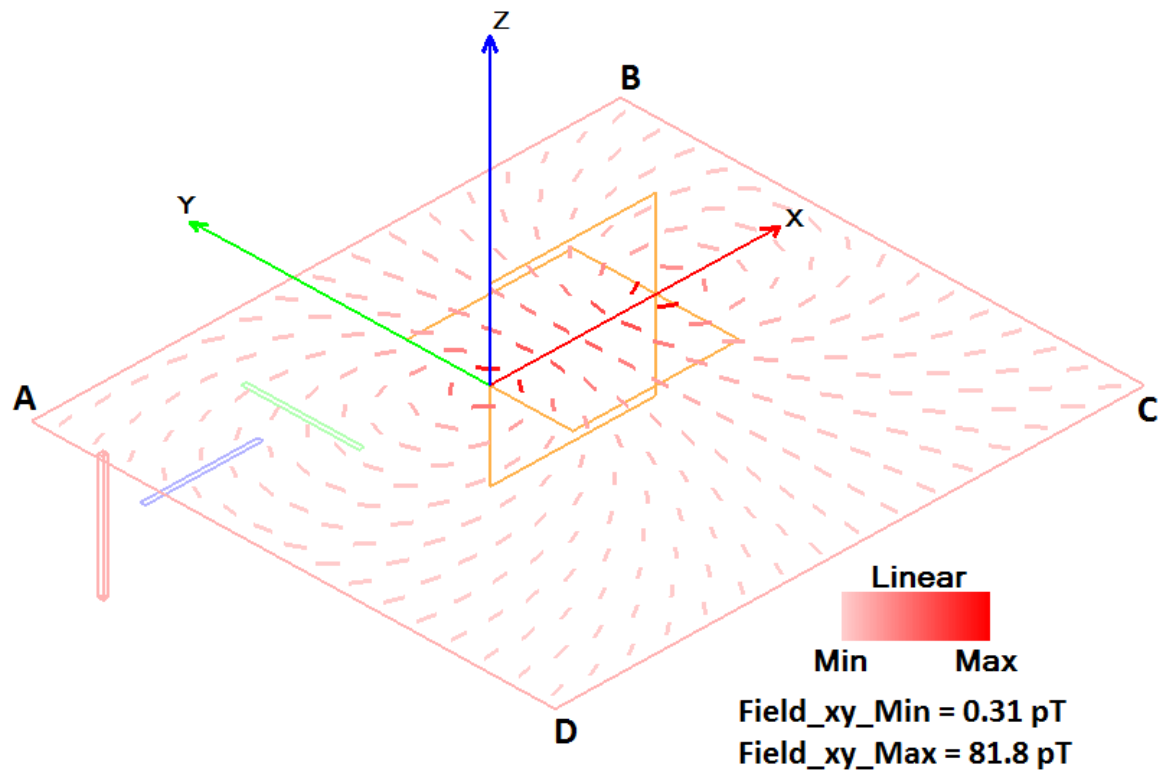


Figure 7.9 page 159

BOOLEAN VARIABLE SETTINGS NEEDED ARE:

```
bool Multiple_Angles = false;  
bool Multiple_Phases = false;  
bool MAG03_display = false;
```

in *display()* function one must use
`gluLookAt(-300 , -300 , 270, 0, 0, 0, 0,0,1);`
for oblique angle.

SIMULATION OF EQUIVALENT PERPENDICULAR COILS - 2D GRAPH OF FIELDS
AT MAG-03 SENSORS AS FUNCTION OF PHASE ANGLE OF SINUSOIDAL CUR-
RENTS

Mechtenna-c-2-face-ANGLES-MAG03-B2B-2-wire-loop-phases.cpp

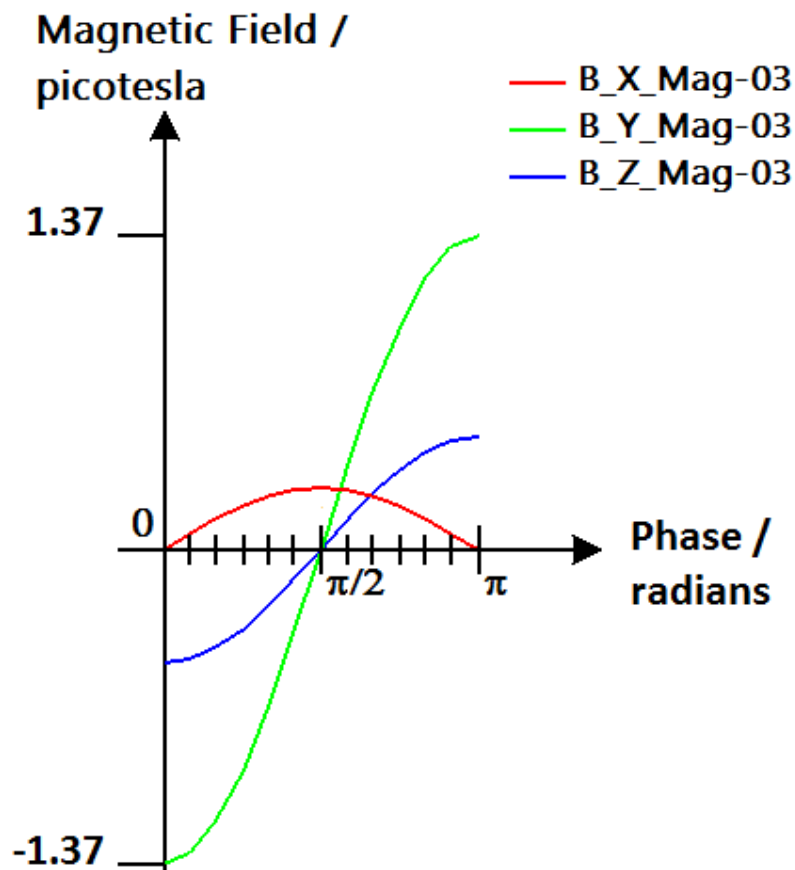


Figure 7.10 page 160

```
bool Multiple_Angles = false;  
bool Multiple_Phases = true;  
bool MAG03_display = true;
```

in *display()* function one must use
`gluLookAt(0, 0,10, 0, 0, 0, 0,1,0);`
to view *xy* plane, used to plot graph.

THIN SQUARE ELECTRET ROTATING OFF CENTER

Mechtenna-c-2-face-ANGLES-MAG03-B2B-COMPAQ-off-centre-2b-Diagrams.cpp

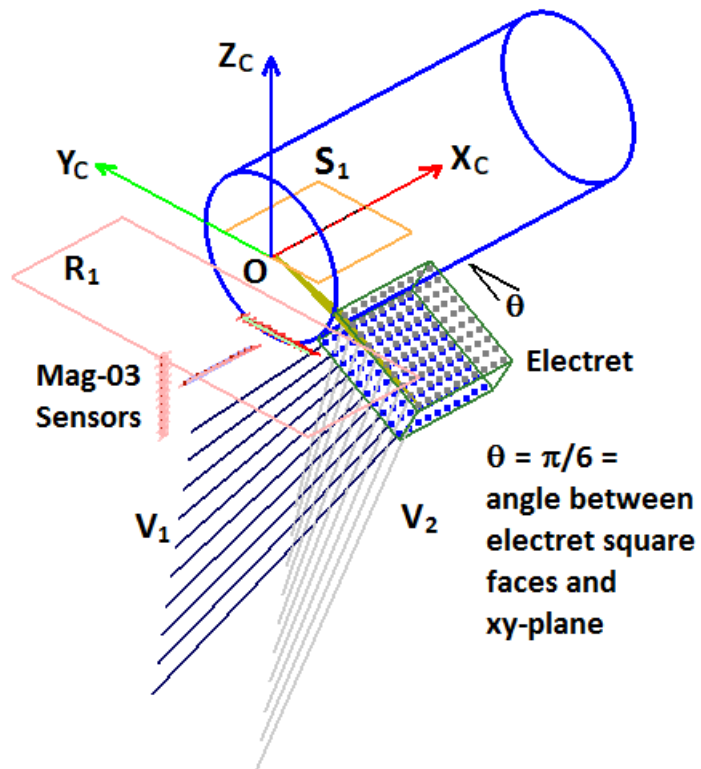


Figure 8.1 page 166

ANGULARLY SLICED CYLINDRICAL CAPACITOR

Mechtenna-inner-outer-cylinder-sections-B2B.cpp

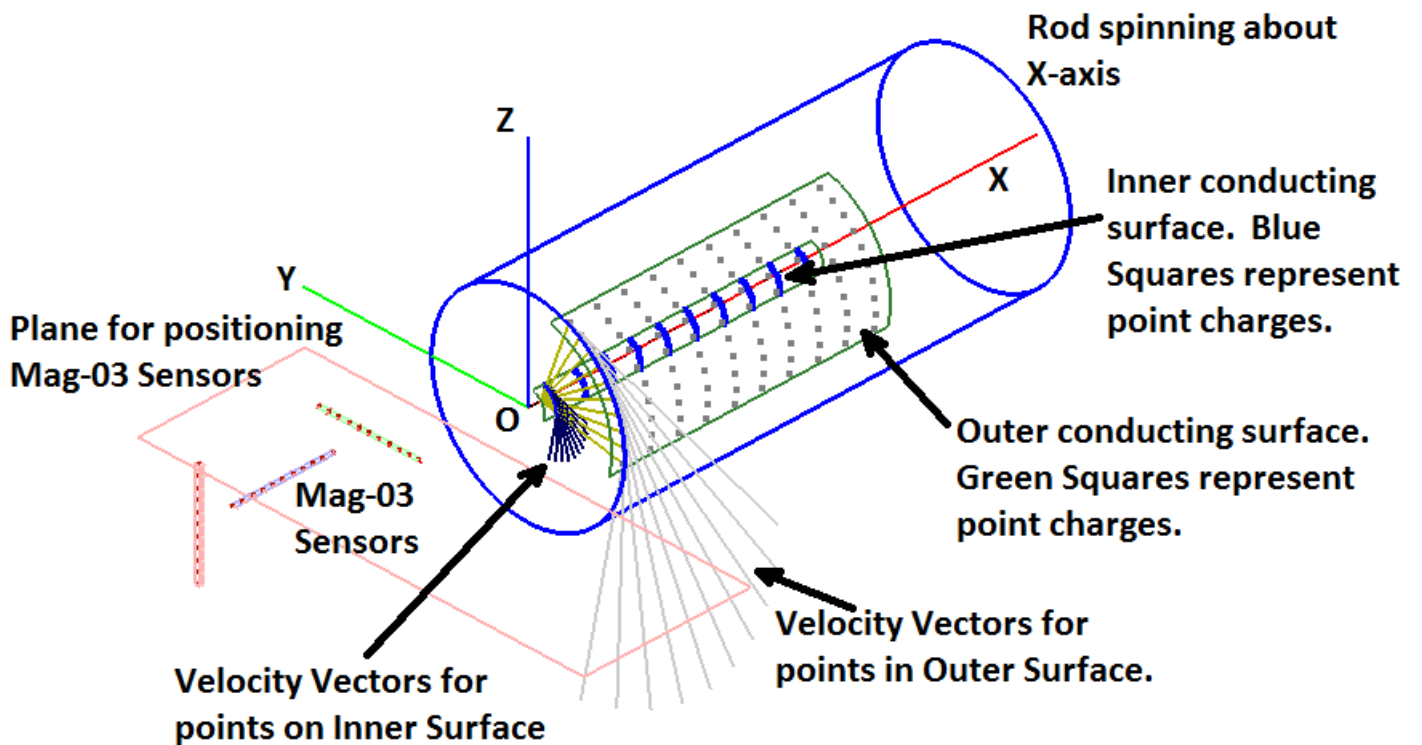


Figure 8.4 page 170

Line 1005 is made active with `//`, line 1005 is to remove the inner surface charge. This was a test to see what effect removing the inner surface charge, and so only using 1 sign of charge, would have.

SIMULATION BASED ON EXPERIMENTAL PUBLICATION OF CHEN WANG ET ALIA

Mechtenna-cylinder-B2-multiple-phi-B-nov21-2c.cpp

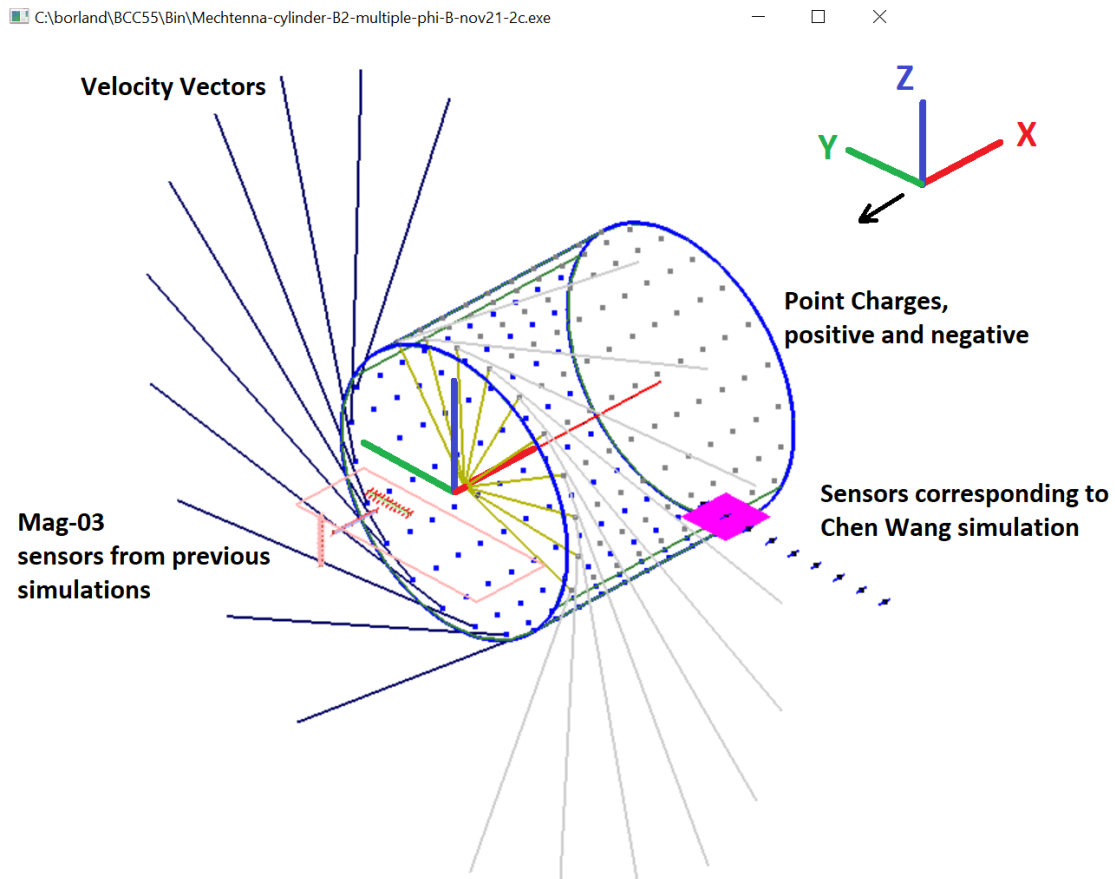


Figure 8.11 page 178

SIMULATION OF ROTATING CAPACITOR EXPERIMENT ELECTRIC FIELD DISPLAYED WITHIN PLANE OUTSIDE ROTATING CAPACITOR AND ALSO WITHIN PLANE OF 1 TURN OF COIL

Mechtenna-COMPAQ-Mar-21-D2.cpp

```
bool Multiple_Angles = false ;
bool MAG03_display = false ;
```

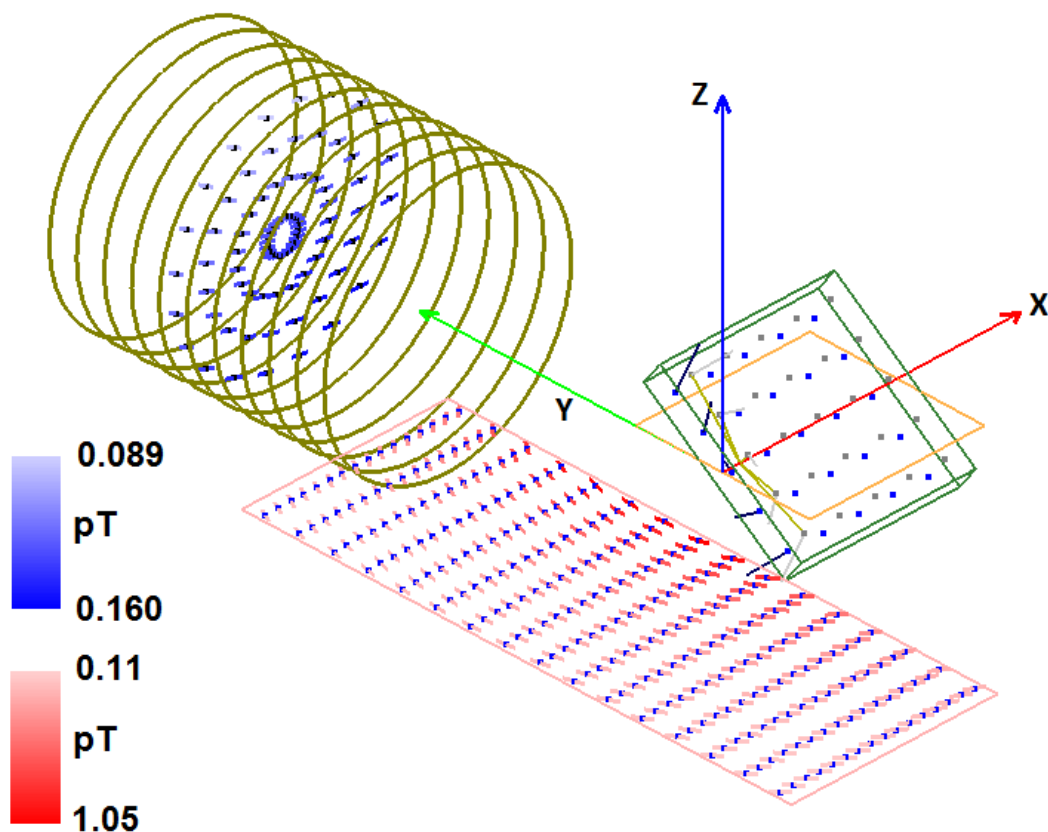


Figure 9.25 page 200

In order to produce the data for the graphs of Figure 9.26, we change the Boolean variable

```
bool Multiple_Angles = true ;
```

to simulate the capacitor turning on its axis making multiple angles with the xy plane. The program then outputs a comma-separated value file

Flux-and-Voltage.csv

To produce the graphs of Figure 9.26, we imported this data into Microsoft Excel, and then we used Microsoft Excel's graph plotting tools.

```
*****
```

SIMULATION OF ROTATING CAPACITOR EXPERIMENT

CALCULATION OF ELECTROSTATIC POTENTIAL AT POINTS IN SPACE A,B,C,D

Mechtenna-COMPAQ-Mar-21-E2-elec.cpp

```
bool Multiple_Angles = false ;
bool MAG03_display = false ;
```

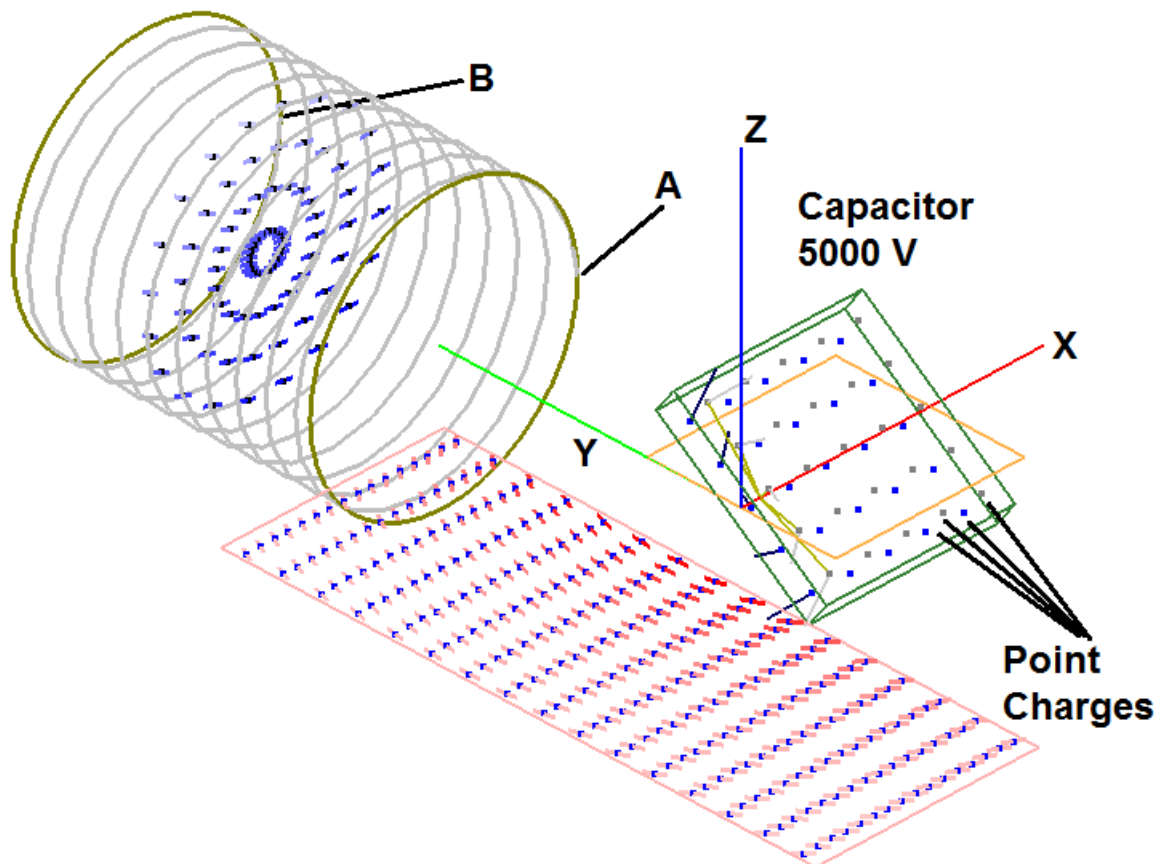


Figure 9.27 page 203. Note that in this figure the coil is modeled as a spiral, whereas in the previous code version the coil is modeled as a set of 11 rings in parallel planes.

In order to produce the data for the graphs of Figures 9.28 and 9.29, we change the Boolean variable

```
bool Multiple_Angles = true ;
```

to simulate the capacitor turning on its axis making multiple angles with the xy plane. The program then outputs comma-separated value files

Voltage_AB.csv

Voltage_CD.csv

To produce the graphs of Figure 9.26, we imported this data into Microsoft Excel, and then we used Microsoft Excel's graph plotting tools.