

# *The Coca-Cola Cavity*

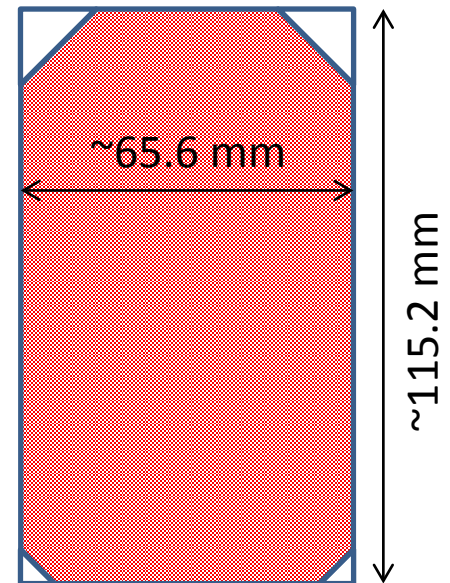


# A simple coke can...

- A typical 330 ml coke can, resembles a cylindrical cavity.
- Field solutions can be found analytically with the correct boundary conditions.
  - TM and TE modes (see lecture notes)
- TM<sub>010</sub> – accelerating mode.
  - Resonant frequency given by:

$$f = \frac{c \cdot x_1}{\pi D}$$

- c – speed of light
- D – diameter
- x<sub>1</sub> – 2.40483

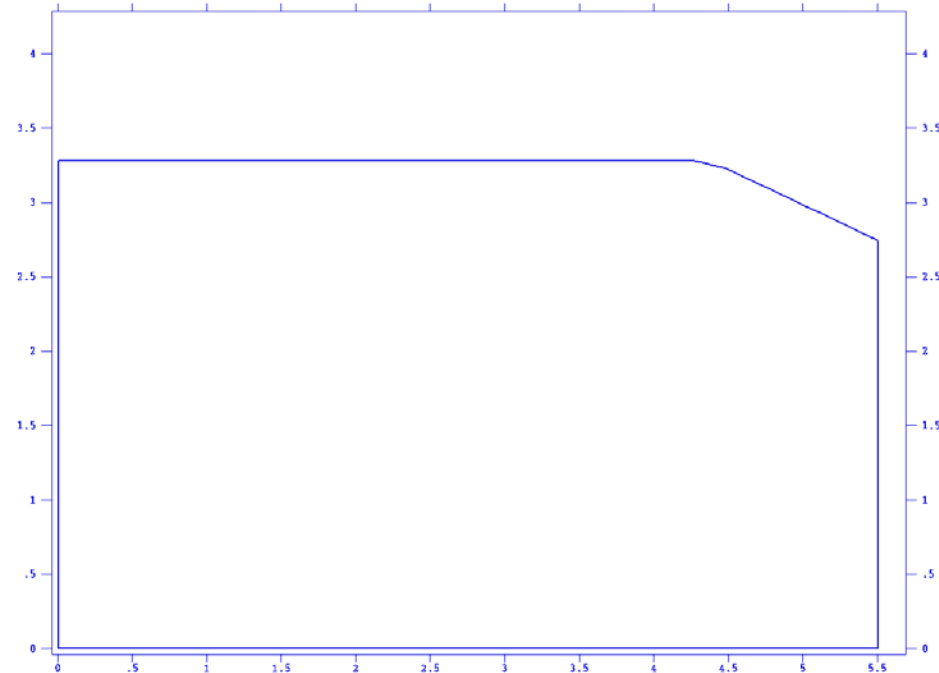


f ≈ 3.5 GHz

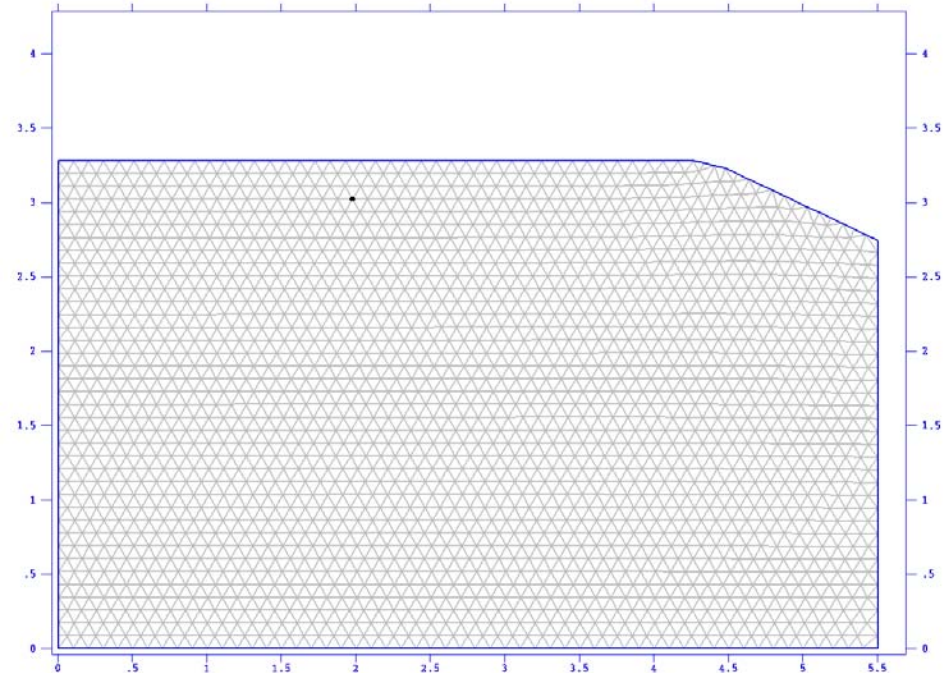
# 2D Model

- Model A
- Superfish
  - 2D cylindrical symmetry assumed.

Geometry



Mesh

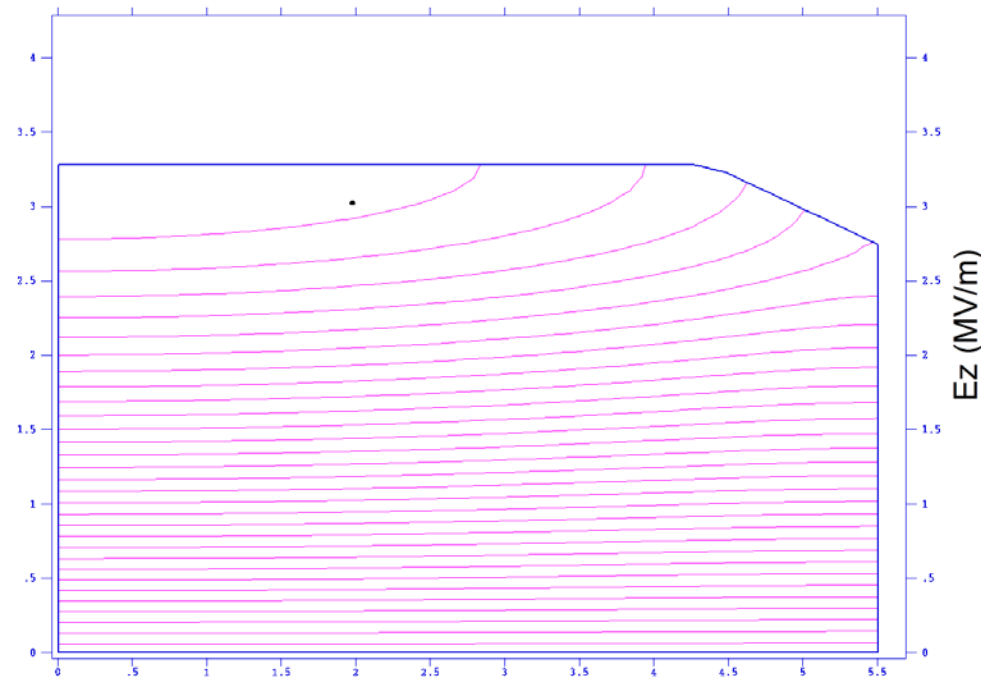


# 2D Model

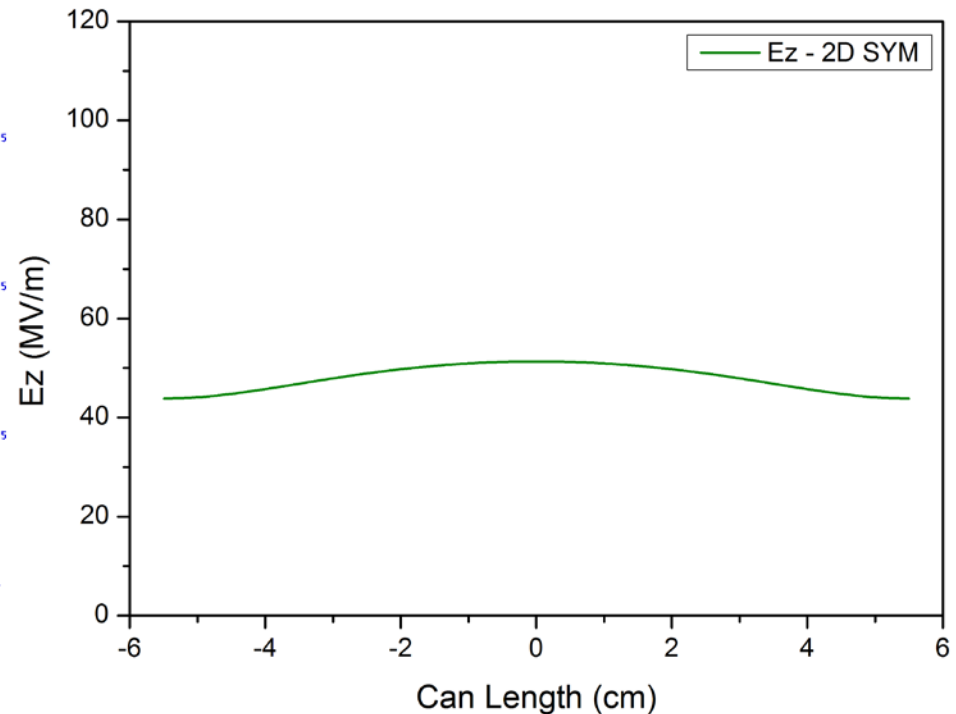
- Model A
- Superfish
- Field normalisation: 1J stored energy/cavity

$f \approx 3.548$  GHz

Field Lines



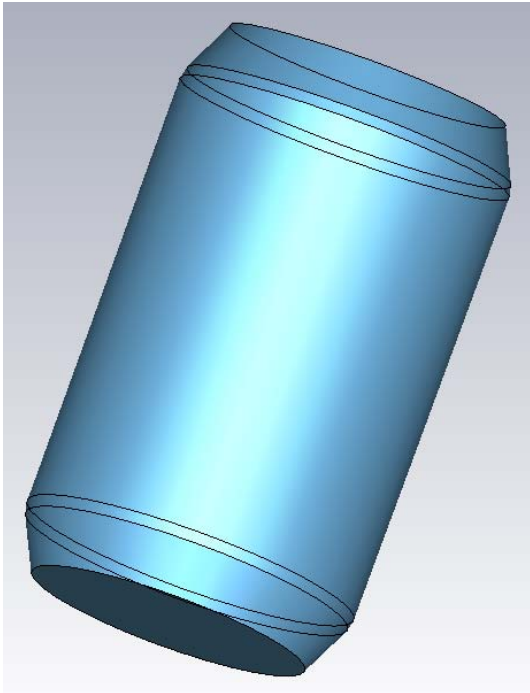
1D Field Line ( $E_z$  on axis – full can)



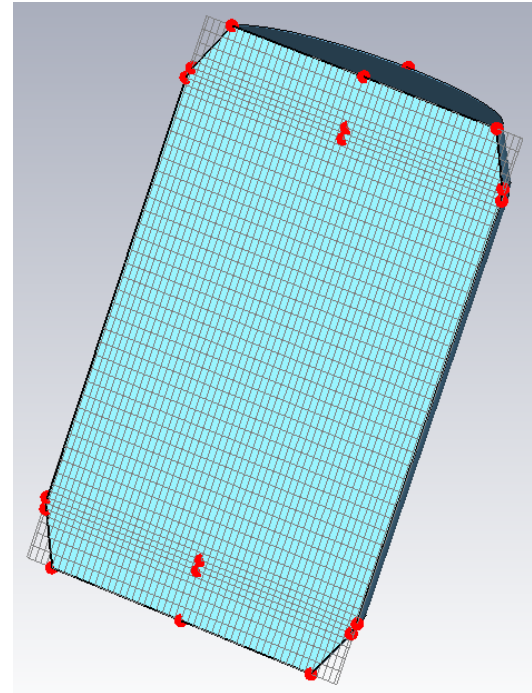
# 3D Model

- Model B
- CST MicroWave Studio
- Symmetric (like the 2D model)

Geometry



Mesh

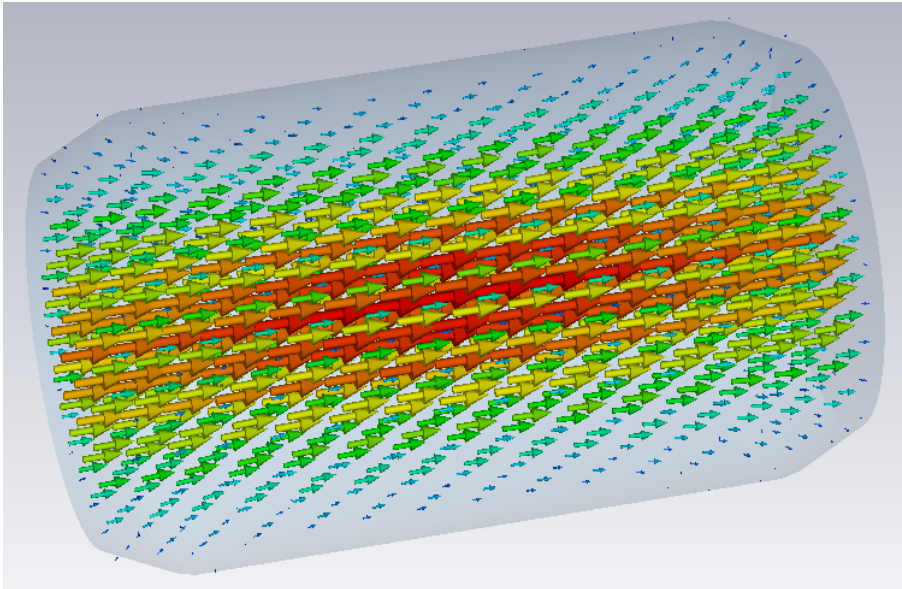


# 3D Model

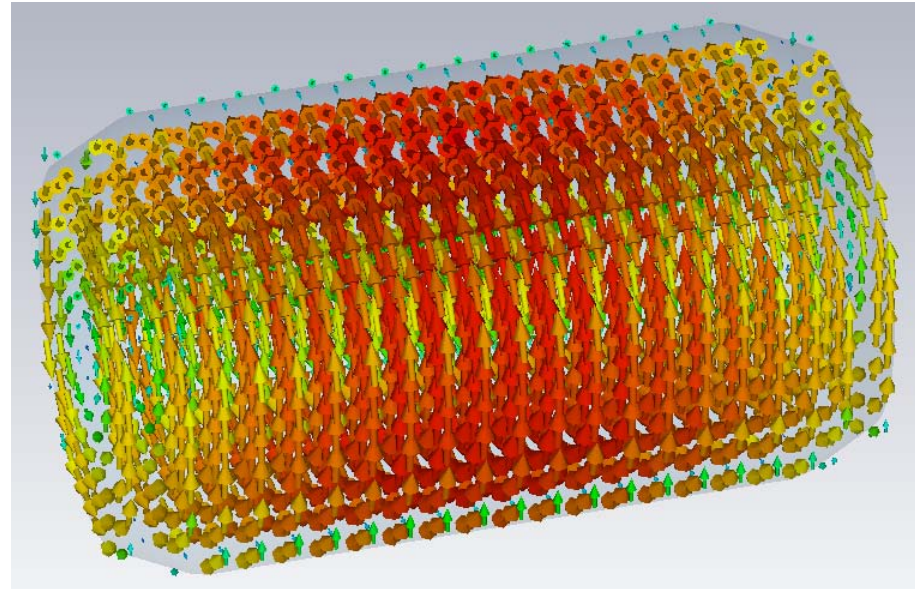
- Model B
- CST MicroWave Studio

$f \approx 3.549$  GHz

Electric Field



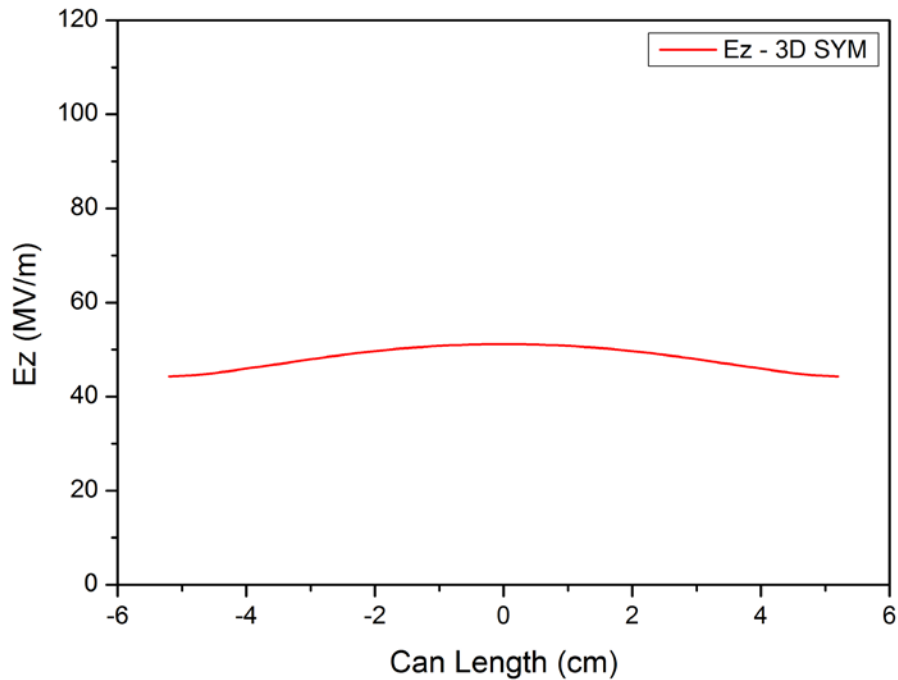
Magnetic Field



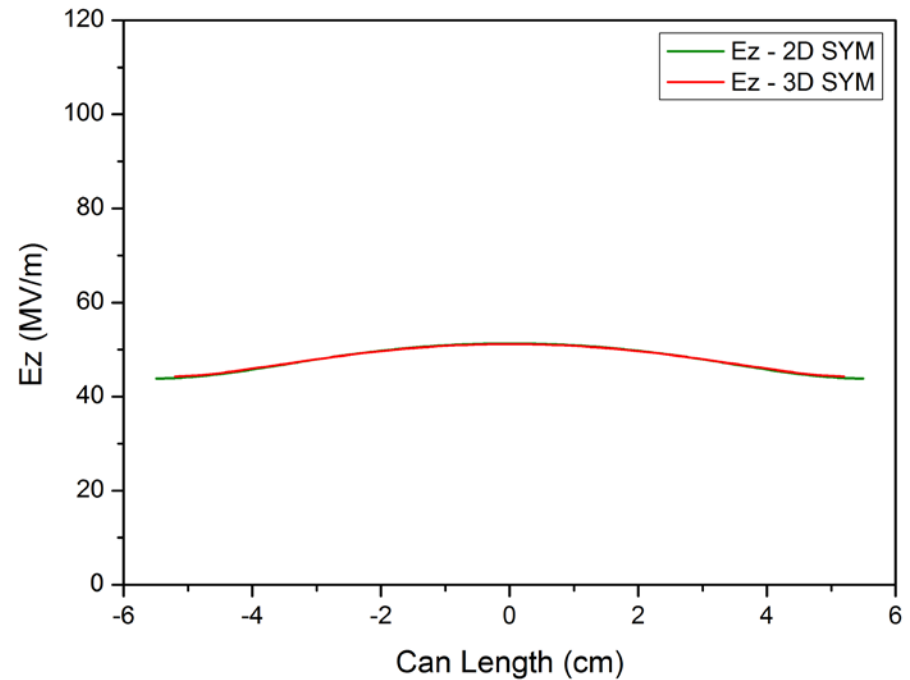
# 3D Model

- Model B
- CST MicroWave Studio
  - Field Normalisation: 1J stored energy/cavity

1D Field Map (Ez on axis)



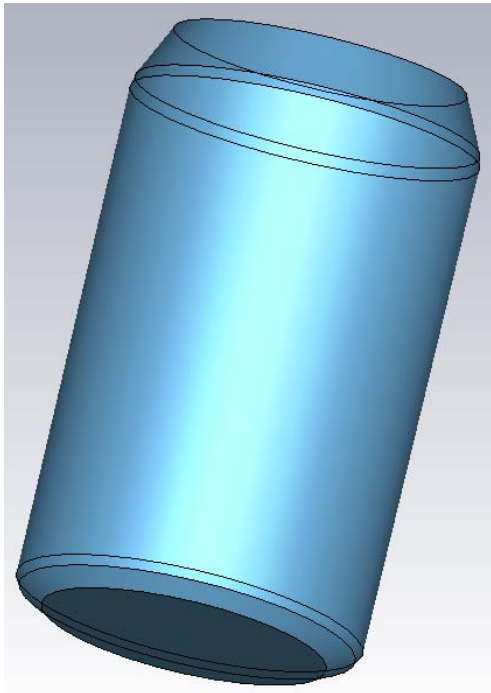
Comparison with the 2D Superfish result



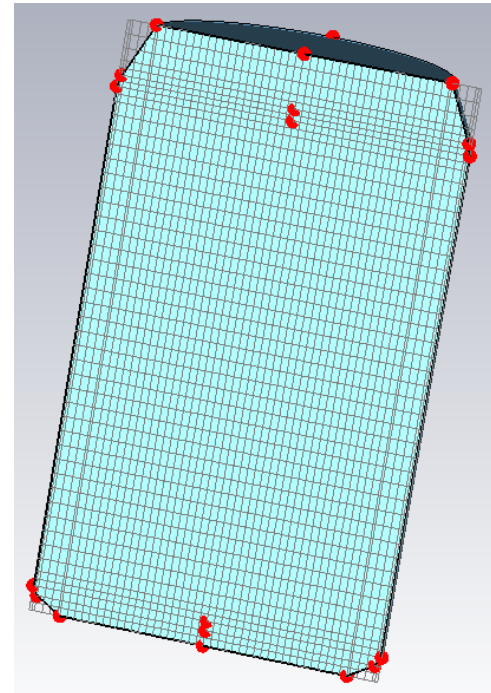
# 3D Model

- Model C
- CST MicroWave Studio
- Asymmetric (closer to an actual coke can geometry)

Geometry



Mesh



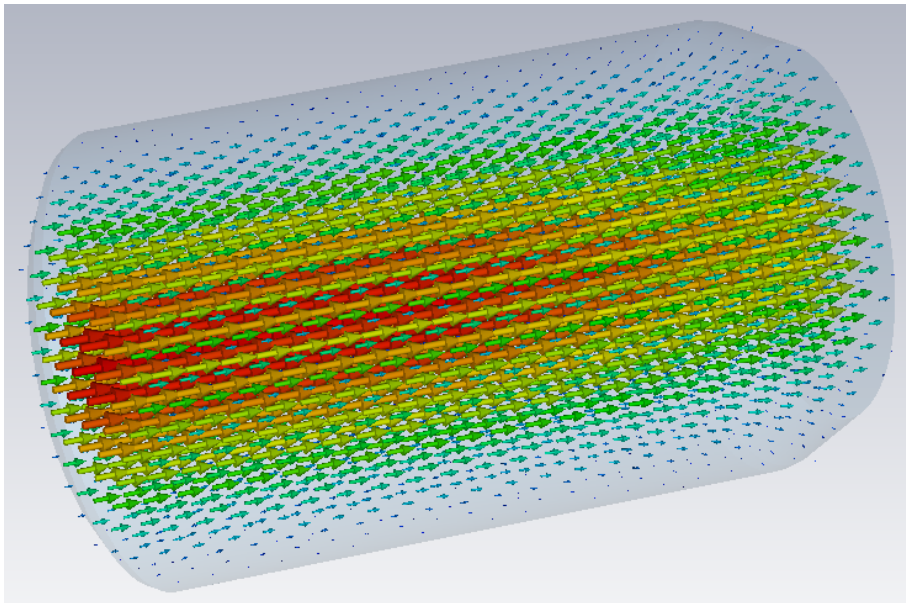


# 3D Model

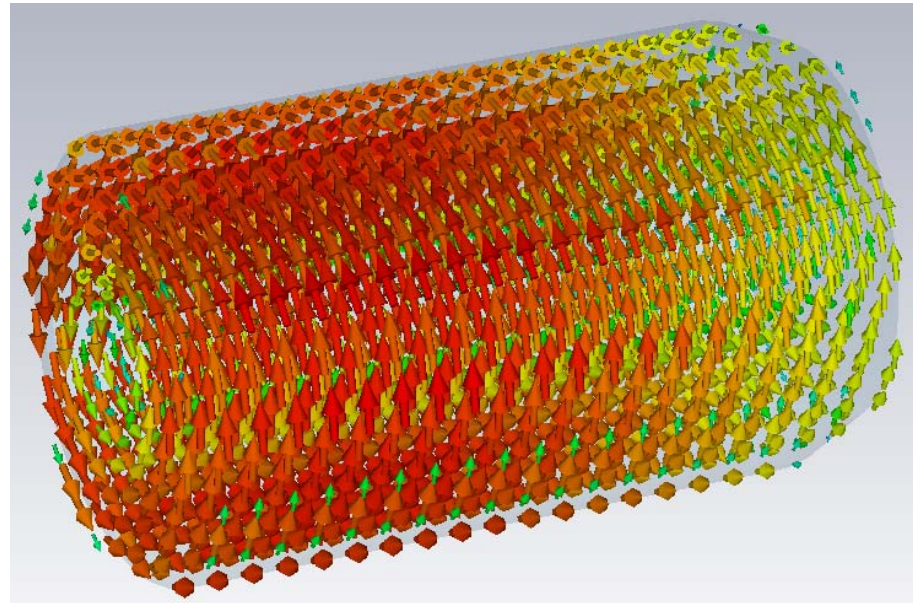
- Model C
- CST MicroWave Studio
  - Different scaling

$f \approx 3.531$  GHz

Electric Field



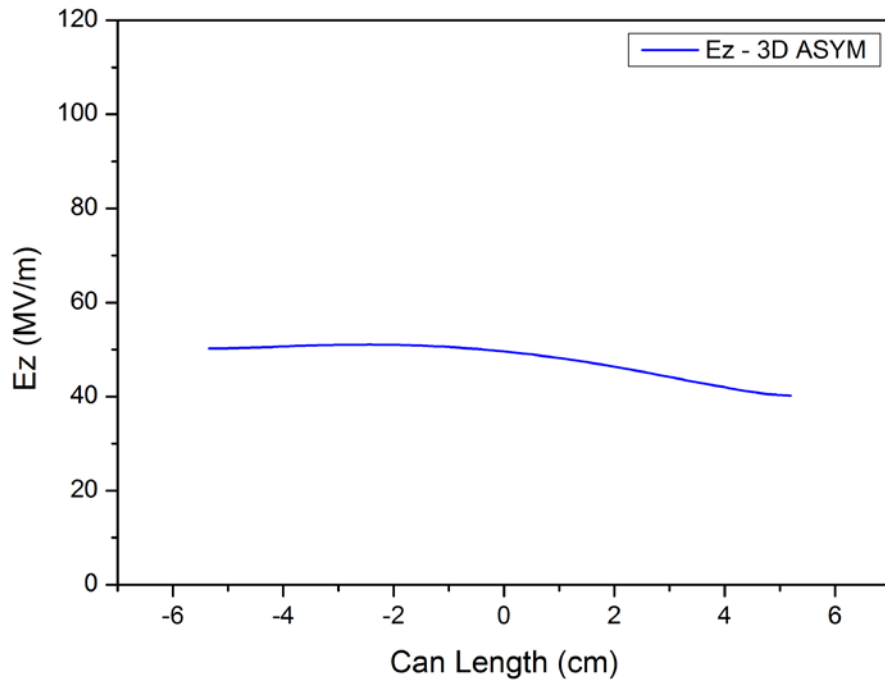
Magnetic Field



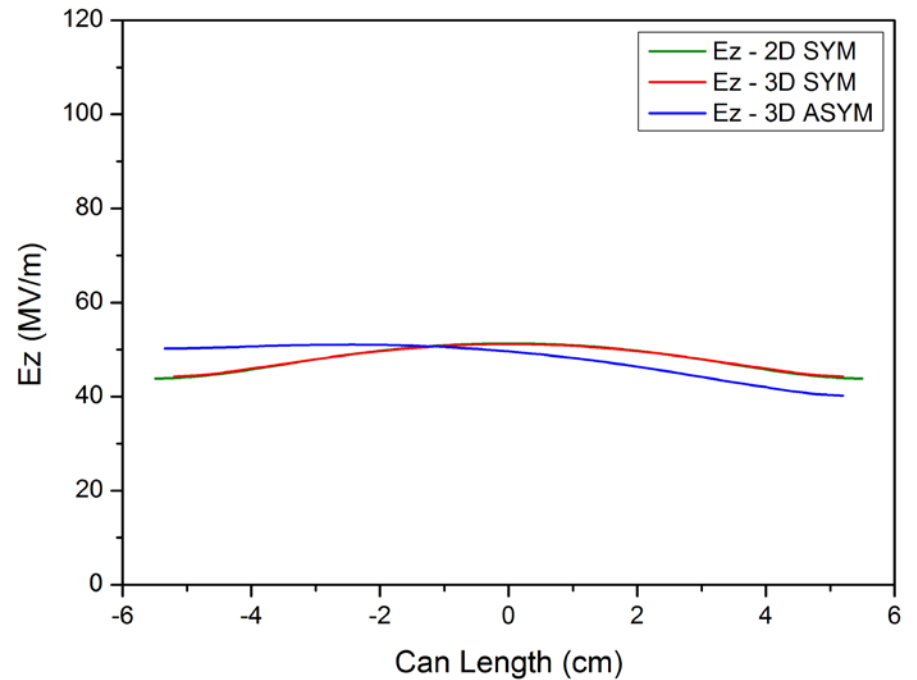
# 3D Model

- Model C
- CST MicroWave Studio
  - Field Normalisation: 1J stored energy/cavity

1D Field Map (Ez on axis)



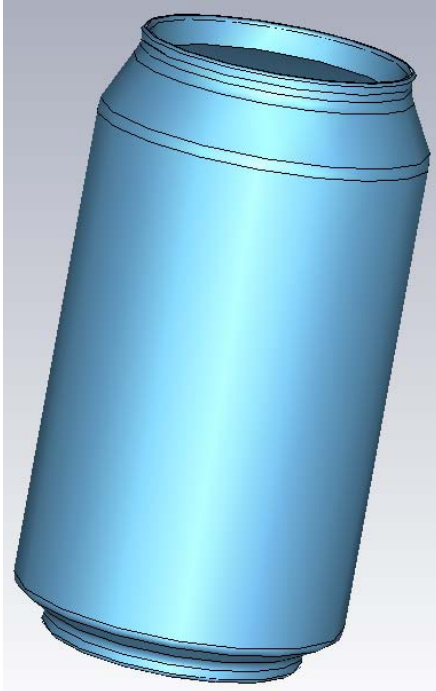
Comparisons...



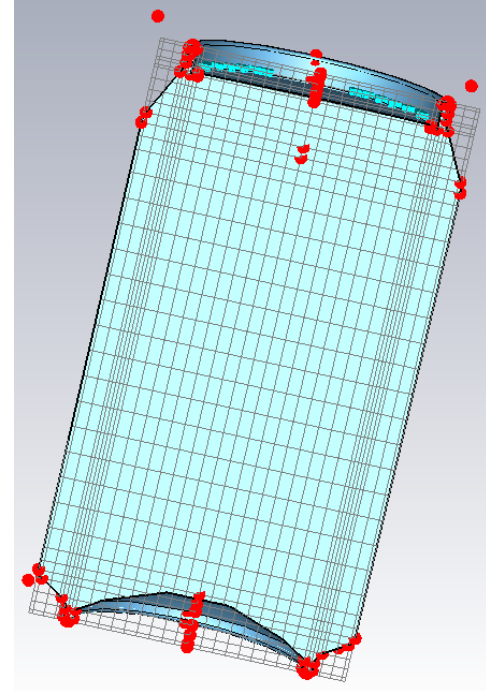
# 3D Model

- Model D
- CST MicroWave Studio
- Most Details (curves, corners, etc)

Geometry



Mesh

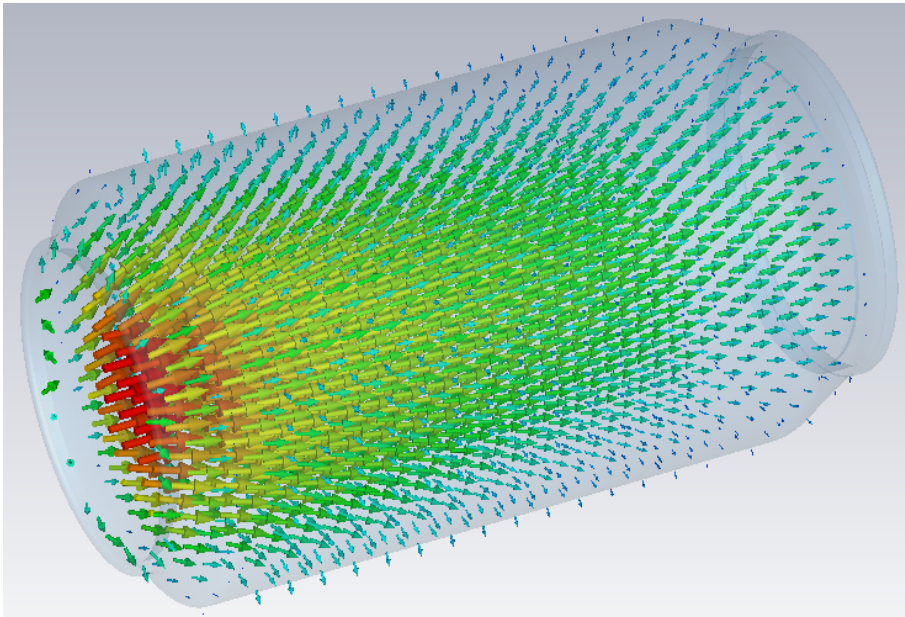


# 3D Model

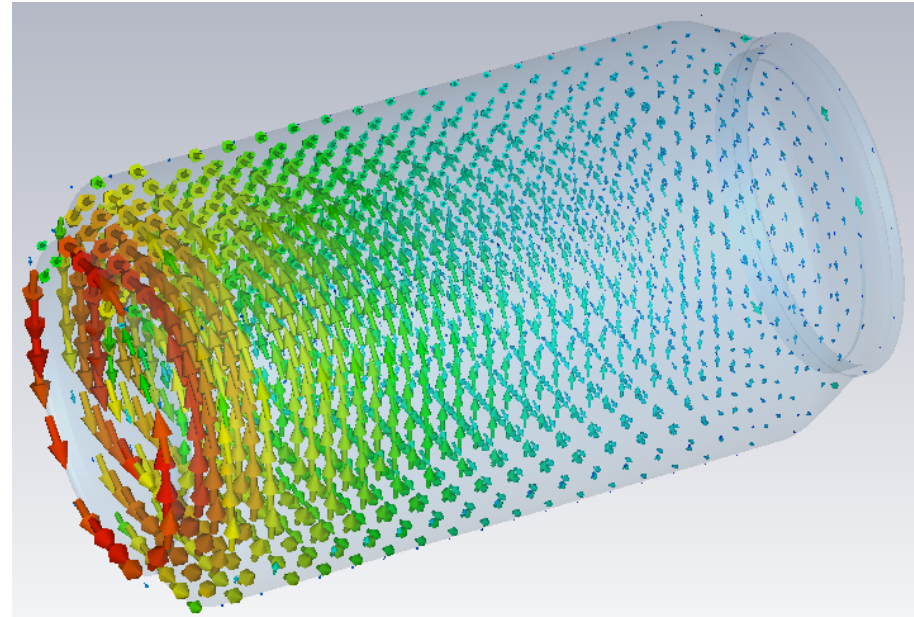
- Model D
- CST MicroWave Studio
  - Different scaling

$f \sim 3.398$  GHz

Electric Field



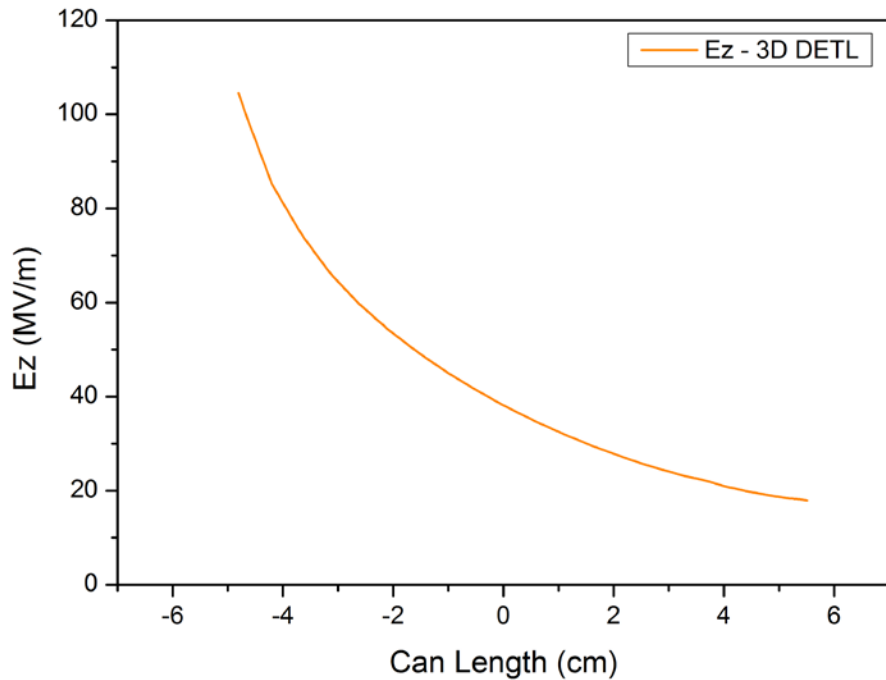
Magnetic Field



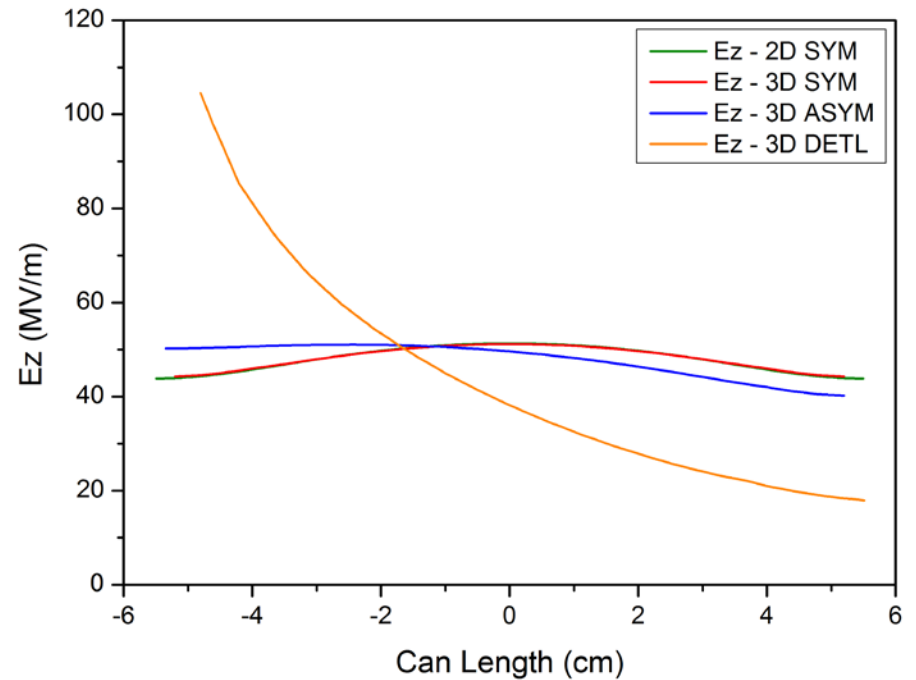
# 3D Model

- Model D
- CST MicroWave Studio
  - Field Normalisation: 1J stored energy/cavity

1D Field Map (Ez on axis)

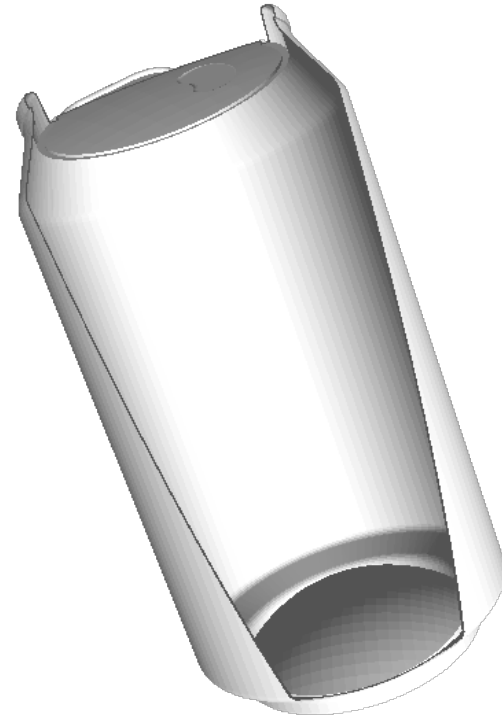
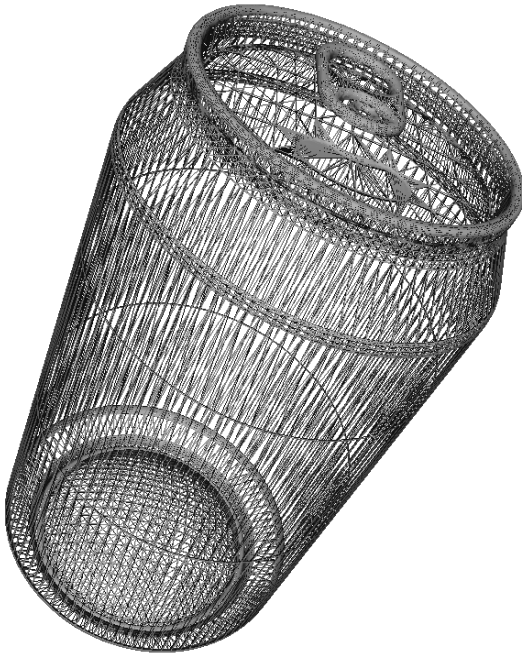


Comparisons...



# 3D Model

- Model E
- CST MicroWave Studio
- Full Details Imported CAD Model ([www.grabcad.com](http://www.grabcad.com))



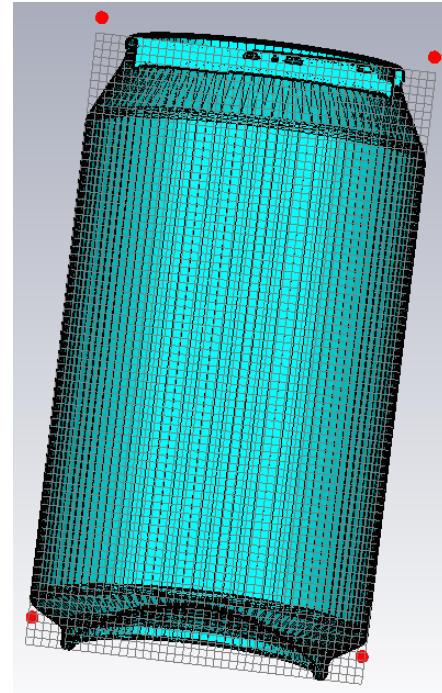
# 3D Model

- Model E
- CST MicroWave Studio

Geometry



Mesh

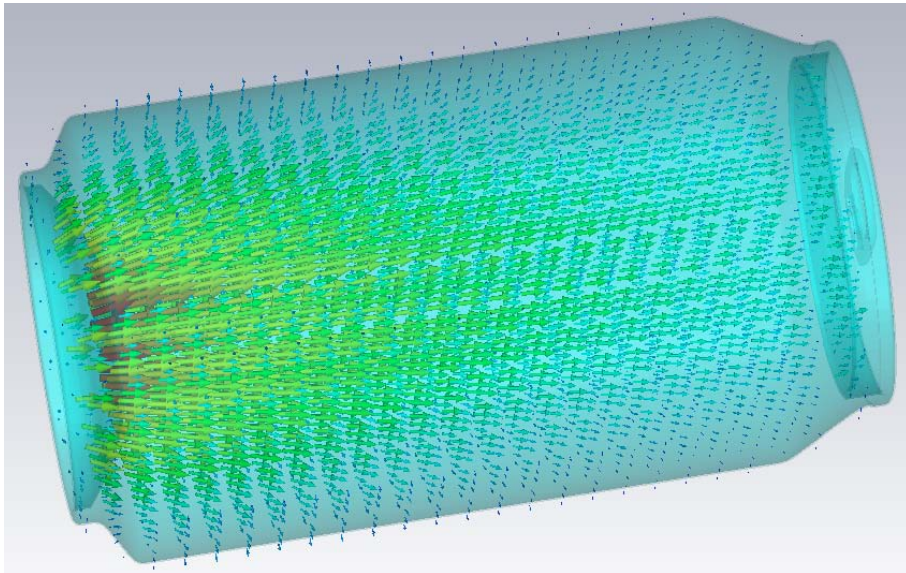


# 3D Model

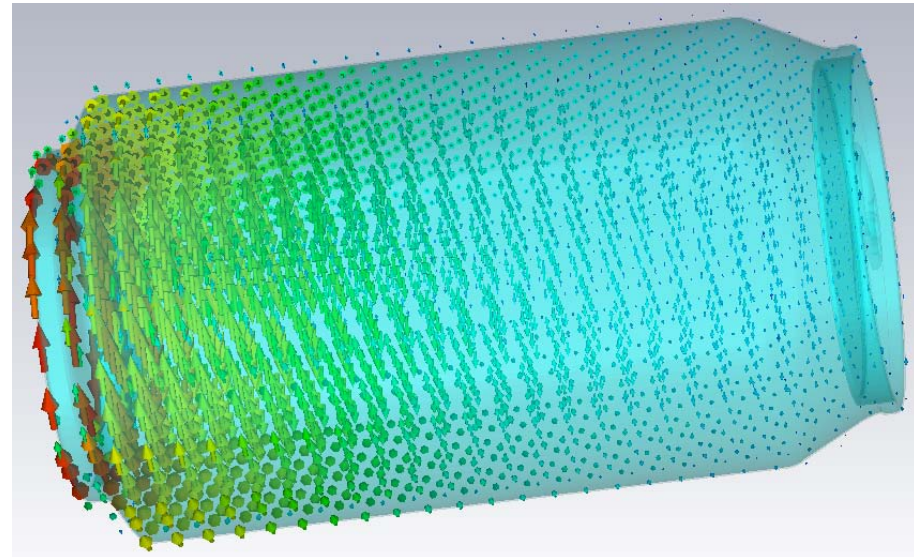
- Model E
- CST MicroWave Studio
  - Different scaling

$f \sim 3.371 \text{ GHz}$

Electric Field



Magnetic Field

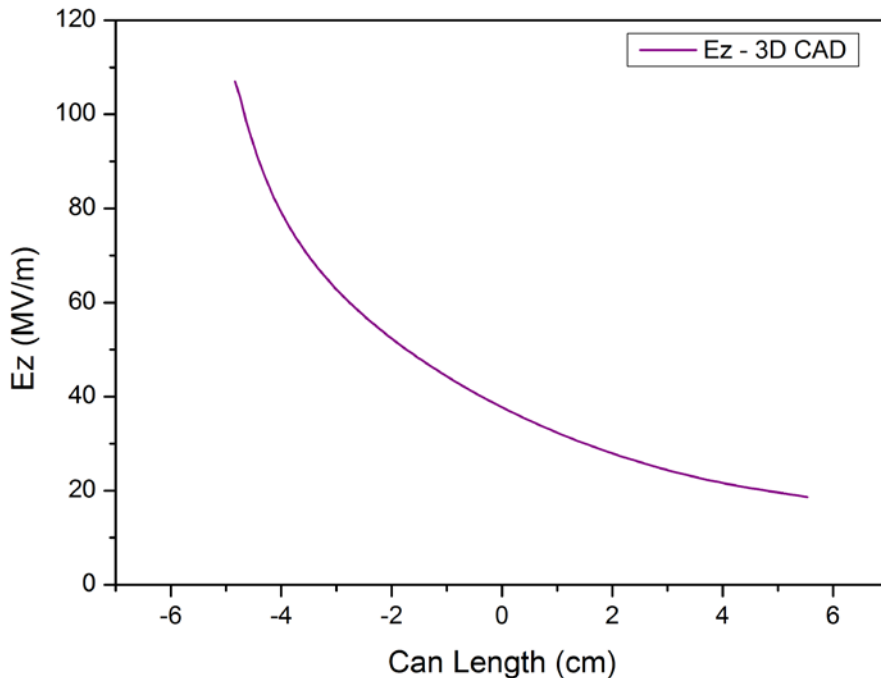




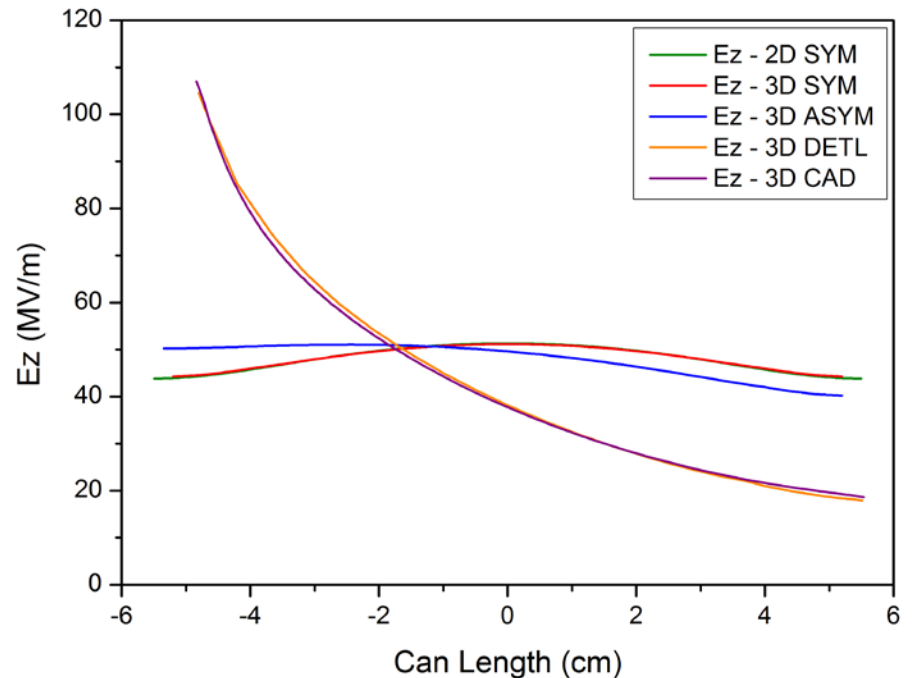
# 3D Model

- Model E
- CST MicroWave Studio
  - Field Normalisation: 1J stored energy/cavity

1D Field Map (Ez on axis)



Comparisons...



# Experimental Measurement

- Network Analyser: Rohde & Schwarz ZNB8
  - Frequency widely
  - Q-factor

