

The Coca-Cola Cavity

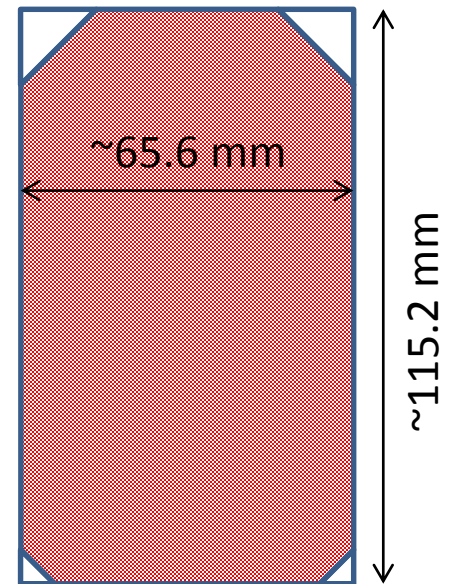


A simple coke can...

- 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)
- TM₀₁₀ – accelerating mode.
 - Resonant frequency given by:

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

- c – speed of light
- D – diameter
- x₁ – 2.40483

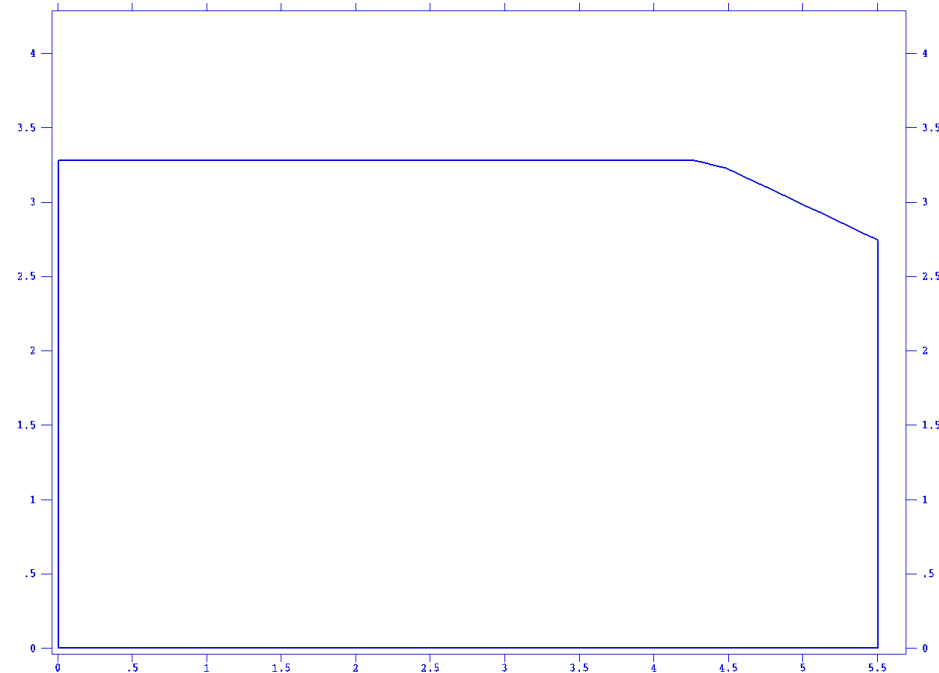


f ≈ 3.5 GHz

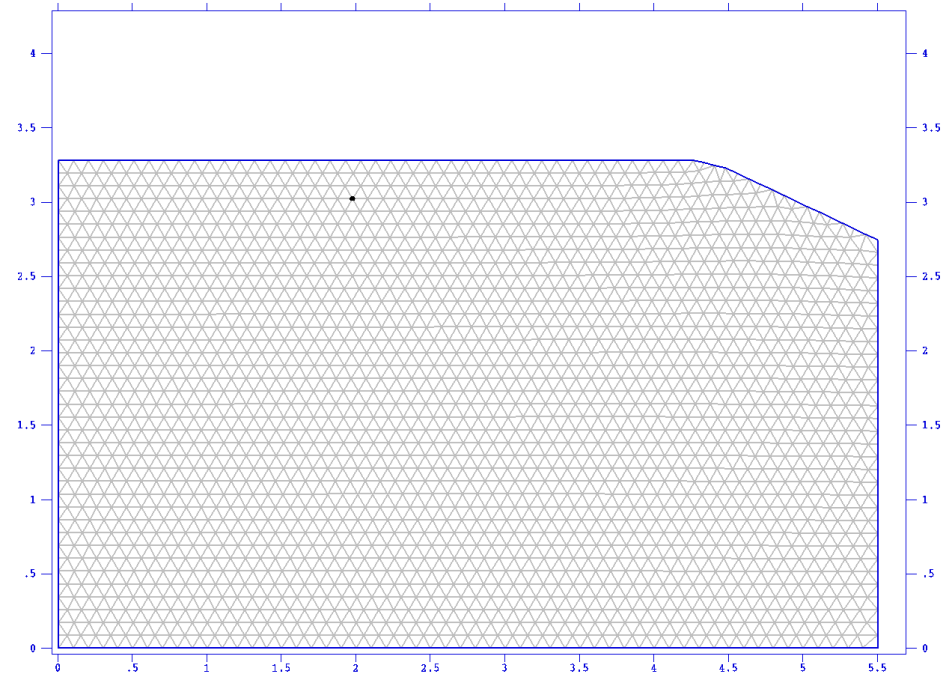
2D Model

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

Geometry



Mesh

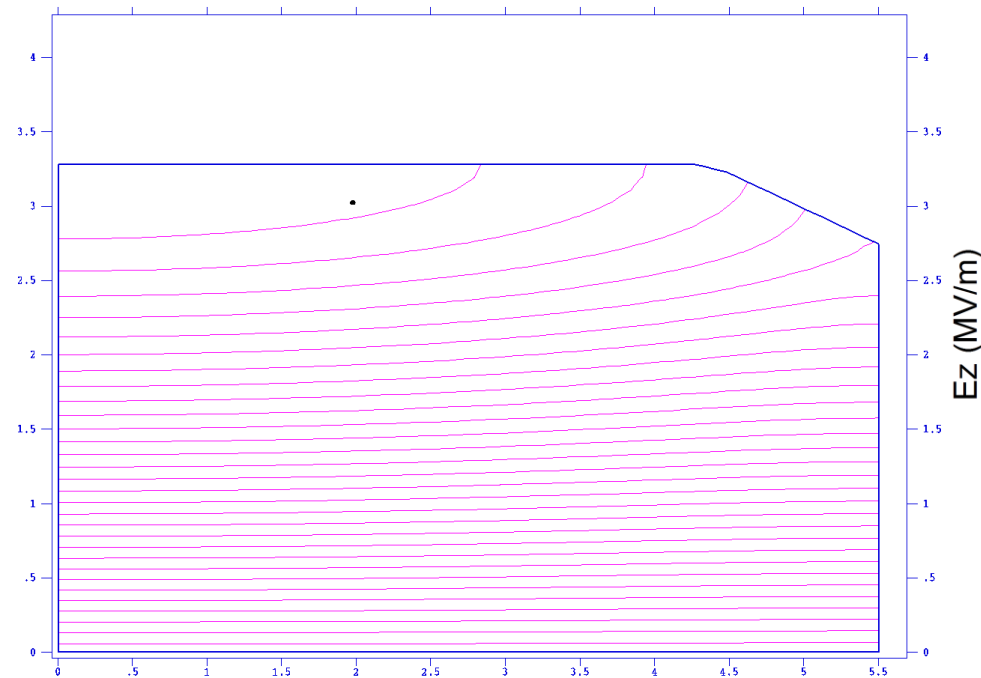


2D Model

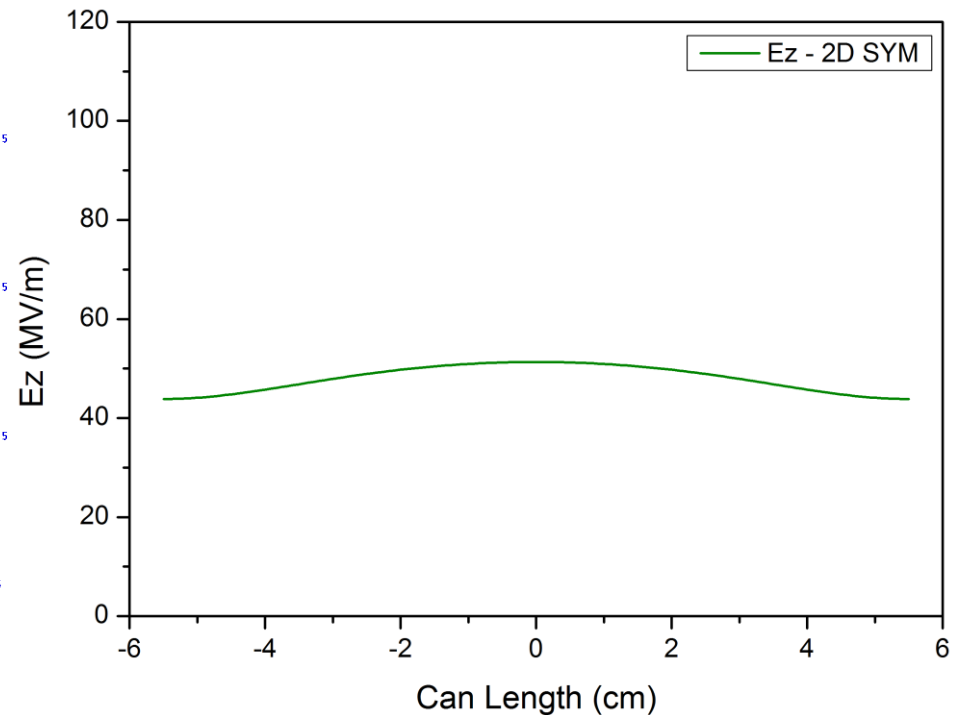
- Model A
- Superfish
- Field normalisation: 1J stored energy/cavity

$f \approx 3.548$ GHz

Field Lines



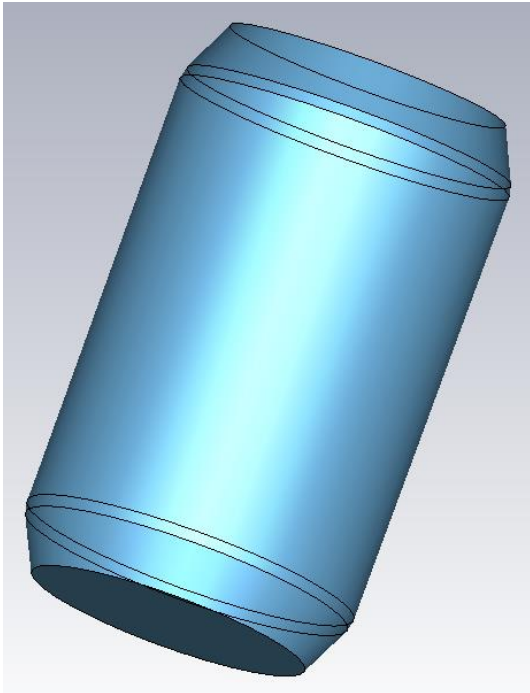
1D Field Line (E_z on axis – full can)



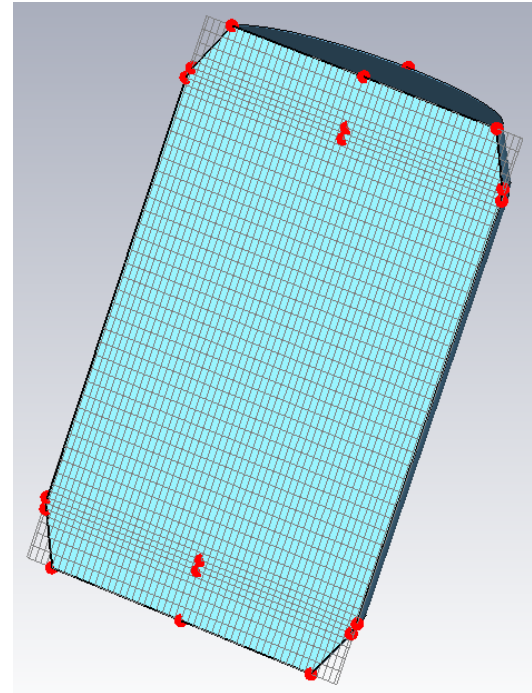
3D Model

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

Geometry



Mesh

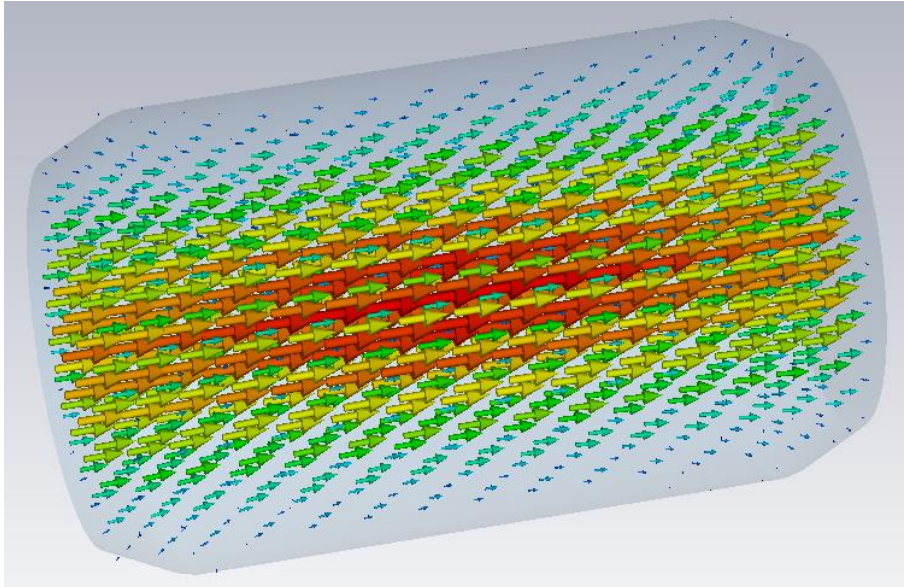


3D Model

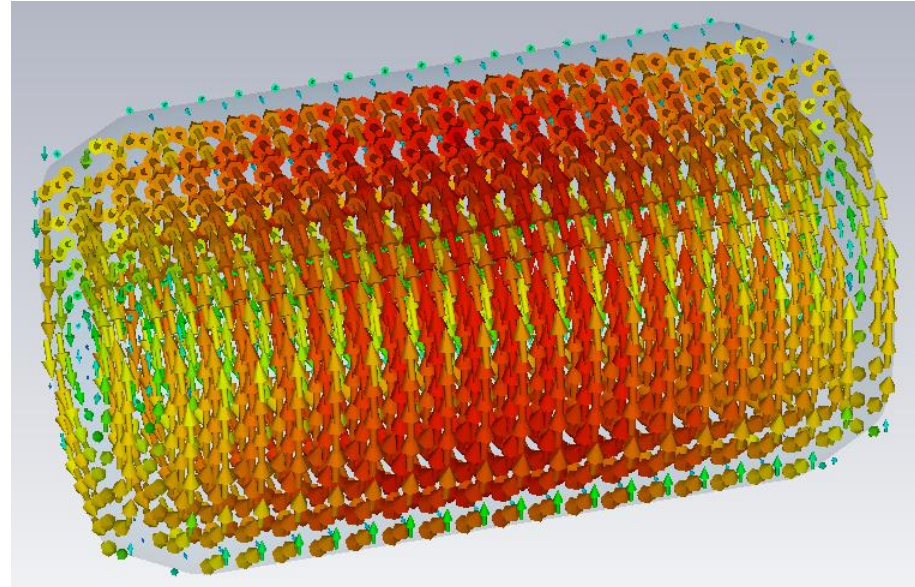
- Model B
- CST MicroWave Studio

$f \approx 3.549$ GHz

Electric Field



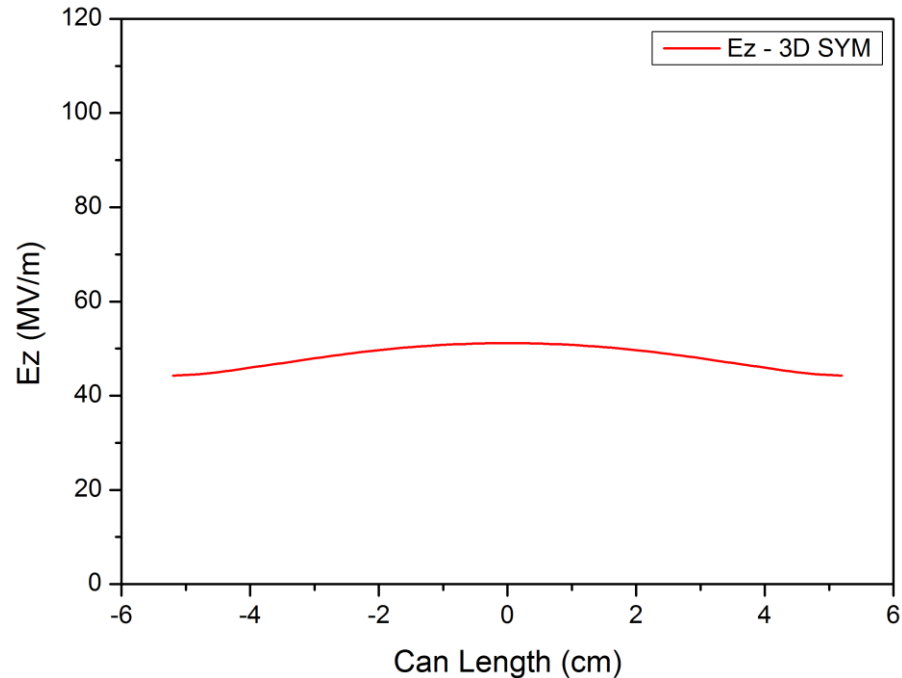
Magnetic Field



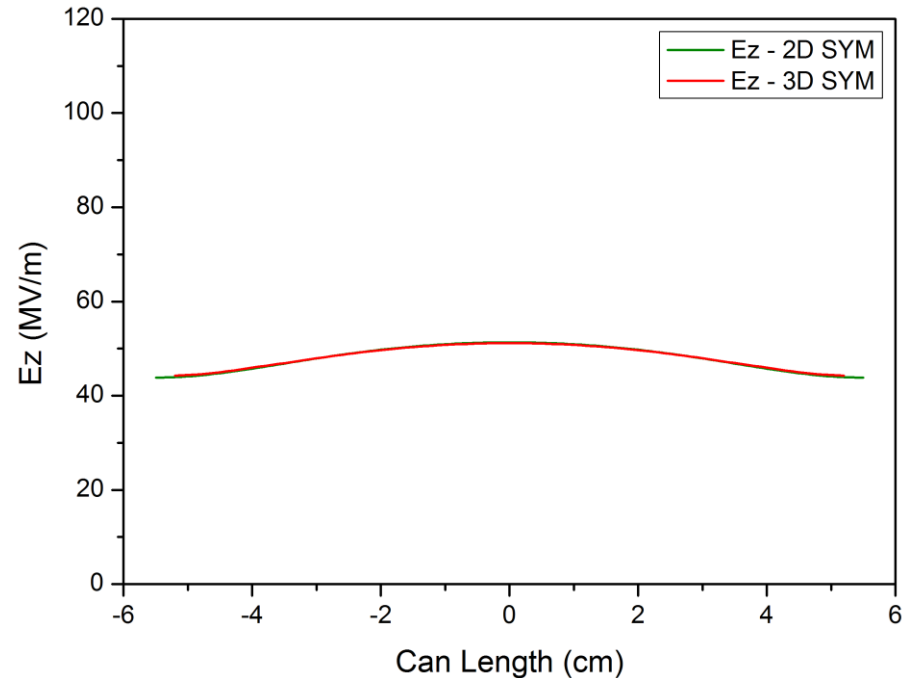
3D Model

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

1D Field Map (Ez on axis)



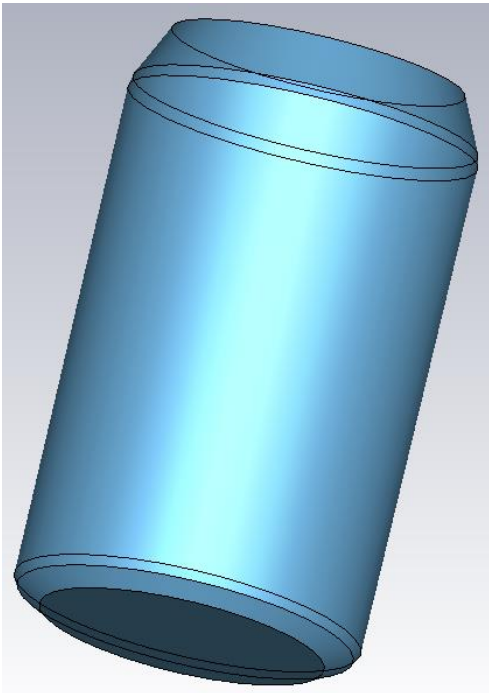
Comparison with the 2D Superfish result



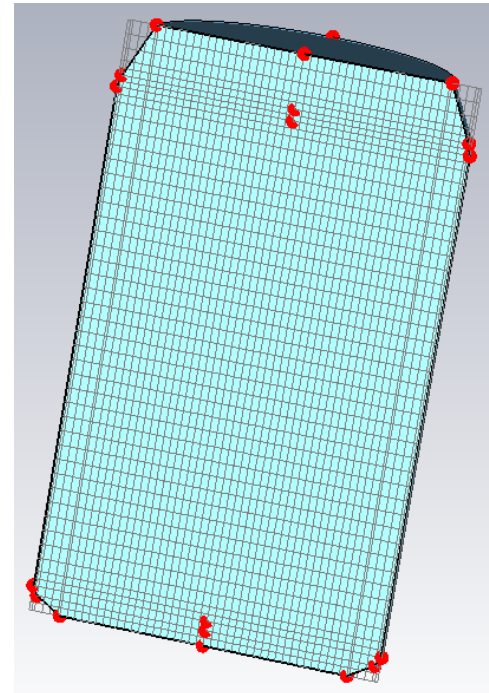
3D Model

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

Geometry



Mesh

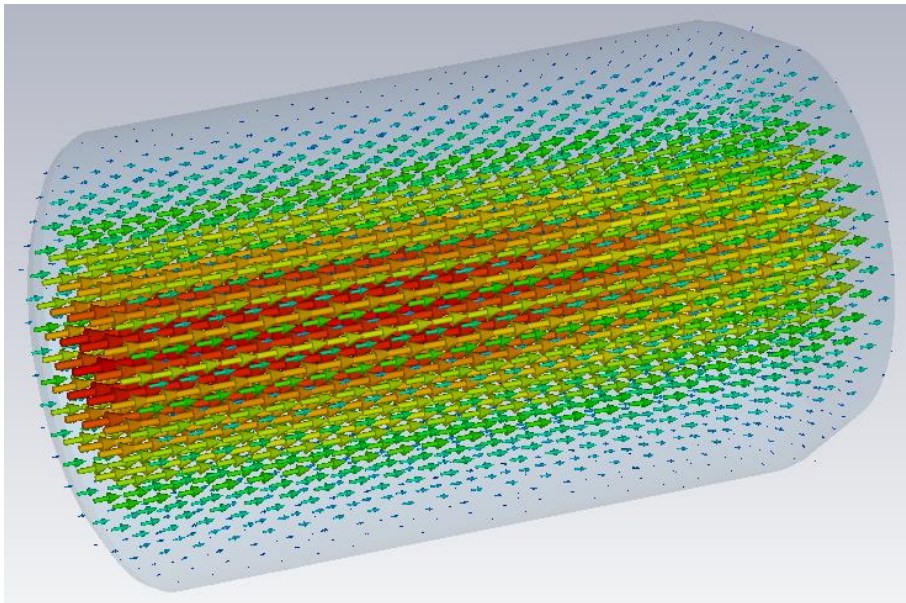


3D Model

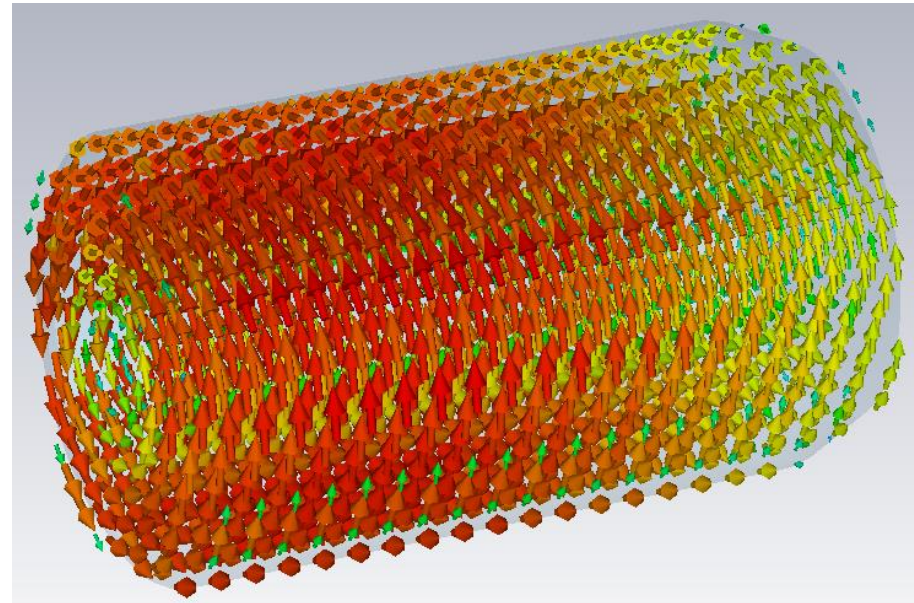
- Model C
- CST MicroWave Studio
 - Different scaling

$f \approx 3.531$ GHz

Electric Field



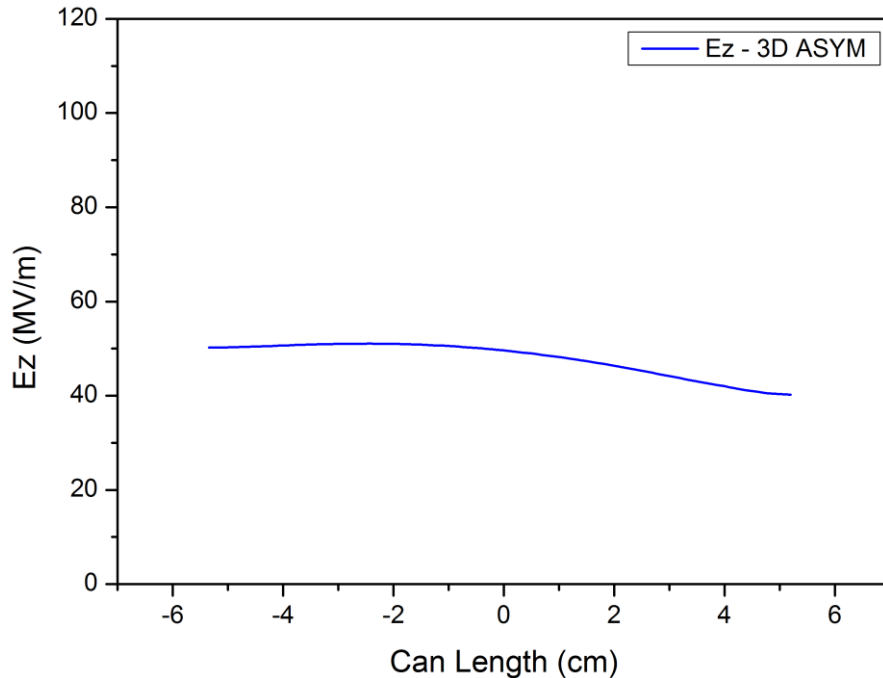
Magnetic Field



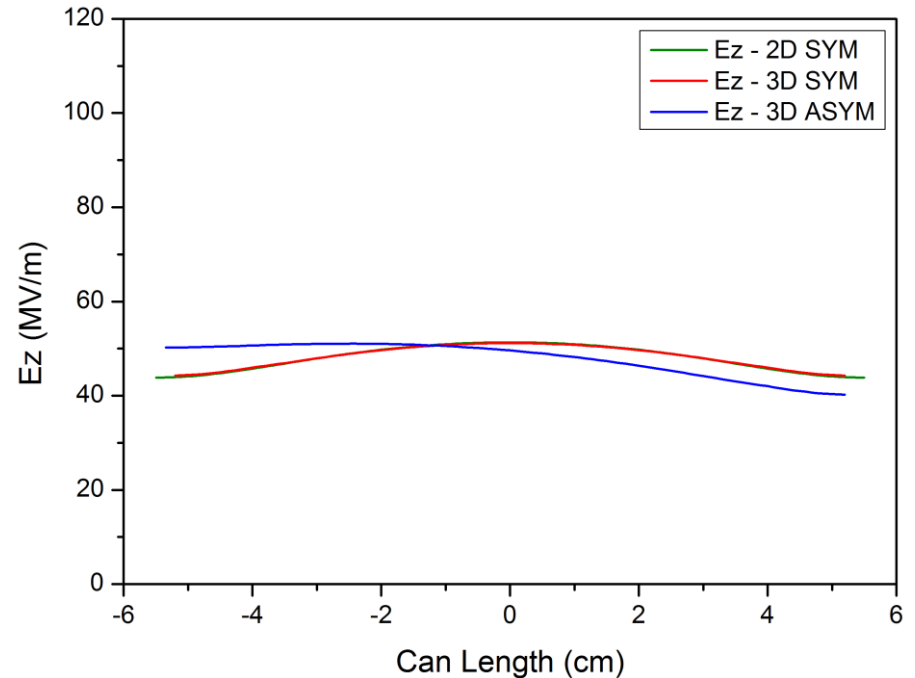
3D Model

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

1D Field Map (Ez on axis)



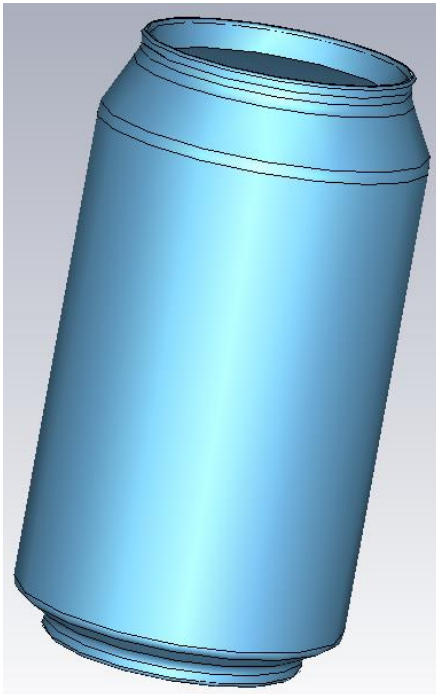
Comparisons...



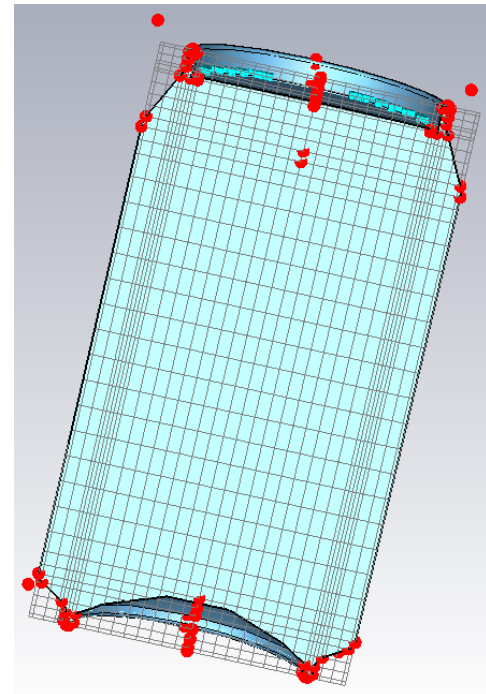
3D Model

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

Geometry



Mesh

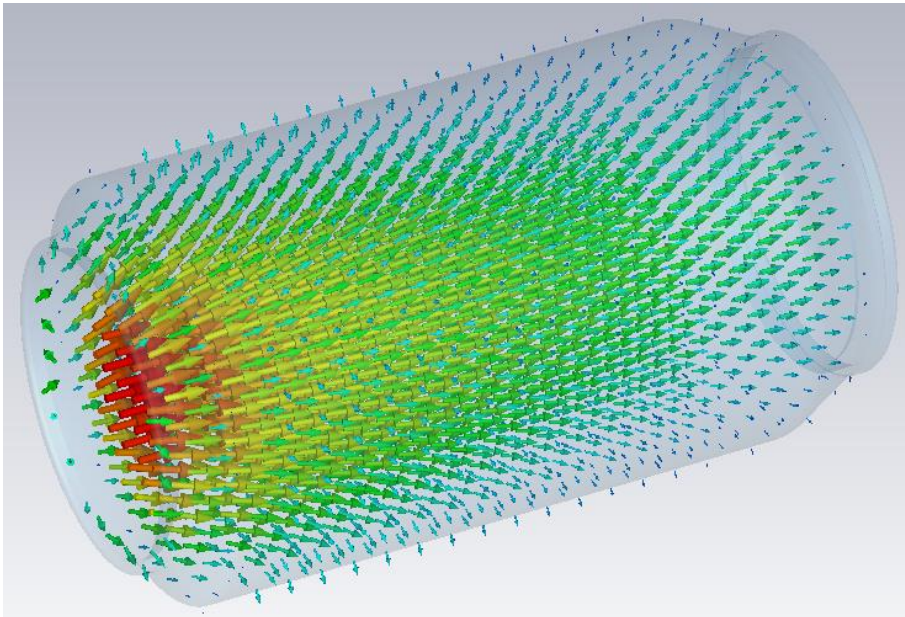


3D Model

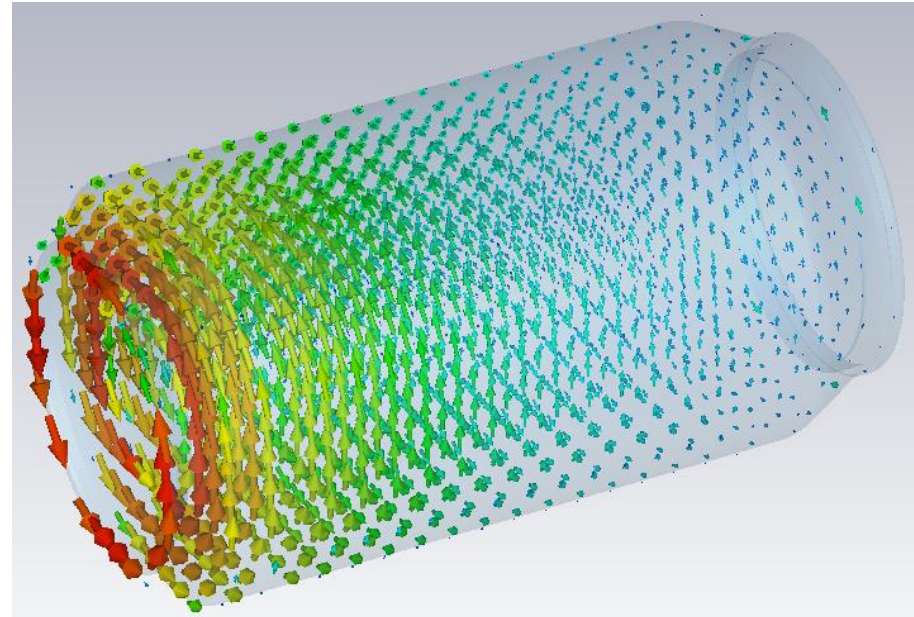
- Model D
- CST MicroWave Studio
 - Different scaling

f= \sim 3.398 GHz

Electric Field



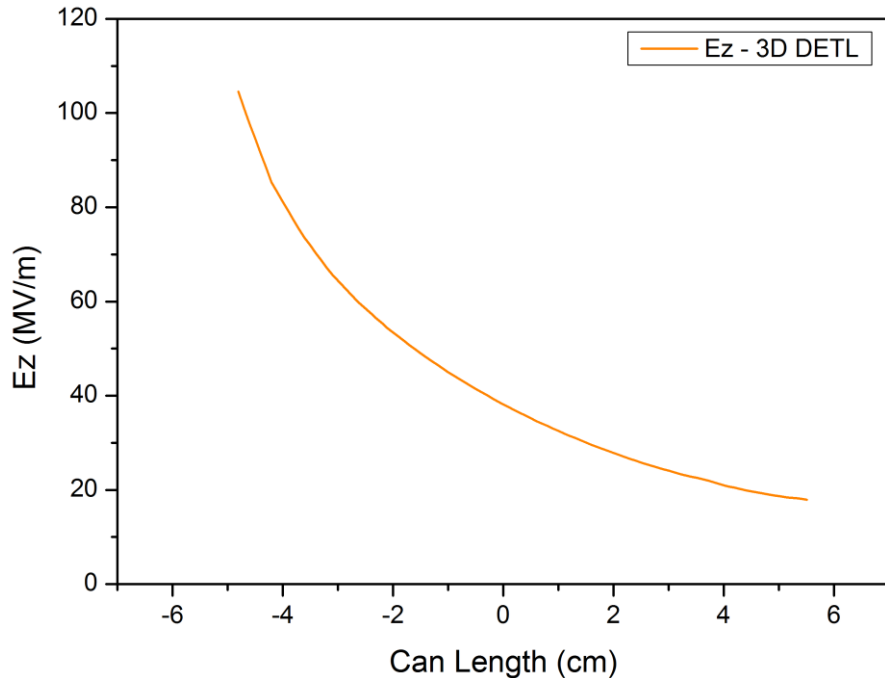
Magnetic Field



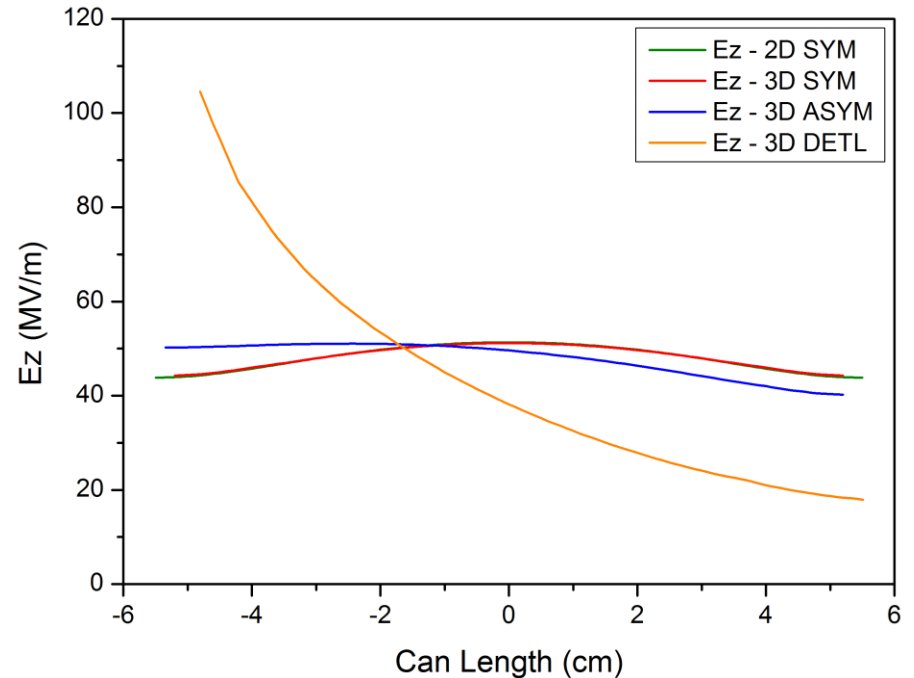
3D Model

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

1D Field Map (Ez on axis)

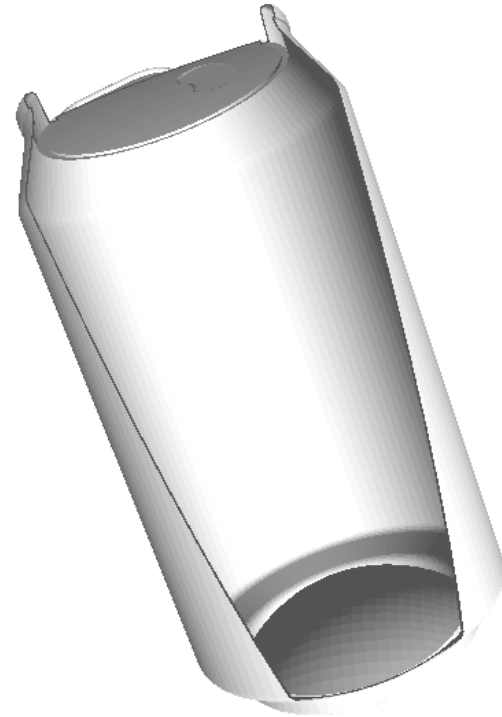
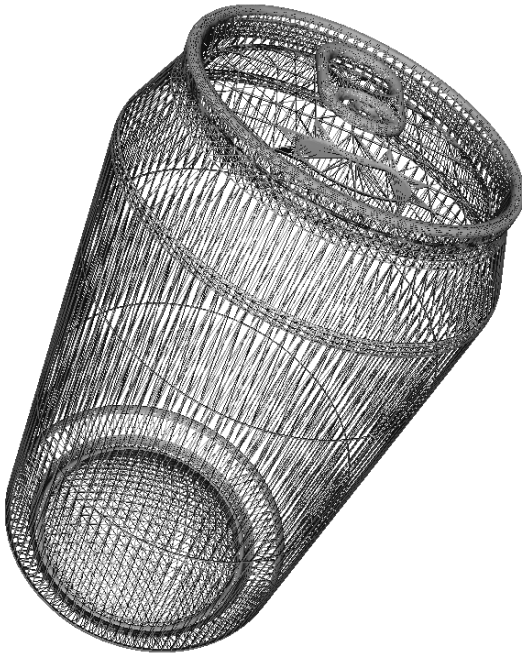


Comparisons...



3D Model

- Model E
- CST MicroWave Studio
- Full Details Imported CAD Model (www.grabcad.com)



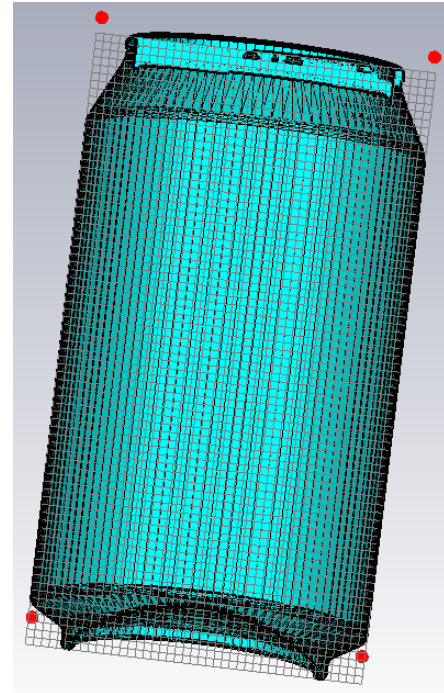
3D Model

- Model E
- CST MicroWave Studio

Geometry



Mesh

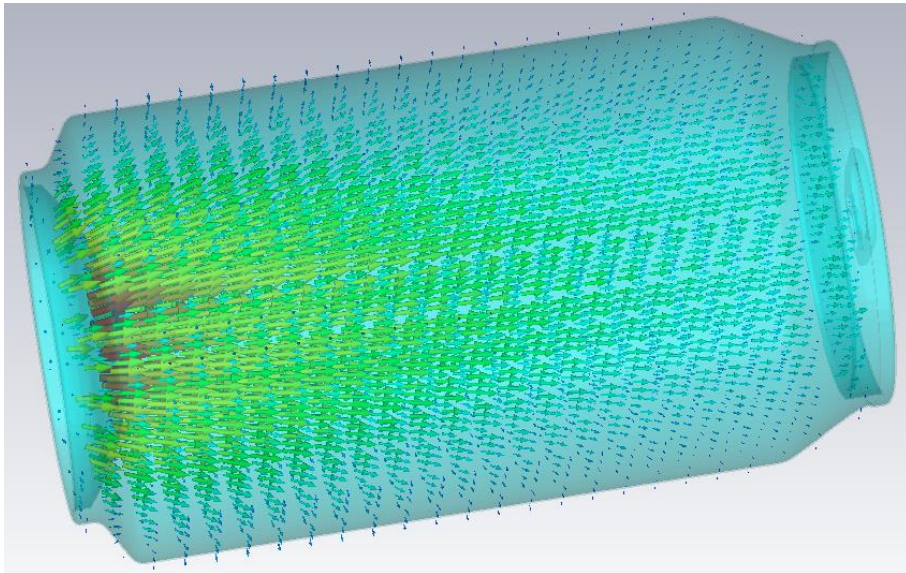


3D Model

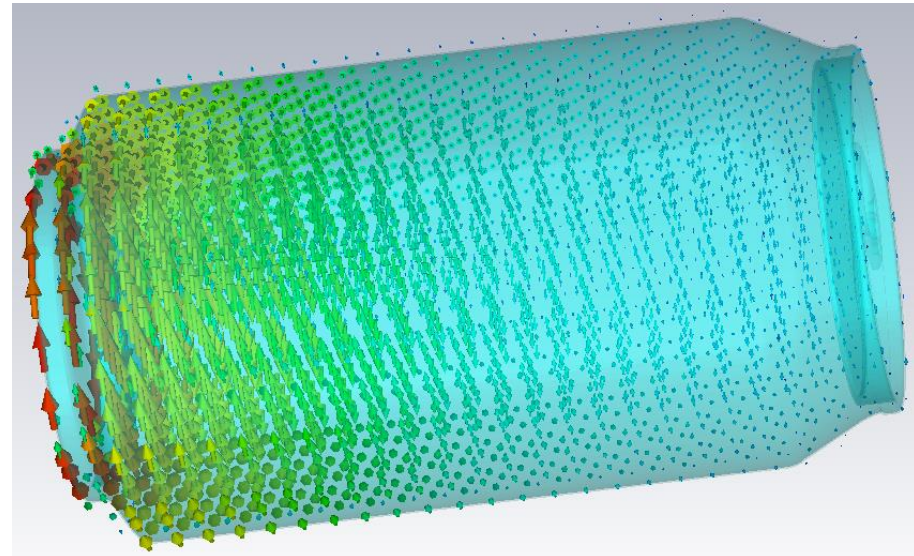
- Model E
- CST MicroWave Studio
 - Different scaling

$f \sim 3.371 \text{ GHz}$

Electric Field



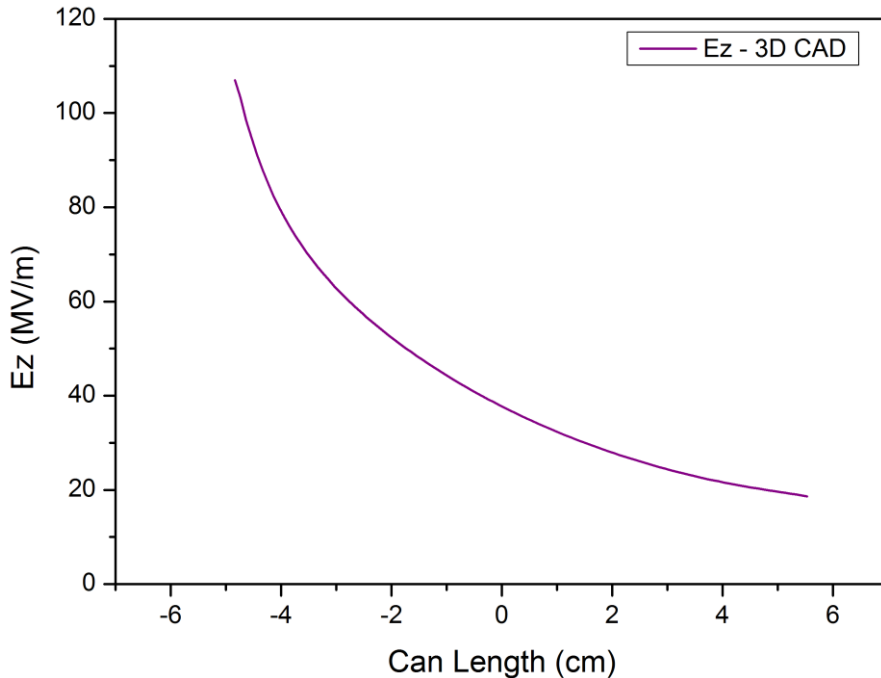
Magnetic Field



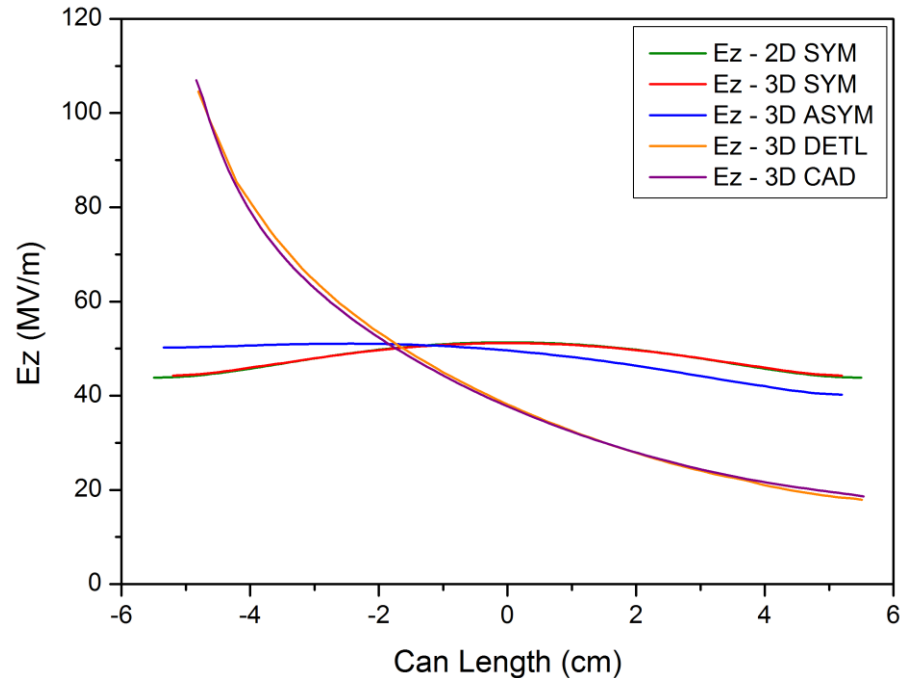
3D Model

- 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
 - Q-factor

