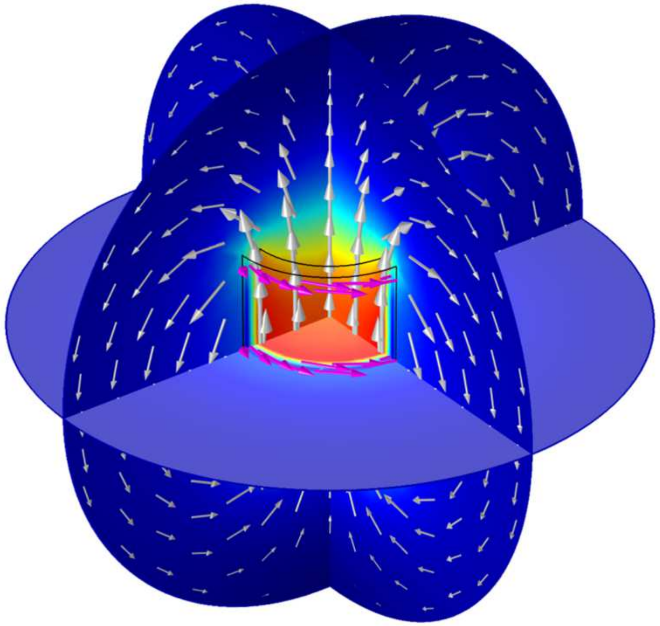
Single-turn and multi-turn coil domains in 3D

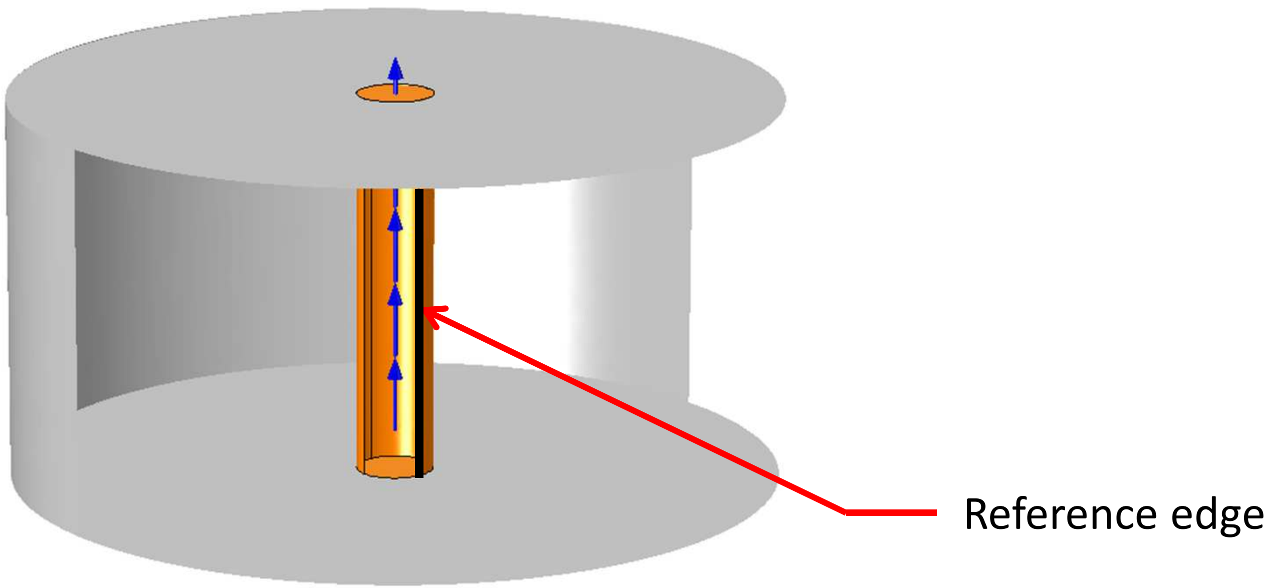


Multi-turn coil – Linear

- Multiple parallel straight wires bundled in a sleeve
- Leads are modeled
- Geometry should not form a closed loop and must have a straight longitudinal axis
- Cross section can be arbitrary

Coil excitation method

- Direction of current flow is modeled by specifying a **reference edge**
- Also the two end surfaces should touch the external walls of the air domain surrounding the conductor

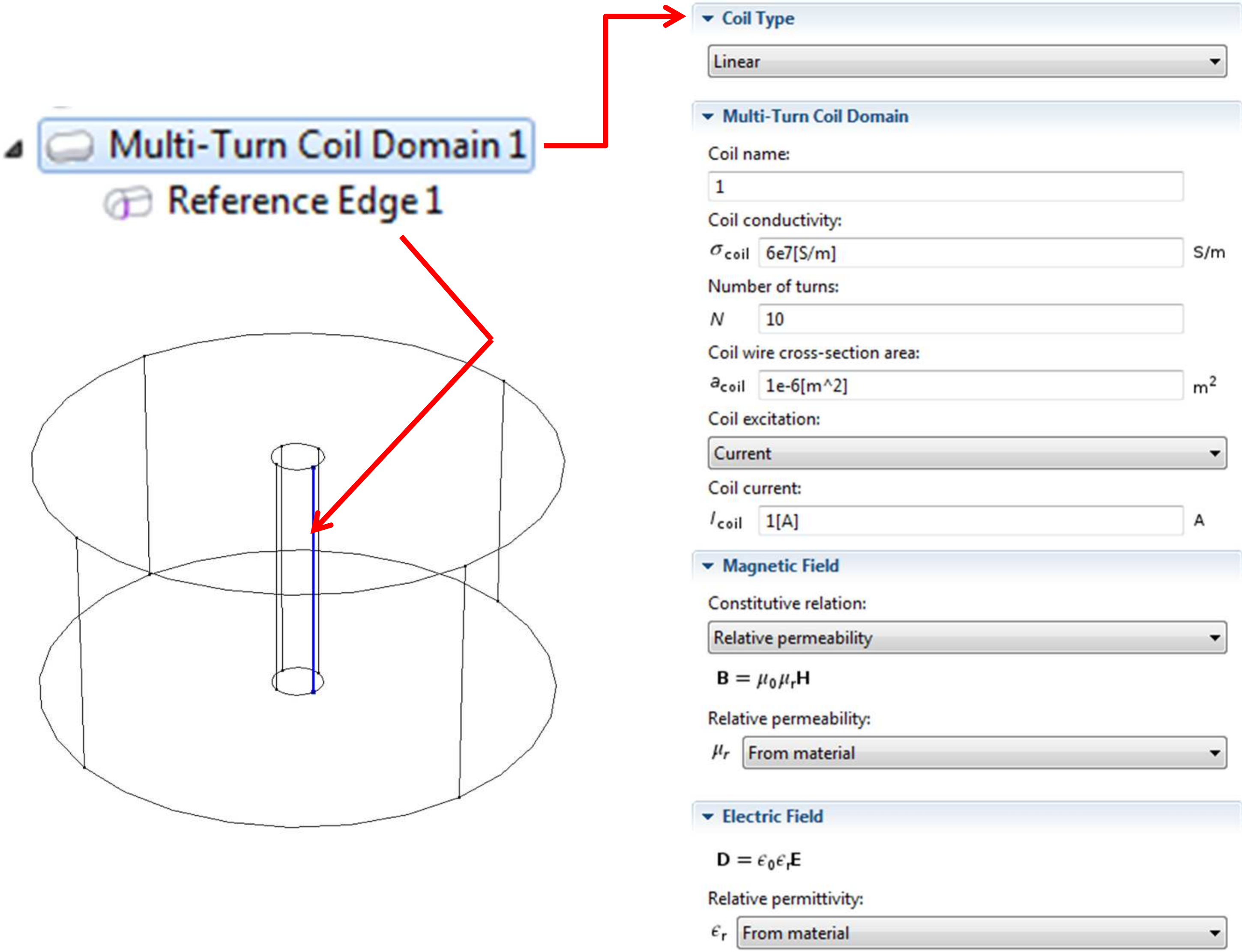


COMSOL

Modeling in COMSOL

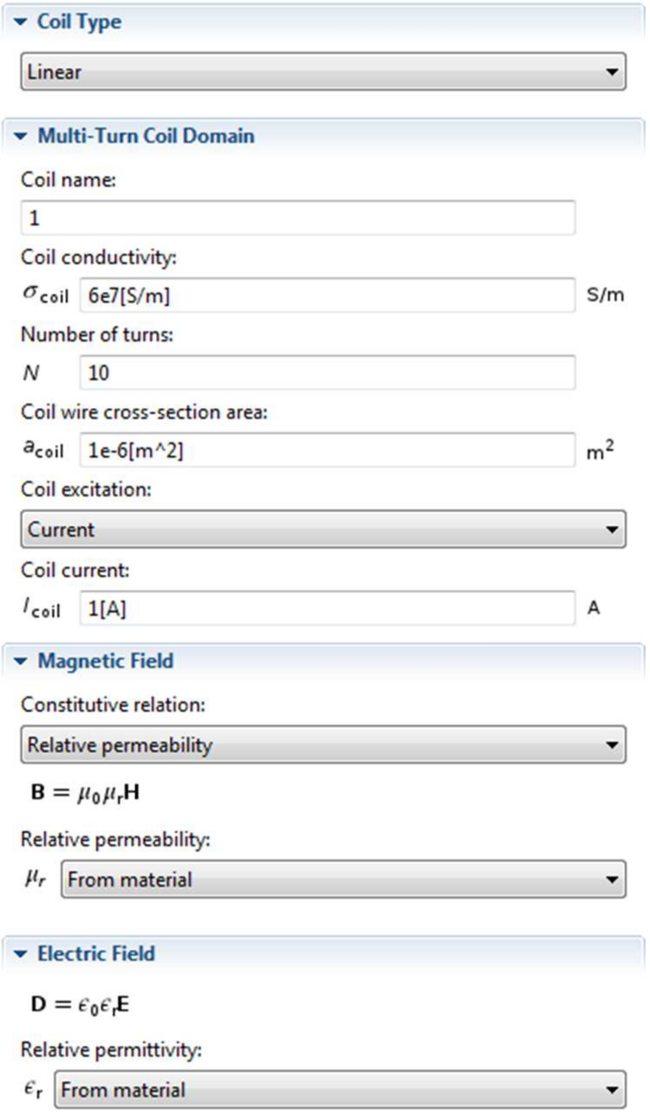
- For detailed modeling steps, see the following file:
  - *multi_coil_linear.mph*
- This model shows only the DC case

Using multi-turn coil domain: Linear



COMSOL

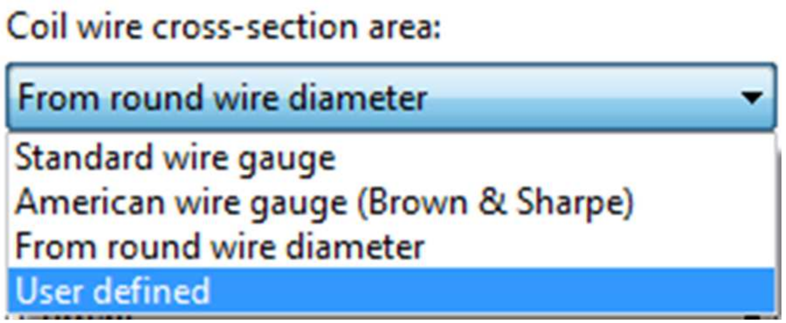
Note on coil properties



- This is the electrical conductivity of the wire material
- This is the cross section area of each wire
- COMSOL uses these for computing coil resistance

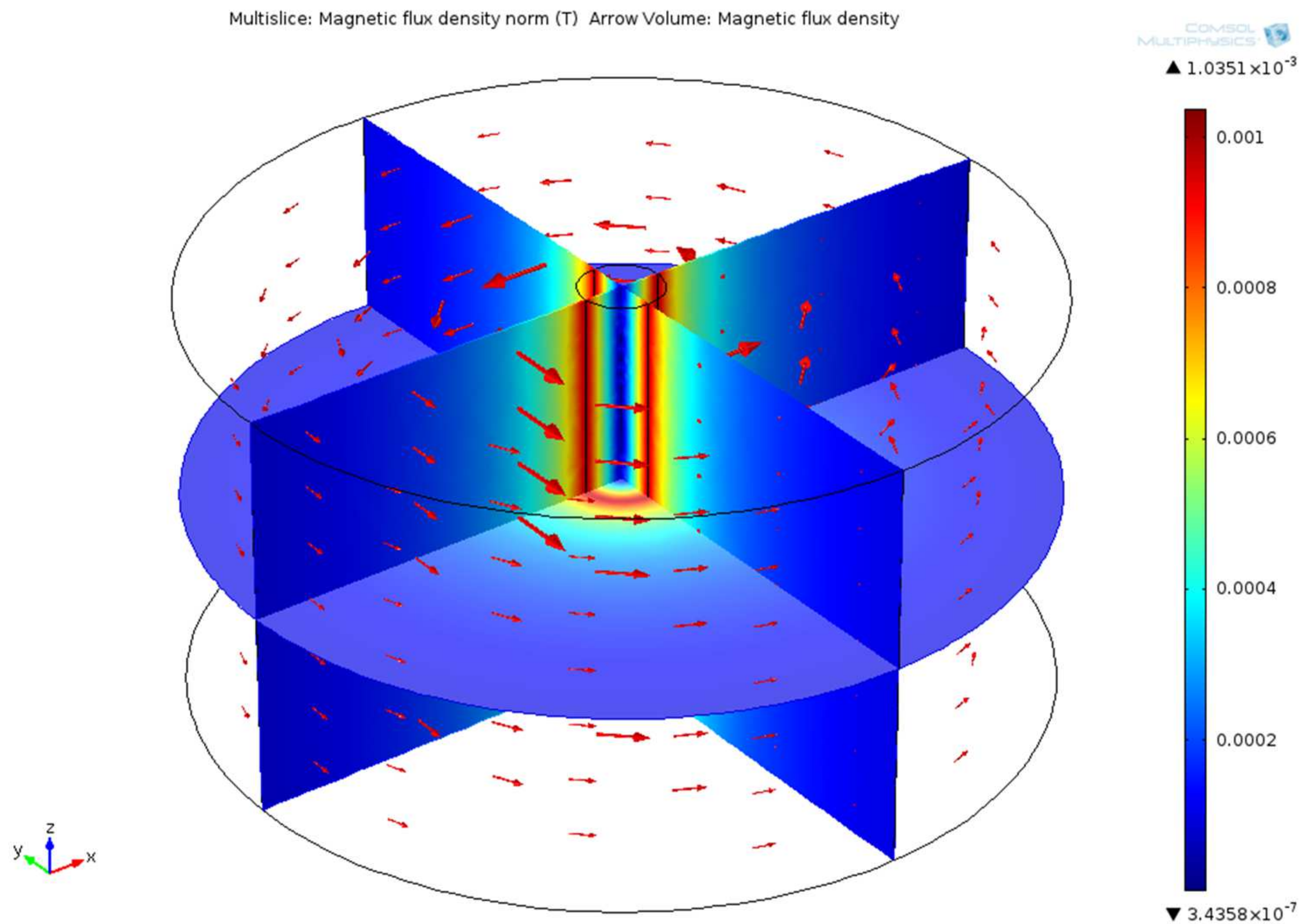
- The relative permeability and relative permittivity values are for the homogenized coil domain

Options for wire cross section



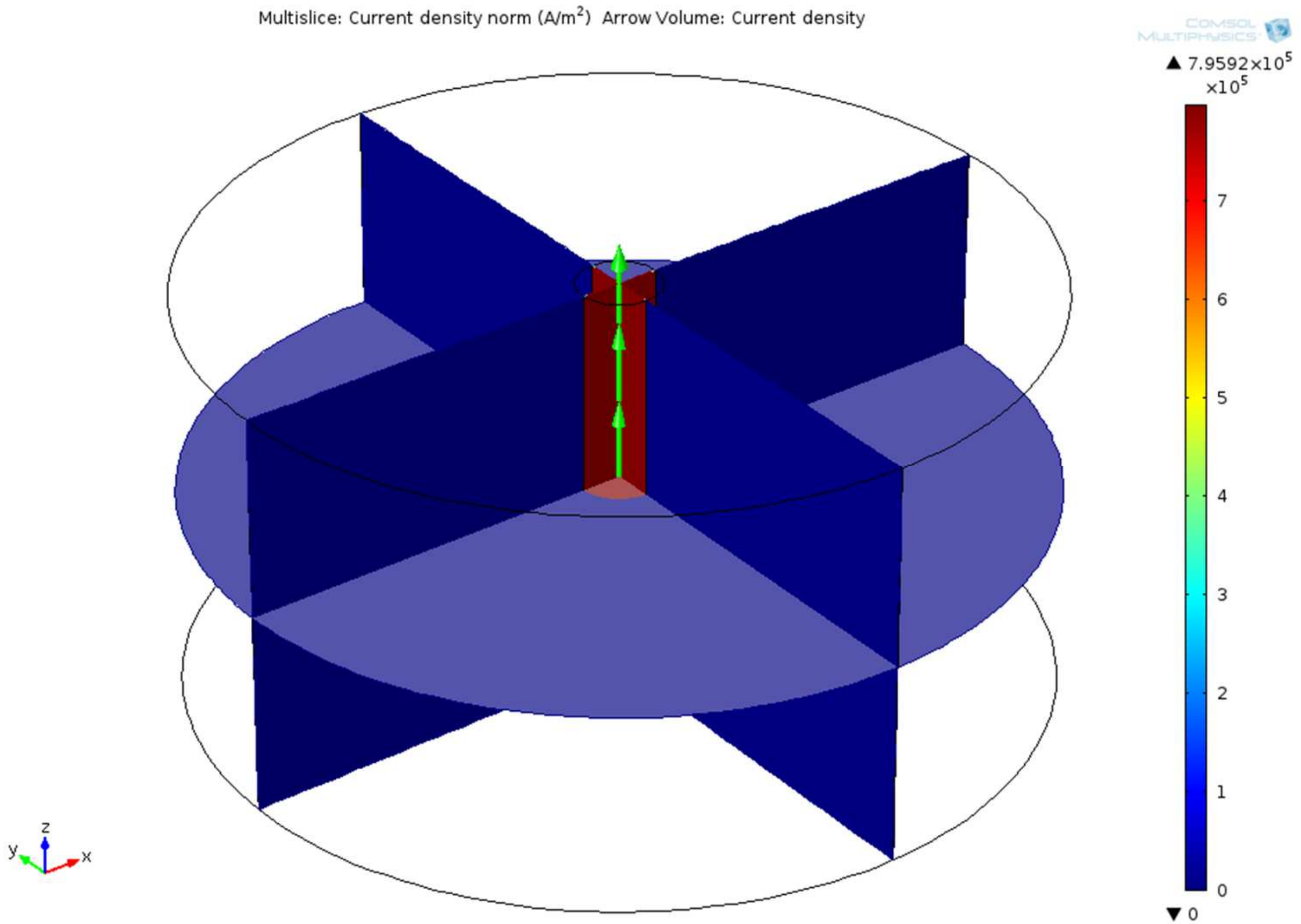
- Default is set to **User defined** cross section area
- Can specify the wire diameter of round wire
- Can also specify AWG or SWG number
- **Note:** We are still not geometrically resolving the wires

Results – Magnetic flux density



Inductance = 1.02e-6 H

Results – Current density



Resistance = 0.003 Ω