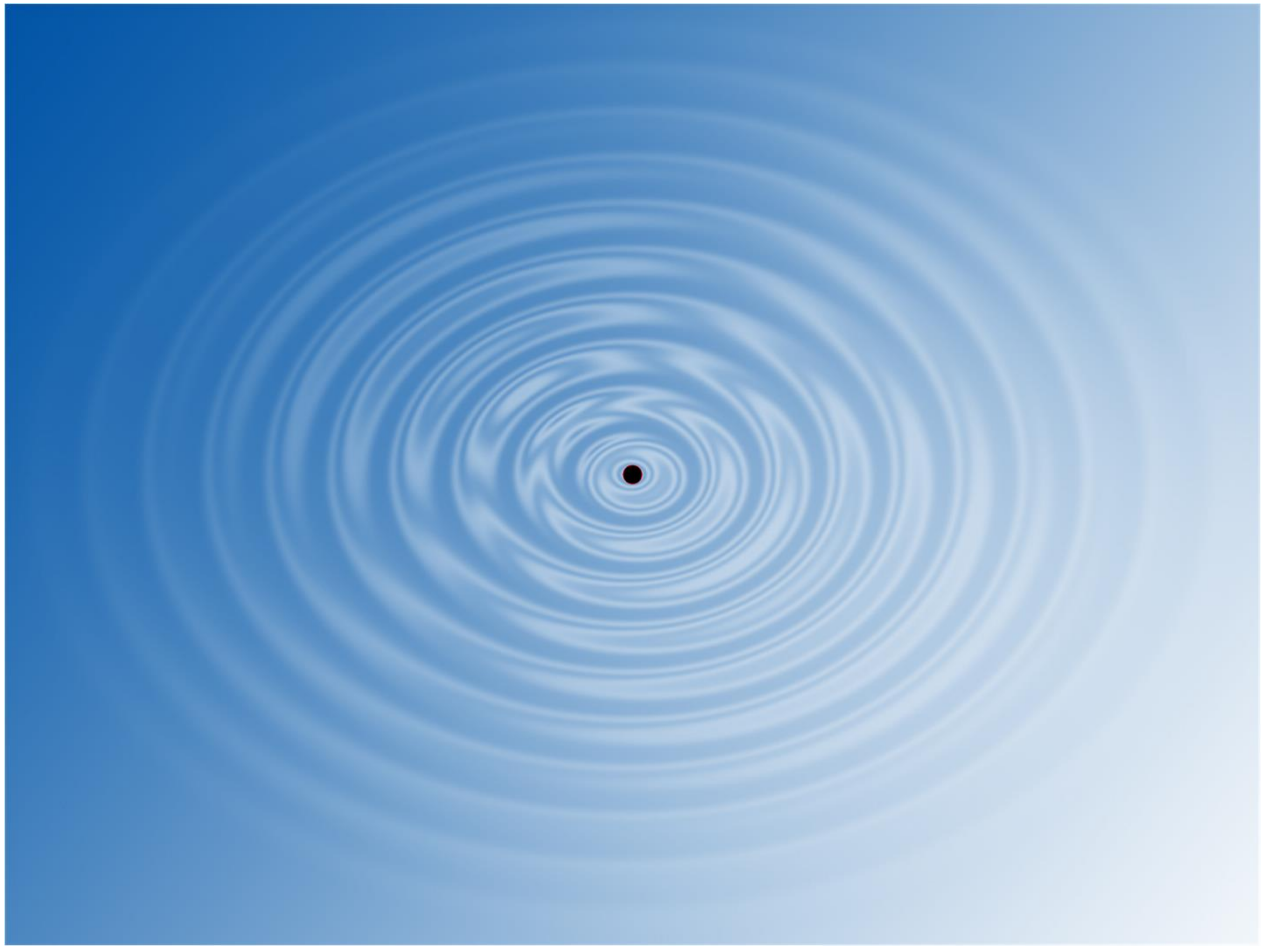
ETH zürich

P&S COMSOL® Design Tool

Week 2: EM Introduction & Introduction to COMSOL

Taichiro Fukui, Maximilian Bosch

COMSOL: Last Time – Point Source Field



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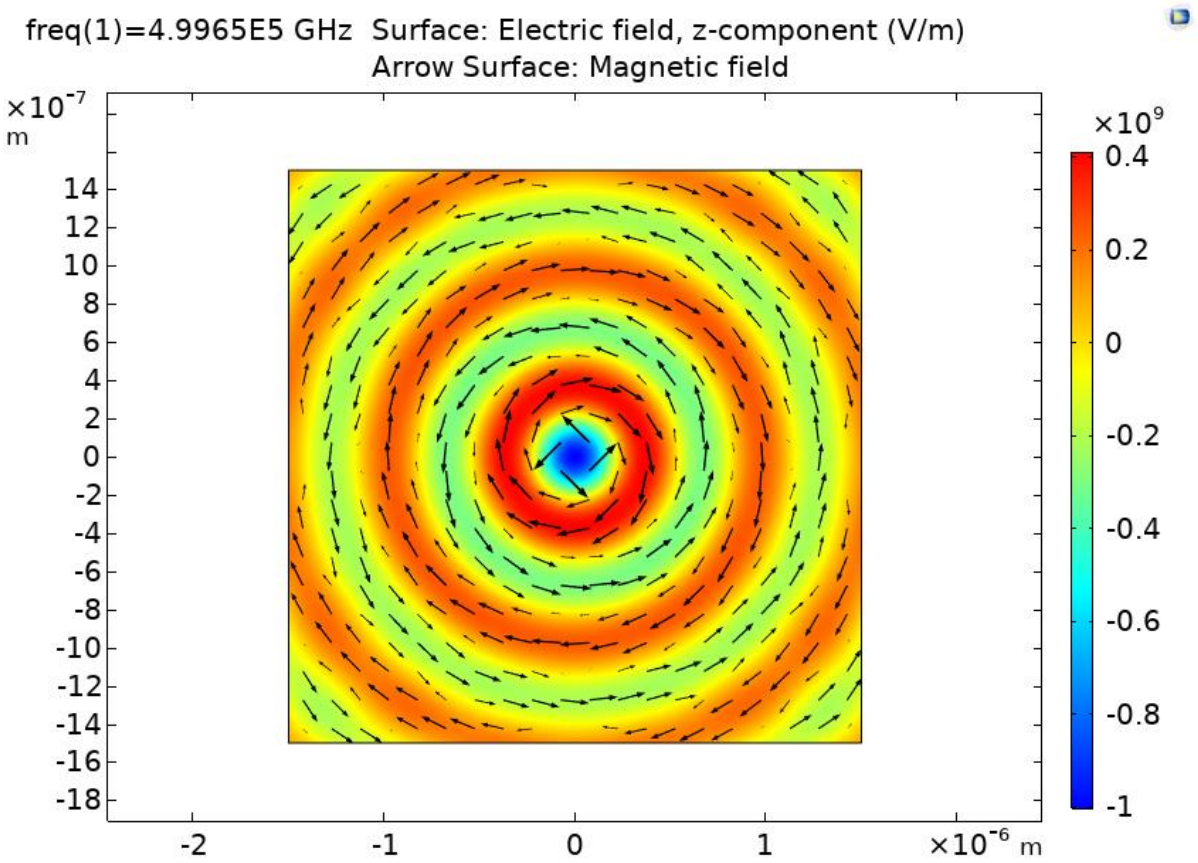
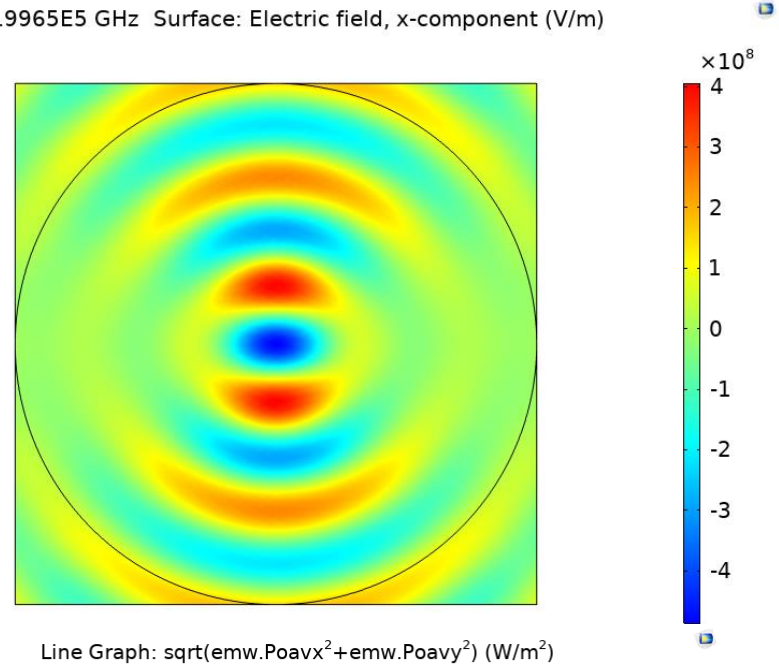
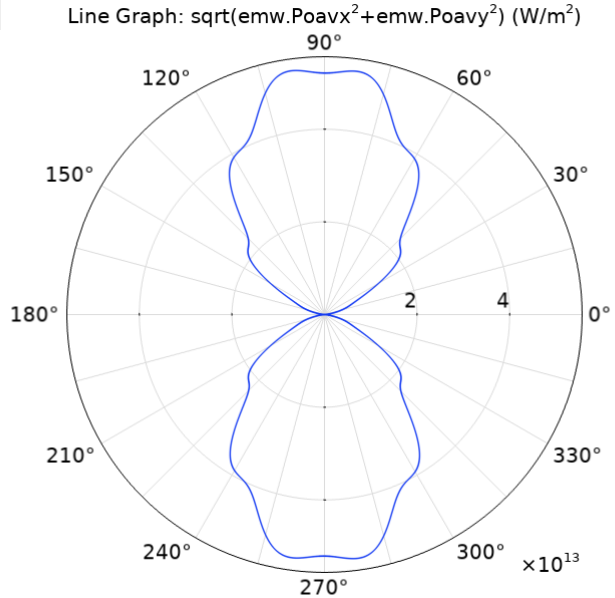
COMSOL: Last Time – Point Source Field



Using line current



Using electrical dipole



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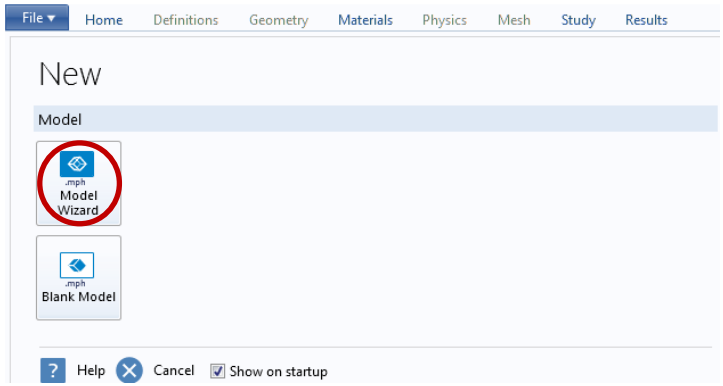
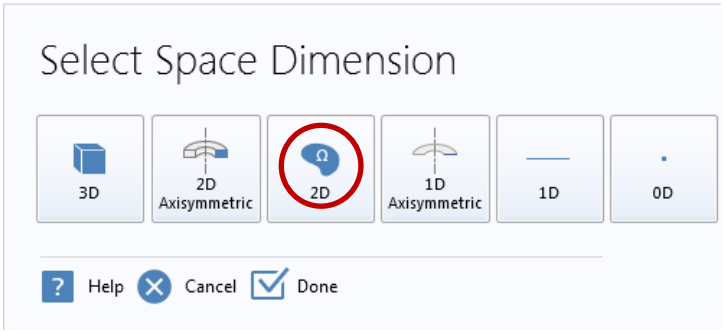
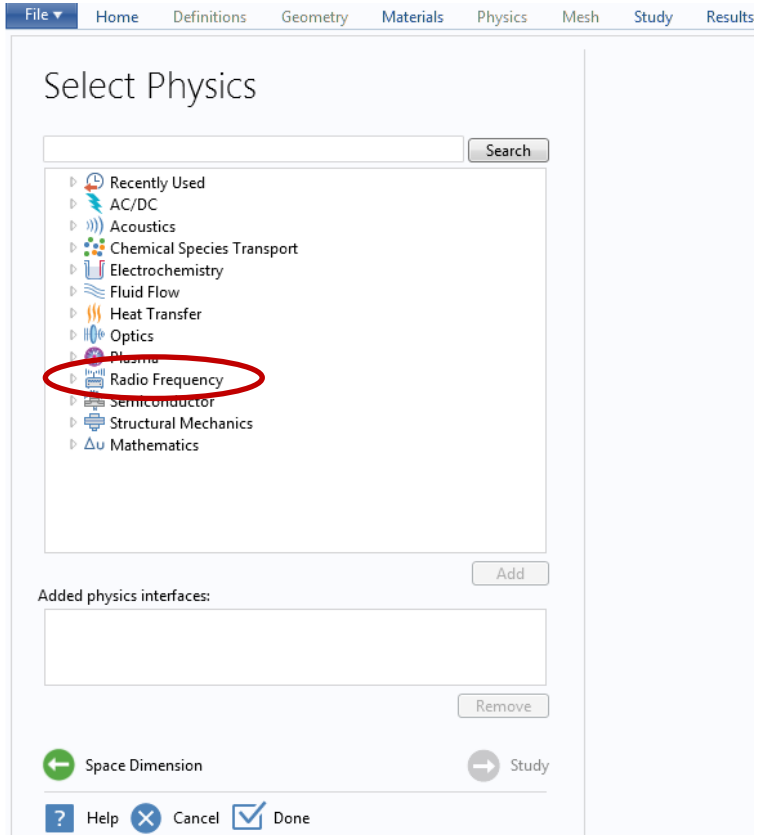
COMSOL: Last Time







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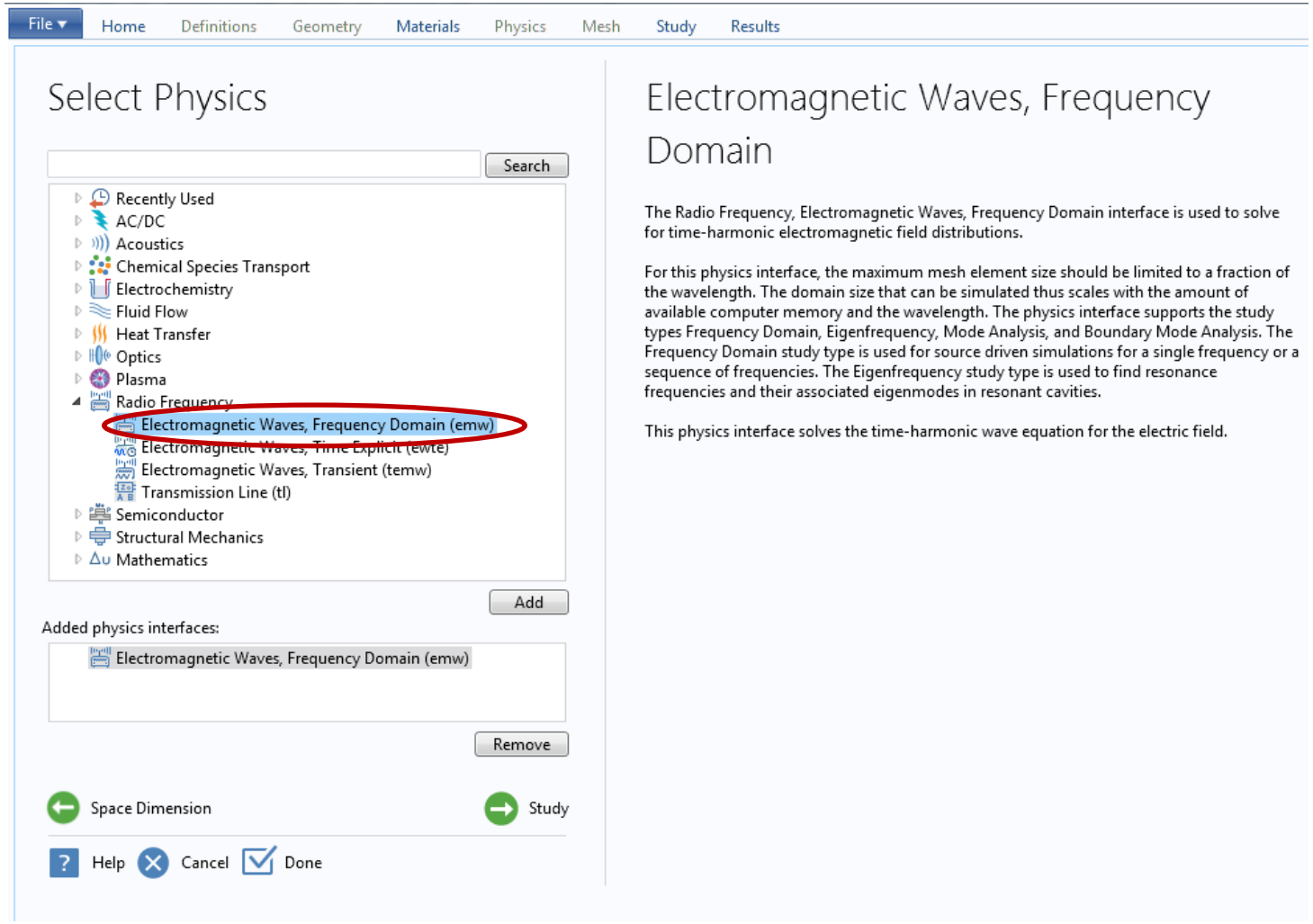
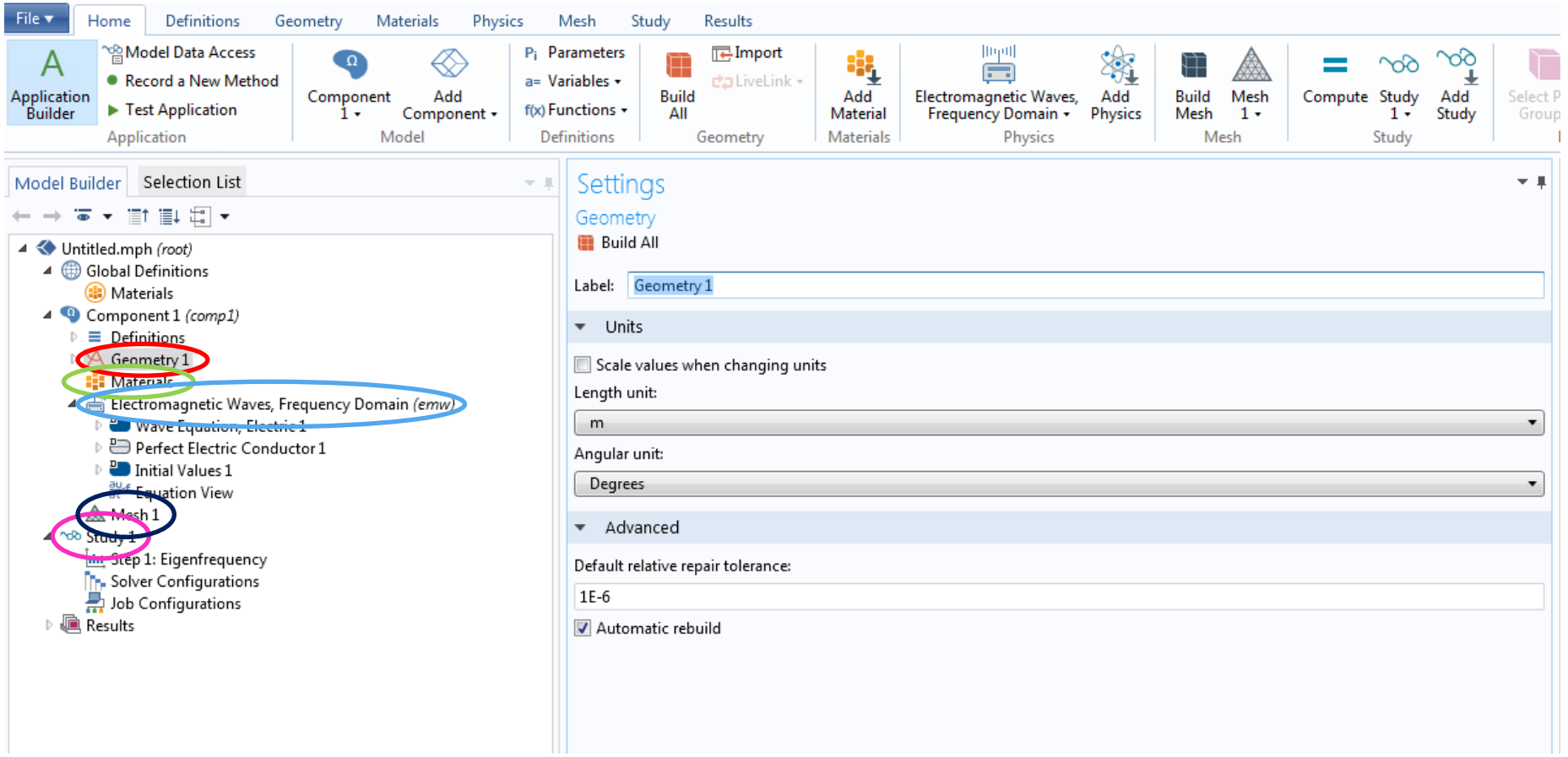
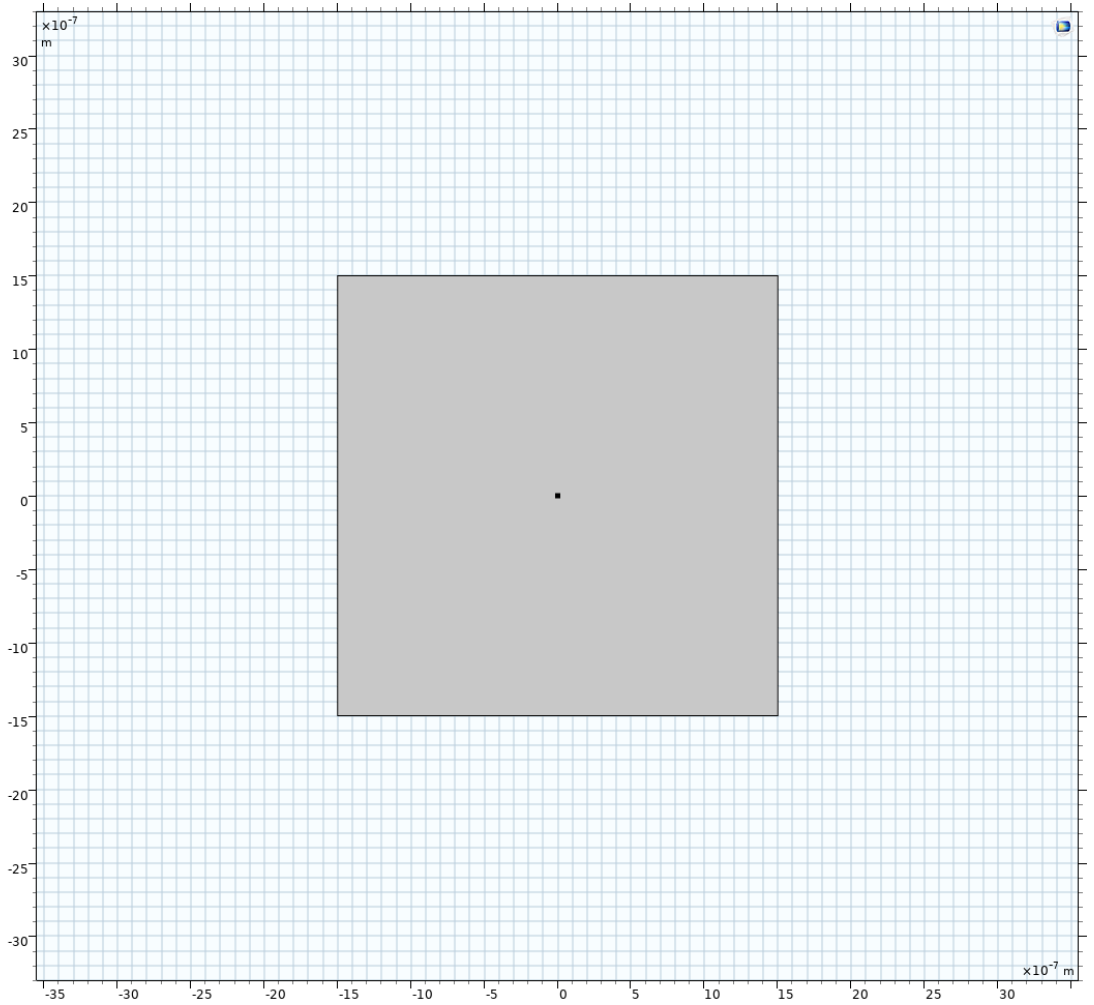


COMSOL: Last Time



COMSOL: Last Time

- Define simulation domain
- Build geometry



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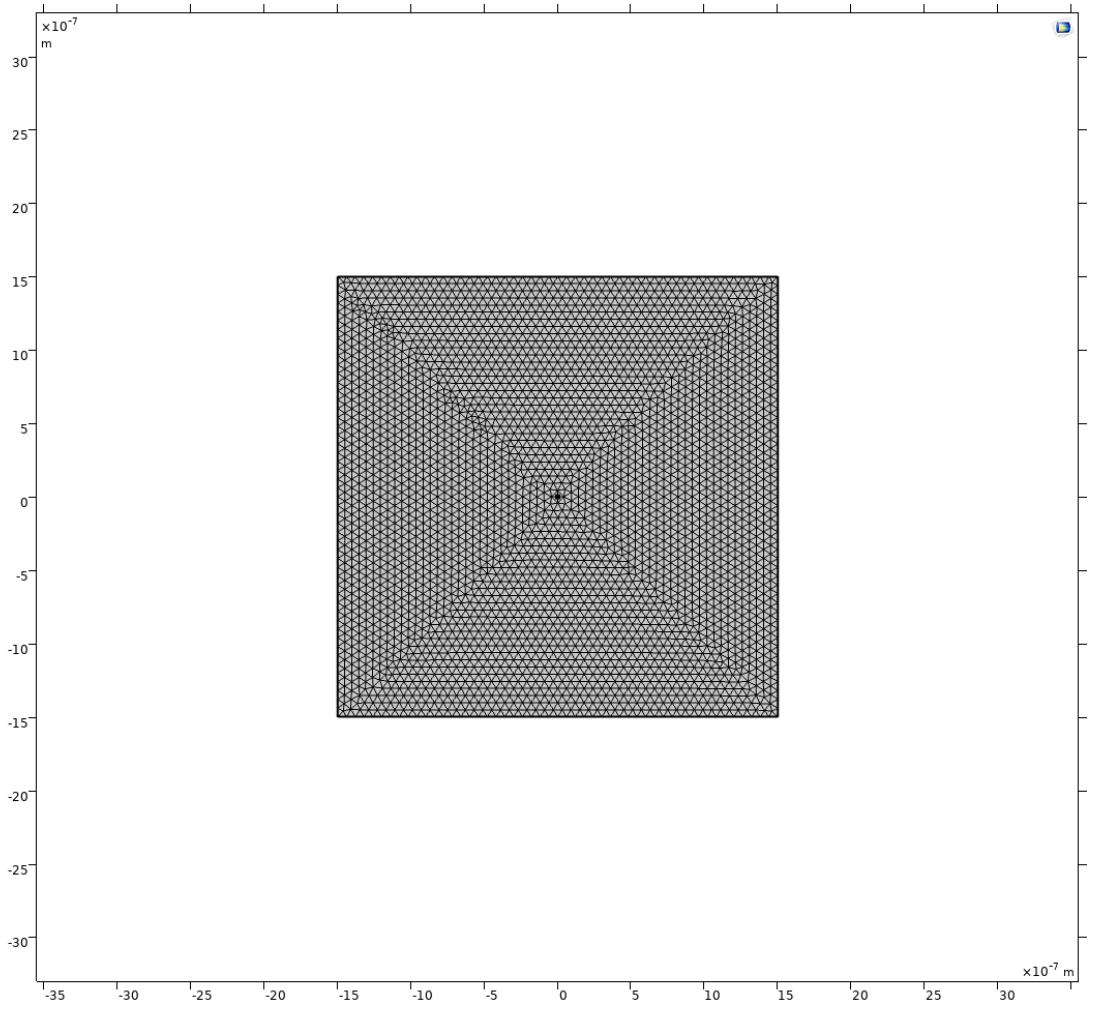
COMSOL: Last Time

- Discretization of simulation domain
  - Build mesh
- Mesh size determines accuracy of solution
  - Too large mesh ⇒ wrong results
- Accuracy vs. simulation time
  - **Today**: Optimization by manual refinement



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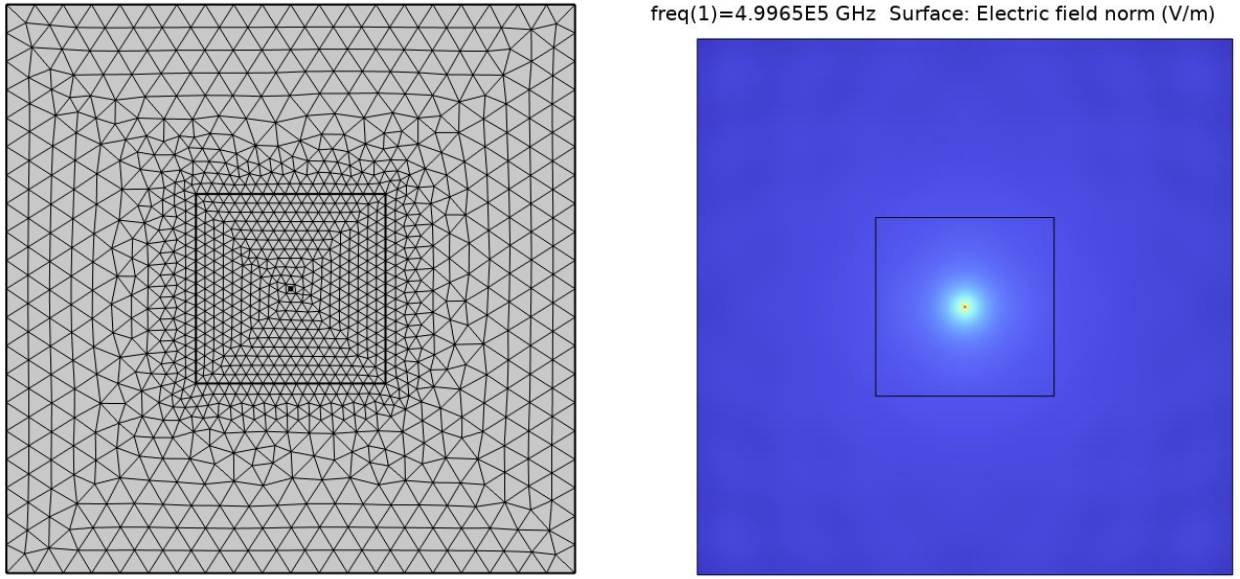
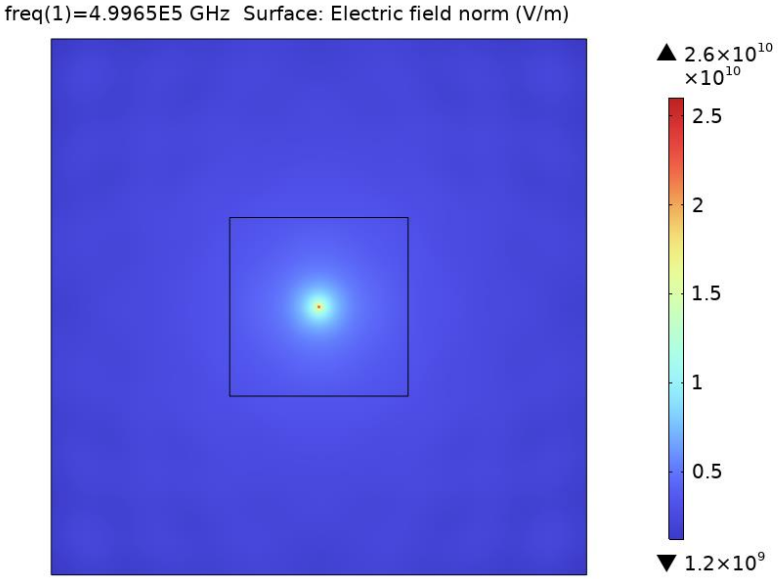
COMSOL: Today

- Accuracy vs computation time
  - Too coarse mesh: incorrect results
  - Too fine mesh: unecessary large computation time

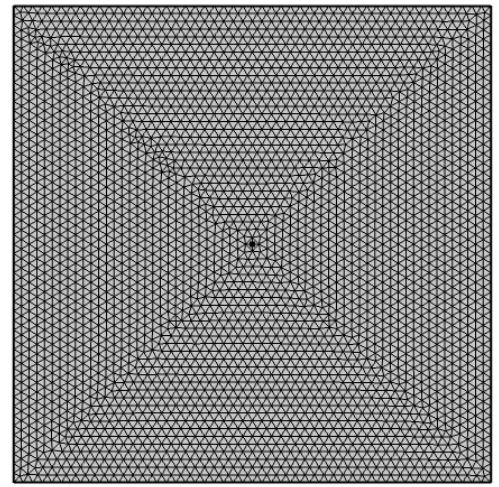
- Applying manual refinement
  - Refining **only in the region of interest**

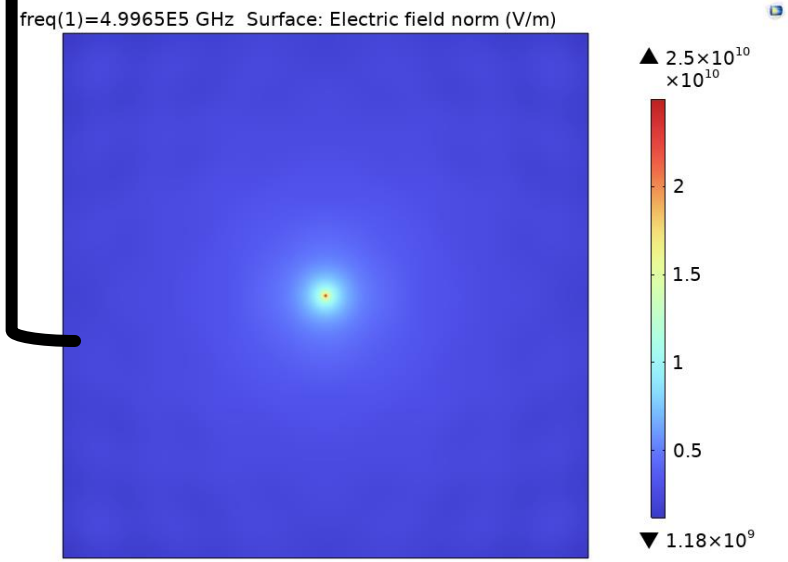




~ 4s

~ 10s





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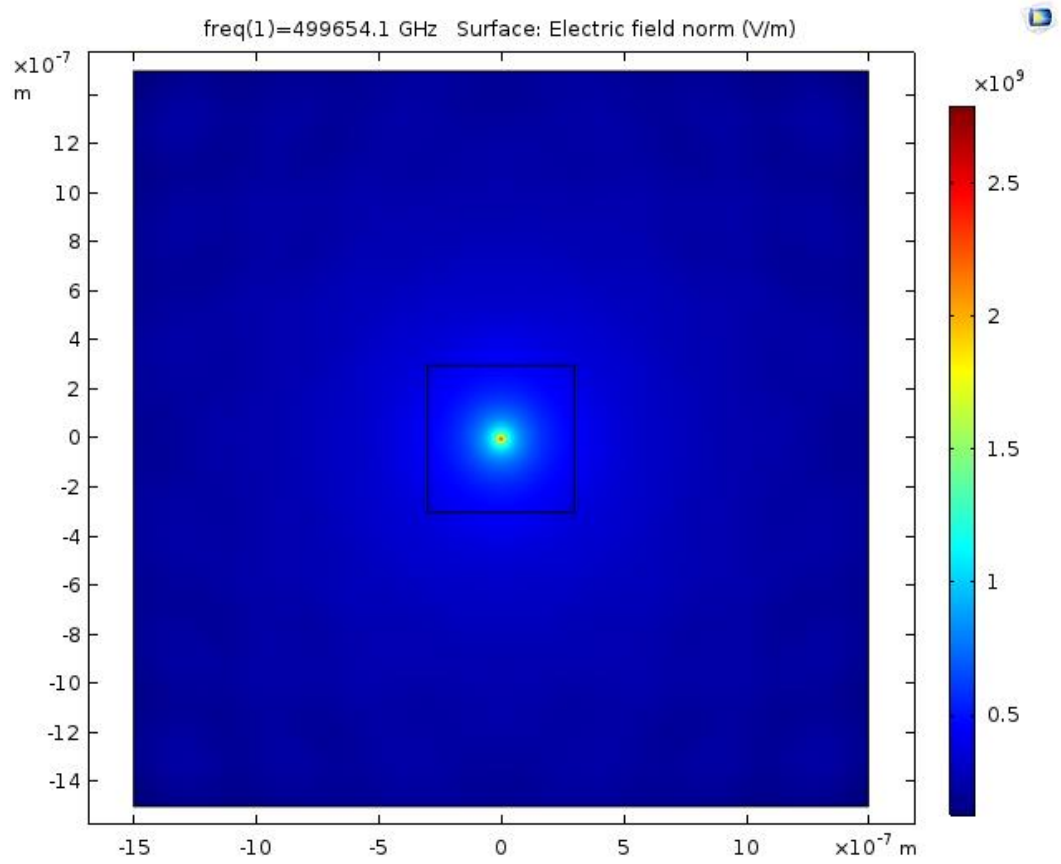
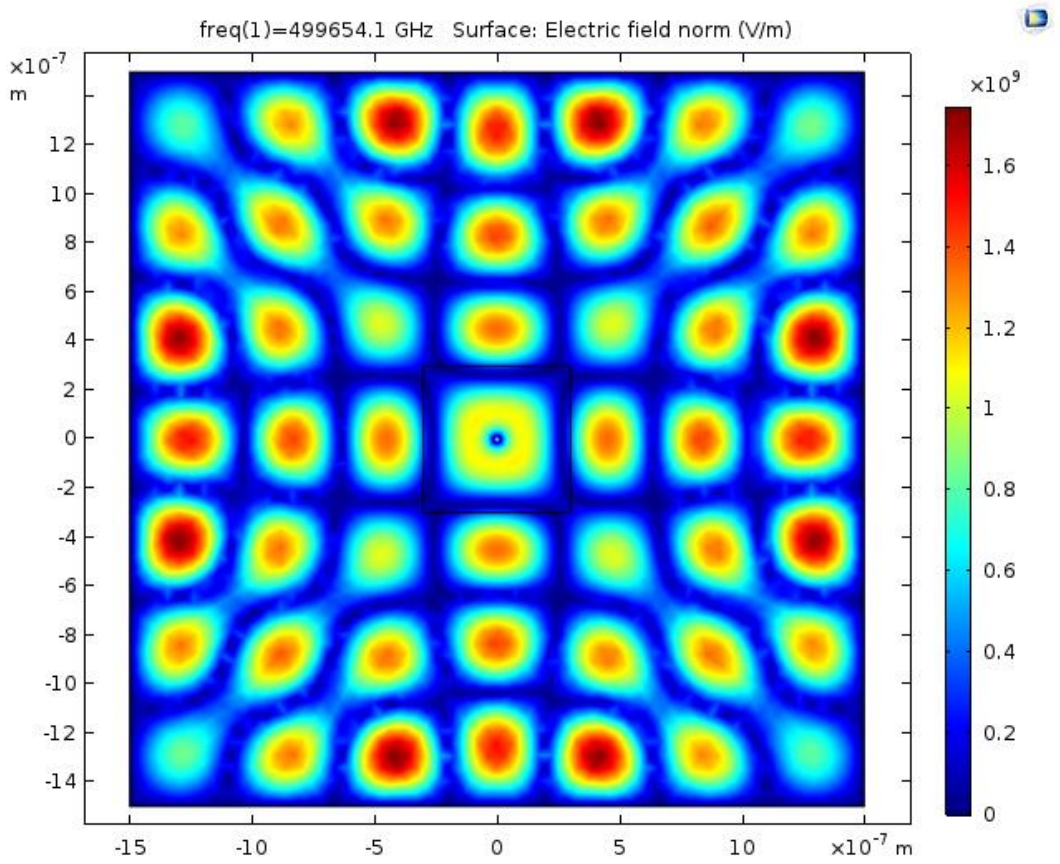
COMSOL: Last Time



Scattering Boundaries



PEC Boundaries

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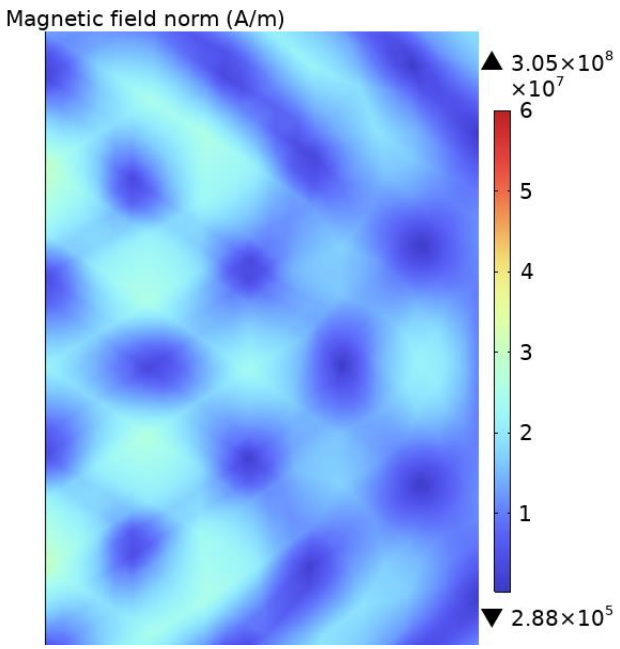
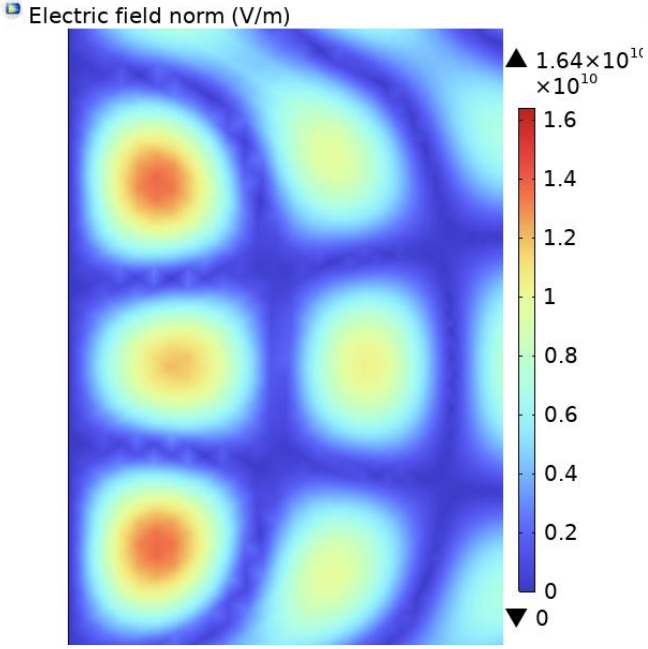
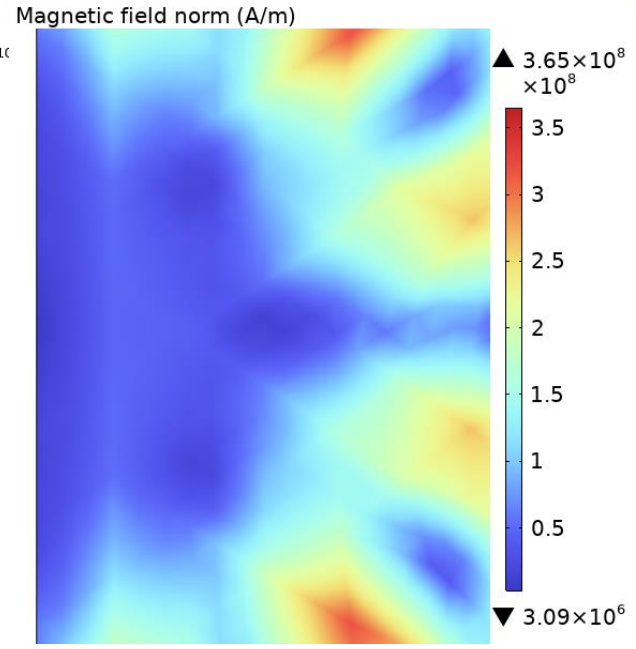
COMSOL: Today

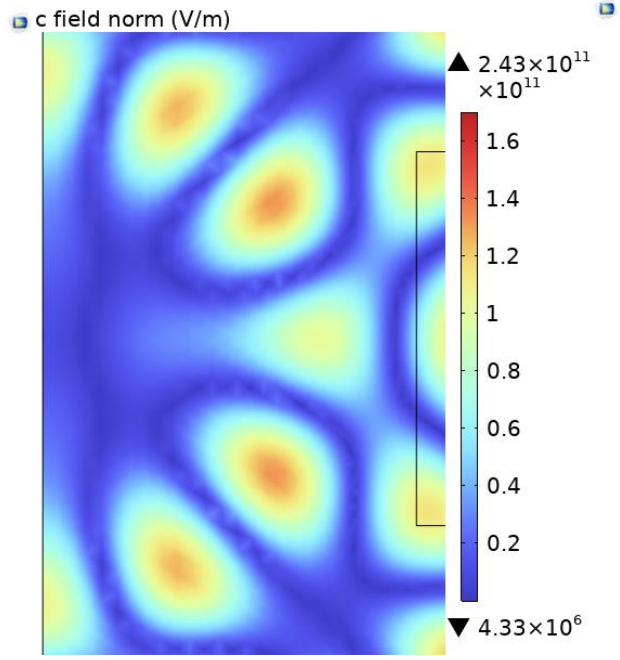
- Distinction between PEC and PMC





PEC
$\boldsymbol{E} = \boldsymbol{0}, \boldsymbol{H} \neq \boldsymbol{0}$ at boundaries





PMC
$\boldsymbol{H} = \boldsymbol{0}, \boldsymbol{E} \neq \boldsymbol{0}$ at boundaries

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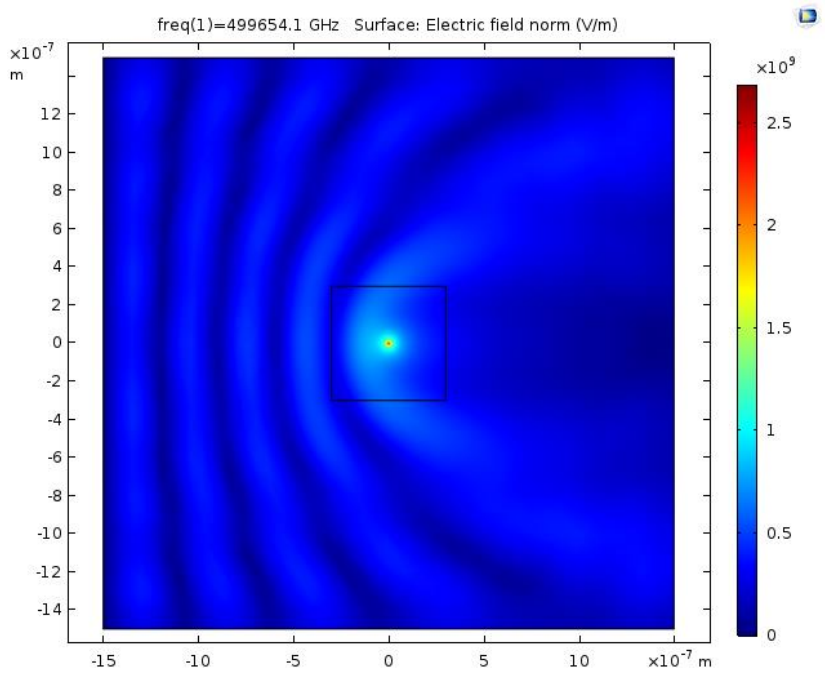
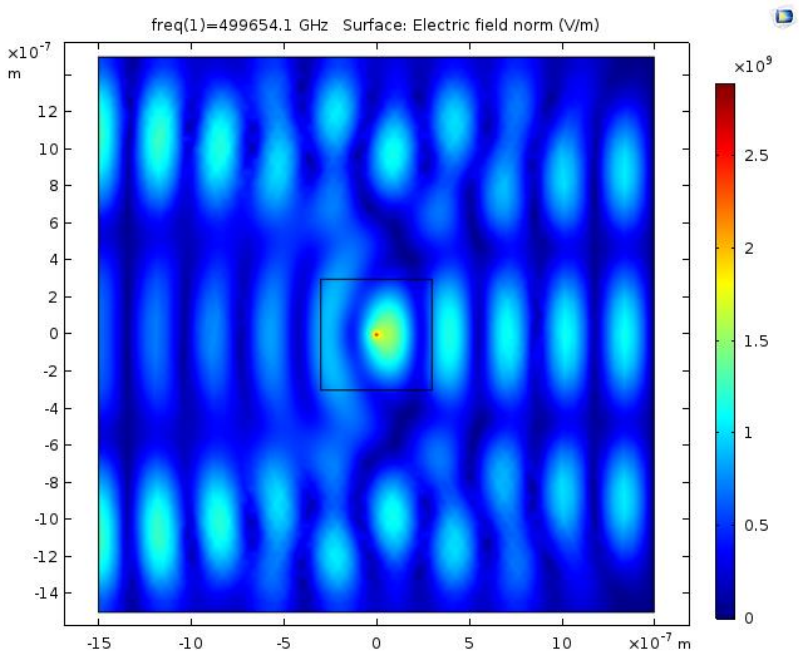
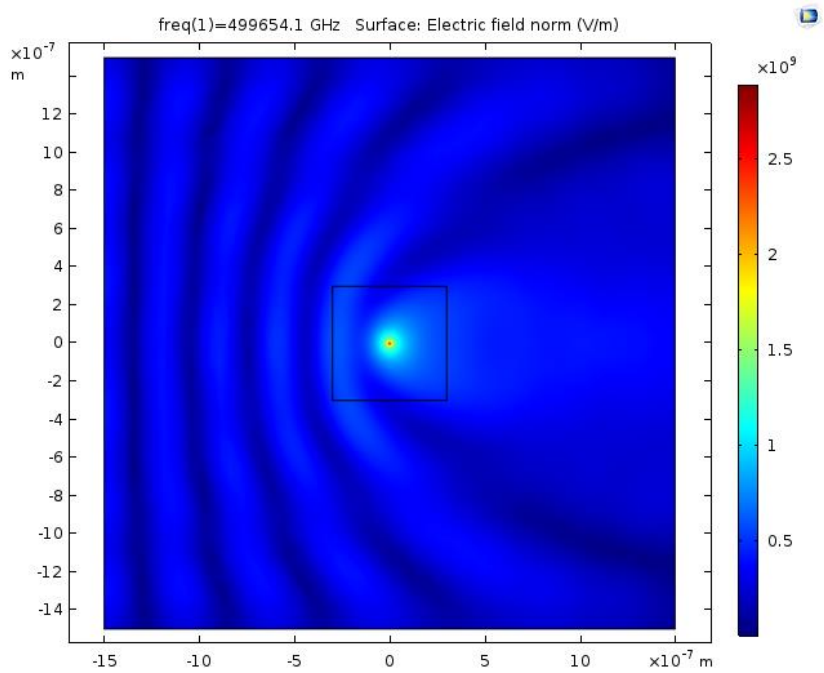
COMSOL: Today

- Mirror effect by using different boundary conditions



Can you see the difference?
Can you guess the boundary conditions?





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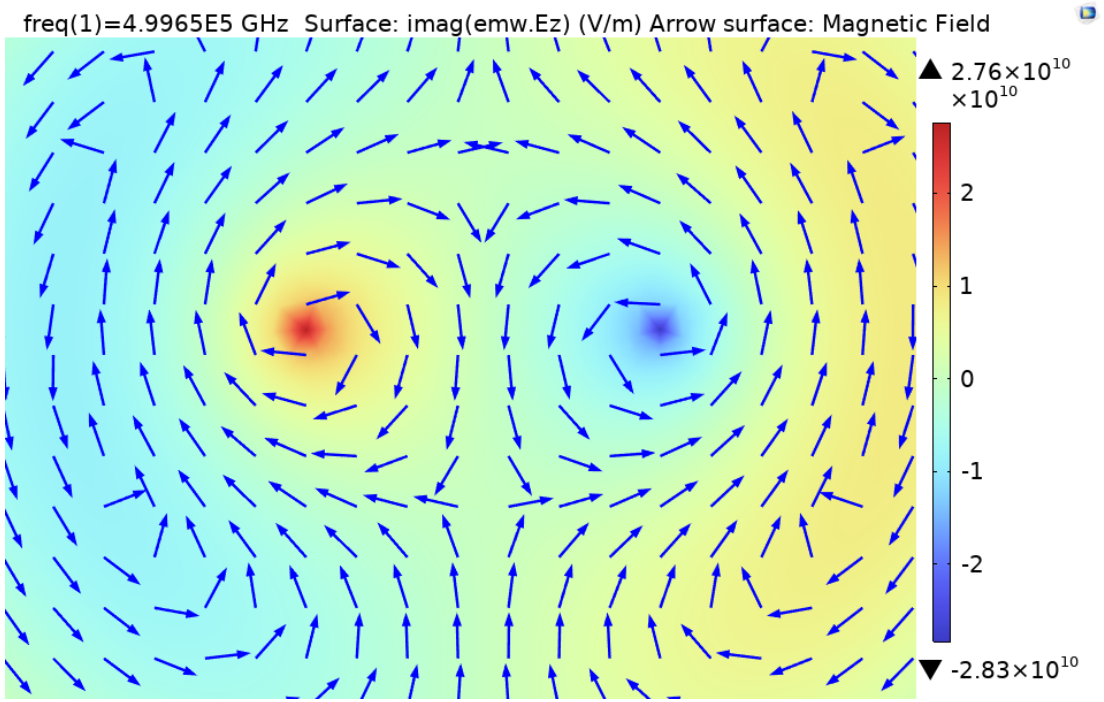
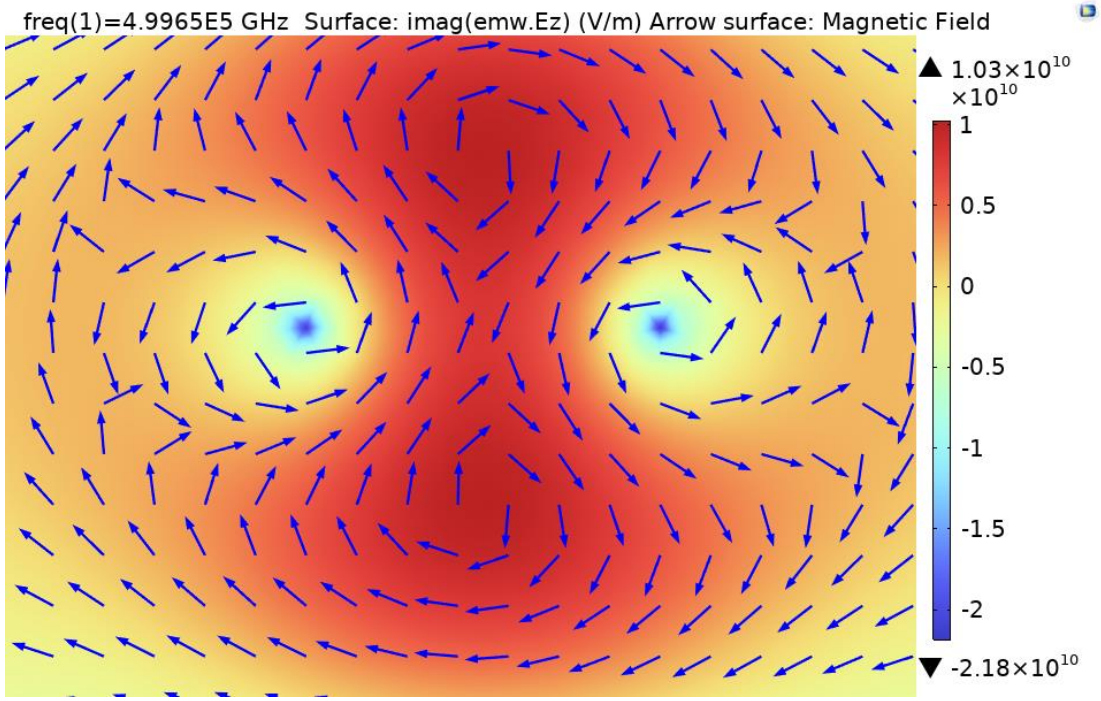
COMSOL: Today

- Double Source



With two currents in opposite direction



With two currents in same direction

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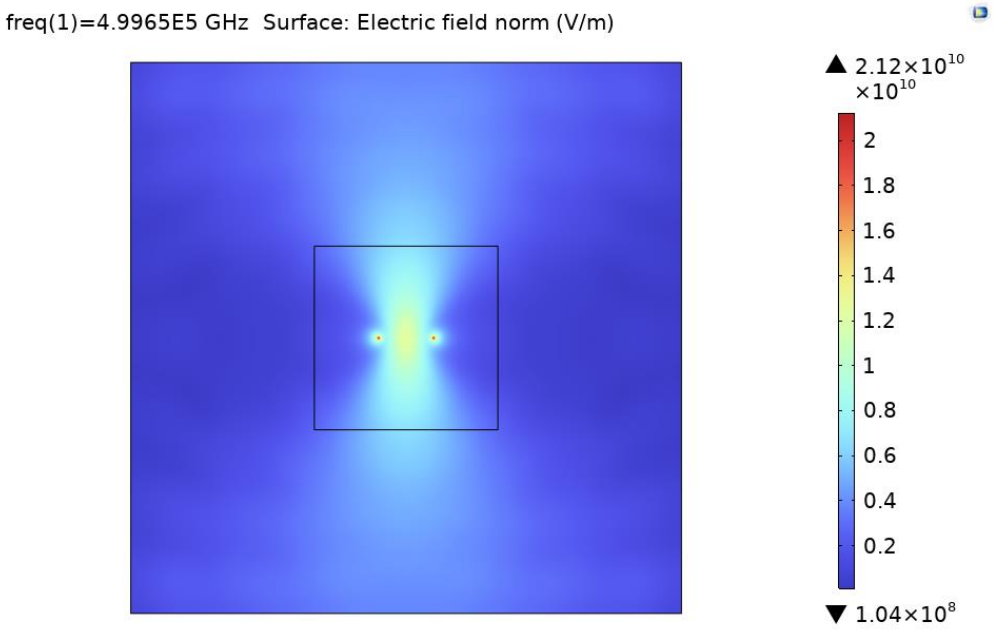
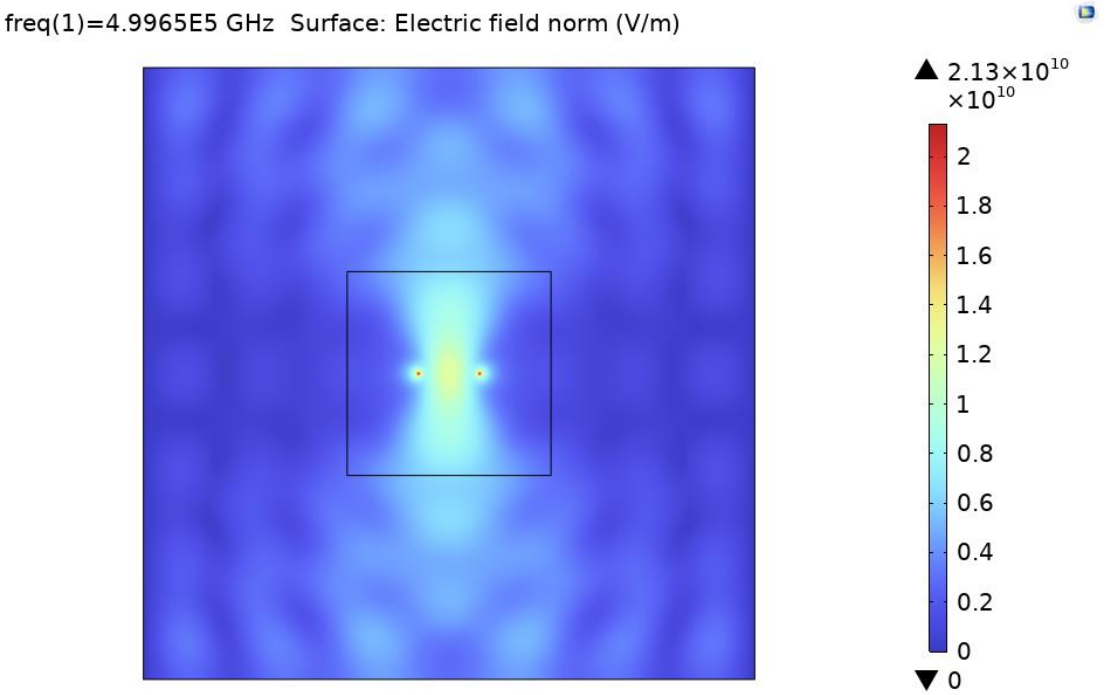
COMSOL: Today

- Effects of BCs
  - PECs behave as a mirror interface



SBCs everywhere



PECs at which boundary?

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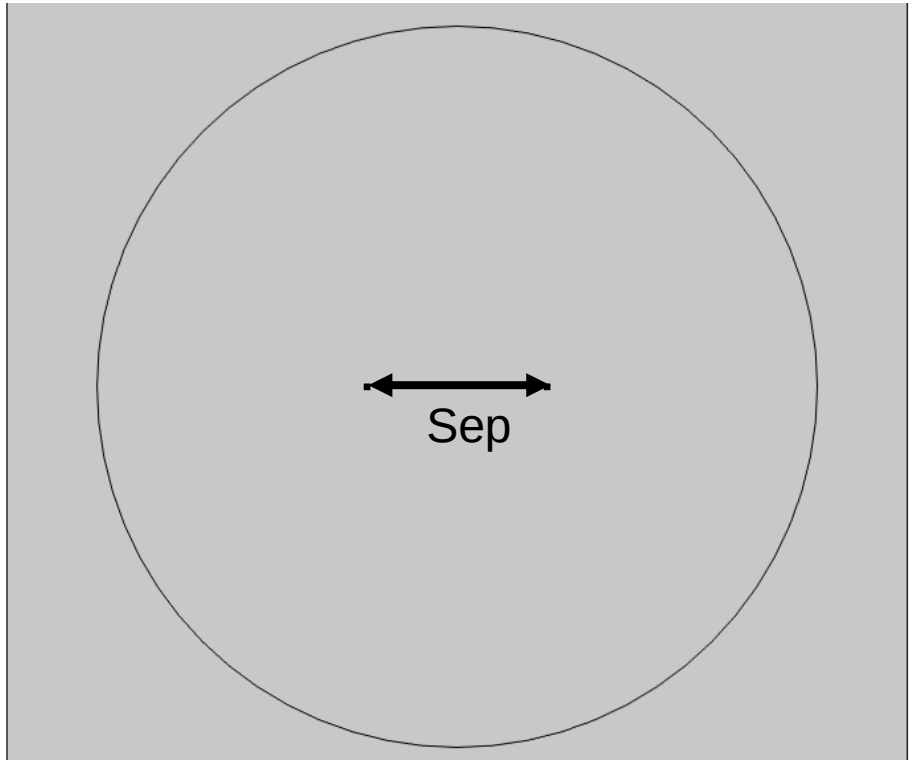
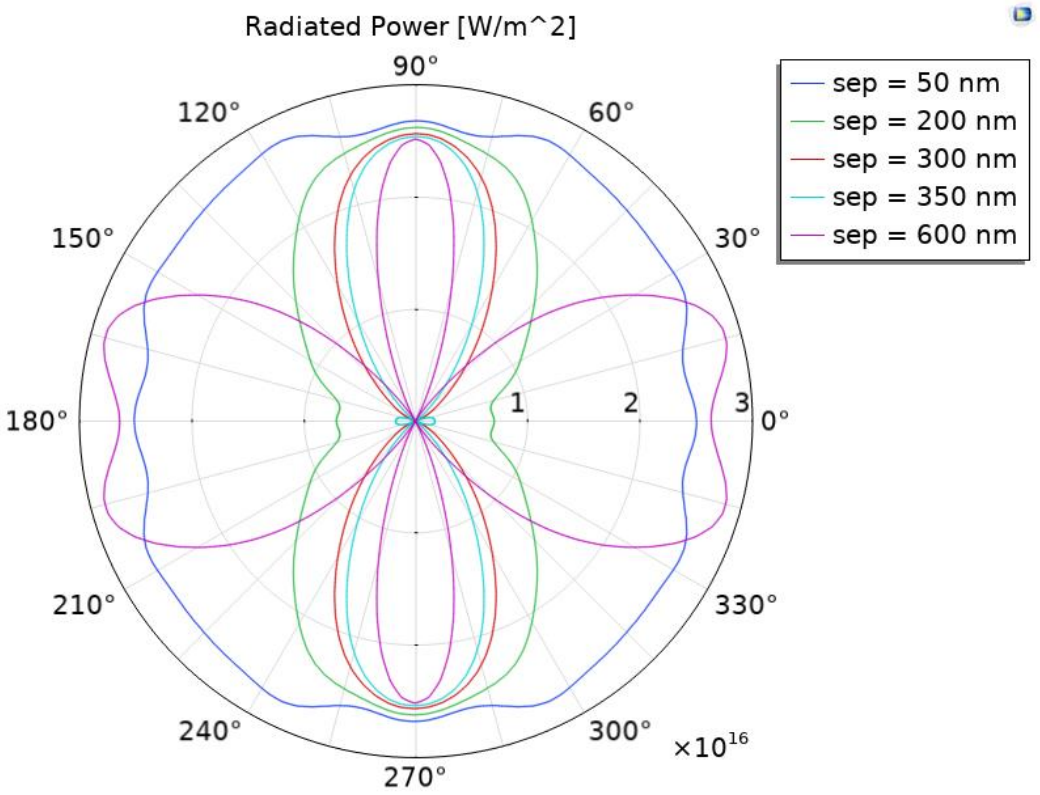
COMSOL: Today

- Optimizing a parameter → parameter sweep
  - It allows us to evaluate our model's properties w.r.t this parameter





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