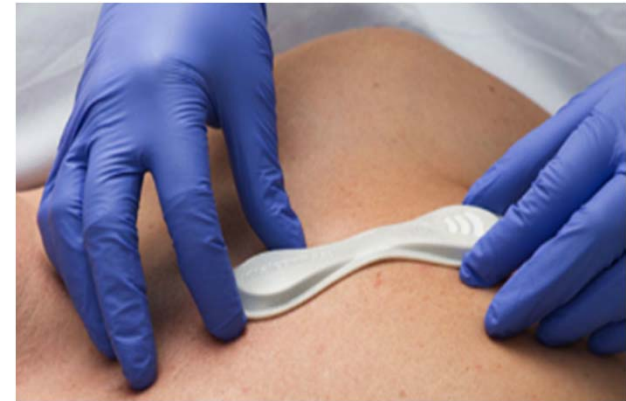
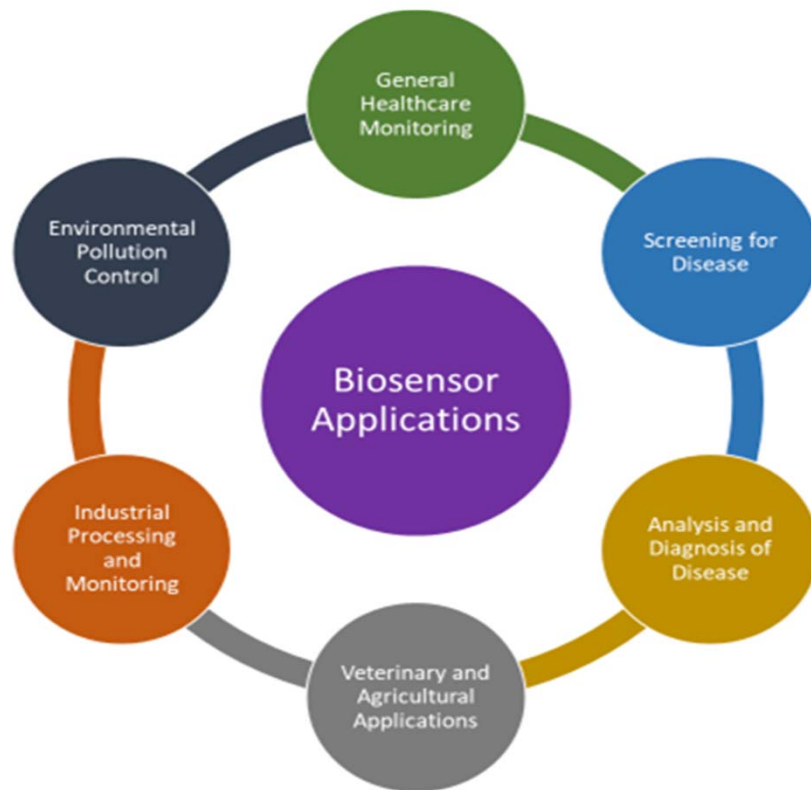


Photonic Biosensor

Advisor: Dr. Eric Seabron
Samuel Dowling, Jerome Halsell,
Rachel Hurst, David Masale

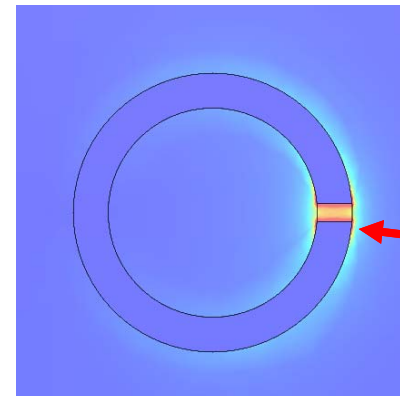
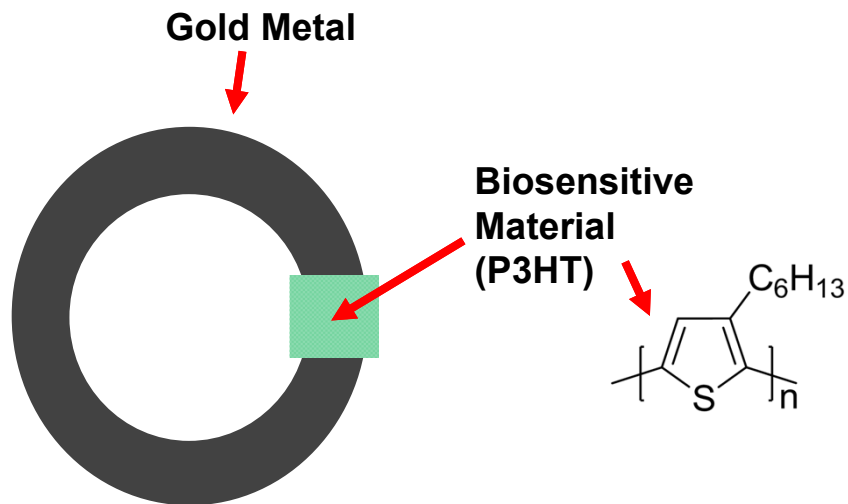
Why Biosensors?



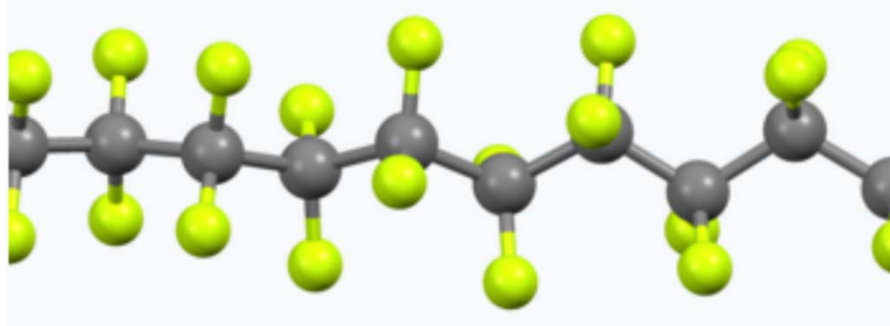
Background



Design Requirements



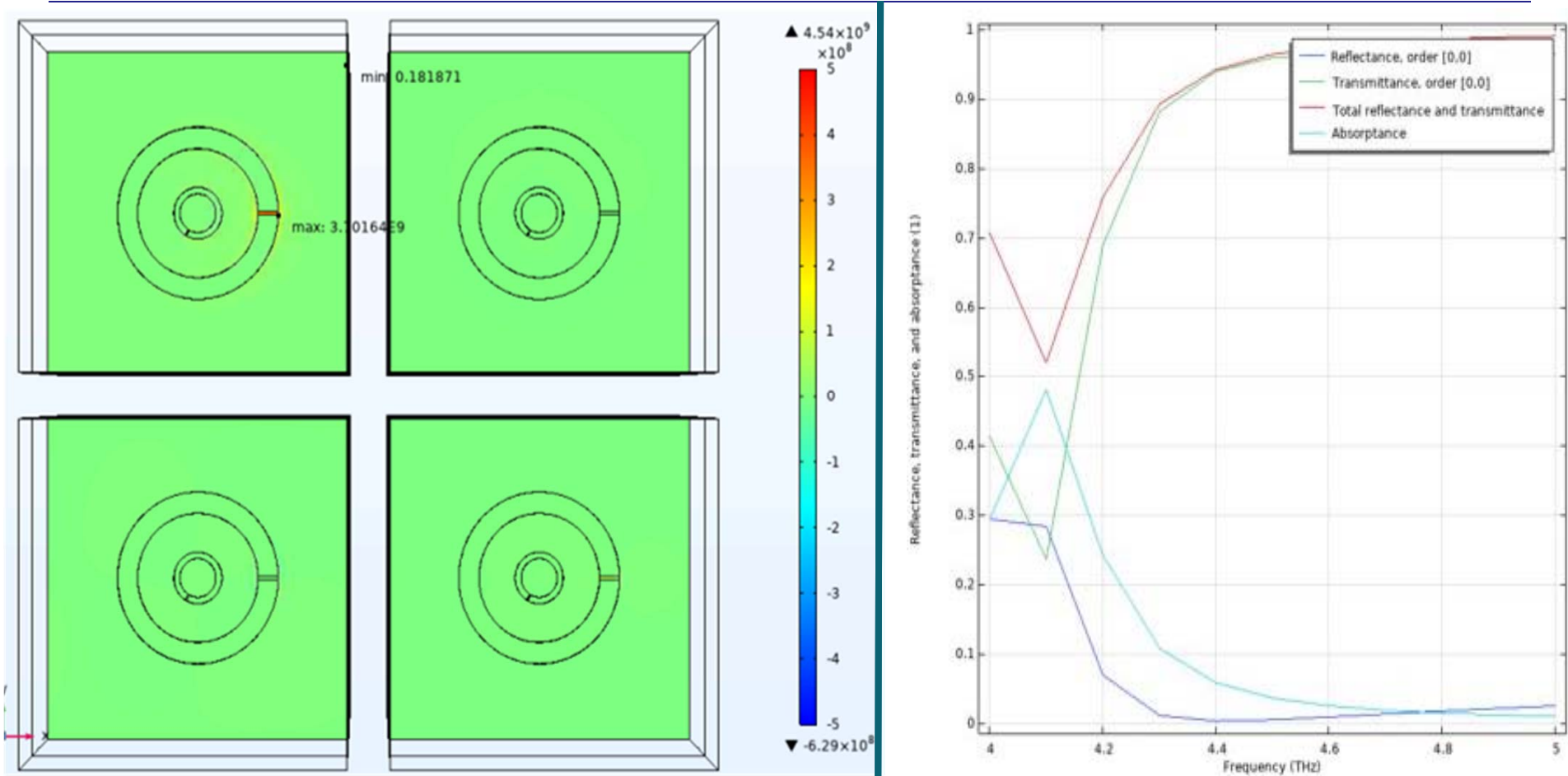
COMSOL EM Simulation for Split Ring Resonator



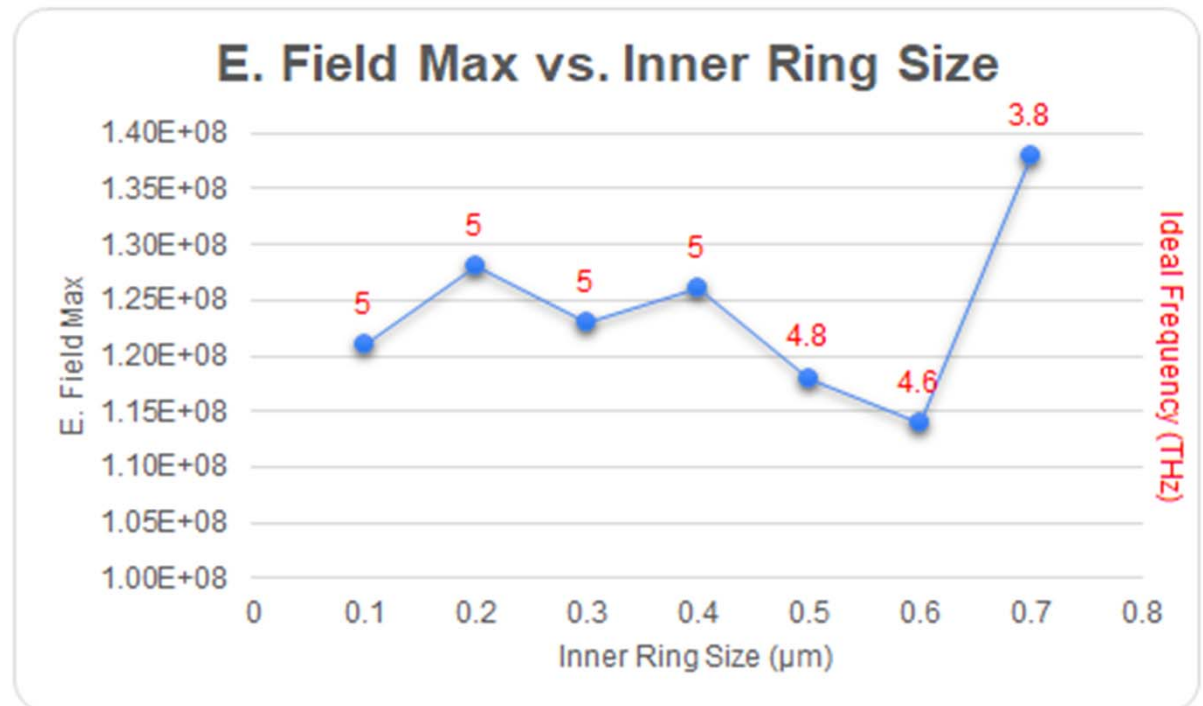
Polytetrafluoroethylene (PTFE)



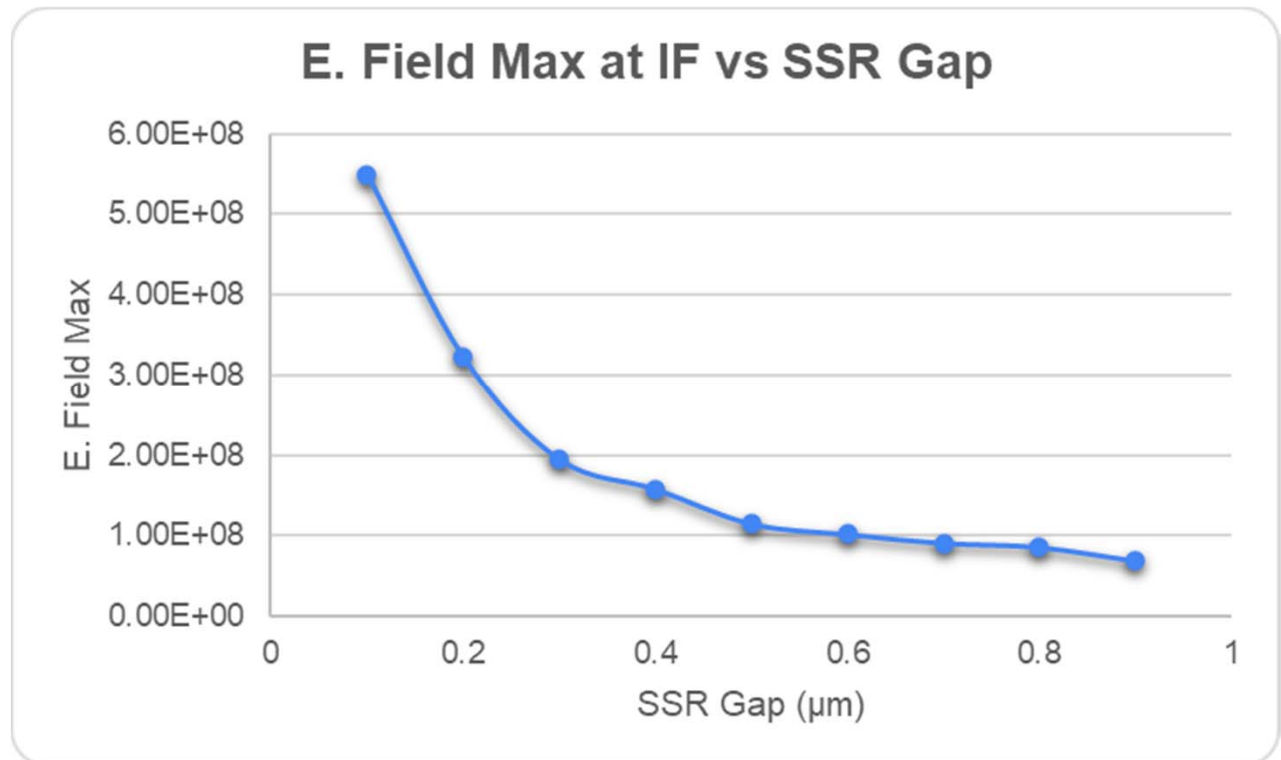
Solution Design



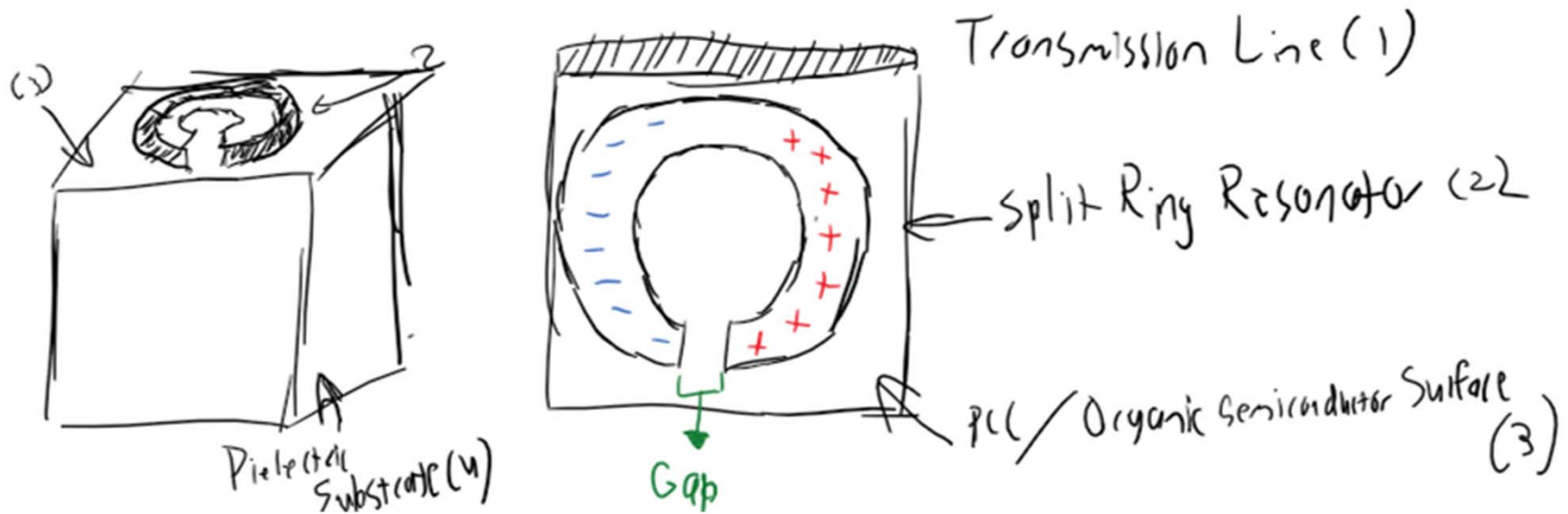
Inner Ring Size (μm)	Ideal Frequency (IF) (THz)	E. Field Max
0.1	5	1.21E+08
0.2	5	1.28E+08
0.3	5	1.23E+08
0.4	5	1.26E+08
0.5	4.8	1.18E+08
0.6	4.6	1.14E+08
0.7	3.8	1.38E+08



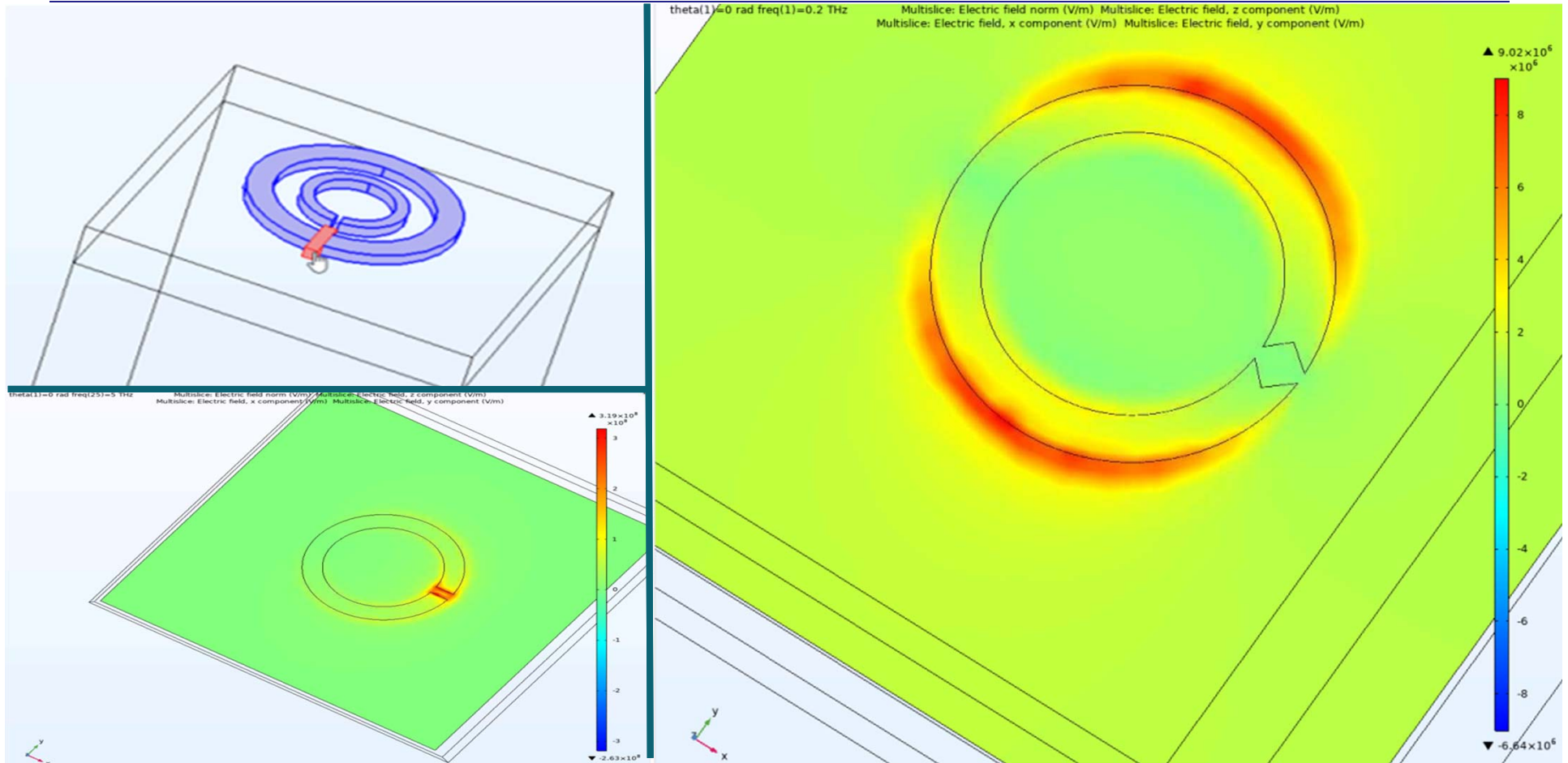
SSR Gap (μm)	E. Field Max at Ideal Frequency
0.1	5.50E+08
0.2	3.23E+08
0.3	1.95E+08
0.4	1.58E+08
0.5	1.15E+08
0.6	1.02E+08
0.7	9.11E+07
0.8	8.60E+07
0.9	6.89E+07

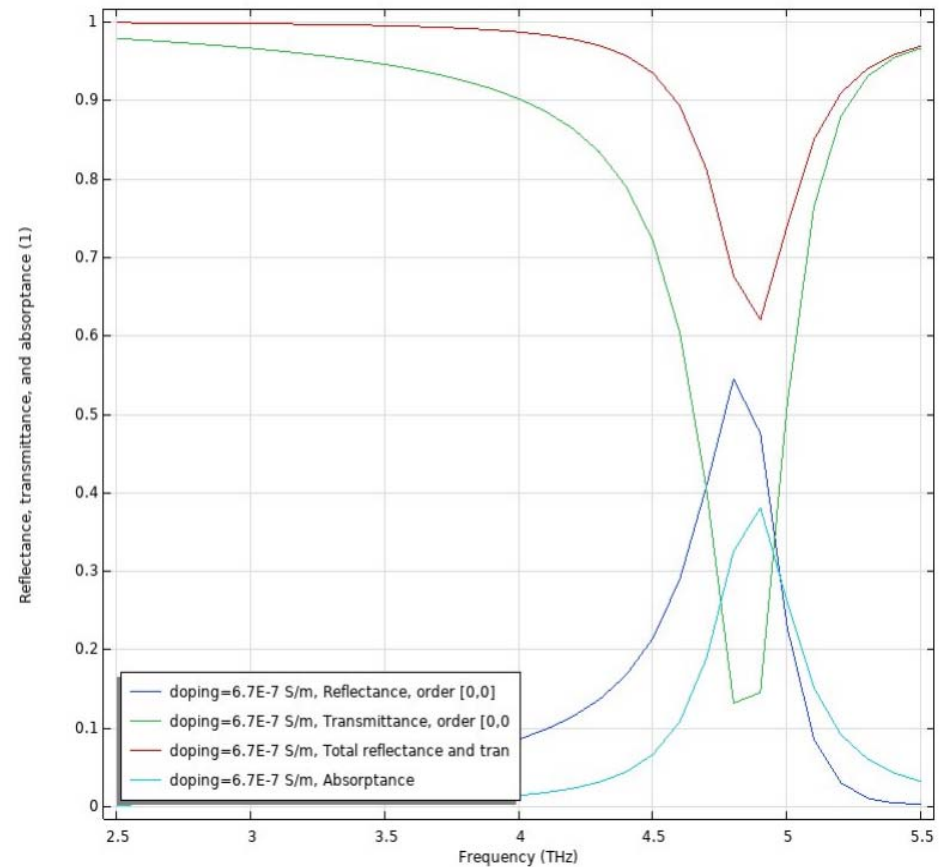
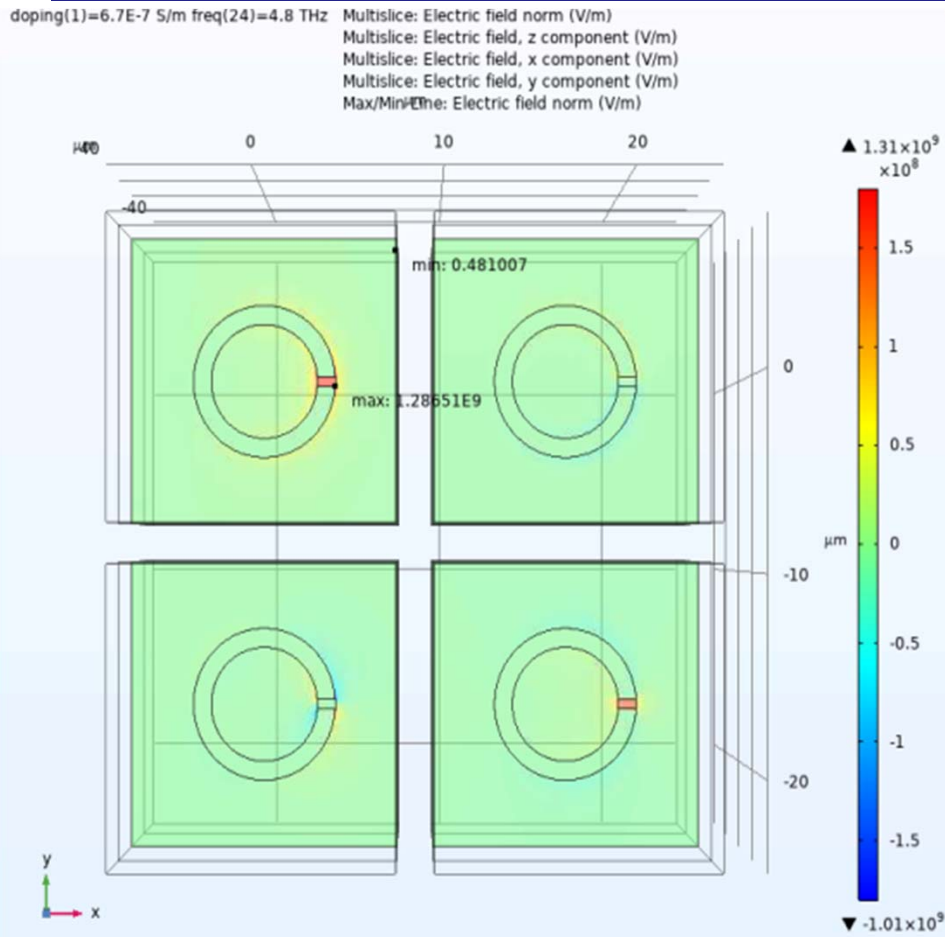


Implementation Process: Sprint 1



Implementation Process: Sprint 2





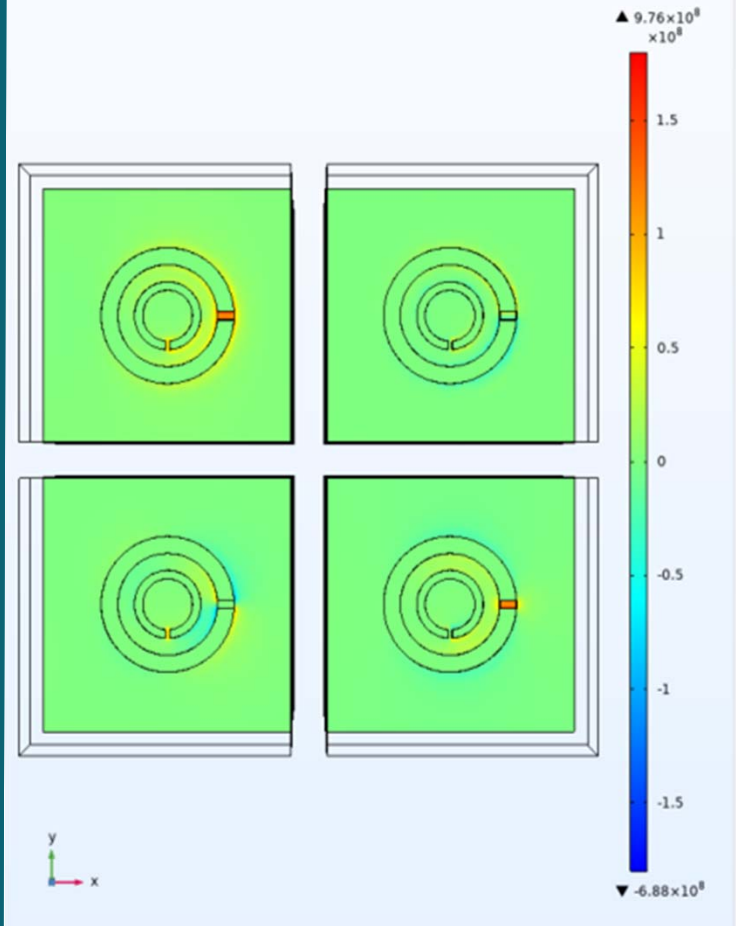
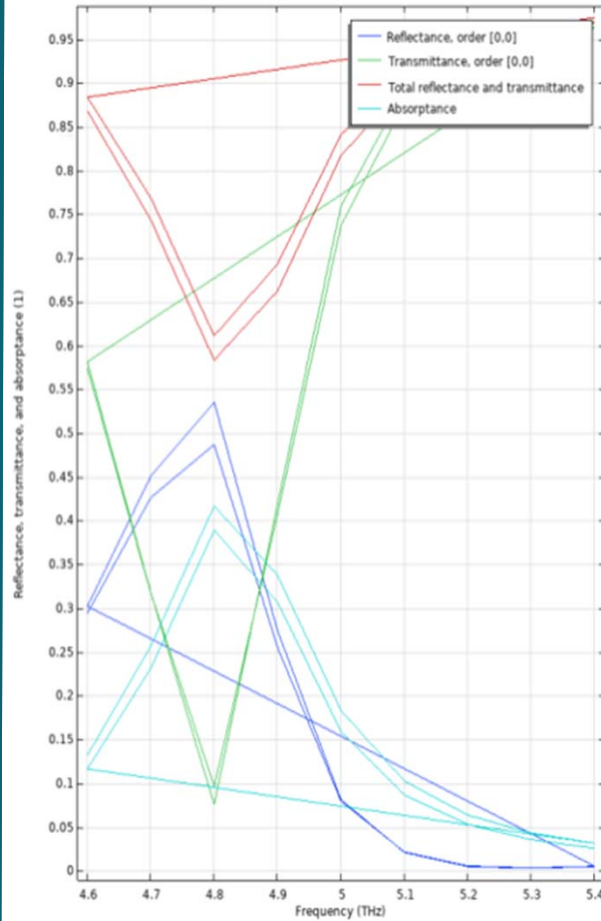
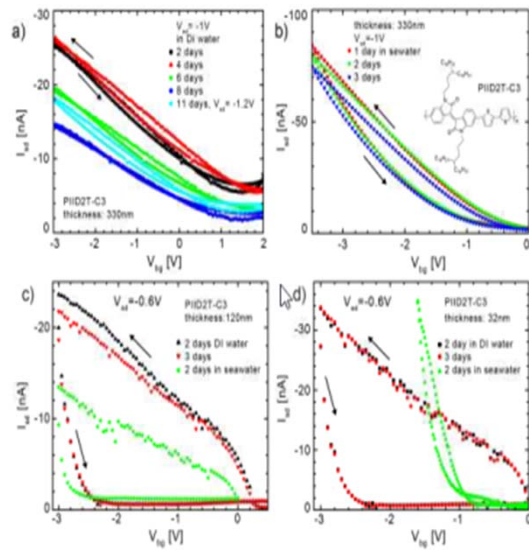


Figure 6. Transmission spectral curves of the blank sensor and the sensor covered with six different CSs.

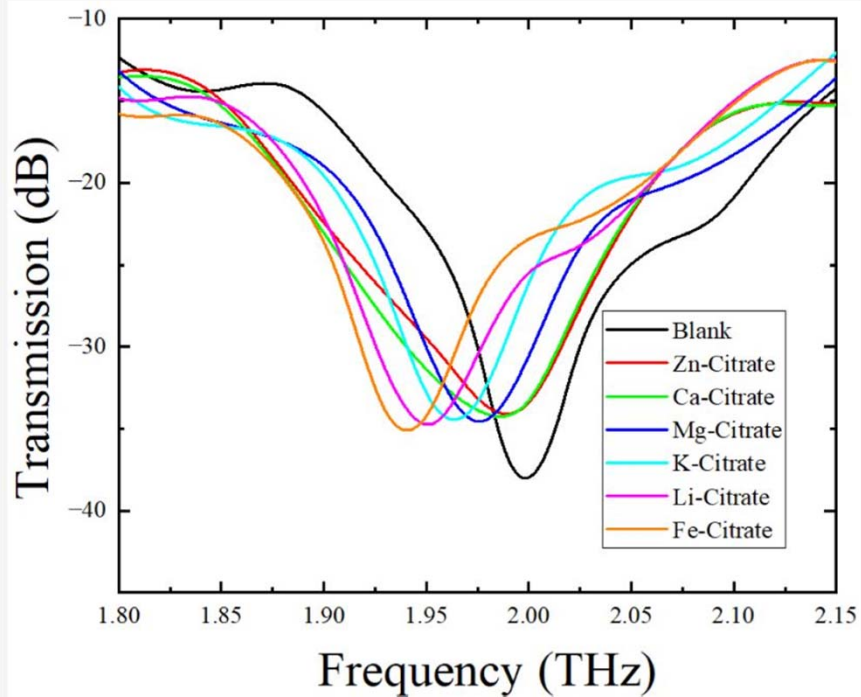
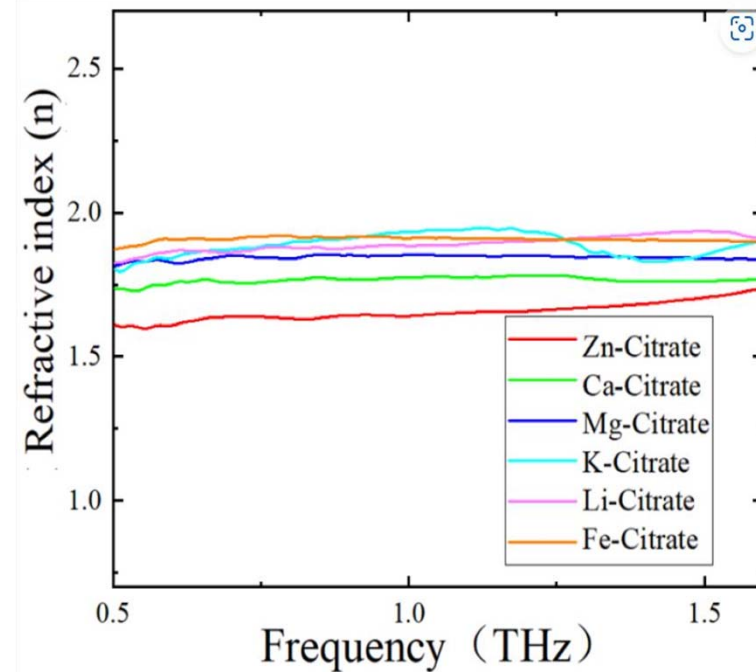


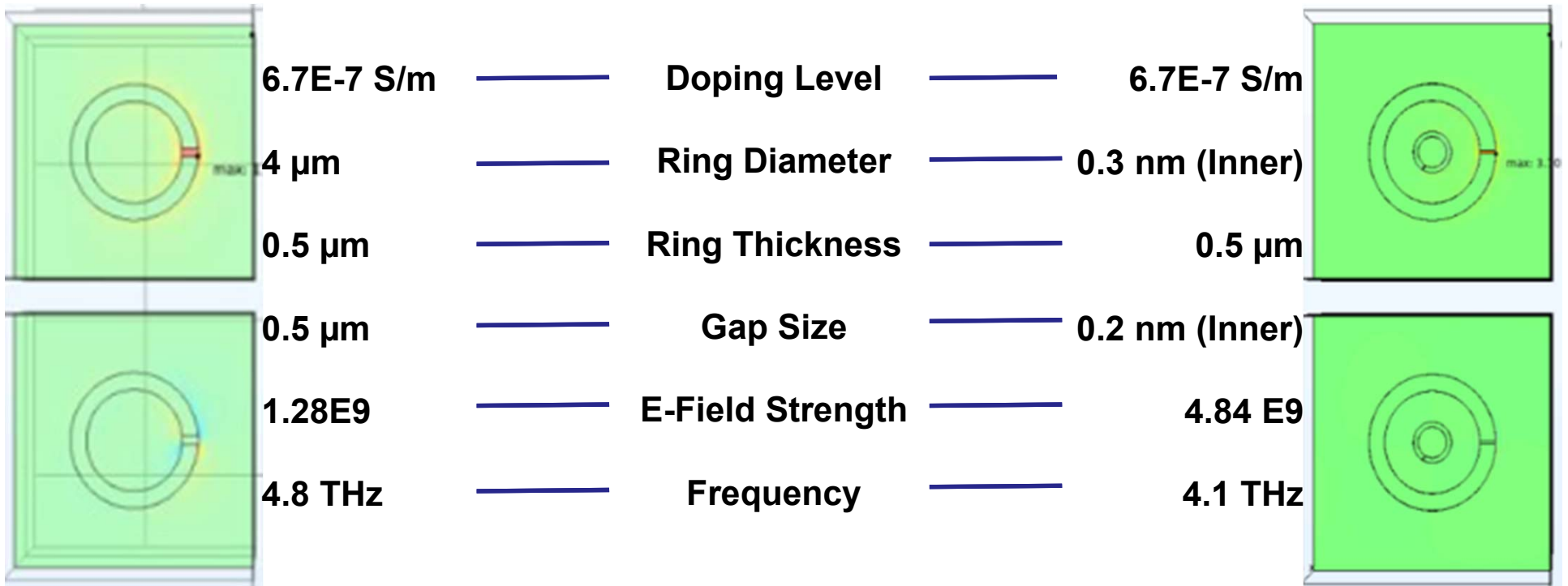
Figure 7. Refractive indices of CSs measured by THz-TDS system.



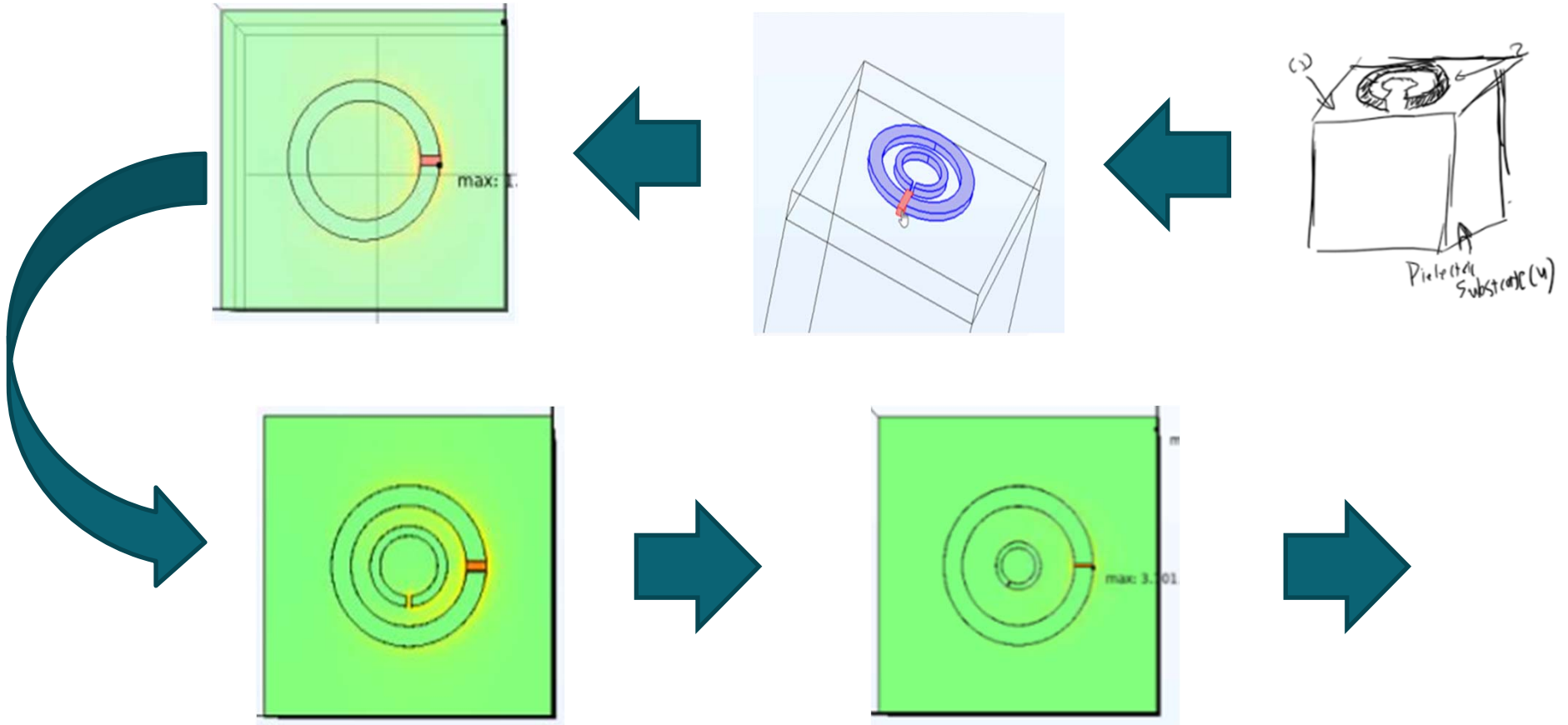
Conclusion

Single Split Ring Resonator

Nested Split Ring Resonator



Conclusion



Conclusion

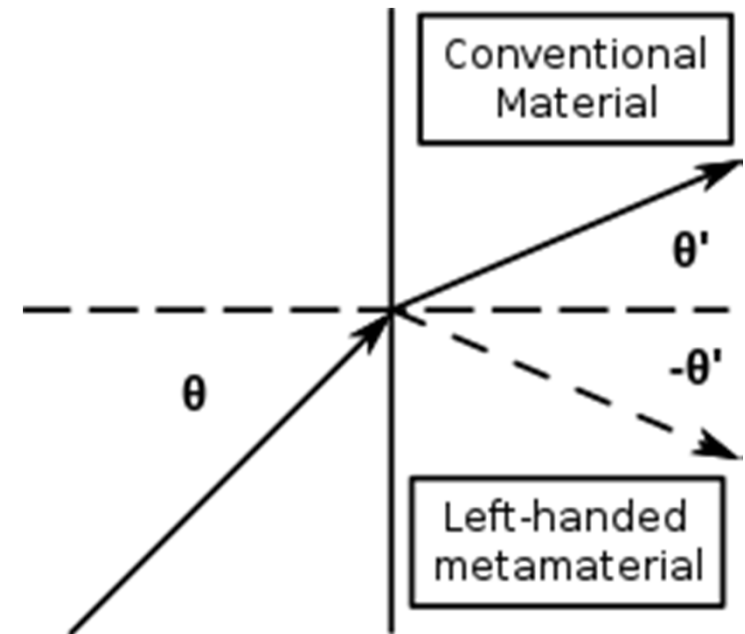
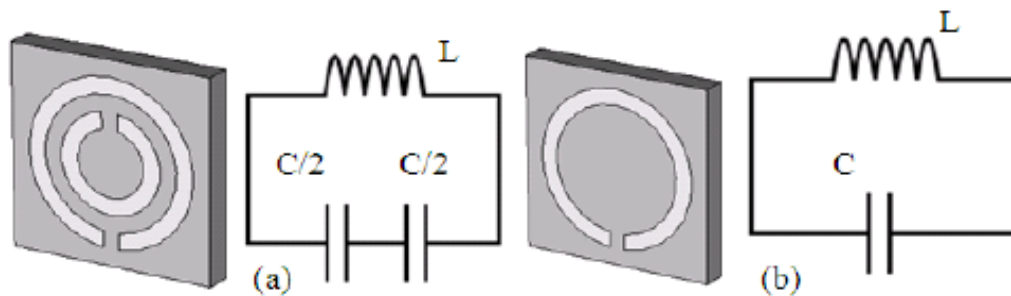
Goal accomplished!

Sensitivity increased by

71.8%

Conclusions

- Split ring resonator equivalent circuits
- Finite element analysis
- Sensitivity analysis on photonic devices
- Physics of Photonic devices
- Meta Materials and left-handed media

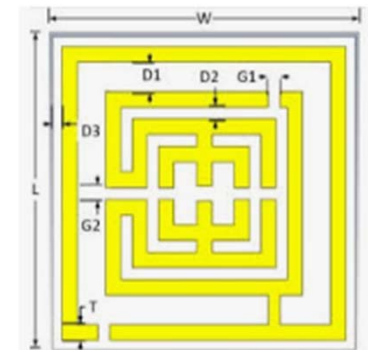
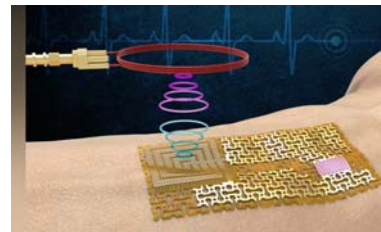
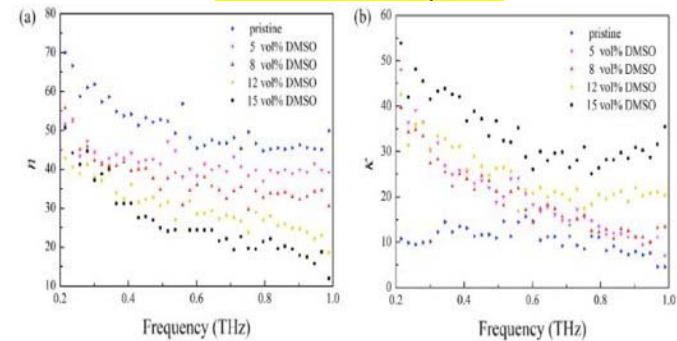


https://www.researchgate.net/figure/Split-ring-resonator-and-its-equivalent-circuit-a-double-SRR-b-single-SRR_fig1_236635495

https://en.wikipedia.org/wiki/Negative_refraction

- Simulate Various environments (ie on skin, inside body, etc)
- Explore Exotic Resonator Geometries to maximize sensitivity
- Experiment with electrostatic integration for optoelectronic devices
- Further explore biosensor sensitivity to other analytes (salinity, iron concentration in blood, etc)

PEDOT THz Response



**Thank you for your
time!**

Any questions?