

Miniaturizing Ion Thruster using Split Ring Resonator (SRR)

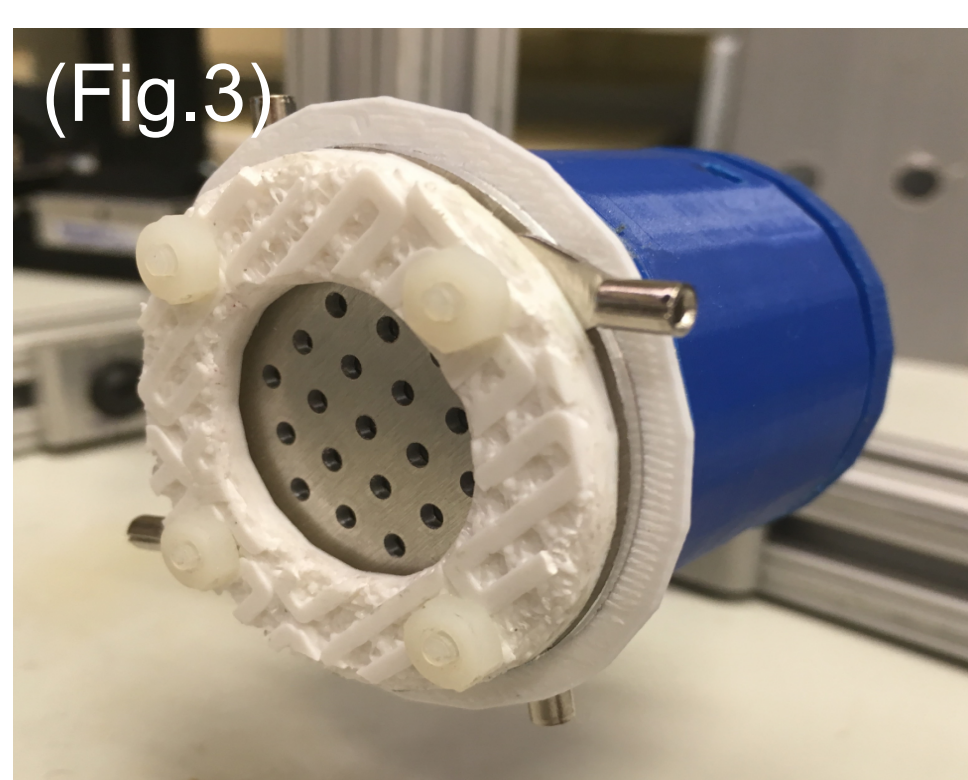
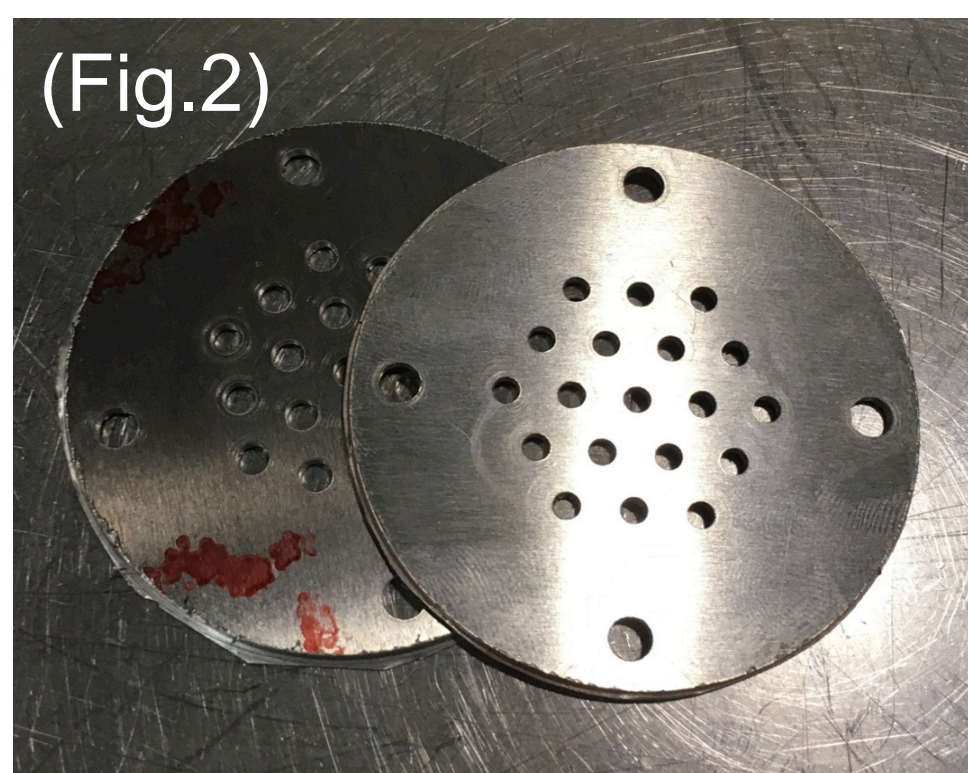
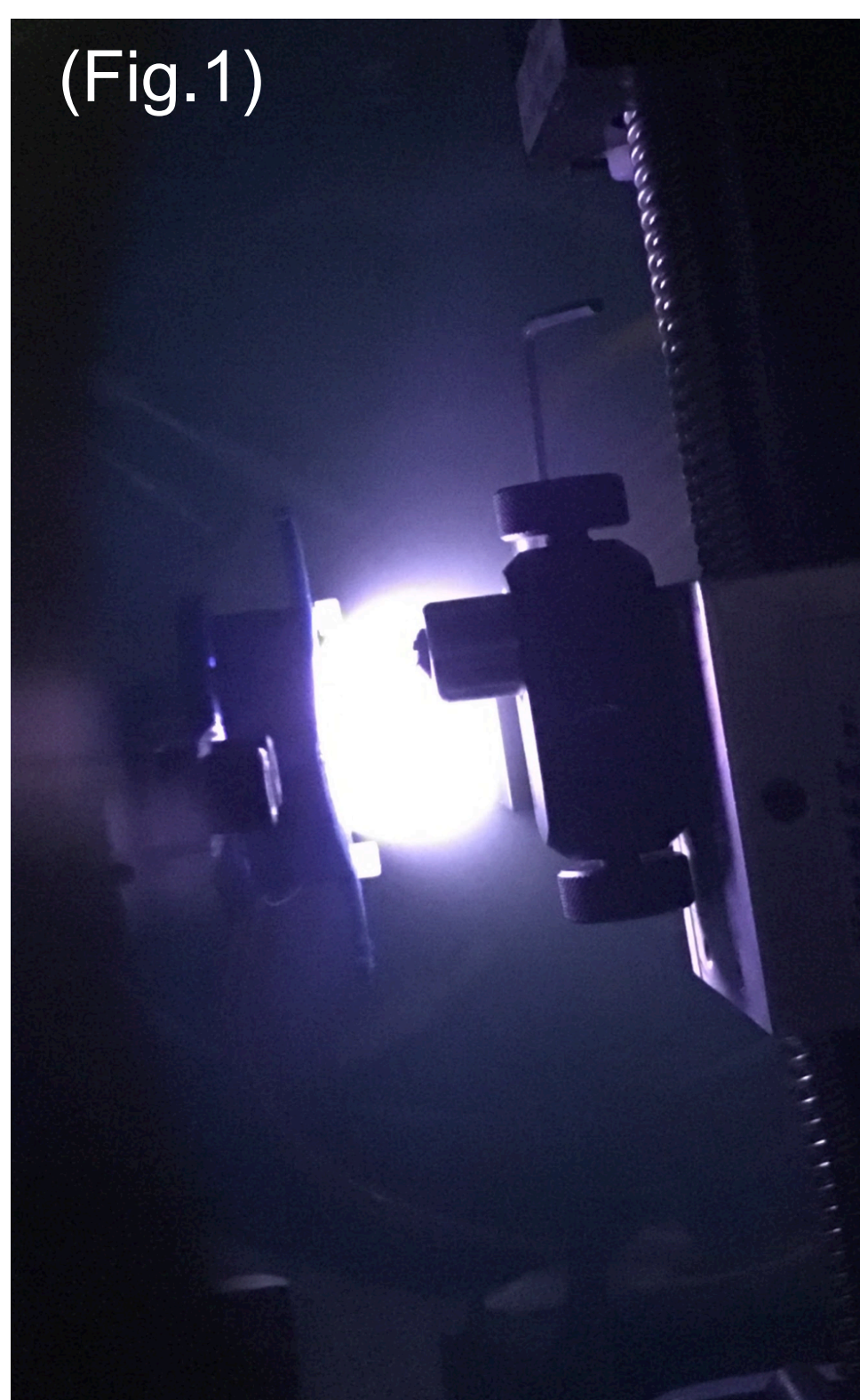
Toyofumi Yamauchi, Dr. Gabe Xu
Mechanical and Aerospace Engineering

Motivation

- The goal of this project is to use a Split Ring Resonator (SRR) as the plasma generator in a small ion thruster.
- The growth of the small satellite field means an increased need for miniaturized thruster systems.
- The SRR has the small size, long lifetime, simple design, low cost, and the potential to be a good plasma generator in small ion thruster.

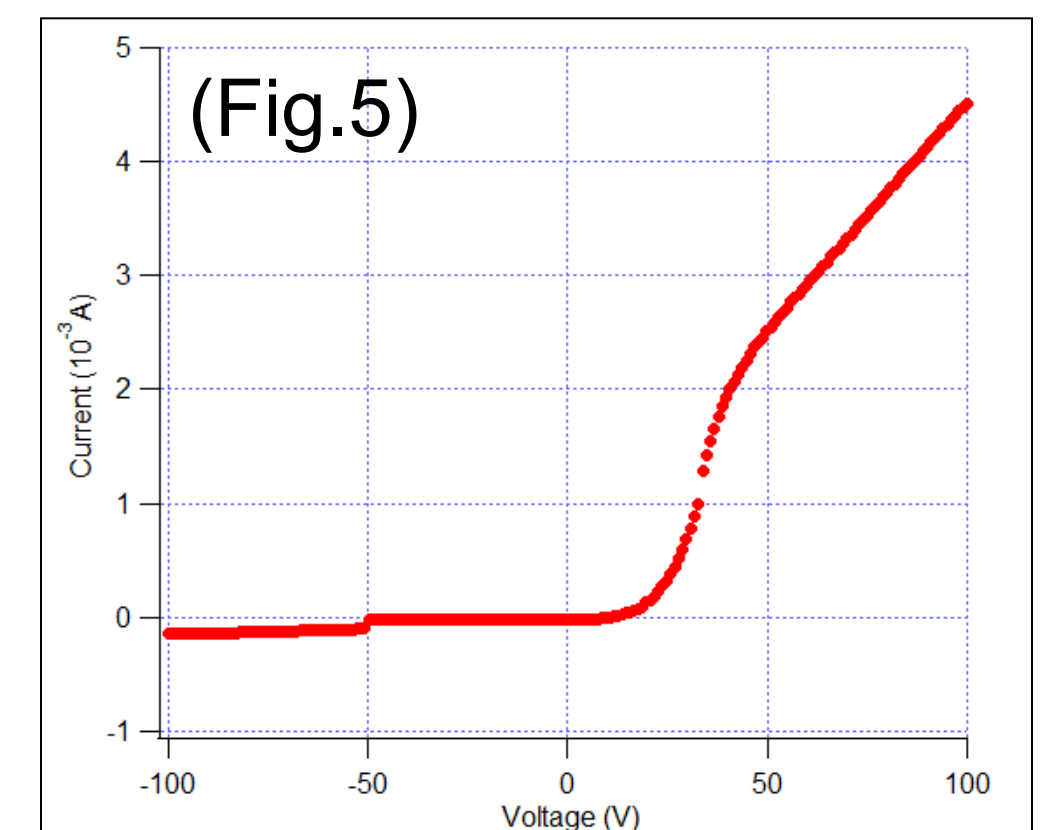
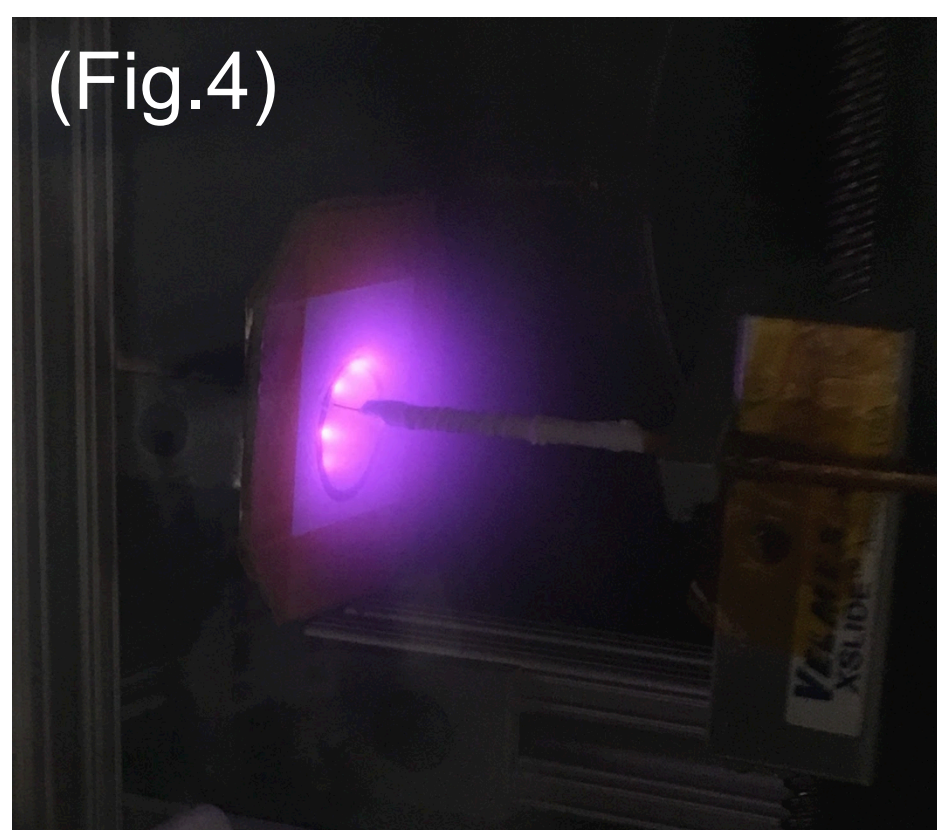
Result

- The SRR was fabricated at PRC and it successfully generated plasma. (Fig.1)
- The ion optics was designed based on the measured plasma properties and it was fabricated at UAH Machine Shop. (Fig.2)
- The thruster has been assembled, but not operated yet. (Fig.3)



Method

- Langmuir probe was used for measuring plasma properties generated at SRR. (Fig.4)
- Plasma properties (T_e and n_i) calculated from I-V curves (Fig.5) will determine the dimension of the ion optics and the performance of the ion thruster.



Simulations

- The dimension of SRR was selected based on the simulation results. (Fig.6)
- ANSYS High Frequency Structural Simulation (HFSS) was used.

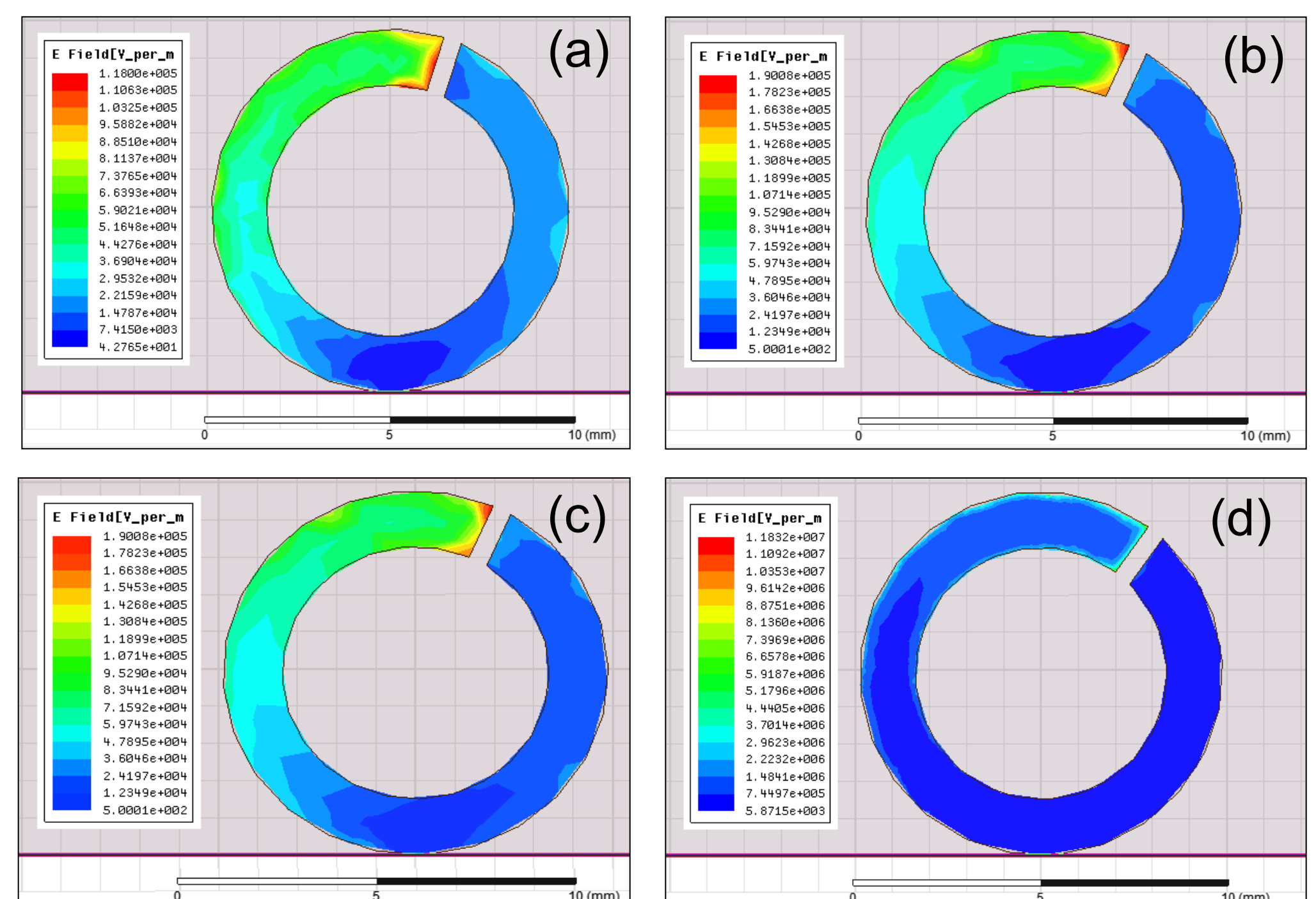


Fig.6: ANSYS HFSS results (a) 18° (b) 24° (c) 30° (d) 36°
(1.5 mm ring width, 500 μm gap 1.8 GHz frequency)

Acknowledgements

The author would like to thank UAH Honors College for the support over the summer. The author also appreciate with Robert Dexture and Daniel Corey for their help on fabrication.