Introduction
- Underground localization in mining situations is very important for worker safety, and methods like GPS do not work as GPS cannot penetrate through the ground.
- A system was designed using RFID tags hung on the walls of the mine, a wearable antenna, and a receiver antenna & processor.
- Our goal was to refine this design, and my portion was to design a 915 MHz monopole antenna with a highly directional pattern.
- We went through several iterations (see below) using HFSS and CEMS:
  - Dipole with and without a tuning inductor
  - A monopole with a cylindrical reflector
  - A monopole with varying sizes of corner reflector

Simulation Results
- We looked at three main parameters: $S_{11}$, Realized Gain, and main beam width.
- We optimized several parameters of our final design, including reflector height (H), angle ($\Theta$), and distance of the monopole from from reflector apex (S).

Optimized Design & Results
- We found that a monopole with a corner reflector generated the most ideal results:
  - Resonance: 875 MHz – 1 GHz
  - $S_{11}$ at 915 MHz ≤ -14dB
  - Maximum Realized Gain: 7.9 dB
  - Beam Width in XY Plane: 14.93 Degrees

Conclusion
- Future work for this project involves optimizing the design to have a significantly smaller footprint.
- Fabrication of the antenna and measurement in the anechoic chamber
- Integration of the antenna with the other components of the localization system.

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References