COE TTHP Fourth Annual Technical Webinar Meeting

AN008: ILS Zone 3 Measurement

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Center of Excellence for Technical Training & Human Performance

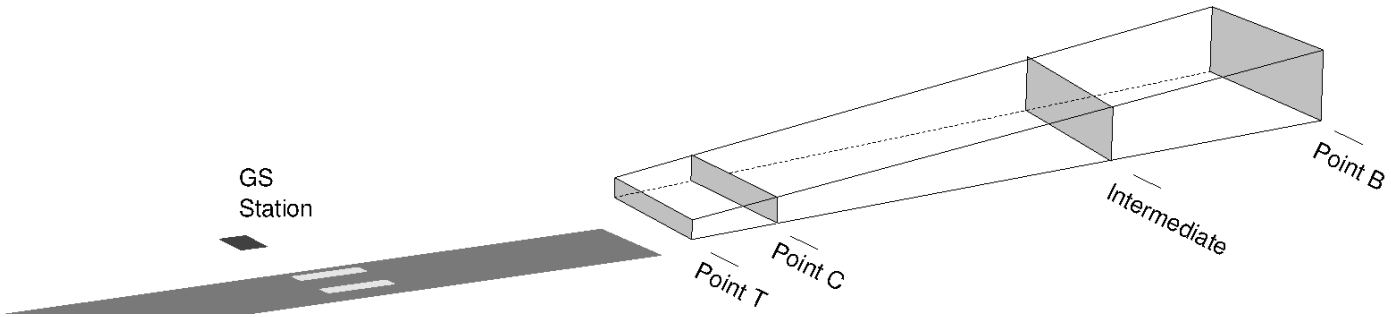
In Situ Measurement of ILS Signals

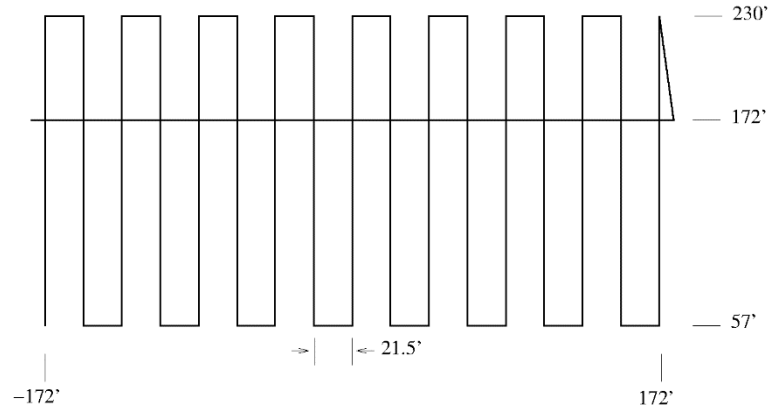
- Historically performed exclusively with manned inspection flights
  - Time consuming
  - Expensive
  - Limited area coverage
- Augment with UAS-borne measurements
  - Rapidly deployable
  - Less costly
  - May focus on identified signal anomalies
- Enhance station calibration and improve safety

Oklahoma State University Efforts

- Integrate software-defined radio (SDR) ILS receiver developed by University of Oklahoma to a moderate sized rotary-winged UAS
- Measure ILS signals in situ in Zone 3
  - RTK-GPS integration provides precise navigation
- Visualize measured signals throughout Zone 3
  - Redistributable software package
  - Easily readable and interpretable by human operators

Measurement Plan





- UAS will sample signals in cross-sectional planes of Zone 3
  - Fine spatial sampling to identify signal structure
  - Vertical-based sampling in plane
    - Samples glide-slope deviations more finely
    - Optimal use of battery life

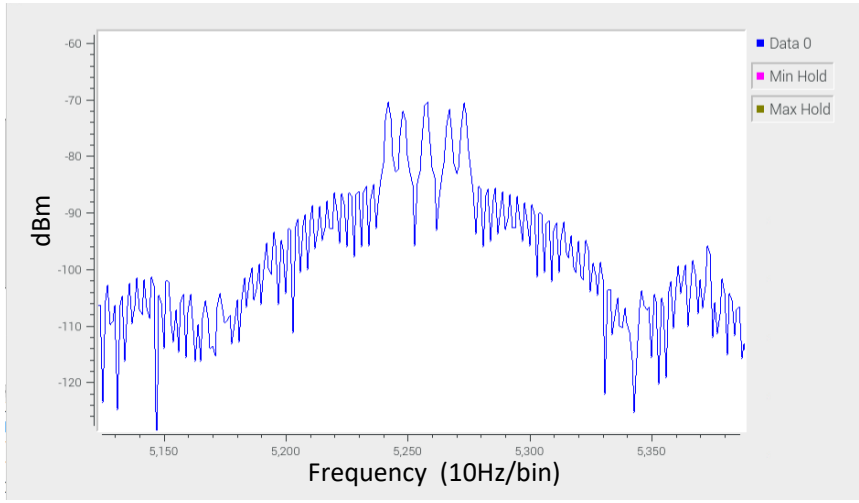
Initial Test Flights

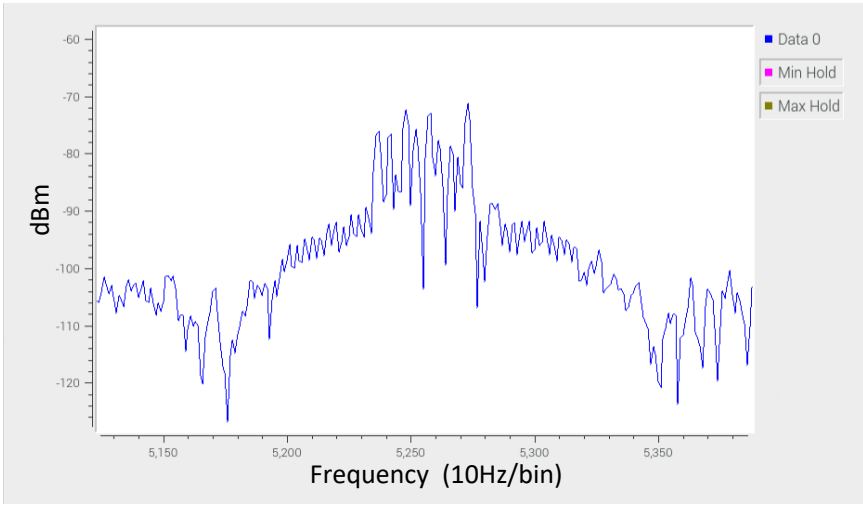
- In situ measurements north of Stillwater Regional Airport (SWO)

Challenges

- Signal interference
  - Electromagnetic interference (EMI) from UAS communication system and electric motors
  - Propeller-induced Doppler spreading
- Local test configuration established

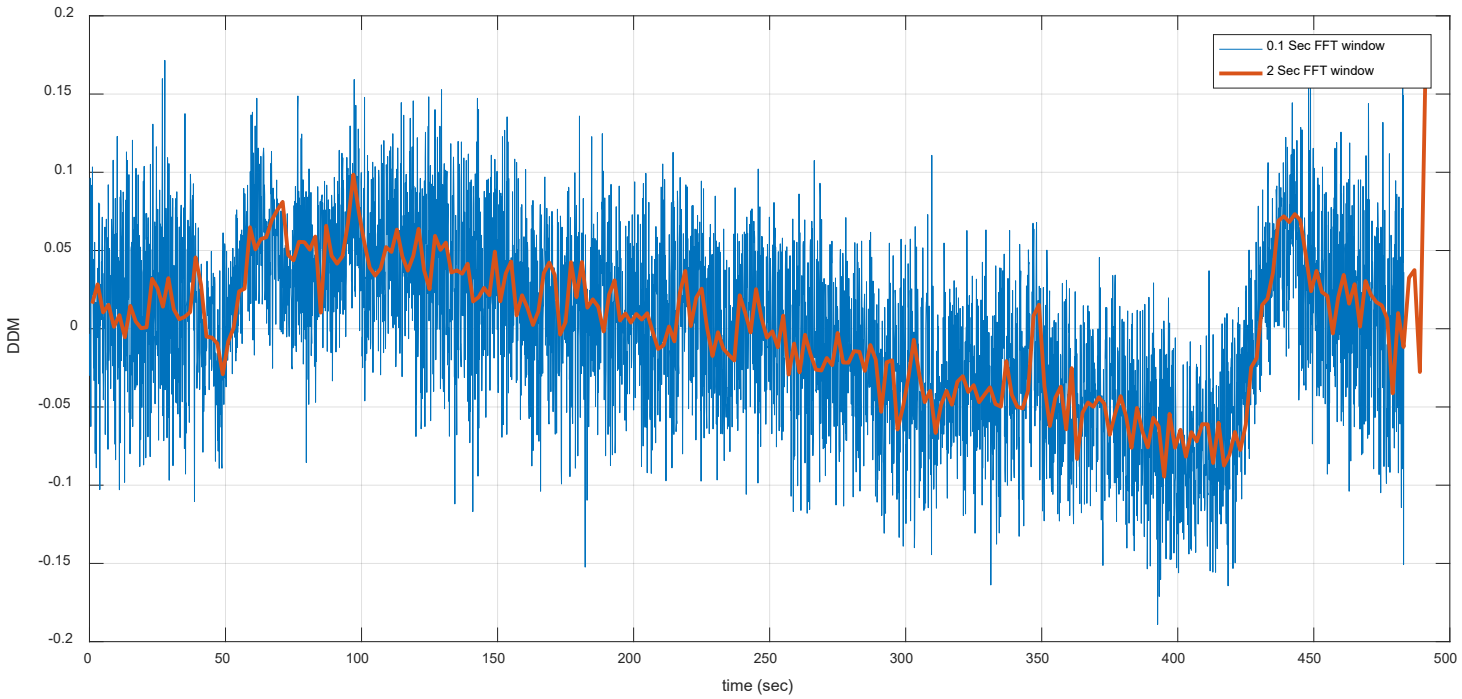
FFT window duration = 0.1 sec





LOC Signals

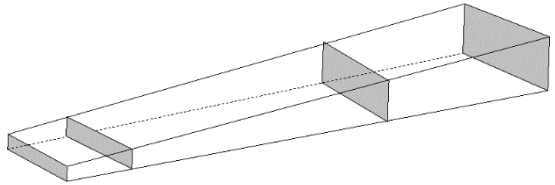
- Interference affects measured DDM
  - Improved with filtering at expense of resolution

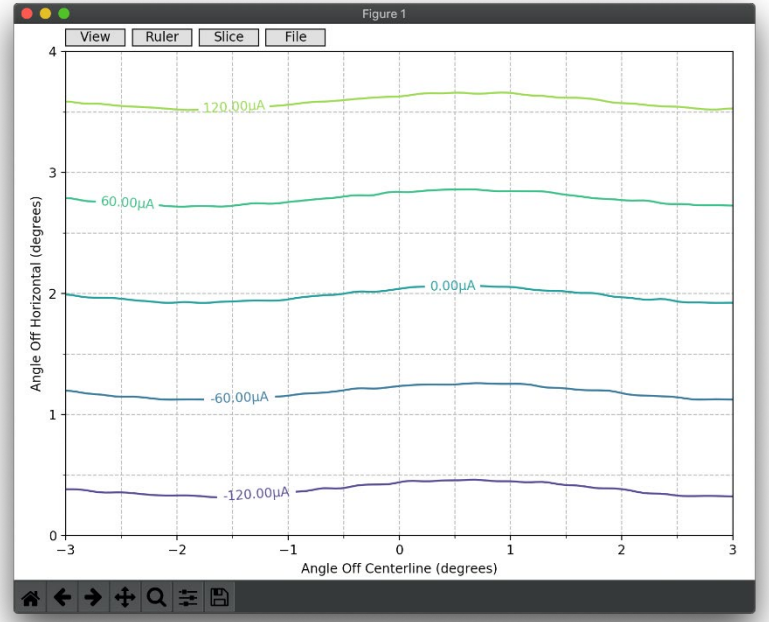


LOC DDM – May 1st flights

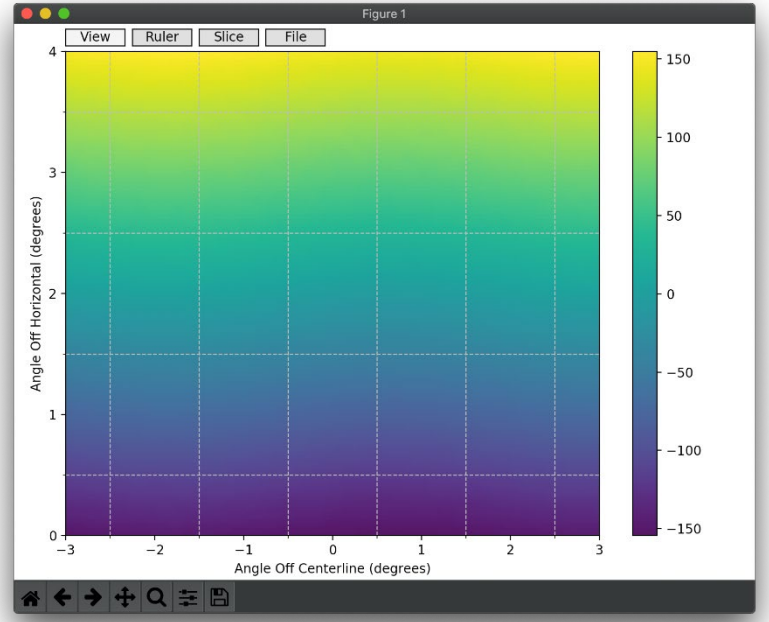
Visualization

- Being implemented using simulated measurements
- Interpolated throughout 3-D Zone prism





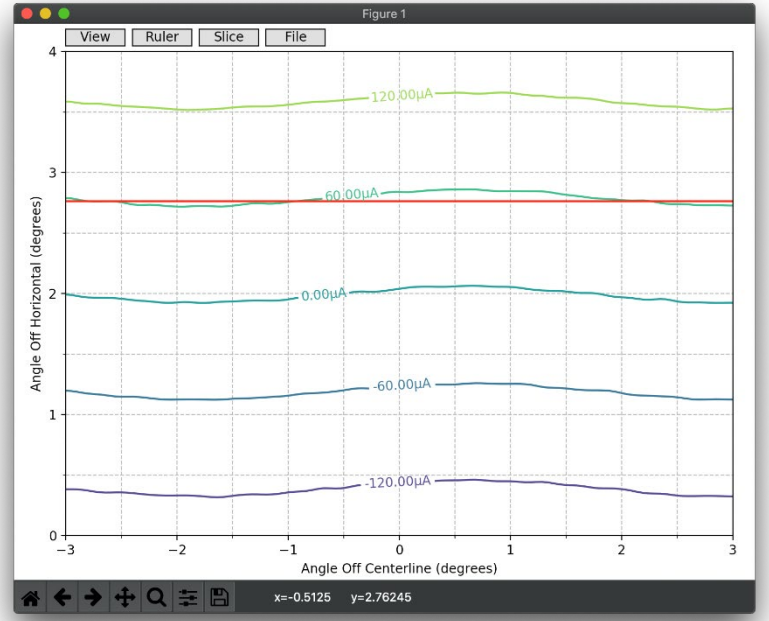
Glide-slope isolines

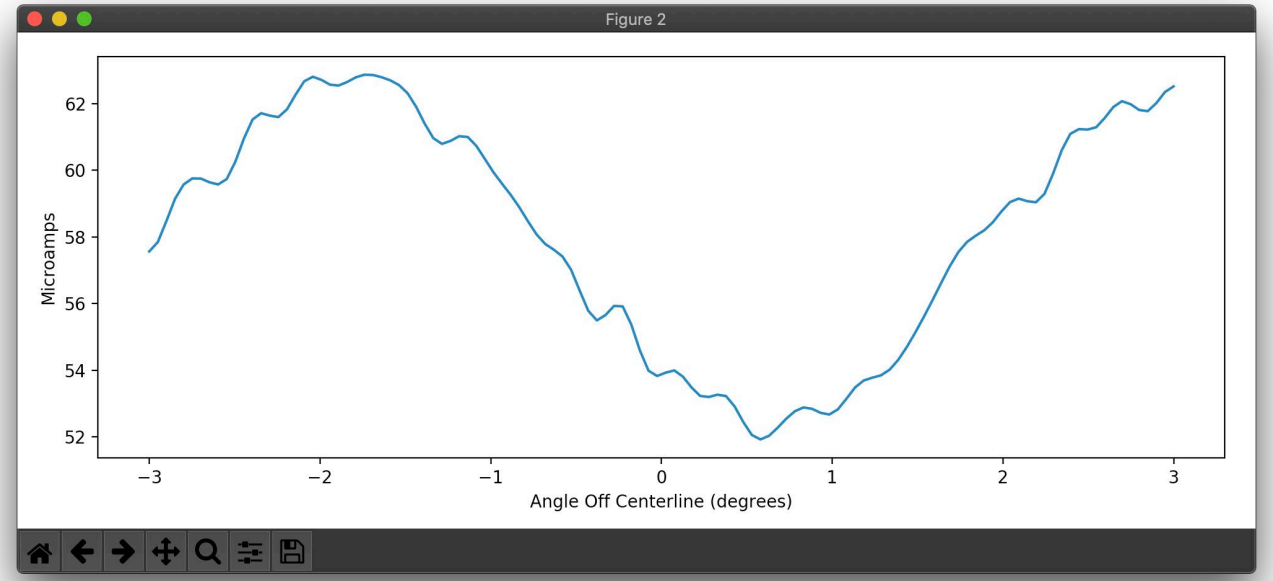


Glide-Slope Heatmap

Visualization

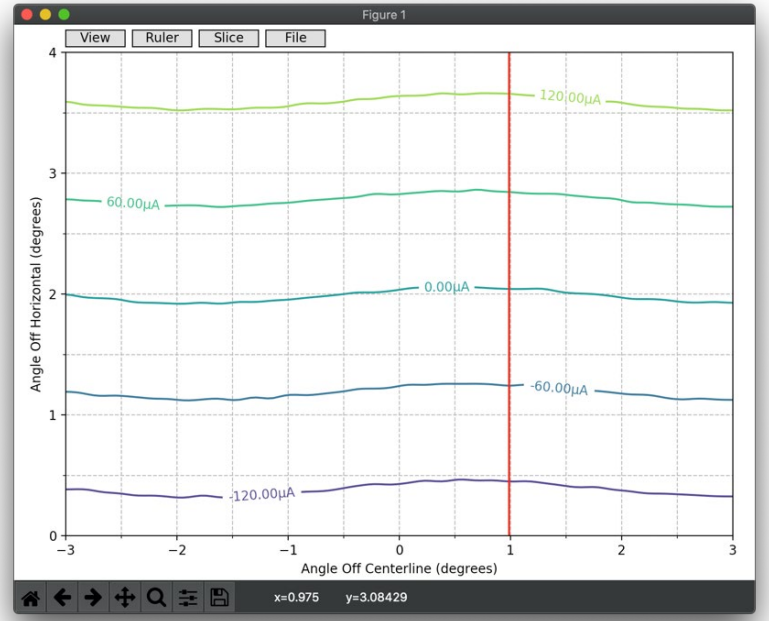
- Horizontal slice

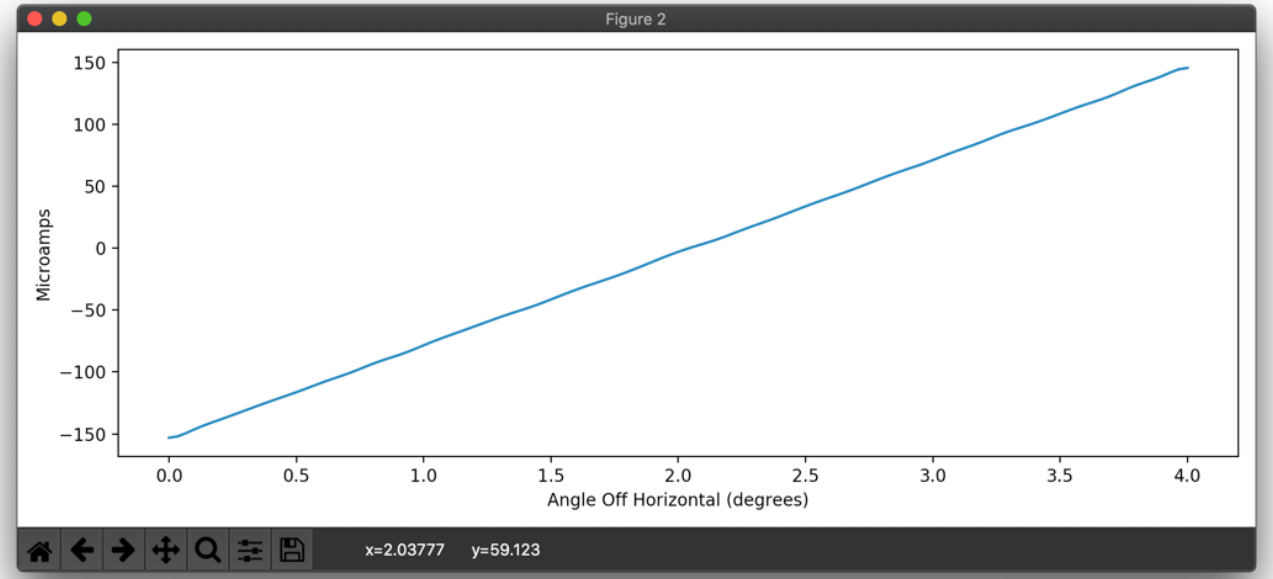




Visualization

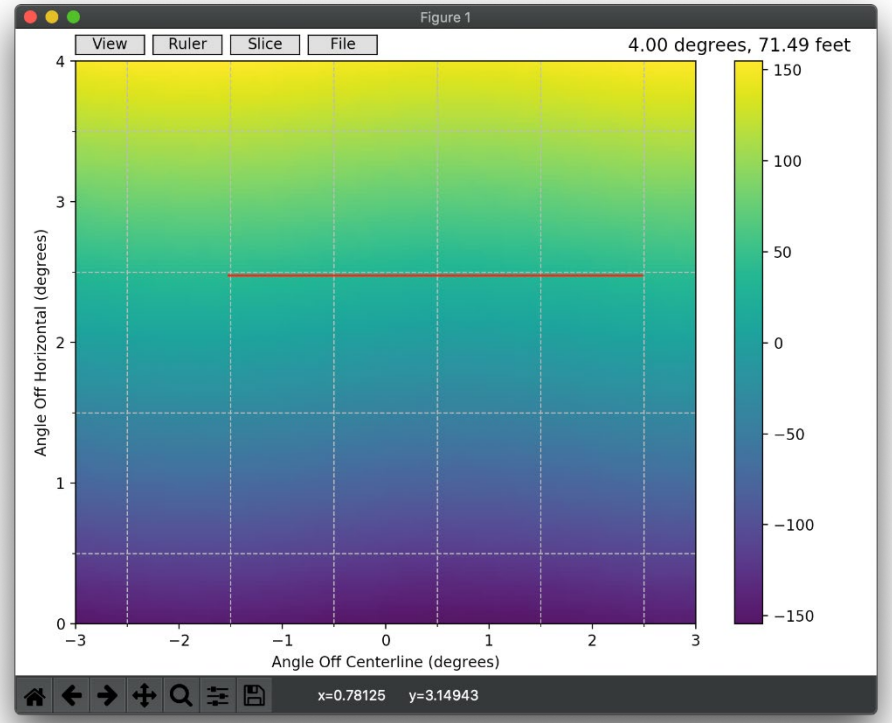
- Vertical slice

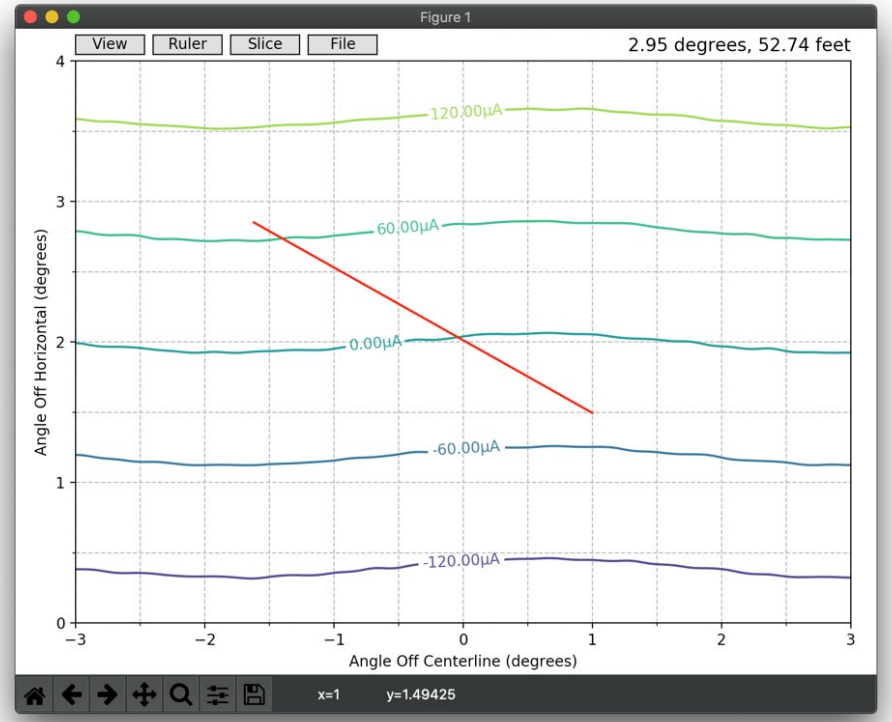




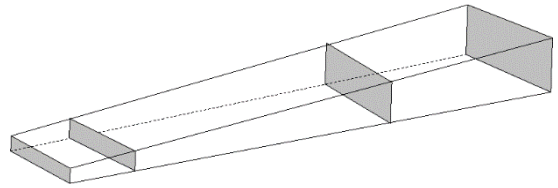
Visualization

- Ruler distance

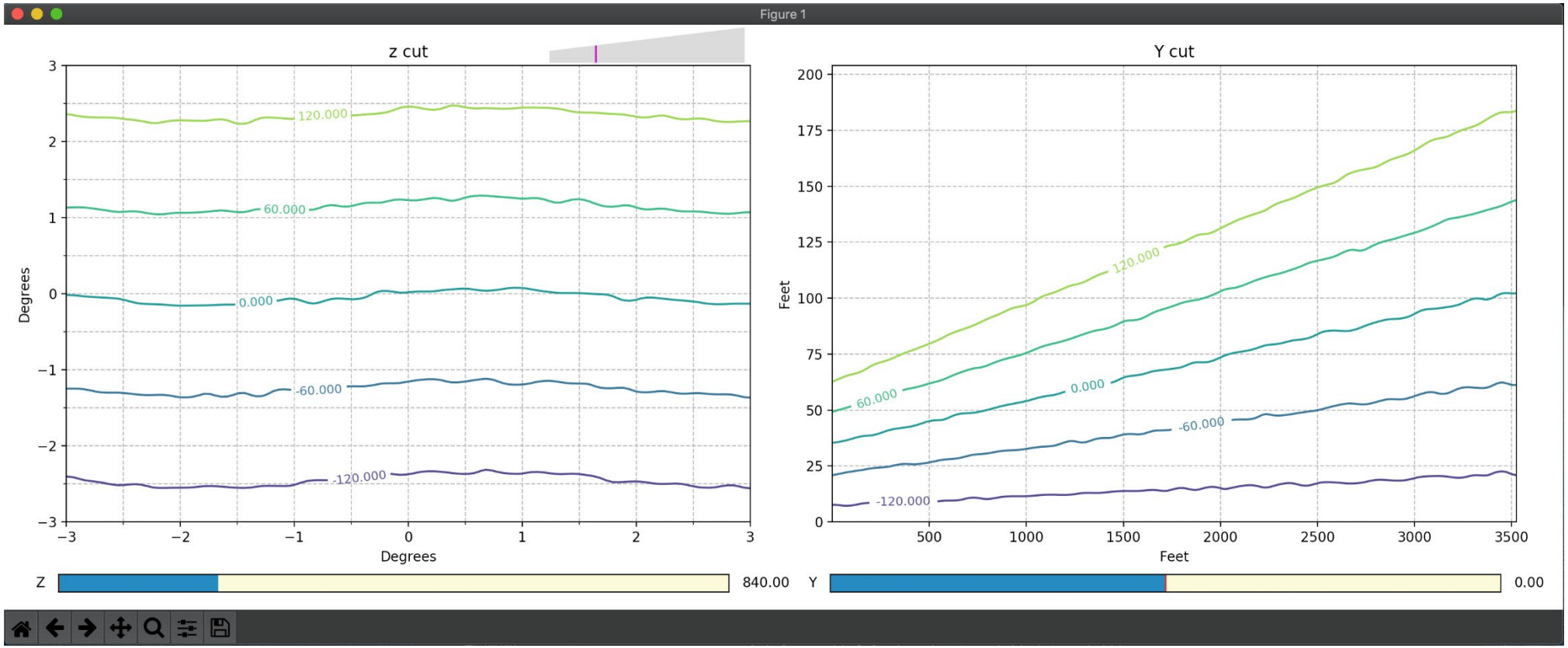




Visualization

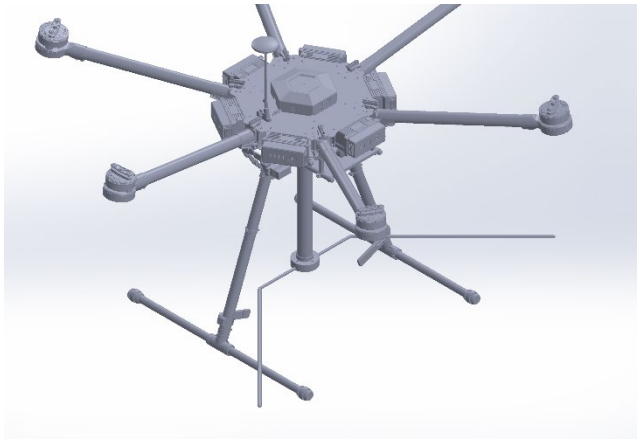


- Adjustable range



Future Work

- Modify ILS antenna mount to allow landing gear to be raised in flight
  - Increases distance from communication antennas
- Enclose motors in Faraday cages
- Refine visualization in consultation with FAA end users
- Development of a dedicated UAS platform
  - In conjunction with new industry partner Essential Aero
  - Fully NDAA compliant
  - Address interference issues
    - ILS antenna will be distanced from propellers, motors, and communication antennas
    - Shielding cages integrated into design
    - Non-conducting propellers



Questions?

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