<u>Simulation</u>

1. DTOA/DDOP.

Built localization simulation in matlab:

- a. Build a model for DTOA/DDOP measurements.
- b. Create grid in geo-coordinates and use PlotMap function.
- c. Add buttons to add platforms and create their paths on the grid.
- d. Add button to choose emitter location.
- e. Add optional inputs of f0, sample rate/ sample times, platform velocity in km/h (or m/h).
- f. Add button to show the size of the gradient at each point on the grid.
- g. Find σ_n as a function of the following noises: measurmetrs ($\mathbf{y} = \mathbf{y} + \Delta \mathbf{y}$), platform location errors, platform velocity errors and central frequency errors.
- h. Preform the localization algorithm DTOA, DDOP, DTOA+DDOP for 90% containment.
 - i. Create algorithm to choose N-1 pairs i.i.d

i.

- j. Calculate the CRLB and draw the final ellipse as function of this additional buttons/inputs:
 - i. SNR (typical values will be between 10-20dB)
 - ii. BW (from slider)
 - iii. Coherent time
 - iv. β_r (typical value is 1kHz).
- k. Preform the localization algorithm DTOA, DDOP, DTOA+DDOP for 90% containment.
- 2. Is the containment percentage equal to 90%?
- 3. Analyze these cases and explain the results:
 - a. All the sampling points are around the emitter in perfect circle.
 - b. The difference between 2 cases:
 - i. The emitter inside the convexhull of the sampling path
 - ii. The emitter outside the convexhull of the sampling path
 - c. The paths create X shape (one plane 45 degrees up and one 45 degrees down), the emitter is close to the center.
 - d. Your own examples.
- 4. Thoughts about the simulation
 - a. Assuming known sampling paths and initial point, can you locate all points on the grid?
 - b. Assuming known sampling paths and known samples, does the algorithm converge for all points in the grid? Show different examples.
 - c. System stability. For fixed sampling path, initialize emitter on each grid point, initiate the algorithm close to the emitter and measure stability (you can define your own score).
 - d. CDF (and heatmap on the grid) of the ellipse area for fixed sampling path and emitter in each point on the grid.
 - i. For each point run N Monte Carlo processes:
 - ii. Will you concatenate them or do something else?

Show results for different paths and analyze.