

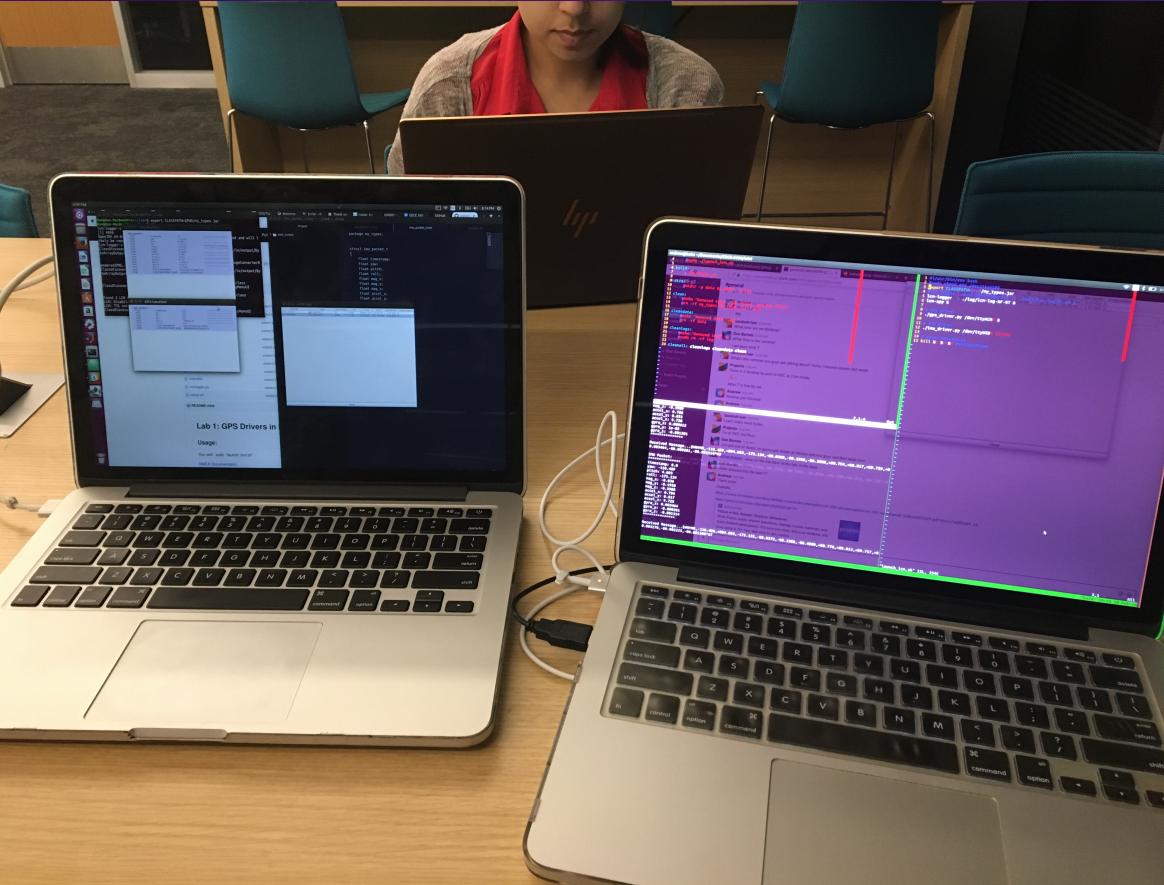
GPS VS IMU DEAD RECKONING EXPERIMENT

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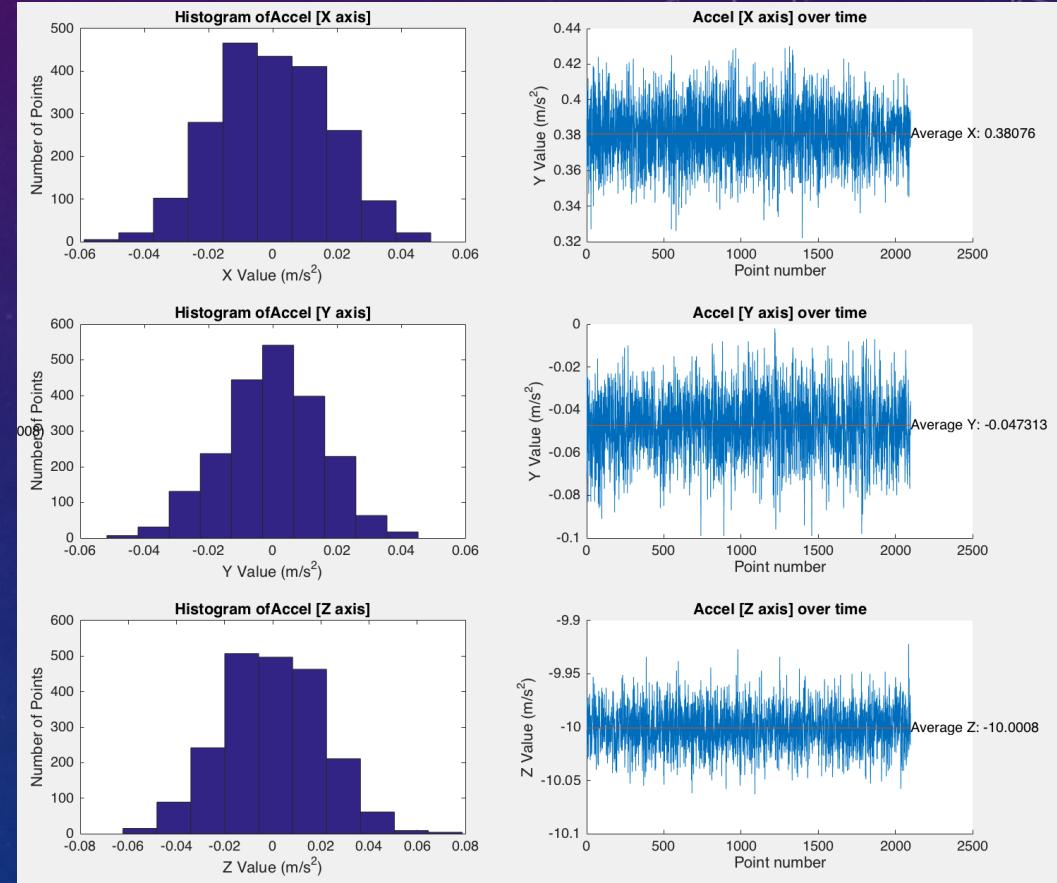
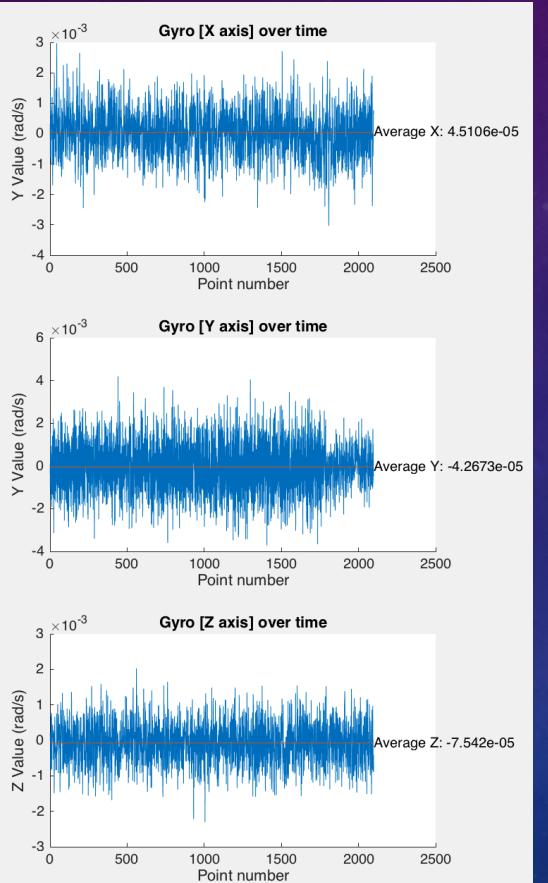
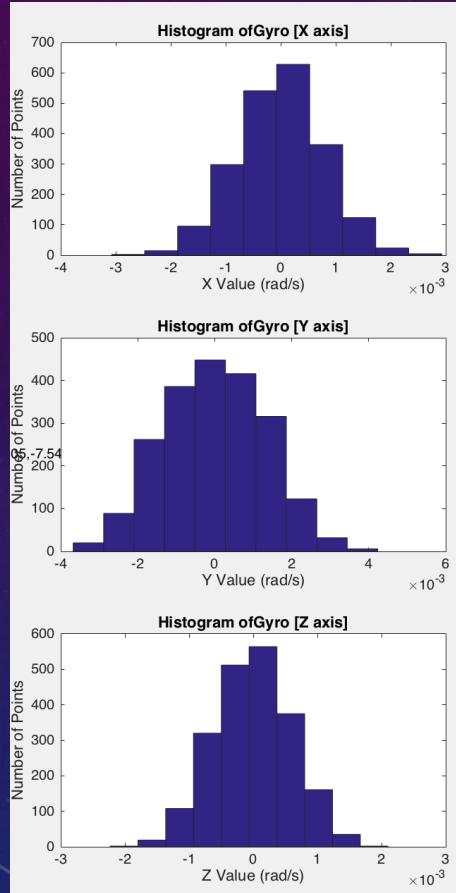
LCM OVER WIRELESS CONNECTION



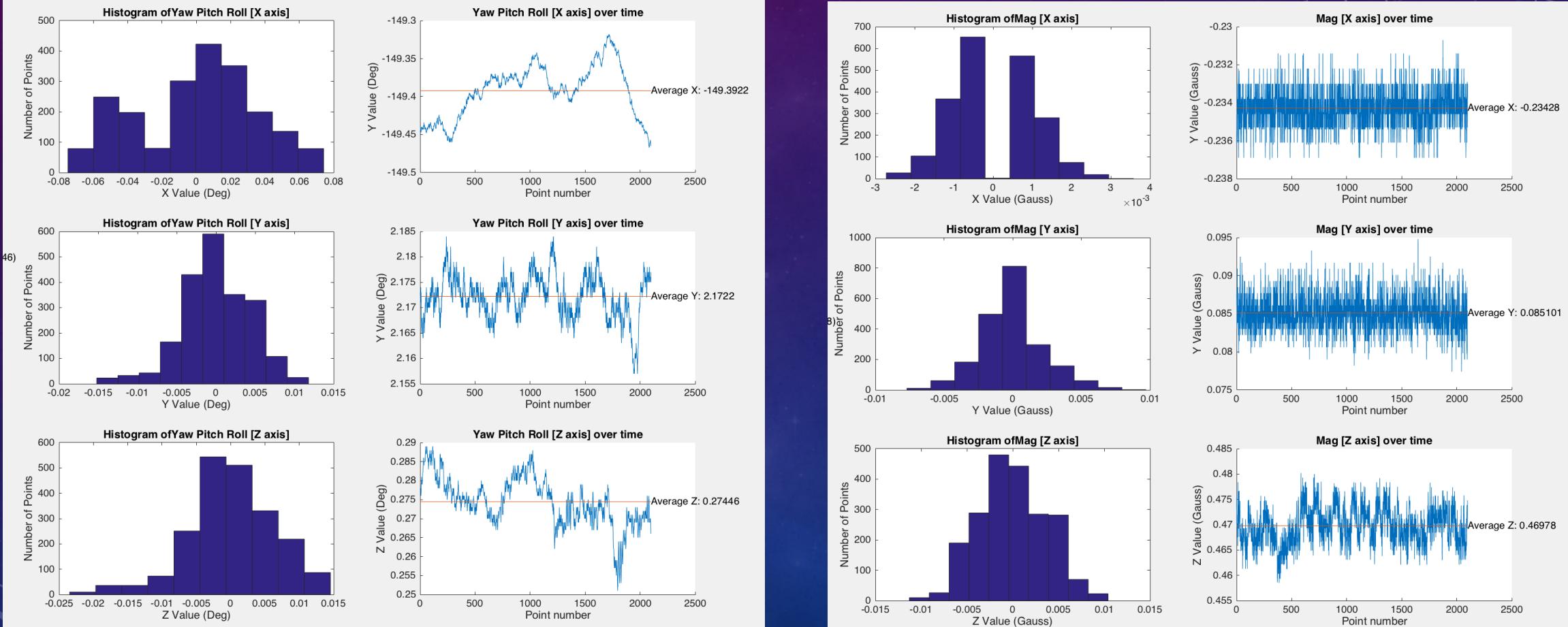
\NOISE CHARACTERISTIC SUMMARY

- Most cases: Gaussian error distribution
- In case of gyro and accelerometer, need to zero sensor to account for drift error
- Mag and Roll/Pitch/Yaw sensor doesn't matter to much b/c those are relative values
- Need to calibrate magnetometer values to account for hard + soft iron distortions

NOISE CHARACTERISTICS



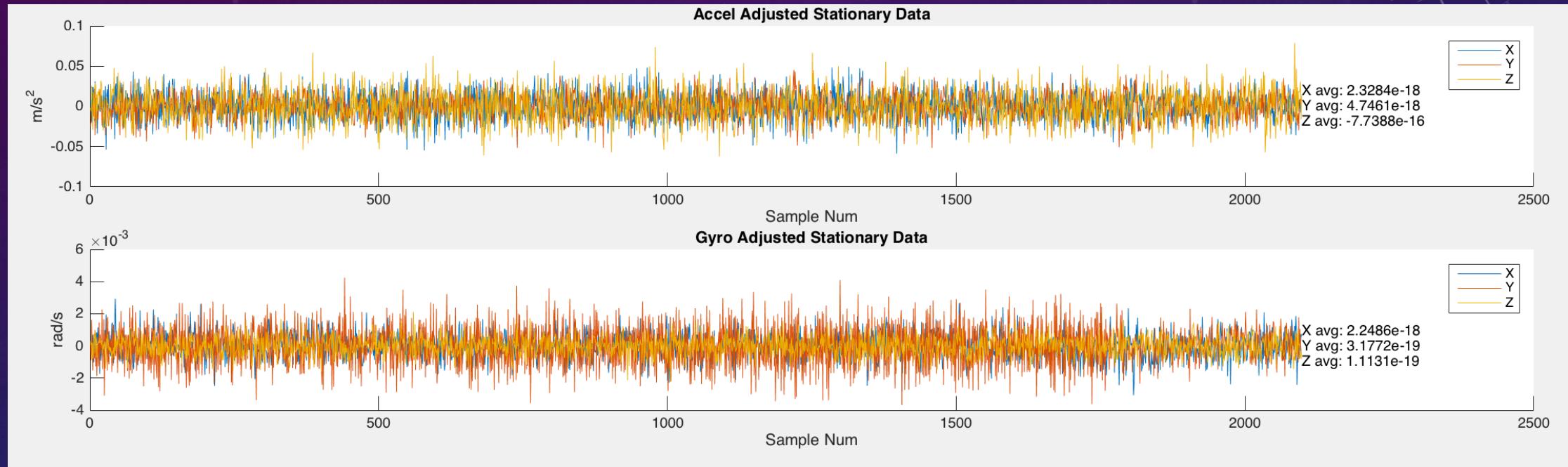
NOISE CHARACTERISTICS



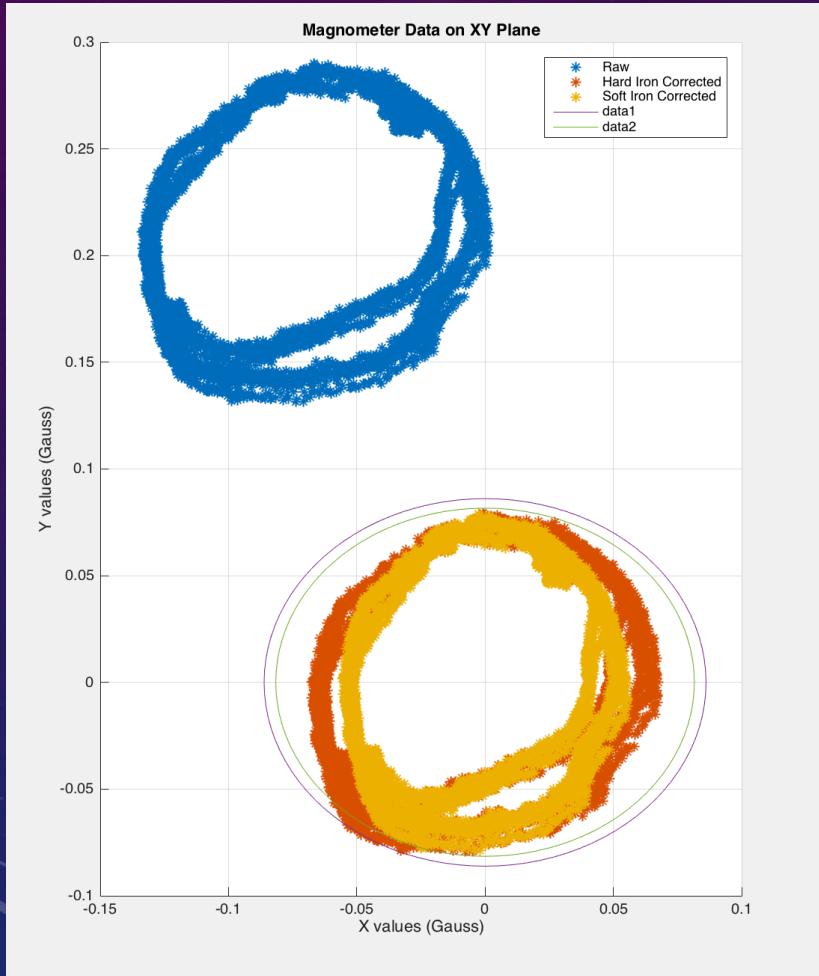
NON ZERO VALUES FOR STATIONARY DATA



ELIMINATING 0 MOVEMENT BIAS



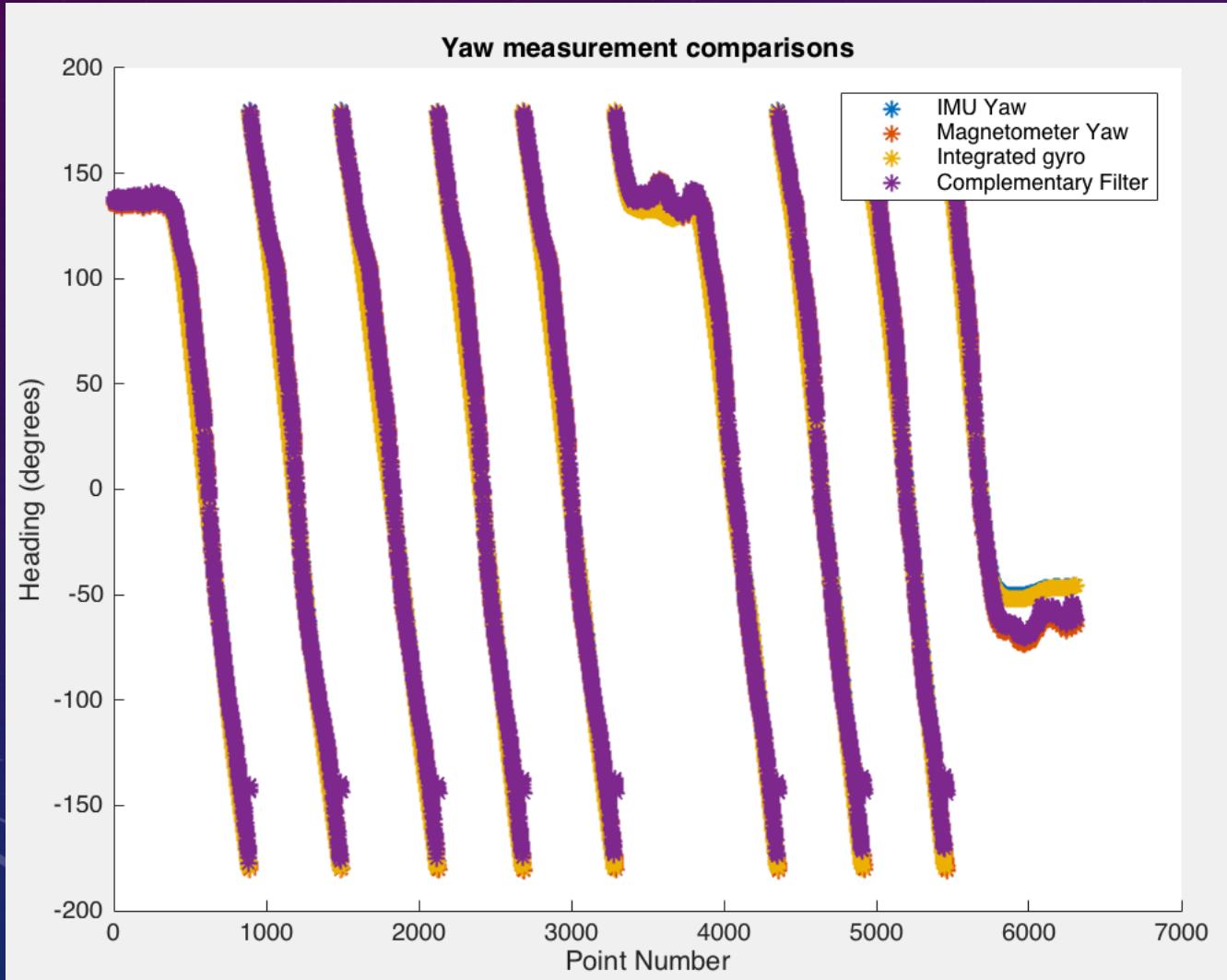
CALIBRATING MAGNETOMETER (HARD + SOFT IRON)



Hard Iron Correction: Shift values to center circle around origin

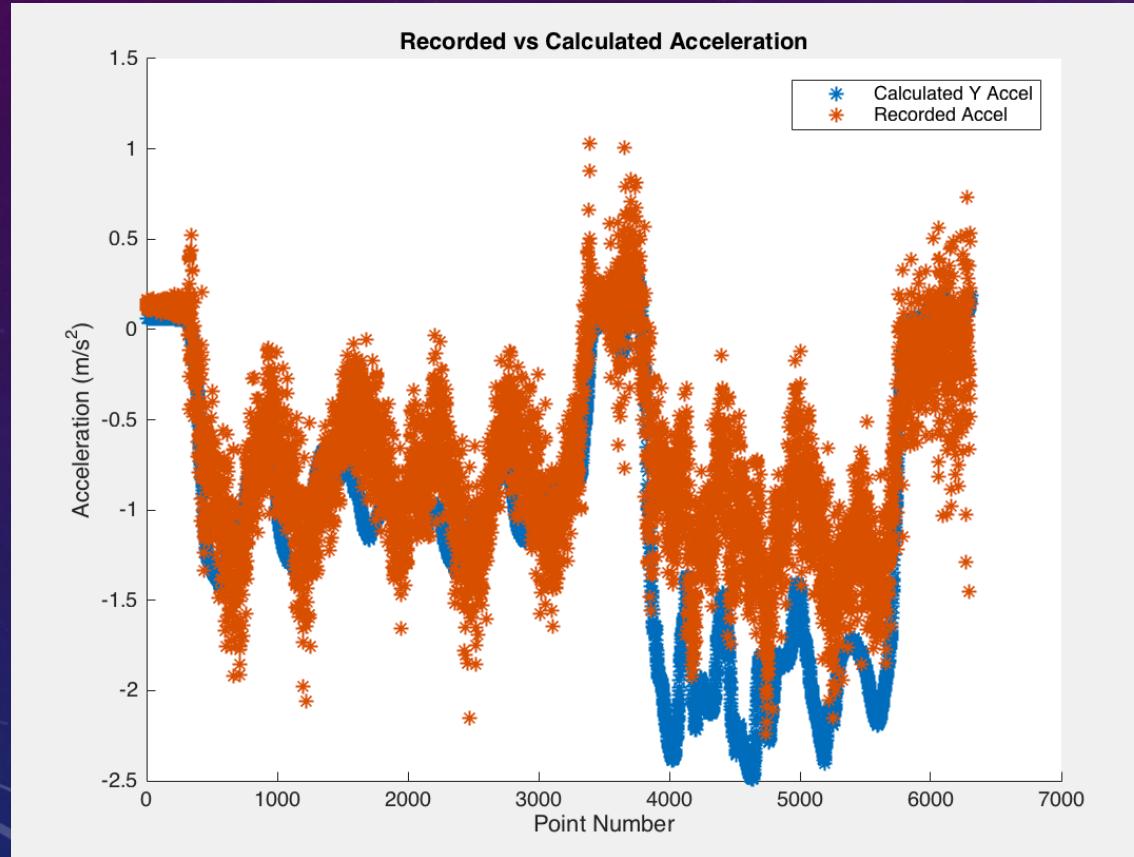
Soft Iron Correction: Scale values to change oval to more circular shape

CALCULATED YAW VS GIVEN YAW



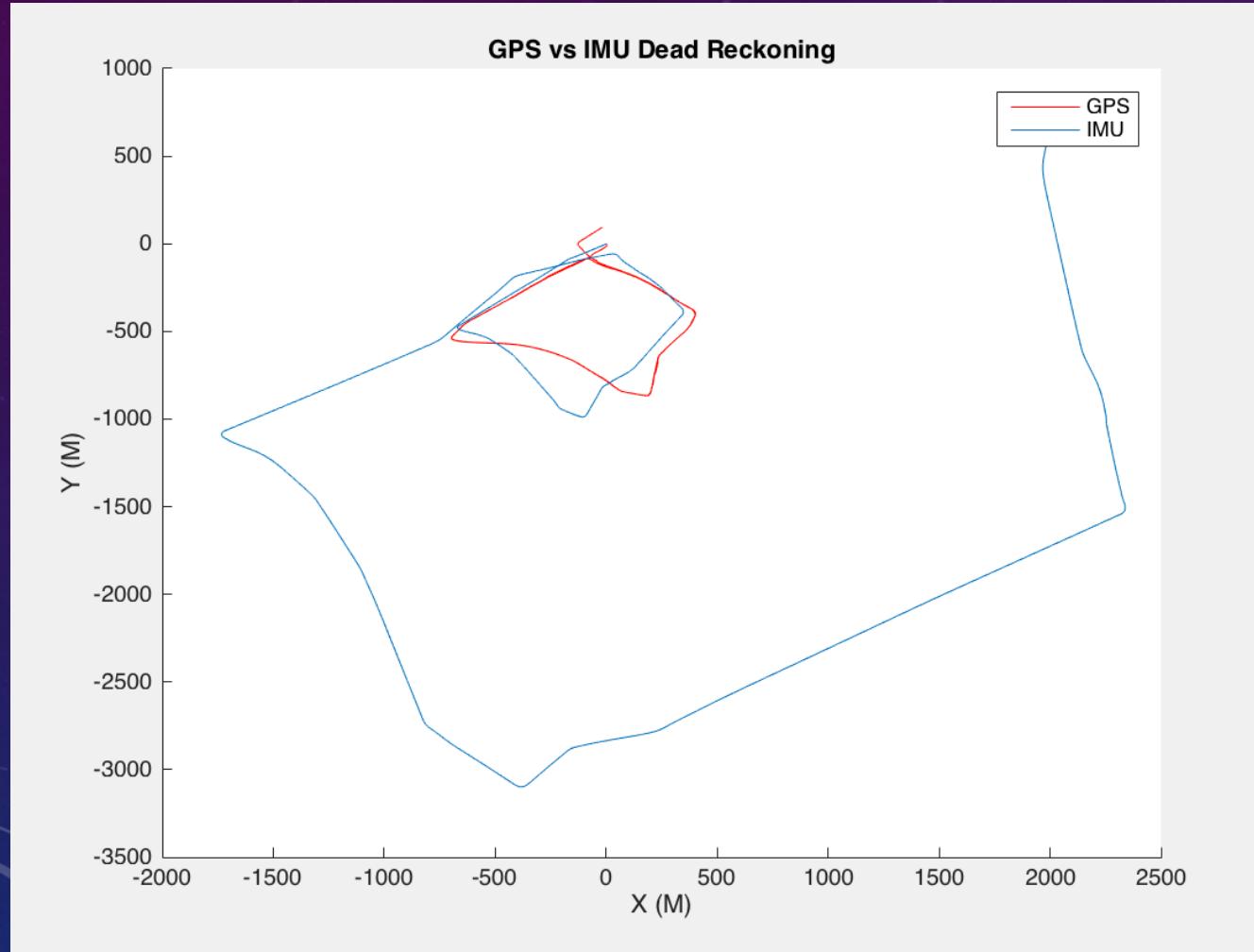
- Integrated gyro data perfectly lines up to the given yaw.
- Magnetometer results are skewed from yaw
- Since Magnetometer data was more heavily weighted (90%) in the complementary filter, combined results are skewed too.
- Skew in magnetometer likely a result of driving over an incline (not account for z error)

CALCULATED VS RECORDED ACCELERATION



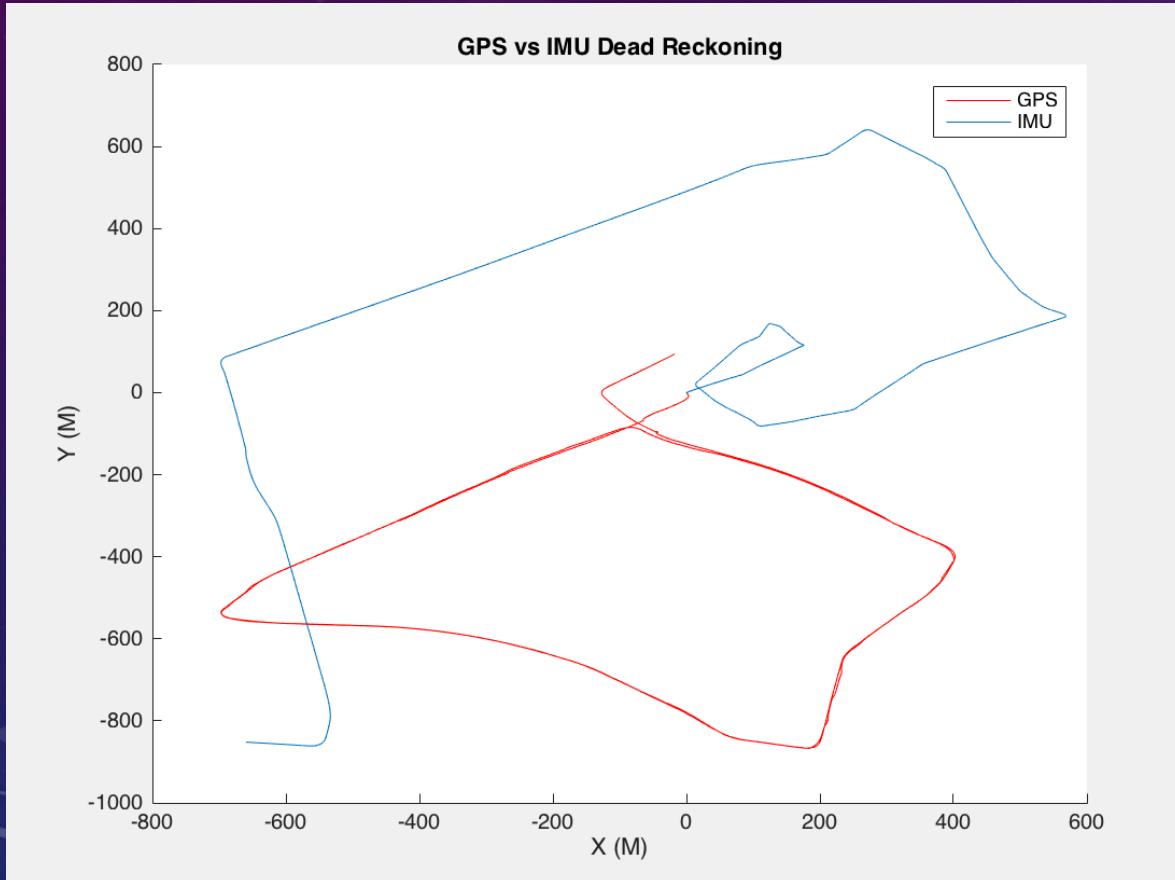
- Scale factor: 1/45 applied to the calculated value
- Recorded signal is noisy compared to the values calculated from the gyroscope
- Calculated value has slightly greater amplitude than the recorded value.
- Calculations will drift over time as a result

GPS VS DEAD RECKONING TRAJECTORIES



- Scale factor of IMU has factor of $1/45$ applied
- Drive consisted of two loops
- First loop was accurate in terms of scale—errors mainly occurred when turning
- Second loop: scale error of $2-3x$ in distance traveled.
- Shape still matches correctly
- Result of accumulating errors in drift (second round through, spent a lot of time stuck in traffic)

ACCOUNTING FOR STATIONARY DRIFT DID NOT IMPROVE RESULTS



- Scale factor: 1/45
- Accounted for the bias found in the stationary data collection
- Resulting data is still not appropriately scaled (now the larger route is roughly the correct scale but the smaller box is too small)