RTK LiDAR Measurement Analysis

DJI L1
Pulse Cloud Rate 3 returns 480,000 pts/s
Ranging accuracy 3 cm (0.10 ft) @ 100 m (328 ft)
Yaw accuracy Post-processing 0.05°
Pitch/Roll accuracy Post-processing 0.025°
FOV 70.4°

DJI L2
Pulse Cloud Rate 5 returns 1,200,000 pts/s
Ranging accuracy 2 cm (0.07 ft) @ 150 m (492 ft)
Yaw accuracy Post-processing 0.05°
Pitch/Roll accuracy Post-processing 0.025°
FOV 70°

RAW LiDAR combined error from the RTK, IMU, LiDAR. The error does add up if you use the largest value of each step.[1]   ① ② ③

Largest potential error (It can happen but normally the results are much better)
L1: Horizontal 0.24' (7.3 cm); Vertical 0.25' (7.6 cm)
L2: Horizontal 0.27' (8.2 cm); Vertical 0.26' (7.9 cm)

You have to consider the entire chain of measurement events to determine what could be the potential error of the full process.

Even with several potential points of failure, it is amazing that we are getting the accurate data that we do get.

I am typically getting from 0.05' (1.5 cm) on a good day to 0.15' (4.5 cm) on an average day for elevation after filtering and adjusting the **RAW LiDAR** data.[2]

1) GCPs set via RTK will have a potential error as well.
2) There will be noise in the point cloud due to the IMU limitations.

IMU potential error after post-processing accounting for the FOV, AGL, Pitch, Roll and Yaw accuracies.

② L1: Horizontal 0.11' Vertical 0.08' (300' AGL)
L2: Horizontal 0.17' Vertical 0.12' (400' AGL)

Each laser measurement will have a N, E, Z based upon the position of the LiDAR unit while flying which will need to be post-processed (rectified).

Post-processing will rectify (apply RTK corrections) to the N, E, Z for each laser measurement to the RTK datum from the LiDAR unit and calculate the LiDAR return position on the surface.

① RTK from base/controller
Typical RMSE values
N, 0.03', E 0.03', Z 0.07'
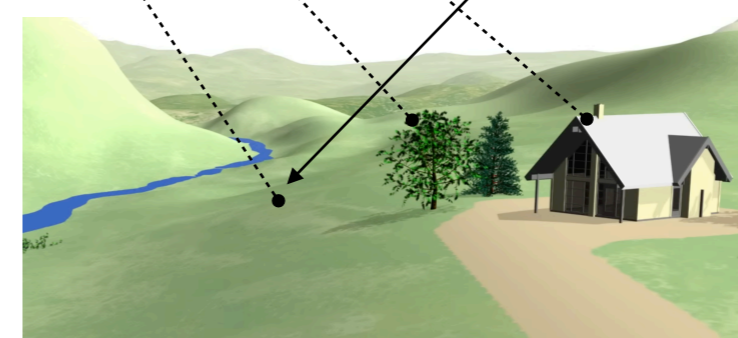
LiDAR pulse measurement ranging accuracy

L1: 3 cm (0.10 ft) @ 100 m (328 ft)
L2: 2 cm (0.07 ft) @ 150 m (492 ft)   ③

The LiDAR unit accuracy is what manufactures disclose. See statement above for the full measurement process for consideration.

Rectified surface point cloud
N, E, Z positions

RTK Base fixed position which can be autonomous, surveyed coordinates, NTRIP from a network.

N, E, Z sent to the drone controller from the RTK base