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LiDAR Cloud Calibration

By Mike Kalmbach

A new tool for LiDAR calibration is in MBMAX64 (64-bit HYSWEEP® EDITOR), Q1 release (version21.1.2). It uses cloud points instead of the cross section of our traditional patch test. While there are advantages to each method, cloud calibration seems well suited to LiDAR systems.

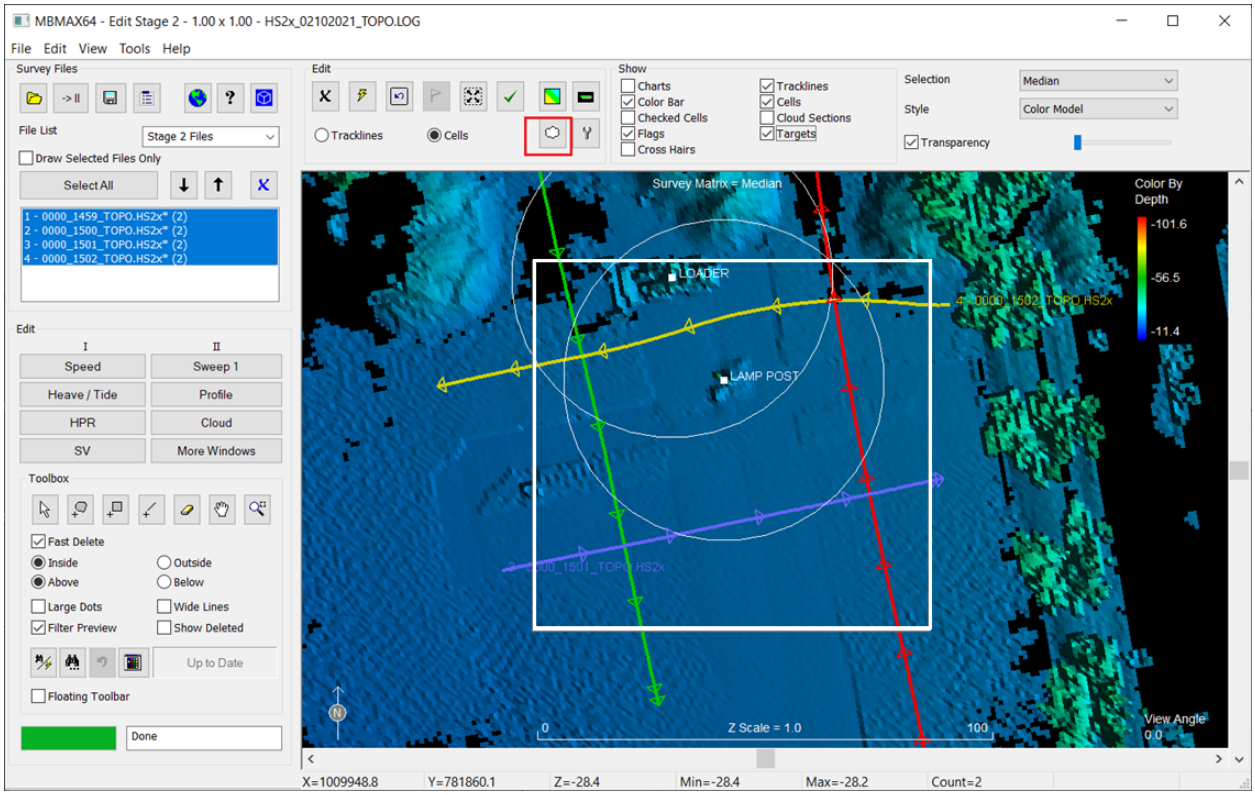
This is entirely manual (for now) and doesn't provide error analysis. Jog offset angles and look at the result. This is useful and a starting point for automatic, best-fit calibration, which is high on the HYPACK® roadmap.

Enough of that, let's see how it works.

Starting out with basic calibration lines used with a Payload (SBG Ellipse inertial system, Velodyne VLP16 LiDAR): a four-line rectangle around a light pole. Figure 1 shows the lines loaded into MBMAX64 with median elevation selection.

Click the cloud tool (red) then mouse select the points used for calibration (white rectangle).

Figure 1. LiDAR Calibration Lines in MBMAX64—Red highlights the cloud popup tool. The white box outlines popup points selected for calibration.

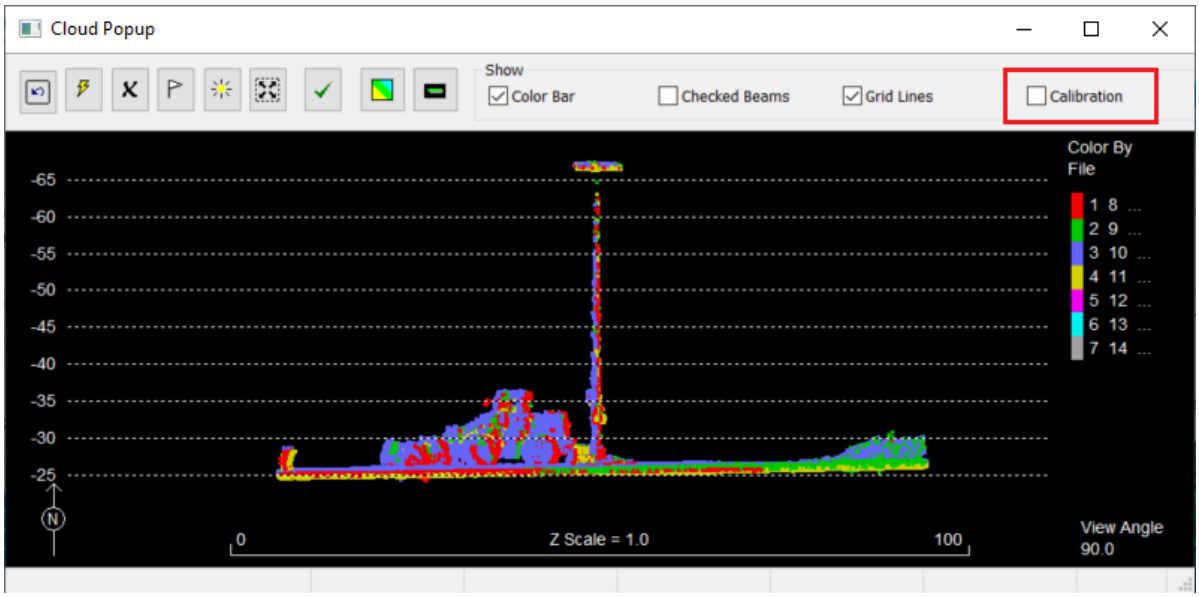


The cloud popup is shown in Figure 2. If you aren't familiar with it, you are missing one of the best features of MBMAX64. All the editing and visualization tools of the program are available for whatever subset of data you have chosen. With a right-click, you can save the points to XYZ.

NOTE: The Cloud tool is only enabled with north up display in map view. Click the zoom extents button for the proper orientation.

Here's is the Cloud Popup you've seen in the past. The check box for calibration is the new part. Click it.

Figure 2. Cloud Popup Window with New Checkbox for Calibration.



The calibration panel appears at the bottom. It's intuitive for the most part.

1. Enter **Step** to change the step size.
2. Use **Pitch, Roll** and **Yaw** to change the angles. Angles may be stepped with the arrow buttons or entered directly.
3. Use **[Adjust]** after entering.

Here's the view after big angle changes. So we can see the results.

Figure 3: Cloud popup with calibration panel.

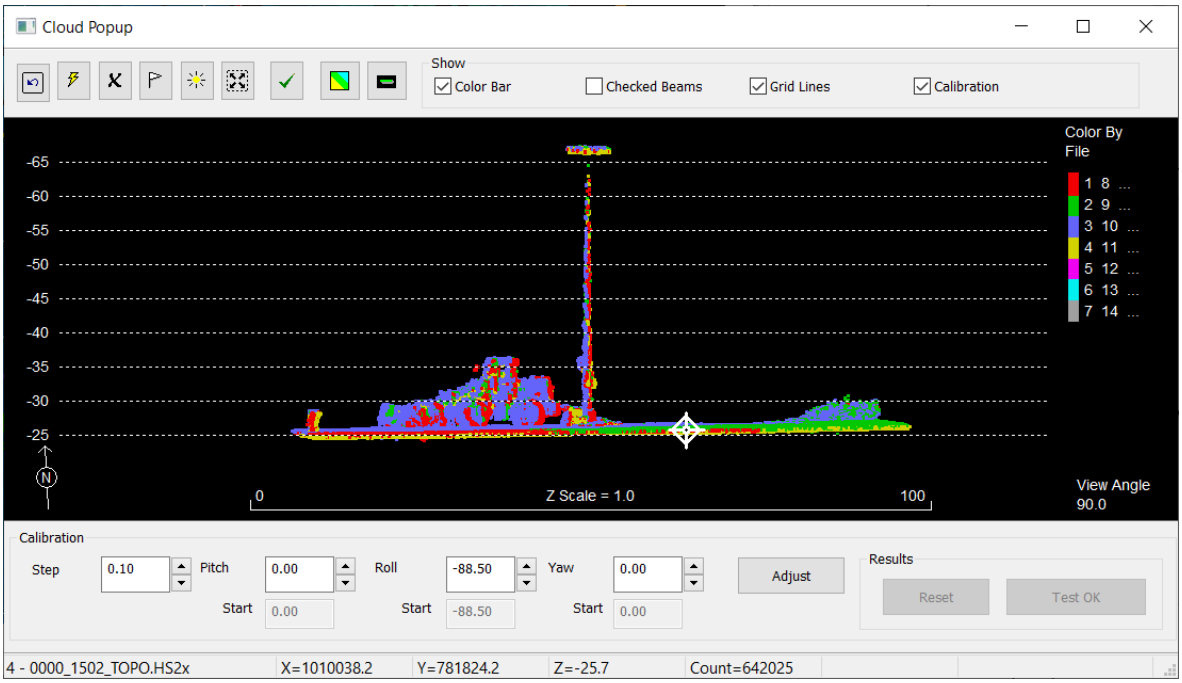
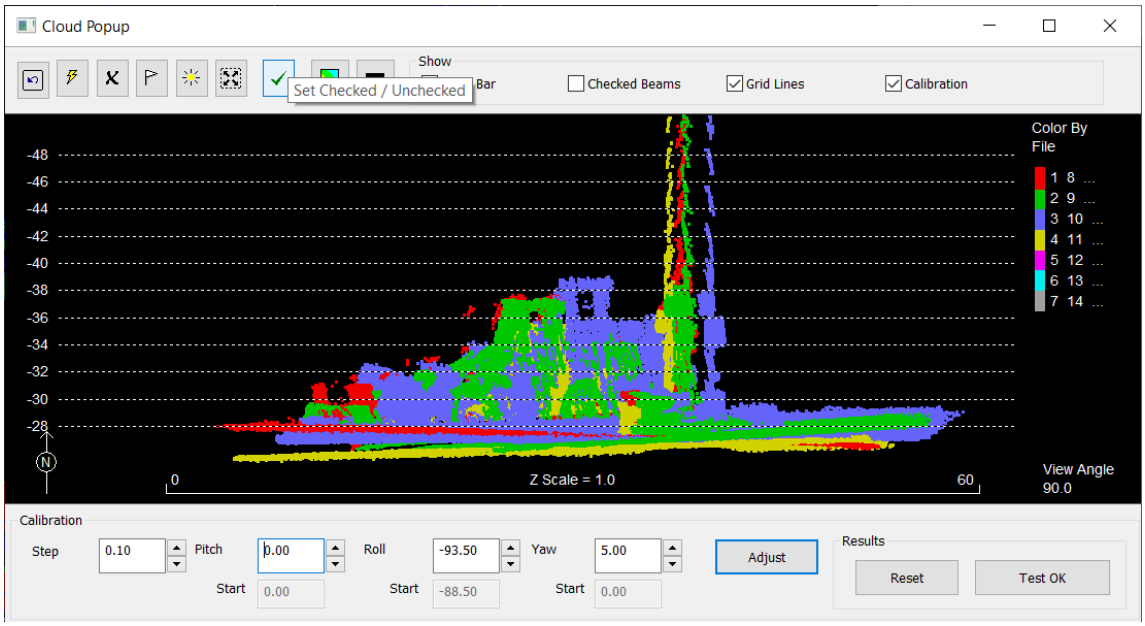


Figure 4. Example of poor calibration choices.



The angle changes made in the Cloud Popup affect points in the popup display. For speed, the changes do not affect other survey points or the matrix display. When you are done, choose one of the results options to finish.

- **Results – Reset:** Resets calibration angles to starting values. We're not going to keep changes.
- **Results – Test OK:** Apply updated angles to the entire survey and update the matrix.

I like to look at matrix results afterward, using the Z Range color codes. The Z Range shows all the blemishes. The last two figures show a relatively good calibration compared to the really bad one.

Figure 5. Z range result of a decent calibration.

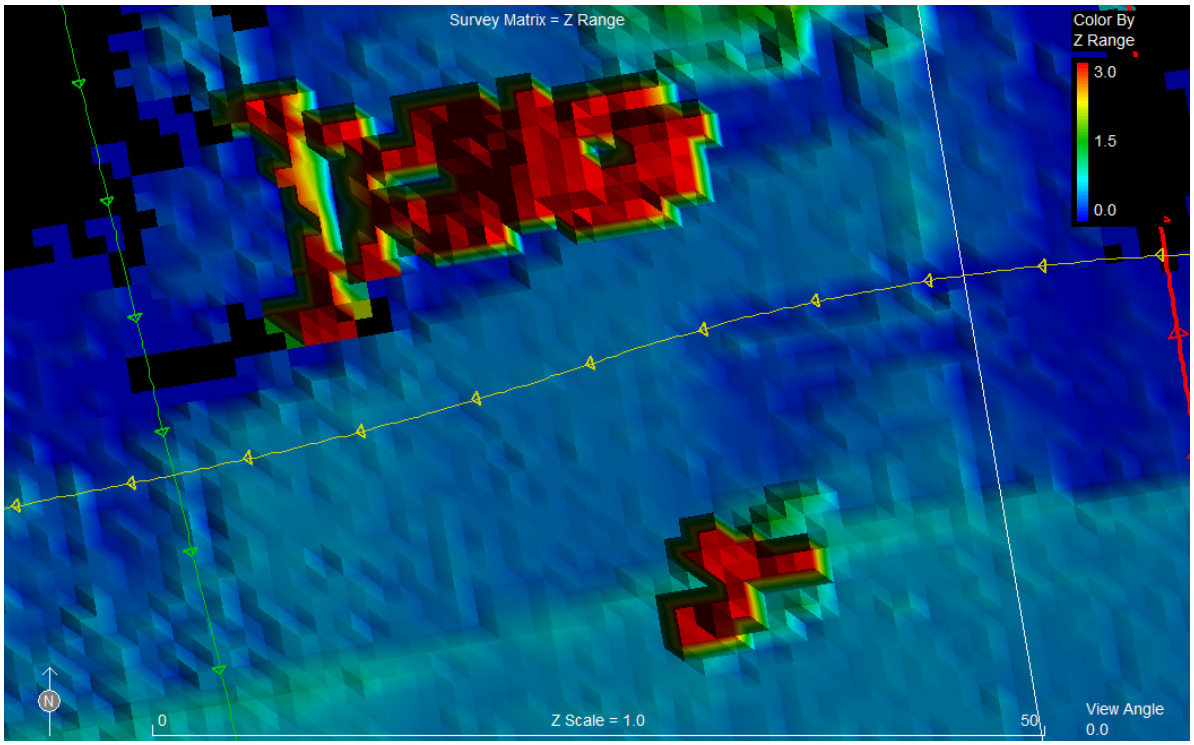


Figure 6. Z range from the bad calibration.