**Tools, Tips, and Workflows**

# An Introduction to LAS File Analyst

LP360

BSAU | AWG

In 2016 we added a very powerful new tool to LP360 (standalone version) called Feature Analyst. This is a tabular-driven tool that synchronizes a table view of Features, Feature Parts and Vertices with their graphical representation in the Map and Profile views. This tool has improved the creation, editing and quality checking of features such as breaklines by an order of magnitude.

We are now working on a new analyst tool for LAS files. LAS File Analyst is being created to satisfy the needs of our government customers who accept LIDAR data (e.g. the USGS, the USDA, USACE and so forth) as well as those who prepare LIDAR data for delivery to these agencies. Like Feature Analyst, LAS File Analyst is a powerful, tabular-based tool that will allow you to review, analysis and repair some LAS file issues.

LAS File Analyst has several very important applications:

- Viewing LAS file header data – sometimes you just need to review the overall content of a LAS file. This is useful when you want to know things such as the date of acquisition, the file version, the number of points, returns and so forth. This has been available in LP360 for some time in the File Open section of the program. However, this was not useful if you wanted to examine a file header once you had loaded files. Now you can easily view these data at any time during your LP360 session.
- Scanning the file content – as anyone experienced in dealing with data knows, just because it says it in the header does not mean it is true! LAS File Analyst can scan files selected in the tabular view, reading all data points in the file and displaying the actual content. Based on feedback regarding our original design from Dr. Al Karlin of Southwest Florida Water Management District (SWFWMD), we enhanced this section of the tool to include very useful information such as the top 10 Point Source IDs in the file. A truly useful addition.
- Analyzing the File for LAS compliance – this function tests the header and scans file content to ensure that it is in compliance with the American Society for Photogrammetry and Remote Sensing (ASPRS) LAS Specification. There is an options dialog that allows you to set the tests that you would like to perform (see Figure 1).



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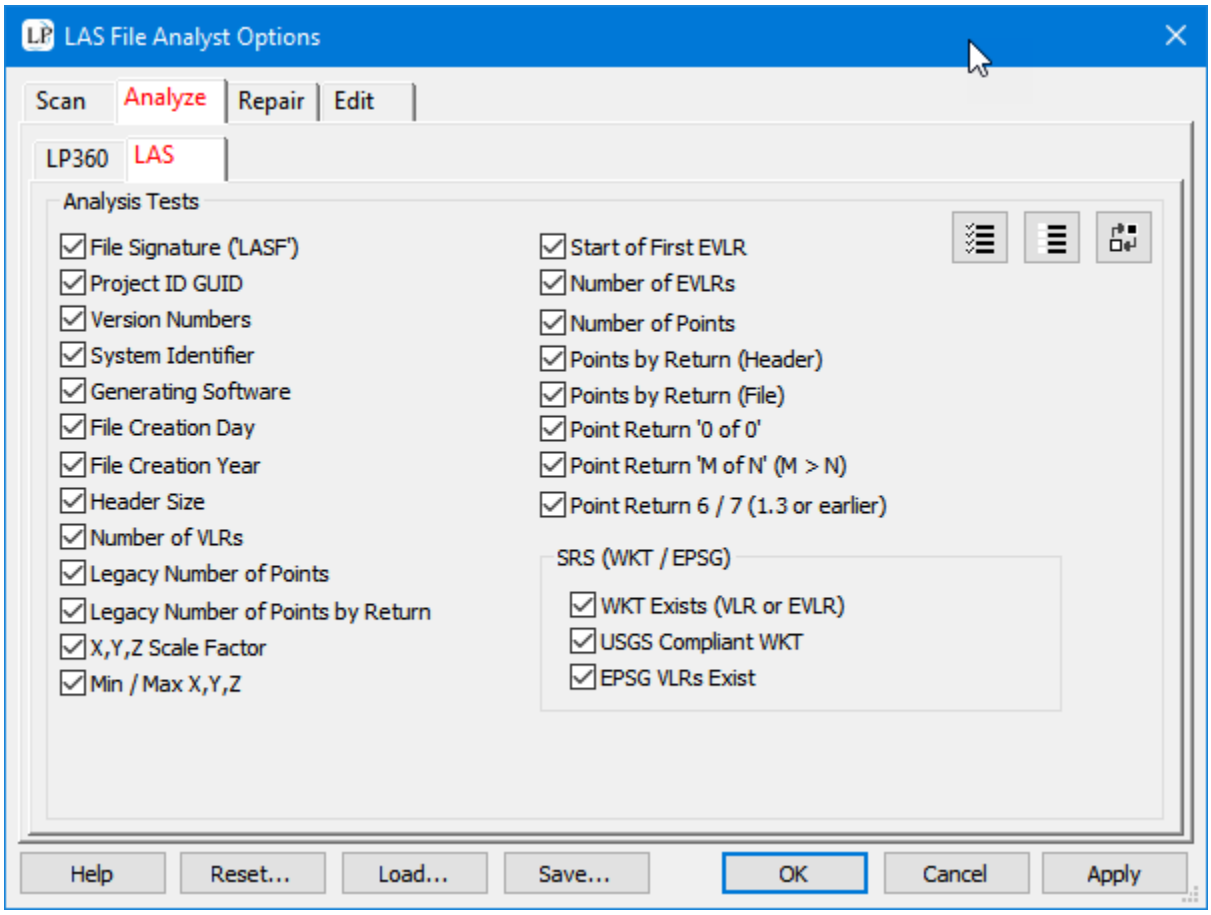



*Figure 1: LAS File Scan Tests*

- Repair – this is a powerful set of tools that allow you to repair and/or edit the content of LAS files. For example, you will be able to manually write header information, repair erroneous point counts and so forth. This tool should make quick work of fixing files that are being rejected by recipient organizations for LAS compliance violations

Viewing, scanning and analyzing are licensed at the Basic level. Repair is licensed at the Standard level. I'll provide a bit of an overview of the tools in LAS File Analyst. We will soon be posting an experimental (EXP) release of LP360 that will allow those on current maintenance to try out this new tool.

LAS File Analyst is invoked by either pressing a tool button on the main LP360 toolbar (in which case the currently Active LAS layer will be loaded) or right-clicking a LAS Layer in the LP360 table of contents (TOC) and selecting *LAS File Analyst.* The main dialog of LAS File Analyst is shown in Figure 2.

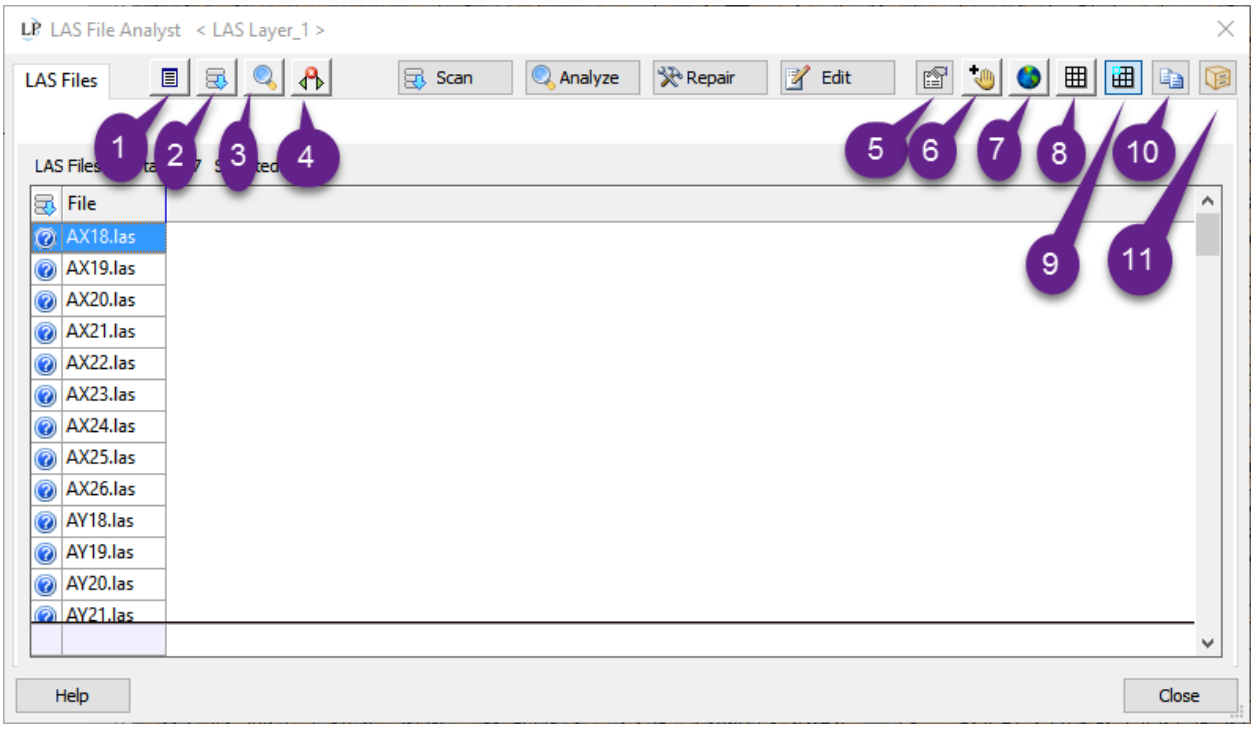



*Figure 2: LAS File Analyst Main Dialog*

The labeled tools perform the following functions:

1. View Header Columns
2. View Scan Columns (information from the actual point data records)
3. View Analyze Columns – view analysis test results (you can select the tests in the options dialog) of LAS compliance
4. Expand Test Columns – insert actual text in test column headers
5. Open the Options dialog (Figure 1). This dialog is "non-modal" which means it can stay open while you perform other functions in LP360
6. Window center the Map View on the selected rows in the table
7. Fit the Map View to the selected rows in the table
8. Turn on/off LAS File boundaries in the Map View
9. Select LAS files by selecting their boundaries in the Map View
10. Export the table to the clip board (nice for pasting a report into Excel)
11. Move selected files (selected in the table view) to a different location. This is a so-called Quarantine function used to isolate files that cannot be repaired within LAS File Analyst. Obviously, you can also use it to simply move your LAS files to a different location for utility purposes.

The four action buttons in the center of the dialog perform the actions indicted on their labels on the files *selected* in the table view. *Scanning* all the files in a LIDAR project can be quite time consuming (we have to read every point in every file). LAS File Analyst will include some smart caching algorithms aimed at avoiding rescans where they are not necessary.

Interestingly, two days after the Scan function was implemented I was asked to analyze data from a company developing a new set of automatic classification algorithms. When I looked at the classified data in LP360, I noticed some anomalies whose cause was not immediately obvious. For example, I thought I was seeing a shift in the ground points! After tinkering for a bit, I decided to scan the file using the just minted Scan functions in LAS File Analyst.

A minor thing I noticed were odd-ball point scaling numbers (see Figure 3). While not a violation of the LAS specification, it is a guideline to keep scaling as clean powers of 10. These odd scaling numbers are just asking for round-off issues. The scaling is part of the LAS header so any tool that can read the header will reveal these sorts of issues.

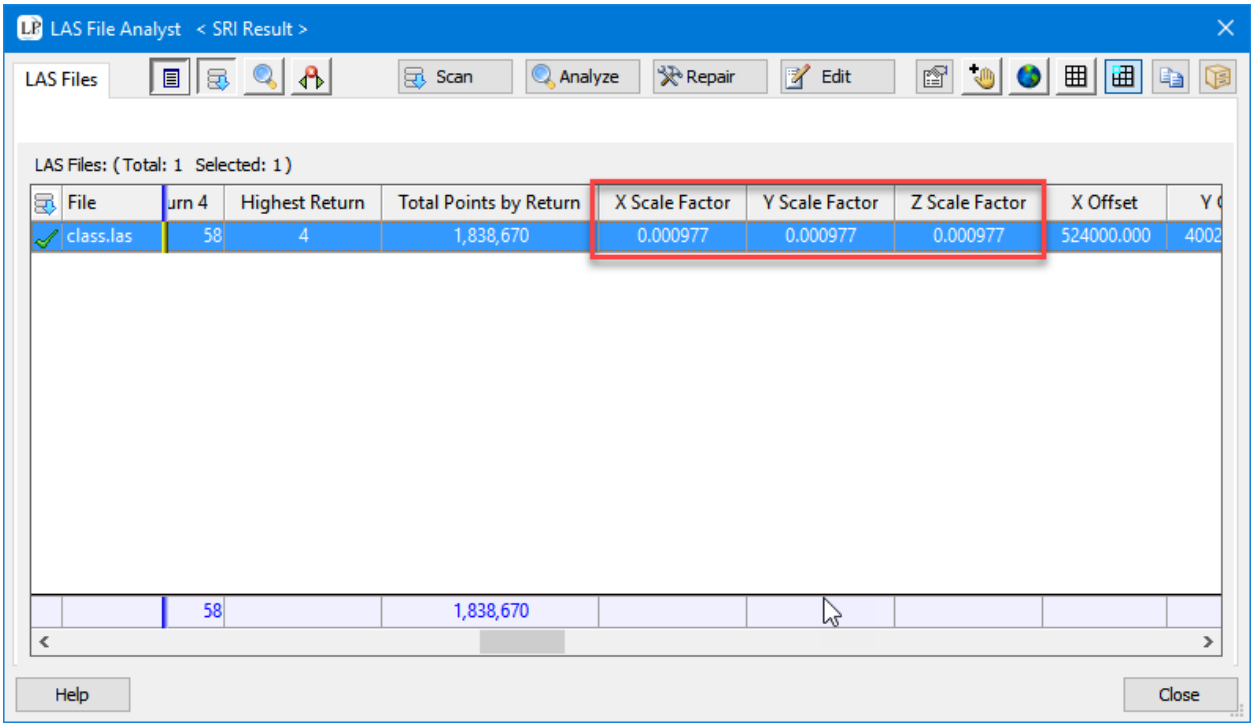
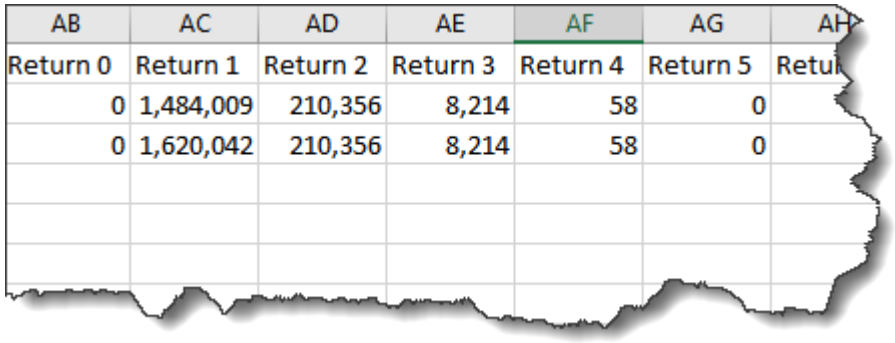



*Figure 3: Poor choice in scaling numbers*

A second observation (again from header data) was a change in the spatial reference system (SRS). The original source was a realization of NAD83. The processed data was encoded as WGS84! Now obviously one would not expect a classification algorithm to reproject the data so this must simply be a file writer error.

The next thing I observed could only be revealed by a file scan. Now the fact the algorithm changed the SRS meant that LP360 loaded the source and destination LAS files on different layers (LP360 is smart about this, preventing many unintended errors!). This meant that I could not examine both files simultaneously in LAS File Analyst. No worries, I could just export both tables to Excel and compare there. A use for the Excel path already!

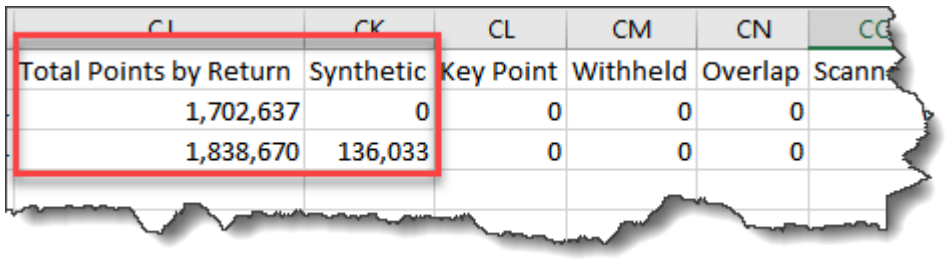
Scanning across various data fields, I noticed that the number of First Returns increased in the processed file (see Figure 4). The other returns had not decreased so it looks as if points have somehow been added to the file!



| AB | AC | AD | AE | AF | AG | AH |
|---|---|---|---|---|---|---|
| Return 0 | Return 1 | Return 2 | Return 3 | Return 4 | Return 5 | Retu |
| 0 | 1,484,009 | 210,356 | 8,214 | 58 | 0 | |
| 0 | 1,620,042 | 210,356 | 8,214 | 58 | 0 | |

*Figure 4: Return 1 number has increased!*

Scanning on across the file content reveals the change. Additional points have been added to the file. They have been tagged as Return 1 and marked as *Synthetic* (see Figure 5).



| CJ | CK | CL | CM | CN | CO |
|---|---|---|---|---|---|
| Total Points by Return | Synthetic | Key Point | Withheld | Overlap | Scanne |
| 1,702,637 | 0 | 0 | 0 | 0 | |
| 1,838,670 | 136,033 | 0 | 0 | 0 | |

*Figure 5: Synthetic points added to the output file*

Upon further inspection in LP360 using class flag filters in Live View, I discovered that the vendor's ground classification algorithm was adding extra points to the Ground class in "holes" where buildings occur (Figure 6). While this would be fine for certain applications, it would probably not pass muster for a rigorous specification such as the USGS LIDAR Specification version 1.2

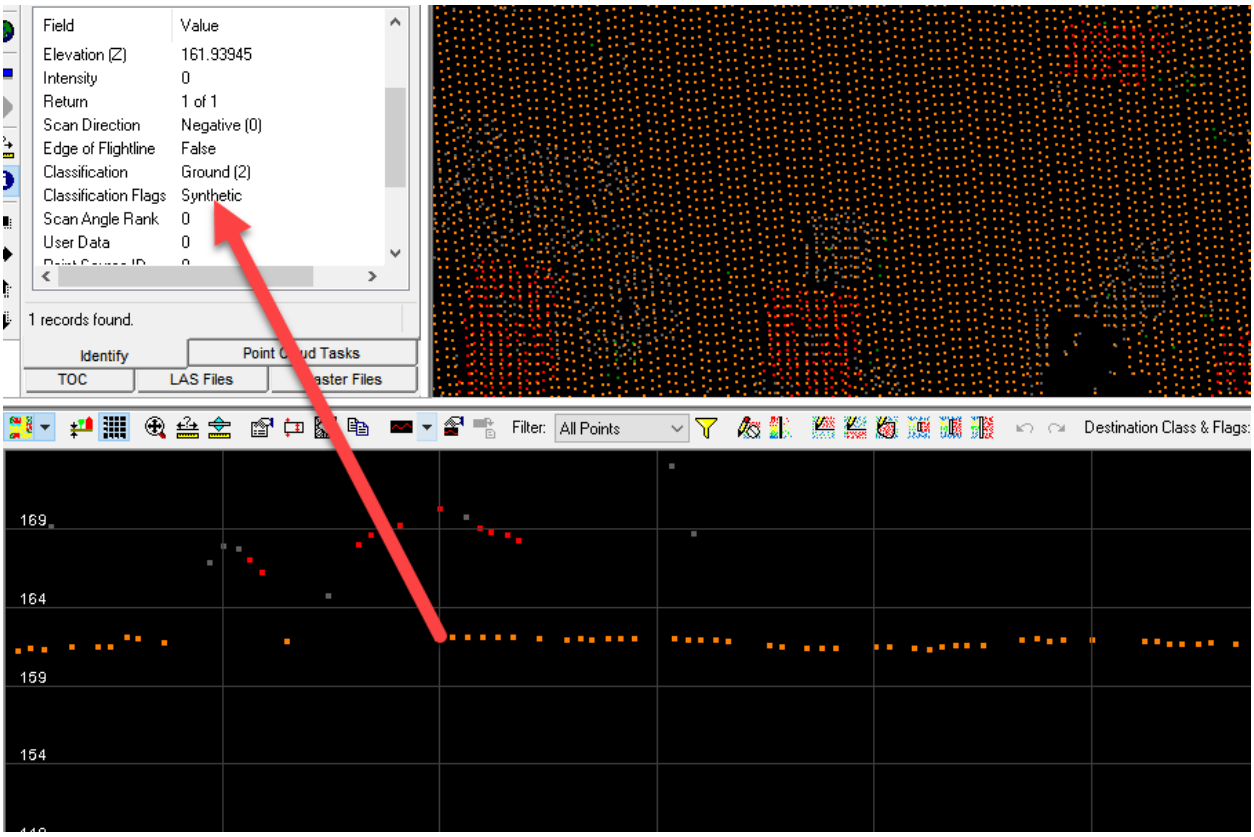



*Figure 6: Adding Synthetic Ground points*

A scan through the remaining Scanned fields revealed that the Synthetic points were given a point source ID of zero (nothing wrong with that). However, one additional observation was that the GPS Time Stamps of all points (Synthetic and the original) were all being set to zero.

The point (pun intended) in all of this is not what this particular algorithm was doing in creating an output LAS file but rather the ease of analysis provided by LAS File Analyst. Without this tool, I would no doubt have eventually discovered the defects in this output file but it would have required quite a bit more work and certainly a lot more time.

LP360 has long been recognized as the best overall LIDAR QC tool on the market. The addition of LAS File Analyst extends these QC capabilities in very important new ways. Very shortly I will be able to report on the LAS Repair tools. Between Analysis and Repair, our new tools are going to be a tremendous help in delivering first time accepted LAS files.