Release 2.5

Release Notes

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Document-Version:
16.11.2020

SCANTRA 2.5.5.189

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1 New Features

1.1 Corner matching

Setting up the network graph is a challenging task especially if no pre-orientations are given. Therefore, the *Corner Matching* algorithm was developed. *Corner matching* detects, as the name already suggests, corners as a start. A challenging task in all matching algorithms is to determine corresponding information which is why a novel descriptor was developed that characterises every single corner. Note that corners are not restricted to corners of rooms but all geometric configurations where three planes intersect at a sufficient degree. This algorithm not only automatically generates relations between individual scans but also computes pre-orientations which additionally accelerates registration. *Corner matching* can be applied to individual groups or selected stations. It is recommended to apply the algorithm to sets of scans whose geometric content is somewhat unique and does not contain repetitive pattern. Figure 1 illustrates the outcome of the *Corner Matching* algorithm. All lines were automatically generated and have pre-orientations. For the remaining stations, the algorithm could not find unique corners. Hence, a different strategy needs to be chosen from *Tools → Generate adjacencies* to tie in these stations.

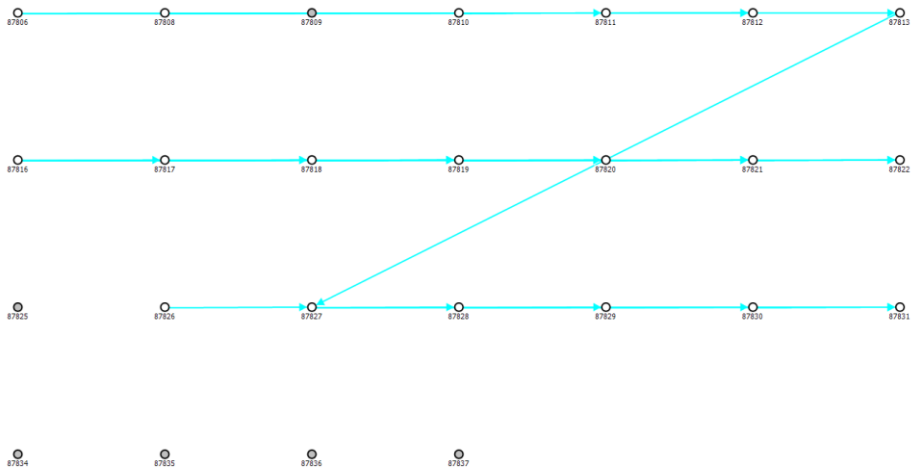


Figure 1: Result of the Corner Matching algorithm

1.2 Matchmaker

Assuming a project where no pre-orientation and no documentation is given. A suitable tool in this case is the novel *Corner Matching* algorithm. If this tool fails, the operator needs to define adjacencies using a different strategy which may be tedious especially if the data was captured by another person. For these scenarios we have developed the *Matchmaker*. The general idea is inspired by dating apps that younger folks like to use. The user can browse through all scans within a group or switch groups. If a redundantly captured area was identified, a match can be set by clicking the heart icon. A new relation will be added to the adjacency graph and the user can move on to define more relations.

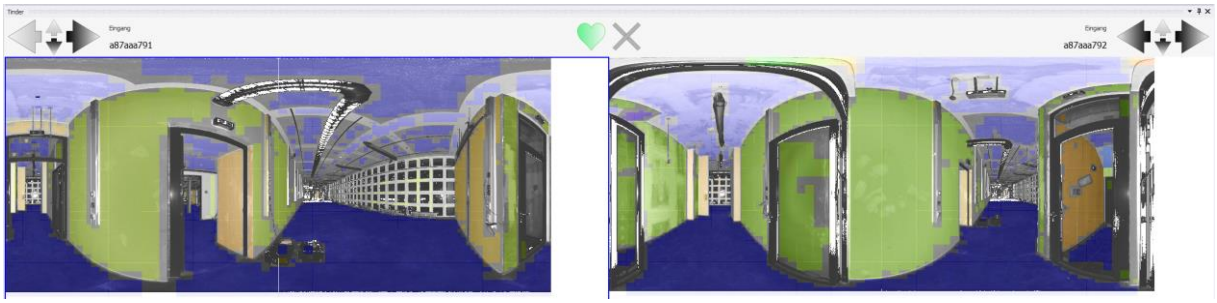


Figure 2: Matchmaker dialogue

1.3 PointCab interface

Interfaces and formats between different software make the life of users a lot easier. Hence, the SCANTRA team is very delighted to announce a novel interface to PointCab. Since there are numerous users of PointCab that also use SCANTRA (or vice versa) this interface was a logical step. Users can now create a new project in PointCab, including the import and organisation of all required data. The generated files (*.pcp, *.lsd, *.lsdx) can then be imported to SCANTRA. After registration with SCANTRA the lsdx-file is updated with the computed registration parameters and can finally be re-imported to PointCab where the final deliverables are generated.

1.4 Improved speed of plane calculation and pixel interpolation

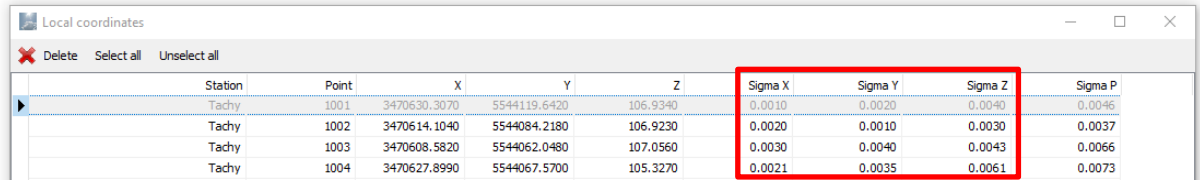
The last years in the world of laser scanning have witnessed an increase of speed of scanners and hence a notable increase of data volume. Since the first step in SCANTRA is to detect planes, larger point clouds yield in longer detection times. Consequently, our team has reviewed and accelerated this vital step of the processing chain. Depending on file format and data volume users of SCANTRA 2.5 can expect a tremendous increase in speed somewhere between 50 and 60% compared to previous versions.

1.5 Collecting new plane identities during plane matching

Before this release, plane identities that caused tensions during pairwise matching of scans were rejected while new ones were not established. In some cases, the quality of registrations could be improved by repetitive application of plane matching especially when poor pre-orientations were given. This workaround is no longer needed since plane matching now incorporates both rejecting and establishing new plane identities which saves time and leads to more accurate results.

1.6 Weighting of individual coordinate components for ground control points

Introducing individual weights for single points was always possible in SCANTRA ever since its first release. However, the interface was restricted to define stochastic information only in 3D. In many practical cases it makes sense to individually weigh components differently to receive more realistic results. In addition, this function also allows to e.g. deploy 1D control points. This can be particularly interesting if very high vertical accuracy is required, for instance in settlement measurements. In order to introduce individually weighted control points, SCANTRA offers two options. The first one is the import of control points by using the *Import points* dialogue which has been extended by three new entries, namely sigma x, y and z. Alternatively, points can be imported and manipulated in the extended point browser as depicted below.



Station	Point	X	Y	Z	Sigma X	Sigma Y	Sigma Z	Sigma P
Tachy	1001	3470630.3070	5544119.6420	106.9340	0.0010	0.0020	0.0040	0.0046
Tachy	1002	3470614.1040	5544084.2180	106.9230	0.0020	0.0010	0.0030	0.0037
Tachy	1003	3470608.5820	5544062.0480	107.0560	0.0030	0.0040	0.0043	0.0066
Tachy	1004	3470627.8990	5544067.5700	105.3270	0.0021	0.0035	0.0061	0.0073

Figure 3: Extended point browser

1.7 Histogram equalization

Some manufacturers do not support third party file formats too well - one prominent example is E57. This popular format contains entries that allow to set upper and lower boundaries of e.g. the intensity values. If default entries are added to these sections, then the resulting intensity images in SCANTRA will likely appear dark and weak in terms of contrast as depicted on the left of Figure 4. Hence, we have added a histogram equalisation algorithm that automatically sets optimal intensity boundaries and leads in a much richer representation, as illustrated on the right of the figure.

Figure 4: Generated intensity image before (left) and after (right) histogram equalisation (Data courtesy of intermetric GmbH)

2 Improvements

2.1 Block adjustment based on selected stations

Finding errors in very large and / or highly contaminated projects can be quite tedious. In addition to the *Inspector* and the *Hatchet* tool, which are very mighty for the given task, we have added the option to perform a local block adjustment based on a selection. This can be quite helpful quick local checks in suspicious regions.

2.2 Option *Method of sampling*

For the processing step Plane-Detection, the points of the point cloud are read from SCANTRA into the computer memory. For reasons of memory consumption and processing speed, the point cloud is not read completely into memory, but only partially. For this purpose, the value *Maximum points to be read* could be set in the options dialog in the register tab *Plane-Detection*. The default setting of this value is 20000000 (20 million). Until now, the number of points was reduced by simple subsampling. This option is still available.

However, for scans with very different measuring distances, simple subsampling could result in details being lost at great distances while at the same time objects near the scanner were imaged with

unnecessarily many points. To avoid this effect, it is possible from version 2.5 on to select the option *Depth of kd tree* in the radio group *Method of sampling*. This option causes a regular density of the points in the developed view, the above-mentioned problems of detailing are thus avoided. The disadvantage of this option, however, is that all points of the point cloud must first be read from the medium, which may result in a slightly slower processing speed.

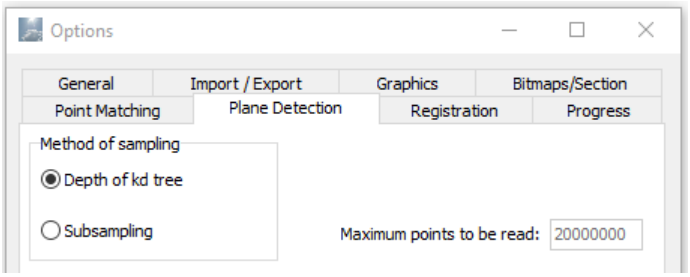


Figure 5: Option Method of sampling

2.3 Advanced Voxel Export

The feature of voxel export, which already exists since version 2.4, was extended in version 2.5. For the extended voxel export, the dialog *Voxel export* is opened in the main menu via *File > Export > Voxel export...* (see Figure 6).

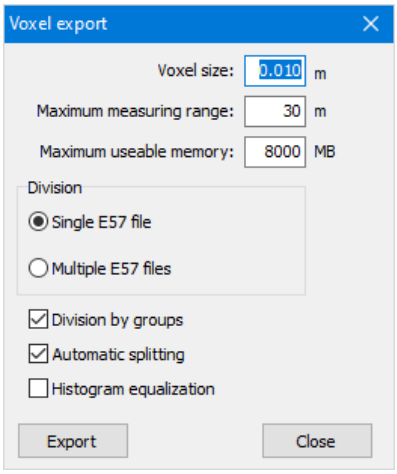


Figure 6: Dialog Voxel export

The checkbox *Division by groups* determines whether the points to be exported are grouped by station or by group. The Radio group *Division* decides whether the resulting point groups are written to a single E57 file or each one separately.

The *Automatic splitting* option allows the voxel export of even larger point clouds. If the maximum usable memory for the octree is exhausted, the current octree is dismantled, and the construction of a new octree is started from the next point group on. Although this can lead to an overlapping of octrees in some places and thus to an increased point density, this ensures that the voxel export of large point clouds can be performed without memory overflow.

If the *Histogram equalization* checkbox is ticked, such an adjustment is performed during the export (see point 1.7).

2.4 Consideration of not directly substituted point identities

Up to now, SCANTRA has only considered point identities for block adjustment that either guarantee the connection to the superordinate reference system or connect isolated transformation blocks with

each other. It was assumed that the information of all other point identities is mapped by pairwise transformations. In most cases this is also the case.

There are, however, network configurations in which previously unconsidered point identities influence the result of the block adjustment. This is the case, for example, if a large loop of pairwise transformations can only be closed by a single point identity. For this reason, from SCANTRA 2.5 onwards, all those point identities are also considered in the block adjustment that are not directly substituted by a pairwise transformation.

2.5 Change invalid scan file paths dialogue

SCANTRA requires access to point clouds during plane detection, extraction of meta data from a file's header or when checkerboard targets are digitised. If the *.scdb-database or the originally imported scans were moved in relation to each other, access to required files will not be possible due to invalid scan file paths. Hence, a new file manager was added that allows to quickly assign new paths to all files. In addition to that, parts of a path or file suffixes can be easily changed by a find and replace function.

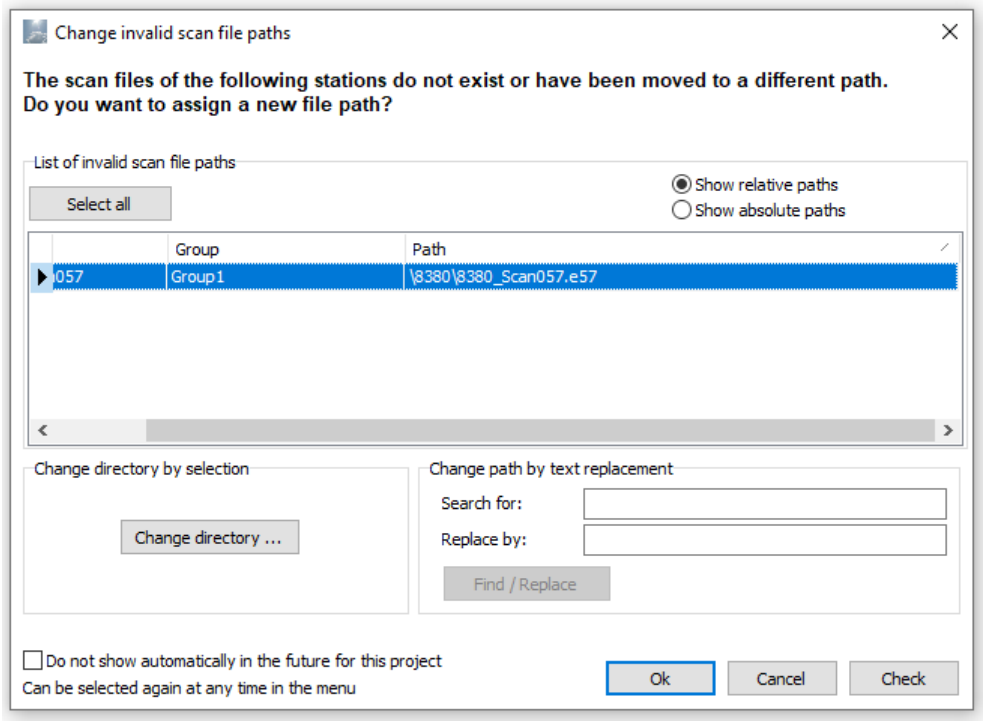


Figure 7: Change invalid scan file paths dialogue

2.6 Deactivation of local coordinates

If a local coordinate was identified as a blunder, it could previously only be switched off by separately searching for and deactivating all point identities in which the local coordinate in question was involved. Now it is also possible to deactivate local coordinates in the inspector browser, the browser of the local coordinates, in the project tree and in the graphic window.

3 Bugfixes

3.1 Handling corrupt or inconsistent E57 files

E57 files from different sources sometimes show inconsistencies. These could cause SCANTRA to crash during import. In such a case, an error message is now displayed without the program crashing.

3.2 Black tinted relations in the adjacency graphs

Uncontrolled / poorly controlled relations were tinted in black in the adjacency as well the scaled adjacency graph when the network analysis was activated. This was confusing since switched off relations are also tinted in black. This bug is now fixed.

3.3 Showing intersecting planes without detected planes

In projects that were registered by e.g. targets where no planes were previously detected SCANTRA crashed when the user wanted to show an intersection of the planes (that did not exist). This bug is now fixed.

3.4 Incomplete reference station import

The reference station, e.g. Tachy, did not appear in the registration, which contained the imported global stations. This could become a problem when defining reference frames. Now during the import, if no global station for the reference station exists, a global station is created.

3.5 Local coordinates were missing in the inspector

Point identities were displayed in the inspector browser, but not local coordinates. In the protocol, however, the top ten list also showed incorrect local coordinates. This bug has been fixed.

3.6 Missing entry in the inspector

In the context menu of the Top 10 browser, the menu item Show horizontal section was missing.