Leica ATS600

The Leica ATS600 is a unique instrument that combines both precision reflectorless measurement with the more traditional Laser tracker measurement capabilities.

Prerequisites

- All Leica trackers are shipped with 192.168.0.1 as the IP address as default. The Leica ATS600 also offer a wireless connection option which uses a different IP by default. Adjustments to the tracker's IP address should be made within Tracker Pilot.
- The current version of Tracker Pilot can be downloaded directly from the Laser Tracker Controller. To do so, open a web browser and type *http://192.168.0.1* in the search bar. This will open a link to the tools saved on the tracker controller. To learn more about configuring IP addresses, see the IP Address Basics section.

LMF Tracker DLL installation

If you have any trouble running the ATS you may need to update your .net framework and you can then try the following procedure:

1. Navigate to *C:\Analyzer Data\LMF_Deployment.*
2. Right-click on *deployLMF_showResults.bat* and select "Run as administrator".

Compensation

The ATS600 trackers and accessories can be compensated within Tracker Pilot (if you need the current Tracker Pilot you can browse directly to http://192.168.0.1 (or the trackers IP) and download Tracker

Pilot from the controller).

- Compensation Password: Expert (Full and Intermediate, ADM, Reflector Definition, Camera Compensation, etc.)
- Server Settings Password: Administrator (TCP/IP address, Time/Date, etc.)

Starting the Interface

1. Select **Instrument > Add**  and choose the respective Leica Tracker from the ***Add Instrument to SA*** dialog.

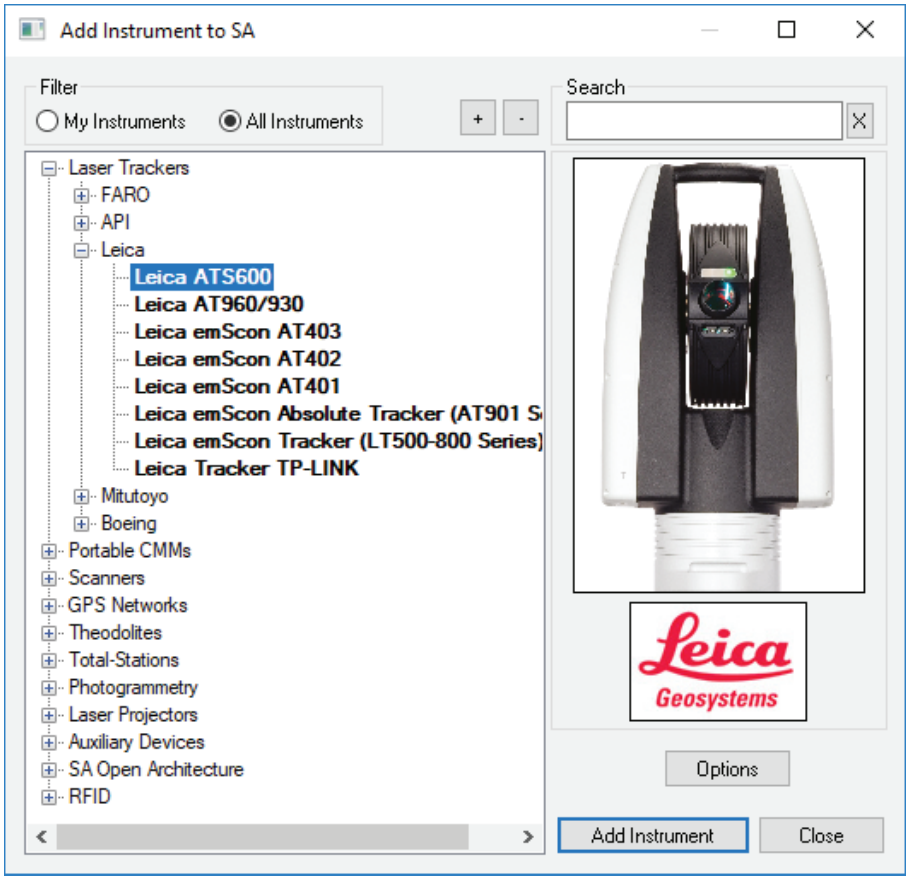

Figure 3-79. Adding a Leica ATS600 tracker.

2. Now run the instrument interface module using **Instrument > Run Interface Module** (with the drop down below the Connect button) and choose **Laser Trackers**.
3. Select the instrument model you want to connect to in your SA job from the network list and press OK to move to the connection dialog (Figure 3-80).

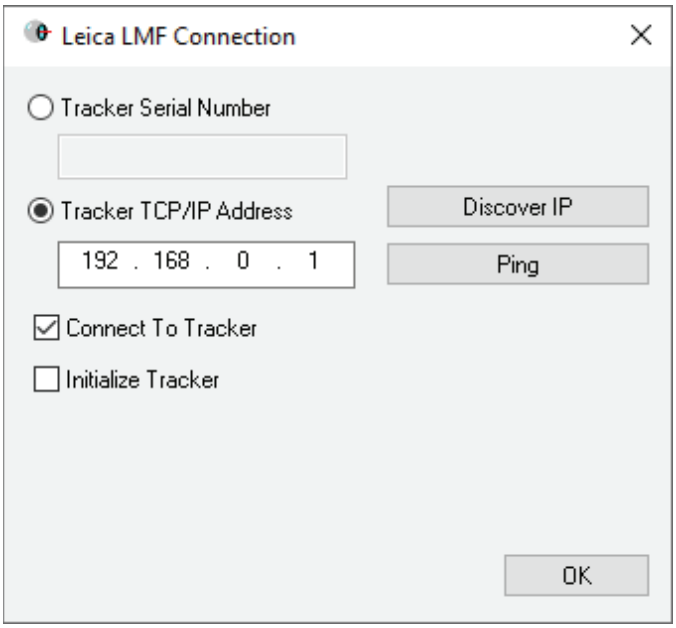

Figure 3-80. The Leica Tracker connection window.

Within the Connection dialog Enter the tracker's IP address, or use the IP discover utility, and use the Ping button to test the connection if needed. Once satisfied, press OK. The next time the interface is started, you can simply click the Run Interface by pressing Connect . This will use the last saved settings and automatically connect the instrument. The interface is now connected and ready for use. Please refer to the Laser Tracker section for details on the laser tracker interface ("Laser Tracker Interface" on page 10).

ATS600 Overview in SpatialAnalyzer - https://youtu.be/xzm-1dcn22Y

Tracker Specific Settings

The ATS600 is a unique tracker in that it can take reflectorless surface measurements. It can also automatically scan tooling balls using a built in utility. To support this two unique functions, tooling definitions have been added:

- **Retro: Surface.** Is used to measure surfaces directly.
- **Scan Target: Custom Sphere.** Is used to scan a tooling ball of a given diameter and returns the sphere center point. These target definitions are defined within Tracker Pilot and will then be available for use within SA (Figure 3-81).

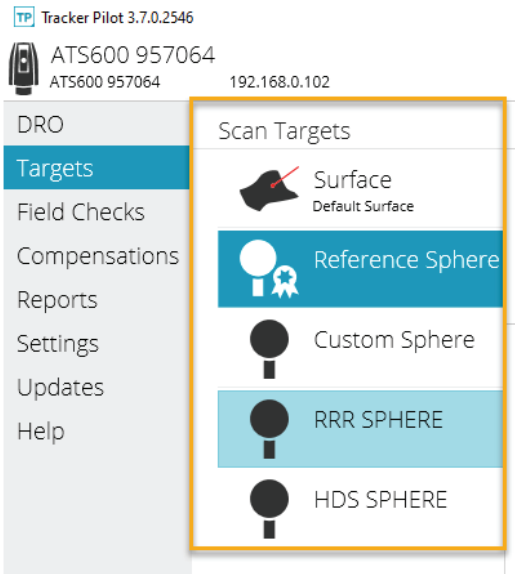

Figure 3-81. Scan Targets

Basic Scan Operations

The Over View Camera (OVC) can be directly accessed from both the Toolbar (Figure 3-82) and the full instrument interface (Drive head/ OVC). Basic scan options can be performed directly from this control and do not require the use of any measurement profiles. This approach is simple in that you define a region and can immediately scan that region, but does not offer the ability to save regions or control additional filtering. These options are available as part of a measurement profiles definitions (see following sections.

To perform a basic scan do the follow:

1. Open the OVC camera using the Drive Beam Icon (Figure 3-82).

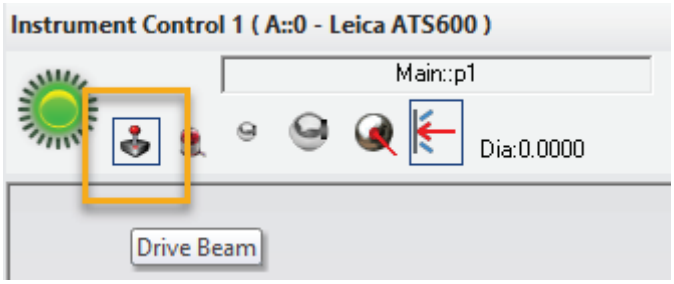

Figure 3-82. Drive Beam Icon

2. Define regions and lines as desired. See section below for more information on the OVC controls.
3. Press use the Red custom profile button (which is preset to OVC Scan for the ATS) to control start and stop of the scan.

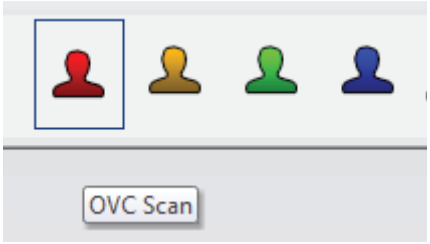

Figure 3-83. OVC Scan Button

This same basic scan control can be accessed from the OVC button in the full interface as well.

When the OVC Scan button is pressed the tracker will measure *All* the regions defined on the controller, both lines and polygons. Therefore you need to remove any definition you do not want to directly use. Specific regions can be saved as part of a measurement profile for use later if needed. The greater controls and options for this are as follows.

This independent measurement process can also be directly accessed from the full interface using the Drive Head/OVC button. The Camera button will open the tracker OVC and the Scan button can be used to initiate a scan defined directly (Figure 3-84).

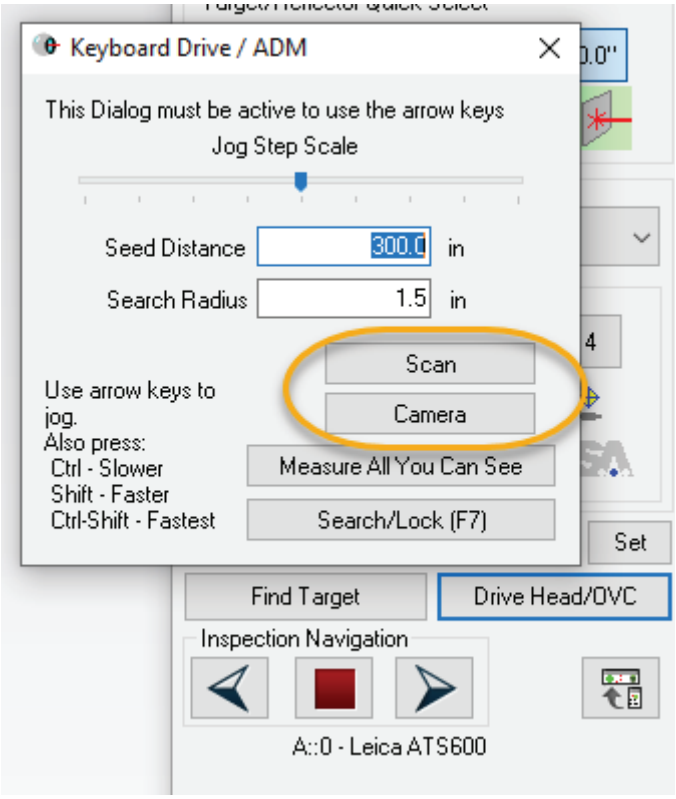

Figure 3-84. Drive Head/OVC Scan access

Saving Scan Region Definitions with Measurement Profiles

The definitions of scan Area and Line regions have been streamlined as follows:

- While the OVC is option, whatever is showing in the OVC will always be Measured, no matter how the OVC was opened (from a profile definition or from the Drive Head/OVC control).
- If you open the properties of a measurement profile using the edit icon and the OVC using the Show Regions (or Show Lines) button, this will automatically push the saved scan regions from within the measurement profile to the OVC and the saved regions will be displayed. This will replace any regions previously defined on the OVC before the Show Regions (or Show Lines) button is pressed.
- With the properties dialog open you can edit the regions within the OVC and use them in the edited condition, but they will not be saved with the measurement profile until the measurement profile is saved. Any changes to the Area or Line scan definitions made within the OVC should be saved to a profile, using the Save button in the profile, before closing the OVC or the changes will be lost.

The ATS600 also offers 3 default measurement profiles that can be edited and saved with user defined region definitions:

- **Area Scans.** Provide the ability to define a boundary around a part or feature of interest and scan within that boundary.
- **Line Scans.** Define a line or Polyline that can be used to either scan along in a **Linear** mode (scanning along a line) or in rectangular regions along a lines path in a **CrossLine** mode.
- **Ring Scans.** All scanning in a full arc about the tracker.

Area Scans using Regions and Polygons or Perimeters

Three default Area Scan measurement profiles were added to support area scanning:

- **Area Scan Cloud.** This is the most commonly used profile. It provides full scan configuration and will return a point cloud.
- **Area Scan Points.** In cases where a scan needs to return points individually rather than a point cloud this profile can be used.
- **Area Scan Plane.** If a scan is intended to return a particular geometry the raw measurements this profile provides an example of how to use a scan to build a plane.

Note: The Area San measurement profiles require a Retro: Surface target selection.

By request, we force this target type to be set any time an Area Scan mode is active.

As always, these three are just default starting points, and you are free to define your own custom profiles. Note also that *Stable Point* measurement profiles also work very well with reflectorless measurements.

Regions used to define the extents of Area Scans are defined in advance as part of a measurement profile definition. To do so, select one

of the pre-defined **Area Scan** profiles as the active measurement profile and press the View Selected Profile button to edit the profile settings (see Figure 3-85).

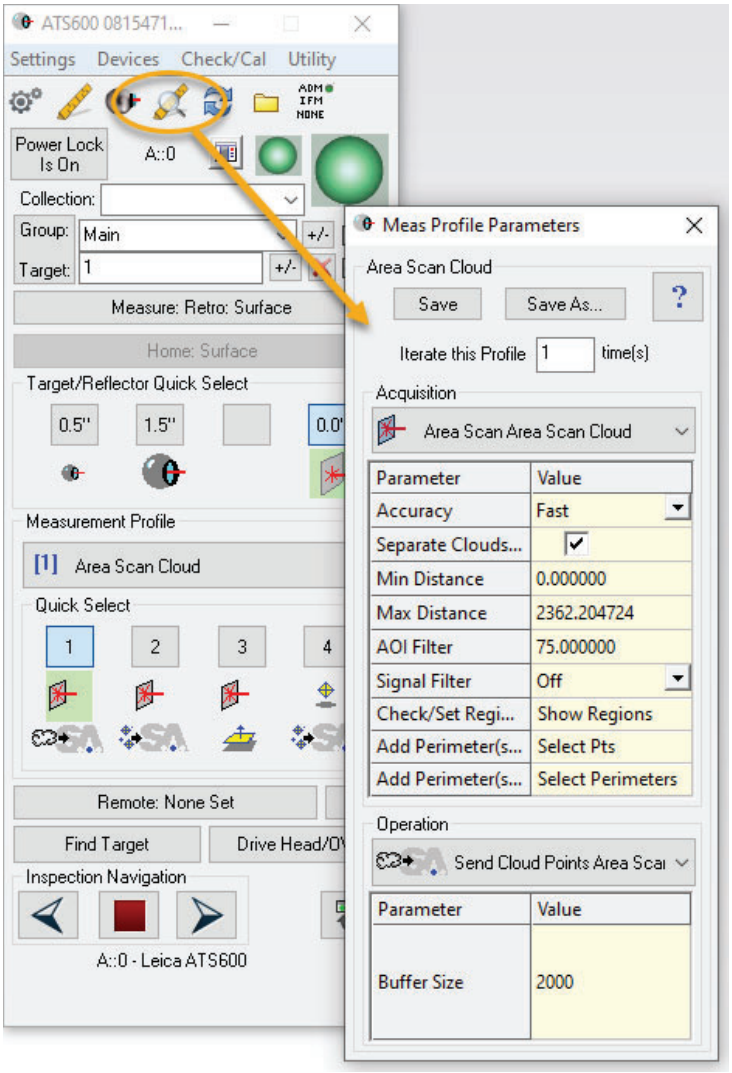

Figure 3-85. ATSInterfaceandScan Profile configuration

An Area Scan profile offers the following settings:

- **Accuracy.** Set as Fast, Standard or Precise.
- **Separate Clouds.** This check box determines if separate clouds will be used for different perimeters.
- **Min Distance.** Defines a minimum limit such that data closer than this threshold will not be recorded.
- **Max Distance.** Defines a maximum limit such that data further than this threshold will not be recorded.

NOTE: You can move the tracker head to the desired position, and click directly in the profile grid on the *Min Distance* and *Max Distance* labels to make the tracker set these by measuring the distance to the surface where it is pointing.

- **AOI Filter.** The Angle Of Incidence (AOI) filter will exclude data recorded on a surface at a greater angle in degrees than the set value.
- **Signal Filter.** This filter can be set to "Off, Low, Medium, and High" settings, and is based on a combination of broadening value and intensity.
- **Check/Set Regions - OVC.** The Value section for this Parameter operates as a button that will open the trackers OVC camera.
- **Add Perimeter(s) - SA.** The Select Pts option here will trigger a perimeter selection mode within SA in which an operator can select points to define a perimeter.
- **Add Perimeter(s) - SA Perimenters.** The Select Perimeters option here will trigger a perimeter selection mode within SA in which an operator can select predefined perimeters from SA.

Defining CAD Perimeters for Scan Areas in SpatialAnalyzer -

https://youtu.be/XYrh7-QyBU4

Patch Scans

The Patch Scan Cloud profile was added to facilitate auto-measure type operations where the reference points define the center of a patch of a give size. Selecting points from SA defines a collection of scan regions on the controller such that each point is scanned using a square patch.

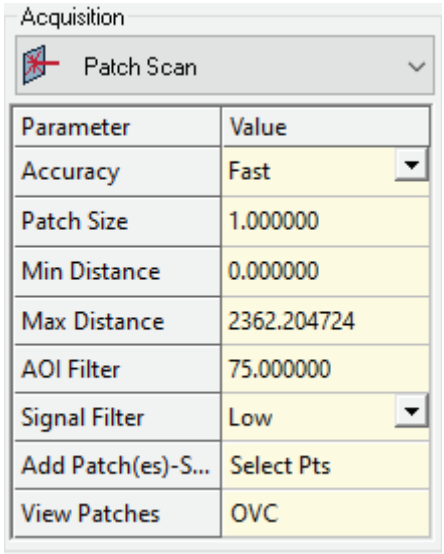

Figure 3-86. PatchScanAcquisition

From the Patch Scan profile window:

1. Select "Add Patch(es)-SA Pts" to select points from SA. Hit "Enter" to create the patches, and update the OVC if it is open.

2. Select "View Patches" to open the OVC to show your patches and control the region density, or to update the OVC with changed settings.

The patch size (length of square perimeter around each selected point, perpendicular to tracker line of sight) can be set here as well. Patches are shown in the OVC's Regions tab. Point to Point spacing and Grow/Shrink Width is set there, like it is for Area Scans (both are per-region parameters).

Note - Any pre-existing Patch perimeters are cleared when creating new ones, unlike perimeters in an Area Scan, where new perimeters are added, and existing regions are not cleared.

Line Scans using Lines and Polylines

Line definitions provide an alternative way to measure either in a linear progression or using a series of crossing lines perpendicular to a poly line. This measure mode is accessed using a **Line Scan** Acquisition (Figure 3-87).

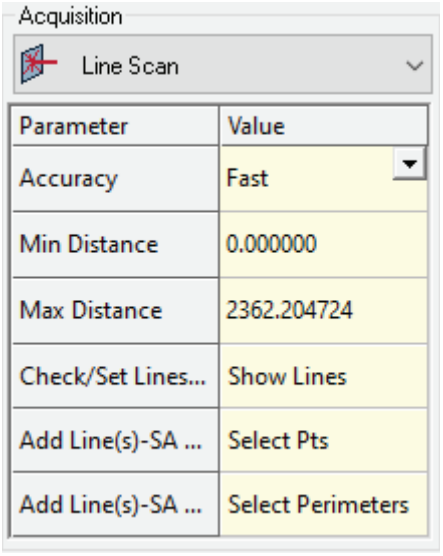

Figure 3-87. Line Scan Acquisition Parameters

A Line Scan profile offers the following settings:

- **Accuracy.** Set as Fast, Standard or Precise.
- **Min Distance.** Defines a minimum limit such that data closer than this threshold will not be recorded.
- **Max Distance.** Defines a maximum limit such that data further than this threshold will not be recorded.

NOTE: You can move the tracker head to the desired position, and click directly in the profile grid on the *Min Distance* and *Max Distance* labels to make the tracker set these by measuring the distance to the surface where it is pointing.

- **Check/Set Lines - OVC.** The Value section for this Parameter

operates as a button that will open the trackers OVC camera.

- **Add Line(s)-SA Pts.** The Select Pts option here allows a user to select points directly from with SA for use in a Line Scan Region definition, once set, it is then viewable through the OVC.
- **Add Line(s)-SA Perims.** The Select Perimeters option here allows a user to select perimeters directly from with SA for use in a Line Scan Region definition. It builds a line for each side of the defined perimeter, and will be visibible through the OVC. Use the **Closed Perimeter** check box in the perimeter properties to add an additional polyline returning to the start, if desired.

*Note - Lines are saved as part of the measurement profile. To clear them out you will need to delete them from within the OVC and Save the measurement profile. You should then see a notification "*No Lines defined in Line Scan mode on the controller*". Re-opening the OVC will re-import any saved regions from the measurement profile.

Ring Scans

Ring Scan definitions provide a means to measure a full arc about the tracker. This is accomplished using a **Ring Scan** Acquisition (Figure 3-88). This is the only profile that does not offer access to the OVC. The ring scan definitions are defined only using a Zenith angle (zero being straight upward and 90 degree being straight outward from the tracker base) and a point/line spacing definition.

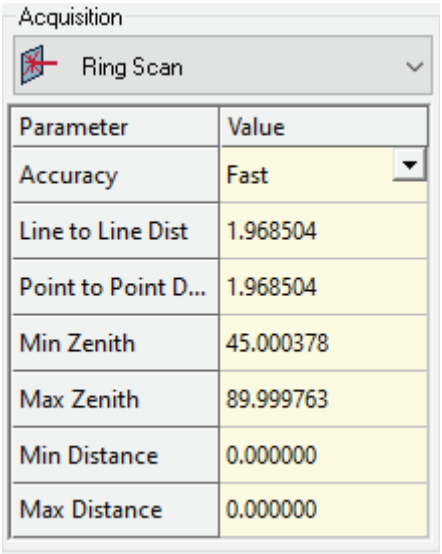

Figure 3-88. Ring Scan Acquisition Parameters

A Ring Scan profile offers the following settings:

- **Accuracy.** Set as Fast, Standard or Precise.
- **Line to Line Distance.** Defines the distance between line or arcs about the tracker.
- **Point to Point Distance.** Defines the point spacing along a line or arc.

- **Min Zenith.** Defines the lower limit in the vertical angular range covered by the arc recorded by the tracker.
- **Max Zenith.** Defines the upper limit in the vertical angular range covered by the arc recorded by the tracker.

NOTE: You can move the tracker head to the desired position, and click directly in the profile grid on the *Min Zenith* and *Max Zenith* labels to make the tracker set these by measuring the vertical encoder of the tracker. The values are always in degrees. The current azimuth (horizontal angle) position of the tracker will not matter for this setting.

- **Min Distance.** Defines a minimum limit such that data closer than this threshold will not be recorded.
- **Max Distance.** Defines a maximum limit such that data further than this threshold will not be recorded.

NOTE: You can move the tracker head to the desired position, and click directly in the profile grid on the *Min Distance* and *Max Distance* labels to make the tracker set these by measuring the distance to the surface where it is pointing.

Defining Measurement Profiles for the ATS600 in SpatialAnalyzer -

https://youtu.be/5PWdwjhEs5E

Using the built in OverView Camera (OVC)

By using the video, and selection points from the image, a region can be defined. To do so perform the following steps:

1. In the *Check/Set Regions - OVC* (or *Check/Set Lines*) parameter Click on the Show Regions (or Show Lines) button in the Measurement Profile Acquisition. This will open the Leica Overview Camera (Figure 3-89).
2. Select the Add Region button and left-click in the graphics to define a polygon, use right-click to complete the polygon or Escape to cancel. A "Region" has a single set of point to point and line to line distance parameters. A tighter grid will result in a longer scan time.
3. Add additional polygons within a region definition through use of the Add Polygon button, if needed. Select a polygon and press green circle to toggle the polygon from interior/exterior in order to define exclusion zones.

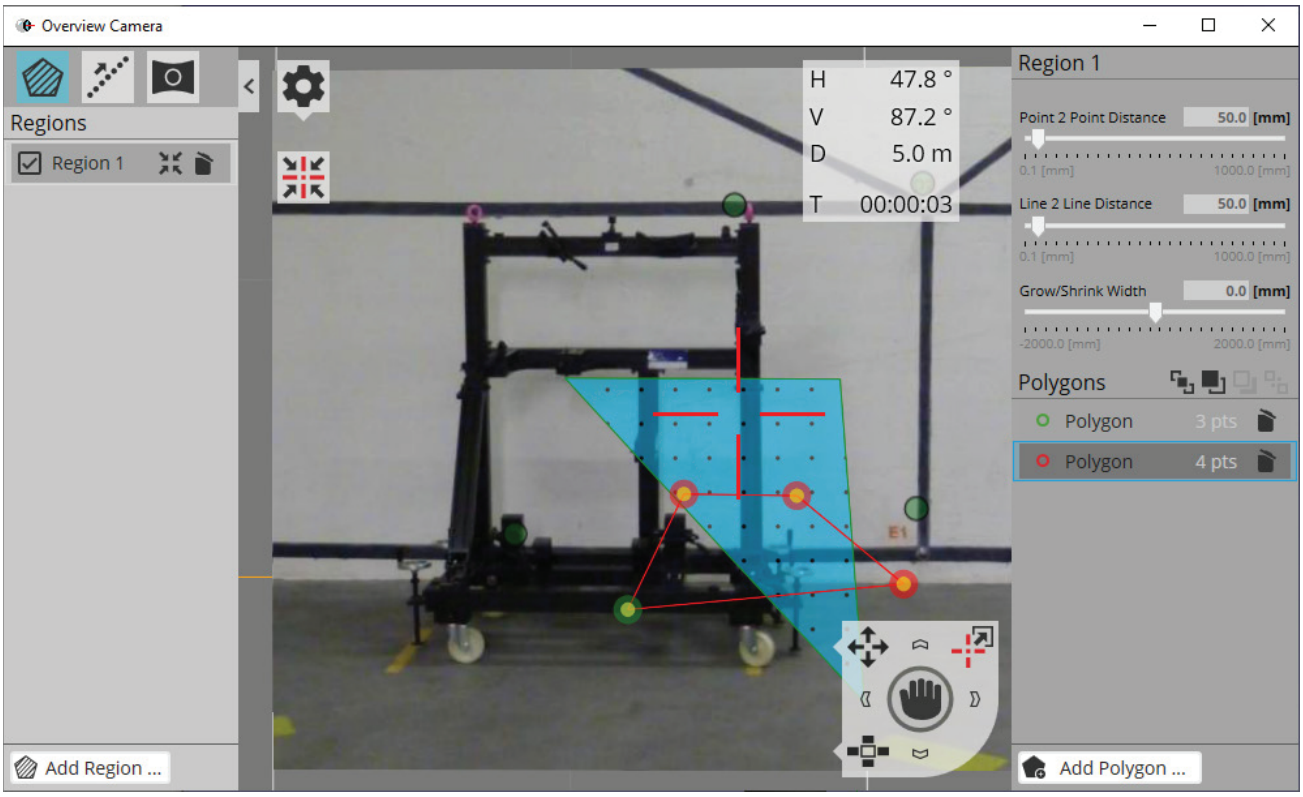

Figure 3-89. LeicaOverviewCamera and selection region

4. Add additional Regions to the OVC as desired to define regions with different point resolution as part of a single scan.
5. Close the OVC. This process will save the current region and polygon settings from the OVC to the active measurement profile.

Line profiles are defined the same way using the Line Scans tab. A "Line" is equivalent to a "Region" while a "Polyline" is equivalent to a "Polygon". The biggest difference is that the Line Scans profile can be defined with either (or both) Linear and CrossLine measurements.

Measuring points directly from the OVC camera

Measurements can be taken directly from the OVC camera using mouse clicks. This can be done using the play button in the drive control (Figure 3-90).

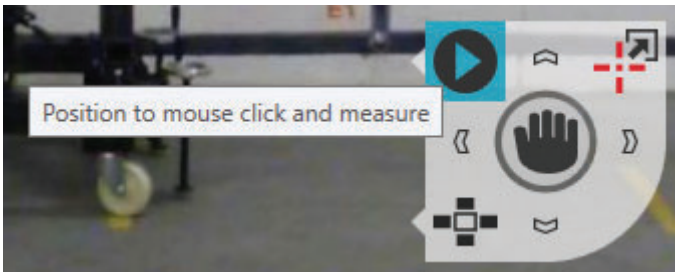

Figure 3-90. Direct Measurement from the OVC camera

Using 3D Region Definitions

The region definitions built either through the OVC (using the Set Distances option) or using a perimeter built from SA are 3D and defined in World coordinates. This allows you to define a set of regions from a CAD surface for example, save the profile, jump instrument and immediately measure with the same profile to scan the same region from a different perspective within the same job file. This can be very helpful in getting enough coverage for feature extraction.

Scan Data, Intensity, broadening and Color

Each cloud point returned from an ATS includes color information in Red, Green and Blue. These are used to indicate a quality matrix about the cloud point recorded.

- Blue and green together represent the ATS return intensity value. Higher blue and green values mean higher intensity (usually good).
- Red represents the broadening value. Higher red value means higher broadening (usually bad), meaning steeper incidence angles or beam splitting and deflection.

Both Intensity and Broadening values are in a range from 0-255. Leica's recommended filter settings for broadening are as follows:

- **Off.** Don't reject any red value's
- **Low filtering.** Reject red values > 170
- **Med filtering.** Reject red values > 42
- **High filtering.** Reject red val > 2

In general terms the broadening value is a measure of the return pulse in comparison to the start pulse. It the intensity and duration of return is compared and the continuity of this return is computed. As an example, the signal broadening from a split surface might look like this, where the full peak is the intensity but the difference in front and back signal define the broadening value:

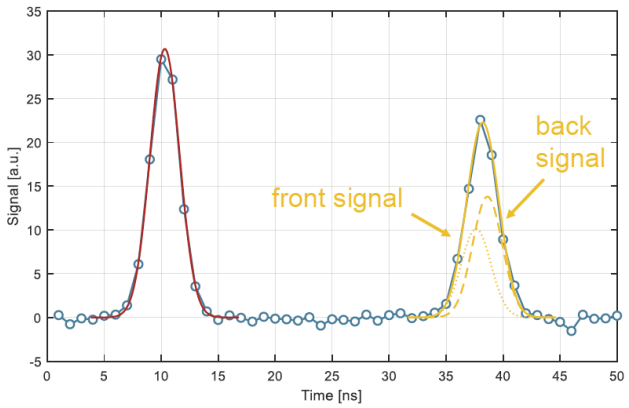

Figure 3-91. Broadening of a signal return.

As shown in the picture below. Removing regions with low intensity and higher red or broadening values can provide a helpful way of removing unwanted data (Figure 3-92).

Figure 3-92. Beforeandafterimage of color filtering

In order to filter out cloud points of a particular color right-click on the point cloud and select the **RGB Filtering** option.

Using RGB Filtering with ATS600 in SpatialAnalyzer - https://youtu.be/m11ufArEkJU

Surface Vector intersection Measurements

The ATS refectorless measurement capability provides a means to precisely measure a point location on a surface. Vectors normal to that surface can be used to identify exactly where to measure on an actual part regardless of thickness variation. This corrects for a potentially significant shift in the location of the returned point depending on the incidence angle to the part if nominal points on the part are used rather than vectors. SVI (Surface Vector Intersection) measurements provides an aut-measure function which can be used for this type of application.

For settings, go to the Gear Tool (General Settings) in the main tracker interface window, and hit [Leica ATS] button (Figure 3-93).

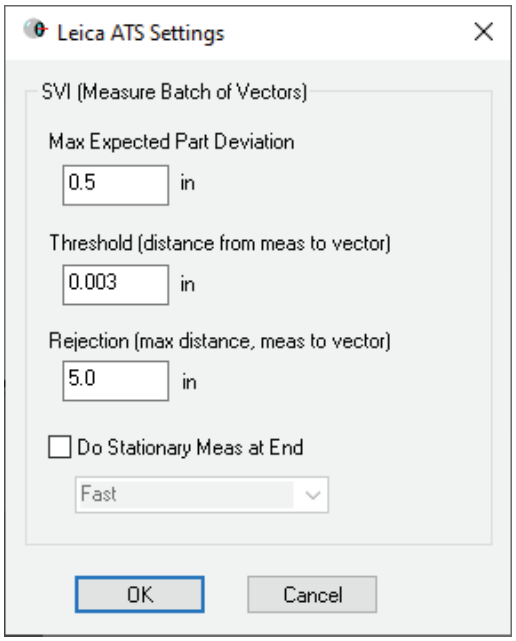

Figure 3-93. Controls for the Surface Vector Intersection measurements within the tracker interface.

- **Max Expected Part Deviation.** Is the size of an initial 3-point search along the reference vector, and at least one of the positions must hit the part.
- **Threshold (distance from meas to vector).** Defines how close you want the search to get in order to yield a measurement whose distance from the vector is within that threshold.
- **Rejection (max distance, meas to vector).** Fail the measurement if this threshold is exceeded, and add a report to the Instrument History in SA, identifying the failed point. The addition will help to avoid the condition where the tracker cannot point to the expected intersection point, or along the search vector, and to diagnose it when it does happen.
- **Do Stationary Meas at End.** By enabling this option the live distance reading still guides to beam to the desired location, but rather than simply sampling the distance a more accurate point measurement is then triggered. This can be set to Fast, Standard or Precise surface point modes.

To initiate this measurement, just go to the SA Instrument menu, and select **Instrument>Automatic Measurement > Measure Batch of Vectors** (Figure 3-94).

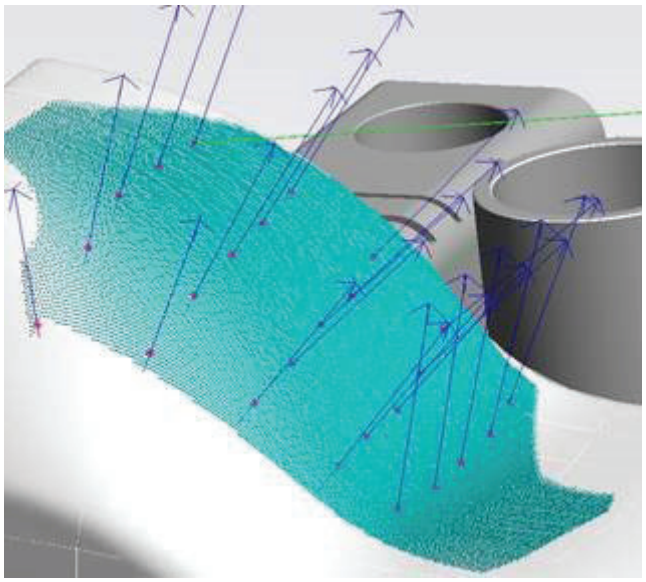

Figure 3-94. Example set of SVI surface measurements at the specified vector locations

Measurement details will include the "Max Expected Part Deviation" and "Threshold" values used, and the resultant point's distance from the vector.

Surface Vector Measurements with ATS600 in SpatialAnalyzer -

https://youtu.be/QHjj5IP7J6s

Running the Tracker Interface Separately

One of the unique features about SA's architecture is that the instrument interface can be run separately from SA. This provides a means to run multiple trackers independently on different machines while connect to a single SA for data storage. Doing so also provides the ability to separate the persistence files for individual trackers, as the persistence file will be saved in the directory as where the tracker interface is launched, as opposed to the ***C:\Analyzer Data\Persistence*** folder.

In order to run the SA Laser Tracker process separately some additional support files are required. These include the following files (Figure 3-95):

Name	Date modified	Type
GeomfitDLLuvc19.dll	9/29/2021 11:40 AM	Application exten...
MeasurementDLLuvc19.dll	9/29/2021 11:40 AM	Application exten...
NRKDLL64uvc19.dll	9/29/2021 11:34 AM	Application exten...
NRKDLLuvc19.dll	9/29/2021 11:40 AM	Application exten...
SALaserTrackersuvc19.exe	9/29/2021 11:41 AM	Application
Surflibsvc19.dll	8/18/2021 4:54 PM	Application exten...
TrackerDLLuvc19.dll	9/29/2021 11:41 AM	Application exten...
TrackerUnicode.dll	8/18/2021 4:54 PM	Application exten...

Figure 3-95. Required Files to run the SA Laser Tracker process independently from SA.

MP support for Automation

In addition to the standard Laser Tracker MP support there are a couple of commands of note that will be directly helpful for the ATS:

- **Scan Within Perimeter.** Provides the means to select a perimeter and configure a scan's resolution using the ATS600.
- **Scan CAD Faces.** Takes the scan within perimeter idea and applies it to a list of CAD faces. This command can include exclusion zones defined by holes in the selected CAD faces.

When using this command, the "**Parameter set name**" (A2) can be used to define the resolution of the scan within the perimeter you select in A1. Enter a string for the **Parameter set name** as follows:

- **"uuPxx".** To set point to point (P) spacing only for an area scan.
- **"uuPxxGSWxx".** To set point to point (P) spacing and apply a Grow/shrink Width (GSW) to an area scan.
- **"uuPxxLWxx".** Line scan using the specified Point to Point distance (Pxx) and Line Width (LWxx).
- **"uuPxxLWxxLtoLxx".** Cross line scan using the specified Point to Point distance (Pxx), Line Width (LWxx), and Line to Line distance (LtoLxx).
- **"C or P.** You can append either C or P to any of the strings to enforce measurement using a Point Cloud (C) or a point group (P). Use "inP0.2C" for example to scan a point cloud with a 0.2 inch density.

Where "uu" can be either "mm" (millimeters) or "in" (inches). For example: entering a value such as "mmP10" would produce a scan with a 10mm spacing between the points within the specified perimeter.

In 2022.3 a dialog entry method has been added to simplify this process (Figure 3-96).

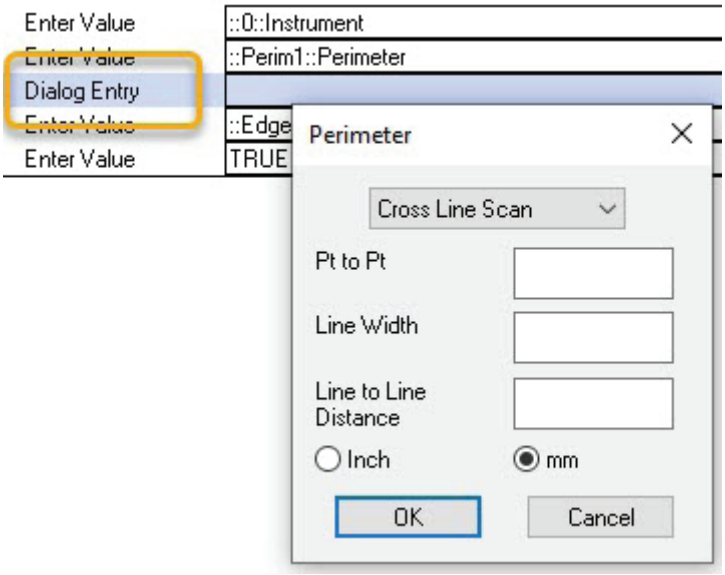

Figure 3-96. Dialog Entry

- **RGB Cloud Point Filter.** Can be used to adjust visibility of cloud point data based upon intensity and broadening values.

There **Instrument Operational Check** command "*camera view*" can be used to open the OVC and while open, **Configure and Measure** can be used to trigger measurements using the user defined OVC definitions, as long as it is used with the OVC still open. This is a means to have a user guide a measurement setup from MP.