## GSI V-STARS Photogrammetry System

Software Installed and Setup:

SA does not interface with the cameras directly but rather with the host application Vstars. Vstars must be installed and running on the machine prior to using the interface with it in SA. Follow the manufacturer directions for this process.

Starting the Interface

1. Select **Instrument > Add** and choose the GSI V-Stars Photogrammetry System from the Instrument List (Figure 17-20).

**Figure 17-20.** Adding a V-STARS camera system to SA.
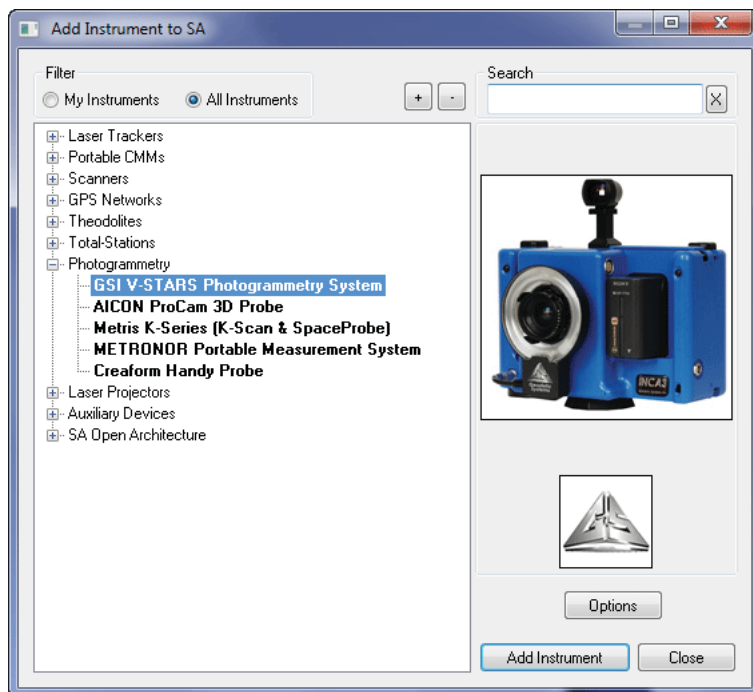
2. Run GSI V-stars 4.7.A16 or later.

3. Start the instrument interface using **Instrument > Run Interface Module and Connect** or 🏃 .

GSI Vstars Interface Overview

The GSI Vstars Interface can be divided into 4 sections (Figure 17-21):

- Section 1 - Provides data naming controls
- Section 2 - Provides trigger functions to record data
- Section 3 - Provides data type selection
- Section 4 - Controls SA's processing of that data

Figure 17-21. The V-STARS interface.
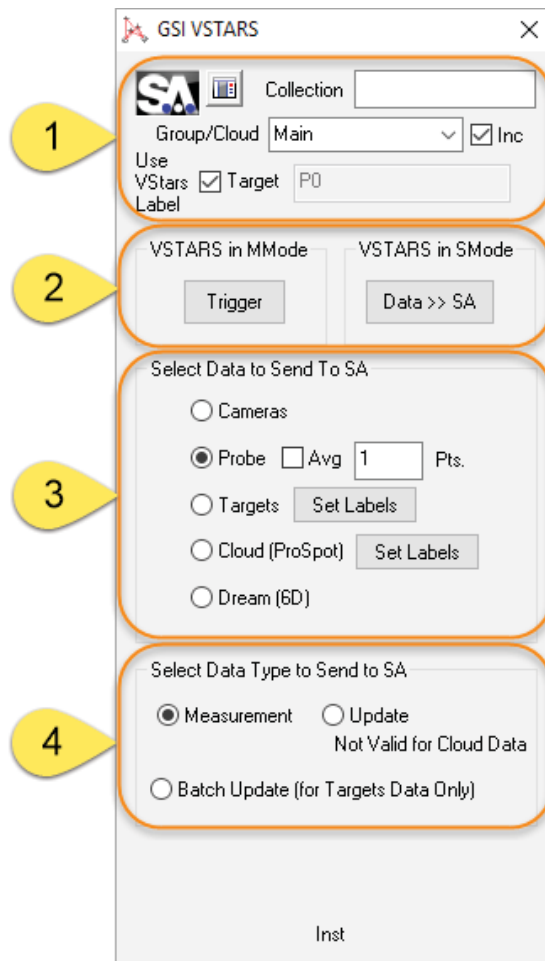
Section 1: Target Label Definition

This section designates the Collection Group/Cloud and Target sent to SA for a particular target. Typically the target names sent to SA should match those used by Vstars. To ensure this Check the *Use VStars Label* Check box. Checking the *Inc* checkbox will auto-increment Group/Cloud names. When checked, the group or cloud name will automatically increment after each time data is send to SA.

**Figure 17-22.** Section 1 – Point naming controls
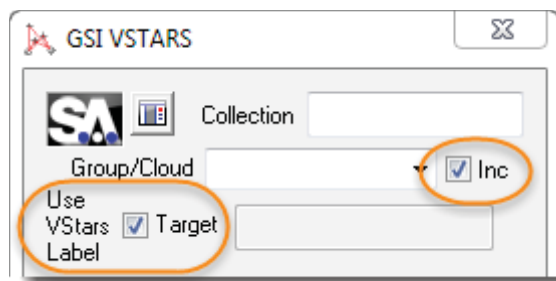
Section 2: Trigger Functions

Data triggering needs to be defined and set up within Vstars. When in M-Mode either a single trigger can be sent or Vstars can be set to a continuous mode. The buttons in section 2 then act as a start stop

function for either M-Mode or S-Mode. (Figure 17-24):

- **Trigger (M-Mode).** The Trigger Button will initiate data transfer to SA in multi-camera mode. The data type sent is defined in the following section (Camera, Probe, Targets, Clouds (ProSpot), or Dream (6D)). This will either be a single event or a continuous transfer depending on the setting defined in Vstars.

- **Data>>SA.** Using the Data >> SA button will initiate an immediate project import from V-STARS. This is a great way to start and to get a constellation of points in SA to use as a frame of reference.
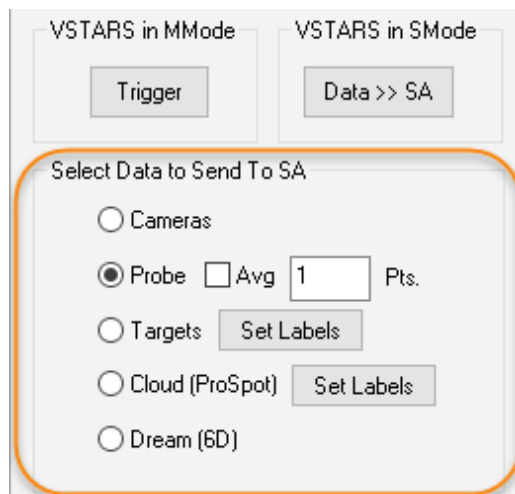

Figure 17-23. Section 2 - Trigger Functions
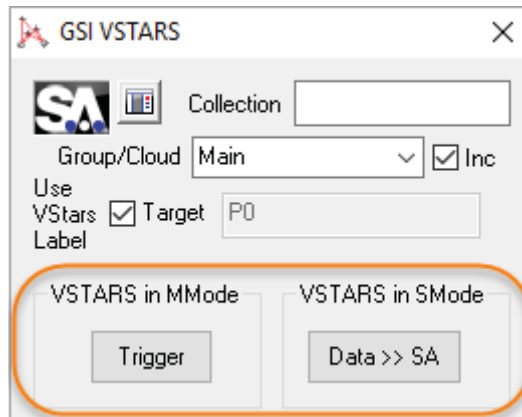
Section 3: Data To Send to SA

The data type sent to SA is when a Trigger event is recorded is controlled by a set of radio buttons.

**Figure 17-24.** Section 3 -Data To Send to SA

Data Source controls work as follows:

- **Camera.** The camera transforms are sent to SA updating the camera positions shown in the graphics.

- **Probe.** The most recent PROBE point is sent to SA. Checking the *Avg* chekbox will send a single averaged point when the

point count has been reached. Typically used in continuous mode.

▪ **Targets and Cloud (ProSpot).** A filtered selection of particular target types can be sent based upon user selection (Figure 17-25). Selecting Cloud (ProSpot) will send data to SA in the form of a point cloud once a trigger event occurs. Note that the cloud sent will carry then name shown in the 'Group/Cloud' edit box.

Figure 17-25. Data Type Selection and Target Labels
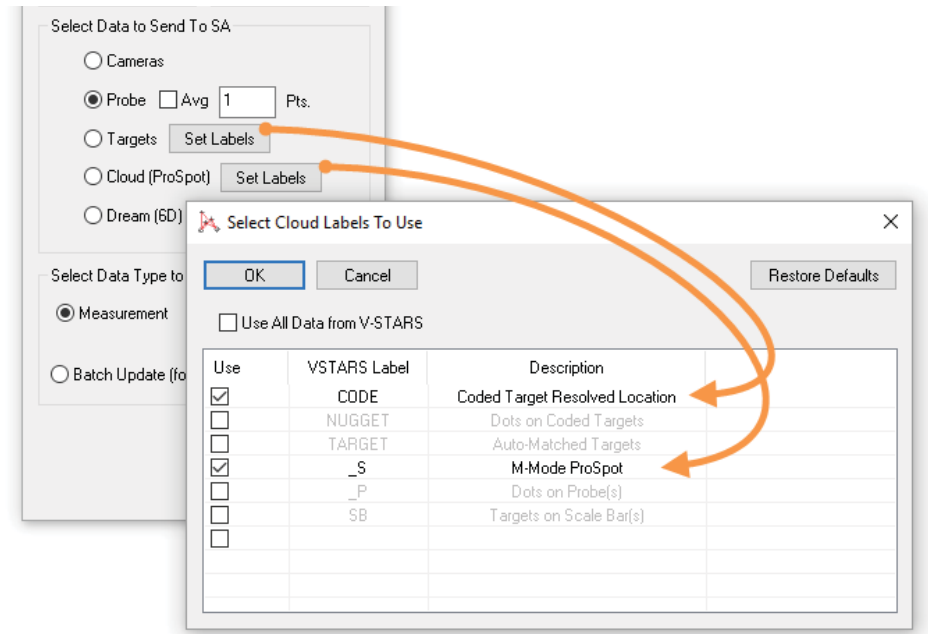
The Set Labels buttons provide access to a filters control. They are used to set the Vstars data types (labels) which will be sent when measuring either 'Targets' or 'Cloud (ProSpot)'. The Targets data selection defaults to "CODE", and the Cloud (ProSpot) data selection defaults to "S". The selections denote strings. When any of the selected strings are found in the Vstars label of a point, that point will be sent to SA in the selected data form ('Targets' means points, and 'Cloud (ProSpot)' means a point cloud). To include additional data types simply check the use check box next to the data type.

▪ **Dream (6D).** With this selected, under "Select Data Type to Send to SA", if you select: *Measurement*, you will get point data with 6D data embedded. You can construct frames on these points using the embedded 6D data if desired. When set to *Update*, you will get 6D updates. With VSTARS M-Mode in "Continuous Trigger", these updates can be used for 6D tracking ("TransTrack") in SA. - Support for 6D tracking requires VSTARS v.4.9.1-dev360 (from 11/28/2016) or later.

Section 4: Data Type to Send to SA

▪ **Measurements.** By default, the interface sends measure-

ments to SA as points or clouds which are stored as such. This setting preserves this default behavior.

- **Update.** Updates are not added to the SA Tree Database like Measurements. Rather, are used as updates for monitoring processes such as Watch Windows. Updates are meant to be used with Probe data (see section 3), but can be used with all but the Cloud data.

Figure 17-26. Section 4 - Data Type to Send to SA
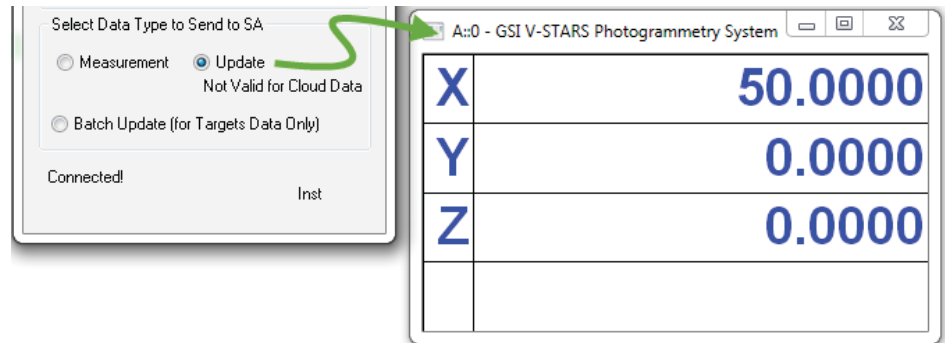
- **Batch Update.** Originally intended for use with SA's Instrument >> Automatic Measurement >> Measure Batch of Points, this command lets you transmit a batch of pts to the instrument, set tolerances, and update that set of points once the instrument sends the batch back to SA. Being photogrammetry, the VStars system sends them all back at once (those it can see at least).

MP Command List:

Vstar specific MP include the follows:

- **Set Instrument Group and Target**

Instrument Operational Check strings:

- **"Open Template "**
- **"Take Picture"**
- **"Save Picture"**
- **"Process Data"**
- **"Send Data"**
- **"Close Project"**

GSI V-Stars Photogrammetry Simulation

The Vstars simulation utility provides the user with the ability to lay out a network of cameras and points, establish which of the points are within the camera's field of view, bundle the cameras together and determine the network uncertainty for each point. This a very powerful tool for predesigning a measurement process.

Requirements

- Vstars 4.7.A16 or later must be installed and running on the local machine
- You must load and run the simulation from a 32-bit version of SpatialAnalyzer (*simulation is not supported in our 64-bit product).

Simulation Controls

1. Graphically select the points and/or vectors to consider in the simulation.

Points and/or vectors can be selected graphically. If you have a CAD model vectors can provide additional information

2. Set the Camera Parameters to match those of your camera and the incident angle threshold.

The **Camera Parameters** dialog allows the user to establish the field of view of each camera, which establishes the points/vectors visible. This field of view is established using the parameters of the camera to be used. The size of the CCD and the focal length of the lens establish the angle of visible area while the range parameters establish the distance parameters in clear focus or within range. The *Incident Angle* is used only with vectors and further limits the number of points considered. If the incident angle is larger than the tolerance you set it will be excluded from the calculation (Figure 17-27).

- **Focal Length.** Distance from the focal point to the CCD
- **CCD Height.** Height of the CCD
- **CCD Width.** Width of the CCD
- **Range Min.** Minimum range from the focal point to the near ned of the field of view.
- **Range Max.** Maximum range from the focal point to the far end of the field of view
- **Incident Angle.** The angle between the camera shot line and the normal of the surface.
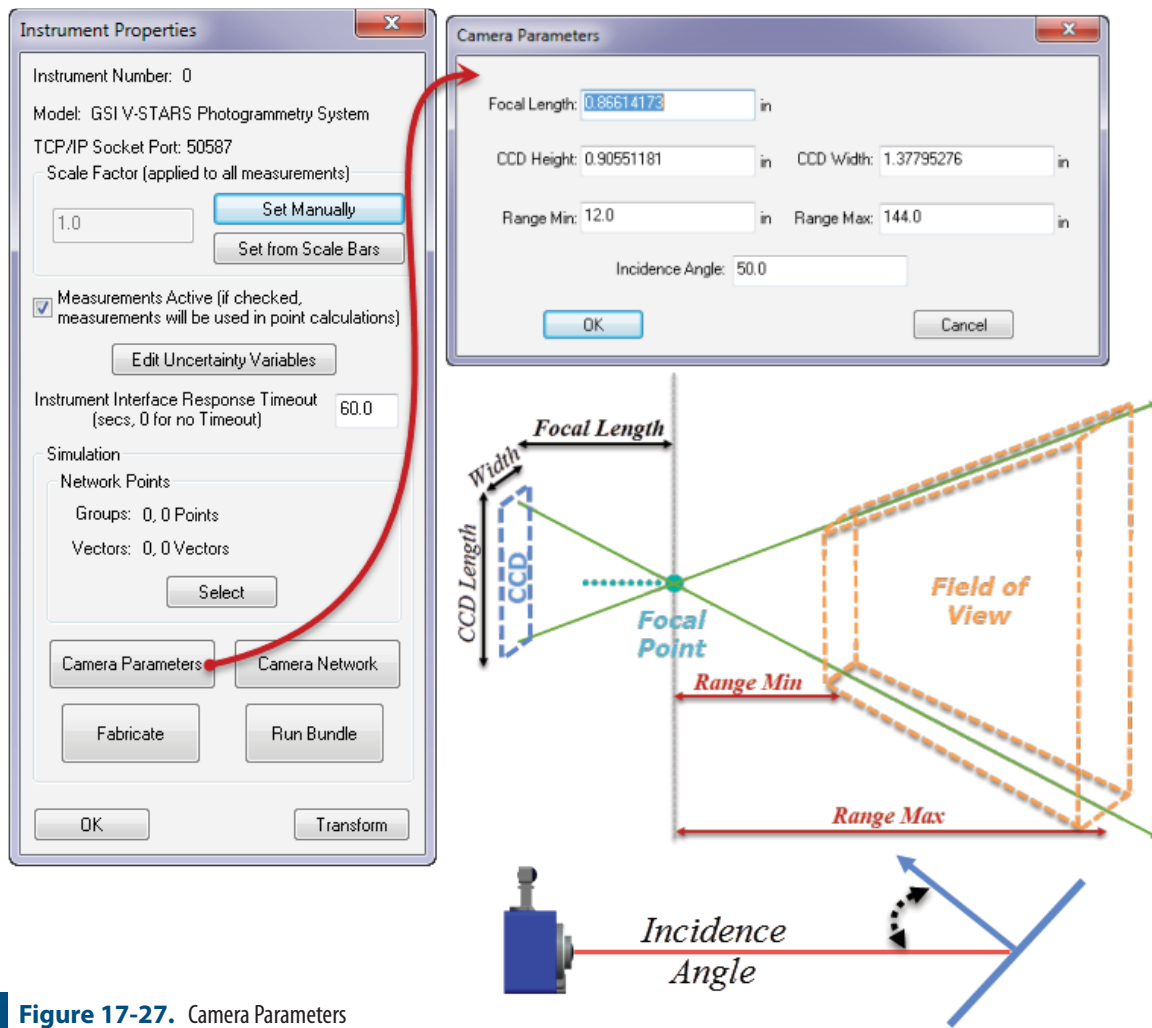
Figure 17-27. Camera Parameters

3. Establish and editing the *Camera Network Configuration*

The Camera Network button provides full control over the cameras within a Vstars network and their display within SA. Remember that a single instrument added to the SA tree represents a network of camera locations and each camera location relative to the network frame is controlled from this dialog. Here you can add or import cameras to the network, edit there position and orientation and change their display attributes.

This dialog can be used before, during and after shots are fabricated and the bundle is run. It is a very useful tool for analysis in that it allows individual shots from particular cameras to be turned on or off and the field of few analyzed. Parameters of a particular camera can be accessed by right-clicking on the camera in the network list and multi-camera control is provided through the buttons in the right panel (Figure 17-28).

- **Load Cameras.** Load a predefined camera network.
- **Save Cameras.** Save an existing camera network.

- **Add Camera.** Places a new camera at the current working frame and display the transform dialog for the newly added camera.

- **Field of View ON.** Turn on field of view display for the selected cameras from the list.

- **Field of View OFF.** Turn off field of view display for the selected cameras from the list.

- **Show.** Cause the selected cameras to be displayed within the graphics view window.

- **Hide.** Cause the selected cameras to be removed from the graphics view display window.

- **Highlight ON.** Cause the selected cameras to become highlighted within the graphics view display window.

- **Highlight OFF.** Cause the selected cameras to become de-highlighted within the graphics view display window.

- **Shot Rays ON.** Cause the selected cameras to display shot rays to their visible measurements.

- **Shot Rays OFF.** Disable shot ray display for the selected cameras.

- **Move.** Move the selected cameras about the current working frame.

- **Delete.** Delete the selected cameras.

- **Un-Check.** Un-check ALL items within the list.

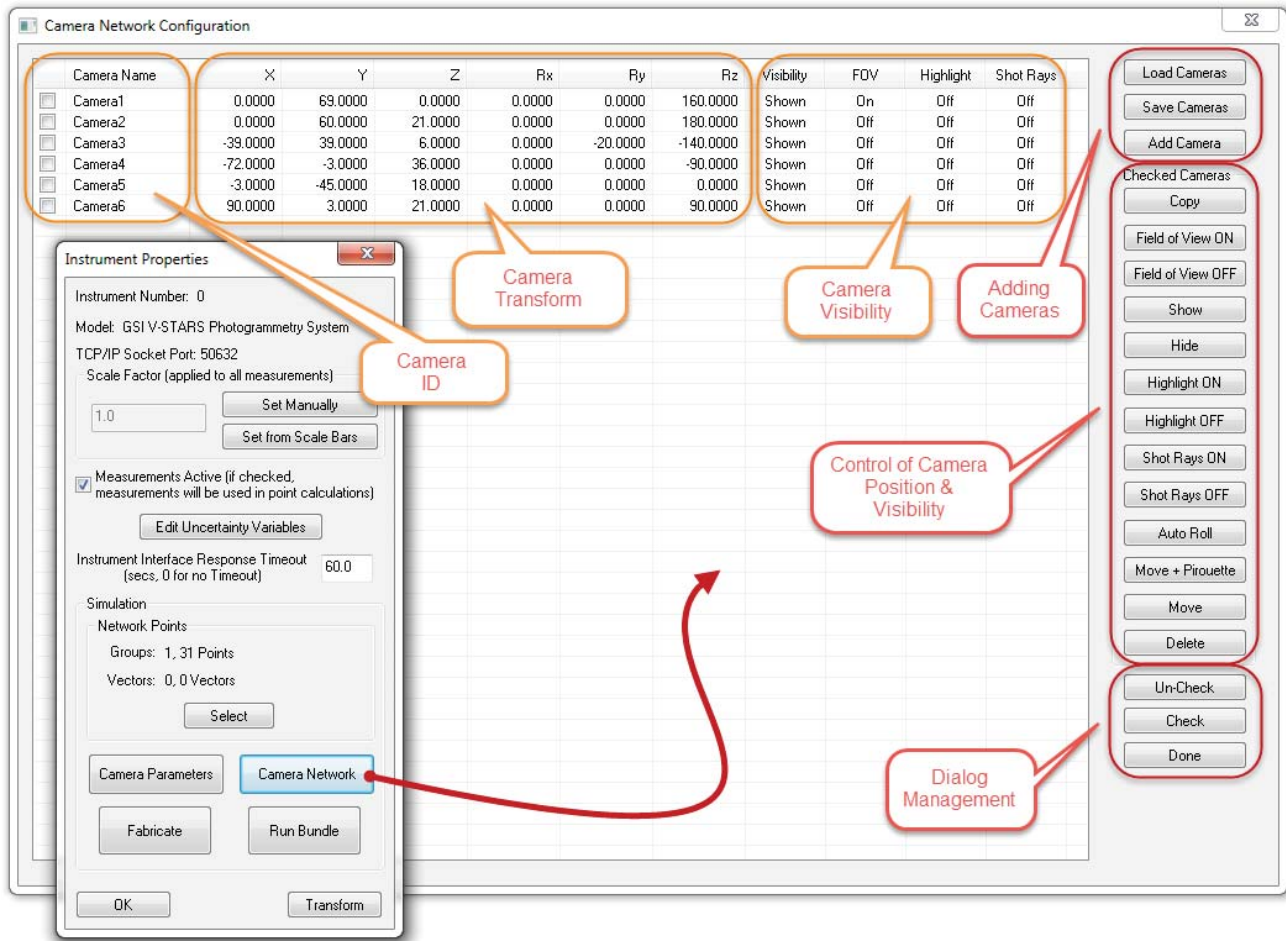- **Check.** Check ALL items within the list.

Figure 17-28. Camera Network

4. Fabricating Measurements

Pressing the Fabricate button causes SA will evaluate which of the selected points/vectors should be included in the analysis for a particular camera and builds measurements to them if they fit the criteria. Points must be within the established field of view and not obscured by any surface in the job file. Vectors must also fit the criteria of points and have an incidence angle less than the established limit. Shots will be fabricated and shot lines will become visible for points or vectors that fit the criteria. These parameters can then be viewed individually or as a group using the camera network controls (Figure 17-29).

Figure 17-29. Fabrication.
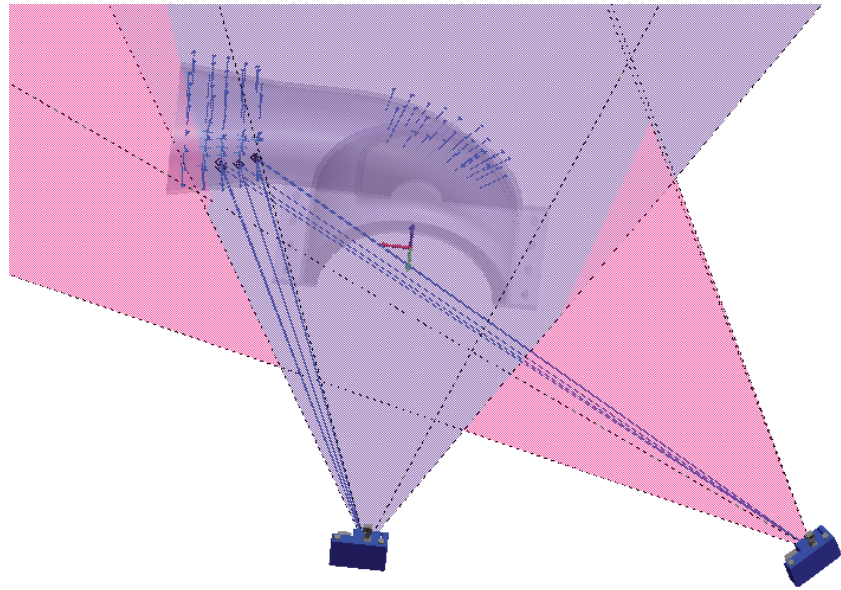
5. Running the Bundle and uncertainty analysis

Once measurements have been fabricated the cameras with common measurements can be bundled together and the uncertainty resulting from the camera positions can be calculated for each point or vector. SA should report that it is 'Performing Target Sensitivity Analysis' on the results from V-Stars. When complete you should be able to zoom in within SA to visually inspect the uncertainty cloud data around the points. Vstars must be running and Vstars requires at least one camera station to be rotated 90 degrees about the lens axis to successfully bundle (Figure 17-30).

Figure 17-30. Photogrammetry uncertainties.