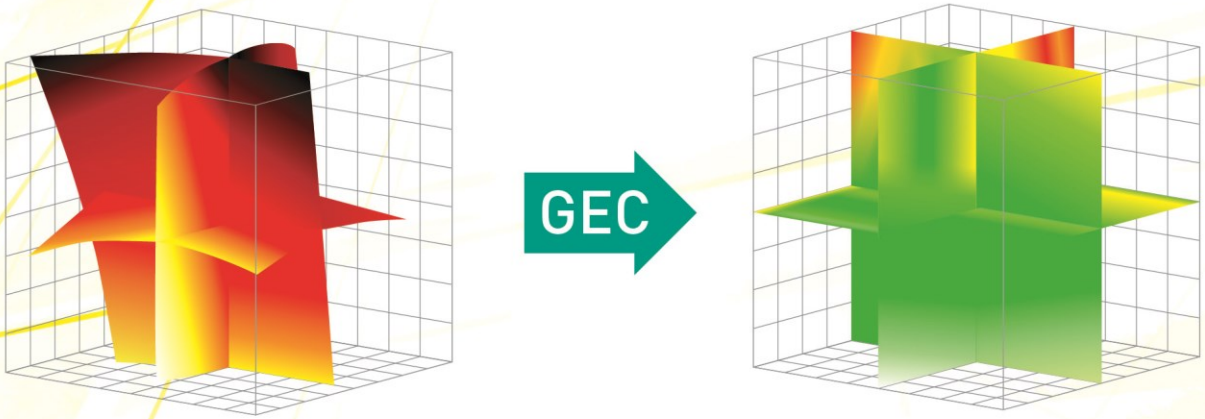
pantec metrology



GEC

Geometric Error Compensation

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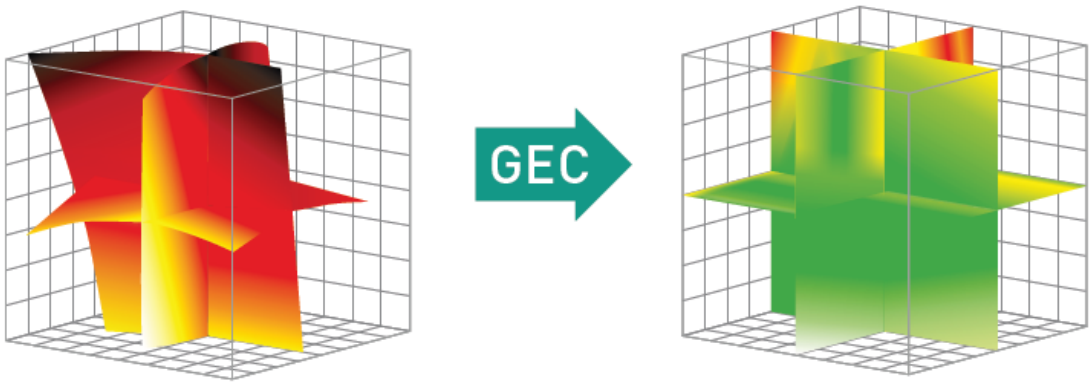


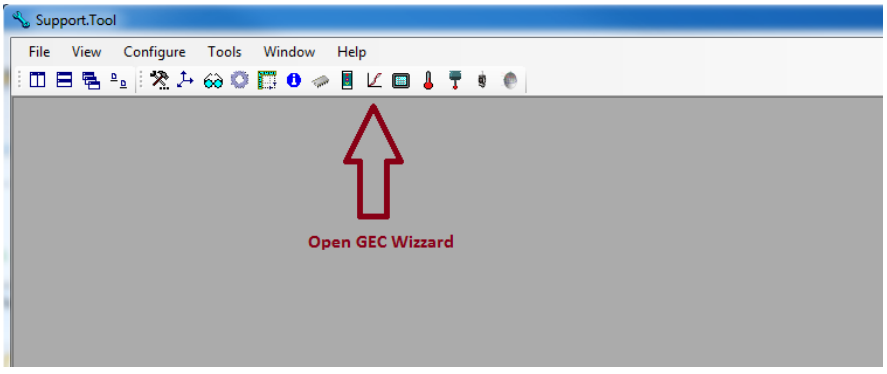
GEC involves the compensation of inherent geometric and thermal errors of CMMs. With the newest release of Pantec's GEC, dynamic temperature monitoring and compensation as well as linearity and squareness correction is already performed ***inside*** the Pantec controller. For those customers who require higher accuracy, the full 21-parameter error model (including roll, pitch and yaw errors) is available through our driver-based solution. Both GEC options cover the most common kinematic chains for CMMs, including machine configurations with the following axes sequences: Y-X-Z, X-Y-Z, X-Z-Y.

For convenience and ease of use, the entire compensation procedure is done through the Pantec Support Tool tuning and analysis software. The GEC Wizard incorporates the calibration laser and the machine type to add optimum flexibility in error capture, correction, and validation of results. An efficient design with minimal clicks offers a high level of operational convenience.

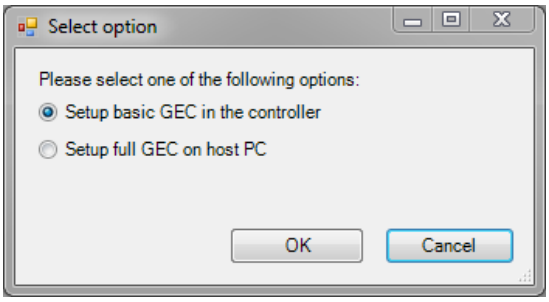
The Pantec Support Tool (v4.0.2) is used for the following steps:

- Set-up the GEC configuration
- Automatic or manual capturing of Laser and machine position
- Direct set-up of error
- Review and management of correction parameters in the GEC editor

1. Open Support.Tool v4.0.2 and launch the GEC Wizard

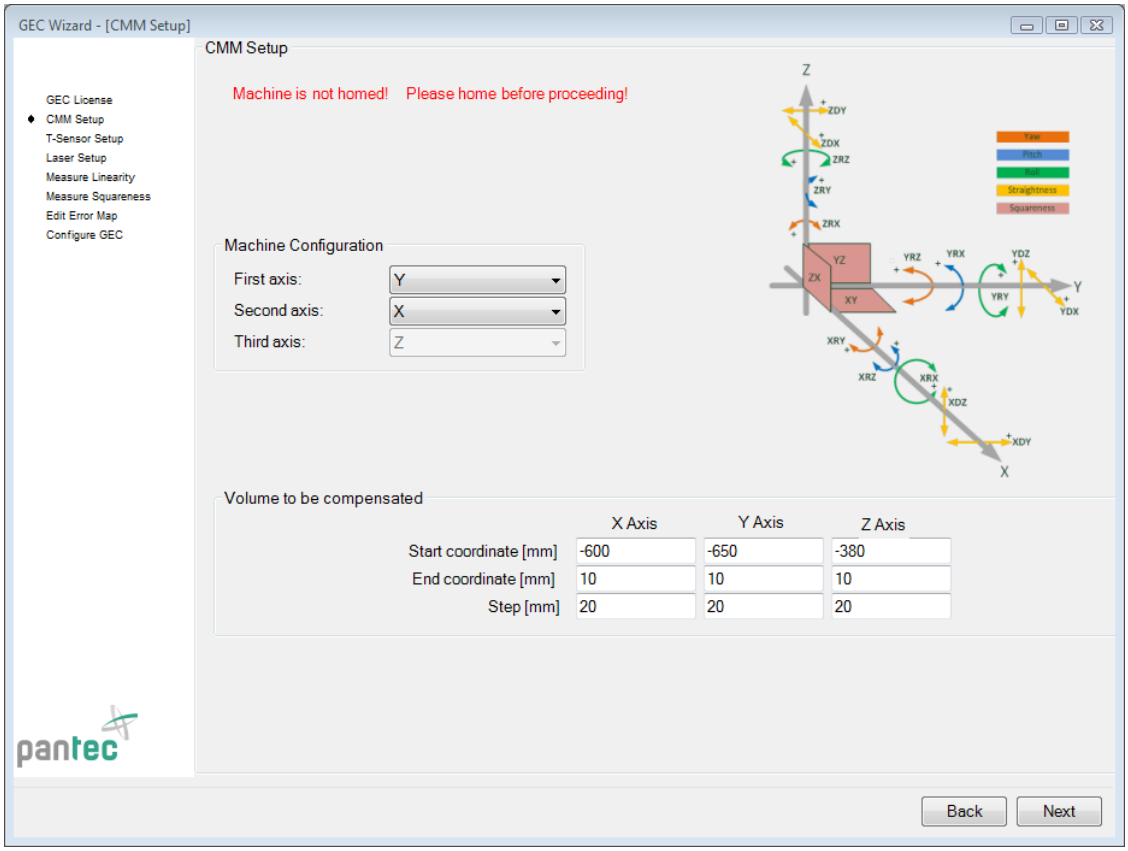


2. Choose the location of the compensation:



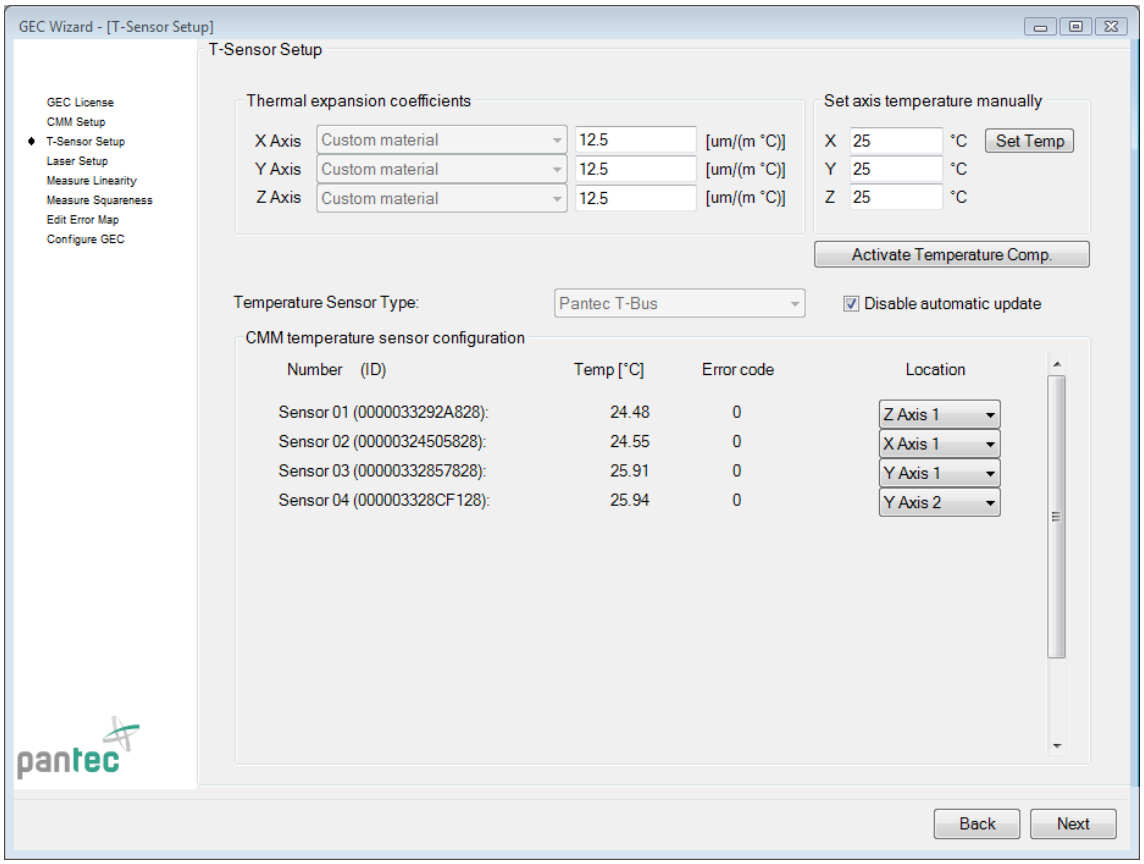
Select whether you want to configure a limited error compensation model (i.e. linearity, squareness errors as well as linear thermal expansion) in the EAGLE/CONDOR controller, or a full 21-error parameter model compensation computed by EAGLE.Driver on the host-PC.

3. Configure the setup for the CMM



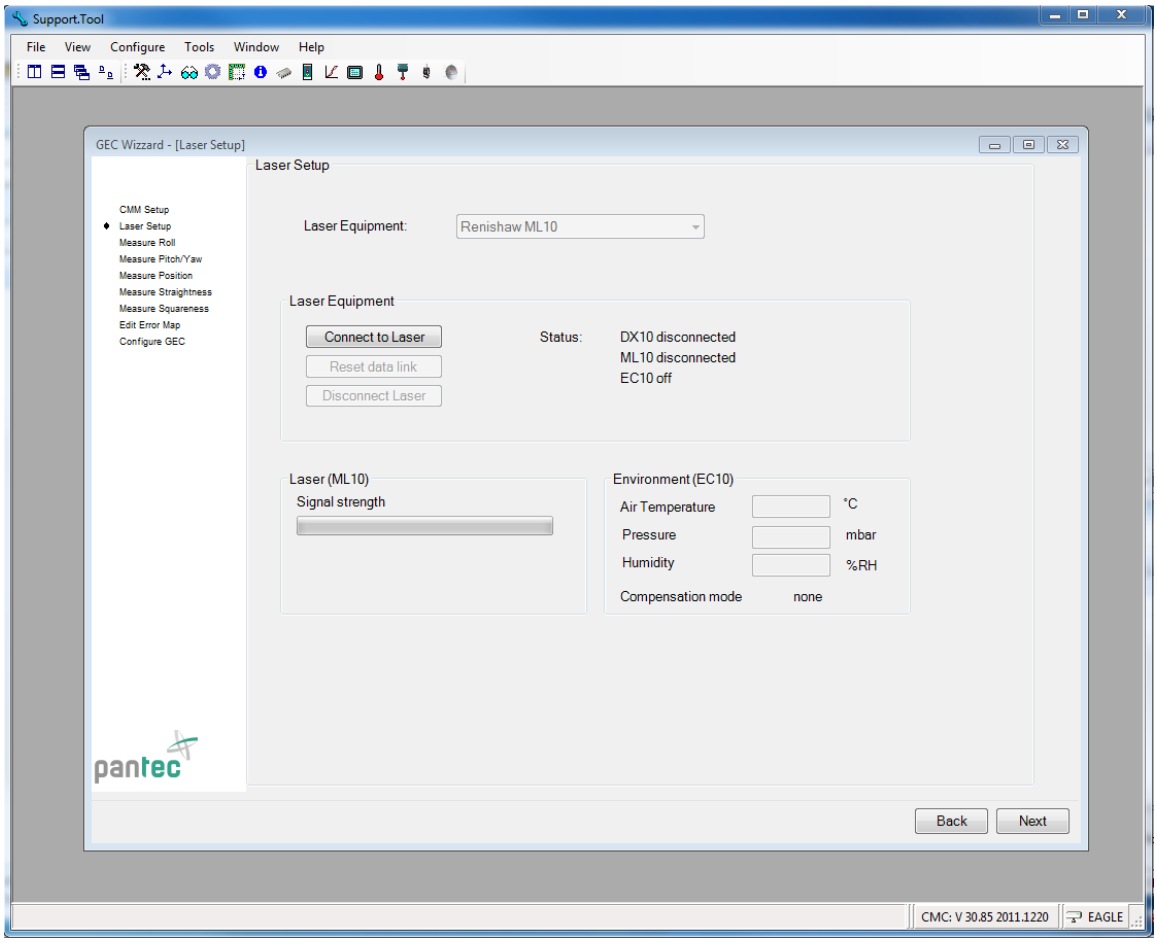
On the *CMM Setup* page of the GEC Wizard the CMM-related parameters, such as the machine dimensions, are defined. In case the machine is not homed, a warning is shown. It is mandatory to complete a home procedure before measuring the error parameters

4. Configure the setup for thermal expansion compensation



To compensate for the effects of thermal expansion a first order correction model is applied. On the *T-Sensor Setup* page, the linear thermal expansion coefficients of the scales attached to the CMM can be adjusted. If a Pantec T-Bus is connected to the controller, the current temperature data provided by the available sensors are shown. Each temperature sensor can be associated to the corresponding axis. Alternative temperature sensor types may be incorporated via our software interface.

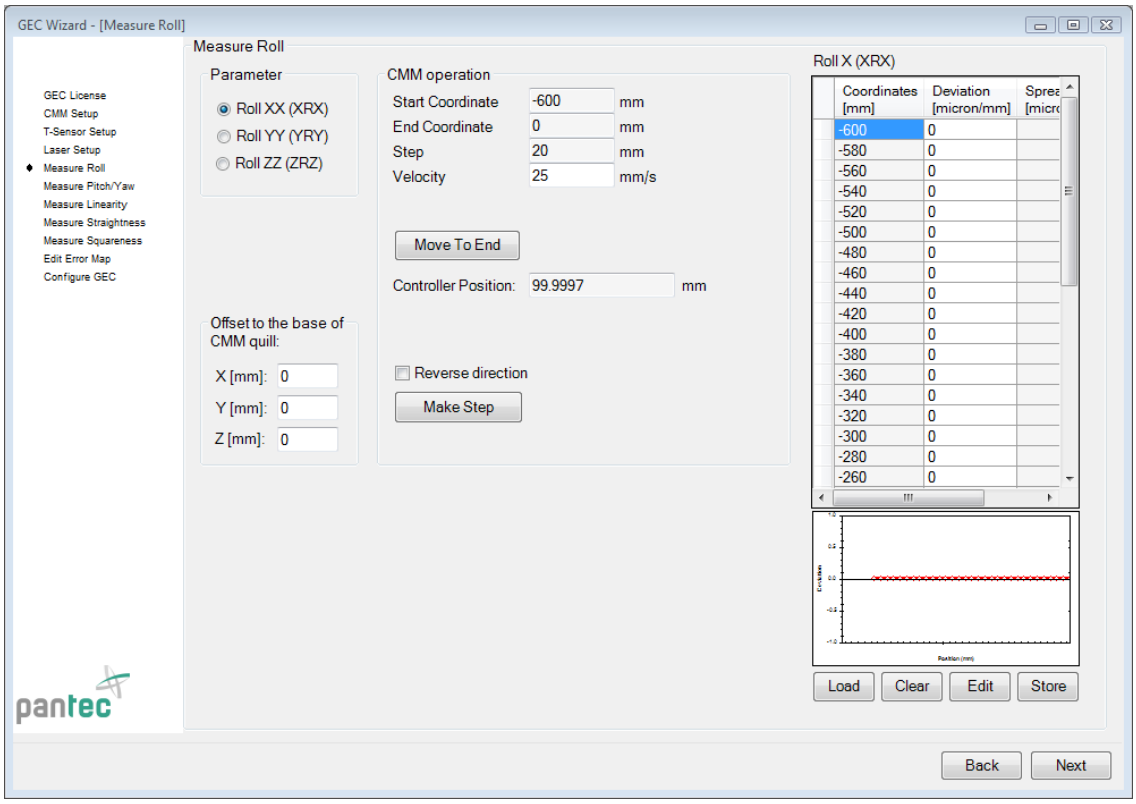
5. Laser Setup



On the Laser Setup page the user is intended to connect to a laser. Currently, the Renishaw XL80 and ML10 (via USB interface) including their corresponding environmental measurement stations are supported. Once connected, the current laser signal strength and environmental data are displayed.

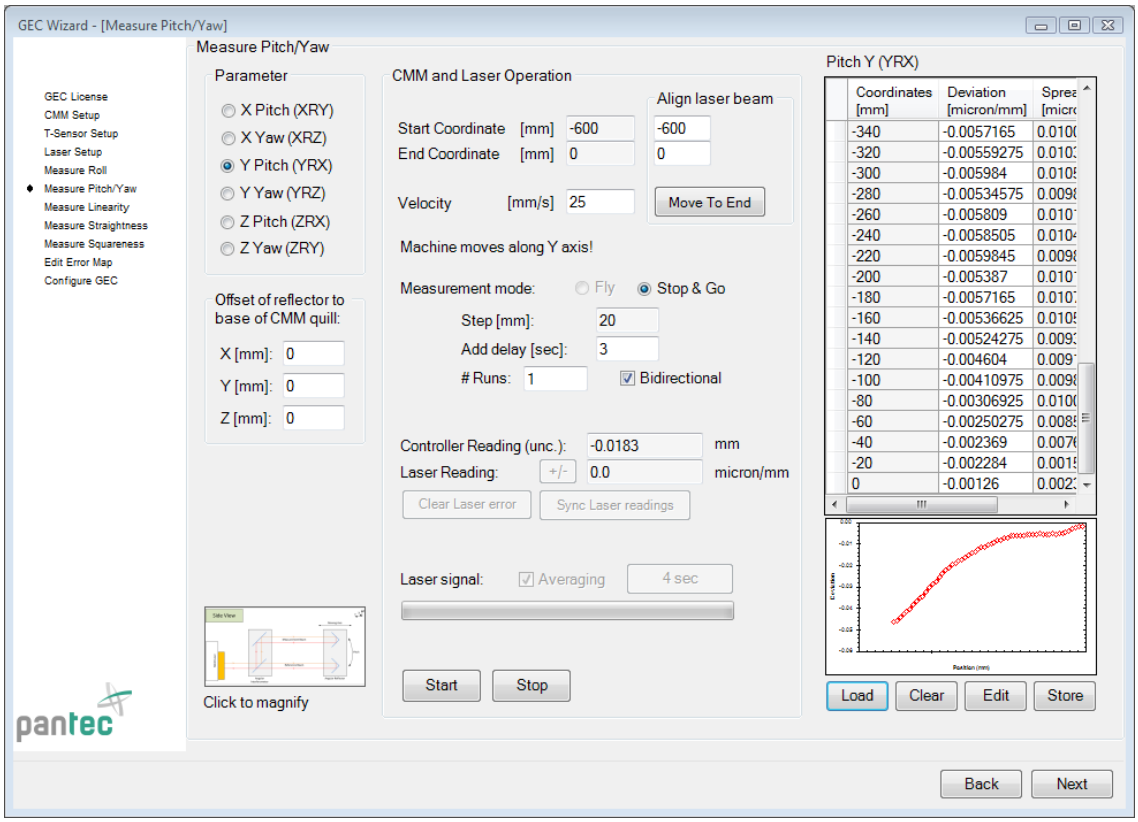
Subsequently, the various error parameters are measured with the laser or using other devices. It is recommended to measure the parameters according to the order presented in the GEC Wizard.

6. Measurement of roll errors



The angular error due to roll is commonly not measured by a laser, but by other tools and devices. On this page the user can move the machine in steps along the predefined grid, perform the measurement and then enter the deviations into the given fields corresponding to the current coordinates. It is also possible to load external data, as well as scaling and storing the entered data for later use.

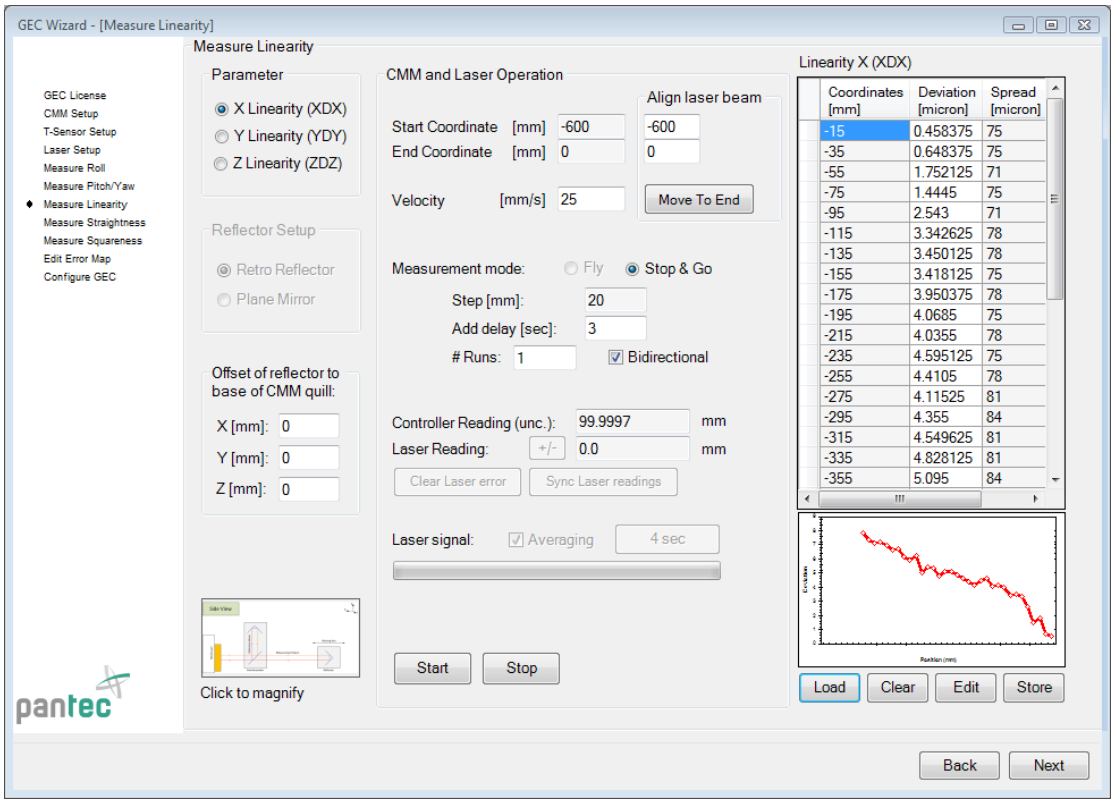
7. Measurement of pitch and yaw errors



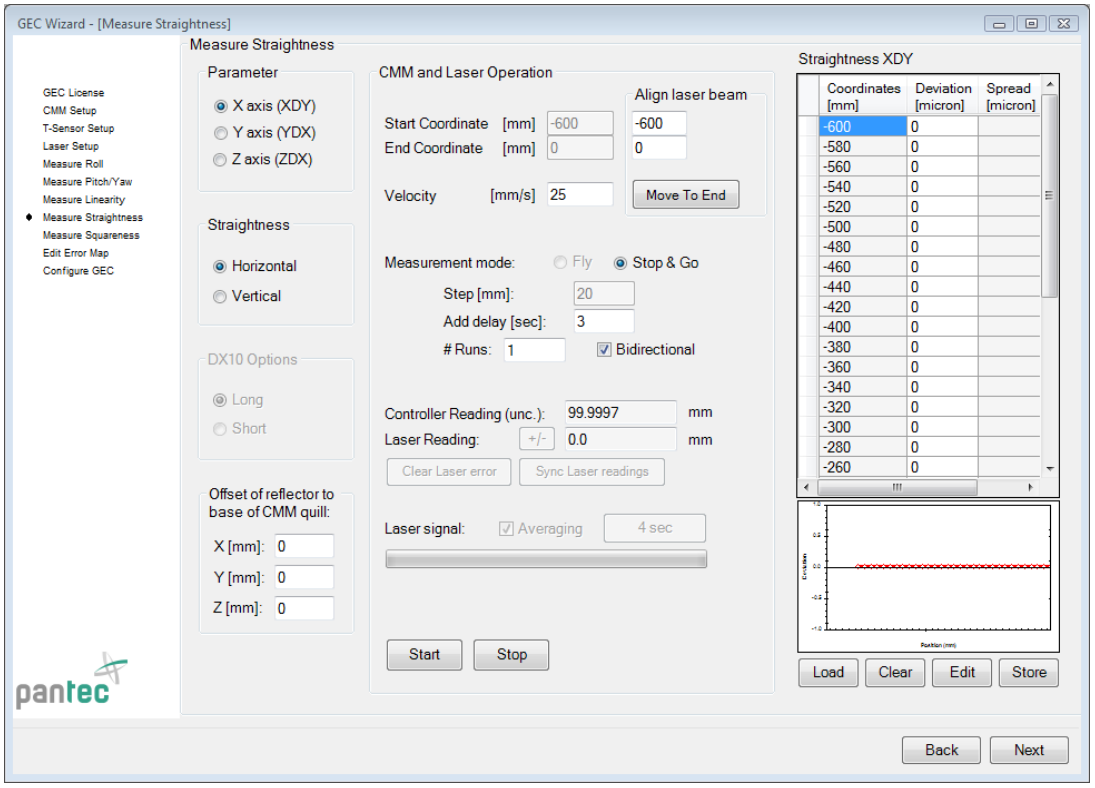
After the rough alignment of the laser the precise alignment and actual laser measurement are done with the GEC Wizard according to the following steps:

- Open the “Measure Pitch/Yaw” page
- Select Pitch or Yaw for the desired axis
- Align laser using the “Move To End”/”Move To Start” button and ensure that the signal strength is sufficient and does not change significantly along the whole moving path
- If the laser beam was obscured it may be necessary to click on “Clear laser error”.
- Make sure that the rotation direction is correct: tap on mirror and check if the laser reading follows the right-hand rule. The rotation direction can be changed by clicking on the “+/-“ button.
- At the start coordinates click on “Zero laser readings”
- Enter the number of runs and whether to perform the measurement bidirectional or unidirectional
- Press “Start” to begin with automatic data gathering
- When data gathering is completed it is recommended to store the data in a file (for potential later use) by clicking on the “Store” button below the diagram.
- To redo the measurement click on “Clear” below the diagram and press “Start” again

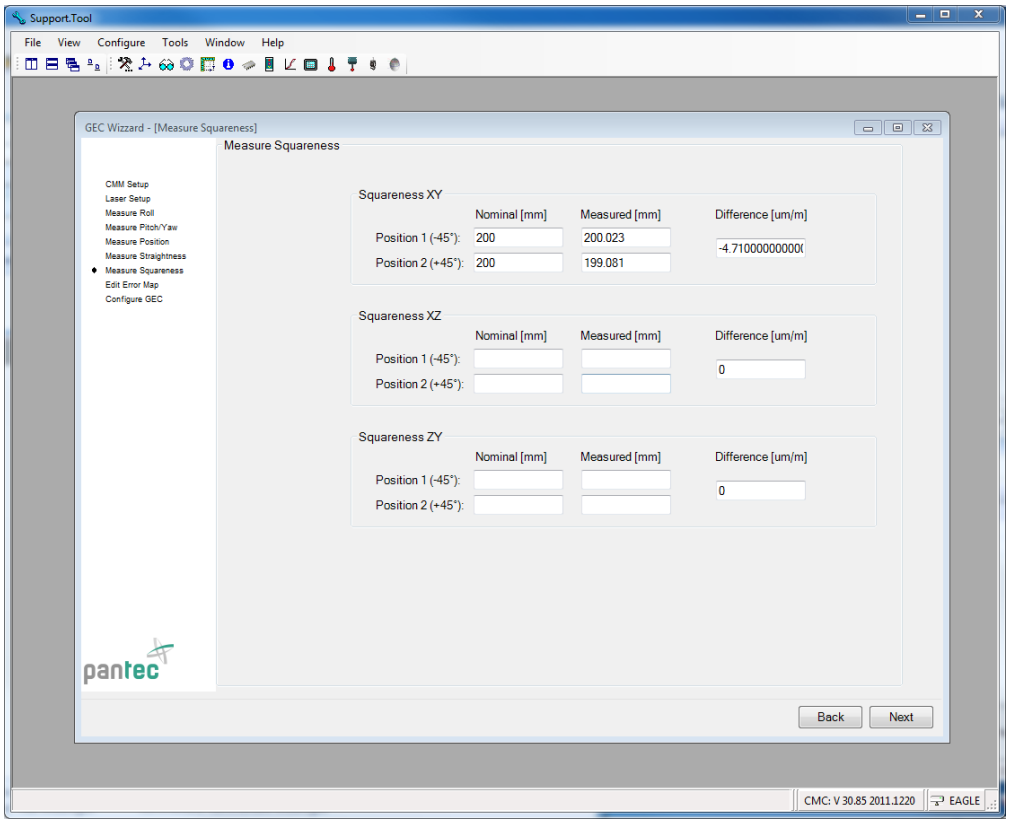
8. Measurements of linearity and straightness deviations



The procedure for linearity and straightness errors is the same as shown in the previous step. The only additional option concerns the chosen mirror setup.

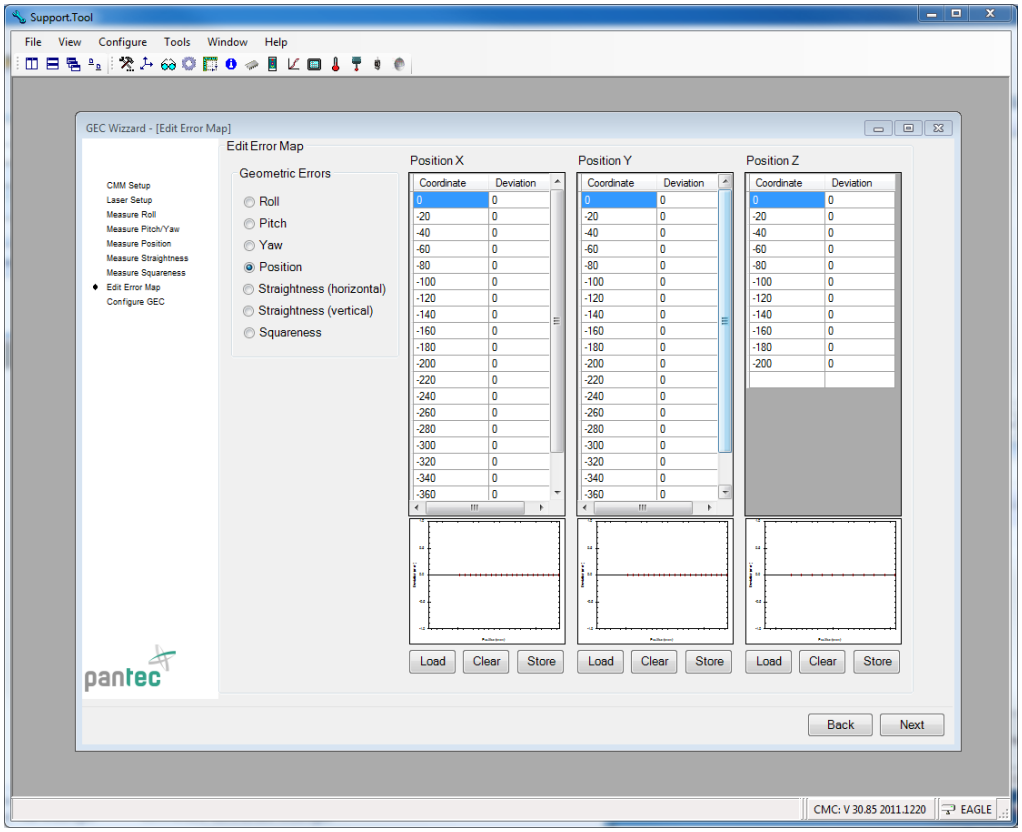


9. Squareness measurement



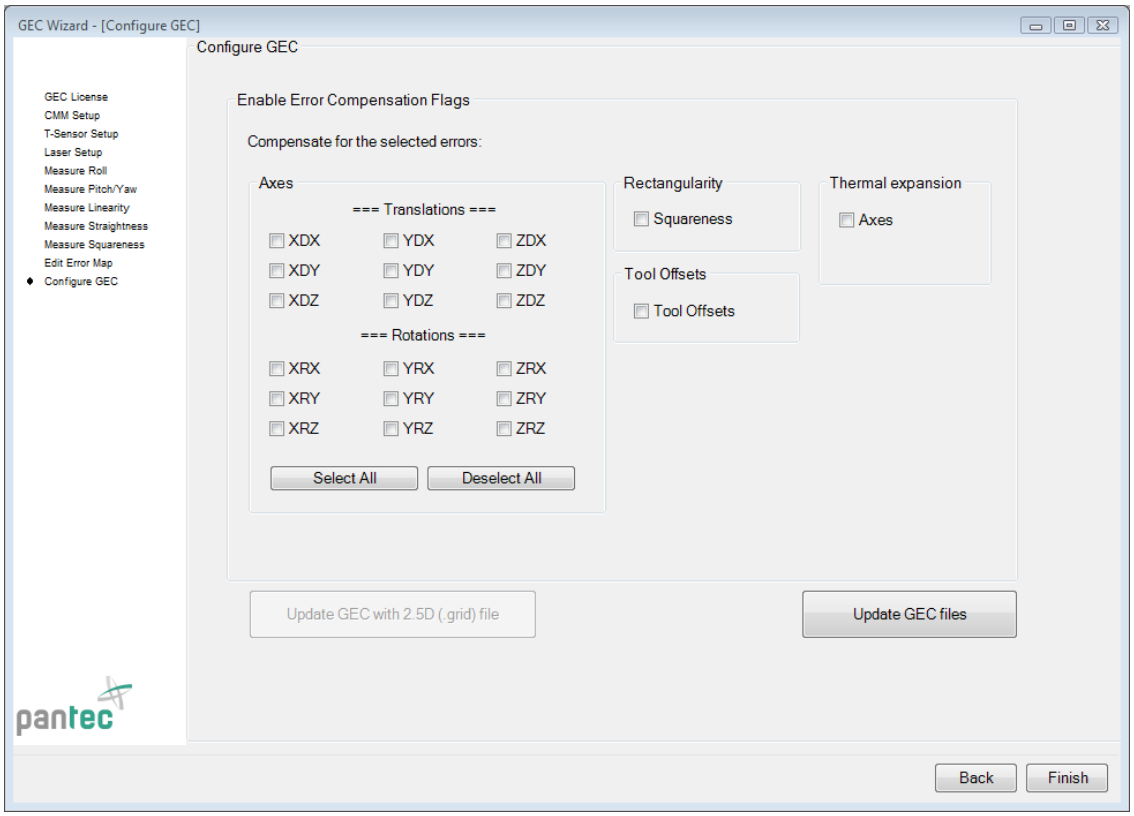
The squareness error is commonly measured with gauges. Enter the values for nominal and measured distance into the corresponding fields for squareness XZ and ZY. The compensation parameter is computed immediately.

10. Error map editor



The error map editor allows further adjustment of the error compensation data.

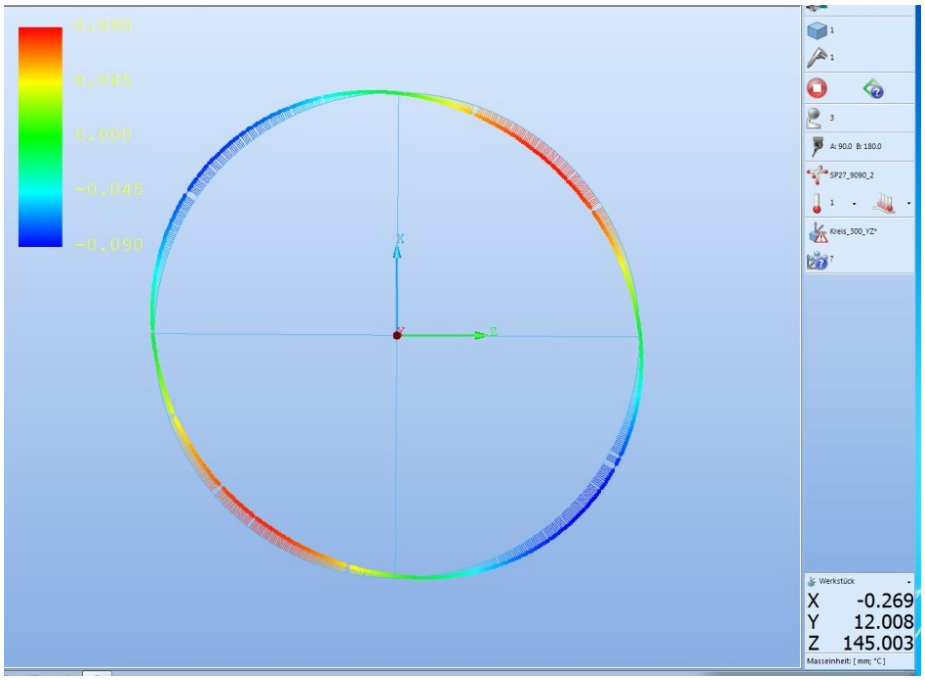
11. Configuration of the geometric error compensation



On the final page the various compensation parameters can be activated and deactivated. The compensation data files and the GEC configuration are written when pressing the button “Update GEC files”.

12. Example: squareness compensation

In this example the measurement of a 300.001 mm ring measured in the XZ plane without compensation shows a clear deviation from rectangularity.



Using the GEC Wizard the squareness compensation parameter was determined. After the update of the compensation data files with the new values the situation improves significantly. The remaining deviations are due to other error components.