# Rocking Curve Pre-Measurement Part

# Contents

# 1. How to set Part conditions

In this chapter, how to set the **Rocking Curve Pre-Measurement** Part conditions is described.

## 1.1 Setting conditions

Set the basic conditions in the **Rocking Curve Pre-Measurement** dialog box.

The scan conditions of the rocking curve pre-measurement are determined based on the pre-measurement conditions. The scan conditions can also be customized.

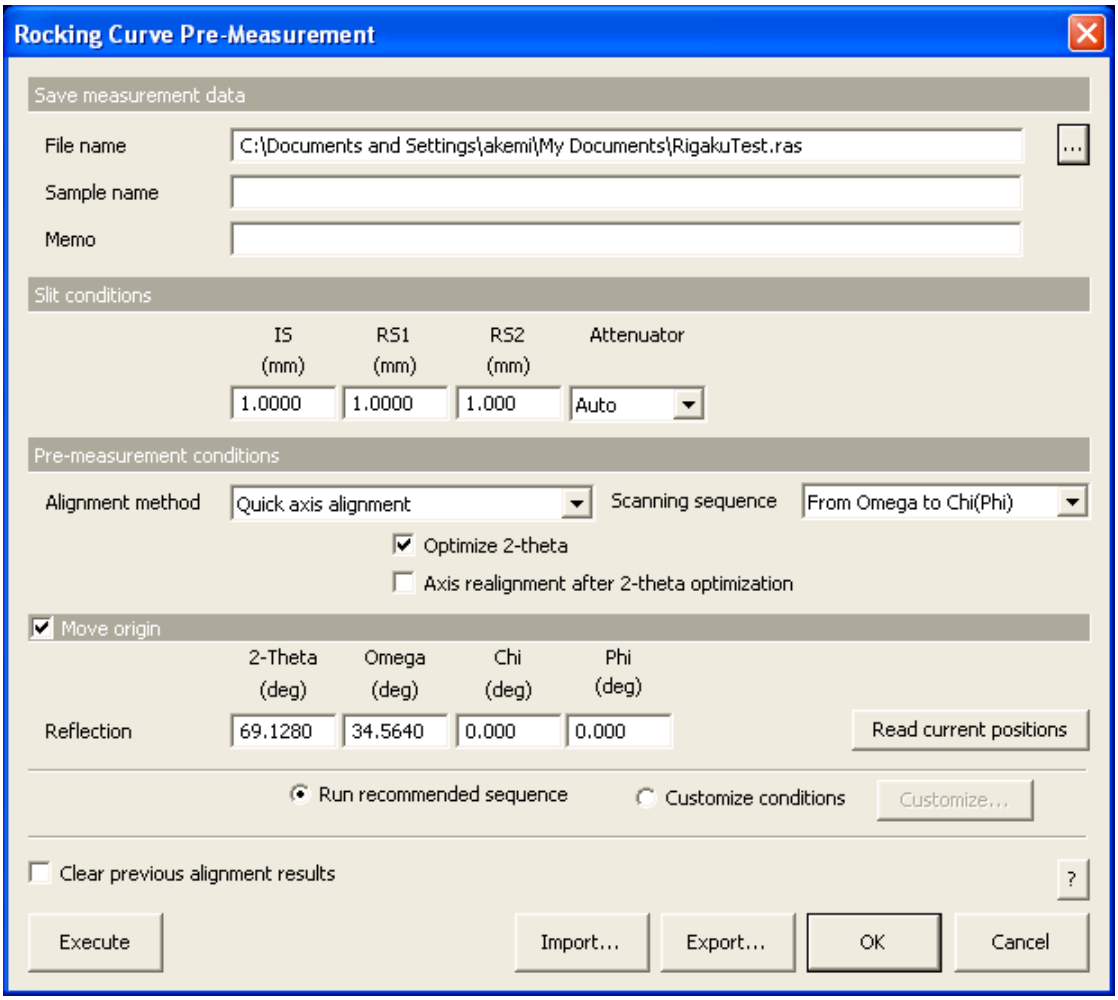
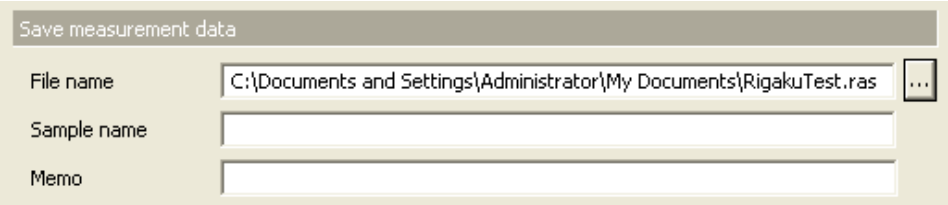


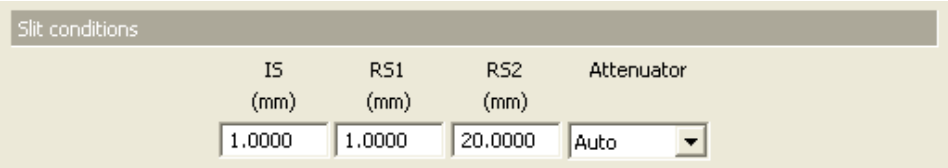

**Fig. 1.1.1 Rocking Curve Pre-Measurement dialog box**




**File name** Enter the name of the file to save the measurement data in.

**Sample name** Enter the sample name (optional). The sample name entered here will be saved in the measurement data file.

**Memo** Enter the memo (optional). The memo entered here will be saved in the measurement data file.



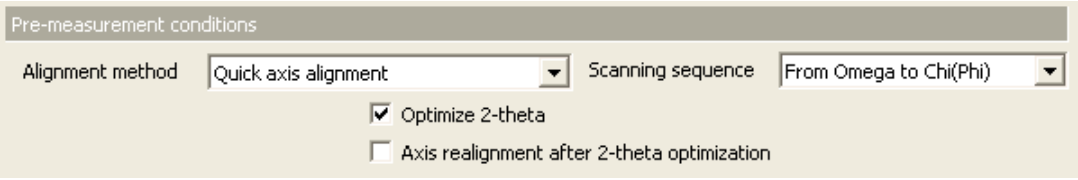

**IS (mm)** Enter the width of the incident slit.

**RS1 (mm)** Enter the width of the receiving slit # 1.

**RS2 (mm)** Enter the width of the receiving slit # 2.

**Attenuator** Select the attenuator to be used for the measurement from **Open**, **1/70**, **1/1000**, **1/10000**, or **Auto**.

Tip: If **Auto** is selected, an automatic attenuator scan is performed while the attenuator is automatically switched based on intensity.




### Alignment method

Select from **Without axis alignment**, **Quick axis alignment**, **Recursive axis alignment**, **Standard axis alignment**, or **Precise axis alignment** if the RxRy attachment is installed.

| | |
|---|---|
| Without axis alignment | Drive each axis to the specified position of the reflection. An additional alignment will not be performed. |
| Quick axis alignment | Drive each axis to the reflection position entered in the **Reflection** boxes, and align the omega and chi axes (for symmetric reflection) or phi axis (for asymmetric reflection). |
| Recursive axis alignment | Drive each axis to the reflection position entered in the **Reflection** boxes, and perform the omega scan as driving the chi axis (for symmetric reflection) or phi axis (for asymmetric reflection) step-by-step. Plot the peak intensity vs. the chi (or phi) axis and move the chi (or phi) axis to the optimized position, then align the omega axis. |
| Standard axis alignment | Drive each axis to the reflection position entered in the **Reflection** boxes, and perform the *R*x, *R*y scan to face the phi axis to the normal of the lattice plane. Then, align the omega axis. |
| Precise axis alignment | Drive each axis to the reflection position entered in the **Reflection** boxes, and perform the omega scan at four positions (phi = 0°, 180°, 90°, –90°) to face the phi axis to the normal of the lattice plane. Then, align the omega and chi axes. |

Select from **Without axis alignment**, **Quick axis alignment,** or **Recursive axis alignment** if another attachment is installed.

| | |
|---|---|
| Without axis alignment | Drive each axis to the reflection position entered in each **Reflection** box. An additional alignment will not be performed. |
| Quick axis alignment | Drive each axis to the reflection position entered in each **Reflection** box, and align the omega and chi axes (for symmetric reflection) or phi axis (for asymmetric reflection). |
| Recursive axis alignment | Drive each axis to the reflection position entered in each **Reflection** box, and perform the omega scan as driving the chi axis (for symmetric reflection) or phi axis (for asymmetric reflection) step-by-step. Plot the peak intensity vs. the chi (or phi) axis and move the chi (or phi) axis to the optimized position, then align the omega axis. |

Tip: If the **Move origin** box is unchecked, the axis alignment will be performed using the selected alignment method without driving each axis.

**Scanning sequence**

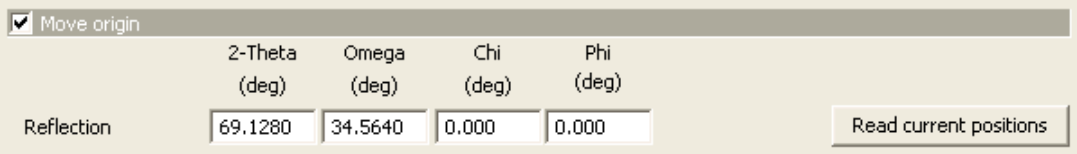
Select **From Omega to Chi(Phi)**, **From Chi(Phi) to Omega**, **Omega only**, or **Chi(Phi) only** if **Quick axis alignment** is selected from the **Alignment method** box.

**Optimize 2-theta**

Check the **2-theta refining** box to determine the position of the reflection (2-theta) precisely.

**Axis realignment after 2-theta optimization**

Check the Axis realignment after 2-theta optimization box to perform the axis alignment again after determining the position of the reflection (2-theta) precisely.




**Move origin** — If each axis will be driven to the reflection position of the substrate or layer before alignment, check the **Move origin** box and enter the reflection positions of the substrate or layer.

**2-Theta (deg)** — Enter the destination angle of the 2-theta axis.

**Omega (deg)** — Enter the destination angle of the omega axis.

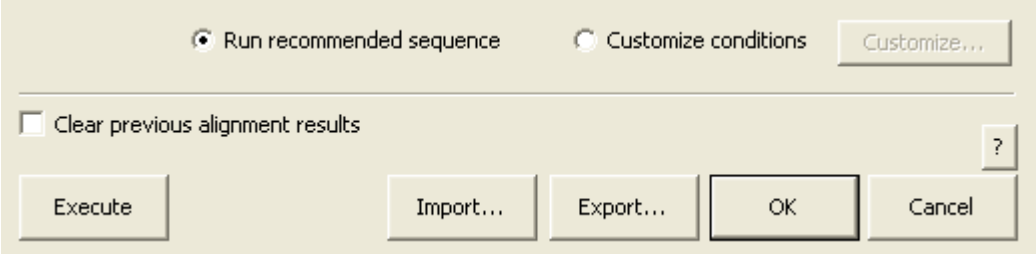
**Chi (deg)** — Enter the destination angle of the chi axis.

**Phi (deg)** — Enter the destination angle of the phi axis.

**Read current positions** — Sets the current positions of the axes in the **2-Theta(deg)**, **Omega(deg)**, **Chi(deg)**, and **Phi(deg)** boxes, respectively.

Tip:

- The values entered in the **2-Theta(deg)** and **Omega(deg)** boxes are used to distinguish between a symmetric and an asymmetric reflection as follows:
  - Symmetric reflection: when the absolute value of "omega - 2-theta/2" is lower than 3 deg
  - Asymmetric reflection: when the absolute value of "omega - 2-theta/2" is equal to or larger than 3 deg
- In the standard and precise axis alignment, the axis alignment of the symmetric reflection is performed using the *R*x and *R*y axes. The chi axis (tilt axis) is always positioned at 0 deg during the axis alignment.




**Run recommended sequence** Performs the axis alignment under the recommended conditions determined based on the selected alignment method, reflection position, and slit conditions, etc.

**Customize conditions** Performs the axis alignment under the conditions specified in the **Customize** dialog box.

**Customize** When the **Customize conditions** radio button is selected, click the **Customize** button, then set the scan conditions.

1.2 Customizing scan conditions

**Clear previous alignment results**

Check the **Clear previous alignment results** box to perform the axis alignment after driving the *R*x and *R*y axes to 0 degree. (This function is available only when the RxRy attachment is installed.)

**Execute** Executes the rocking curve pre-measurement under the conditions specified in the **Rocking Curve Pre-Measurement** dialog box.

CAUTION: Clicking the **Cancel** button after executing the rocking curve pre-measurement does not cancel the specified conditions.

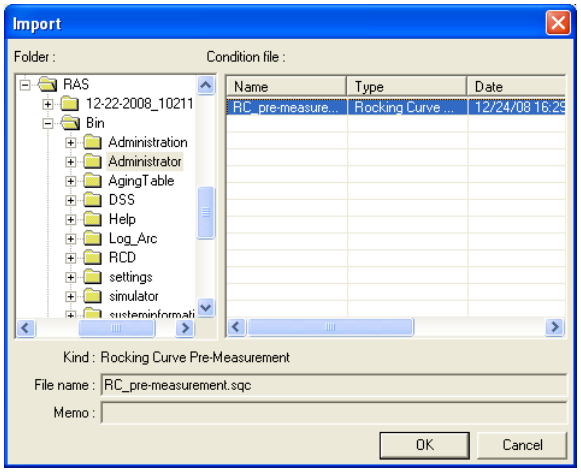
Tip: The rocking curve pre-measurement is executed with the **Rocking Curve Pre-Measurement** dialog box open. While the rocking curve pre-measurement is running, the Part conditions cannot be changed. They can be changed again after the measurement has been completed.

The setting of (Show confirmation messages) on the flow bar becomes invalid.

**Import**

Loads the saved Part conditions.

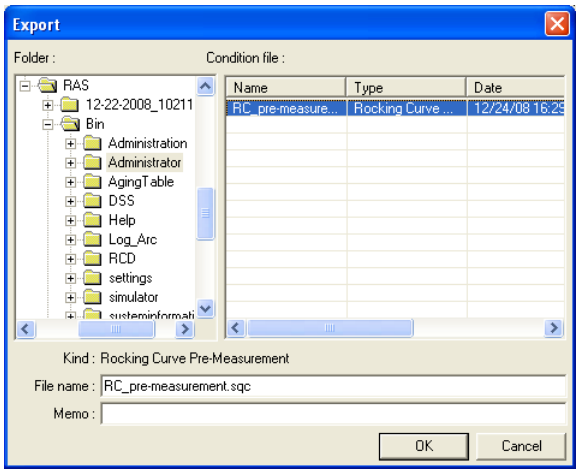
Clicking the **Import** button opens the **Import** dialog box. Select the folder including the file you want to import from the **Folder** tree view. In the **Condition file** list, select the condition file you want to import and click the **OK** button to load the Part conditions.




**Export**

Saves the specified Part conditions in a file.

Clicking the **Export** button opens the **Export** dialog box. From the **Folder** tree view, select a destination folder to save the conditions file then enter a file name in the **File name** box. Enter comments in the **Memo** box, if needed. After entering them, click the **OK** button.




**OK**

Sets the conditions and closes the dialog box.

CAUTION: When selecting another Package measurement or switching the task to the **Manual Control** task, etc. the specified conditions will be cancelled. To save the specified conditions in a file, click the **Export** button and save the conditions.

**Cancel**

Does not set the conditions and closes the dialog box.

**?**

Opens the online help of this Part.

## 1.2 Customizing scan conditions

If you want to customize the scan conditions, etc. of the rocking curve pre-measurement, set the conditions in the **Customize** dialog box.

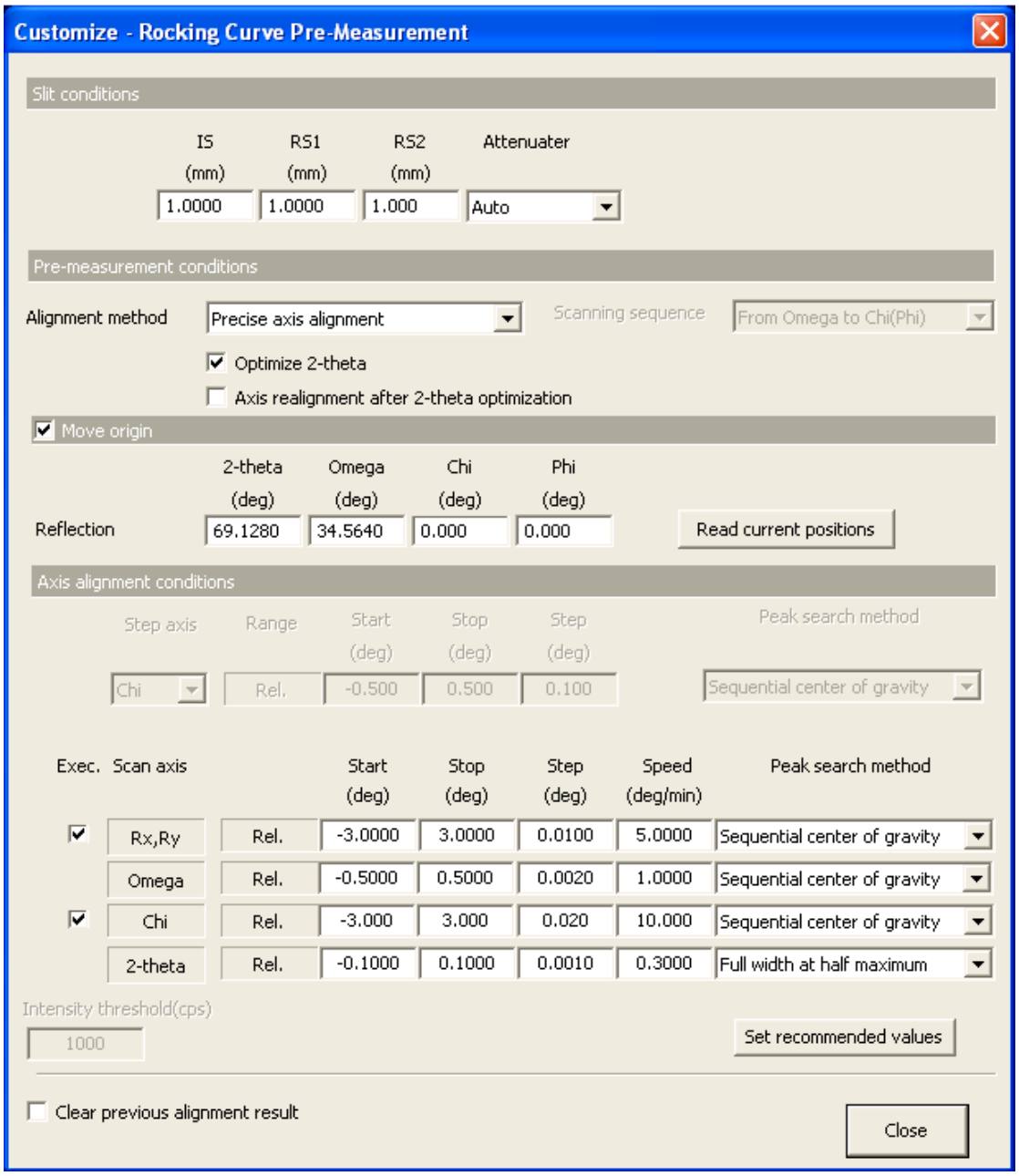
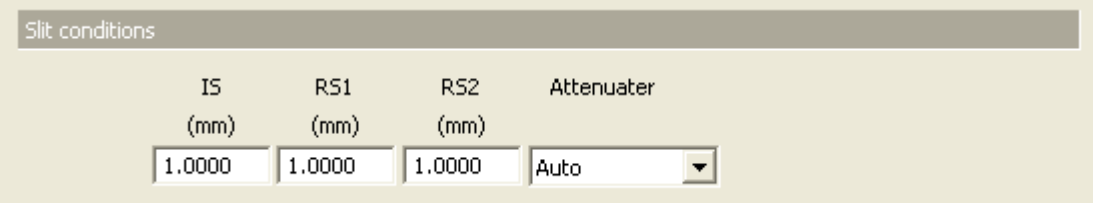



**Fig 1.2.1 Customize dialog box**



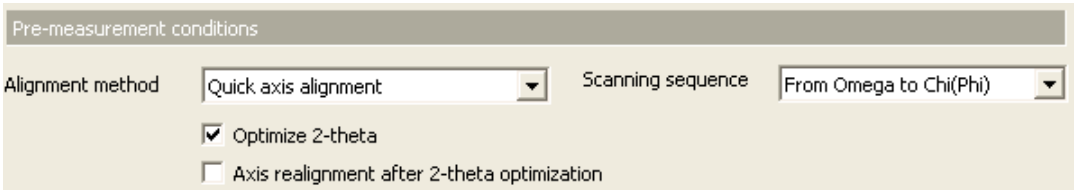

**IS(mm)** Enter the width of the incident slit.

**RS1(mm)** Enter the width of the receiving slit # 1.

**RS2(mm)** Enter the width of the receiving slit # 2.

**Attenuater** Select the attenuator to be used for the measurement from **Open**, **1/70**, **1/1000**, **1/10000**, or **Auto**.

> Tip: If **Auto** is selected, an automatic attenuator scan is performed while the attenuator is automatically switched based on intensity.




**Alignment method** Select from **Without axis alignment**, **Quick axis alignment**, **Recursive axis alignment**, **Standard axis alignment**, or **Precise axis alignment** if the RxRy attachment is installed.

| | |
|---|---|
| Without axis alignment | Drive each axis to the reflection position entered in each **Reflection** box. An additional alignment will not be performed. |
| Quick axis alignment | Drive each axis to the reflection position entered in each **Reflection** box, and align the omega and chi axes (for symmetric reflection) or phi axis (for asymmetric reflection). |
| Recursive axis alignment | Drive each axis to the reflection position entered in each **Reflection** box, and perform the omega scan as driving the chi axis (for symmetric reflection) or phi axis (for asymmetric reflection) step-by-step. Plot the peak intensity vs. the chi (or phi) axis and move the chi (or phi) axis to the optimized position, then align the omega axis. |

| | |
|---|---|
| Standard axis alignment | Drive each axis to the reflection position entered in each **Reflection** box, and perform the *R*x, *R*y scan to face the phi axis to the normal of the lattice plane. Then, align the omega axis. |
| Precise axis alignment | Drive each axis to the reflection position entered in each **Reflection** box, and perform the omega scan at four positions (phi = 0°, 180°, 90°, –90°) to face the phi axis to the normal of the lattice plane. Then, align the omega and chi axes. |

Select from **Without axis alignment**, **Quick axis alignment**, or **Recursive axis alignment** if another attachment is installed.

| | |
|---|---|
| Without axis alignment | Drive each axis to the reflection position entered in each **Reflection** box. An additional alignment will not be performed. |
| Quick axis alignment | Drive each axis to the reflection position entered in each **Reflection** box, and align the omega and chi axes (for symmetric reflection) or phi axis (for asymmetric reflection). |
| Recursive axis alignment | Drive each axis to the reflection position entered in each **Reflection** box, and perform the omega scan as driving the chi axis (for symmetric reflection) or phi axis (for asymmetric reflection) step-by-step. Plot the peak intensity vs. the chi (or phi) axis and move the chi (or phi) axis to the optimized position, then align the omega axis. |

Tip: If the **Move origin** box is unchecked, the axis alignment will be performed using the selected alignment method without driving each axis.

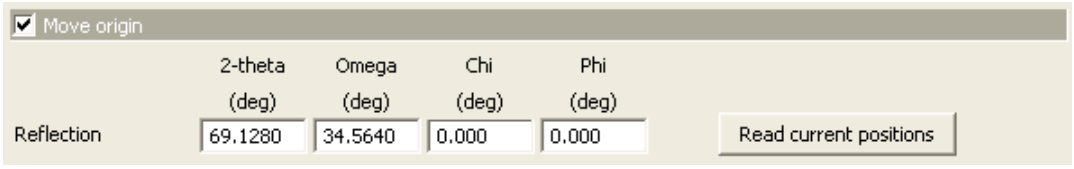
### Scanning sequence

Select **From Omega to Chi(Phi)**, **From Chi(Phi) to Omega**, **Omega only**, or **Chi(Phi) only** if **Quick axis alignment** is selected from the **Alignment method** box.

**Optimize 2-theta** Check the **2-theta refining** box to determine the position of the reflection (2-theta) precisely.

**Axis realignment after 2-theta optimization**

Check the Axis realignment after 2-theta optimization box to perform the axis alignment again after determining the position of the reflection (2-theta) precisely.




**Move origin** If each axis will be driven to the reflection position of the substrate or layer before alignment, check the **Move origin** box and enter the reflection positions of the substrate or layer.

**2-Theta (deg)** Enter the destination angle of the 2-theta axis.

**Omega (deg)** Enter the destination angle of the omega axis.

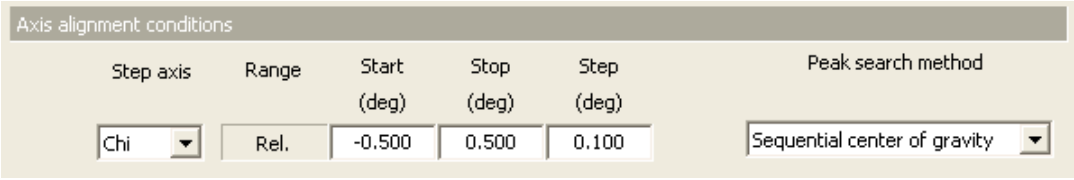
**Chi (deg)** Enter the destination angle of the chi axis.

**Phi (deg)** Enter the destination angle of the phi axis.

**Read current positions** Sets the current positions of the axes in the **2-Theta(deg)**, **Omega(deg)**, **Chi(deg)**, and **Phi(deg)** boxes, respectively.

Tip:

- The values entered in the **2-Theta(deg)** and **Omega(deg)** boxes are used to distinguish between a symmetric and an asymmetric reflection as follows:
  - Symmetric reflection: when the absolute value of "omega - 2-theta/2" is lower than 3 deg
  - Asymmetric reflection: when the absolute value of "omega - 2-theta/2" is equal to or larger than 3 deg
- In the standard and precise axis alignment, the axis alignment of the symmetric reflection is performed using the *R*x and *R*y axes. The chi axis (tilt axis) is always positioned at 0 deg during the axis alignment.




**Step axis** Select **Chi** or **Phi** only when **Recursive axis alignment** is selected in the **Alignment method** box.

**Start(deg)** Enter the relative distance of the start position of the step axis from the reflection position.

**Stop(deg)** Enter the relative distance of the stop position of the step axis from the reflection position.

**Step(deg)** Enter the step width of the step axis.

**Peak search method** Select the peak search method to determine the peak position for the omega scan intensity plot vs. the chi (or phi) axis in the recursive axis alignment. Select **Sequential center of gravity**, **Full width at half maximum**, or **Maximum. intensity**.


The scan axes used in the axis alignment depends on the selected alignment method, The axes used in each axis alignment are shown in Table 1.2.1. The 2-theta axis is available when **Optimize 2-theta** box is ON only.

**Exec.** When **Precise axis alignment** is selected from the **Alignment method** box, check the **Exec.** box to align the *R*x, *R*y axes or chi axis.

**Scan axis** Displays the axes used in the axis alignment. If **Quick axis alignment** is selected in the axis **Alignment method** box, select **Chi** or **Phi** to be used from the box.

**Start(deg)** Enter the relative distance of the start angle of the scan from the reflection position.

**Stop(deg)** Enter the relative distance of the stop angle of the scan from the reflection position.

**Step(deg)** Enter the step width of the scan.

**Speed(deg/min)** Enter the scan speed.

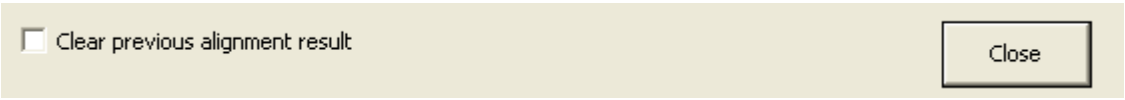
**Peak search methed** Select **Sequential center of gravity**, **Center of FWHM**, or **Max. intensity** as the peak search method.

**Intensity threshold(cps)** Enter the intensity threshold to abort the scan after a peak is detected.

**Set recommended values** Sets the conditions in the **Axis alignment conditions** section to the recommended values based on the conditions set in the **Slit conditions** and **Pre-measurement conditions** sections.

**Table 1.2.1 Scan axis used in each axis alignment**

| Alignment method | Scan axes |
|---|---|
| Without axis alignment | No scan axis used |
| Quick axis alignment | Omega, Chi (or Phi) axes |
| Recursive axis alignment | Omega axis |
| Standard axis alignment | *R*x, *R*y, and Omega axes |
| Precise axis alignment | *R*x, *R*y, Omega and Chi axes |




**Clear previous alignment result**

If the **Clear previous alignment result** box is checked, drive the *R*x and *R*y axes to zero and perform the axis alignment. This checkbox is available only when the RxRy attachment is installed

**Close** Close the **Customize** dialog box.

## 2. Measurement sequence

Described below is the measurement sequence of this Part.

> CAUTION: If the sample is changed, execute sample alignment using the **Sample Alignment** Part before executing this Part as a general rule.

(1) Set the widths of the slits (IS, RS1, RS2) to the values specified in the **Slit conditions** section.

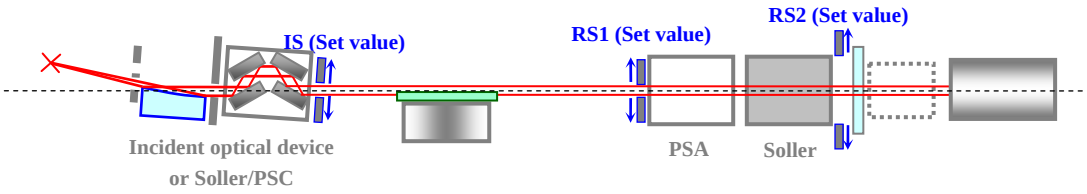



**Fig. 2.1 Setting the slit widths**

(2) Perform the axis alignment based on the reflection using the selected alignment method.

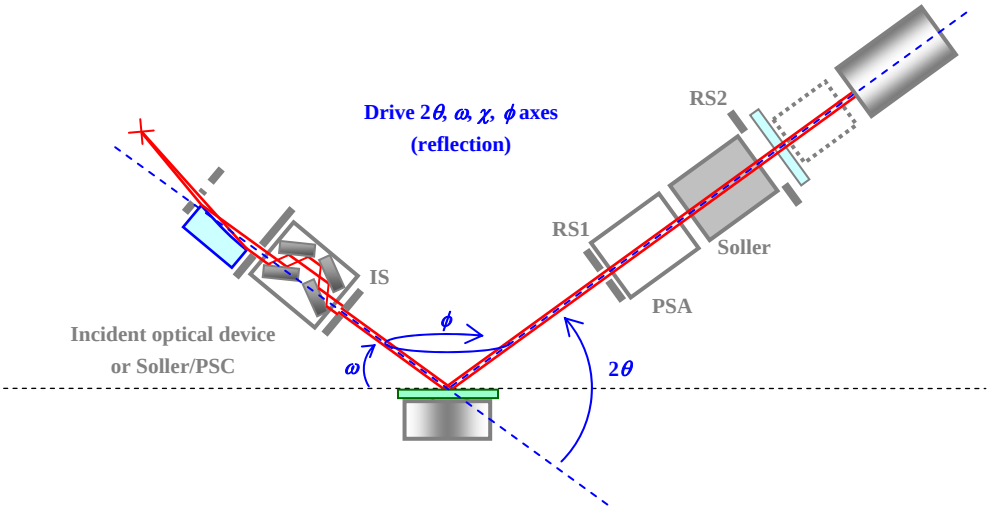



**Fig. 2.2 Setting the axes to the positions of the substrate reflection**

(3) Perform the rocking curve pre-measurement (omega scan) and calculate the FWHM of the peak. When the **Optimize 2-theta** box is checked, determine the position of the reflection (2-theta) precisely.

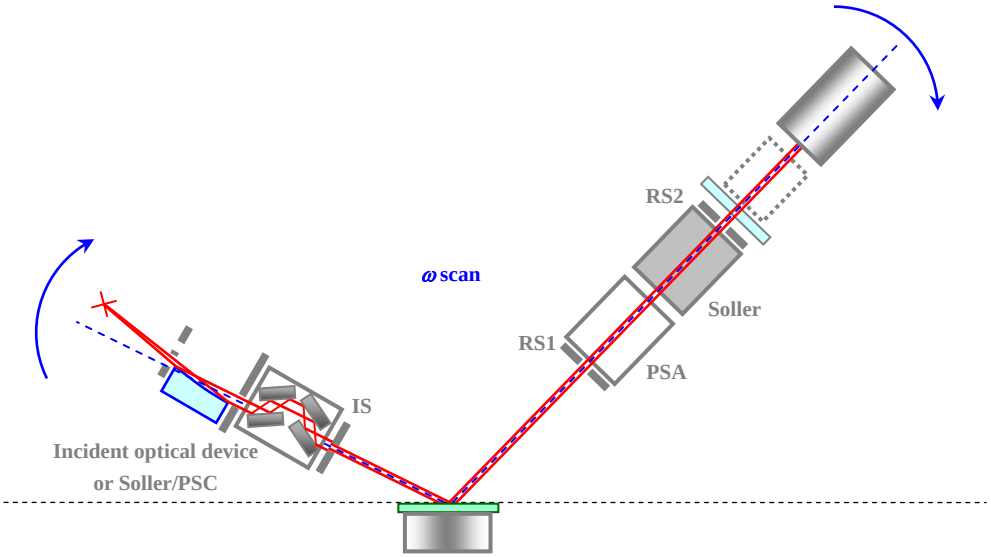



**Fig. 2.3 Rocking curve pre-measurement (omega scan)**

(4) Drive the 2-theta and omega axes to the positions determined by the axis alignment. This is the end of the rocking curve pre-mneasurement.