

**Rocking Curve / Reciprocal Space Mapping  
Package Measurement**



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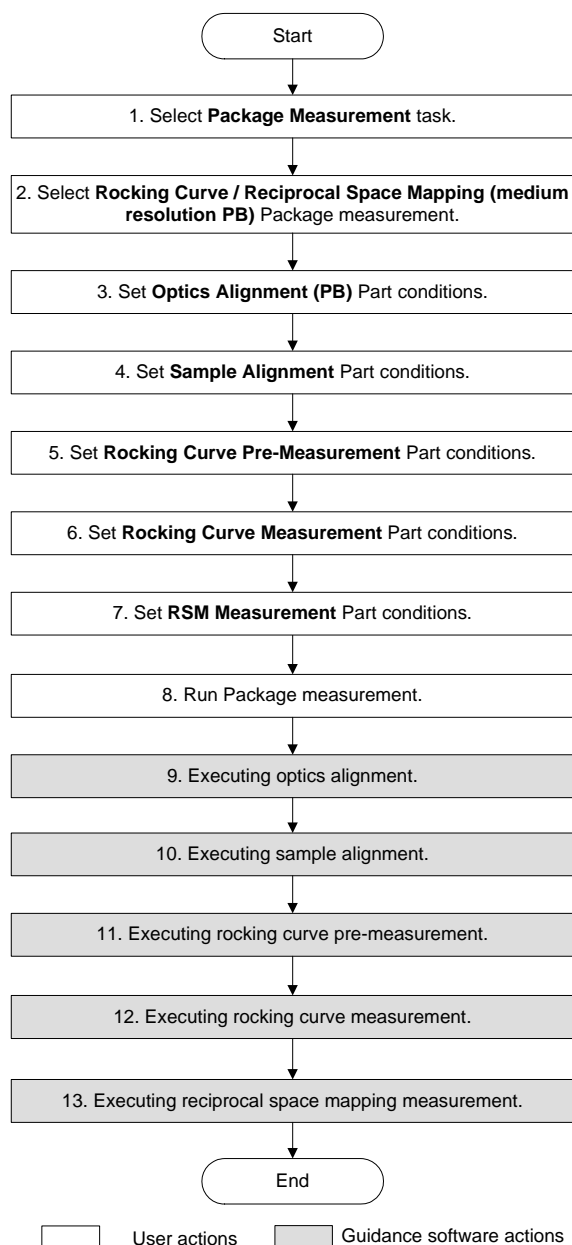
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## 1. Package measurement flow

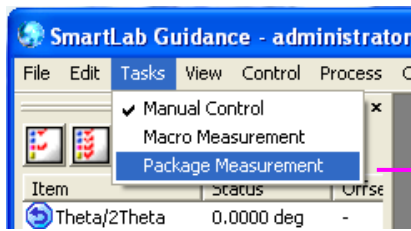
This manual describes how to set the measurement conditions and how to execute the Package measurement when the **Rocking Curve / Reciprocal Space Mapping (medium resolution PB)** Package measurement is selected. Also, the conditions can be set and the measurement can be executed in the same way when one of the other Rocking Curve / Reciprocal Space Mapping plane Package measurements is selected.

Figure 1.1 shows the procedural flow for a **Rocking Curve / Reciprocal Space Mapping (medium resolution PB)** Package measurement.

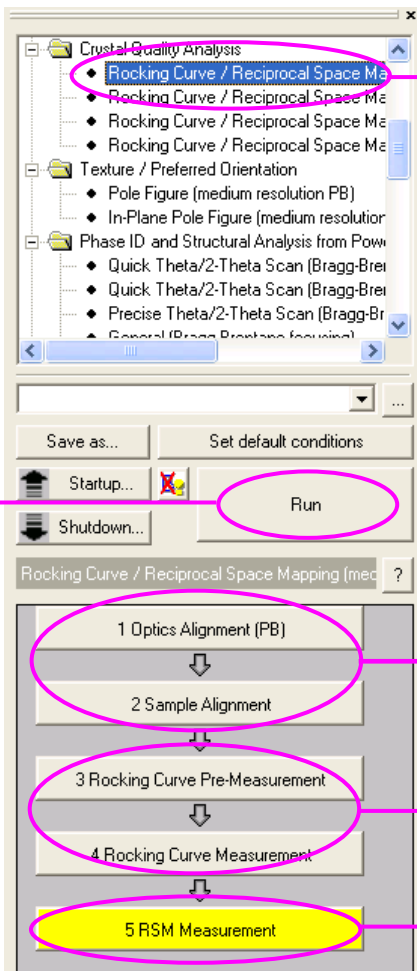


**Fig. 1.1 Rocking Curve / Reciprocal Space Mapping (medium resolution PB) Package measurement procedural flow**

# 1. Package measurement flow



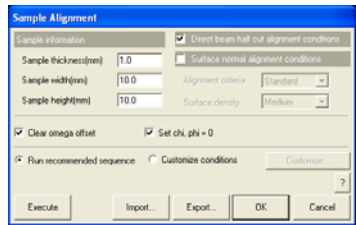
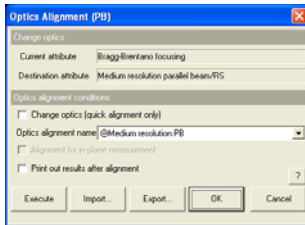
1. Click **Package Measurement** in the **Tasks** menu.



2. Click **Rocking Curve / Reciprocal Space Mapping (medium resolution PB)**.

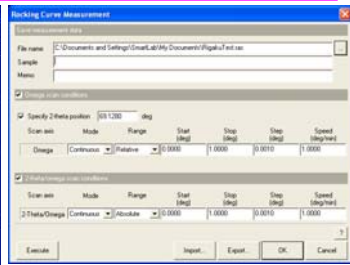
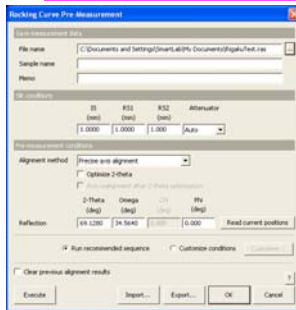
3. Set the **Optics Alignment (PB)** Part conditions.

4. Set the **Sample Alignment** Part conditions.



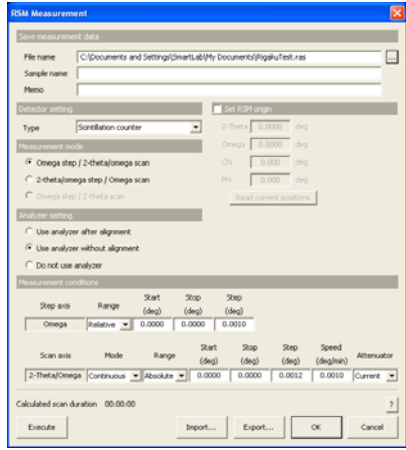
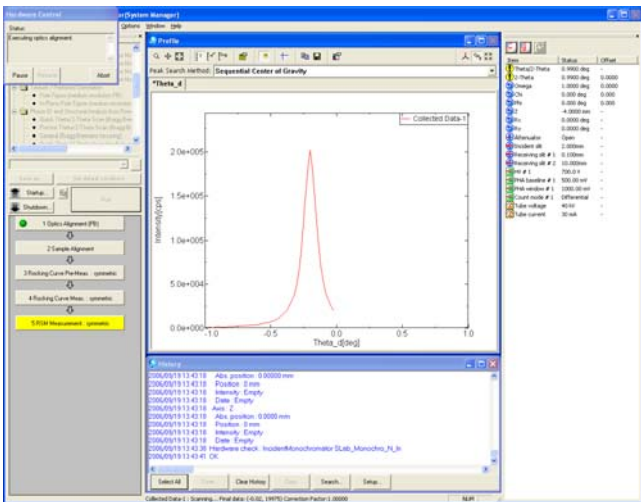
5. Set the **Rocking Curve Pre-Measurement** Part conditions.

6. Set the **Rocking Curve Measurement** Part conditions.



8. When the **Run** button is clicked, the optics alignment is started.

7. Set the **RSM Measurement** Part conditions.



## 2. Measurement procedures

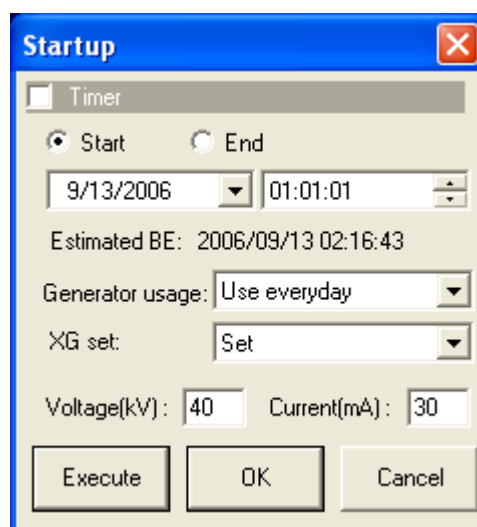
### 2.1 Startup

Before measurement, set the output of the x-ray generator (XG) as described below.

- (1) Click the **Startup** button on the flow bar to open the **Startup** dialog box.



- (2) Uncheck the **Timer** box.



**Fig. 2.1.1 Startup dialog box**

- (3) Select an appropriate setting in the **Generator usage** box, based on the frequency of XG usage.
- (4) Select **Set** in the **XG set** box.
- (5) Enter the following values in the **Voltage (kV)** and **Current (mA)** boxes.

When using 3-kW sealed tube	40 kV, 30 mA
When using 9-kW rotating anode	45 kV, 200 mA

- (6) Click the **Execute** button.
- (7) The aging operation begins. The XG output will be set to the values entered in step (5) within 30 to 60 minutes.



**CAUTION:** If **Not used for more than 3 weeks** is selected in the **Generator usage** box, the aging operation will take approximately five hours.



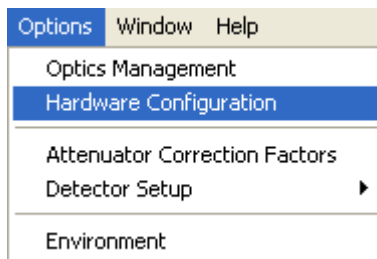
**Tip:** For other functions available from the **Startup** dialog box, refer to Chapter 21 of the *SmartLab Guidance Reference Manual* (ME13365A).

## 2.2 Hardware setup

Before measurement, the equipment configuration must be set up for a Rocking Curve / Reciprocal Space Mapping Package measurement.

The hardware setup method is described below.

- (1) Select the **Hardware Configuration** command under the **Options** menu to open the **Hardware Configuration** dialog box.



- (2) The **Hardware Configuration** dialog box shows the current hardware configuration.

The screenshot shows the 'Hardware Configuration' dialog box. At the top is a schematic diagram of an X-ray diffractometer with labels for X-Ray Generator, Incident Optics, Base Attachment Config., Attachment, Goniometer, Receiving Optics, and Detector. Below the diagram is a table with five columns: X-Ray generator, Incident optics, Goniometer, Receiving optics, and Detector. The table contains specific configuration details for each component. At the bottom right are 'Update' and 'Close' buttons.

X-Ray generator	Incident optics	Goniometer	Receiving optics	Detector
3kW Hermetic Mo 1mm x 10mm Normal 3,000kW(0.002kW Step) 20~60kV(1kV Step) 2~60mA(1mA Step)	CBO unit Standard incident optical unit Standard incident slit box	SmartLab(In-plane)  Base attachment config. Std. chi cradle  Attachment RxRy	Standard receiving slit box # 1 Standard receiving unit # 1 Standard receiving optical unit # 2 Standard receiving slit box # 2 Standard Attenuator	SC-70

**Fig. 2.2.1 Hardware Configuration dialog box**

- (3) Table 2.2.1 shows the hardware configuration that enables the Rocking Curve / Reciprocal Space Mapping Package measurement. If the configuration units shown in the **Hardware Configuration** dialog box differ from those indicated in Table 2.2.1, install the units specified in Table 2.2.1 at the designated locations, referring to the *Horizontal Sample Mount X-Ray Diffractometer for Thin Film Analysis Instruction Manual (ME11550A)*.

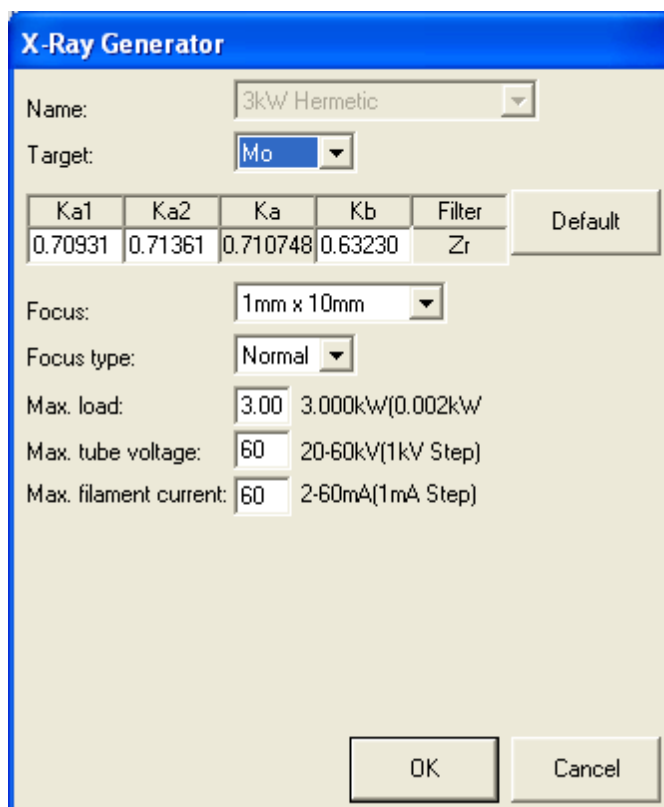


**Table 2.2.1 Hardware configuration for the Rocking Curve / Reciprocal Space Mapping Package measurement**

Hardware configuration	Configuration units
X-ray generator	Cu target
Incident optics	CBO unit Standard incident optical unit Standard incident slit box
Goniometer	SmartLab or SmartLab(in-plane)
Base attachment configuration	Standard chi cradle
Attachment	Any
Receiving optics	Standard receiving slit box # 1 Standard receiving optical unit # 1 Standard receiving optical unit # 2 Standard receiving slit box # 2 Standard attenuator
Detector	Scintillation counter SC-70

For example, if the target is set to **Mo** in the **X-Ray Generator** dialog box, you must change the target setting to **Cu**, since the Rocking Curve / Reciprocal Space Mapping Package measurement will not be made unless the Cu target is used. For sealed tubes, you must replace the Mo tube with the Cu tube.

- (4) Click the **X-Ray Generator** button to open the **X-Ray Generator** dialog box.



**Fig. 2.2.2 X-Ray Generator dialog box**

## 2. Measurement procedures

- (5) Select **Cu** in the **Target** box. Change other applicable parameters, such as wavelength.
- (6) Click the **OK** button to close the **X-Ray Generator** dialog box and register the changes made in the **Hardware Configuration** dialog box.
- (7) If necessary, change configuration units using the **Incident Optics**, **Receiving Optics**, and **Detector** buttons. Modify the conditions in the **Hardware Configuration** dialog box in the same way.
- (8) Click the **Update** button in the **Hardware Configuration** dialog box.



Tip: Mounted configuration units are automatically detected for **Base Attachment Configuration** and **Attachment**.

- (9) Confirm that each configuration unit displayed in the **Hardware Configuration** dialog box corresponds to the configuration unit indicated in Table 2.2.1, then click the **Close** button to close the dialog box.

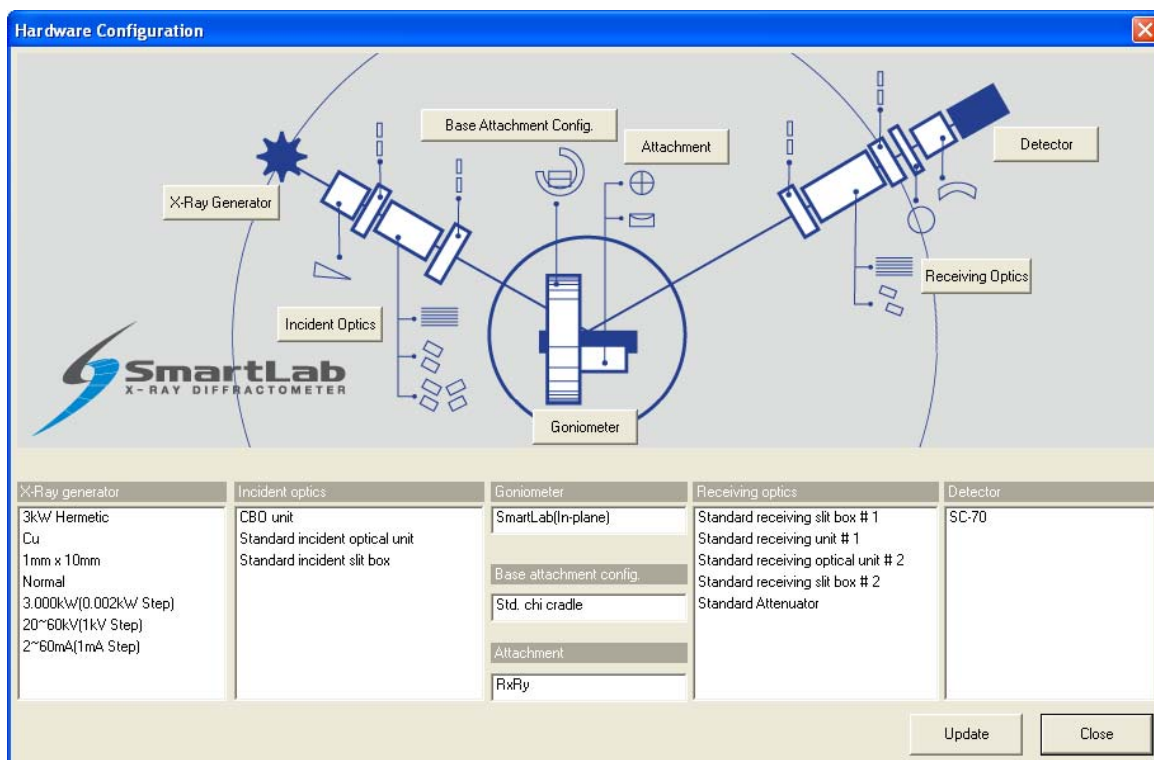


Fig. 2.2.3 Hardware Configuration dialog box

## 2.3 Setting Package measurement conditions

The Parts included in the Rocking Curve / Reciprocal Space Mapping Package measurements are shown in the table below.

Package measurement	Configuration Parts
Rocking Curve / Reciprocal Space Mapping (medium resolution PB)	<ul style="list-style-type: none"> <li>• Optics Alignment (PB)</li> <li>• Sample Alignment</li> <li>• Rocking Curve Pre-Measurement</li> <li>• Rocking Curve Measurement</li> <li>• RSM Measurement</li> </ul>
Rocking Curve / Reciprocal Space Mapping (high resolution PB-Ge(220)x2)	<ul style="list-style-type: none"> <li>• Optics Alignment (PB-Ge(220)x2)</li> <li>• Sample Alignment</li> <li>• Rocking Curve Pre-Measurement</li> <li>• Rocking Curve Measurement</li> <li>• RSM Measurement</li> </ul>
Rocking Curve / Reciprocal Space Mapping (high resolution PB-Ge(400)x2)	<ul style="list-style-type: none"> <li>• Optics Alignment (PB-Ge(400)x2)</li> <li>• Sample Alignment</li> <li>• Rocking Curve Pre-Measurement</li> <li>• Rocking Curve Measurement</li> <li>• RSM Measurement</li> </ul>
Rocking Curve / Reciprocal Space Mapping (ultra-high resolution PB-Ge(220)x4)	<ul style="list-style-type: none"> <li>• Optics Alignment (PB-Ge(220)x4)</li> <li>• Sample Alignment</li> <li>• Rocking Curve Pre-Measurement</li> <li>• Rocking Curve Measurement</li> <li>• RSM Measurement</li> </ul>
Rocking Curve / Reciprocal Space Mapping (ultra-high resolution PB-Ge(440)x4)	<ul style="list-style-type: none"> <li>• Optics Alignment (PB-Ge(440)x4)</li> <li>• Sample Alignment</li> <li>• Rocking Curve Pre-Measurement</li> <li>• Rocking Curve Measurement</li> <li>• RSM Measurement</li> </ul>

To perform the Package measurements, you must set the conditions of each of the five Parts individually. Described below is how to set the conditions of each Part.



**CAUTION:** If another Package measurement is selected or another task such as the **Manual Control** task is chosen, discard the set Part conditions. To save the set conditions to a file, click the **Export** button in each dialog box or save Package measurement conditions as described in the “Tip” section in Subsection 2.3.5 (8).

### 2.3.1 Setting Optics Alignment Part conditions

Described below is how to set the conditions of the **Optics Alignment (PB)** Part. Conditions can be set for the other Optics Alignment Parts in the same way.

- (1) Click the **Optics Alignment (PB)** button on the flow bar to open the **Optics Alignment (PB)** dialog box.

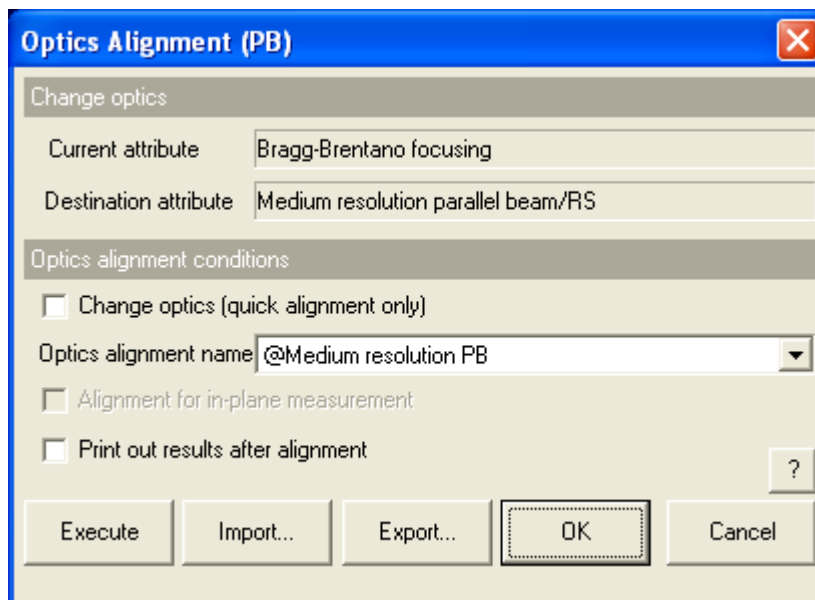


Fig. 2.3.1 Optics Alignment (PB) dialog box

- (2) Uncheck the **Change optics (quick alignment only)** box.



Tip: Check the **Change optics (quick alignment only)** box to switch optics for the rocking curve or reciprocal space mapping measurement using the alignment results stored under the selected optics alignment name by performing a quick alignment.

- (3) In the **Optics alignment name** box, select a location for storing optics alignment results.



Tip: To store optics alignment results under a new optics alignment name, click the **OK** or **Cancel** button to close the **Optics Alignment (PB)** dialog box. Then, select the **Optics Management** command from the **Options** menu to open the **Optics Management** dialog box and add a new optics alignment name. After adding a new optics alignment name, return to step (1) in this subn. For more information on creating an optics alignment name, refer to Chapter 17 of the *SmartLab Guidance Reference Manual (ME13365A)*.

- (4) To print the optics alignment results, check the **Print out results after alignment** box.

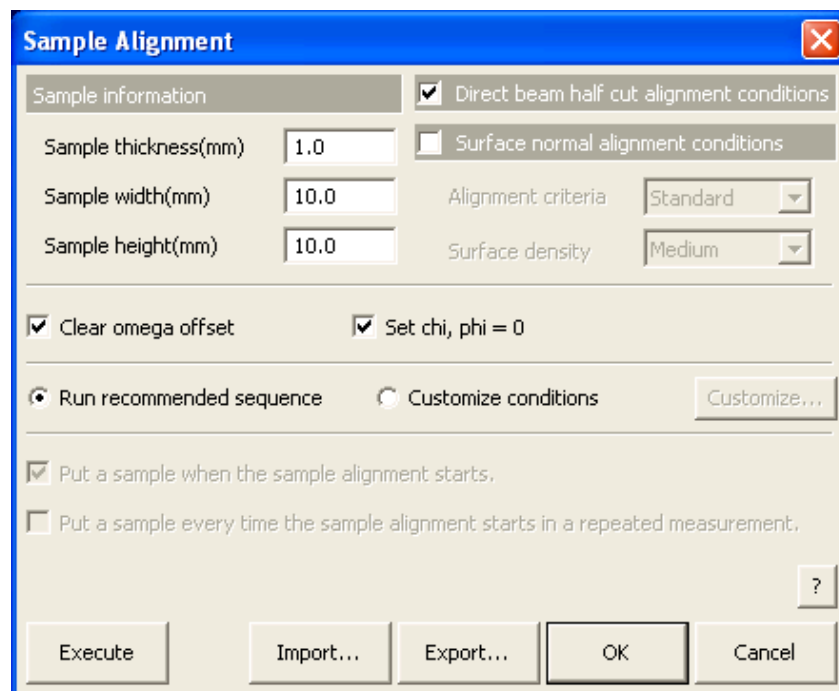


Tip: If both the **Change optics (quick alignment only)** and **Print out results after alignment** boxes are checked, the alignment results stored under the selected optics alignment name will be printed.

- (5) Click the **OK** button to close the dialog box.

### 2.3.2 Setting Sample Alignment Part conditions

- (1) Click the **Sample Alignment** button on the flow bar to open the **Sample Alignment** dialog box.

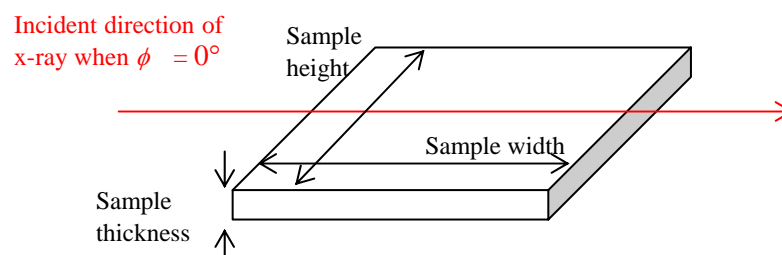


**Fig. 2.3.2 Sample Alignment dialog box**

- (2) Enter the sample thickness, sample width and sample height in the **Sample thickness (mm)**, **Sample width (mm)** and **Sample height (mm)** boxes.



Tip: The sample thickness, sample width and sample height refer to the dimensions (unit: mm) of the sample in the directions shown below.



- (3) Check the **Direct beam half cut alignment conditions** box.  
 (4) Uncheck the **Surface normal alignment conditions** box.

- (5) Check the **Clear omega offset** and **Set chi, phi = 0** boxes.



Tip: If the results of the previous sample alignment are kept, the next sample alignment uses this position as a reference and may not work correctly. In ordinary cases, check the **Clear omega offset** and **Set chi, phi = 0** boxes.

- (6) Select the **Run recommended sequence** radio button.



Tip: To confirm or set the scan conditions, select the **Customize conditions** radio button, then click the **Customize** button.

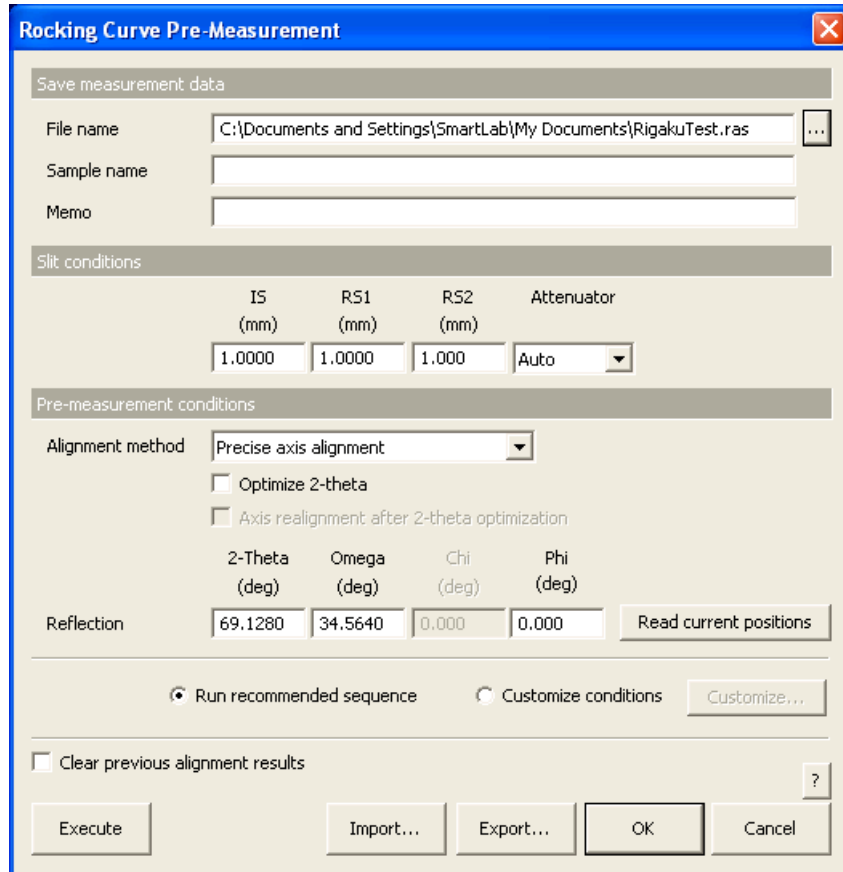


[2.4.1 Customizing Sample Alignment Part conditions](#)

- (7) Click the **OK** button to close the dialog box.

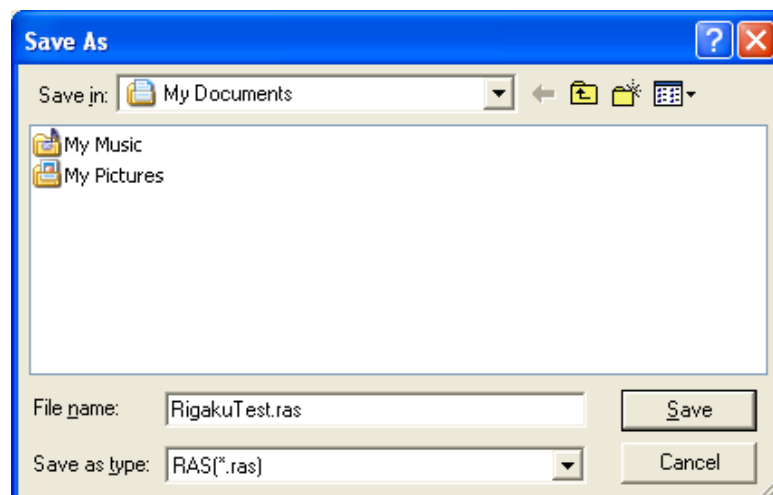
### 2.3.3 Setting Rocking Curve Pre-Measurement conditions

- (1) Click the **Rocking Curve Pre-Measurement** button on the flow bar to open the **Rocking Curve Pre-Measurement** dialog box.



**Fig. 2.3.3 Rocking Curve Pre-Measurement dialog box**

- (2) Set the folder to store the measurement data and the name of the measurement data file in the **File name** box in the **Save measurement data** section. After completing the rocking curve pre-measurement, the measurement data will be saved with the specified file name.
  1. Click the [...] button to open the **Save As** dialog box.



**Fig. 2.3.4 Save As dialog box**

## 2. Measurement procedures

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2. Enter the settings in the **Save in** and **File name** boxes.
3. Click the **Save** button.
- (3) Enter any required information in the **Sample name** and **Memo** boxes (optional).



**CAUTION:** The information entered here will be saved to the file. Any number of characters may be entered, but only the first 30 characters of the sample name and the first 84 characters of the memo will appear on the printed measurement data.

- (4) Set the slit conditions.



**Tip:** If any information of the diffraction peak (position, FWHM, etc.) to be measured is not obtained, it is recommended to set the slit conditions as follows:

IS = 1 mm, RS1 = 1 mm, RS2 = 20 mm

And select **Auto** in the **Attenuator** box.

- (5) Select **Standard axis alignment** in the **Alignment method** box.



**Tip:** If currently installed is not the RxRy attachment, select **Quick axis alignment**.

- (6) Uncheck the **Optimize 2-theta** box.
- (7) Enter the positions of the substrate reflection in the **2-Theta (deg)**, **Omega (deg)**, and **Phi (deg)** boxes.



**Tip:**

- Unless the RxRy attachment is installed, enter the position also in the **Chi (deg)** box.

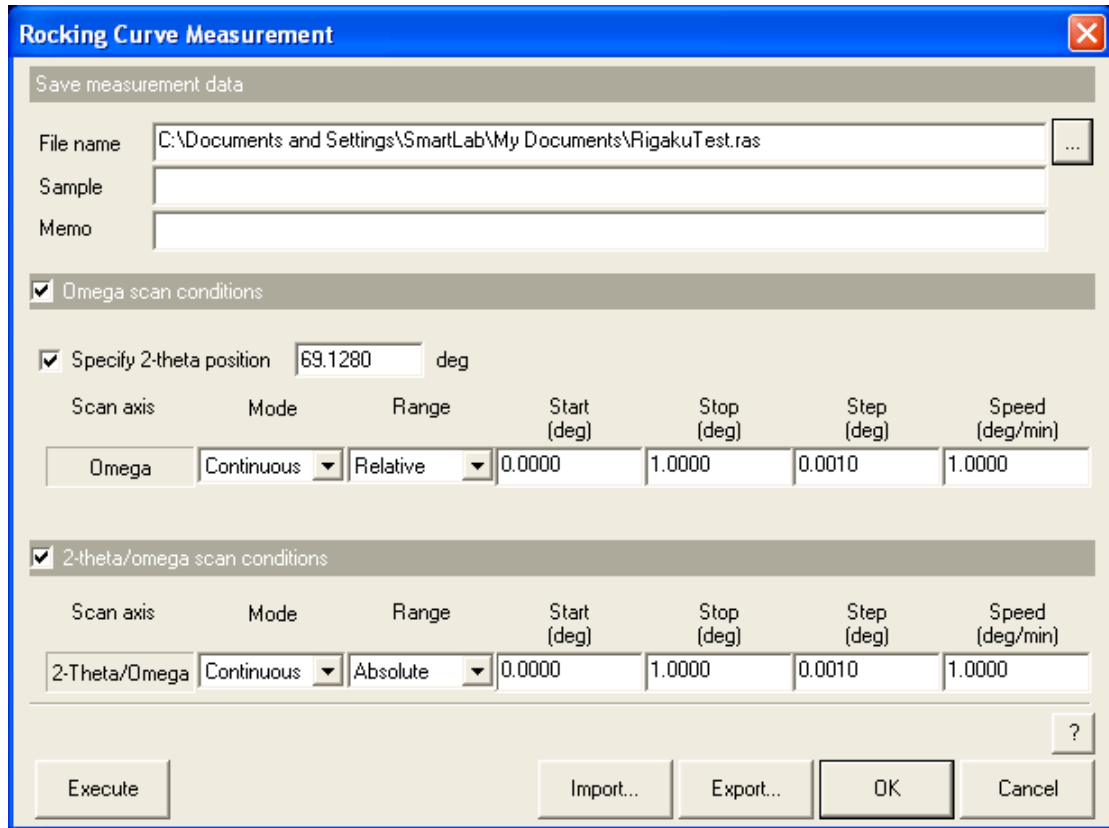
- The positions of the substrate reflection can be simulated using the Diffraction Space Simulation features. For information on how to use Diffraction Space Simulation, refer to the *Diffraction Space Software. User's Manual* (ME13305A).

- (8) If the RxRy attachment is installed, check the **Clear previous alignment results** box.
- (9) Click the **OK** button to close the dialog box.



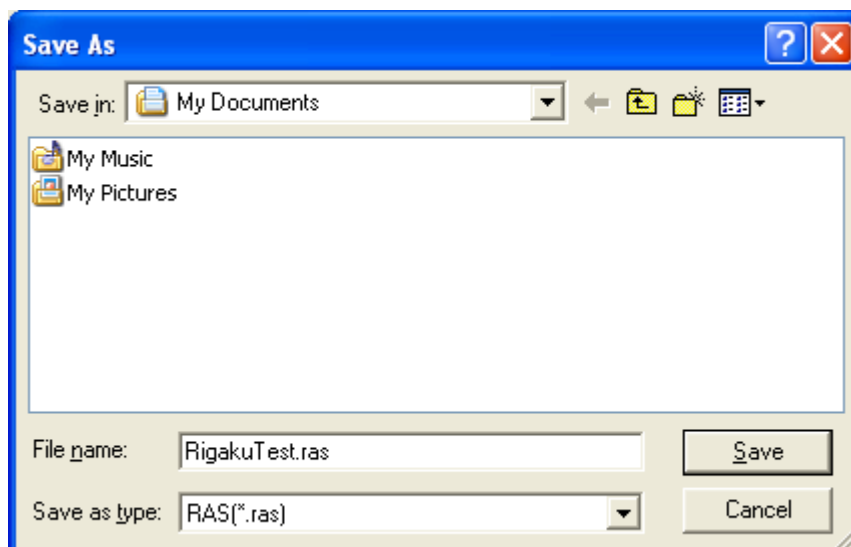
### 2.3.4 Setting Rocking Curve Measurement Part conditions

- (1) Click the **Rocking Curve Measurement** button on the flow bar to open the **Rocking Curve Measurement** dialog box.



**Fig. 2.3.5 Rocking Curve Measurement dialog box**

- (2) Set the folder to store the measurement data and the name of the measurement data file in the **File name** box in the **Save measurement data** section. After completing the rocking curve measurement, the measurement data will be saved with the specified file name.
  1. Click the [...] button to open the **Save As** dialog box.



**Fig. 2.3.6 Save As dialog box**

## 2. Measurement procedures

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2. Enter the settings in the **Save in** and **File name** boxes.
3. Click the **Save** button.
- (3) Enter any required information in the **Sample name** and **Memo** boxes (optional).



**CAUTION:** The information entered here will be saved to the file. Any number of characters may be entered, but only the first 30 characters of the sample name and the first 84 characters of the memo will appear on the printed measurement data.

- (4) Check the **Specify 2-theta position** box, and enter the position of the film reflection in deg in the box.
- (5) If the omega axis is scanned, check the **Omega scan conditions** box and set the omega scan conditions.
- (6) To perform a 2-theta/omega scan, check the **2-theta/omega scan conditions** box and set the 2-theta/omega scan conditions.



**Tip:** To set the scan conditions, refer to “Rocking Curve Measurement Part” Help Topic of the online help section of the SmartLab Guidance software.

- (7) Click the **OK** button to close the dialog box.

### 2.3.5 Setting RSM Measurement Part conditions

- (1) Click the **RSM Measurement** button on the flow bar to open the **RSM Measurement** dialog box.

**RSM Measurement**

Save measurement data

File name: C:\Documents and Settings\SmartLab\My Documents\RigakuTest.ras

Sample name:

Memo:

Detector setting:   Set RSM origin

Measurement mode:

- Omega step / 2-theta/omega scan
- 2-theta/omega step / Omega scan
- Omega step / 2-theta scan

Analyzer setting:

- Use analyzer after alignment
- Use analyzer without alignment
- Do not use analyzer

Measurement conditions:

Step axis	Range	Start (deg)	Stop (deg)	Step (deg)
Omega	Relative	-1.0000	1.0000	0.0100

Scan axis	Mode	Range	Start (deg)	Stop (deg)	Step (deg)	Speed (deg/min)	Attenuator
2-Theta/Omega	Continuous	Relative	-1.0000	1.0000	0.0100	1.0000	Current

Calculated scan duration: 06:42:00

Buttons: Execute, Import..., Export..., OK, Cancel

**Fig. 2.3.7 RSM Measurement dialog box**

- (2) Set the folder to store the measurement data and the name of the measurement data file in the **File name** box in the **Save measurement data** section. After completing the reciprocal space mapping measurement, the measurement data will be saved with the specified file name.
  1. Click the [...] button to open the **Save As** dialog box.

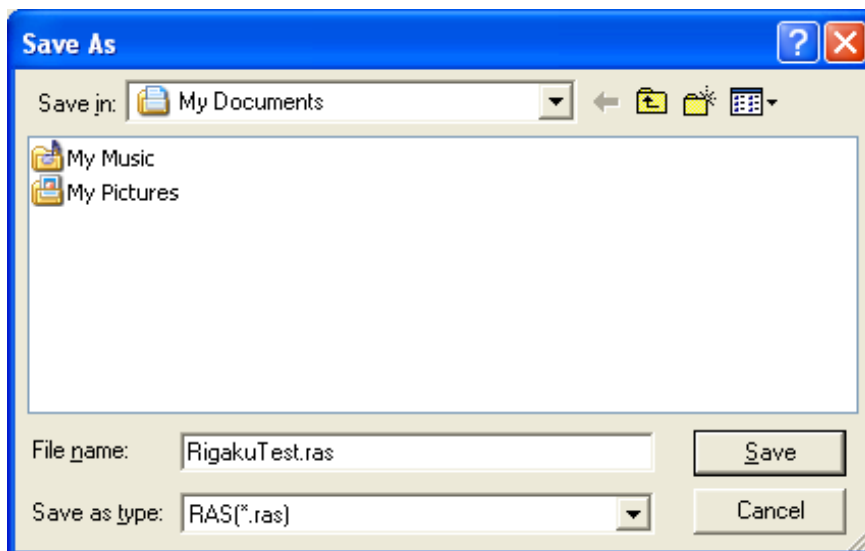


Fig. 2.3.8 Save As dialog box

2. Enter the settings in the **Save in** and **File name** boxes.
  3. Click the **Save** button.
- (3) Enter any required information in the **Sample name** and **Memo** boxes (optional).



**CAUTION:** The information entered here will be saved to the file. Any number of characters may be entered, but only the first 30 characters of the sample name and the first 84 characters of the memo will appear on the printed measurement data.

- 4) Select **Scintillation counter** from the **Type** box.
  - 5) Select **Omega step / 2-theta/omega scan** in the **Measurement mode** section.
  - 6) Select **Use analyzer without alignment** in the **Analyzer setting** section.



**CAUTION:** If the 2-bounce analyzer is not available, select **Do not use analyzer**.

- 7) Uncheck the **Set RSM origin** box.

- (8) Set the measurement conditions.



Tip: If any information of the diffraction peak (position, FWHM, etc.) to be measured is not obtained, it is recommended to set the measurement conditions as shown in the following figure.

Measurement conditions							
Step axis	Range	Start (deg)	Stop (deg)	Step (deg)			
Omega	Relative	-1.0000	1.0000	0.0100			
Scan axis	Mode	Range	Start (deg)	Stop (deg)	Step (deg)	Speed (deg/min)	Attenuator
2-Theta/Omega	Continuous	Relative	-1.0000	1.0000	0.0100	1.0000	Auto

- (9) Click the **OK** button to close the dialog box.



Tip: To save all the Part conditions set in Subsections 2.3.1 through 2.3.5 to a single file, click the **Save as** button on the flow bar to open the **Save As** dialog box, then enter the settings in the **Save in** and **File name** boxes. Click the **Save** button.

The image shows a 'Save As' dialog box with the following details:


- Save in: My Documents
- File name: BBopticsDefault.sqp
- Save as type: Package files(\*.sqp)
- Buttons: Save, Cancel

Select a saved Package measurement conditions file (\*.sqp) in the box shown on the flow bar to load the conditions stored in that file.

The image shows a software interface with a dropdown menu. The selected item is 'BBopticsDefault.sqp <C:\Documents and Set', which is circled in pink. Below the dropdown are buttons for 'Save as...' and 'Set default conditions'.

## 2.4 Customizing Part conditions

The user is free to set scan conditions and slit conditions of the **Sample Alignment** Part. Use the **Customize** dialog box to set scan conditions and slit conditions.

 **Tip:** To confirm the conditions set for **Run recommended sequence**, click the **Set recommended values** button in the **Customize** dialog box.

### 2.4.1 Customizing Sample Alignment Part conditions

- (1) Select the **Customize conditions** radio button in the **Sample Alignment** dialog box.
- (2) Click the **Customize** button to open the **Customize** dialog box.

Customize - Sample Alignment

Sample information		<input checked="" type="checkbox"/> Direct beam half cut alignment conditions	
Sample thickness(mm)	<input type="text" value="1.0"/>	<input type="checkbox"/> Surface normal alignment conditions	
Sample width(mm)	<input type="text" value="10.0"/>	Alignment criteria	<input type="text" value="Standard"/>
Sample height(mm)	<input type="text" value="10.0"/>	Surface density	<input type="text" value="Medium"/>

<input checked="" type="checkbox"/> Clear omega offset	<input checked="" type="checkbox"/> Set chi, phi = 0
--	--

Slit conditions		Scattering angle for alignment	
IS(mm)	IS L(mm)	RS1(mm)	RS2(mm)
<input type="text" value="0.050"/>	<input type="text" value="10.0"/>	<input type="text" value="0.050"/>	<input type="text" value="20.000"/>
			Alignment 2-Theta(deg)
			<input type="text" value="0.5000"/>

<input checked="" type="checkbox"/> Direct beam half cut alignment measurement conditions						
Attenuator	<input type="text" value="1/10000"/>	Intensity threshold(cps)	<input type="text" value="5000"/>			
Scan axis	Range	Start (mm)	Stop (mm)	Step (mm)	Speed (mm/min)	Delta (mm)
Z	Absolute	-3.0000	1.0000	0.0100	8.0000	0.5000
Scan axis	Range	Start (deg)	Stop (deg)	Step (deg)	Speed (deg/min)	Delta (deg)
Omega	Absolute	-3.0000	3.0000	0.0100	8.0000	1.0000

<input type="checkbox"/> Surface normal alignment measurement conditions							
Attenuator	<input type="text" value="1/1000"/>	Intensity threshold(cps)	<input type="text" value="3000"/>	Repeat	<input type="text" value="3"/>		
Scan axis	Range	Start (mm)	Stop (mm)	Step (mm)	Speed (mm/min)	Delta (mm)	
Z	Relative	-0.3000	0.3000	0.0100	4.0000	0.3000	
Exec.	Scan axis	Range	Start (deg)	Stop (deg)	Step (deg)	Speed (deg/min)	Delta (deg)
	Omega	Relative	-0.2000	0.2000	0.0020	1.0000	0.1500
<input checked="" type="checkbox"/>	Chi	Relative	-3.0000	3.0000	0.0500	15.0000	3.0000

Fig. 2.4.1 Customize dialog box

The conditions set in the **Sample Alignment** dialog box are indicated in the **Sample information**, **Direct beam half cut alignment conditions**, **Surface normal alignment conditions** sections, and the **Clear omega offset**, **Set chi, phi = 0** boxes.

- (3) If necessary, set conditions in the **Slit conditions**, **Scattering angle for alignment**, **Direct beam half cut alignment measurement conditions** and **Surface normal alignment measurement conditions** sections.






**CAUTION:** Clicking the **Set recommended values** button changes settings in the **Slit conditions**, **Scattering angle for alignment**, **Direct beam half cut alignment measurement conditions** and **Surface normal alignment measurement conditions** sections to the values recommended based on the settings specified in the **Sample information** and **Surface normal alignment conditions** sections. For more information, refer to “Sample Alignment Part” Help Topic of the online help section of the SmartLab Guidance software.



- (4) After setting the conditions, click the **Close** button to close the **Customize** dialog box.


### 2.5 Executing a Package measurement

Described below is the procedure for executing the complete series of measurement operations from the optics alignment to the rocking curve / reciprocal space mapping measurements.

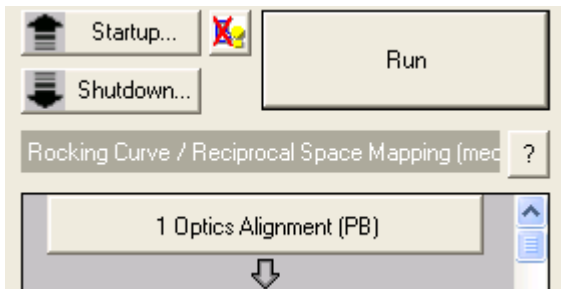
 Tip: When executing optics alignment only, sample alignment only, rocking curve pre-measurement only, rocking curve measurement only, or reciprocal space mapping measurement only, refer to [3. Executing a Part](#) individually.



- (1) Click the  (Show confirmation messages) button to set it to  (Don't show confirmation messages).

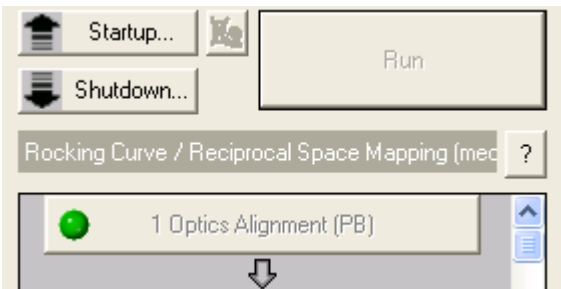
 Tip: To confirm the optics alignment results or to show the message to verify that each Part has been completed, set it to  (Show confirmation messages).



- (2) Click the **Run** button on the flow bar.

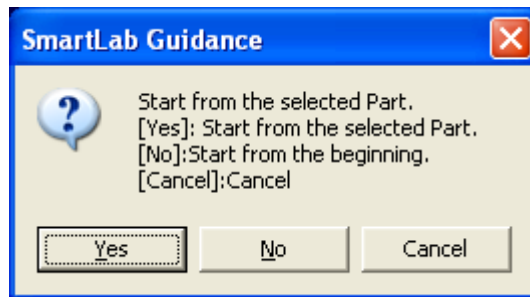


 Tip: After executing a Package measurement, the  mark appears on a button on the flow bar. The mark indicates that the Part corresponding to the button is in progress.





- (3) If the following message appears, click the **No** button.

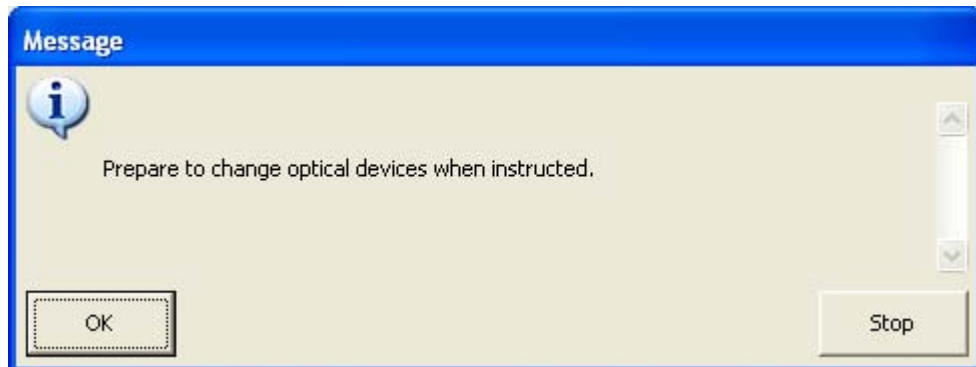


**CAUTION:** If the current hardware configuration setting is different from that for the operation of the Rocking Curve / Reciprocal Space Mapping Package measurement, the measurement will be aborted and the **Hardware Configuration** dialog box will open. If this happens, replace the configuration units (e.g., the attachment) as prompted by the message in the dialog box.



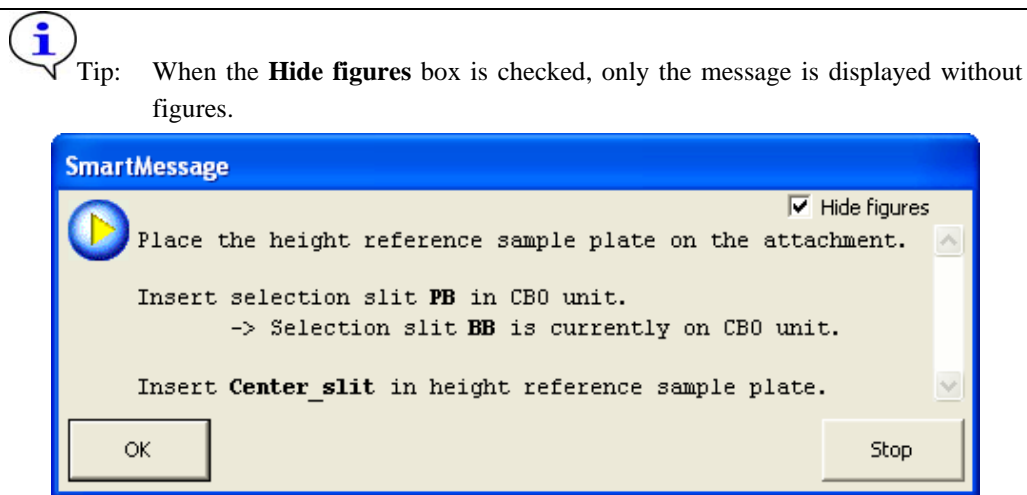
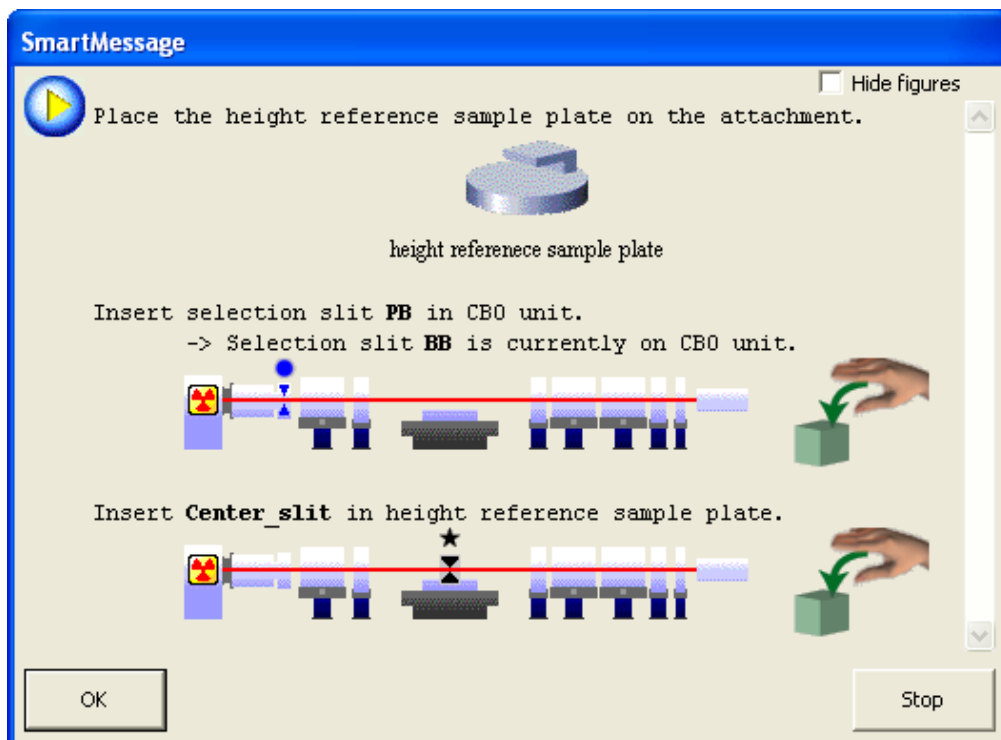
[2.6 Changing configuration units](#)

- (4) A message will prompt you to replace optical devices in the middle of the measurement. Confirm the message and click the **OK** button.






## 2. Measurement procedures

- (5) When the following message appears, place the height reference sample plate on the attachment and insert the center slit into the height reference sample plate. If another message appears at the same time prompting for replacement of the optical device(s) such as the selection slit, install the specified optical device(s) as indicated by the message.




- (6) Click the **OK** button to execute optics alignment.  
The optics alignment will be performed under the recommended conditions, and it will be completed in about 10 minutes.

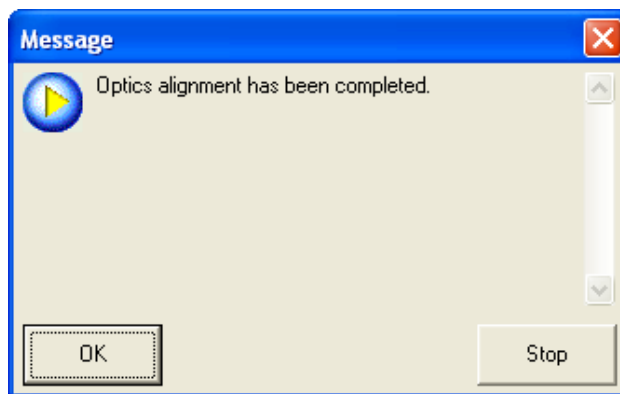
- (7) The specific procedure in this step depends on the setting  or  on the flow bar. Follow the directions given below.

When  (Don't show confirmation messages) is set:

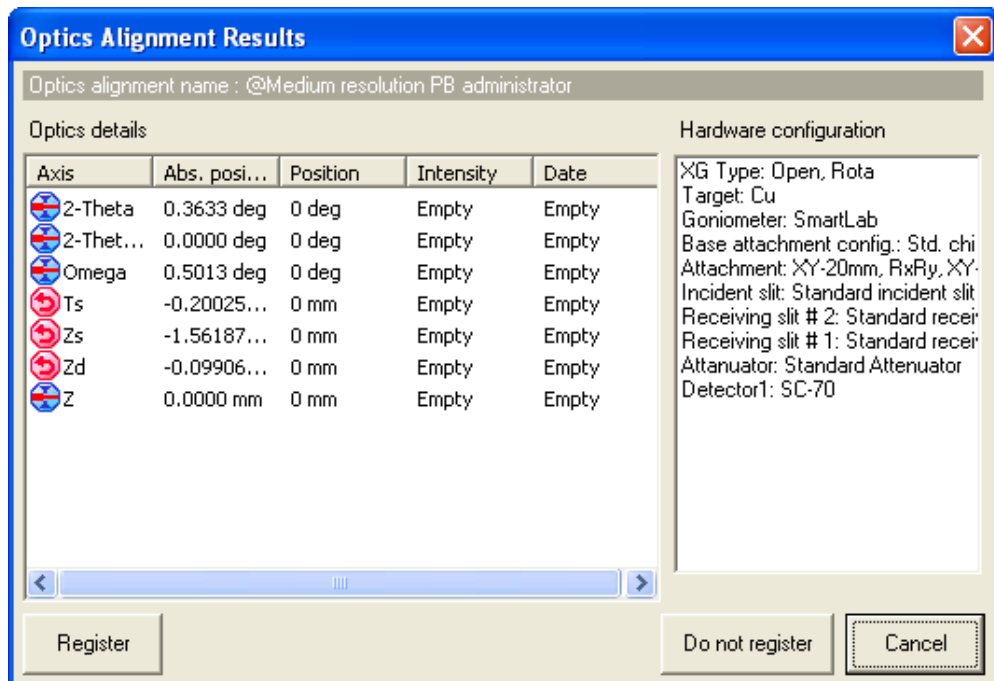
The optics alignment results will be registered in the optics management database.

When  (Show confirmation messages) is set:

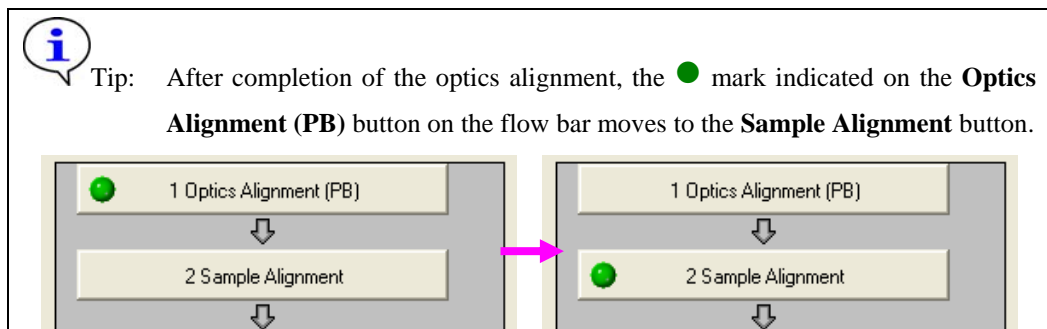
1. The message will appear to verify the optics alignment has been completed. Click the **OK** button.



2. The **Optics Alignment Results** dialog box will appear. Confirm the results and click the **Register** button. The optics alignment results will be registered in the optics management database.

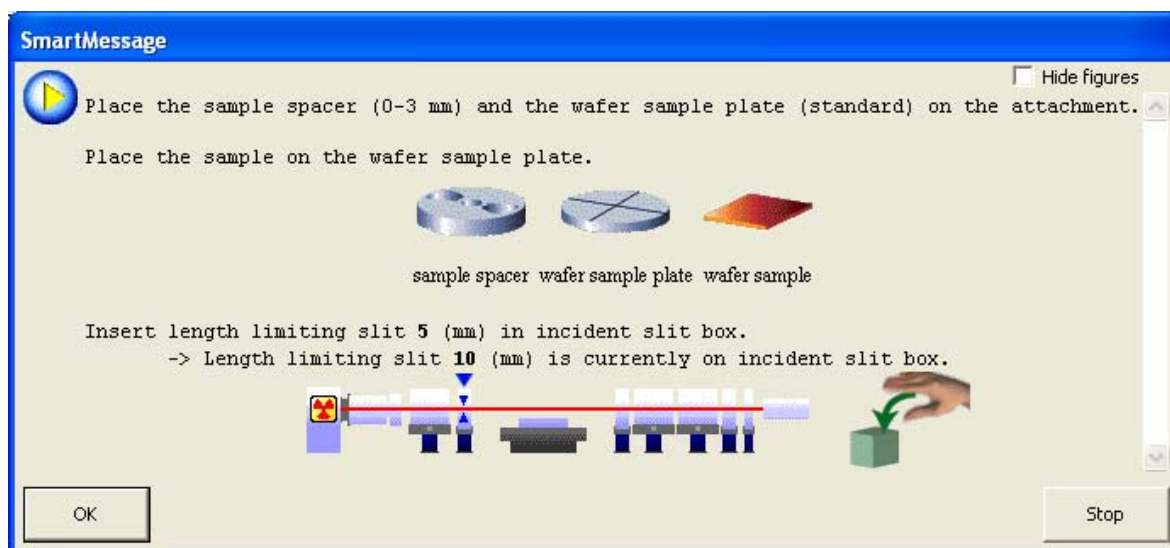


**CAUTION:** Clicking the **Do not register** button sets the zero offset value for each axis, but does not register the optics alignment results in the optics management database.




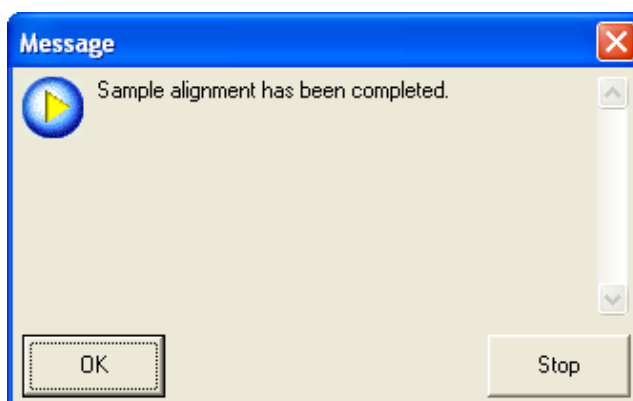
Tip: After completion of the optics alignment, the ● mark indicated on the **Optics Alignment (PB)** button on the flow bar moves to the **Sample Alignment** button.

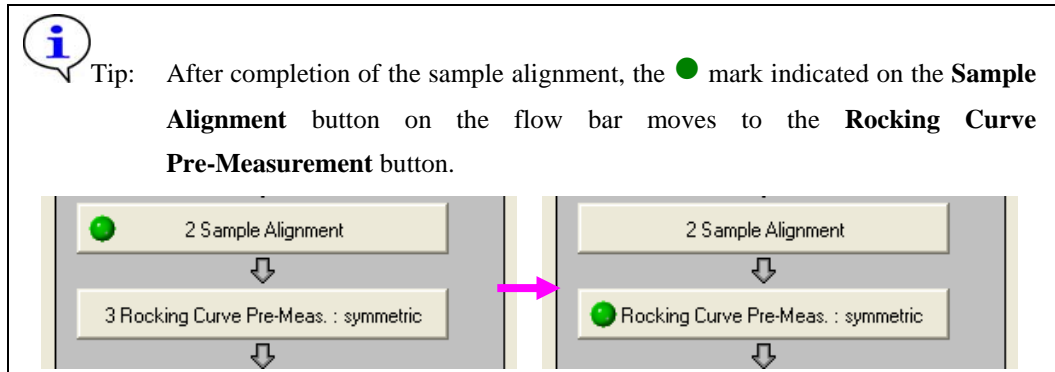
- (8) The following message will appear. Based on this message, place the sample spacer on the attachment, place the wafer sample plate on the sample spacer, and place the sample on the wafer sample plate. If another message appears at the same time prompting for replacement of the manual exchange slit(s) such as the length limiting slit, install the specified manual exchange slit(s) as indicated by the message.



- (9) Click the **OK** button to execute sample alignment. Direct beam half cut alignment will be performed under the specified conditions. The sample alignment will be completed in about 5 minutes.

Only when  (Show confirmation messages) is set on the flow bar, the message will appear to verify the sample alignment has been completed. Click the **OK** button.




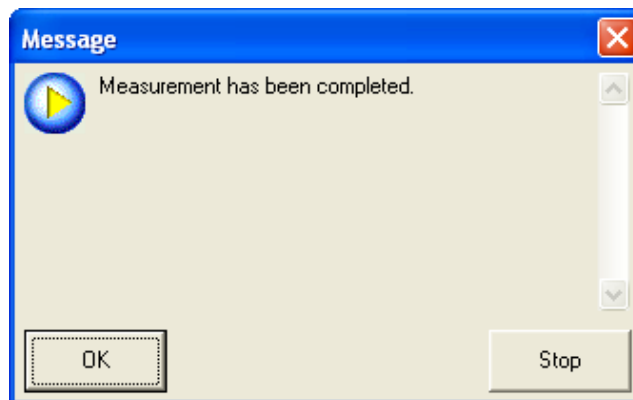


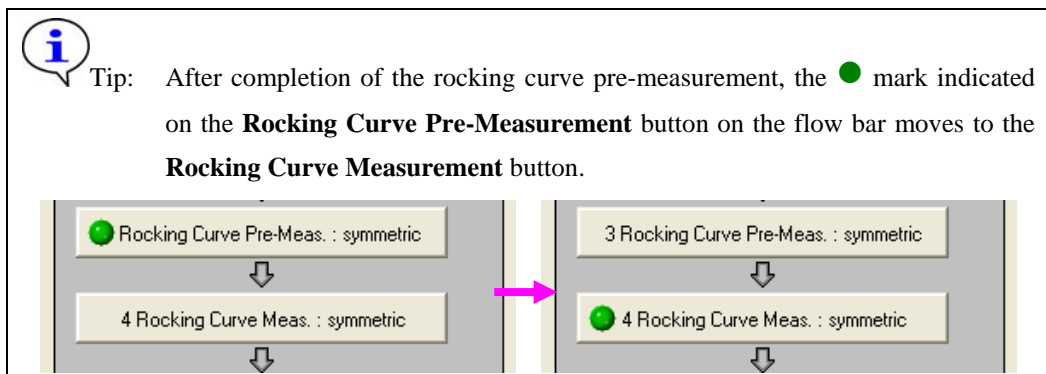
- (10) A rocking curve pre-measurement will be executed.

After an axis alignment using a substrate diffraction peak, the rocking curve pre-measurement will be made under the recommended conditions. The measurement will be completed in 5 to 30 minutes.

- (11) After completion of the measurement, the measurement data will be saved under the file name set in Subsection 2.3.3 (2).

Only when  (Show confirmation messages) is set on the flow bar, the message will appear to verify the rocking curve pre-measurement has been completed. Click the **OK** button.






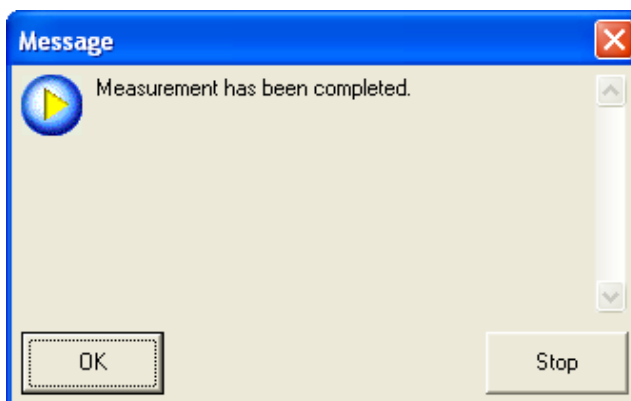
(12) A rocking curve measurement will be executed.

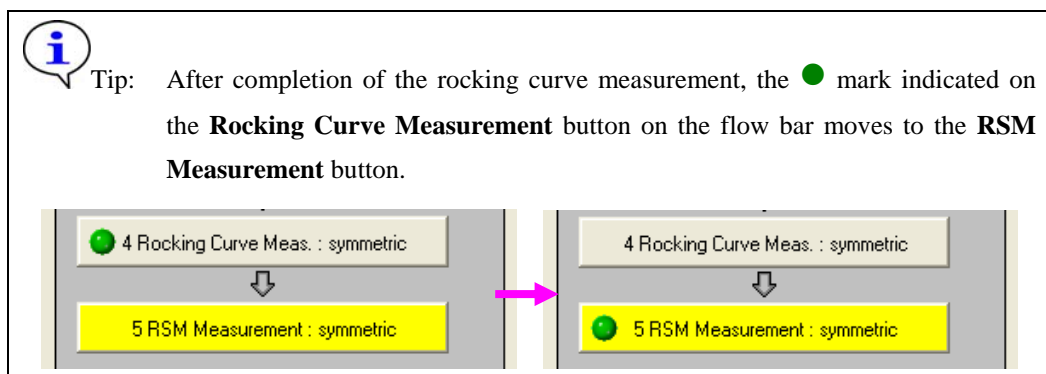
If the **Omega scan conditions** box has been checked in the **Rocking Curve Measurement** dialog box, the omega scan is performed first.

If the **2-theta/omega scan conditions** box has been checked in the **Rocking Curve Measurement** dialog box, the 2-theta/omega scan is performed next.

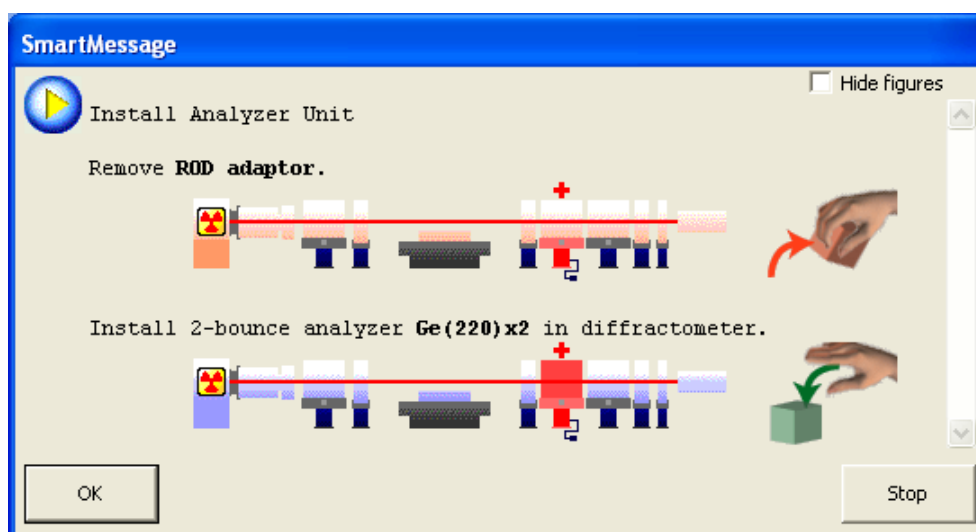
(13) After completion of the measurement, the measurement data will be saved under the file name set in Subsection 2.3.4 (2).

Only when  (Show confirmation messages) is set on the flow bar, the message will appear to verify the rocking curve measurement has been completed. Click the **OK** button.




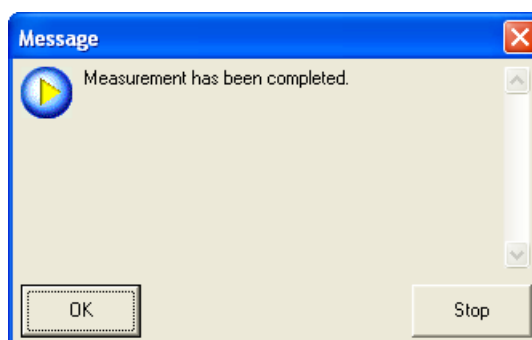


- (14) If **Use analyzer after alignment** or **Use analyzer without alignment** is selected in the **Analyzer setting** section in the **RSM Measurement** dialog box, the following message will appear. If instructed by this message, install the 2-bounce analyzer.



- (15) Click the **OK** button to execute a reciprocal space mapping measurement.  
After a fine axis alignment using the substrate diffraction peak, the reciprocal space mapping measurement will be made.
- (16) After completion of the measurement, the measurement data will be saved under the file name set in Subsection 2.3.5 (2).

Only when  (Show confirmation messages) is set on the flow bar, the message will appear to verify the reciprocal space mapping measurement has been completed. Click the **OK** button.



This is the end of the Rocking Curve / Reciprocal Space Mapping Package measurement.

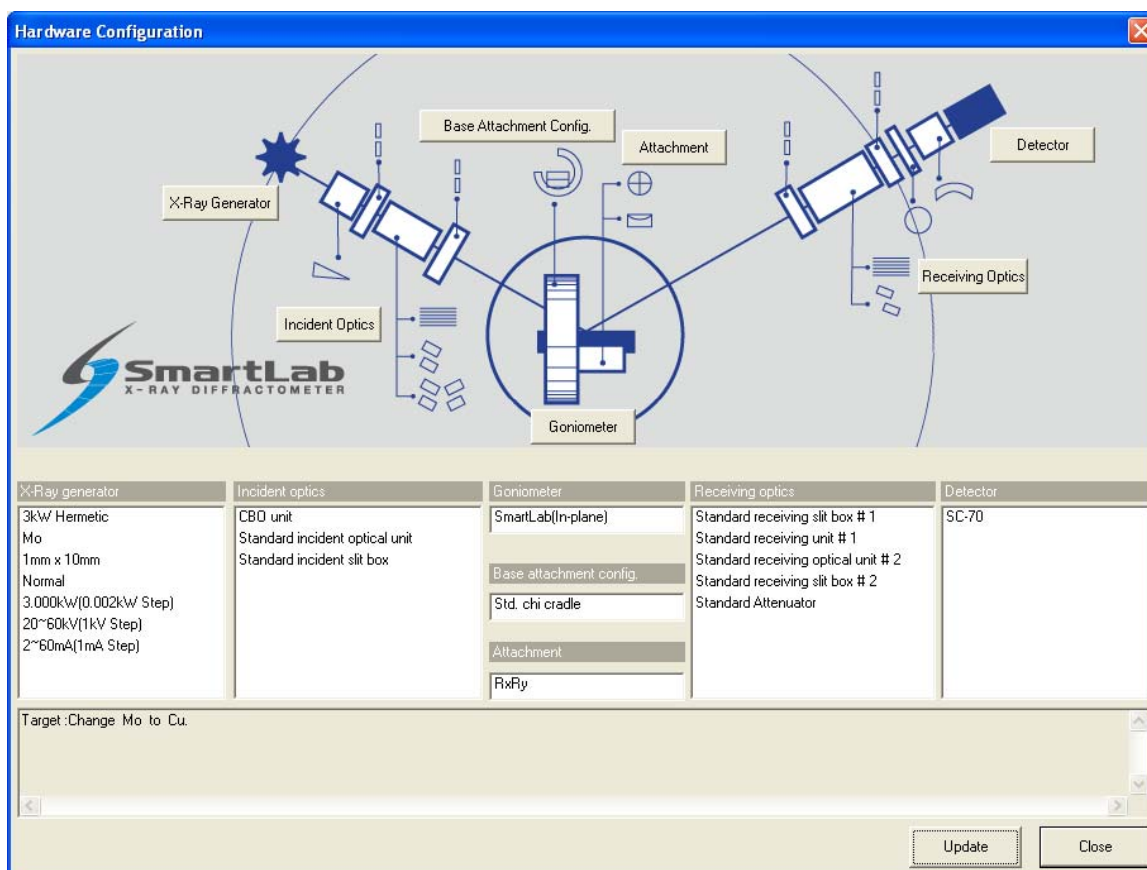
## 2.6 Changing configuration units

After a Package measurement (or Part) is executed, and the hardware configuration is not set for the Package measurement or the Part, the **Hardware Configuration** dialog box will open. A message appears below the dialog box prompting you to change the configuration units preventing the use of the Package measurement or the Part.

For example, if the target has been set to **Mo** in the **X-Ray Generator** dialog box, the displayed message will show “Target: Change Mo to Cu.”, since the target must be Cu for the Rocking Curve / Reciprocal Space Mapping Package measurements.



**CAUTION:** Execution of the Package measurement or Part aborts when the **Hardware Configuration** dialog box appears.



**Fig. 2.6.1 Hardware Configuration dialog box**

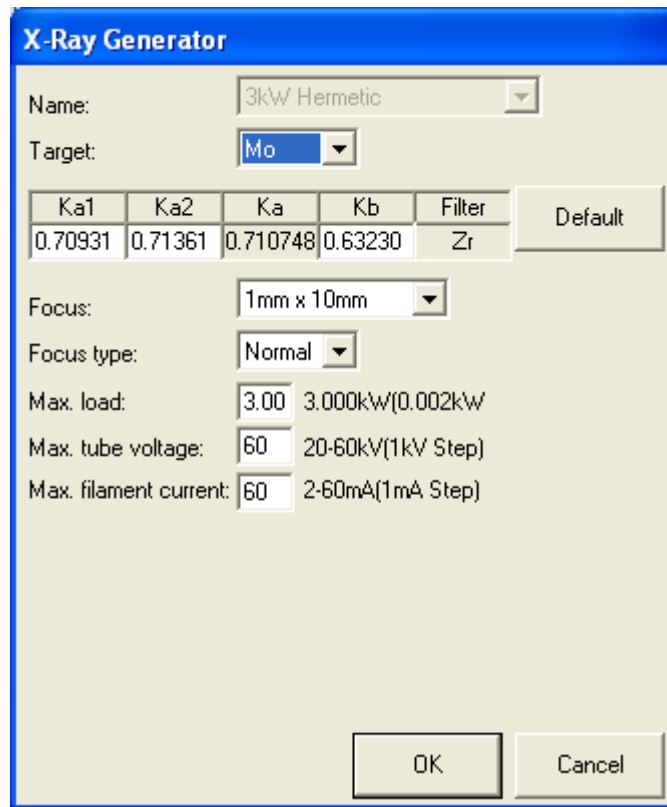
If the **Hardware Configuration** dialog box appears, replace the configuration units as prompted by the message in the dialog box and update the contents of the **Hardware Configuration** dialog box.

This procedure is described below.

- (1) Change the target in the x-ray generator from Mo to Cu. For sealed tubes, replace the Mo tube with the Cu tube.

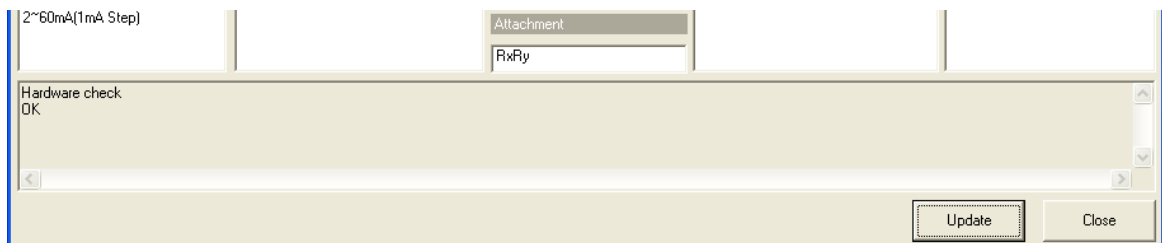


- (2) Click the **X-Ray Generator** button to open the **X-Ray Generator** dialog box.



**Fig. 2.6.2 X-Ray Generator dialog box**

- (3) Select **Cu** in the **Target** box. Change any other parameters as necessary.
- (4) Click the **OK** button to close the dialog box.
- (5) If necessary, make changes for **Incident Optics**, **Receiving Optics**, and **Detector** in the same way.
- (6) Click the **Update** button in the **Hardware Configuration** dialog box.
- (7) Confirm that the **Hardware Configuration** dialog box displays the message “Hardware check OK”, then click the **Close** button to close the dialog box.



**CAUTION:** To execute the measurement once again, click the **Run** button on the **Package Measurement** flow bar or the **Execute** button in the applicable Part dialog box.

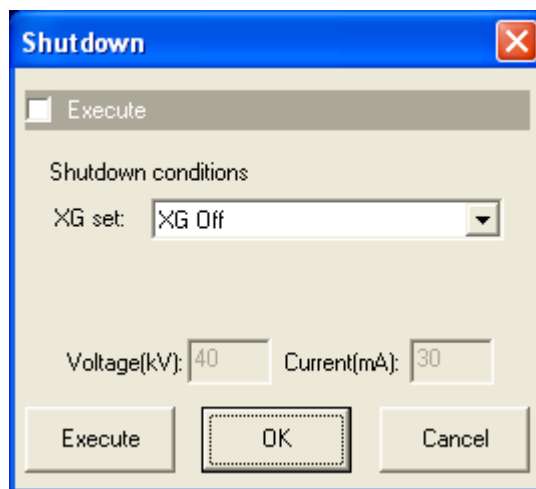
## 2.7 Shutdown

After completion of all measurements, turn off the x-ray generator as described below.

- (1) Click the **Shutdown** button on the flow bar to open the **Shutdown** dialog box.



- (2) Uncheck the **Execute** box.



**Fig. 2.7.1 Shutdown dialog box**

- (3) Select **XG Off** in the **XG set** box.
- (4) Click the **Execute** button.
- (5) The shutdown operation is executed. The x-ray generator will be turned off in about 10 minutes.



Tip: For information on other functions available from the **Shutdown** dialog box, refer to Chapter 21 of the *SmartLab Guidance Reference Manual* (ME13365A).

### 3. Executing a Part individually

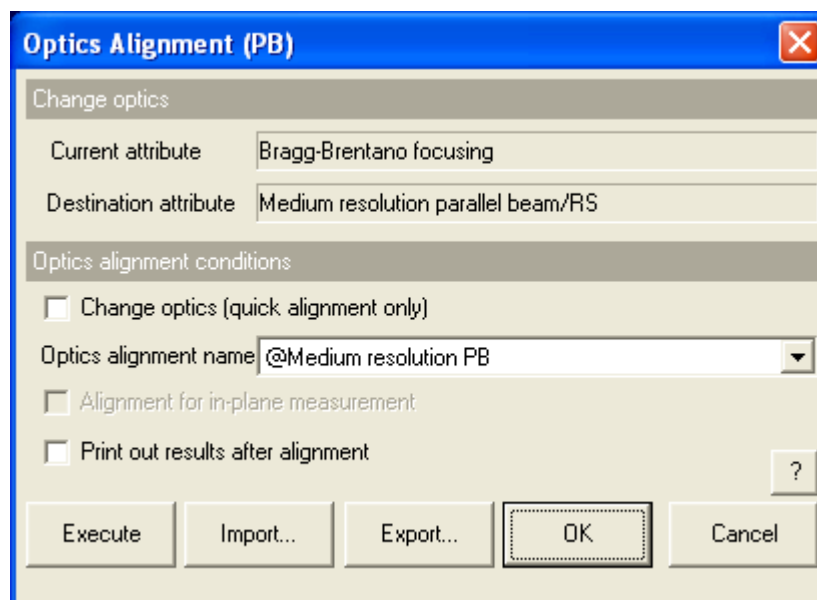
In this chapter, how to execute the following Parts individually is described.

- Optics Alignment (PB) Part**
- Sample Alignment Part**
- Rocking Curve Pre-Measurement Part**
- Rocking Curve Measurement Part**
- RSM Measurement Part**

#### 3.1 Executing the Optics Alignment Part

Described below is how to execute the **Optics Alignment (PB)** Part. The other Optics Alignment Parts can be executed in the same way.

- (1) Click the **Optics Alignment (PB)** button on the flow bar to open the **Optics Alignment (PB)** dialog box.



**Fig. 3.1.1 Optics Alignment (PB) dialog box**

- (2) Uncheck the **Change optics (quick alignment only)** box.



Tip: Check the **Change optics (quick alignment only)** box to switch optics for the rocking curve or reciprocal space mapping measurement using the alignment results stored under the selected optics alignment name by performing a quick alignment.

- (3) In the **Optics alignment name** box, select a location for storing optics alignment results.



Tip: To store optics alignment results under a new optics alignment name, click the **OK** or **Cancel** button to close the **Optics Alignment (PB)** dialog box. Then, select the **Optics Management** command from the **Options** menu to open the **Optics Management** dialog box and add a new optics alignment name. After adding a new optics alignment name, return to step (1) in this section. For more information on creating an optics alignment name, refer to Chapter 17 of the *SmartLab Guidance Reference Manual* (ME13365A).

- (4) To print the optics alignment results, check the **Print out results after alignment** box.



Tip: If both the **Change optics (quick alignment only)** and **Print out results after alignment** boxes are checked, the alignment results stored under the selected optics alignment name will be printed.

- (5) Click the **Execute** button in the **Optics Alignment (PB)** dialog box.  
(6) Optics alignment is executed followed by steps (5) through (7) in Section 2.5.



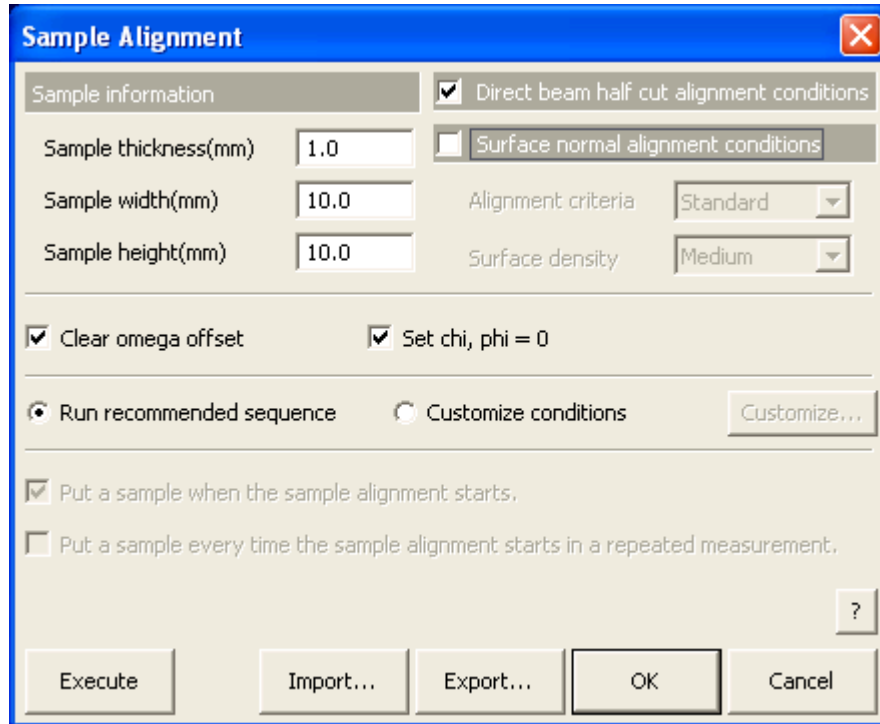
**CAUTION:** If the current hardware configuration setting is different from that for the operation of the **Optics Alignment (PB)** Part, the optics alignment will be aborted and the **Hardware Configuration** dialog box will open. If this happens, replace the configuration units (e.g., the attachment) as prompted by the message in the dialog box.



[2.6 Changing configuration units](#)

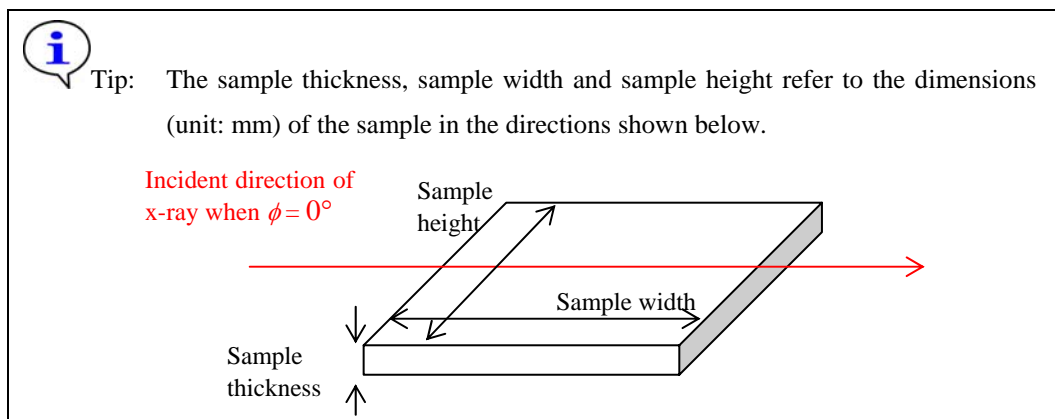
### 3.2 Executing the Sample Alignment Part

- (1) Click the **Sample Alignment** button on the flow bar to open the **Sample Alignment** dialog box.

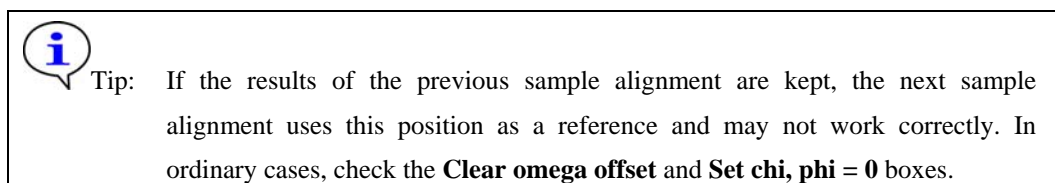


**Fig. 3.2.1 Sample Alignment dialog box**

- (2) Enter the sample thickness, sample width and sample height in the **Sample thickness (mm)**, **Sample width (mm)** and **Sample height (mm)** boxes.



- (3) Check the **Direct beam half cut alignment conditions** box.
- (4) Uncheck the **Surface normal alignment conditions** box.
- (5) Check the **Clear omega offset** and **Set chi, phi = 0** boxes.



### 3. Executing a Part individually

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- (6) Select the **Run recommended sequence** radio button.



Tip: To confirm or set the scan conditions, select the **Customize conditions** radio button, then click the **Customize** button.



[2.4.1 Customizing Sample Alignment Part conditions](#)

- (7) Click the **Execute** button in the **Sample Alignment** dialog box.
- (8) Sample alignment is executed followed by steps (8) and (9) in Section 2.5.



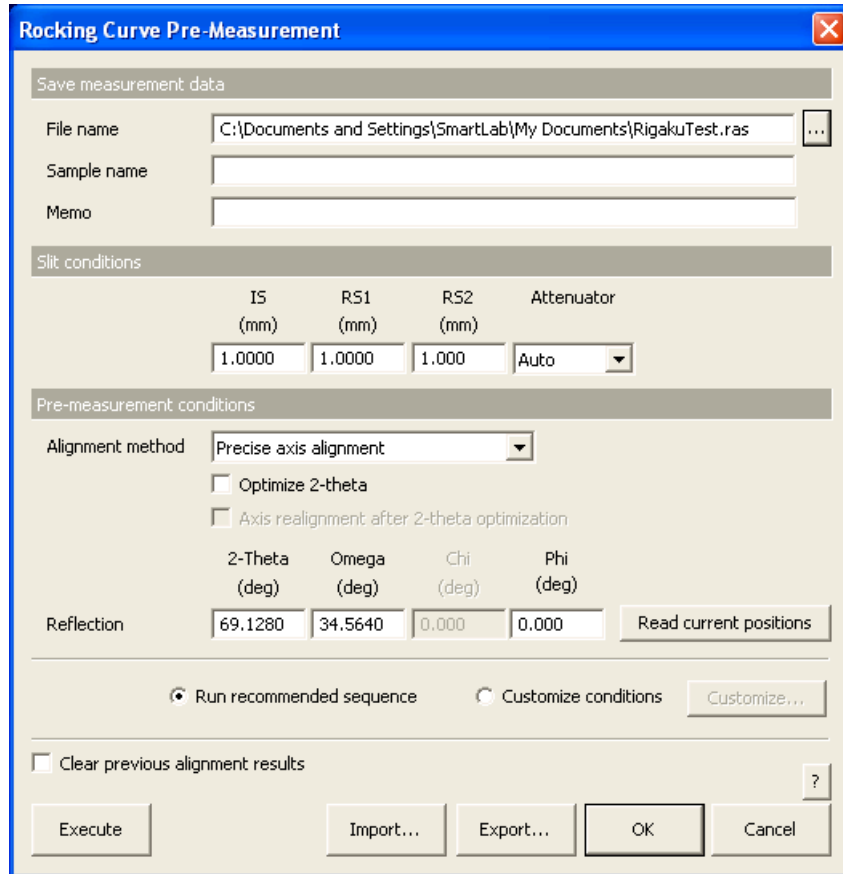
**CAUTION:** If the current hardware configuration setting is different from that for the operation of the **Sample Alignment** Part, the sample alignment will be aborted and the **Hardware Configuration** dialog box will open. If this happens, replace the configuration units (e.g., the attachment) as prompted by the message in the dialog box.



[2.6 Changing configuration units](#)

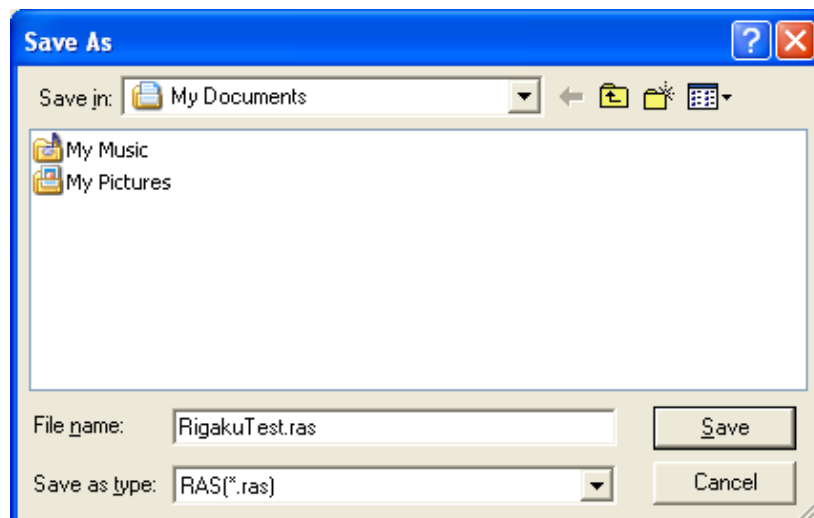
### 3.3 Executing the Rocking Curve Pre-Measurement Part

- (1) Click the **Rocking Curve Pre-Measurement** button on the flow bar to open the **Rocking Curve Pre-Measurement** dialog box.



**Fig. 3.3.1 Rocking Curve Pre-Measurement dialog box**

- (2) Set the folder to store the measurement data and the name of the measurement data file in the **File name** box in the **Save measurement data** section. After completing the rocking curve pre-measurement, the measurement data will be saved with the specified file name.
  1. Click the [...] button to open the **Save As** dialog box.



**Fig. 3.3.2 Save As dialog box**

### 3. Executing a Part individually

---

2. Enter the settings in the **Save in** and **File name** boxes.
3. Click the **Save** button.
- (3) Enter any required information in the **Sample name** and **Memo** boxes (optional).



**CAUTION:** The information entered here will be saved to the file. Any number of characters may be entered, but only the first 30 characters of the sample name and the first 84 characters of the memo will appear on the printed measurement data.

- (4) Set the slit conditions.



**Tip:** If any information of the diffraction peak (position, FWHM, etc.) to be measured is not obtained, it is recommended to set the slit conditions as follows:

IS = 1 mm, RS1 = 1 mm, RS2 = 20 mm

And select **Auto** in the **Attenuator** box.

- (5) Select **Standard axis alignment** in the **Alignment method** box.



**Tip:** If currently installed is not the RxRy attachment, select **Quick axis alignment**.

- (6) Uncheck the **Optimize 2-theta** box.
- (7) Enter the positions of the substrate reflection in the **2-Theta (deg)**, **Omega (deg)**, and **Phi (deg)** boxes.



**Tip:**

- Unless the RxRy attachment is installed, enter the position also in the **Chi (deg)** box.

- The positions of the substrate reflection can be simulated using the Diffraction Space Simulation features. For information on how to use Diffraction Space Simulation, refer to the *Diffraction Space Software.User's Manual* (ME13305A).

- (8) If the RxRy attachment is installed, check the **Clear previous alignment results** box.
- (9) Click the **Execute** button in the **Rocking Curve Pre-Measurement** dialog box.
- (10) Rocking curve pre-measurement is executed followed by steps (10) and (11) in Section 2.5.



**CAUTION:** If the current hardware configuration setting is different from that for the operation of the **Rocking Curve Pre-Measurement** Part, the rocking curve pre-measurement will be aborted and the **Hardware Configuration** dialog box will open. If this happens, replace the configuration units (e.g., the attachment) as prompted by the message in the dialog box.

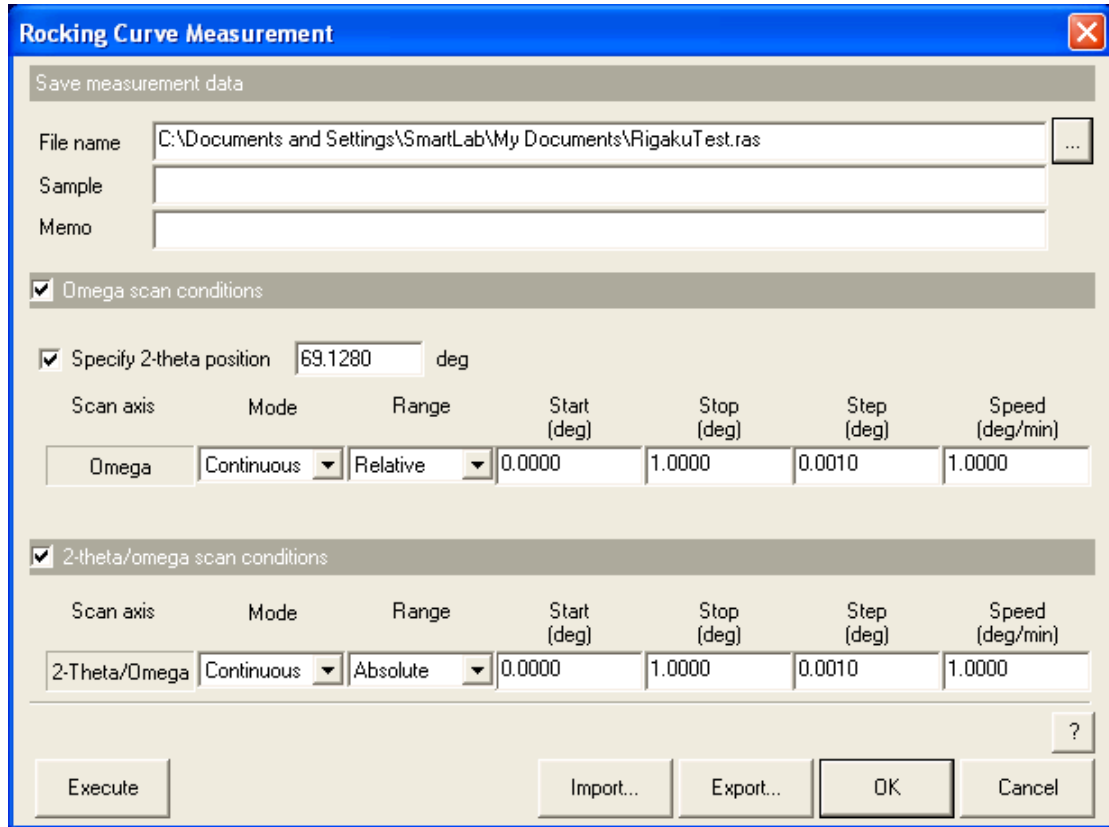


[2.6 Changing configuration units](#)



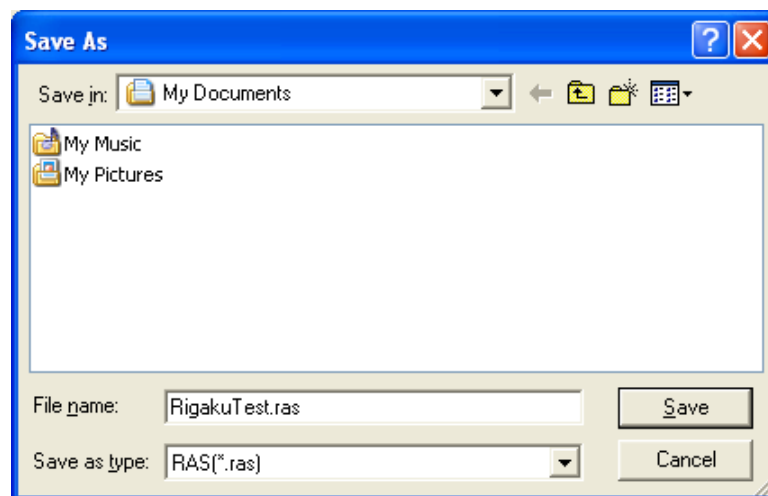
### 3.4 Executing the Rocking Curve Measurement Part

- (1) Click the **Rocking Curve Measurement** button on the flow bar to open the **Rocking Curve Measurement** dialog box.



**Fig. 3.4.1 Rocking Curve Measurement dialog box**

- (2) Set the folder to store the measurement data and the name of the measurement data file in the **File name** box in the **Save measurement data** section. After completing the rocking curve measurement, the measurement data will be saved with the specified file name.
  1. Click the [...] button to open the **Save As** dialog box.



**Fig. 3.4.2 Save As dialog box**

### 3. Executing a Part individually

---

2. Enter the settings in the **Save in** and **File name** boxes.
3. Click the **Save** button.
- (3) Enter any required information in the **Sample name** and **Memo** boxes (optional).



**CAUTION:** The information entered here will be saved to the file. Any number of characters may be entered, but only the first 30 characters of the sample name and the first 84 characters of the memo will appear on the printed measurement data.

- (4) Check the **Specify 2-theta position** box, and enter the position of the film reflection in deg in the box.
- (5) If the omega axis is scanned, check the **Omega scan conditions** box and set the omega scan conditions.
- (6) To perform a 2-theta/omega scan, check the **2-theta/omega scan conditions** box and set the 2-theta/omega scan conditions.



**Tip:** To set the scan conditions, refer to “Rocking Curve Measurement Part” Help Topic of the online help section of the SmartLab Guidance software.

- (7) Click the **Execute** button in the **Rocking Curve Measurement** dialog box.
- (8) Rocking curve measurement is executed followed by steps (12) and (13) in Section 2.5.



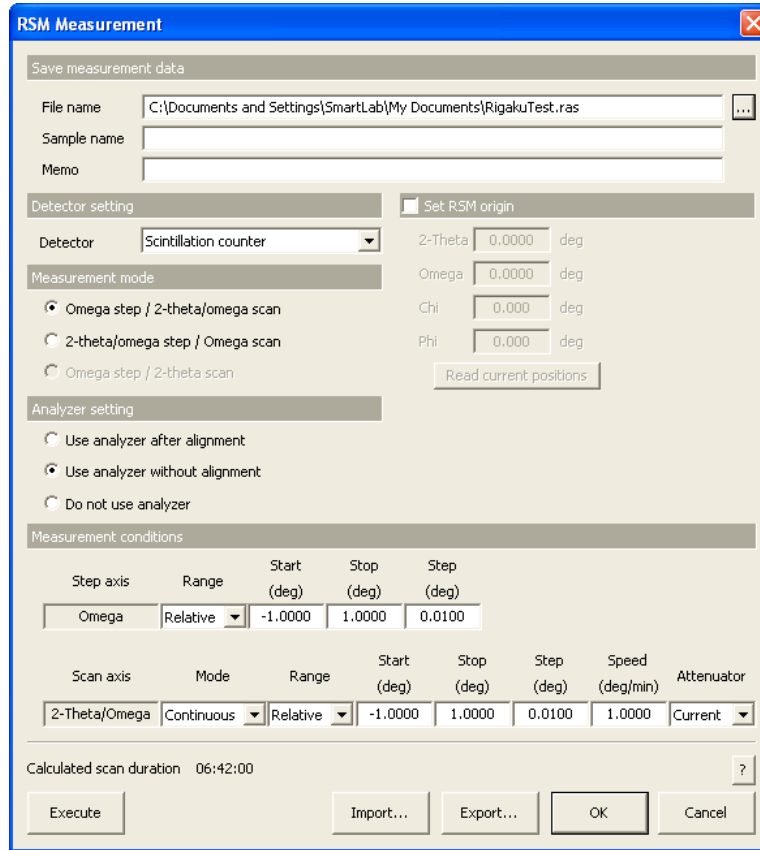
**CAUTION:** If the current hardware configuration setting is different from that for the operation of the **Rocking Curve Measurement** Part, the rocking curve measurement will be aborted and the **Hardware Configuration** dialog box will open. If this happens, replace the configuration units (e.g., the attachment) as prompted by the message in the dialog box.



[2.6 Changing configuration units](#)

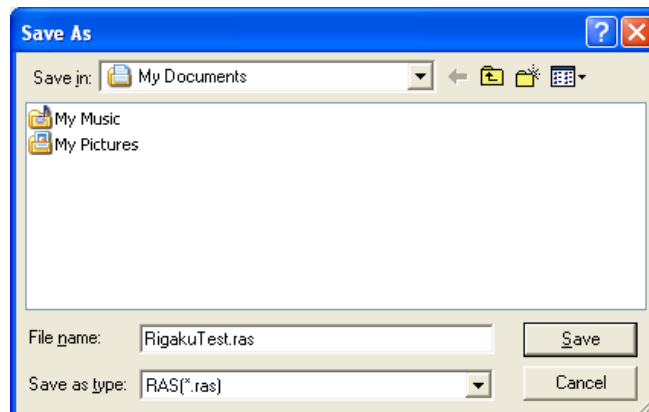
### 3.5 Executing the RSM Measurement Part

- (1) Click the **RSM Measurement** button on the flow bar to open the **RSM Measurement** dialog box.



**Fig. 3.5.1 RSM Measurement dialog box**

- (2) Set the folder to store the measurement data and the name of the measurement data file in the **File name** box in the **Save measurement data** section. After completing the reciprocal space mapping measurement, the measurement data will be saved with the specified file name.
  1. Click the [...] button to open the **Save As** dialog box.



**Fig. 3.5.2 Save As dialog box**

2. Enter the settings in the **Save in** and **File name** boxes.
3. Click the **Save** button.

### 3. Executing a Part individually

- (3) Enter any required information in the **Sample name** and **Memo** boxes (optional).



**CAUTION:** The information entered here will be saved to the file. Any number of characters may be entered, but only the first 30 characters of the sample name and the first 84 characters of the memo will appear on the printed measurement data.

- (4) Select **Scintillation counter** from the **Detector** box.  
(5) Select **Omega step / 2-theta/omega scan** in the **Measurement mode** section.  
(6) Select **Use analyzer without alignment** in the **Analyzer setting** section.



**CAUTION:** If the 2-bounce analyzer is not available, select **Do not use analyzer**.

- (7) Check the **Set RSM origin** box, and enter the origin of the reciprocal space mapping measurement in the **2-Theta, Omega, Chi, and Phi** boxes.



**Tip:** To set the current positions of the four axes (2-theta, omega, chi, and phi) in the **2-Theta, Omega, Chi, and Phi** boxes as the origin of the reciprocal space mapping measurement, click the **Read current positions** button.

- (8) Set the measurement conditions.



**Tip:** If any information of the diffraction peak (position, FWHM, etc.) to be measured is not obtained, it is recommended to set the measurement conditions as shown in the following figure.

Measurement conditions							
Step axis	Range	Start (deg)	Stop (deg)	Step (deg)			
Omega	Relative	-1.0000	1.0000	0.0100			
Scan axis	Mode	Range	Start (deg)	Stop (deg)	Step (deg)	Speed (deg/min)	Attenuator
2-Theta/Omega	Continuous	Relative	-1.0000	1.0000	0.0100	1.0000	Auto

- (9) Click the **Execute** button in the **RSM Measurement** dialog box.  
(10) Reciprocal space mapping measurement is executed followed by steps (14) through (16) in Section 2.5.



**CAUTION:** If the current hardware configuration setting is different from that for the operation of the **RSM Measurement** Part, the reciprocal space mapping measurement will be aborted and the **Hardware Configuration** dialog box will open. If this happens, replace the configuration units (e.g., the attachment) as prompted by the message in the dialog box.



[2.6 Changing configuration units](#)

## 4. Troubleshooting

Problem	Response
Previously saved conditions cannot be imported through the <b>Optics Alignment (PB)</b> dialog box.	<ul style="list-style-type: none"> <li>• Confirm that the user name displayed on the title bar of the main window is correct.</li> <li>• Add the name of the optics alignment again in the <b>Optics Management</b> dialog box.</li> </ul>
Previously saved conditions cannot be imported through the <b>Sample Alignment</b> dialog box.	<ul style="list-style-type: none"> <li>• Confirm that the user name displayed on the title bar of the main window is correct.</li> </ul>
Previously saved conditions cannot be imported through the <b>Rocking Curve Pre-Measurement</b> dialog box.	<ul style="list-style-type: none"> <li>• Confirm that the user name displayed on the title bar of the main window is correct.</li> </ul>
Previously saved conditions cannot be imported through the <b>Rocking Curve Measurement</b> dialog box.	<ul style="list-style-type: none"> <li>• Confirm that the user name displayed on the title bar of the main window is correct.</li> </ul>
Previously saved conditions cannot be imported through the <b>RSM Measurement</b> dialog box.	<ul style="list-style-type: none"> <li>• Confirm that the user name displayed on the title bar of the main window is correct.</li> </ul>
Package measurement cannot be executed.	<ul style="list-style-type: none"> <li>• Check to see if the XG output is as specified.</li> <li>• Check to see if the door of the radiation enclosure is closed.</li> </ul>
Clicking the <b>OK</b> button in a message box will result in the same message box reappearing.	<ul style="list-style-type: none"> <li>• Confirm that the specified slit and other devices are installed correctly. Also, make sure that the necessary devices have not been removed.</li> </ul>
Sufficient intensity cannot be obtained for rocking curve or reciprocal space mapping measurement.	<ul style="list-style-type: none"> <li>• <u>Check to see if an absorber is inserted in the receiving slit box.</u></li> <li>• Confirm that the XG output has reached the specified levels.</li> <li>• Measure the Si wafer reference sample and check the intensity.</li> </ul>