Transmission/Reflection Pole Figure Measurement Part

Contents

1. How to set Part conditions

In this chapter, how to set the **Transmission/Reflection Pole Figure Measurement** Part conditions is described.

CAUTION: Combination of either of the following hardware will be required for this Part. (Combination differs depending on the attachment base and the attachment used.)

Attachment base	Attachment	Incident optics			
		Selection slit	Incident optical device	Incident slit box	Length limiting slit
Standard Z stage	α β χ φ	BB PB	Soller slit In-plane PSC	Standard incident slit box	Length limiting slit
Standard χ cradle	Standard XY-20 RxRy XY-4″φ*1	BB PB MA	Soller slit In-plane PSC	Standard incident slit box	Length limiting slit
		Pinhole Pinhole(PB)		Collimator holder	Collimator*2
		PB	CBO-f	Standard incident slit box	Length limiting slit
				Collimator holder	Collimator*2

*1 The XY-4" φ attachment and the collimator cannot be used in combination.

*2 When using the collimator, use the microdiffraction sample holder.

ttachment bas	Attachment	Receiving optics		
		iving optical d	Receiving Soller slit	Detector
Standard Z stage	α β χ φ	PSA	Soller slit In-plane PSC	Scintillation counter
Standard χ cradle	Standard XY-20 RxRy XY-4″φ	PSA	Soller slit In-plane PSC	Scintillation counter

1.1 Setting conditions

Set the basic conditions in the Transmission/Reflection Pole Figure Measurement dialog box.

The scan conditions and slit conditions of the pole figure measurement are determined based on the basic conditions. The scan conditions and slit conditions can also be customized.

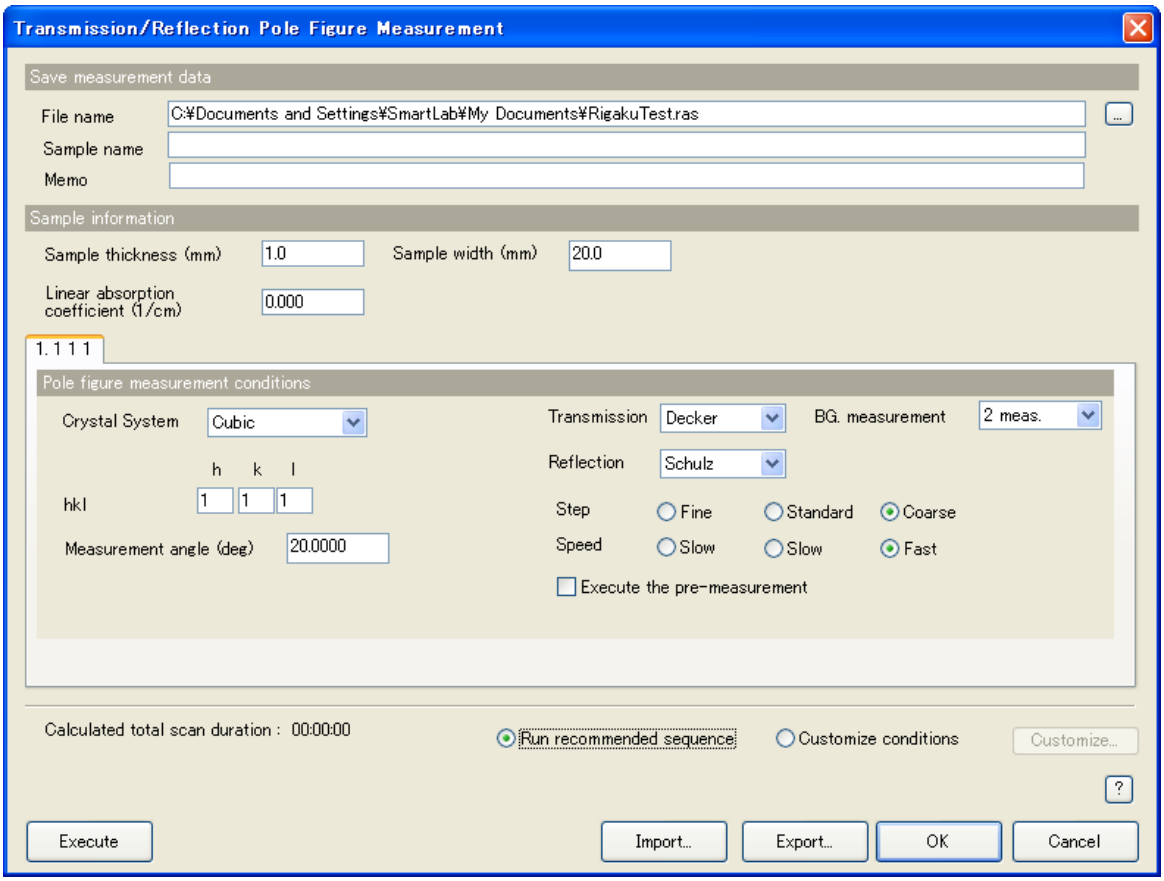


Fig. 1.1.1 Transmission/Reflection Pole Figure Measurement dialog box

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.

Sample thickness (mm) Enter the sample thickness (optional).

Sample width (mm) Enter the sample width.

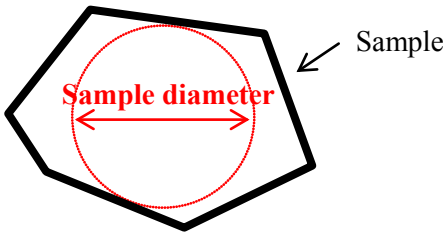
Tip: A "sample width" indicates the size (unit: mm) of samples described below.

1 Sample diameter for round samples

2 Length of a side for square samples

3 Length of the short side for rectangular samples

4 Maximum diameter when assuming a circle within the sample inner area for irregular-shaped samples



When the sample shape is irregular

Linear absorption coefficient (1/cm)

Enter the linear absorption coefficient of sample material (optional).

Tip: If the linear absorption coefficient is known by calculations, etc., enter that value. For **Linear absorption coefficient** measurement of actual samples, refer to 3. Measurement of linear absorption coefficient μ

Crystal system Select the crystal system of the sample material from **Cubic**, **Tetragonal**, **Orthorhombic**, **Rhombohedral**, **Hexagonal**, **Monoclinic**, **Triclinic**, or **Unknown**.

hkl Enter the Miller indices of the diffraction peak to be used for pole figure measurement.

Measurement angle (deg) Enter the diffraction angle 2-theta to be used for pole figure measurement. If the pre-measurement is made, the data measurement will be made at the diffraction angle 2-theta determined based on the pre-measurement results, regardless of the value entered here.

Transmission Select the measurement technique of the transmission method from **Decker**, **Schulz**, or **Not execute**.

Reflection Select the measurement technique of the reflection method from **Schulz**, or **Not execute**.

Tip: About each measurement technique, refer to "Texture Analysis Group" Help Topic of the online help section of the SmartLab Guidance software.

BG.measurement

Select the number of background measurement point from **2 meas.**, **1 meas.**, or **Not execute**.

Step

Select the step width from **Fine**, **Standard**, or **Coarse**. In ordinary cases, select **Standard**.

Fine	Sets the step widths of the alpha and beta axes to 1 deg.
Standard	Sets the step widths of the alpha and beta axes to 3 deg.
Coarse	Sets the step widths of the alpha and beta axes to 5 deg.

Speed

Select the scan speed from **Slow**, **Standard**, or **Fast**. In ordinary cases, select **Standard**.

In case Alpha Beta stage is used

Slow	Sets the scan speed of the beta axis to 100 deg/min.
Standard	Sets the scan speed of the beta axis to 300 deg/min.
Fast	Sets the scan speed of the beta axis to 600 deg/min.

In case the other stage than Alpha Beta stage is used

Slow	Sets the scan speed of the beta axis to 100 deg/min.
Standard	Sets the scan speed of the beta axis to 150 deg/min.
Fast	Sets the scan speed of the beta axis to 200 deg/min.

Execute the pre-measurement

Check the **Execute the pre-measurement** box to make the pre-measurement to determine the diffraction angle 2-theta for the data measurement and the angle 2-theta to be used for the background measurement. If the diffraction angle is known, not need to execute the pre-measurement.

Run recommended sequence

Makes the pole figure measurement using the recommended sequence.

Customize conditions

Makes the pole figure measurement 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 and slit conditions.

1.2 Customizing scan conditions and slit conditions

Calculated scan duration Shows the calculated duration of the pole figure measurement.

Execute Executes the pole figure measurement under the conditions specified in the **Transmission/Reflection Pole Figure Measurement** dialog box.

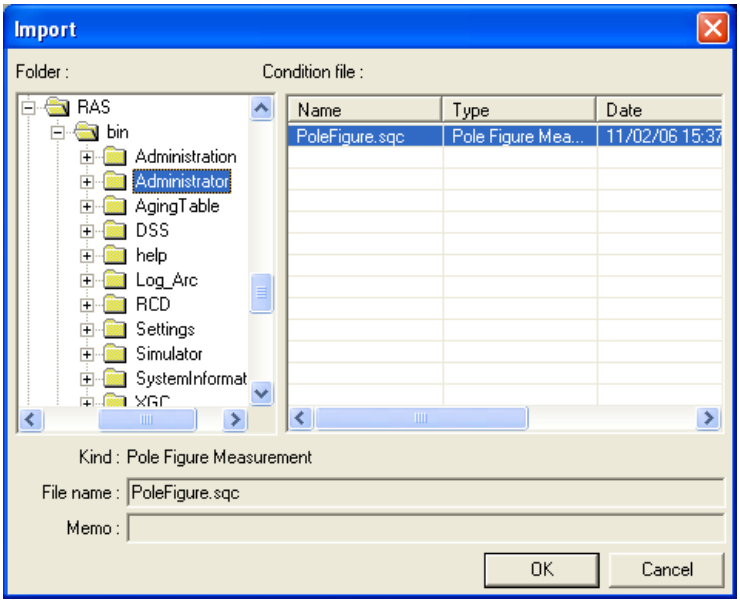
CAUTION: Clicking the **Cancel** button after executing the pole figure measurement does not cancel the specified conditions.

Tip: The pole figure measurement is executed with the **Transmission/Reflection Pole Figure Measurement** dialog box open. While the pole figure 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.

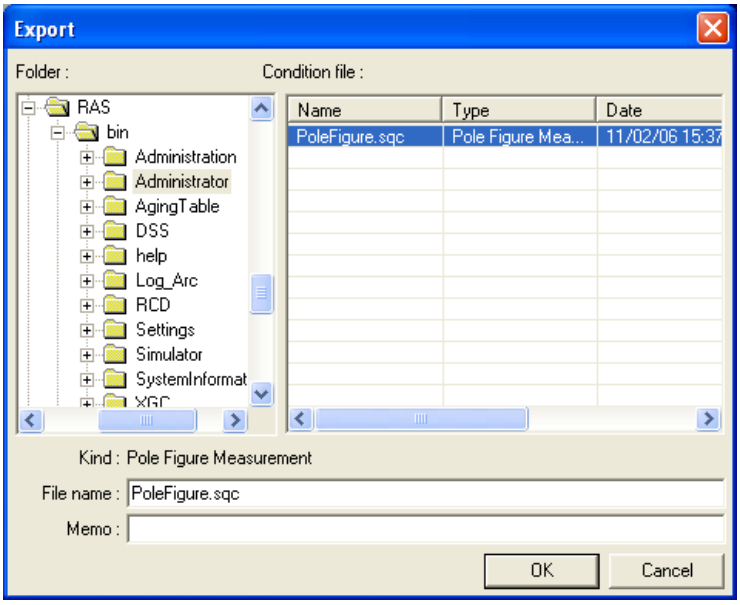
Import Loads the saved Part conditions.

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.

Tip: Clicking the **Cancel** button also cancels the conditions specified in the **Customize** dialog box.

?

Opens the online help of this Part.

1.2 Customizing scan conditions and slit conditions

If you want to customize the scan conditions and slit conditions of the pole figure measurement, set the conditions in the Customize dialog box.

> Tip: Refer to 2. Measurement sequence to set the scan conditions and slit conditions.

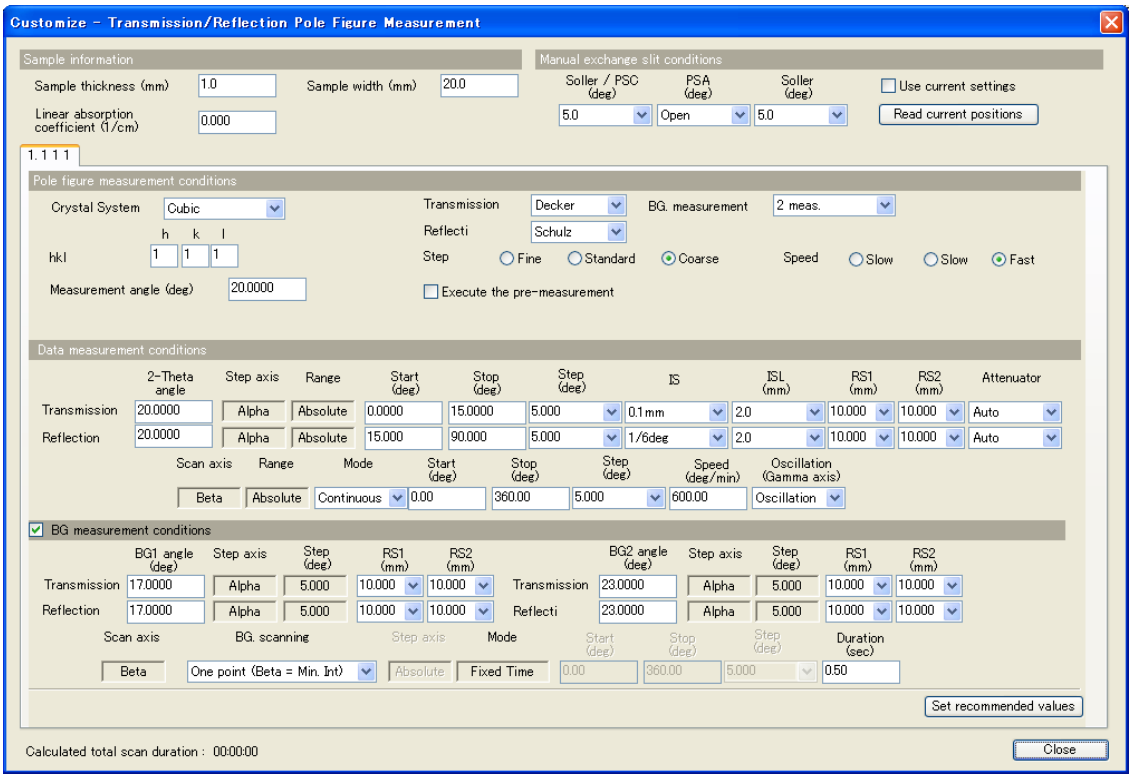
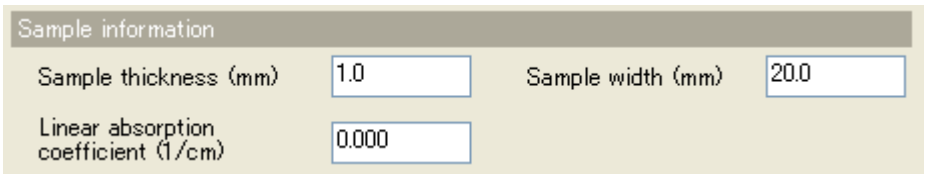


Fig. 1.2.1 Customize dialog box

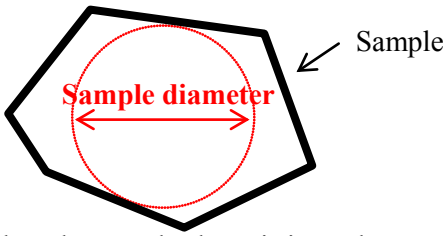


Sample thickness (mm) Enter the sample thickness (optional).

Sample width (mm) Enter the sample width.

Tip: A "sample width" indicates the size (unit: mm) of samples described below.

1. Sample diameter for round samples
2. Length of a side for square samples
3. Length of the short side for rectangular samples
4. Maximum diameter when assuming a circle within the sample inner area for irregular-shaped samples



When the sample shape is irregular

Linear absorption coefficient (1/cm)

Enter the linear absorption coefficient of sample material (optional).

Tip: If the linear absorption coefficient is known by calculations, etc., enter that value. For **Linear absorption coefficient** measurement of actual samples, refer to 3. Measurement of linear absorption coefficient μ

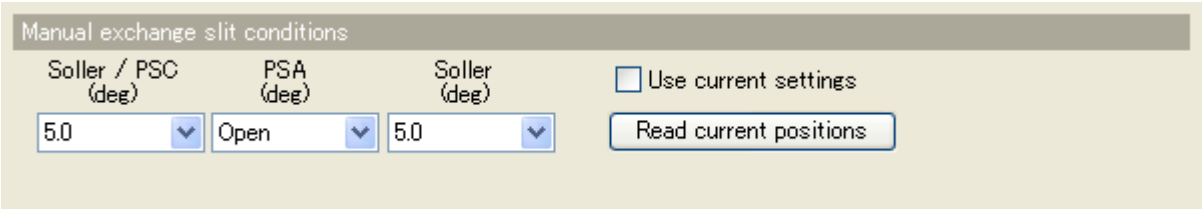


Table 1.2.1 shows the choices of the aperture angles of the parallel slits and PSA, and the length of the length limiting slit.

Soller/PSC (deg) Select the aperture angle of the incident parallel slit.

PSA (deg) Select the aperture angle of the PSA.

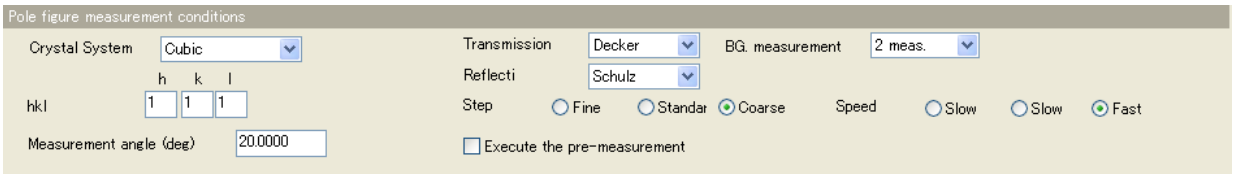
Soller (deg) Select the aperture angle of the receiving parallel slit.

Table 1.2.1 Choices of the length or aperture angle of each slit

Slit	Length or aperture angle
Soller/PSC (deg)	5.0, 2.5, 1.0, 0.5, 0.15, Open, None, No_unit
PSA (deg)	1.0, 0.5, 0.114, Open, None, No_unit
Soller (deg)	5.0, 2.5, 1.0, 0.5, 0.114, Open, None, No_unit

Use current settings Check the **Use current settings** box to make measurement leaving Soller/PSC, PSA, and Soller current settings.

Read current positions Sets the current position of each slit in the **Soller/PSC (deg)**, **PSA (deg)**, and **Soller (deg)** boxes.



Crystal system Select the crystal system of the sample material from **Cubic**, **Tetragonal**, **Orthorhombic**, **Rhombohedral**, **Hexagonal**, **Monoclinic**, **Triclinic**, or **Unknown**.

hkl Enter the Miller indices of the diffraction peak to be used for pole figure measurement.

Measurement angle (deg) Enter the diffraction angle 2-theta to be used for pole figure measurement. If the pre-measurement is made, the data measurement will be made at the diffraction angle 2-theta determined based on the pre-measurement results, regardless of the value entered here.

Transmission Select the measurement technique of the transmission method from **Decker**, **Schulz**, or **Not execute**.

Reflection Select the measurement technique of the reflection method from **Schulz**, or **Not execute**.

> Tips : About each measurement technique, refer to “Texture Analysis Group” Help Topic of the online help section of the SmartLab Guidance software.

BG.measurement Select the number of background measurement point from **2 meas.**, **1 meas.**, or **Not execute**.

Step Select the step width from **Fine**, **Standard**, or **Coarse**. In ordinary cases, select **Standard**.

Fine	Sets the step widths of the alpha and beta axes to 1 deg.
Standard	Sets the step widths of the alpha and beta axes to 3 deg.
Coarse	Sets the step widths of the alpha and beta axes to 5 deg.

Speed

Select the scan speed from **Slow**, **Standard**, or **Fast**. In ordinary cases, select **Standard**.

In case Alpha Beta stage is used

Slow	Sets the scan speed of the beta axis to 100 deg/min.
Standard	Sets the scan speed of the beta axis to 300 deg/min.
Fast	Sets the scan speed of the beta axis to 600 deg/min.

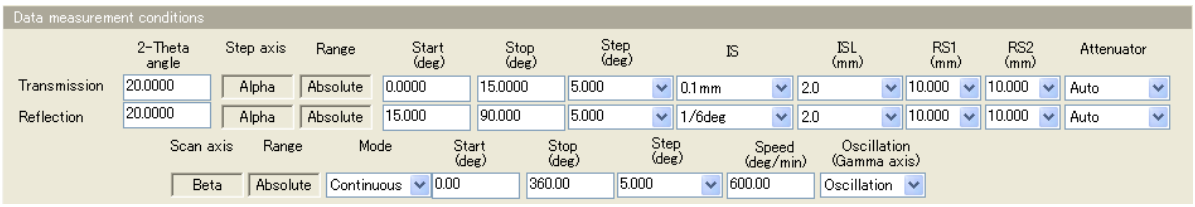
In case the other stage than Alpha Beta stage is used

Slow	Sets the scan speed of the beta axis to 100 deg/min.
Standard	Sets the scan speed of the beta axis to 150 deg/min.
Fast	Sets the scan speed of the beta axis to 200 deg/min.

Execute the pre-measurement

Check the **Execute the pre-measurement** box to make the pre-measurement to determine the diffraction angle 2-theta for the data measurement and the angle 2-theta to be used for the background measurement. If the diffraction angle is known, not need to execute the pre-measurement.

Tip: When the **Close** button is clicked after setting nine conditions in the **Pole figure measurement conditions** section in the **Customize** dialog box, the conditions in the **Transmission/Reflection Pole Figure Measurement** dialog box will also be changed.



Transmission

2-Theta angle (deg)

Enter the diffraction angle 2-theta to be used for pole figure measurement.

Start (deg)

Enter the absolute start angle of the step axis.

Stop (deg)

Enter the absolute stop angle of the step axis.

Step (deg)

Select the step width of the step axis from **0.500**, **1.000**, **1.500**, **2.000**, **2.500**, **3.000**, **3.500**, **4.000**, **4.500**, **5.000**, or **10.000**.

Arbitrary number can also be entered.

IS Select the width of the incident slit.

Table 1.2.2 Choices of the width or aperture angle of the incident slit (Transmission method)

Method	Hardware configuration	Width or aperture angle
Decker	---	0.05mm／0.1mm／0.2mm／0.3mm／0.4mm／0.5mm／0.7mm／1.0mm
Schulz	Selection slit BB	0.05mm／0.1mm／1/6deg／1/3deg／1/2deg／2/3deg／1deg
	Selection slit PB	0.05mm／0.1mm／0.2mm／0.3mm／0.4mm／0.5mm／0.7mm／1.0mm

IS L (mm) Select the length of the length limiting slit.

Table 1.2.3 Choices of the length of the length limiting slit (Transmission method)

Kind of the slit box	Length
Standard incident slit box	15.0／10.0／5.0／2.0／0.5（Option）

RS1 (mm) Select the width of the receiving slit # 1 from **1.000**, **2.000**, **3.000**, **4.000**, **5.000**, **6.000**, **7.000**, **8.000**, **9.000**, **10.000**, **11.000** or **12.000**. Arbitrary number can also be entered.

RS2 (mm) Select the width of the receiving slit # 2 from **1.000**, **2.000**, **3.000**, **4.000**, **5.000**, **6.000**, **7.000**, **8.000**, **9.000**, **10.000**, **11.000** or **12.000**. Arbitrary number can also be entered.

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

Reflection

2-Theta angle (deg) Enter the diffraction angle 2-theta to be used for pole figure measurement.

Start (deg) Enter the absolute start angle of the step axis.

Stop (deg) Enter the absolute stop angle of the step axis.

Step (deg) Select the step width of the step axis from **0.500**, **1.000**, **1.500**, **2.000**, **2.500**, **3.000**, **3.500**, **4.000**, **4.500**, **5.000**, or **10.000**. Arbitrary number can also be entered.

IS Select the width of the incident slit.

Table 1.2.4 Choices of the width or aperture angle of the incident slit (Reflection method)

Hardware configuration	Width or aperture angle
Selection slit BB	0.05mm／0.1mm／1/6deg／1/3deg／1/2deg／2/3deg／1deg
Selection slit PB	0.05mm／0.1mm／0.2mm／0.3mm／0.4mm／0.5mm／0.7mm／1.0mm
Collimator holder (Option)	Not selected

IS L (mm) Select the length of the length limiting slit.

Table 1.2.5 Choices of the length of the length limiting slit (Reflection method)

Kind of the slit box	Length
Standard incident slit box	15.0／10.0／5.0／2.0／0.5 (Option)
Collimator holder (Option)	0.8mm φ／0.5mm φ／0.3mm φ／0.2mm φ／0.1mm φ／0.05mm φ (Option)

RS1 (mm) Select the width of the receiving slit # 1 from **1.000**, **2.000**, **3.000**, **4.000**, **5.000**, **6.000**, **7.000**, **8.000**, **9.000**, **10.000**, **11.000** or **12.000**. Arbitrary number can also be entered.

RS2 (mm) Select the width of the receiving slit # 2 from **1.000**, **2.000**, **3.000**, **4.000**, **5.000**, **6.000**, **7.000**, **8.000**, **9.000**, **10.000**, **11.000** or **12.000**. Arbitrary number can also be entered.

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

Beta scanning conditions

Mode Select the scan mode from **Continuous** or **Step**.

Start (deg) Enter the absolute start angle of the scan.

Start (deg) Enter the absolute stop angle of the scan.

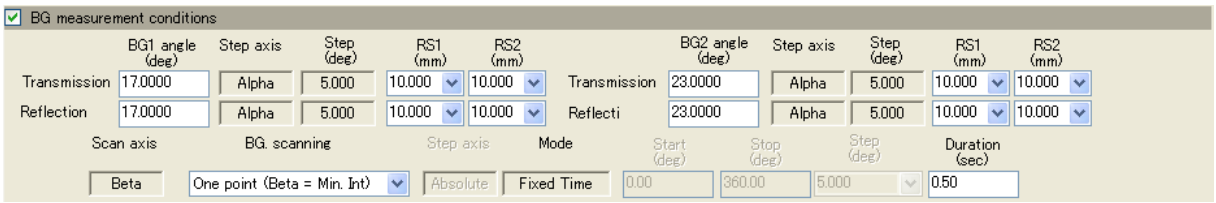
Step (deg) Select the step width of the step axis from **0.500**, **1.000**, **1.500**, **2.000**, **2.500**, **3.000**, **3.500**, **4.000**, **4.500**, **5.000**, or **10.000**. Arbitrary number can also be entered.

Speed (deg/min) / Duration time (sec)

When **Continuous** is selected as the scan mode, enter the scan speed. When **Step** is selected as the scan mode, enter the duration time per measurement point.

Oscillation (Gamma axis) Select the oscillation of gamma axis from **Execute**, or **Not execute**.

Tip: The **Oscillation (Gamma axis)** is available only when the αβ attachment compatible with the oscillation of gamma axis is installed.



BG measurement conditions Check the **Background measurement conditions** box to execute the background measurement.

Transmission

BG1 angle (deg) Enter the angle 2-theta to be used for background # 1 measurement.

RS1 (mm) Select the width of the receiving slit # 1 from **1.000**, **2.000**, **3.000**, **4.000**, **5.000**, **6.000**, **7.000**, **8.000**, **9.000**, **10.000**, **11.000** or **12.000**. Arbitrary number can also be entered.

RS2 (mm) Select the width of the receiving slit # 2 from **1.000**, **2.000**, **3.000**, **4.000**, **5.000**, **6.000**, **7.000**, **8.000**, **9.000**, **10.000**, **11.000** or **12.000**. Arbitrary number can also be entered.

BG2 angle (deg) Enter the angle 2-theta to be used for background # 2 measurement.

RS1(mm) Select the width of the receiving slit # 1 from **1.000**, **2.000**, **3.000**, **4.000**, **5.000**, **6.000**, **7.000**, **8.000**, **9.000**, **10.000**, **11.000** or **12.000**. Arbitrary number can also be entered.

RS2(mm) Select the width of the receiving slit # 2 from **1.000**, **2.000**, **3.000**, **4.000**, **5.000**, **6.000**, **7.000**, **8.000**, **9.000**, **10.000**, **11.000** or **12.000**. Arbitrary number can also be entered.

Reflection

BG1 angle (deg) Enter the angle 2-theta to be used for background # 1 measurement.

RS1(mm) Select the width of the receiving slit # 1 from **1.000**, **2.000**, **3.000**, **4.000**, **5.000**, **6.000**, **7.000**, **8.000**, **9.000**, **10.000**, **11.000** or **12.000**. Arbitrary number can also be entered.

RS2(mm) Select the width of the receiving slit # 2 from **1.000**, **2.000**, **3.000**, **4.000**, **5.000**, **6.000**, **7.000**, **8.000**, **9.000**, **10.000**, **11.000** or **12.000**. Arbitrary number can also be entered.

BG2 angle (deg) Enter the angle 2-theta to be used for background # 2 measurement.

RS1(mm) Select the width of the receiving slit # 1 from **1.000**, **2.000**, **3.000**, **4.000**, **5.000**, **6.000**, **7.000**, **8.000**, **9.000**, **10.000**, **11.000** or **12.000**. Arbitrary number can also be entered.

RS2(mm) Select the width of the receiving slit # 2 from **1.000**, **2.000**, **3.000**, **4.000**, **5.000**, **6.000**, **7.000**, **8.000**, **9.000**, **10.000**, **11.000** or **12.000**. Arbitrary number can also be entered.

Beta scanning conditions

Meas. mode Select the background measurement mode from **Scan, One point (Beta=0)** or **One point (Beta=Min. Int.)**.

Start (deg) If **Scan** is selected as the background measurement mode, enter the absolute start angle of the scan.

Stop (deg) If Scan is selected as the background measurement mode, enter the absolute stop angle of the scan.

Step(deg) Select the step width of the step axis from **0.500**, **1.000**, **1.500**, **2.000**, **2.500**, **3.000**, **3.500**, **4.000**, **4.500**, **5.000**, or **10.000**. Arbitrary number can also be entered.

Speed (deg/min)/Duration time (sec)

If **Scan** is selected as the background measurement mode, enter the scan speed.

If **One point(Beta=0)** or **One point(Beta=Min. Int.)** is selected as the background measurement mode, enter the duration time.

Set recommended values Checks the **Background measurement conditions** boxes, selects One point(Beta=Min.Int.) as the background measurement mode and sets the conditions in the **Slit conditions**, **Data measurement conditions**, and **Background measurement conditions** sections to the recommended values based on the conditions specified for **Measurement angle (deg)**, **Step**, and **Speed**. The recommended values are shown in Tables 1.2.6. through 1.2.15.

Calculated total scan duration Shows the calculated duration of the pole figure measurement.

Close Closes the **Customize** dialog box.

Table 1.2.6 Recommended conditions of manual exchange slits

Soller/PSC	PSA	Soller
5.0deg	Open	5.0 deg

Table 1.2.7 Recommended conditions of the data measurement

Method	2-Theta angle	Step axis Scan axis	Mode	Start	Stop	Step	RS1	RS2	Attenuator
Trans.	Measurement angle of the pole figure measurement conditions	Alpha	-	0 deg	Measurable angle (Max. 40 deg)	1 deg (Fine) 3 deg (Standard) 5 deg (Coarse)	10 mm	10 mm	-
Ref.	Measurement angle of the pole figure measurement conditions	Alpha	-	15 deg	90 deg	1 deg (Fine) 3 deg (Standard) 5 deg (Coarse)	10 mm	10 mm	-
-	-	Beta	Continuous	0 deg	360 deg	1 deg (Fine) 3 deg (Standard) 5 deg (Coarse)	-	-	AUTO

Table 1.2.8 Recommended conditions of the data measurement (IS width; Transmission, Sample width = 20mm)

Method	Hardware configuration	IS width (Transmission)								
		2-Theta angle (deg)								
		10	20	30	40	50	60	70	80	90
Decker	Selection slit BB	0.1 mm								
	Selection slit PB	0.7 mm								
Schulz	Selection slit BB	1/6 deg	1/2 deg	2/3 deg	1 deg					

Table 1.2.9 Recommended conditions of the data measurement (ISL length; Transmission)

ISL length(mm: Transmission)				
Sample width (mm)				
10	20	30	40	50
2.0	5.0	10.0		

Table 1.2.10 Recommended conditions of the data measurement (IS width; Reflection, Sample width = 20mm, Set Schulz slit (Alpha-beta or Chi-phi stage))

Hardware configuration	IS width (Reflection)								
	2-Theta angle (deg)								
	10	20	30	40	50	60	70	80	90
Selection slit BB	1/6 deg				1/2 deg	2/3 deg	1 deg		
Selection slit PB	0.5 mm			0.7 mm					

Table 1.2.11 Recommended conditions of the data measurement (IS width; Reflection, Sample width = 20mm, Not set Schulz slit (Other stage than Alpha-beta or Chi-phi stage))

Hardware configuration	IS width (Reflection)								
	2-Theta angle (deg)								
	10	20	30	40	50	60	70	80	90
Selection slit BB	1/6 deg								
Selection slit PB	0.5 mm								
Selection slit MA (Option)	0.5 mm				0.7 mm				
CBO-f (Option)	1.0 mm								

Table 1.2.12 Recommended conditions of the data measurement (ISL length; Reflection, Set Schulz slit (Alpha-beta or Chi-phi stage))

Hardware configuration	ISL length (mm: Reflection)
Selection slit BB	2.0
Selection slit PB	

Table 1.2.13 Recommended conditions of the data measurement (ISL length; Reflection, Not set Schulz slit (Other stage than Alpha-beta or Chi-phi stage))

Hardware configuration	ISL length (mm: Reflection)
Selection slit BB	0.5 (Option) / 2.0
Selection slit PB	
Selection slit MA (Option)	0.5 (Option)
CBO-f (Option)	10.0
Collimator holder (Option)	In-use collimator (Option)

Tip: The recommended conditions of IS and ISL in Table 1.2.8 to Table 1.2.13 are guides and change depending on sample width, measurement 2-theta angle, oscillation of gamma axis, and system configuration.

When either the sample width is 20 mm or less, measurement 2-theta angle is 20 deg or less, or the Shulz slit cannot be used in the system configuration, especially upon reflection method, the x-ray beam irradiation area may become larger than the sample. In this case, intensity correction by a random orientation distribution sample measurement may be necessary.

Table 1.2.14 Recommended conditions of the data measurement (Beta scanning speed)

Stage	Speed
Alpha-Beta stage	100 deg/min (Slow) 300 deg/min (Standard) 600 deg/min (Fast)
Other	100 deg/min (Slow) 300 deg/min (Standard) 600 deg/min (Fast)

Table 1.2.15 Recommended conditions of the background measurement

BG1 angle	BG2 angle	Alpha range Alpha step	RS1	RS2	Meas. mode	Duration time
[Meas. angle] – 3 deg	[Meas. angle] + 3 deg	Same as data measurement	10 mm	10 mm	One point (Beta=Min.Int)	[Beta step]/[Beta speed]*60 sec

2. Measurement sequence

The pole figure measurement is performed automatically when **Run recommended sequence** is selected in the **Transmission/Reflection Pole Figure Measurement** dialog box. Described below is the measurement sequence using the Alpha-Beta stage when **Run recommended sequence** is selected.

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

(1) Set the widths of the slits (IS, RS1, RS2), the length of the incident length limiting slit (IS L), and the aperture angles of the Soller slits to the recommended values of the transmission method.

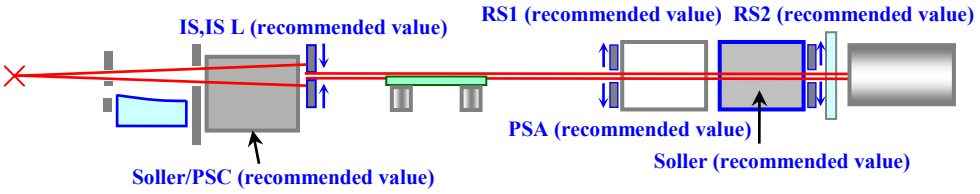


Fig. 2.1 Setting the slits and Soller slits (Transmission method)

> CAUTION: Figure 2.1 shows the medium resolution parallel beam/RS optics, which may differ from the current optics.

(2) Switch the Alpha-Beta stage to the transmission arrangement.

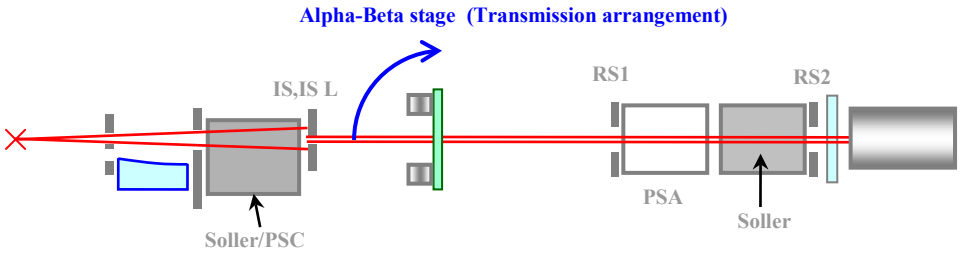


Fig. 2.2 Switching the Alpha-Beta stage to the transmission arrangement

(3) Make the data measurement at the diffraction angle in the transmission method.

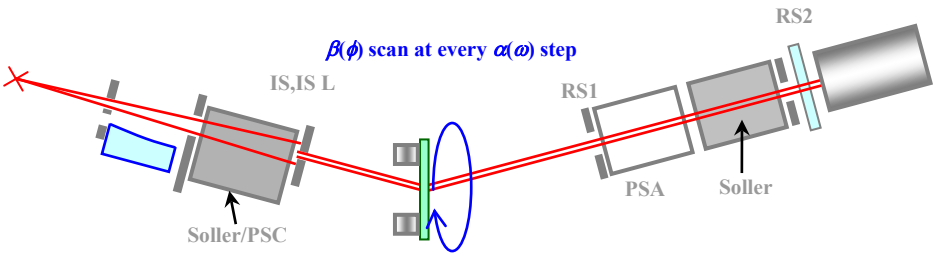


Fig. 2.3 Data measurement (Transmission method)

(4) Make the background measurement under the recommended conditions.

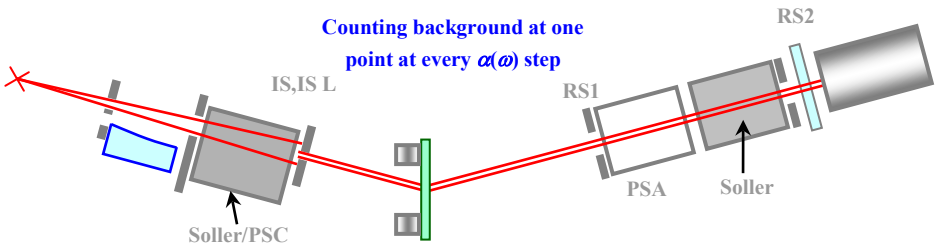


Fig. 2.4 Background measurement (Transmission method)

(5) Set the widths of the slits (IS, RS1, RS2), the length of the incident length limiting slit (IS L), and the aperture angles of the Soller slits to the recommended values of the reflection method.

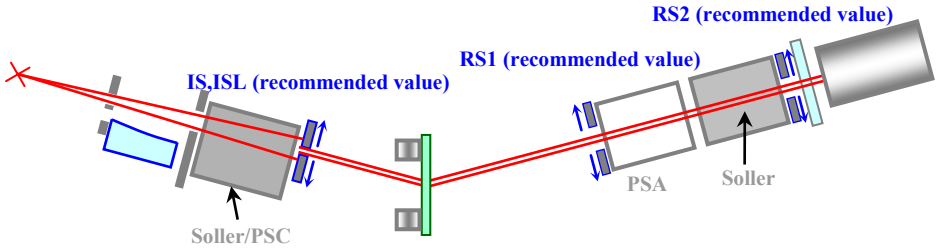


Fig. 2.5 Setting the slits and Soller slits (Reflection method)

(6) Switch the Alpha-Beta stage to the reflection arrangement.

Set the Schulz slit to the Alpha-Beta stage.

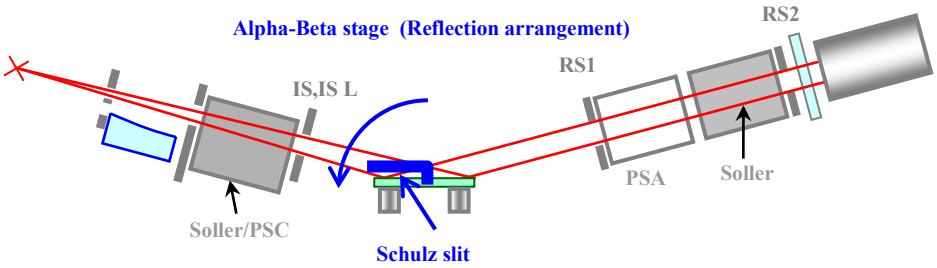


Fig. 2.6 Switching the Alpha-Beta stage to the reflection arrangement

(7) Make the data measurement at the diffraction angle in the reflection method.

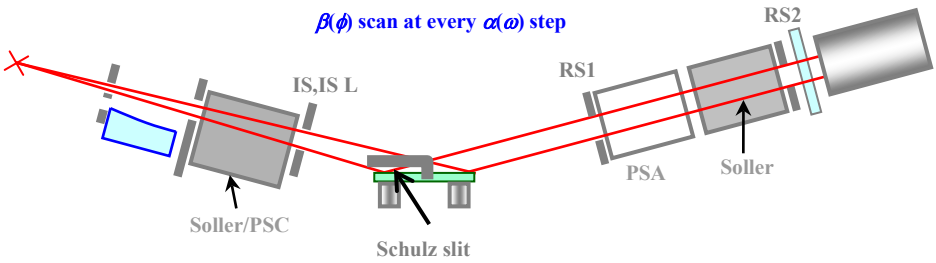


Fig. 2.7 Data measurement (Reflection method)

(8) Make the background measurement under the recommended conditions.

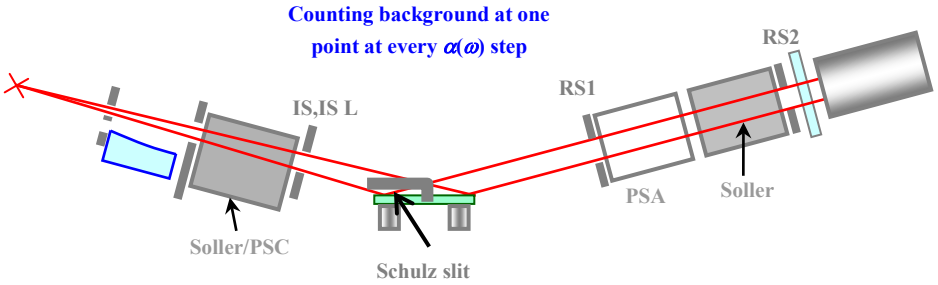


Fig. 2.8 Background measurement (Reflection method)

3. Measurement of linear absorption coefficient μ

The linear absorption coefficient μ is used for absorption correction of measurement data. Also, μt (t: sample thickness, unit cm) is used as an indicator for determining the optimal sample thickness upon transmission method measurements.

If the x-ray beam transmits through the sample, the incident x-ray intensity I_0 and the transmission x-ray intensity I_t are in the following relationship, and thus μt and μ can be calculated.

$$I_t = I_0 \exp(-\mu t) \qquad \text{Equation (3.1)}$$

$$\mu t = \ln \frac{I_0}{I_t} \qquad \text{Equation (3.2)}$$

$$\mu = \frac{1}{t} \cdot \ln \frac{I_0}{I_t} \text{ (unit: 1/cm)} \qquad \text{Equation (3.3)}$$

The measurement is performed by transmitting a monochromatized x-ray to the sample.

3.1 For para-focusing optics

The incident x-ray beam is not monochromatized in para-focusing method. Therefore, the diffraction beam of either single crystal (Si substrate) or powder (Si powder) is used as the incident x-ray beam I_0. The following steps describe the measurement flow when using a Si powder reference sample as the sample.

(1) Performs optics alignment with **Optics Alignment (BB)** part.

(2) Place the Si powder reference sample on the height reference sample plate.

(3) Execute the measurement of Si 111 diffraction peaks by referring to the conditions below (use Manual Measurement or General Measurement part).

Measurement conditions

Incident slit: ½ deg, Receiving slit 1: ½ deg, Receiving slit 2: 0.3 mm

Incident length limiting slit: select a slit which the x-ray beam will not irradiate outside of sample

Scan axis: theta/2-theta

Scan conditions

Start: 28.0 deg, End: 29.0 deg, Step: 0.01 deg, Speed: 2 deg/min, Attenuator: Open

(4) Record the intensity of the observed peak as I_0.

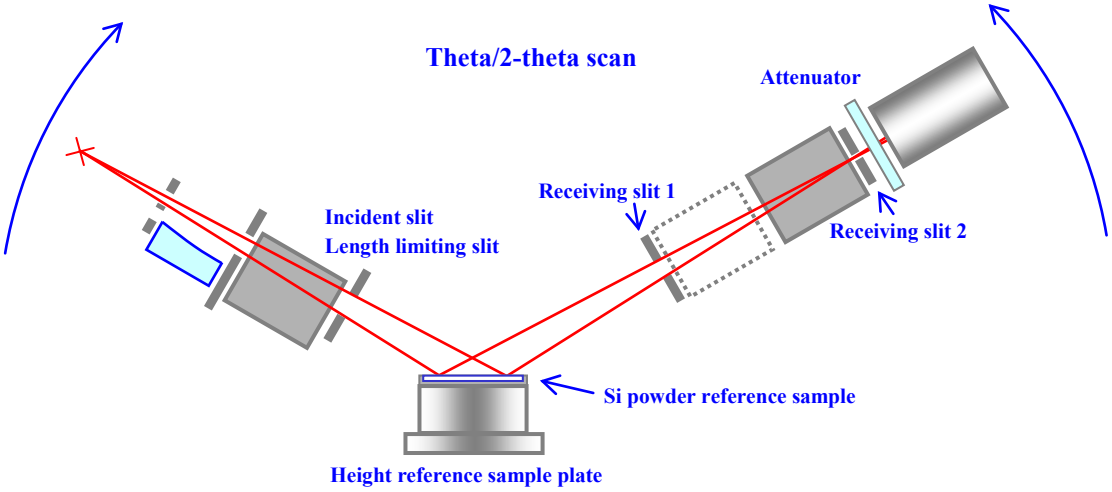


Fig. 3.1.1 I_0 measurement by para-focusing optics

(5) Open the radiation enclosure cover, and attach (with a tape, etc.) the sample for the pole figure measurement on the window of the receiving slit box 1.

(6) Perform the measurement of Si 111 diffraction peaks under the same conditions as step (3).

(7) Record the intensity of the observed peaks as I_t.

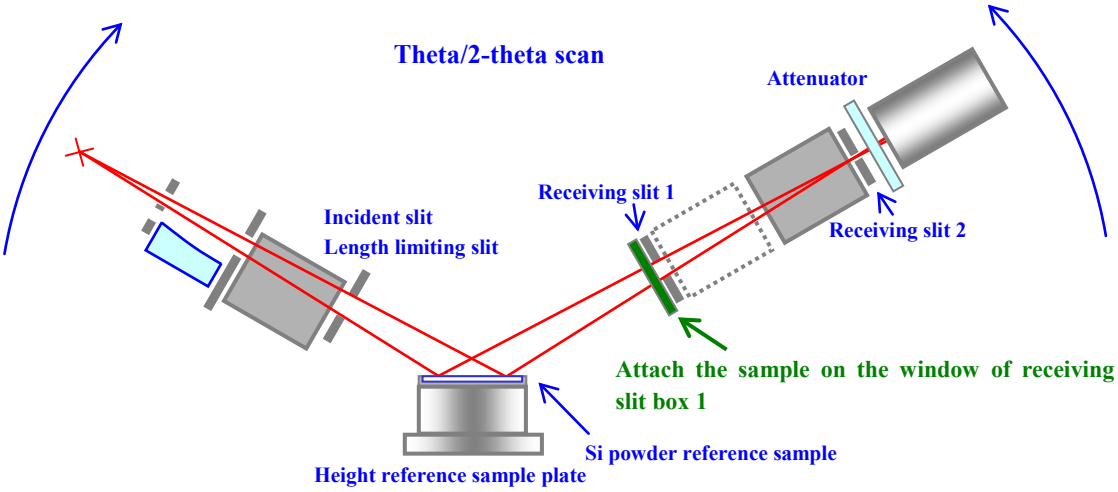


Fig. 3.1.2 I_t measurement by para-focusing optics

(8) Calculate μt or μ from I_0 and I_t, using equations (3.1) and (3.2).

3.2 For parallel beam optics

The incident x-ray beam is monochromatized by the multilayer mirror in parallel beam method. Therefore, the direct beam is used as the incident x-ray beam I_0. The following steps describe the measurement flow.

(1) Performs optics alignment with Optics Alignment (medium resolution PB) part.

(2) Remove the sample.

(3) Execute the direct beam measurement by referring to the conditions below (use Manual Measurement or General Measurement part).

Measurement conditions

Incident slit: 0.1 mm, Receiving slit 1: 1 mm, Receiving slit 2: 1 mm

Incident length limiting slit: select a slit which the x-ray beam will not irradiate outside of sample

Scan axis: 2-theta

Scan conditions

Start: -0.5 deg, End: 0.5 deg, Step: 0.01 deg, Speed: 2 deg/min

Attenuator: Auto or 1/10000

(4) Record the intensity of the observed peak as $\boldsymbol{I_0}$.

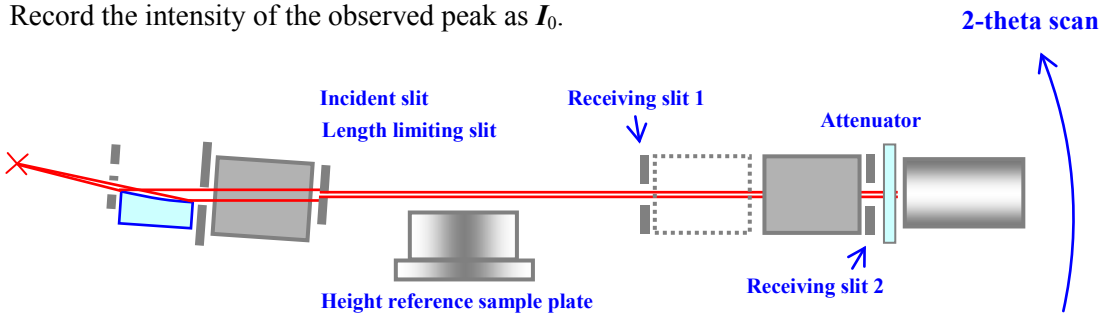


Fig. 3.2.1 I_0 measurement by parallel beam optics

(5) Open the radiation enclosure cover, and attach (with a tape, etc.) the sample for the pole figure measurement on the window of the receiving slit box 1

(6) Perform the direct beam measurement under the same conditions as step (3).

(7) Record the intensity of the observed peaks as I_t.

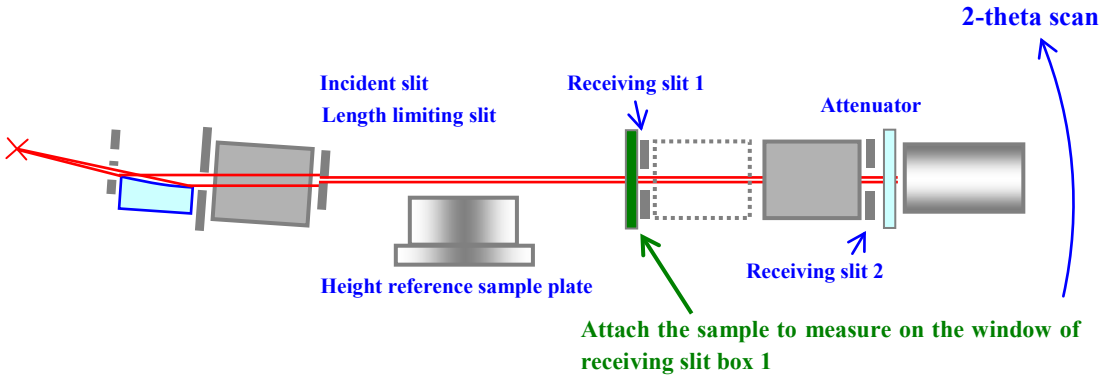


Fig. 3.2.2 I_t measurement by parallel beam optics

(8) Calculate μt or μ from I_0 and I_t, using equations (3.1) and (3.2).