

F C C S c h m i d C a l c

B C C S c h m i d C a l c ソフトウェアの動作

2023年01月10日

*HelperTex Office*

## 概要

材料の加工性としてSchmidFactorを求めることがあります。

CTRソフトウェアでは、FCC、BCC、HCP向けにSchmid因子計算がサポートされています。

FCCはBCCソフトウェアに含まれています。

以下に操作方法と手計算を説明します。

### BCCSchmidCalcソフトウェア

BCCSchmidFactorCalc3 3.05T[23/04/30] by CTR

File Help Text SlipProfile

InputFile(TXT)

LaboTex VolumeFraction(SumVFmode) {1 1 0}<1 -1 2> 100.0

Disp  DISP

Slip Systems

{011}<11-1>  {112}<11-1>  {123}<11-1>  FCC{111}<1-10> Inverse

Data input

{h k l} or [h k l] {h k l}<u v w> phi1 PHI phi2

ND Input Input Input

{h k l}<u v w> VF(%)

AlongRD(X) AlongTD(Y)<=0 AlongND(Z)

3 0 2 0 1 0 4 0

SlipDisp Schmidcalc

Symmetry SchmidCalc

SchmidFDisp

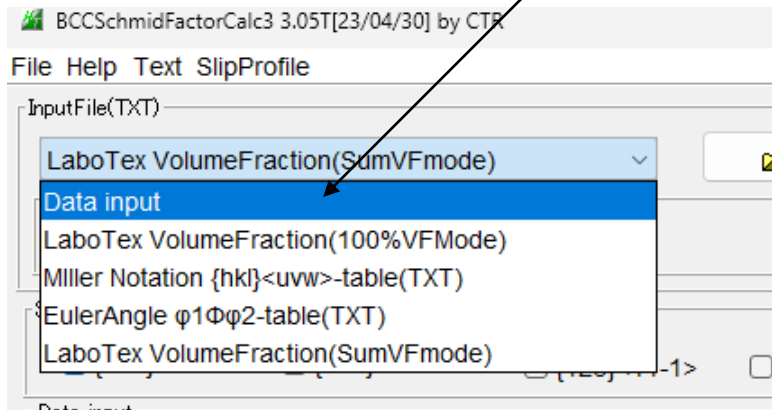
SchmidFactorProfile

ND->RD Step 1

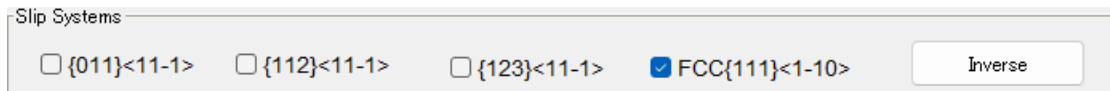
AXISRotation  HKLDouible

{30, 8, 95} の FCC schmid 因子を求める

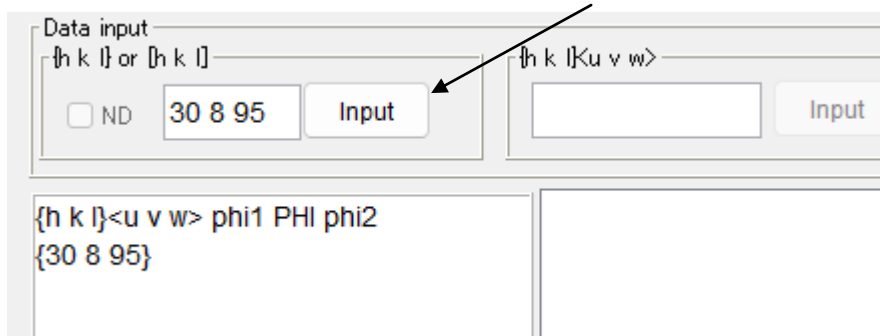
計算する方位を入力する。 Datainput の選択



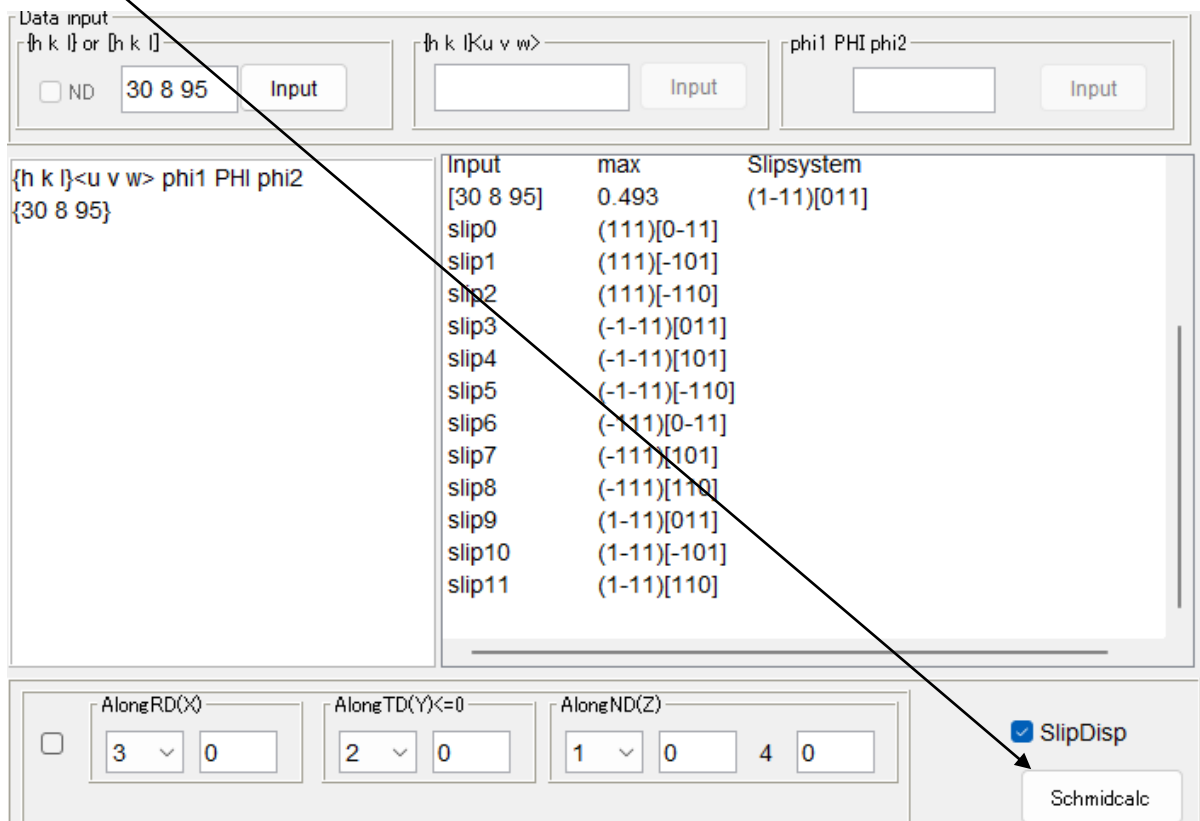
FCC の選択



方位の入力 30895を入力し Input



計算開始





最大値は

nputData

{h k l}<u v w> phi1 PHI phi2  
{30 8 95}

Calc Schmid's Factor

ND	slip0	slip1	slip2	slip3	slip4	slip5	slip6	slip7	slip8	slip9	slip10	slip11
{30 8 95}	0.473	0.353	-0.12	0.24	0.291	-0.051	0.26	0.373	0.113	0.493	0.311	0.182
nput	max	Slipsystem										
{30 8 95}	0.493	(1-11)[011]										
slip0	(111)[0-11]											
slip1	(111)[-101]											
slip2	(111)[-110]											
slip3	(-1-11)[011]											
slip4	(-1-11)[101]											
slip5	(-1-11)[-110]											
slip6	(-111)[0-11]											
slip7	(-111)[101]											
slip8	(-111)[110]											
slip9	(1-11)[011]											
slip10	(1-11)[-101]											
slip11	(1-11)[110]											

最小値は slip2 (111)[-101]である。

手計算

最大值 (1-11)[011]

最小值 (111)[-110]

Schmid 因子  $\cos \phi * \cos \theta$

$$\cos \phi = \frac{h_1 h_2 + k_1 k_2 + l_1 l_2}{\sqrt{(h_1^2 + k_1^2 + l_1^2)(h_2^2 + k_2^2 + l_2^2)}}$$

$$\cos \theta = \frac{u_1 u_2 + v_1 v_2 + w_1 w_2}{\sqrt{(u_1^2 + v_1^2 + w_1^2)(u_2^2 + v_2^2 + w_2^2)}}$$

最大值(1-11)[011]

(h1,k1,l1)=(1,-1,1)

(u1,v1,w1)=(0,1,1)

(h2,k2,l2)=(30,8,95)

(u2,v2,w2)=(30,8,95)

h1	k1	l1	u1	v1	w1		
1	-1	1	0	1	1		
h2	k2	l2	u2	v2	w2		
30	8	95	30	8	95		
cos $\phi$	0.6759						
cos $\theta$	0.7305						
cos $\phi$ cos $\theta$	0.4937						

最小值 (111)[-110]

(h1,k1,l1)=(1,1,1)

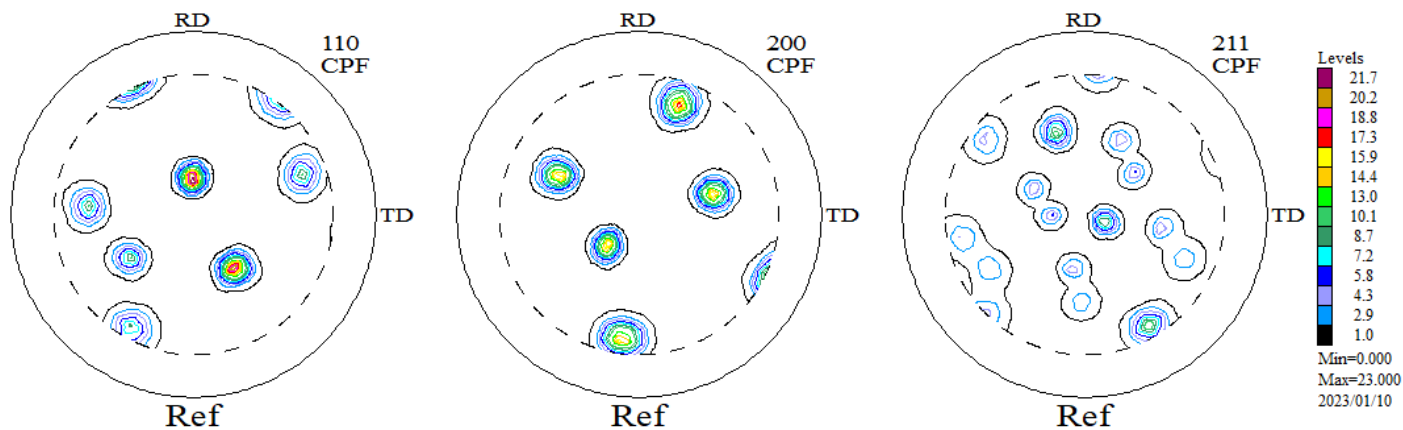
(u1,v1,w1)=(-1,0,1)

(h2,k2,l2)=(30,8,95)

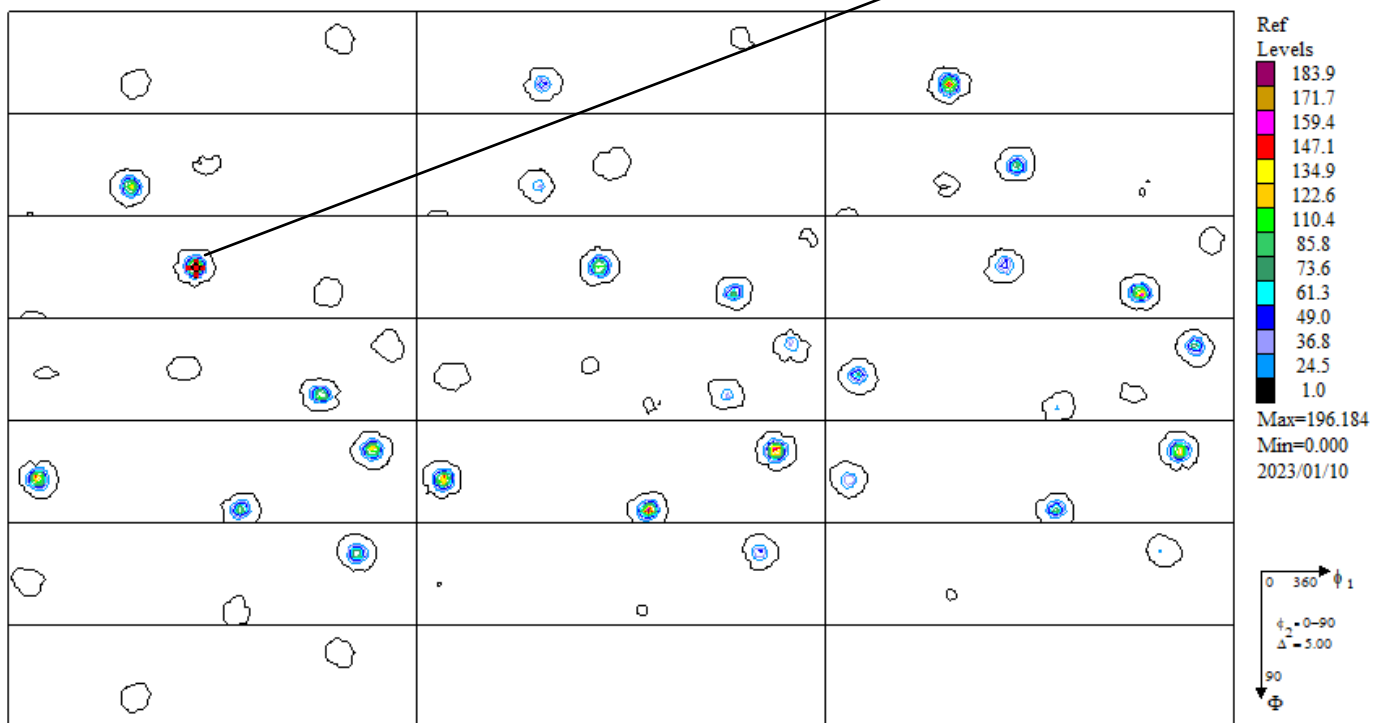
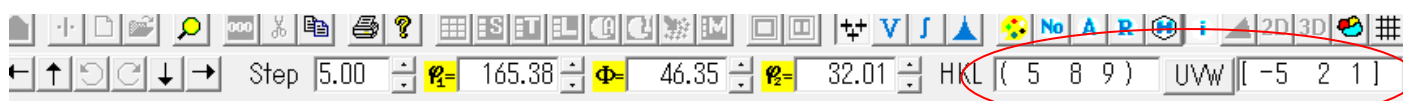
(u2,v2,w2)=(30,8,95)

h1	k1	l1	u1	v1	w1		
1	1	1	-1	0	1		
h2	k2	l2	u2	v2	w2		
30	8	95	30	8	95		
cos $\phi$	0.7683						
cos $\theta$	-0.1560						
cos $\phi$ cos $\theta$	-0.1199						

実測定データの場合



ODF 解析後方位の決定



この部分をクリック

Approx. Miller Indices	Euler Angles
$[ 5 \ 8 \ 9 ] [ -5 \ 2 \ 1 ]$	$[ 165.38, 46.35, 32.01 ]$
$[ 9 \ 5 \ 8 ] [ 1 \ -5 \ 2 ]$	$[ 27.54, 52.15, 60.95 ]$
$[ 8 \ 9 \ 5 ] [ 2 \ 1 \ -5 ]$	$[ 278.72, 67.45, 41.63 ]$

どの方位も ODF 図上の強い部分であること確認する。

Volume Fraction 決定のため

$\{ 5 \ 8 \ 9 \} \langle -5 \ 2 \ 1 \rangle$  をデータベースに登録

Ste

Orientations Analysis

- Show PF(s) or/and ODF(s) Value(s)
- Choose (HKL)[UWV]...
- Max. Value of Miller Indices...
- Orientations Type Database...**
- Sort of Orientations from Database by PF or ODF Values...
- Show of Next Orientation from Database
- Show of Previous Orientation from Database
- Auto
- Near (HKL)[UWV] Orientations (Right Mouse Click)...

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- Quantitative Analysis - Integration Method...
- Quantitative Analysis - Model Functions Method...

Orientations Type Database

Crystal Symmetry Systems: Cubic

Number of Orientations: 22

No	Orientation Type Name	$\varphi_1$	$\Phi$	$\varphi_2$
1	{ 1 1 0 } < 1 -1 2 > brass	54.74	90.00	45.00
2	{ 1 1 2 } < 1 -1 1 > coppe	-90.00	35.26	45.00
3	{ 0 0 1 } < 1 0 0 > cube	0.00	0.00	0.00
4	{ 1 1 0 } < 0 0 1 > goss	90.00	90.00	45.00
5	{ 0 0 1 } < 1 1 0 >	-45.00	0.00	0.00
6	{ 1 1 0 } < 1 -1 1 >	35.26	90.00	45.00
7	{ 1 1 1 } < -1 -1 2 >	90.00	54.74	45.00
8	{ 1 0 1 } < 5 2 -5 >	-105.79	45.00	90.00
9	{ 5 2 5 } < 1 -5 1 >	15.23	47.12	68.20

Buttons: Delete, Edit, New, **New (HKL)<UWV>**

Orientation Euler Angles

Fiber

Orientation Type Name: -----

Angle Part: { 0.0, 0.0, 0.0 }      Name:       $\varphi_1$ : (-360 - 360)       $\Phi$ : (-180 - 180)       $\varphi_2$ : (-360 - 360)

Buttons: Add/Change, Cancel

Close

Database - Add (HKL)<UWV> - Symmetry Cubic

Choose (HKL) [UWV]

H: 0, 1, 2, 3, 4, **5**, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15

K: 0, 1, 2, 3, 4, 5, 6, 7, **8**, 9, 10, 11, 12, 13, 14, 15

L: 0, 1, 2, 3, 4, 5, 6, 7, 8, **9**, 10, 11, 12, 13, 14, 15

U: 0, -1, -2, -3, -4, -5, -6, -7, -8, -9, -10, -11, -12, -13, -14, -15

V: 0, 1, **2**, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15

W: 0, 1, **1**, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15

(HKL): ( 5 8 9 )      [UWV]: [-5 2 1]

Fiber      (HKL)[UWV] [ 5 8 9 ] [-5 2 1]

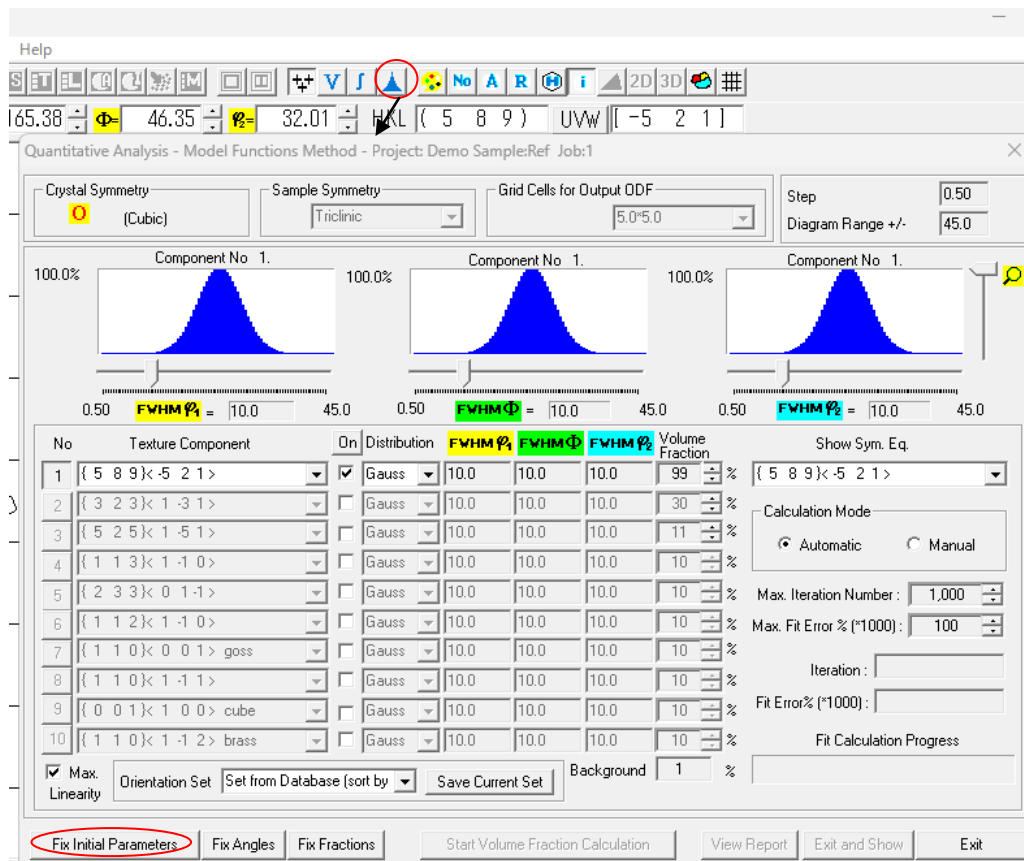
Database

Orientation Type Name	$\varphi_1$	$\Phi$	$\varphi_2$
{ 5 8 9 } < -5 2 1 >	165.38	46.35	32.01

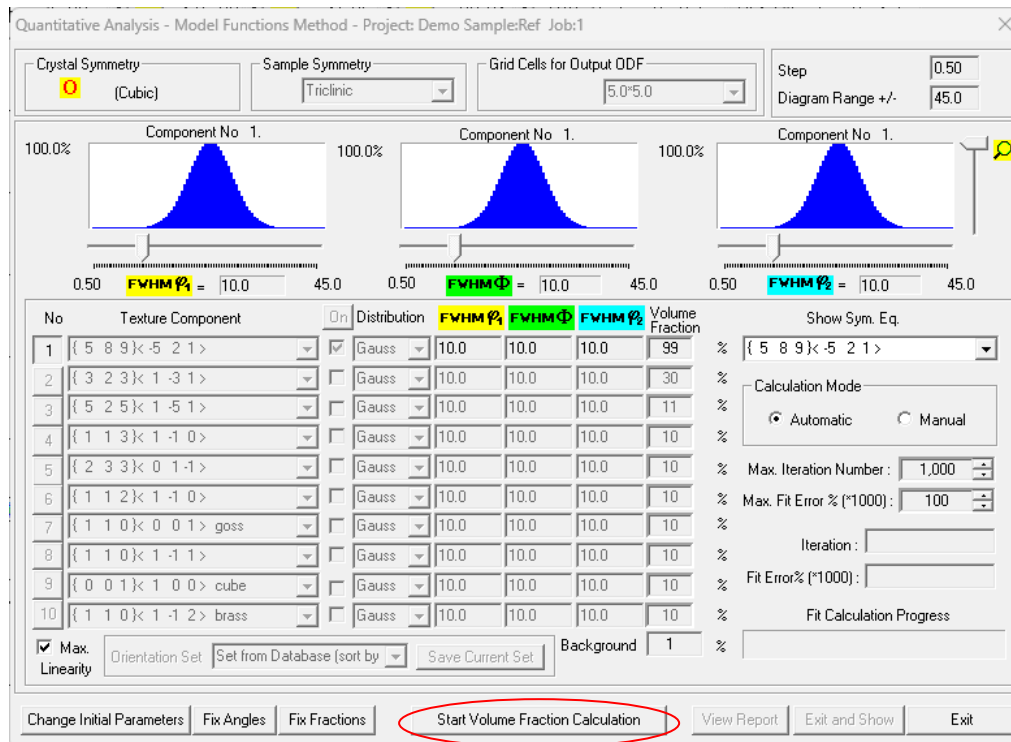
**Add to Database**

Close

# VolumeFraction を求める

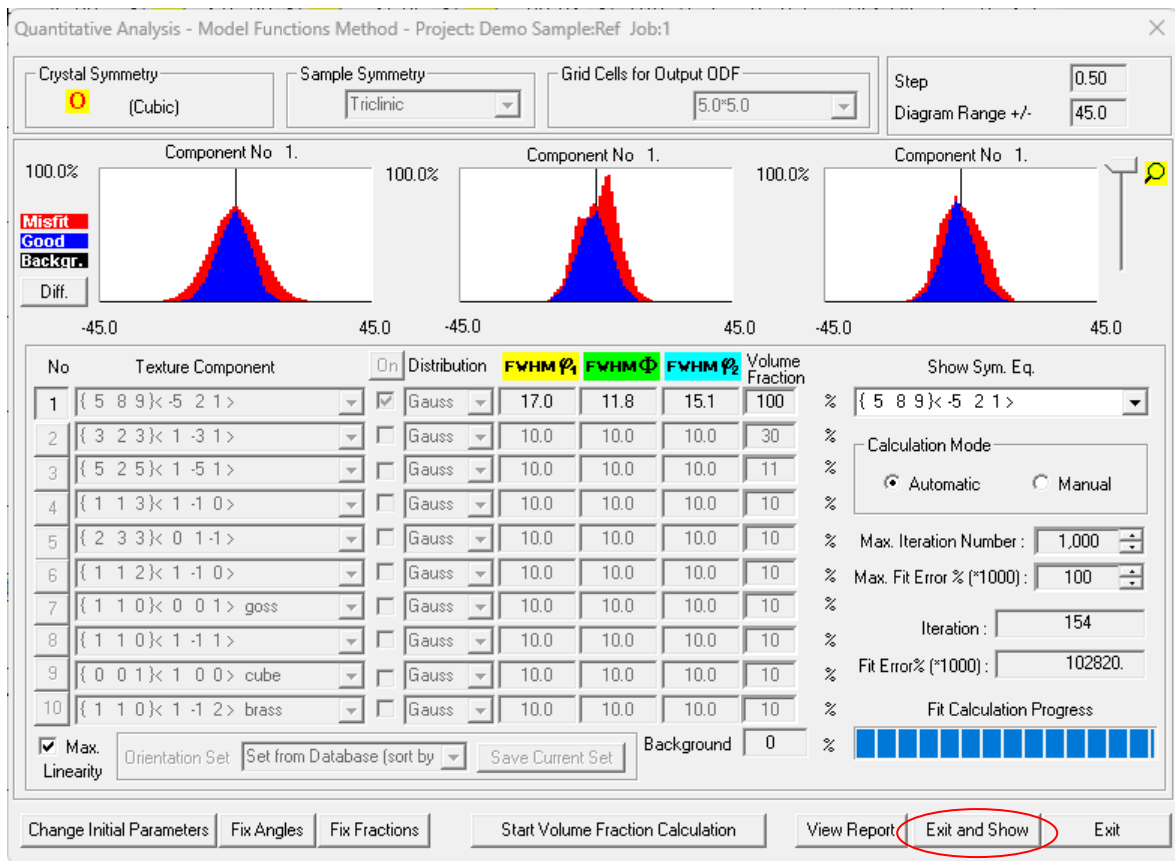


Fix Initial Parameters で {589} <-521>のみを選択し Fix Initial Parameters 再度選択



数回計算する



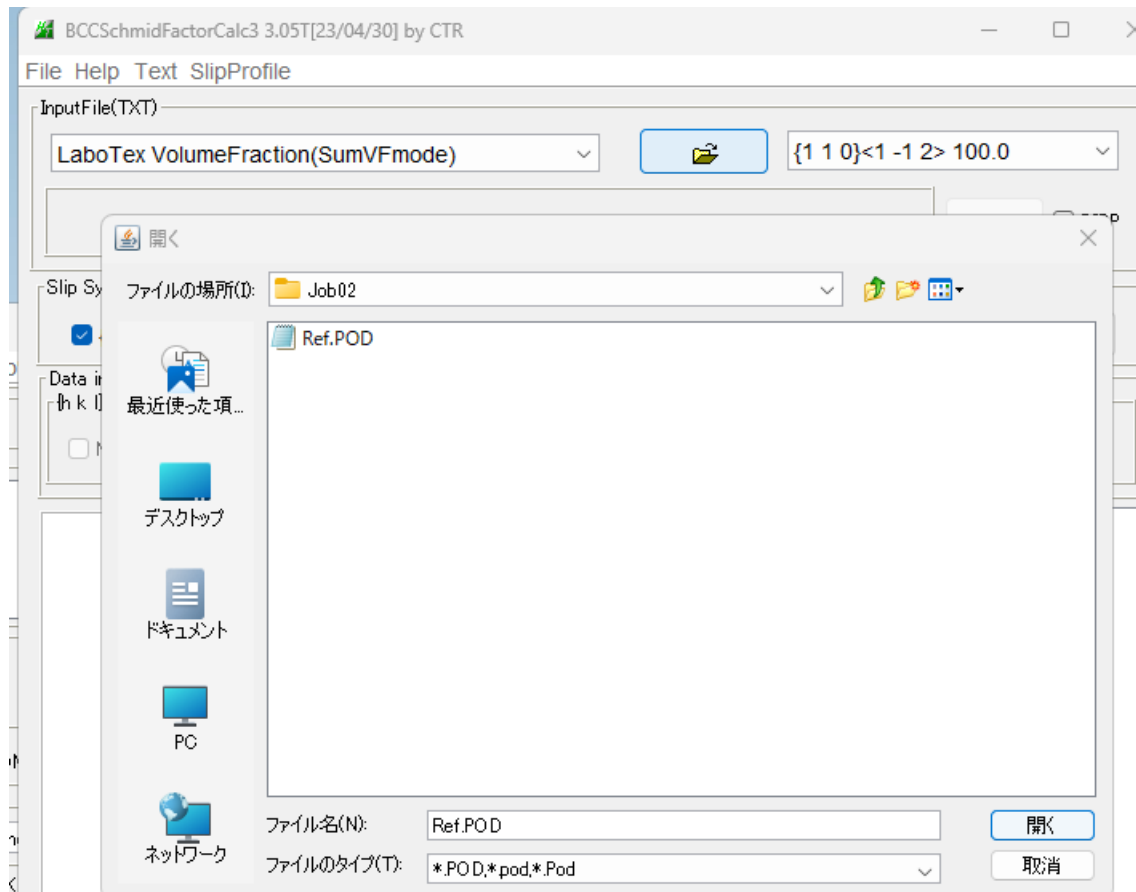


ExitandShow で終了

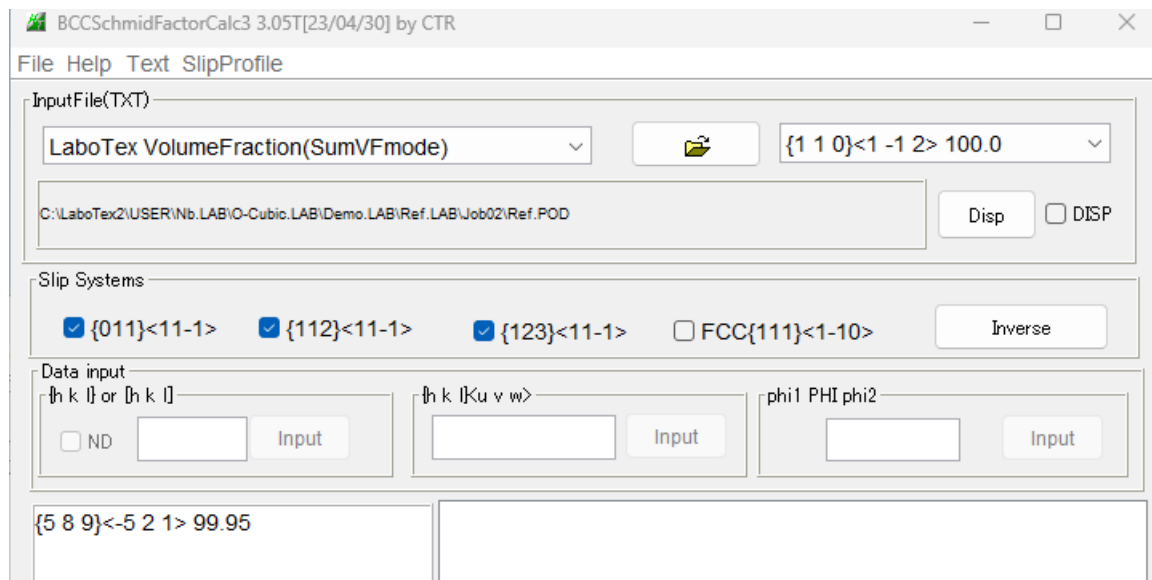


# BCCSchmidCalc

先ほどのPDFを選択



{5 8 9} <- 5 2 1> が取り込まれます。



{5 8 9}<-5 2 1> 99.95

	0.447	0.12	0.272	0.174
	0.316	0.12	0.027	0.256
	0.234	0.207	0.136	
input	VF%	Schmid	VF*Schmid%	
{5.08.09.0}<-5.02.01.0>	99.95	0.449	0.449	
VFsum=99.95%		VF*Schmidsum=0.449		
SchmidFactor(SumVF)=0.449				

slip0 (01-1)[111]  
slip1 (-101)[111]  
slip2 (1-10)[111]  
slip3 (0-1-1)[-1-11]  
slip4 (101)[-1-11]  
slip5 (-110)[-1-11]  
slip6 (01-1)[-111]

AlongRD(X) 3 0    AlongTD(Y)<=0 2 0    AlongND(Z) 1 0 4 0

SlipDisp

Schmidcalc

Symmetry SchmidCalc

SchmidFDisp

SchmidFactorProfile  
 ND->RD    all    Step 1

S c h m i d C a l c

TextDisplay 1.14S C:\CTR\work\SchmidLowBCC\SchmidFactor.txt

File Help

inputData  
{5 8 9}<-5 2 1> 99.95

Calc Schmid's Factor  
{5.08.09.0}<-5.02.01.0> rotation (2[0.0],1[0.0],0[0.0]3[0.0])

slip0	slip1	slip2	slip3	slip4	slip5	slip6	slip7	slip8	slip9	slip10
-0.053	0.211	-0.158	0.163	-0.134	-0.029	-0.029	0.403	-0.375	-0.245	0.058
input	VF%	Schmid	VF*Schmid%							
{5.08.09.0}<-5.02.01.0>	99.95	0.449	0.449							
VFsum=99.95%		VF*Schmidsum=0.449								
SchmidFactor(SumVF)=0.449										

slip0 (01-1)[111]  
slip1 (-101)[111]  
slip2 (1-10)[111]  
slip3 (0-1-1)[-1-11]  
slip4 (101)[-1-11]  
slip5 (-110)[-1-11]  
slip6 (01-1)[-111]  
slip7 (101)[-111]  
slip8 (-1-10)[-111]  
slip9 (0-1-1)[1-11]  
slip10 (-101)[1-11]  
slip11 (110)[1-11]  
slip12 (-211)[111]  
slip13 (1-21)[111]