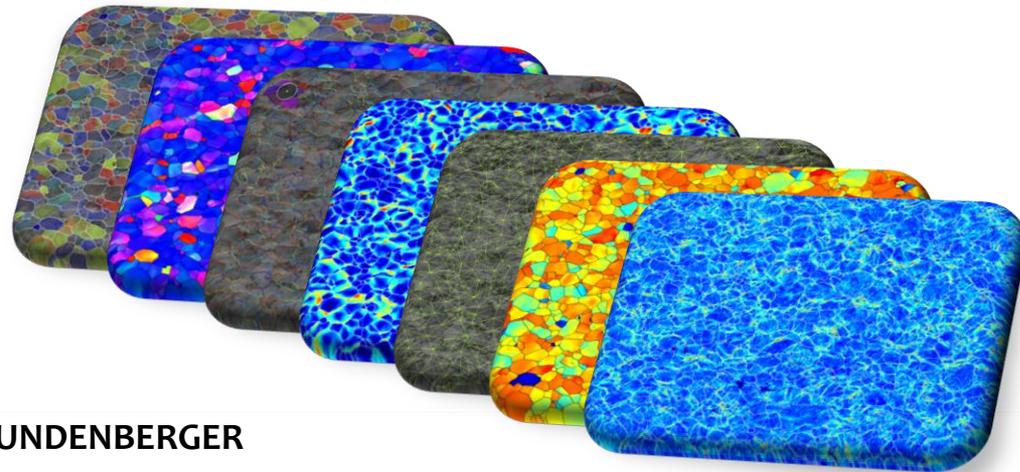


## Analysis Tools for Orientation Mapping



**Benoît BEAUSIR & Jean-Jacques FUNDENBERGER**

*JTEX and ATOM are free for non-commercial use.*

JTEX© and ATOM© Software (2013) source codes and documentations are copyrighted (IDDN.FR.001.420015.000.R.P.2014.000.20700) and may not be redistributed or placed on public Web servers without permission.

## Outlines



### ❖ ATOM Software

- ❖ EBSD data – IF Steel after 12% Rolling

### ❖ JTEX Software

- ❖ X-Ray measurements on Al deformed by one pass ECAP

# Input File Formats

- ➔ CTF – CPR/CRC (Channel5) – ANG – OSC (TSL)
- ➔ Any ASCII file format (\*.TXT): Data Import Interface

001 : Channel Text File  
 002 : Prj unnamed  
 003 : Author [Unknown]  
 004 : JobMode Grid  
 005 : XCells 761  
 006 : YCells 571  
 007 : XStep 0.5  
 008 : YStep 0.5  
 009 : AcqE1 0  
 010 : AcqE2 0  
 011 : AcqE3 0  
 012 : Euler angles refer to Sample Coordinate system (CS0)!

Phase	X	Y	Bands	Error	Euler1	Euler2	Euler3	MAD	BC	BS	TiltAngle
014 :	3.66	3.66	3.66	0	247.6709	30.7493	71.8259	1.1921	181	255	
015 :	1	0	0	8	247.515	30.6624	71.8282	1.2472	192	255	
016 :	1	0.4999	0	7	246.5884	30.8769	73.3608	1.1861	170	255	
017 :	1	0.9998	0	9	247.3007	30.5634	72.9287	1.4579	174	255	
018 :	1	1.4996	0	8	248.8337	30.1518	72.7071	1.0353	162	255	
019 :	1	1.9995	0	7	248.0059	29.7261	73.4395	1.3789	164	255	
020 :	1	2.4994	0	9	146.1928	34.5642	204.659	1.237	172	255	
021 :	1	2.9993	0	6	342.7401	45.2398	19.9064	1.4427	182	255	
022 :	1	3.4992	0	11	342.712	45.2966	20.3353	1.3943	198	255	
023 :	1	3.999	0	11	342.8224	46.3073	20.8773	1.2746	202	255	
024 :	1	4.4989	0	8	342.7721	46.1346	21.7218	0.7375	204	255	
025 :	1	4.9988	0	10	342.2116	45.6614	21.0205	1.267	202	255	
026 :	1	5.4987	0	10	0	0	0	0	0	185	255
027 :	0	5.9986	0	0	337.2319	44.1037	20.7715	1.3513	196	255	
028 :	1	6.4984	0	11	337.1225	43.2828	19.2007	1.2794	199	255	
029 :	1	6.9983	0	11	337.3527	42.9424	19.1168	0.9632	195	255	
030 :	1	7.4982	0	8	335.7885	42.9226	18.3423	1.2404	199	255	
031 :	1	7.9981	0	9	335.8368	42.9097	18.1047	1.1593	199	255	
032 :	1	8.498	0	8	0	0	0	0	178	255	
033 :	1	8.9978	0	0	0	0	0	0	178	255	
034 :	0	8.9978	0	0	0	0	0	0	178	255	

➔ ATM file created for the next run

# Starting: BC, BS, M.A.D.

The screenshot displays the ATOM software interface. At the top, the title bar reads "A T O M - Reference: 'B. Beausir, J.-J. Fundenberger, Université de Lorraine - Metz, 2015, ATOM - Analysis Tools for Orientation Maps, http://atom-software.eu/'". The menu bar includes File, Basics, Grains, Advanced, Statistics, Tools, Textures, Help, and About. The File menu is open, showing options for Open, Import, Export, and Close. A Report window is also visible, with the title "IFi-ApTr12-fwcorr100\_SUBSE".

The main workspace shows a grayscale microstructure map of a metal grain structure. On the right side, there is a "My Maps" panel with three thumbnails: "BAND\_CONTRAST IFi-ApTr.BMP", "BAND\_SLOPE IFi-ApTr.BMP", and "M.A.D. IFi-ApTr.BMP".

At the bottom of the interface, a status bar provides the following information: "IFi-ApTr12-fwcorr100\_SUBS | Points: 681 x 461 = 313941 | Step: 0.5 x 0.5 | Map size: 340.5 x 230.5 | Phase: 1 | MAD: 0.6 | BC: 73 | BS: 158 | Euler: 303.09, 43.26, 47.15". The bottom right corner of the status bar displays "Université de Lorraine".

# Basics: IPF Maps

ATOM - Reference: "B. Beausir, J.-J. Fundenberger, Université de Lorraine - Metz, 2015, ATOM - Analysis Tools for Orientation Maps, <http://atom-software.eu/>"

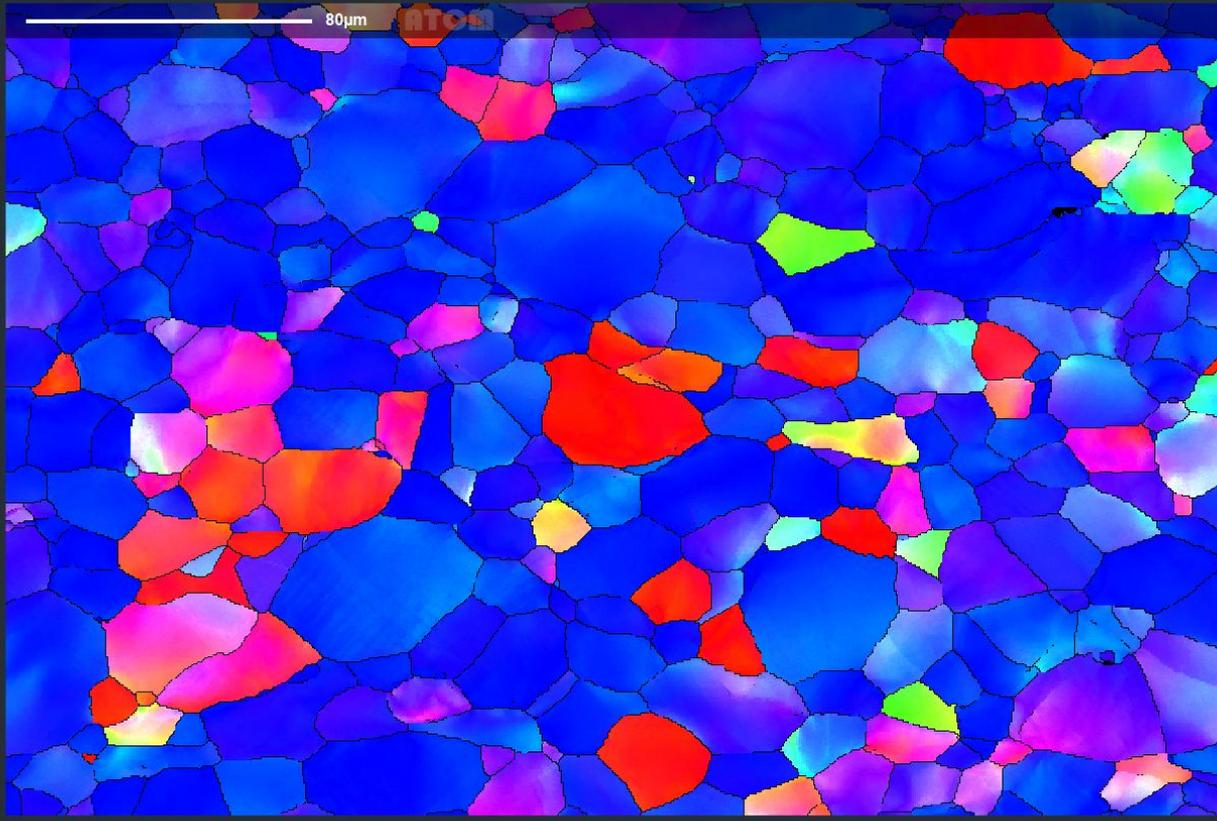
File Basics Grains Advanced Statistics Tools Textures Help About

**Inverse Pole Figure Maps**  
 Projection Axis: 0 0 1  
 Phase: 1  
 Add Grain Boundaries

**Boundaries**  
 Min / Max Disorientation Angle (°): 5 62  
 Coloring: Rainbow  non-indexed  
 Background coloring: Band Contrast

**Particular Boundaries**  
 Min / Max Disorientation Angle (°): 5.0 62.0  
 Disorientation axis (uvw): 1 1 1 Axis Tolerance Angle (°): 2.0  
 Coloring: Rainbow Background coloring: Band Contrast  non-indexed

**Plans Trace**  
 Show Trace  
 h k l: 1 1 1  
 Full Family Length: 10



80µm

My Maps

- BAND\_CONTRAST IFr-ApTr.BMP
- BAND\_SLOPE IFr-ApTr.BMP
- BOUNDARIES IFr-ApTr.BMP
- IPF\_PH1 axis 0 0 1 IFr-ApTr.BMP
- M.A.D. IFr-ApTr.BMP

001 111 101

IFr-ApTr12-fwcorr100\_SUBS | Points: 681 x 461 = 313941 | Step: 0.5 x 0.5 | Map size: 340.5 x 230.5 | Phase: 1 | MAD: 0.5 | BC: 93 | BS: 238 | Euler: 121.87, 41.94, 71.62

Université de Lorraine

# Boundaries

ATOM - Reference: "B. Beausir, J.-J. Funderberger, Université de Lorraine - Metz, 2015, ATOM - Analysis Tools for Orientation Maps, <http://atom-software.eu/>"

File Basics Grains Advanced Statistics Tools Textures Help About

**Inverse Pole Figure Maps**  
 Projection Axis: 0 0 1  
 Phase: 1  
 Add Grain Boundaries

**Boundaries**  
 Min / Max Disorientation Angle (°): 5 62  
 Coloring: Rainbow  non-indexed  
 Background coloring: Band Contrast

**Particular Boundaries**  
 Min / Max Disorientation Angle (°): 5.0 62.0  
 Disorientation axis (uvw): 1 1 1 Axis Tolerance Angle (°): 2.0  
 Coloring: Rainbow Background coloring: Band Contrast  non-indexed

**Plans Trace**  
 Show Trace  
 h k l: 1 1 1  
 Full Family Length: 10

80µm 5.00e0 6.20e1

**My Maps**  
 BAND\_CONTRAST IFr-ApTr.BMP  
 BAND\_SLOPE IFr-ApTr.BMP  
 BOUNDARIES IFr-ApTr.BMP  
 IPF\_PH1\_axis\_0\_0\_1 IFr-ApTr.BMP  
 M.A.D. IFr-ApTr.BMP

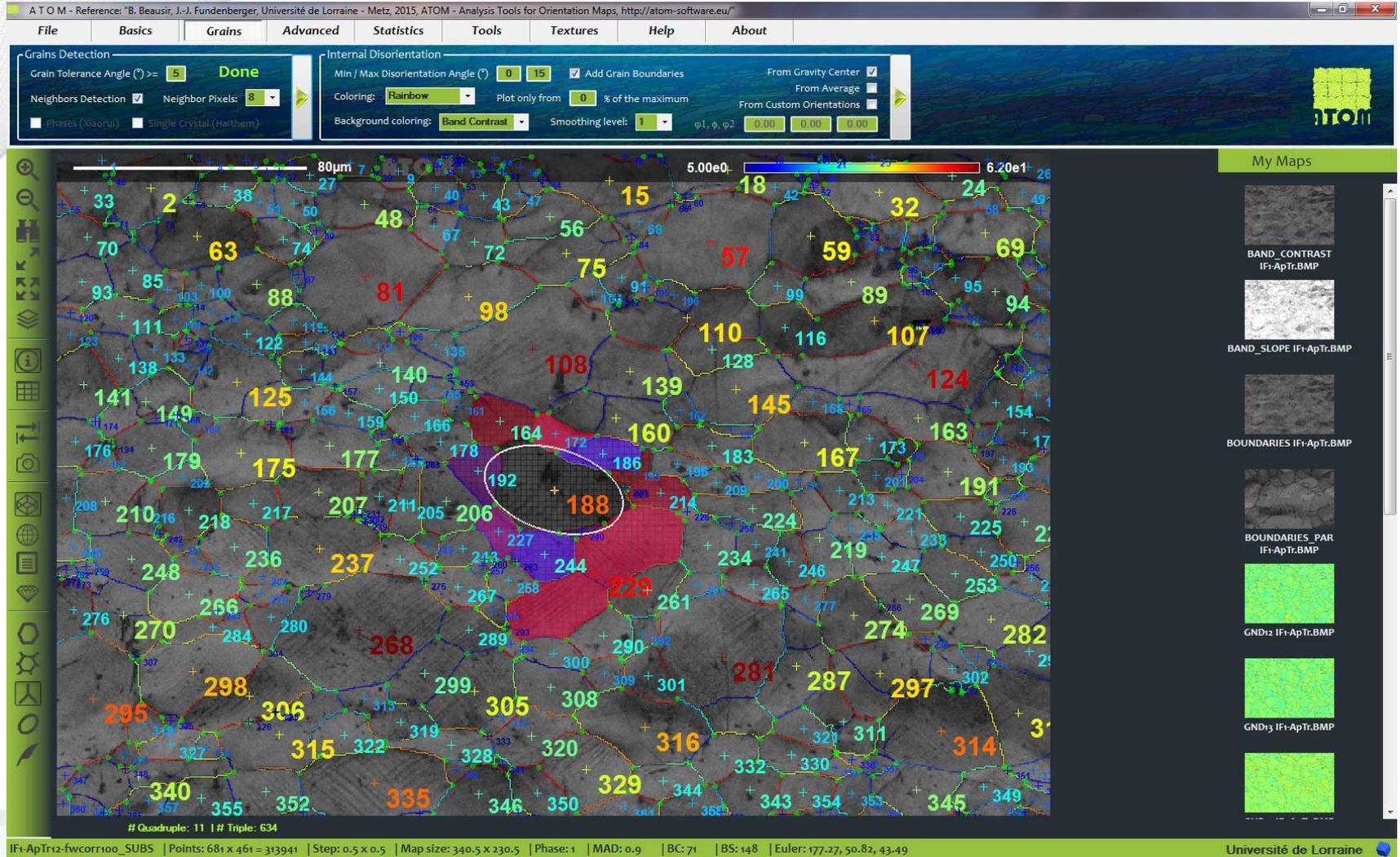
**ATOM - Disorientation Axes Projection**  
 Phase: 1  Stereographic  Equal Area  
 Plot only one over: 1  
 Color With: Current Map  
 Pole Figures Size: 1  
 # Pole figures: 12  
 Min / Max Disorientation Angle (°): 2.0 62.0  
 Save

2° - 7°	7° - 12°	12° - 17°	17° - 22°
22° - 27°	27° - 32°	32° - 37°	37° - 42°
42° - 47°	47° - 52°	52° - 57°	57° - 62°

IFr-ApTr12-fwcorr100\_SUBS | Points: 6

Université de Lorraine

# Grain Identification, Neighbours, Triple Junctions



# Grain Shape

ATOM - Reference: "B. Beausir, J.-J. Funderberger, Université de Lorraine - Metz, 2015, ATOM - Analysis Tools for Orientation Maps, <http://atom-software.eu/>"

**File** **Basics** **Grains** **Advanced** **Statistics** **Tools** **Textures** **Help** **About**

**Grains Detection**  
 Grain Tolerance Angle (°) >= **5** **Done**  
 Neighbors Detection  Neighbor Pixels: **8**  
 Phases (Xiaoru)  Single Crystal (Hartmann)

**Internal Disorientation**  
 Min / Max Disorientation Angle (°) **0** **15**  Add Grain Boundaries  
 From Gravity Center   
 From Average   
 From Custom Orientations   
 Coloring: **Rainbow** Plot only from **0** % of the maximum  
 Background coloring: **Band Contrast** Smoothing level: **1**  $\phi_1, \phi_2$  **0.00** **0.00** **0.00**

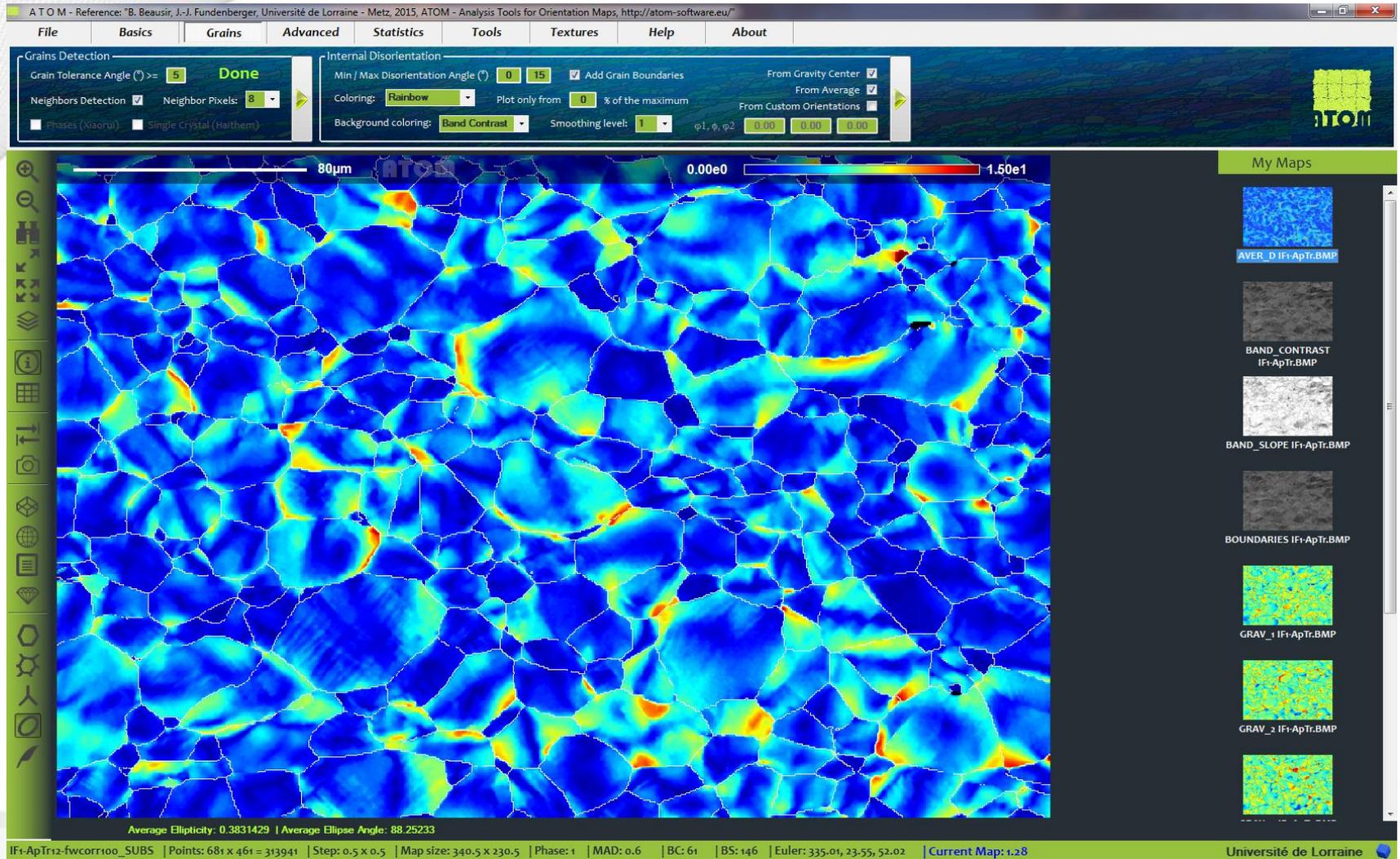
**My Maps**  
 BAND\_CONTRAST IFr-ApTr.BMP  
 BAND\_SLOPE IFr-ApTr.BMP  
 BOUNDARIES IFr-ApTr.BMP  
 IPF\_PH1 axis 0 0 1 IFr-ApTr.BMP  
 M.A.D. IFr-ApTr.BMP

**Average Ellipticity: 0.3831429 | Average Ellipse Angle: 88.25233**

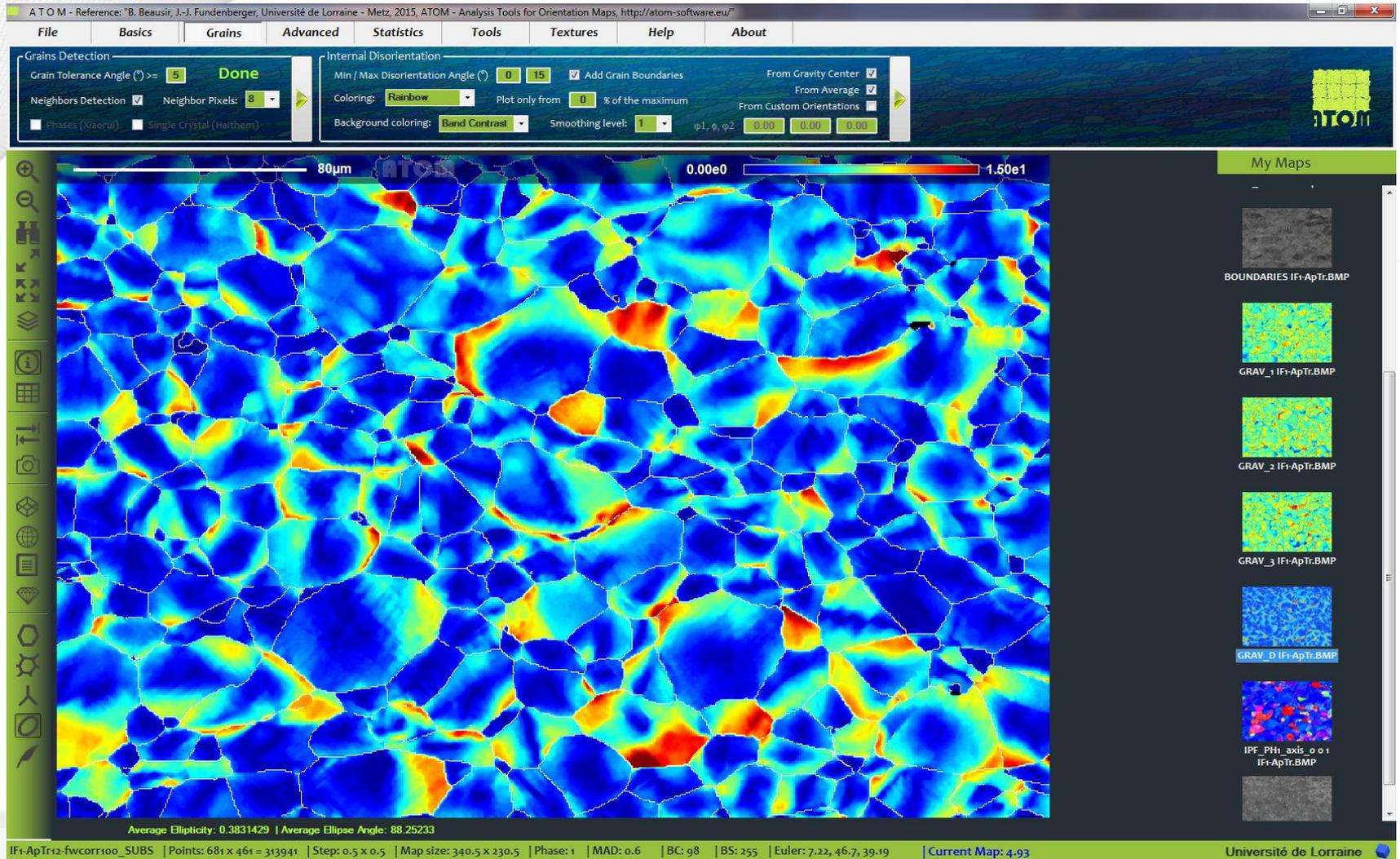
IFr-ApTr12-fwcorr100\_SUBS | Points: 681 x 461 = 313941 | Step: 0.5 x 0.5 | Map size: 340.5 x 230.5 | Phase: 1 | MAD: 0.6 | BC: 80 | BS: 226 | Euler: 203.17, 13.58, 14.04

Université de Lorraine

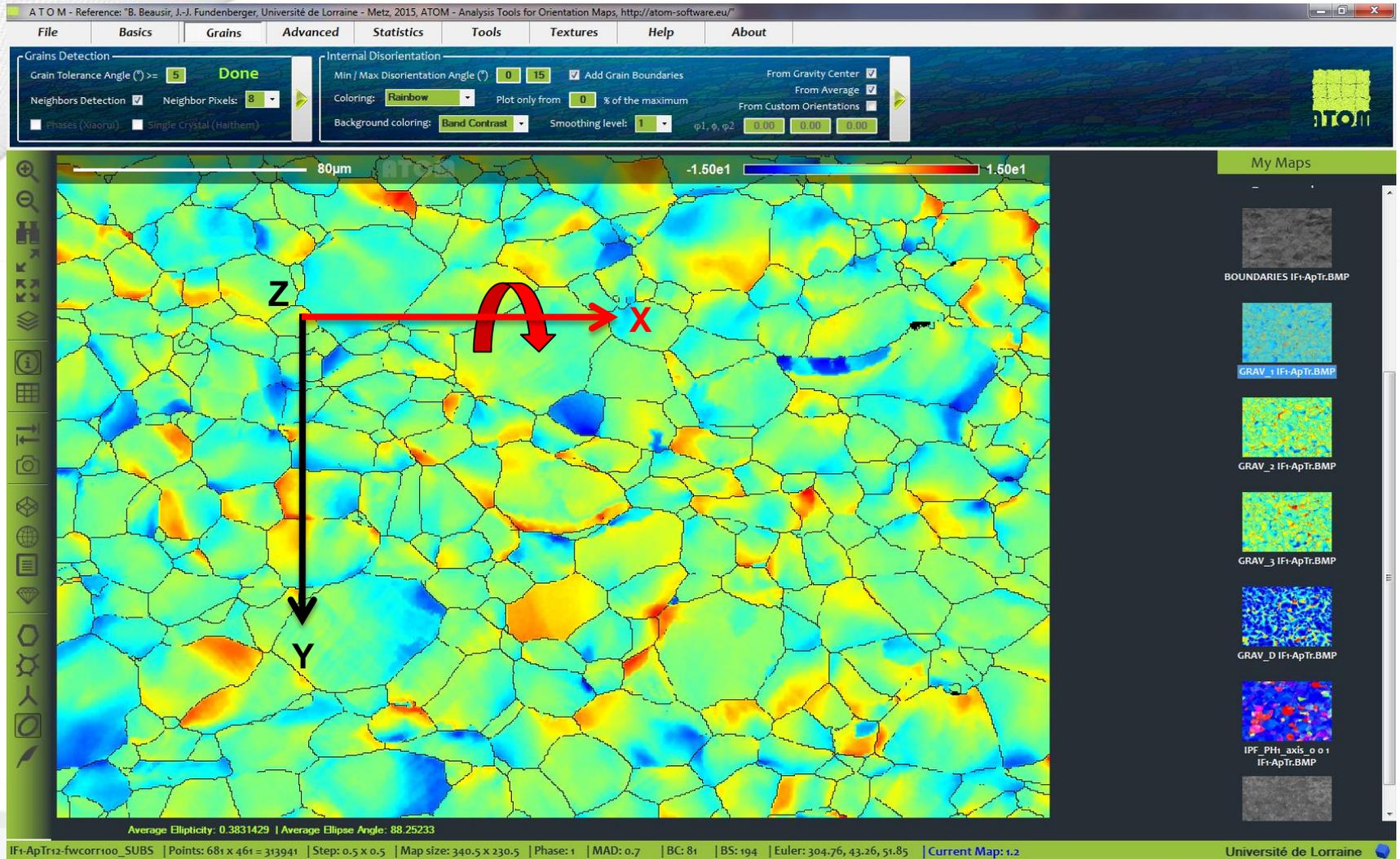
# Intragranular Quantities : Disor. from the average



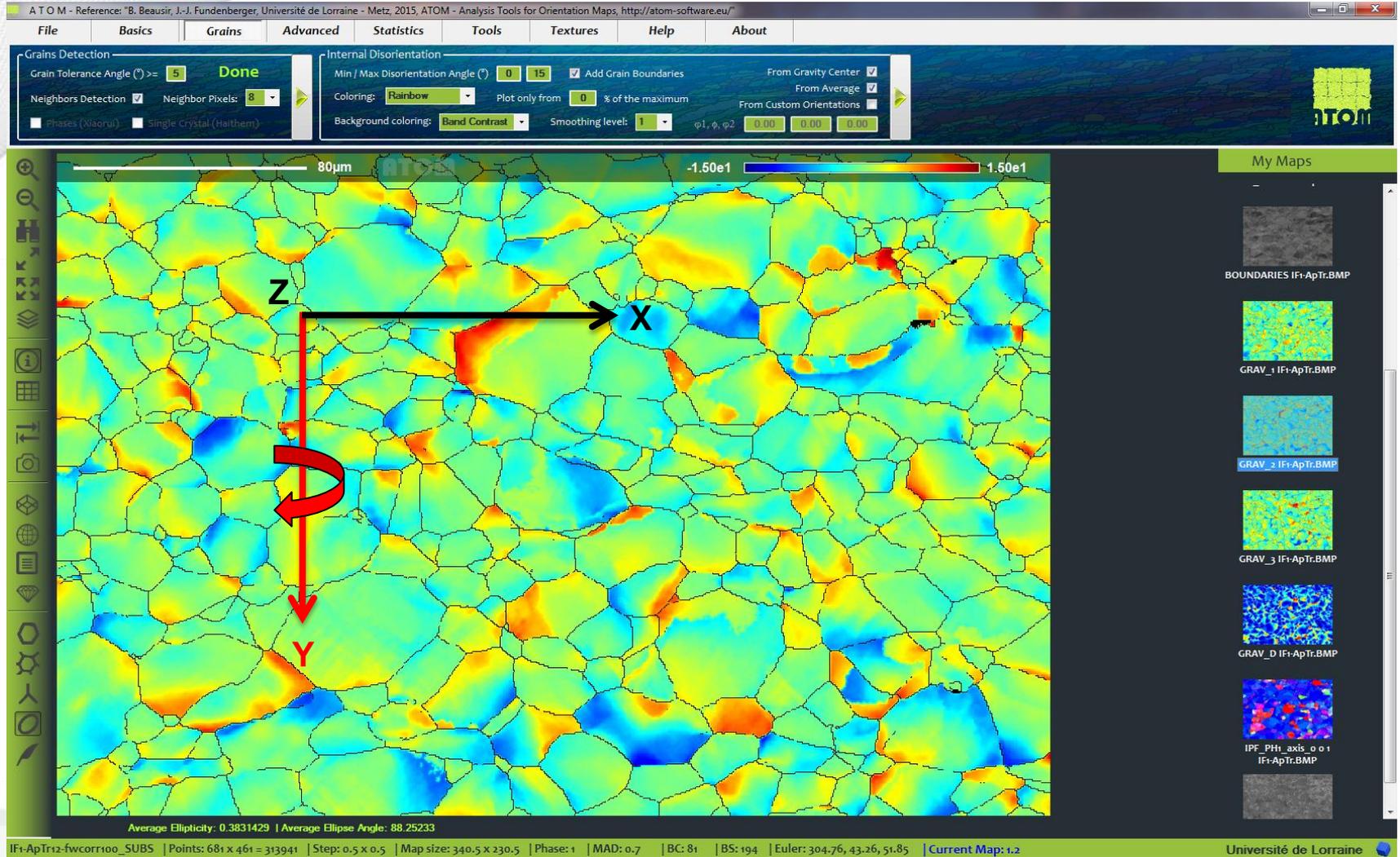
# Intragranular Quantities: Disor. from the gravity center



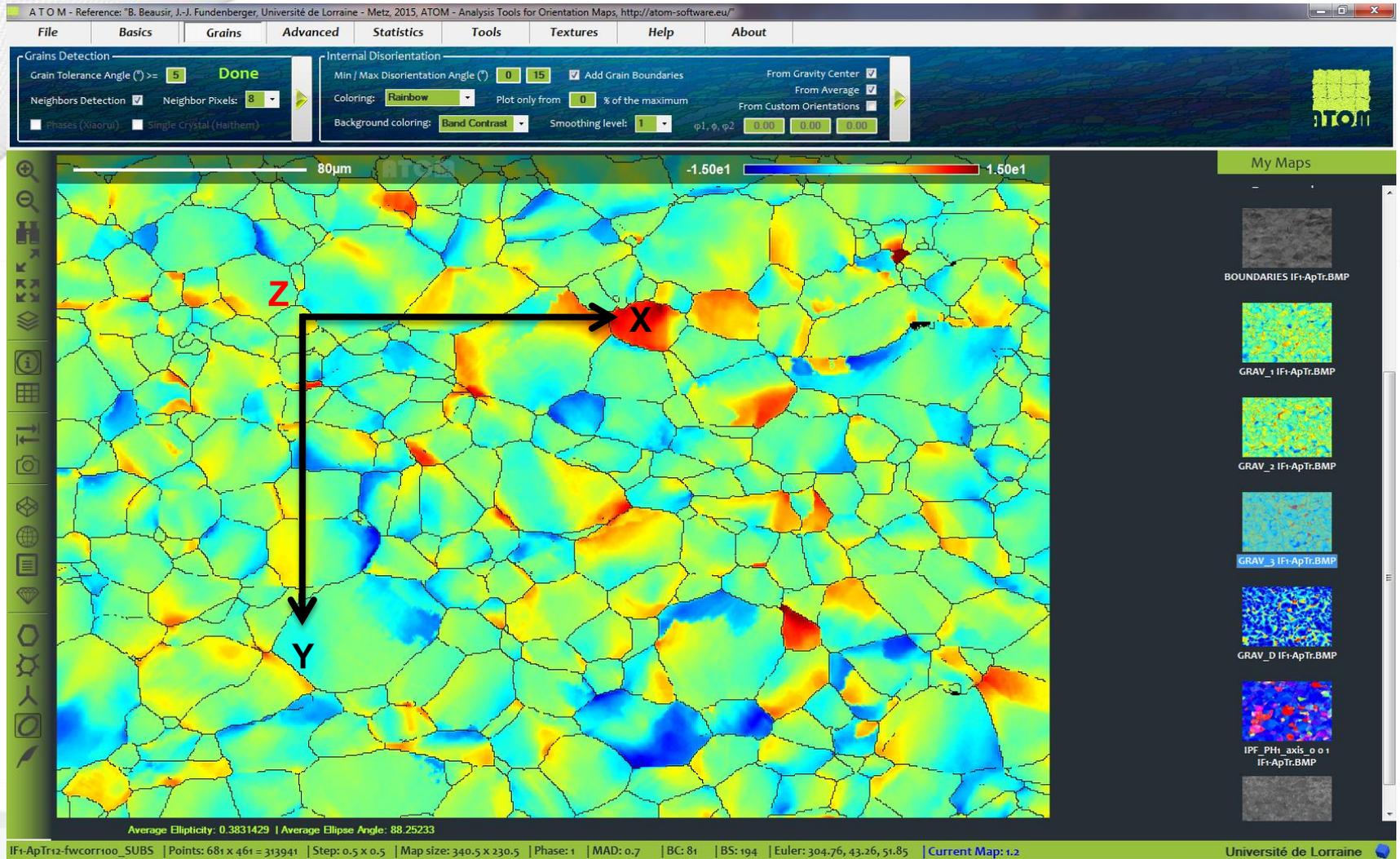
# Intragranular Quantities : Disor. / axis



# Intragranular Quantities : Disor. / axis



# Intragranular Quantities : Disor. / axis



# Geometrically Necessary Dislocations

ATOM - Reference: "B. Beausir, J.-J. Fundenberger, Université de Lorraine - Metz, 2015, ATOM - Analysis Tools for Orientation Maps, <http://atom-software.eu/>"

File Basics Grains Advanced Statistics Tools Textures Help About

Geometrically Necessary Dislocation and Disclinations

Min / Max Disorientation Angle (°) 0 5 Add Grain Boundaries  3D Step Z: 0.5  
 Coloring: Rainbow G.N.D.  Load layer +1 ...  
 Smooth level: 1 GND in Crystal Ref Sys.  Load layer +2 ...  
 Disclinations  See More

Schmid Factor  
 Tension Axis: 0 0 1  
 Slip system:  
 h k l: 1 1 1  
 u v w: 1 -1 0

Properties Network

80µm -1.64e-1 1.48e-1

My Maps

- BAND\_CONTRAST IF1-ApTr.BMP
- BAND\_SLOPE IF1-ApTr.BMP
- BOUNDARIES IF1-ApTr.BMP
- GND12 IF1-ApTr.BMP
- GND13 IF1-ApTr.BMP
- GND21 IF1-ApTr.BMP
- GND23 IF1-ApTr.BMP

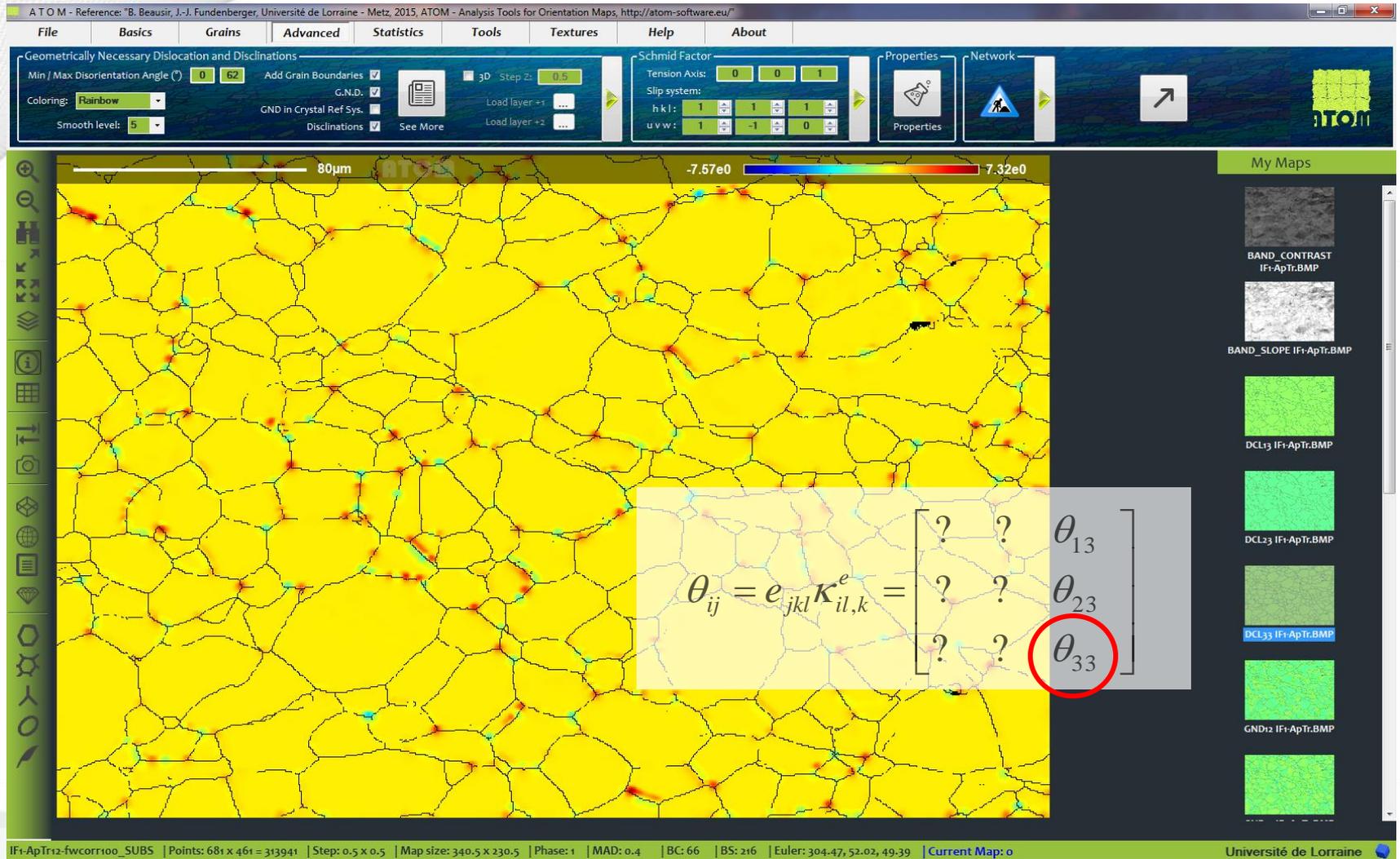
Average Ellipticity: 0.3831429 | Average Ellipse Angle: 88.25233

IF1-ApTr12-fwcorr100\_SUBS | Points: 681 x 461 = 313941 | Step: 0.5 x 0.5 | Map size: 340.5 x 230.5 | Phase: 1 | MAD: 0.4 | BC: 53 | BS: 138 | Euler: 197.56, 48.36, 54.89 | Current Map: -0.08 | Université de Lorraine

$$\alpha \cong \text{tr}(\kappa_e) \mathbf{I} - \kappa_e^t = \begin{bmatrix} ? & \alpha_{12} & \alpha_{13} \\ \alpha_{21} & ? & \alpha_{23} \\ ? & ? & \alpha_{33} \end{bmatrix}$$



# Disclinations



## Disclination densities from EBSD orientation mapping

B. Beausir, C. Fressengeas

International Journal of Solids and Structures 50 (2013) 137–146

# Schmid Factor

Schmid Factor

Tension Axis:

Slip system:

h k l:

u v w:

ATOM - Reference: "B. Beausir, J.-J. Fundenberger, Université de Lorraine - Metz, 2015, ATOM - Analysis Tools for Orientation Maps, <http://atom-software.eu/>"

File Basics Grains Advanced Statistics Tools Textures Help About

Geometrically Necessary Dislocation and Disclinations

Min / Max Disorientation Angle (°)   Add Grain Boundaries  3D Step Z:  Load layer +1 ... Load layer +2 ...

Coloring:  G.N.D.  Load layer +1 ... Load layer +2 ...

Smooth level:  GND in Crystal Ref Sys.  Disclinations  See More

Schmid Factor

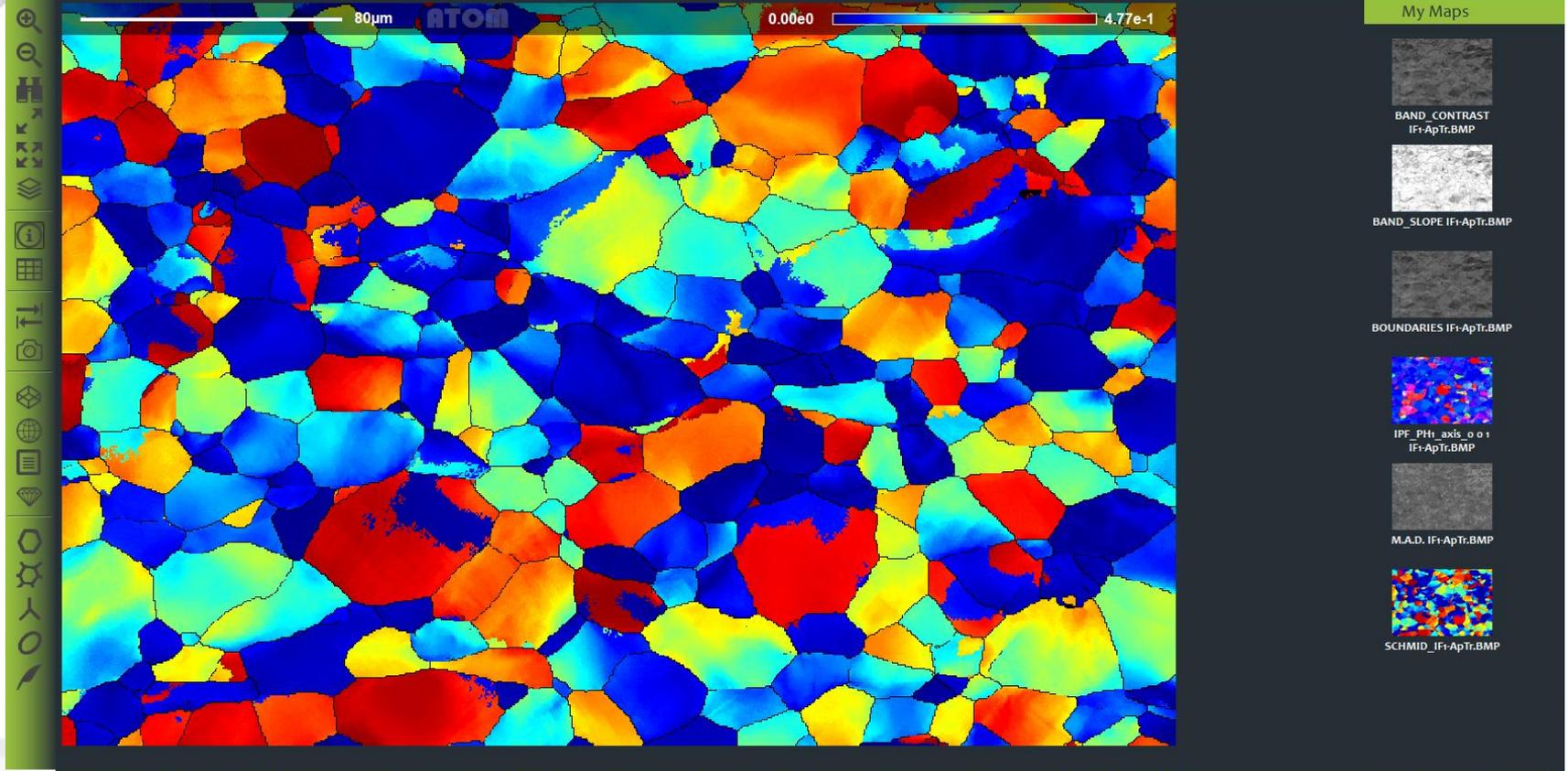
Tension Axis:

Slip system:

h k l:

u v w:

Properties Network



IFr-ApTr12-fwcorr100\_SUBS | Points: 681 x 461 = 313941 | Step: 0.5 x 0.5 | Map size: 340.5 x 230.5 | Phase: 1 | MAD: 0.4 | BC: 70 | BS: 229 | Euler: 116.2, 51.8, 44.75 | Current Map: 0.244285 | Université de Lorraine

# Properties of the polycrystal

ATOM - Reference: "B. Beausir, J.-J. Fundenberger, Université de Lorraine - Metz, 2015, ATOM - Analysis Tools for Orientation Maps, <http://atom-software.eu/>"

File Basics Grains Advanced Statistics Tools Textures Help About

Geometrically Necessary Dislocation and Disclinations  
 Min / Max Disorientation Angle (°) 0 5 Add Grain Boundaries  3D Step Z: 0.5  
 Coloring: Rainbow G.N.D.  Load layer +1 ...  
 Smooth level: 1 GND in Crystal Ref Sys.  Load layer +2 ...  
 Disclinations  See More

Schmid Factor  
 Tension Axis: 0 0 1  
 Slip system:  
 h k l: 1 1 1  
 u v w: 1 -1 0

Properties Network

80µm 1.68e2 2.35e2

My Maps

RAND CONTRAST

Materials

To add or modify a material, you can edit the properties.ini file located in the install directory.

Elastic Stiffness Thermal Properties Electrical Properties Mechanical Properties

C in Voigt matrix representation (GPa)

11	168.09	121.45	121.45	0	0	0
22	121.45	168.09	121.45	0	0	0
33	121.45	121.45	168.09	0	0	0
23	0	0	0	75.11	0	0
31	0	0	0	0	75.11	0
12	0	0	0	0	0	75.11

Voigt

211.79	103.28	95.92	1.79	-0.07	0.58
103.28	215.81	91.9	-0.67	-0.13	-0.95
95.92	91.9	223.17	-1.13	0.21	0.38
1.79	-0.67	-1.13	45.56	0.38	-0.13
-0.07	-0.13	0.21	0.38	49.58	1.79
0.58	-0.95	0.38	-0.13	1.79	56.94

Reuss

192.61	113.62	104.76	2.86	-0.1	1
113.62	197.41	99.96	-0.76	-0.37	-2.07
104.76	99.96	206.28	-2.1	0.46	1.06
2.86	-0.76	-2.1	132.67	1	-0.34
-0.1	-0.37	0.46	1	143.67	6.22
1	-2.07	1.06	-0.34	6.22	169.21

Hill

202.2	108.45	100.34	1.61	-0.06	0.54
108.45	206.61	95.93	-0.53	-0.16	-0.99
100.34	95.93	214.72	-1.09	0.22	0.45
1.61	-0.53	-1.09	39.36	0.31	-0.11
-0.06	-0.16	0.22	0.31	42.75	1.67
0.54	-0.99	0.45	-0.11	1.67	49.62

Component (Map to be plotted): 1 1

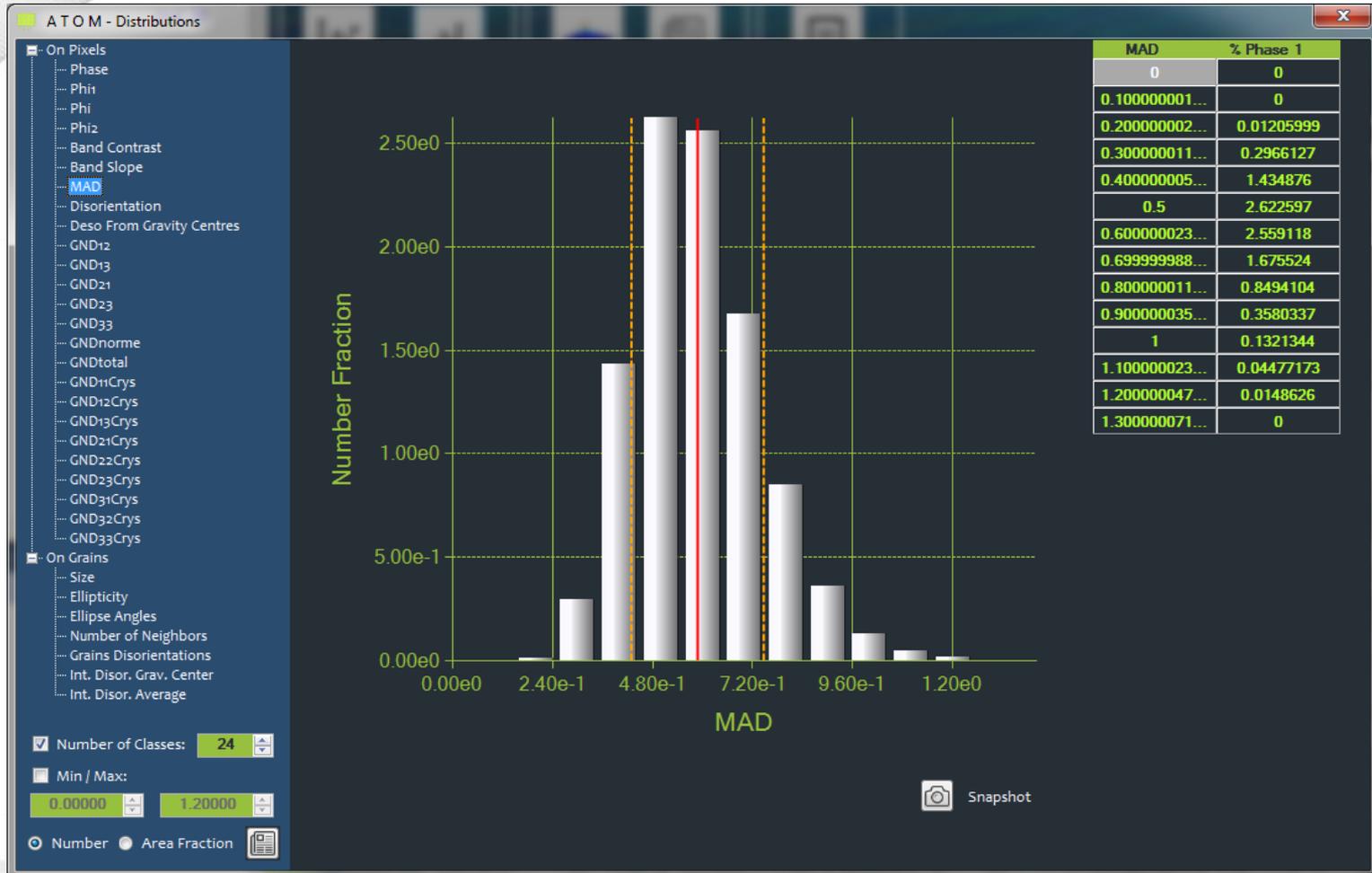
Voigt  Reuss  Hill

Add Grain Boundaries on Maps

IF1-ApTr12-fwcorr100\_SUBS | Points: 681 x 461 = 313941 | Step: 0.5 x 0.5 | Map size: 344

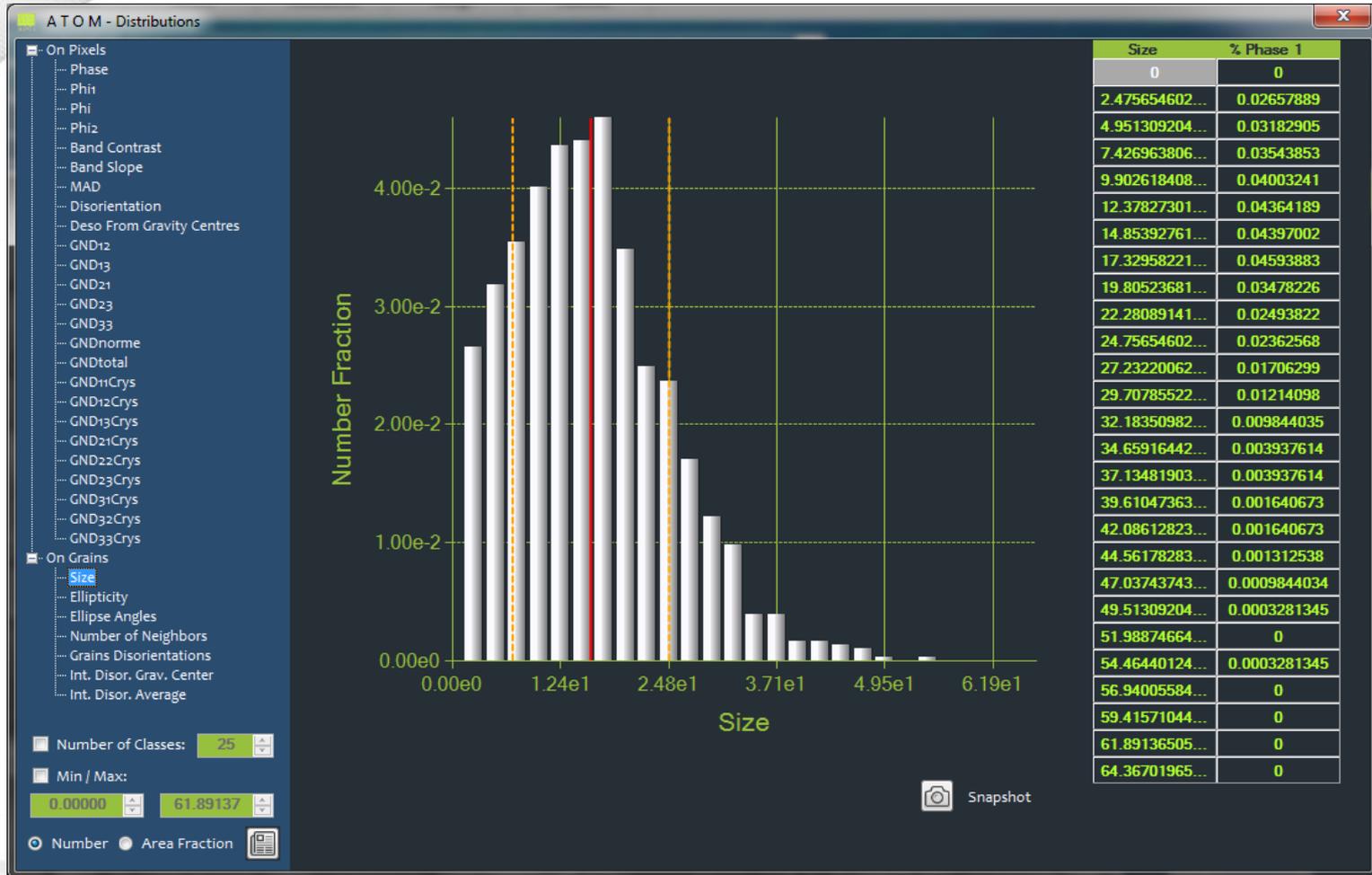
# Distributions

➔ MAD Distribution



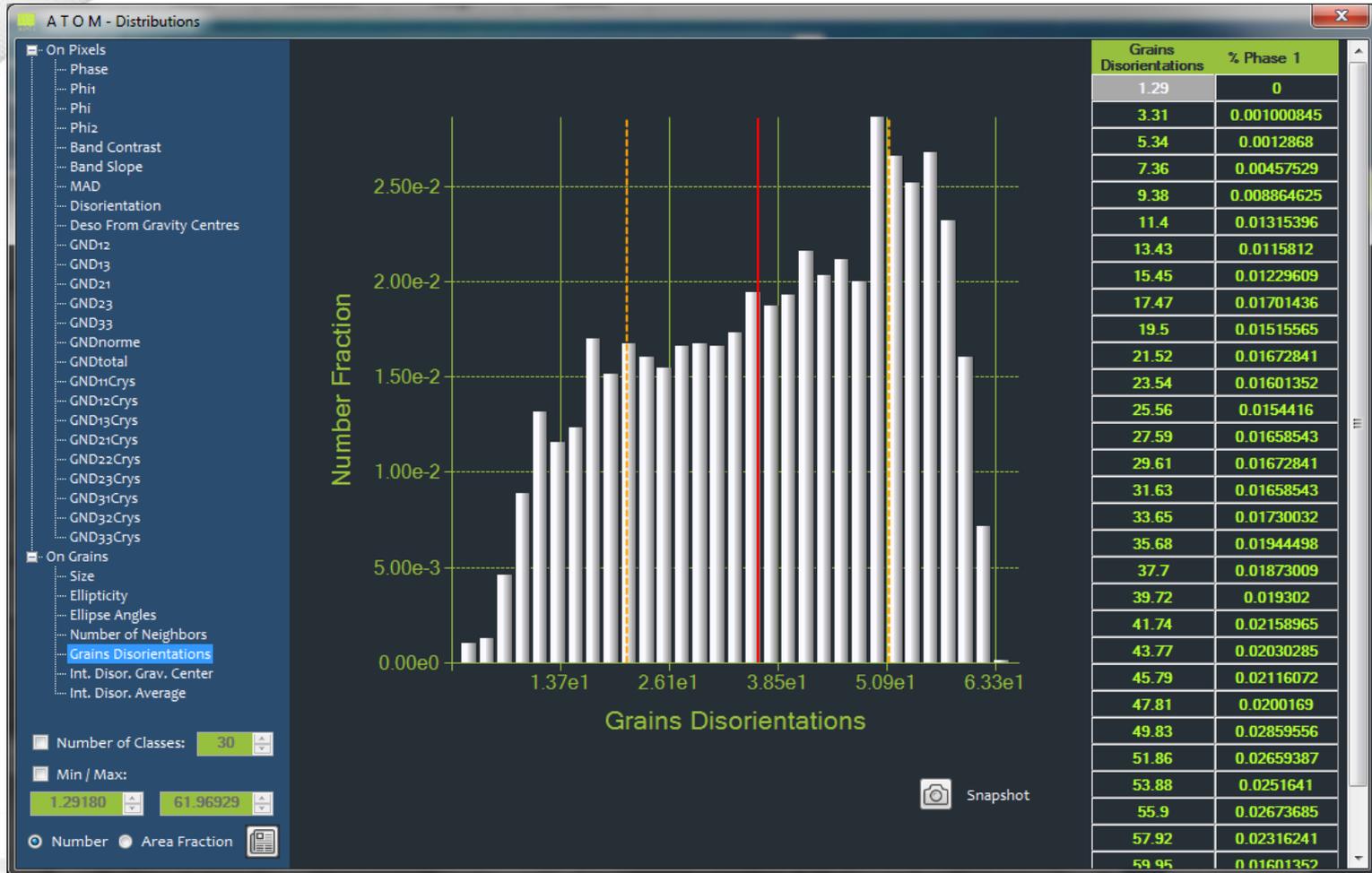
# Distributions

➔ Grain Size Distribution

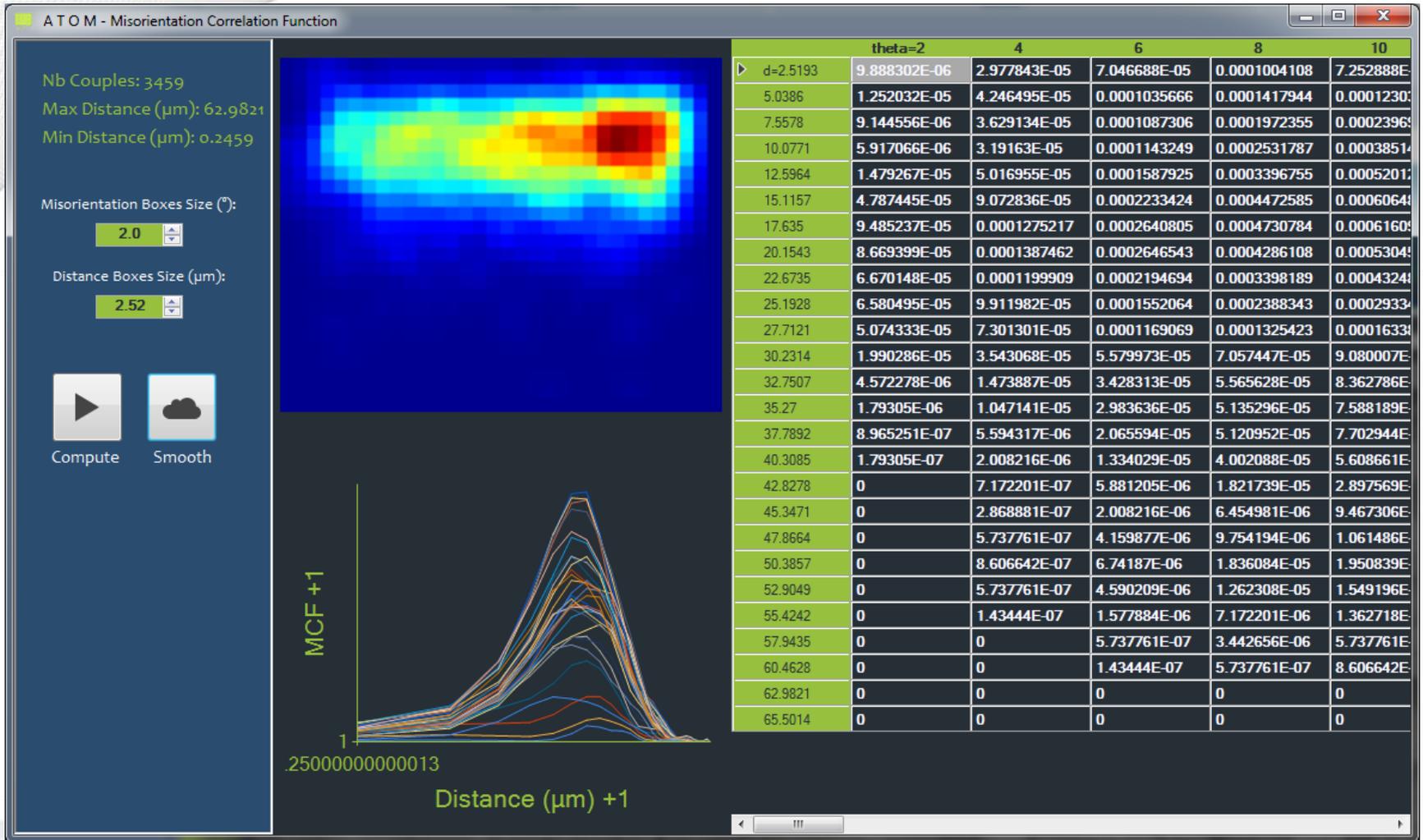


# Distributions

➔ Grain Disorientation Distribution



# Misorientation Correlation Function



## Spatial correlation in grain misorientation distribution

B. Beausir, C. Fressengeas, N. P. Gurao, L. S. Toth, S. Suwas

*Acta Materialia* 57 (2009) 5382–5395

# Local Informations: Lattice Orientation

ATOM - Reference: "B. Beausir, J.-J. Funderberger, Université de Lorraine - Metz, 2015, ATOM - Analysis Tools for Orientation Maps, <http://atom-software.eu/>"

File Basics Grains Advanced Statistics Tools Textures Help About

Distribution Instant Plots Distributions Mis. Correlation Function M. C. F. See More Results Show Results

80µm

My Maps

- BAND\_CONTRAST IFr-ApTr.BMP
- BAND\_SLOPE IFr-ApTr.BMP
- BOUNDARIES IFr-ApTr.BMP
- IPF\_PHI\_axis\_0\_0\_1 IFr-ApTr.BMP
- M.A.D. IFr-ApTr.BMP
- PROPER\_IFr-ApTr.BMP
- SCHMID\_IFr-ApTr.BMP

ATOM - Unit Cell Orientation

Phase: 1  
 BC: 99  
 BS: 255  
 MAD: 0.4  
 X= 230.4, Y= 39.16  
 Euler: 215.37, 43.72, 46.29

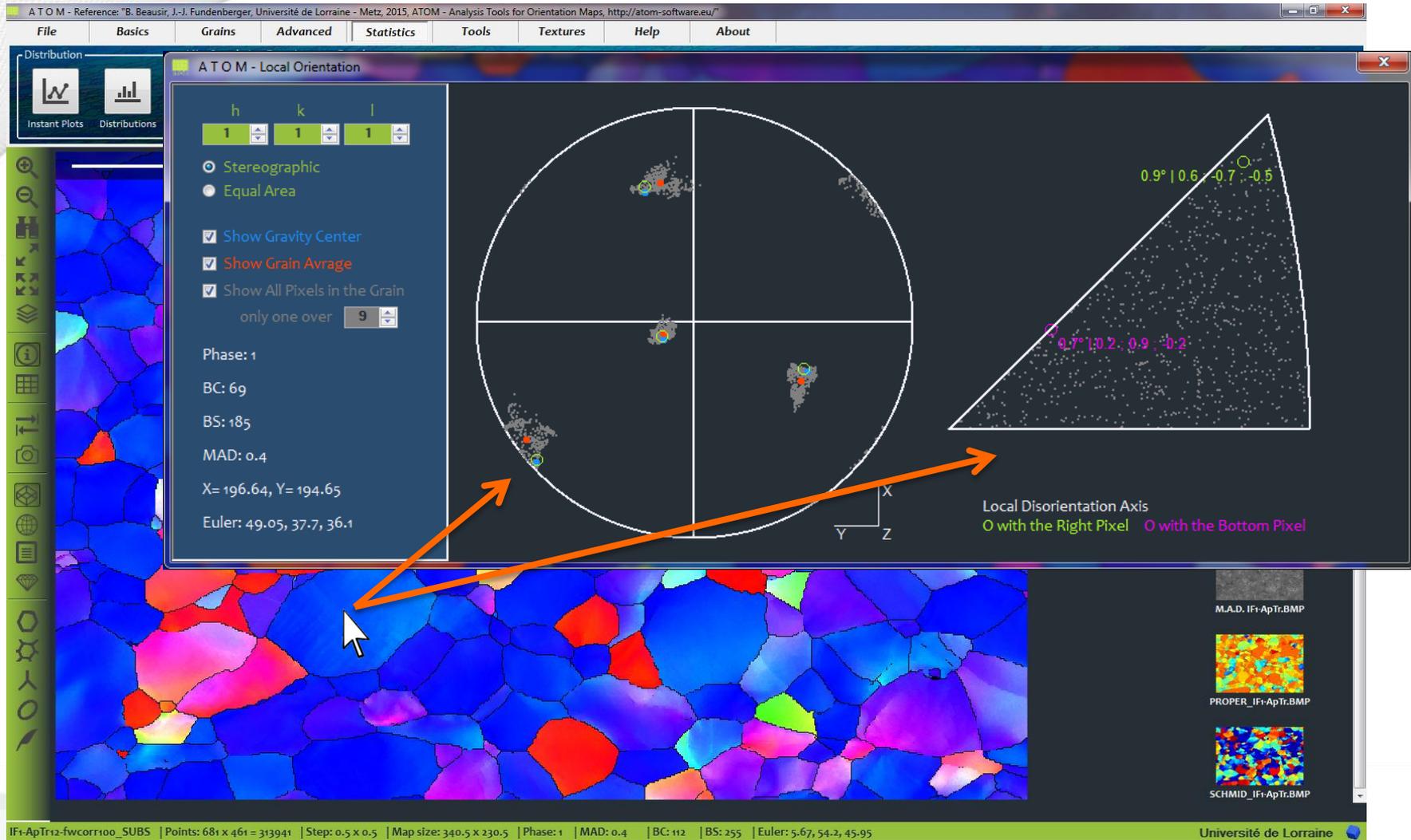
Show Faces  
 Show Edges

Zoom

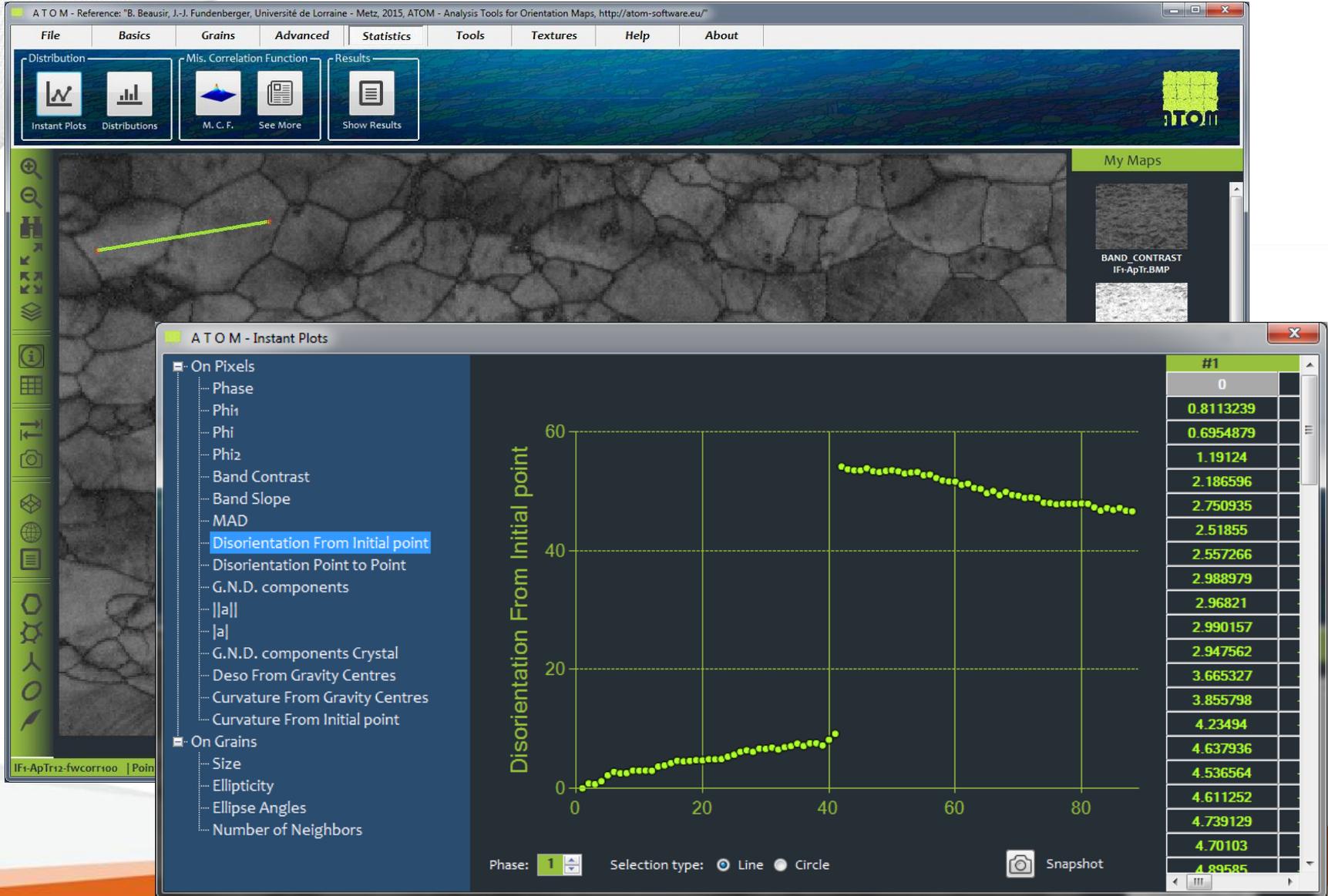
Pick a point on the map to save a png file of the unit cell

X Y Z

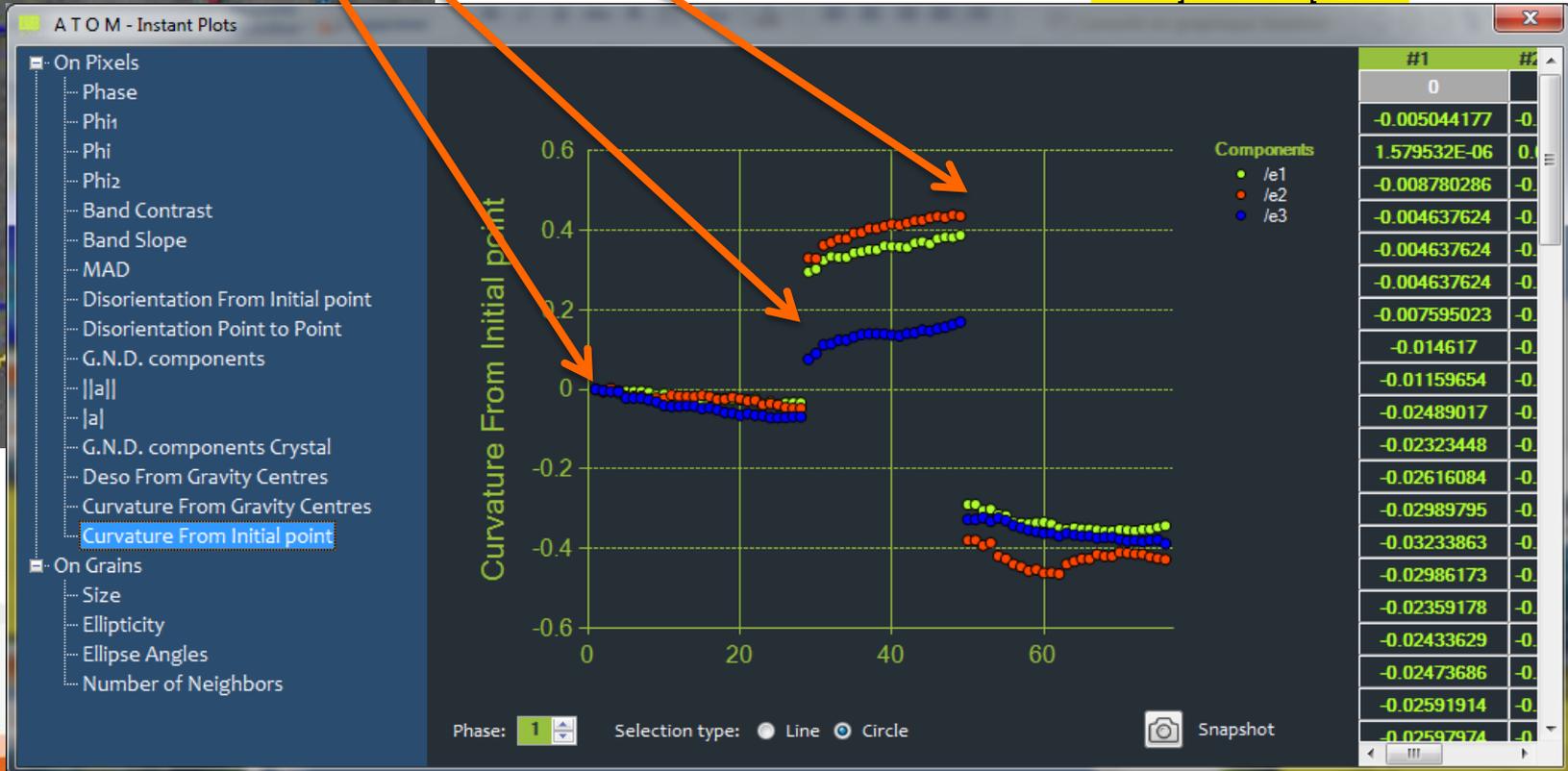
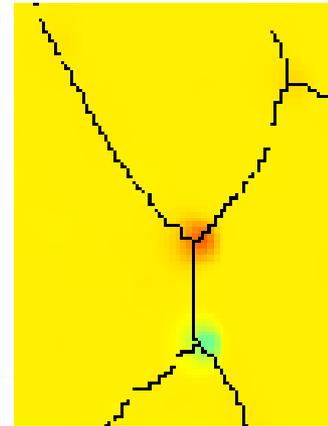
Université de Lorraine



# Local Informations

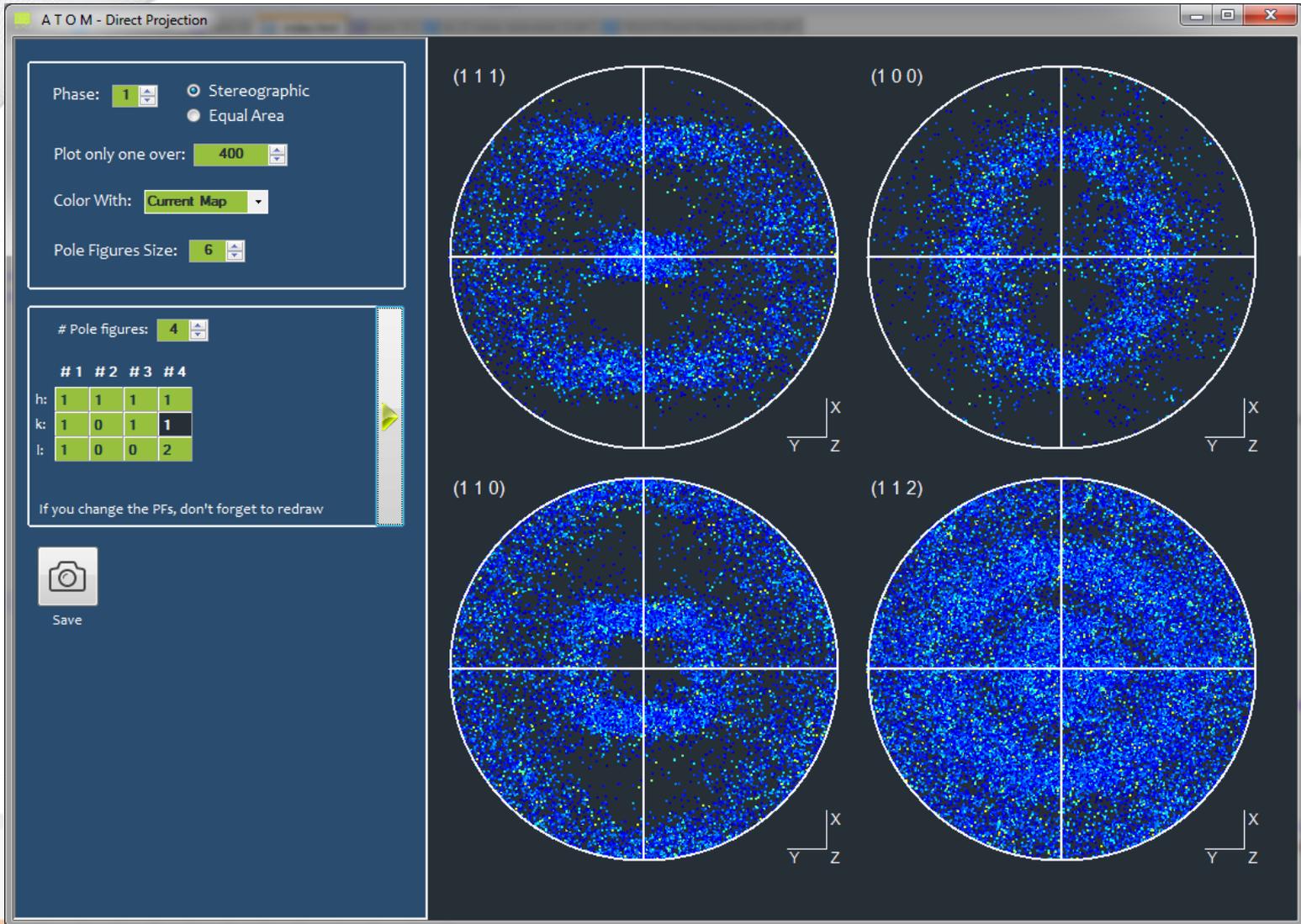


# Local Informations



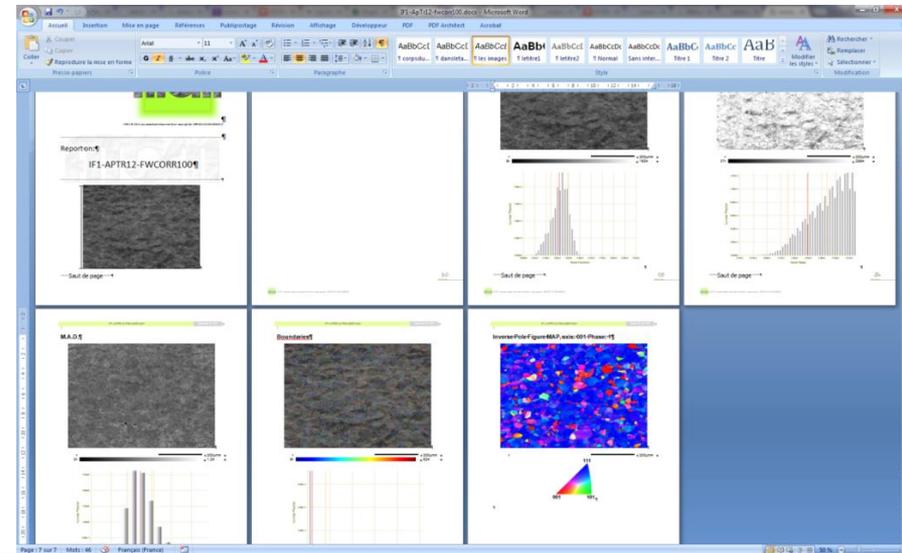
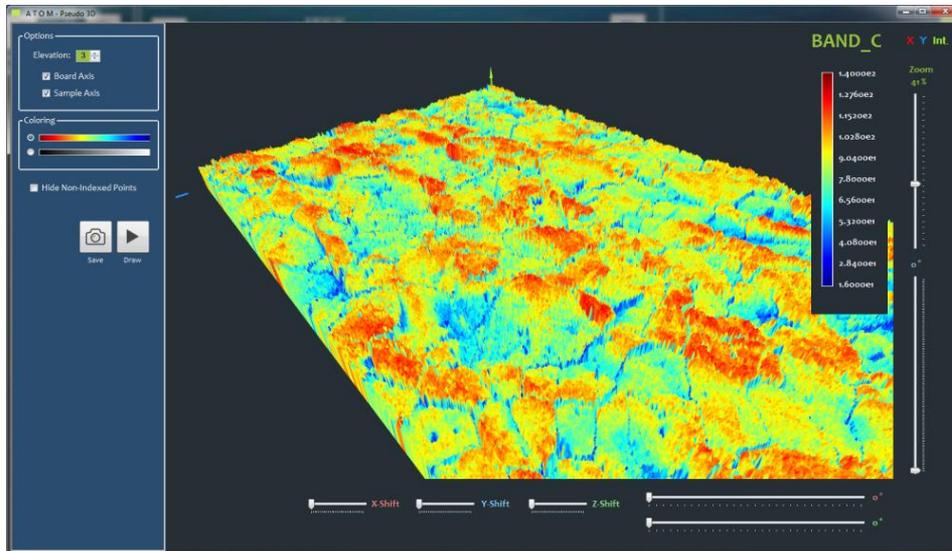


# Textures: Orientations on Pole Figures



## Miscellaneous

- ✦ Corrections, Noise Reduction
- ✦ Imaging Filtre (High Pass, Laplacian, Smoothing...)
- ✦ SuperImpose Maps
- ✦ Pseudo 3D view
- ✦ Reports



## Outlines

### ❖ ATOM Software

- ❖ EBSD data – IF Steel after 12% Rolling

### ➔ ❖ JTEX Software

- ❖ X-Ray measurements on Cu deformed by two passes ECAP

**JTEX** Université de Lorraine

open	pole figures	euler sections	i.p.f.	x-ray	exit		
save	simulations	compare	components	prop.	tools	options	help

**FSM448\_RCX.jtx**  
C-coefficients file - CUBIC; 1; 1; 1 - 90; 90; 90  
Coef. from Xray, L\_Even=34, L\_Odd=33 PF\_Exp: (111)(200)(220)(311)

Close Jtex  
Minimize Window  
Open Help  
About  
License  
Switch Screen  
Switch Wallpaper  
Calculator  
Users  
References

Please cite: J.-J. Fundenberger, B. Beausir, Université de Lorraine - Metz, 2015, JTEX - Software for Texture Analysis, <<http://jtex-software.eu/>>

# Input File Formats: Three Kinds

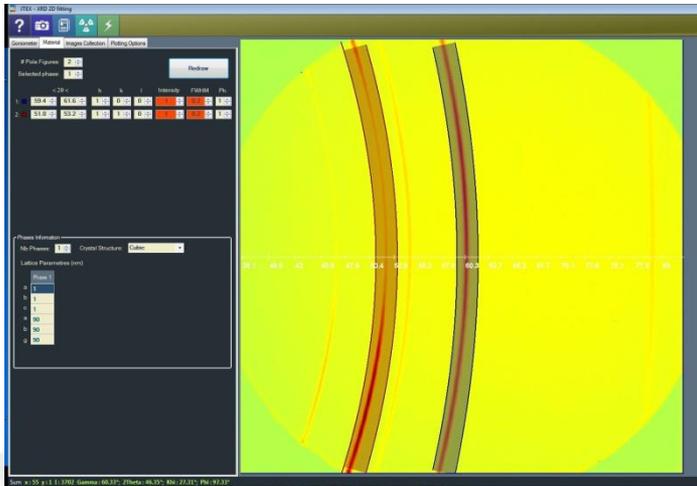
From Single Orientations

- \*.CTF \*.CPR/CRC (Channel5 Text Files)
- \*.ANG , \*.OSC (from TSL software)
- \*.ATM (From ATOM)
- Any \*.TXT (Euler Angles)

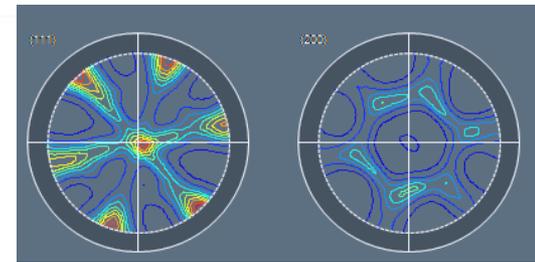
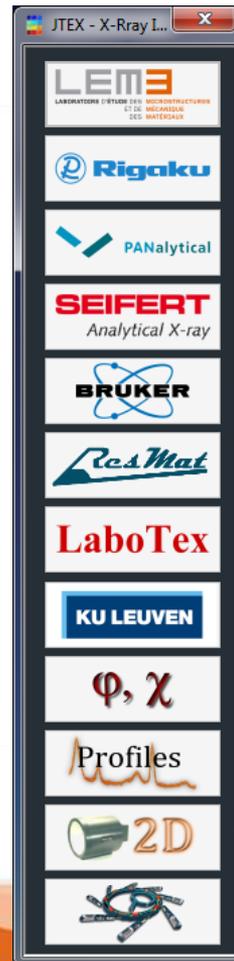
From XRD measurements

From Spherical Harmonic Coeff.

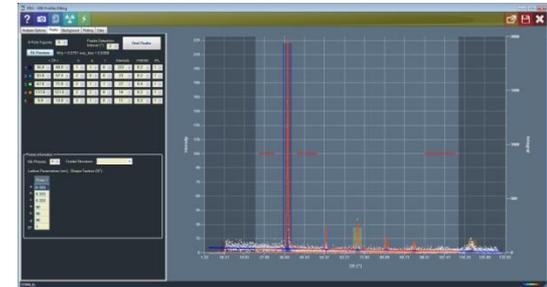
\*.CLM (C-Coefficients)



2D Detector



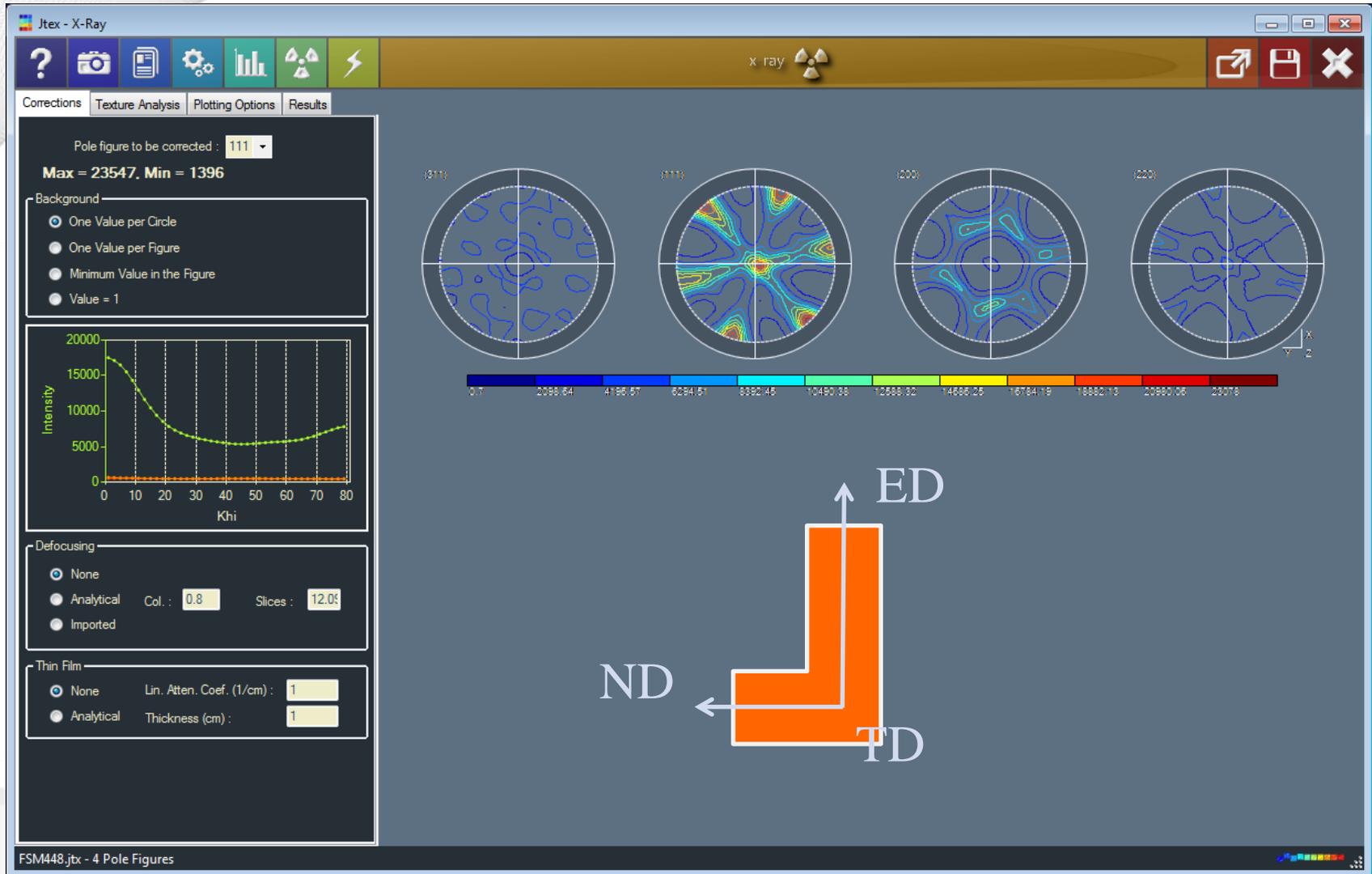
Pole Figures



Diffraction Profiles

Synchrotron (not yet finish)

# X-ray Pole figures



# X-ray PF – Corrections: Background

**Jtex - X-Ray**

Corrections | Texture Analysis | Plotting Options | Results

Pole figure to be corrected : **111**  
 Max = 23547, Min = 1396

Background

- One Value per Circle
- One Value per Figure
- Minimum Value in the Figure
- Value = 1

**Initial**

(111) (111) (200) (200)

Intensity vs K<sub>h</sub> graph (Initial):

K <sub>h</sub>	Intensity
0	20000
10	15000
20	10000
30	7000
40	6000
50	5500
60	5000
70	5000
80	5000

Color scale: 0.7 to 23078

---

**Jtex - X-Ray**

Corrections | Texture Analysis | Plotting Options | Results

Pole figure to be corrected : **111**  
 Max = 23547, Min = 1396

Background

- One Value per Circle
- One Value per Figure
- Minimum Value in the Figure
- Value = 10000

**Corrected**

(111) (111) (200) (200)

Intensity vs K<sub>h</sub> graph (Corrected):

K <sub>h</sub>	Intensity
0	20000
10	15000
20	10000
30	7000
40	6000
50	5500
60	5000
70	5000
80	5000

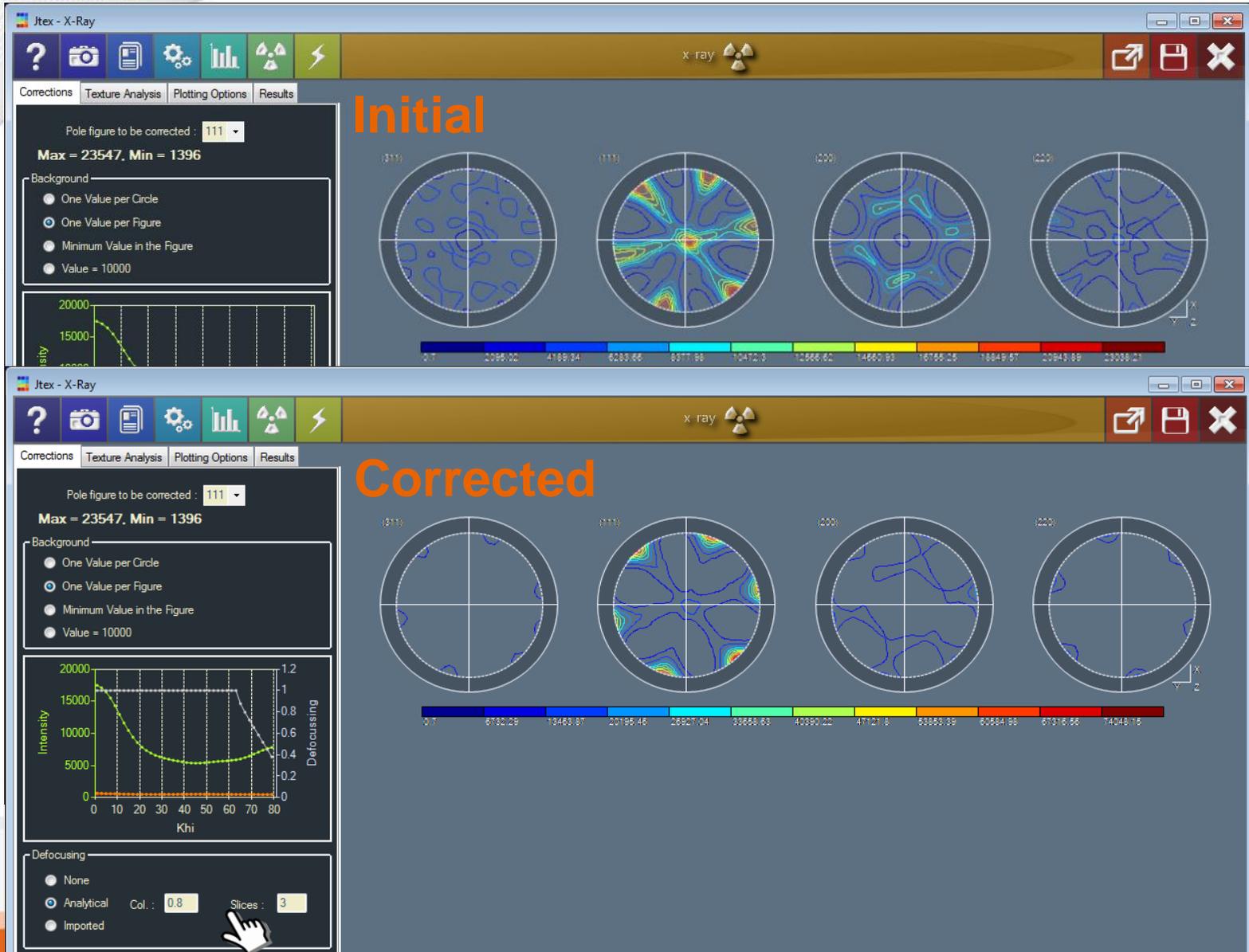
Color scale: 0.7 to 13547

Enter Background value dialog:

Enter Background Value :

Buttons: OK, Annuler

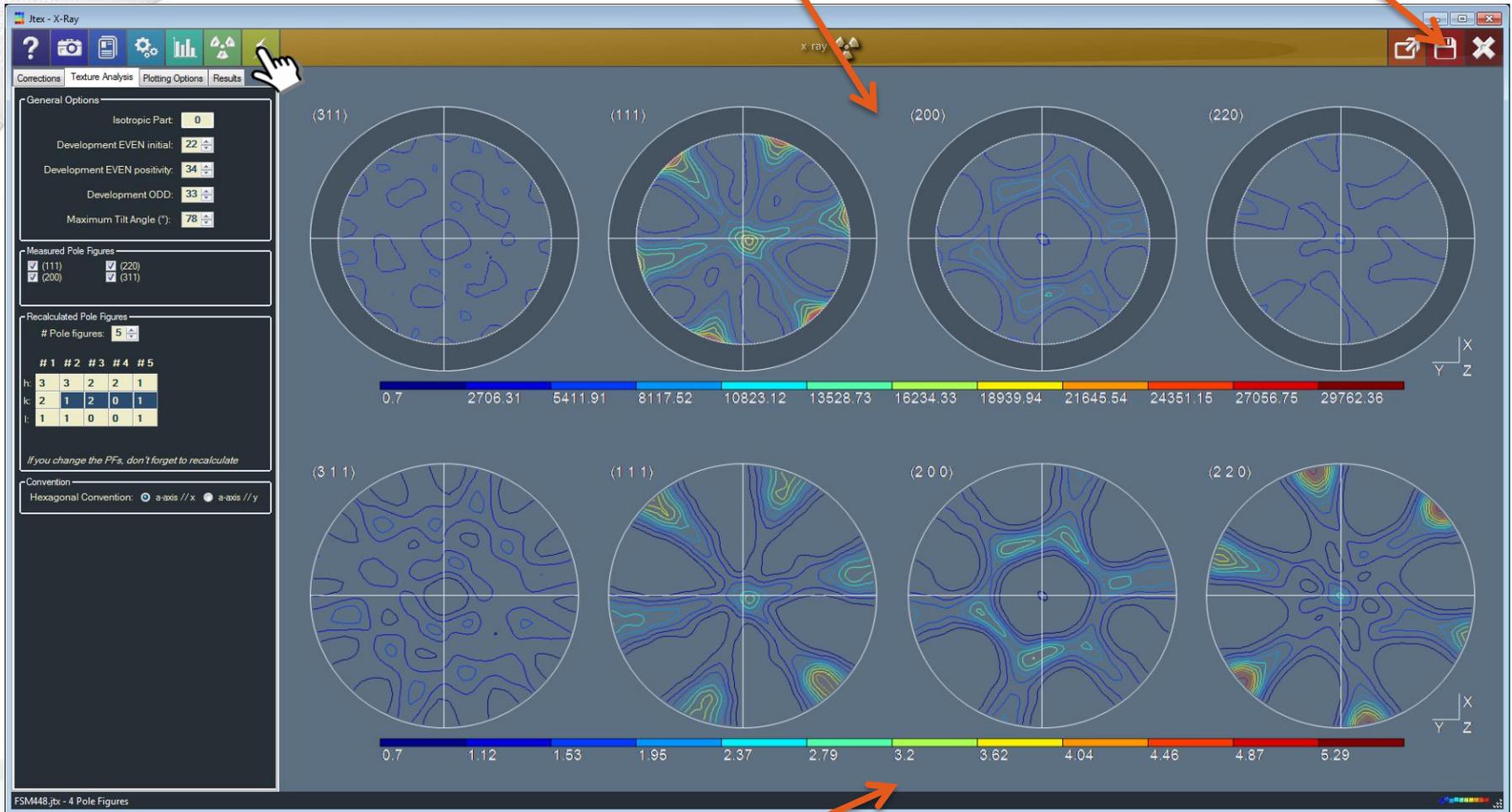
# X-ray PF – Corrections: Defocalization



# X-ray Pole Figures: Analysis

Incomplete Measured Pole Figures

Save as \*\_RCX.jtx file



Calculated Pole Figures

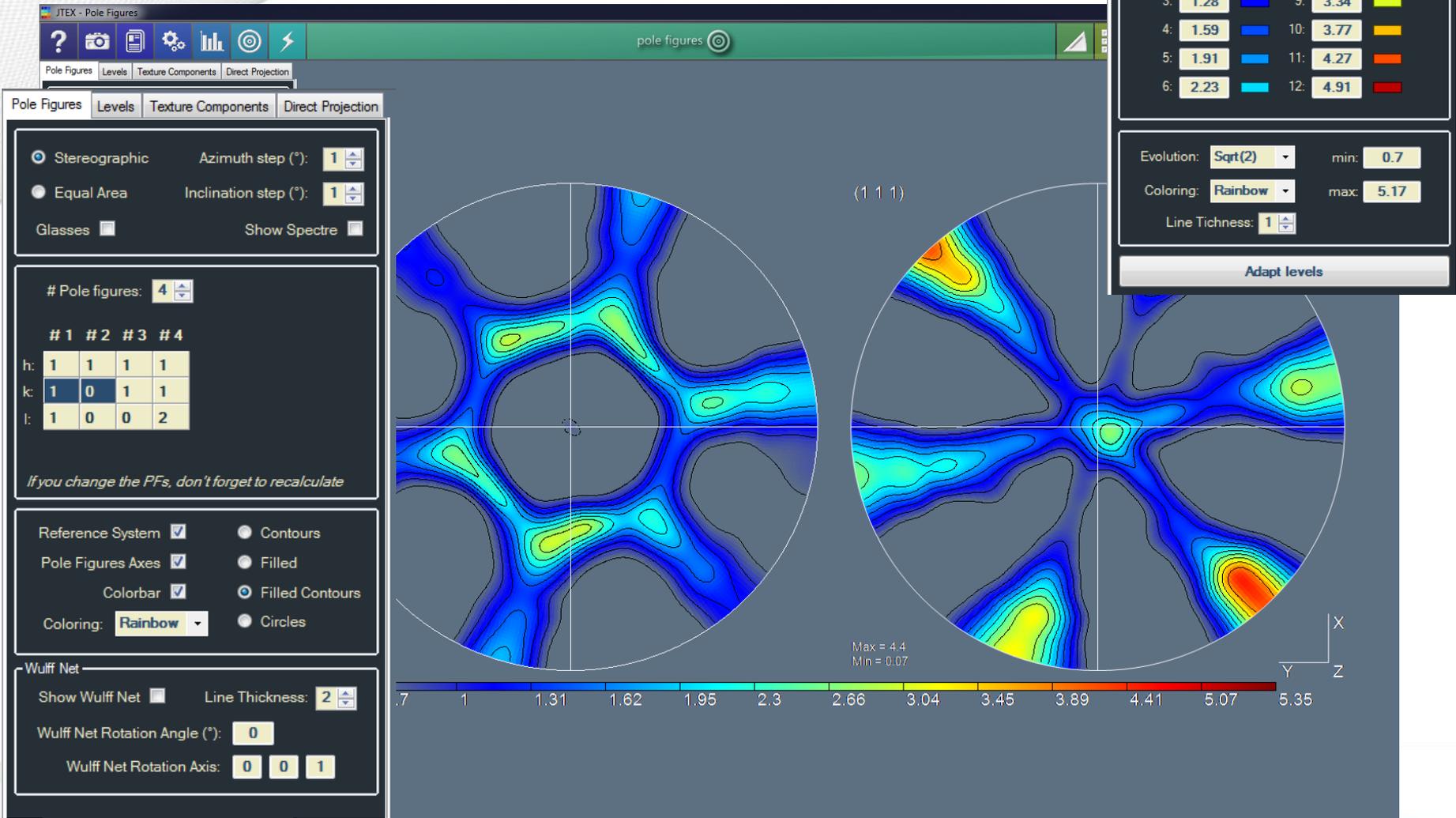
**JTEX** Université de Lorraine

open	pole figures	euler sections	i.p.f.	x-ray	exit		
save	simulations	compare	components	prop.	tools	options	help

**FSM448\_RCX.jtx**  
C-coefficients file - CUBIC; 1; 1; 1 - 90; 90; 90  
Coef. from Xray, L\_Even=34, L\_Odd=33 PF\_Exp: (111)(200)(220)(311)

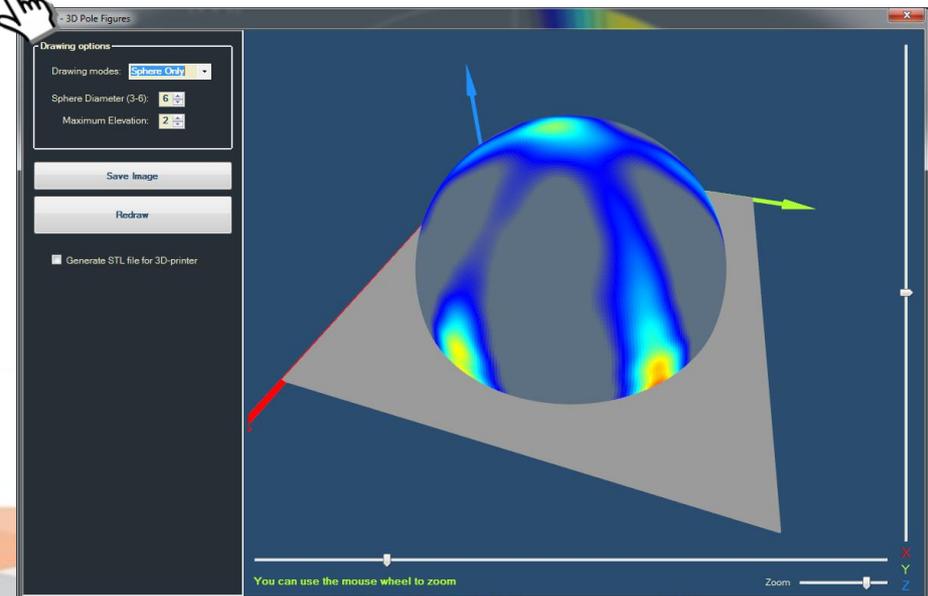
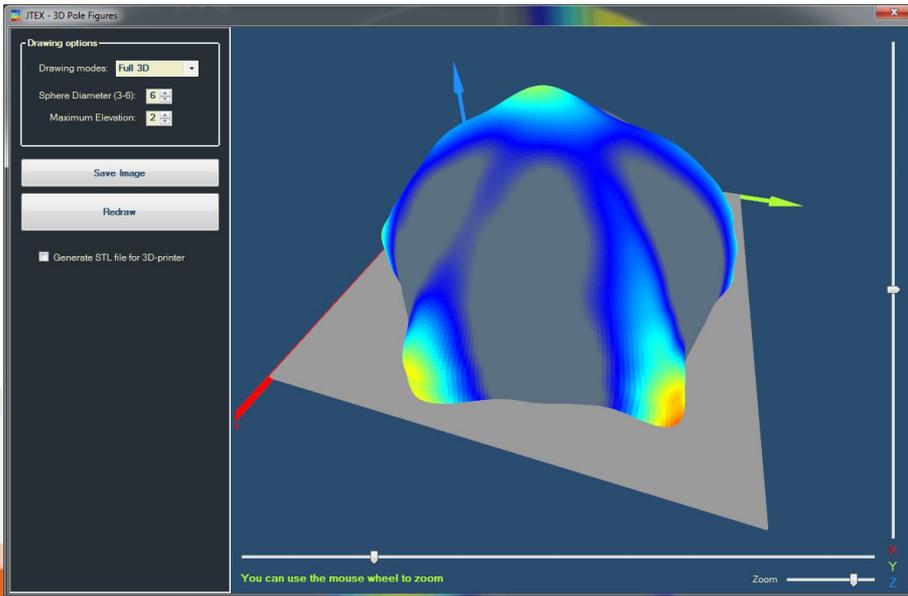
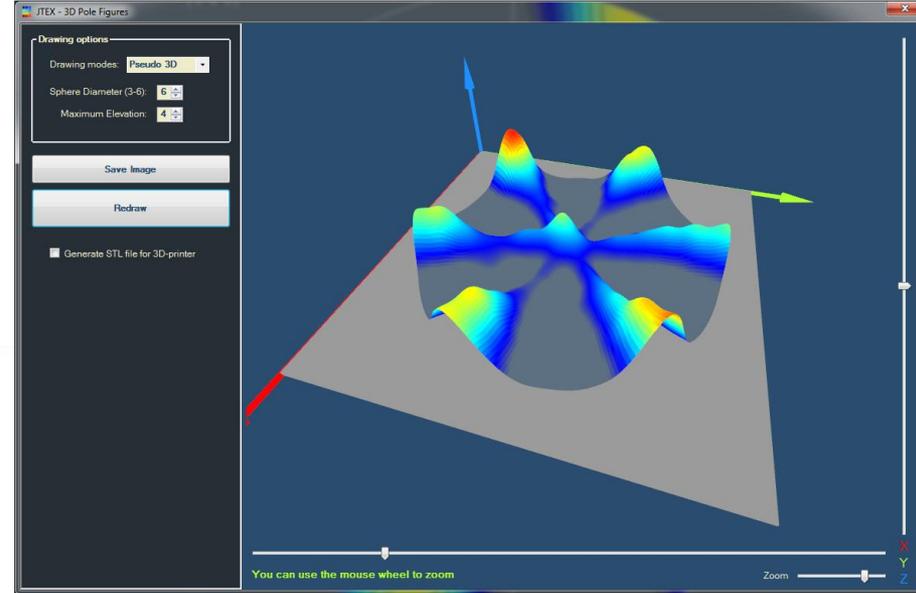
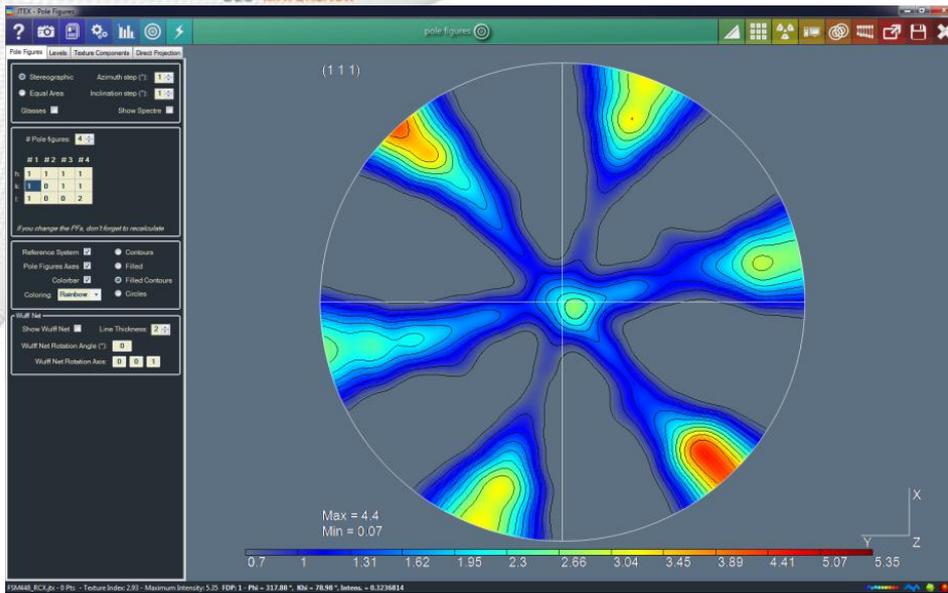
Please cite: J.-J. Fundenberger, B. Beausir, Université de Lorraine - Metz, 2015, JTEX - Software for Texture Analysis, <<http://jtex-software.eu/>>

# Pole Figures

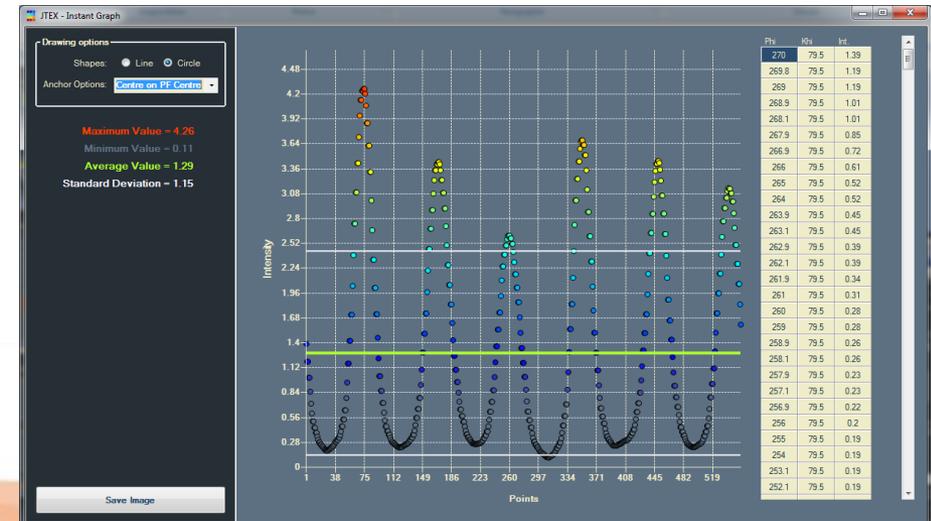
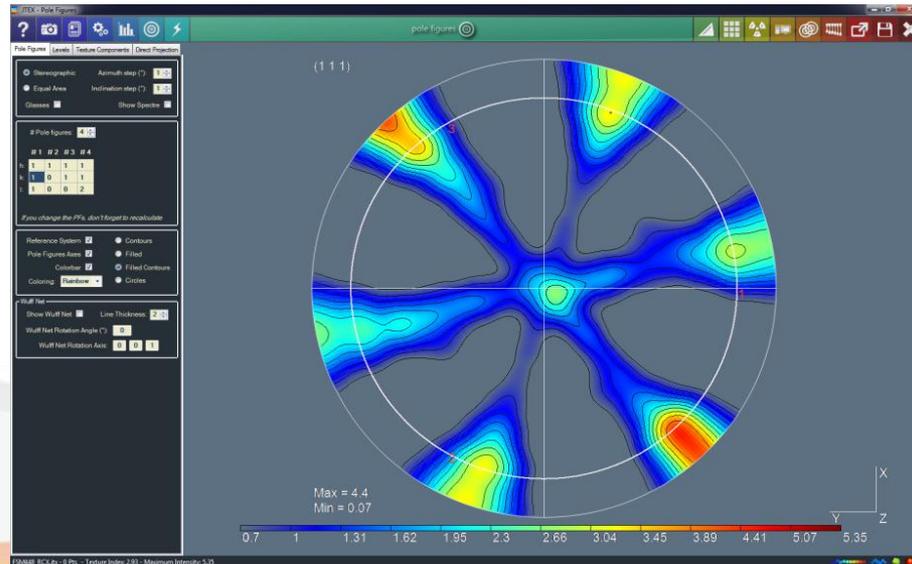
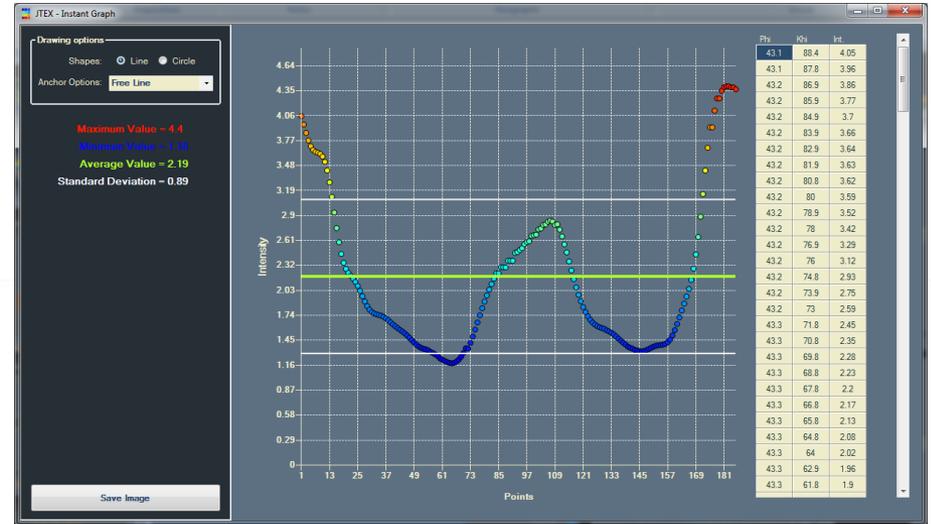
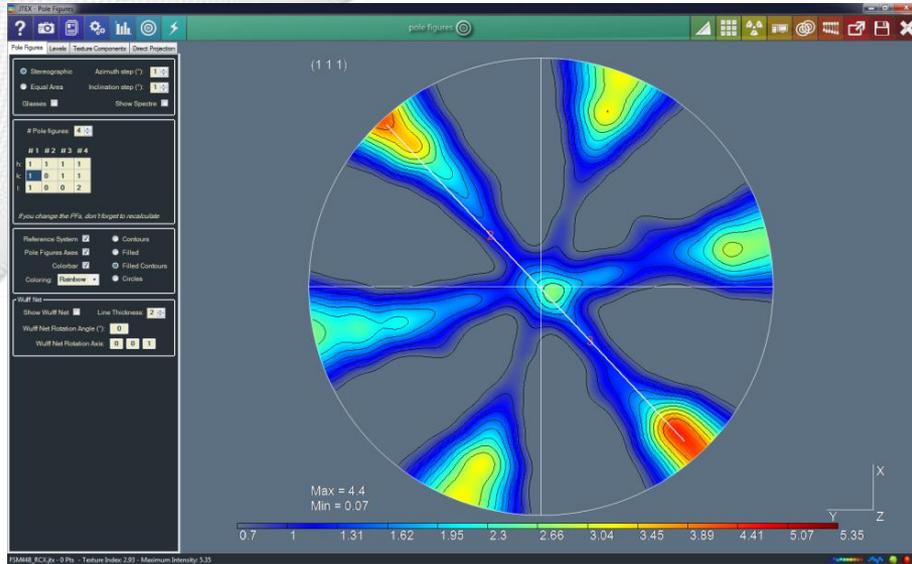


FSM448\_RCC\jtx - 0 Pts - Texture Index: 2.93 - Maximum Intensity: 5.35

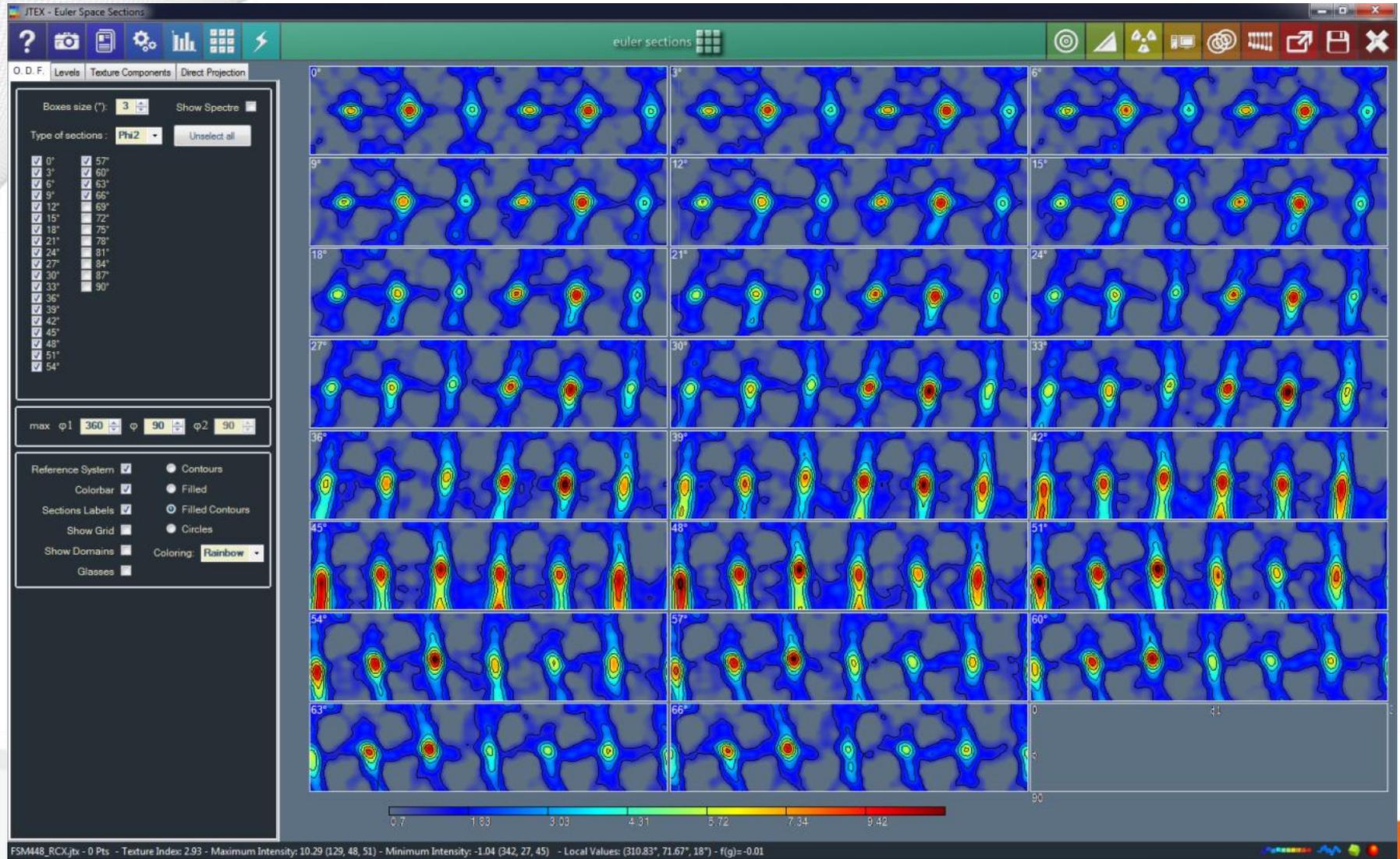
# Pole Figures: 3D view



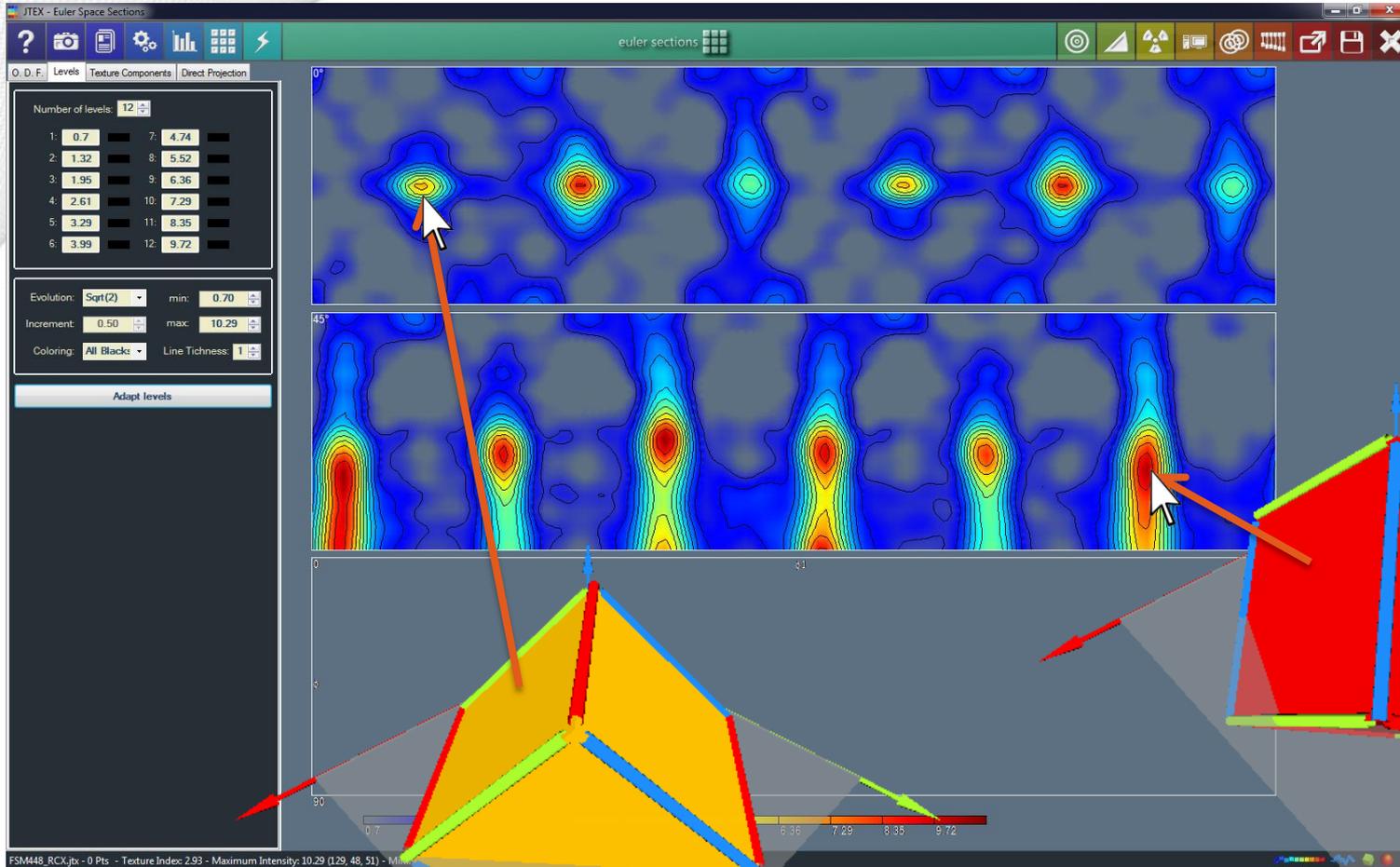
# Pole Figures: local information



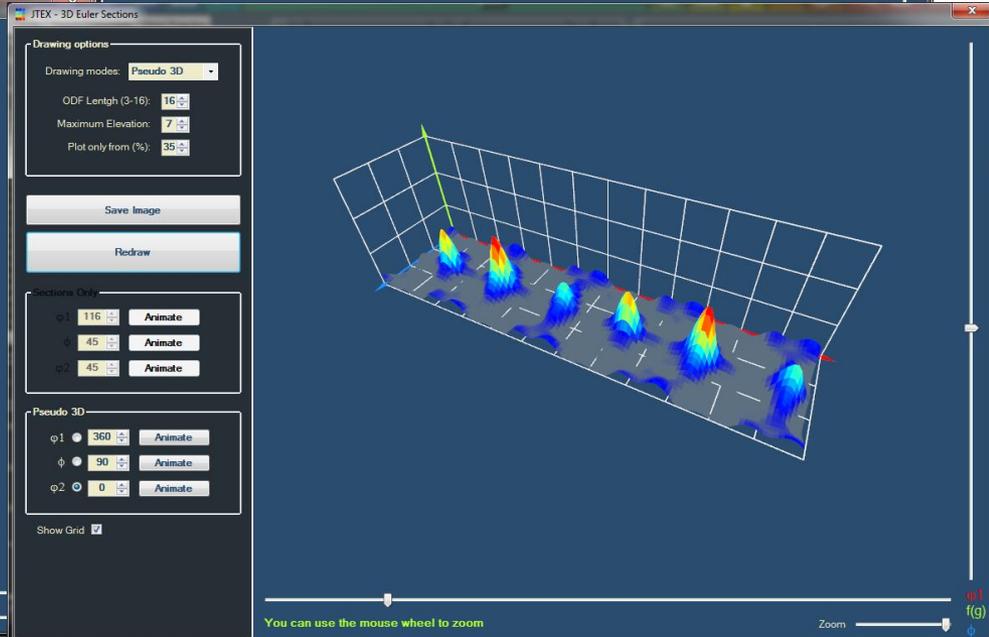
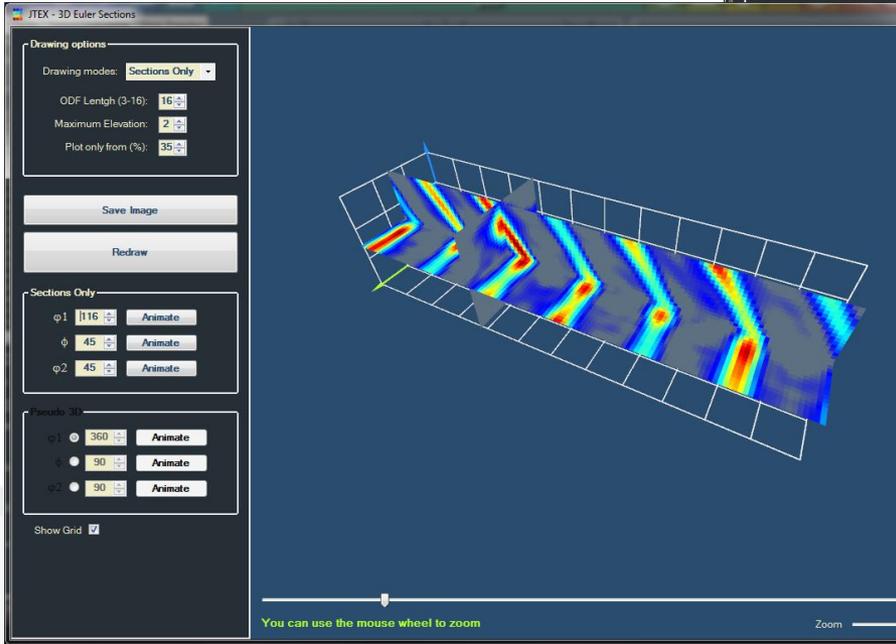
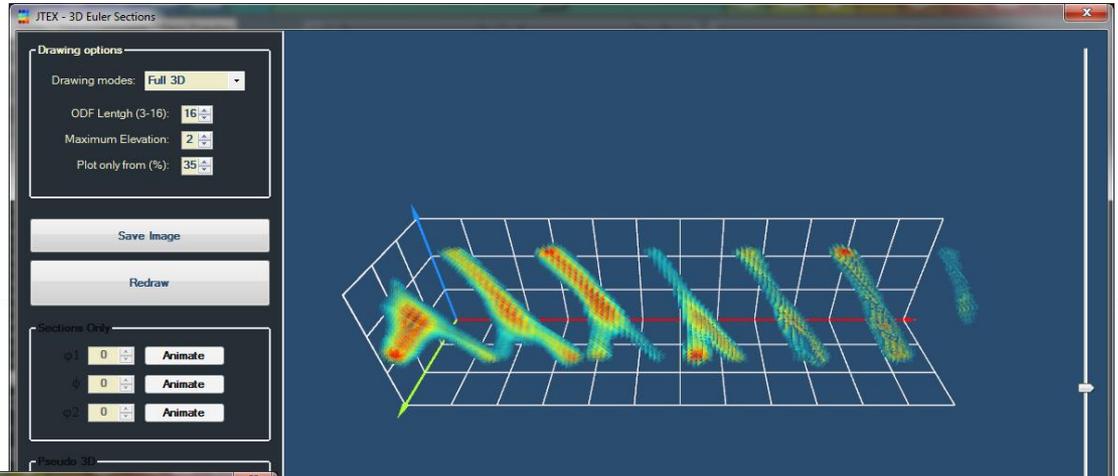
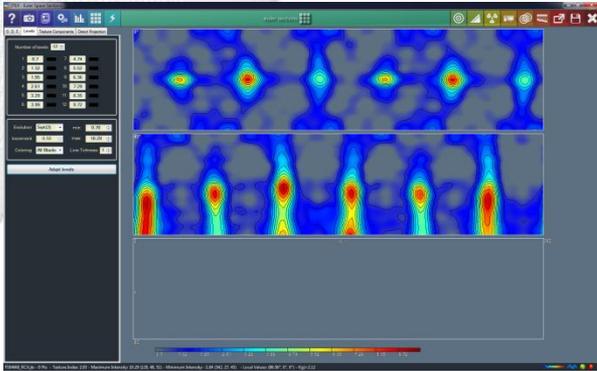
# Euler Space Sections



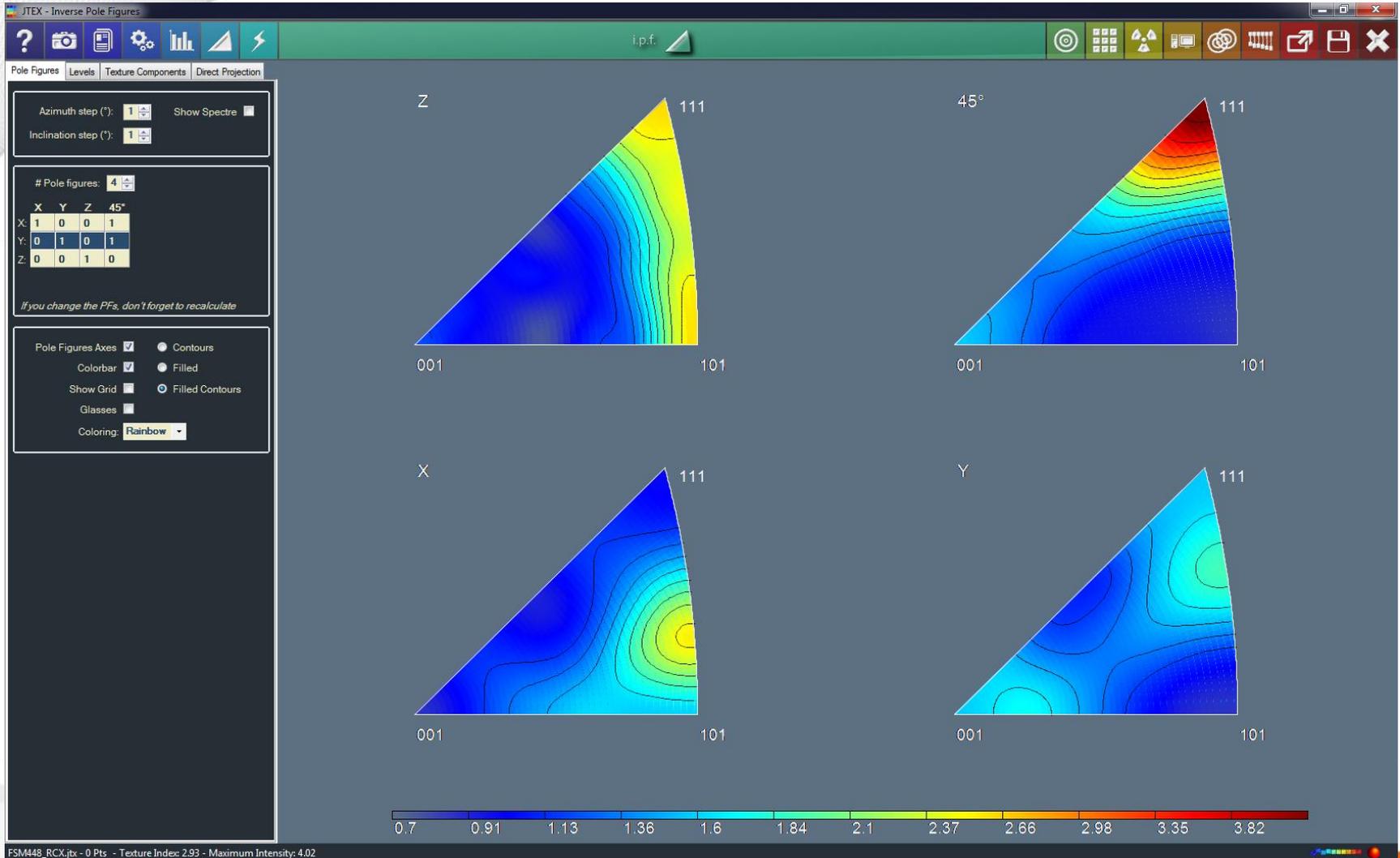
# Euler Space Sections: local orientation



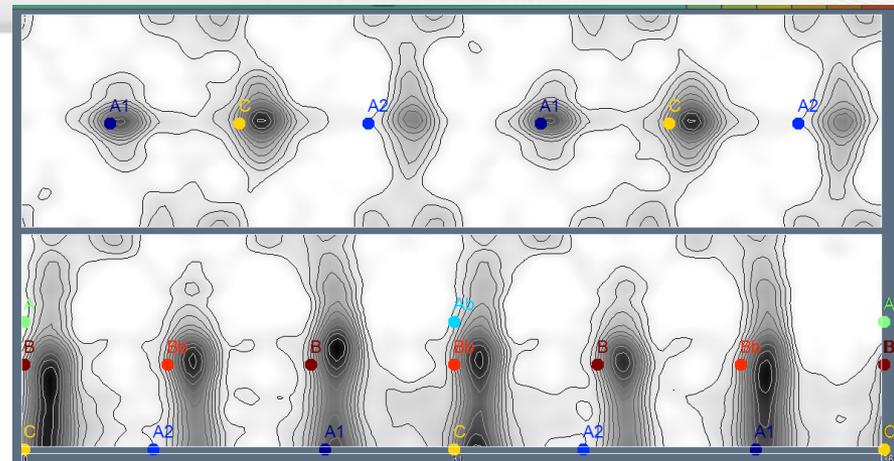
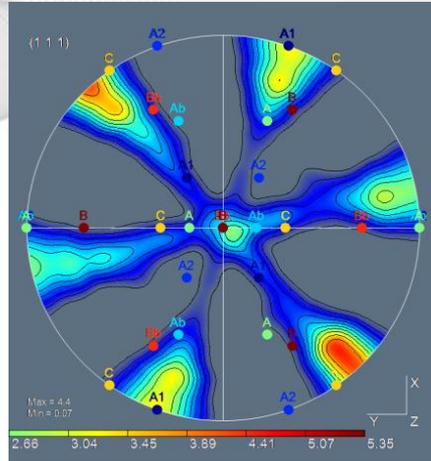
# Euler Sections: 3D View



# Inverse Pole Figures



# Volume Fractions



JTEX - Texture Components

components

Texture Components

- From Euler
- Euler Fibre
- From List: Sheared fcc
- From Miller
- Miller Fibre
- Defined

Phase: 1

Name: ID

Symbol:  $\phi_1, \phi, \phi_2$  0 0

Color: [Color Selection]

Rotation Angle (°): 0 Sample Rotation A

Disor. Angle (°): 5 Sample symmetry

- A1: [2 -1 1](0 1 1) (35.26, 45, 0) \* 5
- A2: [2 -1 1](0 1 1) (144.74, 45, 0) \* 5
- Ab: [-1 1 0](1 1 2) (180, 35.26, 45) \* 5
- A: [2 1 -1](1 1 2) (0, 35.26, 45) \* 5
- C: [0 -1 1](0 1 1) (90, 45, 0) \* 5
- Bb: [-1 -1 0](1 1 1) (180, 54.74, 45) \* 5
- B: [1 -1 0](1 1 1) (0, 54.74, 45) \* 5

Color Modify Rotate Remove Add

L. S. Tóth, P. Gilormini, J. J. Jonas  
Acta Metallurgica 1988, 36, pp.3077-3091

SDIIX - TDIIZ - NDIYY

Volume Fraction (%)

	A1	A2	Ab	A	C	Bb	B
O. D. F.	5.199	0.637	0.758	0.104	3.163	2.157	1.921
Vol. Frac. (%)	0.392	0.05	0.066	0.016	0.269	0.191	0.172

# Simulations of Deformation Texture

JTEX - Simulation

simulations

Self-Consistent     Taylor  
 Sachs

Number of increments:

EqvM strain increment:

Strain rate sens. (1/m):

Number of orientations:

Velocity gradient shape:

<input type="text" value="0"/>	<input type="text" value="1"/>	<input type="text" value="0"/>
<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>

Slip System Families:

(111)<110> FCC  
 1 12 3 1 !tau0, nbsys, 3ind,  
 sym=1 to 11

1	1	-1	0	1	1
1	1	-1	1	0	1
1	1	-1	1	-1	0
1	-1	-1	0	1	-1
1	-1	-1	1	0	1
1	-1	-1	1	1	0
1	-1	1	0	1	1
1	-1	1	1	0	-1
1	-1	1	1	1	0
1	1	1	0	1	-1
1	1	1	1	0	-1

(100)<110> FCC  
 0 6 3 1 !tau0, nbsys, 3ind

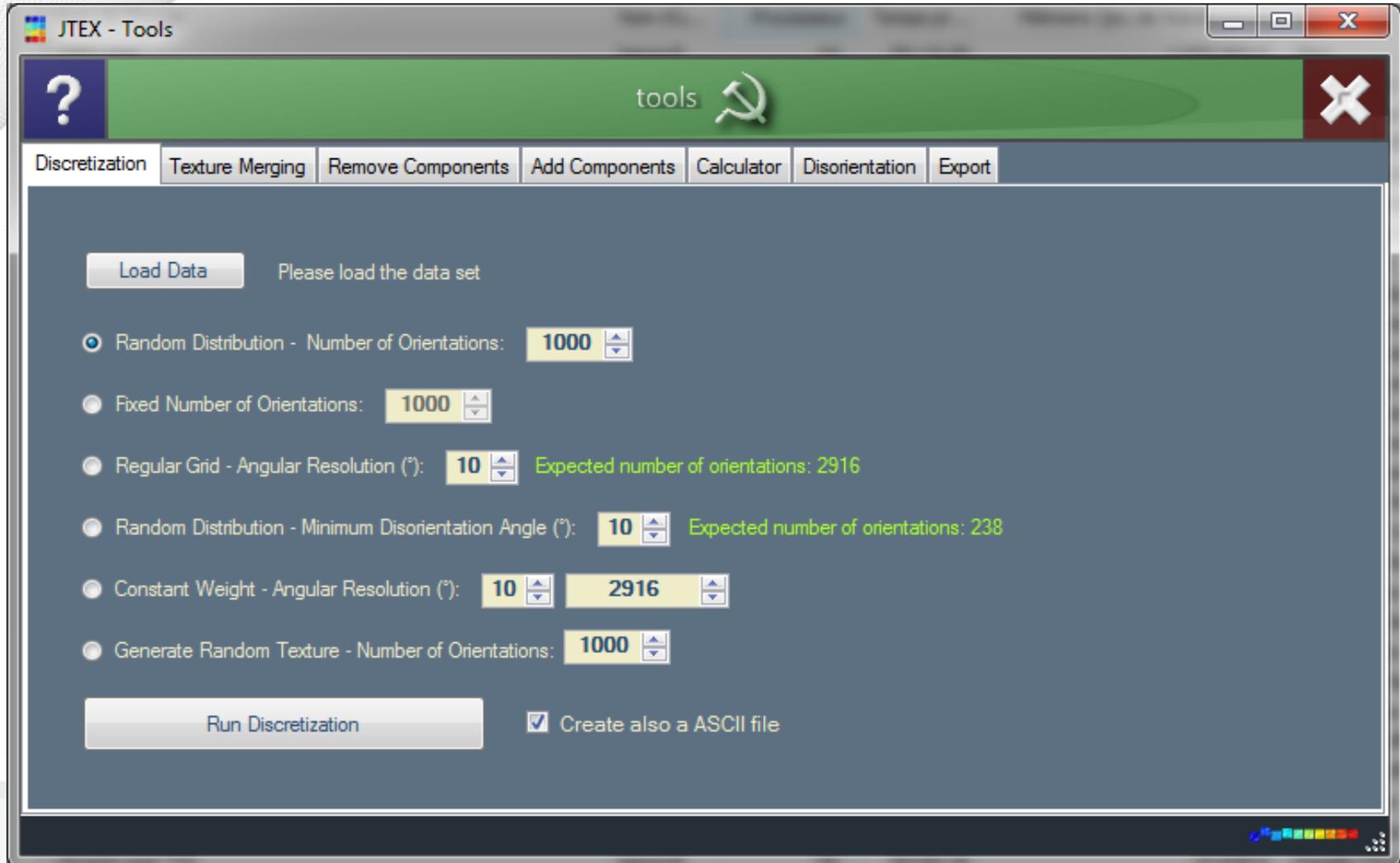
1	0	0	0	1	1
1	0	0	0	1	-1
0	1	0	1	0	1
0	1	0	1	0	-1
0	0	1	1	1	0
0	0	1	1	-1	0

%	inc	EvM	SvM	mu	err
8	1	0.0010	1.8117	0.1133	0.0000
16	2	0.0020	1.8117	0.1133	0.0000
25	3	0.0030	1.8118	0.1133	0.0000
33	4	0.0040	1.8137	0.1135	0.0000
41	5	0.0050	1.8141	0.1135	0.0000
50	6	0.0060	1.8143	0.1134	0.0000
58	7	0.0070	1.8166	0.1137	0.0000
66	8	0.0080	1.8172	0.1137	0.0000

Default

IF-A-2 Map Data 2.jtx - 1681696 Pts

# Tools



# Tools

JTEX - Tools

tools 

Discretization Texture Merging Remove Components Add Components Calculator Disorientation Export

Miller Indices

$n(h, k, l) // z$	<input type="text" value="1"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	Convert	$n(h, k, l) // z$	<input type="text" value="1"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
$[u, v, w] // x$	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="1"/>		$[u, v, w] // x$	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="1"/>

Euler Angles

$\phi_1, \phi, \phi_2$	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	Convert	$\phi_1, \phi, \phi_2$	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>

Quaternion

$q_0, q_1, q_2, q_3$	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	Convert	$q_0, q_1, q_2, q_3$	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>

Axis - Angle

$x, y, z, \text{angle}(\circ)$	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	Convert	$x, y, z, \text{angle}(\circ)$	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>



# Properties of the polycrystal

JTEX - Properties

Copper (273K)  Elastic Stiffness  Thermal Prop.  Electrical Prop.  Mechanical Prop.

Elastic Stiffness Thermal Properties Electrical Properties Mechanical Properties

C in Voigt matrix representation (GPa)

11	169.8	122.6	122.6	0	0	0
22	122.6	169.8	122.6	0	0	0
33	122.6	122.6	169.8	0	0	0
23	0	0	0	75.3	0	0
31	0	0	0	0	75.3	0
12	0	0	0	0	0	75.3
	11	22	33	23	31	12

Voigt

214.27	104.71	96.03	0.35	0.42	0.36
104.71	210.86	99.44	0.64	-0.05	-0.4
96.03	99.44	219.54	-0.99	-0.36	0.04
0.35	0.64	-0.99	52.14	0.04	-0.05
0.42	-0.05	-0.36	0.04	48.73	0.35
0.36	-0.4	0.04	-0.05	0.35	57.41

Reuss

195.29	114.38	105.33	0.8	0.75	0.7
114.38	191.74	108.87	1.18	-0.05	-0.75
105.33	108.87	200.8	-1.97	-0.7	0.05
0.8	1.18	-1.97	152.07	0.14	-0.21
0.75	-0.05	-0.7	0.14	141.7	1.2
0.7	-0.75	0.05	-0.21	1.2	171.34

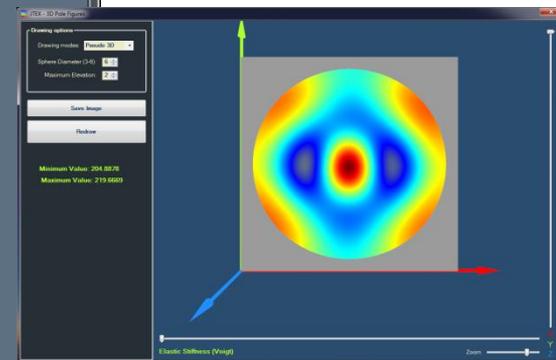
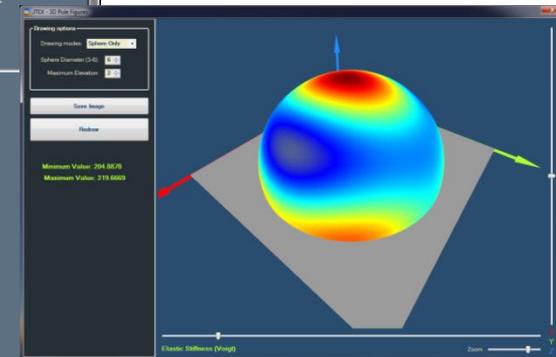
Hill

204.78	109.54	100.68	0.37	0.4	0.35
109.54	201.3	104.16	0.61	-0.04	-0.39
100.68	104.16	210.17	-0.99	-0.36	0.03
0.37	0.61	-0.99	45.08	0.04	-0.05
0.4	-0.04	-0.36	0.04	42.08	0.32
0.35	-0.39	0.03	-0.05	0.32	50.12

Azimuth (0-360°): 0.0  214.27 / 195.29 / 204.78  Every Direction

Elevation (0-90°): 0.0  Voigt  Reuss  Hill

FSM448\_RCX.jtx - 0 Pts



## Texture correlation

### Reports

**Report on:**  
 IF-A-2 MAP DATA 2

**Pole Figures**

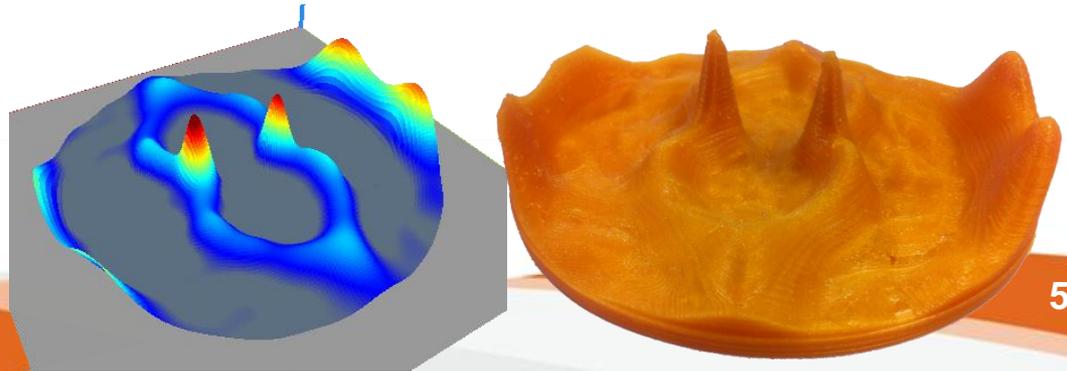
Axis	Rotation Type	Rotation Angle (°)	IC (°)	PO (0-5)
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
9	0	0	0	0
10	0	0	0	0
11	0	0	0	0
12	0	0	0	0
13	0	0	0	0
14	0	0	0	0
15	0	0	0	0
16	0	0	0	0
17	0	0	0	0
18	0	0	0	0
19	0	0	0	0
20	0	0	0	0
21	0	0	0	0
22	0	0	0	0
23	0	0	0	0
24	0	0	0	0
25	0	0	0	0
26	0	0	0	0
27	0	0	0	0
28	0	0	0	0
29	0	0	0	0
30	0	0	0	0
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35	0	0	0	0
36	0	0	0	0
37	0	0	0	0
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39	0	0	0	0
40	0	0	0	0
41	0	0	0	0
42	0	0	0	0
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45	0	0	0	0
46	0	0	0	0
47	0	0	0	0

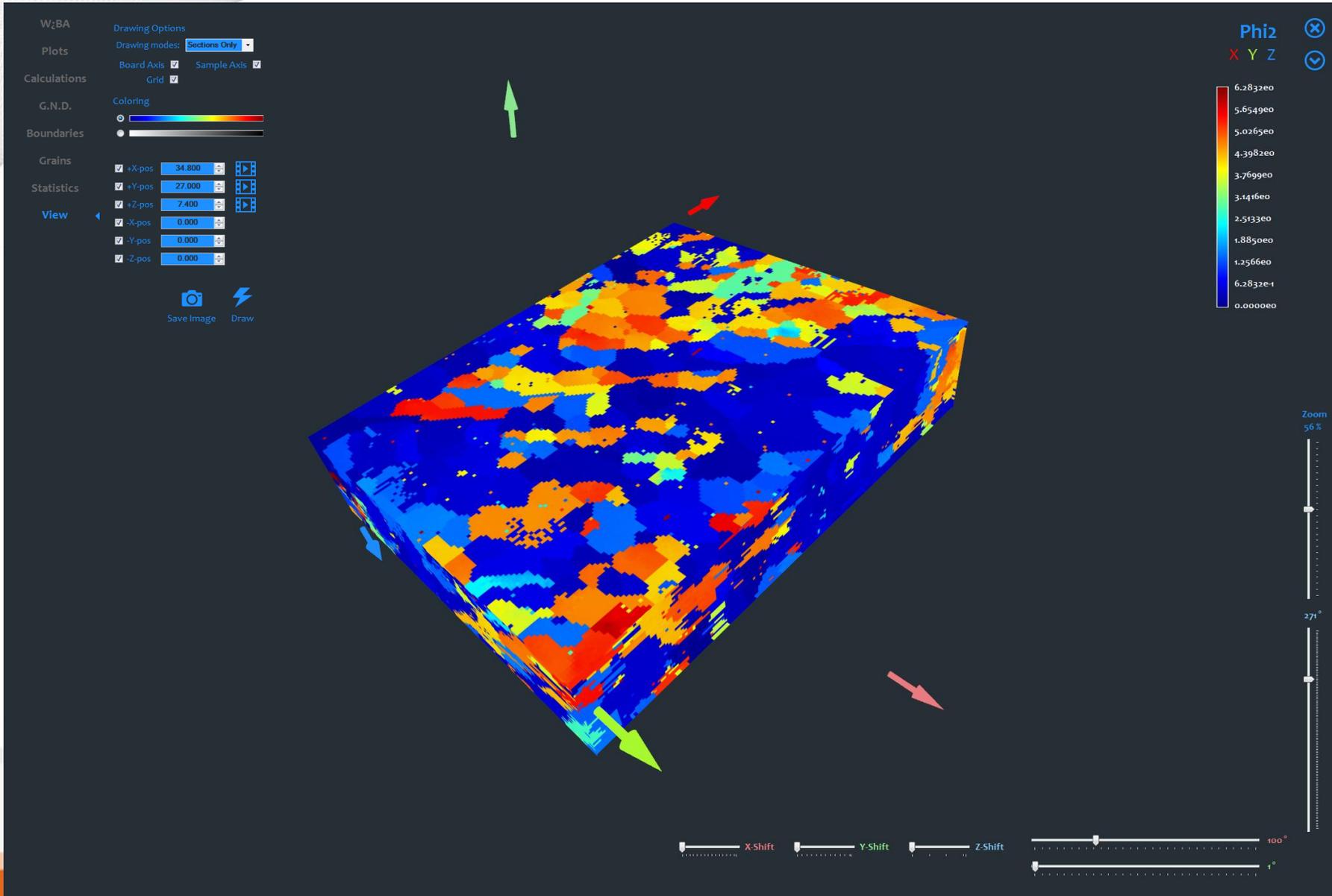
**Inverse Pole Figures**

Axis	Rotation Type	Rotation Angle (°)	IC (°)	PO (0-5)
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2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
9	0	0	0	0
10	0	0	0	0
11	0	0	0	0
12	0	0	0	0
13	0	0	0	0
14	0	0	0	0
15	0	0	0	0
16	0	0	0	0
17	0	0	0	0
18	0	0	0	0
19	0	0	0	0
20	0	0	0	0
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23	0	0	0	0
24	0	0	0	0
25	0	0	0	0
26	0	0	0	0
27	0	0	0	0
28	0	0	0	0
29	0	0	0	0
30	0	0	0	0
31	0	0	0	0
32	0	0	0	0
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36	0	0	0	0
37	0	0	0	0
38	0	0	0	0
39	0	0	0	0
40	0	0	0	0
41	0	0	0	0
42	0	0	0	0
43	0	0	0	0
44	0	0	0	0
45	0	0	0	0
46	0	0	0	0
47	0	0	0	0

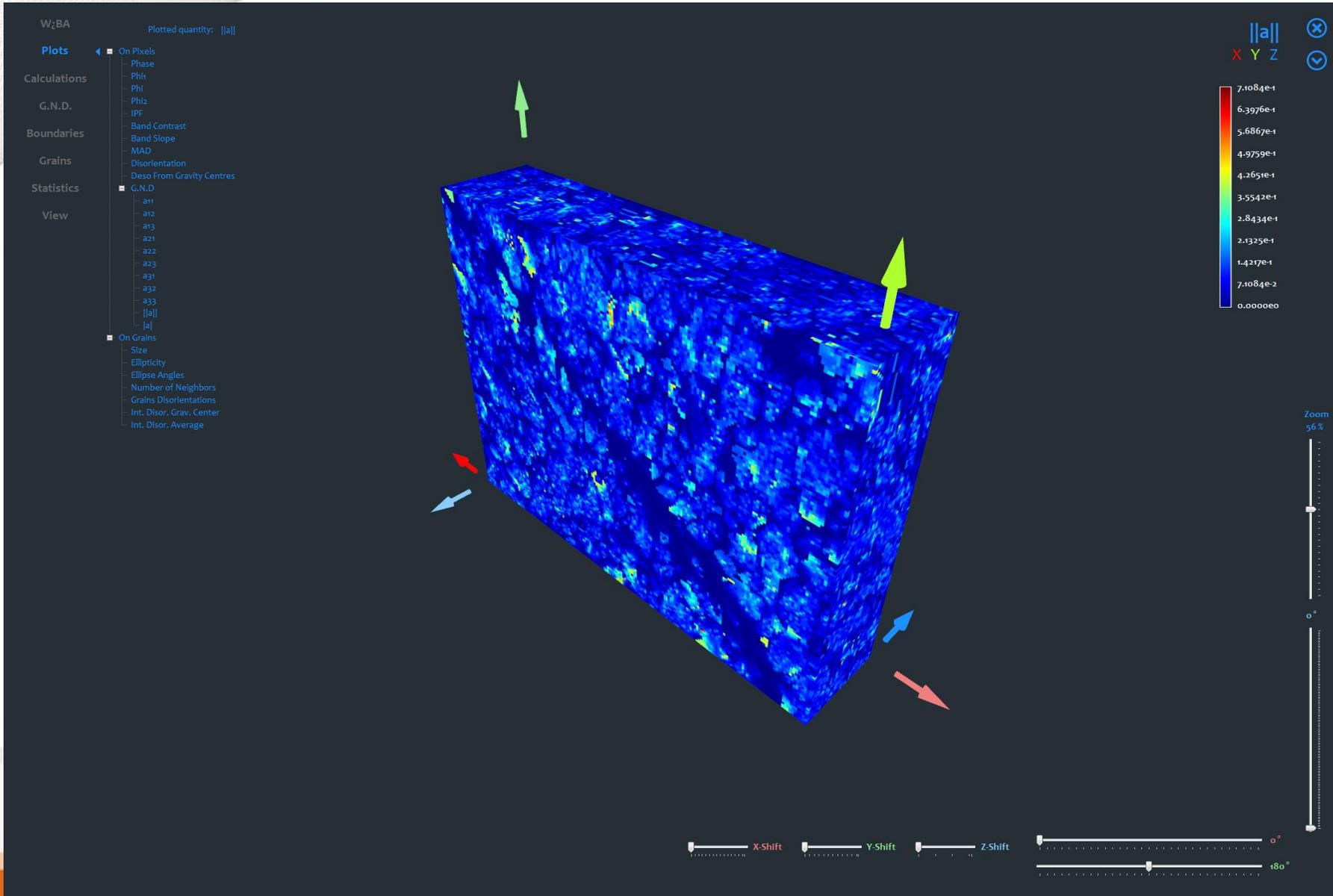


### Export to 3D Printer





# Software for 3D Data



Thank you for your attention

