

LaboTex

Version 3.0

The Texture Analysis Software for Windows

Texture Analysis on the Base of EBSD Data

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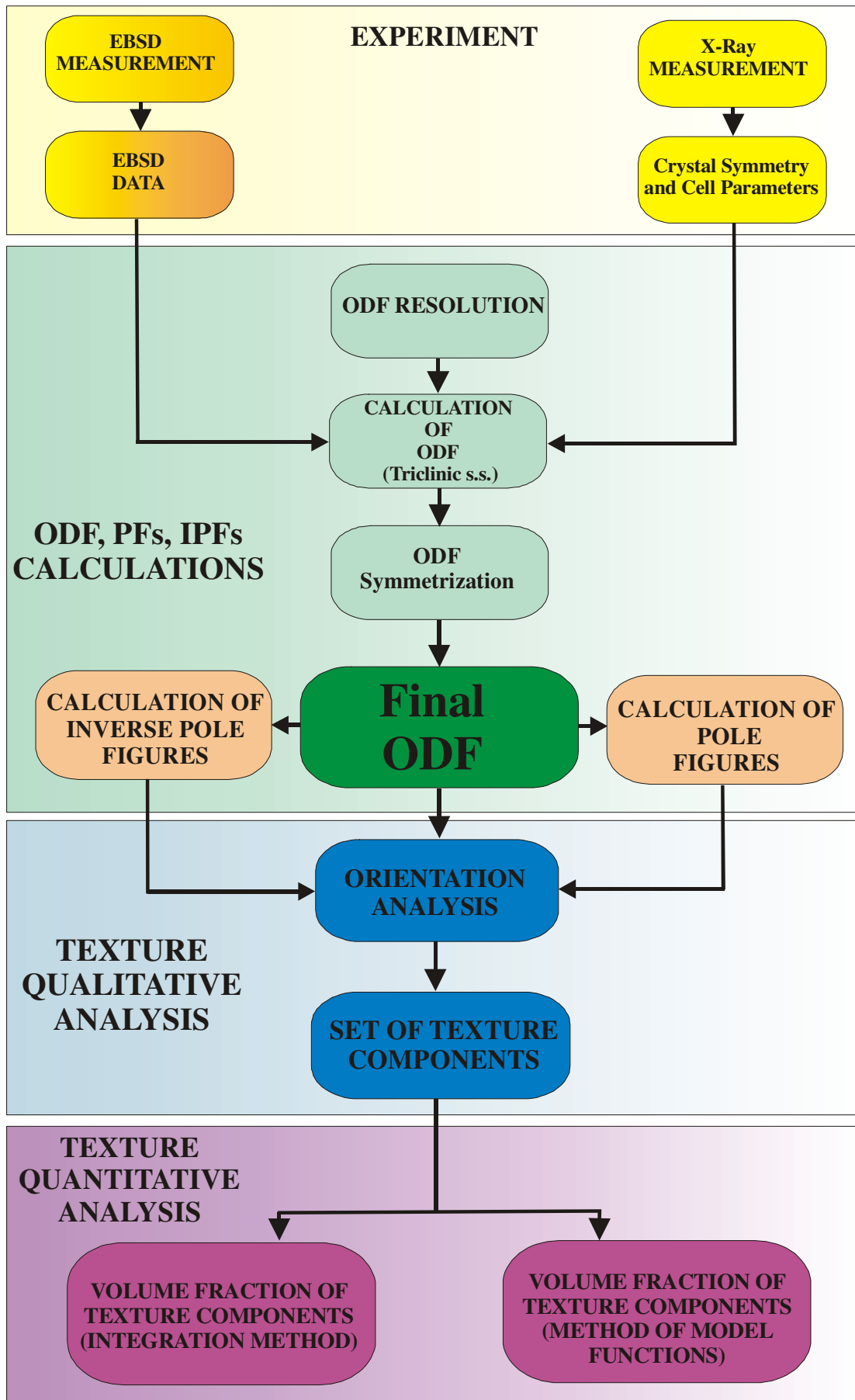


Figure 1. Processing of EBSD data in LaboTex

1. Format of EBSD data

1.1 LaboTex format

LaboTex format for EBSD data is very simple. Files with EBSD data in LaboTex format consist with 4 lines of heading and with EBSD data. Each EBSD data occupies one line and it contains 3 Euler angles and optionally statistic weight of orientation. LaboTex recognizes files with EBSD data by SOR filename extension (*filename.SOR* – Single ORientation File). Below is description of *filename.SOR* data format:

Line	No of data in line	Description	Type
1 - 2		Arbitrary title	Character
3		Remarks for data in line 4	
4	1	Structure Code (symmetries after Schoenflies): 1 - C ₁ (triclinic) 2 - C ₂ (monoclinic) 3 - D ₂ (orthorhombic) 4 - C ₄ (tetragonal) 5 - D ₄ (tetragonal) 6 - T (cubic) 7 - O (cubic) 8 - C ₃ (trigonal) 9 - D ₃ (trigonal) 10 - C ₆ (hexagonal) 11 - D ₆ (hexagonal)	Integer
4	2	Lattice constant, a (absolute or relative)	Real
4	3	Lattice constant, b (absolute or relative)	Real
4	4	Lattice constant, c (absolute or relative)	Real
4	5	Lattice angle, α in degrees	Real
4	6	Lattice angle, β in degrees	Real
4	7	Lattice angle, γ in degrees	Real
4	8	Step for output ODF (grid cells). Permissible values (deg): 1.0, 1.2, 1.25, 1.5, 2.0, 2.5, 3.0, 3.75, 5.0, 6.0, 7.5, 10.0*	Real
4	9	<i>Weight</i> for data (1 – present, 0 – absent)	Integer
4	10	Angle Unit: 0 – deg, 1 – rad	Integer
4	11	Angle Convention: 0 – Bunge 1 – Roe	Integer
5 to the end	1	ϕ_1	Real
5 to the end	2	Φ	Real
5 to the end	3	ϕ_2	Real
5 to the end	[4]	Weight (optionally) (if parameter <i>weight</i> in line 4 is 1)	Real

Note: Real and integer input data must be separated in line by one or more spaces.

*LaboTex allows new grid cell from version 21.006: 1.8x1.8,2.25x2.5,3.6x3.6,4.5x4.5 (exceptions: trigonal, hexagonal crystal lattice symmetry)

1.2 LaboTex format - Example

```
-----
Remark line 1
Remark line 2
Structure a b c alfa beta gamma grid weight deg/rad Bunge/Roe
7 1.00 1.00 1.00 90.00 90.00 90.00 5.00 1 0 0
205. 12. 4. 0.2
210. 15. 15. 0.3
215. 20. 2. 0.3
220. 31. 4. 0.2
225. 13. 5. 0.1
200. 13. 5. 0.1
...
-----
```

1.3 Non-LaboTex Formats with EBSD data

LaboTex can also input EBSD data in other formats:

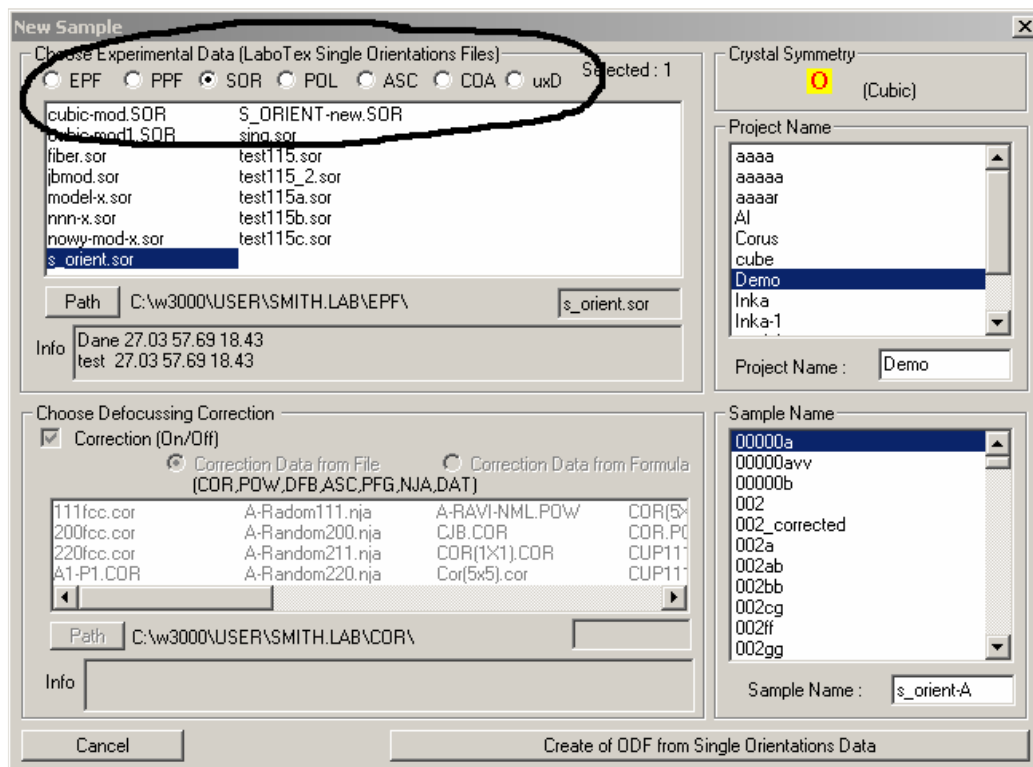
- 'CTF' HKL® Single Orientations Files, *.CTF list)
- 'SNG' TSL® Single Orientations Files, *.SNG
- 'TXT' HKL® Single Orientations Files, *.TXT
- 'TSV' Single Orientations Files: *.TSV

2. Input EBSD data to LaboTex

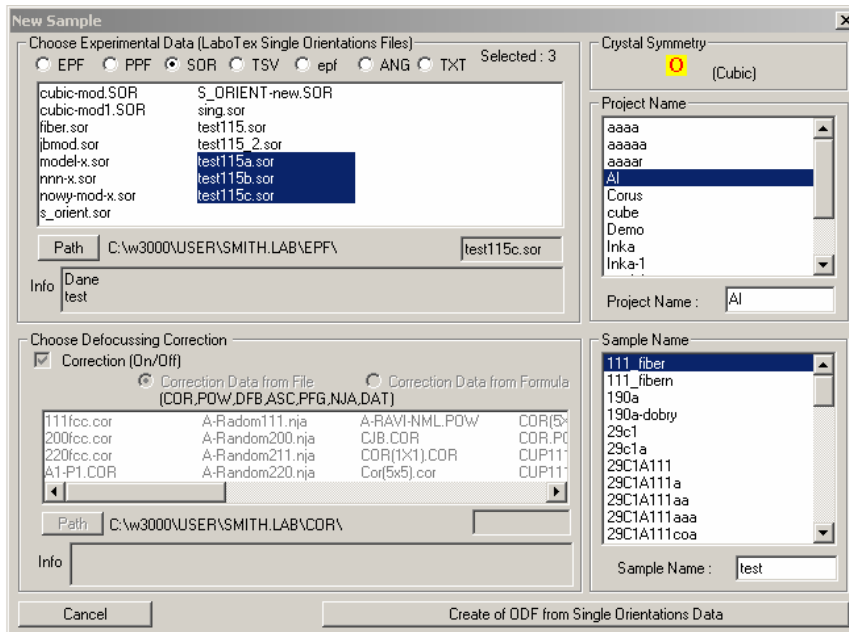
User input EBSD data file(s) from 'New Sample' window. This window can be opened using icon which is marked on the image below or from menu 'File'.



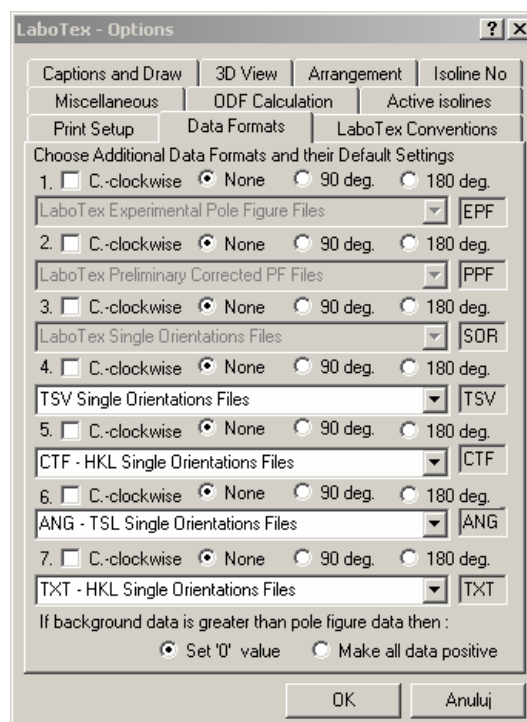
When user choose SOR radio button in 'New Sample' window then LaboTex displays only files with SOR extension. LaboTex also shows in Info area the text from remark lines of SOR file when user clicks on the filename. Of course, in case of files with single orientation data (formats : SOR, CTF, SNG, TXT, TSV...) defocussing correction list is greyed.



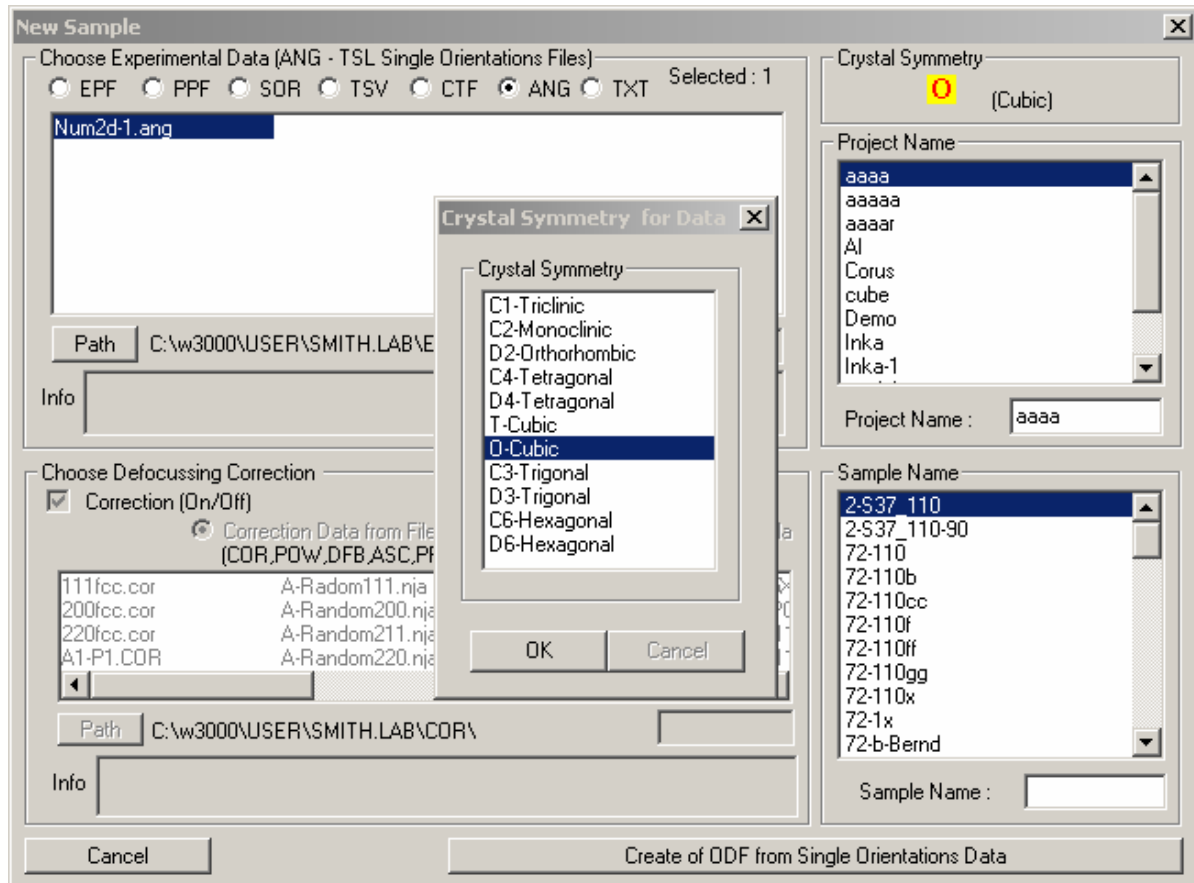
Next user should choose project name from the 'Project Name' list (right upper side of the 'New Sample' window). User can also defines new project name. Next LaboTex needs new sample name - original in this project,. If user has single orientations data divided on the several files then he should makes multiselection as on the image below by selection several files using mouse left button with simultaneously holding down 'Ctrl' (control) key.



LaboTex inputs data in about 30 data formats, but only 7 data formats can be active simultaneously. For example: EPF, PPF, SOR, TSV, epf (popLA), ANG, TXT data formats are available on the picture above. User can change active data formats No. 4 to 7 in 'LaboTex Options' > 'Data Formats'. For example: on the Figure below user has changed data formats epf (popLa) on the CTF (data formats No. 5) hence now available in 'New Sample' window are formats: EPF, PPF, SOR, TSV, CTF, ANG, TXT.



Settings: 'C-clockwise', '90 deg.', '180 deg.' are non-active in case of single orientations data. Only 'SOR' single orientations data format contains information about crystal symmetry of sample. If you input data in other data format than 'SOR' then LaboTex will ask you for crystal symmetry of your sample (see on the figure below).

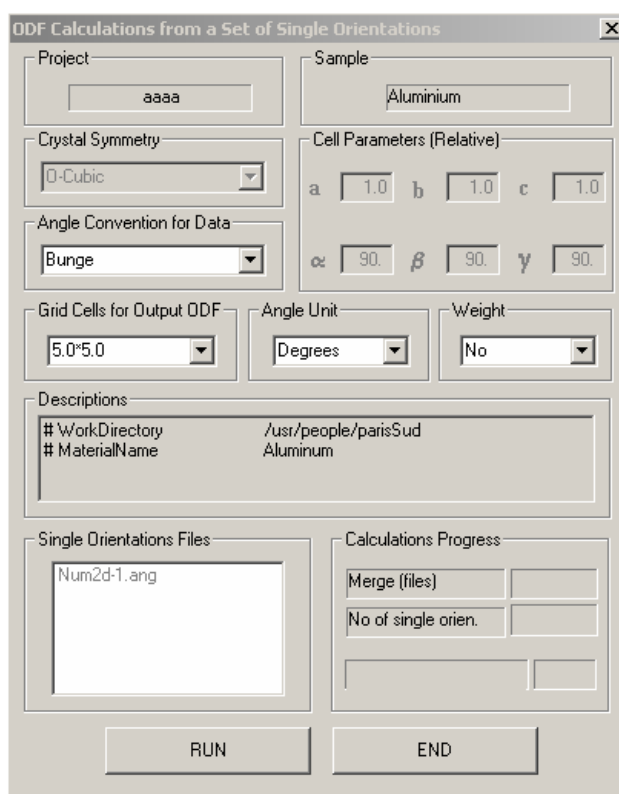


Finally, when you have chosen all files with single orientation data for your sample and when you have inputted project name, sample name and crystal symmetry for your sample then you should click on the button 'Create of ODF from Single Orientation Data' for continuation of ODF calculation.

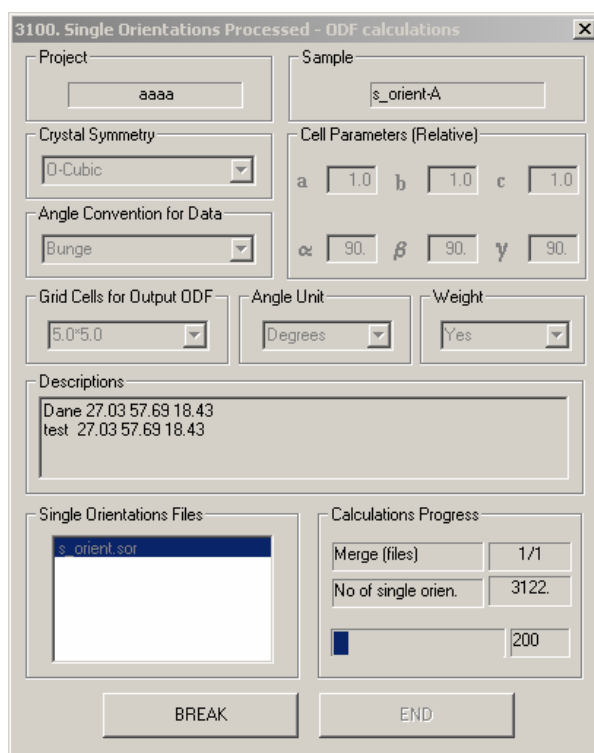
You will see new dialog window which displays information about your data. If you use other format's for single orientation data than 'SOR' then you also have to complete additional information essential for proper processing of your data:

- Euler angle convention for data: user can choose 'Bunge' or 'Roe' convention;
- Cell parameters (only in case of samples with crystal symmetry lower than cubic). Cell parameters has to be inputted in proper sequence. For details please see to Report: "Pole Figures: Registration and Plot Conventions";
- Angle unit: user can choose 'degrees' or 'radians';
- Weight (weights of measurements): user can choose 'yes' or 'no'. If 'yes' then file contains three Euler angles and weight for each measurement;
- Grid cells for output ODF. User can choose grid: 1., 1.2 ,2. ,1.25 ,1.5, 2. ,2.5 ,3. ,3.75 ,5. ,6. ,7.5 ,10. degrees.

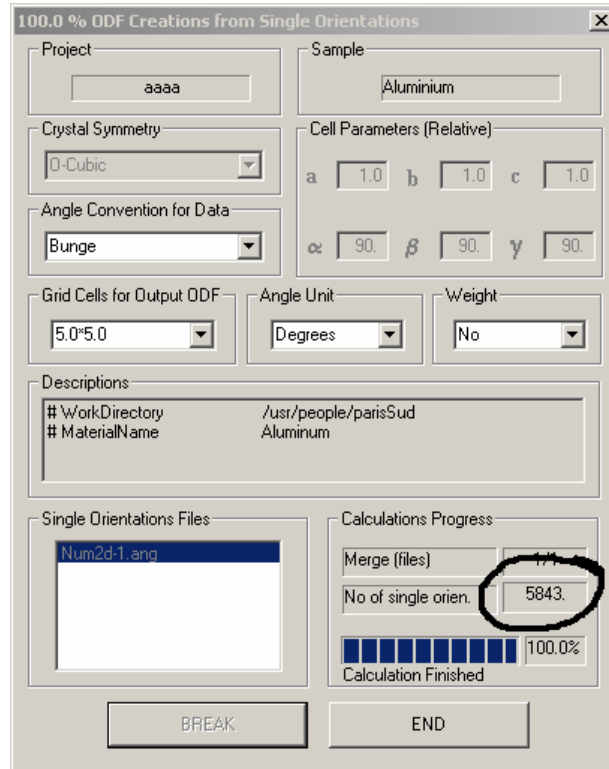
For some formats you can also add descriptions (remarks) for your data. When you complete the information requested on the screen please click the "Run".



LaboTex starts ODF calculation and you can observe progress of calculation. You can stop calculation in any moment ('BREAK' button). LaboTex displays also current number of processed orientations.

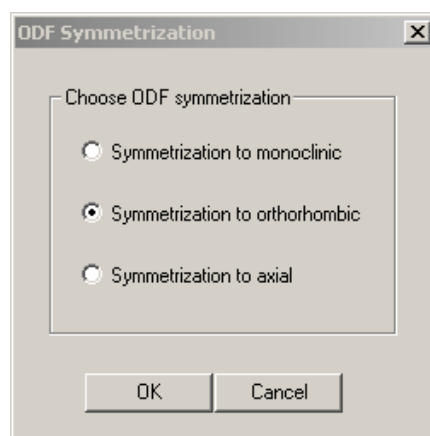


LaboTex displays a message 'Calculation Finished' when ODF calculation are finished. You can also observe number of single orientations processed during ODF calculation (mark on the figure below) and names of files which was used (merged) during calculation. When you click on the 'End' button LaboTex opens your new ODF.

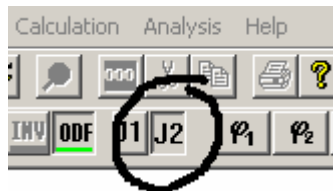


3. ODF symmetrization -

LaboTex always calculates ODF in triclinic sample symmetry when calculation are made from single orientations data. If your ODF has higher sample symmetry you should make ODF symmetrization. Dialog window for symmetrization you can open in menu 'Calculation' > 'ODF symmetrization' or directly from toolbar. Next you can choose kind of ODF symmetrization:

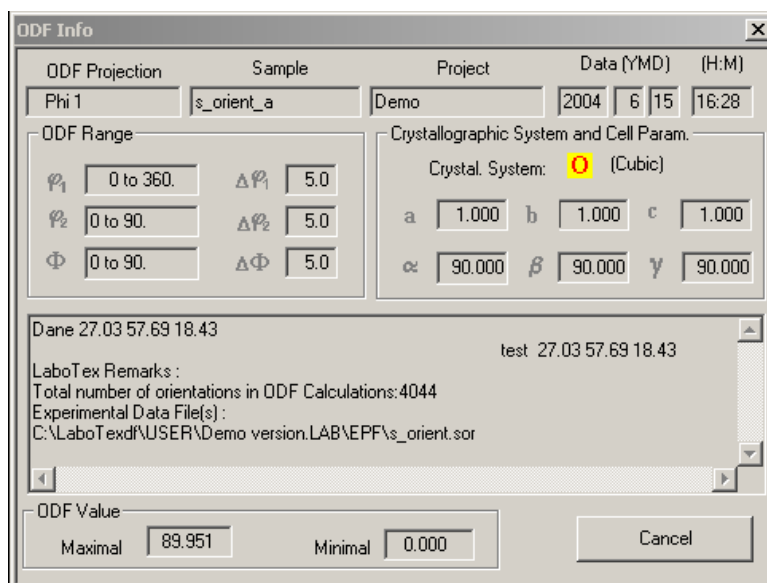


New ODF (ODF after symmetrization) is placed in job nr 2. If you will make next symmetrization its result ODF will be in job nr 3. Original ODF you always can find in job nr 1. Maximal number of jobs is equal 9.



When you click right mouse button on the projection of ODF then LaboTex displays details about ODF ('ODF Info' dialog). In 'ODF Info' you can find :

- ODF Projection (i.e. denotation of projection which is current displayed by LaboTex);
- Name of project and name of sample;
- data and time of ODF creation;
- ODF range and grid;
- Crystal system;
- Cell parameters;
- Maximal and minimal ODF value;
- Description of ODF or sample (from remarks line of SOR file);
- Number of orientations used in ODF calculation;
- Name of all files with single orientations data used in ODF calculation (there are also path to these files);

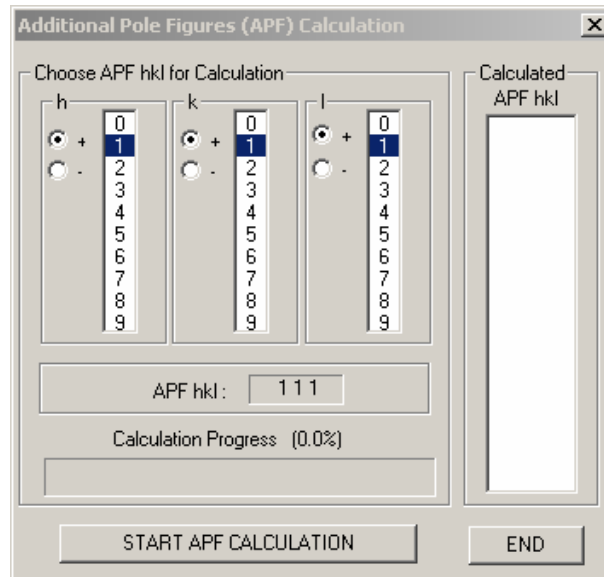


4. Pole Figures and Inverse Pole Figures calculations

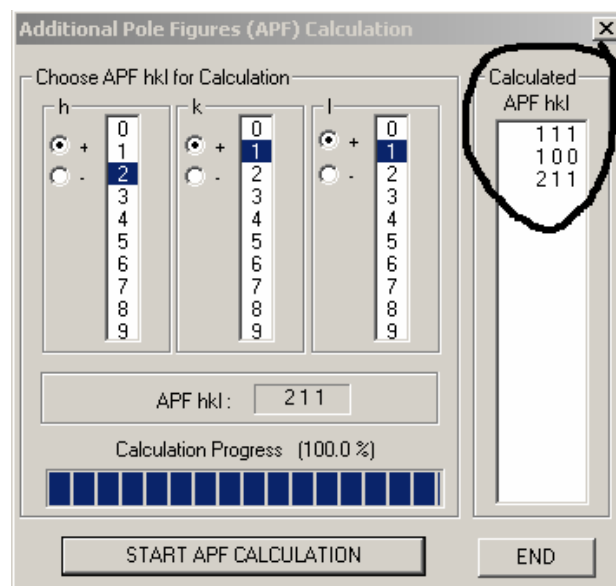
When you have done final ODF then you can make calculations of pole figures. In menu 'Calculation' are menu items : 'ODF to APF' and 'ODF to INV'. You can also click directly on the icon to start dialog window for calculation of pole figures:



In 'ODF to APF' dialog window you can make calculation of normal pole figures. You only have to choose miller indices h, k, l of pole figure which you want create and next click on the button 'START APF CALCULATION'.



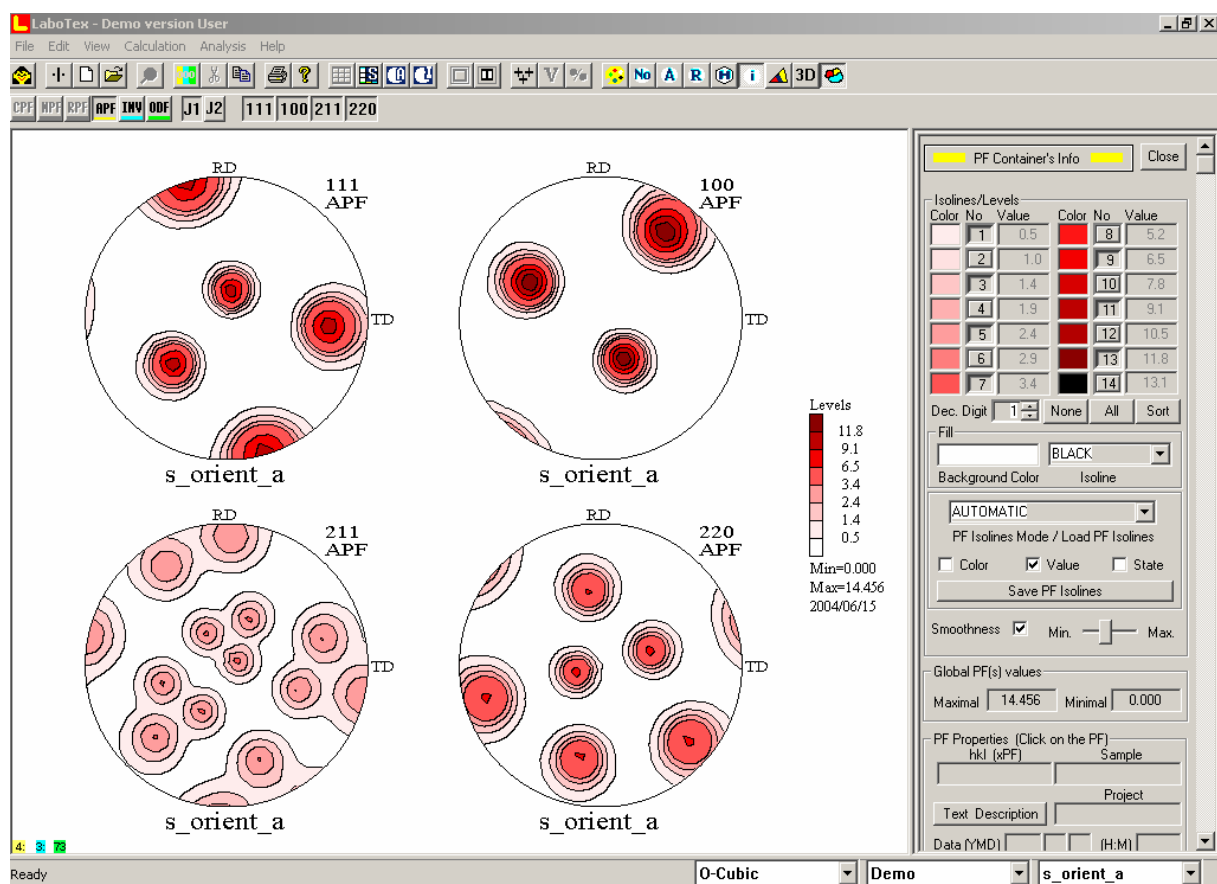
Miller indices of calculated pole figures are displayed on the list as marked below.



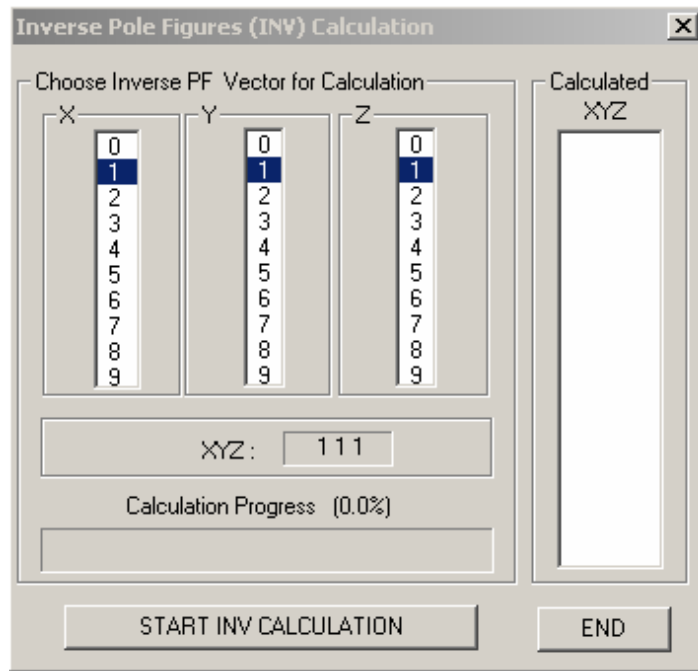
When you finish calculation of pole figures then click 'END' button. All your pole figures are always available when you choose APF (Additional Pole Figures) icon on the toolbar. When you click on the '111', '100', '211' icon then LaboTex displays one or more pole figures. If you would like to display pole figures from job number 2 you have to click first on button 'J2' and next you should choose 'APF' icon and finally you should click on the pole figures icons.



Note: Pole figures for each job are calculated on the base of ODF from this job.



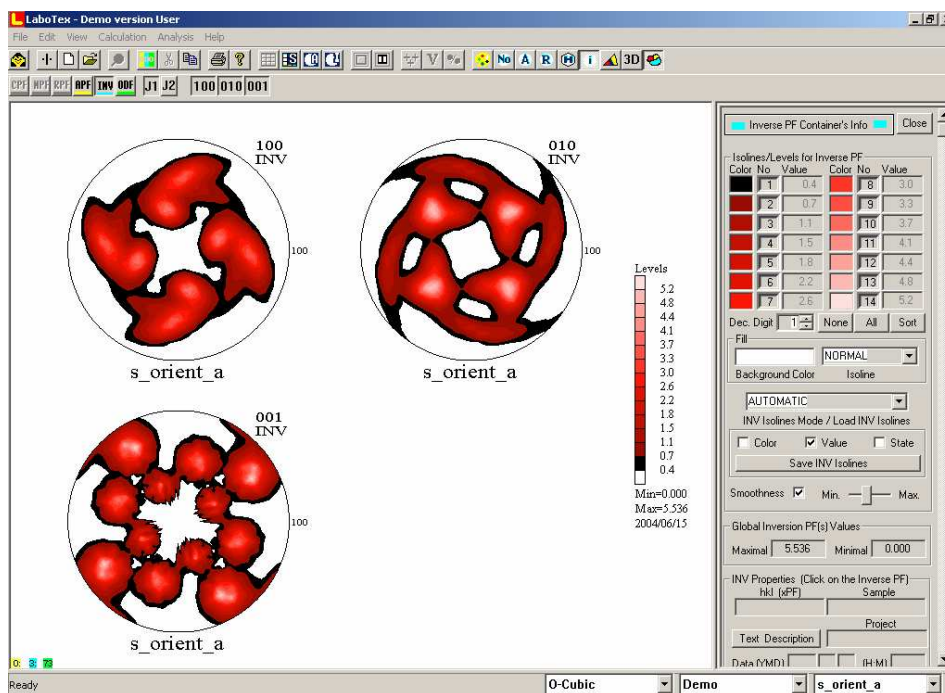
Analogically you can create inverse pole figure (menu item : 'ODF to INV'). In this case you have to choose the vector components: X, Y, Z for which LaboTex calculates orientation distribution on the stereogram. The most popular are directions of axis: 001 (ND direction), 010 (TD direction) and 100 (RD/LD direction). Details you can find in Report : "The Nomenclature of Inverse Pole Figures Use in LaboTex" (see: <http://labotex.com>).



All your inverse pole figures are always available when you choose INV (INVERSE pole figures) icon on the toolbar:



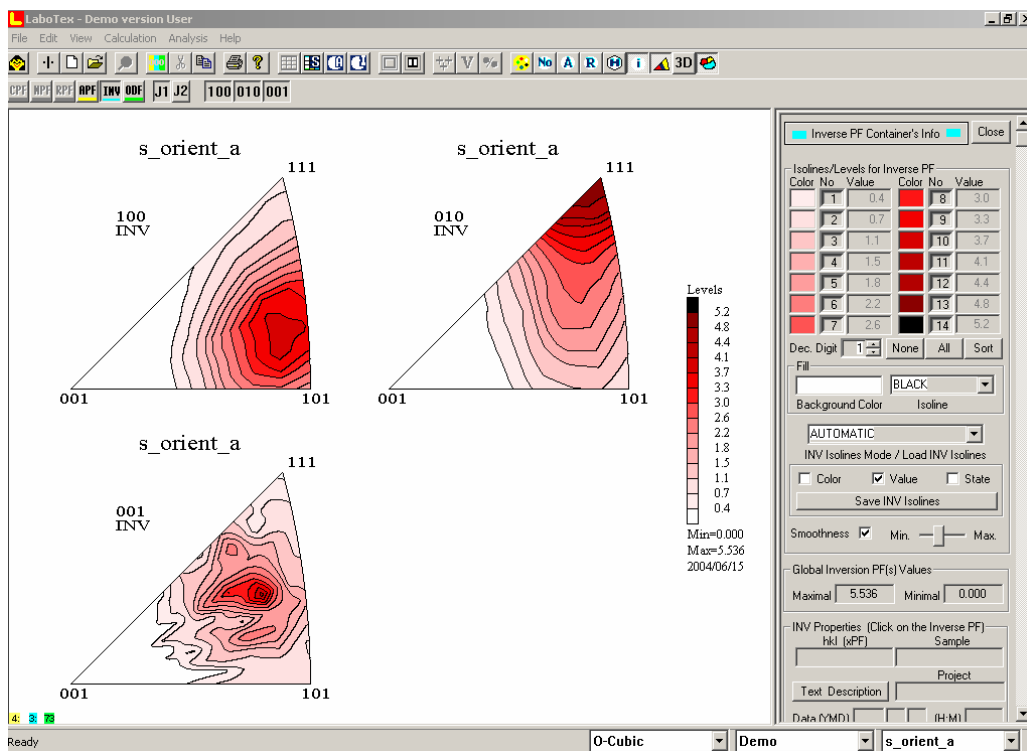
When you click on the '001', '100', '010' icon then LaboTex displays one or more complete inverse pole figures:



If you would like display partial inverse pole figures (orientations distribution of a sample axis on a standard stereographic triangle) you should click on the icon with triangle or you should choose item 'Basic Region' in menu 'View'.



When this icon is pressed LaboTex displays partial inverse pole figures in place of complete inverse pole figures:



Note: if icon for basic region is pressed then analysis icons are grayed.

5. Texture qualitative and quantitative analysis

When you have calculated ODF, pole figures and inverse pole figures you can do the qualitative and quantitative analysis. Execution of these analysis is analogical as for other samples from X-Ray, neutron or synchrotron measurements. Details you can find in reports on LaboTex WWW pages (<http://www.labotex.com>):

- 1) *Introduction to LaboTex 3.0* ;
- 2) *Menu Guide to the LaboTex* ;

- 3) *Determination of Volume Fraction of Texture Components Using LaboTex - Integration Method ;*
- 4) *Determination of Volume Fraction of Texture Components Using LaboTex - Model Functions Method ;*
- 5) *The Nomenclature of Inverse Pole Figures Use in LaboTex ;*
- 6) *Pole Figures: Registration and Plot Conventions ;*
- 7) *LaboTex: Modelling of ODF, Pole Figures and Inverse Pole Figure ;*
- 8) *"Device-independent" pole figures for quantitative texture analysis (Techniques: PIM and IM).*