ANALYSIS TOOLS FOR ELECTRON AND X-RAY DIFFRACTIONS

# Notice for Orientation Relationship module

07/12/2022

**Version 4.00 Academic Edition**

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*B. Beausir, J.-J. Fundenberger, Analysis Tools for Electron and X-ray diffraction, ATEX - software, www.atex-software.eu, Université de Lorraine - Metz, 2017*

*M. Humbert, F. Wagner, H. Moustahfid, C. Esling, Determination of the Orientation of a Parent β Grain from the Orientations of the Inherited α Plates in the Phase Transformation from Body-Centred Cubic to Hexagonal Close Packed. J. Appl. Cryst. (1995). 28, 571-576.*



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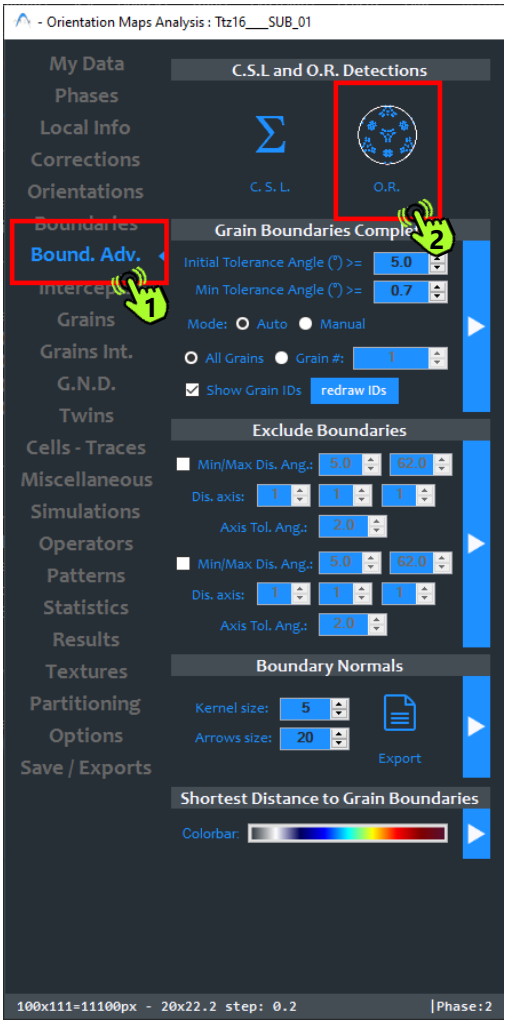
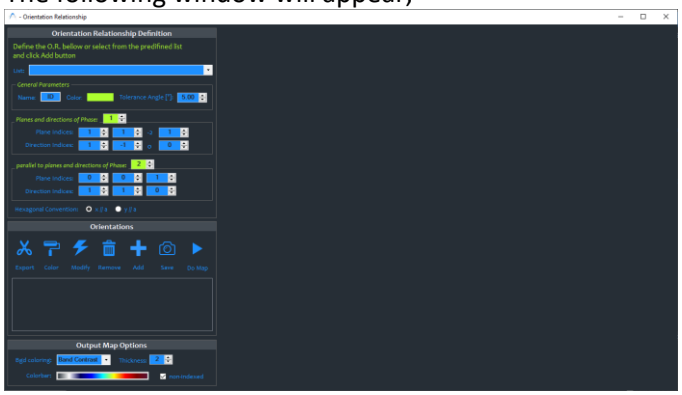
# Summary

# 1. Orientation Relationship Module

The module is located in the “Boundaries Advanced.” Tab. Click on “O.R.” button to open it.




The following window will appear,





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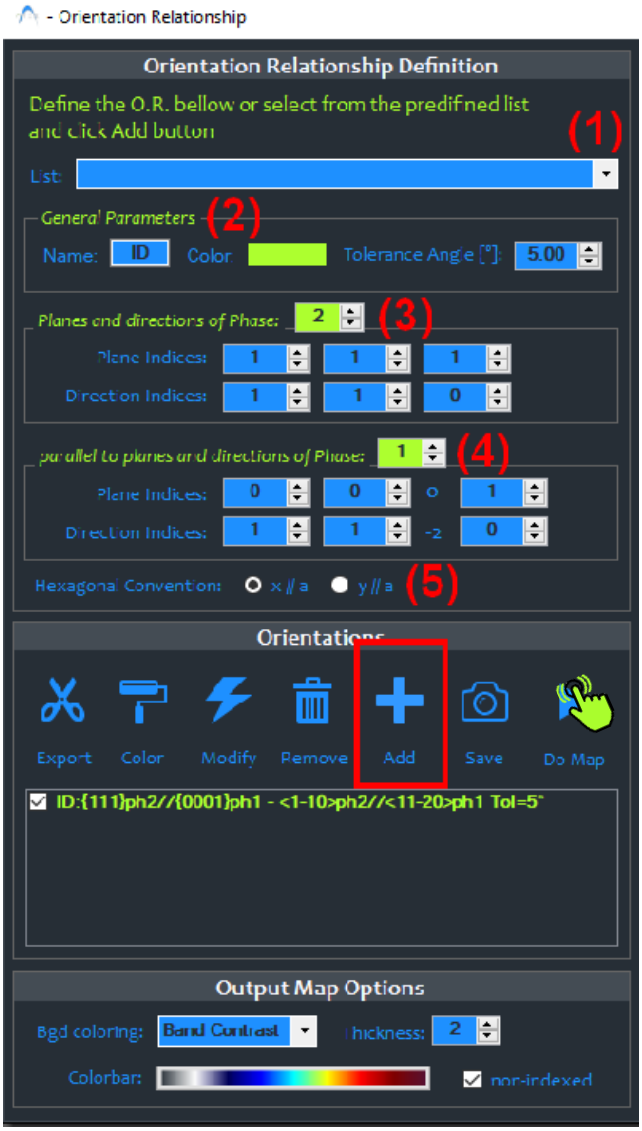
# 2. Set your Orientation relationship(s)




You can set your orientation relationships either manually **(3)(4)** or from the predefined list **(1)**

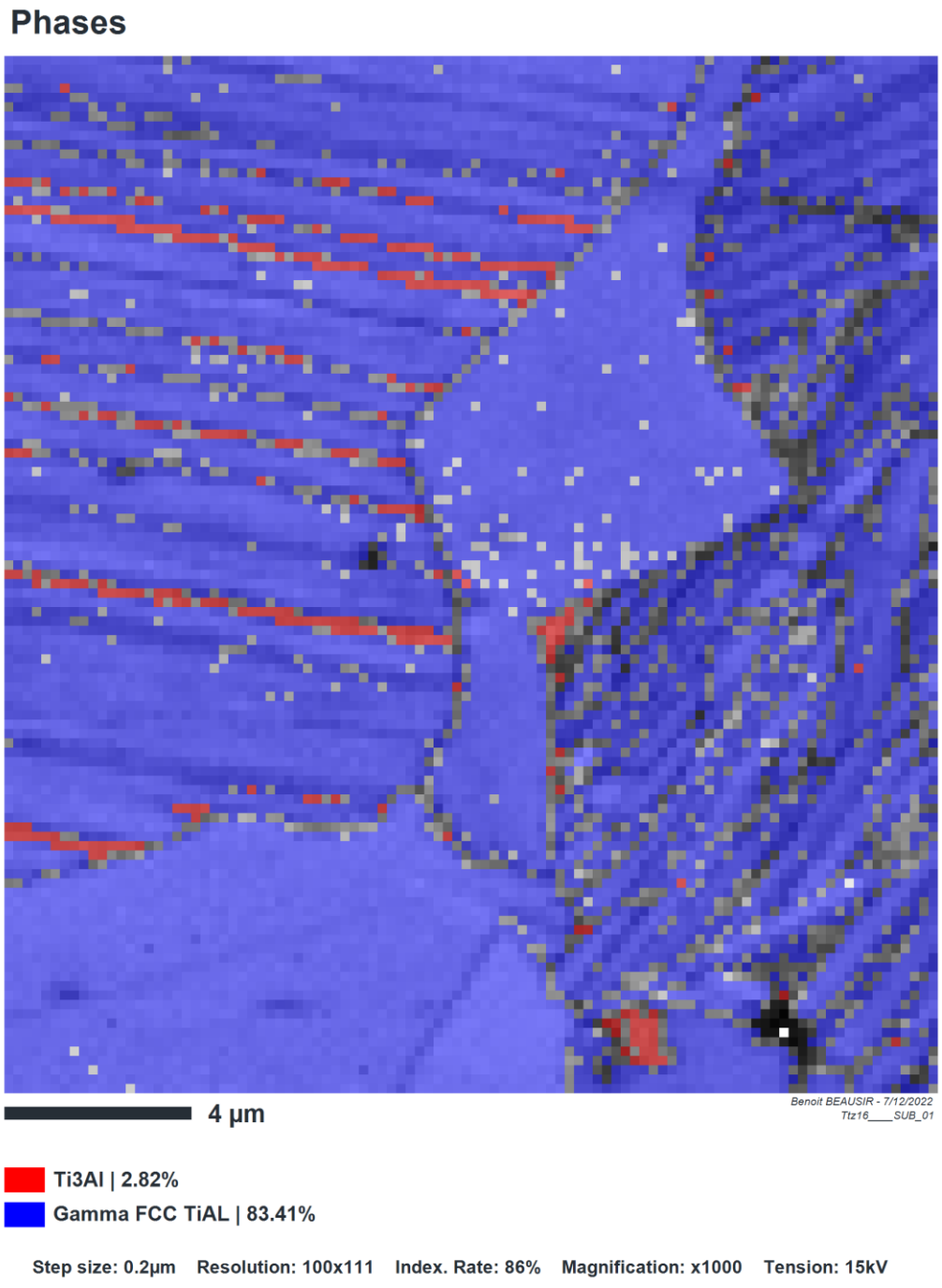
**(2)** Set the name, the color and the disorientation tolerance angle for which the orientation relationship will be considered to be in orientation relationship or not.

**(3,4)** set the respective phases, the planes and directions of the O.R. According to your data, don't forget to choose the appropriate convention for phase with hexagonal symmetry. **(5)**.

Click on the "Add" button to include the O.R. in the list

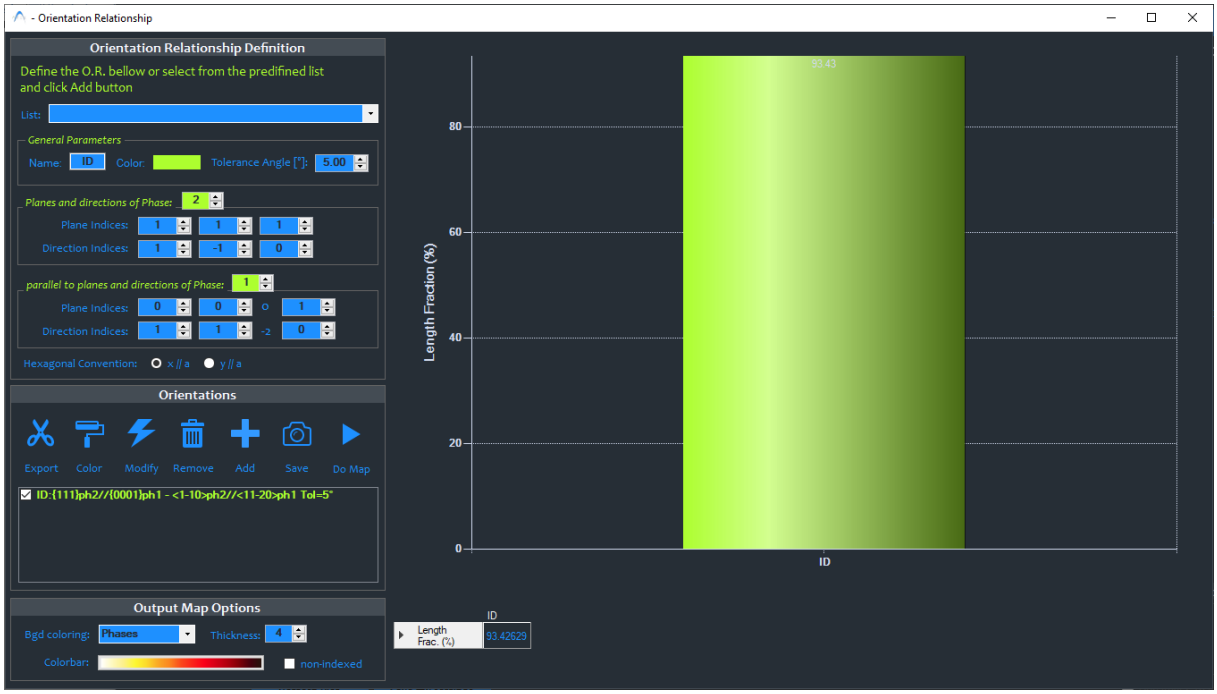
Click on "DO MAP" button to look for the O.R. in your map. (you can also set some options for the output map in the bellow panel)

# 3. Example with an γ-based Titanium // Aluminides



The Orientation Relationship is

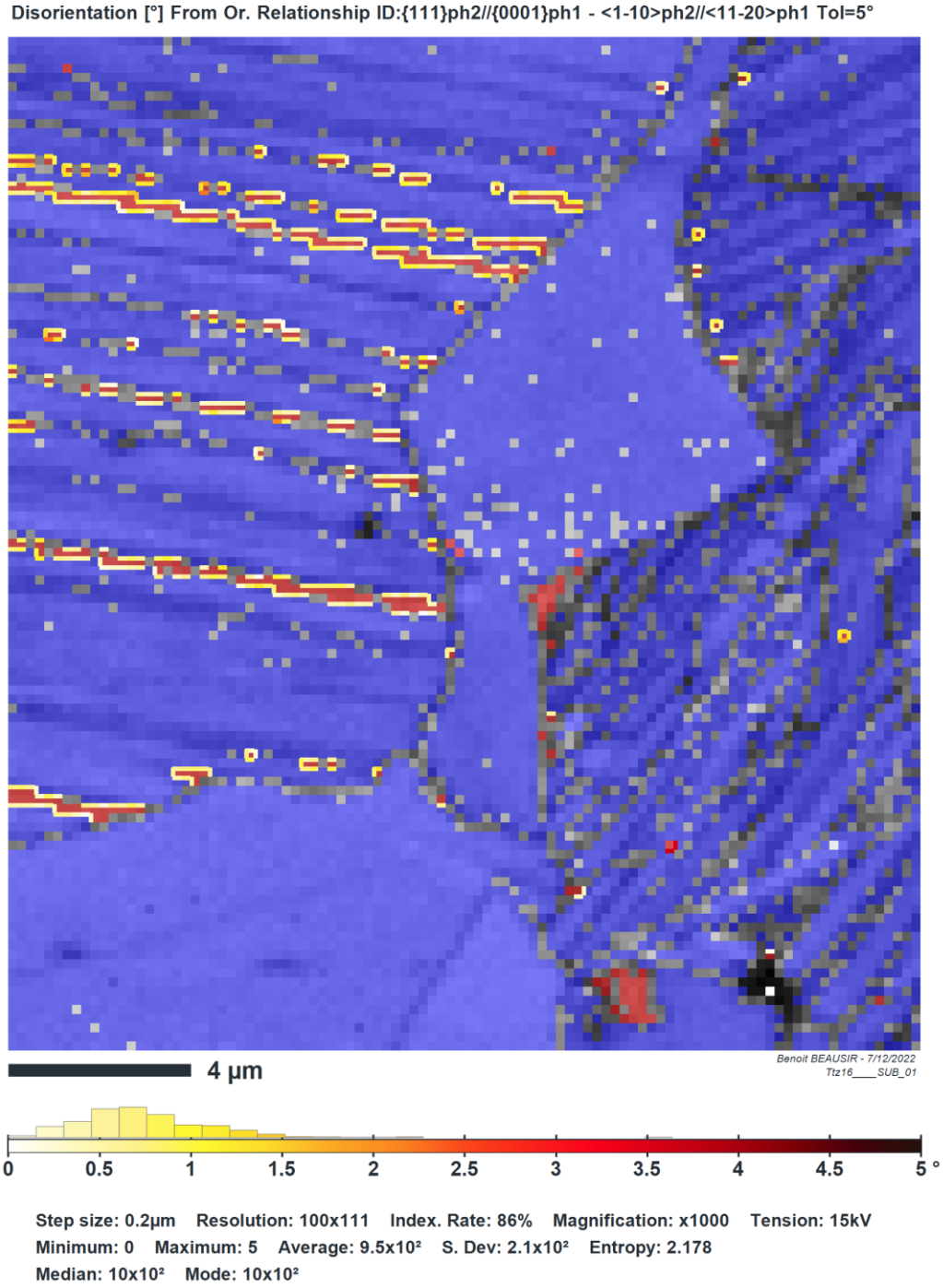
**(0001)hcp//(111)c and [11-20]hcp//[1-10]c**




93.4% of the boundaries between the two phases are in orientation relationship, with a disorientation less than 5°.

Note that if you add several O.R. in the list, if more than one OR display a disorientation less than the tolerance angle, the nearest (less disorientation) will be chosen and a map colored by the OR color will be plotted.

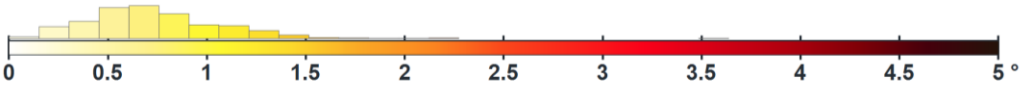
Here is the corresponding map, boundaries in O.R. are colored with respect to the deviation of disorientation angle.



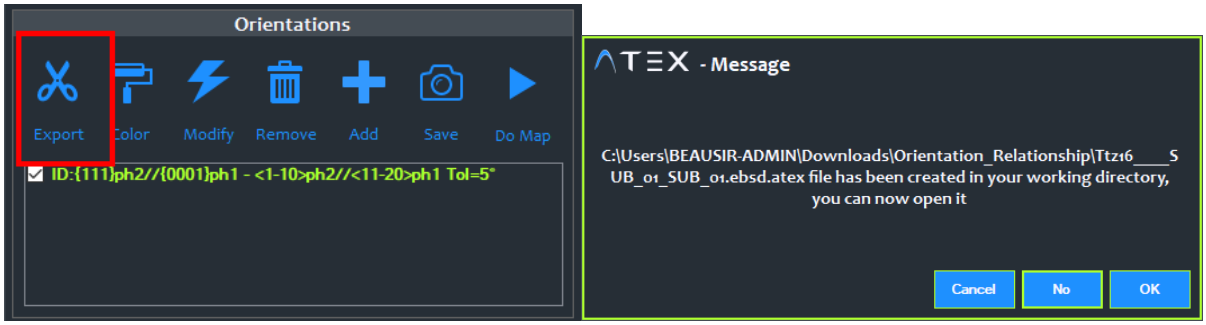
You can plot the disorientation distribution of the O.R. in the “Statistic” Tab → Distribution button


**(1)** Make sure the O.R. map is selected
**(2)** Select “All phases” to consider both phases in the distribution
**(3)** Adapt the min and max of the distribution
**(4)** If needed modify the number of classes
**(5)** Click on the redraw button

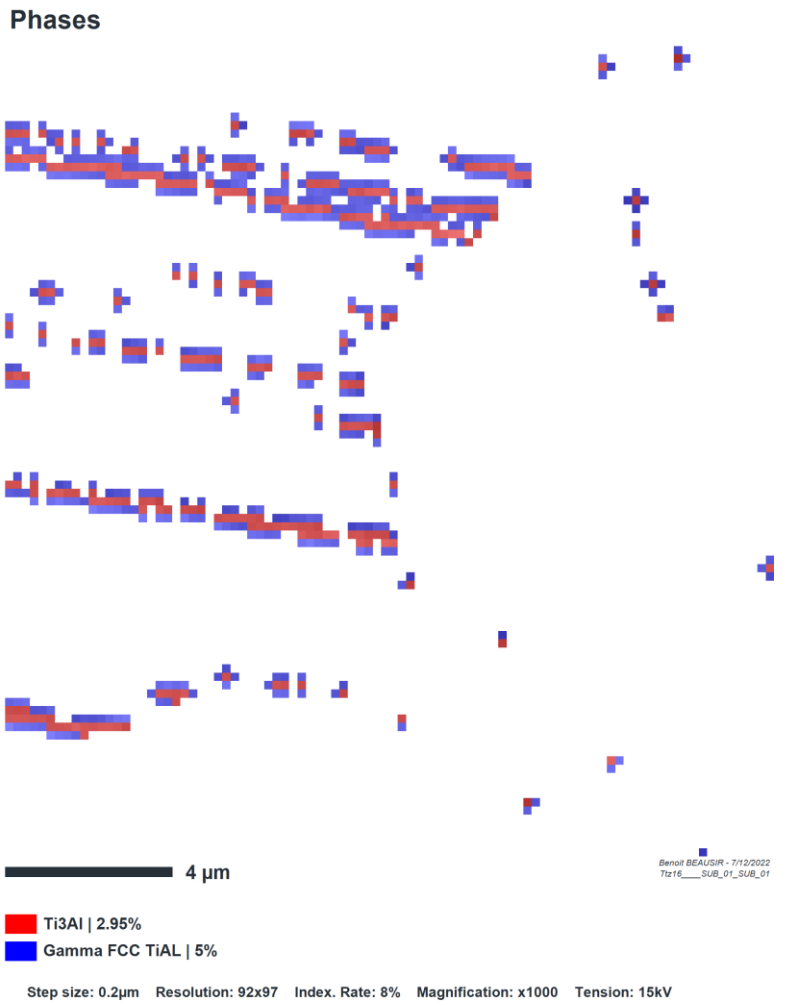
The distribution should be the same than the one on the colorbar of the map



You can also export the pixels in O.R. to plot their orientation by clicking on the “Export button”, a new ebsd.atex file will be created in your working directory.




Click OK to open it, here is the exported phase map.



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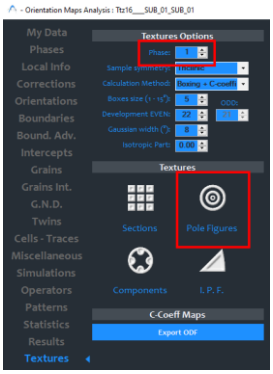
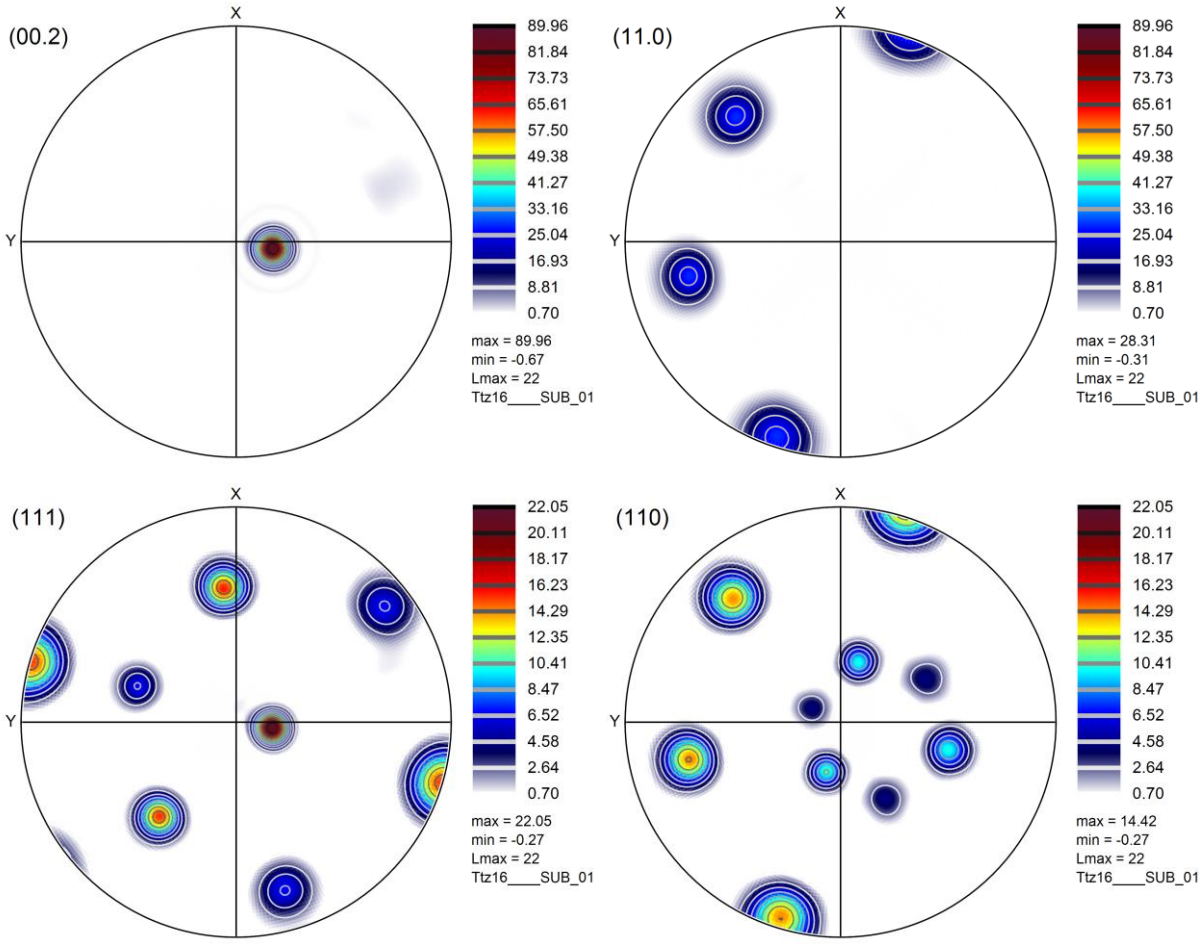



You can now plot the orientation distribution function of the two phases in the “Textures” tab. Select the phase you want to plot the texture and click on “Pole Figures” Button.

The two variants are well visible on (111) and (110) pole figures



# 4. References

[1] M. Humbert, F. Wagner, H. Moustahfid, C. Esling, Determination of the Orientation of a Parent β Grain from the Orientations of the Inherited α Plates in the Phase Transformation from Body-Centred Cubic to Hexagonal Close Packed. J. Appl. Cryst. (1995). 28, 571-576.

[2] L. Germain, S.R. Dey, M. Humbert, N. Gey, Determination of parent orientation maps in advanced titanium-based alloys, Journal of Microscopy, Vol. 227, (2007), pp. 284–291.