# Virtual Upscaling through Modelling Factory. Leartiker

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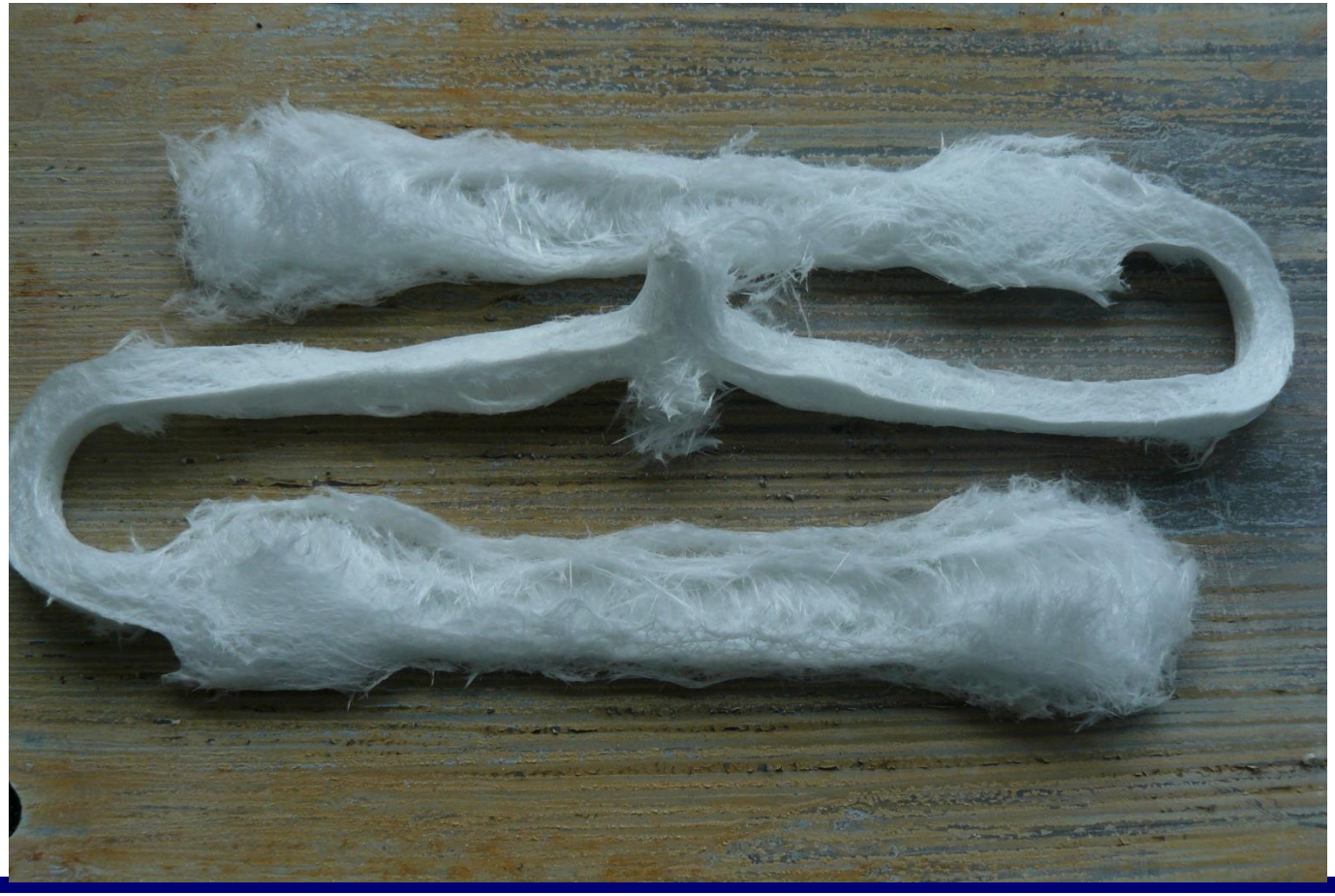
## Task 3.1: Extracting requirements for Modelling Factory with sub case study 1

Description: Work will be carried out using following steps:

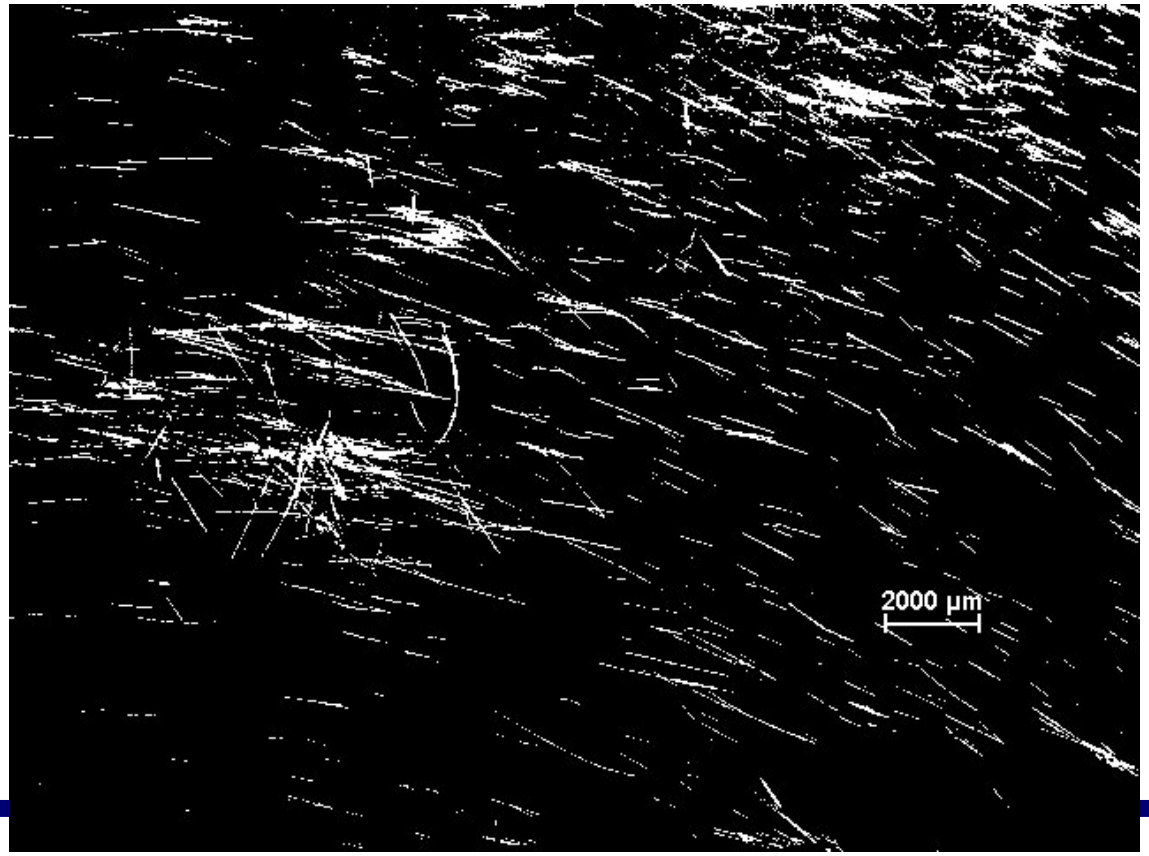
- Analysis of the heterogeneity of the process (already done in other projects).
- Simulations with commercial material models (already done in other projects).
- Generate novel material models
- Simulate with novel material models, and select the best options
- Standardize the best models and define the virtual upscaling method in collaboration with WP4.
- Used Software: Autodesk Moldflow (fibre size, fibre orientation, and porosity), Digimat (material modelling from micro to macro scale, ANSYS (structural performance prediction at component level).

# Measuring the fibres:

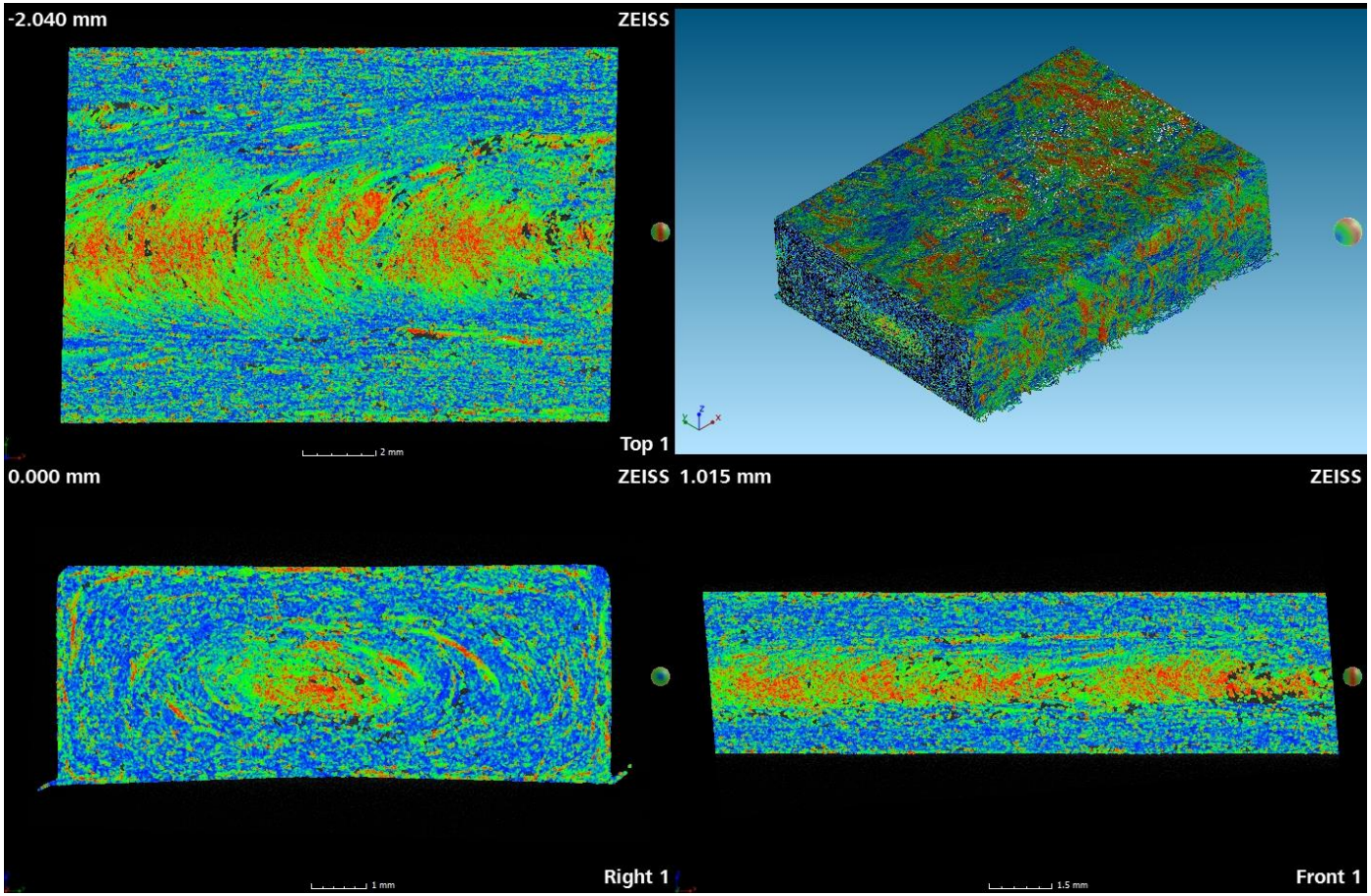


# Measuring the fibre length:

## Threshold calibration; ImageJ use automatization of the process

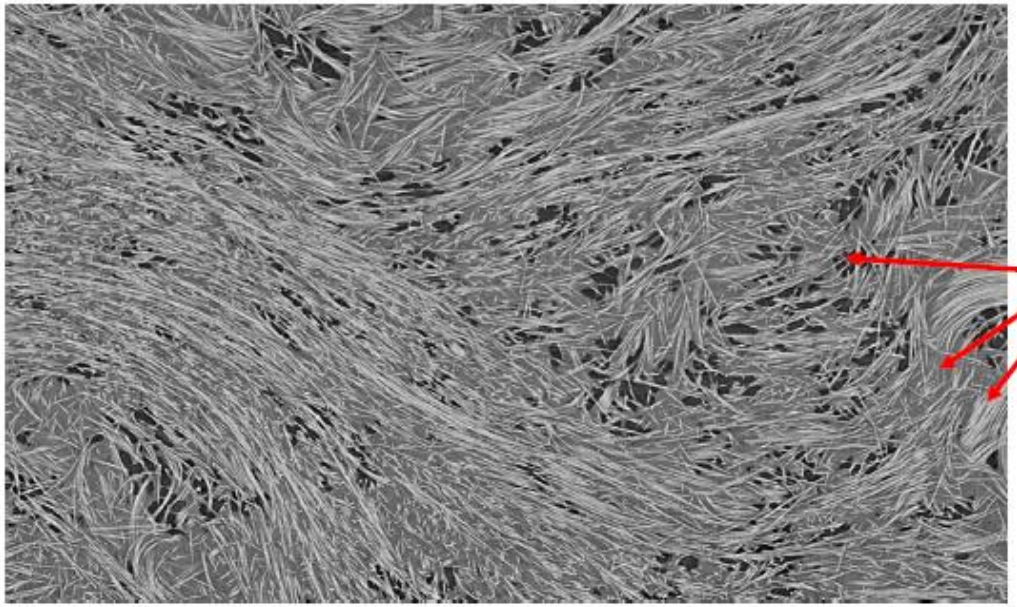


# Tomography:



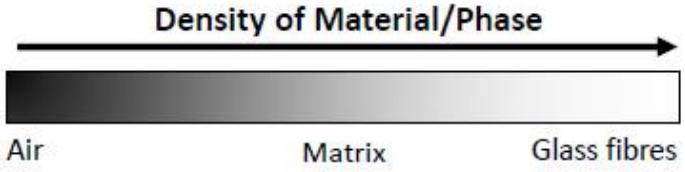
# Tomography:

Example of 2D reconstructed slice extracted from the volume located in the middle of the principal plane of Sample 3



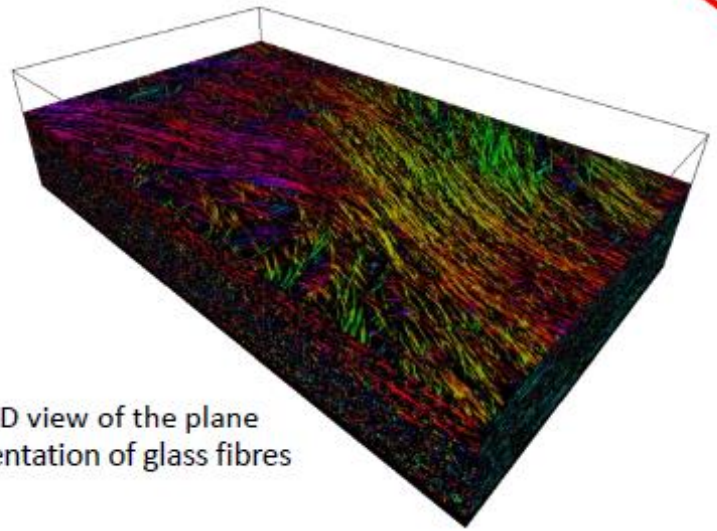
The grey levels are correlated to the local density of material. It is possible to distinguish 3 different phases in this image:

- Air in black
- Matrix in grey
- Glass fibres in White



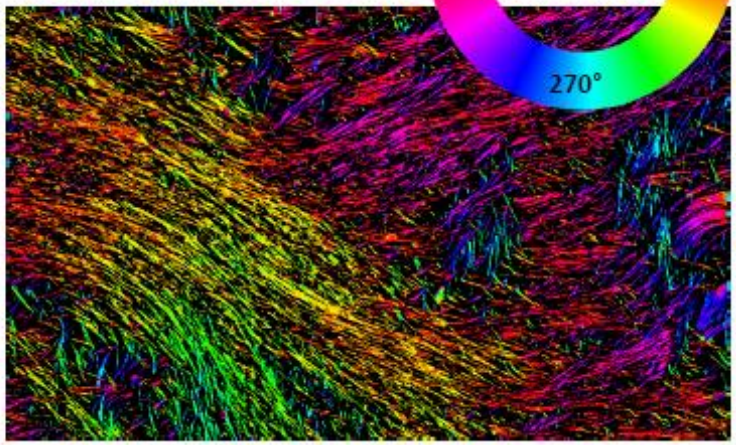
# Tomography:

- In the light of the previous results we have calculated the 2D orientation only in the principal plane.
- A 3D map was obtained where the RGB colors are correlated to the 2D plane orientation of glass fibres.

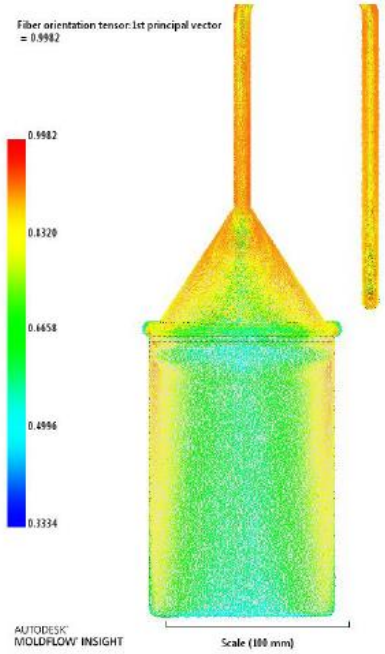


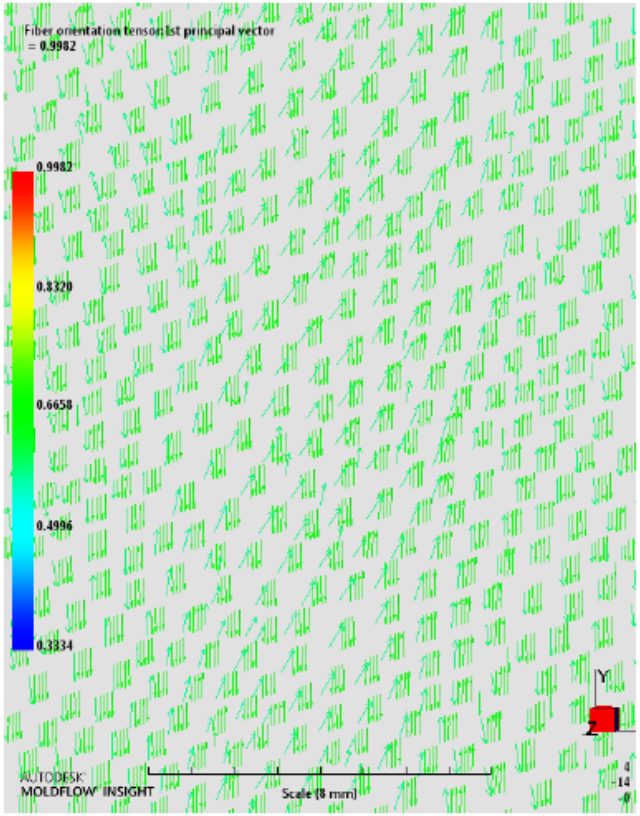
3D view of the plane orientation of glass fibres

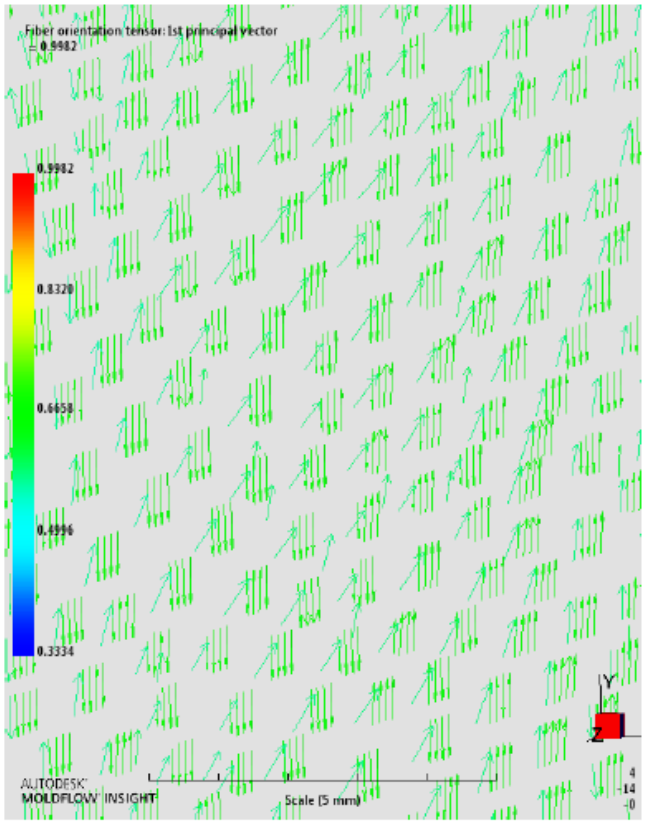
2D reconstructed slice extracted from the volume



# MOLDFLOW:

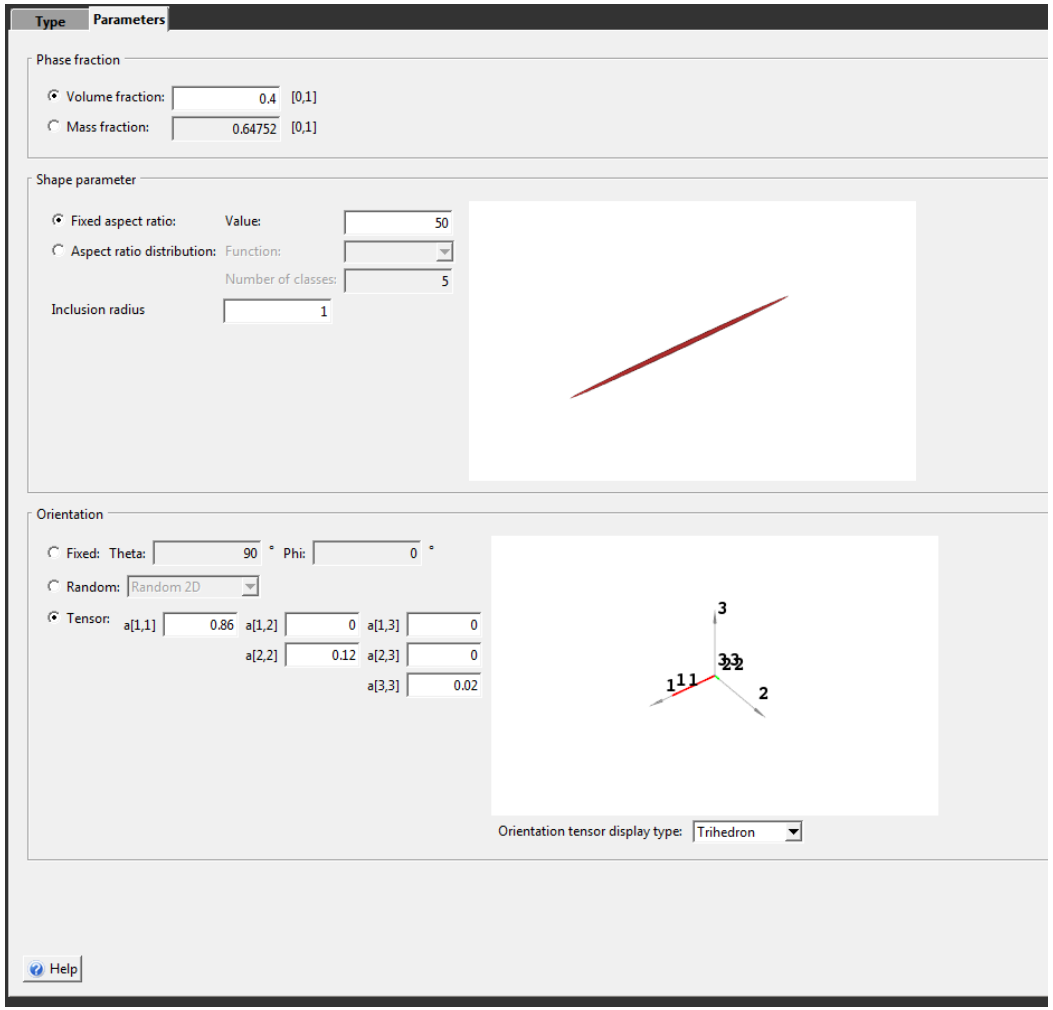

Fiber orientation tensor: 1st principal vector
= 0.9982
0.9982
0.8320
0.6658
0.4996
0.3334
AUTODESK
MOLDFLOW INSIGHT
Scale (100 mm)


Fiber orientation tensor: 1st principal vector
= 0.9982
0.9982
0.8320
0.6658
0.4996
0.3334
AUTODESK
MOLDFLOW INSIGHT
Scale (8 mm)


Fiber orientation tensor: 1st principal vector
= 0.9982
0.9982
0.8320
0.6658
0.4996
0.3334
AUTODESK
MOLDFLOW INSIGHT
Scale (5 mm)

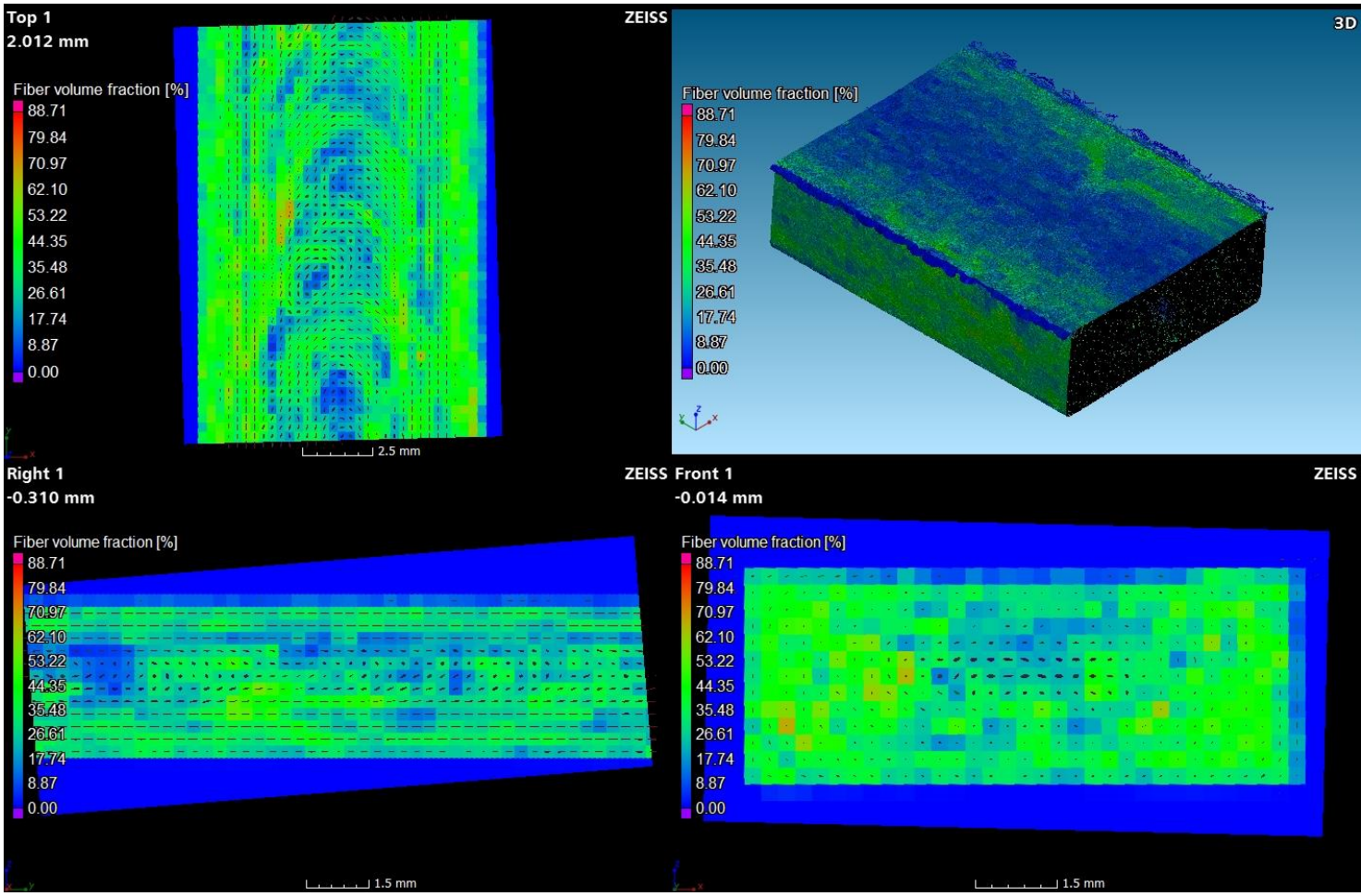
# DIGIMAT:

A single orientation tensor is introduced in the part, some orientations according to the thickness have to be introduced to optimize the structural calculations



# DIGIMAT:

The orientation tensors can be exported to excel and from them introduced in Digimat



# Comparison Moldflow/Tomography:

- The orientations can be extracted from Tomography, either using Volumegraphics or Avizo softwares. These data can be implemented in Digimat for further structural simulations.
- The results provided by Moldflow don't fix. Further calibration of the moldflow parameters is required.
- It will be necessary doing more tomographies in different materials and geometries to determine the orientation patterns and calibrate the parameters of the Moldflow until a good agreement is reached.