Towards a quantification of glass fiber content and orientation

Polymers are increasingly used as structural parts e.g. in the automotive industry to save weight compared to the traditional metal design. To achieve the required mechanical performance polymers like polyamids (“Nylon”) are mixed with glass fibers, frequently up to 50% weight content. A typical production route is injection molding that allows to produce complex shapes in massive amounts. During this process the glass fibers in the molten polymer are oriented in a typical core-shell structure. Software packages allow the prediction of fiber orientation and the resulting direction dependent local mechanical properties of the composite. However, these methods are still a field of active research. Consequently it is of interest to determine the **actual** local fiber content, their distribution and orientation from injection molded samples to verify the results of such computations. A promising route is to use Micro-CT scans, slices of which are presented in Fig. 1.

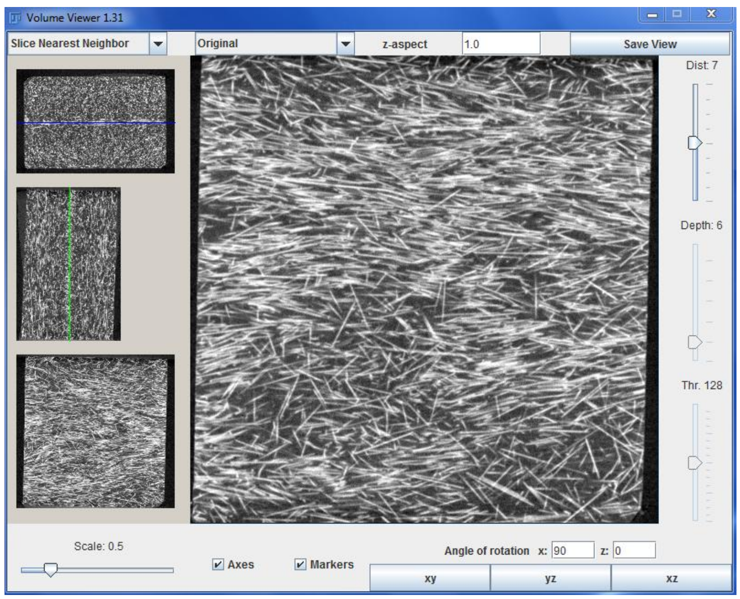

Figure 1: Micro-CT scan of a glass filled polymer.

Goal of this Software Lab is to write a preprocessor for this data which generates the following quantities:

- the local fiber content
- fiber orientation
- fiber length distribution

as function of space directly from a Micro-CT scan. The raw data is available in DICOM format, the implementation could use the Matlab image processing toolbox. Along the way, you will have to investigate into existing algorithms as well as develop and implement your own algorithms.

DSM is a global life science and material science company with a strong portfolio in high performance engineering plastics. The Materials Science Center is located in the south of the Netherlands. This work will jointly be supervised by Dr. Stefan Kollmannsberger, CiE TUM and Dr. Uli Heisserer, DSM.