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Foams scans and data-processing with ScanIP

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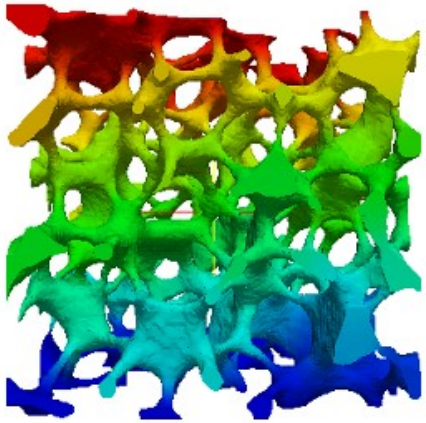
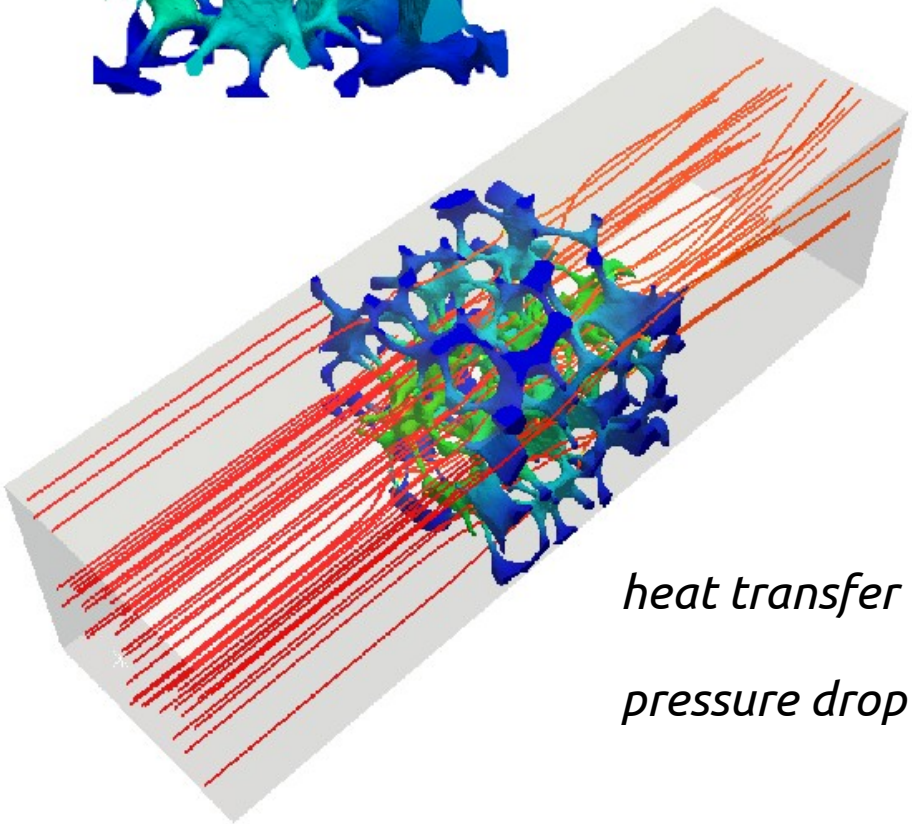
Foams simulations with OpenFOAM

Micro-scale models



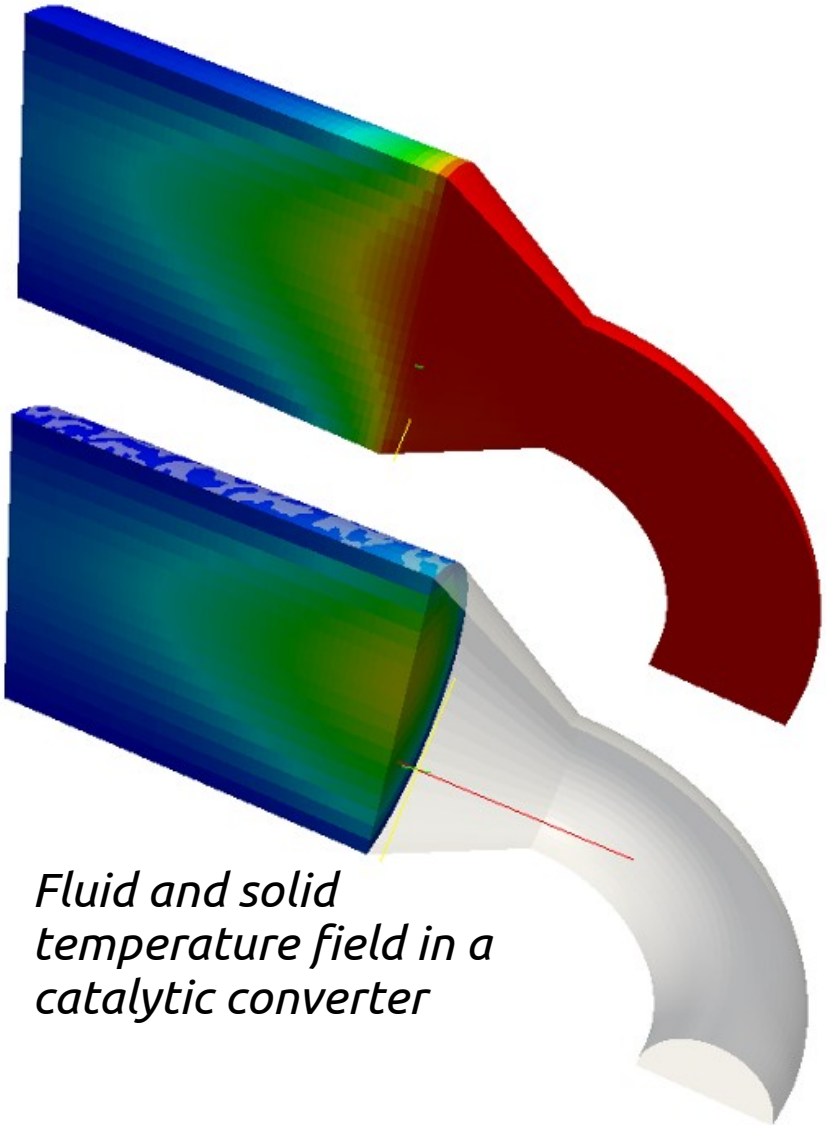
conduction



heat transfer

pressure drop

Macro-scale models



Fluid and solid temperature field in a catalytic converter

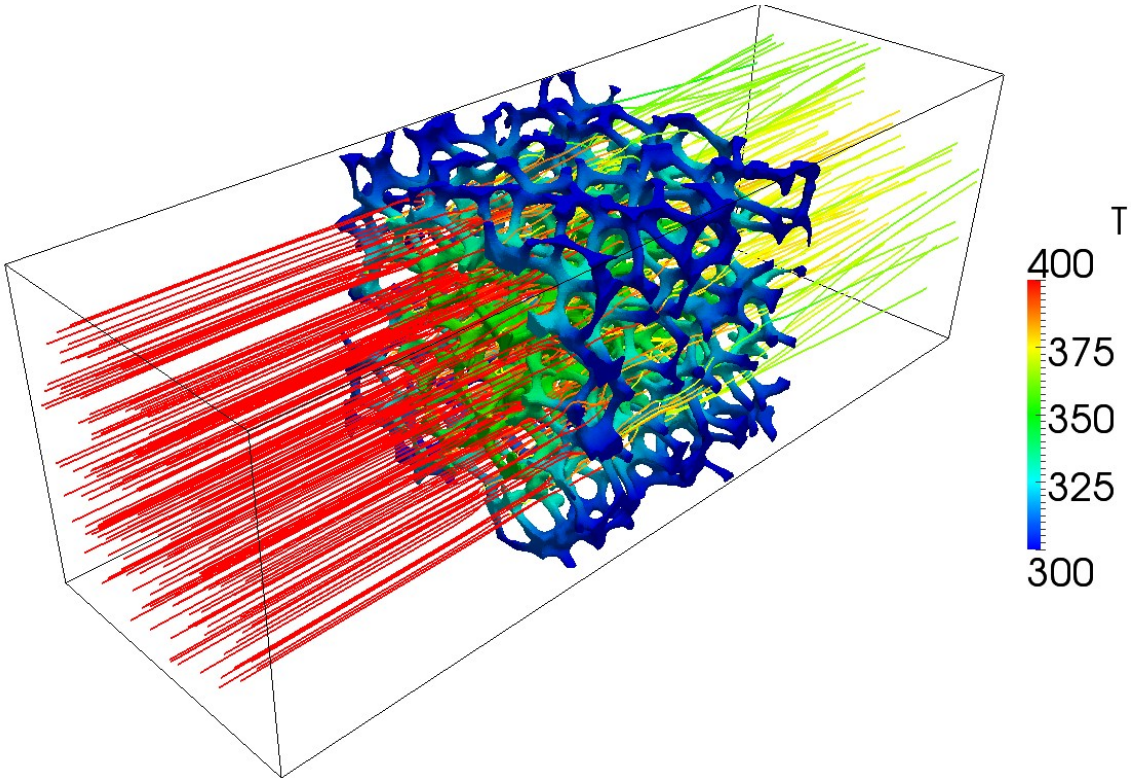
Mesh generation

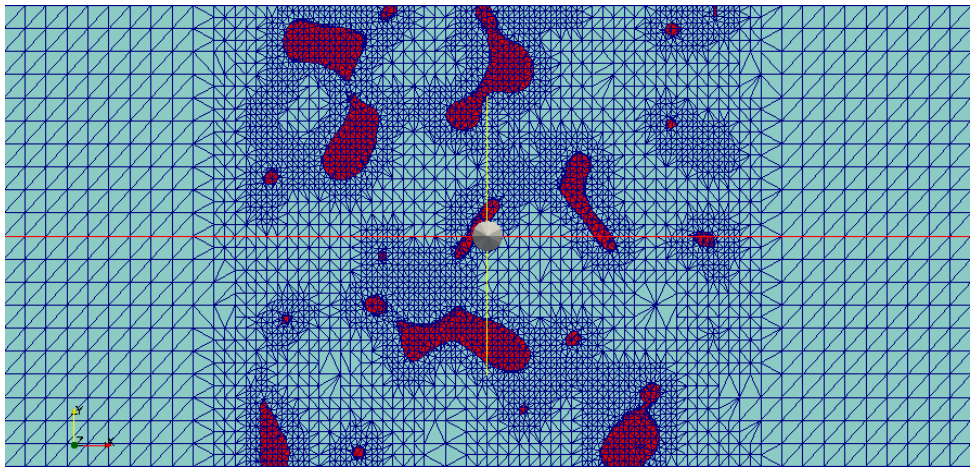
For conjugate heat transfer simulations double fluid-solid mesh is needed.

Mesh is generated using `snappyHexMesh` OpenFOAM utility starting from a STL surface.

Is it possible to do the same with scanIP?

With regard to the only fluid mesh is it possible to add boundary layer near the foam walls?

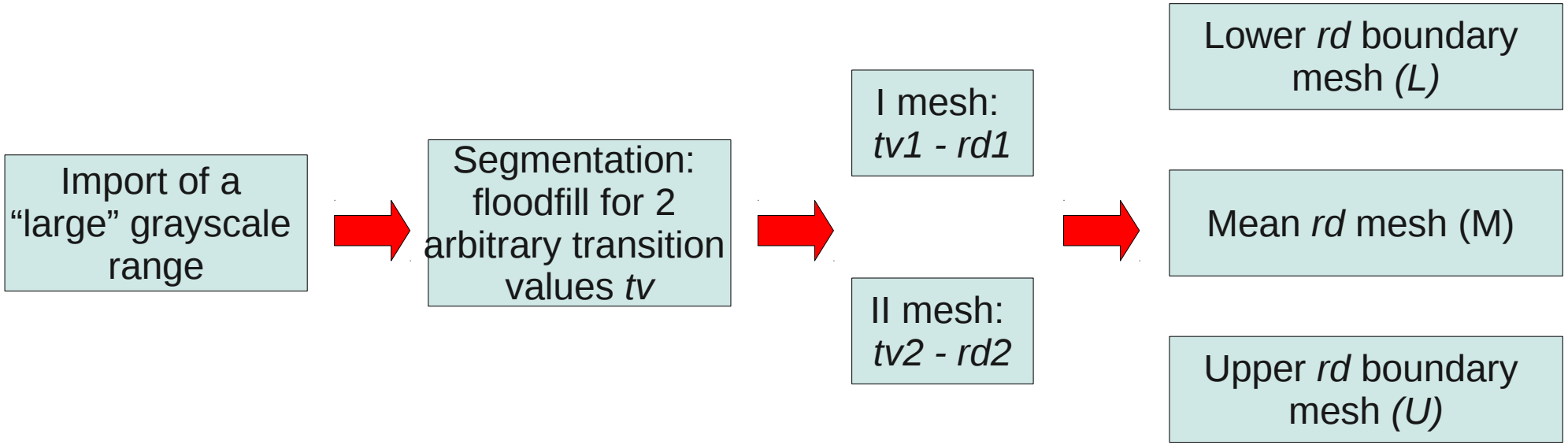




STL generation in ScanIP

Since the experimental relative density (rd) of the foam is known for most of the samples, this parameter is used for finding a reasonable fluid-solid transition value on the gray-scale.

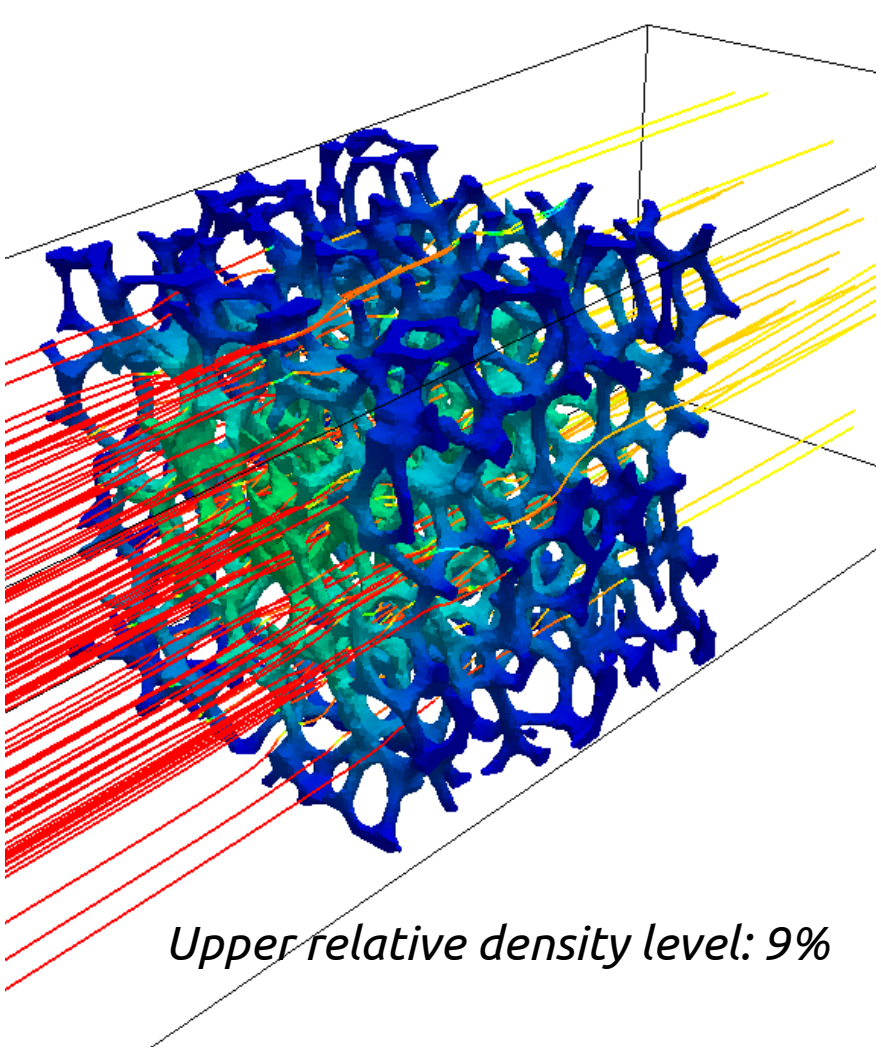
Moreover, since the experimental rd is provided within a certain confidence interval, a surface is generated also for the upper and lower rd level and a sensitivity analysis is addressed.



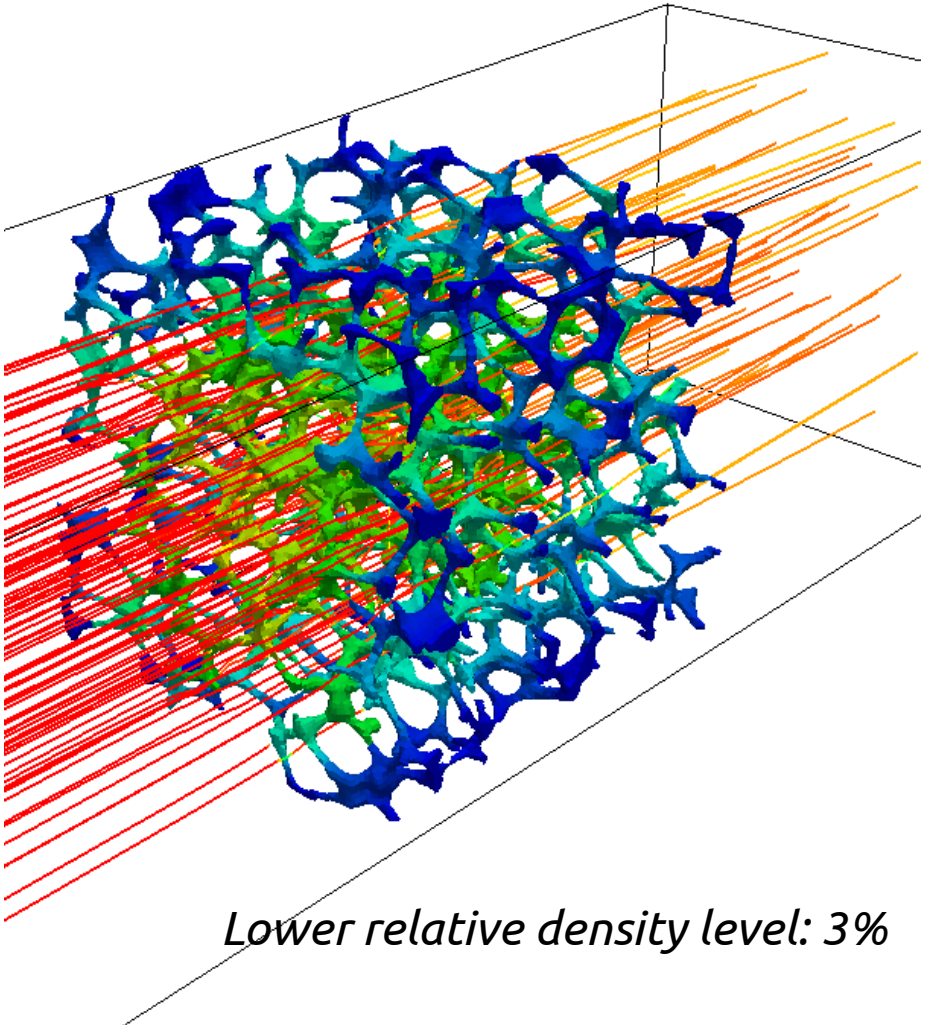
The final values are easily found by linear interpolating between the tv-rd values of the two preliminary meshes

Sensitivity analysis

The choice of transition value on the gray-scale (and so of the relative density) has a great impact on the conductive properties of the foam.



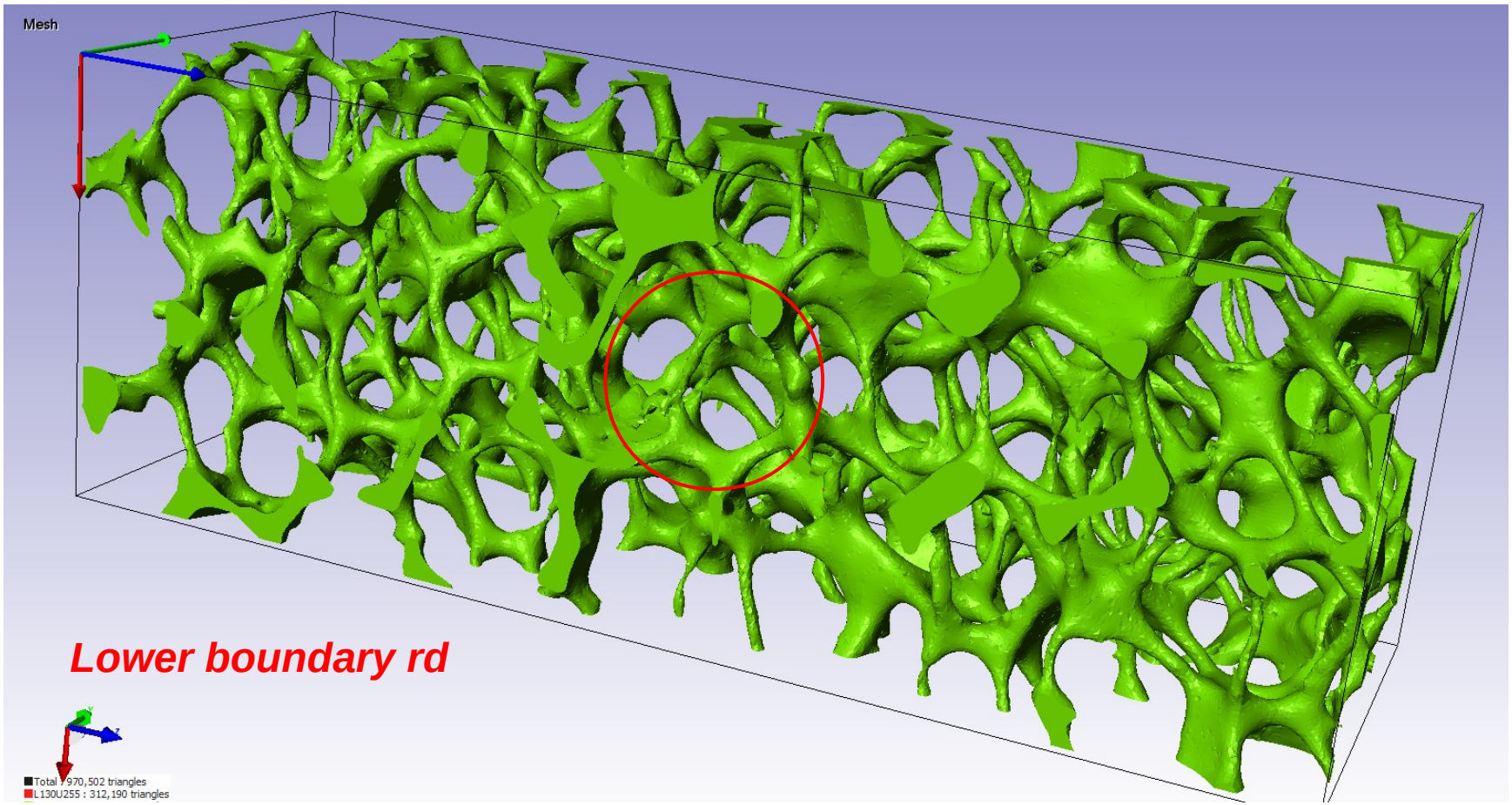
Upper relative density level: 9%



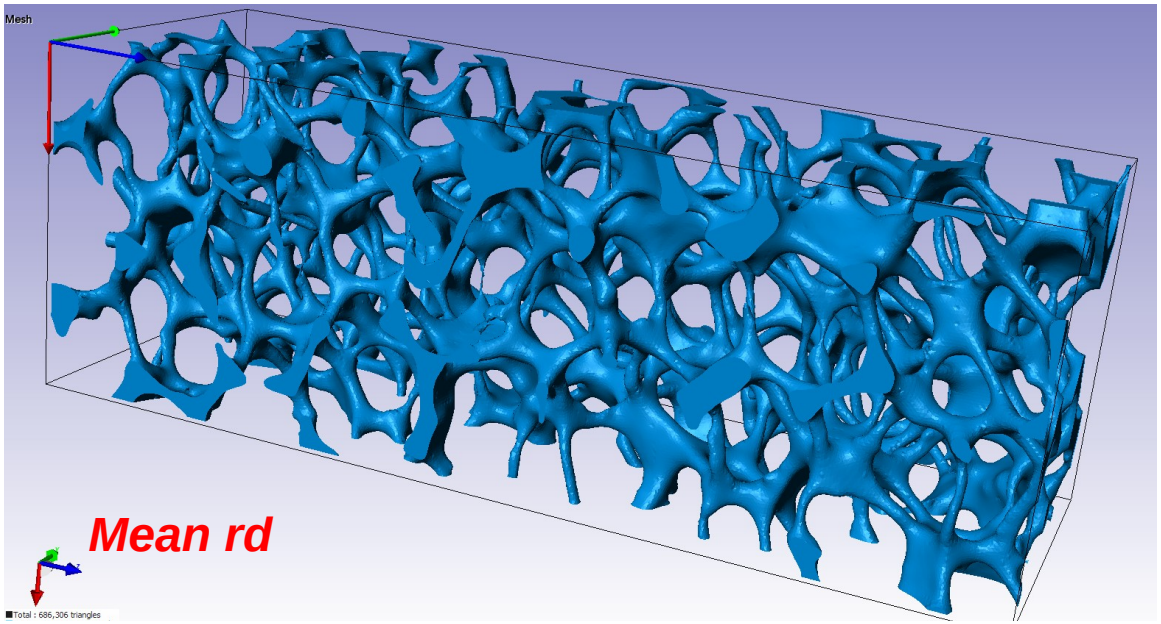
Lower relative density level: 3%

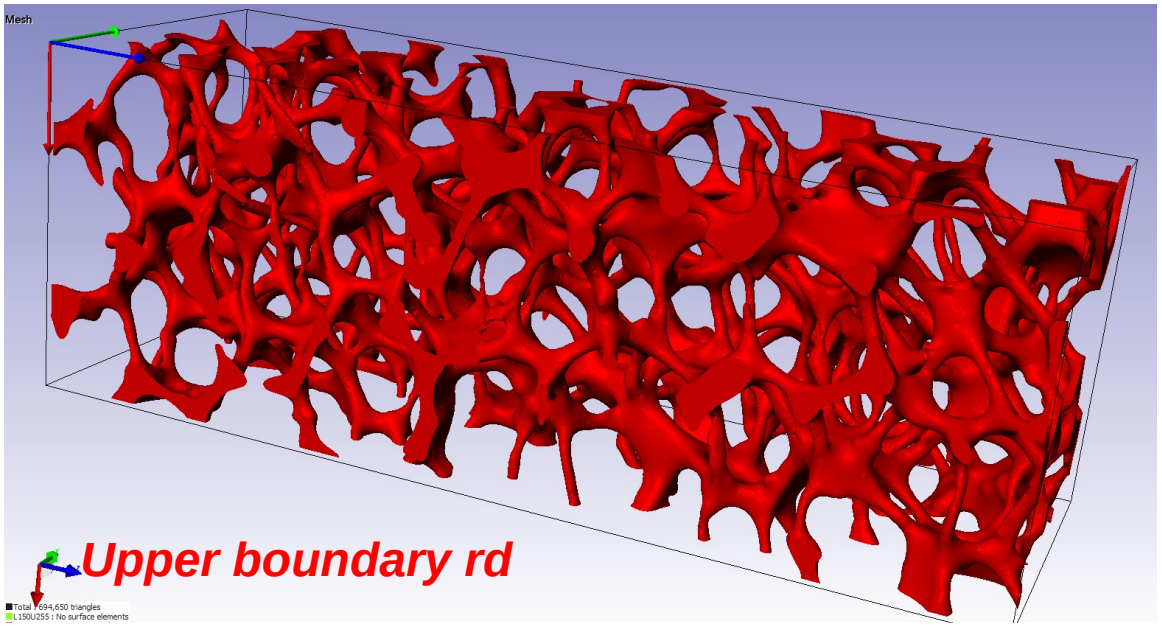
STL surface quality

The foam ligaments are very thin. *How to improve the quality of the surface in these regions?*



STL surface quality



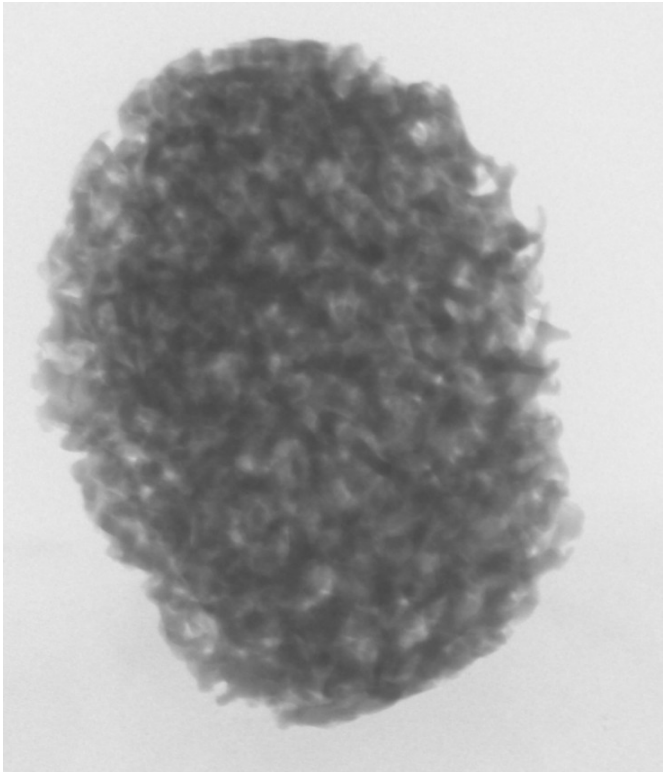


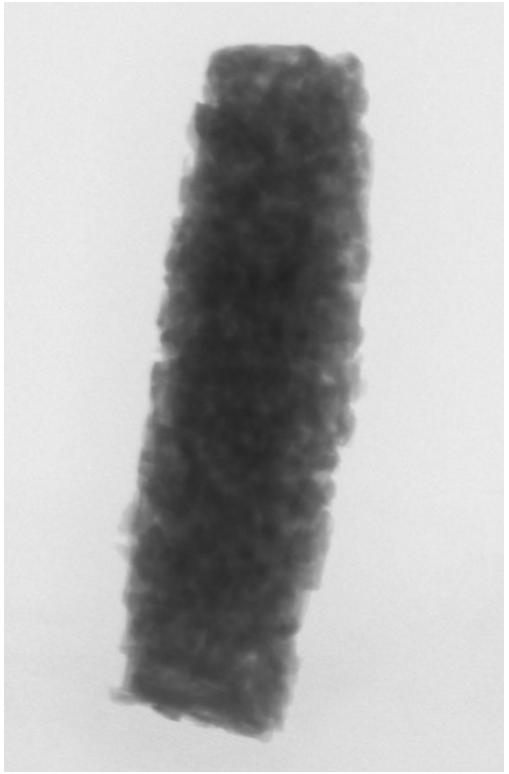
Step of the data processing:

- Import: skip pixel = 2 *(I did that for reducing the dimension of the case but I saw also an improvement in the surface smoothness)*
- Resample: none
- Filtering: none *(what do you recommend for this case?)*
- Segmentation: floodfill *(I saw a better result than threshold)*
- Surface generation: STL(RP) and STL(FE/CFD) with different optimization. *(STL(FE/CFD) gives a better result in term of smoothness but takes a longer time. However when optimization is adopted often fail to mesh)*

Import of the micro-CT data

Is it possible to directly import in scanIP raw data non in coordinate grid, such as the *.tiff images provided by the micro-CT scan, which are XY planes with different angles?





Cases