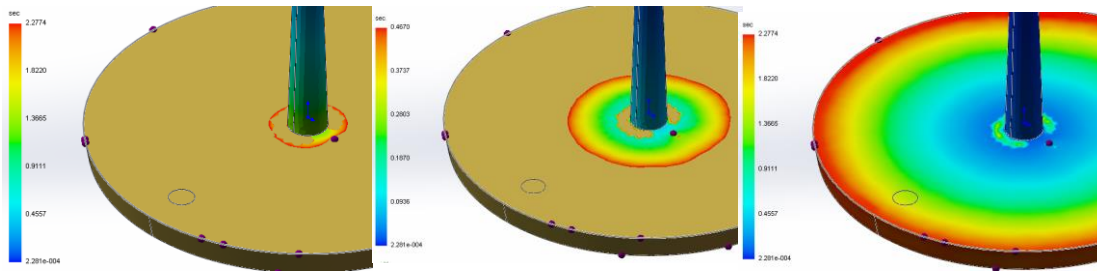# aim4np: simulations to estimate nanoroughness

Commercial software

Simulations for all the plastic part with fine mesh showed wrong results requiring submodelling technique.
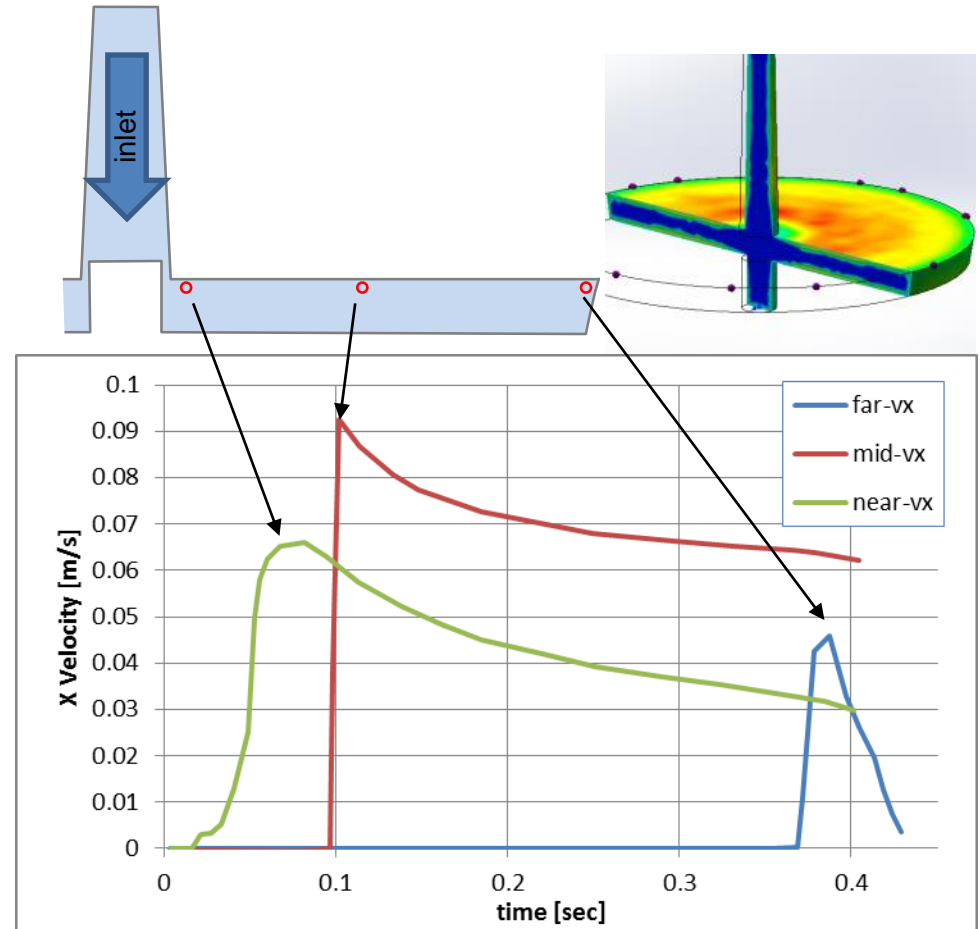

Simulation: https://youtu.be/cYOieuvh9t8

Mesh transitions: https://youtu.be/thfCbnYch2s
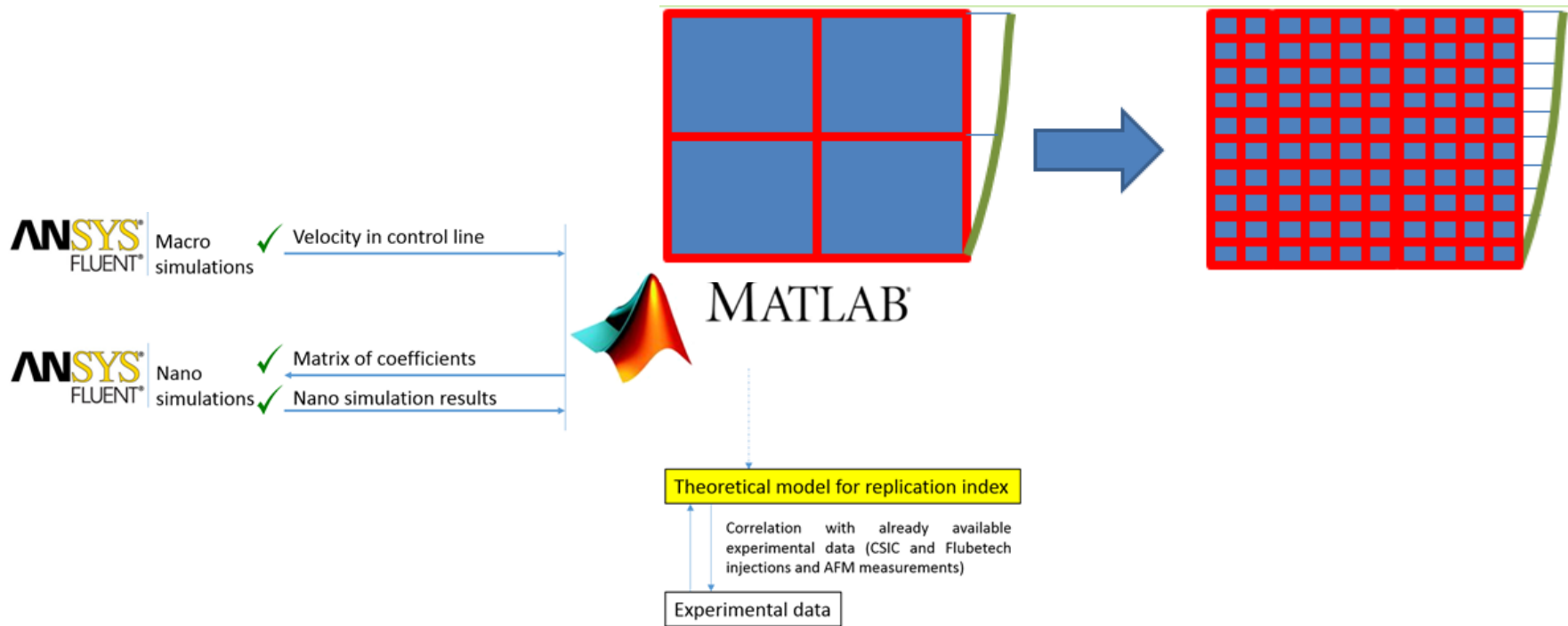
Mesh problems: https://youtu.be/hv90hEr3SpA

Boundary conditions

In order to simulate a portion of the mould with fine mesh macro simulations are carried out to obtain valocities, temperatures, pressures for each location as a function of time.
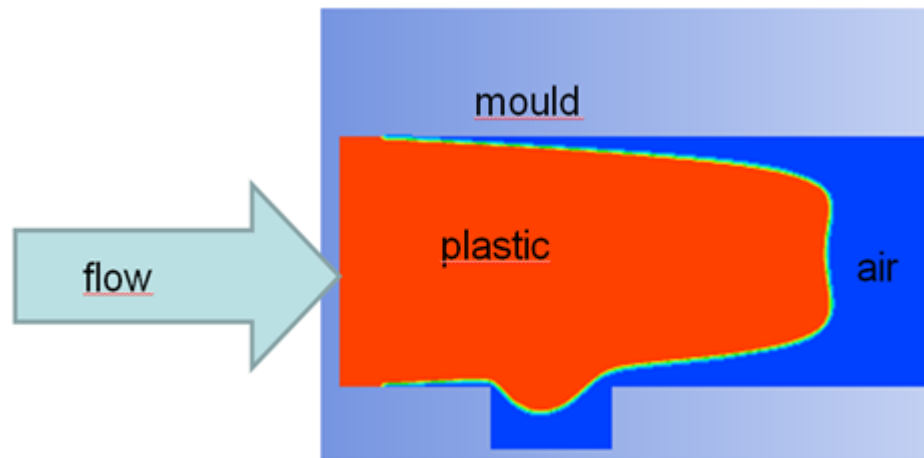
Scripting

Such parameters are interpolated in position and time from macro mesh into nano mesh.

Initial wrong boundaries results

With this technique initial results were obtained to estimate it the plastic flow would fill all cavities.

This model was wrong on the upper face were wall conditions were forcing velocity zero instead of macro-mesh velocity.

Model coupling

Simulations have been improved by adding the right wall conditions and improving the viscosity model for polymer as a function of pressure and temperature.

Polymer inlet

Macro simulation

300nm
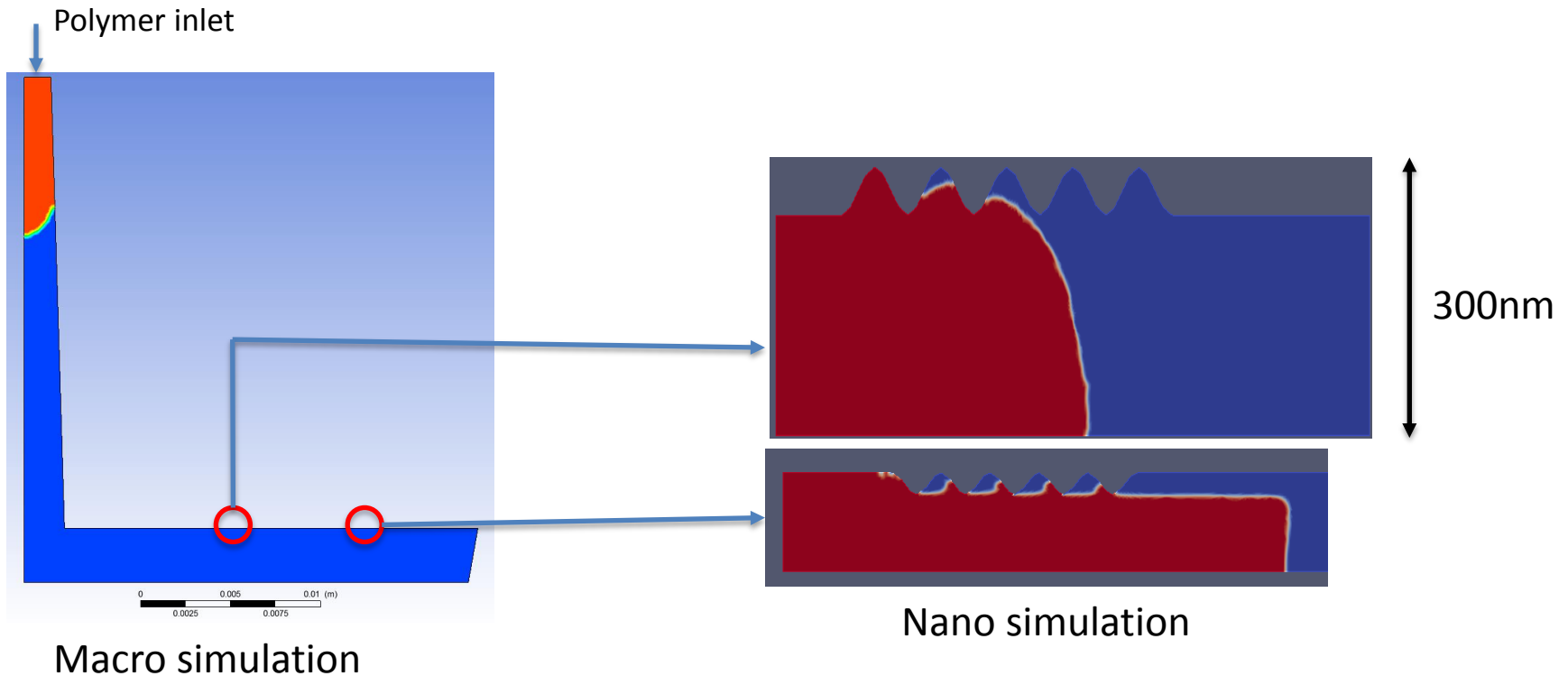
Nano simulation

Wave length

Experimental points of Sw were analysed on different regions of the measurement to obtain Ra=47.7±6.9 and Sq=58.9±8.6nm with Sq/Ra=1.24 in order to compare properly with simulations of just 1/10th of this model.


```
elements
pentas :1301860
total  :1301860
```
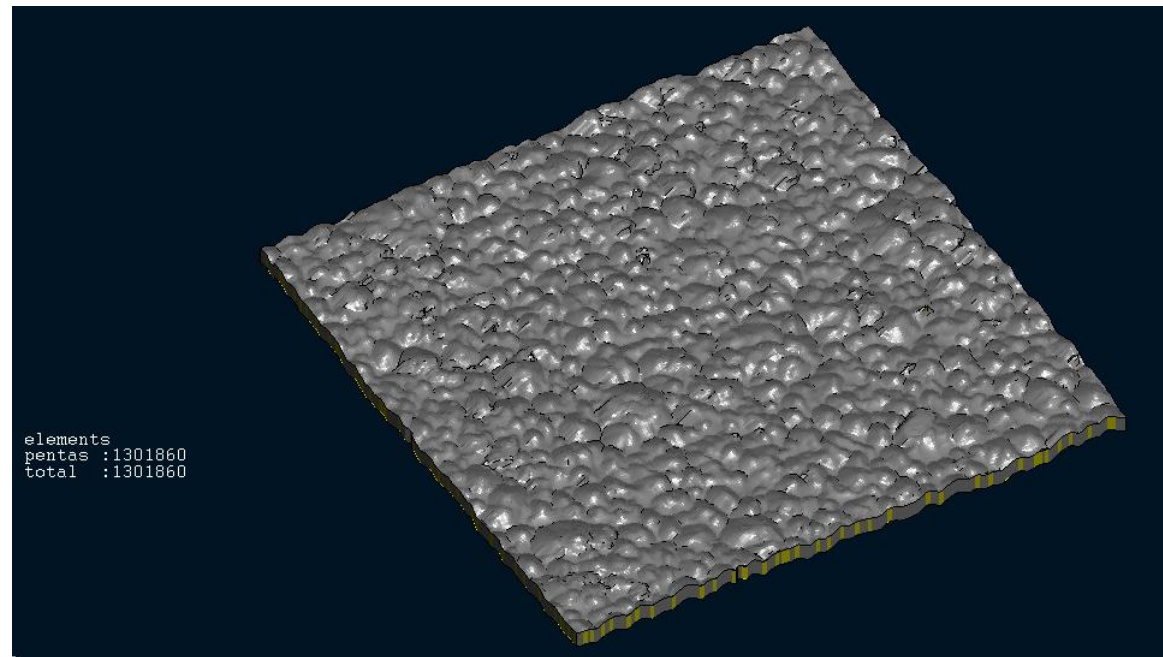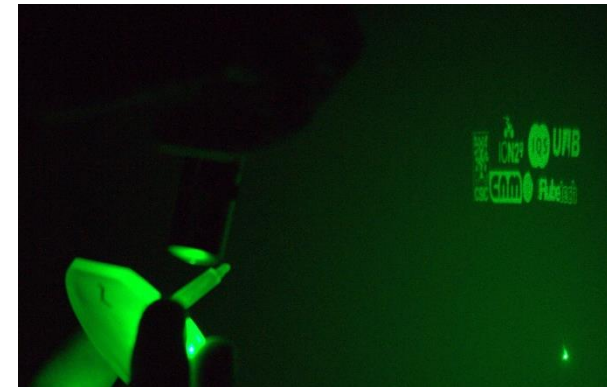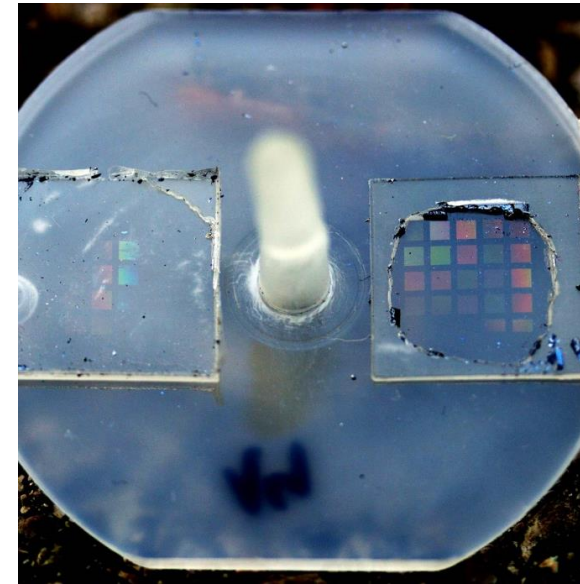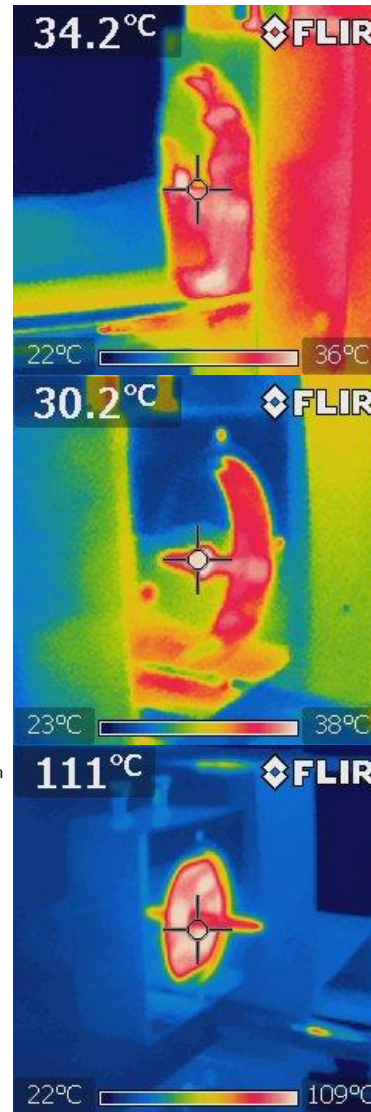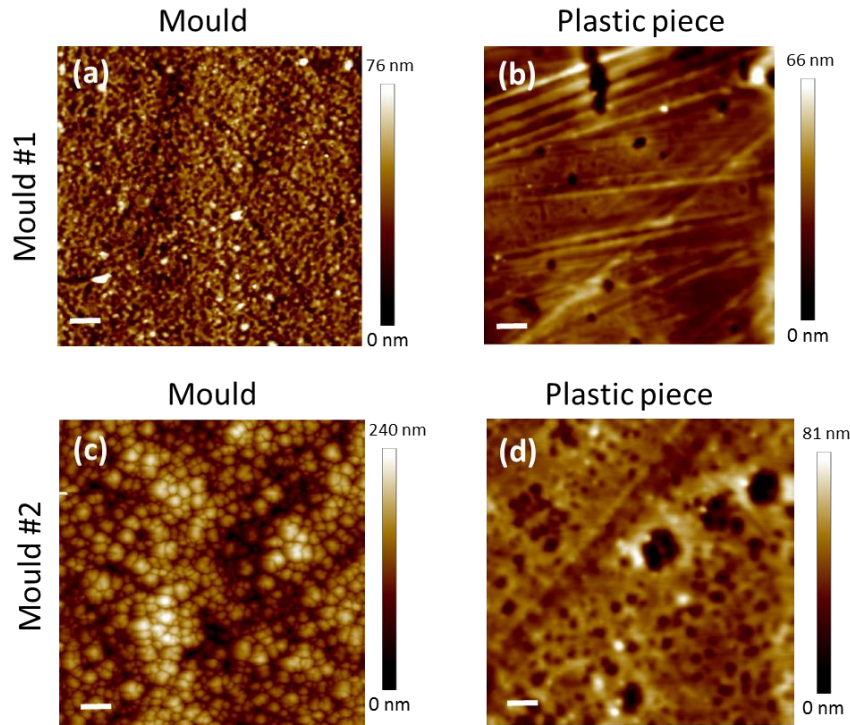
Simulations: Wave length

Replication for different wave lengths. If we ignore the flat chip we only have experiments for mould#1 and mould#2.

Narrow simulations with same Sq in mould were more difficult to copy. Difficult to place a experimental point.

Experiments

Mould

Plastic piece

Mould #1

Mould #2

https://youtu.be/INkpHtasv50

Confidential
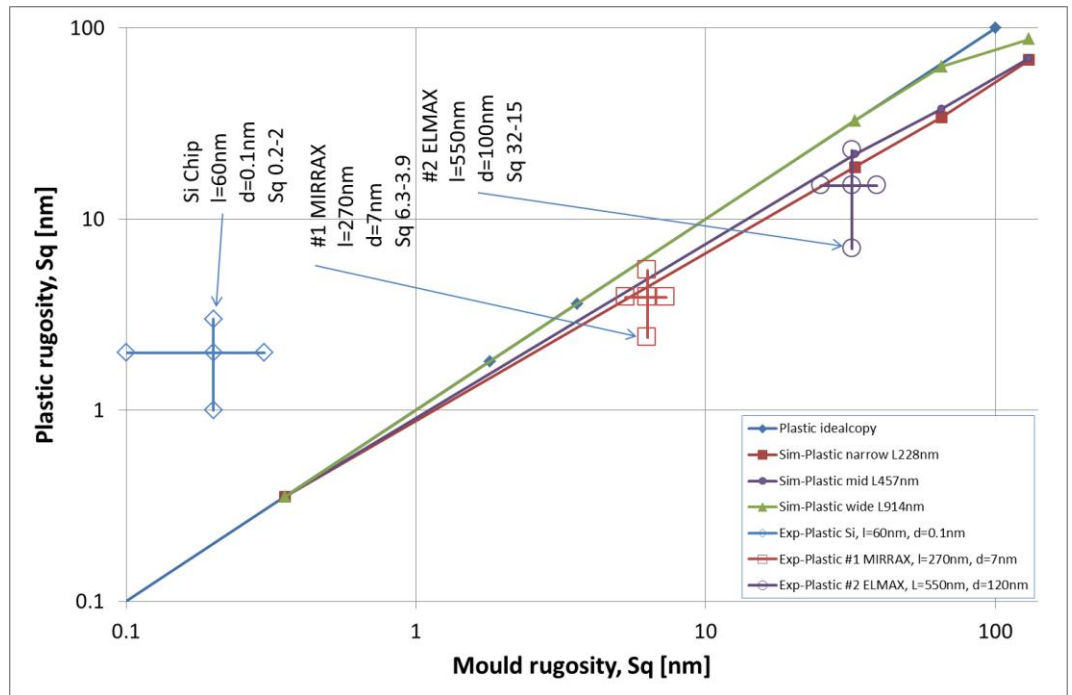
Summary

- Simulations have been improved to include wall effects and a more realistic material behaviour linking pressure and temperature with velocity.

- Simulations were able to predict that narrow wave lengths are more difficult to copy.

- Simulations are very difficult to compare and validate with two experimental points with variable wave lengths and scatter in Sq depending on the region analysed.

- Further experimentas are planned for validation on mould #3.

aim4np