



Experimental validation of tool deflection control by using Flexflow technology

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Company Structure



AUTOMOTIVE



EXTERIOR



LIGHTING



INTERIOR



UNDERHOOD

APPLIANCES



DOMESTIC APPLIANCES



TECHNICAL APPLICATIONS



HOUSEWARE



LOGISTICS & ENVIRONMENTAL

LIGHTING



LIGHTING

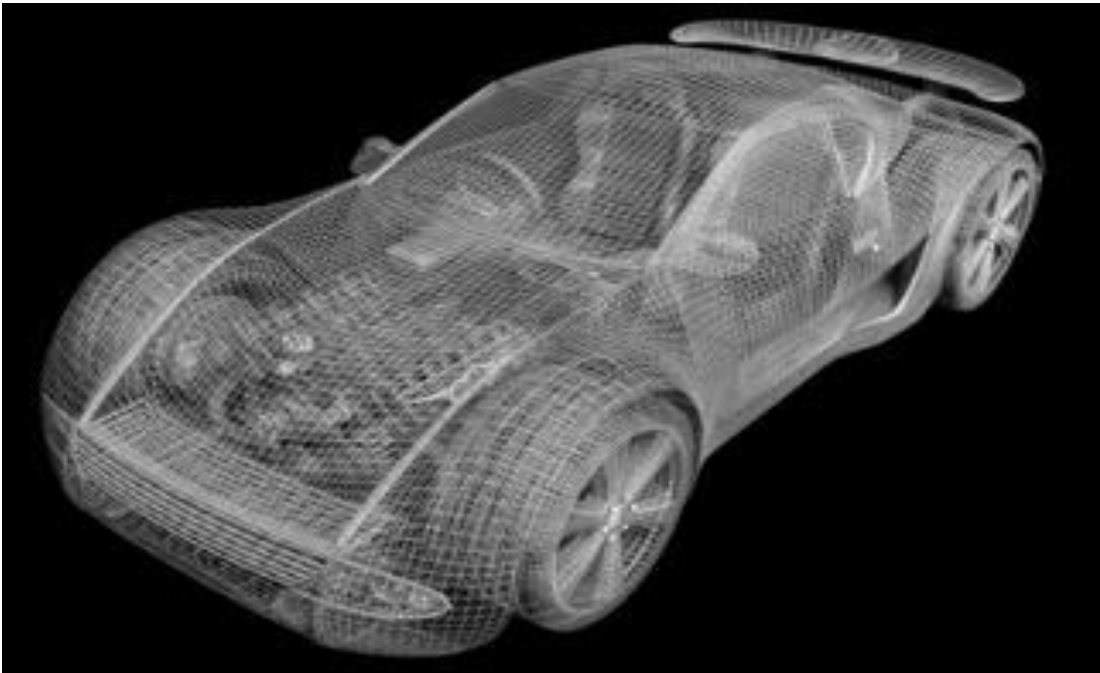


GLAZING



Passion for expertise

HRSflow: a Worldwide reliable partner



- **Around 14.000** Systems delivered in 2017
- **42.000** Drops produced in 2017
- **More than 2000** Customers
- **More than 1100** End users
- **More than 140** Designers in 10 countries

HRSflow: a Worldwide reliable partner

- **15** Plastic engineers in the world
- **5** Teams on different jet lags
- **More than 1800** Simulation projects concluded in 2017
- **Expert Certification**
- **Moldex Certified**

Certification of Outstanding Partner

Presented to Mr. Nicola Pavan

for his excellent technical input and most valuable feedback of an experienced user of the

Advanced Hot Runner Simulation

October 27, 2017

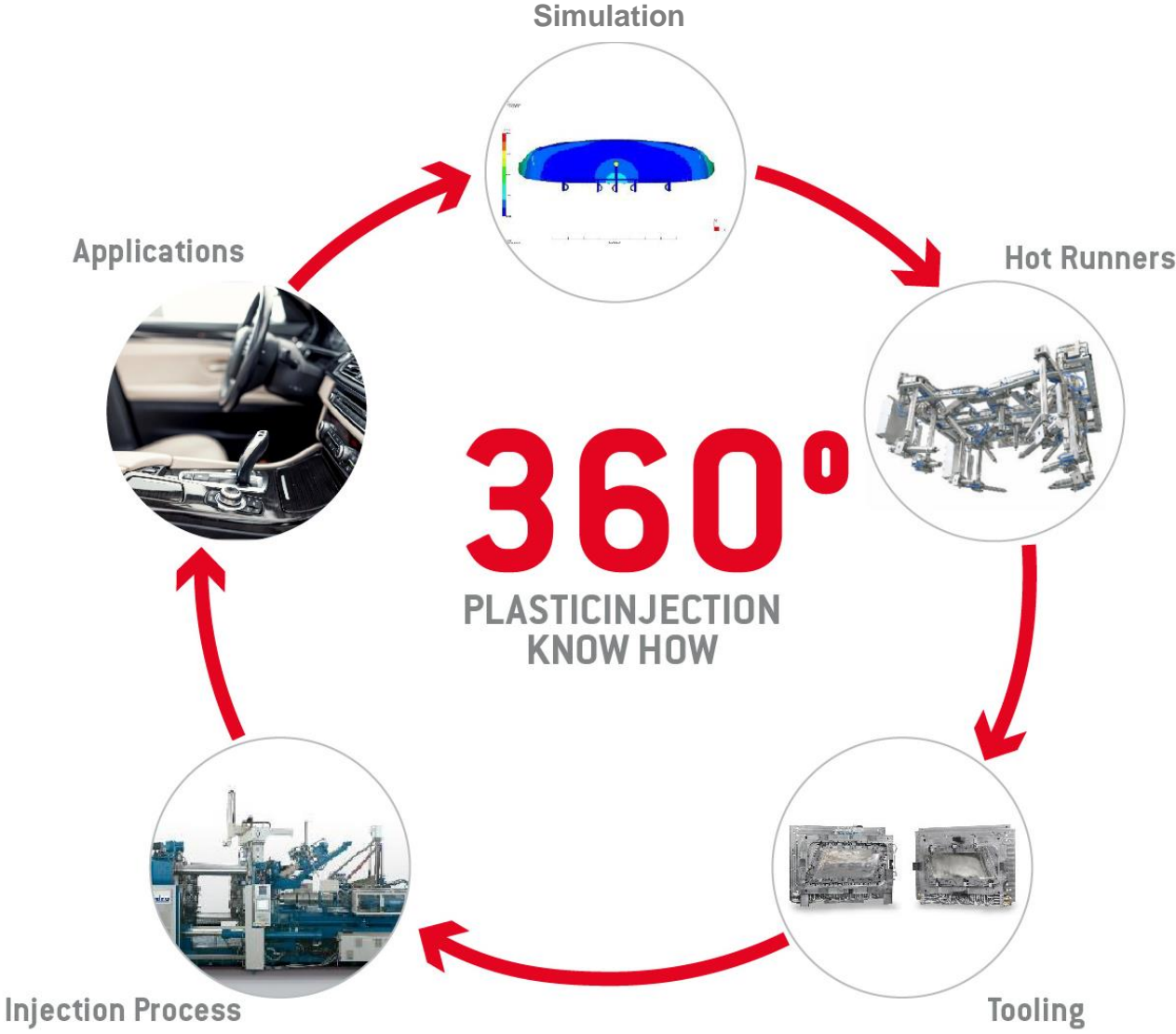
Rong-Yan Chang

Our people,
your value



MOLDEX*
FLOW* INSIGHT

CERTIFIED EXPERT



Our production plants

Italy - San Polo di Piave
50km north of Venice



China – Hangzhou
175km south west of Shanghai



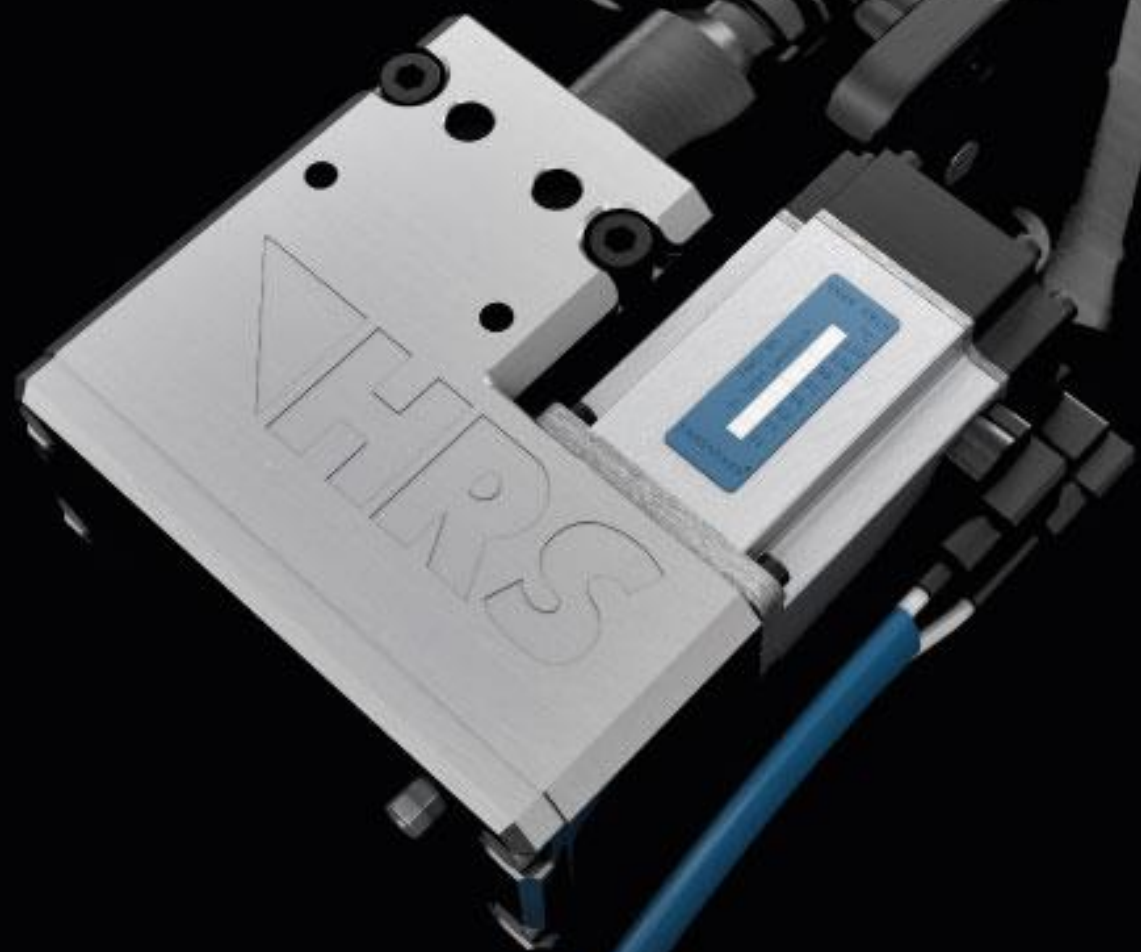
USA- Michigan – Grand Rapids
250km west of Detroit



3  PRODUCTION PLANTS

/52

 SALES/SERVICE BRANCHES AND OFFICES




FLEX*flow*

FLEXflow numbers



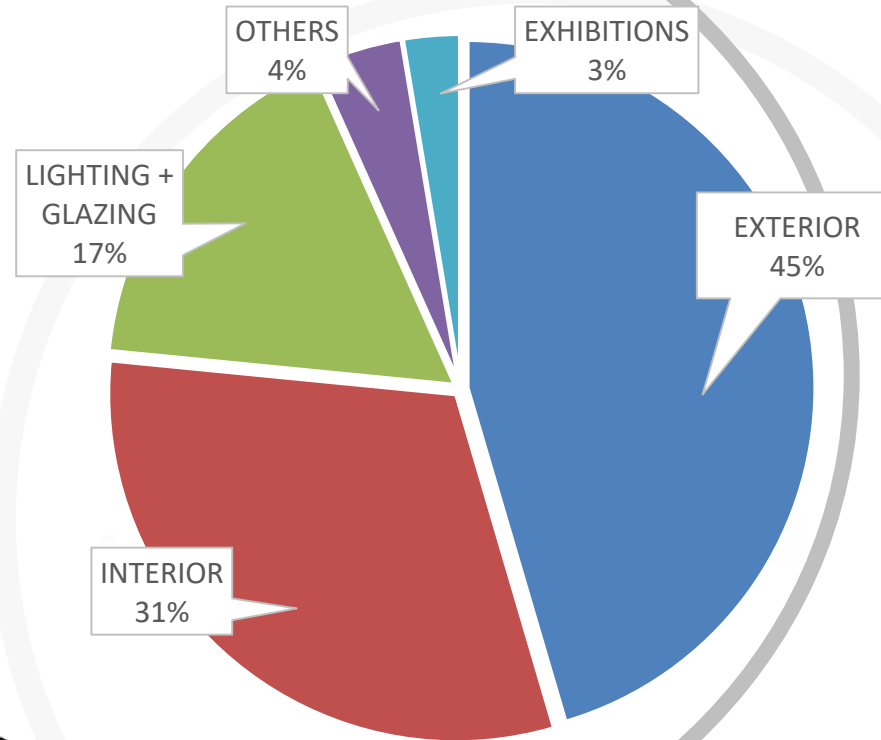
More than **30** OEM involved



Molders involved: more than **100** different companies



Produced more than **500.000** parts in 3 years – bumper



Electric valve gate system

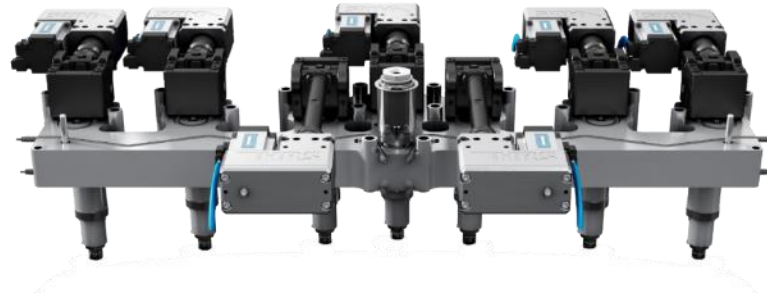
Pressure and flow rate control

Local stroke velocity and force

Improve quality

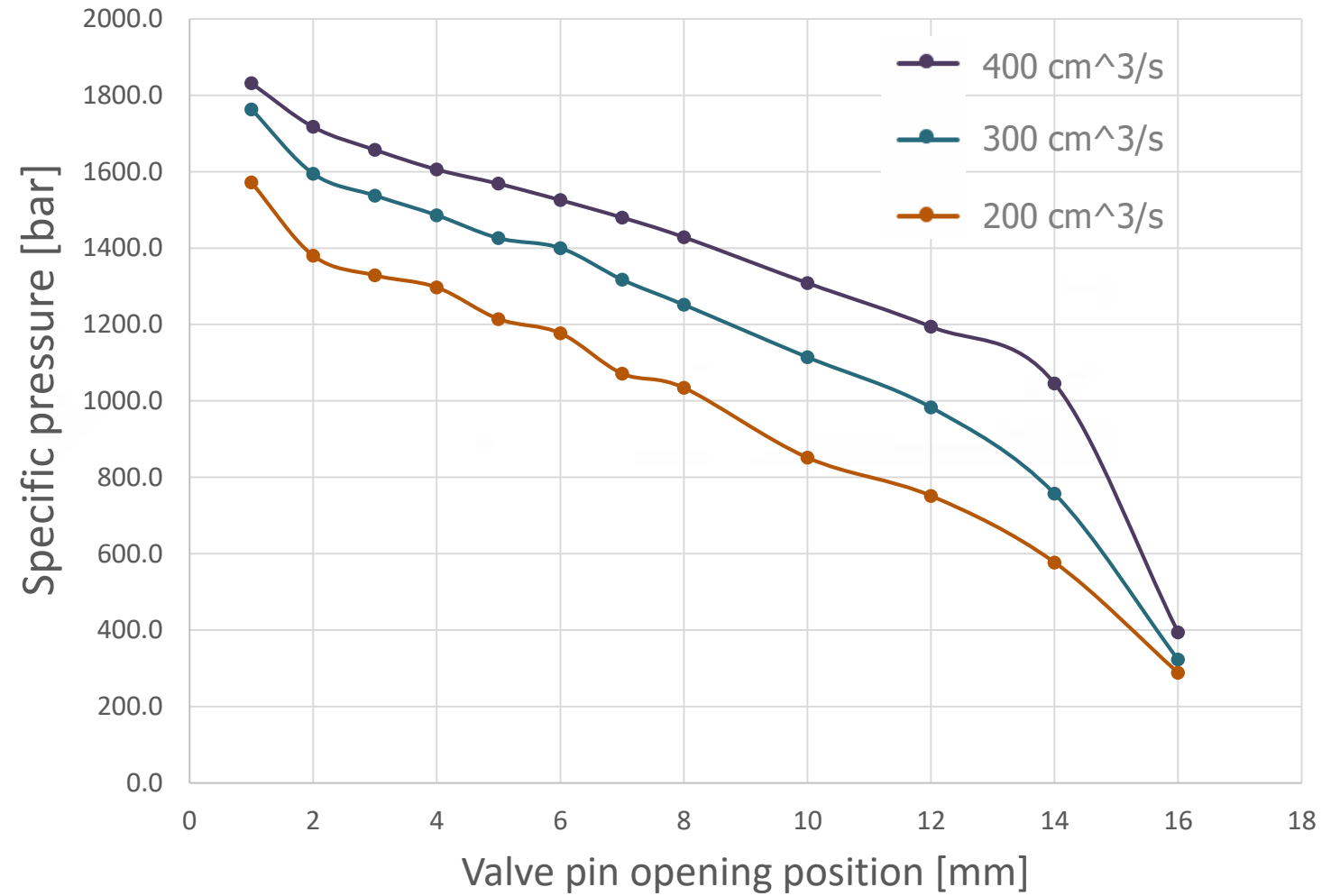
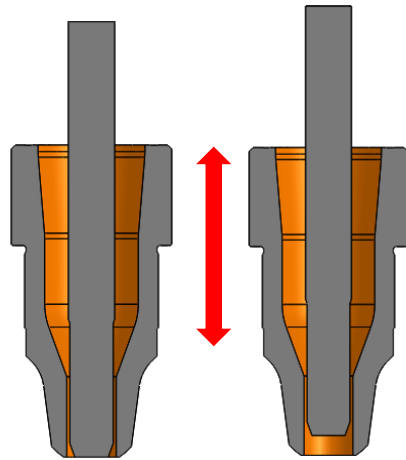


Motor unit installed in the mold

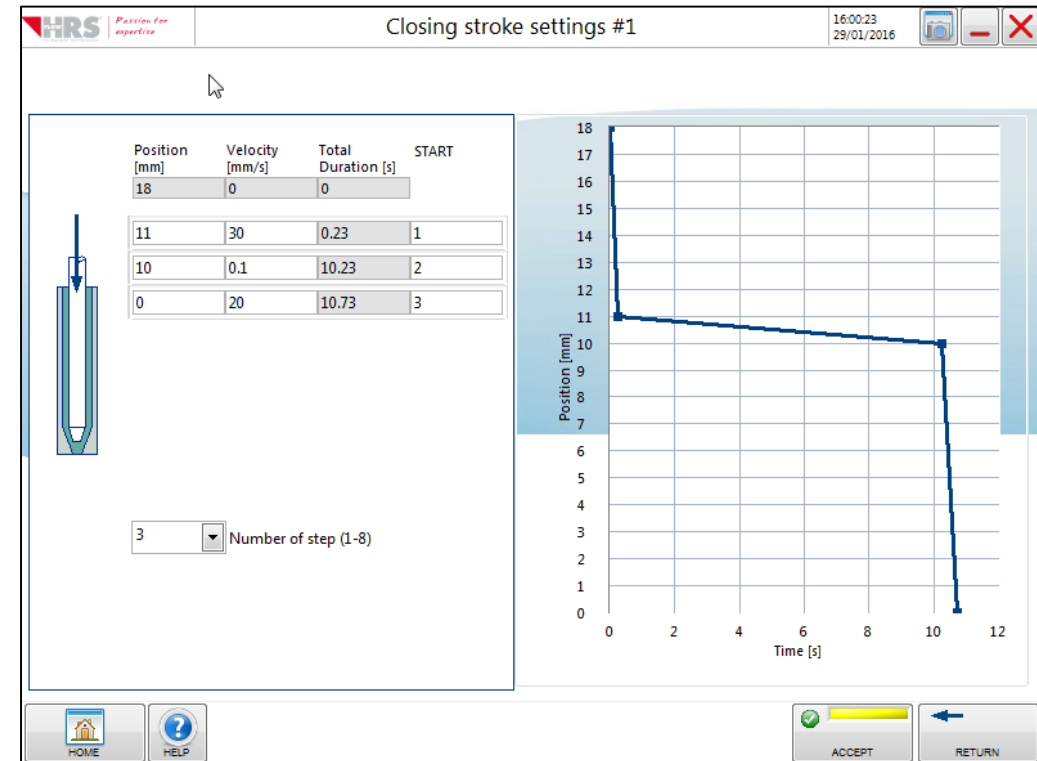
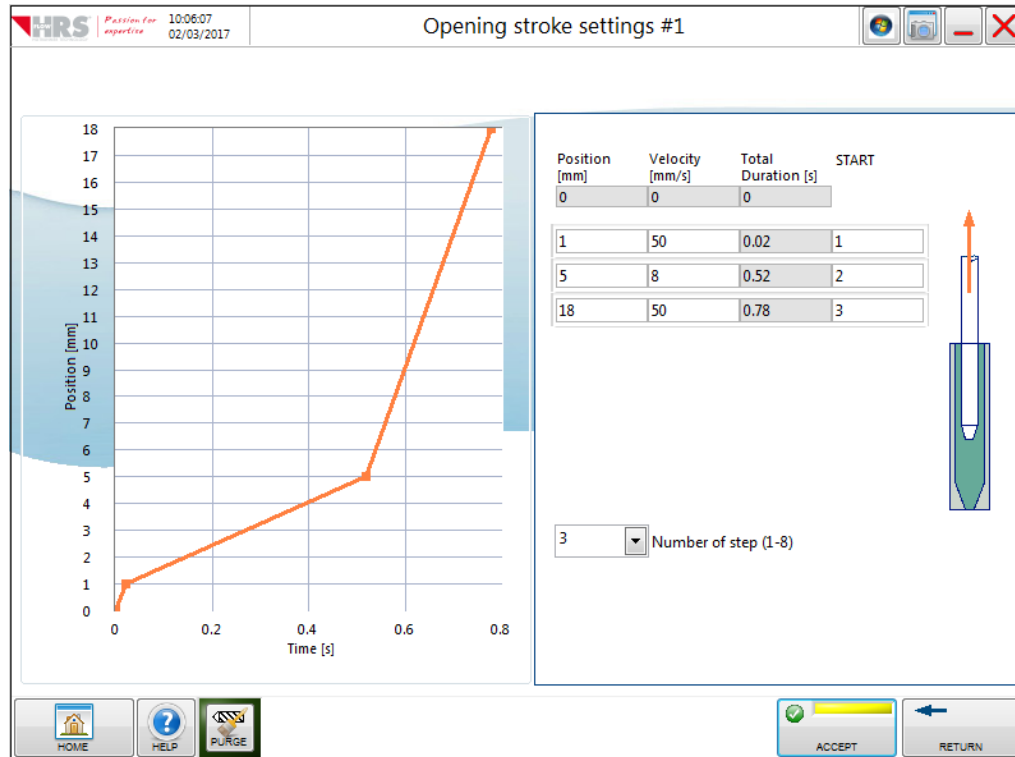


External and independent Controller

Tip optimized for fine pressure regulation

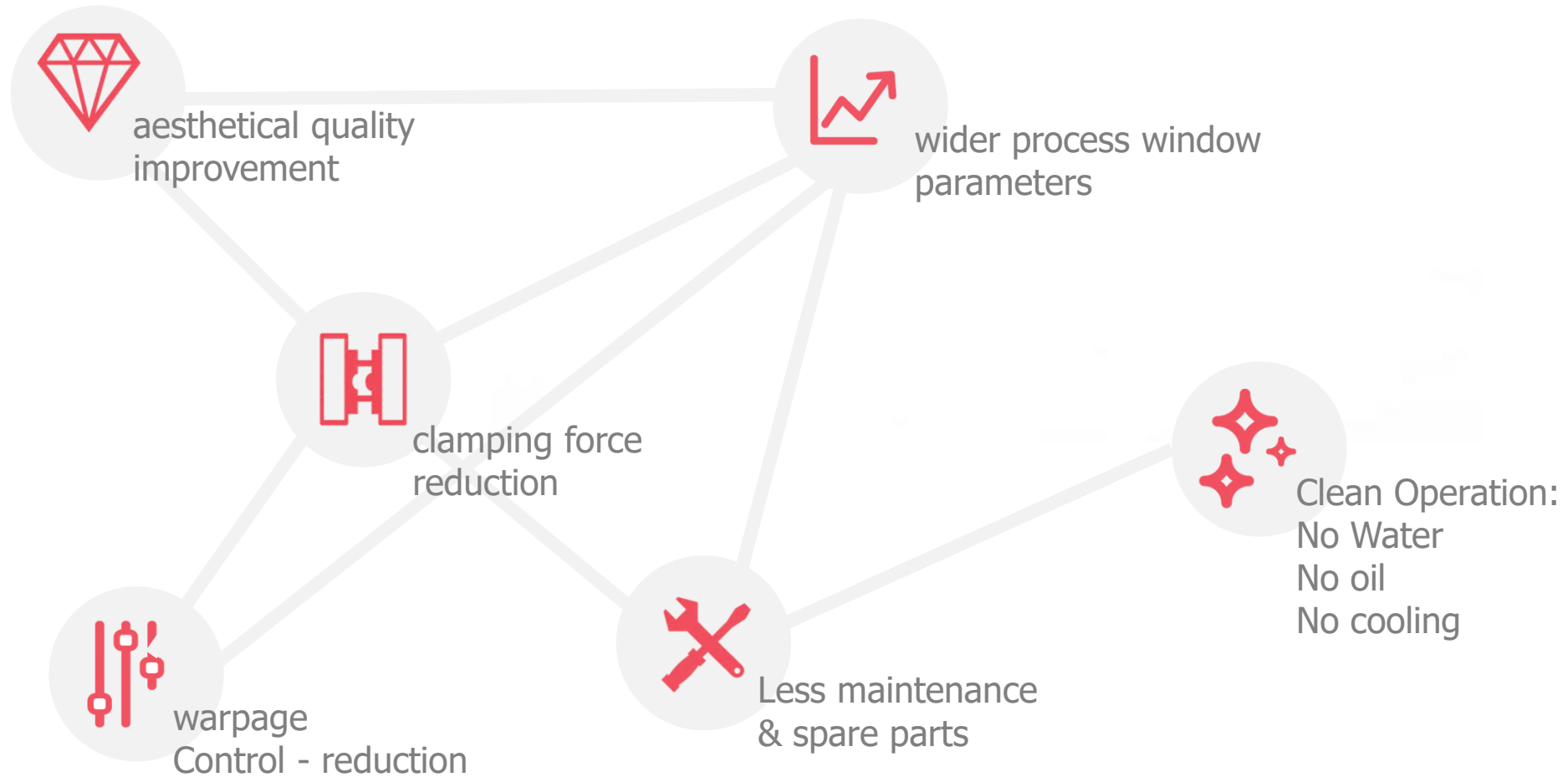


FLEXflow - Controller user interface: Page "Settings"



- Opening and closing settings - Max 8 steps can be set
- Sequence parameters based on **time** or **screw position** or **pressure value** in the cavity
- Possibility to handle up to 2 different injection units on the same IMM.

Benefit



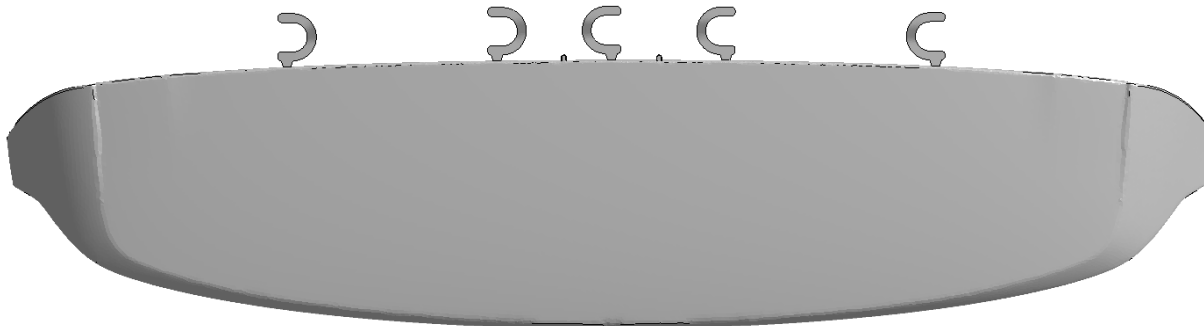
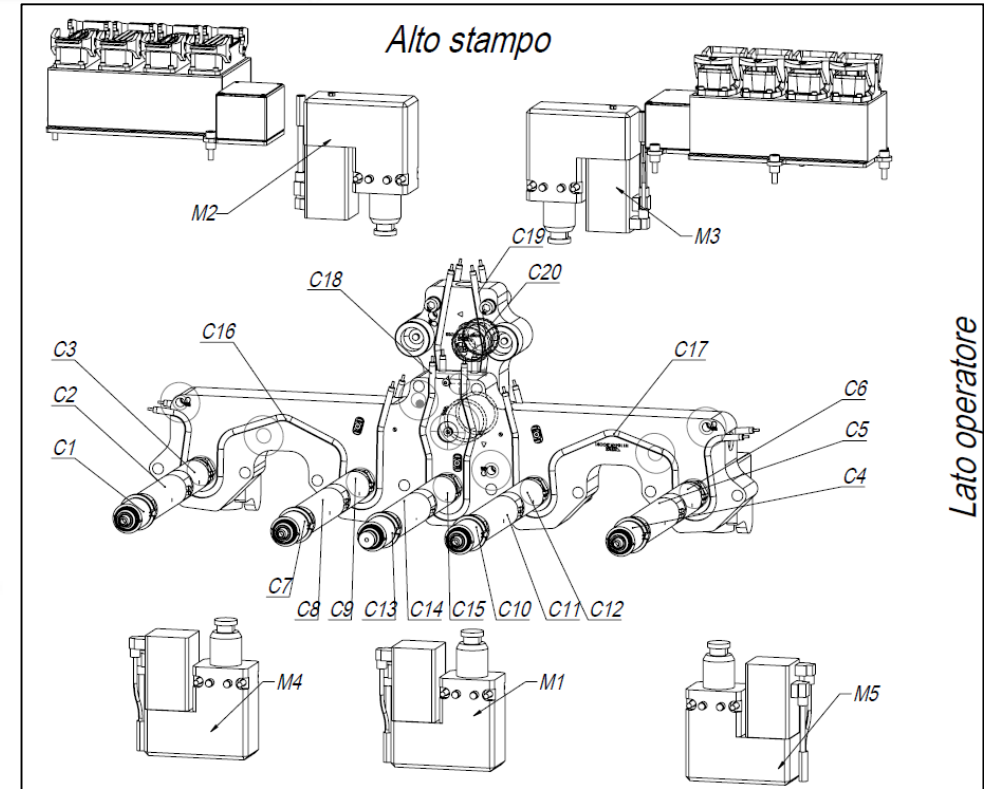
Experiment Description



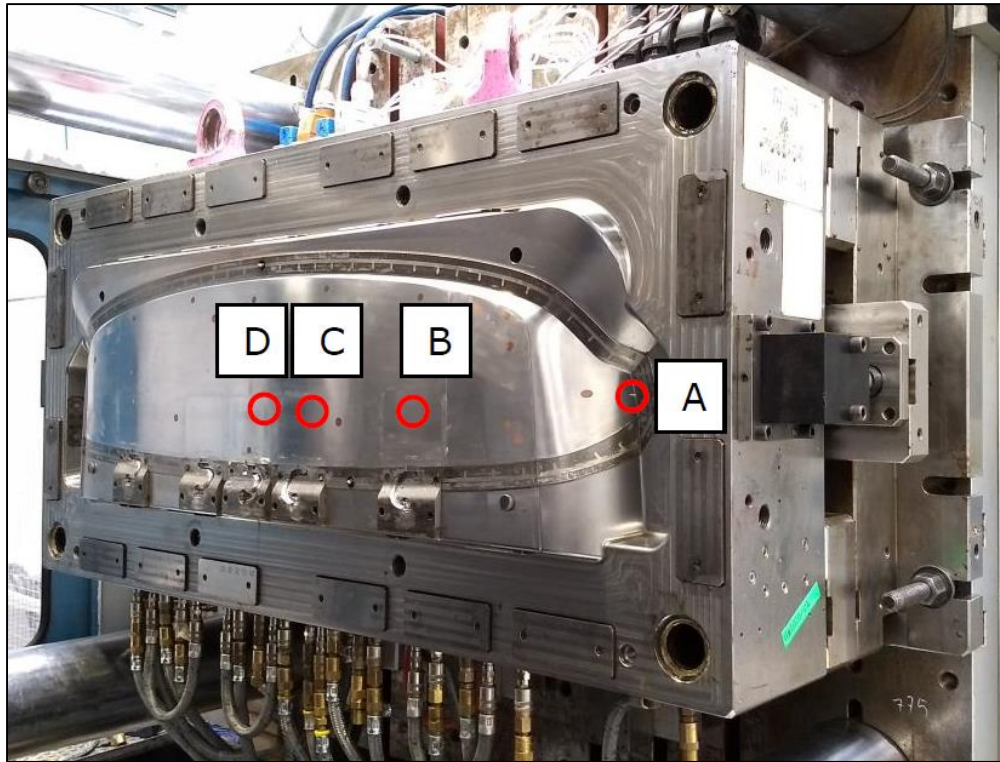
Equipment Description

Part Name: Spoiler
Molding Material: PP/EPDM 20% Talc
System series: G series
Drops n°: 5 drops VG
System type: FLEXflow
Pressure sensors: yes (4)
Force sensors: yes (3)

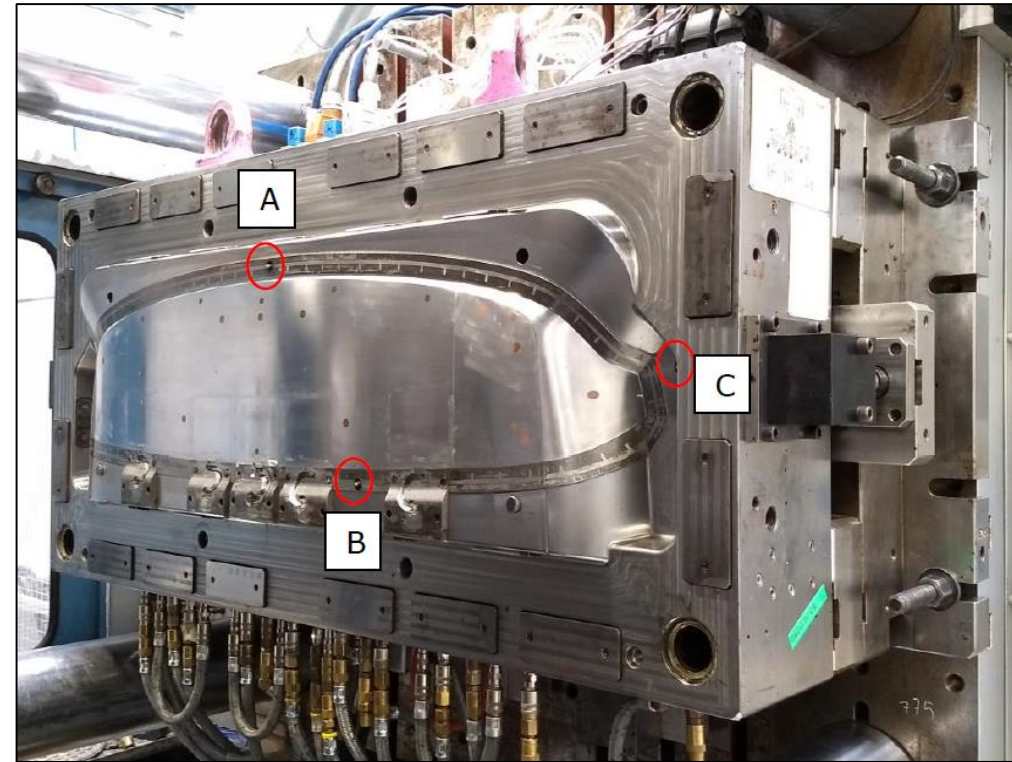
Thickness: 3 mm
Size: 1260 x 280 mm
Nominal weight: 1060 g



Pressure sensor



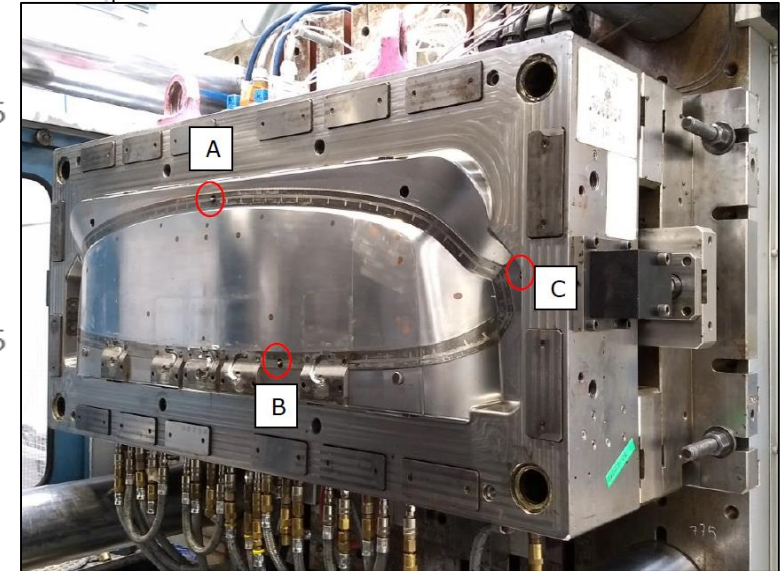
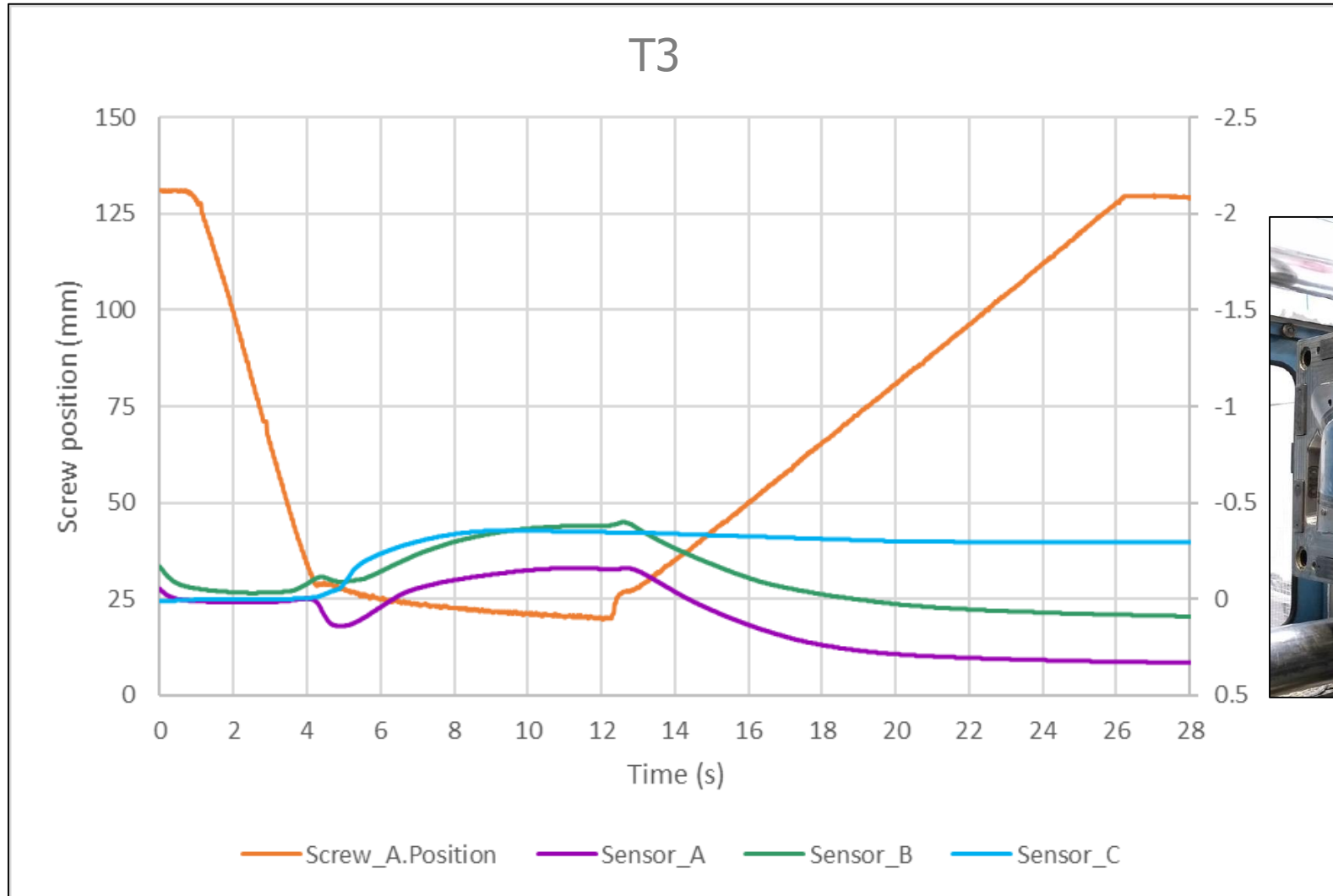
Displacement sensor



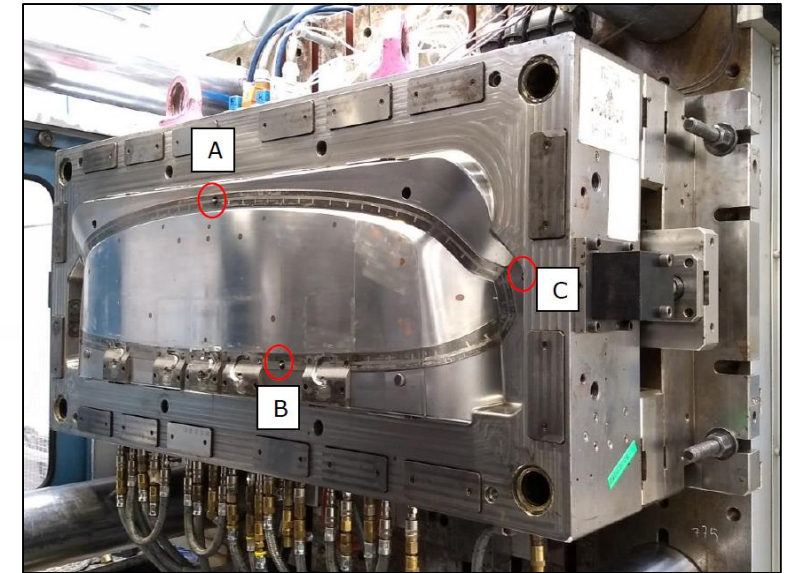
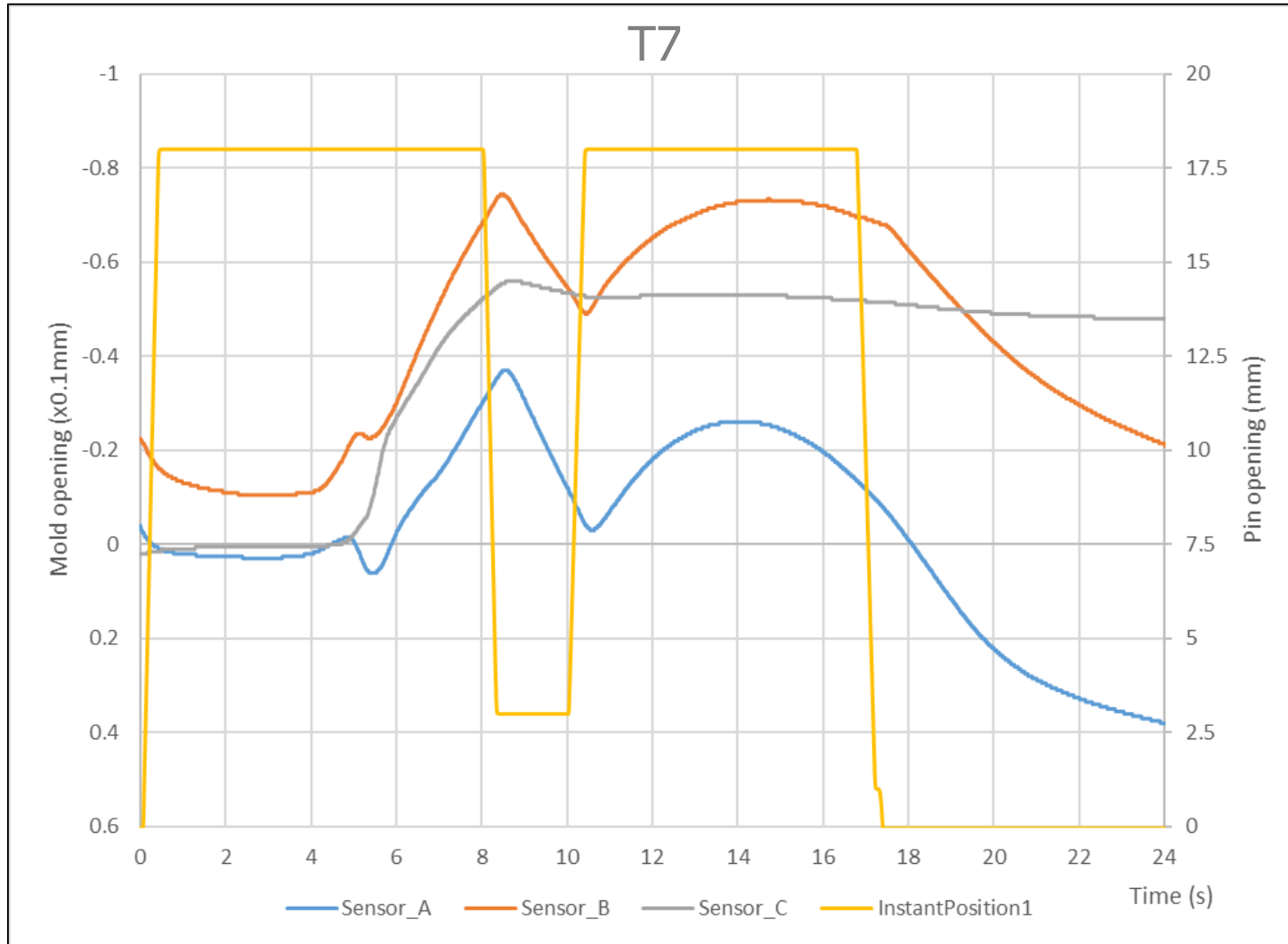
Test description

Run	Packing pressure	Packing time	Settings
1	Low	Short	All open
2	Medium	Short	All open
3	High	Short	All open
4	High	Long	All open
5	Medium	Short	Intermediate Closing step
6	Medium	Long	Intermediate Closing step
7	High	Long	Intermediate Closing step
8	Low	Long	Flexflow
9	Medium	Long	Flexflow
10	High	Long	Flexflow

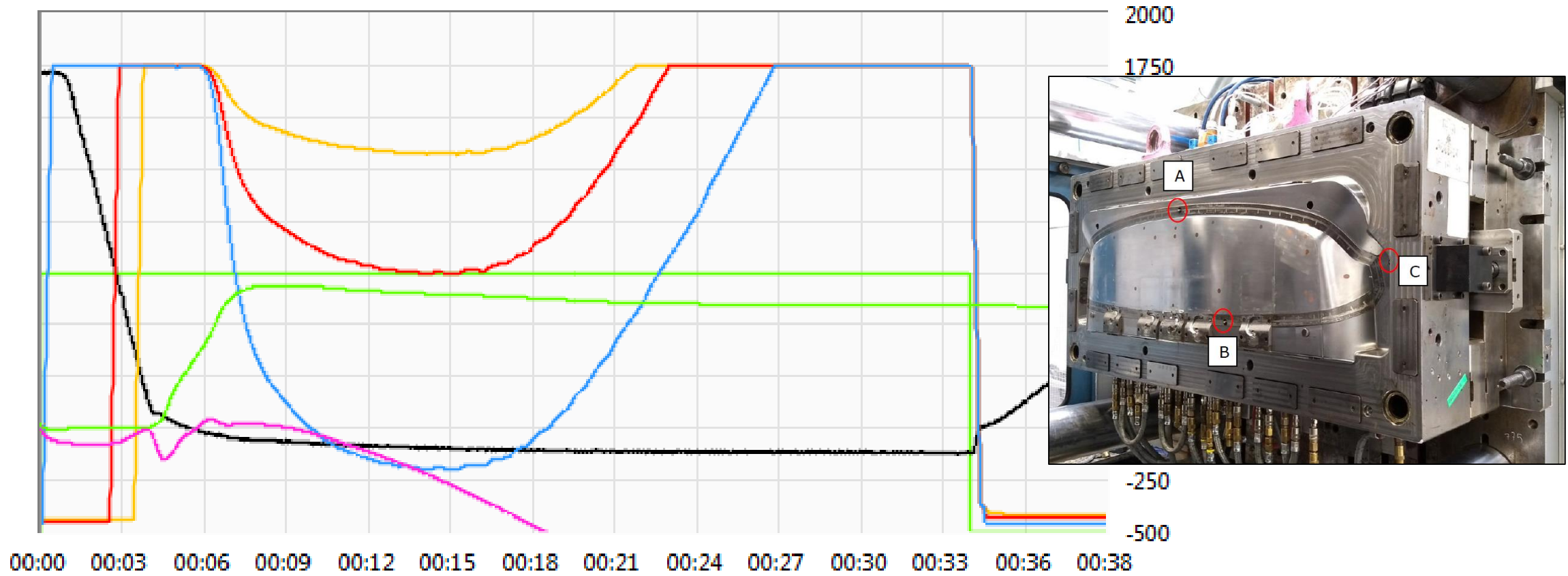
Trial Results



Trial Results



T9



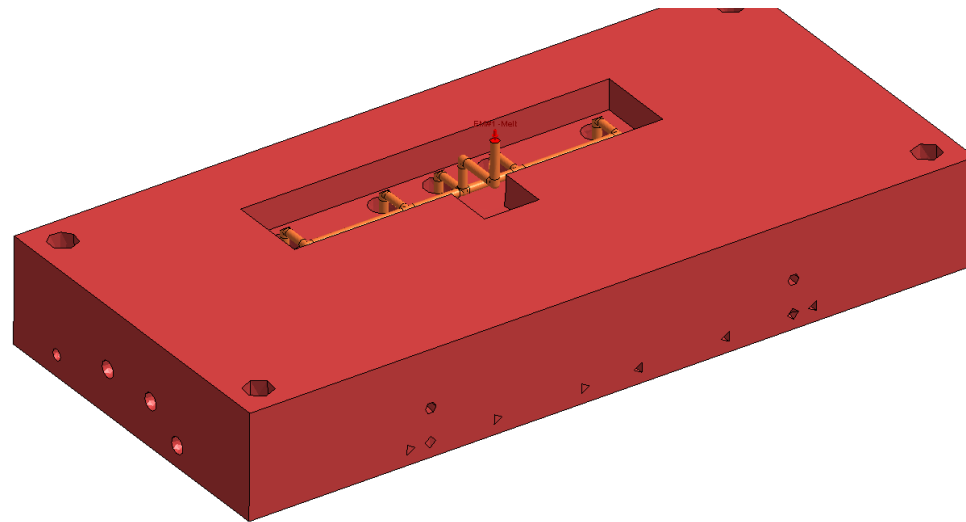
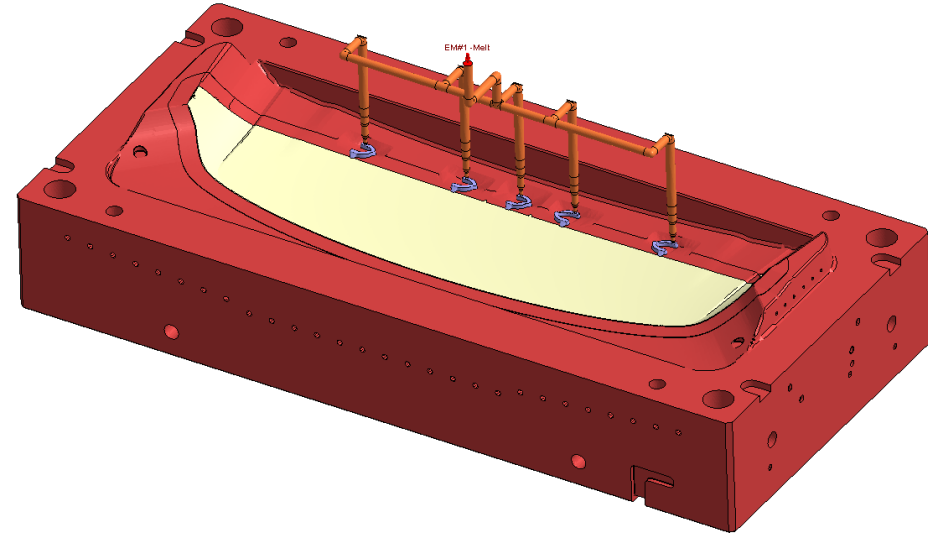
Simulation comparision



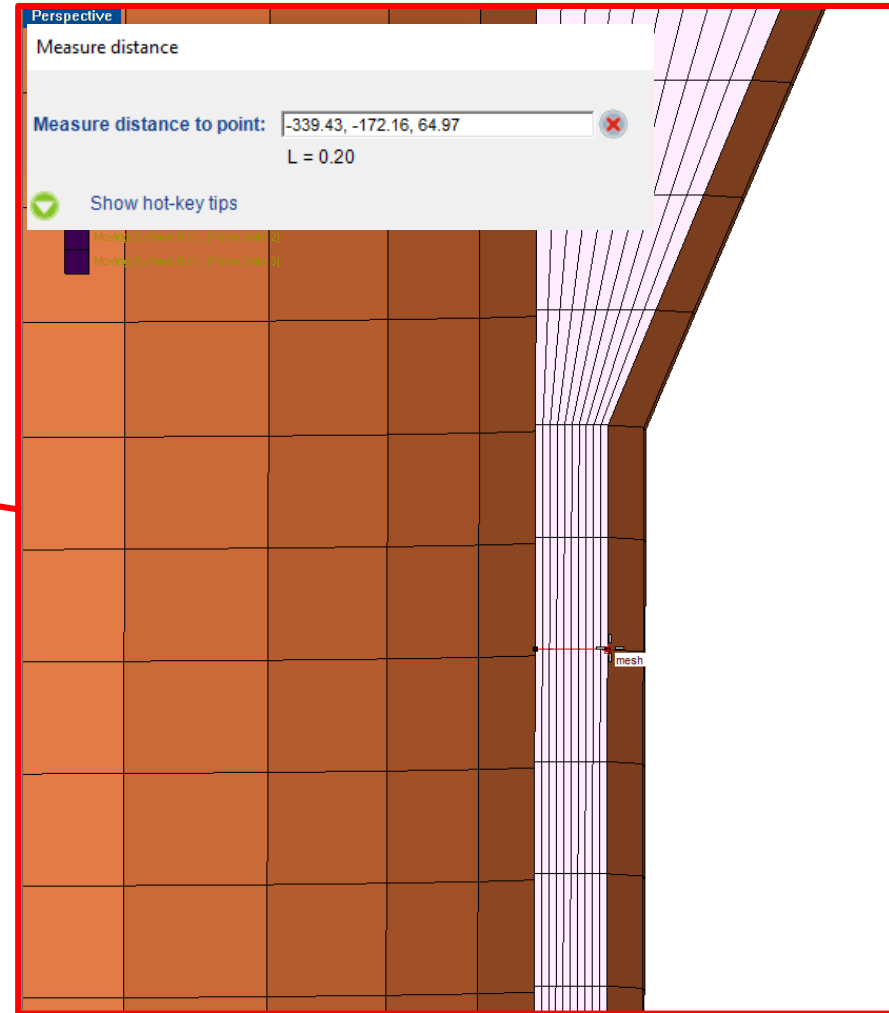
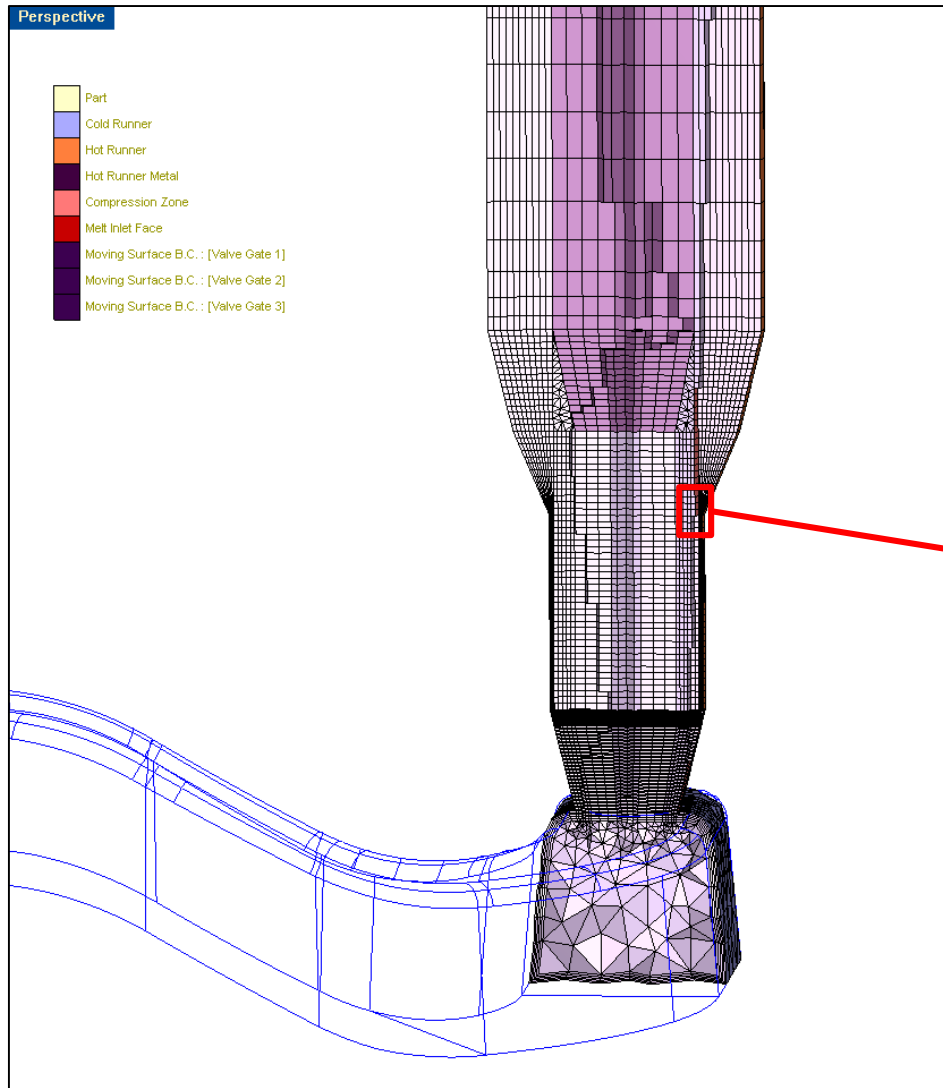
Model introduction

Part model: BLM 5 layers
Part elements: 980 k
Runner model: BLM 10 layers
Movable pin: Yes
Runner elements: 1130 k
Simulation type: Process + core shift FS1

Cavity and core sides modelled as insert



Model introduction



Core-shift boundary conditions

Core

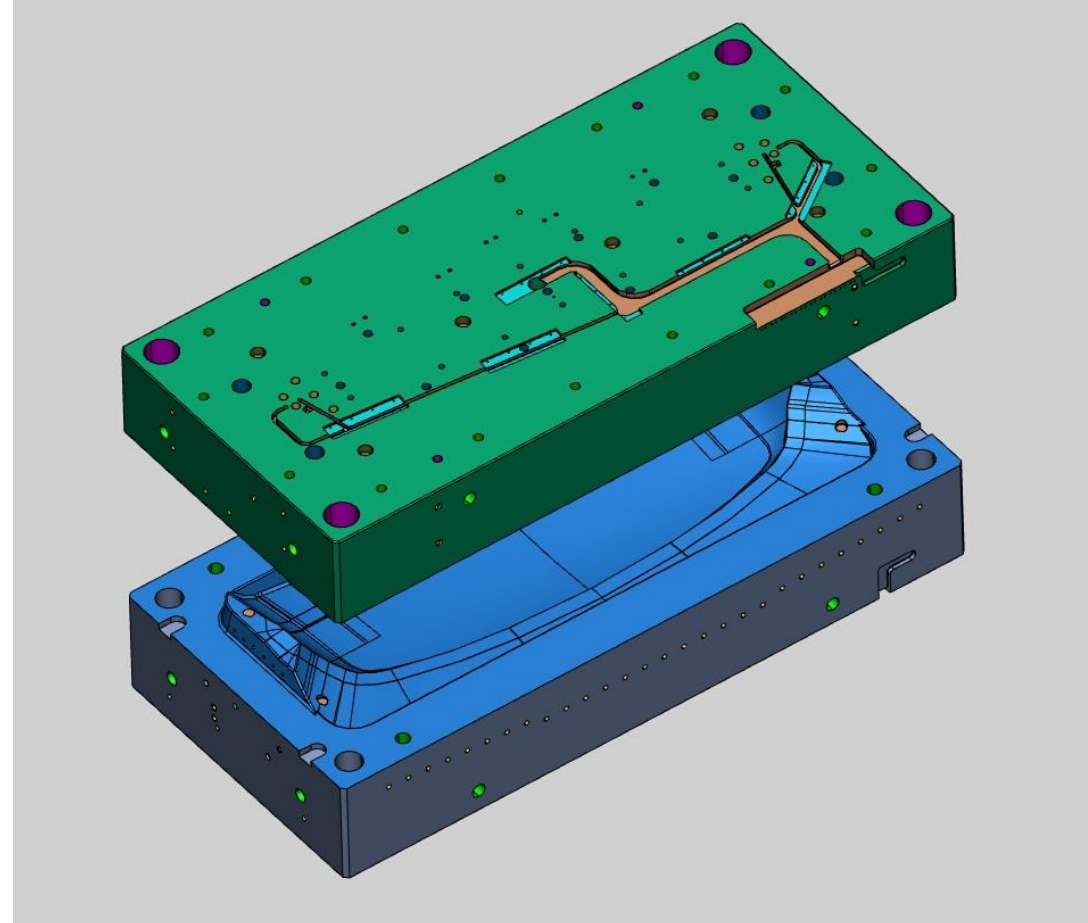
Fixed nodes at plate interface

Fixed XY translation on columns

Cavity

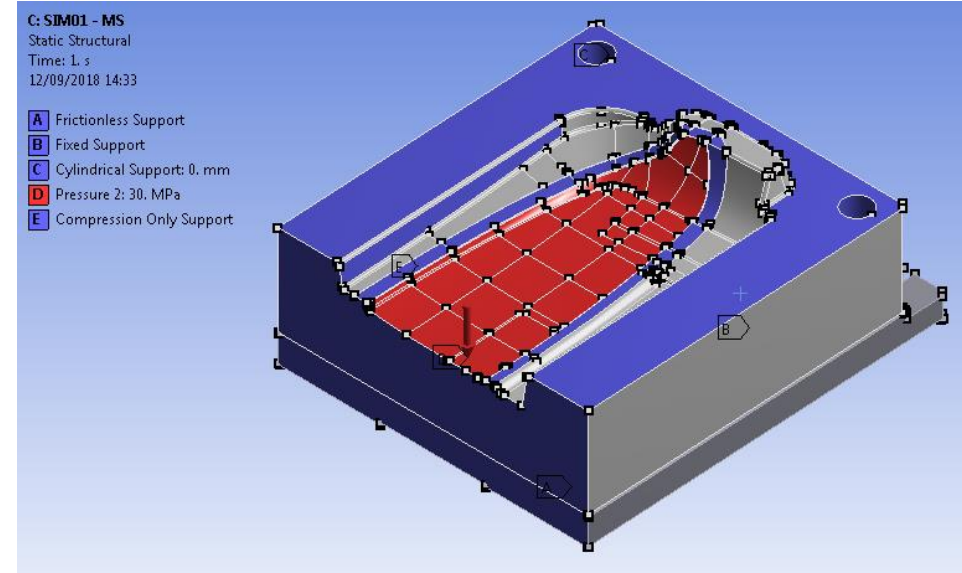
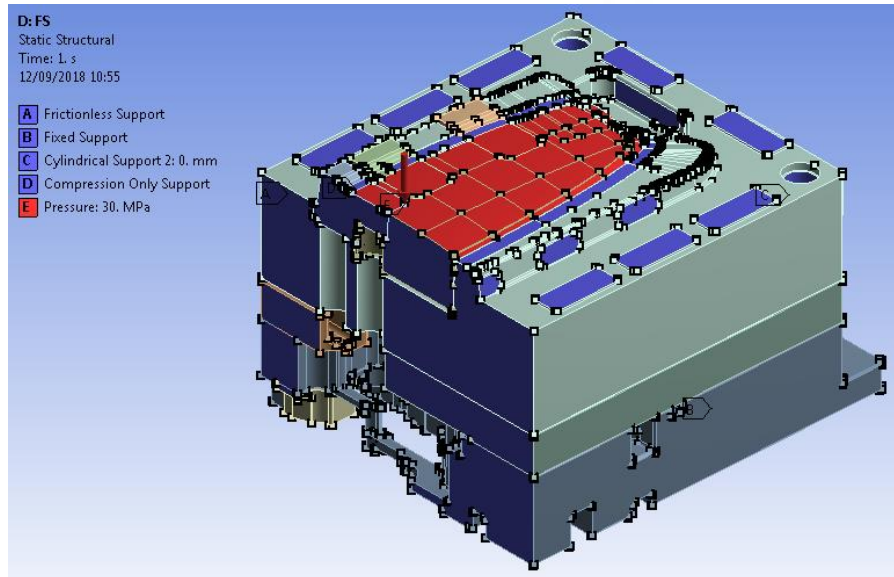
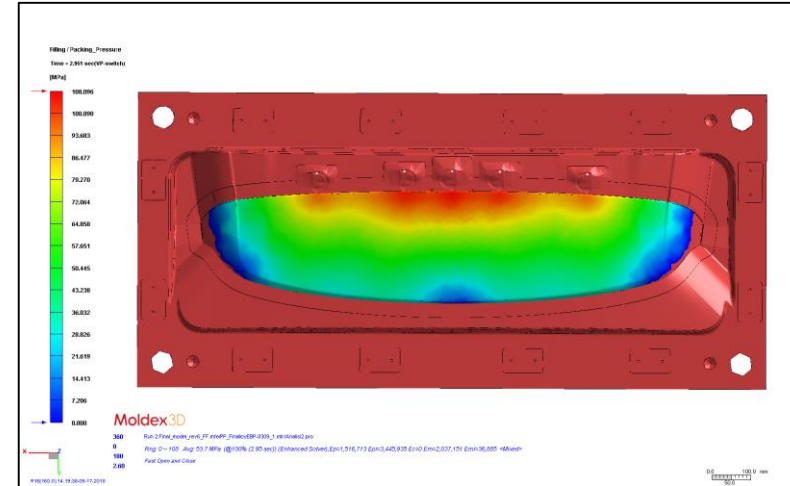
Fixed nodes at plate interface

Fixed XY translation on columns

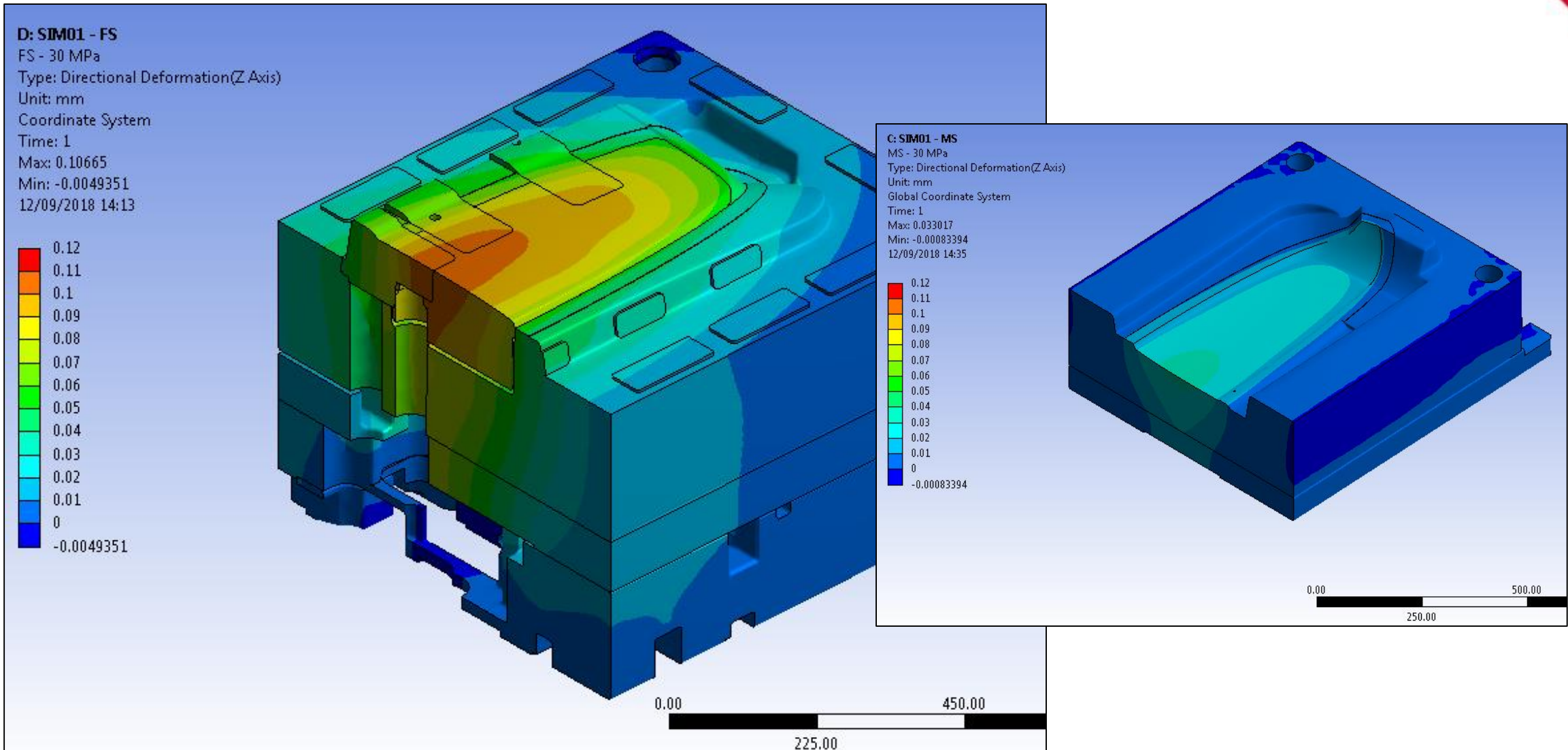


Structural validation

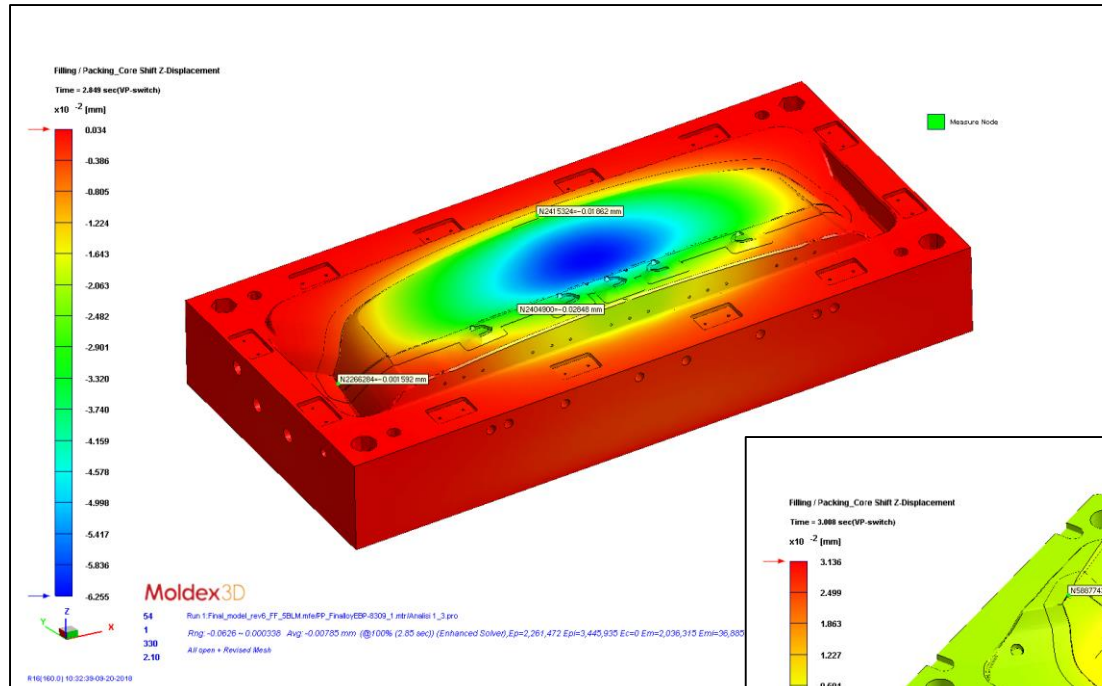
- Symmetric mold
- Fixed constraint on IMM
- Compression only support on pressure plates
- Cylindrical support on pillars
- Bonded contact between all bodies
- Pressure distribution mapped from simulation



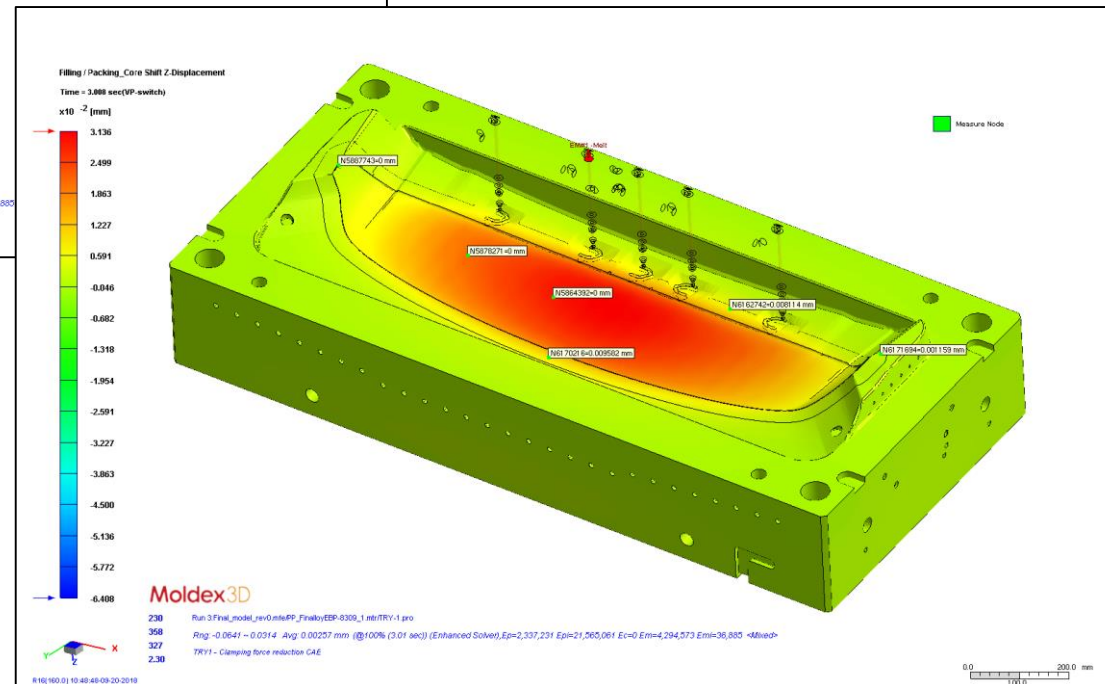
Structural validation



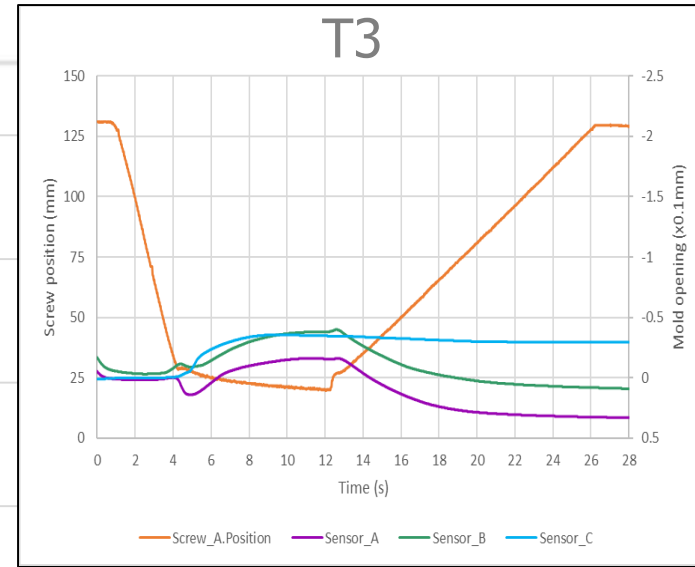
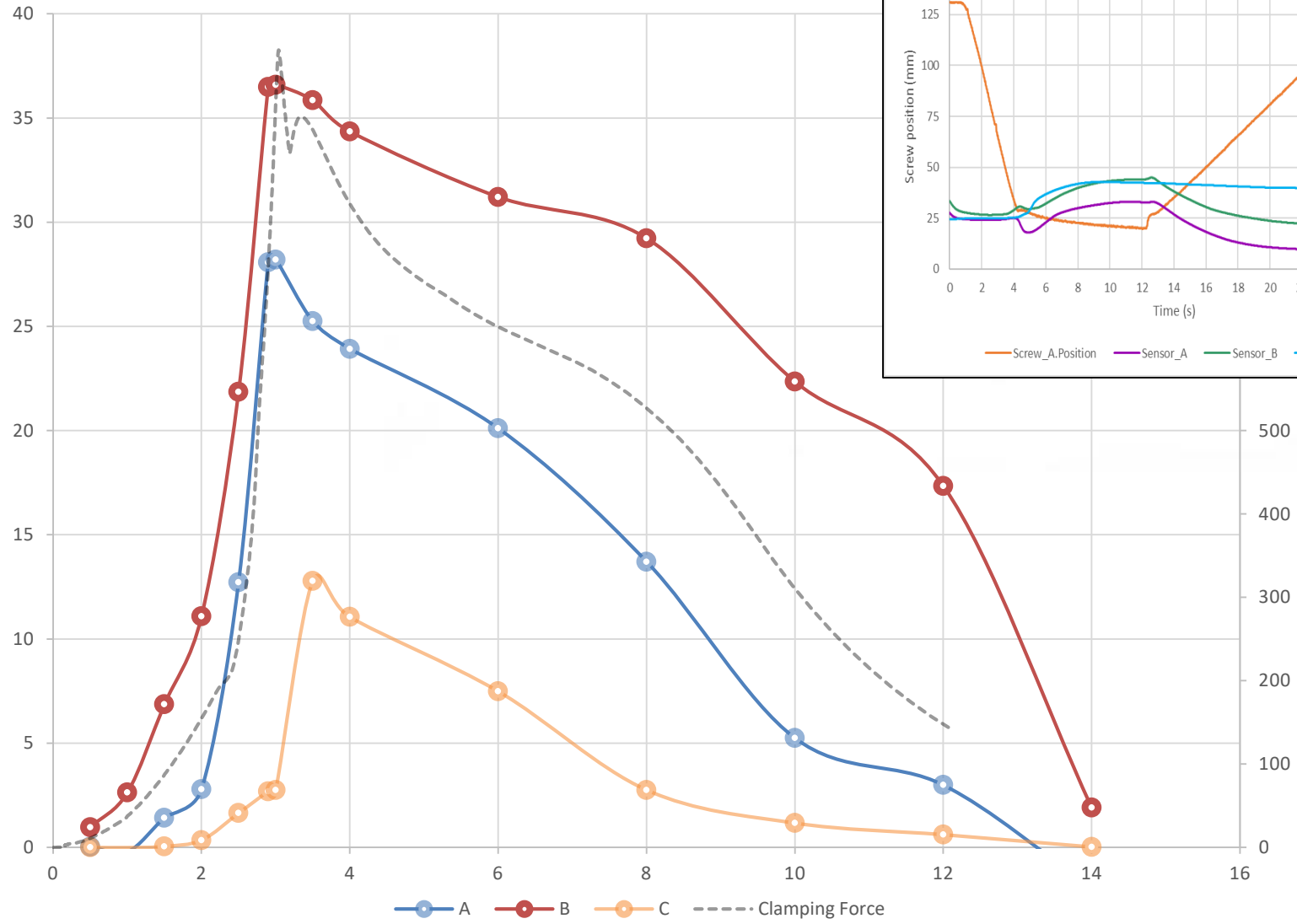
Structural validation



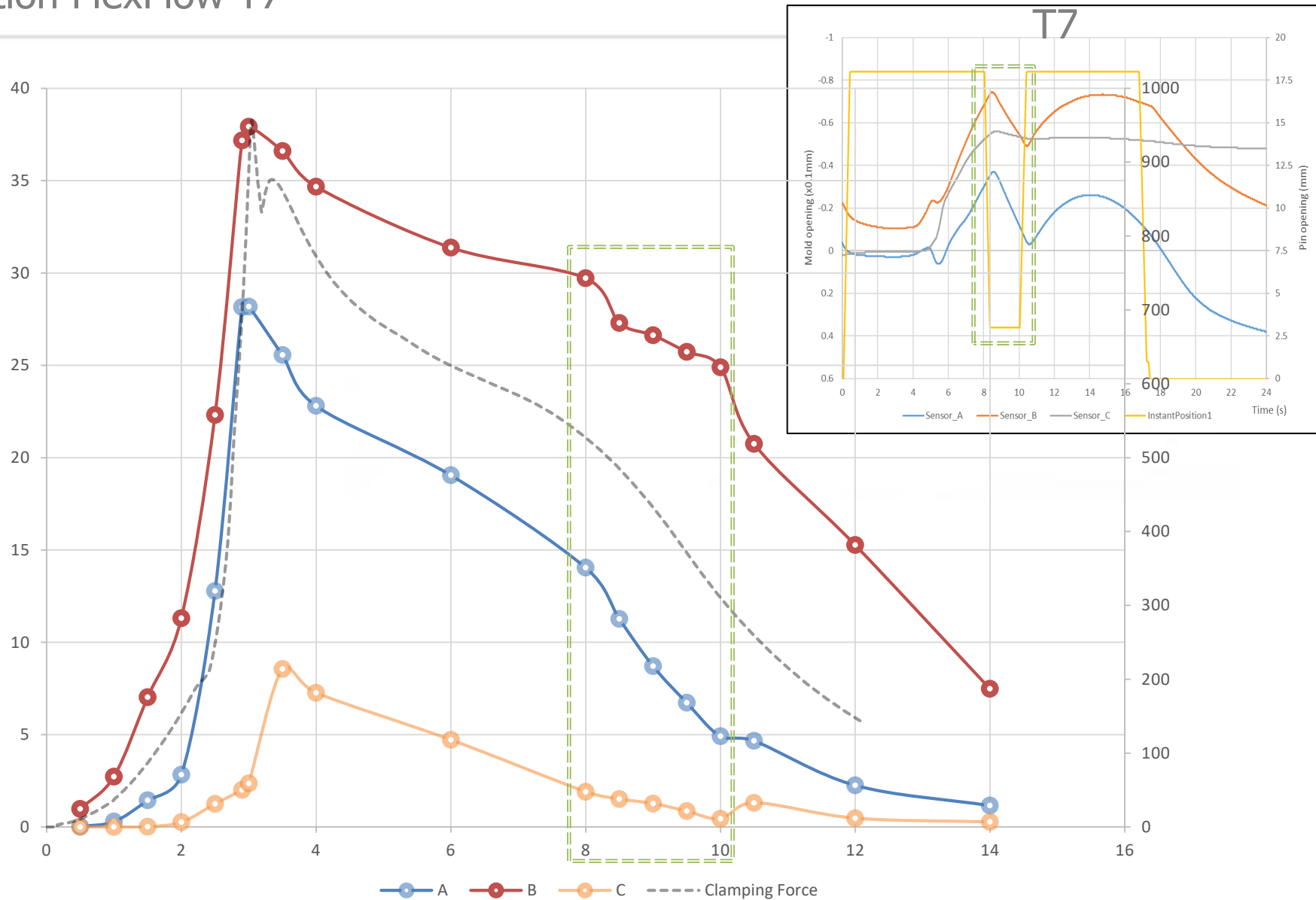
Position	A	B	C
Structural	0.0492	0.0605	0.013
Moldex 3D	0.0280	0.0364	0.003



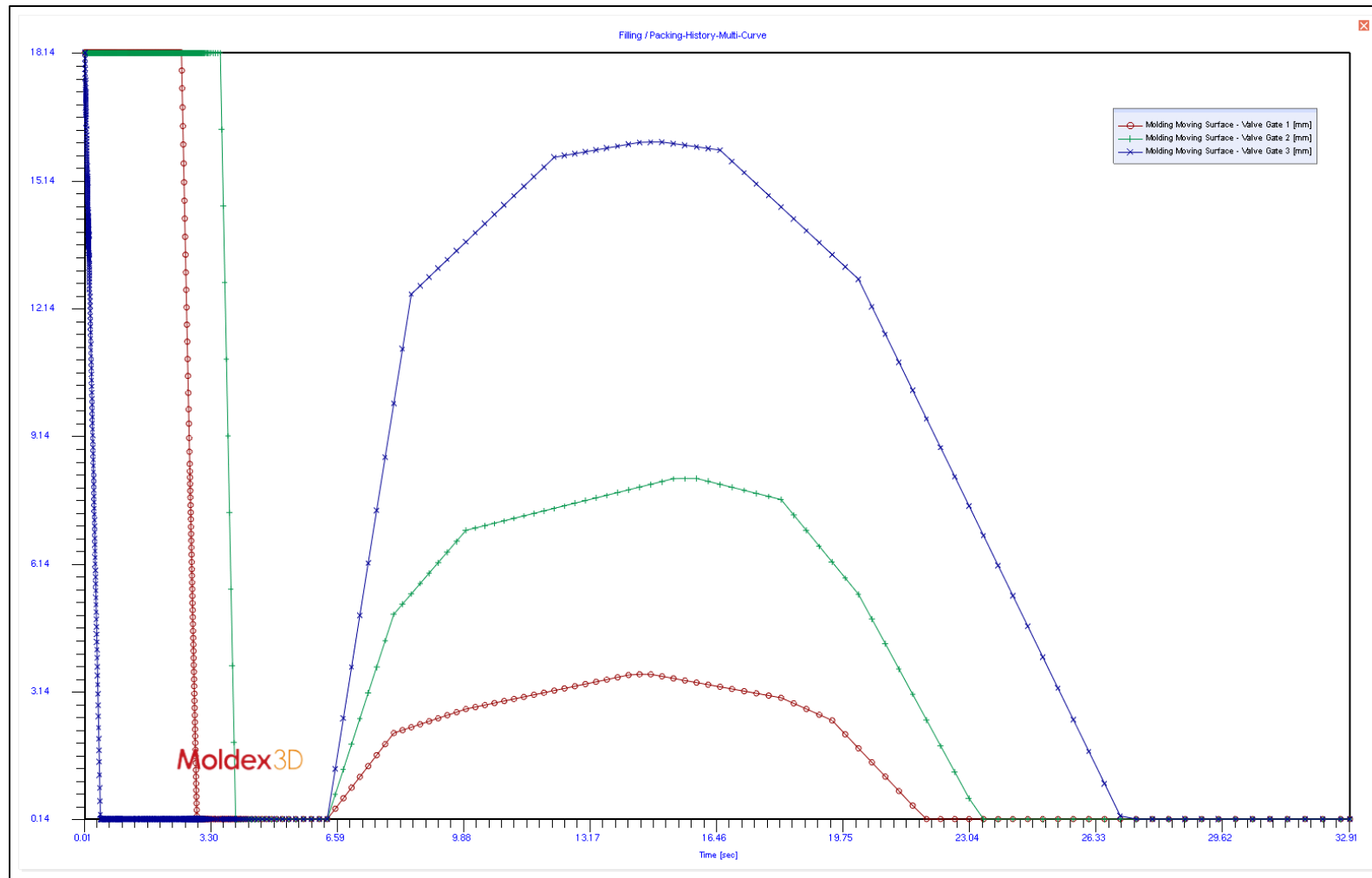
Deflection FlexFlow T3



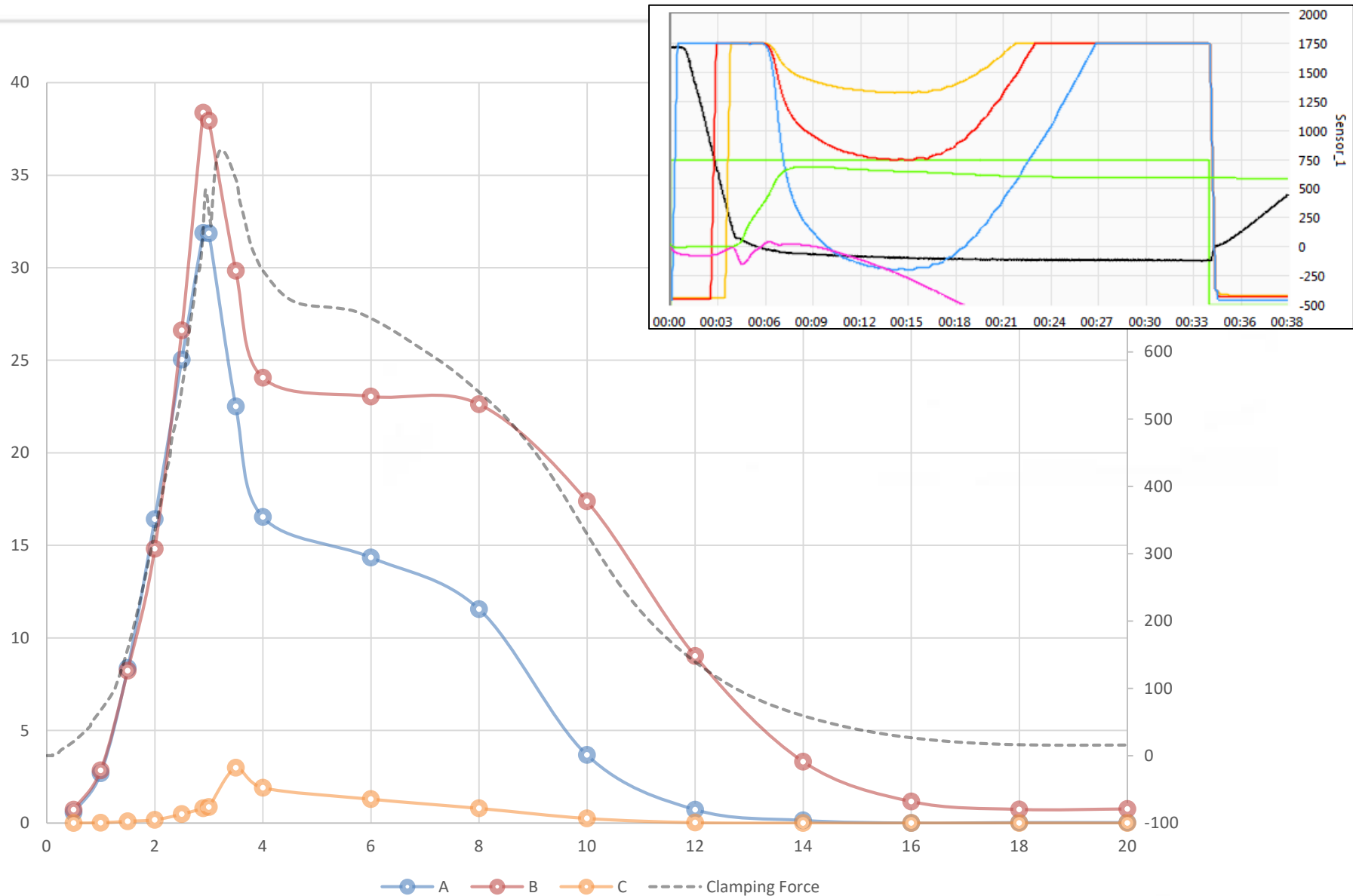
Deflection FlexFlow T7



Deflection FlexFlow T9



Deflection FlexFlow T9

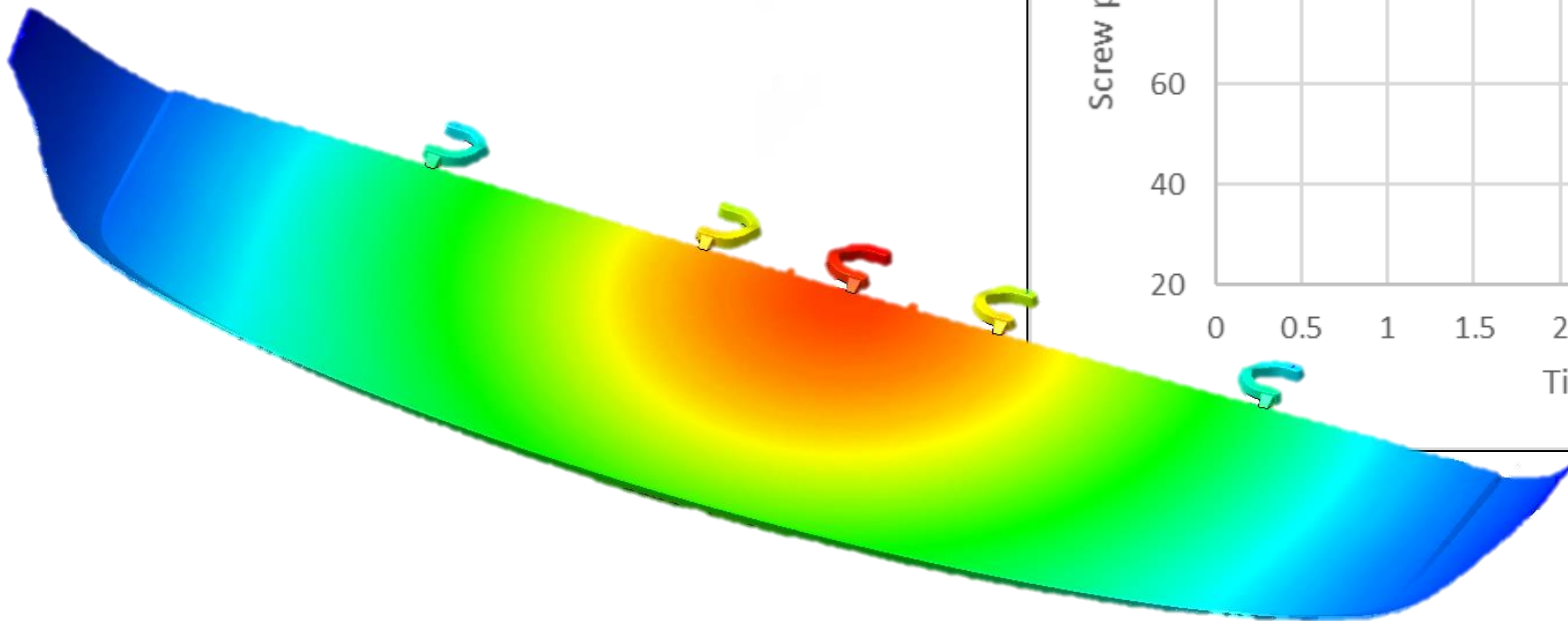
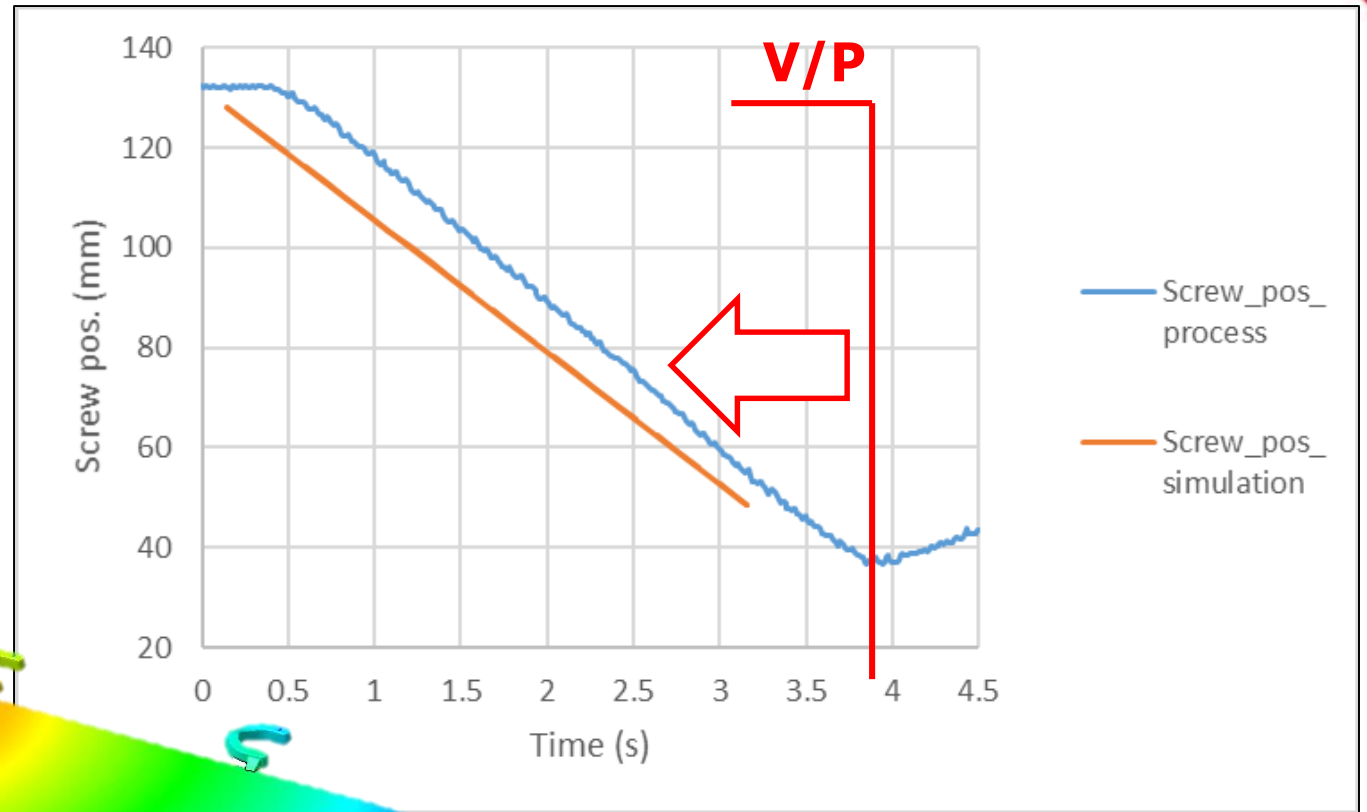


Mismatch analysis

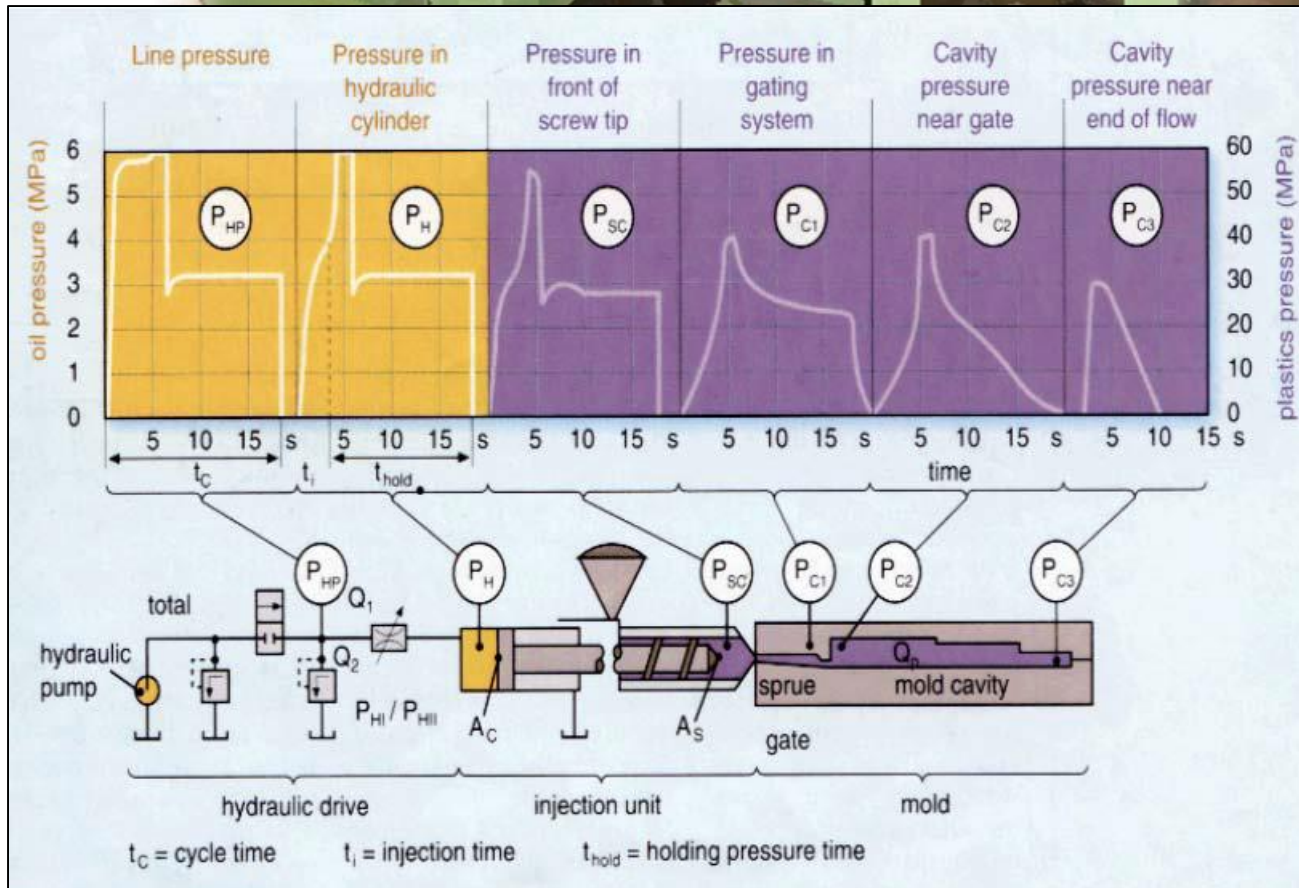


Filling mismatch

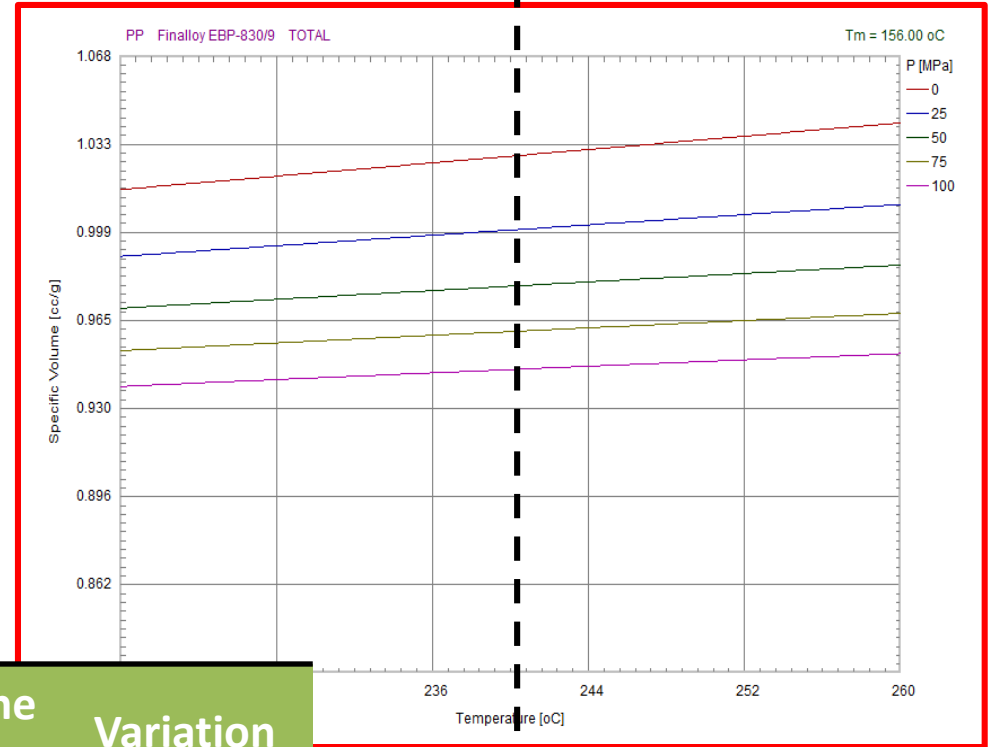
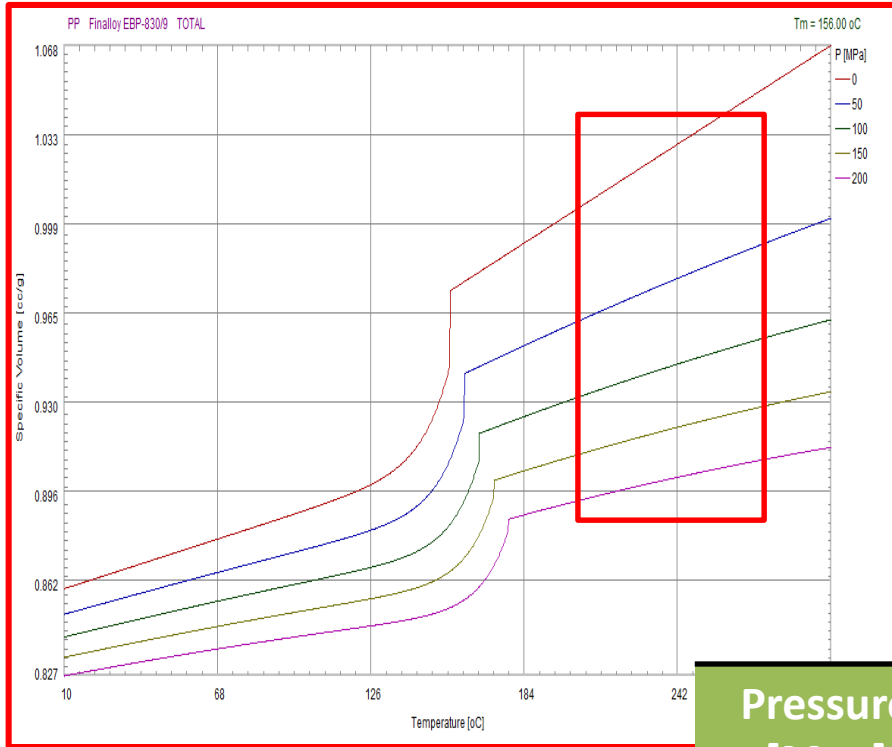
- Real filling 4s
- Simulation filling s



Compressibility on barrel

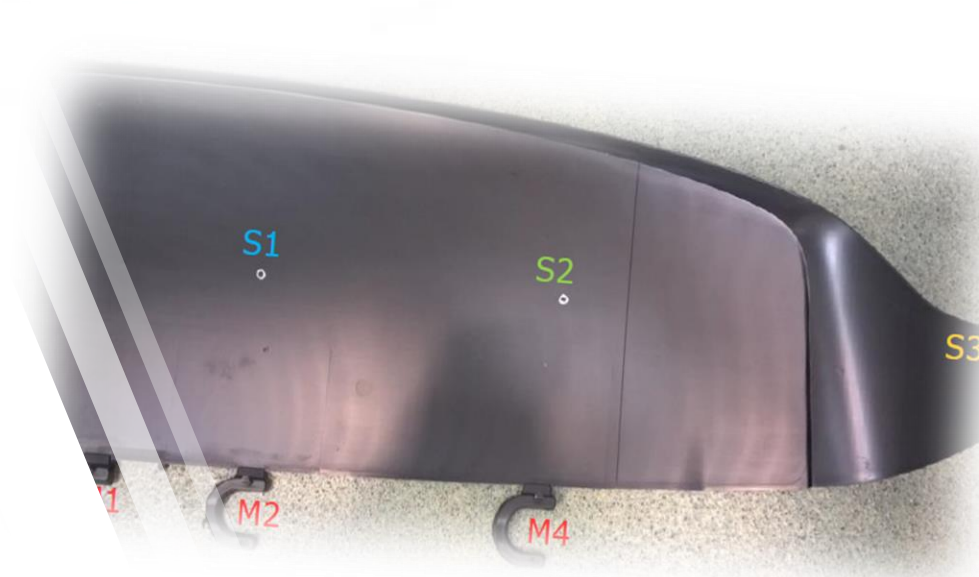
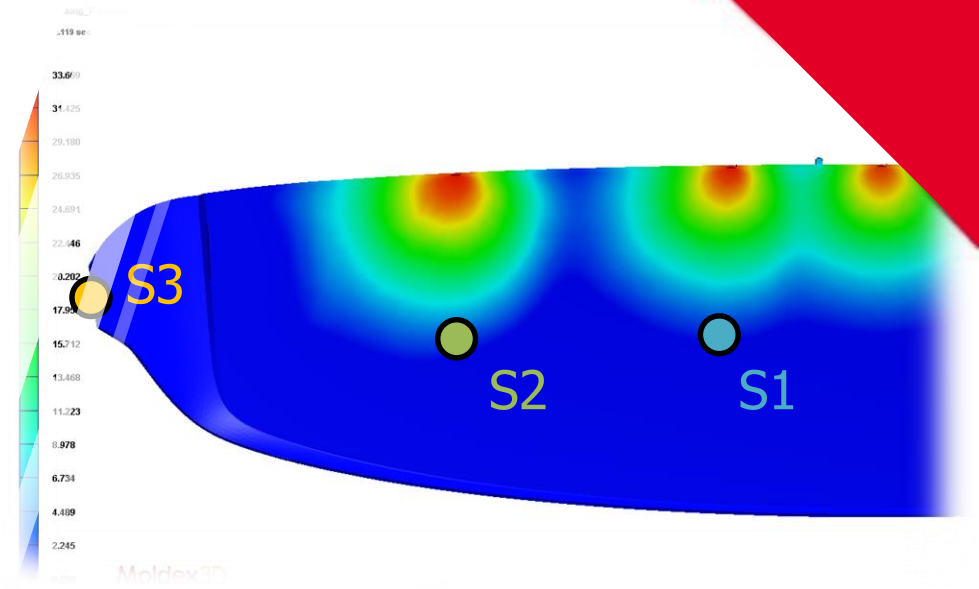
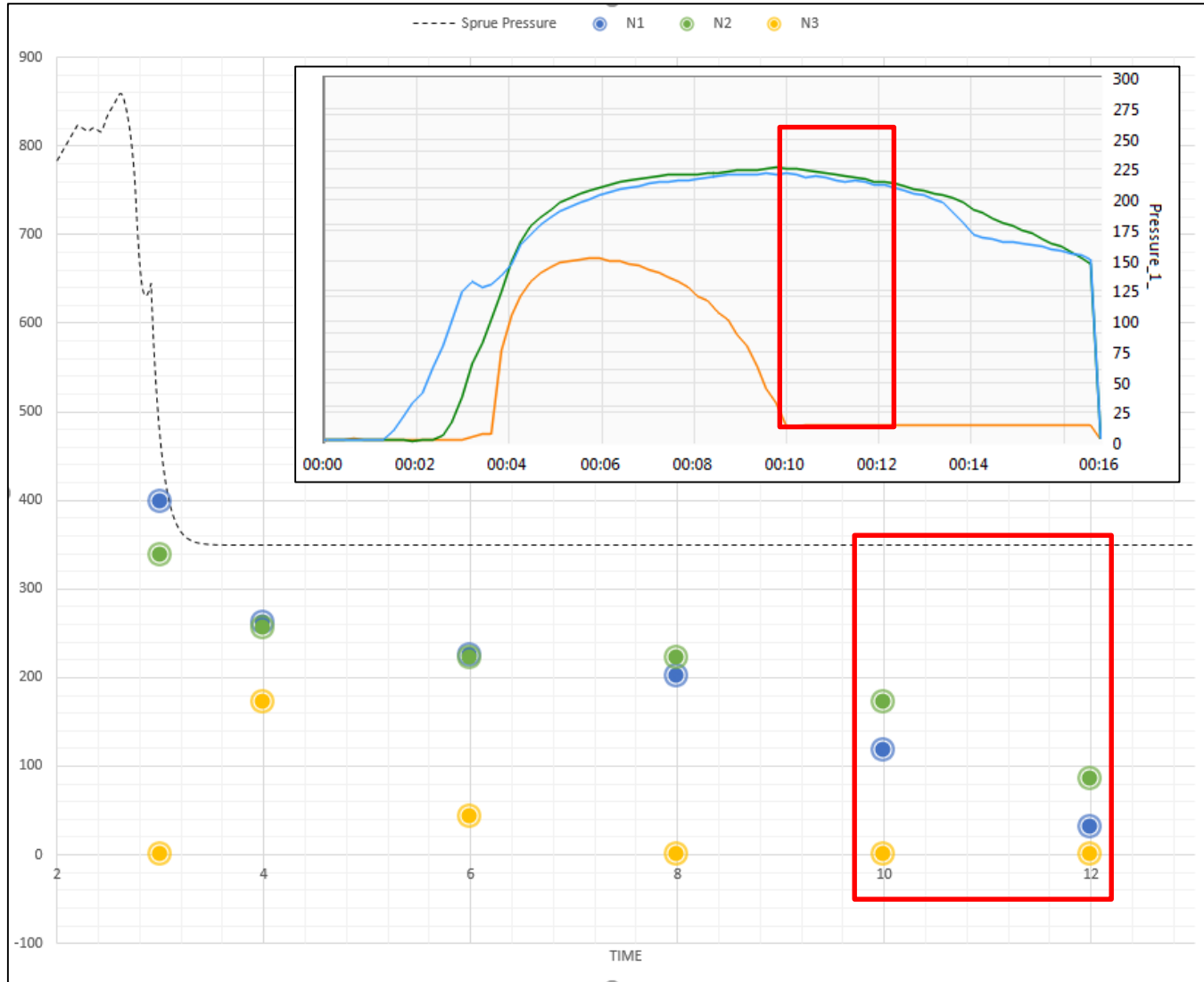


Compressibility on barrel

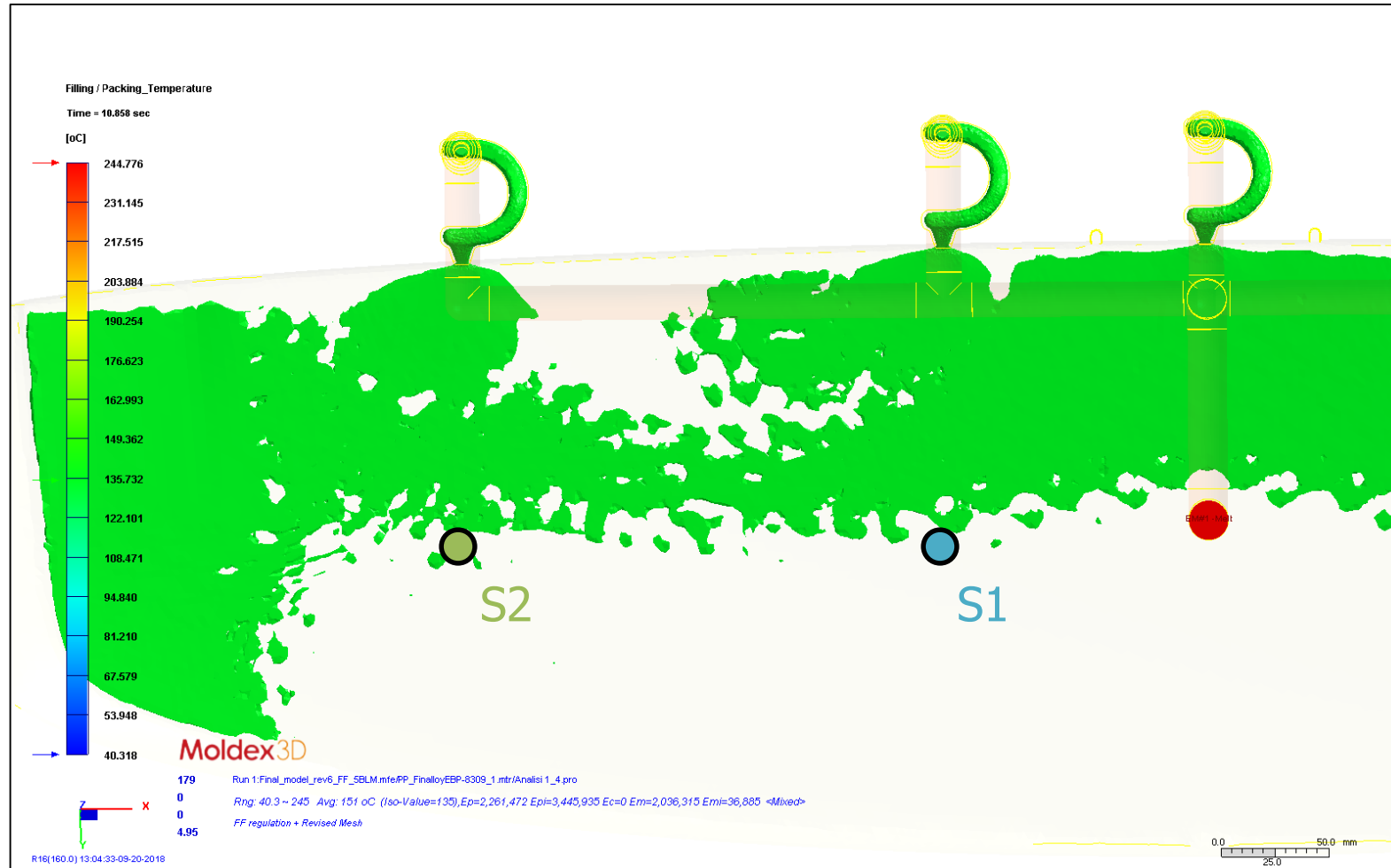


Pressure [Mpa]	Specific Volume [cm ³ /g]	Variation
0	1.0289	-
25	1.0001	2.7%
50	0.9775	5%
75	0.9601	6.9%

Pressure mismatch



Pressure mismatch



Conclusion





Technology **FLEXflow**

- FlexFlow regulation had a significant impact on tool deflection
- Tool reaction is very fast to pin movement

Simulation

- Matching of absolute deflection value
- Peak always recorded at maximum clamping force
- Good pressure distribution matching in first part of packing phase

Next Steps

- Investigate more realistic boundary conditions
- Better investigate the pressure evolution into the cavity after V/P (new VE module?)
- Evaluate different mold deflection simulation options
- Include cooling simulation