



Stefano Quaresimin
Virtual Analysis Engineer

Previsione e ottimizzazione dei problemi di stampaggio ad iniezione con Autodesk® Moldflow® con particolare evidenza a problematiche di deformazione

**De'Longhi**

An international Group with brands that made the history of small domestic appliances.



The De' Longhi Group is a world's leading players in small domestic appliances associated with the world of coffee, kitchen, air conditioning, and home care.

€ 2,351.3 mln
Revenues in 2020

9.000+ employees
Worldwide

Over 120
Market presence

€ 52 mln
Investments in R&D in 2020

5 iconic brands

**De'Longhi**

Smart Plastics 2021

**PRISMA
TECH**

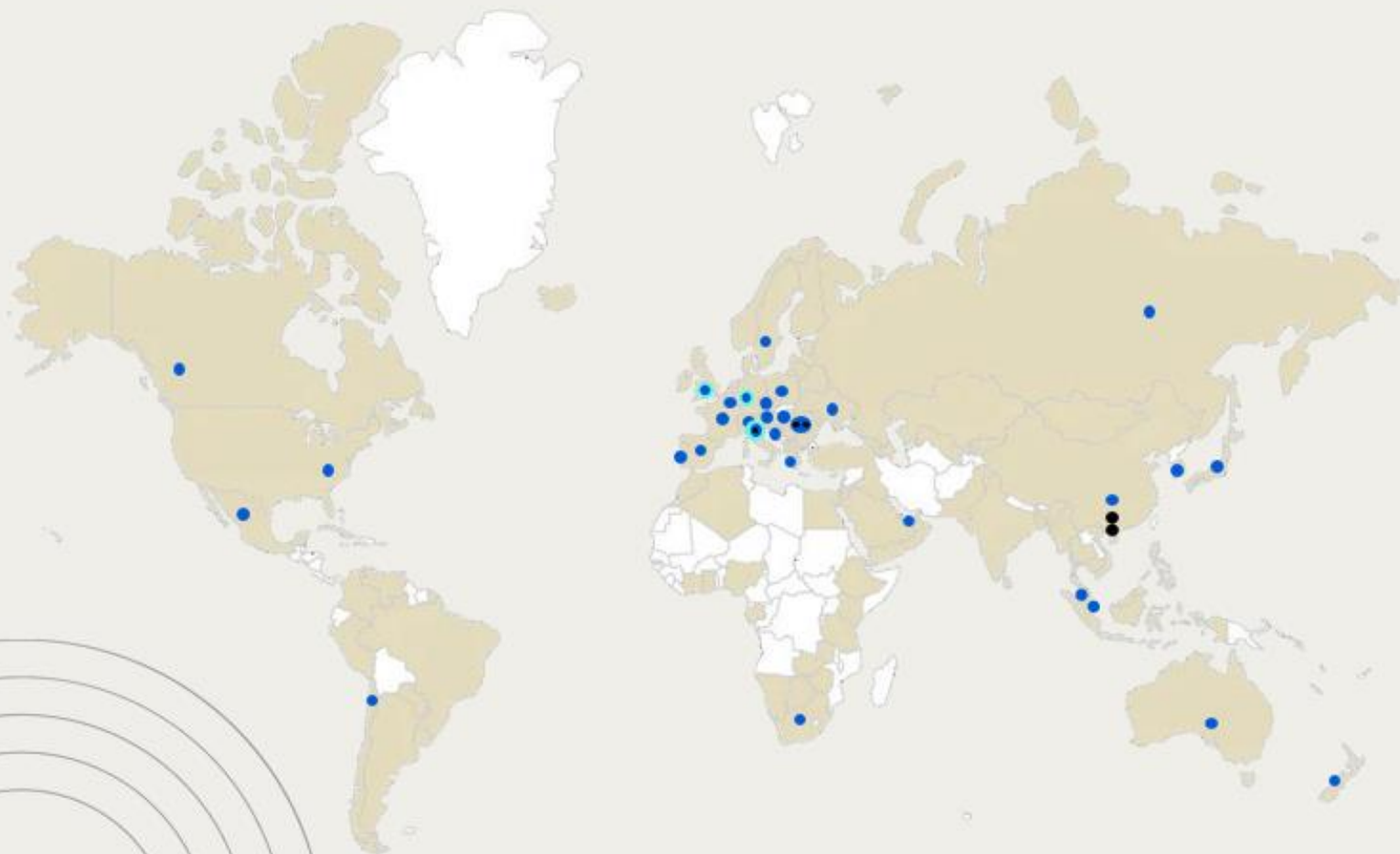
AUTODESK
Gold Partner

Worldwide presence

The Group, whose headquarters are located in Treviso (Italy), is present in **over 120 markets** worldwide, also through **3 technical centers** and approximately **50 commercial subsidiaries**.

Our manufacturing footprint counts on **5 manufacturing plants** located in Italy, Romania (2) and China (2), as well as a plant in Joint Venture in China.

- Manufacturing plants
- Technical centers
- Commercial subsidiaries



Our portfolio

Five brands to improve everyday life



Global market leader in coffee, comfort and selected kitchen categories



The most loved & admired brand in food preparation



Leading premium brand in high volume «everyday home essential»



Leading personal blender in accessible nutrition



Multispecialist offering smart daily solution with attractive colored Italian design

MISSION

KEY CATEGORIES

KEY MARKETS

Coffee
Comfort
Breakfast

Baking
Food processing
Other kitchen appliances

Hand blenders
Ironing
Other kitchen appliances

Personal blenders
Juicers
New kitchen products

Home
Kitchen appliances
Fun

EMEA
North America
China/Asia

EMEA
Australia & New Zealand
Other selected markets

EMEA
North America
China/Asia

North America
Australia & UK
New markets

EMEA
China/Asia
Other selected markets



Smart Plastics 2021

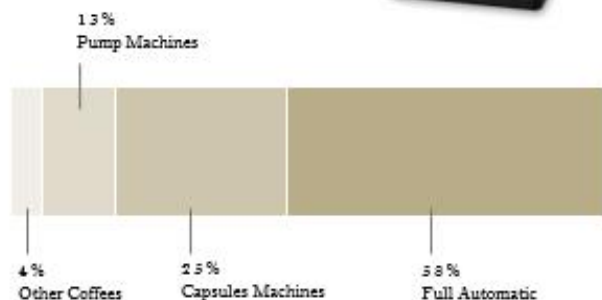


Business by products

The Group's brands enjoy a clear global leadership in its core product segments.

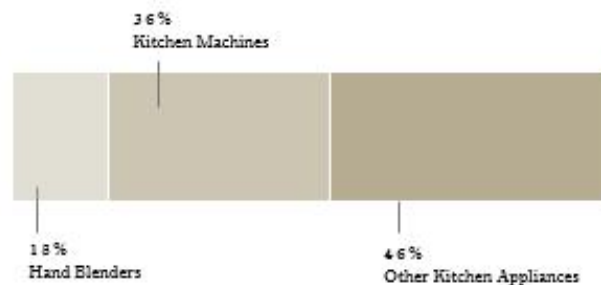
COFFEE MAKERS

52% OF TOTAL SALES



FOOD PREPARATION

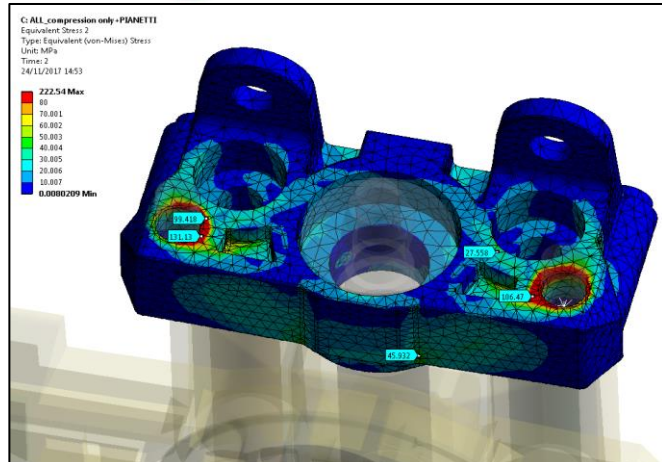
28% OF TOTAL SALES



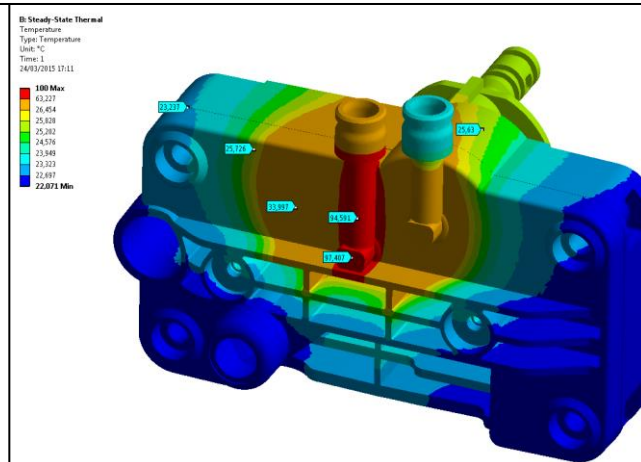
HOMECARE & COMFORT

20% OF TOTAL SALES

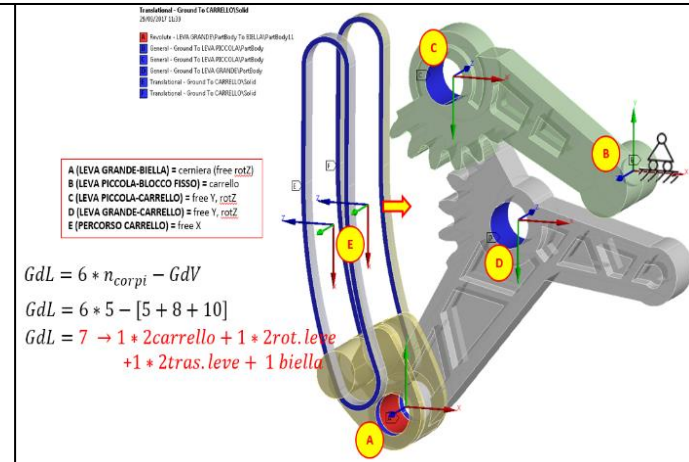




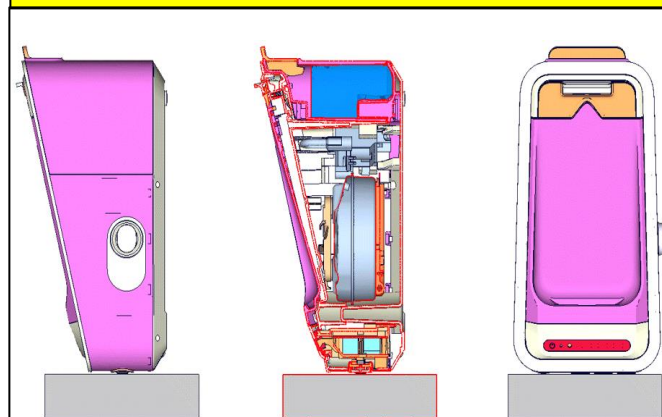
ANALISI MECCANICHE



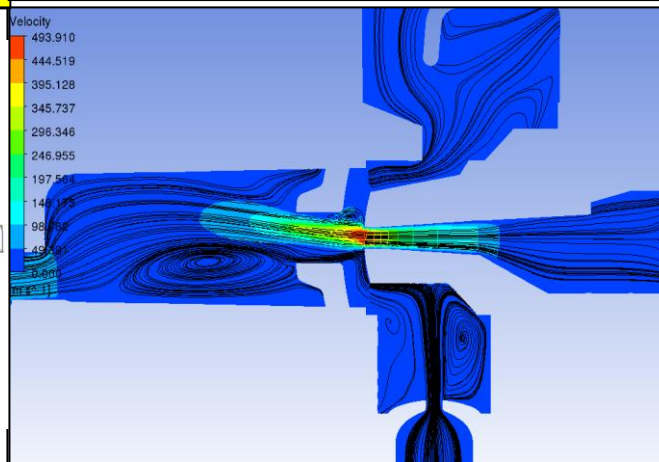
ANALISI TERMICHE



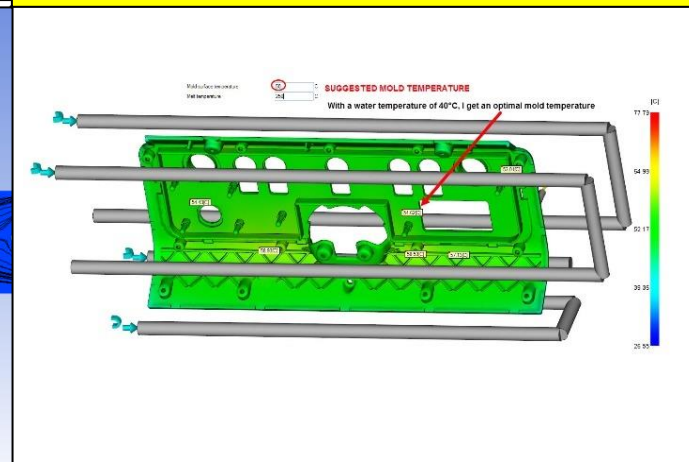
ANALISI CINEMATICHE



ANALISI IMPATTO (DROP-TEST)



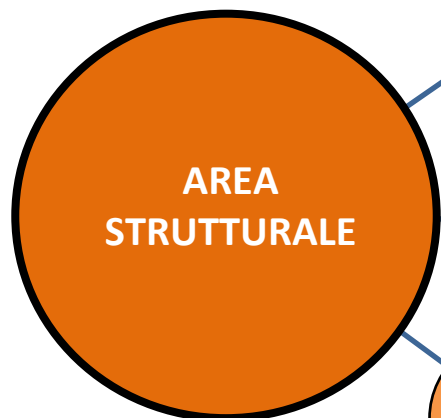
ANALISI FLUIDODINAMICHE



ANALISI STAMPAGGIO



SIMULAZIONE CAE - STATUS DeLonghi



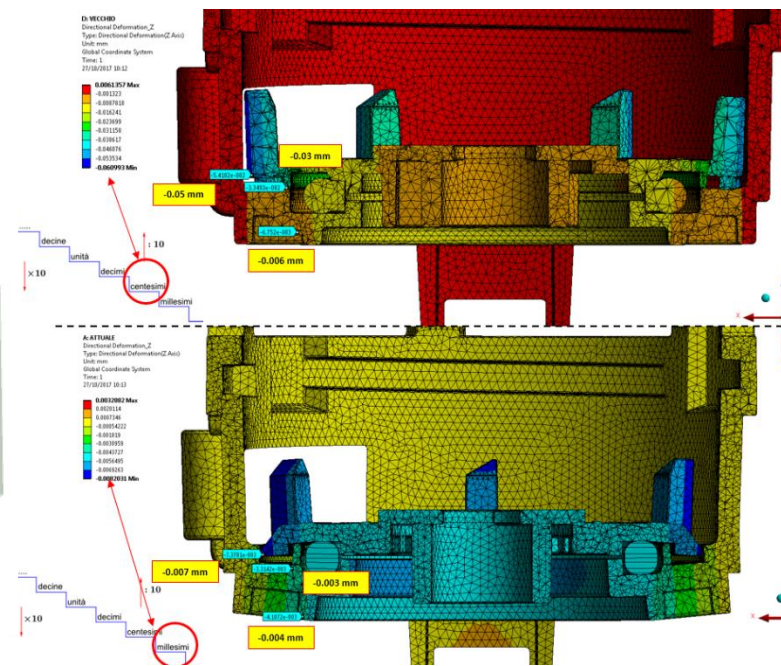
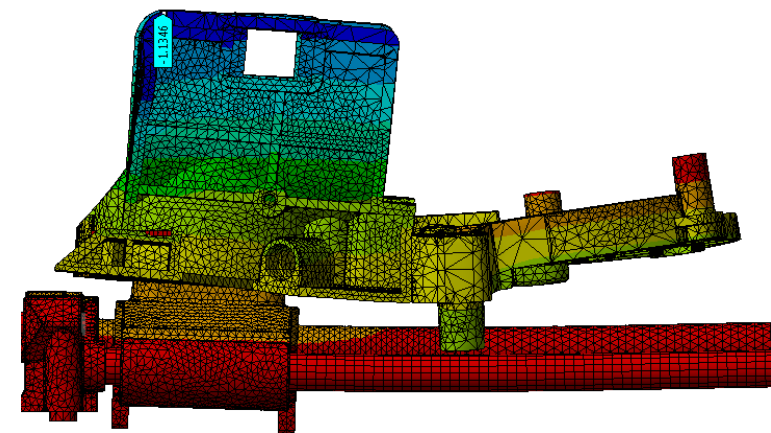
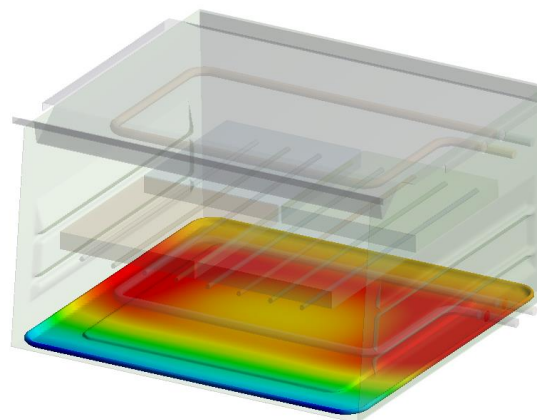
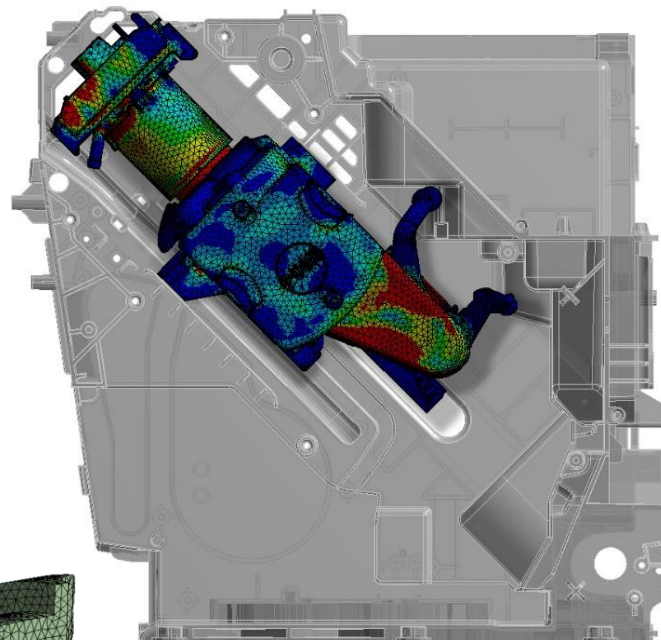
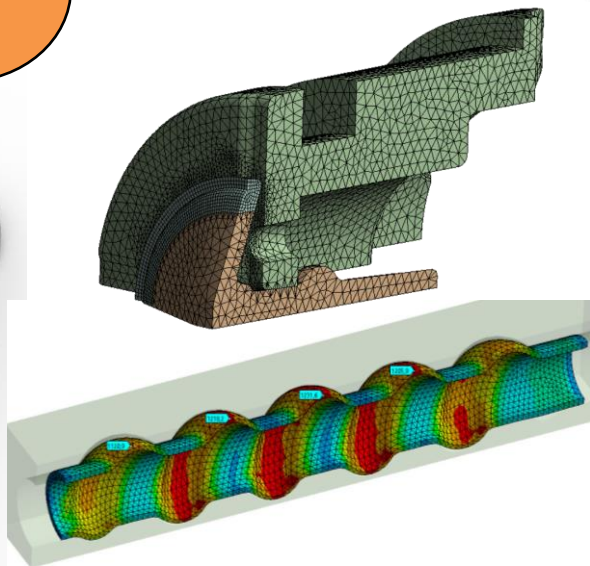
- TELAIO
- MACININO
- PANNELLI

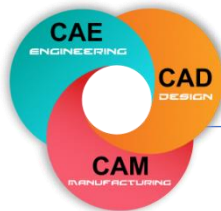
STRUTTURA
TELAIO
ECAM

- DESIGN OPTIMIZATION
- LIGHTWEIGHT DESIGN
- NUOVI MATERIALI/PROCESSI

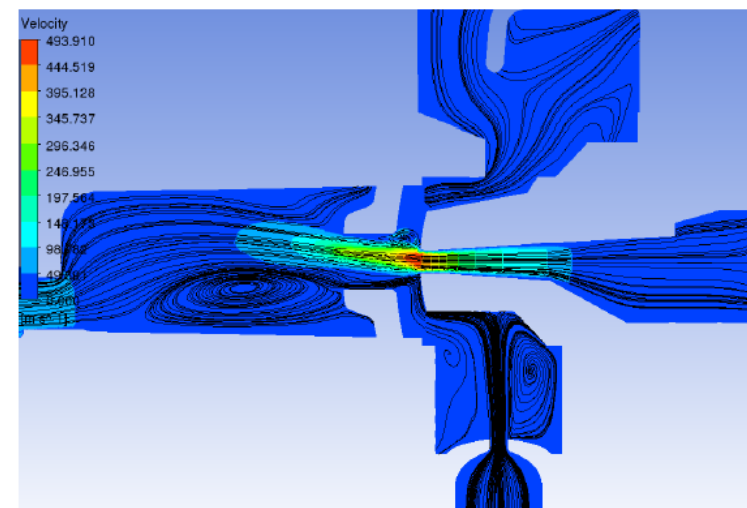
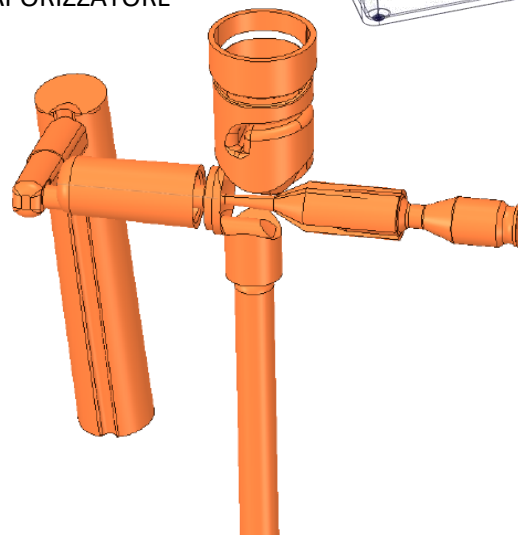
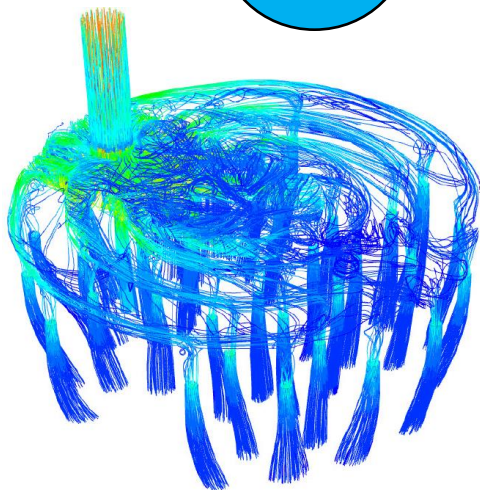
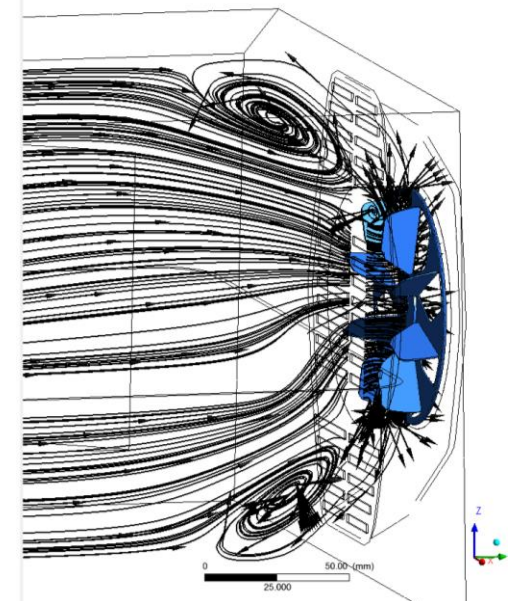
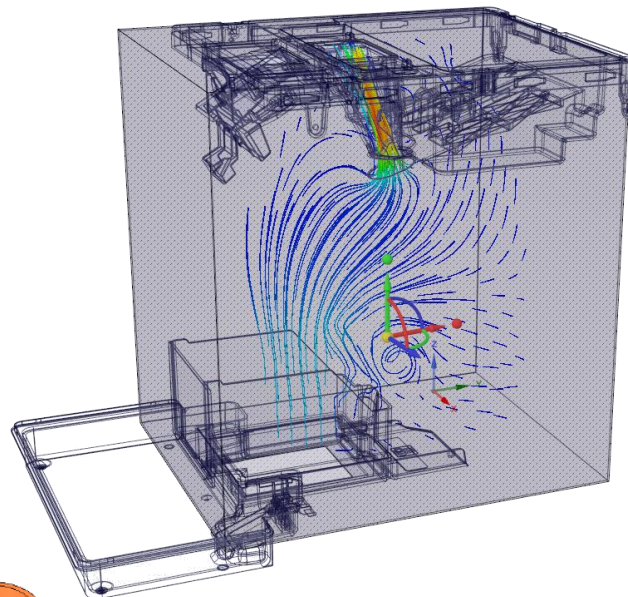
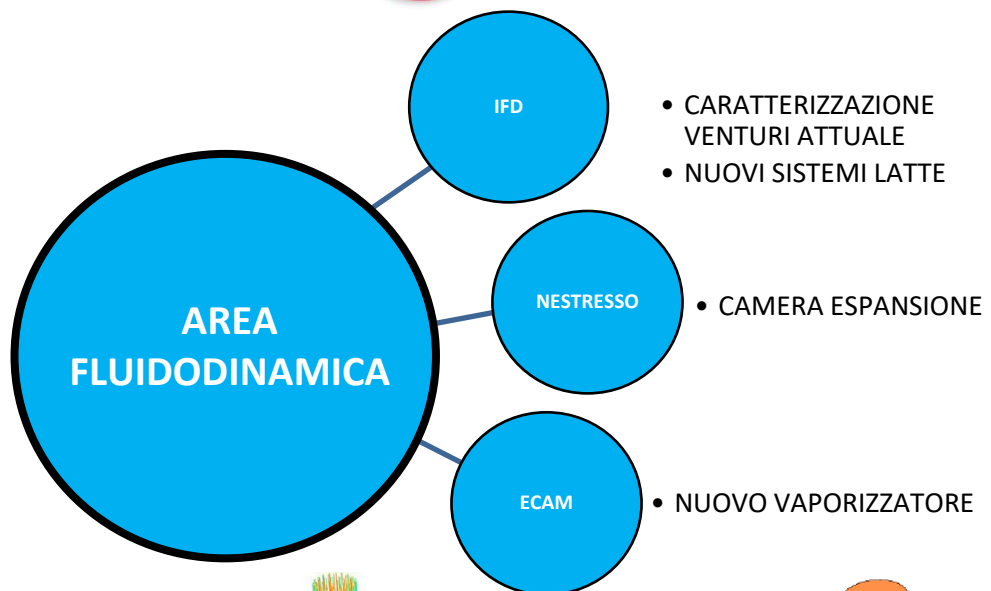
MOVIMENTAZIONE

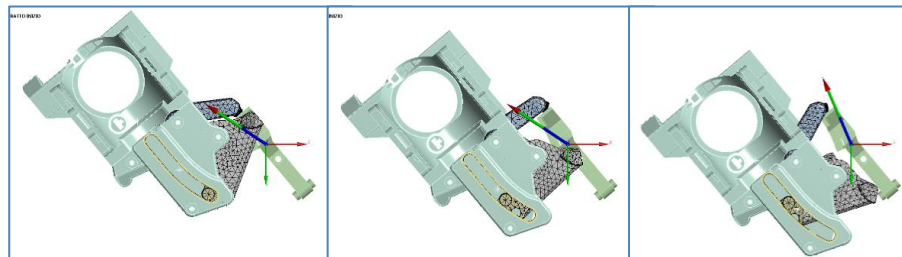
- NUOVO GRUPPO



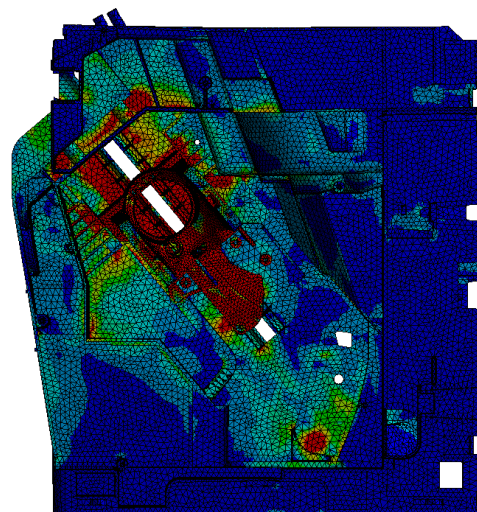


SIMULAZIONE CAE - STATUS DeLonghi





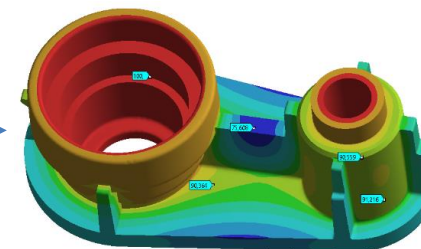
ANALISI CINEMATICHE



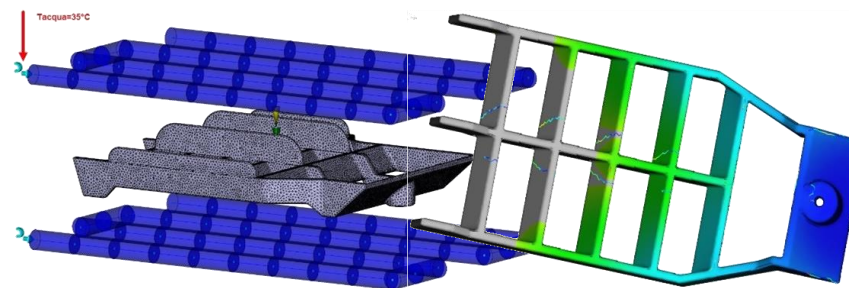
ANALISI MECCANICHE



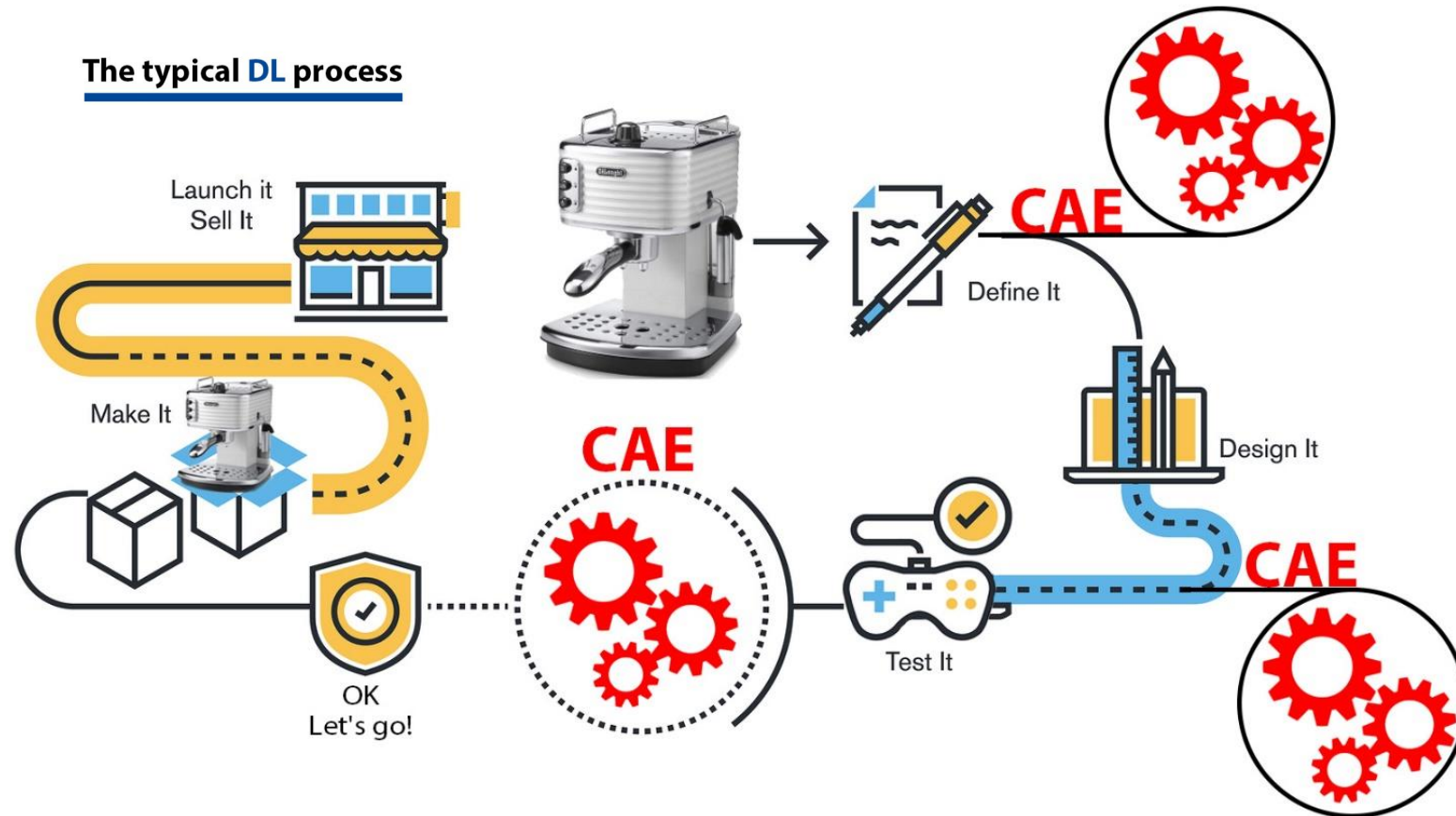
ANALISI TERMICHE



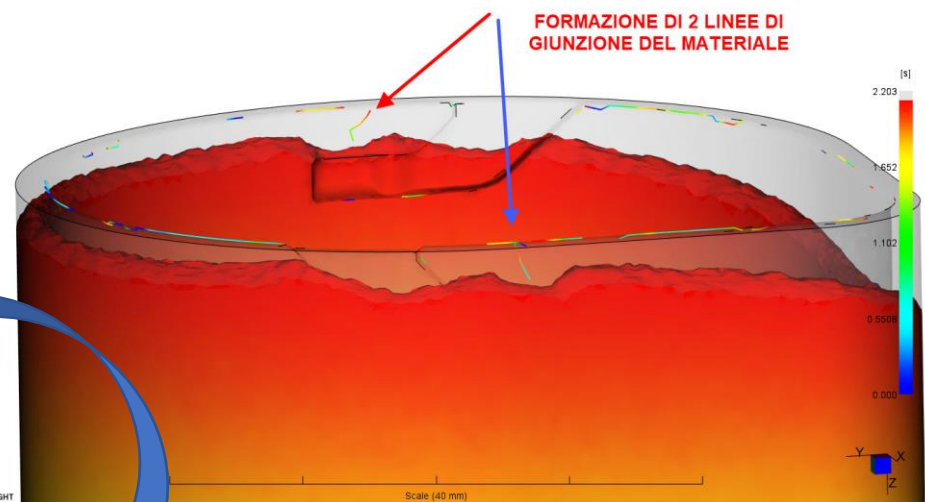
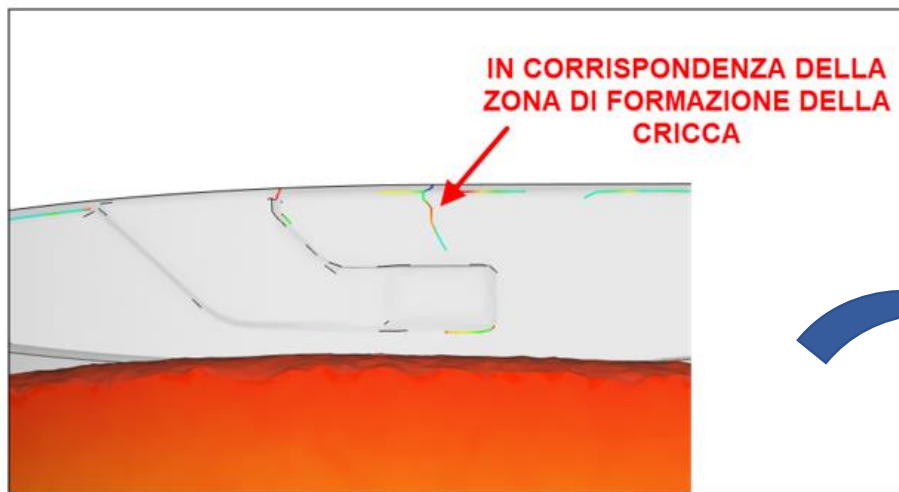
ANALISI DI STAMPAGGIO



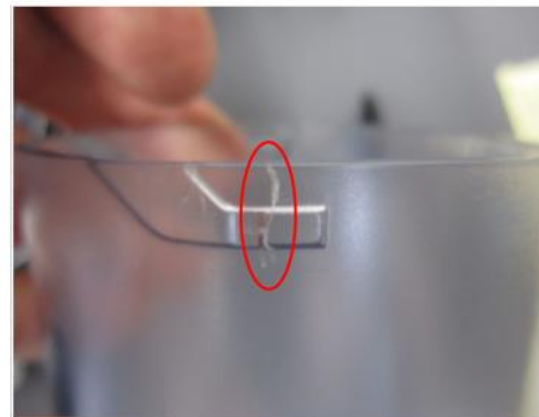
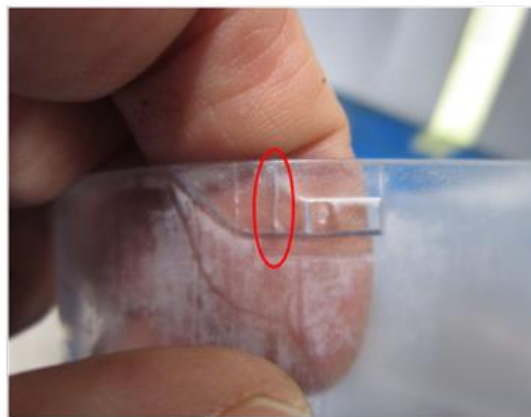
The typical DL process



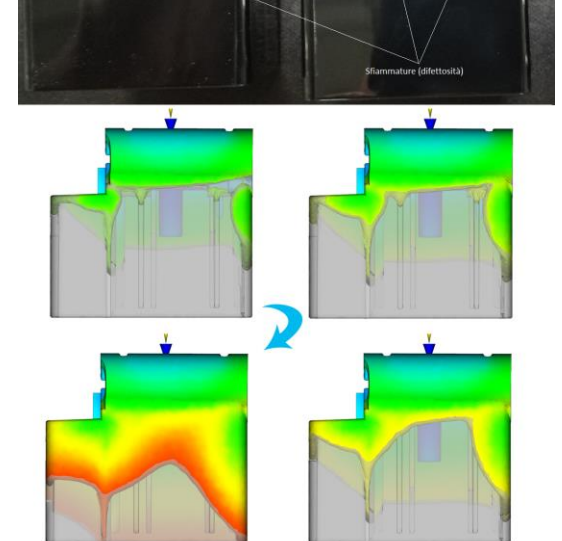
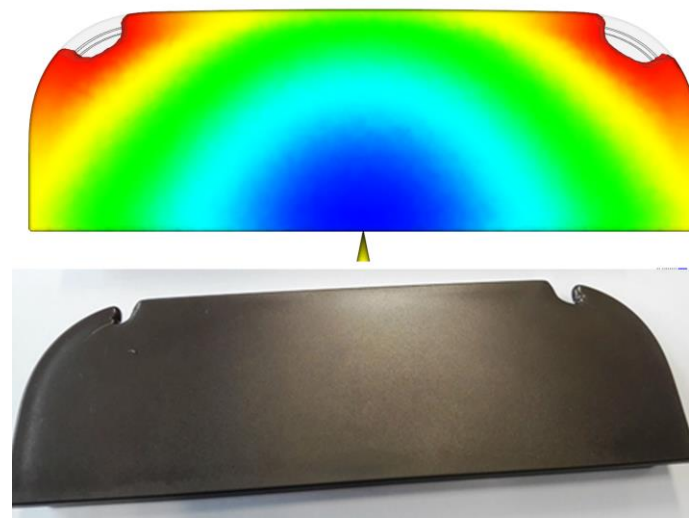
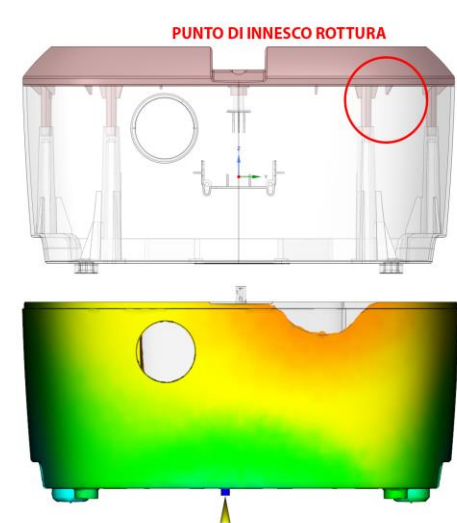
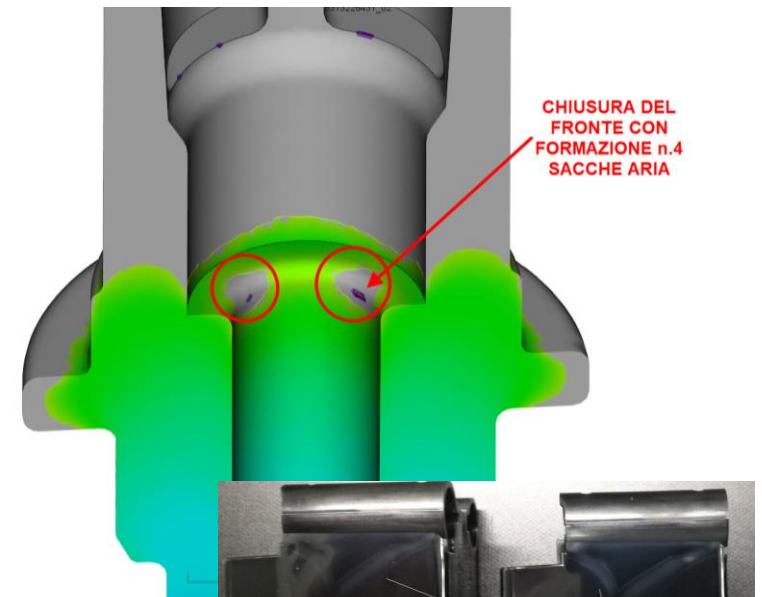
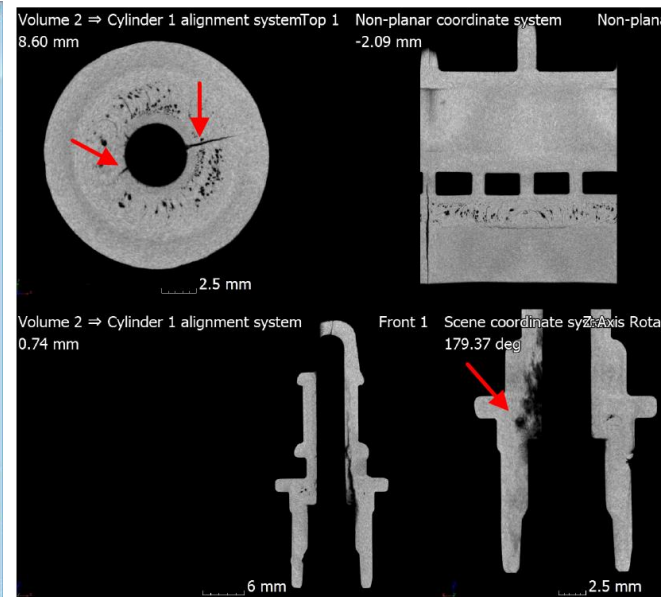
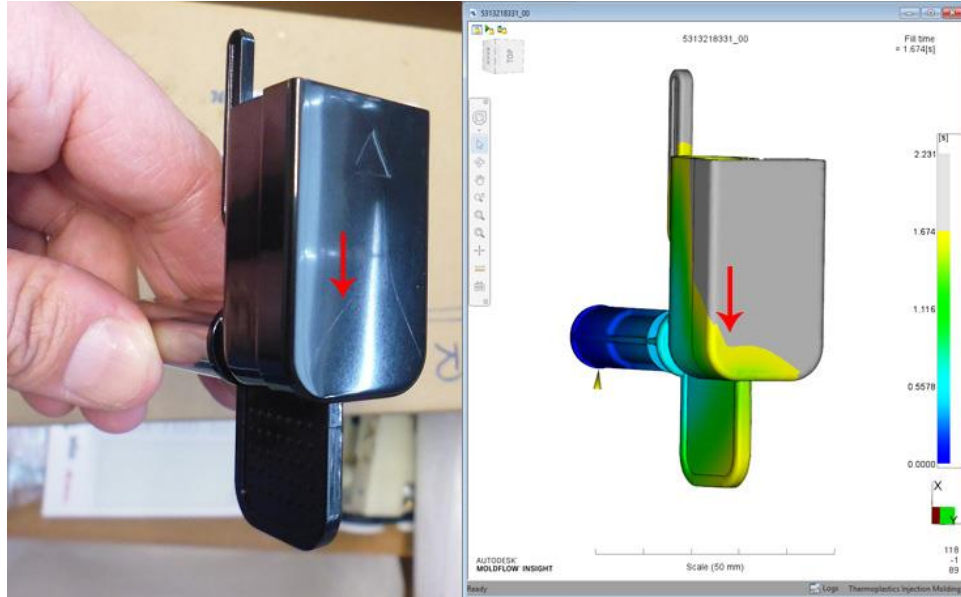
ESEMPI: difetti riempimento



Su alcune caraffe in prova vita troviamo queste criccate nella zona aggancio baionetta

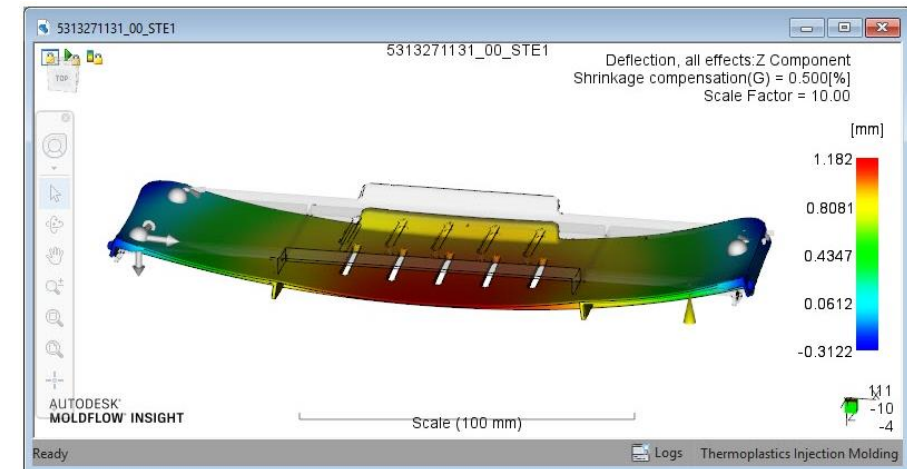


ESEMPL: difetti riempimento

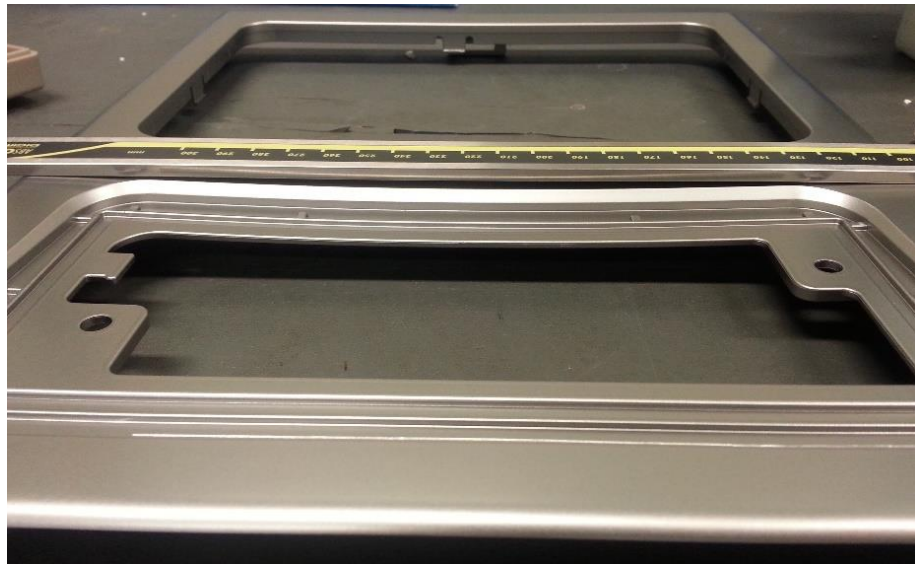


Contributi sulla deformazione

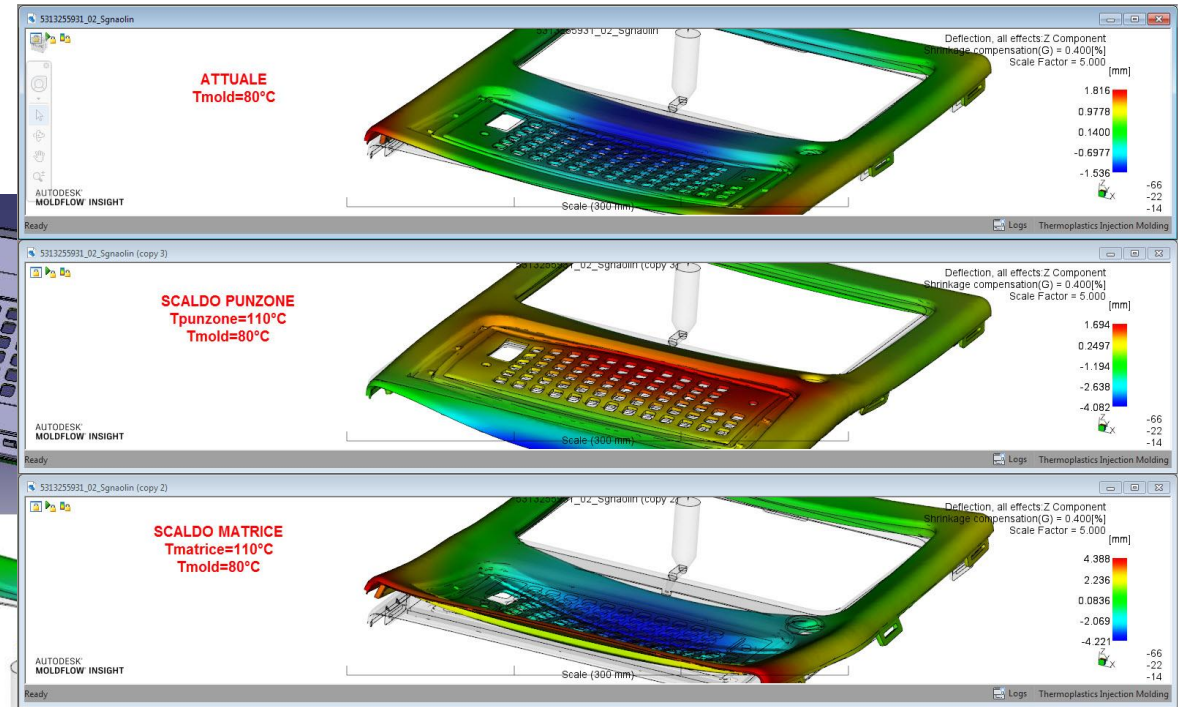
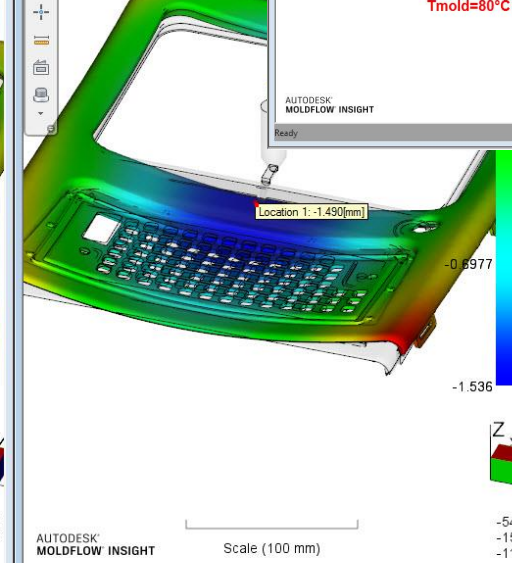
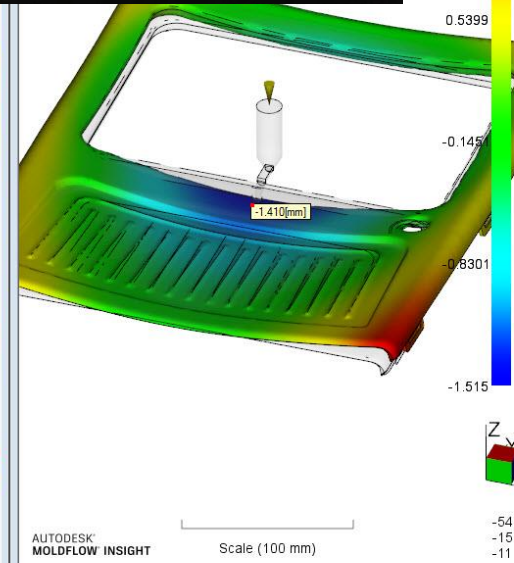
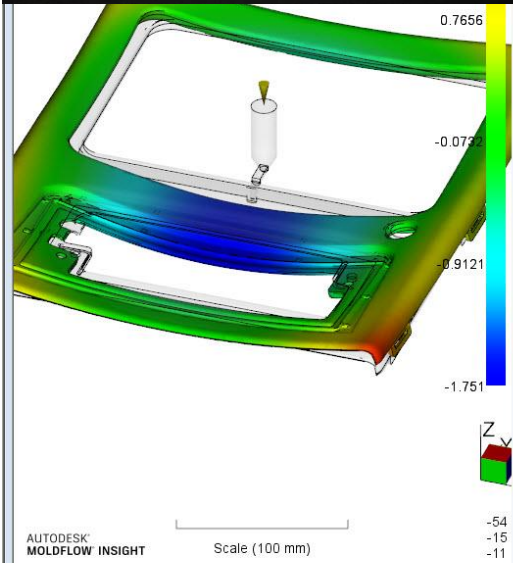
- Design e industrializzazione del componente
 - Spessore
 - Variazioni di spessore
 - Rigidità/forma
 - Angoli
- Progetto stampo
 - Posizione gate
 - Dimensionamento gate e canali
 - Condizionamento
 - Estrazione
- Processo
 - Temperatura stampo
 - Temperatura fuso
 - Tempo di iniezione
 - Tempo di pack
 - Pressione di pack
- Materiale
 - Struttura molecolare
 - Semi-cristallino
 - Amorfo
 - Rinforzi/cariche



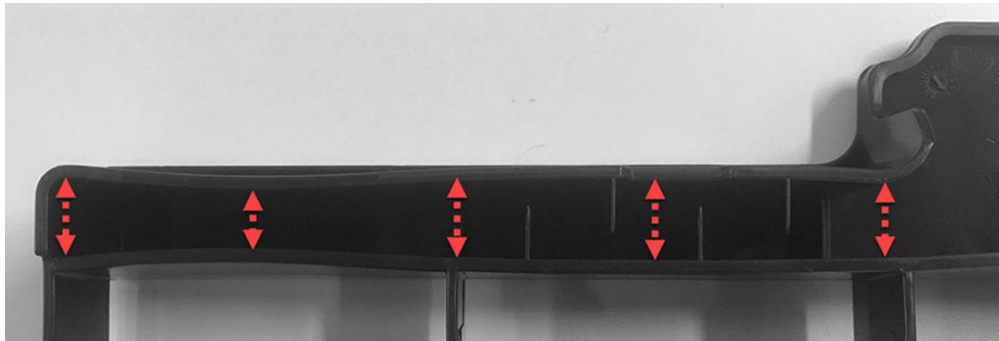
ESEMPI: deformazioni post-stampaggio - COPERCHIO



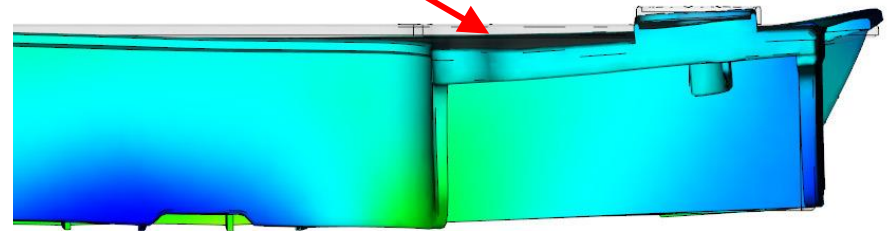
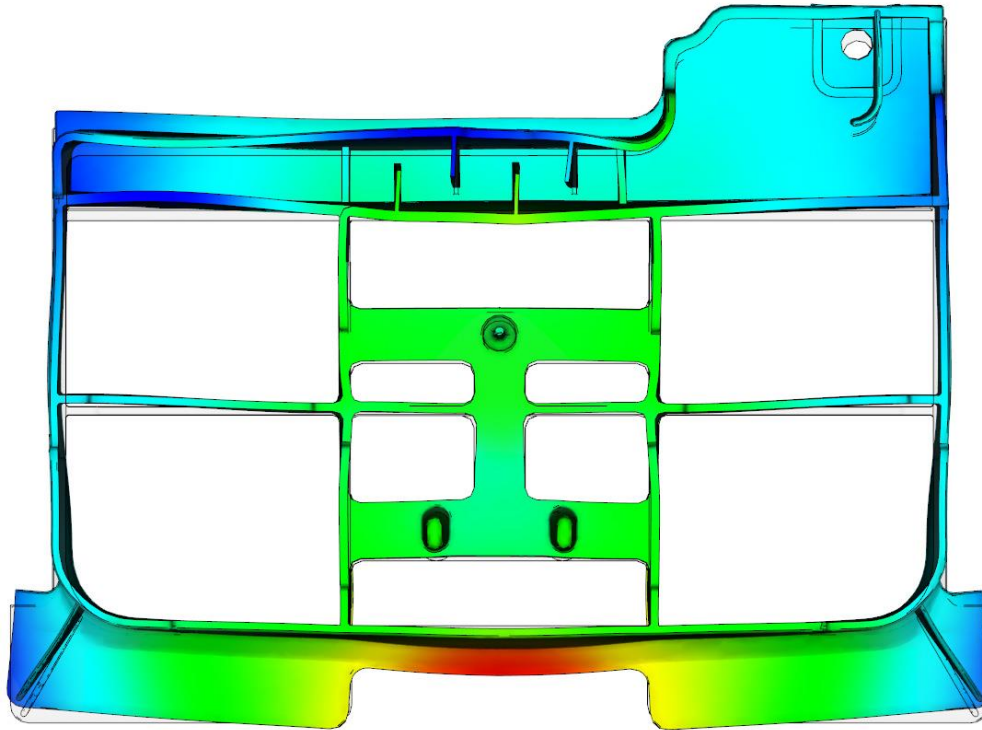
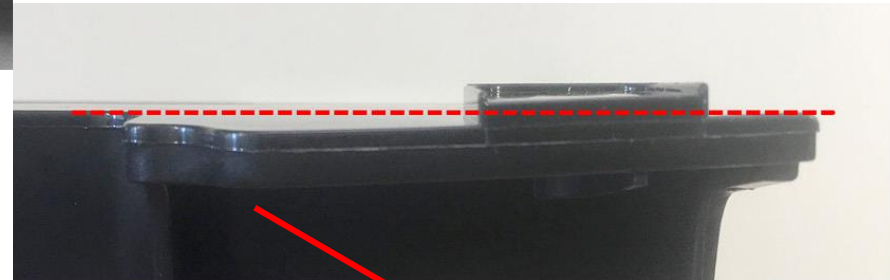
Z Component
G) = 0.400[%]
Factor = 10.00



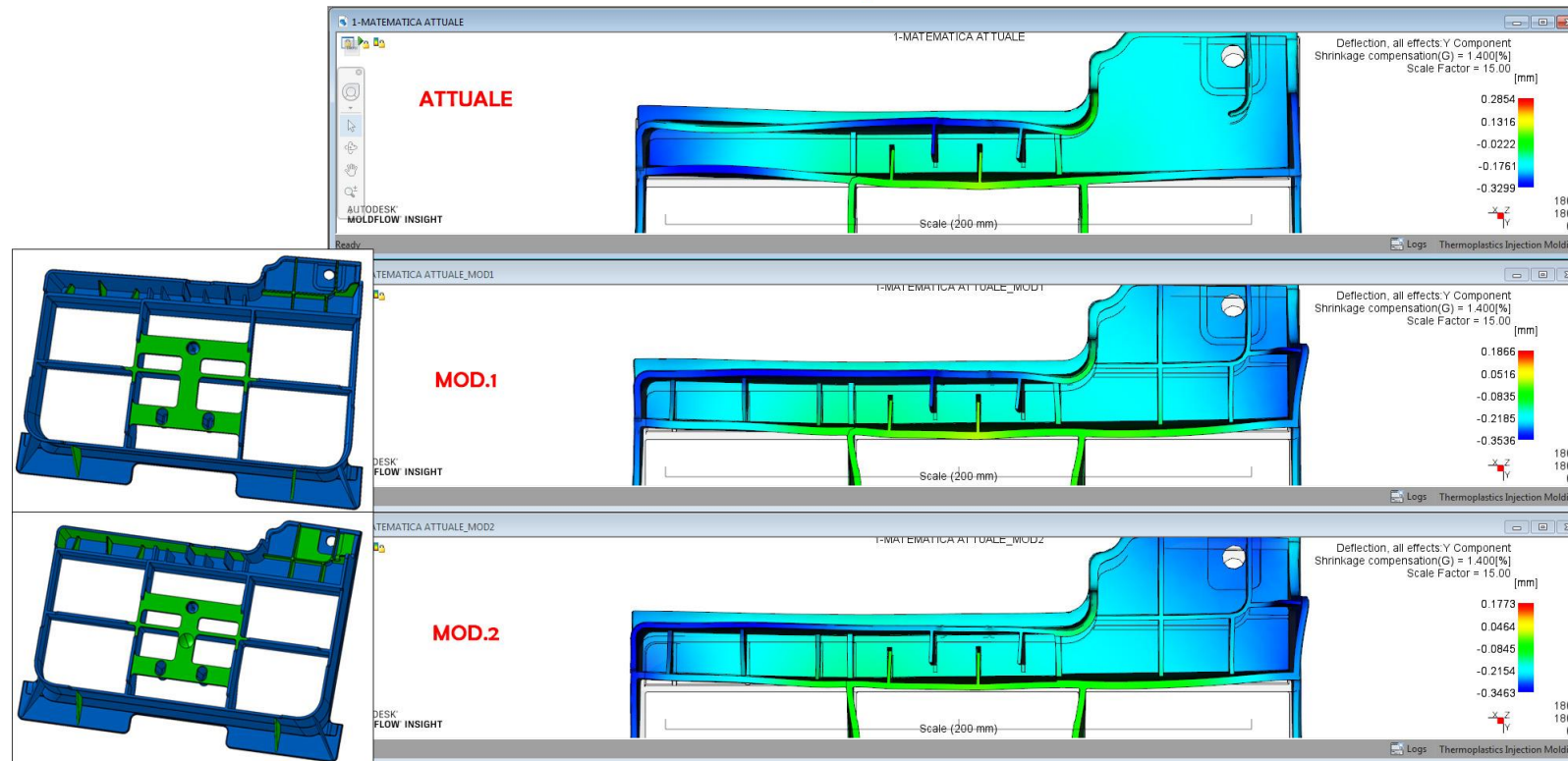
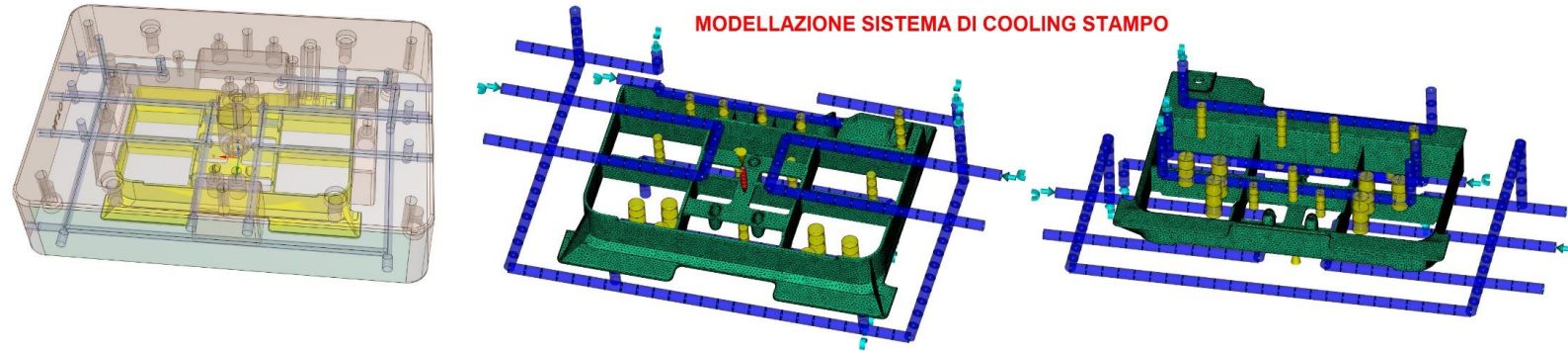
ESEMPLI: deformazioni post-stampaggio - GRIGLIA POGGIATAZZE



DEFORMAZIONI



ESEMPI: deformazioni post-stampaggio - GRIGLIA POGGIATAZZE



ESEMPLI: deformazioni post-stampaggio - FIANCO

3° Velocità:	28 %	38 mm	TEMP. CILINDRO [±20°C]	
4° Velocità:	25 %	28 mm	Grafico Temp.	
5° Velocità:	%	mm	Ugello:	40 %
6° Velocità:	%	mm	1° Resistenza:	238 °C
7° Velocità:	%	mm	2° Resistenza:	235 °C
8° Velocità:	%	mm	3° Resistenza:	230 °C
9° Velocità:	%	mm	4° Resistenza:	225 °C
10° Velocità:	%	mm	5° Resistenza:	215 °C
Tempo di Iniezione:	3,47 s		6° Resistenza:	210 °C
Max Pressione di Riempimento:	175 bar		7° Resistenza:	°C
Commutazione post-pressione:	25 mm		TEMP. CAMERA CALDA [±20°C]	
1° Post-pressione:	100 bar	1 s	1° Inietttore	245 %
2° Post-pressione:	90 bar	2 s	2° Traversa	245 %
3° Post-pressione:	78 bar	3,5 s	3° Traversa	240 %
4° Post-pressione:	68 bar	3,5 s	4° Fascia	240 %
5° Post-pressione:	bar	s	5° Zona:	%

TEMP. STAMPO [±12°C]		
Parte Fissa:	70 °C	
Parte Mobile:	60 °C	
Carrelli:	°C	

INSERIMENTO PARAMETRI IN MOLDFLOW

Process Settings Wizard - Fill+Pack Settings - Page 1 of 2

Mold surface temperature: 65 °C

Melt temperature: 245 °C

Filling control

Injection time: 3.4 s [0:]

Velocity/pressure switch-over

By %volume filled at 99 % [0:100]

Pack/holding control

Packing pressure vs time

Cooling time

Specified 35 s [0:]

☒ Fiber orientation analysis if fiber material

☐ Crystallization analysis (requires material data)

Pack/Holding Control Profile Settings

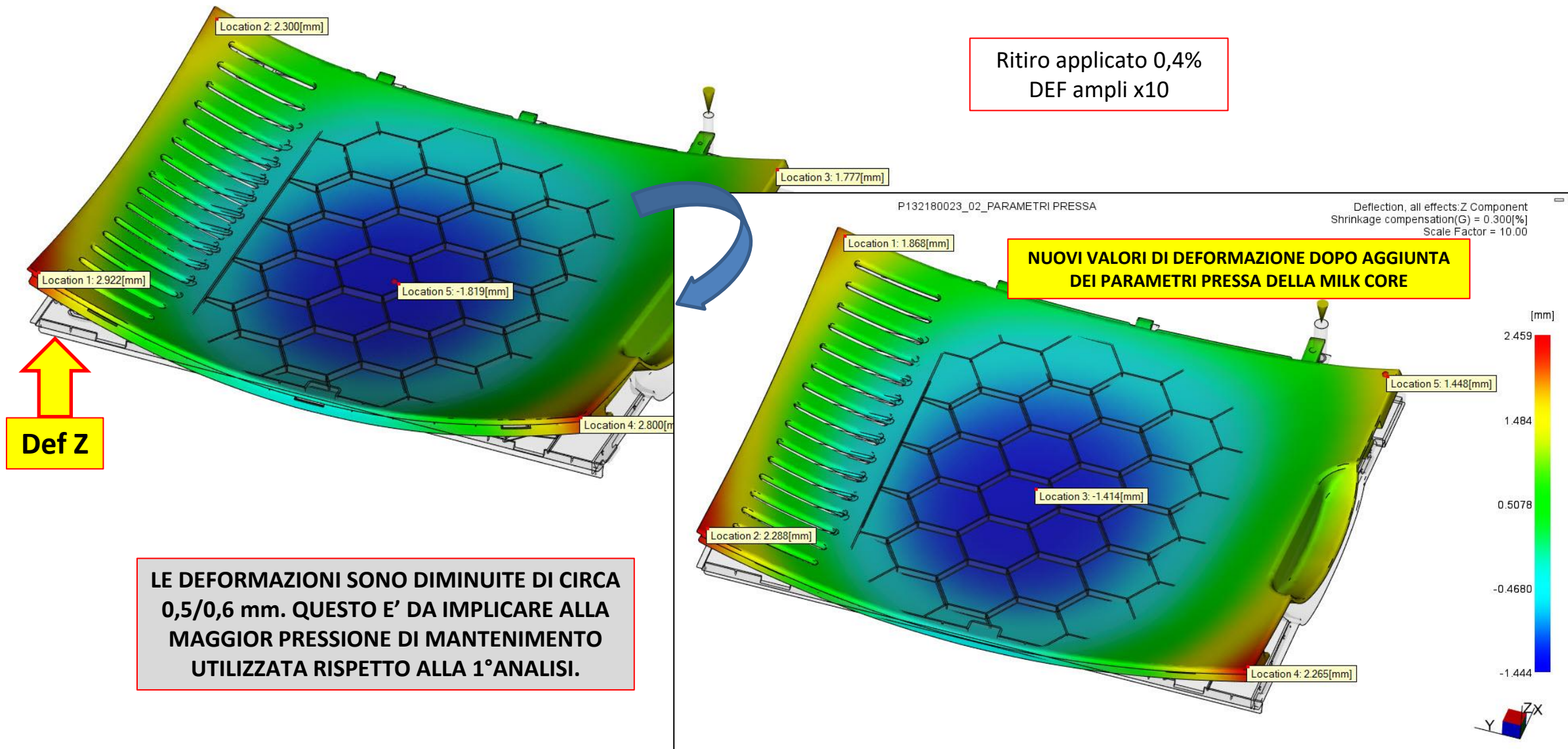
Packing pressure vs time

	Duration s [0:3600]	Packing pressure MPa [0:500]
1	0.1	90
2	1	90
3	2	80
4	3	68

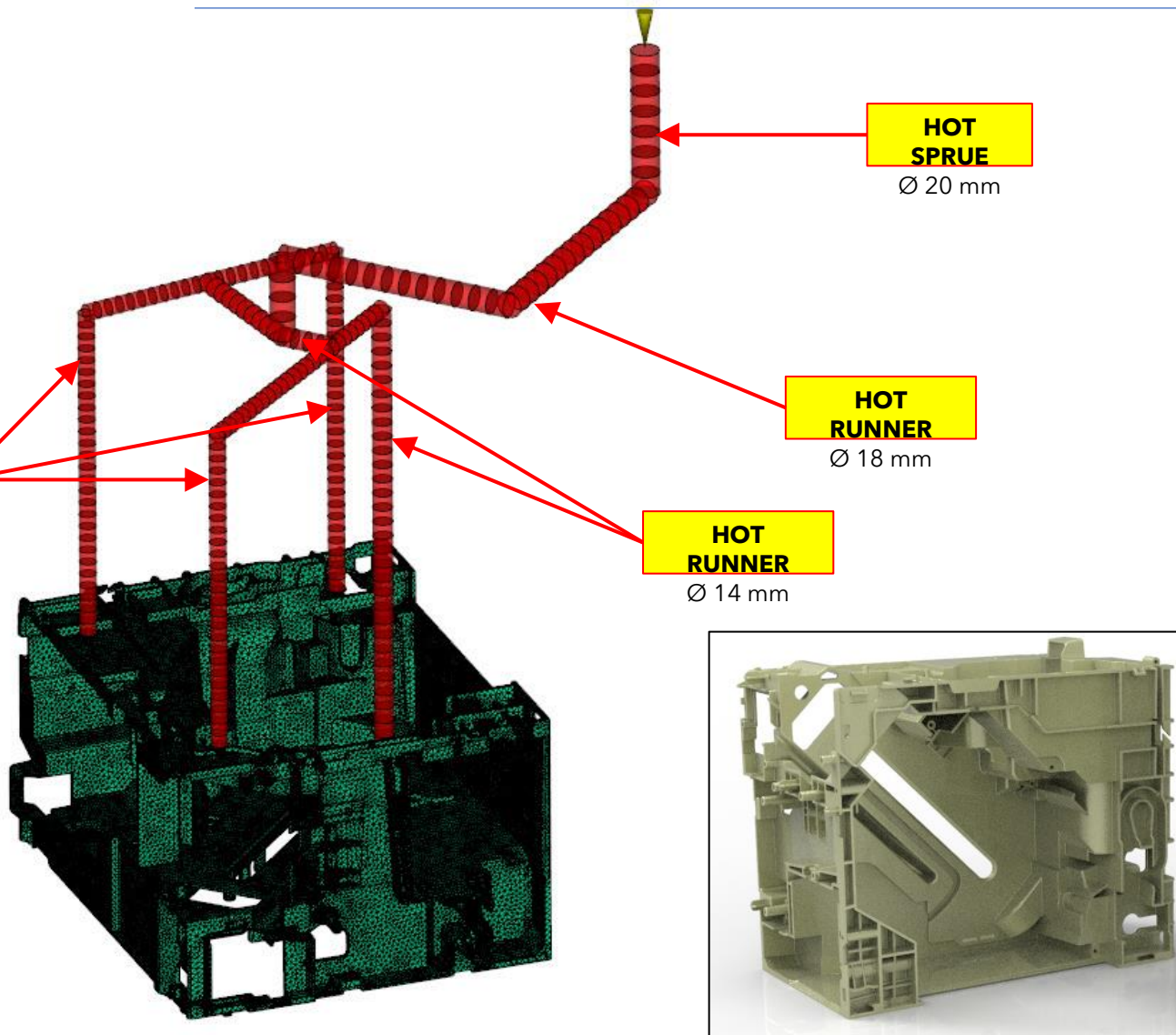
Import Profile... Plot Profile...

OK Annulla ?

ESEMPLI: deformazioni post-stampaggio - FIANCO

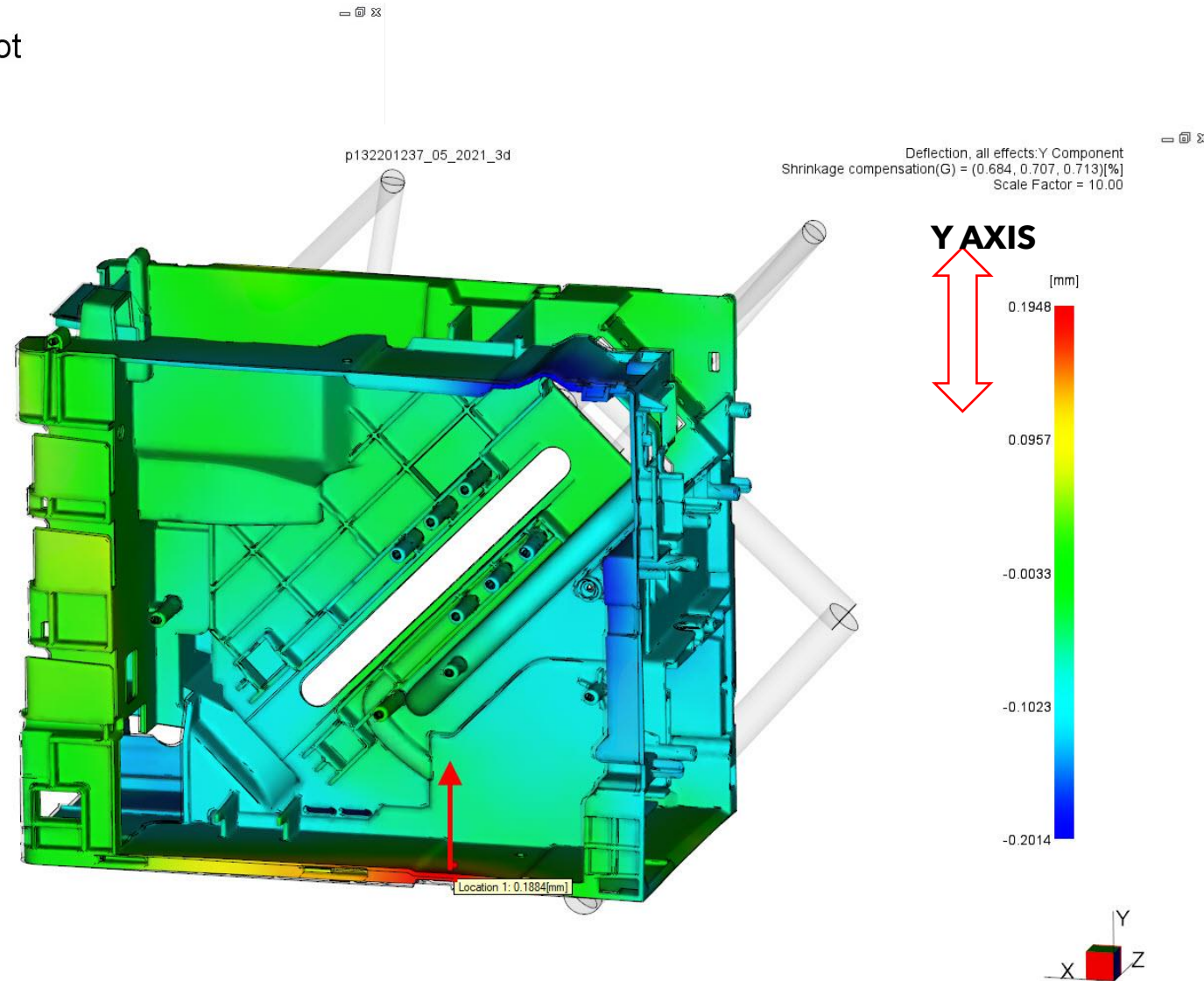
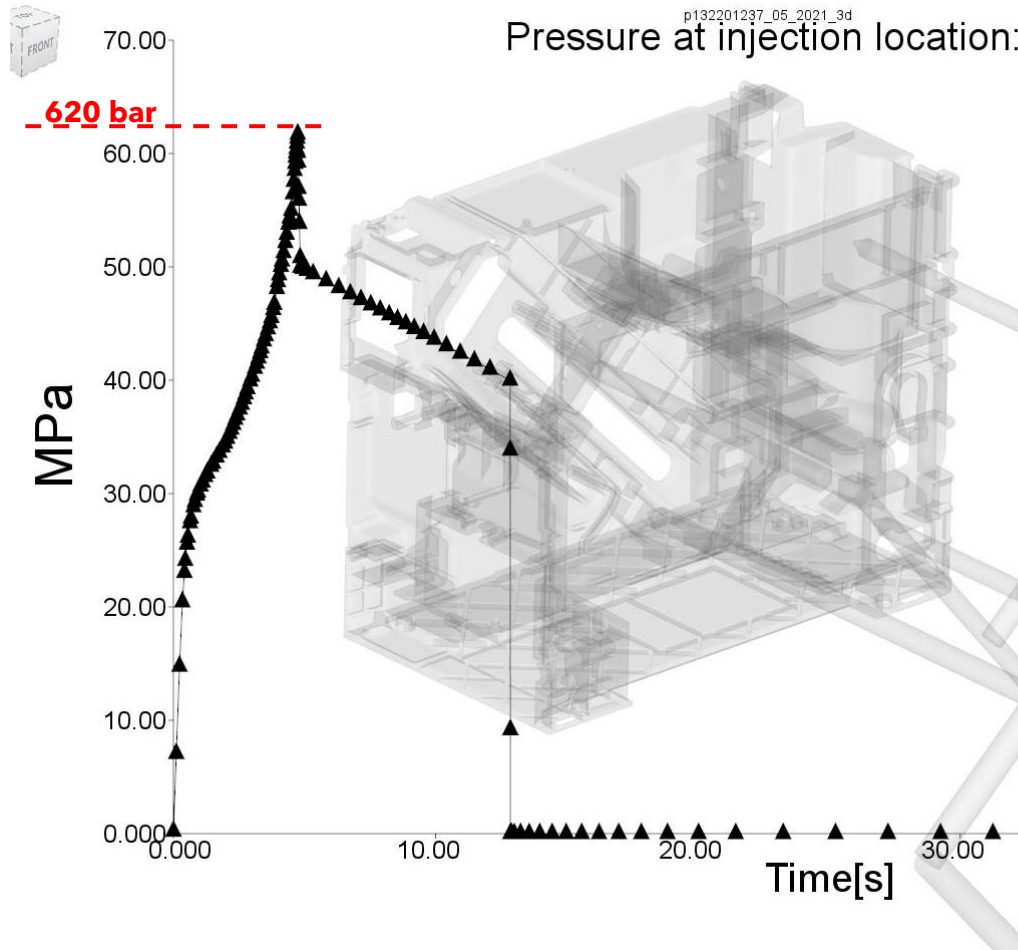


ESEMPLI: deformazioni post-stampaggio - TELAI



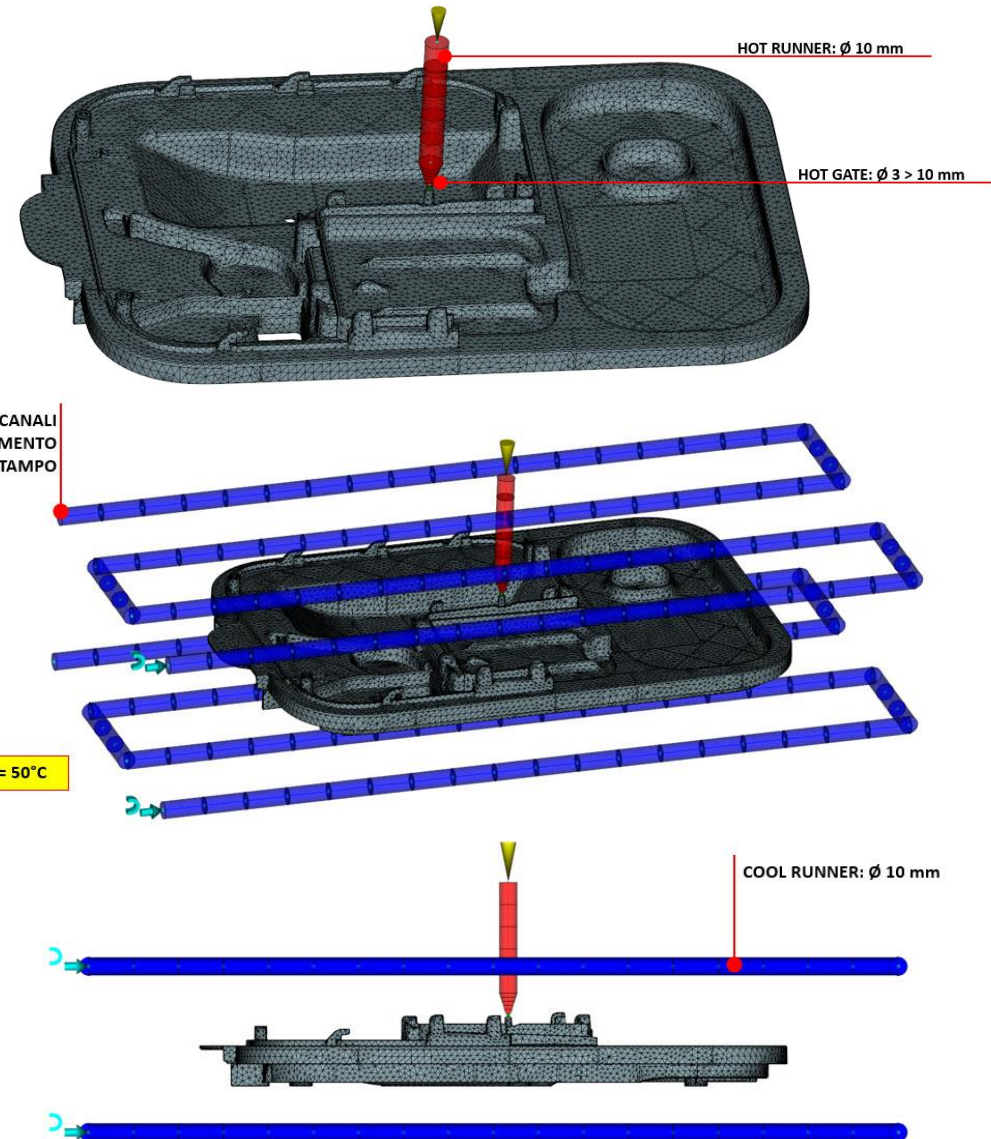
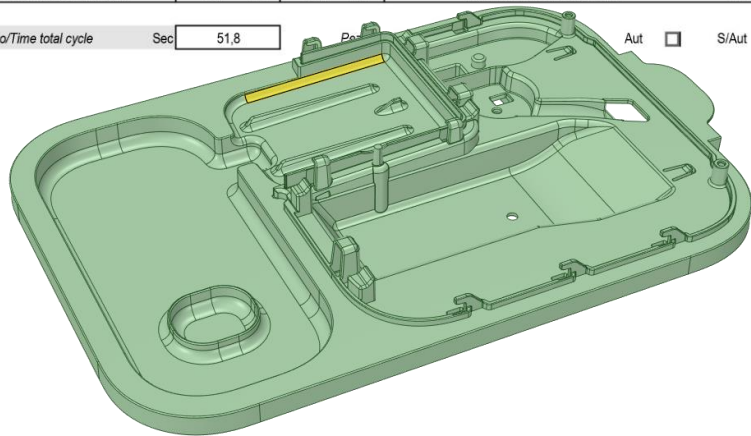
DeLonghi		VALIDATION SHEET PROCESS		INJECTION PARAMETERS		Date 13/06/2015	
Produzione/Production ☒		Campionatura/Sampling ☐		N° RoD Pass N°			
PRODOTTO / PRODUCT							
PRODUCT	Denominazione/Name immagine						
	Stampatore/Stamper						
	Codice/Code n° cavità/cavity		5513216731		1		
	Famiglia/Family		ESAM		Cespite/Asset		
SPECIFICHE STAMPO / MOLD SPECIFICATION							
MOLD SPECIFICATION	Costruttore/Toolmaker						
	Dimensioni/Dimensions BHP			Peso/Weight			
	Interasse candeletta/injection extraction			X		n°	
	Anello centraggio/Locating ring Ø			200		Corsa estrazione /Stroke extraction mm	
	Estrazione centrale/Extraction central ☐			Sicurezza su estrazione/Safety of extraction ☒			
	Iniezione/Injection:						
3 plastron/Third plate ☐			Ugello singolo aperto/Open single nozzle ☐		Camera calda con ugelli/Hot runner nozzles ☒		
Canale freddo/Cold runner ☐			Ugello singolo con otturatore/Shot off single nozzle				
Soffio aria parte mobile/Air blow moving part ☐			Soffio aria parte fissa/Air blow fixed part ☐		Movimenti idraulici/Hydraulic movements ☒		
MATERIALE / MATERIAL							
MATERIAL	Essiccamento materiale/Drying material ☐			C° 95		Deumidificazione/Dehumidification ☐	
	Peso stampato completa/Part moulding weight			gr 1686		Peso pezzo singolo/Single piece weight	
	Materiale/Material			8010040201 p0 140		Colori/Color nero	
STAMPAGGIO/MOULDING PROCESS							
MACHINE	Pressa/Injection machine model			bmb 800 p90		Tonnellaggio/Tonnage	
	Diametro cilindro/Screw diameter			Ø 110		Forza chiusura/Clamping force t	
	C° Cilindro pressa / Cylinder temperatures			Tolleranza /tolerance		± 20°C	
	Ugello/Nozzle			Zone 1 220 Zone 2 220 Zone 3 225 Zone 4 225 Zone 5 220			
HOT RUNNER							
HOT RUNNER	C° Camera calda / Hot runner			Tolleranza /tolerance		± 20°C	
	Zone 1 215 Zone 2 215 Zone 3 215 Zone 4 215 Zone 5 210 Zone 6 210 Zone 7 210 Zone 8 210 Zone 9 210						
	C° Condizionamento / Cooling			Parte fissa/Fixed half		Parte mobile/Moving half	
	frigo 16 °C Toll ± 12			frigo 16 °C Toll ± 12		Canti/Sliders	
COOLING							
COOLING	Parte fissa/Fixed half			Parte mobile/Moving half		Canti/Sliders	
	frigo 16 °C Toll ± 12			frigo 16 °C Toll ± 12		Aste/Lift	
	Iniettori/Nozzle			Toll ±		Toll ±	
	Altro/Other			Toll ±		Toll ±	
Settaggi iniezione / Injection set							
INJECTION	Pressione impostata/set pressure			Bar 140		x 10	
	Pressione assorbita/pressure input			Bar 87		Toll ± 10%	
	Pressione mantenimento/Holding pressure			Bar 45		Toll ± 10%	
	Contropressione/Back pressure			Bar 2			
	Risucchio/Retreat dimension			mm 9		cm3	
	Quota passaggio/Share step 2° press.			mm 18,5		cm3	
	Quota dosatura/Course dosage			mm 200		cm3	
	Modo passaggio 2° press/ mode switch over 2° press			Time ☐ bar ☐ quot ☒			
Velocità iniezione/speed injection			cc/sec		v/min		
Tempo mantenimento/Holding time			Sec 9		Toll ± 10%		
Tempo iniezione/injection time			Sec 5,42		Toll ± 10%		
Tempo raffreddamento/Cooling time			Sec 36				
Mat. rim. in fase di 2° press/Mass cushion real			mm 13		cm3		
Tempo dosaggio/Time dosage			Sec 17,66		Toll ± 10%		
Tempo ciclo/Time total cycle							
Sec 66,36			Pezzi ora/Pcs/hr		Aut ☒ S/Aut ☐ Robot ☒		
NOTE:							
Per materiali FC è stata verificata la compatibilità delle temperature impostate con quanto richiesto dalla scheda materiale For FC material the compatibility of set temperatures have been checked with material specification sheet							
Responsible pressa/responsible injection machine VENERUZZO STEFANO Responsible De'Longhi/responsible De'Longhi VENERUZZO STEFANO							

ESEMPI: deformazioni post-stampaggio - TELAIIO



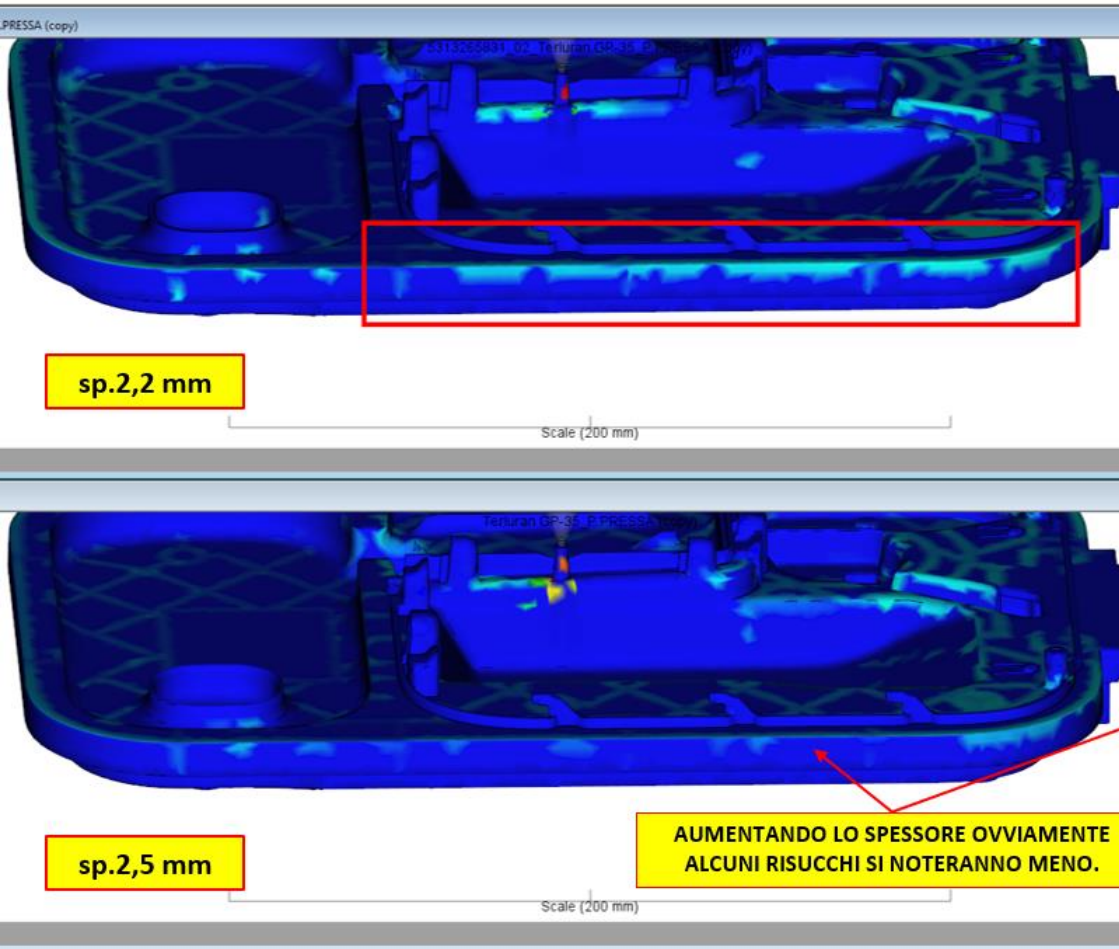
ESEMPLI: deformazioni post-stampaggio - BASAMENTO

DeLonghi		VALIDATION SHEET PROCESS INJECTION PARAMETERS		Date	27/11/2018	
Produzione/Production ☐		Campionatura/Sampling ☒		N°	1	
RdO Pass N°						
PRODUCT	Denominazione/Name				BASAMENTO EN650	
	Stampatore/Stamper				DL2 stampaggio	
	Codice/Code				5513234861	
	Famiglia/Family				Nespresso EN650	
STAMPAGGIO/MOULDING PROCESS		Immagine				
MACHINE	Pressa/Injection machine model		P85/8		Tonnellaggio/Tonnage	t 350
	Diametro cilindro/Screw diameter		Ø 70		Forza chiusura/Clamping force	t 350
	C° Cilindro pressa / Cylinder temperatures		Tolleranza /tolerance ± 20°C			
	Ugello/Nozzle		35			
HOT RUNNER		Tolleranza /tolerance ± 20°C				
Zone 1		235	Zone 2	235	Zone 3	235
Zone 4		235	Zone 5		Zone 6	
Zone 7			Zone 8		Zone 9	
Zone 10			Zone 11		Zone 12	
Zone 13			Zone 14		Zone 15	
Zone 16			Zone 17		Zone 18	
COOLING		C° Condizionamento / Cooling				
Parte fissa/Fixed half		Parte mobile/Moving half		Carri/ Sliders		Aste/ Lift
Toll ±		Toll ±		Toll ±		Toll ±
50		40		16		Toll ±
Settaggi iniezione / Injection set		Modo passaggio 2° press/ mode switch over 2° press				Time ☐ bar ☐ quot ☒
Pressione impostata/set pressure		Bar 1116		Velocità iniezione/speed Injection		cc/sec 280 vimms 73
Pressione assorbita/pressure input		Bar 925 Toll ± 10%		Tempo mantenimento/Holding time		Sec 18 Toll ± 10%
Pressione mantenimento/Holding pressure		Bar 720 Toll ± 10%		Tempo iniezione/Injection time		Sec 2,7 Toll ± 10%
Contropressione/Back pressure		Bar 150		Tempo raffreddamento/Cooling time		Sec 12
Riscucchio/Retreat dimension		mm 2 cm3 7,7		Mat. rim. in fase di 2° press/Mass cushion real		mm 27,6 cm3 106
Quota passaggio/Share step 2° press.		mm 50 cm3 192		Tempo dosaggio/Time dosage		Sec 8 Toll ± 10%
Quota dosatura/Course dosage		mm 110 cm3 423				
Tempo ciclo/Time total cycle		Sec 51,8		Aut ☐ S/Aut ☒ Robot ☐		

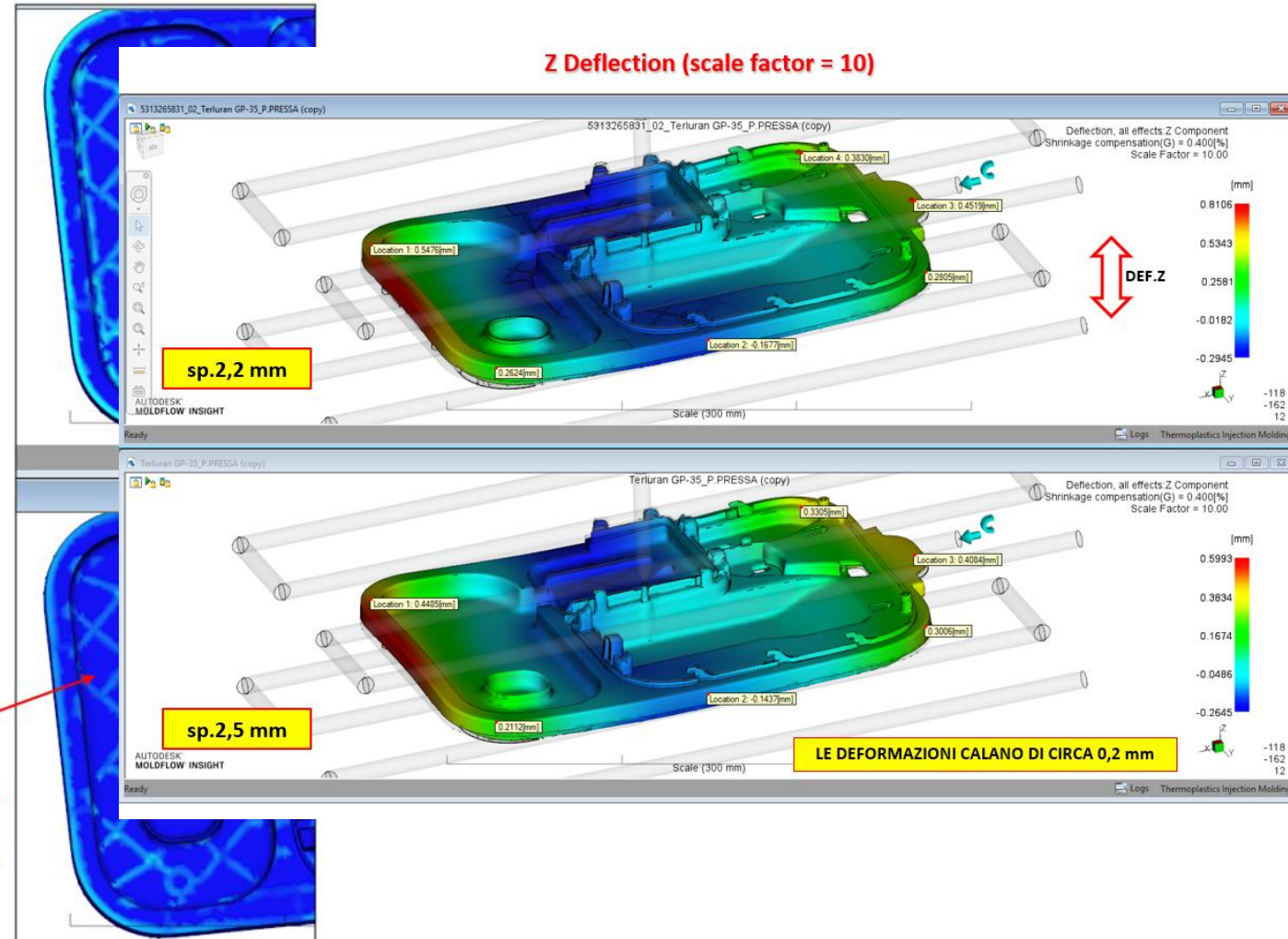


ESEMPI: deformazioni post-stampaggio - BASAMENTO

Sink marks



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