

# Case study: Using parameter optimization

# Setting up

Optimization module ✕

Initial parameters

Initial parameters

- 1 - Initial casting temperature
- 2 - Initial mould temperature
- 3 - Thickness
- 4 - Heat conduction
- 5 - Temperature of media
- 6 - "Feeding" pressure
- 7 - Piston velocity in phase 1
- 8 - Piston velocity in phase 2

N	Initial casting tempera...	Initial mould temperat...	"Feeding" pressure, Bar	Piston velocity in pha...	Piston velocity in pha...
1	690.000	220.000	200.000	0.300	3.000
2	690.000	230.000	250.000	0.400	3.500
3	690.000	240.000	300.000	0.500	4.000
4	690.000	250.000	350.000	0.600	4.500
5	690.000	260.000	400.000	0.700	5.000

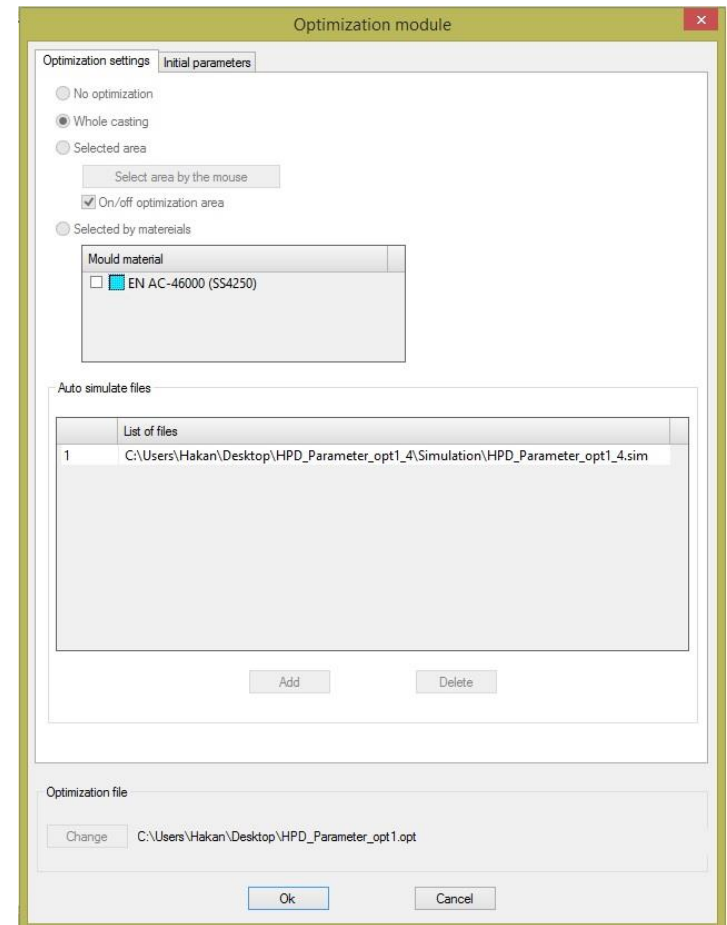
Add
Delete
Ok
Cancel

# Parameter optimization basics

- You can do design of experiments in the computer to find optimal process parameters
- You can test the limits for your process to see how robust your casting, gating and feeding design is.
- You can vary: Casting temperature; mold temperature, coating thickness, coating heat conduction, feeding pressure, Velocities in piston movement and for pressure casting trigger

# Parameter optimization basics

- Possible define one solid to evaluate
- Select area by mouse
- You can also add any design to this list of Autosimulate files that will then be evaluated



# Result

Optimization results

Optimization file  
 C:\Users\Hakan\Desktop\HPD\_Parameter\_opt1.opt

Optimization results

N	Project na...	Filling time, s	Volume of liquid phase, %	Casting temperature at filling...	Solidification time, s	Total shrinkage, %	Metal volume/poured volum...	Volume shrinkage, %
1	HPD_Par...	0.265	97.768	624.319	21.619	3.996	96.004	0.566
2	HPD_Par...	0.222	95.483	603.406	20.917	3.829	96.171	0.454
3	HPD_Par...	0.207	91.151	585.977	20.259	3.645	96.355	0.309
4	HPD_Par...	0.213	86.616	574.436	19.925	3.894	96.106	0.446

Initial parameters

N	Project na...	Initial ca...	Initial m...	Mould ...	Coatings	Temper...	"Feedin...	Piston v...	Pisto...	Pou...
1	HPD_Par...	690.000	220.000	18739....	0.000	50.000	200.000	0.300	3.000	1
2	HPD_Par...	660.000	230.000	18781....	0.000	230.000	300.000	0.400	2.500	1
3	HPD_Par...	630.000	240.000	18823....	0.000	240.000	400.000	0.500	2.000	1
4	HPD_Par...	610.000	250.000	18866....	0.000	250.000	100.000	0.600	1.500	1

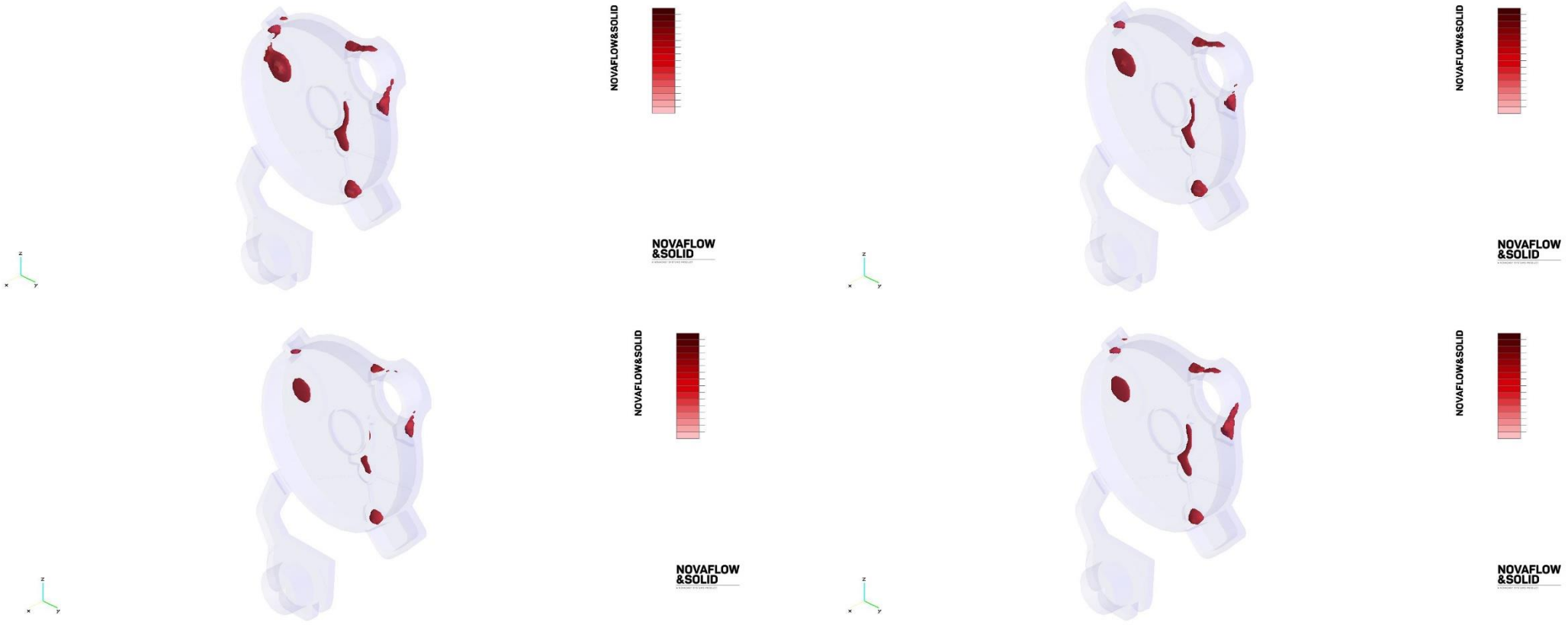
Condition

Optimization results	From	To
<input checked="" type="checkbox"/> 1 - Filling time, s	0.000	0.000
<input checked="" type="checkbox"/> 2 - Volume of liquid phase, %	0.000	0.000
<input checked="" type="checkbox"/> 3 - Casting temperature at filling, °C	600.000	700.000
<input checked="" type="checkbox"/> 4 - Solidification time, s	0.000	0.000
<input checked="" type="checkbox"/> 5 - Total shrinkage, %	0.000	3.900
<input checked="" type="checkbox"/> 6 - Metal volume/poured volume, %	96.100	100.000
<input checked="" type="checkbox"/> 7 - Volume shrinkage, %	0.000	0.400

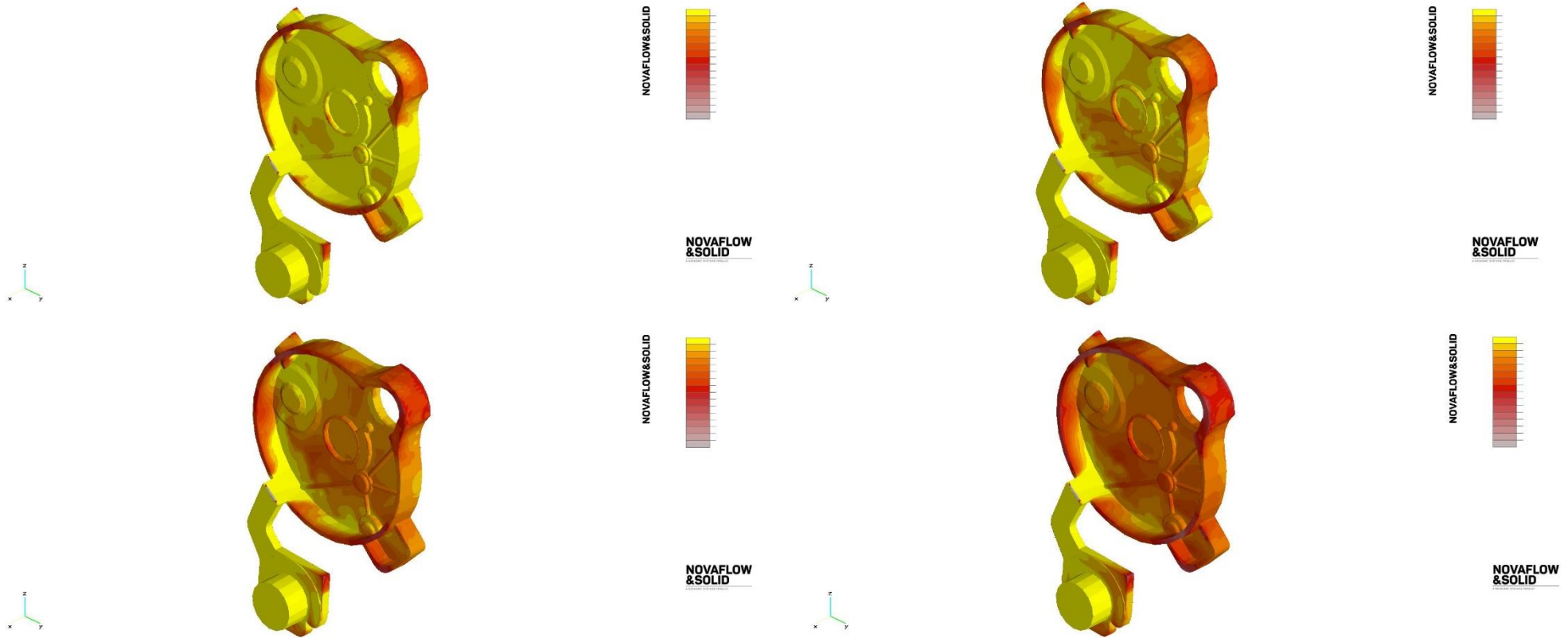
# Result - evaluation

- You have 7 different optimization results that is measured during the simulation.
- All those seven conditions will be possible to set limits for under conditions so that you can evaluate according to rules like minimum is the best or maximum is the best.

# Shrinkage result

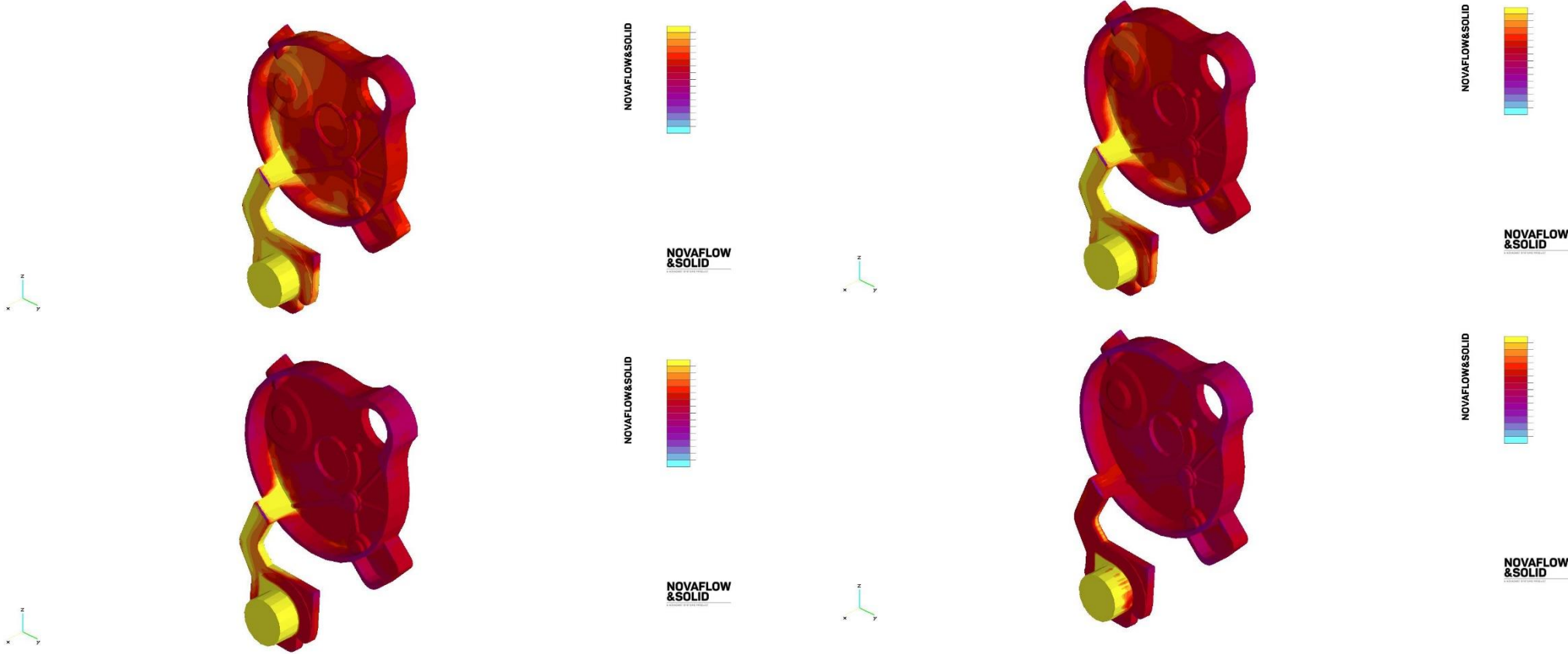


# Liquid phase filled result





# Temperature filled result



# Updated parameter optimization in version 6.3

- We have added V3 and V4 for HPD (It is definition of piston curve with four points)
- We have added CLFu, CLFd, CLFp. (In this way you can use this function to calibrate NFS)
- You can define if minimum or maximum is the best. For example shrinkage % = minimum is best
- We highlight minimum or maximum values by green color in the table.
- Visualization is done by different graphs in order to find correlation.
- Also, there is a standard variant for a DOE (Design of experiment) according to Taguchi methods called L9. L9 is a DOE based on 9 trials consisting of four parameters on three levels.

# Updated parameter optimization

Optimization module

Use Taguchi method (select 4 factors)

Initial parameters

Initial parameters	1	2	3
<input checked="" type="checkbox"/> 1 - Initial ca...	580.000	620.000	660.000
<input type="checkbox"/> 2 - Initial m...			
<input type="checkbox"/> 3 - Thickness			
<input type="checkbox"/> 4 - Heat co...			
<input type="checkbox"/> 5 - Tempera...			
<input checked="" type="checkbox"/> 6 - "Feeding..."	200.000	400.000	800.000
<input type="checkbox"/> 7 - CLF up			
<input type="checkbox"/> 8 - CLF down			
<input type="checkbox"/> 9 - CLFpres			
<input checked="" type="checkbox"/> 10 - Piston ...	0.200	0.300	0.400
<input checked="" type="checkbox"/> 11 - Piston ...	2.000	3.000	4.000

N	Initial casting temperature, °C	"Feeding" pressure, Bar	Piston velocity in phase, m/s 1	Piston velocity in phase, m/s 2
1	580.000	200.000	0.200	2.000
2	580.000	400.000	0.300	3.000
3	580.000	800.000	0.400	4.000
4	620.000	200.000	0.300	4.000
5	620.000	400.000	0.400	2.000
6	620.000	800.000	0.200	3.000
7	660.000	200.000	0.400	3.000
8	660.000	400.000	0.200	4.000
9	660.000	800.000	0.300	2.000

Add Delete Ok Cancel

# Updated parameter optimization

Optimization results ×

Optimization results | Graph | Taguchi L9

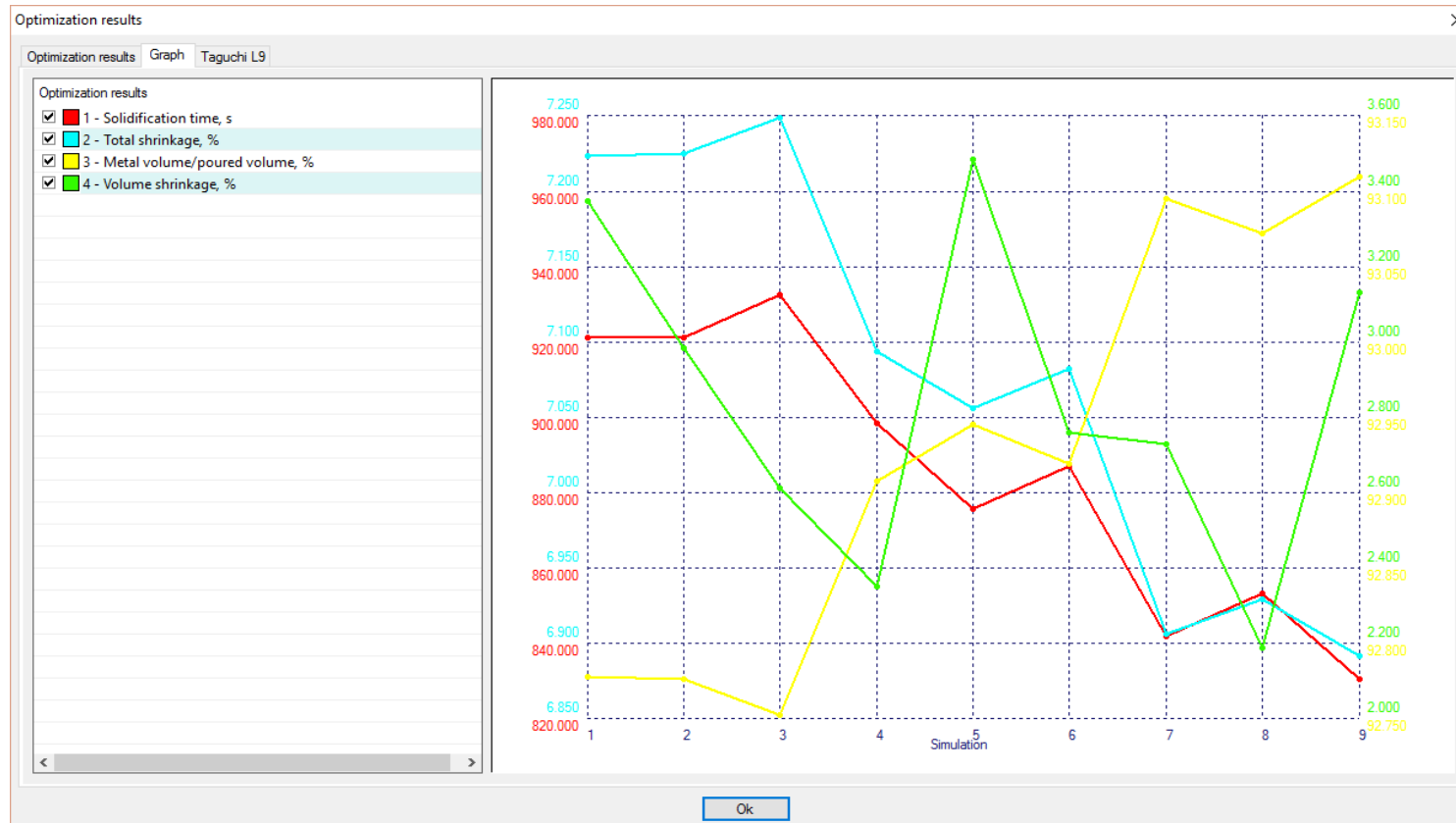
Optimization file  
 C:\Users\Hakan\Desktop\Opt\_solid\_test\OPT\_solid.opt

Condition				Optimization results					
Optimization results	From	To	Min/Max	N	Project na...	Solidification time, s	Total shrinkage, %	Metal volume/poured volume, %	Volume shrinkage, %
<input checked="" type="checkbox"/> 1 - Solidificati...	0.000	0.000	Min	1	OPT_solid	920.877	7.223	92.777	3.370
<input checked="" type="checkbox"/> 2 - Total shrin...	0.000	0.000	Min	2	OPT_soli...	920.877	7.225	92.775	2.981
<input checked="" type="checkbox"/> 3 - Metal vol...	0.000	0.000	Min	3	OPT_soli...	932.213	7.248	92.752	2.611
<input checked="" type="checkbox"/> 4 - Volume sh...	0.000	0.000	Min	4	OPT_soli...	898.150	7.093	92.907	2.348
				5	OPT_soli...	875.481	7.055	92.945	3.481
				6	OPT_soli...	886.816	7.082	92.918	2.757
				7	OPT_soli...	841.559	6.906	93.094	2.727
				8	OPT_soli...	852.895	6.929	93.071	2.185
				9	OPT_soli...	830.223	6.891	93.109	3.129

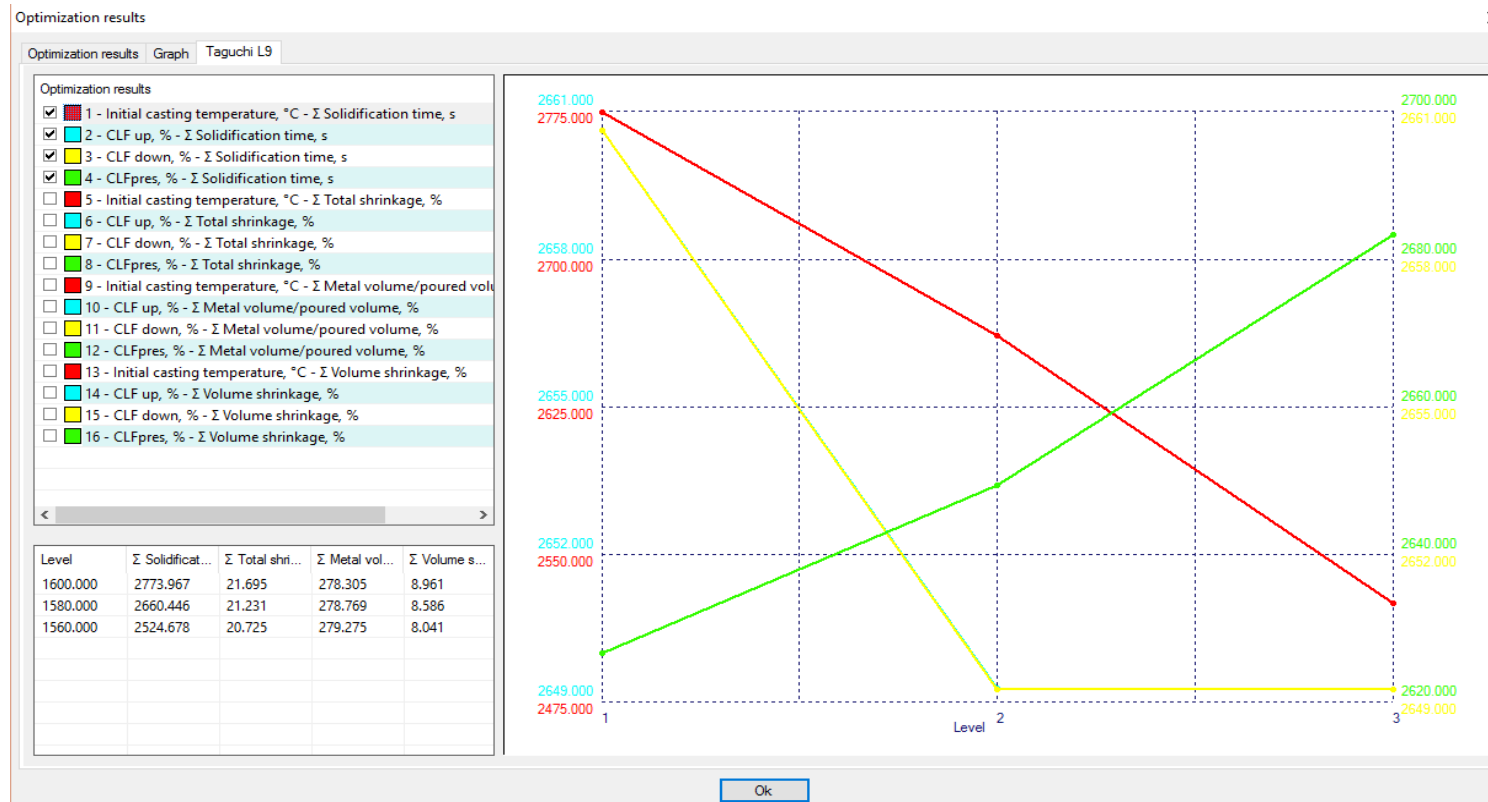
  

Initial parameters							
N	Project na...	Initial casting temperature, °C	Mould material properties	CLF up, %	CLF down, %	CLFpres, %	Pou
1	OPT_solid	1600.000	0.076	70.000	45.000	36.000	0
2	OPT_soli...	1600.000	0.076	80.000	60.000	46.000	0
3	OPT_soli...	1600.000	0.076	90.000	75.000	56.000	0
4	OPT_soli...	1580.000	0.076	70.000	60.000	56.000	0
5	OPT_soli...	1580.000	0.076	80.000	75.000	36.000	0
6	OPT_soli...	1580.000	0.076	90.000	45.000	46.000	0
7	OPT_soli...	1560.000	0.076	70.000	75.000	46.000	0
8	OPT_soli...	1560.000	0.076	80.000	45.000	56.000	0
9	OPT_soli...	1560.000	0.076	90.000	60.000	36.000	0

# Updated parameter optimization



# Updated parameter optimization



**So, let's reduce the  
environmental footprint.**

