

DEMİSAŞ



Dramatic Cost Saving with Magma Frontier Module at TRW Brake Body

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***Demisaş Döküm ve Emaye Mamülleri Sanayi A.Ş**
****Magma Turkey**

Agenda

1. DEMİSAŞ Profile
2. General DEMİSAŞ Simulation Applications
 - Solidification Simulations
 - for increasing yield
 - for shrinkage determination
 - for new projects
 - Filling Behaviour
 - for low air entrapment
3. Magma Frontier Simulation Example



Company Profile

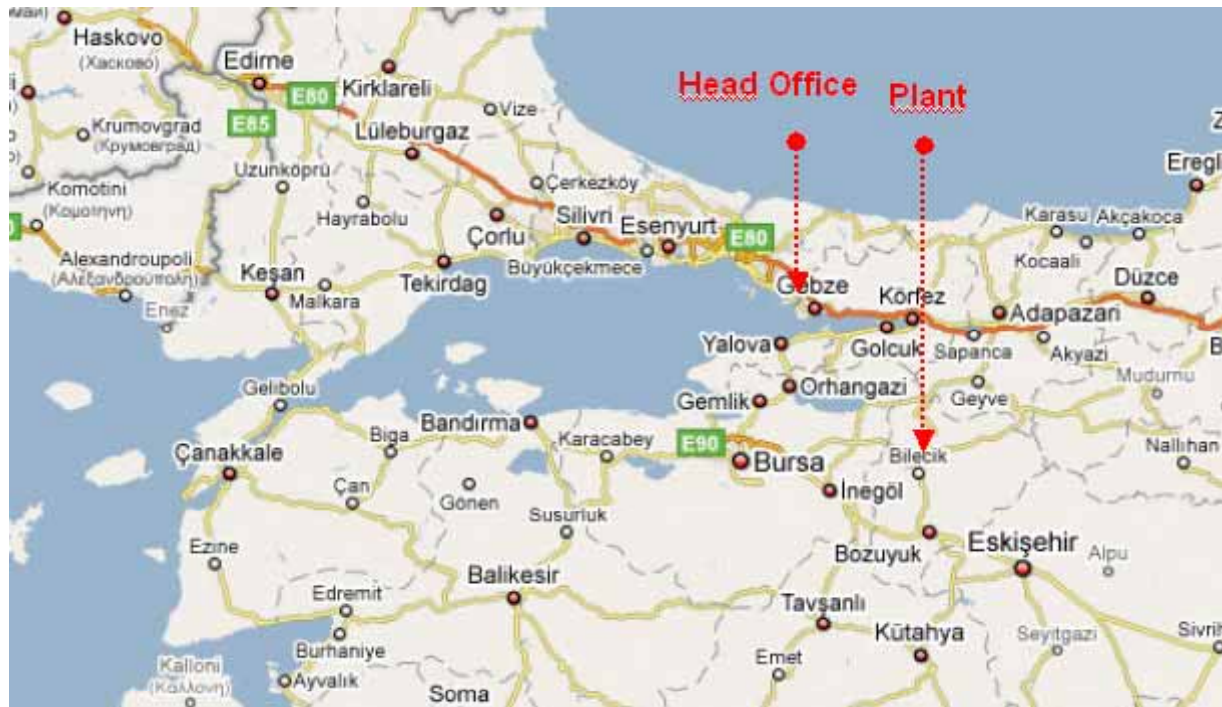
** Founded in 1974, The majority shareholder with 44 % of the shares is SARKUYSAN, a major copper products company.*

LOCATION : Head office - Istanbul/Kocaeli, Plant - Bilecik

PERSONNAL : In office 37 White Collar- In Plant 63 White Collar, 447 Blue Collar..... Total 547

PRODUCTION : Gray and Nodular Iron..0,1 to 25 kgs.High Quantity. Repetitive Castings.

Around 60.000 tons/year. Mostly export for automotive(brake systems), compressors.



Company Profile

Refrigerating Compressor Castings

Hermetic Compressor Castings; Crankcases, Crankshafts

*Scroll Compressor Castings; Stator Housings, Main Bearing Housings,
Cylinder Heads, Cage Bearings*

Automotive Castings

Brake Safety Castings : Calipers, Brackets, Bridges

Brake Discs, Brake Drums, Flywheels, Secondary Flywheels, Pressure Plates

Exhaust Manifolds

Brackets, Bearing Caps, Pulleys etc.



Company Profile

EXPORTS IN EUROPE : Italy, France, Germany, Spain, United Kingdom, Slovenia, Slovakia, Serbia, Poland, Belgium, Czech Republic



Company Profile

MELTING AND POURING :

- 1 Hot Blast Cupola Furnace – 18 to 24 t/h,**
- 4 Electric Induction Melting - 6 t/h**
- 2 Holding furnaces – 60 tons,**
- 3 Autopour furnaces with laserpour control**

MOULDING :

- 1 Disamatic 2013 Mk 5B (Mould size: 650*535*200/330 mm).**
- 1 Disamatic 230 B (Mould size: 650*535*200/330 mm).**
- 1 Disamatic 2070 Mk 2A (Mould size: 950*700*300/560 mm).**

COREMAKING :

**Cold-Box method is used for coremaking
and all cores are coated and dried.**



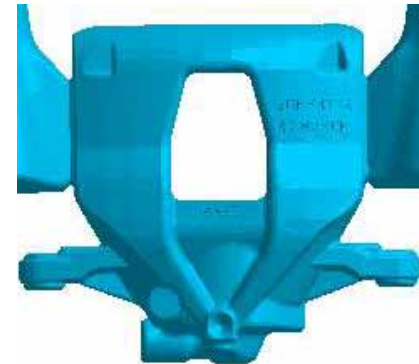
Company Profile

QUALITY CONTROL EQUIPMENT :

*Before and during the production;
Spectrometers, Thermal Analysis,
3D Measurement,
Hardness Measurement, Tensile Measurement
X-Ray Inspection,
Magnetic Particle Inspection for crack detection
Sonic and Eddy Current Inspection*

DESIGN & PATTERNMAKING :

*Unigraphics & Catia CAD-CAM design,
Solidification and Matal Flow Simulations,
CNC Machining for cast iron patterns*



Company Profile

REFERENCES



General Foundry Simulation Applications

- Solidification Simulations

- for increasing yield
- for shrinkage determination and solving problems
- for new projects

- Filling Behaviour

- for low air entrapment



General Foundry Simulation Applications

-Solidification Simulations

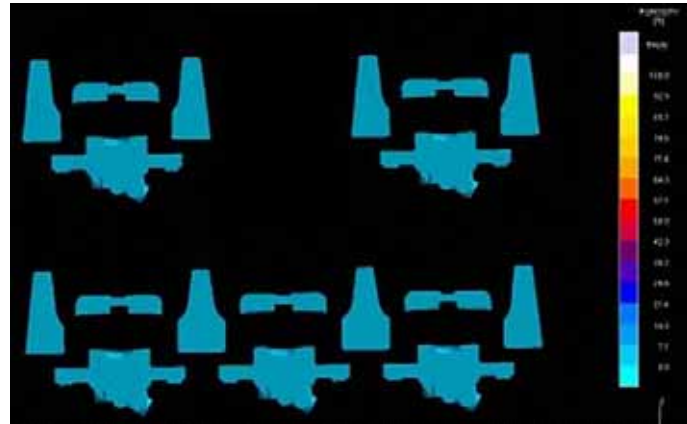
For increasing yield;

Feeder and gating optimization simulation studies are performed. By this, plate yield is increased.

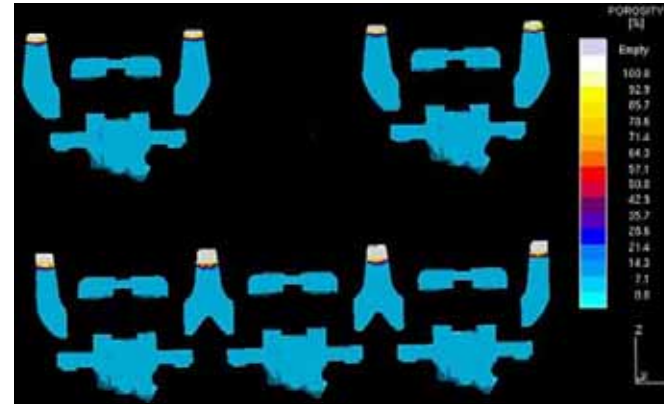
First off all current pattern simulations are performed and the current situation is determined. By cutting feeders or changing gating system, the total weight is decreased. If suitable results are found by simulation programme, these modifications are applied to the feeders or gating system. After these modifications trial productions are performed. If the results are good, these feeders or gating systems are used in serial production.



General Foundry Simulation Applications



Before feeder change
No Shrinkage Risk



After feeder change
No Shrinkage Risk

Simulation of the part with the current feeders are performed and there is no shrinkage risk. Feeders were changed and also there is no shrinkage risk in the modified one.

* This modification is applied to the pattern and the result is good.



General Foundry Simulation Applications

For Shrinkage Determination and Solving Problems;

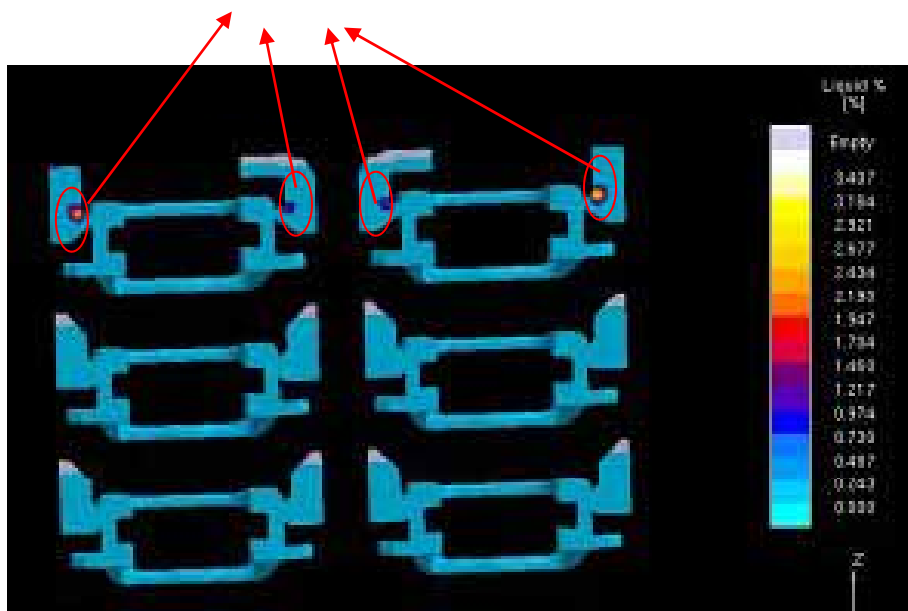
In the serial production if there is a shrinkage problem with the part, simulation studies were performed with changing the design of the feeder, feeder neck or gating system.

The current pattern simulations are performed and the current situation is determined. Simulation studies are performed to solve shrinkage problem with changing feeder, neck or gating system. After these modifications trial productions are done. If the results are good, these feeders or gating systems are used in serial production.



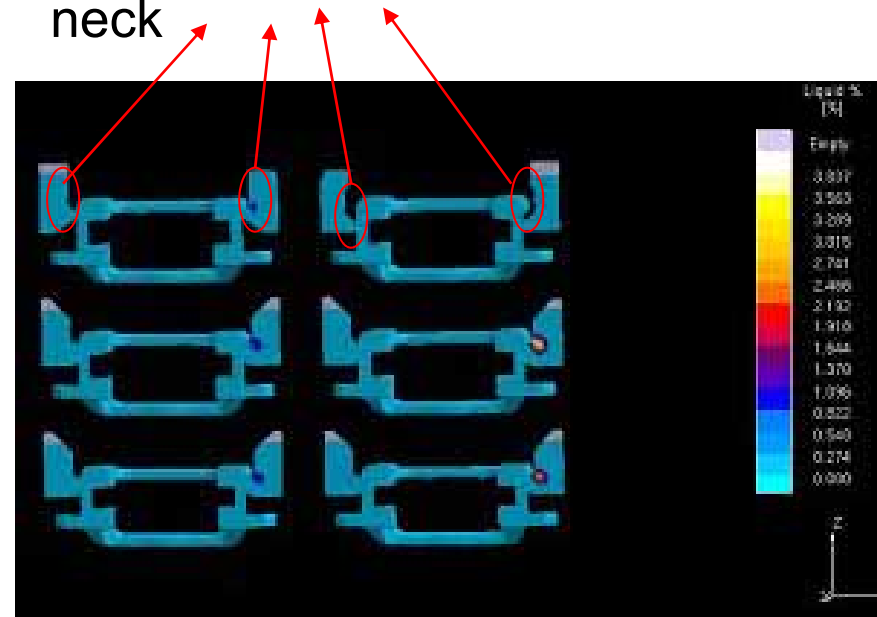
General Foundry Simulation Applications

There is shrinkage risk near to the neck



Before Change

Shrinkage Risk is decreased by changing feeder and the feeder neck



After Change

* This modification is applied to the pattern and the result is good.



General Foundry Simulation Applications

For New Projects;

At new projects, before the serial production simulation studies are performed. The results of the simulations are discussed with the customer and if there is a problem, design change is requested from the customer.



General Foundry Simulation Applications



Before Modification



After Modification

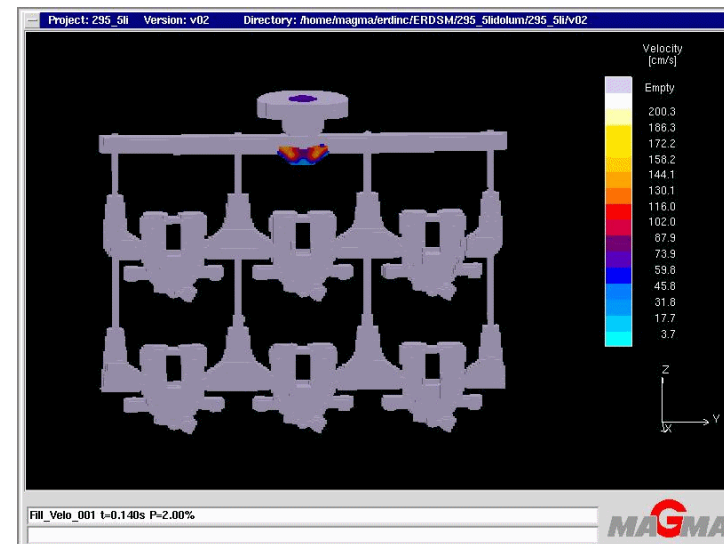
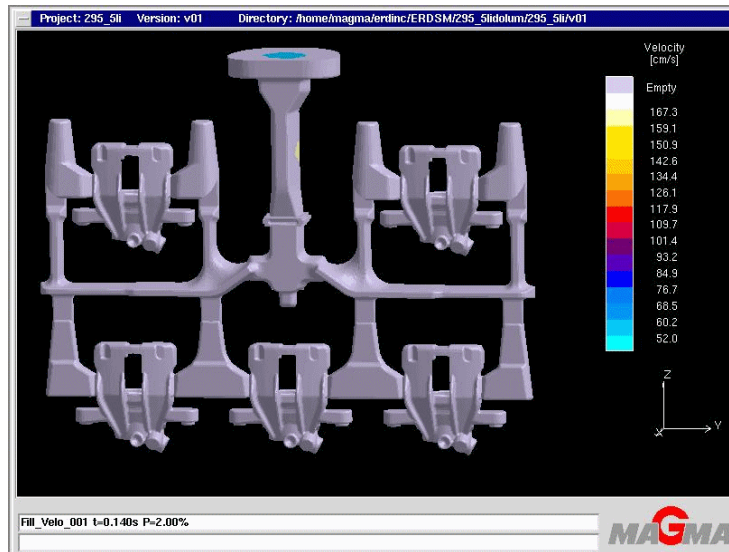
Design Change is applied and shrinkage risk is decreased. This modification is requested from the customer and the customer accepted this request. So this modification was applied



General Foundry Simulation Applications

- Filling Behaviour

Filling simulations are performed for decreasing the scrap rate and new lay out studies.



Magma Frontier Simulation Example

In this project, we changed the type and the dimensions of the feeder by using Magma Frontier.

TRW Brake Body which has material as GJS-500-7. One of the most produced parts in the foundry

Magma Frontier has helped to reduce the shrinkage scrap ratio from 12.09% to 1.45% in 3,5 months period. Objectives were optimizing volume of feeder and minimizing the average porosity. Scrap ratio was decreased but plate yield is also decreased.

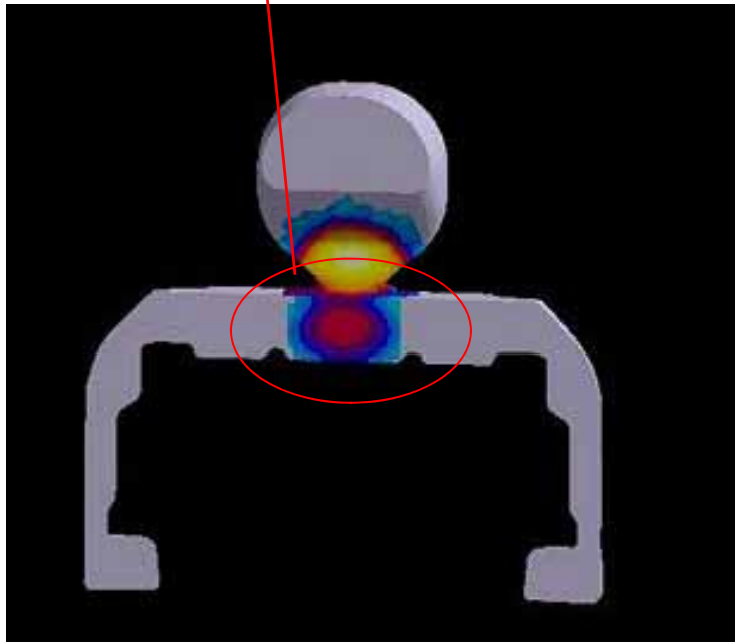
Around 500 simulations were performed

Studies are still going on for increasing plate yield. In 3,5 months period its profit is around 26.000 Euros.

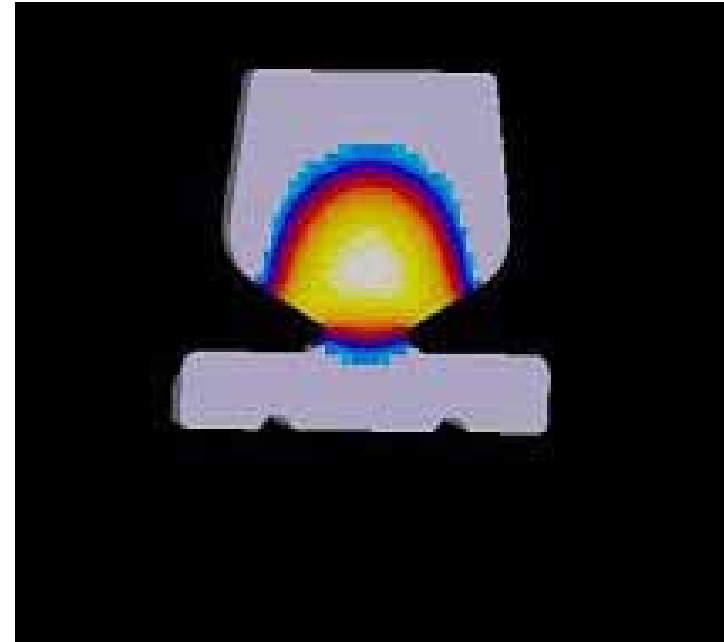


Magma Frontier Simulation Example

Shrinkage risk area



Before Change



After Change



Magma Frontier Simulation Example



Before Change



After Change



Magma Frontier Simulation Example



Before Change
Feeder not working



After Change
Feeder working



Magma Frontier Simulation Example



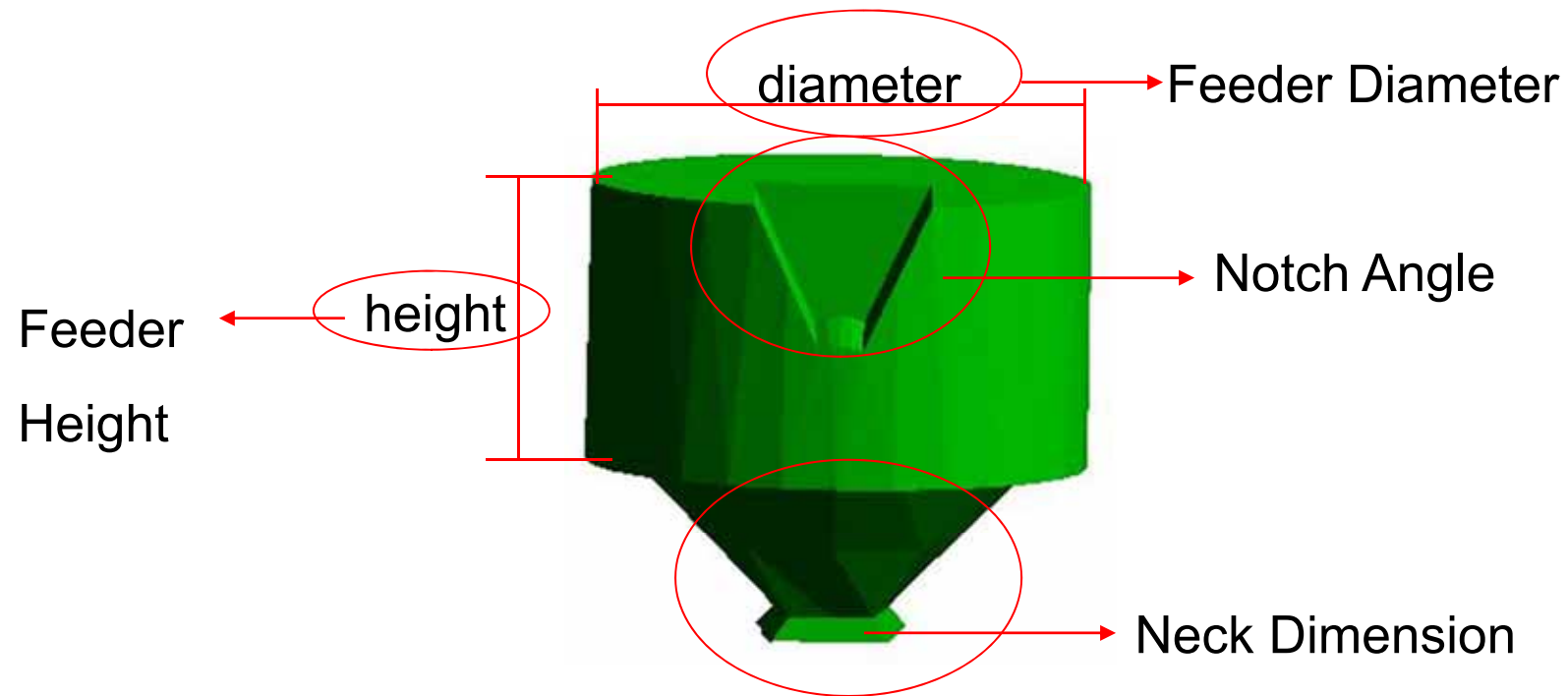
Before Change
Shrinkage



After Change
No Shrinkage



Magma Frontier Simulation Example



Magma Frontier Simulation Example

```

set dvar centik 25 "centik" 1
set dvar usttenkesae 0 "usttenkesae" 1
set dvar x 0 "captankesae" 1
set dvar z 0 "capustkesae" 1

begin macro

# feederneck

set mat 11 1

BEGIN LINE
SET INPV 0
  SET POINT -15,6188 140,083 0
  SET POINT 15,124 140,083 0
  SET POINT 10,9091 115,041 0
  SET POINT -12,1488 115,041 0
CLOSE LINE

BEGIN LINE
SET INPV 0
  SET POINT -10,9091 140,083 0
  SET POINT 10,4132 139,835 0
  SET POINT 7,18008 120 0
  SET POINT -8,18182 120 0
CLOSE LINE
SET INPV 2
  SET POINT 5,45455 0 15,6188
  SET POINT 5,95041 0 20,8264
CLOSE SOLID

# feeder

set mat 12 1

# conical part of feeder

BEGIN LINE
SET INPV 0
  SET POINT -11,157 140,083 0
  SET POINT -0,743802 140,083 0
  SET POINT 10,4132 140,083 0
  SET POINT 8,67769 128,926 0
  SET POINT 7,43802 120 0

```

```

SET POINT -29,2562 153,223 0
SET POINT -0,743802 167,851 0
SET POINT 29,7521 153,471 0
SET POINT 36,4463 128,43 0
SET POINT 25,0413 103,636 0
SET POINT -0,495868 93,9669 0
SET POINT -25,2893 103,636 0
SET POINT -37,438 128,43 0
CLOSE LINE
SET INPV 2
  SET POINT 0,981736 0 20,8264
  SET POINT 3,71901 0 48,843
CLOSE SOLID

# cylinder part of feeder

set cyl 0 132 48 0 132 100 36,5 33

# notch

set mat 3 1

set con
BEGIN LINE
SET INPV 1
  SET POINT 0 125,95 110
  SET POINT 0 125,95 75,8678
  SET POINT 0 91,9835 66,4463
  SET POINT 0 98,1818 110
CLOSE LINE

make rev 0 0 65 0 1 65 $centik
make rev 0 0 65 0 1 65 -$centik

end macro
# CMD Logging started: Mon Jun 28 10:23:39 2010 by magna
#
SET INPV 1
ROT SEL -90
MOVE REL 0 0 5
MOVE REL 0 0 5
MOVE REL 0 0 5
MOVE REL 0 0 -5
MOVE REL 0 0 -5
END CMDLOG
#
# CMD Logging started: Mon Jun 28 10:32:42 2010 by magna
#

```



Written commands in Magma Frontier to create parametric feeder

Magma Frontier Simulation Example

```

# BEGIN BOX
#
# BEGIN BOX
#
SET INPV 1
SET POINT      0      -99*#usttenkesme      90.6336
SET POINT      0      -110.239      177.089

SET INPV 2
SET POINT     -54.5894      0      91.7874
SET POINT      61.3527      0      102.415
CLOSE SOLID

#
# CMD Logging started: Mon Jun 28 10:42:19 2010 by magma
# macro DEL SEL
#
# BEGIN LINE
#
# BEGIN LINE
#
SET INPV 0
SET POINT      40.0918      -36.0147      0
CANCEL

# BEGIN LINE
#
# BEGIN LINE
#
SET INPV 0
SET POINT      38.0533      -35.3352      0
SET POINT      29.899      -120.275      0
SET POINT      69.3113      -116.878      0
SET POINT      71.3499      -31.9376      0
CLOSE LINE
SET POINT      130.468      -41.4509      0
SET POINT      130.468      -41.4509      0
SET POINT      130.468      -41.4509      0
CLOSE LINE
CANCEL

# BEGIN LINE
#
# BEGIN LINE
#
SET INPV 0
SET POINT      37-#x      -41.4509      0
SET POINT      31-#x      -107.365      0
SET POINT      85.6198      -69.9908      0
CLOSE LINE
SET INPV 2
SET POINT      36.2319      0      113.527

```

File: /home/magma/erdinc/ER259/705_yemibesleyici/705_besleyicikese Line: 90

```

SET POINT     -104.775      97.7043      0
#
# BEGIN BOX
#
set wat 3 1
# BEGIN BOX
#
SET INPV 2
SET POINT     -43.2367      0      173.188
SET POINT      45.1691      0      190.338

SET INPV 1
SET POINT      0      -101.561      86.4555

SET INPV 0
SET POINT     -61.3866      -61.0652      0
CANCEL
SET POINT     -55.6015      -39.5317      0

# BEGIN BOX
#
#
set wat 3 1
# BEGIN LINE
#
SET INPV 2
SET POINT     -37.9227      0      173.43
SET POINT      34.058      0      173.43
CANCEL

# BEGIN BOX
#
#
set wat 3 1
# BEGIN BOX
#
SET INPV 2
SET POINT     -40.5797      0      173-#z
SET POINT      42.2705      0      179.952

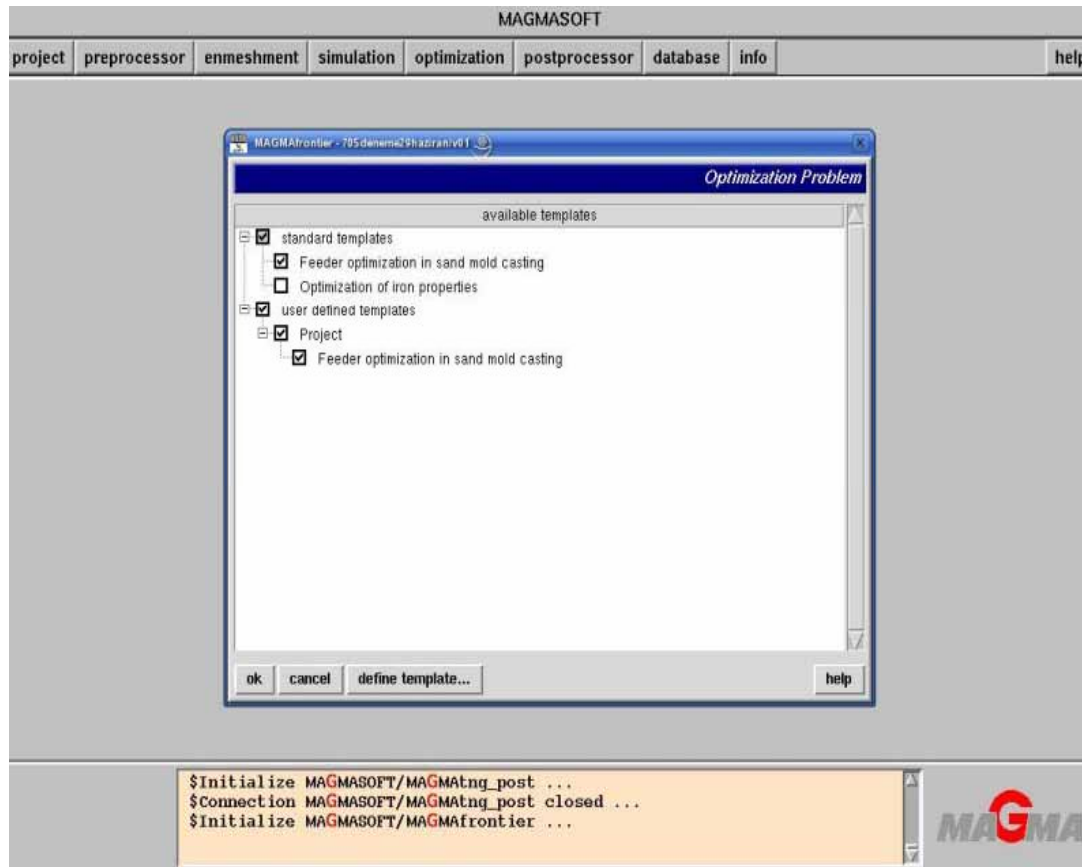
SET INPV 1
SET POINT      0      -36.6391      77.135
SET POINT      0      -110.882      115.06
CLOSE SOLID
end macro

```

Written commands in Magma Frontier to create parametric feeder



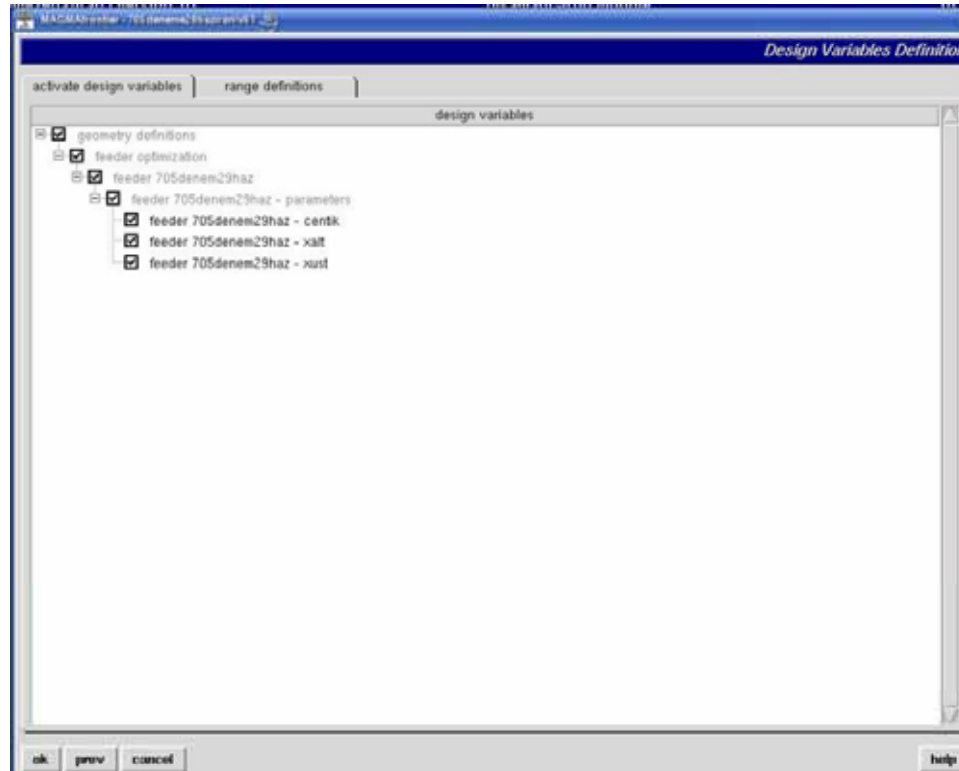
Magma Frontier Simulation Example



User defined templates
feeder optimization



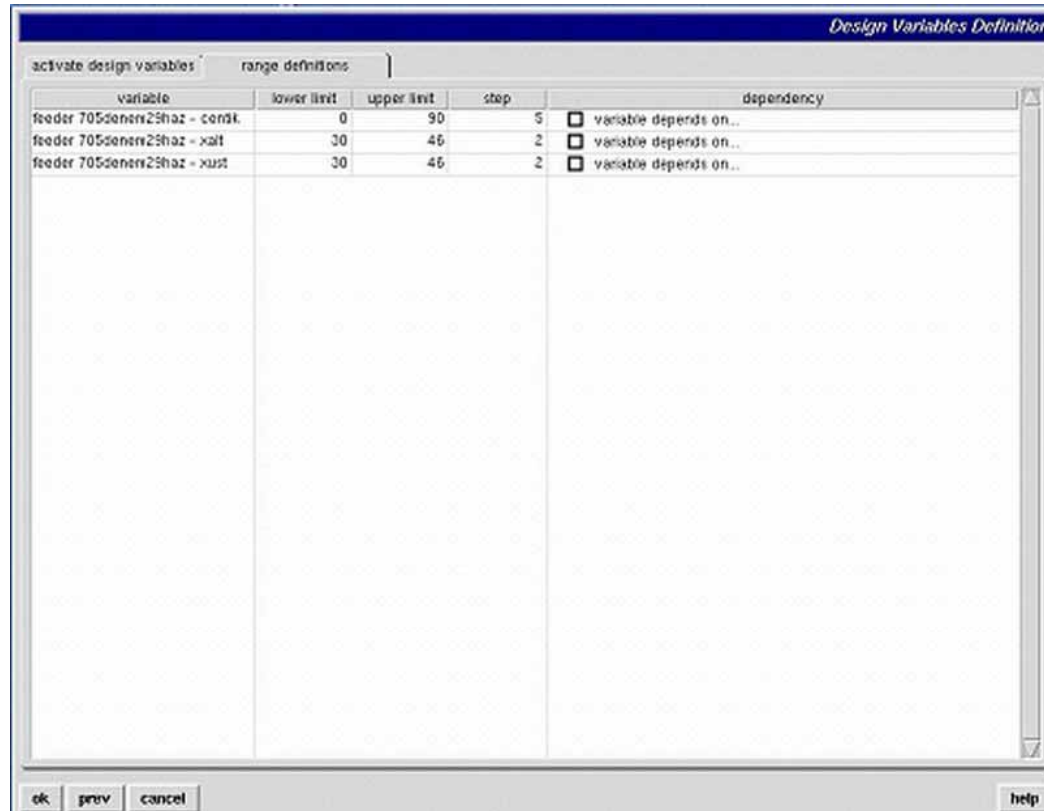
Magma Frontier Simulation Example



Active design variables



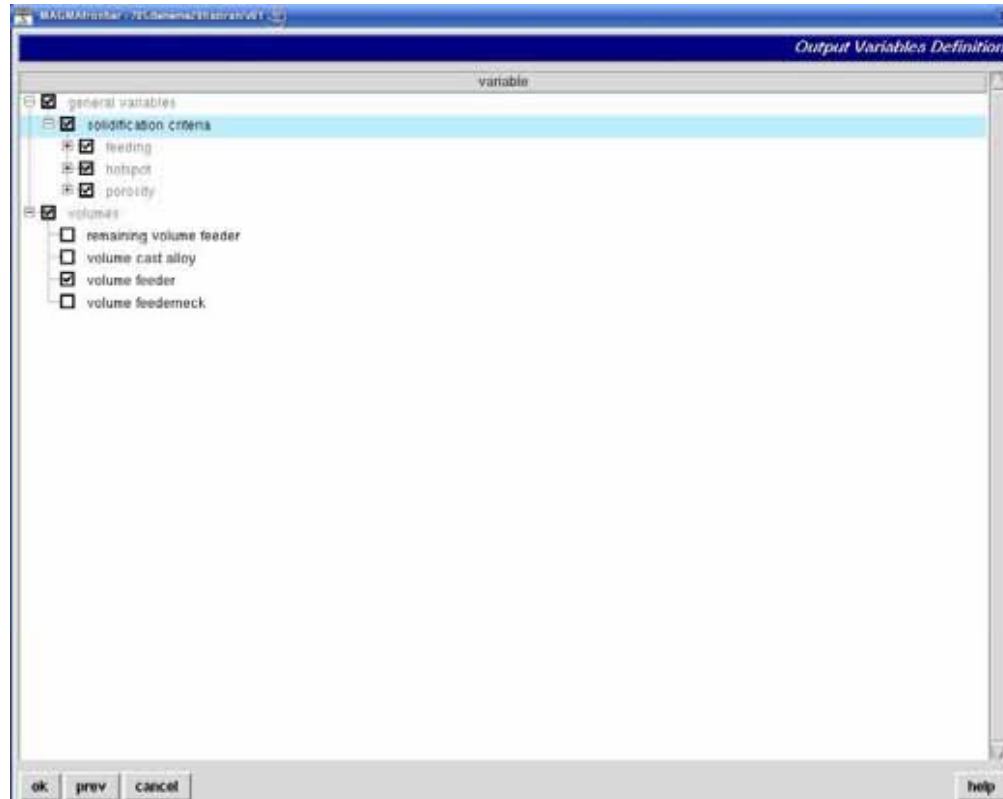
Magma Frontier Simulation Example



Range Definitions



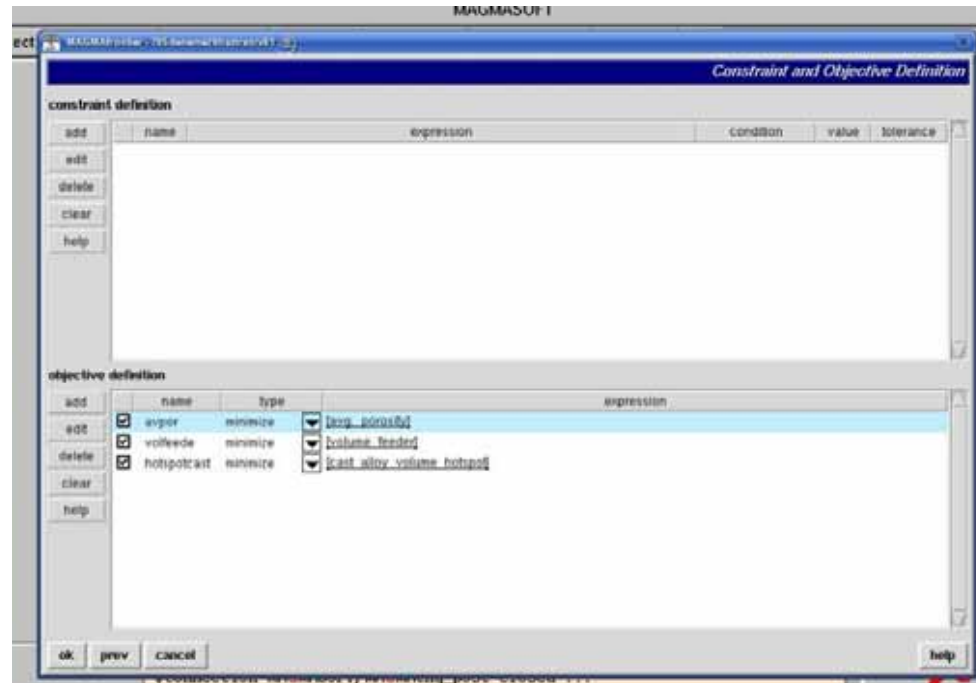
Magma Frontier Simulation Example



General Variables



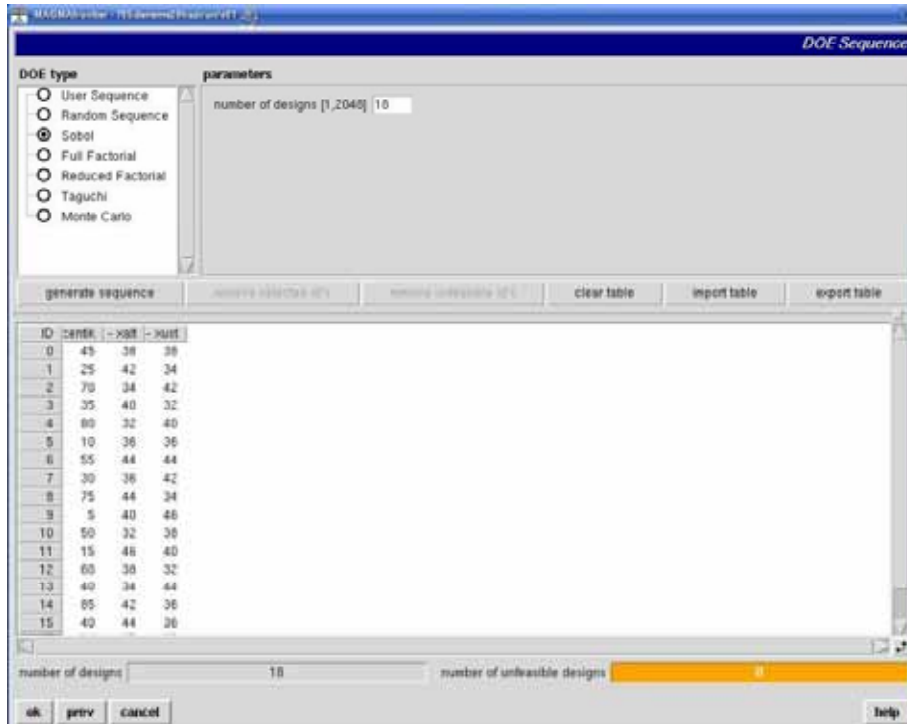
Magma Frontier Simulation Example



Objective Definitions
Minimize Average Porosity
Minimize Volume of Feeder



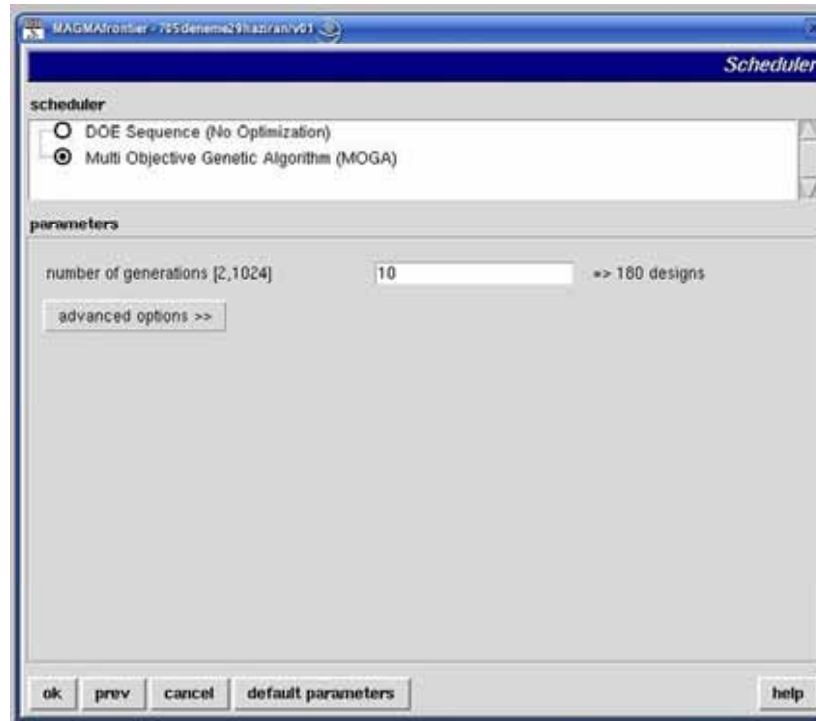
Magma Frontier Simulation Example



Choosing DOE Type



Magma Frontier Simulation Example



Number of Generations;
Simulation Numbers



Magma Frontier Simulation Example

marked	ID	centik	-xalt	-xust	feeding	min. feeding	l volume feeding	al volume hotspot	y volume hotspot	lr volume hotspot	stspot	stity
<input type="checkbox"/>	0	45	38	38	100	66.752533	11741.715994	102659.071200	67753.044804	34906.026396	0	.452
<input type="checkbox"/>	1	25	42	34	100	41.905540	11692.365549	112510.178669	64723.352426	47786.826243	0	.050
<input type="checkbox"/>	2	70	34	42	100	18.332916	11708.524519	105275.962799	66339.619812	38936.342987	0	.655
<input type="checkbox"/>	3	35	40	32	100	44.227543	11760.126019	109593.300866	67148.179848	42445.201018	0	.555
<input type="checkbox"/>	4	80	32	40	100	65.780861	11661.609212	109076.460687	68632.779992	40443.680695	0	.127
<input type="checkbox"/>	5	10	36	36	100	18.442978	11694.139286	108801.411068	70509.250874	38292.160194	0	.159
<input type="checkbox"/>	6	55	44	44	100	48.180290	11921.801942	123862.804929	66663.254321	57179.550608	0	.151
<input type="checkbox"/>	7	30	36	42	100	41.274666	11731.302157	104846.762272	66780.653822	38066.108450	0	.019
<input type="checkbox"/>	8	75	44	34	100	47.947338	11971.027870	108759.786911	62290.932030	46468.854881	0	.279
<input type="checkbox"/>	9	5	40	46	100	44.781048	11681.530569	123351.403297	66907.365136	56444.036160	0	.734
<input type="checkbox"/>	10	50	32	38	100	44.148354	11675.867985	98062.901041	66473.548725	31589.354315	0	.405
<input type="checkbox"/>	11	15	46	40	100	18.026764	11674.526870	69723.276920	67043.299966	2679.976954	0	.191
<input type="checkbox"/>	12	60	38	32	100	42.030087	11671.149814	97312.217852	61452.223190	35859.994662	0	.184
<input type="checkbox"/>	13	40	34	44	100	47.999126	11864.501497	105044.903685	66385.730063	38659.173622	0	.829
<input type="checkbox"/>	14	85	42	36	100	34.448204	11918.651012	107079.199894	63341.351343	43737.846550	0	.198
<input type="checkbox"/>	15	40	44	36	100	40.691978	11743.899803	106124.079034	60101.877475	46022.401558	0	.330
<input type="checkbox"/>	16	85	36	44	100	61.456299	11731.567862	111311.405548	67046.877789	44264.527759	0	.900
<input type="checkbox"/>	17	20	32	32	100	16.496590	11702.762824	98632.580971	65584.547304	33048.033668	0	.305
<input type="checkbox"/>	18	25	38	36	100	44.204670	11722.451097	105341.078745	64275.373938	41065.704807	0	.217
<input type="checkbox"/>	19	60	38	32	100	42.030087	11671.149814	97312.217852	61452.223190	35859.994662	0	.184
<input type="checkbox"/>	20	5	46	40	100	44.781048	11681.530569	122443.075437	66907.365136	55535.710301	0	.734
<input type="checkbox"/>	21	45	36	34	100	18.702339	11714.861835	98854.602291	68642.696520	30211.905771	0	.929
<input type="checkbox"/>	22	20	42	32	100	65.719551	11657.632549	114274.371620	66615.446975	47658.924648	0	.813
<input type="checkbox"/>	23	60	42	36	100	61.133755	11756.163616	109704.056537	63533.206323	46170.850214	0	.829
<input type="checkbox"/>	24	25	38	32	100	44.429157	11781.414721	99331.465047	59678.827373	39652.637674	0	.562
<input type="checkbox"/>	25	40	38	36	100	44.278553	11649.188662	99972.550007	61925.674226	38046.875780	0	.506
<input type="checkbox"/>	26	60	42	36	100	61.133755	11756.163616	109704.056537	63533.206323	46170.850214	0	.829
<input type="checkbox"/>	27	85	30	40	100	60.948032	11810.457935	105128.889731	64606.012809	40522.876921	0	.584
<input type="checkbox"/>	28	15	42	32	100	60.951897	11758.209436	66060.302575	65846.102286	214.200289	0	.800
<input type="checkbox"/>	29	65	34	44	100	40.247845	11798.871815	103120.146008	63193.387300	35926.758708	0	.456

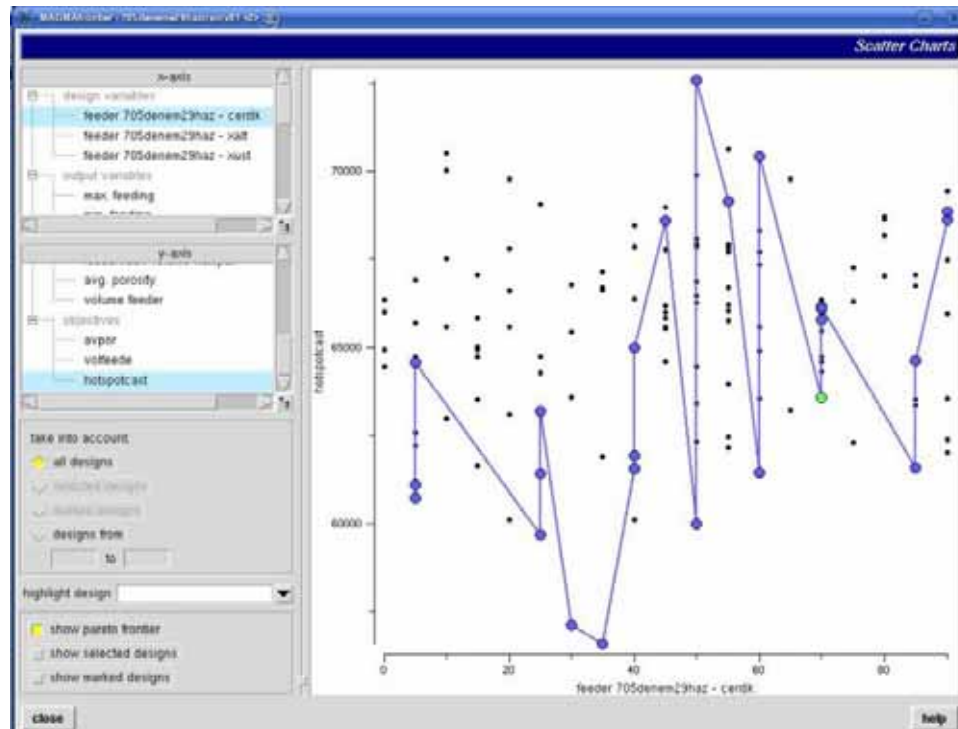
designs: 180 failed designs: 0 unfeasible designs: 0 marked designs: 0 ALL | SU | SF | OFF | AO

dismiss prev start... more generations... stop help

Starting Simulation



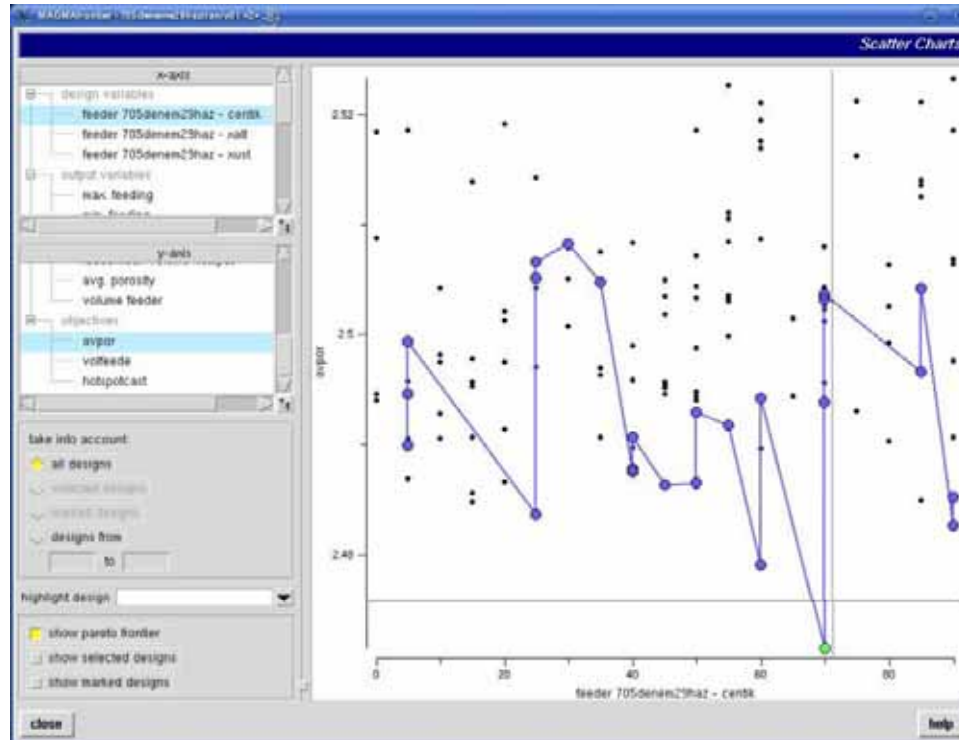
Magma Frontier Simulation Example



Pareto Results Example 1



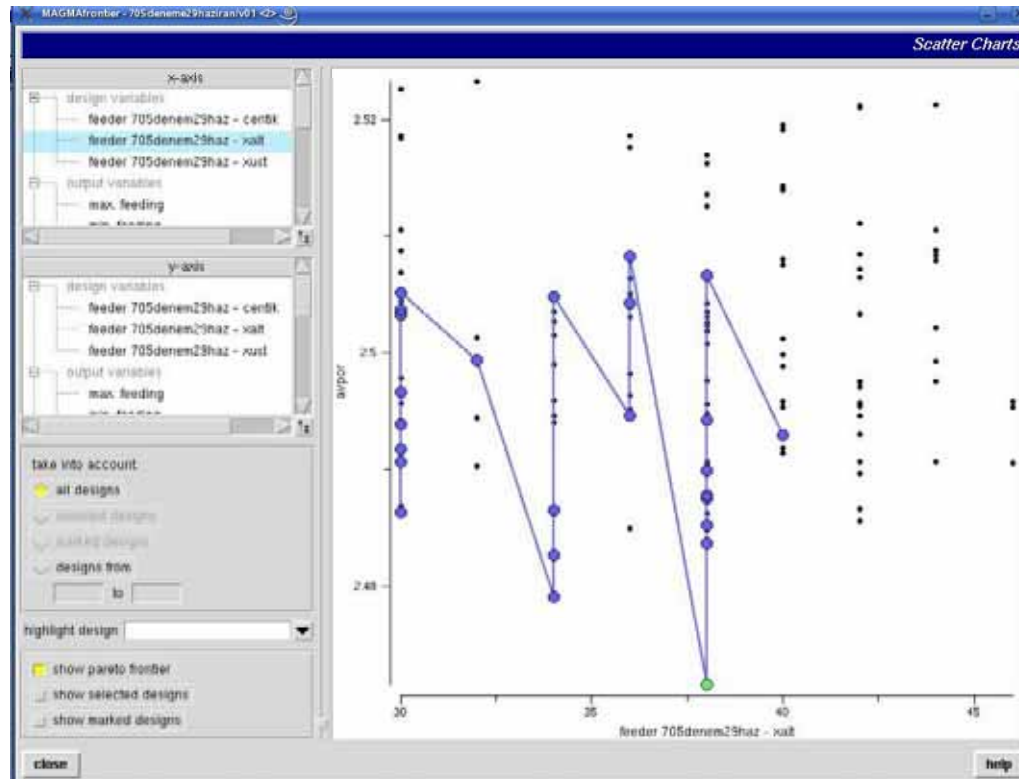
Magma Frontier Simulation Example



Pareto Results Example 2



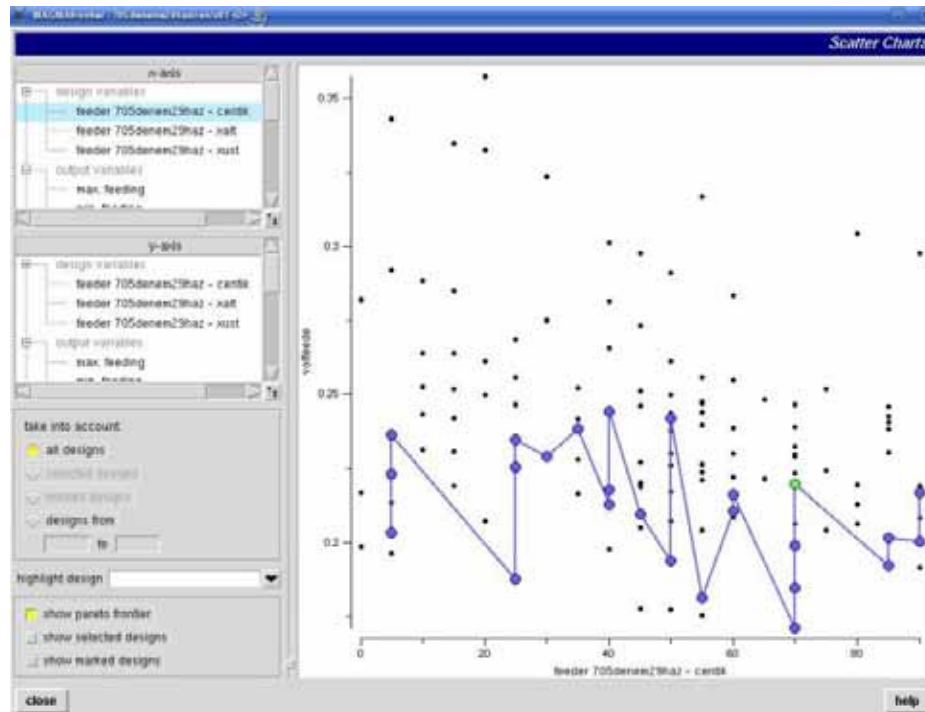
Magma Frontier Simulation Example



Pareto Results Example 3



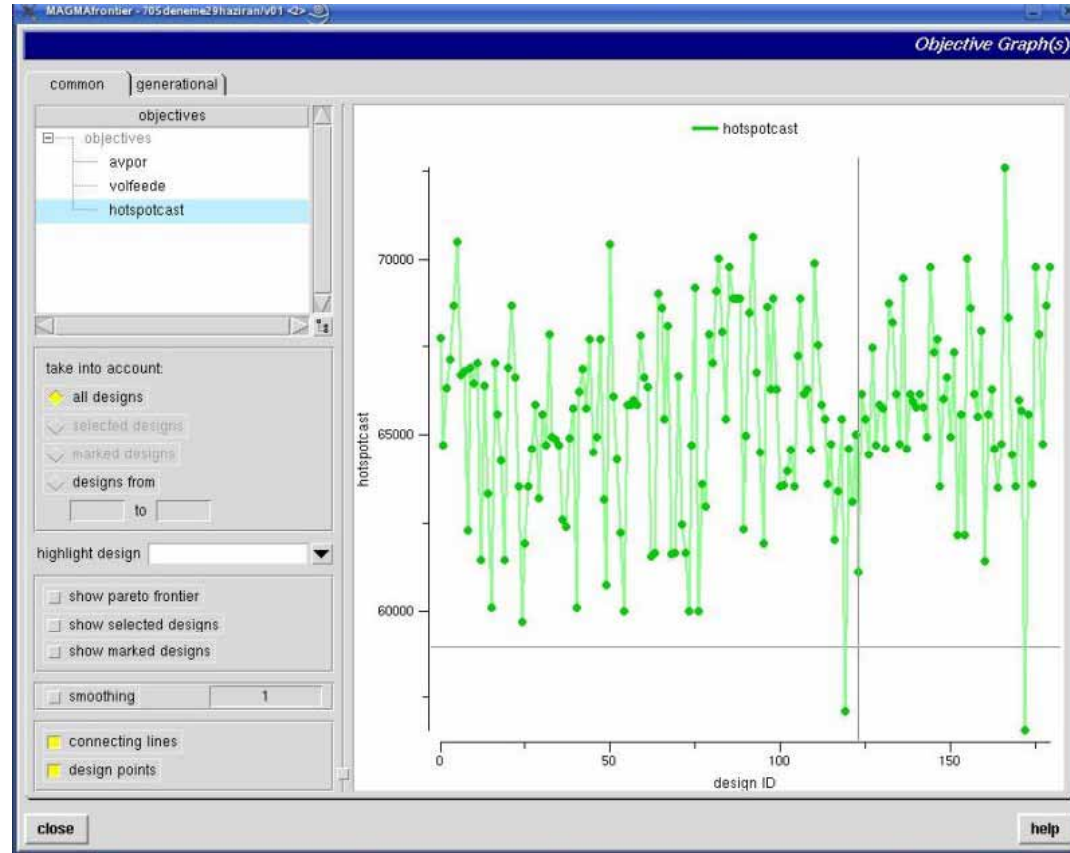
Magma Frontier Simulation Example



Pareto Results Example 4



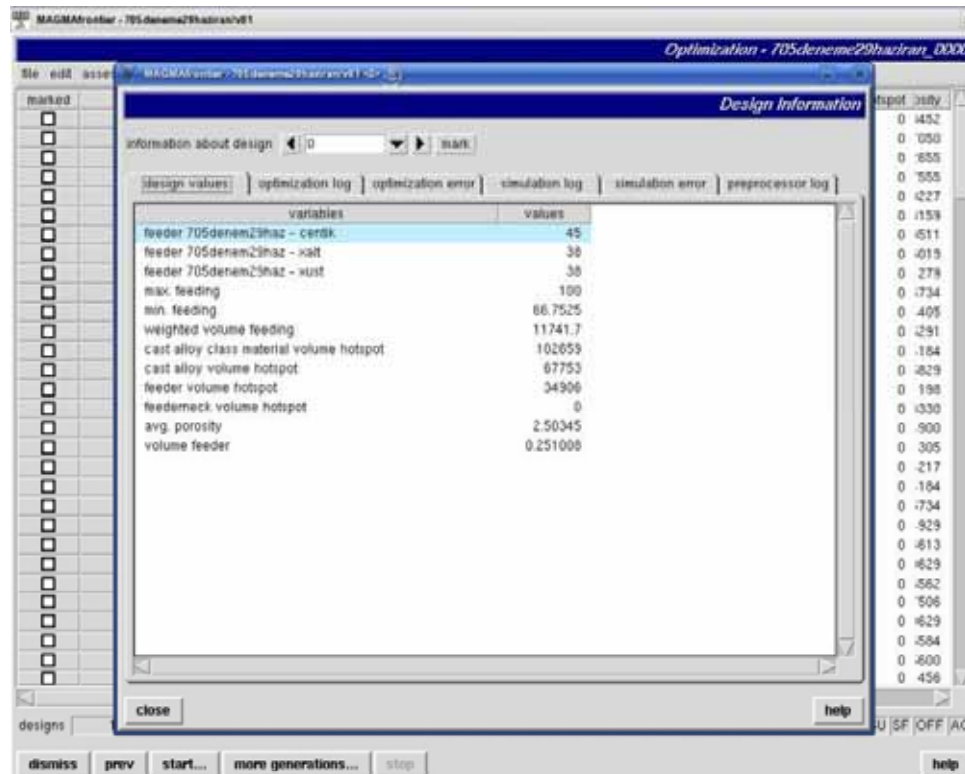
Magma Frontier Simulation Example



Pareto Results Example 5



Magma Frontier Simulation Example



The screenshot shows the Magma Frontier software interface. A 'Design Information' dialog box is open, displaying a table of variables and their values. The table is as follows:

variables	values
feeder 705denem29haz - cardk	45
feeder 705denem29haz - xalt	30
feeder 705denem29haz - xust	30
max. feeding	100
min. feeding	86.7525
weighted volume feeding	11741.7
cast alloy class material volume hotspot	102653
cast alloy volume hotspot	67753
feeder volume hotspot	34906
feederneck volume hotspot	0
avg. porosity	2.50345
volume feeder	0.251006

Design Values



THANK YOU !!!



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