
International MAGMA User Meeting 2024
October 9-11, 2024
RADISSON BLU – Frankfurt
BE PART OF IT
MAGMA

The Economics Perspective in MAGMASOFT 6.1

Workshop

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Frankfurt a. M.

Motivation of ECONOMICS

Status Quo

technical

optimization
robustness
scrap reduction
tolerances
quality
meet requirements / targets

Q 

feeling

yield
manufacturing costs
CO_2
costs per part

MAGMA ECONOMICS

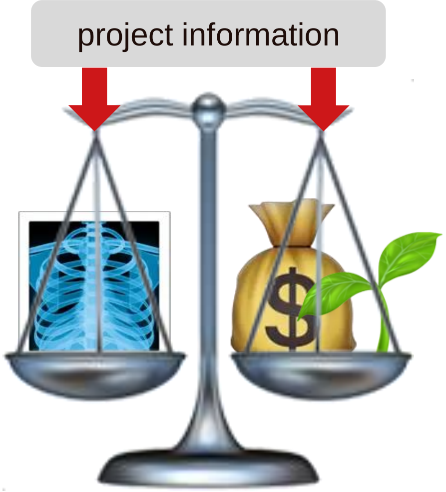
What is it ?

- a new, additional **perspective** in MAGMASOFT®
- **easy to use** & **free** of charge.
- **production costs** and/or **CO_2** emissions estimation for castings

MAGMA ECONOMICS provides further criteria – in addition to quality – for evaluating the best solution: **costs and CO_2.**

- We are talking about costs, **NOT** price!
- It is **NOT** a comprehensive **cost-/CO_2-calculation program!**

MAGMASOFT®
autonomous engineering



MAGMA ECONOMICS

How does it work ?

- With support from the **cost sheets** …
- …and the **already available information** in MAGMASOFT® simulation projects
- …and **without any further input**
- …estimations of **costs** and/or **CO_2 emissions** are automatically calculated.
- Including **DoEs**

MAGMA ECONOMICS

What is the benefit ?

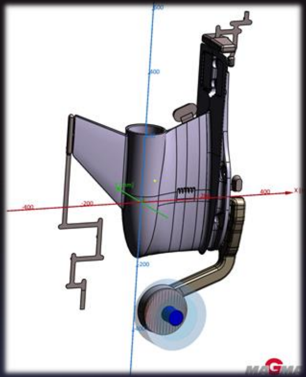
- More **robust**, better and more **sustainable evaluations** & **decisions**…
  - with **additional decision criteria**,
  - by adding **more/different people** in the decision making process and
  - by gains of **knowledge & visualization** the relation btw. **costs/CO_2** and **quality**.

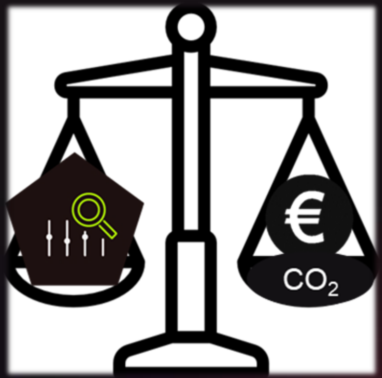
- Furthermore **time can be saved** in the development process by
  - **early considerations** of **costs** and **CO_2** emissions in the simulation phase and by
  - **avoiding** unnecessary simulations.

Feeling?! VERSUS Quantitative Values!

Live Demo

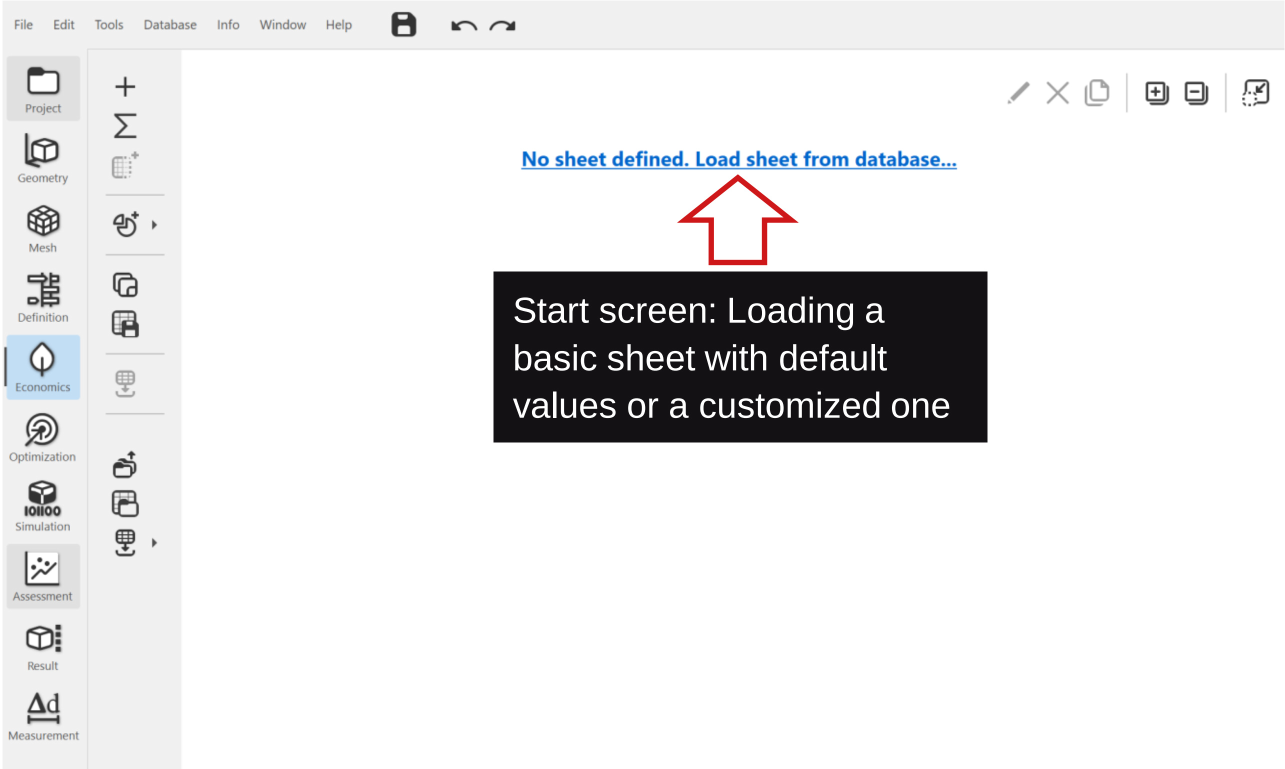
Combine 3 dimensions
- quality
- manufacturing costs
- carbon footprint per part)
and determine your optimum with
MAGMASOFT 6.1 ECONOMICS





Economics Workflow using the example of a DoE

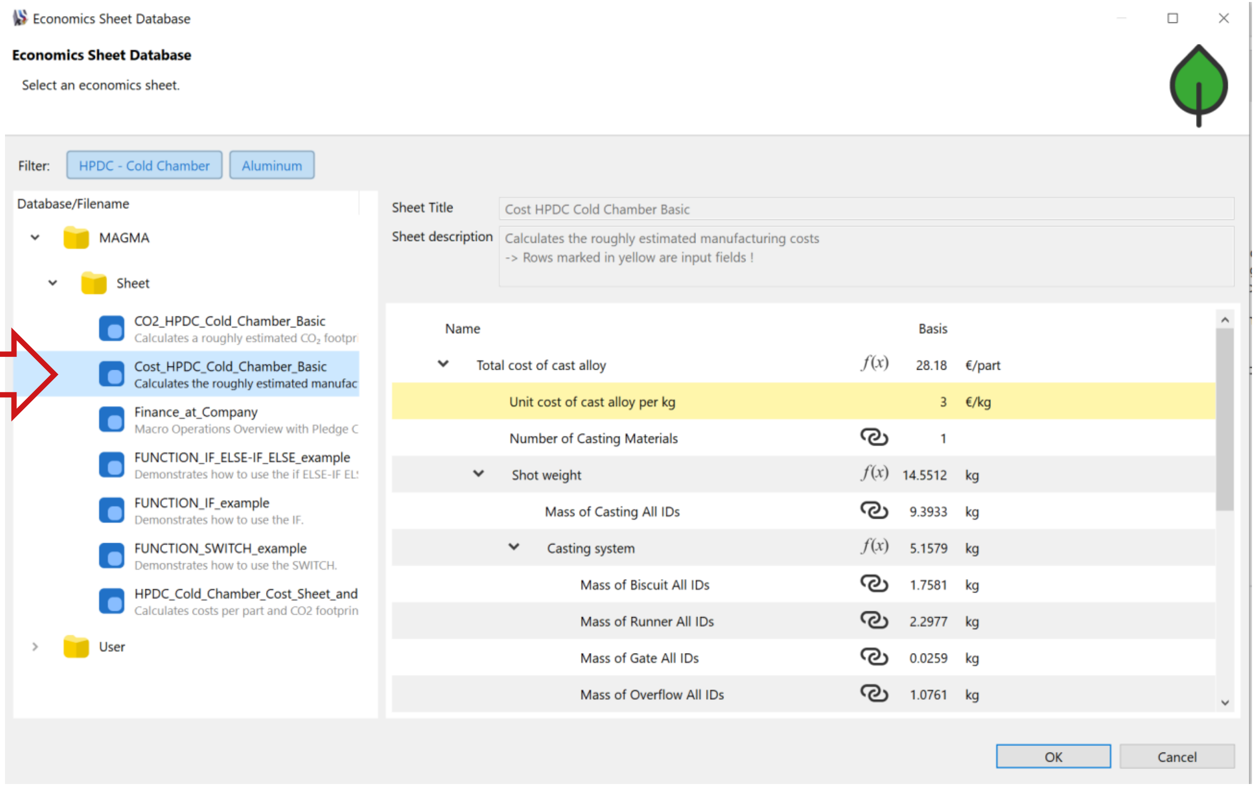
Open Economics Perspective to load a sheet from database



Economics Workflow using the example of a DoE

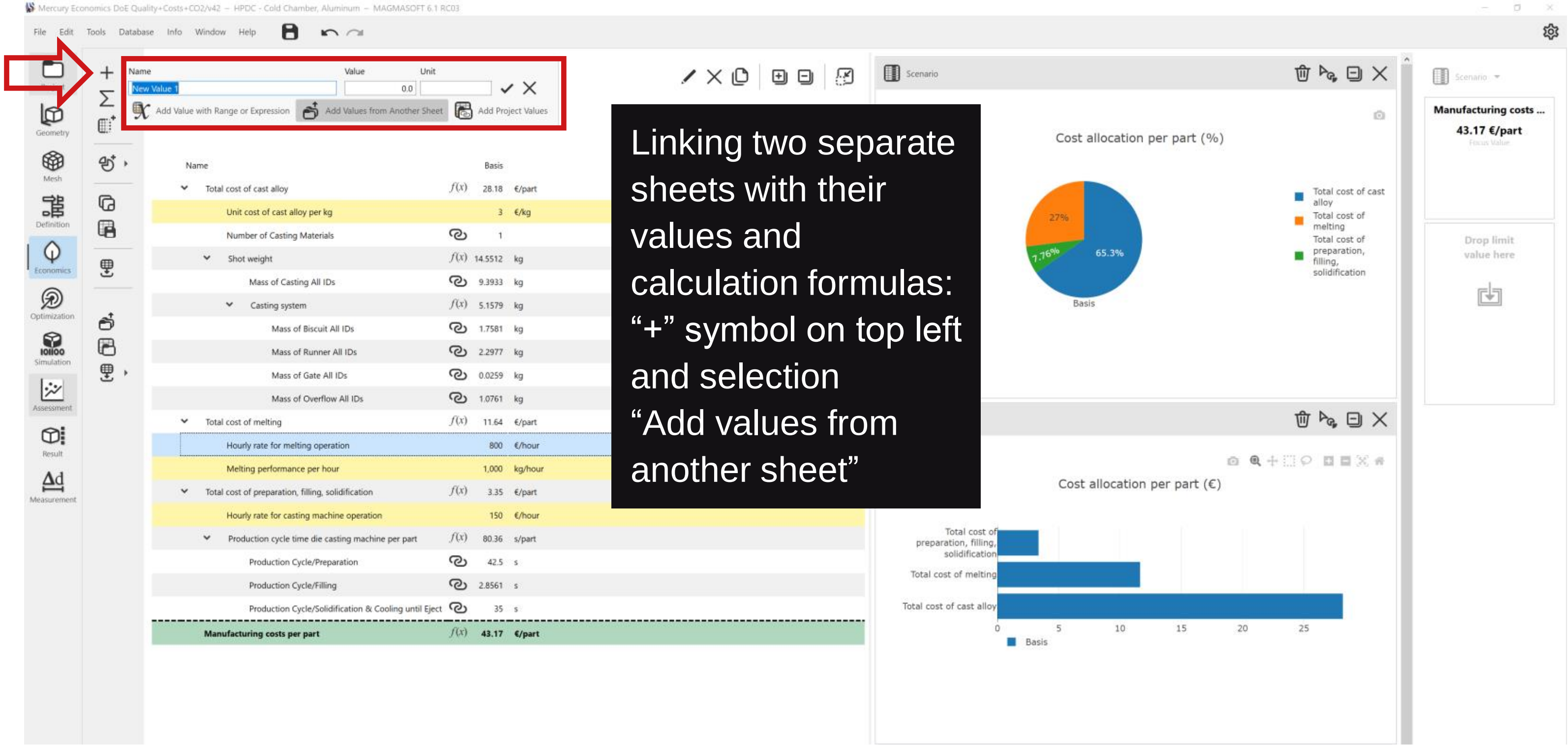
Open the Economics Database and select a default (Basic) or self-defined sheet

Economics sheet database with filter function for process mode and material type: Preview and selection of the desired template



Economics Workflow using the example of a DoE

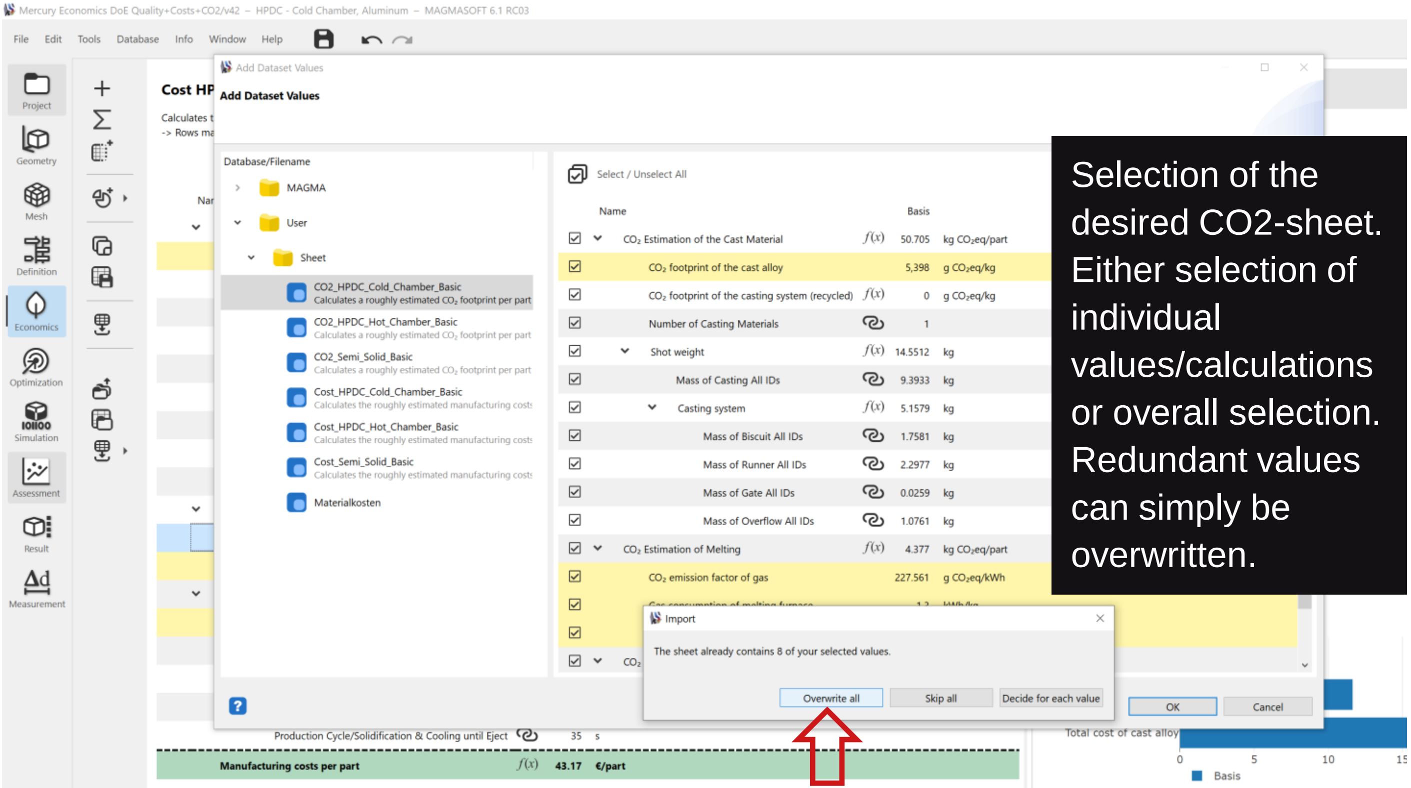
Linking a cost sheet with values from another sheet (e.g. to pre-calculate a PCF)



Linking two separate sheets with their values and calculation formulas: "+" symbol on top left and selection "Add values from another sheet"

Economics Workflow using the example of a DoE

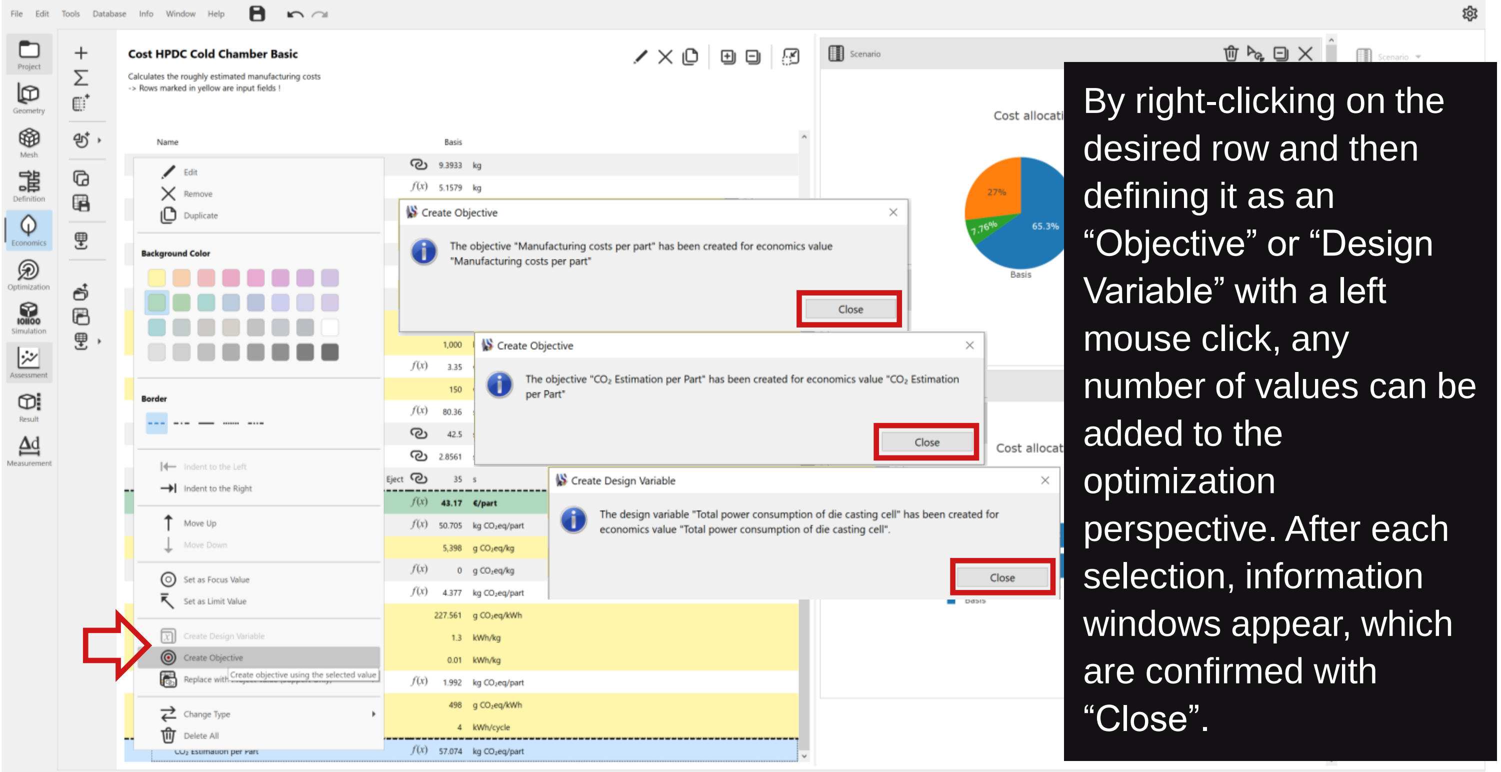
Integrate all values from the carbon footprint calculation into the existing sheet



Selection of the desired CO2-sheet. Either selection of individual values/calculations or overall selection. Redundant values can simply be overwritten.

Economics Workflow using the example of a DoE

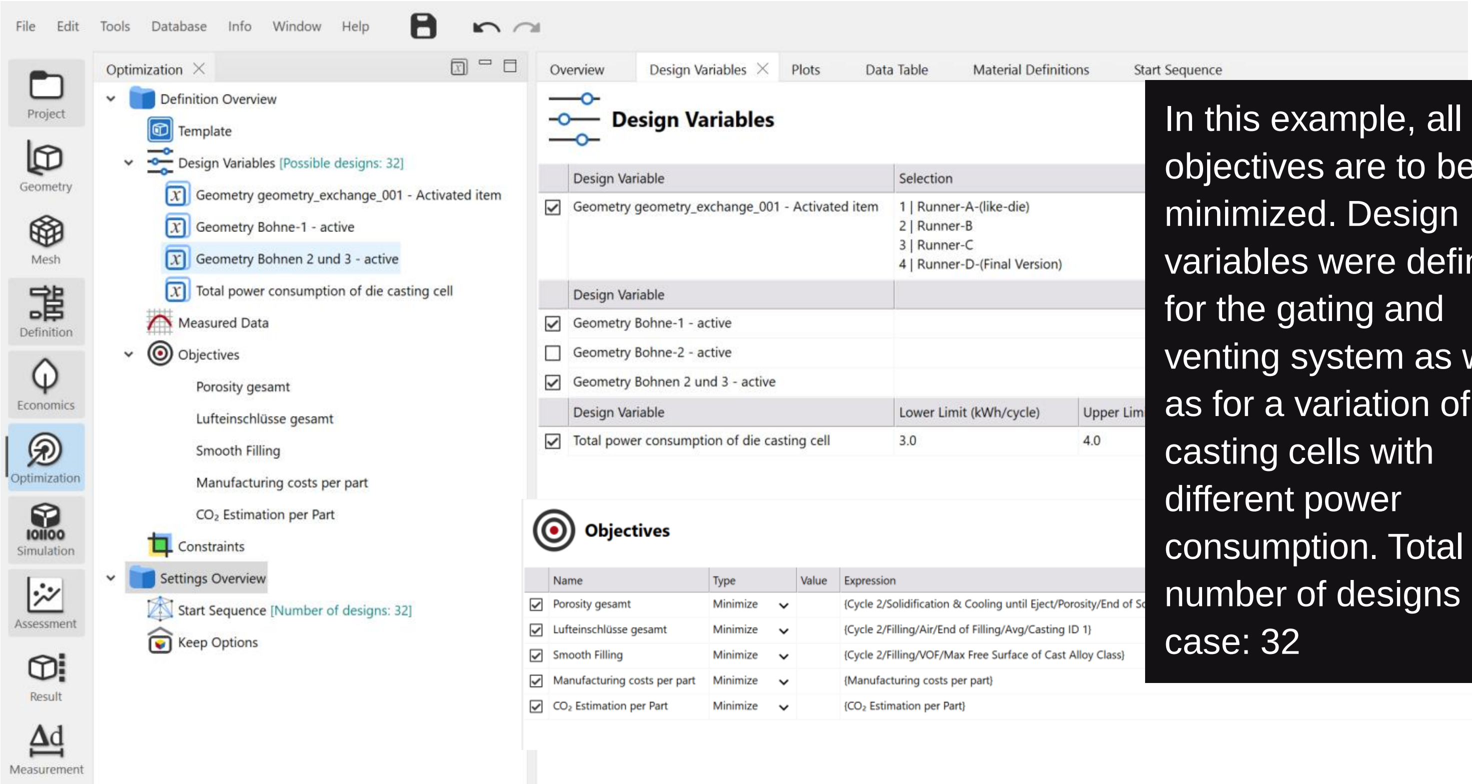
Define the objectives and/or design variables for the DoE in the merged sheet



By right-clicking on the desired row and then defining it as an “Objective” or “Design Variable” with a left mouse click, any number of values can be added to the optimization perspective. After each selection, information windows appear, which are confirmed with “Close”.

Economics Workflow using the example of a DoE

Definition Overview in Optimization Perspective and preparation for the DoE

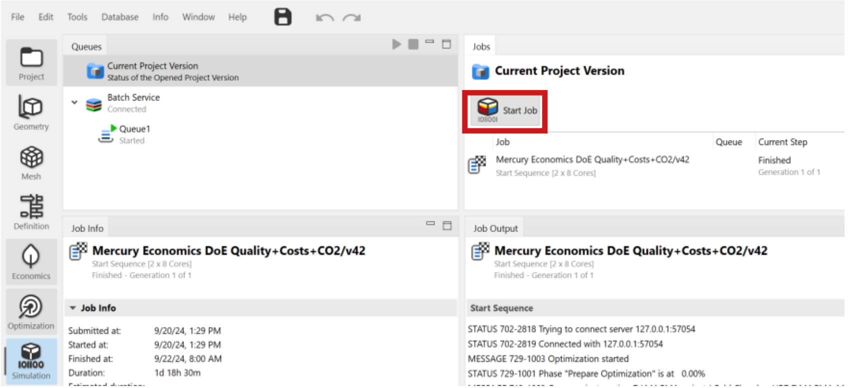


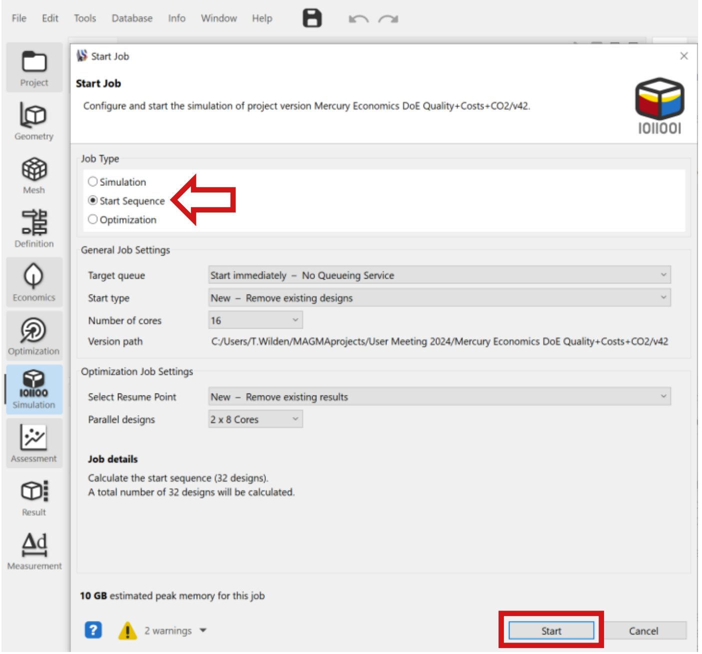
In this example, all objectives are to be minimized. Design variables were defined for the gating and venting system as well as for a variation of casting cells with different power consumption. Total number of designs in this case: 32

Economics Workflow using the example of a DoE

Start sequence (DoE) to calculate a total number of different designs

Press “Start Job” in the simulation perspective and select “Start Sequence” in the context window. Then run the DoE by pressing the “Start” button.



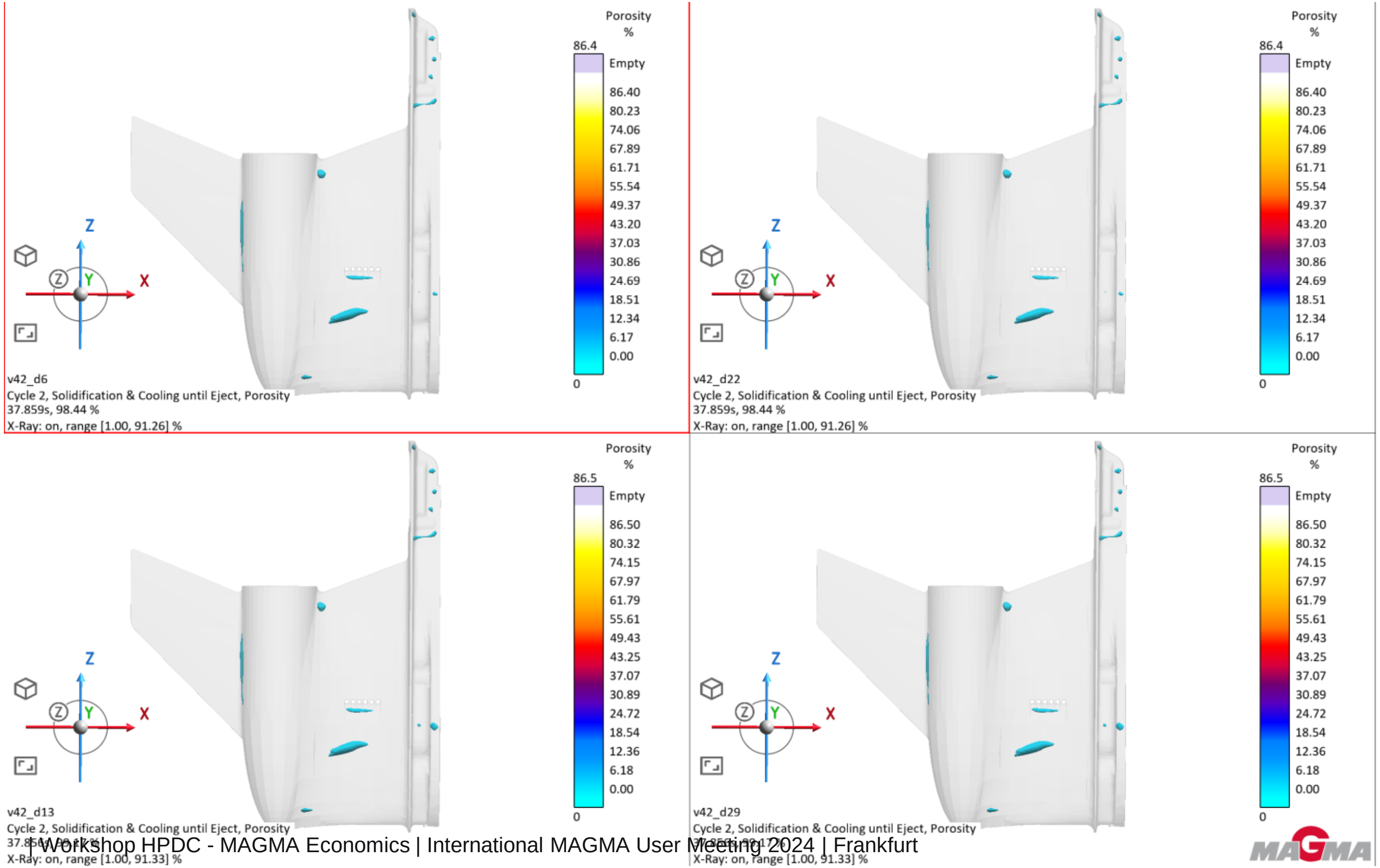


Economics Workflow using the example of a DoE

Porosity results – 2 best and 2 worst designs

Best Porosity designs: D6 / D22

Worst Porosity designs: D13 / D29

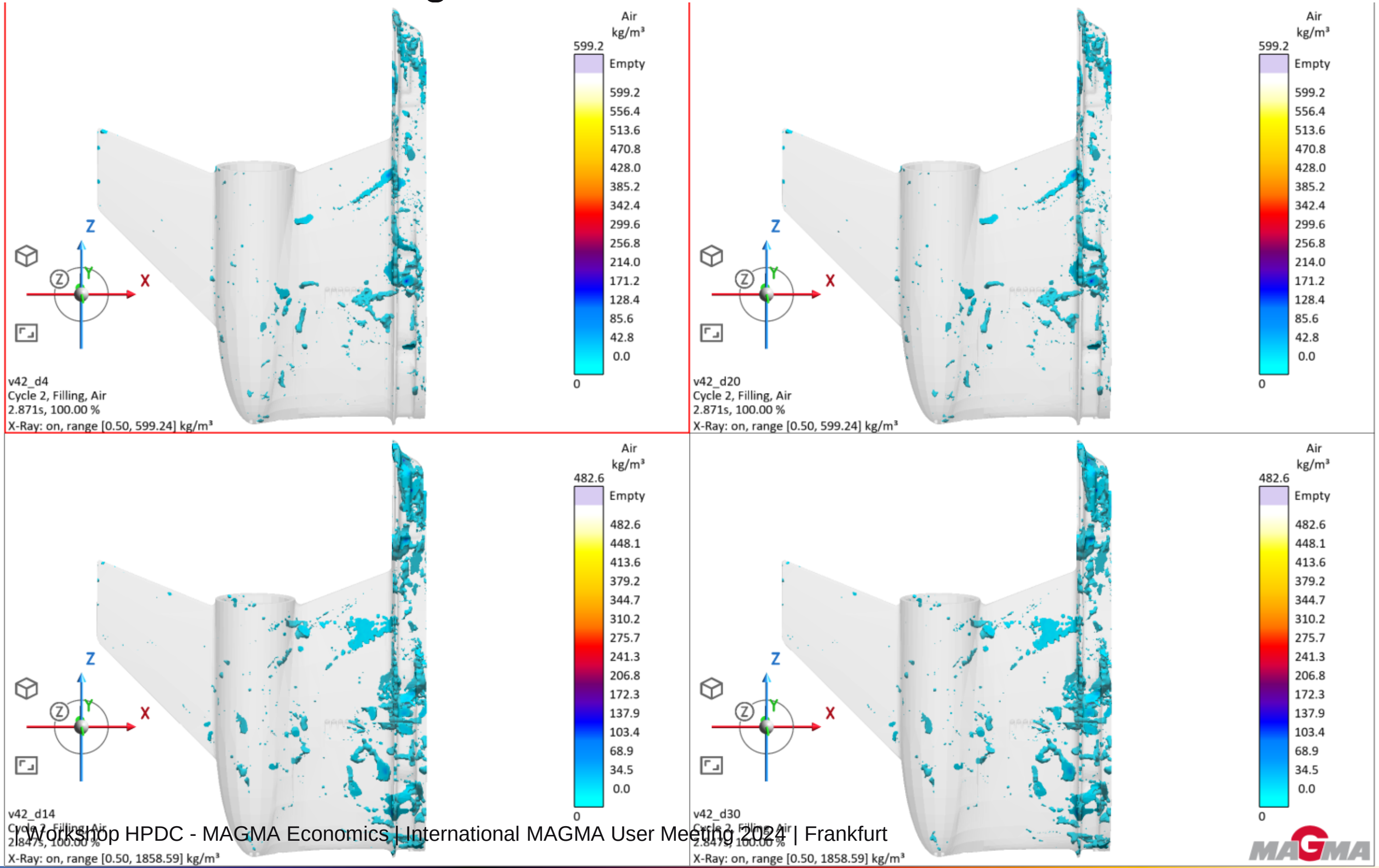


Economics Workflow using the example of a DoE

Air results – 2 best and 2 worst designs

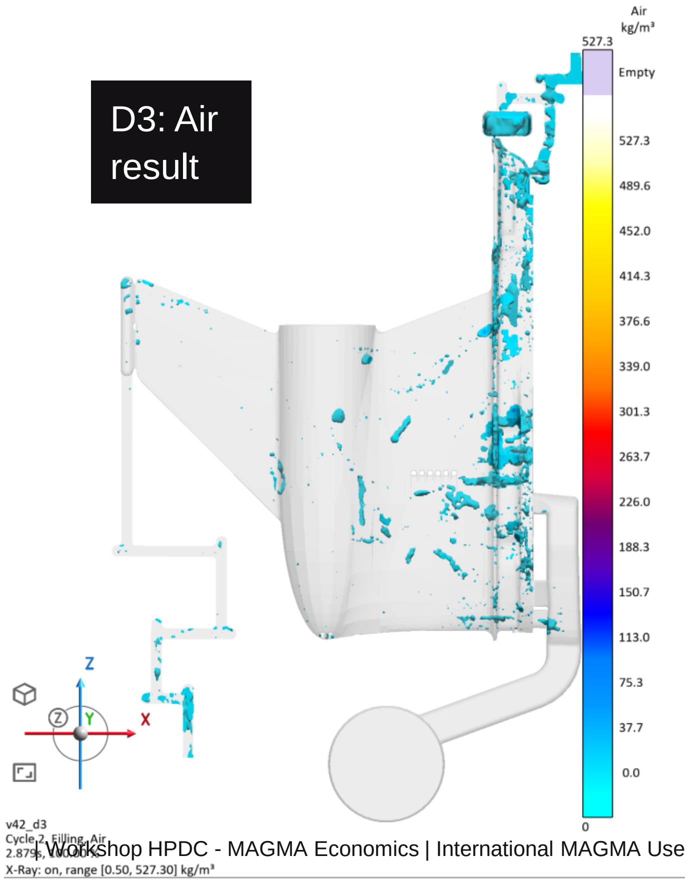
Best Air designs: D4 / D20

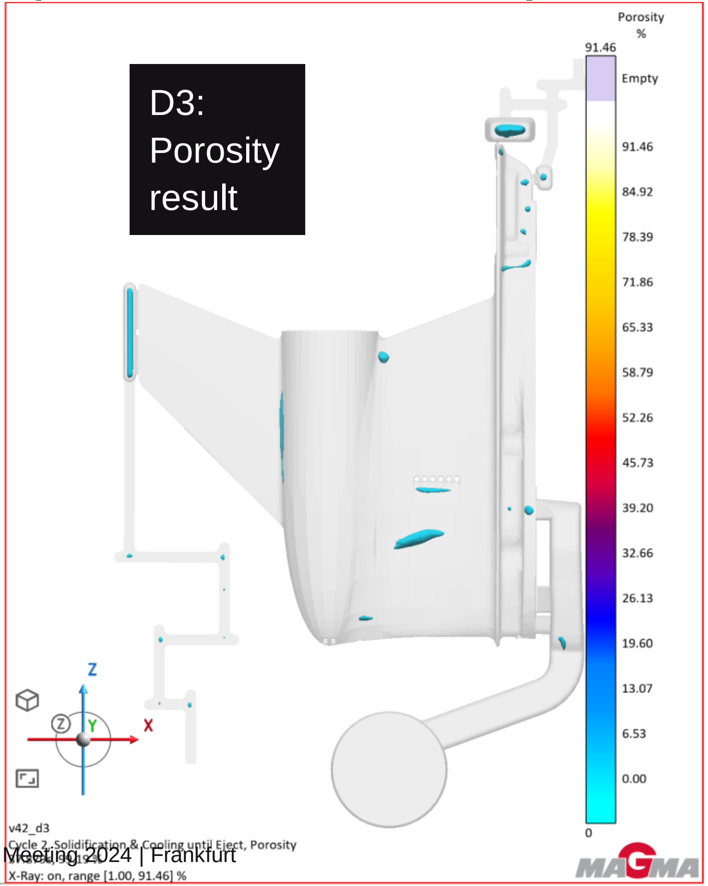
Worst Air designs: D14 / D30



Economics Workflow using the example of a DoE

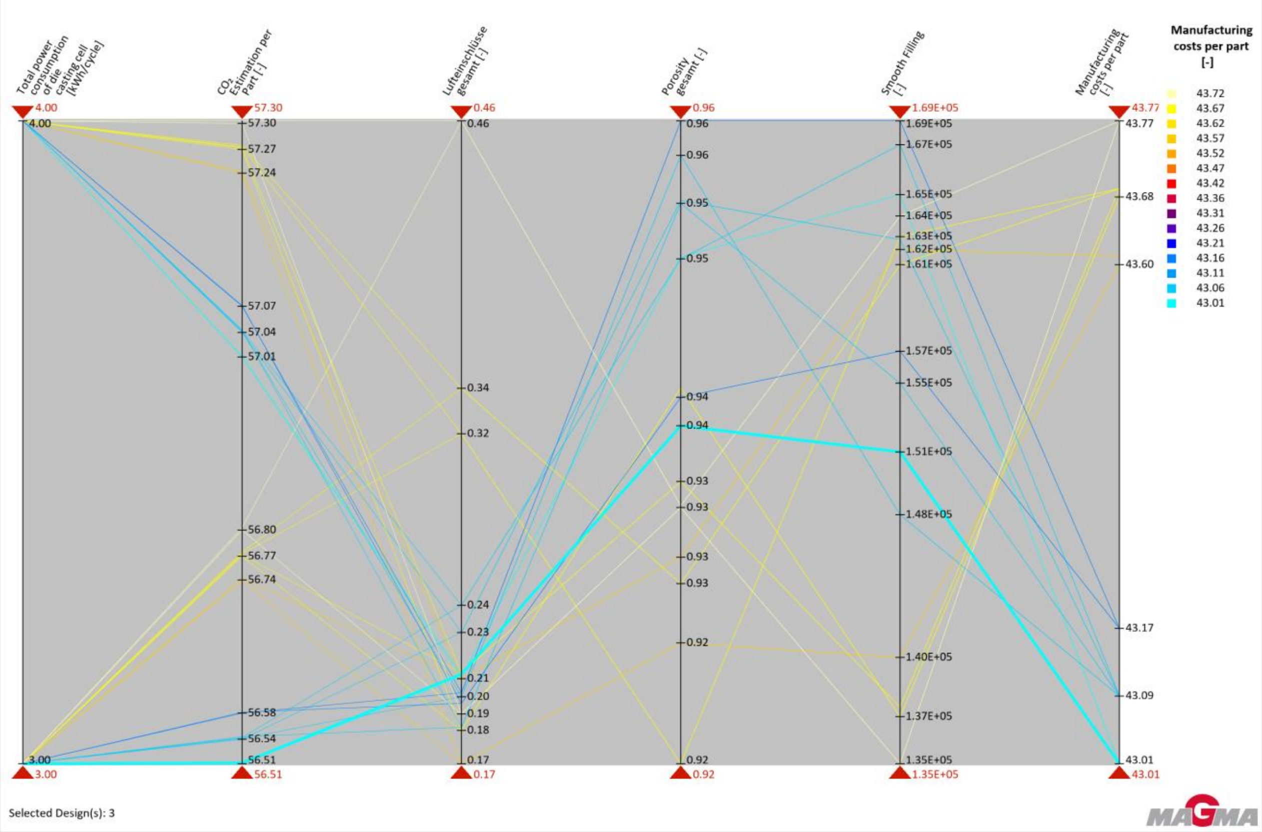
Design 3 as optimum compromise between quality, costs and carbon footprint





Economics Workflow using the example of a DoE

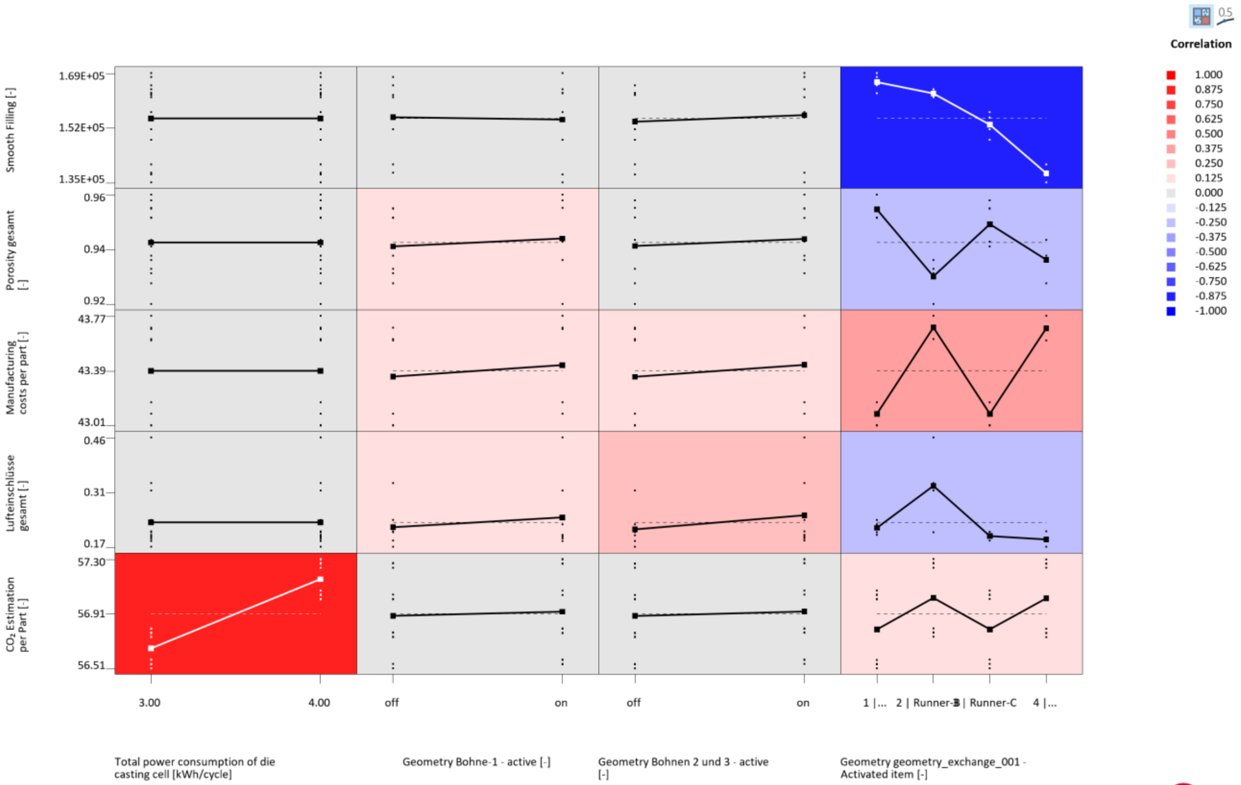
Display of results using Parallel Coordinates



Presentation of DoE-Results: Design 3 on the energy-efficient machine is the best compromise between quality, manufacturing costs and carbon footprint per part !

Economics Workflow using the example of a DoE

Presentation of results as a Main Effect Matrix



Economics Workflow using the example of a DoE

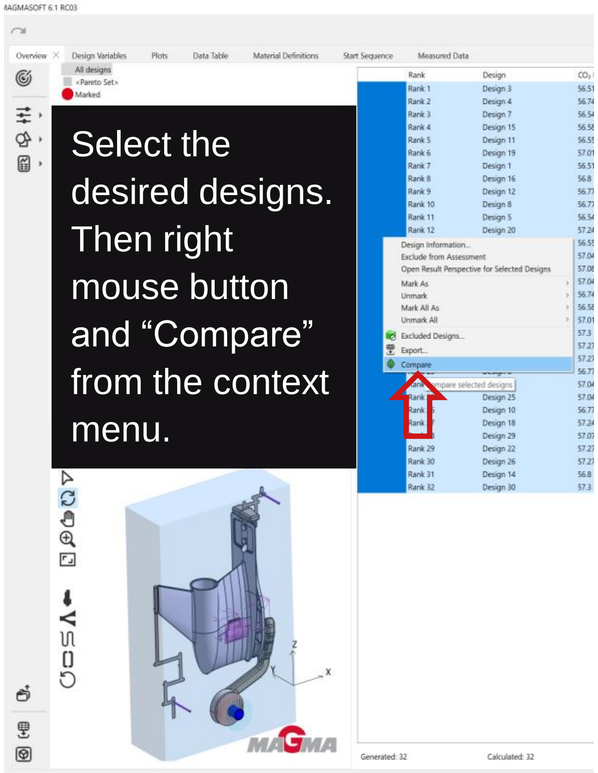
Presentation of results as a Data Table with equal weighting of all variables

Rank	Design	Total power consu...	Geometry Bohne-1...	Geometry Bohnen ...	Geometry geometr...	CO_2 Estimation per...	Lufteinschlüsse ge...	Manufacturing cos...	Porosity gesamt (-)	Smooth Filling (-)
Rank 1	Design 3	3.0	0.0	0.0	3 | Runner-C	56.51	0.209	43.01	0.939	151206.7
Rank 2	Design 4	3.0	0.0	0.0	4 | Runner-D-(Final ...	56.74	0.169			
Rank 3	Design 7	3.0	1.0	0.0	3 | Runner-C	56.54	0.199			
Rank 4	Design 15	3.0	1.0	1.0	3 | Runner-C	56.58	0.196			
Rank 5	Design 11	3.0	0.0	1.0	3 | Runner-C	56.55	0.185			
Rank 6	Design 19	4.0	0.0	0.0	3 | Runner-C	57.01	0.209			
Rank 7	Design 1	3.0	0.0	0.0	1 | Runner-A-(like-...	56.51	0.207			
Rank 8	Design 16	3.0	1.0	1.0	4 | Runner-D-(Final ...	56.8	0.191			
Rank 9	Design 12	3.0	0.0	1.0	4 | Runner-D-(Final ...	56.77	0.209			
Rank 10	Design 8	3.0	1.0	0.0	4 | Runner-D-(Final ...	56.77	0.184			
Rank 11	Design 5	3.0	1.0	0.0	1 | Runner-A-(like-...	56.54	0.228			
Rank 12	Design 20	4.0	0.0	0.0	4 | Runner-D-(Final ...	57.24	0.169			
Rank 13	Design 9	3.0	0.0	1.0	1 | Runner-A-(like-...	56.55	0.24			
Rank 14	Design 23	4.0	1.0	0.0	3 | Runner-C	57.04	0.199			
Rank 15	Design 31	4.0	1.0	1.0	3 | Runner-C	57.08	0.196			
Rank 16	Design 27	4.0	0.0	1.0	3 | Runner-C	57.04	0.185			
Rank 17	Design 2	3.0	0.0	0.0	2 | Runner-B	56.74	0.207			
Rank 18	Design 13	3.0	1.0	1.0	1 | Runner-A-(like-...	56.58	0.201			
Rank 19	Design 17	4.0	0.0	0.0	1 | Runner-A-(like-...	57.01	0.207			
Rank 20	Design 32	4.0	1.0	1.0	4 | Runner-D-(Final ...	57.3	0.191			
Rank 21	Design 28	4.0	0.0	1.0	4 | Runner-D-(Final ...	57.27	0.209			
Rank 22	Design 24	4.0	1.0	0.0	4 | Runner-D-(Final ...	57.27	0.184			
Rank 23	Design 6	3.0	1.0	0.0	2 | Runner-B	56.77	0.317			
Rank 24	Design 21	4.0	1.0	0.0	1 | Runner-A-(like-...	57.04	0.228			
Rank 25	Design 25	4.0	0.0	1.0	1 | Runner-A-(like-...	57.04	0.24			
Rank 26	Design 10	3.0	0.0	1.0	2 | Runner-B	56.77	0.338			
Rank 27	Design 18	4.0	0.0	0.0	2 | Runner-B	57.24	0.207			
Rank 28	Design 29	4.0	1.0	1.0	1 | Runner-A-(like-...	57.07	0.201			
Rank 29	Design 22	4.0	1.0	0.0	2 | Runner-B	57.27	0.317			
Rank 30	Design 26	4.0	0.0	1.0	2 | Runner-B	57.27	0.338			
Rank 31	Design 14	3.0	1.0	1.0	2 | Runner-B	56.8	0.458			
Rank 32	Design 30	4.0	1.0	1.0	2 | Runner-B	57.3	0.458			

Presentation of results as data table:
With 100% equal weighting of all optimization objectives, Design 3 is recommended as the best solution.
In this example, the porosity results of all calculated designs in particular lie within a very narrow range.
This trade-off is solved using the roughly estimated manufacturing costs and the carbon footprint per part.

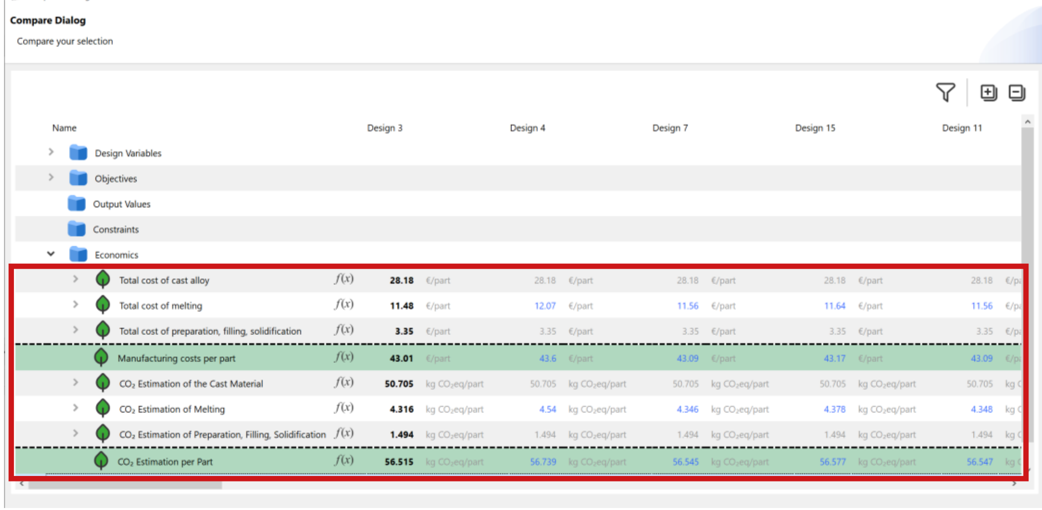
Economics Workflow using the example of a DoE

Detailed view of all calculated designs and their values using the Compare Dialog



Select the desired designs. Then right mouse button and “Compare” from the context menu.

Using the Compare dialog, all calculated values of the design variables and the objectives with their distribution to the individual designs can be listed and analyzed in detail. The screenshot shows the partial results from “Economics” with a list of the individual cost items and the CO2-Estimations.



Thank you for your attention.

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