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simufact additive

Version 2020 FP1

What’s new?

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Hamburg, August 7th 2020

What’s new? – Highlights

- GUI automation by scripting
- New process type “Geometry inspection”
- New process type “Binder jetting” (Technical preview)
- Calibration usability improvements
- Many improvements in usability & stability
  - Implemented 96 features

GUI automation by scripting

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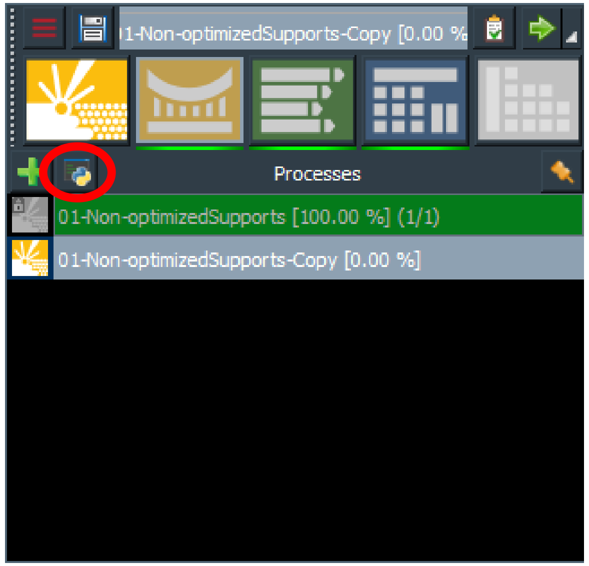
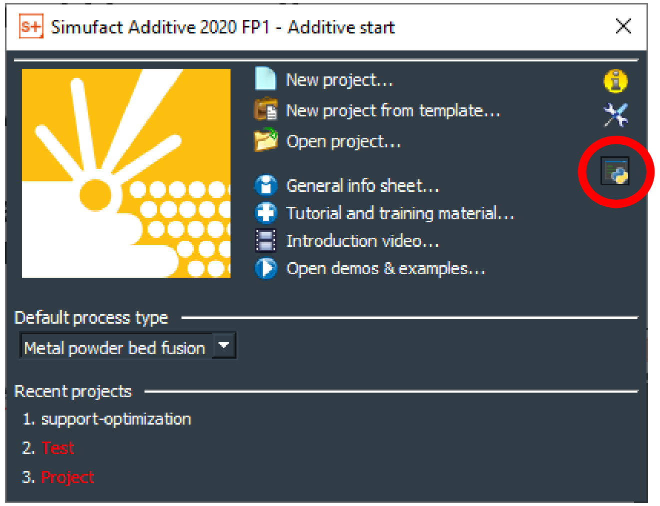
GUI automation by scripting

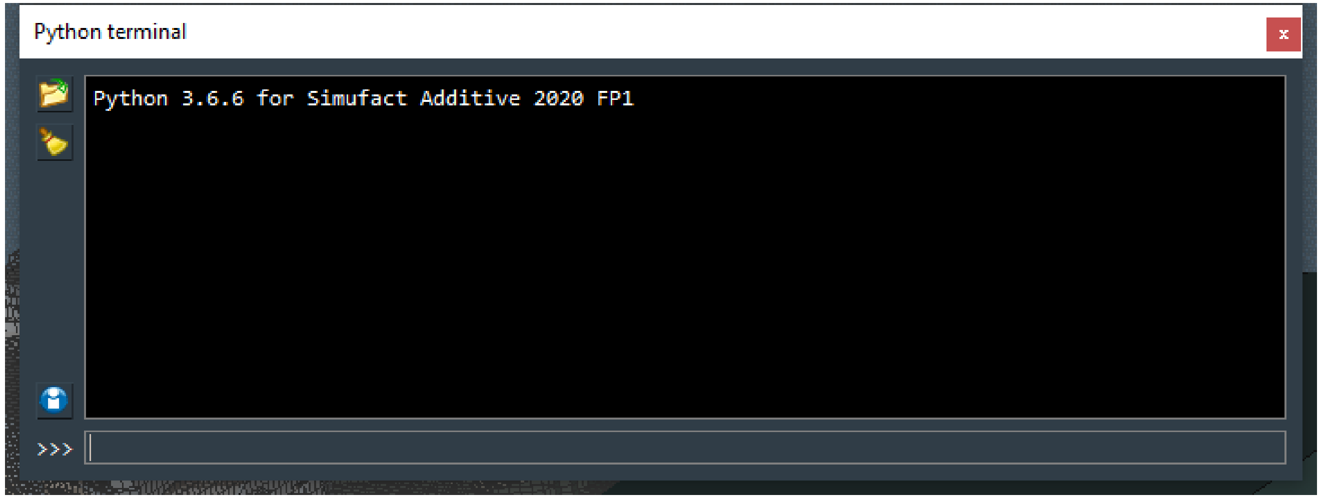
- **Automation is a big key topic when a various number of simulations should run with a minimum amount of user interaction**
- For this reason **Simufact Additive can be automized** using script commands
- **Python allows to drive the GUI** by entering scripting commands manually or start the GUI and attach a script that should be executed by the GUI
- The workflow from creating a project to starting the simulation can be automized using scripting commands





GUI automation by scripting

- **Using the scripting interface, it is possible to drive Simufact Additive from any other 3rd party software**
- This allows e.g. PLM software to interact with Simufact Additive



GUI automation by scripting

- **The well structured and detailed documentation allows to write scripts easy and fast**

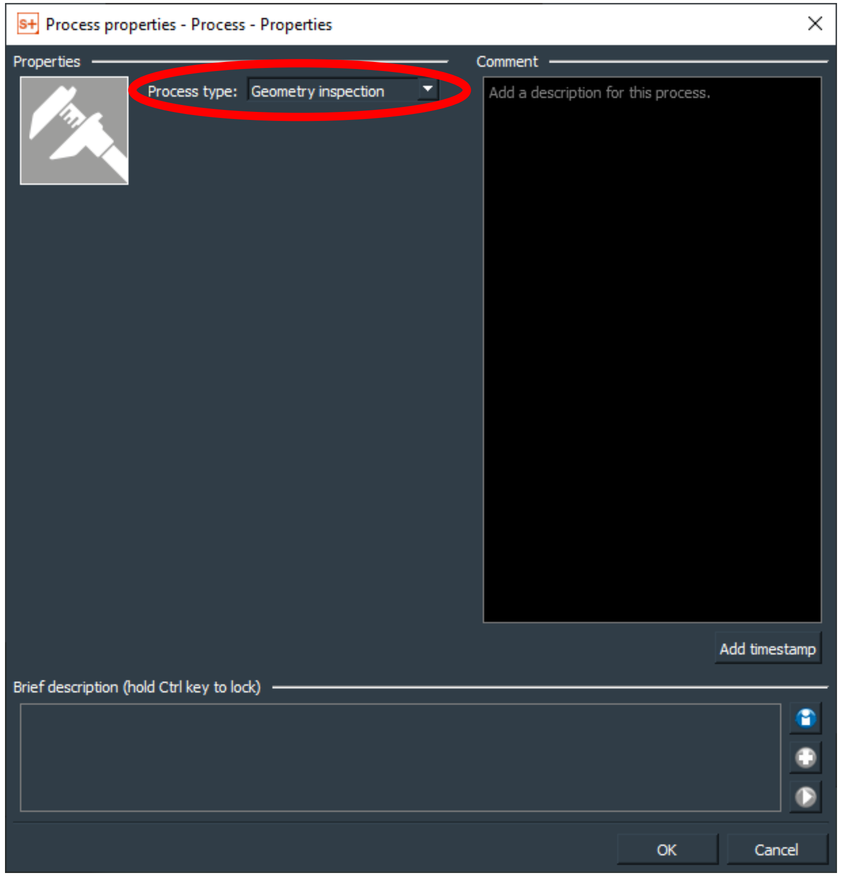
- Reference
  - Module simufact
    - Functions
    - Classes
      - Table
      - TableColumn
      - TextStream
      - UnitValueAcceleration
      - UnitValueAngle
      - UnitValueArea
      - UnitValueCurrency
      - UnitValueCurrencyPerTime
      - UnitValueForce
      - UnitValueForcePerLength
      - UnitValueHtc
      - UnitValueLength
      - UnitValuePercent
      - UnitValuePower
      - UnitValueSpeed
      - UnitValueTemperature
      - UnitValueTime
      - UnitValueTorquePerAngle
      - UnitValueVolumePerTime
      - Vector2D
      - Vector3D
  - Module simufact.additive
    - Functions
    - Classes
      - AdvancedThermalBuildParameters
      - BasePlate
      - BuildStage
      - CuttingStage
      - DistributedInherentStrain
      - HIPStage
      - HatchingEstimation
      - HatchingParameters
      - HatchingStrategy
      - HeatTreatmentStage
      - ImmediateReleaseStage
      - Machine
      - MachineCosts
      - Material
      - MaterialiseBlockSupports
      - MaterialiseLineSupports
      - MechanicalScaling
      - Part
      - PostBuildParameters
      - Process
      - Project

Geometry inspection

Geometry inspection

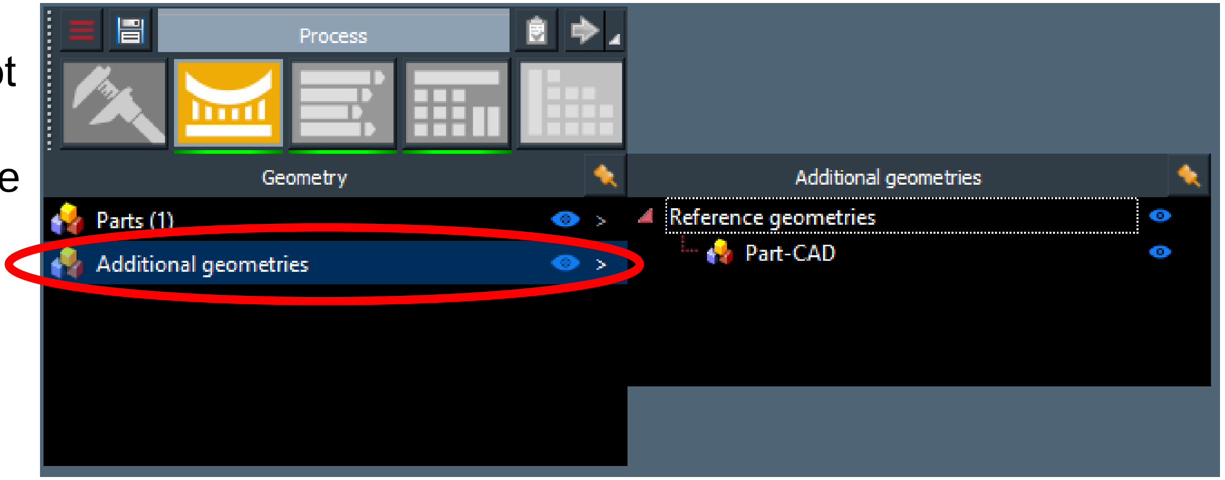
- **Geometry inspection is a new process type** which only works on geometries without the usage of any simulation data
- This process types allows positioning, best fit, transformation and compensation of geometries based on surface deviation

- **Geometry inspection does not require an additional license feature**
- Every process can be changed into a geometry inspection process but not vice versa



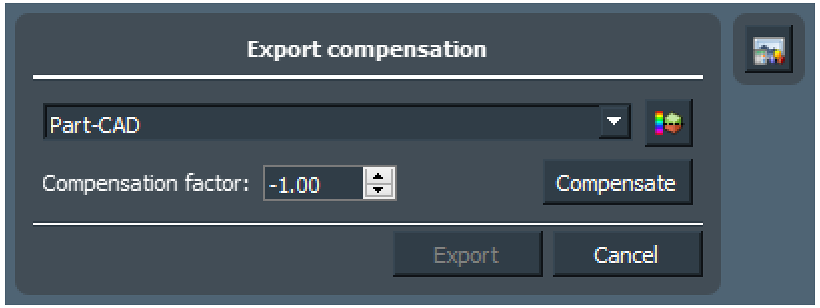
Geometry inspection

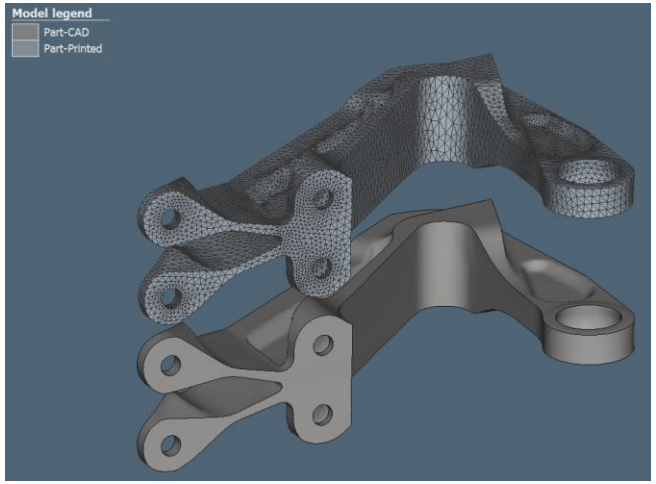
- **Reference geometries are now handled in the geometry widget** under “Additional geometries” and not in the results widget anymore
- Simplifies workflow for geometry inspection process type as well as the handling of reference geometries for distortion compensation
- The GUI is cleaned up for geometry inspection to show just the needed commands and tools

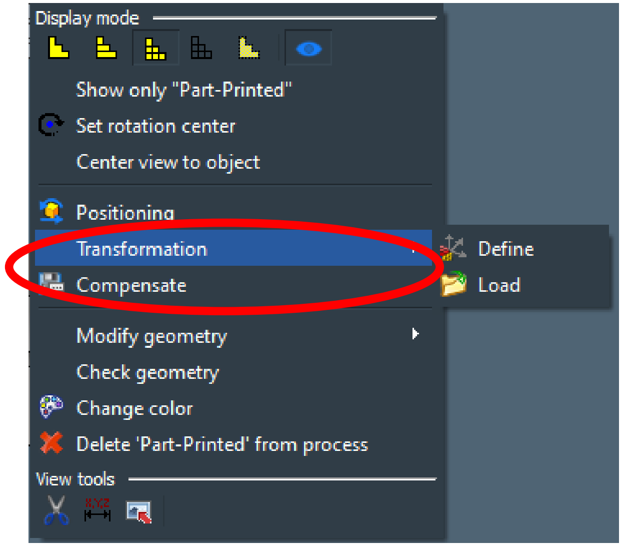


Geometry inspection

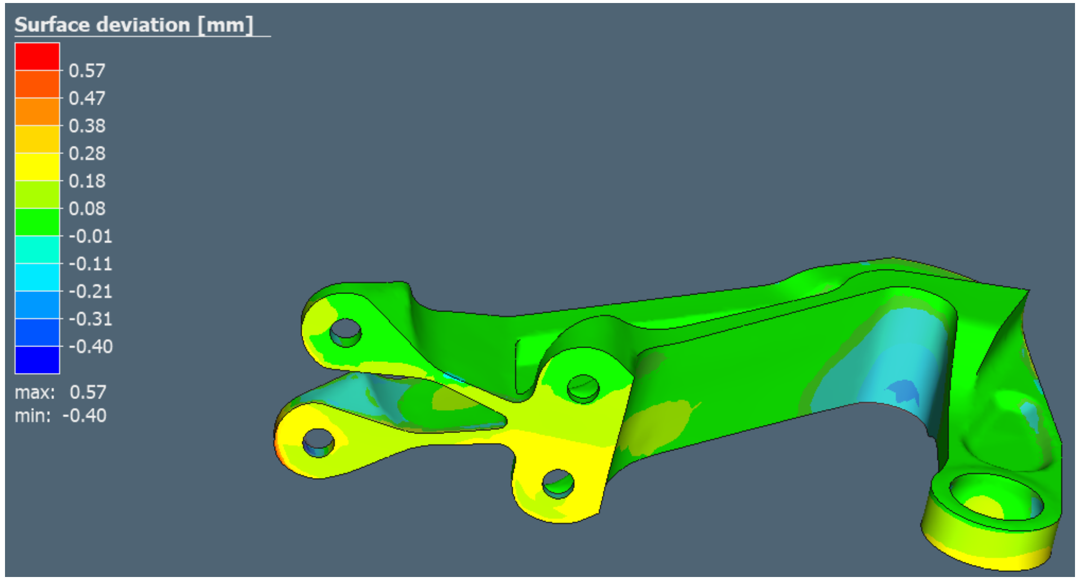
- General workflow:
  - Import reference geometry (e.g. scanned geometry)
  - Import CAD geometry as part
  - Set transformation for geometry with respect to reference geometry using methods also available for result transformation
  - Compensate part



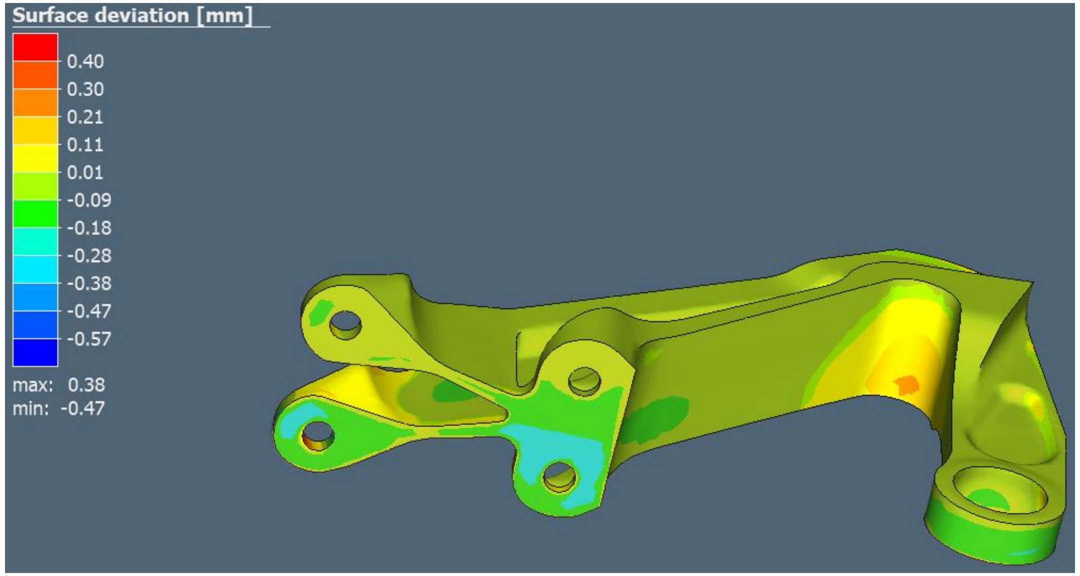




Geometry inspection



Before compensation



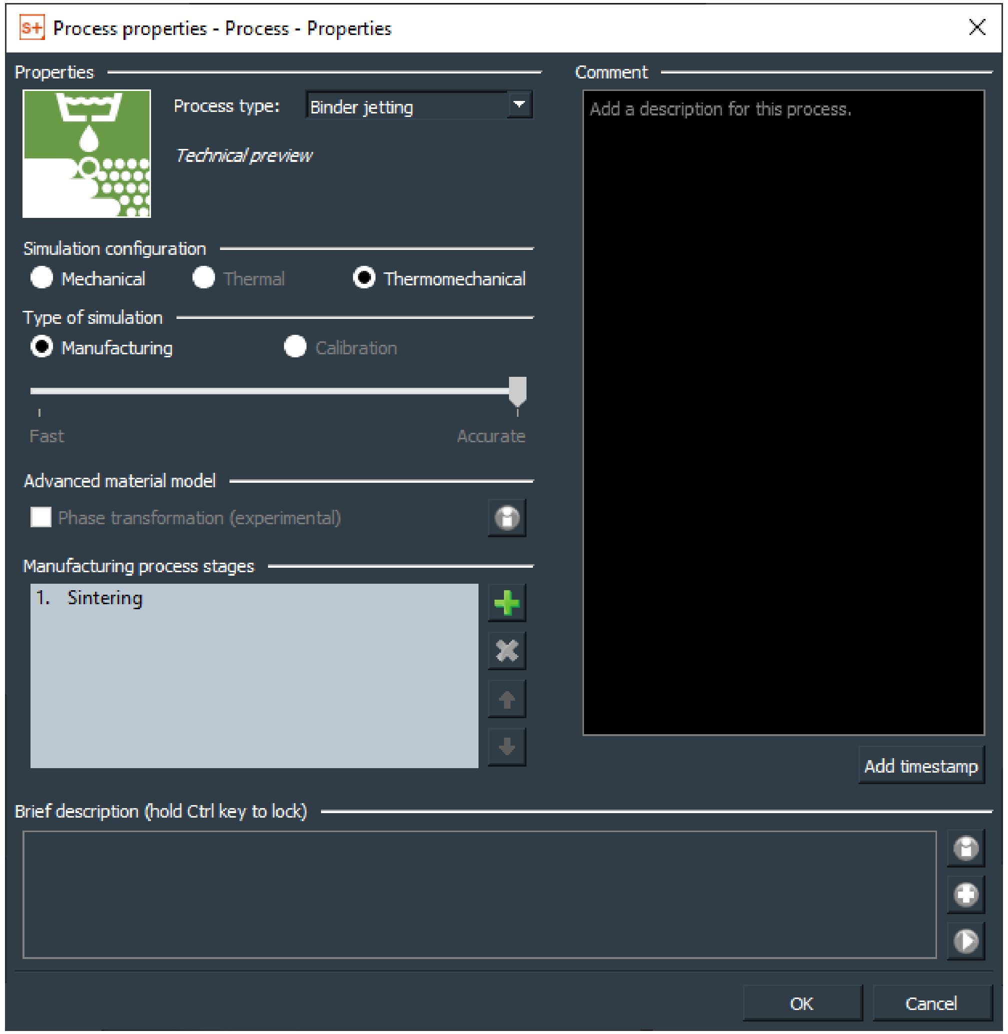
After compensation

Binder jetting
(Technical preview)

Binder jetting

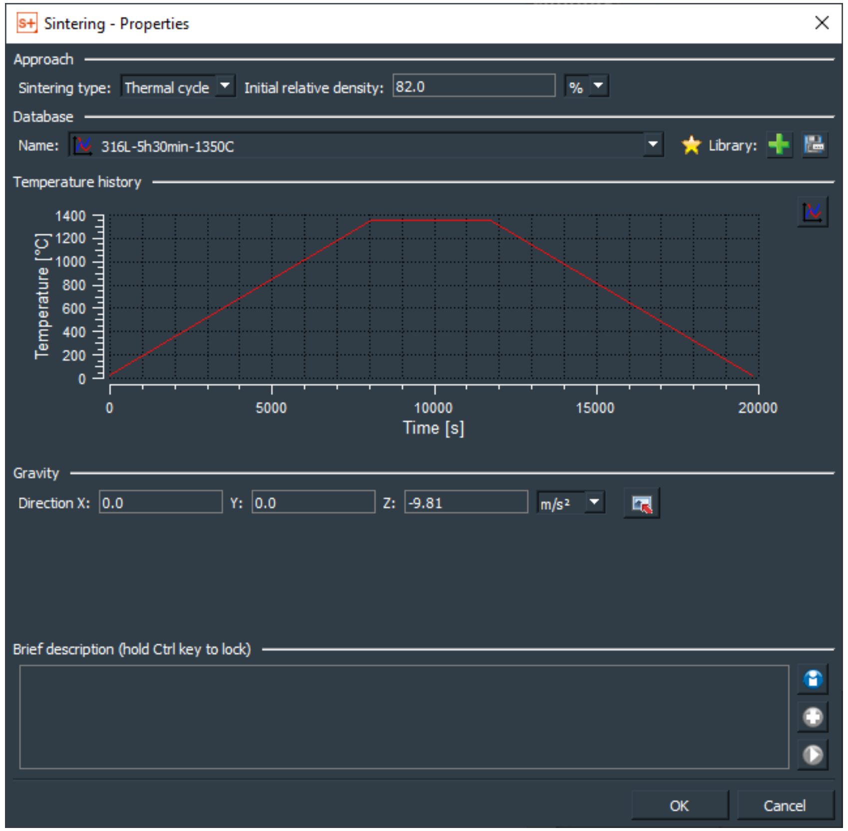
- **Binder jetting is a new and emerging additive manufacturing technology**
- The manufacturing process is a **powder bed based process** where the part is build layer wise
- The geometry is formed by applying a binder on the powder which glues the powder particles
- **The created geometry needs to be sintered** in order to achieve a recent amount of strength
- **Simufact Additive offers a technical preview on the new binder jetting process type**
- **The binder jetting process type is focused on the sintering** where distortions and stresses occur due to large shrinkage of the powder

- For a technical preview not all features and functionalities have to work in all combinations without any problems



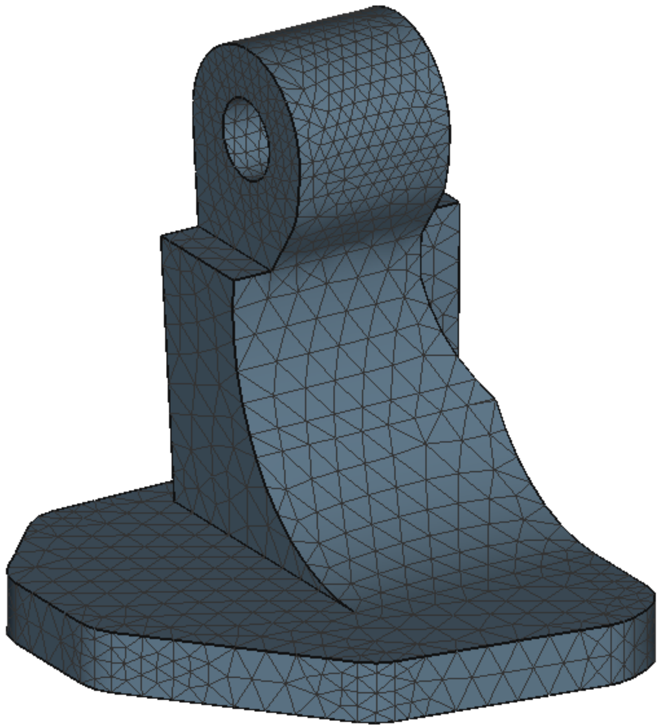
Binder jetting

- **Binder jetting requires an additional license feature**
- The GUI is cleaned up for binder jetting to show just the needed commands and tools
- As the first and mandatory stage, the sintering stage is always present
- The sintering stage requires the thermal cycle as input as well as an initial relative density and the direction of the gravity vector



Binder jetting

- **Binder jetting does not require a voxel mesh**
- The process is based on a tet or hex mesh whereas the tet mesh can be created using the Simufact Additive tet mesher
- Hex meshes as well as tet meshes can be imported when an external mesher was already used to create a finite element mesh



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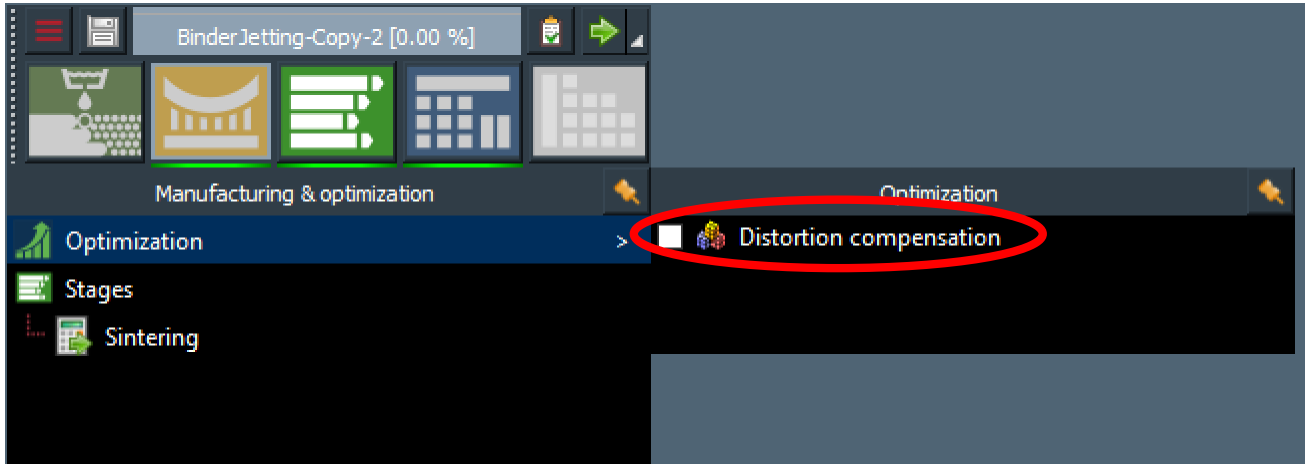
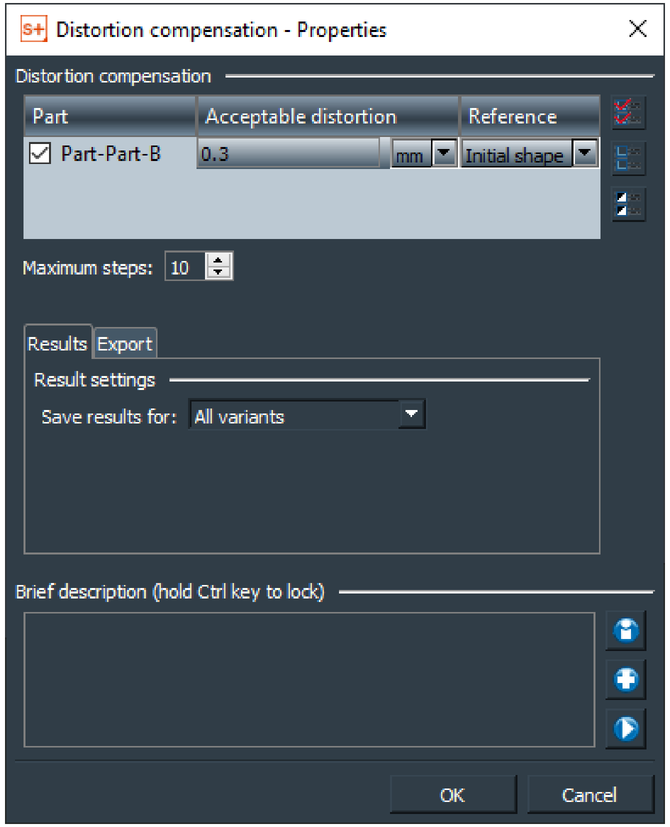
Binder jetting

- **Due to large shrinkage an iterative distortion compensation is required to print a larger geometry which has ideal dimensions after shrinkage**
- The distortion compensation can be activated and defined identical to powder bed fusion processes





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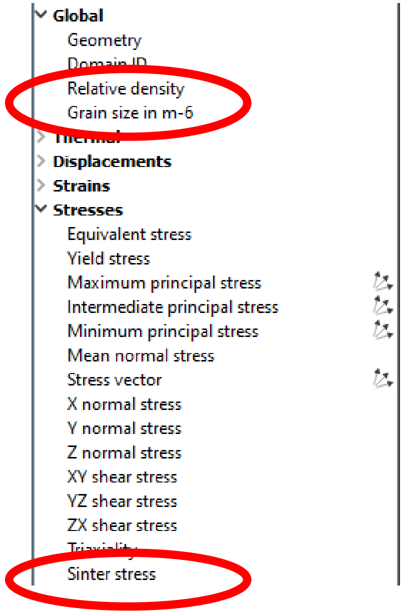
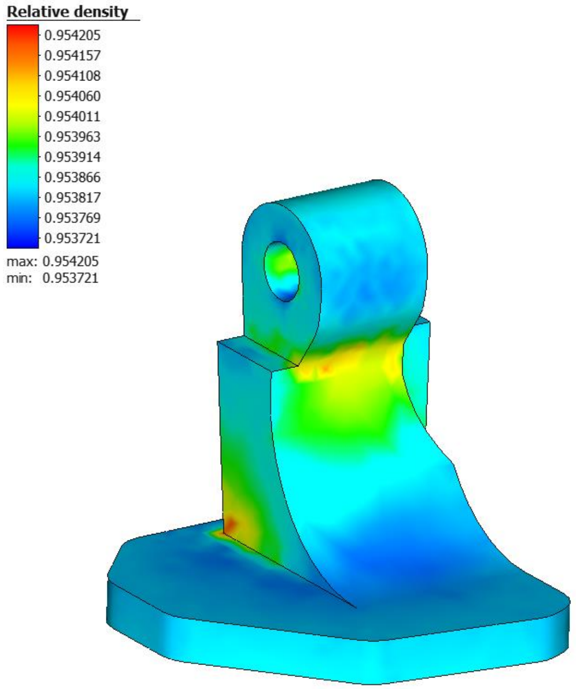
Binder jetting

- **Three additional result variables are added for post processing of binder jetting models**
- These post values are:
  - Relative density
  - Grain size
  - Sinter stress
- The new post values can be used to have a deeper look into the sintering process





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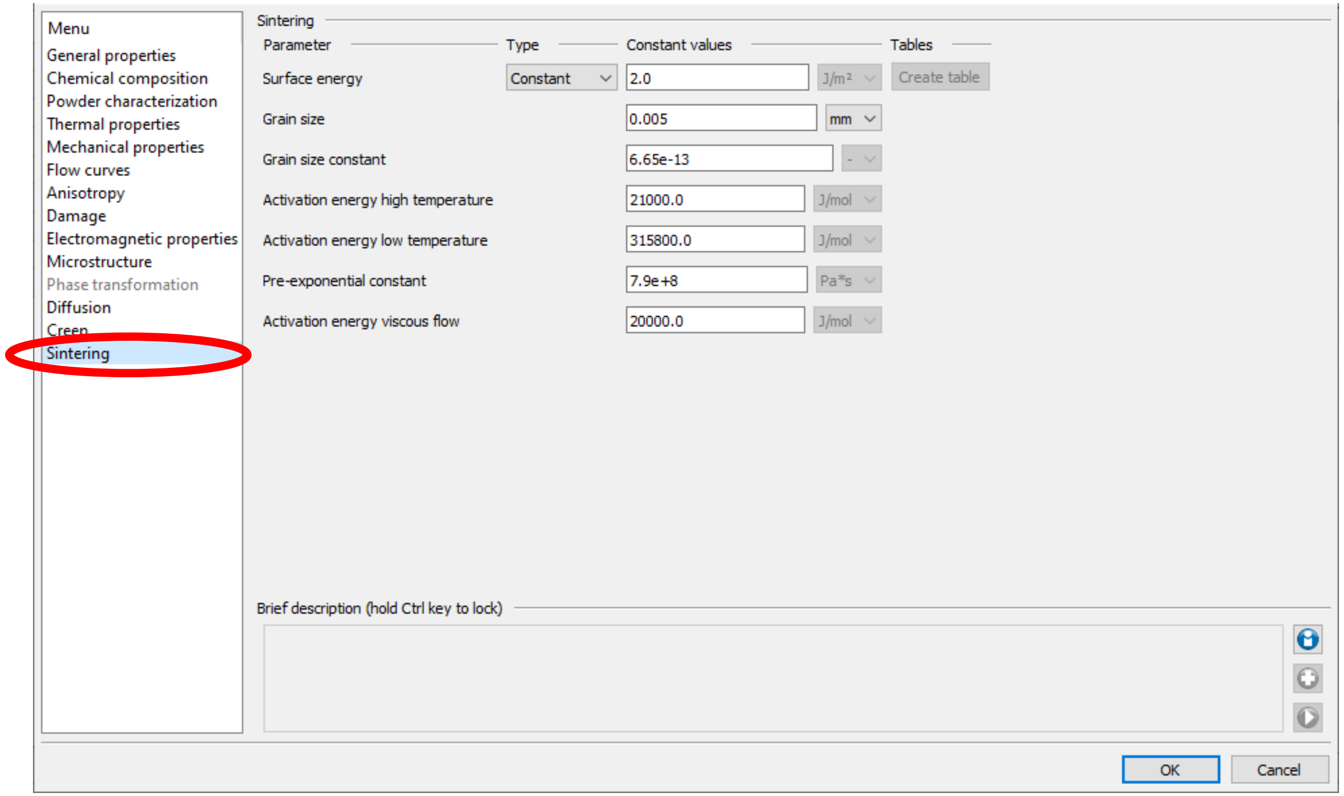
Binder jetting

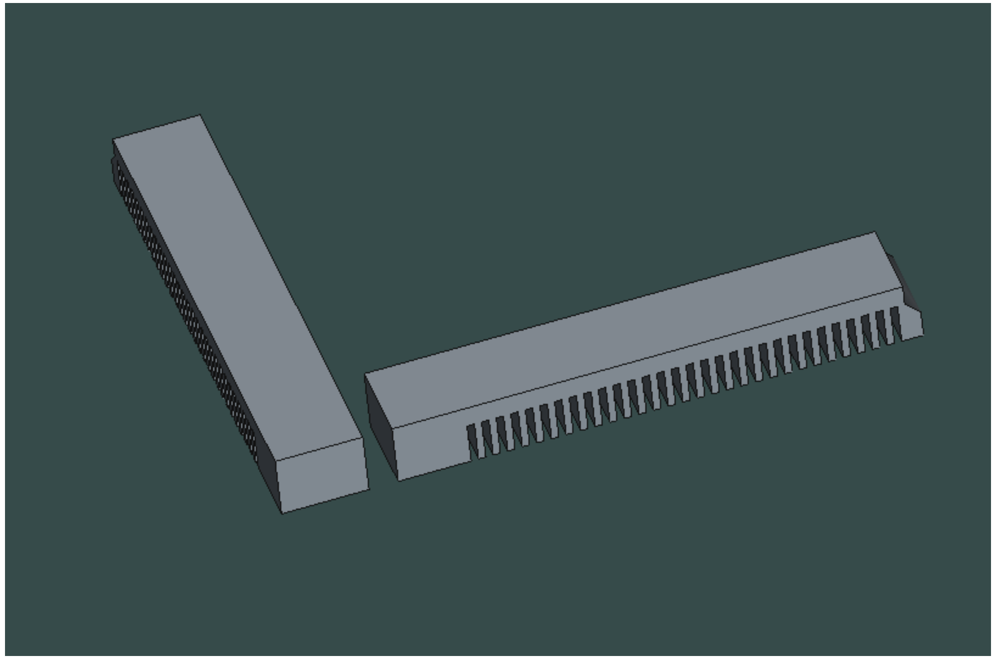
- **All needed material data can be entered using Simufact Material**
- A new page is added which contains the sintering material data
- The 316L powder data was extended and will be shipped with sintering data



Calibration usability improvements

Calibration usability improvements

- **The calibration is important to get the most accurate results for the build simulation**
- The calibration workflow for mechanical simulations in Simufact Additive was improved to simplify the process setup
- **The new default calibration for mechanical processes is defined as uniform orthotropic inherent strains using two cantilevers**



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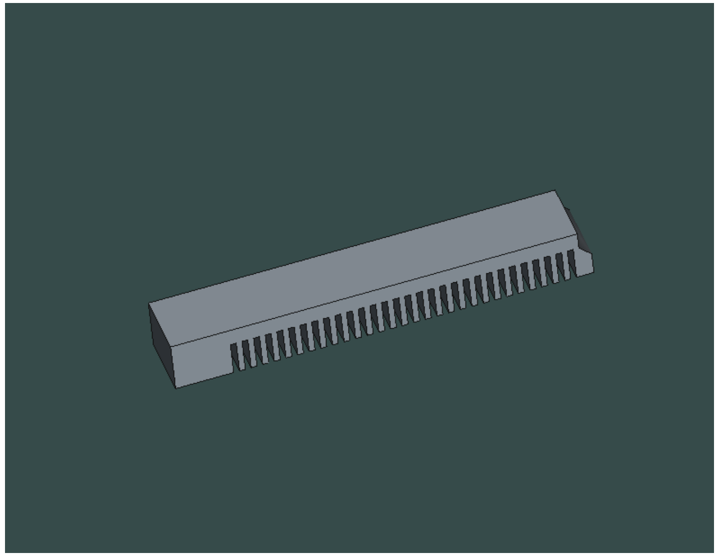
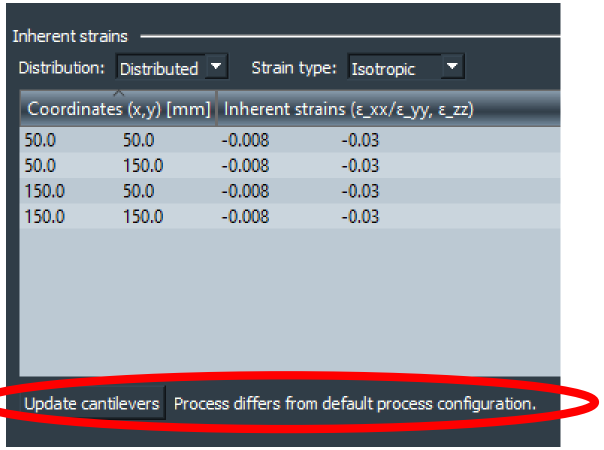
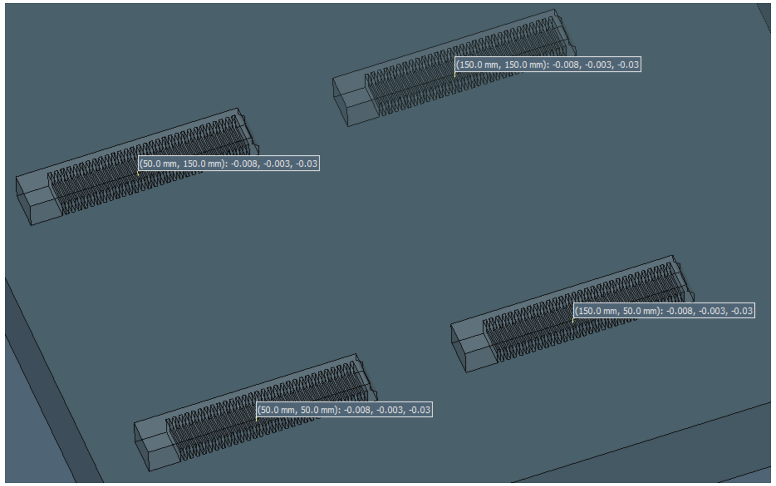
Calibration usability improvements

- **Depending on the strain distribution and strain type, all needed cantilevers will be created automatically by using the “Update cantilevers” button in the build dialog**
- **Cutting stages and measuring points will be adapted as well**

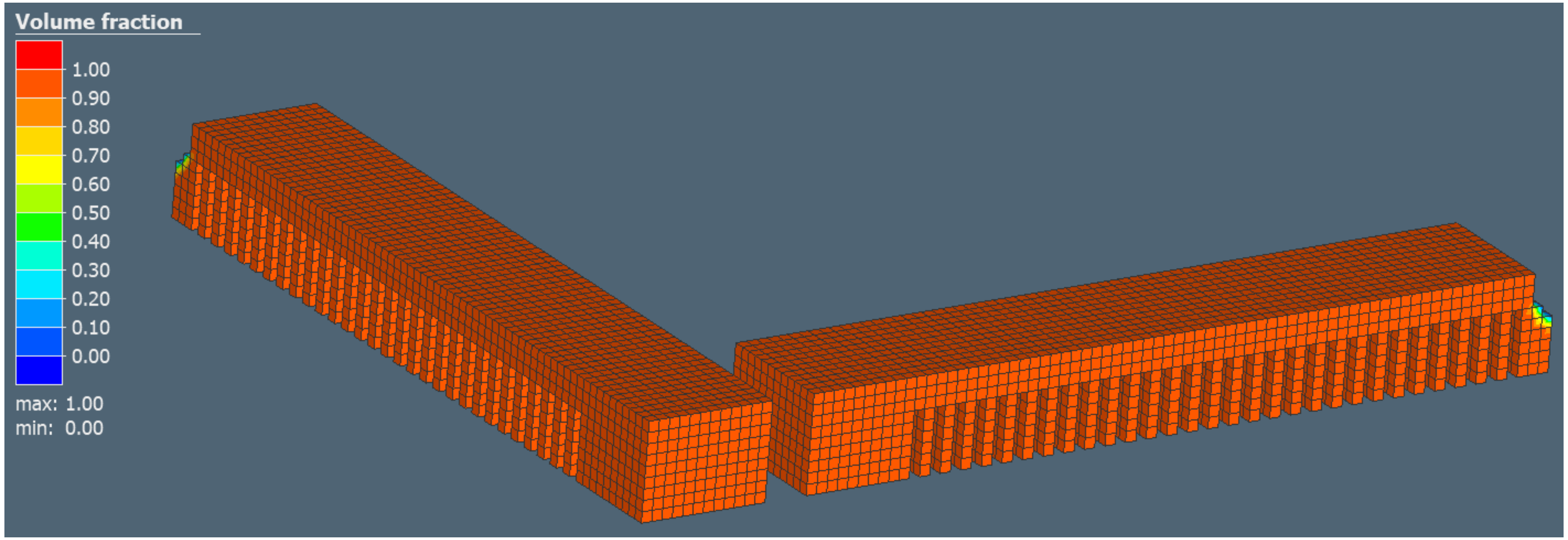






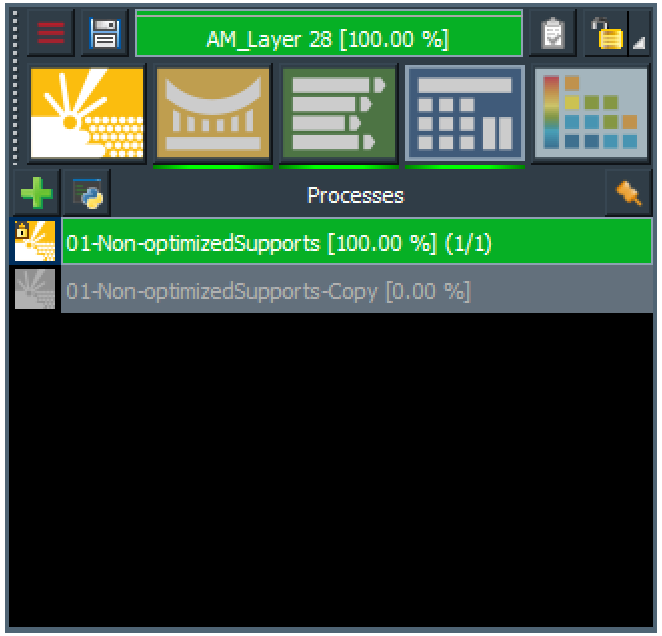
Calibration usability improvements

- **The cantilevers will automatically be positioned in a way that the volume fraction is 100%**
- No need for user interaction to position the cantilevers correctly



Further improvements

Further improvements



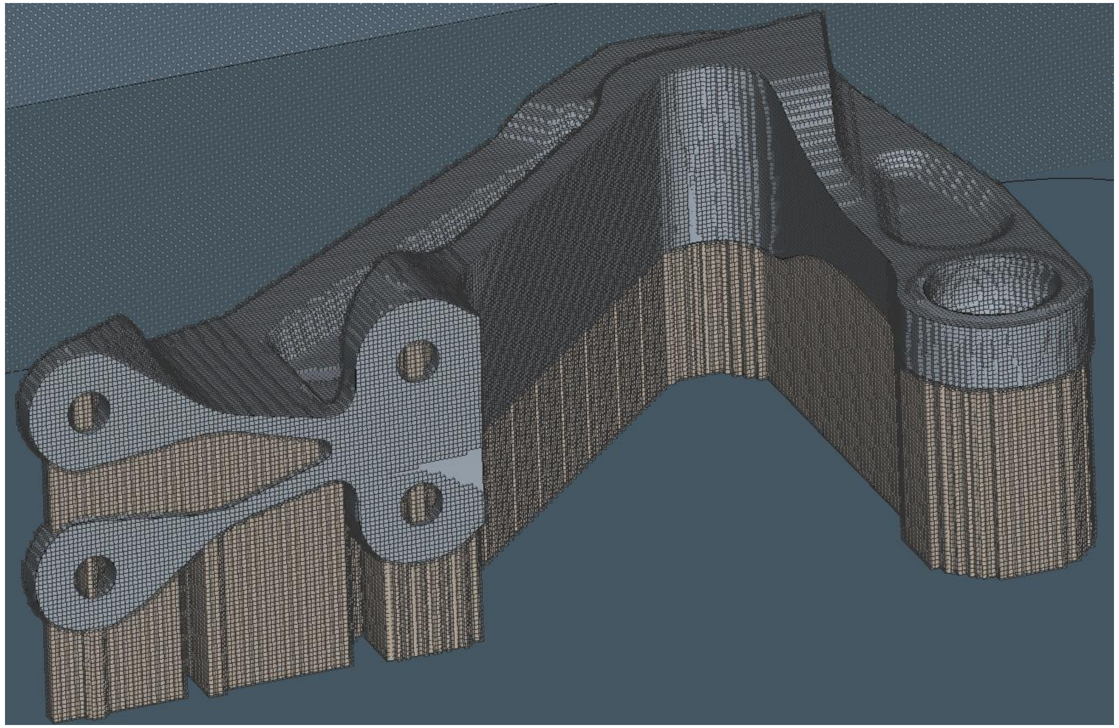
- **Replaced icons in main widget**
- More modern and cleaner look and feel

Further improvements

- **Increased voxel mesher performance by up to factor of 13**
- Performance improvement depends on model size, number of supports etc.

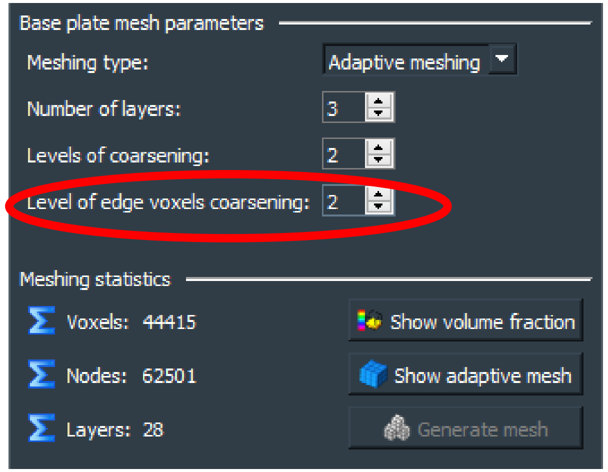
- Example shown on right side:
  - Voxel size: 0.5 mm
  - Meshing time V2020: 460s
  - Meshing time V2020 FP1: 35s

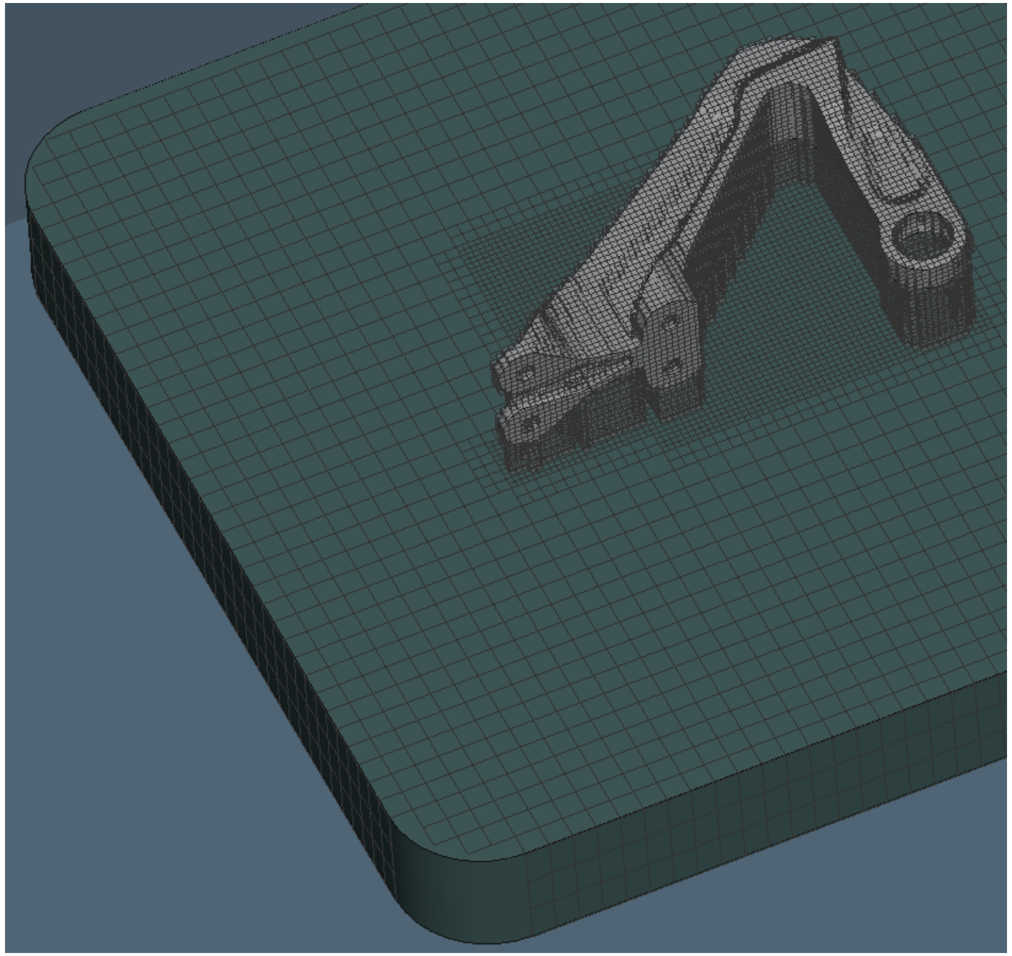
- Also improved error handling during voxel meshing



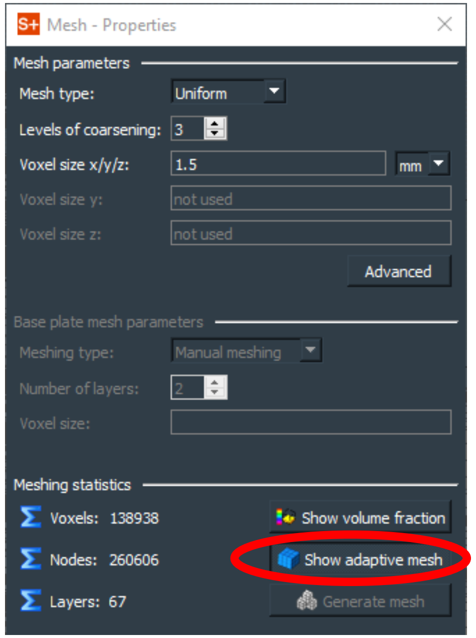
Further improvements

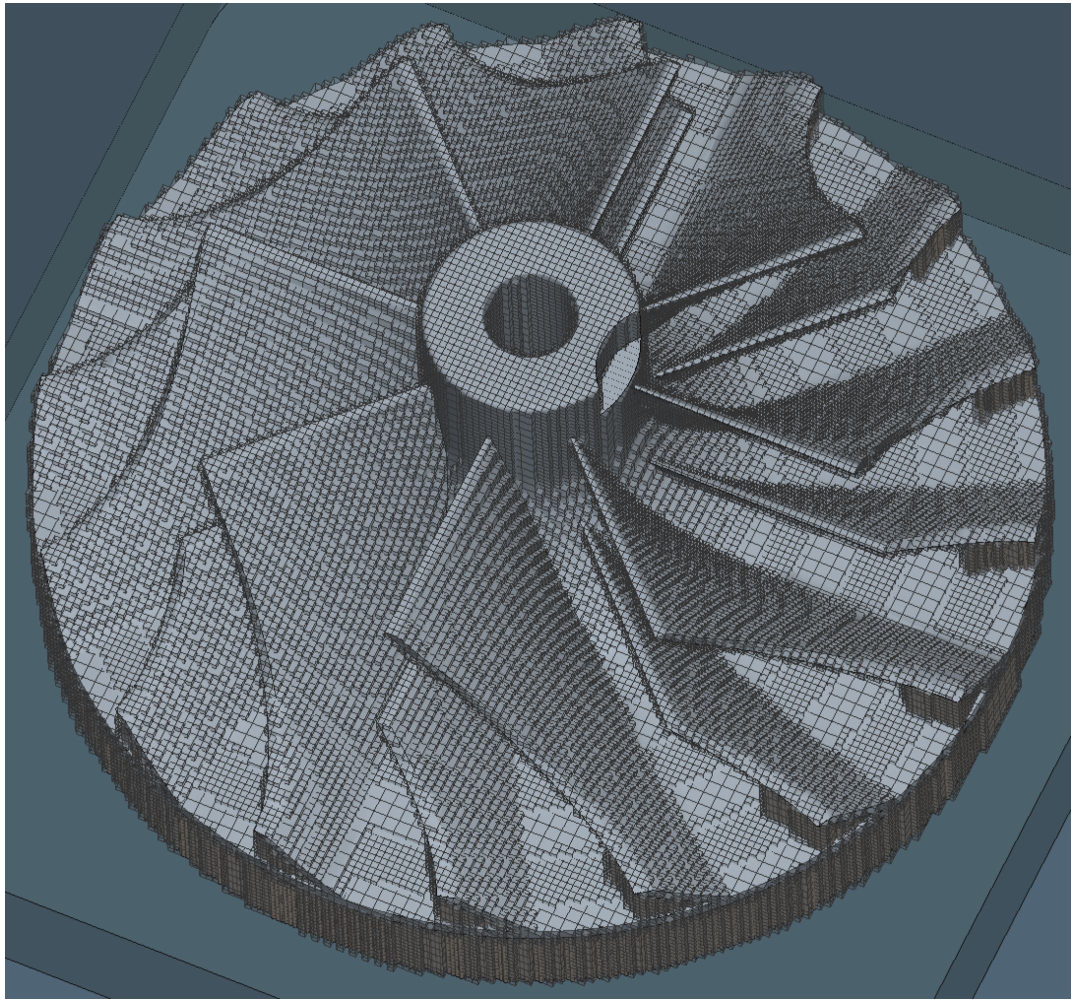
- **More control for adaptive voxel meshing for base plate**
- Elements can be kept coarse at the edges which reduces the element count and thus the simulation time





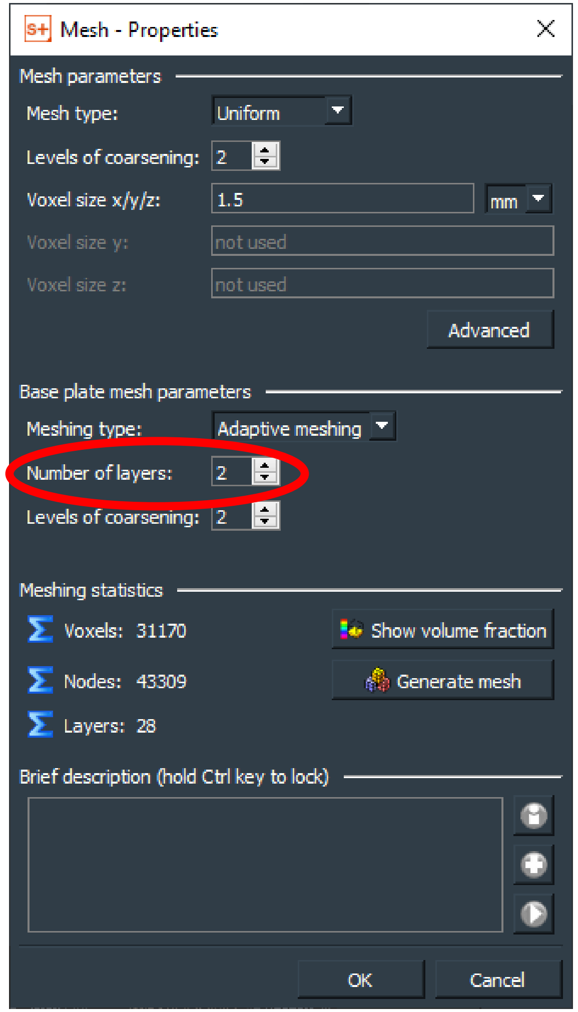
Further improvements





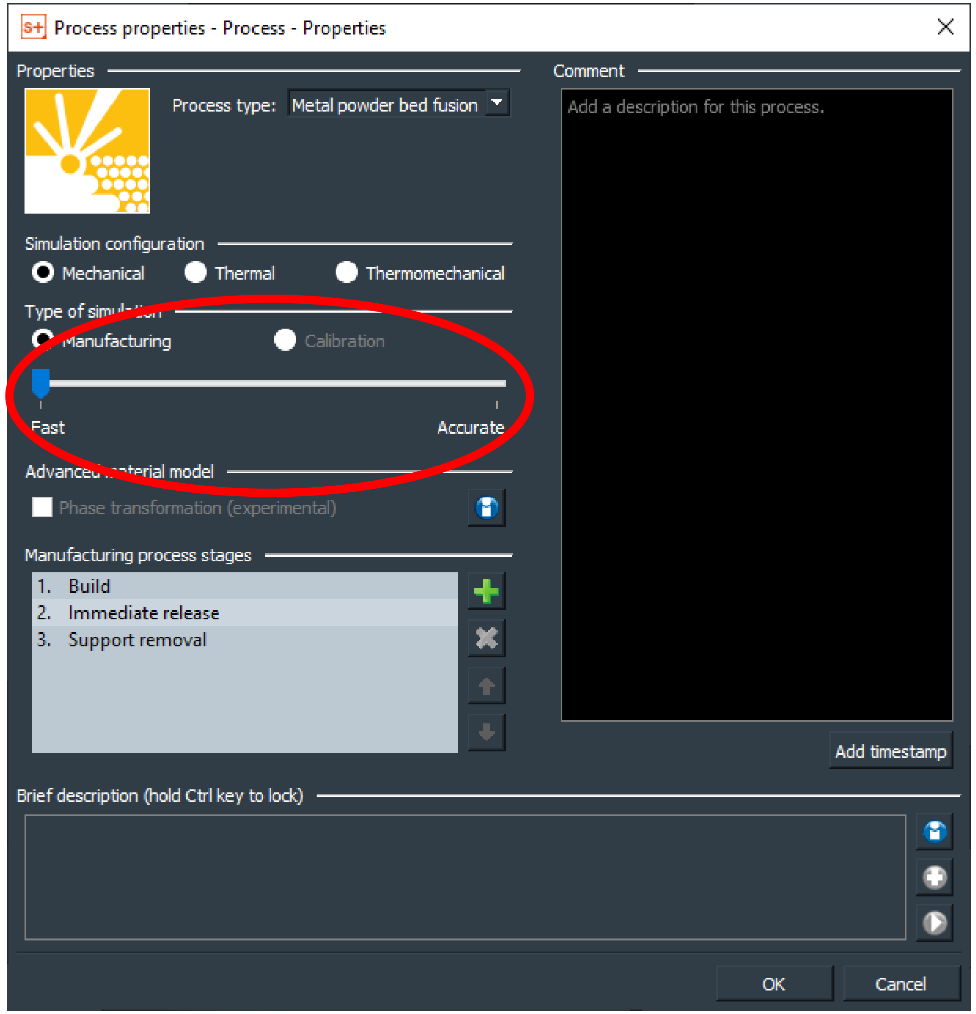
- **Adaptive voxel mesh can be shown as a preview in the meshing dialog**
- Allows to check the resulting mesh used in the simulation

Further improvements



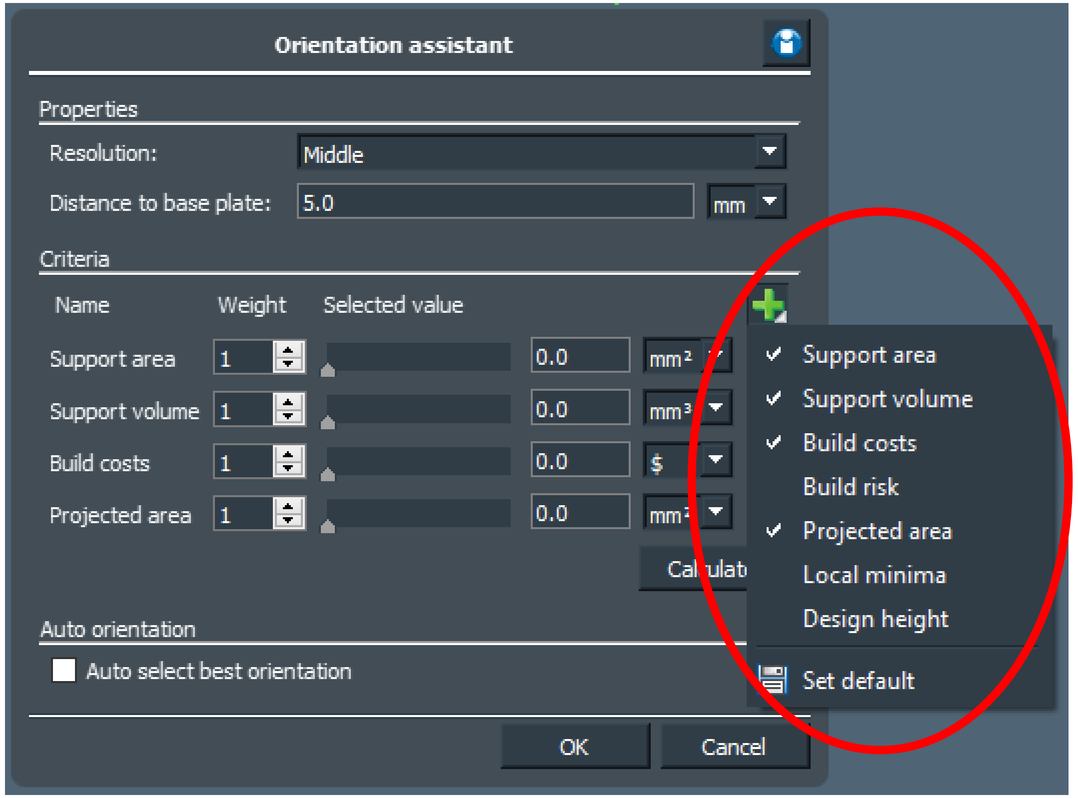
- **Number of layers for base plate voxel mesh cannot be smaller than two**
- Allows to capture the bending behavior correctly with a minimum amount of elements

Further improvements



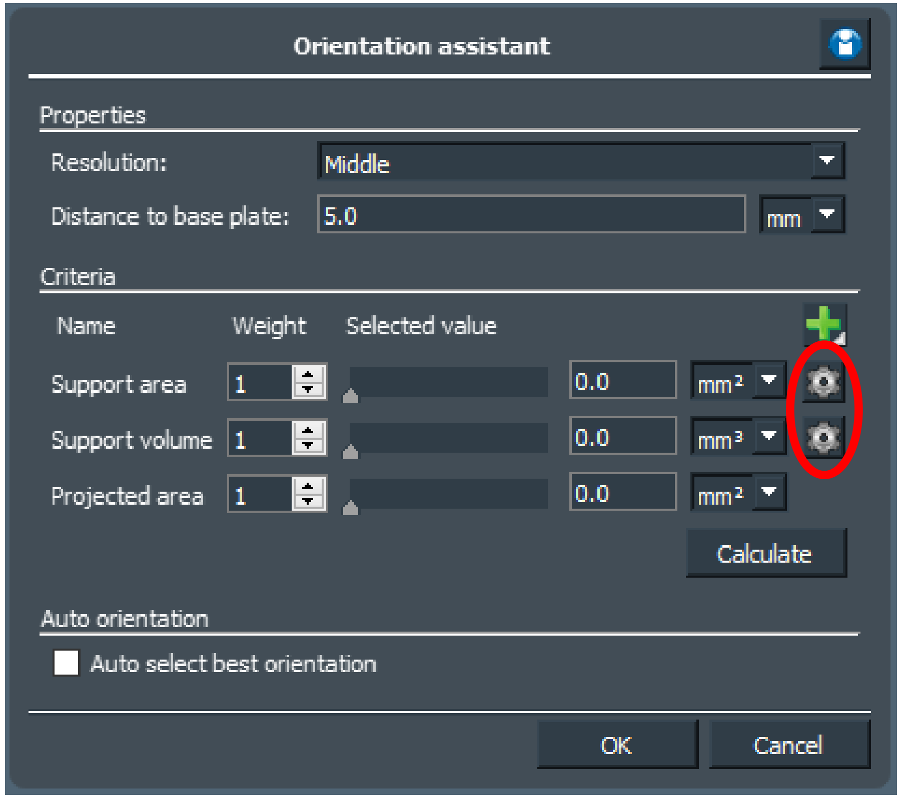
- **Fast mode for mechanical manufacturing simulation saves up to 40% simulation time**
- Can be used to get a fast distortion tendency
- Stresses can not be evaluated

Further improvements



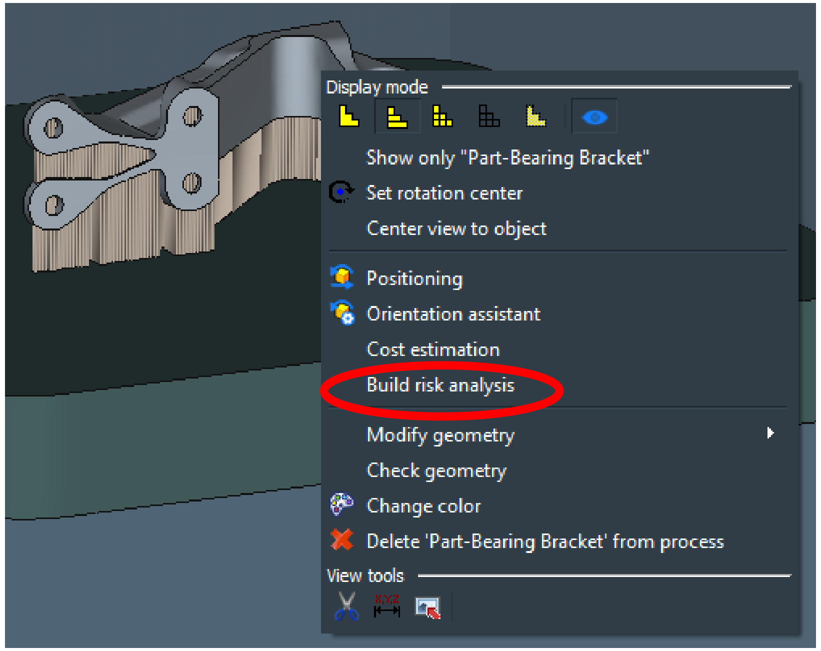
- **Configurable orientation assistant**
- Criteria can be added or removed
- Default set of criteria can be saved

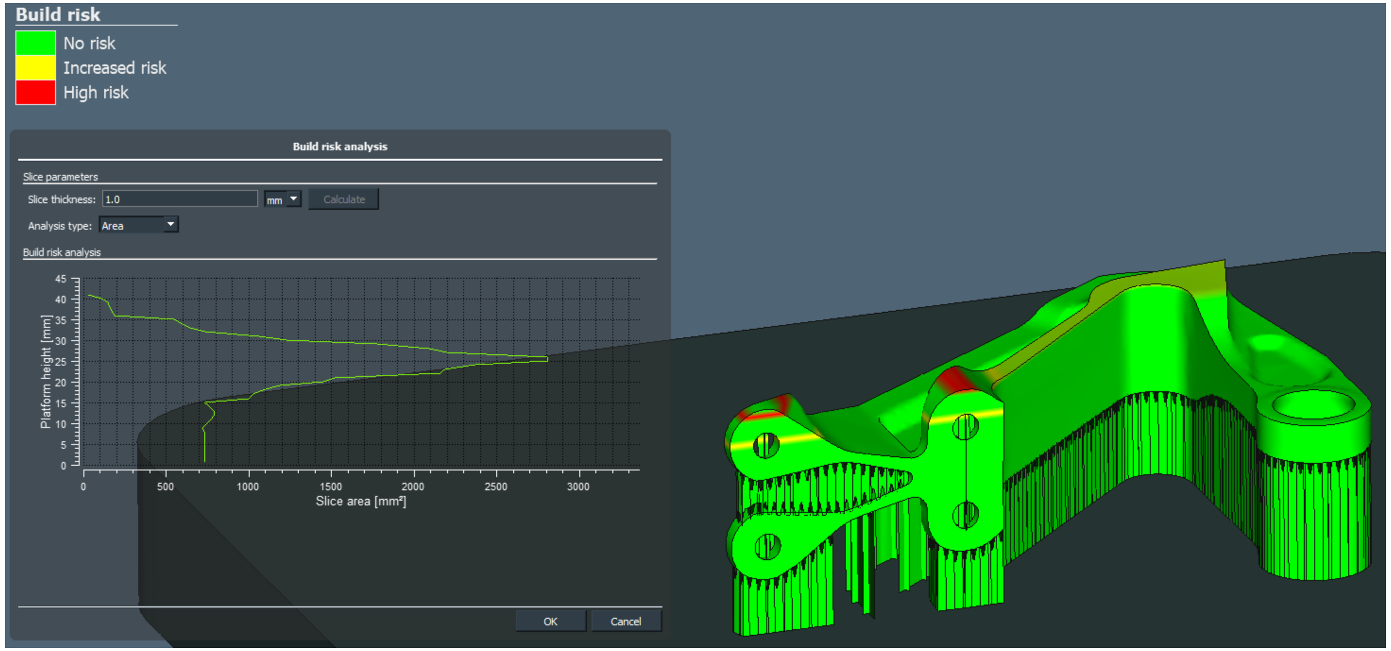
Further improvements



- **Parameter configuration for each criterion can be done directly**
- Clean and easy usage for each criterion and their parameters

Further improvements





- **Build risk analysis allows to identify the build risk of layers based on geometry and orientation**
- The higher the area change from layer to layer the higher is the risk of issues during build process
- Such risks can be recoater contact, shrink lines etc.

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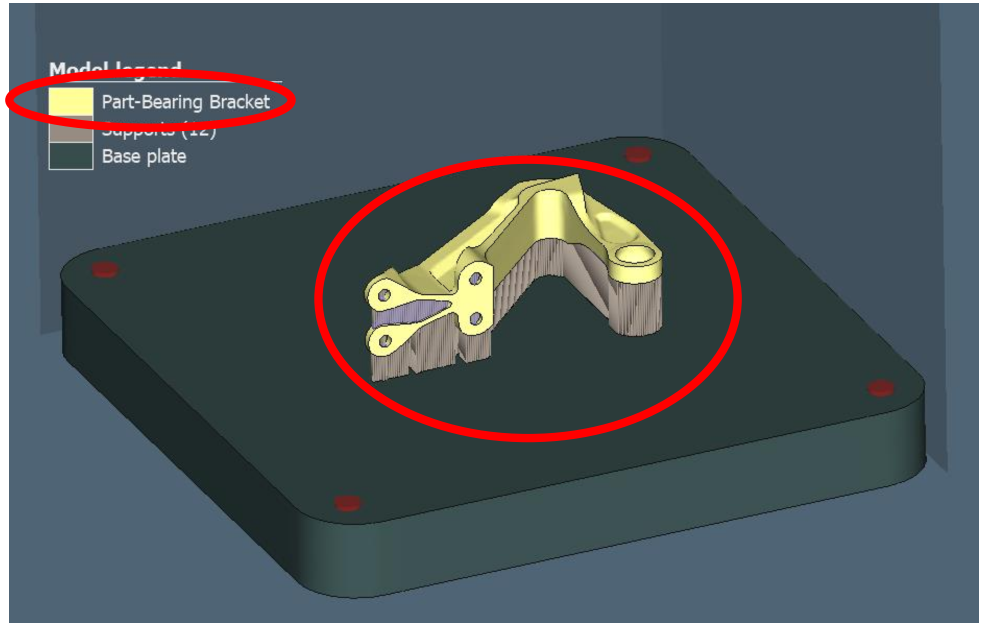
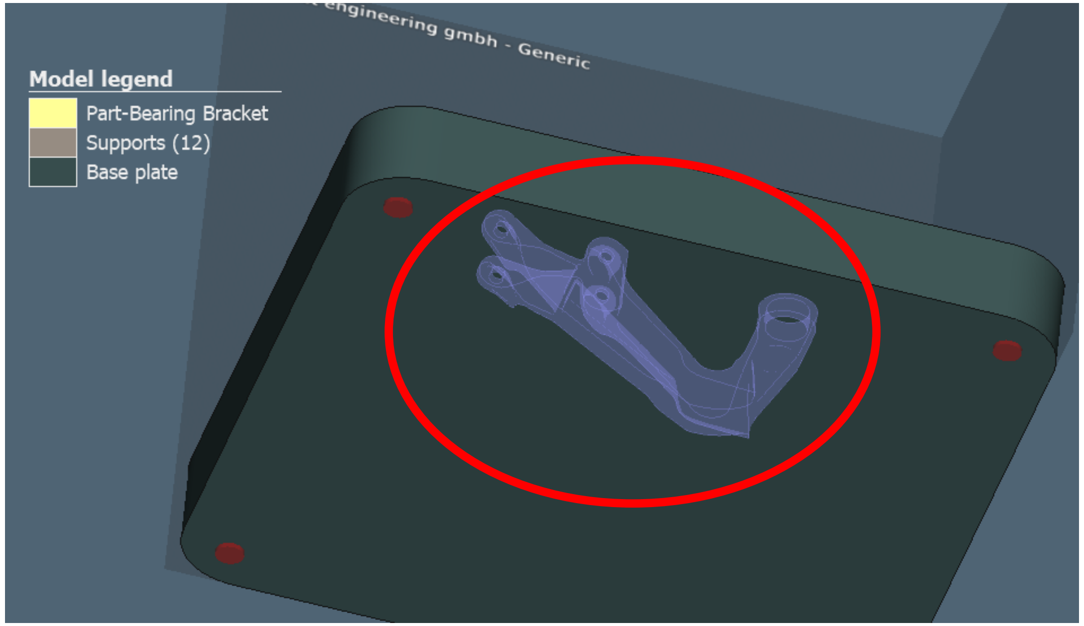
Further improvements

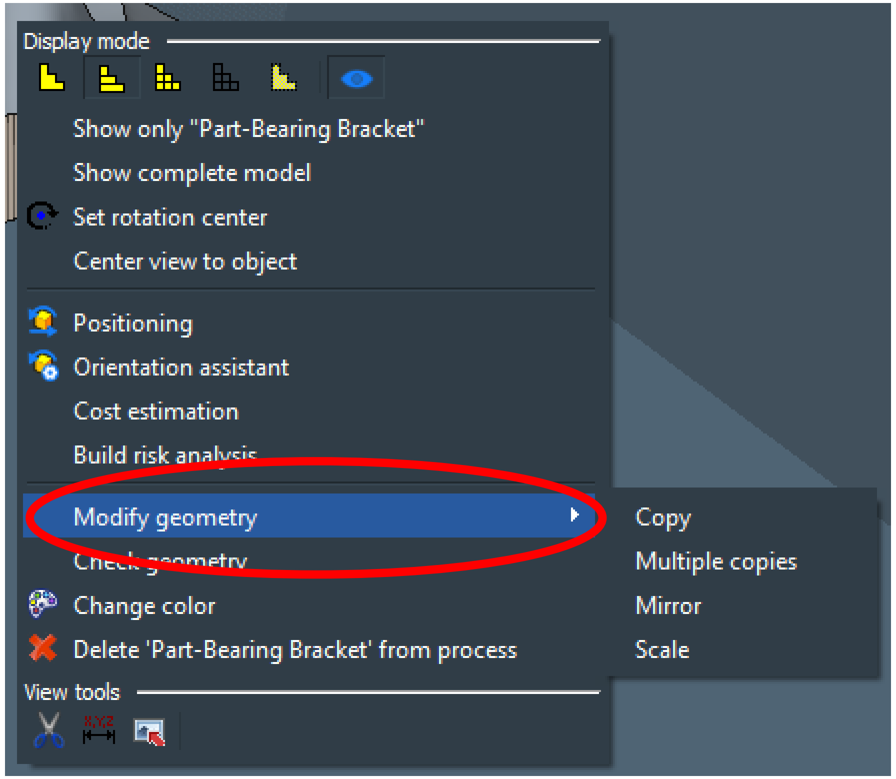




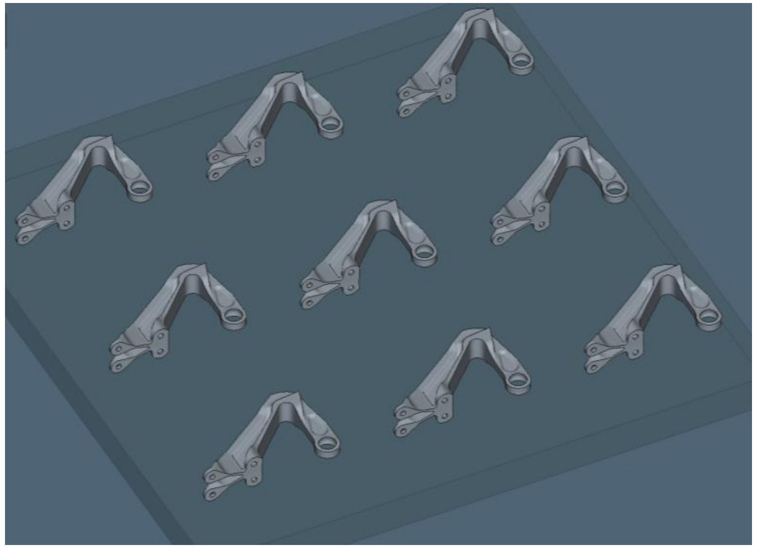
- **Visual feedback by highlighting the selected geometry in the view**
- Geometries also highlighted if hidden behind other geometry
- Geometries can be highlighted by clicking with the left mouse button in the view

Further improvements

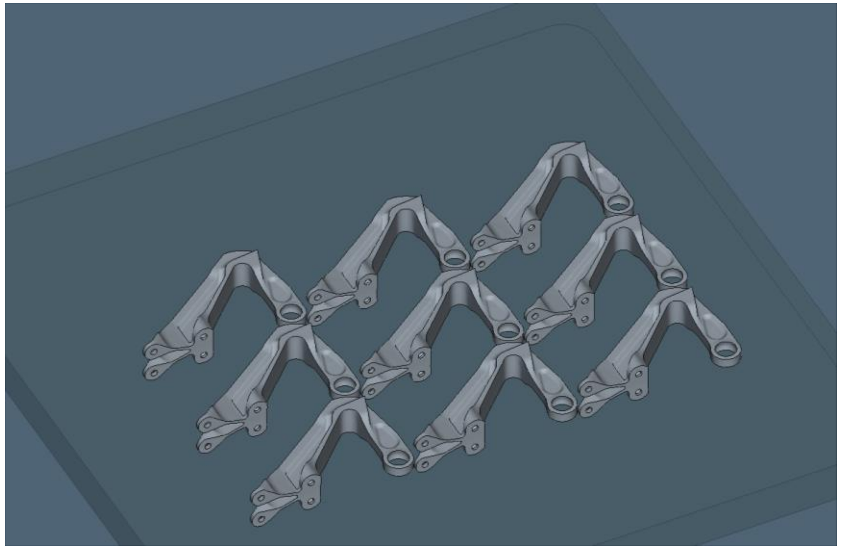
- **Add advanced geometry modification options**
- Allows faster and easier process setup



Further improvements



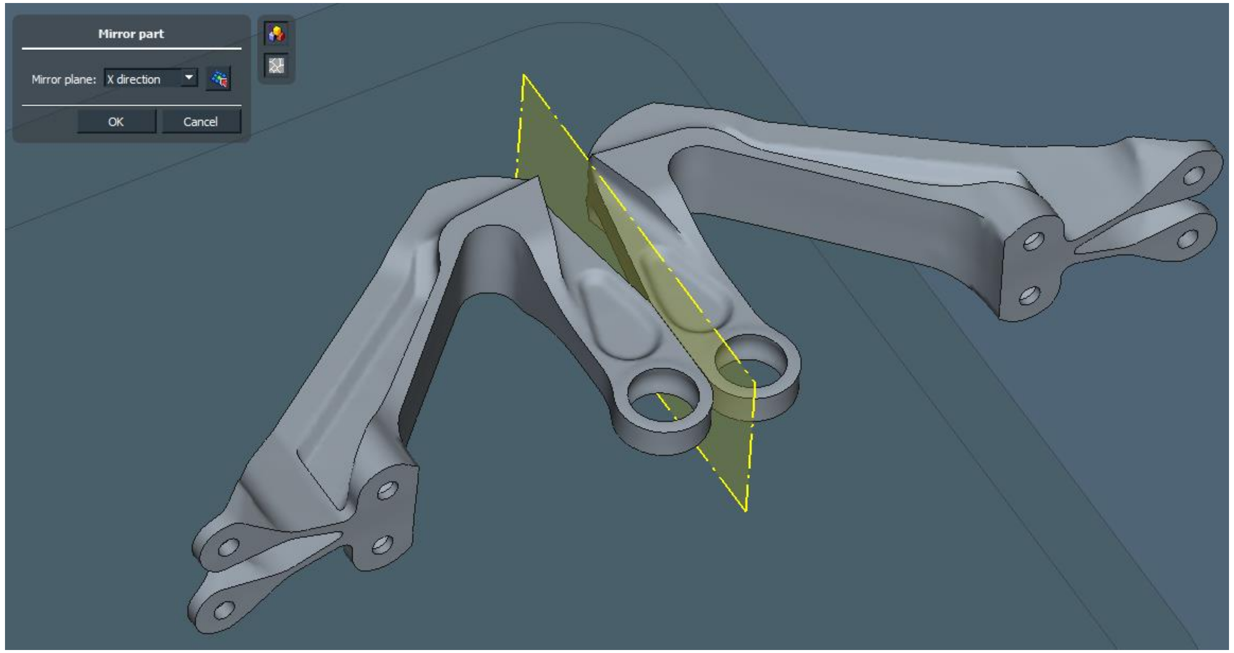
Automatic



Manual

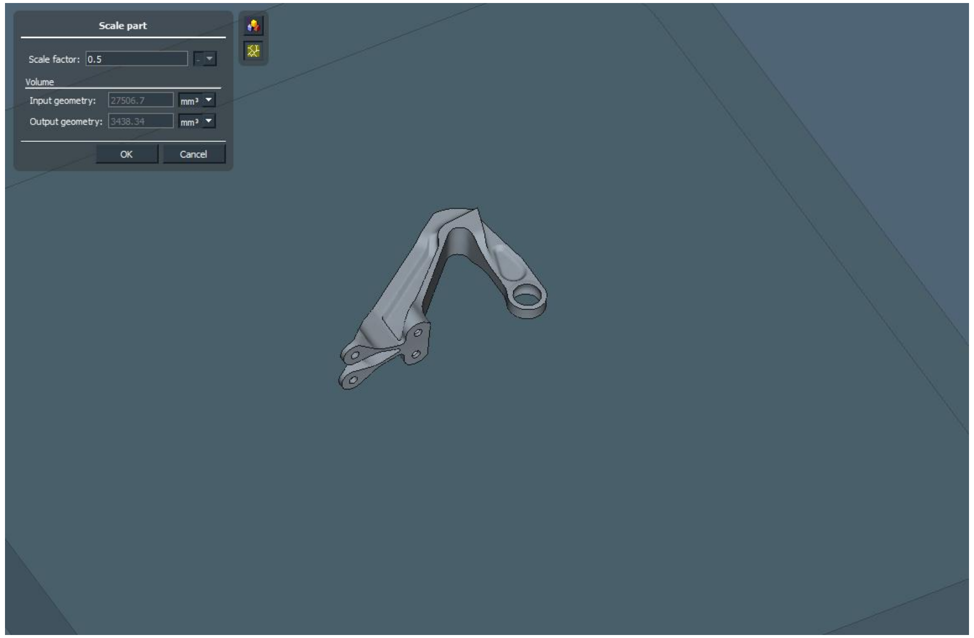
- **Multiple copies allow to set up an array of parts easy and fast**
- Automatic mode uses base plate dimension to position each part
- Manual mode allows to enter the distance between two parts
- Supports will automatically be copied

Further improvements



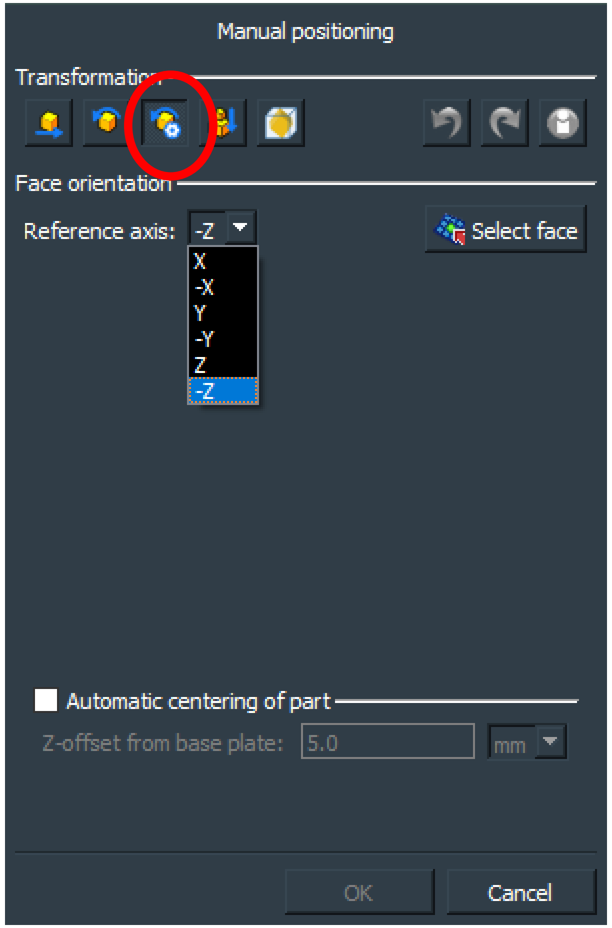
- **Mirror a part using the global coordinate planes**
- Part can also be mirrored using user-defined planes by picking a facet on a geometry
- Supports will not be mirrored automatically

Further improvements



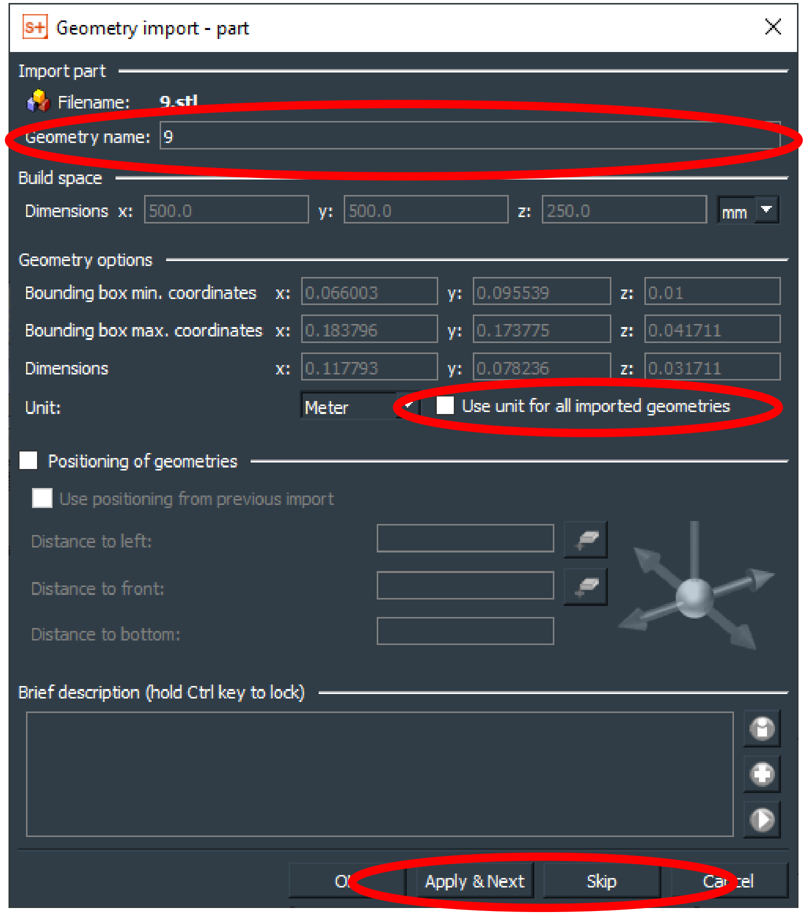
- **Scaling can be used to reduce or enlarge the dimensions of a part**
- Supports will not automatically be scaled

Further improvements



- **Easier and faster positioning by just picking a facet on the part**
- Part is automatically rotated so that the normal vector of the facet shows in the same direction as the reference axis
- **All geometries in the positioning view can be selected using the shortcut Ctrl+A**

Further improvements



- **Improved workflow for import of multiple parts**
- Edit part name during import
- Use unit for all geometries during import
- Skip parts, import parts separately, import all parts with the same settings

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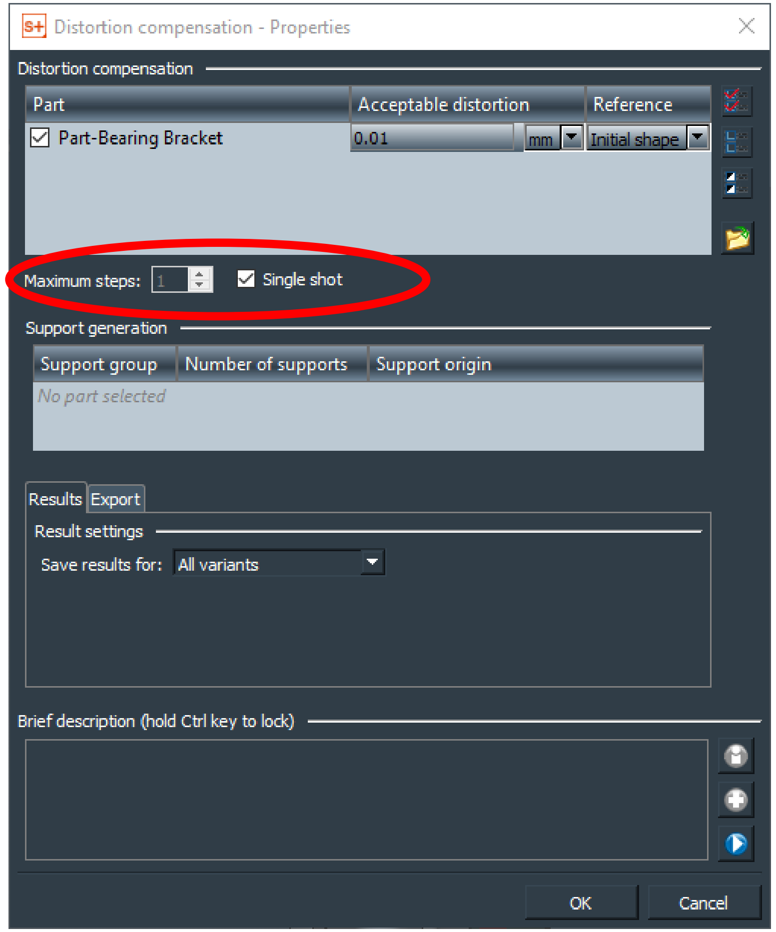
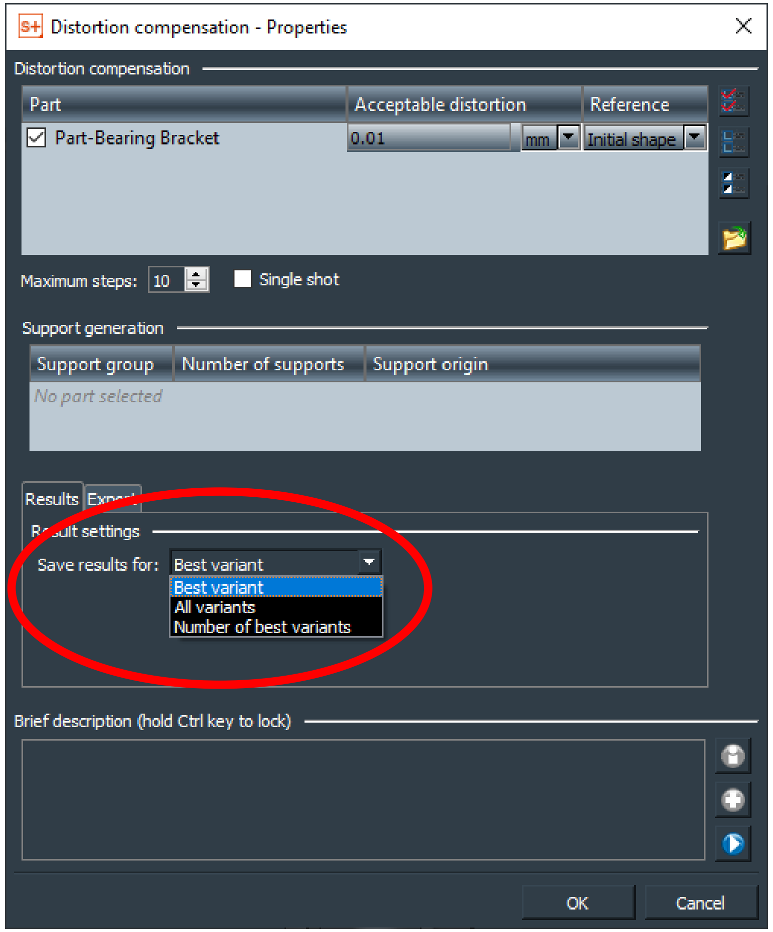
Further improvements



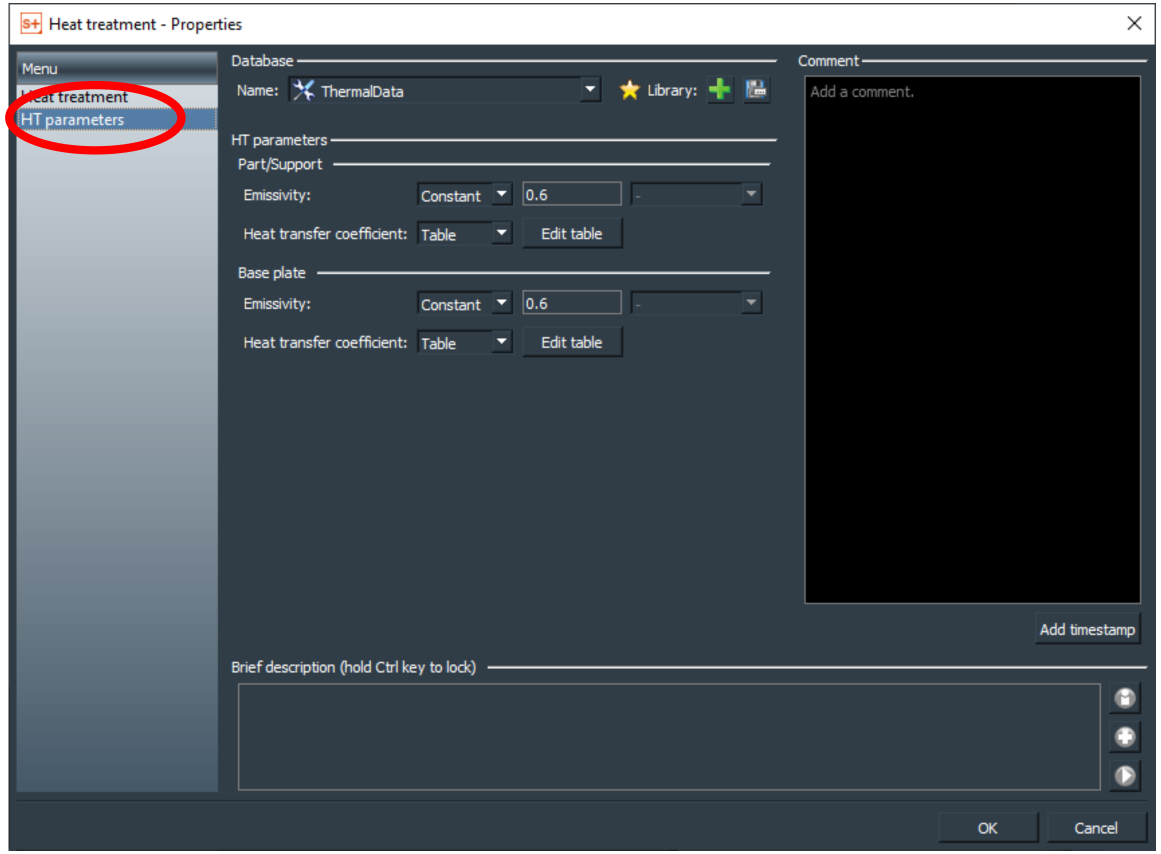
- **Single shot distortion compensation performs only a single iteration**
- Faster results of distortion compensation but not as accurate as when performing the iterative procedure

Further improvements



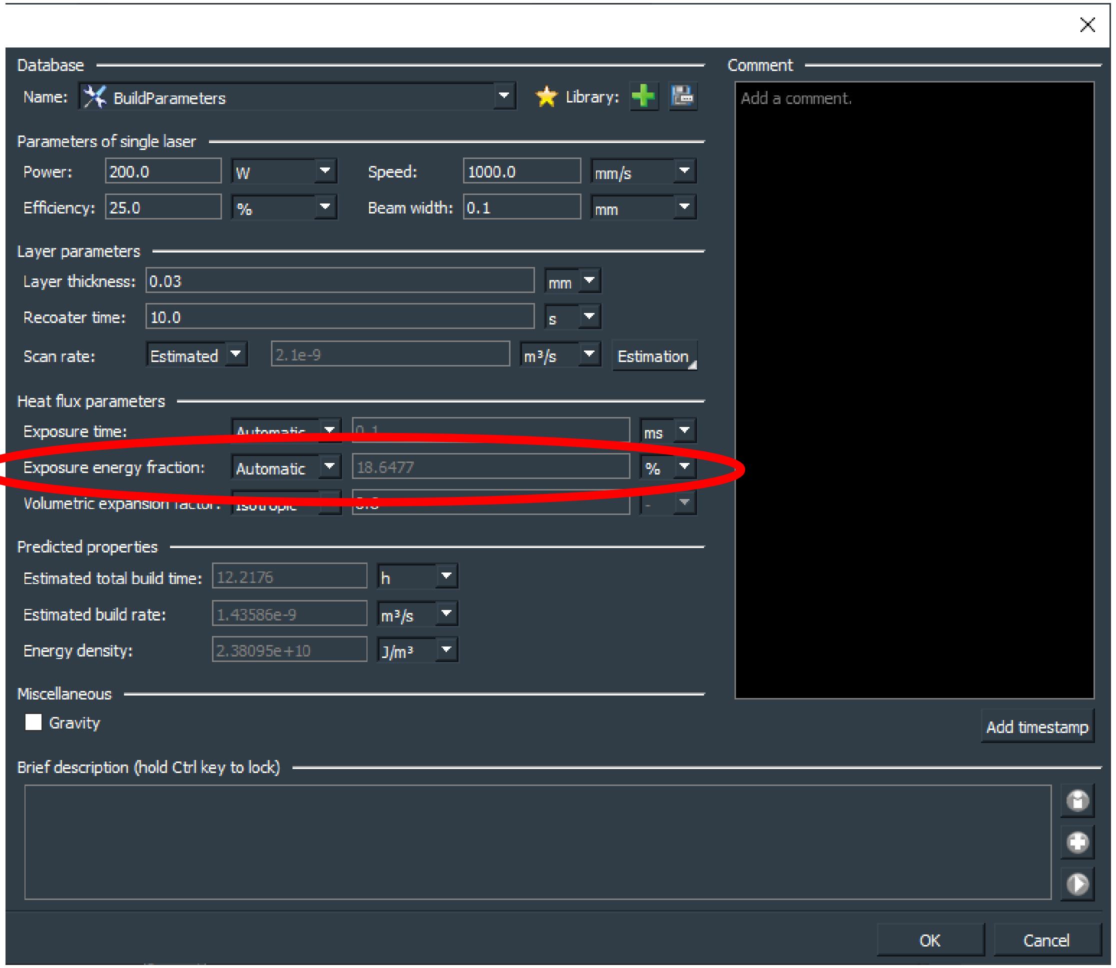
- **Allow to select the result saving strategy for distortion compensation**
- Save only for the best variant
- Save for all variants
- Save for a specific number of best variants

Further improvements



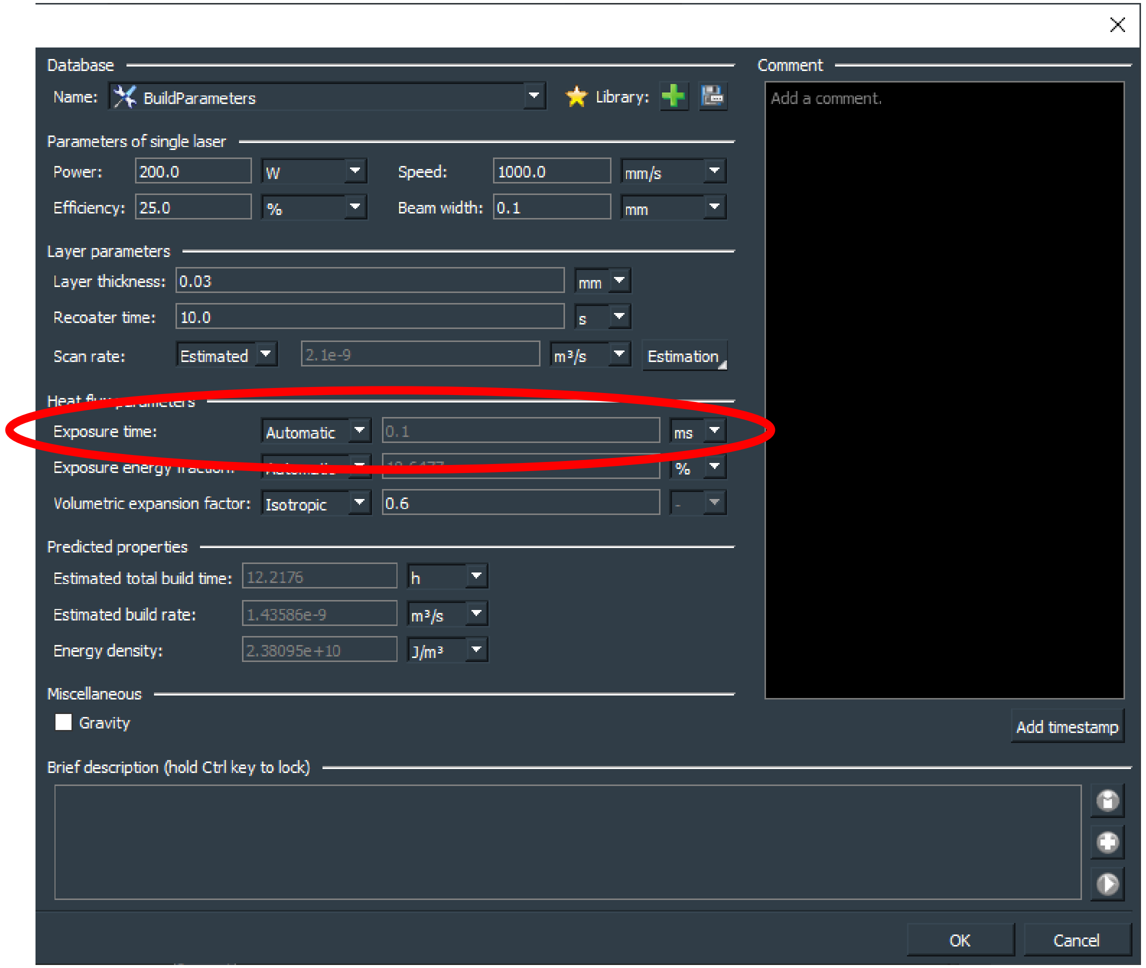
- **Advanced thermal parameters for thermal build, post build, heat treatment and HIP stages**
- Allows to cover the conditions in the build machine more accurately

Further improvements



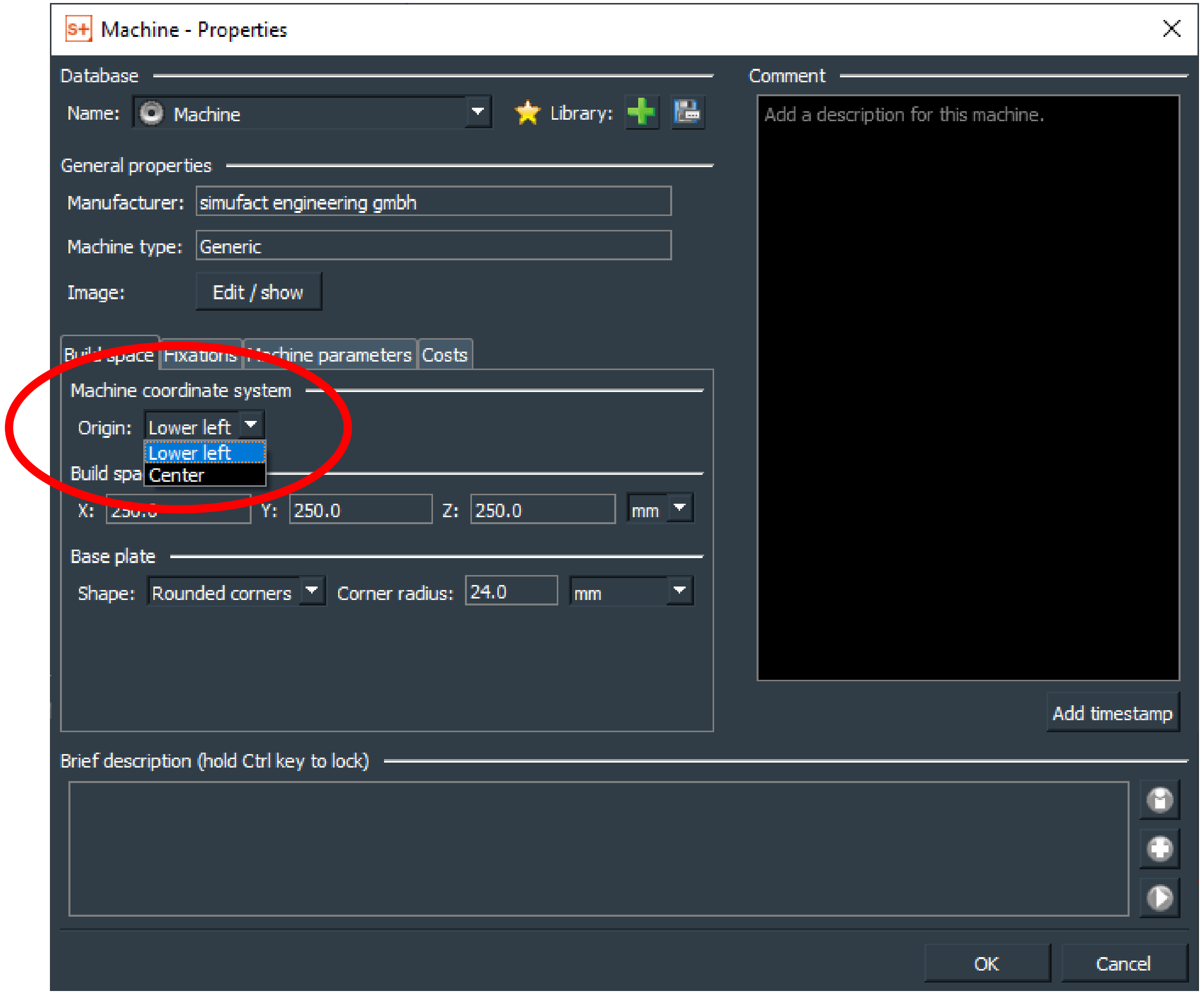
- **Improved calculation of exposure energy fraction automatic mode based on material data**
- More accurate value calculation

Further improvements



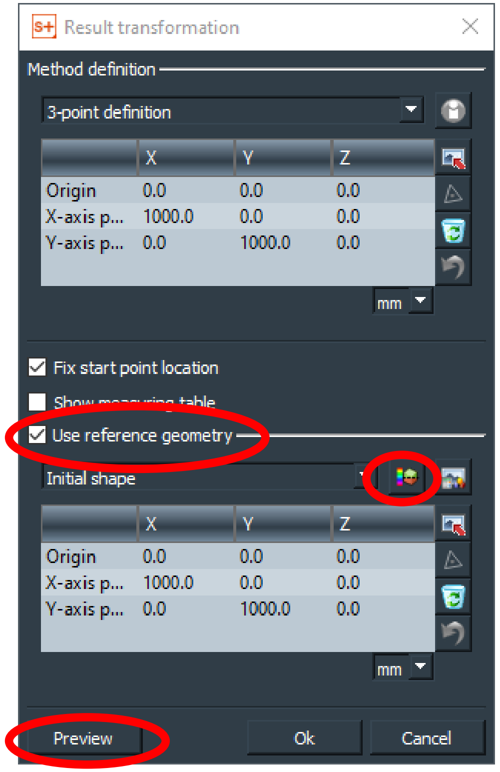
- **New and more suitable default value for automatic exposure time**

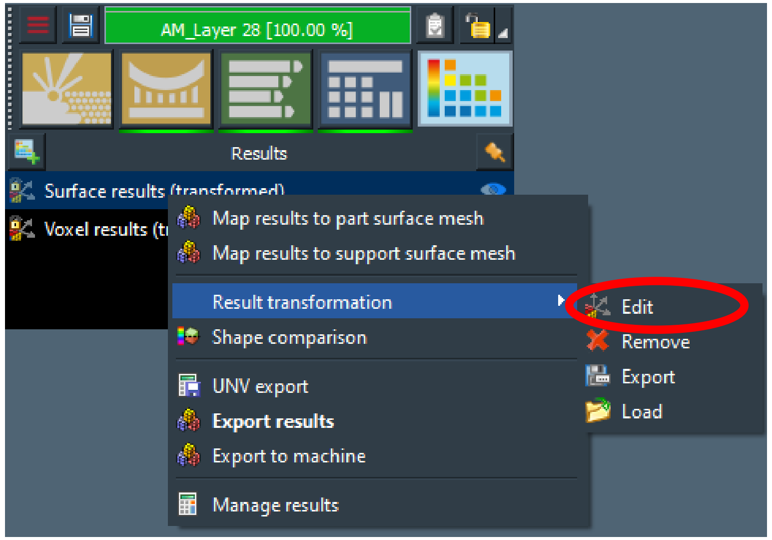
Further improvements



- **Easier machine definition**
- Machine origin can be defined manually
- Previously machine origin was defined at lower left corner of the build space
- Now center of the build space can also be selected
- Base plate is always positioned in the center of the machine

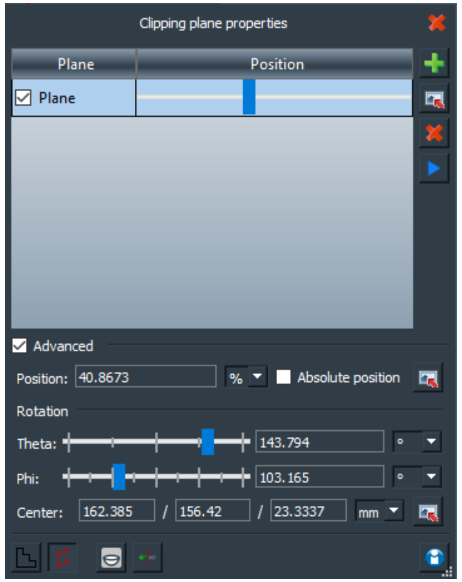
Further improvements

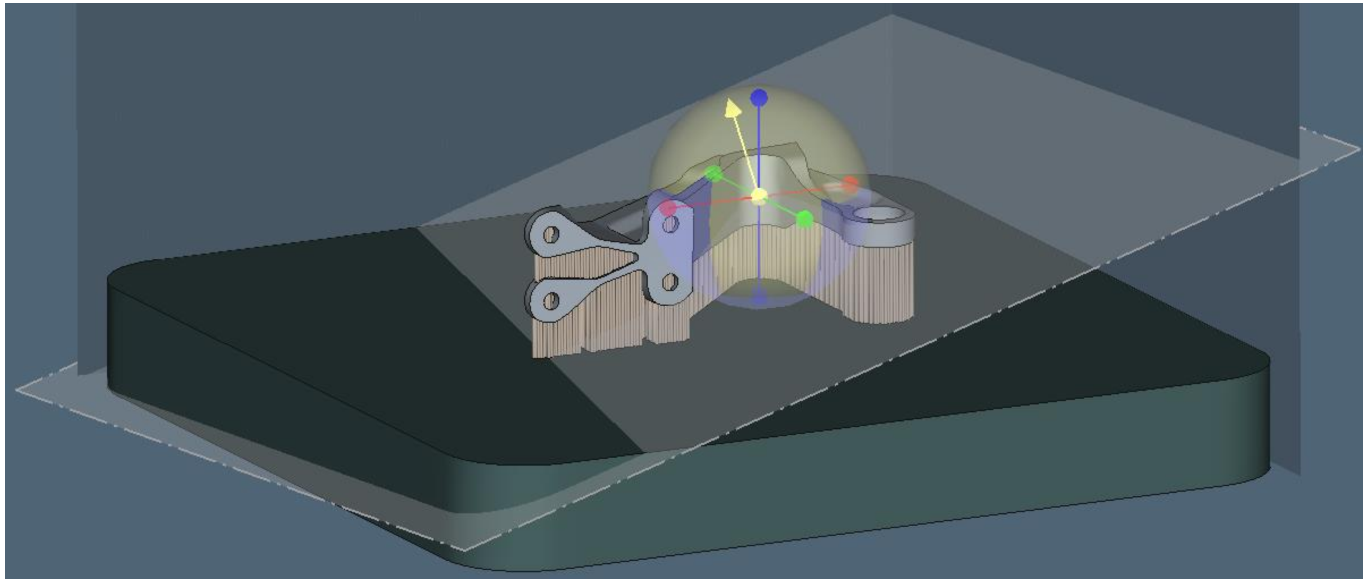




- **Surface deviation can be visualized during result transformation**
- More precise positioning possible by using result transformation methods
- Best fit method can be used for result transformation
- Result transformation can be edited

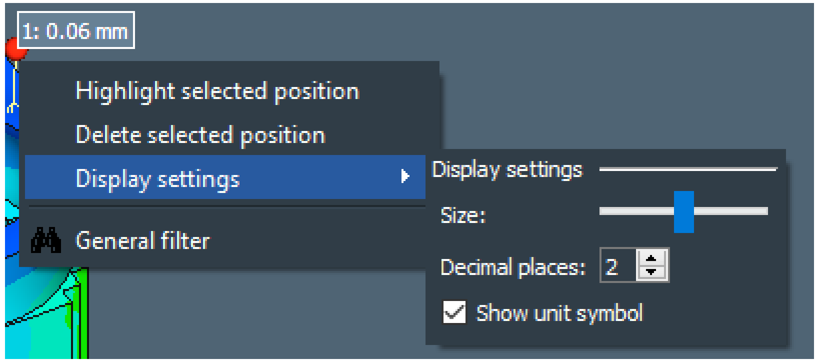
Further improvements

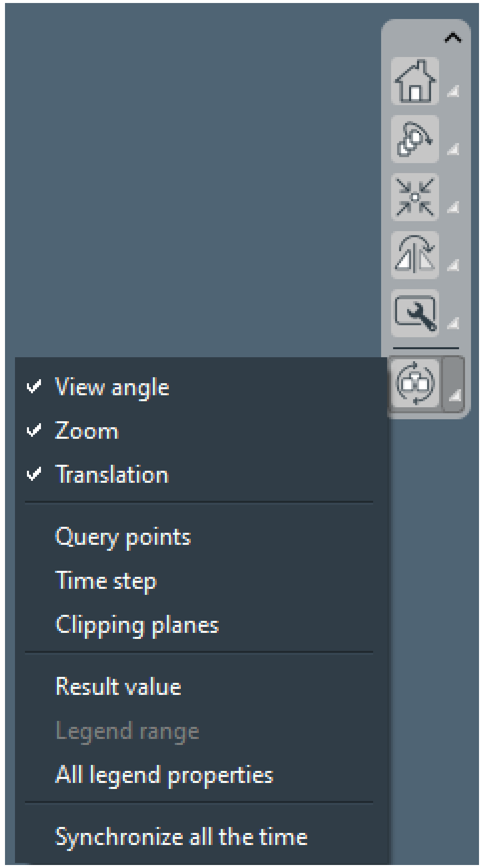




- **Clipping dialog re-designed for more usability**
- Interactive mode for free definition of clipping plane

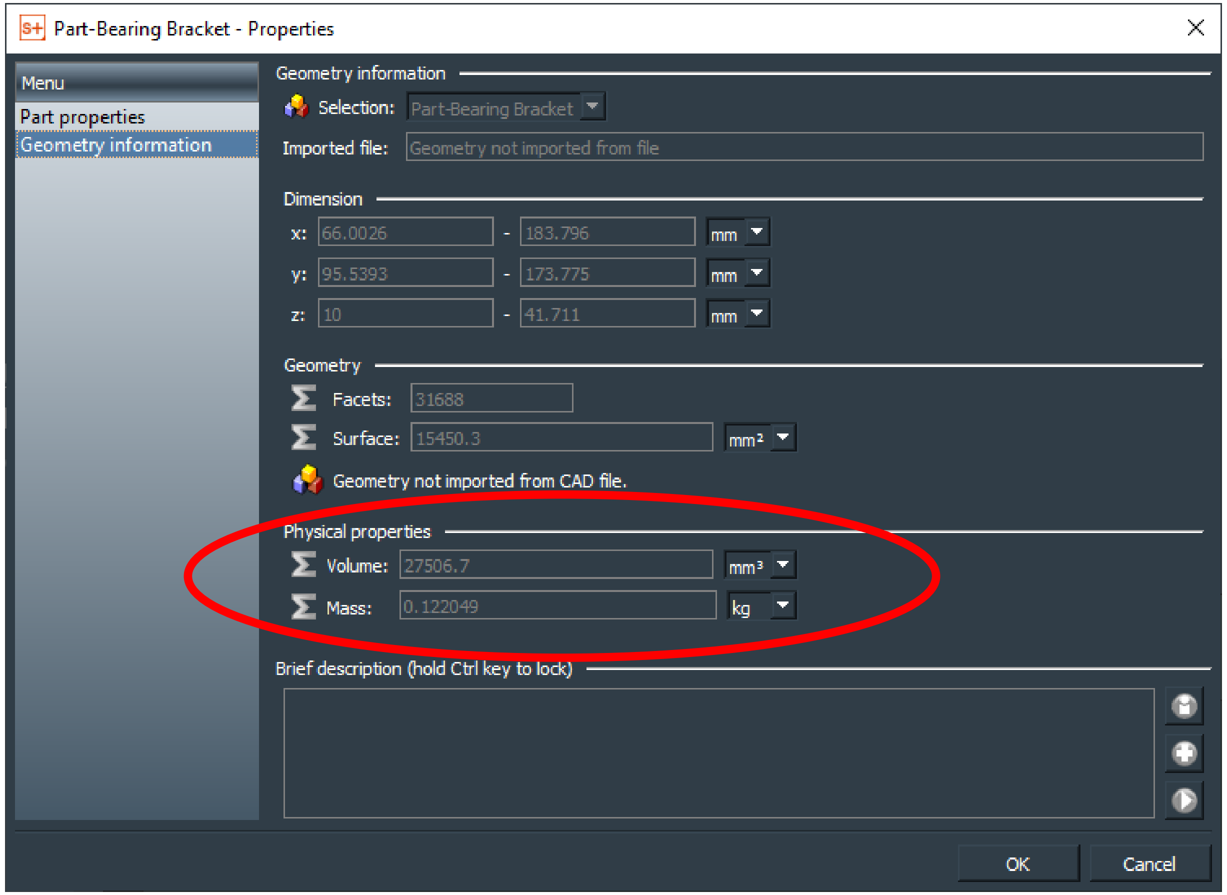
Further improvements





- **Display settings for all query points can be changed in the context menu on the query point**
- **Query points can be synchronized between views so that different processes use the same query point location**

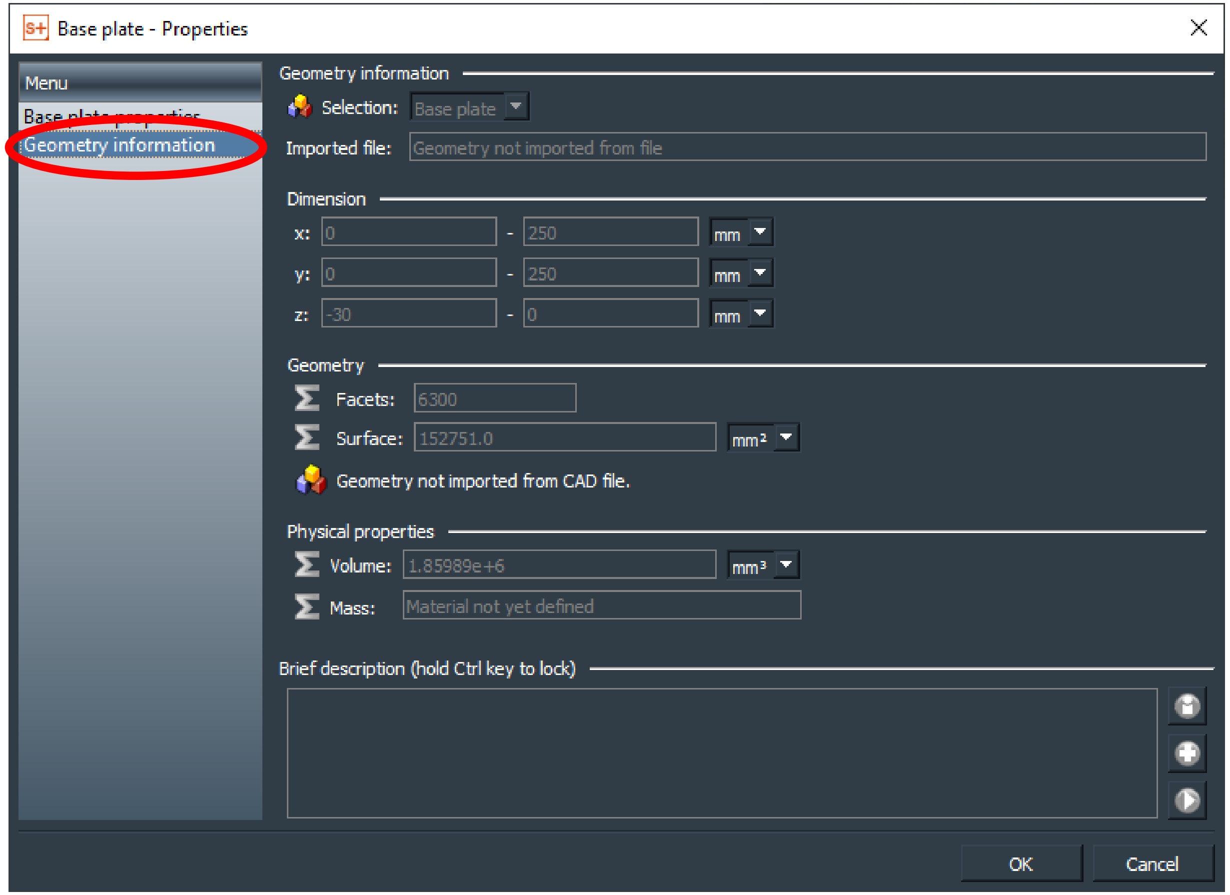
Further improvements



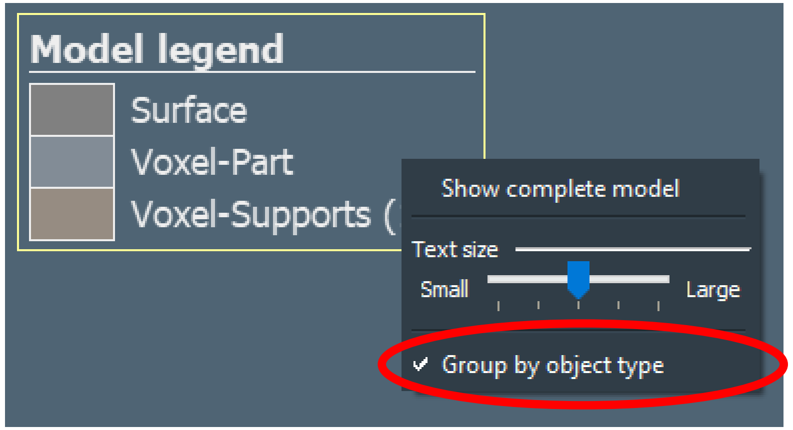
- **Check volume and mass of geometries**
- Mass can only be evaluated if a material is defined

Further improvements

- **Base plate properties now contain geometry information**

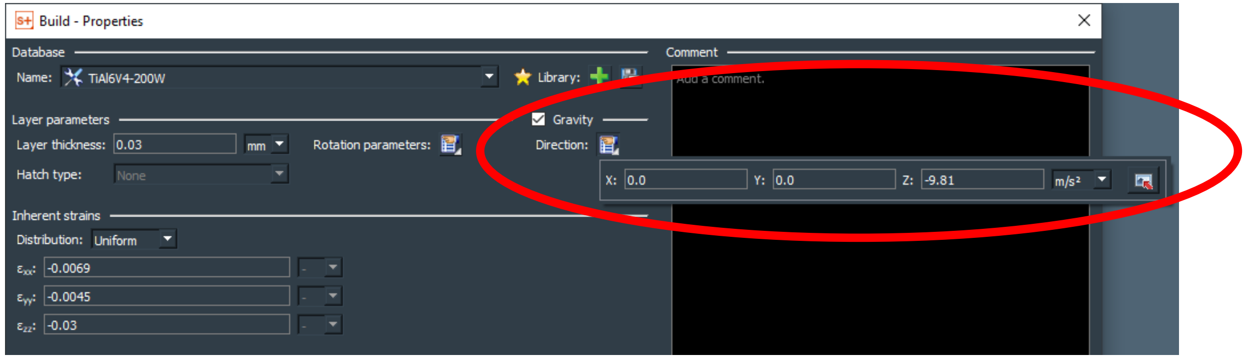


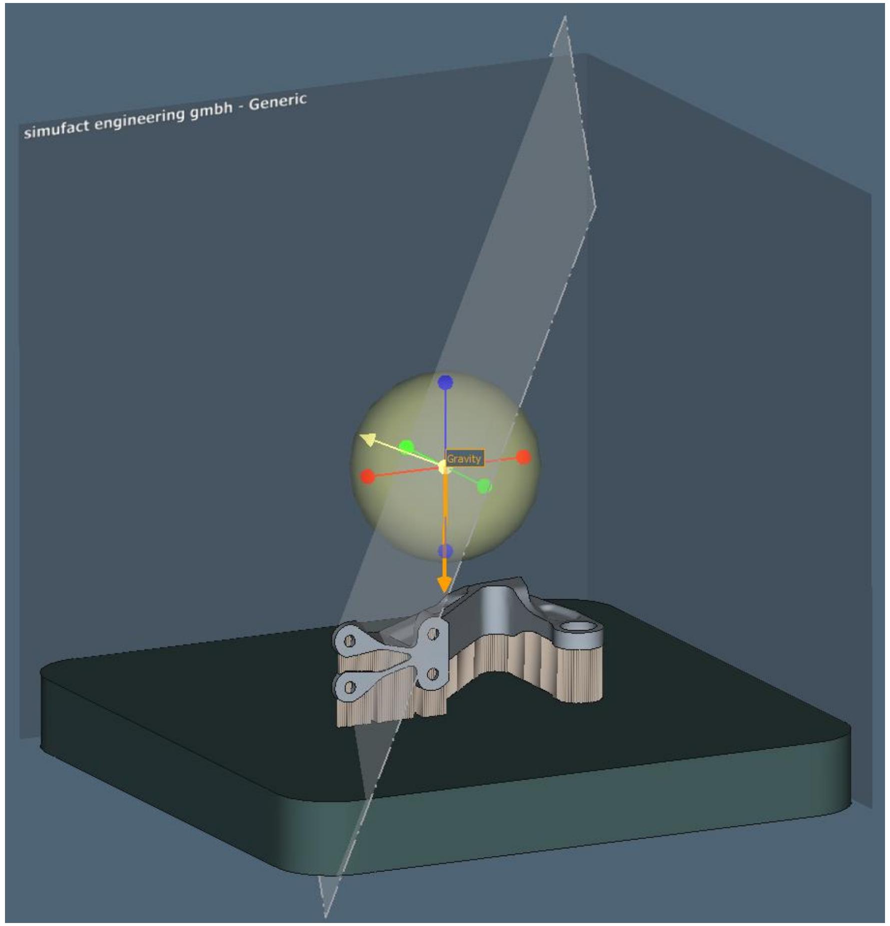
Further improvements



- “Group by object type” is active per default to minimize the amount of information shown in the GUI

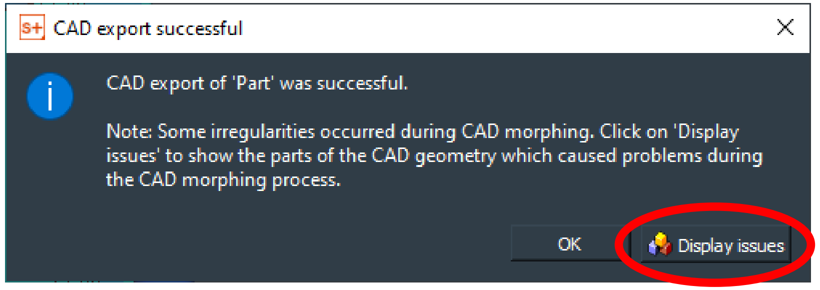
Further improvements

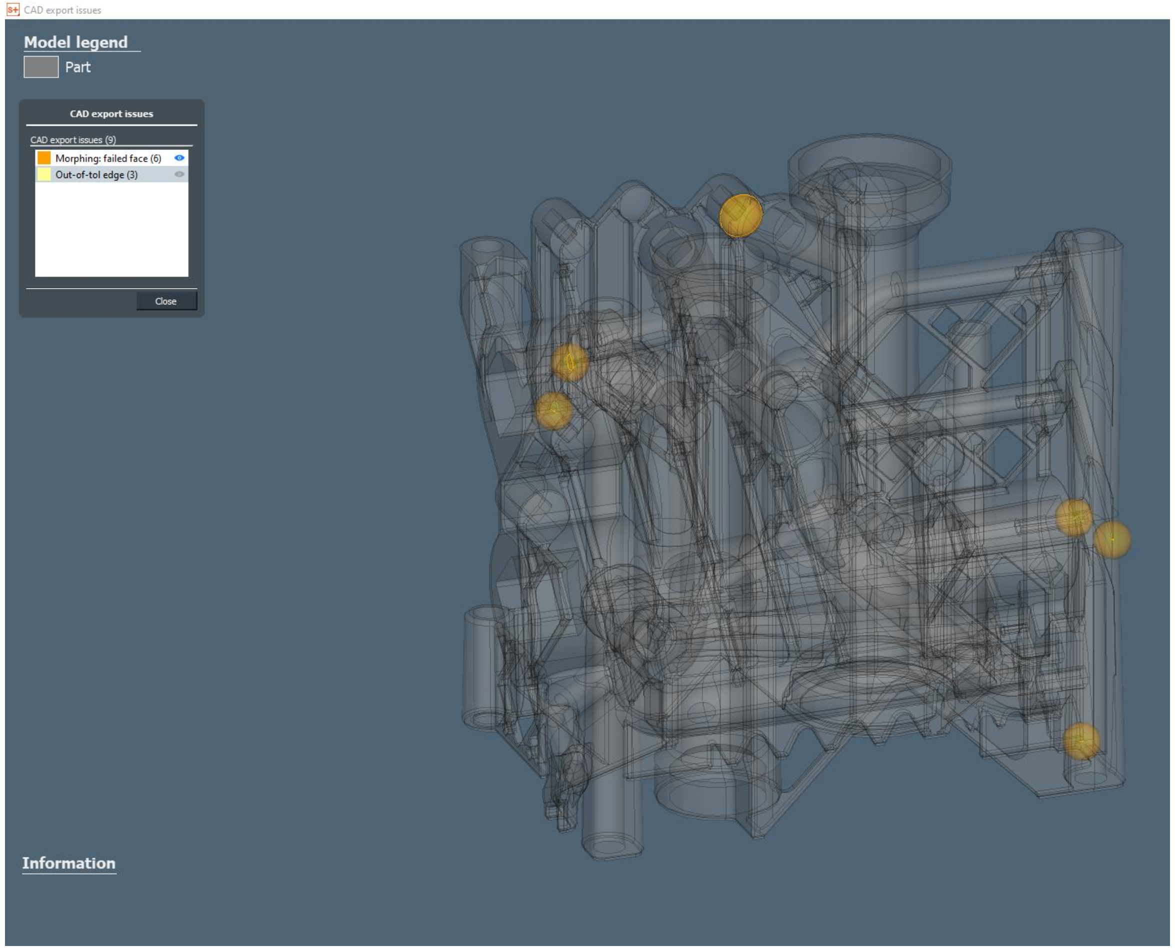




- **Gravity vector can be defined for each stage separately using view interaction**
- More flexible model definition

Further improvements

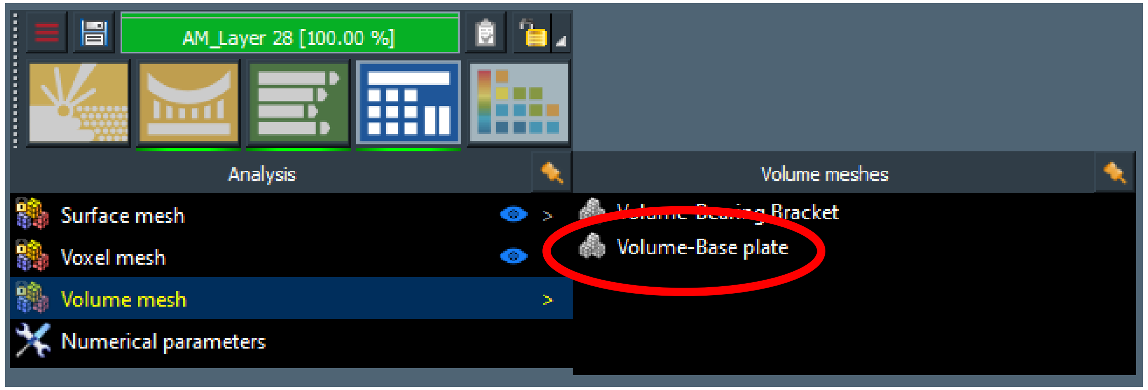




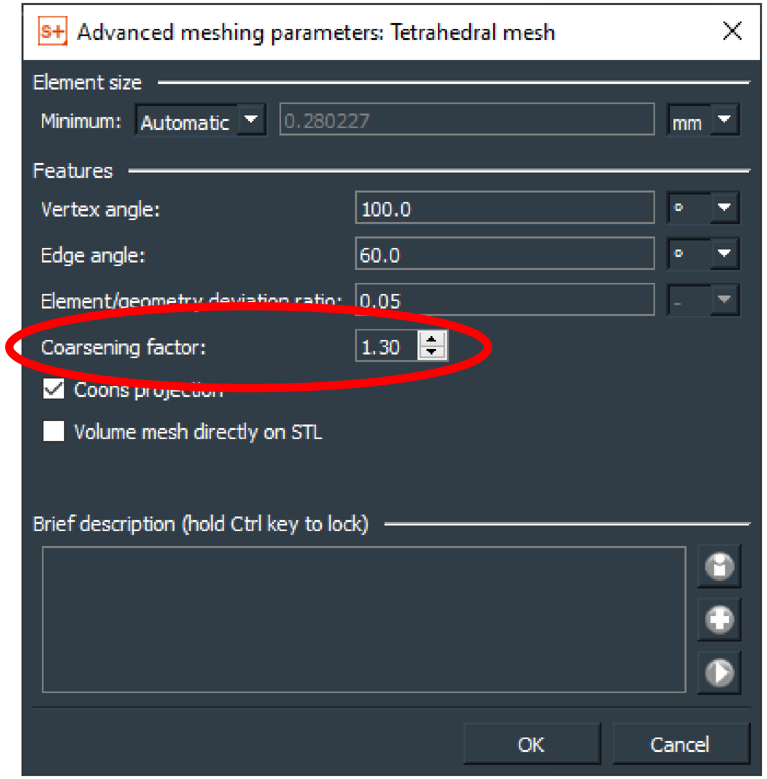
- **Issues during CAD export can be visualized on the CAD files directly**
- More feedback and support to fix issues during CAD export

Further improvements

- **Base plate can be meshed with tetrahedrals and exported using UNV export**
- Improves interoperability with 3rd party software



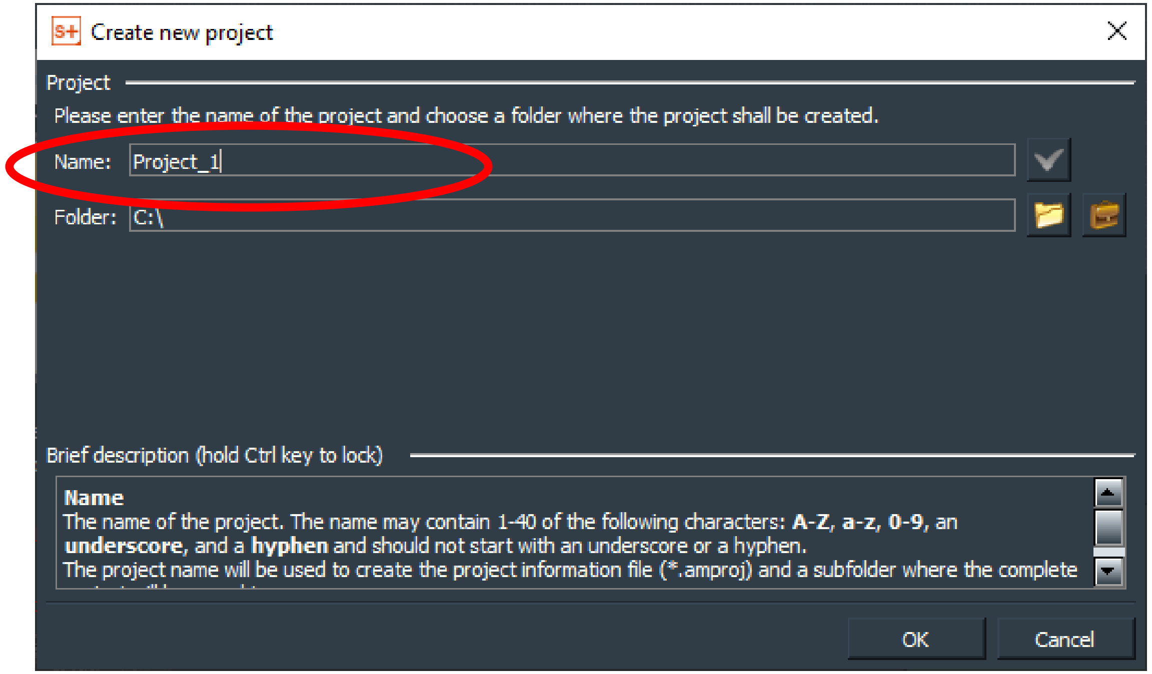
Further improvements



- **Added coarsening factor to advanced volume mesh control**
- Allows to reduce the number of elements for volume mesh used for UNV export

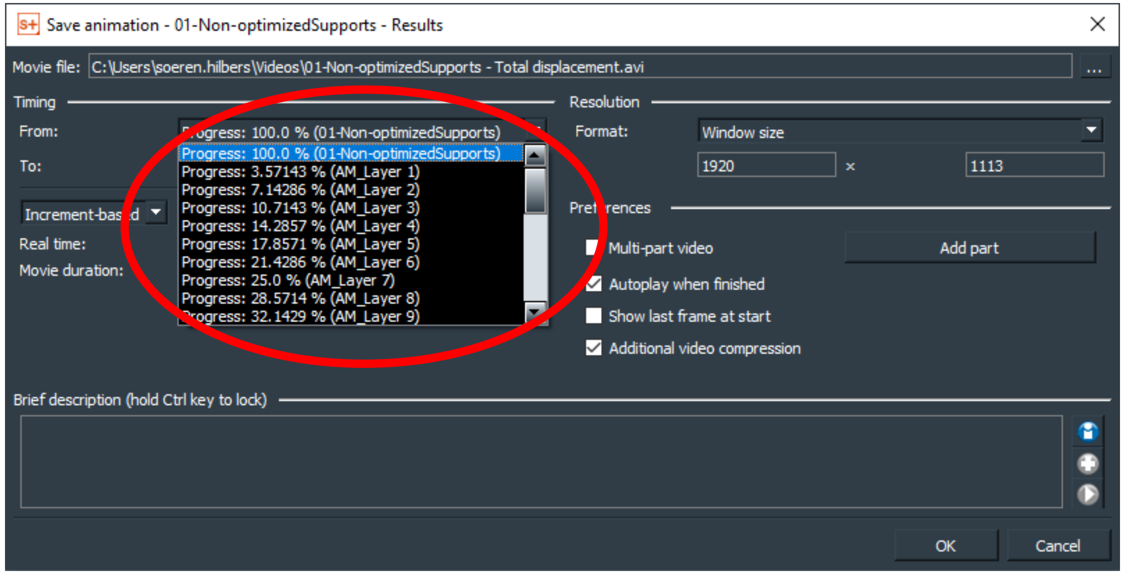
Further improvements

- **Underscore is now supported in project name**

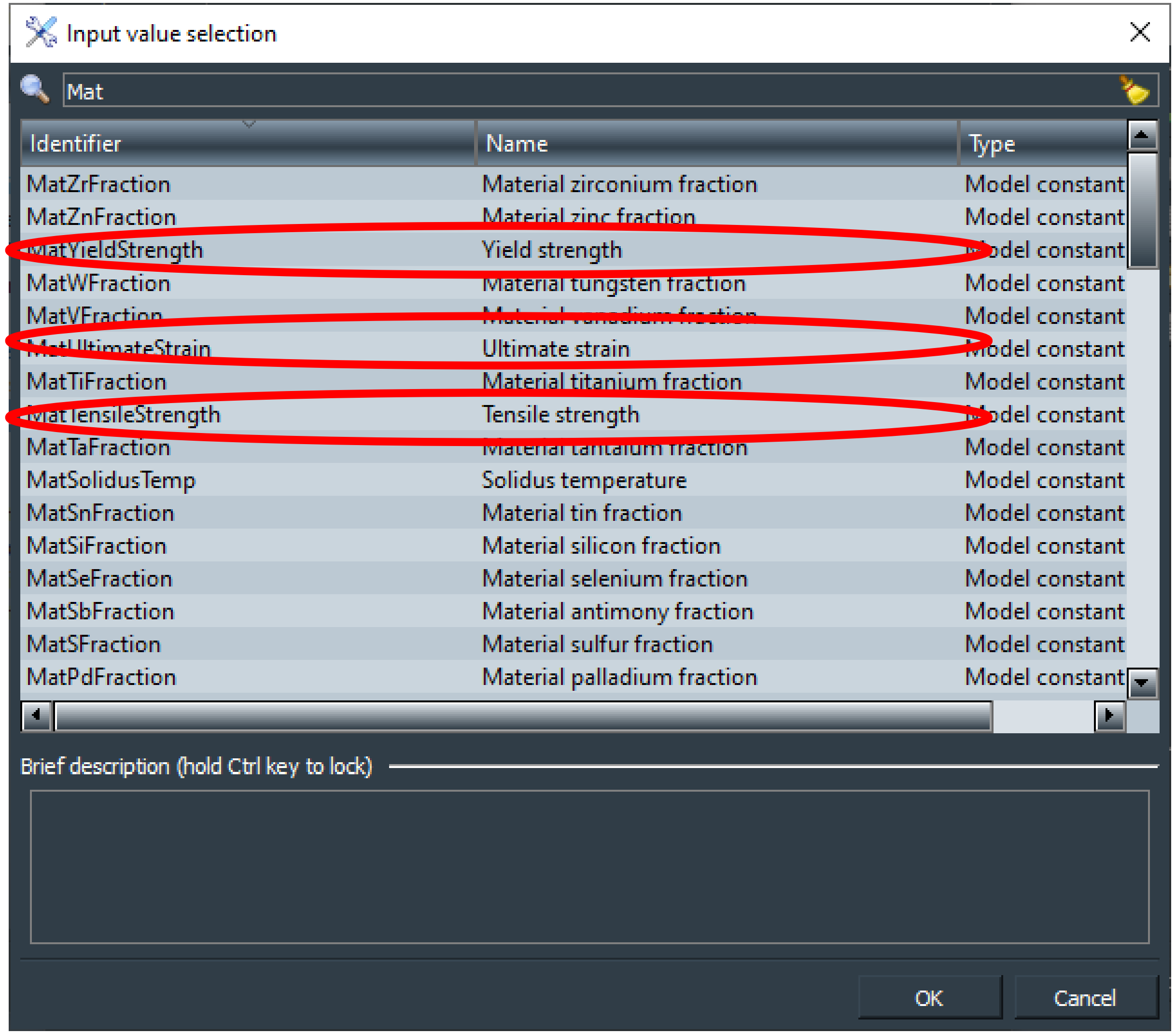


Further improvements

- **Loadcase names are shown in video export settings**



Further improvements



- **Add further material parameters to user-defined result values**
- Allows more flexible result values
- Added:
  - Ultimate strain
  - Yield strength
  - Tensile strength

Further improvements

- Update Materialise API
- Update Adams SDK to latest version
- Update CT component to CT2019SP3
- Update the 3DReshaper SDK
- Update product icons and splash screens to Hexagon standard
- Update Trumpf machines
- Add Additive Industries machine and base plate
- Update Marc documentation
- Improve GUI performance for very large models
- Improve calculation speed for result value limits that are calculated on the fly
- Improve and harmonize geometry export and result export dialogs
- Reduce recycle due to “body to body” and “contact separation” during build load case
- Make the option “Restore imported mesh” available only if the surface mesh has been changed
- Lock domain decomposition method if adaptive meshing is used
- Add progressbar while deleting results in the result manager

Further improvements

- Improve default names of video files
- Improve error message for densification curve dialog page
- Set relative density to 99% if sample point is added
- Add a visualization of the z-axis when fitting the normal direction of the current view
- Remove “Comment” area from tab order
- Unify message boxes where the deletion of a voxel mesh is asked
- Increase waiting time for license status “waiting for license” to 72 hours
- Max. creep strain rate parameter provided in the creep material data must be removed

Thank you