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
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
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 type 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
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.
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
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
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.
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

- **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
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