Selective Laser Sintering (SLS) Process Preparation And Machine Control

DMC software controls laser based additive manufacturing processes, like selective laser sintering (SLS), selective laser melting (SLM) or stereolithography (SLA).

In this particular case, customer was developing a new SLS machine. During prototyping stage a marking software was used for machine control. However process was not fast enough, system often crashed and new developments were needed for machine specific software functionality.

Old software was changed with DMC to have a complete solution for process preparation and control.

Direct Machining Control creates software to control laser machines – DMC.

DMC is used for various laser machining applications including additive laser manufacturing, PCB laser processing, laser engraving, drilling and others.

DMC provides a simple and user intuitive way to prepare and control complex laser machining processes.

The Challenge

Customer had a prototype SLS system assembled for process testing and demo purposes.

The challenges that customer faced:

1. **STL file preparation.** 3D printing / additive manufacturing uses STL files to import models to be printed. After import models are sliced, volume is filled with hatching and object is printed layer by layer. Some of the objects to be printed has a lot of small features and STL file representing them might have millions of triangles and hundreds of MB of information. To handle this information and to convert it to motion data that can be used by positioning stages and/or scanners is a big challenge as conversion uses a lot computer resources. Marking software and similar solutions created for simpler processes tends to crash or take hours for calculations when working with large and complex models.

2. **Long term stability and reliability of the process.** Customer was designing a cost effective solution for SLS. To keep costs at bay a budget galvo and stages controllers were used. To ensure a long term stability, safety measures had to be taken in the software to keep process running for >20 hours at a time. Each crash means aborted process and wasted production time.

3. **Integration of custom hardware.** Some unique hardware was designed by customer to add safety measures, temperature control and other machine functions. That hardware had to be integrated and controlled by DMC software.

4. **Recipe testing.** A prototype machine was used for R&D of sintering recipes for different materials and different printing resolutions. Creating and performing testing routines on existing tools was taking a lot of time. Speeding up the process would allow to achieve better printing quality and reduce machine time to market.

The Solution

We did several on-line Q&A sessions with customer to determine what features are needed and prepared a specification for OEM version of DMC software. Here are some of the features and advantages of DMC that were used to solve the challenges.

1.   DMC has state of the art geometry handling algorithms. That provides our customers with fastest in the market STL slicing, hatching and preparation for printing. Taking full use of 64-bit system, preparation (slicing and hatching) of 5 million triangle STL is done within 30 seconds. Efficient computer resource handling makes DMC reliable and stable when working with large and complex models.
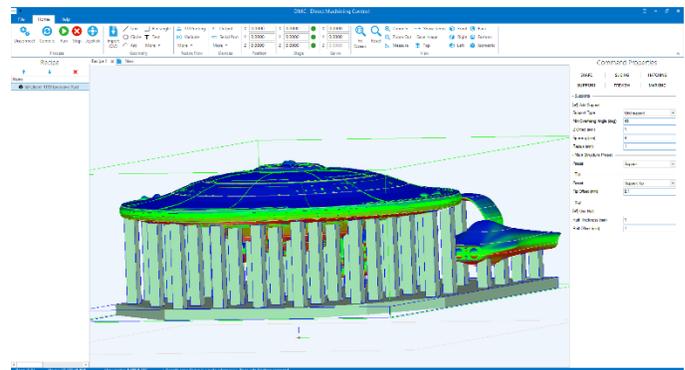
STL model prepared for printing with DMC

2.   Flexible architecture of DMC allowed to implement new stage and galvo scanner controllers quickly and easily. During testing phase special safety measures were implemented to prevent system crashing during long term fabrications.

3.   Support for custom control electronics was developed to implement temperature control and interlock safety features. With these features, operator now can set a specific temperature to reach before fabrication and add some cooling parameters. Temperature is constantly monitored

*Sample printed with machined controlled by DMC software*

and displayed for operator. If temperature goes out of a set range, process is paused to correct it. Fabrication does not start until doors are closed and locked to prevent accidents.

4. DMC has a flexible recipe creation tool to create highly automated and easy to change recipes.

Using that a special recipe was created to print an array of parts, each with a different parameter set. Each part has also a printed number on it for identification purposes. This allowed user to print 40 parts with unique parameter sets and find best parameters quickly.

What parameters are tested (scanning speed, laser power, volume filling density, layer thickness, etc.) and ranges for testing can be easily set in the recipe.

5. A special user interface was created for an operator to streamline the working process.
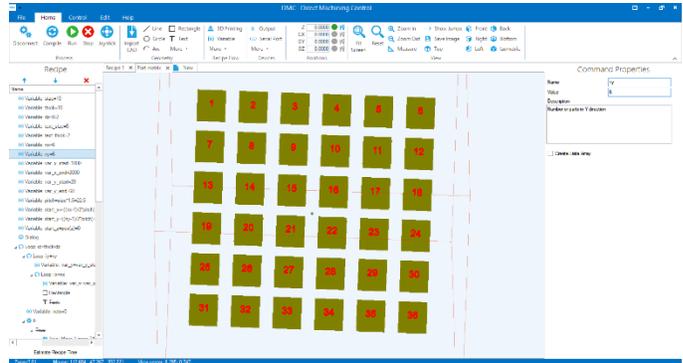
Recipe for printing parts with different parameters
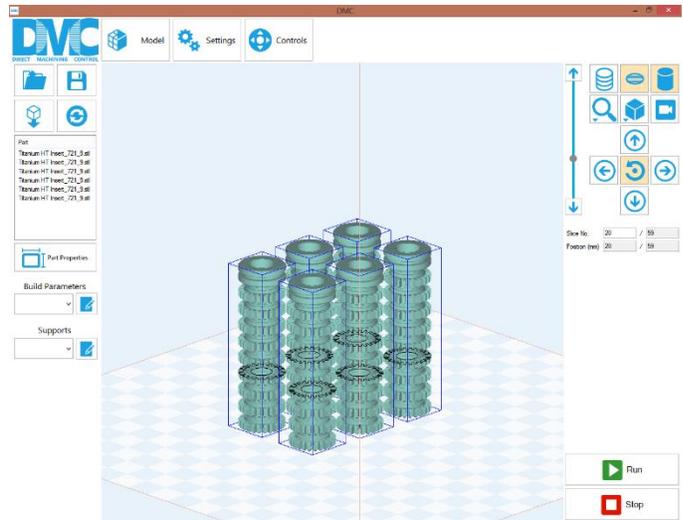
Operator user interface for 3D printing

Results

DMC simplified 3D printing process, as all preparation and control of the machine is done with single software. There is no need for code generation and upload.

Time of process preparation was reduced due to DMC efficiency in 3D model handling and preparation.

Time to market for the machine was greatly reduced as well, since DMC needed just minor adaptations to control the machine and they were implemented within 15 days. Remote on-line and on-site testing was combined to make the testing process cost-efficient, yet to assure reliable operation of the machine.

For more information on DMC use for 3D printing, please contact us at info@directmachining.com