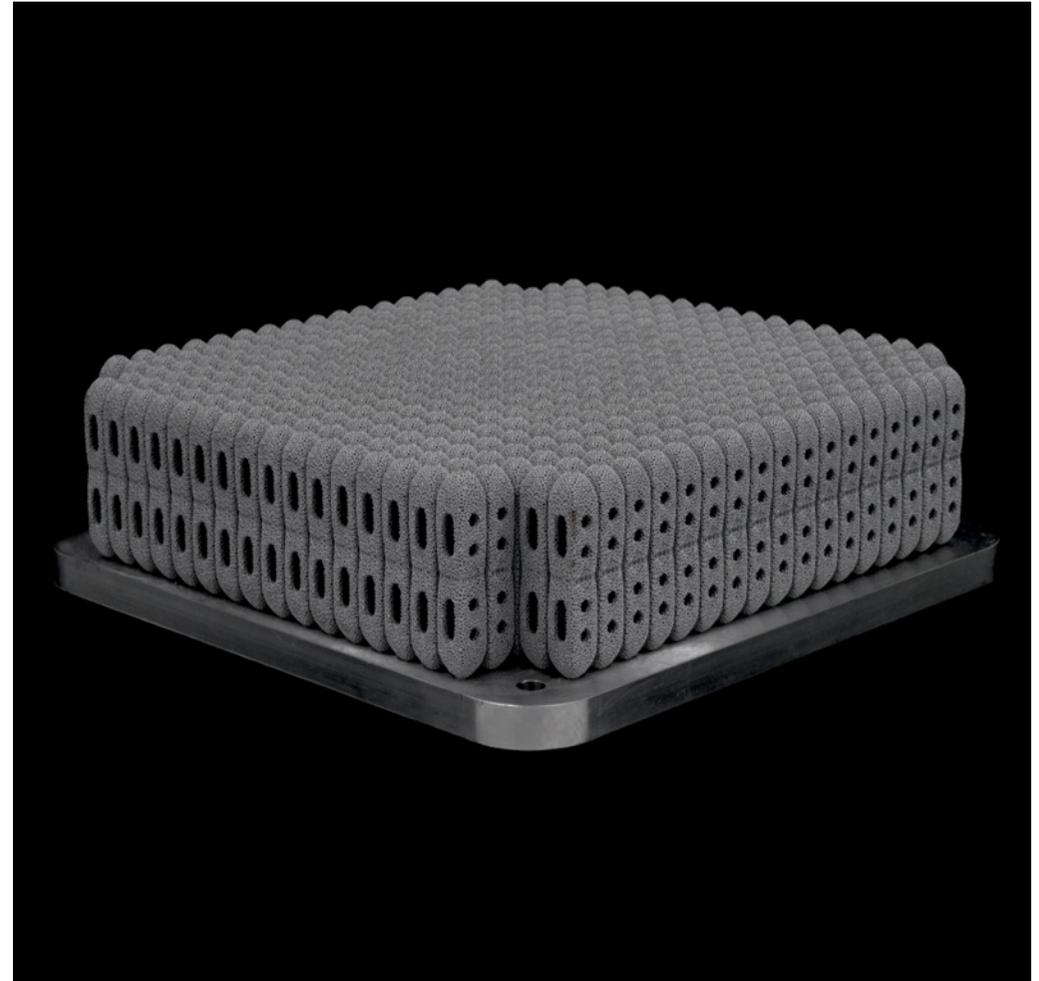


The orthopaedic industry is reinventing itself through the use of metal AM processes for production. Betatype provides key technology and services to unlock the advantages further, increasing productivity by almost 2x.



Metal additive manufacturing (AM) processes such as laser powder bed fusion (PBF) provide real advantages when it comes to the production of orthopaedic implants. PBF can produce both solid and porous geometries in the same process, saving time and materials, while creating complex structures that can simulate the mesh-like porous properties of bone, as well as provide the strength and durability required of a medical implant. Porous textures can be built into implants of any shape or size – from acetabular cups to lumbar cages – allowing medical device manufacturers of orthopaedic implants to offer a full portfolio of superior implants using the PBF process for serial production.

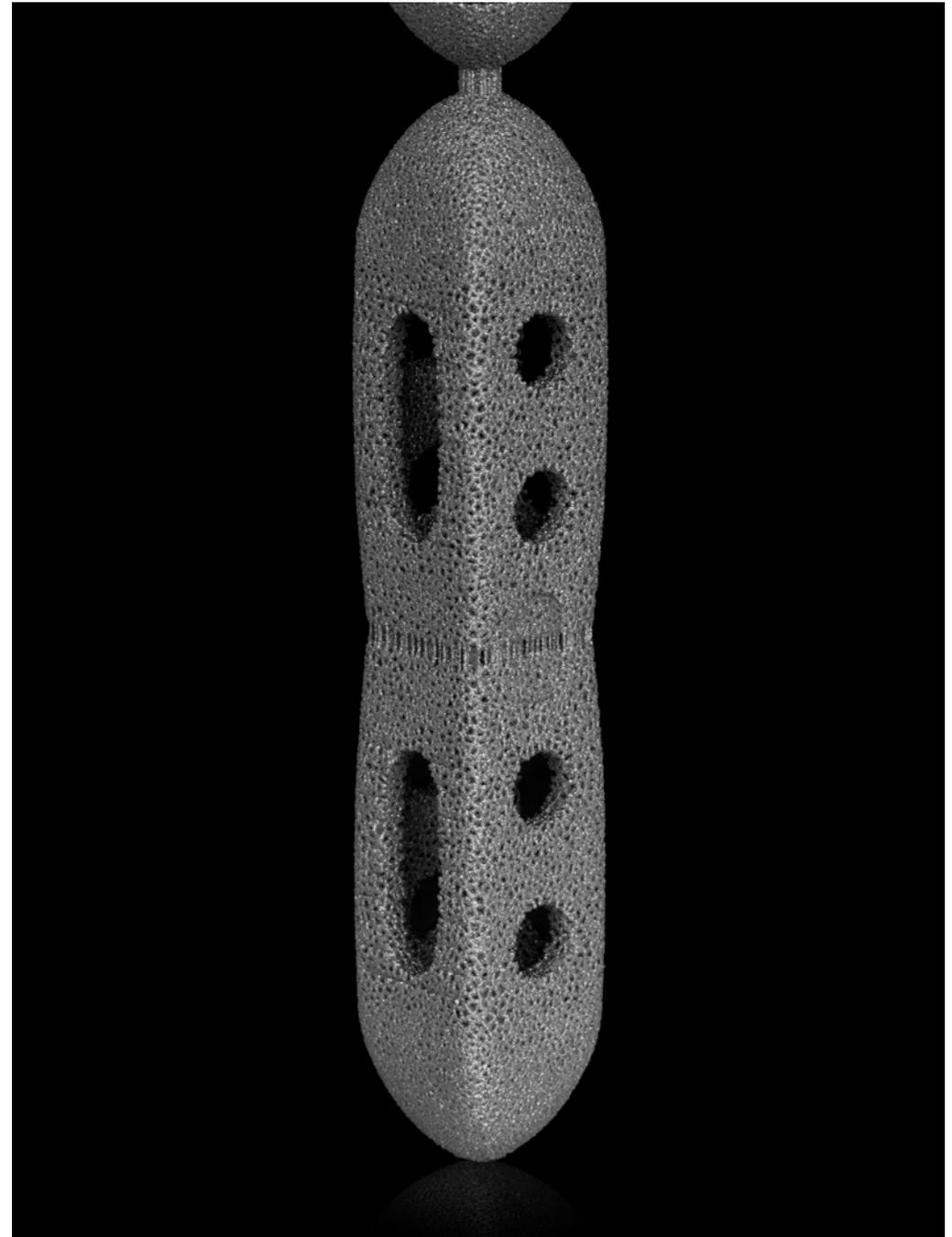
#### KEY BENEFITS TO WORKING WITH US

##### DESIGN FOR AM PRODUCTION

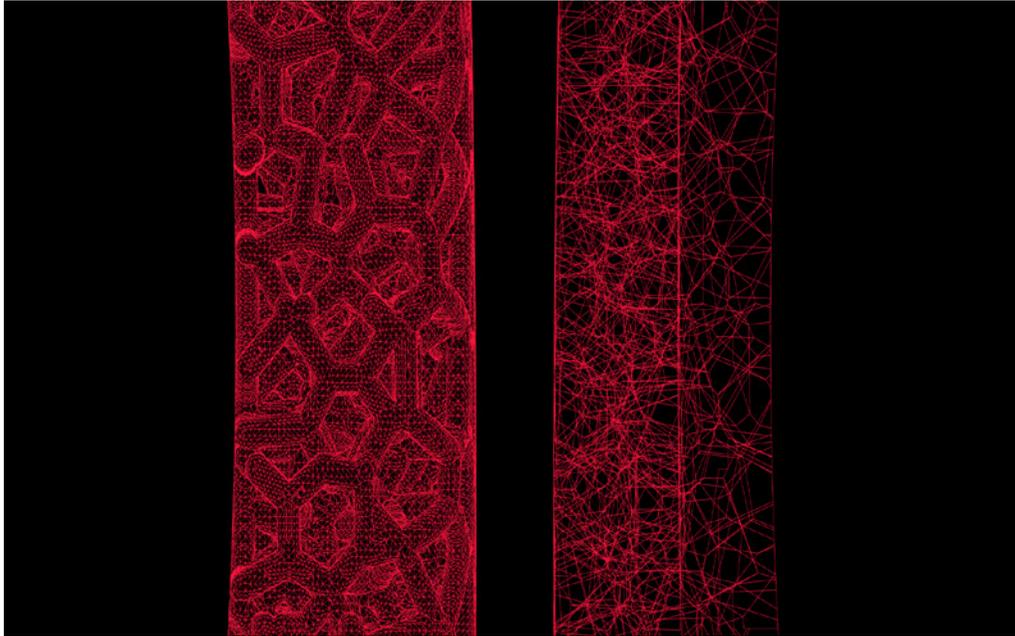
Our expertise delivered designs optimised for AM with maximised packing and minimised supports, delivering over 800 parts on a medium frame LPBF system.

##### GREATER PRODUCTIVITY

Our Process Portfolio, delivered through Engine, reduced build time by 40% from 26 hours to 14 hours on a quad laser medium frame laser PBF system.



Single Stack of Posterior Lumbar Cages / Individual cages are supported via sacrificial beam elements



Macro of CAD of spinal cage / In traditional Mesh format (left), and in ARCH or LTCX format (right)

Betatype helps its clients in the orthopaedic implant sector to further reduce costs and deliver on the advantages of metal AM for serial production of orthopaedic implants through its unique data processing technology, Engine. This is achieved in significant ways by optimising the high volumes of build data, reducing process times and ultimately maximising machine usage, which results in reduced cost-per-part.

### MAXIMISING MACHINE USAGE

Orthopaedic implants demand complex designs to achieve the optimal porosity size and distribution. This necessary complexity results in the generation of high volumes of data that can often slow down build processors, causing bottlenecks or even halting the additive manufacturing process altogether. Betatype's Engine technology build processor provides supercomputing

power to overcome this problem and enable the rapid creation of scan data for laser PBF, paving the way for serial production.

Engine's virtually limitless scalability for build generation can also produce optimised build data. Betatype recently worked with a company to successfully create serial production build data that produced build files in excess of 50GB. These processing requirements would stop most other build processors in their tracks, but with Betatype's Engine technology, the data was generated in hours rather than days.

Moreover, when applying its specialist algorithms for converting complex geometry, Engine allows implant designers to work in lightweight file formats that are up to 96% lighter than traditional STL files, such as Betatype's ARCH format or nTopology's LTCX data. For example, a spinal cage model was only 8MB as an

LTCX file compared to 235 MB as an STL file. These conversions simplify and shorten the process tremendously, making the manufacturing process more flexible and cost-effective. Lightweight representations combined with Engine's unique build data generation enable designers to innovate faster without the head ache of dealing with mesh data.

Improving the utilisation of an AM machine's overall build volume is also key to unlocking the serial production of orthopaedic implants in terms of cost per part. Betatype is able to effectively stack implant parts by designing lattice node matched supports – utilising the full build envelope of the machine and producing multiple, complex implants in a single build. These engineered supports can subsequently be removed using standard media blasting, saving additional time and expense by eliminating the need for manual post processing.

### REDUCING BUILD TIME

Equipment amortisation has a big impact on the cost of parts when it comes to the production of orthopaedic implants with the PBF process. Build time plays a key role in this - the more parts you produce in a build, while reducing the build time, the more cost effective the parts become. Build time can be broken-down into three major components, each of which needs to be addressed to speed up the entire build process:

Betatype has developed a powerful portfolio of technologies that can directly optimise laser firing times and reduce delay times with or without the use of multiple lasers, resulting in the reduction of overall build times by as much as 40%.

In a recent project Betatype worked with an orthopaedic manufacturer and using

this technology portfolio they were able to decrease implant build time from 25.8 to 15.4 hours. For such applications Betatype technologies optimise the laser scan paths to reduce the total amount of firing and movement time required for complex lattice structures. Moreover using galvo-driven path optimisation it is possible to reduce motion time from 13 hours to 3 hours by optimising the delays on an exposure to exposure level, ensuring only the prerequisite delays are applied. This also resulted in a significant reduction in the travel distances required by the laser(s) from 170 km to 100 km.

The combination of metal additive manufacturing, specifically with the PBF process, and Betatype's portfolio of unique technologies, enables faster and more cost-effective serial production of orthopaedic implants. By maximising machine usage, optimising data file sizes and reducing build times, Betatype is working with a range of partners in the orthopaedic implant sector to create safe, robust and more cost effective implants.