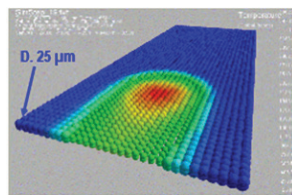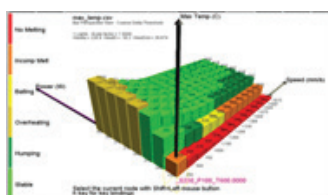# AlphaSTAR

GENOA
3DP SIMULATION

OVERVIEW

GENOA 3DP is an award wining software that offers unparalleled ability to model various additive manufacturing processes and materials across polymer and metal applications. Users can implement micro & macro voids into their process models resulting in virtual precision assembly. The end result is the ability to identify optimal build plan and parameter setting for a quality build in place of costly trial & error. The software can benefit machine operators looking for up front guidance on parameter settings, as well as CAE analysts looking for digital thermal and structural assessment of their printed parts.
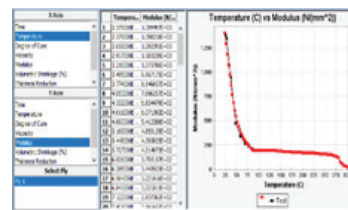
MULTI-SCALE MATERIAL MODELING

Generate material cards for process simulation. Cure-kinetic approach and multi-factor technique are utilized to predict elevated temperature modulus (beyond glass transition) and elevated temperature strengths. Predicted material properties are nonlinear and temperature dependent.

KEY HIGHLIGHTS

GENERATE PROCESS THERMAL AND VOID MAPS

Microscale modeling driven by AM parameters can predict dynamic melt pool evolution and heat affected zones to identify **stable and unstable** regions (i.e., not-melted, incomplete-melting, balling, overheating, humping). Void Map provides insight into transient changes in porosity, density, and changes during 3DP process. These process maps identify range of optimal print parameters for Process Simulation.

POWERFUL THERMAL MODELING
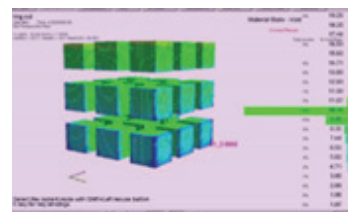
Fast semi analytic simulation process which considers exact layer thickness and is able to go above melting temperature to take into account different thermal states (e.g. heating, melting, melt-superheating, superheat-cooling, solidification/sintering, and cooling periods). Analysis can be conducted element by element to capture thermal history and heat transfer correctly. Temperature distribution and micro voids are predicted which are mapped to the mechanical model.

TOOLPATH ERROR
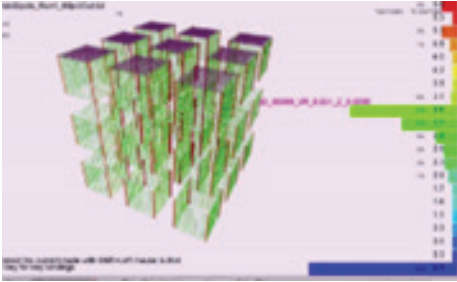
Predict macro voids distributed through the part due to errors in the printing path. These macro voids will modify the modulus, strength, and coefficient of thermal expansion of the printed part. These results are implemented into both process models and in-service loading analysis for highly accurate predictions.

KEY CAPABILITIES

- Supports metal and polymer processes and material systems
- Supports both voxel and conformal mesh
- Predicts micro & macro voids and maps these defects into process simulation model
- Predicts micro scale melt pool size and thermal history
- Predicts structural integrity of printed part
- Predicts mechanical properties with voids at room and elevated temperatures
- Considers printing path method using toolpath as input into process simulation model
- Assesses printer path quality and highlight problematic areas
- Assesses material and process parameter sensitivities
- Coupled with NX-Nastran, Abaqus and Ansys

BUSINESS VALUE

- **Accelerate Time to Market** – minimize process defects to improve performance
- **Improve Engineering Productivity** – integrate process simulation with assessment of properties and structural analysis.
- **Reduce Manufacturing Costs** – reduce scrap rate and trial and error