New (virtual) qualification approach for metal AM parts

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BACKGROUND

Metal AM allows for complex and optimised aerospace parts. However, the AM process and thus the material performance can be significantly influenced by the part geometry. Therefore it is costly to get an AM component certified to fly.

Modelling and simulation can help in optimising the metal AM process for homogeneous and predictable material throughout the part.

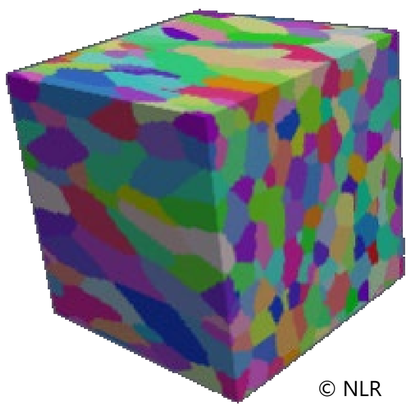
Development of process based qualification approach to support part certification using simulation

HOW?

Numerical models are used to generate variable process parameters to obtain a homogeneous thermal history and prevent local overheating. This will result in predictable material performance.

Advanced monitoring techniques will be used to monitor the stability of the process, detect anomalies and validate simulation methods.

Development of crystal plasticity pipeline to predict material properties based on metal AM microstructures.



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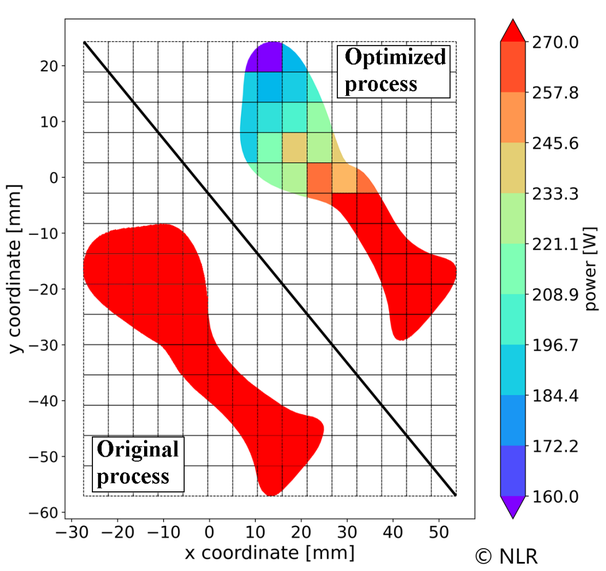

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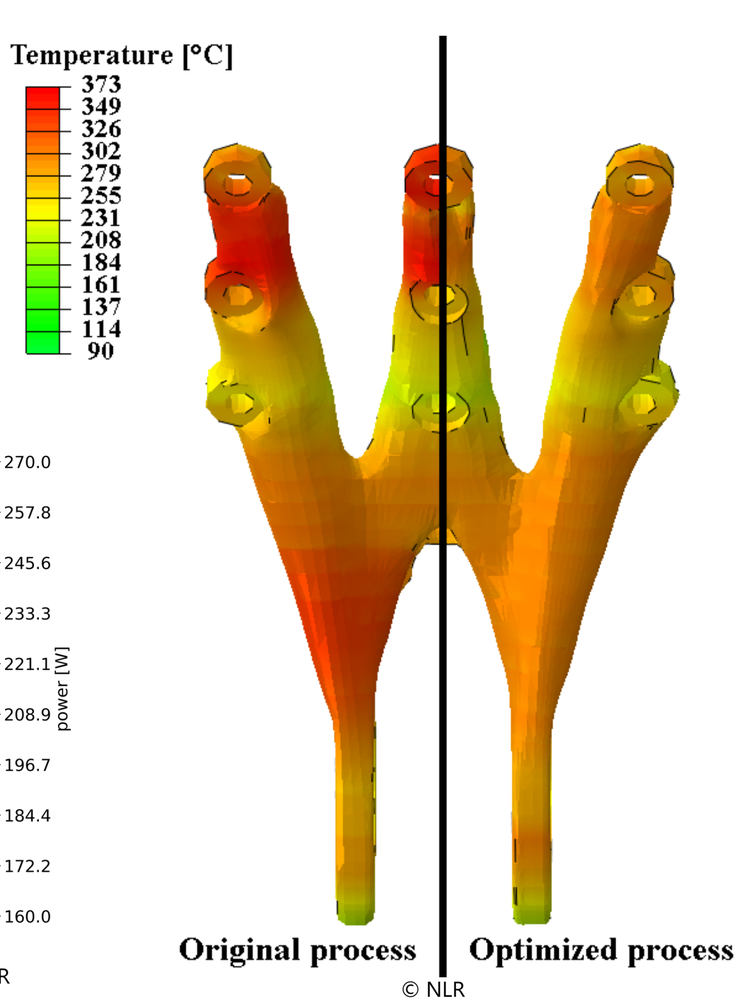

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OBJECTIVE(S)

Variable process parameters optimisation by simulation

Implementation of monitoring systems to monitor process stability and detect defects

Understand and predict process-structure-property relations

WHY?

Process-based qualification requires knowledge of:

<u>Process-structure-property relation</u>

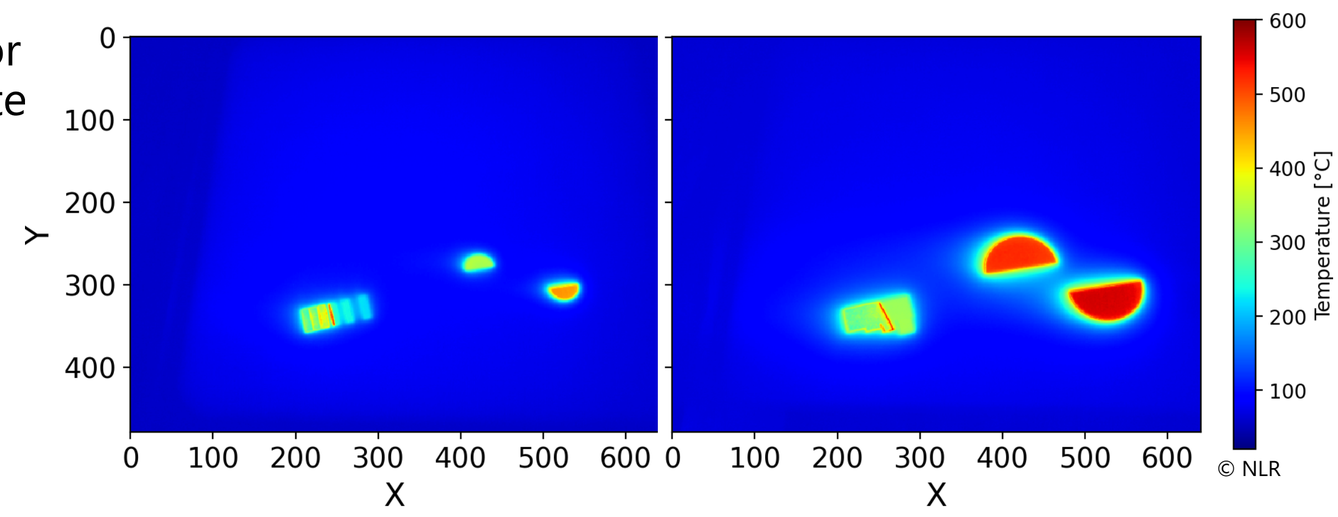
- Property dependency on part design

<u>Methods to obtain a more stable AM process</u>

- Process simulation and optimisation of parameters

<u>Methods to monitor the stability of the AM process</u>

- Thermal imaging and spatter detection



RESULTS

- Developed process optimisation method with regional laser power scaling and inter layer time to produce homogeneous material.
- Monitoring systems have been installed in the new LPBF machine, calibration and validation is ongoing.
- Pipeline built to obtain virtual representation of LPBF microstructures for crystal plasticity models.

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