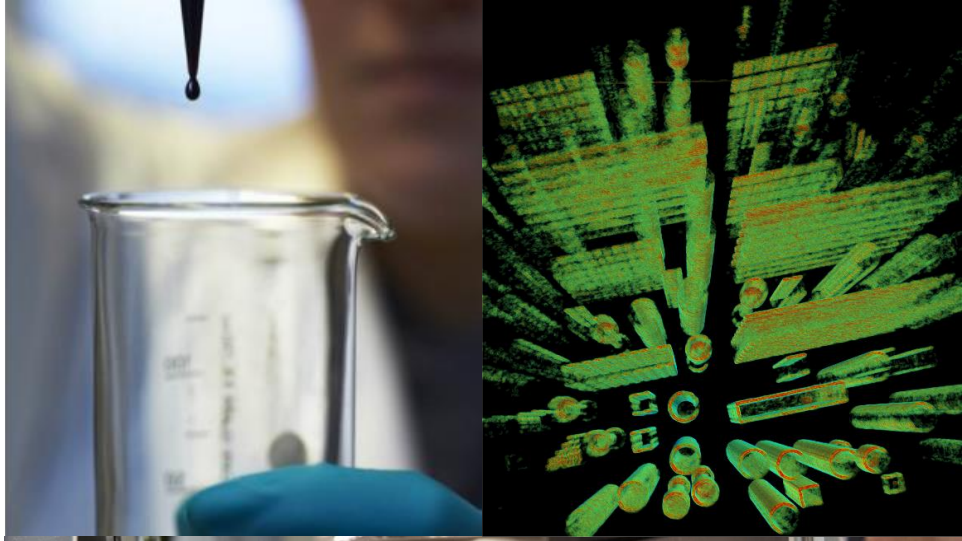


EIT MANUFACTURING - DIGIQUAM

EIT Manufacturing summit

10-12-2020

RISE Research Institutes of Sweden

Material and Production

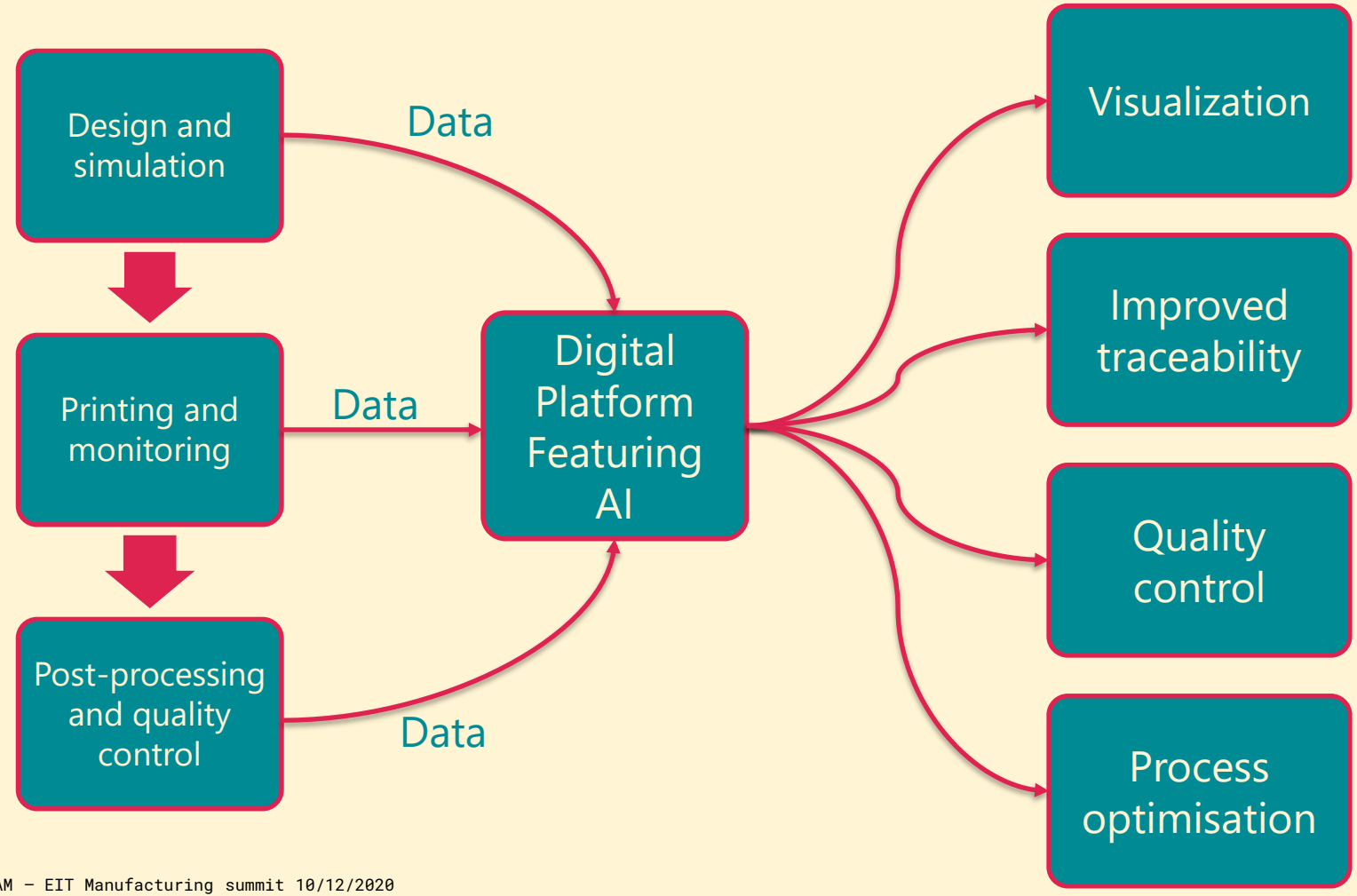
EIT Manufacturing is supported by the EIT, a body of the European Union

Challenge to solve

- Current analytical solution for AM (Additive Manufacturing) have limitation in what they capture, analyze and process.
- Limited to a single step of the process such as the simulation step or manufacturing step.
- Operate as data silos where the data collected is never shared to other steps of the AM process.
- Hinder the traceability and quality assurance of printed parts and limit our understanding of the AM process and its numerous parameters.

DIGIQUAM aims at

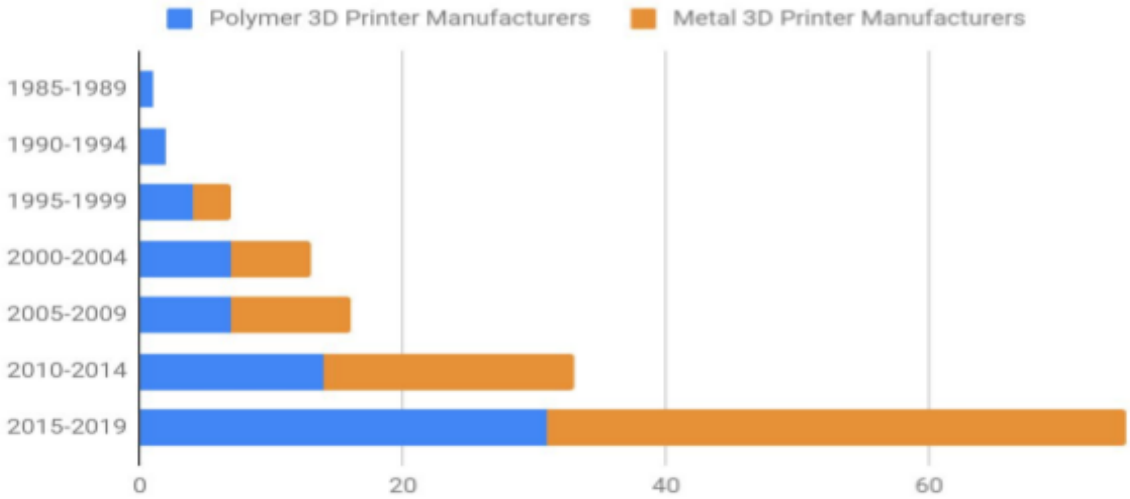
bringing and analyzing the data from all the AM process steps on a unified digital platform and use the power of big data analytics to improve the manufacturing process and traceability.


Design and simulation
Printing and monitoring
Post-processing and quality control
Data
Data
Data
Digital Platform Featuring AI
Visualization
Improved traceability
Quality control
Process optimisation

Additive manufacturing landscape 2019

The AM landscape 2019, https://amfg.ai/2019/02/27/additive-manufacturing-industry-landscape-2019/

Additive manufacturing landscape 2019



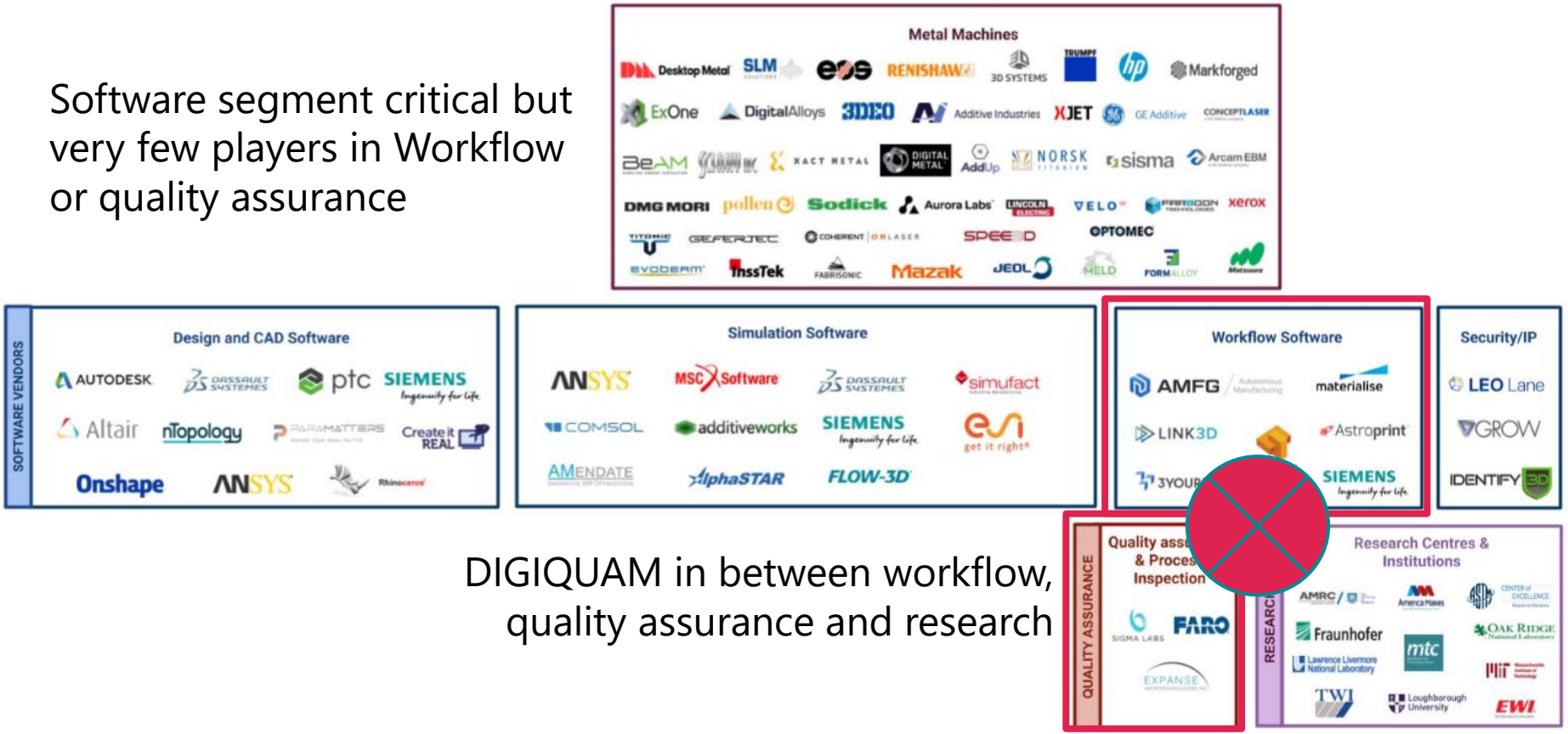
Above: The number of polymer and metal 3D printer manufacturers has risen significantly in the last 5-10 years. Source: AMFG

Metal machines and surrounding technologies shows biggest growth in sales, +80% in 2017/2018

The AM landscape 2019, https://amfg.ai/2019/02/27/additive-manufacturing-industry-landscape-2019/

Additive manufacturing landscape 2019

Software segment critical but very few players in Workflow or quality assurance



DIGIQUAM in between workflow, quality assurance and research

The AM landscape 2019, https://amfg.ai/2019/02/27/additive-manufacturing-industry-landscape-2019/

Project partners

- Chalmers University of Technology is a foundation university offering research and education in technology, science, shipping, and architecture with the vision “Chalmers – for a sustainable future”. Chalmers has more than 10 000 students and 3000 staff. We focus on a future, where we seek ecological, social, and economic sustainability. Chalmers is a strong global player in innovation and industrial collaboration. It is also a renowned university in the area of manufacturing in Sweden and Europe.

- PRIMA INDUSTRIE S.p.A. heads a leading Group in developing, manufacturing and marketing of laser systems for industrial applications, sheet metal processing machinery (Prima Power); industrial electronics and laser sources (Prima Electro) and AM solutions with both Powder Bed Fusion and Laser Metal Deposition technologies (Prima Additive). With over 40 years of experience, the Group has installed more than 13,000 machines in more than 80 countries worldwide and is among the leading worldwide manufacturers in its market.

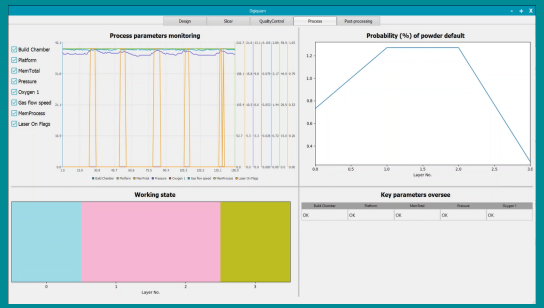
- RISE is the Swedish Research Institute and Innovation partner. In international collaboration with industry, academia and the public sector, we ensure the competitiveness of the business community and contribute to a sustainable society. Our 2,700 employees support and promote all manner of innovative processes. RISE is an independent, state-owned research institute that offers unique expertise and about 100 testbeds and demonstration facilities, instrumental in future-proofing technologies, products and services. We have a long history of acknowledged high-quality research and conducting assignments in each of these divisions. RISE is a non-profit organisation. Our headquarters are located in Gothenburg and have employees all over Sweden.

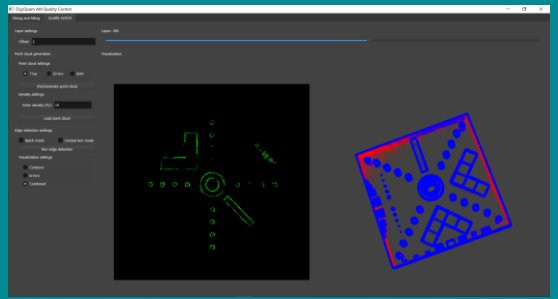
- Manufacturing Alliance AIE is a private and independent alliance of R&D centres. It is composed by 5 organisations in the Basque Country (northern Spain): AZTERLAN, CEIT, IDEKO, LORTEK and TEKNIKER. Manufacturing Alliance sets out to generate, capture and transfer scientific and technological knowledge in order to contribute towards improving the competitiveness of companies and the progress of society. Regarding targeted Technological Areas, Manufacturing Alliance centres bases its activity around eight scientific and tecnological units: Biotechnology, Micro- and nano-technologies, Environmental Technology, Energy, Industrial management and production, Mechatronics, Materials and processes and Information and Communications Technologies. With these units, the RTOs cover the full range of activities, from basic research to development.

DIGIQUAM - Results

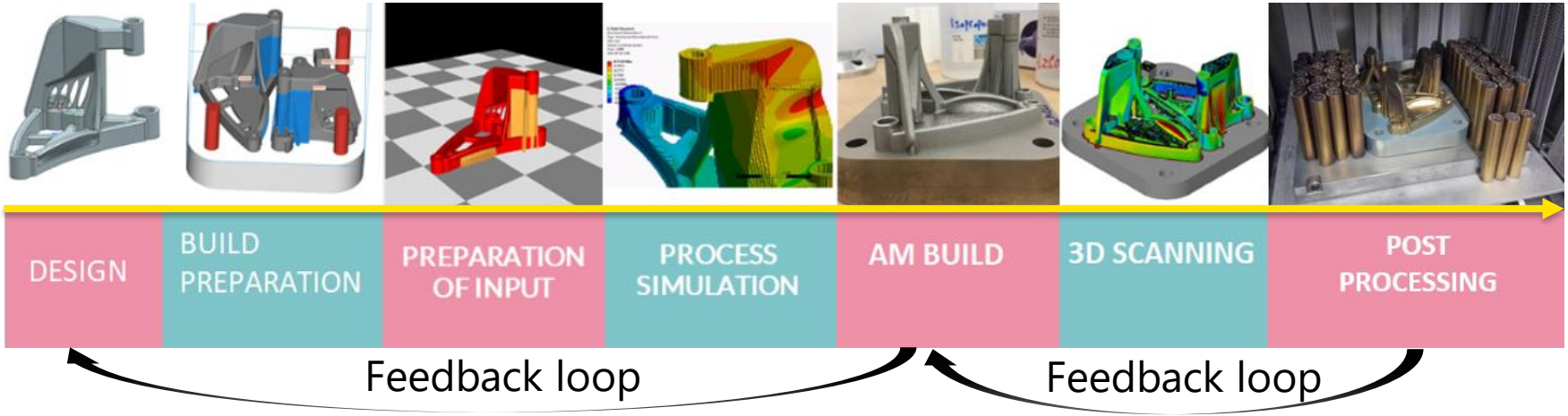
DIGIQUAM is a software that can be connected to a 3D printer to perform real-time or batch analysis. It introduces state of the art features such as:

- Real time sensor monitoring
- Real time powder error prediction algorithm
- Advanced slicer allowing the slicing of multiple stl at once to extract layer design data.
- Improved quality control with real time comparison of a printed component to its CAD



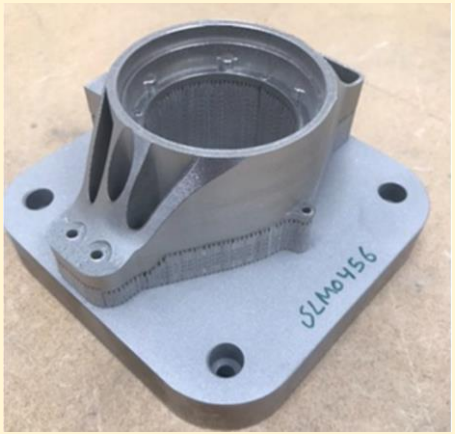


Digital Thread



From design to post-processing, AM can generate up to 100Gb of data per part. DIGIQUAM is a digital platform that builds a digital thread along the whole value chain by collecting and analyzing the data from each step of the manufacturing process. These create feedback loops that can be used by engineers and operators to improve AM process.

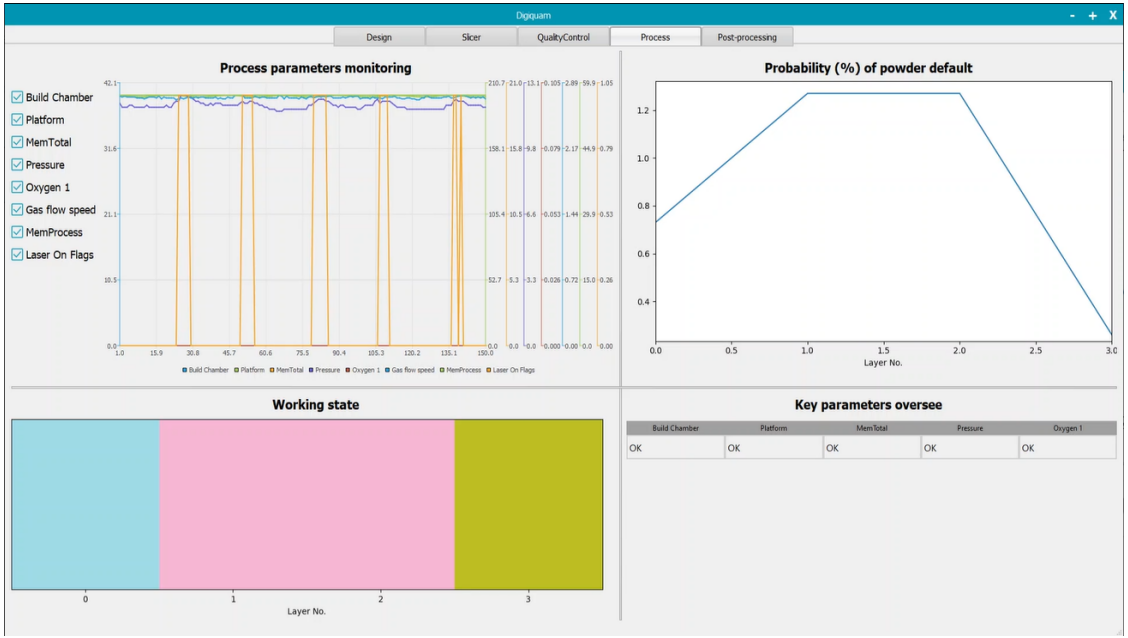
Over a year, DIGIQUAM has collected the data of 8 different prints from design to post-processing.



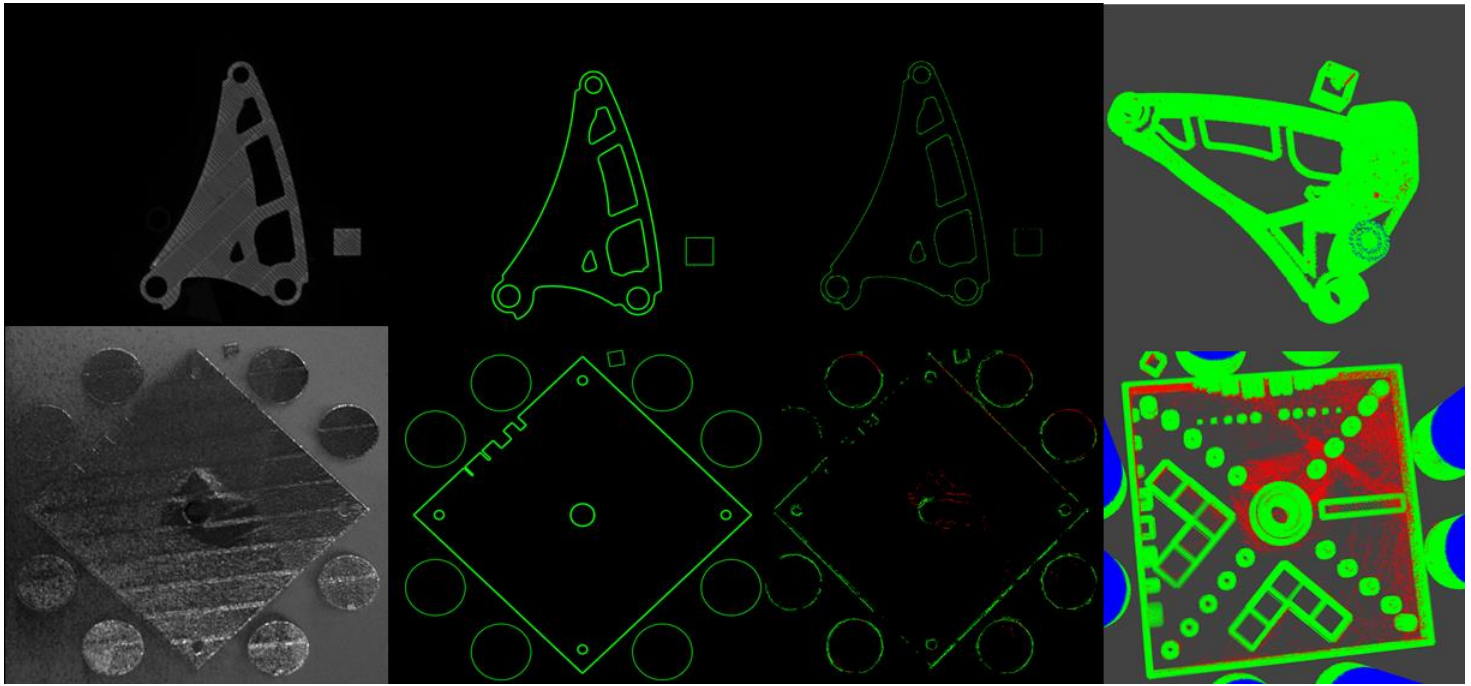
This data has been used to create state of the art algorithms for quality control and process optimisation

Live monitoring and powder defect prediction

The platform can be directly connected to a 3D printer to provide real time sensor monitoring. By feeding the data from the sensors to a machine learning algorithm, DIGIQUAM is able to predict powder default and warn the operator in case of errors.



Improve quality control

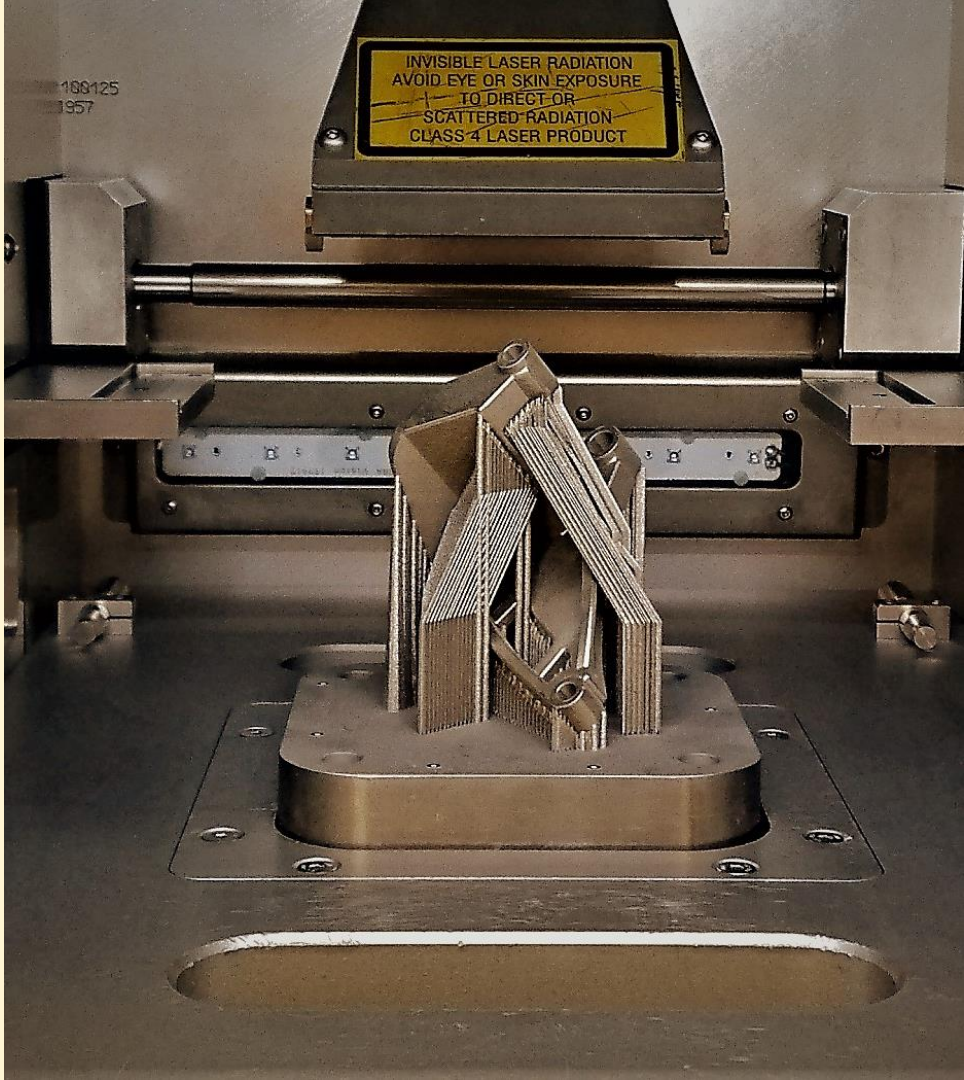


Results from DIGIQUAM's algorithm for deviation detection. The original image (left) is compared to its CAD model (center left) and results in a deviation detection image (center right) where pixels in red show deviations. Finally, a 3D model is made from these images (right). The part at the top shows very little deviation while the part at the bottom shows important ones at its core which wouldn't have been detected with a 3D scan.

DIGIQUAM is part of the next generation of AM software coming on the market that feature AI extensively.

The platform can assist the operators in every step of the process, from design to defect detection during printing to optimized post-processing. It improves quality control and traceability, and help engineers and customers to better understand their print.

DIGIQUAM brings the industry one step closer to live defect correction and will help AM manufacturers to design machine that can adapt their parameters during manufacturing.



Learning content

DIGIQUAM participated in the creation of content on EIT's learning platform by delivering an exclusive learning path of 6 teaching nuggets centered around AM technologies:

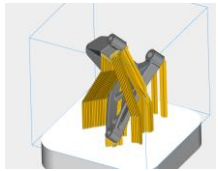
Application of design for AM

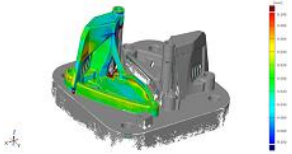
Design simulation for AM

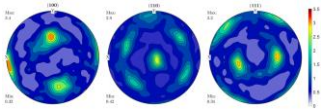
Data analysis for AM

Digital thread for AM

Post-processing for AM ground / advanced level







Next phase

- For the next phase DIGIQUAM platform will feature:
  - Improve deviation detection for defects in the range 50-100µm
  - Include AI for post-process optimisation, able to identify defects that can be resolves by post-processing and the process paramaters to use for it.
- DIGIQUAM is interested in adding new partners to the consortium:
  - SME to use the platform as end-users
  - Software providers to further improve the integration of the platform with other machines manufacturers.

Contacts

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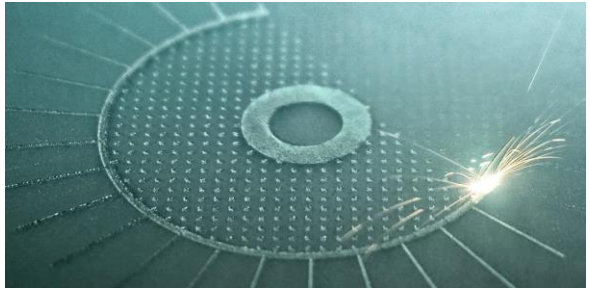
- Prima: gaetano.patrimia@primapower.com
- CEIT: maristizabal@ceit.es



EIT Manufacturing

EIT Manufacturing is supported by the EIT, a body of the European Union

DIGIQUAM

Digitalisation of in-line quality assurance for Additive Manufacturing

https://www.ri.se/sv/vad-vi-gor/projekt/digiquam

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