intellegens

DATA-DRIVEN DISCOVERY

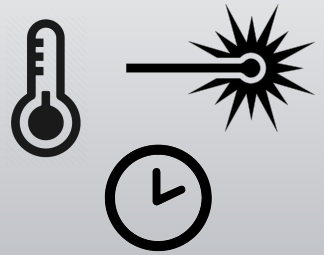
Innovative machine learning for data-driven design of AM materials and processes

The trillion $ formulation problem

High-dimensional,
sparse, noisy data

Ingredients

Processes



Properties

Mechanical properties
Cost
Viscosity
Density
Environmental impact
Stability...

Chemicals, alloys, pharmaceuticals, plastics, foods, paints, cosmetics ...

High reliance on costly, time-consuming experiment

Introducing Intellegens

Unique **deep learning** software and expertise

- Get value from **sparse, noisy data** to solve complex **high-dimensional** problems

Alchemite™ can be applied to any **numerical dataset**

- Key focus areas: materials, chemicals, drug discovery, and manufacturing

Easily deploy models to deliver **immediate ROI**

- Integrate with existing systems and publish through **web based platforms**

One example focus area is additive manufacturing

Our AM work was recognised by ASME with two awards at the AM Tech Event

Selection was made by event attendees and a panel of AM expert judges

Based on a demonstration of Alchemite™ for AM

Selected from 40 new product demos by a global group of AM service providers

Why do AM project leaders come to Intellegens?

Business drivers

Improve **product performance** for customer satisfaction & market share

Minimize business risk by ensuring **reliable and repeatable** processes

Maximize **return on investment** from expensively-acquired project data

Reduce **expense and time** to take a new part to market

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AM technical challenges

Optimize process parameters
Model property / process relationships

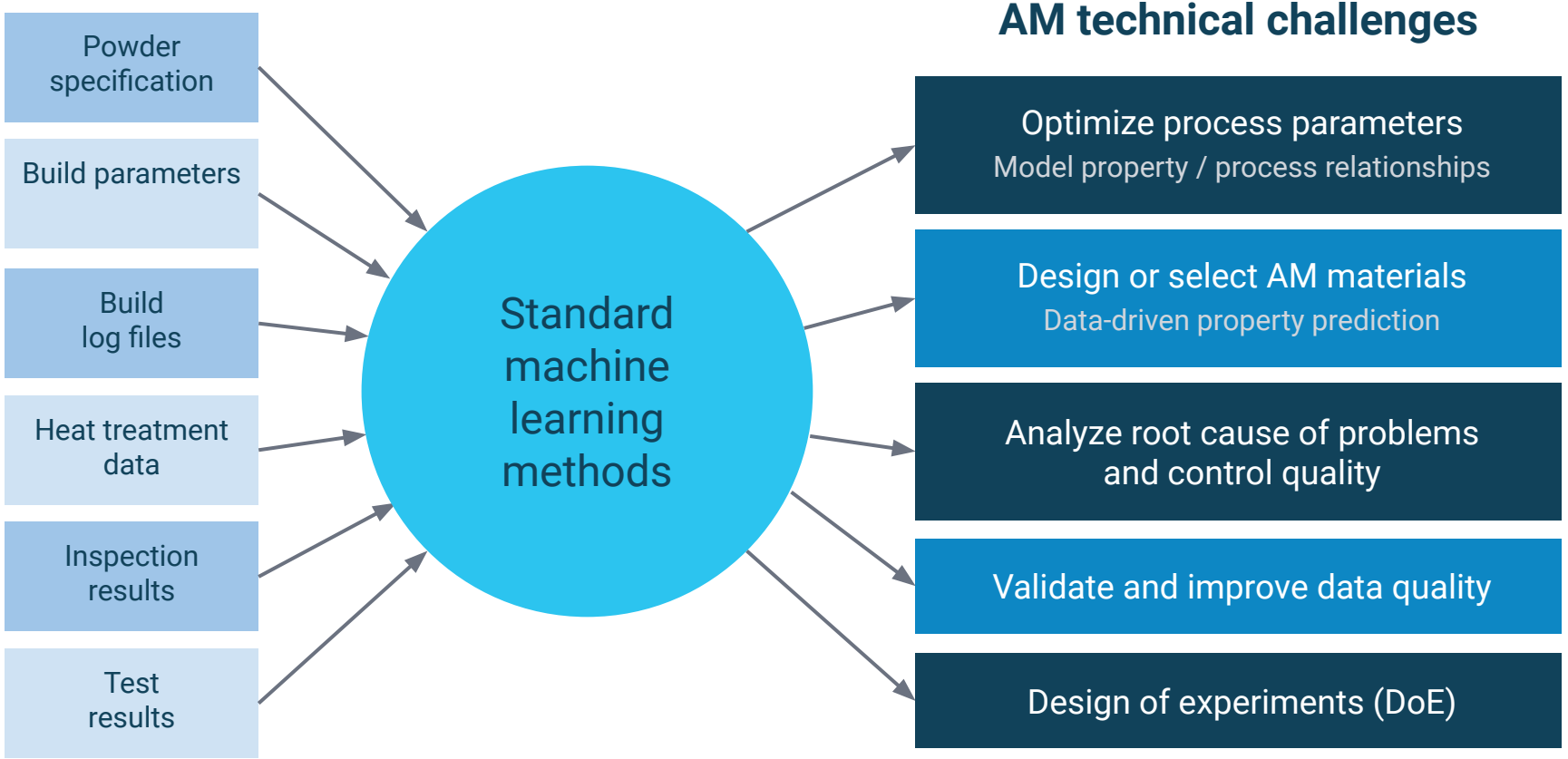
Design or select AM materials
Data-driven property prediction

Analyze root cause of problems and control quality

Validate and improve data quality

Design of experiments (DoE)

Can we use machine learning?



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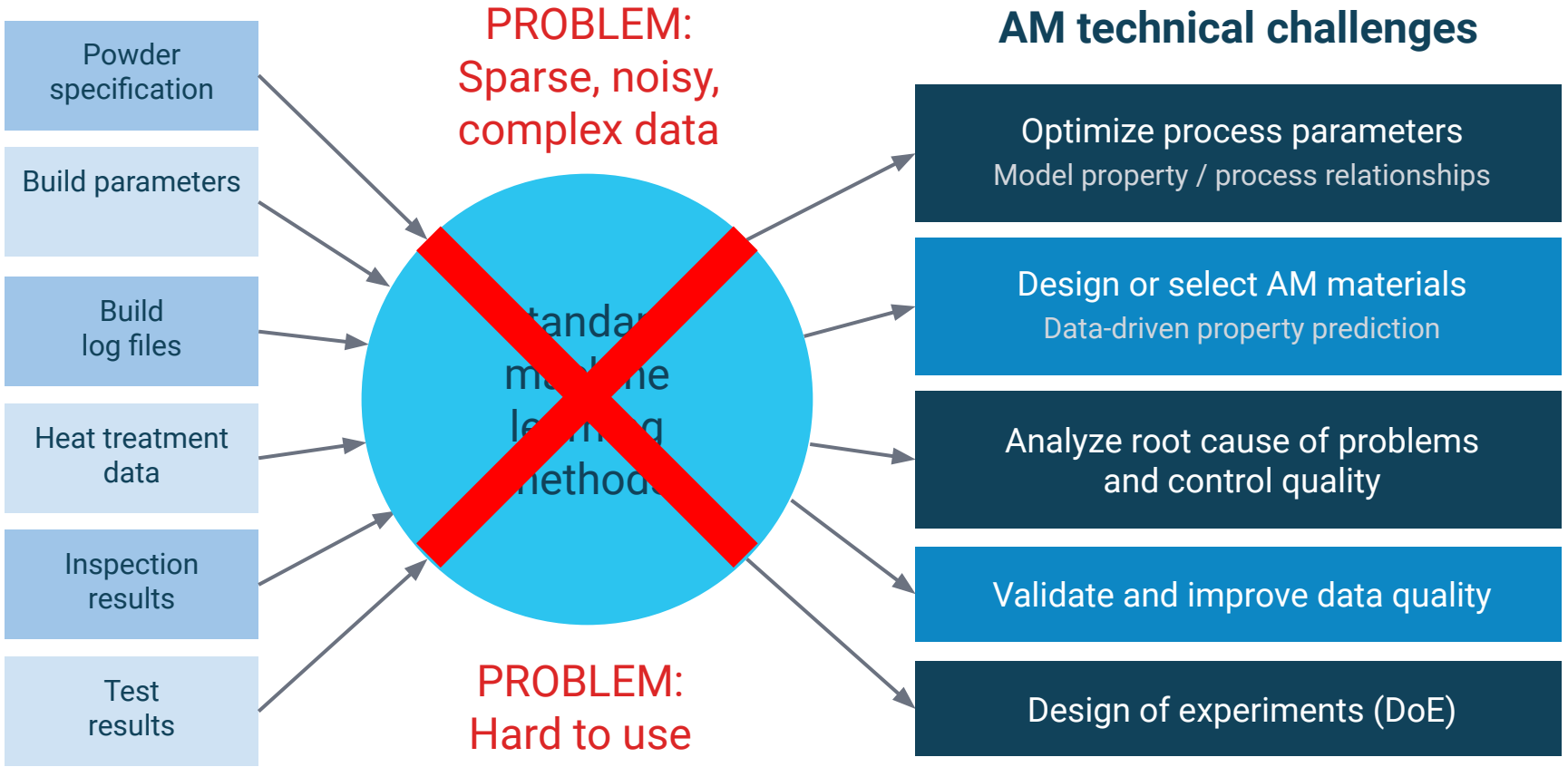
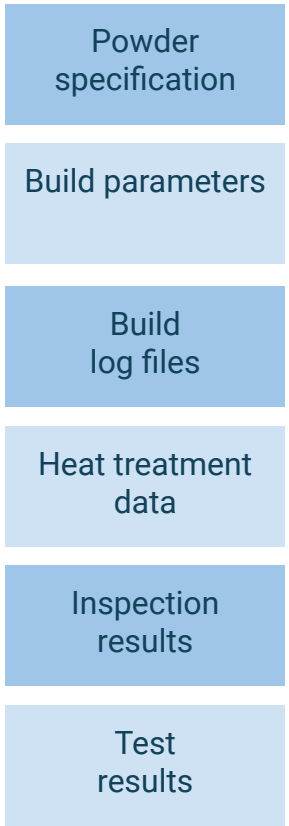


Why is AM project data sparse and/or noisy?



Because it is real-world data:

You cannot test every build for every property

Supplier or legacy data is incomplete or inconsistent

You are combining data from different sources or projects

- Projects with different goals test different properties

Variability of processes, machines, labs, and operators

Alchemite™ technology offers a unique combination

Value from sparse, noisy data

Unique self-consistent, iterative algorithm imputes sparse data

Optimise against multiple targets

Solves high-dimensional problems that were intractable

Quantify uncertainty to enable rational decisions

Accurate method (nonparametric probability distributions)

Make a fast start

Auto-generates models, requiring minimal assumptions

Speed and scalability

Light CPU / memory footprint: fast and works for huge datasets

A global view

E.g., ingredients *and* processing parameters in a combined study

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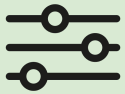

Optimise against multiple targets

Solves high-dimensional problems that were intractable

Handle sparse, noisy, complex data

Quantify uncertainty to enable rational decisions

Accurate method (nonparametric probability distributions)

Make a fast start

Auto-generates models, requiring minimal assumptions

Speed and scalability

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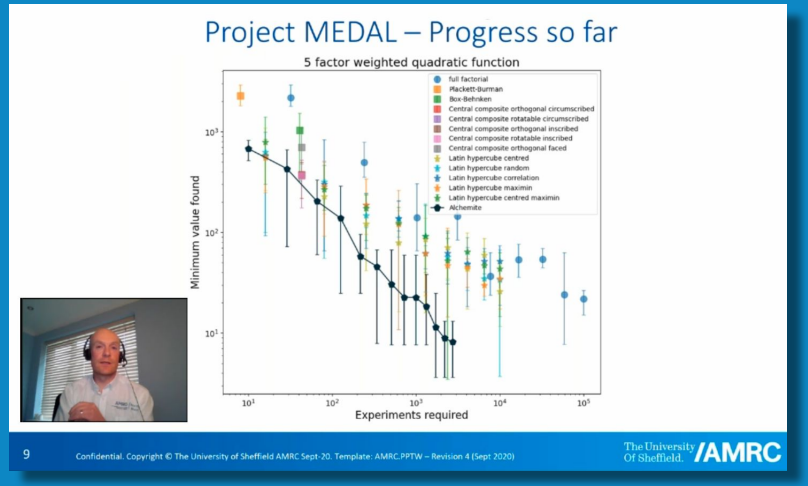
A ready-to-use solution

A global view

E.g., ingredients *and* processing parameters in a combined study



"Alchemite™ was able to converge on the optimum solution with far fewer experiments"

Ian Brooks, Technical Fellow, AMRC

intellegens.ai/webinars/

Example: Project MEDAL

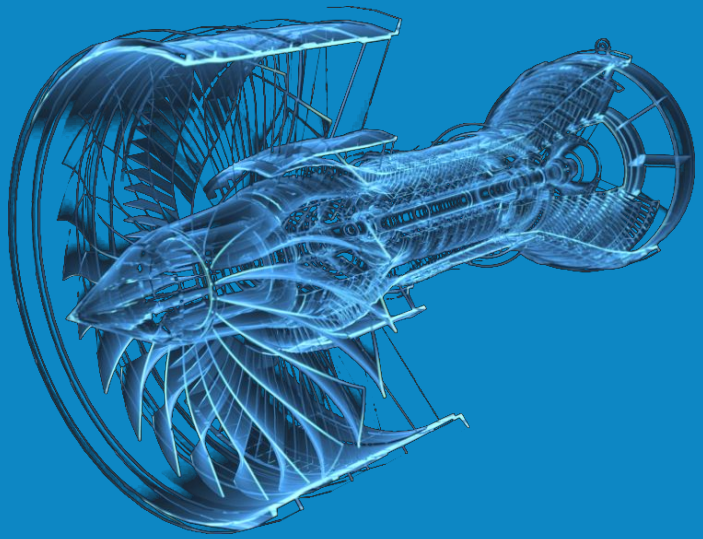
BOEING

The University Of Sheffield. AMRC Advanced Manufacturing Research Centre

Optimise process parameters
(Model property / process relationships)

Design of experiments (DoE)

Making the AM process for metallic alloys cheaper and faster.



intellegens.ai/applications/materials/

*Materials & Design **168**, 107644 (2019)*

Example: High temperature alloy

Design or select AM materials
(Data-driven property prediction)

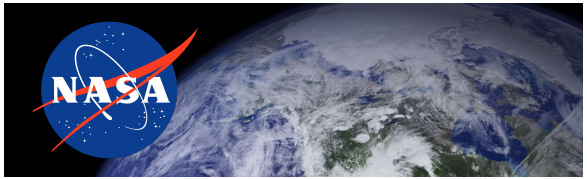
Validated a new alloy design for 20+ composition/process parameters to satisfy 11 physical criteria

90% fewer costly experiments

Reduced costs by $10 million

Accelerated typical discovery and validation time from 20 to 2 years

More examples - beyond additive manufacturing



Material/component design

Validate for heat exchanger and shape memory alloy applications

Ink reformulation

Cut key experimental timescales from months to minutes

Drug discovery

Predict pharmacokinetics to improve compound selection

Automotive catalysts

Speed-up experimentally-intensive design process

Hardfacing materials

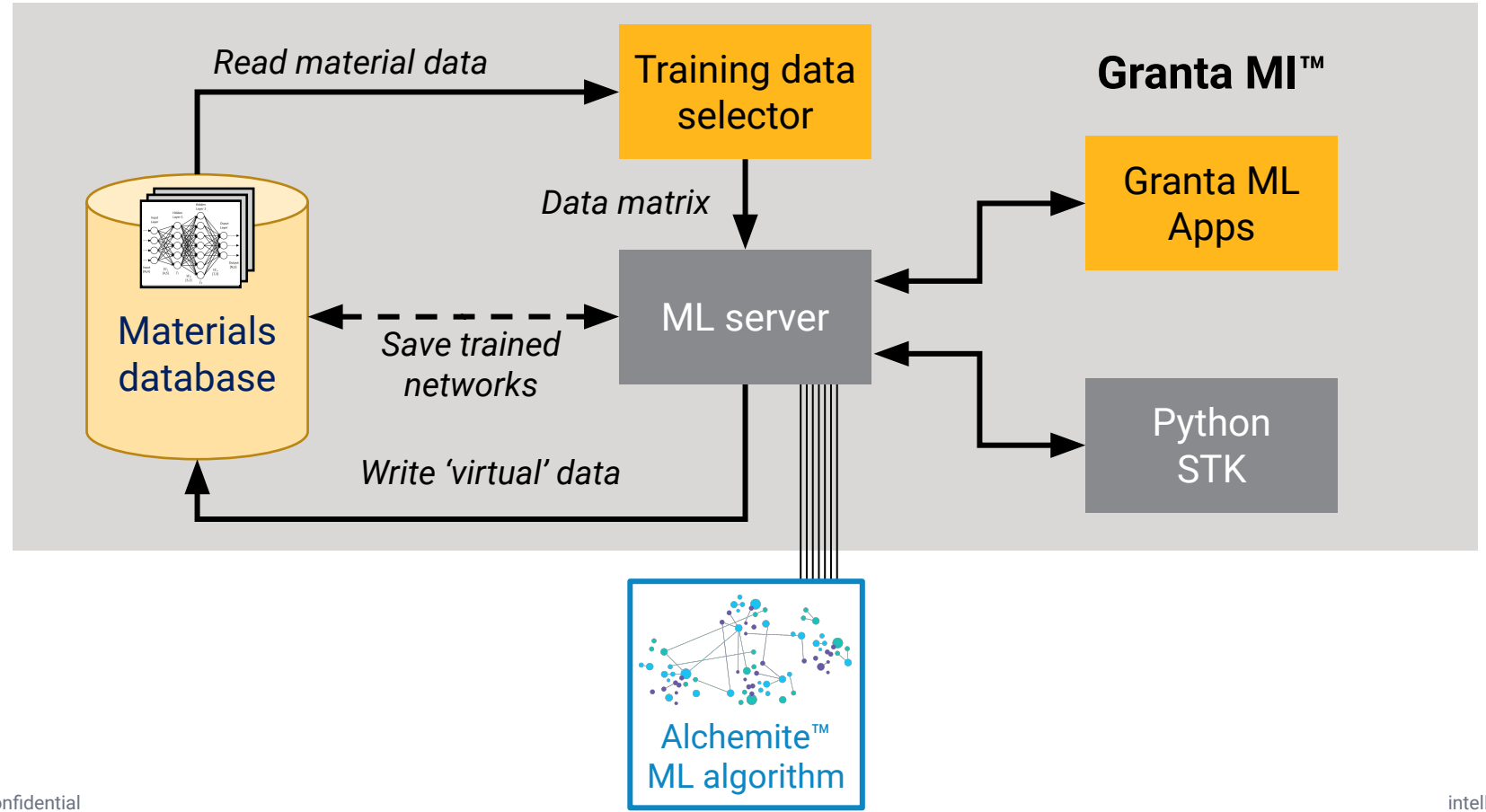
Design new surface treatments to reduce wear

Precision medicine

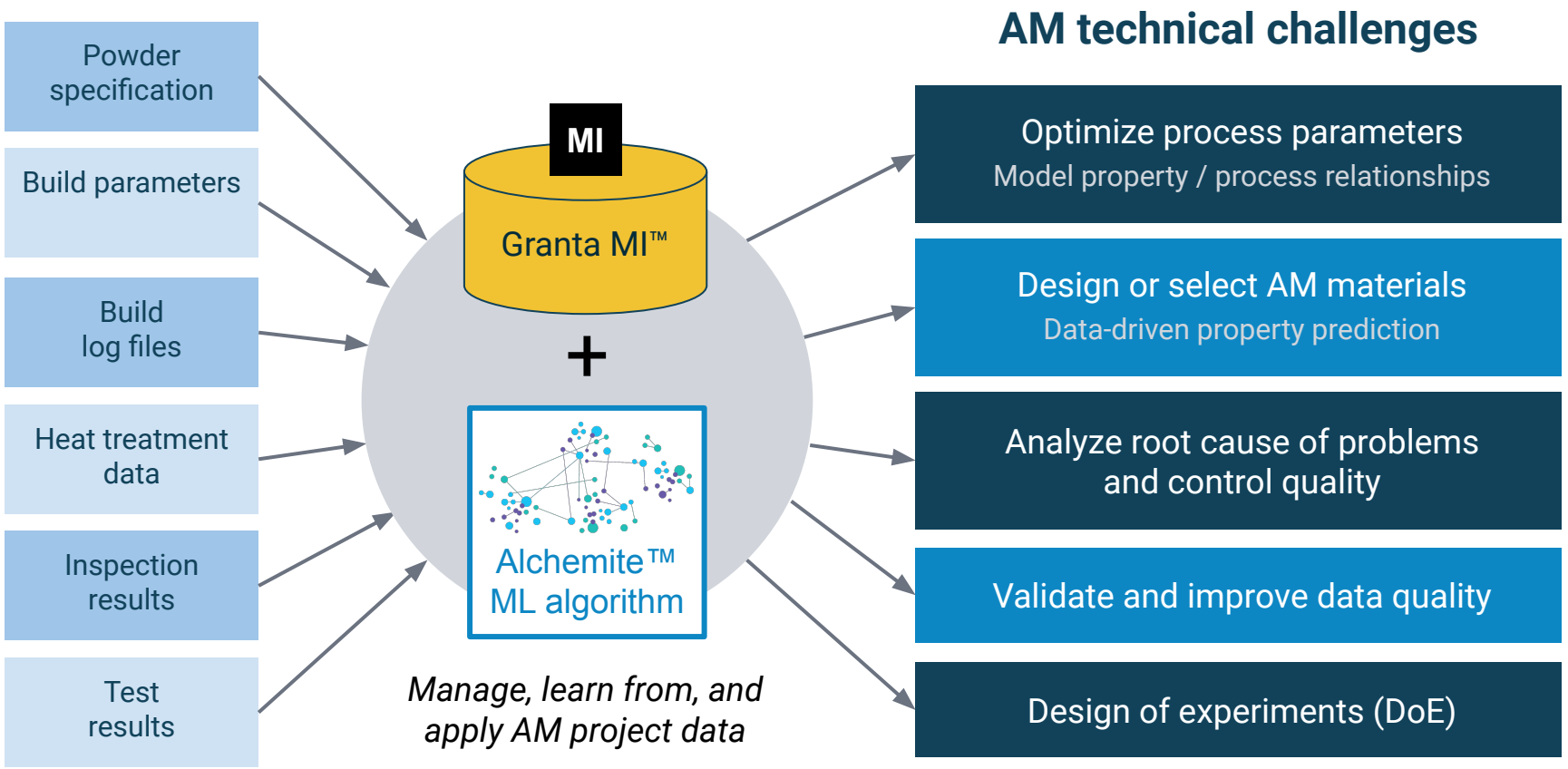
Personalise treatments based on patient data

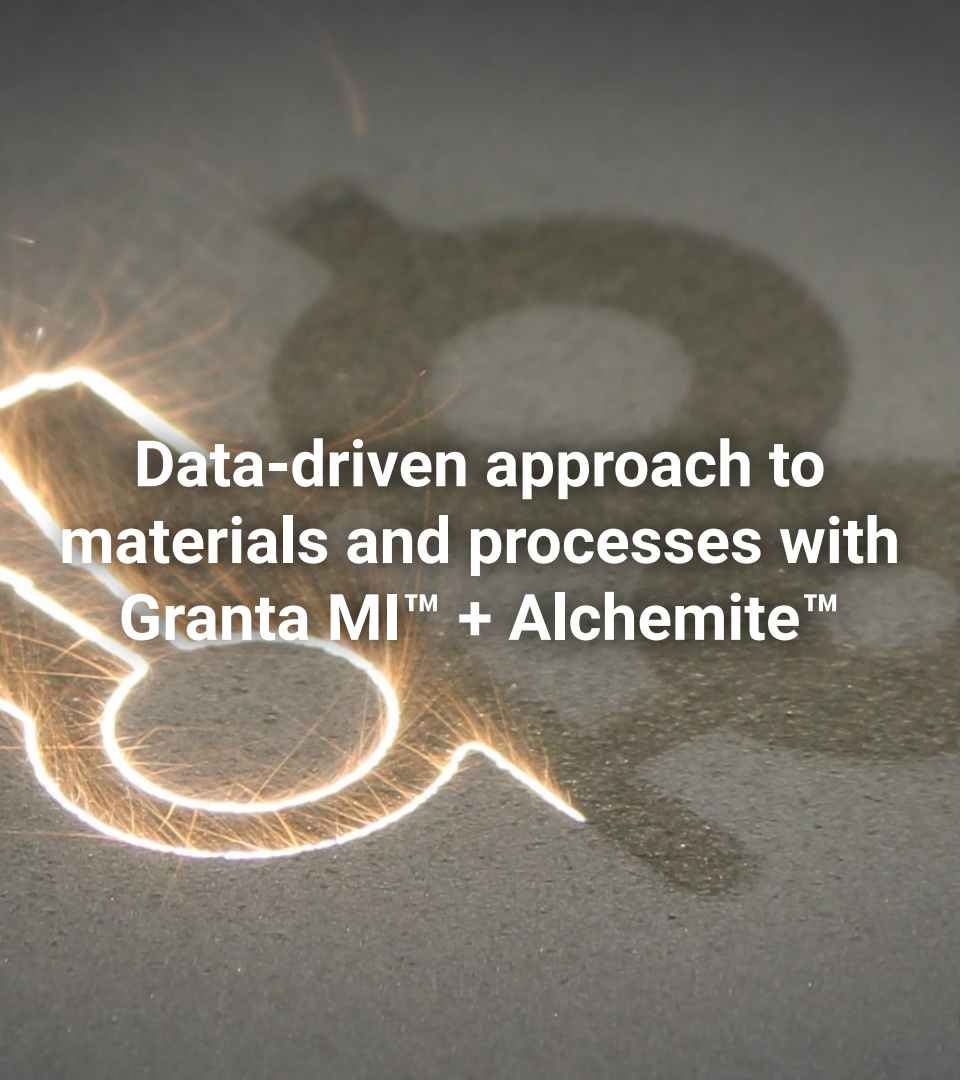
Intellegens and Ansys

Granta MI™ plus Alchemite™



Granta MI™ plus Alchemite™





Intellegens and Ansys

Improve material and process

Minimize risk with repeatable approach

Reduce cost and time to market

Website https://intellegens.ai

Contact gareth@intellegens.ai