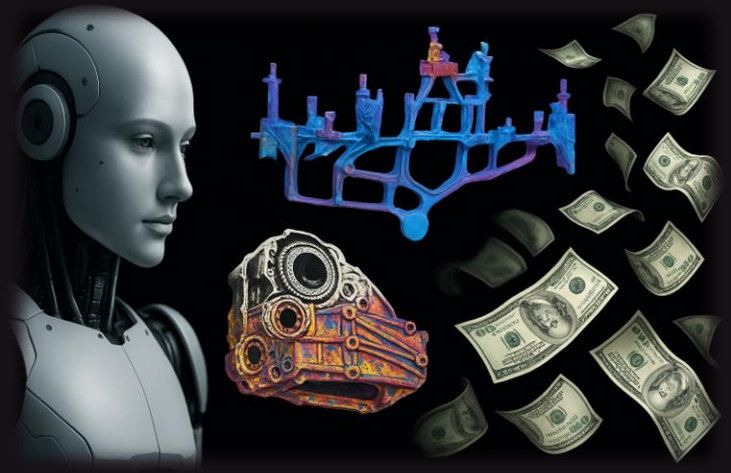


Using free LLM Tools for simple savings calculation

Data, Information, Knowledge Digitalization and Industry 4.0

Jan Eilers - with the input of Dr. Marcus Schopen (MAGMA GmbH)

AI tools (LLMs) & usage example

AI tools (LLMs)

Which tools are commonly used?

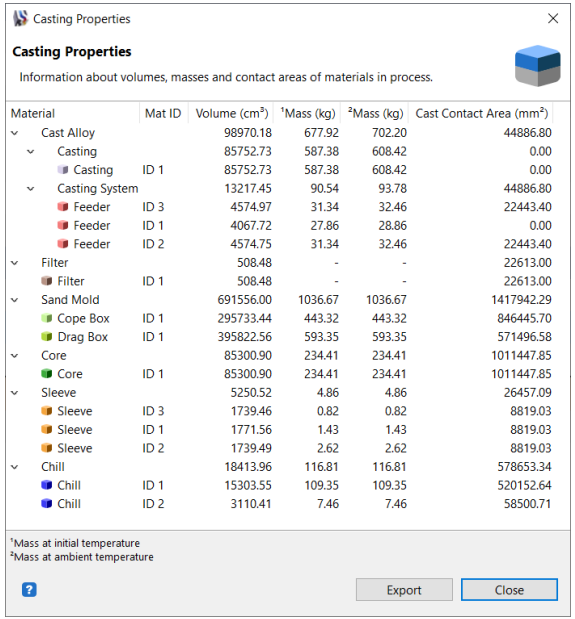
- ChatGPT (Open AI)
- Gemini (Google)
- Copilot (Microsoft)
- Grok (X / Twitter)
- Perplexity, Dall-E, deepseek, Claude, Canva, browseAI, Midjourney

일반적으로 사용되는 AI 툴

MAGMA ECONOMICS

What data do we need?

Name		Value	
Material Costs	f(x)	466.2611	€
Price-Liquid-Iron	f(x)	258.8645	€
Price-molding sand	f(x)	47.1115	€
Price-Core sand	f(x)	12.3909	€
Price-Chills	f(x)	78.1552	€
Price-Feeders per volume	f(x)	57.949	€
Price-Sleeves per piece	f(x)	57.96	€
Price-Filters	f(x)	11.79	€
Production Costs - labor	f(x)	460.8644	€
Moulding	f(x)	272.3741	€
Core making	f(x)	62.2231	€
Cleaning	f(x)	126.2673	€
Annealing	f(x)	54.8128	€
Production Costs	f(x)	927.1255	€
Production Costs per kg	f(x)	1.5223	€/kg



데이터 확보를 위한 LLM 활용
Ex)Economics

AI tools (LLMs) & How usage basics (prompting)

Still in discovery & development phase

So what is our experience?

- ChatGPT (Open AI)
  - great to use for everyday questions, research, brainstorming, creative work (marketing), helping to phrase emails, make translations, etc.
- Grok (X / Twitter)
  - useful when it comes to cost calculations and using it to get technical data and input

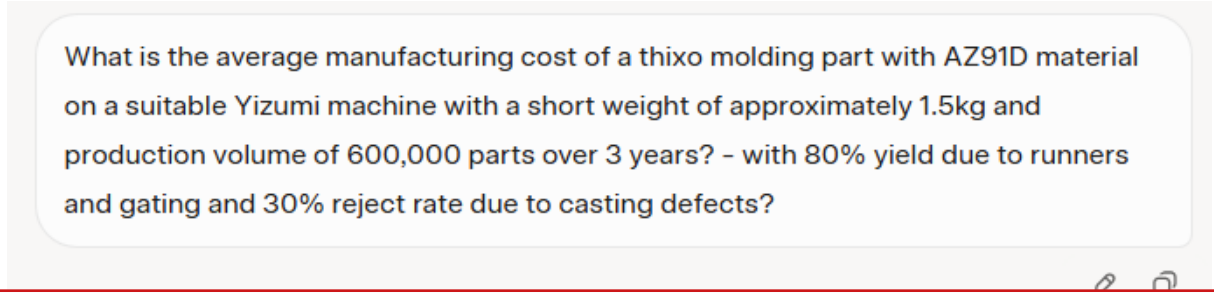
각각의 장점이 있는 LLM
ChatGPT: 일반적인 질문, 브레인스토밍, 마케팅, 이메일 작성, 번역
Grok: 비용 계산이나 기술 데이터 및 자료 수집에 유용

A Thixo Example

Thixo Example

A more detailed description:

MAGMA ECONOMICS 데이터 확보를 위한 LLM 활용 사례
- Thixo 제품의 제조 비용 질문

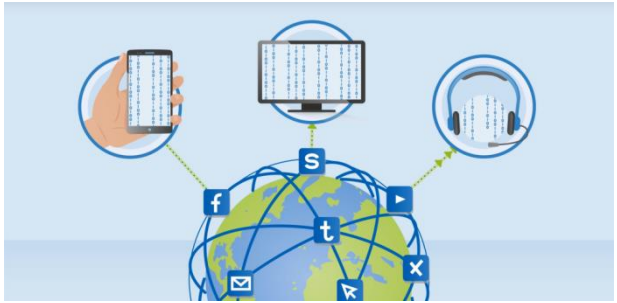


What is the average manufacturing cost of a thixo molding part with AZ91D material on a suitable Yizumi machine with a short weight of approximately 1.5kg and production volume of 600,000 parts over 3 years? - with 80% yield due to runners and gating and 30% reject rate due to casting defects?

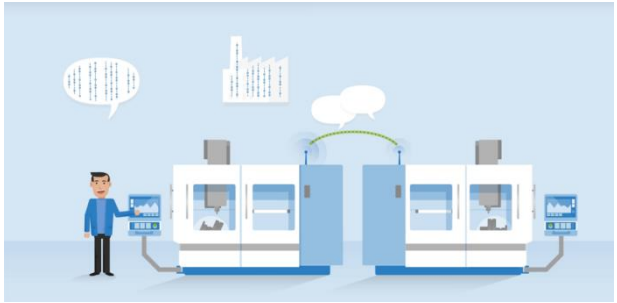
Data, Information, Knowledge
Digitalization and Industry 4.0

Introduction

Change in communication



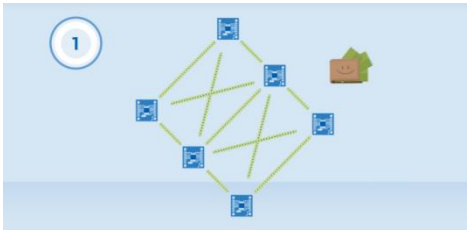
Human/human communication is becoming increasingly digital



Human/machine communication is changing - Machines communicate with each other

Favoring Factors

산업의 차원을 변화시키는 디지털화



Sensors are becoming smaller, more powerful and cheaper

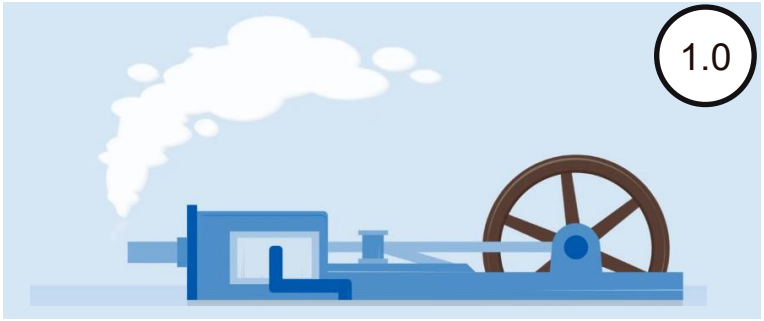
Computing power and **data storage** are becoming more powerful and cheaper

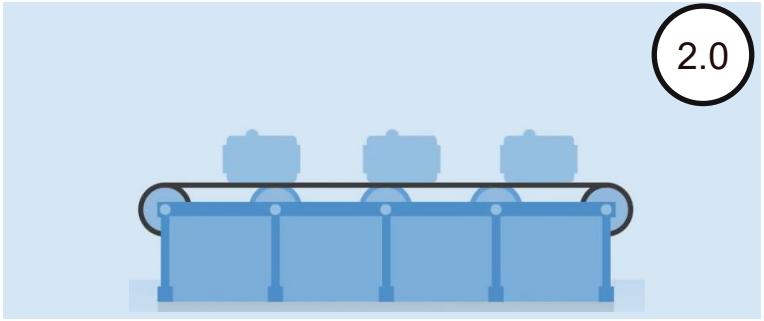
Global **networks** enable **location-independent communication**

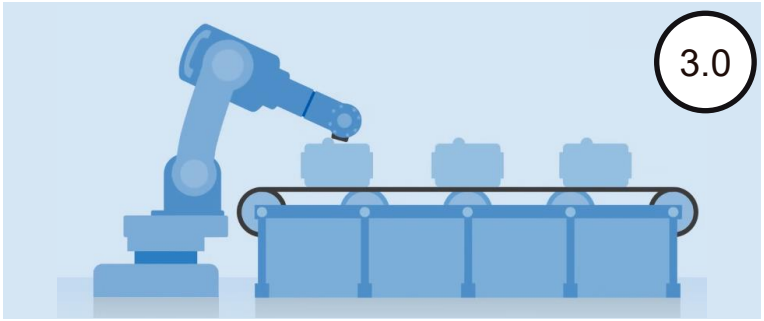
Why 4.0?

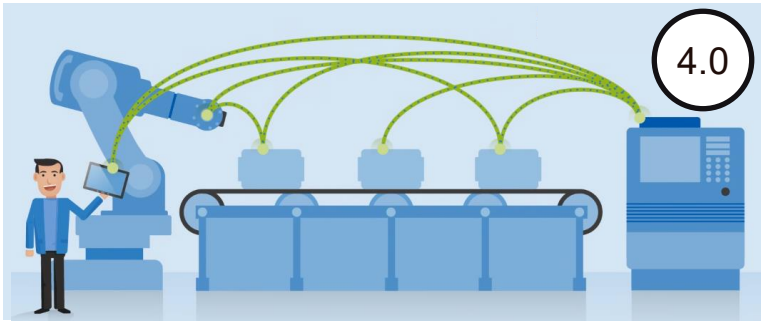
The four industrial revolutions

산업 발전의 역사







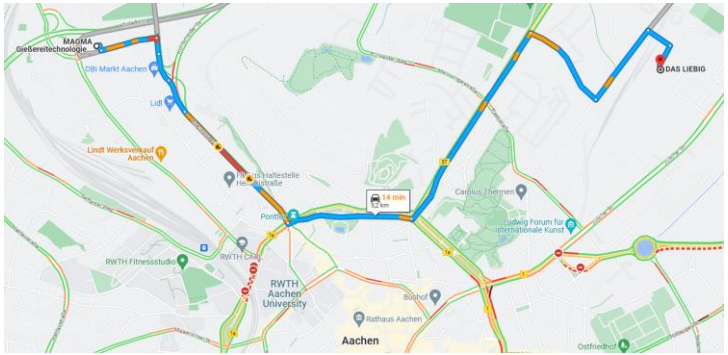


Terminology I

Digital shadow 디지털 섀도우

- Digital **recording** of a **real existing** object

실제 존재하는 객체의 데이터를 단방향으로 디지털 모델에 기록



Digital twin 디지털 트윈

- Virtual replication through process and simulation **models** of the real existing or **not yet existing** object

현실의 시스템을 가상 조건에 복제하여 양쪽이 서로 데이터를 주고 받으며 실시간으로 동기화 되는 모델

Terminology II

Data 데이터

- Sequence of different symbols and signs
- No meaning without context

데이터 그 자체로는 의미가 없음
그저 수치일 뿐

Information 정보

- Data is put into context, processed or linked with each other
  ➔ Information

데이터를 맥락에 맞춰 해석한 것이 정보

Knowledge 지식

- Linking and processing information also with experience

정보를 경험과 연결하여 처리

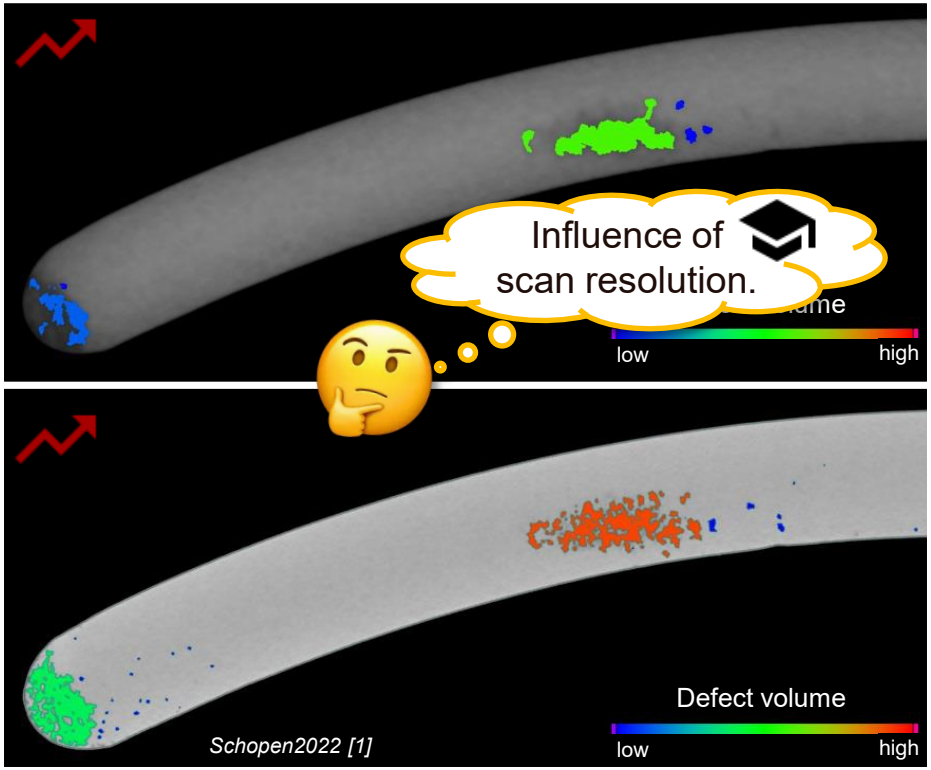
Making decisions, creating value!

Data collection

데이터 수집에서 측정 방식 이해의 중요성
- 같은 것을 측정하더라도 다른 결과를 얻을 수 있음

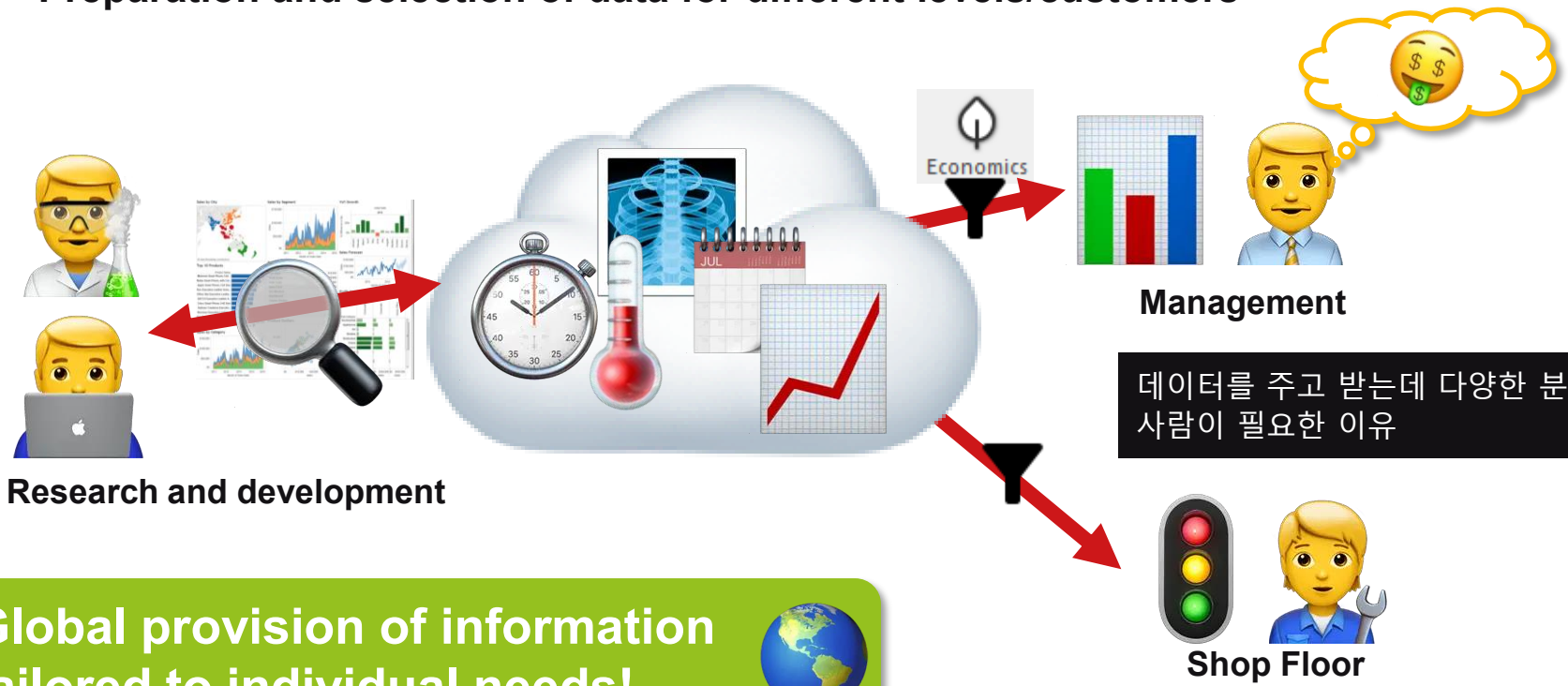
Consideration of the measurement technology is essential!

X-ray and CT evaluation of the same sample



Communication and transparency

Preparation and selection of data for different levels/customers



데이터를 주고 받는데 다양한 분야의 사람이 필요한 이유

Global provision of information tailored to individual needs!

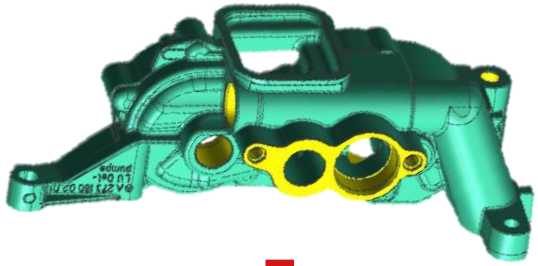
MAGMA

MAGMASOFT®
autonomous engineering

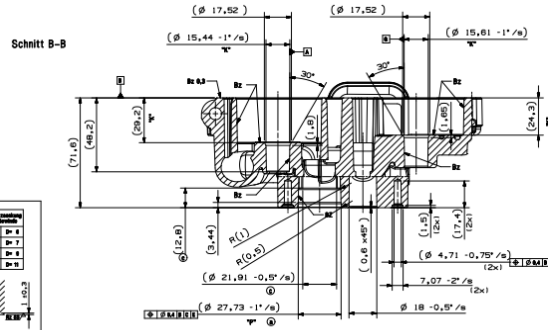
Digitalization and Industry 4.0 @ MAGMASOFT®

Data exchange in MAGMASOFT®

Geometry import and translation of the real quality requirements



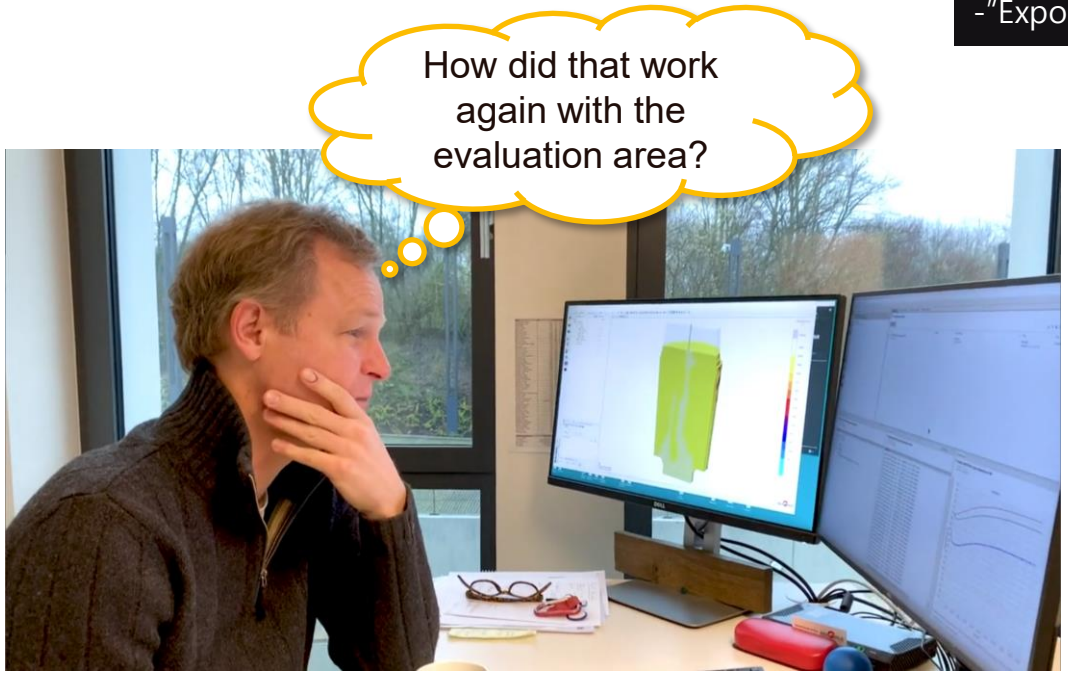
고객사가 가지고 있는 정보
- 제품 형상, 품질 기준, 공정 정보 등

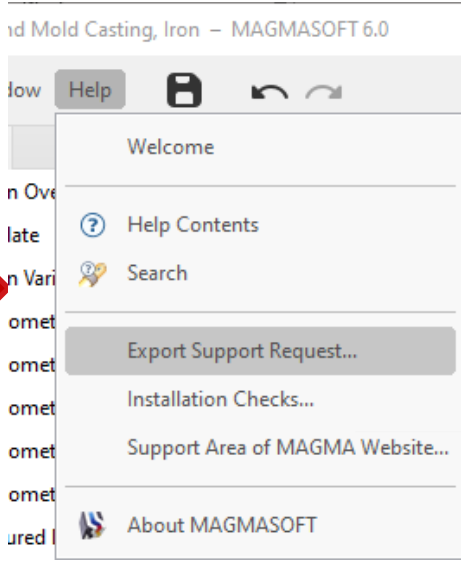


Support Call

Provision of needs-based information

고객사 -> MAGMA 정보의 연계를 위한 기능
-"Export Support Request"

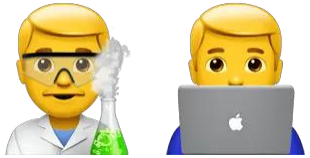


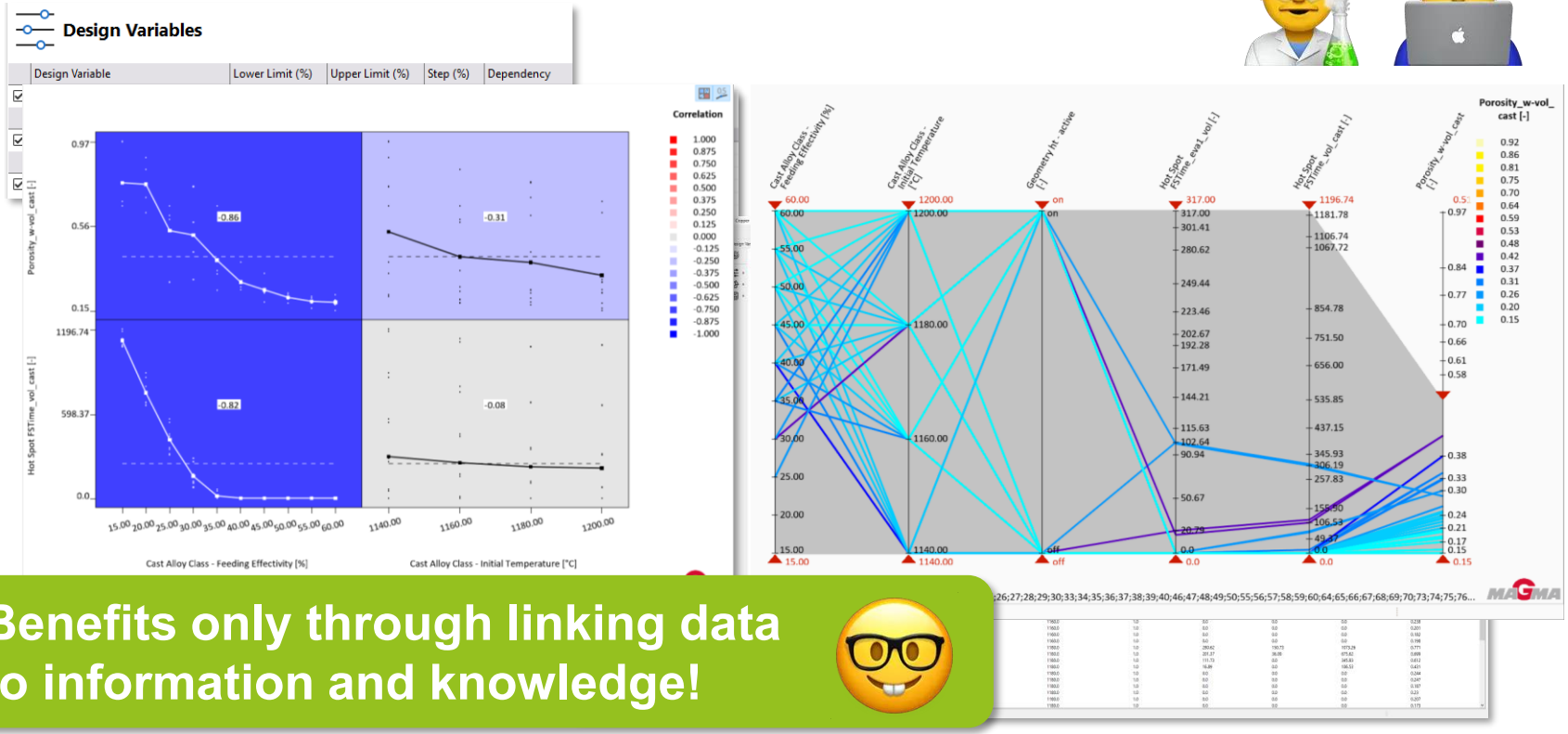


Design of Experiments

데이터 -> 정보 -> 지식 연계

Identifying correlations and defining threshold values

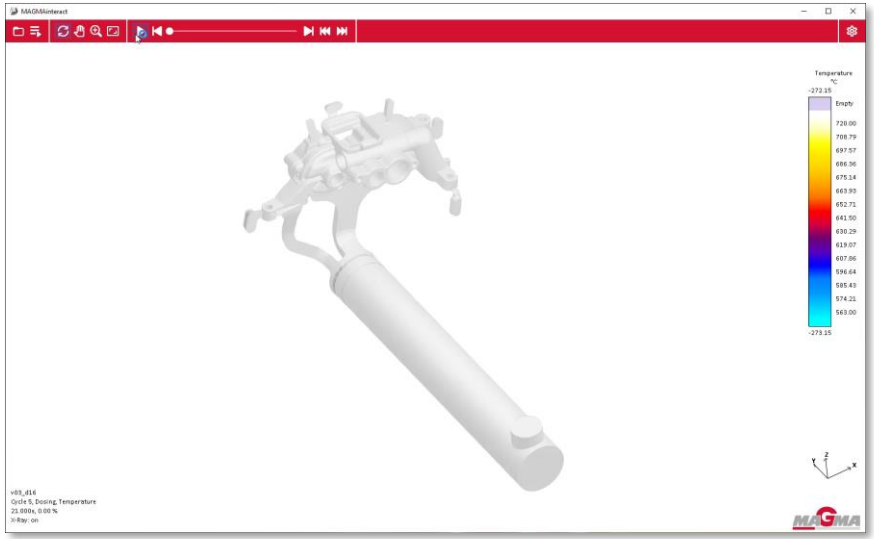


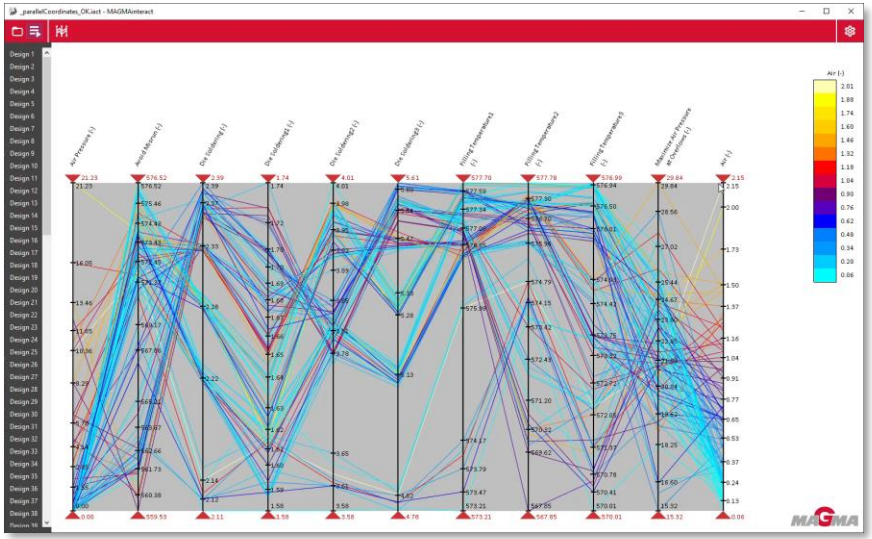


Benefits only through linking data to information and knowledge!

Interact

Sharing results with internal and external customers





Interact: MAGMASOFT의 결과 Viewer 프로그램
- 의사소통 도구로 활용

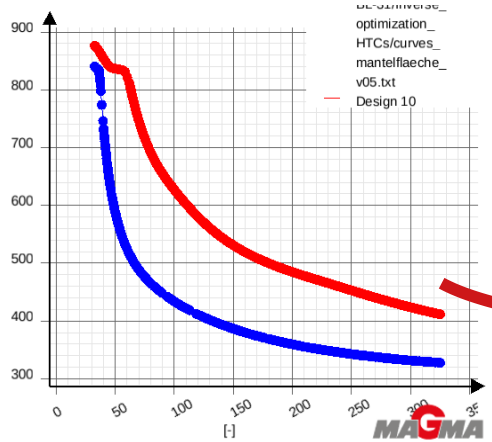
Inverse optimization

Determining simulation parameters

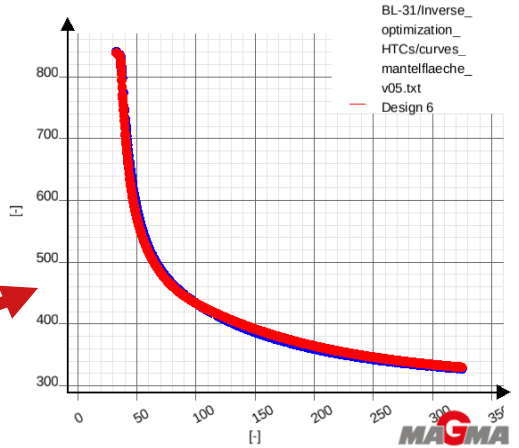
MAGMASOFT에서의 디지털 트윈
- Inverse optimization을 통한 디지털 트윈 달성

- measurement (digital shadow)
- simulation (digital twin)

INVERSE OPTIMIZATION



Material data or Simulation boundary conditions



cmp. temperature curves

Heat transfer coeff.

minimized deviation

Virtual die casting machine

MAGMASOFT®
autonomous engineering

Cooperation partners:

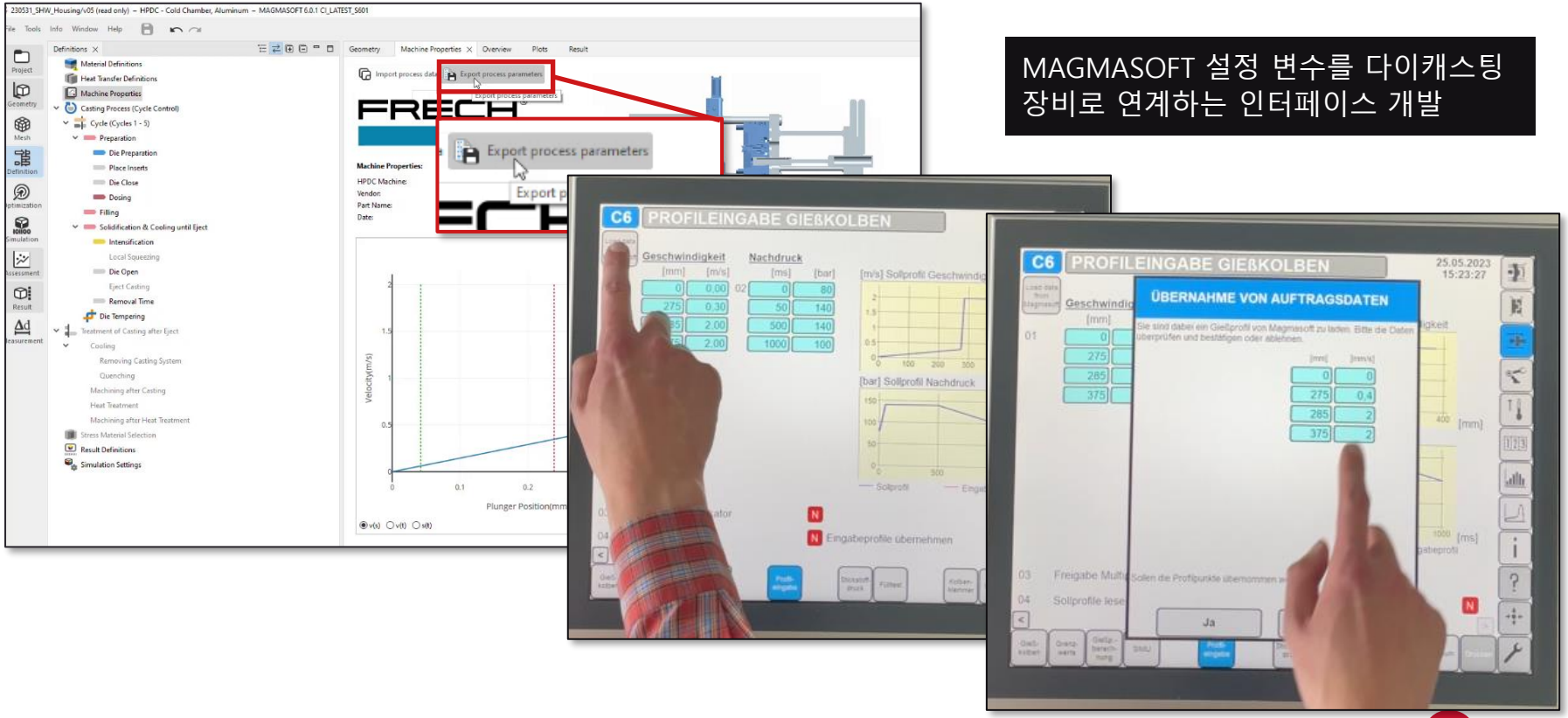
FRECH®

ELECTRONICS

1. Simulation starts Production

Automated transfer of simulation parameters to the die casting cell

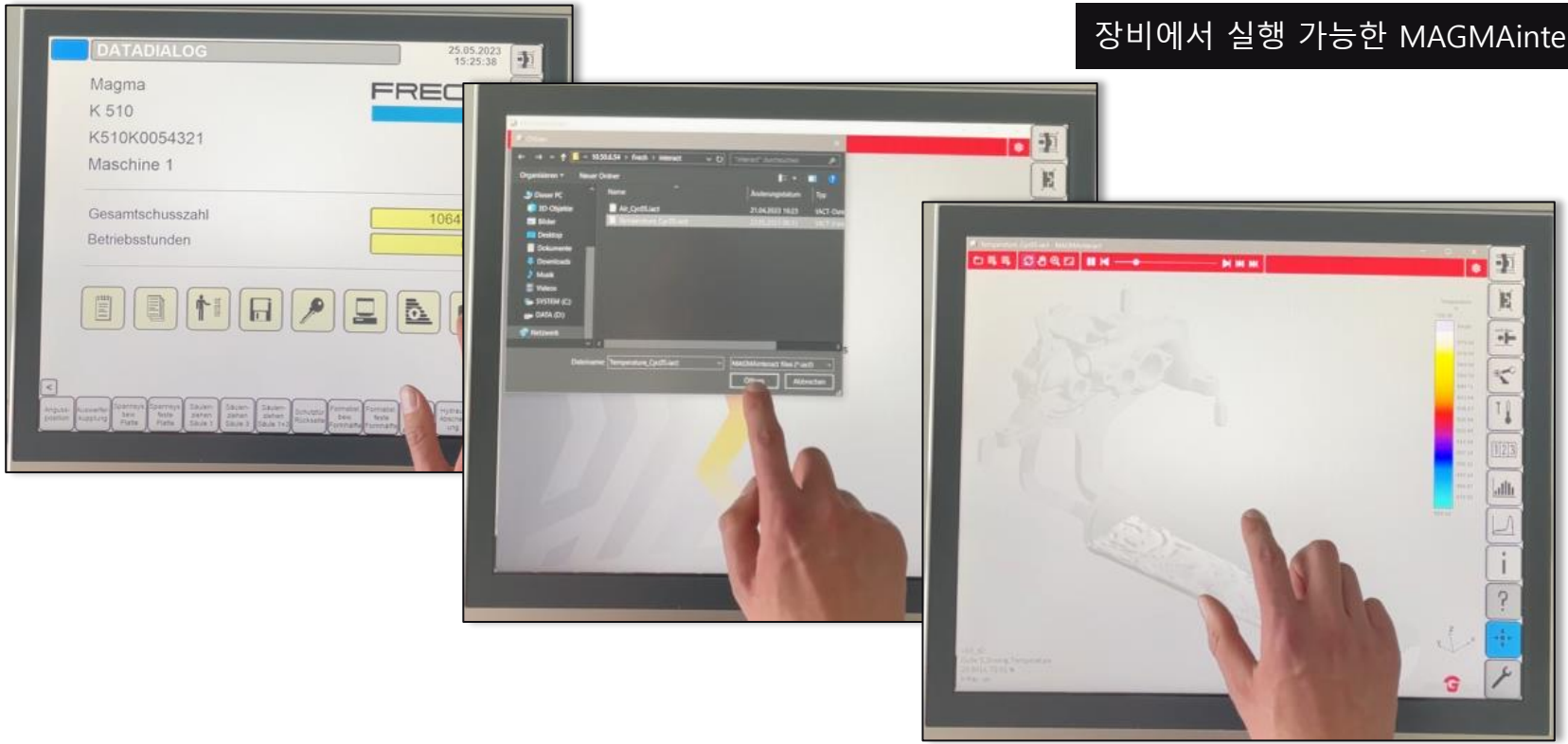
MAGMASOFT 설정 변수를 다이캐스팅 장비로 연계하는 인터페이스 개발



2. MAGMASOFT® meets Shopfloor

3D visualization of simulation results directly on the machine

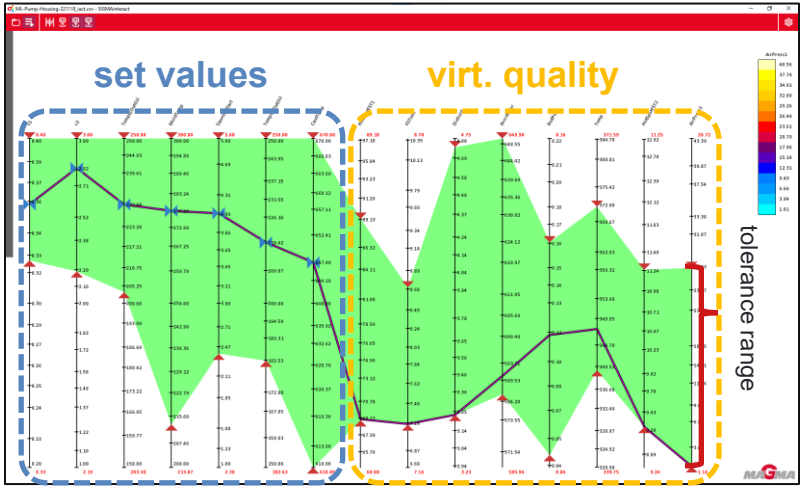
장비에서 실행 가능한 MAGMAinteract

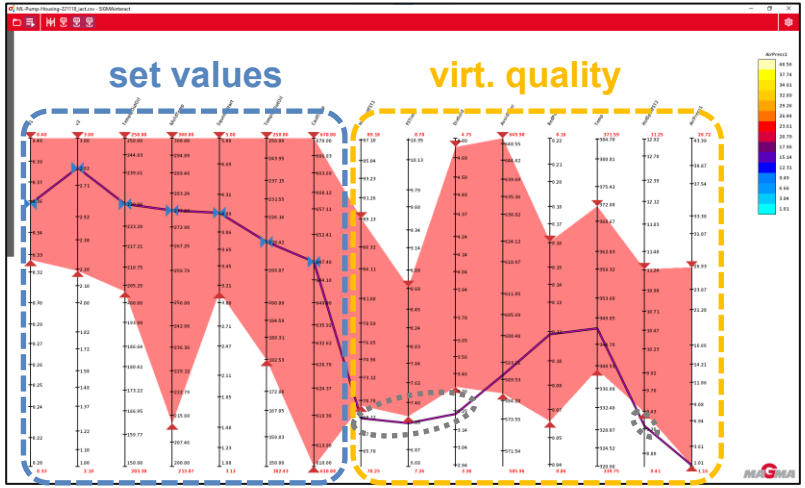


3. Online quality forecast

Huge DoE (~200 designs) trains regression algorithm

해석 장비 연계 DOE 진행
- 생산 중 실시간 적용

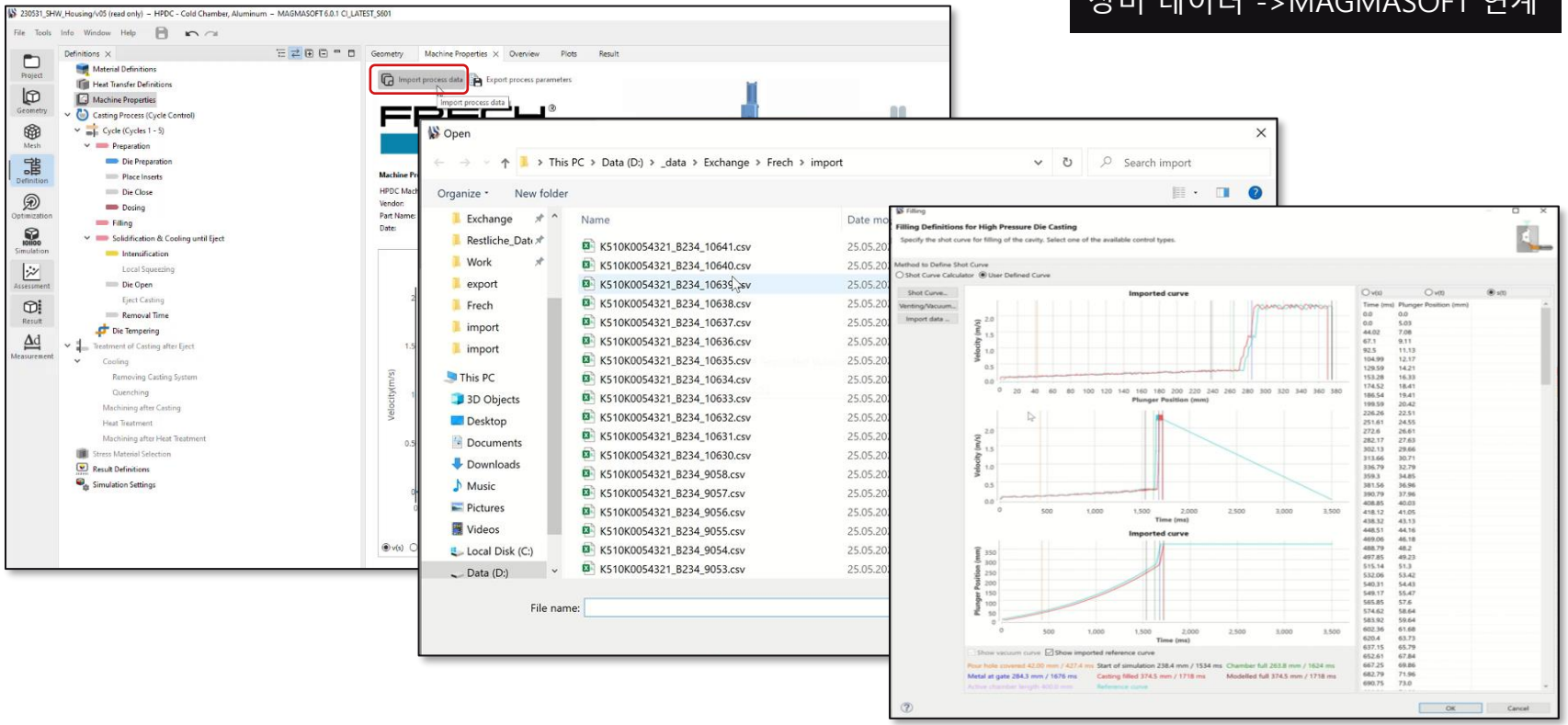




4. Feed back data

Use real process data – without "typing"

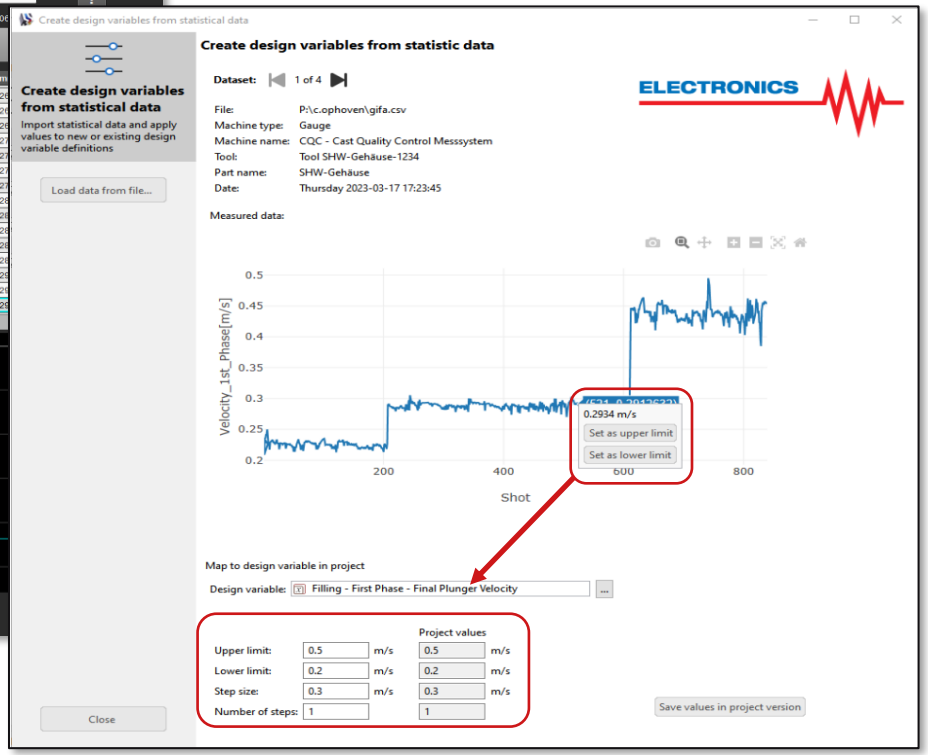
장비 데이터 ->MAGMASOFT 연계



5. Import of statistical data

Importing the real process window into MAGMASOFT®

센서 기술 확보



Thank you for your attention.

Jan Eilers

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