bundesdruckerei.

A method to strategically pre-process data from industrial processes before storage and analysis

JMP Discovery Summit Europe 2023

Date   6-9 March 2023
Place   Sitges, Spain
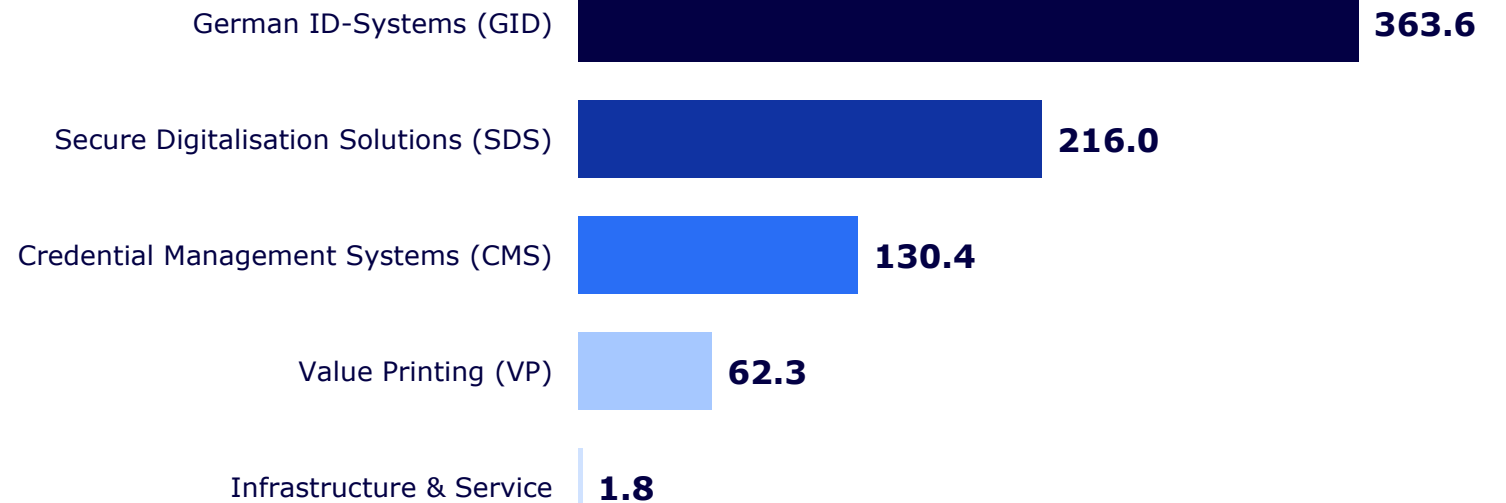Authors   Dr. Luís Fernando Ferreira Furtado, Güneş Pekmezci, Dr. Michael List

The Bundesdruckerei Group in figures

bdr.

Key Figures 2021

4,200 Patents

3,500 Employees

774.0 Sales in EUR million

German ID-Systems (GID)	363.6
Secure Digitalisation Solutions (SDS)	216.0
Credential Management Systems (CMS)	130.4
Value Printing (VP)	62.3
Infrastructure & Service	1.8

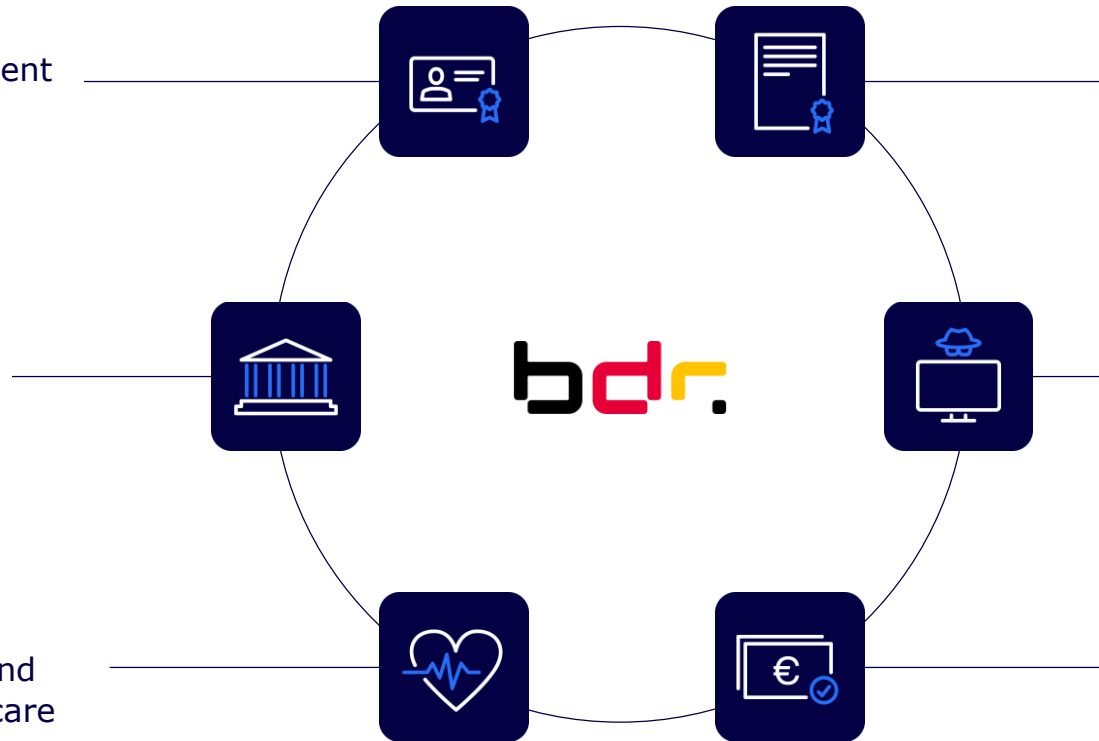# Target markets and customers

Official IDs

Secure official identities and pertinent documents (physical and digital), systems and processes.

eGovernment

Products and systems for secure and trusted digitalization of the public administration.

Health

Products and systems for secure and trusted digitalization of the healthcare system.

Security documents

Official security documents, such as banknotes, postage stamps, tax stamps and the pertinent security features.

High security

Digital products and solutions for security authorities and organizations with higher security requirements.
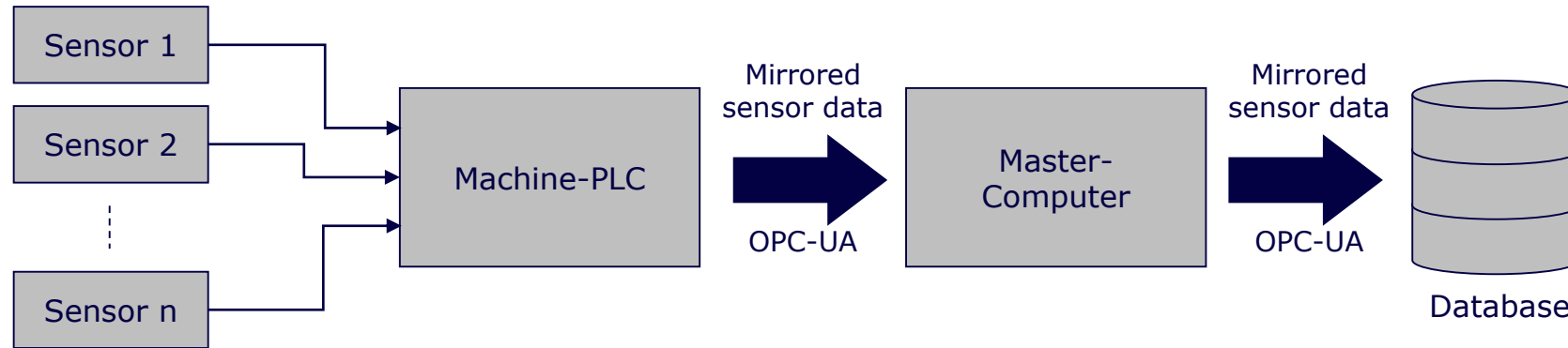
Finance

Products and systems to control and secure financial transactions in both the public and enterprise sector.

(Taxes, banks, insurance, etc.)

Case Study

Document

- German passport.
- Used for the purpose of international travel.
- Expiration: 10 years.
- Complex document.

Process

- Punching process.
- A good process understanding is available.
- The access data from the PLC is possible.

Objective

- Product quality assurance by predictive knowledge of the tool wear state.
- Minimization of machine downtimes.
- Basis for analyzing the long-term behavior of the process.

Product and process
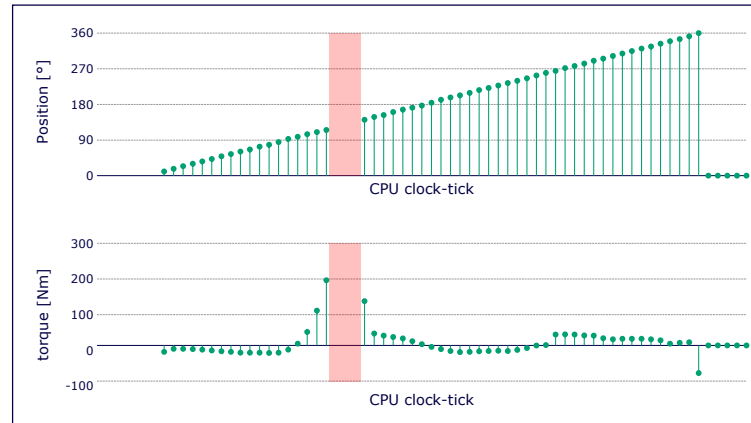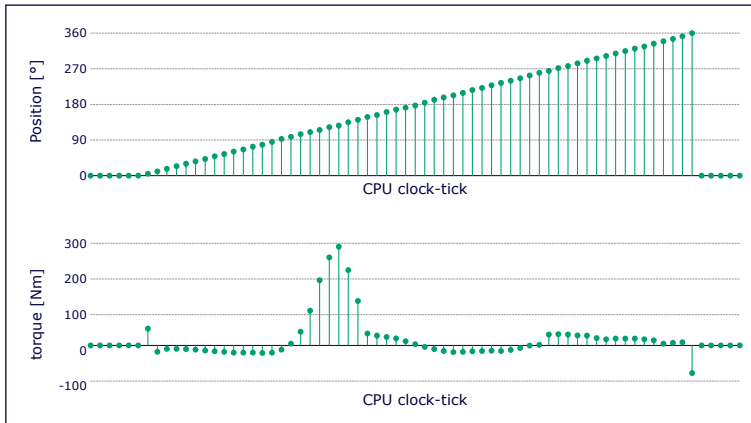
Data handling architecture

Original implementation

Original PLC implementation
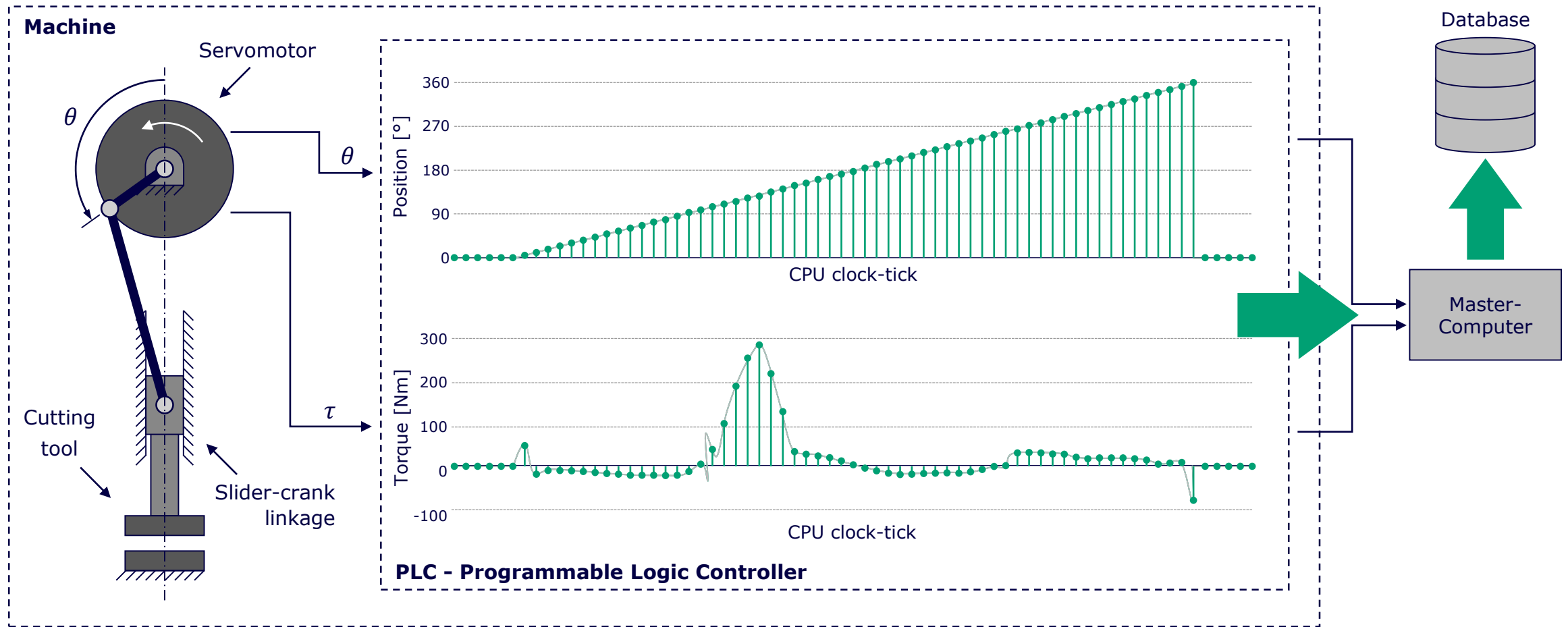
Original implementation and its challenges
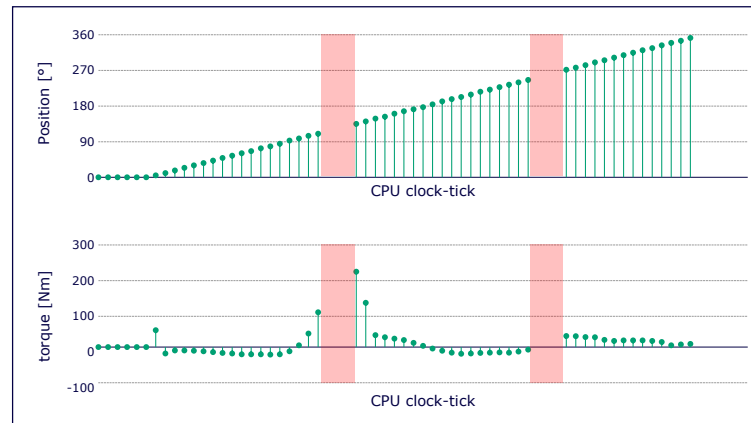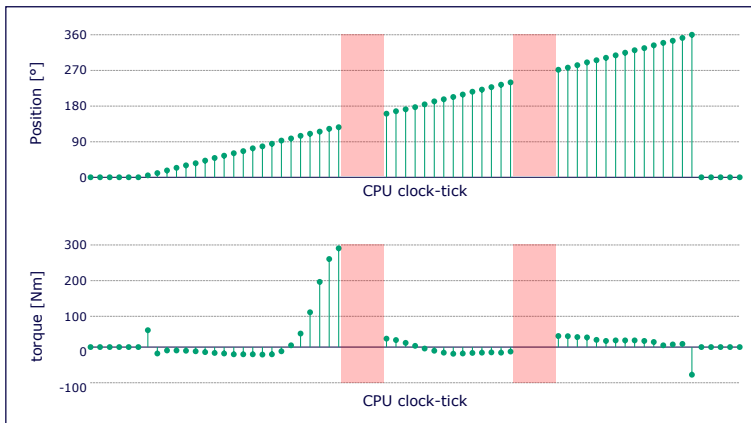
Results

Using the OPC-UA architecture with a 100Hz sampling rate, around 5% of the data is not transferred from the PLC to the database.

Even with only around 95% of the data, it is required a large storage in the database.

Using the original implementation, the tool wearing monitoring is compromised.

Open questions

- Is it possible to reliably measure the tool wear using the motor torque?
- How to reduce the amount of useless data transferred to the server and stored in the database?

Experiment and locally collected data

Overview of the experiment

Using the PLC measuring application to collect data from several machine cycles, four scenarios were tested:

**Old and worn tool** cutting a passport with **32 pages.**

Old and worn tool cutting a passport with **48 pages.**

**New and sharp tool** cutting a passport with **32 pages.**

New and sharp tool cutting a passport with **48 pages.**

Analyze

- All the scenarios presented the same shape of the curve.

- Only the peak value could be used, instead of the whole machine cycle data.

- The peak value of the curve could be used for:
  - Tool wear monitoring.
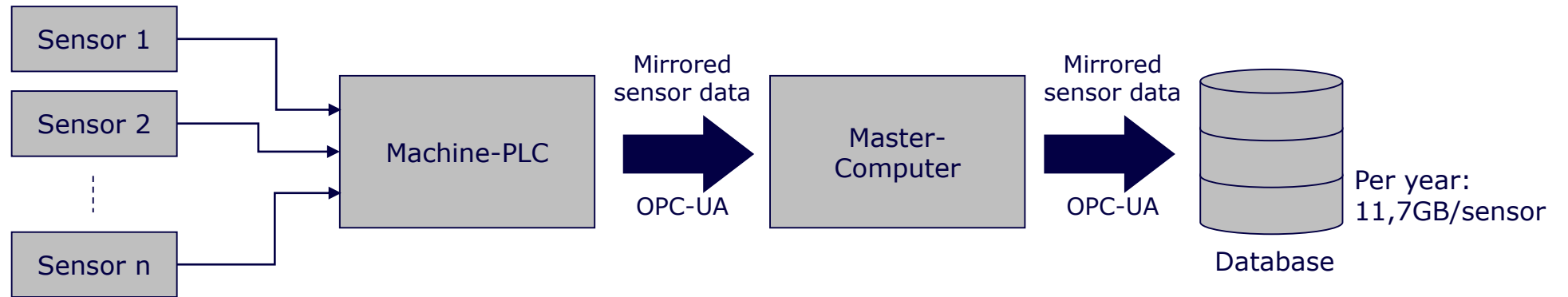 - Product classification (32 or 48 pages).
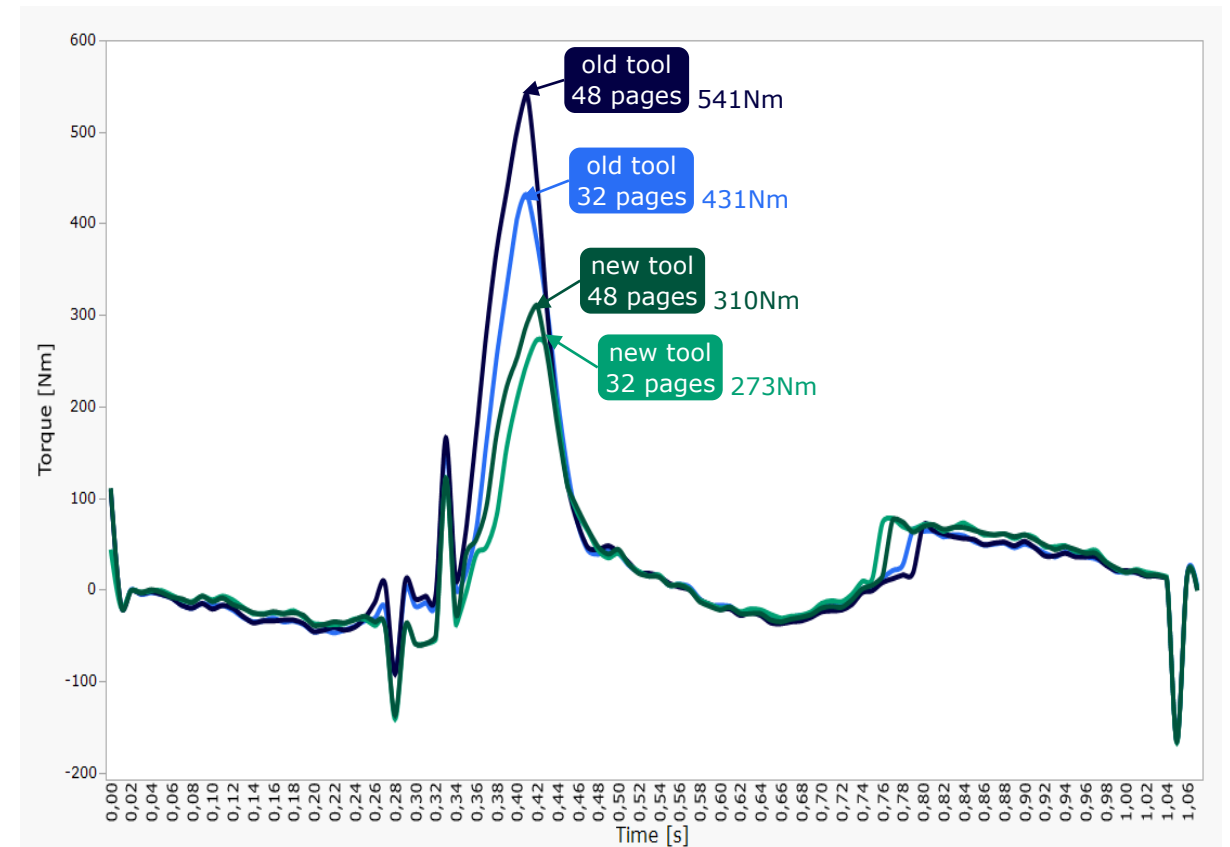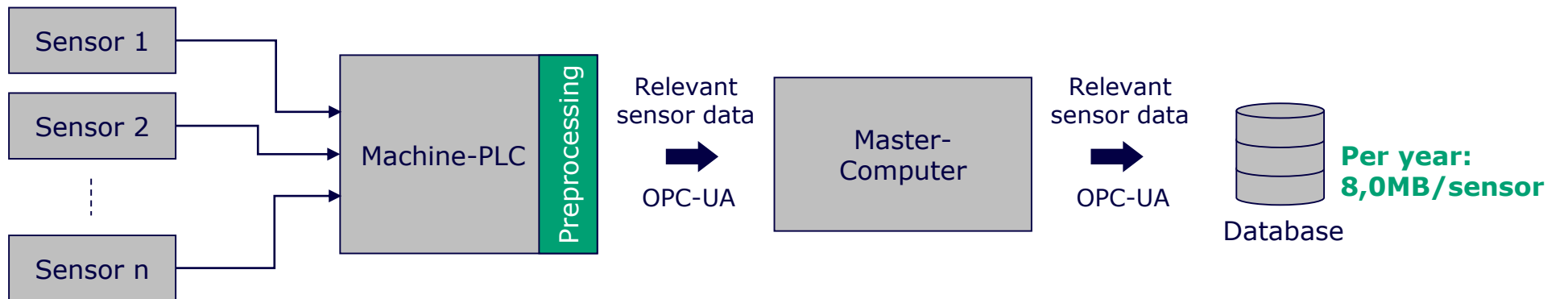
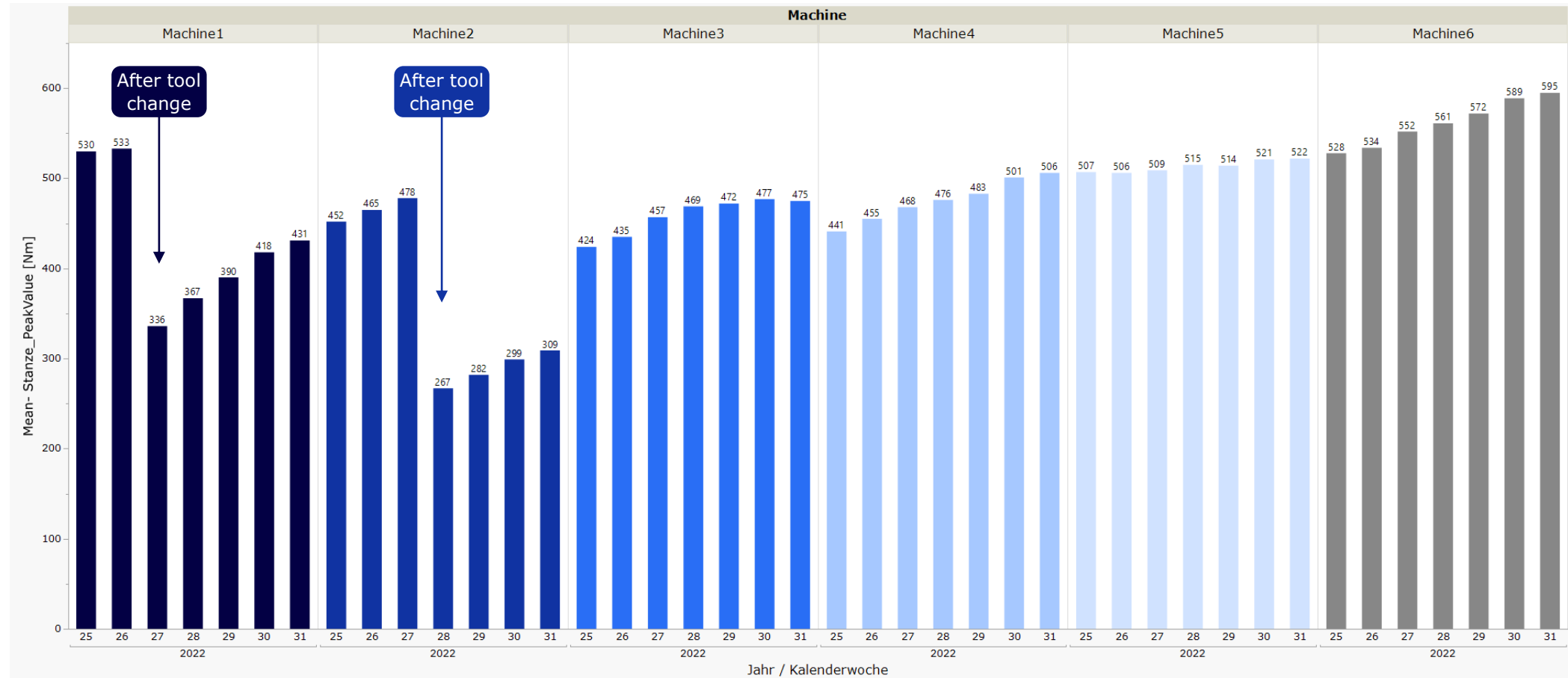# Proposed PLC implementation
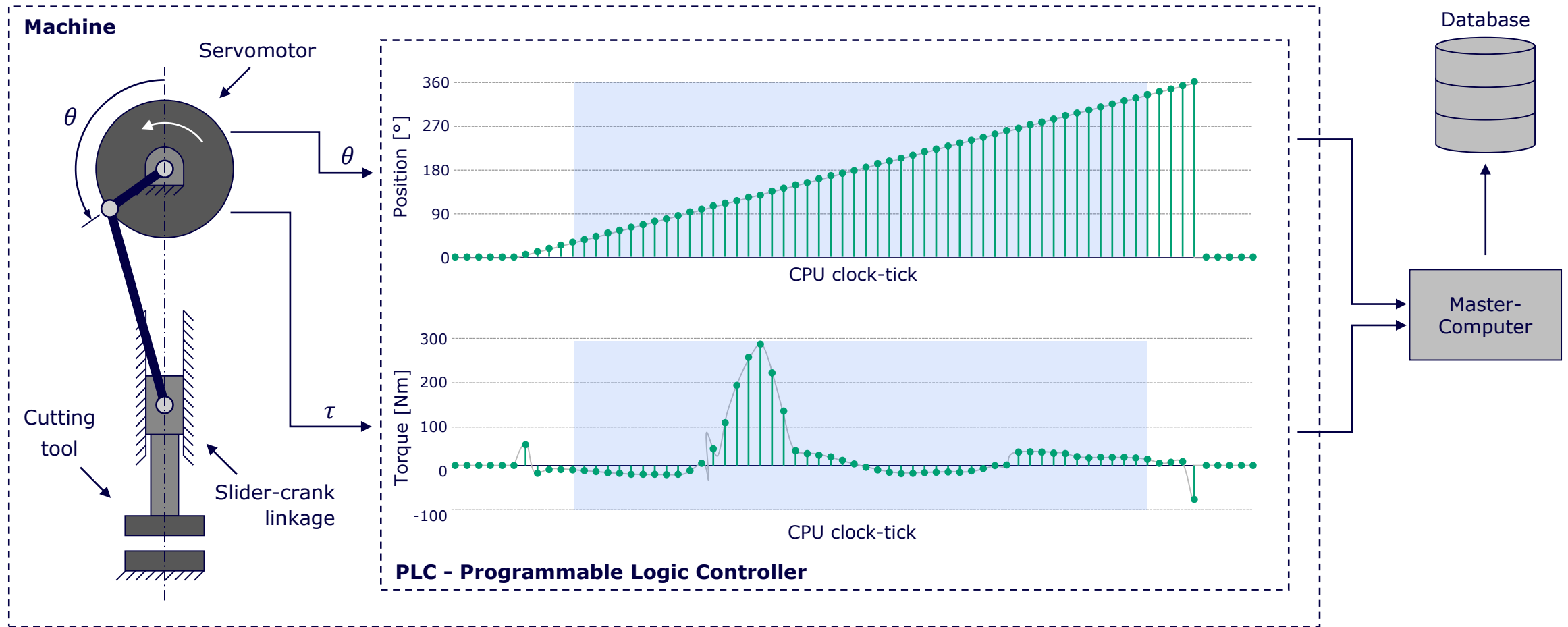
Data handling architecture
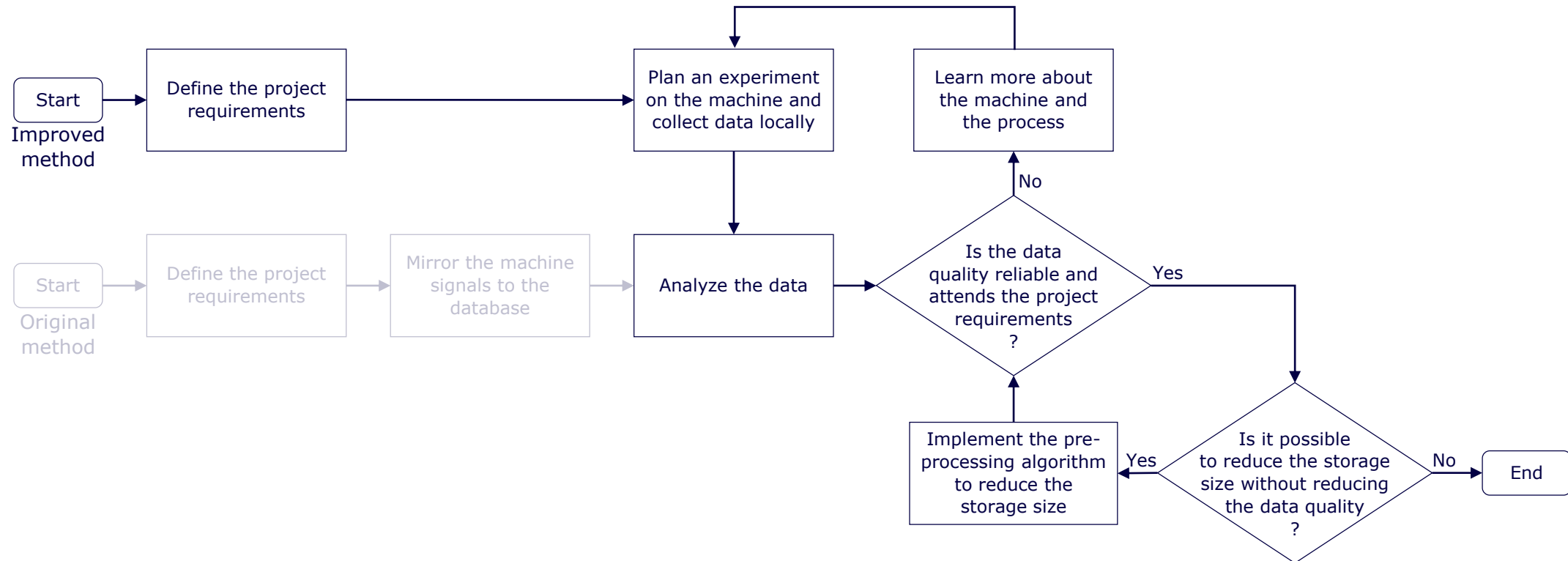
Original implementation

Proposed implementation

Example of a weekly machine report

The proposed method

Summary and outlook

Lessons Learned / Benefit

Lessons Learned
- Application-oriented approach necessary.
- Deep process and machine understanding extremely important.

Benefit
- Reproducible method for other machines and processes.
- Portability to variety of pushing processes in production.
- Knowledge of the tool wear state.
- Machine downtime reduction and consequently cost reduction.
- Basis for analyzing the long-term behavior of tools.
- Data storage improvement due pre-processing.

Thank you.

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