The Importance of Partial Discharge Monitoring in MV and HV Networks

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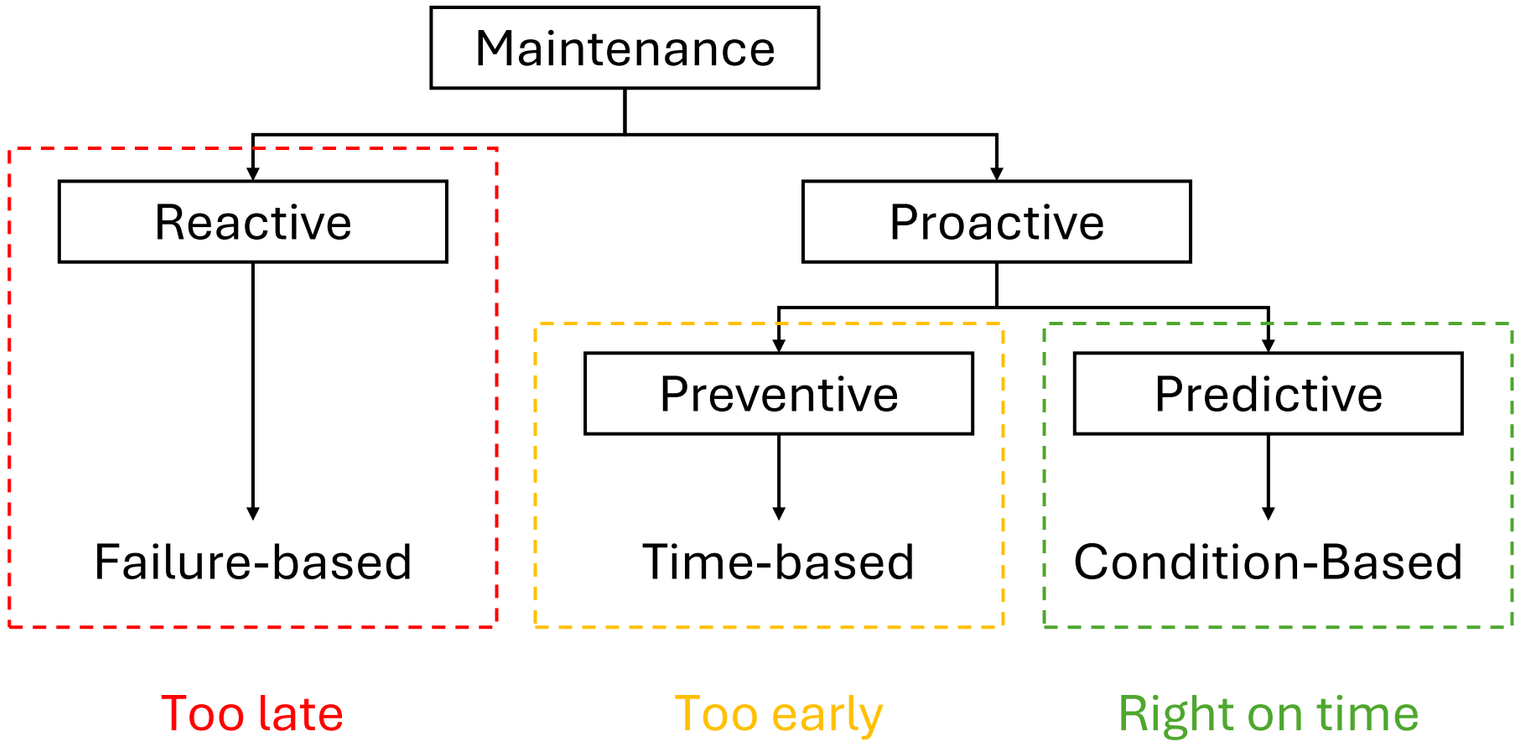
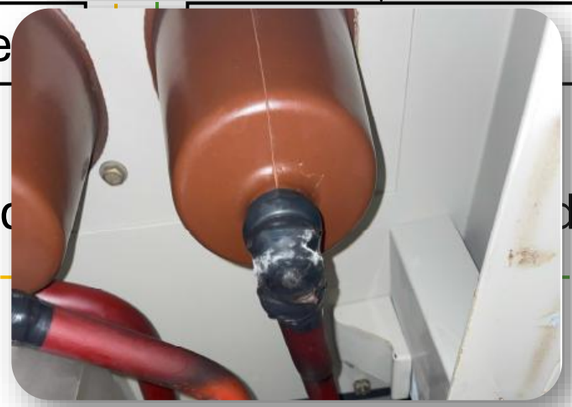
Introduction

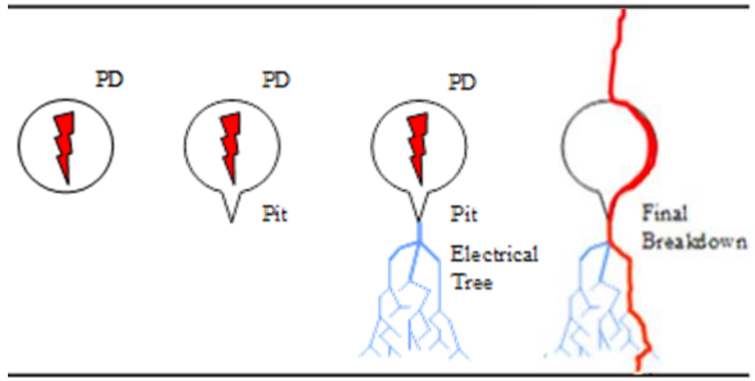


Introduction

Too late

Too early





Partial Discharge Analysis

- PD is related to **local defects** of the insulation system
- PD causes **insulation degradation**
- PD it is the initial stage of a **complete breakdown**

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Summary of the presentation

1. Partial Discharge tests
    - Offline
    - Online spot
    - Online continuous monitoring
2. Online continuous PD monitoring: challenges
3. Online continuous PD monitoring: a novel solution
4. Case studies

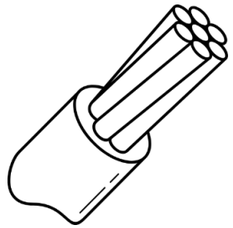
Partial Discharge: introduction

Where can Partial Discharge activity occur?

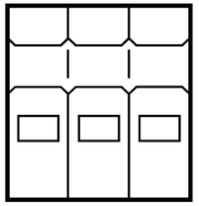
Medium Voltage

High Voltage

Cables

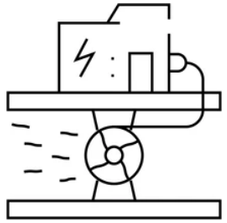


Switchgear

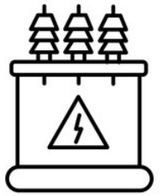


Motors

Generators



Transformers



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Partial Discharge: introduction

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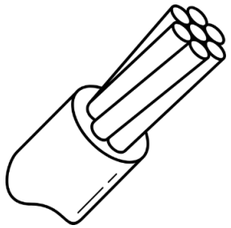

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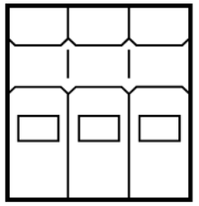

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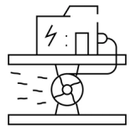

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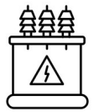

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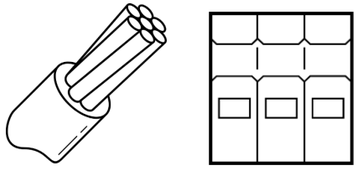
Partial Discharge tests: distribution network



Offline

Online spot

Online monitoring

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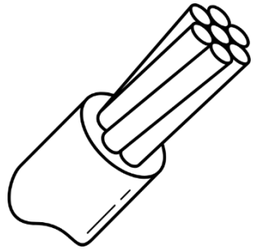
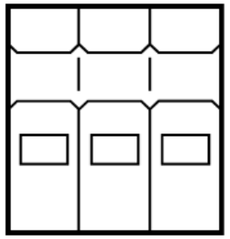
Partial Discharge tests: distribution network





Offline

PROs

- High signal to noise ratio

CONs

- Out-of-service required
- External generator required
- Time consuming
- Electrical asset not in real working condition
  - No current
  - Some components may be not considered

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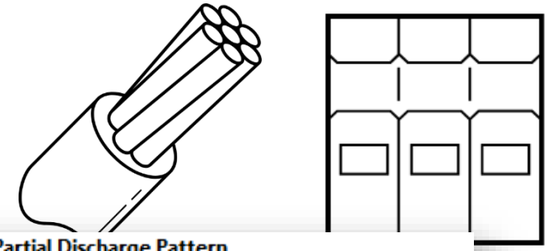
Partial Discharge tests: distribution network

Offline

Online spot

Online monitoring

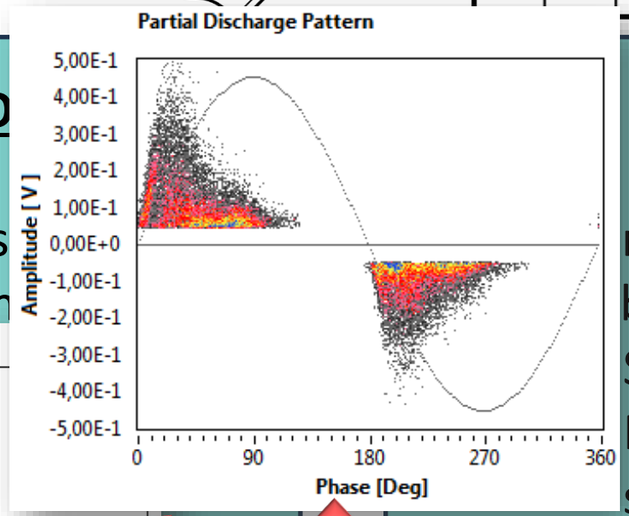


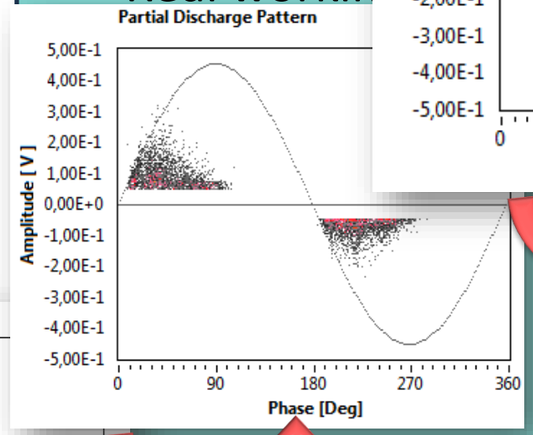
PRO

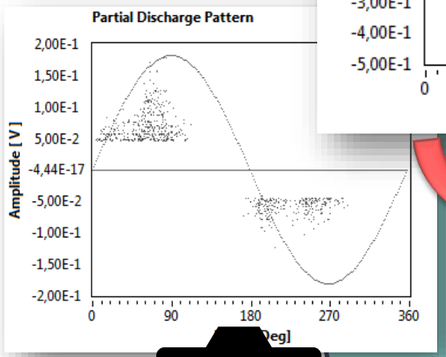
- No out-of-s
- Real workin

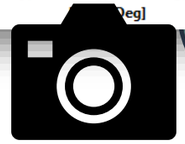
CONs

round noise &
bances
State of the art
PD detection
system
- Expertise in









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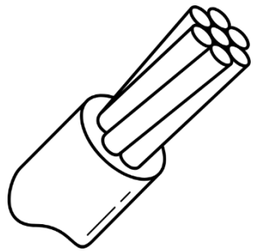
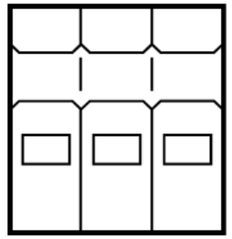
Partial Discharge tests: distribution network





Offline

Online spot

Online monitoring

PROs

CONs

PD signal behavior over the time is key for condition assessment

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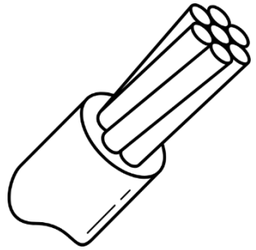
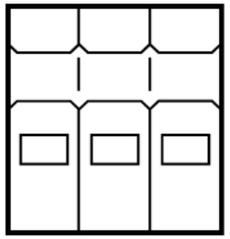
Partial Discharge tests: distribution network





Offline

Online spot

Online monitoring

PROs

- No out-of-service
- Real working conditions
- Trend analysis
- Minimized influence of environmental

CONs

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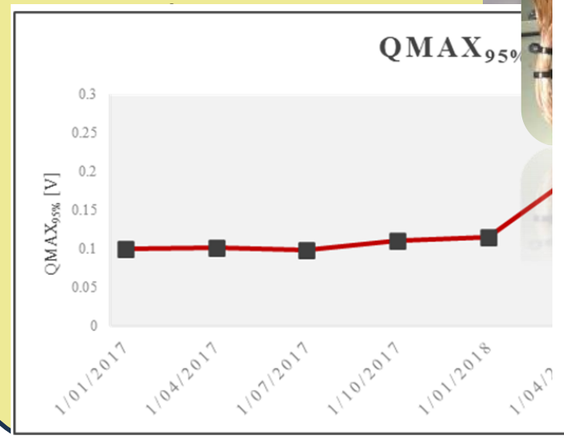
toring devices to



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Online monitoring systems: current challenges

- Can I fully trust the AI algorithms used for data analysis?
- How reliable are the automatically generated alarms?
- What actions should I take when a red alarm is triggered by the monitoring system?

Online monitoring systems: a novel approach

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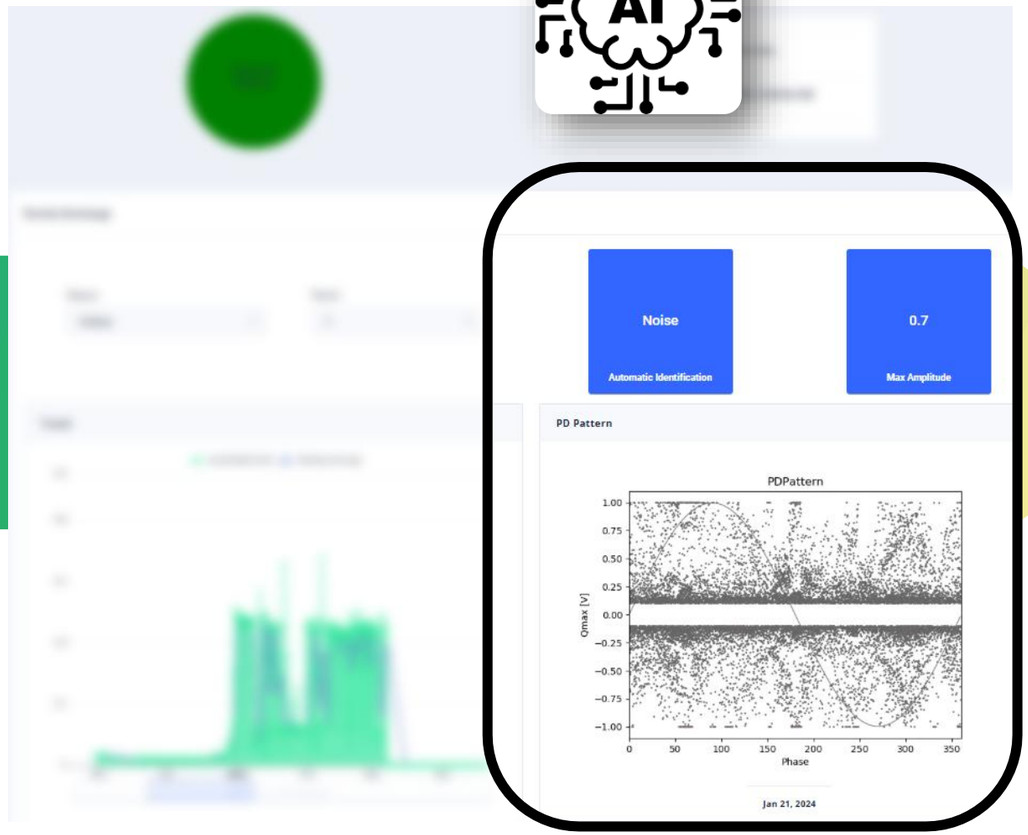
Online monitoring systems: a novel approach

Noise
Automatic Identification

External disturbance
Automatic Identification

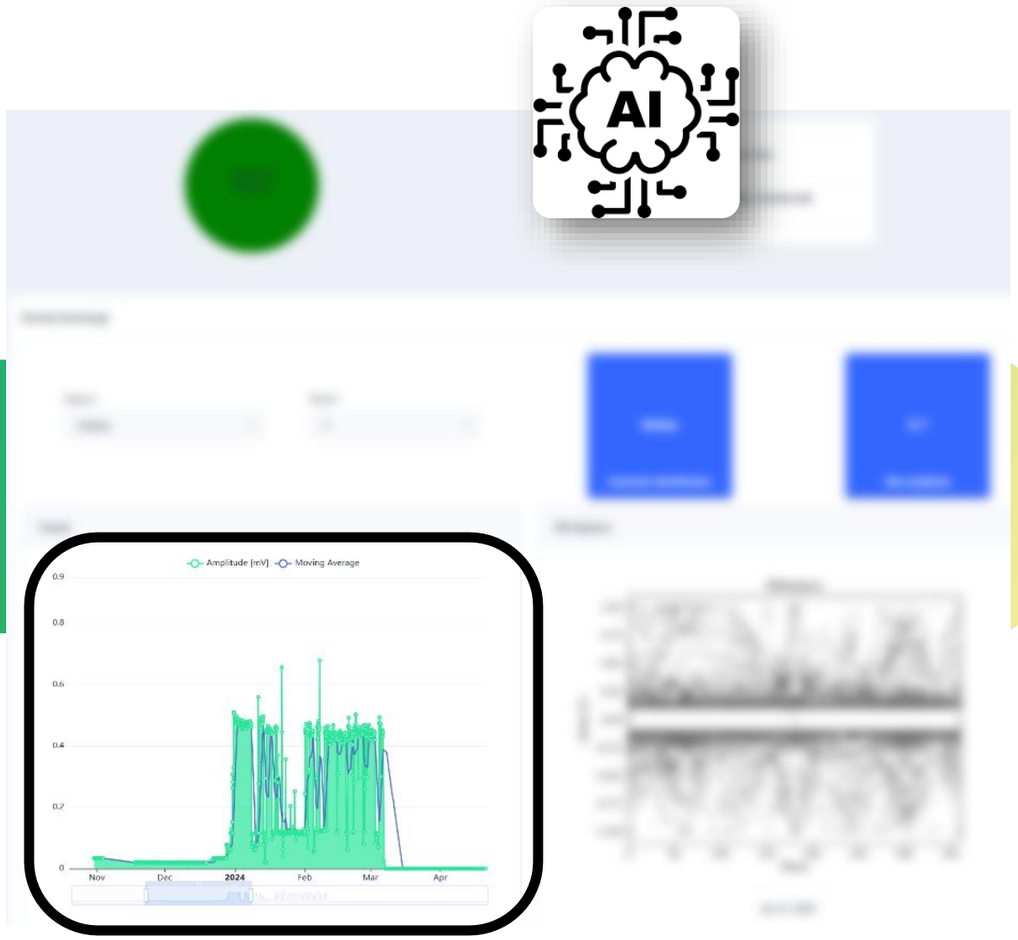
Signal to be analysed
Automatic Identification

AI



PD classification

Online monitoring systems: a novel approach



Trend analysis

Online monitoring systems: a novel approach

Automatic data acquisition

Data stored in secure DB

Data analysed by AI algorithms

Data reviewed by human expert operator

Periodic reports

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Online monitoring systems: case study

- Factory in QLD
- Two sites
- #11 acquisition units
- #62 HFCT sensors
  - Cables
  - Switchgear
- Rated voltage = 11kV

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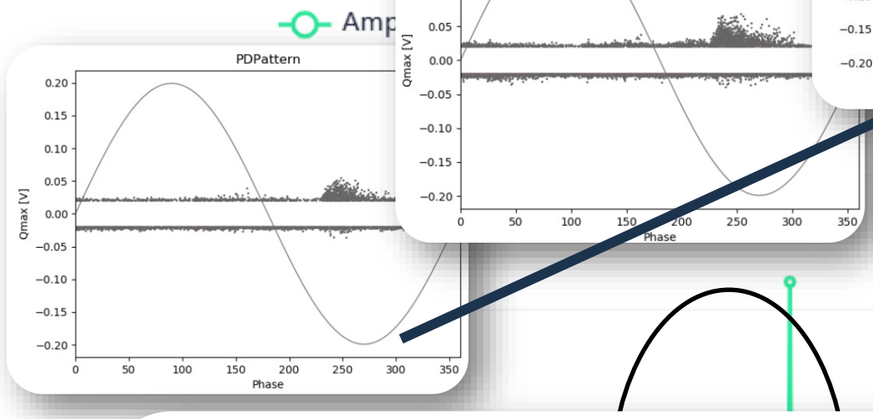
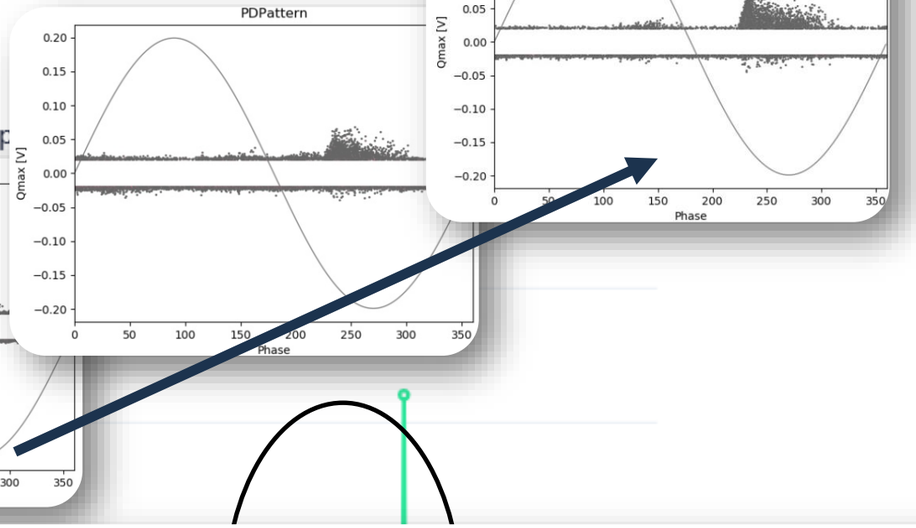
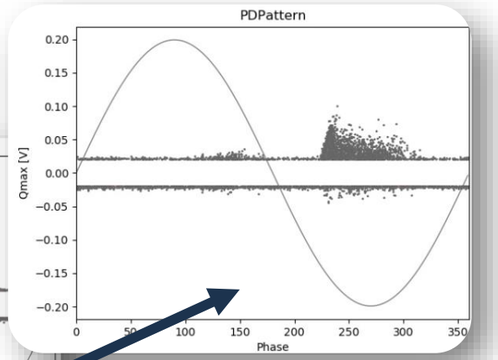
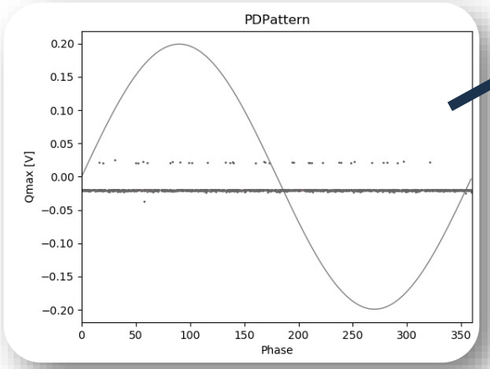
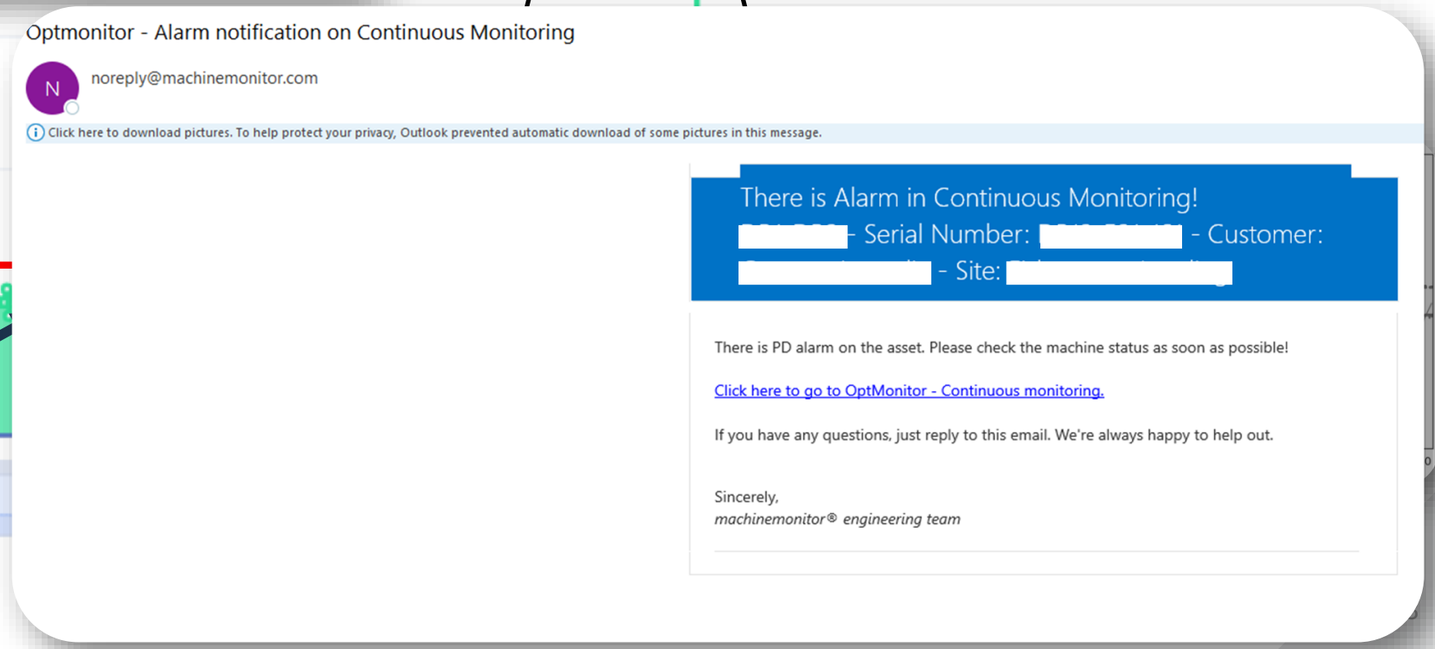
Online monitoring systems: case study











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Conclusion

- **AI** is a powerful tool that can **support** expert engineers in **speeding up data analysis** and focusing on the **most relevant data**.
- Online monitoring systems based only on AI algorithms are prone to **false alarms**.
- The **synergy** between **AI and human experts** offers clients **comprehensive support**, not just diagnostic alerts, but **practical recommendations** for managing Medium and High Voltage assets.

Thank you for your attention!

Questions ?

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