

Advanced Analytics Best Practices Panel Predictive Maintenance of Carbon Black Manufacturing Plant

Jens T. Smits

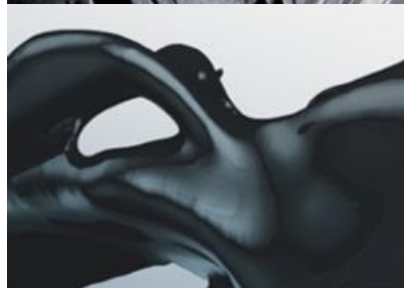
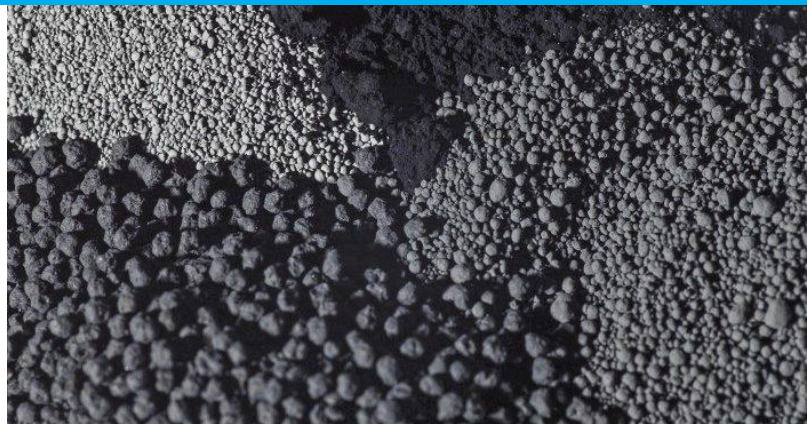


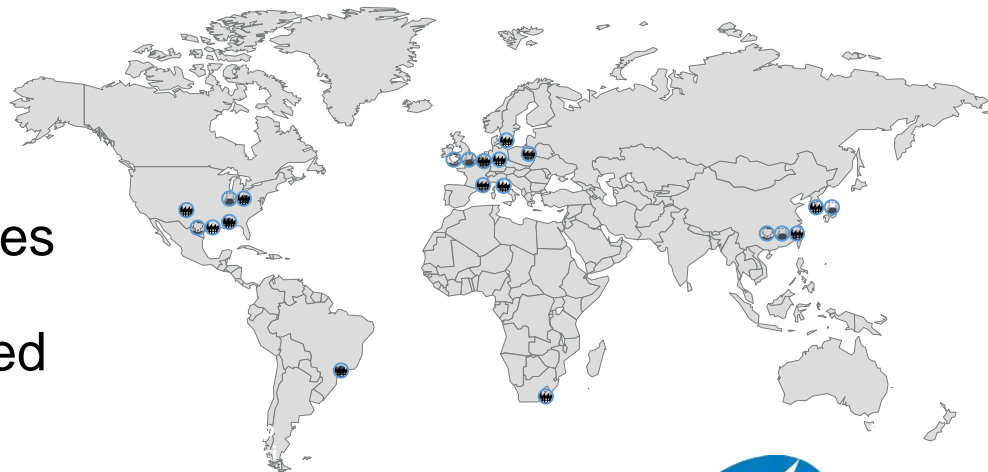
Presenter



- Jens Tonio Smits
- Director Reliability Systems
- Orion Engineered Carbons GmbH
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- One of the world's leading suppliers of Carbon Black
- We offer high-performance products for Coatings, Printing Inks, Polymers, Rubber and other applications
- Our high-quality Gas Blacks, Furnace Black and Specialty Carbon Blacks tint, colorize and enhance the performance of plastics, paints and coatings, inks and toners, adhesives and sealants, tires and manufactured rubber goods





- With more than 1.400 employees worldwide we run 14 global production sites and four Applied Technology centers
- All production sites connected with one central PI server
- >45.000 tags
- Central AF server with 15 data bases
- Globally standardized Asset Framework
- Process data, quality data, ERP data




Reliability Pilot Project

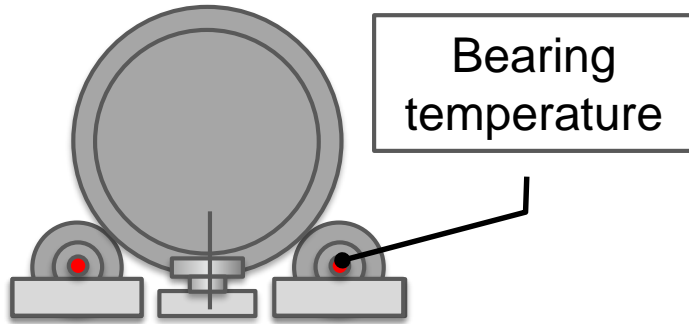
Predictive Maintenance

- Damage prediction based on process parameters
- Feedback into PI System as Prediction Status
- Pilot project in 2 plants
December 2018
- Prediction models for large scale **heat exchangers** and **rotary dryers** deployed May 2019

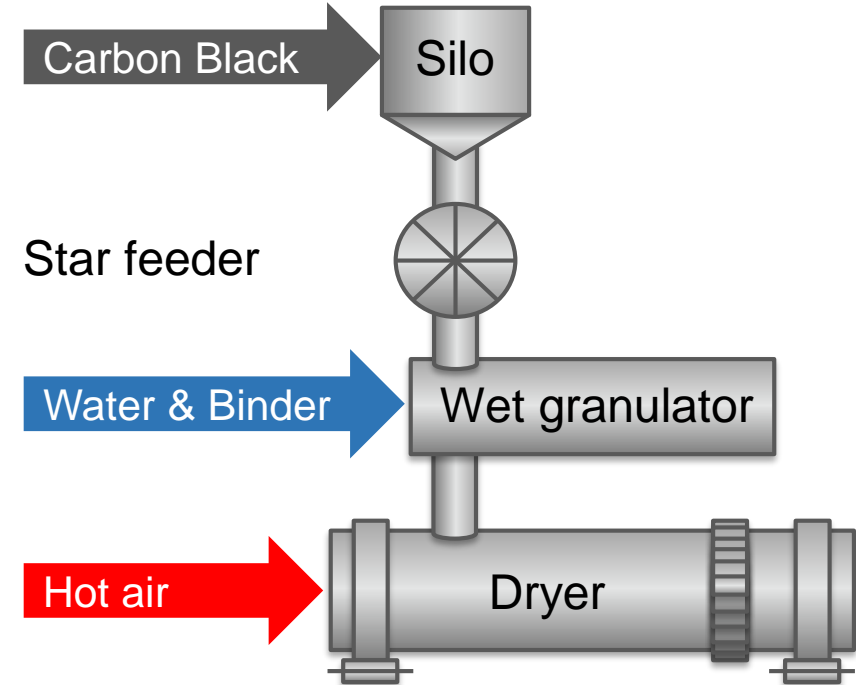
Advanced Data Analytics

- Using advanced data analytics application ProcDNA 
- Statistical & trend analysis
- Correlation indices analysis
- Variables selection
- Dependent & independent variables

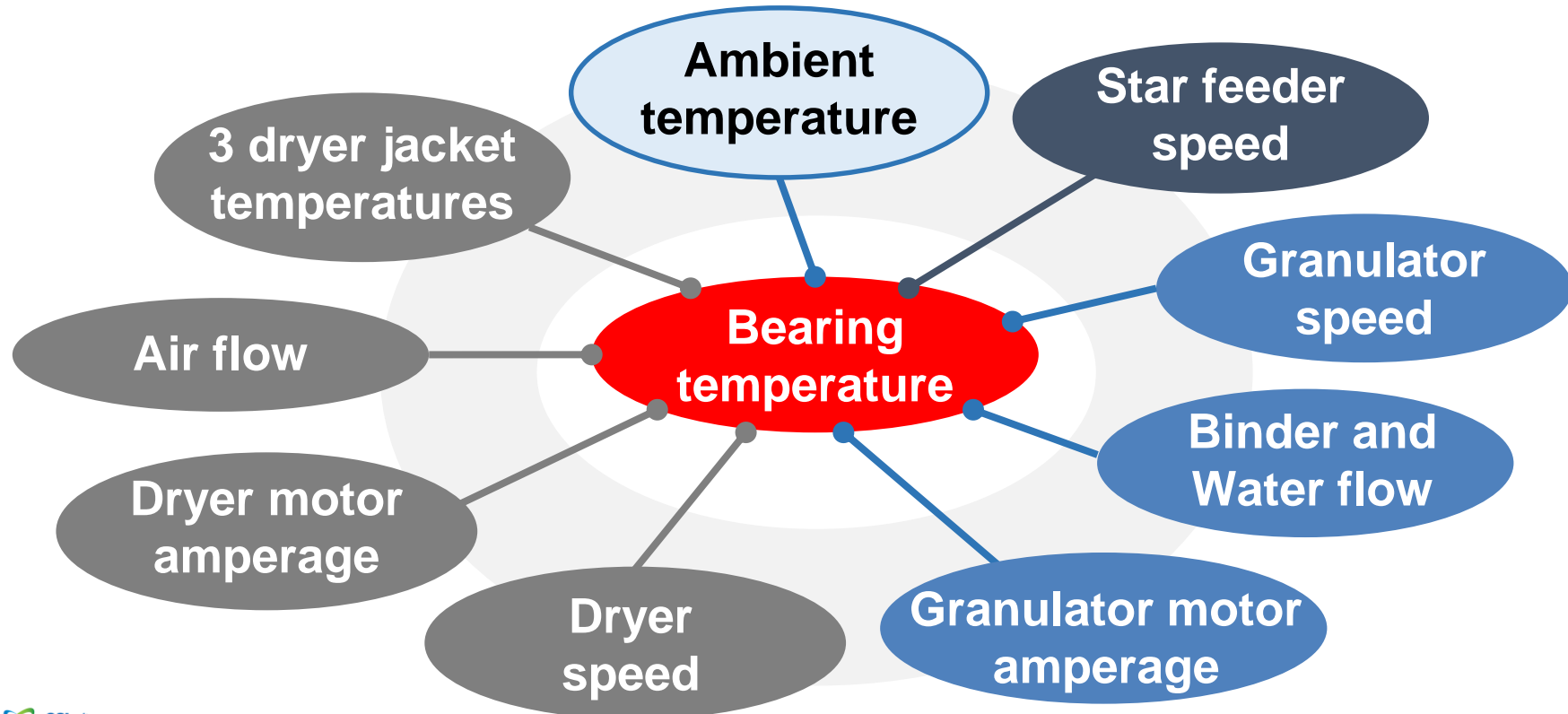
Dryer: Modeling



- Day/night & summer/winter oscillation of bearing temperature
- No fixed temperature limit possible
- Bearing temperature affected by dryer load



Dryer: Independent parameters



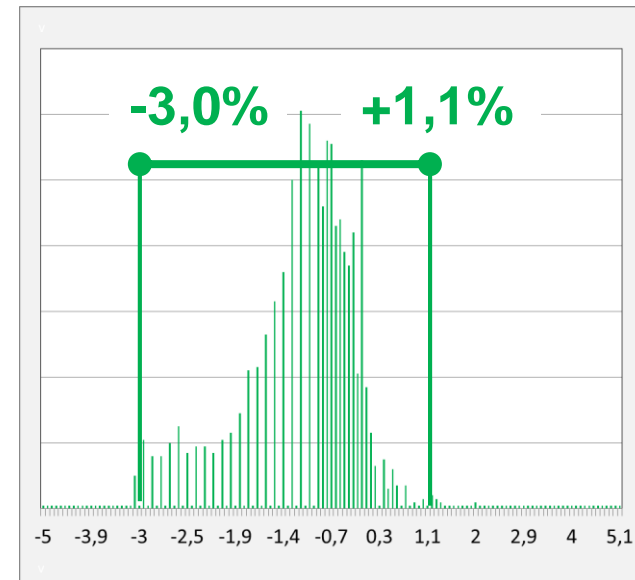
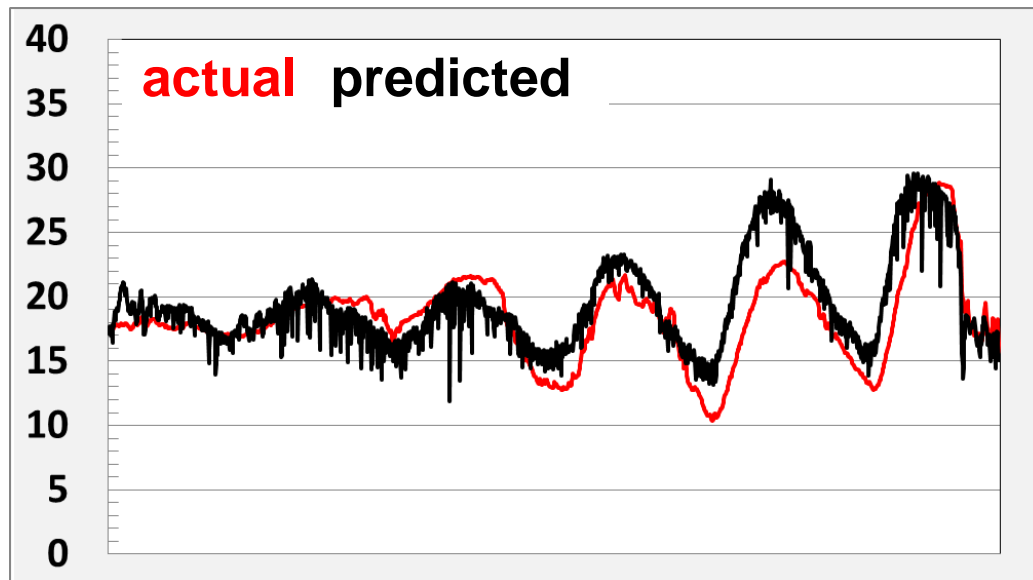
Dryer: model training/testing

Bearing temperature (Dryer)

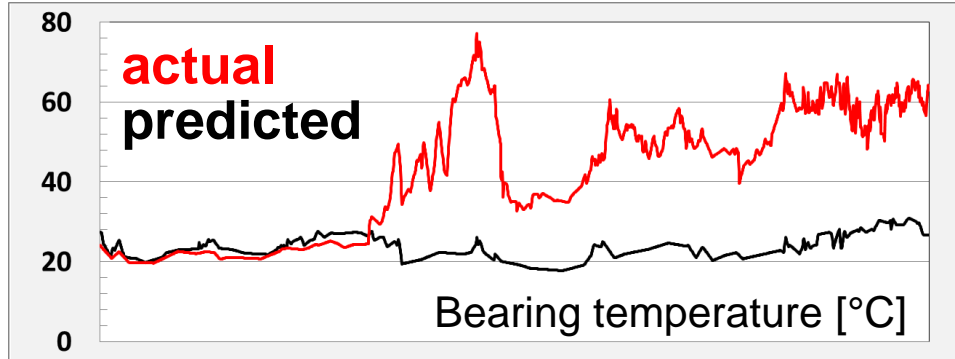
Training data: 6 months data

Deviation (%)

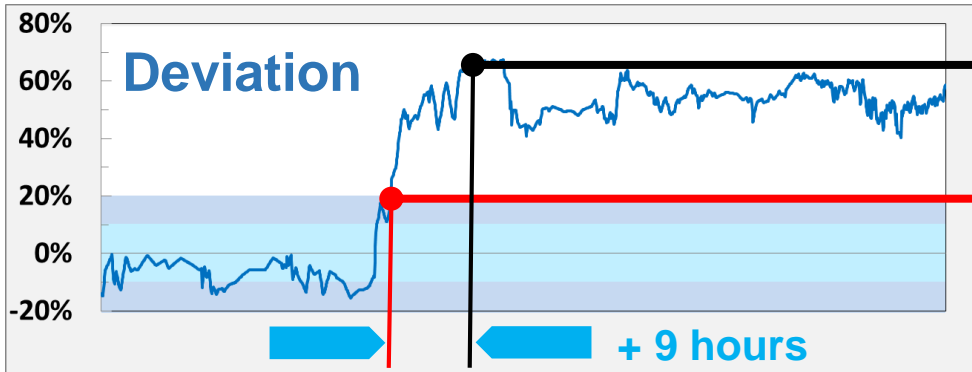
Distribution



Dryer: model verification (real damage)



$$\text{Deviation [\%]} = \frac{\text{actual} - \text{predicted}}{\text{actual}}$$



DCS alarm >70°C

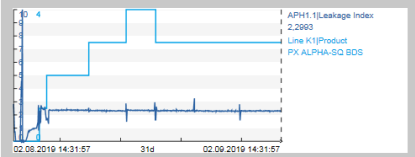
Prediction status:
Alarm: >20% Deviation
Warning: >10%
Good: ≤10%

Connection into AF / PI Vision

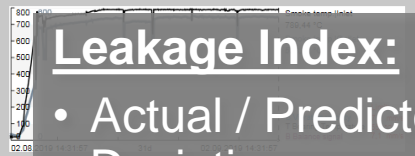
Leakage Index

ORION ENGINEERED CARBONS

Leakage Index (actual)

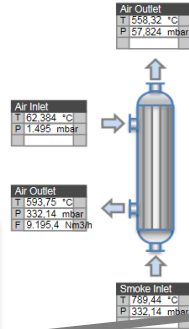


Temperatures for Leakage Index - Smoke

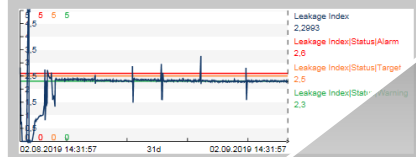


Leakage Index:

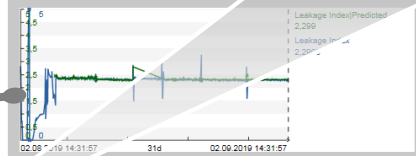
- Actual / Predicted
 - Deviation
- PI AF



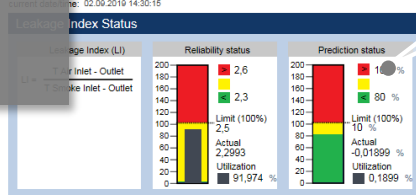
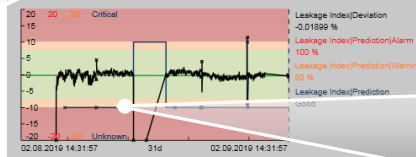
Leakage Index (calculated)



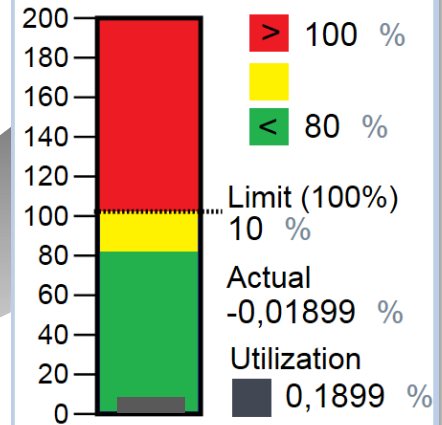
Leakage Index (predicted vs actual)



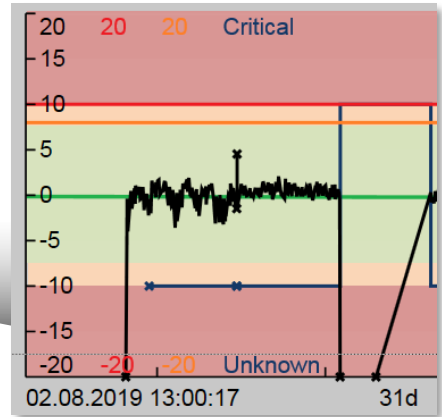
Leakage Index - Deviation (%)



Prediction status



- Prediction status (Deviation / Limit) [%]
- Good/Warning/Alarm



CHALLENGES

- Reactive maintenance
- Unplanned downtime
- Unplanned production loss
- Early detection of equipment failures required

SOLUTION

- ProcDNA application



for advanced data analytics models using historical data of relevant parameters

- Prediction model deployment to real time environment
- Integration of predicted parameters in AF

BENEFITS

- Early warning of potential failures of equipment
- Extra lead time for planning (5 days for heat exchangers leakage, 9 hours for bearing damage)
- Visibility of reliability status: dashboards in PI Vision



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