

Condition Prognosis

failure prediction
with the
machine learning system
NEMO™



“The problems of the world cannot possibly be solved by skeptics or cynics whose horizons are limited by the obvious realities. We need men who can dream of things that never were.”

John Fitzgerald Kennedy

algorithmica
technologies

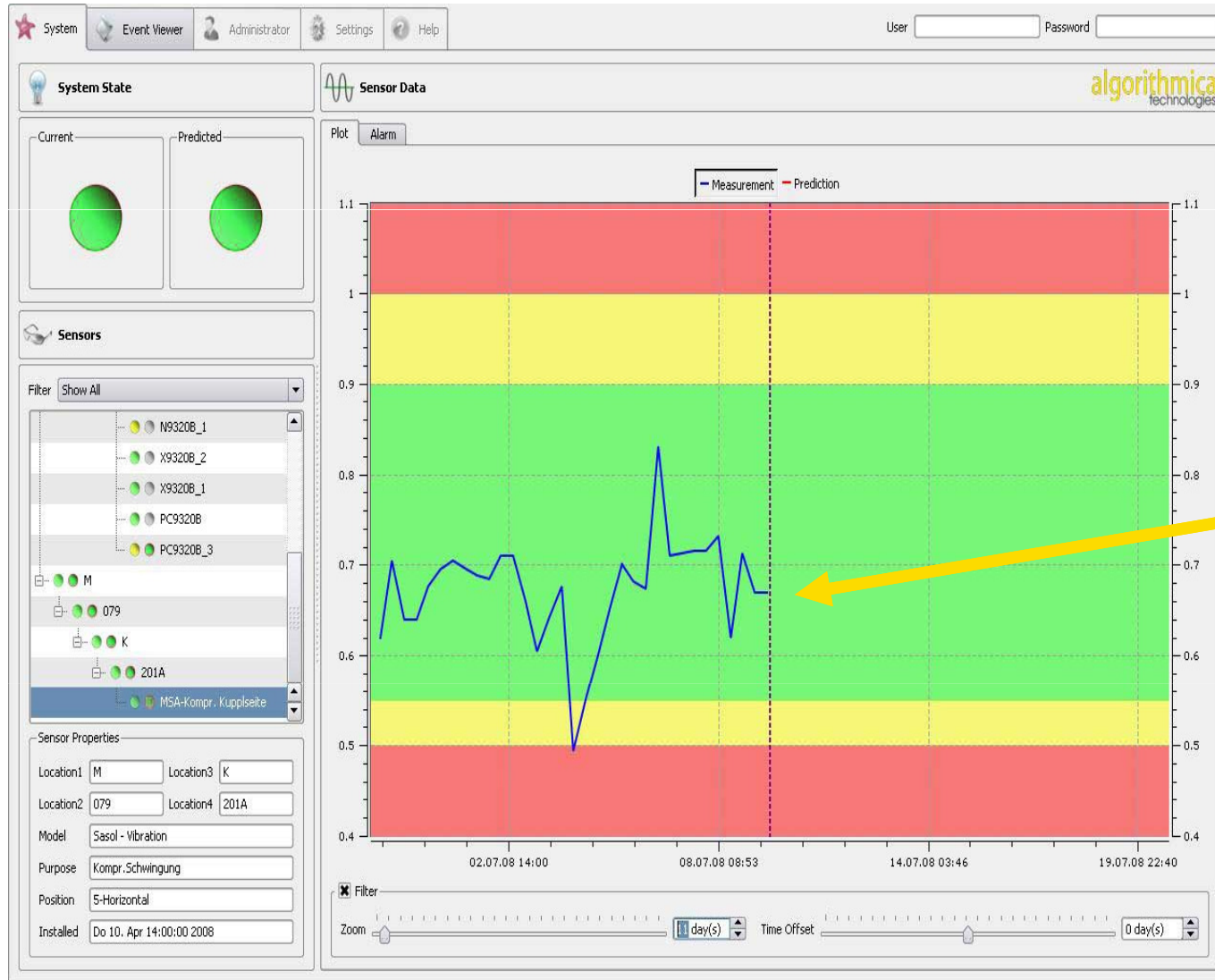
NEMO™ in a nutshell

- The prediction of the state of a production plant with machine learning is possible for several months into the future
- This system automatically computes the predictions using data from the process control system and condition monitoring
- No detailed knowledge or hypotheses about the engineering or technology of the plant are required

Practical lessons learned from the use of NEMO™

- Early recognition of downtime in your plant and planned maintenance at a planned time
- The maintenance budget can be reduced by up to 20% and availability increased by up to 5%
- Return-On-Investment is usually achieved in 3 – 6 months
- NEMO™ has two principal advantages over the current status
 - It removes the need for the “fire-fighting” maintenance strategy by making maintenance planned
 - It is aware of all process correlations and effects that a human engineer could not possibly take into account

Information from conventional condition monitoring

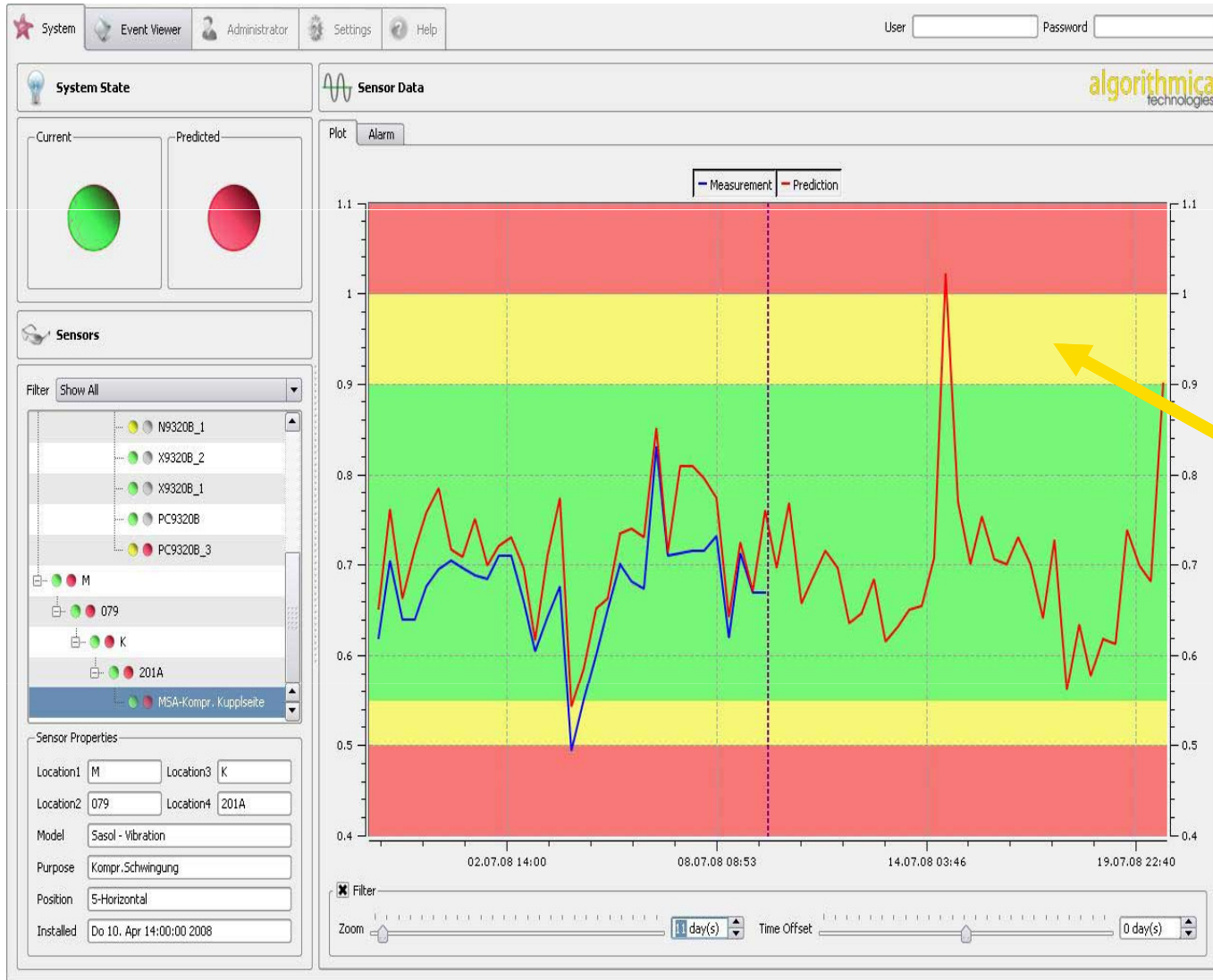


A vibration ...

Blue:
measured state of
the machine from
the past until now
-Interval 3 hours

Heat exchanger,
column, generator,
ventilator, turbine,
motor, pump, etc.

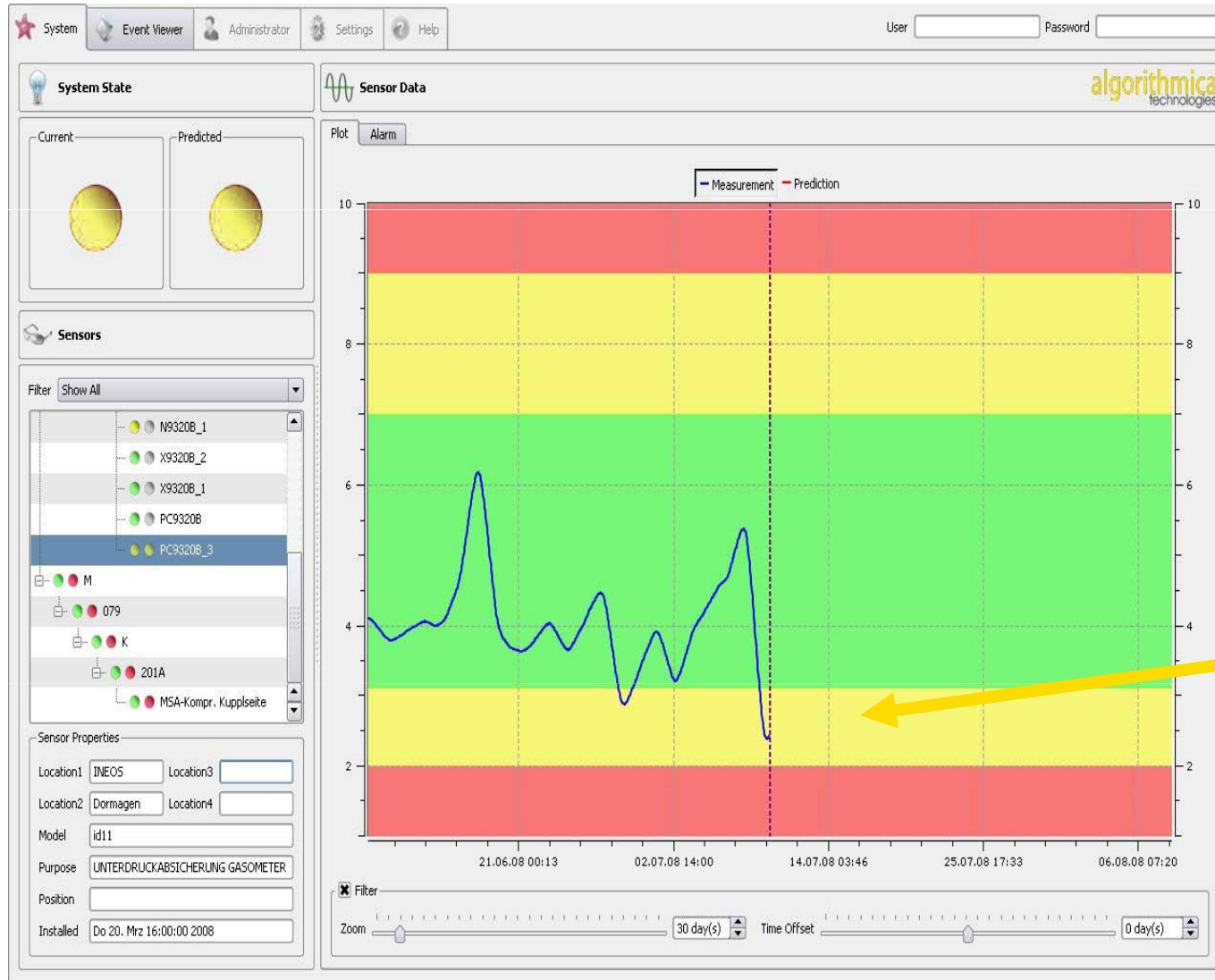
The same compressor: Information from CONDITION PROGNOSIS with NEMO ...



... predicts failure in three days!

Red: predicted machine state in the future

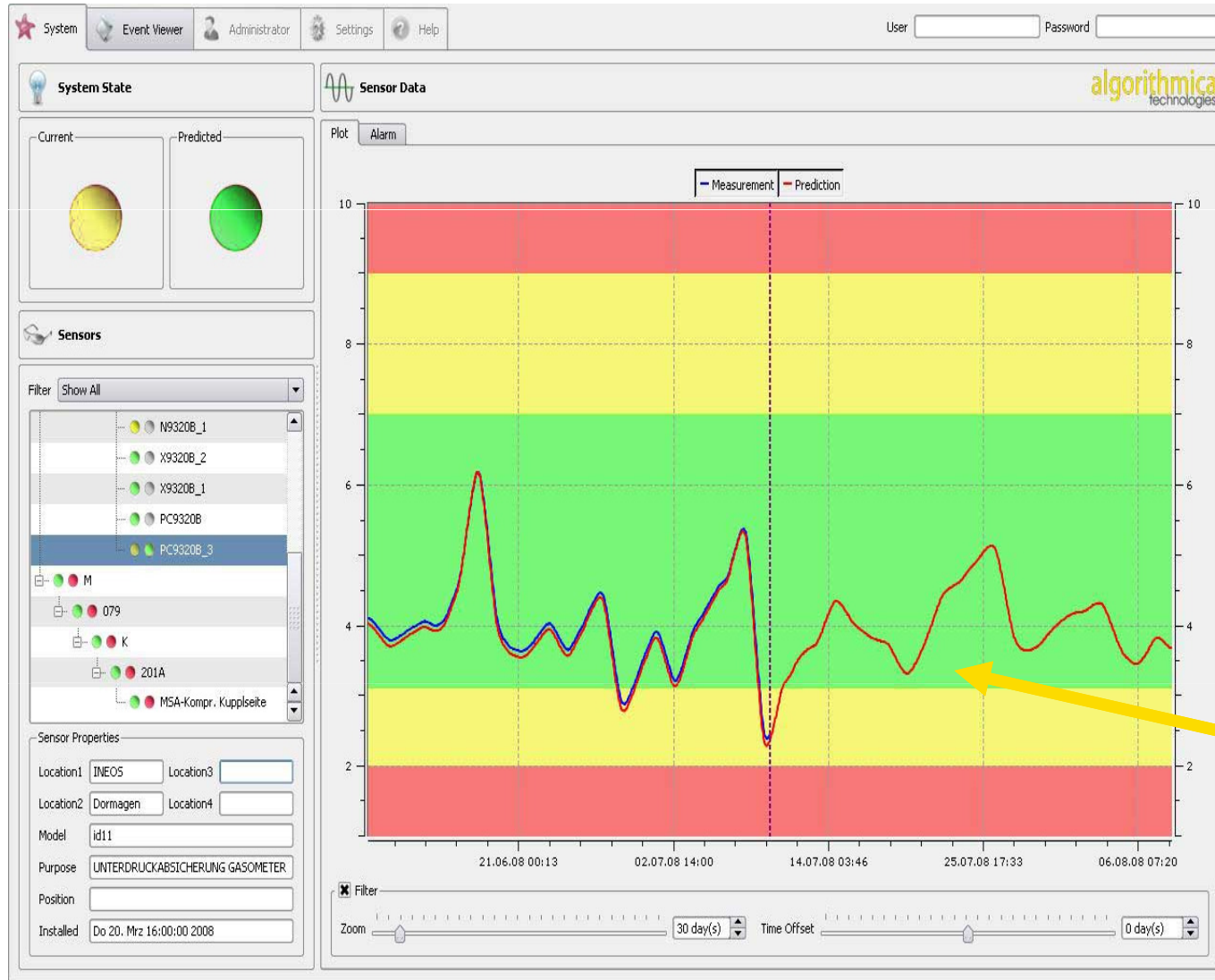
Information from conventional condition monitoring



A pressure decreases rapidly and could lead to failure...

Blue: measured state of the machine using condition monitoring

But CONDITION PROGNOSIS shows that the system is just fine



... but the signal stabilizes in a good state. The system must not be switched off!

Red: predicted machine state

Why can NEMO predict reliably?

- Recording of measurement data from your plant
- Develop mathematical model
- Knowledge about all correlations
 - Wenn Temperature increase at point »A« by »3« degrees, then:
 - Increase of pressure at point »D« by »0.25« PSI
 - Increase of vibration at point »E« by »0.4« millimeters
 - Reduction of power consumption at point »B« by »0.1« Ampere
 - Value at point »C« stays constant (no correlation)
- Now NEMO can predict every measurement reliably

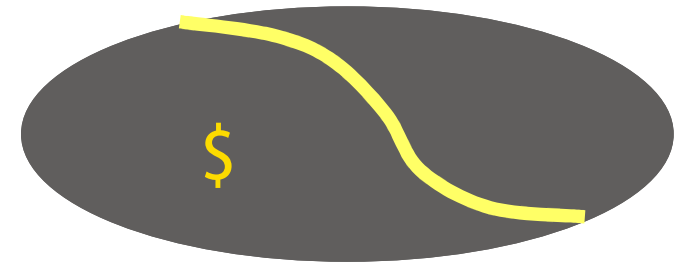
Condition prognosis allows four methods to save costs in the process industry



1. Increase of plant availability due to preventative maintenance
2. Reduction of maintenance costs due to prevention of collateral damage arising from sudden failures
3. Reduction of preventative servicing and inspection via risk and condition-based maintenance
4. Reduction of ad-hoc maintenance via increased planability of measures

Via planable maintenance, a cost reduction of 3 – 5% per year over 5 years can be achieved

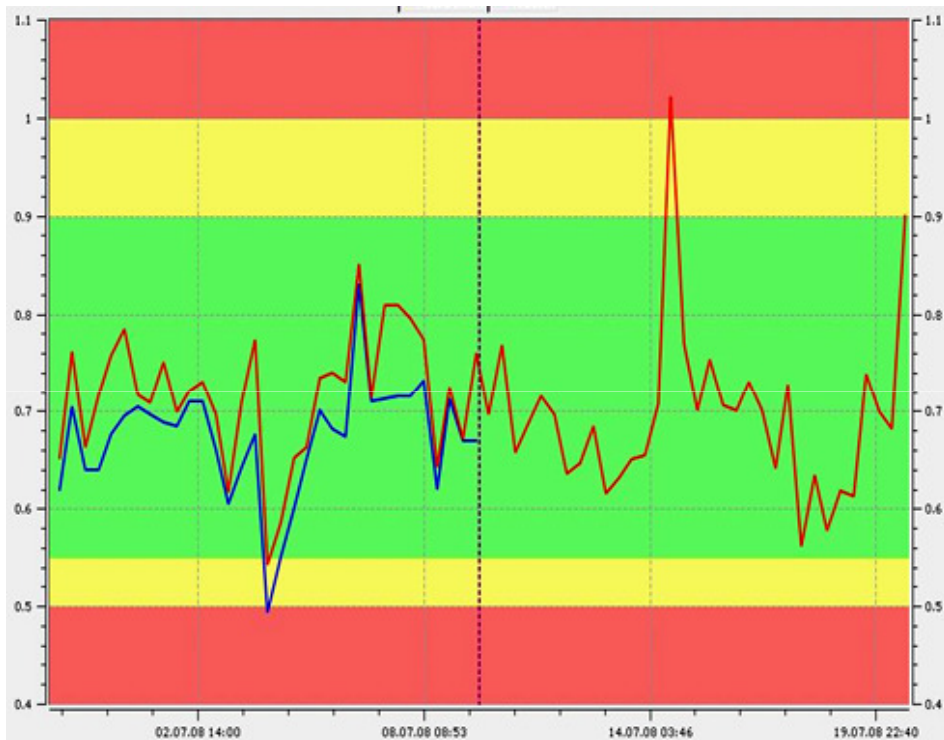
- Basis: Usual priorities for maintenance (1 for failures, 2 for short-term, 3 for long-term)
- Our Analysis: 20% reduction of maintenance budget is achieved when 50% of priority 1 can be transferred to priority 2
- Additionally the availability of the plant is increased (in this example from 80% to 90%)
- Important: yearly cost reduction of 3 – 5% (compound interest effect)
- Viewed with respect to a maintenance budget of 15 million USD per annum yields saving of over 4 million USD in total



Examples show how successful NEMO can be: Here NEMO saves 1 Mio. via the failure prediction of a pump bearing

Condition Prognosis (NEMO):

“The vibrations of pump bearing will be over breaking point in three days ...”



Case Study: Gas Power Plant

Due to NEMO, we have three days in which to ...

- Get spare parts
- Plan maintenance activities
- Allocate resources

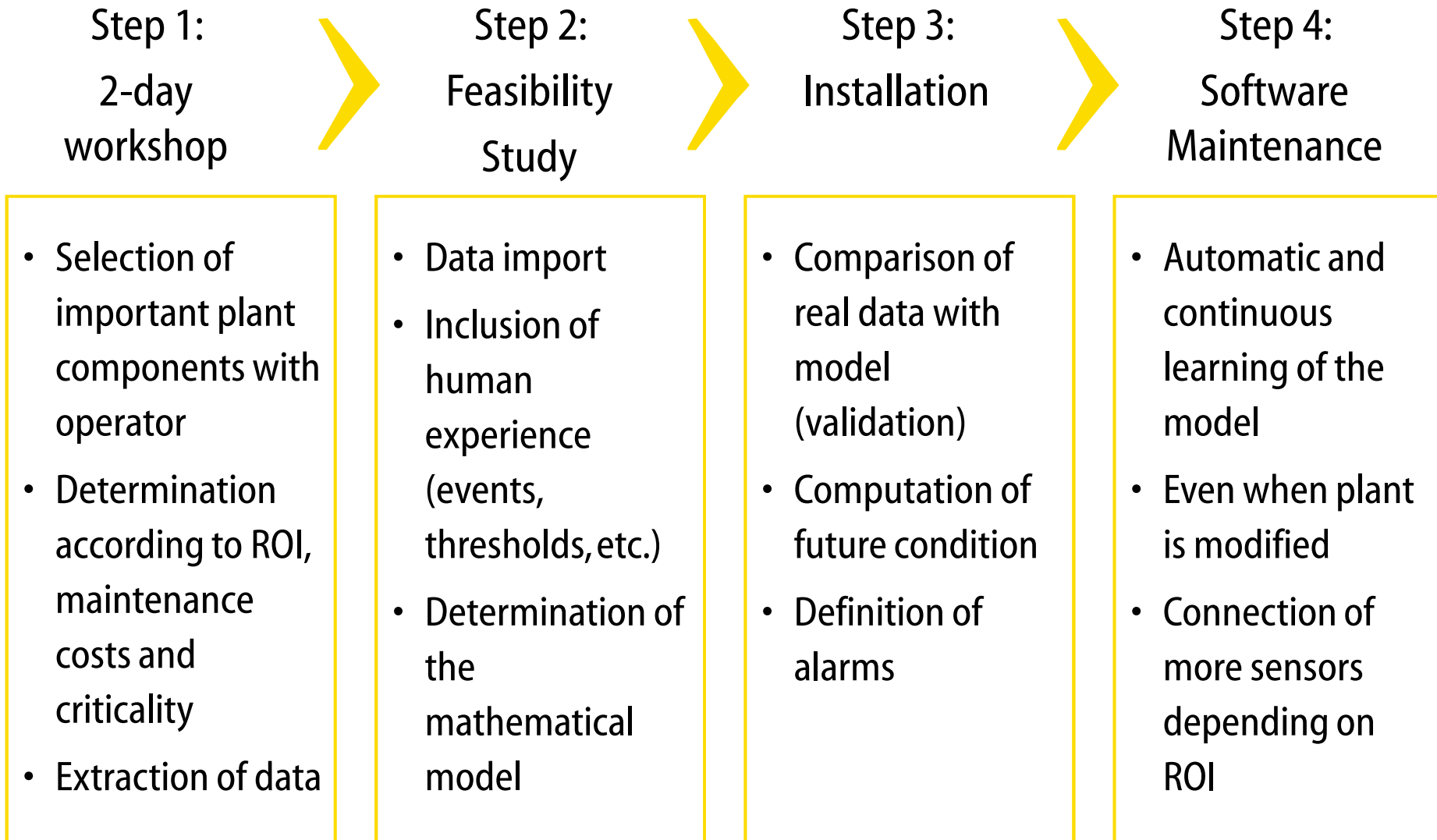


This pump is critical in an ethyl alcohol plant.

Its failure would have lead to damages and loss of product of approx. 1 million USD

Fixing the bearing costs 250 USD

Procedure to apply condition prognosis with NEMO™



Please contact us directly for any questions

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