Proces optimisation with the aid of on-line corrosion monitoring

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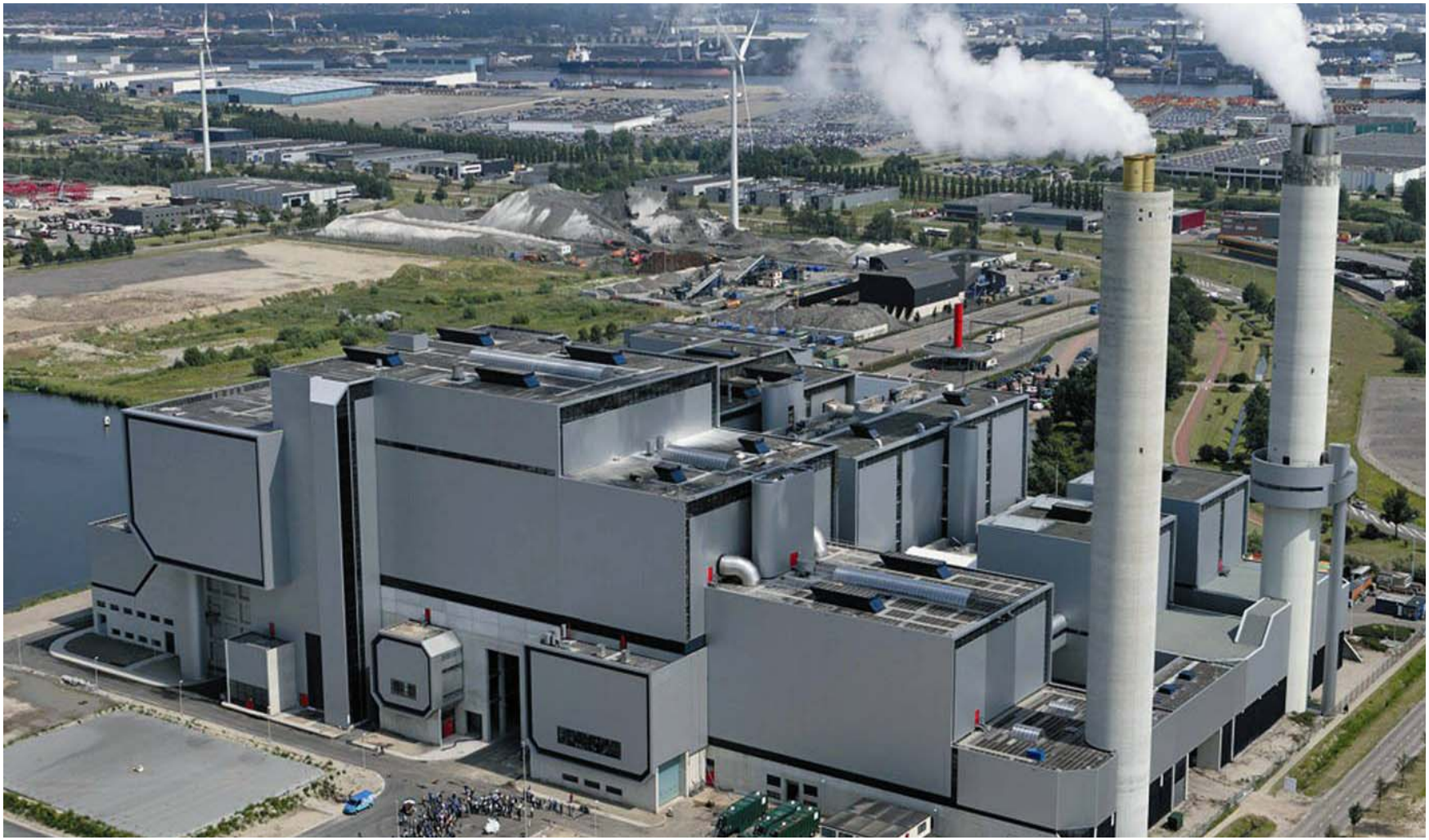
City of Amsterdam Waste and Energy Company

- One of the largest Energy from Waste (EfW) facilities in the world on a single location

- Two plants:
  - Waste to Energy plant
    - Operated since 1993,
    - 850.000 tons MSW, 100.000 tons sewage sludge
  - Waste Fired Power Plant
    - Operated since 2007,
    - 550.000 tons of commercial waste / ISW
    - Highest P/T operating conditions worldwide!



Online electrochemical corrosion monitor

- Radiant Probes

- Superheater Probe

Online corrosion monitor

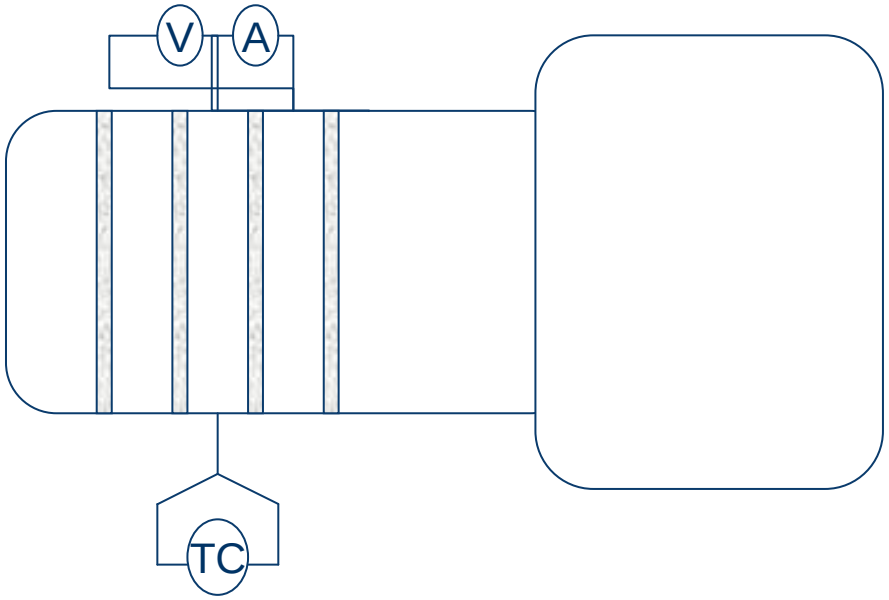


Figure 1: Sensor head of online corrosion monitoring equipment

V: Potential

A: Current

TC: Temperature control

Projects goals

- Not to proof that EC measurements are valid → matured technique and optimised probe design
- Not indicate the influence of single parameters
- Filtering out the relevant factors of the combustion proces combined with easy interpretable graphs (approx. 1300 parameters).
- Provide information for AEB operational engineers to optimise the combustion conditions

Proces optimisation

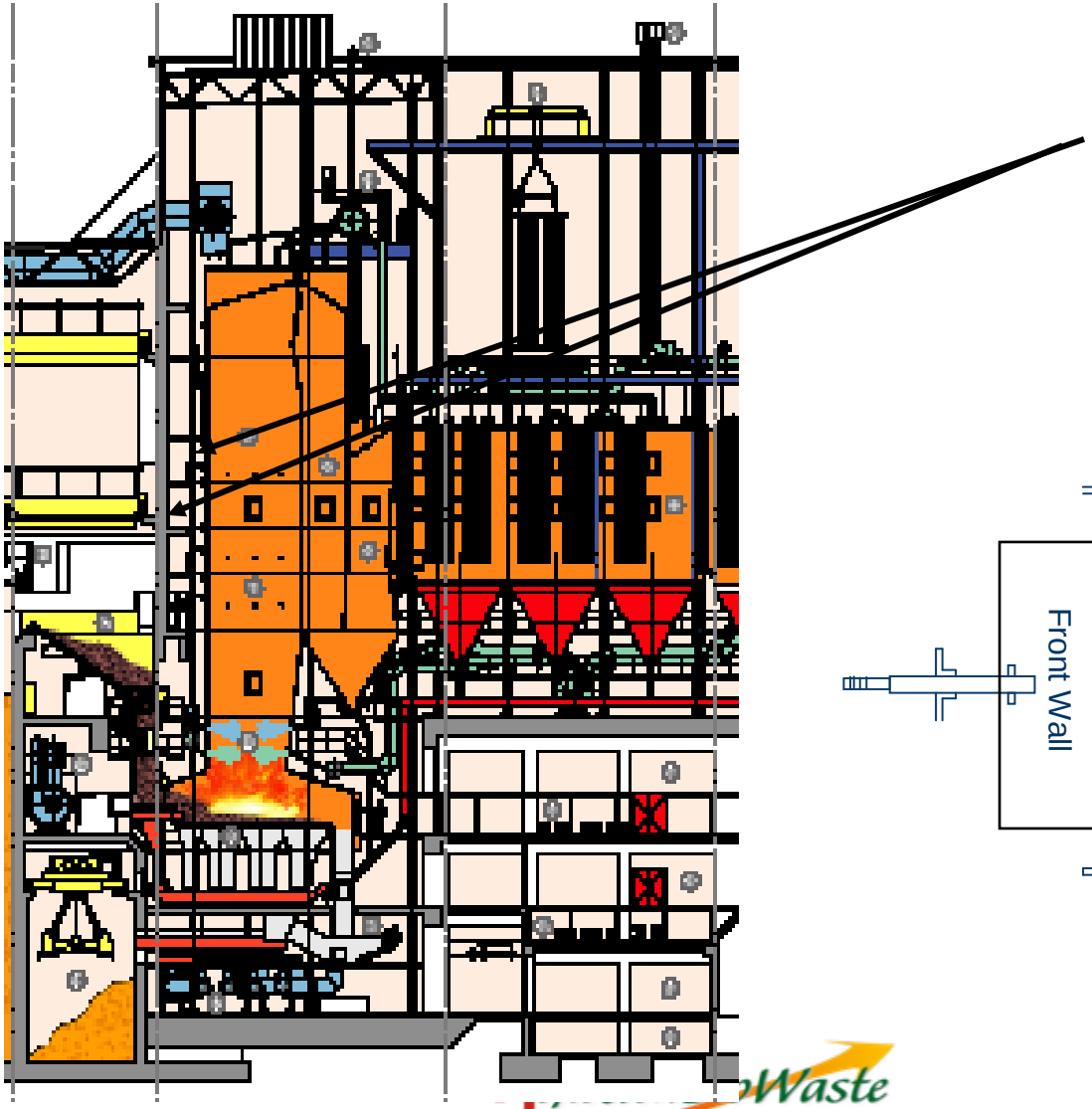
- Phase 1: March~April 2009 two SH probes with alloy 625 sensors on the front wall of 1st pass

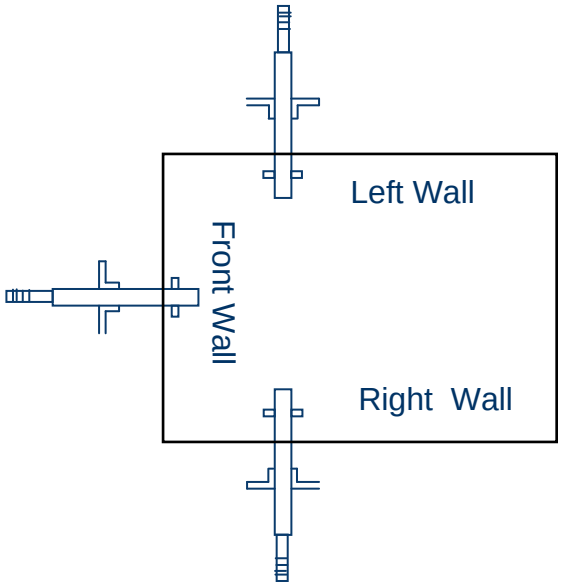
- Phase 2: from 1st August till 2nd November 2009 two new SH-probes with alloy 625 sensors and two new radiant probes with alloy 625 (W)/15Mo3 sensors on the front wall and the side walls of the 1st pass

Why SH probes in the radiant zone?

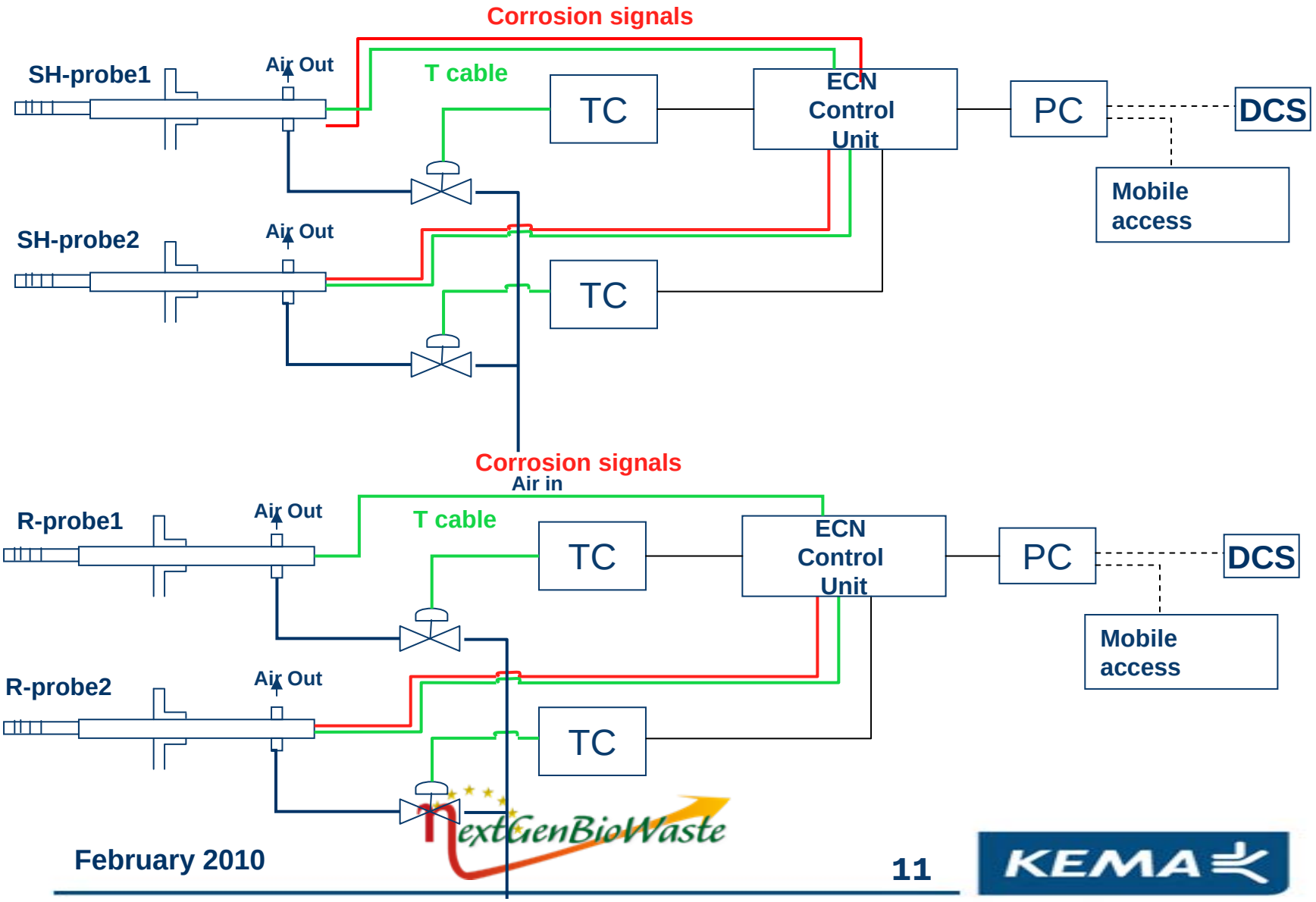
- Phase 1:
  - Due to the shape of the access ports (protruding length required)
  - Corrosion sensors easy to dismantle for destructive analyses
- Phase 2:
  - Determine influence probe design on corrosion trends
  - Investigate galvanic bridging

Probe installation





KEMCOM approach



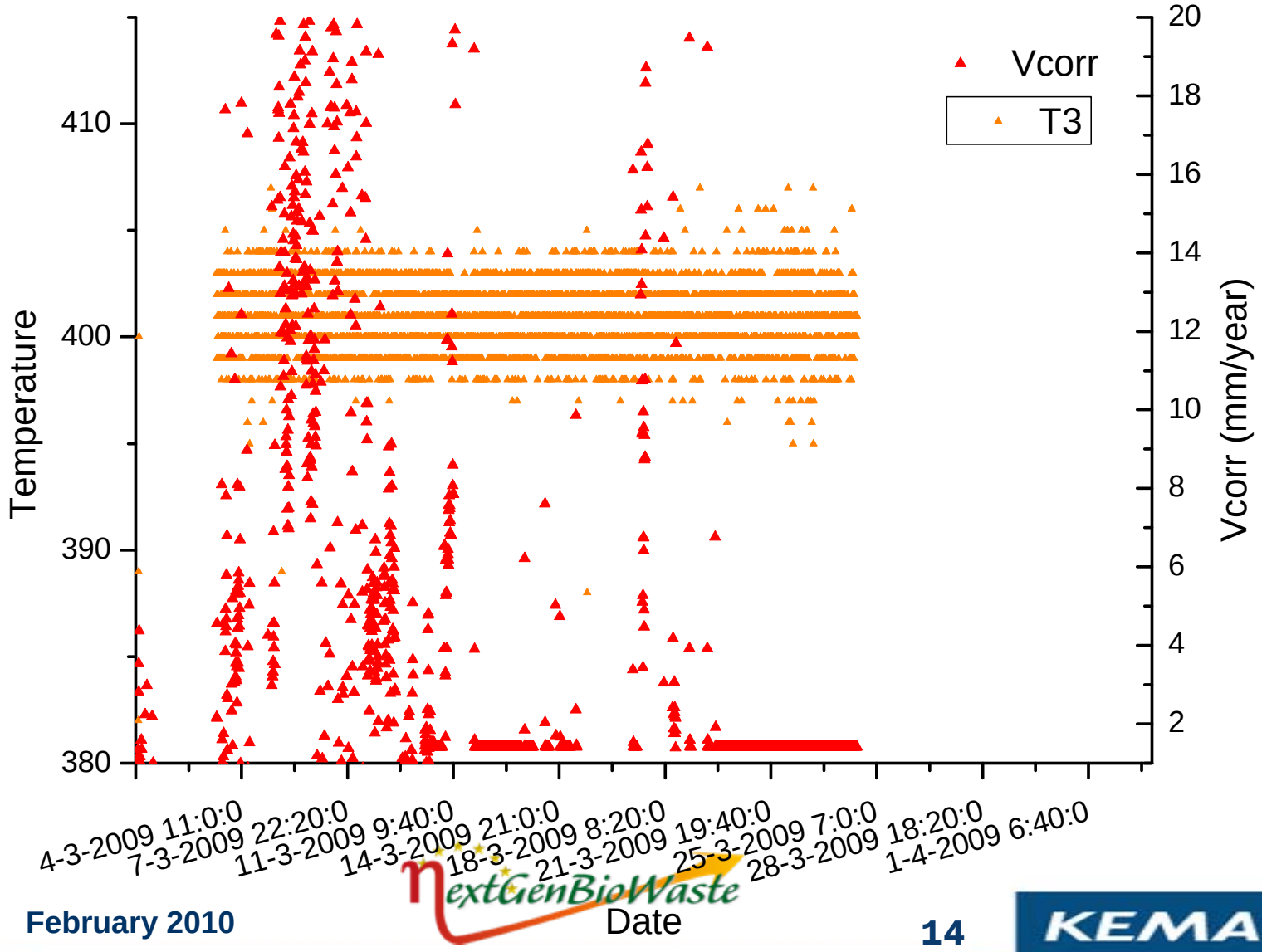

STOP


VUURHAARD TEMP

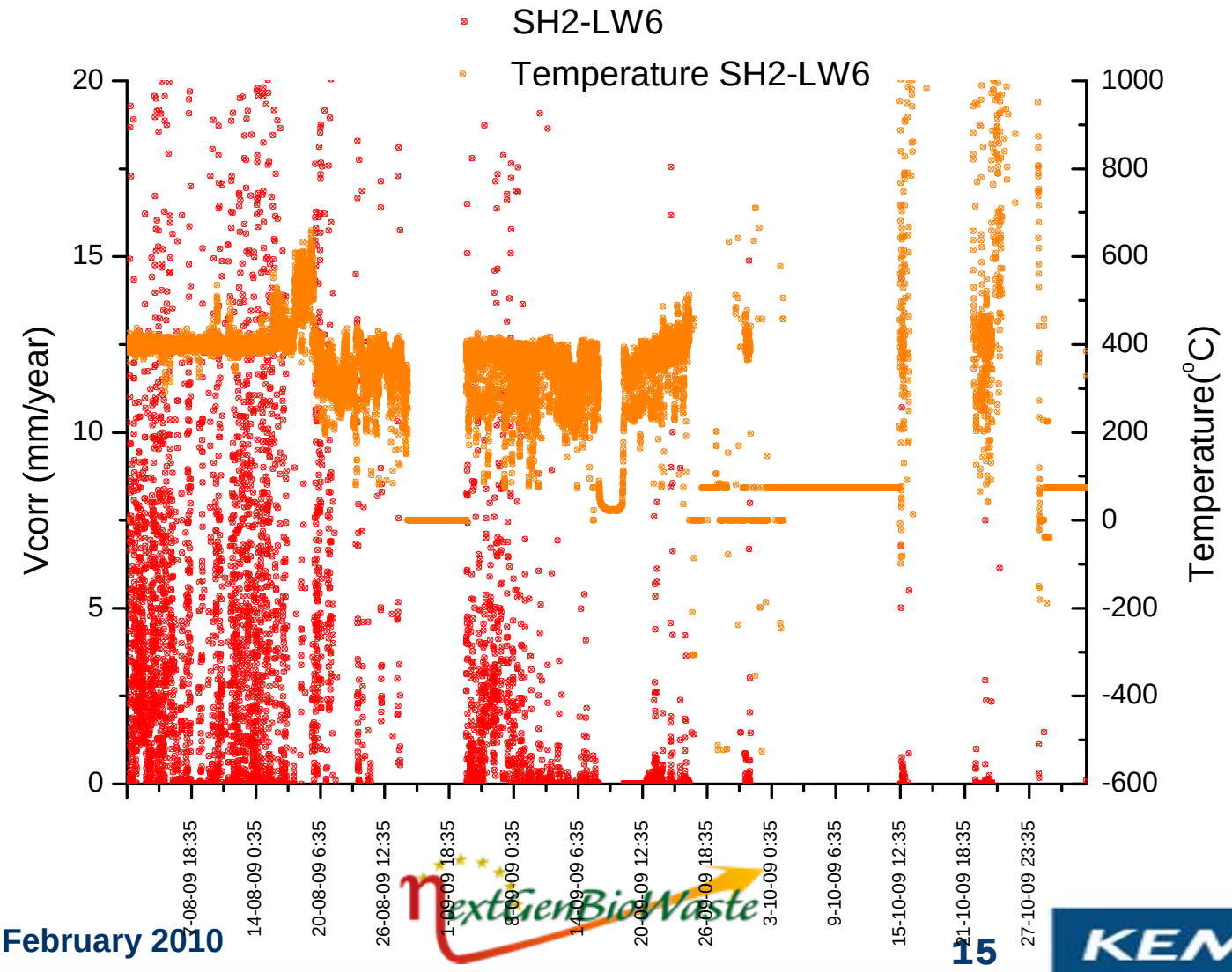
Probe Installation

	Probes	No.	Location	Floor	Height (m)	Code
Phase 1	Superheater probe (SH)	1	Front wall	7th floor	28.4	SH1
		2	Front wall	9th floor	34.0	SH2
Phase 2	Superheater probe (SH)	1	Front wall	7th floor	28.4	SH1-FW7
		2	Left wall	6th floor	25.0	SH2-LW6
	Radiant probe (R)	1	Front wall	9th floor	34.0	R1-FW9
		2	Right wall	6th floor	25.0	R2-RW6

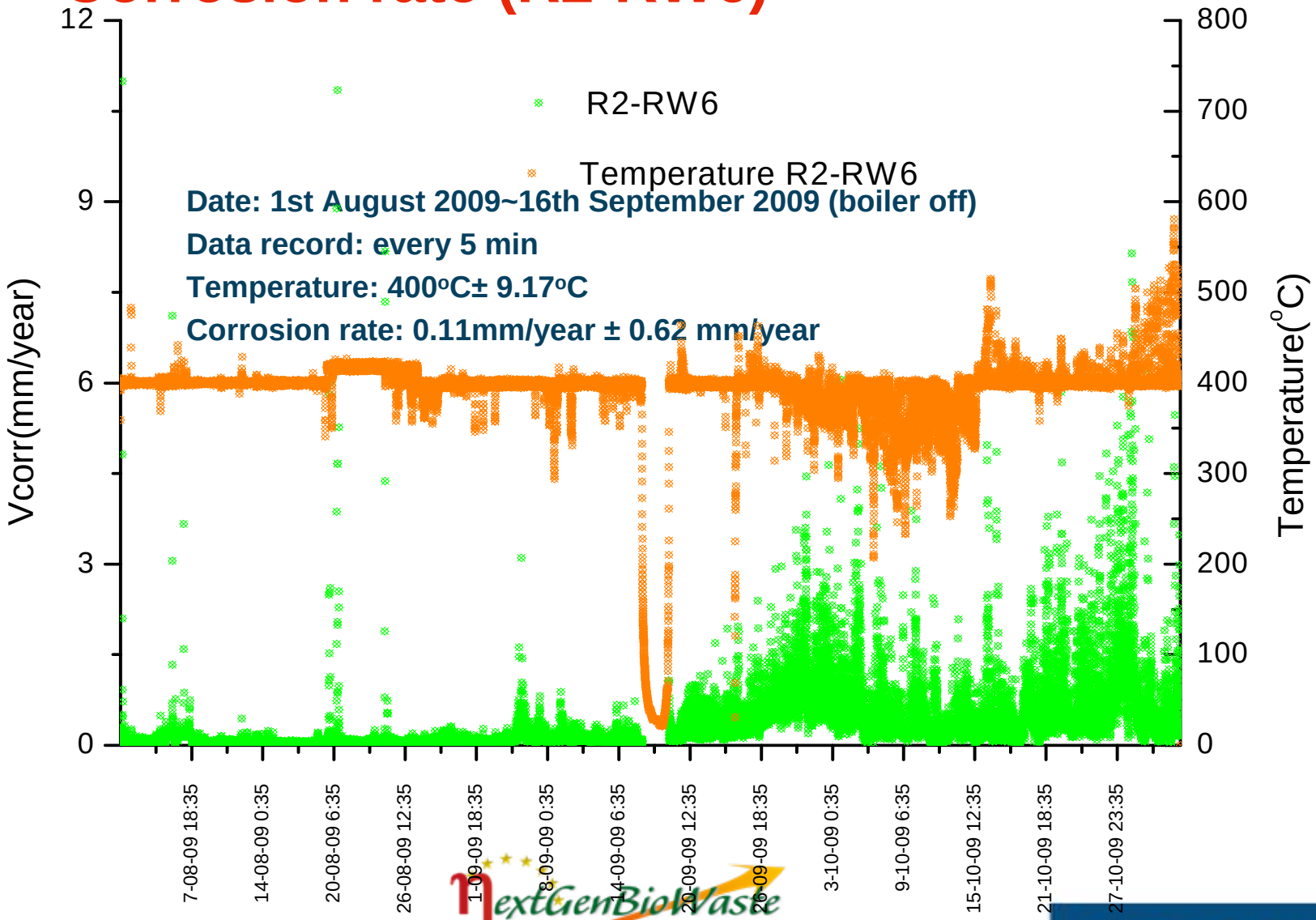
Corrosion rate of SH in Phase 1



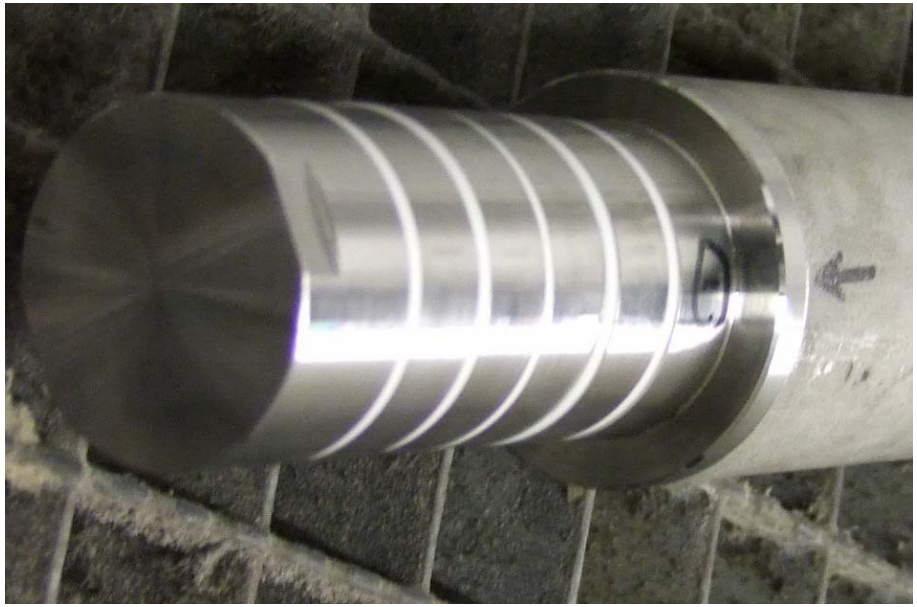
Corrosion rate of SH2-LW6 in Phase 2



Corrosion rate (R2-RW6)



Super heater probe



before **after**

Limited lifetime!

Radiant probe

before

after

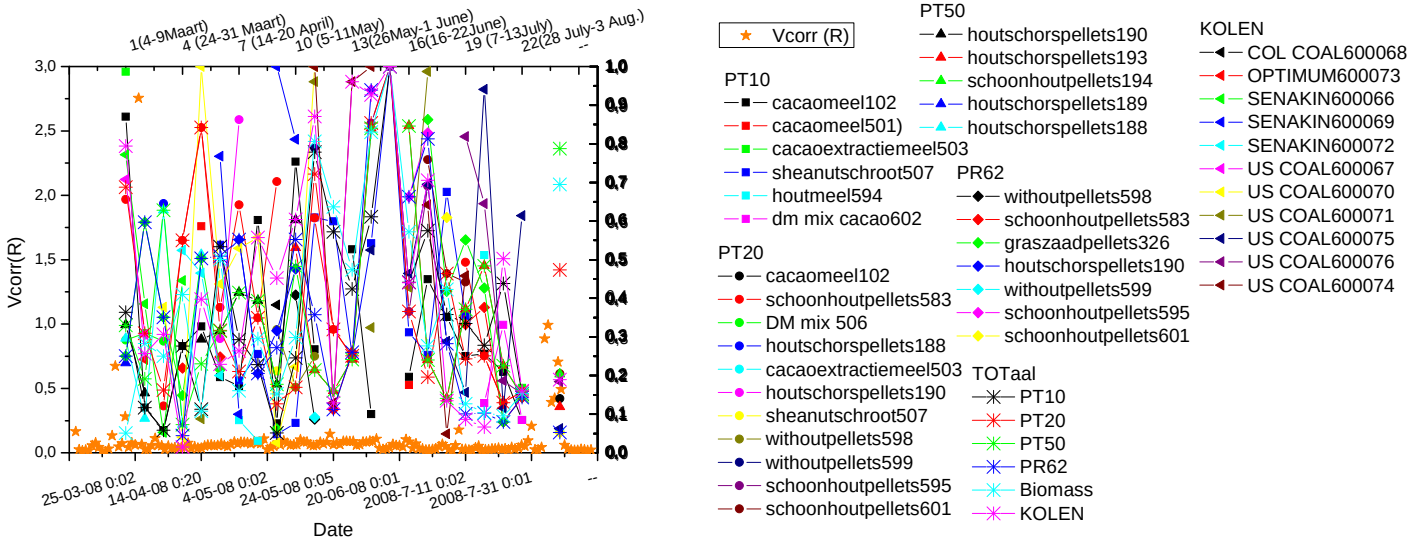
The probe still working after several months!

SH vs. R probe (radiant zone)

	Super heater	Radiant
Lifetime	Limited	Long
Corrosion rate	Too high	actual rate
Optimization process	Yes	Yes
Tip of probe for detailed analysis	Yes	Yes, but more difficult

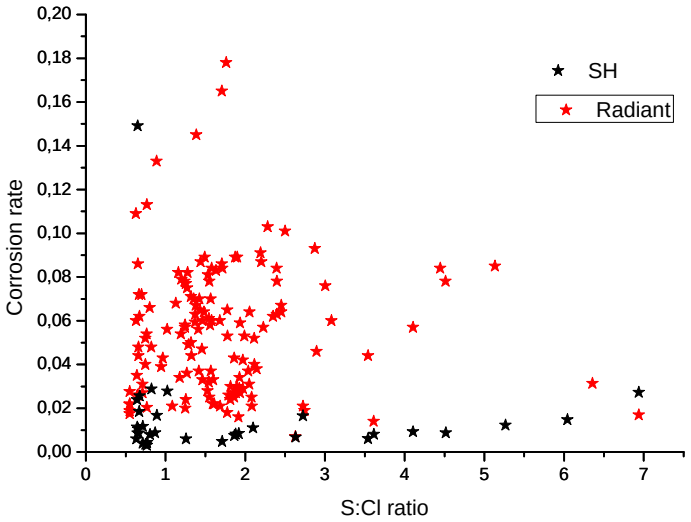
Example of PC boiler + biomass

- Optimised combustion conditions
- Determination influence of fuel composition



Example of results measurement campaign in PC boiler + biomass

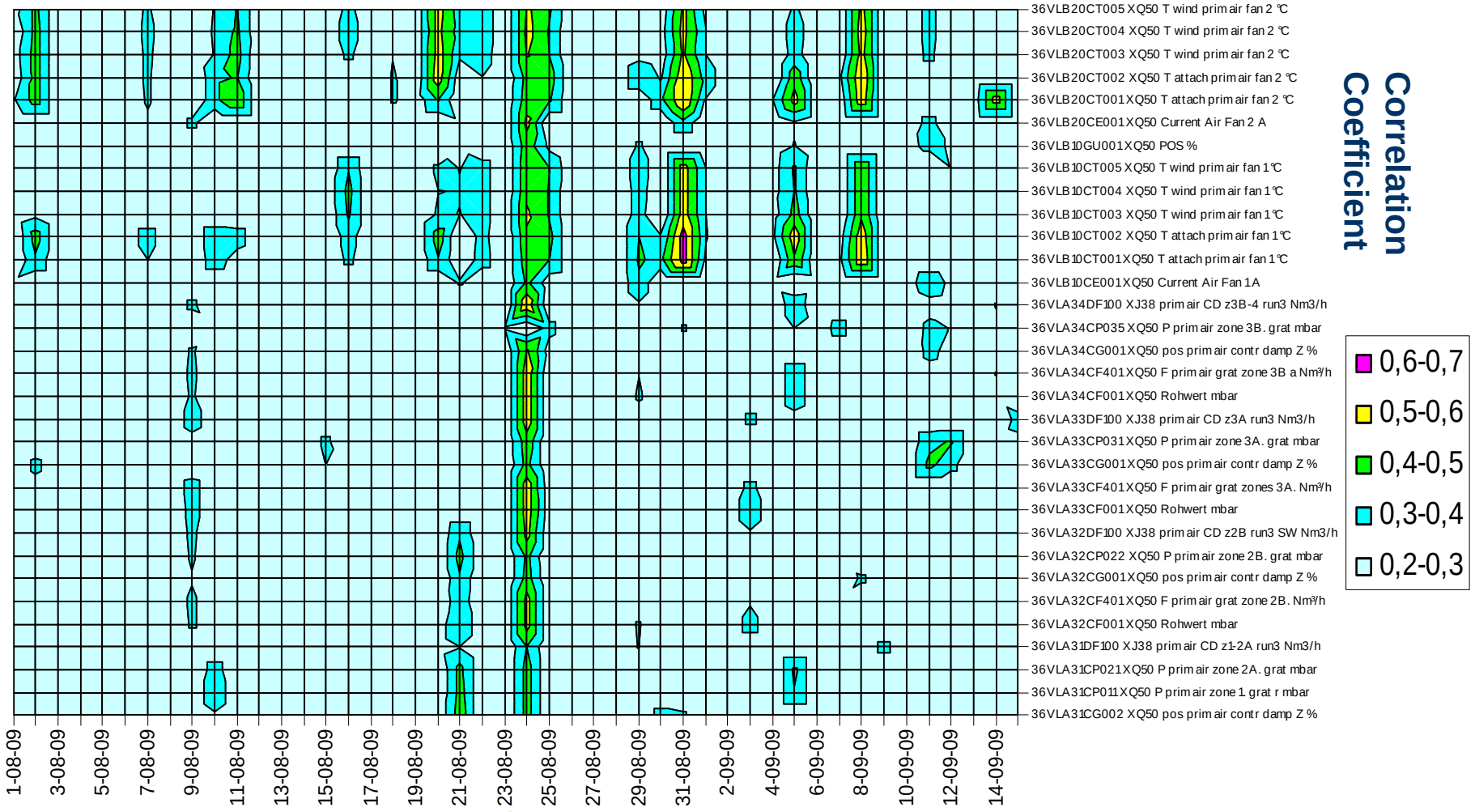
- Known history
- More than 5 years of corrosion monitoring (known areas of interest)



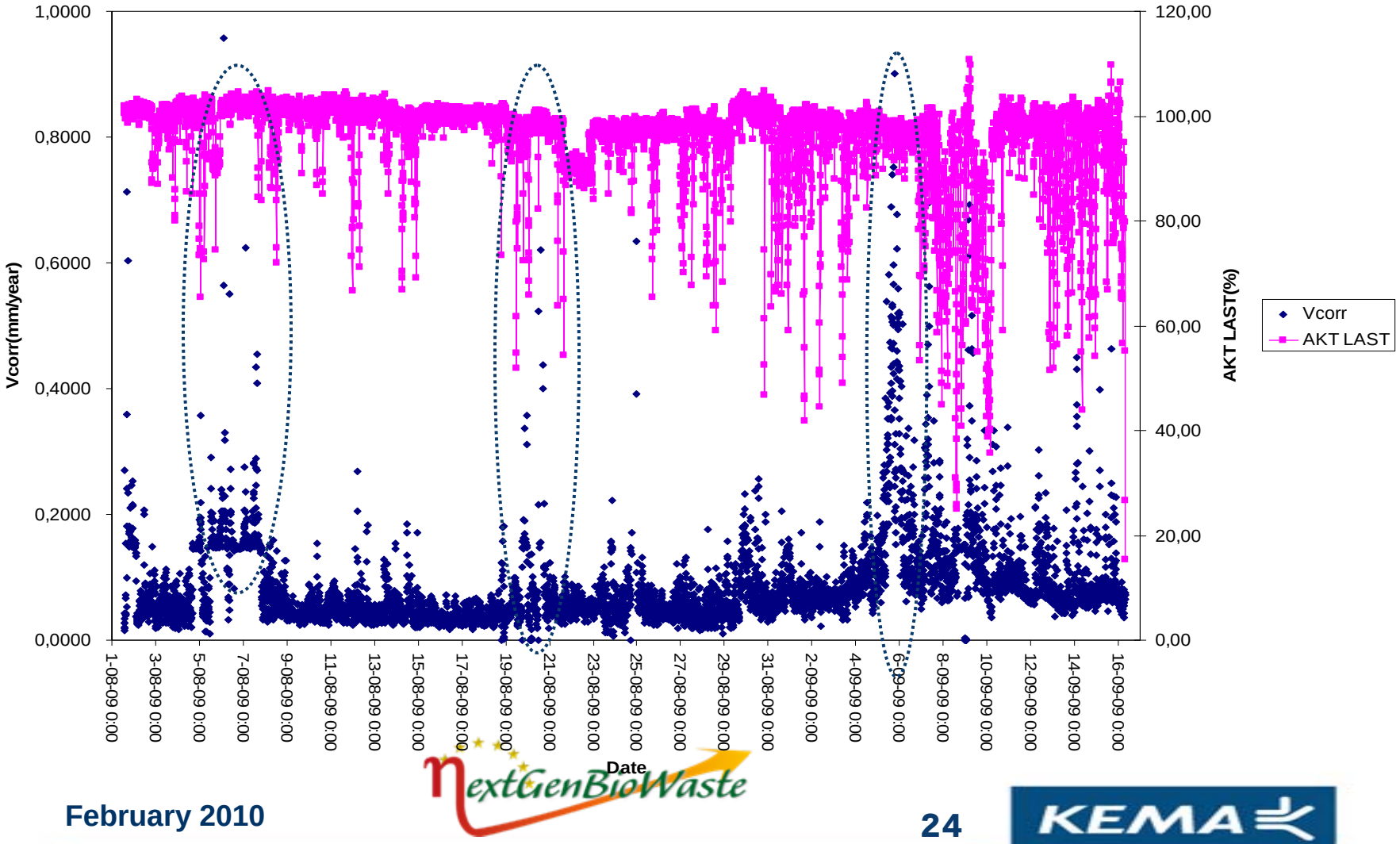
Challenges at AEB

- Variation of both combustion conditions and fuel composition (new conditions)
- Probe positioning (limited plant history)
- Large amount of data (how to present it)
- Multiple probes
- Some incorrect parameters in DCS system (additional challenge during data analyses)

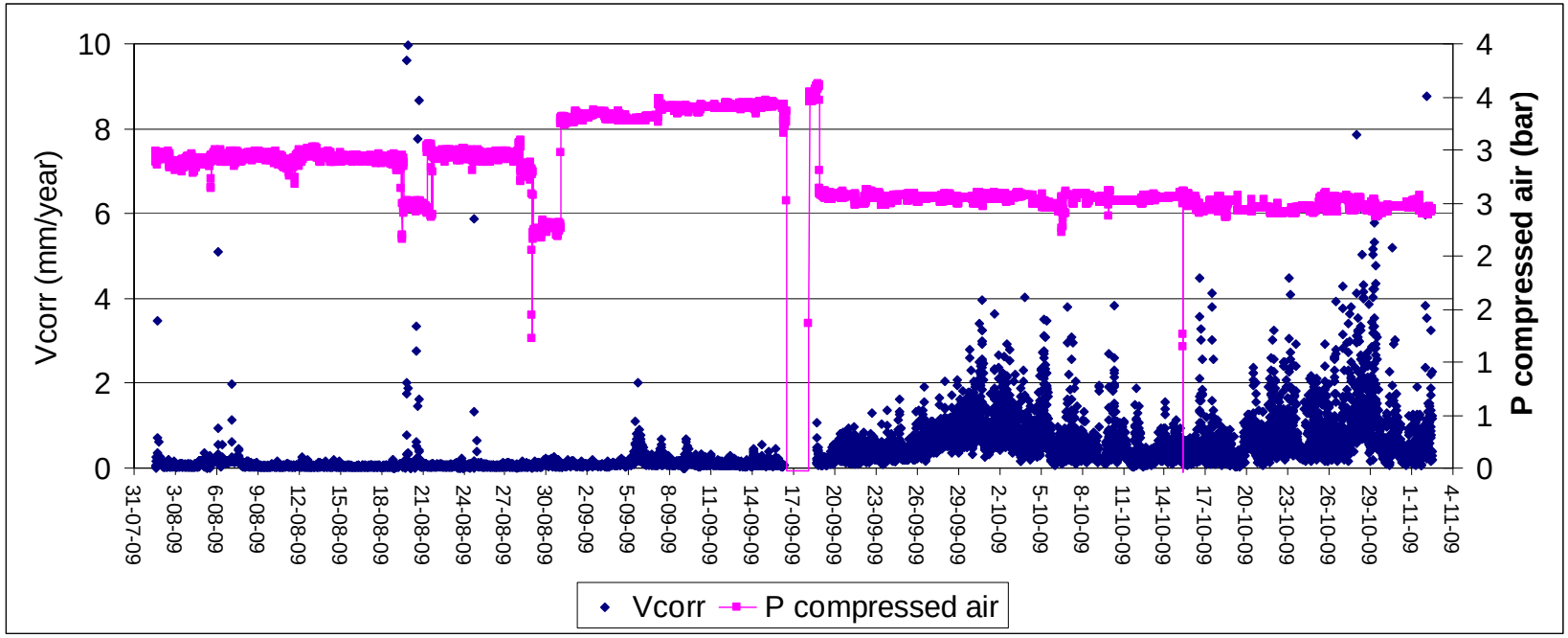
Vcorr vs. Operational conditions



Actual load effect on corrosion rate (Example)



P compressed and corrosion rate



Steps towards optimisation

- First phase: measurement campaign

- Data analyses

- Presenting relevant factors

- Optimisation by operational engineers AEB

- Confirmation/validation EC measurements

Concluding remarks

- Wrong probe type/geometry – no link with water wall conditions
- The effect of Galvanic bridging has been negated
- Measurements EC corrosion verified by
  - Destructive analyses of sensor elements (microstructure)
  - NDT measurements near the probe areas (KEMBUS)
- A crucial step is made towards the optimisation proces

Future plans

- Optimising data-analyses (Neural Network, Magicorr, other tools/approaches)
- Continuation of optimisation processes in WTe plants
- Combining multiple techniques on stream and on-line (NDT techniques, heat flux sensors and EC-monitoring)

Acknowledgement

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NextGenBioWaste