

Real-time monitoring of animals

Precision Livestock Farming (PLF)

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M3-BIORES Catholic University Leuven
(Measure, Model & Manage Bio-Responses)

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Overview

- KU Leuven - Team
- What is Precision Livestock Farming?
- Examples
- Conclusions

Katholieke Universiteit Leuven (°1425)

Leuven

- 25 km North East of Brussels
- 100.000 inhabitants

K.U.Leuven

- > 56.000 Students
- 1.440 Professors
- 5.601 Researchers
- 2.830 Administrative and technical staff

University Hospitals

- 8.434 Clinical staff



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Measure, Model & Manage BioResponses



M3-BIORES

Real-time modelling of individuals

- 2 professors, 4 Post Docs
- 25 – 30 Ph d students
- 20 – 25 Mastertheses/year

2016

**M3-BIORES →A2H-Health
Physiology – immunology - genetics**

- 7 professors
- 60 Ph d students
- 40 mastertheses/year

310 A-Publications

17 products

15 patents

389 Conference papers

2 spin-off companies

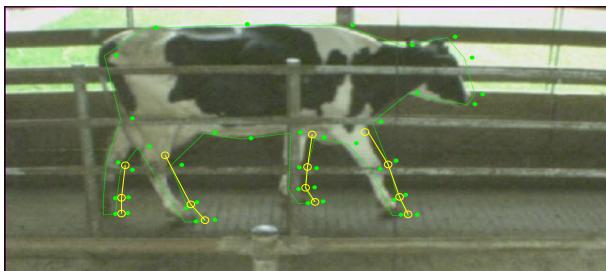
48 contracts with international research partners

Challenges for livestock production

- 65 billion animals are slaughtered every year
- Worldwide **demand for animal products** increases with up to 75% by 2050? (global per capital income doubles, population growth, changing diets)
- **Health:** Relationship between animal health and healthy food
- **Animal welfare** (e.g. EU)
- **Environmental Issues**
- **Social importance**
- **Economic importance** including Valorisation of knowledge

What is Precision Livestock Farming (PLF)?

Precision Livestock Farming



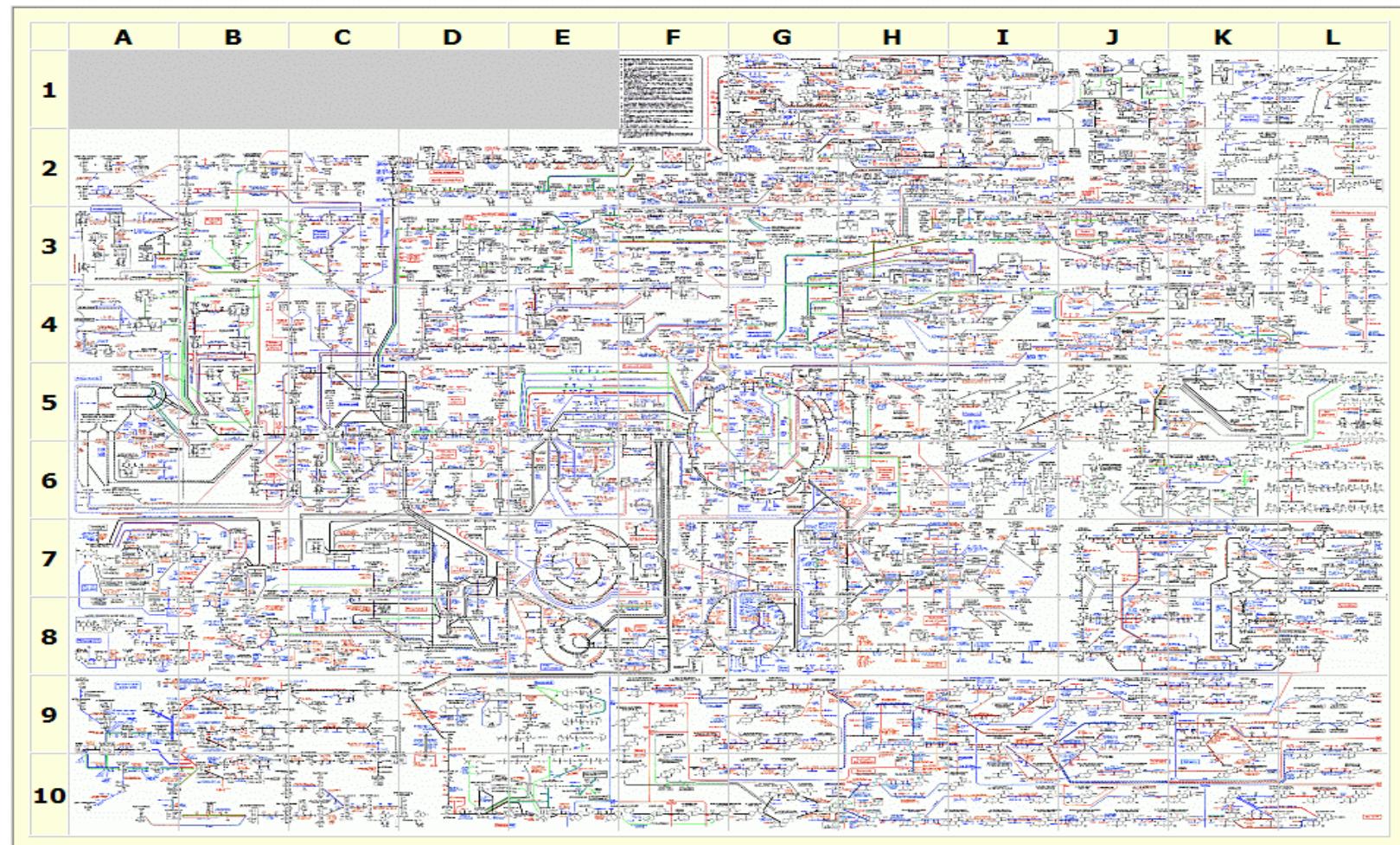
Tool for the **management** of livestock by continuous automated real-time monitoring of production/reproduction, health and welfare of livestock and environmental impact.



A living organism is a CITD system

A living organism:

Complex



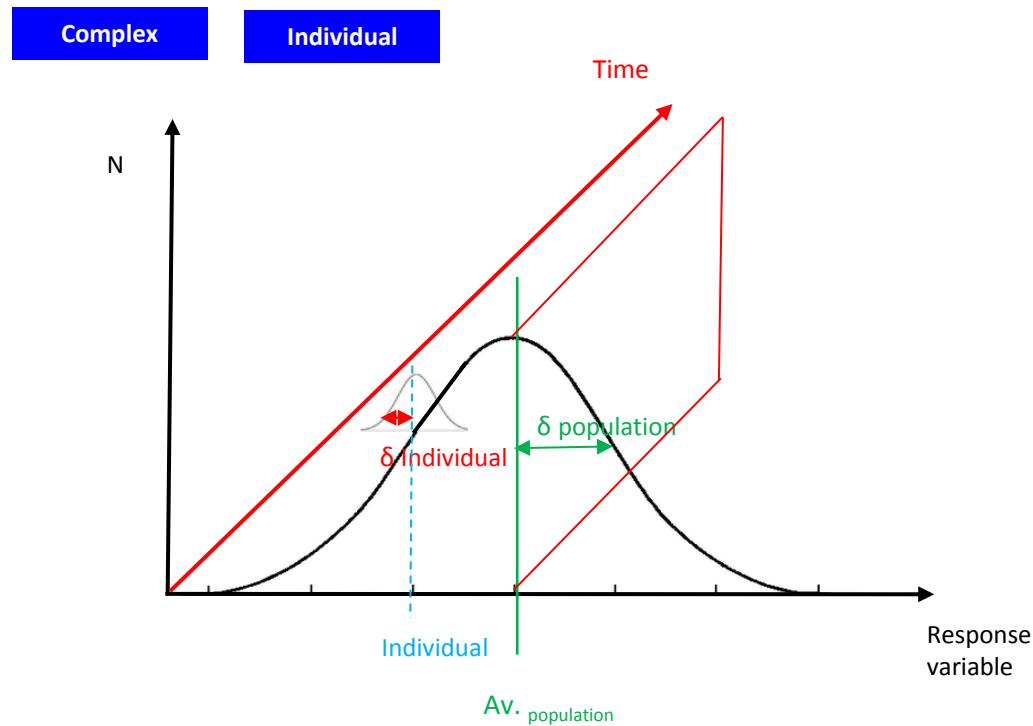
Living organisms are ...



...individually different



A living organism:



12

A living organism:

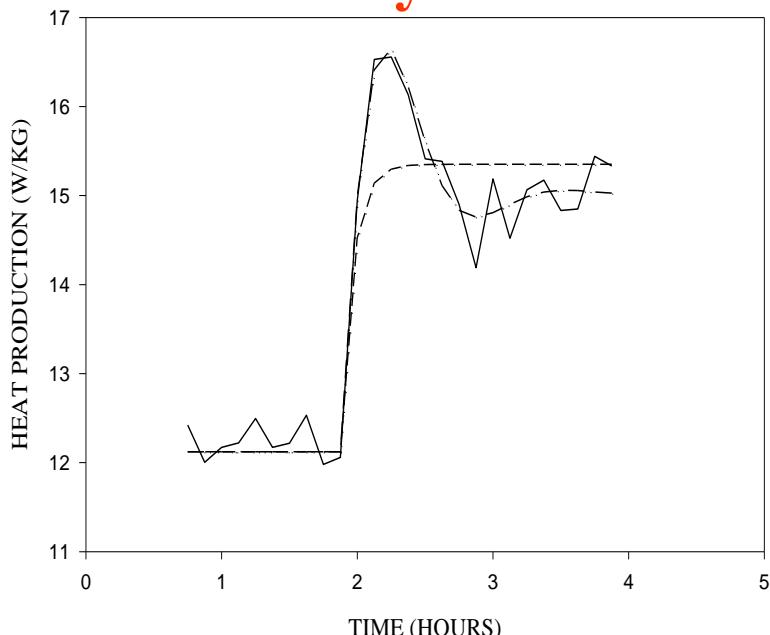
Complex

Individual

Time-Varying

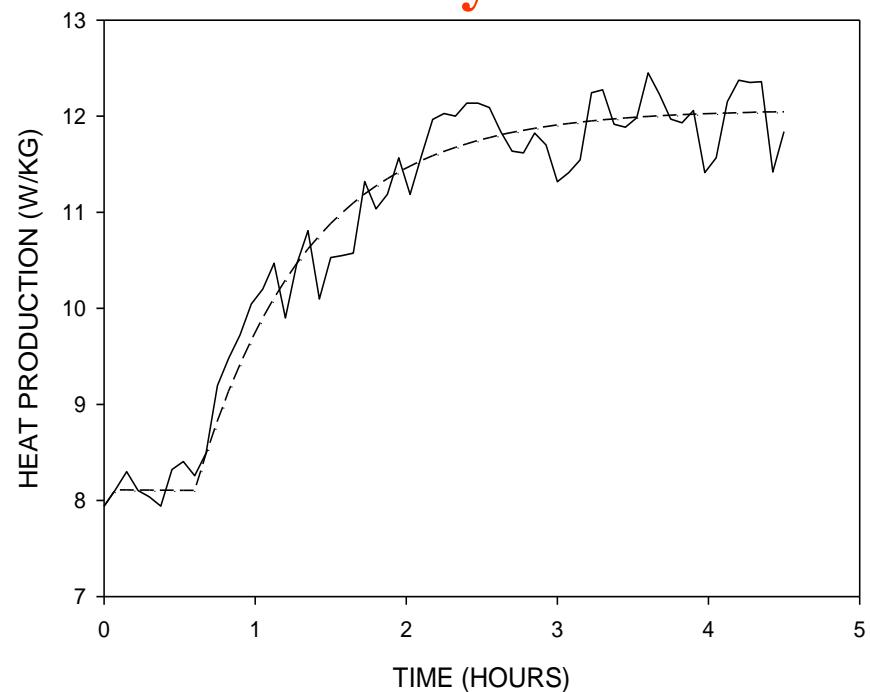
Example: Heat production of broiler chickens

5 days old



— MEASURED
- - - MODELLED (1ST ORDER)
- · - MODELLED (2ND ORDER)

30 days old



— MEASURED
- - - MODELLED (1ST ORDER)

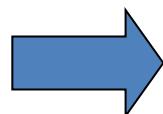
A living organism:

Complex

Individual

Time-Varying

Dynamic



Living organism = **CITD - system**

1. Measure

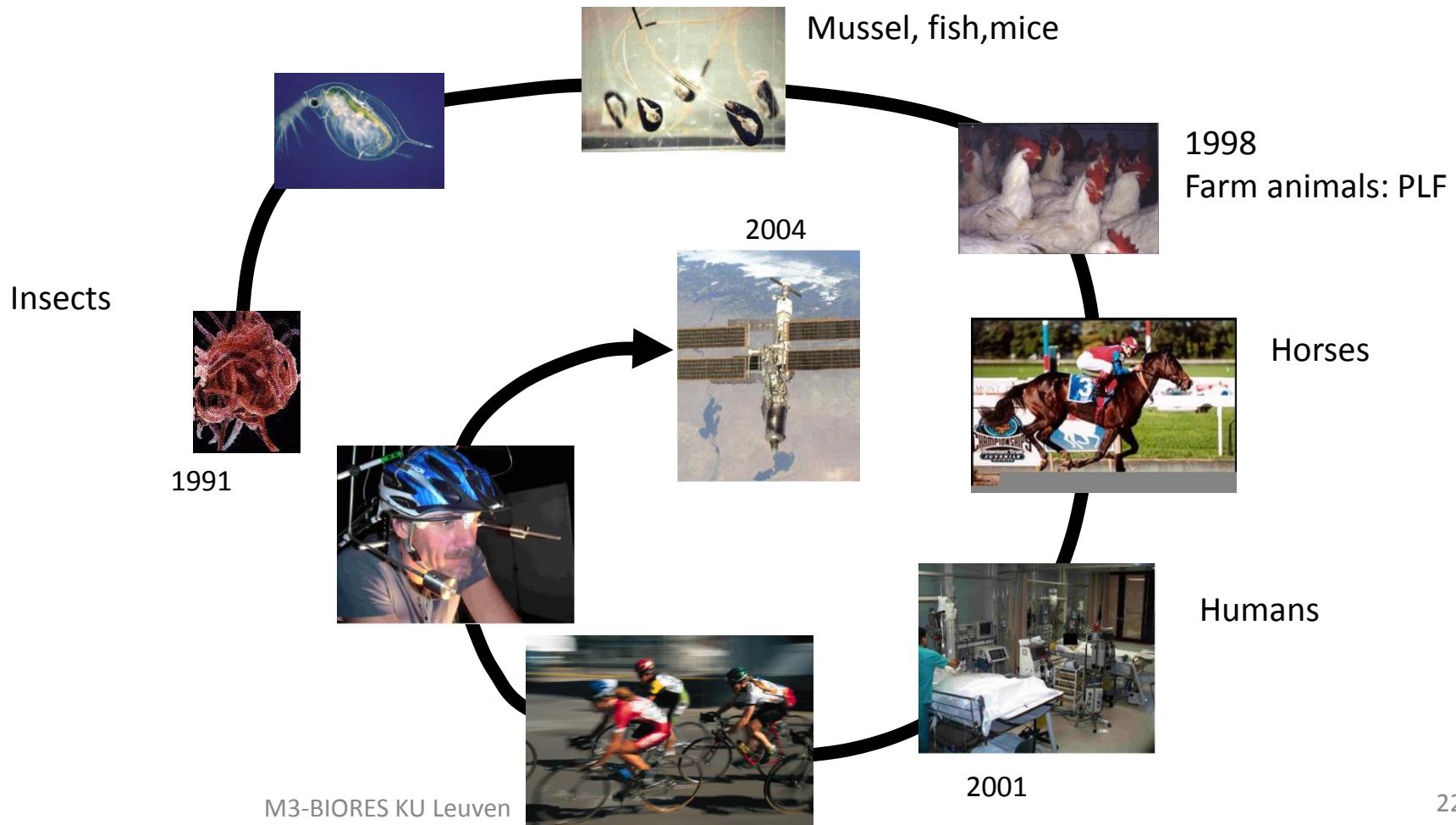
2. Model

3. Monitor &
Manage

In an on-line way
In real-time

M3-BIORES

Trajectory M3-BIORES approach



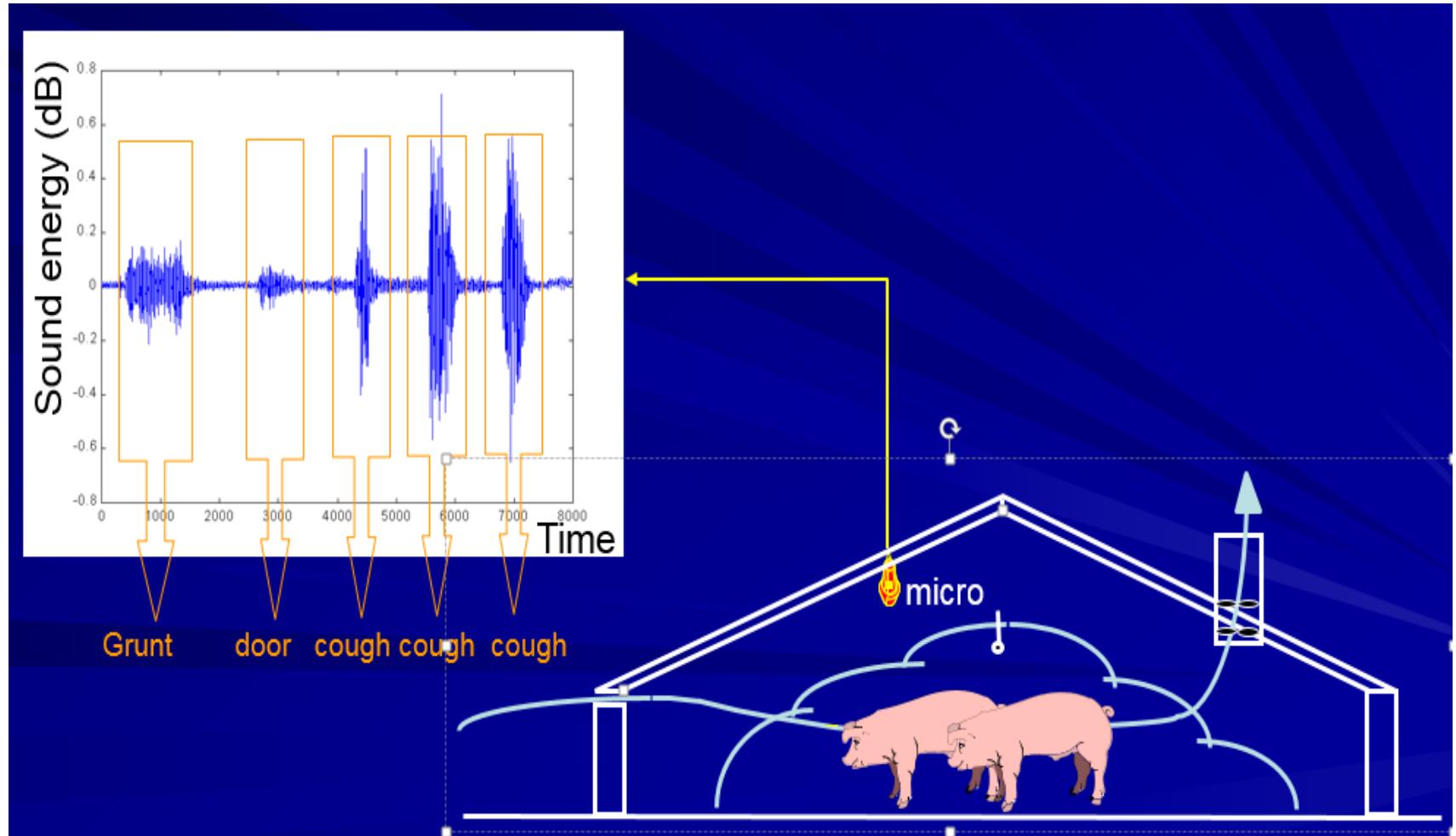
Examples of PLF Technology: What is possible today?

Example: Infection Monitoring by On-line Pig Sound Analysis

i.c.w. University of Milan, SoundTalks NV, Fancom BV

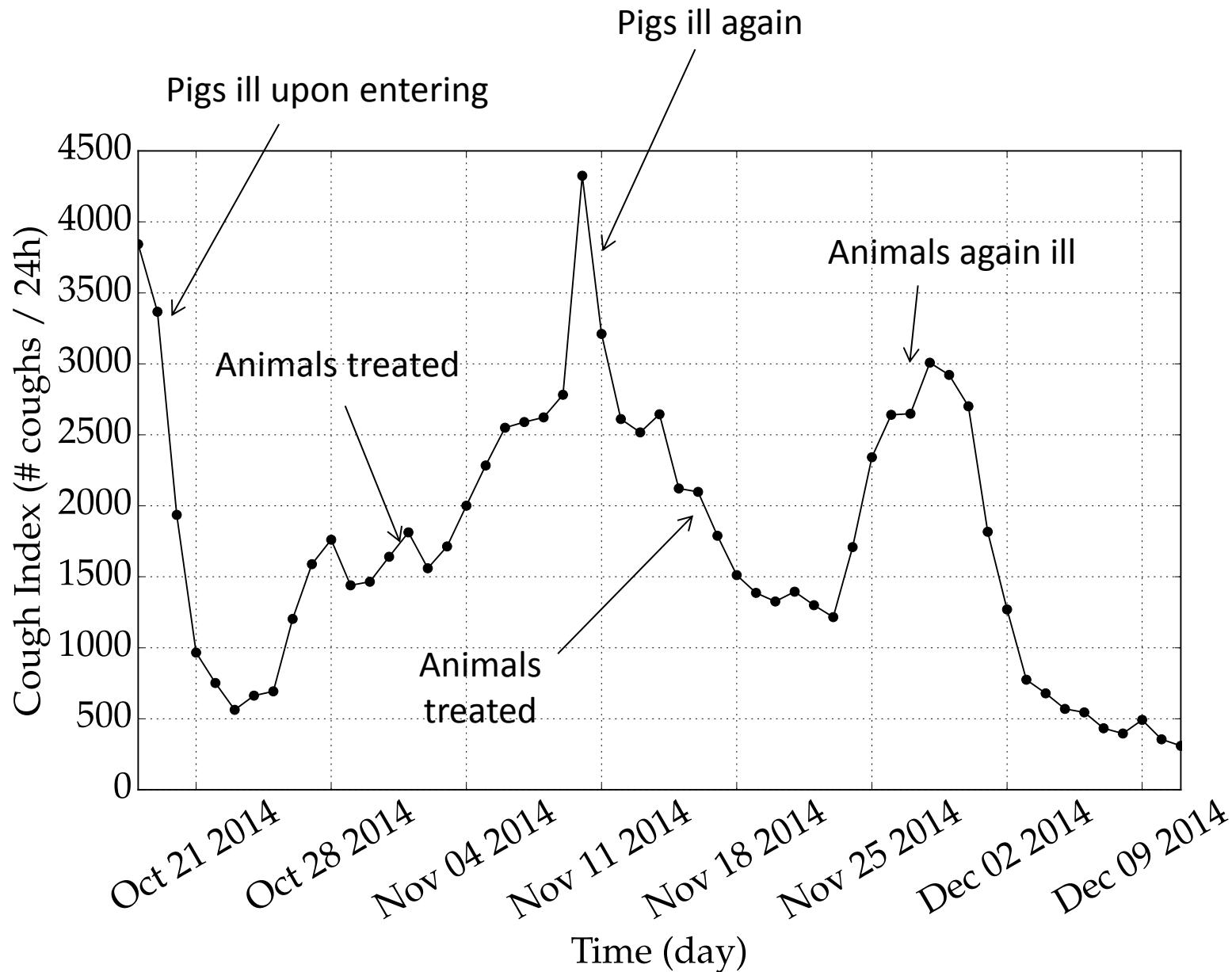


Health monitoring by on-line sound analysis:



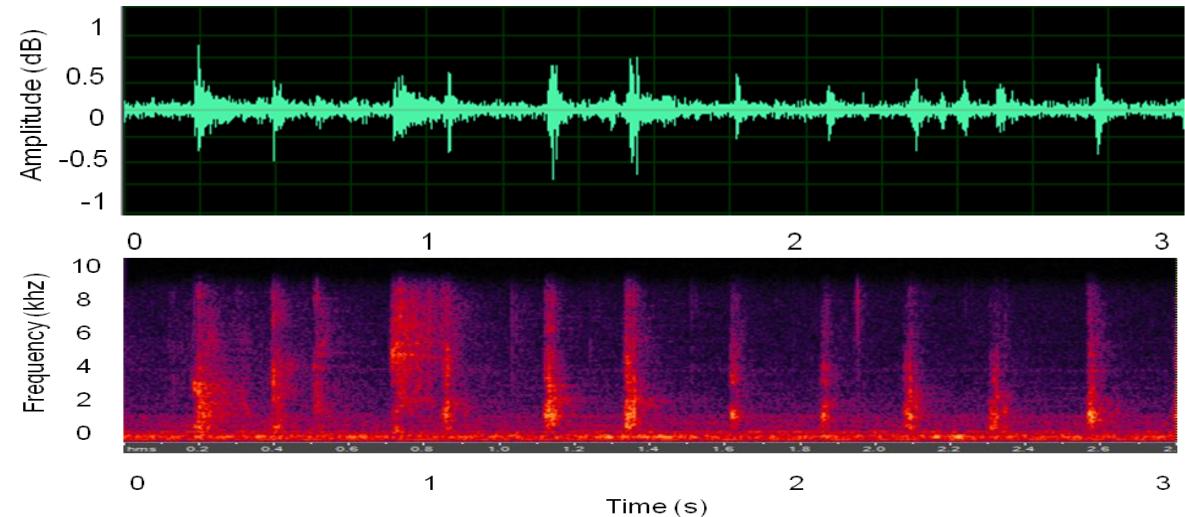
Results

Soundtalks & Boehringer Ingelheim





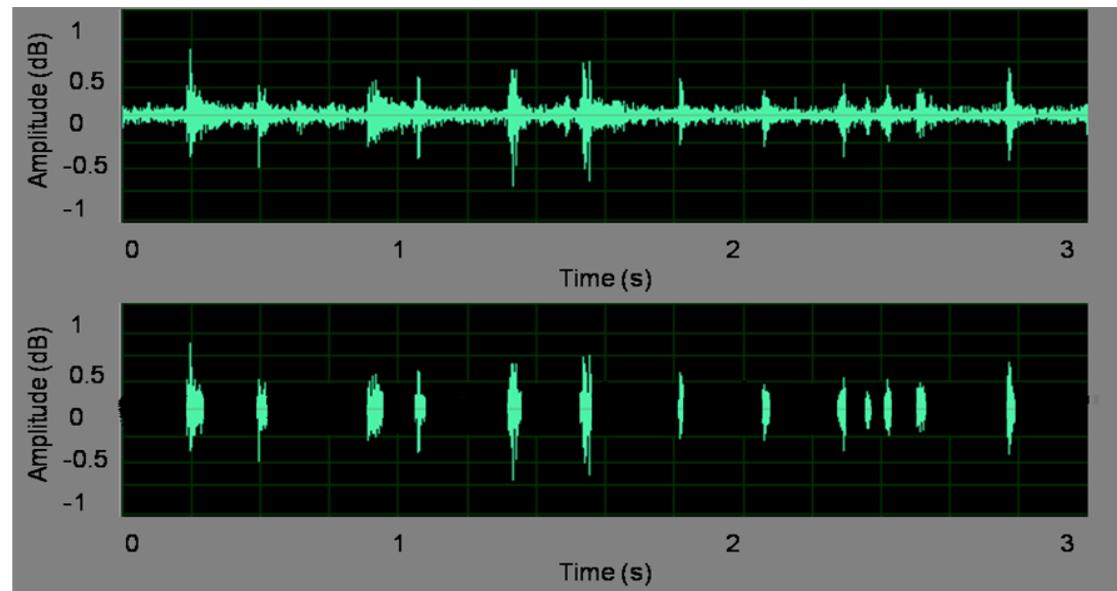
Example: Continuous automated monitoring of feed intake of broilers by sound technology



Play

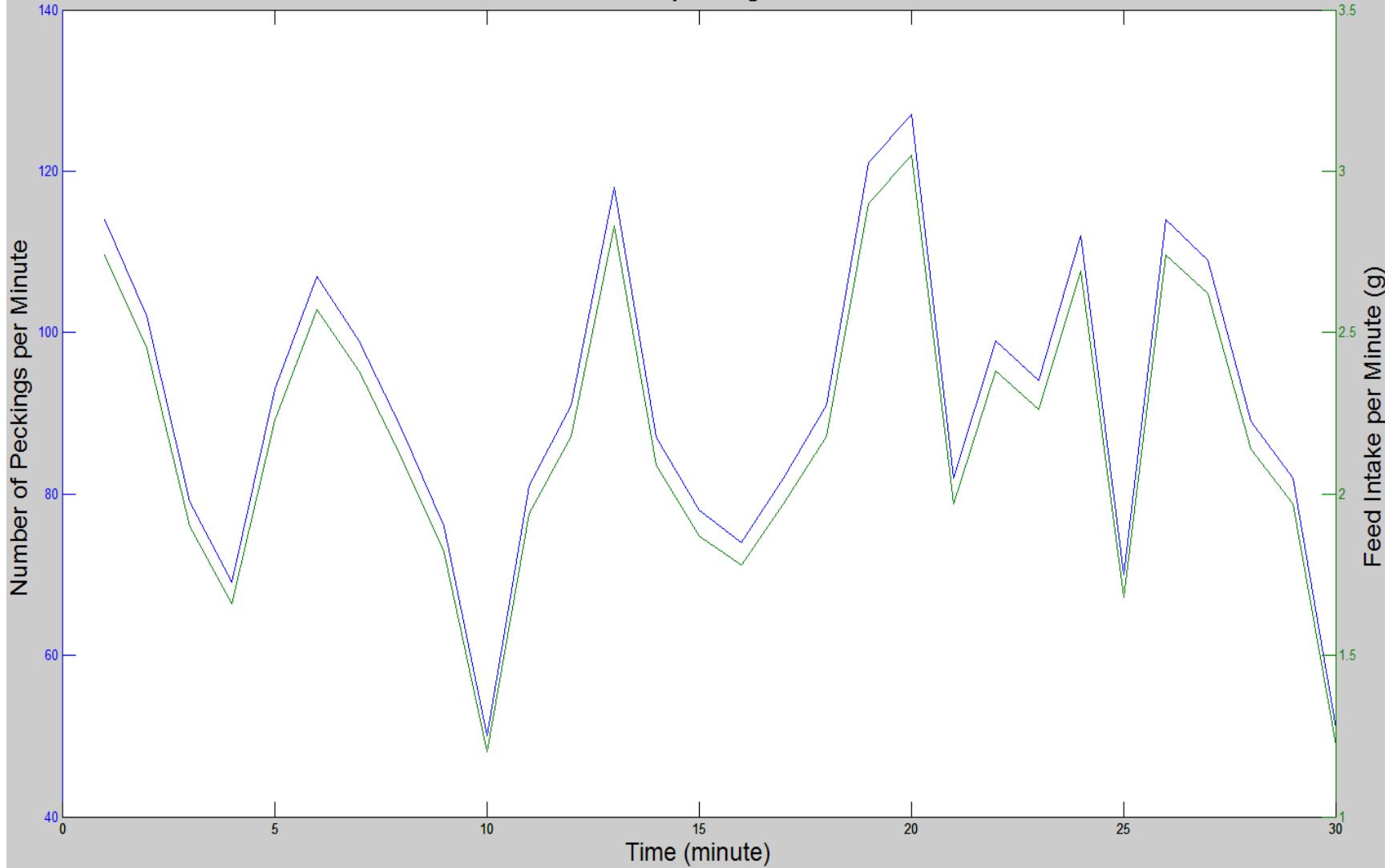


Play



Continuous recording of sounds (top) and individual pecking sounds (bottom) as extracted by the algorithm.

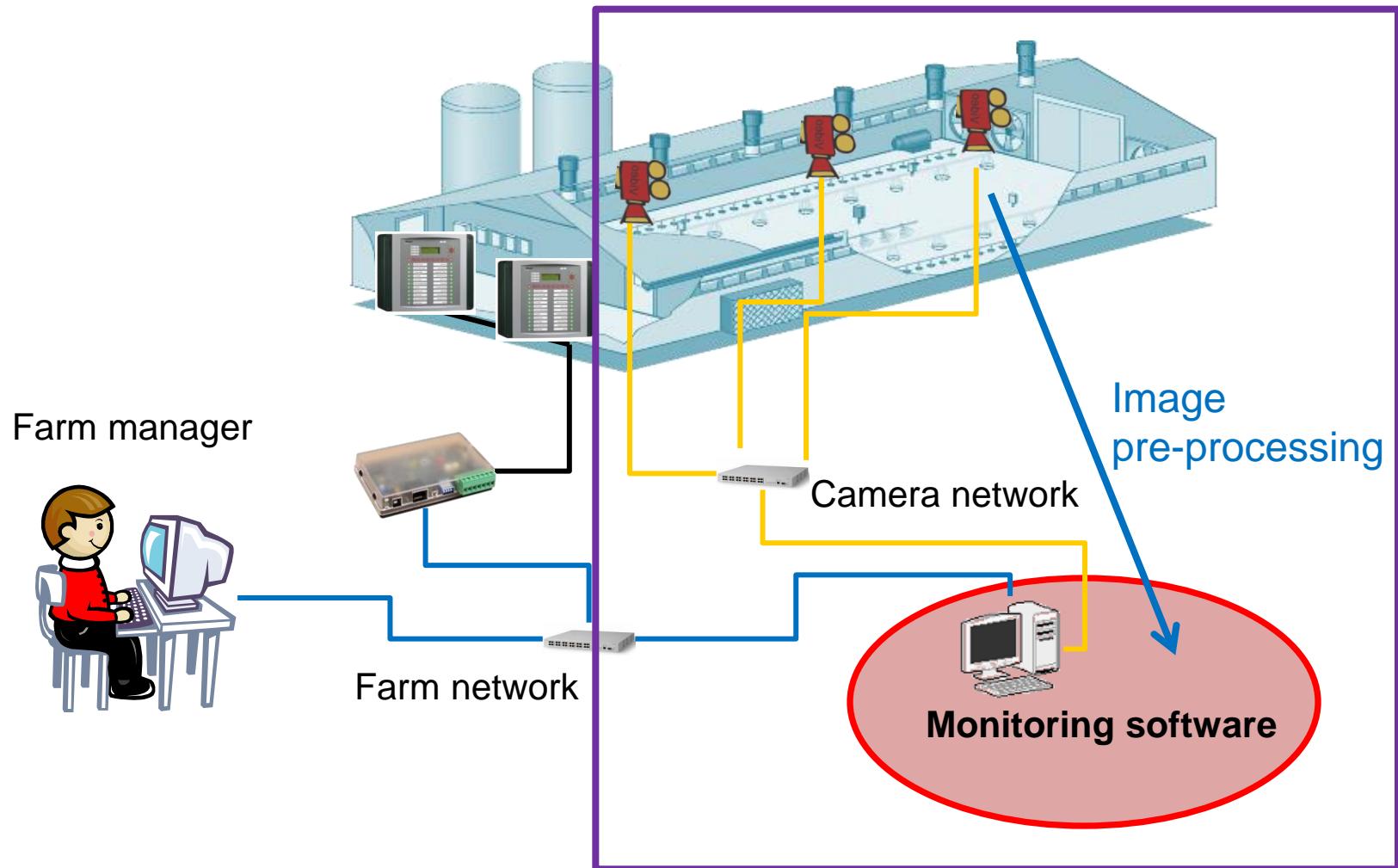
The relation between number of peckings and feed intake of chickens



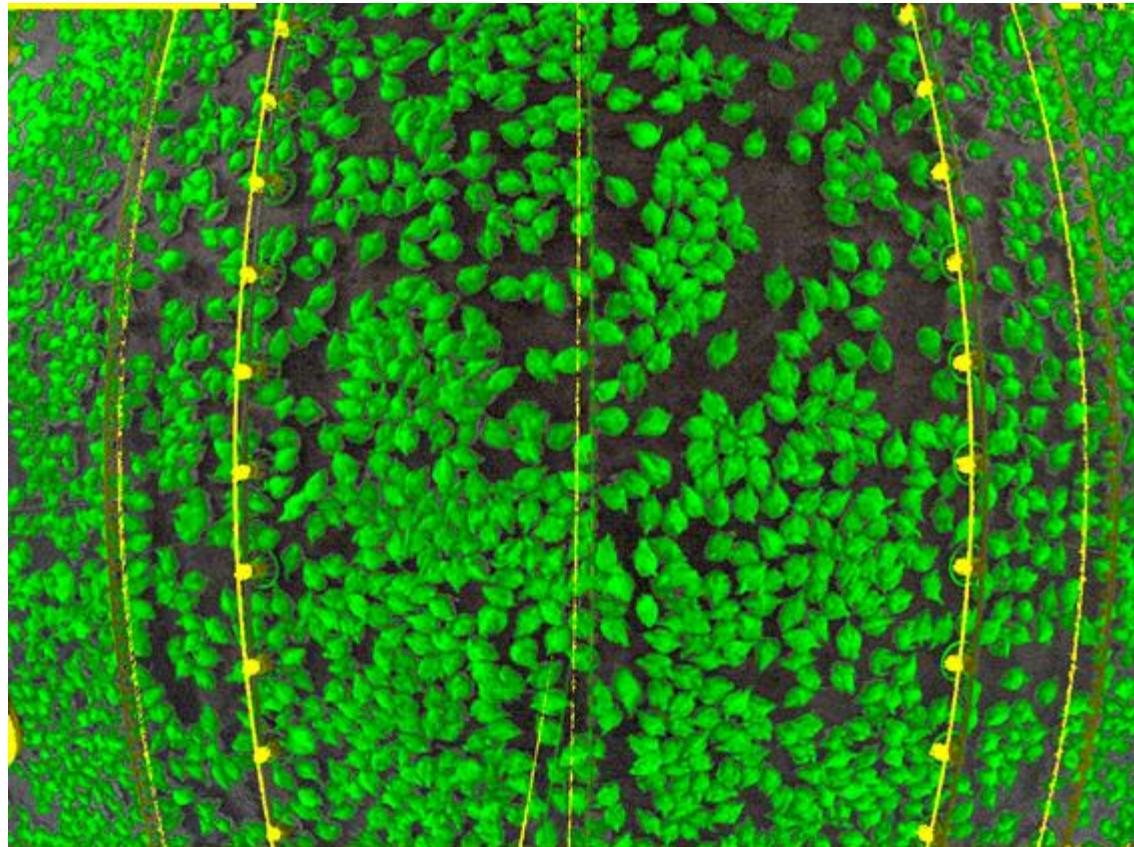
Example : Real time monitoring of problems in a broiler house

i.c.w. Fancom BV

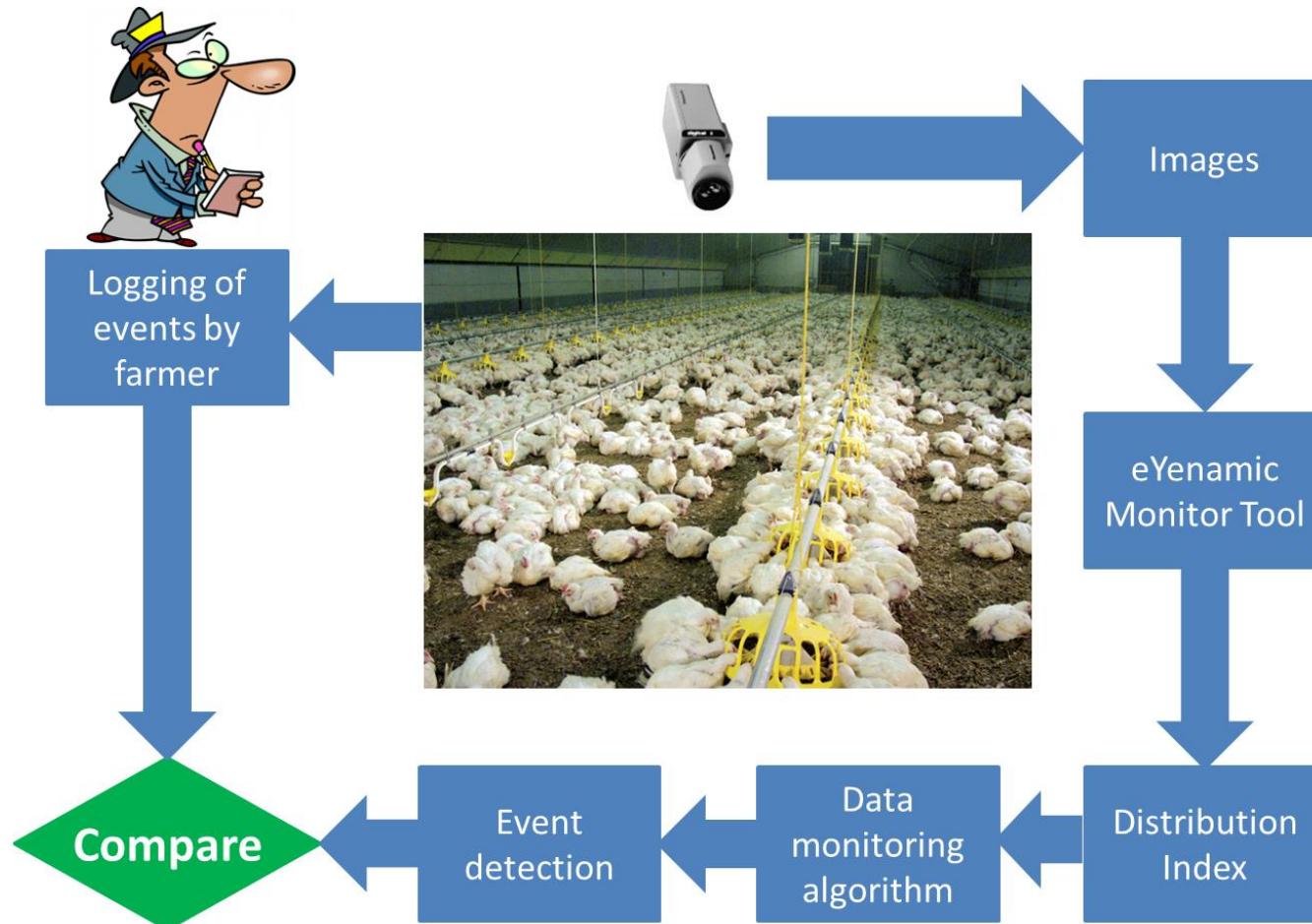
eYeNamic monitor tool



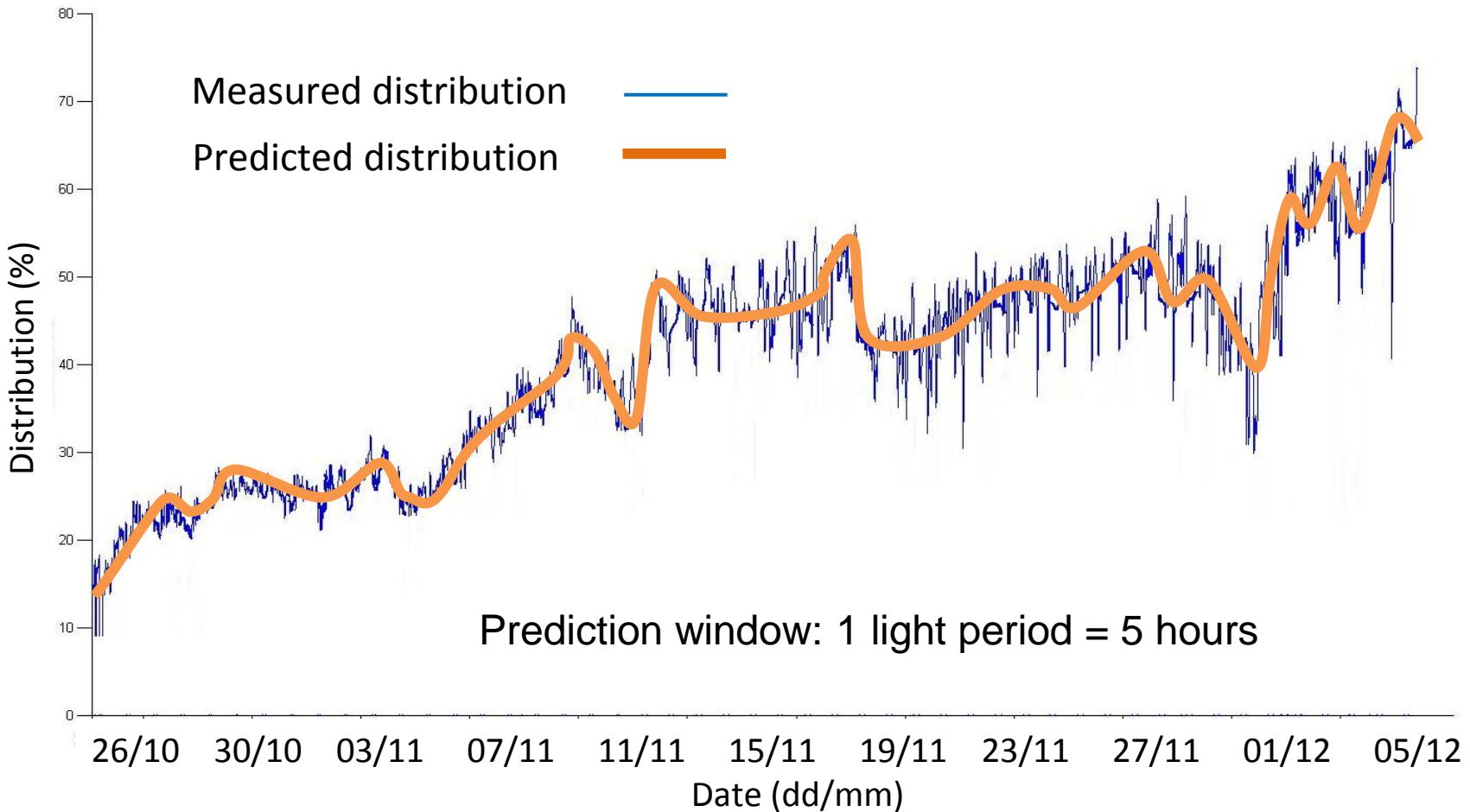
- Detecting malfunctioning in broiler houses
- Produce alarms in real-time when malfunctioning happens (in feeder or drinker lines, light, climate control, etc.)



Farmer logbook and manual video observation as references

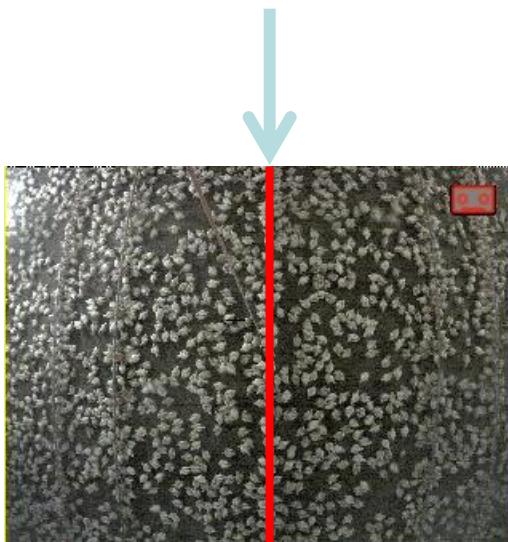


Measured vs. modelled animal distribution

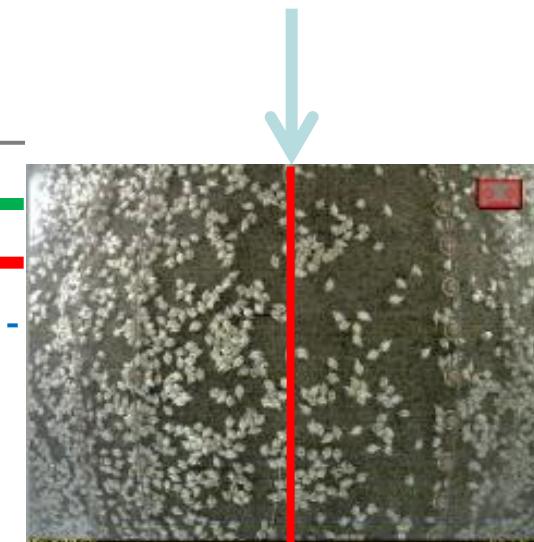


Event detection

Feeder line



Defect Feeder line



Measured values

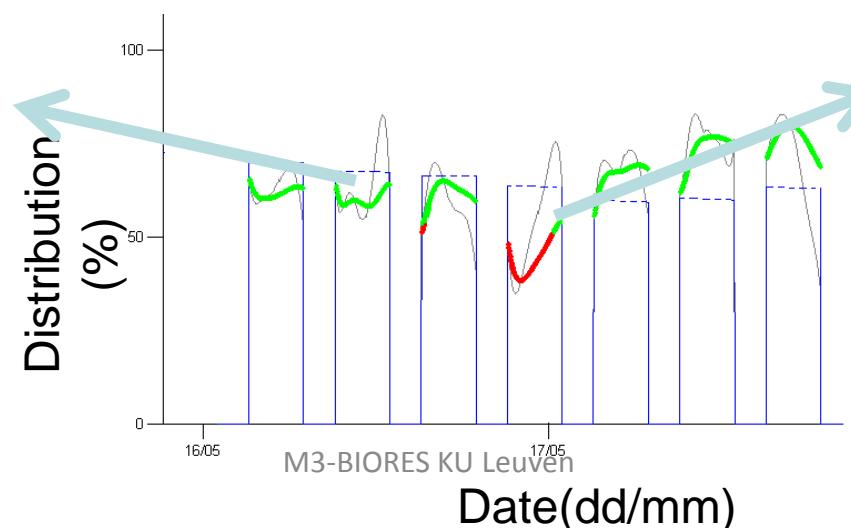
Smoothed values within 25% range

Smoothed values out of 25% range

Predicted values

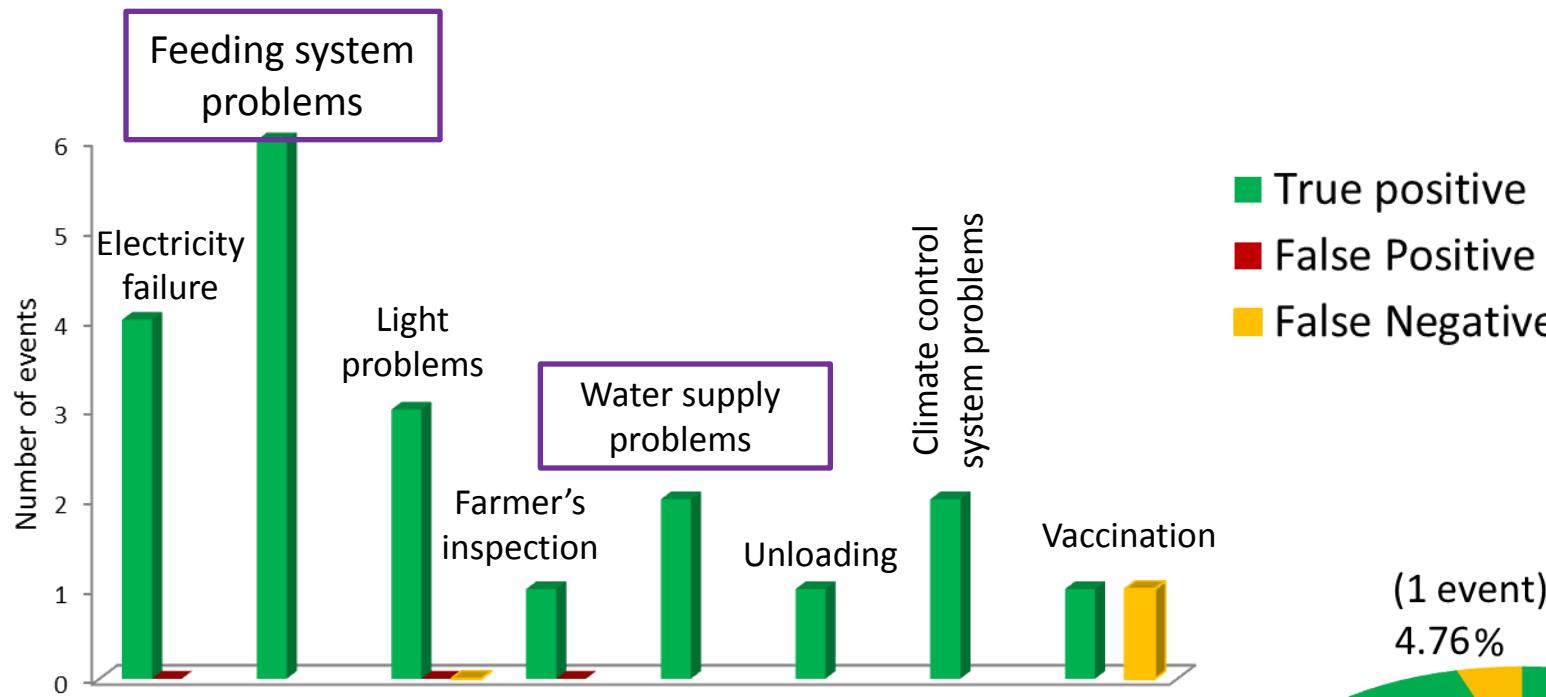


Normal situation

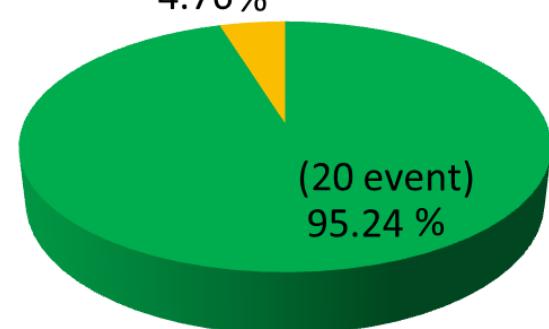


Problem in
feeding lines

Detected events in the validation experiment over 42 days

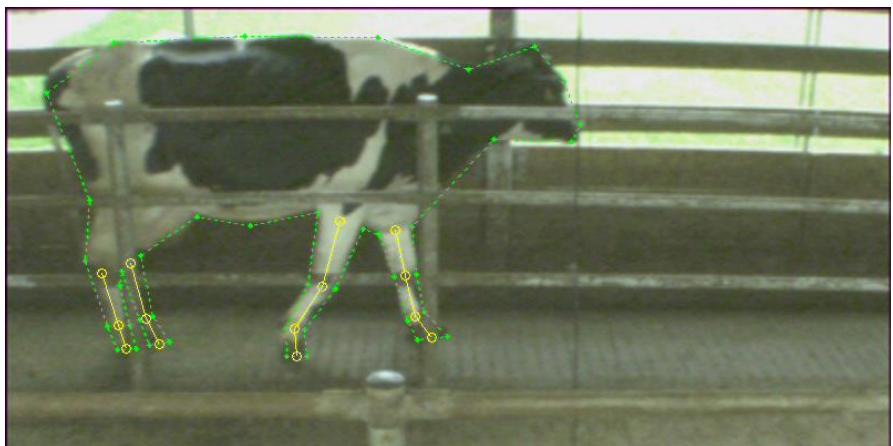


Conclusion: 95 % of all events were detected based upon real-time monitoring of animal behaviour



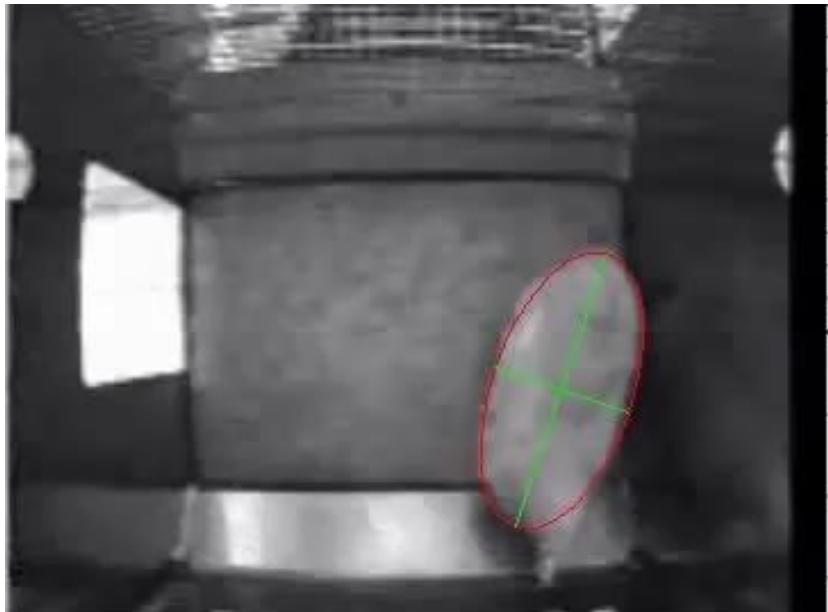
Some other examples

Cow lameness monitor: i.c.w. Volcani, DeLaval, Wur Aggression monitor: Umil, TIHO, Fancom BV

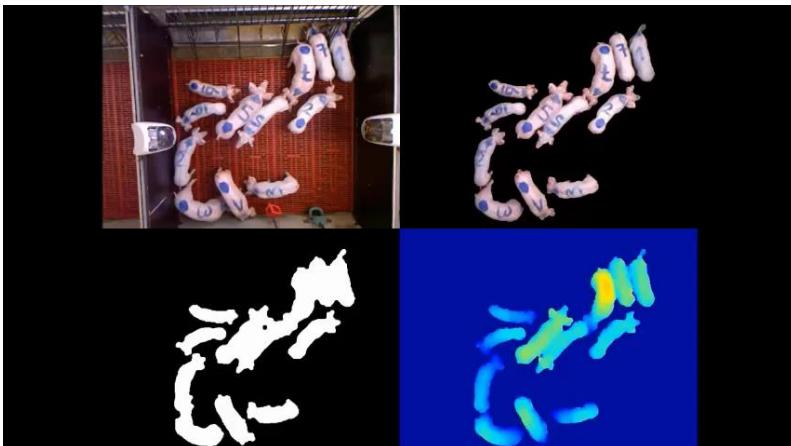


Play

Scratching behaviour: Ughent, ILVO



(c) Laboratory for Agricultural Buildings Research



Play

Weight estimation: Fancom BV, Agrifirm



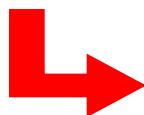
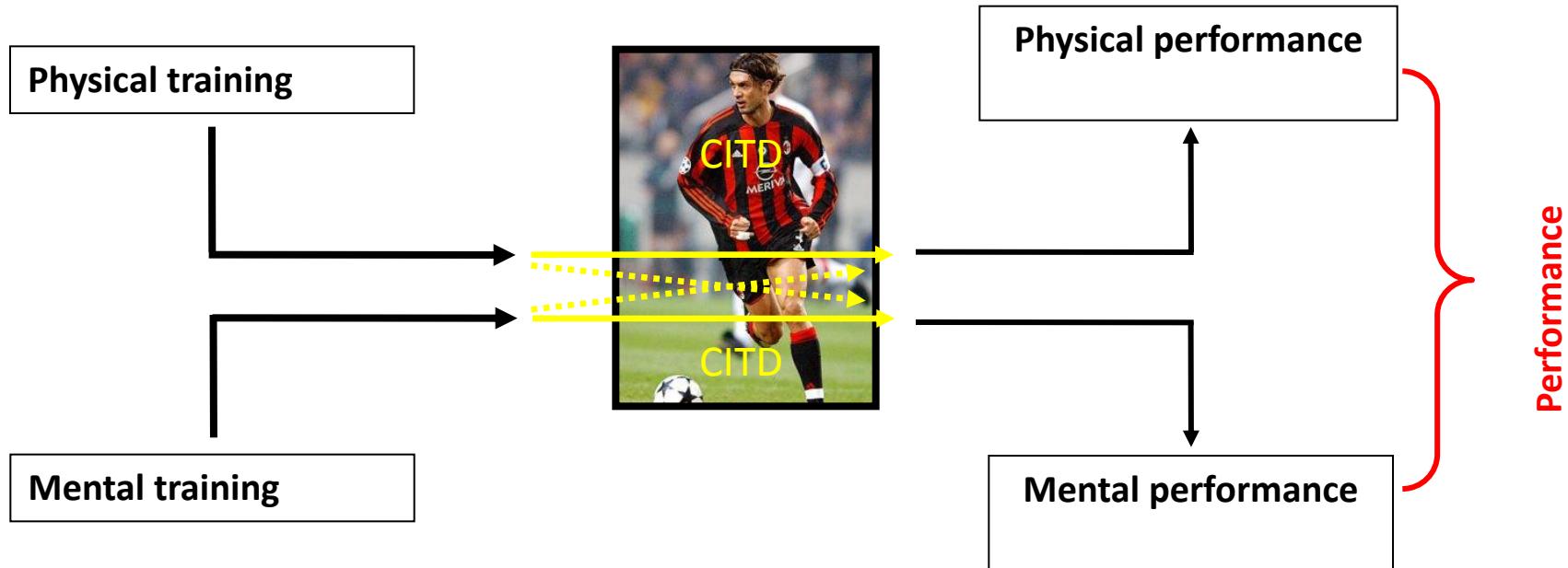
Play

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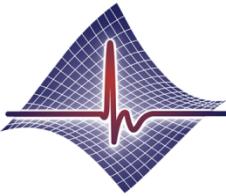
Play

Real Time Stress Monitoring

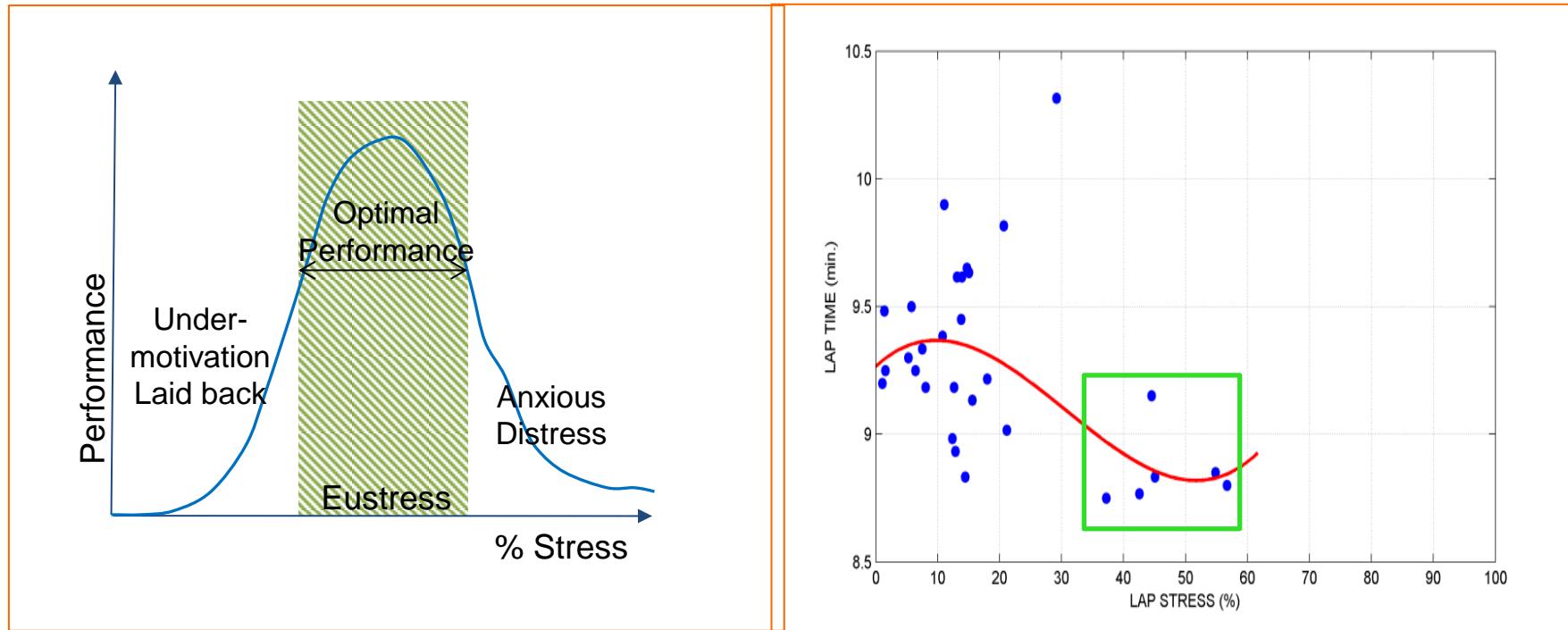
Process: mental monitoring AC Milan 2006

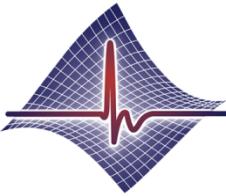


Total performance = Mental performance + Physical performance

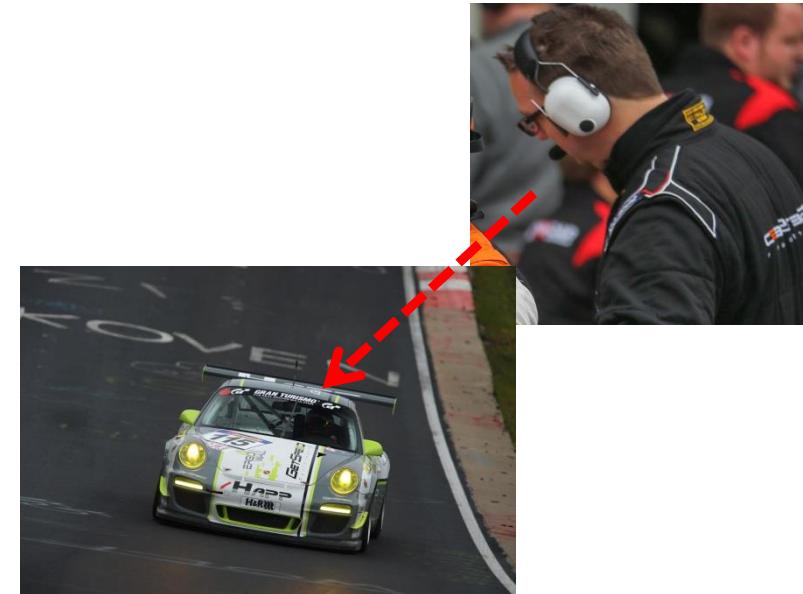
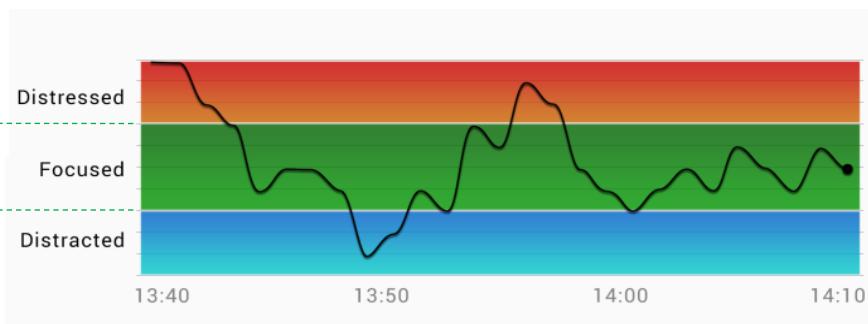
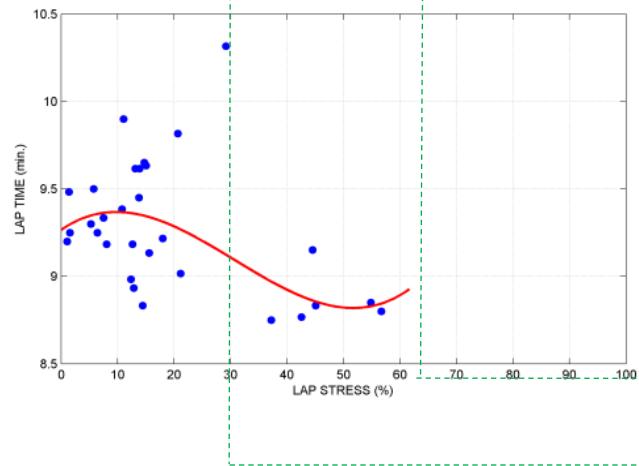
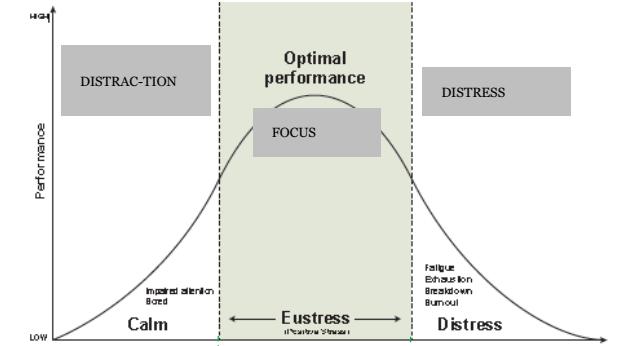


Objective measure for Performance





Real-time stress management



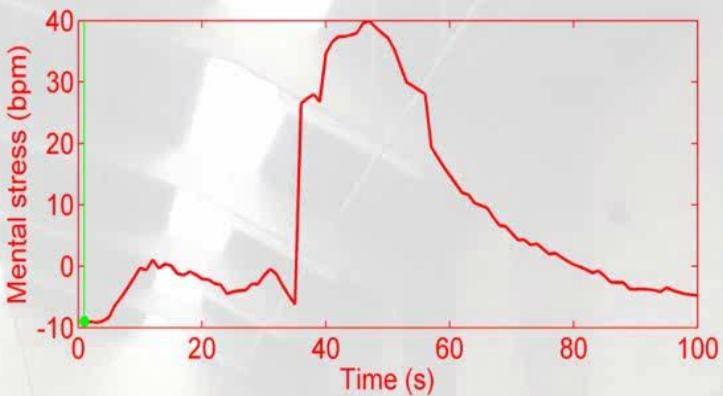
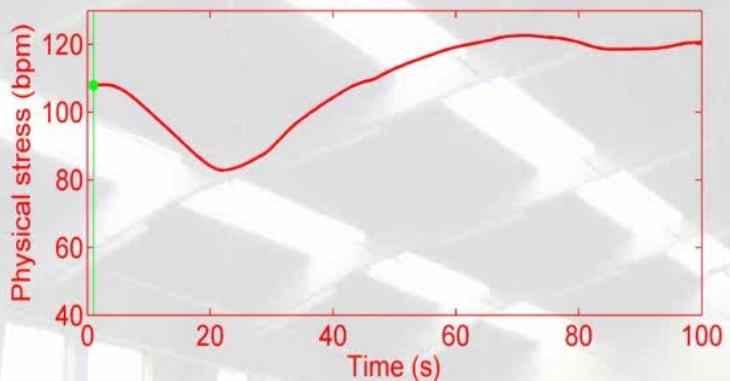
Focus zone



Play

Brave new world: Mental status of animals: Monitoring animal welfare

Real-Time Frustration Monitoring



Real-time animal welfare monitoring (livestock, companion animals)

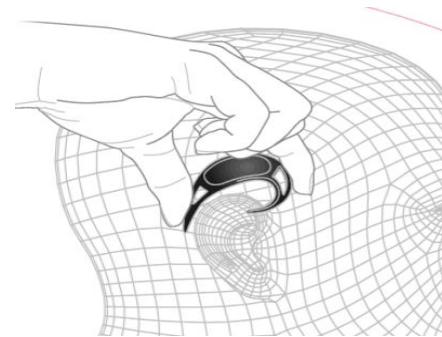


Existing BioRICS Stress Level Monitoring



Existing Sensixa eAr-sensor

(Patent granted)



New technology Delivers:

- Realt Time Stress Level Monitoring
- Real Time adaptive Algorithms
- Wireless connection & recharging

Conclusions

- Fully automated continuous real time detailed monitoring and management of humans and animals becomes a reality.
- PLF brings the farmer to the individual animal that needs his/her attention, active management tool.
- PLF is a tool that helps farmers and stakeholders to realise more sustainable livestock production.
- Worldwide implementation of PLF needs more collaboration between industry, researchers, farmers and stakeholders.
- Development of PLF products needs real collaboration between disciplines .

Thanks for your attention!

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Questions?

