« Dairy cows are like F1. They are fragile. If you drive a F1 on a ground path, it will break »

Didier, a farmer from Jura, France
Can PLF help reduce the mismatch and maintain a good welfare?

When welfare is low, production is low.

Risk of poor welfare in case of a very high production.

Production & welfare increase together.

Animal welfare vs. Milk production.
Increasing the value of existing PLF systems to assure dairy cows’ welfare

Cow Group

KUL (C Bahr then T Norton, A Pena Fernandez) BE
GEA (S Klimpel, KH Sloth, C Pathak) DE-DK
INRA (B Meunier, MM Mialon, M Silberberg, I Veissier) FR
ARO (I Halachmi) IL, SLU (P Nielsen, H Blokhuis), Teagasc (B Earley) IR

EU-PLF Closing conference
29 September 2016, Brussels, Belgium
Dairy farms monitored in EU-PLF

8 farms
- CowView: RTLS ➔ Position
- SoundTalks: sound

CowScout & IceTag: lying, standing

No. cows x cycles (total 1300 cows)

+ Feed intake
  - Weight
  - Milk composition
  - Ruminal pH
+ Feed intake
  - Milk composition
  - Weight

Smart Farming for Europe
Value creation through Precision Livestock Farming
Aim: Getting further with existing sensors and systems

Information from sensors
- Behaviour
- Sound
- Ruminal pH
- ...

Validation Analysis Modelling

Specific information for health, housing, and nutrition management

*Individual approach: each cow is monitored*
PLF and health management
Use of a RTLS to analyse cow activities

Antennas

CowView

Description of the normal time budget of each cow
Cow more active (e.g. walking) than normal ➔ alarm: oestrus?
Cow less active (e.g. resting) than normal ➔ alarm: disease?
Descriptive approach based on single basic activities

Cows spend less time resting and eating at the onset of mastitis. However, due to large variations the difference is not significant.
Modelling approach based on single activities

Just before the problem, cows’ resting time deviates from normal
Activity level = -.15 resting +.12 in alley + .34 eating
Descriptive approach based on average activity & circadian variations

Data from a commercial farm: 350 cows for 5 mo

Normal day vs. Mastitis
Average activity ↗
Circadian variations ↘

P < .001 (1-2 d before)

When the cow overall activity and its circadian variations are taken into account, one can predict the onset of a problem 1-2 days in advance.
Modelling approach based on overall activity

Average Daily Activity

Activity level
Model Prediction
Health Event

Day before event detection

Deviation 4 days before event

Normal situation

Deviation from normal 4 days before mastitis was detected!

Back to normal
Detection of new points of interest with RTLS and image analyses

Reduced time spent licking salt could be used as an alarm.
Detection of cough in calves

SoundTalks

Increased coughing frequency ➔ early detection of respiratory diseases.
Animal welfare

1. **Freedom from hunger or thirst** by ready access to fresh water and a diet to maintain full health and vigour

2. **Freedom from discomfort** by providing an appropriate environment including shelter and a comfortable resting area

3. **Freedom from pain, injury or disease** by prevention or **rapid diagnosis** and treatment

4. **Freedom to express normal behaviour** by providing sufficient space, proper facilities and company of the animal's own kind

5. **Freedom from fear and distress** by ensuring conditions and treatment which avoid mental suffering
Comfort around resting
Investigation of resting behaviour

Poor design of cubicles → difficulties in lying down / getting up

Combining CowScout and CowView allows to know when the cow is lying in a cubicle and the time she takes before she completely lies down.
Animal welfare

1. Freedom from hunger or thirst by ready access to fresh water and a diet to maintain full health and vigour
2. Freedom from discomfort by providing an appropriate environment including shelter and a comfortable resting area
3. Freedom from pain, injury or disease by prevention or rapid diagnosis and treatment
4. Freedom to express normal behaviour by providing sufficient space, proper facilities and company of the animal's own kind
5. Freedom from fear and distress by ensuring conditions and treatment which avoid mental suffering
Use of PFL to manage feeding
Prediction of cow individual feed intake

Model
Dry Matter Intake = β0 + β1 cow location* + β2 production indicators (milk: kg, fat, protein) + β3 physiology status (weight…) + β4 activity measures*...

in real time

<table>
<thead>
<tr>
<th>% explained by the model (R²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without PLF</td>
</tr>
<tr>
<td>With PLF*</td>
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</table>

PLF can help to adjust precisely the diet of cows.

Smart Farming for Europe
Value creation through Precision Livestock Farming
Impacts of changes in meal distribution

Farm 1

Feeding out 6 times/d

Feeding out 12 times/d

Farm 2

Food pushed 3 times/d

Food pushed 10 times/d

PLF can be used to check the impacts of feeding strategies.

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Cow Group
Animal welfare

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Take Away messages

• Simple signals can be used to provide very useful information when they are processed adequately.

• Collaboration between engineers-natural scientists and between industry – academics are essential to gain the most from PLF techniques.

• In cattle, PLF can be applied at individual level allowing a fine tune of the management of each cow and contributing to maintain their welfare.
• Modelling of **activity rhythm** during the day to detect anomalies, relate them to cow status (oestrus, mastitis, lameness, ruminal acidosis, stress...)

• Relation between a cow behaviour and its milk yield as an indicator of its **longevity**

• **Comfort activities** (e.g. use of brushes) and disease / stress

• **Networks between animals** to study the spread of diseases

• Use of RTLS to measure **social behaviour** and **responses to humans** ➔ we could address Freedoms 4 & 5

... **We are open to sponsors!**
Thank you to care for us

and thank you for your attention
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