



AUTOMATION FOR DATA COLLECTION AND LIVESTOCK MANAGEMENT

J-F BOMPA

**INRA – SAGA
Cati SICPA**



Content

INRA GAD units location and IT infrastructure

The animal identification (RFID)

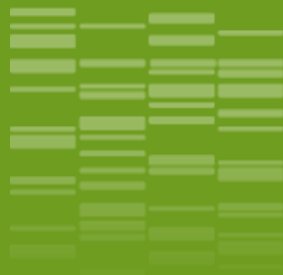
Automation, field equipments and applications

Introduction

Since 1985, INRA GAD (Genetics Animal Division) willpower is to improve the data collection on experimental farms by :

- ❖ Suppressing the “paper/sheet” experimentation.
- ❖ Making the data collection as reliable as possible by minimizing the manual information entry.
- ❖ Making the farmer job easier and more secure.
- ❖ Increasing the quantity and speed data gathering (high throughput).

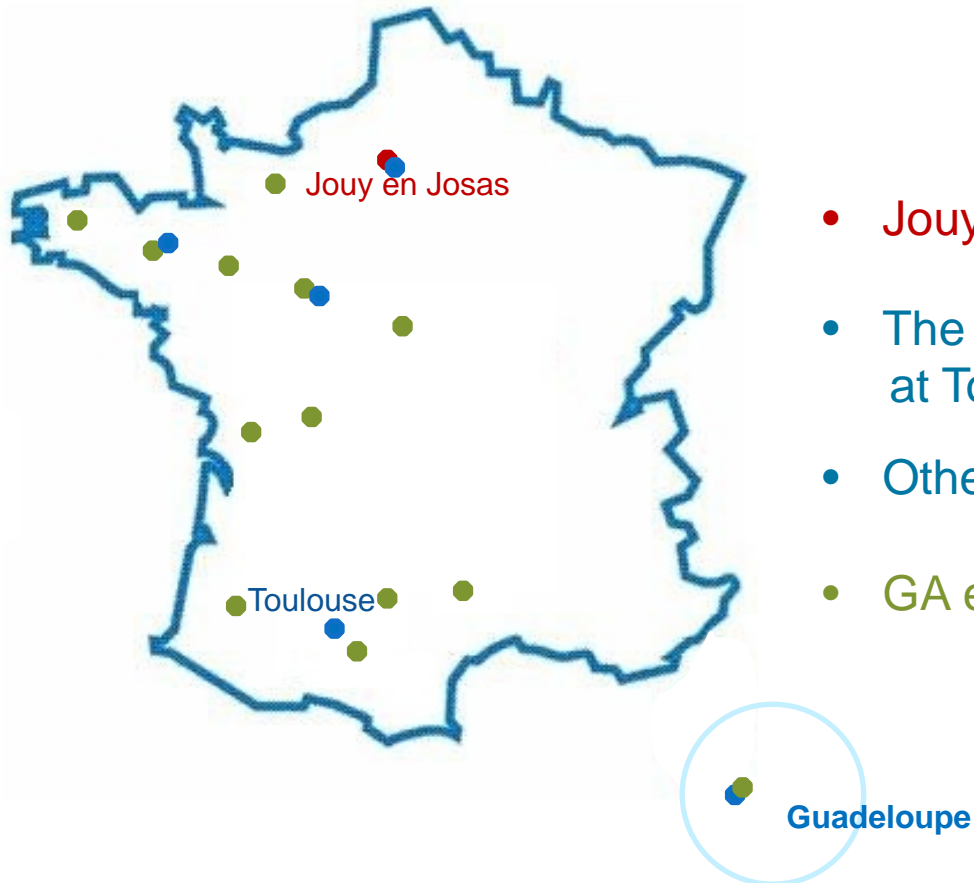
With automation, new variables can be now recorded (milking flow, feed quantity...).



Genetics animal units and IT infrastructure in France

Centralized data available everywhere

INRA GAD units locations

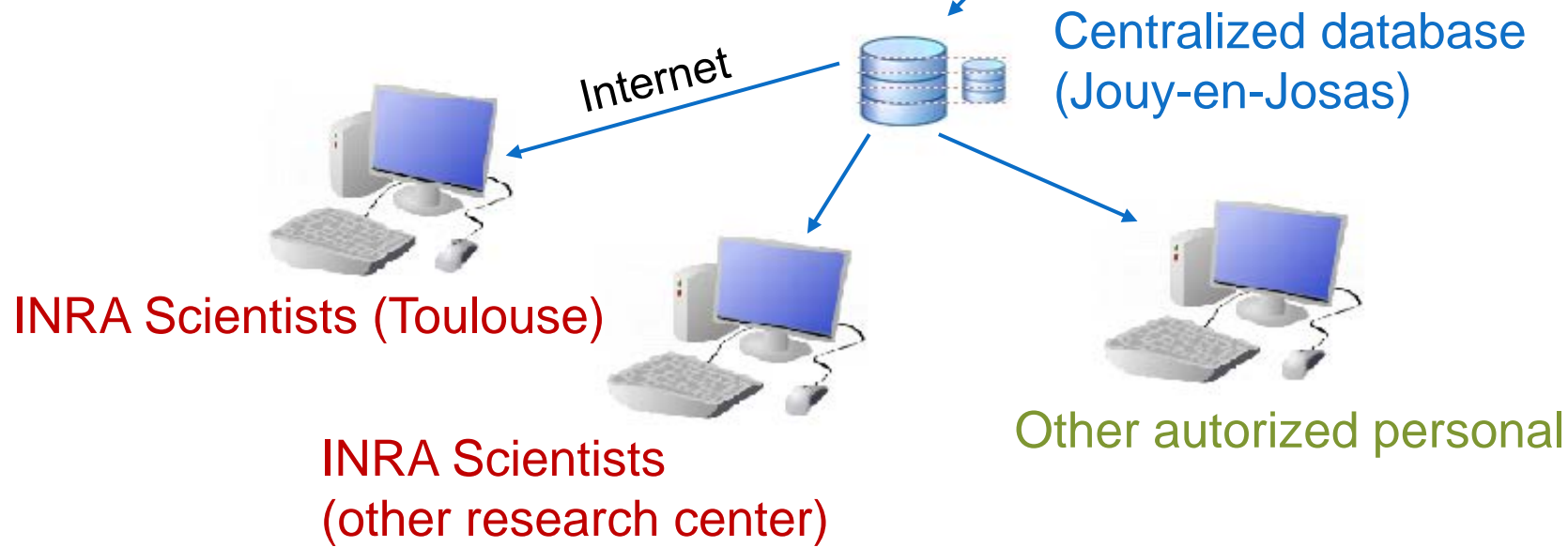
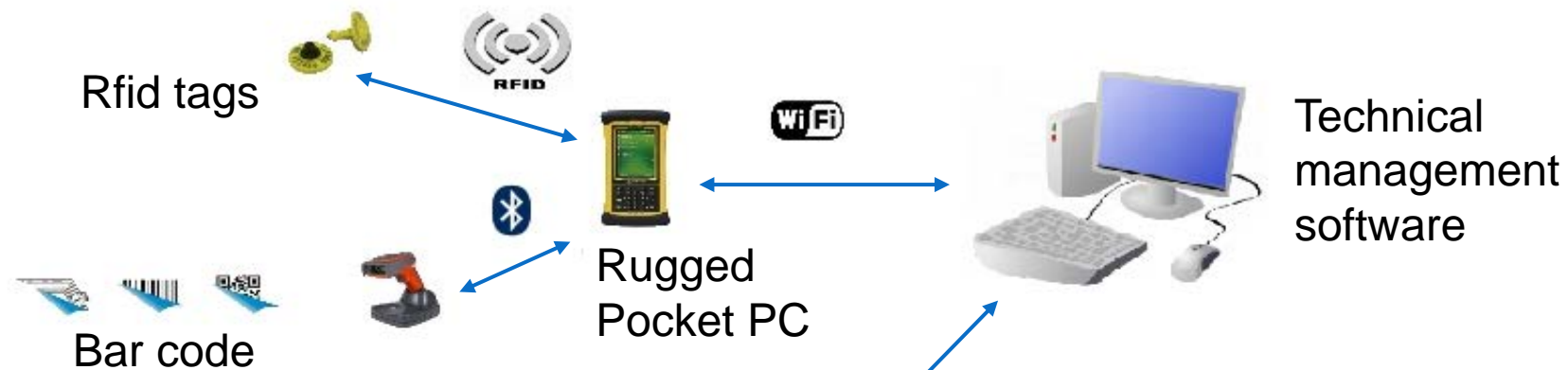


- Jouy en Josas CTIG (Genetics data center)
- The Animal Genetics Improvement Station at Toulouse (SAGA).
- Other research centers
- GA experimental farms for all species

IT infrastructure

- ❖ Structured databases (ORACLE, MySQL, ...) on dedicated servers, located in a data center (CTIG) at Jouy en Josas .
- ❖ A micro computer client/server software in each experimental farm.
- ❖ Rugged handled devices and automatic devices for the reliable data gathering.
- ❖ High speed network connection to interact in real time with the database.
- ❖ Specific or commercial statistical software for scientist analysis.

Experimental farms



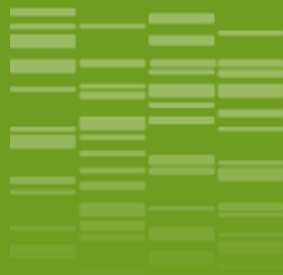
Technical management software in farm

For each species, there's a software management, MARGAUX (cow, pig), GEEDOC (sheep, goat), SIVOL(poultry), GEEL(rabbit).

- ❖ Make the interface between farm and data center.
- ❖ Make the interface with the automatic and handled devices.
- ❖ Manage all the daily routine data and enhance them (average, feeding, birth,... report, livestock inventory).

For more specific and temporary works there is :

SIDEx software for all species, fully user customisable software which manages all the other experimental data.



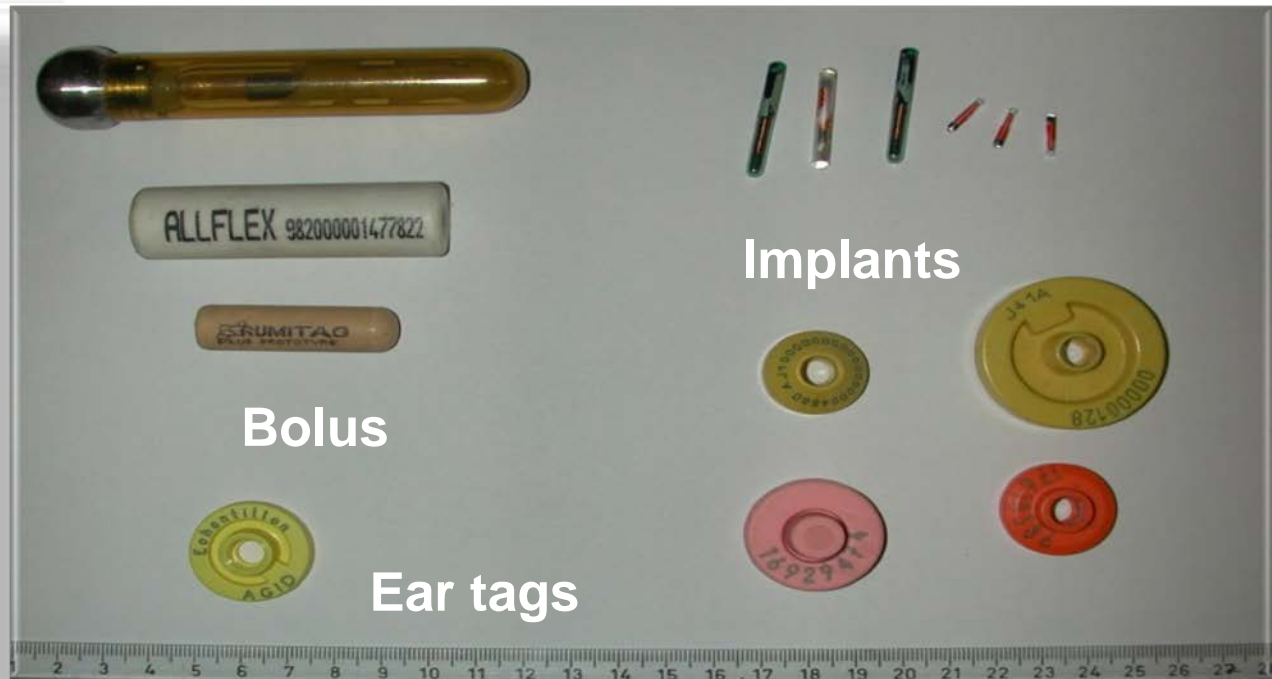
Radio Frequency IDentification technology

RFID, the main link for automation and traceability

RFID in breeding



Leg bracelet



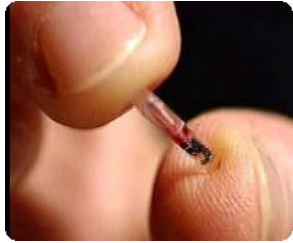
Bolus

Implants

Ear tags

- ❖ **Bolus** : only for ruminants, can't be place at birth, difficult to get back.
- ❖ **Implants** : better for small animals, move during growth, difficult to place and get back.
- ❖ **Ear tag** : for bigger animals, easier to get back, but can be lost.
- ❖ **Leg Bracelet** : difficult to use from birth to old age.

RFID for duck



Implant



Specific reusable
INRA-made housing



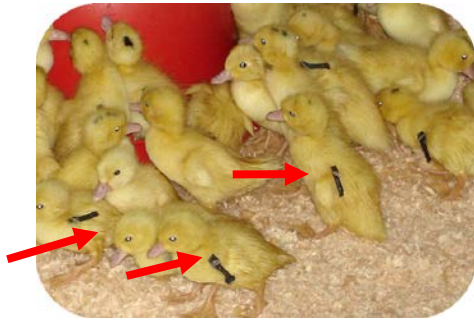
Tagger tool



Nylon fastener

Losses are less important if the identification is placed on the neck rather than the wing.

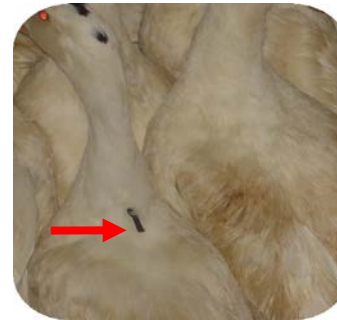
1 day



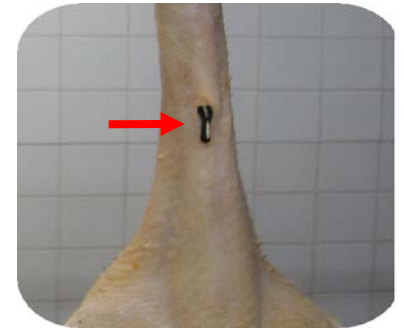
6 weeks



12 weeks



carcass



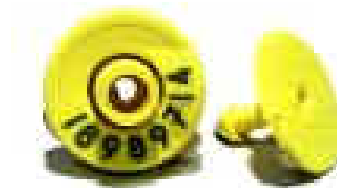
The good choice for cattle, sheep and goat

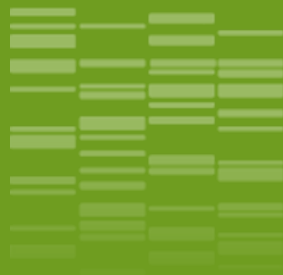
Since 25 years INRA GAD use ear tags for its different farming livestock species, pig, sheep, goat, calf, cow...

Before, read/write ear tag technology was used (Allflex, Nedap), and now according to the legislation, **Full ISO animal** ear tag read only technology is used (Allflex, Agid).

These ear tags (only for cattle, sheep and goat) are provided by the official French breeding agency which ensures the uniqueness of the identification number.

But for specific animal species (fish, poultry, rabbit...), other RFID support can be used.





Automatic devices and field applications

High throughput, easier, faster and secure

Industrial devices or not ?

INRA GAD philosophy is :

- ❖ To create its own automatic device if it doesn't exist.
- ❖ To buy industrial automatic devices if they suit to the experimentation needs.
- ❖ To add extra missing functionalities to the industrial devices if possible.

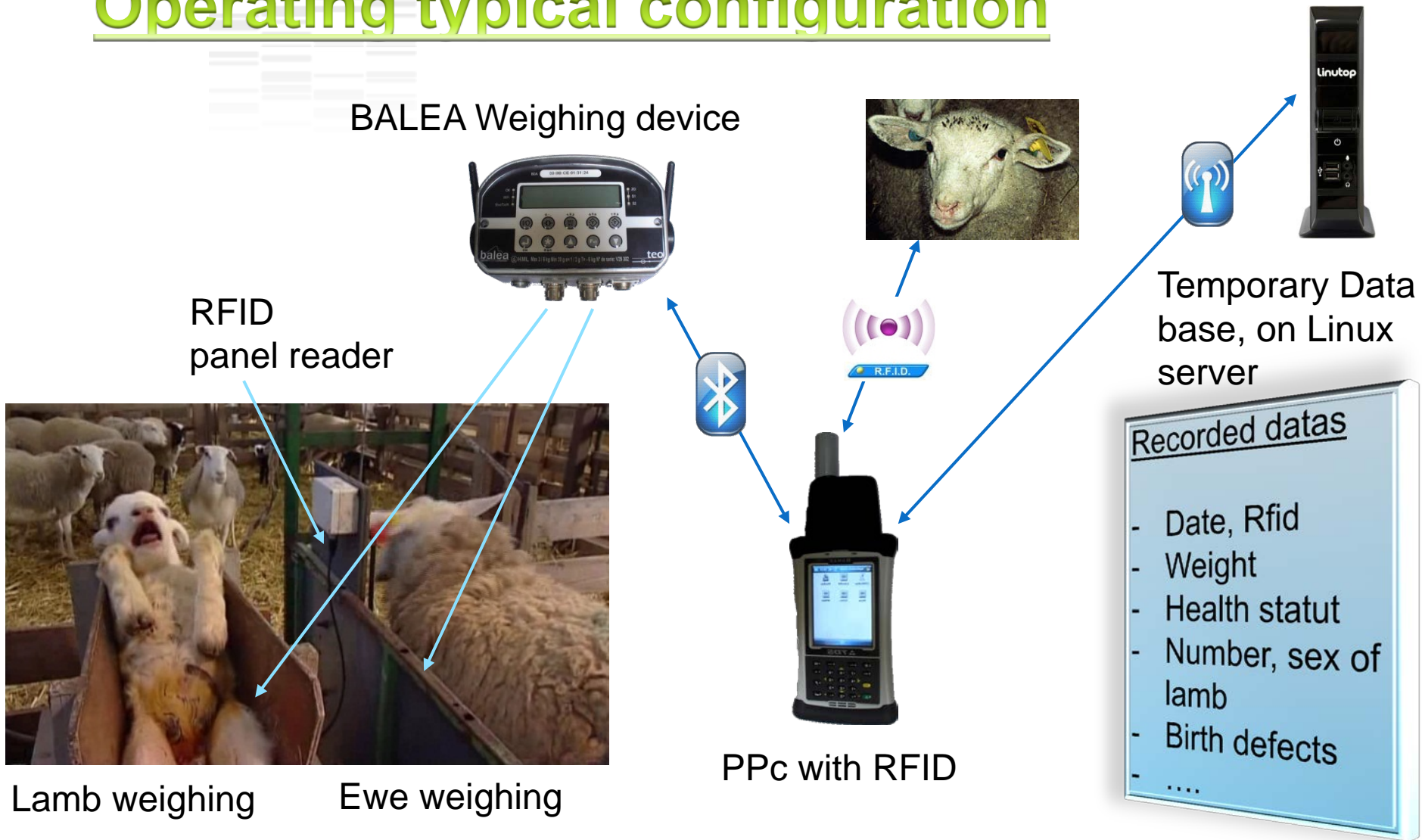
Some devices have been patented and manufactured by third part companies (small ruminant milking recording, animal weighing system, automatic feeder for duck).

Software applications are mainly developed by INRA due to the very specific need and use.

Applications overview

Birth notification

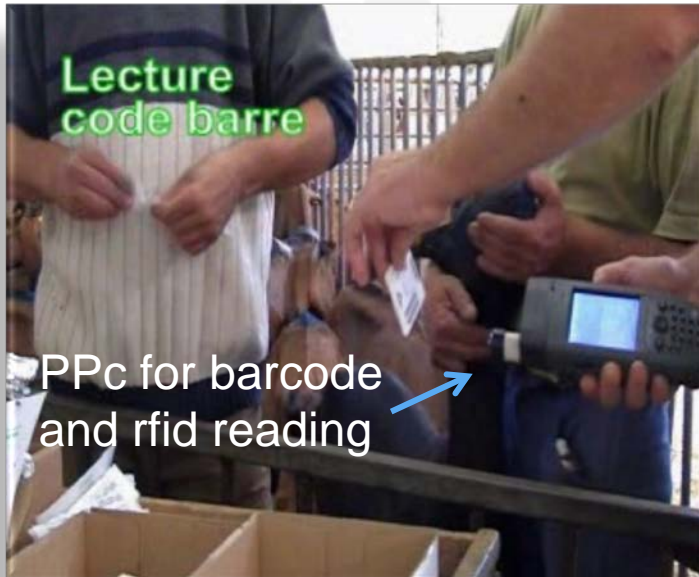
Operating typical configuration





DNA or Blood sampling

DNA or blood sampling operating



DNA or blood sampling allows to :

- ❖ Filiation control.
- ❖ Sampling conservation for breed preservation or future research.
- ❖ Specific gene detection.
- ❖ ...



Automatic feeding

Automatic feeding

Automatic feeders monitor the intake of each animal during its growth or milking period. By steady controls (milk, weight, fattening, health...) we can highlight different points :

- ❖ The efficiency of all distributed aliments type (pellets, fodder, ...)
- ❖ Feed gain ratio and meat quality (carcasses measurement)
- ❖ Individual and eating behaviours
- ❖ Adapt the feeding to the dairy production
- ❖ ...

Automatic pellets distributor

Industrial devices

ACEMO company



Pig

Adaptation
for INRA



Sheep and goat

Recorded data for each animal

- Rfid
- Food weight
- Date, time
- Visit duration
-

2 operating mode :

- Ad libitum
- Rationing

Individual gate feeder for dairy sheep INRA development



- ❖ Quantity of aliment (all type) measurement.
- ❖ Individual food rationing. 1 animal = 1 gate.
- ❖ This application is directly related to the milking control to adjust feeding, in line to milk production and quality.

Automatic duck feeder - INRA development



Food and duck weighing at each visit





Weighing

All species weighing operating

Ecran automate

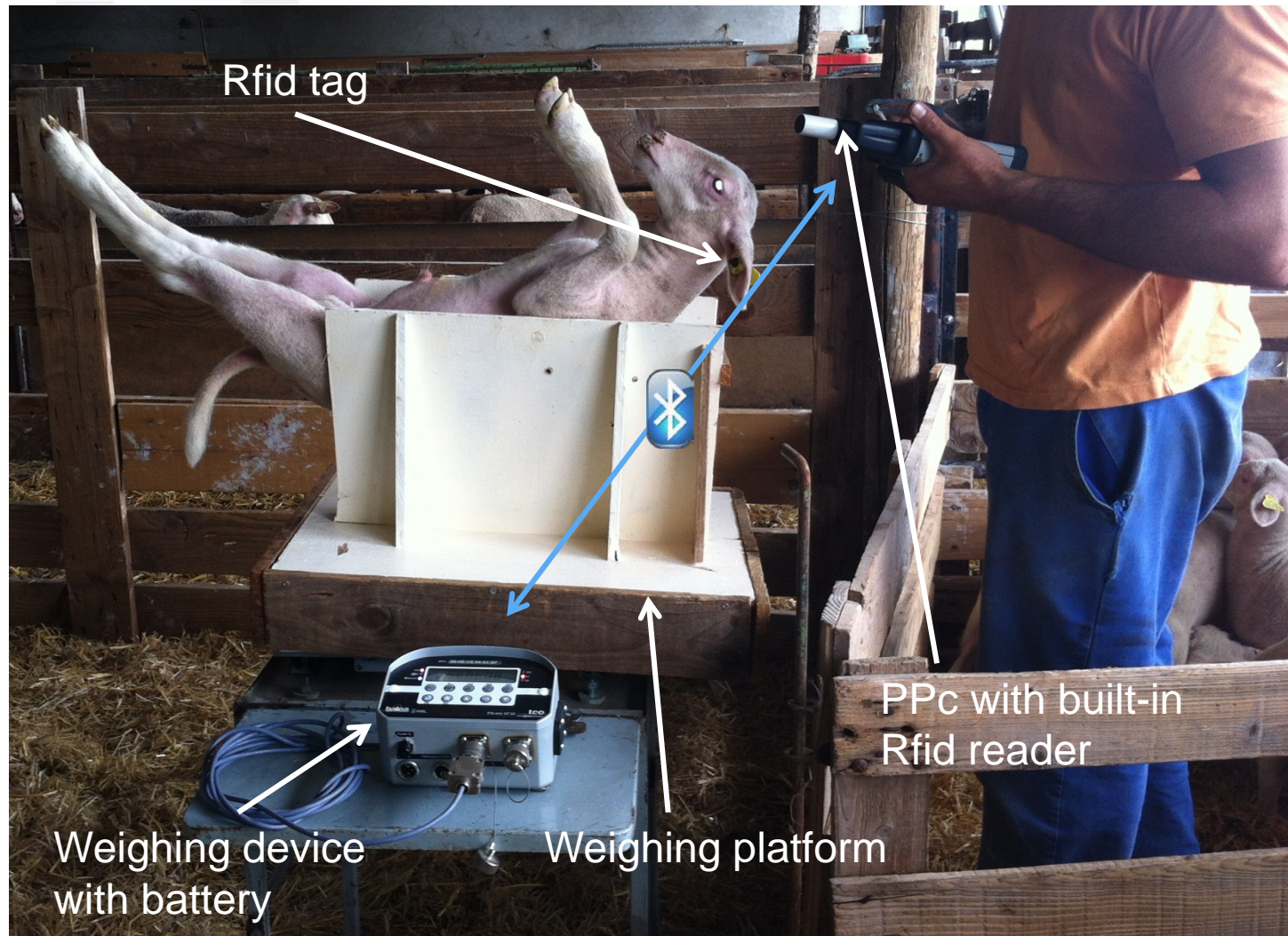
The image shows three sequential screenshots of an automatic weighing screen. The first screen is in 'Attente Identification' mode, showing fields for 'ATTENTE ID' and 'ID:3 CHIP'. The second screen is in 'Boucle lue, pesée en cours' mode, displaying 'ANIMAL: 070003', 'ELEVEUR: 31102541', 'SEXE: FEMELLE', and a 'PESEE' button. The third screen is in 'Animal pesé' mode, showing 'ANIMAL: 070003', 'ELEVEUR: 31102541', 'SEXE: FEMELLE', 'POIDS: 027,52kg', and 'GMQ: 0317g'. Each screen also displays system information like 'LOT:00 CPES:00 REFORME:00', 'BATTERIE:11.8v', and 'CMPT:0000'.

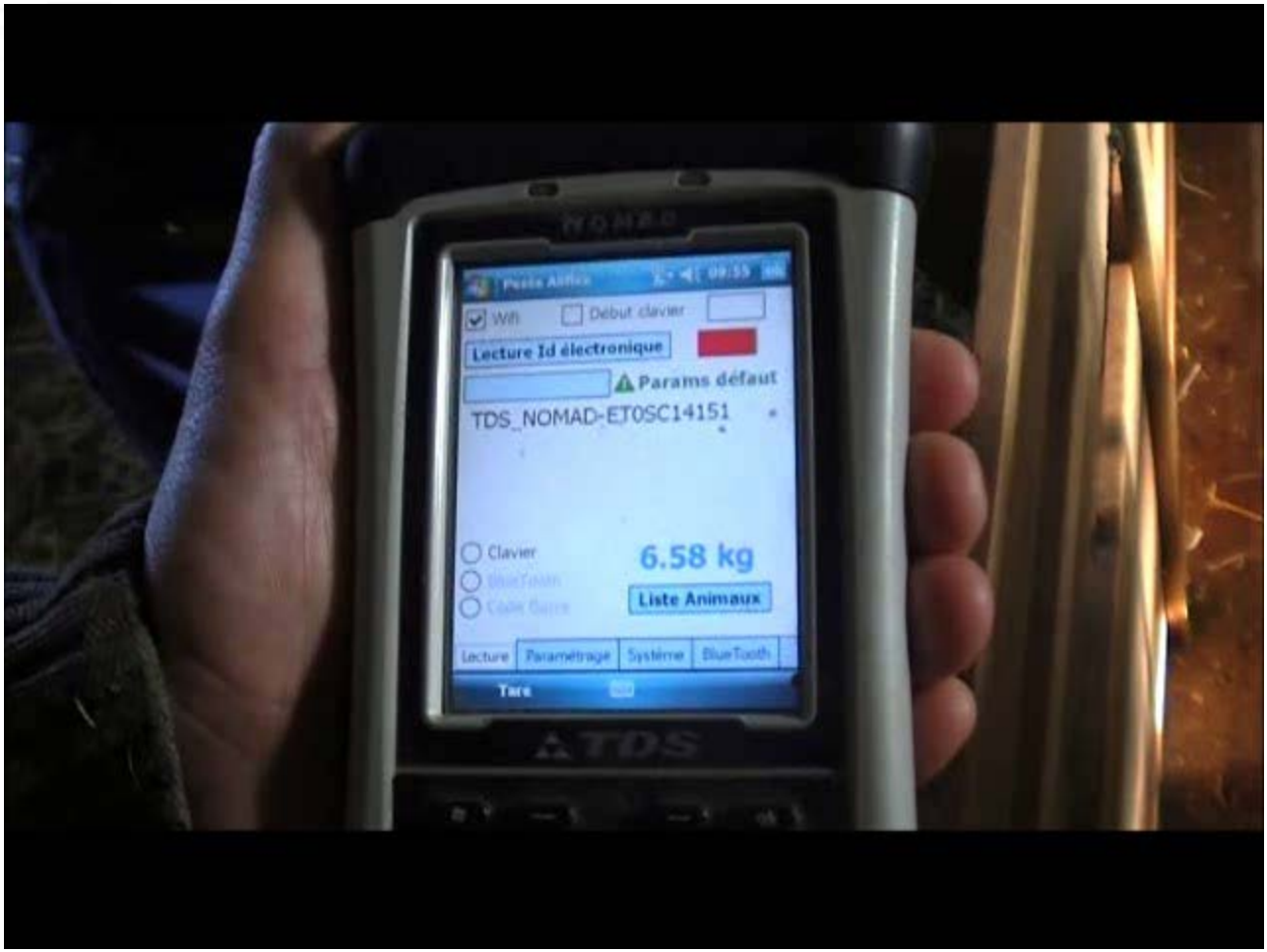
Stage	Screen Title	Key Data
1	Attente Identification	ATTENTE ID, ID:3 CHIP
2	Boucle lue, pesée en cours	ANIMAL: 070003, ELEVEUR: 31102541, SEXE: FEMELLE, PESEE
3	Animal pesé	ANIMAL: 070003, ELEVEUR: 31102541, SEXE: FEMELLE, POIDS: 027,52kg, GMQ: 0317g

Cattle

Pig

One (typical) weighing workstation





Outdoor and stand-alone weighing station



RFID
panel
reader



Small ruminants milk recording INRA development

Small ruminant milk recording

20 years ago, no such registered milk recording for sheep and goat device existed. INRA GAD had to design one which allows :

- ❖ Recording all the data, without slow down the high rate milking.
- ❖ Making several samples of milk, with any quantity, per animal.
- ❖ INRA software management on PDA, connected in Bluetooth and Wifi.
- ❖ Automatic cleaning.

Milk recording system

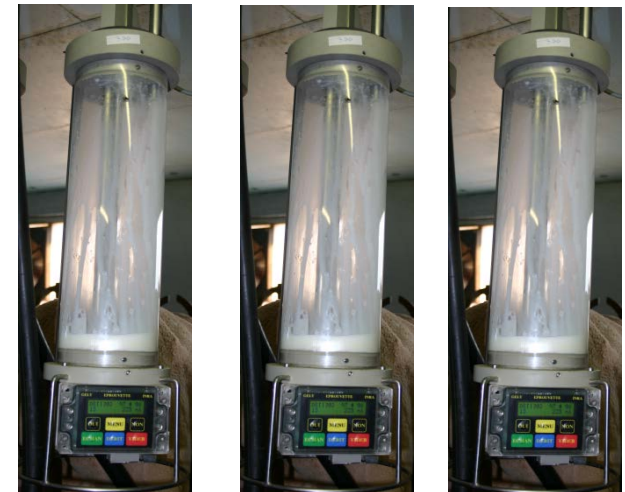
- Recorded datas
- Date, Rfid
 - Milk quantity
 - Latency time
 - Flow measurement
 - Milking time
 - Sample number
 -



INRA patented with Gely company



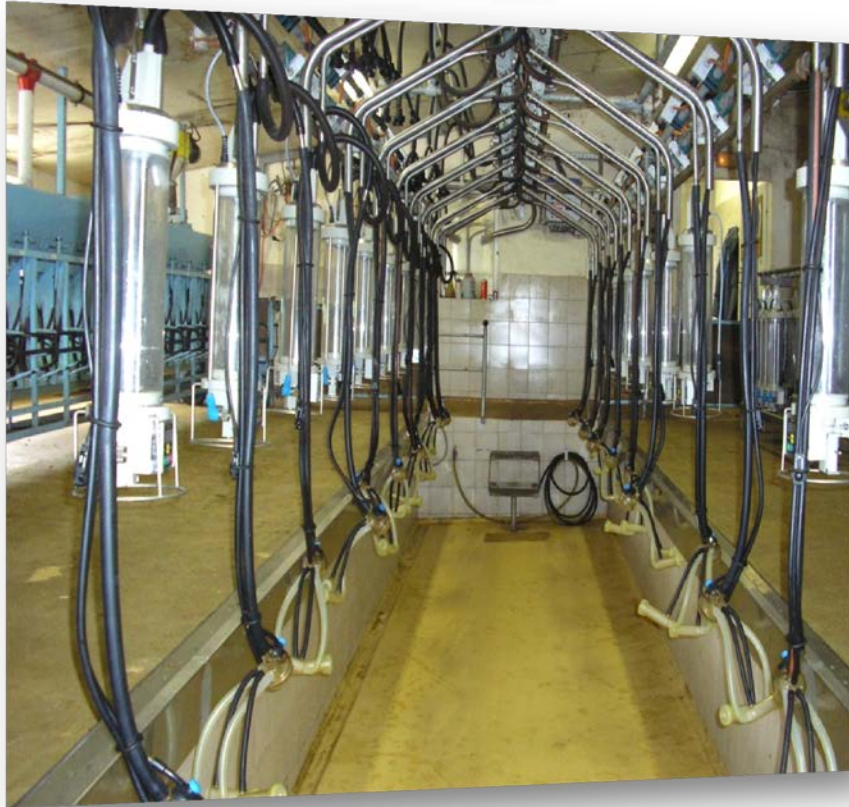
Central unit



n x electronic meters

Wiring

Pit and rotary parlours





Sorting systems

Sorting

The sorting device is very interesting for INRA GAD due to the lot of experimentations carried out. For that, it's necessary to have many groups of animals. Sorting allows to :

- ❖ Make the herd management easier by using groups.
- ❖ Get quickly the inventory of the herd.
- ❖ Weight and sort by infinite criteria.
- ❖ Only one person (and a dog) for sorting.
- ❖

Sorting device for sheep and goat

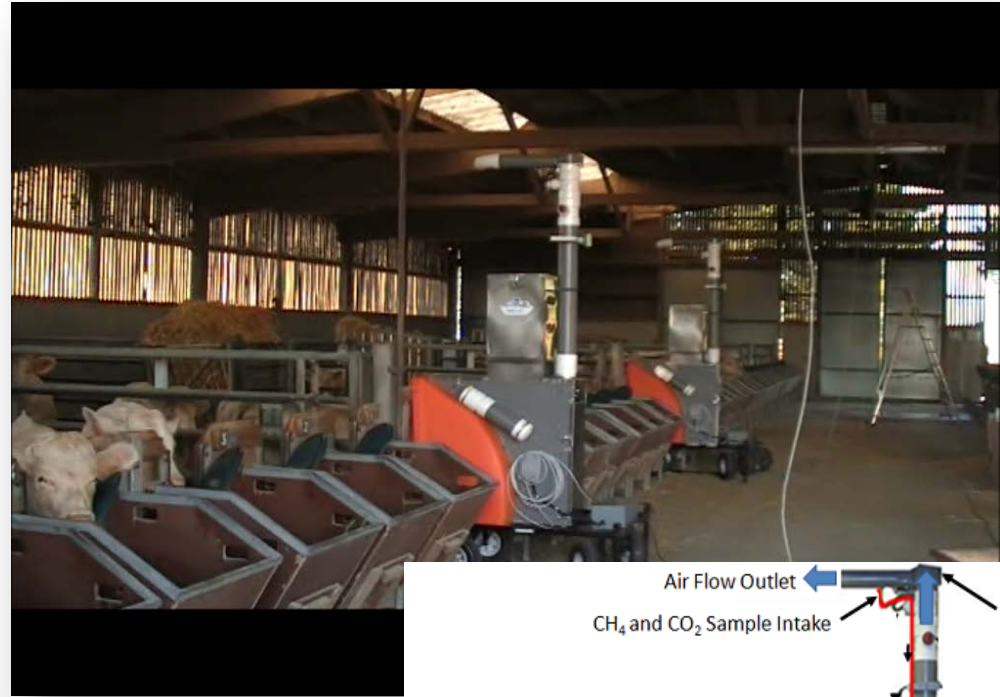




Some other systems

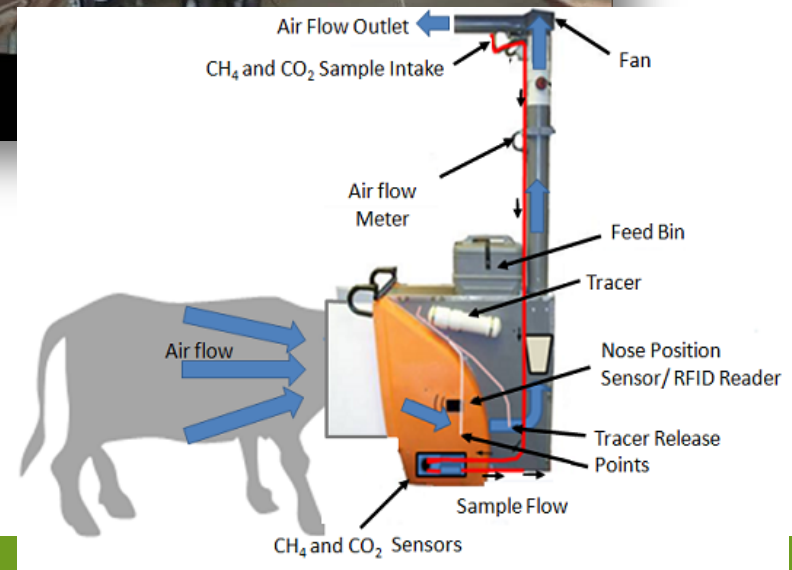
Greenfeed

Methane and carbone dioxide measurement system for cow

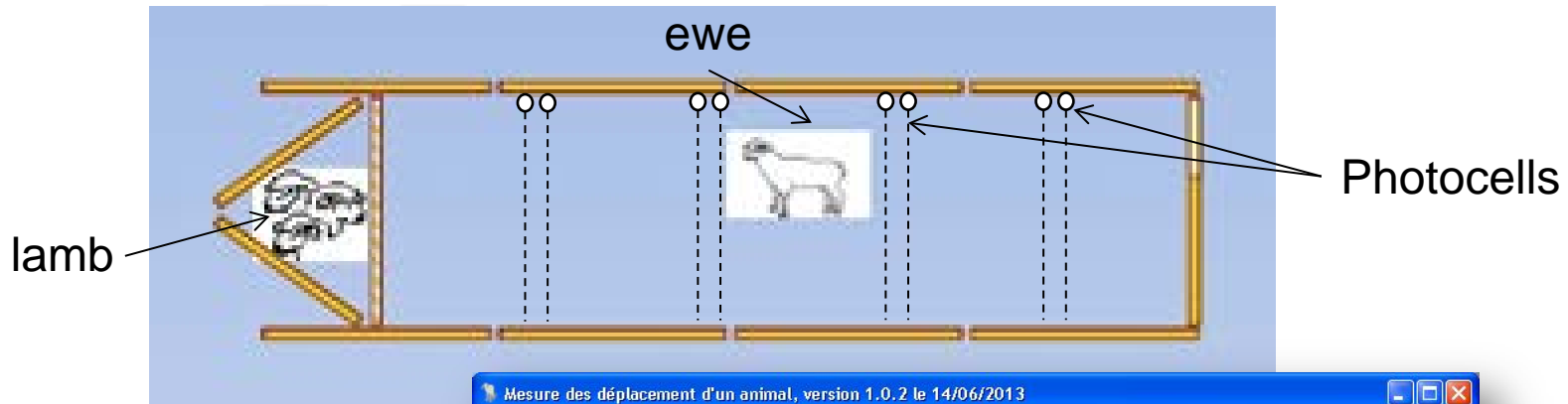


C-lock company

Pictures from C-lock company



One behaviour test (corridor test)



Position of the sheep
in the corridor

Mesure des déplacements d'un animal, version 1.0.2 le 14/06/2013

Fichiers Configuration

Zone0 Zone1 Zone2 Zone3 Zone4 Zone5 Zone6

Dernier animal lu ----- 02322

Id en cours --- - ----- 00009

Saisie Identification 009

Liste des phases à réaliser

- Phase3 durée :15 secondes
- Phase2 durée :60 secondes
- Phase3 durée :60 secondes

Nom du PC : ERRC-LAFAGE
Adresse IP serveur MySQL : 127.0.0.1
Nombre cellules : 12
Millénium 3 pour lecture des cellules sur COM1
Identification manuelle

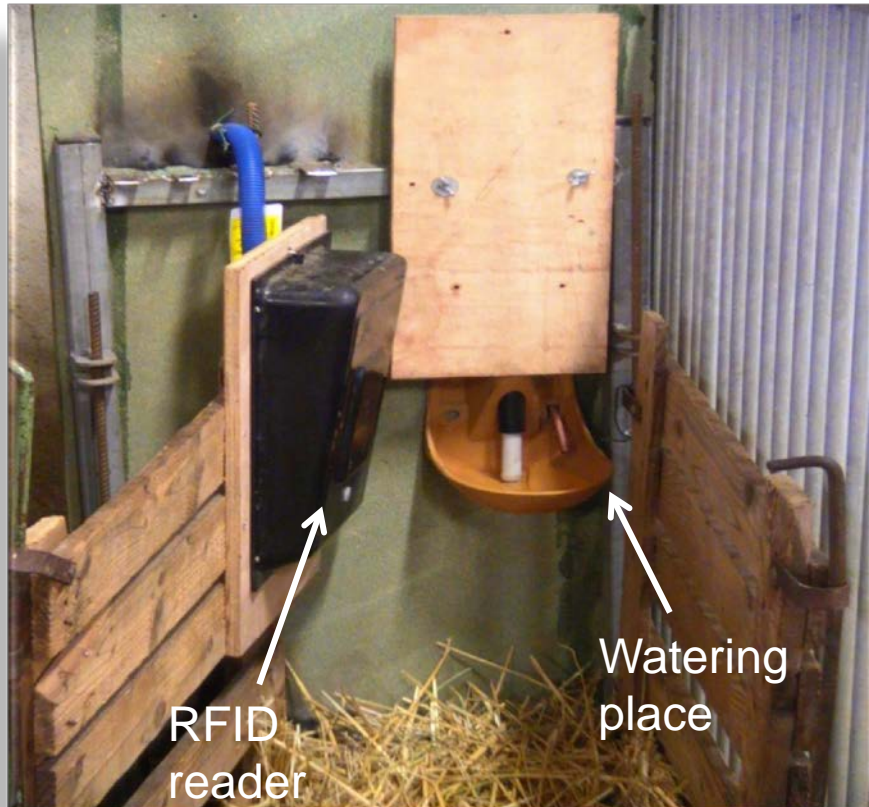
PHASE EN COURS

Début d'une phase Fin des mesures

Under development

Water consumption

(INRA Grignon collaboration)



Milk consumption

Adaptation for lamb and kid



Prototypes

Weighing during milk consumption



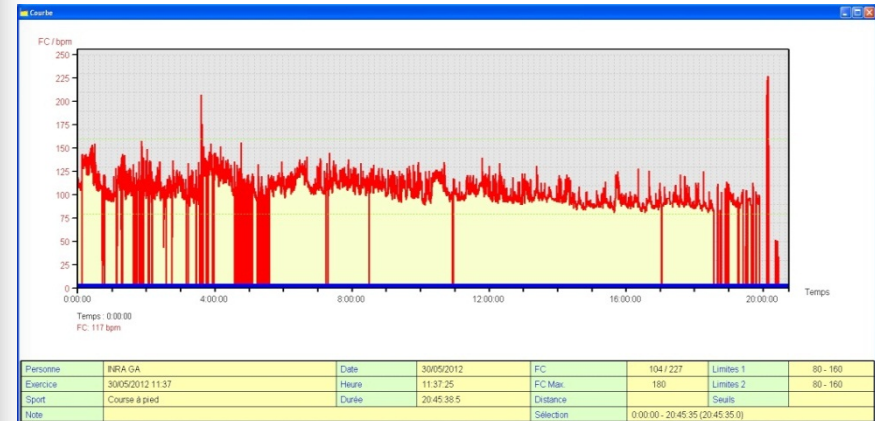
Weighing for stress measurement

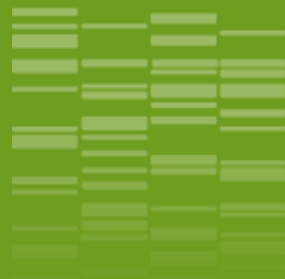


Cardiac rhythm and body temperature recording (INRA St Gilles AADNC collaboration)



Cardiac rhythm





Conclusion :

The goal of automation and data collection

The first innovative developments for automation are focused on animals efficiency, assessed by their ability :

- ❖ to use available food resources including new feedstuffs (feeding efficiency).
- ❖ to adapt to constraining and changing environments while fulfilling their functions of production and reproduction (animal robustness, plasticity or flexibility, milk production).

Furthermore, automation developments :

- ❖ improve data collection, make it very easier, and more reliable
- ❖ generate high throughput data in less time and new variables can be recorded.
- ❖ improve the farm management (animal behaviour: emotional reactivity, social behaviours and general activity) and decrease staff heavy work.

In few figures

- ❖ During 25 years, are electronically identified each year :

Bourges : 2500 animals

Langlade : 800 animals

La Fage : 1000 animals

- ❖ UE GAD (sheeps and goats) recording, per year

45.000 weighings

15.000 sortings due to livestock management and experimental sampling (blood, semen freezing, ...)

20.000 milk records and samples, milk flow, milking time...

4.000 births

10.000 body condition scores

10.000 individual intake measurements

+ other measurements (fleece, teat...)

Thanks for your attention....



Jean-francois.bompa@toulouse.inra.fr

