Session n°65. PLF for health, behaviour and welfare.
Tuesday 3rd September 2024.

Tracking sheep indoors or on pasture using Bluetooth and UHF RFID for welfare management:

feedback from trials conducted in Scotland and France.

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Context and objectives

- PLF tools and digital tech. : **potential value** for welfare management,
- Small Ruminant (SR) farmings systems: **lowcost approach** needed,
- **Few tech. available** on the market **and adapted** to SR farmers.

Morgan-Davies C. et al.,2024. *Review: Exploring the use of precision livestock farming for small ruminant welfare management* ***Animal****. 101233.*

Main objectives:

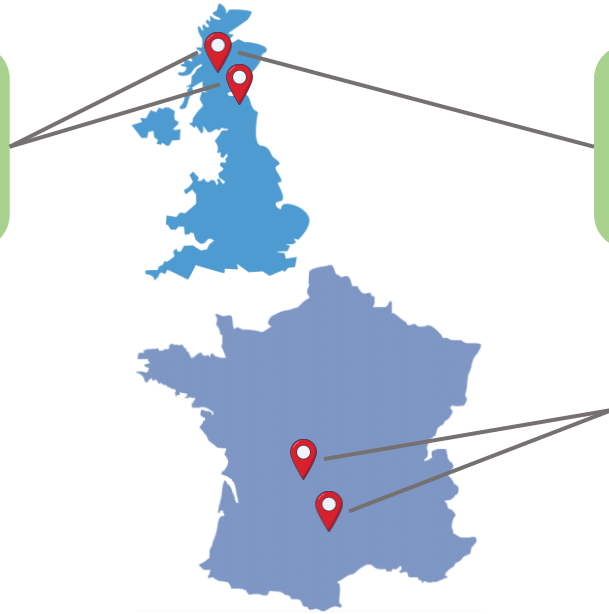
- **Explore** low-cost solutions or new prototypes with **on-farm tests** and **adapt** them to SR context,
- Identify their **advantages and disadvantages**, indoors or on pasture.

Exploring the potential to track and count sheep

BLUETOOTH beacons

RFID ULTRA HIGH FREQUENCY eartags

Monitoring feed blocks attendance



Monitoring feed blocks attendance

Monitoring water trough attendance

On pasture

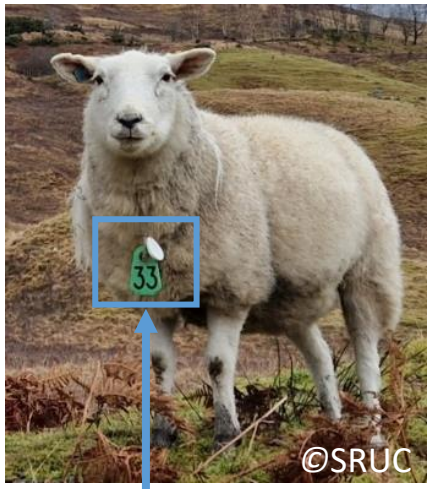
In shed

BLUETOOTH beacons trials in Scotland

Monitoring feed blocks attendance

BLUETOOTH beacons trials in Scotland

Experimental set-up



Visual tag for ID Bluetooth beacons

High energy feed block (molasse)

Bluetooth reader

SRUC BLE prototype

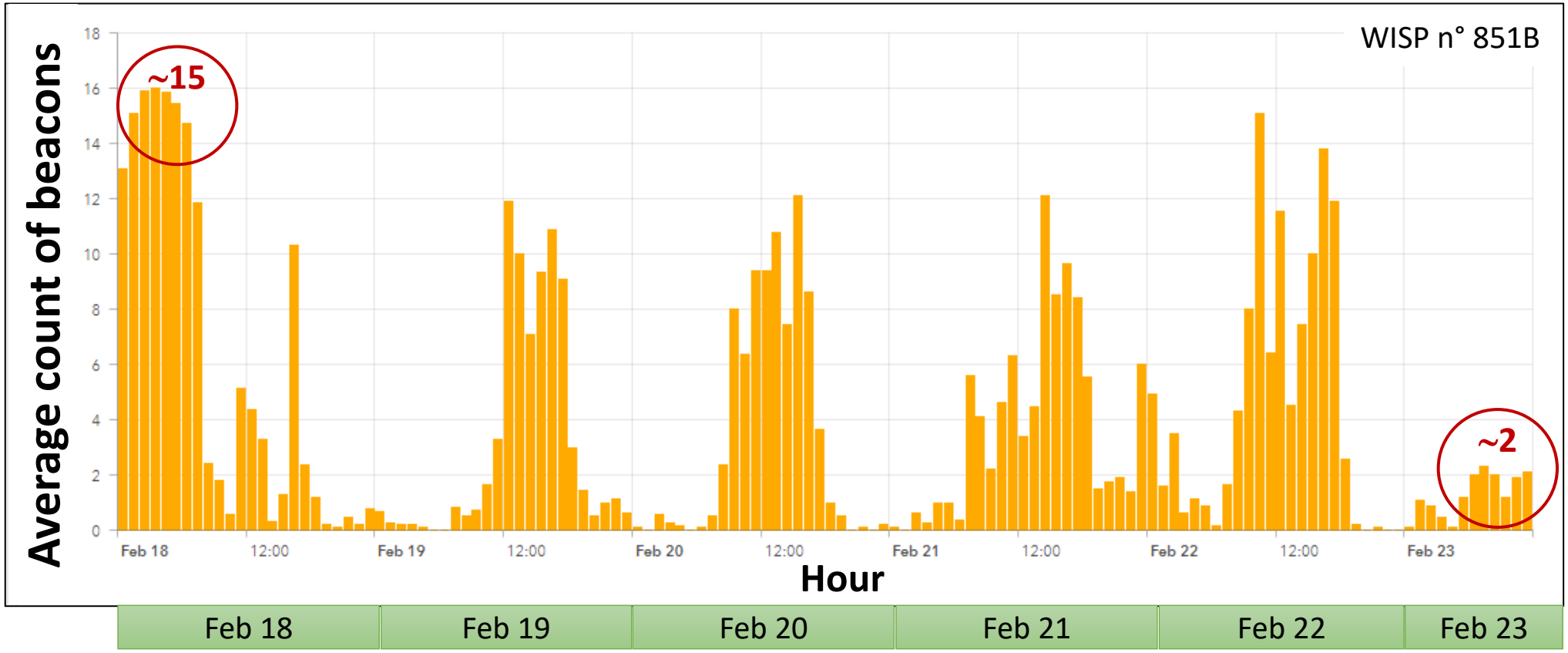
- 2 months trial (winter 2022)
- 100 ewes on ~50 ha rough grazing
- Outdoor/extensive settings

- Data collected:
  - Weight & BCS
  - Welfare assessment (AWIN): ind. scores
  - Bluetooth data (RSSI) collected with reader system via LoraWan:
    - Every 5 min (24h/24h)
    - Record 16 nearest beacons

BLUETOOTH beacons trials in Scotland

Results: Hourly mean count of beacons (ewes) read by one reader

- Large hourly and daily variations of ewes' proximity to feed block
  - Feeding vs. resting time of the flock
- Individual attendances: complex interpretation (few welfare data; effect of dominance…)



RFID UHF trials in Scotland and France

Monitoring feed blocks and water trough attendance

RFID UHF tags trials in Scotland

Experimental set-up

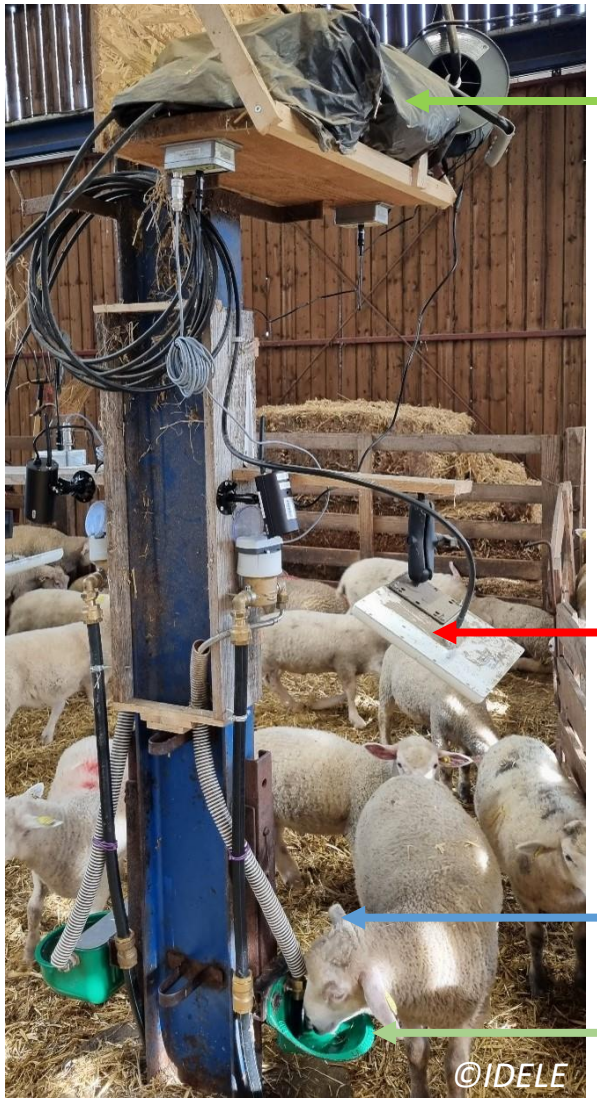
PAGE UP Co. UHF prototype

- 1 month trial (winter 2023)
- 50 ewes on ~20 ha rough grazing
- Outdoor/extensive settings

- Data collected:
  - Weight & BCS
  - Welfare assessment (AWIN): scores
  - UHF data collected with a reader system:
    - Only 8 hours/day (battery capacity)
    - Not at week-end

RFID UHF tags trials in France

Experimental set-up



- 1 month trial (summer 2023)
- 60 fattening lambs
- Indoor settings

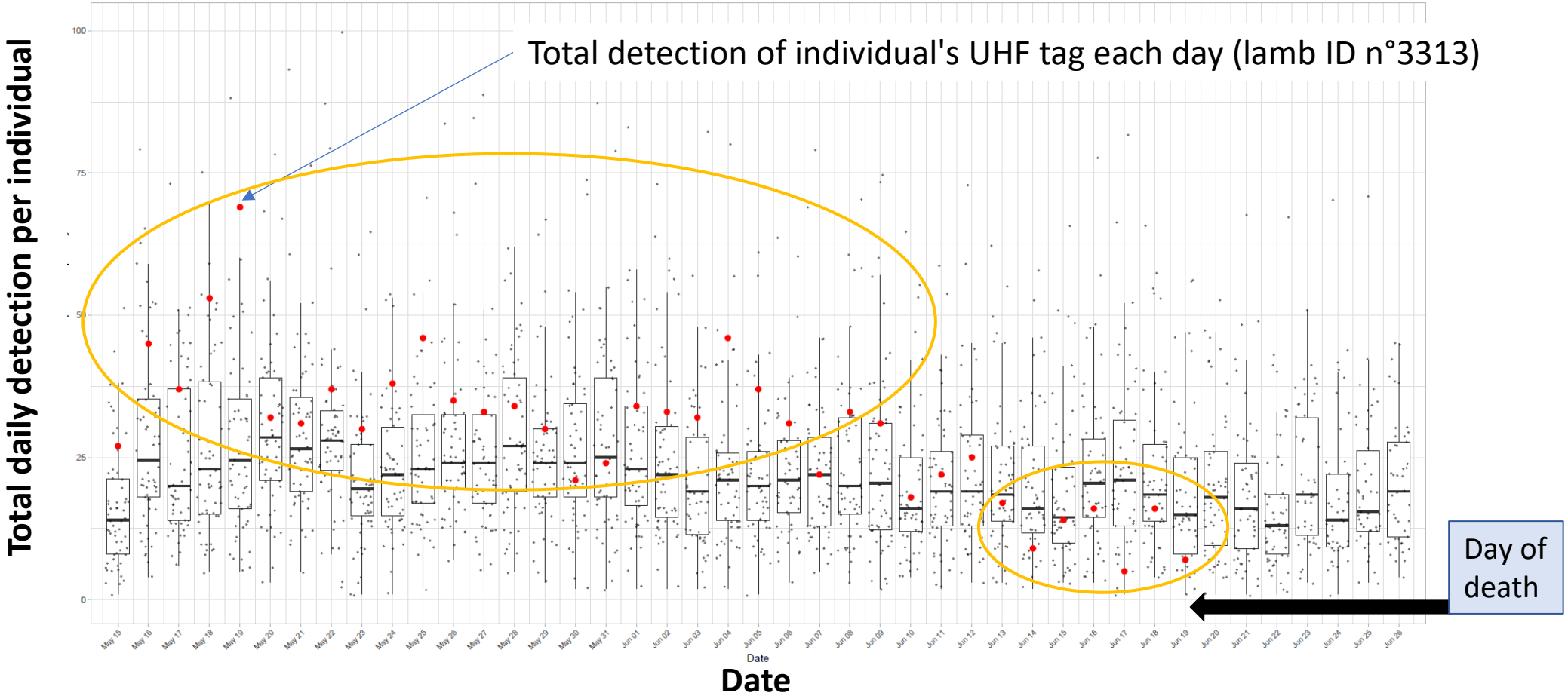
- Data collected:
  - Weigt
  - Welfare assessment (AWIN): scores

  - UHF data collected with a reader system and 4G connection:
    - Every sec. (24h/24h)
    - Power supply; Web Platform.

PAGE UP Co. UHF prototype

RFID UHF tags trials in France

Results: tracking of individual's attendance relative to the group



- Individuals have attendance habits (variability between lambs).
- Not all sick lambs (18/60) reduced attendance. Hypotheses: different impacts depending on the pathologies, effect of dominance…

Results: Pro & Cons of both prototypes tested

	BLE prototype	UHF prototype
Simultaneous detections capacity	**Up to 16 beacons**	**All tags**
Data collection	Average, every 5 min (24/7)	Instant, every 1 sec 524/7)
Data transmission	LoraWan	3/4G
Power	Only small batteries (longevity ~ 10 days)	Mains power or battery (solar panels)
Good reading range	Up to ~60 m	Up to ~6 m
Good reading height	30 cm (for lamb) vs. 70 cm (for ewe)	Adjustable antenna power to desired height
Costs (prototype)	Beacon (12 €/u.) Reader syst. (180 €), Lora antenna (2300 €)	Tag (2€/u.) Reader syst. (3300 €), 4G card sub. (120 €)
Ergonomics	Beacon too bulky for ear tagging Reader box need adjusting as a collar	Tag ok for ear tagging Reader antenna need better weatherproofing
Specific precautions (RSSI: signal data)	Water sensitivity **RSSI → proximity** and location outdoor	Water sensitivity **Metal sensitivity**: RSSI ≠ location proxy in shed

Walker A.M. et al.,2024. *Development of a novel Bluetooth Low Energy device for proximity and location monitoring in grazing sheep.* ***Animal****. 101276.*

Improvement & news uses cases in rangelands

SRUC, TECHCARE, 2023

IDELE, PACAPIT, 2023.

IDELE , 5G4AGRI - Pat'Stress, 2024

BLE prototype

Monitoring **ewe – lambs proximity**

UHF prototype

Monitoring **running order at a gate**

Count running batches returning to the night park

(e.g. batches of 140 animals: 100% reading)

New developments:

- **motion sensor**
- **battery with solar panels.**

Take home messages

BLE beacons and UHF tags systems offer interesting approaches for:

- ✓ **Counting** individuals,
- ✓ **Monitoring presence/absence** at a resource point,
- ✓ **Tracking** individuals under specific technical conditions (RSSI data) .

These trials show **encouraging prospects** for the use of these 2 prototypes …

… but **larger datasets** required to start defining potential alert for welfare management thresholds,

and **technical improvements** needed.

Thank you for your attention

Special thanks to all colleagues who participated in the trials on our farms:
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