

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*





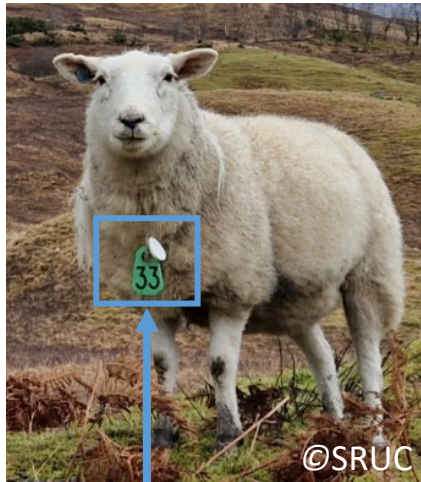
BLUETOOTH beacons trials in Scotland

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



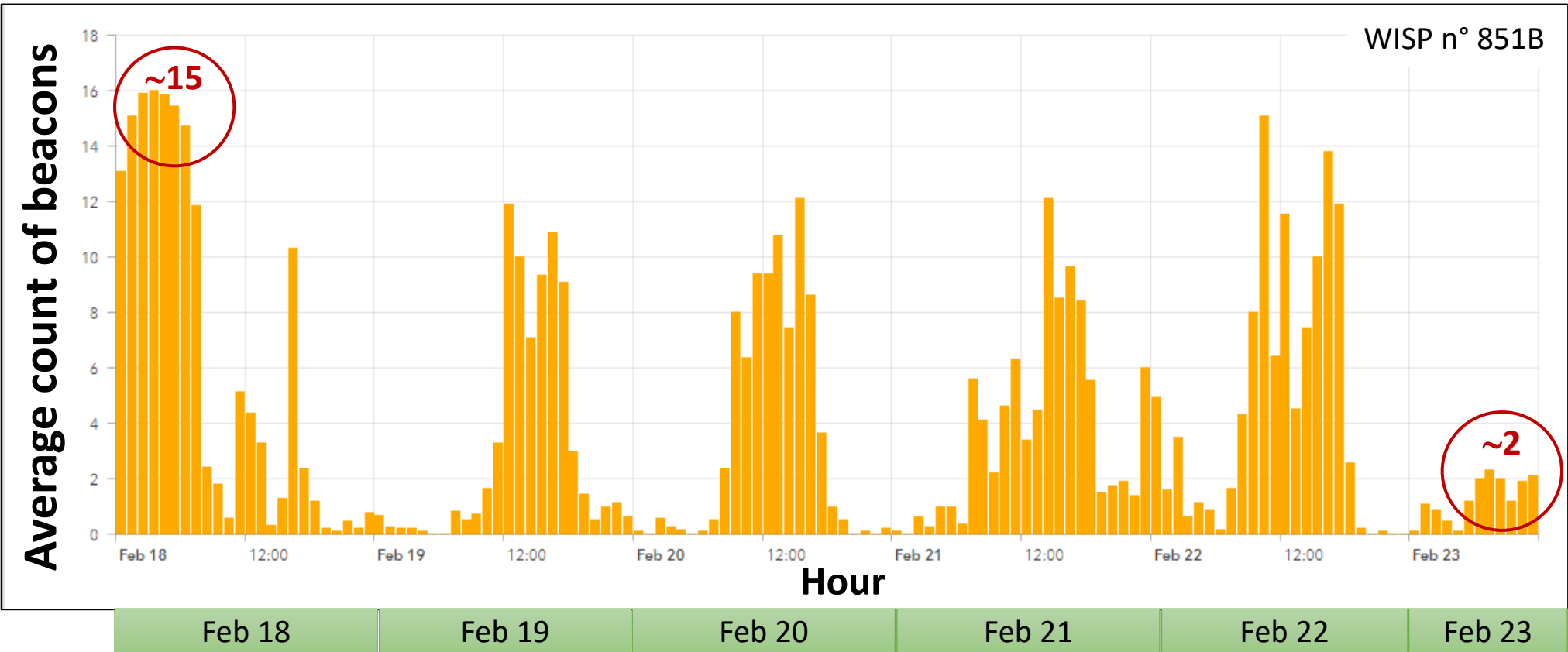
- 2 months trial (winter 2022)
- 100 ewes on ~50 ha rough grazing
- Outdoor/extensive settings
- Data collected:
 - Weight & BCS
 - Welfare assessment (AWIN): ind. scores
 - Bluetooth data (RSSI) collected with reader system via LoraWan:
 - Every 5 min (24h/24h)
 - Record 16 nearest beacons



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



Visual tag for ID
UHF tag on top



Antennas

High energy feed
block (molasses)

UHF suitcase reader
(in waterproof box + power
bank battery & 4G modem)

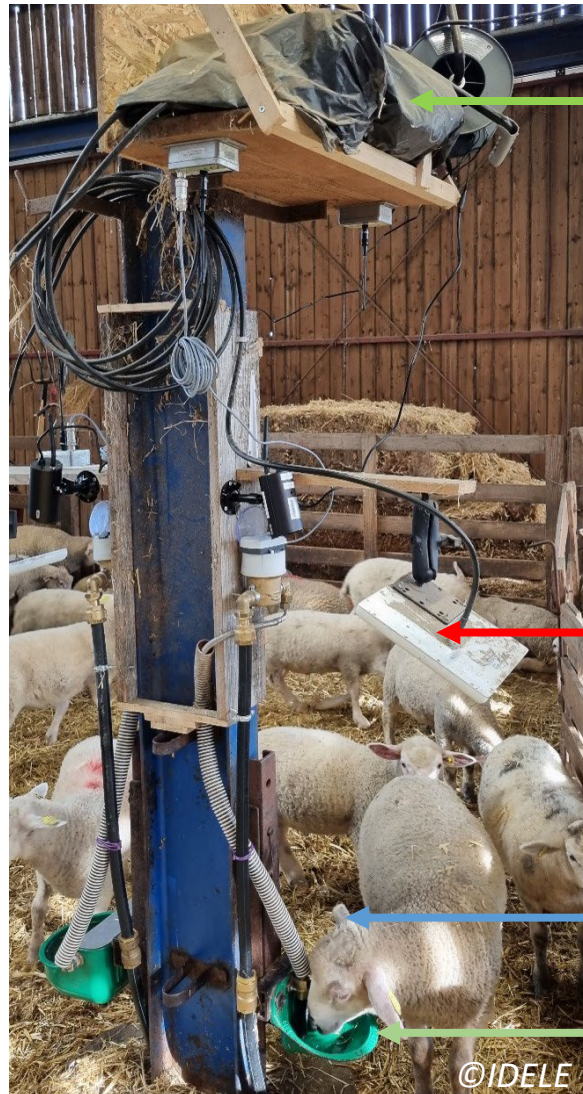
PAGE UP Co. UHF prototype

- 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

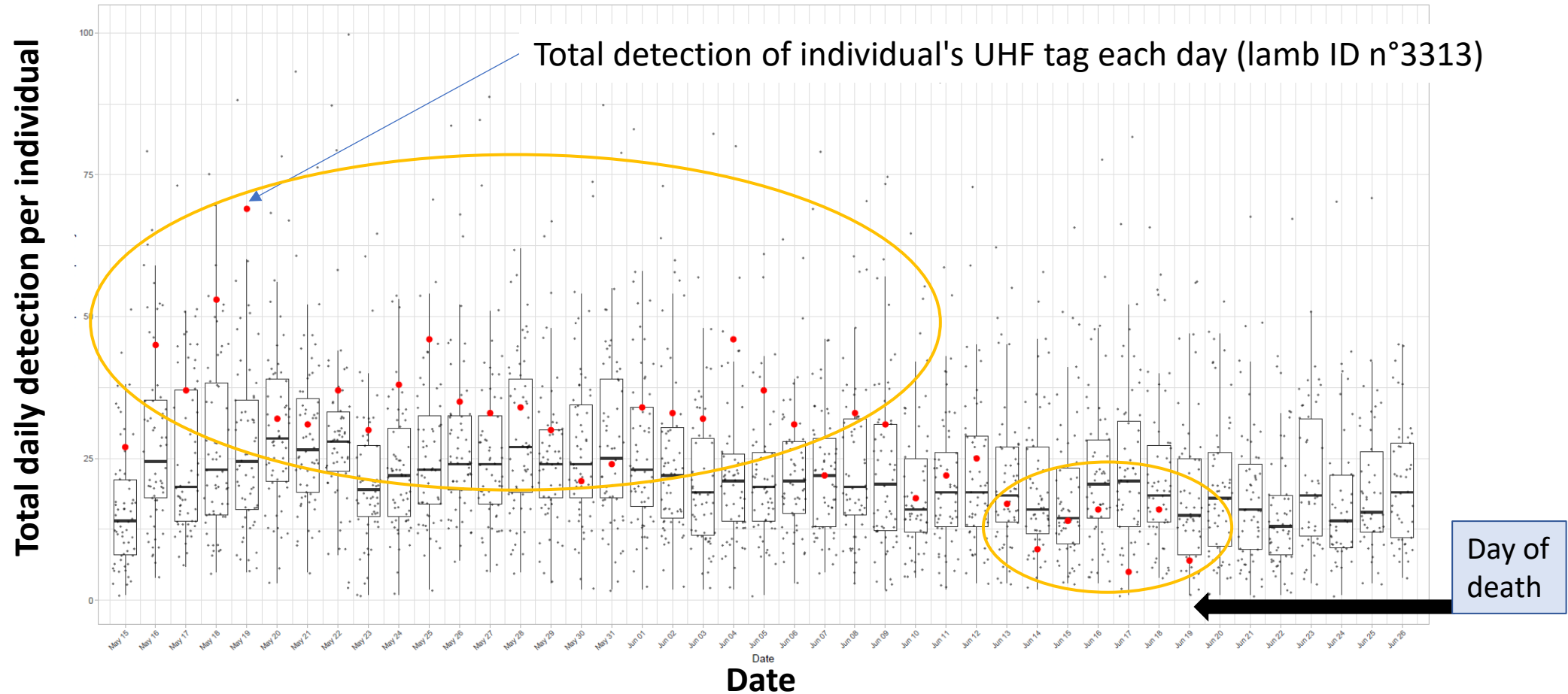


- 1 month trial (summer 2023)
- 60 fattening lambs
- Indoor settings
- Data collected:
 - Weight
 - Welfare assessment (AWIN): scores
 - UHF data collected with a reader system and 4G connection:
 - Every sec. (24h/24h)
 - Power supply; Web Platform.

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 <u>outdoor</u>	Water sensitivity Metal sensitivity : RSSI ≠ location proxy <u>in shed</u>

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

New developments:

- motion sensor
- battery with solar panels.

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



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:
*in France at “Le Clirpo” and “La Cazotte”,
in Scotland at “Kirkton” and “Firth Mains”.*



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