

**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*



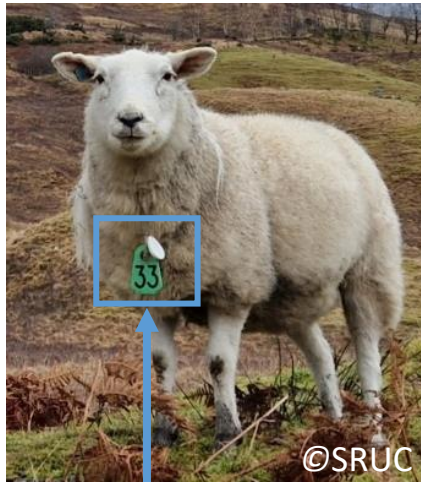


# BLUETOOTH beacons trials in Scotland

*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



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SRUC BLE prototype



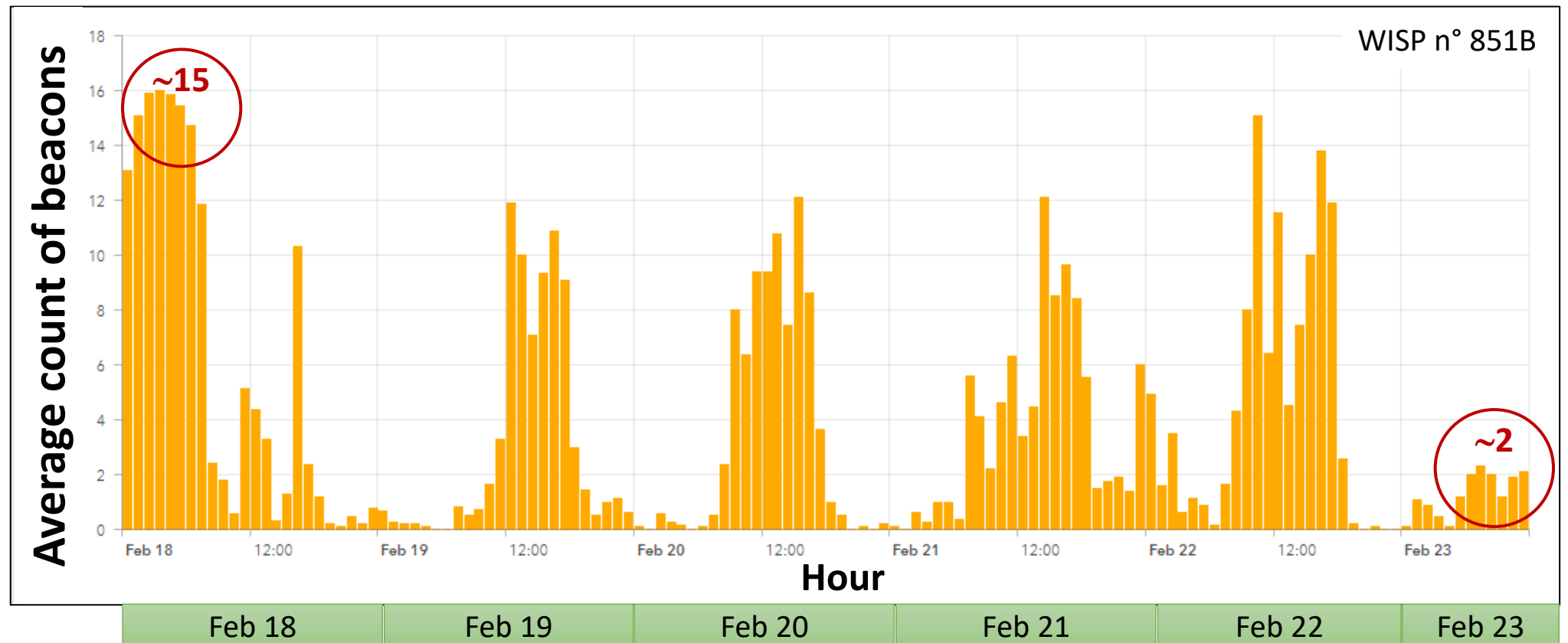
- 2 months trial (winter 2022)
- 100 ewes on ~50 ha rough grazing
- Outdoor/extensive settings
- Data collected:
  - Weight & BCS
  - Welfare assessment (AWIN): ind. scores
  - Bluetooth data (RSSI) collected with reader system via LoraWan:
    - Every 5 min (24h/24h)
    - Record 16 nearest beacons



# 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



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

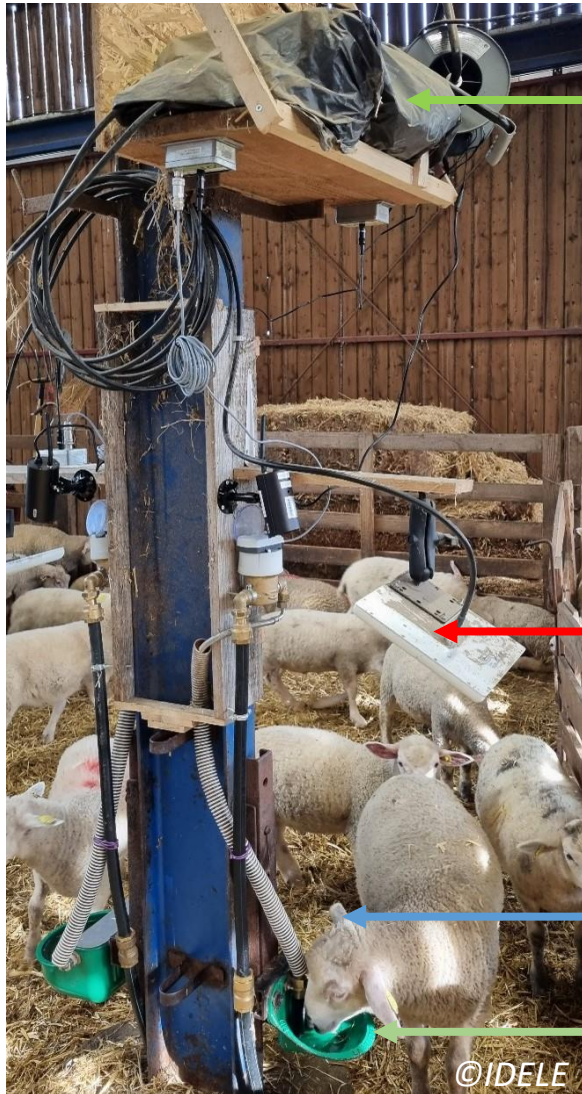
- 1 month trial (winter 2023)
- 50 ewes on ~20 ha rough grazing
- Outdoor/extensive settings
- Data collected:
  - Weight & BCS
  - Welfare assessment (AWIN): scores
  - UHF data collected with a reader system:
    - Only 8 hours/day (battery capacity)
    - Not at week-end





# RFID UHF tags trials in France

## Experimental set-up



UHF suitcase reader

Antenna

UHF ear tag

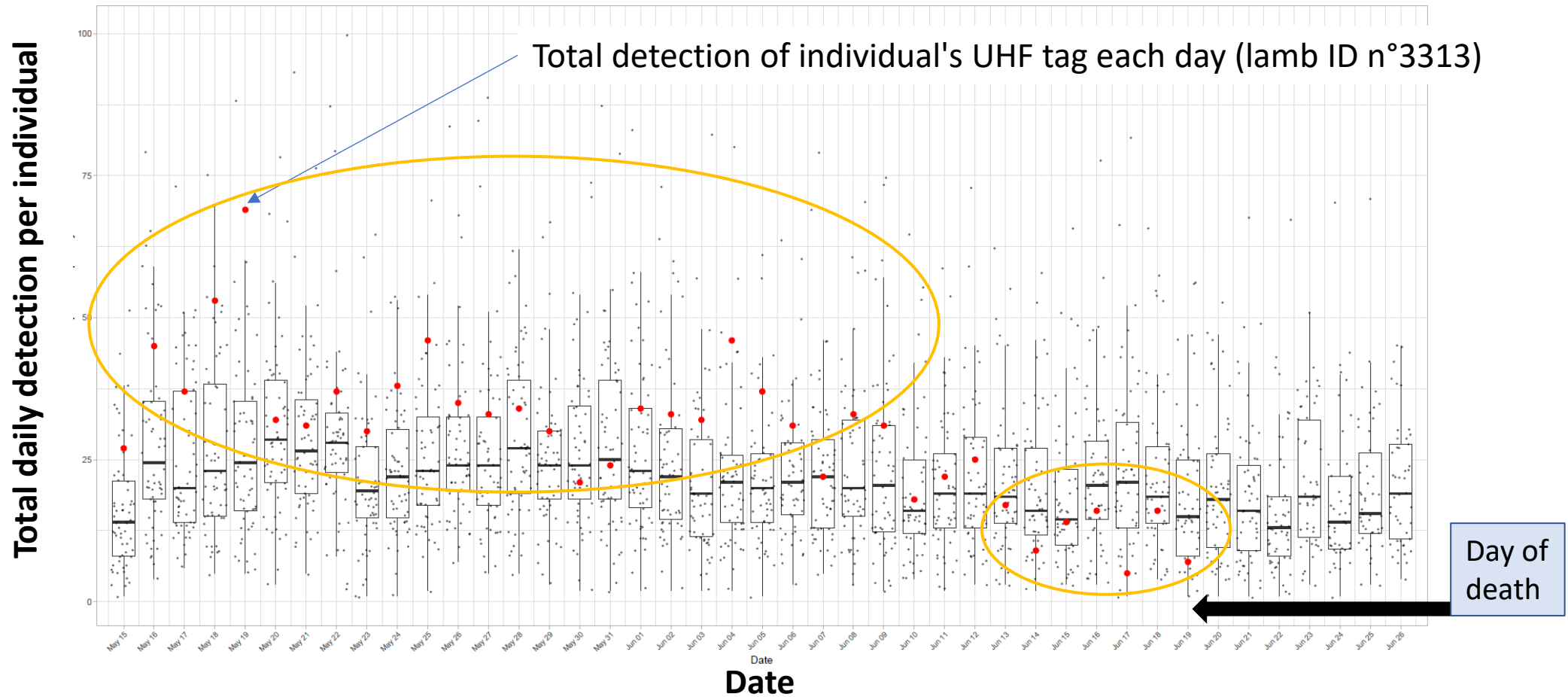
Water trough

- 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

	<b>BLE prototype</b>	<b>UHF prototype</b>
<b>Simultaneous detections capacity</b>	<b>Up to 16 beacons</b>	<b>All tags</b>
Data collection	Average, every 5 min (24/7)	Instant, every 1 sec 524/7)
<b>Data transmission</b>	LoraWan	3/4G
<b>Power</b>	Only small batteries (longevity ~ 10 days)	Mains power or battery (solar panels)
<b>Good reading range</b>	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
<b>Specific precautions</b> (RSSI: signal data)	Water sensitivity <b>RSSI → proximity</b> and location <u>outdoor</u>	Water sensitivity <b>Metal sensitivity</b> : RSSI ≠ location proxy <u>in shed</u>



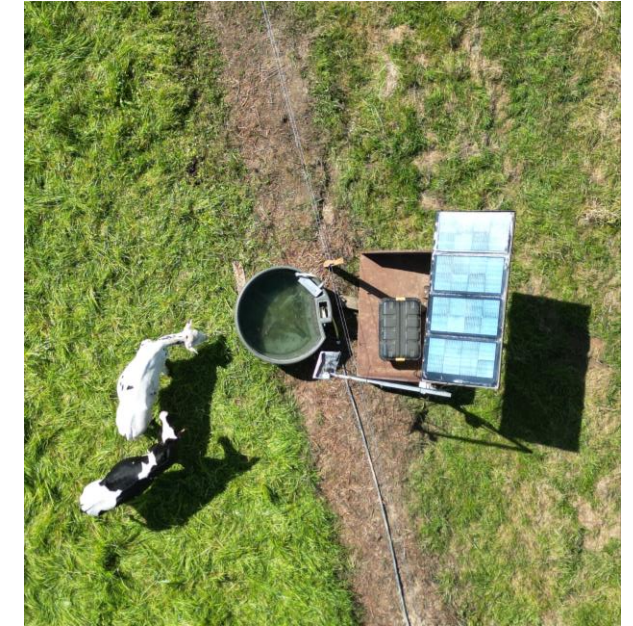
# Improvement & news uses cases in rangelands



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 CIIRPO” and “La Cazotte”,  
in Scotland at “Kirkton” and “Firth Mains”.*



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