



**HAL**  
open science

## Using accelerometers for goat activity monitoring

Mathieu Bonneau, Laura Faillot, Willy Troupé, Lucile Riaboff

► **To cite this version:**

Mathieu Bonneau, Laura Faillot, Willy Troupé, Lucile Riaboff. Using accelerometers for goat activity monitoring. European Federation of Animal Science, Sep 2024, Florence, Italy. hal-04708467

**HAL Id: hal-04708467**

**<https://hal.inrae.fr/hal-04708467v1>**

Submitted on 24 Sep 2024

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

## ➤ Using Accelerometers for goat activity monitoring

M. Bonneau<sup>1</sup>, L. Faillot<sup>1</sup>, W. Troupe<sup>2</sup>, L. Riaboff<sup>3</sup>

<sup>1</sup> UR 0143 INRAE, ASSET, Petit-Bourg, Guadeloupe

<sup>2</sup> UE PTEA, INRAE Le moule, Guadeloupe

<sup>3</sup> UMR1388 GenPhySE, INRAE, Castanet, Tolosan, France

# ➤ Predicting behavior from acceleration signal

- **Objective:** study the link between behavior and parasitism
    - Does behavior changes during infestation to gastrointestinal intestinal nematodes?
    - Does behavior influences the risk of parasitism ingestion?
  - Need to collect individual behavioral information, on the long term:
    - + Accelerometers are well suited for individual data collection.
    - No universal method to predict behavior from acceleration.
- ➔ Development of :
1. A sharable dataset of annotated acceleration data.
  2. A hierarchical LSTM model to predict behavior.



# ➤ Dataset creation : experimental setup

1. Set up animals with accelerometers on the left horn.



- Accelerometers AX3 from Axivity.

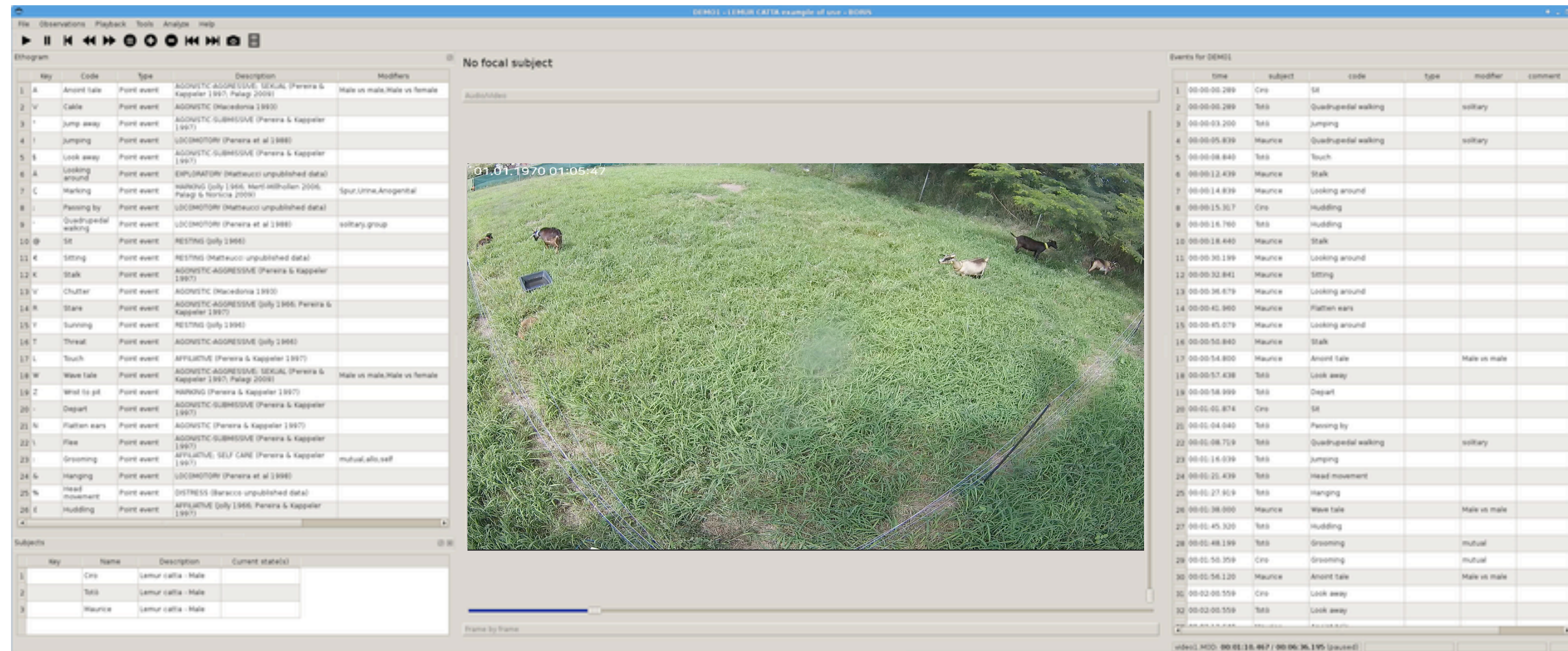
2. Record behavior with a camera



- Experimental paddock 20 x 10 m.
- 2 to 5 adult lactating or pregnant Creole goats.
- Free to graze for 6 to 8 hours.
- Animals are changed every day.

# Dataset creation : experimental setup

3. Use Boris to watch the videos and record the associated behavior for each animal



- Five behaviors:
  - Grazing, Displacement, Ruminating/Chewing, Resting, Other (bleating, social, scratching...)
- Annotation only when possible:
  - Identification of the animal and behavior.



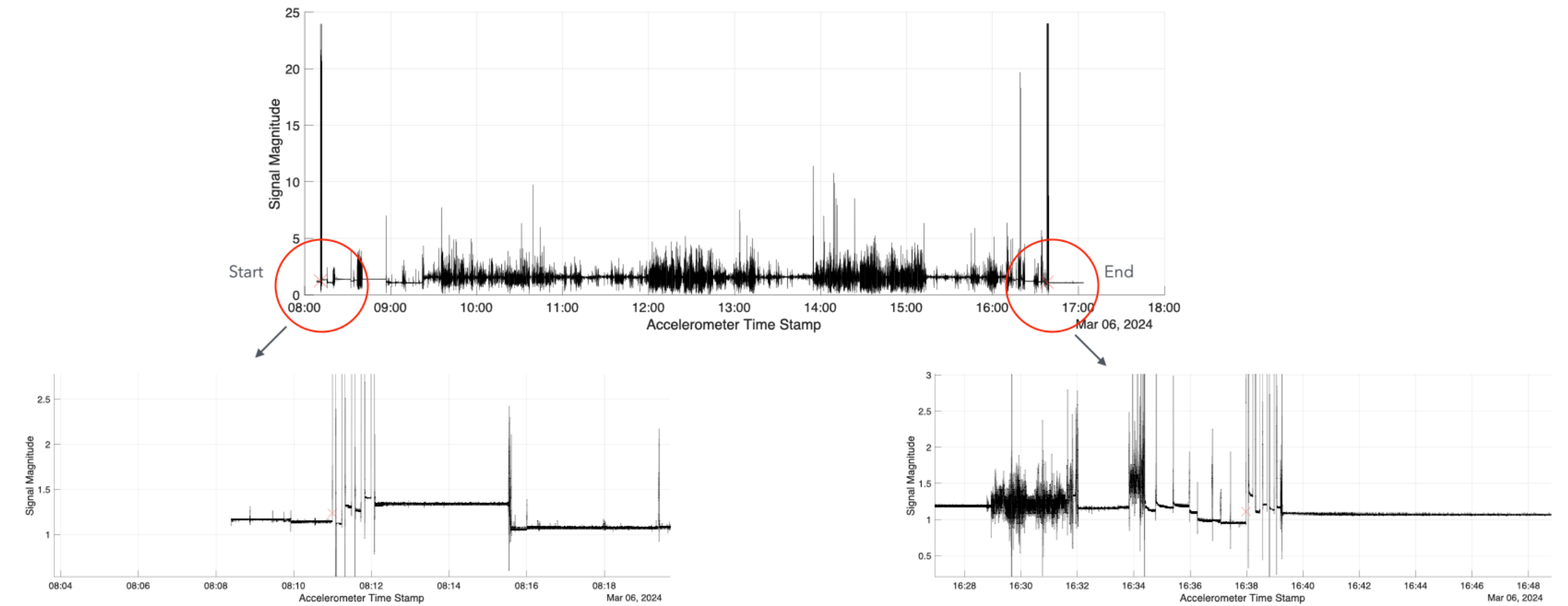
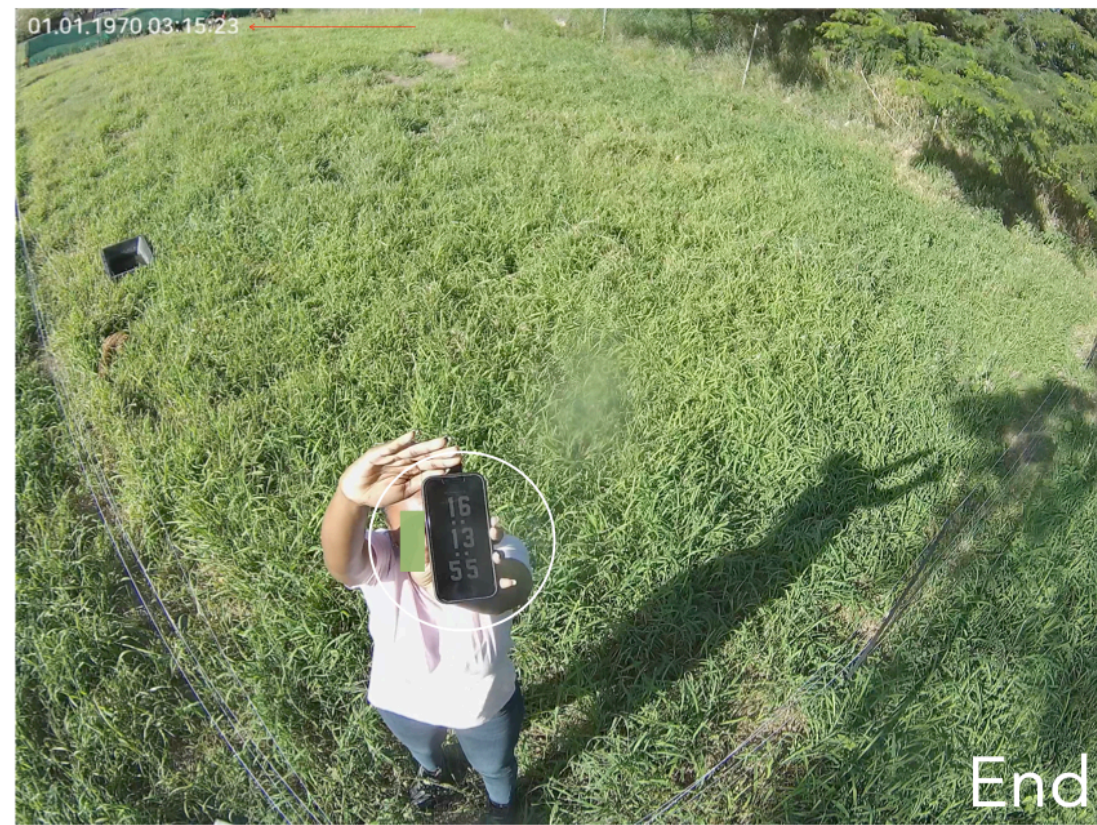
INRAE

Using Accelerometers for goat activity monitoring

01/09/2024 / EAAP Florence / M. Bonneau

# ➤ Dataset creation : experimental setup

## 4. Time synchronization between accelerometers and video frames



### 4.1 Synchronize camera to UTC time:

- Film smartphone time connected to internet.

### 4.2 Synchronize accelerometers to UTC time:

- Create a distinctive acceleration pattern.

### 4.3 Account for time drift:

- 1h of sensor records are not necessarily one hour in reality...
- Compute and add drift to the sensors time.



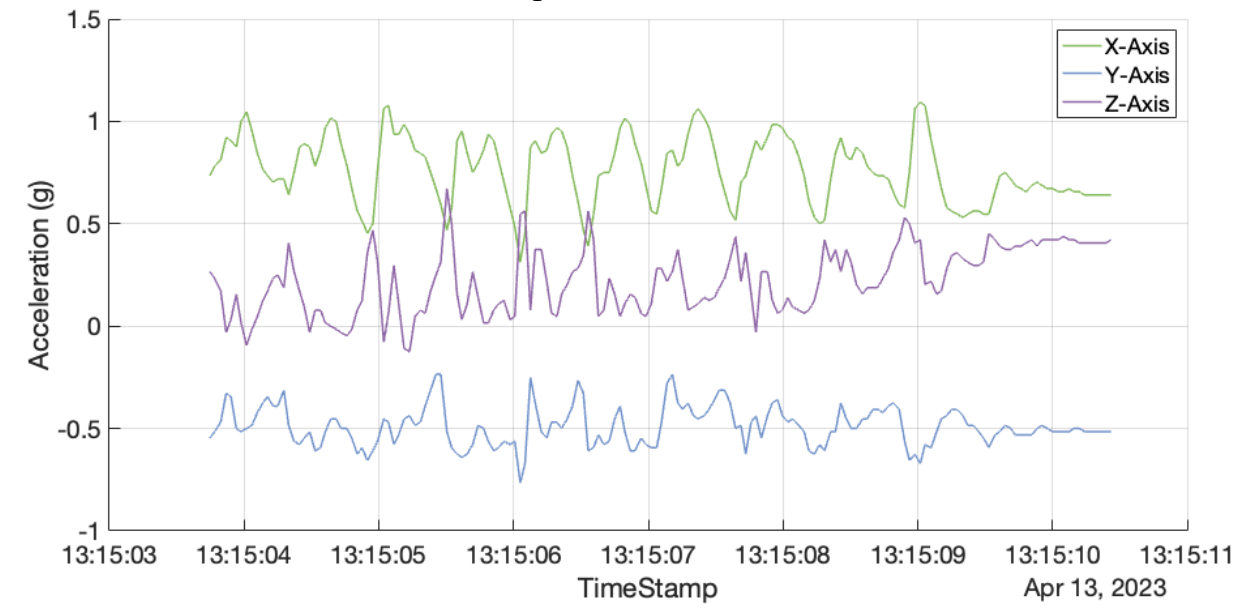
INRAE

Using Accelerometers for goat activity monitoring

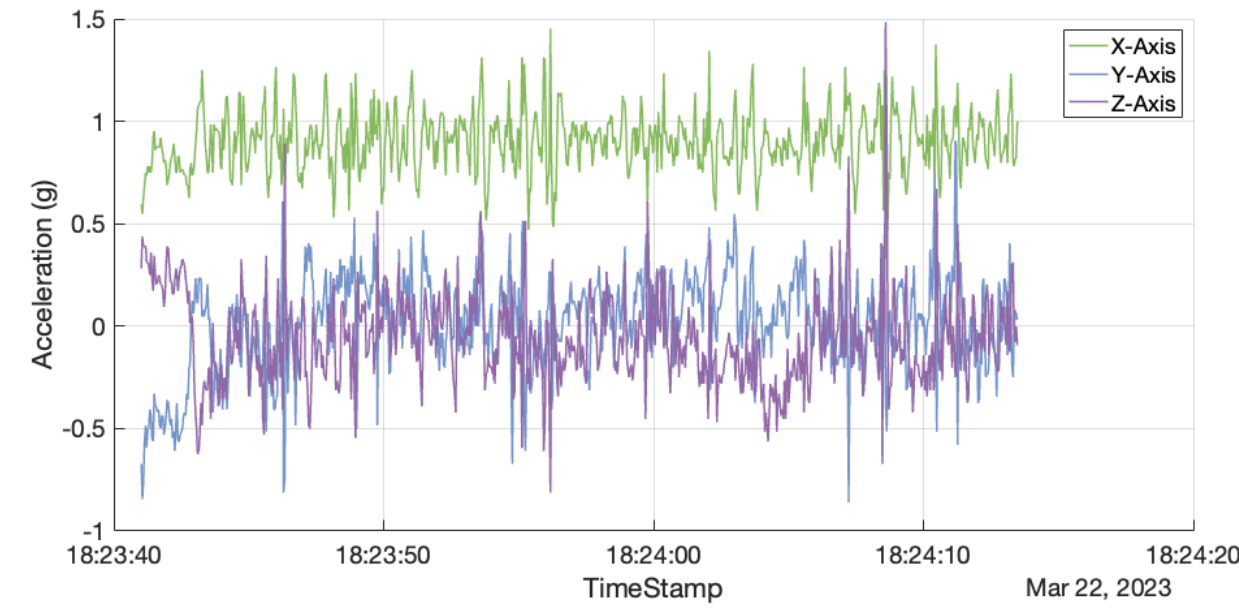
01/09/2024 / EAAP Florence / M. Bonneau

# Final dataset : some examples

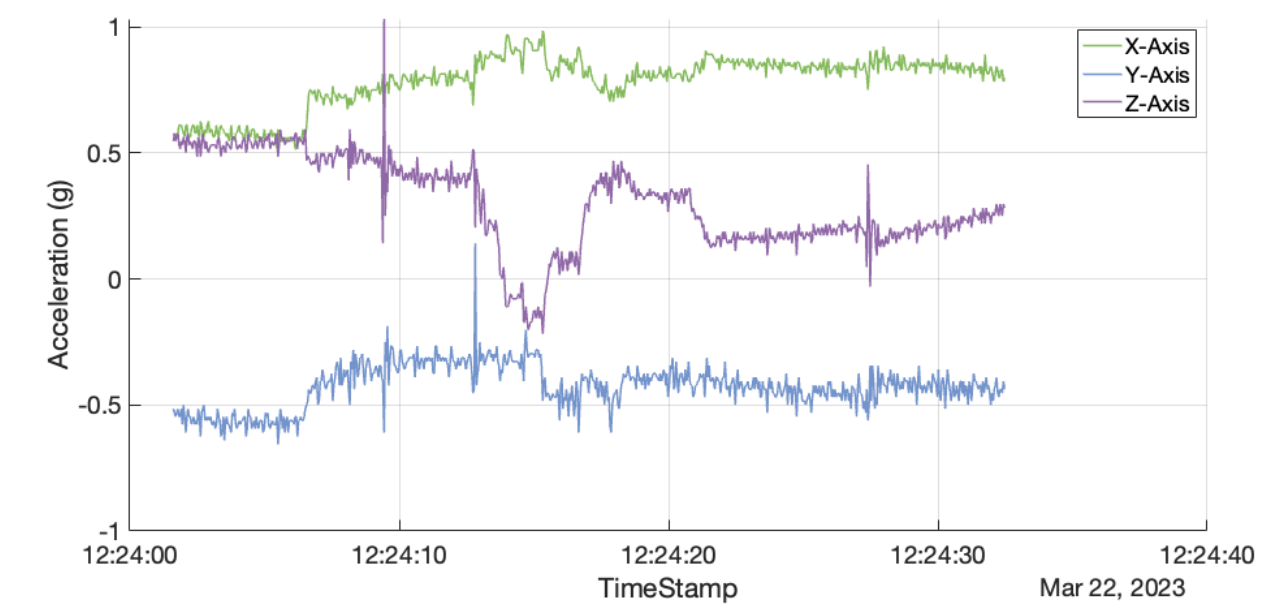
### Displacement



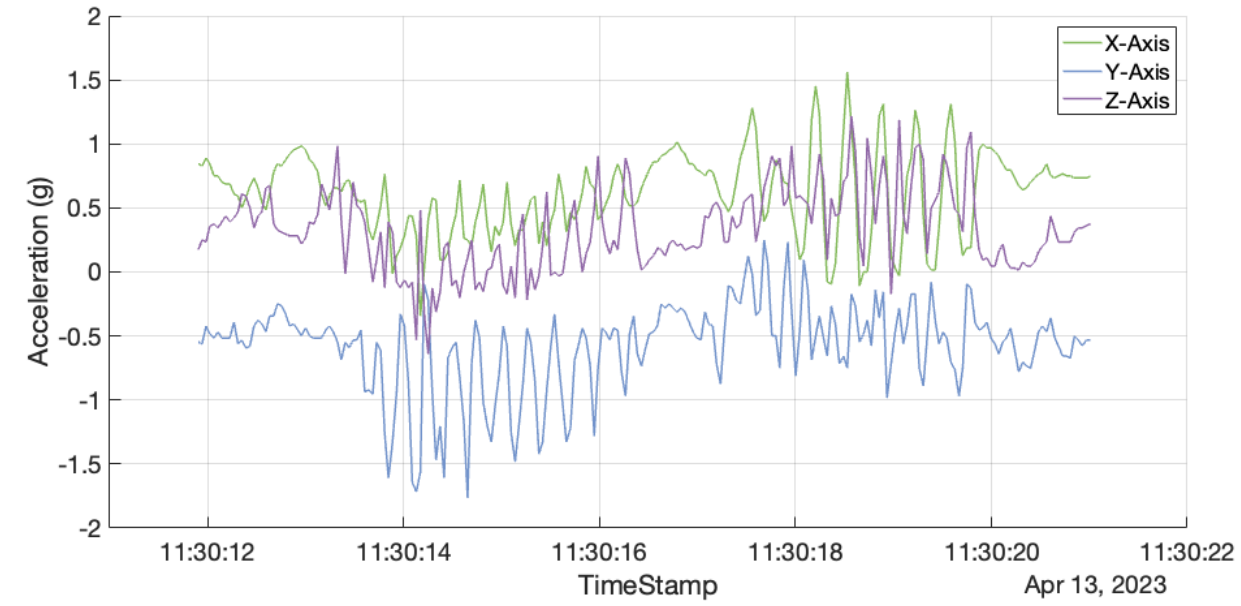
### Grazing



### Ruminating/Chewing



### Other



### Resting



INRAE

Using Accelerometers for goat activity monitoring

01/09/2024 / EAAP Florence / M. Bonneau

# ➤ Final dataset

- 144 hours of annotated videos.
- 59 different animals.
- High heterogeneity of labelling time and sequence duration....
  - Had to be accounted for when designing the prediction method !

Behaviors	Cumulated time (h)	Mean sequences duration (s)
Displacement	0.61	7.03
Grazing	67.67	32.93
Ruminating / Chewing	10.58	29.73
Other	6.23	9.23
Resting	59.55	42.2

- Sharable dataset:
  - Data paper submitted to Data In Brief



INRAE

Using Accelerometers for goat activity monitoring

01/09/2024 / EAAP Florence / M. Bonneau



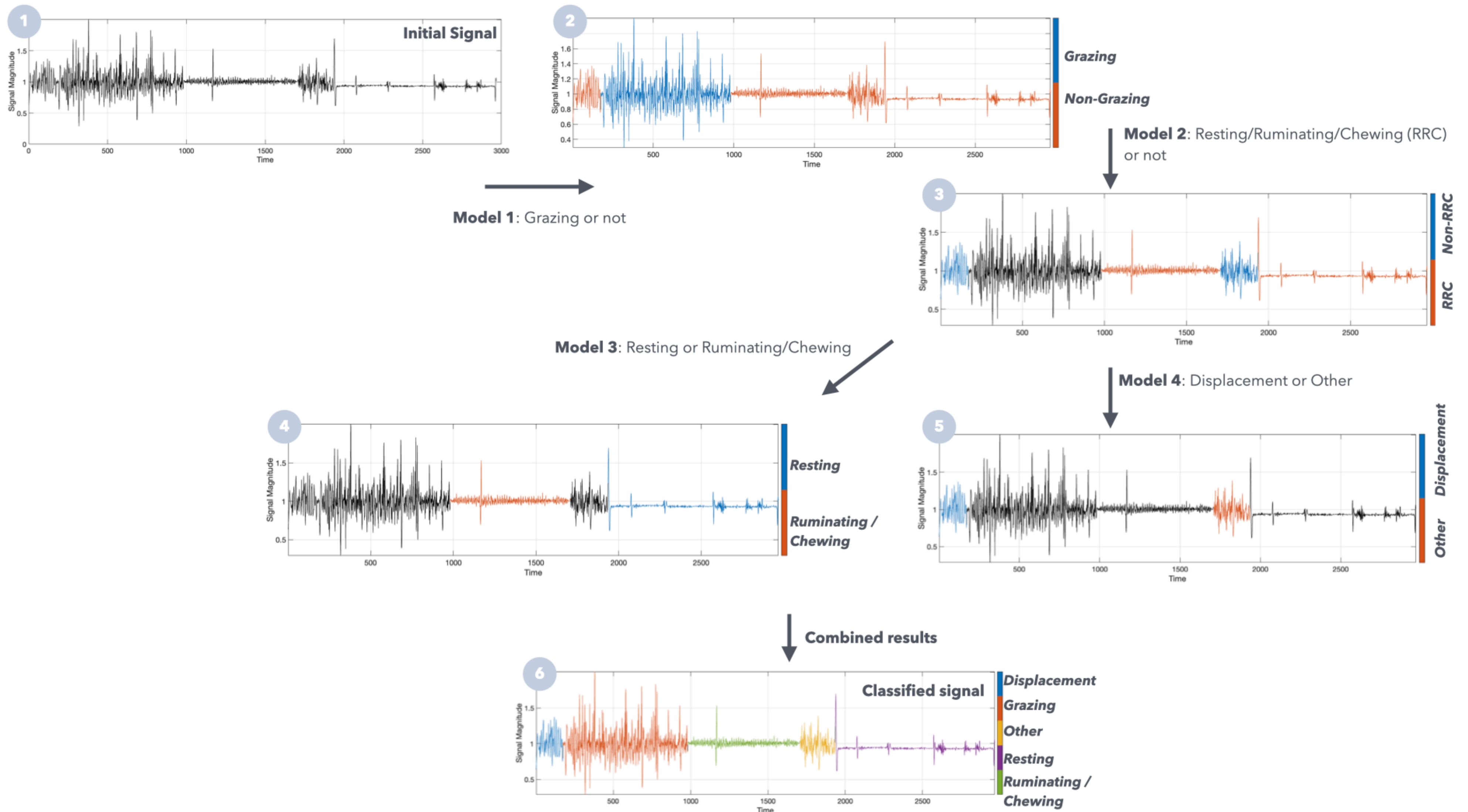
# ➤ Behavior prediction: Challenges

- Long Short Term Memory (LSTM) neural networks are well suited for prediction using time series.
- High heterogeneity of behavior sequences:
  - Difficult to use one model suited for all behavior type.
  - Development of a hierarchical model.

Behaviors	Cumulated time (h)	Mean sequences duration (s)
Displacement	0.61	7.03
Grazing	67.67	32.93
Ruminating / Chewing	10.58	29.73
Other	6.23	9.23
Resting	59.55	42.2



# ➤ Hierarchical LSTM model for prediction

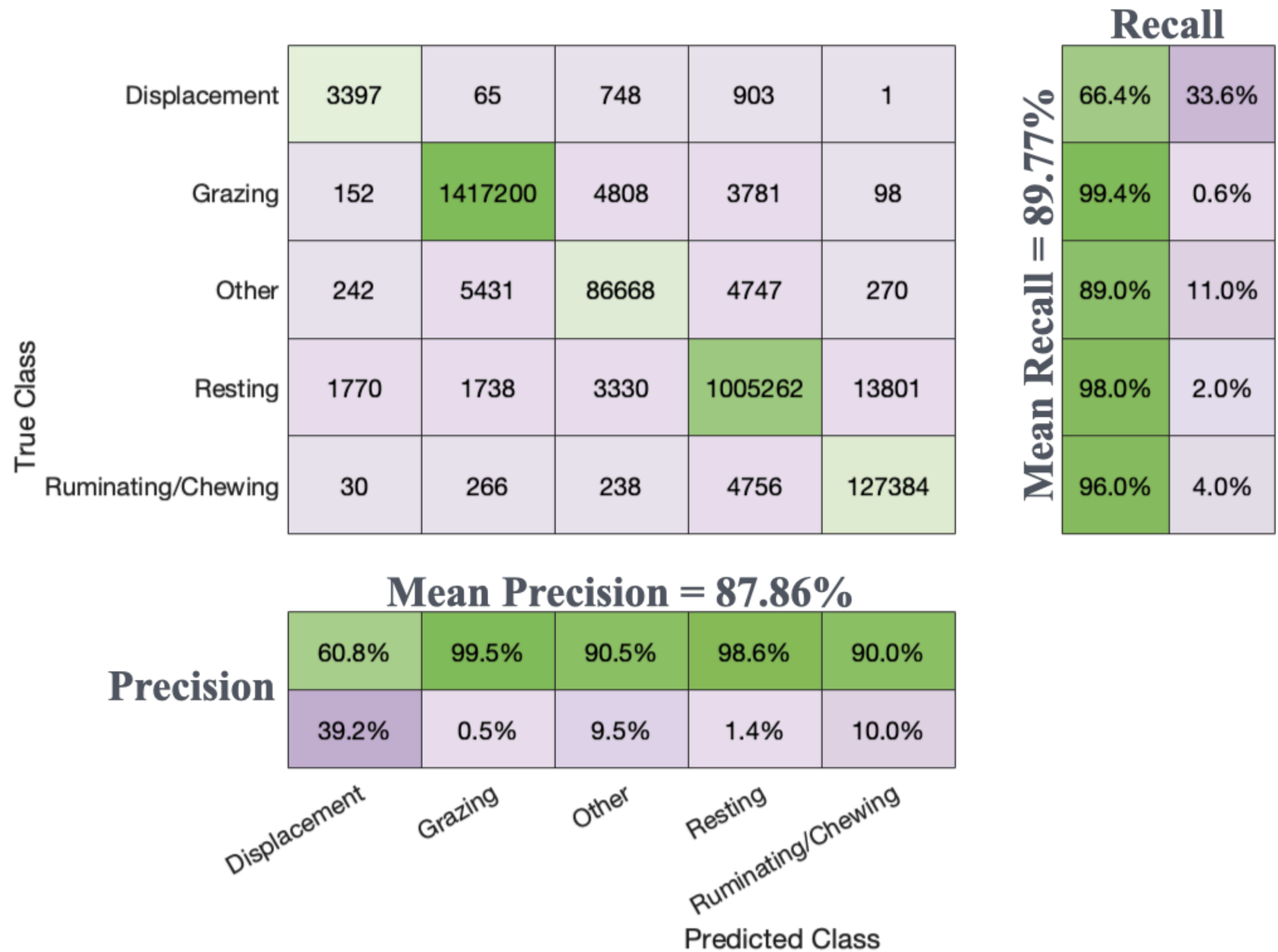


INRAE

Using Accelerometers for goat activity monitoring  
01/09/2024 / EAAP Florence / M. Bonneau

# ➤ Hierarchical LSTM models for prediction

- 7 animals for test (21%).
- 52 animals for training (79%).



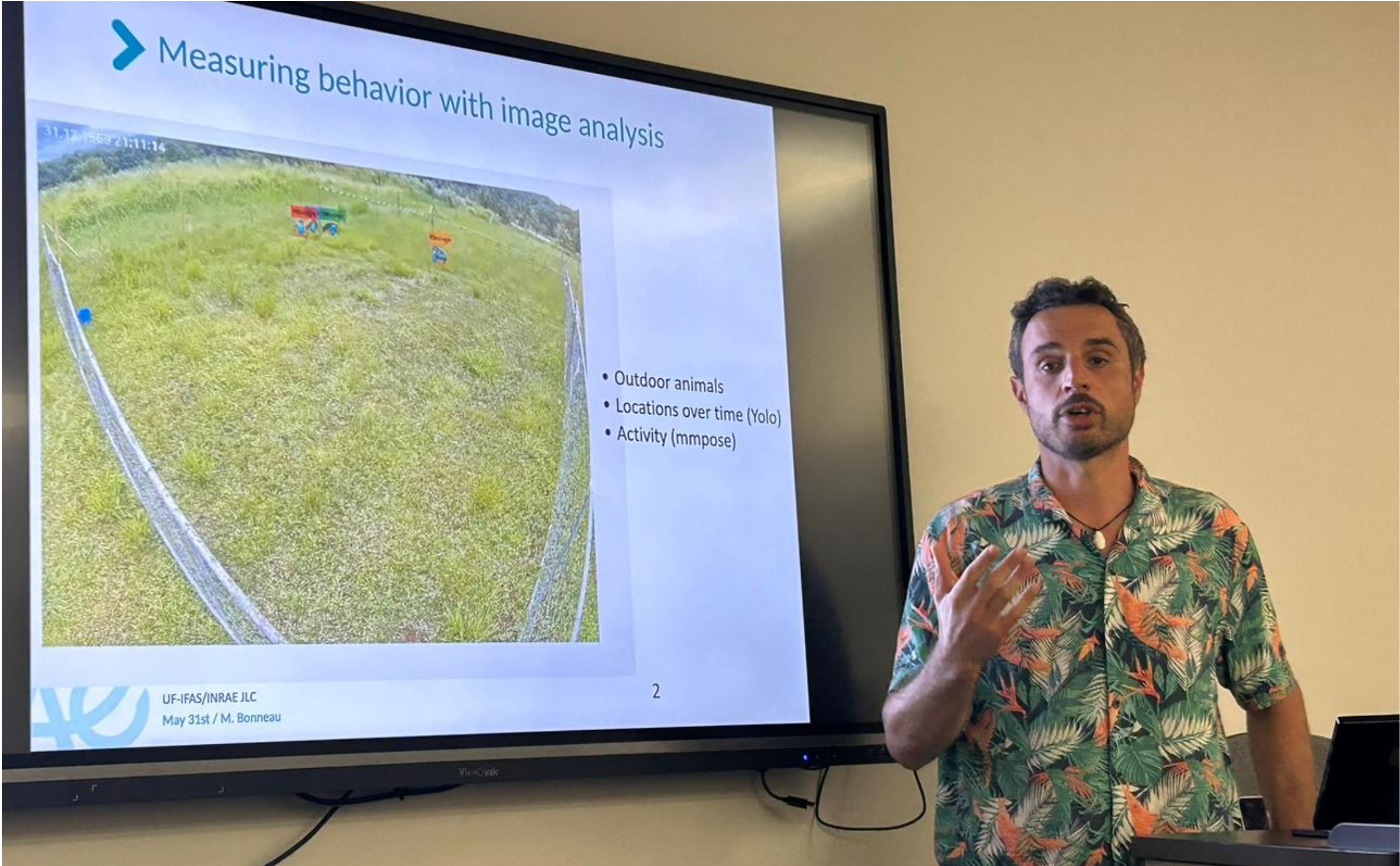
INRAE

Using Accelerometers for goat activity monitoring  
01/09/2024 / EAAP Florence / M. Bonneau

# ➤ Hierarchical LSTM models for goats behavior prediction

Thank you !

[mathieu.bonneau@inrae.fr](mailto:mathieu.bonneau@inrae.fr)



INRAE

Using Accelerometers for goat activity monitoring  
01/09/2024 / EAAP Florence / M. Bonneau