

Measurement of Rumen Motility using a Tri-axial Gyroscopic Bolus

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Neck Mounted Sensors/pH Bolus

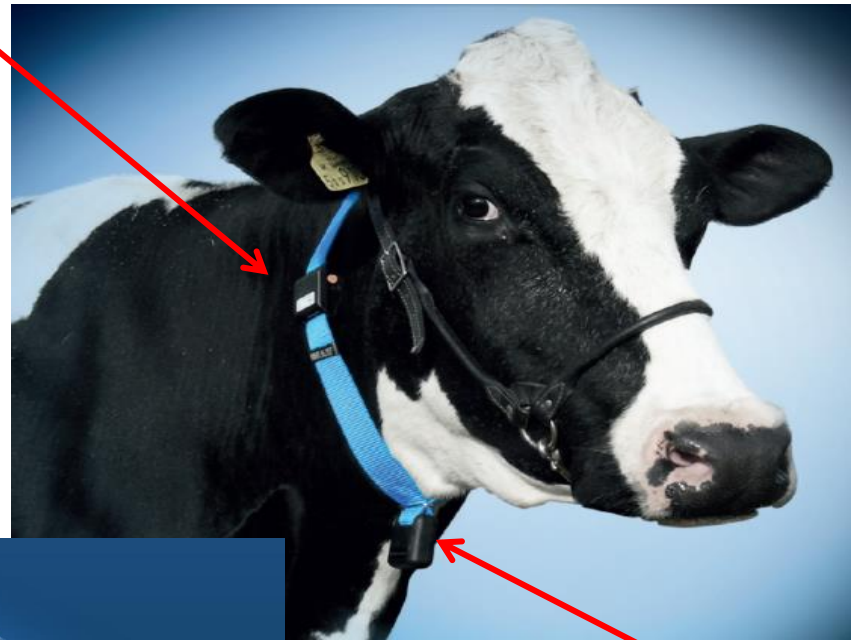
Location for
collar sensor

Collars

- Cow Activity
- Determination of Eating and Ruminating
- Oestrus, calving, illness
- Lifetime >5 years

pH Bolus

- pH value in reticulum
- indicator of SARA?
- lifetime typically 3 months
- Other measurands?



Weight

What else can a bolus measure?

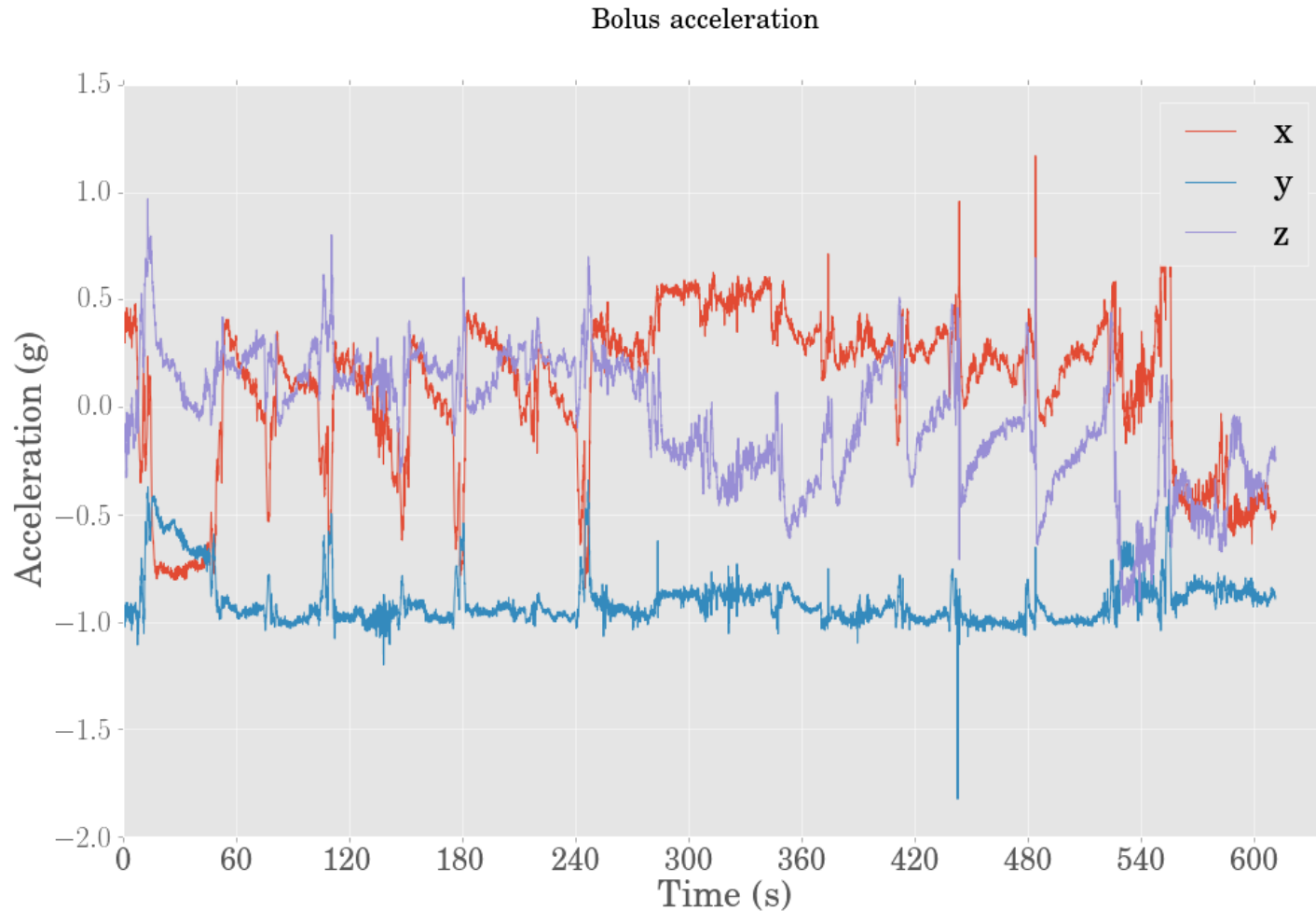
- Temperature
- Motility
 - Is this an indicator of welfare?
 - Does this offer any more information than a collar gives?
 - Accelerometer/gyroscope
 - Lifetime of years?

Experiment

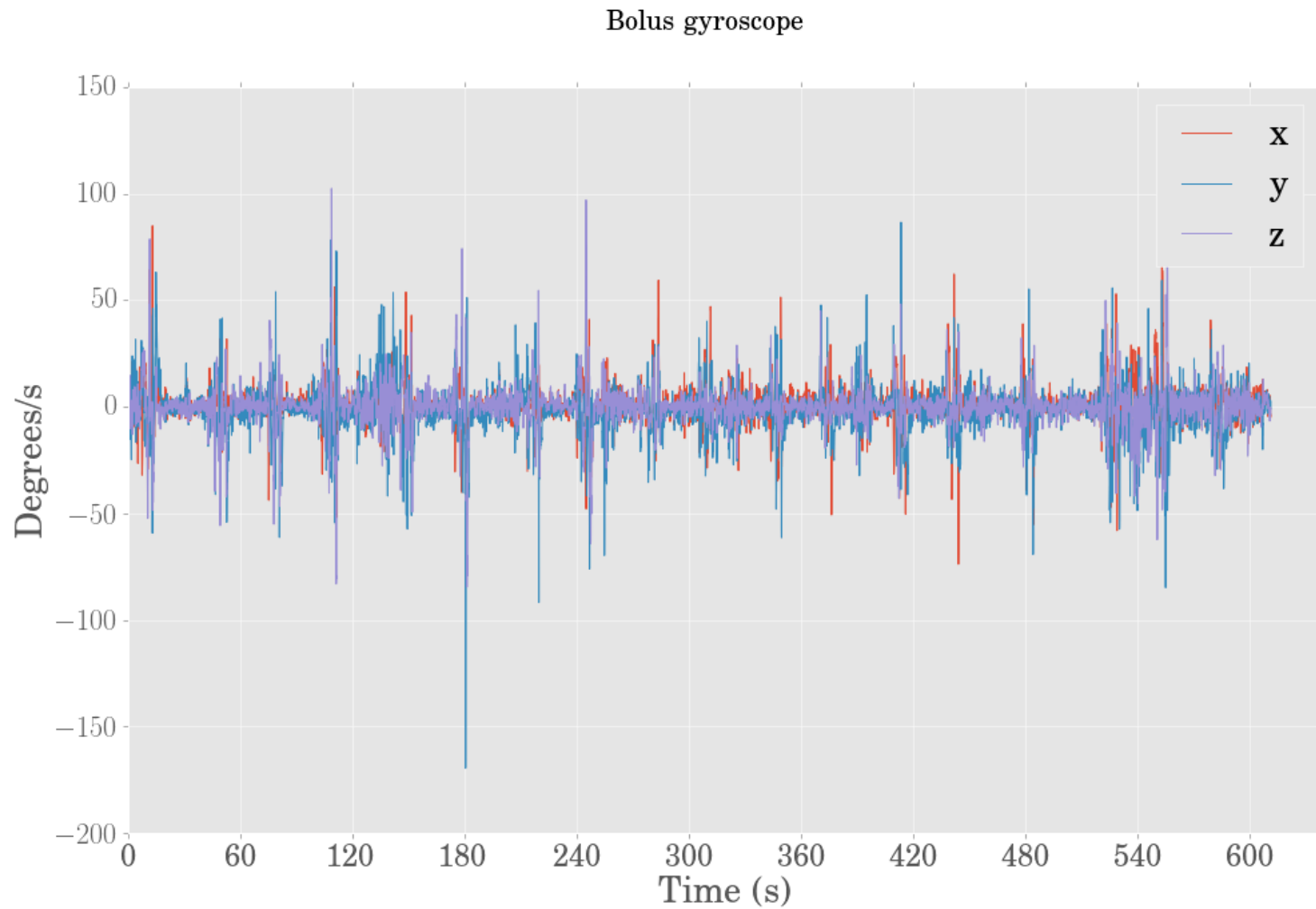
- 4 Jersey cows with ruminal canulae
- 4 ruminal bolus with 3 axis gyro/accelerometer, SD card, Real Time Clock (RTC)
- 4 Collars with 3 axis gyro/accelerometer, SD card, RTC
- Cattle housed indoors in a straw yard
- Feed - hay *ad libitum*, with 300 g lightly roller-milled barley grain fed to each cow at 08:00 h and 15:00 h each day

Preliminary Results

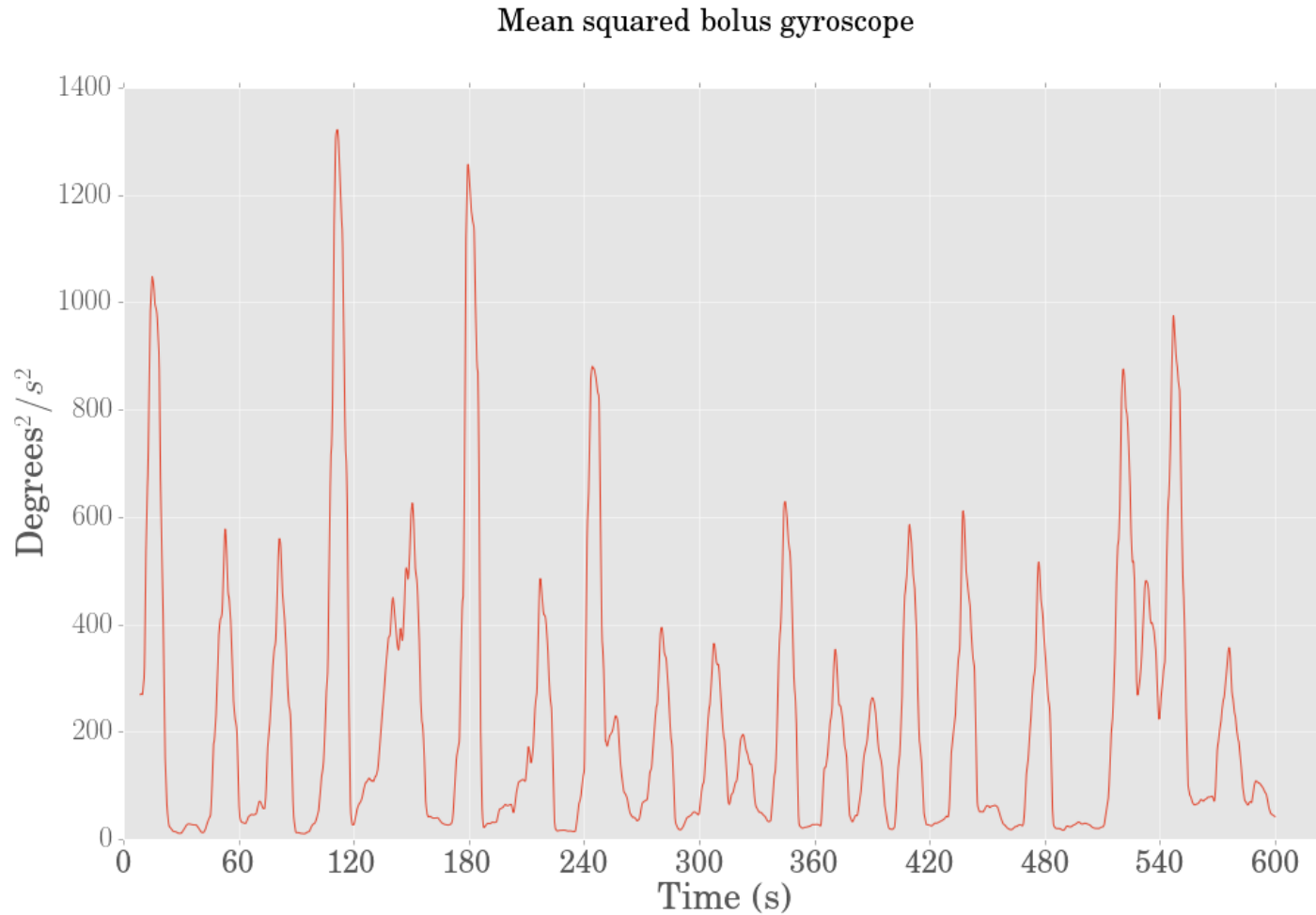
Bolus Accelerometer Trace



Bolus Gyroscope Trace



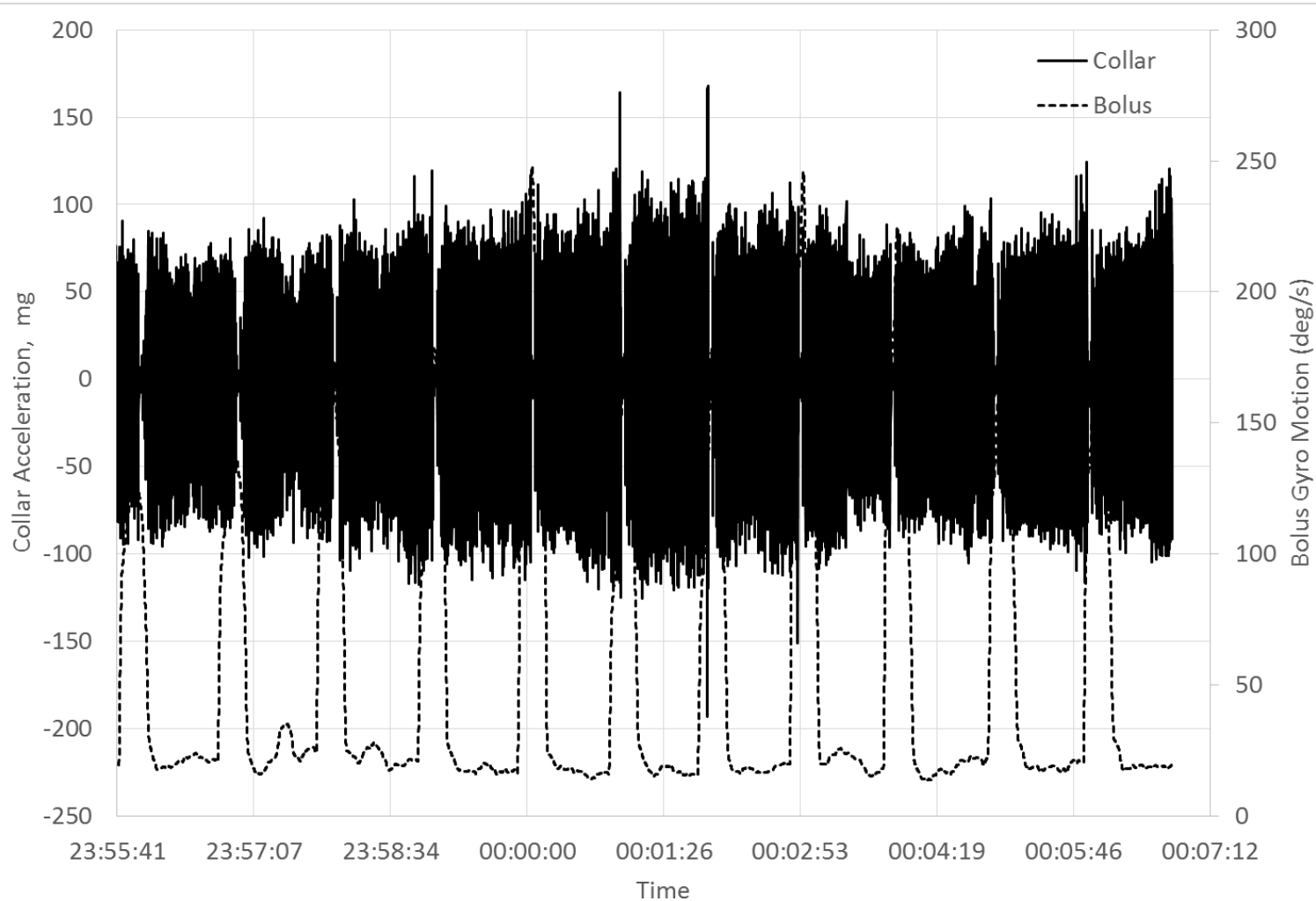
Mean Squared Gyroscope Output



Alignment with collar and bolus

- Real Time Clock (RTC) – precision synchronisation
- Time alignment of known period of activity as example e.g. rumination

Bolus Contraction and Collar Output

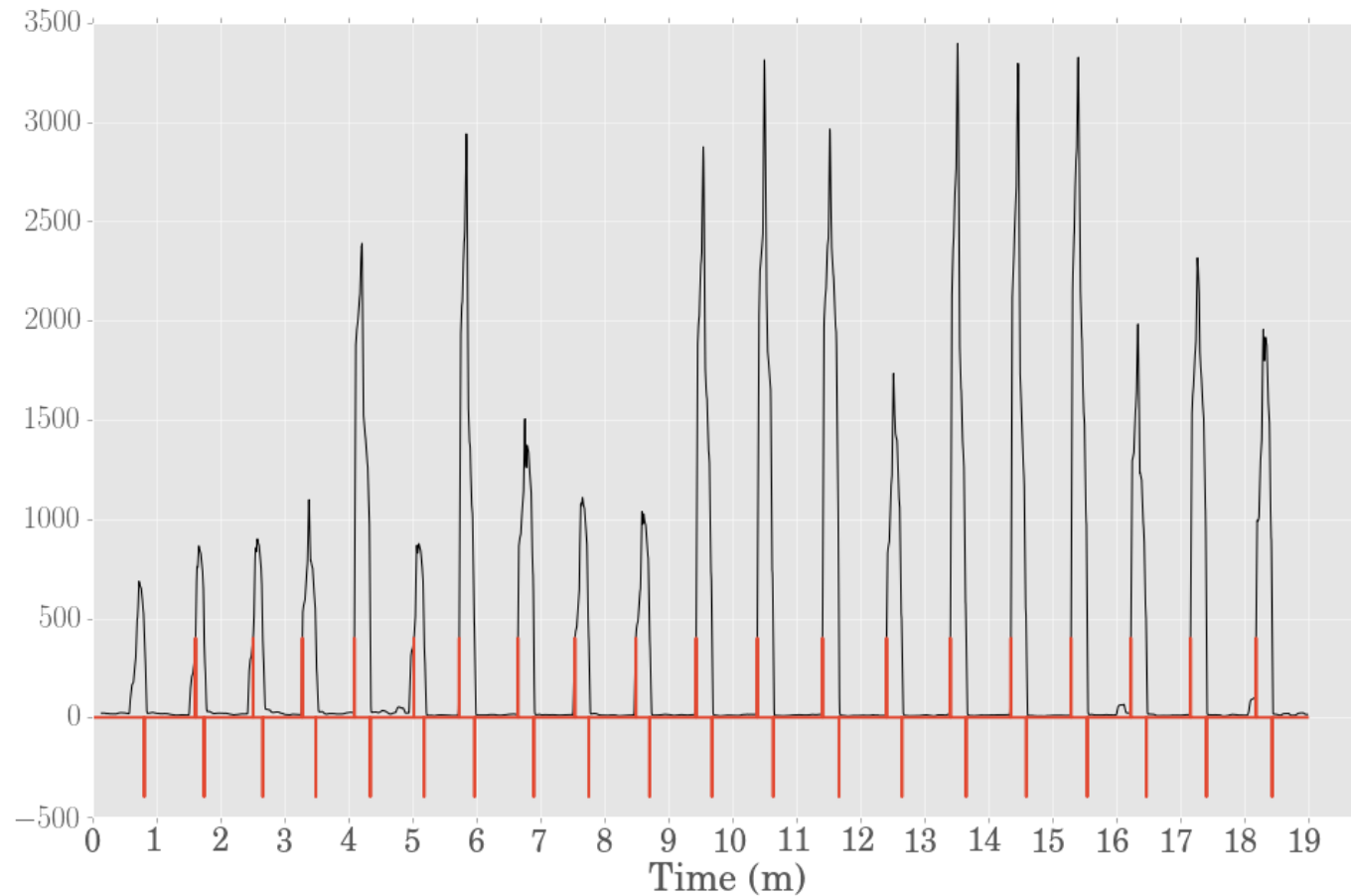


Bolus/Collar Relation

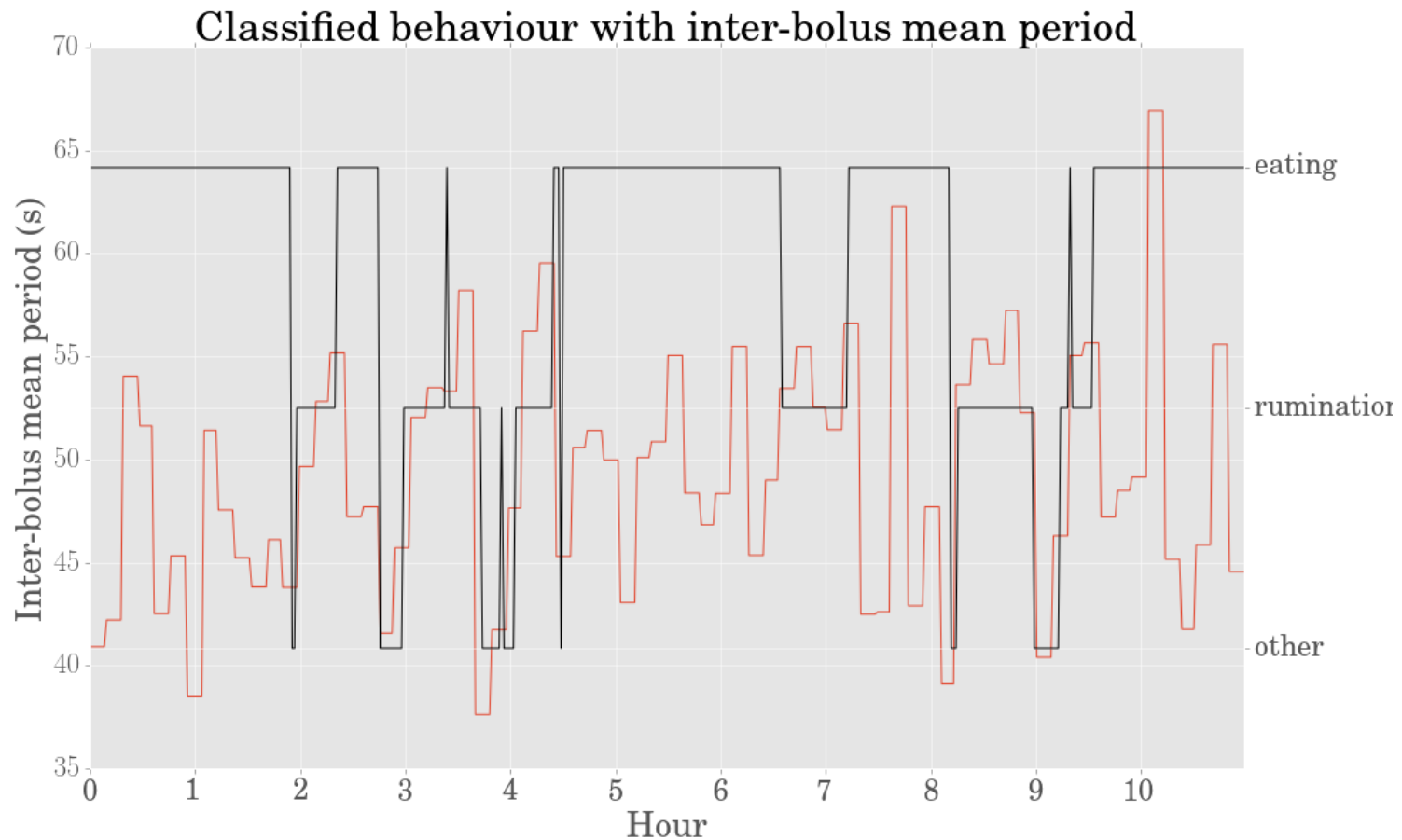
- Clear alignment between rumination periods and rumen contractions
- Collar can only detect when cow is ruminating
- Is there any difference?
- Is measuring it of value?

Calculating Inter-bolus Period

Sum of Variance signals, with rising and falling edge detection.

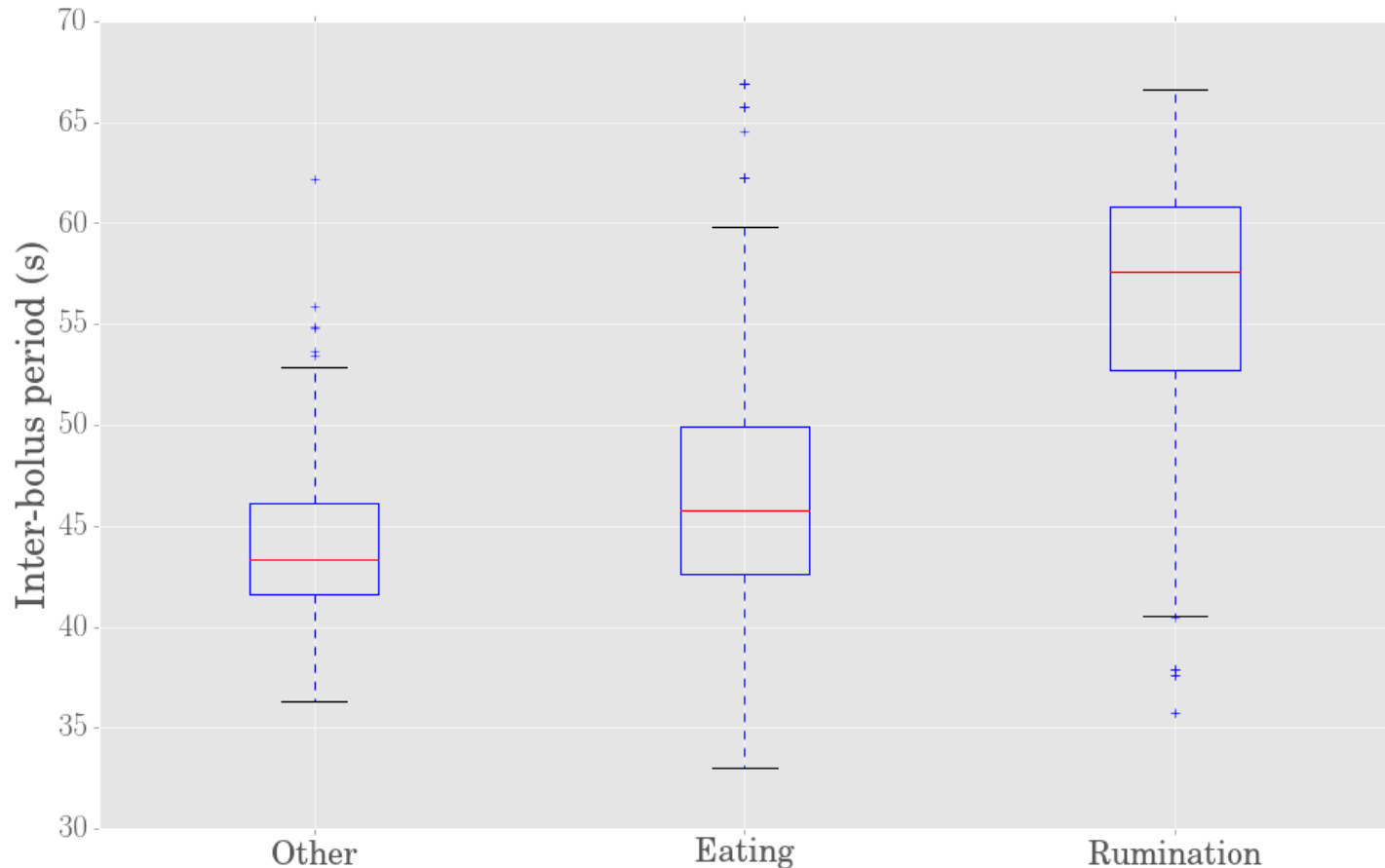


Inter-bolus Period varies with Activity?



Inter-bolus Period - 1 cow; 4 days

Inter-bolus period, by behaviour



Conclusions

- Reticulum contraction clearly identifiable with motion sensitive bolus
- Gyroscopic sensor slightly easier to process
- Early results indicate possible variation with activity
- Potential alternative to collar based measurement
 - Similar battery lifetime anticipated

Acknowledgement

Malcolm Bateman of WellCow Ltd is gratefully thanked for supplying empty boluses for experimentation.