

Automatic Prediction of Calving Point using Tail Mounted Tri-axial Accelerometers

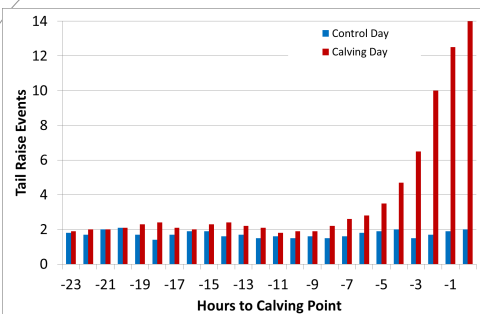
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Introduction: Recently, increasing attention has been directed towards methods which assist in estimating welfare of livestock. Oestrus detection systems for example are now routinely deployed within farms to improve the overall farm fertility [1]. Estimation of the point of calving, through analysis of standing and lying patterns along with a general restlessness parameter, has also been reported [2]. More intrusive sensors that measure vaginal temperature and detect the process of the calf being expelled have been reported in the open literature and are currently commercially available [3]. Detailed analysis of cow behaviour during the hours approaching the calving point, has shown that in the hours preceding calving a cow raises its tail for increasing periods of time [4]. Here we report on the performance of an accelerometer based tail measurement sensor that allows the automatic detection of tail raise events such that the frequency and duration of tail raising can be quantified. This can facilitate studies related to animal behaviour patterns approaching calving. We report on an algorithm which tracks the number and duration of tail raises within an hour exhibited by a cow as an indicator of the calving point. The frequency and duration of tail raises have been demonstrated to indicate the onset of calving.

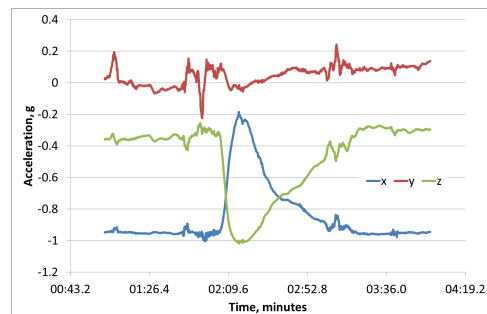
Calving Point Identified by Tail Raise Frequency



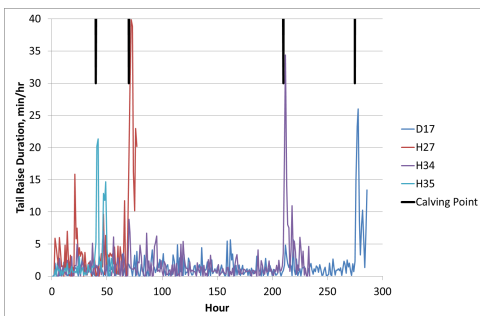
Tail raising frequency (shown above as average over 20 cows based on video analysis) [3] increases close to calving point.



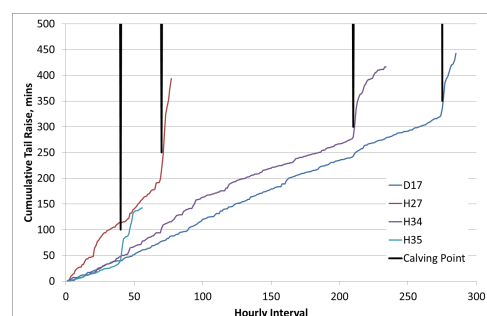
Tail Mounted Sensor



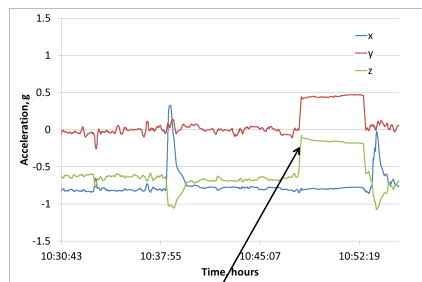
Short section of data showing typical tail raise event. x – acceleration rises while z-acceleration falls, y-acceleration does not change



Tail Raise Counts Per Hour for selection of cattle: Increase approaching calving point is evident



Cumulative Tail Raise Counts for selection of cattle: Increase approaching calving point is evident



Potential for Detecting Lying Ventral

Conclusion We have measured acceleration signatures on cattle and identified a typical tail raise feature. Tail raise frequency can be used to predict the calving point and the sensor can also be used to detect standing lying transitions, and when a cow is lying ventrally. This work was funded by the Technology Strategy Board, TSB, whose support is gratefully acknowledged.

References

- [1] C Michie, I Andonovic, M Gilroy D Ross, C-A Duthie, L Nicol, 'Oestrus Detection in Free Roaming Beef Cattle', European Conference on Precision Livestock Farming, Leuven Belgium, September 2013;
- [2] E Malz 'A Practical Way to Detect Approaching Calving of the Dairy Cow by Behaviour Sensor', pp 141-145 Precision Livestock farming 2007;
- [3] http://www.medria.fr/en_GB/produits/vel-phone.htm
- [4] H M. Miedema, M S. Cockram, C M. Dwyer, A. Macrae, 'Changes in the behaviour of dairy cows during the 24 h before normal calving compared with behaviour during late pregnancy' Applied Animal Behaviour Science, Vol 131, Issues 1–2, April 2011, Pages 8–14



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