



## PROJECT REVIEW

<b>NAME: Sophia Stavrakakis</b>	
<b>INSTITUTE: Newcastle University</b>	<b>FULL TIME- Final Year</b>
<b>TITLE: Predicting leg soundness using biomechanical assessment of gait in pigs</b>	
<b>AIMS &amp; OBJECTIVES:</b>	
<ul style="list-style-type: none"> <li>To parameterise normal gait in pigs through the use of motion capture technology</li> <li>To ascertain how gait changes with increasing age/weight of the pig</li> <li>To determine the effect of floor surface on the gait of pigs at different ages</li> <li>To ascertain the predictive power of early gait score measures to identify later predisposition to lameness</li> <li>To further develop quick, simple locomotion assessment methods for commercial application</li> </ul>	

<b>KEY MILESTONES:</b>	<b>TARGET DATE:</b>	<b>ACHIEVED DATE:</b>
1. Complete University registration process	Oct 2011	Oct 2011
2. Complete BPEX induction including introduction to UK pig industry seminar	Nov 2011	Nov 2011
3. Compile literature review on leg problems and methods of gait assessment	End Mar 2011	End Mar 2011
4. Development of a strategy to approach the problem experimentally	End Mar 2011	End Mar 2011
5. Motion capture tests	End Jun 2011	End Apr 2011
6. Conduct pilot experiments	End Sept 2011	End Nov 2011
7. Refinement of methodology and plan for next experimental steps	End Oct 2011	End Oct 2011
8. Commence long-term study	End Jan 2012	Early Jan 2012
9. Analysis of pilot study data and preparation of a draft thesis chapter	End Mar 2012	End March 012
10. Analysis of marker repeatability trial and preparation of paper	End Nov 2012	End Nov 2012
11. Analysis of longitudinal predictive study data	End Dec 2012	In prep
12. Complete data analysis and publication	End Aug 2013	In prep
13. Submission of PhD thesis	End Oct 2013	In prep (target Jan 2014)

<p><b>PROJECT REVIEW AND COMMENTARY:</b></p> <p>Following the successful start of the long-term breeding sow study in January 2012 (entitled: 'Longitudinal predictive gait study of a cohort of female breeding pigs'), the experiment continued in a 'three weeks on farm - three weeks in office' rotation until Nov 2012, when the on-farm involvement was reduced to one week in every three weeks. Recruitment of the experimental population of 84 breeding gilts was achieved in July 2012, and the final batch of animals was captured for a last time in July 2013.</p> <p>Alongside experimental data collection and processing, the following pieces of data analysis and presentation have been achieved:</p> <ol style="list-style-type: none"> <li>Nov 2012: Completion of analysis of the marker placement repeatability trial undertaken in the second year and generation of an abstract and a paper (accepted for publication by the journal Biosystems Engineering).</li> <li>November 2012: Press visit to Cockle Park Farm by reporter Adam Henson from the BBC Countryfile programme, with subsequent airing of the interview in December 2012.</li> <li>Dec 2012: Presentation at the BPEX annual PhD seminar covering findings to date and ongoing research.</li> <li>January 2013: Hosted a one-week visit of a Belgian colleague (Liesbet Pluym, ILVO, Vet school Ghent) to demonstrate kinematic motion capture technique and exchange knowledge on quantitative leg soundness assessment.</li> <li>April 2013: Theatre presentation of a paper at the BSAS annual conference in Nottingham. Results from a subgroup of the 'Longitudinal predictive gait study' investigating gait changes (displacement) in lame female pigs compared to normal matching controls' were reported. .</li> <li>June 2013: Pilot test at Cockle Park farm of the Windows Kinect motion sensing input device, to investigate the ability of Kinect to track changes in the head and trunk vertical movement of lame pigs in comparison to the high-tech Vicon Motion capture data collected in the experimental population of pigs. The Kinect system has the potential to be a simple on-farm movement tracking device when mounted above pigs.</li> <li>August 2013: Presentation of two abstracts (see publications below) at the International Society of Biomechanics (ISB) congress in Brazil. Funding to attend the conference was provided by awards from the Sir Kenneth Blaxter award and the Douglas Bomford trust award for research in Agricultural Engineering.</li> <li>September 2013: Completion of analysis of the floor treatment study (Experiment 1) and generation of a journal paper, currently resubmitted to the journal Animal following minor revision.</li> </ol>
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9. In Progress: Preparation of a journal paper on the association between subjective clinical scoring (including known joint disease) with quantitative gait measures provided by the Vicon system. (target submission date Dec 2013).

10. In progress: Data processing and analysis of the long-term study (Experiment 3) to produce three journal papers:

1. Descriptive gait of more than 60 female pigs, before breeding, during pregnancy and after lactation.
2. Gait changes in 30 pigs as they progress through two consecutive pregnancies and of 16 pigs as they progress through three consecutive pregnancies.

Predictive study: Analysis of the gait histories of lame pigs in Experiment 3, since it is now known that the period prevalence of lameness of grade 2 (general gait irregularity) and 3 (minimal weight-bearing lameness) in the population enrolled in the present study was 27% (incidence 38%).

### Summary

The project is well on course to achieve the objectives set out above, and provides a detailed account of the quantitative biomechanical changes in the gait of both normal pigs and those which suffer from a degree of lameness/leg weakness. However, the time necessary to capture the locomotion of pigs in digital form and to process the images prior to statistical analysis was underestimated at the inception of the project so that submission of the final PhD thesis has been delayed. Nevertheless, the scientific findings of the project to date have been well received by the academic community and the pig industry. Steps are now being made to prepare a follow-on grant to commercialise the technology developed in the project and develop a farm-level version to automatically capture gait and detect lameness, however subtle, in groups of commercially-managed pigs.

### Publications since previous report

Stavarakakis S., Guy J.H., Warlow O.M.E., Johnson G.R., Edwards S.A. (2013) **Seeking the most characteristic quantitative movement changes in lame pigs – potential for automatic herd-lameness tracking on farms.** In: *Proceeding of the British Society of Animal Science, Annual Meeting 16-17 April 2013.* Nottingham, United Kingdom. (Abstr.) p 3.

Stavarakakis, S., Guy, J.H., Ioannis, S., Johnson, G.R. and Edwards S.A. (2013). **The pig as a quadruped model of modified body movement and inter-limb support coordination changes in the presence of lameness.** In: *Proceedings of the International Society of Biomechanics Congress (ISBC), 04-09 August 2013, Natal, Brazil.* (Abstr.) p 249.

Stavarakakis, S., Guy, J.H., Warlow, O., Johnson, G.R. and Edwards SA. (2013). **Intra-operator reliability of skin marker placement in kinematic studies of the pig.** In: *Proceedings of the International Society of Biomechanics Congress (ISBC), 04-09 August 2013, Natal, Brazil.* (Abstr.) p 250.

Stavarakakis, S., Guy, J.H., Warlow, O., Johnson, G.R. and Edwards S.A. (2013). **Intra-operator repeatability of skin marker derived segment measures and gait kinematics in pigs.** *Biosystems Engineering*, in press.

### POTENTIAL BENEFIT TO INDUSTRY:

This study will increase our understanding of locomotion of pigs on different floor types and at different stages of development. The industry may benefit from the application of this knowledge as follows:

1. "Screening" replacement gilts for leg soundness with automated and objective methods of biomechanical gait assessment. This allows for reassurance of the structural quality and longevity of the future breeding sow which could lead to reduced replacement rates and fewer sows being culled for leg problems.
2. The same strategy could also allow breeding companies to apply selection criteria to improve leg soundness of slaughter generation pigs - fewer leg problems and reduced culls in the finishing herd would lead to improved growth rates and so greater annual meat output per sow.

**SUPERVISOR:** Jonathan Guy, Sandra Edwards and Garth Johnson

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**DATED:** 07/11/2013

**Notes from Seminar:**