Novel maternal traits affecting piglet survival

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Selection for hyperprolific sows:

- Increased litter size
- More piglets being born with reduced birth weight (Rutherford *et al*, 2013; Root *et al*, 2012)
- More intra-litter birth weight variation (Rutherford *et al*, 2013; Baxter *et al*, 2013)
- Increased crushing risk

Photo courtesy of E. Baxter (SRUC)

More than just low birth weight?

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- Low birth weight piglets may be:
  - Small for gestational age (SGA)
  - Intrauterine growth restricted/retarded (IUGR)

- IUGR piglets typically identified by birthweight

- However, birthweight does not indicate whether a piglet has been exposed to IUGR during development

- Chevaux *et al* 2010 developed scoring system for identifying IUGR piglets based on head morphology

Normal vs IUGR head shape

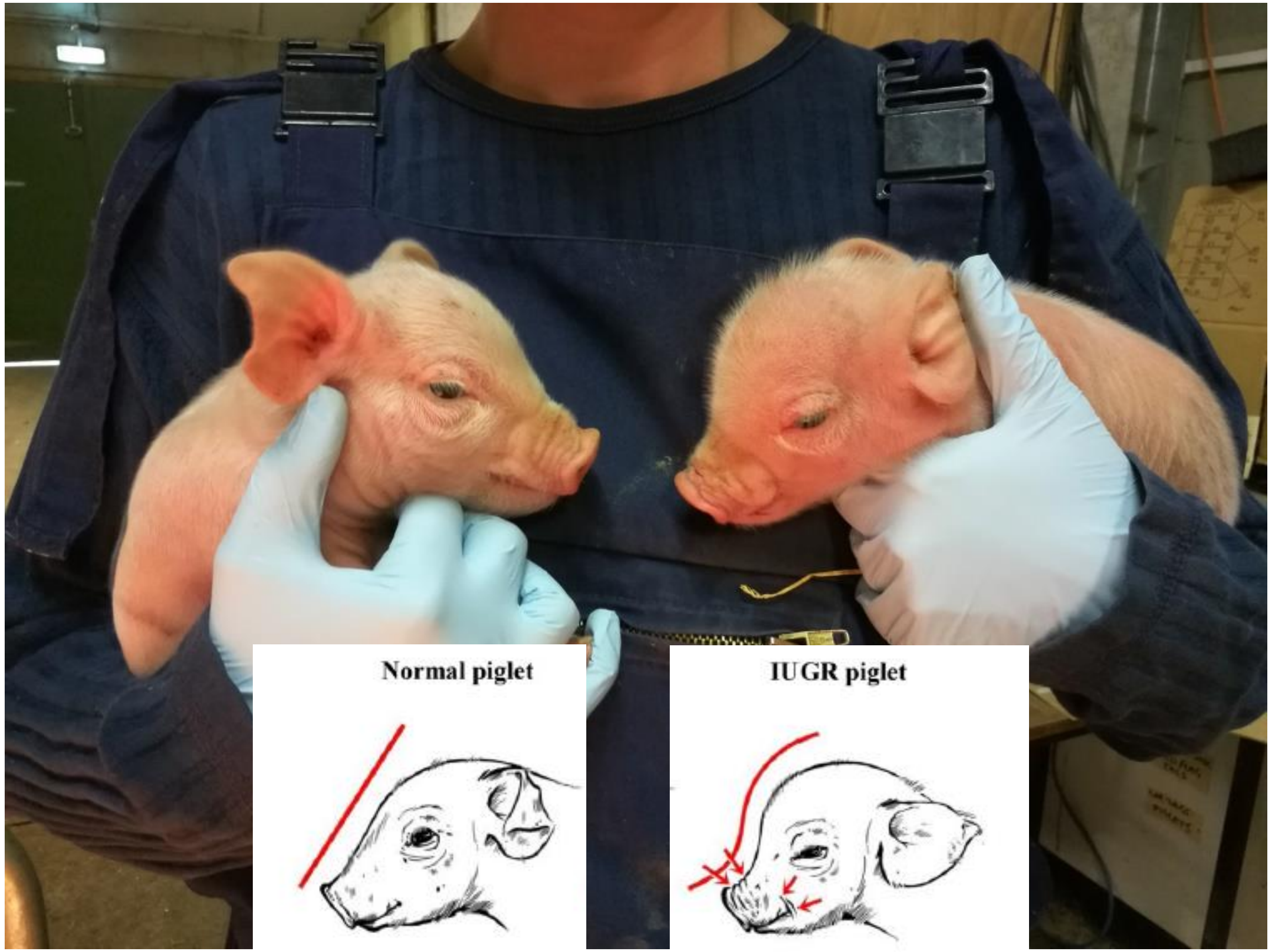
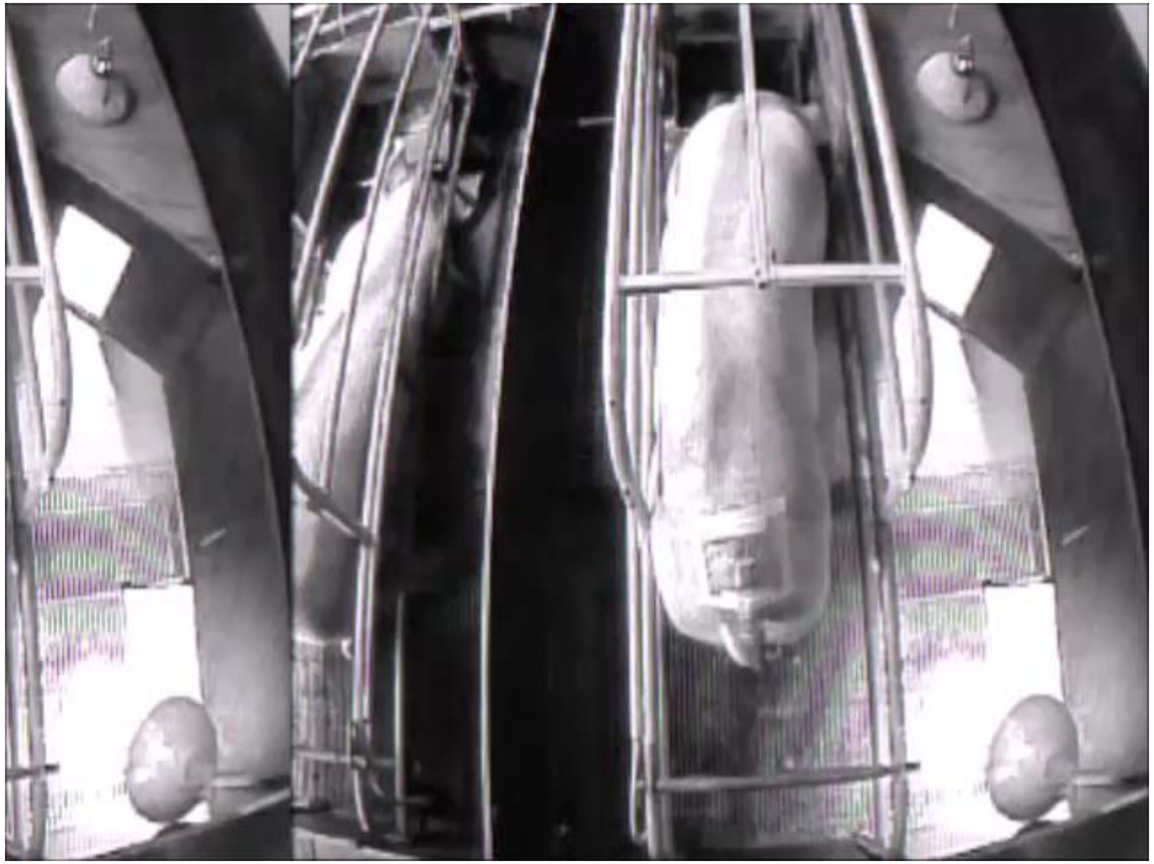


Photo courtesy of E. Baxter (SRUC)

IUGR illustration Hales *et al*, 2013

Posture change and crushing

- Characterise differences in lying quality
- Accelerometer traits – rump-mounted



Accelerometer traits

- Duration of transition
- Maximum acceleration
- Rate of change of acceleration (JERK)
- Range of acceleration
- Rate of pitch change

- Rate of roll change

Data collection

- Data collection over 52 weeks
  - JSR multiplier herd (2015-2016)
- 1,575 farrowings (862 individual sows; 21,159 piglets)

For each litter	Subset of litters
Proportion IUGR	Proportion crushed – Birth-processing
Proportion SURV (processing)	Proportion crushed – Processing-weaning
av BWT	Accelerometer traits – Downward transitions
sd BWT	Accelerometer traits – Sideways transitions
Littersize	

Results - Proportion of IUGR in a litter

	IUGR-PROP	avBWT	sdBWT	Littersize	SURV-PROP
IUGR-PROP	**0.20** ± 0.05	-0.68 ± 0.01	0.27 ± 0.02	0.38 ± 0.02	-0.20 ± 0.02
avBWT	-0.90 ± 0.06	**0.33** ± 0.07	-0.07 ± 0.03	-0.60 ± 0.02	0.27 ± 0.02
sdBWT	-0.29 ± 0.24	0.60 ± 0.18	**0.12** ± 0.04	0.19 ± 0.03	-0.12 ± 0.03
Littersize	0.46 ± 0.20	-0.59 ± 0.15	-0.52 ± 0.29	**0.11** ± 0.05	-0.14 ±0.02
Surv-PROP	-0.80 ± 0.32	0.84 ± 0.29	0.53 ± 0.41	-0.62 ± 0.36	**0.04** ± 0.03
Repeatability	0.29 ± 0.03	0.33 ± 0.07	0.16 ± 0.04	0.24 ± 0.03	0.13 ± 0.04

Asreml model – parity !r ANIMAL ide.(ANIMAL)

IUGR Conclusions

- Piglet survival is phenotypically impaired by large litter size and low piglet birth weight (nothing new)

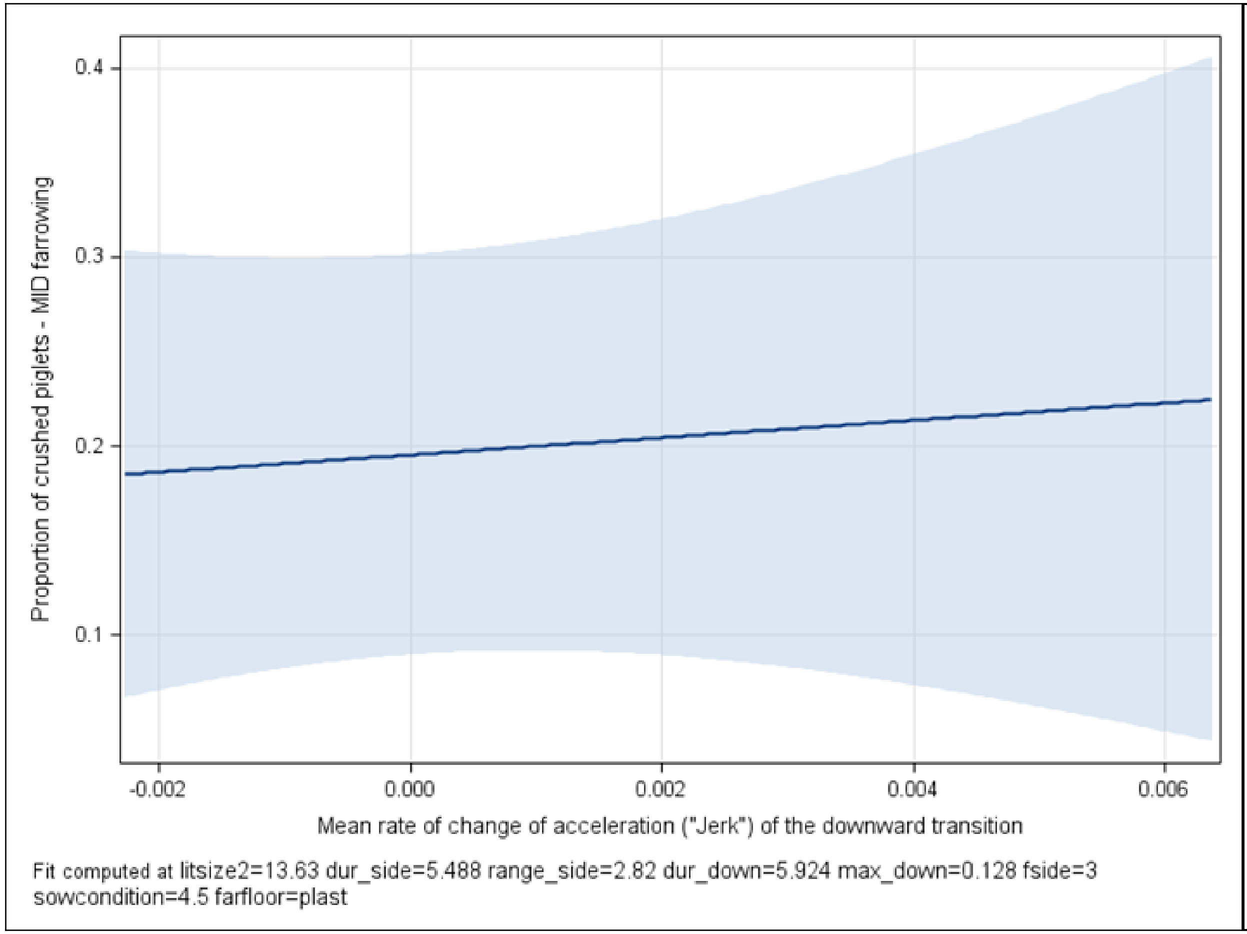
- IUGR has detrimental effects on survival – these are in addition to the influence of birth weight

- IUGR using head shape as a simple phenotypic marker is amenable to genetic selection
  - Selection at the **sow level** against IUGR could be highly effective in improving piglet survival

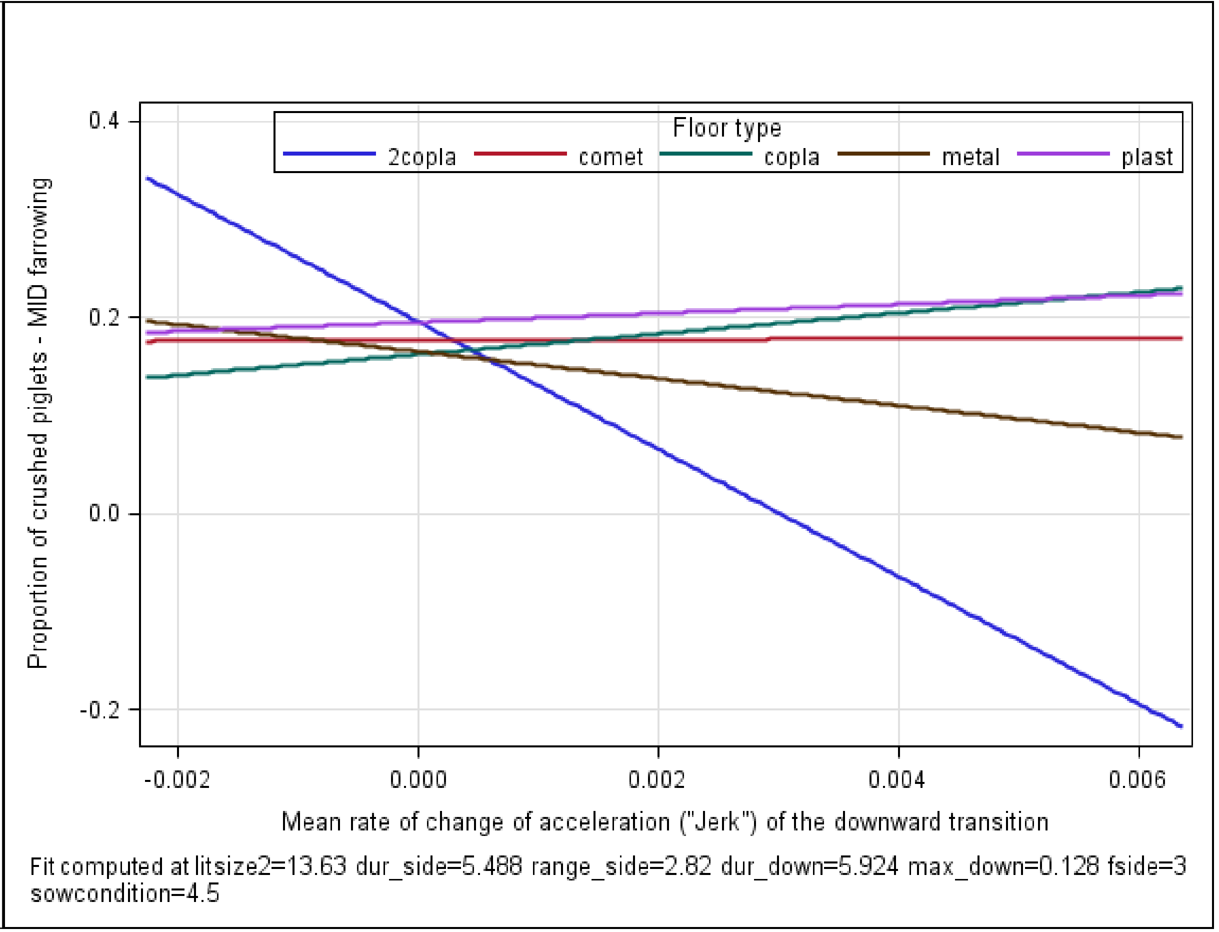
- Selection for lower proportion of IUGR in a litter has favourable genetic correlations with average birth weight and survival
  - However, the genetic correlation with litter size is unfavourable

Accelerometer traits and crushing – birth to processing

- JERK –
- downwards transition (P=0.02)

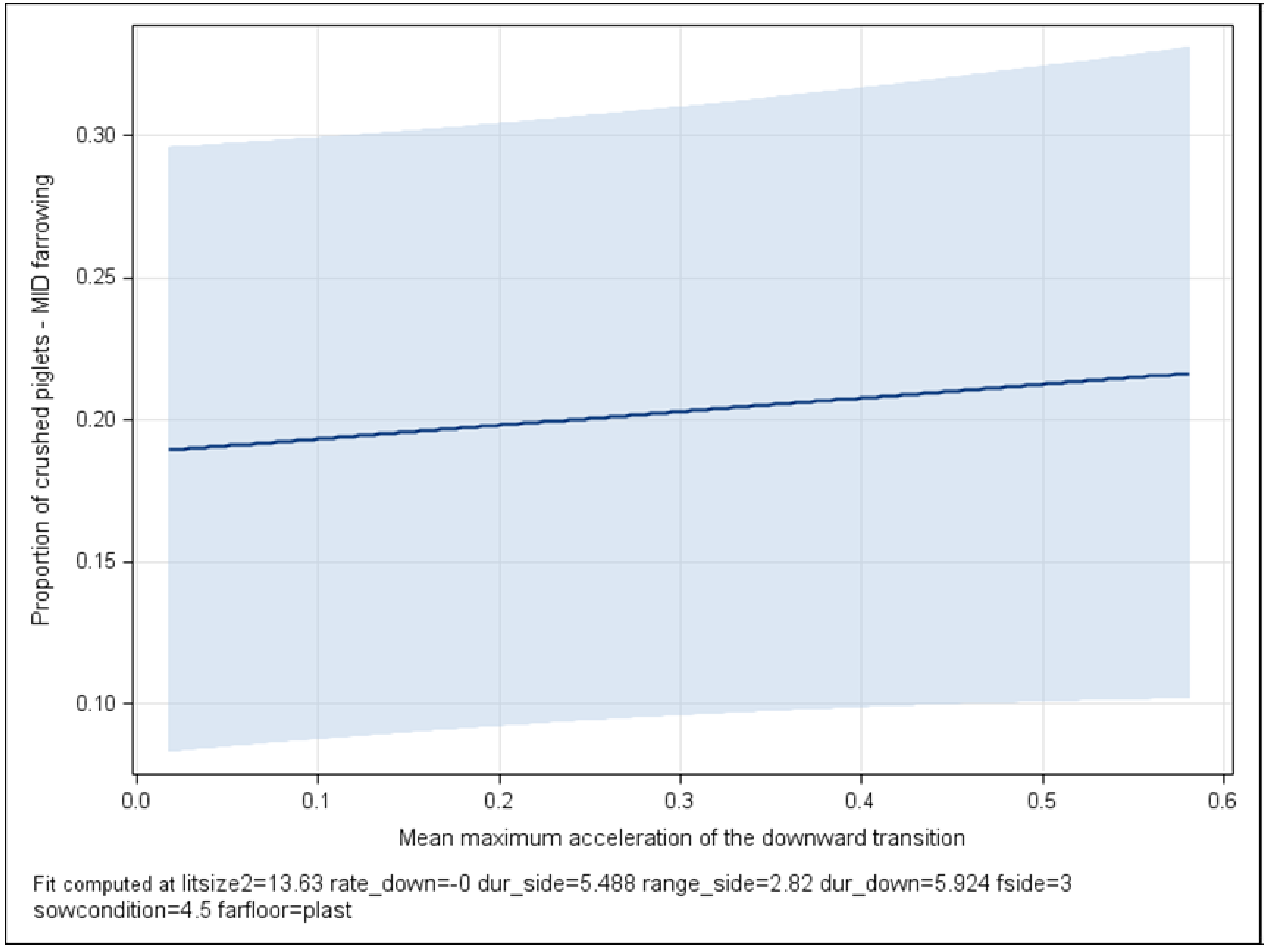


- JERK*FLOOR –
- downwards transition (P<0.001)

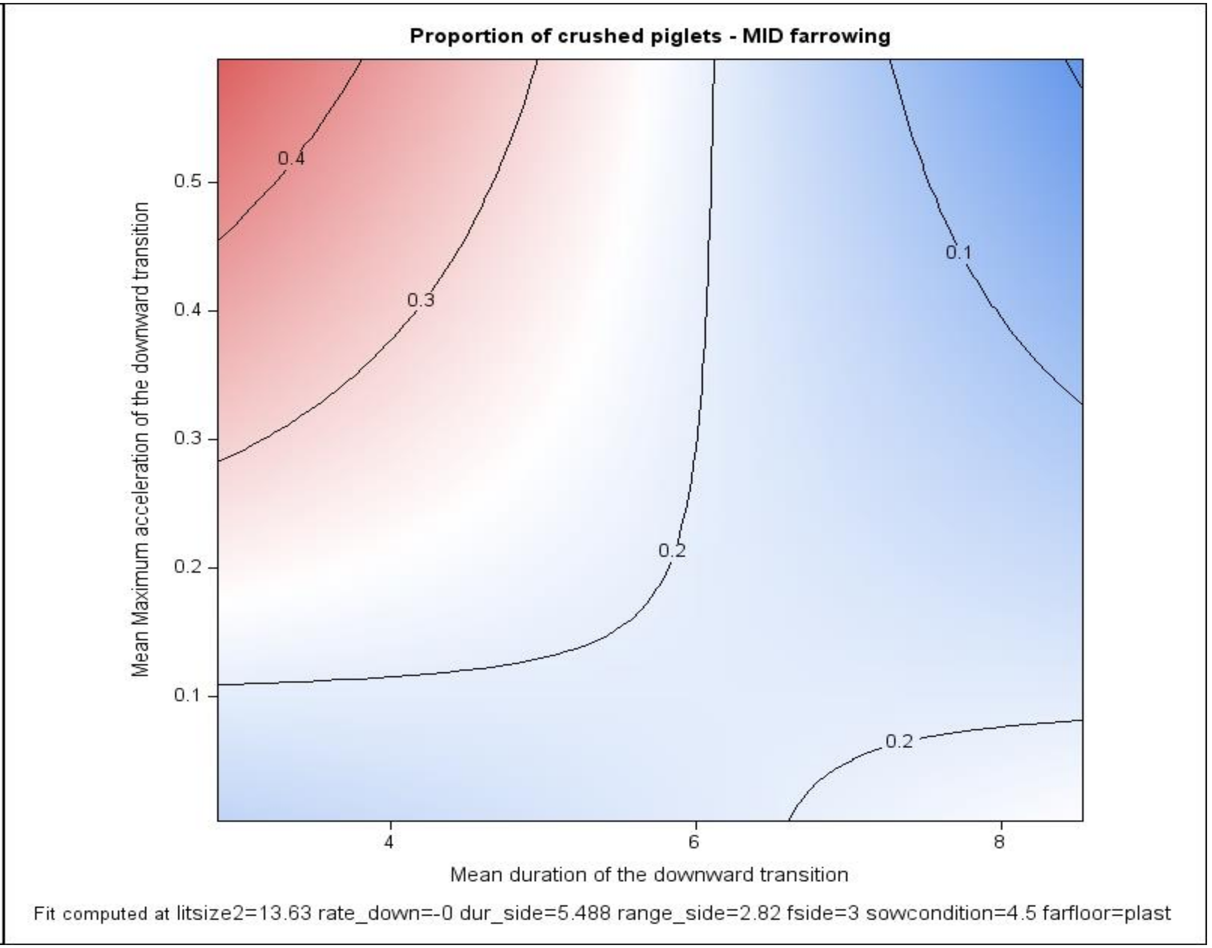


Accelerometer traits and crushing – birth to processing

- MAX Acceleration –
- downwards transition (P=0.03)



- MAX Acceleration*DURATION –
- downwards transition (P=0.04)

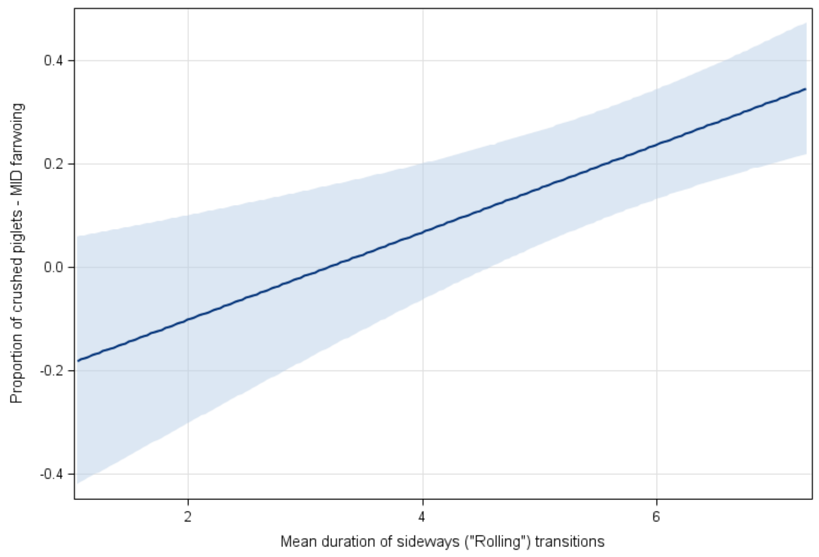


Accelerometer traits and crushing – birth to processing

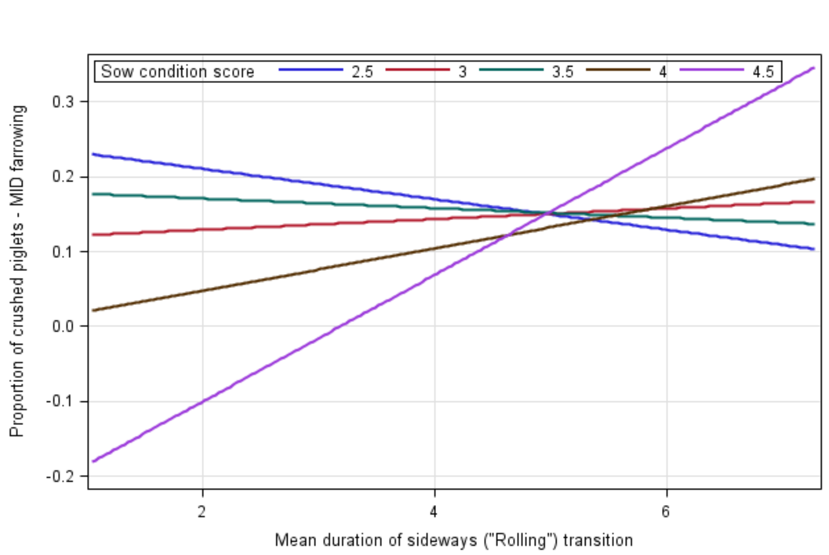
- DURATION –
- sideways transition (P=0.006)

- DURATION*Sow Condition –
- sideways transition (P=0.001)

- Range of acceleration –
- sideways transition (P=0.02)



Fit computed at litsize2=13.63 rate_down=-0 range_side=2.82 dur_down=5.924 max_down=0.128 fside=3 sowcondition=4.5 farfloor=plast



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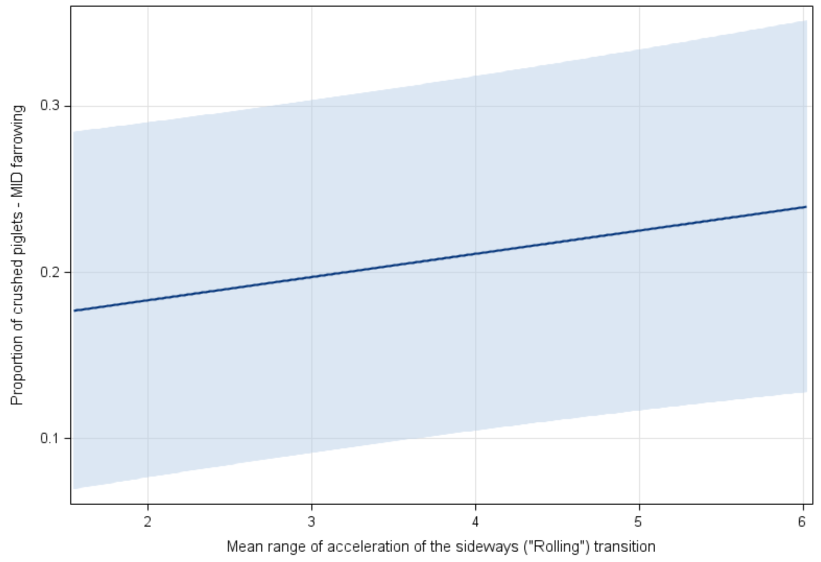
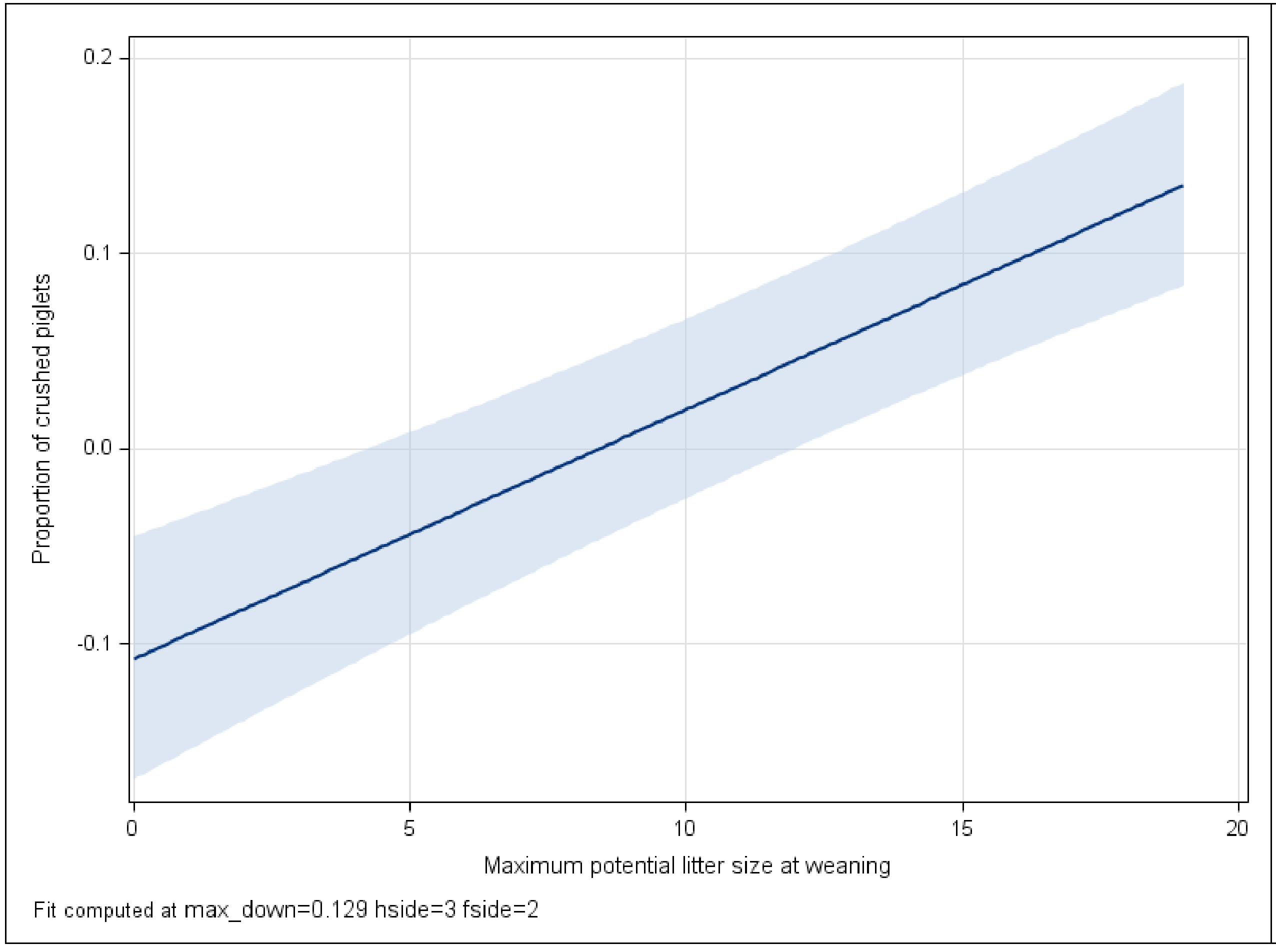


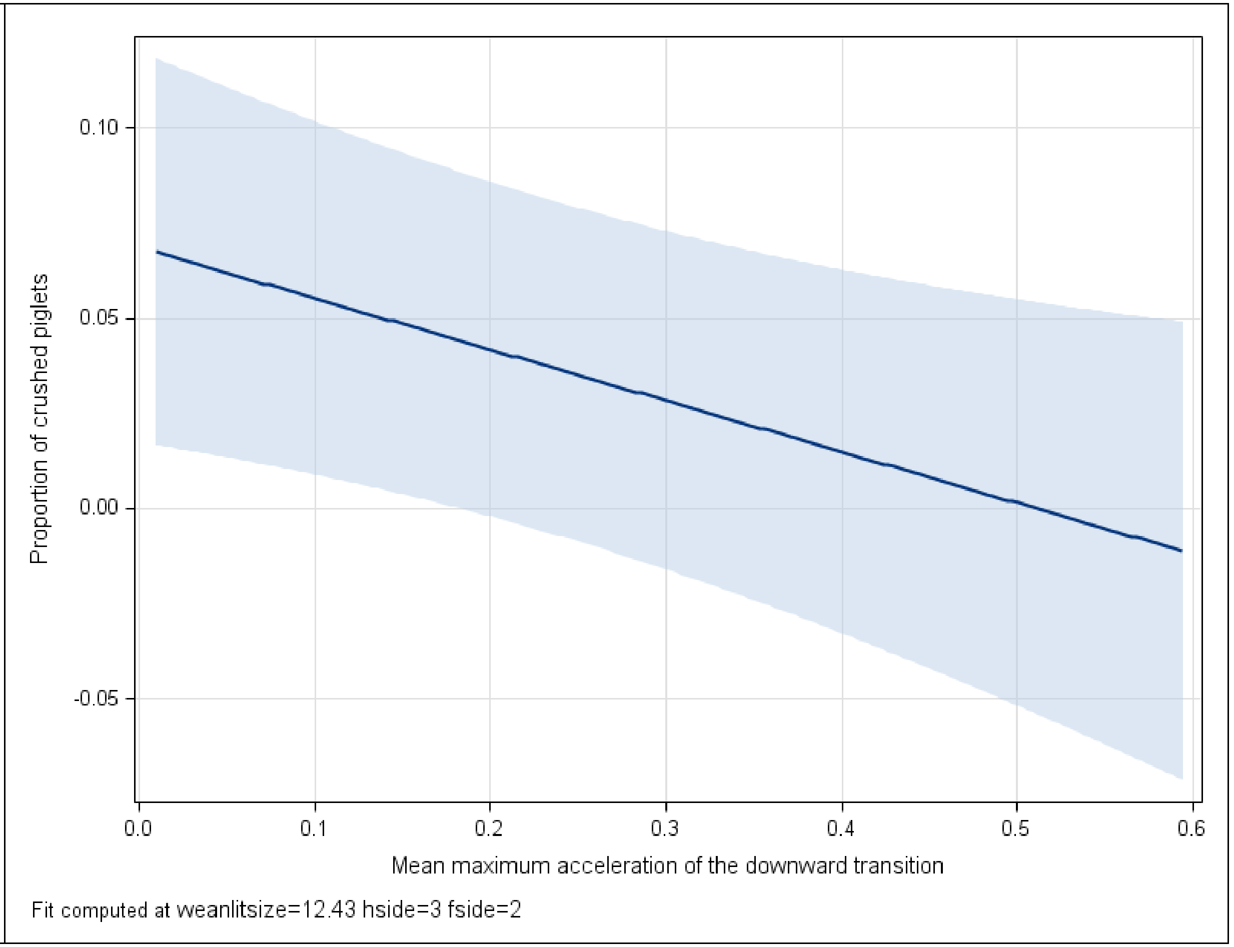
Fit computed at litsize2=13.63 rate_down=-0 dur_side=5.488 dur_down=5.924 max_down=0.128 fside=3 sowcondition=4.5 farfloor=plast

Accelerometer traits and crushing – processing to weaning

- Maximum littersize –
- downwards transition (P<0.001)

- MAX Acceleration –
- downwards transition (P=0.02)





Heritabilities – accelerometer traits

Birth – Processing		Processing - Weaning	
JERK downwards	0.007 ± 0.003		
MAX ACC downwards	0.052 ± 0.022	MAX ACC downwards	0.000 ± 0.000
DURATION downwards	0.004 ± 0.011		
DURATION sideways	0.015 ± 0.021		
RANGE ACC sideways	0.056 ± 0.021		

- Sow posture transition affects crushing both directly and in interaction with both other transition features and with sow body composition and environment
- Transition features do not appear to be particularly heritable in the subset of sows

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