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The use of precision monitoring in animal research

Precision monitoring (PM) in pig housing, health & welfare research

Animal Welfare Science Unit **Johannes Baumgartner, Christina Pfeiffer** April 23, 2026




Fotos: Stephanie Scholz/Vetmeduni, Michael Bernkopf/Vetmeduni, Thomas Suchanek/Vetmeduni, Niko Havranek/Vetmeduni

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Content

- Background
- Pig-Vetfarm Medau
- Precision monitoring in pig research
  - Pig housing & management
  - Pig behaviour, health & welfare
  - Transport and slaughter
  - Inside aWish – validation tail length algorithm

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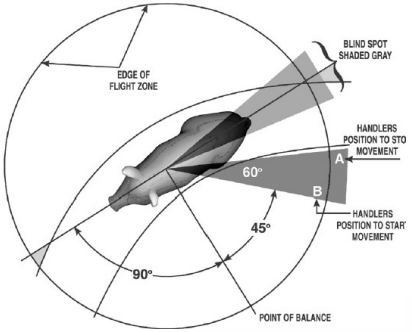
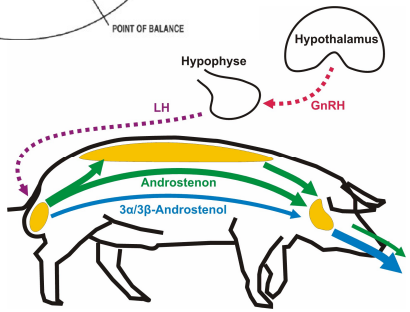
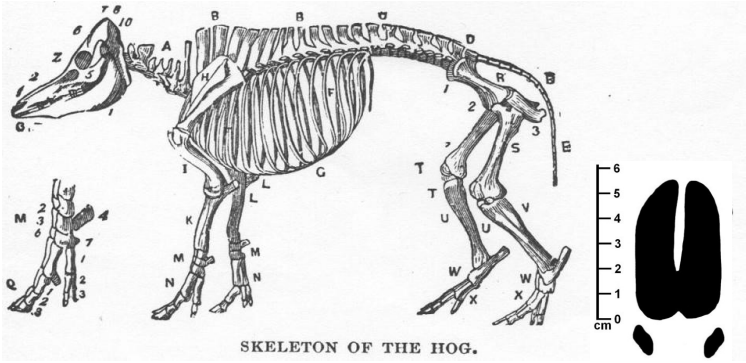
Pig Biology [Repetition]

Wild boar

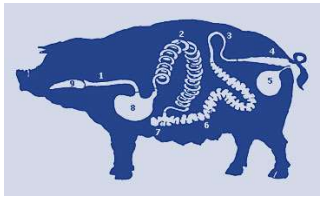




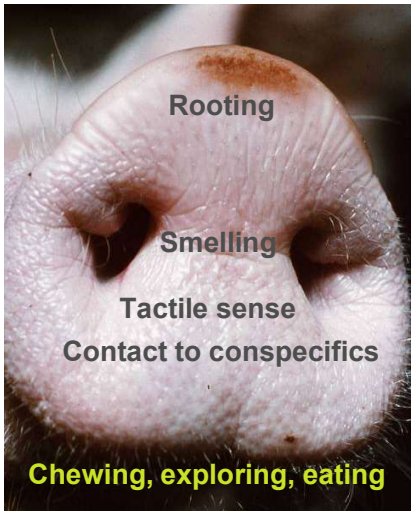
Ungulates



monogastric



omnivor



Behaviour

COMPASSION in world farming

- Live in stable social groups
- Establish a dominance hierarchy
- Rest together
- Spend most time on foraging
- Destinct between lying and dunging area
- Thermoregulate by swallowing and huddling

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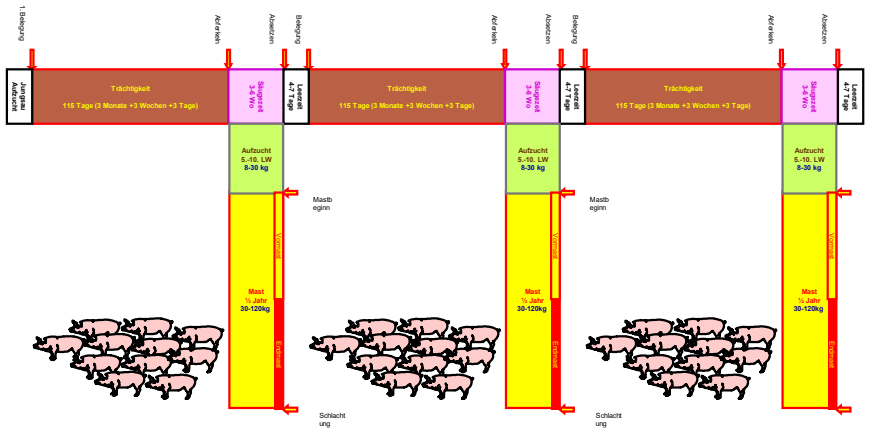
Complex Pig Produktion System



3-Wochen-Rhythmus mit 4 Wochen Säugeperiode

Woche / Gruppe	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
I		G			A	B				T													G			A	B				T				T							G			A	B				T
II					G			A	B				T												G			A	B				T									G			A	B			
III								G			A	B				T												G			A	B				T									G				
IV										G			A	B					T												G			A	B				T											
V	T												G			A	B				T												G			A	B				T									
VI			T												G			A	B				T												G			A	B				T						
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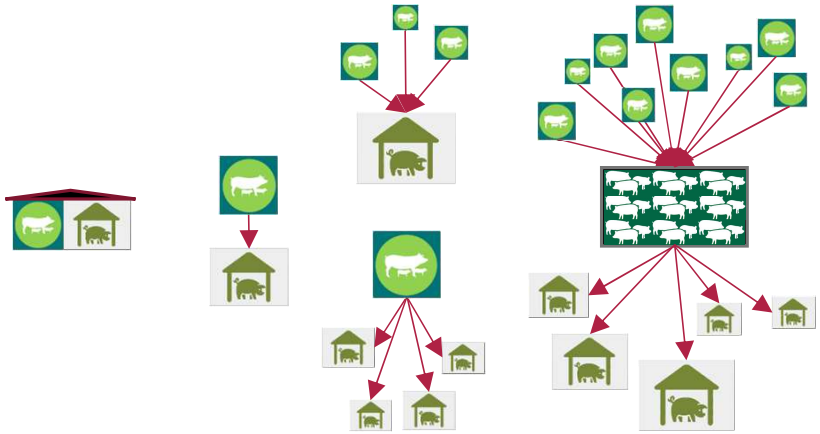

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Precision Livestock Farming (PLF)

Precision livestock farming (PLF) is the use of **sensors**, **data analytics**, and **automated systems** to **continuously monitor** and manage individual animals or groups in **real time**, with the goal of optimizing **productivity**, **health** and **welfare**, **resource use**, and **environmental impact**.

Crop production > cattle > poultry > pigs | conventional > organic



Berckmans et .al, 2003

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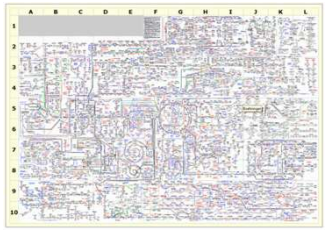
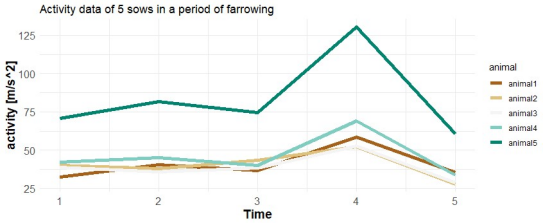
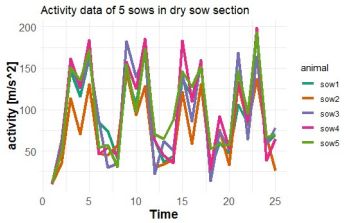
Living organism = CITD – system (Oczak)

Complex | **I**ndividual | **T**ime-varying | **D**ynamic







- Observation and classifying is time consuming and stupid work, prone to errors and hard to interprete
- ➢ Automated 24/7 monitoring instead of anectotic human observation
- ➢ But loss of empathy, a very efficient ability to judge the status of animals
- ✓ Precision Monitoring will be standard instrument in future animal-related research
- ✓ Use of PM in research differs from application in practical conditions

VetFarm$_{Pigs}$ Medau

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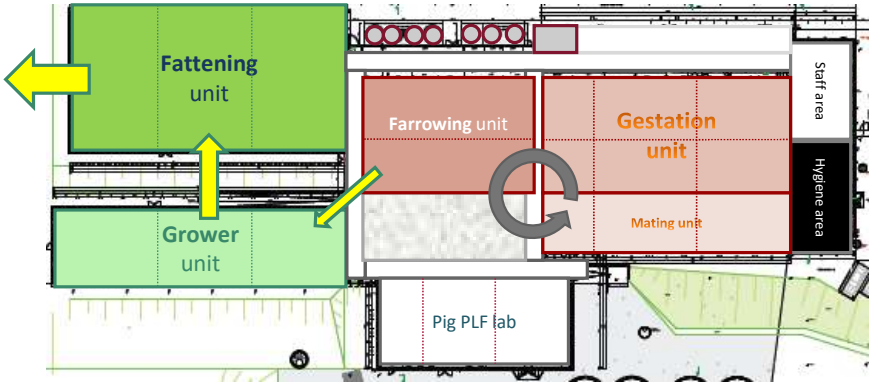
University of Veterinary Medicine, Vienna

- Research and teaching farm
- Built in 2013
- Permanent innovation
- Good pig welfare standard
- Solid floor + slurry system
- High **biosecurity** standard

- 100 LW sows + piglets
- High health herd
- Operated by 2.5 persons
- 5 week cycle, all-in-all-out
- Great flexibility in housing
- Separate pig research lab



Medau - Priorities

1. Teaching & research
2. Pig health & welfare
3. Biosecurity
4. Work quality
5. Economy

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VetFarm | Virtual Tour

PigView Virtual Roundtrip

http://www.pigview.eu

Username: pigviewer

Password: Medau16

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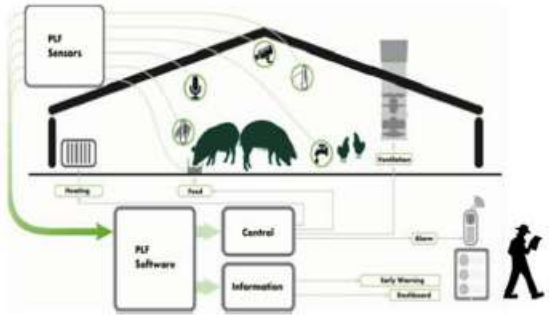
PLF topics in gestating sows

Production features

- Body condition monitoring
- Heat detection
- Pregnancy examination
- Feed and water intake
- Climate control
- …



Health & welfare monitoring

- Activity level
- Basic behaviours
- Aggressive behaviour
- Lameness
- Body temperature
- …

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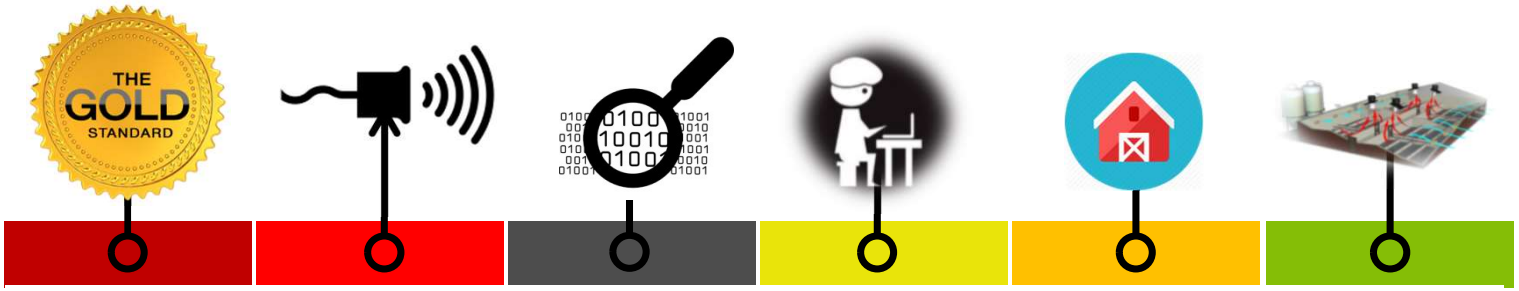
Development of PM/ PLF tools



Engineering

Animal Sciences

Behaviour

Housing

Feeding

Health

Human Animal Interaction

Welfare

Farm management

Signal processing

System identification

Image analysis

Mathematical modelling

System development

Technology development

Applied research

Basic research

Oczak

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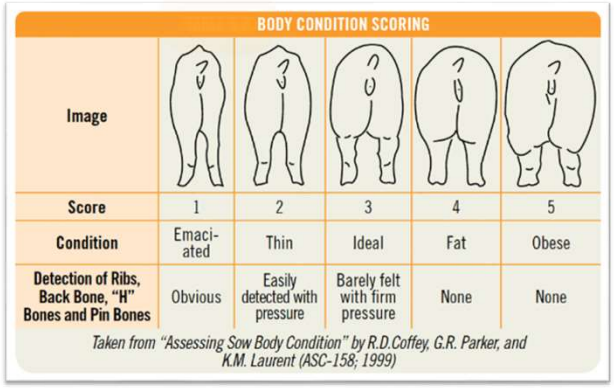
Project FEEDURA in VetFarm Medau

SCHAUER PERFECT FARMING SYSTEMS

Automated body condition monitoring

- Replace human BodyConditionScoring
- in Electronic Sow Feeder
- 24/7 computer vision approach
- definition of gold standard
  - (body weight, body length, body width, backfat thickness, muscle thickness and BSC)
- hardware setup

➢ continuous adjustment of feed curve



BODY CONDITION SCORING

Image					
Score	1	2	3	4	5
Condition	Emaci-ated	Thin	Ideal	Fat	Obese
Detection of Ribs, Back Bone, "H" Bones and Pin Bones	Obvious	Easily detected with pressure	Barely felt with firm pressure	None	None

Taken from "Assessing Sow Body Condition" by R.D.Coffey, G.R. Parker, and K.M. Laurent (ASC-158; 1999)

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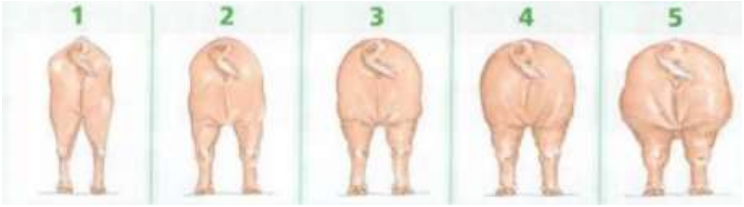
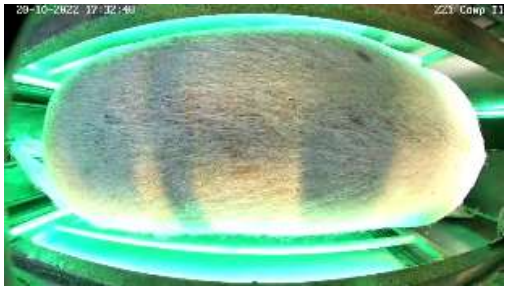
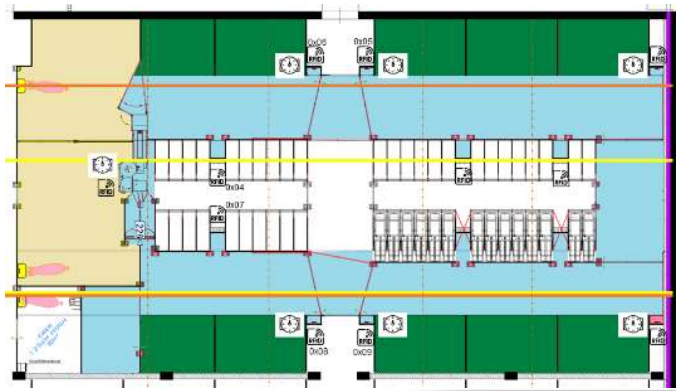
FEEDURA

Automated body condition monitoring







FFG Forschung wirkt.

SCHAUER PERFECT FARMING SYSTEMS

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Body Condition Monitoring

Data from 3 farms, 154 sows, 6863 feedings:

- Body weight:
  R^2= 0.924, MAE= 8.58 ± 7.7 kg
- Body length:
  R^2= 0.885, MAE= 3.0 ± 2.1 cm
- Backfat thickness:
  R^2= 0.549, MAE= 2.0 ± 4.2 cm

ANIMAL WELFARE SCIENCE

Video recordings – computer vision

Accelerometer - Smartbow ear tags

Monitoring of sow activity & behaviour

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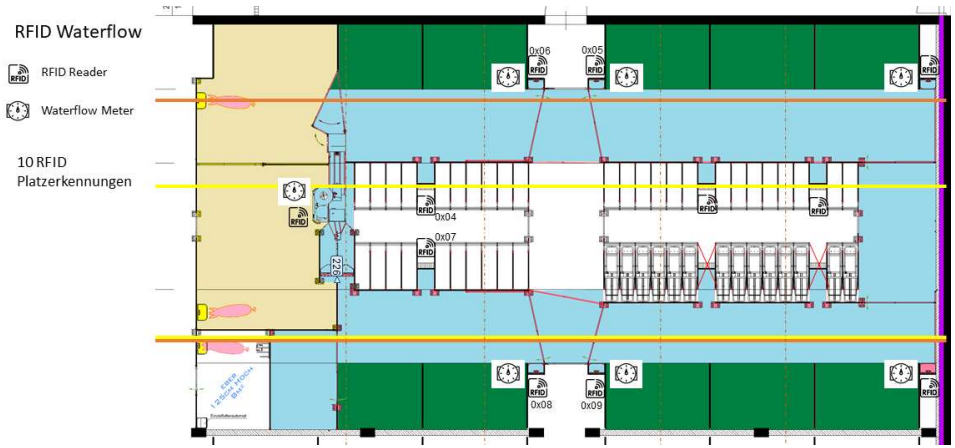
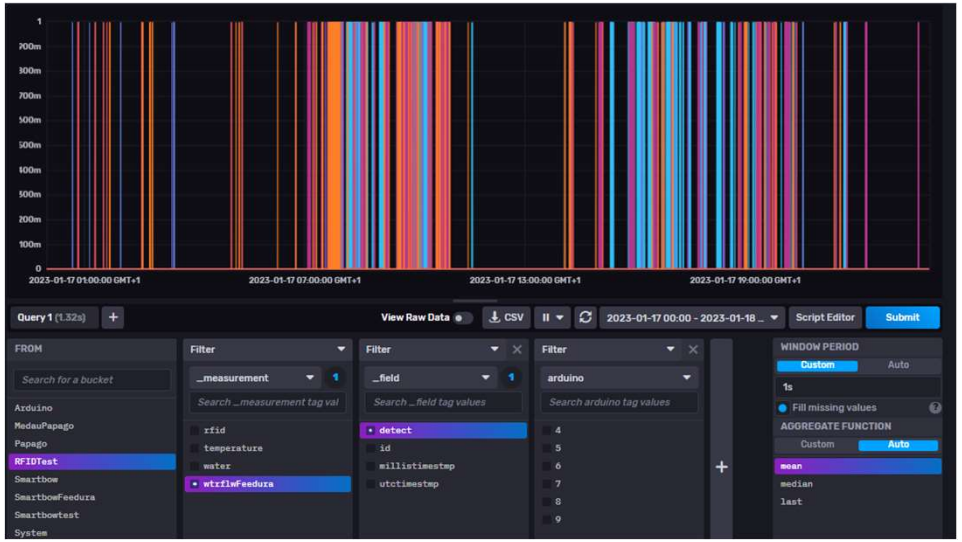


RFID network – drinkers & hay rags



SCHAUER
PERFECT FARMING SYSTEMS

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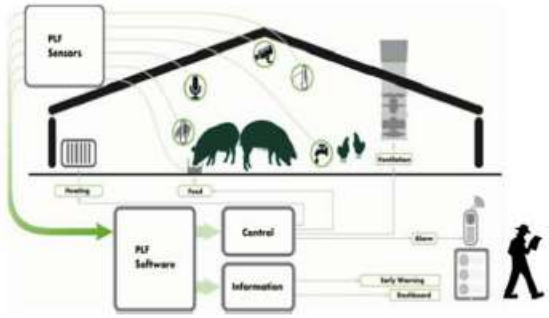
PLF topics in farrowing and lactating sows

Production features

- Farrowing prediction
- Farrowing monitoring
- Close and re-open of crate
- Feed and water intake
- Climate control
- …



Health & welfare monitoring

- Nest building behaviour
- Piglet crushing
- Body temperature
- Activity level
- Sholder ulcers
- …

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PLF in Farrowing Pen

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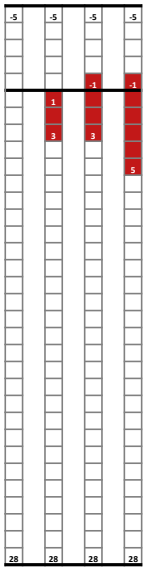
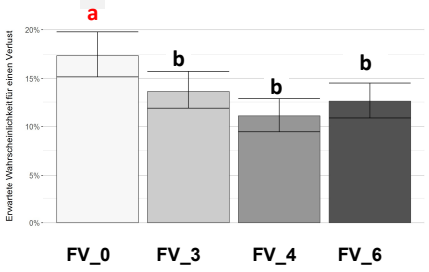
University of Veterinary Medicine, Vienna

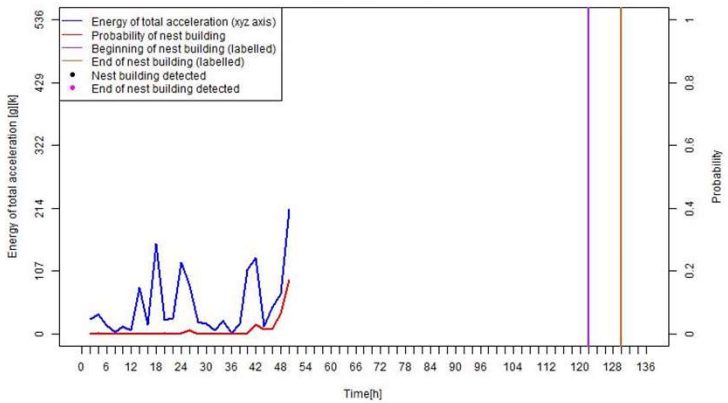
Pro-SAU

Temporary crating in farrowing pen

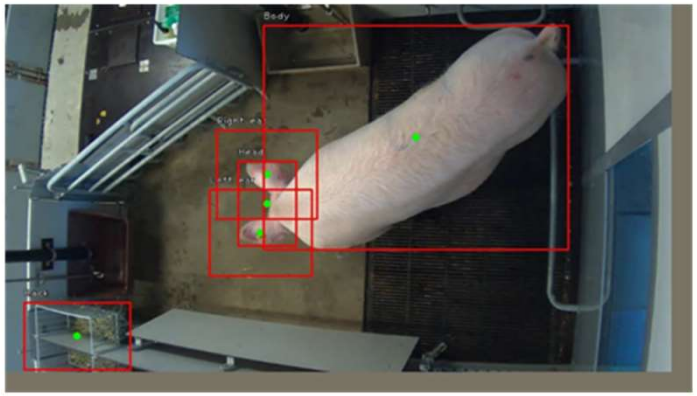


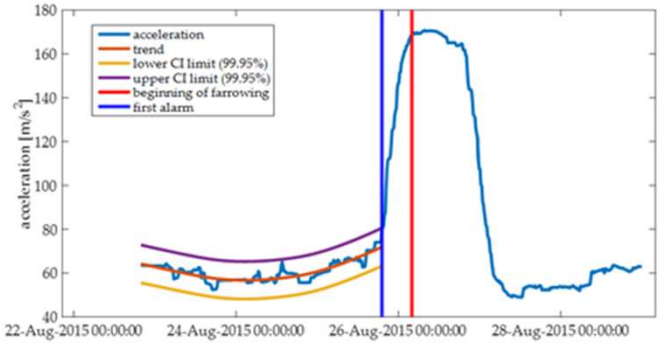


Nest-building: Acceleration



and Computer Vision approach





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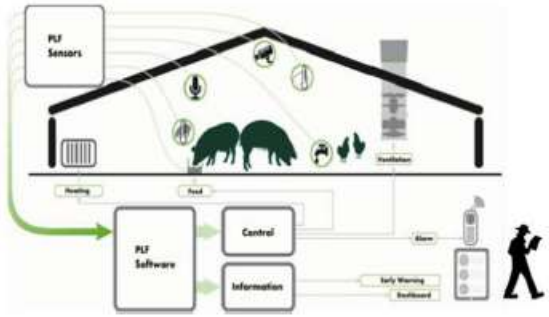
PLF topics in growing and fattening pigs

Production features

- Body weight monitoring
- Feed and water intake
- Climate control
- …



Health & welfare monitoring

- Coughing and sneezing
- Tail and ear biting
- Activity, basic behaviour
- Aggression
- Body temperature
- Transport
- Meat inspection

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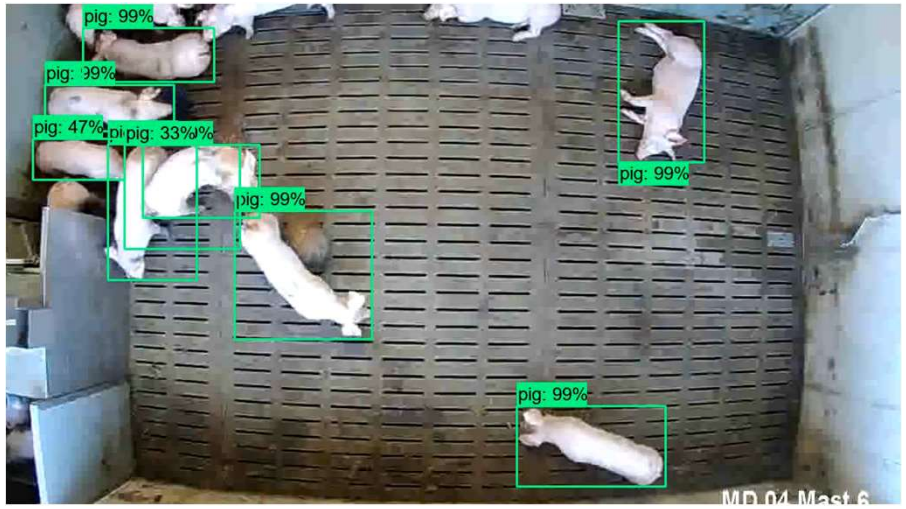
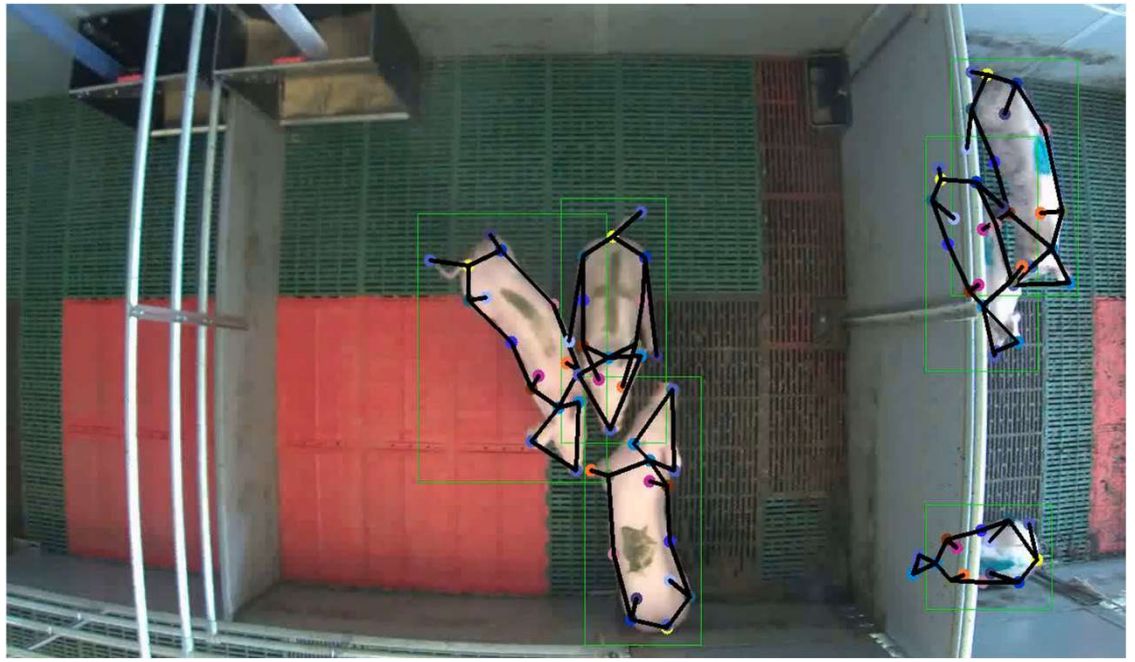
Objekt detection and tracking





(Oczak et al.)

PIG.AI: „**Early detection of tail biting**“ in collaboration with Austrian breeding company

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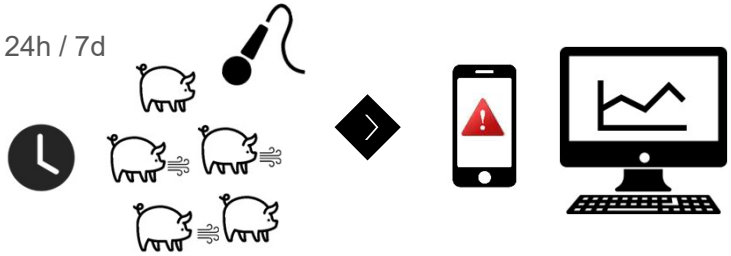
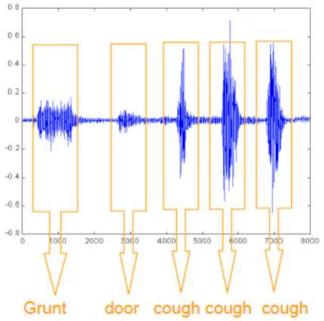
Pig Cough Monitor (PCM)

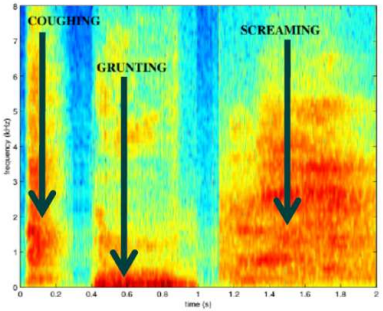
SoundTalks

1 micro per room records sound



Sound filters for coughing and sneezing of pigs





Detects respiratory disease 1 week before care taker +6,5 €/MP (SoundTalks)

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SoundTalks

Audio and video data recording and extraction

Vocalisations of piglets


Grunts


Screams


Squeals


Squeaks


Bleats

- **Behaviour** of individual pigs
  - agonistic actions (e.g. head knocks, biting, etc.)
  - social interactions (fighting / social play)
  - playing
  - compfort behaviour
  - basic activities (lying, sitting, active)
- Group-level behaviour including
  - no. of agonistic actions per time
  - duration social interactions (fighting / playing)
- Automatic detection of group activity via algorithm

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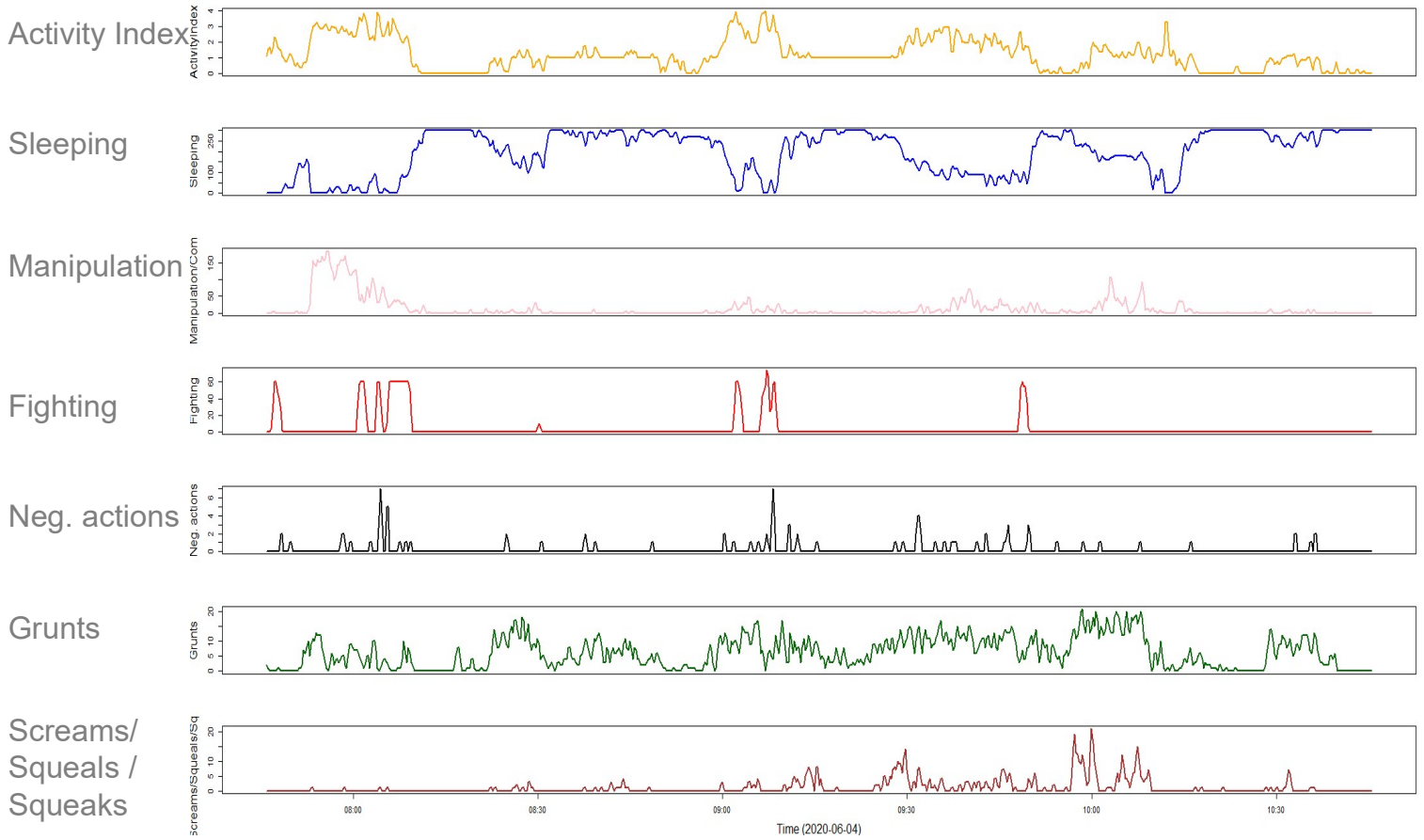
Extracted audio & video data over 3 hours



PILOT 5: OVERVIEW TECHNOLOGIES

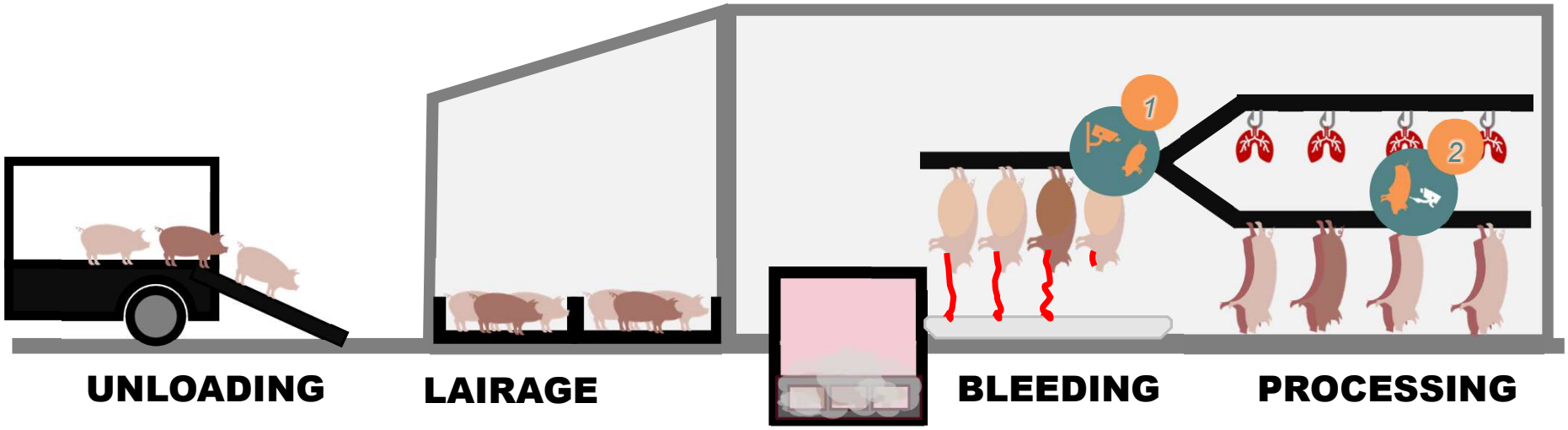


Figure based on NVWA figure (Sensortechnology at the slaughterhouse)

NEW

1 **PigInspector (CLK GmbH)**

2 **CLASSPRO OPTISCAN TP - pH (probe) + Meat Classification (camera scan)**

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Validation study on automatic tail length assessment in fattening pigs

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aWISH

Introduction

The pig tail as an iceberg indicator

Tail length captures the history:

- **Tail biting** (multifactorial, complex problem)
  - Stumpy tails, uneven length across batches

- Tail docking (procedure to reduce the risk of tail biting)
  - Routine **tail-docking** is prohibited in the EU

- On-farm assessment is extremely time consuming and expensive and not objective
- Large-scale automated monitoring in slaughterhouses

vetmeduni/Bernkopf

vetmeduni

aWISH

Aim

Measure tail length post-mortem

The development and validation of a **computer vision-based algorithm** to measure **tail length** at the **slaughter chain.**

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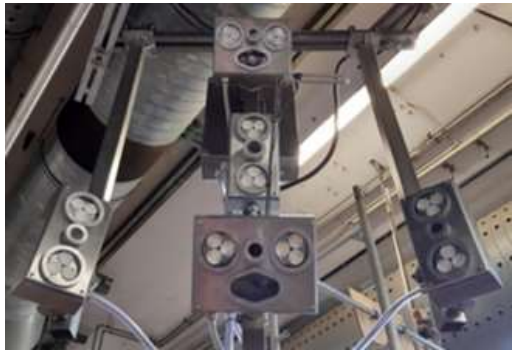
Material and methods

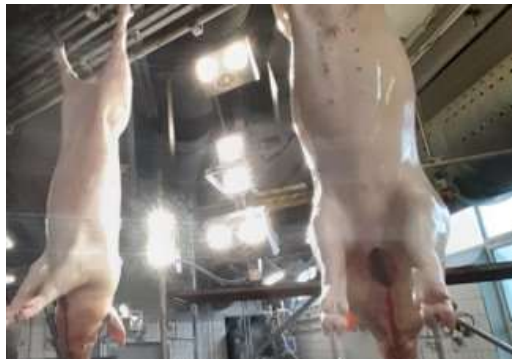
Technical set up

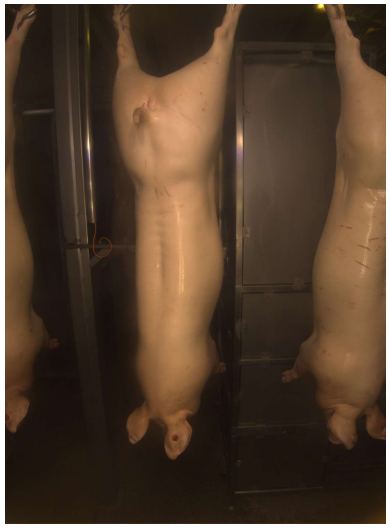
CLK GmbH
Bildverarbeitung & Robotik

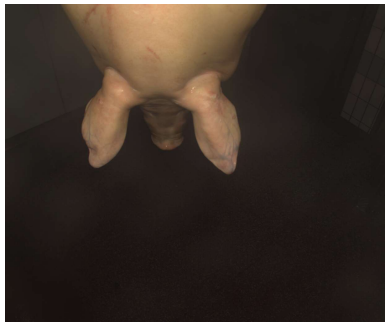
aWISH

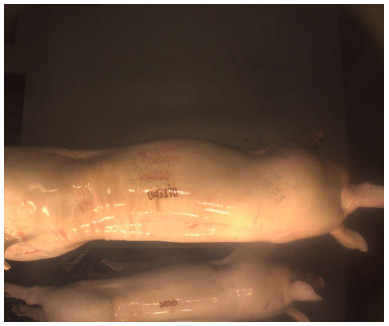
- Stereo 3D camera
- Five/three images per carcass
- Upstream of the decontamination area











Source:
CLK GmbH

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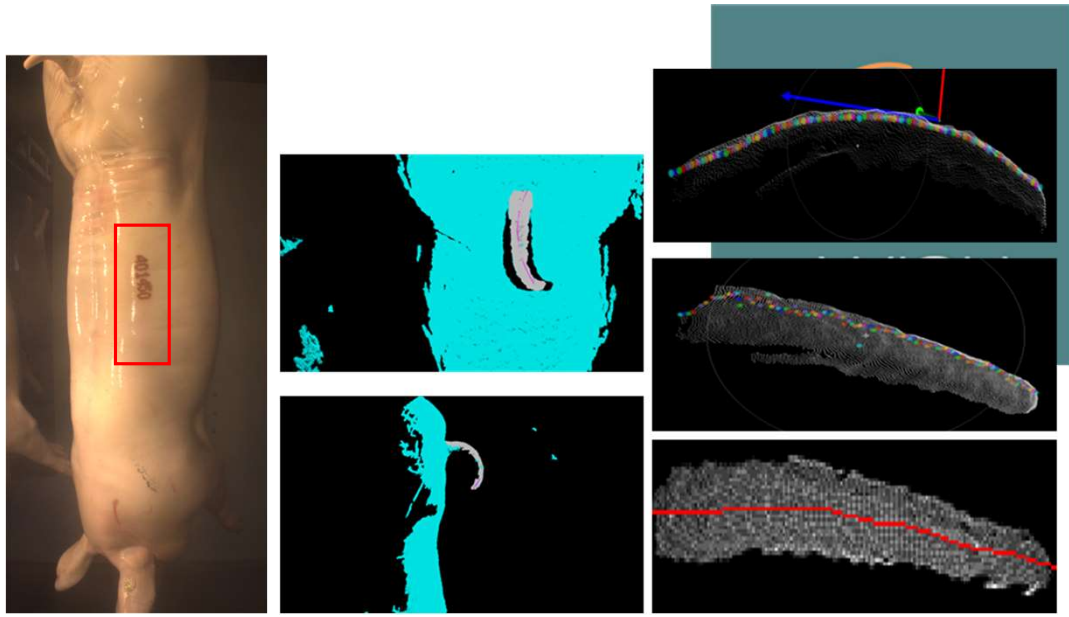
Material and methods

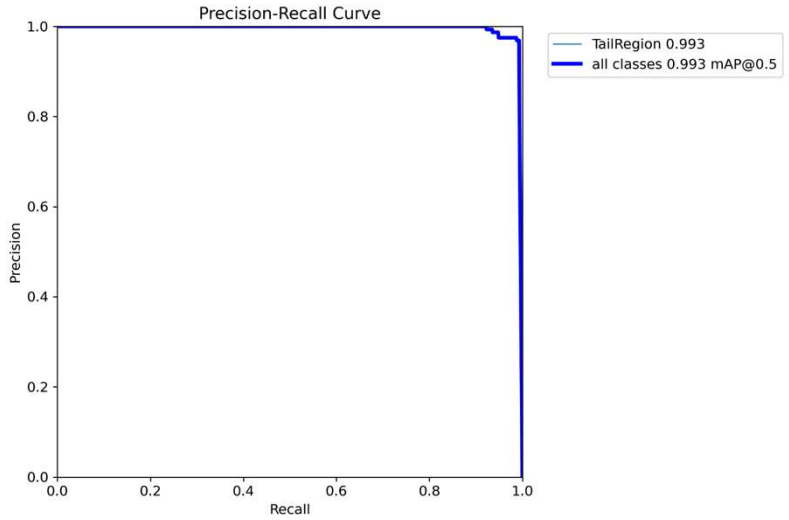
Algorithm development

- Application of an OCR – algorithm for individual animal identification

- Two step approach for tail length measurement
  - Segmentation model (Yolov8) applied to 3D images
  - Annotation of 1252 3D images (CVAT)
    - Training (876), validation (188) and test (188) data sets

  - Geometric length estimation
    - 3 different methods





Source:
CLK GmbH

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aWISH

Material and methods

Reference data

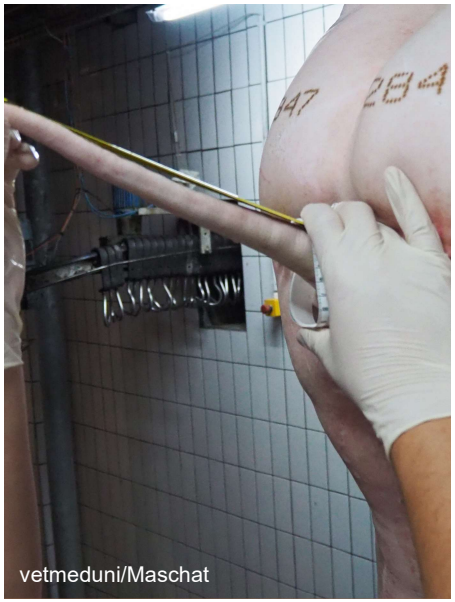
- Development of '*TailSizer*'

Internal validation

- Slaughterhouse Austria: 1,102 tails measured
  - 688 left for analysis

External validation

- Slaughterhouse Netherlands: 500 tails measured
  - 480 left for analysis



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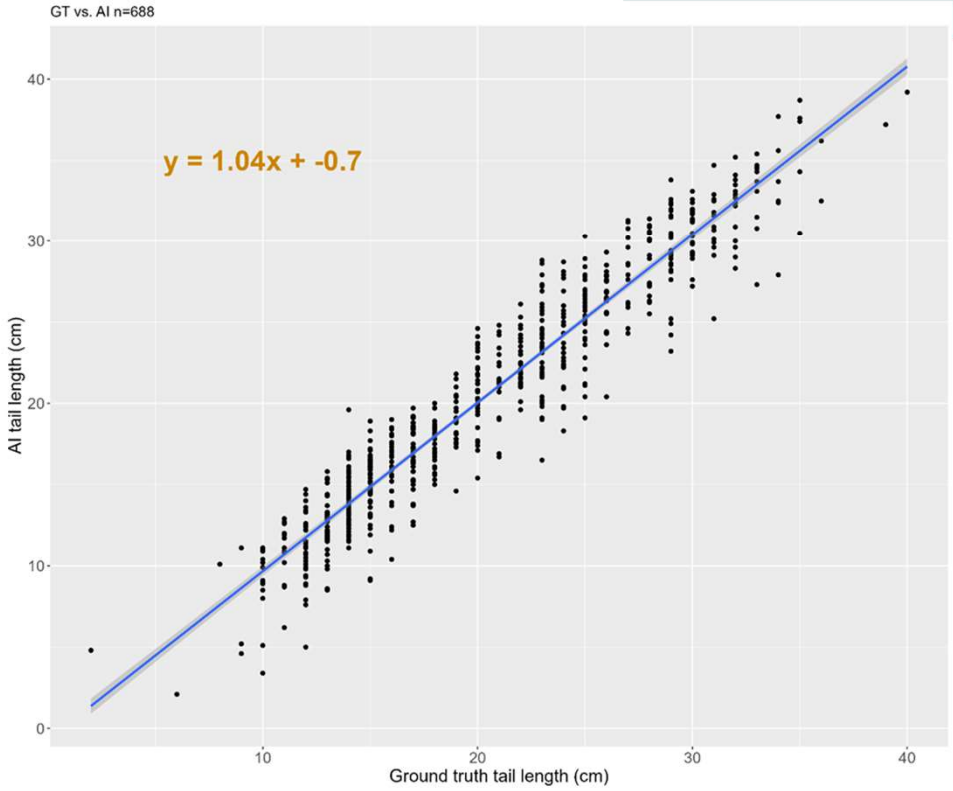
Results and discussion

Internal validation

	n	Mean ± SD	Median	Min-Max	Spearman Corr.	MAE
Tail Length (cm)	688	20.25 ± 6.56	20.0	2.00 - 40.0	0.96	1.67
PI AI (cm)	688	20.30 ± 7.12	19.5	2.10 - 39.2		



R^2=0.991 (p<0.001)

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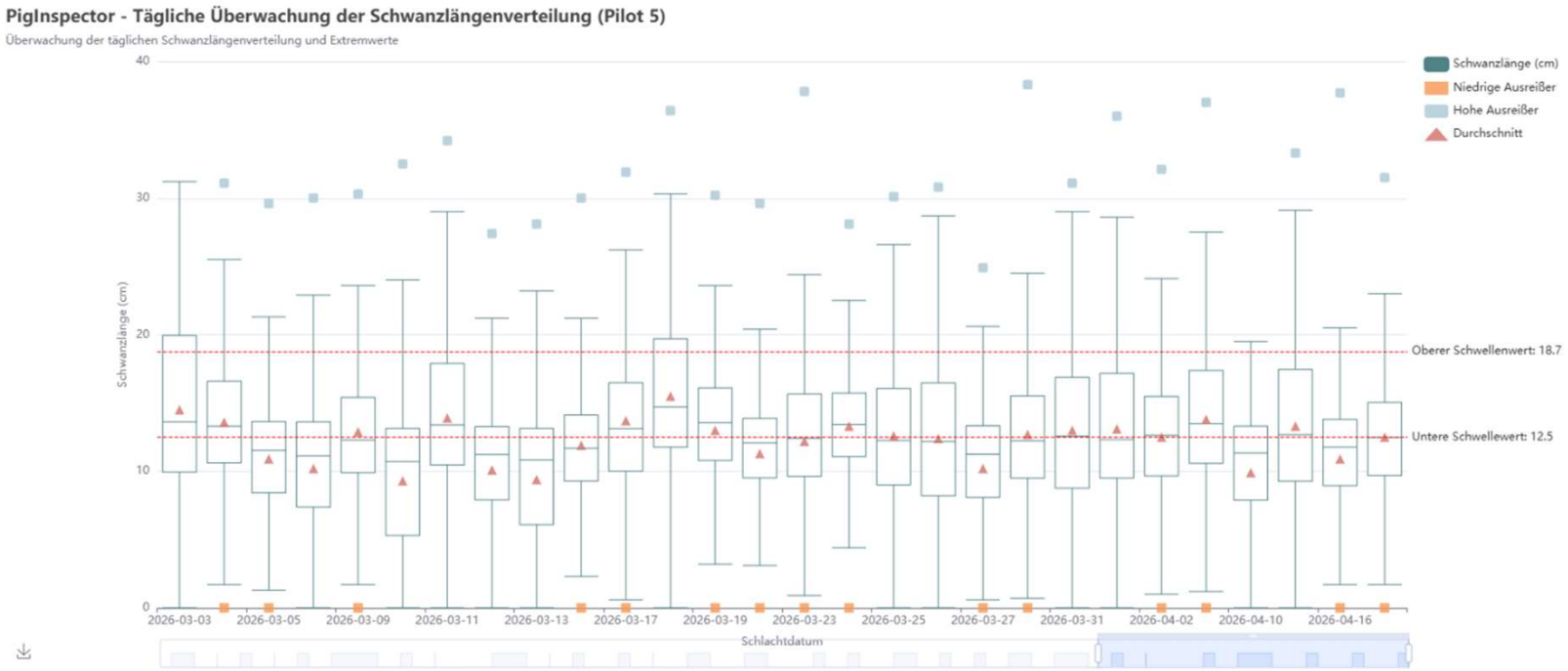
Results

Feedback on data platform – Slaughterhouse



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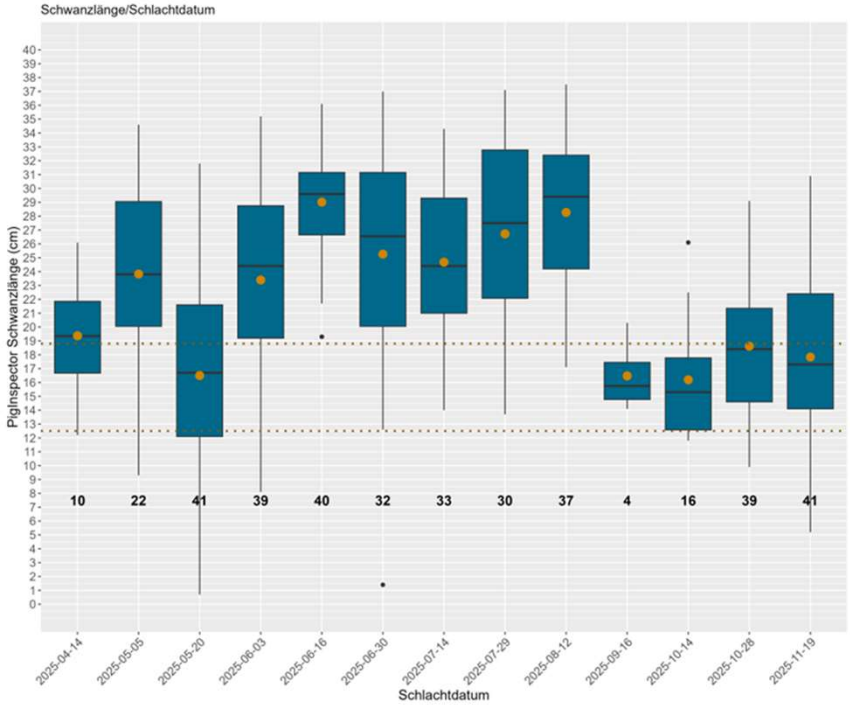
Results

Feedback on data platform – farmers



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Thank you for your attention!

Any questions?

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