ATB
Leibniz-Institut für Agrartechnik
Potsdam-Bornim e.V.

Monitoring the body temperature of cows and calves with a video-based infrared thermography camera

G. Hoffmann, M. Schmidt

Leibniz-Institute for Agricultural Engineering Potsdam-Bornim, Department of Engineering for Livestock Management, Potsdam, Germany

Leibniz-Gemeinschaft

Structure

- Introduction
- Material and methods
  - Experimental design
  - Video based infrared thermography camera (IRC)
- Results
- Discussion
- Conclusion

Introduction: background and problem

- Health problems are often accompanied by hyperthermia
- Measuring the rectal temperature requires direct contact with animals and is time consuming
- Thermometer type and insertion depth can have an effect on the temperature values
- Other technologies (e.g., rumen bolus or subcutaneous implant) are invasive

Introduction: aim

- The objective was to investigate if an infrared thermography camera is usable to detect the body temperature in cows and calves.
- The technologie should be non-invasive and suitable for installation on farms to measure daily the body temperature of every animal.

Material and methods: experimental design

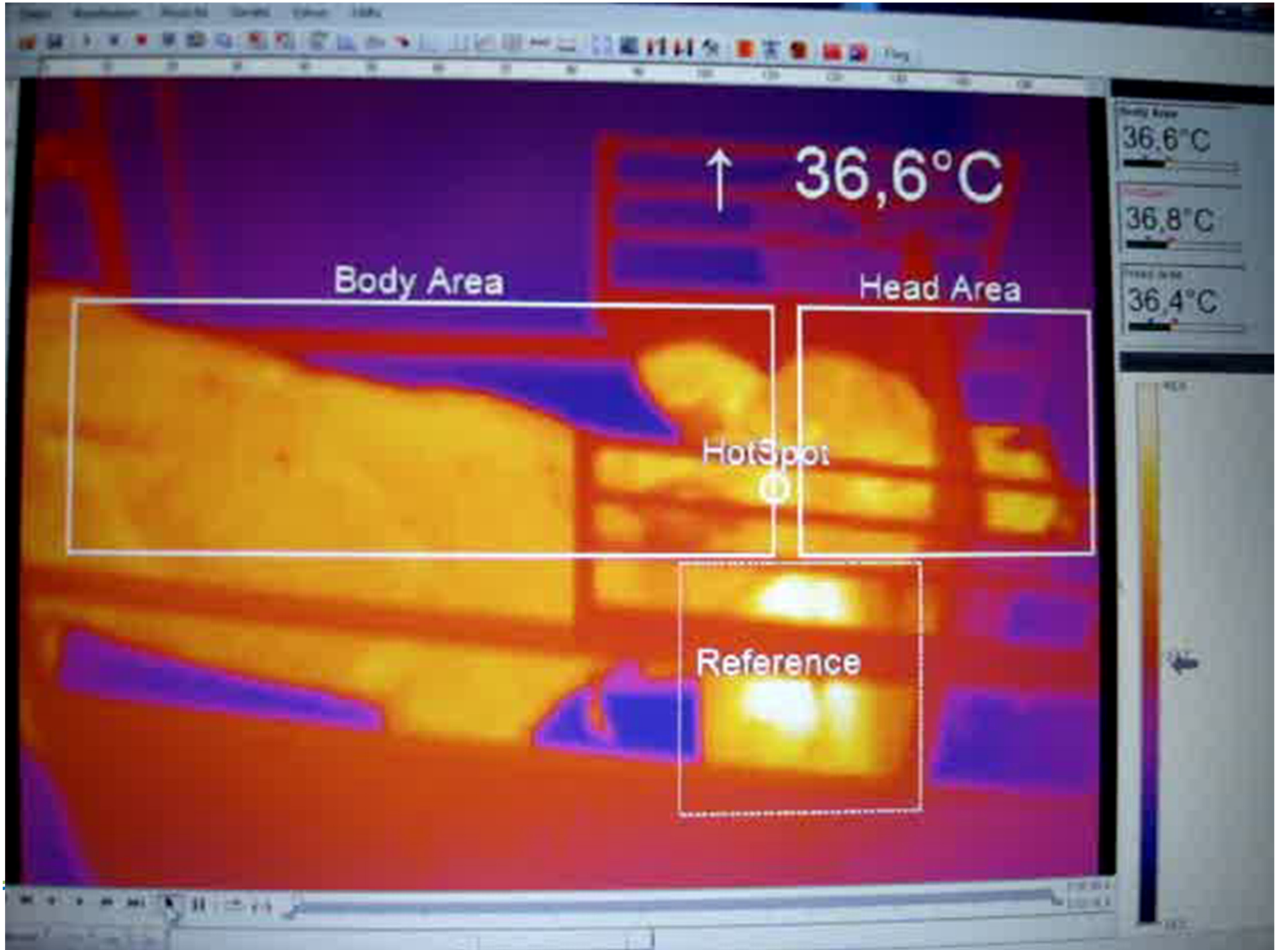
- Dairy farm located in Brandenburg (Germany)
- a total of 10 cows and 9 calves (German Holstein-Friesians)
- Camera was installed in front of an automatic milking system (cows) or sideways to an automatic calf feeder (calves)
- Camera recorded IR thermography videos (9 frames/second)
- Plate with preset temperature (40.0°C) used as reference
- Rectal temperature was measured with a digital thermometer

Method: Video based infrared thermography camera

- Infrared camera Optris® PI 160 (Optris, Berlin, Germany)
- Temperature range: -20 to 900°C (resolution of 0.1°C)
- Sensitivity: 0.08 K
- Resolution: 160 x 120 pixels
- Emissivity: 0.985
- Video clip duration: 8 - 16 min (cow) & 5 min (calves)

Thermography of the calves

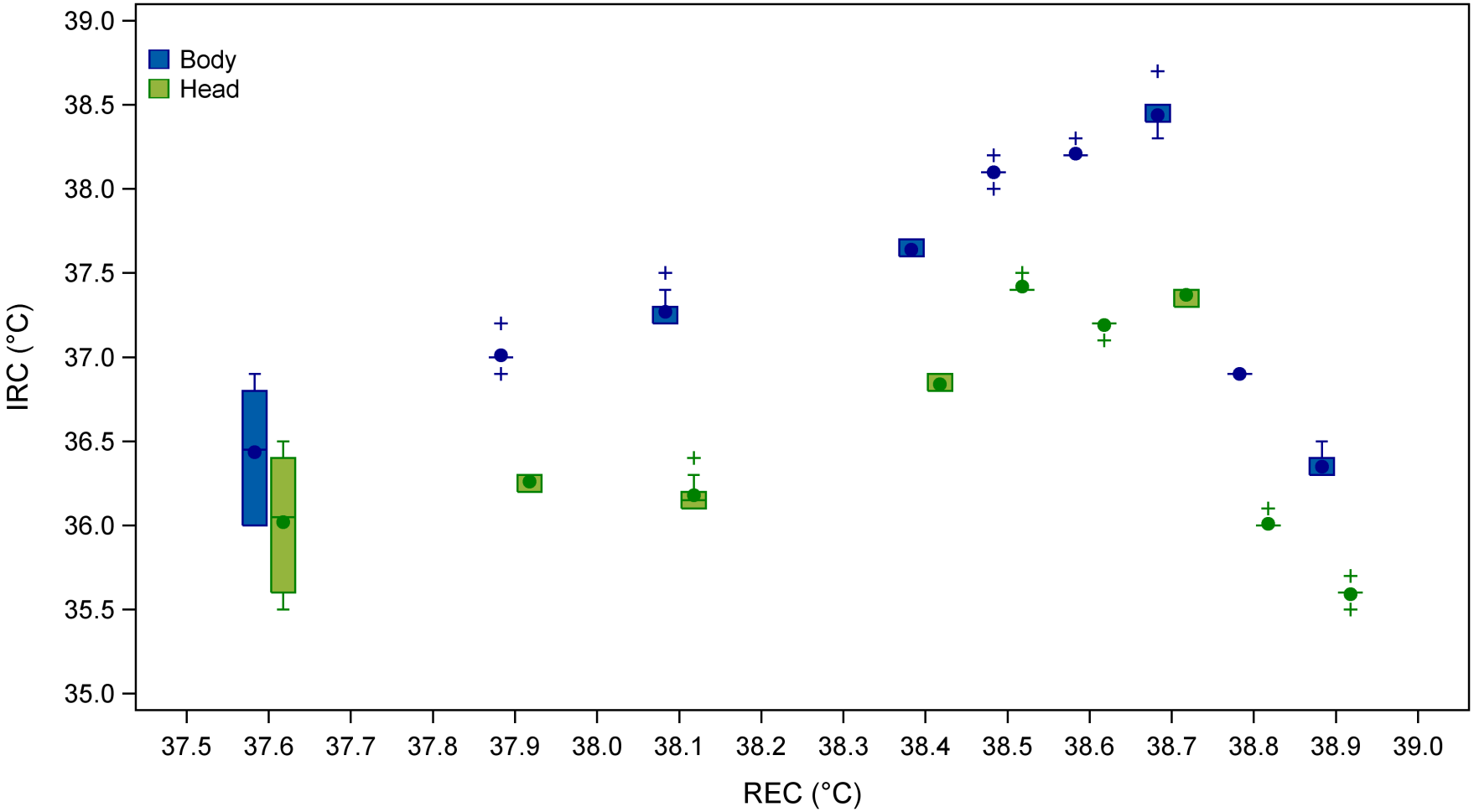
- 10 maximum temperatures per video clip were used for further statistical analysis (body and head area, respectively)


36,6°C
Body Area
Head Area
HotSpot
Reference
36,6°C
36,8°C
36,4°C

Results

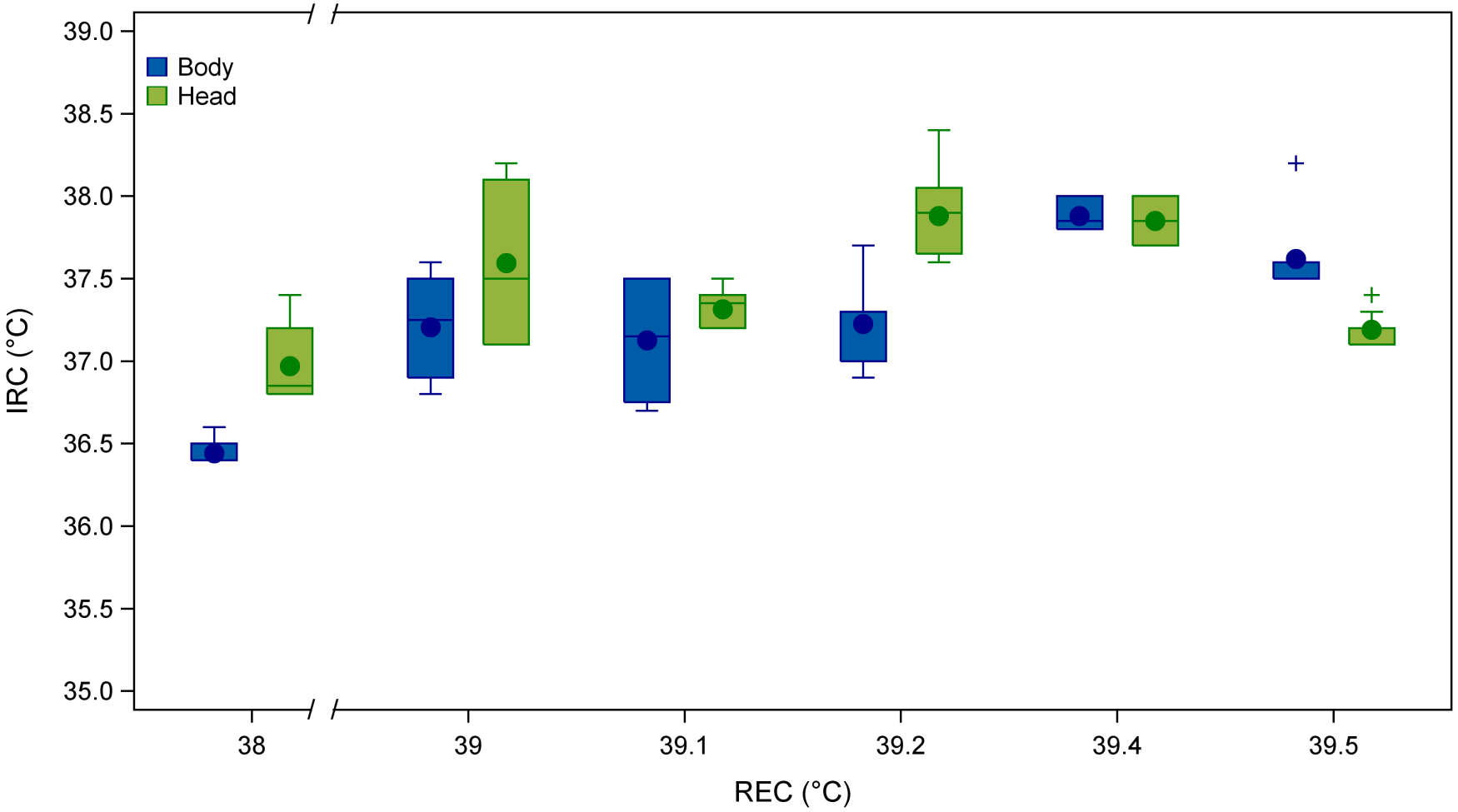
- Mean of the infrared temperature was always significantly lower than the corresponding rectal temperature
- Hot spots on the video clips were in most cases located at the back of the ear (body area) and at the eye region (head area)
- Maximum temp. of body area > max. temp. of head area in cows, and vice versa in calves
- Tendency recognisable for increasing IRC temperatures with increasing rectal temperatures

Results: cows



Rectal temperature (REC) and body surface temperature (IRC), measured at the head and body area of 10 cows

Results: calves



Rectal temperature (REC) and body surface temperature (IRC), measured at the head and body area of 9 calves

Discussion

- Other researchers also advocated the fixed position of an infrared camera and used the orbital region to detect hyperthermia and fever in calves (e.g., Schaefer et al., 2012).
- Measurements of previously used IR cameras were based on single images.
- The advantage of the video-based system used in the present study is the sampling of a large number of images in a short period of time.
- Method also seemed to be promising for temp. measurements in sows (Schmidt et al., 2013).

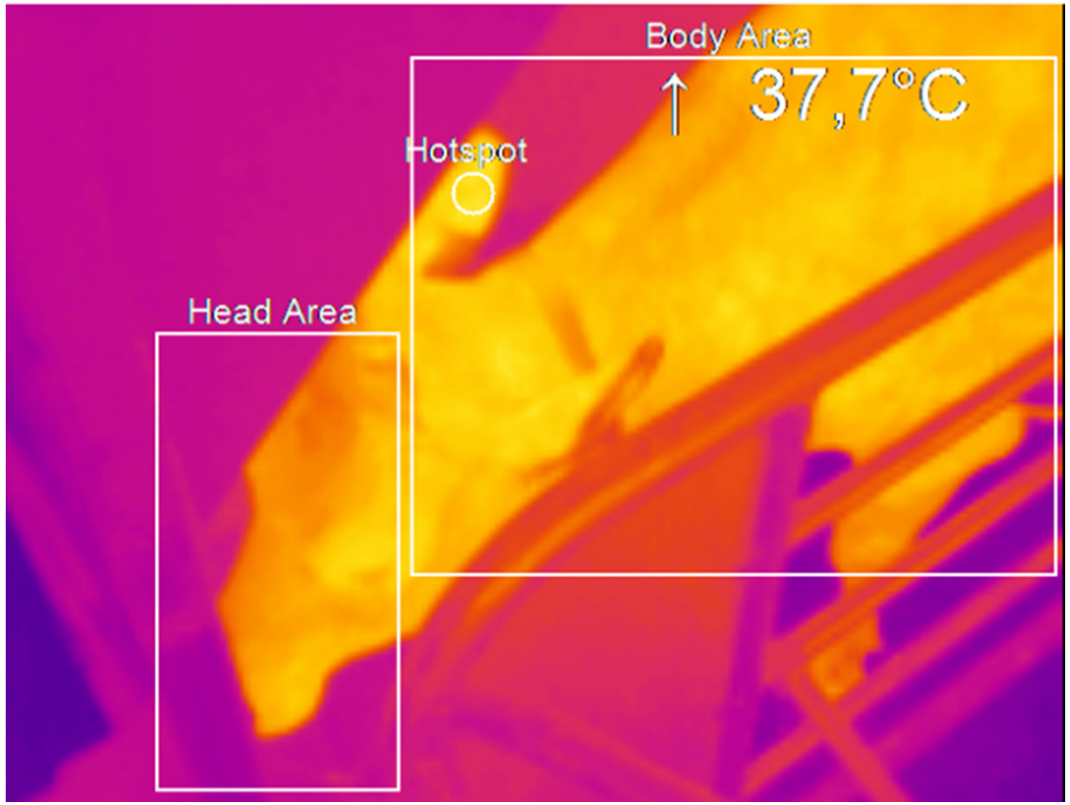
Conclusion

- Infrared thermography videos might have the potential to serve as a monitoring system of body temperature in cows and calves.

- More research necessary:
  - with febrile animals and larger sample of animals,
  - to find algorithms (every animal as ist own control),
  - to define thresholds (critical temperature difference to previous measurements).

- Connection to the animal ID and management software.

Many thanks for your attention!



Leibniz Institute for Agricultural Engineering Potsdam-Bornim
DVM Gundula Hoffmann
Max-Eyth-Allee 100, 14469 Potsdam, Germany
www.atb-potsdam.de
ghoffmann@atb-potsdam.de