

Automatisierte Lahmheits- erkennung beim Rind

Adrian Steiner
(adrian.steiner@vetsuisse.unibe.ch)

Lahmheit

- Symptom
- Ausdruck von Schmerz (>99%)
- Funktionell/mechanisch (<1%)
- 90% im Bereich der Zehen der

HGM lokalisiert (Murray et al., 1996; Weaver, 2000)





Zeitliche Entwicklung



-1980



-1995



1995-



Lahmheits-Prävalenzen

- In dairy farms
- Weltweit: 26% (Cook NG, 2016)
- 8.1% (NZ) – 54.8% (US)
- 36% (A) (Rouha-Mülleder et al.; 2009)
- 15% (CH) (Becker et al. 2012)
- 48% (Mittel-D, konventionell); 24% (D, Bio) (Dippel S et al., 2009)

Lahmheits-Prävalenz

- The worldwide average lameness prevalence is approximately equal to 35% (Schlageter-Tello et al., 2015)

Haltung





Bild: M. Ruiters, RGD Bern

Bild: M. Ruiters, RGD Bern

Wirtschaftlich relevant?



*Fruchtbarkeit
Störungen*

Mastitis

Lahmheiten

Lame cows are more frequently affected with mastitis, metabolic disorders, and reduced fertility (Green et al., 2014).

(Enting, H. et al., 1997; Green et al., 2002; Hernandez et al., 2002; Bruijnis et al., 2010; Cha et al., 2010; Huxley, 2013)

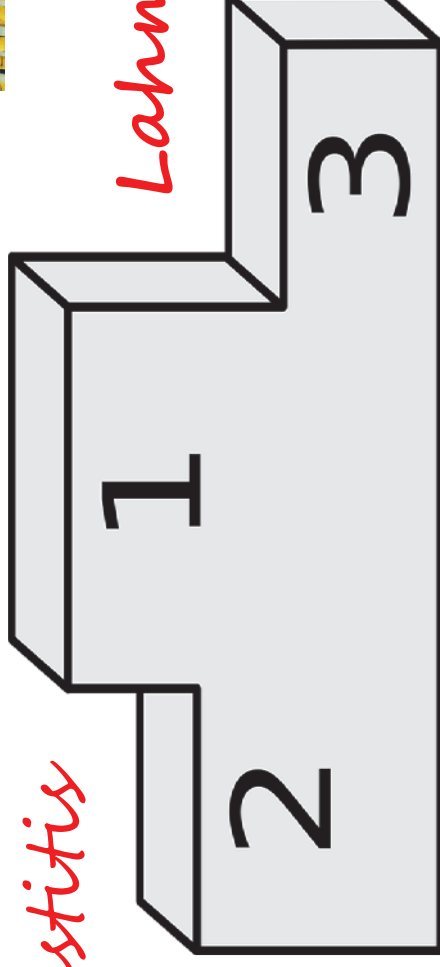
Wirtschaftlich relevant?



*Fruchtbarkeits-
Störungen*

Mastitis

Lahmheiten



(Enting, H. et al., 1997; Green et al., 2002; Hernandez et al., 2002; Brujinis et al., 2010;
Cha et al., 2010; Huxley, 2013)

Zusammensetzung der Kosten



(Cha et al., 2010)

Verluste pro lahme Kuh und Lakt resp. Fall



Jahr	Autoren	Kosten/Verlust
1997	Greenough P, et al.	\$412
1999	Rajala-Schultz et al.	310.5 kg Milch
2008	Amory et al.	369 - 574 kg Milch
2009	Willshire and Bell	\$100.5 - \$689.91
2013	Huxley J, et al.	270 - 574 kg Milch
2017	Charfeddine N, et al.	\$53 - \$622
Mean		\$375.2 = Euro 335
Mean	Umrechnung: 39cts; 40%	419 kg Milch = Euro 408
2014	Kofler, J	450 Euro

Was professionelle Klauenpfleger in USA denken

- ...”the most important benefits of reducing foot disorders were enhanced **animal welfare** and **increased milk production**, whereas the least important benefit was reduced veterinary and hoof trimmer fees.” (Dolecheck KA et al, 2018)



Welfare

A cartoon illustration of a veterinarian in a blue coat and cap, holding a stethoscope, examining a cow. The cow is brown and white, and there are some medical supplies like a syringe and a bandage nearby.

“Lameness, because of its high prevalence and because it is a source of prolonged suffering, is considered to be **the single most important welfare problem in dairy COWS**” . (Whay and Shearer, 2017; Vet Clin NA)

Welfare

Curative trimming of hoof lesions in dairy cows can inflict severe pain.

(Chapinal et al., 2010 in JDS; Stoddard and Cramer, 2017 in Vet Clin NA)



Welfare

The reality is that most hoof trimmers or farmers treat hoof lesions without consulting a veterinarian and without any pain management. *(Horseman et al., 2013; Vet J)*



Erkennung durch Landwirte



- Massive Unterschätzung der Lahmheitsproblematik bei Landwirten in UK (Leach et al., 2010)
- Nur ein Drittel (nur stark lahme) der lahmen Kühe werden durch Landwirte erkannt (Whay et al.; 2003, Espejo and others 2006, Leach et al.; 2010)

Erkennung durch Landwirte



- Generell ungenügend und zu spät:
27 ± 19 Tage nach Erkennung
durch spezialisierten Tierarzt (*Tranter und Morris, 1991*)
- Hochgradige Lahmheiten: 21 Tage
und milde Lahmheiten: 70 Tage
Verzögerung (*Alawneh et al.; 2012*)

Erkennung durch Landwirte



- Nur 24% der durch Spezialisten erkannten lahmen Kühe wurden gleichentags in Australischen Farmen auch durch den Landwirt erkannt (Beggs DS et al, 2019)

Prognose I



- Die Prognose von Klauenerkrankungen zeigt eine sehr hohe negative Korrelation zur Dauer der Erkrankung

(Groenevelt et al. 2014; Leach et al. 2012; Schulz T, et al.; 2016)

- Erfolgsrate bei Geschwüren:
 - <14 Tage: >50% Heilung innerhalb von 35 Tagen *(Thomas et al., 2015)*
 - >14 Tage: ca 15% Heilung innerhalb von 42 Tagen *(Thomas et al., 2016)*



Prognose II

Signifikant erhöhte Wahrscheinlichkeit: Gleiche Pathologie erneut in der folgenden Laktation

(Oikonomou et al., 2013)



Erkennen von Lahmheiten

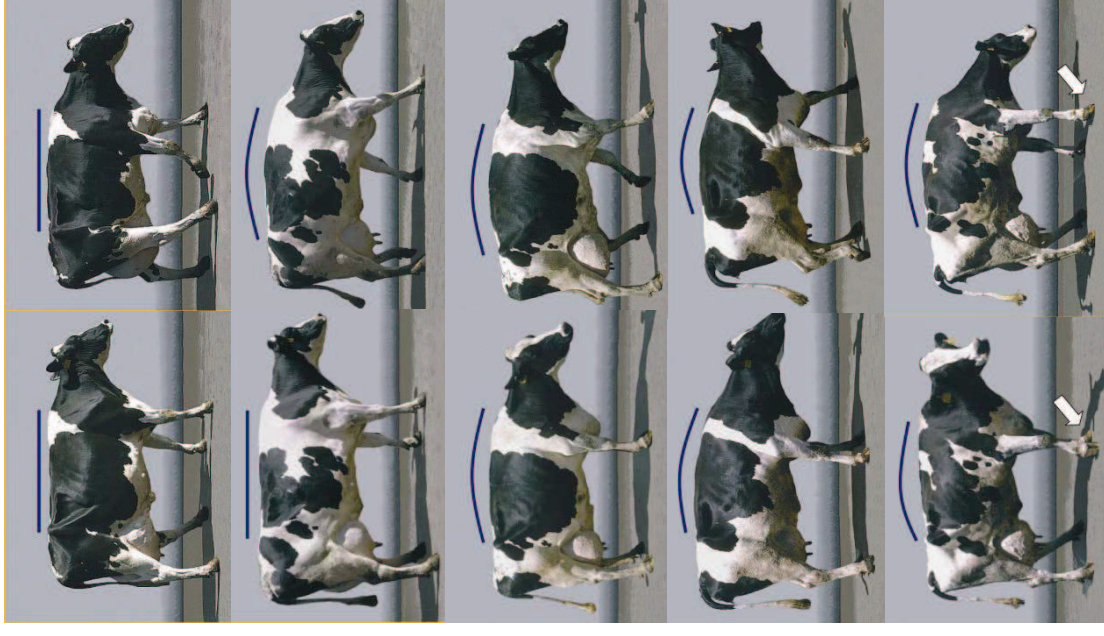
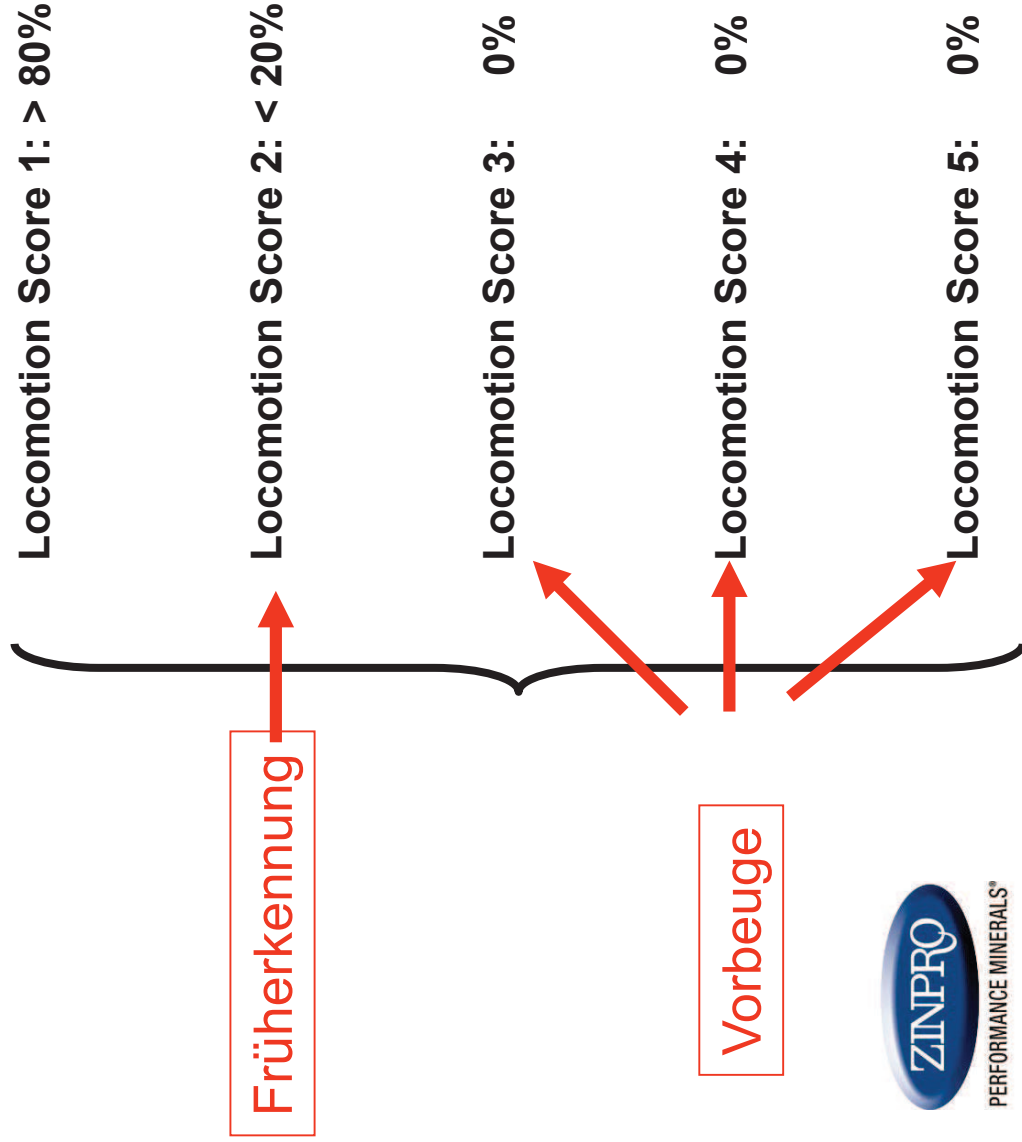
- Goldstandard: Mobility/locomotion scoring: wöchentlich
- Automatisierte Erkennung: kontinuierlich

➤ “A sensor attached to the cow was preferred, followed by a walkover system and a camera system.”

et al. 2017)

(Van De Gucht T,

Locomotion scoring nach Sprecher et al. (1997)



Probleme:

- Personeller Aufwand
- Übereinstimmung zwischen und innerhalb der Beobachter
 - **68%** inter-observer (*Winckler and Willen 2001*)
 - **56%** intra-observer and **37%** inter-observer (*O`Callaghan et al., 2003*)

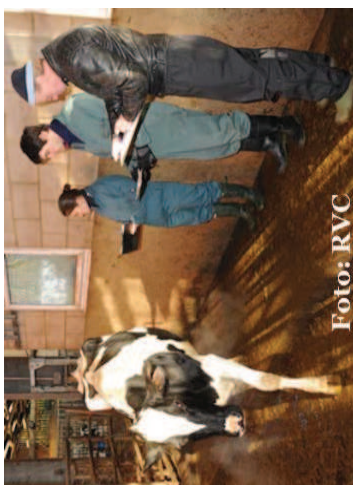


Foto: RVC

Webseite zur Anmeldung

www.onlinetted.de

Freischaltcode

2 Nutzer online





Sessioncode

anmelden

Zur Hauptseite



Automatisierte Lahmheitserkennung: Techniken

- ✓ Thermographie
- ✓ 4-Gliedmassen-Waage
- ✓ Nasenbandsensoren
- ✓ Videoanalyse (Rückenkrümmung)
- ✓ Daten aus Herdenmanagementprogramm
- ✓ Besuch der Kratzbürste (Mandel et al, 2017)
- ✓ Melkreihenfolge
- ✓ Halsbandsensoren
- ✓ Accelerormeter (Fuss)



4D4F

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Automatisierte Lahmheitserkennung: Eigene Forschungs-Resultate

- ✓ Thermographie
- ✓ 4-Gliedmassen-Waage
- ✓ Nasenbandsensoren
- ✓ Accelerormeter (Pedometer)
- ✓ ...+ Daten aus Herdenmanagement-programm

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A field trial of infrared thermography as a non-invasive diagnostic tool for early detection of digital dermatitis in dairy cows

M. Alsaad^{a,*}, C. Syring^a, J. Dietrich^a, M.G. Doherr^b, T. Gujan^c, A. Steiner^a

^a Clinic for Ruminants, Vetsuisse-Faculty, University of Bern, Switzerland

^b Veterinary Public Health Institute, Vetsuisse-Faculty, University of Bern, Switzerland

^c Institute of Agricultural Sciences, Swiss Federal Technical School of Zürich, Switzerland



Thermographie

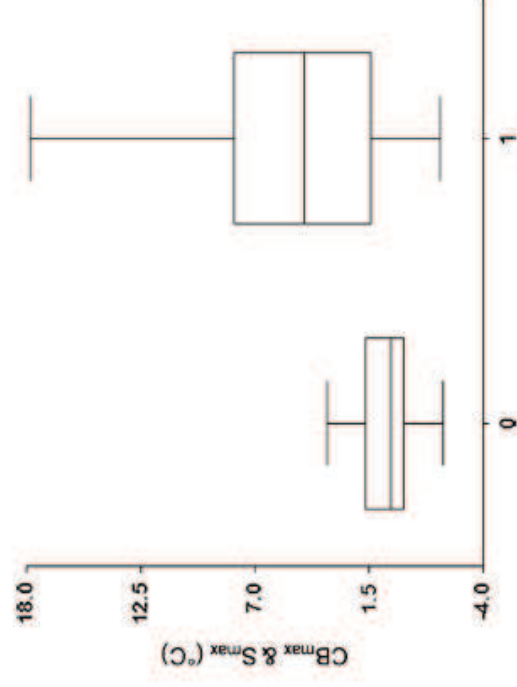
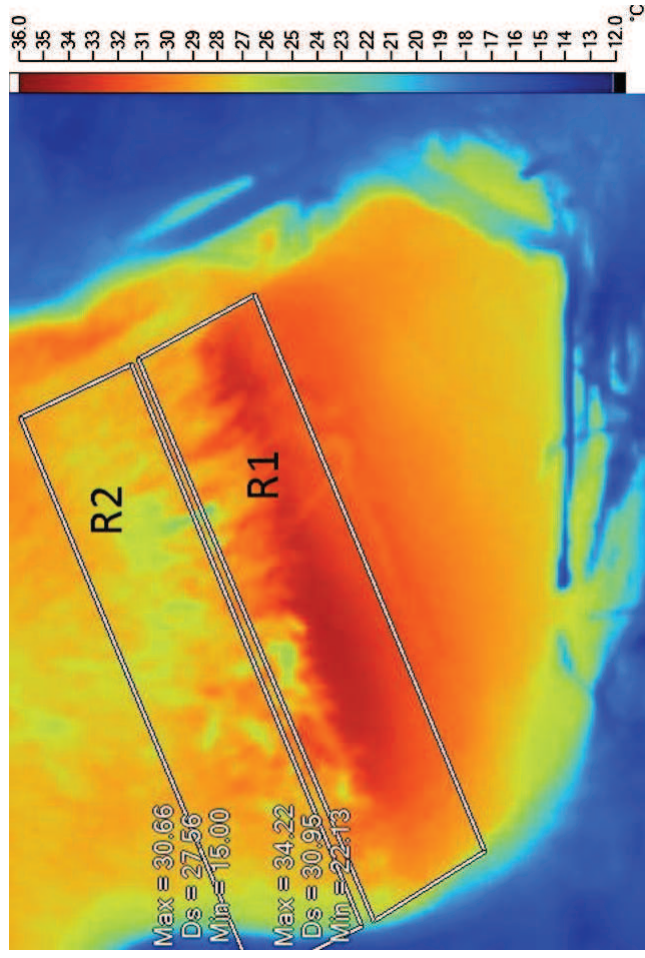
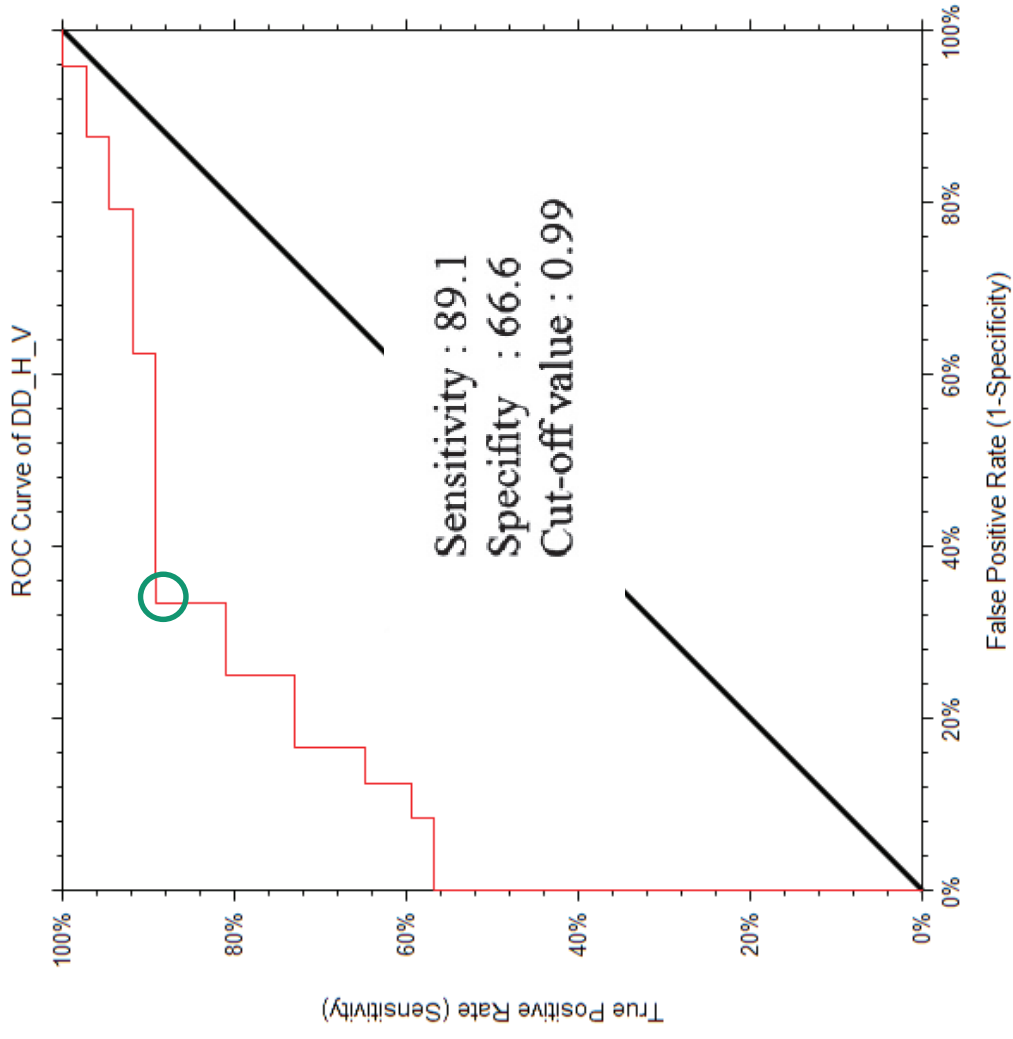


Fig. 2. Box plot of the temperature differences between rear and front feet after summation of coronary band (CB_{max}) and skin (S_{max}) temperature of each foot, comparing cows with four healthy feet (0; n = 24) and cows with digital dermatitis (1; n = 37) on at least one rear foot and with two healthy front feet ($P < 0.001$).





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Analysis of behavioral changes in dairy cows associated with claw horn lesions

K. Nechanitzky,^{*} A. Starke,[†] B. Vidondo,[‡] H. Müller,[†] M. Reckardt,[†] K. Friedli,[§] and A. Steiner^{*1}

^{*}Clinical for Ruminants, Vetsuisse-Faculty, University of Bern, 3012 Bern, Switzerland

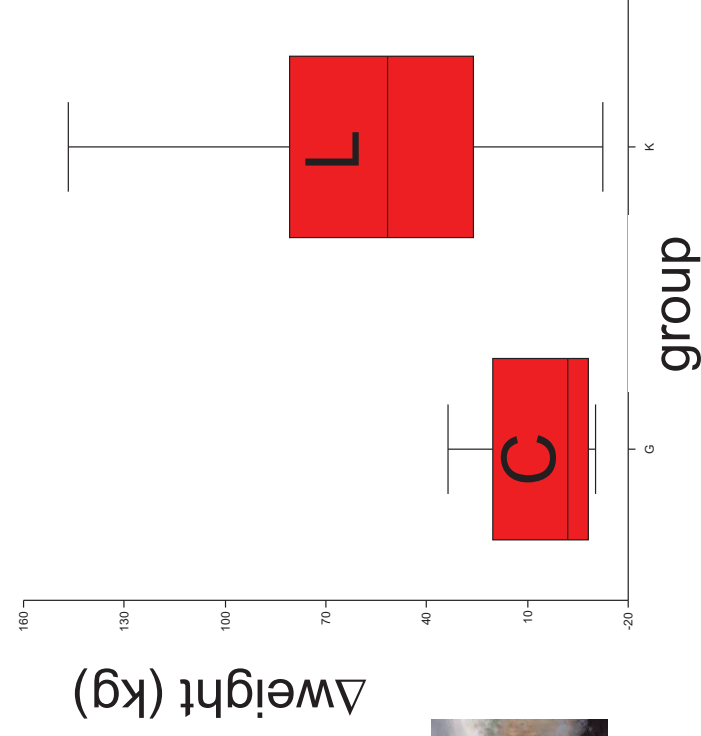
[†]Clinic for Ruminants and Swine, Faculty of Veterinary Medicine, University Leipzig, An den Tierkliniken 11, D - 04103 Leipzig, Germany

[‡]Veterinary Public Health Institute, Vetsuisse-Faculty, University of Bern, 3012 Bern, Switzerland

[§]Federal Food Safety and Veterinary Office, Centre for Proper Housing of Ruminants and Pigs, 8356 Ettenhausen, Switzerland



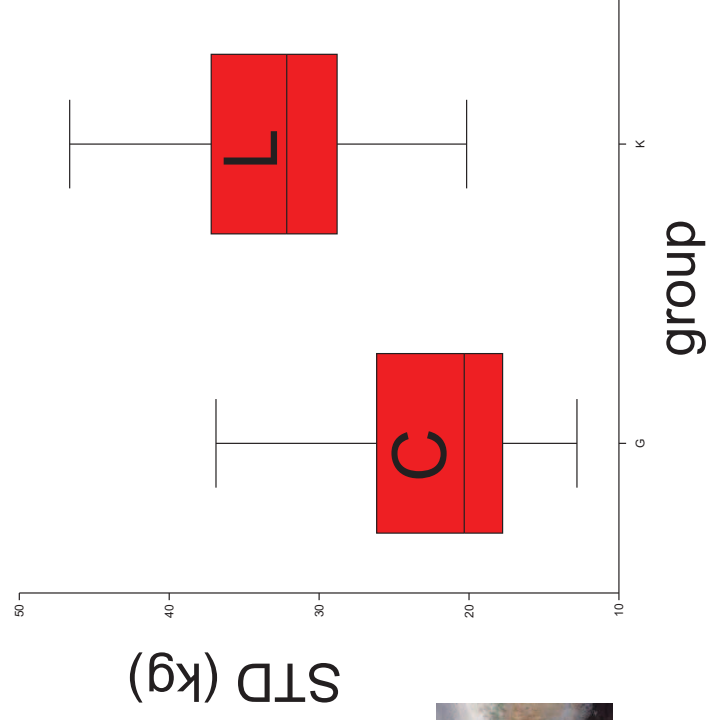
Differenz („schwer – leicht“)



Signifikanter
Unterschied
zwischen den
Gruppen ($p=0.001$)

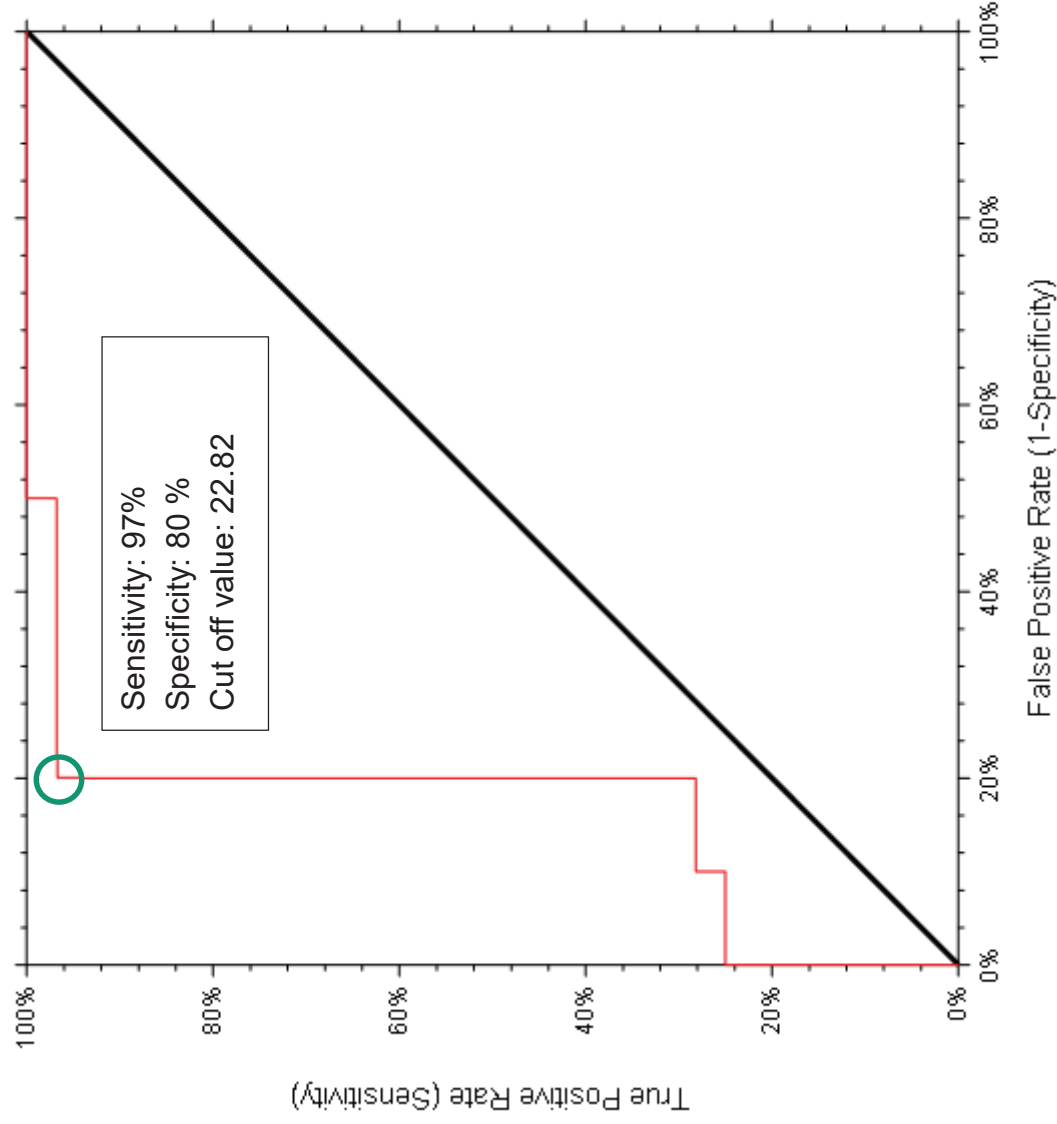


STD des Gewichtes auf der „leichteren“ GLM



Signifikanter
Unterschied
zwischen den
Gruppen ($p < 0.001$)





STD



RESEARCH ARTICLE

Use of Extended Characteristics of Locomotion and Feeding Behavior for Automated Identification of Lameness in Dairy Cows

Gian Beer^{1*}, Maher Alsaad¹, Alexander Starke^{2‡}, Gertraud Schuepbach-Regula^{3‡}, Hendrik Müller², Philipp Kohler¹, Adrian Steiner¹

1 Clinic for Ruminants, Vetsuisse-Faculty, University of Berne, Berne, Switzerland, **2** Clinic for Ruminants and Swine, Faculty of Veterinary Medicine, University of Leipzig, Leipzig, Germany, **3** Veterinary Public Health Institute, Vetsuisse-Faculty, University of Berne, Berne, Switzerland

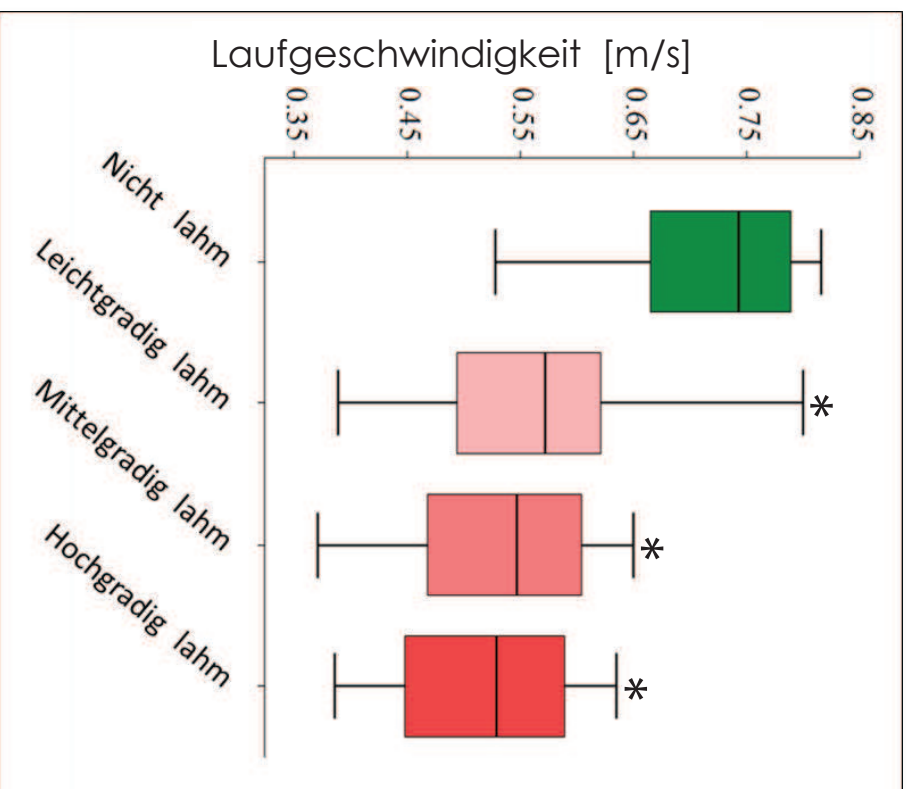
 These authors contributed equally to this work.

 These authors also contributed equally to this work.

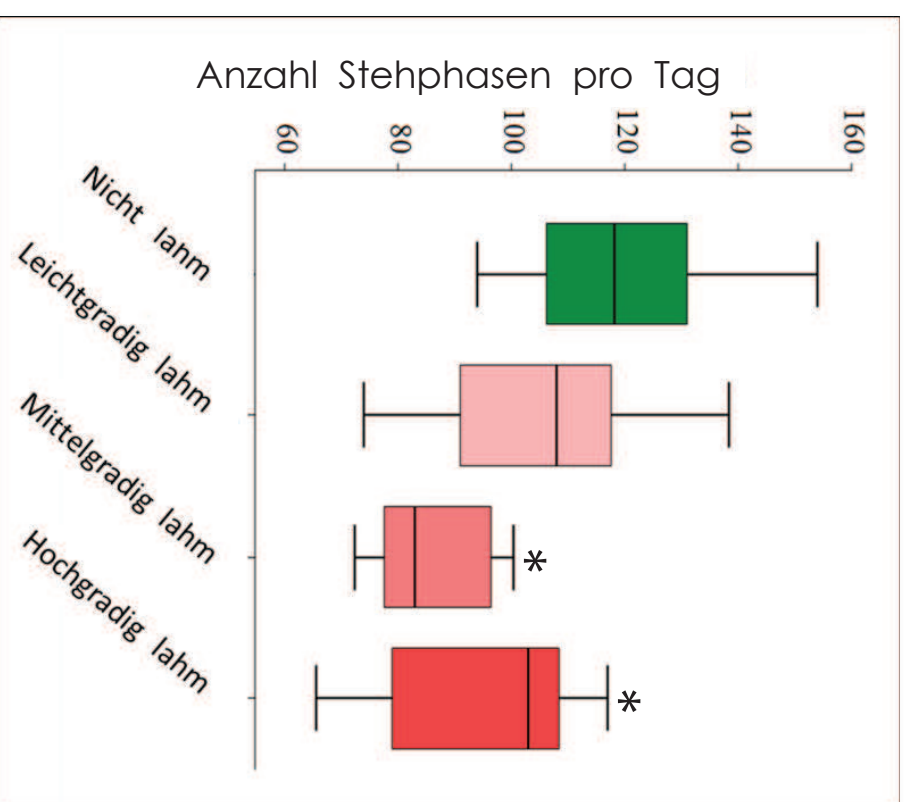
* gian.beer@vetsuisse.unibe.ch



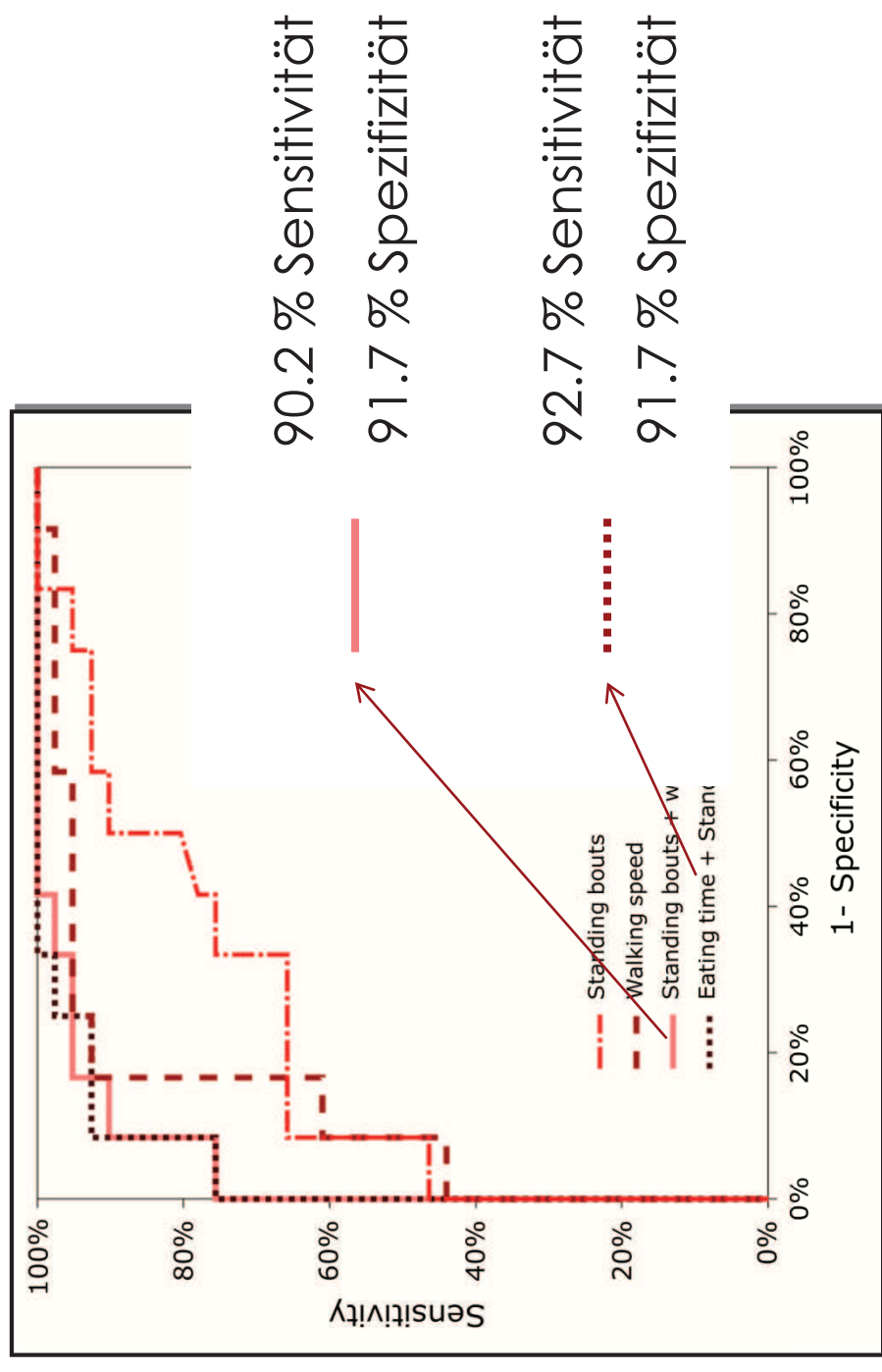
Laufgeschwindigkeit



Anzahl Stehphasen



Modelle



Daten aus Herdenmanagement + Accelerometern und Nasenbandsensoren



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Moderate lameness leads to marked behavioral changes in dairy cows

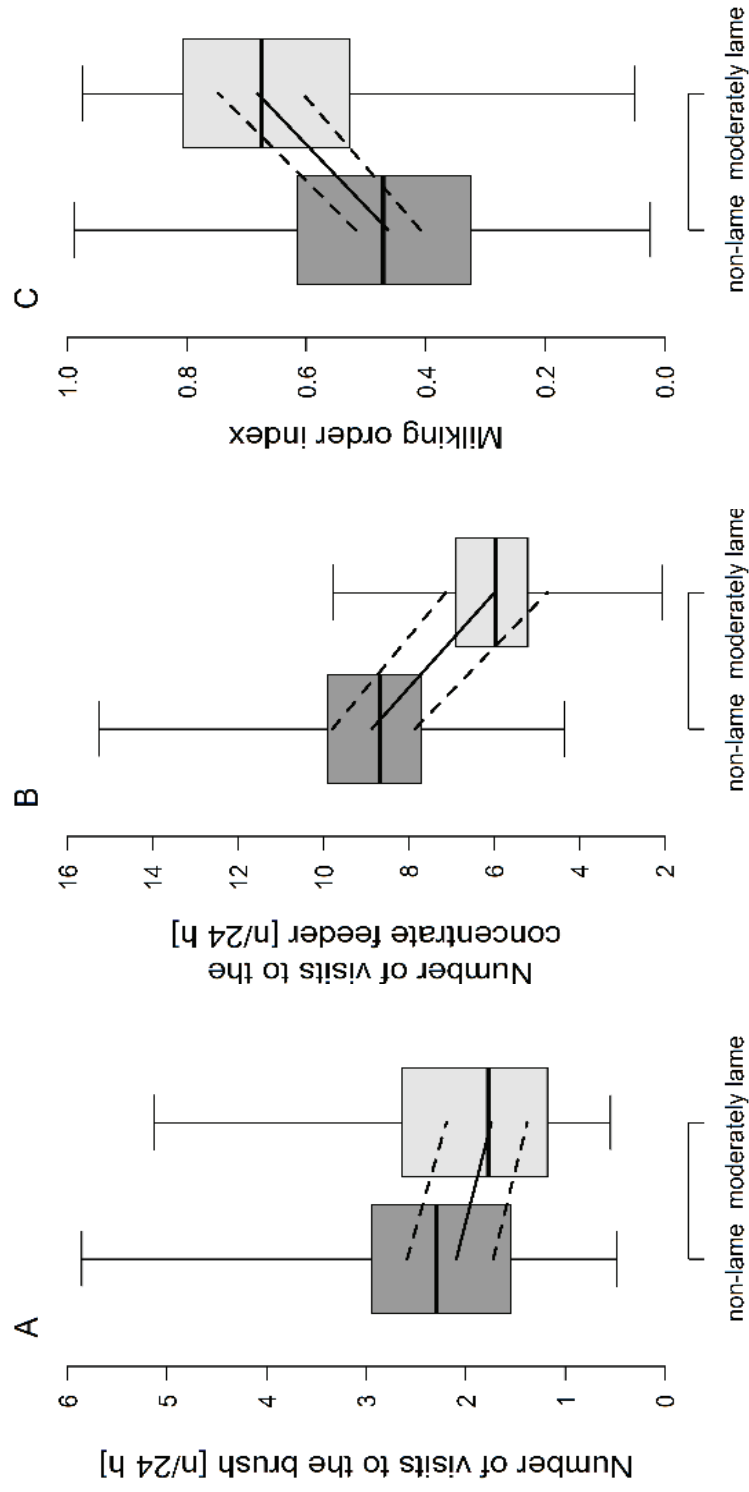
H. C. Weigle,^{*1} L. Gyga,^{*2} A. Steiner,[†] B. Wechsler,^{*} and J.-B. Burla^{*}

^{*}Centre for Proper Housing of Ruminants and Pigs, Federal Food Safety and Veterinary Office (FSVO), Agroscope Tänikon, Ettenhausen 8356, Switzerland

[†]Clinic for Ruminants, Vetsuisse-Faculty, University of Bern, Bern 3012, Switzerland

Lahme im Vergleich zu nicht lahmen Kühen

- Liegen länger
- Liegen weniger häufig
- Zeigen weniger Beinaktivität
- Zeigen weniger Kopfbewegungen
- Fressen weniger lang
- Machen weniger Fressbissen





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The cow pedogram—Analysis of gait cycle variables allows the detection of lameness and foot pathologies

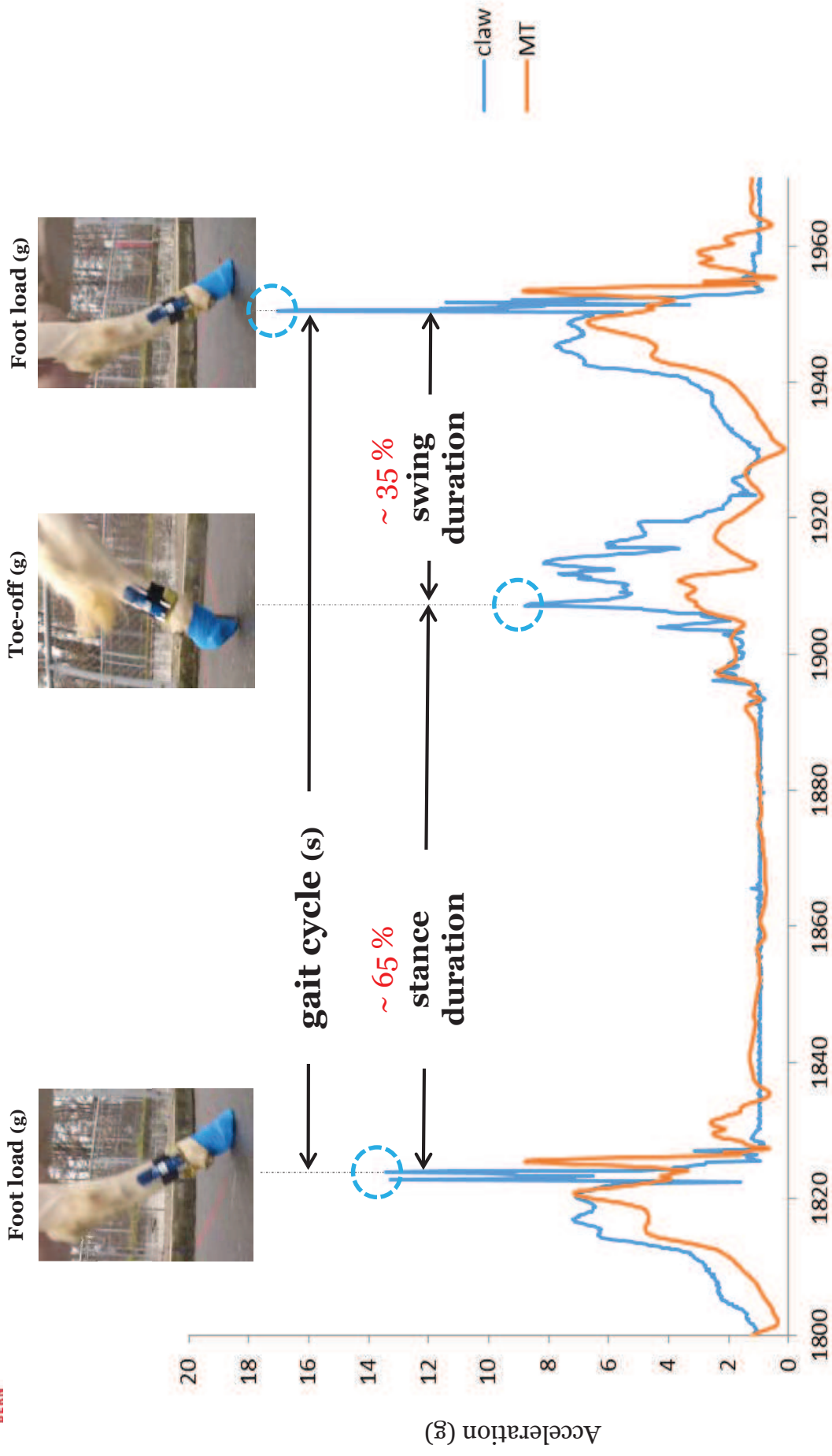
M. Alsaad,^{*1} M. Luternauer,^{*} T. Hausegger,[†] R. Kredel,[†] and A. Steiner^{*}

^{*}Clinic for Ruminants, Vetsuisse-Faculty, and

[†]Institute of Sport Science, Faculty of Human Sciences, University of Bern, 3001 Bern, Switzerland

Fokus Einzeltier, 2 Pedometer, 400 Hz

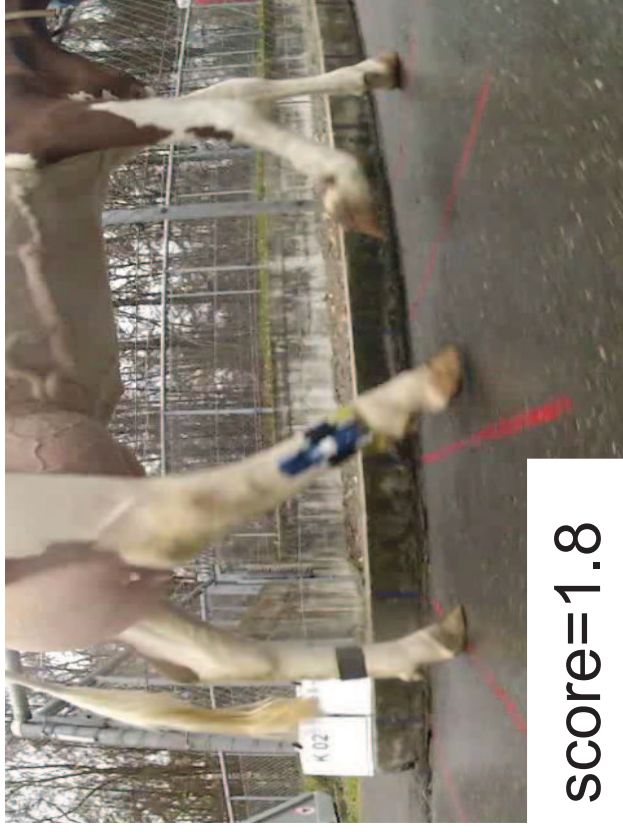
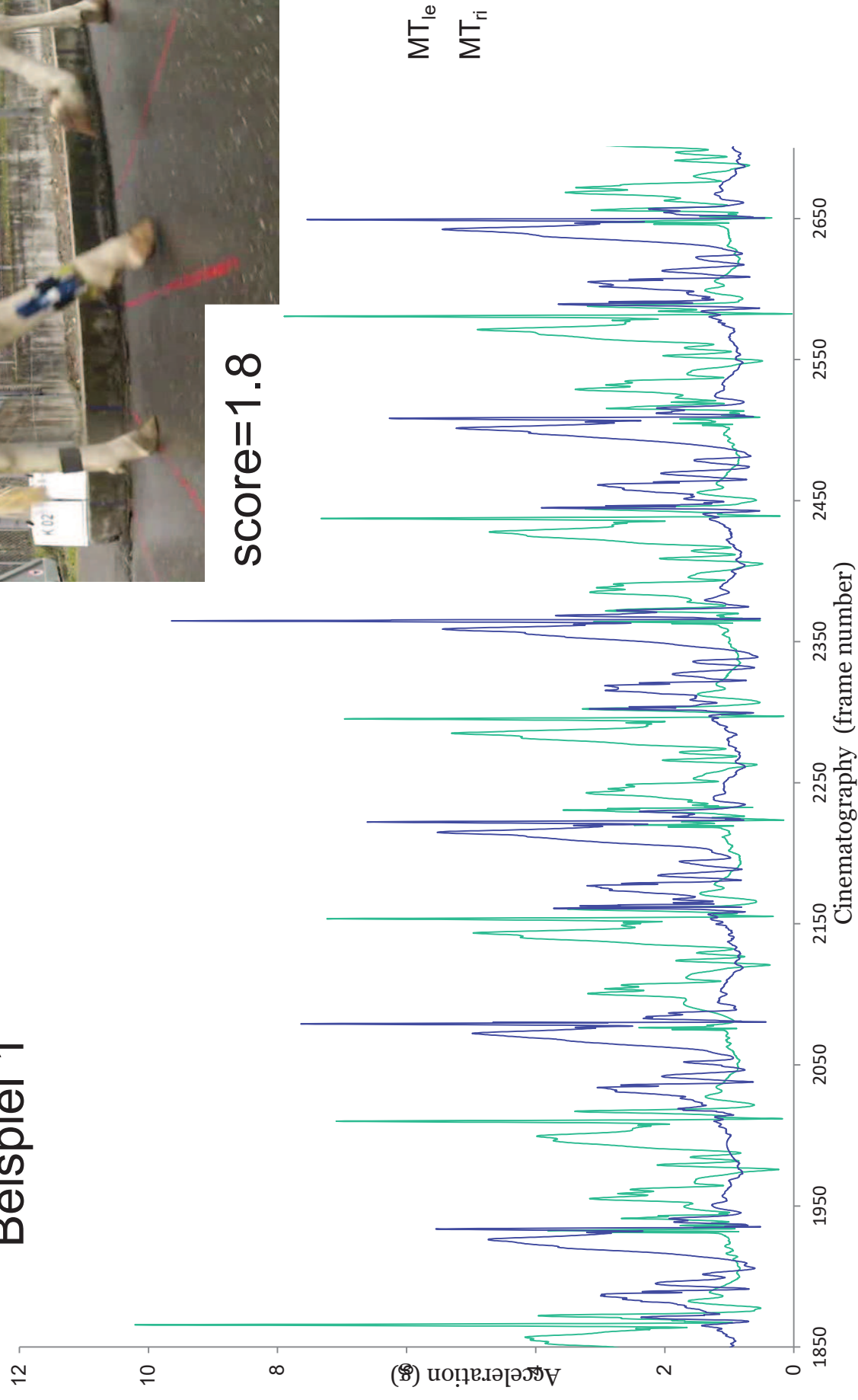




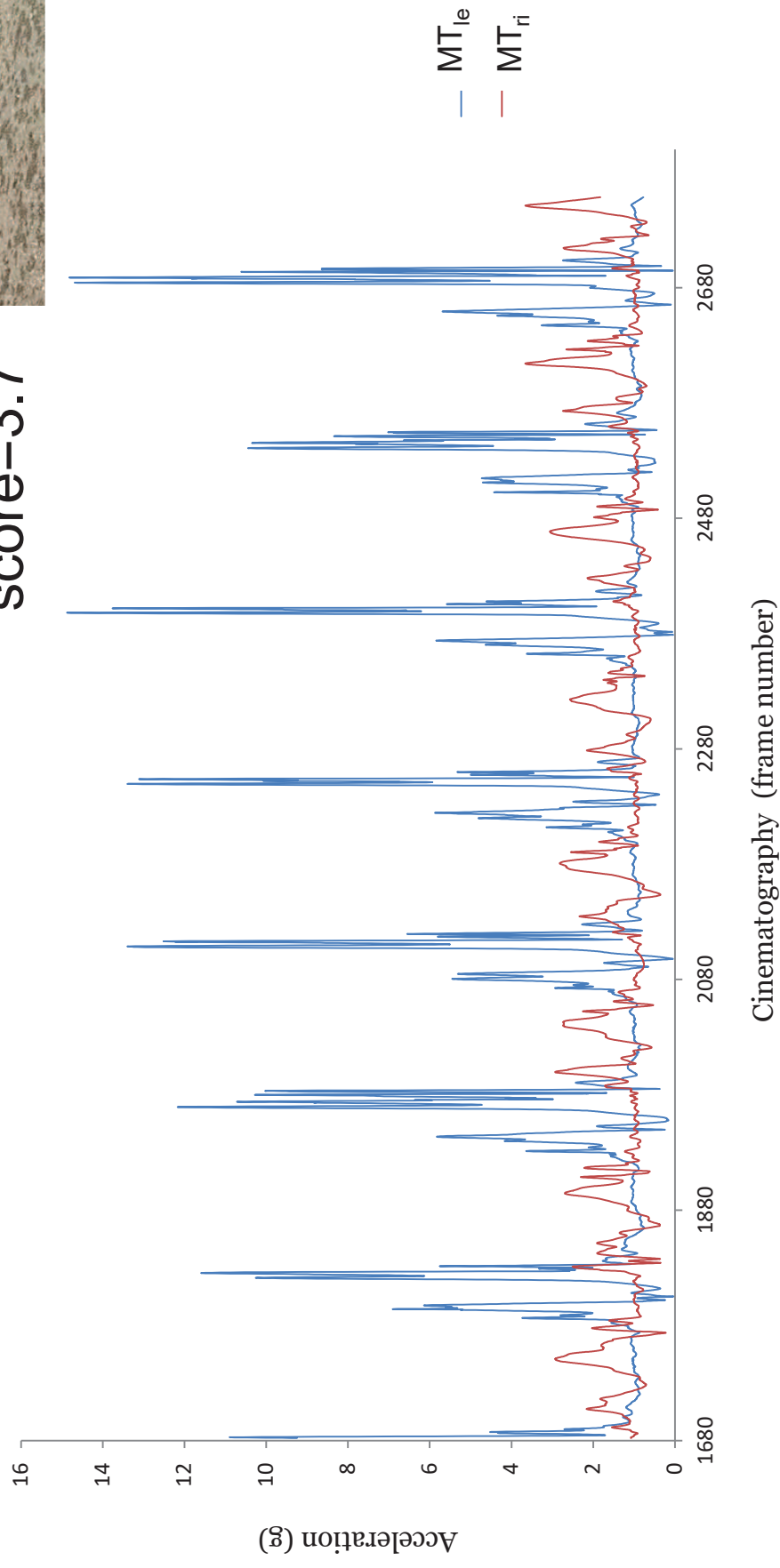
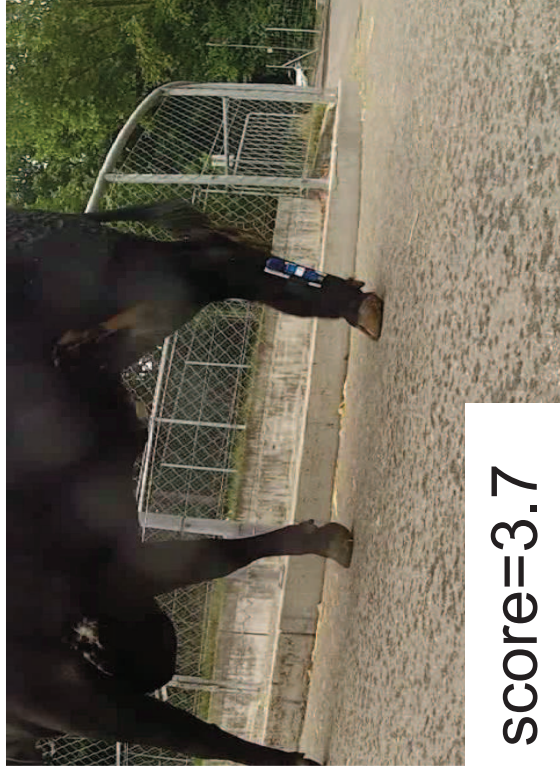
Cinematography (frame number)

u^b

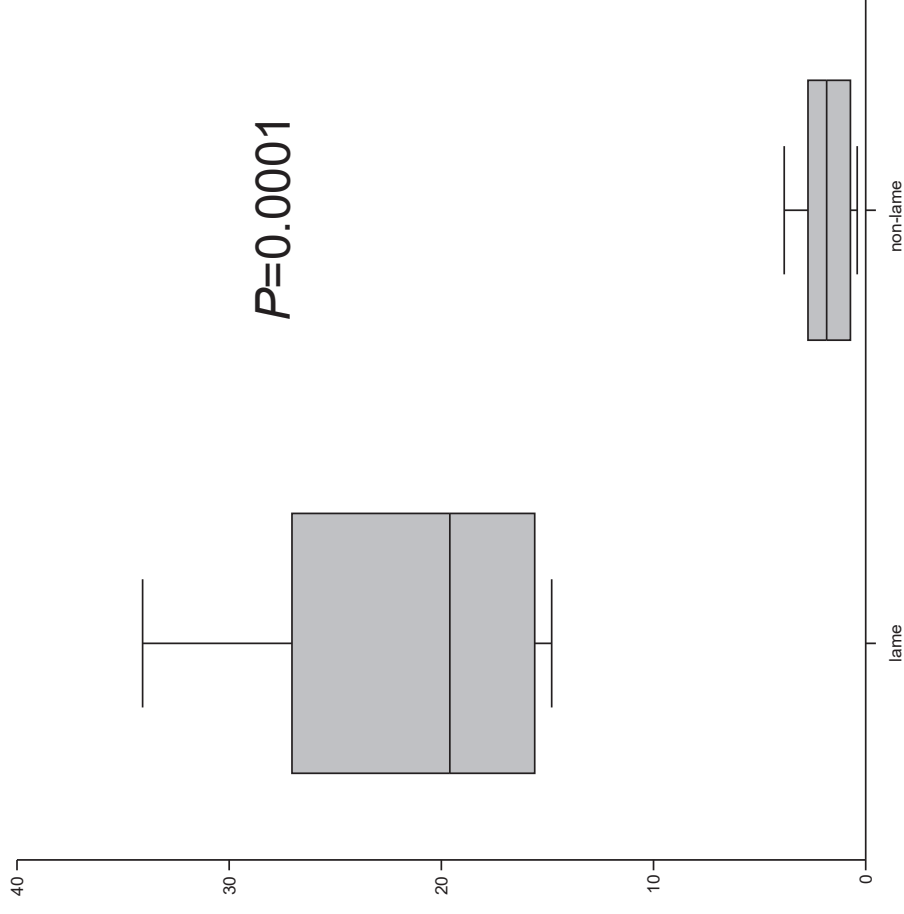
Beispiel 1



Beispiel 2



Rel. Dauer der Belastungs- phase



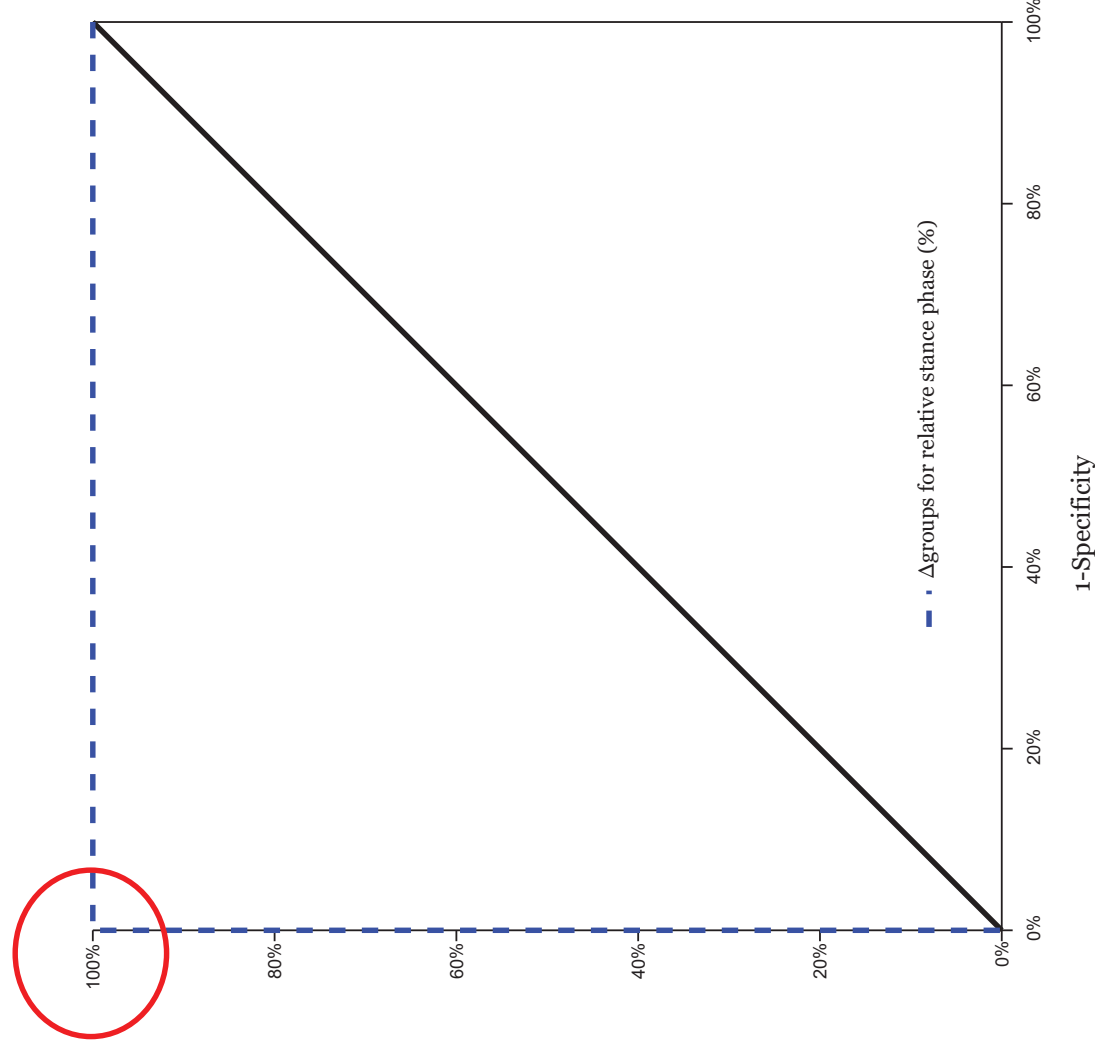
Belastungs- phase

ROC analysis

cut-off = 2.53%

100% sensitivity

100% specificity



Objektive postoperative Überwachung

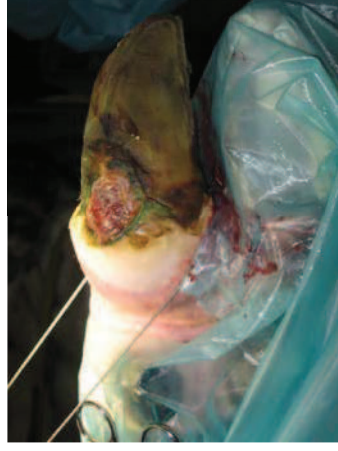


RESEARCH ARTICLE

Objective assessment of lameness in cattle after foot surgery

Lindsay L. Buisman^{1,2}, Maher Alsaad^{1*}, Esther Bucher¹, Johann Kofler³,
Adrian Steiner¹

1 Clinic for Ruminants, Vetsuisse-Faculty, University of Bern, Bern, Switzerland, **2** Faculty of Veterinary Medicine, Utrecht University, Utrecht, The Netherlands, **3** Clinic for Ruminants, University of Veterinary Medicine Vienna, Vienna, Austria



Postoperativer Schmerz
(pedogram und Waage)

Fallbeispiel

Signalement

- Stier
- Simmental
- 1.5 Jahre
- rot-blösch
- „Boris“
- 120.1074.3623.5
- 590 kg



Anamnese

- 20.04.2016: Lahmheit im Schulterbereich:
lokale Applikation von Salbe und Gabe von
«homöopathischen Mitteln»
- 04.05.2016: Beginn einer Behandlung mit
Penicillin für 4 Tage
- 09.05.2016: Einweisung zur Abklärung, da
keine Besserung





Webseite zur Anmeldung

www.onlineted.de

Freischaltcode

2 Nutzer online

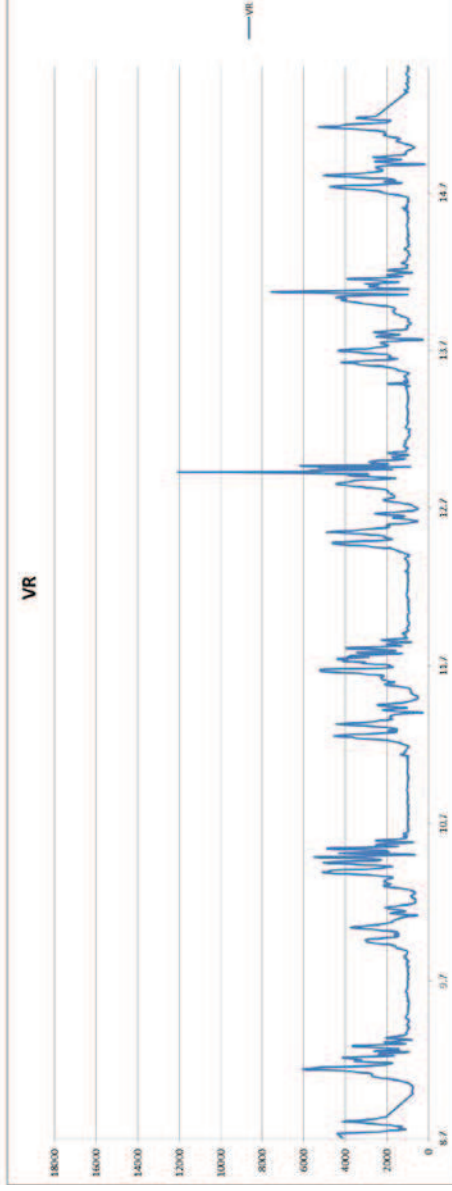
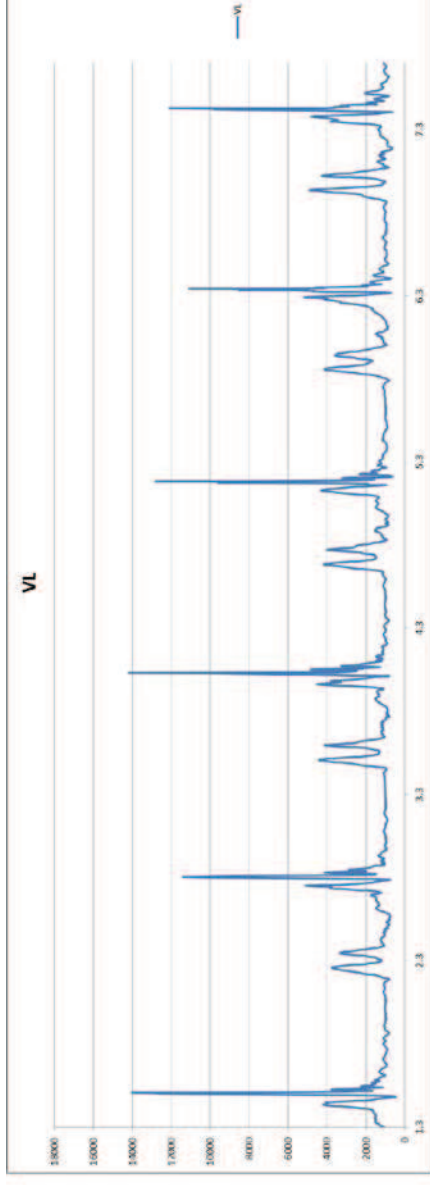




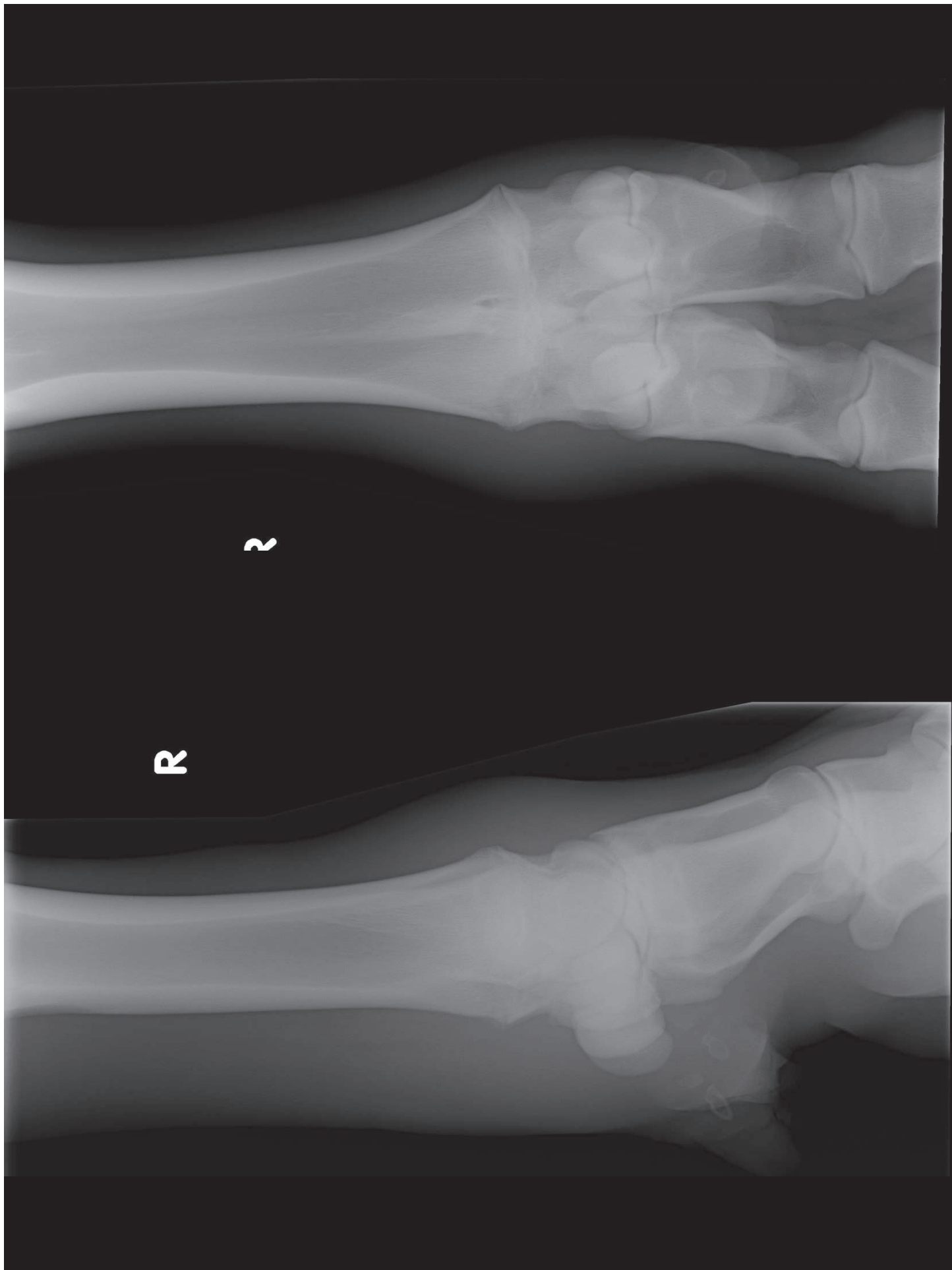
Waagedaten

Date	mean		mean		mean		meandiff
	VoLI[kg]	VoRE[kg]	HiLI[kg]	HiRE[kg]	HiLI-	HiRE[kg]	
09.05.2016 16:10	192.932	143.805	126.807	135.046	-8.23882		

Pedogramm







Take-home Informationen

- Lahmheitsprävalenz: 25% - 35%
 - Verlust: >5% des Milcherlöses
 - Früherkennung wichtig: Prognose, Wirtschaftlichkeit, Tierwohl
 - Früherkennung schwierig für Landwirte
 - Automatisierung: Waage, Accelerometer (10 Hz) und Thermographie, Kombination mit Daten aus Herdenmanagementsoftware: Potential
 - 2 x 400 Hz: Einzeltierdiagnostik
- **Consulting und Knowhow im Bereich Lahmheiten mehr denn je gefragt**

Finanzielle Unterstützung



