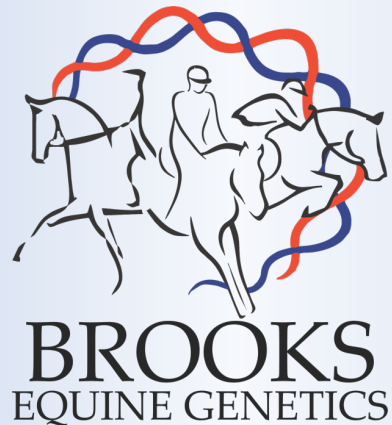


Assessing the effect of fatigue on stadium jumping penalty scores in elite three-day event horses utilizing artificial intelligence

Lauren T. Johns, Madelyn P. Smythe, Savannah Dewberry, Elizabeth A. Staiger, Kyle Allen, Samantha A. Brooks



TEXAS A&M UNIVERSITY
School of Veterinary Medicine
& Biomedical Sciences

What is eventing?

- Equestrian Triathlon
- Heart rate, body temperature, lactatemia, creatine kinase
 - → detect modified movement and locomotion (Amory, et. Al., 1993)
- Obstacle height and course length varies between venues (Becker, et. Al., 2022)

Day A
inspection



Dressage



Cross-country



Veterinary
examination

Day B
inspection

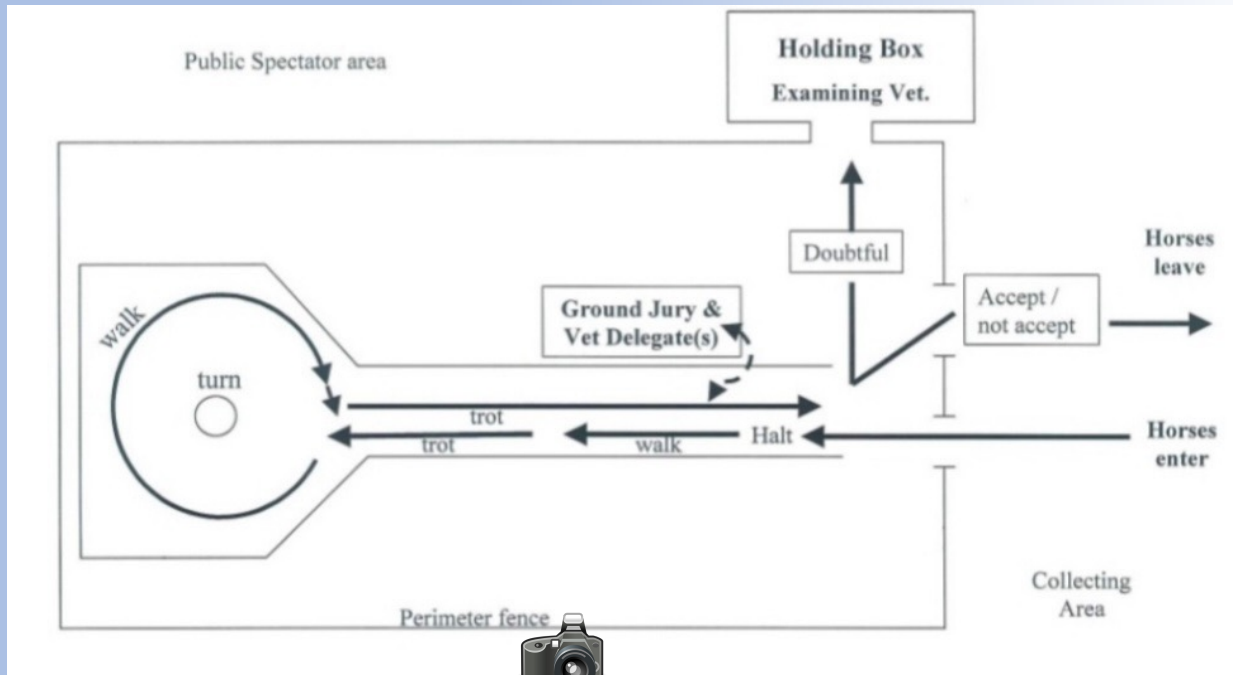
Stadium jumping



(Internationale,
F.E., 2023)

Veterinary Inspections

- Pre-competition and post cross country by same veterinary panel as Day A
 - Accepted, not accepted, or holding box
- Based on subjective and non-repeatable guidelines
 - Re-inspections are possible



(Internationale, F.E.,
2023)

Objective and Hypothesis

- Hypothesis: Gait changes post cross-country as detected with Artificial Intelligence technologies will negatively impact performance in the show jumping phase of competition
- Objectives
 - Quantify show jumping performance based on total penalties
 - Assess gait changes pre and post cross country using DeepLabCut





Show jumping performance

Jump Faults



Clear Round



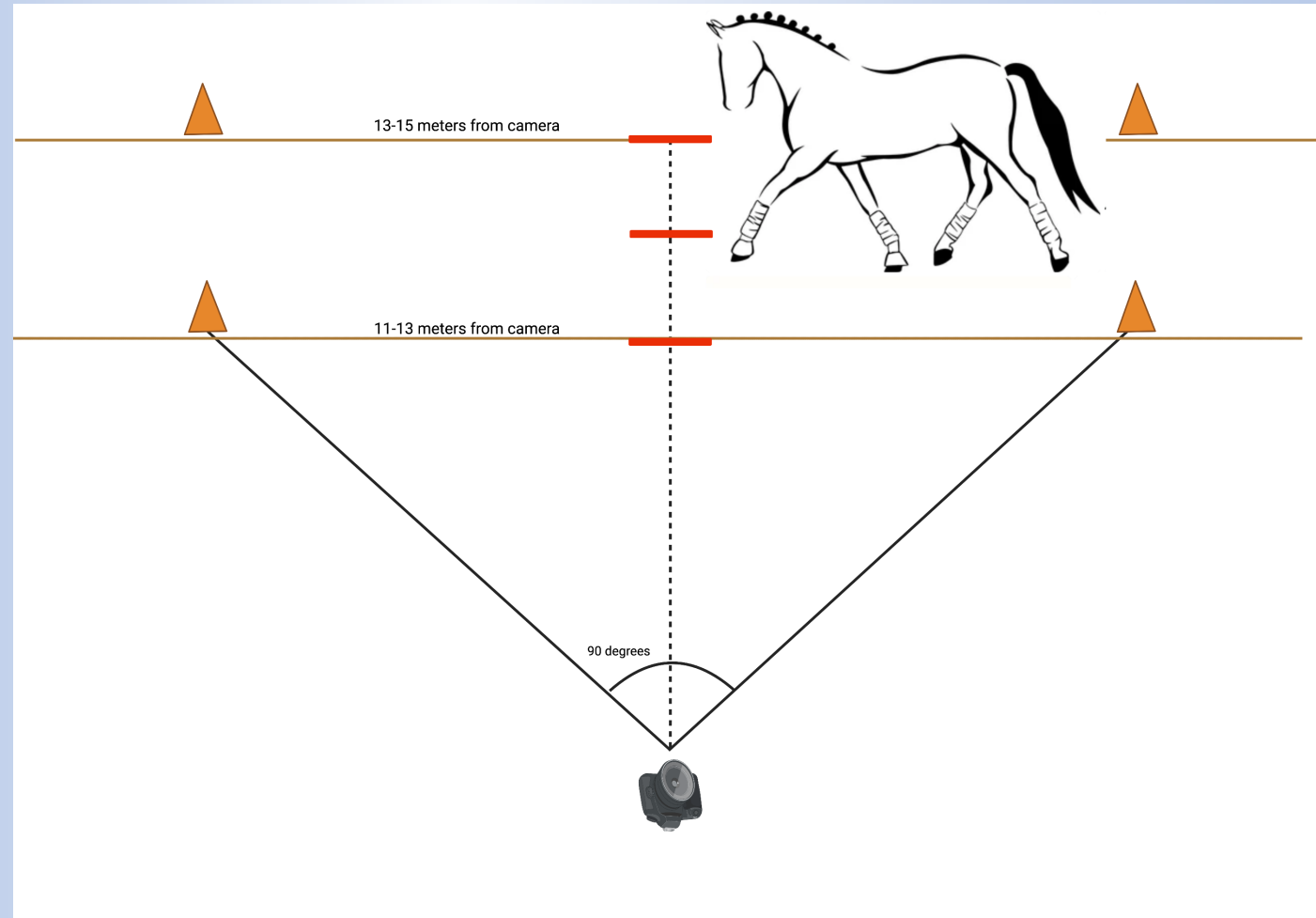
Time Faults



Video Collection Protocol



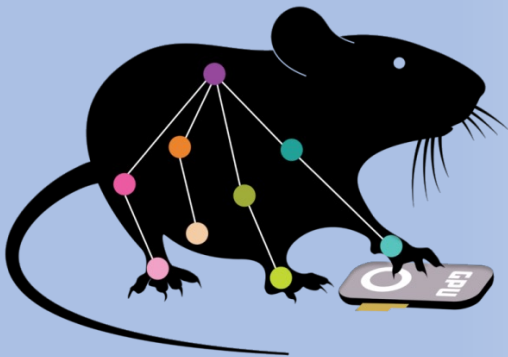
- Camera Specs:
 - Sony α 6400
 - 1080 x 720p
 - 120 fps
- 194 privately owned horses
 - evententries.com
- 3 International levels
 - CCI2*, CCI3*, CCI4*
- 5 venues
 - KY and FL



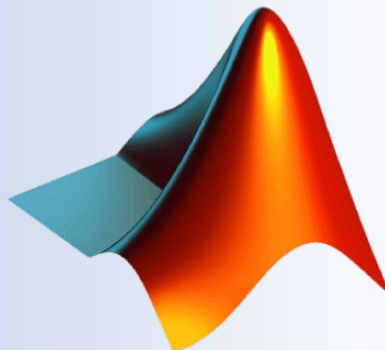
Video Processing



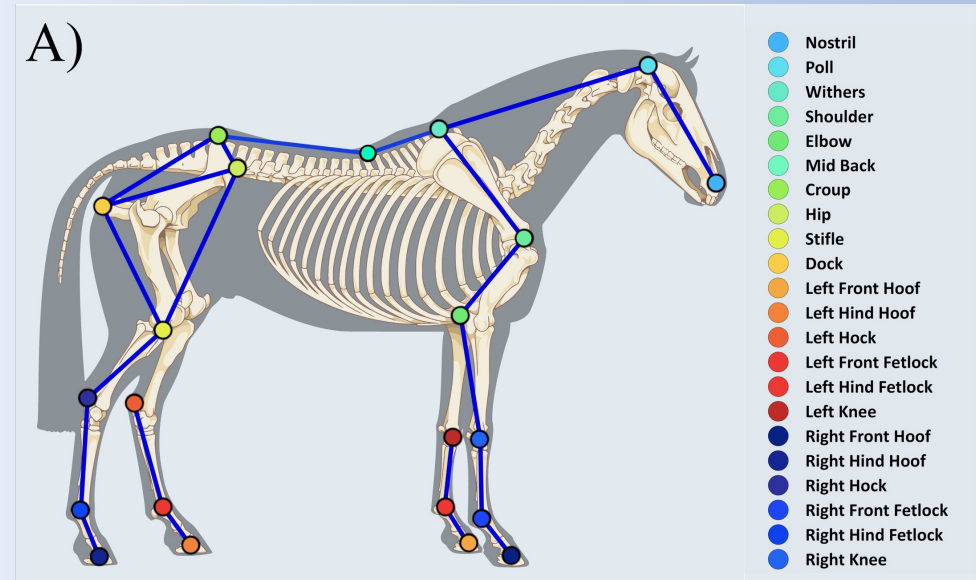
- Software: DeepLabCut
 - 26 Physiological landmarks
- Custom MatLab Pipeline:
 - Produced custom gait parameters

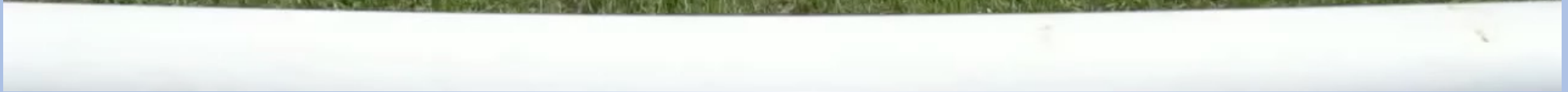


DeepLabCut:
a software package for
animal pose estimation



MATLAB





Statistical Analysis

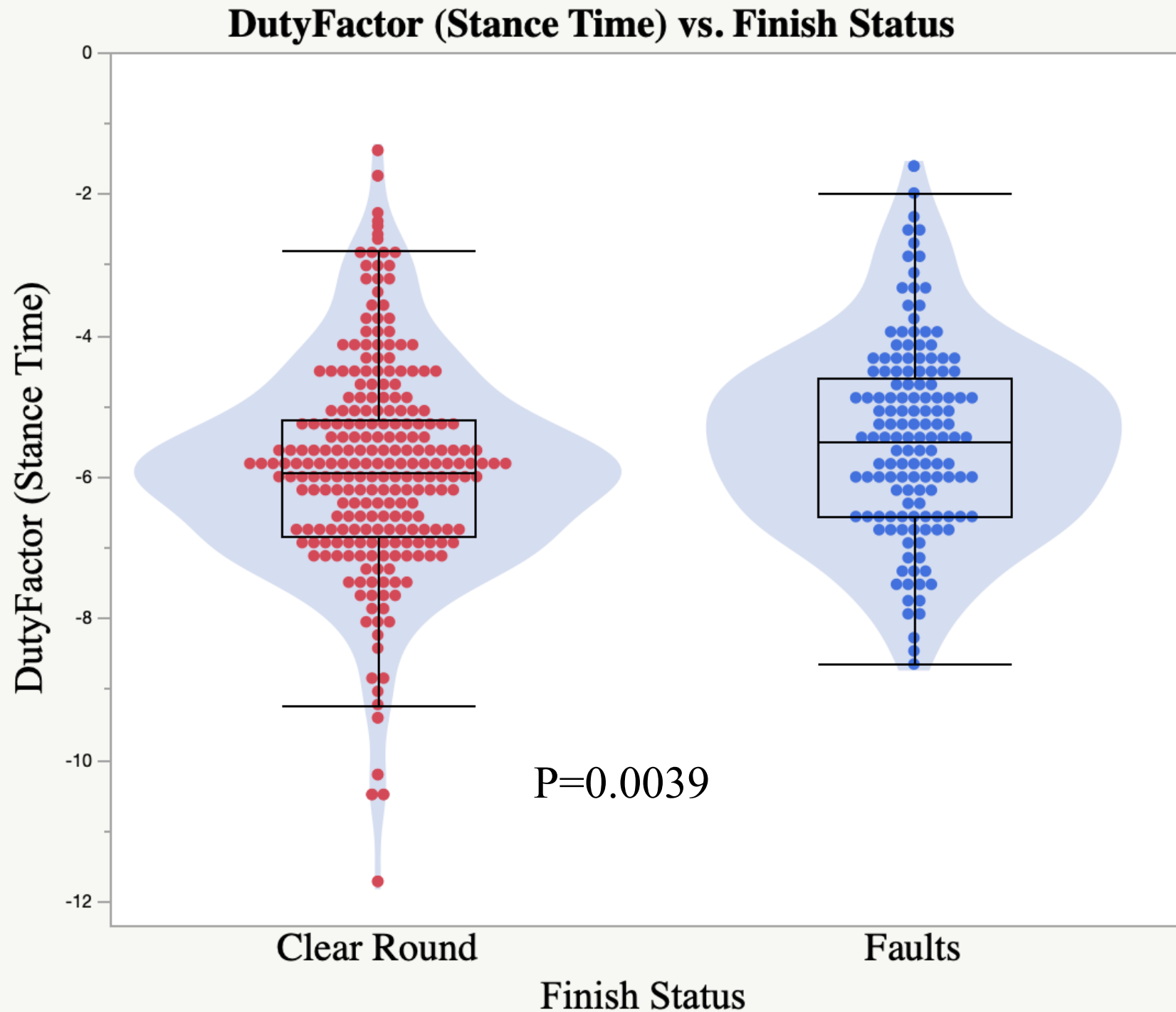


- Horses must have passed both the first and second veterinary inspection (N= 194)
- Parameters: Duty Factor (Stance Time), Speed, Stride Length, Fore Limb Extension, Hind Limb Extension
- Standard T-test to compare gait parameters from morning inspection and stadium performance
- Summarized changes pre and post cross country with a Qualitative Discriminant Analysis



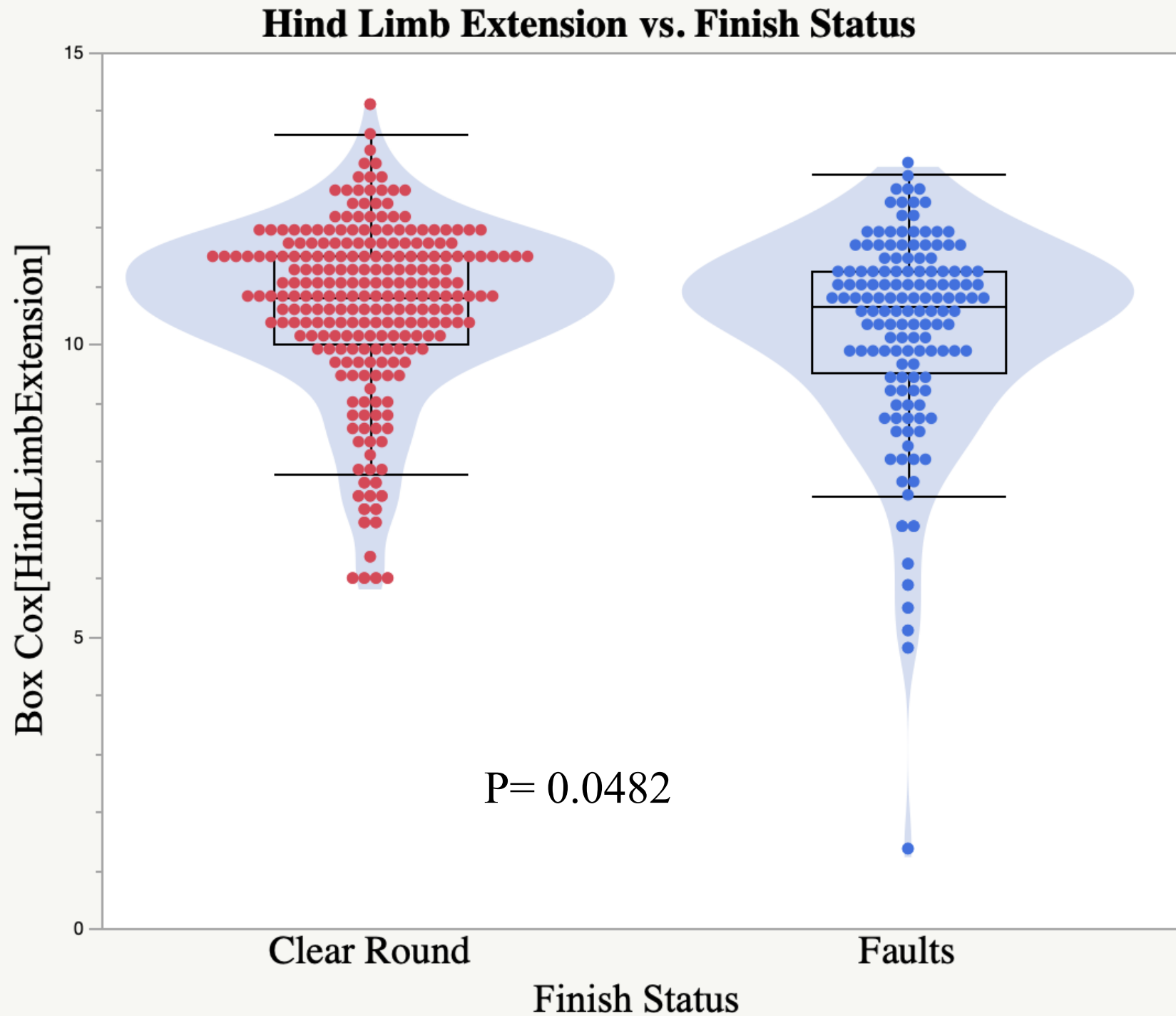
Results

- Morning inspection duty factor



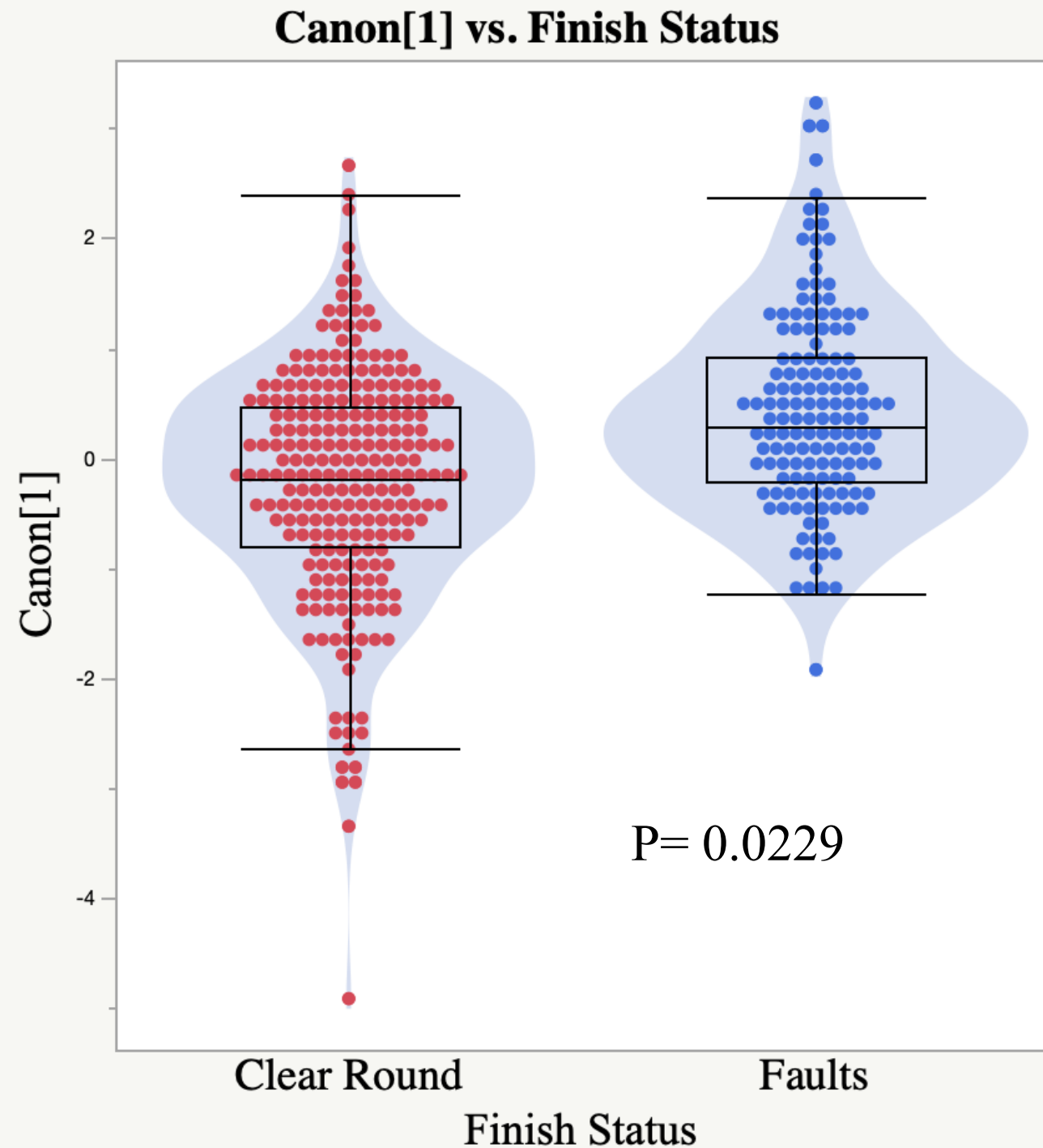
Results

- Morning inspection hind limb extension



Results

- Pre/Post cross-country summary score (6 gait parameters)



Discussion

Stride parameters and hindlimb length in horses fatigued on a treadmill and at an endurance ride

S. J. WICKLER, H. M. GREENE, K. EGAN, A. ASTUDILLO, D. J. DUTTO, D. F. HOYT

- Stride durations were 5% longer resulting in lower stride frequencies
- In endurance horses, hindlimb length was shorter in fatigue horses

Last Remarks and Limitations

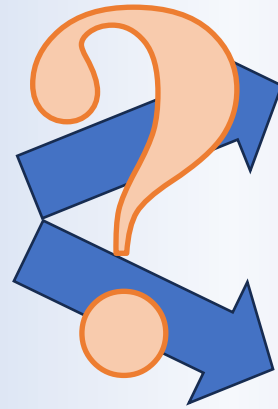


- **Not meant to replace veterinarians' role in the mandatory inspections**
- Athletic ability and conditioning may vary horse to horse
 - Hoof conformation (Trotter, et. Al., 2004)
- Rider error
- Not a direct detection of gait changes that are indicative of fatigue or minor lameness



Conclusions

- Horses with a greater change in gait post cross country were less successful in show jumping
- Artificial intelligence methods hold promise to detect subtle gait changes



A Look into the Future



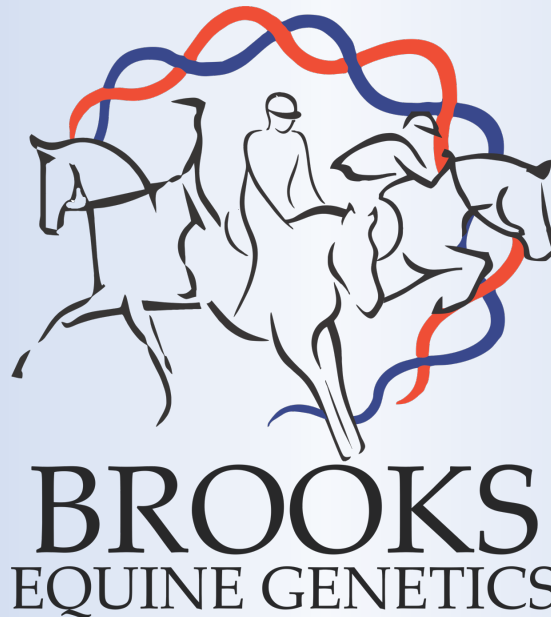
- Increase sample size to improve predictive capabilities
- Provide the opportunity to enhance the procedures for mandatory veterinary inspections rather than replace them



Acknowledgments

- Thank you to all horse owners and venues for allowing us to collect video data!
- Thank you Maddy, Dr. Brooks, and all associates for making me this study possible!

- Contact:
 - laurenjohns@ufl.edu



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- UF Center for Undergraduate Research Travel Award [02010902-101-4600-CRRNT-7000000]

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