

Impact of adding cows to the current EUROGENOMICS bull reference population

H. Alkhoder, Z. Liu and F. Reinhardt
IT-Solutions for Animal Production (vit), Germany

IB-Meeting 2017, Tallinn, August 25th-28th

German female genotyping and phenotyping projects



■ R&D genotyping project ***Kuh-L***

- About 20,000 cows genotyped from 56 large herds
- Born in 2011, mostly 2012, and 2013
- 5000 cows genotyped with 50K v2 chip, 15,000 with EG10K v4 or v5

■ R&D project ***GKUHplus***

- Data recording for novel traits
- More regions and herds involved
- Mastitis, claw health (6), reproduction (2) and metabolism (3)

■ Industry founded project ***KuhVision***

- Goal: 100,000 reference cows within 3 years, started in 2016
- Whole-herd genotyping, > 600 herds participating
- The novel traits from GKUHplus also collected

==> Maintain and increase accuracy of genomic prediction



A genomic validation study

- Phenotype, genotype and pedigree data from April 2017 evaluation
 - 34,707 Holstein bulls in EUROGENOMICS reference population
 - Deregressed MACE EBV for bulls and national EBV for all cows

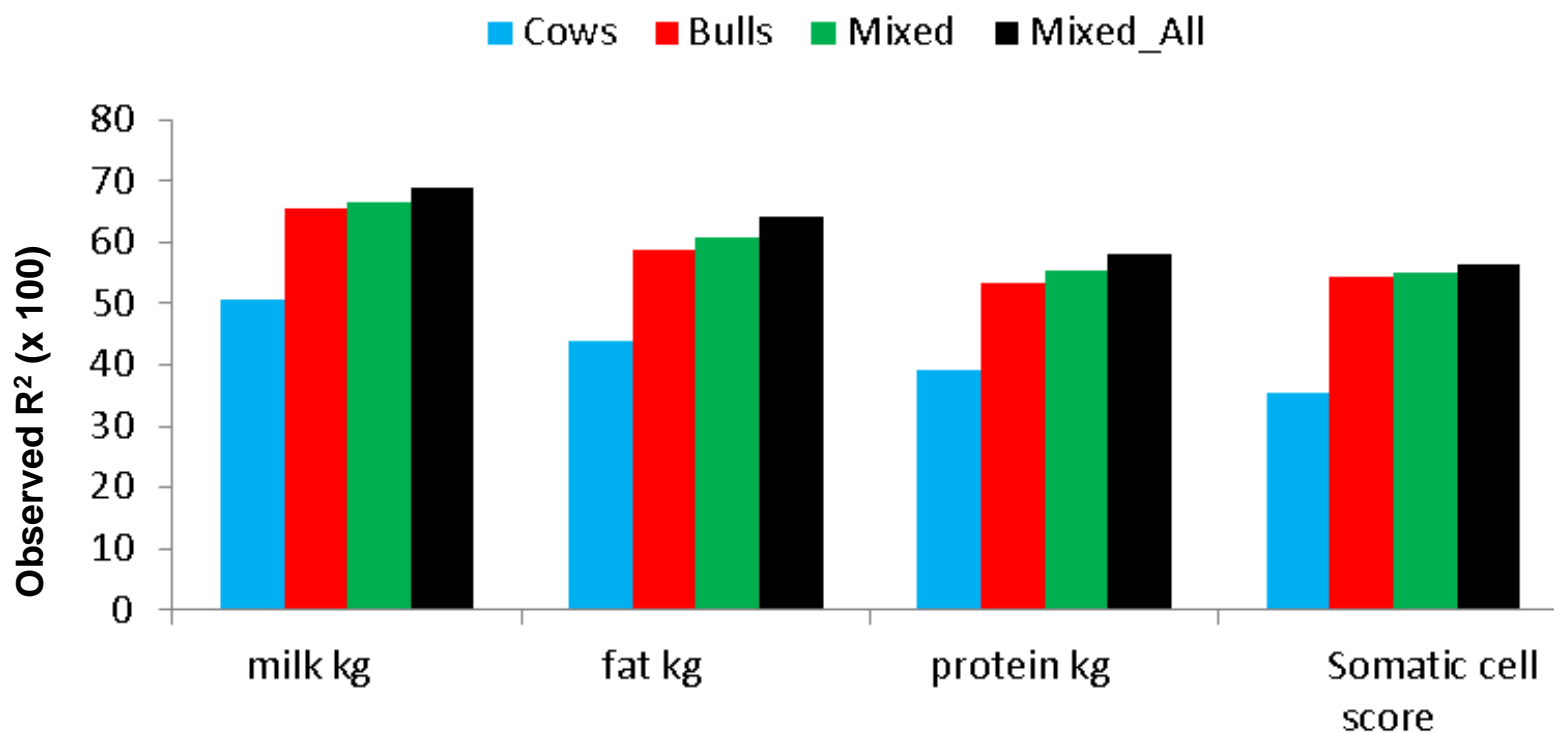
- Four scenarios for the reduced reference populations
 - **Bulls**: 31,428 Holstein bulls born before 2010
 - **Cows**: 19,064 cows from *Kuh-L* project
 - **Mixed**: 50,492 bulls and *Kuh-L* cows
 - **Mixed_ALL**: 81,002 animals (31,428 bulls + 49,574 cows)

- Selection of validation bulls: 894 Holstein bulls
 - Domestic Holstein bulls born 2010 to 2012
 - No sires of daughters included in the *Kuh-L* cow reference population

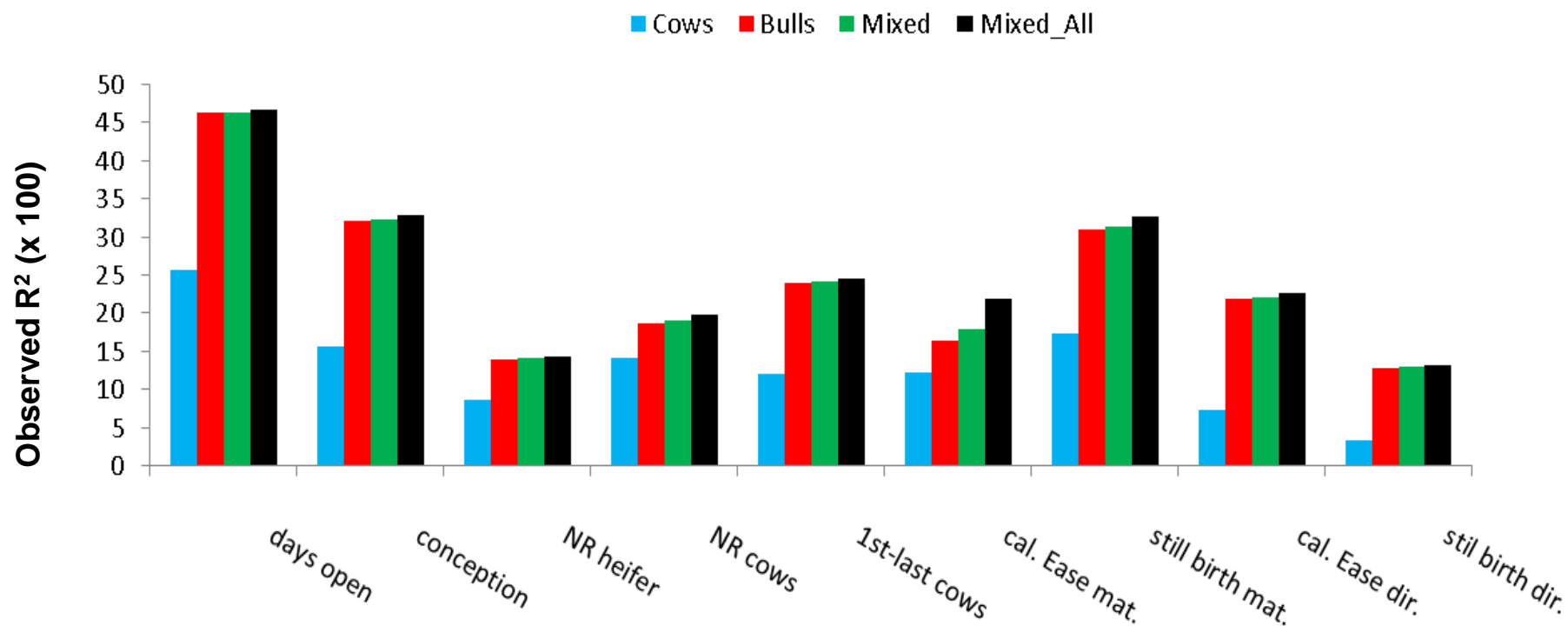
- All regular traits, plus health traits



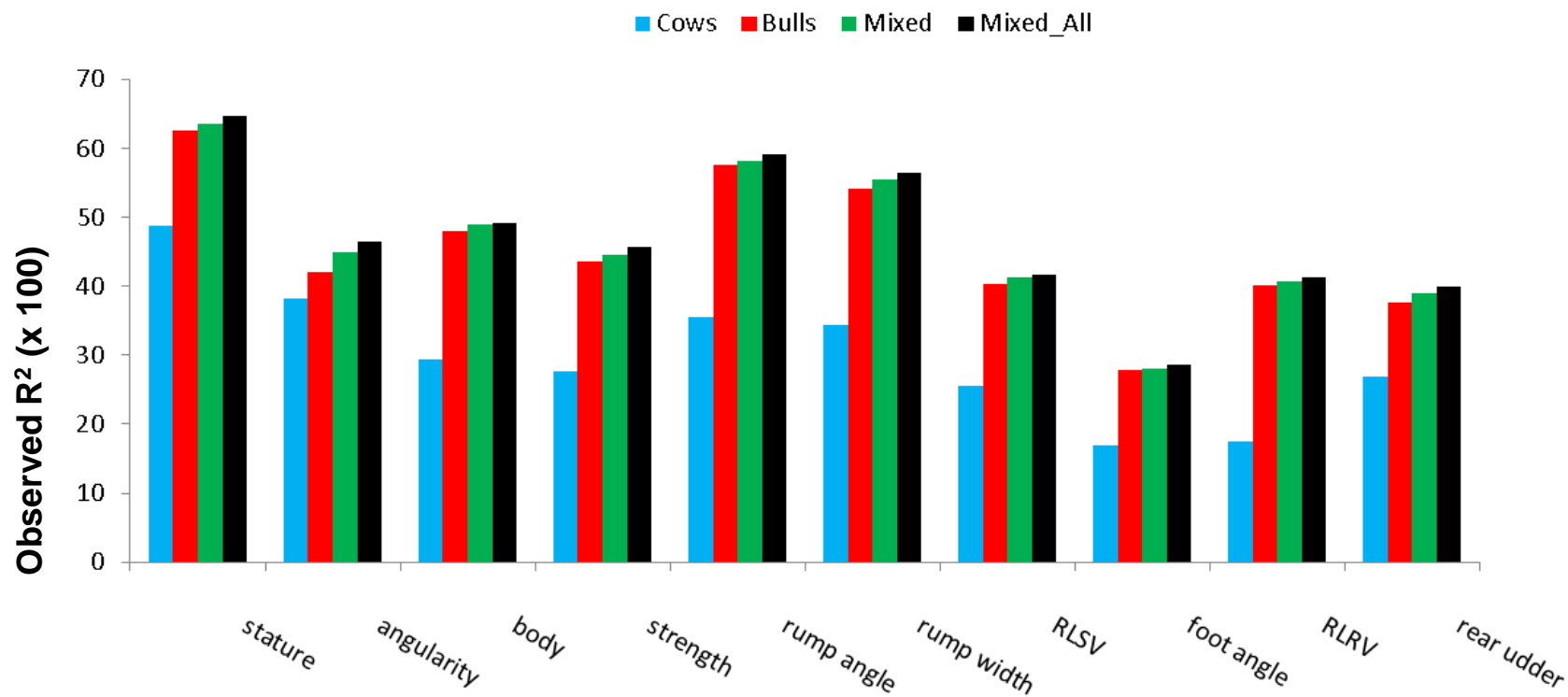
Results: observed validation R^2 values from GEBV test for milk production traits and somatic cell score



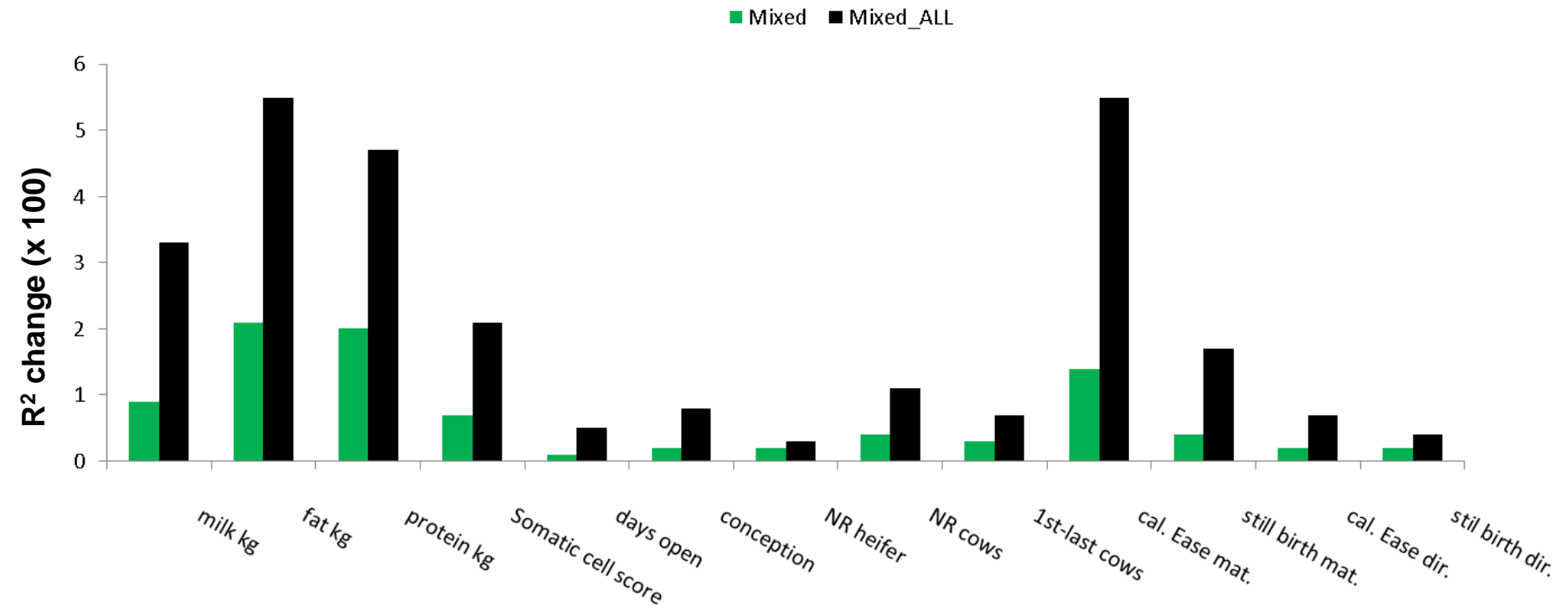
Results: observed validation R^2 values from GEBV test for reproduction traits



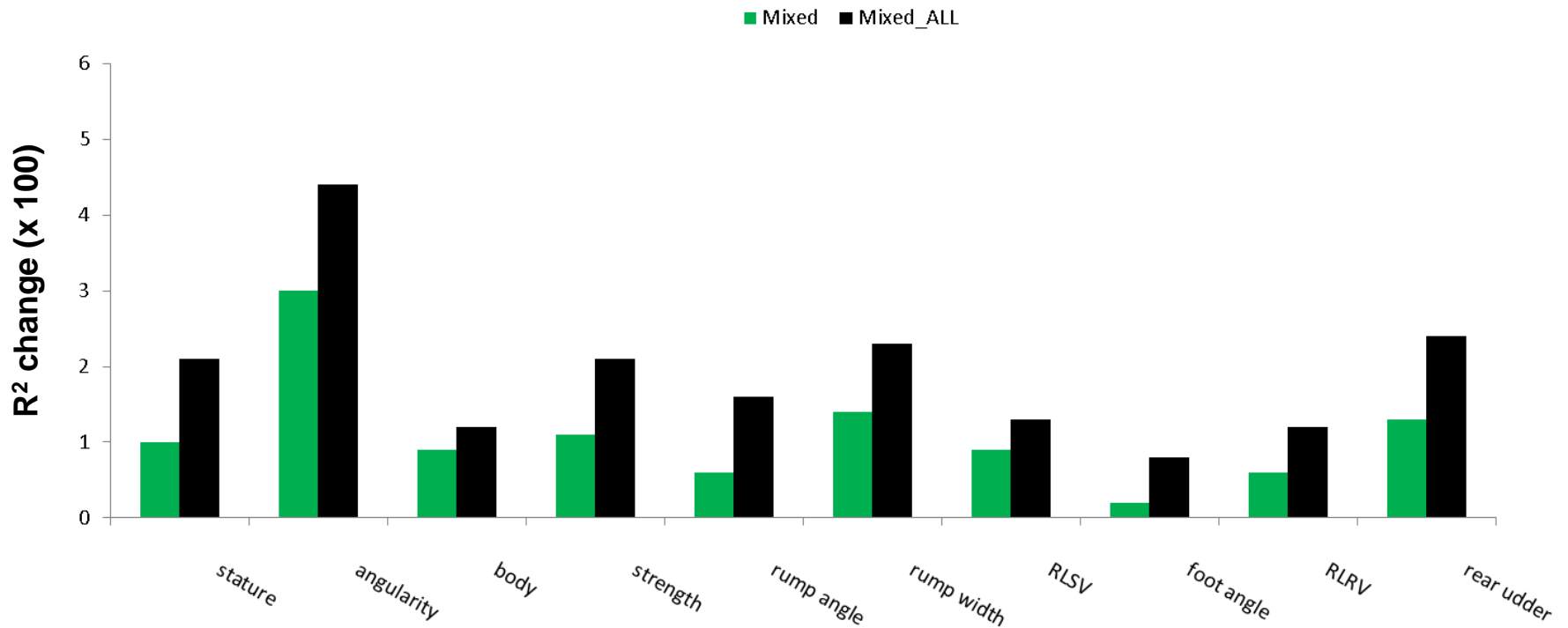
Results: observed validation R^2 values from GEBV test for selected conformation traits



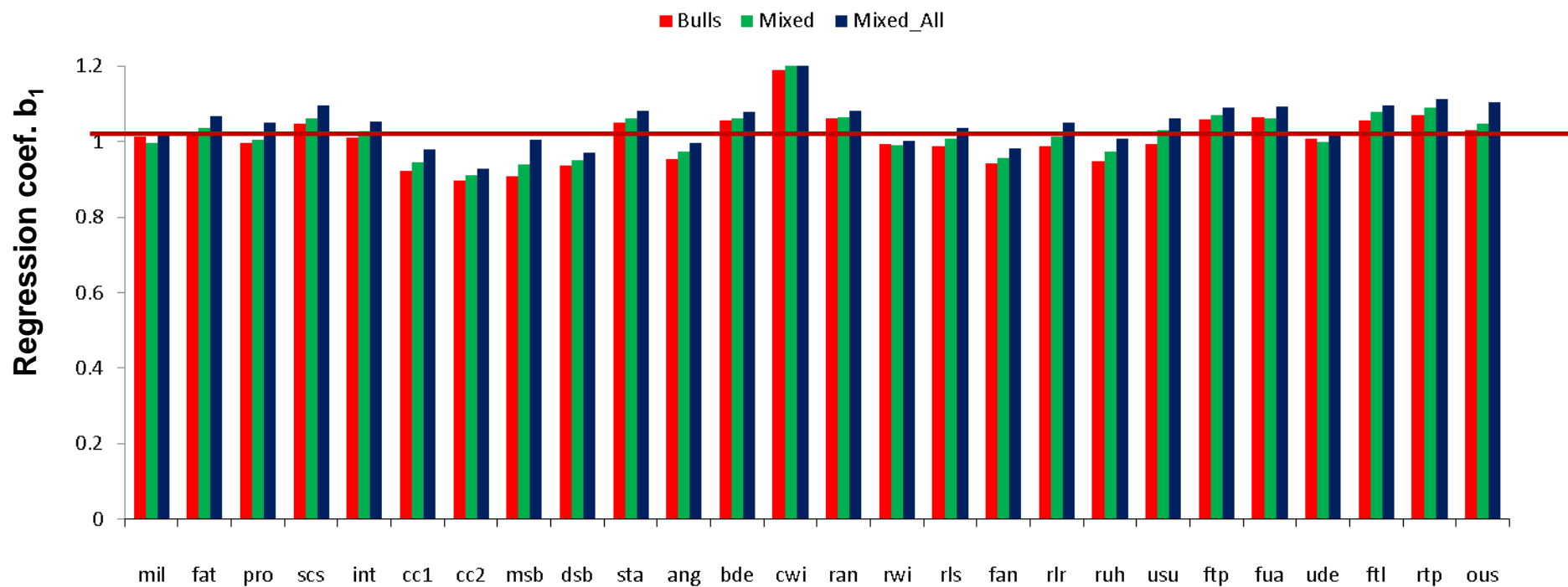
Results: changes in the validation R^2 by adding cows for milk production traits, somatic cell score, fertility and calving traits



Results: changes in the validation R^2 by adding cows conformation traits



Results: prediction bias, regression of DRP on GEBV



Comparison of SNP effect estimates: milk yield

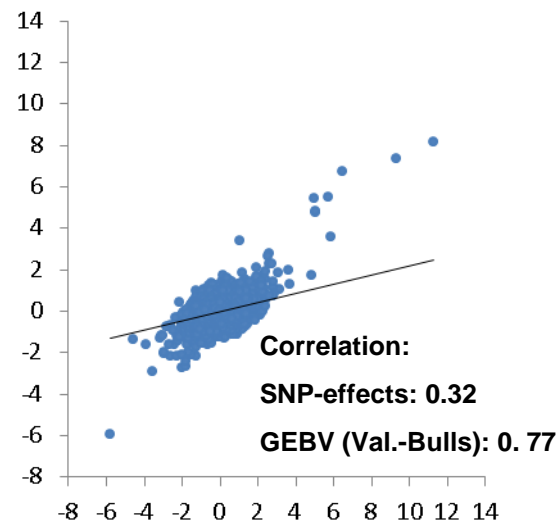
The SNP BLUP model with
the same RPG: 5%

Bulls: 31,428 reference bulls

Cows: 19,064 reference cows

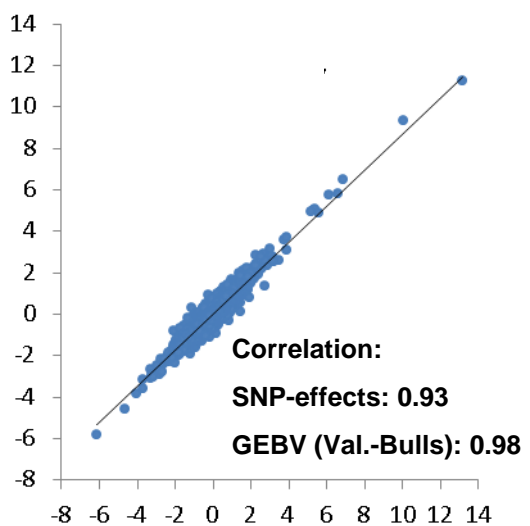
Mixed: 50,492 mixed RP

Cows



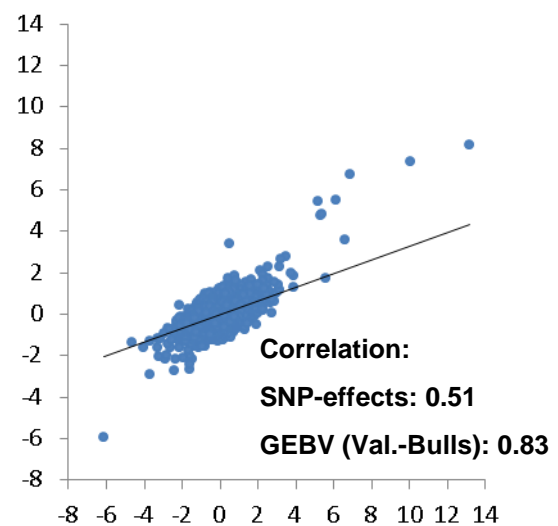
Bulls

Bulls



Mixed

Cows



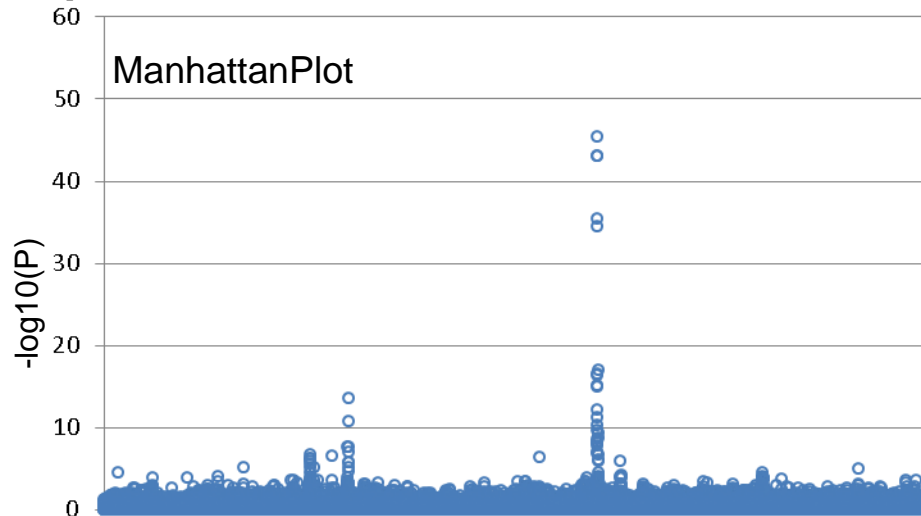
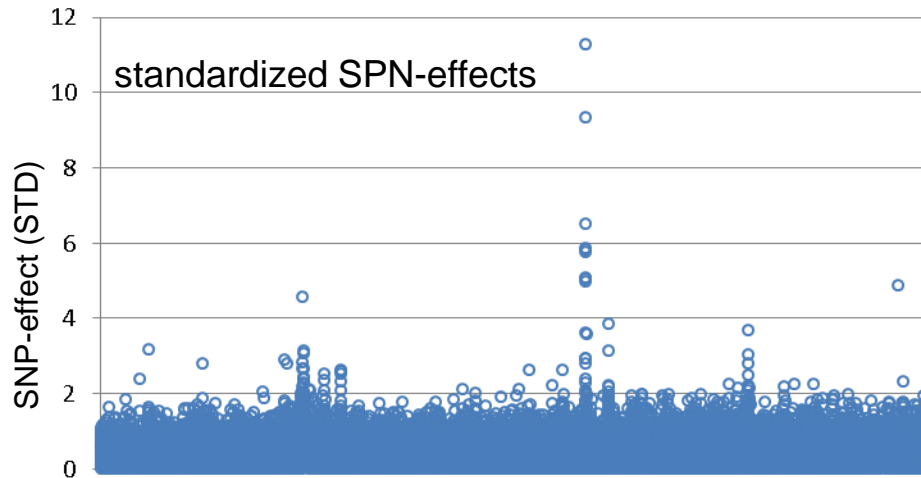
Mixed



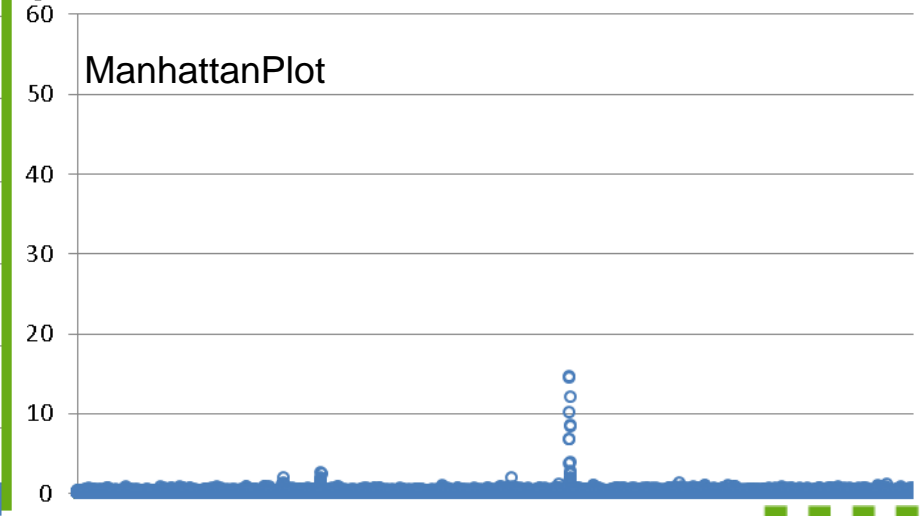
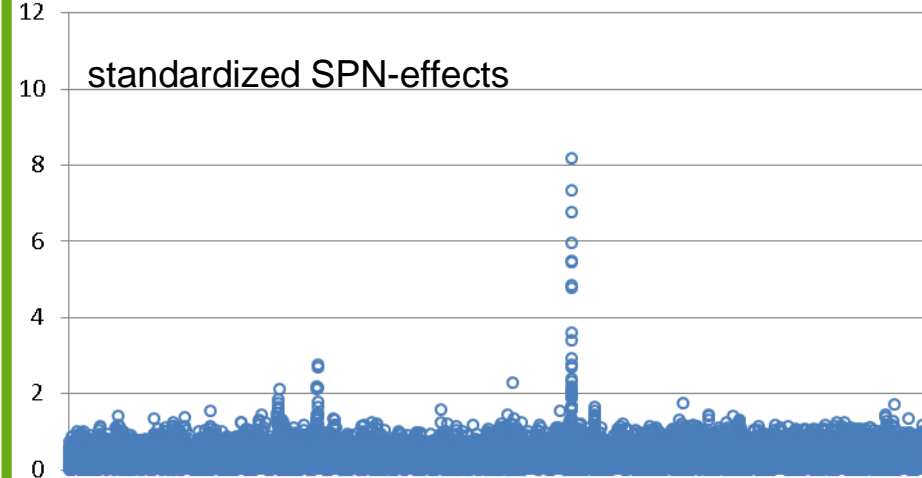
SNP-Effects (SNP-BLUP) and GWAS Analysis for Milk-kg



Bull-Ref



Cow-Ref



A genomic validation study for health traits

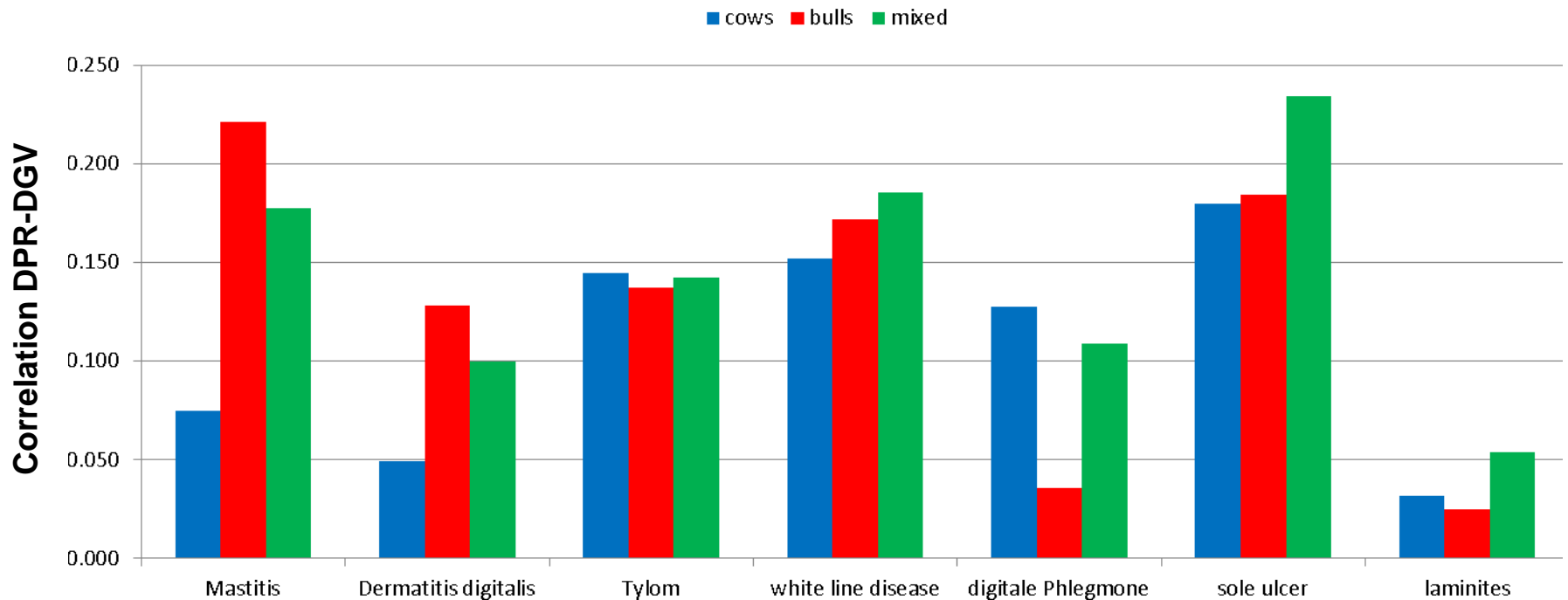
The SNP BLUP model: RPG 10%

Bulls: 2,007 reference bulls

Cows: 16,206 reference cows

Mixed: 18,210 mixed RP

Validation bulls: 250



Comparison of SNP effect estimates claw health traits and mastitis (e.g. sole ulcer $h^2=0.123$)

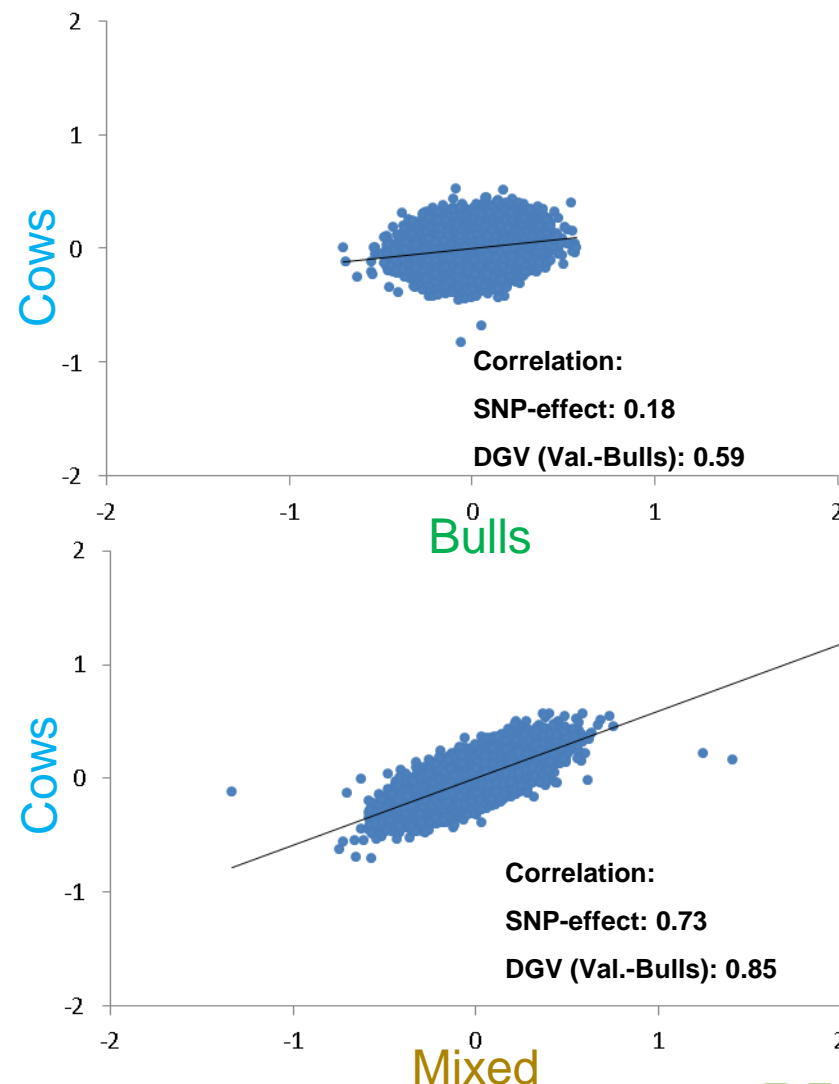
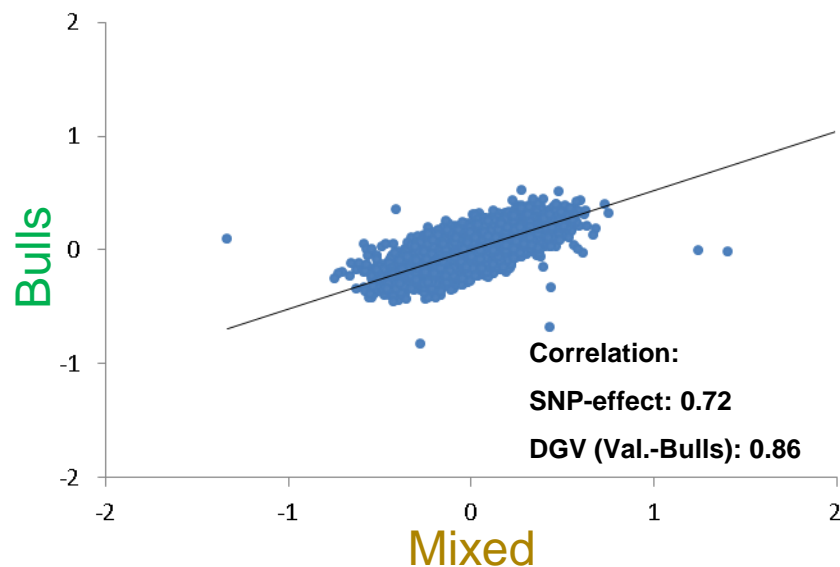
The SNP BLUP model:
RPG 10%

Bulls: 2,007 reference bulls

Cows: 16,206 reference cows

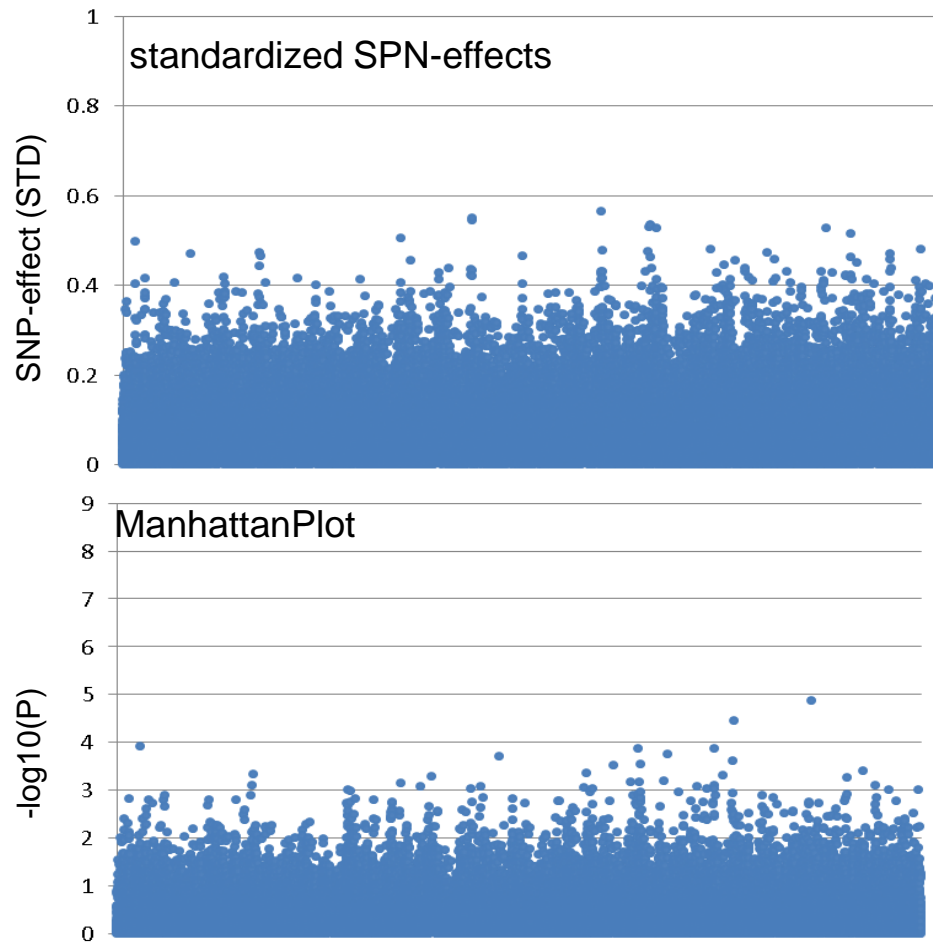
Mixed: 18,210 mixed RP

Validation bulls: 250



SNP-effect (SNP-BLUP) and GWAS Analyses for Sole Ulcer

Bull-Ref



Cow-Ref



Conclusions

- Adding cows (20,000/50,000) to the EG bull reference population resulted for all trait in higher accuracy (R^2)
- Mixed reference population always had the highest accuracy
- Mixed reference population also unbiased
- SNP-estimation model for cow and mixed reference populations still not optimized due to bias (RPG%)
- **INTERBULL** validation criteria are reached in all traits using mixed reference population, too
- Current cow reference population for health traits (16,000) too small
→ low accuracy and biased
- The dGW for new health traits had too low accuracy as of little data yet



Acknowledgement

- ❑ German Federal Government (BMBF) for funding the project
- ❑ Project partners
 - ❑ German Holstein organization (FBF),
 - ❑ Univ. MLU (Halle),
 - ❑ Univ. Kassel



Bundesministerium
für Bildung
und Forschung



Institut für Agrar- und Ernährungswissenschaften
Martin-Luther-Universität Halle-Wittenberg
Professur für Tierzucht

The logo for the University of Kassel, featuring a stylized green leaf pattern.

U N I K A S S E L
V E R S I T Ä T



Thanks for your attention!

vit



IT-Solutions for Animal Production