Application of the Interbull genomic reliability method for single-step evaluation of test-day and conformation traits in German Holsteins

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Data materials for single-step genomic reliability calculation

April 2023 evaluation	Test-day traits	Conformation traits
Frequency of	4 traits, e.g. protein yield	25 traits in 3 sub-groups
Genotyped Holstein animals	1,318,780 (1,138,039 females and 180,741 males)	
Cows and bulls with phenotypes	13,528,444	3,144,366
--- Phenotypic records	263,673,267	3,144,366
Genotyped or phenotyped animals	14,402,662	4,131,336
Animals in pedigree	21,850,276	10,048,593
Reference animals (cows & bulls)	524,187	386,062

Genomic reference populations for April 2023 evaluation

	Protein yield PKG	Stature STA	Locomotion LOC	Angularity ANG	Udder balance EUB
Reference cows	478,588	357,365	349,083	198,170	305,122
Reference bulls	45,591	28,635	27,696	27,748	27,205
Total	524,179	386,000	376,779	225,918	332,327

Data materials for validating genomic reliability values

| Frequency of	Test-day traits Full evaluation 2104 and truncated 2104VAL (== 1704)	Conformation traits Full evaluation 2304 and truncated 2304VAL (== 2104)
Genotyped Holstein animals	949,636	1,318,780
Cows and bulls with phenotypes	12,571,710	3,144,366
--- in truncated evaluation	11,032,395	2,862,770
Animals in pedigree	20,461,400	10,048,593
Reference animals (cows & bulls)	353,347	386,062
--- in truncated evaluation	156,970	263,252

Results: exact, theoretical DGV reliabilities for genotyped Holstein AI bulls
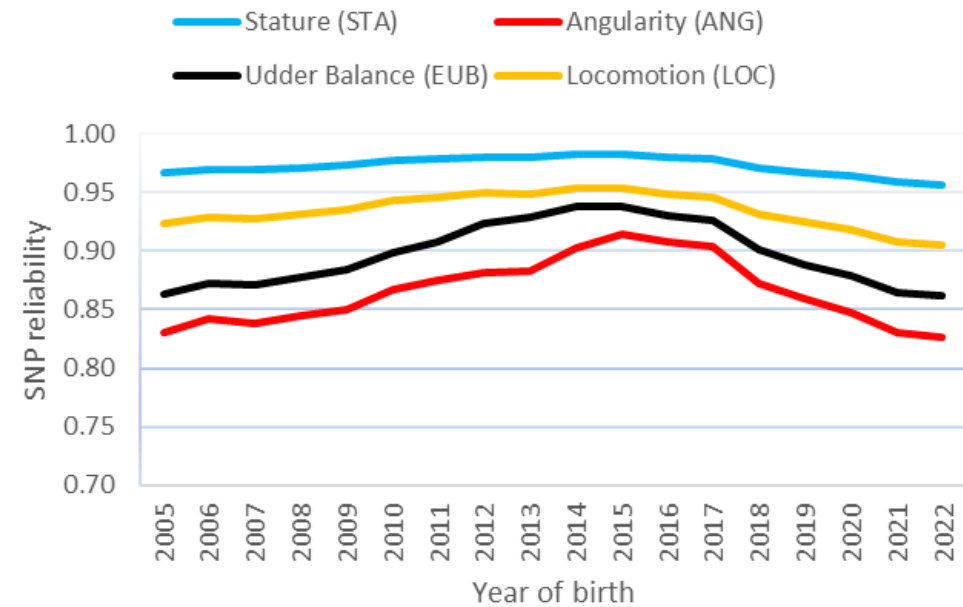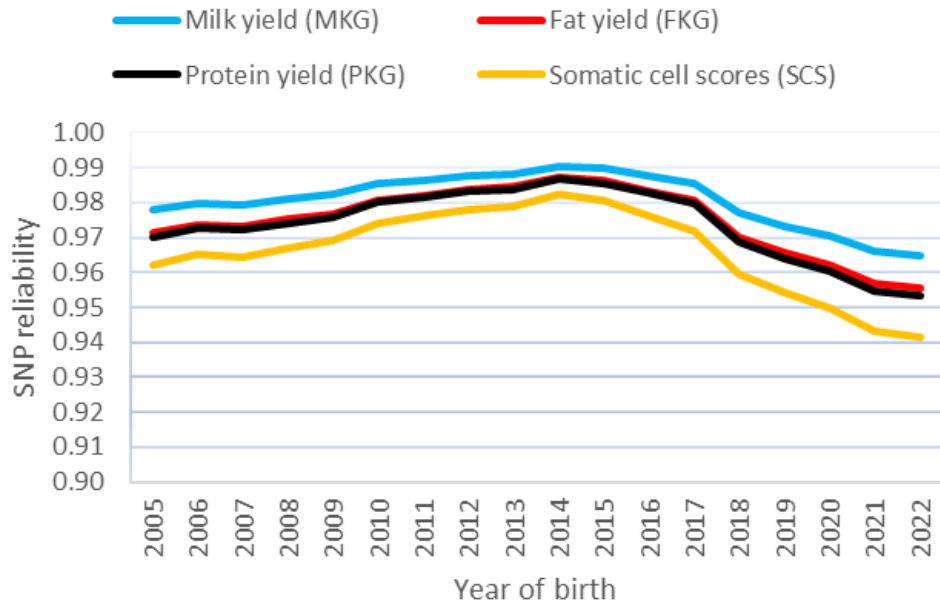
8,123 German Holstein AI bulls born from 2005 to 2022

Results: Variation in exact, theoretical DGV reliabilities for genotyped German Holstein AI bulls
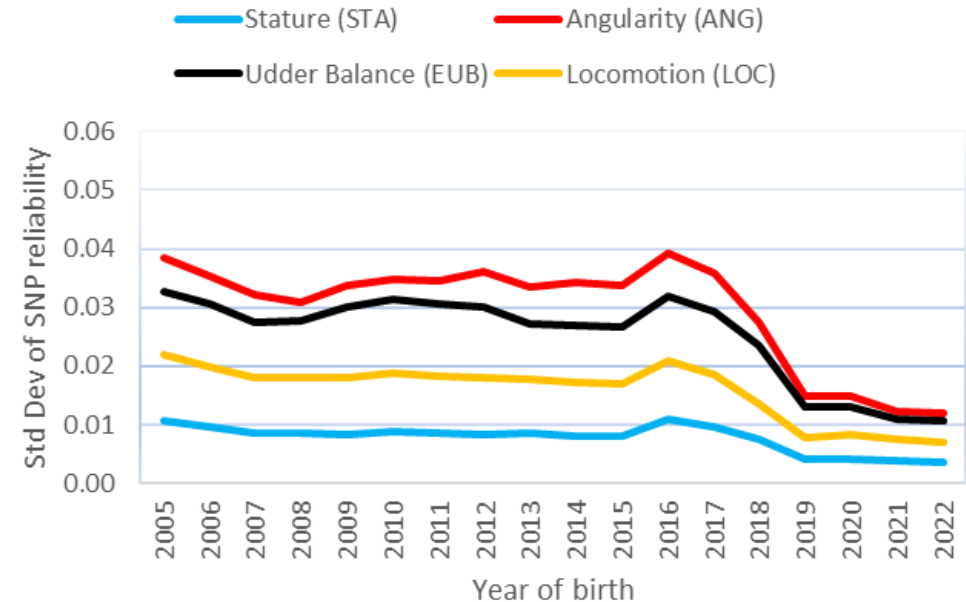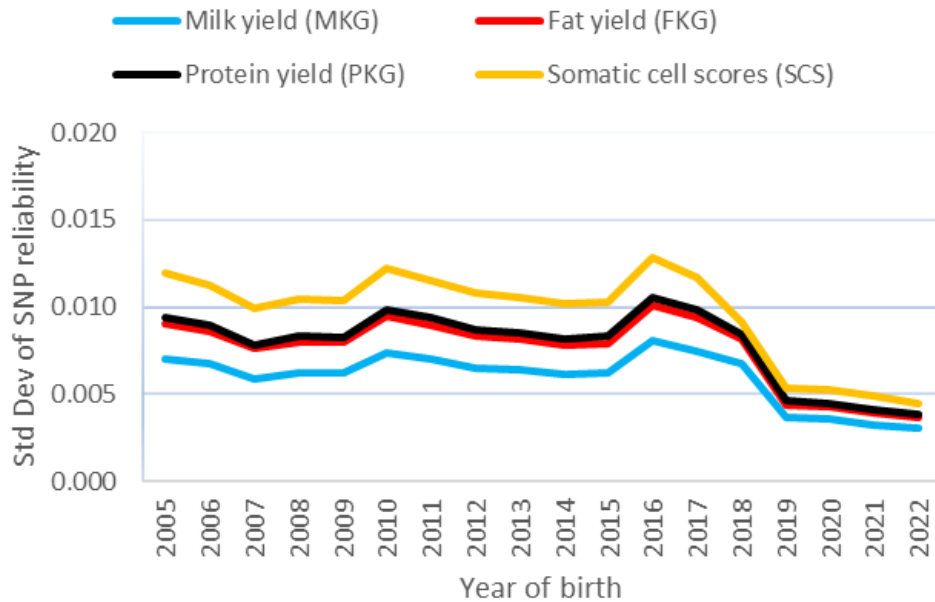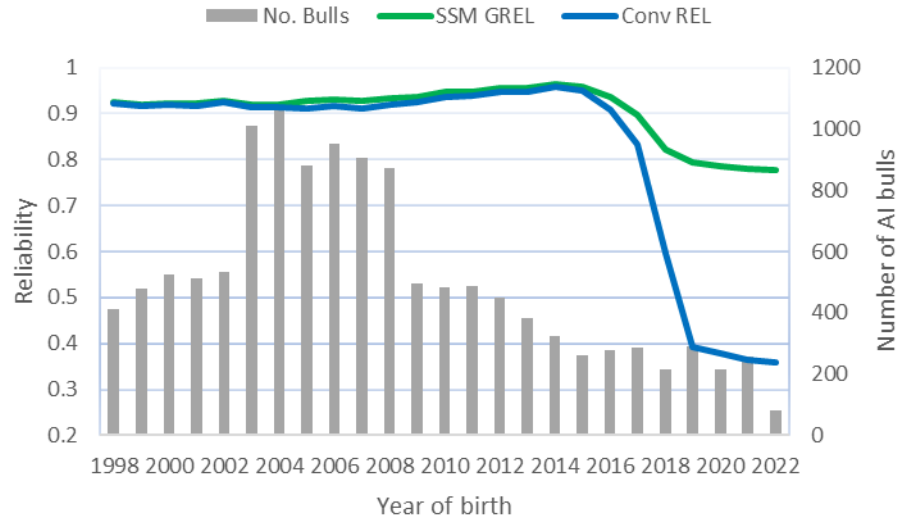

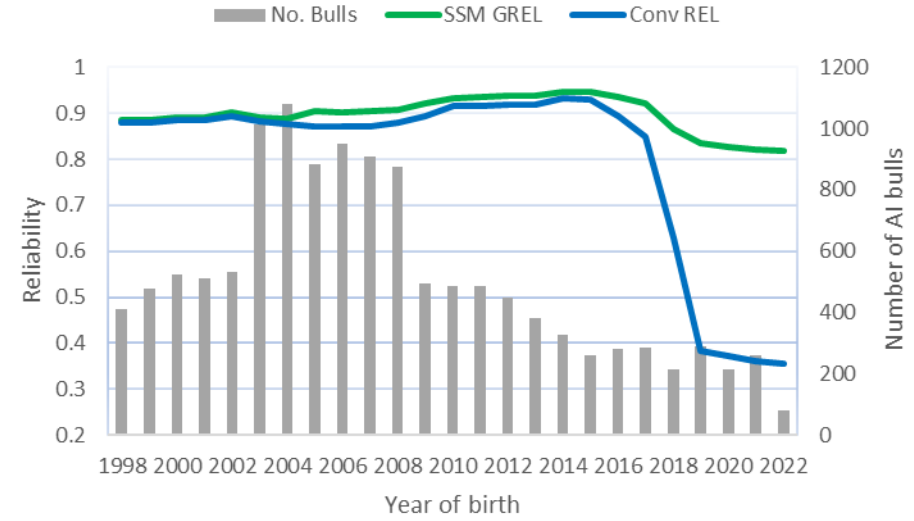8,123 German Holstein AI bulls born from 2005 to 2022

Results: Final genomic and conventional reliabilities of Holstein AI bulls
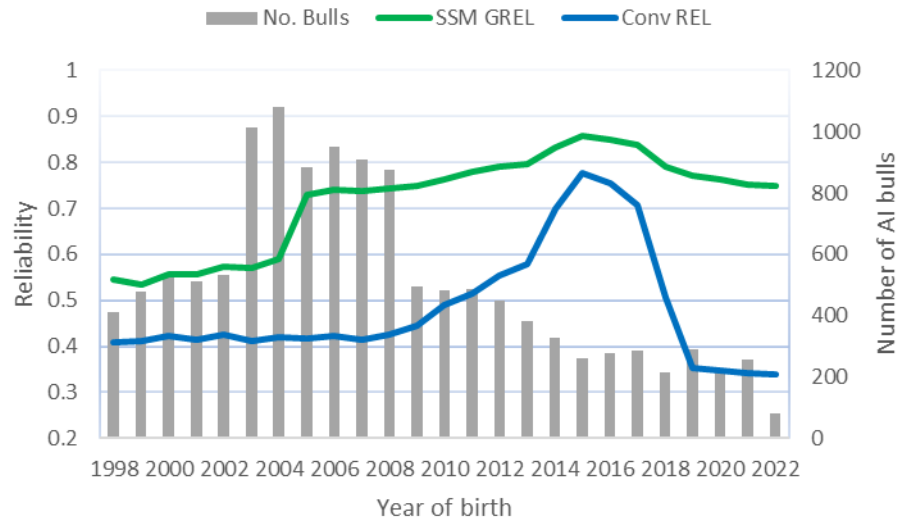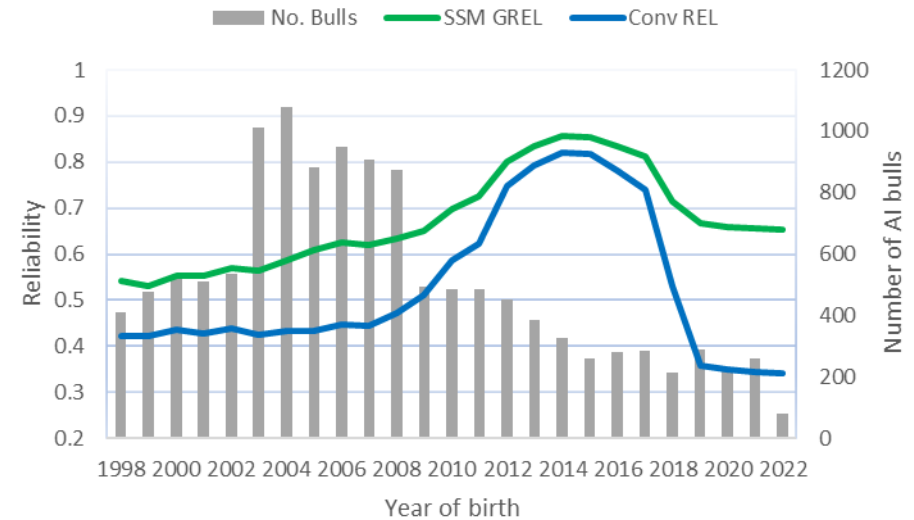

Protein

Stature

Angularity

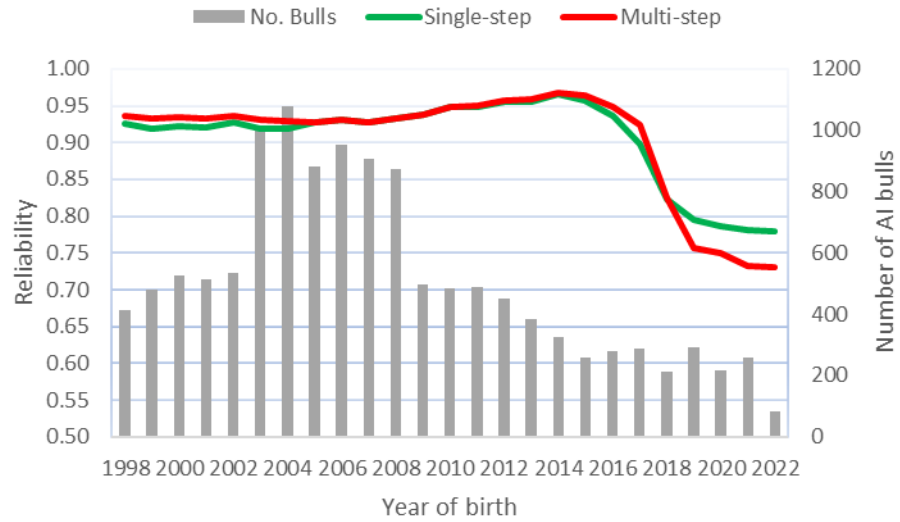Udder balance

12,673 German Holstein AI bulls born from 1998 to 2022

Results: Final single- & multi-step genomic reliabilities of Holstein AI bulls

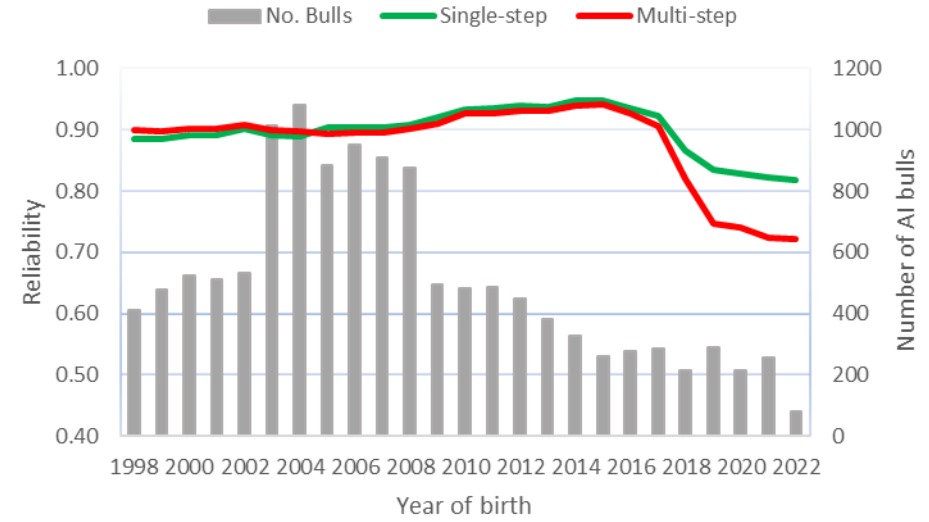Protein

Stature

Angularity

Udder balance

12,673 German Holstein AI bulls born from 1998 to 2022
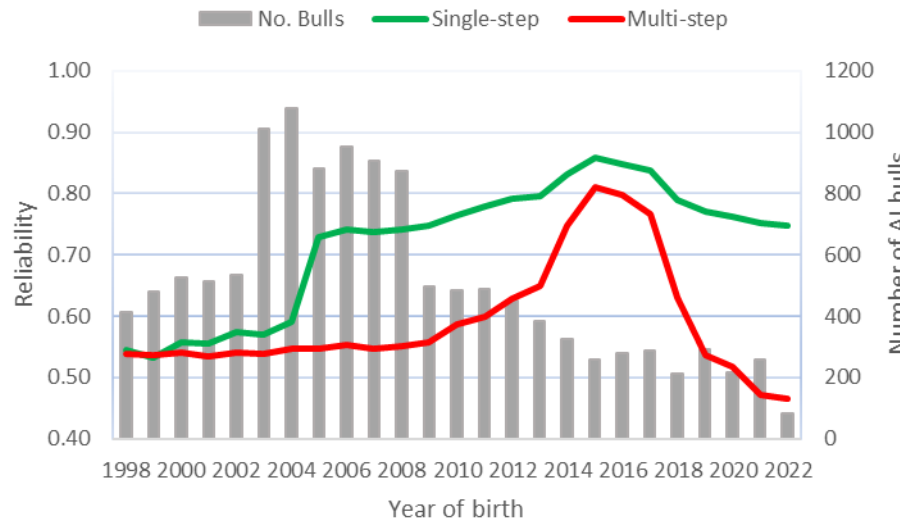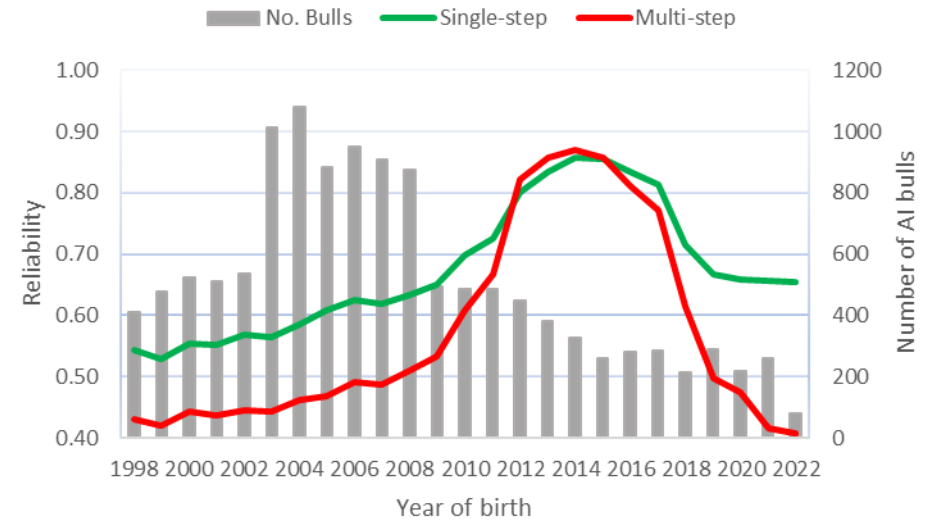
Summary and conclusions

- Interbull genomic reliability method was tested in DEU
  - For single-step evaluations of test-day and conformation traits
  - Using > 1.3 million genotyped Holstein animals
  - With > 0.5 million reference animals

- Exact theoretical DGV reliabilities for young candidates very high
  - Due to the extremely large reference population
  - Important to adjust the genomic EDC gain based on the genomic validation results

- Small variation of theoretical DGV reliabilities within birth year
  - Less critical to calculate animal individual DGV reliability
  - A constant genomic EDC gain may give an reasonably approximation
  - Ensure the proper level of genomic reliabilities for young candidates
  - Skip the time-consuming part of theoretical DGV reliability calculation in routine evaluation

Summary and conclusions

- Comparable national genomic reliabilities by implementing the Interbull method

    - For a new model implementation or a major model update:
        - Calculate exact DGV reliabilities via the snp_blup_rel provided by Luke

        - Adjust genomic reliability level using GEBV test results

    - For routine single-step evaluation with computing resources limitation
        - A constant genomic EDC gain is a good alternative for faster calculation

        - Another option is to reduce the number of SNP markers to 15,000

Thank you for your attention!

Thanks to the members of
Interbull GREL working group!

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