abacusbio.
BRIDGING SCIENCE & BUSINESS

DairyNZ

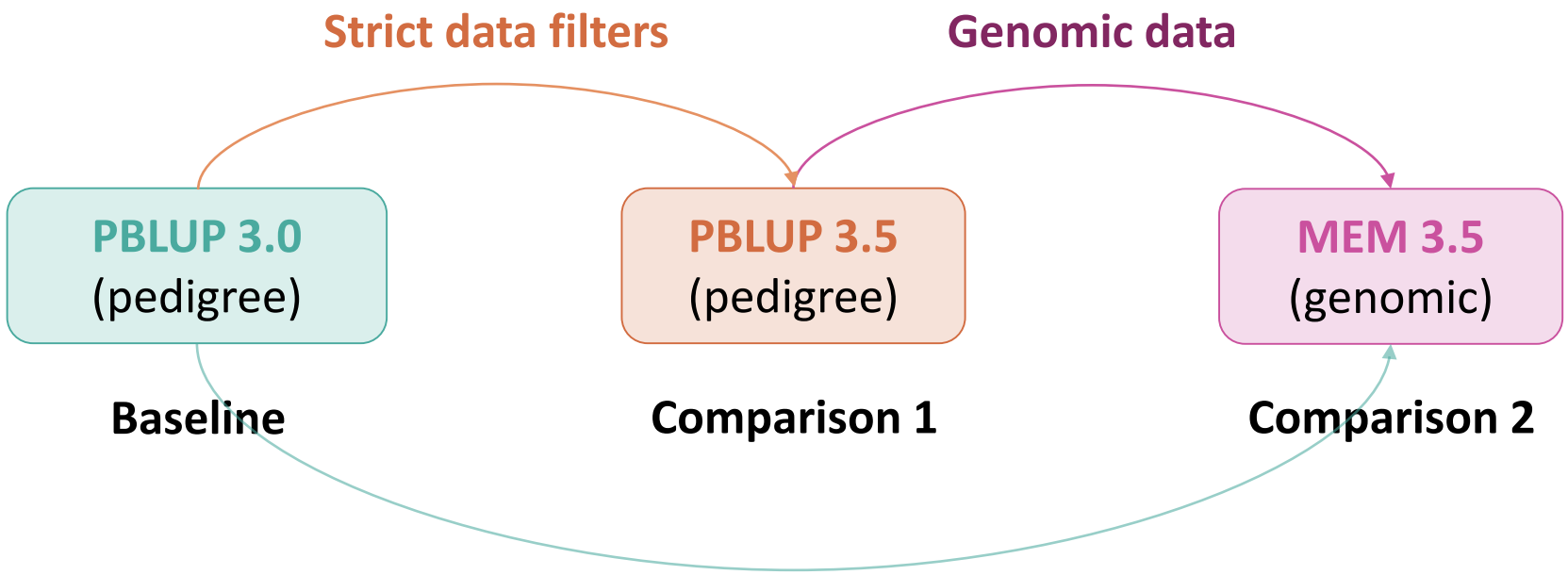
Designing a Validation Application for Genetic and Genomic Evaluation in the New Zealand Dairy Industry

E. Ooi, M. Price, K. Stachowicz, P. Amer, R. Handcock, M. Stephen

Interbull: Lake Bled, Slovenia, May 2024

Context

- NZAEL 3.5 proposes significant improvements for the New Zealand dairy industry:



Will the **new NZAEL 3.5 genetic evaluation system** be better than the old NZAEL 3.0 system?

Context

- Current national genetic evaluation system does not include genomics
  - Will allow farmers to rank bulls across companies on the same scale using genomic technology
  - Significant investment of farmer levy funds

- A robust validation process is crucial for the successful implementation of NZAEL 3.5.
  - System-wide overhaul of all current traits
  - Models developed using BOLT and Helical software

Project timeline

2023 — 1. Pipeline development

February 2024 — 2. Planning workshop

- **Build the NZAEL 3.5 validation map:** a practical guide for development decisions.
  - Define the scope of the project
    - Prioritise the target audience
    - Distinguish ‘core’ validation pipeline from ‘exploratory’ analysis

What do **we need** to feel confident that the new system is genuinely ‘better’?

Guiding principles

- **How do we know the new EBVs are 'better?'**
  1. Do they make sense (e.g., genetic trends and breed differences)?
  2. Do differences in EBVs accurately predict differences in phenotypes?
  3. Are they stable when more information is included?
  4. Are they biased?
  5. Will they pass Interbull testing?

- What tests and metrics do we need to check for each of these?
- What are the trigger points for identifying a problem?
- Which focal groups should we track?
- How do we present these results?

DairyNZ

Validation process

2023

February 2024

1. Pipeline development

2. Planning workshop

3. App development

Trait Analysis Dashboard (Revie

abacusbio.shinyapps.io/NZAEL_validation_review/

AbacusBio Analytics All Bookmarks

Trait Analysis

Choose a Trait:

Liveweight

Choose a Focal Group:

OmitPhn_NonGeno-cows

Version 1.1.8

Show Changelog

COWS

OmitPhn NonGeno

OmitPhn Geno

BULLS

LowInfo

LowInfo Geno

Changelog

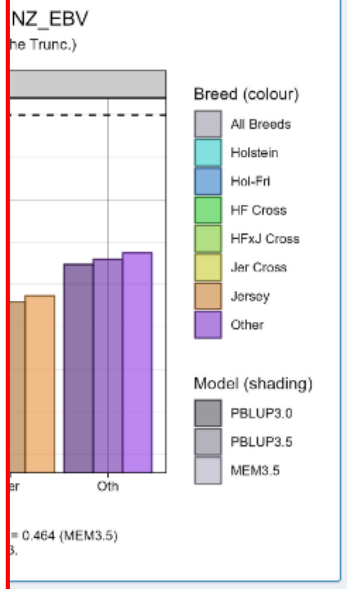
Version 1.1.8 (2024-05-11)
- Bull count column added to trend test tables.
- New BCS trend test 2 & 3 results added for Holstein PBLUP 3.0 & PBLUP 3.5.
- Removed redundant "mas" trait for SCS Interbull results.

Version 1.1.7 (2024-05-09)
- Fixed Interbull tt4 file format, updated results - shows gen sd now rather than gen var.
- Added results for BCS (reviewer version), Lwt and TOP_TL

Version 1.1.6 (2024-05-07)
- Added Interbull results for trend test 4, and overview tables for all the traits (BCS is the only incomplete trait at this point).

Version 1.1.5 (2024-05-03)
- Added standard deviation trend plots.
- Added intercept plots.
- Updated genetic trend plots to define 'BirthYear' from the 1st of June onwards (season versus calendar year).
- New logic to dynamically determine (per trait & sex) count thresholds for datapoints of trend plots.
- Added Interbull results for trend tests 2 & 3 for MEM3.5_14 models.

Version 1.1.4 (2024-04-22)
- Reran MFPS and updated to _14 'relaxed filter' runs.
- Removed results for validation cows with number of herd tests < 3 due to unreliable phenotypes.
- Same-HT focal group adjusted using file AP2_FG_12_35.csv.bz2.
- LowInfo focal group counts fixed when using DYD file for daughter counts.
- Added Interbull trend test 2 (DYD trend) & 3 (EBV trend accounting for new daughters) results.



Example

For liveweight, how much does genotype data improve the predictive ability of EBVs?

Trait Analysis Dashboard (Revie

https://abacusbio.shinyapps.io/NZAEL_validation_review/

AbacusBio Analytics All Bookmarks

Trait Analysis

Choose a Trait:

Liveweight

Choose a Focal Group:

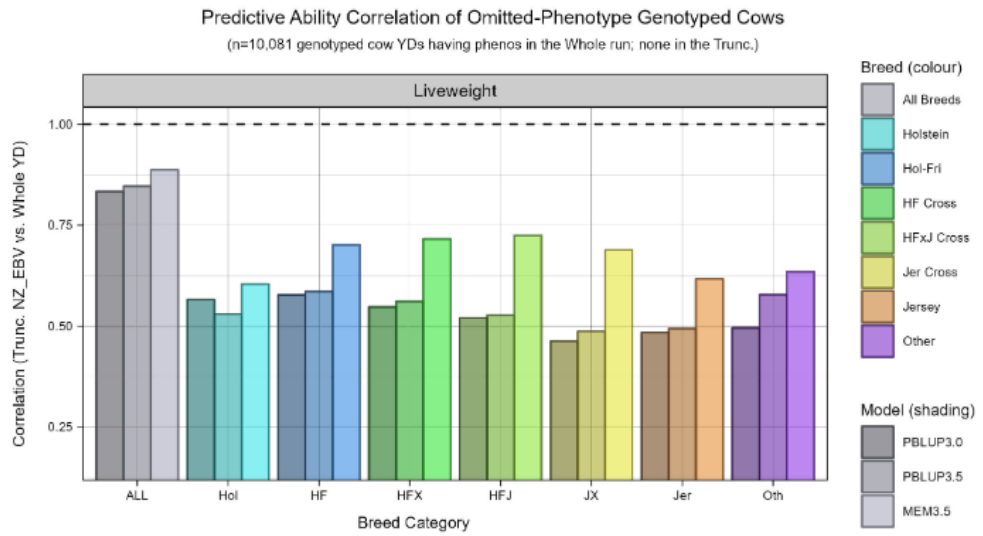
OmitPhn_Geno-cows

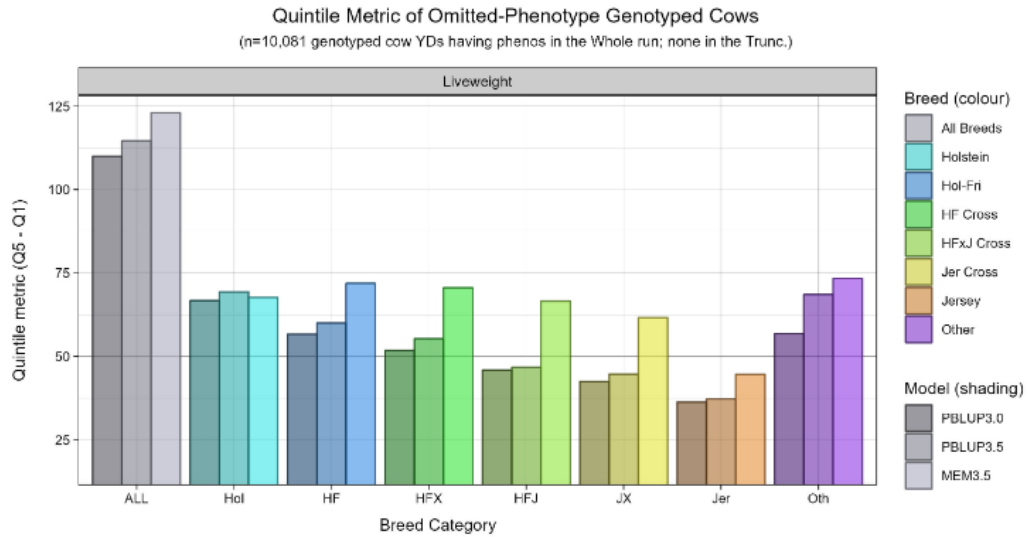
Version 1.1.8

Show Changelog

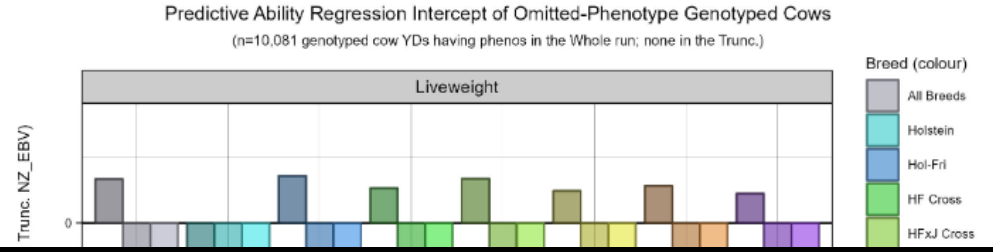
Overview | Sense-Making | Predictive Ability | Bias and Stability | Interbull

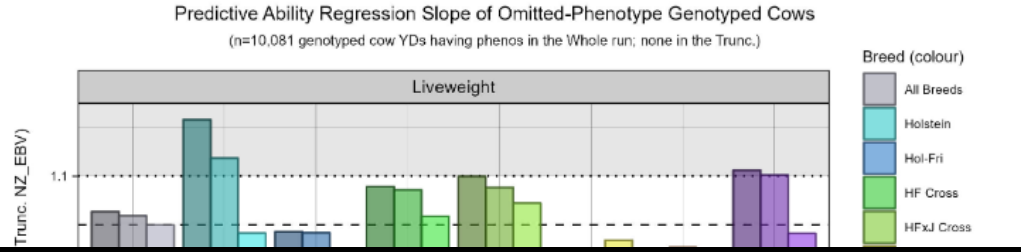
Regression Correlation and Quintile Analysis





Regression of Adjusted Phenotypes on EBVs

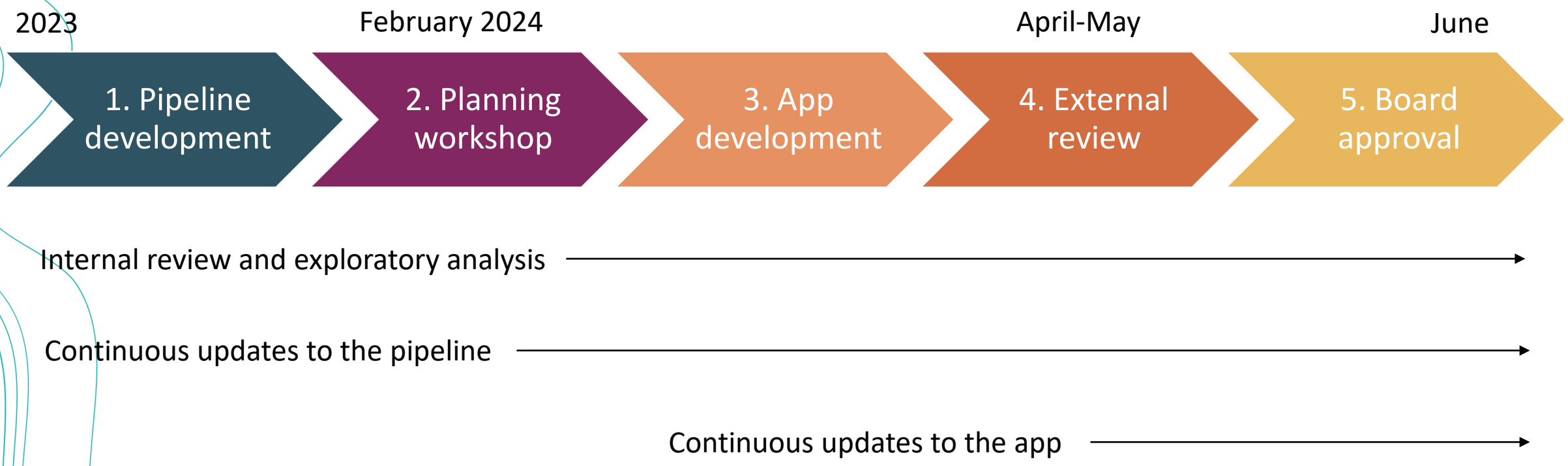




OmitPhn_Geno Cows

	ALL	Hol	HF	HFX	HFJ	JX	Jer	Oth	
Focal group - count	10,081	148	1,811	1,344	1,983	727	3,639	429	All
(D)YD on EBV - corr	0.83	0.57	0.58	0.55	0.52	0.46	0.48	0.50	P3.0
(D)YD on EBV - corr	0.85	0.53	0.59	0.56	0.53	0.49	0.49	0.58	P3.5
(D)YD on EBV - corr	**0.89**	**0.60**	**0.70**	**0.72**	**0.72**	**0.69**	**0.62**	**0.63**	G3.5
(D)YD on EBV - slope	1.03	1.22	**0.99**	1.08	1.10	0.89	0.94	1.11	P3.0
(D)YD on EBV - slope	1.02	1.14	0.98	1.07	1.08	0.91	**0.95**	1.10	P3.5
(D)YD on EBV - slope	**1.00**	**0.98**	0.94	**1.02**	**1.04**	**0.97**	0.85	**0.98**	G3.5
EBV on EBV - bias	-1.36	15.30	**-0.01**	**1.78**	**-0.14**	-2.98	-4.63	2.34	P3.0
EBV on EBV - bias	-0.12	12.73	1.46	2.98	0.58	-1.92	-3.00	3.37	P3.5
EBV on EBV - bias	**0.03**	**10.52**	1.90	2.72	0.63	**-1.55**	**-2.60**	**2.24**	G3.5
EBV on EBV - corr	0.89	0.66	0.67	0.63	0.58	0.55	0.58	0.57	P3.0
EBV on EBV - corr	0.90	0.65	0.69	0.66	0.60	0.59	0.60	0.67	P3.5
EBV on EBV - corr	**0.94**	**0.76**	**0.82**	**0.82**	**0.81**	**0.81**	**0.76**	**0.76**	G3.5
EBV on EBV - slope	1.07	1.26	1.03	1.09	1.09	0.91	0.94	1.11	P3.0
EBV on EBV - slope	1.06	1.21	1.03	1.10	1.10	0.96	**0.99**	1.12	P3.5
EBV on EBV - slope	**1.04**	**1.05**	**0.99**	**1.04**	**1.06**	**1.01**	0.91	**1.02**	G3.5
Quintile - q1q5	109.97	66.77	56.68	51.81	45.92	42.52	36.30	56.85	P3.0
Quintile - q1q5	114.65	**69.34**	60.07	55.30	46.69	44.71	37.19	68.52	P3.5
Quintile - q1q5	**123.00**	67.72	**71.86**	**70.62**	**66.58**	**61.58**	**44.67**	**73.37**	G3.5

Next steps


2023
February 2024
April-May
June
1. Pipeline development
2. Planning workshop
3. App development
4. External review
5. Board approval
Internal review and exploratory analysis
Continuous updates to the pipeline
Continuous updates to the app

Conclusion

- Acknowledgements
  - The Helical Company
  - New Zealand Animal Evaluation Limited (NZAEL)
  - DairyNZ
  - New Zealand dairy farmers

- Questions?