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CANADIAN NETWORK FOR DAIRY EXCELLENCE

# Using Interbull validation tests to improve national genomic models

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# Interbull GEBV test

## New software in 2025

- Improved genomic validation **methods**, accounting for:
  - **GPS** : Genomic pre-selection effects
  - **$A_{ij}$>0** : Relationships among test bulls (not i.i.d)
  - BASEADJ : aligns reduced data with the current BASE
- **New diagnostics to help improve national models**
- Higher requirements for GMACE improves **quality assurance**
  - Need to apply the **GEBV test bi-annually**, starting in 2026
  - Same 2-years rule now in place for both **GMACE and MACE**

# Interbull GEBV test software

## New diagnostic options / features

- --target and --weight
- --min_byear
- --traitsincl and --outdir with -m
- --baseadj
- …

More details can be found here:

- **Interbull bulletin 58**: Sullivan, 2023, presented in Rome, Italy
- **Software Usage**: https://interbull.org/ib/gebvtest_software
- **Code of Practice**: https://interbull.org/ib/cop_appendix8

# Interbull GEBV test

## TWO Purposes

1. **Validation:** The official test requires default options for a uniform international standard. Passing validation confirms national GEBV are accurate and unbiased as "validated by Interbull"
2. **Diagnostics:** The new software options added in 2023 were for trouble-shooting of detected biases and to inform national model improvements, not to find alternative tests are easier to pass

The best practice to follow is:

1. **Validate**, and if not Passing
2. **Diagnose** the biases
3. **Improve** the national GEBV and **repeat** back to 1

# GEBV test criteria for

## Pass / Warn / Fail

- **Passing** the test requires **$0.90 < b_1 < 1.20$**
- The **Warning** range is **$0.80 < b_1 < 1.25$** for **$b_1$** outside of Pass
  - Warnings encourage investigation where needed, allowing time to improve national GEBV before reaching a Fail
  - Purpose to minimize changes in the data included for GMACE
- A **Failing** trait, with $b_1$ is outside the Warning range, is not accepted as input to GMACE, so preventing Fail results is important to maintain stability of the GMACE service

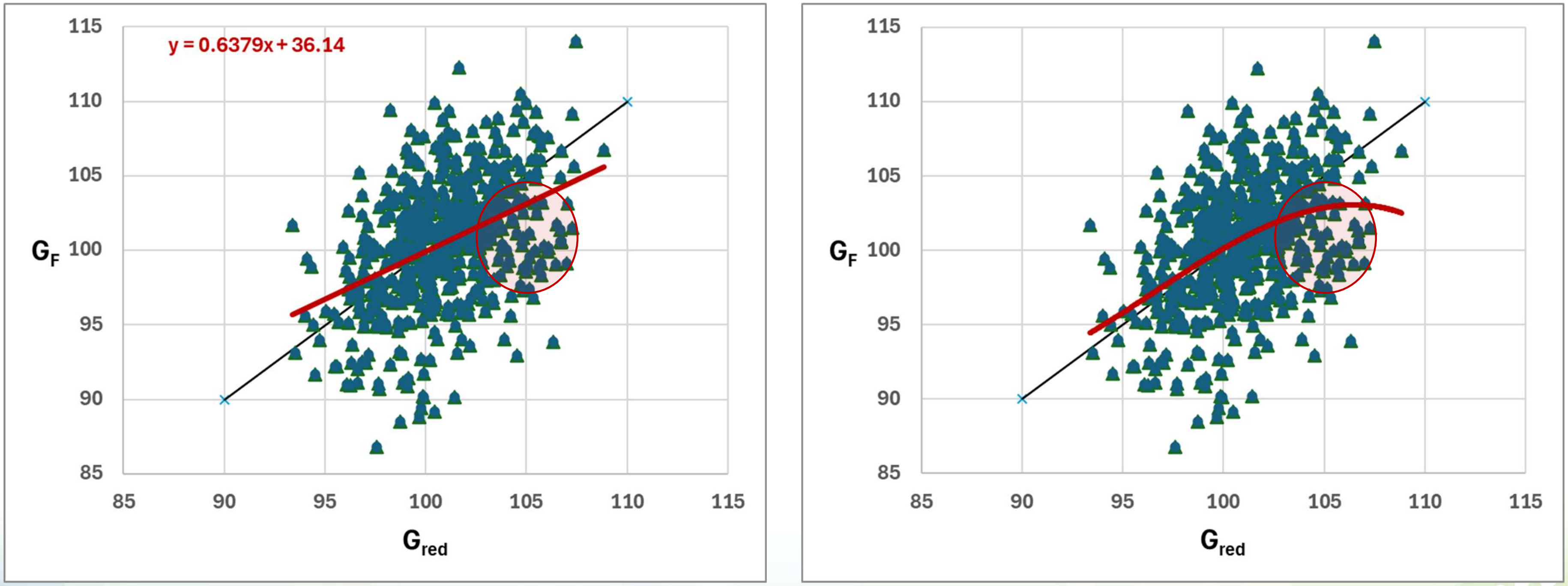
# GEBV tests for Canadian Holsteins

## DATA

- **$G_F$** = GEBV published in **August 2025**, using current phenotypes, programs, models, pedigree and genotypes
- **$G_{red}$** = GEBV from reduced data, phenotypes after **August 2021** deleted, current programs, models, pedigree and genotypes
- Validation test results for 16 traits covering **all trait groups**: Production, Conformation, Udder, Fertility, Longevity, Calving, and Workability

# Using the merged/BaseCorrected files

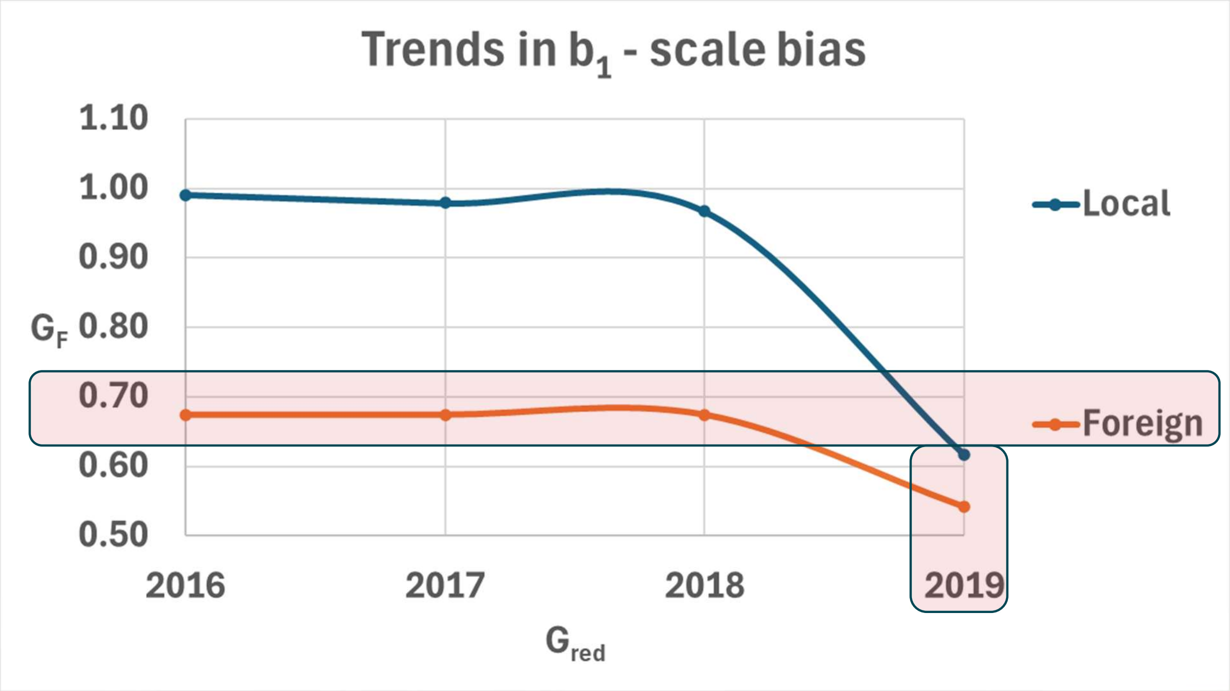
## **Diagnostics** for trait dlo: Fails with $b_1$=0.64



Mainly Foreign bulls + their clones in this group
Clones get a copy of the donor GEBV: need to exclude clones for validation

# Diagnostics for Longevity (dlo)

## Validation with extra regressions (VanRaden, 2021)



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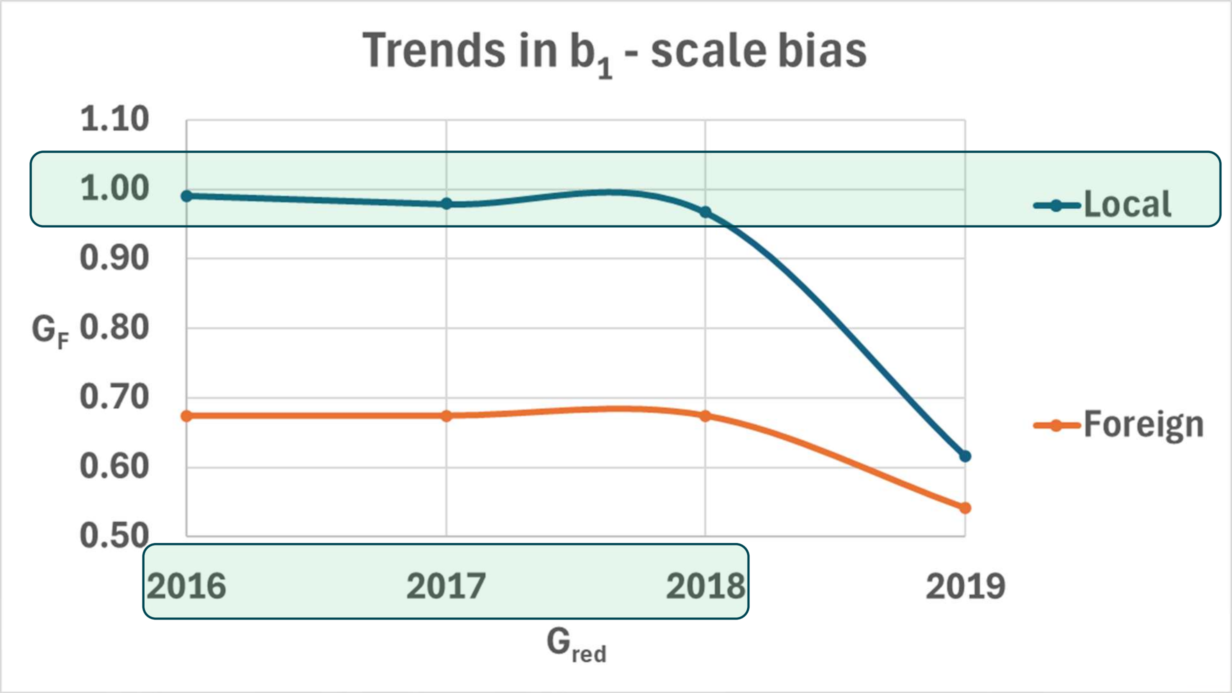
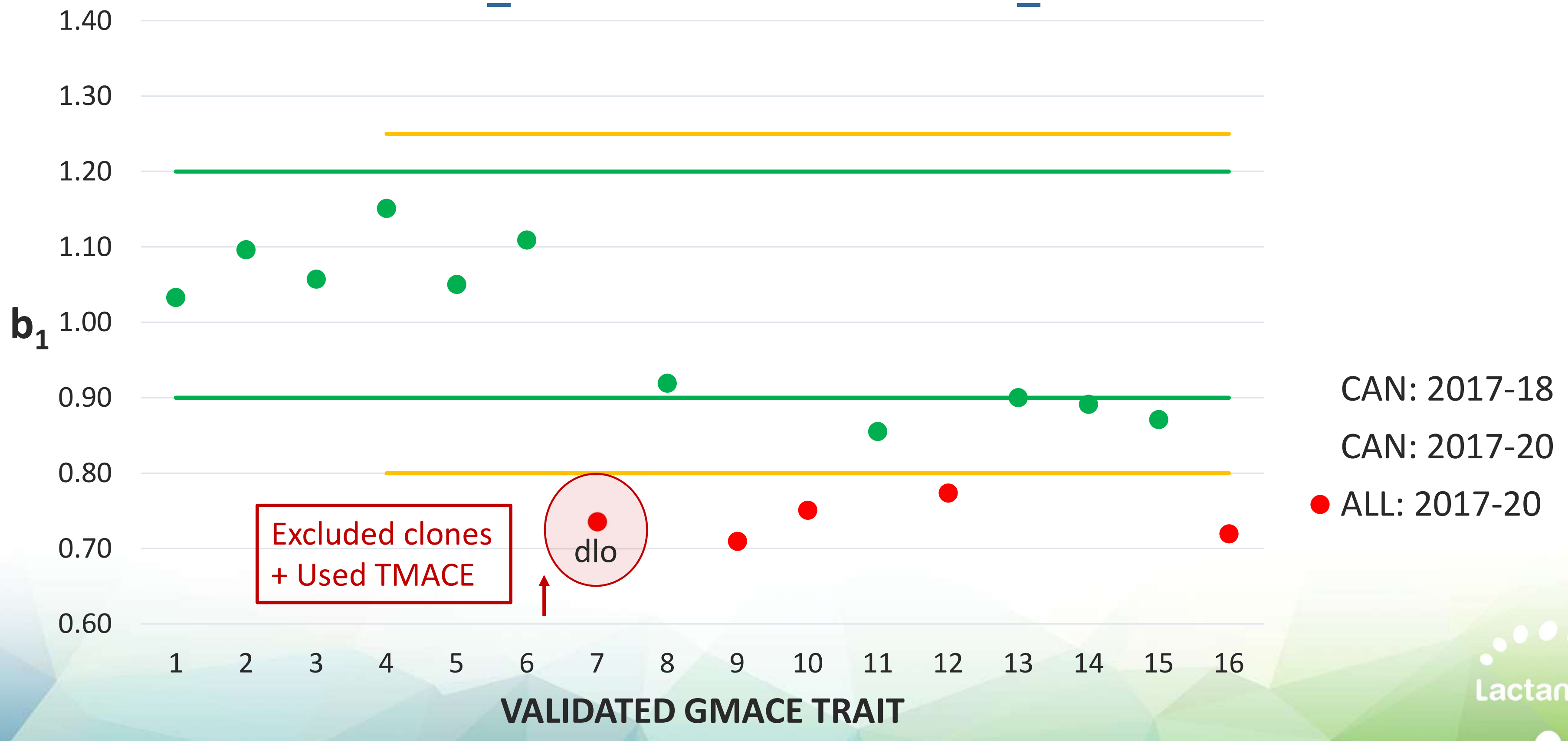


# GEBV validation slopes (CAN+Foreign)

## $(G_{F\_2025} = b0 + b1*G_{red\_2021})$

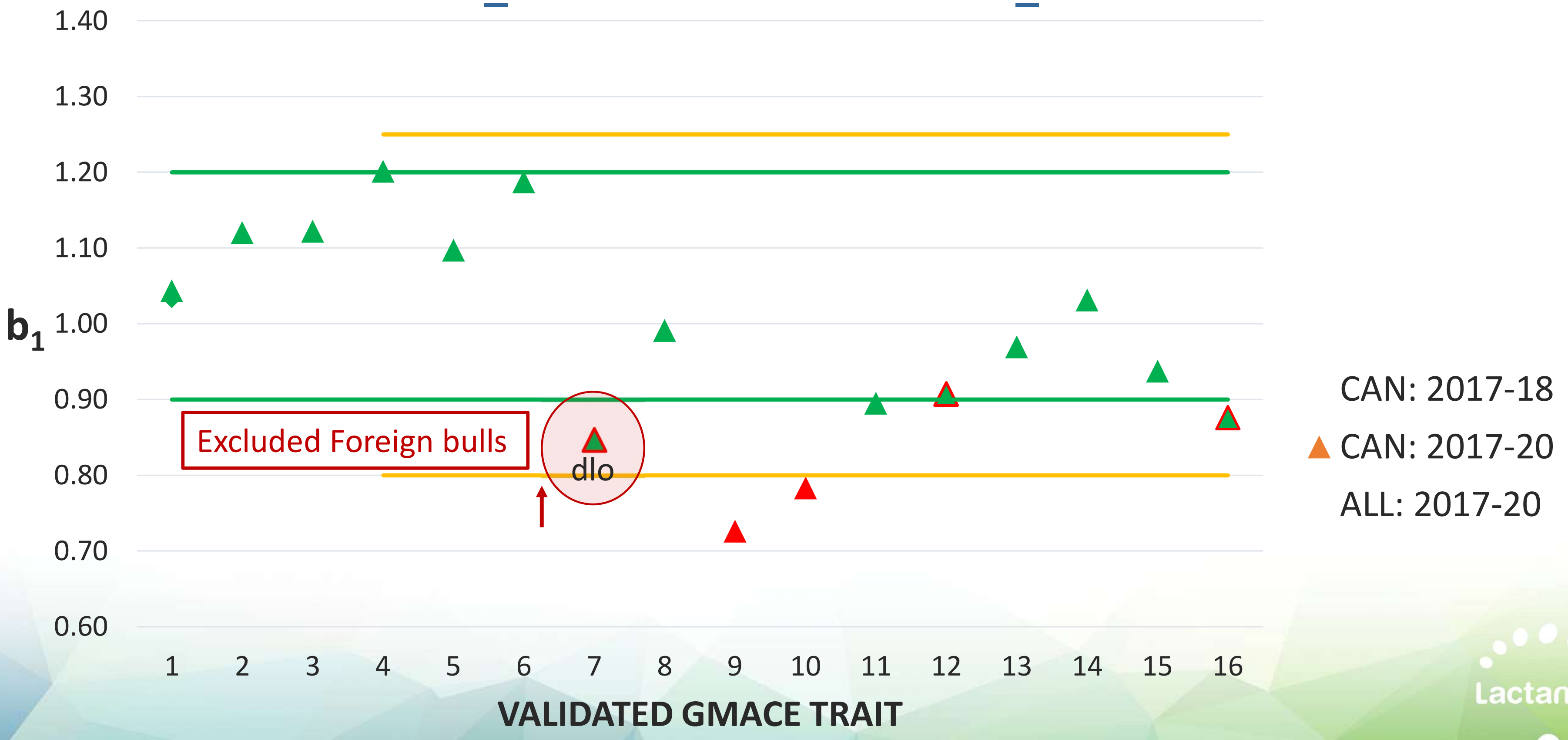


Excluded clones
+ Used TMACE

dlo

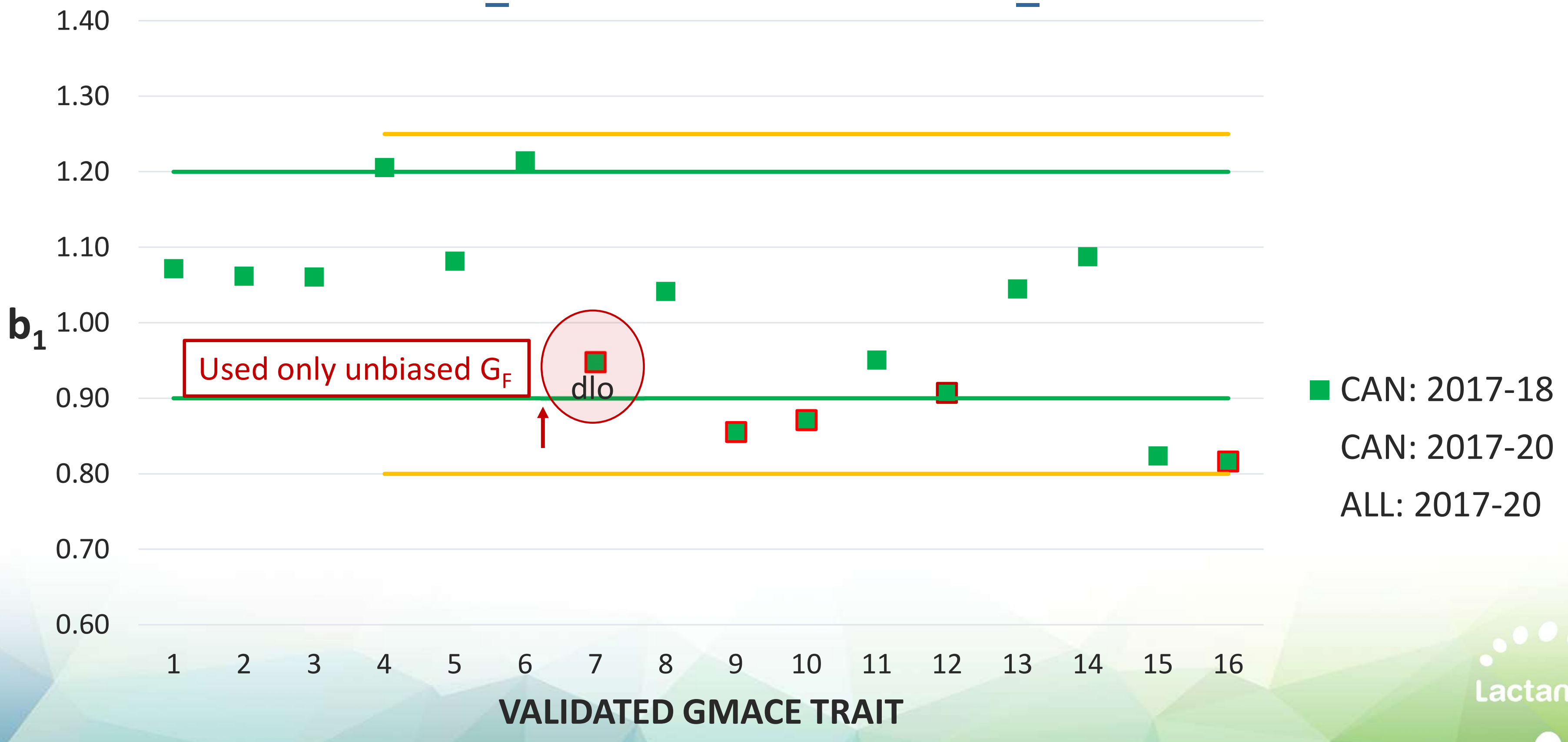
# GEBV validation slopes (CAN only)

## $(G_{F\_2025} = b0 + b1*G_{red\_2021})$



# GEBV validation slopes (CAN + unbiased $G_F$)

## ($G_{F\_2025} = b0 + b1*G_{red\_2021}$)



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# Don’t just stop at passing the test…

## Try to improve national GEBV for ALL bulls

- Our main sources of bias, as detected via GEBV test software are from:

1. **Biased parent averages** from BLUP models without genotypes
2. **Integrating external MACE** proofs of foreign bulls for SNP estimation
   - These first two sources of bias likely exist for both Single-Step and Multi-Step evaluations, and Single-Step will not fix these
3. Misleading test results due to **GPS bias in the early** progeny proofs ($G_F$) of youngest validation bulls
   - This bias can be reduced with **Single Step**, but it is only temporary until bulls accumulate more data, so it is not a major concern

- A future GPS-MACE model might help with #2, but national **integration methods** for MACE might be the more important area to focus on

# Summary

- New Interbull software has better validation methods, but also MUCH MORE
  - ➢**New diagnostics** help eliminate, isolate and identify specific biases
- Foreign bulls are optional, when needed to increase validation group size
  - ➢Interbull TMACE service is very important for GEBV tests with foreign bulls
    - ✓Next 4 years in Canada, due to new USA fertility trait models in 2026
  - ➢For traits defined differently between Canada and USA (e.g. dlo=PL vs. HL):
    - Foreign bulls not helpful, while Canadian validation bulls Pass for all traits
- The validation TEST is for reduced-data GEBV ($G_{red}$), but the validation MODEL does not distinguish if bias is in the full-data GEBV ($G_F$) versus $G_{red}$
  - ➢The TEST for bias in $G_{red}$ is better if we minimize GPS-bias in the $G_F$ validation target, by validating only the older bulls with more complete progeny data