



Females in MACE: Status Update

Interbull Open Meeting- 1st June 2026

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THE GLOBAL STANDARD
FOR LIVESTOCK DATA





Why Females in MACE?



Moderate-sized breed, valued for *adaptability* and *milk quality*

Investigate the opportunity for international collaboration to increase the accuracy of genetic evaluations for smaller dairy breeds across multiple countries



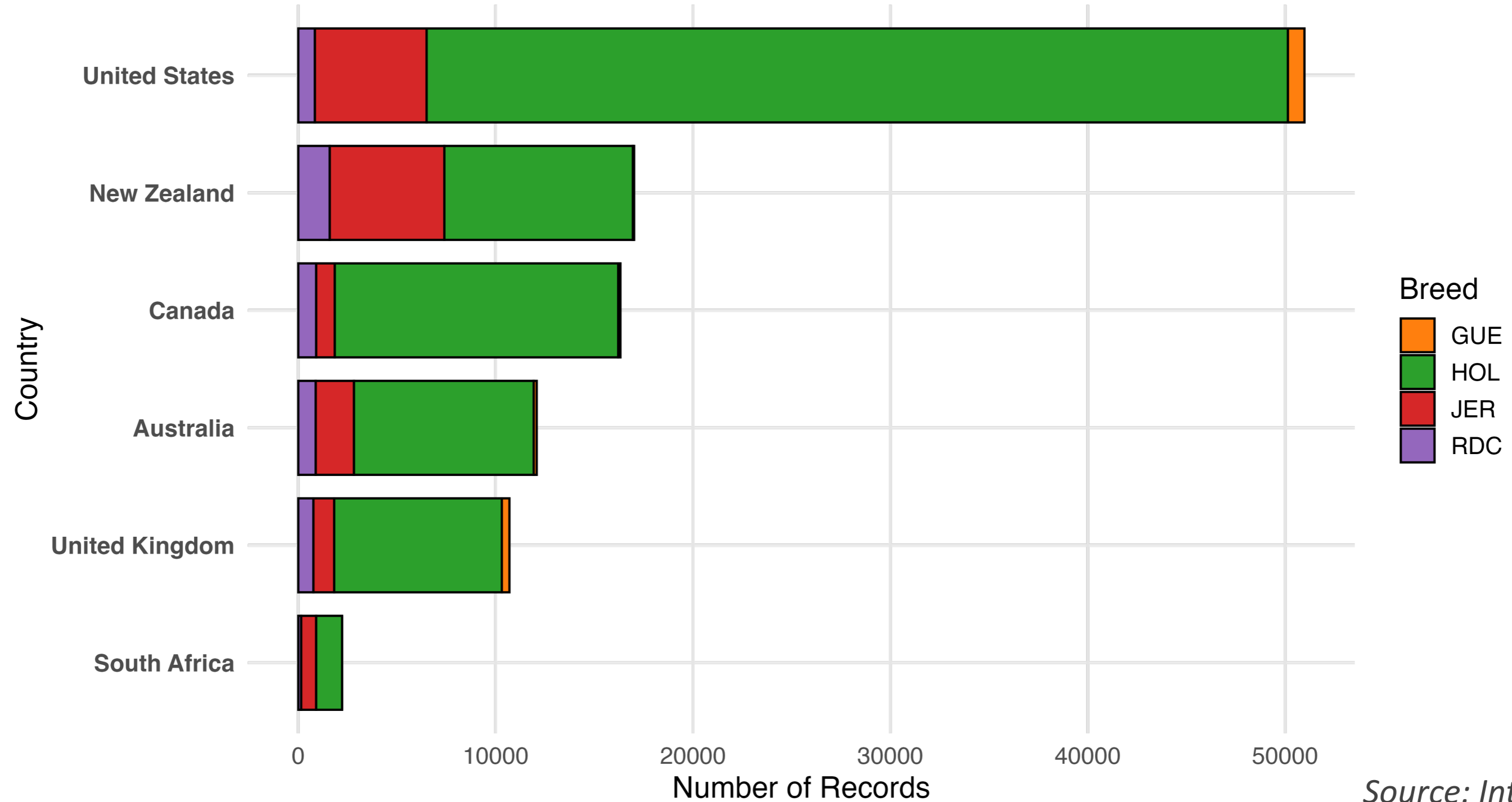
Benefits:

- Adding cow data would increase and allow faster growth of the current **reference population**
- Maximize the benefit from **genotyping cows**
- **Reliability gains** over time for both national and international genetic and genomic evaluations



Why small populations?

Number of Dairy Production Trait Records by Country and Breed
Interbull Evaluation Data - April 2025



Source: Interbull centre



MACE: Multiple Across Country Evaluations

BREED GROUPS



Holstein
Jersey
Guernsey
Red Dairy Cattle
Brown Swiss
Simmental



TRAIT GROUPS

- **Production (3 traits: milk, protein, fat)**
- **Conformation (38 traits) - stature**
- **Udder health (2 traits)**
- **Longevity (1) - direct longevity**
- **Calving (5)**
- **Female fertility (4)**
- **Workability (2)**



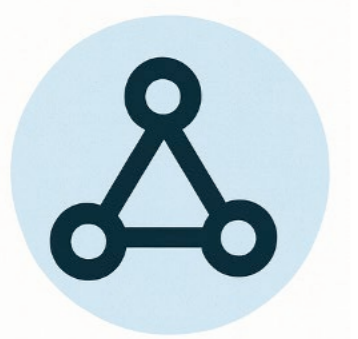
Objectives of Females in MACE



*Modify the current **MACE pipeline** to allow countries to submit national EBVs including cows*



*Provide unbiased **cow** and **bull** MACE outputs to participating countries*



Use Interbull platforms for sharing cow data among participating countries



Interbull: International bull evaluations

MACE: Multiple Across Country Evaluations

Method for international genetic evaluations to calculate across-country measures of genetic merit for individual traits

National ranking

Country A
Bull A6
Bull A3
Bull B3

Country B
Bull B6
Bull B5
Bull B3
Bull B1

MACE

International ranking

Country A
Bull A6
Bull A3
Bull B5
Bull B3
Bull B6
Bull B1

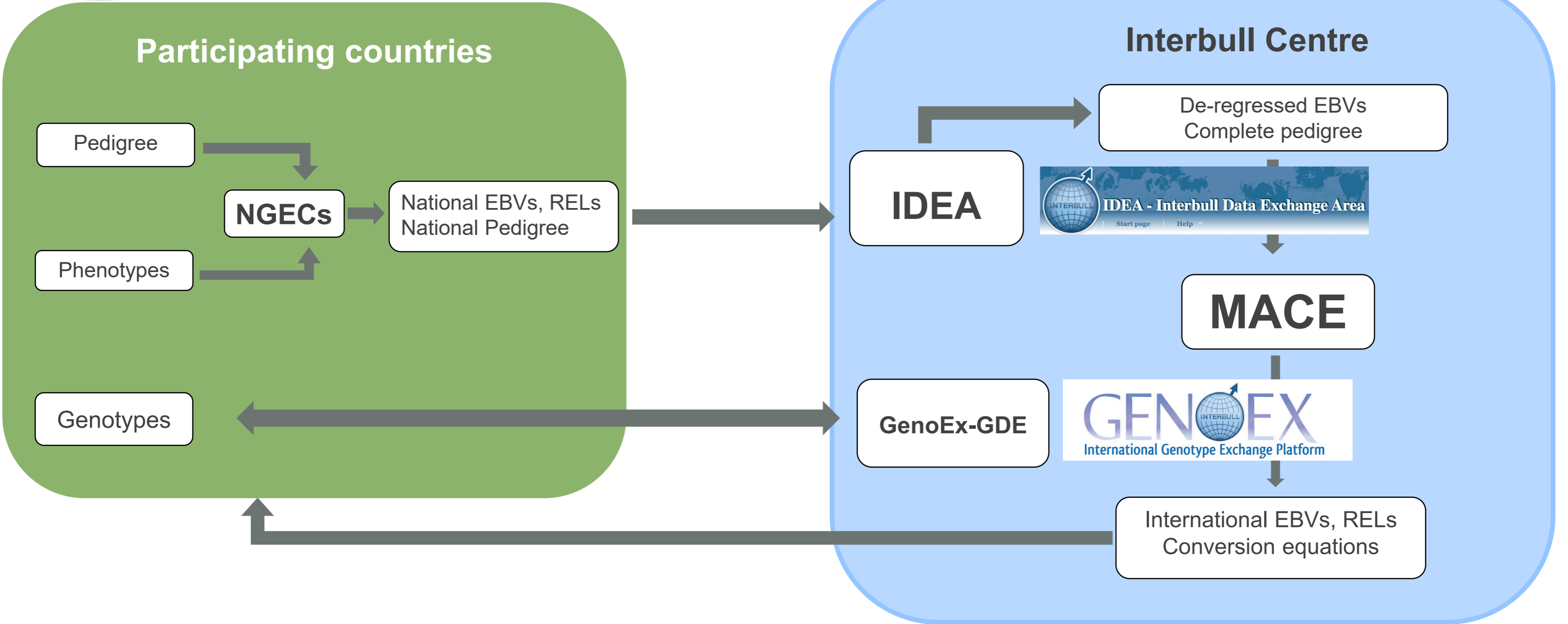
Country B
Bull A6
Bull B6
Bull B5
Bull B3
Bull A3
Bull B1

BENEFITS

- Enables comparison of local bulls and imported bulls directly on national scales
- Considers G x E across countries by enabling genetic correlations less than 1
- Animals are evaluated on different scales, traits do not need to have the same definition
- Reliability on the scale of each country increases as information is shared across all countries.



Implementation





Overview

Assessing the feasibility of including females in MACE

Investigate level of bias in MACE results

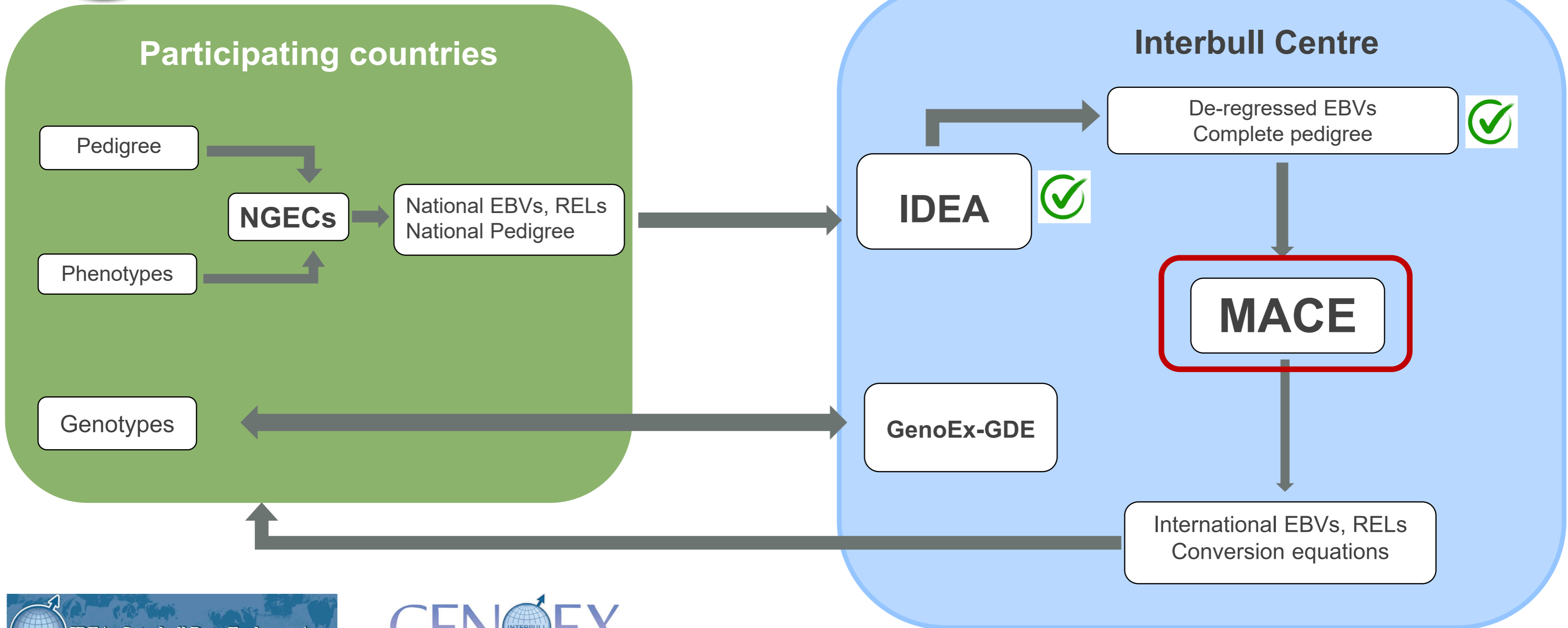
Assess the gain in reliability

Obtain unbiased MACE (both cows and bulls) proofs to be distributed to participating countries

Verify and adjust the current conversion equations

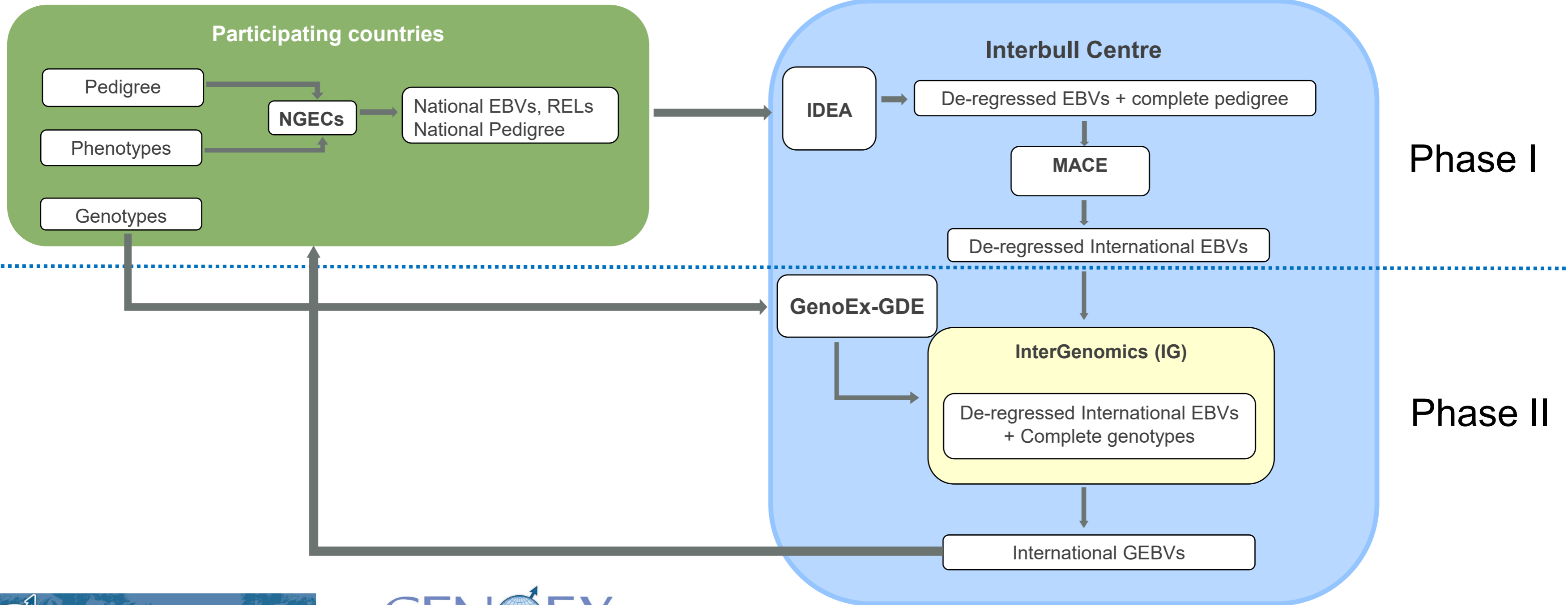


Implementation





Implementation





Number of Ayrshire Animals by Sex

Country	Country Code	Bulls	Cows	Total
Australia	AUS	121	29,729	29,850
Canada	CAN	655	6,532	7,187
United States	USA	1,049	124,367	125,416
Great Britian	GBR	870	99,348	100,218
South Africa	ZAF	788	58,117	58,905
Total		3,483	318,093	321,576



Results: milk

Comparisons between the conventional Official MACE and females in MACE for BULLS

Pop	N	$Frel_{int}$	$Mrel_{int}$	$Cor_{febv_{int}, mebv_{int}}$
AUS	187	91.2	91.1	0.999
CAN	908	92.2	91.9	1.000
GBR	762	95.9	95.9	1.000
USA	841	86.7	86.6	0.999
ZAF	138	89.7	89.6	1.000

Pop; Population, $Frel_{int}$; Females in MACE international reliability, $Mrel_{int}$; Current official MACE international reliability based on bulls only



Results: milk

Comparisons between national evaluations and the international MACE with females for COWS

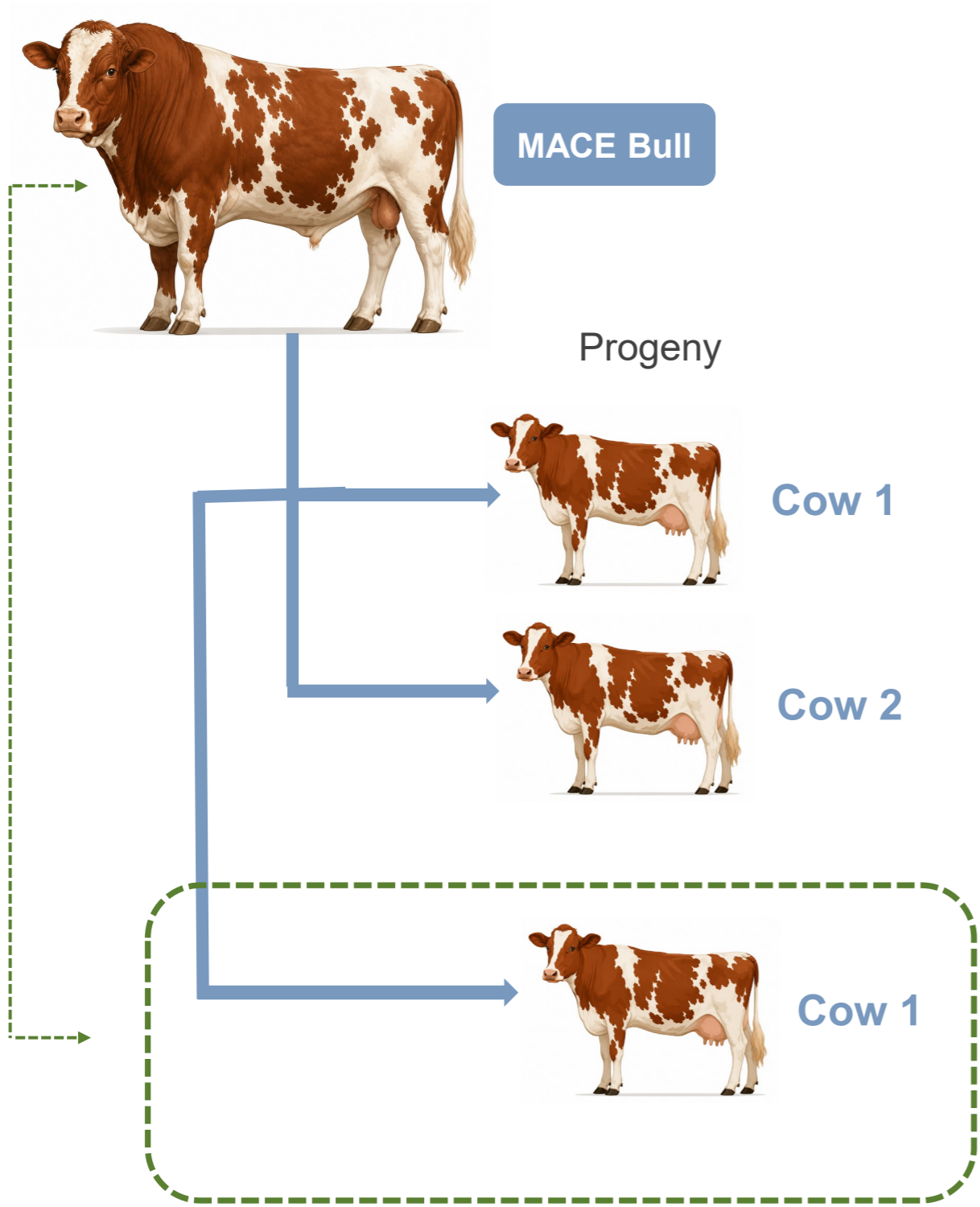
Pop	N	Frel _{int}	Frel _{nat}	Cor _{Febv_{nat},Febv_{int}}
AUS	307	63.2	65.3	0.994
CAN	7,526	65.3	63.0	0.999
GBR	1,112	66.1	61.1	0.998
USA	2,271	47.1	49.1	0.988
ZAF	663	52.1	56.4	0.996

Pop; Population, Frel_{int}; Females in MACE international reliability, Frel_{nat}; National reliabilities as provided by countries

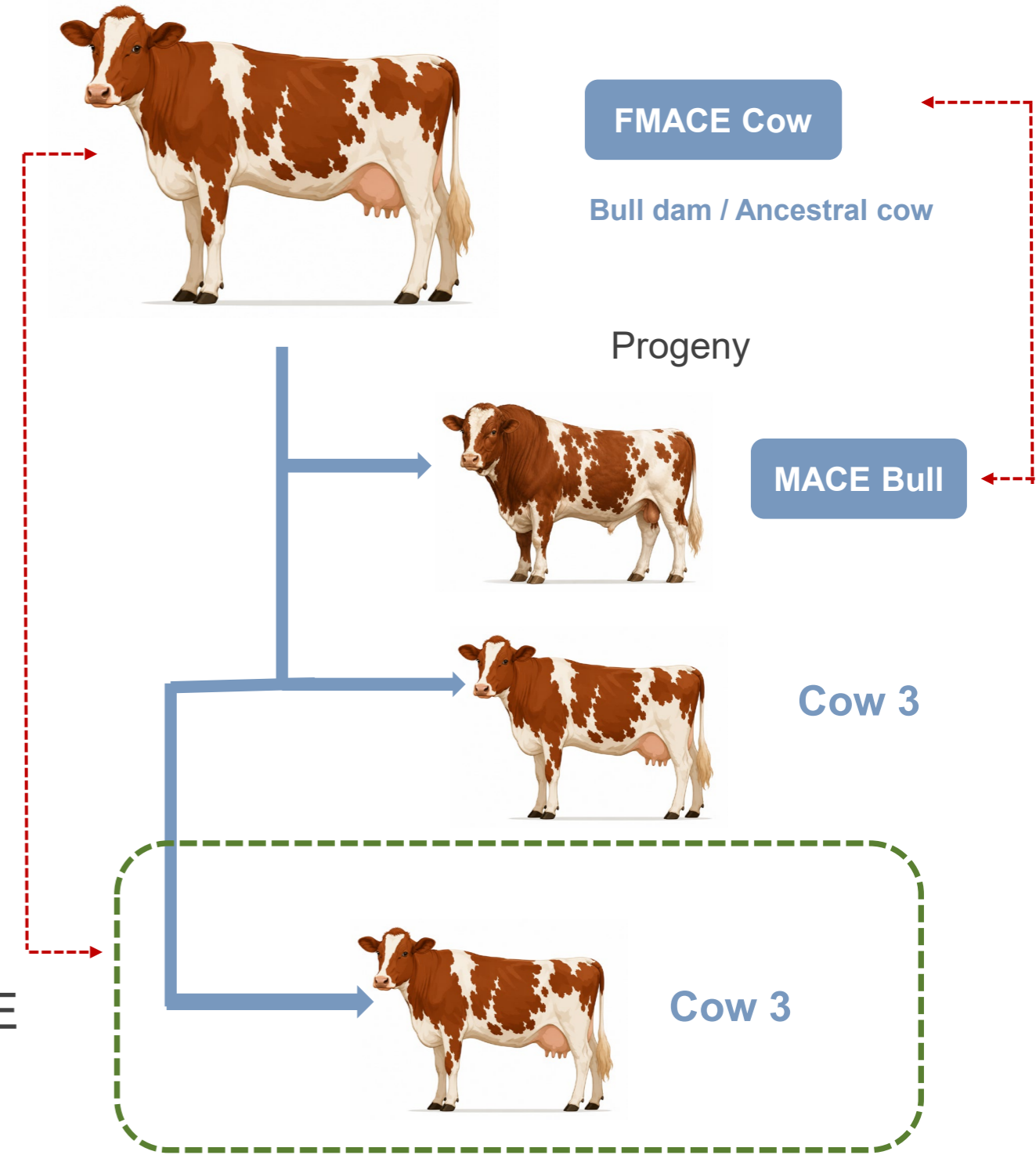


Where does the double counting come from?

Adjust the Effective Daughter Contribution (EDC) to remove contribution from Cow 1



Females in MACE





Proposed method for double counting....

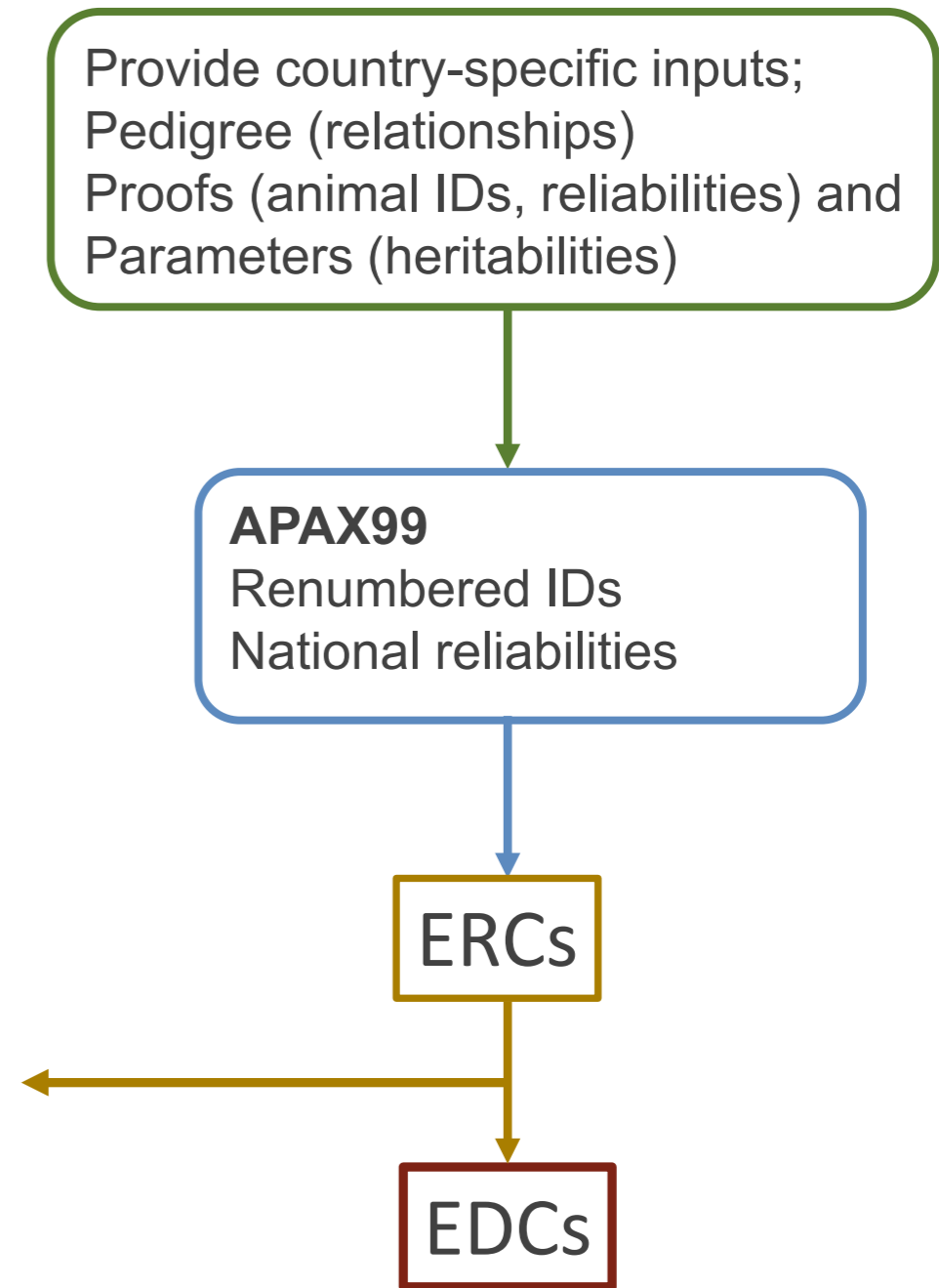
Single-trait reverse reliability approximation

- Implemented in **apax99** iteratively
- Uses the *Harris and Johnson (1998)* algorithm
- Use national reliabilities to obtain weights

Effective record contributions (ERCs)

- Convert ERCs to EDCs

$$EDC_{adj} = ERC \frac{(4 - h^2)}{(1 - h^2)}$$





Next Steps

MACE Run the proposed method

Test the adjustment of EDCs across the five traits and countries

Adjusted EDC threshold

Investigate minimum cow EDC thresholds for inclusion in Females in MACE.

Refining the pipeline continues

Continue refining the Females in MACE pipeline and reliability estimation procedures following feedback from the ITC.

Guernsey Females in MACE

Issue a data call for Guernsey

Impact for non-participants

Evaluate the impact of Females in MACE results on BULLs of non-participating countries.



Thank you for listening

