



Gembloux Agro-Bio Tech
Université de Liège



Combination of national and international phenotypic, pedigree and genomic information: First results

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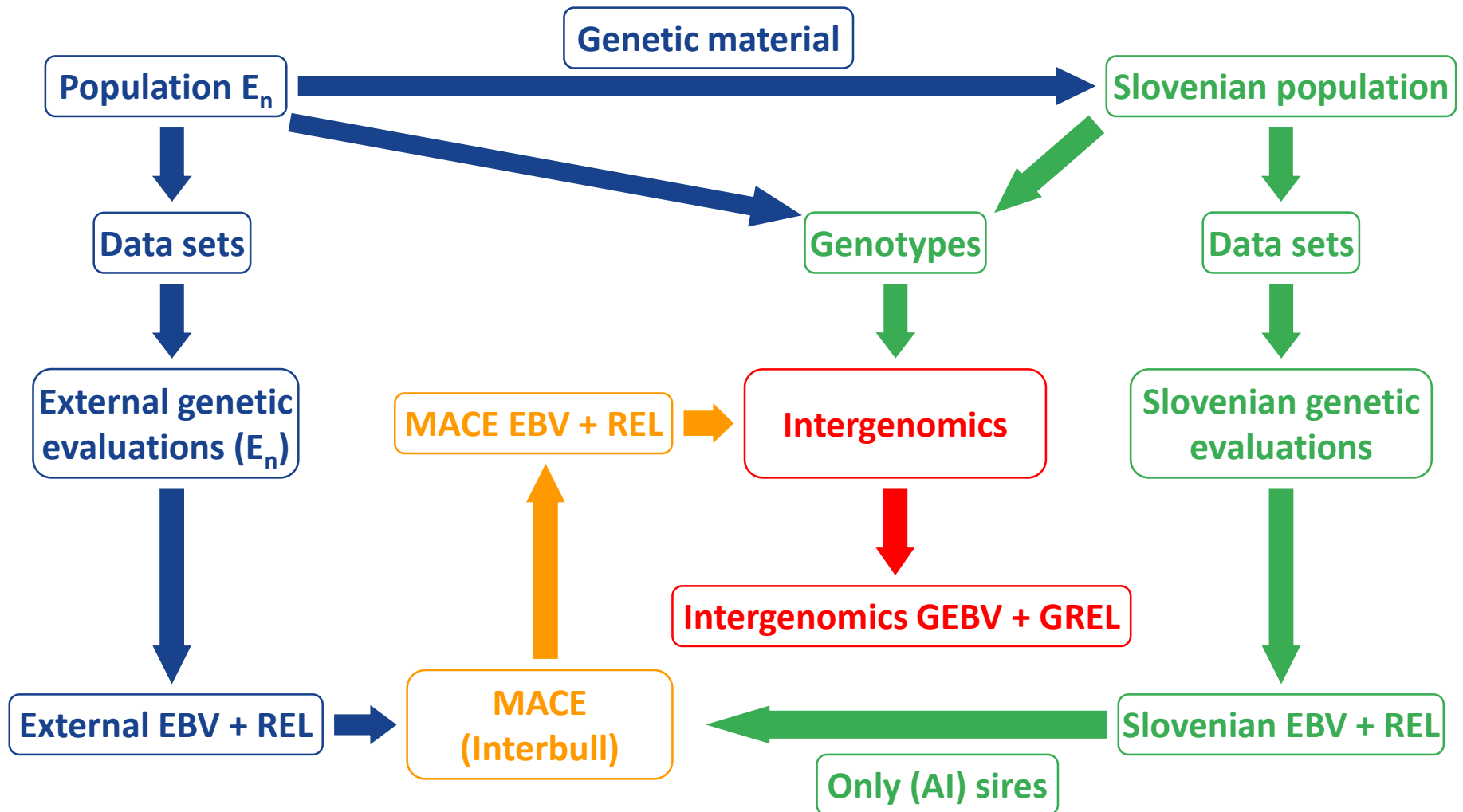
⁴ University of Ljubljana, Biotechnical Faculty, Slovenia

Rodica, 23rd January 2015

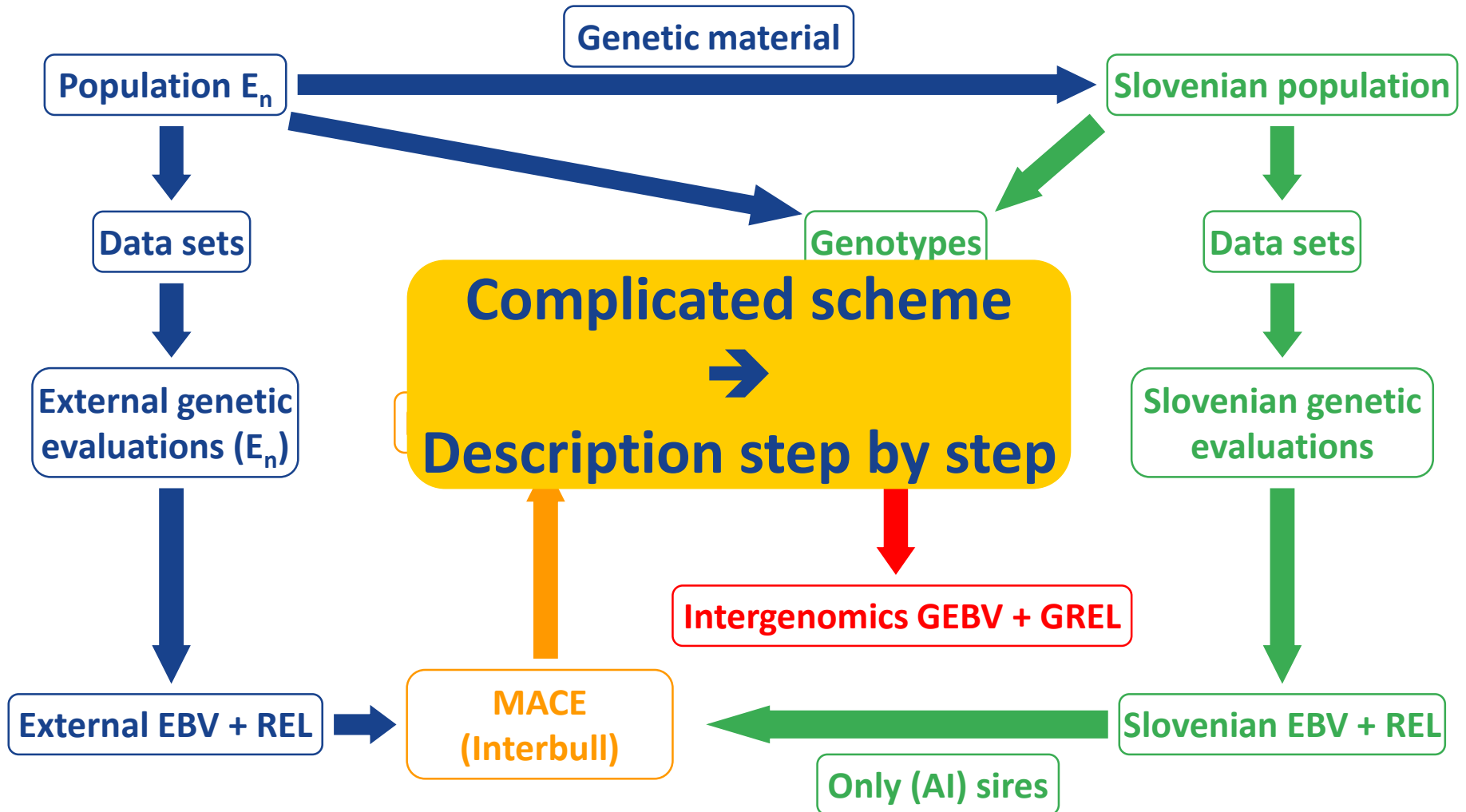
Current Slovenian situation

- ✓ Brown Swiss dairy cattle
- ✓ Traits: Milk, fat and protein milk yields
- ✓ Possible different genetic/genomic EBV and REL associated with an animal
 - ❑ Slovenian genetic evaluation
 - ❑ MACE evaluation
 - ❑ Intergenomics evaluation

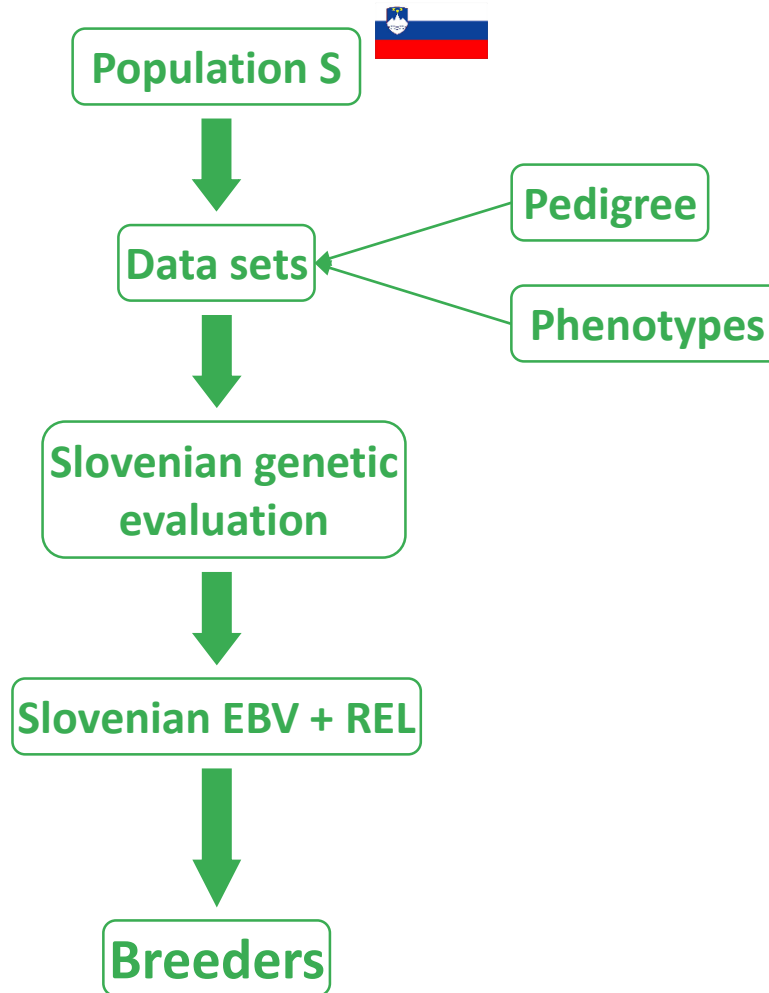
Current Slovenian situation



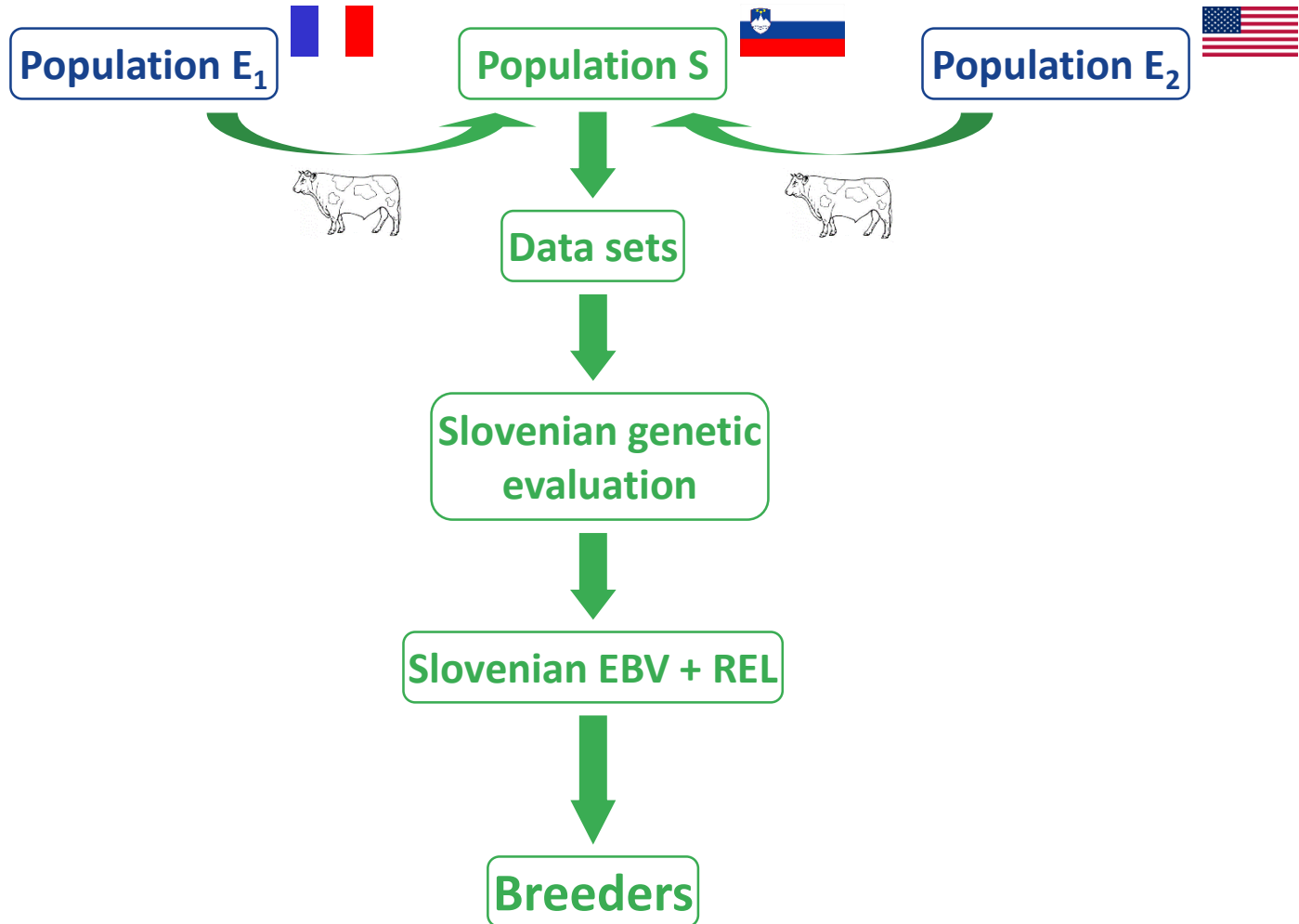
Current Slovenian situation



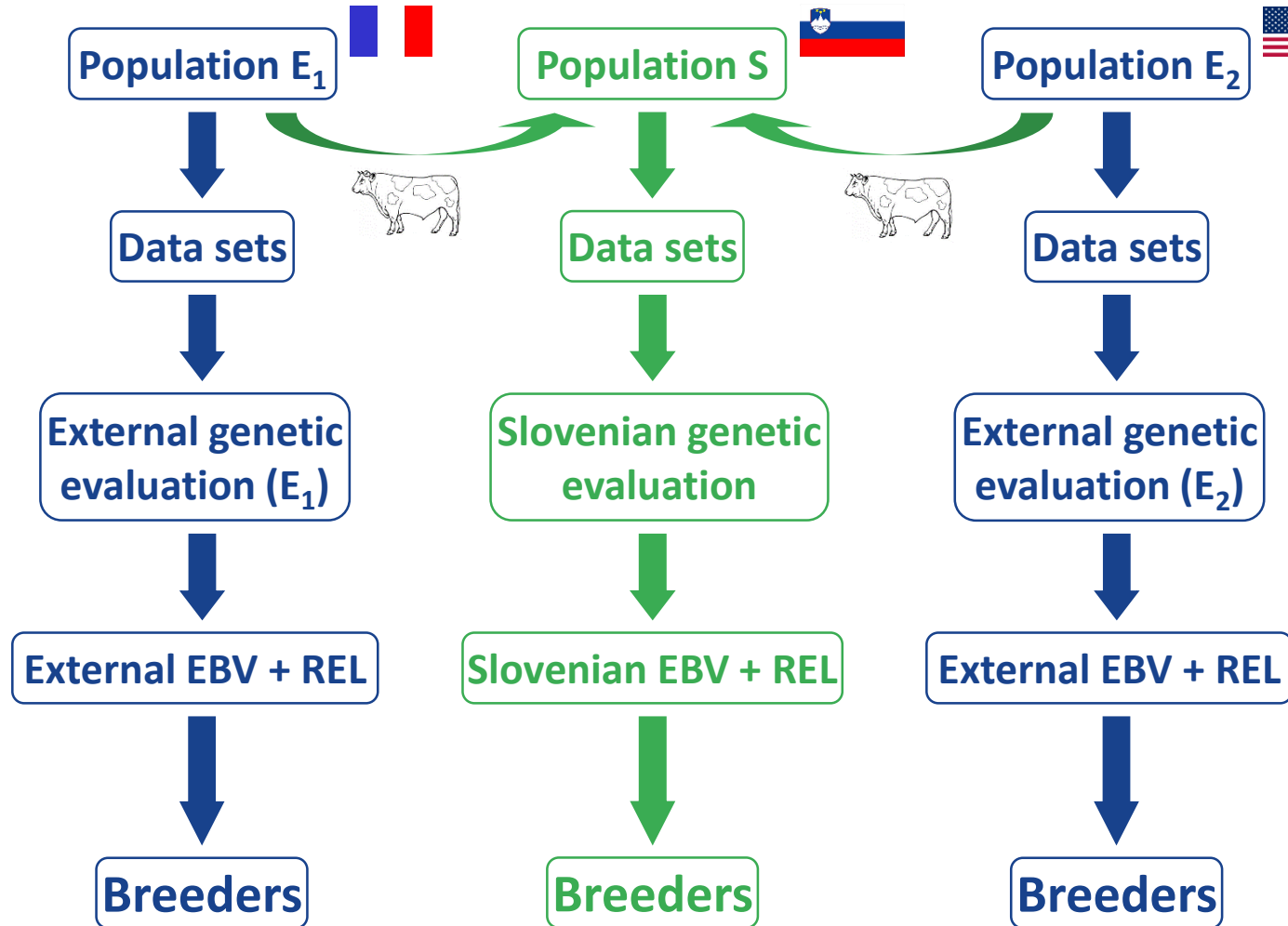
Slovenian genetic evaluations



Exchange of genetic material

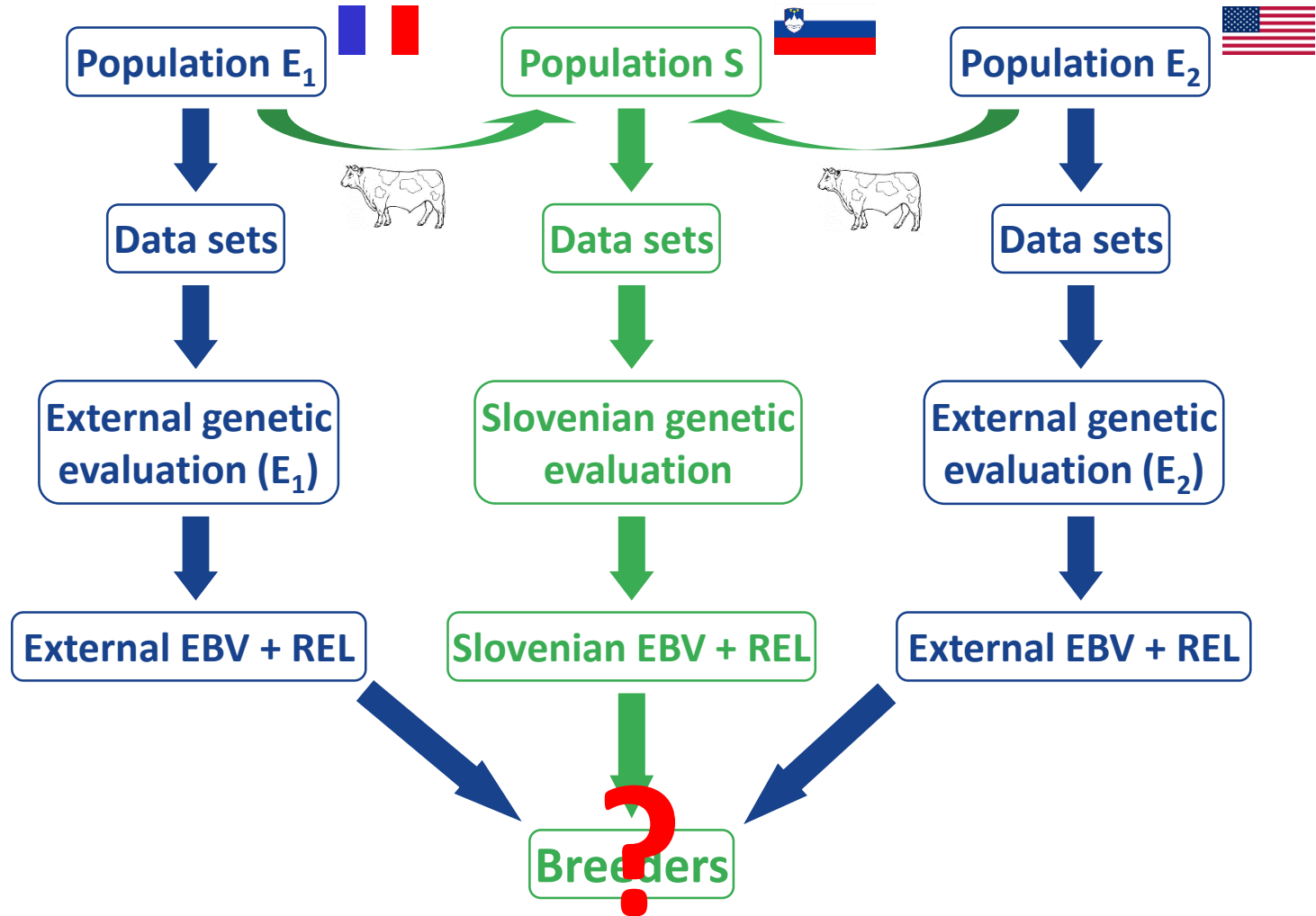


National genetic evaluations

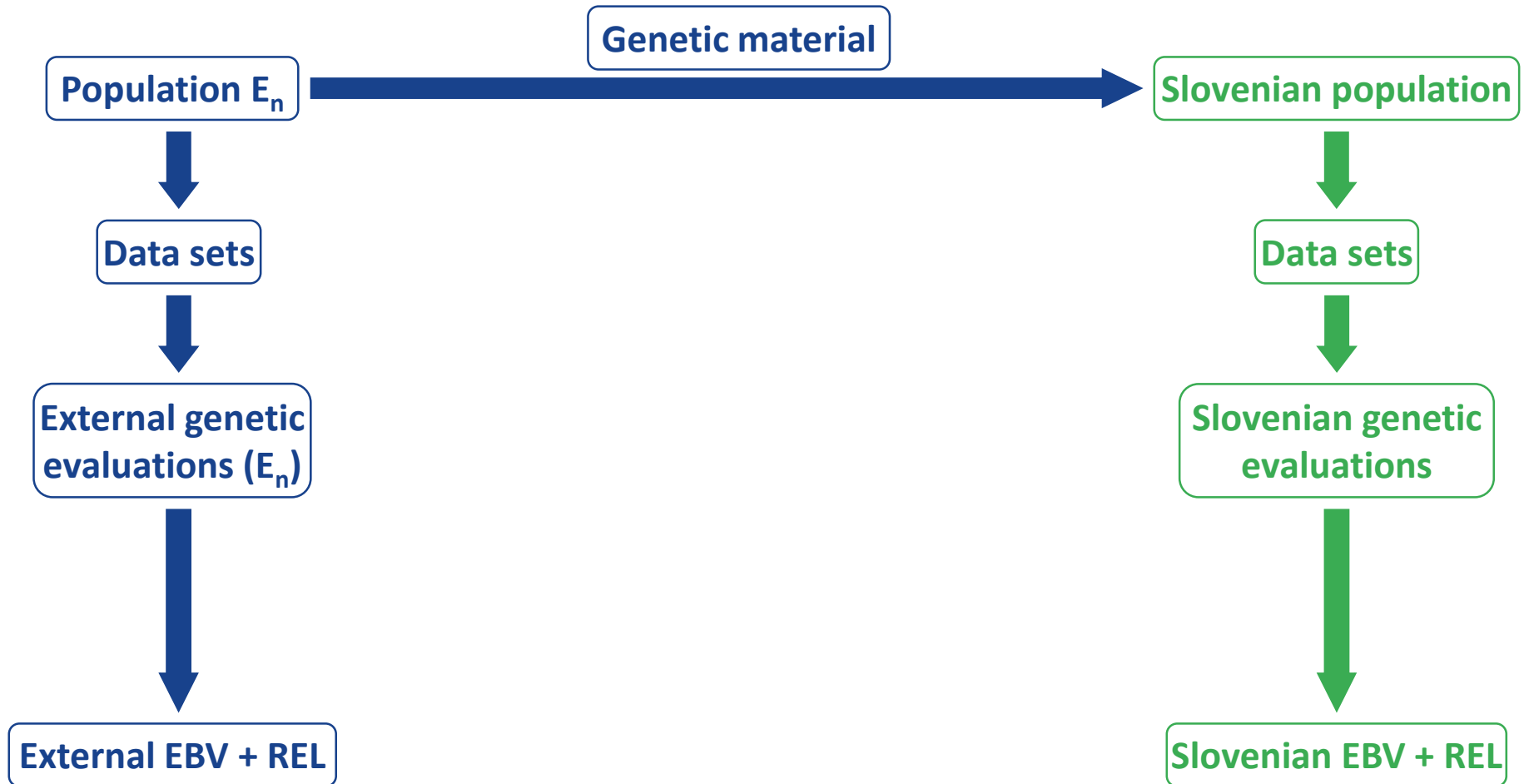


Usually, genetic evaluations **within well defined borders**

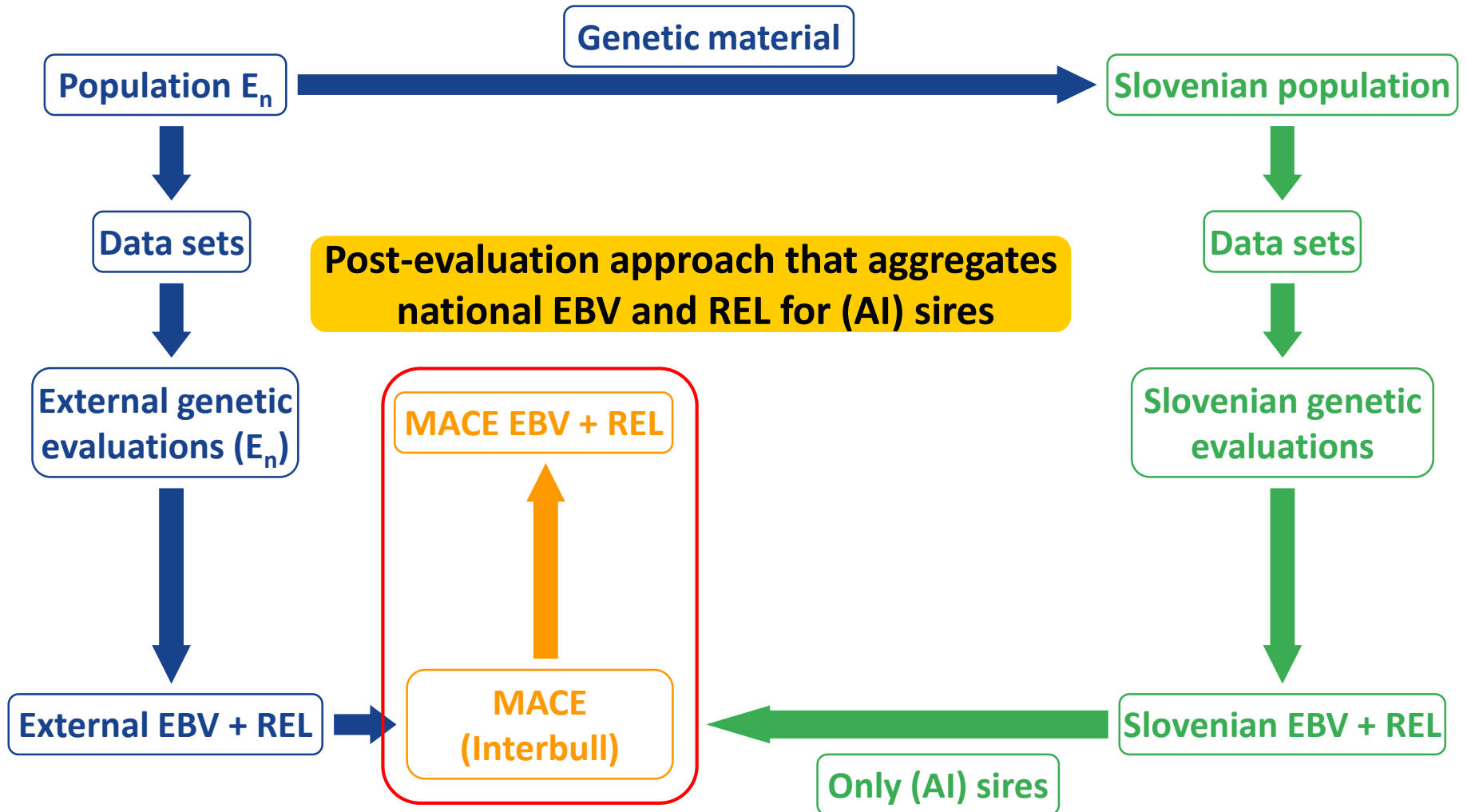
National genetic evaluations



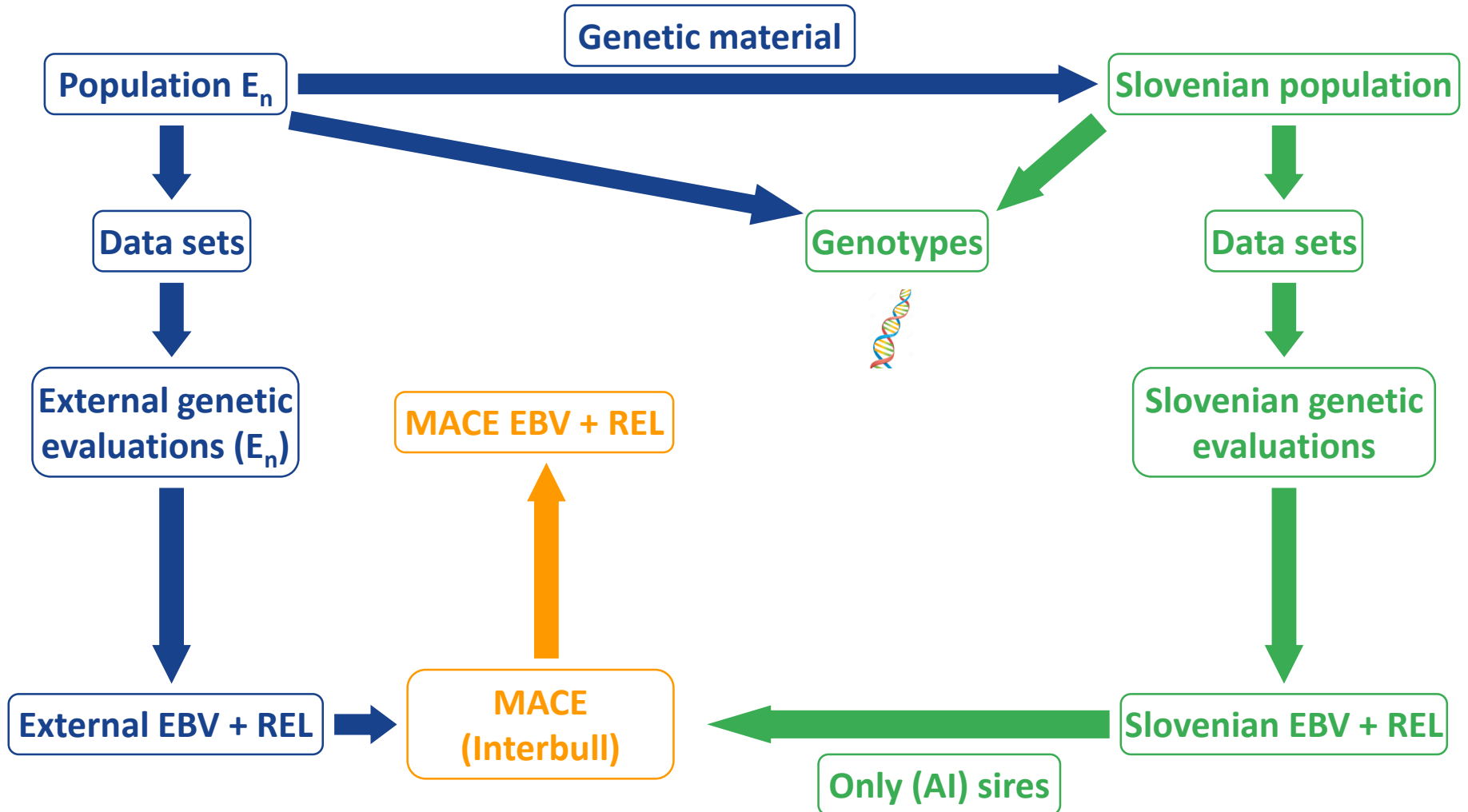
Multiple Across Country Evaluation



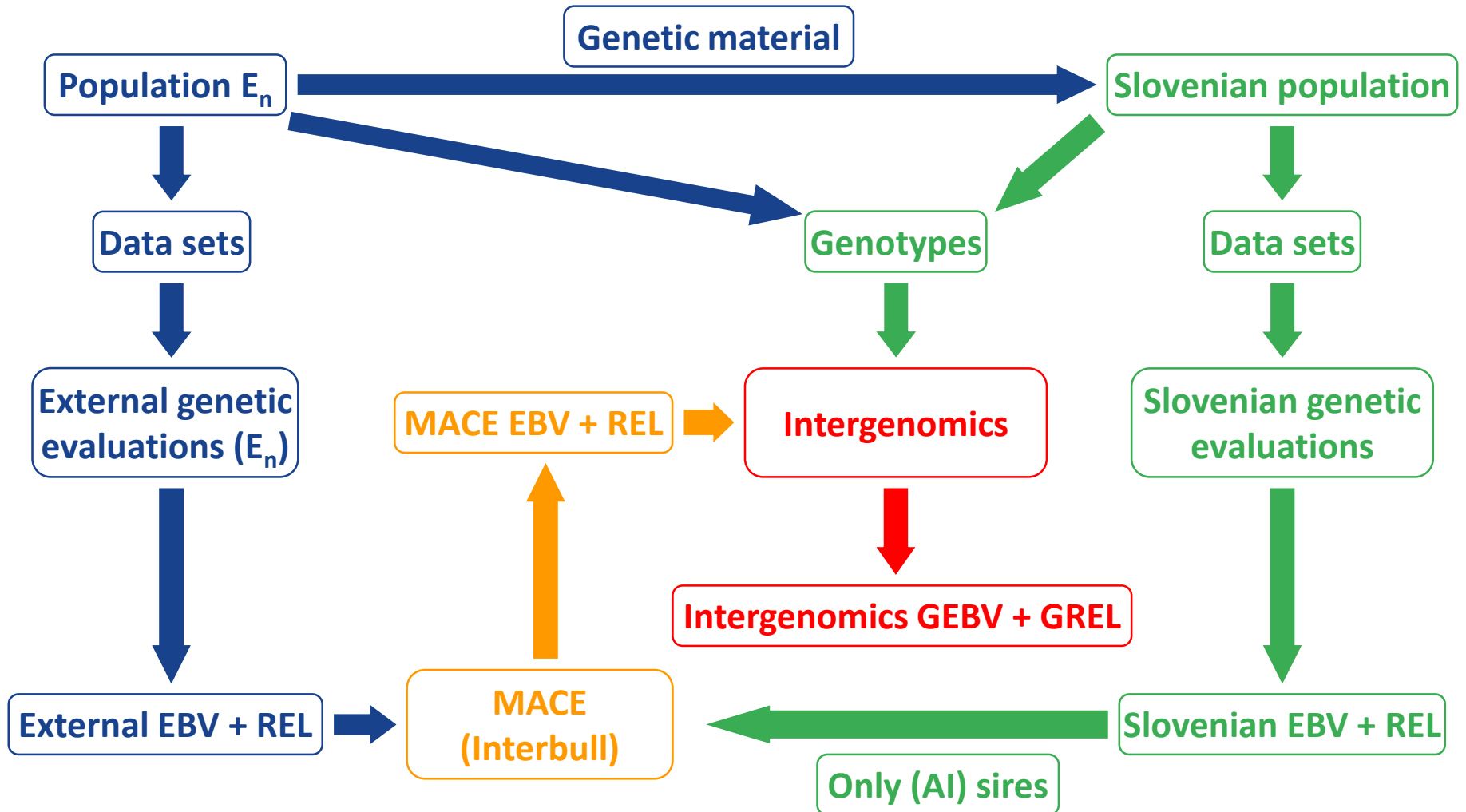
Multiple Across Country Evaluation



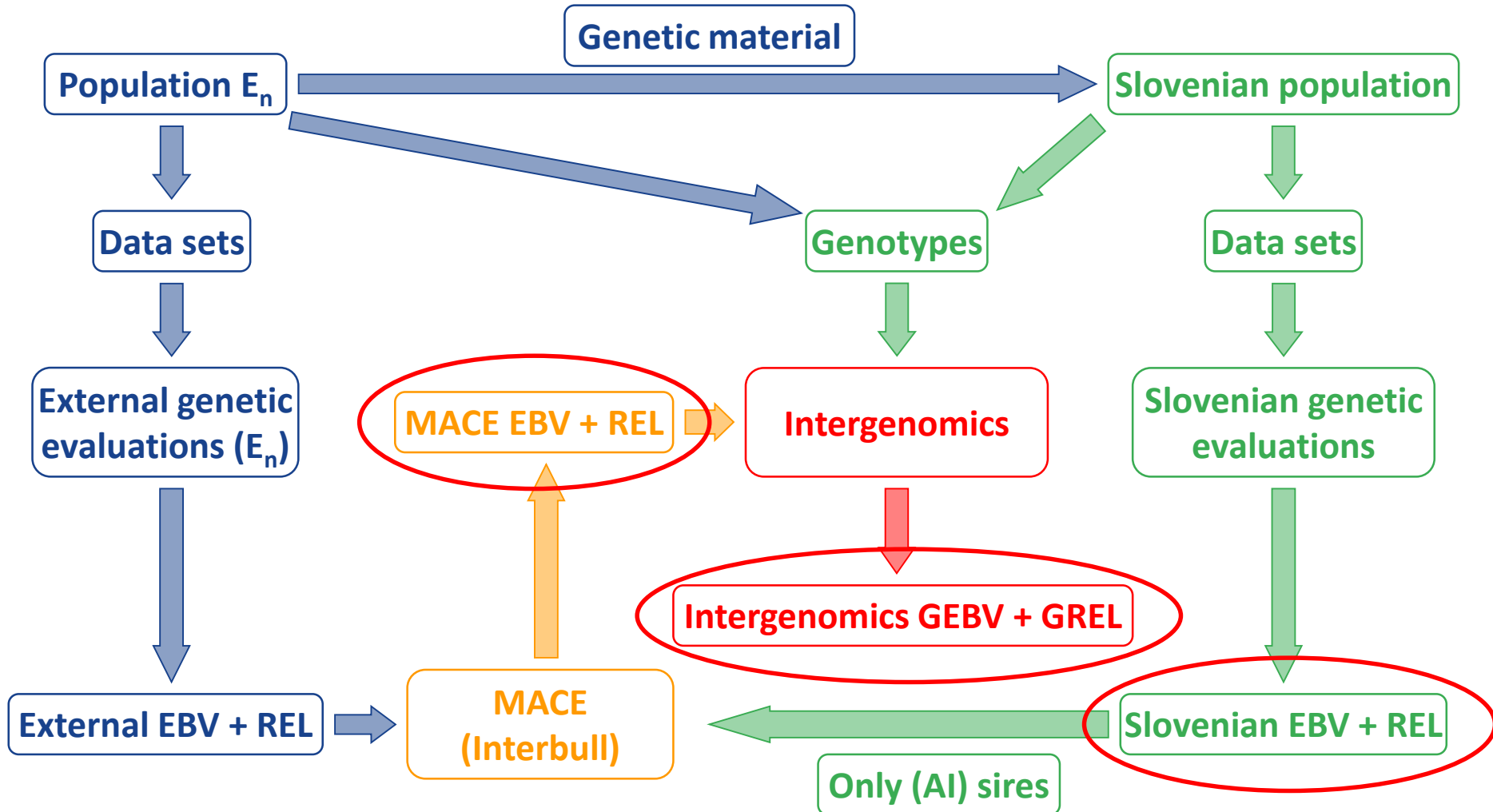
Intergenomics



Intergenomics



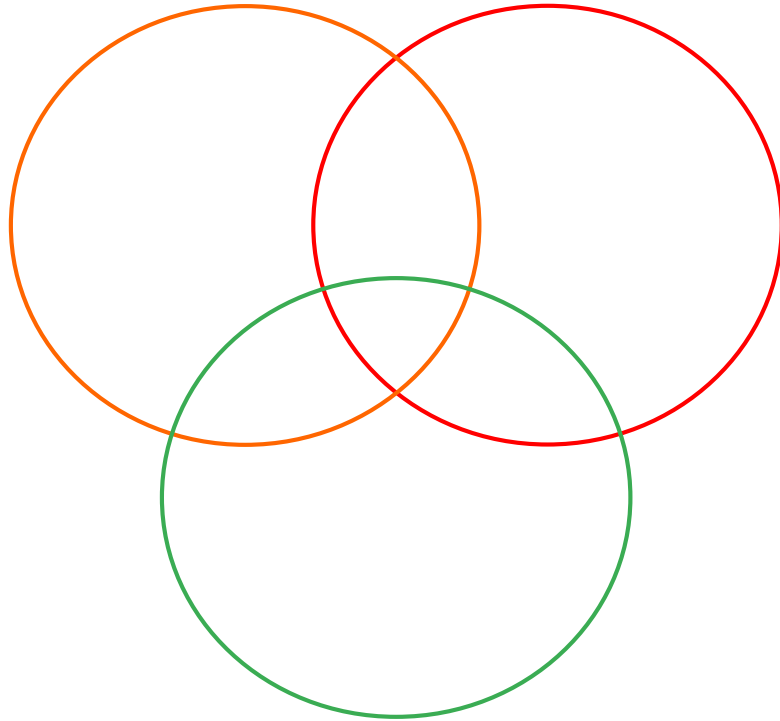
What to do with this information?



What to do with this information?

MACE EBV + REL

Intergenomics GEBV + GREL

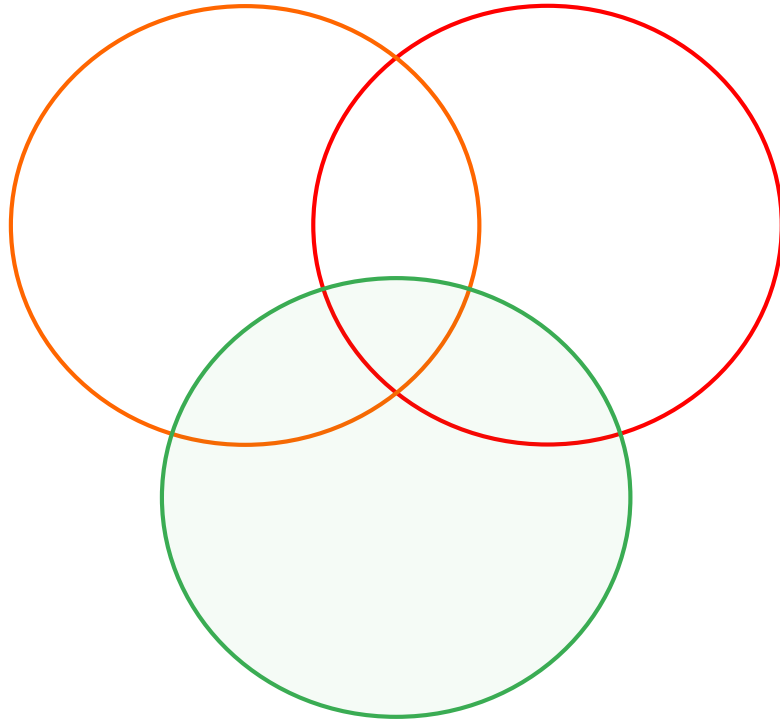


Slovenian EBV + REL

What to do with this information?

MACE EBV + REL

Intergenomics GEBV + GREL



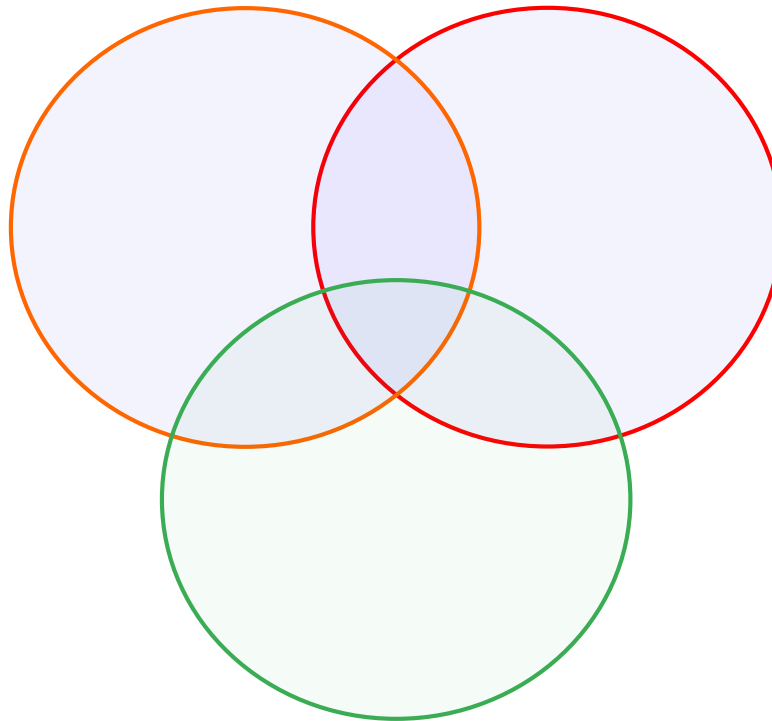
Slovenian animals
(e.g., cows, young bulls)

Slovenian EBV + REL

What to do with this information?

MACE EBV + REL

Intergenomics GEBV + GREL



Only bulls

Slovenian animals
(e.g., cows, young bulls)

Slovenian EBV + REL

Aim

✓ Combination of

- ❑ Pedigree
- ❑ Slovenian phenotypes
- ❑ Genotypes
- ❑ External information
 - ❑ MACE EBV and REL
 - ❑ Intergenomics GEBV and GREL

for milk, fat and protein yields
for Brown Swiss dairy cattle

First solution...

MACE EBV + REL

Intergenomics GEBV + GREL

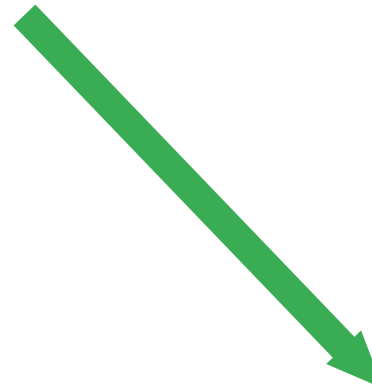
Genotypes

Slovenian population

Data sets

Genomic evaluation 1

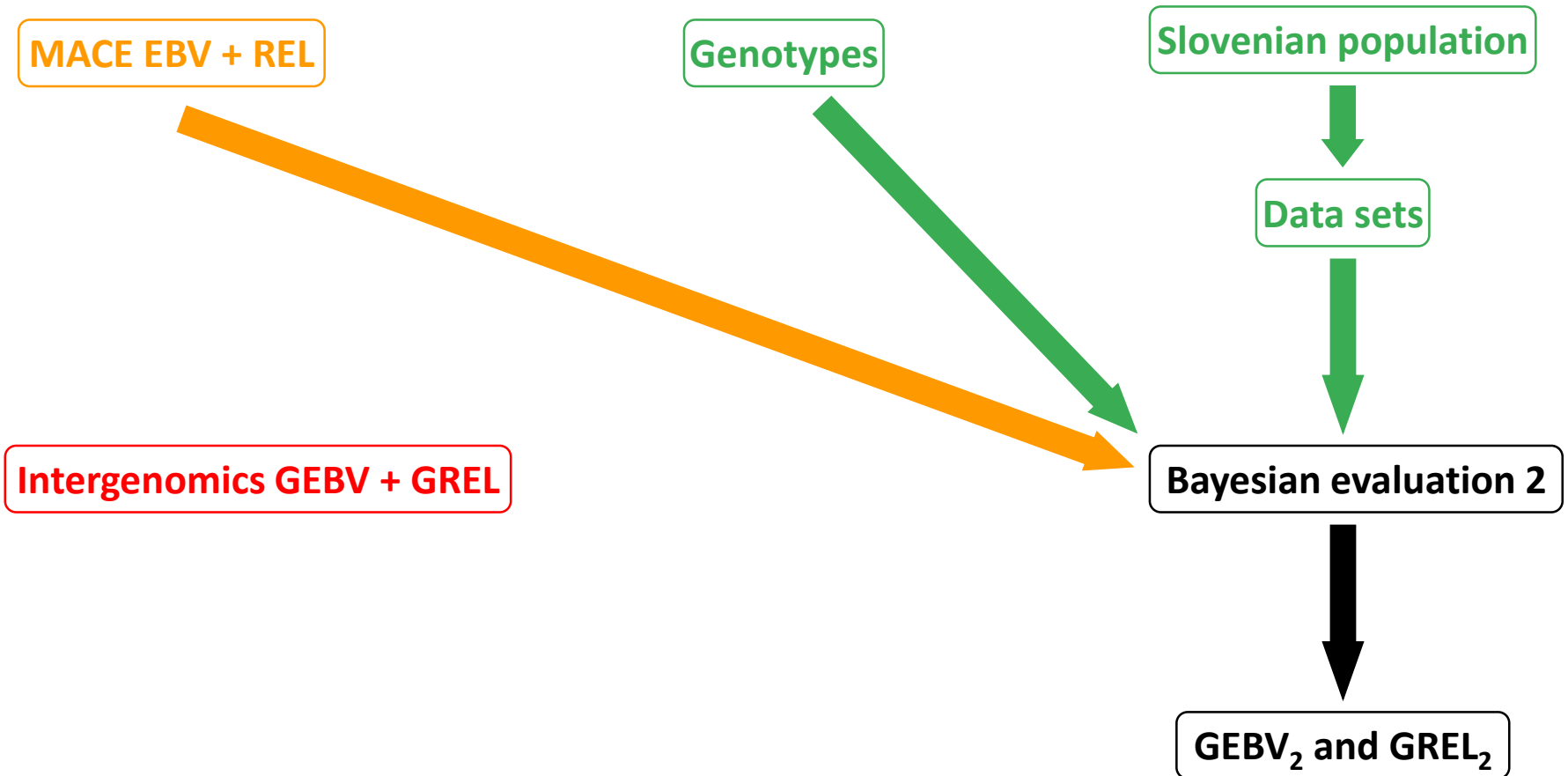
GEBV₁ and GREL₁



First solution...

- ✓ Genomic evaluation (single-step)
- ✓ But...
 - ❑ No consideration of external information (MACE or Intergenomics (G)EBV and (G)REL)

Second solution...



Second solution...

- ✓ Genomic evaluation (single-step)
 - ❑ Easy consideration of genotypes for cows, young animals,...
- ✓ Consideration of MACE EBV and REL
- ✓ Similar to the Intergenomics evaluation
- ✓ But...
 - ❑ Not the same methodology
 - ❑ Not the same information

Third solution...

MACE EBV + REL

Genotypes

Slovenian population

Data sets

Intergenomics GEBV + GREL

Bayesian evaluation 3

GEBV₃ and GREL₃



Third solution...

- ✓ « Genomic » evaluation

- Consideration of Intergenomics GEBV and GREL

- ✓ But...

- How to consider genotypes for cows, young animals,...

Fourth solution...

MACE EBV + REL

Genotypes

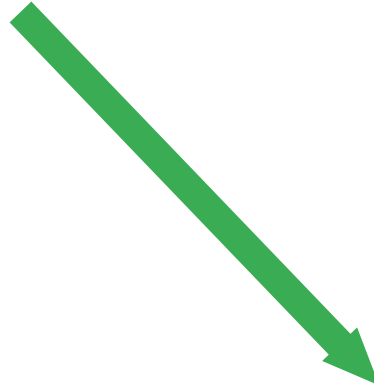
Slovenian population

Data sets

Intergenomics GEBV + GREL

Bayesian evaluation 4

GEBV₄ and GREL₄



Fourth solution...

- ✓ Genomic evaluation (single-step)
 - ❑ Easy consideration of genotypes for cows, young animals,...
- ✓ Consideration of Intergenomics GEBV and GREL
- ✓ But...
 - ❑ Double-counting of genomic information (through genotypes and GEBV (GREL))
 - ➔ Possibility to take into account for few animals (<30,000?)

Results

- ✓ Brown Swiss population
 - Consideration of 5 groups of animals

- ✓ Reference evaluation
 - Function of the considered group of animals
 - Intergenomics or Slovenian evaluation
 - Consideration of 5 groups of animals

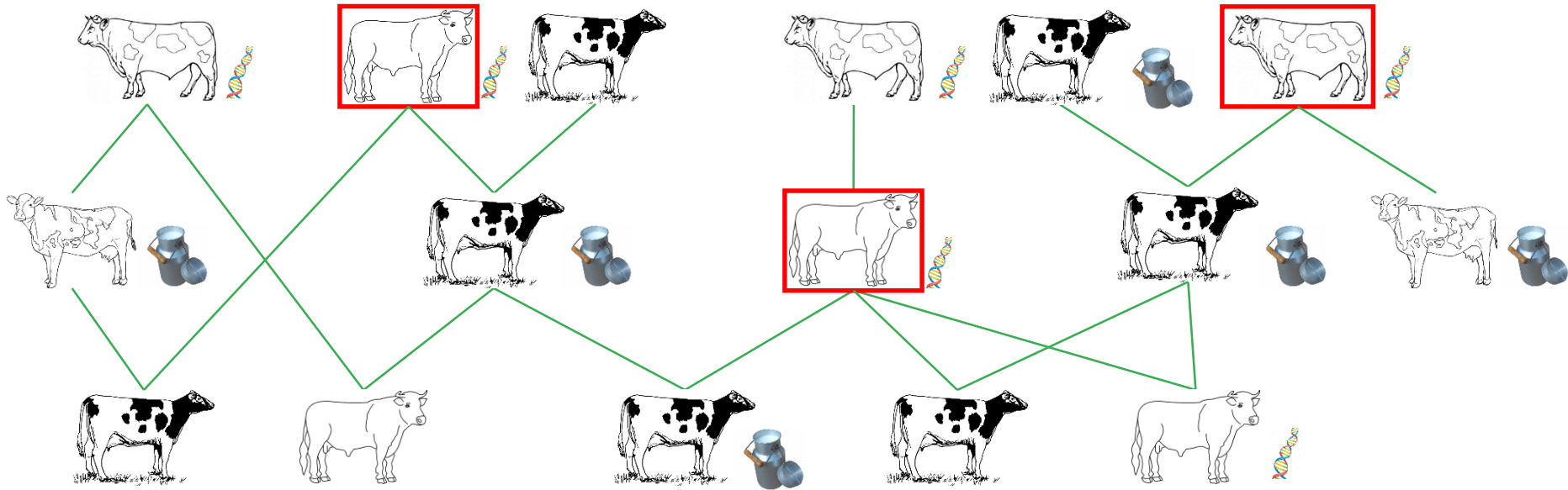
Internally used sires

✓ Bulls (Slovenian or not)

- ❑ Associated with Intergenomics GEBV and GREL
- ❑ Having female progeny with Slovenian milk yield records
- ❑ Reference evaluation: Intergenomics evaluation

➔ 319 internally used sires

Internally used sires

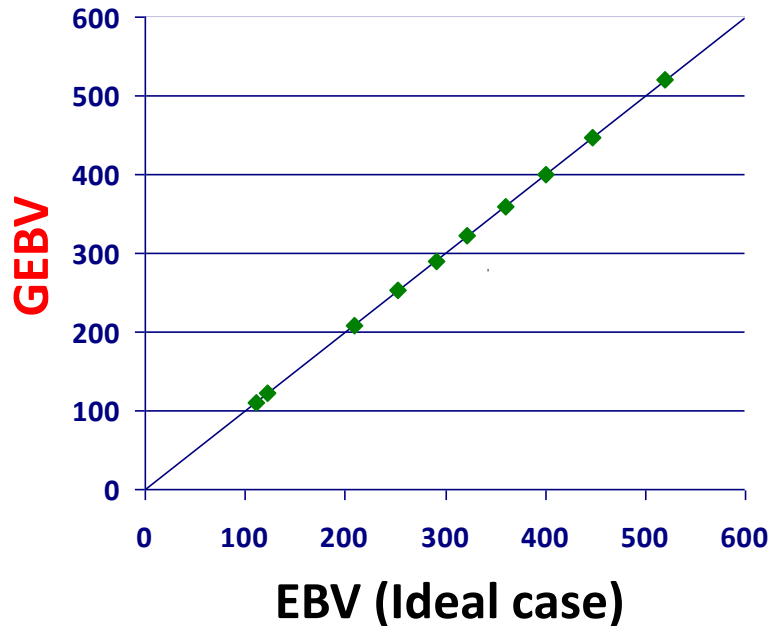


Reference: Intergenomics GEBV

1) Rank correlation (r)

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1) Rank correlation (r)

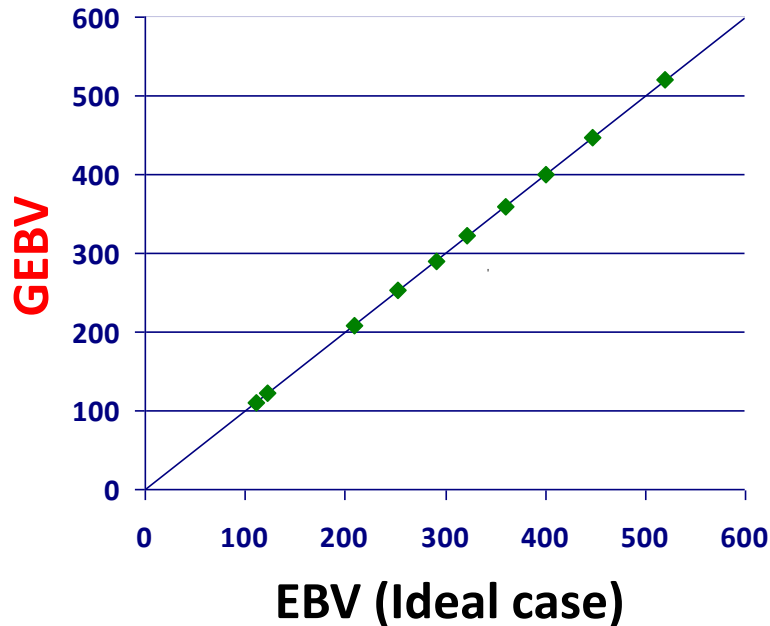


Ideally

1.00

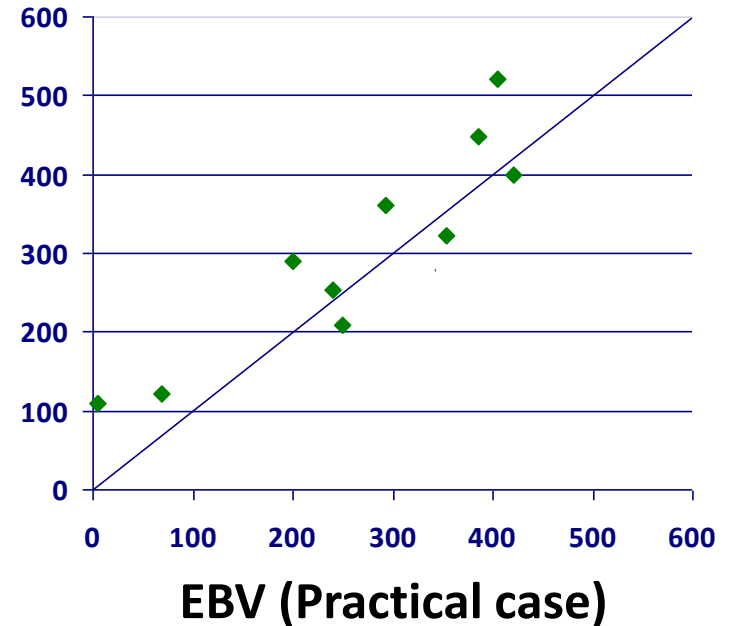
Reference: Intergenomics GEBV

1) Rank correlation (r)



Ideally

1.00



Actually

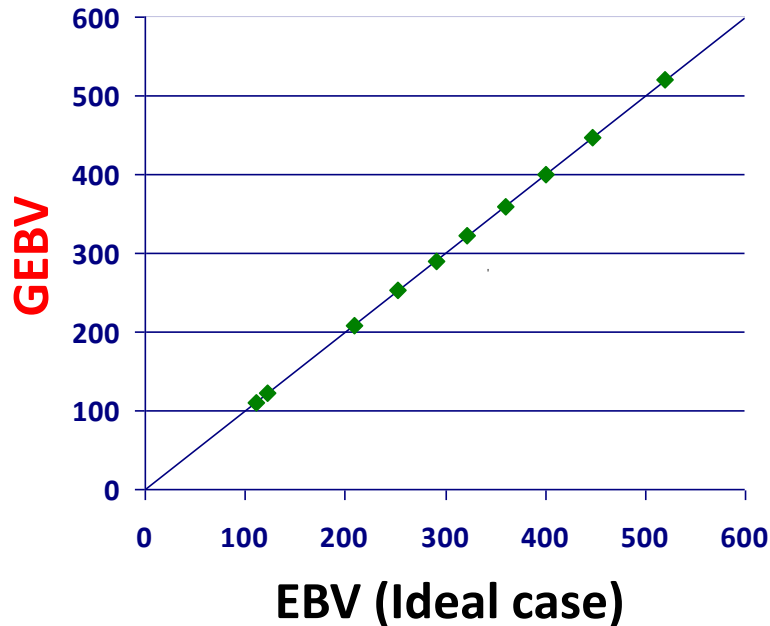
<1.00

Reference: Intergenomics GEBV

2) Relative mean squared error (rMSE)

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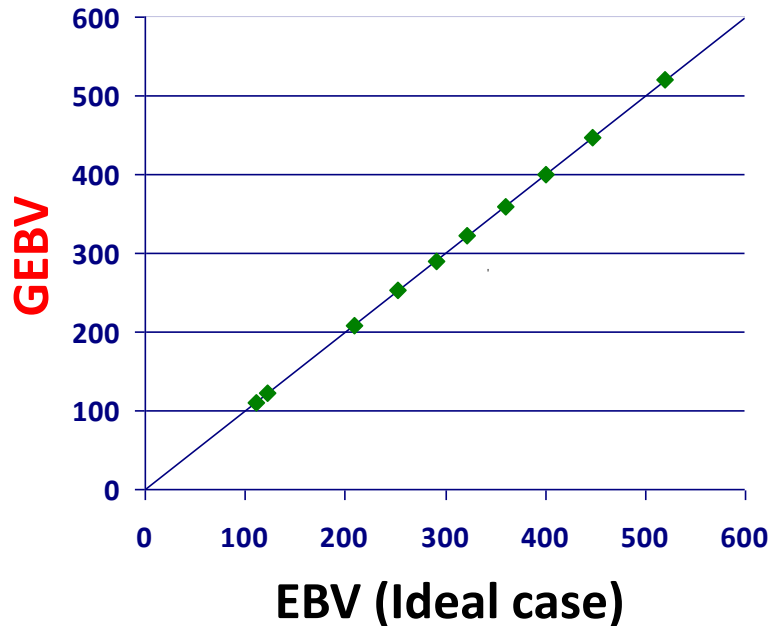


Ideally

0.00

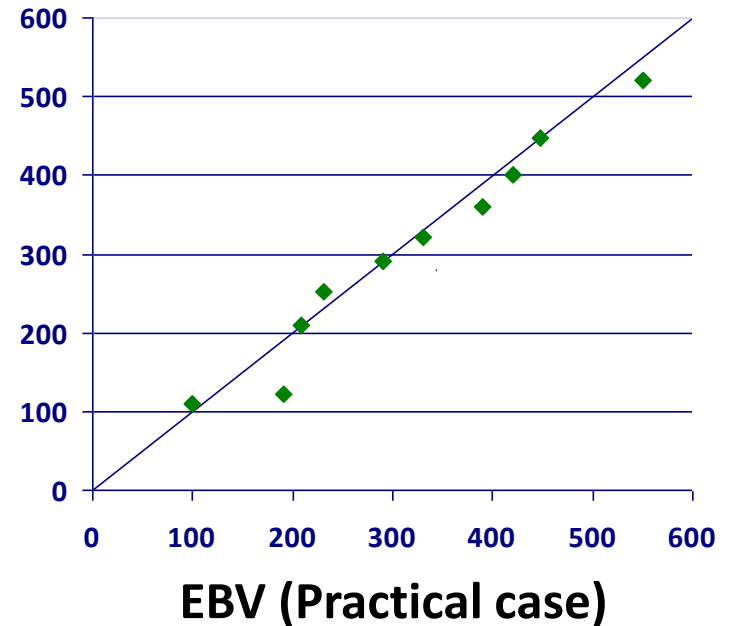
Reference: Intergenomics GEBV

2) Relative mean squared error (rMSE)



Ideally

0.00

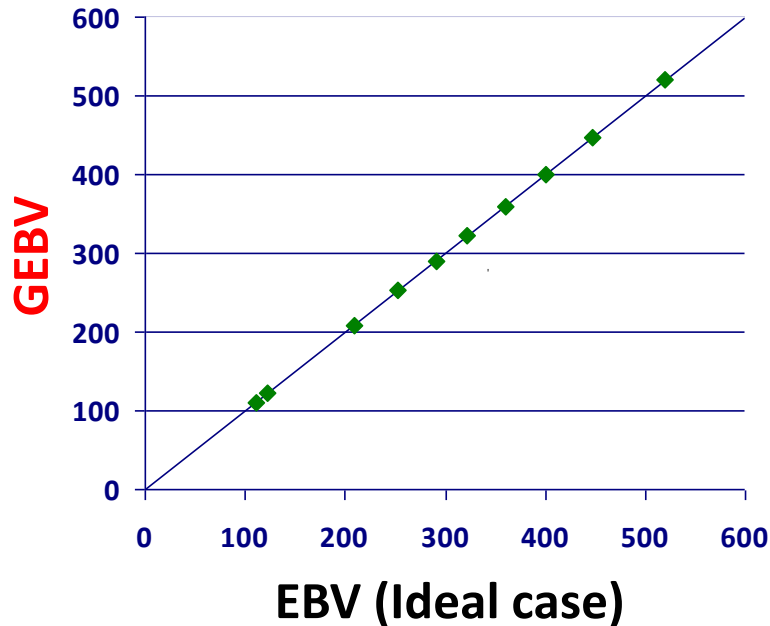


Actually

>0.00

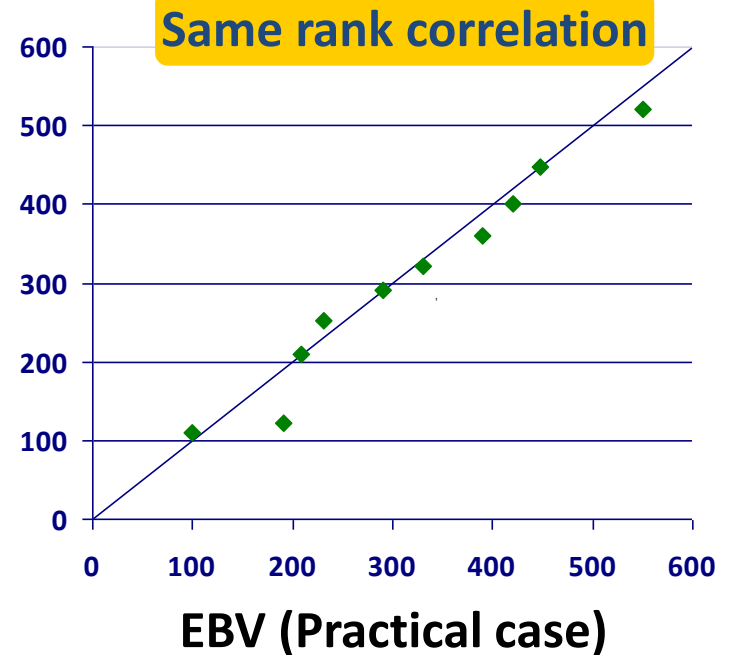
Reference: Intergenomics GEBV

2) Relative mean squared error (rMSE)



Ideally

0.00

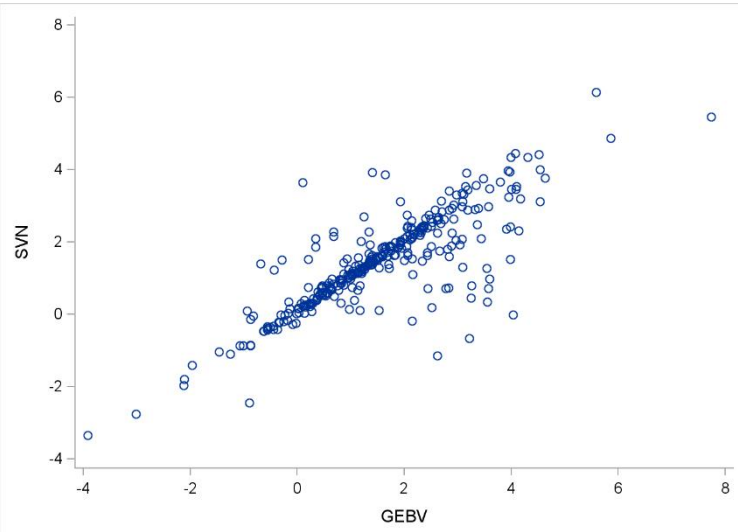


Actually

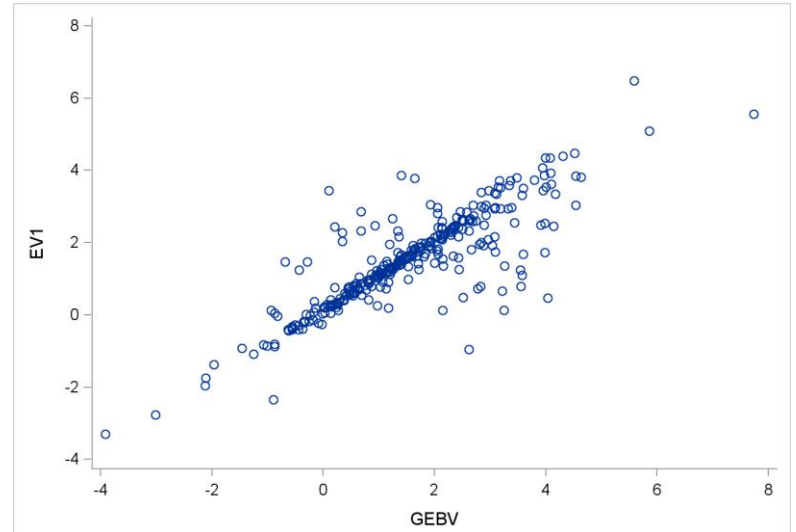
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Internally used sires: different EBV vs GEBV

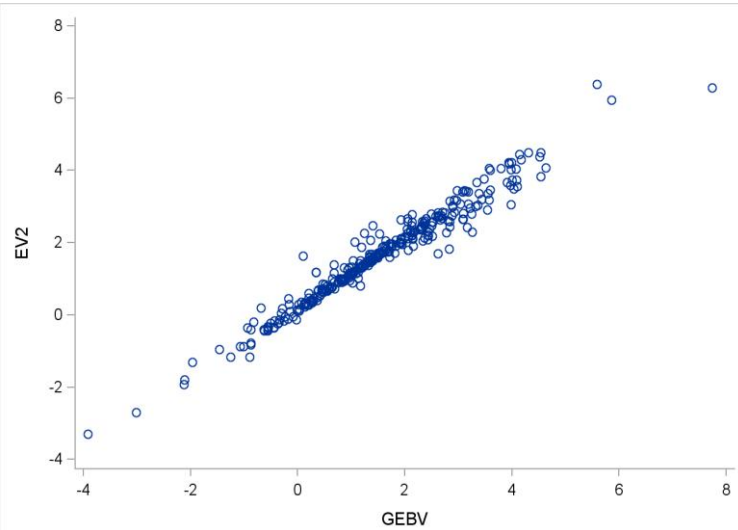
SVN



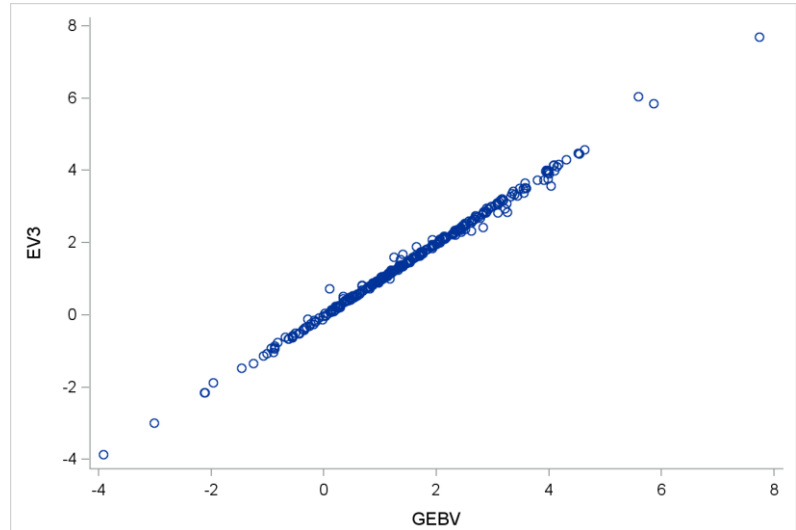
1



2

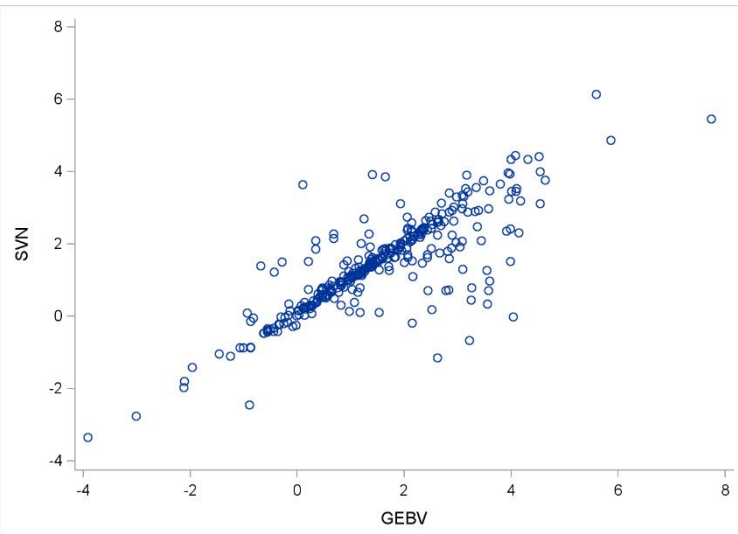


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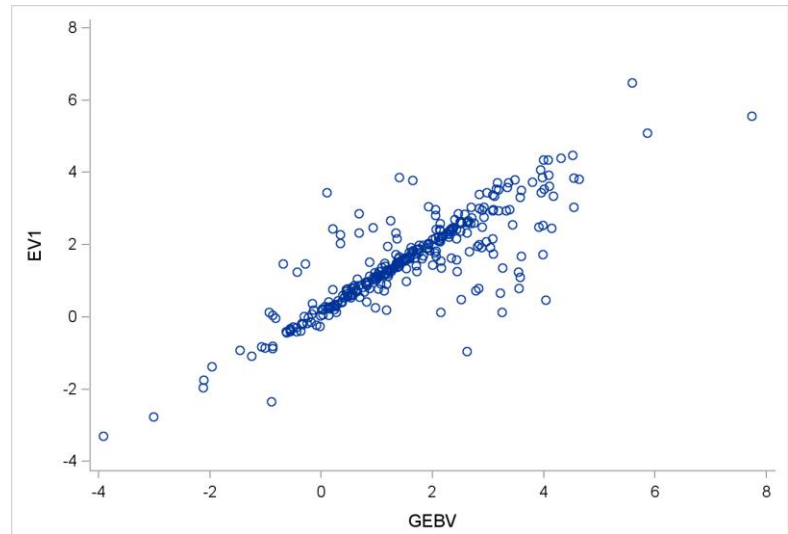


Internally used sires: different EBV vs GEBV

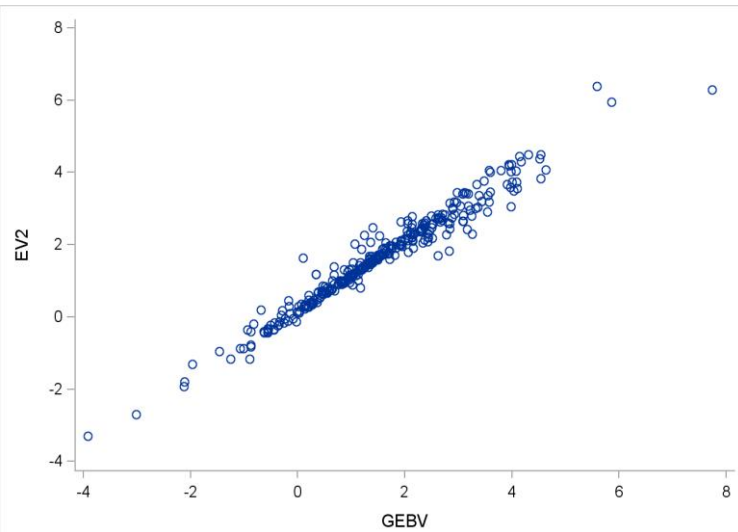
SVN



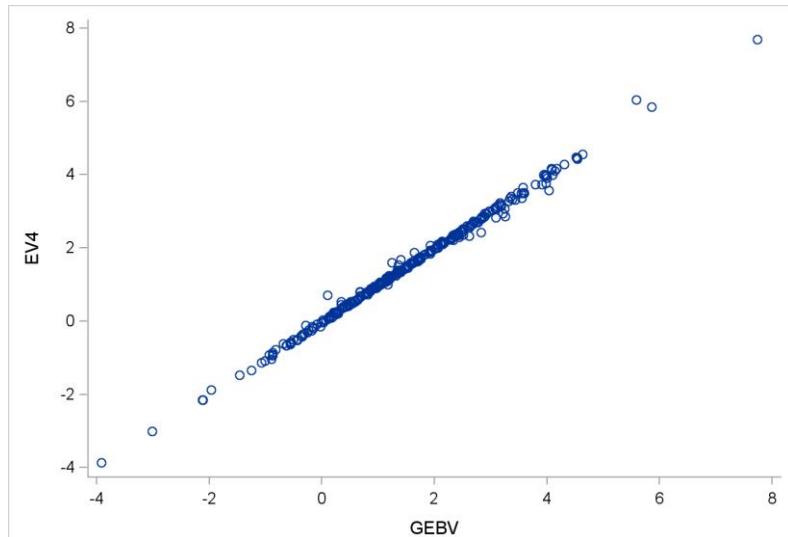
1



2

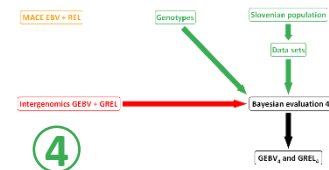
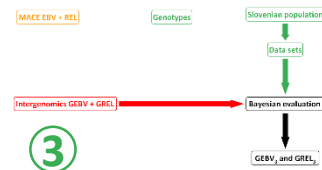
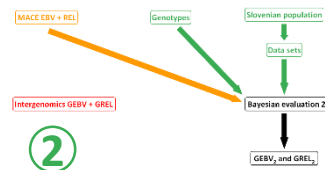
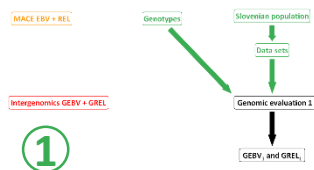


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Internally used sires

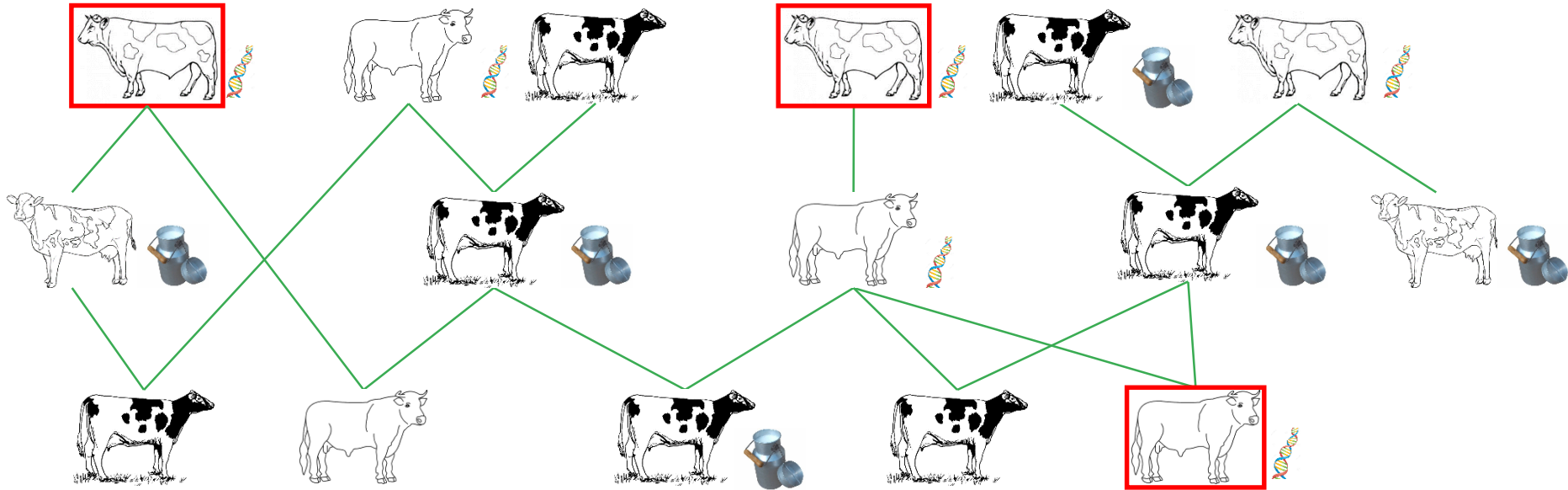
Evaluations	r	rMSE	REL (SD)
Intergenomics	1.00	0.00	0.97 (0.02)
Slovenian	0.79	100.00	0.87 (0.19)
1	0.82	86.9	0.88 (0.18)
2	0.98	15.41	0.94 (0.05)
3	>0.99	1.12	0.97 (0.02)
4	>0.99	1.13	0.97 (0.02)



Internally unused sires

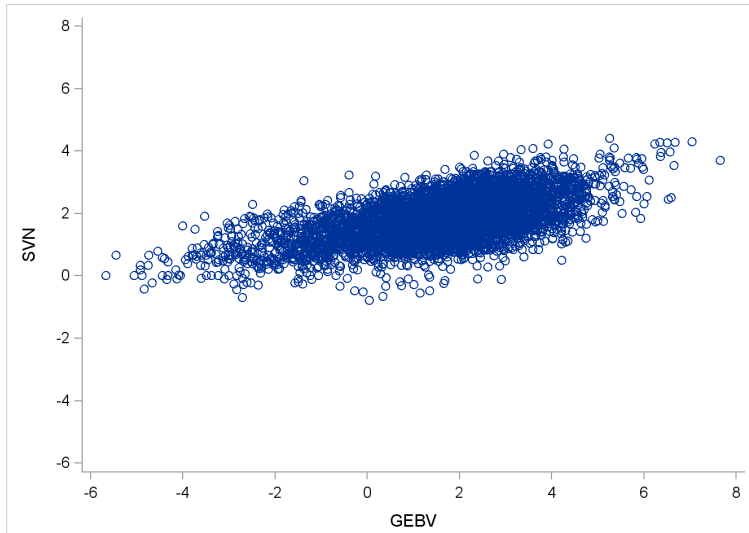
- ✓ Bulls (Slovenian or not)
 - ❑ Associated with Intergenomics GEBV and GREL
 - ❑ Having NO female progeny with Slovenian milk yield records
 - ❑ Reference evaluation: Intergenomics evaluation
- ➔ 5,533 internally used sires

Internally unused sires

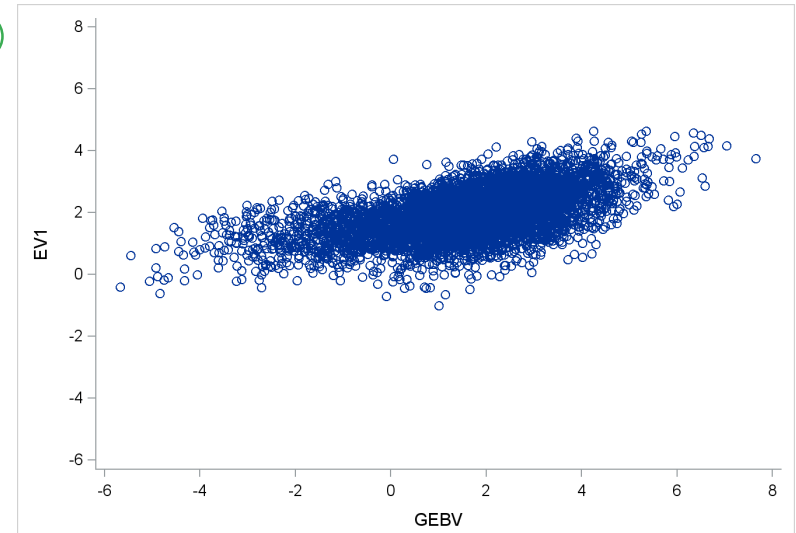


Internally unused sires: different EBV vs GEBV

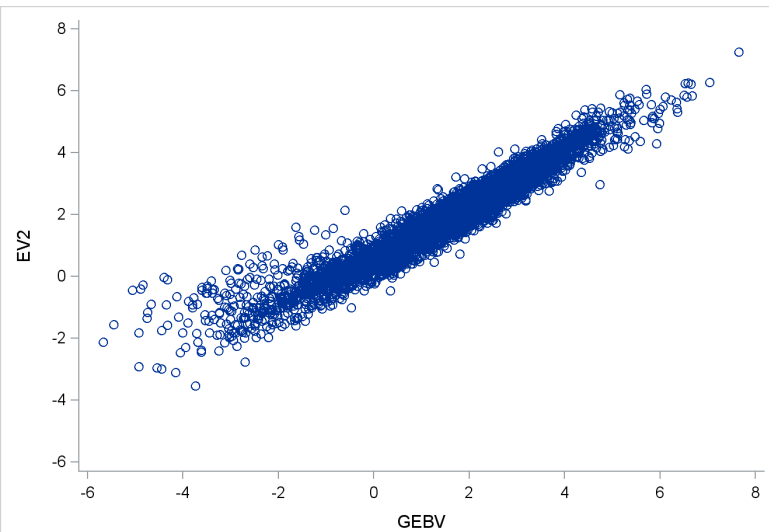
SVN



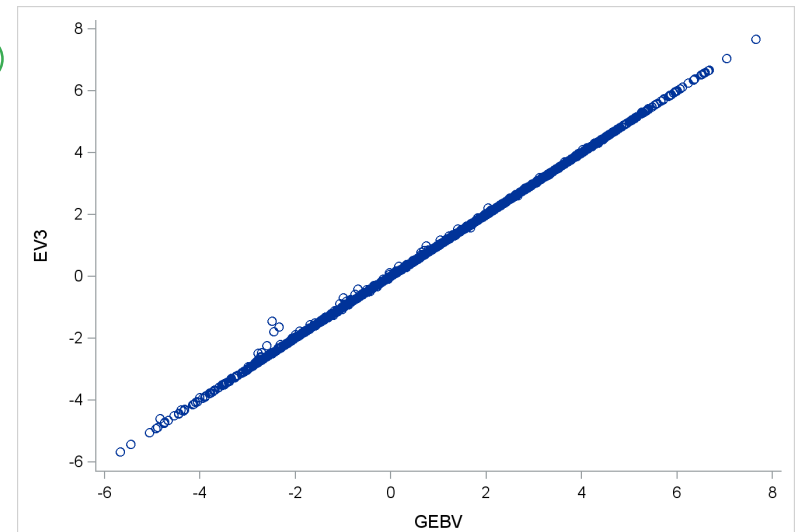
①



②

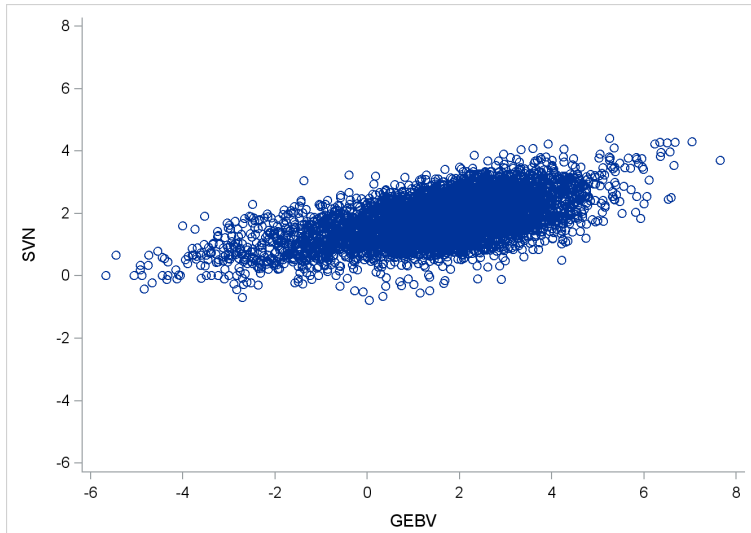


③

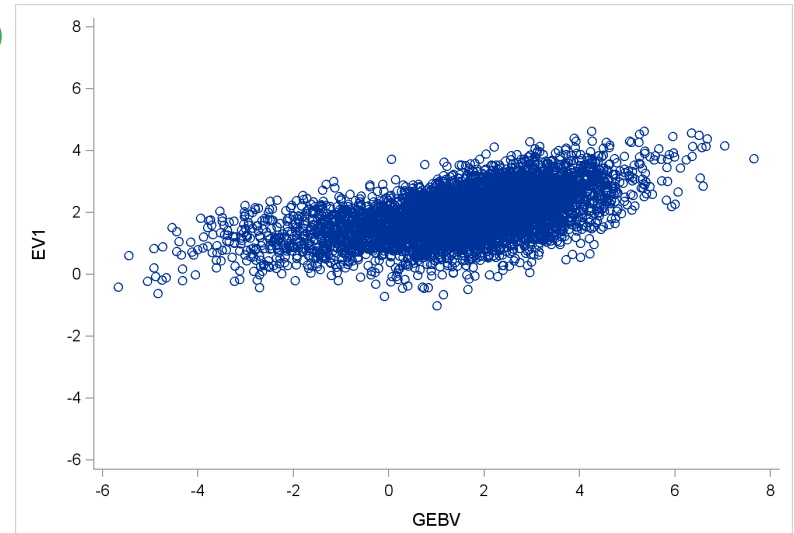


Internally unused sires: different EBV vs GEBV

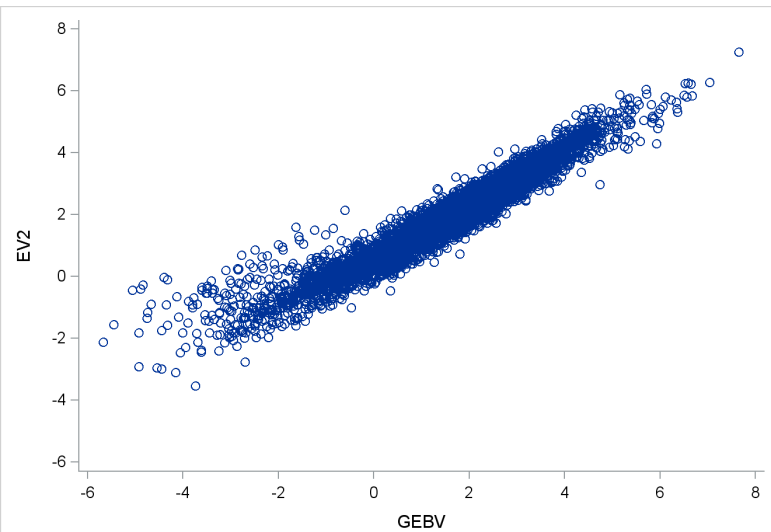
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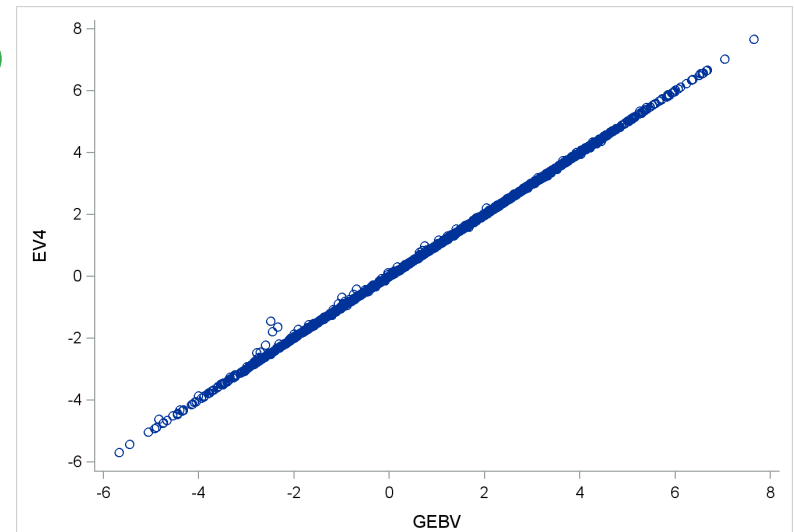
①



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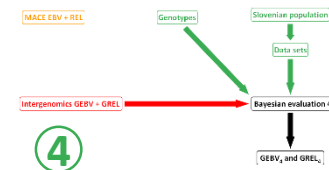
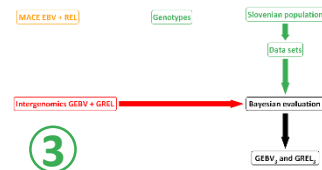
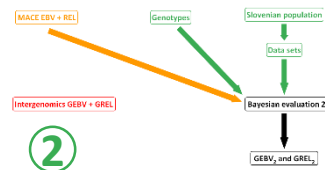
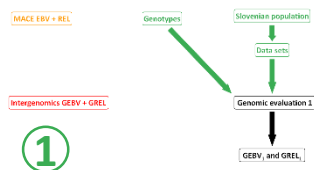


④



Internally unused sires

Evaluations	r	rMSE	REL (SD)
Intergenomics	1.00	0.00	0.90 (0.02)
Slovenian	0.55	100.00	0.17 (0.10)
1	0.54	17.70	0.22 (0.09)
2	0.97	3.21	0.78 (0.06)
3	>0.99	0.01	0.91 (0.02)
4	>0.99	0.01	0.91 (0.02)

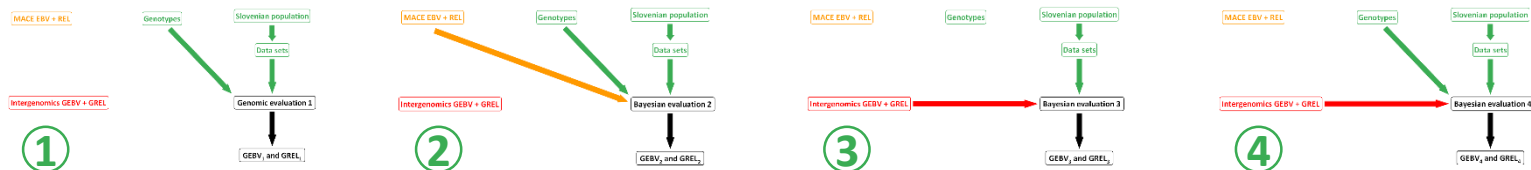


Slovenian cows

- ✓ Slovenian cows with Slovenian milk yield records
 - ❑ Sired by an internally used sire (i.e. with Intergenomics GEBV and GREL)
 - ❑ Reference evaluation: Slovenian genetic evaluation
- ➔ 43,007 Slovenian cows

Slovenian cows

Evaluations	r	REL (SD)
Slovenian	1.00	0.74 (0.09)
1	>0.99	0.74 (0.09)
2	>0.99	0.74 (0.09)
3	>0.99	0.74 (0.09)
4	>0.99	0.74 (0.09)

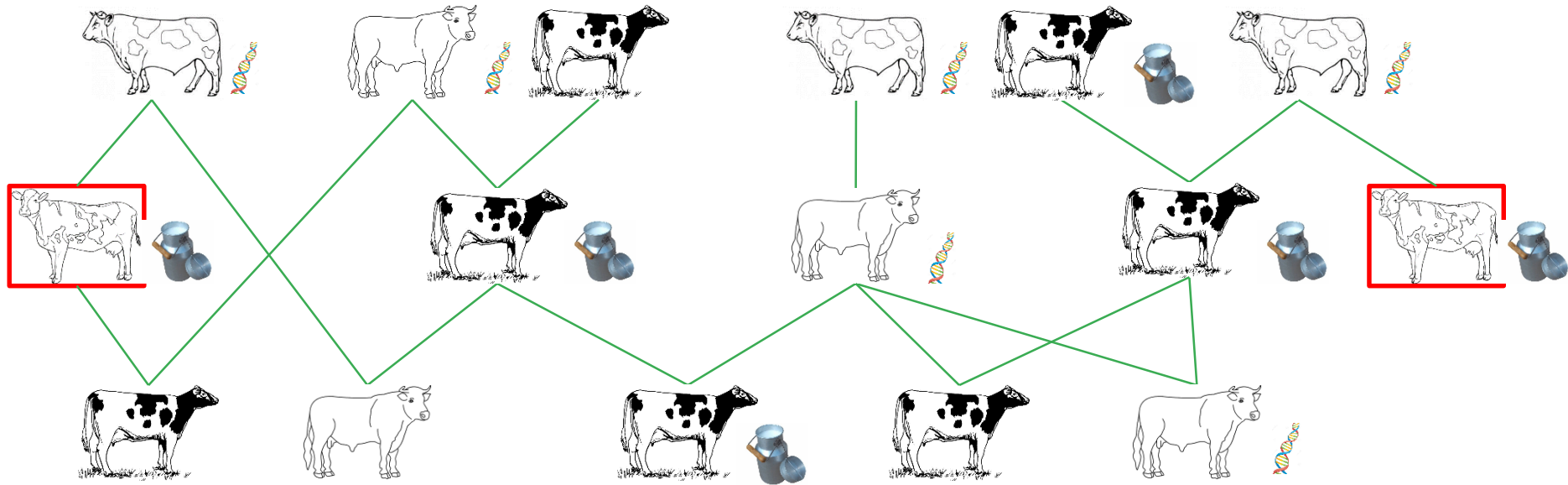


Imported cows

- ✓ Foreign cows associated with Slovenian milk yield records
 - ❑ Sired by an internally unused sire (i.e. with Intergenomics GEBV and GREL)
 - ❑ Reference evaluation: Slovenian genetic evaluation

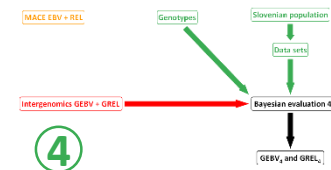
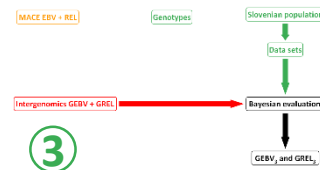
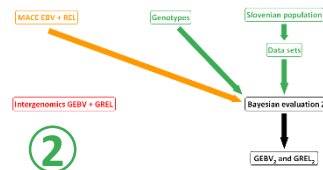
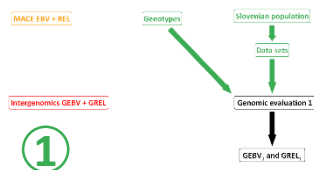
- ➔ 23 imported cows

Imported cows



Imported cows

Evaluations	r	REL (SD)
Slovenian	1.00	0.67 (0.14)
1	0.99	0.70 (0.12)
2	0.99	0.70 (0.12)
3	0.98	0.70 (0.12)
4	0.98	0.70 (0.12)



Slovenian animals - no milk yield

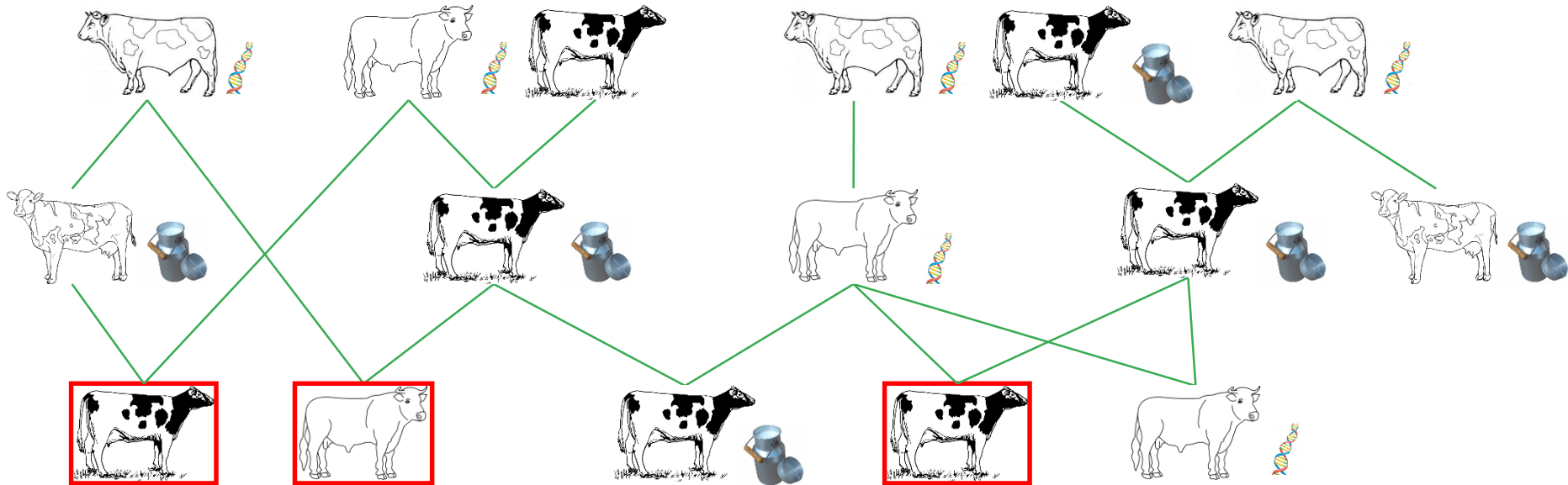
✓ Slovenian animals

- ❑ Not associated with Slovenian milk yield records
- ❑ Sired by an internally used sire (i.e. with Intergenomics GEBV and GREL)
- ❑ Reference evaluation: Slovenian genetic evaluation

➔ 3 groups in function of Slovenian REL (REL_S)

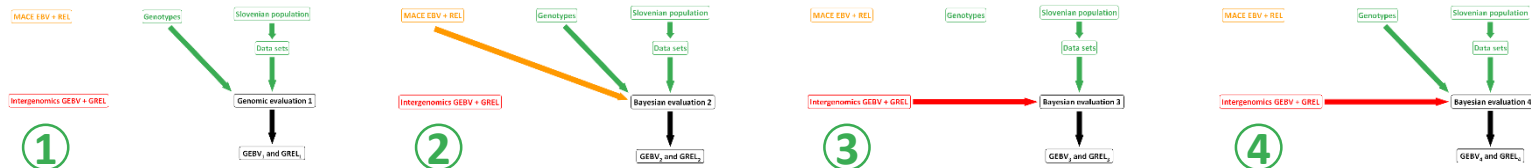
- ❑ $REL_S < 0.50$ 1,520
- ❑ $0.50 < REL_S < 0.75$ 348
- ❑ $REL_S > 0.75$ 103

Slovenian animals - no milk yield



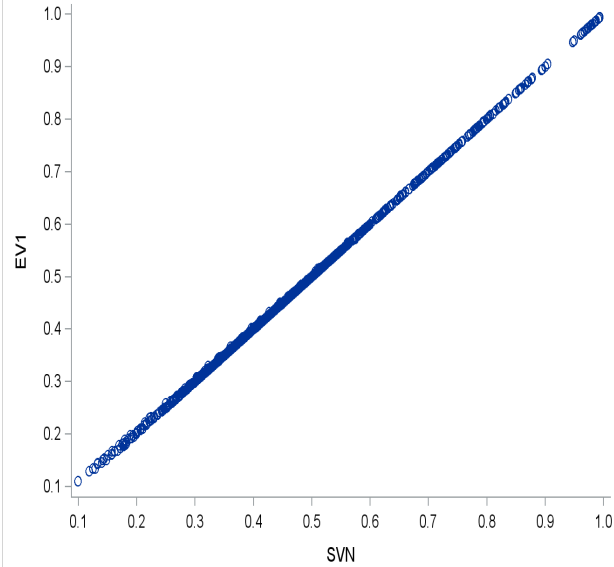
Slovenian animals - no MY- r

Evaluations	$REL_S < 0.50$	$0.50 < REL_S < 0.75$	$REL_S > 0.75$
Slovenian	1.00	1.00	1.00
1	0.99	0.99	0.99
2	0.98	0.99	0.99
3	0.95	0.99	0.99
4	0.95	0.99	0.99

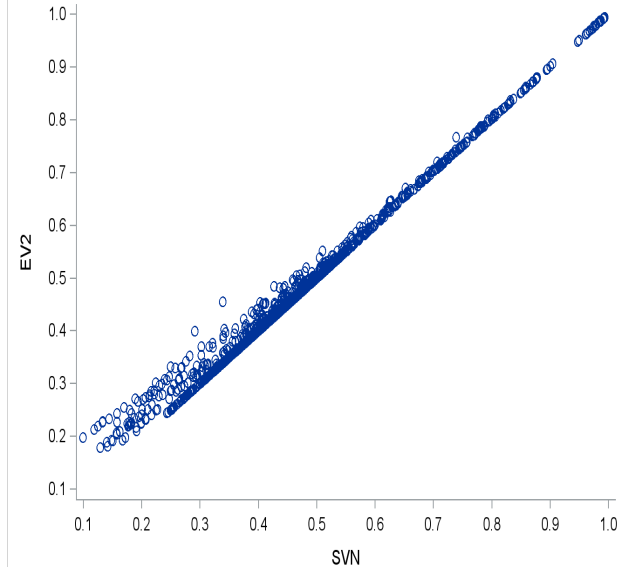


Slovenian animals – no MY: REL

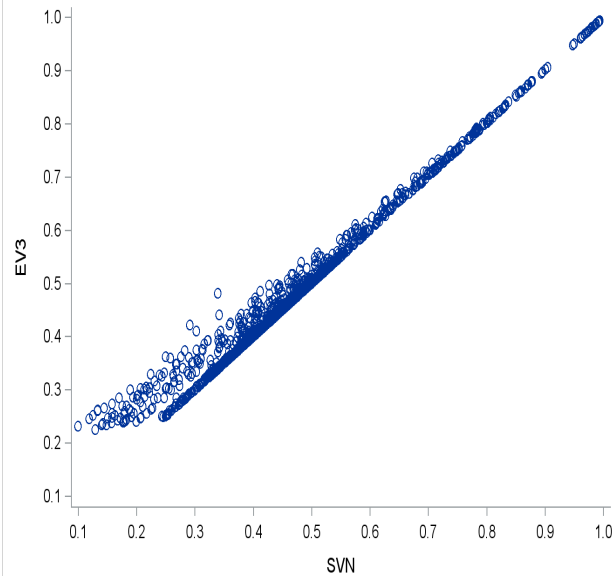
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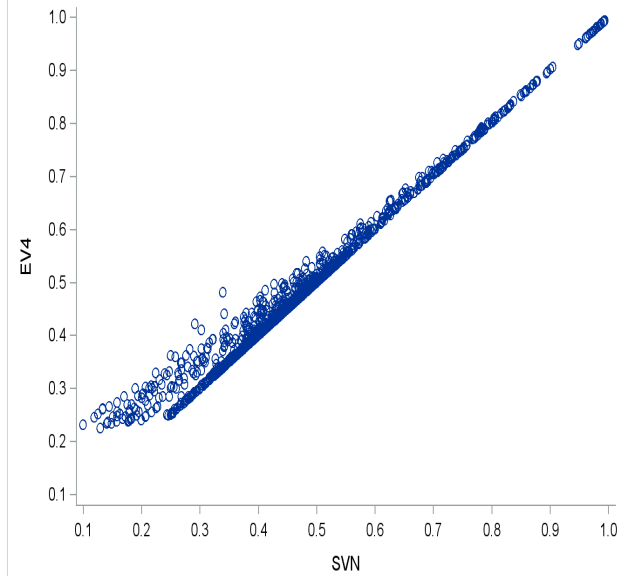
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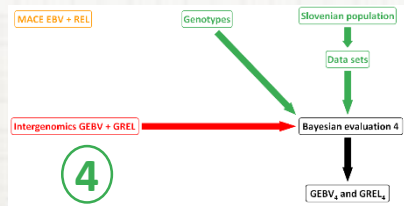
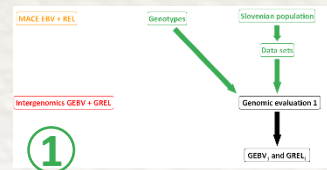
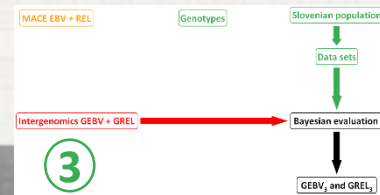
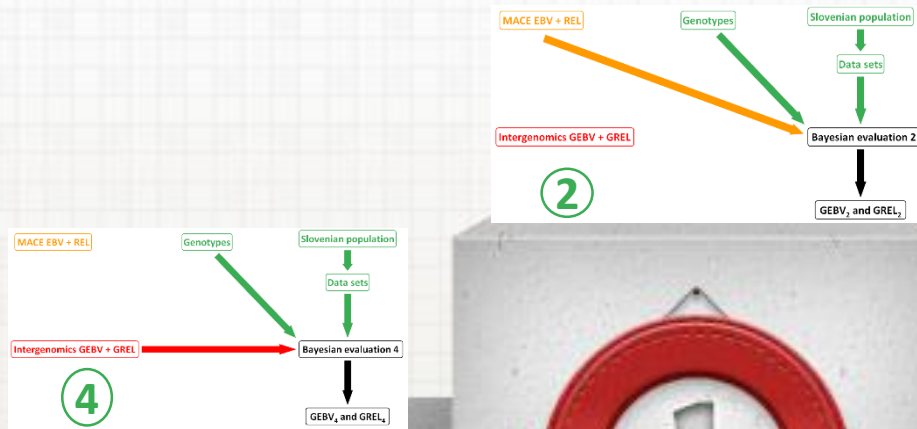
③



④



Solutions - comparison



Discussion-conclusions

✓ Solution 2 & 4-?

- ❑ Relevant „national“ genomic evaluation
- ❑ No changes for cows
- ❑ Minor changes for bulls

✓ Terms and Conditions

- ❑ Genotypes exchange
- ❑ Software - methodology

It seems that could be applied also to other dairy population



Acknowledgments



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- ❑ University of Liege
- ❑ Wallonie-Bruxelles International
- ❑ Public Service of Wallonia
- ❑ European Commission, Directorate-General for Agriculture and Rural Development



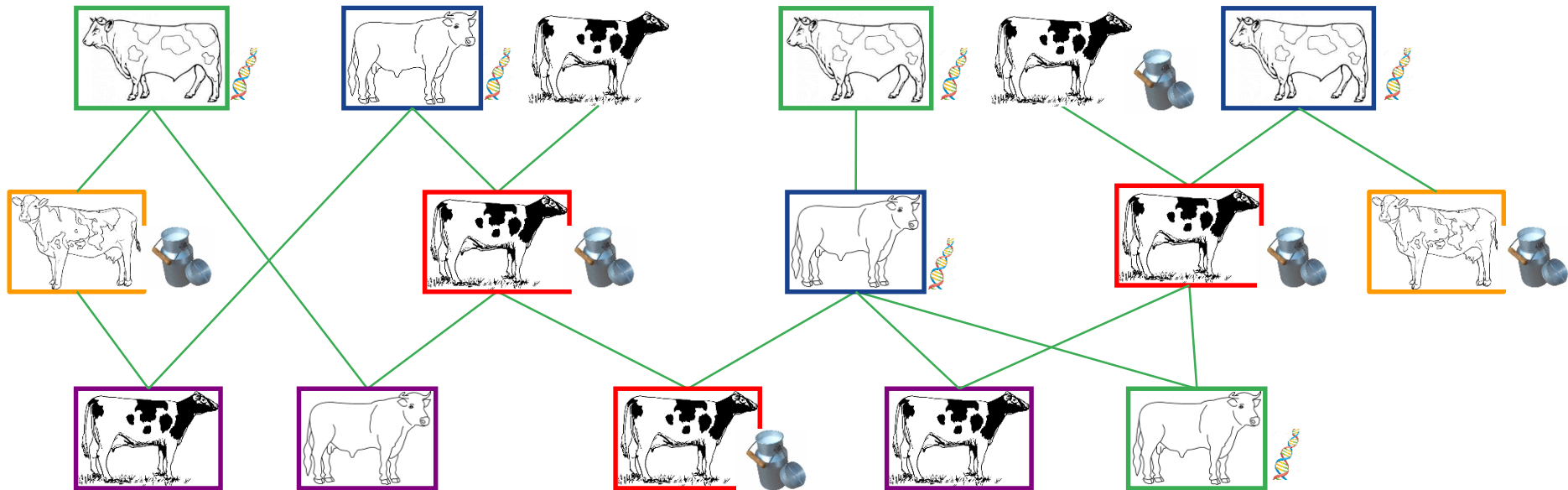
✓ CECI for computational resources

✓ Animal and Dairy Science Department, University of Georgia, Athens, USA

✓ Animal Science Department, University of Ljubljana, Slovenia



Brown Swiss population



Internally used bulls

Internally unused bulls

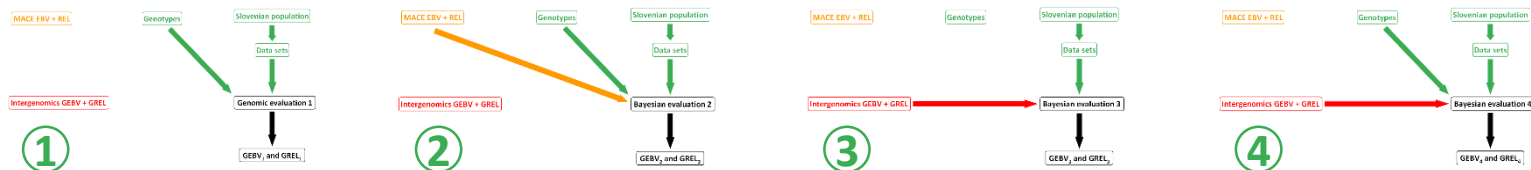
Slovenian cows

Imported cows

Slovenian animals

Slovenian animals

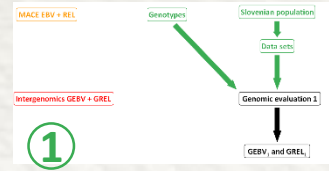
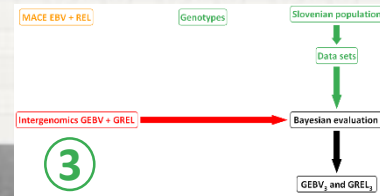
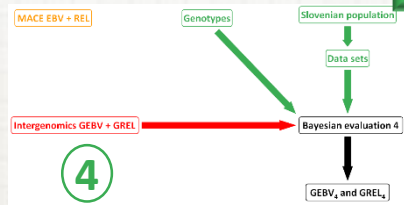
Evaluations	$REL_S < 0.50$		$0.50 < REL_S < 0.75$		$REL_S > 0.75$	
	r	REL (SD)	r	REL (SD)	r	REL (SD)
Slovenian	1.00	0.40 (0.07)	1.00	0.57 (0.07)	1.00	0.85 (0.08)
1	0.99	0.40 (0.07)	0.99	0.57 (0.07)	0.99	0.85 (0.08)
2	0.98	0.40 (0.07)	0.99	0.58 (0.07)	0.99	0.85 (0.08)
3	0.95	0.41 (0.06)	0.99	0.58 (0.07)	0.99	0.85 (0.08)
4	0.95	0.41 (0.06)	0.99	0.58 (0.07)	0.99	0.85 (0.08)



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Marija

Gregor



THANK You for Your attention