New French genetic evaluations of fertility and productive life of beef cows
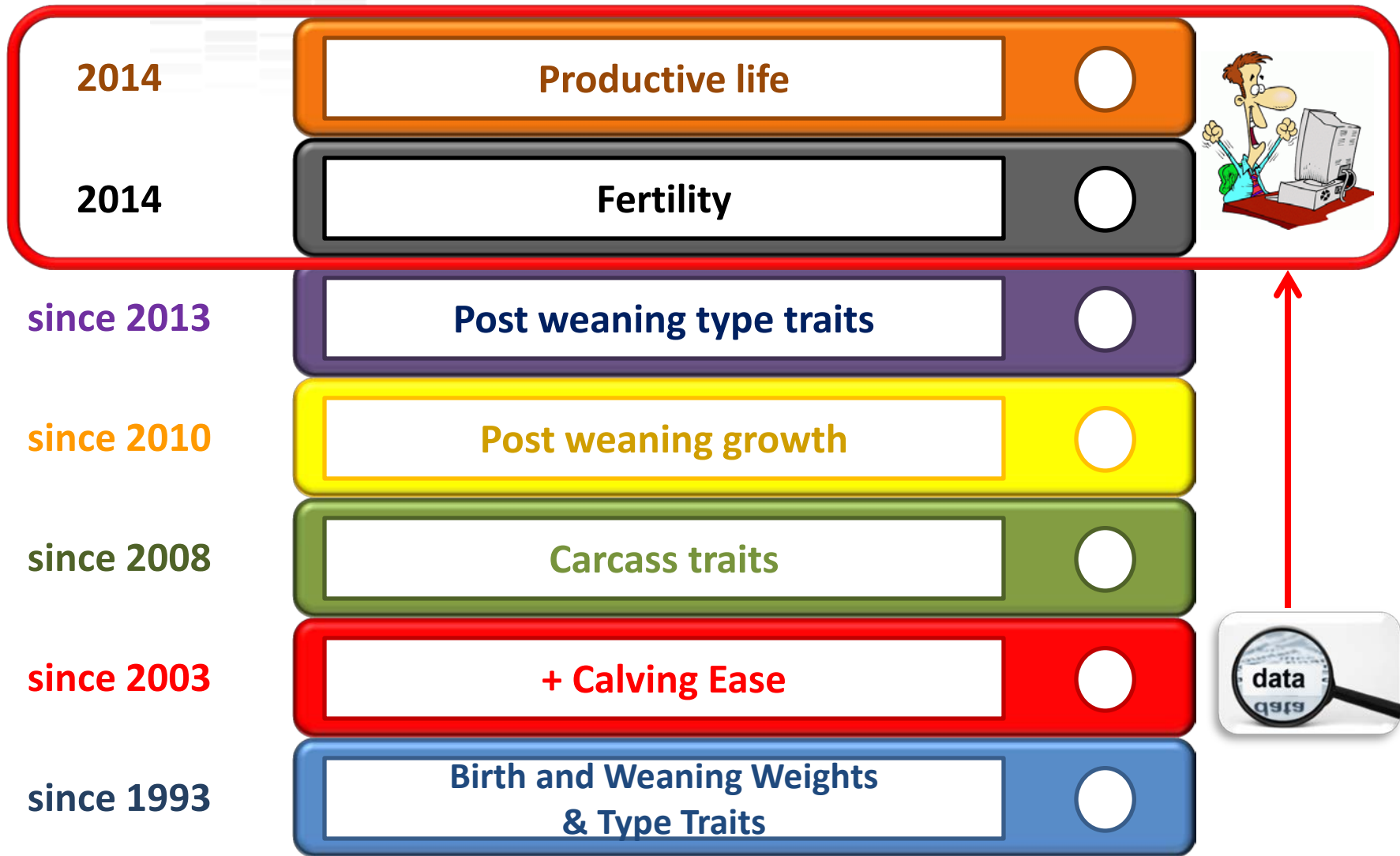
Eric VENOT, Pilar SCHNEIDER, Serge MILLER, Mathilde AIGNEL, Marine Barbat, Vincent Ducrocq, Florence PHOCAS
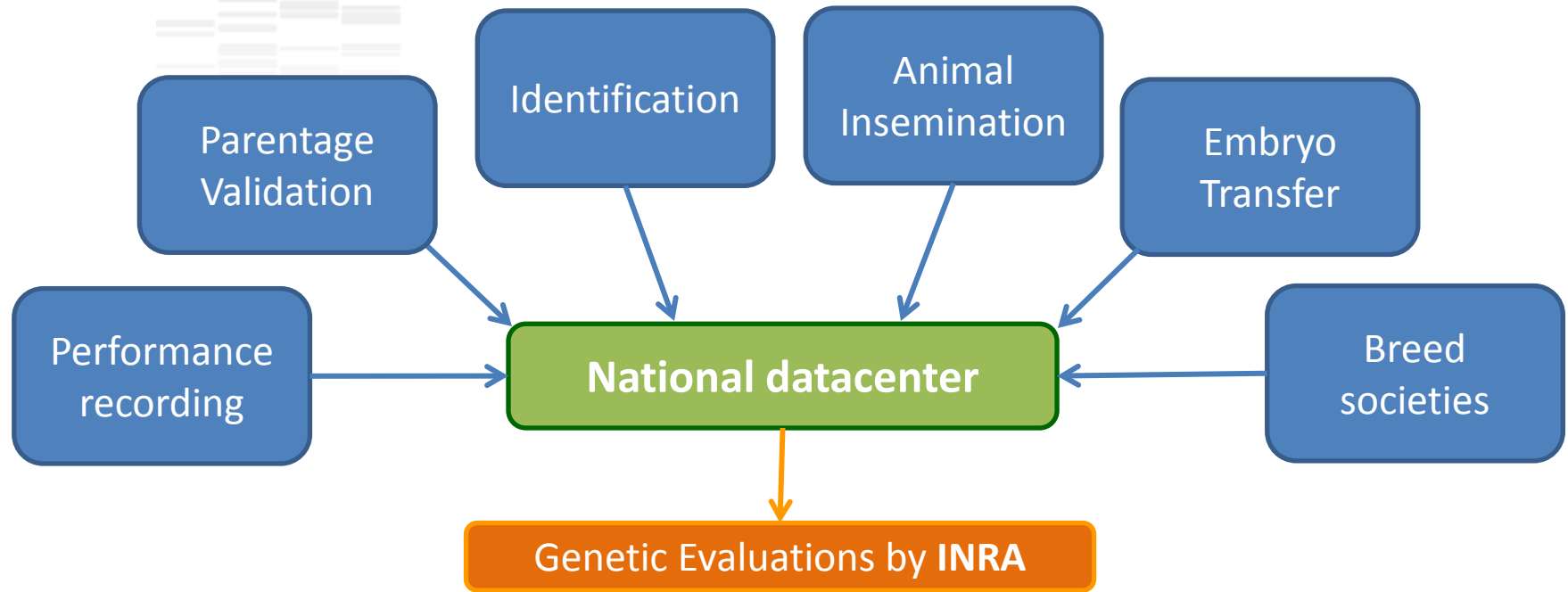
Interbull meeting – Nantes – 25th August 2013

French beef cattle genetic evaluations

2014	**Productive life**	
2014	**Fertility**	
since 2013	**Post weaning type traits**	
since 2010	**Post weaning growth**	
since 2008	**Carcass traits**	
since 2003	**+ Calving Ease**	
since 1993	**Birth and Weaning Weights & Type Traits**	

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Data available

> **Extraction from the national database:**

- **Animal insemination**
- **Animal movements between herds**
- **Calving information**
- **Pedigree**

Fertility and Cow productive life

2 main breeder wishes can now be addressed:

1 **"I want my heifer gives birth to a calf after first AI"**

=> **heifer calving success after first AI (HCS)**

2 **"I want my cow has a maximum number of calves born"**

=> **productive life**

HCS: Trait definition

Rule to determine whether first AI is successful:

- based on breed specific gestation length mean (GL in days):

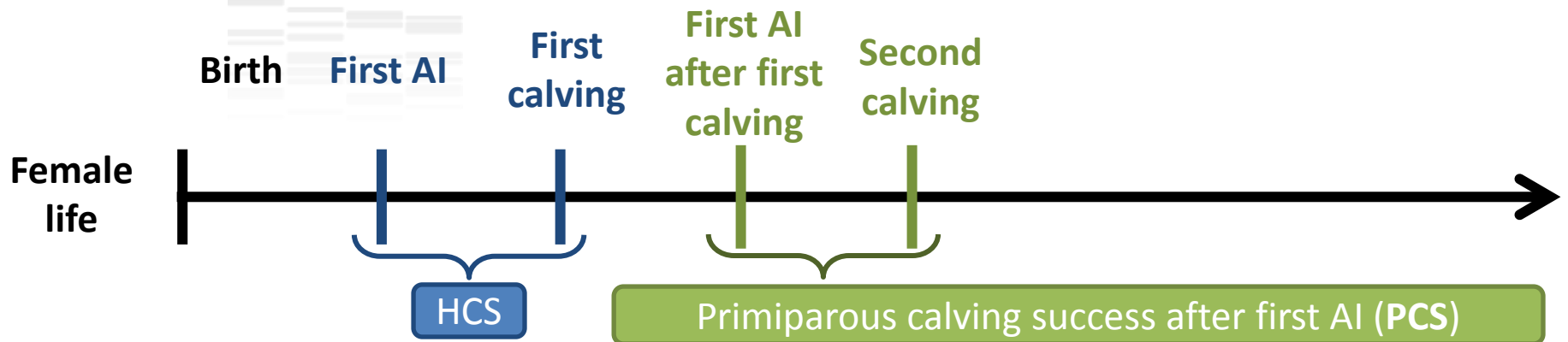| AUB	SAL	CHA	PAR	ROU	GAS	BAZ	LIM	BLA
285	285	287	288	288	289	290	291	295

- correction of GL for differences:
    - between sex: -1 day for female,
    - if twin: -5 days.

=> GL*

First AI is said successful if
Calving Date – AI date = GL* ± 19 days

HCS: Model and parameters

Female life timeline: Birth — First AI — First calving — First AI after first calving — Second calving

HCS (between First AI and First calving)

Primiparous calving success after first AI (**PCS**)

Bi-trait BLUP animal model

Software: genekit (Ducrocq)

Fixed effects:

HCS = CG (AI herd x AI camp x AI subgroup) + Age_class + AI_season + AI_day

PCS = idem + time between 1st Calving and AI + Calving Ease + Calf Sex ← **Info on first calving**

Random effects: AI bull   +   AI technician   +   Animal

Genetic parameters

- Similar for all breeds,

- Heritabilty = **0.015**

- Genetic correlation between HCS and PCS = **0.50**

- AI bull variance part = 0.002

- AI technician variance part = 0.004

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Fertility and Cow productive life

2 main breeder wishes can now be addressed:

(1) **"I want my heifer gives birth to a calf after first AI"**

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(2) **"I want my cow has a maximum number of calves born"**

=> **productive life**

2 complementary ways to assess cow productive life:

- **Longevity** ⇔ ability of a cow to achieve a long career

=> **either in time or in number of calvings**

- **Reproductive efficiency** ⇔ number of calves born at a target age

Preliminary studies on cow productive life

⬇

Goal
define the best trait to be used for national genetic evaluation

Comparison between:

Comparison between 2 French breeds: specialized vs hardy

Charolais

Aubrac

Survival rate vs Number of calving
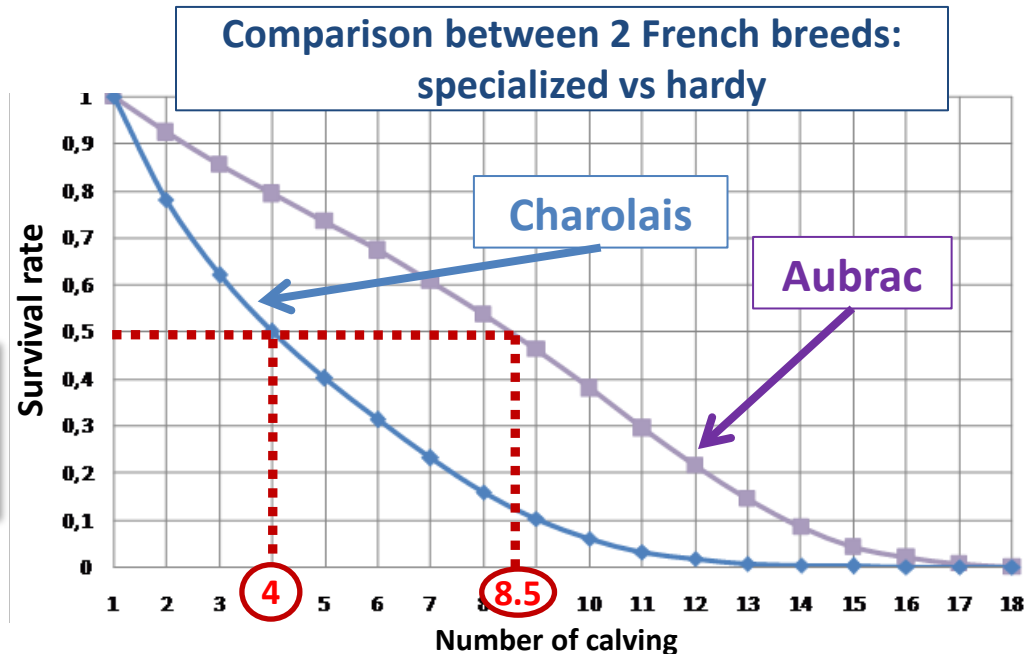
(1) **Survival analysis of longevity in terms of Lifespan vs Number of calves**

(Phocas and Ducrocq, WCGALP 2006)   **=> Number of calves**

(2) **Survival model applied on Number of calves (SURV) and**

Linear model applied on Number of calves at 2 different fixed ages:

- **78 months (NC78)** ⇔ **6.5 years: opportunity of 4 calvings (1st at 3 years)**

- **150 months (NC150)** ⇔ **12.5 years: opportunity of 10 calvings**

Models

- **Longevity** : culling risk $h(t)=ho(t)*exp(NC)$

Fixed effects   Random effects   Residual

$$NC = ageV1 + moisV1 + cn + jusexe + parace + partroup + parcamp + troupcamp + père + e$$

Fixed effects relatives
to 1st calving

Effects relatives
to the previous calving

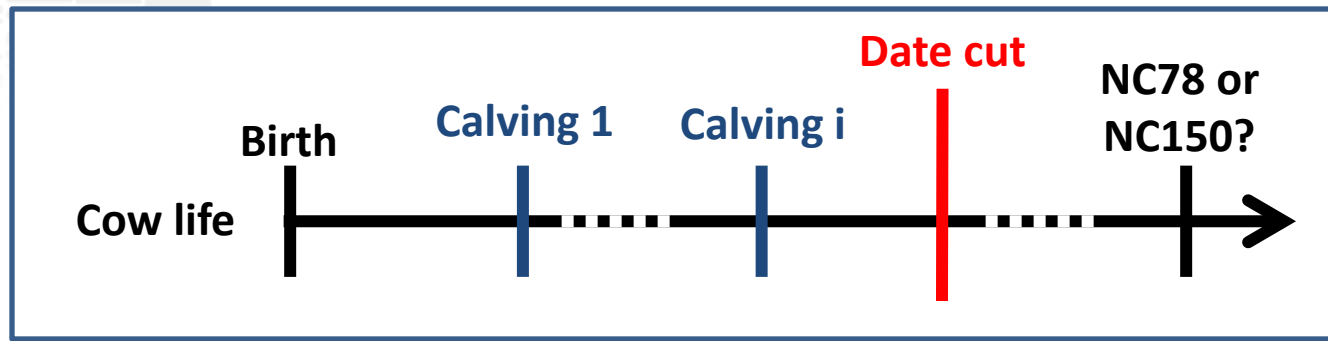Survival Kit (Ducrocq et al.)

- **Reproductive efficiency:**

$$\begin{matrix} NC78 \\ or \\ NC150 \end{matrix} = hyC1 + age\_C1 + \overline{Calving\_Ease} + animal + e$$

Fixed effects relatives to 1st calving and to calving
ease mean observed on the other calvings

Genekit (Ducrocq)

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Censoring and prediction

Censure Rate:

	at 78 months	at 150 months
Aubrac	**56 %**	**35 %**
Charolais	**26 %**	**19 %**

Prediction of the number of calving in case of censoring after calving i:

=> Brotherstone et al. (1997) method

based on survival probability and interval between calving i and calving i+1

obtained from the complete career dataset

Comparison between traits

Heritability

Correlations between Sire EBVs

	SURV	NC78	NC150
SURV	0.08	0.65	0.76
NC78		0.04	0.85
NC150			0.06

- **Heritabilities low for all traits (not directly comparable between SURV and NC)**

- **Correlations between SURV and NC sire EBV's are rather high**

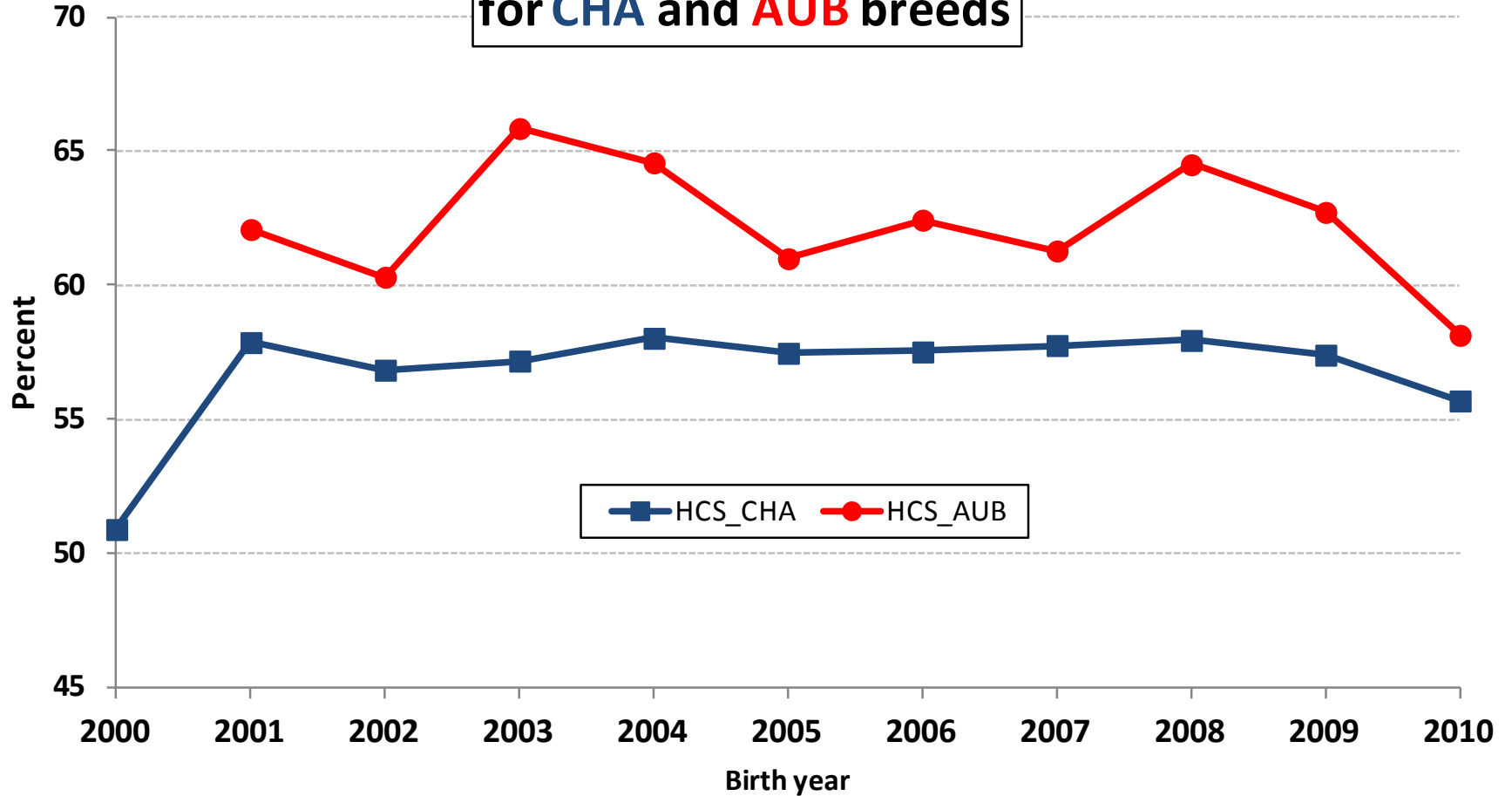- **Genetic correlation between NC78 and NC150 = 0.95**

+ **Practical point: easier to handle in the national genetic process (software, result explanation)**

Choice of NC78 analyzed with Linear model for national genetic evaluation
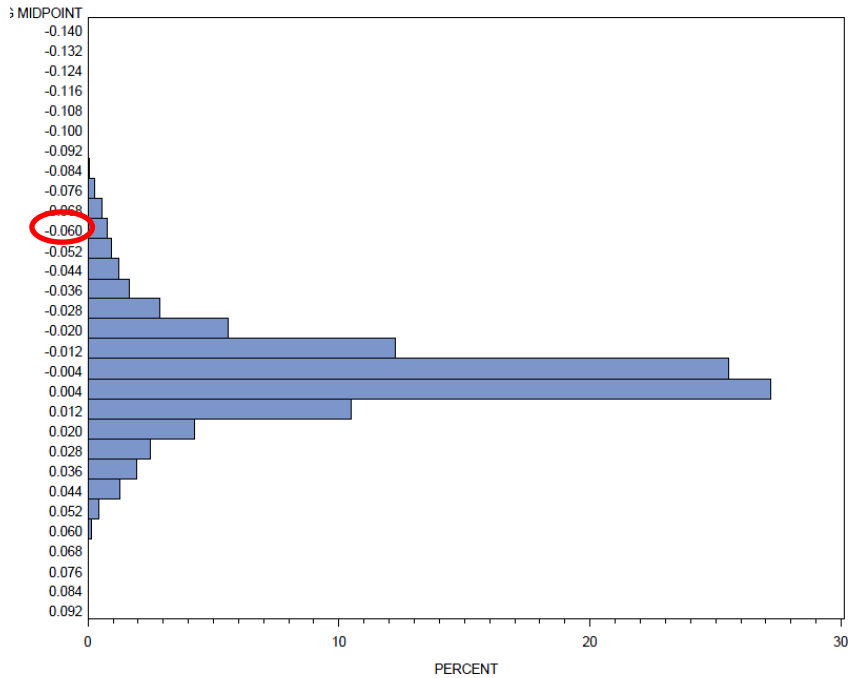
Practical results – Heifer Calving Success
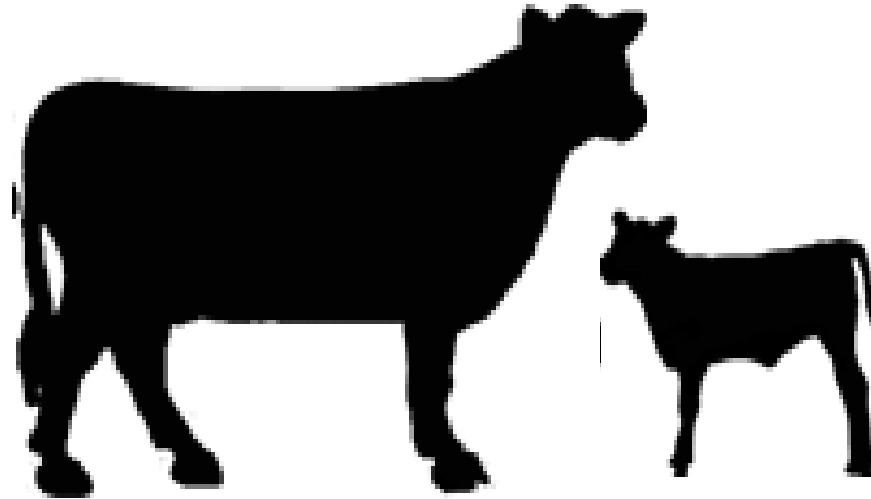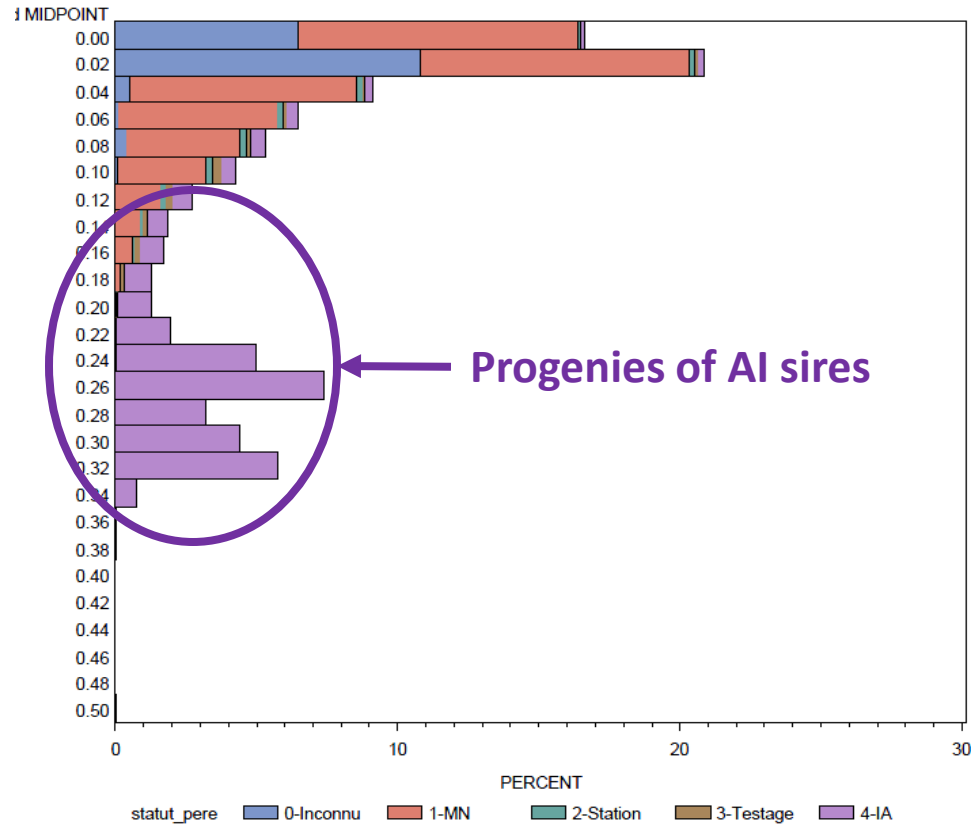
Heifer Calving Success for CHA and AUB breeds

EBV and REL – HCS - CHA

EBV distribution

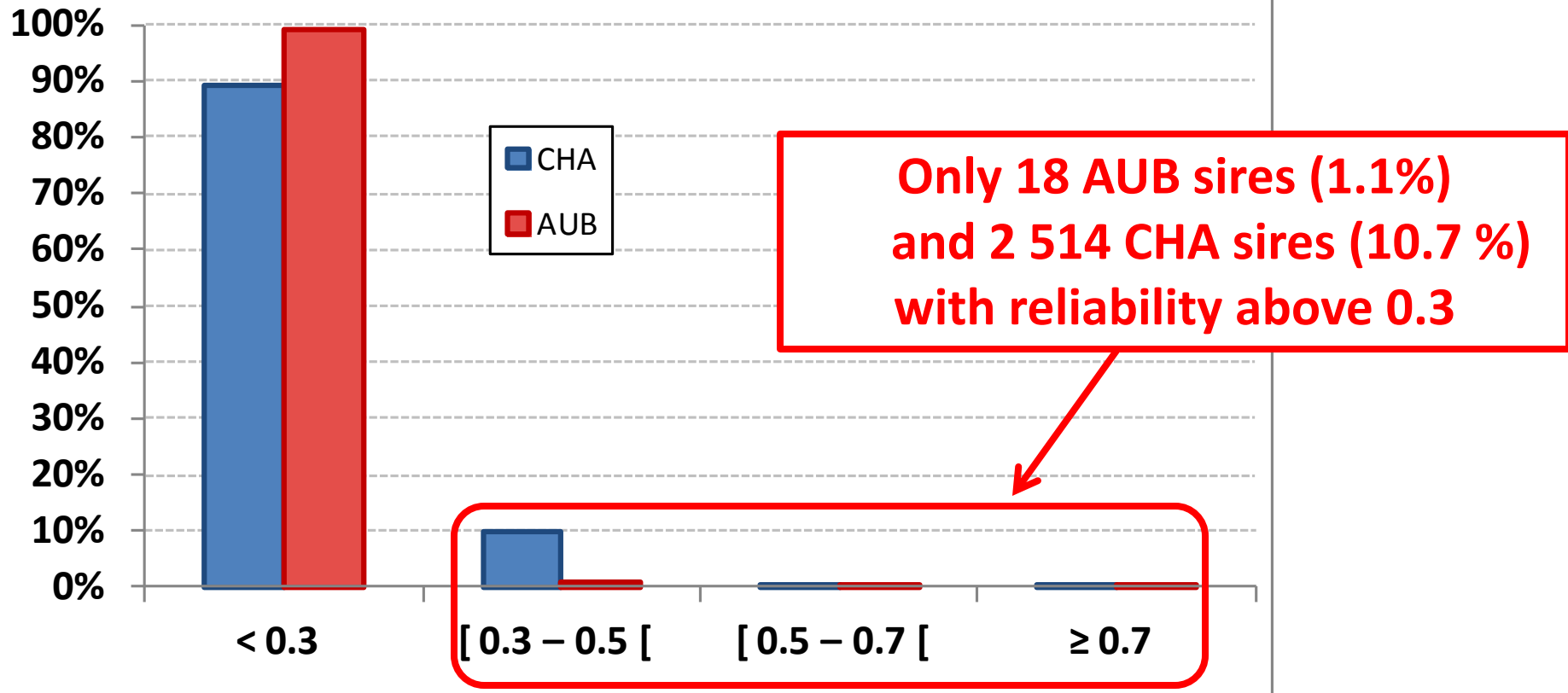**REL distribution**

Progenies of AI sires

statut_pere: 0-Inconnu, 1-MN, 2-Station, 3-Testage, 4-IA

=> same pattern for Aubrac with lower Reliabilities

HCS Sire reliability distribution
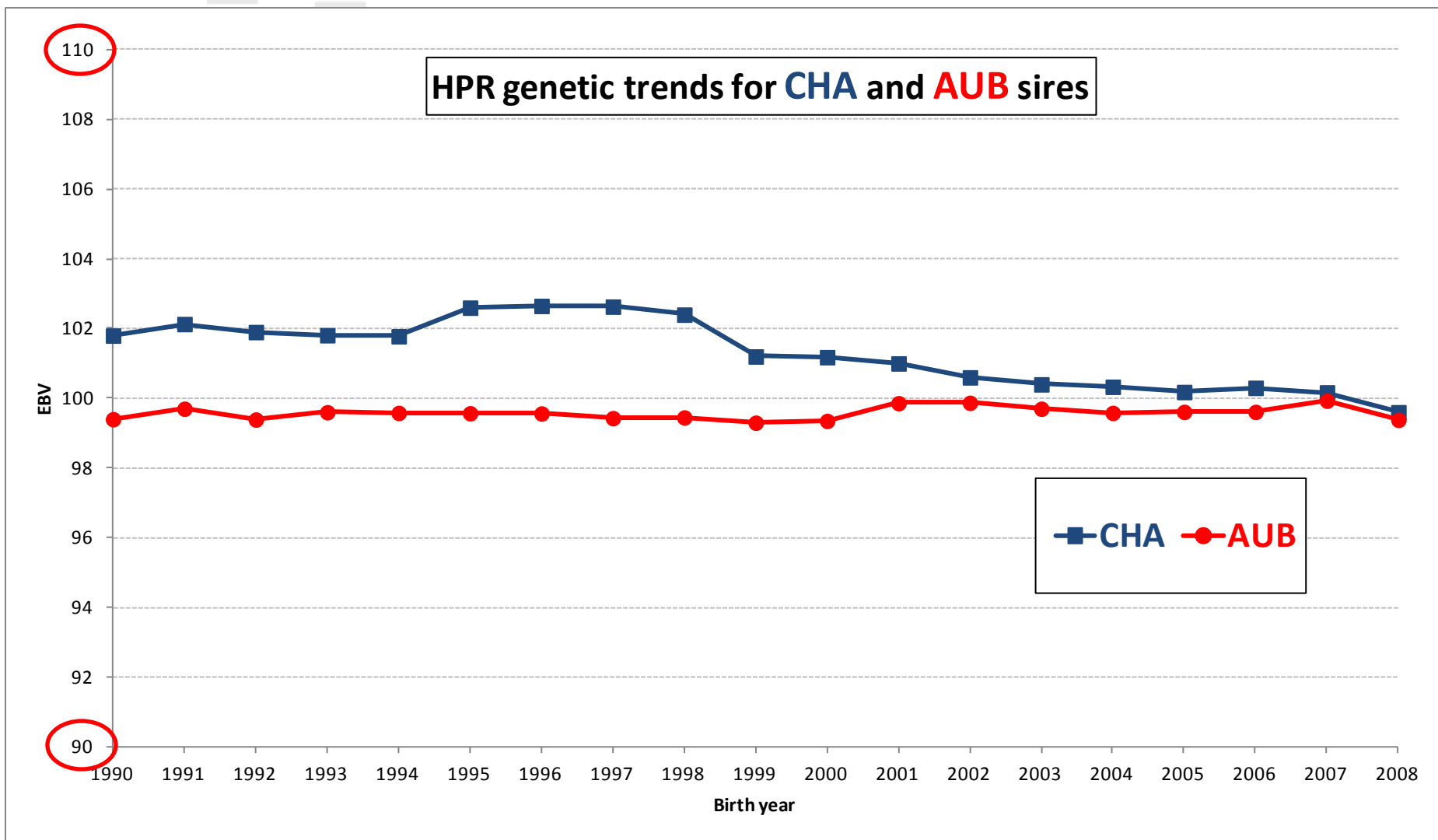
Only 18 AUB sires (1.1%) and 2 514 CHA sires (10.7 %) with reliability above 0.3

Legend: CHA, AUB

X-axis categories: < 0.3, [0.3 – 0.5 [, [0.5 – 0.7 [, ≥ 0.7

HPR genetic trends for CHA and AUB sires

(Standardized EBV: mean=100 and std = 10
Reference population: females born between 2001 and 2011 with perf)

Practical results – Productive Life
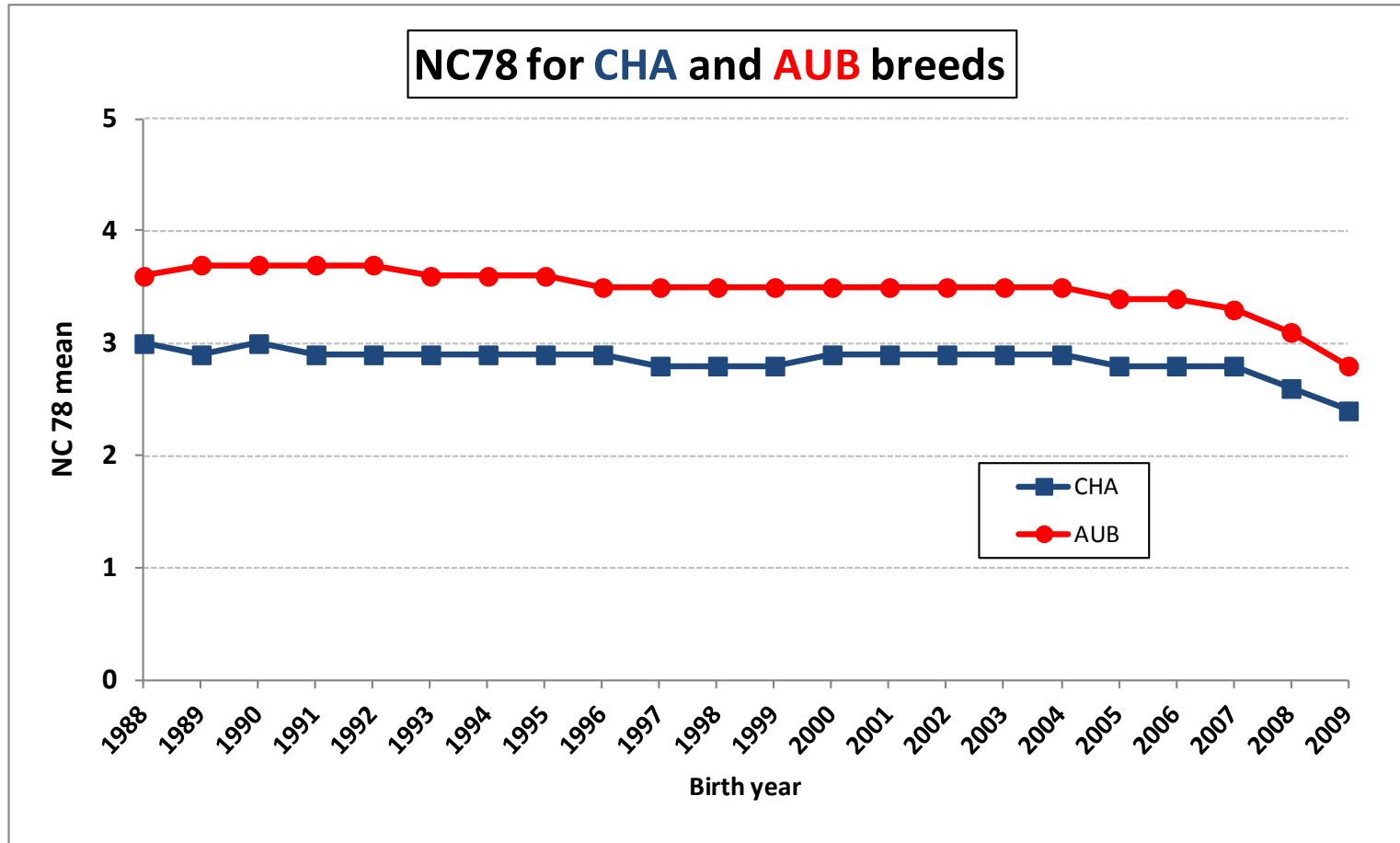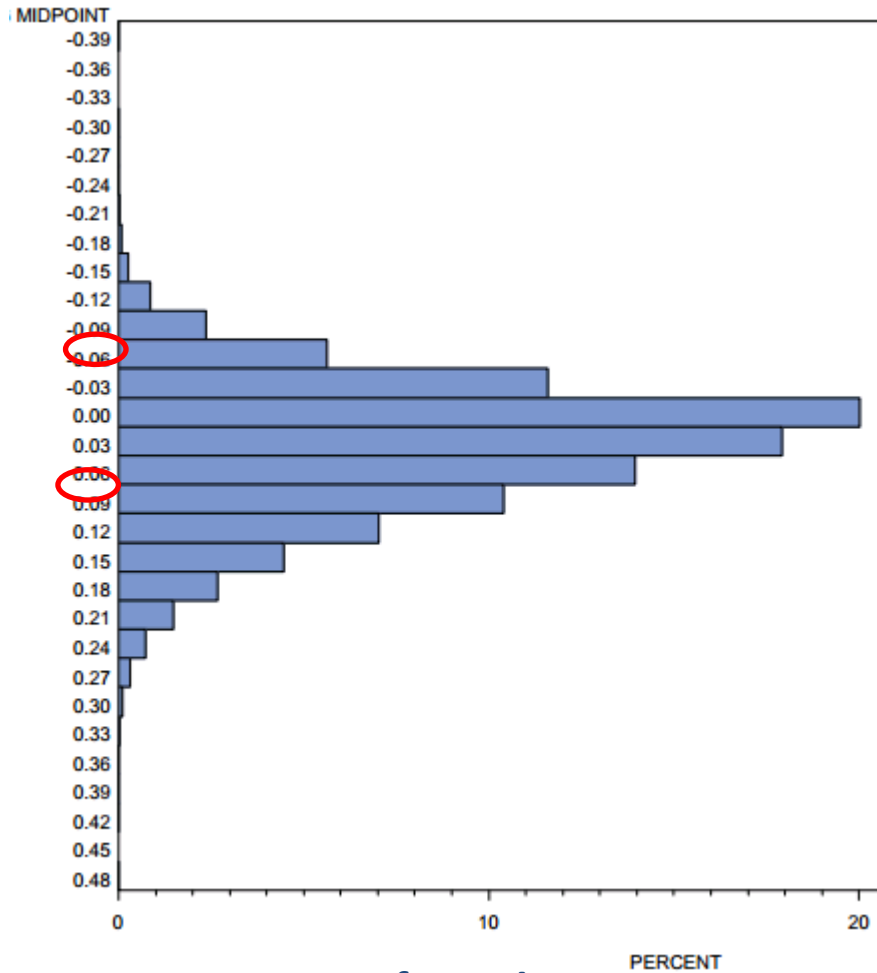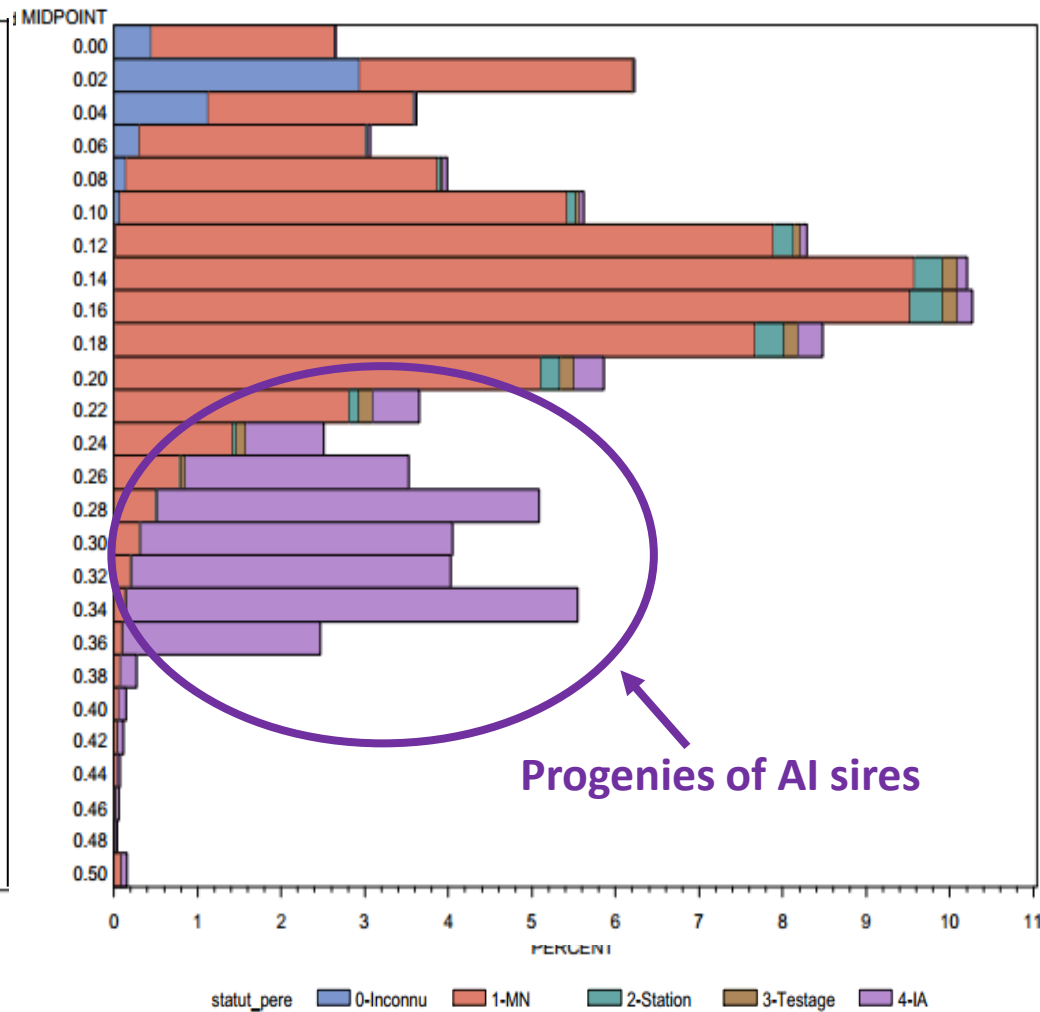
NC78

CHA	AUB
2.8 ± 1.2	3.4 ± 1.0

NC78 for CHA and AUB breeds

EBV and REL – NC78 - CHA

EBV distribution

REL distribution

=> **same pattern for Aubrac**

Progenies of AI sires

statut_pere   0-Inconnu   1-MN   2-Station   3-Testage   4-IA

NC78 Sire reliability distribution

Legend: CHA, AUB
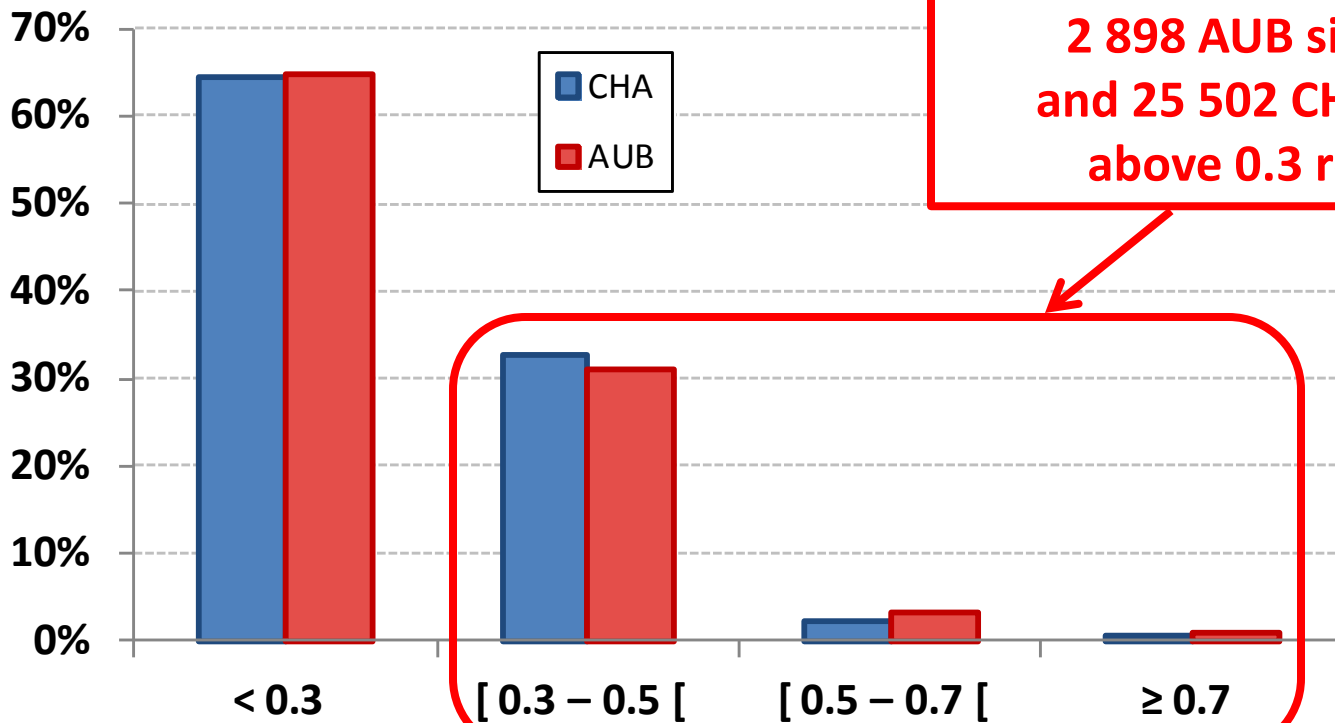
2 898 AUB sires (35%) and 25 502 CHA sires (36 %) above 0.3 reliability
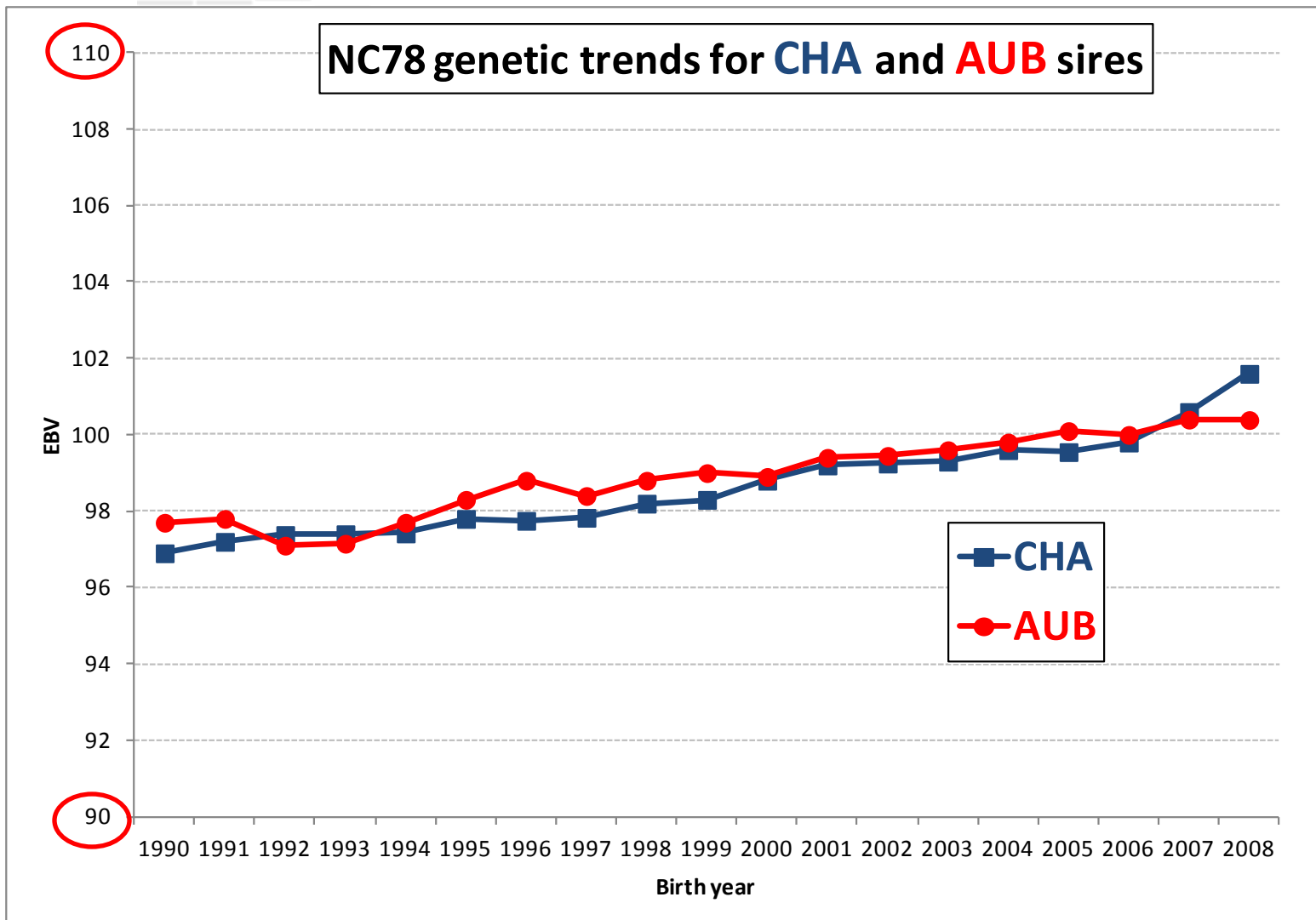
Categories: < 0.3, [0.3 – 0.5 [, [0.5 – 0.7 [, ≥ 0.7

(Standardized EBV: mean=100 and std = 10
Reference population: females born between 2001 and 2011)

Conclusions

- **Data now available in the national database to work on fertility and productive cow life**

- **Analysis of number of calves along cow career with survival analysis**

    or number of calves at a target age with linear model

    => good correlation   => Number of calvings at an "early stage" 78 months

- **Heritabilities are similar for all breeds (specialized / hardy breeds)**

- **Heritabilities are low: 0.015 for HCS and 0.04 for NC78**

- **EBV reliabilities are low**

    => results will be mainly used for <u>planned mating</u>

- **Discussion now with partners on publication rules**

    => genetic evaluation in practice at the end of this year

THANK YOU

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