



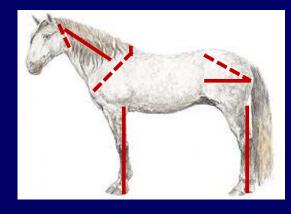


# Linear profiling in Lusitano horses: genetic parameters and plans for further development

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#### Lusitano Horse



- Main equine native breed from Portugal
  - Others are Sorraia, Garrano and Terceira poneys;
- One of world's oldest saddle horses!
- Considered in ancient times, by Greeks and Romans as the world's best saddle horse
- Considered hotblooded horse
- Selected by the gineta combat
- Versatile, docile, agile, courageous











#### Lusitano Horse



- Historically very particular conditions, favorable to horse breeding, in southwest Europe:
  - Last glaciation of Würm without full effect
  - Continued contact with man husbandry
- Historical records with thousands of years confirming the presence in the Iberian Peninsula of a fine horse, light, agile, hot-blooded
  - with continuity lines, with fine head, long, dry, slightly convex, ...
- Always indicated as fast ("son of the wind")
- Skilled for superior riding and masterly fighting in the gineta type combat.



#### Lusitano Horse



- Result of the selection of thousands years as an horse for fieldwork, hunting and fighting:
  - wars, cattle herding, fighting the gineta
- It is the archetype of the Baroque horse
  - very typical and harmonious model, endowed with extreme courage, but at the same time, docility and sociability
  - recognized long ago as one of the world's best saddle horses
- Combining good temper and mental with easy and light movements and ability to collect.

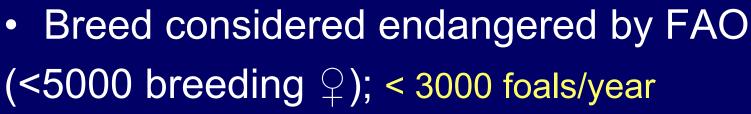


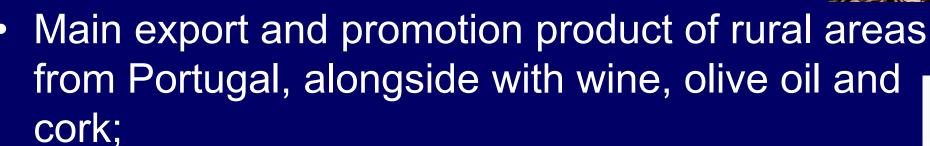
#### Distribution of the breed



- Around 4000-4500 breeding mares all over the world, distributed by (APSL, 2022):
  - Portugal (2000-2400)
  - Brazil (750-900)
  - France (350-450)
  - Spain (300-400)

















#### Lusitano world dissemination





 Known presence of the Lusitano horse in 63 countries, with different owners (data up to 2020).





#### Functional skills of the Lusitano



- Outstanding versatility:
  - Bullfighting
  - Dressage
  - Carriage
- Working Equitation
- Portuguese Equitation
- Showjumping
- Horse-ball
- Vaulting
- Eventing
- TREC
- Equestrian art
- Fieldwork
- Cinema
- Conformations comp.
- Beauty comp. ....































#### **Linear Profiling**



#### • Since 2017:

Implementation of Linear Profiling in the Lusitano

Conformation profiling 0-40 scale (5 points interval)

After several studies: recommendation to breeders association for more objective data

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#### Linear Profiling in the Lusitano



**Conformation profiling: LEGS** 



Gaits profiling: walk, trot, canter

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#### How it works in the Lusitano



- Collection of linear profiles since 2017:
  - With tablet directly to "R.campo" software from Ruralbit
  - Digital photo taken
  - When animals are being graded for Studbook approval
    - ✓ for males 3 judges in the grading and one for linear profiling. Mares only one judge
- Annual judges' meetings to homogenize scoring system
  - 23 judges worldwide (12 nat/11 int.)











### Lusitano Linear Profile Example



	Modelo							1	/alo	r					Defeito
	Estrutura			ligeira	0	5	10	15	20	25	30	35	40	pesada	
Aspecto Geral	Tipicidade			pouca	0	5	10	15	20	25	30	35	40	muita	
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	Boca			redonda	0	5	10	15	20	25	30	35	40	exageradamente em bico	
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Cohesa	Forma			triangular	0	5	10.	15	20	25	30	35	40	comprida	
Cabeça	Olho			rasgado	0	5	10	15	20	25	30	35	40	redondo	
	Orelha			curta	0	5	10	15		25	30	35	40	comprida	
	Expressão			apagada	0	5	10	15	20	25	30	35	40	viva	
	Ligação cabeça	pescoço		fina	0	5	10	15	20	25	30	35	40	espessa	
	Comprimento			curto	0	5	10	15	20	25	30	35	40	comprido	
December	Posição			horizontal	0	5	10	15	20	25	30	35	40	vertical	-Golpe de machad
Pescoço	Adiposidade			pouca	0	5	10	15	20	25	30	35	40	muita	-"Gato"
	Bordo ventral		cóncayo	0	5	10	15	200	25	30	35	40	invertido		
	Comprimento			curto	0	5	10	15	20	25	30	35	40	comprido	
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Dorso	Linha do dorso			selada	0	5	10	15	20	25	30	35	40	encarpada	
	Comprimento			curto	0	5	10	15	20	25	30	35	40	comprido	-Sacro atrasado
	Orientação			ascendente	0	5	10	15	20	25	30	35	40	mergulhante	
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	Orientação do c	oxal		horizontal	0	5	10	15	20	25	30	35	40	vertical	-Horizontal -Inserção da caud
	Orientação do s	acro		horizontal	a	5	10	15	20	25	30	35	40	vertical	-Horizontal -Saliência sacro-ilia
	Comprimento			curta	0	5	10	15	20	25	30	35	40	comprida	-Desproporcionad
Garupa	Largura			estreita	0	5	10	15	20	25	30	35	40	larga	-"De vaca" -Estreita piramida
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	Muscularidade			fraça	0	5	10	15	20	25	30	35	40	forte	-Sem calção

	***	0							60					
	Modelo	1						/alo	r					Defeito
		Comprimento	curtos	0	5	10	15	20	25	30	35	40	compridos	Deproporcionados
		Canela	curta	0	5	10	15	20	23	20	35	40	comprida	
		Quartela	curta	0	5	10	15	20	25	30	39	40	comprida	
	Anteriores		vertical	0	5	10	15	SC	25	30	35	40	horizontal	
		Defeitos do aprumo late	ral		curve	irvo		nscu	OV	es	taca	ia	Nota:	
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		Defeitos no aprumo vist	o de frente	joel	ho de	o de boi.		esquerdo		car	aver	ho	Nota:	5
		Comprimento	curtos	0	5	10	15	20	29	30	39	40	compridos	-Deproporcionados
Membros		Canela	curta	D	5	10	15	20	25	30	35	40	comprida	
Membros		Quartela	curta	0	5	10	15	20	20	20	30	40	comprida	
	Posteriores	Guarieia	vertical	0	5	10	15	20	25	30	35	40	horizontal	
		Defeite		acurvilhad		ado	desal			xo Pa	taf.		Nota:	
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	0.00 to No.000 to	Definição das articulações	finas	0	5	10	15	20	25	30	35	40	espessas	-Estrangulamentos
	Genérico	Amplitude dos cascos	estreitos	0	5	10	15	80	25	30	35	40	largos	-Assimetrias
		Comprimento dos talões	curtos	0	5	10	15	20	25	30	39	40	compridos	-Assimetrias
	Andament						1	/alo	r					Defeito
	Amplitude		curto	0	5	10	15	20	25	30	30	40	largo	
	Соттеçãо		desvia p/ dentro	Ů.	5	10	15	20	25	30	35	40	desvia p/ fora	
Passo	Regularidade		pouco	0	5	10	15	20	25	30	39	40	muito	
	Definição dos	quatro tempos	lento	O	5	10	15	20	25	30	35	40	precipitado	
	Entrada dos po	osteriores	pauco	D	5	10	15	20	25	30	35	40	muito	
	Amplitude		curto	0	5	10	15	20	25	30	39	40	largo	-lrregularidade
	Impulsão		fraca	o	5	10	15	20	25	70	35	40	poderosa	entra-securitations
	Regularidade		pouco	0	5	10	15	20	29	30	39	40	muito	
	Eslasticidade e	suspensão	Dácido	O	5	10	15	20	25	30	35	40	com tonus	
Trote	Elevação dos a	interiores	raste;ro	0	5	10	15	20	25	20	35	40	com "joelho"	
	Direção dos ar		tapa-se	0	5	10	15	20	25	30	39	40	ceifa	
	Liberdade de e	espāduas	tensas	0	5	10	15	20	25	30	39	40	livres	
		istrada dos posteriores		0	5	10	15	20	25	30	35	40	muito	-Pernas fora da massa
	Amplitude		pauco	0	5	10	15	20	25	30)	35	40	largo	-Irregularidade
	Posição e susp	oensão	em espáduas	0	g	10	15	20	29	30	39	40	para cima	processor and control of the
			pouco	O.	5	10	15	20	25	30	35	40	muito	
Galope	Regularidade													
Galope	Regularidade Transicões (ala	argar-encurtar)	fraças	0	5	10	15	20	25	Sn	35	40	poderosas	





#### M&M – Linear Profiling analysis



#### **Analysis model studied for the Lusitano**



#### **BLUP – Animal Model (REML)**

**Trait** 

Fixed effects –
Genetic effect

**Error** 

Age (linear & quadratic)
Inbreeding (linear)
Year of evaluation
Gender/Presentation type



Mixed Model with single records

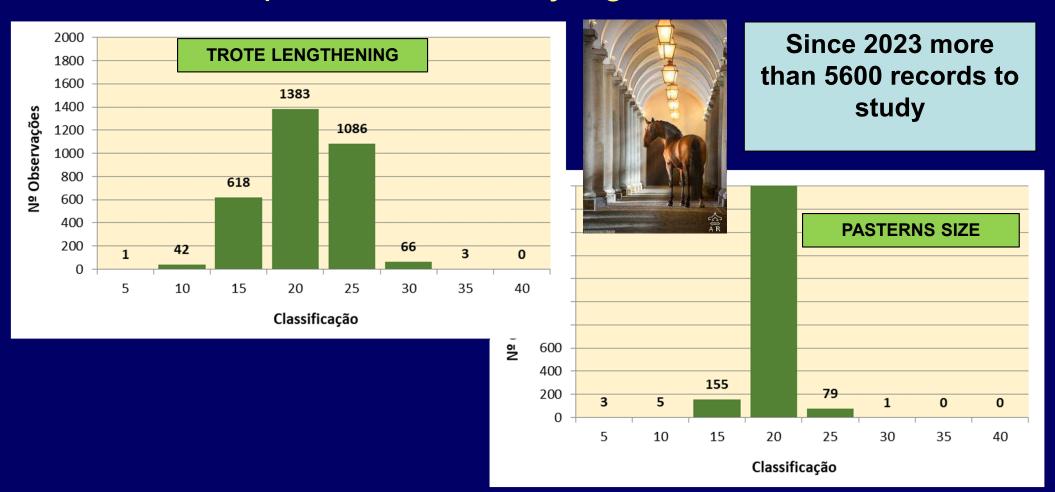




#### First results for the Lusitano



- 3200 evaluated animals 2017 to 2021
  - 63 traits (0 a 40 pts; inter. 5pts) (in 2023 >5600 animals)
  - 23 descriptive defects; 63 judge's combinations

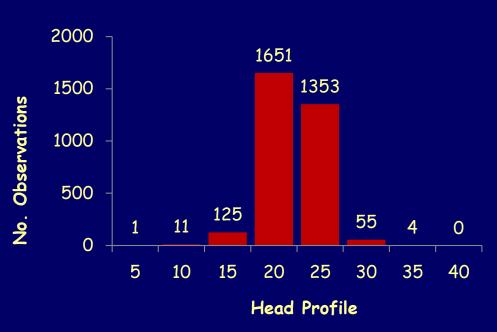


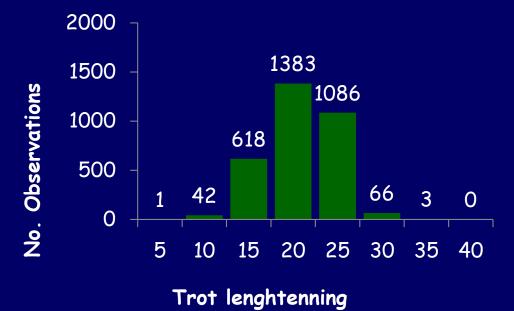




#### **Examples of distribution of some traits**







Source: M. Mateus, 2022





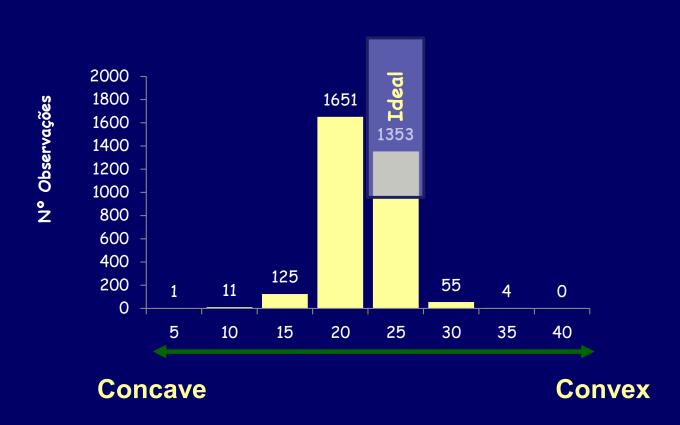
7th IWSLP GER - March 2023, A. Vicente et al



#### **Optimum score?**



## Not all traits have the ideal score of 20 pts, there are some traits where the ideal tends to one of the extremes...





Distribution
of the score
of the
characteristic
"Head
Profile"

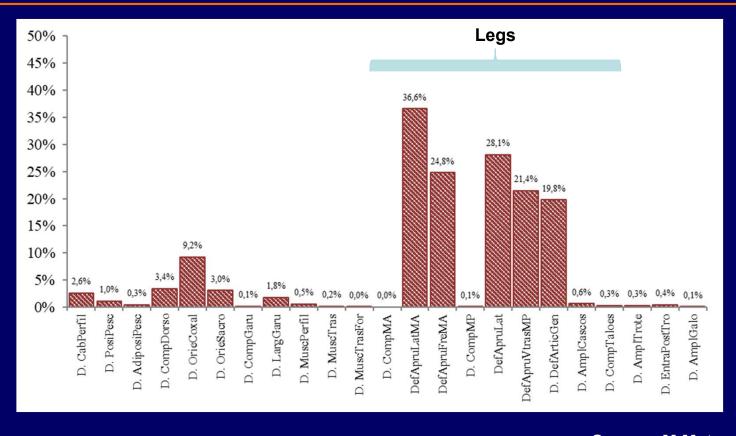
Source: M.Mateus, 2022





#### Incidence defects in the pop evaluated





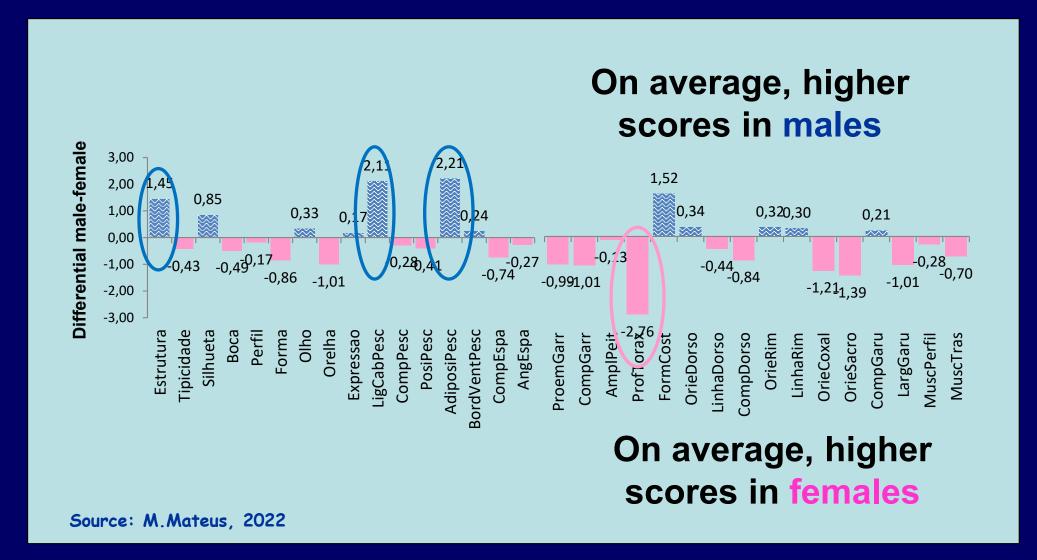
Source: M.Mateus, 2022

- Hip orientation angle defect: 9.2%
- In the limbs, the defects of the leg stances: 21.4% to 36.6% of the animals
- Defect of limb joints (strangulations): 19.8%



## Gender Effect (males vs females)



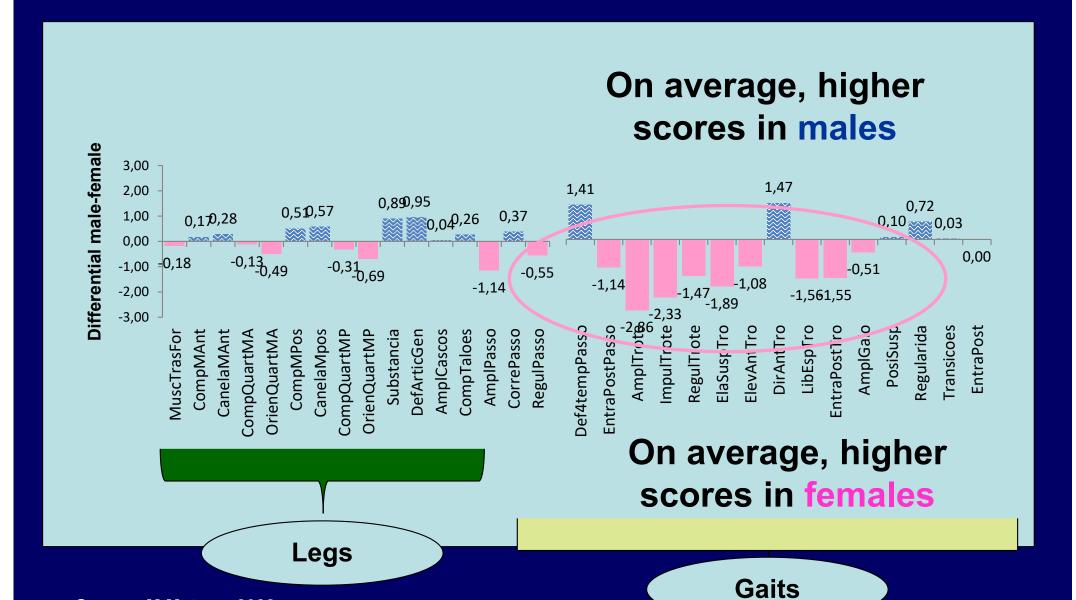




Source: M.Mateus, 2022

#### Gender Effect (males vs females)





7th IWSLP GER – March 2023, A.Vicente et al



#### **Average Heritabilities (h²)**



- Linear traits studied have a low to moderate heritability.
- There are characteristics with moderate higher heritabilities (0.301-0.453), as is the case of characters associated with gaits.
- There are also traits associated with conformation with moderate heritabilities.
- Very low heritabilities for linear features related to conformation, namely in the limbs.

Trait		n	Average (h²)	min-má× (h²)
Model				
Type		3	0,275	0,086 - <b>0,399</b>
Head		7	0,248	0,095 - <b>0,393</b>
Neck		4	0,225	0,156 - 0,301
Shoulder		2	0,249	0,201 - 0,297
Withers		2	0,265	0,253 - 0,277
Chest		1	0,235	0,235
Ribcage		2	0,168	0,111 - 0,224
Back		3	0,129	0,101 - 0,147
Loin		2	0,119	0,113 - 0,124
Croup		7	0,192	0,096 - 0,310
	Front	4	0,110	0,009 - 0,195
Legs	Hind	4	0,095	0,000 - 0,189
	Generic	4	0,155	0,105 - 0,174
Gaits				
Walk		5	0,182	0,057 - 0,272
Trot		8	0,355	0,181 - <b>0,453</b>
Canter		5	0,302	0,253 - <b>0,343</b>

Source: M. Mateus, 2022 7th IWSLP GER - March 2023, A. Vicente et al



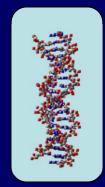


## Classical gradings h<sup>2</sup> & $\sigma_A$



TRAIT		h <sup>2</sup> ±SE	<b>σ</b> <sub>A</sub>
Height Withers		0.61±0.015	2.98 cms
Total Score	Coef.	0.18±0.015	1.78 pts
Head and Neck	1	0.18±0.015	0.32 pts
Shoulder & Withers	1	0.13±0.014	0.22 pts
Chest & Ribcage	1	0.12±0.014	<u>0.21 pts</u>
Back & Loins	1.5	0.15±0.015	0.40 pts
Croup	1	0.14±0.014	0.26 pts
Legs	1.5	<u>0.07±0.012</u>	0.24 pts
Overall Impression	1.5	0.14±0.014	0.36 pts
Gaits	1.5	0.16±0.015	0.42 pts









### Lusitano selection strategy



- Routine genetic evaluation (2022) for:
  - Morphology and gaits scores from breeders' approval grid
  - Linear Evaluation for chosen traits
- Sporadic genetic evaluation:
  - Functionality in Dressage, Working Equitation and Model and Movements competitions
- Missing: genomics and phenomics





#### Plans for the future



- Selection and genetic improvement in horses with greater complexity
  - Need to collect more objective data!
- Breeders' guidance with selective matings
  - Using information from linear profiling
- Refine models of analysis in use
  - Alternatives?
- Estimation of genetic correlations
  - Between linear data and results from breeders gradings and functional traits (Dressage, Working Equitation)





#### References



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## Lusitano Linear Profiling









#### 7<sup>th</sup> International Workshop on Linear Profiling in the Warmblood Horse on 29<sup>th</sup> - 30<sup>th</sup> March 2023 in Grebin / Plön, Germany

with focus on practical linear description of gaits in horses of different age and on technologies which could supplement linear profiling applications for sport horses

#### - FINAL PROGRAM -

(theoretical part at Festscheune Rixdorf close to Plön, practical part at Gut Schönweide, Grebin)

- 10:00 10:30 Registration; coffee and refreshments at Festscheune Rixdorf
- 10:30 10:45 Welcome and introduction to the 7<sup>h</sup> International Workshop on Linear Profiling in the Warmblood Horse (IWSLP)
- 10:45 12:00 Theory session I: presentations preparing for the practical part ('warm-up')
- 10:45 11:05 K. F. Stock (Germany) / EAAP HC, WBFSH:

Lessons learned from working with linear data

- how to let the equine community benefit from collaborative initiatives
- 11:10 11:30 A. Gmel (Switzerland) and M. Ablondi (Italy):

Using sensor technology to quantify gait quality

- what to consider and how to organize measurements in the field
- 11:35 11:55 *I. Workel and P. Eitenmüller (Germany):*

Linear description in the Oldenburg studbooks

- overview and introduction of the routine collection of linear data
- 12:00 13:00 Lunch at Festscheune Rixdorf
- 13:30 18:00 **Practical exercises on linear description**, supplemented by practical demonstration of sensor technology for gait analysis in horses, at Gut Schönweide, Grebin, followed by a guided stud tour
- 13:30 15:45 Practical exercises part I (linear description / 4 groups)
- 15:45 16:15 Coffee break
- 16:15 17:15 Practical exercises part II (sensor technology / 2 systems)
- 17:15 18:00 Guided stud tour
- 18:00 19:00 Time to check in at accommodation
  - 19:30 Conference dinner (optional) at restaurant 'Prinzenhuus' in Plön

#### Thursday 30<sup>th</sup> March 2023 (Festscheune Rixdorf close to Plön)

- 08:30 09:45 Theory session II: linear description in sport horse breeding
- 08:30 08:50 *L. Chapard, I. Meurrens, N. Buys, <u>S. Janssens</u> (Belgium):

  Early life jumping traits and their genetic correlations with later success in competitions in Belgian Warmblood horses*
- 08:55 09:15 *S. Bonow, S. Eriksson, E. Strandberg, E. Thorén Hellsten, <u>Å. Gelinder Viklund</u> (Sweden):

  Linearly scored traits associated with sport performance in Swedish warmblood horses*
- 09:20 09:40 <u>K. F. Stock</u>, M. Wobbe, H. Alkhoder, I. Workel, A. Hahn, W. Schulze-Schleppinghoff (Germany): Genetic and genomic correlation analyses of linear traits and their implications for targeted support of sport horse breeding





09:45 - 10:00 Cd	ffee and	l refreshment	t
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- 10:00 11:35 Theory session III: developments in using linear data and more in horse breeding and population management
- 10:00 10:20 <u>A. Vicente</u>, M. Mateus, J. Ralão-Duarte, N. Carolino (Portugal):
  Linear profiling in Lusitano horses: genetic parameters and plans for further development
- 10:25 10:45 *V. Asti, <u>M. Ablondi</u> (Italy):* Objective movement assessment in horses: first results from using sensor technology in Italian horses
- 10:50 11:10 <u>A. Gmel</u> et al. (Switzerland): Shape and gaits 2.0: four seasons of objectively measuring young Swiss horses in the field
- 11:15 11:35 A. Ricard, P. Pourcelot, <u>B. Dumont Saint Priest</u>, N. Crevier-Denoix, S. Danvy (France):

  Use of automatically collected data on horses in France: 3D morphology breeding values of stallions
- 11:40 11:45 Short break
- 11:45 12:45 Summary and wrap-up: considerations for the future
- 11:45 11:55 <u>W. Conlon</u> (Ireland), I. Madsen (Denmark) / IYB: Linear description in education and training – potential and challenges
- 12:00 12:15 *K. F. Stock (Germany) / EAAP HC, WBFSH:*Summary of the practical exercises and key points from the presentations
- 12:15 12:45 *all speakers and audience:*General discussion; further plans for the IWSLP event series and activities around linear profiling
- 12:45 13:45 Lunch

#### How to get to the workshop venue?

The 7<sup>th</sup> IWSLP is held at **Festscheune Rixdorf** (Gut Rixdorf; <a href="http://www.festscheune-rixdorf.de/">http://www.festscheune-rixdorf.de/</a>). From Plön city centre it takes about 10 minutes by car to get there. The larger number of workshop participants travelling by their own cars or having rental cars should allow that those without cars can be picked up. Coordination of transfers (airport to Plön, Plön to conference venue and stud) is ongoing.

Street address: Alte Schmiede Rixdorf, 24306 Rixdorf

The practical part is organized at the nearby stud **Gut Schönweide** (<a href="https://www.schoenweide.de">https://www.schoenweide.de</a>), and we are very grateful that we will be welcomed in these beautiful surroundings. From the venue, it is approximately 10 km by car, and again, nobody needs to be worried about how to get there. We will be enough people with cars, implying that there will be someone who can give you a ride.

Street address: Gut Schönweide, 24329 Grebin

The conference diner (optional) will give the opportunity to continue the talks in relaxed atmosphere. It will be at the restaurant 'Prinzenhuus' in Plön. Please be prepared to pay by your own; diner is not included in the conference fee. Street address: Markt 14, 24306 Plön

#### Conference fee

Invoices have been issued using the billing address entered in the registration form. Payment is possible either cash (not by card!) at the registration desk on 29 March 2023 or online via Paypal (to: iwslp.eaaphc@email.de; indication of event title 'IWSLP2023' plus first name and surname of the registrant or of all registrants paid for). Receipts will be sent by e-mail and handed over on-site.

If you have any questions concerning the workshop, please do not hesitate to contact the organization team of the 7<sup>th</sup> IWSLP, reached through the representative of the EAAP Horse Commission, Kathrin F. Stock (E-mail: <a href="mailto:friederike.katharina.stock@vit.de">friederike.katharina.stock@vit.de</a>; phone: +49 4231 955623).