Classification of boar carcasses with a Mass Spectrometry based EN

S. Ampuero, G. Bee, Uppsala June 2005

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EN specifications

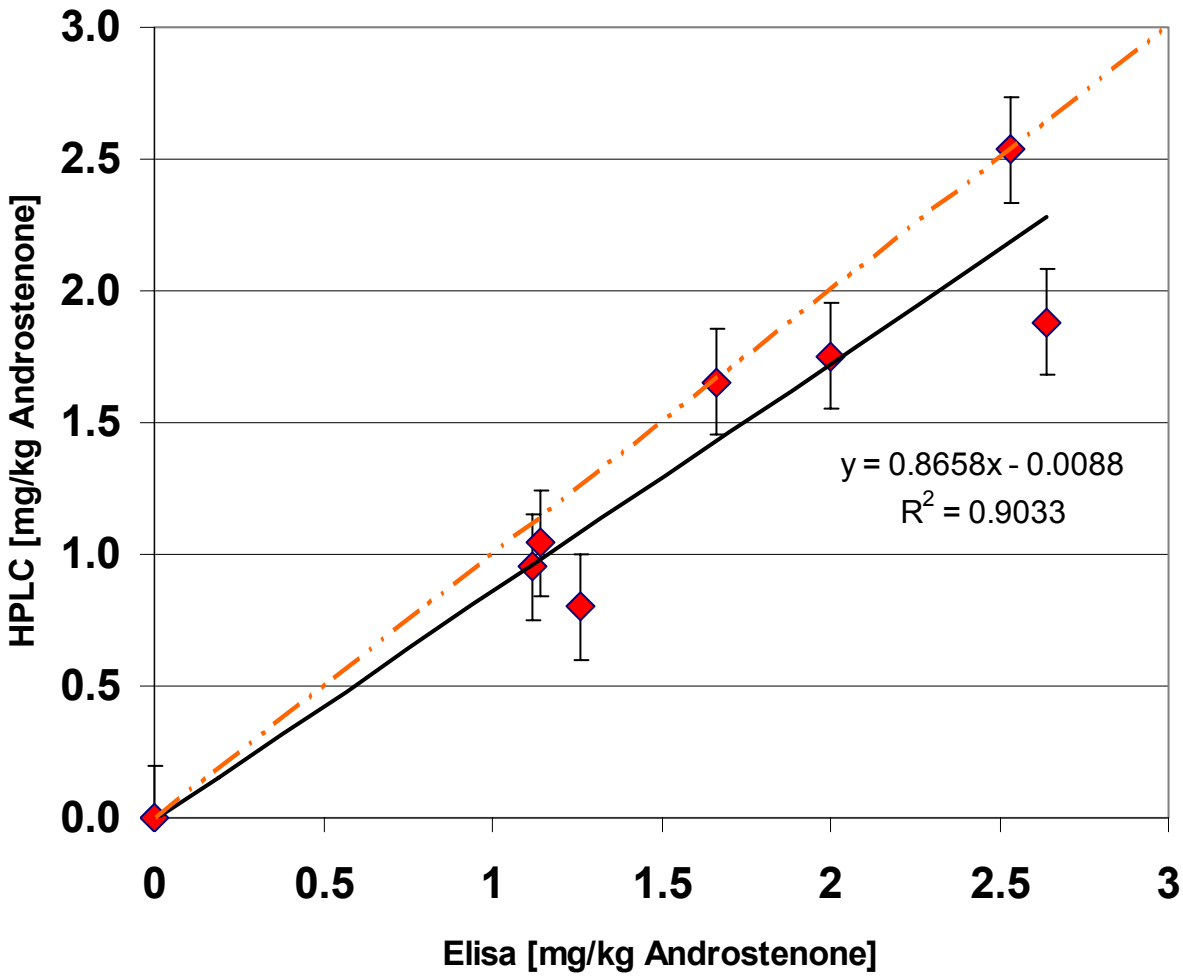
- Global analysis: Androstenone, Skatol, Indole,...
- Model corresponding to human classification
- Limit of detection, ppm A: 0.5? 1? 0.3?; ppm S: 0.1? 0.2?
- Sensitivity: doubtful samples
- Speed of analysis: 3500 pigs/day 1750 u/day = 3 u/min
- Costs

Definition of boar taint

Model sample groups

- Veterinarian discrimination (olfaction of cooked salivary glands, muscular, adipose tissu)
- Concentration of androstenone, skatol, indol or models (HPLC Elisa, GC,...)
- Sensory panel analysis (olfaction of heated backfat)
- Consumers test on meat (cooking odour and flavour)

HPLC vs ELISA



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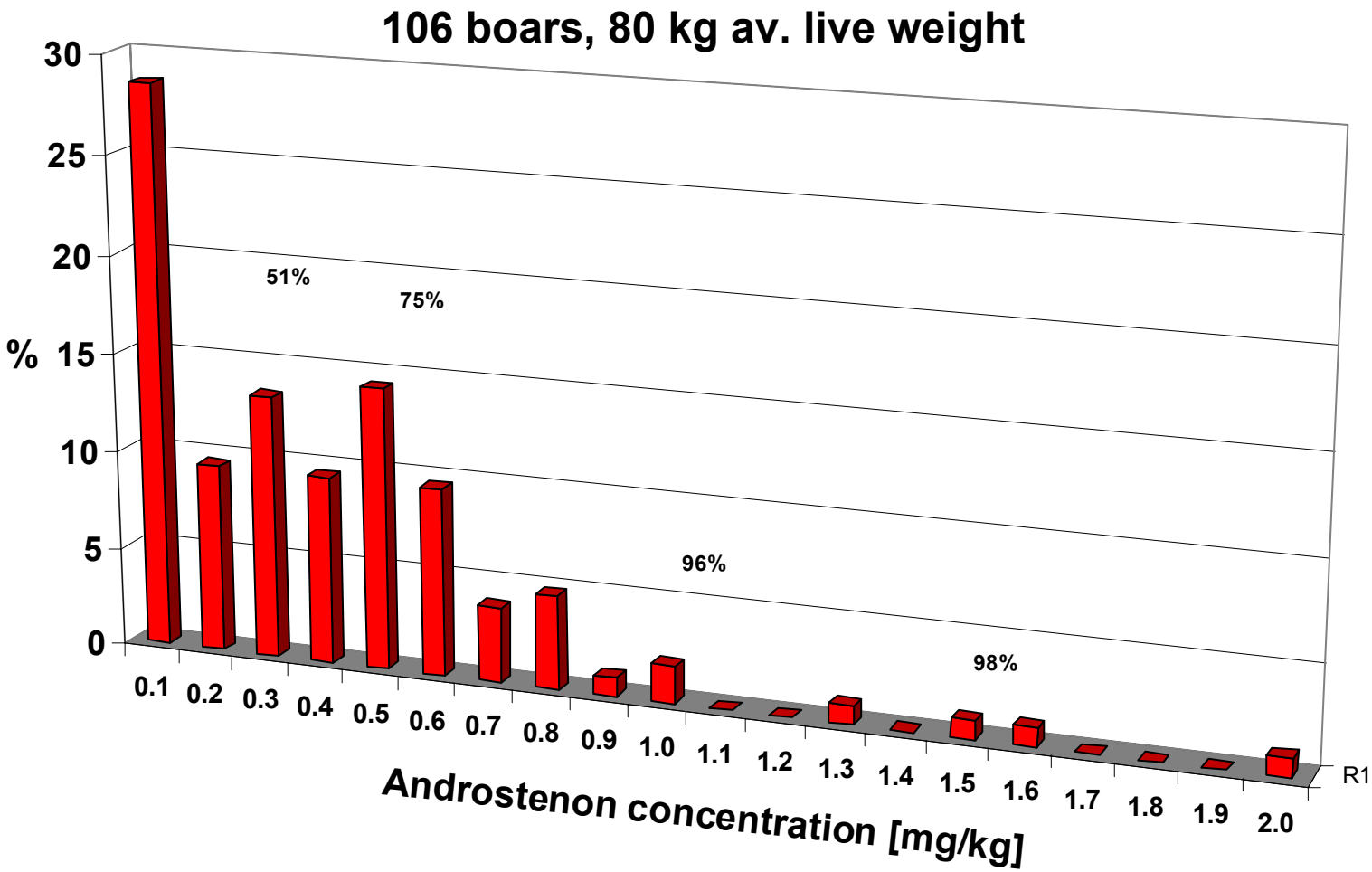
A Swiss case

Androstenone distribution



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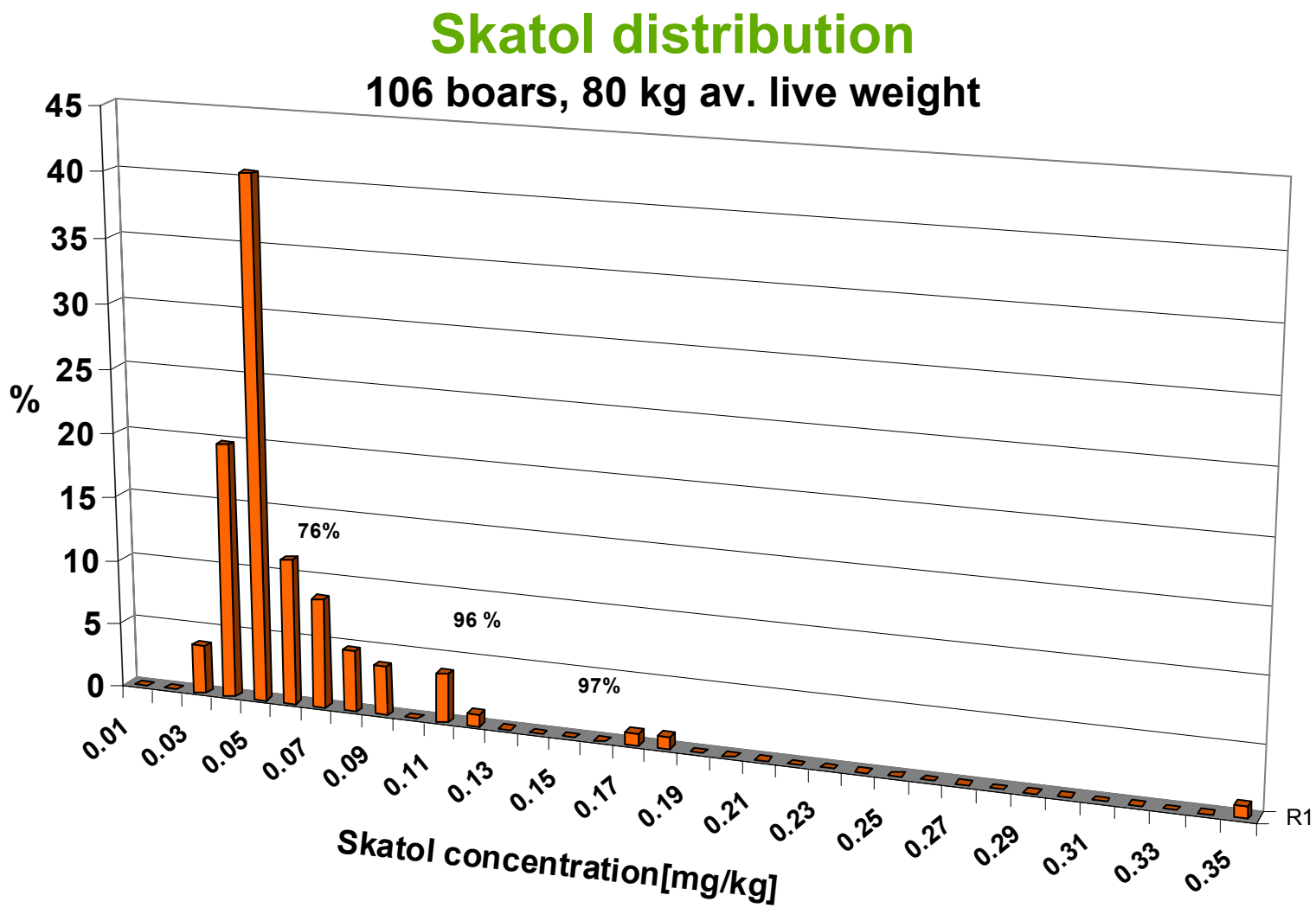

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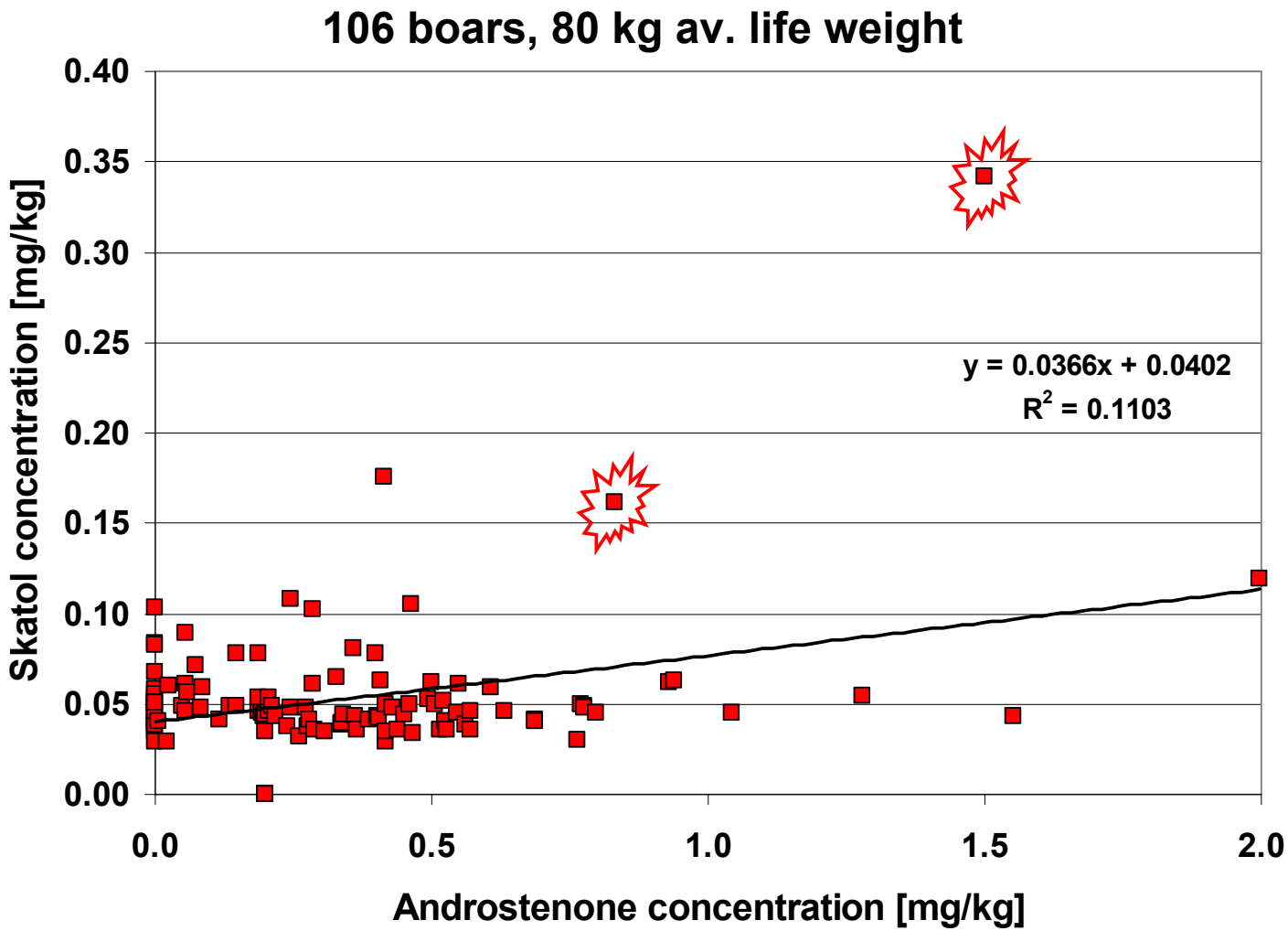
Skatol vs Androstenone



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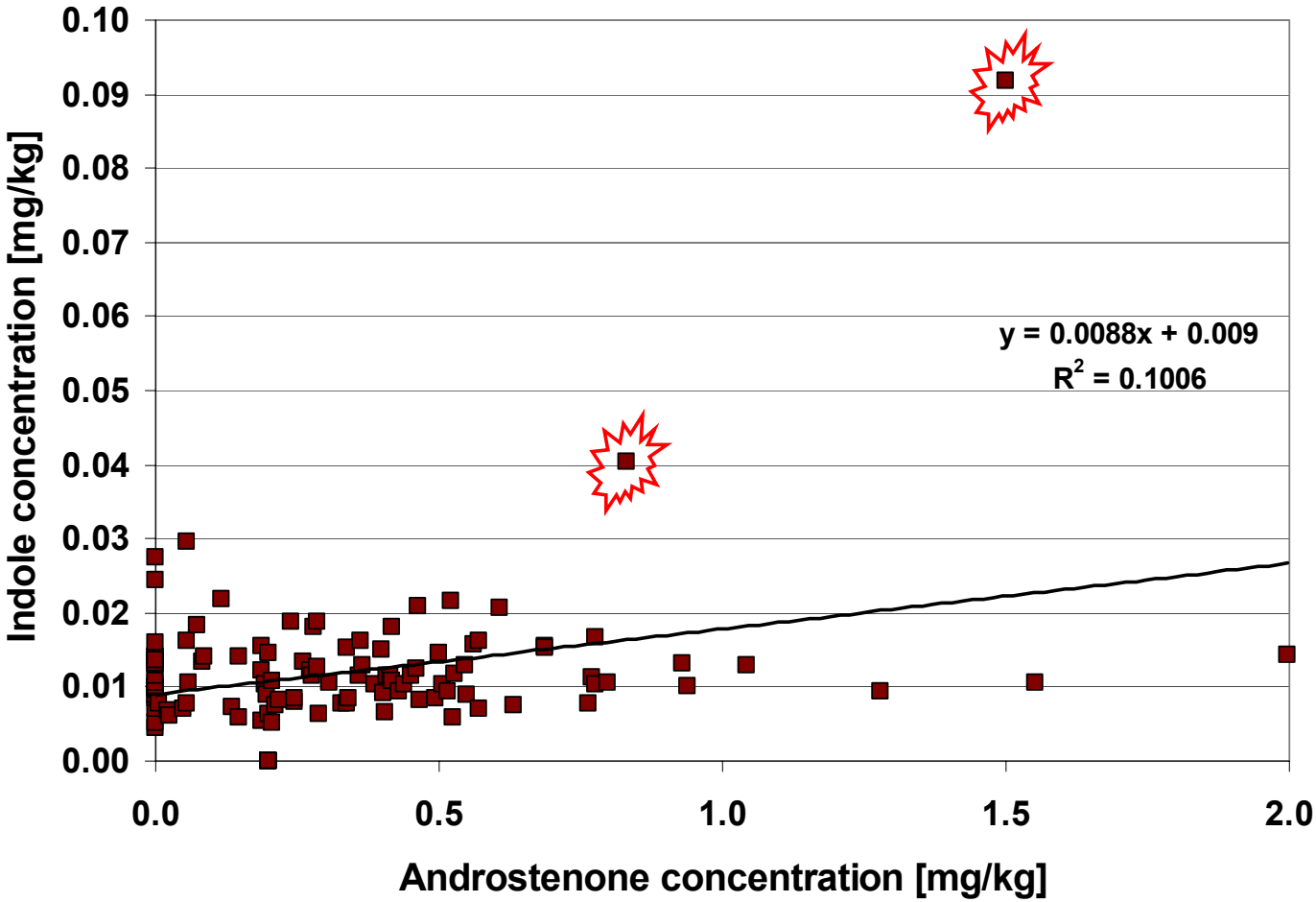
Indole vs Androstenone

106 boars, 80 kg av. life weight



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Indole vs Skatol

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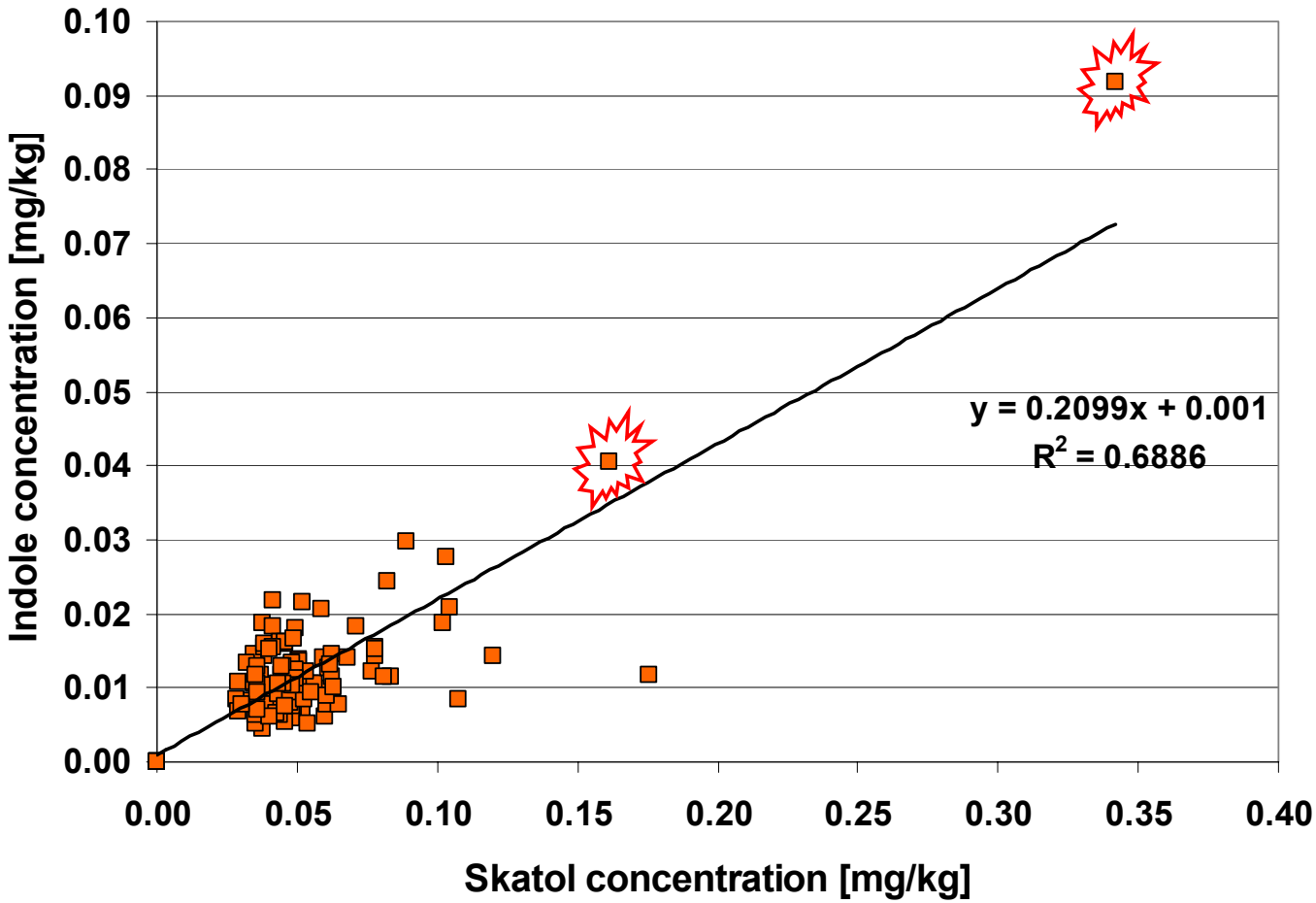

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Olfaction of Fat Samples

Samples		Panel	Detection range
29	Positif boars	29	
6	Negatif boars	⇩	
3	Castrates	**8**	

Androstenone:	0,1	0,2	**0,3**	0,4	ppm
Skatol:	0,02	0,03	0,04		ppm

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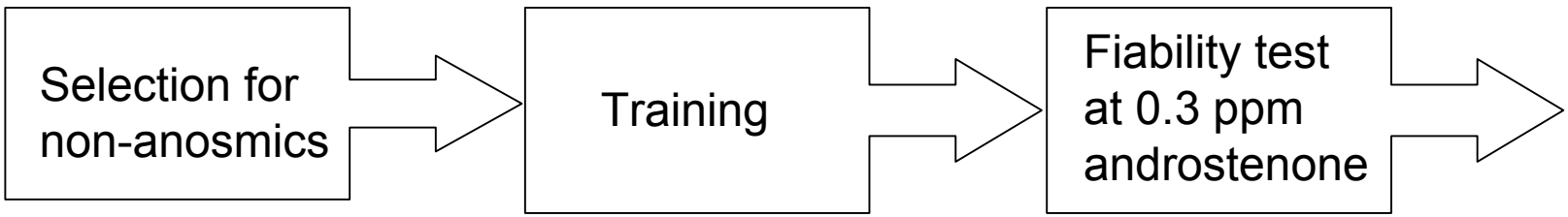
Sensory panel

Olfaction of Fat Samples, training



Pur compounds

Test: 3AFCD

Test: 5 pairs of samples
(1 castrate – 1 sample)
OK = 4 of 5 correct pairs

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Olfaction of Fat Samples, testing

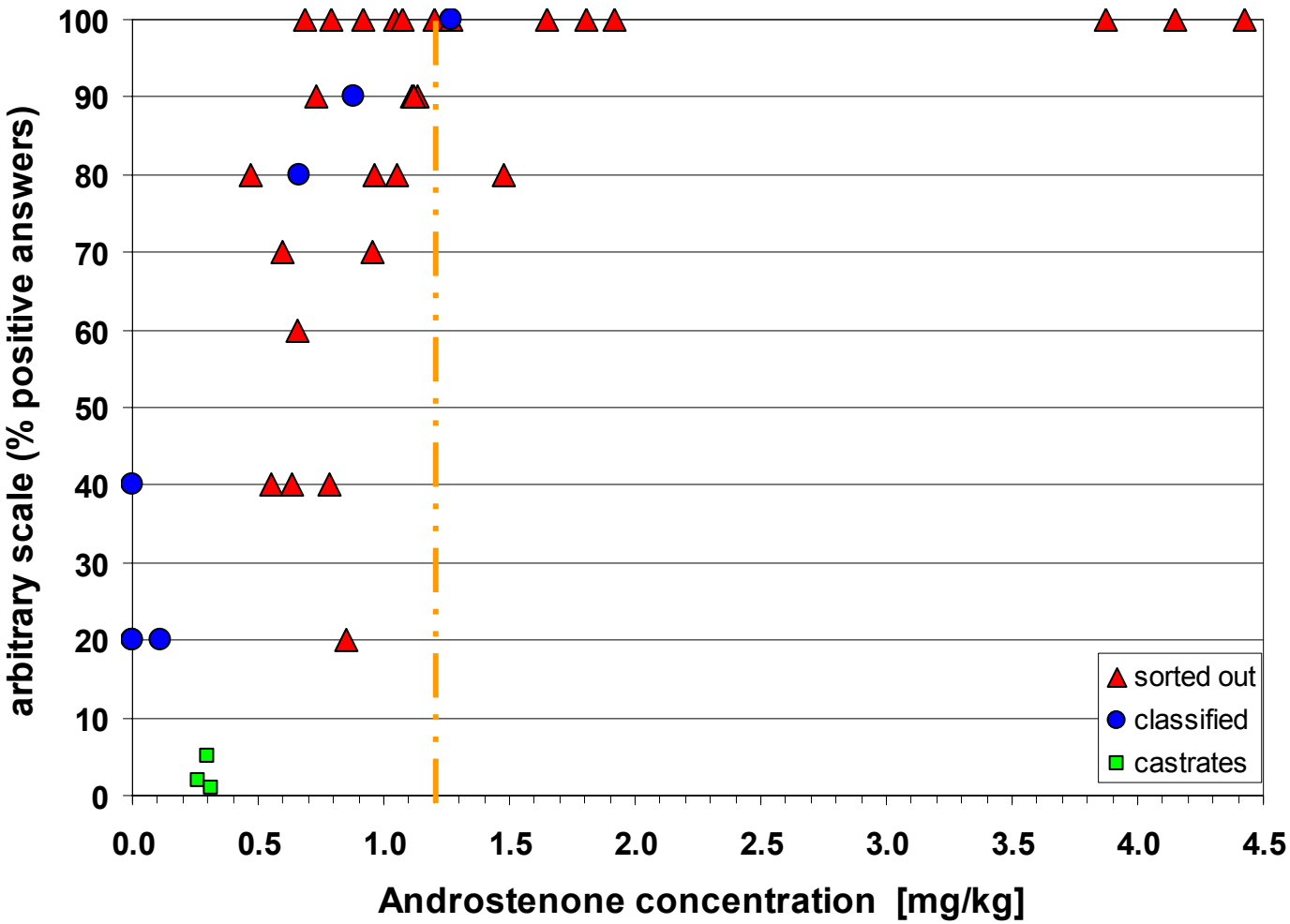
Test: unknown pairs (1 castrate – 1 sample)

	Different sure S	Different unsure S?	Same unsure N?	Same sure N
signal	a	b	c	d
noise	e	f	g	h

Statistical analysis: R-index

$$R_i = \frac{a(f+g+h) + b(g+h) + c(h) + 0.5(ae+bf+cg+dh)}{(a+b+c+d)(e+f+g+h)}$$

Sensory panel



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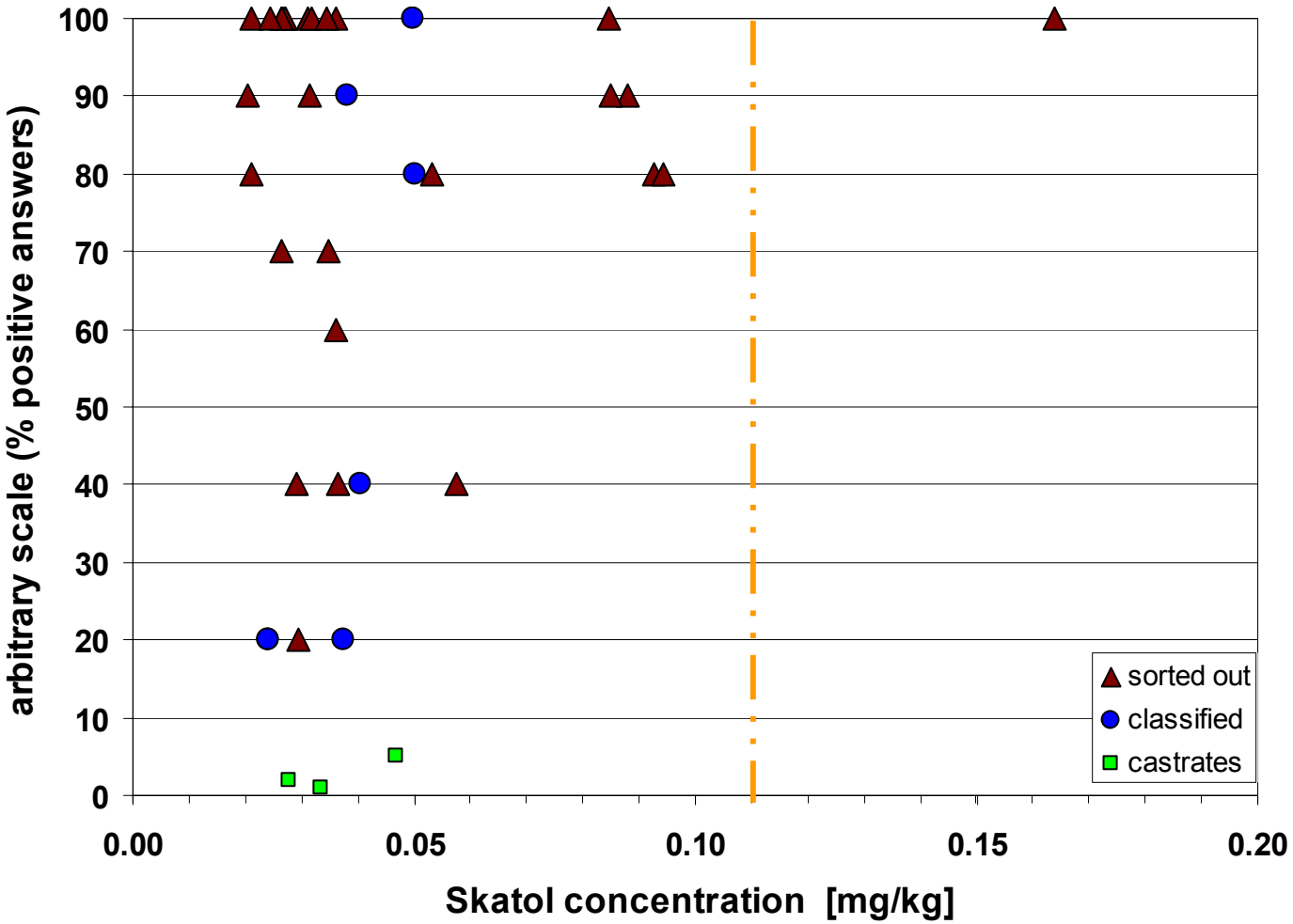
Sensory panel



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Classifying with an EN

Sampling → **Detection** → **"Pattern recognition"**

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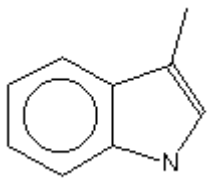
Classifying with an EN

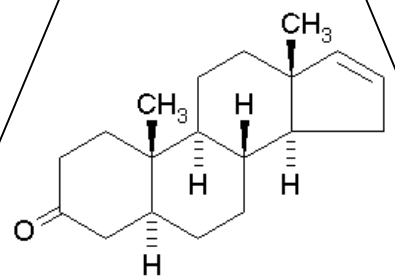


Skatol

MW: 131.17 g/mol
BP : 538.7 °C

$$K = \frac{C_{air}}{C_{matrix}}$$

- Preconcentration (SPME,SPDE, Twister)
- Pyrolysis
- Derivatisation



5α-Androst-16-en-3-one

MW: 272.4 g/mol
FP: 140-145 °C

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Boar carcasses classifications, Pyrolysis

	Androstenone	Skatol	Indole
	(± 0.2 ppm)	(± 0.05 ppm)	(± 0.05 ppm)
JH_5965	5.2	0.16	0.07
JH_5913	2.9	0.15	0.02
JH_5956	1.9	0.48	0.12
JH_5964	1.9	0.09	0.00
JH_5053	1.5	0.09	0.00
JH_6083	1.4	0.09	0.01
JH_5939	1.3	0.09	0.00
JH_6029	1.2	0.11	0.00
JH_5982	1.2	0.12	0.01
JH_6060	1.1	0.09	0.00
JH_6087	1.0	0.09	0.00
JH_6048	1.0	0.10	0.01
JH_5955	1.0	0.14	0.01
JH_5068	0.9	0.09	0.00
JH_6082	0.8	0.09	0.00
JH_6091	0.8	0.09	0.00
JH_5966	0.8	0.09	0.00
JH_5087	0.8	0.09	0.00
JH_6069	0.8	0.09	0.00
JH_5075	0.7	0.09	0.00
JH_6032	0.7	0.09	0.00
JH_6108	0.7	0.08	0.00
JH_6065	0.6	0.08	0.00
JH_6062	0.6	0.09	0.00
JH_6078	0.6	0.09	0.00
JH_6080	0.6	0.09	0.00
JH_6105	0.6	0.09	0.01
JH_6086	0.5	0.09	0.00
JH_6042	0.2	0.09	0.00

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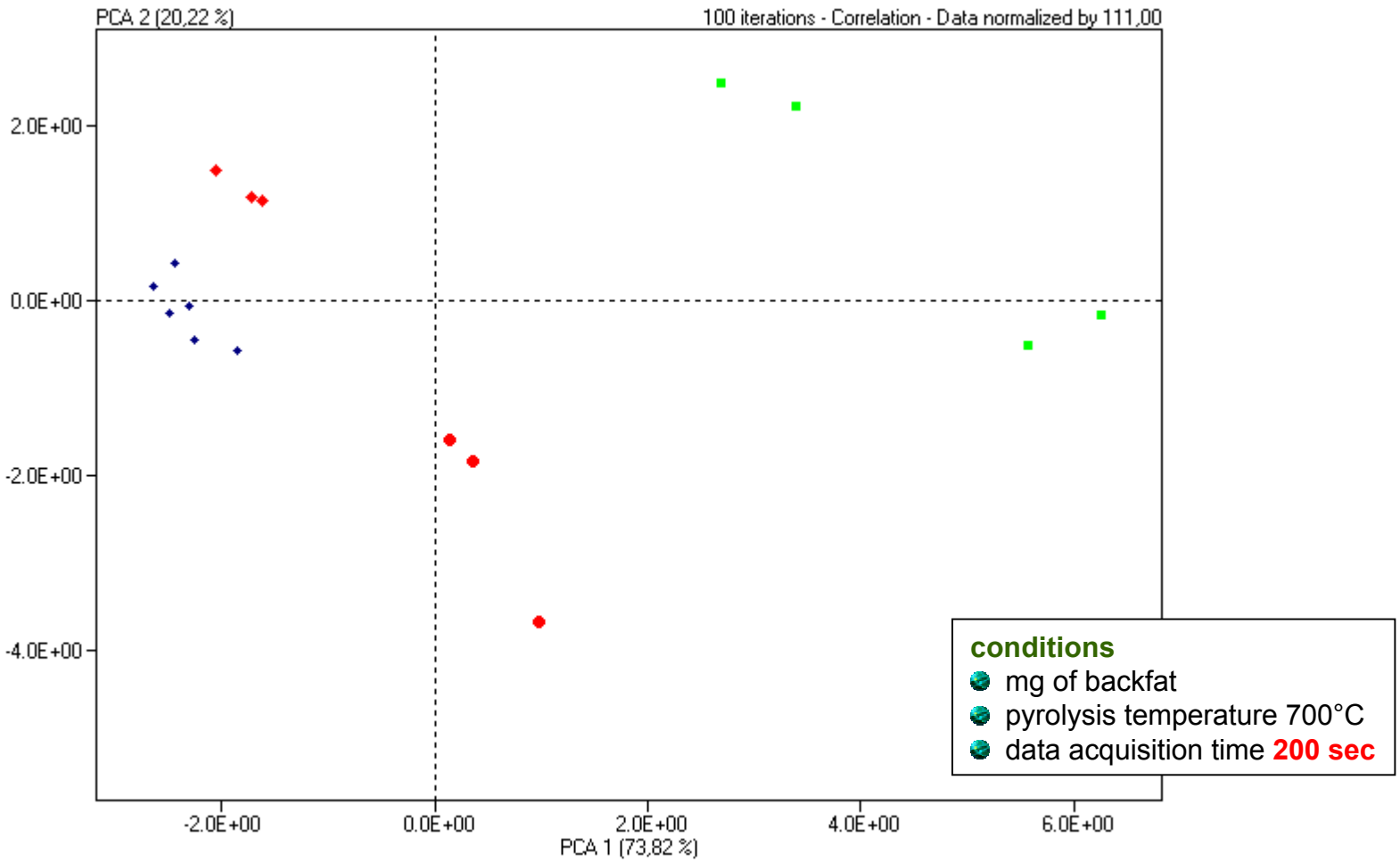
Boar carcasses classifications, Pyrolysis



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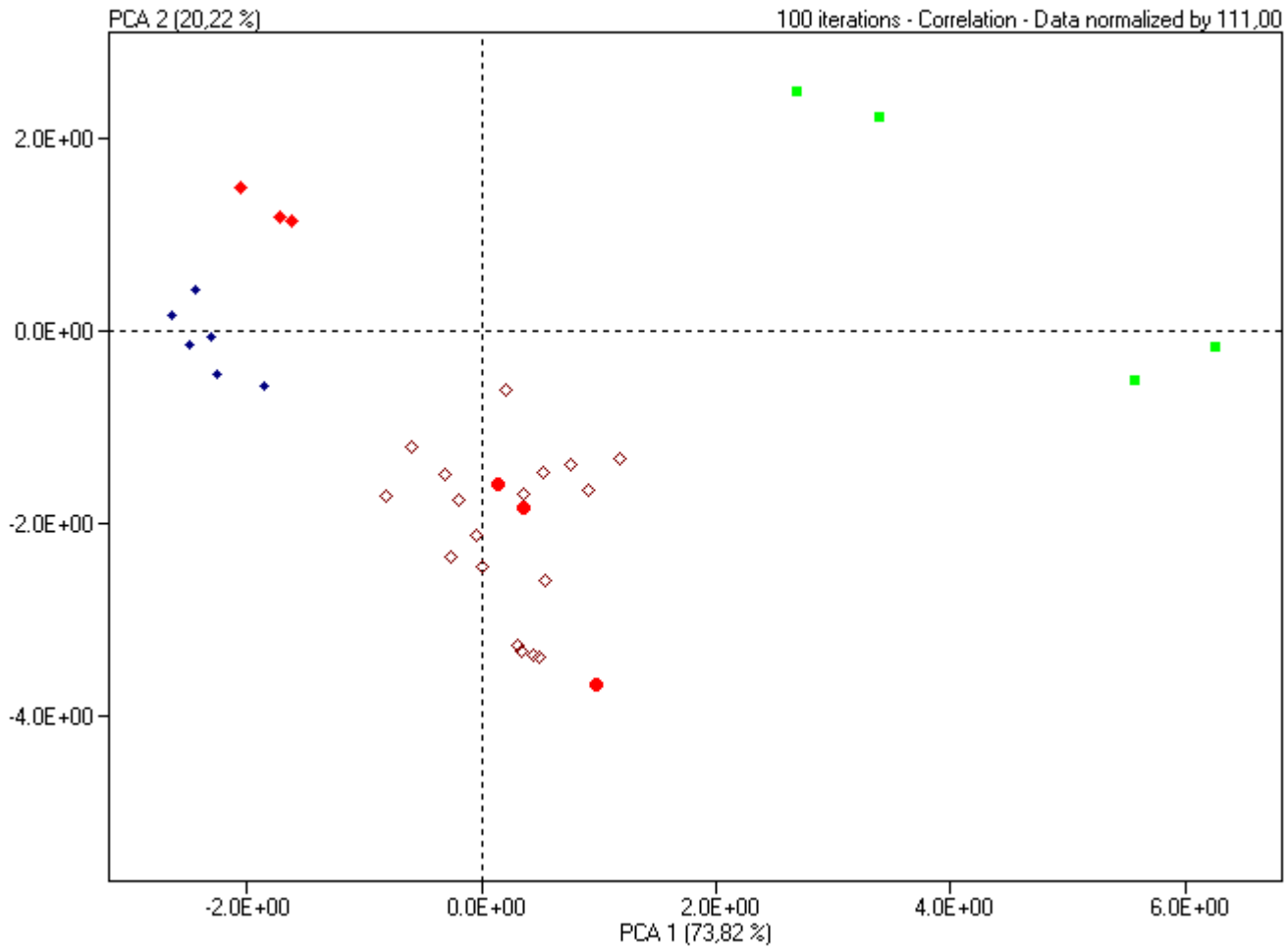

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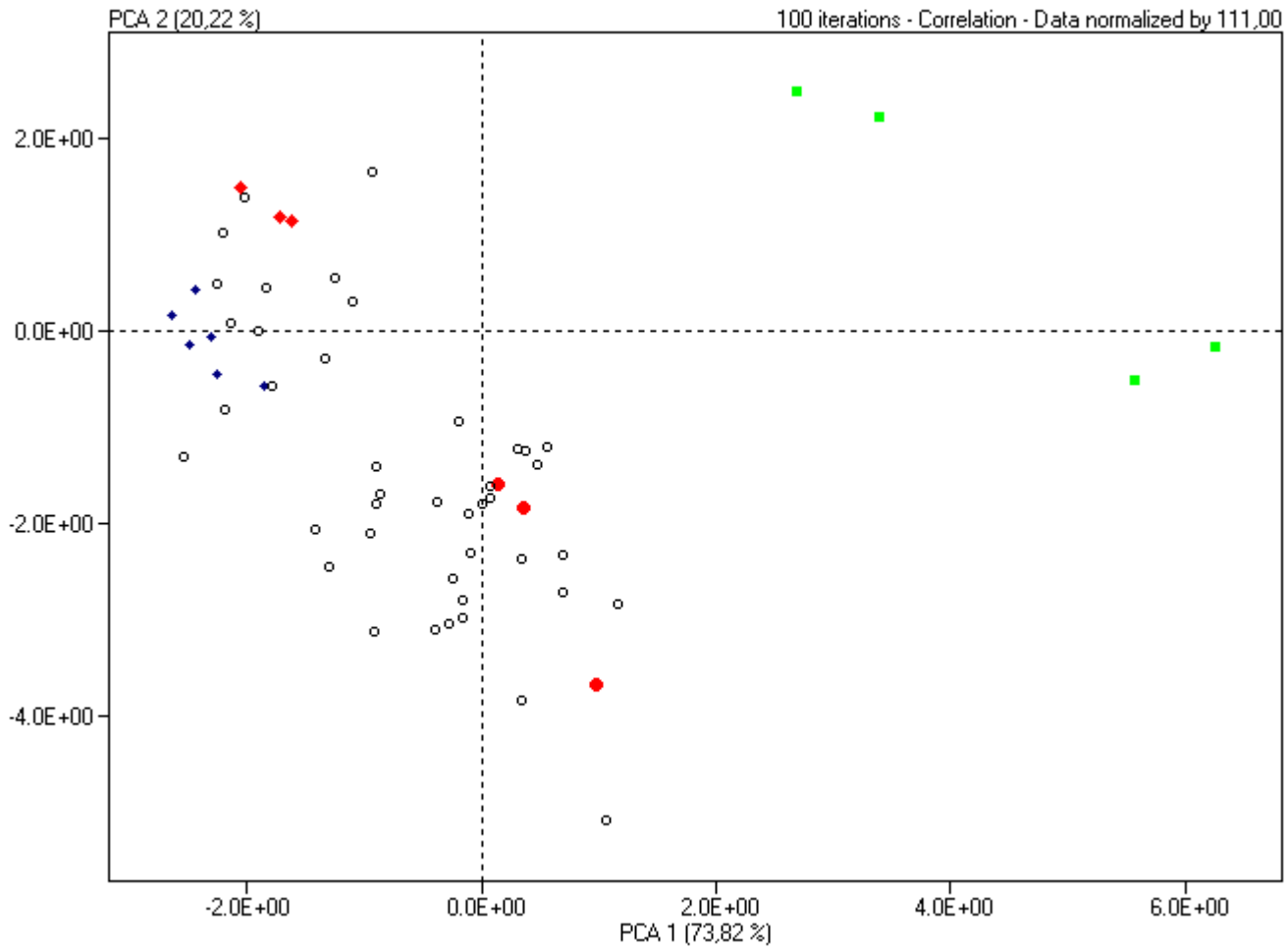

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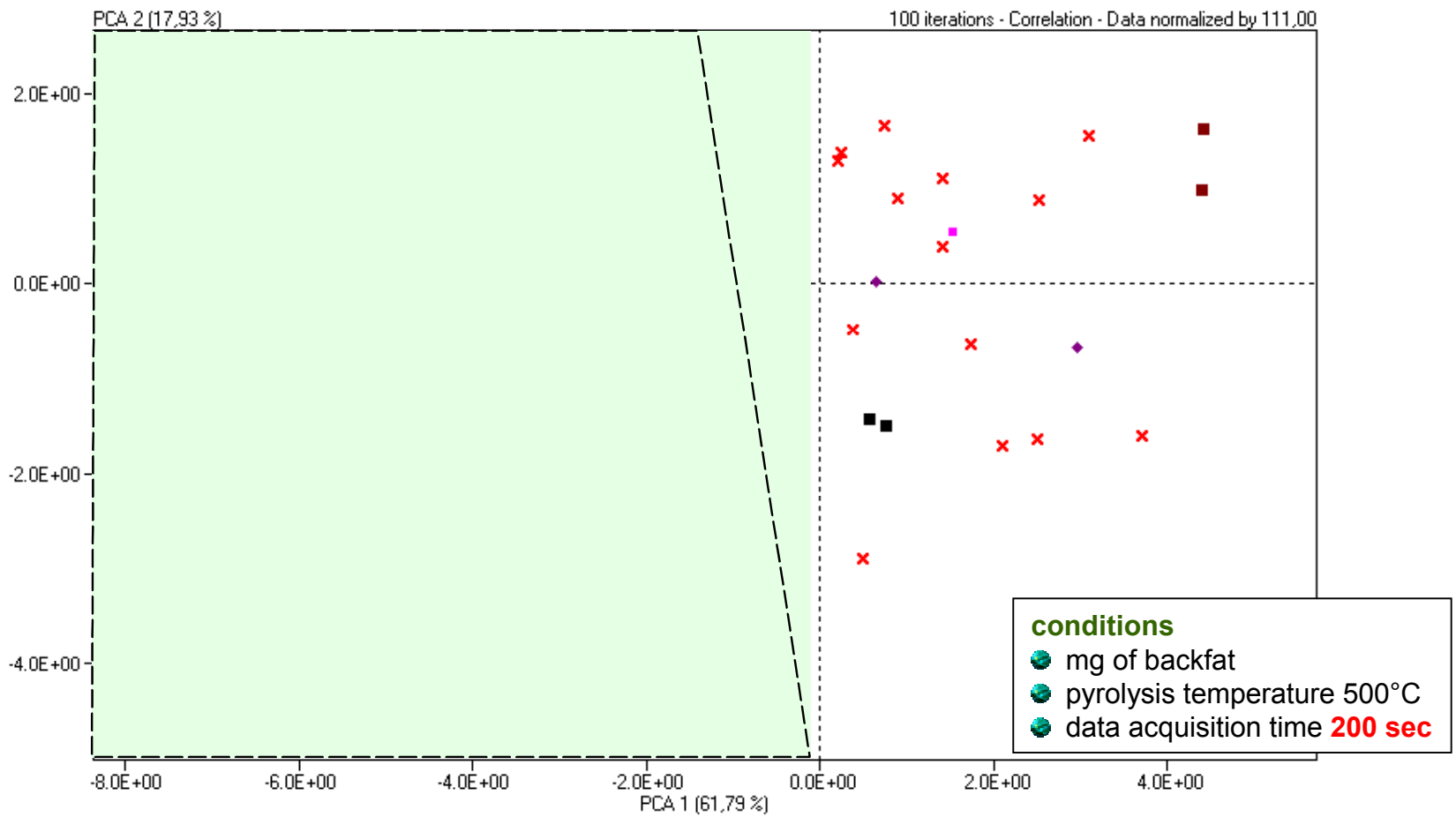

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Conclusions

- (Better) definition of model samples
- Standard analytical methods
- Pyrolysis presents several advantages: sensitivity, fastness

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Sensory panel (29 people)

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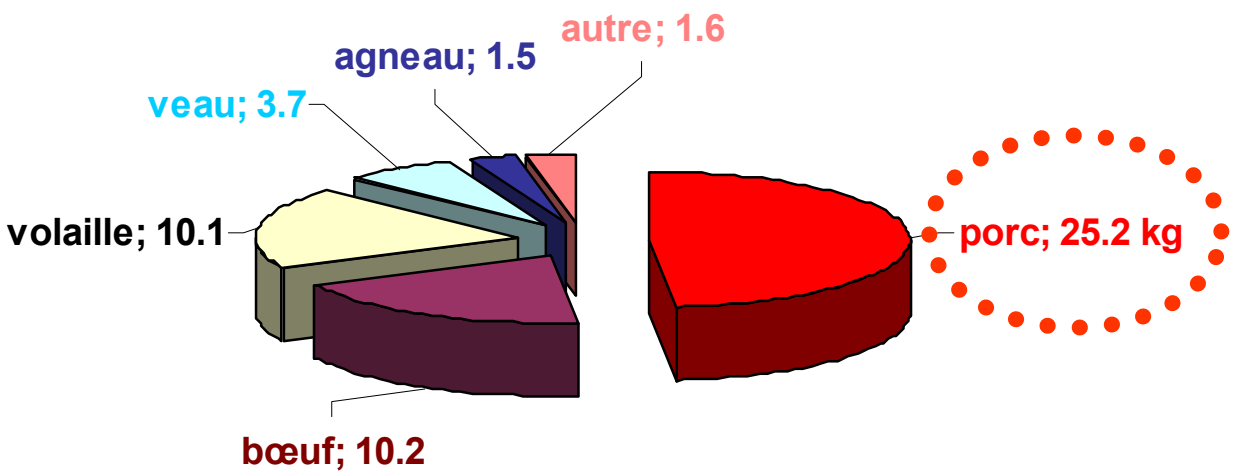
L’odeur de verrat

Consommation de viande en Suisse

(kg de viande achetés par personne en 2003)



1.3 Mio. porcs mâles castrés en 2003

AGIR 6.05.2003

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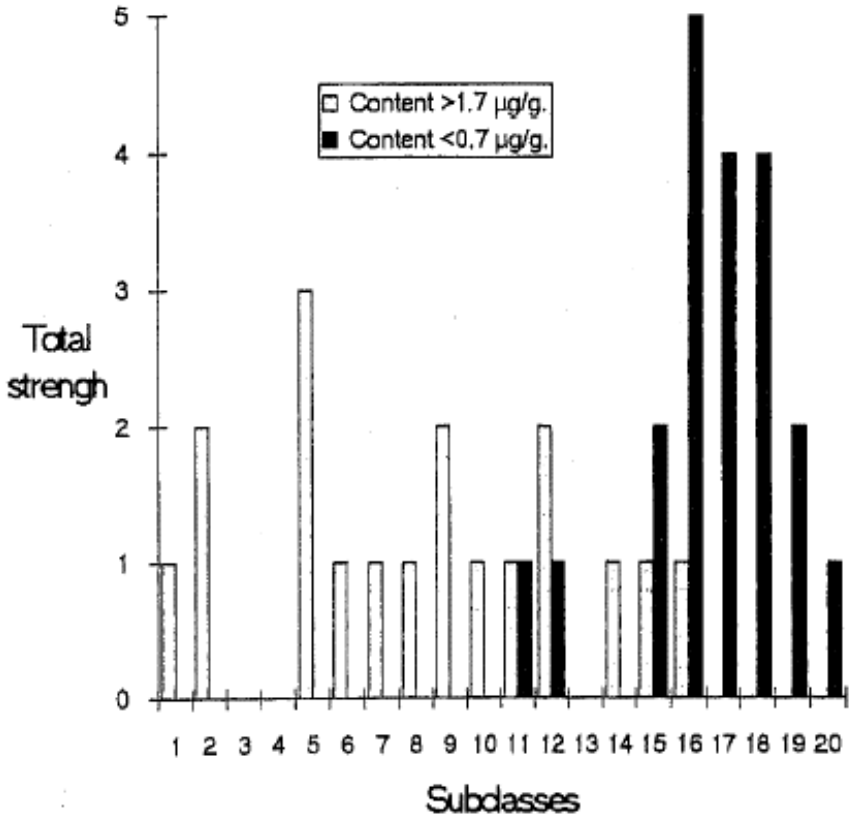
Classification de verrats avec un nez électronique-MOS

Echantillons modèle d'après le conténu en androsténone
38 échantillons de tissu adipeux dorsale



Bourrounet et al, Sensors and Actuators B 26-27 (1995) 250-254

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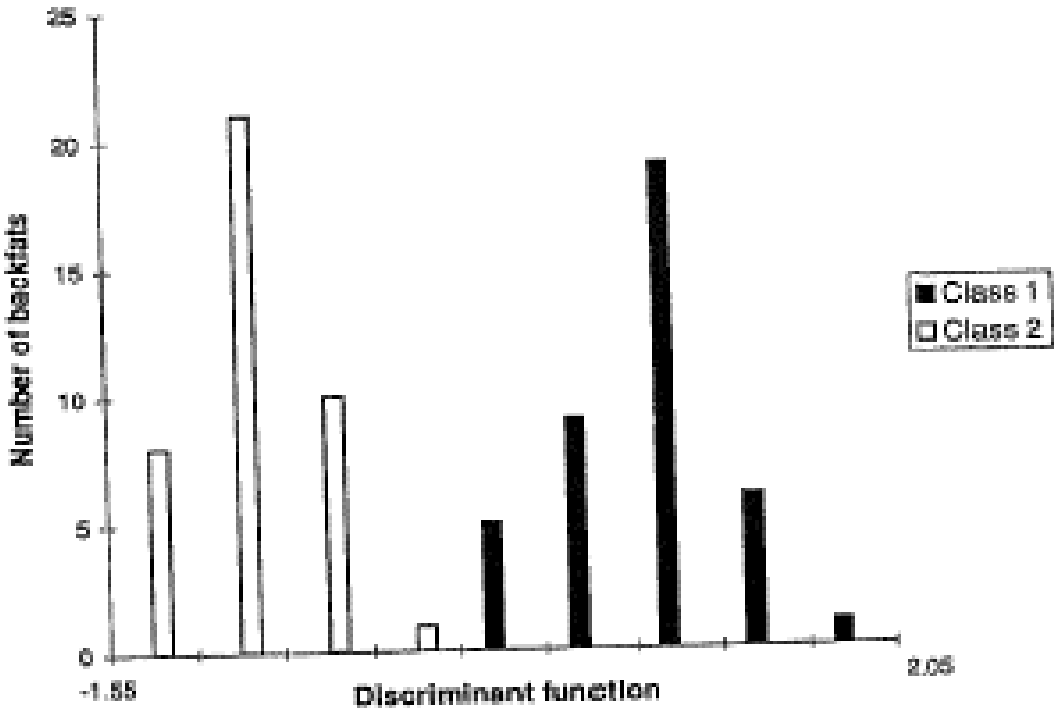
Classification de verrats avec un NE pyrolyse-MS

Echantillons modèle d'après le conténu en androsténone
40 échantillons de tissu adipeux dorsale



Androstenone
< 0.7 mg/g
➢1.6 mg/g

Berdagué et al, Science des aliments 16 (1996) 425-433

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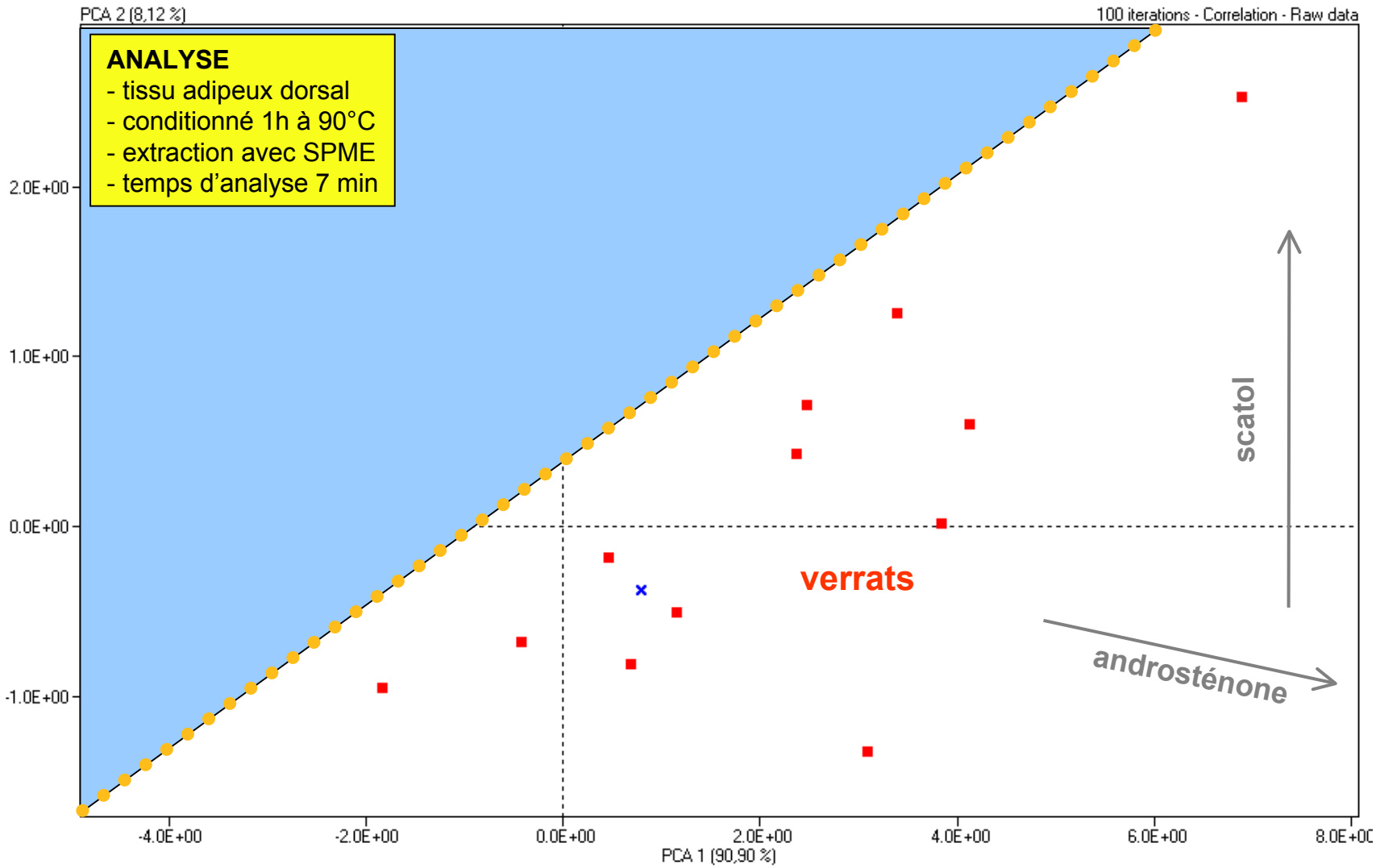
L'odeur de verrat

Consumers detection limit

	Limite de détection µg/g	Réference
Androsténone	0.2 – 1 0.5 - 1	Annor-Frempong I (1997) Riux Solé (2001)
Scatol	0.008 – 0.06 0.1 – 0.25	Annor-Frempong I (1997) Riux Solé (2001)

	Carcasses avec odeur	Réference
Androsténone	24 %	Hansen-Moller (1994)
Scatol	58 % 50 %	Hansen-Moller (1994) Riux Solé (2001)
Androst. + scatol	66%	Hansen-Moller (1994) Riux Solé (2001)

Boar carcasses classifications, SPME



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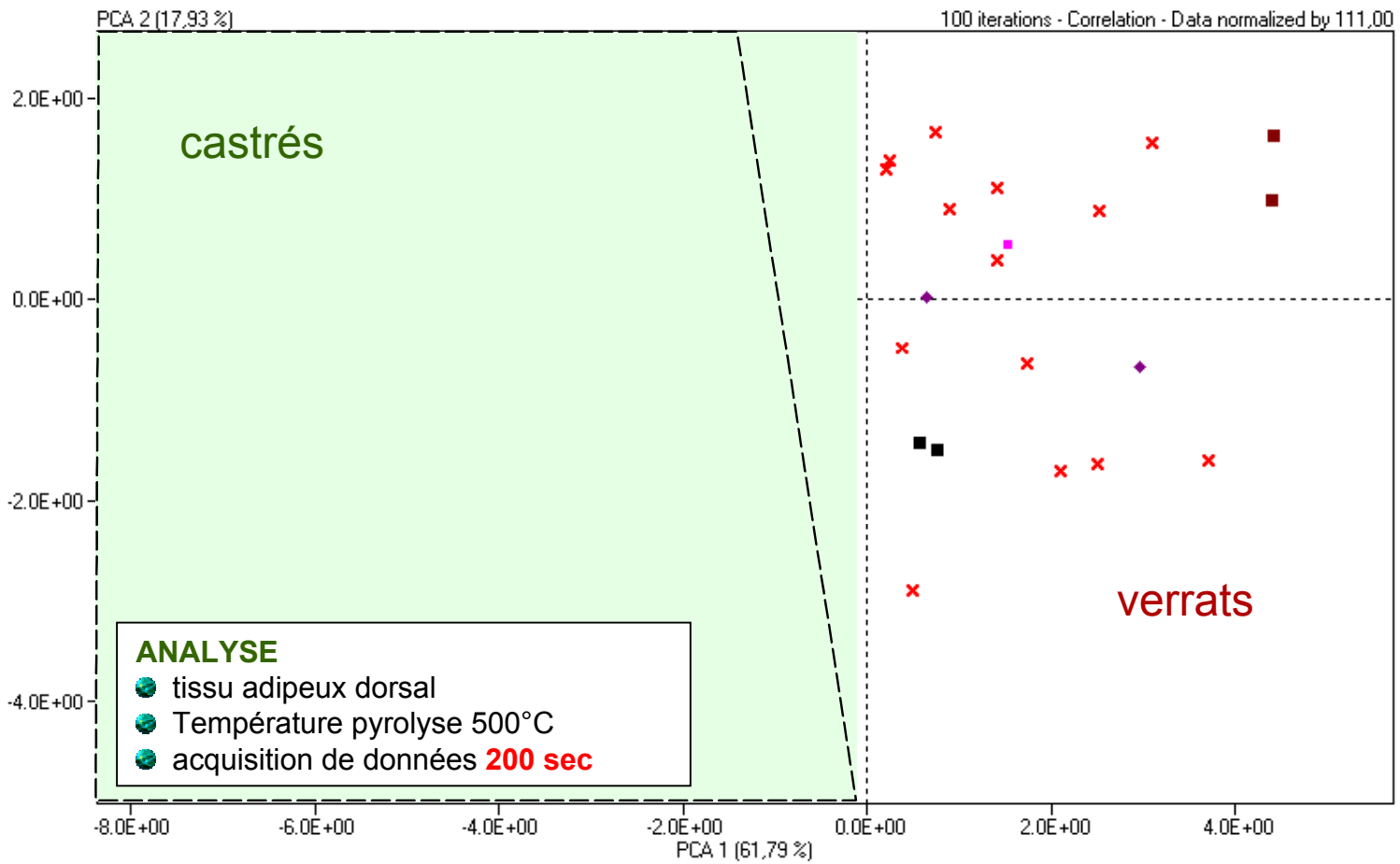
Boar carcasses classifications, Pyrolysis

100% classification correcte de castrés et verrats



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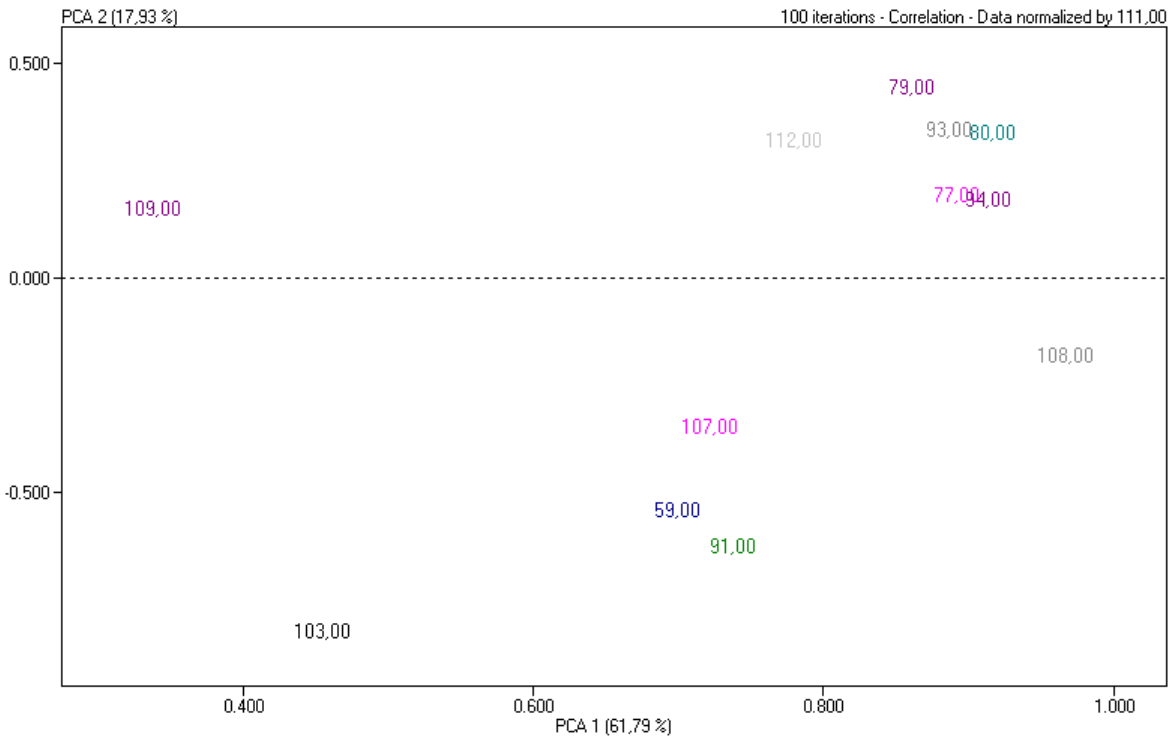
Pyrolysis



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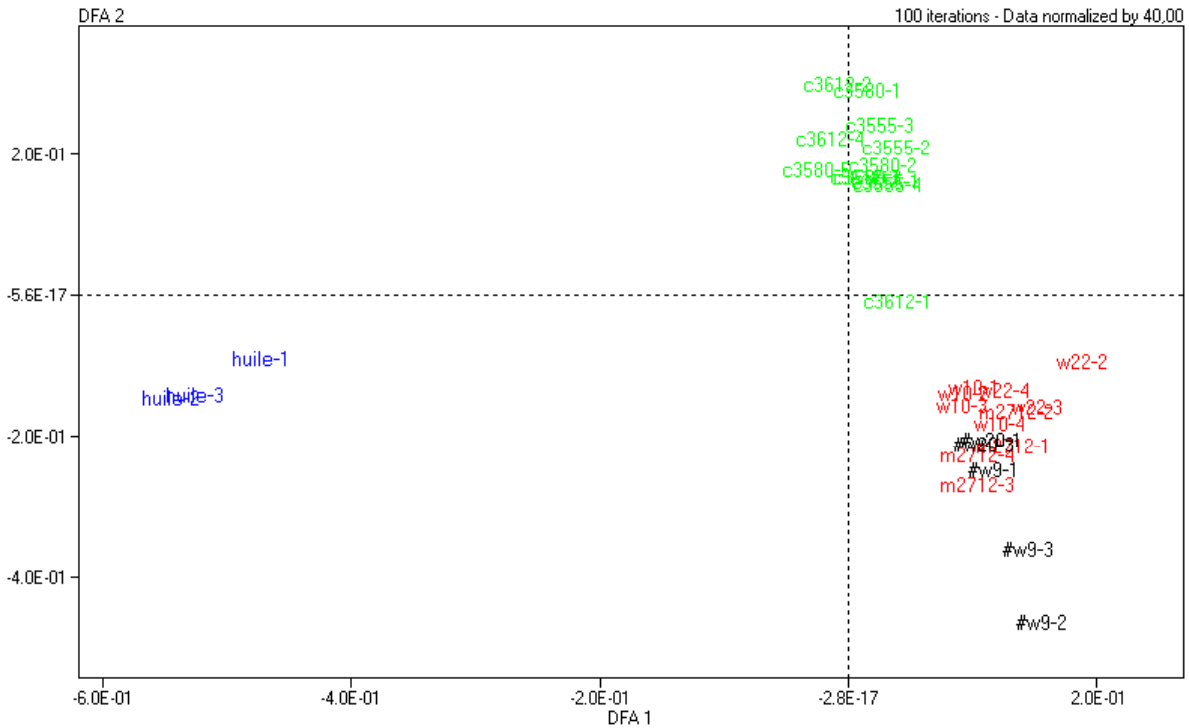

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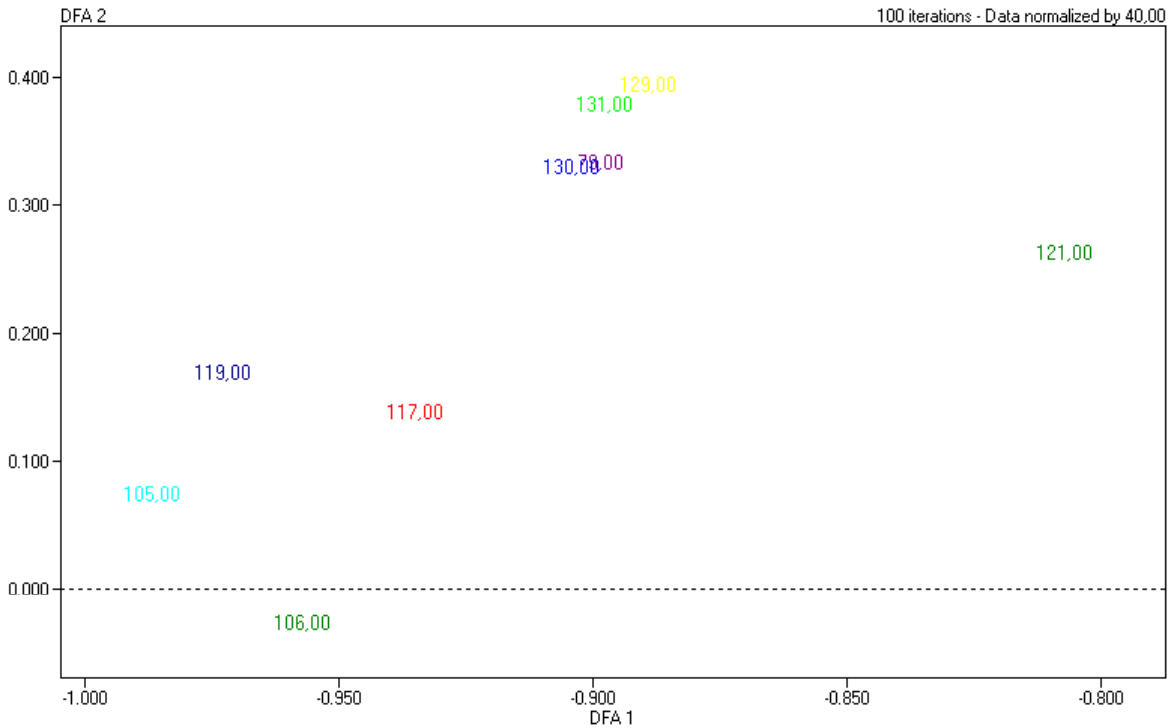
Pyrolysis



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