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S15. Sustainable Animal Production: Productivity aspects related to milk & meat quality

Using electronic identification and molecular markers for lamb traceability

(Abstract #1659)

G. Caja[1]*, J.J. Ghirardi[1], M. Hernández-Jover[1], J.C. Pozo[3], D. Albardonedo[4], N. Jiménez[2], A. Sánchez[2]

[1]Grup de Recerca en Remugants; [2]Servei Veterinari de Genètica Molecular; Universitat Autònoma de Barcelona, Bellaterra, Spain.
[3]Ovino del Suroeste S.C.L., 08700 Villanueva de la Serena, Spain; [4]Asociación Española Criadores Ovinos Precoces, Castelló 45, 28001 Madrid, Spain.

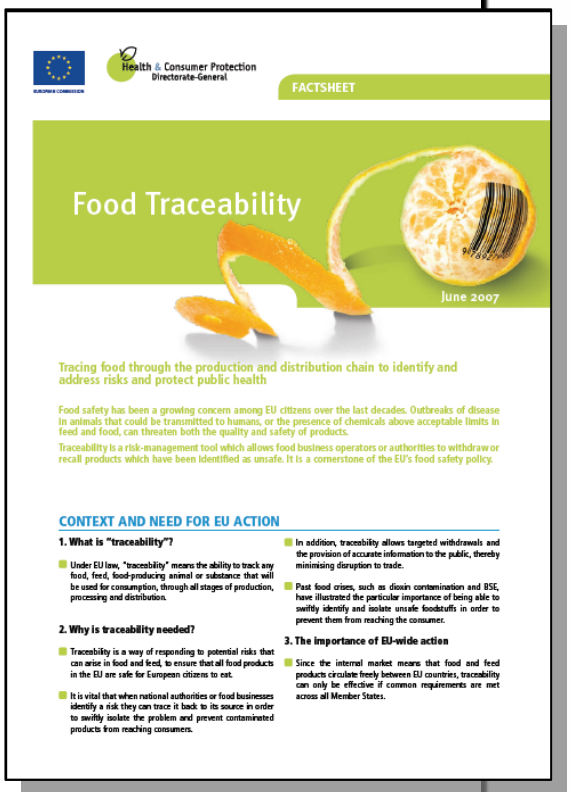
Traceability of lambs & calves using electronic identification (e-ID) & molecular markers (DNA): 'e-ID+DNA'

Outline:

- **Project UE FAIR5 QLk1-02229: 'e-ID+DNA Tracing'**
- **Introduction: EU regulations**
- **Electronic ID by e-bolus: how it works and costs?**
- **Traceability implementation by 'e-ID+DNA'**
  - **Case 1: Fattening lambs ('Cordero Pascual')**
- **Conclusions**

Food traceability: a current ‘hot topic’ for cattle, sheep & goat in Europe

The 3 first examples in the EU ‘Factsheet’ on traceability!



Health & Consumer Protection Directorate-General

FACTSHEET

Food Traceability

June 2007

Tracing food through the production and distribution chain to identify and address risks and protect public health

Food safety has been a growing concern among EU citizens over the last decades. Outbreaks of disease in animals that could be transmitted to humans, or the presence of chemicals above acceptable limits in feed and food, can threaten both the quality and safety of products.

Traceability is a risk-management tool which allows food business operators or authorities to withdraw or recall products which have been identified as unsafe. It is a cornerstone of the EU's food safety policy.

CONTEXT AND NEED FOR EU ACTION

1. What is "traceability"?

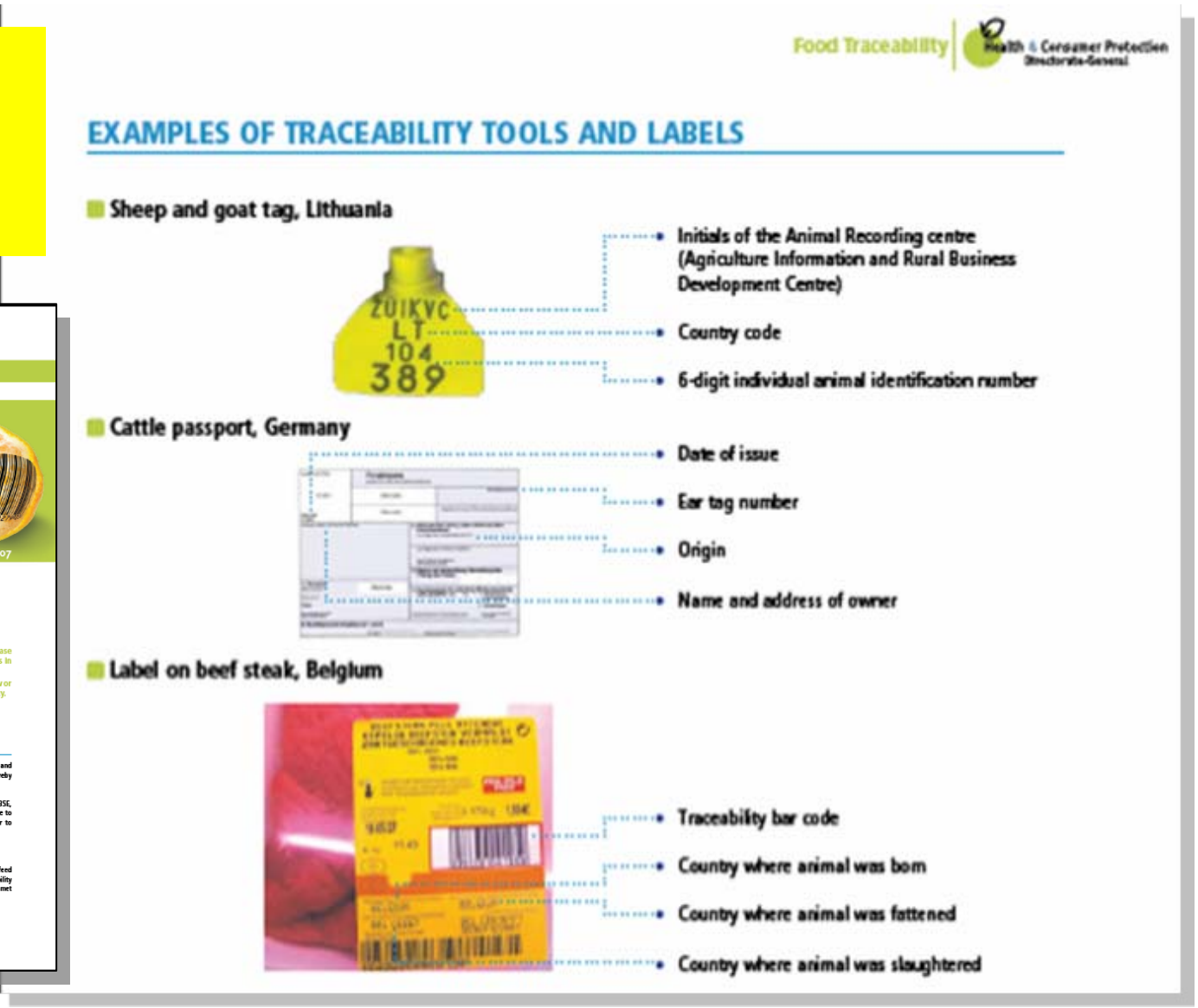
- Under EU law, "traceability" means the ability to track any food, feed, food-producing animal or substance that will be used for consumption, through all stages of production, processing and distribution.

2. Why is traceability needed?

- Traceability is a way of responding to potential risks that can arise in food and feed, to ensure that all food products in the EU are safe for European citizens to eat.
- It is vital that when national authorities or food businesses identify a risk they can trace it back to its source in order to swiftly isolate the problem and prevent contaminated products from reaching consumers.
- In addition, traceability allows targeted withdrawals and the provision of accurate information to the public, thereby minimising disruption to trade.
- Past food crises, such as dioxin contamination and BSE, have illustrated the particular importance of being able to swiftly identify and isolate unsafe foodstuffs in order to prevent them from reaching the consumer.

3. The importance of EU-wide action

- Since the internal market means that food and feed products circulate freely between EU countries, traceability can only be effective if common requirements are met across all Member States.



Food Traceability | Health & Consumer Protection Directorate-General

EXAMPLES OF TRACEABILITY TOOLS AND LABELS

Sheep and goat tag, Lithuania

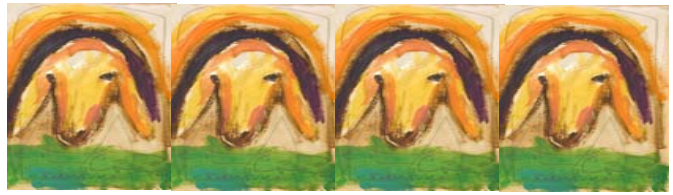
Cattle passport, Germany

Label on beef steak, Belgium

Current European Regulations on animal ID&R and traceability: 2/2

- **Regulation CE 21/2004: Sheep & goat**
  - **Art. 2:** All EU sheep & goat born after **6/01/2005** shall wear **1 ear tag + 2nd ID device** (ear tag, tattoo) before **6 months** of age or leaving the farm were they were born.
  - **Art. 9:** The 2nd ID device shall be **electronic (e-ID) after 1/01/2008 (?)** if the country has more than **0.6 million** of small ruminants.

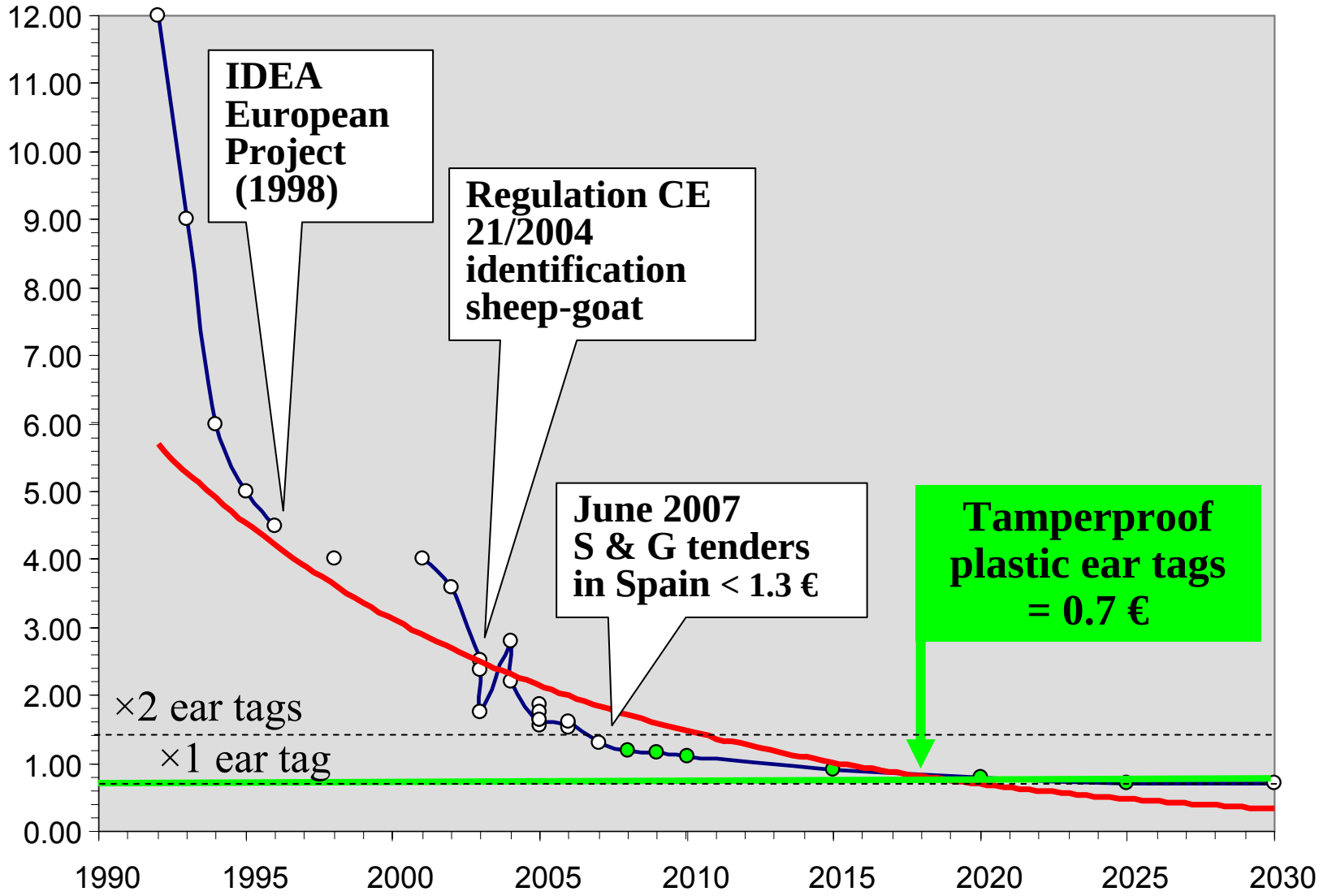
Spain (27 million S&G): started e-ID in 7/09/2005 (RD 97/2005)
(> 6 million ewe-lambs already e-ID in 2007)



Requirements for an efficient *e*-ID system for livestock ID & R & Traceability:

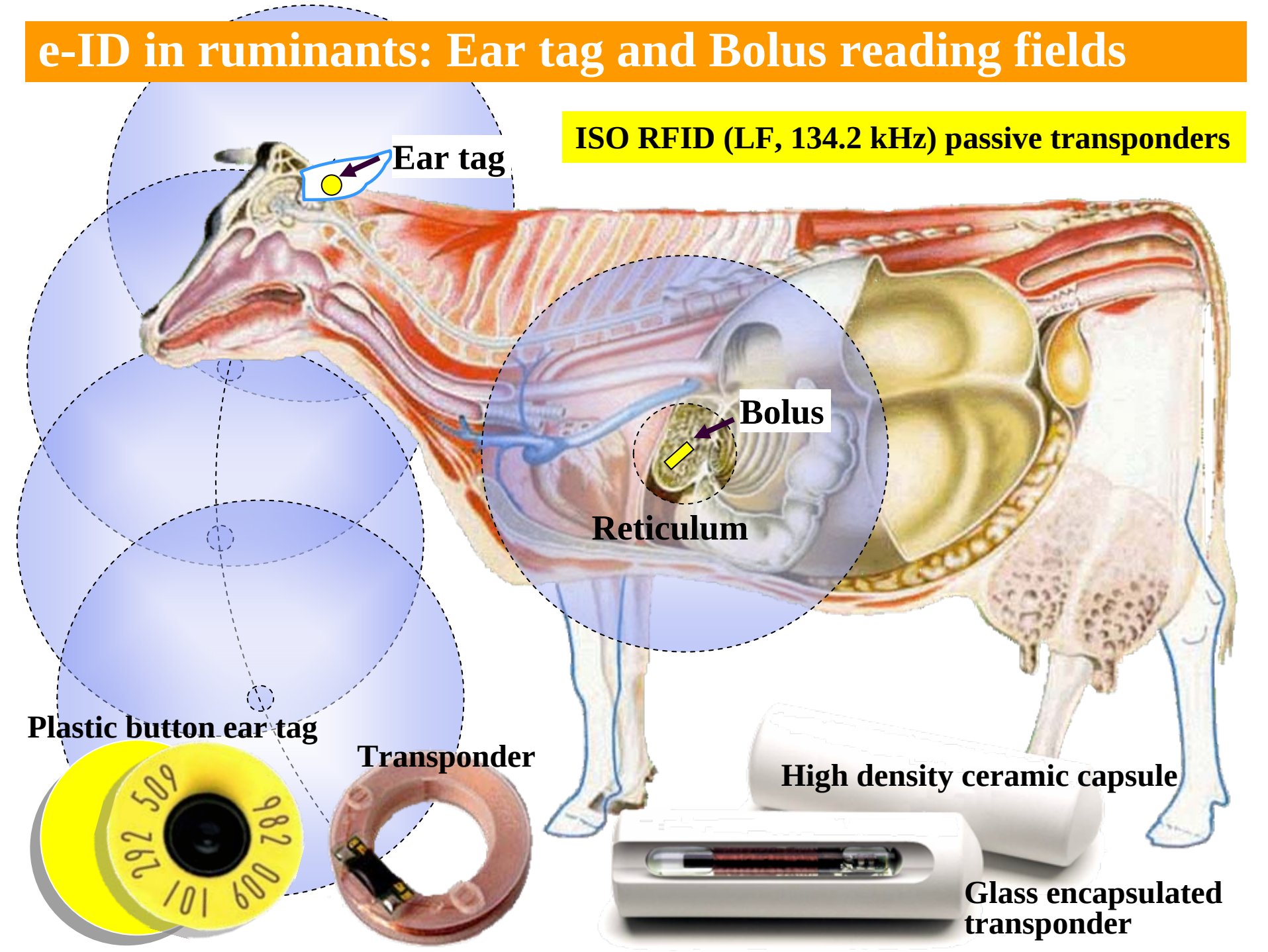
- **Resistant** (*no breakages*, *no failures*) and **permanent** (*no losses*) under **livestock conditions** (*on farm*, *harvesting*): **ICAR > 98%.**
- **Long-life passive device** (*without batteries*, *>10 yr*, *>10^6 readings*).
- **Readable a distance** (*hand-held >20 cm; stationary >80 cm*).
- **Tamperproof** & ID code **automatically recordable.**
- **Biocompatible** (*wellbeing and performance*); **Early** (*young animals*) and **easy** (*farmer*) application.
- **Easy recovery** and **no residues** (*food safety*) in carcass or meat.
- **Low cost.**

Price of e-ID devices in the European market
(Caja, 2007; *historical data and personal estimations*)



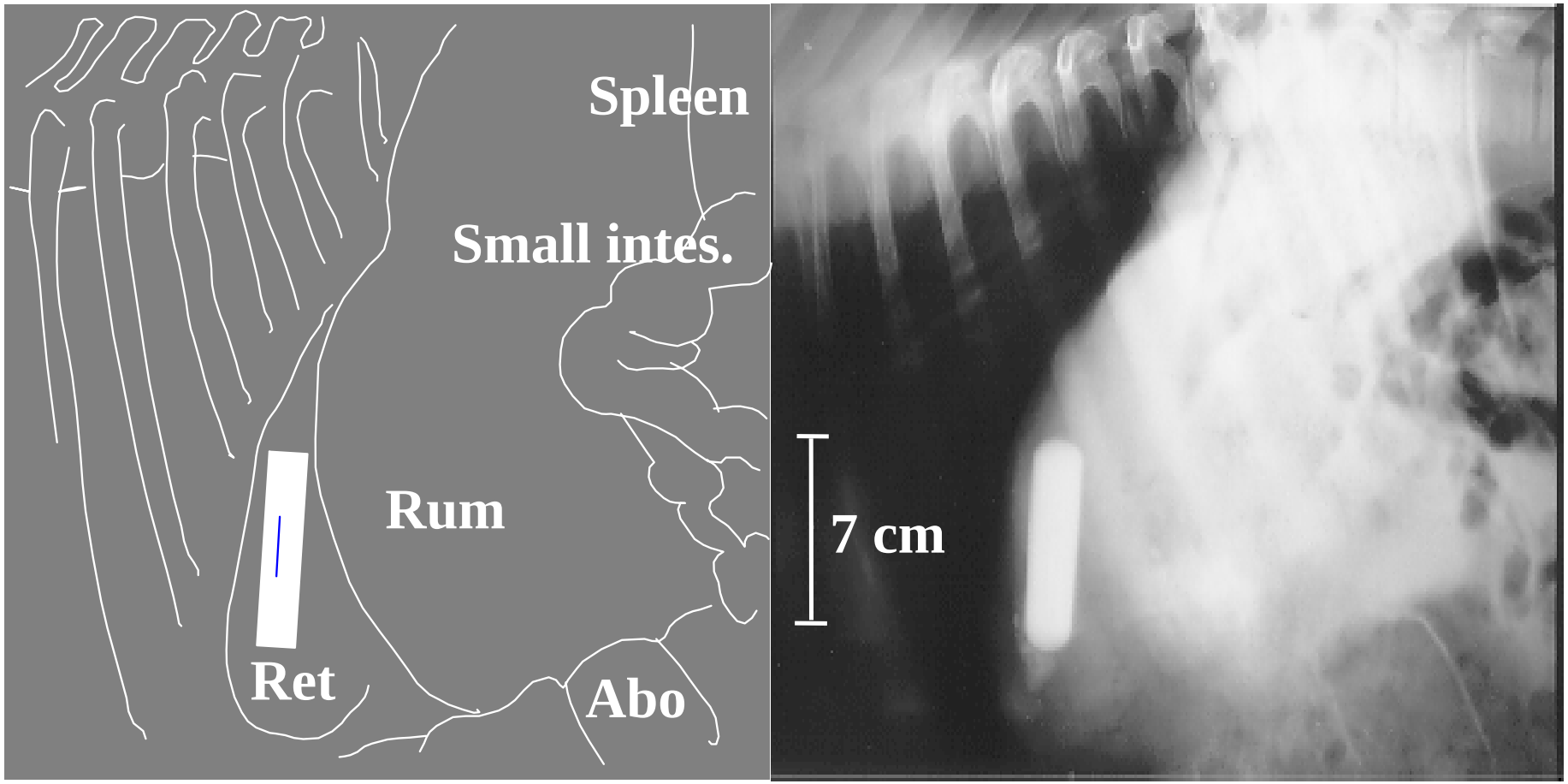
e-ID in ruminants: Ear tag and Bolus reading fields

ISO RFID (LF, 134.2 kHz) passive transponders



X-ray location of e-ID boluses in the reticulum

(Caja et al., 1999; Comp. Elec. Agr. 24:45-63)



Milk fed Holstein calf (1 wk of age, 42 kg BW)

Key points of an animal and meat traceability scheme :

- **ID devices:** permanent and individual
- **Movement registration** system
- **Data Base** permanently updated
- Independent **auditing system**

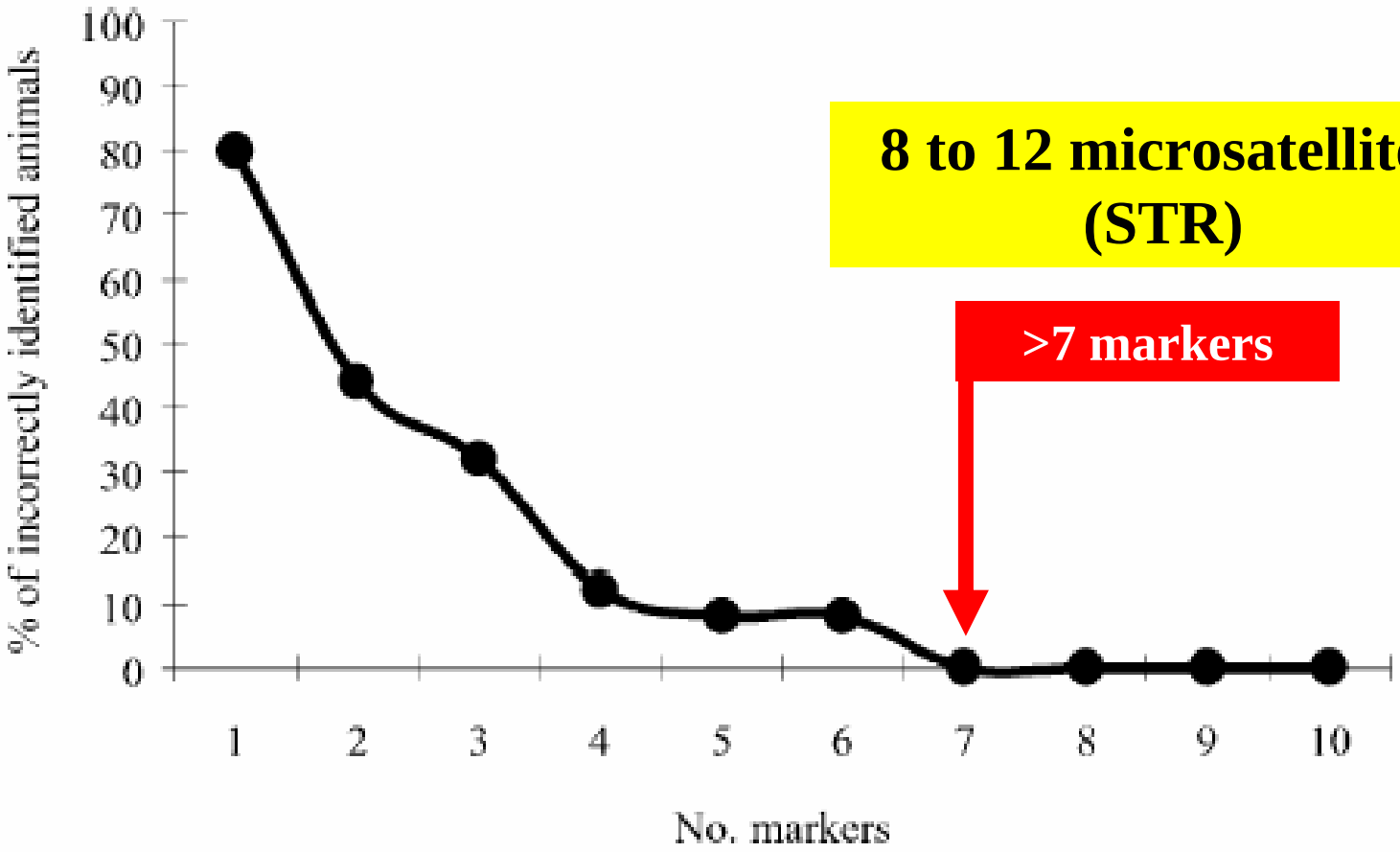
e-ID

DNA

Double system of traceability & auditing ‘e-ID+DNA’
(Project EU FAIR5-QLk1-02229: 2001-06)

Incorrectly identified beef samples according to number of markers

(Arana et al., 2002; Meat Sci. 61:367–373)



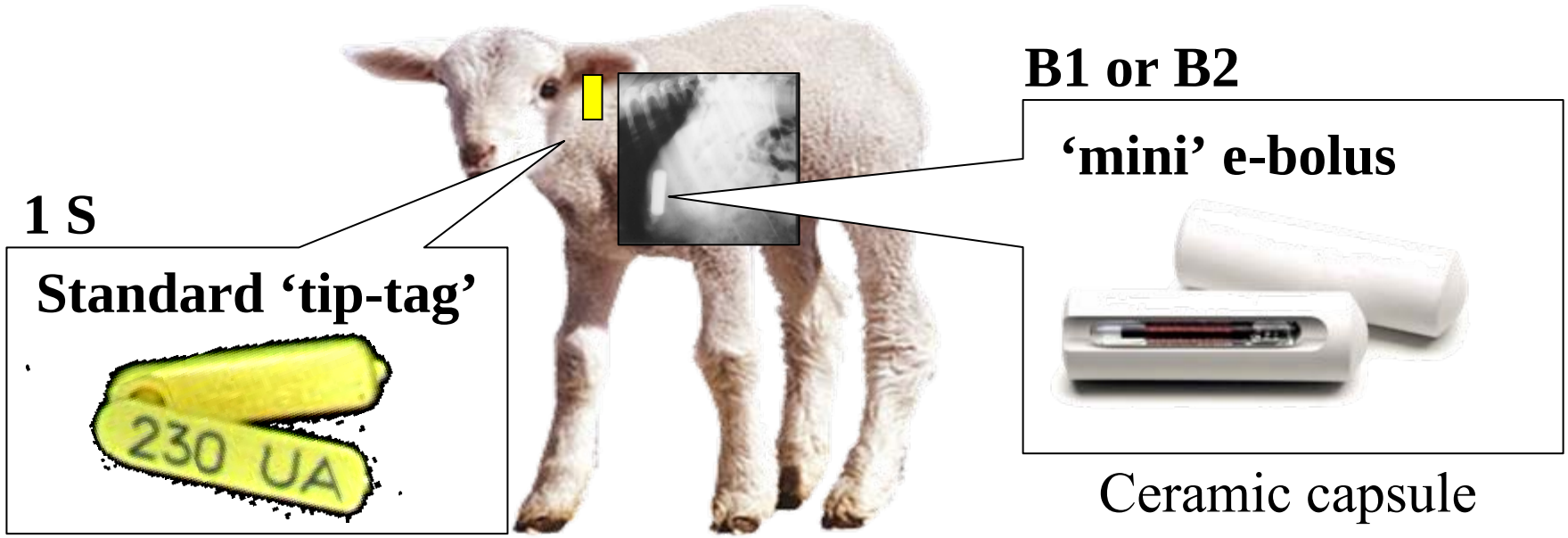
Objectives :

To study under on field conditions the:

- **Performance of visual and e-ID devices** (LF bolus, 134.2 kHz) **for meat traceability**
  - Standard ear tags (flag) for lambs
  - Small ear tags (button)
- **Use of e-labels** (HF inlays, 13.56 MHz) **for automatic ID code transfer and carcass identification.**
- **Use of DNA analysis** (microsatellites) **as an independent auditing system for traceability.**
- **Cases: 1) <u>Lambs</u> (‘Pascual’)**

‘e-ID+DNA’: on farm lamb identification

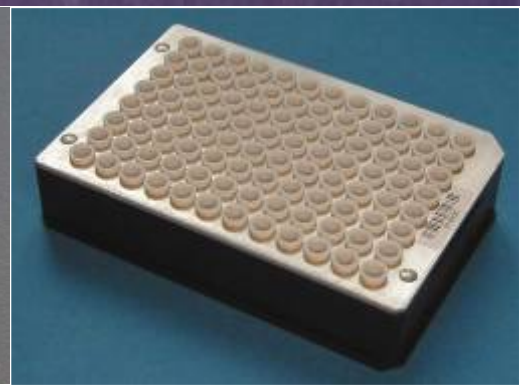
- **Animals: 1,908 lambs** of 4 breeds (Me, Mn, Ri & Lc), intensively reared in 7 holdings (B, BA & GI, Spain). Harvested at 30-35 kg BW in 2 slaughterhouses (200-400 lambs/h)
- **Identification:** during suckling (< 30 d)
  - **1 standard tip tag**, left ear (**S, 1.5 g**, n = 1,908; Azasa-Allflex, Spain) at birth.
  - **1 ‘mini’ e-bolus**, **B1** (**9 g**; 10×39 mm; n = 1,091) or **B2** (**20 g**; 11×56 mm; n = 817), with ISO HDX transponder (Rumitag, Spain).



‘e-ID+DNA’: DNA sampling

- **DNA tissue samples:**
  - **<u>Biopsying ear tags</u>** at bolusing (**E1**, Biopsytec, Germany; **E2**, Tipy-Fix, Switzerland) in the right ear.
  - **<u>Carcass sampling</u>** (**E1**, Biopsytec; Identigen **sticks**, Ireland) at the end of harvesting.

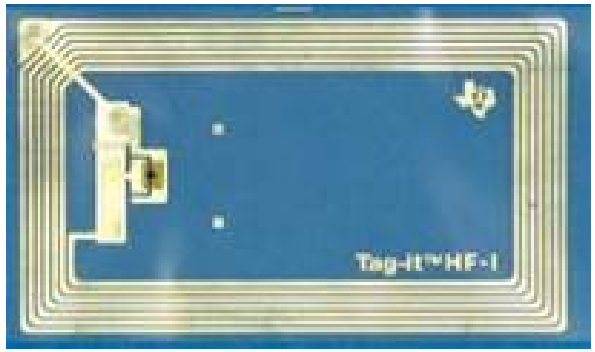


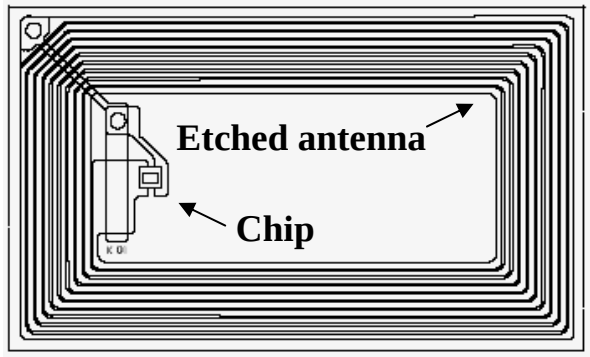



  - Samples stored frozen (-20ºC) until analysis.

‘e-ID+DNA’: ID transfer & auditing

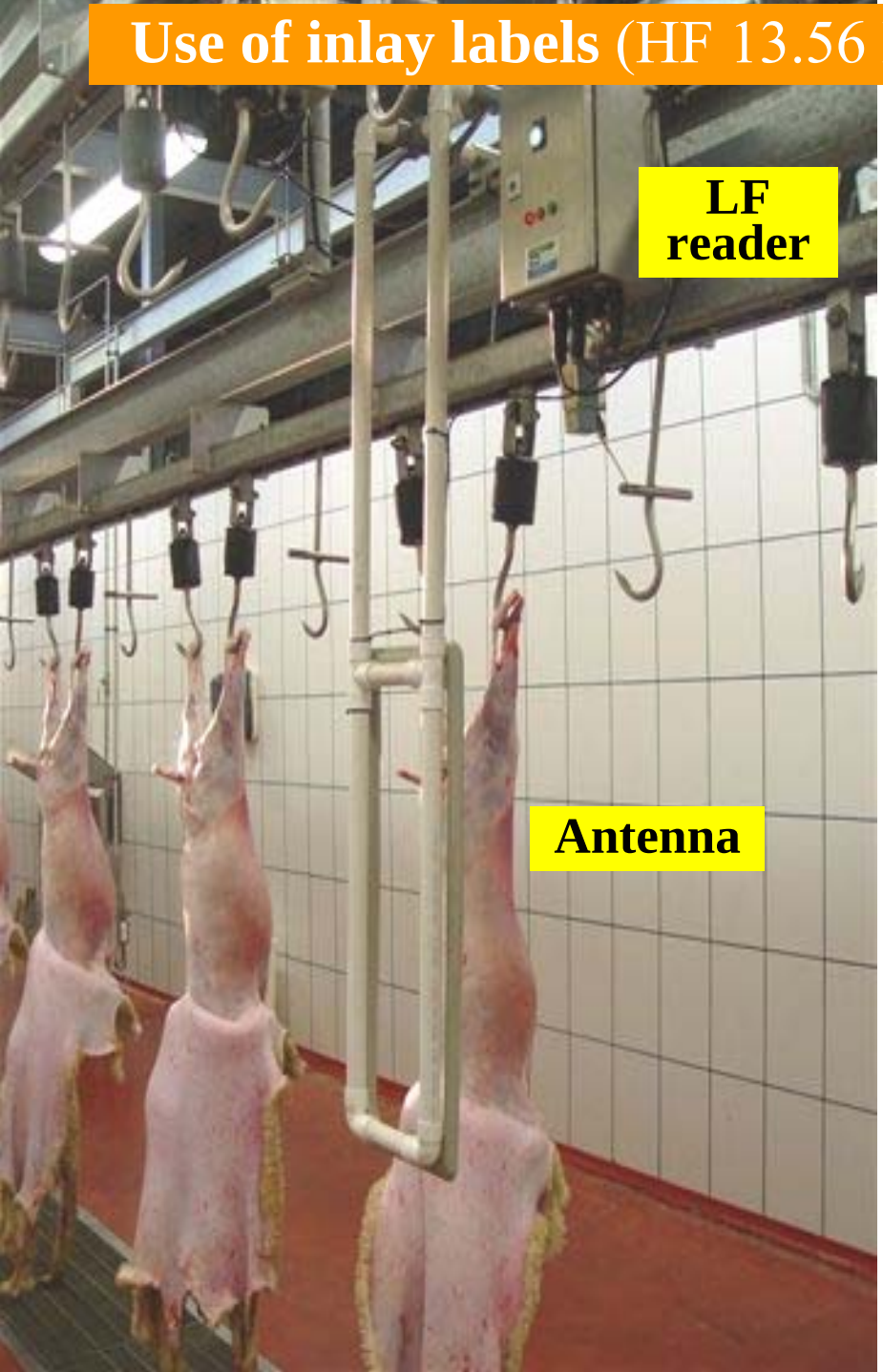
- **Automatic recording & transfer of ID** codes from animal (e-bolus) to carcasses by **HF RF inlays** (45 × 76 mm, **13.56 MHz**; Tiris, The Netherlands) at evisceration.





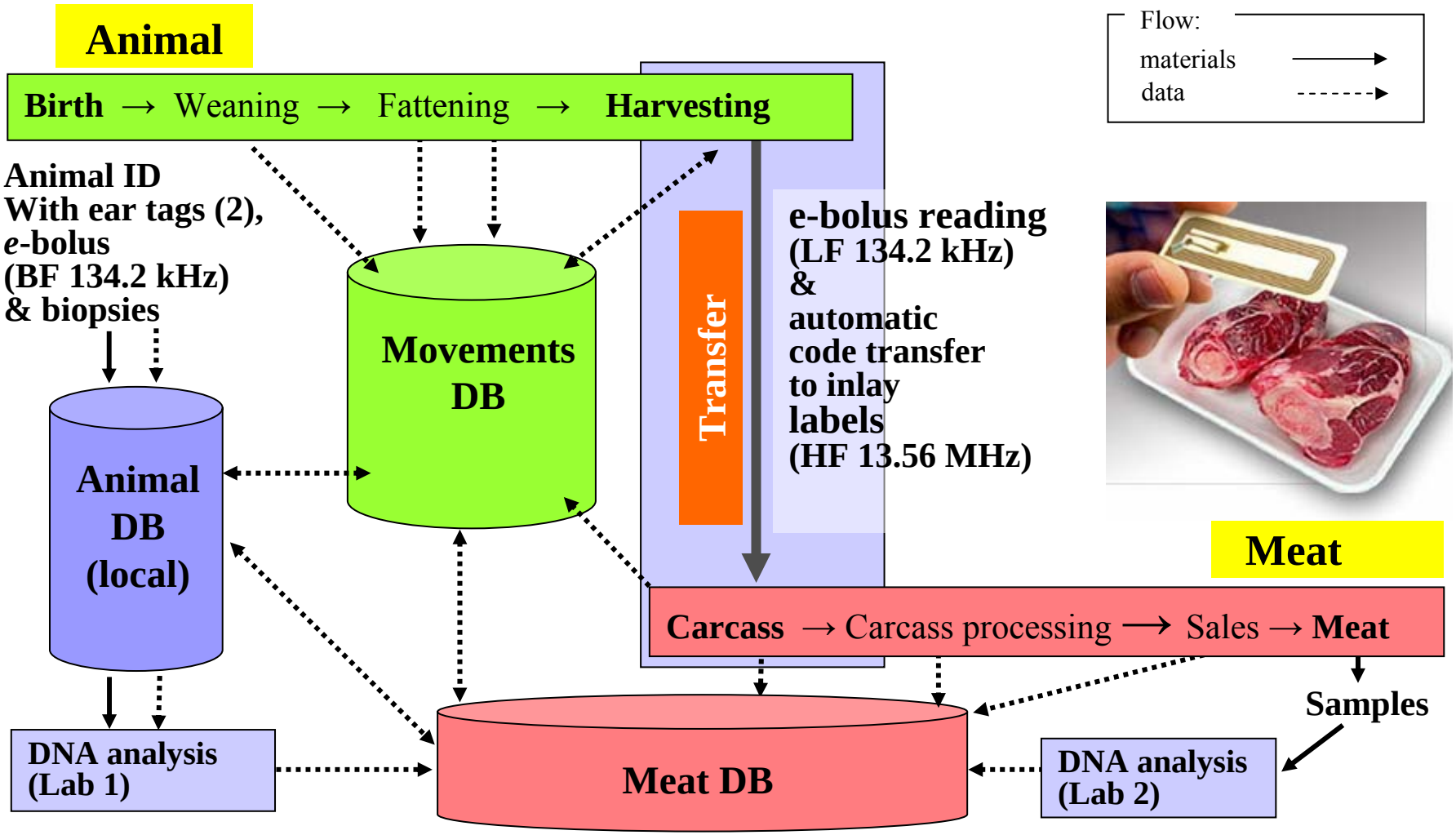
- **DNA analysis**: 5% samples (panel of 8-12 ISAG standardized microsatellites for sheep) in the ‘Servei Veterinari de Genètica Molecular’ of the UAB (Bellaterra, Spain).

Use of inlay labels (HF 13.56 MHz) for e-ID transfer in lambs



‘e-ID + DNA’: Data management from animal to meat

(Project FAIR 5, QLk1-02229)



From ‘farm to fork’ Data & DNA matching

‘e-ID + DNA’ : Results of traceability in intensively fed ‘Pascual’ lambs (n = 1.908)

(Projet FAIR 5, QLk1-02229)

	Ear tags		‘Mini’ e-boluses	
	S	**E1**	**B1**	**B2**
Applied, n	1,908	980	1,091	817
Lost, %	2.1	0.3	1.6	0
No readable, %	1.1	0	0	0
On farm traceability, %	**96.8^{c}**	**99.7^{b}**	**98.4^{b}**	**100^{a}**
Harvested, n			998	797
Bolus reads on-line, %			99.7	99.9
Labeled carcasses, %			98.0	100
Not recorded inlays, %			2.0	0
Harvesting traceability, %			**97.7^{b}**	**99.9^{a}**
Total traceability, %			**96.1^{b}**	**99.9^{a}**
Biopsies, n			868	
DNA analyzed, n (%)			50 (5.8)	
No matching samples, n (%)			1 (2.0)	
Matching, %			**98.0**	

Ear tags: S = Standard, E1 = Biopsier; Bolus: B1 = 9 g, B2 = 20 g (^{a,b,c} $P < 0.05$)

Conclusions:

- **On farm traceability:**
  - 'Tip tags'not enough retained (<97%) in intensive lambs for 3 mo.
  - 'Button ear tags' (biopsiers) better retained (>99%) than standard, but difficult to read.
  - e-Bolus retention varied according to bolus type and was >99% by using the appropriate bolus design.
- **Automatic e-ID reading** (LF, 134.2 kHz) **& transfer to inlays** (HF, 13.56 MHz): was possible under slaughterhouse conditions (> 98%), but should be improved.
- **Unmatching DNA was found in the 'farm to harvesting' process.**
- **Total traceability with the double 'e-ID + DNA' system was 98% (lambs).**

Thanks for your attention. For more information visit:

http://www.uab.es/tracing/

The European Commission (5th Research Program)
Project QLk1-2001-02229: 'EID + DNA Tracing'