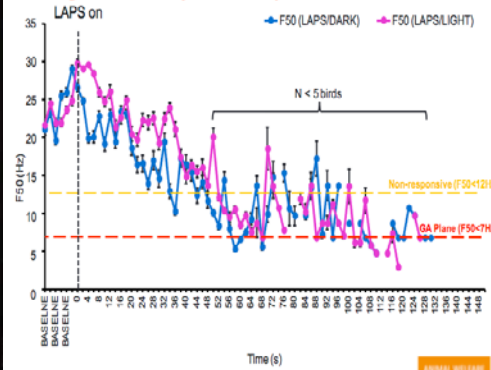




Results – LAPS in dark or light Trial 2 (EEG F50)



COMMISSION IMPLEMENTING REGULATION (EU) 2018/723

of 16 May 2018

amending Annexes I and II to Council Regulation (EC) No 1099/2009 on the protection of animals at the time of killing as regards the approval of low atmospheric pressure stunning

(Text with EEA relevance)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the functioning of the European Union,

Having regard to Council Regulation (EC) No 1099/2009 of 24 September 2009 on the protection of animals at the time of killing (1), and in particular Article 4(2) and point (b) of the first subparagraph of Article 14(1) thereof,

After consulting the Standing Committee on Plants, Animals, Food and Feed,

...

Low atmospheric pressure (LAPS) as new method for broiler stunning: effects on animal welfare, meat quality and safety

David G Pritchard

Animal Welfare Science and Practice London

Seminar “ Animal welfare, quality and microbiological safety of meat” Teramo Italy 22

November 2018,,

ANIMAL WELFARE
SCIENCE AND
PRACTICE

AGENDA

- Altitude and Physiology LAPS Development
- Why Laps is Needed
- LAPS Animal welfare Science evidence base; Physiology, Pathology Behavior Neuroscience
- EU Regulations
- Meat quality
- Safety Microbiological. Operator

LAPSINFO.COM

Effects of ambient temperature and water vapor on chamber pressure and oxygen level during low atmospheric pressure stunning of poultry

Paul H. Holloway and David G. Pritchard 2017 Poultry Science 0:1–12

<http://dx.doi.org/10.3382/ps/pex066>



ANIMAL WELFARE
SCIENCE AND
PRACTICE

WHY LAPS is needed?

- To replace
 - water bath electrical systems which are welfare unfriendly - EFSA 2004
 - gas systems - although **avoid live shackling** there is **no ideal system** (HAS 2005, EC 2012,)
- LAPS had both **lower economic and environmental costs** than gas systems and **improved the working conditions** (EC2012)

HAS 2005 <http://www.hsa.org.uk/downloads/technical-notes/TN12-gas-killing-of-chickens-and-turkeys.pdf>

EC 2012

http://ec.europa.eu/food/animals/docs/aw_practice_slaughter_study_stunning_poultry_en.pdf

What is Low Atmospheric Pressure stunning (LAPS)?

- Novel approach to pre-slaughter stunning (developed in the U.S.)
- Renders birds unconscious by progressive **hypobaric hypoxia**
- LAPS involves gradual decompression (280s cycle) according to a prescribed set of curves, which are temperature dependent
- Potentially shares advantages of controlled atmosphere stunning (CAS) systems (e.g. reliable irreversible stunning and no shackling or loading/unloading of birds while conscious).



Pilots' Altitude chamber

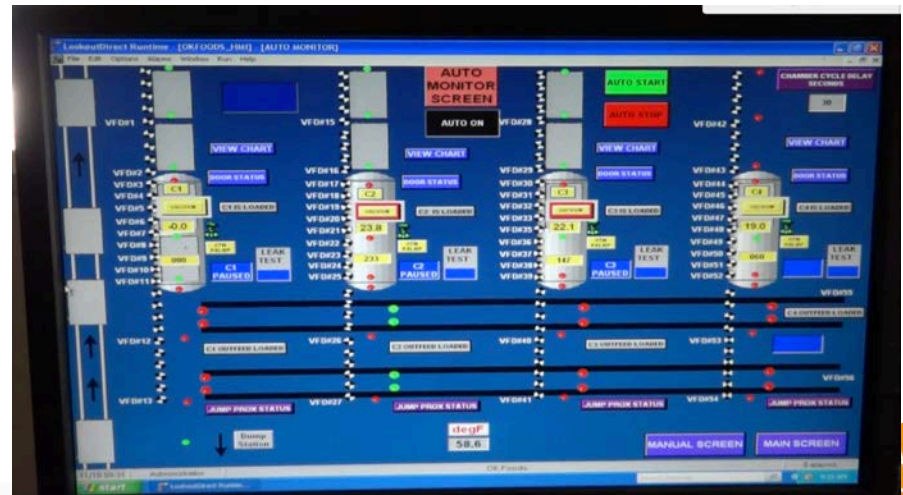


(CAMI's new altitude chamber delivered in 1998. The only chamber to date that meets the P.V.H.O. standards)



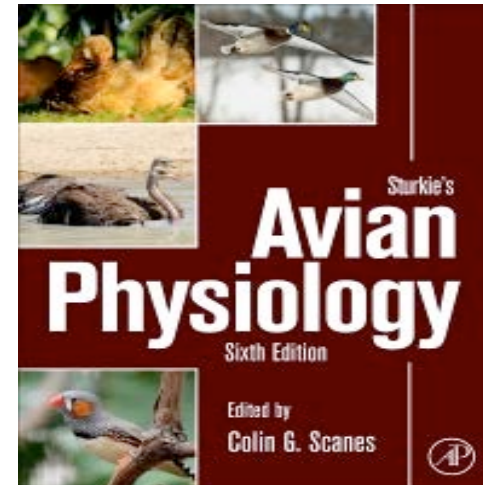
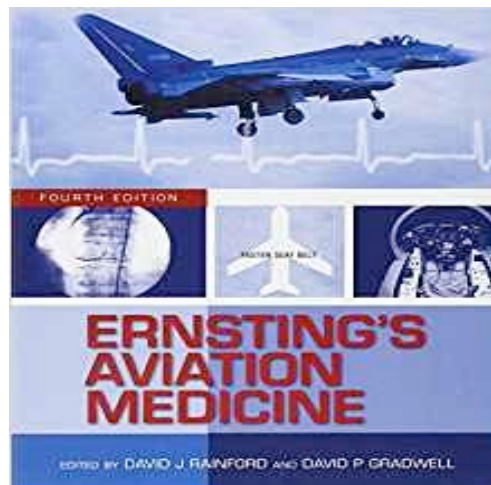
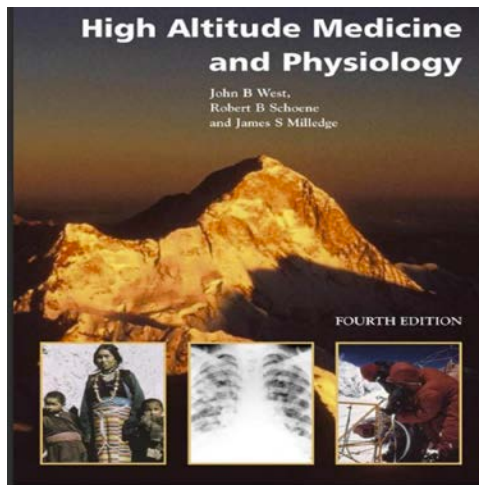
(Control Console with manual and computer controls)

LAPS



Scientific background to LAPS

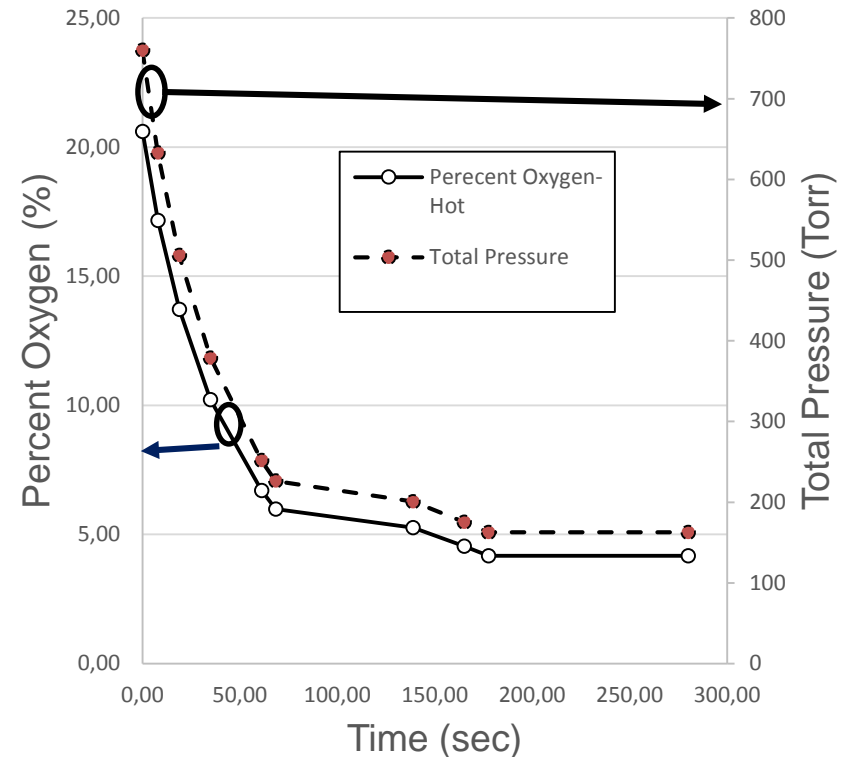
- ◆ Experiments on the effects of high altitude and low barometric pressure on animals and man resulted in large body of knowledge on
- ◆ **Decompression** – SLOW >10secs, RAPID <10, EXPLOSIVE <1 secs
- ◆ **Dysbarism** (medical conditions resulting from changes in ambient pressure.)



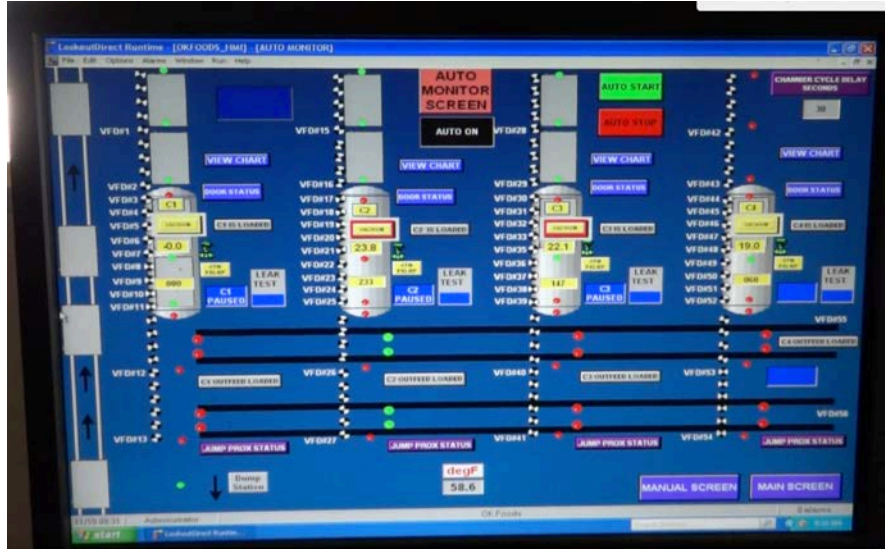
ANIMAL WELFARE
SCIENCE AND
PRACTICE

Technical challenge of LAPS

- ◆ The technical challenge of LAPS is to **precisely control the pressure reduction curve** to ensure poultry are irreversibly stunned with minimal discomfort with a cycle time which is economically viable.



PLC COMPUTER SYSTEM WITH HMI HUMAN MACHINE INTERFACE



PUMPS

DOORS & CRATES



Technical challenge of LAPS

Temperature and RH curve

- ◆ Adiabatic cooling,
- ◆ fog production and
- ◆ outgassing of water from surfaces influence the changes in temperature and relative humidity of the vacuum.

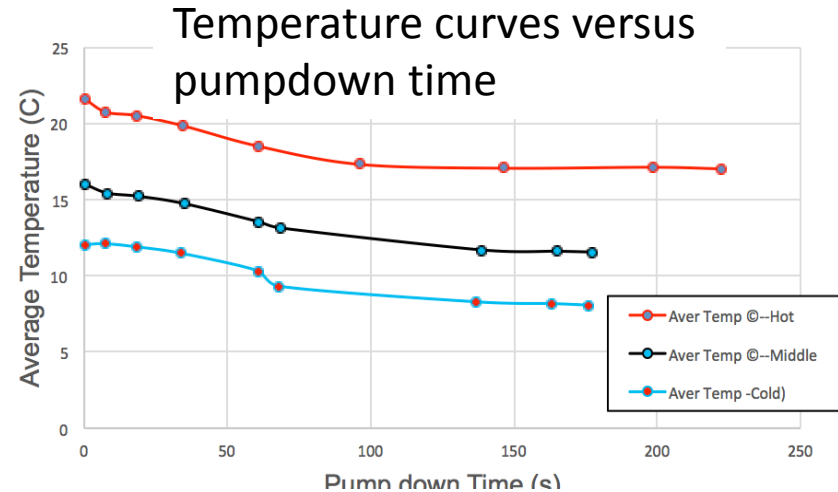


Figure A6/3. LAPS Chamber Temperature and RH for at temperature range 13 to 18 °C

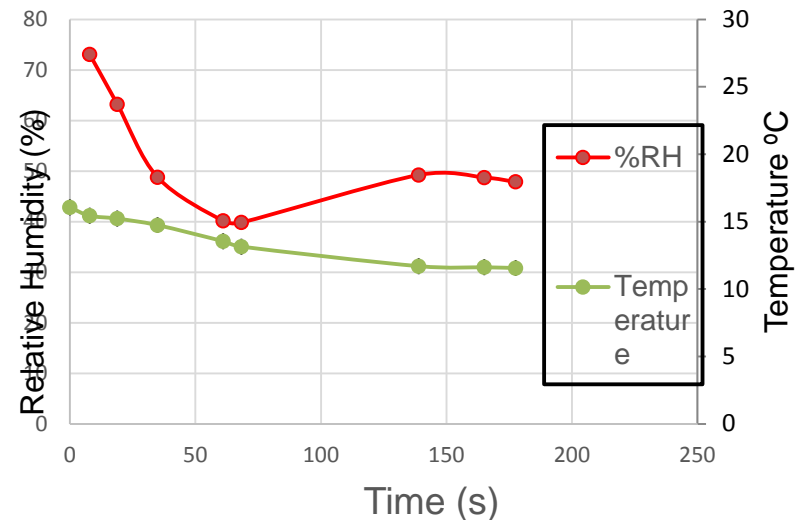
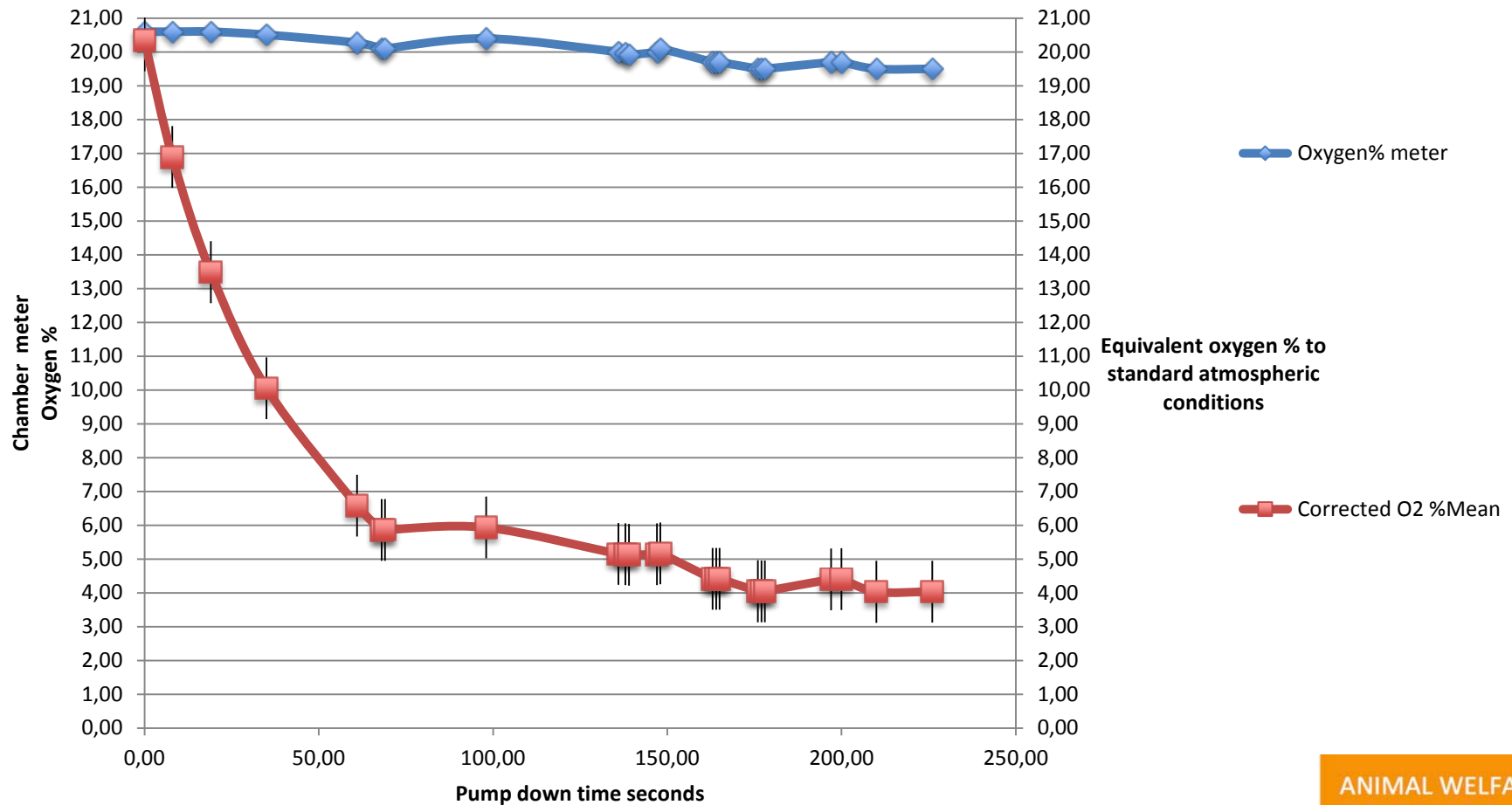


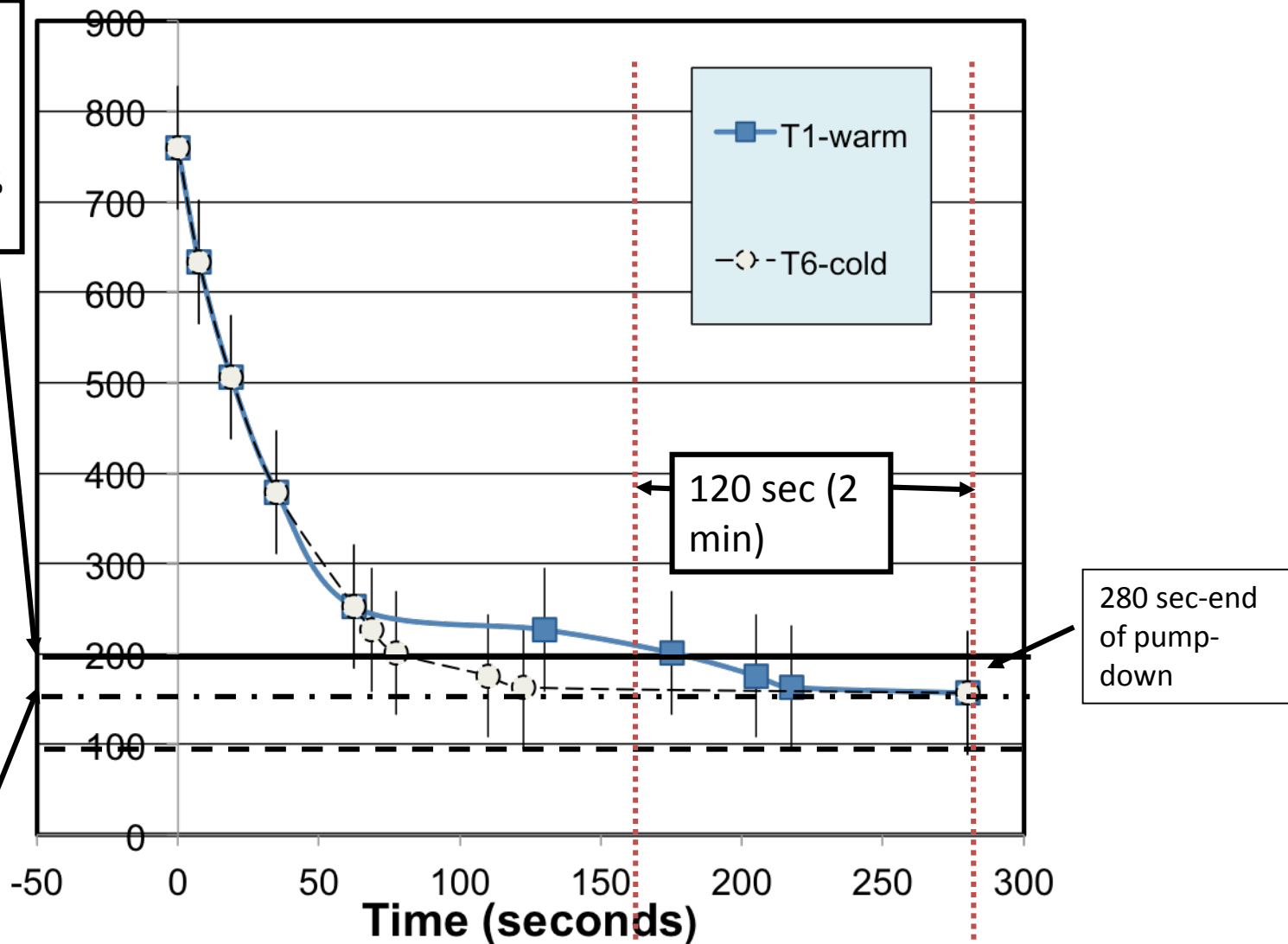
Figure A6/2 Meter % Oxygen and atmosphere equivalent O₂ (\pm SE) adjusted for chamber pressure and water vapour pressure versus pump down time
(10 runs at temperature range 13 to 18 °C)



200 Torr;
dry air-5.513% O₂;
30C, 70% RH-5.350%
O₂;
41C, 100% RH-5.090%
O₂

Absolute Pressure (Torr)

150 Torr;
dry air-4.16% O₂;
30C, 70% RH-
4.013% O₂;
41C, 100% RH-
3.817% O₂



USDA process for “no objection” 2010



- Checked whether new technology may affect :
 1. Inspection procedures ;
 2. Safety of Federal inspection personnel;
 3. Adversely affect product safety;
 4. FSIS Regulations
- **LAPS can slaughter poultry consistent with good commercial practice(GGP) (humanely)**
- Defined operational parameters for lapse time, decompression pressure and holding time times
- LAPS should result in minimal pain and distress during slaughter :
- Monitoring programme

Mobile Laps unit for killing for end of lay hens in Canada.



LAPs in use by Alberta Egg Farmers (2014-2018)

Video AEF and Dr. Mike Petrik <https://www.youtube.com/watch?v=41yNuAm4YvM&feature=youtu.be>
for killing end of lay hens



System can be used
for broilers, broiler
breeders, Turkeys or
layers



I found the system to
be efficient, quick
and very humane

EC legal Process for approval of new stunning method

1. Annex I may be amended to take account of **scientific and technical progress** on the basis of an **opinion of EFSA**.
2. Any such amendments shall ensure a level of animal welfare **at least equivalent to that ensured by the existing methods**
3. Amendment of Annex 1 of 1099/2009 by proposal from Commission to Standing Committee on Plants, Animals, Food and Feed (**PAFF Committee**) (Three months)

METHODOLOGY overview

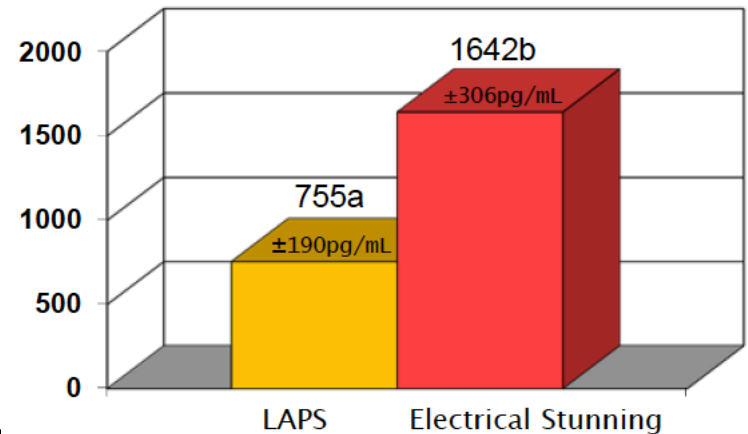


Vizzier Thaxton et al 2010 – Pathology conclusions

- **Meat quality as good or better than Electrical stunning**
- Minor inflammation of foci were observed HISTOLOGICALLY in the histopathology samples taken from LAPS-processed birds..
- This is a marked contrast to reports of haemorrhagic lesions found in the lungs, brain, and heart of animals undergoing rapid decompression (Van Liere 1943)

Comparison of LAPS and electrical stunning at commercial plant Vizzier Thaxton et al 2010

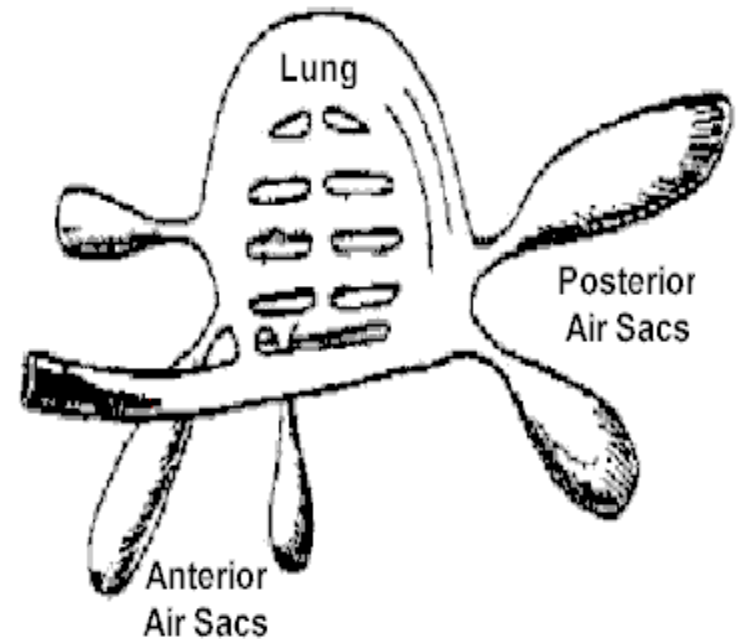
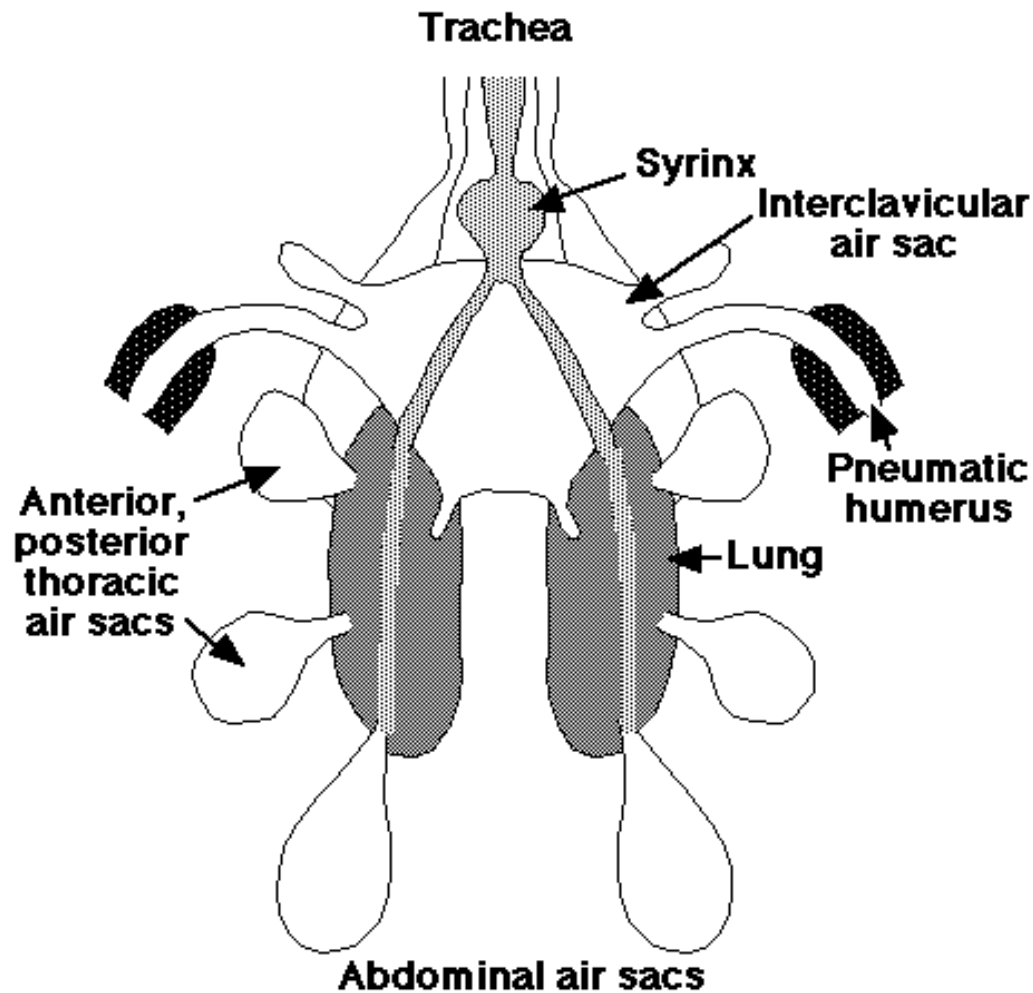
- Lower corticosterone in LAPS than electrical stunning
- No pathological changes in lungs , liver or muscle tissues
- No ear drum damage
- No aversion (escape behavior)
- No vocalisations
- Every bird is adequately stunned by LAPS
- Conclusion LAPS is a humane method of stunning



RISK OF DYSPBARISM IN CHICKENS

- ◆ Since chickens have lungs that do not expand during respiration, and air is moved in and out at the same time through a complex of air sacs it is unlikely that gasses would be trapped inside the abdomen of the bird unless the trachea was blocked (Vizzier-Thaxton et al., 2010)

Chicken respiratory system



Source: <http://numbat.murdoch.edu.au/Anatomy/avian/fig3.2.GIF>

EFSA 2013 Guidance On Studies for Stunning Interventions

EFSA Journal 2013; 11(12): 3436

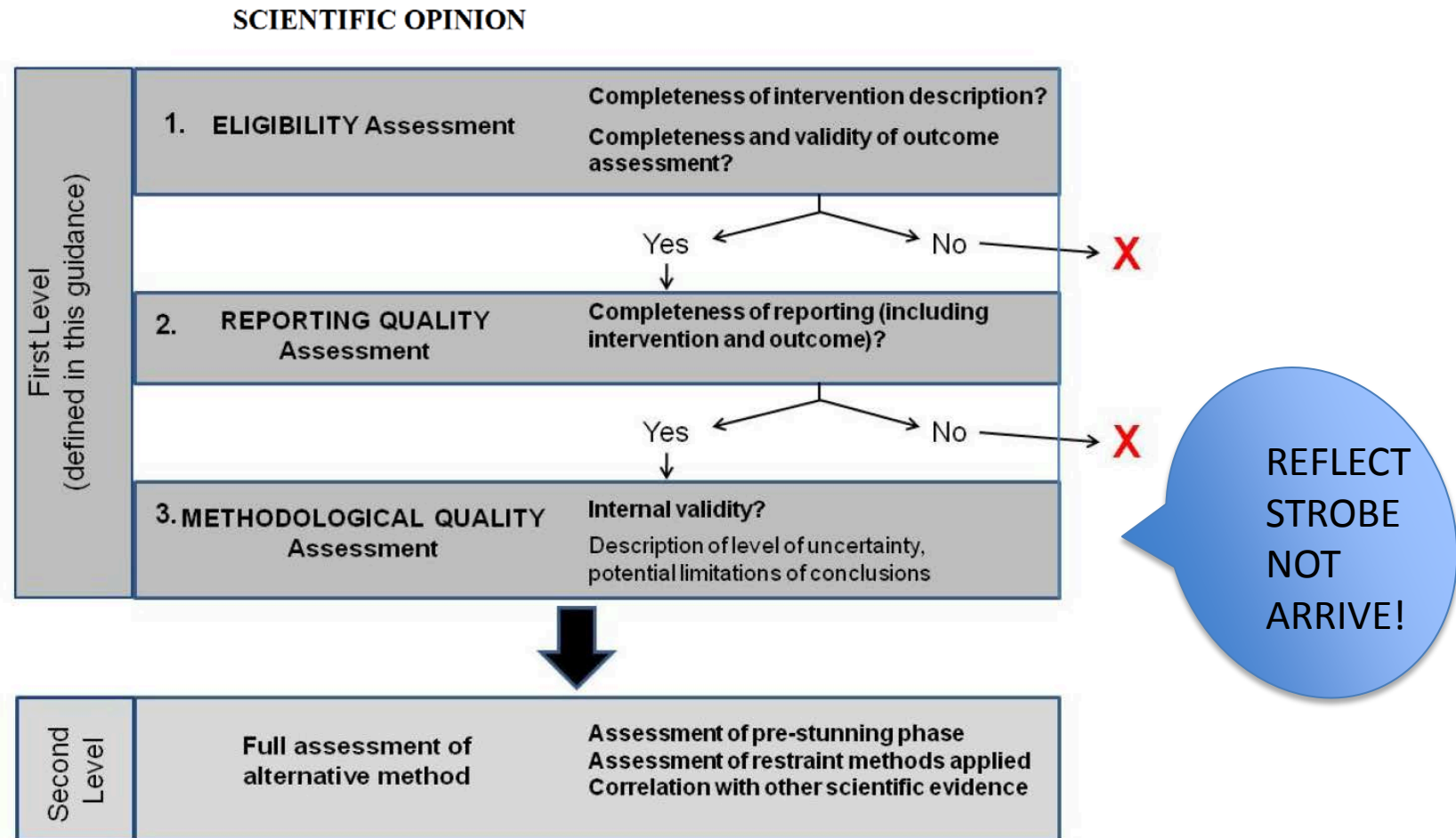
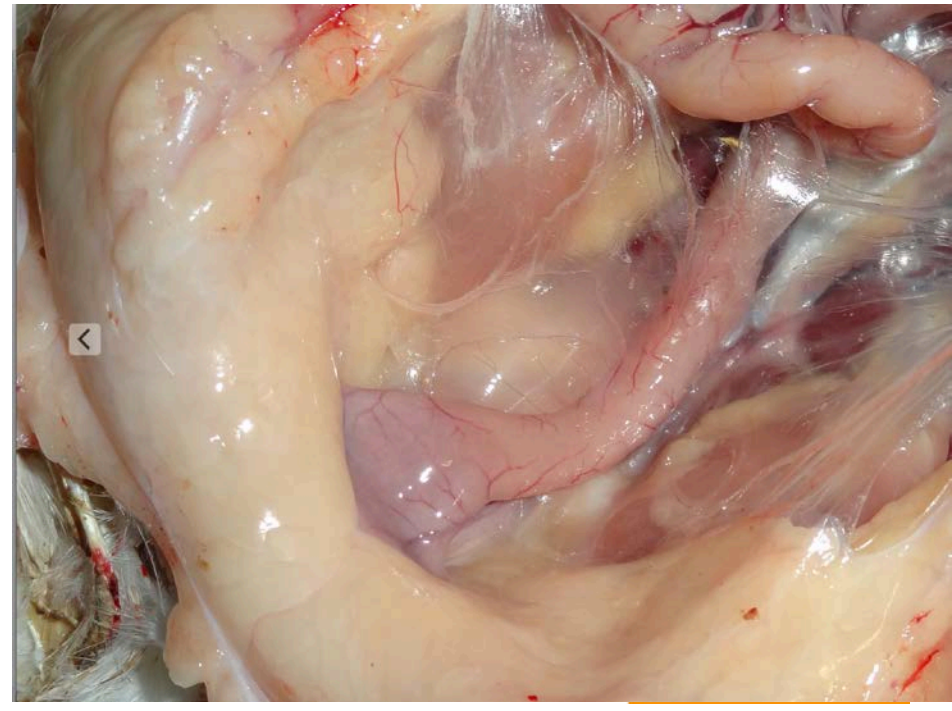
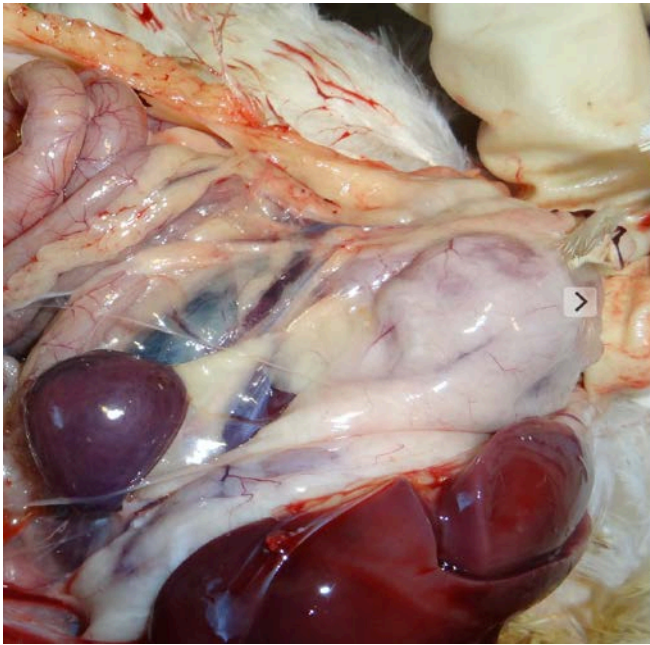


Figure 1: The approach to the assessment of studies evaluating alternative stunning interventions (X = exclusion of study from further assessment; in this case a description of the shortcomings and indications of improvements that are required before the study can be assessed further will be provided)

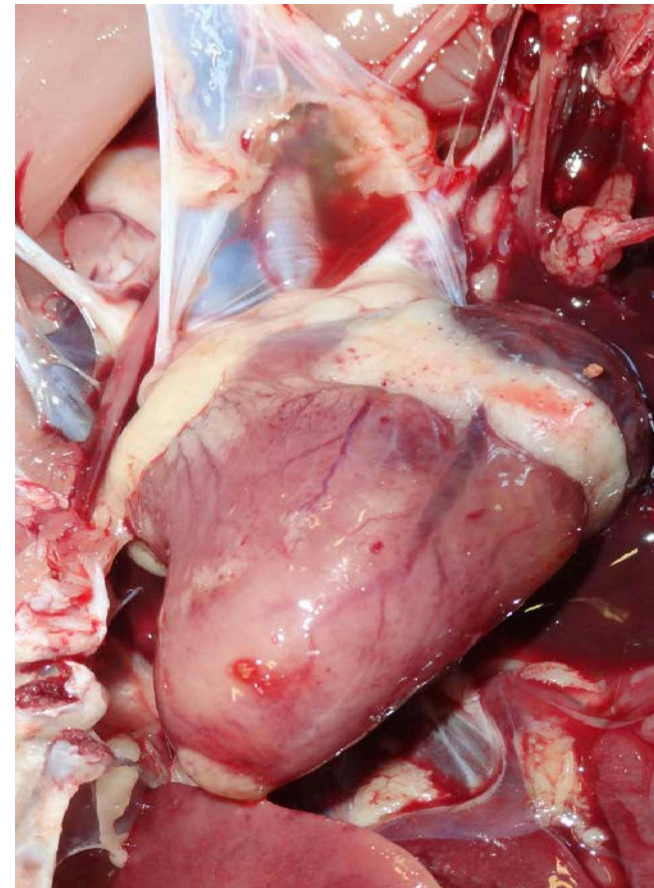
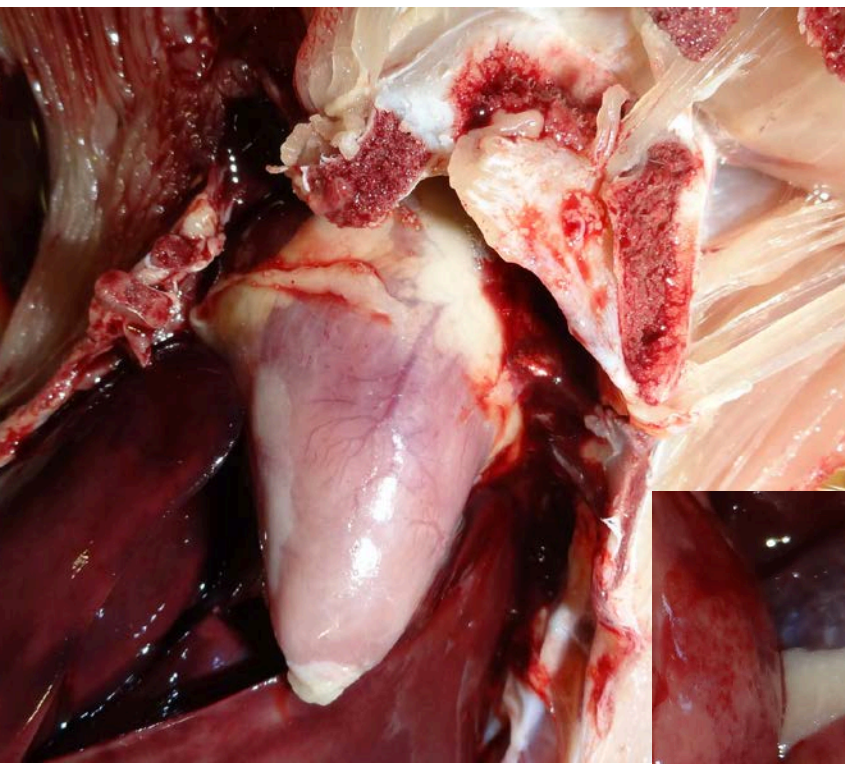
EFSA 2014 LAPS peer review

- *The submitted studies were peer-reviewed by the AHAW Panel as outlined in its “Guidance on the assessment criteria for studies evaluating the effectiveness of stunning intervention regarding animal protection at the time of killing”.*
- *“It is unclear from the submitted documents whether the rate of decompression used in LAPS induces unconsciousness and death without causing avoidable pain and suffering in poultry”.*
- **EFSA reported nothing to suggest that LAPS was not humane but that they needed further studies and more information to come to an opinion.**

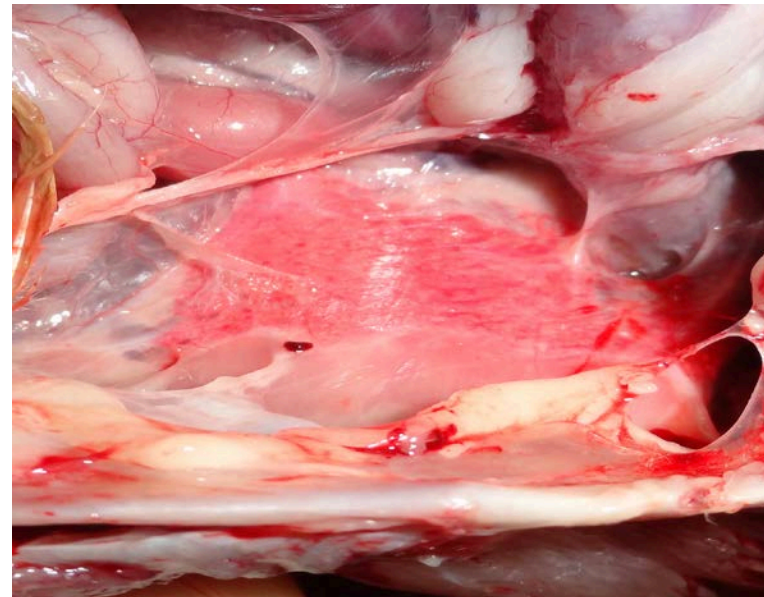
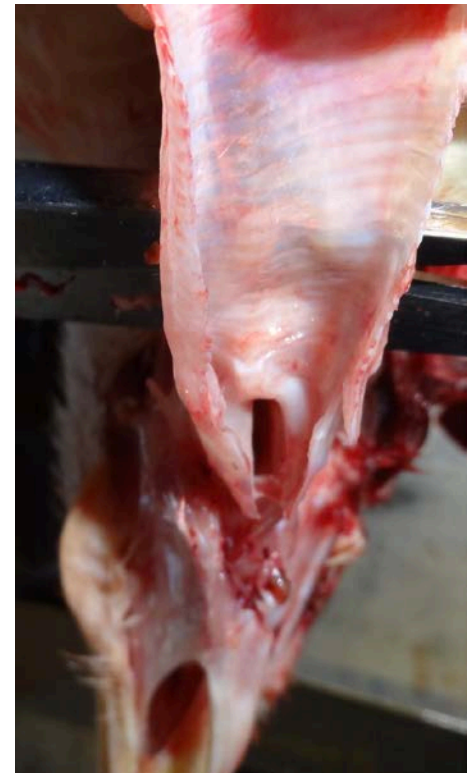
Ceolomic cavity
of three broilers
post LAPS
Fort Smith AK
10/ 11/2014



Hearts of broilers post LAPS Fort Smith AK 10/ 11/2014



Respiratory system post LAPS 10/ 11/2014



Aims of TechnoCatch Second Submission To European Commission

- ◆ International program of research funded by Technocatch and the Humane Slaughter Association developed to fully meet EFSA's requirements.
- ◆ This programme included further characterisation of the intervention and integrated behavioural, physiological and neurological studies using the best available techniques to assess bird welfare.

Humane slaughter assessment

Stunning methods are only acceptable when they result in **minimal signs of agitation and distress before loss of consciousness**



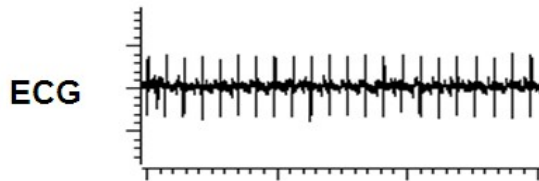
Behaviour / reflexes



Respiration

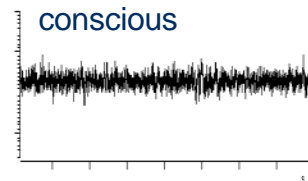
Assessment

Heart rate (ECG)

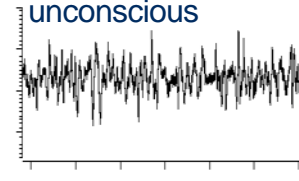


Electroencephalogram (EEG)

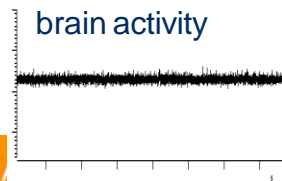
Awake -
conscious



Anaesthetised -
unconscious



Isoelectric – no
brain activity



Second submission 2016 LAPS papers

- ◆ Paper1 – Mckeegan 2013- EEG
- ◆ Paper 2- Thaxton 2010- Behaviour, Physiology, and pathology
- ◆ Paper 3 Schilling 2012 deboning, customer acceptance
- ◆ Paper 4 Battula 2008 product quality
- ◆

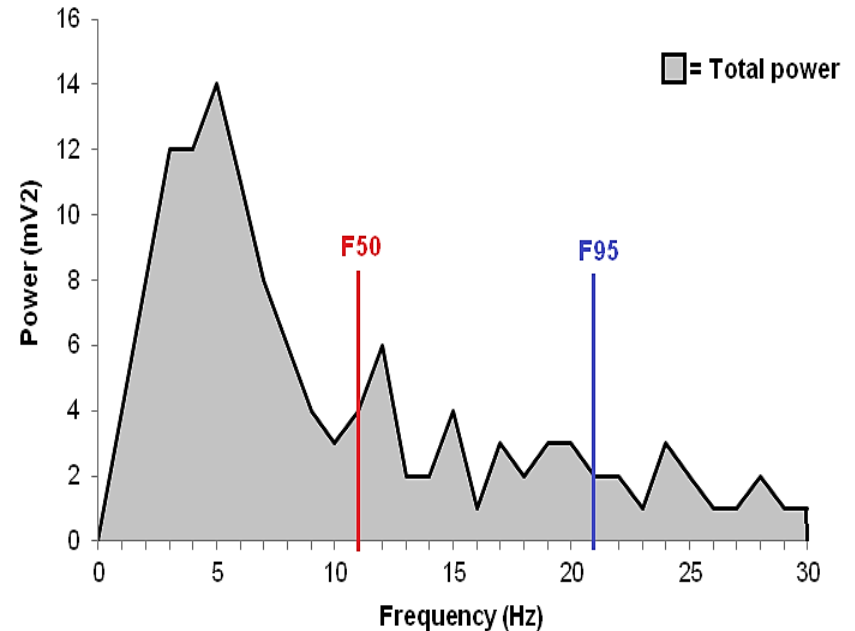
- ◆ Paper 5- Mackie 2016 Temperature - Behaviour
- ◆ Paper 6- Martin 2016- Pain- Behaviour
- ◆ Paper 7- Martin 2016- Temperature EEG ECG Behavior
- ◆ Paper 8 Martin 2016 -Sham EEG ECG Behaviour
- ◆ Paper 9 Holloway 2017 –Pressure, Temperature , RH O2.

LAPS: Onset of unconsciousness and insensibility

- ◆ Paper 1 used EEG and inferred movements
- ◆ Paper 2 used group behaviour
- ◆ Papers 7 and 8 on LAPS employed behavioural, Quantitative EEG indicators to assess state of consciousness.
- ◆ Used **validated spectral thresholds** for states of consciousness in chickens, (Sandercock et al 2013, Martin et al 2016) indicators derived from Fast Fourier Transformation of the EEG such as total power and median frequency .

Power spectrum analysis of the EEG

- Plots wavelength against power (amplitude)
- Time domain into frequency domain
- Objective numerical data from traces – PTOT and F50
- Compare EEG characteristics at different time points



State	Key spectral ranges
Non-responsive	F50 < 12.7Hz
General anaesthetic plane	F50 < 6.8Hz
Isoelectric (brain death)	PTOT < 170mv; F50 > 22Hz

(Sandercock et al 2014; Martin et al 2016a, 2016b)

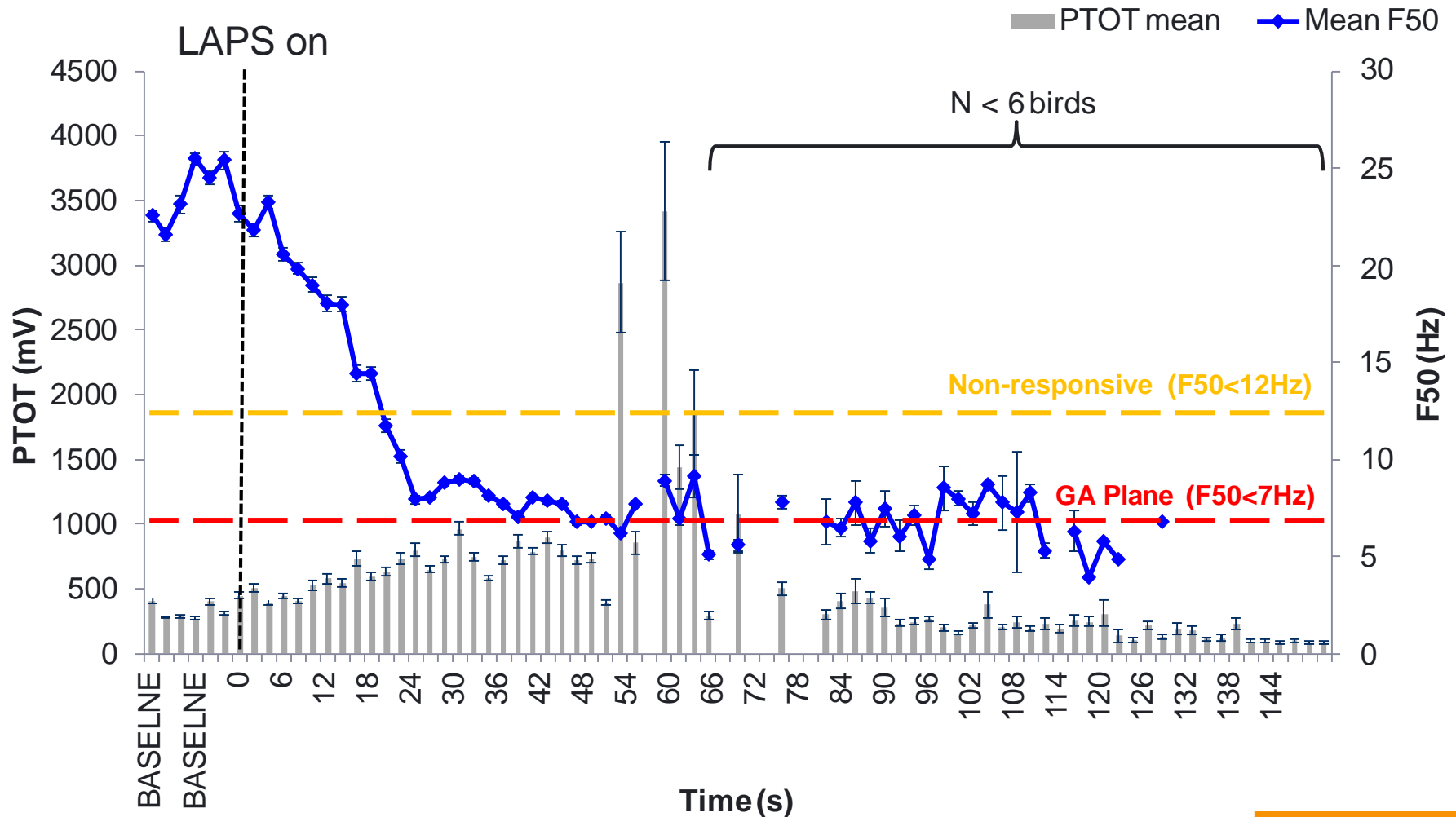
Objectives

- Trial 1: Behavioural, brain and cardiac responses to LAPS in broiler chickens
 - 1st Aim: Examine broiler responses to LAPS through behavioural, electroencephalogram (EEG) and electrocardiogram (ECG) recordings.
 - 2nd Aim: Effect of 2 temperature settings on broiler responses to LAPS.
- Trial 2: Effects of light on responses to LAPS in broiler chickens
 - Effect of illumination and sham treatment on broiler responses, through behavioural, electroencephalogram (EEG) and electrocardiogram (ECG) recordings.



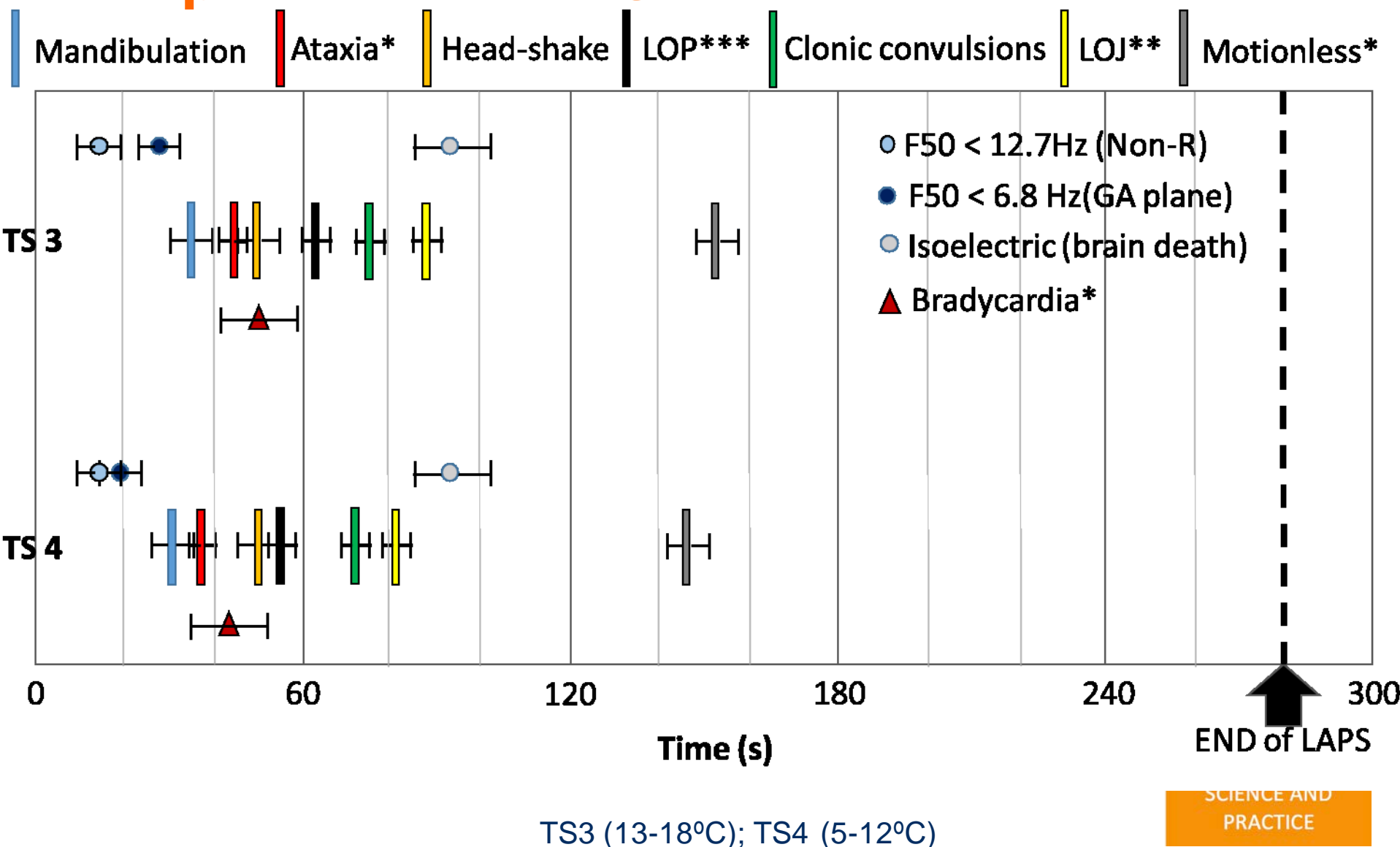
All work conducted under EU Directive 2010/63 and authorized by the University of Arkansas Institutional Animal Care and Use Committee.

Results – Trial 1 (EEG F50, PTOT)



Results – Trial 1

Behavioural, brain and cardiac responses to LAPS in broiler chickens



Methods – Trial 2

Effects of light on responses to LAPS in broiler chickens

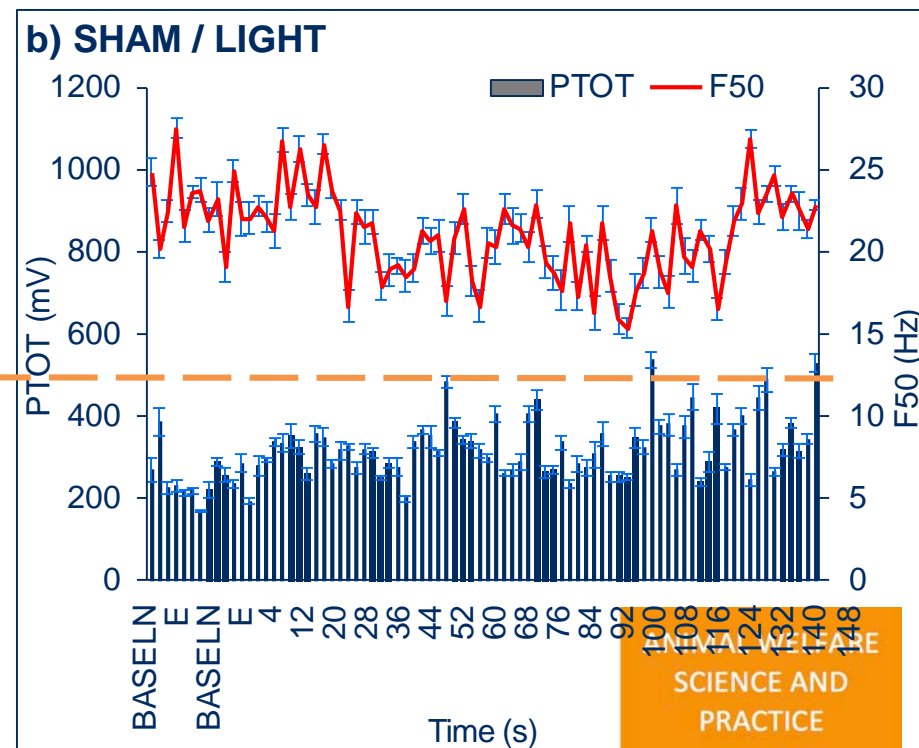
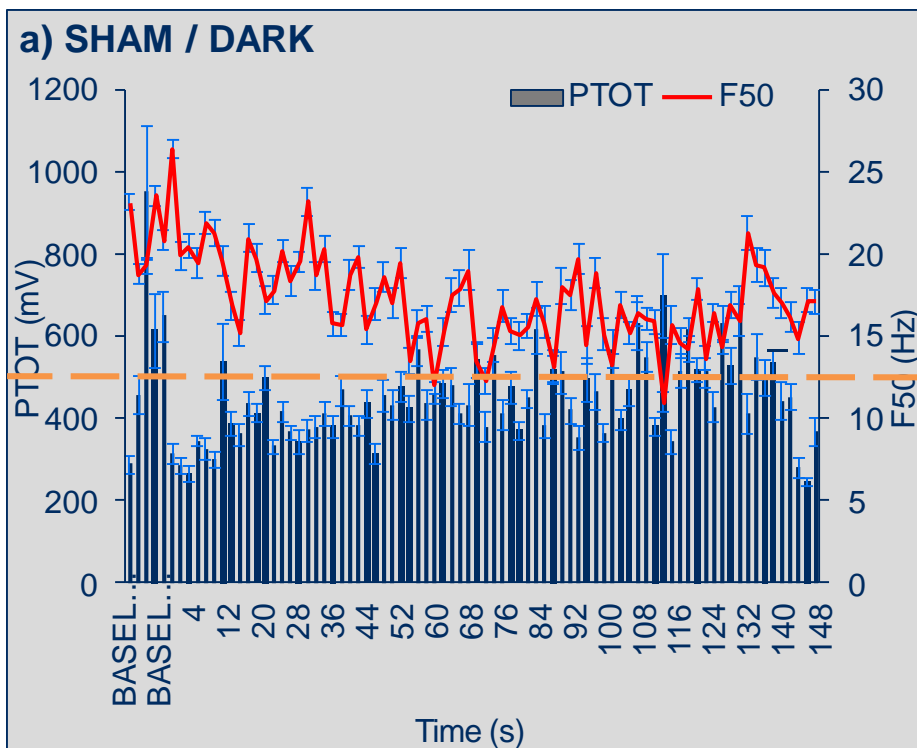
- 2x2 factorial design: LAPS/dark, LAPS/light, SHAM/dark, and SHAM/light
- SHAM = 280s in chamber without LAPS
- All LAPS cycles at TS4 only
- 20 pairs of Cobb 550 male broilers at 44-45d of age per treatment (mean weight $3.0 \pm 0.4\text{kg}$)
- In each pair, one bird was instrumented for recording of EEG and ECG responses
- Behaviour (e.g. LOP, ataxia, etc.) recorded as before



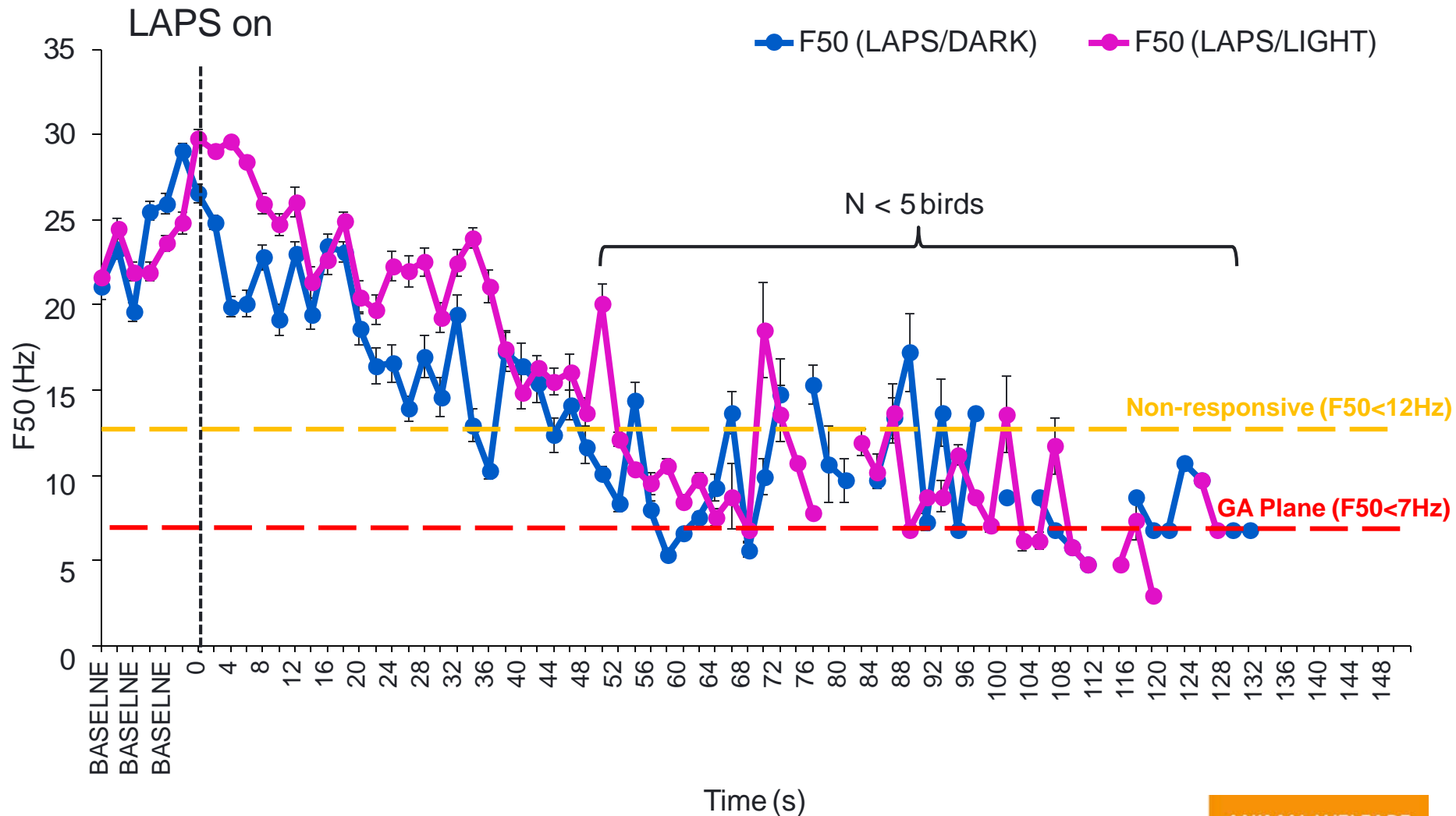
Results – Trial 2 (shameffects)

Effects of light on responses to LAPS in broiler chickens

- In **SHAM** treatments birds:
 - displayed “conscious” behaviours (e.g. stand/sitting) and did not display LOP, ataxia or motionless.
 - displayed sleep-like EEG waveforms (illumination^{***})
 - bradycardia and brain death absent



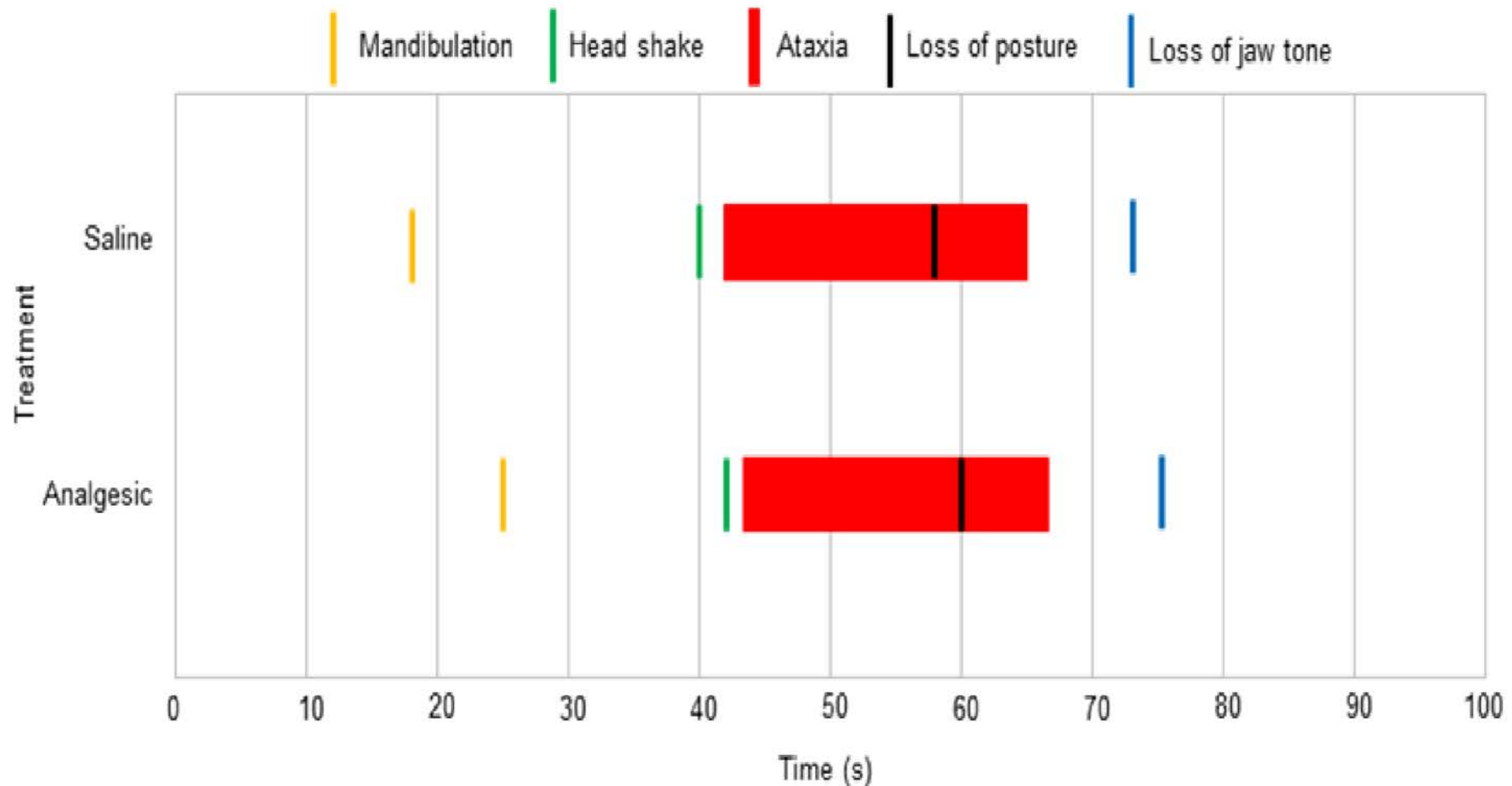
Results – LAPS in dark or light Trial 2 (EEG F50)



LAPS: Animal based measures in relation to pain, distress and suffering

- ◆ Four approaches were used to assess LAPS:
- ◆ Detailed **behavioural** analysis (papers 2, 5, 6, 7, 8)
- ◆ **Analgesic** intervention paradigm (paper 6)
- ◆ **Sham** paradigm as recommended by EFSA (paper 8)
- ◆ Assessment of **synchronisation of EEG** in conscious birds (papers 7 and 8)

Summary of Randomised controlled analgesia trial



Conclusions LAPS analgesia study

- ◆ These findings support the notion that during the period of the gradual reduction of pressure in LAPS the behavioural responses seen are primarily related to exposure to hypoxia rather than hypobaric conditions.
- ◆ No studies on pain during controlled atmospheric stunning with inert gases or carbon dioxide have been published and this study is the first such attempt to assess pain during stunning using modifications of behaviour following analgesic treatment.
- ◆ The patterns of behaviour are similar to those seen in normobaric hypoxia using inert gases, and **thus in terms of welfare, this stunning method is equivalent to controlled atmosphere stunning with inert gases.**

Overall conclusions

- Consistent sequence of behaviours in LAPS: ataxia, loss of posture, clonic/tonic convulsions and motionless
- Maintenance of dark induced slow-wave EEG patterns in the early part of LAPS (while birds are still conscious) is strongly suggestive that LAPS is non-aversive.
- Effects of LAPS/sham primarily related to the presence/absence of hypoxia
- Recommendation that LAPS is carried out in darkness, as is currently the case commercially.
- Behavioural and EEG responses to LAPS are indicative of a process that is largely equivalent to controlled atmosphere stunning with anoxic gases.
- This evidence is part of a project which has been presented to EFSA to facilitate approval of the method in the EU.

MAIN OUTCOMES OF THE ESFA 'S (2017) OPINION ON LAPS

- ◆ LAPS should be approved for use in the EU and current legislation should be amended
- ◆ EFSA Expert judgment study ranked LAPS as having the lowest welfare hazards for stunning systems.
- ◆ Comparing LAPS to either Waterbath or Gas stunning **using objectively measurable criteria is not possible as little research using the same scientific methods has been conducted on the other stunning systems**

OUTCOMES – Hazards ranking

Method	Hazard	Rank estimate (n=19)	Min	Max
W	Unintended electric shock	12	11	12
W	Needle			
W	Bleeding			
G	Acid			
W	Harsh lighting			
G	Respiratory mix			
L	Gas intake			
L	Restraint			
W	Harsh			
G	Tipping / Tilting	3	3	3
L	Noise	2	1	2
L	Decreasing air humidity	1	1	2

Results (with lower scores meaning lower welfare risk):

LAPS - 3.5,
 CAS with carbon dioxide -7,
 Electrical Waterbath Stunning - 10.
 LAPS has lower welfare hazard scores than both of the currently allowed systems.

L = LAPS
 G = gas
 W = waterbath

$L \leq G < W$

Wilcoxon Rank
 Sum Test
 Stat = 28,
 p-value = 0.025

EFSA Expert judgment

SCILAPS*

<http://www.lapsinfo.com/>

<u>STUNNING METHOD</u>	<u>FACT/OPERATION /PROCESS IN CONCIOUS ANIMALS</u>	<u>DESCRIPTION OF WELFARE CONCERN</u>	<u>RANK ESTIMATE</u>	<u>COMMENTS ON WELFARE CONSEQUENC ES*</u>	<u>REFERENCE FOR COMMENT</u>
<u>L</u>	<u>Noise</u>	<u>Being exposed to a sudden unexpected loud noise</u>	<u>2</u>	<u>Birds show vigilance for a few seconds at start of pressure cycle.</u>	<u>Martin et al, 2016a [29] Martin et al, 2016b [30] Martin et al, 2016c [31]</u>
<u>L</u>	<u>Potential gas expansion in body cavities/internal organs</u>	<u>Potential expansion of the gases contained in the intestine, the air sacs, and the internal ear due to a reduction of the atmospheric pressure in the environment</u>	<u>9</u>	<u>Detailed pathological examinations including internal organ, facial sinus, and ear drum inspection provide no evidence of damage during the LAPS decompression.</u>	<u>Vizzier-Thaxton et al, 2010 [42] USDA, 2010 [40] CFIA, 2013 [3] EFSA, 2017 [15]</u>

* By Pritchard DG, McKeegan DEF, and Martin JAK, 2018 on behalf of the authors of the papers and 2016 Application to the European Commission for approval of use of LAPS in Poultry in the Member States of the European Union

Commission implementing Regulation EU 2018/73 states:

- ◆ Following opinion of SCOPAFF
- ◆ LAPS can be used for killing for “depopulation”
- ◆ Amends Annex I to add LAPs to list of approved methods
- ◆ Amends Annex II re layout, construction and equipment

Addition to ANNEX I

Table 3- Controlled atmosphere methods

No	Name	Description	Conditions of use	Key parameters	Specific requirements of Chapter II of this Annex
'7	Low atmospheric pressure stunning	Exposure of conscious animals to gradual decompression with reduction in available oxygen to less than 5 %.	Broiler chickens up to 4 kg live weight. Slaughter, depopulation and other situations.	Rate of decompression. Duration of exposure. Ambient temperature and humidity.	Points 10.1 to 10.5

IMPLEMENTATION OF LAPS IN MEMBER STATES

- ◆ May be no need for national legislation.
- ◆ Administrative procedures same as any new system being installed in a plant namely:
 - Instruction/ training by National competent Authority (CA) to/of officials and advice to industry.
 - Manufacturers instructions
 - Training /certification of operatives
 - Standing Operating procedures for all LAPS processes (Unloading, lairage, movement , restraint, stunning, checks, bleeding)

Improvements in meat quality with Gas stunning CO₂

- ◆ ES, Gas CO₂ and LAPS methods differs in their mechanisms of stunning,
- ◆ Rigor mortis patterns are more rapid on Gas (Raj 1990) (and in LAPS), than electric stunning (Some Low voltage Electrical stunning also has rapid rigor mortis)
- ◆ Differ in physical meat characteristics.
- ◆ CO₂ VS ES Reduced blood spots in breast and thigh muscle **(Hoen and Lankhaar 1999) due to less convulsions)**
- ◆ Increased breast meat tenderness was reported when compared to ES when stunning was conducted at level of 40 or 45% CO₂ (Raj *et al.* 1990a· Fleming *et ell.*, 1991)

Inert gas stunning (AR, Nitrogen)

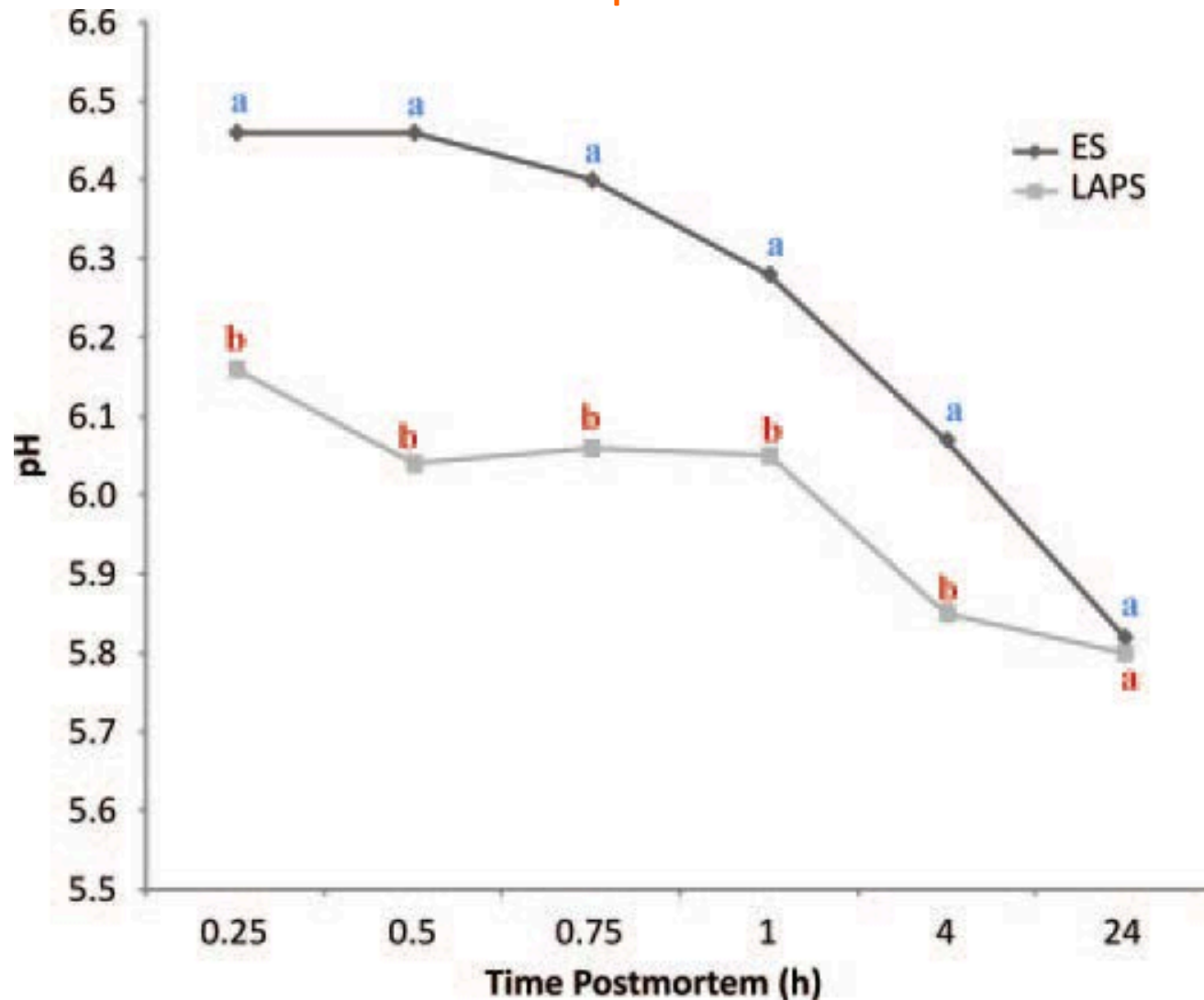
- ◆ CON: Raj *et al.* (1992) observed a higher incidence of **wing damage in poultry** subjected to inert gas stunning in comparison to electrical stunning (EU electrocution) which was attributed to the severe convulsions during inert gas stunning.,
- ◆ McKeegan *et al.* (2007) concluded that a combination of **CO₂ and O₂** provided an advantage to poultry processors since there are a lower percentage of **fractured wings (1.6 vs. 6.8)** as compared to broilers subjected to stunning with **argon**
- ◆ McKeegan *et al.* (2007) also reported greater susceptibility of the birds to exhibit agitated behavioural responses, including wing-flapping, jumping, twitching, and paddling along with severe convulsions, when stunned by a gas mixture containing argon, which could lead **to carcass quality defects such as fractured wings and fillet haemorrhages.**
- ◆ PRO: Raj and Gregory (1991) concluded that argon stunning resulted in fewer muscle haemorrhages, a more rapid decrease in early *post mortem* pH, and an earlier deboning time for breast meat when compared to electrocuted broilers

LAPS and meat quality Battula *et al.* (2008)



- ◆ **similar L^* values** (56.1) in breast meat from LAPS birds deboned after 4 h *post mortem*, compared to those from electrically stunned (US) birds (L^* value= 57.3).
- ◆ The a^* value (**redness**) was 1.6 and 1.3 in LAPS and electrically stunned (US) carcasses respectively, while the b^* value (**yellowness**) was 1.8 and 2.1.
- ◆ No differences were observed in **shear force** (19.9N - 20.6N), pH 24 h *post mortem* (5.99 - 5.95),
- ◆ and **consumer acceptability** among breast meat from electrically stunned (US) or LAPS birds and the authors concluded that both stunning methods yield high-quality breast meat with minimal product differences) compared the effect of LAPS and electrical stunning (US) on broiler breast meat quality and consumer acceptability times.

Schilling 2012 -Decline of broiler breast meat (n = 144) over time postmortem from broilers that were stunned through electrical stunning (ES) and low atmosphere pressure stunning (LAPS). Different letters at each time postmortem indicate a difference



Schilling et al 2012 Meat parameters ES vs LAPS

LOW ATMOSPHERE STUNNING EFFECTS ON MEAT QUALITY

3219

Table 1. The effects of stunning method (LAPS or electrical) and deboning time on the color, pH, brine absorption, and cooking loss of broiler breast meat

Treatment ¹	Ultimate pH	CIE ² L* (lightness)	CIE a* (redness)	CIE b* (yellowness)	Brine absorption (%)	Cooking loss (%) marinated	Cooking loss (%) nonmarinated
LAPS0.75H	5.9 ^a	58.2 ^b	1.8 ^a	6.2 ^a	14.6	19.6 ^{ab}	24.6 ^a
ES0.75H	5.9 ^a	56.6 ^c	0.6 ^c	4.6 ^c	14.3	17.1 ^c	22.5 ^b
LAPS4H	5.8 ^a	59.7 ^a	1.6 ^a	4.9 ^{bc}	13.5	19.9 ^a	22.5 ^b
ES4H	5.9 ^a	59.9 ^a	1.0 ^b	5.2 ^b	13.4	18.3 ^{bc}	22.0 ^b
SE	0.03	0.73	0.23	0.66	0.63	0.58	0.65

^{a-c}Means within a column with the same letter are not significantly different ($P < 0.05$).

¹LAPS = low atmospheric pressure stunning; ES = electrical stunning; H = hours deboned after slaughter.

²CIE = Commission Internationale d'Eclairage.

The study conducted in commercial settings revealed that the LAPS system could be successfully used in poultry plants without detrimental breast fillet quality problems with respect to color, texture, and consumer acceptance, in comparison with electrical stunning..

Sensory quality of LAPS and ES stunned broiler breast meat deboning time (0.75 and 4H) and cooking methods baking, frying, and sous vide

- ◆ Larger proportion of consumers liked the 4 h LAPS and ES treatments when compared to the 0.75 h LAPS and ES treatments for all cooking methods.
- ◆ No differences between fried and sous vide cooked breast meat
- ◆ The LAPS treatment that was deboned at 4 h had enhanced sensory characteristics when oven baked compared with 0.75 H and 4h ES
- ◆ Schilling and co-authors concluded their study revealed that both the stunning systems can be successfully used in commercial poultry plants without detrimental breast fillet quality problems with respect to colour, texture and consumer acceptance.
- ◆ M. W. Schilling V. Radhakrishnan Y. Vizzier-Thaxton K. Christensen J. B. Williams P. Joseph Sensory quality of broiler breast meat influenced by low atmospheric pressure stunning, deboning time and cooking methods Poultry Science, Volume 94, Issue 6, 1 June 2015, Pages 1379–1388, <https://doi.org/10.3382>

Can Gas expansion lead to meat quality or food safety issues?

- ◆ Gas expansion the intestines depends on the diet and gut fill and the rate of decompression. and recompression at end of the cycle. The GI tract is an open tube and gas in stomach is readily expelled as it is in the large bowel and rectum.
- ◆ Except for the caecum the intestines are not a closed cavity. It is closed cavities such as pockets in teeth or blocked sinuses or middle ear which do cause pain in man but more on descent and rarely on ascent.
- ◆ The decompression rates in LAPS are similar those in a military Jet and designed to allow for the animals to accommodate to the changes in pressure so to allow animals to adjust to changes in pressure .
- ◆ Post mortem studies of chickens which have undergone LAPS have not found any signs of gross damage to the GI tract..



Effect of LAPS on animal welfare and meat quality WIN WIN

- ◆ Gas and LAPS avoid live hanging and therefore have great welfare advantage over Electric stunning . This reduces stress and thereby improves meat quality
- ◆ Note some Gas systems require dumping of live birds on conveyors which may cause some stress and injury thereby possibly reducing meat quality and yield.
- ◆ With regard to LAPS extensive studies have shown that LAPS is humane and there is no evidence of pain and distress during the induction phase whilst birds are conscious.
- ◆ Following loss of consciousness wing flapping and paddling can occur in both CO₂ and Anoxic gas as well as LAPS . These may result in haemorrhages in wing and leg muscles but overall meat yield and meat quality is reported to be higher in Gas and LAPS than with ES

PURPOSE OF FEED WITHDRAWAL (FW)

“The purpose of FW is to enhance the clearance of the gastrointestinal tract and to reduce contamination of poultry carcasses.”(May and Lott 1990)

Most utilized definition of FW is “the total length of time between raising the feeders to the cage placed on the receiving line in the back of the plant”

Average FW time in the US = 8-12hrs

Feed withdrawal /Emptying bowel

- ◆ In chickens, LAPS results in emptying the contents of the large bowel from cloaca to caecum and so reduces the overall bacterial load entering the plant .
- ◆ This does allow shortening of the feed withdrawal time for broilers but no scientific studies
- ◆ Economic evaluation of shortened feed drawal leading to reduction in weight loss during transport and lairage indicates this can add up to 0.5% meat yield s on this .

Colon and Coprodeum Contents

POST ELECTRICAL
STUNNING



IMAGE:JEFF BUHR USDA

POST LOW PRESSURE
ATMOSPHERIC STUNNING (LAPS)



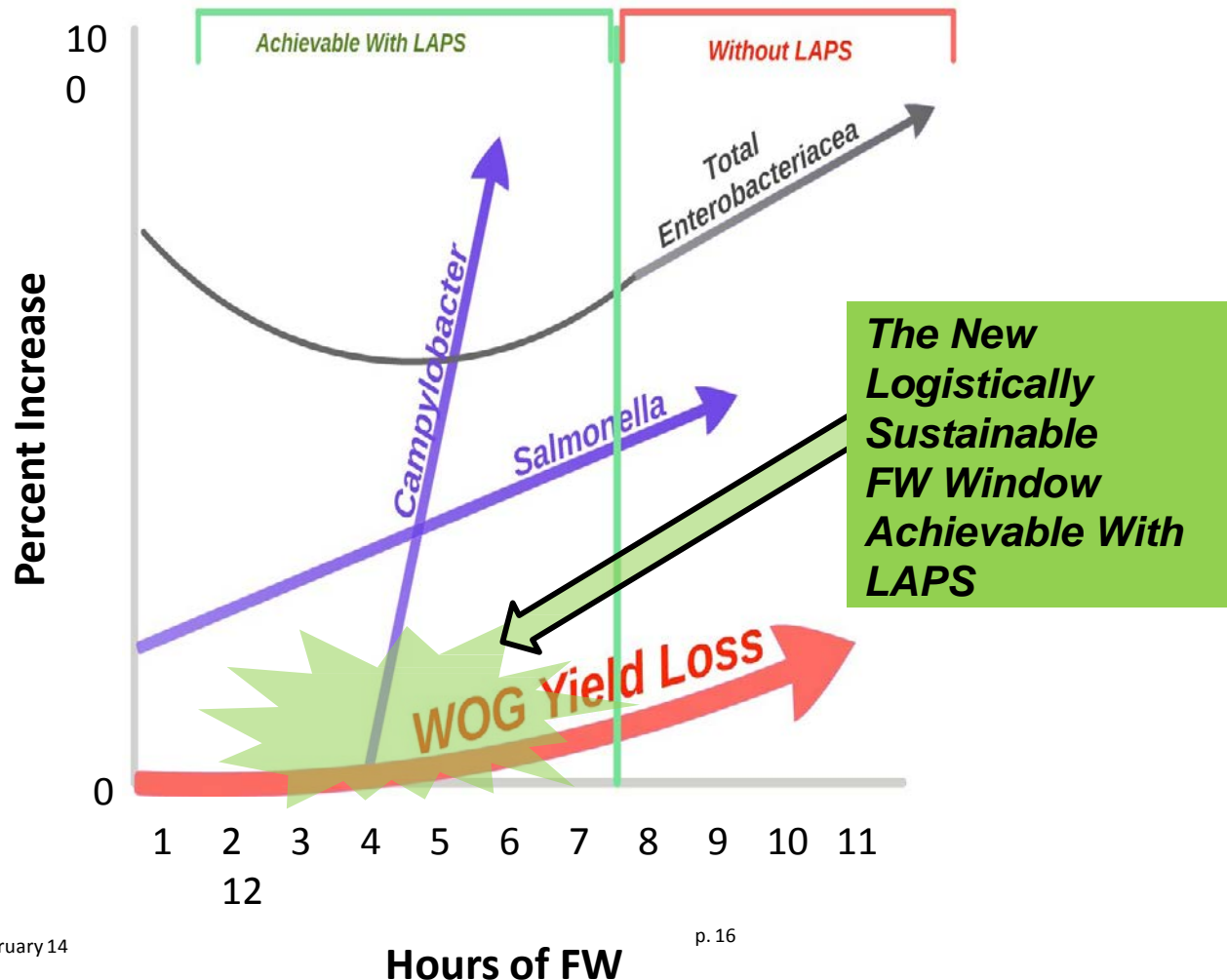
IMAGE:JEFF BUHR USDA

Large intestine empty post LAPS



<https://www.youtube.com/watch?v=PaJjJ6zk894>

LAPS Provides Access to the Financial Benefits Provided by Less Than 8 hour FW



SUMMARY OF LAPS BENEFITS

- LAPS offers significant advantages over other commercial methods of slaughter, from animal welfare, operational and economical perspectives.
- Shorter Feed Withdrawal due to LAPS will increase yield.
- LAPS offers the poultry industry a **potential** important new tool to lower the introduction of pathogens into the processing plant.

Human safety and health_Post LAPS

Hanging on—improved operating conditions

Good light, less dust less staff turnover



PROCESSING PLANT BENEFITS OF LAPS

- ◆ Reduced/Improved working conditions for hanging room employees, less turnover
- ◆ Bleed out is equivalent to electrical stunning
- ◆ No increased blood spots in the breast meat
- ◆ No annual gas cost
- ◆ No harmful gas exposure to the atmosphere for employee
- ◆ Consistent bird presentation into the picker for better results
- ◆ Less fecal material entering the plant

AGENDA

- Altitude and Physiology LAPS Development
- Why Laps is Needed
- LAPS Animal welfare Science evidence base; Physiology, Pathology Behavior Neuroscience
- EU Regulations
- Meat quality
- Safety Microbiological. Operator

LAPSINFO.COM

Effects of ambient temperature and water vapor on chamber pressure and oxygen level during low atmospheric pressure stunning of poultry

Paul H. Holloway and David G. Pritchard 2017 Poultry Science 0:1–12

<http://dx.doi.org/10.3382/ps/pex066>



ANIMAL WELFARE
SCIENCE AND
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