

Smart Dairy Production

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SRUC: Dairy Research Centre

Agri-EPI Centre Ltd



Leading the way in Agriculture and Rural Research, Education and Consulting

Outline of talk



- Introduction to Agri-EPI Centre Ltd
 - UK AgriTech Centres
 - Innovation Hubs
 - Satellite farms
 - Dairy Development Centres
- Smart Dairying capability at SRUC
 - Adult cattle
 - Calves
 - GHG emissions

Agri-tech Innovation Strategy

- £150 million funding stream from BEIS; managed by Innovate UK
- £70 million project funding ('catalyst')
- £80 million for 'Centres for Agricultural Innovation'

We work with
Innovate UK

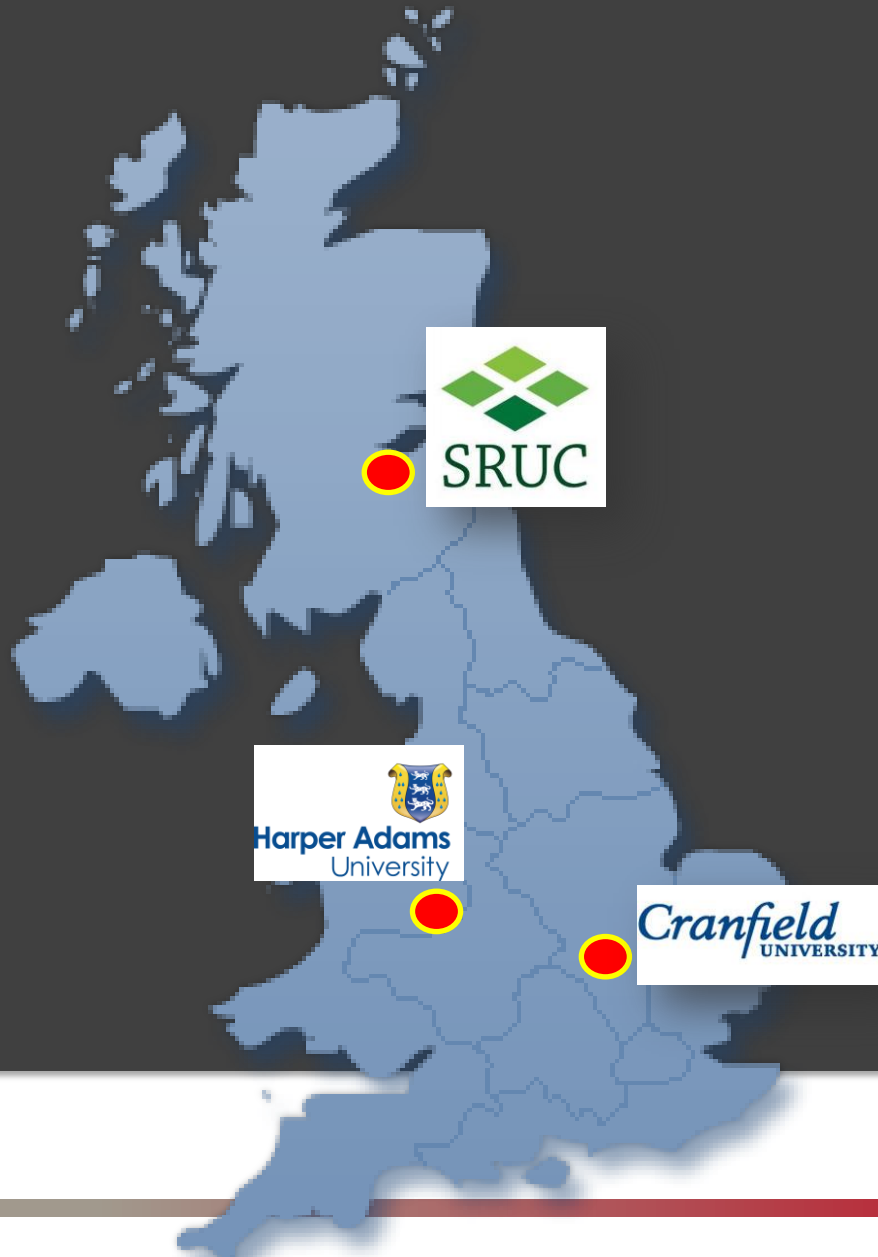
Centres for Agricultural Innovation



Agri-EPI Centre: What is it?

Agri-EPI Centre focuses on the delivery of research, development, demonstration and training on precision agriculture and engineering for the livestock, arable, horticulture and aquaculture sectors.

Agri-EPI Centre – Hubs



Northern Hub (Easter Bush)

- Opens late 2019



Western Hub (Harper Adams)

- Opened 2017



Tenants “TAFE”, (£20 billion T/O business) from India, testing the water with a UK base



Southern Hub (Cranfield)

- Hub construction underway – glasshouse and sensor platform operational

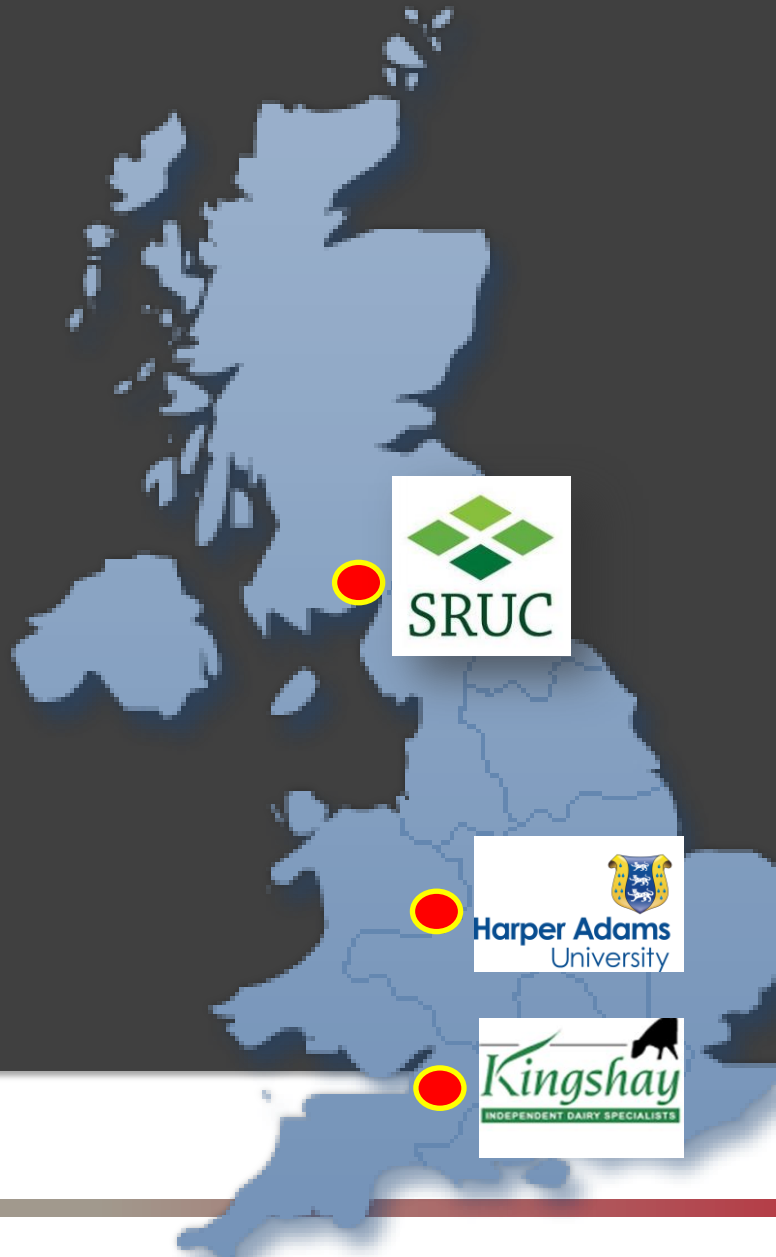


Satellite farms

- 28 satellite farms established
- Small meeting rooms
- 'Precision' technology appropriate to the farming sector
- Demonstrate and evaluate precision technology
- Collect data from high-performing real farms



Dairy Development Centres



Somerset (Kingshay)



Shropshire (Harper Adams)



Dumfries (SRUC)



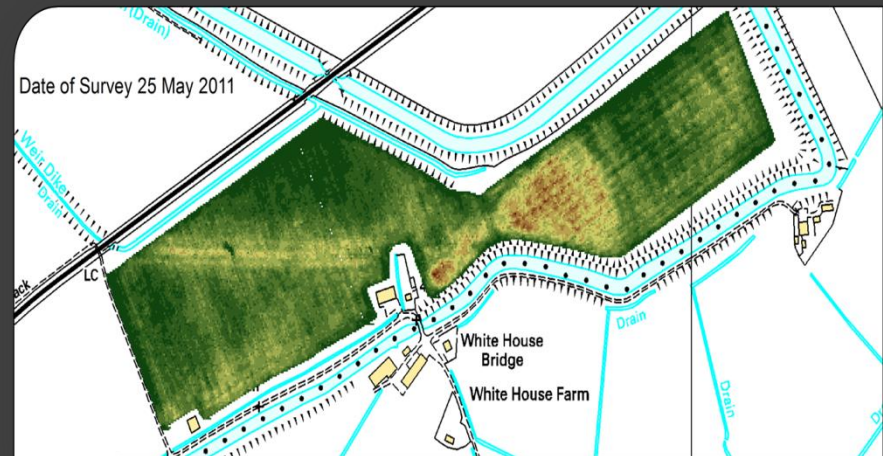
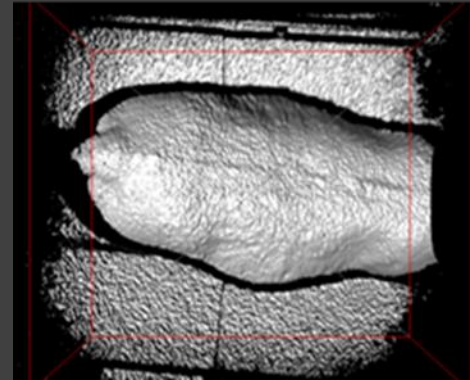
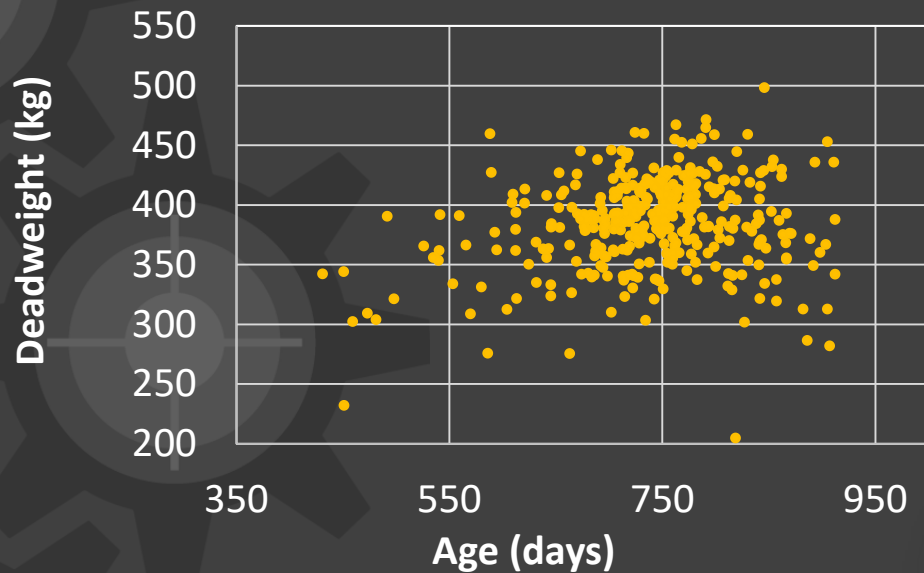
Calf facilities at Dumfries

- Individual recording of:
 - Milk intake
 - Water intake
 - Concentrate intake
 - Forage intake
 - Live weight
- Other equipment for monitoring calves and their environment

Calf projects

- Milk feeding and weaning strategies
- Precision monitoring technologies for performance, health and welfare
- Lifetime trajectories of animals (intake, growth) – both for dairy and dairy-beef; mechanisms (epigenetics)
- Adding detail to database for Langhill animals

A vision around variance



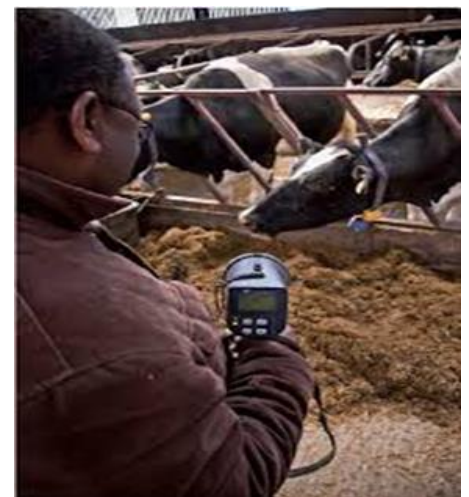
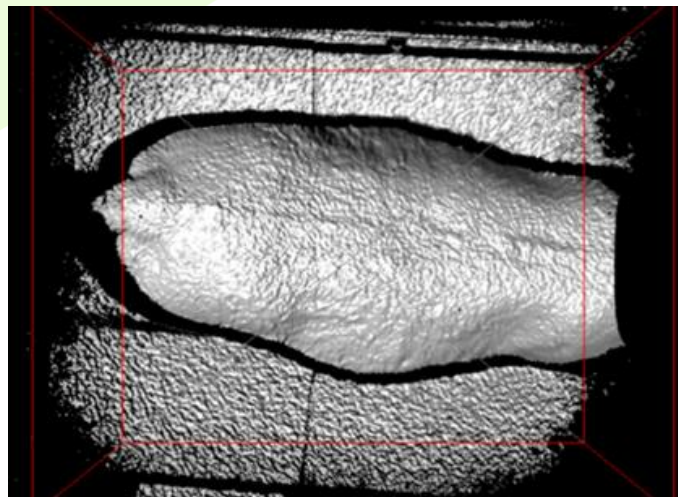
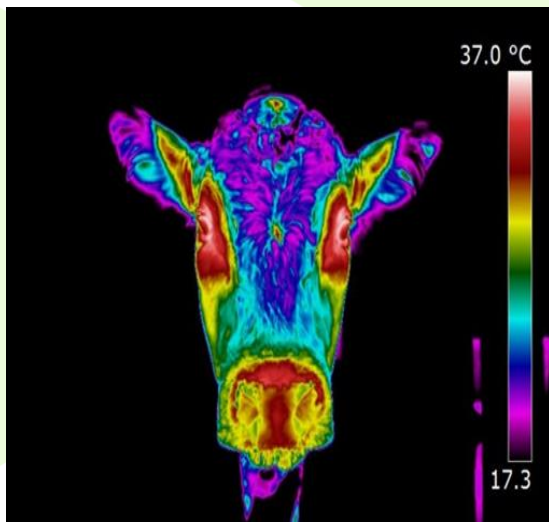
Examples developed in Scotland



Technology from other sectors



- Thermal imaging – defence (night vision)
- 3D imaging – computer games
- Ultrasound imaging – medical physics
- Accelerometers – aircraft and bridges (vibration)
- Laser methane detector – health & safety



New uses for 'old' sensors

- Accelerometers originally applied to monitor oestrus activity
- Developed algorithms to look at intake and rumination behaviour
- May be possible to identify other behaviours?



Combinations of technology

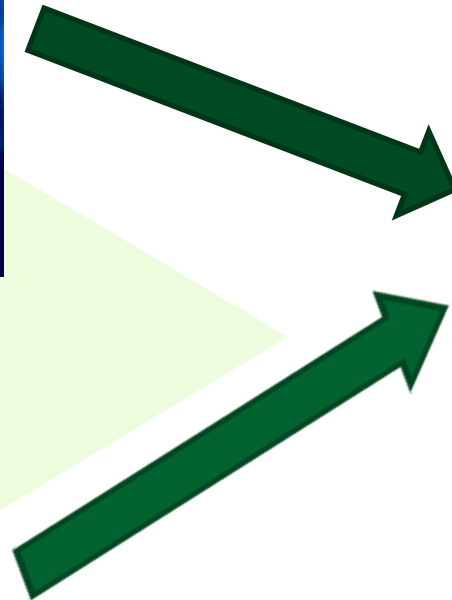
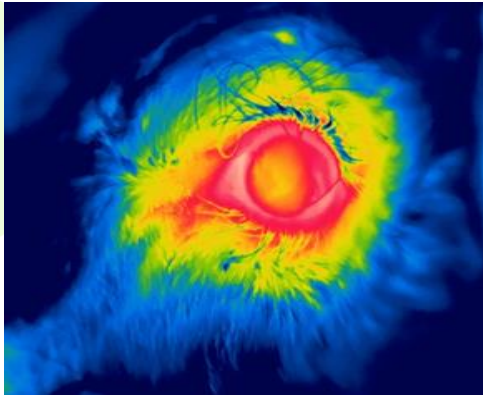


- Innovate UK-funded 'Cow Health Monitor' project
- Based on Fullwood Merlin² robot
- Cow contentment high
- Sensor combinations for health



We work with
Innovate UK

Techniques – body temperature



Techniques – health prediction



Calf Health Scoring Criteria				
0	1	2	3	
Rectal temperature				
100-100.9	101-101.9	102-102.9	≥103	
Cough				
None	Induce single cough	Induced repeated coughs or occasional spontaneous cough	Repeated spontaneous coughs	
Nasal discharge				
Normal serous discharge	Small amount of unilateral cloudy discharge	Bilateral, cloudy or excessive mucous discharge	Copious bilateral mucopurulent discharge	
Eye scores				
Normal	Small amount of ocular discharge	Moderate amount of bilateral discharge	Heavy ocular discharge	
Ear scores				
Normal	Ear flick or head shake	Slight unilateral droop	Head tilt or bilateral droop	
Fecal scores				
Normal	Semi-formed, pasty	Loose, but stays on top of bedding	Watery, sifts through bedding	

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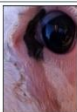










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Cooperative Extension

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Bovine respiratory disease scoring system for pre-weaned dairy calves^{1,2}

Clinical sign	Score if normal	Score if abnormal (any severity) ³
Eye discharge	0 	2  Or  Or 
Nasal discharge	0 	4  Or  Or 
Ear droop or Head tilt	0 	5  Or  Or 
Cough	0 No cough	2 Spontaneous cough
Breathing	0 Normal	2 Rapid or difficult breathing
Temperature	0 < 102.5° F	2 ≥ 102.5° F

Add scores for all clinical signs, if total score is ≥ 5, calf may be positive for bovine respiratory disease

¹ Love VL, Lehenbauer TH, Kass PH, Van Eenennaam AL, Aly SS. (2014) Development of a novel clinical scoring system for on-farm diagnosis of bovine respiratory disease in pre-weaned dairy calves. *Preval 2:4238*. <https://doi.org/10.1186/2161-0038-2-4238>.

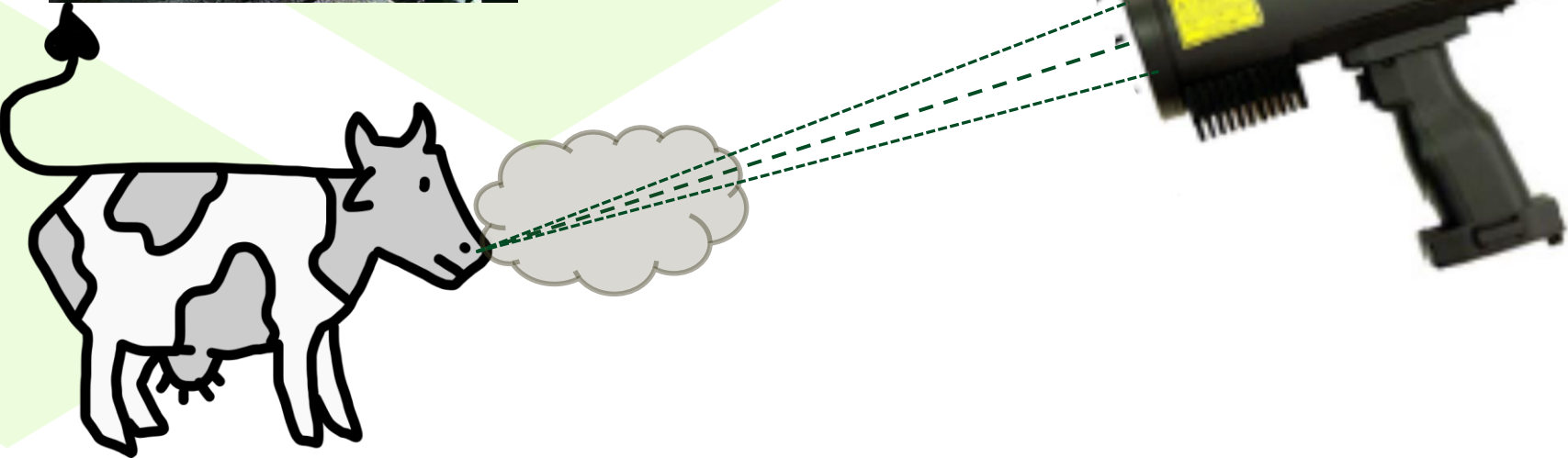
² Aly SS, Love VL, Williams DR, Lehenbauer TH, Van Eenennaam AL, Drake C, Kass PH, Fanter TB. (2014) Agreement between bovine respiratory disease scoring systems for pre-weaned dairy calves. *Animal Health Research Reviews* 15: 2 Pages 148-150 <http://dx.doi.org/10.1017/S1446748113000000>.

³ Any abnormality including, but not limited to, the examples shown in the above pictures.

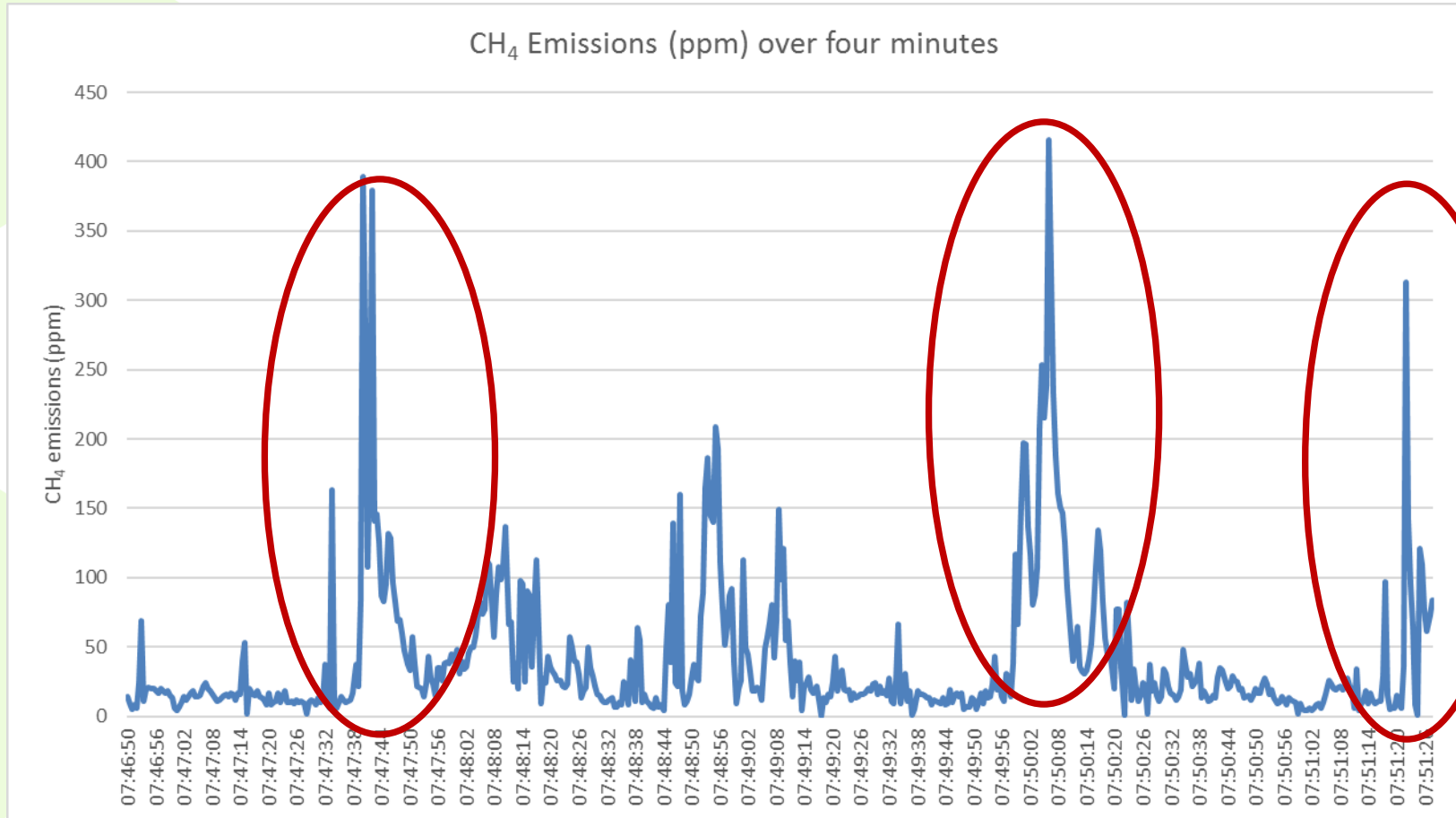
Laser Methane Detector (LMD)



- CH₄ emissions estimated using LMD
- Two readings per second
- Animal in each treatment groups monitored for approximately 4 mins
- Previous studies have shown comparability with chambers



Continuous monitoring: 4 mins



Questions?