WASP wireless sensing concept for next generation Herd Control

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Introduction of the Technology

- **Wireless Accessible Sensor Populations (WASP)**
  - Battery operated micro computer systems (nodes)
    - Processor
    - Memory
    - Radio
    - Sensors
      - Temperature
      - 3D acceleration
      - ..
  - Capable of communicating with each other
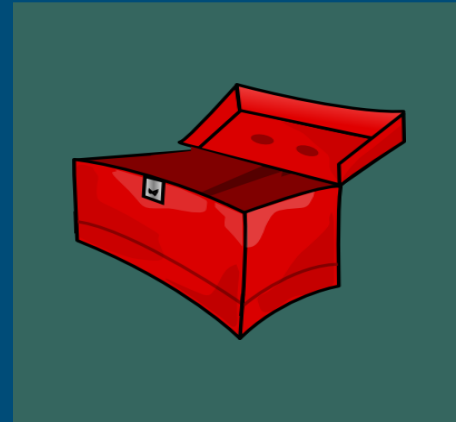- **So far only limited practical applications**
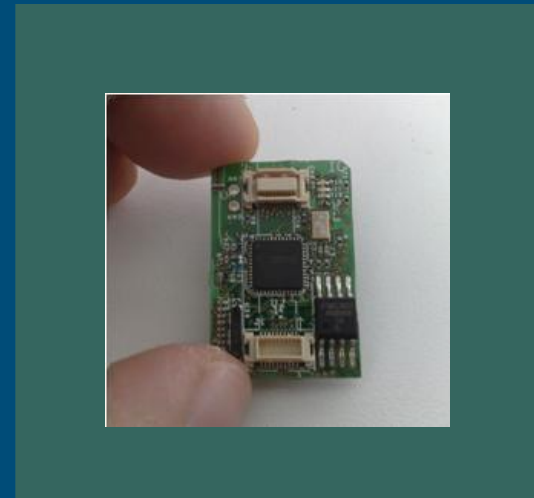
Goal of the WASP project

- **Create technology toolbox**
 - Meeting practical application requirements
    - Sensors and hardware integration
    - Service-based framework
    - Discovery of new sensors/gateways/services
    - Software platform and cross layer optimisation
    - Alarming
    - Integration with enterprise systems
    - Security and maintenance
- **Plug and play approach for facilitating practical applications**

WASP implementation architecture
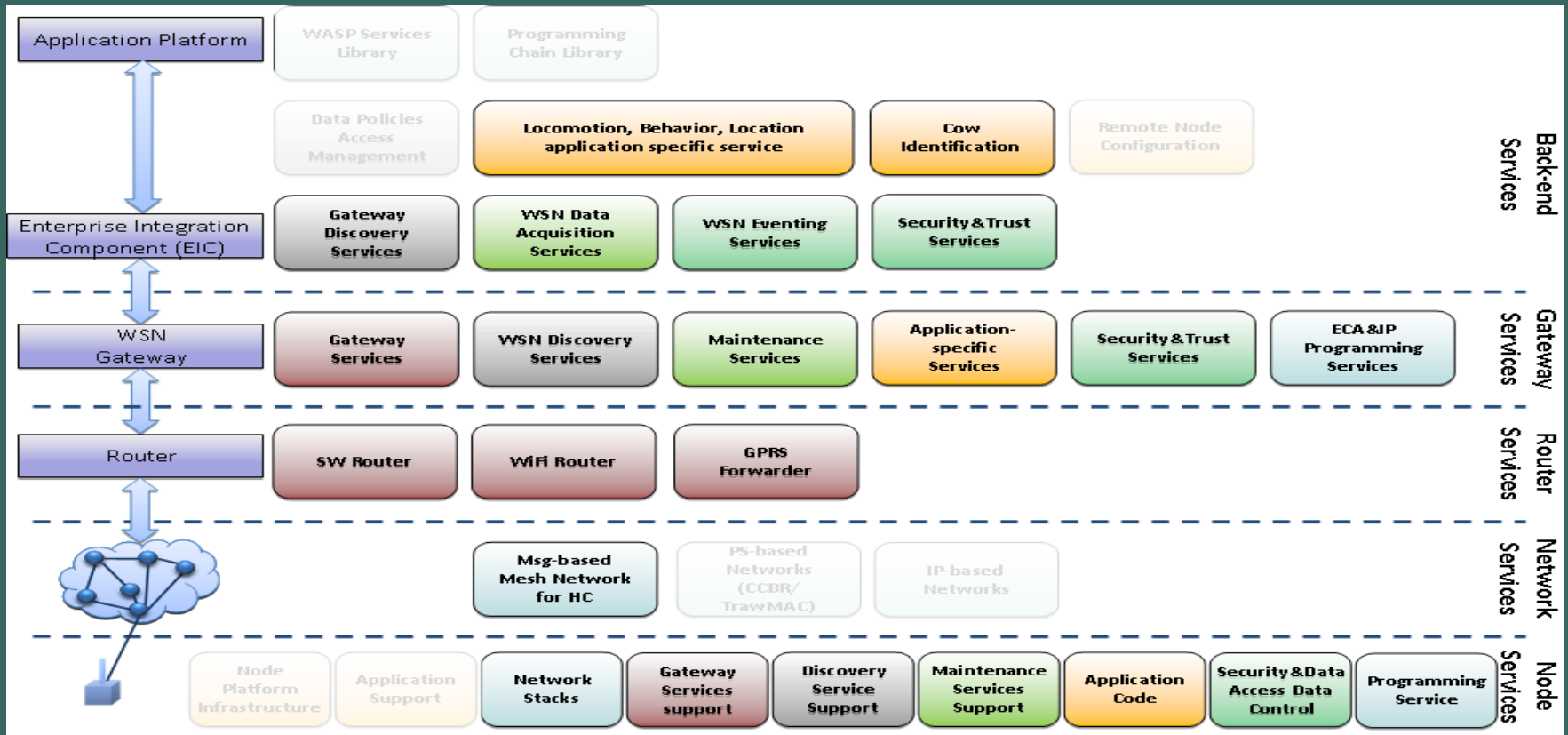
WASP
Integrated project
FP6-IST-2005-2.5.3 Embedded Systems
IST-034963

WASP business application areas

Elderly Care   Herd Control (HC)   Road Management

Europe is very competitive on both cattle and pig market

European market: 90 million cows,150 million pigs (growing farm size)

Investment potential per:

- dairy cow up to 150 Euro

- breeding pig up to 80 Euro per pig

- finishing pigs up to 2 Euro per pig

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Major developments in livestock

Farmers benefit?

Increasing farm scale
Rapid development

Animal welfare
Full in discussion

Animal health
From curative to preventive

Cow's benefit?

Industrial *benefit?*

Technological improvement
Rapid innovations
Inter-sectoral and international

Cow's benefit?

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Possible herd control applications

- Ideas (> 50) harvested in special SME meetings:

  - Lameness detection
  - Virtual fence
  - Animal transport monitoring
  - Process control of cow traffic
  - Stress and well being monitor of animals
  - Controlled strip grazing of cows
  - Selecting of animals (e.g. for slaughter)
  - Locating animals in big flocks
  - Recording mating behavior of sheep
  - Monitoring contacts between animals / humans (tracking & tracing)
  - ....

- HC TEST BED focus:

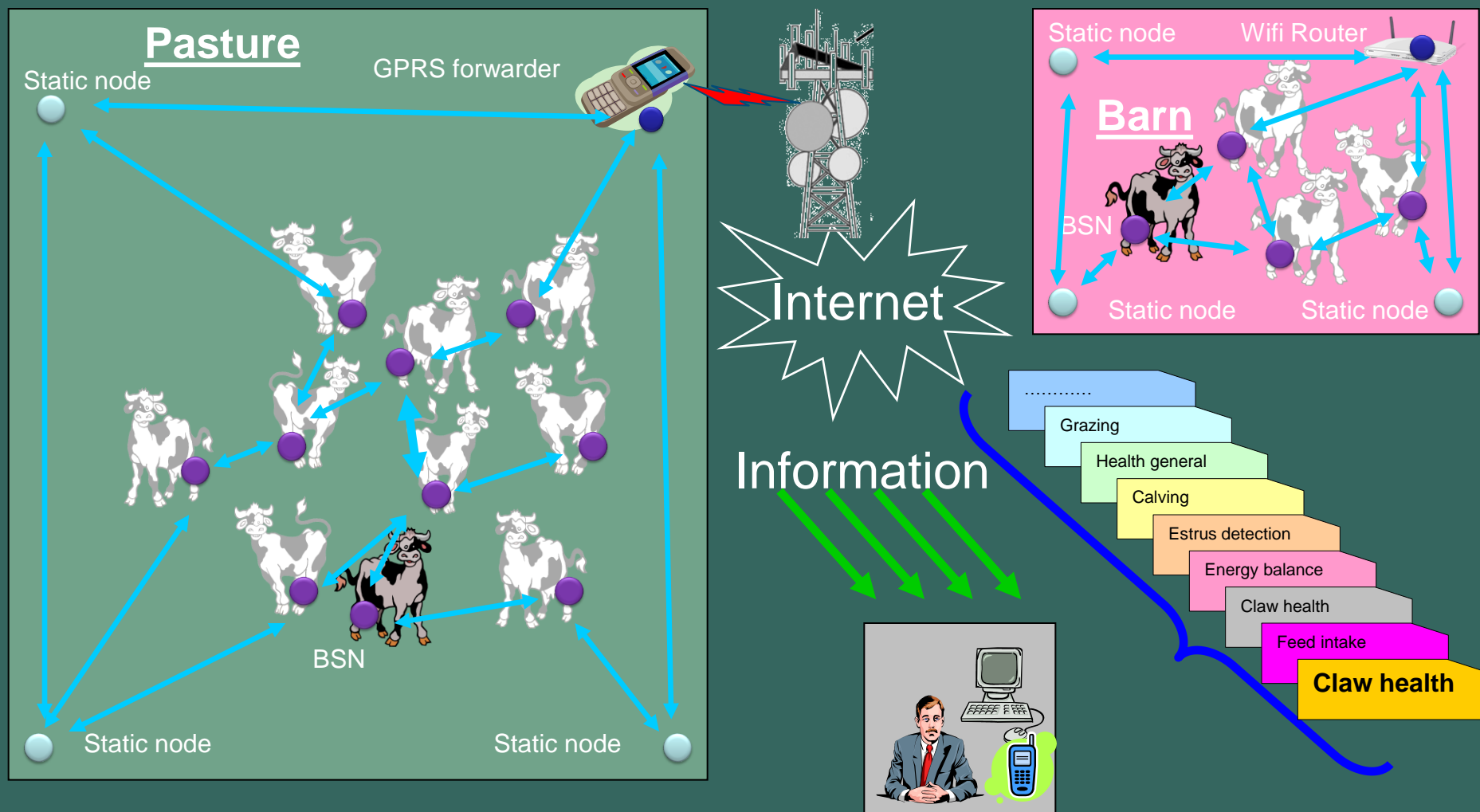 - Detection of health problems with focus on claw health and locomotion

WASP uses HC test bed to focus on:

- **On-node data compression:**
  - Reduce radio traffic
  - Reduction of power consumption

- **Re-programming of nodes:**
  - Updating algorithms
  - Installing additional functionality

- **State based triggering:**
  - Circumstances based activation of software

- **Location awareness:**
  - Measure the position of cows

- **Scaling effects:**
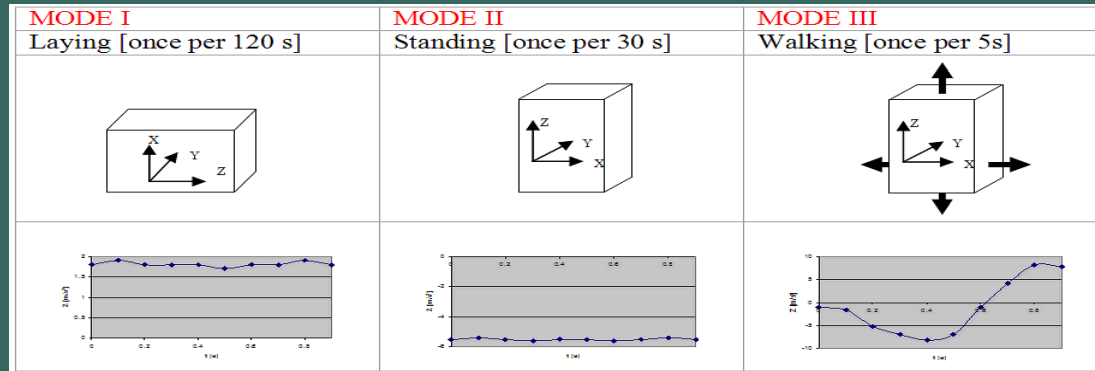 - Possibility to work with high number of nodes
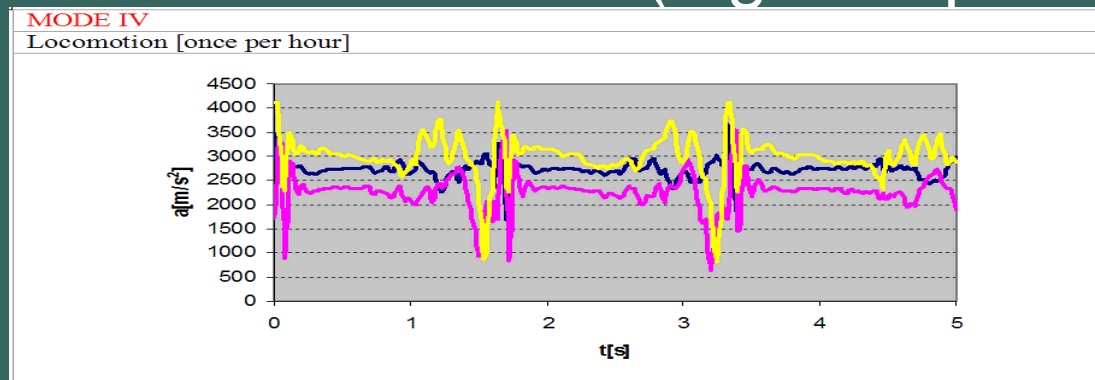
Implementation WASP technology

Pasture

Static node

GPRS forwarder

Internet

Information

Static node

BSN

Static node

Static node

Static node

Wifi Router

Barn

BSN

Static node

Static node

....

Grazing

Health general

Calving

Estrus detection

Energy balance

Claw health

Feed intake

Claw health

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Example of 3D activity sensor use

- **Behavior of animal**

MODE I	MODE II	MODE III
Laying [once per 120 s]	Standing [once per 30 s]	Walking [once per 5s]

- **Locomotion animal (high frequency)**

MODE IV
Locomotion [once per hour]

Behavior analyses

Accelerations (X black, Y red) cow 507 Leg node 10 day 32

Time [h]

Calculated angle cow 507 Leg node 10 day 32

Time [h]
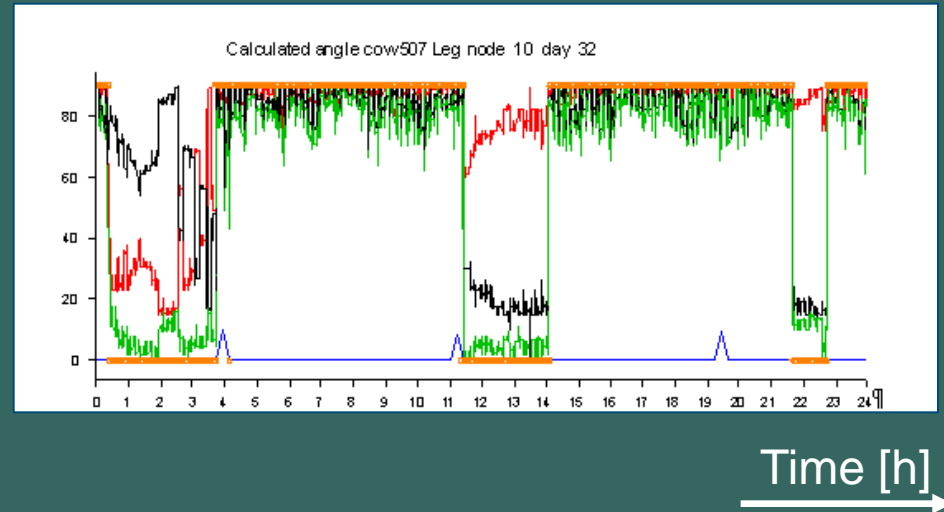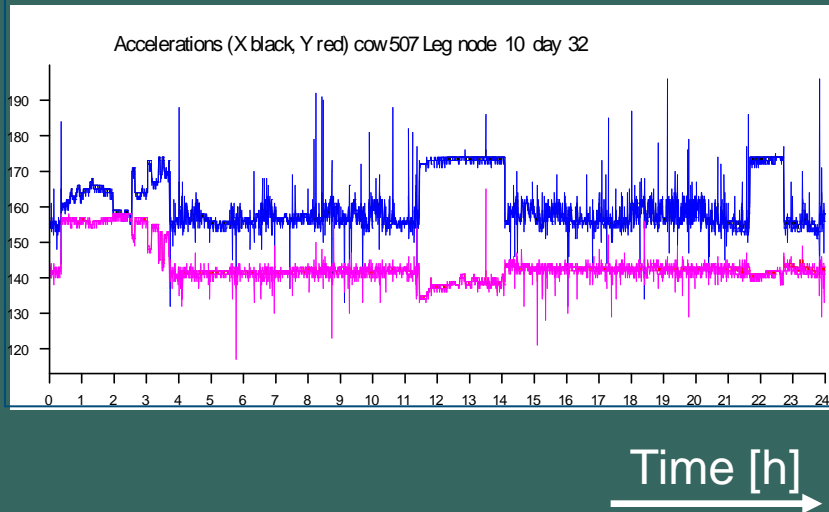
acceleration → data processing → behavior

Laying, standing or walking

Locomotion analyses

MA Filt. Acc. leg node 4 on 2/7

Variance Acc. leg node 4 on 2/7

Minutes since start of experiment

Minutes since start of experiment
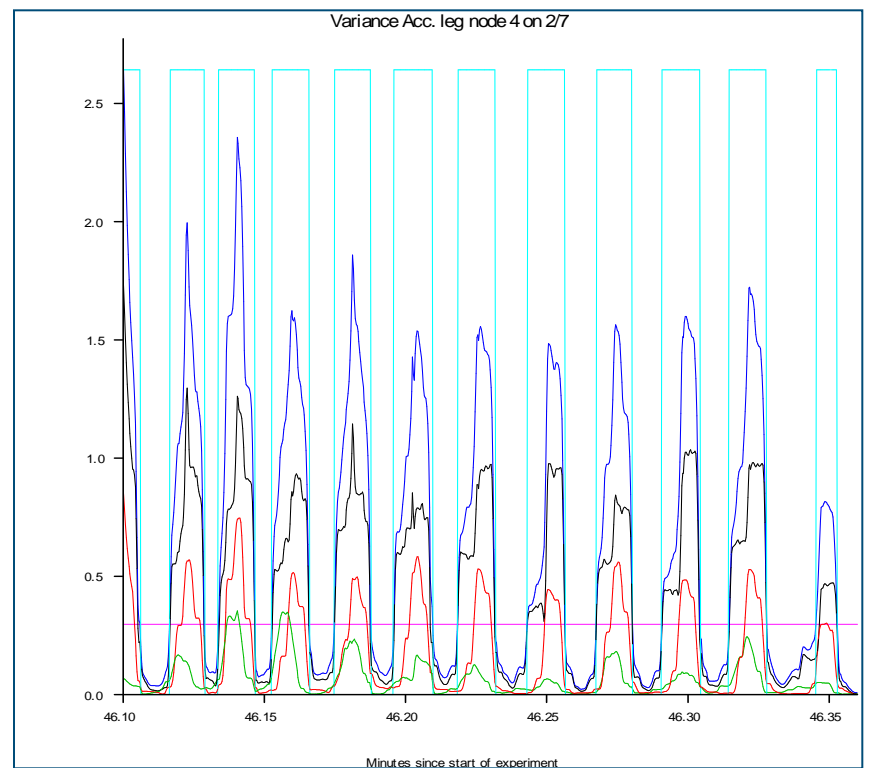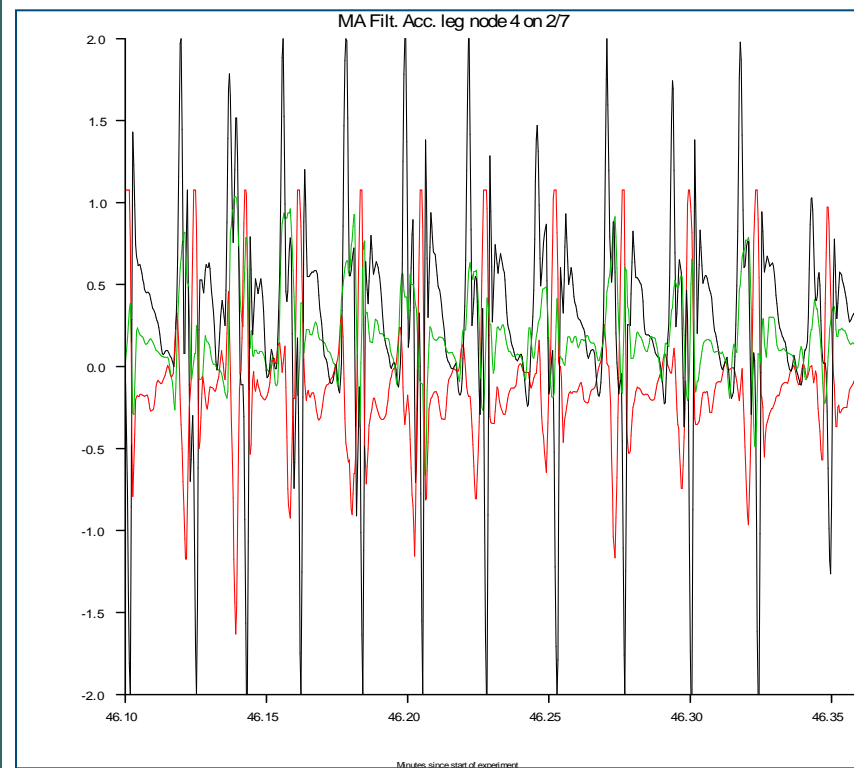
Acceleration	→	Data processing	→	Step detection	→	Step parameters

Length, duration, swing & amplitude

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An impression a HC test bed meeting

- Step detection algorithm
- Cow with WASP node on left hind leg
- Detecting the steps a cow takes

WASP <<   >> HC test bed

- **Test bed and prototyping**
  - Working with real problem
  - Working with real data
  - Developers work together

- **Herd Control will benefit from WASP**
  - Build up experience with WASP technology
  - Network of technical experts working on application

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Thanks

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