



# Smart Monitoring Solutions Sport



## Our Vision

To deliver a step-change in UK sports effectiveness by integrating state of the art technologies from leading industrial and academic organisations into athlete performance monitoring and coaching.

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# Smart Athlete Monitoring for Optimal Performance

Developing On-demand Intelligent Systems and Services for Athletes, Coaches and Teams

EIS is a spin-off from Loughborough University, specialising in the adaption of innovative manufacturing technologies to improve athlete performance, comfort and efficiency.



- ▶ Improve power, comfort and efficiency –the EIS Bike
- ▶ Precision force plate – assess performance for track, gym and swimming
- ▶ Data-to-knowledge – real time feedback with detailed analysis and evaluation of data
- ▶ Optimise performance and reduce imbalances
- ▶ Geometry, kinetic, kinematic and biomechanics



**Wireless Inertial Measurement Unit:** developed using tracking and sensor technology:  
for use on land and in water  
Standalone device which can be combined with our force platform for:  
Dive analysis,  
Sprint analysis  
Weight lifting

# Past and Present

Working with a wide range of athletes, elite and amateur from a variety of disciplines to improve performance through data gathering and analysis.



Over **950 trials with elite sprinters** led to significantly improved consistency of performance.

- ▶ Start and turns testing and analysis of 38 **National Camp swimmers**, who qualified for the London 2012 Olympics
- ▶ Study of elite **cyclists, swimmers, tennis players and track athletes**
- ▶ **Characterisation of sport specific movements** enabling detection of performance indicators in elite and non-elite athletes
- ▶ Athlete **imbalance detection and analysis**

Tennis stroke characterisation and power analysis



# Cycling: Measurements

Optimising cyclist position for power, efficiency and comfort



CODA markers are detected by sensors to accurately record the dimensions and angles of the athletes riding position.

**FAST SET UP** automated adjustment of handlebar and seat position:

**Ergometer** changes position within seconds

**REALISTIC** riding experience with **Touch screen display**

**REAL TIME** feedback and post processing data analysis

## Measurement Data

**Non Invasive EMG**  
Muscle Activation

**CODA**  
Biomechanical Positioning

**Ergometer**  
Cadence, Torque and Power: Left and Right Legs

**Heart Rate Monitor**  
Heart Rate and Effort

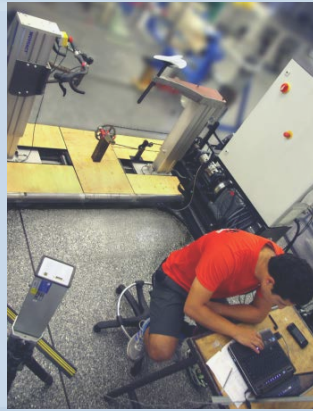
**Verbal Feedback**  
Perceived Comfort



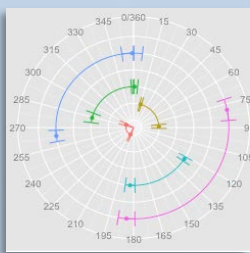
Traditional bike fitting is time consuming and can be inaccurate, with CODA precision measurements are swift and highly accurate

# Cycling: Ergometer

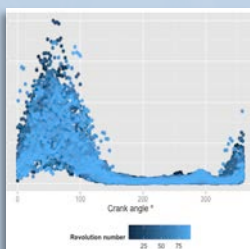
Power Comfort Efficiency



Intuitive, easy to understand data are key to gaining knowledge for improved performance

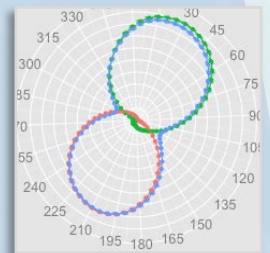


EMG data: intuitively positioned to pedal stroke and colour coded for muscle groups

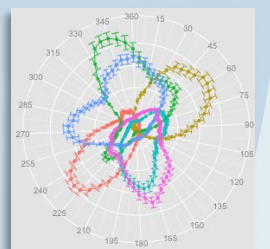


Muscle Activity processed for every revolution analysed and visualised using **state of the art R language programming** techniques

Discover Imbalances: power displayed for left and right leg comparison



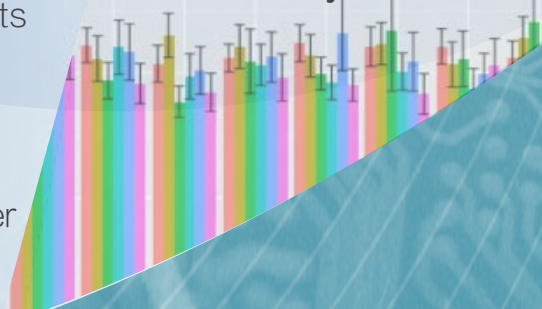
Muscle Activity Magnitude: variability across the pedal cycle for 6 lower leg muscles



- ▶ Synchronous data acquisition provides a complete picture
- ▶ Post processing analysis of results during testing session
  - power, muscle activity, heart rate, cadence and positioning
- ▶ Knowledge: novel machine learning methods (e.g. symbolic regression)

Proprietary software restricts how you can analyse your data. Our software is **extensible, reusable and customisable** to fit the user needs.

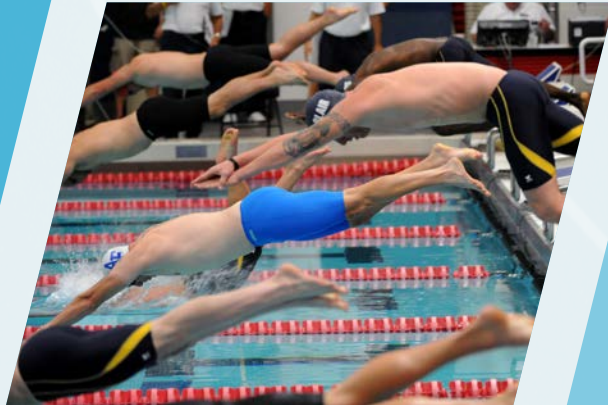
Muscle activity rise and fall times



# Force Plates

Dive, Jump, Lift, Run

Athlete power and movement efficiency analysis



The EIS Force plate dive platform provides data relating to the efficiency, power and balance of a swimmers start

- ▶ Force plate can be packaged for **indoor, outdoor** and **poolside use**
- ▶ **Precision** tri-axial force plates providing insight into athletes force generation during sport specific movements
- ▶ **Data analysis** to indicate changes in **athlete performance** and detect imbalances for correction
- ▶ **Wireless Inertial Measurement Unit** - using specialist tracking and on board sensors to detect athlete body movement on the track, in the pool and in the weights room



Characterisation of weight lifting movements and jumps for Elite track athletes. Detection of imbalances and changes in power output



# Wireless Inertial Measurement: Swimmer Case Study

velocity, stroke analysis and turn data

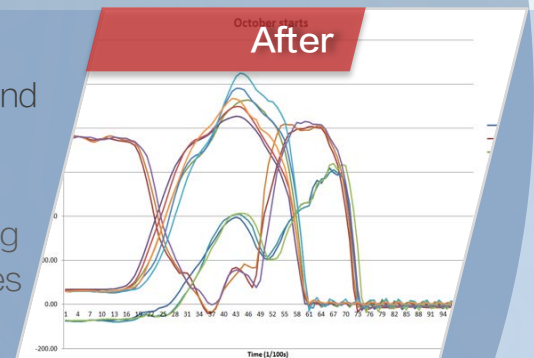


Force plate, swimmer node and video analysis are used to assess swimmers movements from dive to turns



Significant improvements in athlete **force**, **performance** and **consistency**

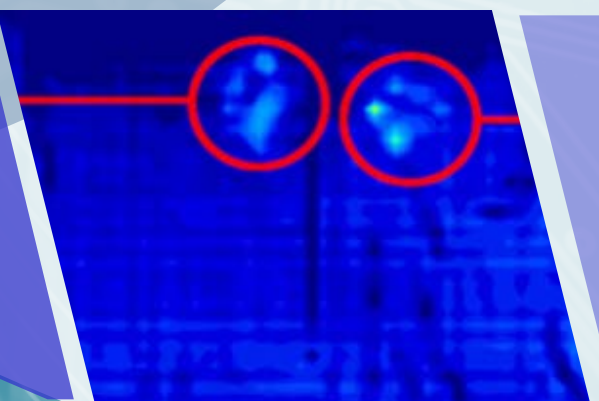
Trials carried out with **British Swimming**, National Swimming Camp and 2012 Olympic games athletes



## Working with Athletes and Coaches to analyse and improve:

- ▶ Kick velocity
- ▶ Depth and speed of swim
- ▶ Rotation time on turns
- ▶ Glide time

Using pressure pad the right and left foot position can also be determined



# Smart Services and Web Solutions

Custom-Designed, Integrated EIS  
Solutions for Teams, Athletes and  
Coaches

While EIS devices yield large quantities of monitoring data, intelligent algorithm design and semantic technology are used to provide innovative prediction and harness the value of available knowledge.

Smart networks and cloud computing enable us to expose services as API based endpoints without stipulations on client infrastructure. Access to timely information provided by integrated systems becomes ubiquitous.

- ▶ Fast
- ▶ Accurate
- ▶ Manageable
- ▶ Scalable
- ▶ Reliable

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