
Advanced implant technologies and systems

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SIXTH FRAMEWORK PROGRAMME



Information Society
Technologies

Overview

ETB is microsystem design company, specialising in physical sensor systems and is the project co-ordinator for Healthy Aims.

Healthy Aims is a 23M€, four year EU FP6 project with the goal to develop a number of intelligent medical implants and diagnostic systems, integrating a range of underpinning micro- and nano- technologies.

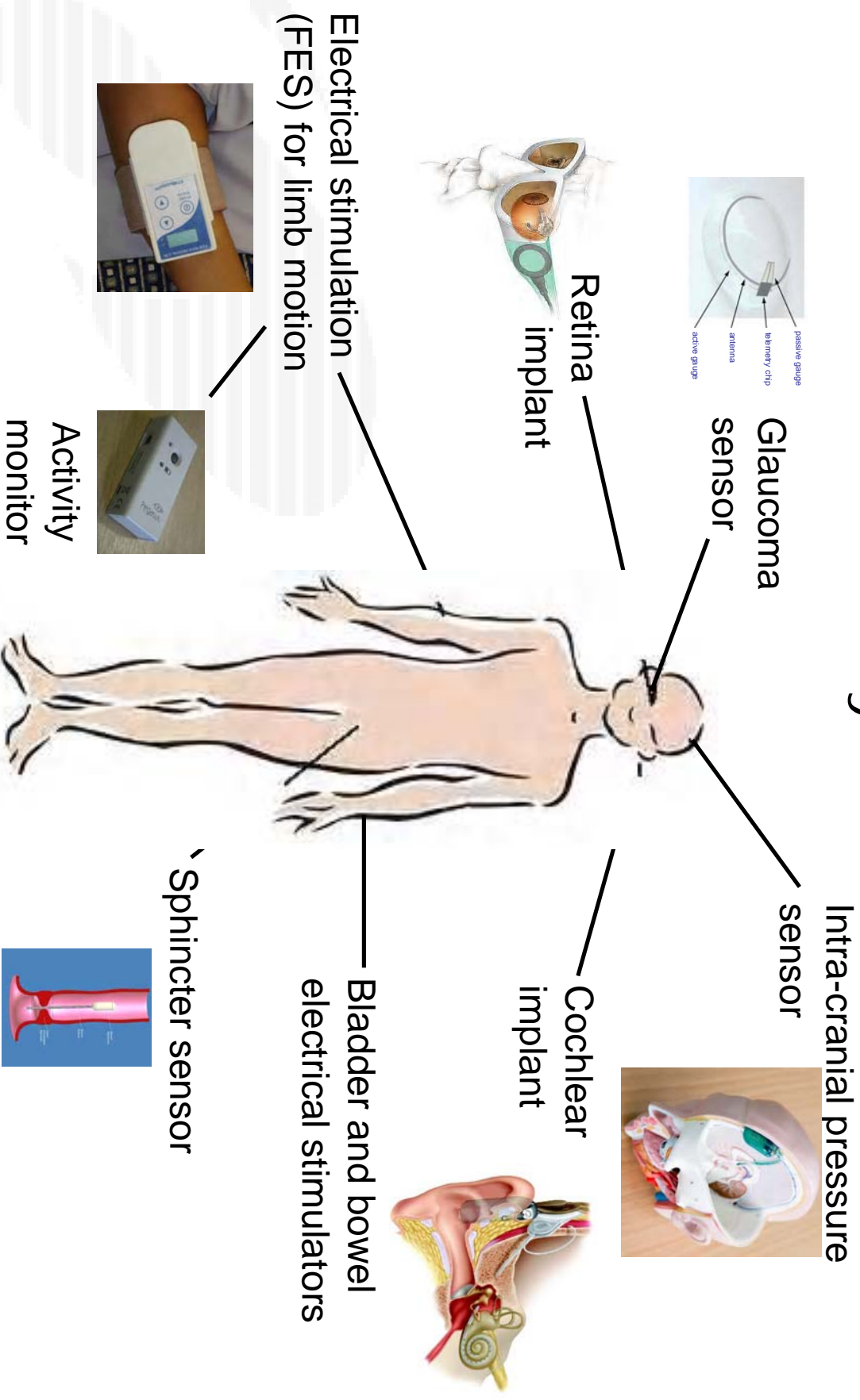
The medical diagnostic equipment undergoing patient trials within the Healthy Aims project provide a benchmark of today's state-of-the-art worldwide.

There are 25 partners from 10 EU countries, six of which are clinical partners. Their role is to help develop the system specifications, guide the development work and carry out clinical trials on prototypes.



Implant systems being developed within

Healthy Aims



How nanotechnology is applied to the products

The medical systems integrate nanotechnology, for example:

- **Coating materials**
- **Features on sensors**
- **Surface treatments**
- **Joining technologies**

The Healthy Aims project provides a range of examples of the integration of nanotechnology in medical systems.



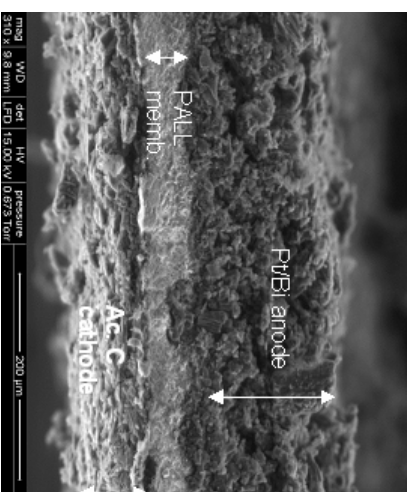
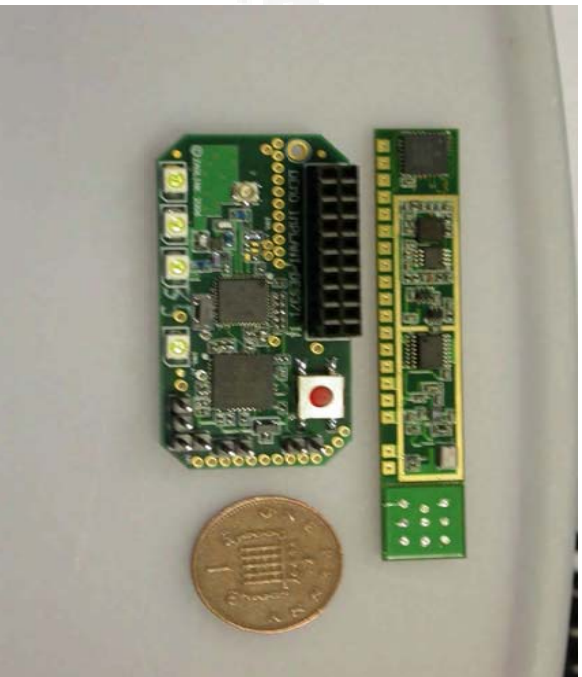
Core components & materials developed ready for integration into medical products

- **Medical Implant Communications Service (MICS) system**
- **Secondary cell**
- **Biofuel cell**
- **3-axis gyro**
- **Range of electrode arrays suitable for implantation**
- **Biomaterials for coating implants and electrodes which contact nerves**



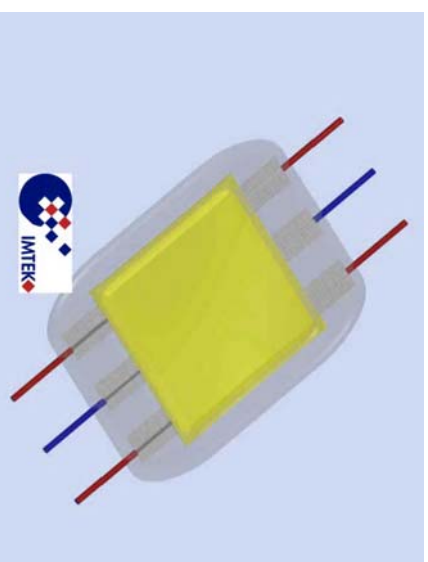
Key Implant components suitable for functional stimulation applications

Medical Implant Communication Service (MICS)



156 μm
50 μm
72 μm

Implant battery to
provide the power

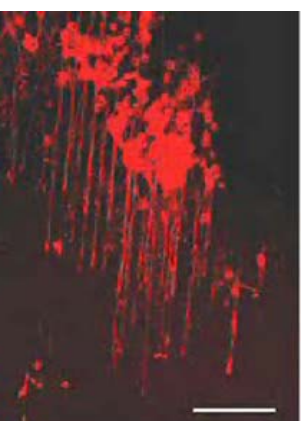


Biofuel cell for low power
implants, e.g pacemaker

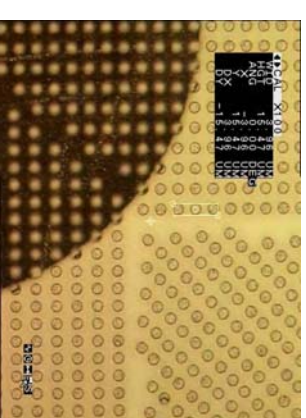


Encapsulating Biomaterials and functional interface between electrodes and nerves in the body

- Means of improving the connection between the electrode and the nerve cells to optimise charge transfer.



Aligning electrically active neurons to the electrode surface

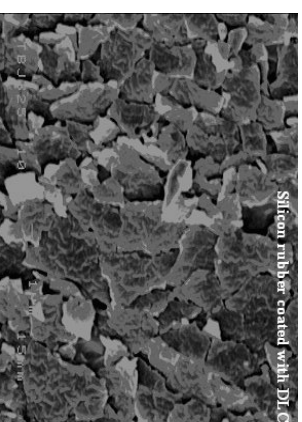


Preventing adhesion of non electrically active cells.

- Biocompatible encapsulating materials to stop water ingress into the implant and prevent leeching of materials from the implant into the body.



Intracranial pressure sensor implant with Diamond Like Coating (DLC)



Silicone rubber coated with diamond-like carbon (DLC)

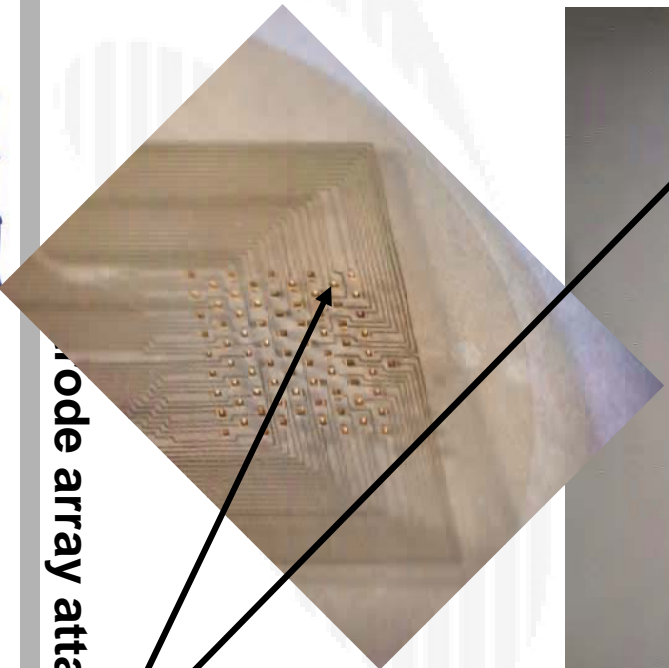
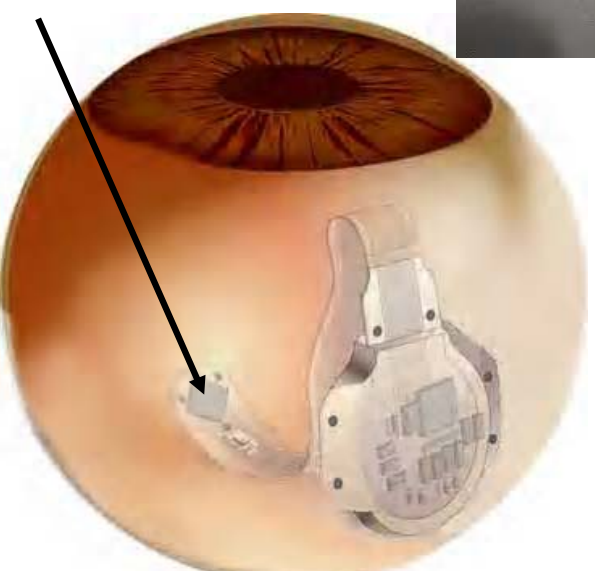


Implant systems being in trials

- **Retina implant**
- **Upper arm functional electrical stimulation (FES)**
- **Cochlear implant**
- **Intracranial pressure monitoring**
- **FES systems for bladder and bowel control**



Retina implant



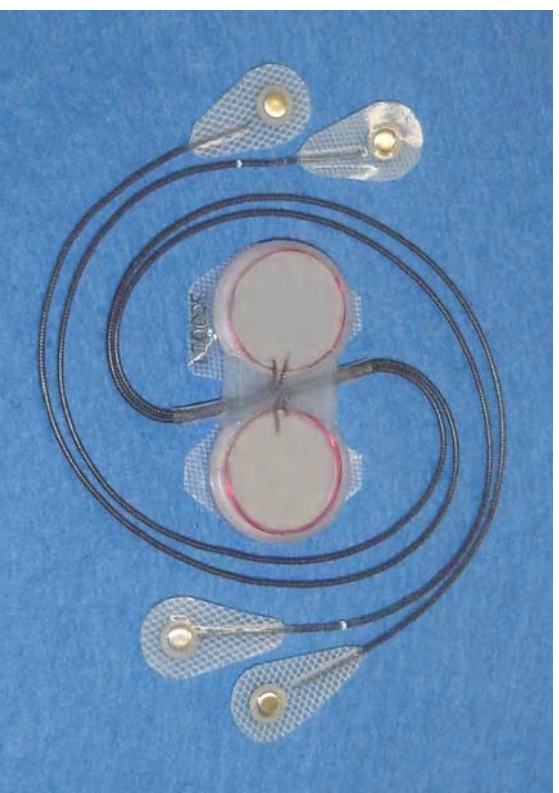
Microarray attached to the retina



Upper arm Functional Electrical Stimulation (FES)



Stroke Patient with 2 channel stimulator

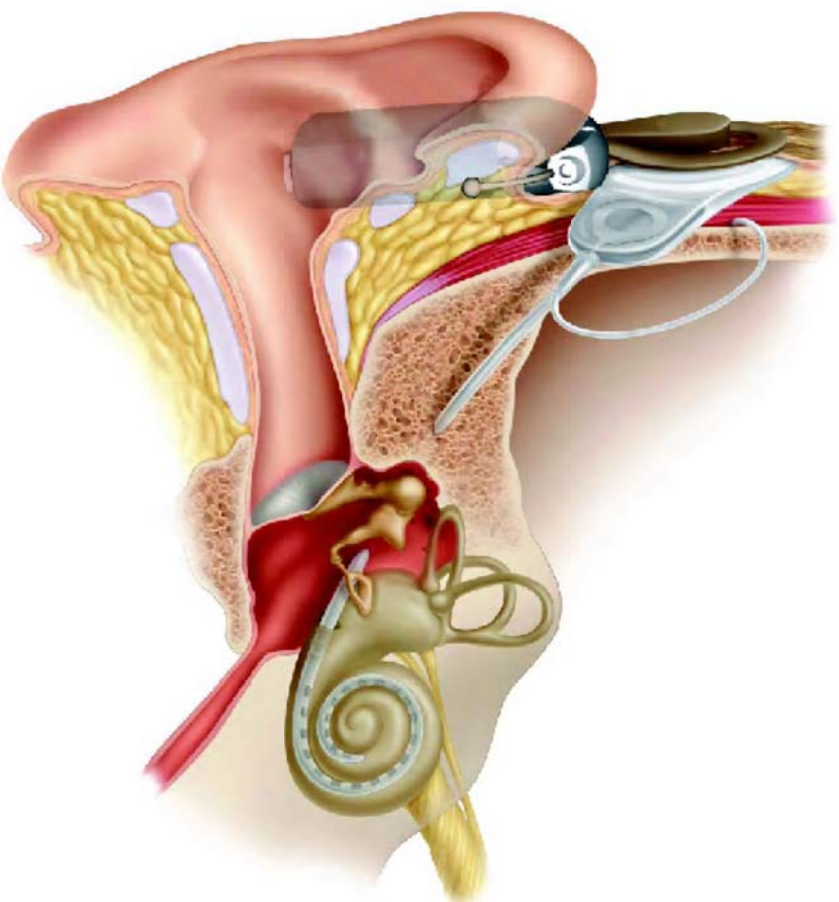


Implant electrodes



Cochlear implant

Current implants have the electrodes in the cochlear



New electrodes are being developed which fit into the modiolus, to reduce damage to residual hearing



Intra Cranial Pressure monitoring

Long term applications include shunt monitoring in hydrocephalus patients over a lifetime



Pressure sensor head is inserted into the brain and hence the coatings must be biocompatible and thin in order not to affect the stability of the pressure reading



On the body diagnostic systems in trials

- **Catheter for urology applications**
- **Glaucoma sensor**
- **Activity monitor and gait classifier system**



Catheter for urology diagnosis

Gauges



Catheter assembly

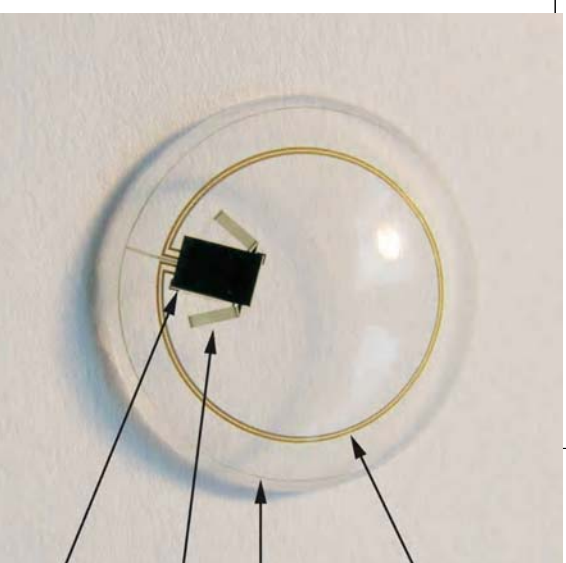
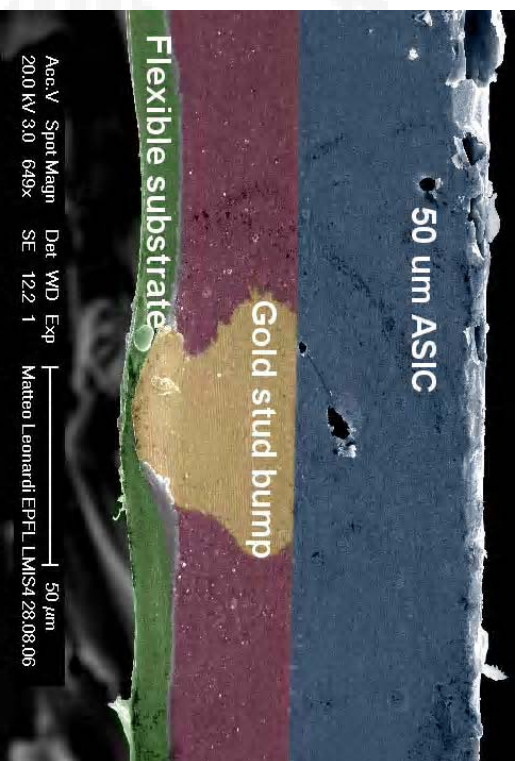
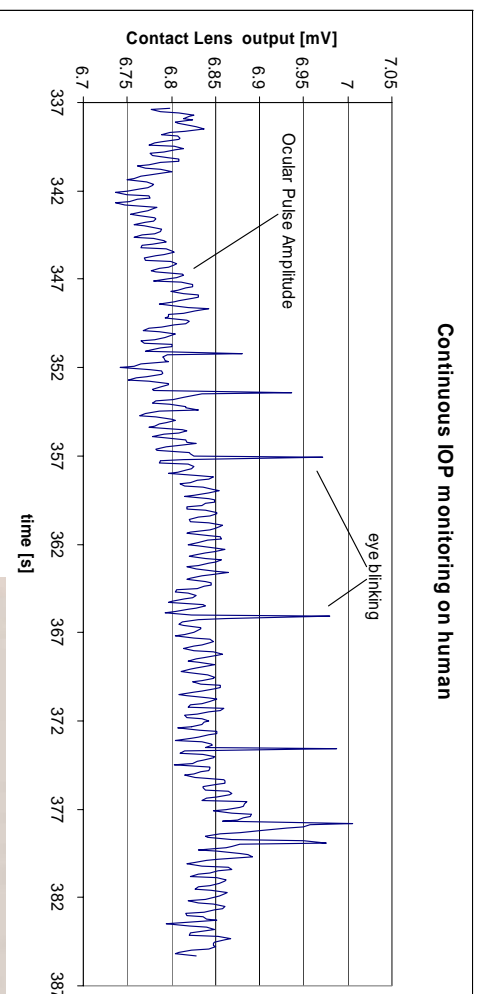


Ambulatory 24 Hr Logger Unit



Glaucoma sensor integrated into a contact lens

Continuous IOP monitoring on human



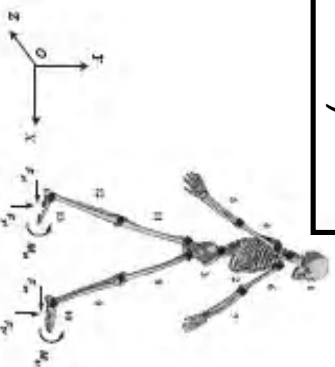
Antenna
Active gauge
Passive gauge
ASIC



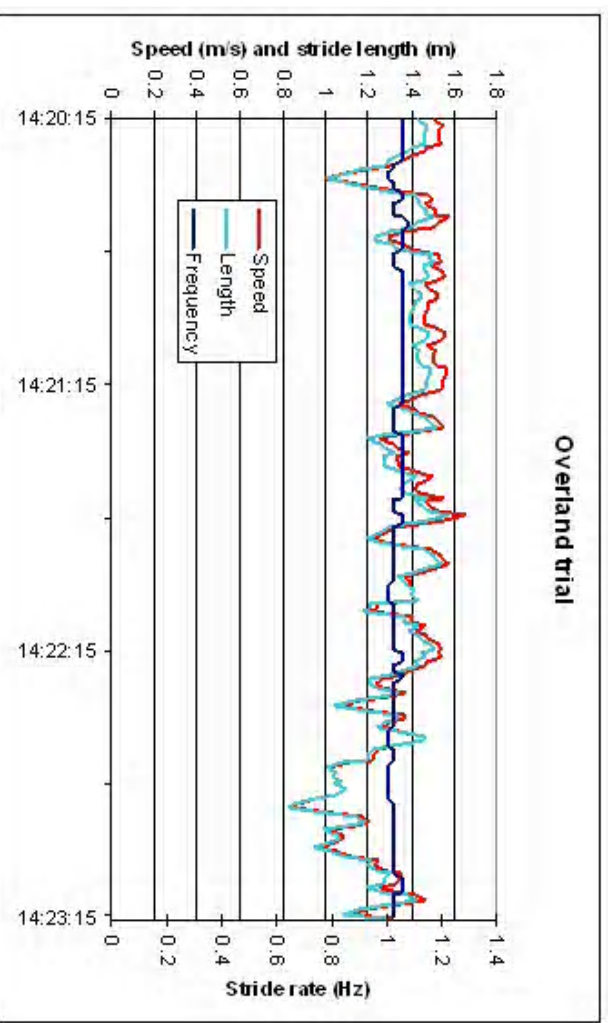
Activity and human gait monitoring



Storage 6 degree of freedom IMU ("out of the gait lab" system)



Activity monitor integrating inertial sensors



Summary and acknowledgements

Some of the medical implants and diagnostic equipment developed within the Healthy Aims project are successfully undergoing clinical trials, advancing the state-of-the-art in medical equipment.

Nanotechnology, combined with other technologies, for example wireless communications, biomaterials and micro-fabrication, have provided key building blocks for these medical systems.

Future technology advancements will help to improve the viability and performance of new medical implants and diagnostic equipment.

The financial support of the EU FP6 programme is greatly appreciated by the Healthy Aims consortium.





Healthy Aims partners

