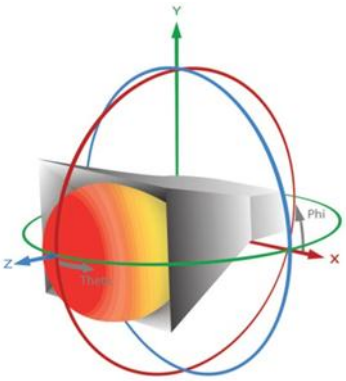
PROJECT FINAL REPORT ILLUSTRATIONS



Grant Agreement Number: **FP7-SME-2008-1-232140**

Project acronym: **MICRODRY**

Project title: **MICROWAVE DRYING FOR THE RAPID REMEDIATION OF FLOODED BUILDINGS**

Funding Scheme: **FP7 RESEARCH FOR SMEs**

Date of latest version of Annex I against which the assessment will be made: 14/2/2011

Periodic report: **2nd (P2 – 16-27 Months)**

Period covered: **from 1st April 2011 to 18th March 2012**

Name, title and organisation of the scientific representative of the project's coordinator:

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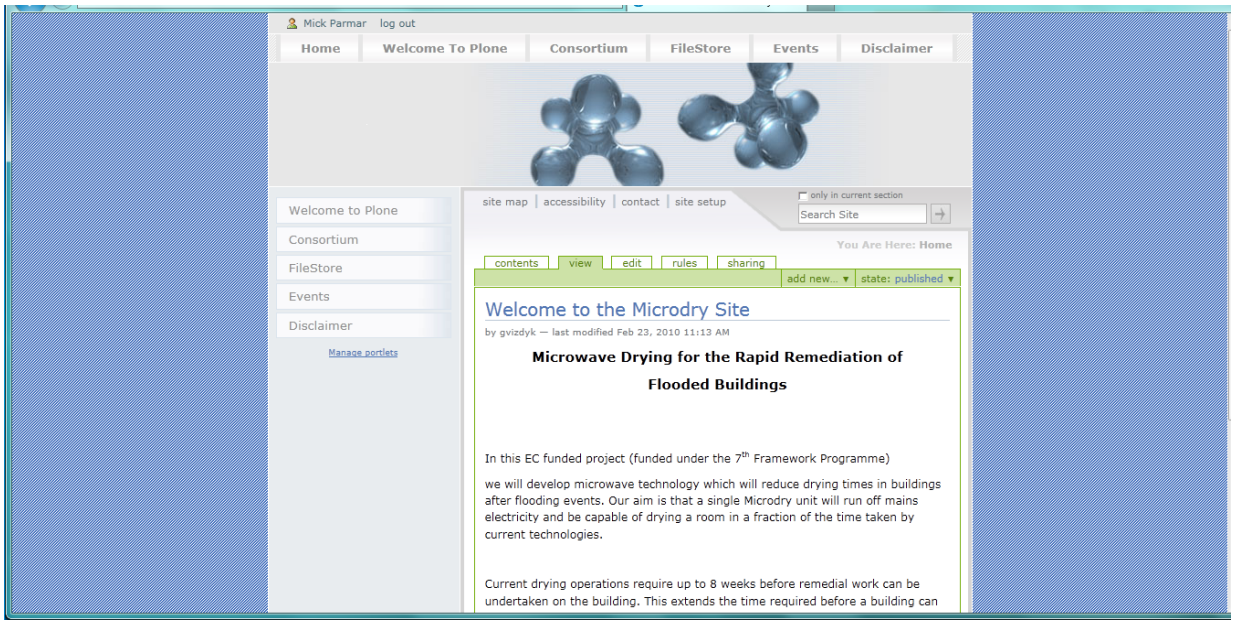
Coordinator Fax: +34 942 29 13 47

E-mail: alejandro.flores@erzia.com

Project website[1] address: http://microdry.pera.co**Project website** –. The portal home page presents a general introduction to the Microdry Project and the portal home page presents a general introduction to the Microdry Project as shown below.



The Consortium Members Page can be seen in the picture below :

The Microdry project was also disseminated at the annual reunion for the Rainbow network on the 4th & 5th of March 2011 as well as in 2012. Overall feedback was very positive. There were also senior representatives from Rainbow International from Germany and the USA. They were also very interested in the project and want to be kept informed as the project is moving forward

UK Matri held an Open day where the project was

Stand 19
Workshop
Project Value
€1,467,000

Radical

Project Manager: Mark Russell
Demo Leader: Paul Jepson

Development of an innovative, accurate, monolithic 2D CVD Diamond based radiation dosimetry system for conformal radiotherapy solutions

Radical project will develop an innovative, high resolution, monolithic 2D CVD diamond array based radiation dosimetry system which will deliver the levels of performance required by IMRT.

Our innovations will be in i) CVD diamond deposition, (PIP), (ii) overcoming priming effects and sensor fabrication, (iii) ultra low signal conditioning electronics with a self evaluation system to monitor degradation.

The market potential for such a product is €101 million.

Stand 20
Acoustics Lab
Project Value
£799,000

Quiet Panel

Demo Leader: Richard Wheatley

Active and passive noise cancellation in composite structures

In 2005/06, 68,000 people in the UK suffered from work related hearing problems, simple sound absorbing materials being of limited effectiveness. We aim to produce composite panels incorporating active noise control systems, utilising an integrated listening and actuation device, capable of neutralising panel vibration and the transmission of sound.

We will utilise recent advances in modern high-speed Digital Signal Processing (DSP) techniques with actuators based on the novel magnetostrictive material Terfenol-D. This has ideal characteristics for our application as it generates high forces with low energy consumption, operating over a broad frequency range. We will also be able to monitor equipment reliability by analysing changes in control requirements over time.

This mix of technology has exciting potential and will be used for noise cancellation in the transport sector, and modifying the acoustic response of the modern built environment.

Stand 21
Workshop
Project Value
€1,360,000

MicroDry

Demo Leader: Dave Smart

Microwave drying for the rapid remediation of flooded buildings

Now that an excess of 50 million European citizens are living in areas at risk of flooding a rapid drying solution is required to extract the moisture from walls and floors.

Current drying operations require up to eight weeks before remedial work can be undertaken on the building. Our idea is to develop microwave technology which will reduce drying times in buildings after flooding events. A single Microdry unit will run off mains electricity and be capable of drying a room in just 10% of the time taken by current technologies.

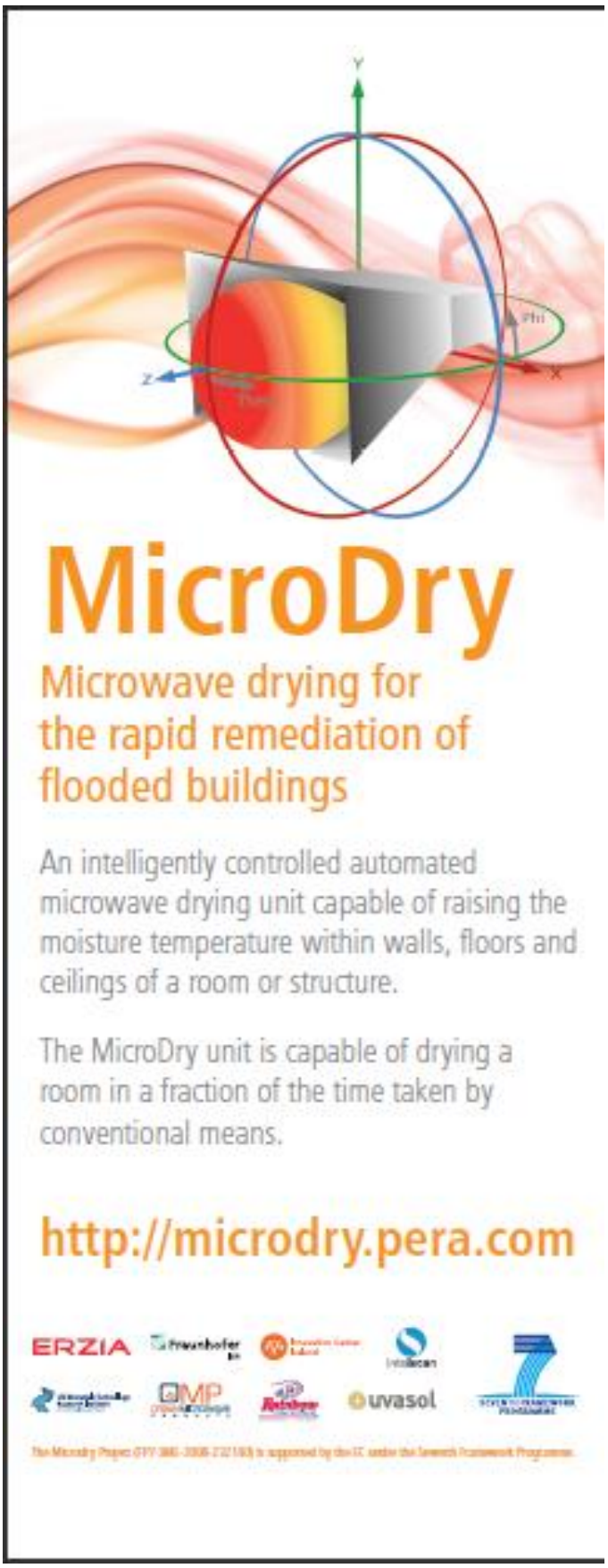
We will develop an intelligent control system that will measure the reflected microwaves to determine residual moisture content and adjust the power output accordingly to maximise efficiency.

presented to Matri staff and guests.

Microdry Video clip, also uploaded in the ‘unlisted’ mode of Youtube at the following link

http://youtu.be/h6zpDPcX0jE

MicroDry Project Banner



MicroDry Project Hand-out

MicroDry

Microwave drying for the rapid remediation of flooded buildings

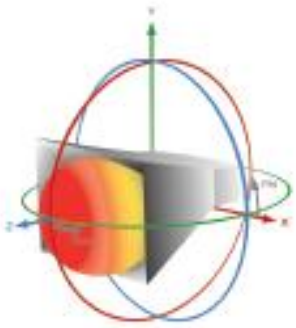
An intelligently controlled automated microwave drying unit capable of raising the moisture temperature within walls, floors and ceilings of a room or structure.

Now that in excess of 50 million European citizens are living in areas at risk of flooding a rapid drying solution is required to extract the moisture from walls and floors.

Current drying operations require up to eight weeks before remedial work can be undertaken on the building. Our concept is to develop microwave technology which will reduce drying times in buildings after flooding events.

The Microdry unit operate from a mains electricity supply and be capable of drying a room in a fraction of the time taken by conventional means.

The Microdry project will develop an intelligent control system that will utilise microwave moisture detectors and remote temperature sensors to adjust the output power accordingly to maximise efficiency. The increased temperature of the moisture within the structure significantly increases diffusion rates decreasing the drying times of flooded buildings and returning people to their business and homes more quickly.



For more information, please visit

http://microdry.pera.com

ERZIA Fraunhofer IPA uvasol

The Microdry Project (FP7-SME-2008-232140) is supported by the EC under the Seventh Framework Programme.

Microdry Case Study

Case Study

Microdry

Microwave drying for the rapid remediation of water damaged buildings, returning people to their homes and businesses more quickly following flood events

Flooding is likely to increase due to climate change and more than 50 million European citizens now live in areas at risk of flooding. Microdry safely reduces drying times by as much as 60% cutting flood remediation time significantly.

Objectives

Develop understanding of the moisture diffusion behaviour from aged and micro-fractured concrete and building materials.

Develop understanding of the microwave behaviour of building materials and the subsequent moisture diffusion and evaporation

Partners

- Orban Microwave
- UVaSol Ltd
- Erzia Technologies
- Intelscan
- UK MatRI
- Innovation Centre Iceland
- Fraunhofer
- Rainbow UK

Funding

Seventh Framework Programme (FP7)

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Water damage to buildings affects citizens and businesses across the EU. Types of water damage include flooding (natural disaster), bursts and faulty domestic appliances. Water damage accounts for over 60% of buildings insurance claims across the EU.

Damage to buildings can range in severity from minor effects to serious structural damage. The major costs of flood remediation result from the lengthy drying times required by existing technologies; these costs include alternative accommodation, equipment hire and service company labour cost.

The Concept:

The Microdry system is a safe microwave technology operating on mains electricity capable of drying a room in a fraction of the time taken by current technologies.

Our technology uses microwave that is capable of increasing moisture temperature within building materials in a controlled manner improving evaporation rates and reducing drying times. A control system monitors the drying process for residual moisture content adjusting power output to maximise efficiency.

Safety is paramount so a series of measures are employed to ensure safe installation, microwave energy containment and monitoring during operation including communication of drying status to a remote operator.

The Benefits:

Approximately €6.8billion is spent on temporary accommodation due to long drying time alone. Based on reductions in drying time alone, Microdry could potentially save EU insurance companies some €850million.

'An average 500,000 homes are flooded in the EU every year costing €38billion in insurance.'

Market Potential

The Microdry unit is targeted at drying domestic and industrial properties that have suffered flood damage. For domestic housing, drying costs ~€1000/week per house are common with timescales of over 8 weeks. If the Microdry system had been used to dry all 75,000 homes flooded in the UK 2007 summer floods, it would saved an estimated €525million.

Rainbow, the UK leader in flood remediation, provides direct access to the market assisting in achieving worldwide market acceptance. With this in mind, we predict sales into the global market of €6.8million pa 5 years post project (a market penetration of 0.5%).

UK Materials Technology Research Institute
A Pera Technology company

Scientific Publications:

Our paper as follows has been accepted for both for oral and poster presentation at IMPI 46 Symposium of International Microwave Power Institute on 19 to 22 June 2012 in Las Vegas

MICROWAVE ABSORPTION AND LEAKAGE CHARACTERISTICS OF COMMON BUILDING MATERIALS

Ali Imran Javaid*, Dr. Tej Pochiraju, Jón Matthíasson*****

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Abstract— *A microwave drying system, MicroDry, has been developed for rapid remediation of flood-affected buildings. The system incorporates feedback of temperature and microwave leakage to ensure safe and efficient drying through closed-loop control of microwave emissions. This paper discusses the material studies, simulations and design that form the basis of the system. Extensive results from the validation drying trials are also presented. Drying times have been reduced by up to 60%, demonstrating the suitability of the system to such drying operations.*

Keywords - permittivity; microwave heating; drying of building materials; microwave leakage detector

I. INTRODUCTION

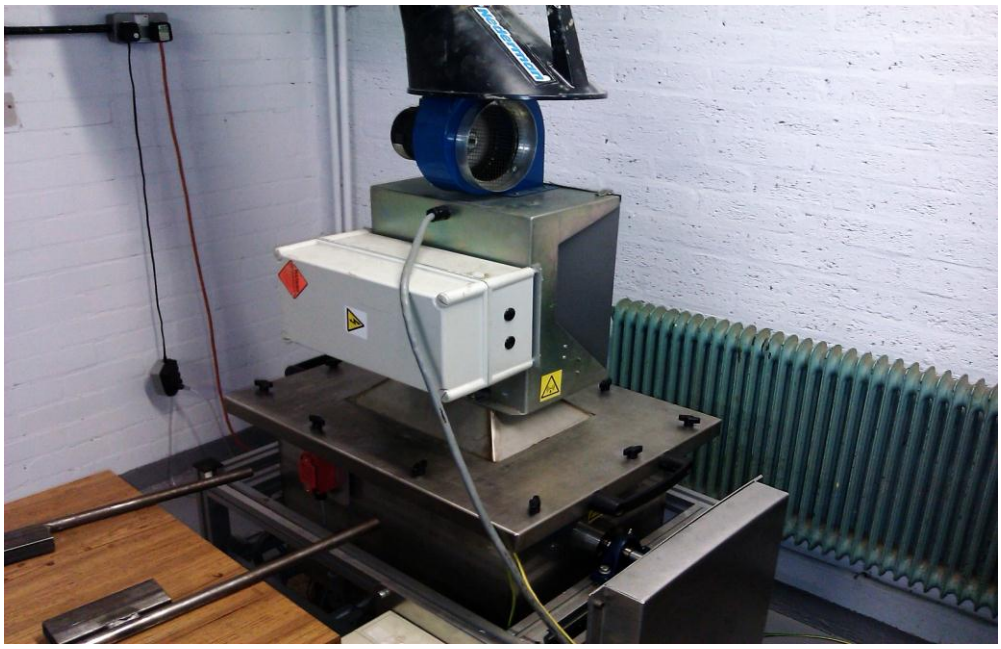
Water damage accounts for over 60% of buildings insurance claims across the EU. Types of water damage include flooding (natural disaster), pipe bursts and faulty domestic appliances. Damage to buildings can range from minor effects on walls, floors, basements and services to serious structural damage along with growth of fungi and bacteria. Majority of the cost of water damage remediation results from the lengthy drying time required by existing technologies; these costs include provision of alternative accommodation, equipment hire and service company labour cost.

Only modest improvements in drying times are possible from dehumidifiers and conventional heaters due to the small vapour pressure changes offered by such techniques. A European consortium has designed and developed a microwave drying system, MicroDry, for use in flood remediation operations. The system employs industrial microwave technology in combination with sensor feedback and an intelligent control system to significantly reduce the drying times of flooded buildings while ensuring safety of personnel and equipment in the treatment area and the surrounding environment.

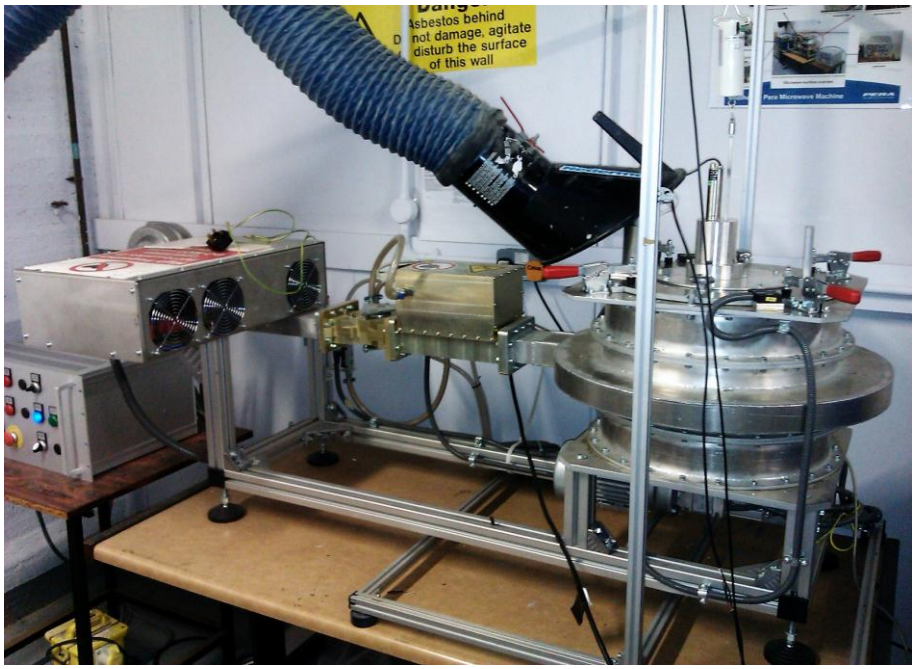
Drying systems based on microwave energy have previously been developed for building materials, e.g. the Plasmatronika system developed by a Polish SME, Ertec (Ertec Poland 2012). This system used an array of horn antennas held against the wall surface to be dried. As a result there is a considerable setup time and cost involved before the system can be used. A mobile microwave dryer is discussed in the patent, US 5797194, (Zettergren 1998). The present system is similar in concept to this mobile dryer but the novelty of the Microdry system is derived from the closed-loop feedback control of the microwave emission.

The following sections describe the design, implementation and test results of the MicroDry system while highlighting critical issues and workarounds.

WP1 Enhancement of Scientific Knowledge

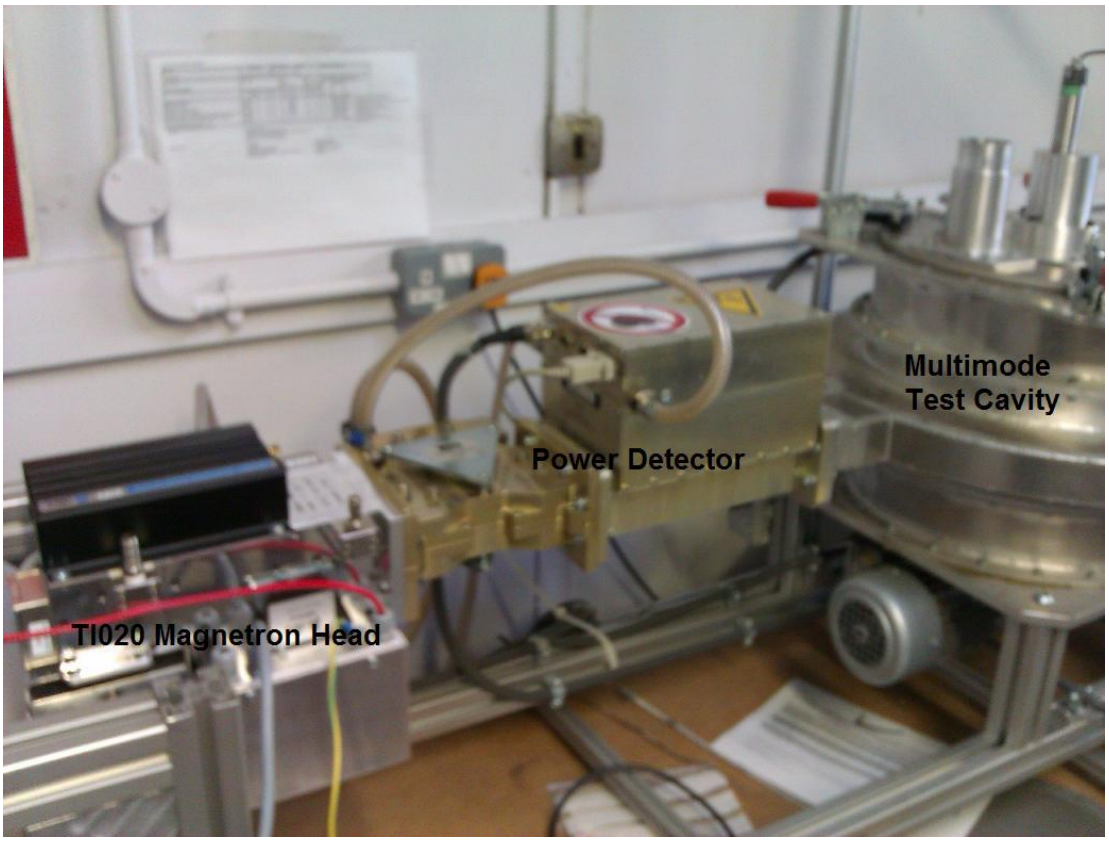


Cylindrical cavity setup used to treat brick and concrete samples

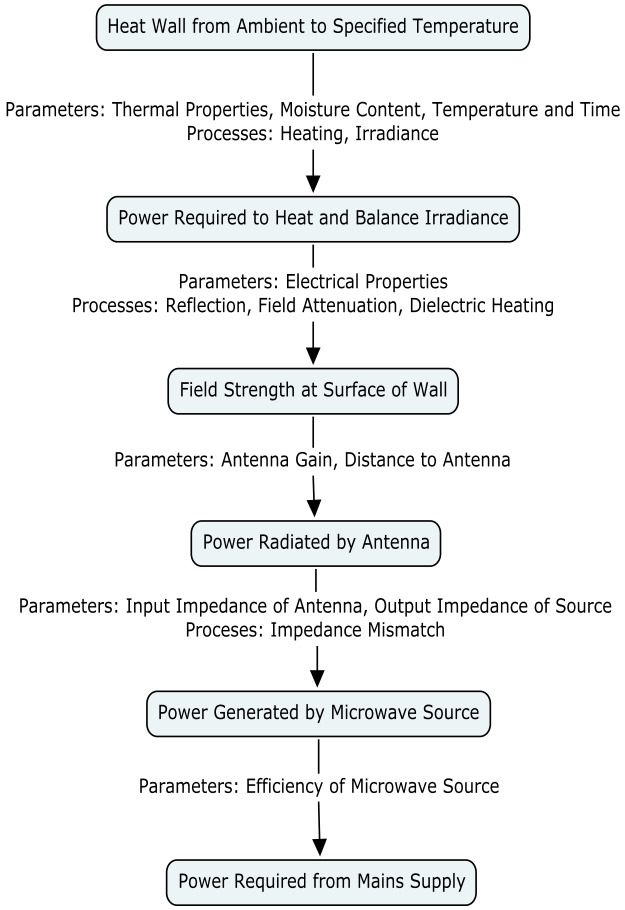


Rectangular cavity used to treat wood samples

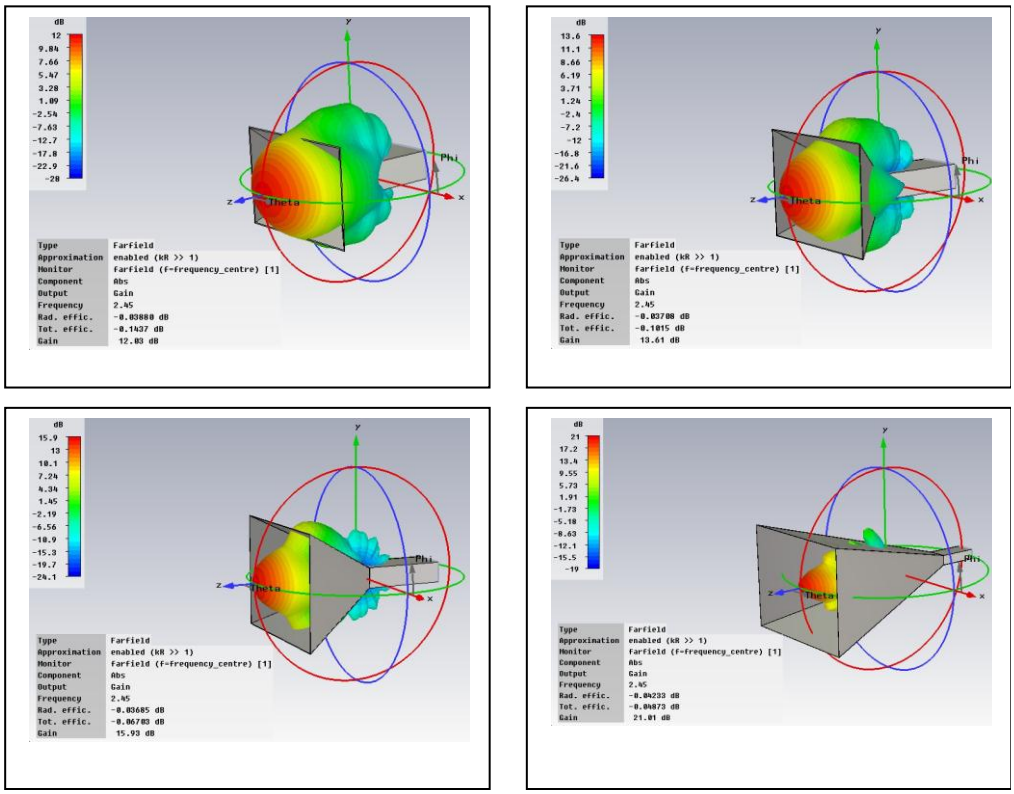
WP2 Design and Development of Microwave Emitter Array



Alter 3kW 2.45GHz microwave source with cavity used for testing

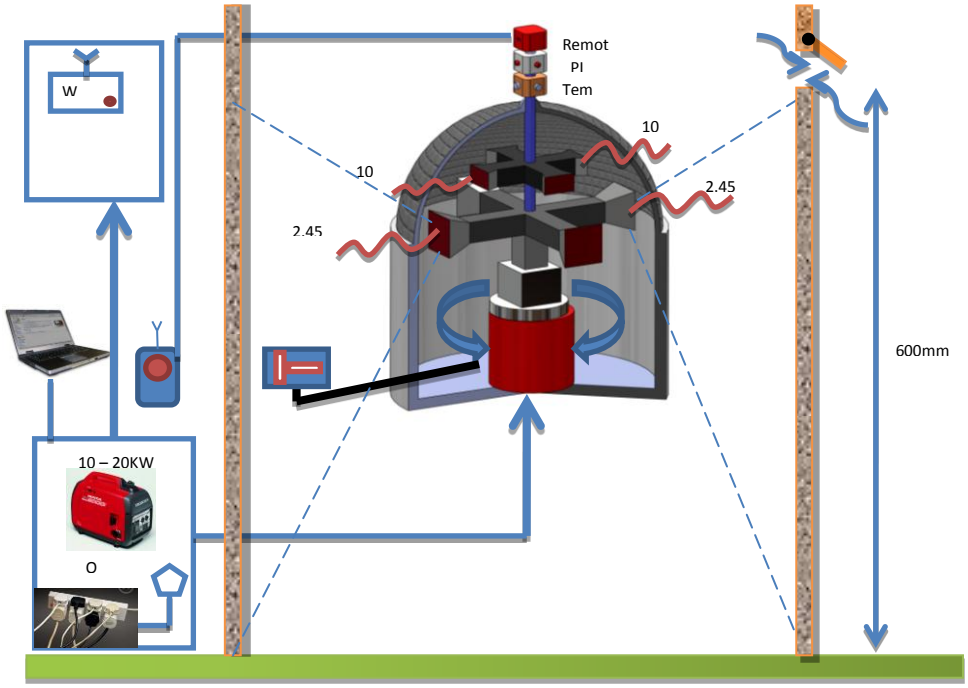


Flowchart showing parameters and processes involved in calculating power requirements

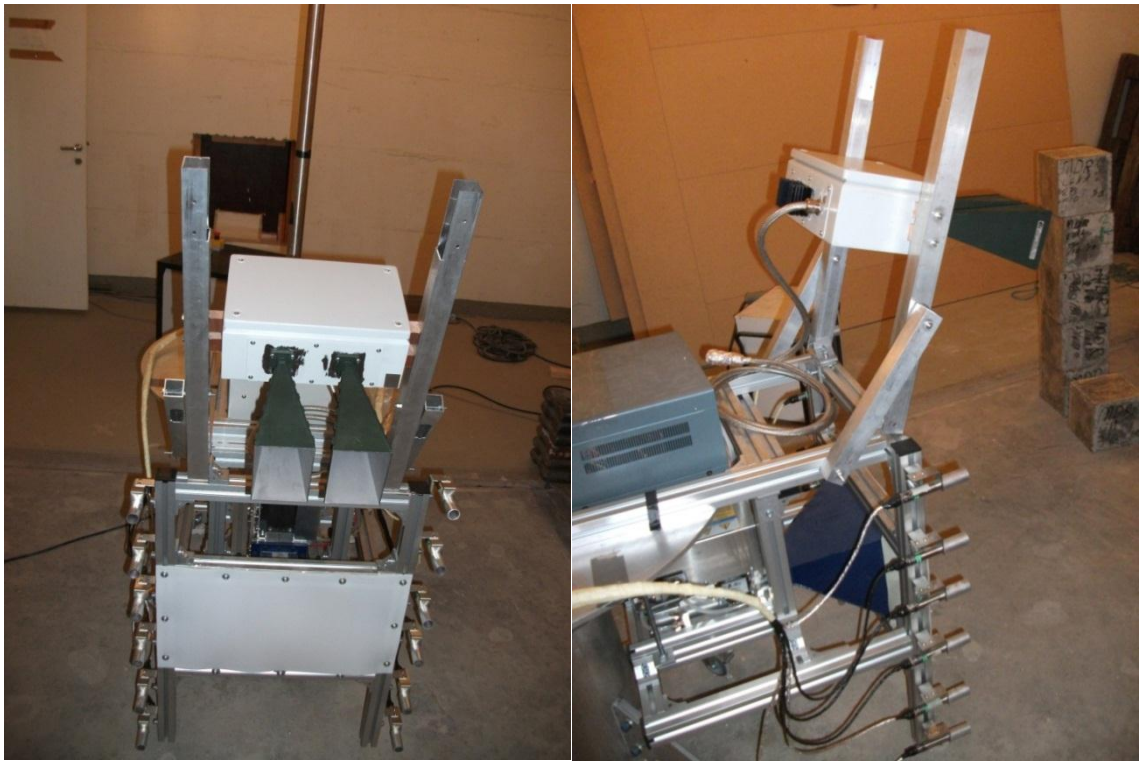


3D farfield pattern of horn antenna for 12, 14, 16 and 21 db gain rotating clockwise from upper left corner.

Work Package WP3 – Design and Development of Moisture Monitor

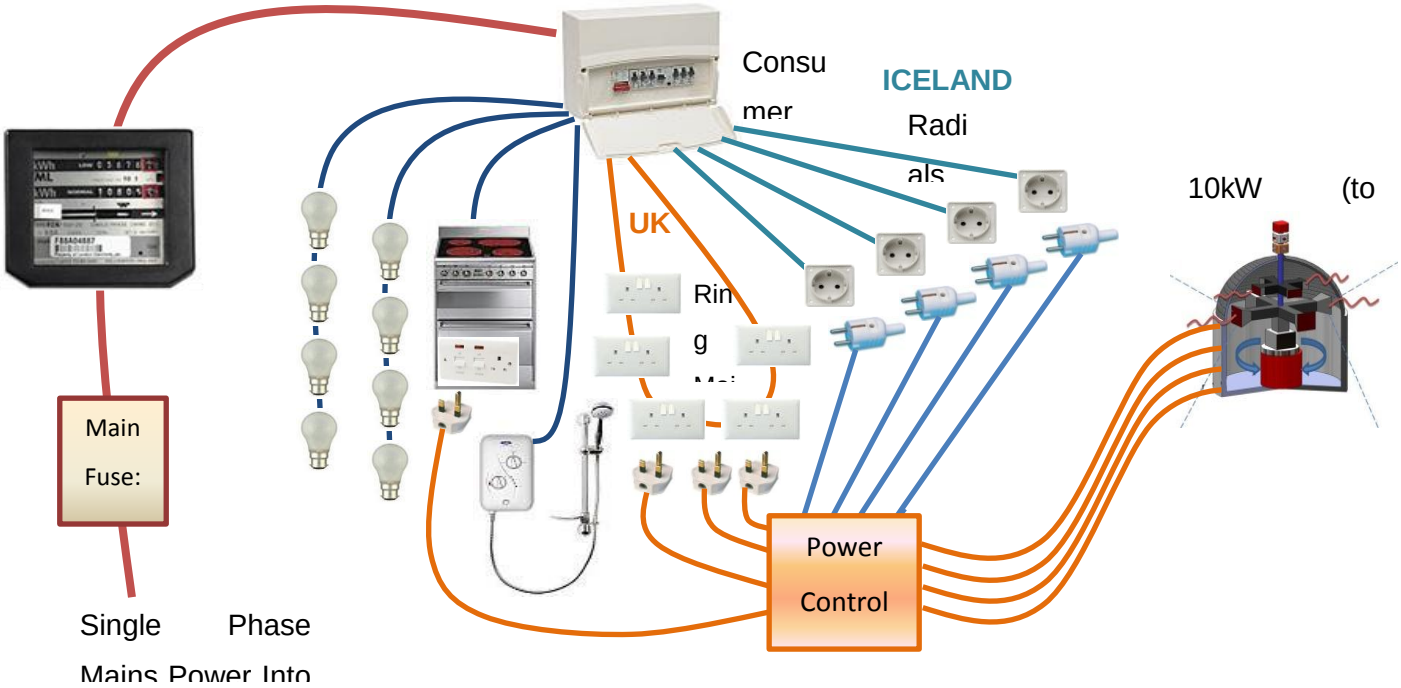


Microdry Concept

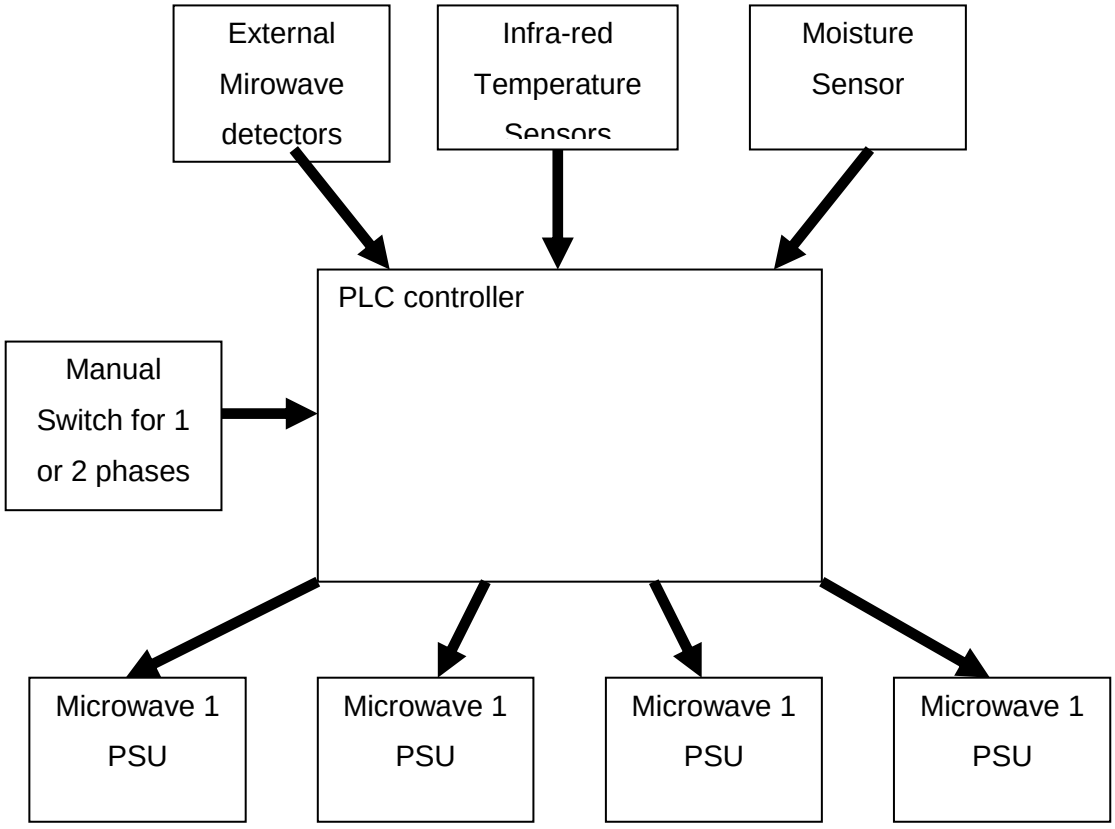


Microwave Moisture Sensor Prototype II mounted on the Microdry unit

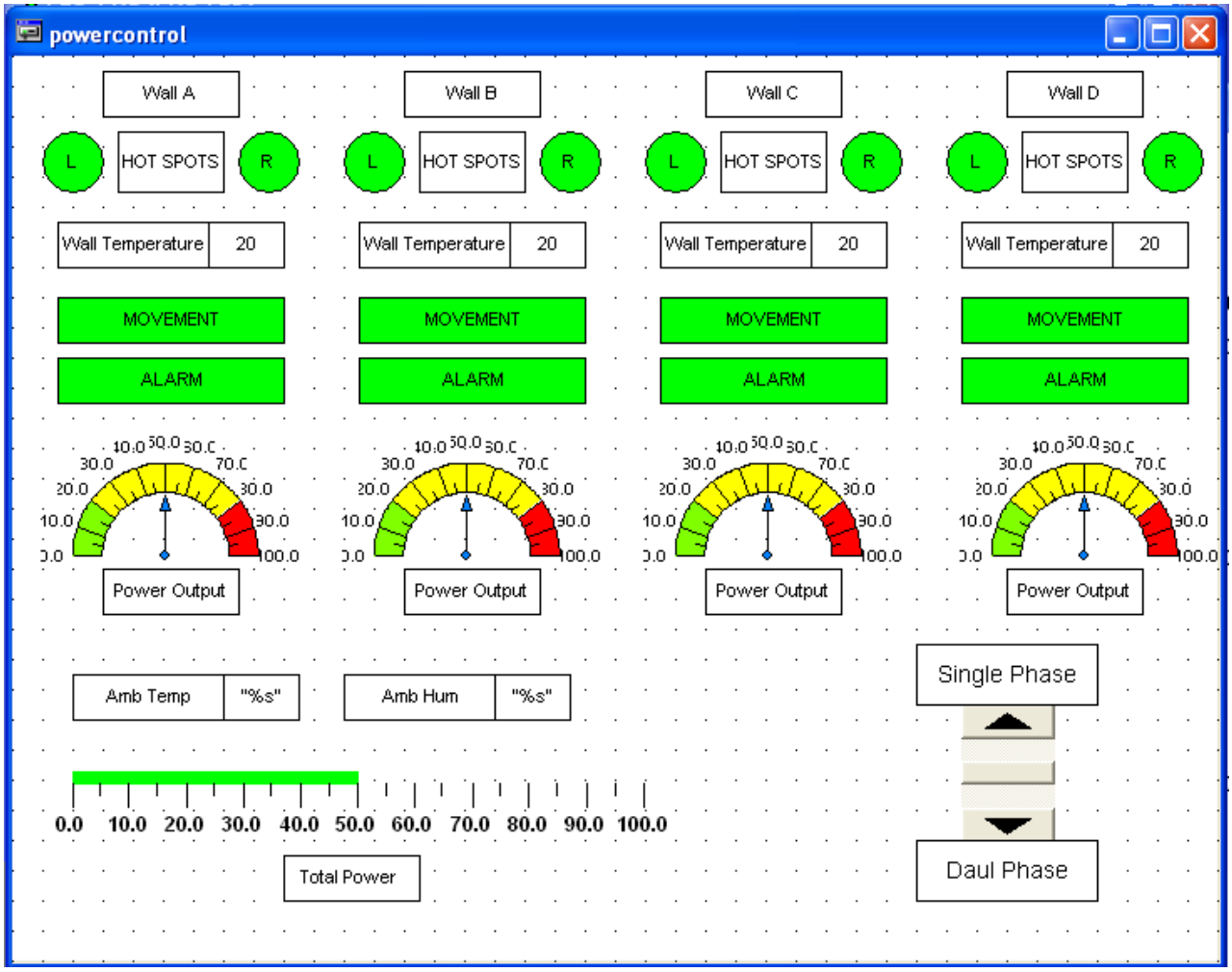
WP4 Power Management and Control System



Updated power architecture (UK and Iceland)



Block Diagram of System



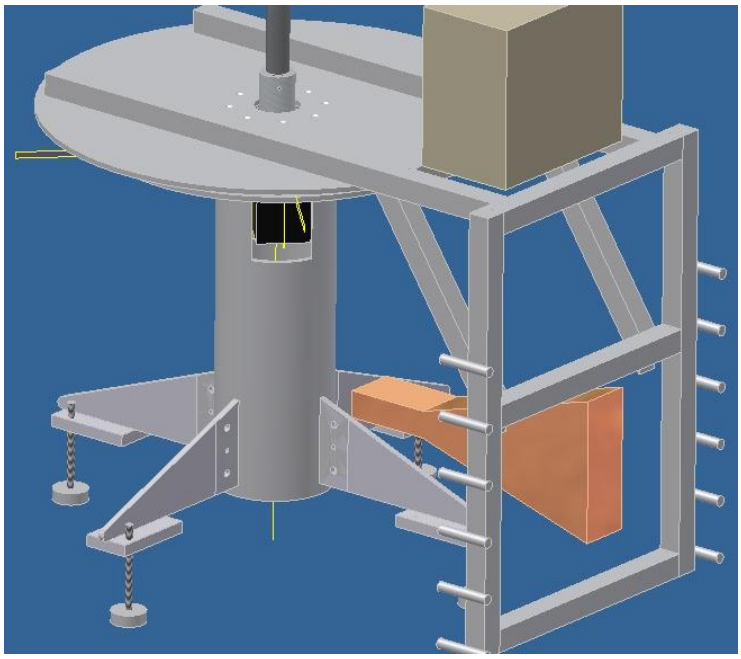
Screen View of Control System

Microwave Power Supply with the PLC Control Box & Computer Interface

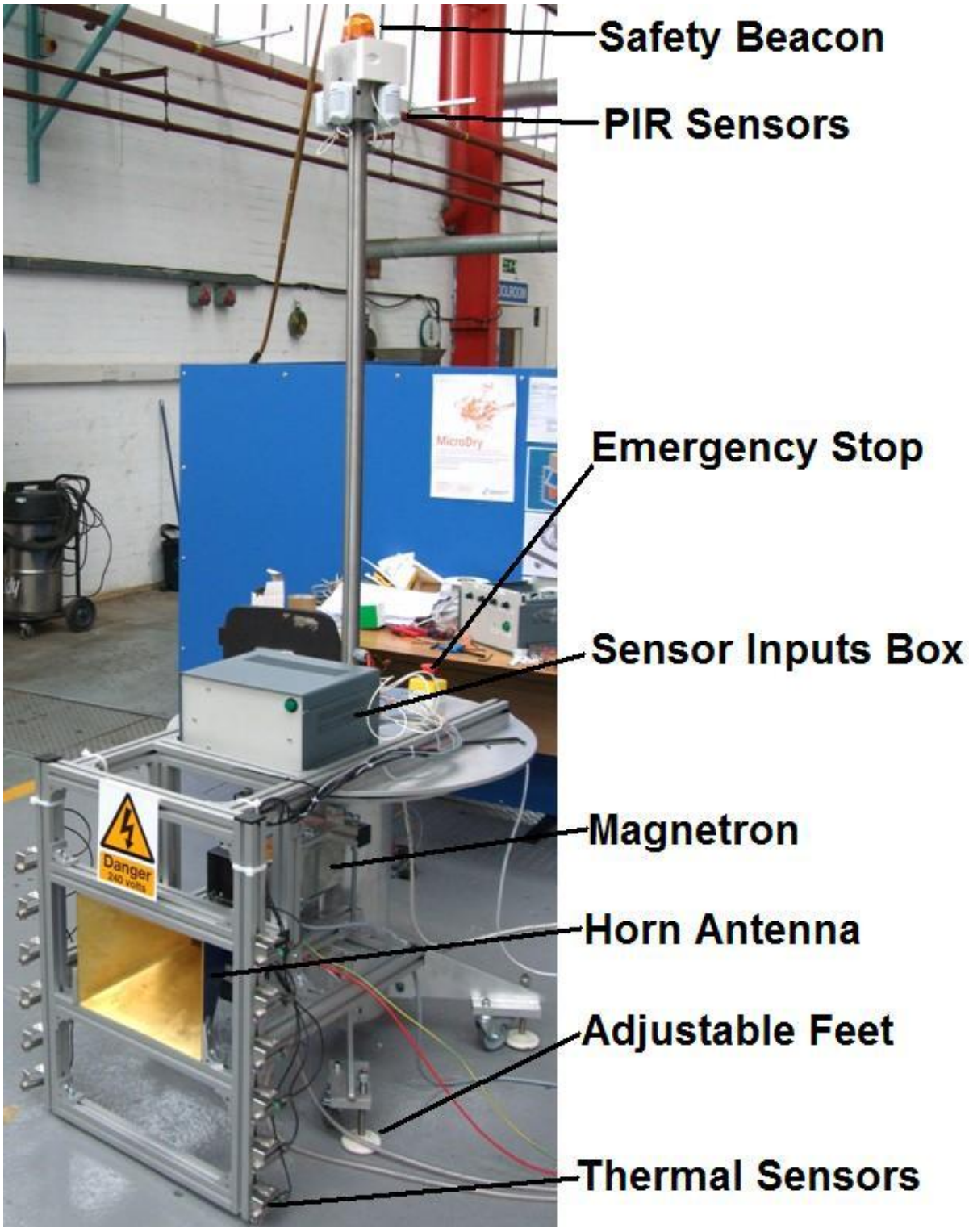
Control Box & PLC in Control Cabine & ***Front End of Microdry Unit with Infra-Red Sensor***

Infra-Red Sensors Connected

Work Package WP6 Integration

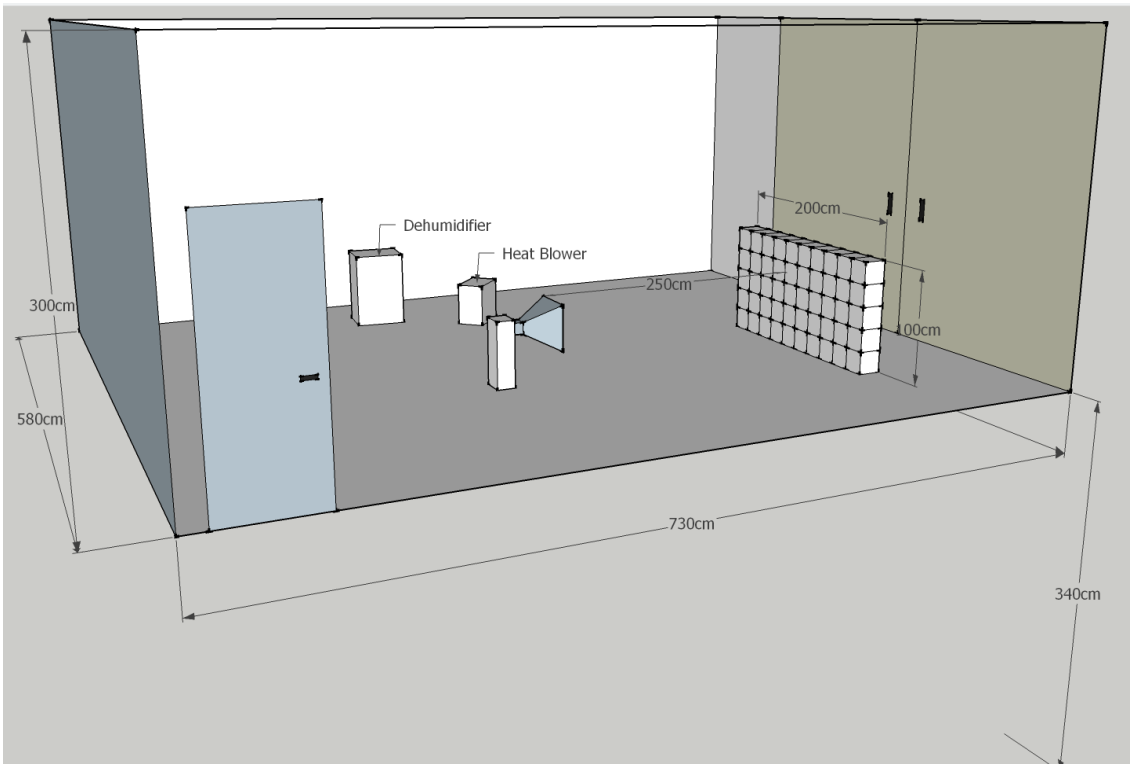


Support frame for horn antenna



Assembled MicroDry unit

WP7 Validation



Test room showing MicroDry system and test wall

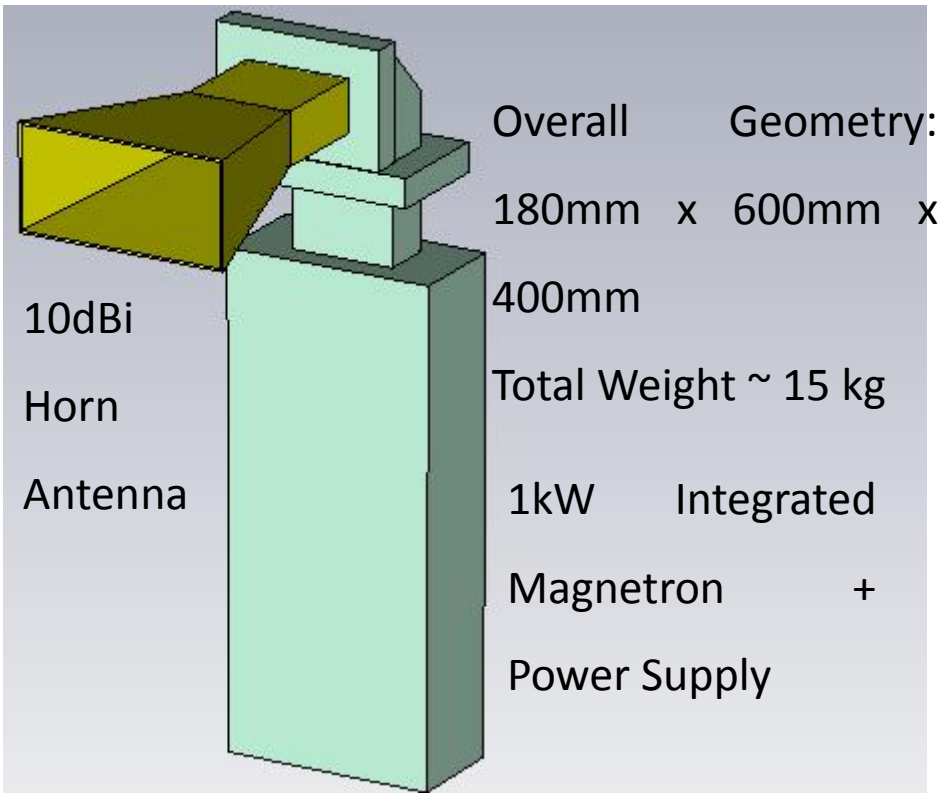
The building with the test room on the 2nd floor, behind the wooden door; microwave radiation was measured to be within safe limits around the building up to a height of 2.5m

Left and bottom right: Microdry system; Top right: Power supply and control cabinet

Left: Nails 3-4 in LWC concrete; right: Nails 7-8 in Thermalite

Left: Nails 1-2 in Pine; right: Nails 5-6 in Brick

WP8 Innovation Related Activities (Demonstration & Dissemination)



Potential Commercialised Microdry Unit

- Wireless sensors – microwave leakage and movement
- Simple control panel mounted on top – On/Off, Security Key, Visual Indicator of Power Output
- No rotation
- Only power cable leaves unit