

STIMULATING MICROWAVE AND RF APPLICATION INNOVATION

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ABSTRACT

Microwave and RF engineering is an enabling technology essential for a wide range of scientific and commercial applications. The use of this technology in many sectors is established whilst the advantages for others are still to be realised. Two years ago, the UK setup a major initiative to stimulate the uptake of microwave and RF technology for commercial applications. The initiative is referred to as the High Power RF Faraday Partnership. Michael Faraday's name is used because of his passion for disseminating scientific information so that all could understand the advantages that science held for them. The Faraday Partnership supports and extends Michael's aspirations and is driven by four underlying principles:

- To facilitate the transfer of new and novel business concepts between partner organisations
- To promote the advantages of long term partnering between industry and academia
- To initiate core research
- To support life long learning

The applications of microwave and RF technology covers many topics ranging from particle accelerators probing the fundamental building blocks of our universe through food processing to all the topics listed for presentations at the 4th World Congress and more. RF systems are at the core of all accelerators, and their requirements are used to drive microwave and RF technology forward. For example, to get the energy levels required by physicists, one design for the next generation of linear accelerator requires over three thousand (3,000+) klystrons. To make this affordable, an order of magnitude reduction in cost needs to be achieved that will have to come from much improved manufacturing techniques. These advances in technology will have benefits in any commercial application through reduced running costs and lower capital (equipment procurement) costs.

The commercial applications for microwaves and RF in the process industries are numerous, but as a general rule, process industries are not interested in developing novel technology. They want to buy proven process equipment, install and commission it in the shortest possible time. The challenge therefore must be to turn the laboratory scale demonstrations into commercially viable process plant.

To turn laboratory research into full scale process plant requires effective, multi-disciplinary teams to be established. As a minimum, the plant will need whatever is being processed delivering to the microwave cavity and then removing when complete, so materials handling experts will be required. In addition other disciplines (eg chemists, food technologists, doctors, etc) may be required depending on the specific application. The Partnership has experience of creating and managing such teams.

It is the technical and commercial challenge of turning laboratory research into energy efficient, high productivity process plant that the High Power RF Faraday Partnership is addressing. To enable it to do this it has partners covering all aspects of the development lifecycle including

- academic researchers in RF and other disciplines
- device manufacturers
- system designers and manufacturers
- maintenance companies
- process companies
- investors

The Partnership is progressing on two strategic and synergistic fronts,

- to improve microwave and RF technology to meet the requirements of the next generation of high energy physics accelerators and improve the financial and technical attractiveness of the technology
- to find microwave and RF applications which can be commercially exploited into profitable product lines for process equipment manufacturers

A key element to the successful exploitation of laboratory scale work is in the cost effective scale up. To assist this process the Partnership is embarking on an ambitious project to set up a high power microwave and RF laboratory which will give researchers and developers from around the world access to large scale equipment (eg microwave systems, material handling equipment, etc) and expertise which can be used for concept demonstration projects.

In order to stimulate the take up of this technology, education is also required. Decision makers from the process industries need to be educated on the benefits that this technology will bring to them in terms of environmental and financial returns, along with basic information on how microwave and RF systems actually work, the legislative framework and safety requirements. The Partnership is investigating a multi-media education package to fulfil this requirement. For specialists, the Partnership has launched a post graduate qualification in High Power RF Engineering. This professional qualification covers all aspects of microwave and RF systems including advanced electromagnetics, active and passive components and power supplies.

Through its members, the Partnership has access to world class, multidisciplinary, scientific, engineering and financial expertise. Since its inception, it has improved the knowledge flow and communication between all organisations, several of whom are now regularly working together.

The technology of producing microwave and RF power from electrical power is mature, what is only now becoming apparent are the many potential applications to which this technology can be advantageously applied. In the correct applications, this technology can achieve significant energy savings and have a role to play in achieving a knowledge based, high tech, low carbon economy. It also has other potential environmental benefits including recycling of modern materials commonly found in consumer goods which presently go to land fill sites.

Legislative and environmental issues are exerting a force in favour of microwave and RF technology. The Partnership aims to harness this and other factors to produce a financially and technically healthy academic and industrial community to service the demands of the market place.