Low-temperature gains

IF Finland is known for its low temperatures, it is also becoming known for its low-temperature research. One of the leading groups in the field, with a growing international reputation, is the Low Temperature Laboratory at the Helsinki Technical University, based in the Helsinki suburb of Espoo.

A special interest of the laboratory has been the application of low-temperature physics to the study of the brain. Physicists at the laboratory have been working since the mid-1960s on ways of measuring the very weak magnetic fields in the femtotesla range produced by the electric fields flowing in the human cerebral cortex. From the early days they have been doing this with the use of SQUIDS (superconducting quantum interference devices), using these weak magnetic fields to map out neural activity in the brain.

This method, known as magnetoencephalography, allows noninvasive localization of the activated brain areas with a special resolution of a few millimetres and temporal resolution, under favourable circumstances, of a millisecond. Such measurements provide detailed insight into the organization and functioning of the brain.

A number of experimental devices have been produced in the laboratory for these purposes, starting with the world's first multichannel instrument for magnetic field mapping, a four-channel gradiometer, built in 1983. After two intermediary version, using seven and 24 channels respectively, the latest device to emerge from the laboratory is a 122-channel neuromagnetic measuring system, made up of 61 two-channel thin-film units evenly distributed over the whole of the head, known as Neuromag-122.

Channel vision: The Neuromag-122 in action.

The advantage of the new instrument is that it allows a complete set of data to be collect from an experimental subject without repositioning the instrumentation allowing processes in different areas to be followed simultaneously.

A small company has been set up to develop Neuromag. One fifth of the shares are owned by members of the research team, 30 per cent by Instrumentarium Corporation, Finland's major producer of medical instruments, and the rest by the Finnish National Fund for Research and Development (SITRA).

Although currently operating from the laboratory itself, the company is soon to relocate to its own premises, from which it hopes to sell the new machine to university research groups throughout the world.

Marketing the new machine will be done through Instrumentarium. "It is obvious that the Neuromag machine is the final answer for this type of equipment, but in a small country like Finland our main difficulty is marketing," says Olli Lounasmaa, professor of physics and director of the department. "We have had many enquiries about this instrument and have been asked for several quotations, although so far we are waiting for a firm order."

Lounasmaa says that, unlike in some other countries, there is little opposition to university scientists becoming involved in commercial activities. "In some countries, people are worried about the possibility of conflicts of interest with those working on government funds. But in Finland, it is just the opposite. The government is very happy about supporting this kind of activity in universities which will lead to commercial products."

As with virtually all other research groups in Finland, Lounasmaa says that he expects a slight reduction in his research budget next year. But he hopes to be able to take advantage of two policy changes: one is a greater concentration of research funds in university-based centres of excellence, the other is the potential availability of funding from Brussels through the Human Capital fund.

Two applications from his group — one in biomagnetism and the other in ultra-low-temperature physics — have already received high marks from scientific reviewers, and both projects are candidates for funding early next year.

"It is always a difficult problem for a small country that, if it joins a large programme such as the European Space Agency, it finds that the big countries — Germany, France and the United Kingdom — tend to get the most interesting parts, and small countries are very likely to get the bits and pieces which no one else is interested in, with the danger of just becoming a footnote. The attraction of these new applications is that the installation will be in Finland, and we will have control over them." □

Talking to Europe

SEPARATED by vast distances and hostile terrain, it is perhaps not surprising that the scattered inhabitants of the Nordic countries have become the world's greatest enthusiasts for mobile telephones. A survey earlier this year showed Sweden, Finland and Norway topping the international league with between 6 and 7 per cent of the population owning such telephones in each country; in Britain and the US, the figure is just over 2 per cent, and in Germany less than one.

Having a strong market on its doorstep has been an important key to the success of the mobile telephone business of Finland's Nokia Corporation. And this itself has been made possible by agreement in the early 1980s between the four Scandinavian countries of a common mobile network through agreement on a single operating standard. Both experiences have encouraged the company to become involved in many of the high-technology research programmes, such as ESPRIT and RACE, organised by the European Commission in Brussels.

According to Viljo Hentinen, Nokia's vice-president of research and development, 40 per cent of the company's spending on R&D — which, at Fmk 933 million (£130 million) last year represents 6 per cent of the company's annual turnover, and 20 per cent of the total R&D spending by Finnish industry — is now done through international projects. This is partly to collaborate in pre-competitive research, and partly to enable the company to participate in the setting of international standards.

After a period of rapid growth in the 1980s, the company suffered a loss last year, but telecommunications and mobile telephones have remained two bright spots. Both represent the fruits of heavy investment in research and development. In the case of mobile telephones, where the company has pioneered the use of digital cellular telephone systems and is now the second largest producer in the world (after Motorola), R&D represents 10 per cent of the divison's turnover.

Hentinen admits that Nokia does not spend much of its research money with university departments — at present, less than 2 per cent of its total R&D budget. But it is still keen to benefit from the fruits of Finnish research, and its Tampere and Espoo laboratories work closely with the nearby universities.

Hentinen is keen to see universities build on their top-quality research teams. "Universities which do high level research must create centres of excellence, hopefully in areas of interest to industry," he says. "This is the way of the future."