

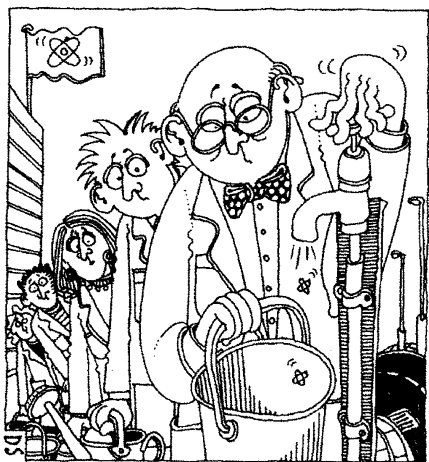
Europe is warned of a 'neutron drought' ...

Paris. European physicists and other researchers warned last week that the closure of many smaller neutron sources, at a time when the demand for neutron scattering techniques is growing, raises the prospect of a "neutron drought" in Europe, with demand for neutrons outstripping supply around the turn of the century.

The warning emerged from a workshop on nuclear scattering techniques organized by the European Science Foundation (ESF) and the European Neutron Scattering Association in Autrans near Grenoble in France, and attended by 80 leading scientists and engineers. The meeting concluded that an immediate shortage of neutrons can be avoided only by upgrading existing large facilities, and also recommended building a third-generation neutron source in Europe early in the next century.

Neutron scattering techniques are increasingly used by materials scientists, condensed-matter physicists, structural biologists and others studying the structure of molecules, or *in situ* processes such as enzyme transport across membranes. These neutrons are produced either as a steady stream generated by nuclear reactors, or as short pulses produced by accelerating protons into a target made of a heavy metal such as depleted uranium or tantalum — a process known as spallation.

Europe has the world's two most powerful neutron sources, the 58.3-MW reactor at the Institut Laue-Langevin (ILL) in



Grenoble and the ISIS pulsed spallation source at the Rutherford Appleton Laboratory in the United Kingdom. (Japan has a 5 per cent stake in ISIS, but itself plans to begin building a machine — Spring-8 — three times more powerful in 1997.)

But both ILL and ISIS are already oversubscribed, while only two of Europe's 19 other existing facilities — the reactor at the Hahn-Meitner Institute (HMI) reactor in Berlin and the Orphie reactor in Paris — will be running at the end of the century, according to a 1993 report of the OECD's

Megascience Forum. The only new source scheduled to have come on line by this time is the planned 20-MW FRM2 research reactor in Munich, Germany (see below).

At the same time, demand for neutron sources is growing and expected to continue to do so. Neutron scattering is shifting from "an exotic to a routine tool", says Reinhard Scherm, director of ILL. Neutron researchers also argue that a third-generation machine will eventually be needed for studies of more complex materials.

Last week's meeting represents an attempt by the diverse community of neutron users to lobby more effectively for better facilities. The fact that they are "now speaking with a single voice" is important to gaining support for neutron facilities, says Peter Tindemans, the chairman of the OECD Megascience Forum, which is expected to set up a working party on neutron sources at a meeting this week.

The recommendations from the Autrans meeting also reflect a new pragmatism which acknowledges that Europe's cash-strapped research agencies are unlikely to back the building of new facilities in the short term, and that to gain such support, the scientific community must make a more convincing case than in the past.

"We can no longer even begin to contemplate building a new machine until the scientific community has itself made a watertight case for the need for it," says Peter Day, professor of chemistry at the Royal Institution in London, and a member of ESF's working group on physical and engineering sciences. The consensus achieved at last week's meeting by the users of neutron sources themselves is a big step in this direction, he says.

Political support for neutron sources is certainly lacking. Although ILL was recently refurbished at a cost of ECU50 million

(US\$62.5 million), budgetary restrictions caused by a reduced contribution from the United Kingdom, which along with France and Germany is one of the main contributors to ILL, led to the number of beamlines being reduced last year from 31 to 25. Similarly, a proposal by ISIS to install a second target, which would double its capacity, has not yet obtained funding.

European researchers are keen to maintain their lead over the United States in neutron scattering, one of the few capital-intensive areas of research where this is the case. Europe has three times as many neutron scientists as the United States, and has spent five times more on neutron facilities over the past three decades.

Last year, the United States abandoned work on the \$3-billion Advanced Neutron Source (ANS), which was to have been built at Oak Ridge National Laboratory (ORNL) in Tennessee and would have been five times more powerful than ILL. The Department of Energy subsequently set up a high-level committee to reassess the needs of US researchers for neutron sources.

But the proposals that are likely to emerge will at best allow the United States to catch up with Europe. A proposal to upgrade ORNL, for example, would result in a machine equivalent to ILL. ORNL and the Argonne National Laboratory in Illinois are also candidates for a proposed 1-MW spallation source. Although this would be five times as powerful as ISIS, Europe already has plans for a much larger machine.

This is a proposed 5-MW European Spallation Source (ESS being designed jointly by the Rutherford Appleton Laboratory in the United Kingdom and the KFA Jülich in Germany, and would be 30 times more powerful than the 160-KW ISIS facility.

Declan Butler

... as leak fuels German uranium debate

Munich. A document leaked from within Germany's federal research ministry (BMBF) has suggested that the government may be reconsidering its support for the construction by the Technical University of Munich in Garching of a neutron source based on a research reactor — known as FRM2 — designed to use controversial highly enriched uranium (HEU).

The memorandum was sent to the research ministry from the federal environment ministry. It describes a telephone conversation in which Anton Axmann, the project leader of the FRM2, apparently admits that the research reactor that provides the neutron source could be redesigned, without significant loss of performance, to burn uranium that is only 70 per cent enriched.

The leak has coincided with a visit to Bavaria of officials from the US Departments of State and Energy, who are trying to persuade both Bavarian government officials and scientists from the university to redesign the reactor to burn low-enriched — that is, less than 20 per cent — uranium (LEU). Fuel elements at the 70 per cent enrichment level referred to by Axmann had been designed by the Argonne National Laboratory for the US Advanced Neutron Source, which was abandoned last year during the planning stage. But US officials say that this intermediate enrichment level would still be of weapons grade, and therefore unacceptable.

The research reactor, if built as now planned, would be the first specifically designed to burn weapons-grade HEU, at ►