

Japanese tokamak

Plasma now in production

Tokyo

PLASMA was successfully produced in Japan's giant JT-60 tokamak fusion machine for the first time last week. Although this milestone has long since been passed by both of JT-60's competitors — the Tokamak Fusion Test Reactor (TFTR) at Princeton in the United States and the Joint European Torus (JET) at Culham in England — any of the three might be first sometime around 1987 to reach the immediate goal of break-even.

JT-60 scientists were clearly very pleased at how smoothly the tokamak had run. Operation began in April and produced plasma exactly as expected almost immediately. The machine was then run in a discharge cleaning mode to remove impurities from the inner sides of the vacuum chamber and shut down for the installation of diagnostic apparatus which will be used to monitor plasma parameters in the next phase of development.

In the first test run, ohmic heating alone was used and temperatures in the 100-200,000°C range achieved for around 80 milliseconds — a long way from the 100 million degrees and 1-second confinement needed to achieve the break-even condition when the reactor produces as much energy as it consumes. But to achieve that goal, JT-60 will not be following quite the same route as either TFTR or JET.

Unlike either of its competitors, JT-60 will use radio-frequency waves to drive current in the plasma. In the other designs, currents are induced to flow in the plasma by a set of coils around the tokamak that act as the primary winding of a d.c. transformer — the plasma itself acts as the secondary winding. But such a system allows only pulses of current to be produced, for in a d.c. transformer the current in the primary would have to increase indefinitely to continue to drive current in the secondary, a clearly impossible condition. Driving the current by radio-frequency waves, however, allows operation to continue as long as needed as electrons are pushed along the magnetic field by transfer of the waves' momentum.

The JT-60 team is also proud of the neutral beam injector equipment that will be used to heat the plasma in the future. All three tokamaks are using neutral beams but, according to Masaji Yoshikawa, director of Large Tokamak Research at JT-60, the Japanese designs are at least a year ahead of the others in their technical development.

JT-60 also incorporates a unique method of dealing with impurities — metal atoms or gas molecules that may be knocked out of the tokamak inner wall by the plasma — in its magnetic limiter or divertor, and if it works as predicted, will provide a crucial advance towards practical fusion. The idea is to give the plasma in the

tokamak a figure of eight, rather than circular, cross-section, and to keep impurities away from the main body of the plasma in the upper "circle" of the figure of eight.

JT-60 is now expected to be run until the end of June with ohmic heating and then shut down for six months while both neutral beam and radio-frequency heating systems are installed. Next year, power will be put into the plasma from all the systems and, if all goes well, break-even will be reached in the winter of 1987.

All these experiments are to be run with a hydrogen-deuterium plasma; there is no intention to switch to the deuterium-tritium

plasma that would be used in a commercial reactor and will be the subject of second-stage experiments for both TFTR and JET. Neutrons produced in the latter reaction are very energetic and make the whole tokamak radioactive; expensive and difficult remote handling techniques thus become essential.

The Japanese are leaving this stage to their next reactor, the fusion experimental reactor, which will follow JT-60. That is, rather, if some form of massive international effort does not follow on from the three projects now running. Increased costs are making the advantages of international cooperation more and more obvious and recent talks have produced hopes that it might eventually take place.

Alun Anderson

Hungarian education

New law spawns discontent

HUNGARY'S new education law, passed last month, lays special stress on the unity of education and research, and the need to provide more flexible forms of post-university training, according to the Minister of Education and Culture, Mr Bela Koepeczi. Presenting the bill to the National Assembly (Parliament), Koepeczi said that although it is not the task of the law to lay down specific conditions for higher and postgraduate education, the new law makes it clear that the provision of proper material conditions in the education sector is the duty of the government. And the government, he assured the assembly, has undertaken to continue its investment in the reconstruction of the universities and to improve the supply of equipment and other necessities for university-based research.

The new law, which replaces the existing legislation of 1961, covers the whole educational process from kindergarten to post-graduate and is intended not as a radical reform but as a gradual process of development, Koepeczi explained. The prospect of new legislation, however, triggered a debate in the universities on academic autonomy, and, in particular, the allocation of senior appointments. A number of academics, Koepeczi said, have gone so far as to press for "decentralization". This term is at present used in Hungarian political circles to mean the reform of 1982, by which industrial enterprises elect their own managers (choosing from at least two candidates). In other words, these scholars advocate that the universities should be allowed to elect their own rectors and senior administrators.

This, Koepeczi says, is not a true "materialization of democracy" since the appointments in question are the concern not only of the institutions individually, but also of the wider scientific and professional community. Although, therefore, the new law gives the universities considerably more control over syllabuses, teaching methods

and day-to-day administration, senior appointments will still be the concern of the government or of the relevant minister. "Democratization" will continue to be ensured by the government or minister consulting with the relevant committees of the Hungarian Academy of Sciences, which thus serve as a kind of watch-dog for scientific public opinion.

Since, in Hungary, members and researchers from the Academy of Sciences frequently simultaneously hold university posts, the system has so far worked reasonably well. The "decentralization" lobby, therefore, seems to have based its stand rather on a matter of principle than on the need to reform any current shortcomings.

This inevitably evokes the question whether the "decentralizers" have not, to some extent, been influenced by the present endeavours of the Polish universities to retain the autonomy won in 1980-1981, in which the right of the universities to elect their own rectors and deans is one of the most burning issues.

Naturally, Mr Koepeczi made no reference to the Polish situation in his address to the National Assembly. The new law was presented as a purely Hungarian concern. Nevertheless, on one point at least, those responsible for drafting the law seem to have had an eye on developments in Poland. In drawing up the bill, the government, Koepeczi said, considered it extremely important to provide a legal background to the operation of student "self-government bodies", an issue that has so far aroused no great controversy in Hungary, but which in Poland is at present a major point of confrontation between the vast majority of the student body (over 90 per cent in some universities) and the governmental Committee for Social and Political Questions which seeks to reduce the self-government committees to a mere adjunct of the Party youth movement.

Vera Rich