

Editorial

ESS: its state of the union

Bonn showed that ESS is ready for take-off. Even the German Science Council admits that only ESS can maintain Europe's lead in neutron science and technology. Neutrons, together with other tools, are vital for unravelling nature's secrets and developing tomorrow's materials and drugs. Users dream of the new venues ESS will open.

Encouraged by the new MoU, the ESS partners will be

working on the basic engineering design until the end of 2003. Exciting instrument concepts are available for exploiting the huge potential of ESS even more fully. The site contenders have provided a strong momentum with a regional flavour and attention is now shifting to the political scene. We are part of the working group that will report at the end of 2002 to the EU ESFRI Forum (Page 3). We have to work hard at a national levels, too. Governments have ignored the Barcelona Summit goal of 3% of GDP for research. As the German Science Council has cast doubt on the need for neutrons, we have re-submitted ESS for new recommendations. Four times a year this Newsletter will inform scientists, the media, governments, industry and the public about events inside and outside ESS and reveal the results of research with neutrons and their importance for the scientific community and society as a whole. Europe needs the ESS!

Peter Tindemans,
Chairman, ESS Council

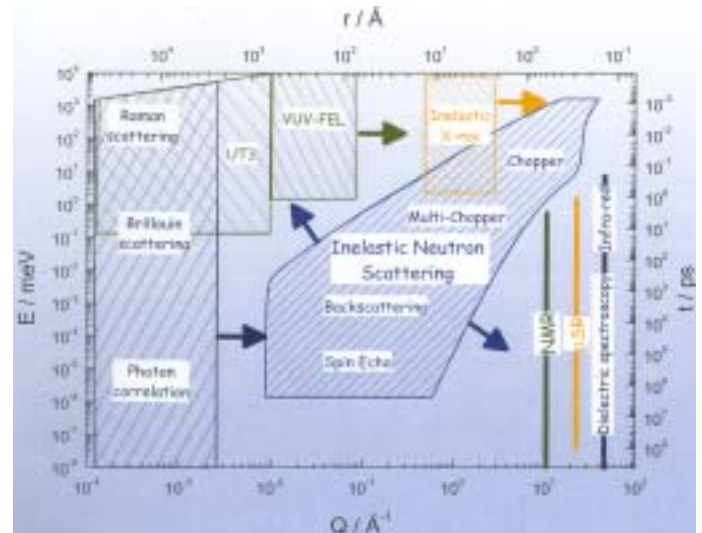
ESS status

Why Europe needs the ESS

The arguments for ESS are fairly straightforward if one considers the potential of neutrons and the global position of Europe in neutron research. Not so for the German Science Council, which in its recent assessment of nine large facilities ignores a worldwide consensus that neutrons will remain an important research tool. At the same time the European Union member states and the EU Commission have started a process that hopefully will result in decisions on the future of neutron research in Europe. (Page 3)

**Europe needs the ESS,
and we can do it**

ESS is the European cornerstone of the three-tier strategy proposed by the OECD Megascience Forum for Europe as part of a global strategy. As the European Neutron Scattering Association ENSA stated: a network of regional facilities is the first tier; ILL and ISIS, the current global flagship facilities, the second; the third is ESS, which together with the MW sources now under construction in the US (the SNS) and Japan (the JSNS) is opening up new and exciting vistas in condensed matter research across all disciplines. The increasing need to facilitate the evolution from 'design-by-trial' to 'tailored-functionality' of advanced technological materials through the revolutionary new insights into the structure and dynamics of matter afforded by neutron scattering, the expansion of the scientific community dealing with such problems,



Range in time and distance covered by inelastic neutron scattering and other techniques. With the advent of ESS and the UV and the X-ray-free electron lasers the ranges will extend in the directions indicated by the arrows. Techniques that do not directly provide distance information are indicated only as bars along the time axis

notably in areas such as soft condensed matter and biology, and the impending decline in the availability of neutrons, were the motivation for the OECD's global strategy.

ESS will address a wide range of problems in soft and hard condensed matter science. In many cases these problems have a direct technological and industrial relevance: engineering, new materials, energy storage and conversion, chemical engineering, geotechnology, biotechnology etc. The unprecedented intensity offered by ESS (surpassing by far SNS and JNS) and two fully-optimised target station configurations will enable in-situ, in-vivo, real-time, real-life kinetic measurements to be performed on hitherto unrealisable timescales and reduce measurement times by factors of 10 to 100 in some cases,

thus making feasible what is now at and beyond the limits of sensitivity.

ESS's Technical Advisory Committee of experts from many laboratories in Europe (DESY, CERN, ESRF, ILL etc.) and the US and Japan has stated that the present ESS design is entirely feasible and can be realised by the ESS partners.

Complementary techniques

Neutrons have some very unique properties: charge neutrality and deep penetration, magnetic moment, large scattering cross section for light elements such as hydrogen and oxygen, sensitivity to neighbouring elements and strongly isotope-dependent scattering lengths, and most importantly unique kinematics that allow simultaneous determination of the structural and

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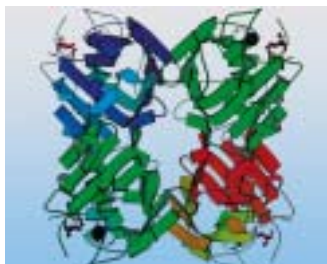
>> dynamic properties of a material. That is why they are complementary to photon and electron methods, and laboratory-based techniques such as NMR, lasers, etc. It is widely felt that with DIAMOND, SOLEIL and the Barcelona source Europe will have a more than adequate supply of third-generation synchrotron sources.

ESS and the X-ray FEL thus provide the new opportunities for Europe. Complementarity deserves some further discussion in this context. Whilst spallation sources are truly the next-generation neutron sources, advancing neutron scattering across all its applications, XFELs are uniquely suited for specific classes of problems and do not address the entire range of applications covered by synchrotron sources. ESS is necessary for a 5,000-strong, existing scientific and technological community in Europe, the XFEL community has still to be identified and built up alongside the demonstration of the XFEL's scientific potential. An appreciation of these very different roles and perspectives is clearly reflected in the US's approach to its own MW spallation source and XFEL projects (in the latter case based on the Basic Science Advisory Committee of DoE).

Elements for the political scenario

Three elements are now required for a science policy decision (should we build ESS, and when?).

- Europe wants to maintain scientific and technological leadership in neutron scattering, and thereby secure its important role in condensed-matter science and technology.



Neutrons can be used to determine the hydrogen position in complex biological molecules

- With the advent of SNS and the JNS a new realm of intensity for spallation sources and science will be opened; a delay of more than five years risks a severe migration of leading neutron scientists and their younger colleagues from Europe to the US, or from neutron science to other fields.
- ESS is the only feasible route through which Europe can remain competitive on the world stage in an area of science which it has led the world for the past 30 years.

The first point is all the more important as there are not many areas of science in which Europe has an acknowledged leading position. And as the Americans themselves say that SNS alone will not take away the shortage of neutrons, SNS will only accommodate an insignificant number, two to four (or perhaps a few more, should a second target station be built) of European instruments.

The time scale depends on SNS being fully on schedule to deliver the first neutrons in 2006. So 2011 should be considered the natural date for ESS to do the same. The question is whether there are dif-

ferent ways to maintain European leadership. The continuation of ILL for another ten years until 2013, and investment in the ILL Roadmap of 2001 are necessary and will help to maintain capacity and provide an advance in quality. But one has to acknowledge that SNS and to an increasing extent JSNS will be an even greater source for many research areas than the ILL. They will also gain a competitive edge on ISIS.

No existing or planned spallation sources other than ESS will be able to compete in anything other than niche areas in the most demanding scientific endeavours which the new MW spallation sources will make their own. Advanced neutron instruments and detectors, lower-power European sources and target stations providing specialised niche area capabilities will not help to achieve the necessary factors of ten or more in power.

The Munich reactor, which expands capacity and approaches ILL in some areas, will not make a major contribution, on average, to Europe's competitive position.

The German Science Council

This is the context in which to assess what is now happening at the political level. ESS – and we were not – alone has left no doubts that its treatment by the Science Council in Germany was not a fair one and that the Council's doubts about the longer-term importance of neutrons were unfounded. As the Council postponed giving recommendations to the government until the Autumn, ESS re-submitted the project in mid-October. It was a pity that the Council's time schedule could not easily accommodate the completion of the work on the science case for the May presentation. The ESS partners have therefore presented the four volumes of the May proposal. We are convinced that this now provides the solid foundation requested by the Science Council for a definitive assessment and priority allocation of ESS, as Volumes II and IV deal >>



Neutrons penetrate deep into matter. Neutron radiography of a rose inside a thick lead container

Letter to "Natur" on the ESS evaluation

Sir – On July 18 (Nature 418, 262; 2002) you reported a review of major facilities and an assessment of the European Spallation Source (ESS) by Germany's science council, the Wissenschaftsrat. Your report said: "The council endorsed an assessment of the ESS by a sub-committee ... that the demand for neutrons does not justify the estimated 1.4-billion-euro (US\$1.4-billion) total investment in an advanced neutron source." This reflects neither the consensus view of the sub-committee nor the opinion of most members. As members of this sub-committee, we have written to the chair of the Wissenschaftsrat with our concerns, paraphrased below.

Further, contrary to the summary of deliberations in the Wissenschaftsrat's report, we do not see reason for concern about the timeliness of the scientific programme. We agree with Japanese and US researchers, who have successfully sought long-term funding for high-intensity spallation, that experiments with neutrons will play a leading role across the sciences for the foreseeable future. The Wissenschaftsrat's statement on the cost of neutrons relative to other techniques is not based on input from us and we do not believe it would be supported by a comprehensive analysis."

*B. Keimer**

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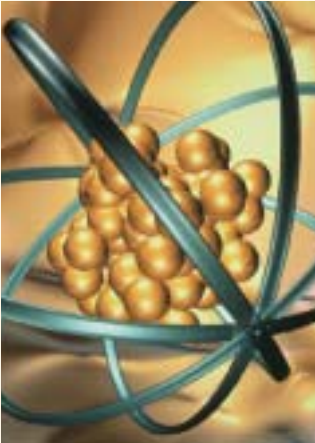
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The new ESS GmbH under construction

The ESS partners feel the need for more flexibility, stronger central control and the possibility to take legal action on behalf of the ESS. For that purpose a company, based on German law, is being set up, to which the partners will pay their financial contributions. It will be called ESS GmbH. A GmbH is a limited liability company ("Gesellschaft mit beschränkter Haftung"), which is a standard legal form for a company, in our case a not-for-profit company.



ESS GmbH is a vehicle for ESS, and for ESS only. It will therefore be under full control of the Council and be operated by the Project Directorate. Its purpose is to facilitate the execution of the work programme established by the Council.

The directors of the company will come from the ESS Project Directorate, and to ensure that the Council determines policy, all Council members will be appointed to the Board of Supervisors. The Board will meet twice a year, coinciding with normal Council meetings.

The activities of ESS GmbH will focus on three areas:

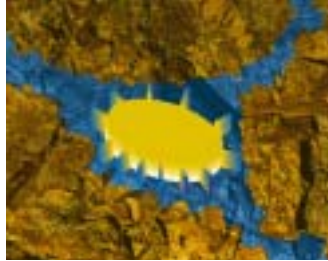
- Management support (through the CPT)
- Information and dissemination activities

- Contributions to technical activities that otherwise could not be carried out or only to an insufficient degree, or too late. This includes co-ordinating projects to be submitted to e.g. the EU for funding under FP6.

The activities of ESS GmbH and ESS will co-ordinated through the annual work programme of ESS, in which the activities of ESS GmbH are being spelled out. Once the Council has approved the work programme, the directors have to carry it out, and as the Board of Supervisors of ESS GmbH the Council members can make sure that the ESS GmbH part of the work programme is also executed according to plan.

>> extensively with the scientific issues that were raised by the Council. On the new science – which the Council thought it had not yet seen – ESS has stated its aim to reclaim for Europe world leadership in neutron science and technology. It will provide source power gains of between 10 and 100 over all existing or currently planned neutron sources, which should be looked at in the context of the factor of four gained since the first dedicated research reactors in the fifties. It will even be a factor of ten better than the American SNS now being built for completion in 2006, in the crucial area of cold neutrons. No other tabled European projects will even approach the performance of the existing world-leading facilities.

In response to the curious doubts as to whether neutrons would still provide

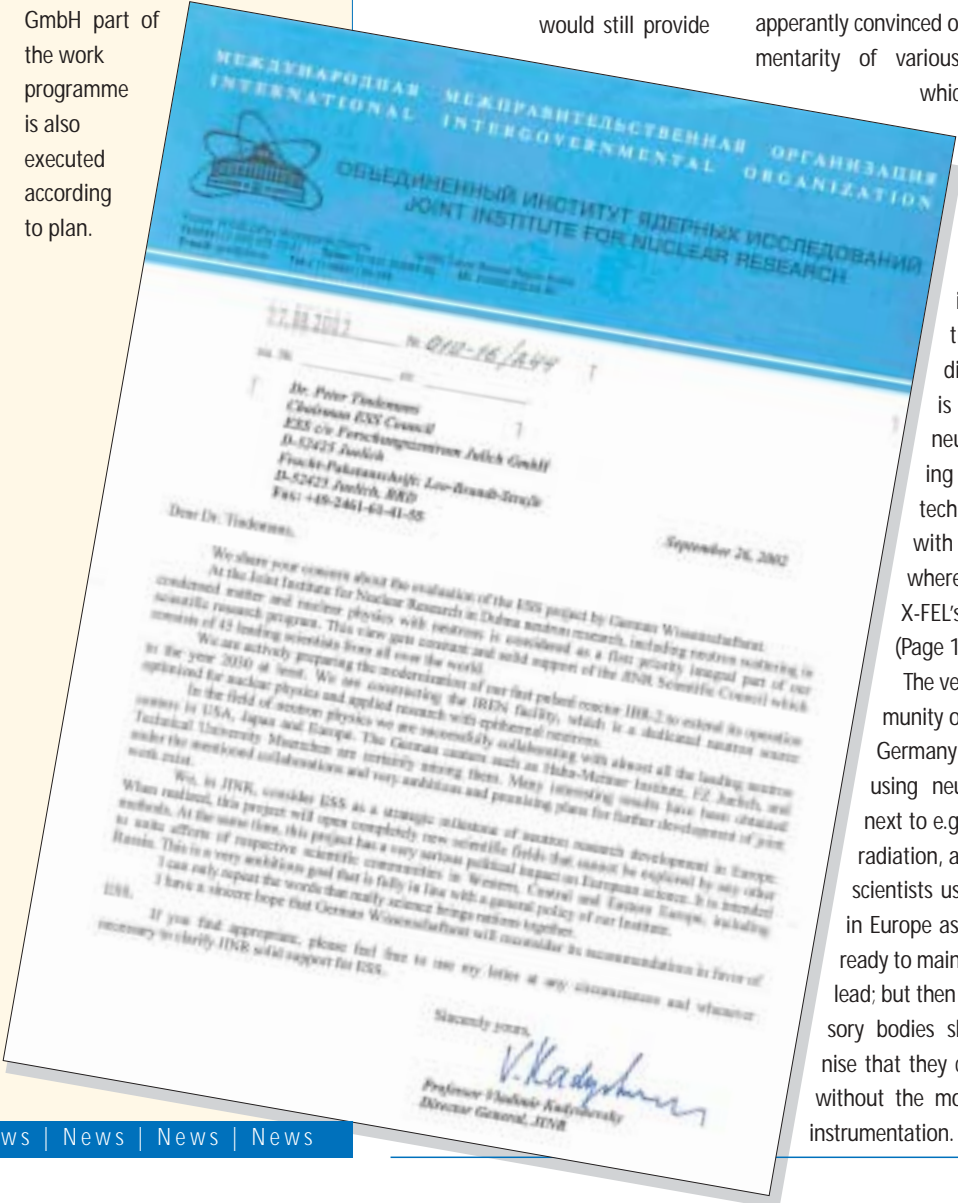


Instrumentation at ESS will enable studies of the function of large molecules in porous media knowledge which is of relevance to oil recovery

insights in ten years' time complementary to other techniques, ESS said that the billions of dollars that the US and Japan are investing in new or upgraded facilities with the explicit aim of regaining world leadership amply demonstrate their belief in the unique contributions of neutrons. These countries are apparently convinced of the complementarity of various techniques

which is evident from even a cursory inspection of the diagram indicating which time and distance range is covered by neutron scattering and other techniques, and with arrows where ESS and X-FEL's will lead us. (Page 1).

The very large community of scientists in Germany who are using neutrons, often next to e.g. synchrotron radiation, and the 5,000 scientists using neutrons in Europe as a whole are ready to maintain Europe's lead; but then science advisory bodies should recognise that they cannot do so without the most advanced instrumentation.



Hope for better decision-making at EU level

On the initiative of Commissioner Busquin, the 15 member states of the EU have established a forum for consultations on new investments in large facilities, or in jargon, research infrastructures. The European Strategy Forum on Research Infrastructures (ESFRI) consists in general of high-level civil servants from each of the member states. Not only established natural sciences need large

facilities; the libraries in the humanities are for example also covered.

ESFRI's chairman is Dr. Hans Chang (NL), who is director of the Netherlands' Physics Research Council (part of the general Research Council NWO); secretaries are Dr. Marco Malacarne and Ms. Elena Righi from the unit for Research Infrastructures in the EU's DG Research. In its first meeting on July 3, 2002 the ESFRI discussed

potential scenarios for neutrons in Europe on the basis of an introduction by Jørgen Kjems, the director of Risø National Laboratory, and former chairman of the ESS Council. It was decided to set up a working group to analyse a few scenarios, one being ESS, another upgrading ISIS and ILL. Its report should be ready by the end of the year.

Chair will be Jørgen Kjems; members come from ESS (Peter

Tindemans), ISIS (Andrew Taylor), ILL (Christian Vettier), AUSTRON (Wolfgang Reiter) and ENSA (Fabrizio Barocchi); a socio-economic expert, Gunnar Törnqvist from Lund University, is also a member. It all fits well with the decision of the ESS Council in June to prepare an analysis of options to demonstrate the value for money of the Bonn ESS reference design.

Regional support for ESS

Sites stand united for the ESS

Five sites expressed interest in hosting the ESS. On September 20 a meeting was convened in Dusseldorf to discuss how to jointly advance the case for the ESS. The locations – Jülich, Leipzig-Halle, Lund, Yorkshire and the RAL site near Oxford – mark a new departure in Europe. Regions are becoming ever more important; they are a natural "habitat" for development agencies, local governments, industry and academia to collaborate in promoting economic, social and cultural development. Much has been done to strengthen the regional partnerships that shore up the site bids.

The business community, the academic institutions and the political actors are often drawn together in advisory councils to structure their contributions. We have formed a network of people responsible for conveying information and promoting the ESS. One common manifestation will be a presentation for European Parliament members and others in Brussels early next year. More activities on the European level will follow. The vivid interest in the ESS is already leading some of the sites to look into building specifics to speed up



Participants at the first joint meeting of the regions interested in hosting the ESS and the ESS team



The delegations from Sachsen/Sachsen-Anhalt and Lund



The delegations from Yorkshire and Jülich



Kurt N. Clausen was representing the ESS Central Project Team

subsequent licensing procedures. The CPT has carried out a preliminary assessment of the technical aspects of the site bids; no major problems seem to exist for any of the sites. Of course, local conditions, such as ground water levels, will have an impact on the cost, and these differentials will have to be elaborated when decisions are made. There is a spirit of enthusiasm about working together for the ESS.



The Newsletter from the ESS presentation in Bonn, 16-17 May 2002, was very well received by the participants.

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