EFDA

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newsletter

EUROPEAN FUSION DEVELOPEMENT AGREEMENT

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Contents

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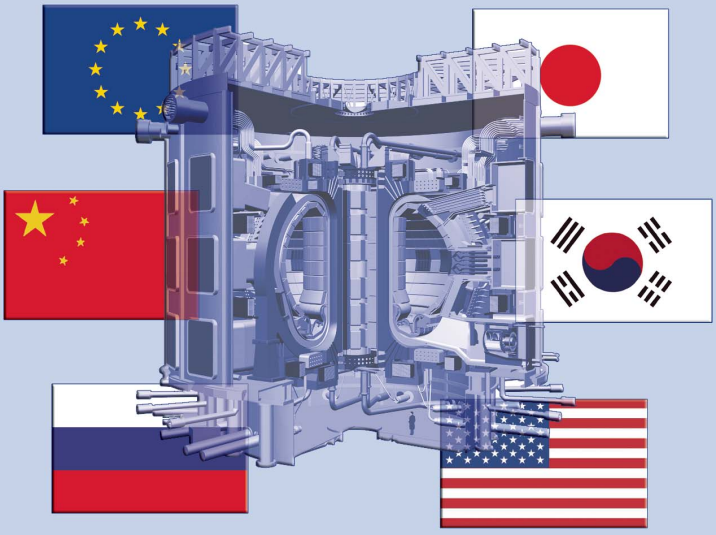
News

Council of Ministers

At their meeting on November 26, 2004, the European Research Ministers tackled the two major dossiers of the European research policy, namely the international negotiations on ITER and the future Community framework research programme. On ITER, the EU Ministers unanimously endorsed the modifications of the negotiation mandate as proposed by the European Commission after its meeting on November 16 in Strasbourg (France), aimed at reaching an agreement among the 6 Parties (the European Union, including Switzerland, Japan, the People's Republic of China, the Russian Federation, the United States of America, and the Republic of Korea) for the construction of ITER at the European site of Cadarache, France, as soon as possible. At the press conference, European Commissioner for Science and Research Janez Potocnik rejected the idea of setting a deadline for reaching a consensus among the six Parties.



ITER - Decision to amend the negotiating directives

The Council, with a view to concluding the international negotiations with the six partners on the site of ITER, decided unanimously to modify the Commission's negotiating Directives.

These directives thus modified:

- ensure the widest possible international partnership;
- confirm the European support for Cadarache as the site for ITER;
- recognise the importance of the broader approach in the negotiations with all partners;
- provide clarification on the transitional arrangements to ensure an efficient start to ITER joint implementation.

For more information please see:

http://europa.eu.int/rapid/pressReleasesAction.do?reference=IP/04/1369&format=HT

http://www.eu2004.nl/default.asp?CMS_ITEM=8EBAFDA0A60346668B670E6A8DA4C83EX1X53197X89

Personalities

Didier Gambier

Directorate J - Energy

Unit 5: Joint development of Fusion
Head of Unit: Didier Gambier

Unit 6: Fusion association agreements
Head of Unit: Yvan Capouet

Unit 7: Administration and finance
Head of Unit: Eduard Rille

Find their Cvs on our web:
http://www.efda.org

Find all 14 directorates and their subunits on

http://europa.eu.int/comm/dgs/research/organisation.cfm?lang=en#ReportDG

New faces in the Commission's Directorate for research

EFDA Newsletter:
Heading the Unit "Joint Development of Fusion" and considering the experience you have gained in your past positions, which aspects of your career would be most valuable for your future task?

D. Gambier: I have gained experience on international technology cooperation in the last years when managing the centre for international science and technology in Moscow and with one sister organisation in Kiev, first as representative of the EU and then as Executive Director of the Moscow Centre. Except for China I was dealing then with the same actors as the one of ITER: Japan, the Russian Federation, the United States and the Republic of Korea. Therefore my past experience has facilitated my integration as a team member of the negotiators for the European Union in a different environment, and focusing on fusion development with ITER and the Broader Approach, rather than on the conversion of former weapon scientists' activities. However, I have experienced the high value of striving to reach consensus among the Parties, sometimes smoothly and sometimes with enormous effort of all, in order to achieve a high level of trust and confidence among the Russian Federation, the host, Japan, the USA and the EU. These have been key elements for the organisation to evolve, achieve best practices in all the Centre's activities, spanning from fundamental to Security Research and Development. And this experience should be of a certain value, I hope, for ITER and for the joint development of fusion.

EFDA Newsletter: *You supported the bilateral science and technology co-operation agreement between the EU and the Russian Federation in the field of life sciences and biotechnology. How could, in your opinion, European industrial and scientific cooperation be improved in the field of nuclear fusion?*

D. Gambier: I operated in the Russian scientific environment for about 9 years. The Russian Federation has maintained a high level of professionalism concerning fusion in general - on the technological as well as on the theoretical side. Being represented by pre-eminent personalities in the field and being directly involved in the ITER engineering design activities I therefore would say that furthering the development of fusion with Russia is not only of high value, it is indispensable and can be further exploited. I'm convinced that many of our colleagues in Russia would stand ready to deliver excellent products for ITER and for fusion in general. Fusion is a Russian field of excellence and therefore the Russian and the European cooperation in this field can be further developed for the benefit of all the ITER Parties.

Yvan Capouet

EFDA Newsletter:
Your present activity is Head of the Fusion association agreements Unit. Considering the experience you have gained in your past positions, for example as Head of Cabinet of the Commissioner for Research, which aspects of your carrier would be most valuable for your future task?

Y. Capouet: Everything that I have done so far in the Commission has always been linked to internal policies, for the European Union, its members States and industry. This means networking people, gathering forces and creating the right framework conditions for co-operation. This was also very much the input I gave to Mr. Busquin as Head of his Cabinet during the last 20 months. In order to cope with the major challenges of ITER we will have to maintain the idea of integration. This has been the case in the past and I'm willing to contribute my own experience to continue to strengthen the integration in the fusion area.

EFDA Newsletter: *As former engineer in the Belgian nuclear safety inspectorate in which way can you use this experience to support nuclear fusion?*

Y. Capouet: My engineering experience is very much related to the project's experience. This means: defining a goal, defining deliverables, doing everything which is necessary to get to the final goal, avoiding traps and anticipating difficulties. I think all that will be relevant as well for the future of the fusion programme. My experience in the field of the nuclear fission energy was also in a time where fission was moving away from the scientists labs, into more cooperation with and ownership by the industry. All these are challenges that we will face also in the field of fusion as our aim is to make fusion a realistic and affordable energy source before the middle of this century.

EFDA Newsletter: *Considering the experience you have gained in your past positions in international organisations, industry and at university, which aspects of your carrier would be most valuable for your future task as head of administration and finance?*

Eduard Rille: The most valuable thing is that I have gained a great deal of experience in working with people. Administration and finance sounds very dry, but in practice this means working on positions, careers, dealing with budgets and public money. In parallel to my management position at LEICA AG in Switzerland I was teaching at the University of Innsbruck in Austria. The most valuable thing I've learned, in working with students and researchers, is patience.

EFDA Newsletter: *At LEICA AG you worked as project manager and director of marketing and logistics. What is in your opinion the most important thing in a good business plan for the European Research Area?*

E. Rille: The European Research Area is a very innovative concept: and it is based on the idea that we should pursue research in areas where the member states alone cannot achieve a certain target. Fusion, especially ITER, is one part of the European Research Area, which demands infrastructures and large installations that require very experienced management skills. The senior management will be adapted to those needs. In Europe we have enough talent and enough young people who combine these important skills and I think that our big challenge will be to involve them effectively.

Interviews: D. Lutz-Lanzinger

Eduard Rille

Conference

American Nuclear Society Topical Meeting on the Technology of Fusion Energy Sept. 14-16, 2004 Madison (USA)

The conference organised by the University of Wisconsin (Madison) has gathered more than one hundred participants in a nice university environment and offered worldwide contributions from eleven countries.

The introductory speech was delivered by Prof. H. “Jack” Schmitt, a former senator and astronaut in the Apollo programme.

Specific sessions were dedicated, among other topics, to ITER, safety issues, experimental devices and reactor studies.

Presentations included a review of the US activities both in magnetic and inertial fusion. The ITER project was represented by two main contributions presented by Dr. V. Chuyanov and Dr. P. Barabaschi. The European technology activities in support of ITER were reported by the EFDA Associate Leader for Technology, Dr. R. Andreani.

The conference presented also an interesting review of the American and Japanese fusion technology programmes. The two countries appear to have very strong relationship and many collaborative programmes in fusion, in particular in the field of materials.

Conference contributions can be downloaded from the conference web site:

http://fti.neep.wisc.edu/tofe/home.html

Associations

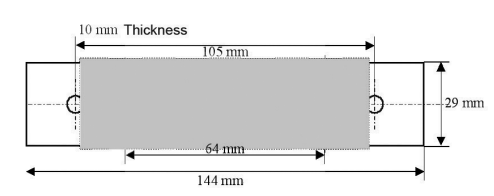
Structural deformation characterisation of ferromagnetic materials by sensitive magnetic flux leakage measurements

In the frame of the Fusion Underlying Technology Work programme, novel electromagnetic non destructive techniques were developed in the Research Institute for Technical Physics and Materials Science in Budapest (Hungary). The physical background of this technique is based on the fact, that structural changes in materials are accompanied by modification of magnetic properties. One of the performed tasks was the characterisation of structural deformation of ferromagnetic materials by the measurement of the stray magnetic field around the specimens. For this purpose a new, fluxgate type magnetic field sensor (Fluxset sensor) was applied for the measurement of magnetic leakage flux in plastically deformed, ferromagnetic, low alloy steel samples.

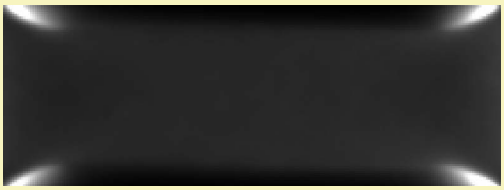
The method can be illustrated by the measurements, performed on a series of A533B type steel specimen. The investigated specimens were shaped in a standard loading test sample as shown in the Figure (top). Different tensile stress up to P=530 MPa were applied on these samples. After loading, prior to the measurement, samples were polarised in 1 kOe magnetic field. The measurement of the flux leakage was performed in zero external field by applying different sensor orientations, parallel (X and Y direction) and normal to the sample surface (Z direction). As an illustration, the leakage flux density, measured by the X direction oriented sensor (along the axis of the sample), scanning over the surface is shown in the bottom part of the Figure, as a function of loading. (Only the highlighted area of the sample was measured.)

The results prove the applicability of this technique: the obtained pictures show the fine details of the flux distribution, which is due to the degradation of the material. It has been found, that high resolution and high sensitivity can be achieved, strong in homogeneities can be revealed in the investigated sample, and the fine structure of the magnetic flux distribution can be detected. Another advantage, is that the measurement can be performed within a short time. The method is especially suitable for the measuring of magnetic fields, parallel to the sample surface.

Samples, having small remanence, can also be measured by this technique, due to the high sensitivity of the applied magnetic field sensor. This means that in many cases the previous magnetisation of the samples is not necessary, which makes the application easier. Last, but not least, the described technique is suitable for the simultaneous measurement of the DC magnetic field and even the AC leakage field as well. An applicable local AC exciting coil makes it possible to apply localised magnetic excitation instead of global magnetic polarisation of the huge samples to be tested, and in addition, it introduces the ability of the eddy current type measurements.



Shape and sizes of the measured sample and the investigated area (in gray)



0 MPa

470 MPa

530 MPa

The magnetic flux leakage distribution over the sample's surface after different loading

Fluxset sensor characteristics:

Operational range:	± 100 µT
Operational temperature range:	
sensor only:	± 100 ºC
sensor with circuit:	- 40 / + 85 ºC
Accuracy:	± 0.5 %
Bandwidth:	DC-10kHz/-3dB
Noise:	< 30 pT / √Hz
Orthogonality:	< 1º
Spatial resolution:	0.5 mm

For **more information** contact
Dr. G. Vértesy
(E-mail: vertesyg@mfa.kfki.hu)
http://www.mfa.kfki.hu/fluxset

Associations

New Virtual Institute for ITER-relevant Plasma Boundary Physics

The Helmholtz Association of German Research Centres (HGF) has approved the application of Research Centre Jülich for a new virtual institute named "ITER-relevant Plasma Boundary Physics" (IPBP). The Jülich Institute for Plasma Physics FZJ, which is a member of EFDA, is a partner of this virtual institute as member of the Helmholtz Association of German Research Centres, while Ruhr-University Bochum and Heinrich-Heine-University Düsseldorf (both in Germany) represent plasma and fusion research at the regional level.

The main strategic goal of the Institute for ITER-relevant Plasma Boundary Physics is to integrate expertise in different disciplines at the partner institutes - especially at the North Rhine-Westphalian universities. Key knowledge in boundary plasma and surface materials such as:

- atomic physics and advanced plasma diagnostics,
- surface physics,
- computational physics and non-linear dynamics, and
- laser plasmas

will be oriented towards the needs of ITER, the next step on the road to a fusion power plant. Fusion and ITER will receive a broader visibility, especially at the university level, gaining more young students for research work. Details are available at IPBP's new web-site http://www.iter-boundary.de .

The Ruhr-University Bochum is represented on http://www.ruhr-uni-bochum.de/index_en.htm

The address of the English home-page of the Heinrich-Heine-University Düsseldorf is http://www.verwaltung.uni-duesseldorf.de/abteilung42/index-e.htm

Plasma-Wall Interaction Experts met in Jülich

The interaction of a fusion plasma with the surrounding walls is a key issue on the way towards a fusion power plant. The subject, increasingly in the focus of European fusion research, is of utmost importance for ITER. Experts in the field of plasma-wall interaction met at Research Centre Jülich (FZJ, Germany) on October 14-15, 2004 to discuss the current progress and to work out immediate future plans within the EU Task Force on Plasma-Wall Interaction. The Task Force was started two years ago under the leadership of Dr. V. Philipps from FZJ with J. Roth (IPP Garching) and A. Loarte (EFDA) as deputy leaders (see Newsletter December 2002), who will remain in function until the end of 2005.

The participants (see photograph) have analysed in detail recent reports of the six special working groups on chemical erosion, gas balance, transient heat loads, high-Z plasma-facing components, tritium removal, and dedicated technology tasks. To highlight some of the results, progress has been achieved in qualifying the carbon chemical erosion source under the divertor conditions in ITER, indicating lower carbon influx than previously assumed. Also the temporal and spatial distribution of disruption power loads indicate less critical margins than previously assumed. However, the main critical question associated with the present ITER wall material choice remains the long term tritium inventory. More work is necessary in present fusion devices to qualify tritium removal methods which are applicable in ITER. Interesting progress with the use of tungsten as main chamber wall material has been obtained in ASDEX Upgrade.

The Task Force is largely organised along topics which is seen as a key ingredient to achieve progress. In the topical areas, well-defined questions and areas in which efforts will be concentrated in the coming year have been identified.

The reports of the special expert working groups were followed by presentations of the work performed in thirteen European Fusion Associations, for the first time including Poland and Slovenia. All questions picked out during the workshop have been discussed in view of their relevance to ITER.

More information on Research Centre Jülich:

http://www.fz-juelich.de/portal/index.php?index=3

All presentations and a short summary of the discussions can be found on the Task Force website (http://www.efda-taskforce-pwi.org/) under the navigation item "News". The site can be used as a reference to current research fields of plasma-wall interaction and to physical concepts associated with the development of plasma-facing components.

JET

"Man in the loop" strategy:

The Remote Handling system is open to manual control when a high level of human supervision and/or adaptability is required. In more routine tasks, or when there is a need for time optimisation and/or accuracy of motion, the Remote Handling system is operated in an automatic or robotic way.

Operational Experience in JET Remote Handling

The radiation levels expected in ITER during the later stages of machine operation are such that maintenance work cannot be carried out by human intervention. Remote Handling (RH) was therefore defined by the ITER project, as the nominal solution for the maintenance of the reactor.

Similar considerations provided the main incentive for the development of the RH system at JET. The in-vessel maintenance and divertor modification that followed the introduction of tritium in the DTE campaign (1997) was possible only thanks to the RH methods. Even today, application of ALARA principles, encourages the JET operator to accomplish most of the in-vessel work using remote handling techniques.

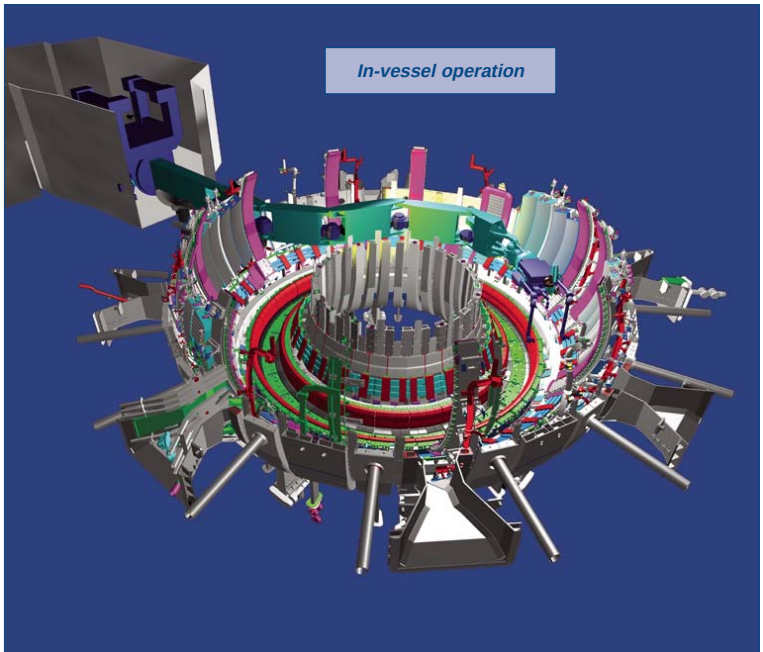
JET has today the only operating platform within the fusion programme where RH techniques have been developed, tested, and improved to a stage that allows in-vessel works to be carried out fully remotely. Although ITER RH will feature a number of differences from the JET system, the experience gained by the JET RH group over many years will be of great importance for ITER. According to JET's experience, the RH systems work efficiently when the following aspects are thoroughly considered:

Adaptability: Experimental facilities, such as JET, are subject to changes in their configuration in order to test new components and systems. To cope with the changes, from the beginning JET adopted a generic **"man in the loop"** RH strategy, which maximised its adaptability to the environment and minimised the need for re-configuration of the equipment from one shutdown to the next. This approach also lends itself well to RH tasks related to unexpected interventions.

Planning: In-vessel maintenance is not limited to component replacement. There are numerous supplementary tasks, e.g. inspection, cleaning, metrology or re-tightening bolts. Many of them require development of specific equipment. Installation of in-vessel services (lights, power lines etc.) should not be underestimated either.

Development: The RH equipment is of one-off nature and it is still vital to predict its reliability. At JET, the reliability was assessed and improved during long-term tests using specially built full scale mock-ups and the general scheme for new RH components is defined by the so-called "life-cycle". The life-cycle can be divided into four phases: design based on definition of the requirements, first version system, development to maturity and, last, RH operation. This evolution can only be efficient if the R&D work is completed and interfaces between RH and machine are frozen.

Space: Designing tools to be remotely operable means providing them with specific features, which reduce the level of risk in performing the task. A common feature is that these tools require more space than would have been needed for manual tooling. The RH equipment also needs a huge amount of external backup, i.e. space outside the working zone for services, operators, mock-ups, maintenance, decontamination, commissioning etc.



In-vessel operation

Control: The local JET RH team has been playing an important role in rationalisation of the RH control systems. For example, recent developments of Virtual Reality at JET show that real improvements for RH operations can be achieved by exploiting 3D computer simulations. Virtual Reality is used extensively during RH preparation and final task execution. Nevertheless, real-time camera views remain central to the JET RH strategy in order to cope with unpredictable situations.

The successful remote handling of JET has demonstrated the feasibility of remote maintenance for fusion. Many lessons have been learnt of which the JET remote handling team consider the most significant to be the necessity for rigorous preparation and attention to detail in the design, build and testing of the remote handling devices and the JET components.

Events

20th IAEA Fusion Energy Conference

From the 1st to 6th of November 2004 the Instituto Superior Técnico through Centro de Fusão Nuclear on behalf of the Portuguese Government and the Association EURATOM/IST hosted the "20th IAEA Fusion Energy Conference" in Vilamoura (Portugal). The Fusion Energy Conference is the main meeting for fusion research worldwide, and attracts delegates and contributions from most countries involved in fusion energy research. This year, 597 delegates representing 33 countries and 3 international organisations participated to the conference.

The meeting took place in Vilamoura, a small holiday town on the South coast of Portugal. The conference venue was perfect to host such a large event, with a main hall were all oral contributions were presented, as well as poster contributions, which were presented in parallel to the oral sessions. The Fusion Expo exhibition was also on display for the whole duration of the conference, and local schools were invited to a guided tour during the week.

The Conference proceedings were opened by a welcome speech by Dr. W. Burkart (IAEA), followed by 3 contributions to the traditional “Fusion Pioneers” section: these were delivered by Dr. C.M. Ferreira (Portugal), Prof. Sir C. Llewellyn-Smith (UKAEA) and Dr. Y. Shimomura (ITER). Dr. Ferreira expressed the strong support of the Portuguese Government to fusion research, and to ITER in particular. Support to ITER and to a vision for the fast realisation of fusion for energy productions (the so-called “fast track to fusion”) was the main theme of the strong and enthusiastic talk of Sir Llewellyn-Smith. In his speech, he conveyed to the audience both the challenge and the rewards that the final development of fusion energy will bring about to humankind in the near future. Finally, Dr. Shimomura gave a thorough update of the status of the ITER project, highlighting the progress towards licensing and construction of the device, as well as the technical and organisational challenges ahead of this ambitious international project.

The summary of the results obtained in the main research laboratories and experiments since the last Fusion Energy Conference (Lyon, France, 2002) were presented in the overview sessions that took place in the first two days of the conference. The rest of the week was dedicated to presentations of talks and posters describing more detailed and specific results of fusion research in the last two years. As customary, the Conference closed with five summary talks, collecting and contrasting all major results and contributions presented during the week. Finally, the conference adjourned with the announcement of the next IAEA Fusion Energy Conference, that will be held for the first time in China, in the city of Chengdu, October 16-22, 2006.

Find **more information** on:

Instituto Superior Técnico
http://www.ist.utl.pt/

Centro de Fusão Nuclear
http://www.cfn.ist.utl.pt/

and
http://www.cfn.ist.utl.pt/20IAEAConf/index.html

Fusion in Paris: “Fête de la Science”

During the second week of October the “Fête de la Science” was held in Paris, France. Part of this yearly science week was the “Village des Sciences”, which was held from October 15th to 17th 2004, in the “Jardin du Luxembourg”. The “Village” was organised by the French Ministry of Science and opened by the French Minister for Research, François d'Aubert. Scientists from the EURATOM - CEA Association, Cadarache (Dr. A. Maas, Dr. J.M. Ané) together with their Dutch colleagues from EURATOM-FOM Association-Rijnhuizen. (Dr. M. Beurskens and Dr. M. Westra) informed the visitors about fusion energy. The beautiful “Jardin du Luxembourg”, which houses the French Senate and is surrounded by government buildings and famous universities like the Sorbonne, was the perfect backdrop of the “Village”. About sixty scientific organisations presented themselves in info tents. Thousands of visitors mostly from Paris found their way to the exhibition during the three days of the event.

The CEA tent consisted of a section on hydrogen, one on granular matter and another on fusion. The Dutch delegation was invited to the festival because of its country being the current holder of the EU presidency. The FOM team performed the Fusion Road Show, which proved to be very popular and effective in drawing a large crowd to the tent. A lecture on fusion was given at the “Ecole des Mines”.

M. Beurskens (FOM, front) and J. M. Ané (CEA, in the back) explaining the principles of fusion

Obituary

Sebastian “Bas” Pease

“Bas” Pease (centre) in front of ZETA 1958, with a BBC broadcast man on left and Bob Carruthers, who designed ZETA, on right.

R. S. "Bas" Pease, former Director of UKAEA Culham for 20 years, died aged 81 on 17 October 2004 after a short illness. After obtaining a wartime Honours degree in Physics at Trinity College, Cambridge, he joined AERE Harwell in 1947, specialising in solid state physics and producing some of the classic work on radiation damage and neutron diffraction.

In 1955 he began his long career in fusion research and became leader of the ZETA Team, coming into the public eye in 1958 when worldwide coverage was given to the results obtained on this machine.

In 1964 he moved to the newly-built Culham Laboratory and became Director in 1968. He played a leading role in worldwide collaboration in fusion research, playing a key role in both bringing JET to Culham and in the early planning of the next international device INTOR - later to become ITER.

Following his retirement in 1987 he took on an active role in Pugwash, an international organisation of influential scholars and public figures concerned with nuclear disarmament.

Among his many awards and honours, he was President of the Institute of Physics from 1978-80 and was elected a Fellow of the Royal Society in 1977 for "his distinguished contributions to the experimental study of behaviour or dense plasmas in strong magnetic fields with particular reference to nuclear fusion". Former colleague Dr.M. Forrest recalls his "ebullient personality and an almost overpowering enthusiasm for the topics and projects he became involved in." For his friend Dr. D. Palumbo, Bas Pease was quite simply "the British representative in the world of the Fusion Programme."

In Memoriam

Kees Braams Memorial meeting

Dr. C.M. (Kees) Braams was the founder and the first director of the FOM-Institute for Plasma Physics Rijnhuizen from 1959 until his retirement in 1987. On October 7th his significance for the Institute and for the international fusion research was commemorated at Rijnhuizen with a ceremony and the inauguration of a bronze plaquette of Kees Braams.

About 150 visitors, mainly scientists who had worked with Kees Braams, participated in the event, many from abroad. The six speakers memorated many aspects of Kees Braams. “The atmosphere of intellectual freedom, the encouragement of creativity and inquisitiveness, the friendliness of human relations of this place stemmed to a great part from the character of its founder Kees Braams.”, said Prof. C. Schüller, who followed Kees Braams as 'Mister Fusion' in the Netherlands.

Among the foreign guests were many representatives of the international fusion community, among whom Dr. D. Palumbo (80), the first director of the European Fusion programme.

All speakers, Prof. P. Vandenplas, Dr. U. Finzi, Dr. P. Stott, Prof. F. Engelmann and Prof. C. Schüller, stressed the important role Kees Braams played in uniting the European Fusion Programme, and his role as one of the founding fathers of JET. From the speeches, a picture emerged of a gentleman of physics with a sharp intellect, critical but able to listen, with a profound knowledge of physics and acute diplomatic skills.

For more information see our EFDA website:

http://www.efda.org

and additionally

http://www.jet.efda.org

http://www.iter.org

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