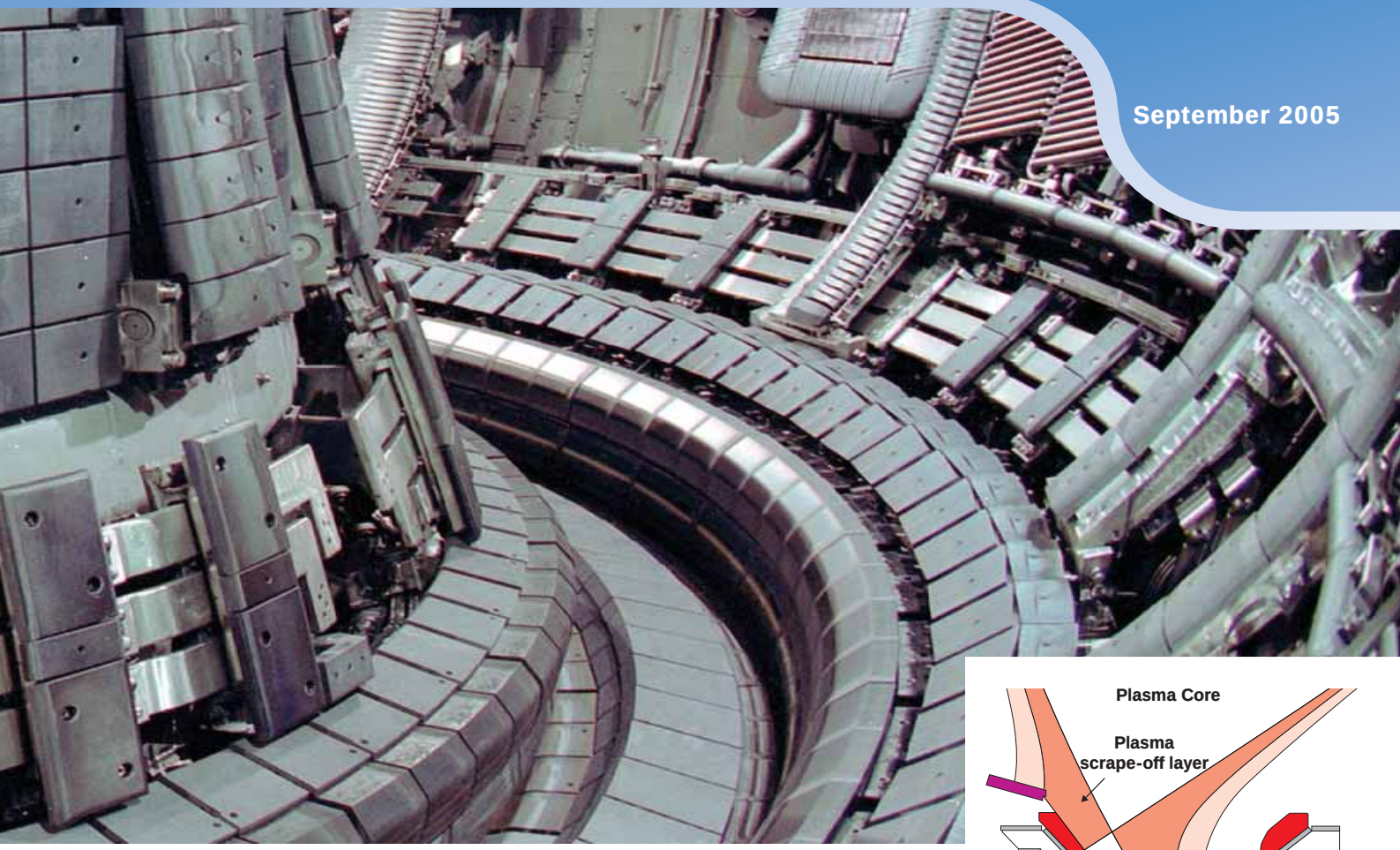
EFDA EUROPEAN FUSION DEVELOPMENT AGREEMENT
JET

EFDA-JET Bulletin

September 2005



JET MkII HD divertor (New tiles in purple)

Getting ready for new experiments with a reinforced scientific capability

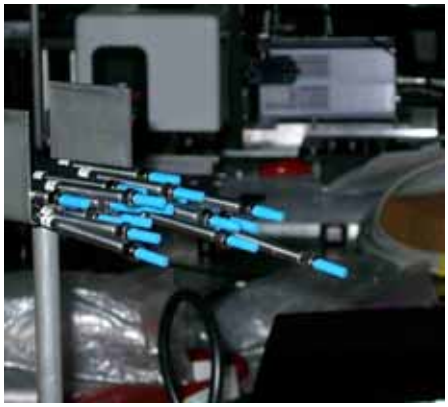
On 7 July 2005, the JET vessel pumpdown concluded a shutdown period that included the installation of more than 20 new systems. This is the most extensive JET Enhancement Programme under EFDA and it will deliver many new scientific results.

The new divertor configuration (see the photograph above) installed on JET is now capable of high-power plasma discharges (up to 40MW for 10s) with strikepoint sweeping and with higher ITER-like triangularity of plasma cross-section (up to δ~0.5). In addition, many new diagnostic systems will enhance the range of measurements possible in the new experimental campaigns, aiming at further development of the plasma scenarios towards fusion reactor relevant conditions. These include new neutron, temperature, density, fast particle, magnetic and plasma-wall interaction diagnostics.

The Enhancement Programme has been based on an extensive collaboration, with eleven EFDA Associations, several non European laboratories and many hi-tech industries directly involved in the projects. Project leaders and technicians sourced from all over Europe and overseas. The Remote Handling facilities were extensively used during the 2004-2005 JET shutdown completing in total over 200 tasks (including welding) and using more than 500 remote handling tools.

During the 2004-2005 shutdown some important components of the new ITER-like ICRH Antenna were installed, such as the new transmission lines. In parallel, to disengage power sources for the new antenna, 3dB couplers were installed between the transmission lines and the existing antennas. Consequently, power losses due to ELMs should be reduced to give higher averaged power. The installation of the antenna is scheduled to be completed during the 2006 shutdown.

The new systems will be commissioned during the present Restart period. This will be followed by Experimental Campaigns comprising 80 days of operation during the winter of 2005-2006. This programme will focus on bringing the new systems up to full performance, the preparation of ITER operation scenarios, critical physics issues for ITER as well as on other specific physics issues of direct relevance to ITER such as transport and burning plasma physics.



Core Charge Exchange Recombination Spectroscopy

A new periscope, faster CCD cameras and two new spectrometers will increase the availability of ion temperature profile, toroidal rotation velocity and impurity density measurements and improve signal to noise ratio

Mark II HD (High Delta) Divertor

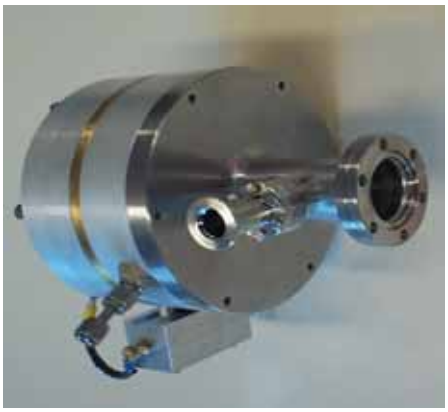
New tilted tiles will accommodate high power plasma discharges with ITER-like triangularity

Bolometry System

Replacement of the vertical and horizontal bolometer cameras, measuring total radiation losses with enhanced resolution in the divertor region

Fast Digitisers

New fast electronics for data acquisition at high sampling frequency

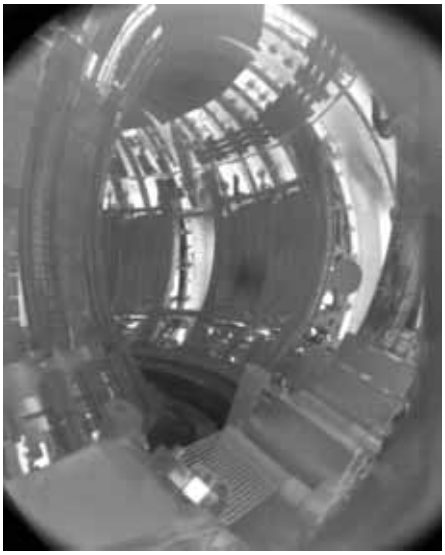


Disruption Mitigation Valve

New valve for gas injecting experiments in order to mitigate plasma energy during disruptions

Halo Sensors

Rogowski coils and magnetic pick-up probes to measure the "halo currents" flowing through plasma and the vessel during vertical displacements (disruptions)

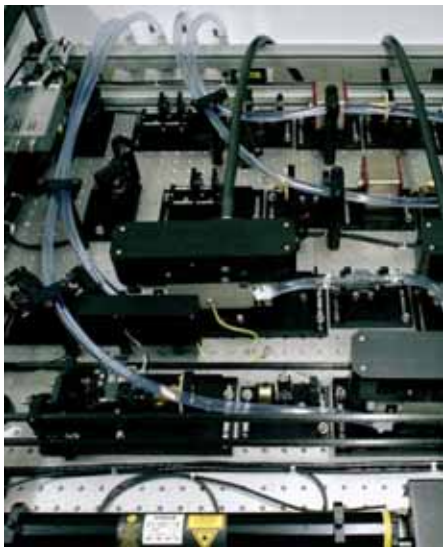


Infrared Camera

Wide angle system for infrared observation of divertor, ICRH antenna, and inner wall, to establish the power load distribution at the first wall

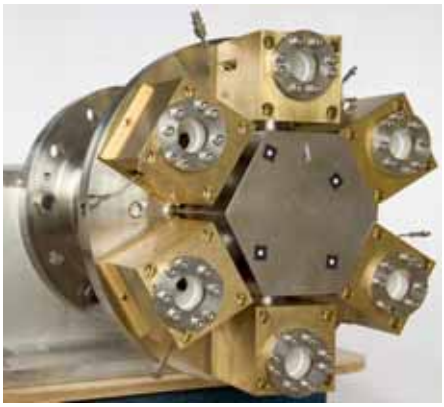
ICRH Transmission Lines and Main Port Bellows

New transmission lines, 3dB couplers and main port bellows for the ELM resilient, ITER-like ICRH antenna (under construction)



High Resolution Thomson Scattering

"Classical" Thomson Scattering with high resolution of electron temperature and density at the edge and at the Internal Transport Barrier. With up to 15 mm space resolution and 20 Hz time resolution it will complement the JET's LIDAR system



Microwave Access

Replacement of lossy waveguides by low-loss microwave transmission with 6 new antennas, will allow broadband reflectometry for density fluctuation measurement as well as for Michelson ECE electron temperature measurement (oblique)

Magnetic Diagnostics

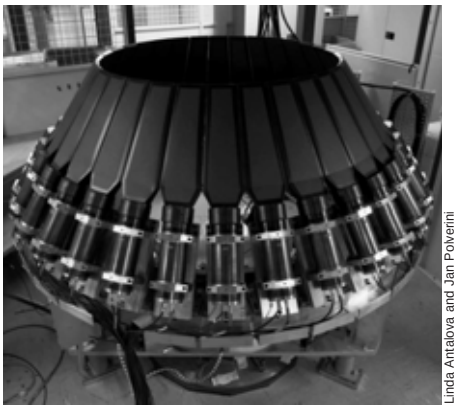
Enhanced system of external and internal coil sensors for improved magnetic reconstruction accuracy

Improved Neutral Beam Neutraliser and new power supplies

Further increase of the power on Octant 8 NBI (~2 MW in D^0) by improving the neutralisation efficiency by ~25%.

Toroidal Alfven Eigenmode Antennas

Two groups of four active and passive antennas to determine stability characteristics of fast Alfven modes (one installed this shutdown)



Linda Antalova and Jan Polverini

Time Of Flight for Optimised Rate (TOFOR)

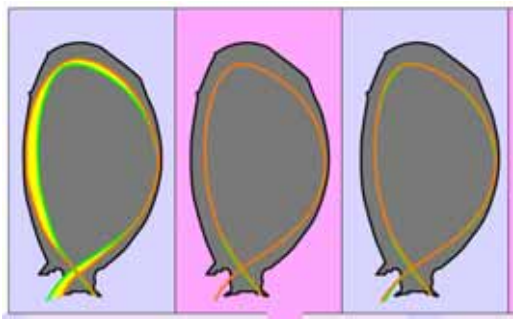
High sensitivity spectrometer for DD (2.5 MeV) neutrons, giving spectra at higher frequency

Magnetic Proton Recoil Upgrade

The neutron spectrometer will extend its range from 14 MeV DT energies down to 2.5 MeV DD energies

Lost Alpha Particle Diagnostics

Faraday collectors *to determine poloidal profile of fast ion loss (left)*
Scintillator probe *for measurements of energy and pitch angles of lost alphas and fast particles (from fusion reactions and heating tails) (right)*



Extreme Shape Controller

Extends the plasma stability towards extremely shaped plasmas - even in the presence of edge localised modes (ELMs) – by better exploitation of all the existing active circuits and control hardware

Tritium Retention Studies

A set of detectors (new quartz micro-balances, rotating collectors, deposition monitors, smart tiles and mirror test units) to address the problems of Tritium retention and erosion/deposition processes

Divertor Diagnostics

Existing set of techniques (thermocouples, pick up coils etc.) that needed refurbishment due to damage and/or new divertor shape will contribute to plasma characterisation in the divertor region

Edge Charge Exchange Recombination Spectroscopy

Will provide high resolution radial profiles of ion temperature, plasma rotation velocity and impurity ion density at the plasma edge

Dr Fidel Castro Diaz Balart visits JET

Dr Fidel Castro Diaz Balart, the Scientific Adviser to the President of the Council of State of the Republic of Cuba visited JET, as part of his visit to the UK with the aim of identifying ways in which to enhance UK/Cuban cooperation in scientific development.

Dr Fidel Castro Diaz Balart showed a great interest in fusion research and asked specific questions related to the ITER scientific programme and the timescale for the demonstration of fusion energy.

Drawing Fusion

Mrs Jane Corbett, artist in residence at the Culham Science Centre, has been running over the summer open drawing workshops. Staff at Culham has been invited to draw the fusion reaction and possible future energy sources. These have attracted a lot of interest and some exciting work was produced.

Professor K R Sreenivasan and Dr C Tuniz visit JET

Professor K R Sreenivasan (Director) and Dr C Tuniz (Special Adviser to the Director) from The Abdus Salam International Centre for Theoretical Physics, Trieste, Italy visited the JET facilities on 22nd July 2005. Teaching of Plasma Physics was discussed in the context of the large fusion projects such as JET and ITER.

JET/Culham Cricket Match

Sunday, 7th August 2005 at Clifton Hampden Cricket Ground.

This year the Clifton Hampden Cricket Ground was again the venue for the annual JET/Culham Cricket match. The aim of this event is as always twofold, to have an enjoyable time and more importantly to teach “continentals” how to play a proper sport, the all-English Cricket.

Departing from the traditional format, the captains opted for two randomly selected teams, imaginatively called the Home Team (Captain Alan Hancock) and the Away Team (Captain Marc Beurskens). Each team contained an unconventional 16 players and every player had the opportunity to try bowling and batting. Thanks to the highly respected and experienced umpire Barry Alper, fair play was the order of the day.

The Home Team lost by 28 runs due to Michael Fitzgerald and Adam Foster in the Away Team, who could actually play cricket and scored 20 runs each. The attractive winning trophy was presented to the proud captain of the Away-Team (see photo).

Close Support Unit in Culham

In July, Richard Kamendje from TU Graz (Association EURATOM-ÖAW) joined CSU as Scientific Assistant to the EFDA Associate Leader for JET. In September, Martin Laxåback from the Alfvén laboratory (Association EURATOM-VR) joined the CSU Programme Department.

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