ACORDO BRASIL EURATOM

Ricardo M.O. Galvão
Universidade de São Paulo

12 de Agosto de 2021

The 1958 Atoms for Peace conference in Geneva, where the United States, Soviet Union, and United Kingdom declassified their fusion research and made it available to all nations. Here, the top officials of the conference (from left): Sir John Cockcroft (U.K.), Dr. Homi Bhabha (India), Dr. V.S. Emelyanov (USSR), Professor S. Eklund (Sweden), Professor F. Perrin (France), Dr. Homi M. Sethma (India), ***Contreadmiral Otacilio Cunha (Brazil)****, Dr. W.B. Lewis (Canada), and Dr. I.I. Rabi (U.S.)*

Colaboração Brasileira no Esforço Internacional

FUSION ENERGY PRODUCTION FROM A DEUTERIUM–TRITIUM PLASMA IN THE JET TOKAMAK

JET Team*
JET Joint Undertaking,
Abingdon, Oxfordshire,
United Kingdom

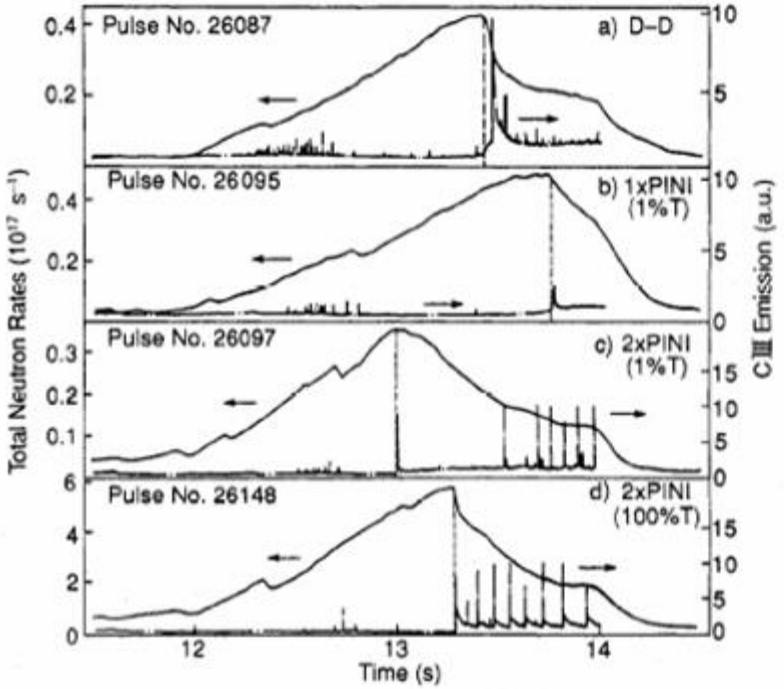

FIG. 15. Variation in the time of termination of the high performance phase of a number of similar discharges as shown by the fall in the neutron emission rate. The dashed vertical lines show the time of the 'carbon bloom' as characterized by increased emission of C III light from the plasma edge. In (a) and (b) the bloom occurs 'naturally', in (c) it is triggered by an ELM, and in (d) it is triggered by a sawtooth collapse coupled to an ELM.

ANNEX

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Participação Brasileira no Esforço Internacional

- Prospecções diplomáticas sobre interesse do Brasil participar do Projeto ITER – início da década de 2000.
- Visita do Sir David King ao Brasil (2005)

ESTADÃO

Ciência

Ciência

Brasil pode fazer parte de projeto do reator Internacional

O Brasil pode se envolver com o Projeto Iter (sigla em inglês para Reator Experimental Termonuclear Internacional), que pretende mostrar que a fusão nuclear é capaz de fornecer eletricidade de forma limpa e com poucos resíduos radioativos. A participação brasileira seria graças à reserva de nióbio localizada em Minas Gerais - a maior do mundo, correspondente a cerca de dois terços do total existente no planeta.O metal, um poderoso condutor, será usado para construir molas gigantes e gerar um campo magnético para conduzir o processo de fusão nuclear dentro do reator.Segundo o principal conselheiro científico da Grã-Bretanha, sir David King, quando o projeto for posto em prática, haverá um grande mercado para o nióbio. King também lembra que há cerca de cem pesquisadores brasileiros com PhD trabalhando no campo da fusão nuclear, que "podem dar uma grande contribuição ao projeto".Uma delegação da Comissão Européia pode visitar o Brasil em breve para estudar alternativas de inclusão no projeto. Hoje, o país que deseja tornar-se parceiro necessita contribuir com no mínimo 10% dos custos por dez anos.

Agencia Estado,
28 de junho de 2005 | 21h08

DESTAQUES EM *CIÊNCIA*

CNEN Comissão Nacional de Energia Nuclear

MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E INOVAÇÕES

PÁTRIA AMADA BRASIL GOVERNO FEDERAL

Participação Brasileira no Esforço Internacional

- Visita do Sir David King ao Brasil (2005).
  - Sugere a participação brasileira principalmente por meio do fornecimento de bobinas supercondutoras.
  - Proposta de empreendimento conjunto para fabricação de bobinas no Brasil (98% das reservas mundiais de nióbio e 92% do mercado internacional).

- Visita do Ministro da Ciência e Tecnologia do Brasil ao JET (2006). Três possibilidades para participação brasileira no ITER foram discutidas.
  - Adesão como membro pleno do consórcio (assumindo 10% doorçamento).
  - Contrato de associação especial (a ser definido posteriormente pelo ITER).
  - Participação através de outro membro europeu.

- Decisão de não fazer parte do Projeto ITER – 2007
  - Incerteza sobre relação custo/benefício (utilização de fusão em futuro próximo).
  - Falta de definição do modelo de associação especial pela Organização ITER.
  - Inexistência de um programa nacional integrado em pesquisa de fusão

Brazil-EURATOM Agreement on Fusion REsearch

]One of the priorities agreed upon in the last summit meeting

JET

EFDA-JET & Brazil collaboration

- General collaboration agreement to be signed between the European Commission and the Brazil Ministry of Science and Education at the end of November 2009.
- Prof. R. Galvão, University of São Paulo, paid exploratory visit to JET 7-12.9.2009, met JET-EFDA and UKAEA key people.
- Several potentially fruitful areas of collaboration were identified and are currently being investigated in detail for implementation within the framework of a Research Agreement between EFDA-JET and Brazilian scientific institutions.

  - **Alfvén Wave (AW) techniques for hydrogenic isotope concentration measurements**
  - **Advanced data analysis/processing and control**
  - **Participation in JET diagnostics and ICRH groups**

Faço saber que o Congresso Nacional aprovou, e eu, José Sarney, Presidente do Senado Federal, nos termos do parágrafo único do art. 52 do Regimento Comum e do inciso XXVIII do art. 48 do Regimento Interno do Senado Federal, promulgo o seguinte

DECRETO LEGISLATIVO Nº 587, DE 2012(*)

Aprova o texto do Acordo de Cooperação entre o Governo da República Federativa do Brasil e a Comunidade Europeia de Energia Atômica na Área de Pesquisa sobre Energia de Fusão, assinado em Brasília, em 27 de novembro de 2009.

Article 1

Objective

The objective of this Agreement is to intensify cooperation between the Parties in the areas covered by their respective fusion programs, on the basis of mutual benefit and overall reciprocity, in order to develop the scientific understanding and technological capability underlying a fusion energy system.

Article 2

Areas of Cooperation

The areas of cooperation under this Agreement may include the following:

(a) tokamaks, including the large projects of the present generation and activities relating to those of the next generation;

(b) alternatives to tokamaks;

(c) magnetic fusion energy technology;

(d) plasma theory and applied plasma physics;

(e) programme policies and plans; and

(f) other areas as mutually agreed upon in writing by the Parties insofar as they are covered by their respective programmes.

Article 3

Forms of Cooperation

1. The forms of cooperation under this Agreement may include, but are not limited to, the following:

(a) exchange and provision of information and data on scientific and technical activities, events, practices and results, and on programme policies and plans, including the exchange of undisclosed information under the terms and conditions set out in Articles 6 and 7;

(b) exchange of scientists, engineers and other specialists for agreed periods of time in order to participate in experiments, analysis, design and other research and development activities in accordance with Article 8;

(c) organization of seminars and other meetings to discuss and exchange information on agreed topics in the areas listed in Article 2, and to identify cooperative activities which may be usefully undertaken in accordance with Article 5;

(d) exchange and provision of samples, materials, equipment (instruments and components) for experiments, testing and evaluation in accordance with Articles 9 and 10;

(e) execution of joint studies, projects or experiments including their joint design, construction and operation;

(f) establishment of data links such as, but not limited to, remote data analysis tools; and

(g) other specific forms of cooperation as mutually agreed by the Parties in writing.

Article 4

Coordinating Committee and Executive Secretaries

1. The Parties shall establish a Coordinating Committee to coordinate and supervise the conduct of activities under this Agreement. Each Party shall appoint an equal number of members to the Coordinating Committee and nominate one of its appointed members as the Head of its Delegation. The Coordinating Committee shall meet annually, alternately in the Federative Republic of Brazil and in the European Union, or at other agreed times and places. The Head of the Delegation of the receiving Party shall chair the meeting.

2. The Coordinating Committee shall review the progress and plans of activities under this Agreement, and propose, co-ordinate and approve future cooperative activities that are within the scope of this Agreement, with regard to their technical merit and level of effort to ensure mutual benefit and overall reciprocity within the Agreement.

3. All decisions of the Coordinating Committee shall be taken by consensus.

4. Each Party shall nominate an Executive Secretary to act on its behalf during periods between meetings of the Coordinating Committee in all matters concerning cooperation that are within the scope of this Agreement. The Executive Secretaries shall be responsible for the routine management of the cooperation.

Dois Projetos de Colaboração Acordados

- Centro Brasileiro de Pesquisas Físicas

Desenvolvimento de Algoritmos de Processamento de Imagens de alta velocidade para detecção em tempo real de MARFEs no JET

- Instituto de Física da Universidade de São Paulo

Aprimoramento do sistema de diagnóstico ativo de auto modos toroidais de Alfvén

A 10 000-Image-per-Second Parallel Algorithm for Real-Time Detection of MARFEs on JET

Márcio Portes de Albuquerque, Andrea Murari, M. Giovani, Nilton Alves, Jr., Marcelo Portes de Albuquerque, and JET-EFDA Contributors

Resultados

- algoritmo desenvolvido e instalado;
- três trabalhos científicos publicados;
- duas dissertações de mestrado concluídas.

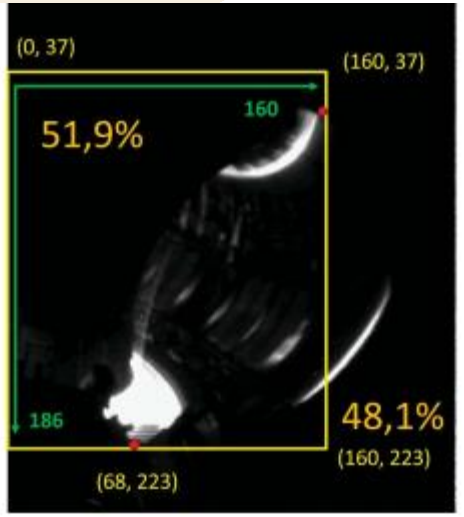
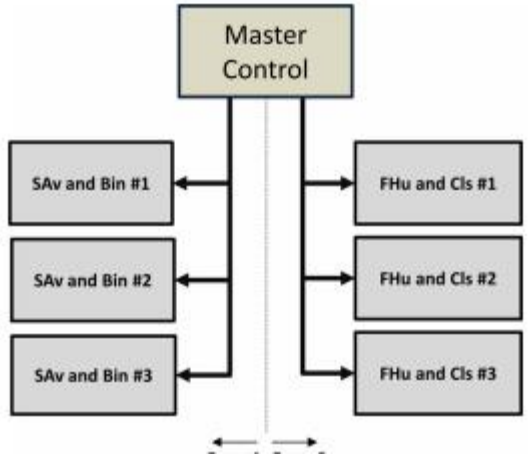


Fig. 5. New RoI for the parallel algorithm implementation. The final image size is 160 × 186 pixels and is 51.9% smaller than the original one.



IOP Publishing | International Atomic Energy Agency
Nuclear Fusion
Nucl. Fusion 56 (2016) 112020 (8pp)
doi:10.1088/0029-5515/56/11/112020

The upgraded JET toroidal Alfvén eigenmode diagnostic system

P. Puglia[1], W. Pires de Sa[1], P. Blanchard[2], S. Dorling[3], S. Dowson[3], A. Fasoli[2], J. Figueiredo[4,5], R. Galvão[1], M. Graham[3], G. Jones[3], C. Perez von Thun[4,6], M. Porkolab[7], L. Ruchko[1], D. Testa[2], P. Woskov[7], M.A. Albarracin-Manrique[1] and JET Contributors[a]

Resultados

- sistemas de amplificadores de alta potência e filtros desenvolvidos e instalados no JET;
- cerca de dez trabalhos científicos publicados;
- duas dissertações de doutorado concluídas;
- efetiva participação da indústria brasileira

TAU Enhancement Project

EUROfusion

PMP: Project Goal and Objectives

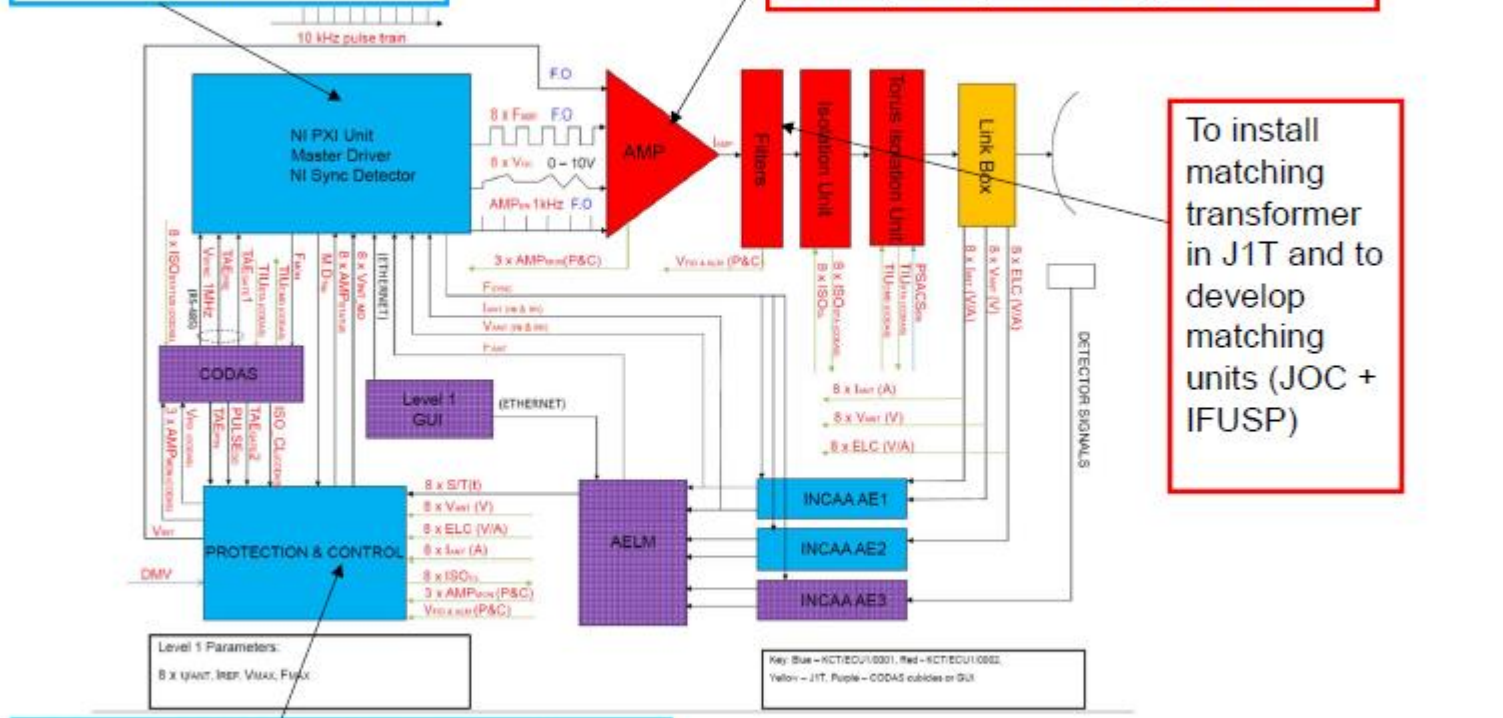
CRPP IFUSP-USP MIT PSFC CCFE

To develop and install a new digital control system (MIT & IFUSP)

To replace the BONN amplifier with 8 Class D power switching amplifier developed & procured by IFUSP

To install matching transformer in J1T and to develop matching units (JOC + IFUSP)

To develop and install new protection and control electronics (JOC)



4kW; Solid-State; 50kHz≤ f ≤ 1Mhz

CNEN Comissão Nacional de Energia Nuclear

MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E INOVAÇÕES

PÁTRIA AMADA BRASIL GOVERNO FEDERAL

Meeting to discuss the internationalization of JET
July 2016