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The Fourth State

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IPR Scientific Outreach Programme @ Vadodara

"Everyone knows *Amba-ma*, *Kali-ma*... but nobody knows Plasma" said Dr. M.H. Mehta, Chairman, Community Science Center, Vadodara during his brief talk on the importance of Plasma physics and technology during the inaugural ceremony of the IPR Scientific Outreach program on 9th October 2015. Probably there could not be a more illustrative manner to sum up the reason why IPR is taking its Social/Scientific Outreach Programme across Gujarat state and possibly beyond too ! The program, jointly organized by IPR and the Gujarat Council on Science & Technology (GUJCOST) was attended by over 25 science teachers and a good number of enthusiasts/students. The Chief guest of the occasion was Shri. S.B. Bhatt from IPR who gave his inaugural speech on Application of Plasma science. The inaugural function was graced by Dr. M.H. Mehta (Chairman & Trustee, CSC Vadodara), Prof. J. P. Singh and Prof. Arun Pratap, and former HOD Physics, MSU Prof. Vijay Potbhare.

Dr. Ramasubramanian anchored the sessions and lectures on energy, basic plasma, fusion, tokamaks and plasma application were given by Bharat Kumar G. A, Mohandas K.K, Hiral B. Joshi, Dharmesh K. Purohit, Priyanka Patel and Tejas J Parekh and Dr, Vinay Kamble. Ms. Chhyaa Chavda coordinated the event. The participating teachers were given kits containing a DVD of all the lecture topics, videos on plasma and its applications as well as the book entitled "Living with Plasmas", three different posters on Basic Plasma, Controlled Nuclear Fusion and Plasma Applications. There were hands-on experiments with Plasma Glow discharge tube, Plasma globes and superconductor magnetic levitation. The program concluded on 10th October evening.



(L) Inauguration of the event at the Vadodara Community Science center. (R) The posters from IPR on display.



The participants of the Scientific Outreach programme at the CSC Vadodara

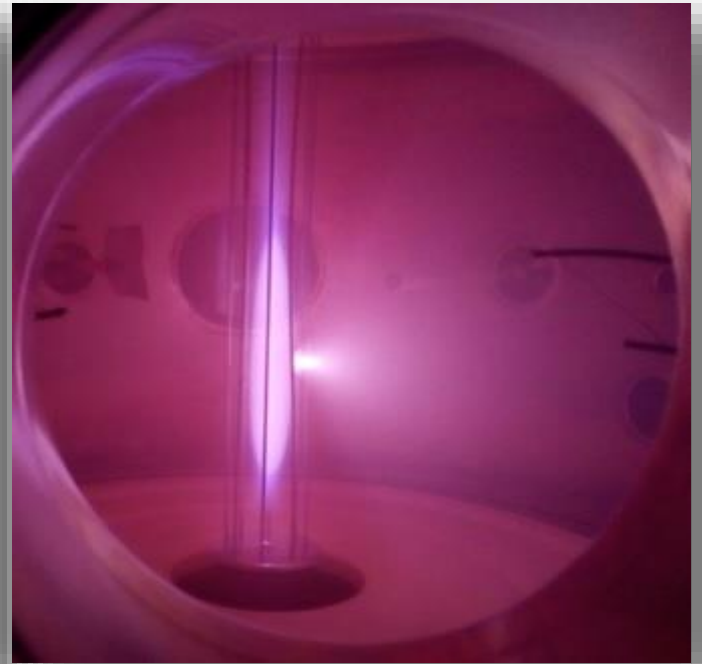
Low Voltage Operation of Inertial Electrostatic Confinement Fusion Device of CPP-IPR 2

Inertial Electrostatic Confinement Fusion device is under operation at low voltage (upto 2kV) and high pressure mode (greater than 10 mTorr) by direct current glow discharge method. The negative voltage is applied to the central cylindrical cathode grid of the device whereas the chamber is kept at ground potential. As a result, a self-sustaining deuterium discharge occurs in the chamber which is maintained by increasing ionization of the background gas by secondary electron emission from the cathode grid. No other external mechanism such as filamentary discharge is used in this experiment. The brighter axial glow at the centre of the grid clearly indicates uniform plasma convergence towards the central axis due to uniform recirculation of deuterium ions.

At higher pressure (greater than 20 mTorr) "jet mode" of operation is prominent as shown in the image. It can also be excited by introducing an asymmetry in the grid, for example by enlarging grid opening at one place in order to define the direction of ion jet propagation. The device will be upgraded for high voltage operation shortly.



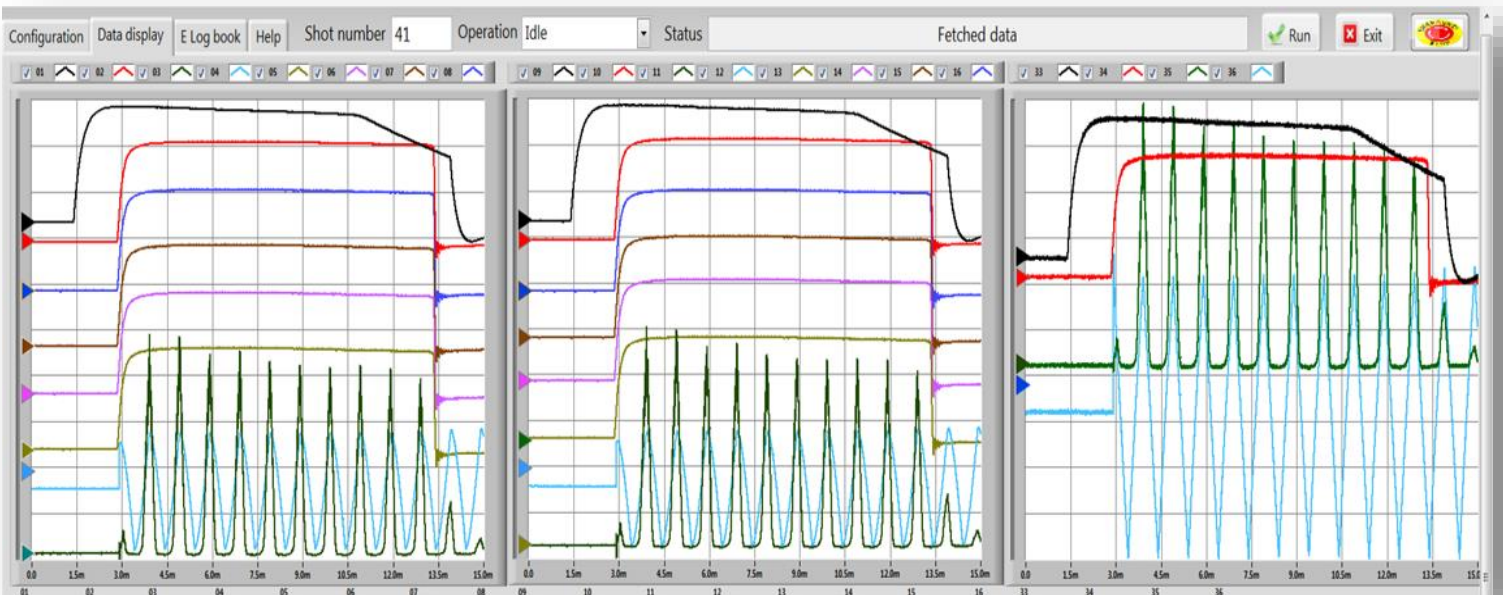
The CPP-IPR IECF device



Jet mode of operation in the IECF device

New data acquisition system for Large Volume Plasma Device

Large volume plasma device (LVPD) is a cylindrical device ($\phi=2\text{m}$, $L=3\text{m}$) dedicated for carrying out investigations on plasma physics problems ranging from excitation of whistler structures to plasma turbulence especially exploring the linear and nonlinear aspects of electron temperature gradient (ETG) driven turbulence. The machine operates in a pulsed mode with repetition cycle of 1 Hz and pulse duration of 15ms. Recently, integration of new PXIe based fast data acquisition system for simultaneous sampling of 40 channels has been successfully demonstrated, by configuring latest available hardware and developed software solutions. This system has replaced the old VXI data acquisition system which has limited capabilities to meet new experimental requirements in terms of numbers of channel (16), bit resolutions (8 bit), record length (30K points) and calibration support for the old modules. The new system is based on PXIe technology and implemented on LabVIEW 2014 platform. The image shows the plasma shot acquired with the new system.



Visualization of the acquired signal of the LVPD

The plasma torch laboratory at FCIPT has developed an enthalpy probe that works on the principle of calorimetry and offers a low-cost, user-friendly solution to measure local (point-to-point) properties of a hot gas, such as enthalpy (heat content) upto few 1000's cal/gm, temperature ~ 3000 – 10000 K, Velocity ~ 200 – 2000 m/s and species composition of gas (mixture) upto ~ 100 a.m.u. Thus, the entire temperature, enthalpy and flow profiles of the hot gas/plasma can be unravelled in two or three dimensions. Such probes can be of use in industrial systems such as thermal spray systems, plasma torch design & development or quality control in an industrial application using hot gas. It can also compliment numerical (computational) modeling and fundamental research.

For an industrial system, this probe can prove to be very useful for system design, process control, stability and repeatability. The development has used entirely in-house techniques and a new probe can be assembled in a matter of 1 hour and installed on the system. It offers significant cost reduction compared to commercially available enthalpy probe systems.



Enthalpy probe in operation with 30 kW torch power

IPR Participation in DAE Safety & Occupational Health Professionals Meet-2015



The 32nd DAE Safety & Occupational Health Professionals Meet-2015 was jointly held by Atomic Energy Regulatory Board (AERB), Mumbai and Raja Ramanna Centre for Advanced Technology (RRCAT), Indore during October 05-07, 2015. The theme for this year's meet is "Safety in Evolving and Advanced Technological Applications" for Industrial Safety and "Positive Health Management" for Occupational Health Safety. This meet was inaugurated by Shri S.A.Bhardwaj, Chairman-AERB. About 350 delegates from various DAE units and DAE aided institutes participated in this meet. Technical Proceeding and CD of the proceeding was released by Dr. P.D.Gupta, Director, RRCAT. A total of 07 papers have been presented from IPR either in oral or poster mode. As a part of the meet various safety competitions were organized in which, all the DAE units actively participated. Mr. Laxmi Narayan Gupta has won consolation prize for Hindi Safety Slogan Competition for his slogan तकनीकी का हो सृजनात्मक एवं सुरक्षित उपयोग, सुरक्षा संस्कृति एवं अनुशासन से करने होंगे प्रयोग।

Popular Talk @ Saurashtra University

Dr. N. Ramasubramanian gave a popular lecture entitled 'Career Opportunities in Science' to the undergraduate students of Saurashtra University, Rajkot. It was arranged by the 'Career Counselling & Development Center', of the Department of Physics, Saurashtra University on 29th September 2015. He also delivered a lecture on 'Interaction With Plasma' to the research students and postgraduate students of the same University in the afternoon.



Dr. N. Ramasubramanian delivering the lecture at Saurashtra University, Rajkot.

IPR Library celebrated the 84th Birth Anniversary of former President of India and the Missile Man Dr. A. P. J. Abdul Kalam on 15 October 2015.

The celebration included an exhibition of Dr. Kalam's books and display of an informative poster about his life and achievements. A good number of library members took part and visited the book exhibition.

The celebration was an attempt to remember the great soul on his birthday, and inspire young minds towards reading books.

The poem of Kalam expressing his passion towards books:

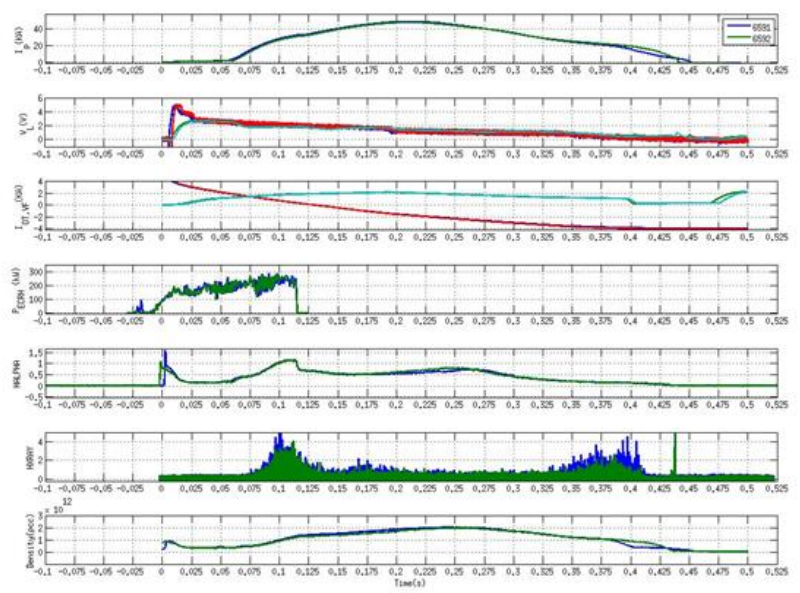
*"Books were always my friends
Last more than fifty years
Books gave me dreams
Dreams resulted in missions
Books helped me confidently take up the missions
Books gave me courage at the time of failures
Good books were for me angels
Touched my heart gently at the time
Hence I ask young friends to have books as friends
Books are your good friends."*

--A. P. J. Abdul Kalam



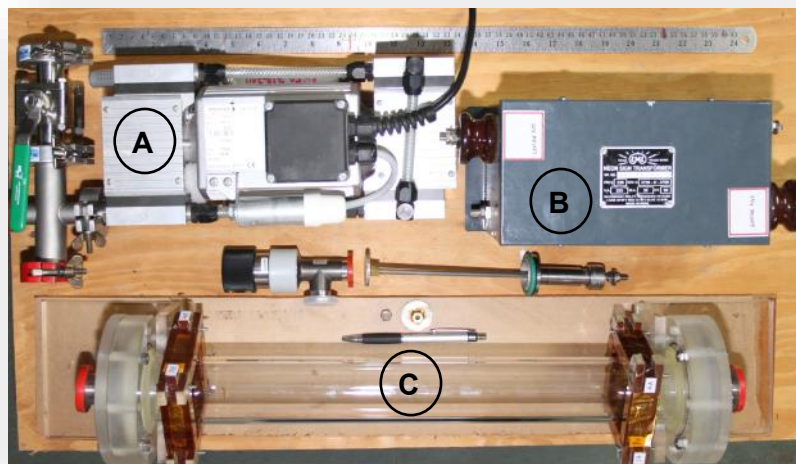
SST-1 Update

SST-1, after the phase-1 up-gradation with plasma facing components being installed, concluded a short but very successful 13th Experimental campaign on Sep 30, 2015 having achieved up to a plasma current of 54.18 KA and plasma pulses lasting up to 500ms. This was a completely new experimental regime especially considering the behavior and effects of the installed Plasma facing components on the plasma discharge characteristics. Towards the end of this campaign, experimental attempts at Lower Hybrid Coupling in SST-1 Ohmic plasma was also tried out with experimental initial signatures being encouraging. The campaign-13 results have been reviewed in a Special Review held at IPR on Oct 05, 2015. Presently, SST-1 machine is being cooled down towards another short experimental campaign initiating (campaign 14th).

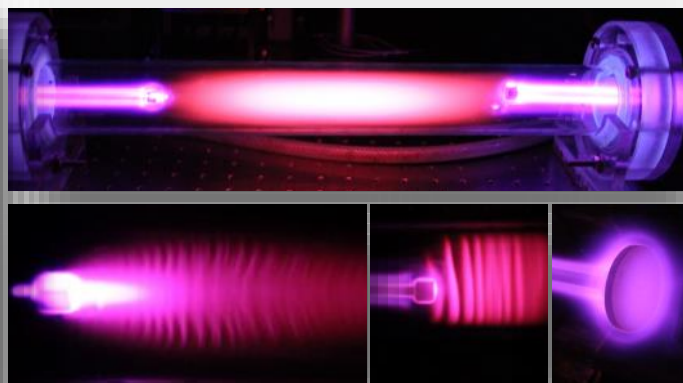


(L) Review of SST-1 in progress on 5th October, 2015. (R) Typical SST-1 Discharge during campaign-13

This simple plasma discharge system was built to be used as a hands-on demonstration unit for IPR's scientific outreach programs. This system is compact and easily portable and can demonstrate various aspects of plasma generation, dependence on pressure and voltage, striations and also effect of magnetic field. This has been a popular exhibit during IPR's scientific outreach programmes. This system consists of a main discharge tube with stand (70 cm x 15 cm), a compact vacuum pump AC/DC powers supply, electrodes of different sizes and shapes, pressure control valve, gate valves, high voltage shields and two sets of 4 permanent magnet configurations, all of which fit into a box of size 75x60x50 cm.



The compact plasma demonstration system complete with (A) vacuum pump (B) HV power supply and (C) discharge tube.



Normal discharge effects can be observed at different voltage & pressure combinations. The formation of striations and electrode sheath can also be easily demonstrated using this system.



Demonstration of the effect of magnetic field on the plasma column. The cross-section is depicted in the image on the left.

Ayudh Puja @ IPR Workshop



Ayudh Puja being performed at the IPR Workshop on 21st October, 2015 as part of the Navaratri festival.

India @ ITER

IN-DA represented by Mr. Arun Chakraborty, participated in CDR of HNB Assembly & Testing held on 23rd September. TBM Division team from IPR participated in Design Review CDR - TBM-Set 6 LLCB & LLCB Ancillary Systems at IO 28 Sep - 1 Oct 2015, at IO, St Paul Lez Durance, France. The objective of this meeting was review of Systems requirements, Interface requirements, project schedules and other horizontal requirements (environmental conditions, etc.). Prof Y.C. Saxena participated in IAIPS (Independent Assessment of ITER Project Schedule) meeting during 23-24 Sep 2015. Experts group is doing independent assessment of ITER Project schedule.



Mr. Laxmi Kant Bansal and Mr. Gaurav Bansal from IPR joined ITER.

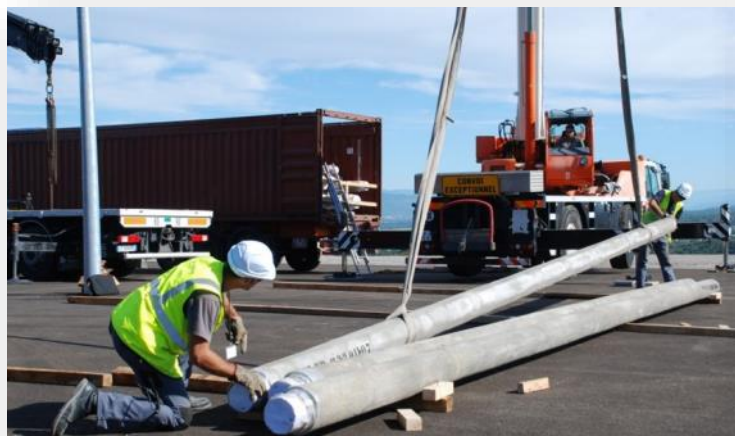


Navratri Festival was celebrated on 25 October 2015 at a community hall in the picturesque village of Ville-neuve, France. The celebration was an annual event for Indians in the nearby area and to get together to celebrate the festival, which also included a garba !



ITER - India News

ITER- India delivered its first lot of cooling water pipes for ITER chilled water and heat rejection systems early August. Each cooling piper is nearly 11m long and diameter of 15-50cm. As a first consignment, ITER-India delivered around 24 such huge pipes to France in two containers loaded at Mundra Port, India. Around 100 such containers are expected from India for ITER's cooling water systems. This also called a celebration inviting team members from the Indian Domestic Agency, ITER, M/s Larsen & Turbo, logistic partner Duergo India and government officials also at the Inland Container Depot, Khodiyar India. Prof. Dhiraj Bora, Director IPR and Shishir Deshpande, ITER- India Project Director addressed and wished all the delegates for their valuable contribution. ITER Director-General Bernard Bigot also conveyed his best wishes to the team through teleconference.



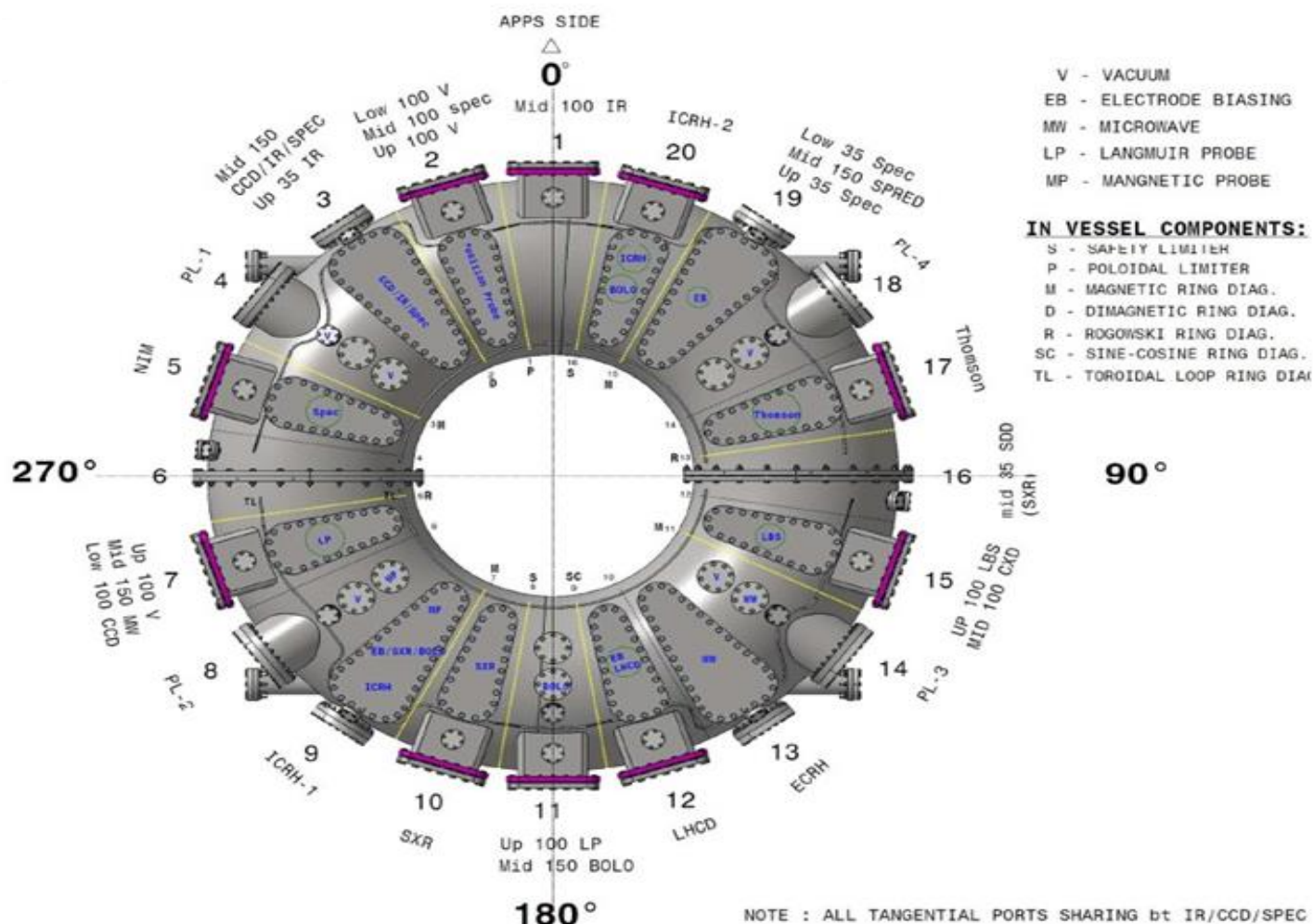
The first batch of cooling water piping loaded at the Inland Container Depot in Khodiyar, India

ITER Cryostat - Journey To France Begins !

All 54 segments of the giant vacuum container has been completed and its all set for packaging the 460-ton consignment. A "flag- off ceremony" was also held on 19 October, 2015 to celebrate this achievement and initiate packing operations that will be completed in a months time. At the end of November, the consignments will be delivered at Fos-sur-Mer harbour - the closest to ITER. Six 19-ton shells will be delivered at ITER site by road. The 60° base sections which comprises of six sub-sections 10 m long, 8.10 m wide and weighing 50 tons each will be transported through the dedicated ITER Itinerary in two separate convoys. Both convoys are expected before the end of the year at ITER—the first elements of the ITER machine to reach the site.


























Tentative Port Allocation for New Vacuum Vessel for Aditya Upgrade: After successful testing of new Aditya vacuum vessel, both the semi torii of the vessel are separated and placed in clean environment in the Aditya hall. It is available for viewing inside the semi torus through end flanges and for mounting of in vessel components. The tentative port allocations for various diagnostics and components have been completed and is shown below.



Welcome

Best wishes to the new research scholars and TTP students who have joined IPR this year.

							
Montu Bhuvu DOJ : 3-8-2015 PhD Scholar	Chinmoy Mallick DOJ : 3-8-2015 PhD Scholar	Mayank Rajput DOJ : 3-8-2015 PhD Scholar	Jay K. Joshi DOJ : 3-8-2015 PhD Scholar	Bhumi Chaudhari DOJ : 3-8-2015 PhD Scholar	Arunsinh Zala DOJ : 3-8-2015 PhD Scholar	Jal Patel DOJ : 3-8-2015 PhD Scholar	Priti Kanth DOJ : 3-8-2015 PhD Scholar
							
Girija Shankar P DOJ : 3-8-2015 PhD Scholar	Niraj Wakde DOJ : 3-8-2015 PhD Scholar	Dipshikha Borha DOJ : 3-8-2015 PhD Scholar	Garima Arora DOJ : 3-8-2015 PhD Scholar	Arnab Jyoti Deka DOJ : 3-8-2015 PhD Scholar	Srimanta Maity DOJ : 3-8-2015 PhD Scholar	Vinod Saini DOJ : 5-10-2015 TTP	Sooraj K. P. DOJ : 5-10-2015 TTP
							
A. Chakraborty DOJ : 5-10-2015 TTP	Abhishek Sharma DOJ : 5-10-2015 TTP	Shivam Kr Gupta DOJ : 5-10-2015 TTP	Sunil Bassi DOJ : 5-10-2015 TTP	Saurav Kumar DOJ : 5-10-2015 TTP	Satyam Tiwari DOJ : 5-10-2015 TTP	Suman Aich DOJ : 5-10-2015 TTP	

- ◆ **Prof. Bikas K. Chakrabarti**, Senior Professor, Saha Institute of Nuclear Physics (SINP), Kolkata, gave a talk on "Econophysics of Income & Wealth Inequalities" on 1st October 2015 (Colloquium # 254)
- ◆ **Prof. Tomas J. Dolan**, University of Illinois, USA, gave a talk on "Fusion-fission Hybrid Reactors" on 6th October 2015
- ◆ **Dr. Prashant Sharma**, Indian Institute of Technology Kharagpur, gave a talk on "Development of Coating for Hot Corrosion Resistance of AISI 304 Stainless Steel and High Temperature Oxidation Resistance of Inconel 718" on 7th October 2015
- ◆ **Prof. Tomas J. Dolan**, University of Illinois, USA, gave a talk on "Molten Salt Reactors and Thorium Energy" on 7th October 2015
- ◆ **Prof. Tomas J. Dolan**, University of Illinois, USA, gave a talk on "Plasma Heating and Current Drive" on 8th October 2015
- ◆ **Prof. Tomas J. Dolan**, University of Illinois, USA, gave a talk on "How to Give Good Technical Presentations" on 9th October 2015
- ◆ **Prof. Amitava Gupta**, Jadavpur University, Kolkata, gave a talk on "Control Over Data Networks-Issues, Challenges, Tools and Techniques" on 9th October 2015 (Colloquium # 255)
- ◆ **Dr. Kushal Shah**, Electrical Engineering Dept, IIT Delhi, gave a talk on "Fermi acceleration in billiards with holes" on 20th October 2015 (Colloquium # 256)

Upcoming Events

- ◆ National Conference on Emerging Trends in Vacuum Electronic Devices & Applications (VEDA 2015), Bangalore, India, 3-5 December 2015 <http://veda2015.hpage.com/>
- ◆ 10th Asia Plasma and Fusion Association Conference (APFA 2015), Institute for Plasma Research, Gandhinagar, 14-18 December 2015 <http://www.ipr.res.in/APFA2015/documents/scientific.html>
- ◆ 30th National Symposium on Plasma Science & Technology (PLASMA-2015) PLASMA 2015, 1-4 Dec 2015, SINP Kolkata. <http://goo.gl/5RZ6AM>

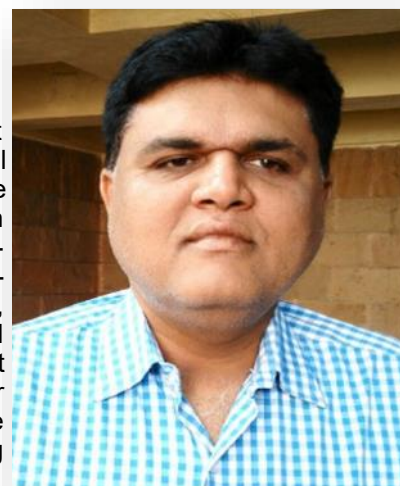
Know Our Colleagues



Dr. Hitesh Pandya joined the Institute in 1990 as a research Scholar. Later in 1995 he joined the Plasma Diagnostic group as a scientist and had been involved in the development and installation of ECE Diagnostics system in tokamaks ADITYA and SST-1. He has been credited with publishing many research papers in national and international journals and has delivered many talks and presentations in national and international conferences. He had the opportunity to work on DIII-D Tokamak at General Atomics, San Diego, USA and also at ITER, Cadarache, France. Currently he is in Plasma Diagnostic Group in ITER-India project. His field of interests and expertise are in Millimeter and THz wave spectroscopy and fusion plasma diagnostics.



Dr. Vipul L. Tanna joined IPR as a research Scholar in 1992 and later as a scientist in 1995 as a member of the SST-1 cryogenic team notably contributing in the conceptual and engineering design of SST-1 Tokamak cryogenics systems and in its operation. He received his Doctorate in 2006 from University of Karlsruhe, Germany in the area of Design and Analysis of superconducting current feeders system for ITER. He has been the division head of SST-1 Cryogenics since 2007 supervising numerous SST-1 tests and validation campaigns using cryo plant. He has wide expertise in the field of Cryo heat loads, Thermo-hydraulics, Current leads, SC feeders, two phase flow and plant process and maintenance. He is serving as mentor and co-mentor at Gujarat Engineering Colleges at Rajkot and Morbi as part of SPFU/ TEQIP activities to motivate engineering faculties for research in Gujarat. He is actively involved in TTP as well as M. Sc. (Eng.) Programs at the Institute and also serves as Ph. D. supervisor in the physics as well as in the Engineering sciences at PDPU, Nirma, HBNI, and GTU Academic Institutions.



The IPR Newsletter Team

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Suryakant Gupta	Ramasubramanian N.	Chhaya Chavda	Shravan Kumar	Hiral B Joshi	