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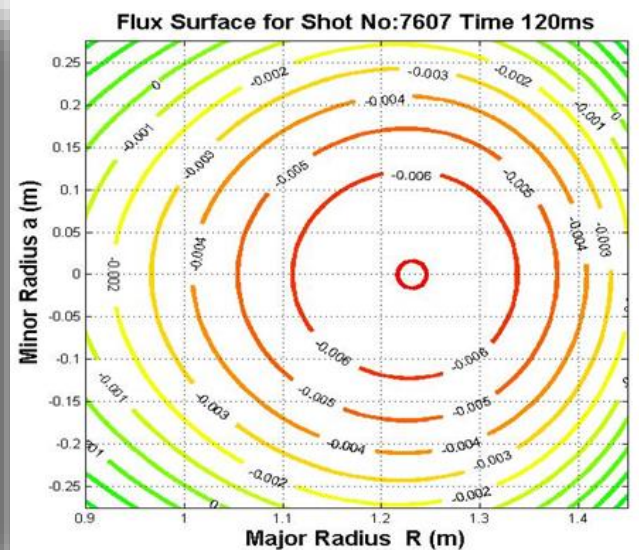
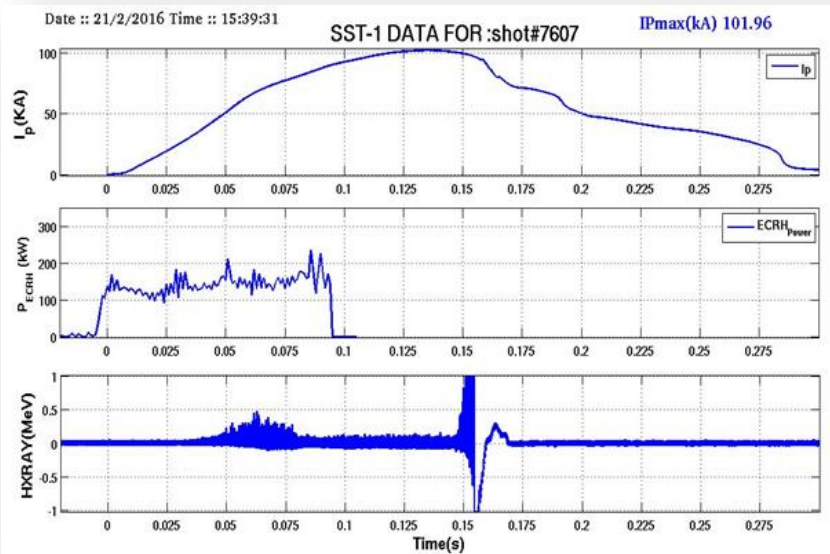
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The Fourth State

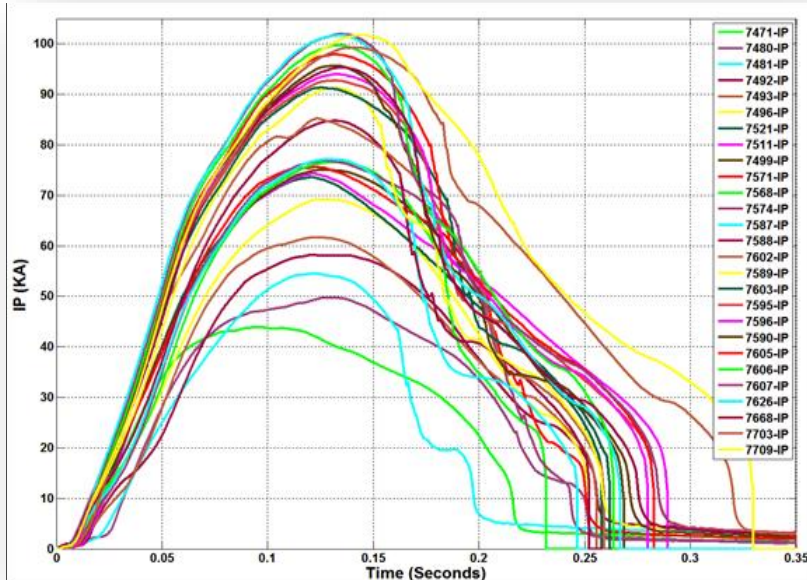
Newsletter of the Institute For Plasma Research, Gandhinagar, Gujarat (India)

SST-1 Update

SST-1 device has achieved the mission objective of obtaining a plasma current in excess of 100 KA at a central field of 1.5 T on 21st February, 2016 during the 16th experimental campaign. SST-1 mission journey had began on 1st January, 2009 with a dedicated SST-1 Mission Team under the leadership of Dr. Subrata Pradhan taking over the SST-1 project from the scratch. The SST-1 Mission has included refurbishment of several core sub-systems, reassembly & integration of SST-1 Machine Shell, engineering validations of the assembled SST-1, First Plasma experiments in SST-1 with limiters, installation & integration of Graphite based First Wall Components and carrying out subsequent experiments in circular plasmas in a central field of 1.5 T. SST-1 has gradually evolved since then consolidating itself as a 'Working at-par experimental Superconducting Tokamak'. The plasma parameters (current, temperature and densities etc) have been systematically increased in the Plasma Facing Components equipped SST-1. During campaign 16th, repetitive shots with plasma current in excess of 95 KA have been achieved with a maximum current of 102 K Amp with line integrated densities in the range of 10^{19} m^{-3} and electron temperature in the range of 300 eV. The upcoming campaigns in SST-1 will focus on lengthening the flat top duration of plasma with required controls as well as achieving higher densities & temperature in SST-1.



(L) Snapshot showing parameters of plasma for shot no. 7607 (R) Analysed Flux surfaces at 120 ms



(L) Snapshot showing repetitive behaviour of plasma currents (R) Dr. Pradhan briefing SST-1 journey

As a part of the National Science Day celebrations of the Gujarat Council of Science City and Gujarat Council of Science & Technology (GUJCOST), Govt of Gujarat, a Science Carnival was organized at the Science City from 28th February to 5th March 2016. IPR was invited to participate in this carnival and 14 exhibits were presented by IPR, out of which, 11 were working models. Demonstration of radiation measurement devices and shielding, Gravity and space-time, magnetic levitation and Ruben's tube with flame were quite popular amongst the visitors to the IPR stall. Static models of SST-1, Plasma pyrolysis and plasma treatment of wool were also displayed apart from informative posters. More than 50 volunteers from IPR participated in this event and managed the IPR exhibits during carnival. A collage of images from the event are below.



Dr. N. Ramasubramanian was the keynote speaker at the National Level Science Symposium 2016 held at Christ College, Rajkot on Sunday 14th February 2016. The title of the talk was '*Glimpses from the Pertinent World of Plasma Science and Technology*'. The one day symposium had more than 1500 registered participants from undergraduate and graduate students. The participants were from Physics, Chemistry and Biology presenting oral/poster on Recent Trends in Science and Technology.



The 45th National Safety Week was celebrated at IPR from 4-10 March 2016. As a part of the campaign, the institute organized various competitions to create safety awareness among its employees. Competitions conducted were a) *Slogan in Hindi & English languages*, b) *Poster*, c) *Quiz* and d) *Essay Writing in Hindi & English languages* based on decided topics for the employees at IPR, FCIPT & ITER-India. Good response was received from the employees for various competitions. In addition to this, Safety Division also organised invited talks on various topics related to safety. On 4th March 2016, Dr. Chenna Reddy also hoisted the Safety Flag at the building site of the Auxiliary labs at IPR.

The concluding session of the Safety Week was organized on 10th March. Prof. Amita Das, Dean delivered the keynote address. Dr. Chenna Reddy, Chairman – Safety Committee addressed the gathering and Mr. D.V.Modi, Safety Officer, IPR, gave a presentation on the *Activities undertaken by IPR Safety Division*.

List of winners of the various competitions organized as part of the safety week at IPR.

Competition	Winner	1st Runner Up	2nd Runner Up
Hindi Slogan	Sandhya Dave	Sunil Misal	Rajnikant Bhatasana
English Slogan	Pratibha Gupta	Shirin Bhesania	Aditya Prakash Singh
Poster	Unnati Patel	Gautam Vadolia	-
Quiz	Chirag Bhavsar	L. N. Srikanth	Prakash Parmar, Ulhas Dethe
Hindi Essay	Minsha Shah	Sandhya Dave	Santosh Kumar Gupta
English Essay	Alphonsa Joseph	Vishal Jain	Hiral Joshi



Dr. Chenna Reddy hoisting the Safety Week Flag.



(L) Expert talk by Shri K. Ramprasad. (R) Prof. Amita Das delivering the Keynote address

45th National Safety Week at CPP-IPR

CPP-IPR also observed the 45th National Safety Week Campaign with the same enthusiasm like last year. Slogan (in both English and Assamese) and Quiz competitions on safety were organized amongst the faculty members and students. On the final day of the campaign, a talk titled "Safety Awareness: At-work, Off-work" was delivered by Mr. Akhil Kumar Das, a renowned fire-safety expert. Mr. Das is the first Indian to have obtained MS in Fire Protection Engineering from Worcester Polytechnic Institute, USA, and has vast industry experience in this field. He served in several national and international organizations and currently he is a Visiting Professor at University of Petroleum & Energy Studies (UPES), Dehradun. The talk was followed by the award distribution ceremony for winners of Slogan and Quiz Competitions. Prof. S. Bujarbarua, founder director of CPP distributed the awards.



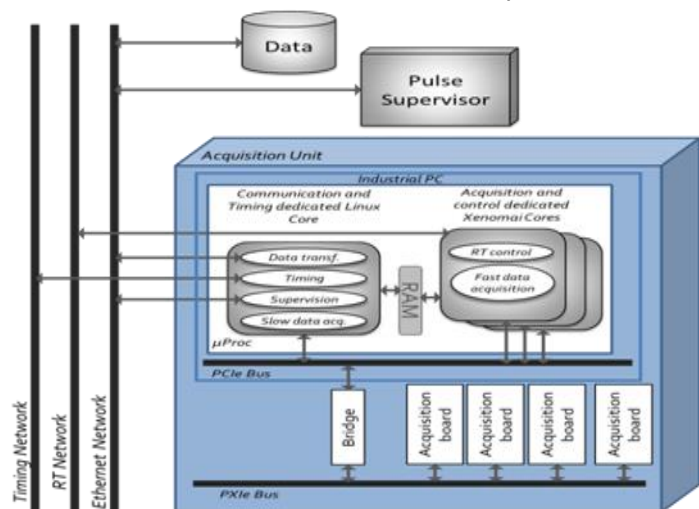
(L-R) Dr. A K Das delivering the talk on safety, View of the audience participating in the competition, Prof. Bujarbarua distributing the prizes.

A 2-day workshop on '**Advances in Surface Engineering and Welding Technology**' organized jointly by IPR, Govt. Engg. College Gandhinagar and ASM International Gujarat Chapter was **conducted at FCIPT on 29th Feb, 2016 and 1st March, 2016**. IPR is a mentoring organization to 7 TEQIP-II colleges of Govt. of Gujarat under an MoU between IPR and Commissionerate of Technical Education, Gandhinagar. The workshop was attended by faculty and students of GEC Gandhinagar, researchers from PDP, IIT Gandhinagar and industry representatives. The International speakers profile included Dr. Zoltan Kolozsvary, Managing Director, SC Plasmatern SA, Romania; Dr. T. Sudarshan, CEO - Materials Modification Inc, USA and Trustee - ASM International; and Prof. Antonello Astarita, Faculty - University of Naples 'Federico-II', Italy, while local speakers included Dr. S. K. Nema from FCIPT, IPR and Prof. Vishvesh Badheka from PDP. The workshop witnessed enhancement in networking amongst the participants and with the speakers and opened areas for mutually beneficial research environment.



IPR Activities @ CEA

The data acquisition and control (DAC) system for the WEST tokamak has its roots in the centralized operation and control system of the Tore supra tokamak namely TSDAQ. The novelty of the new design is use of latest hardware and software technology trends while maintaining the original architecture intact. Main components of TSDAQ main control software are: (1) LIBTSDAQ, a reusable library of common software modules and drivers for interfacing of the diagnostics system with the central control system, (2) TSDAQ_client, software modules for implementation of diagnostics specific applications, (3) TSBASE, a centralized database system for archival of data of the diagnostic systems, and (4) well-tested collection of tools and scripts. The tool named "Top", is used by all the diagnostics systems for the definition of signals, I&C boards and strategy for the storage. The TSDAQ is written in the C language and executes in the Centos Linux operating system on industrial PC. PXIe based FPGA and Multifunction I&C boards from National instruments (NI) are selected for the signal I/O. The DAC system is interfaced with the high speed reflective memory (RT) network, timing network and Ethernet network. The substantial work of software development for the diagnostics, integration with the TSDAQ and testing is currently under progress by a team of technocrats from Institute for plasma research



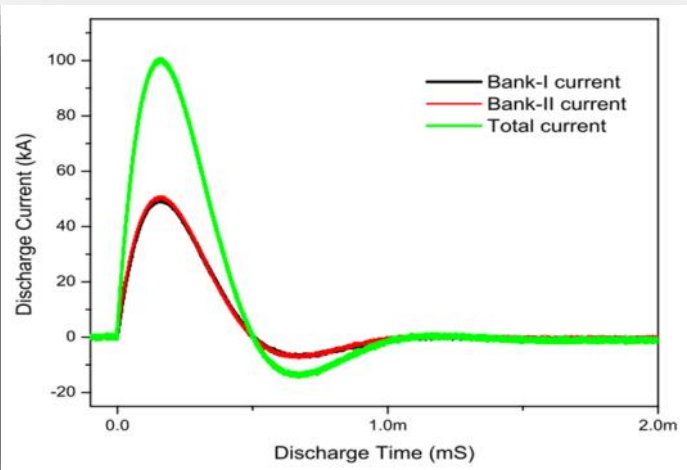
Architectural diagram of the DAQ system (Courtesy. Tore supra team)



IPR collaborators with the Director, CEA during the welcome tea

A welcome tea was organized by Dr. Alain BECOULET, Head, Institute for Research on Magnetic Fusion, CEA / Cadarache, for the on-site collaborators from India. During this interaction, he expressed his pleasure on the ongoing contribution from IPR. He has also discussed the technical challenges and work opportunities in the WEST machine.

After the installation and operation of the first 100 kJ capacitor bank last month, the second bank was also tested successfully. The two banks were coupled to obtain a net energy of 200 kJ. The synchronization of these two high energy capacitor banks has always been an issue of interest for us as this is quite a complicated matter and all the subjects need to be evaluated with precision. Both the 100kJ Pulsed Power Systems are almost identical in electrical connections with a load of 140mΩ sorted to ground. Infra-red lamps are constantly focused on the ignitron to remove deposition of mercury vapours. The whole operation of charging and discharging of capacitor banks is carried out remotely from a control panel which are screened from the high voltage part of the system. The test was first done at a lower voltage to check the performance and connections. After many rigorous test trials, voltage and thermal conditionings, eventually at around 16:20 hrs on 23/02/2016 we have successfully fired the 200kJ bank at a voltage of 15 kV. The peak discharge current is around 100kA. The discharge current signal of each capacitor bank shows good synchronization of their simultaneous triggering. This pulsed energy source will be used to power the Pulsed Plasma Accelerator shortly. The necessary work has already been completed and at present, the assembly of the plasma accelerator is in progress.



(L) The capacitor banks for the 200kJ system (R) The discharge characteristics of the 200kJ system.

ITER-India: 100 KV Power Supplies for NBTF

Under a procurement arrangement between the Indian Domestic Agency and ITER Organization, 100 KV Power Supply components are to be contributed by India in-kind to the Neutral Beam Test Facility in Padova, Italy. With completion of design & manufacturing phases, a total of 9 trucks with 96 boxes containing various components in knockdown condition have begun their journey towards Italy. The supplies include multi-secondary oil filled transformers, SMPS modules, controller, HV racks, cables, disconnector switches, dummy Load, accessories etc. On 1st March 2016, a flag-off ceremony was held at ITER-India laboratory in IPR in the presence of IPR Director Prof. Dhiraj Bora, ITER-India Director Dr. Shishir Deshpande, Project Manager & Deputy Project Manager of ITER-India Power Supply Group Mr. Ujjwal Baruah & Mr. N.P. Singh, ITER-India team and General Manager of prime contractor Electronics Corporation of India Limited, Brigadier A. Umar Farook. The trucks have now embarked to the Mundra port from where they will be shipped for their final destination. -Courtesy ITER newslne



(L) Prof. Dhiraj Bora performing the traditional coconut-breaking ceremony during flag-off. (R) The ITER-India Power Supply Group

IPR Divisions & Groups - Electronics & Instrumentation Group



Electronics & Instrumentation group is prominently responsible for design, development and maintenance of front end electronics and signal conditioning units for various plasma diagnostics of SST-1 and Aditya Tokamak. The group is also involved in development of in-house data acquisition system. Different types of modules are developed supporting variety of sampling rate, resolution and channel density. These modules are standalone and Ethernet based, and they are widely used in various labs of I.P.R and tested in Aditya and SST-1 Tokamaks. The group is also working on different projects such as PLC and PXI based control system, Embedded systems using FPGA, Single Board Computer and Digital Signal Processing based systems used in IPR.

(L-R) : Bharat Arambhadiya, Vismaysinh Raulji, Praveenlal E. V., C. J. Hansalia, Rachana Rajpal, Pramila Gautam, Praveena Shukla, Minsha Shah and Harshad Chauhan

Indranil Bandyopadhyay and Sulaiman Dilshad participated in IIFED/IBF 2016 meet held in Monaco during 8-11 February, 2016. Phillipe Toulini of L&T Paris office represented their work displayed at Stall set up in the exhibition during this meet. First meeting of IC Review Group (ICRG) was held at IO during 15-19 Feb, 2016. A team of from ITER-India lead by IN-DA Project Director Shishir Deshpande participated in this meeting and was accompanied by Mr. Arun Chakraborty and Shrishail Padasalagi. Second meeting of ICRG is planned during 11-15 April 2016.



ITER-India's stall at the IIFED/IBF 2016 @ Monaco

Holi-2016 was celebrated in Parc La Torse in Aix-en-Provence in very joyous mood by more than 100 participants on 20th March 2016. Participants included families of IPR staff on deputation at CEA & IO, and their friends.

The celebrations were kicked off by play of colours followed by lunch, exciting games and competition for children, and other activities. Currently 23 Indians are part of IO Central team (IO staff) among them 16 are from our Institute. CEA currently has 9 persons from IPR.



Indians at ITER enjoying the Holi celebrations at Aix-en-Provence, France

Past Events @ IPR

- ♦ **Mr. Dushyant Kumar Sharma**, Institute for Plasma Research, Gandhinagar, gave a talk on "Slow Wave Characteristics of Metamaterial Loaded Helical Guide" on 25th February 2016
- ♦ **Dr. Robert Pearce**, ITER Vacuum Section, ITER Organization, Cadarache, France, gave a talk on "An overview of the ITER vacuum Systems and practices" on 02nd March 2016
- ♦ **Shri K. Ramprasad**, Head, Industrial Plants Safety Division, Atomic Energy Regulatory Board, Mumbai, gave a talk on "Safety Culture for R&D organizations" on 07th March 2016
- ♦ **Shri Rajnikant Sharma**, Sr. Manager (Fire & Safety), Indian Farmers Fertilizer Cooperative Limited, Kalol, Gujarat, gave a talk on "Behavioral Management of Safety" on 08th March 2016
- ♦ **Shri Ajit Kumar**, Nuclear Power Corporation of India Ltd., Kakrapar, Gujarat, gave a talk on "Nuclear Power Program and Safety" on 09th March 2016
- ♦ **Dr. A.K.Patra**, Head, Environmental Survey Laboratory, Bhabha Atomic Research Centre, Mumbai, gave a talk on "Radiation - A fact of life and Environmental Impact Assessment around KAPS" on 09th March 2016
- ♦ **Dr. Hogun Jhang**, National Fusion Research Institute (NFRI), South Korea, gave a talk on "Influence of zonal flows on dynamical processes in tokamak plasmas: Results from turbulence simulations" on 14th March 2016
- ♦ **Dr. Jae Min Kwon**, National Fusion Research Institute (NFRI), South Korea, gave a talk on "Status of gyrokinetic simulation studies in NFRI" on 15th March 2016
- ♦ **Mr. Vikram Singh Dharodi**, Institute for Plasma Research, Gandhinagar, gave a talk on "Collective phenomena in strongly coupled dusty plasma medium" on 15th March 2016
- ♦ **Mr. Soumen Ghosh**, Institute for Plasma Research, Gandhinagar, gave a talk on "Study of Localized Potential Structure and Heating in Expanding Helicon Plasma" on 17th March 2016

The International Tokamak Physics Activity (ITPA) provides a framework for internationally coordinated fusion research activities. The ITPA operates under the auspices of ITER. The meetings of the International Tokamak Physics Activity (ITPA) - Transport & Confinement (T&C) and Pedestal & Edge Physics (P&EP) task groups were held at the Institute for Plasma Research (IPR) from 16th to 18th March 2016. Around thirty participants from different countries such as USA, EU, Japan, South Korea and India attended the meetings. Many attendees also participated in this meeting *via* video conferencing. Both the meetings were highly successful and many important presentations and fruitful discussions were held during the course of the meetings.



Participants of the ITPA T&C and P&EP meetings held at IPR




Seminar on Plasma Technologies @ GTU

A one-day seminar on Plasma based Technologies was jointly organised by FCIPT/IPR and Research and Consultancy Services Cell, Gujarat Technological University (GTU) in association with PG Research Centre for Governance Systems, GTU on 5th March.

Prof. D. Bora, Director IPR gave the Guest of honour speech followed by Keynote talks by Dr. S. Mukherjee and Dr. S. Nema. Various plasma based technologies were discussed for waste disposal, textile, automobile and nanotechnology applications in the talks of Ms. Alphonsa, Ms. Nisha Chandwani, Dr. Mukesh Ranjan and Dr. Nirav Jamnapara. The faculty from GTU as well as the students actively participated in this event.



Images from the one-day seminar on Plasma based Technologies

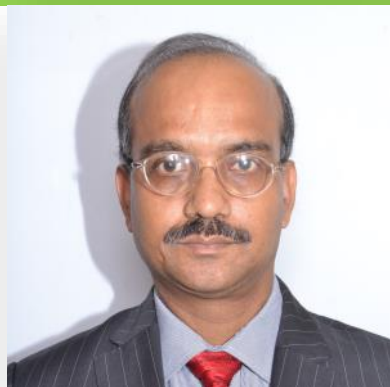
			
Khodiyar Bhoomi Kanaiyalal DOJ: 04-01-2016 Scientific Assistant-B	Chandra Sekhar Singh DOJ: 02-03-2016 Engineer-SC	Shahrukh M. S. Bareja DOJ: 04-03-2016 Scientist-SC	Rajwardhan Mittal DOJ: 15-03-2016 Engineer-SC

On behalf of IPR we extend a very hearty welcome to the new additions to IPR staff this year.

Upcoming Events

- ◆ 47th Annual Meeting on Nuclear Technology (AMNT 2016), Hamburg, Germany, 10-12 May 2016
<http://www.nucleartech-meeting.com/welcome.html>
- ◆ 1st International Workshop on Plasma Agriculture (IWOPA), A.J. Drexel Plasma Institute, Camden, New Jersey, USA, 15-20 May 2016 <http://www.iwopa.org/>
- ◆ 11th International Conference on High Energy Density Laboratory Astrophysics, SLAC National Accelerator Laboratory, Menlo Park, CA USA, 16-20 May 2016 <https://conf-slac.stanford.edu/hedla-2016/>
- ◆ 14th International Workshop on the Fast Ignition and High Field Physics with High Power Lasers (FIWS2016), Yokohama, Japan, 17-20 May 2016 <http://www.ile.osaka-u.ac.jp/FIWS2016/index.html>
- ◆ 43rd IOP Plasma Physics Group Spring Conference, Sabhal Mor Ostaig, United Kingdom, 23-26 May 2016
<http://plasma16.iopconfs.org/home>
- ◆ 9th Chaotic Modeling and Simulation International Conference (CHAOS 2016), London, United Kingdom, 23-26 May 2016 <http://www.cmsim.org/>
- ◆ 22nd International Conference on Plasma Surface Interactions in Controlled Fusion Devices (22nd PSI), Rome, Italy, 30 May-3 June 2016 <http://www.psi2016.enea.it/>

Know Our Colleagues



Dr. Asim Kumar Chattopadhyay Joined IPR in 1996 in x-ray system group. He had developed soft x-ray (SXR) tomography code from the general equations first time at IPR which is extensively used now to elucidate the physics of magneto-hydrodynamic (MHD) instability in the core region of our tokamak plasma. He had worked as a visiting scientist at IPP, Max Planck Institute for Plasma Physics, Garching, Germany under the supervision of Dr. M. Brambilla and Dr. R. Bilato on TORIC code which analyses ion cyclotron resonance heating (ICRH) data as well as simulates the ICRH scenarios in plasma. As a visiting scientist he also worked at General Atomics, San Diego, USA under the supervision of Dr. Lang Lao and Dr. St. John Holger on ONETWO transport code which deals with the transport phenomena in plasma both experimentally and numerically. Presently he is involved studies in MHD instability with SXR tomography, on ICRH scenarios in different physical condition of plasma using TORIC code and on transport phenomena in plasma with ONETWO.

Dr. Paritosh Chaudhuri joined IPR in 1995 as a scientist in the 'First Wall' group of SST-1. He has worked extensively in thermal-hydraulic design and analysis of first wall cooling & baking and the conditioning of graphite tiles for SST-1 tokamak. He has a number of publications in National and International journals in this field. He has been visiting researchers at IPP - Garching, Germany. He is currently responsible for Indian LLCB (Lead Lithium cooled Ceramic Breeder) TBM design activities and the development of Lithium ceramic as the tritium breeder material for fusion reactor.



The IPR Newsletter Team

Ritesh Srivastava	Tejas Parekh	Ravi A. V. Kumar	Priyanka Patel	Swati Roy	Mohandas K.K.
Suryakant Gupta	Ramasubramanian N.	Chhaya Chavda	Shravan Kumar	Hiral B Joshi	