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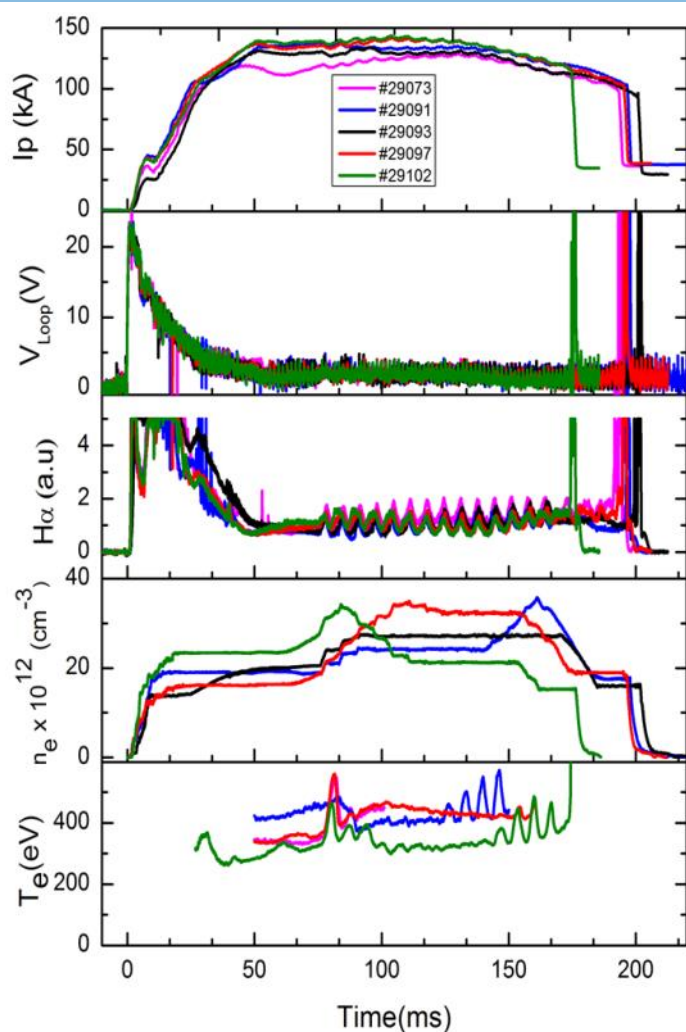
The Fourth State

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

From the editorial desk

The editorial committee of the IPR newsletter wishes to thank all the IPR staff members for their encouragement and support that they have given to the revived newsletter. We hope that this will continue for all the forthcoming issues of "The Fourth State". Please feel free to send any comment / suggestion to the committee at <newsletter@ipr.res.in> for improvement of the look and contents of the newsletter. Thank you..

Aditya Update



In the recent months, Aditya tokamak has been able to produce repeatable plasma shots of high current (~ 140 kA) for close to 200 ms. These are studies being carried out in the final phase of experiments before the machine would go through a major upgrade in terms of vacuum vessel, diagnostics and introduction of a diverter system. The following parameters were obtained for the first time in this machine. Research related to high density, high temperature plasma production and confinement are currently being carried out using this machine.

Max. Plasma Current	~ 145 kA
Plasma duration	~ 200 ms (Repeatable)
Toroidal Magnetic Field	~ 1.05 T (35 kA)
Maximum Vertical Field	~ 480 G (4.3 kA) with Booster power supply operation
Electron Density	$\sim 3\text{--}4 \times 10^{19} / \text{m}^3$
Electron temperature	$\sim 400 - 700$ eV

High plasma current discharges > 140 kA has been achieved for the first time in Aditya !!

With the conclusion of successful experiments under phase-1 of 'experimental program of SST-1', SST-1 has entered into an up-gradation phase across several key sub-systems. Integration of the 80 K Booster system, integration of the SST-1 First Wall components, improvement of the integrated flow distribution system amongst SST-1 superconducting magnet systems, augmentation of the baking facility enabling baking of First Wall Components up to 350 °C, introduction of Supersonic Molecular Beam Injections sub-system for fueling, Control of density, Control of position and plasma currents, up-gradation of data acquisition system beyond one second for long plasma pulses and possible superconducting central solenoids have been some of the key up-gradation aspects in SST-1. This phase of up-gradation is scheduled to be completed by April 2015. The up-graded SST-1 is expected to support longer pulse discharges with improved plasma density and temperatures.



The 80 K SST-1 Booster System has now been completed integrated with SST-1 Machine Shell on Oct 23, 2014. The Booster system would now enable single phase N₂ flow at 5 bar in the SST-1 thermal shields and would improve the cryo-stability



They are mostly seen together in the early mornings; Maybe their relationship is not all that superficial, but one that is anchored in evolutionary history and in the great Indian belief of rebirth and reincarnations !!

The first popular talk in the series organized by IPR for general public as part of the DAE Diamond Jubilee celebrations was delivered by **Padmashri Professor P. I. John** on 15th November, 2014 at the H T Parekh auditorium, AMA building, Ahmedabad. Professor John spoke on the topic of “*The Pervasive Plasma: Socio-Economic Impact of Plasma Technologies*”. The function was inaugurated by Prof. Bora, Prof Kaw, Prof Sen and Prof Amita Das by lighting the traditional lamp. Professor Bora introduced the speaker to the audience. After the talk, Professor John took several questions from the audience and interacted with them.



Prof. P. K. Kaw lighting the lamp



Prof. D. Bora welcoming Prof. John



Prof. Bora introducing the speaker to the audience



Prof. John delivering the talk

Silver Stars Of IPR



Mr. Jayant C. Patel joined IPR in 1989 and was initially in-charge of the Mechanical Engineering workshop. Presently he is with SST-1 and is responsible for warm gas management and air utilities in the Helium liquefaction/refrigeration plant and also takes care of inventory requirement for 80 K as well 4.2 k cool down.



Mr. Rameshchandra T. Pandya joined the Institute in 1989 and was initially associated with the dispatch/courier section of the General Administration department. He is presently working in Establishment Section and takes care of various staff advances and service book updates.



Mr. Dinesh S Varia joined the Aditya operation group in 1990 and continues to be in the group with wide experience in system maintenance and trouble shooting. His responsibilities involve preparation of the system for shots and its daily up-keeping .

Cryostat Workshop at ITER Site Formally Inaugurated

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The Cryostat workshop was formally inaugurated at the ITER site - Cadarache, France on Friday, 21st November 2014 in a ceremony attended by members of ITER-India/IPR, ITER Organization, Larsen & Toubro (contractor), Spie Batignolles (sub-contractor), other important officials as well as the media. Cryostat Building is 110 m X 51 m and 27m in height. It has provision of 200 ton crane with a clear 16 m height below the hook. It has two doors, one of 14 m wide and another which give a clear open passage of 33 m.



The symbolic ribbon at the entrance of the Cryostat Workshop was cut by Benoît Moncade, Director-General of Spie-Batignolles; Professor P. K. Kaw, Shri. M. V. Kotwal, President of Larsen & Toubro's Heavy Engineering Division; and Osamu Motojima, Director-General of the ITER Organization. Also seen in the picture are Dr. Dhiraj Bora, Director IPR & former ITER DDG; Ganesh Iyer, head of the ITER Project at Larsen & Toubro Ltd.

On the podium, from left to right: Benoît Moncade, director-general of the French construction company Spie-Batignolles; Prof. P. K. Kaw, (Former Director, IPR), Shri. M. V. Kotwal, (President of Larsen & Toubro's Heavy Engineering Division), and Osamu Motojima, Director-General of the ITER Organization. About one hundred people attended the ceremony.



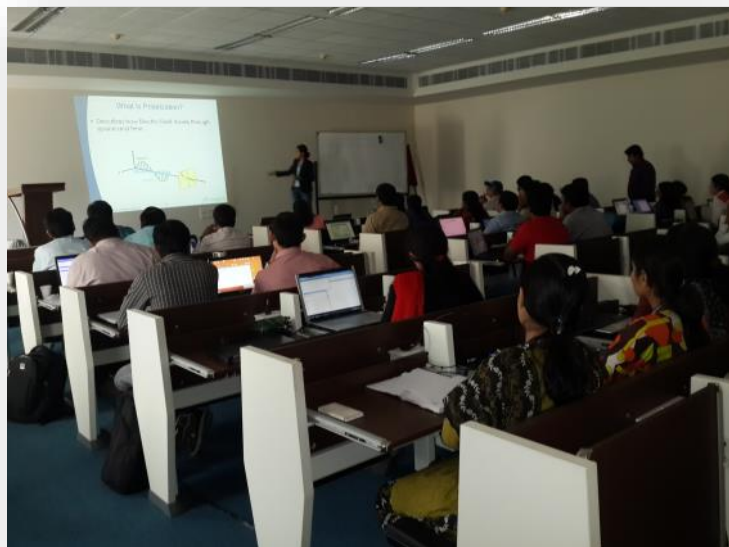
The massive doors of the cryostat building dwarf the members of the ITER-India delegation



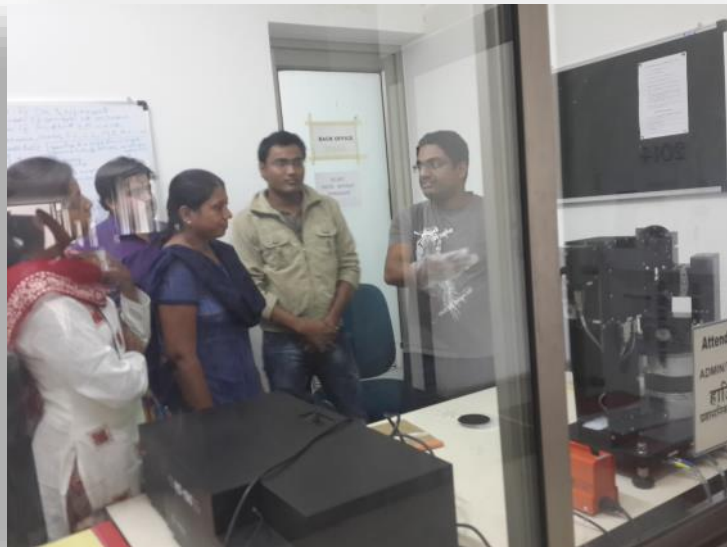
View of the attendees of the inaugural function.

A one-day training school on ellipsometry was conducted at FCIPT/IPR, in which nearly 50 colleagues of IPR from various groups participated along with external candidates from Indian Institute of Technology (IIT), Gandhinagar, Pandit Deendayal Petroleum University (PDPU), Central Salt and Marine Chemical Research Institute (CSMCRI), Gujarat University etc. In this school, basic training of the fundamental principles of ellipsometry as well as various applications of ellipsometry like modeling of refractive index, film thickness measurement, calculations were imparted to the participants using WASE32 software by Ms. Neha Singh, representative of J.A.Woollam Inc. USA.

In later sessions, live demonstrations on operation of Ellipsometer were given and some typical measurements using this device were also demonstrated. Participants also had hands-on experience of measuring as well modeling some examples using the above software. Over all, it was a very successful event and it really created awareness about the use of ellipsometer in R&D activities.



The training session in progress at FCIPT



Participants getting hands-on experience with the device.

Annual ITER Intellectual Property Meeting Held At ITER Organization



Participants to the 6th Annual Meeting of the ITER Intellectual Property Contact Persons (IPCP) from ITER Organization, India, China, European Union, Japan, Korea and USA at ITER Headquarters, Cadarache, France.

The 6th Annual Meeting of the ITER Intellectual Property Contact Persons (IPCP) was held at ITER Organization headquarters in Cadarache, France during 20-21 October 2014. The meeting was very fruitful with regard to the discussions on the ongoing and future intellectual property management activities for the ITER project recognizing the basis of equal Intellectual Property sharing among the ITER partners. The participants from India were Mr. Arun Chakraborty and Mr. Dilshad Sulaiman.

SST-1 @ IAEA FEC

SST-1 has now featured amongst few internationally acknowledged Superconducting Experimental Tokamaks. The 'First Experiments in SST-1' was presented as an 'over view presentation' for the first time in the IAEA Fusion Engineering Conference (FEC) 2014 at St Petersburg, Russia. SST-1 has demonstrated a maximum plasma current in excess of 60 KA for duration ~ 500 ms in the last campaign. ECRH pre-ionization assisted operations with electric field less than 0.35 V/m, Two-phase helium cooled Toroidal Magnet operation at ~ 3.0 T for > 25000 s and cold vapor cooled current leads operations at operating currents of ~ 5000 A apart from sub nano-ohm joint resistances in SST-1 superconducting magnets have been some of the unique and new results of SST-1; which were presented in IAEAFEC 2014.

Science isn't about "why".. It's more about "Why Not ?" !

A three-day workshop on Linear Tokamak Divertor Simulators for PSI Studies was held at CPP-IPR campus a Sonapur, Assam from November 24 to 26, 2014. Participants were introduced to linear magnetized divertor simulator systems developed worldwide and the present trend of plasma surface interaction (PSI) issues investigated in these systems.

The workshop started with an inaugural session where prominent scientists from IPR and CPP-IPR spoke on the importance of fusion and fusion related studies. Altogether, 12 talks were delivered during the workshop by 11 invited speakers, including Prof. Temmerman from ITER, France and Prof. Hennie Meiden from DIFFER, The Netherlands, with topics ranging from plasma surface interactions, role of linear plasma devices in PSI studies, electron/ion beams, characterization of plasma in linear devices, modelling/simulation of PSI, characterization of exposed materials etc. 36 participants from different institutes/universities participated in the workshop including two participants from Nepal and one from Bhutan. Apart from this, students and scientists of CPP-IPR also participated actively in the workshop.

A poster session was also held where 22 posters from the participants were presented. Three participants also presented oral talks during the workshop. A laboratory visit was also arranged where the participants and experts were introduced to "CPP-IPR Magnetized Plasma Experiment for plasma surface interaction" (CIMPLE-PSI), which is a linear magnetized divertor simulator system being developed at CPP-IPR for PSI studies. The participants and experts also visited other laboratories of CPP-IPR. A souvenir and abstract book for the workshop was also published and distributed among the participants and experts. The workshop concluded with a visit to Tribal Museum at Nazirakat and to a nearby tea garden.



Participants of the CPP-IPR Workshop on Linear Tokamak Divertor Simulators for PSI Studies



L-R : Inaugural session, technical session and laboratory visit during the workshop.

News From IPR'ites @ ITER

Two new persons from India joined IO in November – Mr. N.C. Gupta and Mr. N. Kadamdhad both in Plant System Engineering directorate. Total strength of Indian member deputed at IO now stands at 20, out of which 3 members are from other DAE Institutions and two are from CAG.

Mr. Vishnukumar Patel Participated in EPICS Collaboration Meeting at CEA, Saclay, France 20-23 Oct. 2014.

India DA Delegation participating in IO Council Meeting held at IO Head Quarter St. Paul Les Durance, France had an interactive information session, where in deputed Indian staff members made brief presentations to summarise the work done. This activity is held at least once a year. Members who are returning back to India in the next month shared experience of working at IO and knowledge gained as well as highlighted where the experience can be useful back home In India. Other members ongoing activities were also highlighted in short presentations.

The 4th Indo-Russian (IN-RF) Workshop on Indian **Lead Lithium Ceramic Breeder** (LLCB) TBM development was held at the IPR, during 25-27 November, 2014. The workshop initiated with opening remarks by Prof. D. Bora, Director, IPR and followed by Dr. Yuri Strebkov, Head of the Delegation, Russian Federation team. During the workshop, the technical progress made in LLCB TBM design and related R&D activities were presented by IN and RF team participants. The below group photograph shows the participants of the workshop.



Participants of the 4th IN-RF Workshop on Indian Lead Lithium Ceramic Breeder



View of the participants during the technical session of the 4th IN-RF Workshop on Indian Lead Lithium Ceramic Breeder

IPR @ Conferences



Dr. Vipul L. Tanna delivered a talk at the Science and Technology Facility Council at Daresbury, United Kingdom on the occasion of CRYO-OPS (2014) Workshop during Nov 9 – 12, 2014. The topic of his talk was – **“Recent experience and Observations on SST-1 Helium Cryogenic System”**.

Dr. Subrata Pradhan delivered an Overview Presentation **“First Experiments in SST-1”** at the 25th IAEA Fusion Energy Conference (FEC 2014) in St Petersburg, Russia on Oct 14, 2014.



- ◆ **Shri S.G. Belokar**, General Manager, Safety, Health & Environment, Heavy Water Board, Mumbai, gave a talk on “*Safety Management in Research and Development (R&D) Organization*” on 21st November 2014
- ◆ **Dr. Prithwish Nandi**, Dept. of Nuclear Engineering, North Carolina State University Raleigh, USA, gave a talk on “*Waxing and waning of dynamical heterogeneity in the super-ionic state*” on 28th November 2014
- ◆ **Dr. Rameswar Singh**, Laboratoire de Physique des Plasmas, Ecole Polytechnique, 91128 Palaiseau Cedex, France, gave a talk on “*Geodesic acoustic modes*” on 2nd December 2014
- ◆ **Dr. G. Rajasekaran**, Institute of Mathematical Sciences, C I T Campus, Chennai, gave a talk on “*Hundred years of Fundamental Physics and a Crisis*” on 24th November 2014 (Colloquium # 241)
- ◆ **Prof. A. Thyagaraja**, Culham Centre for Fusion Energy and Bristol University, gave a talk on “*Plasma Transport and Turbulence: Some Basic Principles*” on 28th November 2014 (Colloquium # 242)
- ◆ **Dr. Jong-Shinn Wu**, Aerothermal & Plasma Physics Laboratory, Advanced Rocket Research Laboratory, Department of Mechanical Engineering, National Chiao Tung University, Hsinchu 30010, Taiwan, gave a talk on “*Current Low-Temperature Plasma Related Research Activities at Aerothermal & Plasma Physics Laboratory*” on 1st December 2014 (Colloquium # 243)

Upcoming Events

- ◆ 3rd International Conference on Laser and Plasma Applications in Materials Science (LAPAMS 2015), Kolkata, India, 15-17 January 2015 <http://www.lapams2015.in/index.php/2015/lapams>
- ◆ 20th Symposium on Applications of Plasma Processes (SAPP XX) & COST TD1208 Workshop on Application of Gaseous Plasma with Liquids, Taranska Lomnica, Slovakia, 17-22 January 2015 <http://neon.dpp.fmph.uniba.sk/sapp/>
- ◆ Complex Plasma Phenomena in the Laboratory and in the Universe, Rome, Italy, 19-20 January 2015 <https://sites.google.com/site/complexplasmas2015/>
- ◆ DAE Diamond Jubilee National Science Day @ IPR from 8-10 January, 2015

हिन्दी स्वरचित काव्यपाठ प्रतियोगिता

नगर राजभाषा कार्यान्वयन समिति के तत्वावधान में राष्ट्रीय फैशन टेक्नोलॉजी संस्थान, गांधीनगर द्वारा 14 नवम्बर, 2014 को आयोजित हिन्दी स्वरचित काव्यपाठ प्रतियोगिता में संस्थान के श्री राजसिंह, इंजीनियर एसजी एवं सुश्री प्रतिभा गुप्ता, इंजीनियर एसई ने भाग लिया। गांधीनगर में स्थित कार्यालयों के सदस्यों ने इस प्रतियोगिता में भाग लिया था। हमारे संस्थान की सुश्री प्रतिभा गुप्ता, इंजीनियर एसई को हिन्दी स्वरचित काव्य पाठ प्रतियोगिता में सात्वना पुरस्कार प्राप्त हुआ।

अन्य प्रतिभागियों के साथ श्री राजसिंह एवं सुश्री प्रतिभा गुप्ता



From The IPR Archives

Science day 1995 (Left) Street play “Dhonga Babas” enacted to educate people about fraudulent babas and their ways. The actors used KMnO₄ (black stone) Glycerin (water) to enact creating fire on a stone using water. Actors : (L-R) Rajesh Kumar, B. K. Shukla, Avinash Khare (story teller) and Mainak B (dholak player). Right - Street play by S. Varshney, Sunil Kumar, A. Khare, Ranjana M, P. K. Atrey, S. Pradhan and P K Sharma !



The IPR Newsletter Team

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