

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.

Independence Day Celebrations

The 69th Independence day was celebrated with a lot of enthusiasm at IPR. After the traditional flag hoisting and the other official ceremonies, the crowd settled in for some wonderful entertainment programs organized by the Staff Club. The programme was compered by Ms. Sapna Mishra of ITER-India. Amongst the several programs by IPR staff and their children, the most charming one was the fancy dress competition for little children.



SST-1 News

SST-1 is in cool down phase of campaign XI, commenced on 27th August. Coupling of LHCD power with Plasma and long duration of the experimental window are main objectives of this campaign. Meanwhile as a preparation towards the installation of Plasma facing components in SST-1, 3800 graphite tiles have been baked at 1000 ^oC for 12 hours in 18 batches. Baking of copper back plates is also going on in batches for demonstrating their temperature profiles and leak tightness of SS baking pipes. Before the baking of graphite tiles, they have been mounted on respective copper back plates to get hands on experience and to identify the problems (Fig 1-3).

In the SST-1 Cryogenics division, two Valve box have been installed in $80K LN_2$ distribution system. These Valve boxes are installed at an elevated platform which is 10m above from the ground in the SST-1 Cryogenics hall and the process piping work has been carried out. The supply and return valve boxes are interconnected in order to have a combined vacuum system.





Graphite tiles mounted on one of the PFC copper back plates



Copper back plates mounted into a stand for baking up to 350 ^oC

80 K Valve Box at IPR Cryo Hall

Graphite tiles of PFC inserted into the furnace for baking up to 1000 ⁰C for 10 hours.

Development Of Hybrid DC Circuit Breaker

- A novel concept of Hybrid DC circuit breaker prototype which is a combination of mechanical breaker and static breaker has been validated at various current levels up to 1.5kA with Insulated gate bipolar transistor (IGBT) as static breaker unit under Magnet Technology Development Division at IPR.
- The testing has demonstrated successful arc-less current commutation into the dump resistor during simulated quench condition.
- This concept will be upgraded, tested and validated to a full scale prototype for 30kA superconducting magnets in the near future.



Test setup with 220V, 1500A DC Power supply

Current commutation through IGBT based Hybrid DC Circuit Breaker

FCIPT News : Stylus Profileometer

Surface Profileometers are used to measure surface profiles, roughness, waviness and other surface parameters. A Profileometer can measure small surface variations in vertical stylus displacement as a function of position. A stylus is moved vertically in contact with the sample and then moved laterally across the sample for a specified distance and specified contact force. The height position of the stylus generates an analog signal which is converted to the digital signal stored, analysed and displayed. With the use of surface Profileometer one can measure,

- Step Height (Film thickness)
- Surface Roughness
- 3D mapping of the surface using stitching capability of the instrument.

Applications:

This instrument can be used for analysing coating thickness and surface roughness. which can be useful for divisions like Divertor and First Wall Technology Development, TBM, Magnets, Fusion Reactor Materials Development and Characterization etc. This is also useful for coatings which are developed for industrial applications such as solar cells, protective barrier coating for metal surfaces, dielectric coating for electronics industry etc.



Profilometer

Schematic diagram of the working principle.

Upcoming Events

- 16th International Workshop on Radiative Properties of Hot Dense Matter (RPHDM 2014), Vienna, Austria. 29 September 3 October 2014 https://sites.google.com/site/rphdm14/
- 6th International Symposium on Non-equilibrium Processes, Plasma, Combustion, and Atmospheric Phenomena (NEPCAP 2014), Sochi, Russia. 6-10 October 2014 http://nepcap2014.ciam.ru/
- 25th IAEA Fusion Energy Conference (FEC 2014), Saint Petersburg, Russia, 13-18 October 2014, http://www-pub.iaea.org/iaeameetings/46091/25th-Fusion-Energy-Conference-FEC-2014
- 56th Annual Meeting of the APS Division of Plasma Physics, New Orleans, Louisiana USA, 27-31 October 2014 http:// www.aps.org/units/dpp/meetings/annual/index.cfm
- Fusion Academy, Heeze, Netherlands, 29 31 October 2014 http://www.fusionacademy.eu/



They Still Survive!

There was a time when theses species were frequent visitors to the labs, ending up there chasing rats or, more often, to beat the summer heat. It was a herculean task to push them out and there are many interesting stories to tell. Times have changed. Ever since the peacocks found IPR campus to be their ideal home, and also as the once thick woods gave way to the concrete structures, their numbers have declined drastically. These days, the chances of seeing one of them dead are more than alive. Yet, they survive, adjusting themselves to the developments around them and probably assisted by the dogs who keep tabs on the number of peacocks in the campus. Sure, Nature too would be doing its motherly balancing acts !



15th BRFST Board Meeting @ IPR

The 15th meeting of the Board of Research in Fusion Science & Technology (BRFST) was held at IPR during 21-23 August, 2014. This meeting was attended by the BRFST Board members *viz*, Prof P. I. John, Prof. Amit Roy, Prof. A. K. Ray. Prof. Prabal Chattopadhyay, Shri. P. K. Atrey, Dr. Ravi A V Kumar as well as the invited members from Advanced Technology Committee-BRNS, Prof. R. K. Bhandari, Prof A. K. Das, Shri. D. K. Dalal and Dr. Biswanath Sarkar. This meeting reviewed 34 newly submitted R&D projects as well as 20 ongoing projects which are supported under the National Fusion Programme.



DAE Diamond Jubilee Celebrations @ IPR

The Department of Atomic Energy is celebrating its 60th anniversary this year and all the units / autonomous institutes under DAE will also have year long celebrations and activities all through the year until August 2015. In view of this, IPR has also chalked out various activities, including public outreach programs during the next 12 months. The Director, IPR has made a request to all the staff members of IPR to actively participate in these activities and make the Jubilee year programme a big

success. In the meeting convened by the Chairman, DAE on 17th July 2014, he emphasized the need of extending the hands of all the DAE institutions for various social outreach programmes and ensure that the R&D carried out at the units also have a societal benefits.



The Chairman, DAE heading the VC meeting of all the DAE units for Jubilee celebrations on 17th July, 2014

Some of the activities planned at IPR for the DAE Jubilee year

- 1. Science Day celebrations, which will have scientific exhibits from schools in Ahmedabad & Gandhinagar as well as from IPR.
- Open house to celebrate 25 years of Aditya Tokamak. It will have competitions in essay writing, eloquence, quiz and science Olympiad for high school students.
- 3. Popular talks for general public by eminent scientist of DAE units.
- Roadshow for schools in Ahmedabad/ Gandhinagar.
- 5. Active participation of IPR in Vibrant Gujarat 2015.
- 6. Tech-Fest for engineering colleges with special focus on robotics competitions.
- 7. Special programs for the people of Bhat Village, which includes training of their school teachers, teaching skills like a/c maintenance, plumbing, welding, knitting, paper-mache etc to men and womenfolk of the village.
- 8. Training programmes for PG teachers in basics of plasma physics along with hands-on training for plasma based lab experiments.

Inertial Electrostatic Confinement Fusion Experiment @ CPP-IPR

Portable and cheap neutron sources are on demand for various applications such as in oil and gold mining, cancer therapy, fusion material study, non-invasive investigation of illicit drugs and explosive materials, identification of impurities in coal etc. Among the various available neutron sources, inertial electrostatic confinement fusion (IECF) is an extremely compact and

simple device that produces high flux of neutrons. Many laboratories in US and Japan are doing extensive R & D to bring out an economic and compact IECF neutron source for diverse practical utilities.

In India, the first ever IECF based neutron source is currently under development at CPP-IPR. The objective is to develop portable neutron sources having linear and spherical geometry which will operate under continuous and repetitive burst mode and produce neutrons at the rate of 100 million to 10 billion per second. Such high flux neutron source is expected to provide the scope to examine the damage occurring in electronic components and in fusion materials.





The IECF chamber showing glow discharge plasma

System Parameters						
Dimensions of vacuum	Height	30 cm	Cu			
chamber	Diameter	50 cm				
Diameter of inner grid	2,4,6 cm					
Diameter of outer grid	35 , 40 cm		•			
Base pressure	1x10 ⁻⁷ mbar					
Working pressure	1x10 ⁻³ mbar					
Fuel gas	Deuterium		•			
Operating voltage	-20kV to -200kV DC					
Operating current	30 mA to 75mA					
Voltage feedthru	SS feed-through with Alumina Ceramic as insulator		•			
Operation	Both continuous and pulse mode					

Silver Stars Of IPR

Current Status

- Successful installation of cylindrical IECF system.
- Observation of glow discharge plasma.
- Characterization of plasma using OES.



Dr. J. Govindarajan joined in 1990 and was part of the diagnostics group. He was involved in laser blow-off, neutral beams, FIR Interferometry, IR Thermography, charge-exchange neutral particle detection, NDT, *etc.* Presently he is a Diagnostics Engineer/Physicist at the ITER Organization, France.



Mr. Vijay Bedakihale joined the Mechanical Engineering Group in 1989. He headed the design section contributing to the design and fabrication of diagnostics for Aditya Tokamak and was also involved in the assembly of of SST-1. Presently he is on deputation at ITER Project, France. Mr. Y.S.S.Srinivas joined IPR in 1987, and was initially with the Aditya Pulsed Power division and later, with the RF Group. He is involved in designing of HV and auxiliary supply systems for high power RF and microwave tubes including Tetrode , Klystrons and Gyrotrons. राजभाषा कार्यान्वयन समिति (ओलिक) द्वारा 27 अगस्त, 2014 को तकनीकी/वैज्ञानिक विषयों एवं आईपीआर से संबंधित सामान्य विषयों पर हिन्दी सेमिनार का आयोजन किया गया। इस सेमिनार में प्रत्येक प्रतिभागी को अपने प्रपत्र को प्रस्तुत करने के लिए15 मिनट का समय दिया गया। हिन्दी सेमिनार में प्रपत्र प्रस्तुत करने वाले8 प्रतिभागियों ने इन विविध विषयों पर प्रस्तुति दी:

प्रतिभागि	विषय
रमेश जोशी	आईसीआरएच डैक क्लाइंट के लिए एपिक्स आधारित प्रोटोटाइप सॉफ्टवेयर
शैलेन्द्र त्रिवेदी	आईपीआर ईमेल सिस्टम के लिए थंडरबर्ड का सेटअप एवं बैक अप
सुनील मिसाल	कर्मचारियों के अवकाश संबंधी नियम
नितिन बैरागी	मल्टी-लेयर इन्सुलेशन (MLI): एक क्रायोजेनिक अति-प्रतिरोधक
देवेन्द्र मोदी	सड़क सुरक्षा- एक उभरती चुनौती
संतोष पी. पंडया	कंप्युटर उत्प्रेरण द्वारा टोकामक से पलायित अति द्रुतगामी इलेक्ट्रॉनों की उत्पादन, ऊर्जा गतिकी एवं उनका निर्धारण
श्रवण कुमार	ओपन एक्सेस वेब संसाधन
उपेन्द्र प्रसाद	एसएसटी-1 में चुम्बक की भूमिका

प्रतिभागियों ने पवर पॉइन्ट के माध्यम से प्रस्तुतिकरण के पश्चात् सेमिनार हॉल में उपस्थित निर्णायगण एवं श्रोताओं द्वारा पूछे गये प्रश्नों का उत्तर देते हुए उनके संदेहों का निवारण भी किया। इस सेमिनार में डॉ. गौतम सेठिया, राजभाषा कार्यान्वयन समिति के सदस्य डॉ.रत्त्नेश्वर झा, श्री प्रवीण कुमार आट्रेय एवं श्री नरेशचन्द गुप्ता ने निर्णायक की भूमिका निभाई। अंत में संस्थान में चल रही हिन्दी गतिविधियों से कर्मचारियों को भलि-भांति परिचित करवाने और उनमें उत्साहपूर्वक हिस्सा लेने के लिए प्रेरित करने के उद्देश्य से राजभाषा कार्यान्वयन समिति की सदस्य सुश्री प्रतिभा गुप्ता ने आईपीआर में राजभाषा हिन्दी संबंधी गतिविधियों पर पवर पॉइन्ट के माध्यम से एक विशेष प्रस्तुति दी, जिसके माध्यम से कर्मचारियों को हिन्दी गतिविधियों से परिचित कराया गया। डॉ.रत्नेश्वर झा ने तकनीकी/वैज्ञानिक एवं सामान्य प्रशासनिक विषयों को हिन्दी भाषा में सरलता से व्यक्त करने के लिए प्रतिभागियों की सराहना करते हुए उन्हें बधाई दी। श्री संतोष पी.पांडया को प्रथम पुस्कार एवं श्री नितिन बैरागी को द्वितीय पुरस्कार देने की घोषणा की गई। इस प्रकार ओलिक समिति द्वारा सफलतापूर्वक हिन्दी सेमिनार का आयोजन किया गया।

Commissioning of 3MW Dummy Load at ITER-India Lab

ITER-India is developing 3 MW/CW/35-65 MHz Test Bed for conducting full-fledged test as per ITER RF Source requirement. Contract for 3 MW Dummy Load (DL) has been placed to M/s Ampegon AG, Turgi, Switzerland, as a part of high power test bed. After successful Factory Acceptance Test (FAT) at MW level, DL was shipped to ITER-India lab for final commissioning. Dummy Load was commissioned successfully with existing RF power at ITER-India lab & kept ready for site acceptance test of MW level RF amplifiers.

• VNA result exhibits very good performance of Dummy Load in between 35 – 65 MHz frequency range.



ITER-India ICRF group during commissioning of Dummy Load at ITER-India Lab

- Mr. C. J. Hansalia, IPR, gave a talk on "System Engineering Process for ITER Diagnostics I&C design and documentation" on 19th August 2014
- Dr. Ram Prakash and PDT Team, (Plasma Devices Technology Lab), Microwave Tubes Division, CSIR-Central Electronics and Engineering Research Institute, Pilani, gave a talk on "Plasma Devices Research at CSIR-CEERI: Avenues for Collaboration" on 20th August 2014
- Dr. V. Subrahmanyam, Department of Physics, IIT Kanpur, gave a talk on "Quantum Entanglement in Electron/ Spin systems" (Colloquium #235) on 25th August 2014
- Mr. V K Patel, IPR, gave a talk on "Document, data and business process management tools at ITER" on 25th August 2014
- Ms. Supriya Nair, IPR, gave a talk on "Design and Procurement of Steady State Electrical Network (SSEN) Components" on 26th August 2014
- Mr. Prakash Parmar, IPR, gave a talk on "Electrical Interface Management for ITER Steady State Electrical Network (SSEN) design and documentation" on 28th August 2014
- Mr. S Rambabu, IPR, gave a talk on "Structural Analysis of PF coil Supports & Cryostat parts in ITER-IO using ANSYS" on 1st September 2014
- Prof. Gorur Govinda Raju, Emeritus Professor, Head of Department (Retd.), University of Windsor, Ontario, Canada, gave a talk on "Role of Dielectric Theory in Engineering Insulation Problems" on 2nd September 2014
- Dr. Daly Davis, Tata Institute of Fundamental Research, Homi Bhabha Road, Colaba, Mumbai, gave a talk on "Dissociation Electron Attachment in Condensed Phase" on 3rd September 2014
- Dr. Christian Hopf, Max Planck Institute for Plasma Physics, Garching bei Munich, Germany, gave a talk on "Neutral Beam Current Drive Experiments on ASDEX Upgrade- A Status Report" on 4th September 2014
- Mr. Kaushal Patel, IPR, gave a talk on "Arrangement of ITER diagnostic system in the tokamak complex" on 5th September 2014
- Ms. Kirti Mahajan, IPR, gave a talk on "CODAC Core System Software and its Development Process" on 8th September 2014
- Prof. P. Punit, Physics Department, IIT Bombay, Powai, gave a talk on "Coupling chemo-mechanical oscillators" (Colloquium #236) on 9th September 2014
- Dr. Noor Danish Ahrar Mundari, HOD, Electrical Electronics Engineering, Arni University, Himachal Pradesh, gave a talk on "Development of Atomic Oxygen (AO) facility and its effects on Spacecraft Surface Charging" on 10th September 2014
- Mr. Sunil Dani, IPR, gave a talk on "IWS Detail Design and Assembly for VV Sectors" on 10th September 2014
- Mr. Bharat Doshi, IPR, gave a talk on "ITER Cryostat & VVPSS" on 12th September 2014

Mfg. Pro-

to SS 316L)

cess in-

volved

EB welding of Similar (i.e. CuCrZr to CuCrZr)

and dissimilar material (i.e. CuCrZr to Ni & Ni

 Mr. Krishan Gotewal, IPR, gave a talk on "Maintenance and Remote Handling Compatibility Assessment management in ITER" on 15th September 2014

ITER-India's Indigenous Development of Heat Transfer Elements

ITER India has developed Heat Transfer Element Assembly indigenously under the MoU with NFTDC, Hyderabad. Critical Manufacturing Process like CuCrZr raw material development and Electron Beam Welding of Copper alloys & dissimilar material (CuCrZr to Ni & Ni to SS316L) have been established. These Hypervapotrons are technically challenging components in Fusion.



Heat Transfer Element assembly, 370 mm long

..... Continued from page 7

- 1. Maximum RF power handling capability: 3.5 MW for a short duration of ~3s
- 2. Nominal Radio Frequency Power: 3.0 MW
- 3 Pulse length: CWRF (3600 seconds), 25% duty cycle
- 4 Operating Frequency range: 35MHz 65 MHz
- 5 Resistive material: Soda water based
- 6 Load resistance: 50 Ohm
- 7 Input co-axial line & flange type: 12"; 50 Ohm

Dummy Load impedance vs. soda water temperature at

50 MHz

- Measurements were carried out at various soda water temperatures, starting from 40°C up to 80°C.
- \sim 50 W was achieved at 70 °C, as per design value.





Then & now : View from the porch of IPR main building during its construction in 1986 and the same view now...



IPR porch all ready for the inauguration of the IPR building ceremony. Inset : Prof. Pandya breaking the coconut to inaugurate the IPR building. Professor Sen explaining to Prof Bimla Buti and Professor Pandya the plan of the IPR building as Mrs Bharucha (Ex PRL Librarian), Mrs. Phatak (ex-Librarian, IPR), Prof Kaw and Mrs. Kaw, look on.

The above images date back to 1986 when the IPR building was inaugurated. After three locations were surveyed, the current location was chosen as the site for the IPR campus. The inauguration of the IPR building was done by the then Director of PRL, Professor Pandya. Since then, the once barren and treeless landscape has been converted into a thickly wooded area that we all know now as IPR campus.

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