

The Fourth State

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

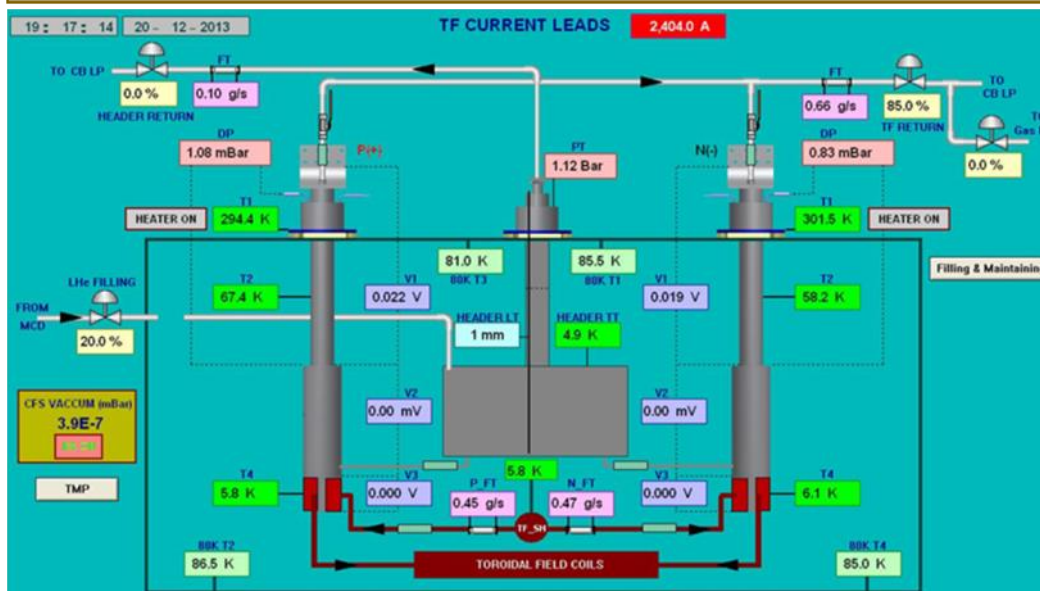
From the editorial desk

It has been over 5 months since the revival of the Fourth State and the editorial committee of the IPR newsletter wishes to thank all the IPR staff members for their overwhelming support and encouragement that they have given. We hope that this will continue for all the forthcoming issues of "The Fourth State". Please feel free to send any comment / suggestion / feedback to the committee at <newsletter@ipr.res.in> for improvement of the look and contents of the newsletter. Thank you..



The newsletter committee takes this opportunity to wish all the staff members of IPR, FCIPT, ITER-India and CPP-IPR a very happy new year ! We sincerely hope that the coming year will not only bring joy, peace and prosperity to one and all, but also scientific and technological advances in the work being carried out by our Institute. In this new year, let us all resolve to give that extra bit to our beloved institute... Thank you..

Validation of Novel Current Leads for SST-1



- ♦ The current leads in Tokamaks serve as a neural string between the power supply (at 300 K) and the superconducting cold magnets (at 4.5 K) as an optimized link of current carrying metallic conductors, working like a heat exchangers in the temperature range of 4.4 K – 300 K.
- ♦ Current leads are major source of consumption of cold power in Superconducting Tokamak like SST-1 (where they consumes as high as 55% of the cold power).

- ♦ In a significant test validation carried out during the SST-1 Campaign VI, SST-1 Toroidal Field current leads could be operated at 2.4 kA transport current (corresponding to 0.7% T of TF field in SST-1 major radius) and supported SST-1 experiments.
- ♦ This is the first time anywhere in the world in superconducting Tokamak operational scenarios, that such operations of current leads has been attempted during plasma shots. SST-1 campaign-VII will resume in Feb 2014.

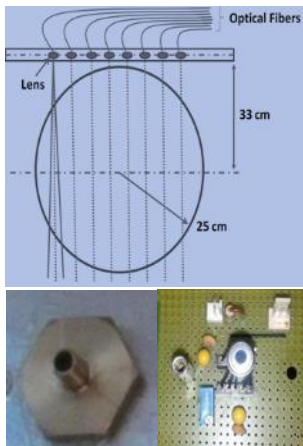


- a) Solution Combustion reaction for the preparation of Li_2TiO_3 powder.
- b) Li_2TiO_3 powder
- c) Produced Li_2TiO_3 pebbles
- d) Extruder and Spherodizer

Ceramic Pebble Development division in TBM group is involved in development of the Lithium Meta Titanate (Li_2TiO_3) as the tritium breeding material in ITER.

- ◆ Li_2TiO_3 powder is prepared at IPR by solution combustion reaction as well as solid state reaction route.
- ◆ Li_2TiO_3 pellets and pebbles are prepared from this powder followed by high temperature sintering.
- ◆ At every stage (powder, pellet and pebble) of preparation extensive characterizations are carried out to meet the desired properties of these materials.
- ◆ Different characterization facilities such as XRD, density, porosity, crush load, Simultaneous Thermal Analyzer (STA), laser flash and the indigenously developed thermal conductivity measurement for pebble bed have been set up at IPR.

Multi-Channel Photodiode System for Plasma Formation Location studies in ADITYA Tokamak



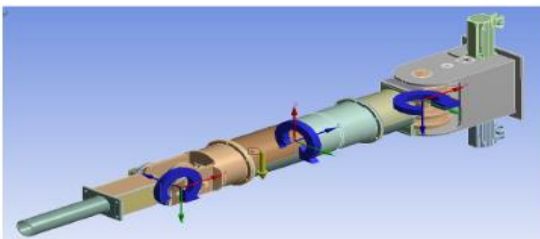
- ◆ Information about the plasma formation location and its characteristics play an important role in evolution of plasma current in tokamaks.
- ◆ The plasma formation location identification experiments are carried out in Aditya tokamak using an 8 channel photodiode detection system.
- ◆ The visible light from the plasma is collected with 8 lens-fiber combinations placed from vertical port of Aditya tokamak covering whole plasma poloidal cross-section and transferred through to eight photodiodes.
- ◆ The results show that the plasma starts forming in the inboard (high-field) region of Aditya tokamak.



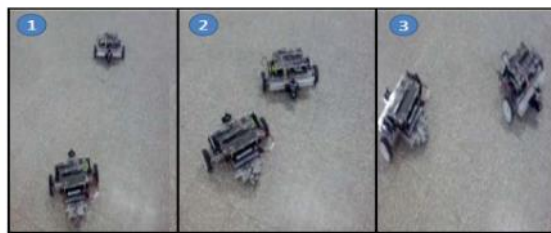
Remote Handling & Robotics Technology Development for Fusion Machine

The Remote Handling & Robotics Technology Development Division, IPR, aims at developing bespoke remote handling (RH) systems that cater to the remote handling and remote monitoring needs of a Fusion machine. Within the past 2 years the group has successfully developed a number of technologies, ranging from RH equipment design, Kinematics/Inverse kinematics simulations & analysis, MBD, advanced control systems, computer vision systems, virtual reality, augmented reality, etc.

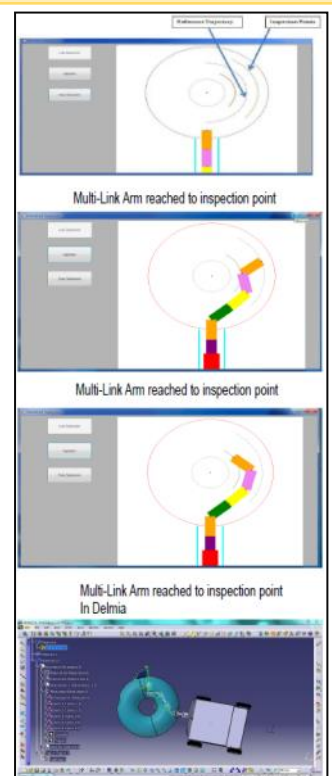
- ◆ Robot self-localization techniques using photogrammetry and stereo vision solutions.
- ◆ FPGA based implementation for Real time path planning algorithms
- ◆ Real time interfacing of DELMIA simulation with real manipulator in work cell
- ◆ Simulation of Multilink Arm
- ◆ Dynamic navigation for a multilink articulated arm to deploy in a tokamak vessel
- ◆ Synthetic Viewing System for real to virtual word interfacing



Simulation of Multilink Arm



Real Time Path planning in FPGA



Multilink arm deployment in Tokamak

Apart from the indigenous developmental activities, the division is working on a **RH project from ITER** regarding validation of ITER RH control system through implementation of a Prototype Work-Cell



Plasma reactor developed by FCIPT, IPR and functioning at MANTRA, Surat.

Technical textiles are one of the fastest growing sectors of the global textile industry. In India too, it is an emerging area with great potential for growth. Coating and lamination are twin technologies that can completely transform all appearance, handle, properties and performance of technical textiles.

In order to improve adhesion between textile substrate and deposited coating or laminate layer, plasma treatment is an environment friendly and economical alternative. Plasma accomplishes this through an improved wetting/surface activation of textiles and enhancing substrate-coating or lamination affinity.

FCIPT has developed a prototype plasma reactor for fabric treatment and is installed at MANTRA (Manmade Textiles Research Association), Surat. The salient features of the plasma reactor are as follows:

- ♦ Dielectric barrier discharge based plasma reactor uses air as a plasma forming gas and works at atmospheric pressure.
- ♦ The power source used for plasma formation operates at low frequency (50 Hz).
- ♦ Continuous plasma treatment of 0.5 m wide fabric with speed of 0.5 m/min to 4 m/min is treated.
- ♦ Plasma power density and exposure time can be varied.

IPR Abstract Management System

IPR's Conference Abstract Management System was developed by the Computer Center. This system with a web portal, developed on Indico open source was launched in October 2013 and was then successfully used to manage the abstracts for the Plasma-2013 conference that was held at KIIT University in Bhubaneswar in December 2013.

More than 400 abstracts were submitted through this online portal and all the post submission tasks viz, sorting, reviewing, communicating the acceptance to the authors as well as generating the abstract book were all carried out using this system.

IPR staff are requested to use this system for abstract management in conferences organized by IPR. This system can be customized as per the needs of the conference. Interested users may contact Mr. Gaurav Garg of the Computer Center.



Congratulations !

Mr. Naresh Chandra Gupta (Engineer-SE) won the 2nd prize in EXTEMPORE competition during HINDI PAKHWARA 2013 organized by Town Official Language Implementation Committee (TOLIC), Ahmedabad.



Shilpa Khandker

Mrs. Shilpa Khandker (Scientific Asst.-B) won the 1st prize in "चित्र देखो, कहानी लिखो" competition during HINDI PAKHWARA 2013 organized by HPCL, Ahmedabad in association with Town Official Language Implementation Committee (TOLIC).

The awards were presented to Mr. Gupta and Ms. Khandker at the 63rd meeting of TOLIC, which was held at the National Institute of Design, Ahmedabad on 20th Dec, 2013.



N.C. Gupta

Upcoming Events

- ♦ 8th International Conference on Reactive Plasmas / 31st Symposium on Plasma Processing, 4-7 February 2014, Fukuoka, Japan. <http://plasma.ed.kyushu-u.ac.jp/~icrp-8/>
- ♦ 6th International Symposium on Advanced Plasma Science and its Applications for Nitrides and Nanomaterials / 7th International Conference on Plasma-Nano Technology & Science, 2-6 March 2014. <http://www.isplasma.jp/>
- ♦ 7th International Conference on the Physics of Dusty Plasmas (ICPDP 2014), 3-7 March 2014, New Delhi. <http://www.icpdp2014.com/home>

The construction of the Cryostat Workshop (110 meters long, 44 meters wide and 27 meters high) is in full swing at ITER site, Cadarache, France. The 54 modules of Cryostat manufactured in India will be brought to ITER site, which will be fabricated further in this workshop into 4 main sections for assembly in the Tokamak pit.

ITER-India who is responsible for the manufacture and delivery of the ITER cryostat is also responsible for the construction of this workshop, where the four cryostat sectors will be prefabricated. Larsen and Toubro Ltd. (L&T), the company contracted by ITER-India for the Cryostat, will manufacture first the smaller 54 sections in its heavy engineering division factory at Hazira, India. These smaller sections will be shipped to the ITER site, which will be further fabricated in this workshop into four sectors weighing from 650-1250 Tons. These four sectors will then be transported from the workshop to the tokamak pit for final welding. The construction of the workshop is being carried out by SPIE-Batignolles, France, who has been subcontracted by L&T. The workshop construction is expected to be completed by August-September 2014.



Cryostat Workshop progress at ITER site — December 2013



Cryostat Workshop progress at ITER site — January 2014

At the L&T Heavy Engineering facility in Hazira, fabrication activities of Cryostat are in progress. The Submerged Arc Welding of First Longitudinal Seam of ITER Cryostat Base Section started on 09 January 2014.



Submerged Arc Welding of First Longitudinal Seam of ITER Cryostat Base Section has started at L&T, Hazira



ITER-India Cryostat and L&T team members at L&T, Hazira

Silver Stars of IPR



K. Sathyanarayana joined IPR in 1984 and has been associated with basic experiments and later on, with the ADITYA Tokamak group. Currently he is with the High Power ECRH Systems Division.



Akshay Ashokkumar Shukla joined IPR in 1984 & continues to contribute to the Institute's Accounts Department in the payment section, and currently he handles high value MOUs, contracts and vendor dealings.



Prof. Ajay Kumar has been with the Laser Diagnostic group since he joined IPR in 1985. He presently heads the diagnostics group and is also part of the proposed Laser Interferometer Gravitational-wave Observatory (LIGO) project in India.

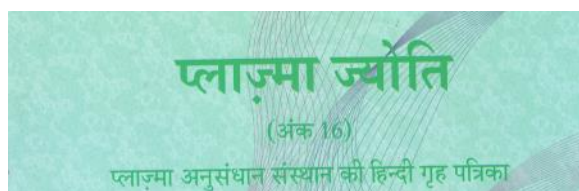
The 5th ITER Intellectual Property Contact Persons (IPCP-05) meeting was held at the International Centre, Goa, India during 12-13 December 2013. This meeting is held every alternate year at ITER Organization (IO) and Domestic Agencies (DAs). The discussions during the meeting were very fruitful on the topics like Background IP, Generated IP, Publication process, Contractual IP provisions, IP database etc. where IO and DAs presented their progress update and future plans.

The participants from India were Mr. Arun Srivastava (DAE), Mr. Arun Chakraborty, Mr. Dilshad Sulaiman and Mr. Vikram Sharma from (ITER-India).



The ITER Intellectual Property Contact Persons (IPCP) group members at the meeting venue in Goa

प्लाज़्मा ज्योति Shines Bright !



The IPR Hindi Magazine “प्लाज़्मा ज्योति”, has won the “Best Official Language Magazine” award in the DAE Aided Institutes category for the 2nd Consecutive year (2011-12 & 2012-13).

Congratulations to the “प्लाज़्मा ज्योति” team !!

Run for a Cause !

On 5th January, 2014, three engineers from IPR- *Vrushank Mehta, Mahesh Jadav and Prabhat Kumar*- participated in Sabarmati Marathon 2014 and successfully completed the 6 km Dream Run.

They all have already started gearing up for the 21 km half marathon next year!

We wish them good luck !!



DAE Safety & Occupational Health Professionals Meet-2013

The 30th DAE Safety & Occupational Health Professionals Meet-2013 was jointly held by Atomic Energy Regulatory Board (AERB) and Uranium Corporation of India Limited (UCIL) at Narwapahar Mines, Dist. East Singhbhum, Jharkhand, during 18-20 December 2013. The meet was inaugurated by Shri S.S.Bajaj, Chairman-AERB. About 200 participants from all the DAE units have participated in this meet. Mr. C. N. Gupta and Mr. D. V. Modi attended from IPR. A poster presentation on “Case Study on Incidents at IPR” was presented by Mr. D.V.Modi & Mr. C.N.Gupta.

As part of the meet, various safety competitions were organized in which, all the DAE units actively participated. IPR has won three prizes i.e. 1st Prize in Hindi Safety Slogan Competition, 2nd Prize in English Safety Slogan Competition and Consolation Prize in Safety Cartoon Competition. Mr. D.V.Modi received the prizes from Shri. D. Acharya, CMD-UCIL on behalf of the winners from IPR.

Always remember - Your Personal Safety Depends on You !

IPR 2nd Tennis Ball Cricket Tournament - 2013

The Finals of the 2nd Tennis Ball Cricket Tournament (TBCT) - 2013 was played on the 5th of January, 2014 at the G. A. Chandkheda Ground between Team Scholars and defending champions ITER-IN Fighters. The match was much like the inaugural match. Team Scholars made 72 runs at the loss of 4 wickets in 15 overs, where ITER-IN Fighters (IIF) chased and won this final by 6 wickets. Mr. Siddharth Kumar (IIF) was adjudged the man of the match and Mr. Vara Prasad (TS), the man of the series (182 runs and 11 wickets) of this tournament.

Photos by Vidhi Goyal



The finalists : Team Scholars (TS) and ITER-IN Fighters (IIF)



Director, IPR and the Captains at the toss



The match in progress



Tense moments for the viewers too !

Brief Scores

Toss : Won by Team Scholars who chose to bat.

Team Scholars innings - 72 for 5 (in 15 overs)
Vara Prasad 36, Siddharth Kumar 4 wickets

ITER-IN Fighters innings- 73 for 4 (in 13.4 overs)
Pratik Kumar Patel 33, Roopendra Singh 2 wickets



The winners for the second year running - ITER-IN Fighters !!



Gaurav Jogi (Captain IIF) with TBCT Trophy



Vara Prasad - Man of the series



Siddharth Kumar - Man of the Match

- ◆ **Prof. Bikas K. Chakrabarti**, Saha Institute of Nuclear Physics, Bidhannagar, Kolkata, gave a talk on "*Quantum Annealing and Computation*" on 24th December 2013
- ◆ **Prof. P.B. Jhala**, Advisor, Plasma Textile Applications, FCIPT, Institute for Plasma Research, gave a talk on "*Plasma Textile Activities & Achievements at FCIPT*" (Colloquium #229) on 24th December 2013
- ◆ **Dr Mukti Ranjan Jana**, Institute for Plasma Research, gave a talk on "*400 MeV Proton Beam Diagnostic at Fermilab MTA using Chromox-6 Scintillation Screen*" on 30th December 2013
- ◆ **Mr. Deepak Sangwan**, Institute for Plasma Research, gave a talk on "*Studies of Plasma Flows in Scrape-off Layer Plasma of ADITYA Tokamak*" on 31st December 2013
- ◆ **Prof. Amitava Bhattacharjee**, Department of Astrophysical Sciences and Princeton Plasma Physics Laboratory, Princeton University, Princeton, gave a talk on "*Fast Reconnection Mediated by the Plasmoid Instability in High-Lundquist-Number Plasmas: Dynamics and Statistics*" on 3rd January 2014
- ◆ **Mr. Sushil Singh**, Institute for Plasma Research, gave a talk on "*Observation and Theory of Electron Temperature Gradient Turbulence in Laboratory Plasma*" on 10th January 2014
- ◆ **Mr. Kshitish K. Barada**, Institute for Plasma Research, gave a talk on "*Wave Propagation and Potential Structure in an Expanding Helicon Plasma*" on 10th January 2014
- ◆ **Dr. Deepti Sethia**, Fusion Reactor Materials Development and Characterization (FRMDC) Division, gave a talk on "Proton conducting ceramic development for Fusion reactor applications" on 13th January 2014



Additional Offices Building at IPR



Photo by Ravi A V Kumar

The Additional Office Building at IPR Campus is ready for occupation. This building, built in the same style as the main building of IPR has 33 office rooms (17 on the ground floor and 16 on the 1st floor), one Board Room, two Committee rooms and a lecture hall. Built over an area of $\sim 4000 \text{ m}^2$, this building will provide office space for approximately 150 IPR staff.

Mohandas K. K.
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The Team

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