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The Fourth State

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

SST-1 Update

Before the 16th campaign, upgradation and maintenance activities of various sub-systems of SST-1 were taken up during 21st December, 2015 to 25th January, 2016 after the 15th experimental campaign in SST-1.

The spectrum of work done is as follows: (1) Modification in the hydraulics of Poloidal field magnets in SST-1 cryostat, (2) Repair of leaks and replacement of isolators in passive stabilizer hydraulic circuit, (3) Modification of integrated flow distribution valve box, (3) In house fabrication and installation of new 3 supply and 2 return LHe transfer line, (4) Cleaning of view ports for diagnostics, (5) Replacement and addition of GDC electrodes in vacuum vessel, (6) Introduction of additional gas feed lines, (7) Modification of temperature diagnostics, (8) Replacement of rupture discs in high pressure Helium storage tanks and (8) Testing of 80K booster system. Parallel to these activities, substantial progress has also been made in the area of fabrication of Nb₃Sn based super conducting central solenoid for SST-1.

The cryostat along with 80 K shield and current lead chamber has been received and tested at IPR. Cabling activities has also been started at vendor's site. Trials for the conduiting and fabrication of low resistance joints has also been started.



(L-R) Addition of new valves in IFDCS box; Wrapped MLI after modification; In-house fabricated L-He transfer line; Cabling of Nb₃Sn based CICC for SST-1 CS



(L-R) New joints made in PF Hydraulics inside the SST-1 cryostat; New PF Headers; In-house developed electrical breaks; Testing of cryostat and 80 K panels for SST-1 CS

Congratulations !!

Mr. Ritesh Sugandhi, Engineer-SF from the Basic Plasma Science Group has been certified by National Instruments as a **Certified LabVIEW™ Associate Developer** (CLAD) on 24-Aug-2015. He is currently the only member from IPR, Gujarat, listed on the National Instruments website in the community





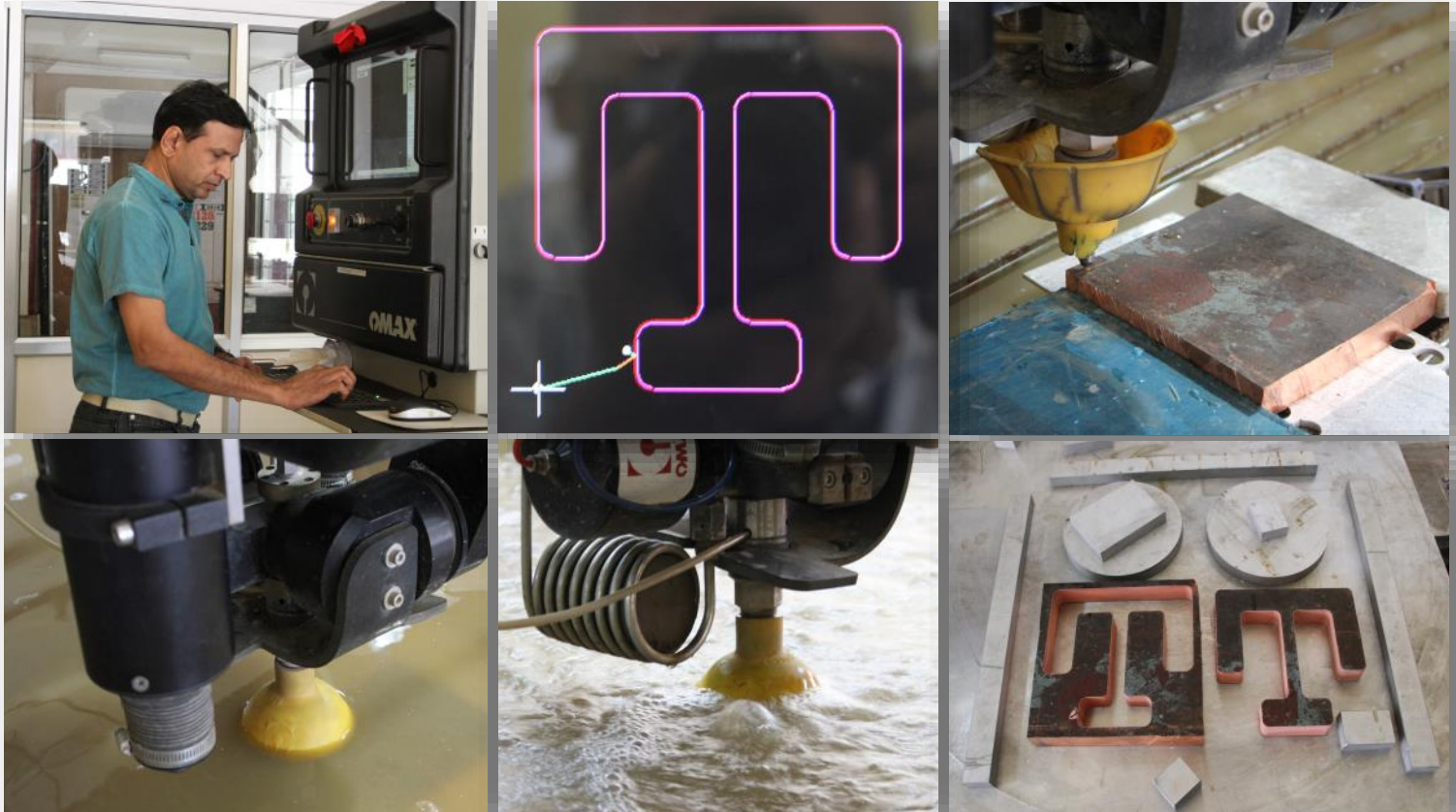
Group photo of the team of LIGO-India scientists who met the Honorable Prime Minister of India at new Delhi on 29th March 2016 to update him on the project a couple of days before the signing of an MOU between DAE, DST and NSF(USA). During the visit, the PM was briefed about the LIGO project, its scientific uses and larger implications to the scientific community by the institute heads. (L-R) Prof. R. Chidambaram (Principal Scientific Advisor to the PM), Prof. Tarun Souradeep (IUCAA), Dr. Sekhar Basu (Chairman, DAE), Prof. Dhiraj Bora (IPR), Shri. Narendra Modi, Dr. P D Gupta (RRCAT) and Prof. Somak Raychaudhury (IUCAA).

वाद-विवाद प्रतियोगिता का आयोजन

प्लाज्मा अनुसंधान संस्थान, गांधीनगर में दिनांक 1 अप्रैल, 2016 को नगर राजभाषा कार्यान्वयन समिति, गांधीनगर के तत्वावधान में वाद-विवाद प्रतियोगिता का आयोजन किया गया जिसमें गांधीनगर में स्थित केन्द्रीय सरकारी कार्यालय/संस्थान/बैंक/उपक्रम आदि के अधिकारियों/कर्मचारियों ने भाग लिया। वाद-विवाद प्रतियोगिता का विषय था - "देश में अस्वच्छता के लिए जिम्मेदार कौन? सरकार या जनता?"- इस महत्वपूर्ण विषय पर जनगणना कार्य निदेशालय, तट रक्षक क्षेत्र(उ.प.), प्लाज्मा अनुसंधान संस्थान, भारतीय खेल प्राधिकरण, भारतीय स्टेट बैंक और देना बैंक अंचल कार्यालय से आए अधिकारियों/कर्मचारियों ने अपने विचार व्यक्त किये। श्री बी.आर.राजपूत, हिन्दी अधिकारी, अंतरिक्ष उपयोग केन्द्र (SAC), श्री राधेश्याम गुप्ता, हिन्दी अधिकारी, भौतिक अनुसंधान प्रयोगशाला (PRL) एवं श्री गौतमचन्द सेठिया, सलाहकार, प्लाज्मा अनुसंधान संस्थान इस प्रतियोगिता के निर्णायक रहें। सुश्री हिरल जोशी, प्लाज्मा अनुसंधान संस्थान को प्रथम, श्री अभिषेक शर्मा, भारतीय स्टेट बैंक को द्वितीय, श्री आर.के.सिंह, तट रक्षक क्षेत्र (उ.प.) को तृतीय पुरस्कार और श्रीमती शिल्पा खंडकर, प्लाज्मा अनुसंधान संस्थान, श्री रजनीकांत मकवाना व श्री गोविंद सिंह राठौड़, देना बैंक अंचल कार्यालय सांत्वना पुरस्कार के विजेता घोषित किये गये। निर्णायक महोदय श्री राधेश्याम गुप्ता, हिन्दी अधिकारी, पीआरएल ने प्रतियोगियों के विचारों को समाविष्ट करते हुए निष्कर्ष रूप में वाद-विवाद के इस विषय में देश में अस्वच्छता के लिए जनता को प्रमुख रूप से जिम्मेदार ठहराया। राजभाषा कार्यान्वयन समिति के अध्यक्ष श्री राजसिंह ने प्रतियोगिता के दौरान अस्वच्छता से संबंधित अपने कुछ रोचक एवं प्रेरक अनुभवों को श्रोताओं के साथ बांटा। अंततः यही निर्णय सामने आया कि देश में स्वच्छता बनाए रखना प्रत्येक व्यक्ति का कर्तव्य होना चाहिए।



वाद-विवाद प्रतियोगिता की झलकियाँ

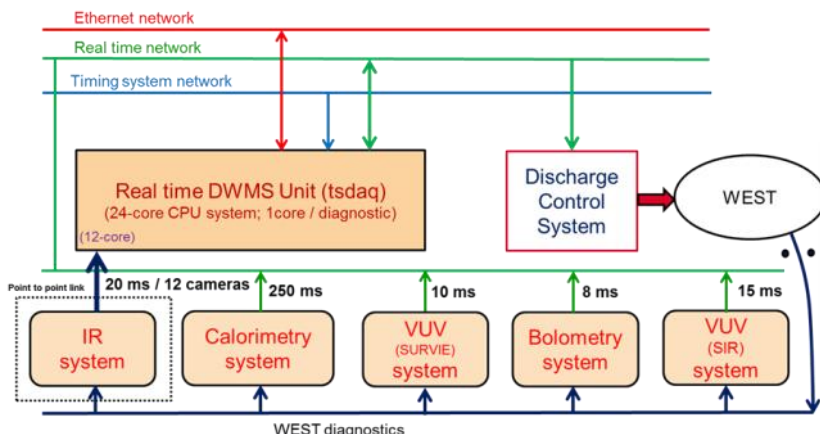


The Water Jet Cutter installed at IPR has become a major machine for the IPR mechanical engineering workshop. This machine uses water at a very high pressure (2000 - 6000 bar) to cut virtually any material. The major advantage is that the cutting zone does not get heated (unlike with conventional cutting tools), so the material integrity is left intact. This machine has been running on full operational load ever since it was installed. Not only most of the necessary primary cuts are now being done with this machine, but also other precision and intricate cutting jobs on any material, including metal are now being done using CNC automated environment which is much faster than conventional methods that were being used until recently.

IPR-CEA Collaboration Update –1

IRFM (Institute for Magnetic Fusion Research) is modifying the Tore Supra plasma facility which is known as the **WEST** project (acronym derived from **W** Environment in **S**teady-state **T**okamak, where W is the chemical symbol for tungsten). The WEST project operates the tokamak with X point configuration under fully metallic environment over long plasma discharges. The challenge that must be faced in WEST is the operation with the Tungsten actively cooled plasma facing components which are less tolerant to overheating than usual carbon components. More specifically WEST is aiming at testing of the ITER like divertor component in ITER relevant heat flux conditions (of the order of 20 MW/m^2). Wall Monitoring System (WMS) has been setup for protection of tungsten based plasma facing components. The WMS will be based on an intensive use of image and multi-sensor analysis. Under the Supervision of Dr. Jean-Marcel Traverre from WMS-CEA, Mr. Vishnu Chaudhary (Laser Diagnostic group) from IPR, India has developed real time system for IR diagnostic which include IR simulator, data acquisition & control action. IR diagnostic consists of 12 IR views: monitoring the WEST divertor and heating systems (7 divertor views, 3 ICRH views and 2 LHCD views). Development done by Vishnu has been tested on 32 bit system. Apart from IR diagnostic, WMS will process data coming from (a) Calorimetry monitoring in/out cooling system temperatures and thermal power extracted (b) Cu/Fe spectroscopy (SURVIE) monitoring Cu/Fe impurities (c) Bolometry monitoring the total radiative power (d) Spectroscopy for monitoring tungsten impurity.

Mr. Mitesh Patel (Non-linear Physic group) will continue further development for Real-time processing algorithm for calorimetry, Spectroscopy and Bolometry. The future work involves implementation of treatments on real time protection of Plasma Facing Components (PFCs). The work carried out by Vishnu & Mitesh will be helpful in WEST project for protection of PFC during discharge phase. It will also be useful to IPR for protection of plasma facing components of SST.



Schematic of the WMS system developed by Vishnu Chaudhary at Tore Supra - IRFM, CEA



(L) Mitesh Patel and (R) H M Yadav recently joined the IPR-CEA collaboration and will work in IRFM-(WMS) Wall Monitoring System and IRFM-(STEP) Service Tokamak Exploitation & Pilotage respectively.

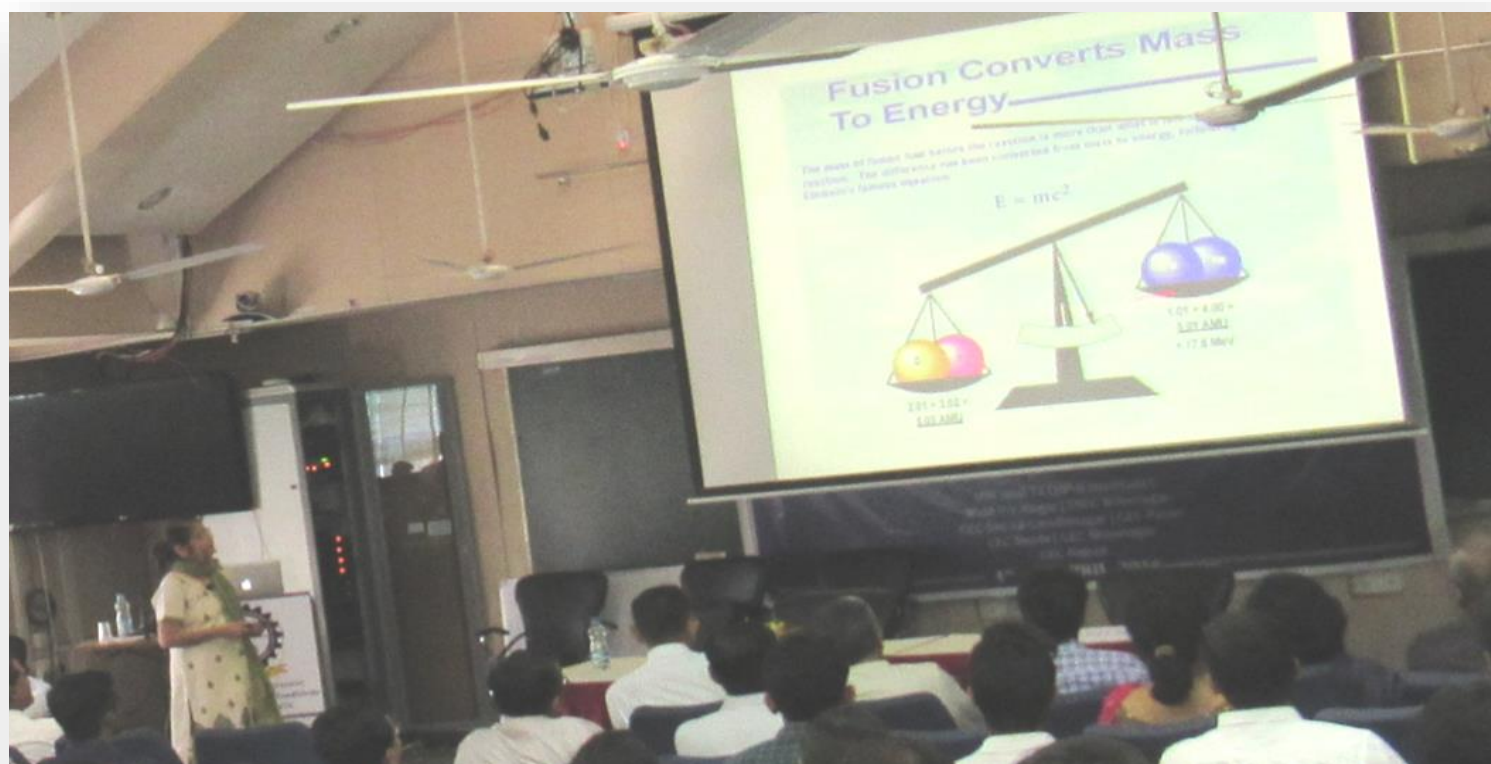


Workshop Services: Workshop provides the basic mechanical manufacturing and fabrication services as per the specific engineering and scientific requirement of the users. It has all modern equipment and tools to undertake works which are, by specific and individual nature, are difficult to get done through outside agencies and that too in the time frames set by the users. Workshop also handle works with special materials like graphite, ceramics, lead, glass fibre etc. On an average, more than 1000 major and medium works are carried out per year in addition to the small but precision jobs that need to be executed at short notices. It also stocks wide variety of engineering materials to meet the day to day activities. The newest facility at the workshop is a high pressure water jet precision cutter which has made the execution of works much faster.

Members of the workshop : (L to R) Jadeja Surendrasinh J, Kaila Vinod D ,Gandhi Jayesh C , Patel Vijaykumar N , Sadiariya Natvarlal P , Chudasama Sunil M , Vihola Jagdish V

National Conference on Emerging Research Trends in Engineering (NCERTE) – 2016

National Conference on Emerging Research Trends in Engineering (NCERTE) – 2016 was organized at Vishwakarma Govt. Engg. College – Chandkheda, Ahmedabad from 4th – 6th April in collaboration with SPFU, CTE, Institute for Plasma Research, and TEQIP – II Institutes of the state. The conference received more than 250 papers in various engineering disciplines, and out of that, approximately, 200 papers were selected for oral/poster presentations. There were three plenary talks and 27 expert talks throughout the conference. Prof. Amita Das (Dean – IPR) was one of plenary speakers in addition to Dr. Sudhir Jain (Director, IIT – Gandhinagar) and Shri N. M. Desai (Deputy Director – SAC, Ahmedabad). Prof. Amita Das talked about plasma physics, nuclear fusion and various societal benefits of plasma science. She also briefed participants about various research activities carried out at IPR. It was well received by the attendees. The conference was inaugurated on 4th April in the presence of Dr. M. N. Patel (Vice Chancellor, Gujarat University), Dr. Sudhir Jain (Director, IIT – Gandhinagar), Dr. V. S. Purani (Jt. Director, CTE), Prof. Usha Neelakantan (SPFU – Coordinator), Dr. Subroto Mukherji (Associate Dean, IPR), Dr. R. K. Gajjar (Principal, VGEC – Chandkheda), Dr. R. A. Thakker (Coordinator, NCERTE – 2016) and other dignitaries, authors, faculty and student participants of VGEC and other Institutes. Overall, there was excellent response from the participants, hence making the NCERTE – 2016 a very successful event.



Prof. Amita Das delivering a talk at the NCERTE – 2016

Based on the directives of the Hon'ble Prime Minister, Department of Atomic Energy and its constituent units are observing Swachhta Pakhwada from April 18-May 02, 2016. Plasma pyrolysis is a home-grown waste disposal technology developed by FCIPT, IPR in 2002. The technology involves use of thermal plasma as heat source for disintegration of waste. High temperature and oxygen starved environment enables it to completely disintegrate organic waste for example plastic, paper, cotton etc and produces useful gases whose major composition is carbon monoxide, Hydrogen and methane. Because of high temperature and controlled environment, this technology safely destroys plastics and hospital waste and emissions of toxic molecules such as dioxins and furans remains well under the limit set by Central Pollution Control Board, Delhi. Continuous effort made by FCIPT team on development and promotion of plasma pyrolysis technology, and various representations made by FCIPT team in CPCB and MoEF, has finally been resulted in acceptance and inclusion of plasma pyrolysis technology in the Gazette of India of Ministry of Environment & Forest, Government of India as a technology that can safely dispose biomedical waste.

The plasma pyrolysis technology has been transferred (licensed) to M/s Bhagwati Pyro-tech Pvt. Ltd., Ahmedabad for bio-medical waste and to M/s B. L. Engineering, Ahmedabad for solid waste (non-biomedical) on non-exclusive basis. The technology is open to industries for absorption on non-exclusive basis.



The plasma pyrolysis system developed by FCIPT

IPR-CEA Collaboration Update - 2

The 1st WEST Experiment Planning Meeting was held on 18-20 April 2016 at CEA Cadarache to discuss the prioritization of experimental and modelling proposals and to define a timeline for the 2016-2017 WEST experimental campaigns. About 120 participants, including fifteen in-visio, met for two and half days of discussions on the experimental WEST program. The 1st WEST Experiment Planning Meeting and second International Workshop for WEST gathers around fifty IRFM participants, researchers from ITER Organization and participants from fusion laboratories worldwide (Indian, Chinese, Japanese, American and European).



Sunil Belsare, Hemant Joshi, Shailesh Kanpara and Yashshri Patil attended meeting at IRFM, CEA, France during the 1st WEST Experiment Planning Meeting, while Raju Daniel, Sameer Khirwadkar, Rajamannar Kildambi, Kedar Bhope and Sudhir Tripathi attended remotely from IPR.

19th Joint workshop in Electron Cyclotron Emission (ECE) and Electron cyclotron Resonance Heating (ECRH) was hosted by Institute for Plasma Research, from 4th -7th April , 2016 at Narayani Heights, located near its premises at Bhat, Gandhinagar. This bi-annual meeting, mainly covered the major areas as: Electron cyclotron (EC-wave) theory, electron cyclotron emission (ECE), electron cyclotron resonance heating (ECRH), electron Cyclotron current drive (ECCD), Experiments on various tokamaks and Stellarators and Technology associated with ECE and ECRH. More than 60 members of the science and fusion community participated in this important event, which included more than 30 international participants.

The conference was inaugurated by the traditional lighting of the lamp by the various dignitaries attending the conference. Along with the technical sessions related ECE and ECRH, members participated and enjoyed an evening of Indian cultural program and the dinner hosted by Director at IPR. Local sightseeing was also arranged for the participants and they visited the Adalaj step well, Gandhi Ashram and ended with a traditional Gujarati dinner at Vishala, Ahmedabad.



(L-R): B K Shukla, P. K. Kaw, E.Westerhof, John Lohr (DIID), G. Denisov (IAP Russia), Tsujimura (NIFS Japan) and Harshida Patel during the inauguration of the conference. Invited speakers at the meeting.



(L-R) View of the audience. Egbert Westerhof & John Lohr during technical session



(L-R) View of the audience, Sightseeing at the Adalaj Vav and dinner at Vishala.



Group photo of the participants of the EC-19 meeting hosted by IPR

Centre of Plasma Physics- Institute for Plasma Research (CPP-IPR) celebrated its silver jubilee with a symposium titled, "CPP-IPR Silver Jubilee Symposium". The decorous two day program was held at Don Bosco Institute, Guwahati. On 21st April 2016, the program started with the welcome address by the Centre Director, Prof. K. S. Goswami. The program continued with the felicitation of Prof. S. Bujarbarua, founder director, CPP and Prof. P. K. Kaw, former Director, IPR, for their monumental contribution towards the institute. Prof. Bujarbarua elaborated the commissioning of CPP and merging it with IPR. Prof. Kaw praised and motivated the constant effort of the researchers of the institute towards solving world class problems. The meeting was graced by the presence of many dignitaries including, Prof. J. N. Goswami, Prof. B. N. Goswami, Prof. Y. C. Saxena, Prof. A. C. Das, Prof. Jayanti Chutia, Prof. H. Bailung, Prof. K. D. krori, Fr. Joseph (Pro-VC Assam Don Bosco university) etc. The special attraction of the symposium was a student interaction with Prof. J. N. Goswami, Prof. B. N. Goswami, Prof. A. C. Das and Prof. Asoke Kumar Sen (Assam University). The session was coordinated by Prof. Y. C. Saxena. In the afternoon the delegates and students were taken to CPP-IPR for the laboratory visit. On, 22nd April, 2016, technical lectures were delivered by Dr. Subrata Pradhan, Prof. Amita Das, Dr. Jaydeep Ghosh, Dr. Mainak Bandopadhyay, Dr. Ujjal Barua and Prof. M. P. Bora (Gauhati University). Dr. Pradhan spoke about the recent developments of SST-1 and Prof. Amita Das touched upon the physics and engineering challenges in magnetic fusion. Dr. M. Kakati presented the recent commissioning of the CIMPLE-PSI device. In the session after lunch, posters from various institutions were presented.



(L-T) Felicitation of Prof. P. K. Kaw and Prof. S. Bujarbarua. Prof. K Goswami giving the welcome address

IPR-St.Xavier's Teaching Collaboration



As part of the ongoing teaching collaboration with St. Xavier College (Ahmedabad), Dr. Mukesh Ranjan from FCIPT was invited to deliver a talk on latest trends in plasma based nanotechnology activities. Talk was mainly attended by students and the faculties of St. Xavier College.

The talk was arranged to motivate the young students for pursuing the career in research and possible opportunities to work at FCIPT/IPR.

This is part of the MoU signed between IPR and St. Xavier's college Ahmedabad.

New Horizons in Vacuum Technology—Theme Meeting

A theme meeting on "**New Horizons in Vacuum Technology**" was organized on 31st March 2016 to share the experiences and achievements in the field. The event showcased 3 technical talks, Shri Arun Chakraborty appraised the audience on IT-ER challenges & Indian contribution while Shri Ziauddin Khan briefed on the upcoming LIGO project. Last but not the least Shri Haresh Pathak shared his experience in Vacuum Technology over the last 4 decades. It was also Shri Pathak's super-annuation day, and the event concluded with a felicitation ceremony.



(L-R) : Inauguration ; Prof. D Bora addressing the gathering ; Shri Haresh Pathak being felicitated by Prof. Shishir Deshpande.

- ♦ **Dr. Purushothama Chippar**, Mechanical Engineering Department, St. Joseph Engineering College, Mangalore, Karnataka, gave a talk on "Design and Optimization of Metal Hydride Vessels for Hydrogen/Tritium Storage and Transportation via experiments and numerical modeling" on 31st March 2016 (Colloquium # 258)
- ♦ **Dr. Charu Lata Dube**, Immobilization Science Laboratory, Department of Materials Science and Engineering, The University of Sheffield, UK, gave a talk on "Radiation stability of nuclear materials for nuclear power generation" on 07th April 2016
- ♦ **Dr. Manis Chaudhuri**, School of Engineering and Applied Sciences, Harvard University, USA, gave a talk on "Exploring strong coupling phenomena in classical many body systems: from dusty plasma to colloids" on 19th April 2016
- ♦ **Dr. Dinesh Nath**, Indian Institute of Technology, Kanpur, gave a talk on "Application of meshless methods to the computation of fixed boundary equilibria and current-hole simulation in tokamak" on 22nd April 2016

Upcoming Events

- ♦ 21st Topical Conference on High Temperature Plasma Diagnostics (HTPD 2016), Madison, USA, 5-9 June 2016 <http://apps.union.wisc.edu/htpd2016/>
- ♦ 13th International Workshop on Hydrogen Isotopes in Fusion Reactor Materials, Milan Italy, 6-8 June 2016 <http://www.ifp.cnr.it/conference/HWS2016/>
- ♦ 11th International Conference on Numerical Modeling of Space Plasma Flows (ASTRONUM 2016), Monterey, California, USA, 6-10 June 2016 <https://www.icnsmeetings.com/conference/astronum2016/index.html>
- ♦ 13th Kudowa Summer School, "Towards fusion energy", Kudowa-Zdroj, Poland, 13-17 June 2016 <http://kudowaschool.ipplm.pl/>
- ♦ 43rd IEEE International Conference on Plasma Science (ICOPS 2016), Canada, 19-23 June 2016 <http://ece.engineering.ualberta.ca/en/icops2016/Home.aspx>
- ♦ 27th Symposium on Plasma Physics and Technology, Prague, Czech Republic, 20-23 June 2016 <http://www.plasmaconference.cz/about.php>
- ♦ 2nd International Workshop on Models and Data for Plasma-Material Interaction in Fusion Devices (MoD-PMI 2016), Loughborough University, United Kingdom, 22-24 June 2016 http://www.ccf.ac.uk/mod_pmi2016.aspx
- ♦ 7th International Workshop & Summer School on Plasma Physics, University of Sofia, Kiten, Bulgaria, 26 June-2 July 2016 <http://iwsspp.deo.uni-sofia.bg/>
- ♦ 18th International Conference on Plasma Physics (ICPP 2016), Kaohsiung, Taiwan, 27 June-1 July 2016 <http://www.isaps.ncku.edu.tw/ICPP2016/>

Know Our Colleagues



Mr. Pratipalsinh A. Rayjada joined IPR in 1996 in Aditya Vacuum Group and contributed in the studies related with vacuum and first wall systems such as development of molecular beam Injection system for gas feeding and plasma surface interaction through characterisation of the plasma exposed surfaces like graphite and SS-304 using different spectroscopy techniques. He was also involved in activities like Aditya discharge cleaning and the investigations on Lithiumization by laser ablation and evaporation methods by characterizing lithium coating on different substrates. He was awarded Monbusho Scholarship of Japan Government during 2001-2003 for pursuing research on Strongly Correlated Electron materials using electron spectroscopic techniques and synchrotron sources at Institute for Solid State Physics (ISSP), University of Tokyo. During 2003-2012 he contributed to the R&D activities of FCIPT and IPR in the areas of material characterization and coatings development. Since 2012 he is in the Fusion Reactor Materials Development and Characterization (FRMDC) division assigned with the responsibility of investigation and development of H₂/D₂ permeation barrier and insulating coating for fusion reactor applications. He is presently pursuing PhD on Er₂O₃ coating development and characterization for fusion reactor applications.

Swadesh Kumar Patnaik joined IPR in 1996 as a Mechanical Draughtsman in the Institute's Drafting Section and was specifically assigned with the SST-1 Project. He worked extensively in the SST-1 Mission and handled the TF related work and the diagnostic systems preparing layouts, schematics, 3D models, assembly in isometrics, interface & composite drawings and also bills of materials and other CAD data to support all phases of assembly and fabrication. As an SST-1 Mission Team member he has received letter of Appreciation for his work from the Director on completion of the SST-1 Mission. He has undergone different specialized training like Geometric Designing & Tolerance (GD & T) conducted by the CII and was also granted DES-B & DES-A role in ENOVIA database under the ITER IO environment. He has contributed by drawing related works for the CPP-IPR also. He is up to date with latest software of his profession and presently uses CATIA-V5 R23 and AutoCAD Mechanical 2012.



The IPR Newsletter Team

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