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# The 4<sup>th</sup> State

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

## DAE Chairman's Visit to IPR

On 26th March 2019, Chairman, DAE, Shri K. N. Vyas visited the Computer Center at IPR, where installation of the new one petaflop High Performance Computing (HPC) system is currently being carried out. Dr. R Ganesh and Dr. R. Srinivasan explained the system to Shri Vyas, who also interacted with the members of the Computer Center. Director, CAO and Dean R&D, were also present during the visit.





The national science day was celebrated at CPP-IPR on 28th February, 2019, with day-long activities. The event was inaugurated by the Centre Director, Prof. B. K. Saikia. Over 300 students and teachers from 21 schools and colleges from greater Sonapur, South Guwahati city and the neighboring state of Meghalaya participated in this event. The activities included Drawing, Quiz, Eloquence as well as Science Model competitions. Research scholars of CPP-IPR arranged an exhibition of basics of plasma science, including live demonstration of plasma production processes through glow discharge and high-voltage spark discharge to the visiting students and teachers. The concluding session was held in the afternoon where the prizes for the various competitions were given out by the Centre Director, Prof. B. K. Saikia and the chairman of the organizing committee, Dr. B. J. Saikia. Some of the schools and colleges that won prizes in multiple events are Sai Vikash Junior College, Guwahati, Saint Patrick's High School, Nazirakhat, Green View Academy, Khetri, Saint Agnes School, Khetri, etc.



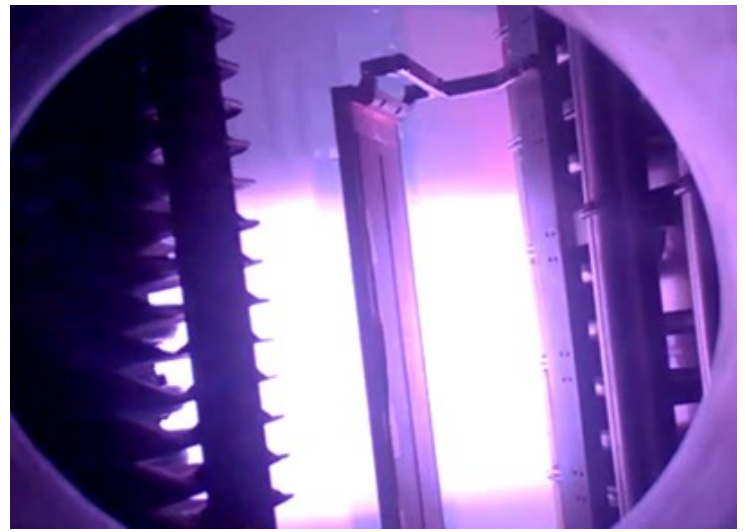
Images from the national Science Day celebrations at CPP-IPR



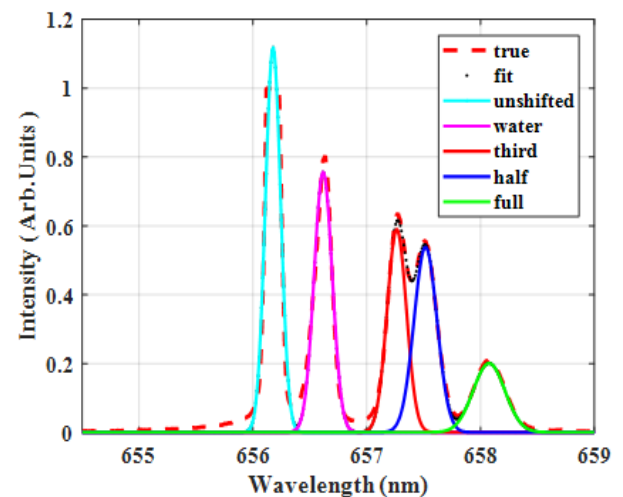
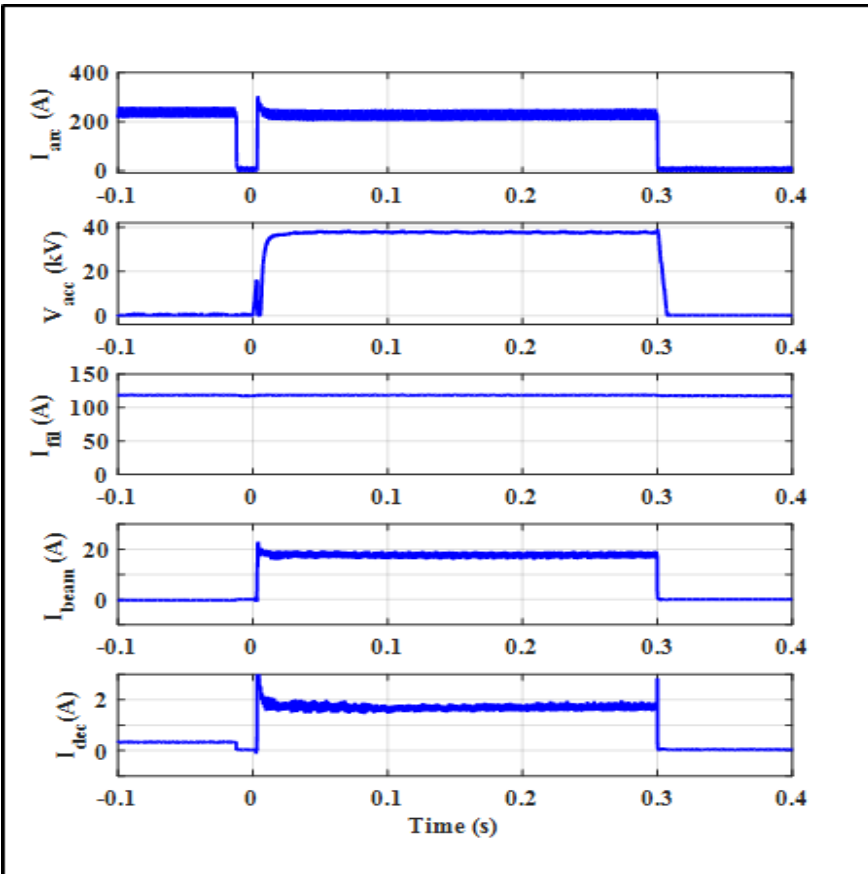
The Neutral Beam Injector (NBI) system at IPR is developed for injecting about 1.7 MW of neutral beam ( $H^0$ , 30-55 keV) power to the SST-1 tokamak plasma for performing heating and current drive. SST-1 NBI is operational in testing mode since 2009. Hydrogen ion Beams up to 20 A at 40kV have been routinely extracted with a PINI (Plug In type Ion Source) and were characterized using electrical diagnostics, Doppler shift spectroscopy and thermal diagnostics. In August, 2014 experiments were terminated to modify the beam line for enhancing extraction current higher than 20A and also for shifting & integration of the injector with SST-1 tokamak. Since then, the injector had undergone a major revamp.

After a shutdown period of 3 years, the current beam line now has: (1) Actively cooled beam line components made of heat transfer components (CuCrZr) which withstand beam powers of  $10 \text{ MW/m}^2$  (2) A new cooling water system which fully operational now (3) The Ion Separation Magnet System (4) Four Cryopumps and (5) New set of filament power supplies for increasing reliability. Following the re-assembly, the test stand was brought back to operation with an objective of re-establishing the earlier established parameters i.e., neutral beam output power of  $\sim 800 \text{ kW}$  (ion currents up to 20 A at 40 kV). From the beginning of operation in mid-January 2019, the system has reached the earlier operating parameter regime of  $\sim 20\text{A}/40\text{kV}$  operation just in  $\sim 4$  weeks of operational campaign. Preliminary tests with the Ion-Removal magnet system too have been conducted.

The SST-1 NBI will now continue to operate on test stand with the objective of characterizing the system, enhancing extracted beam current, beam neutralization efficiency and improving the beam divergence from the present  $2^\circ$  to  $1^\circ$ . Apart from these objectives, attempts will be made to find out the highest safe Operating Limit of the system without Cryopumps which will enable us to explore alternative usages of the  $\sim 1\text{MW}$  ion beam.



(L) The SST-1 NBI test stand (R) Image of the 38 kV beam



(Above) Doppler shifted beam spectrum. Full: beam energy  $E$ , Half and third :  $E/2$  and  $E/3$ , respectively.

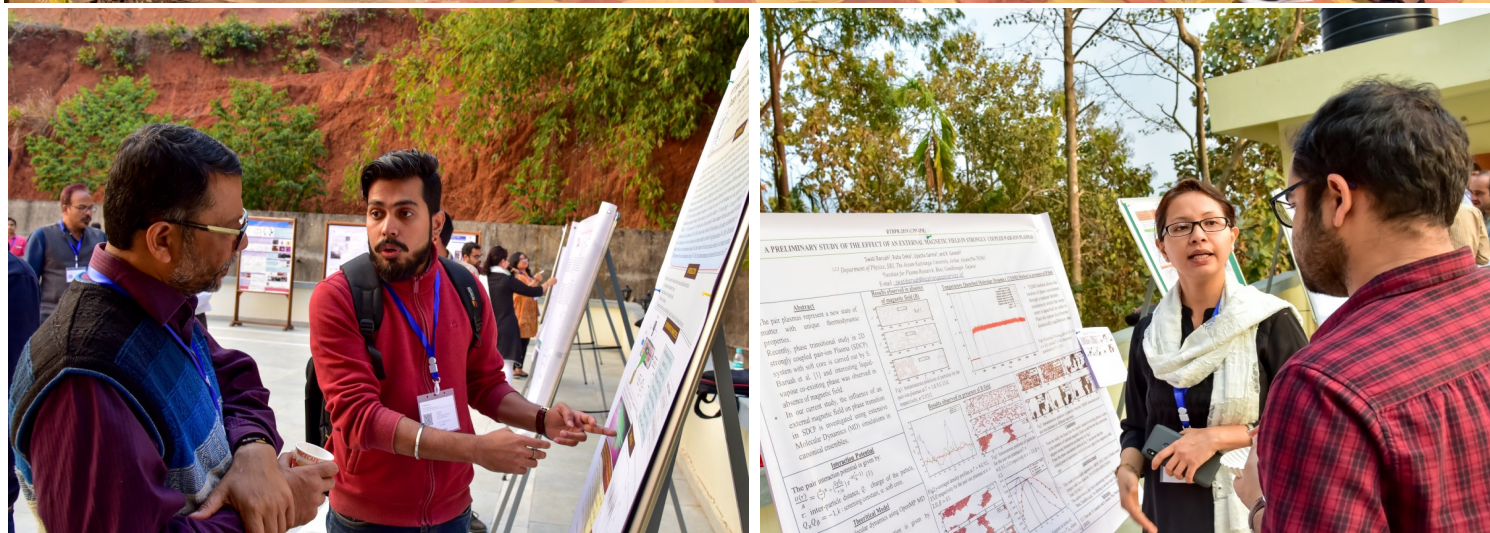
(L) Electrical traces obtained from the operation of PINI ion source.  $I_{dis}$ ,  $I_{beam}$ ,  $V_{beam}$ ,  $I_{fil}$  and  $I_{dec}$  denote the Plasma arc current (discharge), the ion beam current, the ion beam acceleration voltage, the filament current (thermionic), respectively.



## One-day Symposium on Recent Trends in Basic Plasma Research @CPP

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A one-day symposium on Recent Trends in Basic Plasma Research was organized at Centre of Plasma Physics - Institute for Plasma Research (CPP-IPR) in which 40 external participants as well as 30 participants from CPP-IPR attended. The objective of the symposium was to develop greater understanding of the fundamental problems in the field and its possible perspective towards industrial applications. Altogether, 7 talks were delivered by different speakers namely, Prof. H. Bailung, IASST, Guwahati, Prof. M. P. Bora, Gauhati University, Guwahati, Prof. N. Das, Tezpur University, Tezpur, Dr. G. Kumar, IITG, Guwahati, Dr. R. Moulick, LPU, Jalandhar, Dr. M. Kakati, CPP-IPR, and Dr. S.R. Mohanty, CPP-IPR. Participants from institutes/universities in remote places of North-East India along with 5 participants from Nepal took part in the symposium making it a grand success. A poster session with 12 external and 5 internal posters were presented. The young researchers got the opportunity to interact with the dignitaries and to get access to the various disciplines of plasma physics. The symposium opened up the scope of collaborative approach for using the existing facilities of different institutions and universities to contribute to the plethora of diverse applications in plasma sciences.



Images from the one-day symposium held at CPP-IPR

## National Safety Week @ CPP-IPR

CPP-IPR observed the 48<sup>th</sup> National Safety Week Campaign with a 2 day programme on 04/03/2019 and 11/03/2019 respectively. A slogan completion on this year's theme and a quiz competition on general safety awareness were conducted among the employees. On the Inaugural day on 04/03/2019, the function started with the inaugural address by the Acting Centre Director, Prof. B. K. Saikia, followed by the quiz competition among the employees. The concluding function on 11/03/2019 was started with a brief speech on Safety Awareness and area of concern on safety at CPP-IPR by Mr. A. Baishya, the safety coordinator. It was followed by prize distribution ceremony by Acting Centre Director, Prof. B. K. Saikia.

| Slogan (Assamese)    | Slogan (English)      | Slogan (Hindi)      | Quiz                 |
|----------------------|-----------------------|---------------------|----------------------|
| 1st : Tarulata Deka  | 1st : Dharitri Dutta  | 1st : Tarulata Deka | 1st : B. J. Saikia   |
| 2nd : Dharitri Dutta | 2nd : Tarulata Deka   | 2nd : Pallab Das    | 2nd : Sayan Adhikari |
| 3rd : Pallab Das     | 3rd : T. K. Borthakur | 3rd : P. K. Deka    | 3rd : Sumit Singha   |



The 48<sup>th</sup> National Safety Week was celebrated at IPR from 4-10 March 2019. The institute organized various competitions during this week to create safety awareness among its employees. Competitions were organized on *Slogan in Gujarati, Hindi & English, Cartoon Making, Quiz and Essay Writing in Gujarati, Hindi & English* based on decided topics for the employees of IPR, FCIPT & ITER-India. Encouraging response was received from the employees for various competitions.

| Competition     | 1st Prize        | 2nd prize         | 3rd prize                        |
|-----------------|------------------|-------------------|----------------------------------|
| Gujarati Slogan | Dikens Christian | Unnati Patel      | Rajnikant Amaliar                |
| Hindi Slogan    | L.N. Gupta       | Miteshkumar Patel | Sunil Misal<br>Gaurang Mahesuria |
| English Slogan  | Nisha Panghal    | Tejas Parekh      | Miteshkumar Patel                |
| Cartoon         | Suman Aich       | Unnati Patel      | -                                |
| Quiz            | Pratibha Gupta   | Rajiv Sharma      | L.N. Srikanth                    |
| Gujarati Essay  | Unnati Patel     | K.G. Parmar       | -                                |
| Hindi Essay     | Pratibha Gupta   | Sandeep Gupta     | -                                |
| English Essay   | Alphonsa Joseph  | Pranav Barapatre  | Bharat Doshi                     |

During the concluding event on 8th March, 2019, Shri Devendra Modi gave the welcome address, which was followed by a presentation on "Safety in Mechanical Works" by Shri Bharat Doshi. The safety message was then read out by Shri P.K. Atrey, Dean (R&D). He emphasised that the best way to enhance safety across the Institute is to enhance the safety culture among us. He also administered the Safety Pledge. Dr. Vipul Tanna conducted a Safety Quiz for the audience. Director IPR delivered the keynote address on safety. He highlighted that safety is a continuous process and it does not end with National Safety Week, and that one should not learn safety through accidents. He congratulated the winners of various competitions as well as best safety co-ordinators of IPR. Prizes were also distributed to them. Shri Sunil Kumar, Chairman-Safety Committee presented the vote of thanks.



Images from the concluding event of NSW-2019



## Best Safety Coordinators

| Name of the safety coordinators    | Division / Group                           |
|------------------------------------|--|
| Kushagra Nigam & K.P. Sooraj       | FCIPT                                      |
| Vijay Patel & J.C. Gandhi          | Workshop                                   |
| Amit Ojha                          | Coil Power Supply                          |
| Anuj Garg & S. H. K. Madeena Valli | Cryo Distribution & Cryo lines, ITER-India |





## Educational Visits to IPR/FCIPT – Feb-Mar 2019

| Name Of the Institution                  | Date        | Number of visitors   |
|--|-------------|--|
| Ahmedabad Institute Of Technology        | 20-Feb-2019 | 70 BTech students and two faculty members  |
| Bahauddin Science College, Junagadh      | 21-Feb-2019 | 42 B.Sc. students and three faculty members  |
| MN College, Visanagar                    | 27-Feb-2019 | 102 B.Sc. / M.Sc. students and faculty members   |
| Saurashtra University , Rajkot           | 01-Mar-2019 | 37 B.Sc. /M.Sc. Applied Physics students and faculty Members of Department of Nano Science & Advanced Materials, |
| Raksha Sakthi University, Gandhinagar    | 06-Mar-2019 | 45 M.Tech (Cyber Security), PGDCICS & CF students two faculty members  |
| College of Food Processing Technology of | 07-Mar-2019 | 15 students along with 4 staff members   |
| Govt. Polytechnic, Dahod, Gujarat        | 13-Mar-2019 | 21 Electronics & Communication Engineering Students and two faculty members                                      |



Students from Raksha Sakthi University, Gandhinagar, during their visit to IPR



Students from Anand Agricultural University during their visit to FCIPT





**Dr. Mukesh Ranjan** gave an invited talk "*Investigation of yield behaviour and surface patterns after the bombardment of low energy ions on graphite and W surfaces*" at the Indo French Seminar on Radiation Damage in Nuclear Materials (RADIUM), jointly organised by IUAC, New Delhi and Amity University, Noida during 18-20 February.



**Dr. Sarveshwar Sharma** of the Theory Division gave an invited talk entitled "*An overview of capacitive discharges: A key tool for plasma processing*" at the Photonics, Metamaterials & Plasmonics (PMP-2019) held at the Jaypee Institute of Information Technology (JIIT), Noida during 14-16 February 2019.

### Holi Celebrations @ IPR

Ahead of the festival of colors, which also indicates the arrival of spring, "*Holi*" was celebrated at IPR with a lot of fun and frolic on 22nd March, 2019 at IPR lawns as well as in FCIPT. Exchange of colors and greetings, singing / dancing and snacks were the highlights of the festivities of "*Holi*". IPR and FCIPT staff actively took part in this celebration of colors.



Images from the Holi celebrations held at (Top) FCIPT (Bottom) IPR



- ◆ Mr. Mohammed Zubairuddin, Institute for Plasma Research, Gandhinagar, gave a talk on "Thermo-mechanical Analysis of GTA Welding of Mod. 9Cr-1Mo Steel considering the effects of Phase transformation, Pre heating and Post heating" on 28th February 2019
- ◆ Dr. Sabbir Ahmed, Amrita Centre for Research and Development, Coimbatore, gave a talk on "Characteristics of Adhesive Joining of PEEK to Titanium for Aerospace Application" on 1st March 2019
- ◆ Mr. Vishal Gupta, Institute for Plasma Research, Gandhinagar, gave a talk on "Thermo-Structural Analysis of SST-1 Cryopump" on 6th March 2019
- ◆ Mr. Bharat Doshi, Institute for Plasma Research, Gandhinagar, gave a talk on "Electro Magnetic Pulse Welding of Similar and Dissimilar Materials and Characterization of Weld Joint" on 8th March 2019
- ◆ Ms. Harshita Raj, Institute for Plasma Research, Gandhinagar, gave a talk on "Study of Runaway Electrons and their Interaction with Magnetic and Electric fluctuations in ADITYA and ADITYA-U tokamak" on 8th March 2019

## Upcoming Events

- ◆ Joint ICTP-IAEA School on Atomic and Molecular Spectroscopy in Plasmas, Trieste, Italy, 06-10 May 2019 <http://indico.ictp.it/event/8660/>
- ◆ 3rd European Conference on Plasma Diagnostics (ECPD), Lisbon, Portugal, 06-10 May 2019 <https://www.ipfn.tecnico.ulisboa.pt/ECPD2019/>
- ◆ 5th EuroSciCon Conference on Quantum and Plasma Physics, Stockholm, Sweden, 9-10 May 2019 <https://plasmaphysics.euroscicon.com/>
- ◆ Les Houches school on plasma physics: The multiple approaches to plasma physics from laboratory to astrophysics, France, 13 May 2019 <https://plasmas2019.sciencesconf.org/>
- ◆ 2nd International Conference on Data Driven Plasma Science, Marseille, France, 13-18 May 2019 <https://icddps2019.sciencesconf.org/>
- ◆ 12th IAEA Technical Meeting on Control, Data Acquisition and Remote Participation for Fusion Research, Daejeon, Republic of Korea, 13-17 May 2019 <https://nucleus.iaea.org/sites/fusionportal/Pages/12th-TM-on-CDA-and-RP-for-FR.aspx>
- ◆ 17th International Conference on Plasma-Facing Materials and Components for Fusion Applications (PFMC 2019), Eindhoven, Netherlands, 20-24 May 2019 <https://www.pfmc2019.com/home>
- ◆ 1st International Conference on Innovative Fusion Approaches, China, 26-28 May 2019 <http://icifa.xjtu.edu.cn/>
- ◆ 3rd IAEA Technical Meeting on Fusion Data Processing, Validation and Analysis, Vienna, Austria, 27-31 May 2019 [https://nucleus.iaea.org/sites/fusionportal/pages/data processing/2019/info.aspx](https://nucleus.iaea.org/sites/fusionportal/pages/data%20processing/2019/info.aspx)

## Know Our Colleagues



**Dr. Shrichand Jakhar** joined IPR as a technical trainee in 2001 and subsequently appointed as Scientist - SC in X-Ray Diagnostics group. He holds M. Sc. degree in Physics from University of Rajasthan, Jaipur and Ph.D. in Fusion Neutronics from HBNI, Mumbai. In the initial years of his career, he was responsible for the design and development of hard X-ray tomographic system for SST-1 and hard X-ray monitor in Aditya tokamaks. Since 2007, he was engaged in the development of facilities for neutronics experiments at IPR for fusion applications. During 2011-12, he worked on the conceptual design development of ITER Neutron Diagnostics at ITER-IO, France. In 2014, he was selected for the position of Nuclear Analyst in the Central Integration Office at ITER-IO, France. During his five year tenure at ITER-IO, his main contribution to ITER project was production of baseline radiation maps which are essential for worker safety and equipment design. He has delivered invited and oral talks in many national and international conferences. His areas of expertise include radiation transport analyses using Monte Carlo technique, neutron activation analyses, development of neutron diagnostics for fusion machines, and fusion neutronics benchmark experiments. He is also reviewer in various international fusion and nuclear science journals.

**Mr. Kirit Patel** joined IPR (SST-1 Operation and Control Group) in 2002 as Engineer-SC after completing the TTP-2001 training course. While working in SST-1 operation and control group, he developed expertise in VME board development using FPGA, DSP based control system development, high speed fiber-optic communication and coil power supply interfacing with SST-1 Central Control system. He also acquired experience in the areas of design, development, integration, commissioning, testing and operation of control systems. He contributed shoulder to shoulder in the machine operation and plasma experiments on SST-1. Since 2016, he is at ITER organization as Coil Power Supply Control Engineer, where, he is responsible for design, integration and commissioning of I&C system of ITER coil power supplies and integration of the ITER coil power supply with central CODAC systems.



## The IPR Newsletter Team

|                   |                    |                  |                |              |                  |
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