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Issue 083

June 2020

The Fourth State

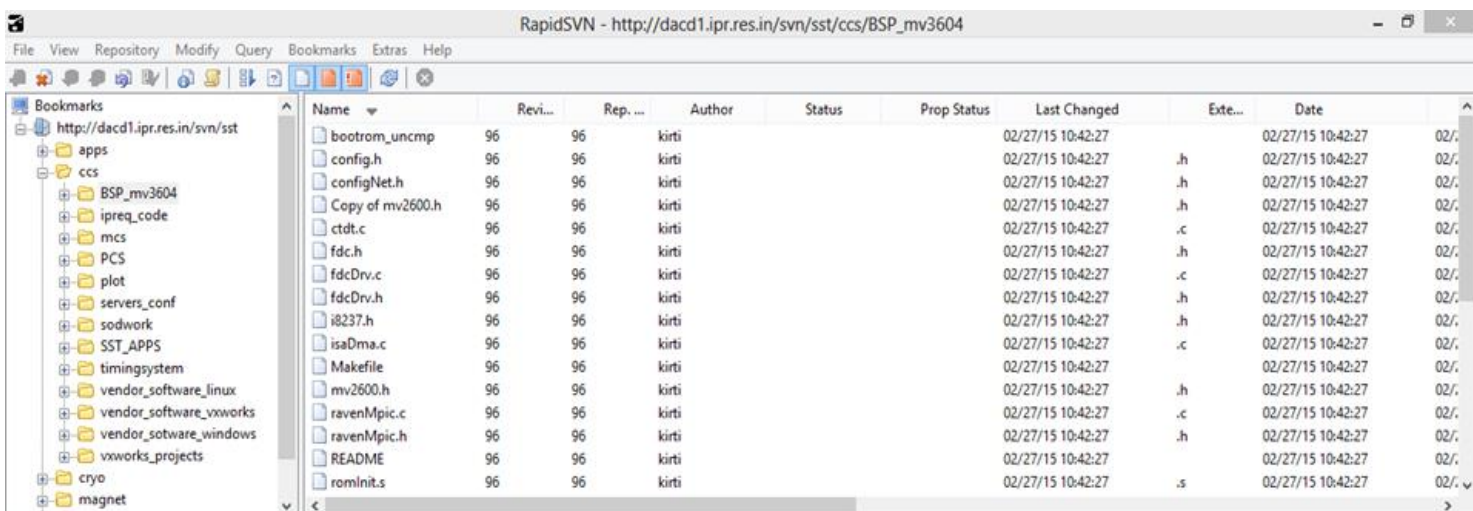
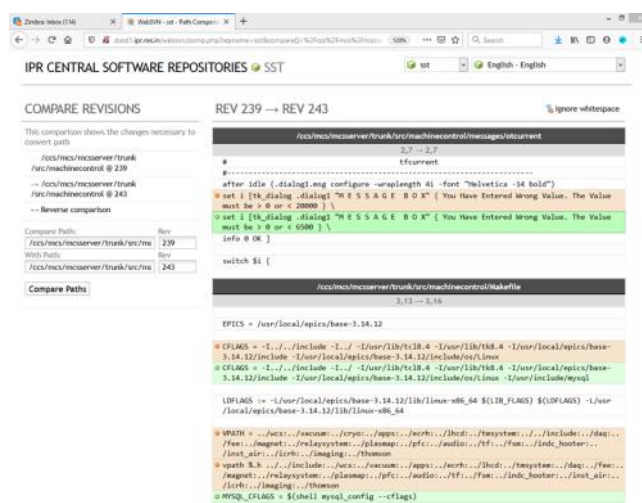
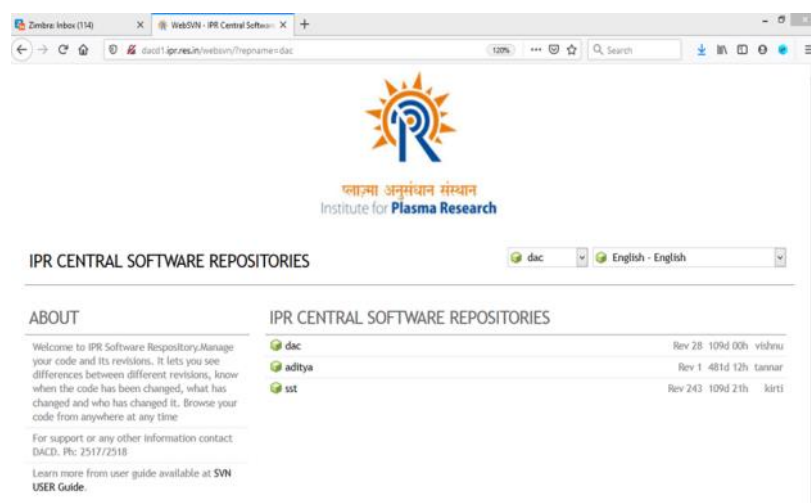
Newsletter of the Institute For Plasma Research, Gandhinagar, Gujarat (India)



IPR Central Software Repository

DAC division has setup central software repository for software versioning and revision control. The advantages of setting up central software repository are many folds; having centralized availability of software code, no need to take complete backup of a software unit when one does small or big changes to one or many of the files of a software unit, changes are logged, easy to find out who changed what, when and why, changes are easy to trace out, if needed one can revert back changes easily, very useful to work in collaborative environment with a local team or with remote distributed team. Concurrent access and modification to same software unit is possible. If such modifications cause any conflicts they are resolved during merge process. The repository has been setup using open source software "Apache's subversion control system – SVN (version 1.9.3). A web interface has also been configured in order to browse the repository from anywhere in the campus. In order to work with the repository, the user needs to install one of the following client tools; RapidSVN, TortoiseSVN, Trac etc. RapidSVN and Trac are available for Linux, Mac and Windows platform, while TortoiseSVN is for Microsoft Windows Only.

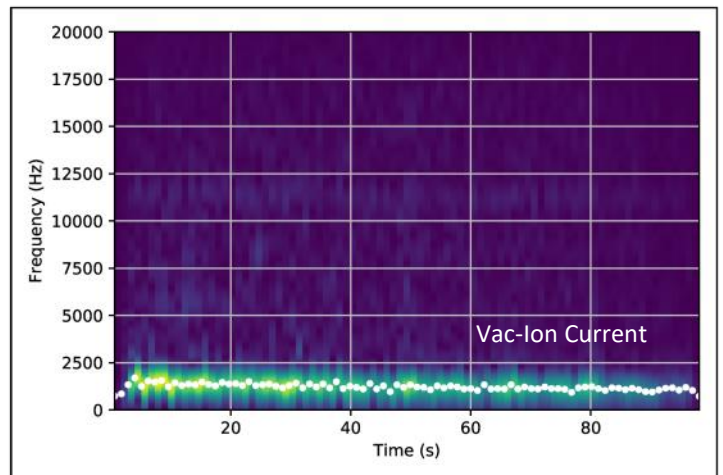
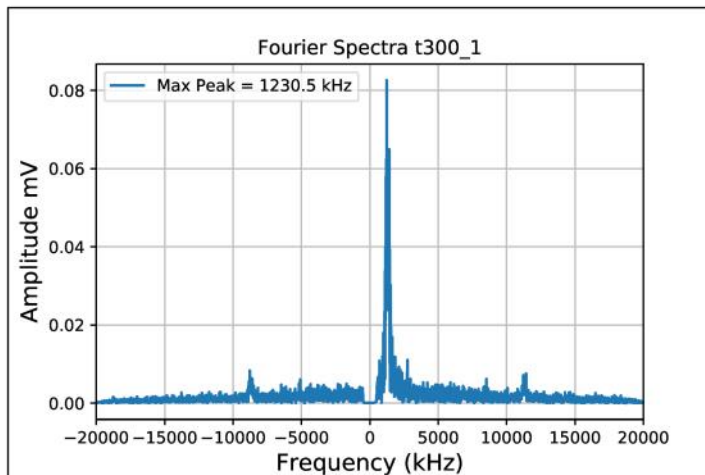
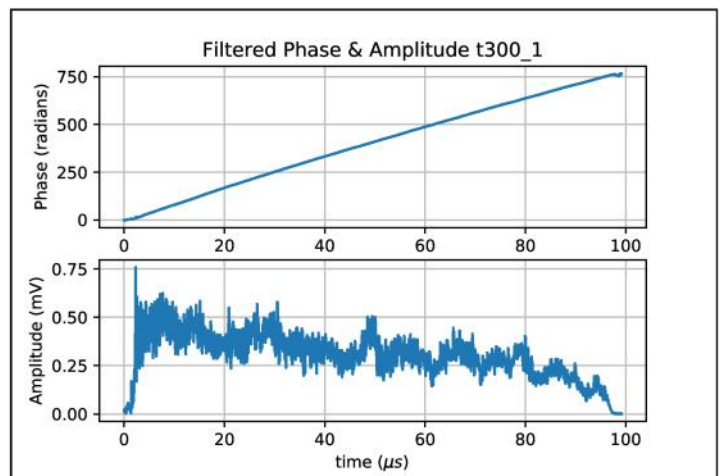
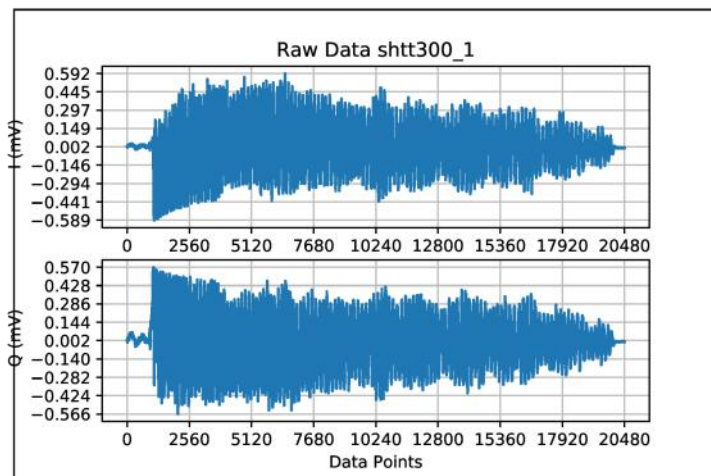
At present the repository is being used for SST-1 central control software and Data acquisition division software. The repository is organized on the basis of projects and credential are defined per project basis. Present SVN installation is on a Desktop PC and it is working as a proof of concept. In order to setup it as IPR wide repository a server class machine with few TB storage and LDAP integration for authentication is needed, which can be setup in coordination with IT team.



Clockwise from TOP : The web interface of the software repository; Option of version comparison ; RapidSVN Interface

A digital signal processing code has been written to analyze the KA-Band reflectometer experimental data. This code was modified significantly during the past month to refactor it to make it more manageable and easier to maintain and update/upgrade. The code has been modified to work irrespective of the operating system namely Windows10 or Linux (Ubuntu 20.04LTS). The complete code is now upgraded to the new and latest version of the Python viz. 3.7.7 from the now unsupported version 2.7. However the most important and major work done was to completely rewrite the code so that it now has only two distinct modules, unlike previous version which has more than four to five modules with significant code/operations repeating itself. New version has a analysis module which takes the user inputs, plots and stores the data while the second function module contains the actual analysis code which is grouped in terms of functions.

The analysis module takes care of the fact that reflectometer data is not continuous for a shot but is divided into multiple sweeps with number of sweeps per shot ranging from 10 to several hundred. An advantage of this method is that it allows flexibility to analyze all or selected sweeps for every shot. An even more important advantage is that addition/deletion of some mathematical operation is simply adding a line in the analysis module without affecting other code and no other code needs to be modified thereafter. The older version of the code generated multiple (e.g. ~ 10 files per sweep) intermediate files to transfer data between the multiple modules, this led to multiple I/O operations slowing down the runtime and cluttering the directory making the actual useful files difficult to find. The newer version now generates only one file per sweep containing all the plots and two other data files. This should lead to significant improvement in runtime because of the drastic reduction in file I/O. The code has been completely tested on both Windows and Ubuntu operating systems for multiple test shots with each shot containing multiple sweeps. We can thus conclude that the newer upgraded version of the reflectometer analysis code to be much more faster and easier to maintain than the previous version.



WHO Recommends The Following Simple Steps To

STAY HOME

STOP
CORONAVIRUS

STAY SAFE

Wash your hands frequently

Maintain social distancing

Avoid touching your eyes, nose and mouth

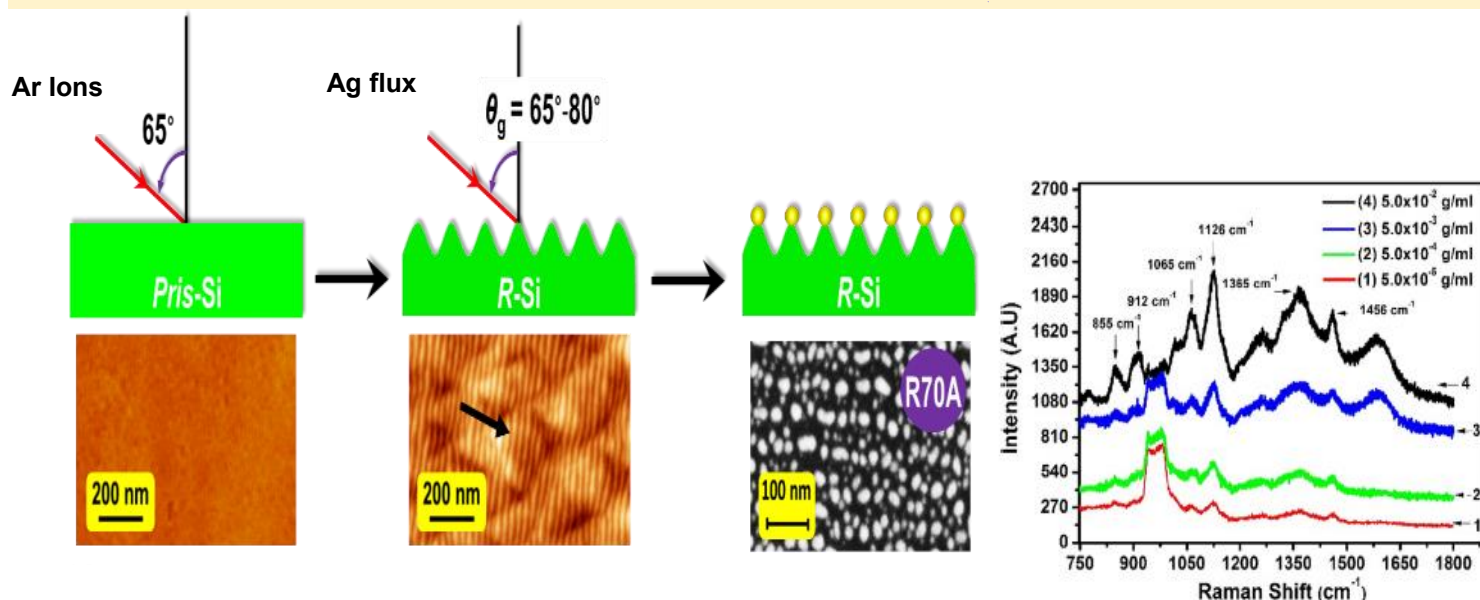
Practice respiratory hygiene

If you have fever, cough and difficulty in breathing, seek medical care early

Stay informed and follow advice given by your healthcare provider

Download and use "Arogya Setu" app of the Government of India to fight the Covid-19 pandemic.

Millions of people around the world are affected by Diabetes which requires frequent monitoring of blood glucose level. Blood glucose levels are monitored by taking blood samples from the patient. So there is an urgent requirement for the development of non-invasive sensing techniques for glucose. Low concentration detection technologies are essential for the development of non-invasive glucose sensors. Noble metal (Gold, Silver) nanoparticles have shown the possibility to detect molecules in very low concentration using the concept of Surface Enhanced Raman Scattering (SERS) spectroscopy. In this method, molecules under investigation are brought in contact to metal nanoparticles of typically 10 - 50 nm in size and standard Raman signal is observed. In the work conducted at FCIPT/IPR, the possibility of detection of glucose having concentration much lower than blood glucose using nanoparticle arrays without using any binder molecule is demonstrated. Diluted Glucose molecules dropped on nanopatterned Si substrate produced by low energy ions and decorated with Ag nanoparticle arrays.



Steps of making arrays of Ag nano-particles on nanopatterned Si surface along with, detected Glucose SERS spectrum for various concentrations.

Precautions Against Covid-19 @ IPR

The MESD Division of IPR has designed and IPR Workshop has fabricated and installed two important gadgets to help prevent spread of Covid-19 in the IPR campus. The first one being foot operated sanitizer dispenser and the other, foot operated door openers for toilet and other doors, were installed at IPR for the benefit of staff coming to office.

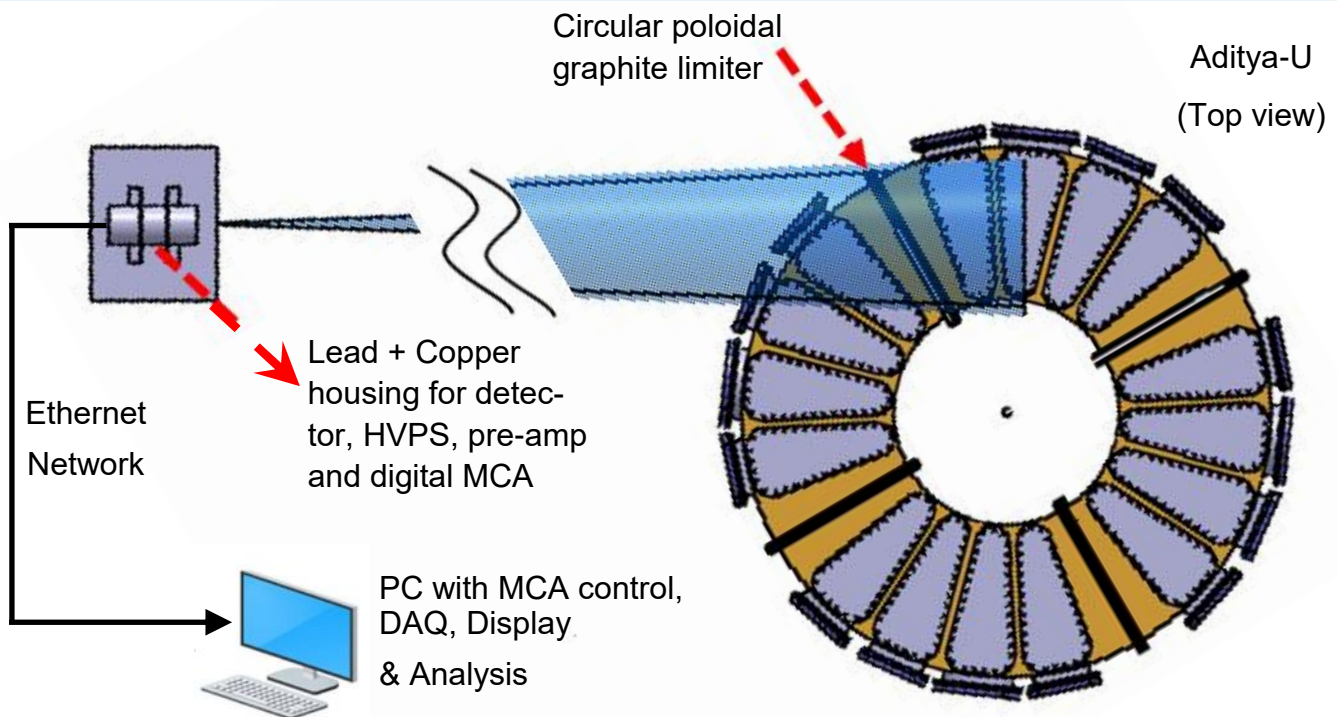


(L & M) The foot operated sanitizer dispenser (R) The foot operated door opener for doors, both designed and implemented by MESD and IPR Workshop.

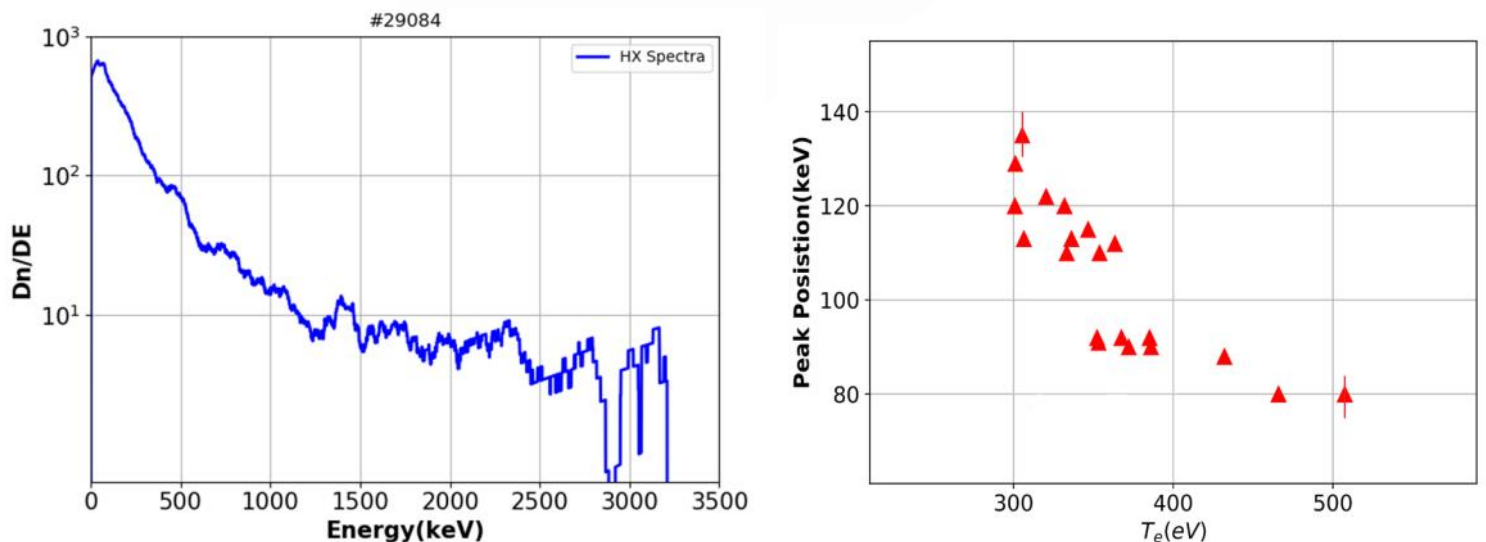
Study of hard X-ray (HX) spectrum is an important tool to understand the runaway electrons (RE) behavior present in the tokamak plasma as these energetic electrons, especially those generated during disruption, represent a major threat to tokamak plasma devices in terms of melting and damaging the plasma-facing component (PFC) and thereby reduced the lifetime of first wall.

A LaBr₃(Ce) detector based spectroscopic diagnostic has been set up on the Aditya tokamak to measure the HX spectrum. This diagnostic consists of a photomultiplier tube and multi-channel analyzer (MCA) along with the detector, viewing the whole plasma tangentially along a line of sight terminating on the limiter. The system has total ~2000 channels covering the energy range of 75 keV to few MeV and spectral resolution of ~19.86keV at 662 keV, which is lowest among the many scintillation based detectors. The typical HX spectra which integrated over the discharge duration. The spectrum has been observed in the energy range of around ~ 75 keV to 3 MeV and is continuum in nature.

The spectra is calibrated in energy as well as photon space. The measured spectrum shows peaks within ~ 85 to 150 keV for the analyzed discharges. The peak position of HX spectra peak height is directly related to the maximum population of HX flux, and subsequently can be approximately attributed to RE population, at a particular energy. The HX spectra peak height exhibits an inversely proportional nature with the plasma thermal temperature. Hence, the lower value of energy at peak height at higher thermal T_e indicates that the plasma is mostly dominated by lower energy RE.

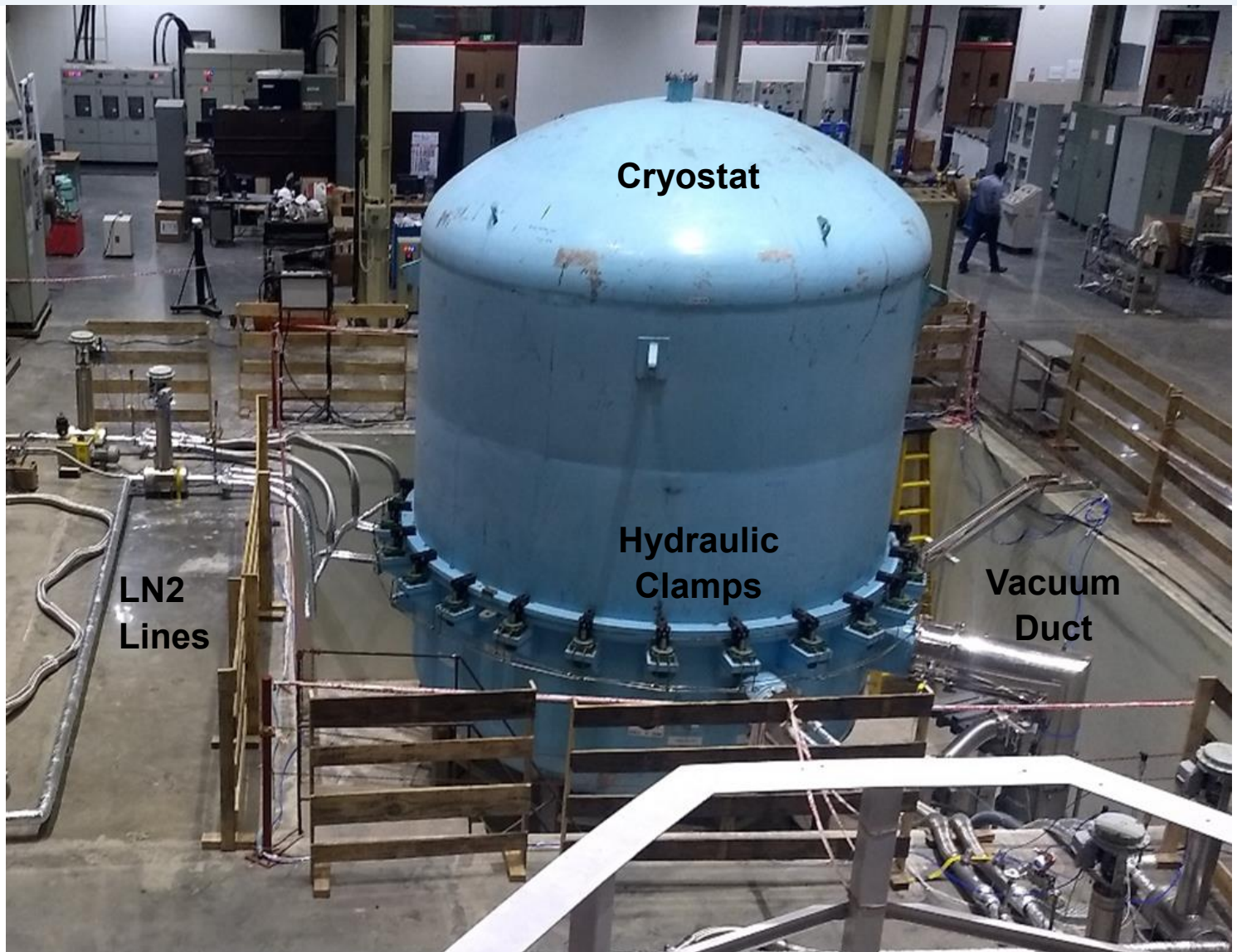


Schematic diagram of the installed HX spectroscopy system at Aditya Tokamak.

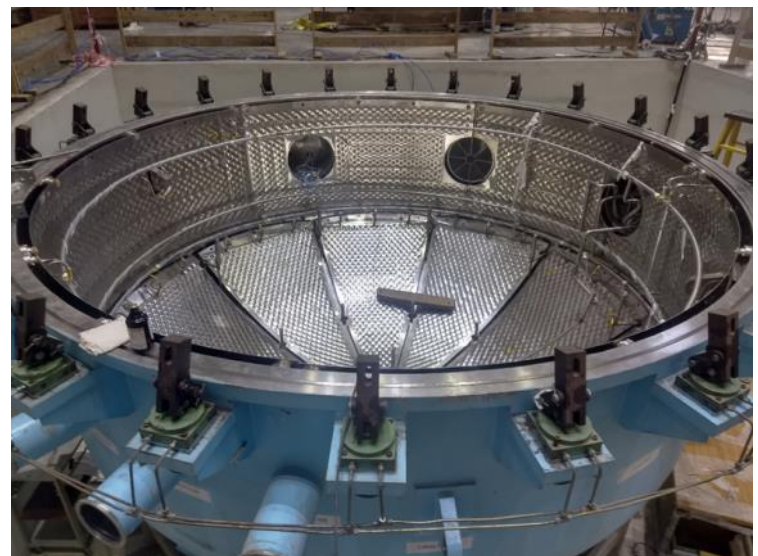
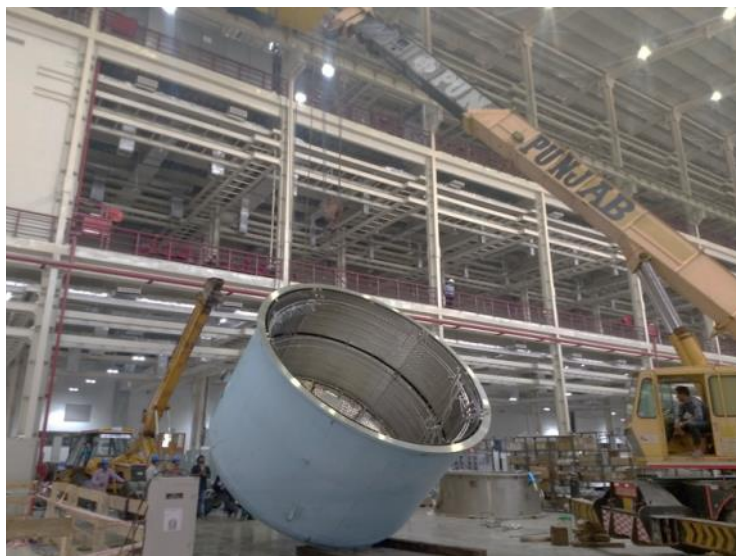


(L) The HX spectra for a typical Aditya discharge (R) The HX spectra peak position as a function of thermal plasma temperature (T_e).

A cryostat for testing the large superconducting magnets having 5 m height and 4 m diameter was recently commissioned by Magnet System Division at IPR. This cryostat has liquid nitrogen cooled thermal shields. The available volume inside the cryostat is around 83 m³ and total weight of the cryostat is around 21 tons. During the commissioning, the cryostat was pumped down to 1.25×10^{-5} Torr and thermal shield was cooled down to ~80 K using liquid nitrogen. The performance of cryostat was found to be as per requirements. This system is now available for testing of large size superconducting magnets relevant to Tokamak and other applications.



The cryostat installed in its position in the new laboratory building

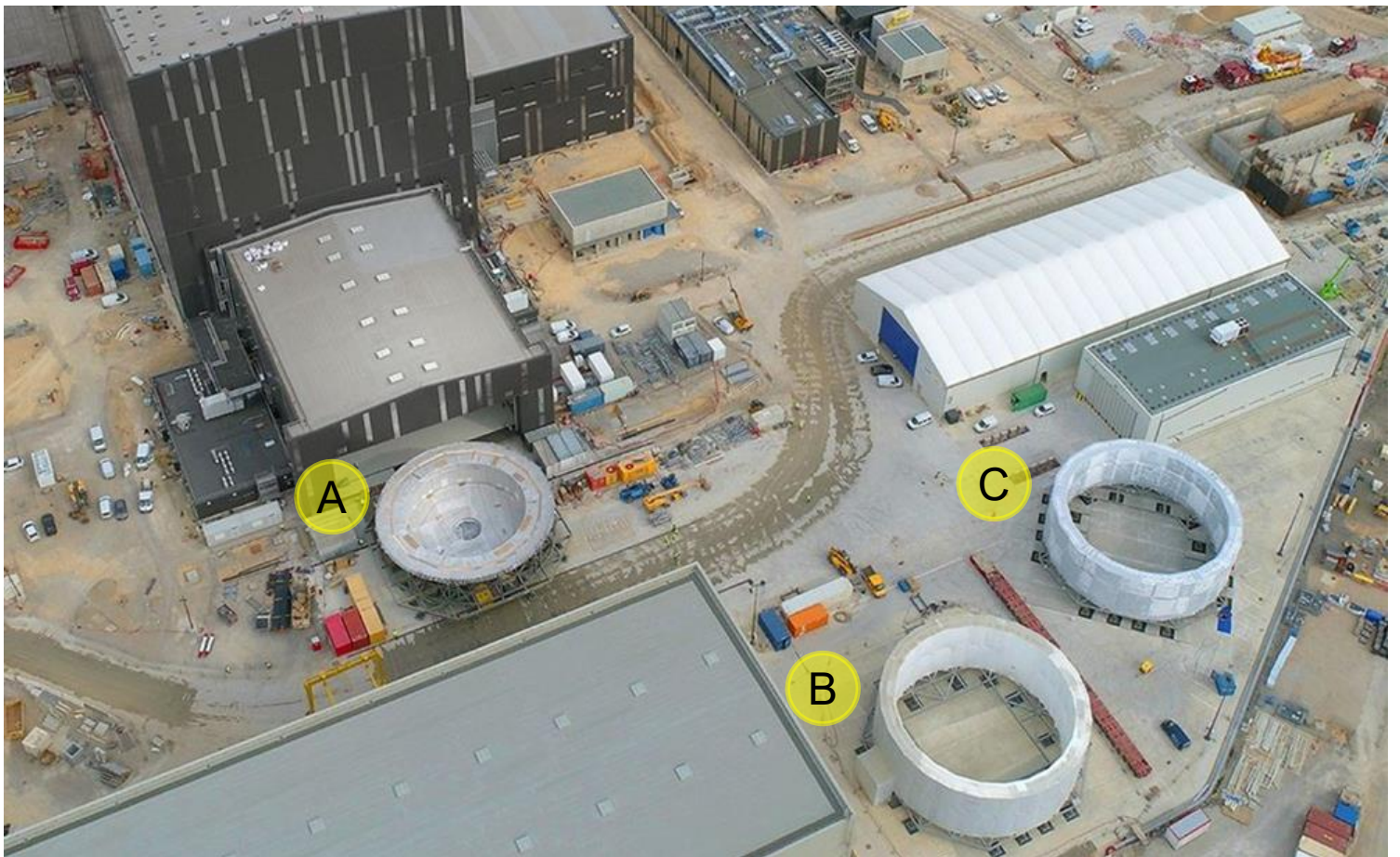


(L) The upper portion of the cryostat being moved into position (R) The bottom portion of the cryostat showing the installed LN2 bubble panel thermal shields.

The Upper Cylinder, one of the four major sections of the Cryostat, weighing nearly 430 tons, has been completely manufactured along with sub-assembly, and handed over to ITER Organization, France. With the completion 3 of 4 sections of the Cryostat viz. Base Section, Lower Cylinder, Upper Cylinder, now the Cryostat manufacturing is 80% complete. The Base Section previously handed over by India to IO, has now been moved into the ITER Assembly Hall, initiating preparations for its installation in the Tokamak pit soon. The Cryostat when fully manufactured and assembled will be the largest vessel of its kind in the world. It is the outer vacuum boundary of the ITER Tokamak.



ITER Cryostat Lower Cylinder completed, wrapped and moved from Cryostat workshop to intermediate storage



Aerial view of ITER site showing 3 of the 4 Cryostat sections, Lower Cylinder (B) and Upper cylinder (C) in intermediate storage to the right and the Base Section (A) being moved into the assembly hall.



WEBINAR - 3

TITLE OF TALK
Plasma and Its Applications

EXPERT
Dr. Mukesh Ranjan

DATE
07.05.2020

TIME
4:30 - 5:30 PM

Dr. Mukesh Ranjan of FCIPT gave a webinar entitled "Plasma and its Application" in a webinar series about Conceptual and Applied Physics, 5-8 May 2020 jointly organized by Department of Physics, School of Science, RK University & Department of Nanoscience & Advanced Materials, Saurashtra University, Rajkot. Students, teachers and people from the industry participated in this webinar.

He also gave a webinar entitled "Plasma for Plasmonics" organized by Amity University on 13 May, 2020 and conducted meetings with PhD and PDF scholars during the lockdown period via video conferencing.

Dr. S. Sunil of LIGO-India gave a live YouTube lecture entitled "Operating Parameters of Laser Interferometer Gravitational wave Observatory (LIGO)" on 24th April 2020. The lecture series was organized by the LIGO-India Education and Public Outreach group under GW@Home – A LIGO-India Initiative: An Online lecture series.

In this lecture, he gave an overview about sources of gravitational waves, the distortion in space time produced by dense astronomical objects, the parameters and the sensitivity required for terrestrial detectors to measure gravitational waves.

His talk can be viewed at ;

<https://www.youtube.com/watch?v=rzC2XU tRZA>



Know Your Colleague



Ms. Falguni A. Shah joined the Institute in 2009. Initially she was looking after Pay and Pension bills, Long Term Advances, Employees Provident Fund Management, Preparation of Statement of Annual Accounts, Statutory compliance which included Income and Service Taxes and Civil and Maintenance related works. Ms. Shah is a certified Pay and Accounts Officer (PAO) for the National Pension System (NPS) regulated by Pension Fund Regulatory and Development Authority (PFRDA). She is also a Fellow member of The Chartered Accountants of India, New Delhi. She has been extending her expertise in various matters related to the Commercial terms of Purchase orders, Annual Maintenance Contracts, Memorandum of Understanding with different Institutes in terms of technology transfer and various other matters. She is also an active member of the IPR Hindi Committee and has been instrumental in making Tally software, etc. in Hindi. Ms. Shah is supervising the Accounts Section and has been designated as Head, Accounts Section. She has been looking after taxation matters, budgeting and CPP-IPR books of Accounts.

Mr. Nilaykumar M Adhvaryu joined IPR in 2010 as Assistant Accounts Officer. He has been looking after payments and contractual obligations of IPR, most particularly that of AMC and Administration related contracts. He also handles the payments related to all externally funded projects related payments and urgent purchase portfolio are the two among those allied activities taken care of by him. With the introduction of GST in 2017, GST related matter is handled by him. He has been provided the assignment of Registration of vendors/suppliers/service providers for E-payments. Invoicing of services provided by FCIPT towards experimental set-up and invoicing of various MoUS' and Agreements entered into by IPR is also looked after by him.



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