



# R&D Newsletter

INDIAN INSTITUTE OF TECHNOLOGY KANPUR

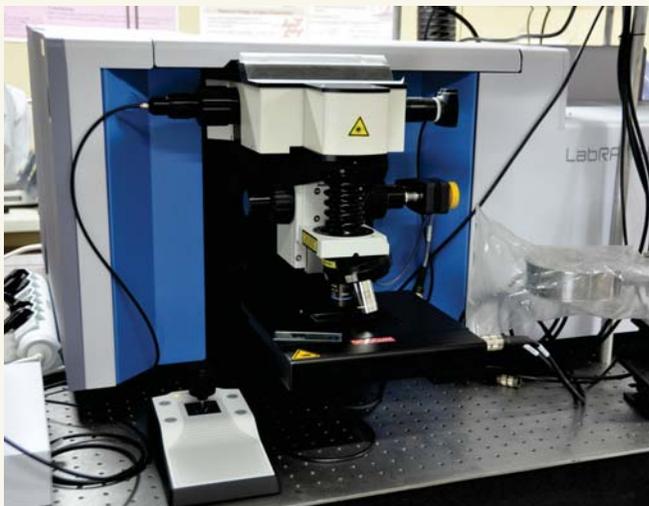
Special issue on   
Advanced Research Equipment   
procured under CARE Scheme of IIT Kanpur 



## LabRam HR 800 Raman Spectrometer

Procurement Year 2014-2015

This spectrometer is suitable for both micro and macro measurements, and offers advanced confocal Raman imaging capabilities in 2D and 3D. Spectrally, the high resolution spectrometer allows subtle sample information such as crystallinity, polymorphism, strain and other band analysis. This combines simple access to very low frequencies down to  $10\text{cm}^{-1}$  with a high throughput single stage spectrometer, using the ultra-low frequency module (ULF). The new generation of notch and bandpass filters allows additional sample characterization to be made in a spectral region rarely available with other basic spectrometers. The spectrometer is also equipped with mapping capabilities.



### Location

Laboratory for Spectroscopy  
at Extreme Conditions  
(ACMS 107)

### Contact

Prof. Rajeev Gupta  
[guptaraj@iitk.ac.in](mailto:guptaraj@iitk.ac.in)

### User Charges

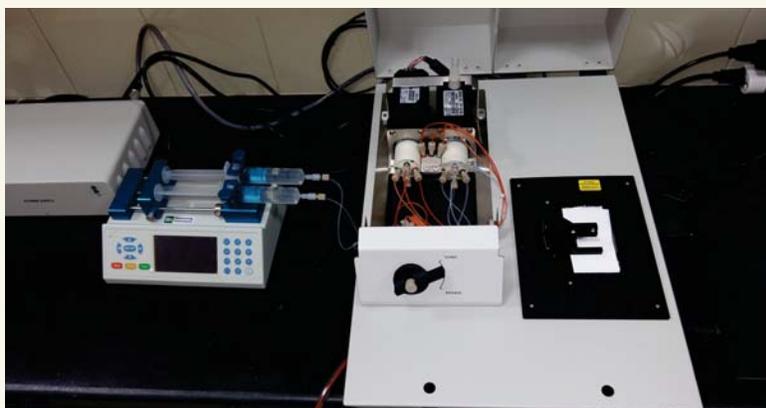
(per sample)  
Rs. 750 (for internal users)  
Rs. 1000 (for outside IITK  
users)

(Service Tax is applicable for outside  
IITK users)

## Surface Plasmon Resonance (SPR) Spectrometer

Procurement Year 2014-2015

Surface plasmon resonance (SPR) spectroscopy is a powerful, label-free technique to monitor noncovalent molecular interactions in real time and in a noninvasive fashion. It has, in particular, proven to be a powerful approach for the determination of kinetic parameters (association and dissociation rate constants) as well as thermodynamic parameters, including affinity constants of interacting molecular partners without the requirement of tagging one of the two partners.



### Location

Southern Lab -213

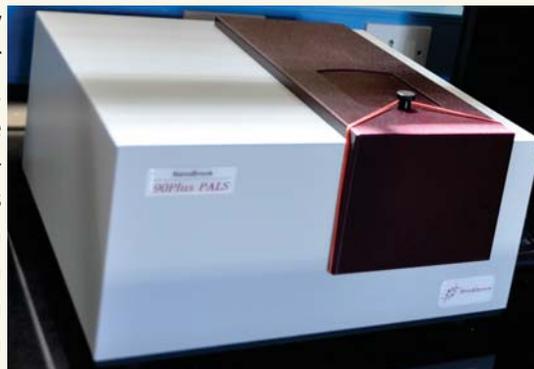
### Contact

Prof. Manabendra Chandra  
[mchandra@iitk.ac.in](mailto:mchandra@iitk.ac.in)

## Dynamic Light Scattering Particle Size and Zeta Potential Analyzer

Procurement Year 2014-2015

The DLS Particle Size and Zeta Potential Analyzer is a user-friendly system for colloidal, nanoparticulate and macromolecular characterization. It can determine particle size distribution, particle zeta potential (related to the magnitude of the electrical charge at the particle surface) and molecular weight of large polymeric substances dispersed in water. The significance of zeta potential is that its value can be related to the stability of colloidal dispersions (e.g., a multivitamin syrup). The zeta potential indicates the degree of repulsion between adjacent, similarly charged particles (e.g., the vitamins) in a dispersion. For molecules and particles that are small enough, a high zeta potential will confer stability, i.e., the solution or dispersion will resist aggregation. When the potential is low, attraction exceeds repulsion and the dispersion will break and flocculate. Dynamic Light Scattering (DLS) principle can be used to determine the size distribution profile of small particles in suspension or polymers in solution. It can also be used to probe the behaviour of complex fluids such as concentrated polymer solutions.



### Capabilities

- Particle Size and Molecular Size: It can measure size between 0.3 nm to 6  $\mu\text{m}$  with a minimum volume 10  $\mu\text{L}$  of sample suspension. It claims an accuracy of  $\pm 2\%$  with a precision of  $\pm 1\%$ .
- Zeta Potential: It can measure wide range of zeta potentials for particles in the size range 1 nm – 100  $\mu\text{m}$ , depending on the type of sample. Minimum sample volume required is 175  $\mu\text{L}$ . It claims an accuracy of 0.12  $\mu\text{m}\cdot\text{cm}/\text{V}\cdot\text{s}$  and a sensitivity of 10 mg/mL (BSA). It can analyse a wide range of suspension concentrations (0.1 ppm to 40% v/v depending on the sample type).
- Molecular Weight of polymers dispersed in solution: On a sample volume of 10-40  $\mu\text{L}$ , the instrument can determine a range between 1kDa to 25 MDa. Accuracy  $< \pm 10\%$

### Location

CESE 108

### Contact

Prof. Abhas Singh  
[abhas@iitk.ac.in](mailto:abhas@iitk.ac.in)

## Universal Measurement Spectrophotometer

Procurement Year 2014-2015

With this single instrument, the various measurements such as UV/Vis-NIR absorbance, fluorescence, absolute specular reflectance, transmission and scattering at a wide range of angles and different polarizations, and diffused reflectance can be performed. Some of the measurements are unique, for example, variable angle absolute specular reflectance, diffuse scattering, glossy scattering, direct transmission, scattered transmission and partial scattered transmission. The equipment can be used in scientific research related to materials, petrochemicals, energy, food, biotechnology and coating technology.



### Location

CL 201D

### Contact

Prof. Nishith Verma  
[nishith@iitk.ac.in](mailto:nishith@iitk.ac.in)

## Visisonics Real Space Audio Camera

Procurement Year 2014-2015

**V**isisonics RealSpace 5/64 Audio/Visual Panoramic Camera is a self-contained 64-channel spherical microphone array together with 5 internal HD video cameras that provide seamless panoramic frame synchronized real time audio and video. It is extensively used for sound source localization, noise visualization, noise source identification, Audio/Visual analysis, recording of meetings and Audio/Visual tracking.

### Capabilities

- Time synchronized 64 channel audio measurements simultaneously in .wav audio format.
- Time synchronized video recordings using 5 HD cameras in .avi video format.
- 360° panoramic display.
- Noise visualization using Audio-Visual Scenes.
- Generates a video of acoustic energy intensity in a frequency band
- Real time beamforming.
- Order tracking and coupled acoustic visualization.



### Location

MiPS Lab, ACES - 203  
Dept. of Electrical Engineering

### Contact

Prof. Rajesh Hedge  
[rhegde@iitk.ac.in](mailto:rhegde@iitk.ac.in)  
[csreddy@iitk.ac.in](mailto:csreddy@iitk.ac.in)

### More Info Available @

<http://202.3.77.107/mips>

## Multi - Channel hdEEG g-tech Setup

Procurement Year 2014-2015

**g**.®Hlamp is g.tec's multi-channel high-end biosignal amplifier with USB technology. The device allows the acquisition of up to 256 biosignal channels such as EEG (Electroencephalogram), EOG (Electrooculogram), EMG (Electromyogram) and ECG (Electrocardiogram) with 24 bit. The sampling frequency can be set up to 38400 Hz. In addition to the above the device also has skin temperature sensor, GSR sensor to measure electro-dermal activity.



### Location

Western Lab 216B  
Dept. of Electrical Engineering

### Contact

Mr. Uday Majumdar  
[uday@iitk.ac.in](mailto:uday@iitk.ac.in)

Mr. Tharun Reddy  
[Tharun@iitk.ac.in](mailto:Tharun@iitk.ac.in)

Mr. Ashish Gupta  
[ashish.gupta.iitkgp@gmail.com](mailto:ashish.gupta.iitkgp@gmail.com)

# High Intensity Solar Simulator with Quantum Efficiency Measurement Capability

Procurement Year 2013-2014

## OAI TriSOL Solar Simulator

**A** Solar Simulator is a light source that approximates the illumination of natural sunlight. Solar simulators with various tailored spectral output are used to test a variety of samples including but not limited to solar cells, materials photo-stability, and other samples (in-vivo or in-vitro) under controlled, repeatable, laboratory conditions. OAI Solar Simulator is certified for Class AAA performance having aperture sizes of 156 mm × 156 mm for 0-4 SUNS with long working distance (~22 inches). It has CPVLD50 adaptor light pipe for 20 SUNS (aperture size: 45 mm × 45 mm) and 50 SUNS (aperture size: 25.4 mm × 25.4 mm) measurement (working distance of ~2 mm). The equipment uses I-V-Rider software which record I-V data in both forward and reverse sweep directions. It also allows calculation of various solar cell parameters such as short circuit current ( $I_{sc}$ ), short circuit current density ( $J_{sc}$ ), open circuit voltage ( $V_{oc}$ ), maximum voltage ( $V_{max}$ ), maximum current ( $I_{max}$ ), maximum power ( $P_{max}$ ), cell efficiency, series resistance ( $R_s$ ) and shunt resistance ( $R_{sh}$ ).



### Location

Room No. 120  
CESE (Center for Environmental  
Science and Engineering)

## Quantum Efficiency Measurement System

**Q**uantum efficiency (QE) and Incident Photon to Charge Carrier Efficiency (IPCE) indicates the ratio of the number of photons incident on a solar cell to the number of generated charge carriers. Oriel Instrument's IQE-200 series system measures the External Quantum Efficiency (EQE) and Internal Quantum Efficiency (IQE) of solar cells, detectors, or other photon-current devices. It covers the spectral ranges of 300 – 1100 nm and 300 – 1800 nm, for both AC and DC operation.

### Location

LAB 303,  
Northern Lab -II

### Contact

Prof. Raju Kumar Gupta  
[guptark@iitk.ac.in](mailto:guptark@iitk.ac.in)

Mr. Rahul Ranjan  
[rranjan@iitk.ac.in](mailto:rranjan@iitk.ac.in)



## Laser Scanning Confocal Microscope with Optical Trapping

Procurement Year 2013-2014

The main equipment consists of Zeiss AxioObserver Z1 inverted research microscope and Zeiss LSM710 confocal scan head. Currently, we have Plan Apochromat 20X/0.80NA, 63X/1.40NA objectives with DIC accessories and 1.4 mega pixel CCD camera. The microscope has the following excitation lasers:

- Multiline Argon 458/488/514 nm - 25mW
- HeNe 543 nm - 1.2mW
- HeNe 633 nm - 5mW
- Diode 405nm - 30mW

In addition, we are in the process of acquiring an optical trapping system with 1064nm trap laser from Elliott Scientific. The trapping system will be integrated with the microscope. The expected date of the installation of the trapping unit is December 2015.



### Location

Himanshu Hatwal Nonlinear Mechanics Laboratory in NLEX (Northern Laboratory I)

### Contact

Prof. Sovan Das  
sovandas@iitk.ac.in

### Charges

INR 500 (per session)  
(Service Tax is applicable for outside IITK users)

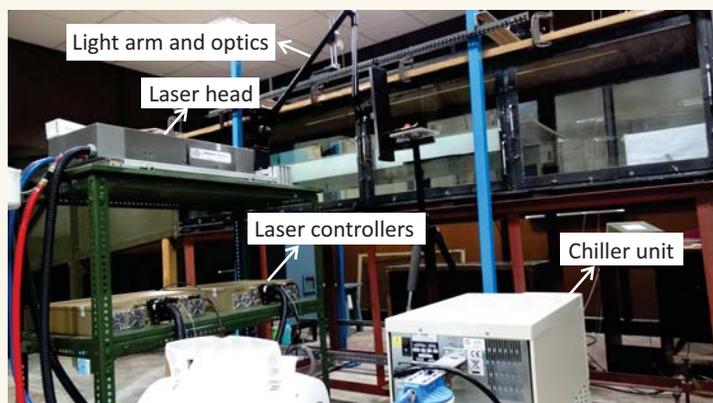
### More Info Available @

<http://web.iitk.ac.in/cmma/cmma/newmachines>

## High Frequency Nd:YLF laser for TR-PIV Measurements

Procurement Year 2013-2014

The laser unit is a dual head diode-pumped laser. The laser head is designed on a monolithic platform. Its energy per pulse is 30 mJ at 1kHz repetition rate, and the duration of a pulse is about 170 ns. The beam diameter is approximately 5 mm. The whole laser unit comprises of a chiller unit for cooling the laser head, two laser controllers, light arm and light sheet optics. This instrument is synchronized with a high frequency double exposure camera for time-resolved particle image velocimetry measurements in a fluid flow.



### Location

Low-speed Aerodynamics Laboratory, Dept. of Aerospace Engineering

### Contact

Prof. A.C. Mandal  
alakeshm@iitk.ac.in  
Mr. Abhinath Kumar Yadav  
abhinath@iitk.ac.in

This engine has an open ECU which can be programmed depending on the type of experiments to be performed. Spark timing, fuel injection timing can be varied with the help of this ECU. The engine has higher efficiency and higher power output because it can work in both stratified mode and homogeneous charge mode. This GDI engine can be operated in thermal head and optical head. Optical investigation can also be performed within this engine using different optical diagnostic technique such as Phase Doppler Interferometry (PDI), and Time resolved Particle Imaging velocimetry (PIV).

This engine is 500 cc, Bore: 86 mm, Stroke: 86 mm, Compression Ratio: 10.5:1, Maximum power:10 KW@3000 RPM, Maximum torque 32NM @ 3000rpm.

### Location

Engine Research Laboratory,  
Workshop complex

### Contact

Mr. Nikhil Sharma  
[snikhil@iitk.ac.in](mailto:snikhil@iitk.ac.in)



This is a confocal thin-film deposition tool in sputter-up configuration, equipped with three RF/DC magnetron guns. Dielectric materials such as  $\text{SiO}_2$ ,  $\text{TiO}_2$ ,  $\text{ZnO}$ ,  $\text{Al}_2\text{O}_3$ , and metal films such as Au, Ag, Pt, Cu and Zn can be deposited. Target to substrate distance is adjustable to achieve desired uniformity and deposition rate. The system can process wafers up to 2" in diameter. With its multi-gun capability, co-sputtering, sequential sputtering and reactive sputtering (with active gas mixtures) are possible.

### Location

Southern laboratory 116  
(ground floor)

### Contact

Prof. R.Vijaya  
[rvijaya@iitk.ac.in](mailto:rvijaya@iitk.ac.in)

### More Info Available @

<http://www.iitk.ac.in/celt/CELT/Magnetron%20Sputtering/index.html>



## Capabilities

Characterization of porous materials and gas sorption analysis:

- To determine BET or Langmuir surface areas
- Pore size analysis
- Total pore volume and average pore radius
- Physisorption isotherms with the N<sub>2</sub>, H<sub>2</sub>, Ar and CO<sub>2</sub> gases

## User Charges

BET surface area analysis (For 12 hrs. slot)

IITK Users: INR 1000

Non-IITK Users: INR 2000

Physisorption isotherms (For 12 hrs. slot)

IITK Users: INR 2000

Non-IITK Users: INR 3000

(Service Tax is applicable for outside IITK users)



## Quantachrome High Pressure Gas Sorption Analyzer

It is a volumetric gas sorption analyzer for performing gas sorption analysis (adsorption, adsorption-desorption and formation or decomposition of hydrides in analytes) of porous solids or powders up to 0-100 bar with H<sub>2</sub> and CO<sub>2</sub> gases.



## Location

Old Core Lab - 204A  
Department of Chemistry

## Contact

Prof. J.N. Moorthy  
[moorthy@iitk.ac.in](mailto:moorthy@iitk.ac.in)

## User Charges

High pressure gas absorption  
isotherms (For 12 hrs. slot)

IITK Users: INR 3000

Non-IITK Users: INR 5000

(Service Tax is applicable for  
outside IITK users)

## Feedback/Suggestions

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[chitrab@iitk.ac.in](mailto:chitrab@iitk.ac.in)

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