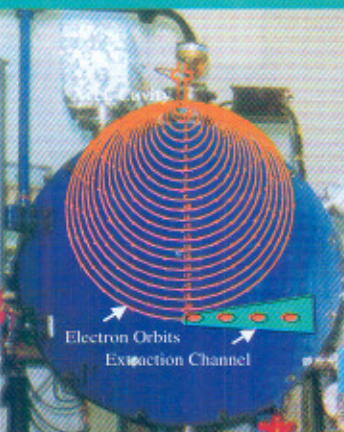



## SOME HIGHLIGHTS OF THE R&D ACCOMPLISHMENTS OF THE CENTRE

### 20 MeV Microtron

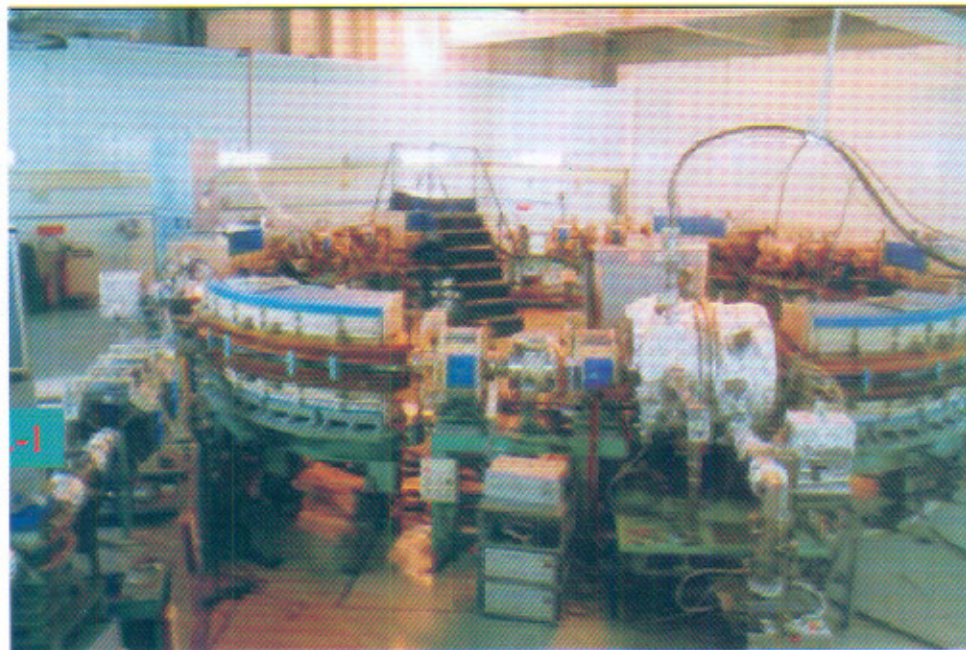


Electron Orbits  
Extraction Channel

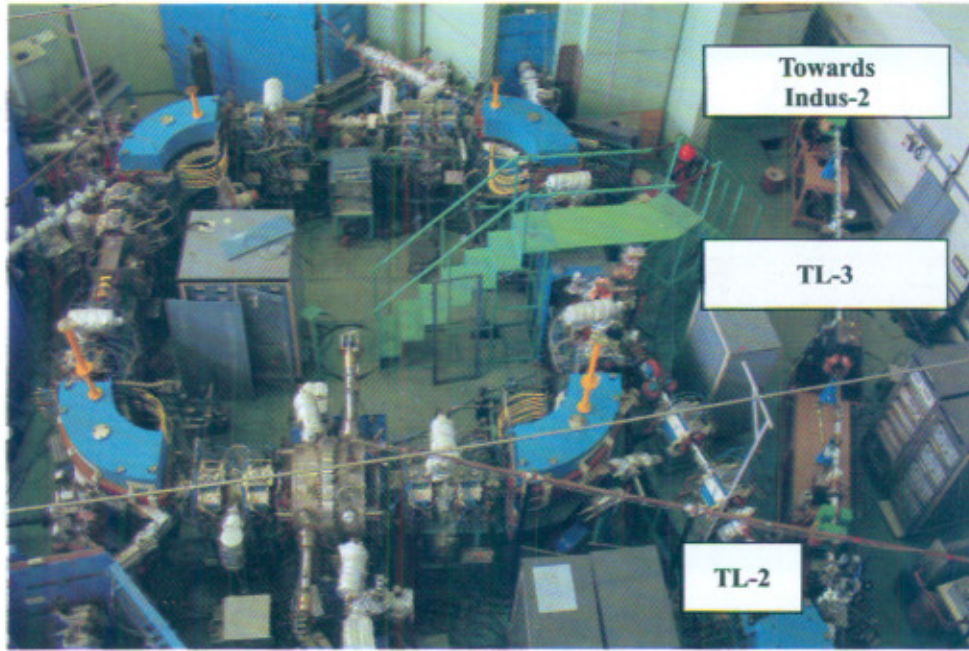
Beam Energy	: 20 MeV
Energy Spread (FWHM)	: 6.2 %
Beam Emittance (Hori/Vert)	: $1 \times 10^{-9} \times 10^{-9}$ mrad
Pulse Current	: 20 nA
Pulse Duration	: 1-2 nsec
Pulse Repetition Rate	: 1-3 Hz
Number of Orbits	: 22
Magnetic Field Strength	: 2836 G
Magnet Diameter	: 1370 mm
Weight of Magnet Assembly	: 2081 Kg
Microwave Source	: Klystron, Varian make
Power of Microwave Source	: 5.0 MW
Frequency	: 2856 MHz
Voltage Developed in Cavity	: 980 kV



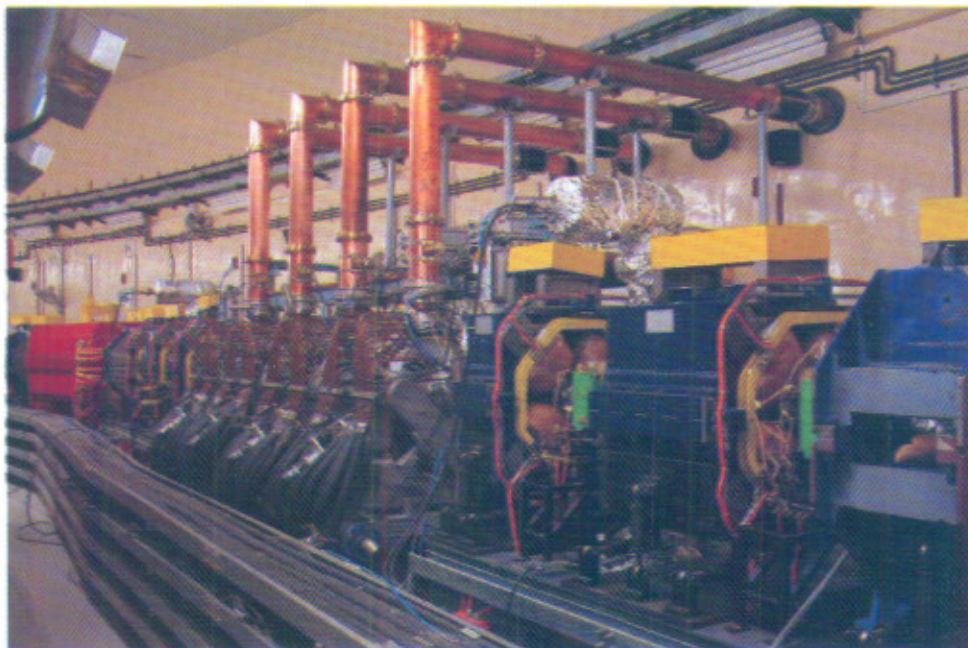
*Microtron (20 MeV electron accelerator) used as pre-injector to booster synchrotron*



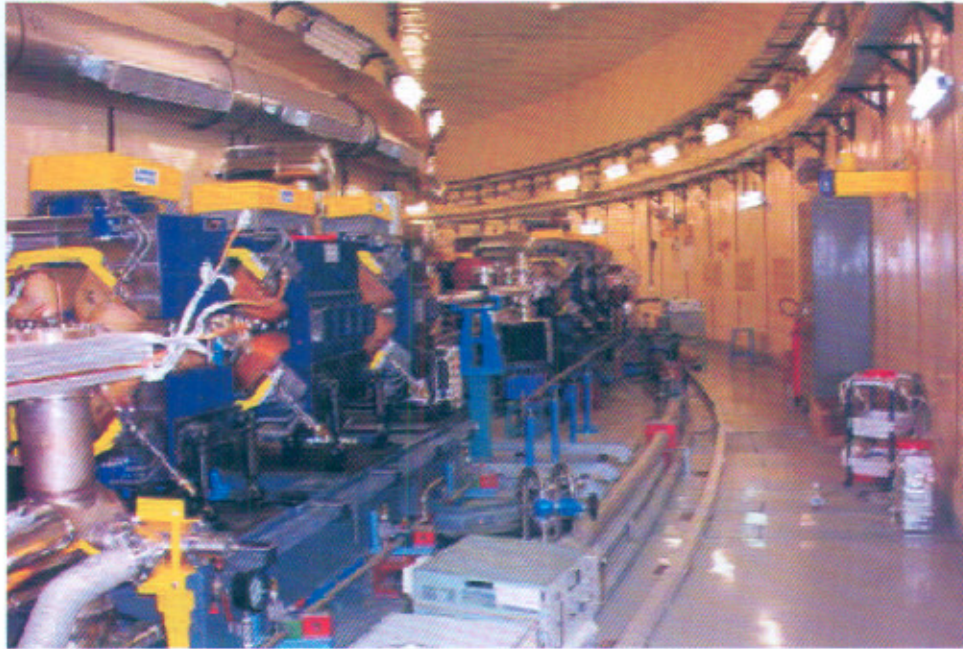
*700 MeV booster synchrotron used as injector for Indus-1 and Indus-2 electron storage rings*



*Indus-1 storage ring, TL-2 and TL-3*



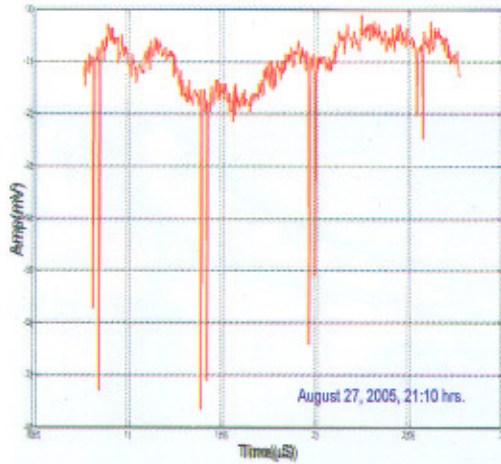
*RF cavities installed in the Indus-2 storage ring*



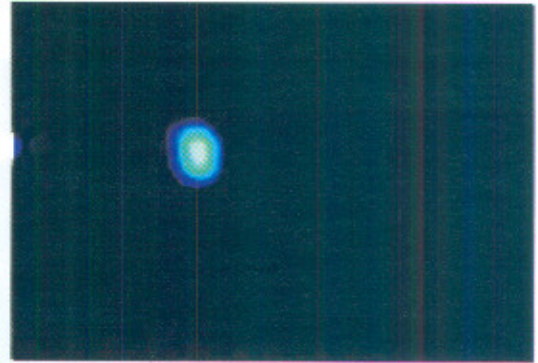
*One of the five long straight sections of Indus-2 for adding insertion devices*



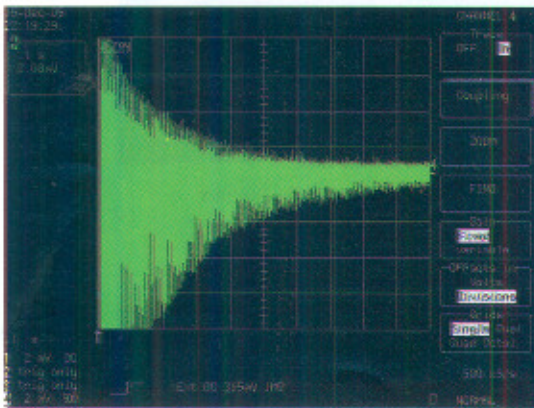
*The common control room for Indus-1 and Indus-2*



*Four-turn circulation of electron beam in the Indus-2 recorded on August 27, 2005*



*First synchrotron light out of Indus-2 recorded on December 2, 2005*



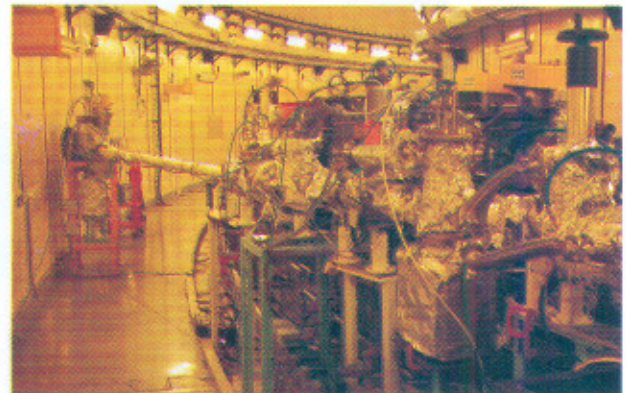
*Beam circulation up to 1 second seen on wall current monitor on December 15, 2005*



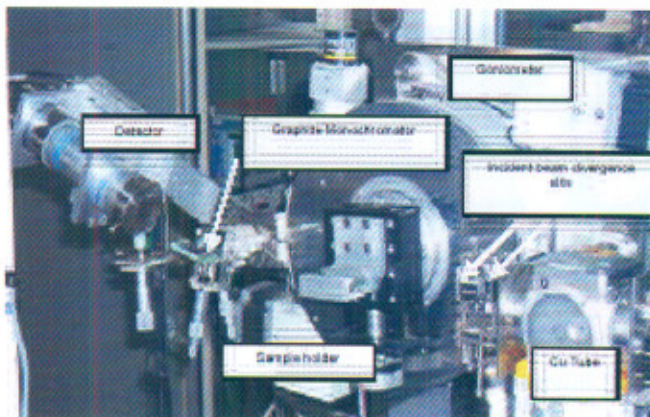
*Soft x-ray reflectometer beamline on Indus-1*



*Assembly of High Resolution X-Ray Diffraction Beam Line (BL-12) in Indus-2 Experimental Hall*



*One of the front ends installed on a bending magnet beamline on Indus-2*



*Hard x-ray reflectometer for surface interface studies and testing of x-ray optics*



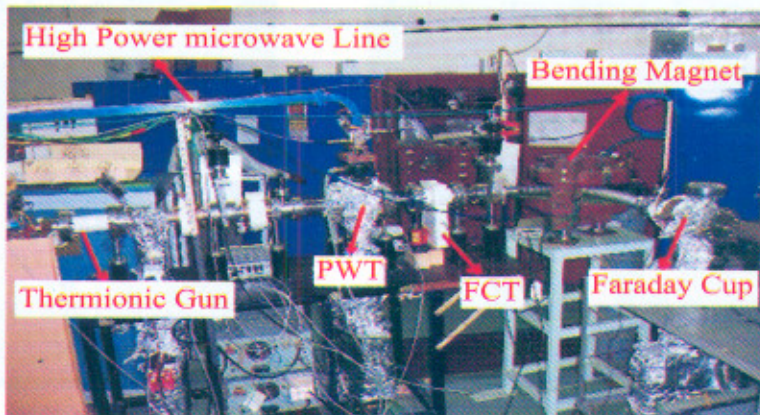
*Ultra high vacuum electron beam evaporation system for fabricating x-ray mirrors*



*750 keV, 20 kW DC accelerator for surface irradiation of agriculture products and radiation processing application*



*10 MeV, 10 kW LINAC for radiation processing application*



*Set up showing electron acceleration using PWT LINAC*



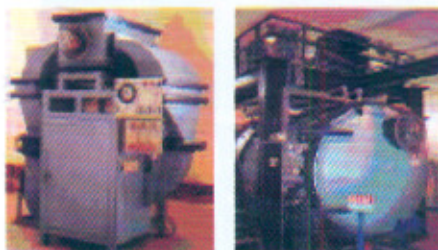
*Microtron set up at Mangalore University (1995)*



*Closed cycle cryocooler capable of producing a temperature of 10K-30K*



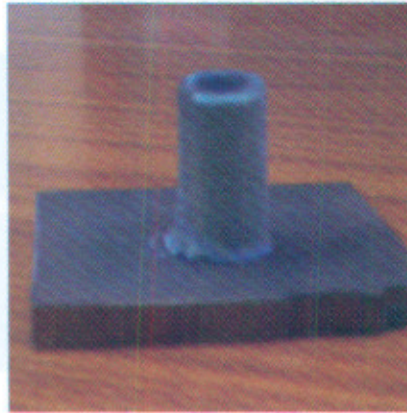
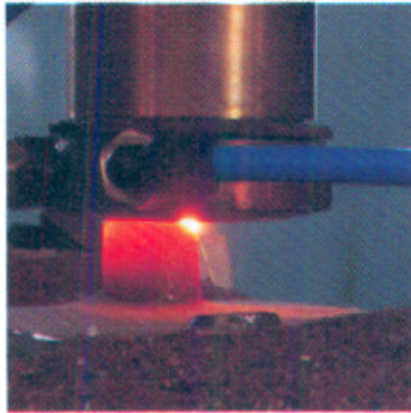
*Turbo molecular pumps (150l/s) and its various parts*



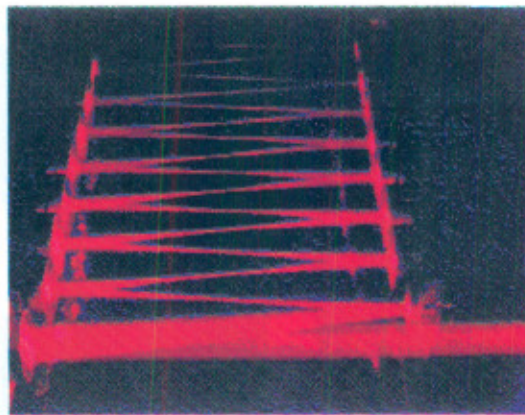
*High power CO<sub>2</sub> (5-20 kW) lasers for various Industrial applications*



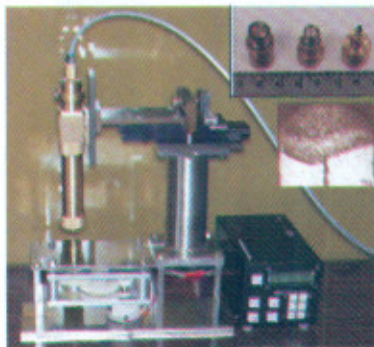
*Laser welded automobile transmission gear assemblies*



*Rapid manufacturing using CO<sub>2</sub> laser*



*Multi-pass set up for isotopic enrichment of C-13 using carbon dioxide laser. The arrangement gives nearly doubly efficient photon utilization*



*Brachytherapy Capsule welding workstation commissioned at Board of Radiation isotope & Technology*



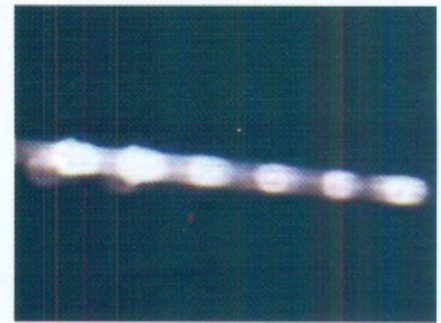
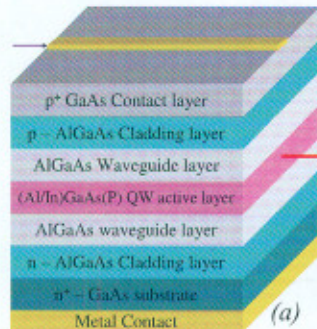
*Cross section of weld-ment*



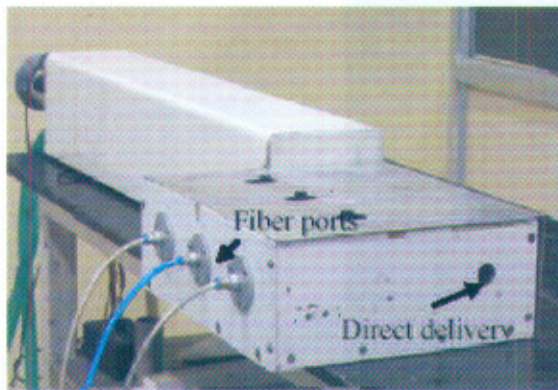
*Welded capsule*



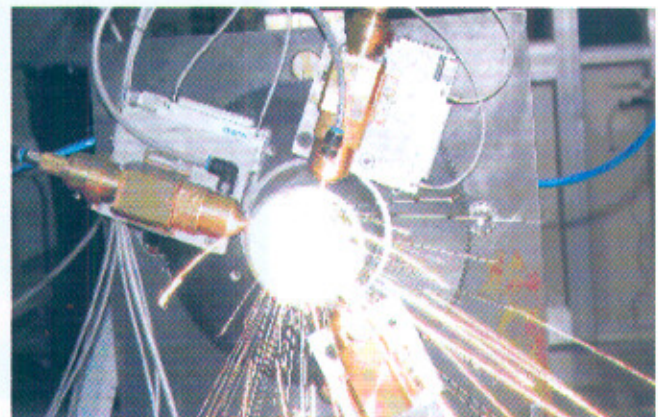
*MOVPE set up being used for making semiconductor laser diode*



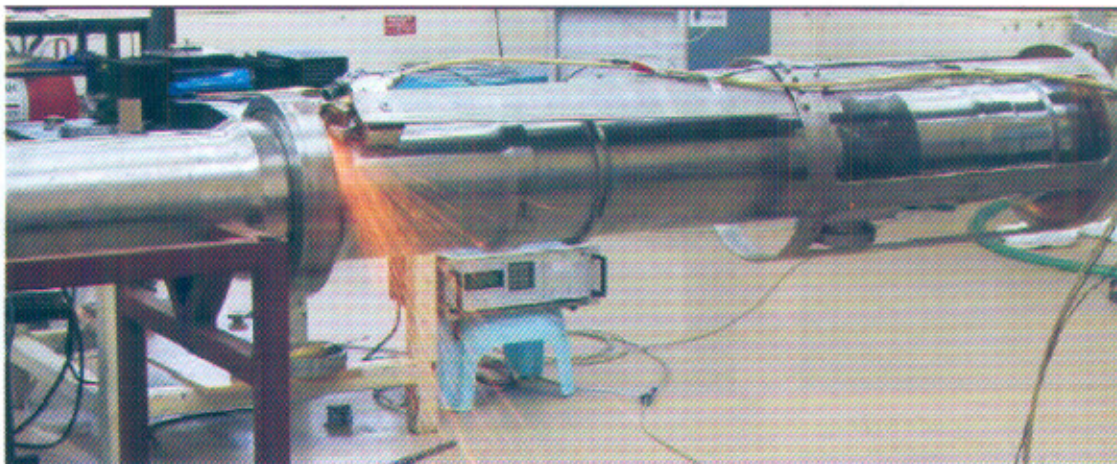
*Schematic of a typical diode layered structure (a), and emission from an array with 6 stripes (b). Each spot is emission from an individual stripe*



*Industrial Nd:YAG laser with time-shared fiber-optic beam delivery commissioned at Narora and Tarapur Atomic Power Stations*

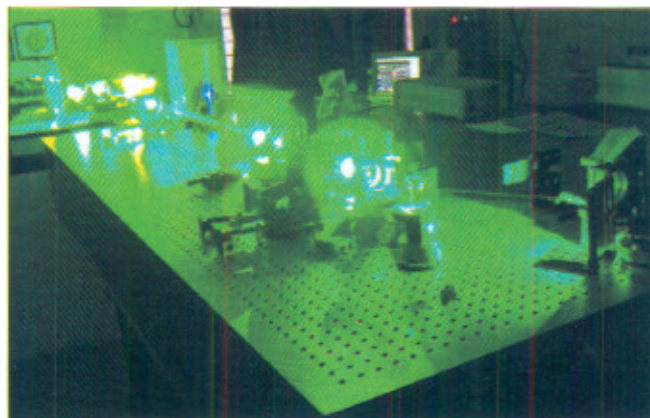


*Laser based cutting of pressure tubes removed from Madras Atomic Power Plant for easy storage*



*Laser based cutting and welding demo for bellow-lips in Pressurised Heavy Water Reactor coolant channel*





*Second harmonic generation of copper vapour laser*



*Laser uranium analyser for trace elemental detection of uranium*



*Miniature N<sub>2</sub> laser for medical application*



*Laser developed to weld pacemaker*



*Surgical carbon dioxide laser*

## Laser photo-coagulator for treatment of diabetic retinopathy

### Diode-pumped frequency doubled Nd:YVO<sub>4</sub> system

Power : 0-1000mW in steps of 10mW  
 Wavelength : Green 532nm  
 Mode : True CW / Foot-switch operated  
 Pulse duration : 50ms to 1000ms  
 Repeat interval : Variable (<50% duty)  
 Cooling : Forced air  
 Aiming Laser : 650nm, diode laser, <1mW  
 Display : Graphical LCD screen, Portable



In Sep 2005, one Prototype unit has been supplied to M/S Aravind Eye Hospitals, Madurai, under an MoU. Clinical trials are on using this unit.

### Diagnosis of Malaria Using Rotation of RBCs in Hyper-tonic Solution Upon Illumination with Laser Beam

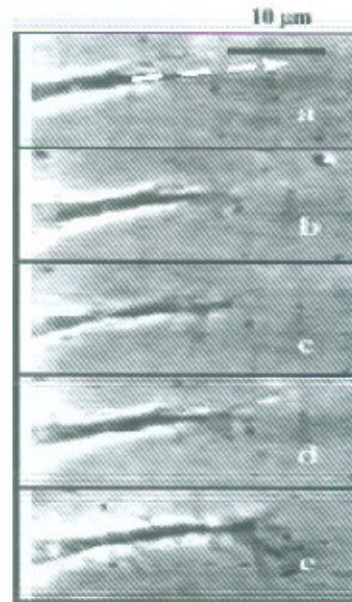


**Normal RBC cells rotate rapidly**

**Malaria-infected cells rotate slowly**

Analysis of cells in a micro-flow

Advantage - Very Sensitive in Detection



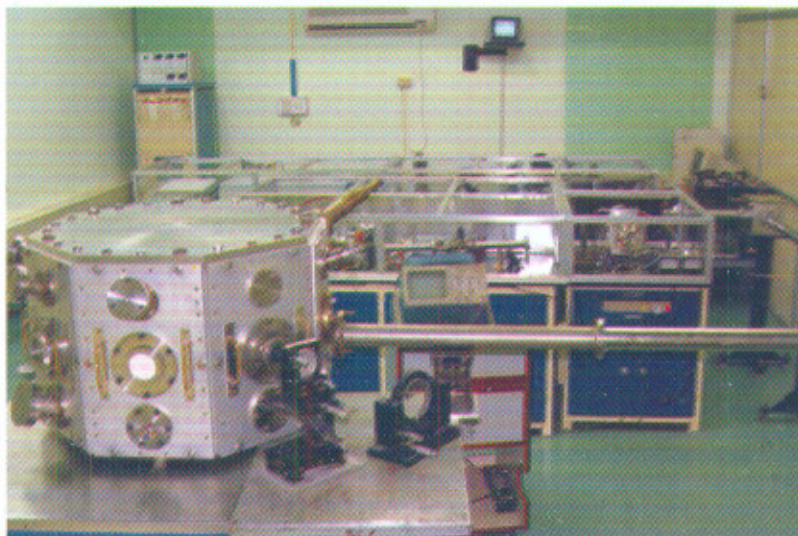
Enhancement of the rate of growth of neuronal growth cones using asymmetric gradient force line optical tweezers



Diagnosis of cancer of the oral cavity using laser induced fluorescence



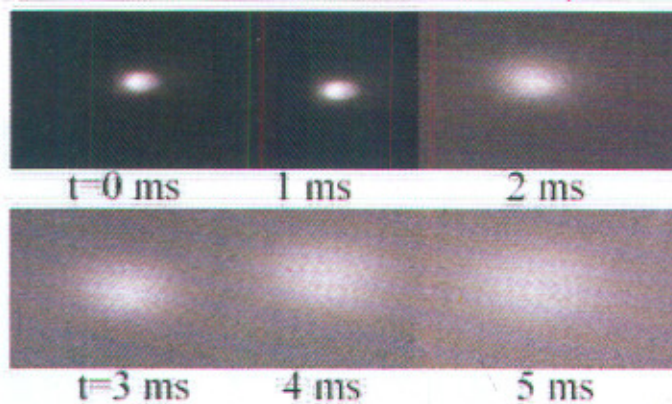
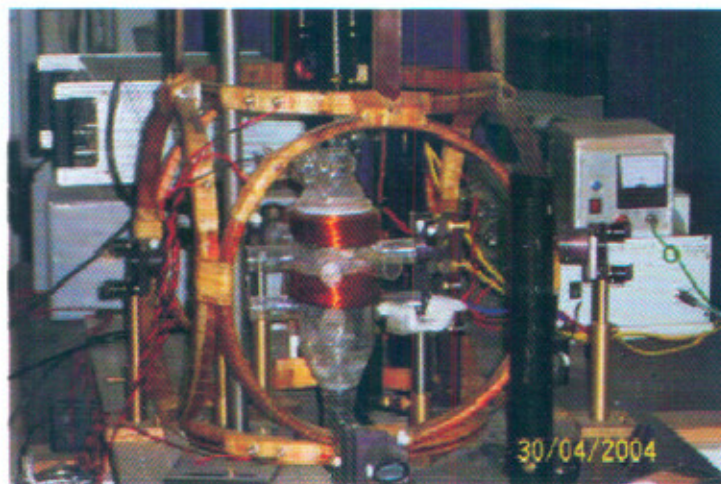
*Laser land-levelling system developed. The system under field trials at PUSA, New Delhi grounds*



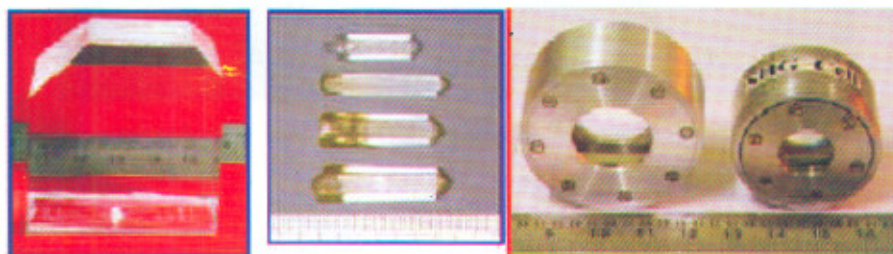
*Table-Top Terawatt Nd: Glass laser system with plasma chamber*



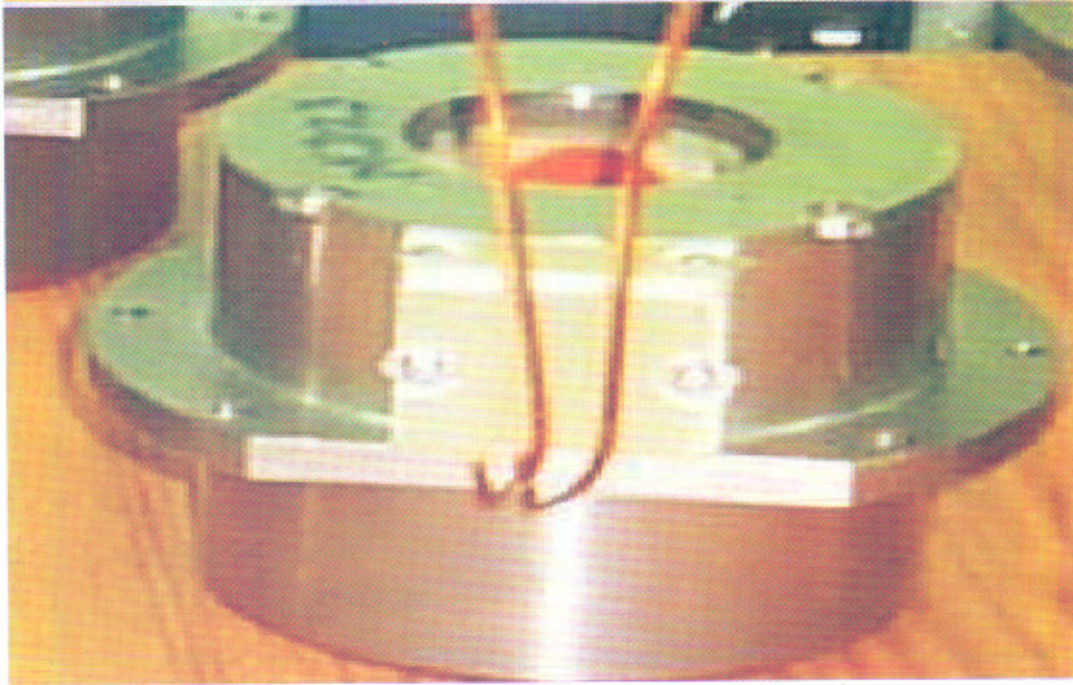
*Coherent soft X-ray radiation generated as high order harmonics using Ti-sapphire laser. The harmonic at 61 nm shows 200X intensity enhancement*



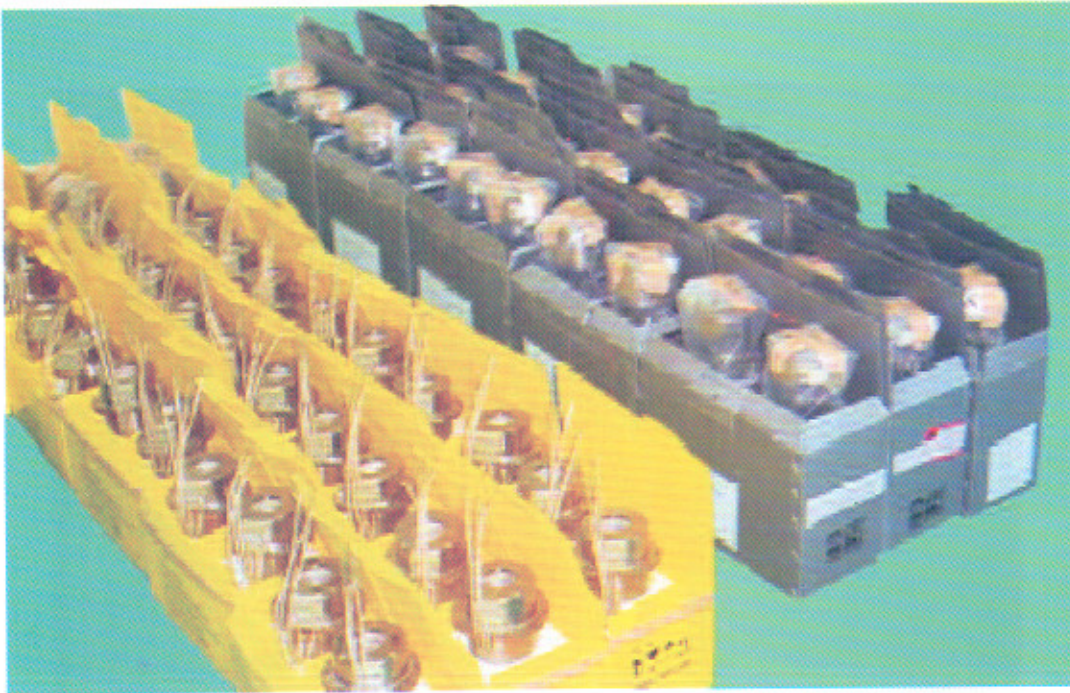
*Magneto-optic trap set up for Rubidium atoms along with the images of cold atom clouds during its free expansion*



*Various non-linear optical crystals, crystal elements and devices*



*Decapole & Octupole Corrector magnet  
(MCDO) assembly for CERN*



*Consignment of Corrector magnets for LHC (built under  
supervision of our Centre's engineers) ready for despatch to CERN*



*Precision alignment jacks being tested at AAL,  
Bangalore before shipment to CERN*



*High precision jacks delivered by our Centre to  
CERN being installed in LHC tunnel*