ALGONQUIN COLLEGE PHOTONICS LABS, EQUIPMENT & CAPABILITIES

Dr. Wahab Almuhtadi, P.Eng., SMIEEE

ALGONQUIN COLLEGE

Overview

What is Photonics?

- Photonics is a broad field of study that involves the research and application of light in all of its many forms. The field is not only interested in the visible light spectrum;
- Photonics is one of the fastest growing high-tech trillion dollar industries in the world today.

Overview

Applications of Photonics

Consumer equipment: barcode scanner, printer, CD/DVD/Blu-ray devices, remote control devices

Telecommunications: optical fiber communications, optical down converter to microwave

Medicine: correction of poor eyesight, laser surgery, surgical endoscopy, tattoo removal

Industrial manufacturing: the use of lasers for welding, drilling, cutting, and various methods of surface modification

Construction: laser leveling, laser range finding, smart structures

Aviation: photonic gyroscopes lacking mobile parts

Military: IR sensors, command and control, navigation, search and rescue, mine laying and detection

Entertainment: laser shows, beam effects, holographic art

Information processing

Metrology: time and frequency measurements, range finding

Photonic computing: clock distribution and communication between computers, printed circuit boards, or within optoelectronic integrated circuits; in the future: quantum computing

Overview

Applications of Photonics

- **Consumer equipment:** barcode scanner, printer, CD/DVD/Blu-ray devices, remote control devices
- **Telecommunications:** optical fiber communications, optical down converter to microwave
- **Medicine:** correction of poor eyesight, laser surgery, surgical endoscopy, tattoo removal
- **Industrial manufacturing:** the use of lasers for welding, drilling, cutting, and various methods of surface modification
- **Construction:** laser leveling, laser range finding, smart structures
- **Aviation:** photonic gyroscopes lacking mobile parts
- **Military:** IR sensors, command and control, navigation, search and rescue, mine laying and detection
- **Entertainment:** laser shows, beam effects, holographic art
- Information processing
- **Metrology:** time and frequency measurements, range finding
- **Photonic computing:** clock distribution and communication between computers, printed circuit boards, or within optoelectronic integrated circuits; in the future: quantum computing

Programs

Photonics Engineering Technology

- Three-year Advanced Diploma, Sept. 2002-April 2012

Bachelor of Applied Technology in Photonics

- Four-year Bachelor Degree, Sept. 2004-April 2011

Bachelor of Information Technology – Photonics and Laser Technology

- Four-year Bachelor Degree with Carleton University starts Sept. 2012

Strengths
Expertise, Facilities and Curriculum

Expertise:

- Faculty with high qualifications (PhD)
- Many years experience in both industry and teaching of undergraduate and postgraduate students
- Solid research and development background

Strengths
Expertise, Facilities and Curriculum

Facilities:

- Optophotonics Lab (Nortel Lab) *(Phase I, Phase II)*
- Advanced Optics & Laser Lab
- Optics & Imaging Lab *+* Optical Fiber Devices & Physics Lab

Curriculum:

- Advanced theory (integrate knowledge and practical applications)
- Hands-on Experience and implementation

Educational Goals

- Produce graduates skilled in joining the opto-photonic industries.
- Produce graduates qualified and experienced with the leading edge technology in photonics and fiber optics.
- Produce graduates who can apply scientific and engineering principles to design, analyze and operate photonic equipment and photonic systems.

Educational Goals…continued

- Grads can lead production teams, demonstrate skills in inter-personal communications, have problem-solving and team building skills, engage in research activities in the multi-sector photonic industry and have specific hands-on experience with photonics technology and applications and work experience in industry.

- After completion of this program the students are eligible to apply for graduate studies at universities in related engineering and science programs.

ALGONQUIN COLLEGE

Facilities Overview

- **T129** Nortel Optophotonics Lab

  Phase I: complete in 2004 by Nortel,

  Phase II: 2011/2012 by Ciena
- **T329** Advanced Optics & Laser Lab
- **T332** Optics & Imaging Lab , Optical Fiber Devices & Physics Lab
- **T218** Wireless Mobility Lab
- **T213** Telecom Lab

Nortel Optophotonics Lab - T129

ALGONQUIN COLLEGE

1.1 Optophotonics Lab – T129

Purpose

- To extend the implementation of our existing Photonics (Laser) Engineering Program by deploying and training with the latest edge SONET/SDH technology in optical fiber communications.

- Students are able to configure, implement, and manage SONET/SDH local and wide area optical networks using the latest technology and sophisticated equipment. (*e.g. Optical Long-Haul and OPTera Metro products/3000 series*)

1.2 Optophotonics Lab – T129
Phase I Capacity

Phase I:

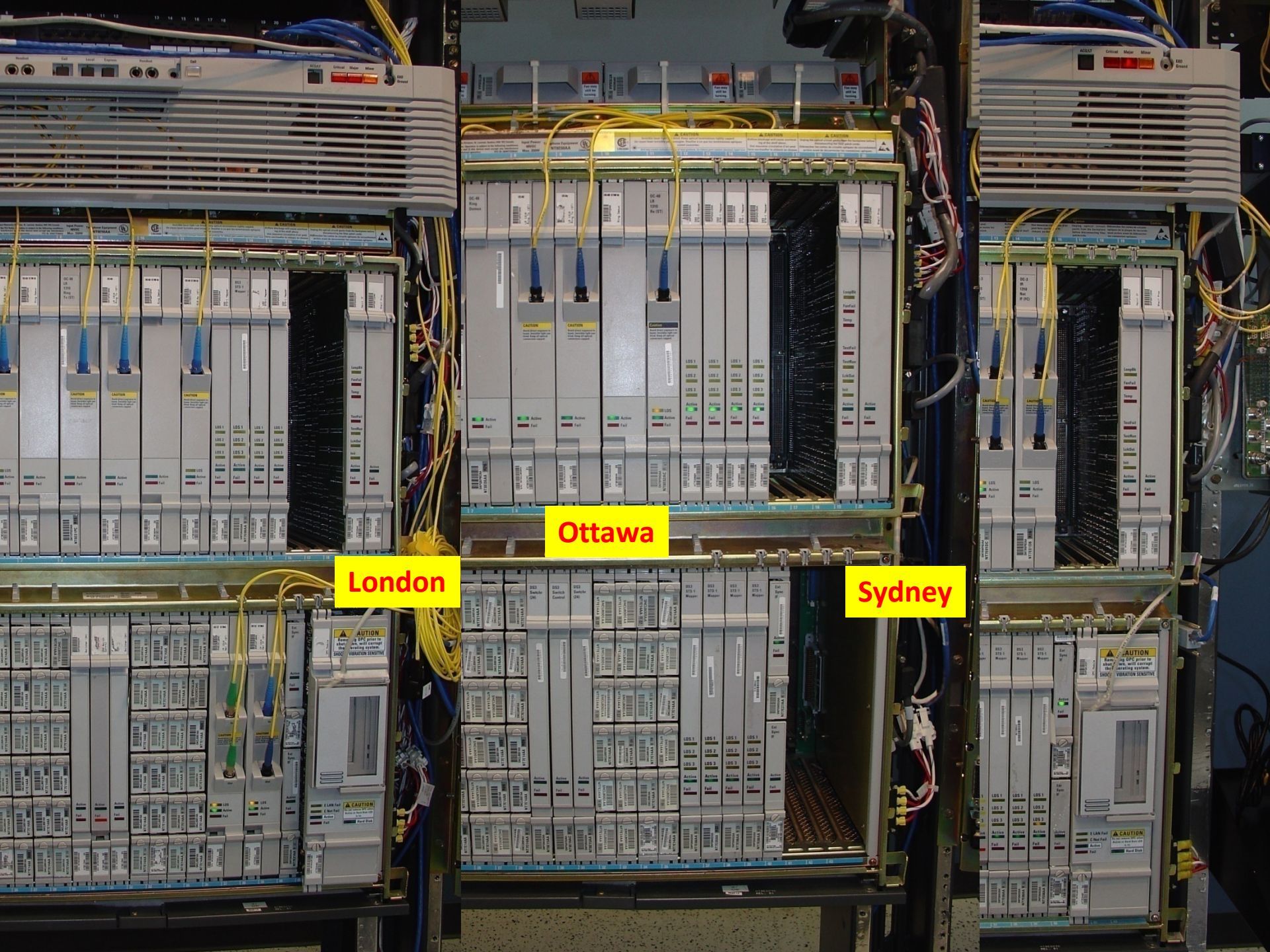
- Three Nortel Long Haul nodes of S/DMS Transport Node OC-48 Synchronous Optical Network Elements.
  Speed Line rate: 2.4 Gb/sec (2400 million bit per second) optical multiplexing system.
  Configuration: three OC-48 nodes configured as Bi-directional Line Switched Ring (BLSR).

1.2 Optophotonics Lab – T129

Phase I Capacity…continued

Phase I:

- Two Nortel Metro nodes of OC-3 Synchronous Optical Network Elements.
  Speed line rate: 155.52 Mb/sec (155.52 million bit per second) optical multiplexing system.
  Configuration: two OPTera Metro OC-3 nodes configured Linear (Point to Point) or Unidirectional Path Switched Ring (UPSR).


London
Ottawa
Sydney

1.2 Optophotonics Lab – T129

Phase I Capacity…continued

Phase I:

- 24 PCs for Operation, Administration, Maintenance & Provisioning (OAM&P)
- Baystock Units (connection between Algonquin ITS and Optophotonics Lab) Fiber Management System
- Global Positioning System (GPS), PC and Sun Servers
- Panel Interface Circuit Breakers, Fiber Cable Distribution Ports, DS1/DS3 Source, DS1 Ports, and DS1/DS3/OC-3/OC-48 Test Sets

1.3 Optophotonics Lab – T129

Phase II Capacity

Phase II:

- Ciena is working closely with the BIT-PLT Program to get **3** Network Elements of Packet Optical Platforms (Ciena 6500 Family Series).
- **Speed Line rate**: 40G/100Gb/sec optical multiplexing system. **Configuration**: three nodes configured either as BLSR or UPSR.

Advanced Optics & Laser Lab - T329

2.1 Laser and Advanced Optics Lab – T329

Purpose

- The lab purpose is to introduce students to a wide range of light & laser interaction & associated measurement equipment.
- Students get hands on experience with a range of important laser interaction machinery (*e.g.CO2., Nd:Yag, Argon ion etc*) and associated equipment (*optics, motion stages*) plus key measuring equipment (*e.g.power meters, digital spectrometers, confocal microscopes*).
- Various applications are studied (*e.g. Drilling, welding, fluorescence,plasmas ,holography*)
- The lab supports teaching material in over a dozen courses in the Photonics program.

2.2 Laser and Advanced Optics Lab – T329

Capacity

Lasers:

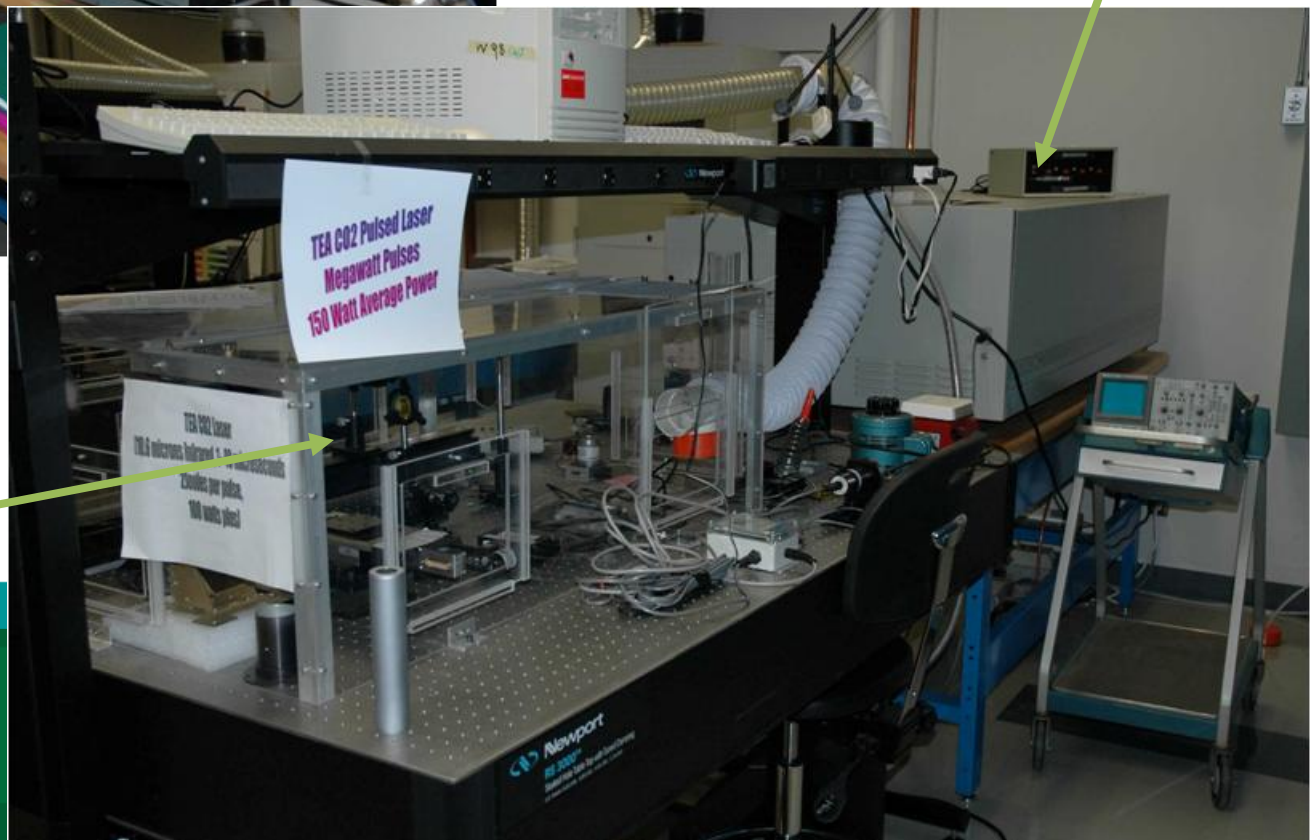
- Two GSI Lumonics PulseMaster Excimer lasers configured as TEA CO2 (**100 watt plus**) and Nitrogen pulsed lasers.
- Associated optics and lenses in the 10.6 micron IR and Uv region of the spectrum.CO2 Wavelength measuring equipment. Gas cabinets for above.
- Three RF Synrad CO2 lasers (**20 watt**) with AOM capability
- Numerous plus 800nm diode lasers (to>**10 watt**).

RF & TE CO2 Lasers

JDS Swept wave system

PulseMaster Excimer laser converted to CO2

Synrad RF CO2 laser



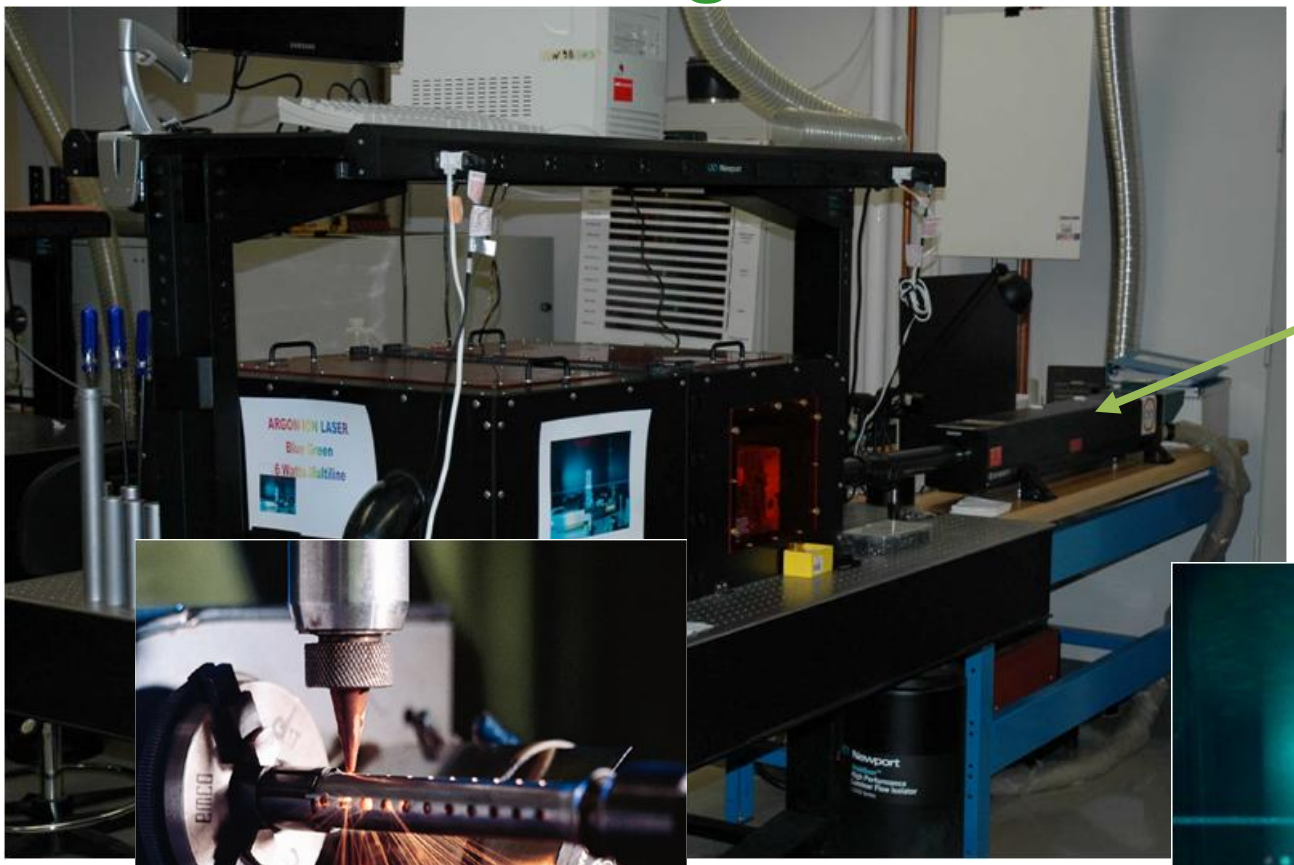
Safety enclosure

2.2 Laser and Advanced Optics Lab – T329

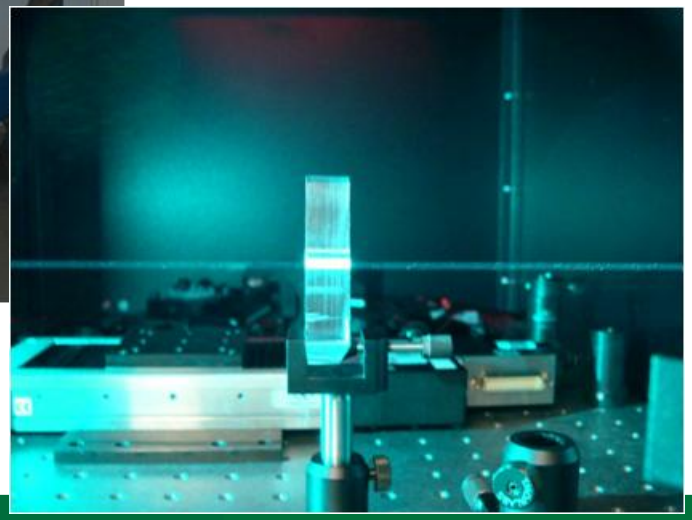
Capacity…continued

- One Coherent Innova 90 Argon Ion laser (**5 watts**) multiline, with Visible and UV optic sets - also a 2 watt diode pumped green laser
- A Quantel pulsed Yag laser w Q switching(also has Second Harmonic crystals) also has associated industrial Yag optical sub-systems.
- Six Melles Griot HeNe laser training kits.

Argon Ion bench



Coherent
Innova 90



2.3 Advanced Optical System / Biophotonics:

- Two JDS Uniphase watt level Swept wave systems (**SWS**) plus associated equipment (15000 series). Tunable to 3 picom in the 1500nm band
- One Scanning confocal microscope & various other standard microscopes.
- Two DNA scanners.
- New Fujinon Endoscope System
- Three digital spectrometers including light sources (coverage from uv to near IR).

VISIONARY ENDOSCOPY
Fujinon system 4400

Related Accessories & Components

- Four Safety enclosures and fume extraction system.
- Various Precision linear driver stages (*to micron level*) plus Three Newport 6000 driver systems.
- Three large Newport optical tables and numerous other breadboards.
- AOM equipment in the visible and IR region.
- Numerous other laser and light related jigs and experimental setups.(*Various scanners, pyrometers, piezo drivers, polarizers etc.)*
- Various oscilloscopes(analog and digital)

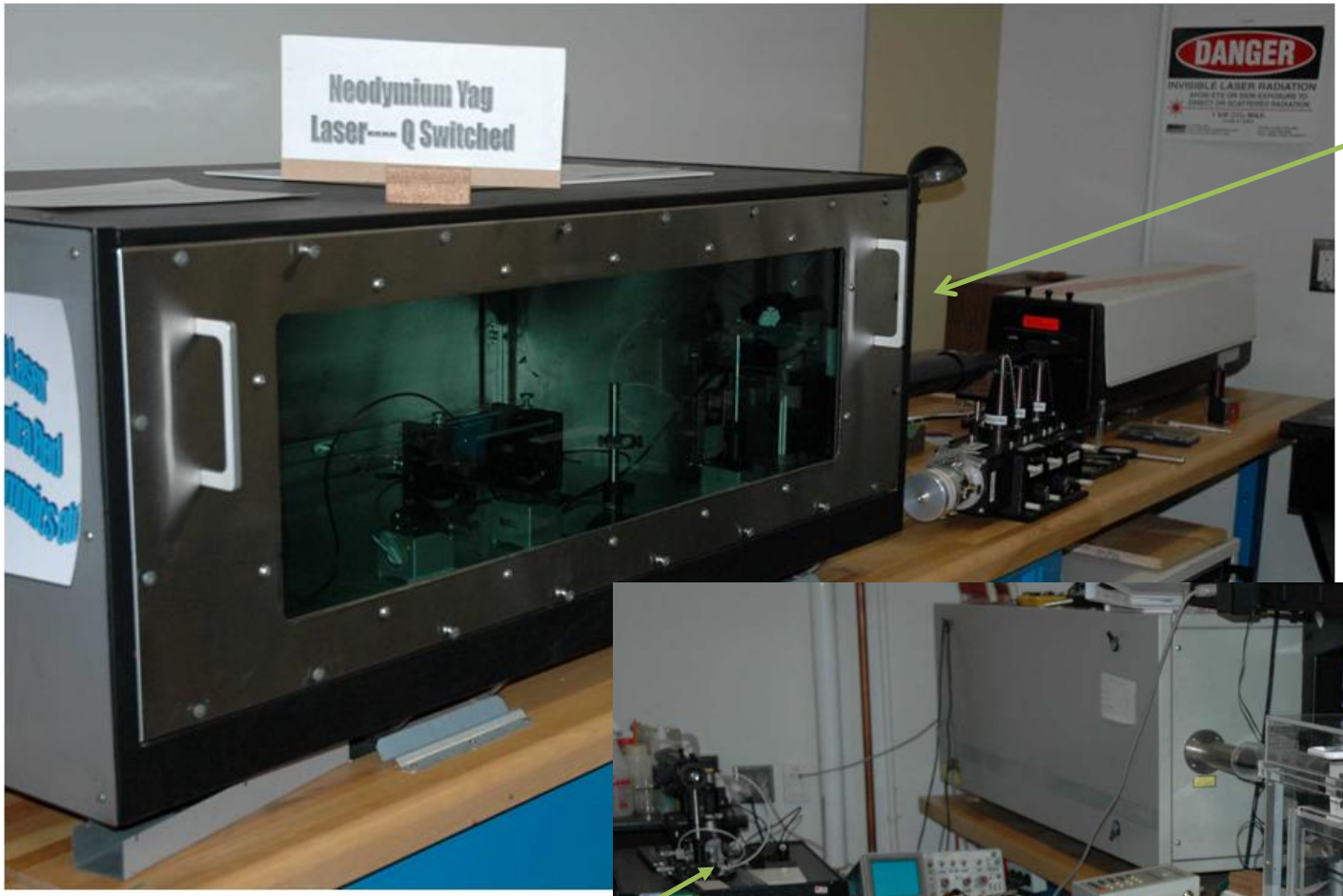
Confocal microscope and DNA Scanner etc

One of various precision adjusters

Scanning Confocal microscope

Polygon scanning measurement jig

DNA Scanner



Quantel pulsed Yag and Safety enclosure

Nitrogen laser bench and safety enclosure

AOM jig, used in laser TV plus other scanner applications.

Optics & Imaging Lab / Optical Fiber Devices & Physics Lab – T332

ALGONQUIN COLLEGE

3.1 Laser and Advanced Optics Lab – T332

Purpose

- **The lab accommodates up to 32 students** working on stations equipped with organized drawers filled with high quality optical components, tools, and lasers devices (Newport/Melles Griot).
- **The lab is used to teach the students many courses,** such as: optics, waves, diffraction, interference, laser technology, kinematics, dynamics, general physics, opto-electronic devices, fluid and vacuum systems, heat and mass transfer, thermodynamics, **software** (e.g. **OSLO, Zemax**) and Photonics research projects**.**

3.1 Laser and Advanced Optics Lab – T332

Purpose…continued

- **Lab equipment includes many types of optical component** such as: mirrors (flat, concave, and convex), lenses (concave and convex for thin and thick), prisms, lasers, beam splitters, filters, polarizing optics etc.
- **The lab also has optical fiber components, tools, devices and systems**, such as fiber optic cables, connectors, splices, packaging, polishing machines, test systems, fiber optic devices, manufacturing fiber optic devices, and systems demonstration kits.

Thank You!

For more information on our programs and facilities please visit
www.algonquincollege.com/photonics

ALGONQUIN COLLEGE