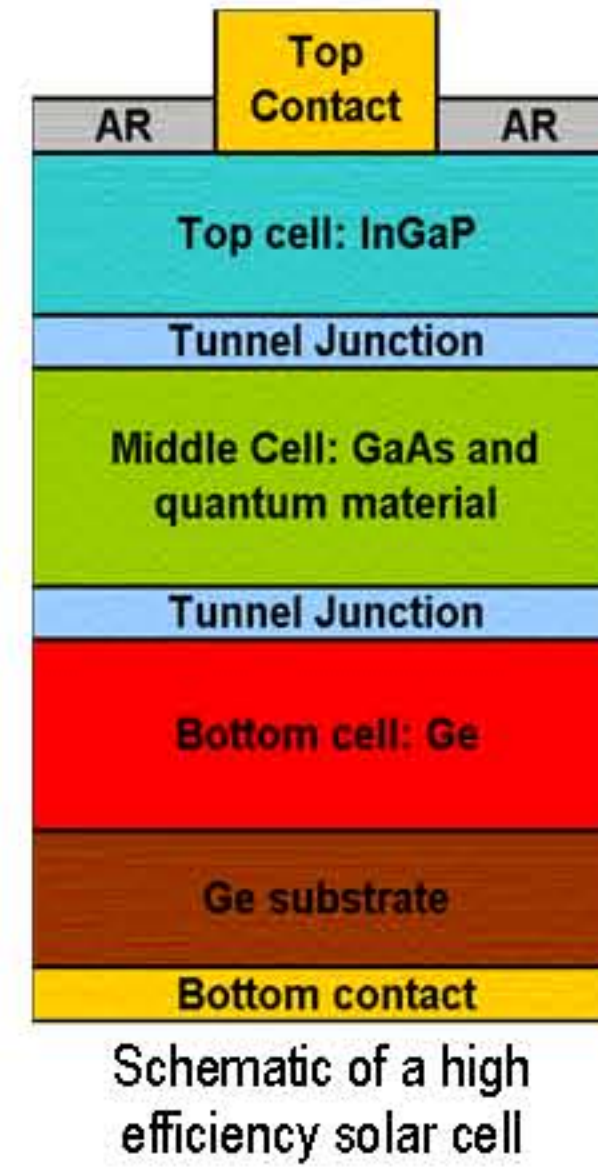


Photonic device integration

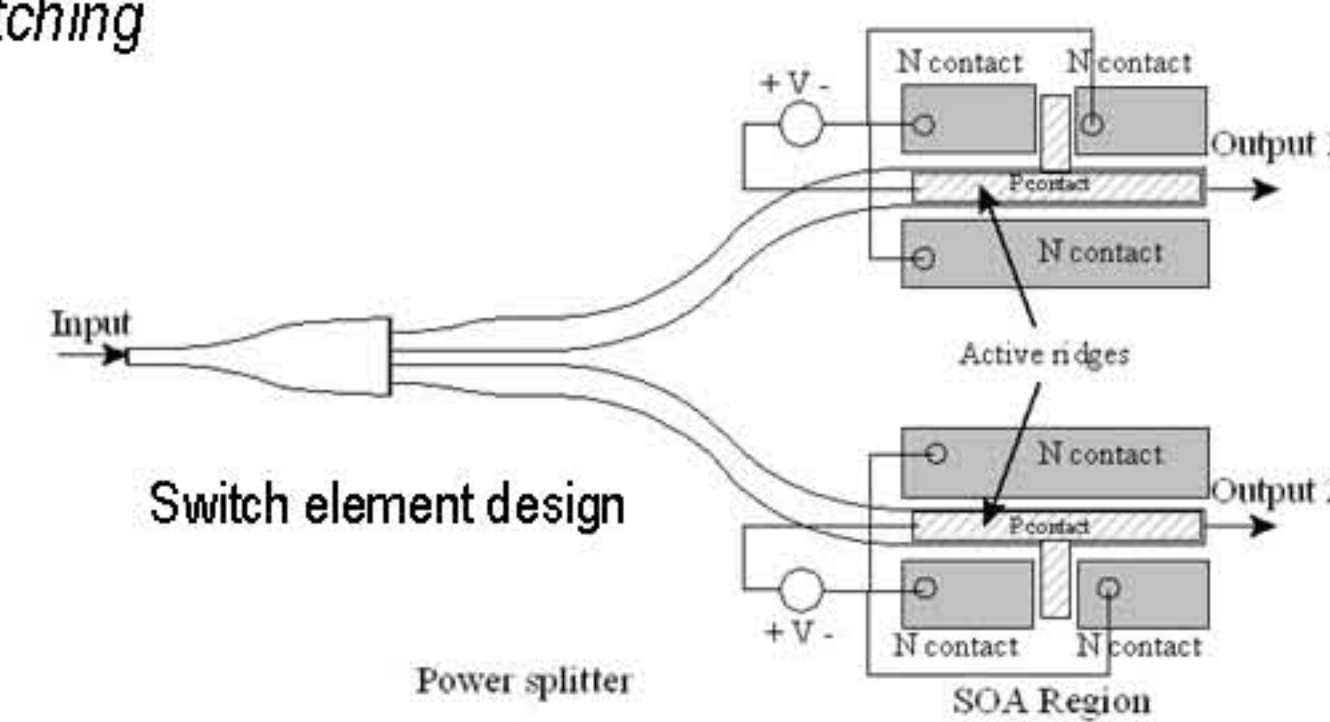
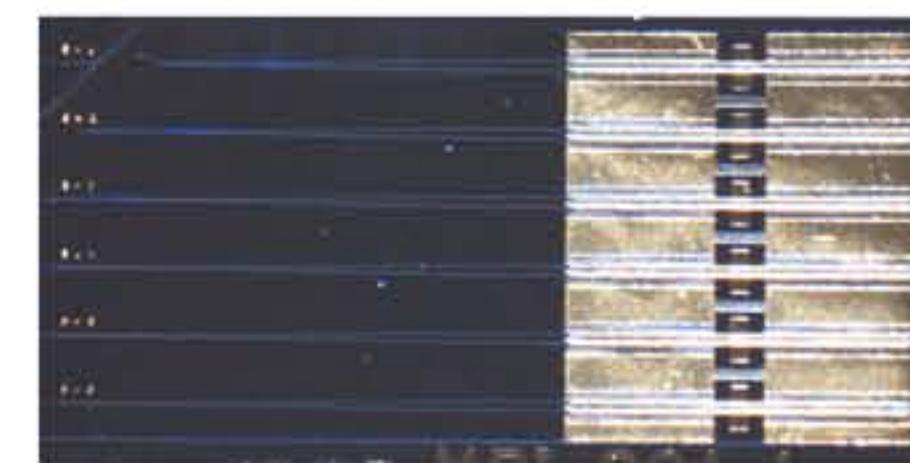
III-V Semiconductor Photonic Device Integration on Group-IV Substrates

- Can we use GaAs on Ge solar cells as a micro-mote's renewable energy source?
- A micro-mote is a chip of $\sim 1 \text{ mm}^3$ that incorporates
 - autonomous sensing
 - computing systems
 - communication systems
- Micro-motes ("smart dust") are used in wireless sensor networks
- The designed solar cells are fabricated at the Canadian Photonics fabrication Facility and characterized and tested at the University of Ottawa



Monolithically Integrated InGaAsP/InP 1x2 SOA Optical Switch

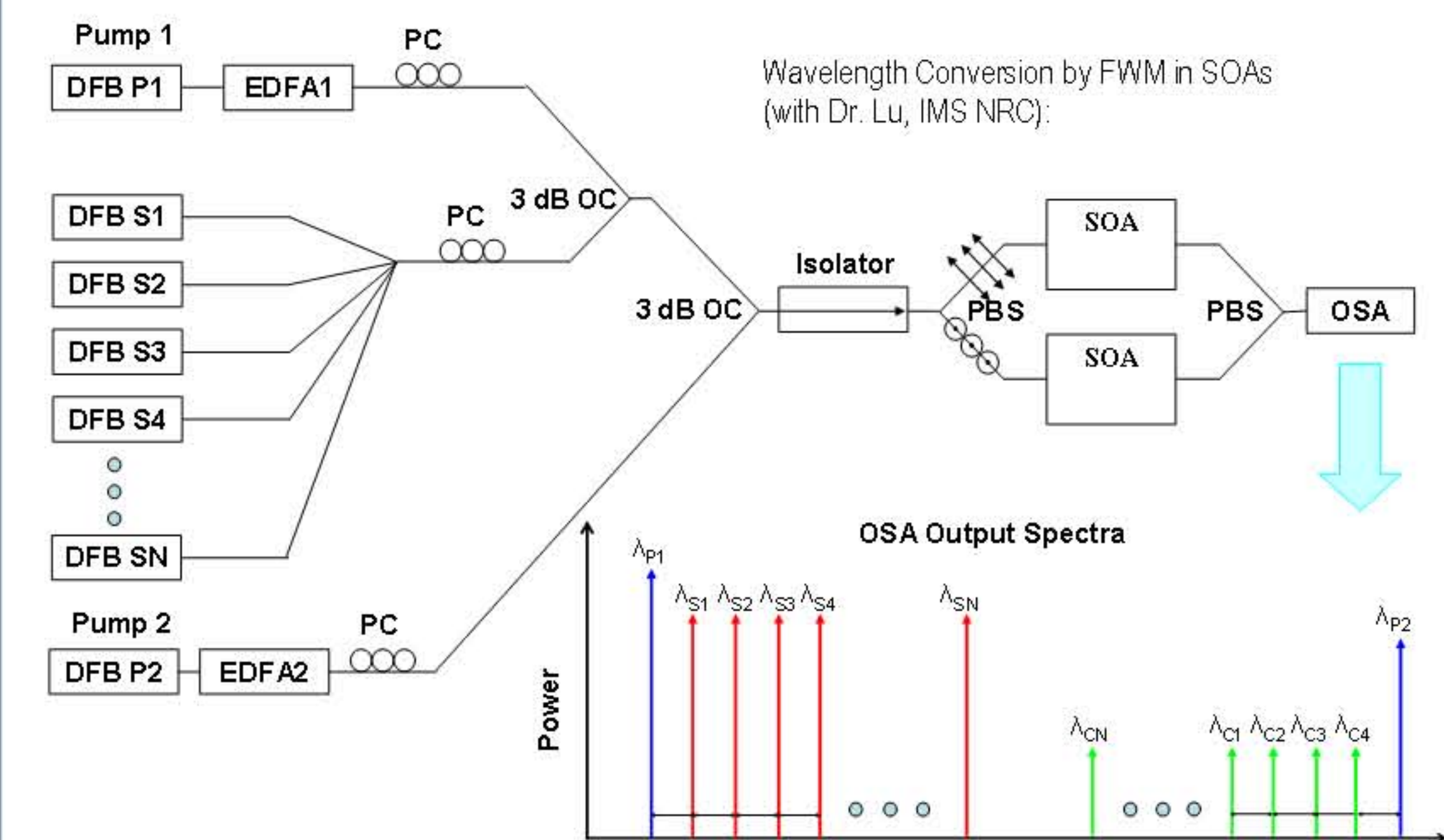
- Design of a practical 1x2 monolithically integrated SOA-based switching element
 - Objective: use it in larger switching fabrics such as ROADMs
- Implemented using single-mode vertical integration (SMVI)
- Fabricated at the Centre for Emerging Device Technology at MacMaster University



Enabling device technologies

Themes

- Quantum dot semiconductor
- Quantum well semiconductor lasers
- All optical logic, fibre ring lasers
- Integrated power splitter and optical switch
- Polarisation insensitive wavelength converter
- Nonlinear optics in crystals



Our laboratory

Established by Professor Trevor J. Hall in August 2002.

Vision

- To contribute new networking, switching and device concepts that improve the service to end-users by
 - the migration of photonics from the core to the edges of the network and
 - the penetration of photonics into the nodes themselves.
- To realise 3D integrated active photonics with the intelligence required for communications and computing applications.

Support

We are supported by governmental and industrial organizations such as NSERC, CMC, PRO, CRC, CPFC, Nortel Networks, JDS Uniphase, Agilent, Altera, Cyrium Technologies, and others.

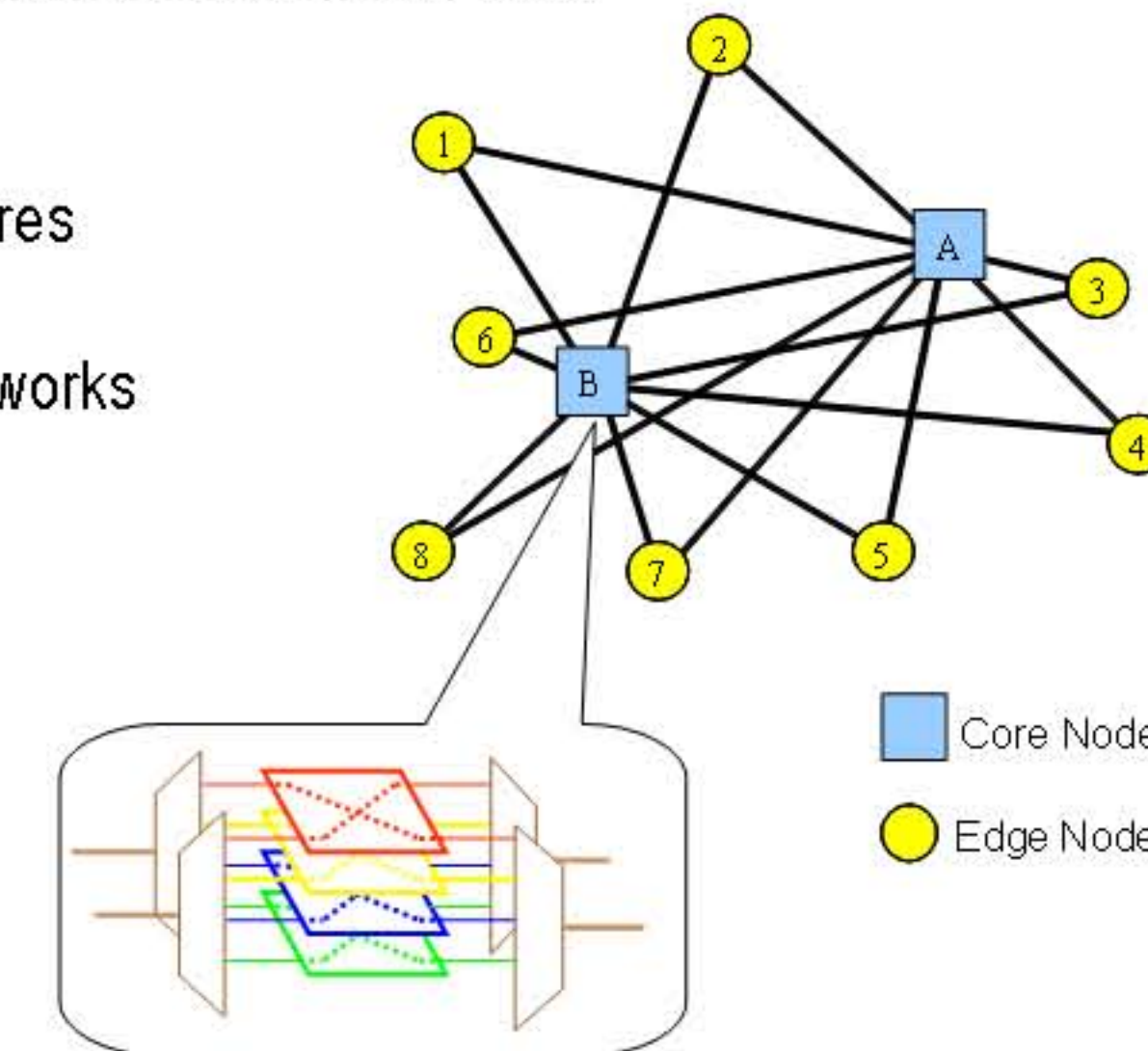
Agile All-Photonic Networks

AAPN architecture

- An overlaid star WDM network with very fast switching at the core ($1 \mu\text{s}$)
- Wavelengths are shared in the time domain by several information flows

Themes

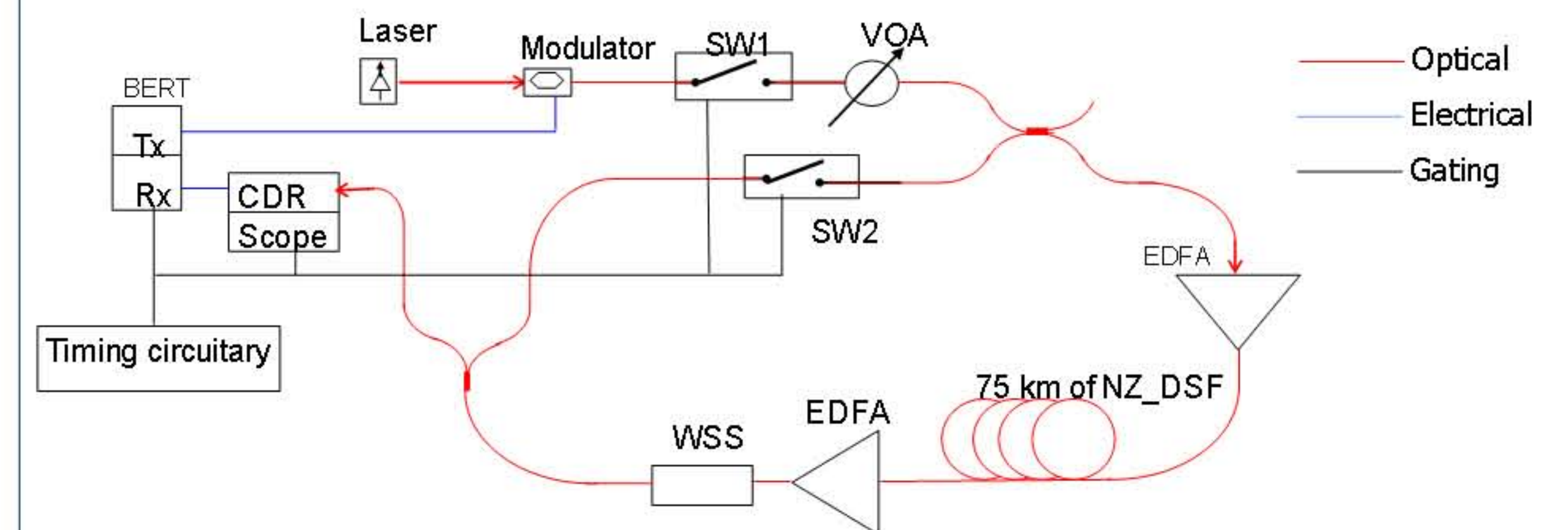
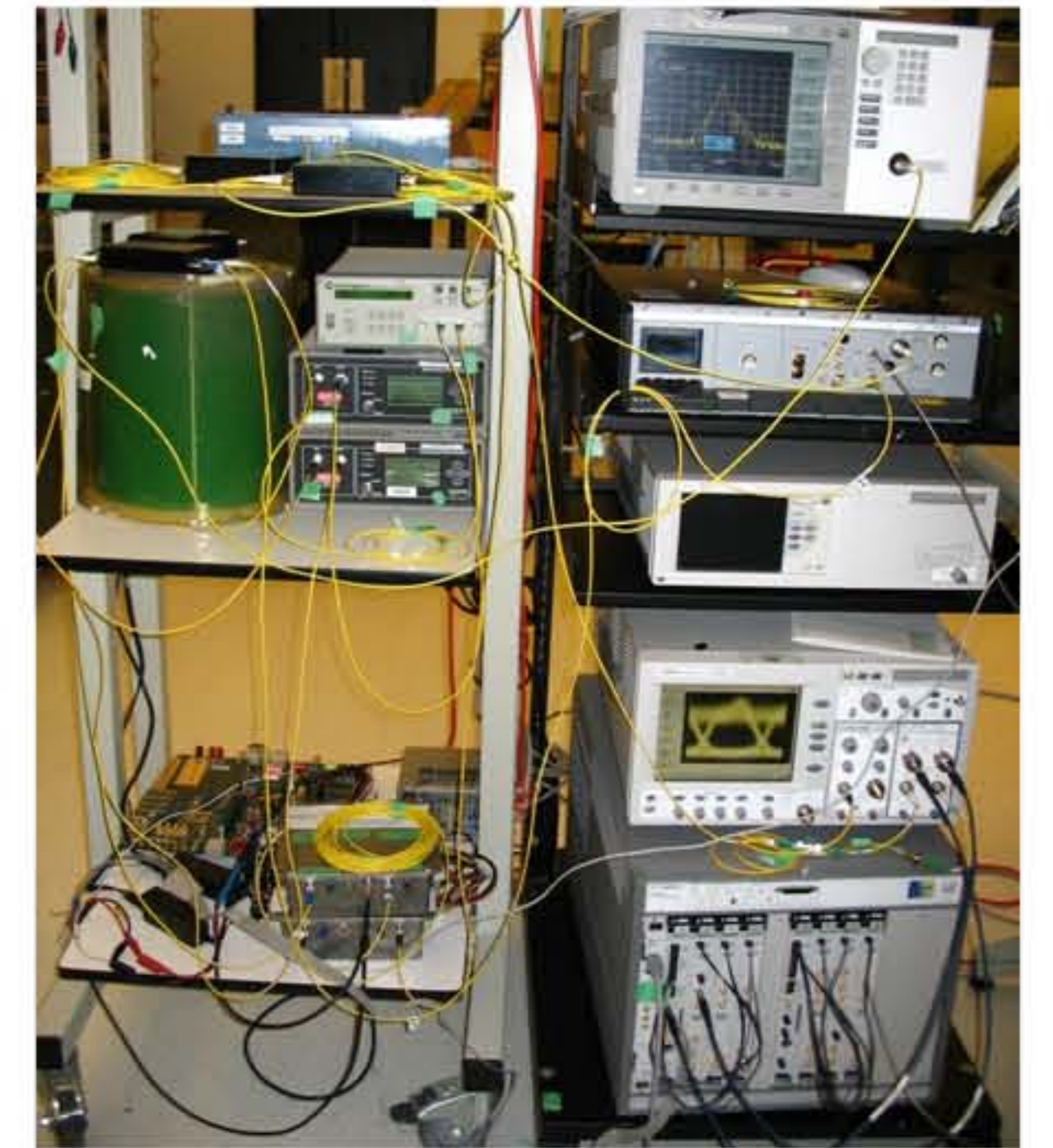
- Bandwidth allocation schemes
- Design of scalable optical core switch architectures
- Design of edge node architectures
- Deploying AAPN over reconfigurable optical networks
- Demonstrator prototype implementation



Reconfigurable optical networks

Themes

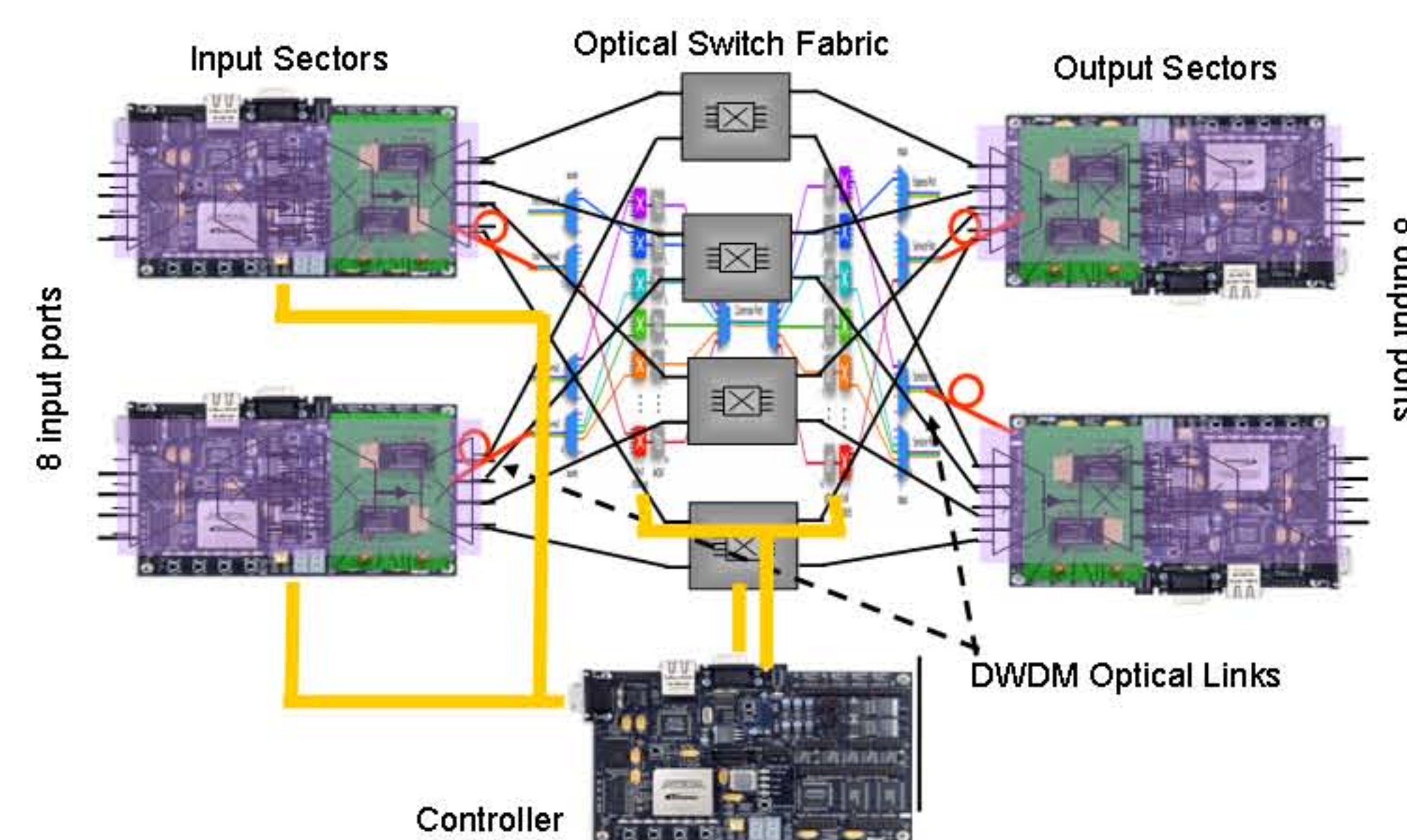
- Reconfigurable Optical Add-Drop Multiplexers (ROADMs)
 - Studies of architectures, protocols, devices, and control methods for this technology
- Metro Agile All-Optical Ring Networks
 - Dynamic routing, wavelength and timeslot assignment schemes
- Recirculating loop testbed
 - To evaluate network scenarios, control strategies and device technologies
 - Multiple concatenated ROADMs through multiple passes on the loop through a single device
 - Provides a cost-effective manner of investigation
 - To devise creative solutions to engineering challenges like:
 - synchronisation
 - optical amplifier transients
 - dynamic OSNR optimization



Opto-electronic packet switches

Themes

- Building demonstrators with electronics implemented with FPGA technology
- Different optical technologies used
- Study of various control mechanisms
 - Flexible Bandwidth Provision in a Packet Switch with an Optical Core (FBP)
 - Load Balancing in a Packet Switch with Layered Cross-Point Queues (LCPQ)



Optical interconnects

Themes

- Fourier lens design for free-space interconnects
- POGED: A fast alternative to computer generated holograms design by simulated annealing
 - Gratings fabricated at the Institute for Microstructural Sciences (NRC)

