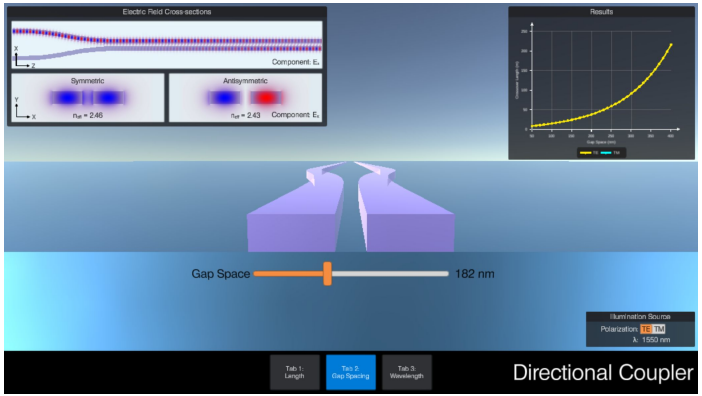
Educational Simulations and Blended Learning for Workforce Training in Photonics



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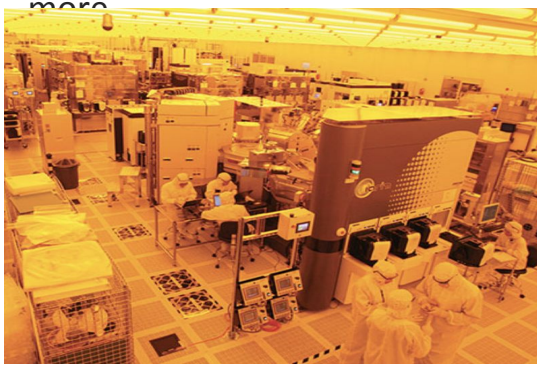
MIT

American Institute for Manufacturing (AIM) Photonics

Technology Development

- Applications in data centers, sensing, autonomous vehicles, and more



People Development

- Education and workforce development at MIT

This is AIM Academy

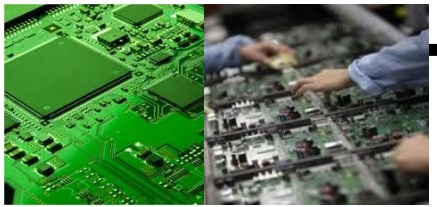
AIM photonics
AMERICAN INSTITUTE for MANUFACTURING INTEGRATED PHOTONICS

Manufacturing USA

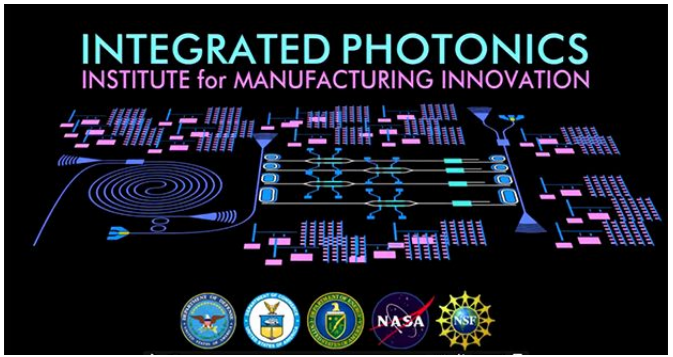
MIT

What is Integrated Photonics?

- **Photonics** is the science and practice of manipulating photons, the smallest unit of light.
- **Integrated photonics** uses *thousands* of photonic components on a single chip. This dramatically reduces **size**, **weight**, and **power consumption**.

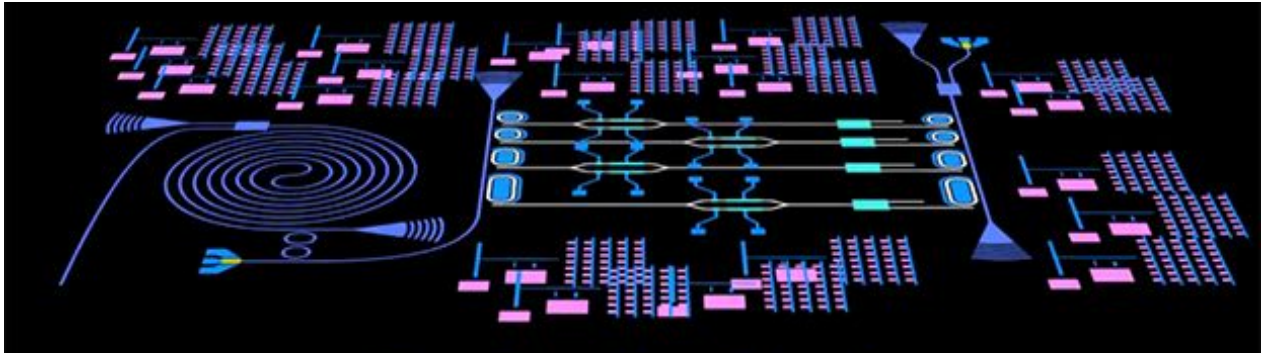


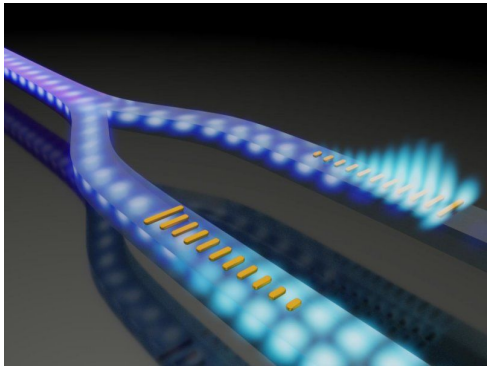
Electronics on a chip

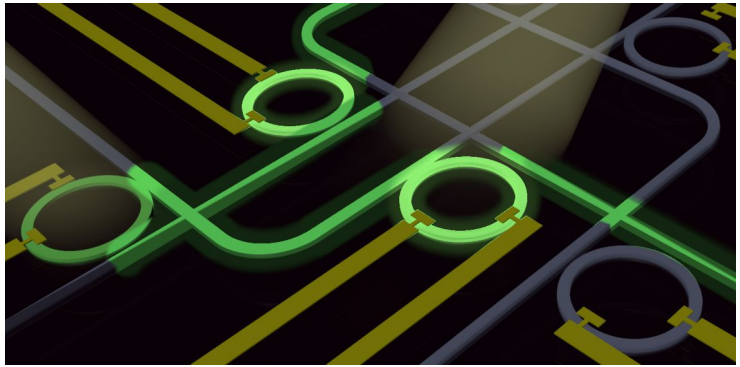


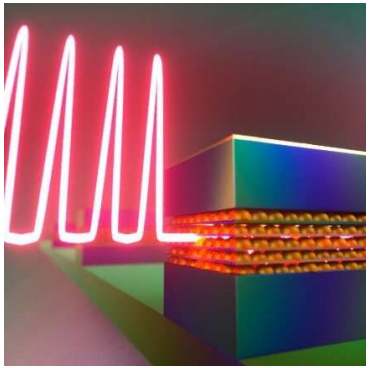
Photonics on a chip

Photonic Integrated Circuits



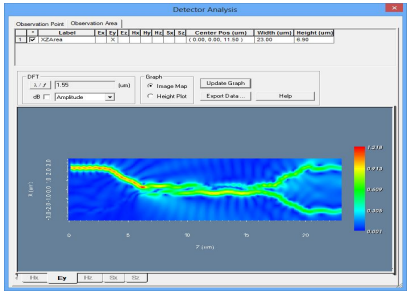


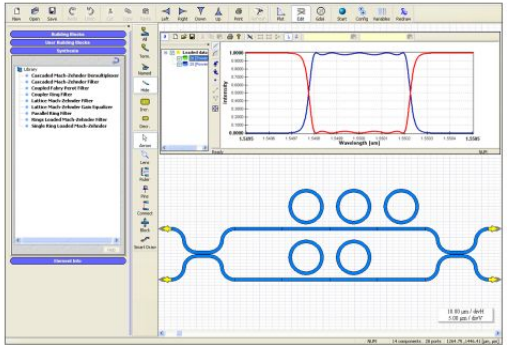




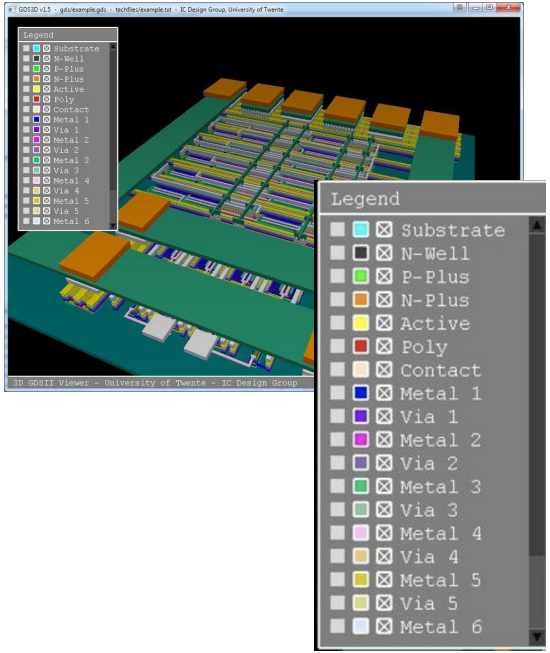
Fabrication of Silicon Photonics Devices

Step 1:
Electronic / photonic simulation





Step 2:
Layout file (GDSII)



Step 3:
Fabrication

AIM Academy Product Portfolio

Education

Summer Academy | Online Education | Virtual Lab | TED-Ed

Workforce Development

LEAPs | Future Leaders | Certification

Roadmap

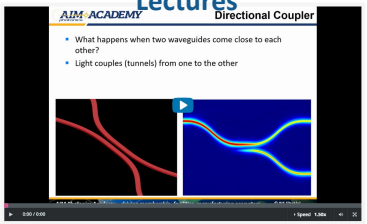
Technical Meetings | Application Interest Groups | Webinars

edX

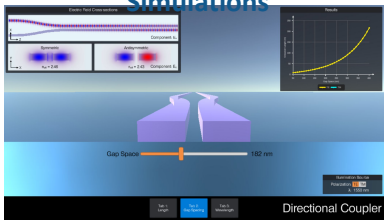
MITx: 3.46.2x

Photonic Integrated Circuits 1 (PIC 1)

Video Lectures



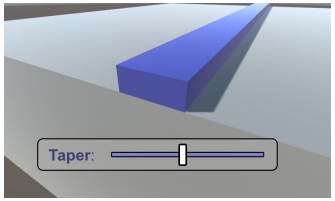
Virtual Lab Simulations



Three MITx courses in 2019-2020:

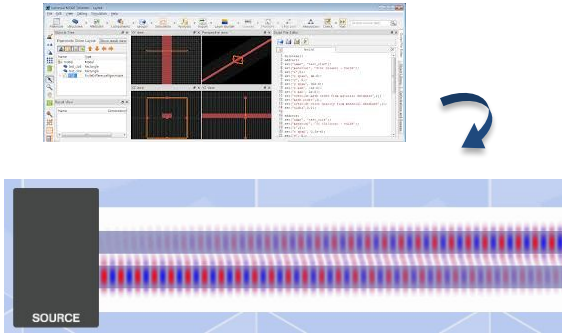
- Fundamentals of Integrated Photonics
- Photonic Integrated Circuits I
- Photonic Integrated Circuits II

1. Game-Based Learning



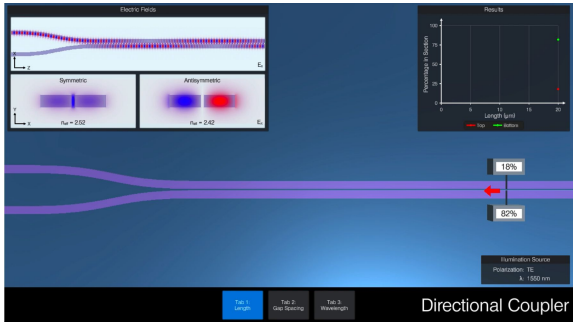
- Engaging game mechanics
- Unity game engine
- Embedded learning objectives

2. Animated Data



- Photonic simulation database
- Low-latency online interface

3. Simulation Modules



- Sequential & level-based pedagogy
- Web-based application

unity

SYNOPSYS® lumerical

Virtual Manufacturing Lab

Online Courses

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- Photonic Integrated Circuits I
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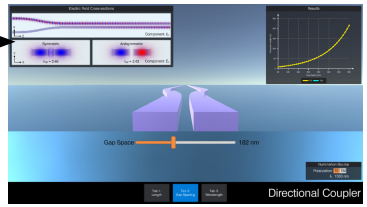
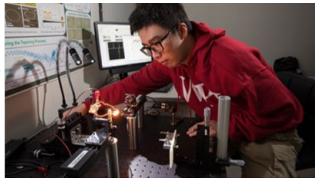
Educational Simulation Library



Blended Learning Bootcamps



Integrated Photonics Design Engineers

SYNOPSYS®
Lumerical
cadence
PhoeniX Software
COVENTOR® A Lam Research Company
Mentor® A Siemens Business

Collaborators

MIT Open Learning

Sanjay Sarma

Bill Bonvillian

MIT | SCHELLER TEACHER EDUCATION PROGRAM education arcade

Eric Klopfer

IMEL Interactive Materials Education Laboratory

Kyle Keane

Anna Musser

MIT | Open Learning

The Workforce Education Project

The Changing Workplace, Worker Displacement and a New System for Workforce Education

"…upskilling the disrupted manufacturing workforce to meet the upcoming demands of advanced manufacturing. "

"…new 'blended learning' (online and face-to-face) content delivery systems for workforce education…"

"…***create a true 'factory of the future' and dramatically change the workplace.*** "

Sanjay Sarma

Bill Bonvillian

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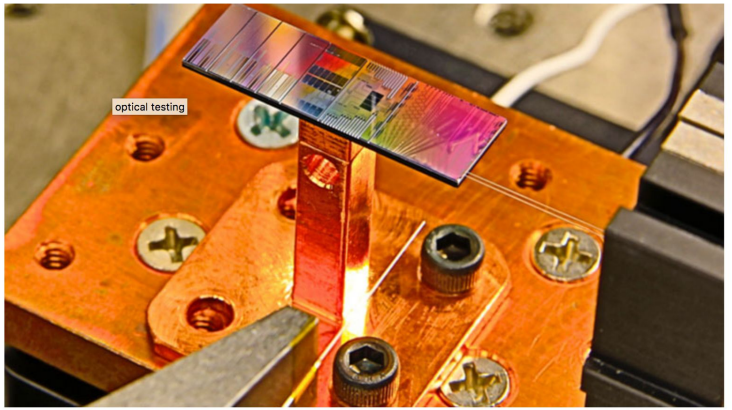
Labs for Education and Application Prototypes (LEAPs)



MASSACHUSETTS TECHNOLOGY COLLABORATIVE

AIM ACADEMY photonics

MassMEP Manufacturing Extension Partnership

WPI

QUINSIGAMOND Community College

Virtual Manufacturing Lab

Online Courses

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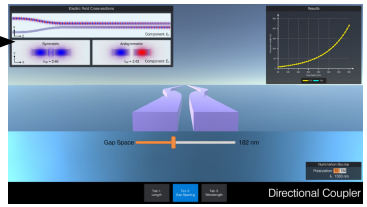
- Photonic Integrated Circuits II

Workforce Training Platform

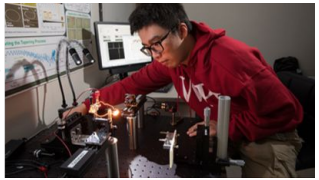
OPENedX

EducateWorkforce

Educational Simulation Library



Blended Learning Bootcamps



Integrated Photonics Design Engineers

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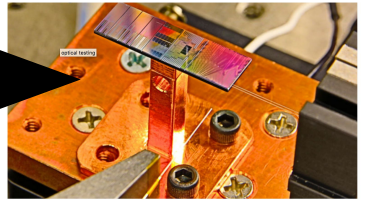
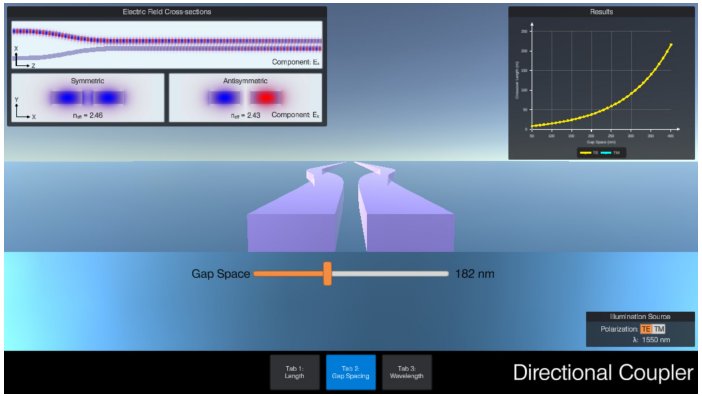
Technician Certification



Utilizing Labs for Education and Application Prototypes (LEAPs)

Educational Simulations and Blended Learning for Workforce Training in Photonics



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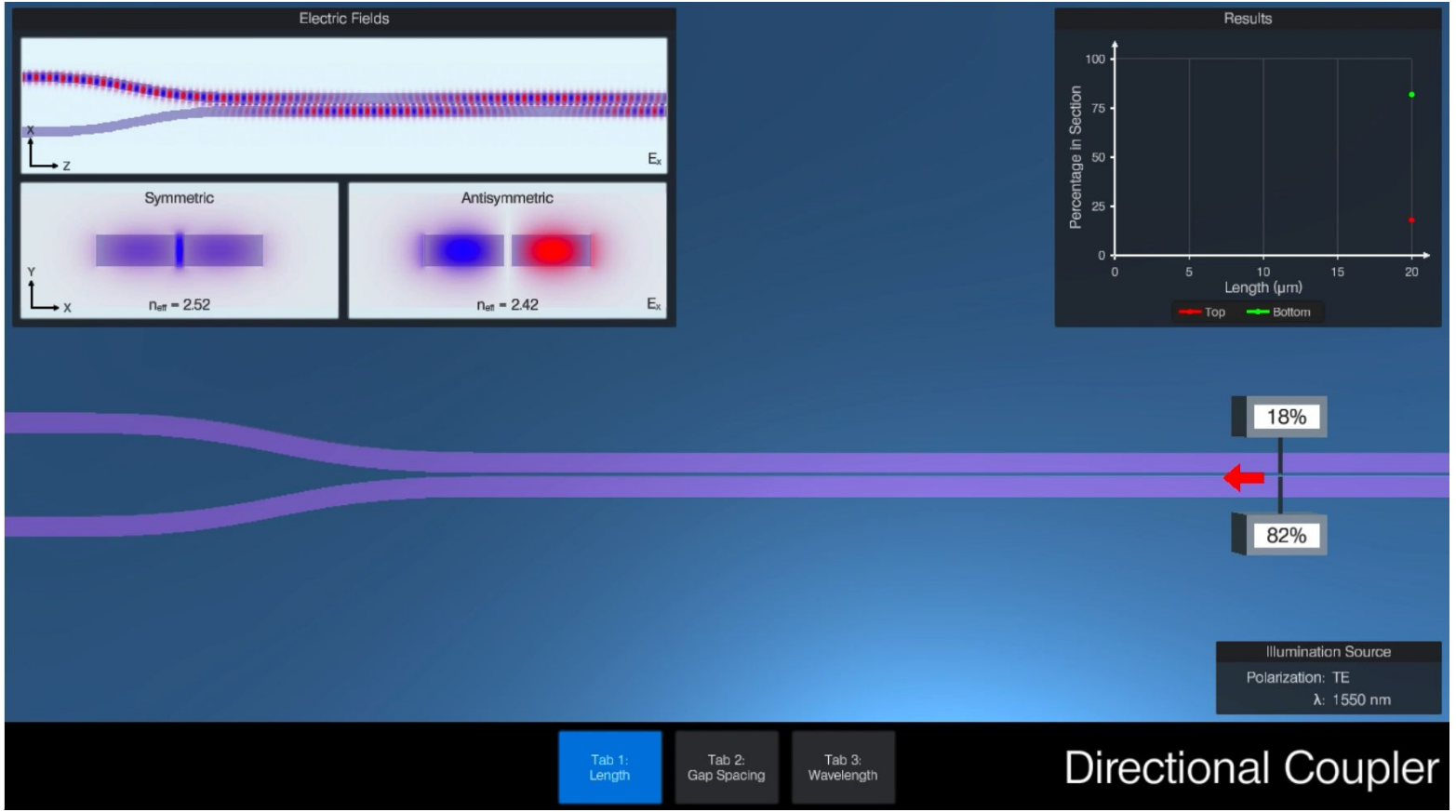
Additional Slides

Educational Simulation



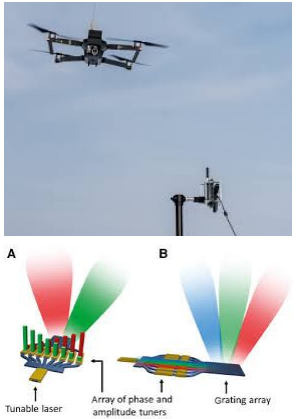
Application Areas

Four major areas of interest:

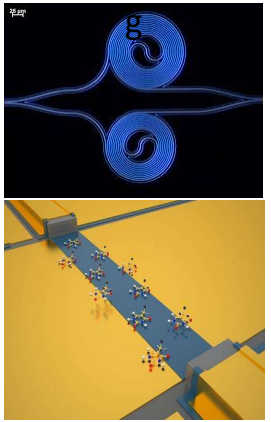
- telecom/datacom
- RF analog applications
- chemical sensors
- LIDAR imaging

Dataco

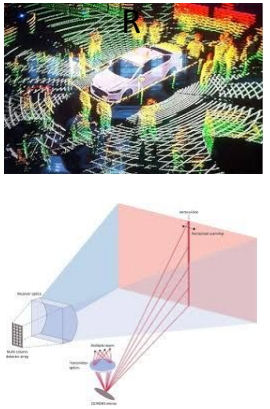
RF



Sensin



LIDA



Application areas include

- **Data Centers**: high speed optical communication directly on chip surface
- **Advanced Military Equipment and Drones**: precision using integrated photonic circuits
- **Food Safety and Medical Sensors**: pathogen detection and biological sensing
- **Autonomous Vehicles**: navigation driven by photonics-based LIDAR
- *Think also about robotics, curved displays, augmented reality, communications…*