ERBIUM DOPED FIBER LASERS

Graduate Internship Program
University of Oregon

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Outline

- Introduction and Background
  - Goals
  - Purpose
  - What is a laser? How does it work?
- Single Clad Erbium Doped Fiber Laser (SC-EDFL)
- Dual clad Erbium Doped Fiber Laser (DC-EDFL)
- Single clad data and analysis
- Dual clad data and analysis
- Boxed laser results

Intro

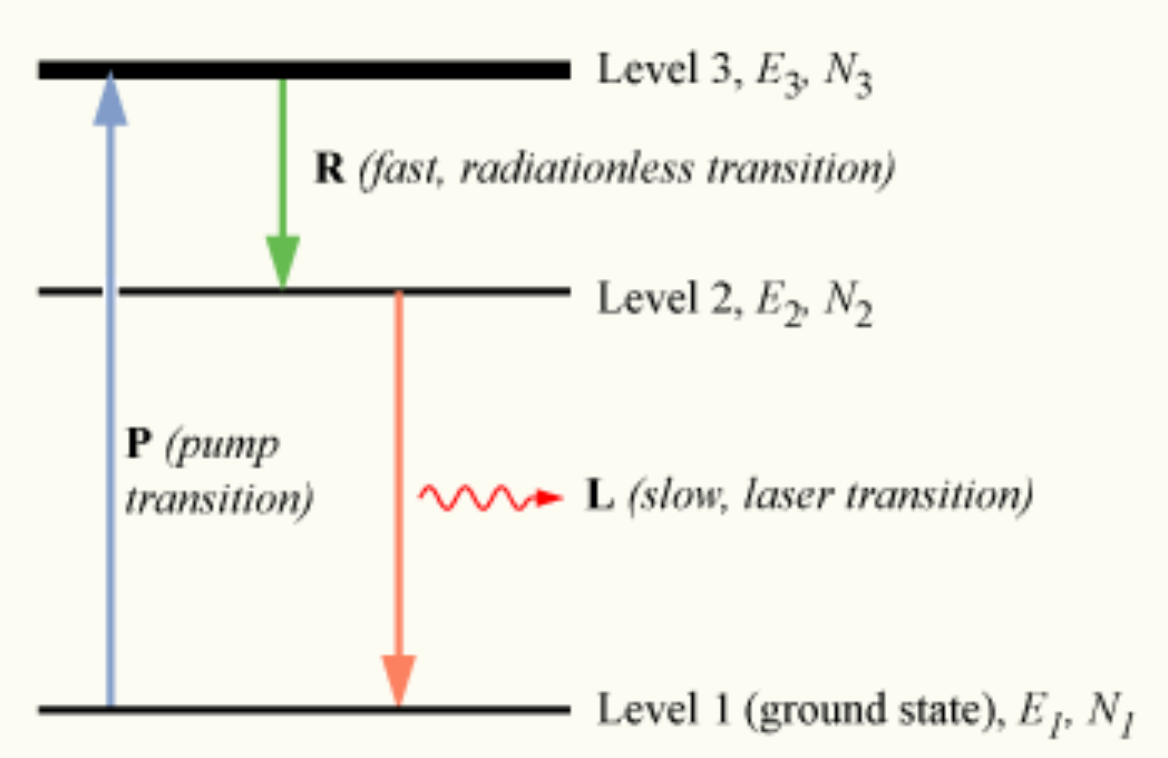
Goals

- Construct a SC-EDFL
- Construct a DC-EDFL
- Box the DC-EDFL

Purpose

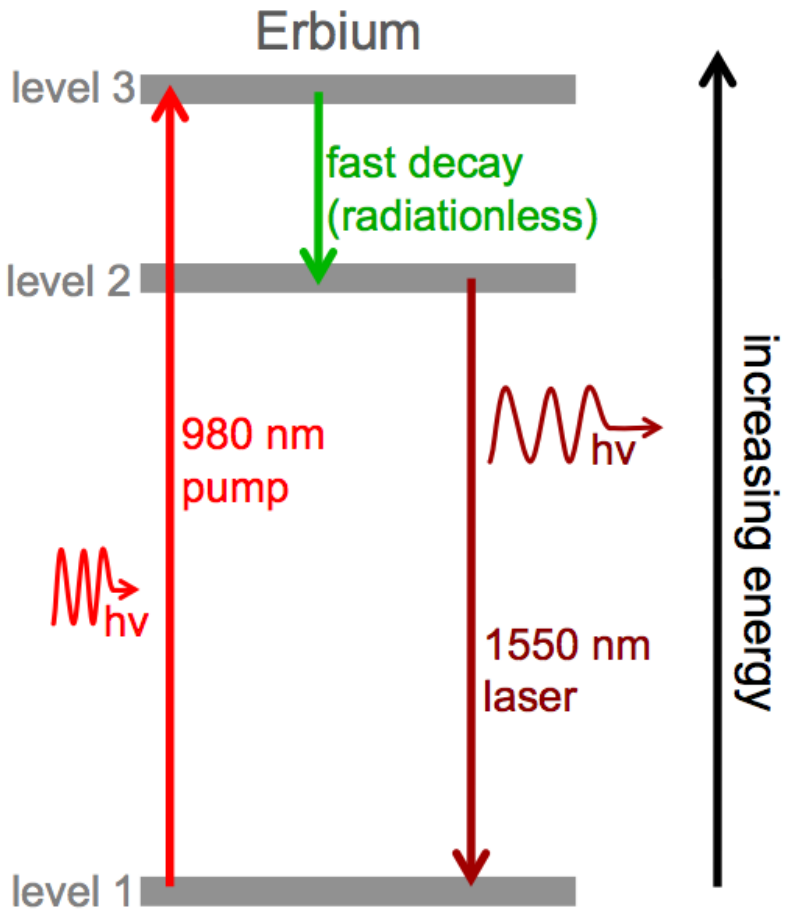
- Greater understanding of laser systems
- Uses:
  - Telecommunications
  - Spectroscopy

What is a laser? How does it work?

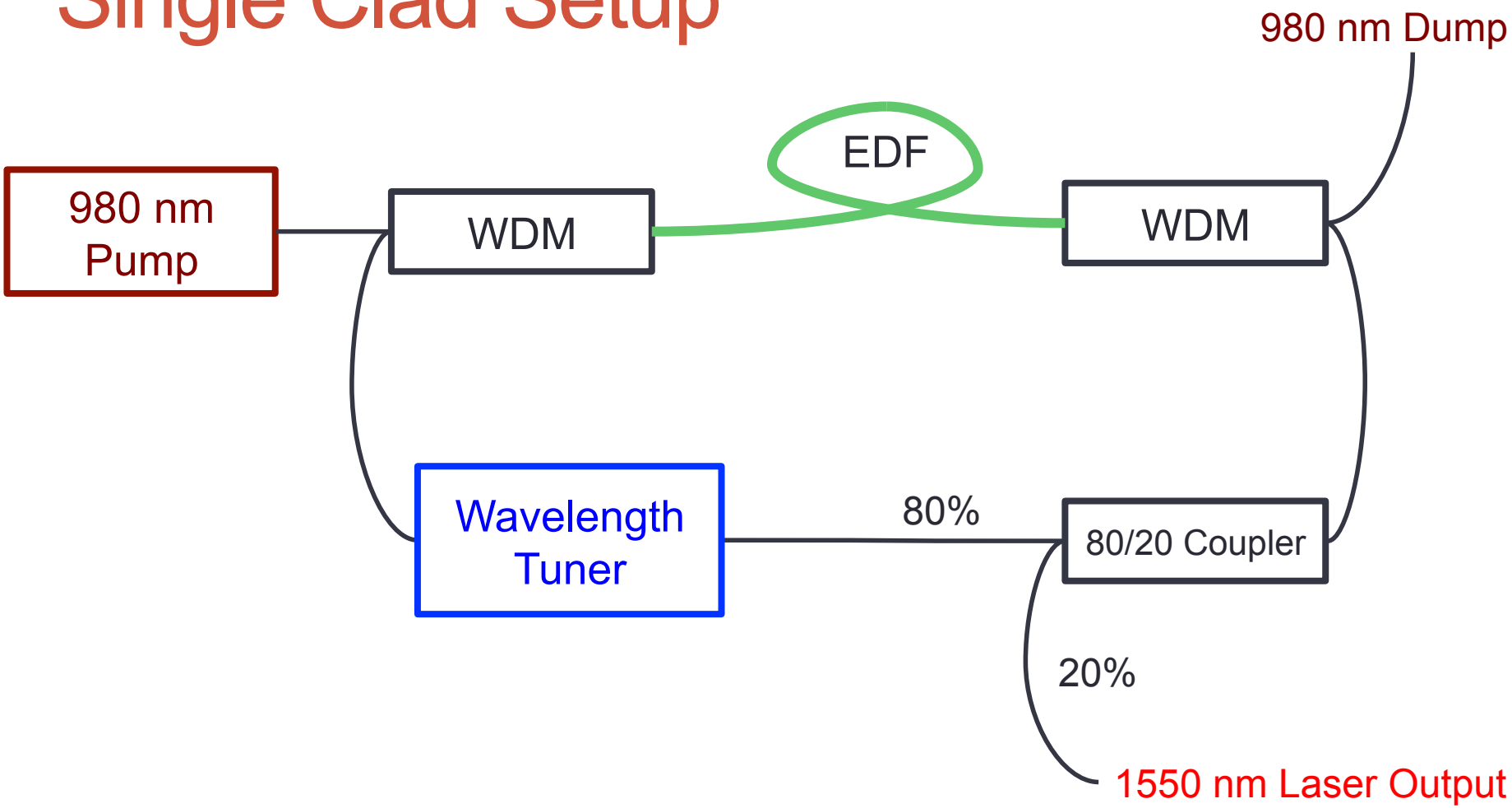


Erbium Doped Fiber Laser

- Erbium doped gain medium
- Ring laser
- Continuous wave

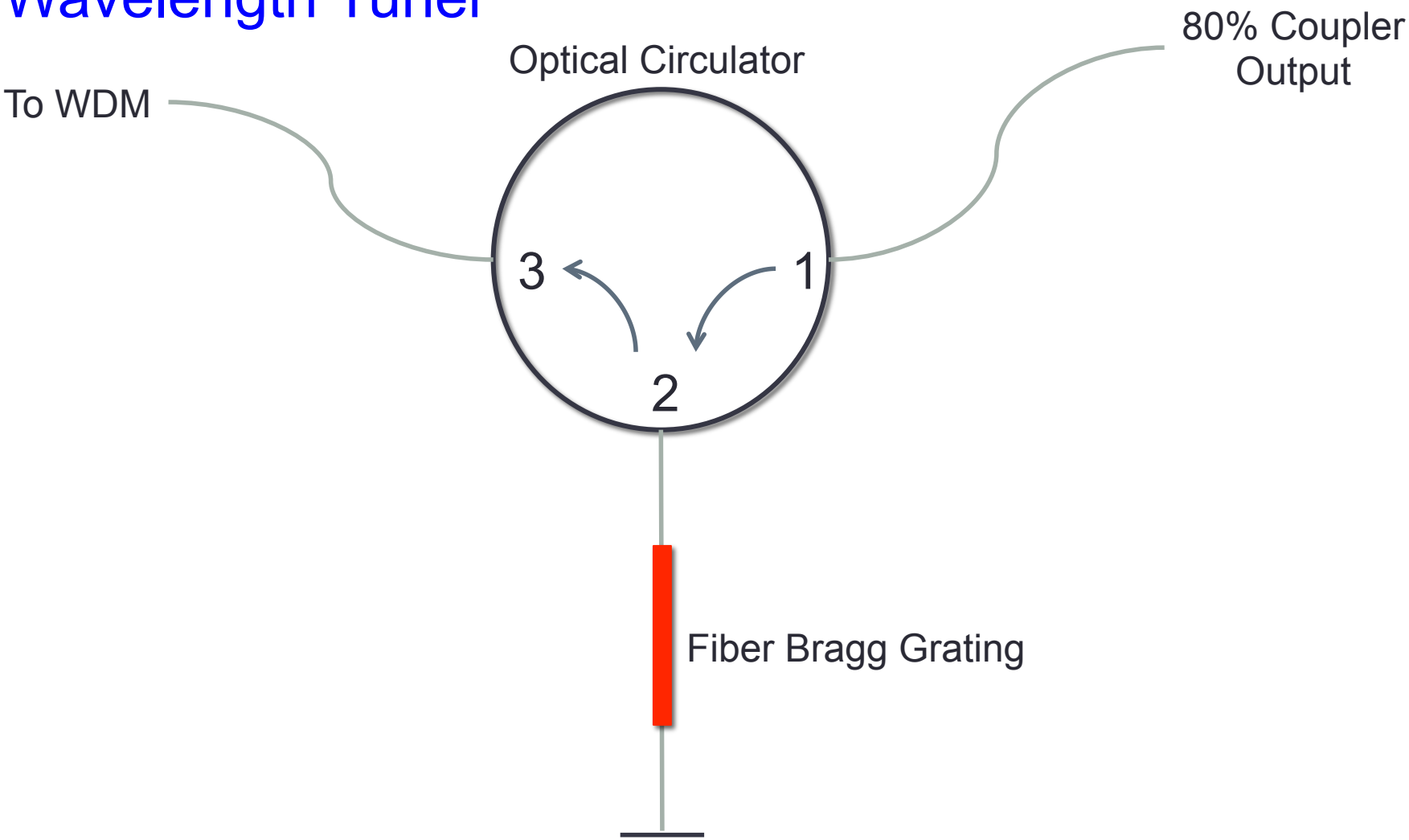


Single Clad Setup



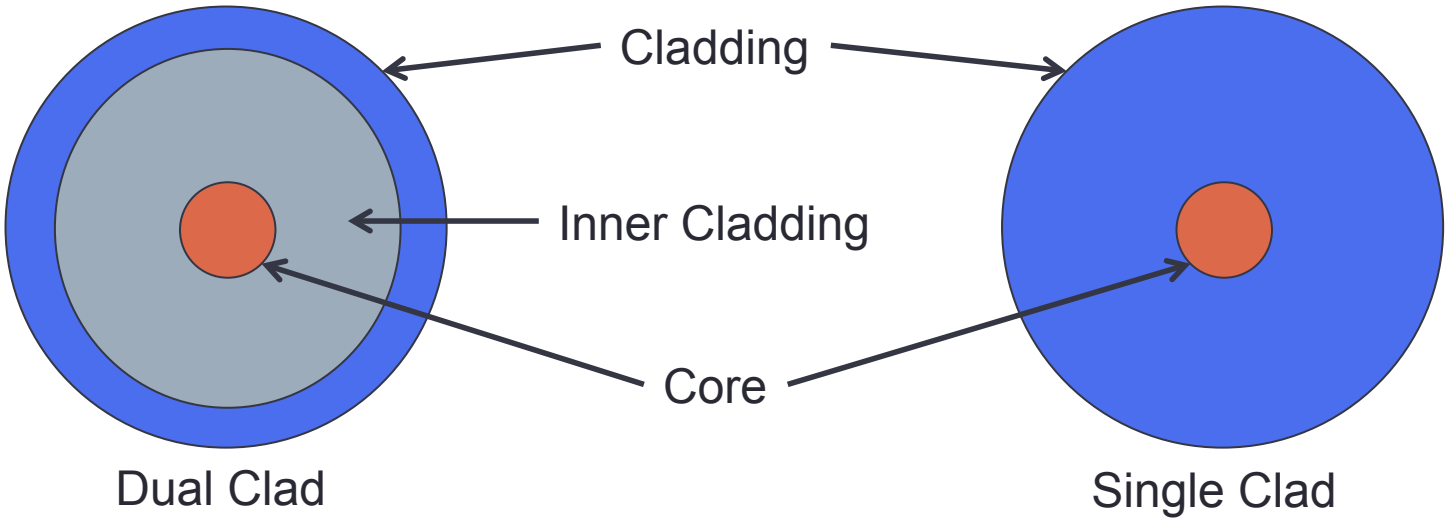
Single Clad Setup

Wavelength Tuner

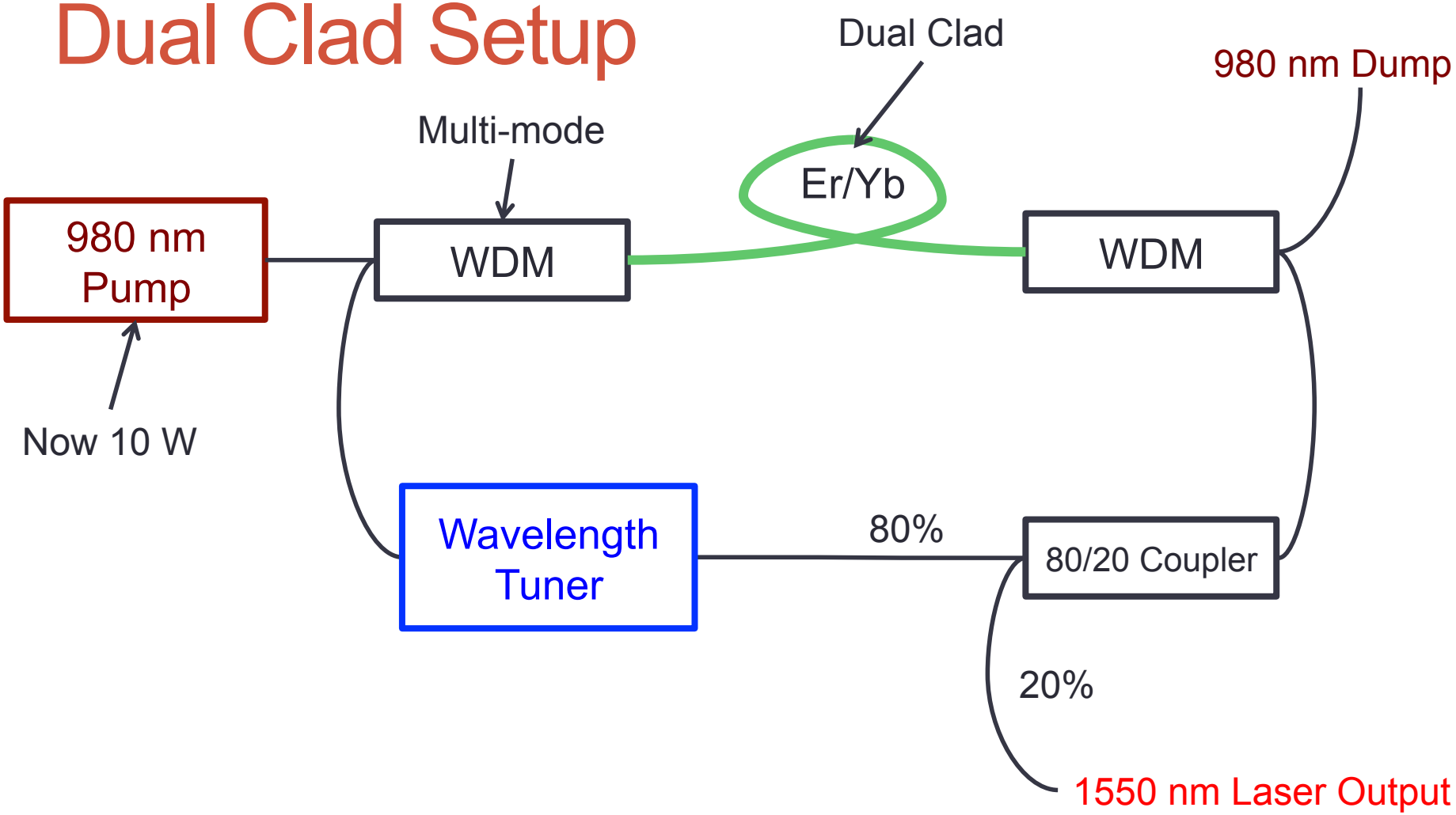


Dual Clad Laser System

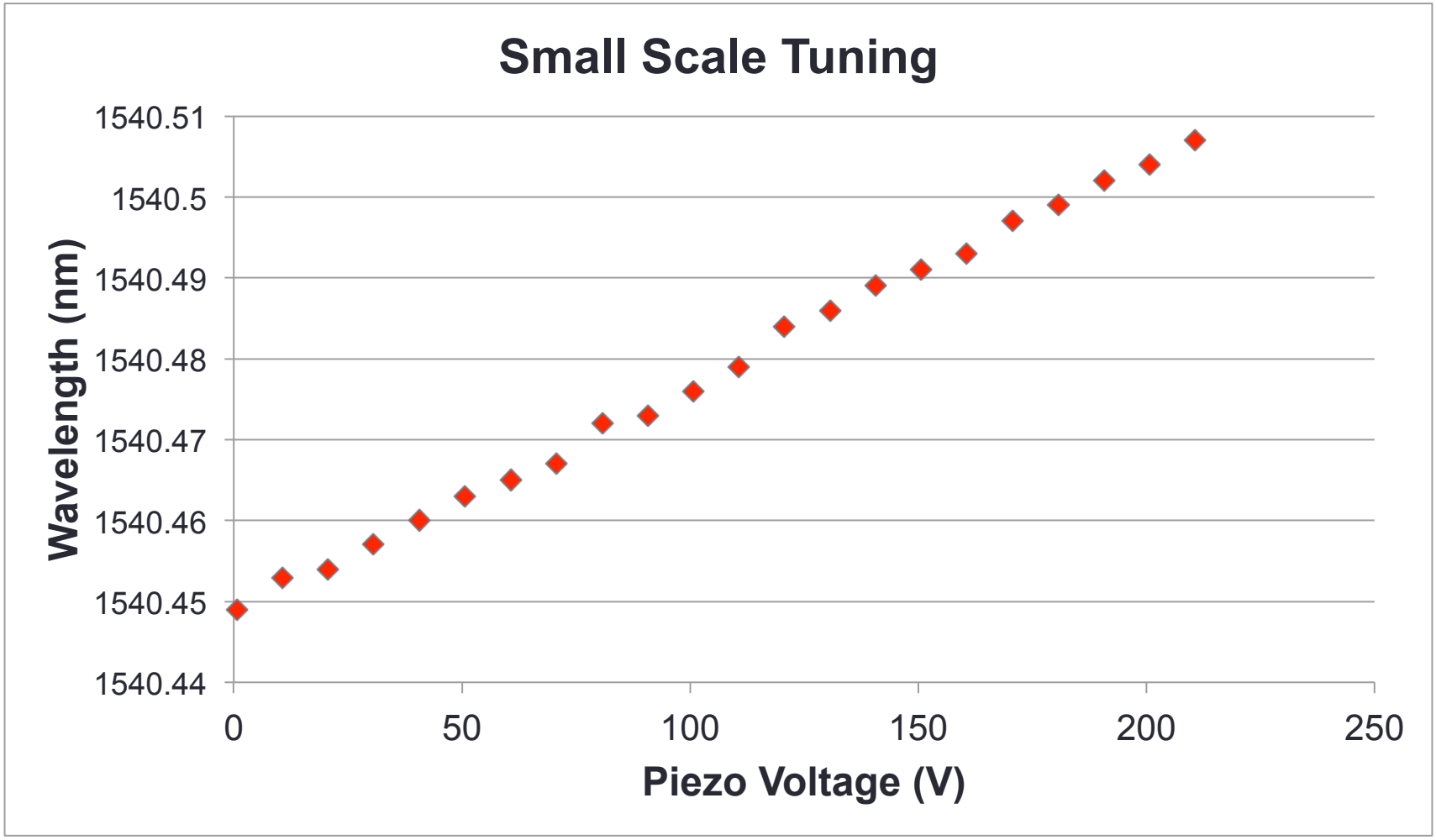
- Extra cladding allows propagation of more modes
- Means greater pump power to the gain medium
- Leads to greater power output than single clad system



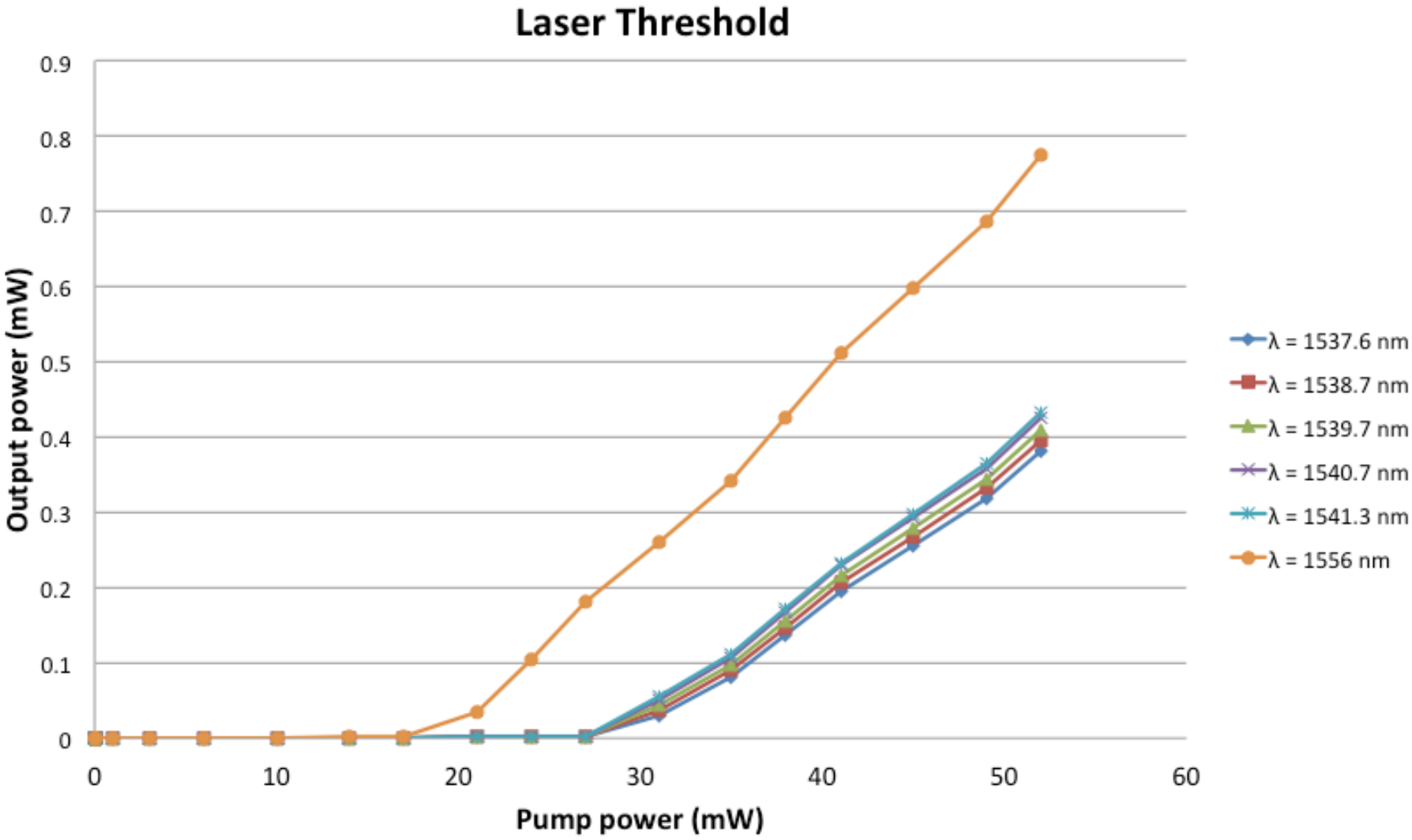
Dual Clad Setup



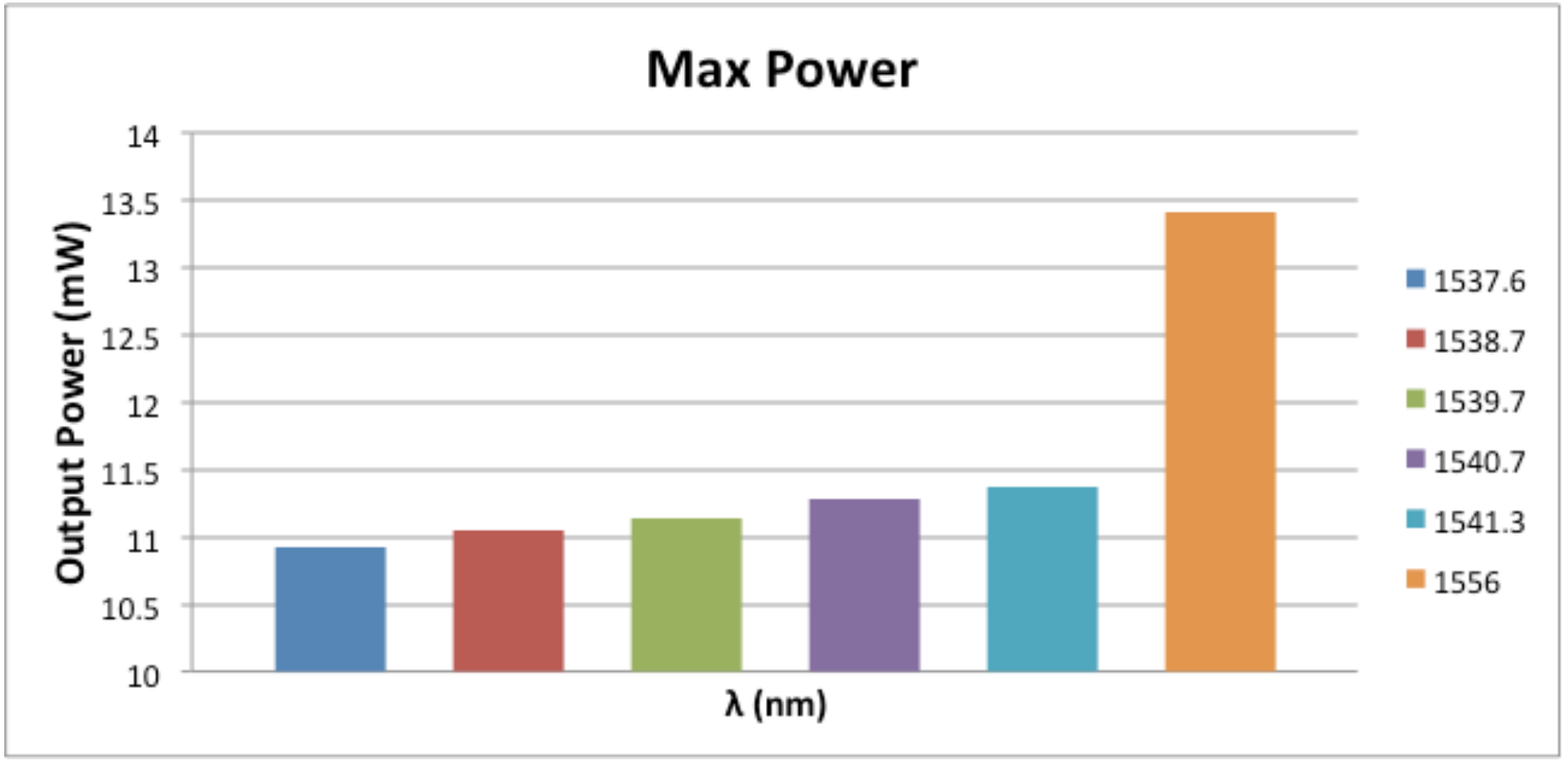
SC Tuning Capabilities



SC Threshold Data



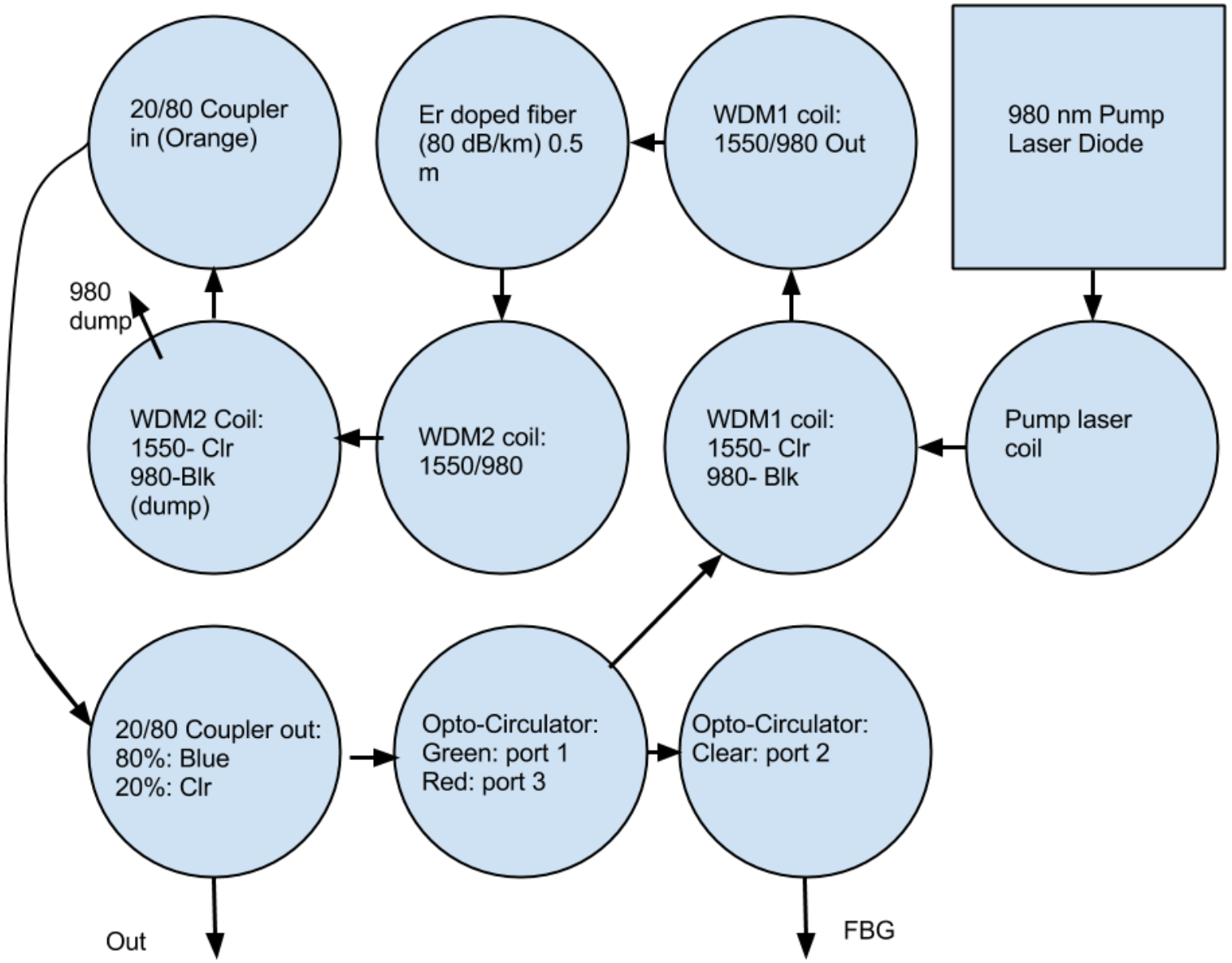
SC Max Power


Max Power
Output Power (mW)
14
13.5
13
12.5
12
11.5
11
10.5
10
λ (nm)
1537.6
1538.7
1539.7
1540.7
1541.3
1556

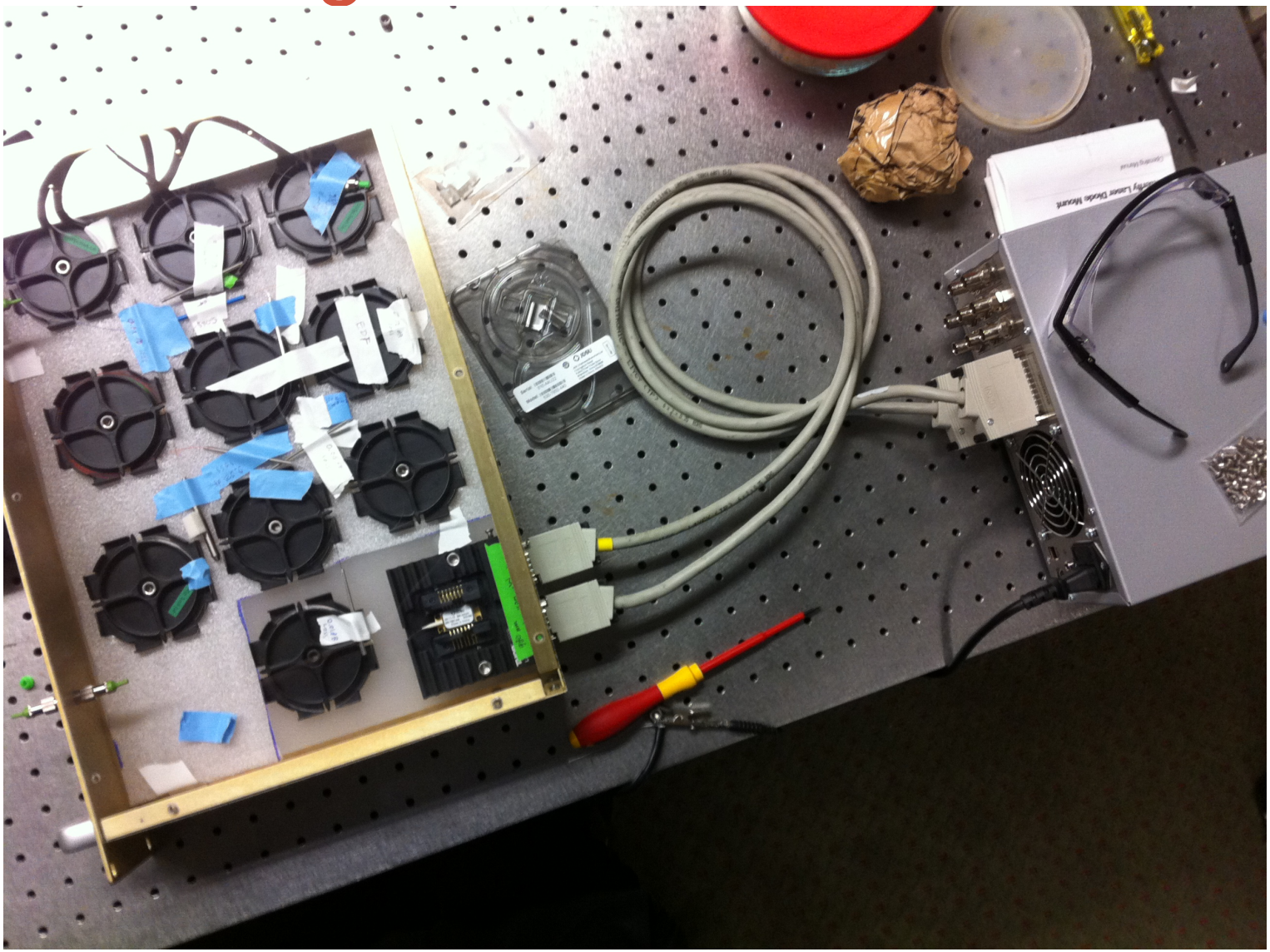
Dual Clad Results

- Unable to construct DC-EDFL
- Dual-clad fiber geometry has a major effect on transmission properties.
- Connectorizing and splicing fibers caused major power loss

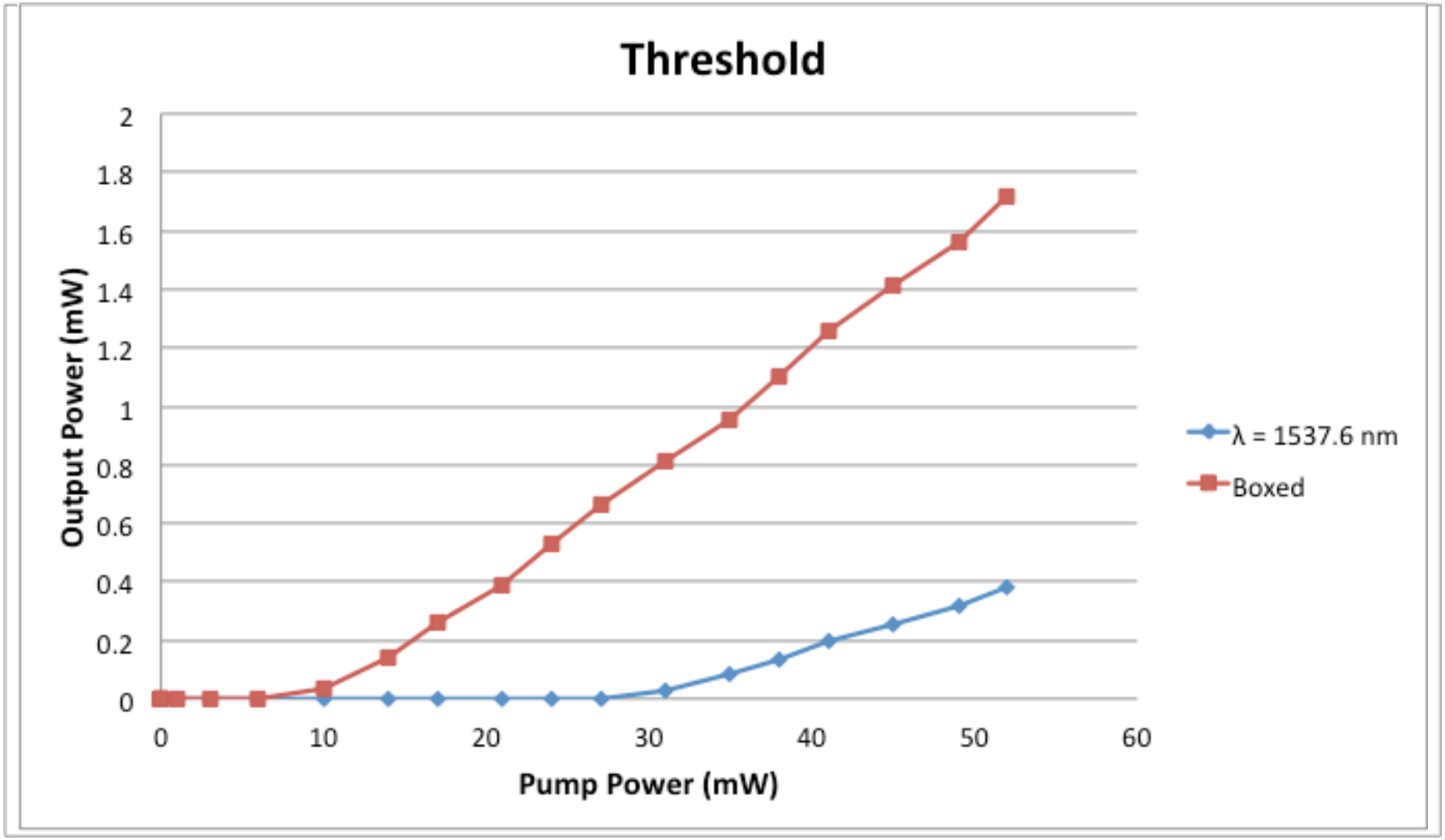
Boxed Single Clad Laser



Boxed Single Clad Laser



Boxed vs. SC Results

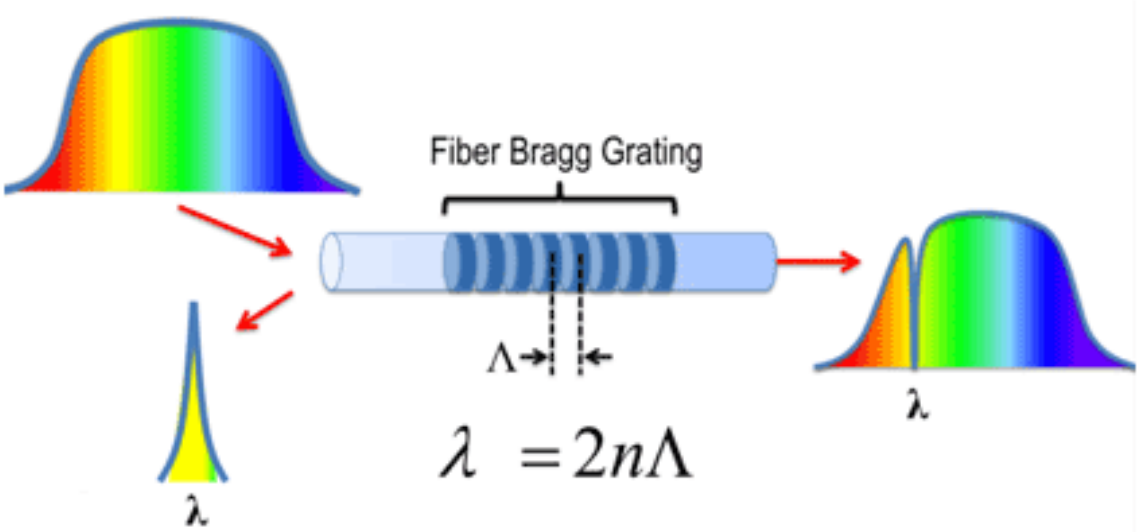


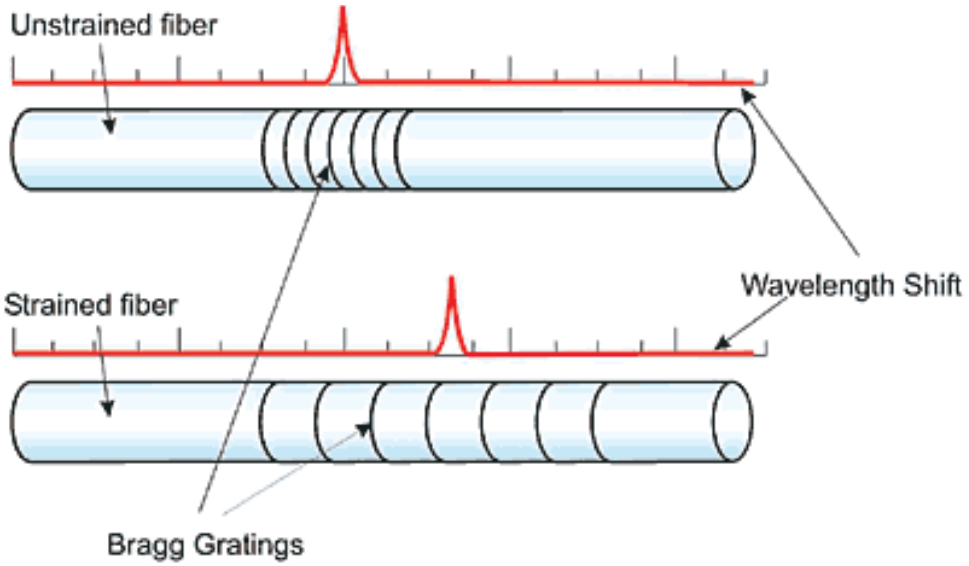
Future Work

- Solve dual clad issues
- Make FBG box
- Install fan or other temperature control device for boxed laser

Questions?

Fiber Bragg Grating



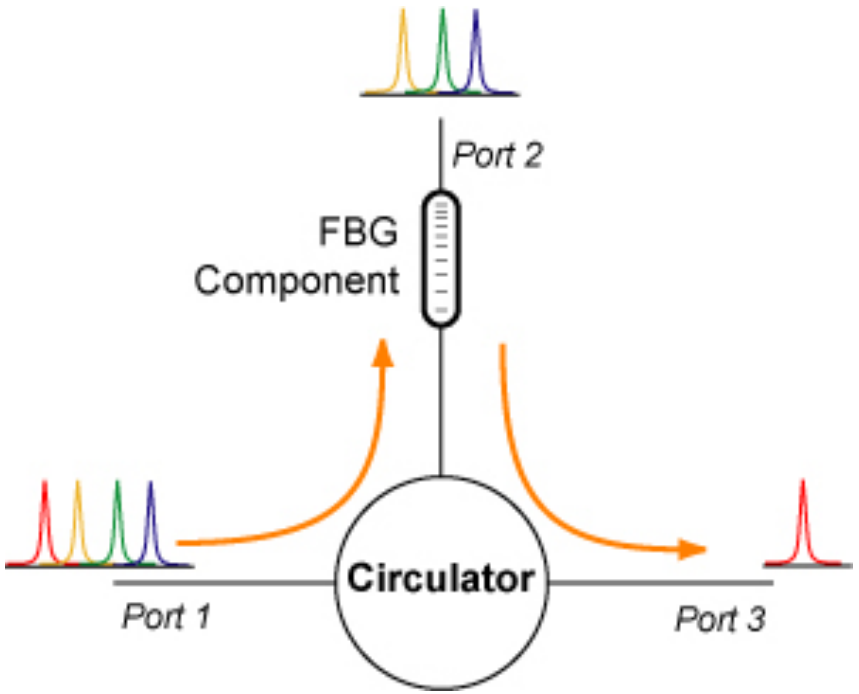


Wavelength Division Multiplexer

- Fibers inside WDM wrapped in a way to allow the evanescing transfer of one wavelength but not the other

Optical Circulator

- Loss from 1 to 2 and 2 to 3 is small. Loss from 3 to 2 and 2 to 1 is large.
- Acts as an optical isolator (restricts propagation of light to one direction)



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Spectroscopy

- Study of the interaction of matter and light

- Used to find:
  - Material absorption
  - Material emission
  - Atomic spectral lines