Scalable Parallel Computing for Photonic Research Simulations

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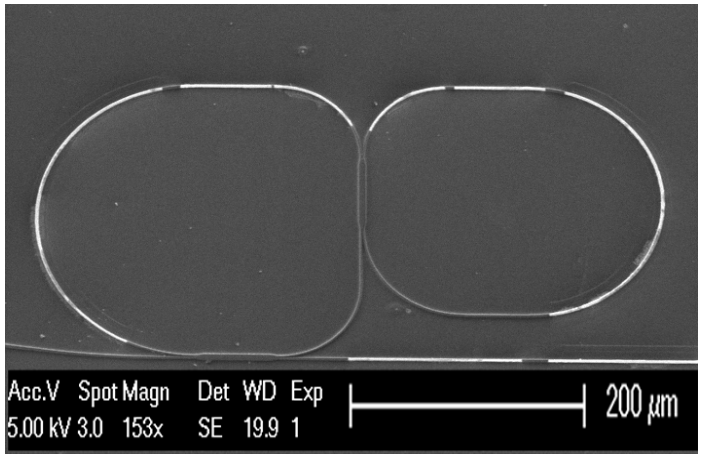
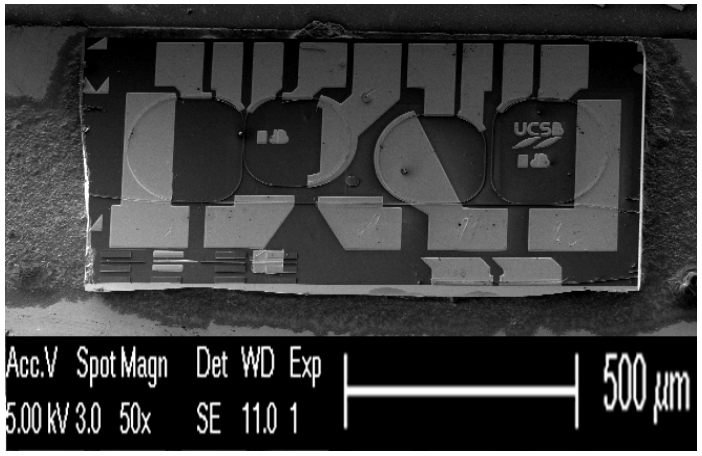
Photonic Integrated Circuits (PICs):

- Optical components on a single chip(10-1000)
- Size < 1cm²
- Applications:
  - Telecom/internet
  - Optical logic
  - Optical memory
- Benefits:
  - Faster data communications
  - Smaller size
  - Less power consumption

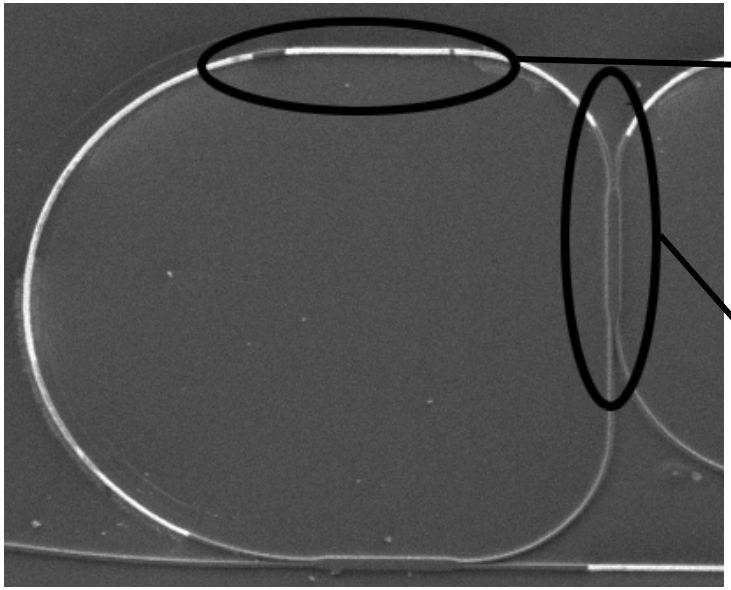


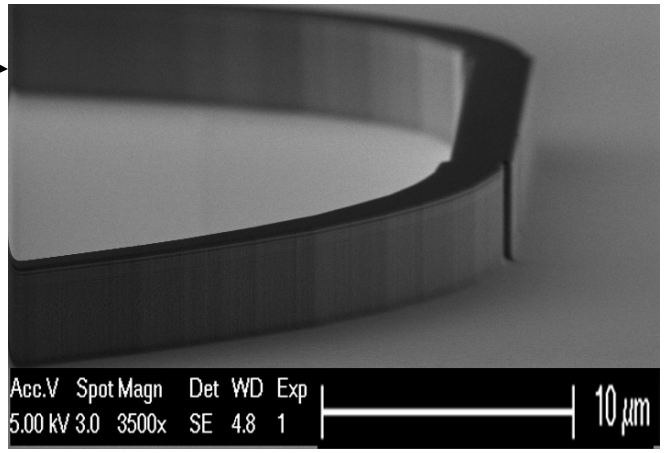
Ring laser (courtesy Coldren group)



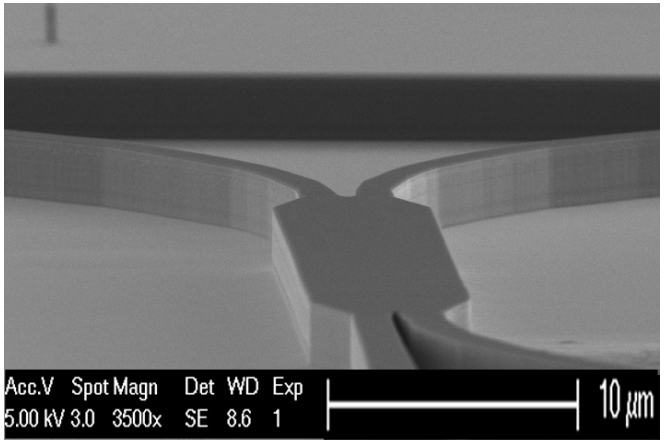
Ring laser with contact pads (courtesy Coldren group)

Optical components





Waveguide (courtesy Coldren group)



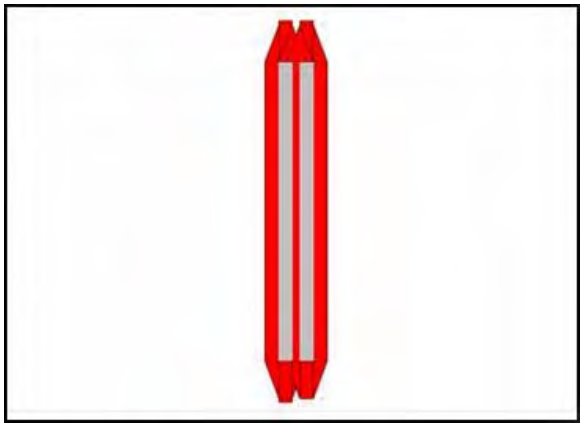
Coupler (courtesy Coldren group)

- Waveguides
- Couplers
- Amplifiers
- Mirrors

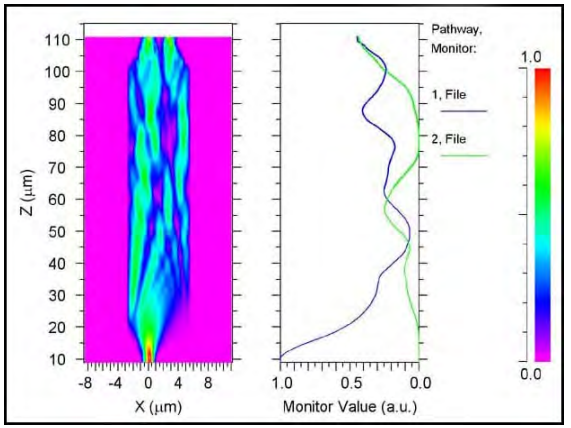
- Individual component designs need to be simulated and tested independently

Device Simulations

- Many simulations (sweeps) are required to optimize design.
- Networked computers needed to speed up the process.
- Build software to network process these sweeps.



RSoft CAD drawing of an optical coupler

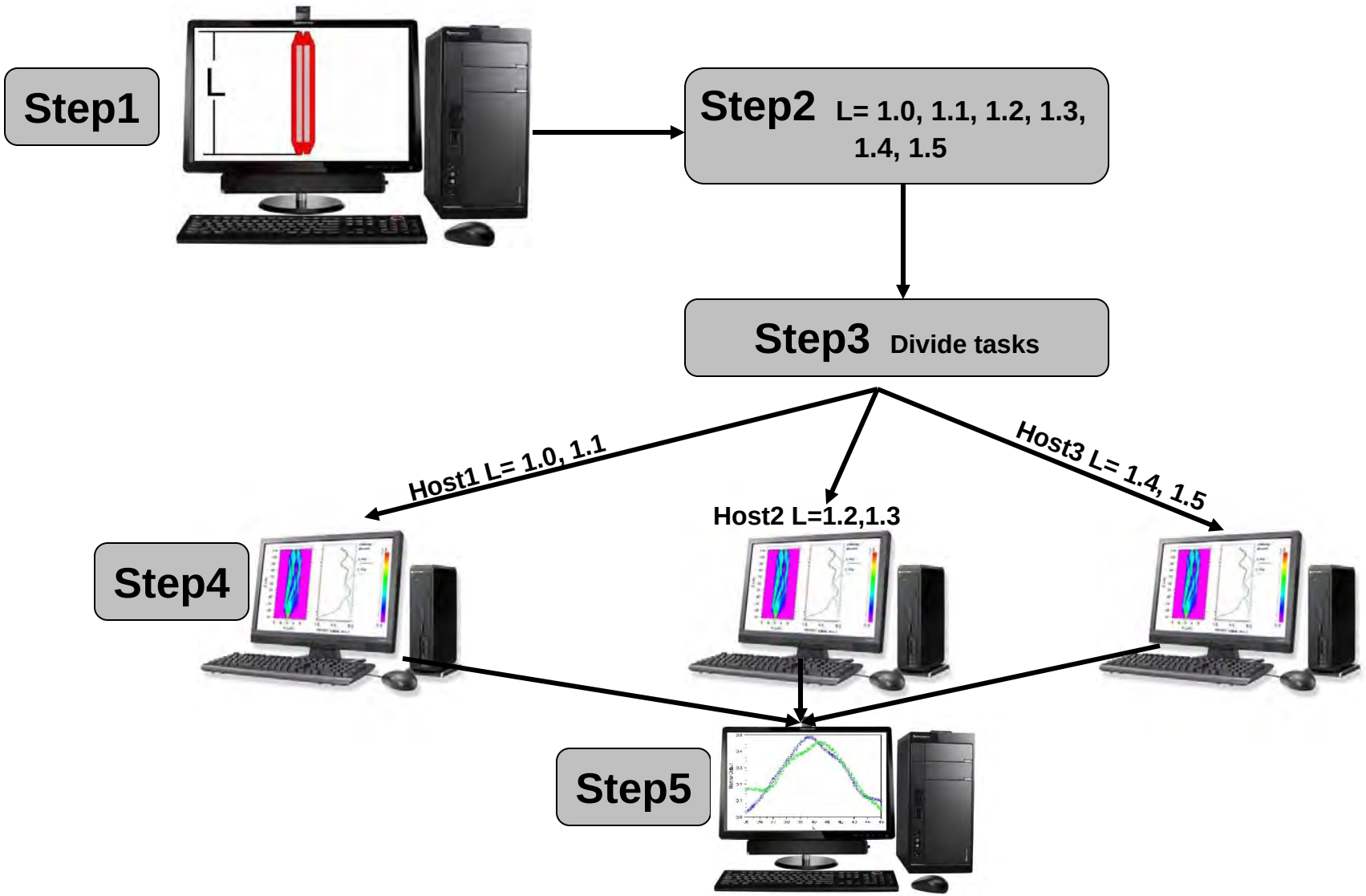


RSoft BeamProp Simulation of a coupler

Batch Simulator Requirements

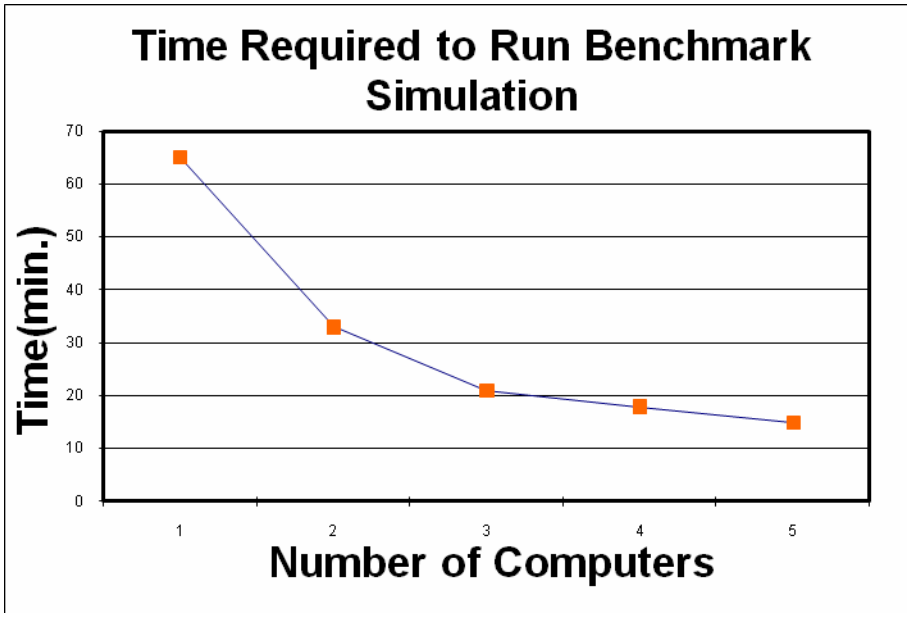
- Interface with existing RSoft CAD software.
- Use existing computers in the lab on the existing network.
- Operate autonomously once sweep data has been inputted.
- Produce results in a form identical to original software.

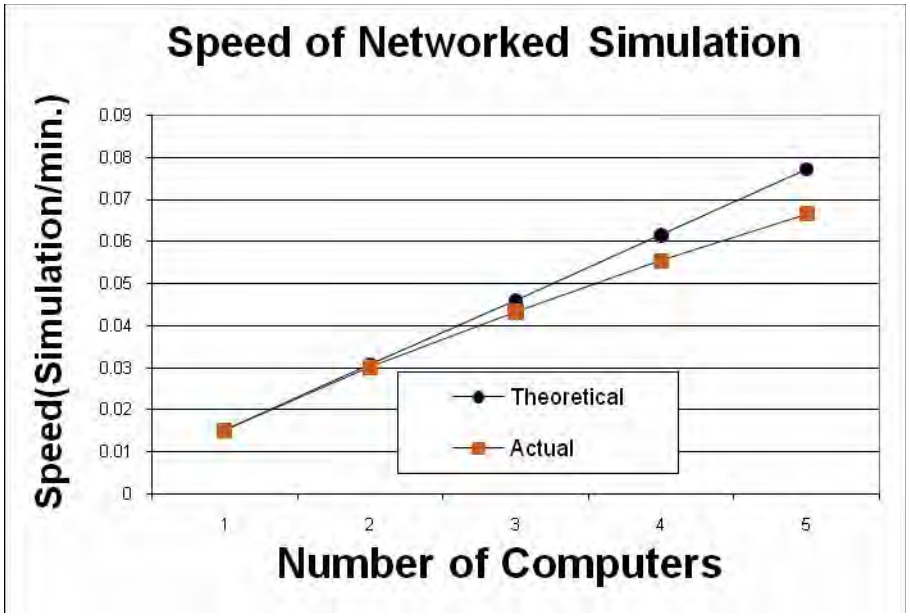
BatchSim Program



Results of Networked Processing

- Identical simulation run on different numbers of machines.
- Substantial decrease in time required as more machines are added.
- Some redundant overhead processes required on each machine reduce efficiency.





Future Work

- Improve Speed
  - Customize workload of each machine based on processor power
- Improve reliability
  - Develop network self diagnostics
- Improve output data presentation
  - Customizable graphs

Acknowledgments

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