

Building an Optical Network

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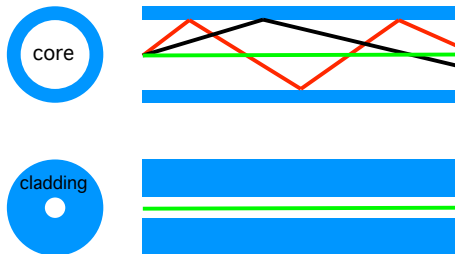
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Optical Network?



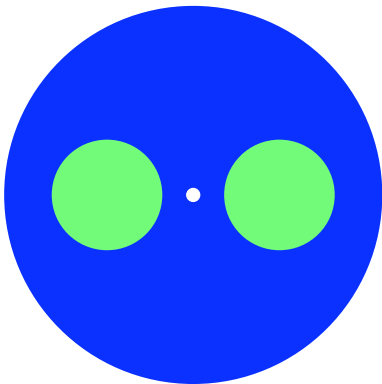
- Use optical fiber and BNC cable to connect Dr. Novikova's lab and Dr. Aubin's lab.
- Allow for the sharing of lasers and instruments, particularly a Ti:sapph laser for which the labs jointly requested funding.
- The Ti:sapph laser cannot be moved between the labs because it is large and sensitive to vibrations.

Types of Fiber



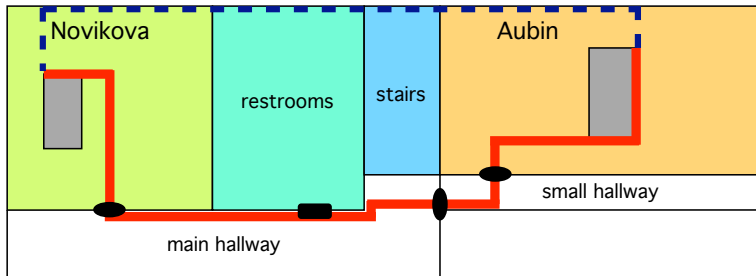
- Multi-mode fibers are much easier to couple to and are cheaper, but the output is dispersed.
- Single-mode fibers output a nice gaussian, but are very difficult to couple to and work for specific light only.

Polarization Maintaining Fiber



- Maintain the polarization of light as it propagates through the fiber.
- Include rods of a different material to make a non-circular cladding.
- The induced stress on the core gives the core different diameters along its axes.
- Different diameters produce different refractive indices, which maintain the polarization of the light.

Length of the Fiber



- Fiber had to reach all points of the optics tables in both labs.
- All corners must be right angles.
- Estimated a minimum length of 37 meters.
- Ordered 45 meter fibers to be on the safe side.

Installing the BNC



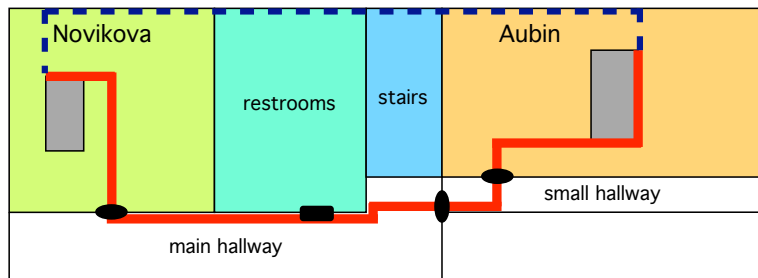
- Dr. Novikova had a large box of long BNC cables.
- Untangled the cables and found there were 10 cables, each approximately 43 meters long.
- Bundled 5 cables together for the network and set the 5 spares aside for later.
- Installed the cables along the desired path with little difficulty.

Installing the Fiber



- When the fiber arrived installed it along the same path as the BNC.
- Installed the multimode fiber first, then then two single mode fibers.
- Three days were spent installing the fiber.
- Two people were needed to string the fiber through the hole in Dr. Novikova's lab and the hole into the small hallway.

Installing the Insulation



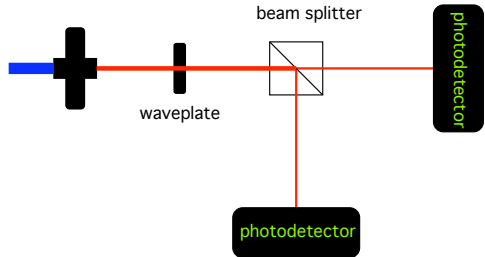
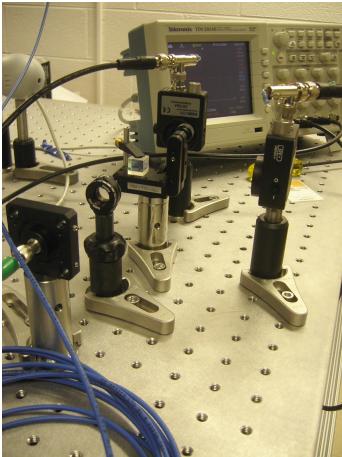
- Insulation was standard pipe insulation.
- Had to insulate a small section of ethernet cord.
- Had to uninstall the BNC and one fiber from Dr. Aubin's lab to untangle things in the small hallway.

Testing for Power Loss



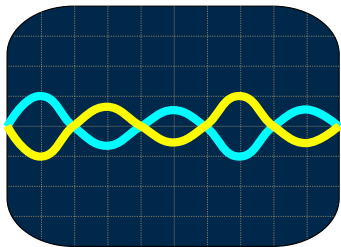
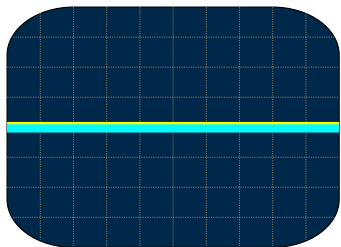
- Attached network fibers to aligned short fibers to test the network fibers.
- Multimode
 - 13% loss with barrel and short fiber.
 - 13% loss with barrel and network fiber.
- Singlemode
 - 25% loss with barrel and short 850nm fiber.
 - 35% loss with barrel and network 850nm fiber.
 - 17.5% loss with barrel and network 633nm fiber.

Testing the Polarization Maintaining Capability



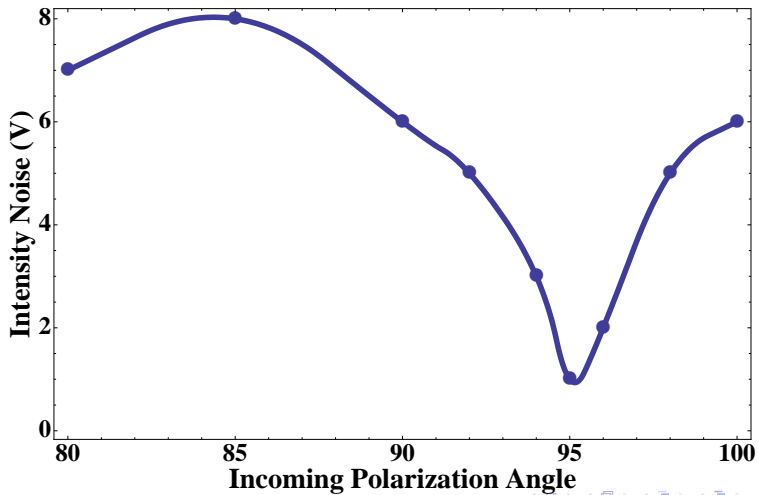
- Beam splitter separates horizontally and vertically polarized light.

Testing the Polarization Maintaining Capability

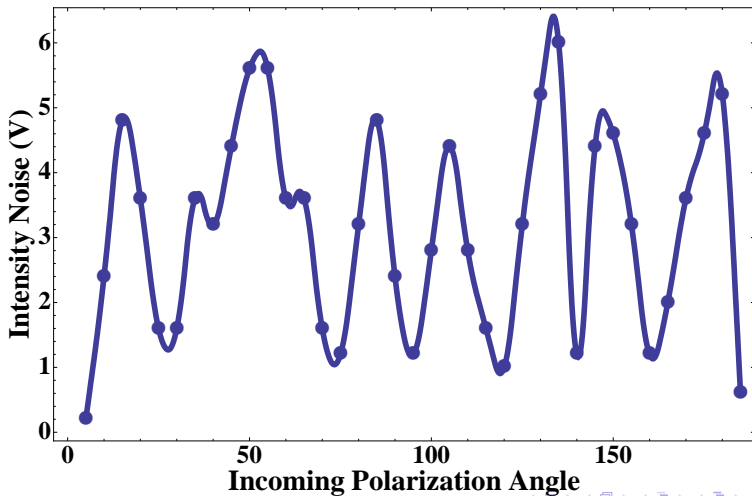


- Ideally output should be a constant line.
- Realistically one polarization's intensity will increase and one will decrease as the polarization in the fiber rotates.
- Must align incoming light along either axis of the fiber.
- Should be four alignments which maintain polarization.

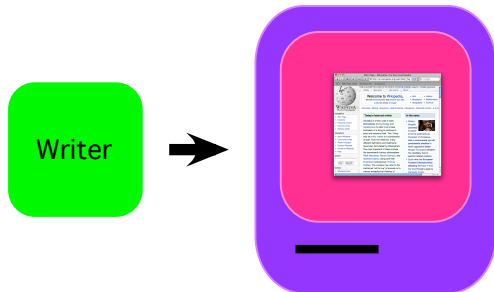
Polarization Alignment



Polarization Maintaining Results

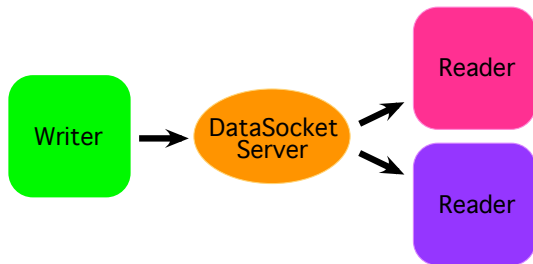


Web Publishing



- Publishes wavemeter output to a webpage very simply.
- Updates only once about every 3 seconds.

DataSocket



- Stream wavemeter output between the two labs using LabVIEW and DataSocket.
- Writer updates twice every second, readers update approximately one update behind.

The End

Questions?