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Fabrication Status of the Quarter Scale Scintillating Strip Muon Detector Prototype Planes

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Motivation

- Fabrication of quarter-size planes (1.4m × 2.8m) will exercise all the steps required to make full-sized planes
- Quarter-size planes are more manageable, easier to transport, etc.
- Conserves raw materials – scintillating strips and fiber
- Will have four detectors ready by end of summer for use in beam tests and/or cosmic ray telescope

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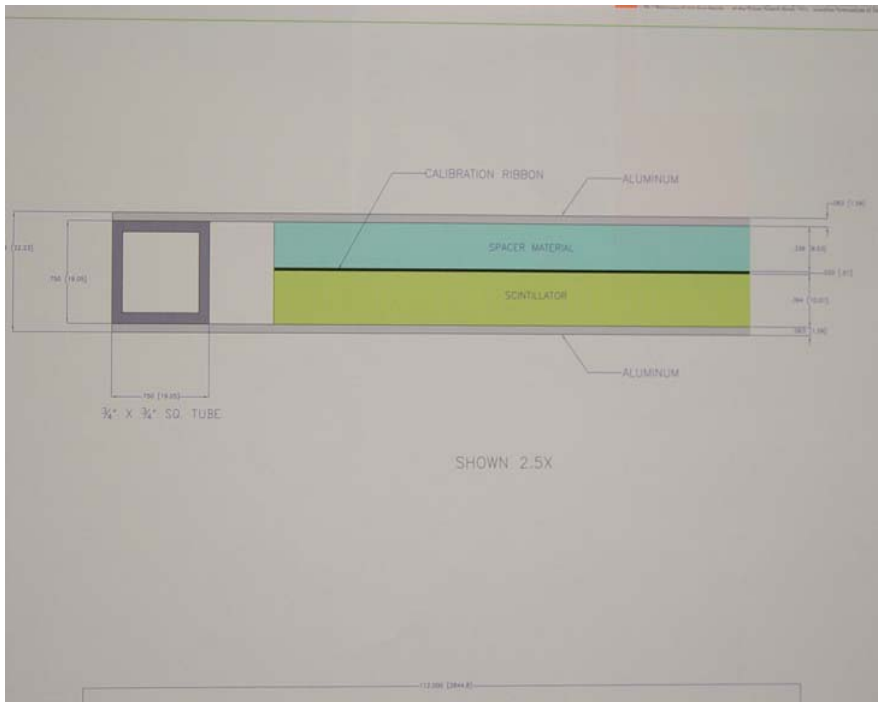
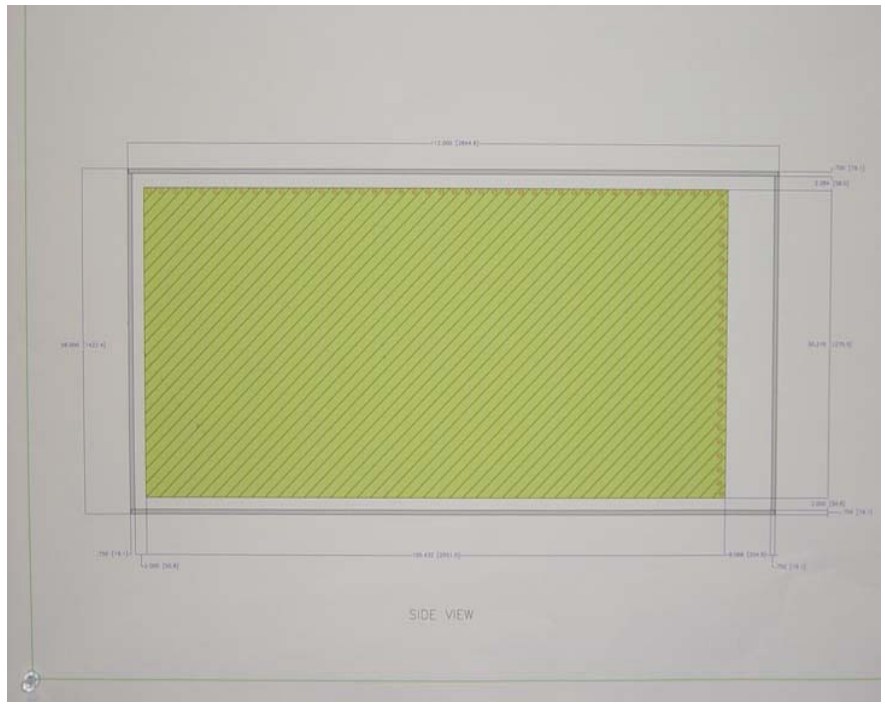
Assembly Concept





- Dimensions: 2.2cm x 1.4m x 2.8m
- 64 active strips with wave shifting fiber readout

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Production Plan

- Build four units
  - Two units with single splice and WLS metalized one end (S+ [//////], S- [\\\\\\])
  - Two units with double splice (D+,D-)
- A few features
  - Thermally straighten fiber ends
  - Paint ends of tiles with BC620
  - Bond WLS in grooves with Epon815,TETA
  - Use MINOS 64 channel cookie

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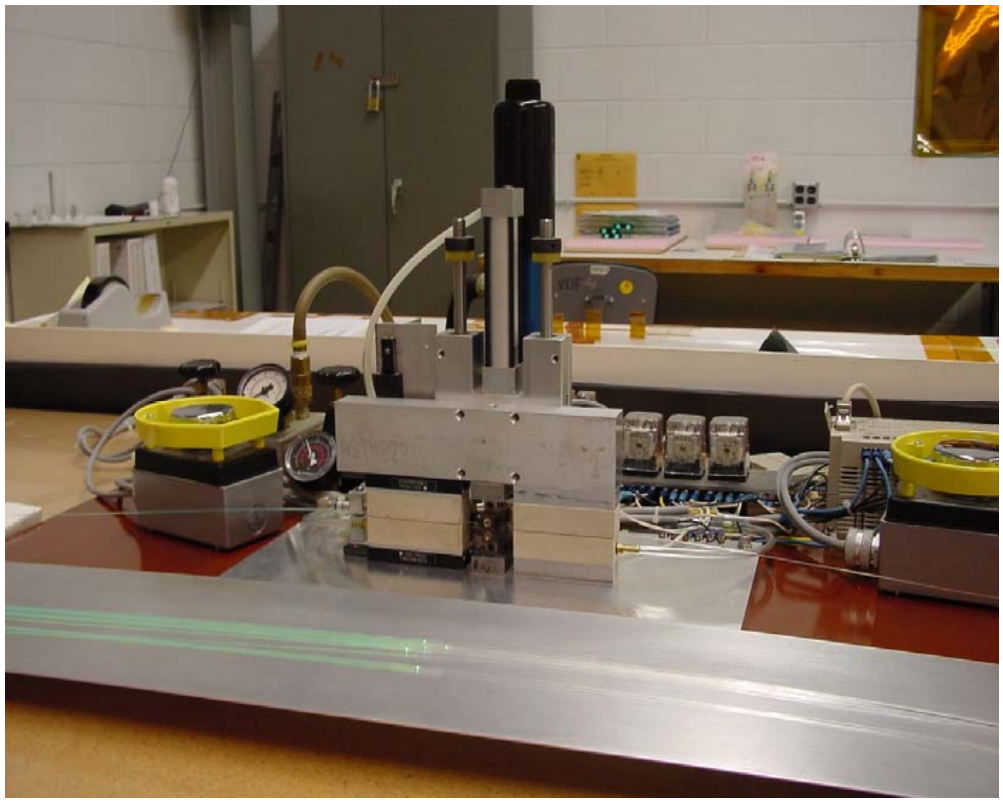
Thermal Splicing

- Splicing machine (U. of Mississippi design) used at Fermilab lab 7



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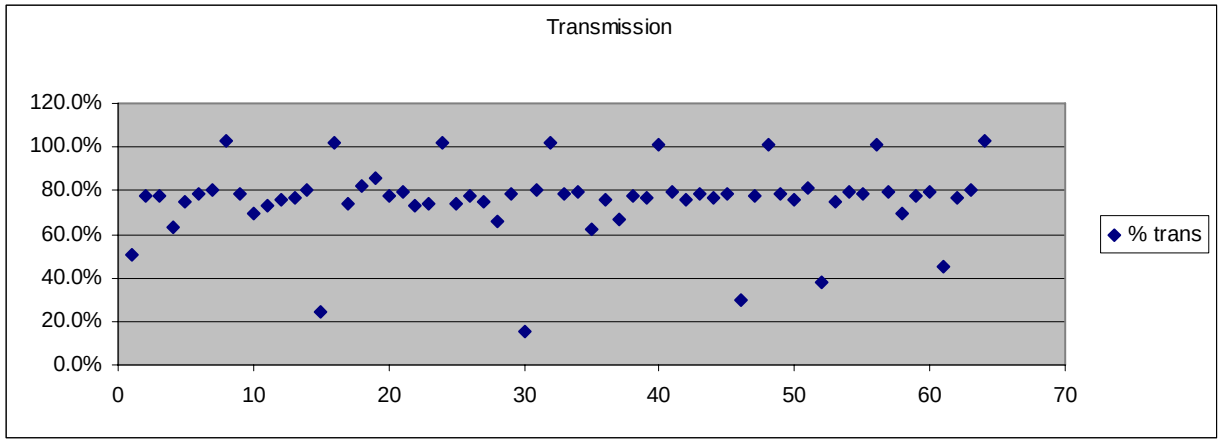
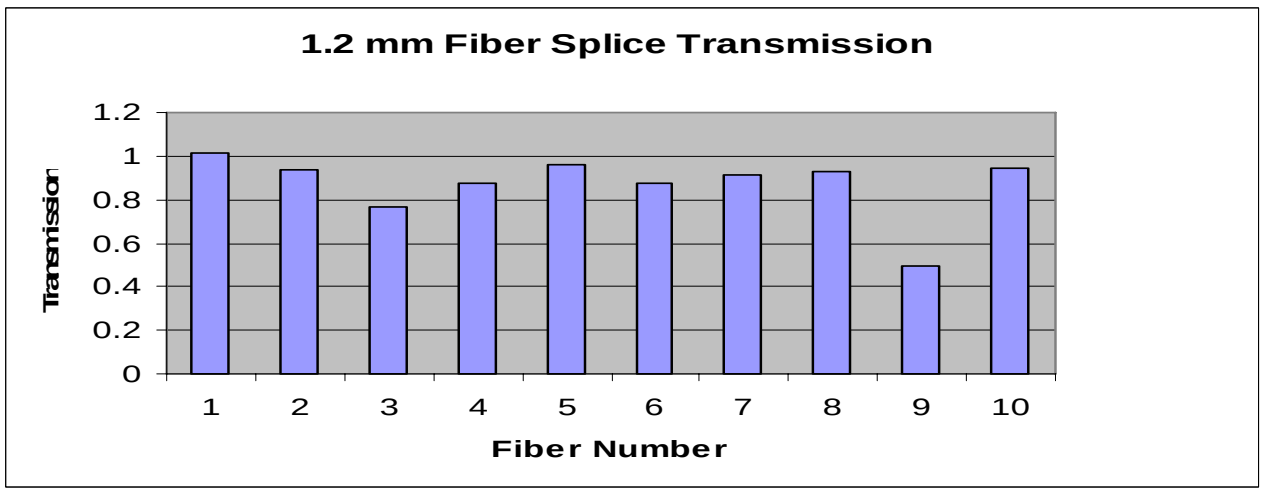
Progress on Fiber Splicing

First test with “non-standard” fiber



Second test with 1.2 mm fibers - 90 % average



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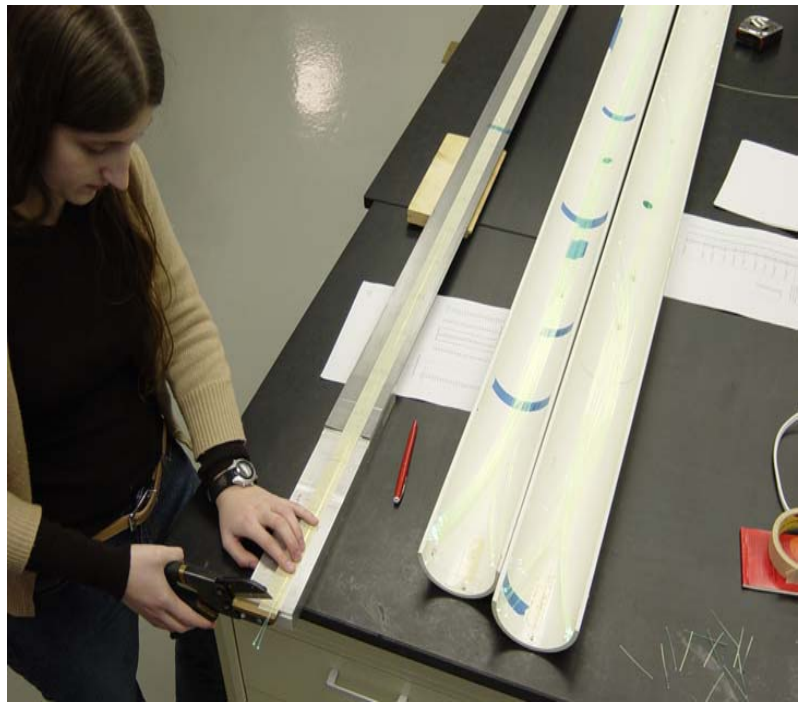
Fiber preparation

- 1.2mm Clear waveguide, spooled
- 1.2mm Wavelength Shifter, spooled

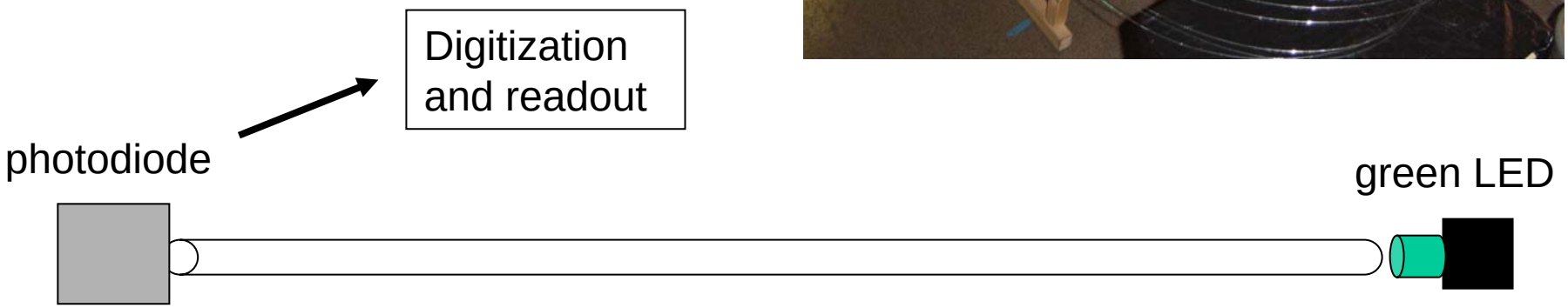
- Visual inspection with LED on end
- Measured on cutting template
- A clean, razor cut is made with ‘HandiCutter’

- All fiber used will be characterized before and after splicing to assure quality

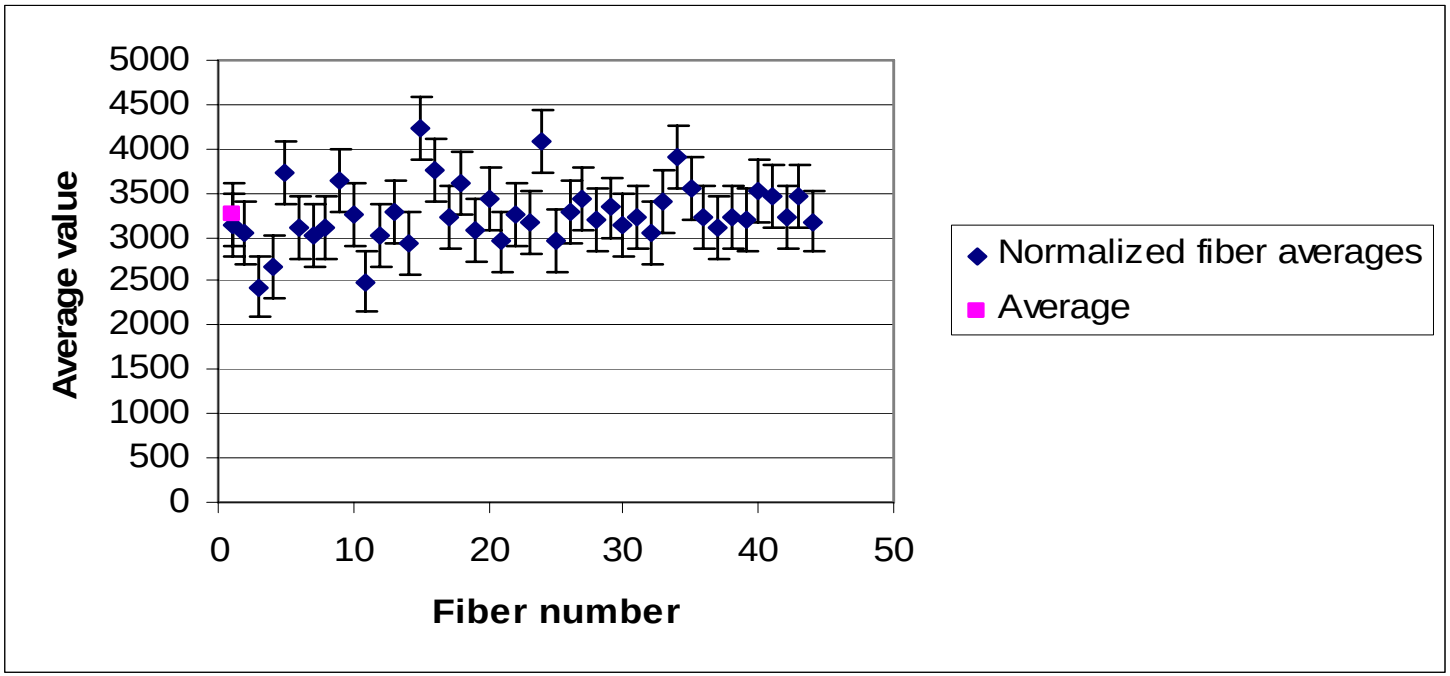


Fiber testing

- Fibers characterized with respect to each other
- Acceptance cut is 70% of average for group
- LED, photodiode, water couplant
- Three test runs each



Light Test of Waveshifting Fiber



44 separate pieces - no rejected fiber

Sigma of ~ 10%

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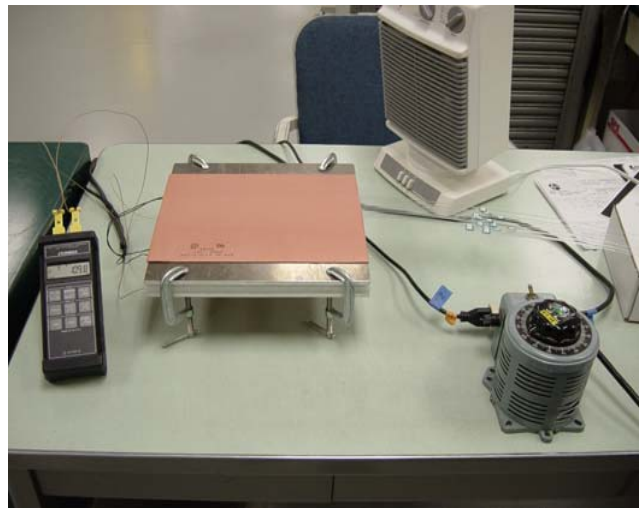
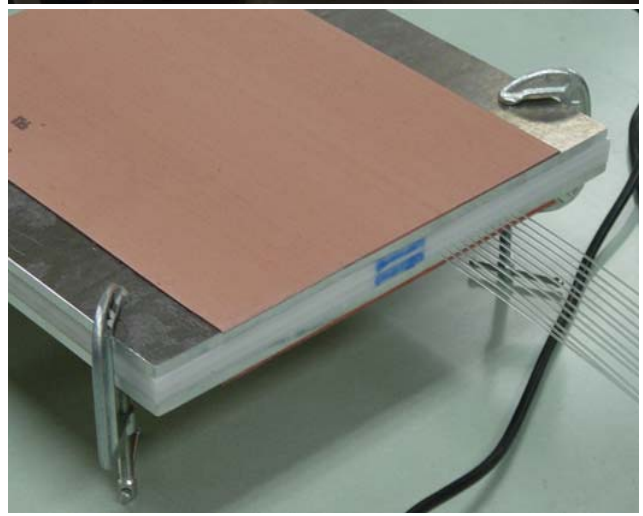
Thermal Fiber Straightening

- The quality and strength of a splice is improved by joining two perfectly flat, square ends because:
  - Fiber can be fixtured and fly cut more perfectly square if the natural bend of spooled fiber is removed.
  - Straight fiber can be fixtured more accurately in the splicing device.
- Temperature increased to 65°C and held for 1 hour.
- After cooling to room temperature, fiber retains straightness.





* Thermal treatment is also helpful to reduce stress on fibers when routing requires tight turns

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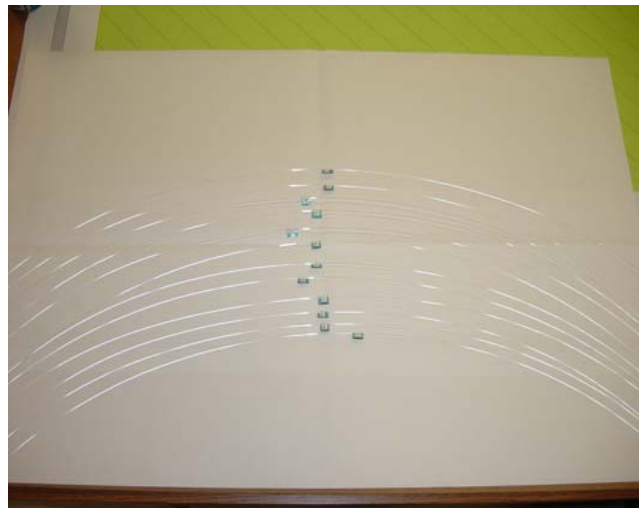
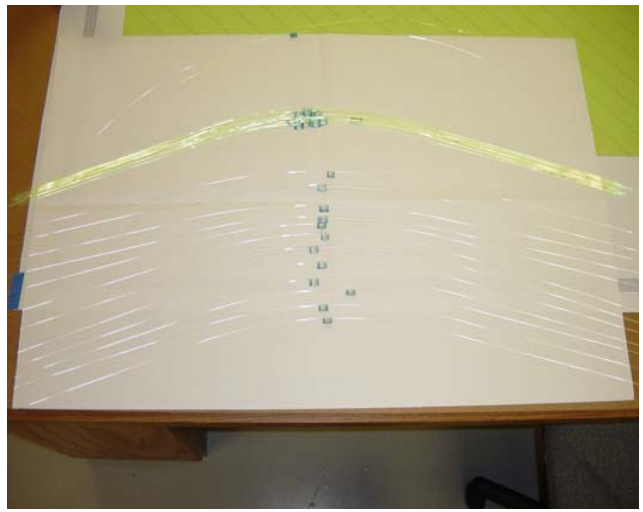
Straightened Fiber

- The natural curvature of fiber off the spool.



- 30cm of each end straightened



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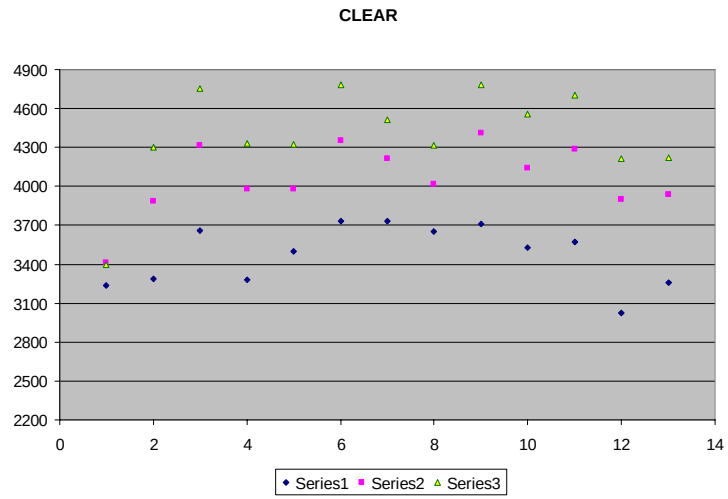
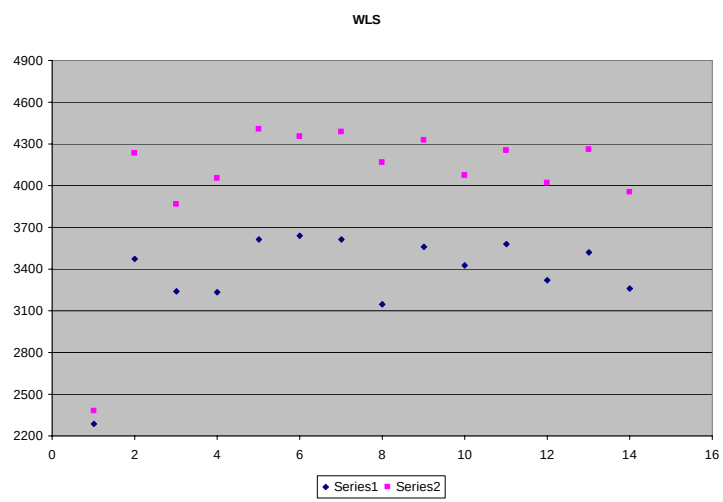
Light Transmission after Straightening

- Clear fiber shows an average 12% net improvement after straightening one end and 22% after both.



- WLS fiber shows an average 22% net improvement after both ends were straightened.



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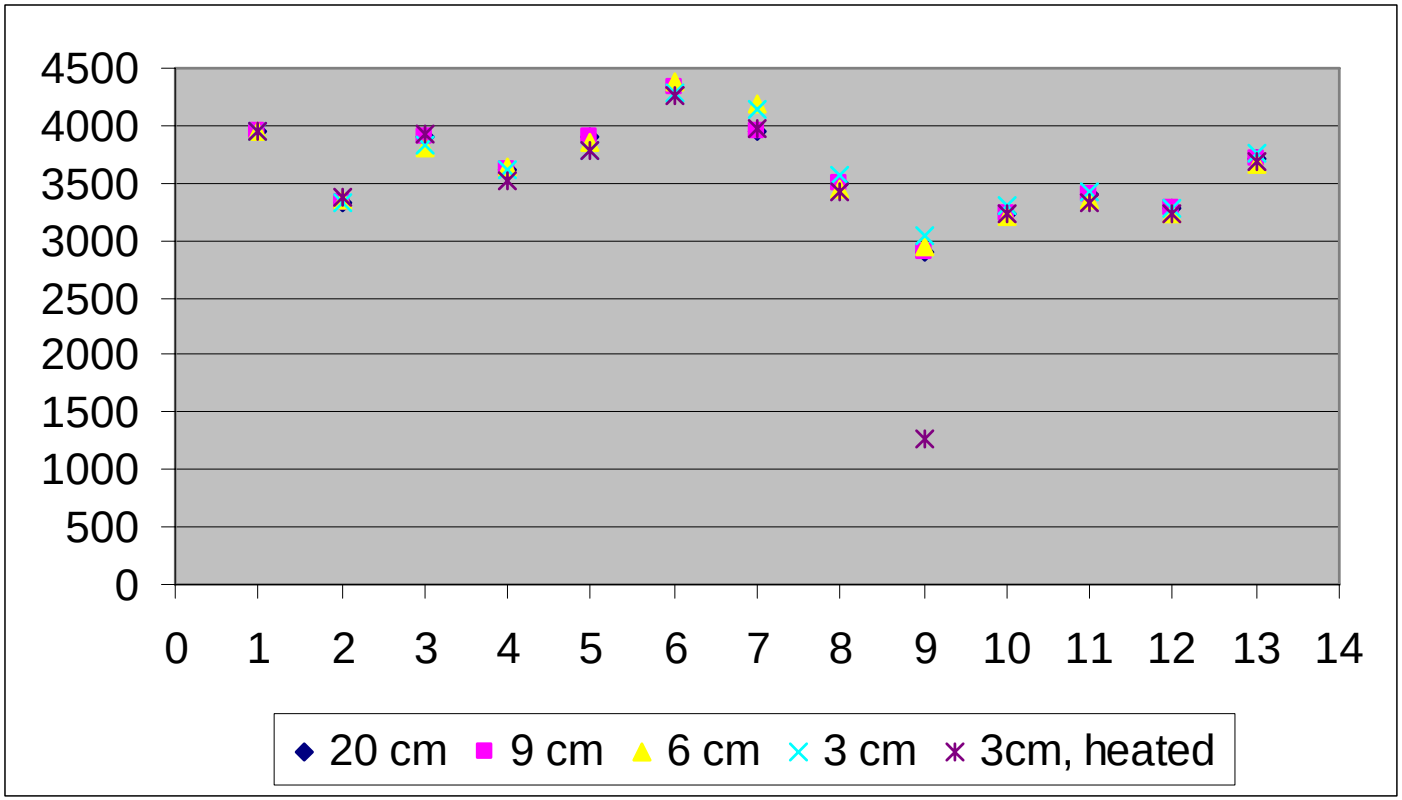
Light Transmission – Composite Fibers



Spliced fibers tested with bend radii of 20, 9, 6 and 3 cm – no degradation of light transmission

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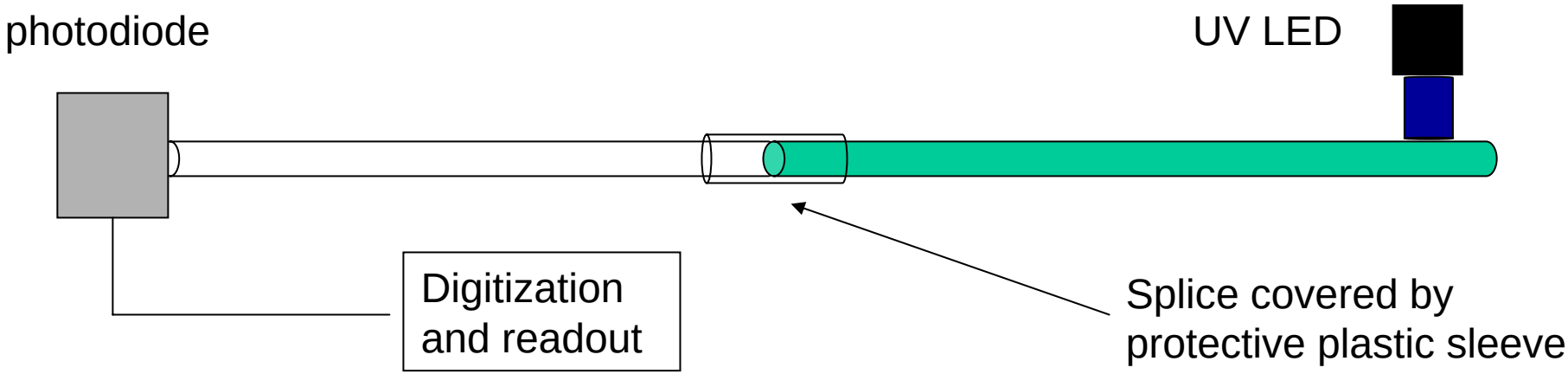
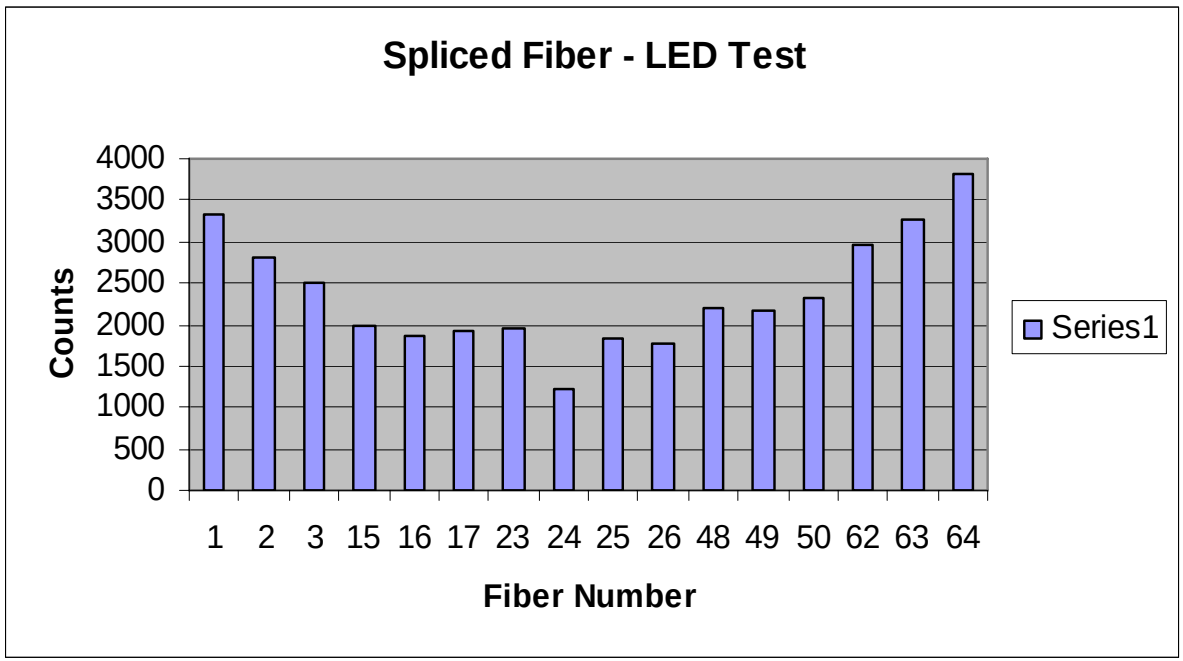
LED Test of Spliced Fibers





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Schedule, Manpower

- First detector plane completed by end of May
- Three more planes completed by the end of summer with the help of the team below plus additional manpower from Quarknet

- The team: MikeMcKenna
  Mark Vigneault
  Sarah Schlobohm
  Tom Burger