Development of the Scintillating Fiber Detector in AEgIS

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AEgIS

- AEgIS - Antihydrogen Experiment: Gravity, Interferometry, Spectroscopy
- AEgIS will measure the gravitational acceleration of antihydrogen
  - the first measurement of gravity in antimatter
- Will also make spectroscopy measurements
AEgIS Overview

1. AEgIS traps antiprotons from the Antiproton Decelerator
2. Positrons are created using a Na-22 source and converted into Positronium
3. Positronium and antiprotons are combined into antihydrogen
4. The atoms are accelerated towards a deflectometer
5. The distortions in the deflection pattern are measured to find gravitational acceleration

Figure: An overview of the AEgIS experiment
My Work

- Work on shift for the antiproton beam
- Made an apparatus for light transmission tests
- Made a control program for a digitizer
- Worked on the setup for polishing the ends of the fibers for the detector
Antiproton Trap

Figure: The penning trap used to catch antiprotons in the AEgIS experiment

- Uses a combination of electric and magnetic fields to trap antiprotons.
- First week spent assisting in tests of lifetime and cooling of captured antiprotons
Scintillating Fiber Detector

- The detector is formed by rings of scintillating fiber
- It can be used for an idea of temperature, time of flight, and location in the trap of the antihydrogen

Figure: The antihydrogen trap surrounded by the scintillating fiber detector
Transmission Tests

- Version one of the transmission test apparatus
- Used to test the transmission efficiency of fiber optic connections and the quality of the fiber polishing.
- Shines light into one end and reads the light output on the other end.
Transmission Test V2

- Version shown on last slide had problems with consistancy
- Uses a plastic frame to achieve reliable connections
- Applies light from the side, reading out light on each side
  - Allows normalization and easy calculations of transmission efficiency without relying on correlations between multiple tests

Figure: The frame to hold the connections for the transmission test.
Digitizer

- Reads the output of several photomultiplier tubes for determining proper thresholds and the characteristics of the signal.
- Programmed in C using vendor provided libraries.

Figure: The digitizer being programmed is circled in blue.
Fiber Polishing

Figure: The setup used for polishing fibers

- Using a diamond cutting bit to cut the fiber smooth and flat (polishing)
- Shown is the jig for holding the fiber in the polishing process
Spent time cleaning a room and setting up a clean workspace for working with the fiber.
Fiber Polishing Cont.

- Created a jig for quickly cutting fibers to length
Next Steps

- Polish fibers
- Mirror the end of the fibers
- Determine the efficiency of the fiber connections and using this to optimize the connections in the detector
Questions?

References

- AEgIS proposal