LIGO Hanford Output Faraday Isolator Tests – 25/03/2014

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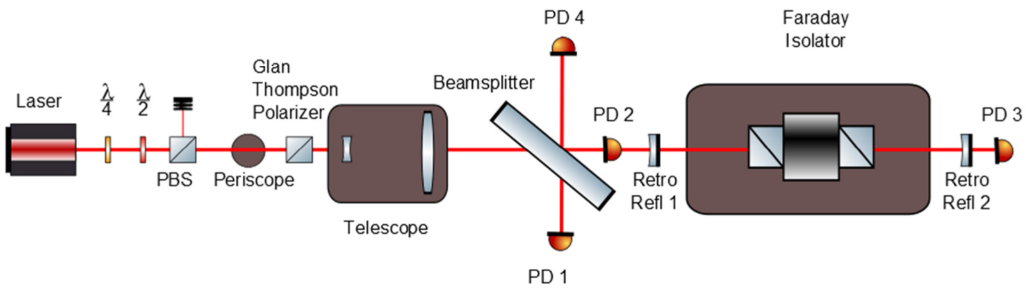
We used a similar method to what is described in LIGO- E1201074-v6. The following optics were used to test the suspended output Faraday isolator.



Transmission Test

The output of the NPRO was attenuated to approximately 4mW so that we could use two Thorlab PDA 100A photodetectors to measure the transmission and isolation. One photodetector was permanently mounted at position 1 to measure the input power. The other photodetector was moved between position 2 and 3. Naturally the retro reflectors were not in place. We used two different beam reducing telescopes to measure the transmission at three different beam sizes.

Beam Size	PD1 reading	PD2 reading	PD3 reading	Notes
2.0 mm	3.24 V	5.01 V		
2.0 mm	3.21 V		4.79 V	

Transmission = 96.5 +/- 0.5%

Isolation Test

This test was performed when the spot size was 2.0mm. In this situation the photodetector was placed in position 4 and an iris was used to mark the beam near the laser. The retro-reflecting mirror was installed such that the beam was retro-reflected in front of the Faraday isolator. A reading was recorded on PD4. The retro-reflecting mirror was then moved to after the isolator, the voltage on PD4 was maximized and the following readings were recorded.

Retro-reflecting Mirror Position	Conditions	PD 4 Voltage
1		5.6 V
2	Full return	6.89 mV
2	Retro Mirror Blocked	6.37 mV
2	Laser Blocked	5.85 mV

From this we know that isolation from light reflecting from the output side is 9.2×10^{-5} and the specular backscatter coefficient is 8.6×10^{-5}. We attempted to increase the transmission by adjusting the rotation of the ½ wave plate in the middle.