

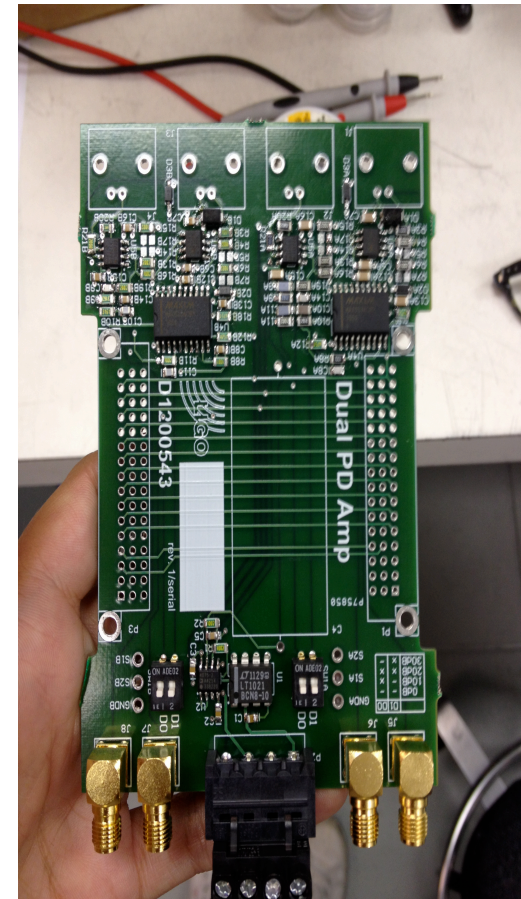
Dual PD Amp Circuit Board Test Results

By Alexa Staley

LIGO G1200781-v1

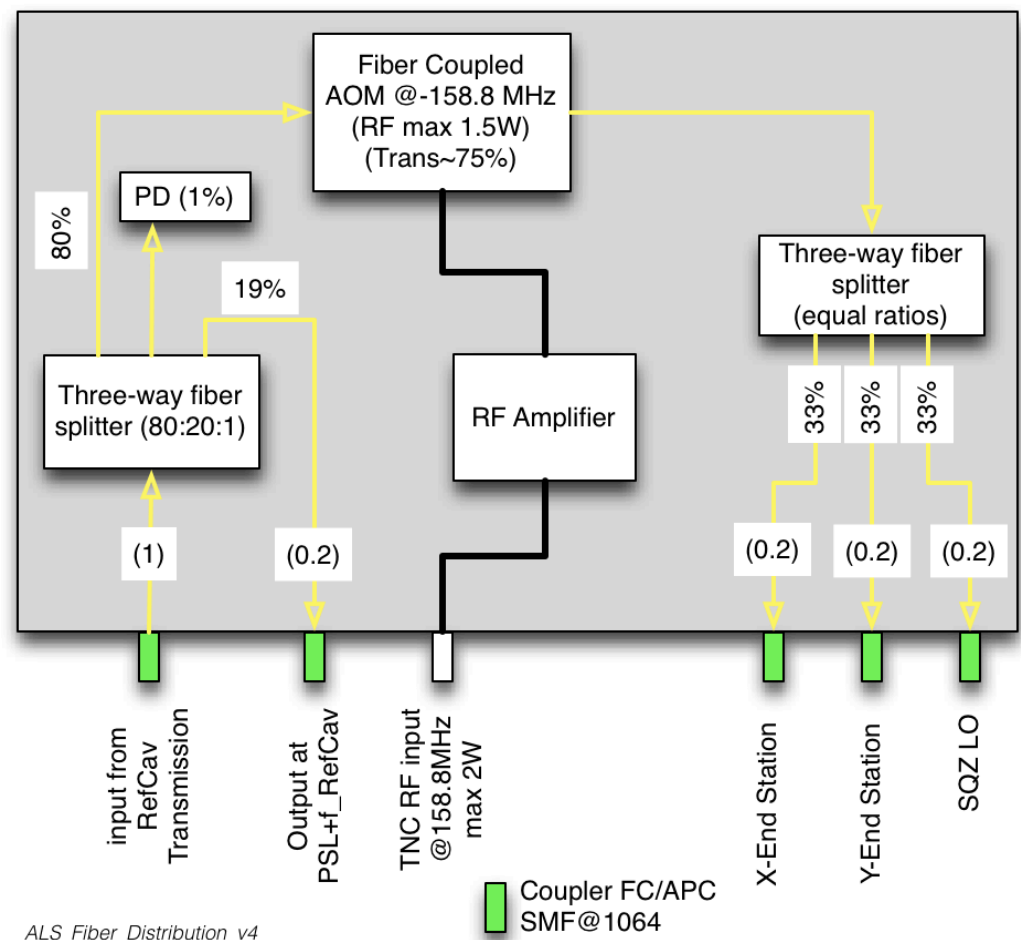
What is the Dual PD Amplifier?

- Will be placed in the five ALS Fiber Distribution Chassis
- Has two channels that amplify a given source via four different gain settings
- D1200543-v1



ALS Fiber Distribution (brief)

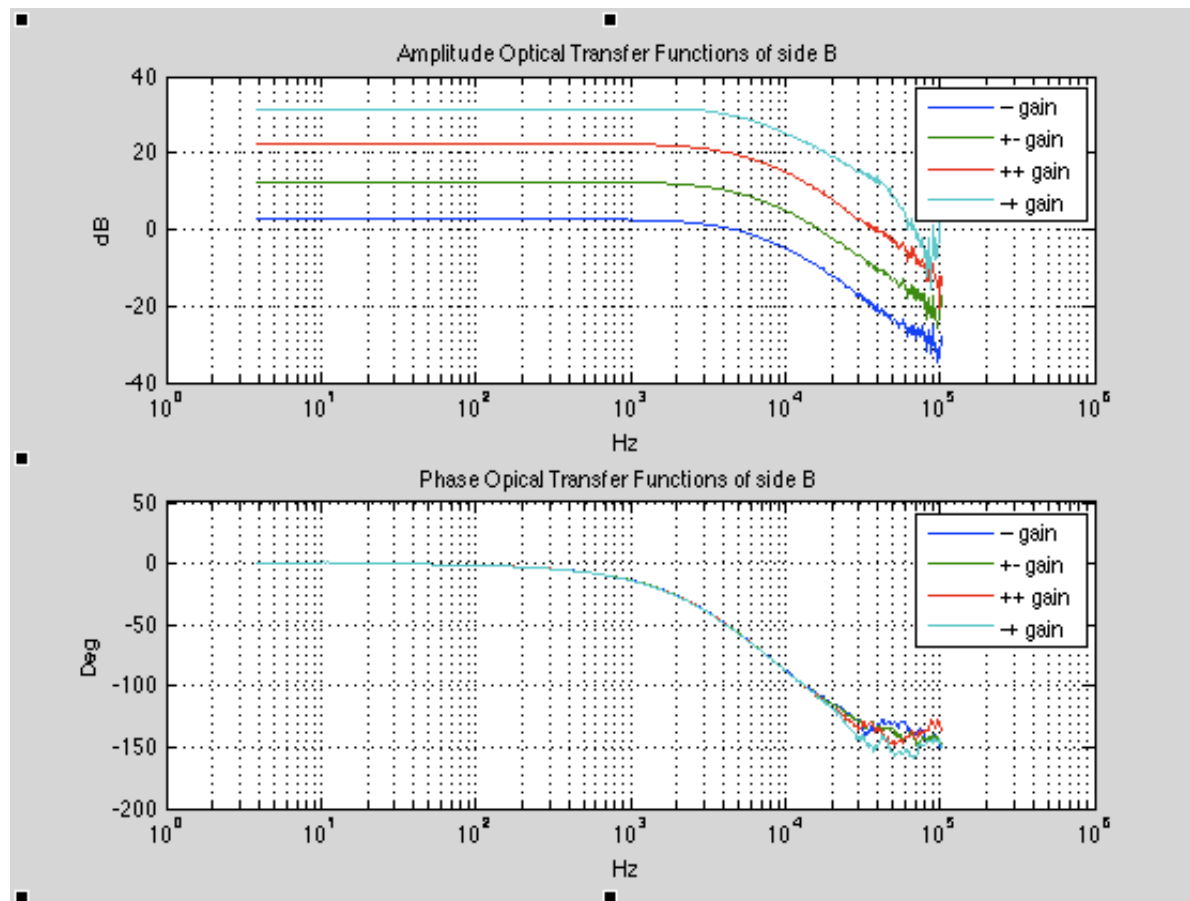
- Shifts the frequency of the PSL laser light after the reference cavity
- Splits the input into four output fibers



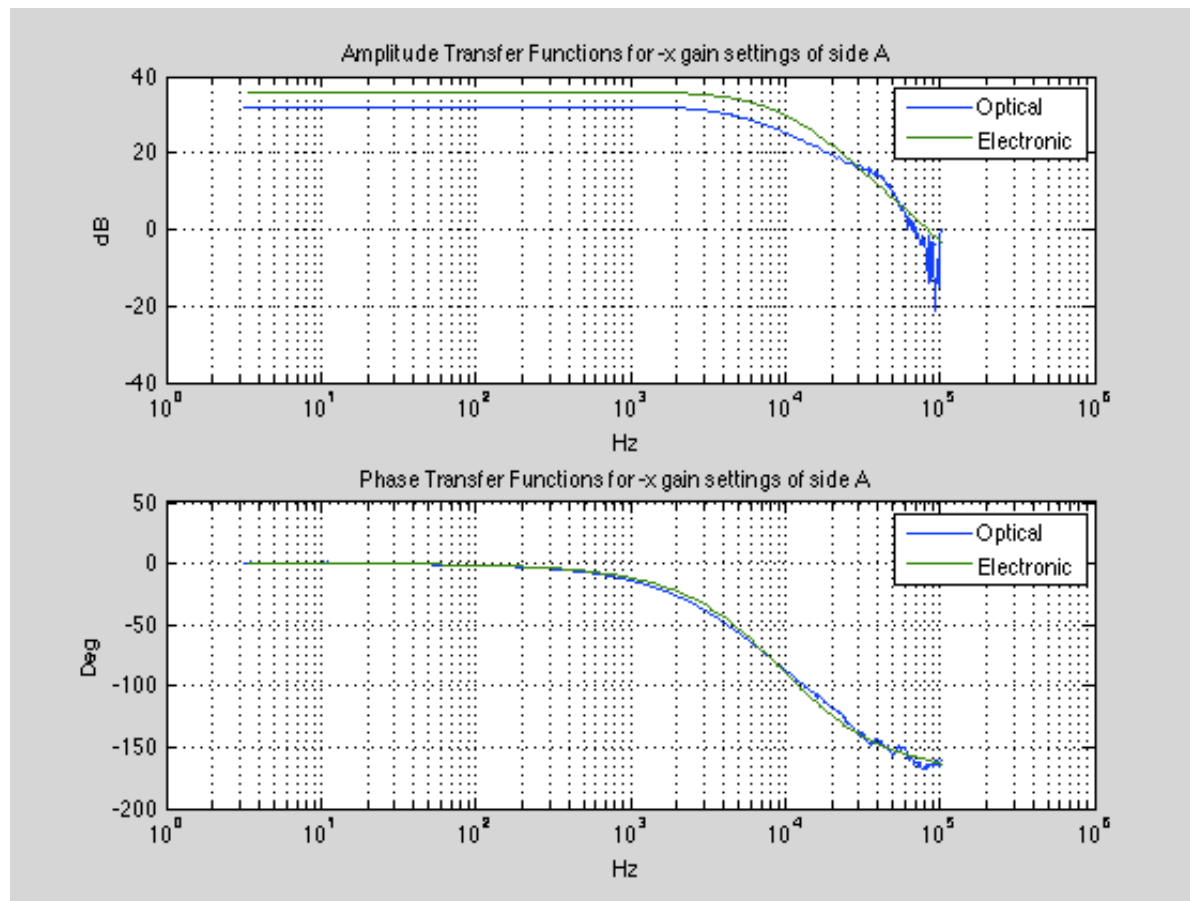
Some Specs.

- When connected to a power supply with no source
 - DC offset is measured to be less than 10mV for each gain settings
 - See less than 20uV AC variations
 - Minimal signal drift (but needs to be tested for longer period of time)

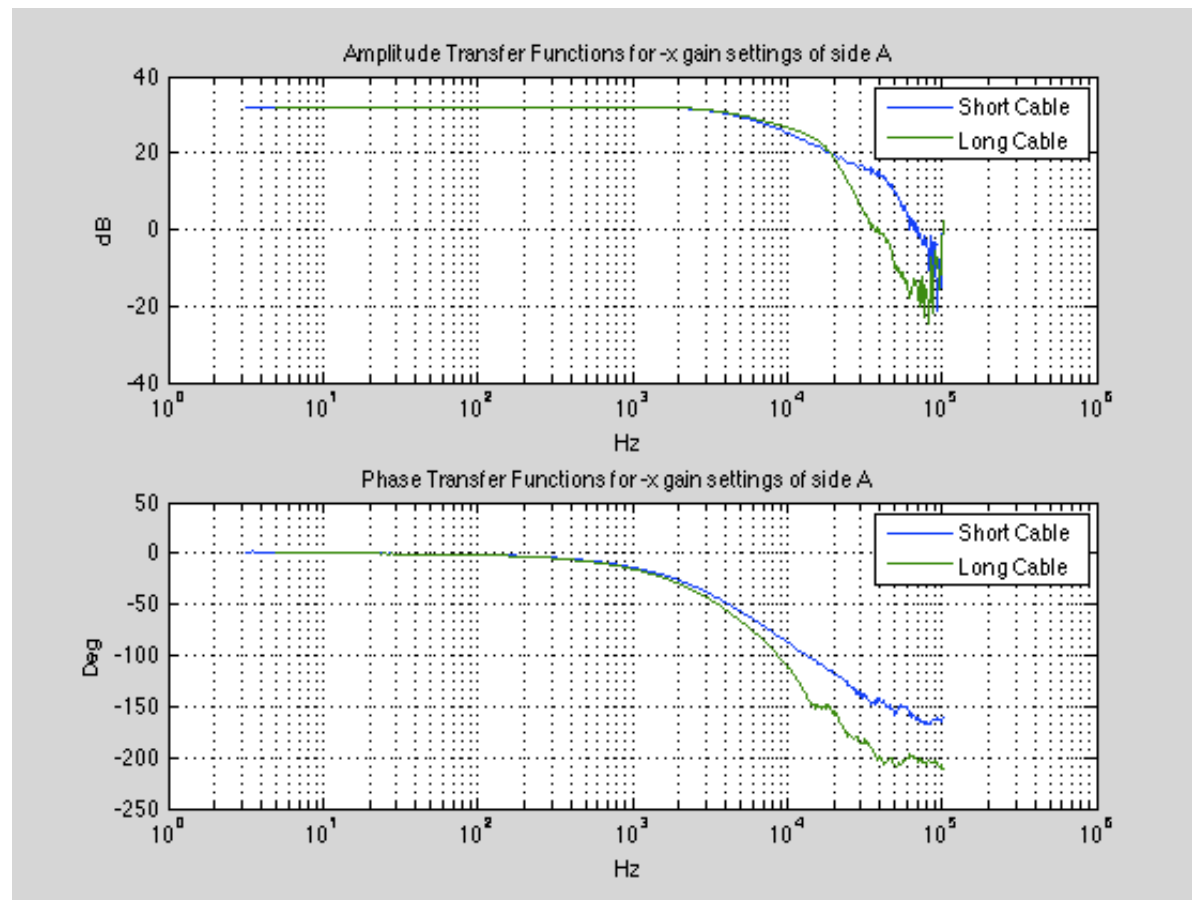
Optical Transfer Function



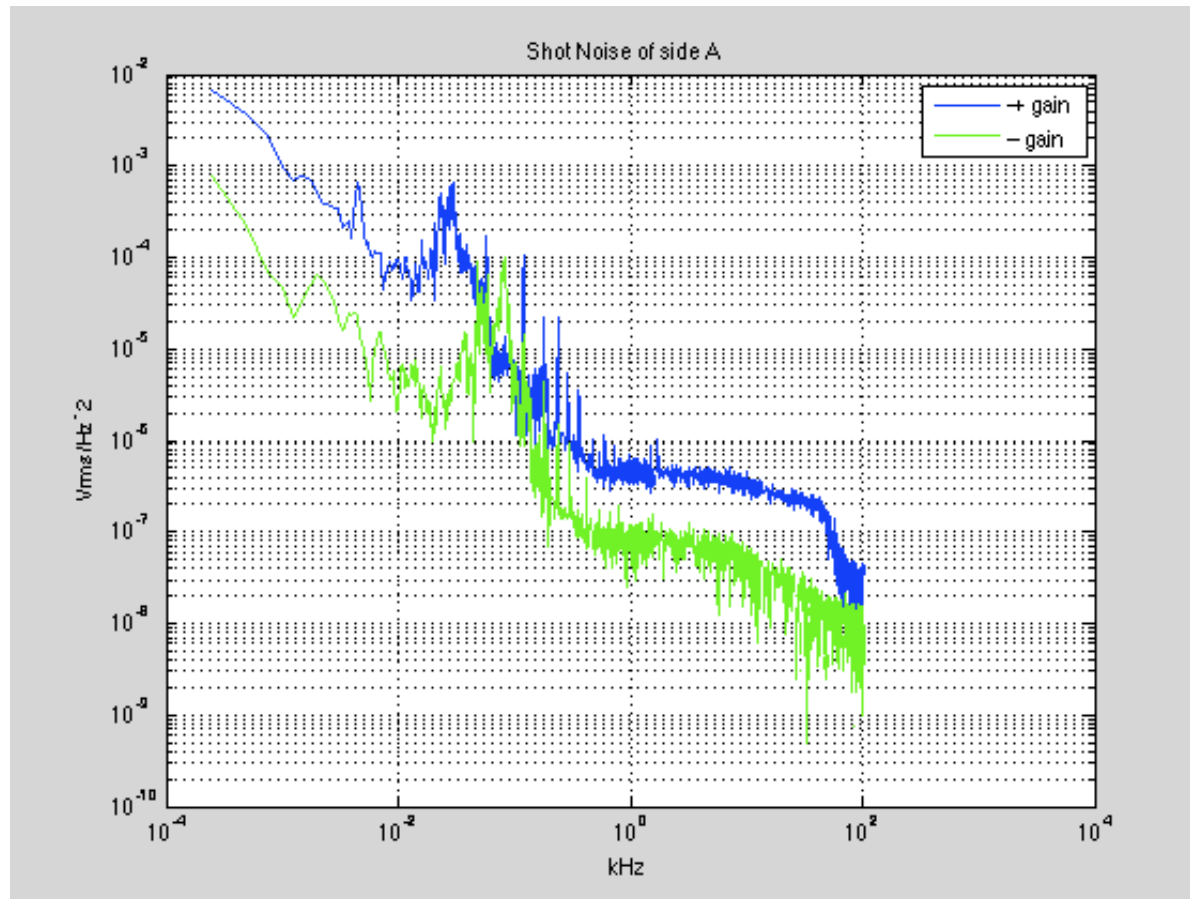
Transfer Functions



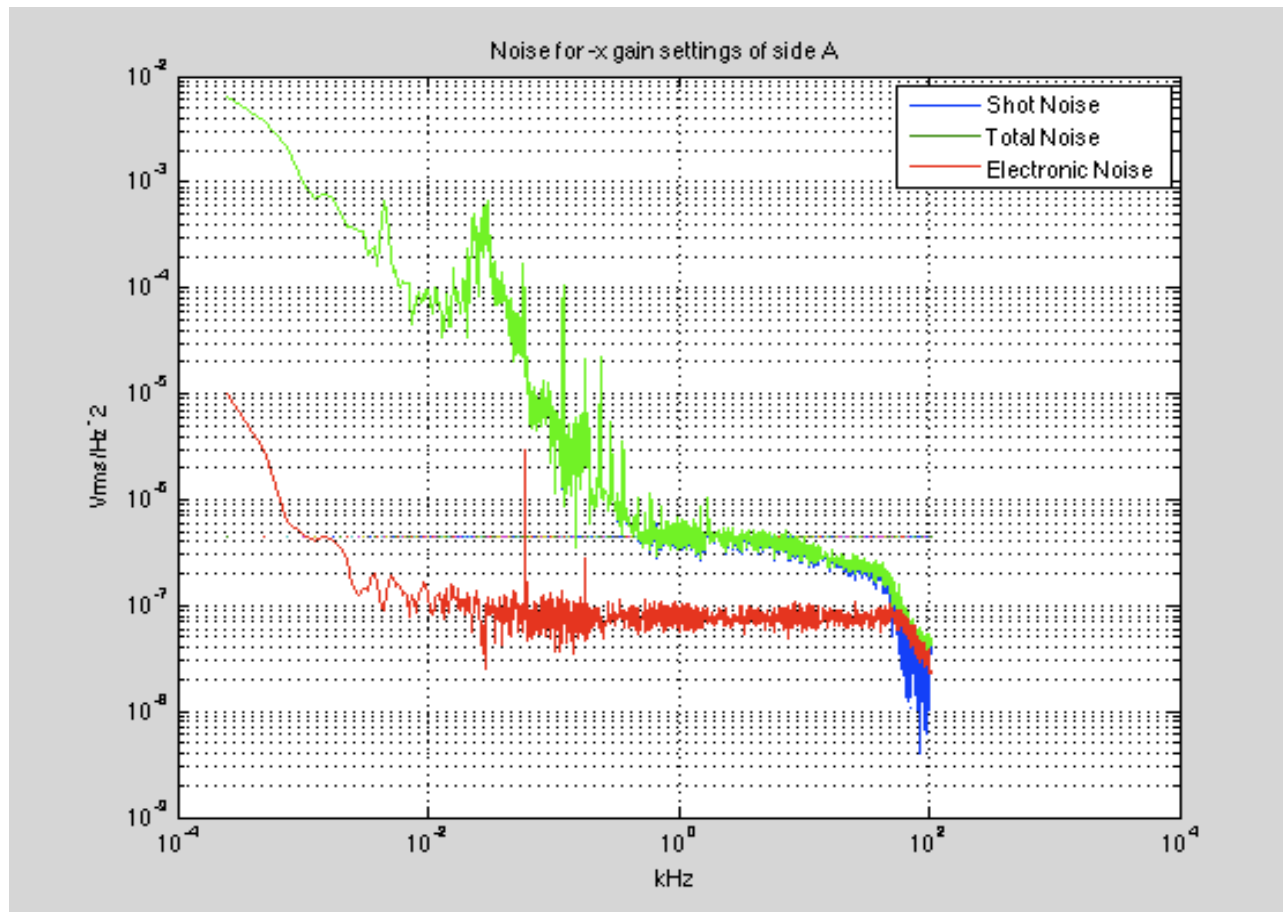
Optical Transfer Function with Long Cable



Shot Noise

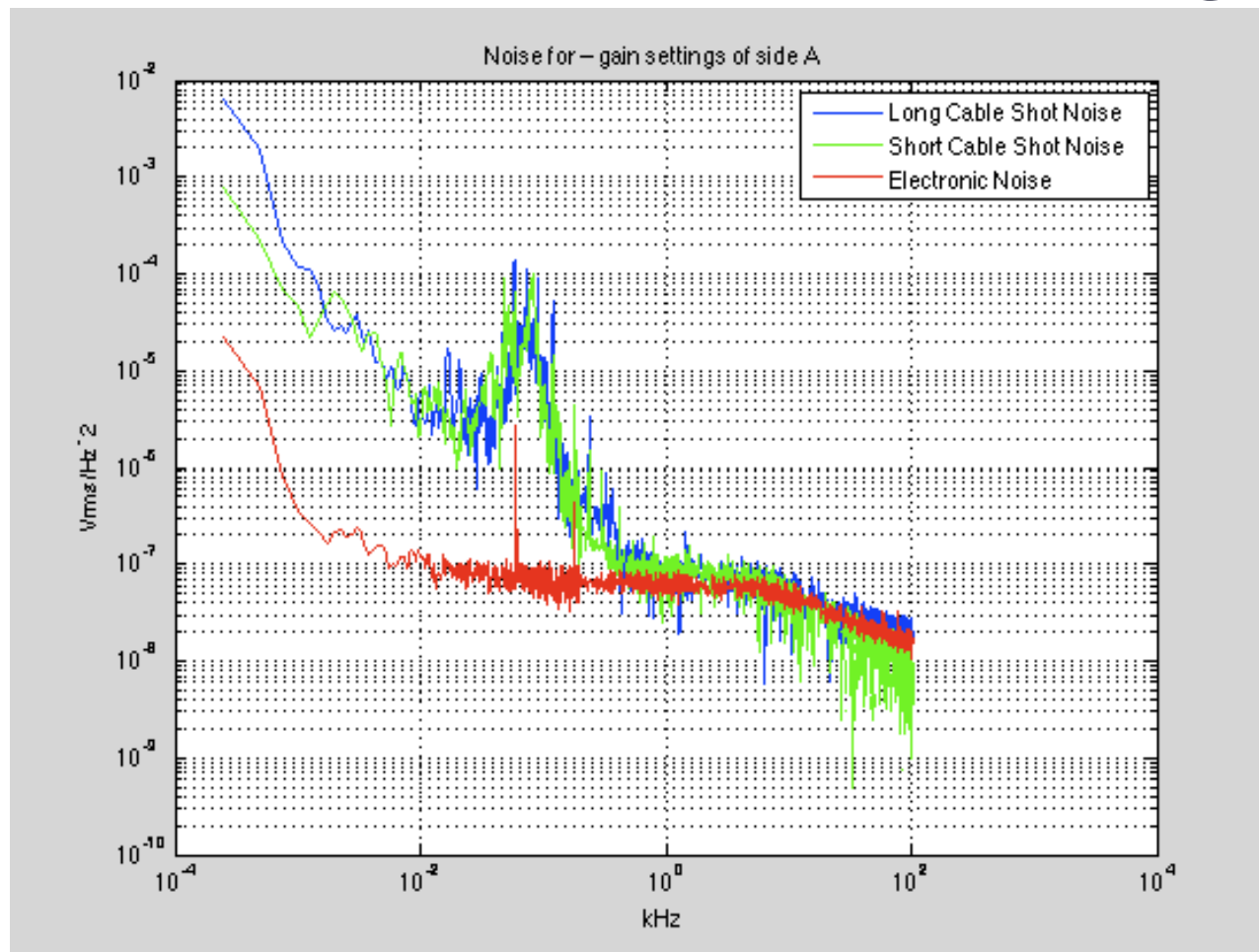


Total, Shot, & Electronics Noise



$$i = \sqrt{2q \frac{V}{R}}$$

Noise for Different Cable Lengths



Noise Data

Board Side B Average nV_{rms}/\sqrt{Hz} from 1kHz to 2kHz

Gain	Transimpedance Gain ($k\Omega$)	Measured Electronics Noise	Deduced Shot Noise	Measured Total Noise	Deduced Long Cable Shot Noise	Expected Shot Noise (Approx)
00	2	63	122	137	108	80
10	6.32	64	182	193	152	142
11	20	69	181	241	298	253
01	63.2	80	428	435	444	449

Board Side A Average nV_{rms}/\sqrt{Hz} from 1kHz to 2kHz

Gain	Transimpedance Gain ($k\Omega$)	Measured Electronics Noise	Deduced Shot Noise	Measured Total Noise	Deduced Long Cable Noise	Expected Shot Noise (Approx)
00	2	63	86	108	105	80
10	6.32	74	188	168	195	142
11	20	67	258	304	257	253
01	63.2	78	486	493	473	449

Next Steps...

- Possibly take measurements with more data points
- Take shot noise measurements with a better light source
- Replace 1206 10k resistors that remain with 0805 size – could reduce noise even further
- Test long term drift
- Produce 5 PCBs and place into ALS Fiber Distribution Chassis → test chassis