Responses to the review committee's recommendations

Rich Abbott and Peter Fritschel

Demodulator

1) The bandwidth of the current design is not sufficient for the mode cleaner servo and maybe even the common mode servo. However, it should be straight forward to make a high speed variant by changing some of the component values.

Agreed

2) The gain on the IF outputs seems high. The outputs will saturate with 0dBm of RF input. We recommend reducing the gain by at least a factor of 4.

I will lower the gain by a factor of 4.

3) The design uses a differential design to amplify the IF signal. It then uses a differential OpAmp to yield a single ended monitor output. Finally, it uses a differential driver for the I and Q outputs. Wouldn't it be simpler to drive the I and Q outputs directly with the IF amplifiers? For the mode cleaner servo chain this would also prevent the differential amplifier to be the slowest amplifier with the slowest slew rate.

I will look into this point.

4) What is the experience with the differential amplifier driving long cables loads? The design implements series damping resistors, but equips them with zero Ohms.

The amplifier specified is capable of driving long cables and large capacitances. The zero ohm component is just a hedge.

5) The bundling of 4 channels into a single chassis poses a packaging challenge. We recommend reordering the rear panel signals, so that the fast I and Q phase signals are separated from the slow RF monitors. We also recommend using N connectors (or at least TNC) for the rear mounted LO inputs. This would make it possible to directly terminate a heliax cable. Otherwise, one will have to terminate both the LO and the heliax in a patch panel and jumper in between.

I will use N connectors for the LO rear panel inputs, and I will separate the signals per the committee recommendation.

6) Both the mode cleaner and common mode servo use TNC input connectors. This will require the use of a breakout panel. Maybe a better approach for this application would be to make a dual channel chassis with the appropriate connectors; see for example D1000181.

I will replace the TNC connectors with SMA to make things compatible.

7) What's the effect on the I and Q phase signals when connecting a load to the RF monitor output? Do we require these outputs to be terminated when not used?

I didn't see anything when I looked with the RF Network analyzer, but I didn't record my observations. I will repeat the measurement and have a good look for an effect, and then I will tell the committee what I saw.

9) We wish to see a test protocol.

The document for the I/Q demodulator has a section (section 8 of LIGO-T1000044) at the end detailing the acceptance tests performed during evaluation. This is the basis for how each unit will be tested. If the committee wishes something more durable, I will provide it.

10) Are there any plans to minimize and test coupling of audio frequency magnetic fields and vibrations to the demodulator boards?

We did spend a few hours looking at this last month. We looked for magnetic field sensitivity by putting it in Rai's old Helmholtz coil. We did see some coupling (Rich has the numbers), but the main thing was to compare the new board with the iLIGO demod board. The new board was less sensitive than the old by a factor of 3 or so. We tried to look for vibrational sensitivity by blasting with a speaker and by tapping the boards -- but we didn't see any coupling with either board.

In-Vacuum Quadrant Photodetector

The presented design for an in-vacuum quadrant photodetector is simple and straight forward. Some detailed comments:

10) Using a fork clamp is convenient but is not the best attachment method when considering post resonances.

Ok, will do. The post is not ready for production, so we can debate the proper mechanical characteristics separately.

11) What's the orientation of the diode relative to the incoming beam? We assume that they are angled off to prevent direct back scattering. Past experience in the field has shown that there is a tendency to align detectors square. It would be an advantage to have the deflection angle built into the mount, so that reproducible orientations can be expected. This would also allow for a fixed beam dump of the direct reflected beam.

Same as the fork clamp comment

13) We wish to see a test protocol.

I will have to generate this. I have added it to my "to do" list.

12) The recessed photodiode design worries us a little because of large angle scattering of stray light onto the diodes and backscattering of light scattered from the diodes. Also, it limits the angle of any cameras focusing on the diodes.
beam dump of the direct reflected beam.

That's a good point. We should look at mounting it so the diode face is not so recessed.