LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY
- LIGO -
CALIFORNIA INSTITUTE OF TECHNOLOGY
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

LIGO Laboratory / LIGO Scientific Collaboration

LIGO-T0900032-v1 2009-February-19

AdvLIGO Sample Clock Time Distribution System Final Design Review

R. Abbott, P. Fritschel, S. Waldman, and V. Sandberg (chair)

Distribution of this document:

Controls and Data Systems Group

This is an internal working note of the LIGO Project.

California Institute of Technology
LIGO Laboratory – MS 18-34
1200 E. California Blvd.
Pasadena, CA 91125
Phone (626) 395-2129
FAX (626) 304-9834
e-mail: info@ligo.caltech.edu

Massachusetts Institute of Technology
LIGO Laboratory – NW22-295
185 Albany St.
Cambridge, MA 02139
Phone (617) 253-4824
FAX (617) 253-7014
e-mail: info@ligo.mit.edu

LIGO Hanford Observatory
P. O. Box 159
Richland, WA 99352-0159
Phone (509) 372-8106
FAX (509) 372-8137

LIGO Livingston Observatory
P. O. Box 940
Livingston, LA 70754
Phone (225) 686-3100
FAX (225) 686-7189

http://www.ligo.caltech.edu

Document number and revision history:

DCC v2.0: LIGO-T0900032-v1	original	2009 February 19

Abstract

The Final Design Review of the "Sample Clock Time Distribution System" was completed successfully on February 19, 2009. The review determined the readiness for fabrication and verified that schematics, code, test plans, and related documentation were in place.

1. Introduction

The Final Design Review of the "Sample Clock Time Distribution System" began January 28, 2009 and was completed successfully on February 19, 2009. The review determined the readiness for fabrication and verified that schematics, code, test plans, and related documentation were in place. The previous timing system reviews were the PDR (**LIGO-T080271-00)** held on 2008-March-28 and the CDR / DDR on 2005-May-02.

The LIGO interferometer control and data acquisition systems require a “clock” that provides stable and accurate timing signals for the converter sample rate generators that govern the analog-to-digital (ADC) and digital-to-analog (DAC) converters and to provide a time-of-day signal to time stamp the acquired signals. The generation and distribution of these timing signals are critical services for the operation of the interferometers.

The proposed system is documented in LIGO-E090003, which provides an overview. The documentation list as prepared by the proposers is included as appendix A of this report.

2. Review

The FDR was guided by the recommendations described in: “Guidelines for Advanced LIGO Detector Construction Activities,” M050220-09-D, 25 July 2008. The review committee confirmed the check list shown below and accepted the test results as presented.

Final Design Review Checklist:

- Subsystem block and functional diagrams
- Drawing package (assembly drawings and majority of remaining drawings)
- Final parts lists
- Design analysis and engineering test data
- Software detailed design
- Plans for acquisition of parts, components, materials needed for fabrication
- Installation plans and procedures
- Final hardware test plans
- Final software test plans

Follow-up questions on the diagnostic capabilities of the system were answered in the documents referenced below:

LIGO-E0900036-v1:
Diagnostics Information for the Advanced LIGO Optical Timing Distribution System

Abstract: In this document we describe diagnostics information transfer, protocol and structure of the Advanced LIGO Optical Timing Distribution System (OTD). We first review how data is collected and transferred from the OTD to a remote computer. Next, we briefly discuss how data is processed. We discuss in detail the structure of the collected data, as it appears on a remote computer. Finally, we describe the status

information that is being collected. In the Appendix, we present an example status information file.

LIGO-T0900050-v1:
Test Result Description Document for the Advanced LIGO Optical Timing Distribution System

Abstract: We present some test results that provide information on the proper operation of the OTD.

Follow-up information on phase noise and testing was answered by Daniel Sigg in an email (included below).

email from D. Sigg:

> When a slave falls out of synchronization, it will detect this at the next 1 PPS marker. If a slave detects 8 misaligned 1 PPS markers in series it will re-synchronize automatically. This information is sent back to the fanout/master thorough the uplink port and then sent to the computer. All data transmissions are guarded with CRC values.
>
> The software which collects the data on the computer exists. It uses DMT technology to make this information available as an XML file in a shared memory partition. We can watch this data by writing it to a file and see the information updating. However, an EPICS interface and an alarm manager are still on the TODO list.
>
> One might ask the question: Are we catching all errors? Is it possible that we are missing data at the same time a synchronization error happens? Of course, this can happen easily. We protect against this by deploying error counters where needed (1-PPS-marker errors, GPS errors, CRC errors, etc.). This way if some information is lost, one can check the corresponding counter and see if it has increased. If so, this would be an indication of an additional error.
>
> Certainly more testing needs to be done. We are hopping to be able to set up a master in parallel with the current timing system during S6. This way we can get some long term exposure with a record on file.

3 Summary

The presentation and question session went very well. The reviewers had no additional questions or comments and stated that the design looks very nice. In summary,

"it is time to build the system."

Appendix - Timing FDR Web Page
http://lhocds.ligo-wa.caltech.edu:8000/advligo/Timing/TimingFDR

CDS Converter Clock Timing System Final Design Review

- Meeting Dates and Times:
- Preliminary Discussion **Thursday, February 5, 2009 9:00 PST**
- Discussions with Presenters and Follow-up Questions **Thursday, February 12, 2009 9:00 PST**
- Final Discussion and Close Out **Thursday, February 19, 2009**

Documents and Links:

1	Advanced LIGO Timing PDR Report	T080271	local link
2	Main document map and overview:	E090003	local link
3	Updated quick start guide:	E080541	local link

Integration Documents:

1	Timing Slave:	E0900016	local link
2	Clock, Gate, DuoTone:	E090001	local link
3	Master/FanOut:	E090002	local link

Assembly and test procedures:

1	Master/Fanout Assembly	D080534	local link
2	Master/Fanout Test Plan	T080083	local link
3	DuoTone Assembly	E0900019	local link
4	Timing Slave Test Plan	E050262	local link

Test Results:

1	Diagnostic Information	E0900036	local link
2	Test Results	T0900050	local link