Gmail **Darkhan Tuyenbayev <darkhan.tuyenbayev@gmail.com>**

Our initial decision on your article: CQG-103064

1 message

Classical and Quantum Gravity <onbehalfof+cqg+iop.org@manuscriptcentral.com> Mon, Sep 26, 2016 at 8:55 AM

Reply-To: cqg@iop.org
To: darkhan.tuyenbayev@utrgv.edu, darkhan.tuyenbayev@gmail.com

Dear Mr Tuyenbayev,

Re: "Improving LIGO calibration accuracy by tracking and compensating for slow temporal variations" by Tuyenbayev, Darkhan; Karki, Sudarshan; Betzwieser, Joseph; Cahillane, Craig; Goetz, Evan; Izumi, Kiwamu; Kandhasamy, Shivaraj; Kissel, Jeffrey; Mendell, Gregory; Wade, Madeline; Weinstein, A; Savage, Richard
Article reference: CQG-103064

We have now received the referee report(s) on your Paper, which is being considered by Classical and Quantum Gravity.

The referee(s) have recommended that you make some amendments to your article. The referee report(s) can be found below and/or attached to this message. You can also access the reports at your Author Centre, at https://mc04.manuscriptcentral.com/cqg-iop

Please consider the referee comments and amend your article according to the recommendations. You should then send us the final version together with point-by-point replies to the referee comments and a list of the changes you have made. Please upload the final version and electronic source files to your Author Centre by 24-Oct-2016.

If we do not receive your article by this date, it may be treated as a new submission, so please let us know if you will need more time.

We look forward to hearing from you soon.

Yours sincerely

Emily Tapp

On behalf of the CQG peer review team

Peer review operations
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Emily Tapp and David Jones - Associate Editors
James Dimond - Editorial Assistant

cqg@iop.org

Adam Day - Publisher

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REFEREE REPORT(S):
Referee: 1

COMMENTS TO THE AUTHOR(S)

The manuscript on "Improving LIGO calibration accuracy..." described the calibration model adopted for LIGO detectors and deals with an important issue of temporal dependence. The authors show that, if it is not taken into account, the uncertainty in the calibration could be rather significant. The error in the calibration translates directly into systematic bias in the parameter estimation of the GW signals.
This work is very important and it should be published. In general I have found that the article is well written and quite clear, however I still have few questions on the presentation and on the results themselves. It would be nice to see the answers before the manuscript is published (as it may improve the clarity).

1. End of the page 3, beginning of the page 4. The parameters kc, fc are introduced and explained twice.

2. Last paragraph on the page 4. How the "estimated systematic errors" presented in the figures 2,3 were obtained. What did you compare it against?

3. Equation 8. Two questions: (i) it would be nice to see explicitly the time dependence on the r.h.s. (ii) which fpcal was used there 1 or 2 or both? (I presume fpcal1)

4. Equation 10, again it would be nice to see explicitly the time dependence on the r.h.s.

5. End of the page 7. "The frequency band around 35 Hz..." was it optimized? meaning was there an investigation on the optimal central frequency and spacing between frequencies of the injected signals?

6. General question: I presume that the calibration lines (signals) are not injected continuously. If not, what was the cadence and duration of each injection?

7. General question: would it help to inject more than 4 lines to have redundancy and to check consistency of your results (or to have more calibration points in the overall frequency band).

8. Figure 7. The negative %, do they mean that the model underestimates the magnitude and phase?

9. General question: Nothing is said about the magnitude of the injected signals. It would be nice to have few lines which discuss that.

Referee: 2

COMMENTS TO THE AUTHOR(S)
Overall: This kind of detector calibration described here has certainly been done more or less in the same way for prototype interferometers and first generation detectors, although the procedure is more complex because of the quadruple pendulum. Still, this paper is informative since the detector calibration and its error are of great interests to general physicists and astrophysicists. Interferometer experts would be more interested in the effect of noise in each system (noise propagation), which is mostly neglected in the argument.

Details:
- Eq. (2): Delta is missing. Also authors should mention and clarify that the final product is time-domain signal. Make the argument consistent with Eq. (14) --- readers would think this equation is NOT used to reconstruct the final signal and get confused.
- Page 4, 2nd sentence: What is the main cause of the alignment drift? Thermally driven mechanical drift and/or electrical drift? General readers (especially astronomers) would wonder why the detector drifts in spite of the many control loops, requiring continuous calibration. Also explain the mechanism that changes the cavity pole frequency.
- Page 4, near the last sentence: give the order of fc (~360Hz) here for easier understanding.
- Figure 2,3,4: I understand these calculations do not include noise --- for G>>1, the feedback signal should give higher accuracy signal and the figure should look different??
- Eq.(8): Explain the deviation of this equation. Define C0 and G0 clearly.
- Eq. (14): I do not understand why d_ctrl has to appear here. It would be smarter to use D and to make things consistent with the earlier discussions (where only d_err appears).
- Figure 7 and corresponding main text: Better explanations are needed. The “models are generated from” “measurements”. And “the errors” “are estimated by calculating the ratios between measurements and

the models". I did not understand what is being done here.

- Figure 8 and corresponding main text: Use consistent terminology --- magnitude "variation" or "error" (relative?)?

Letter reference: DSMo01