Advanced LIGO Engineering Change Request (ECR)

ECR Title: Store suspension mis/alignment values separately in EPICS database

DCC No: E1400107-v2

Date: 2014/03/11

Requester: Jameson Rollins Impacted Subsystem(s): SUS

Description of Proposed Change(s): Add additional EPICS records to the suspension front end models for storing separately the pitch and yaw offsets for the suspension ALIGNED and MISALIGNED states. This will be implemented by breaking up the OPTICALIGN OFFSET path on the top stage of each suspension into several epics records, fed into a 1xn ramping matrix (cdsRampMuxMatrix), which is then multiplied by a calibration gain, and added to the rest of the drive signals as normal.

The amiguousness of "several" and "n" is intential, and is supposed to envoke the opinion of the review team. It is clear we need two: an ALIGNED and MISALIGNED value. However, some suspensions might require additional fields for special case alignment scenarios (such as the TMS which need two extra, for alignment onto the Arm Cavity Baffle PDs during initial green alignment). For that specific case, however, because of shared top-mass library parts, one can't isolate the TMTS from the QUAD or the BSFM. So, do we generically add two, three, four extra? The overhead is minimal, but we run the risk of "hard-coding" a "well, we'll NEVER need more than five!" issue. Of course the mechanical risk is non-existent, but the overhead associated with changing it later is non-negligible.

Reason for Change(s): Currently, the suspension front end models create only a single set of EPICS records for setting pitch/yaw alignment offset values, and are fed through a filter bank solely so that the offset can have an associated ramp. However, there are multiple alignment states that need to be stored for each suspension. The current procedure therefore requires saving the offsets out-of-band, in separate files on disk. This introduces multiple problems, such as synchronization issues (stored offsets out of date) and additional management headaches (maintaining external scripts and files).

Being able to store the aligned and misaligned state offset values separately in the front end would completely eliminate the need for a separate out-of-band process for managing the alignment settings by allowing us to utilize all of the existing infrastructure. The settings would automatically be stored in the SUS model safe.snap files, and in frames and conlog. We will always be able to restore to the most recent alignment settings without requiring additional work by the commissioners, and we will more easily be able to track alignment trends over time.

Estimated Cost: No materials cost. Estimated one-time cost of two (2) person days to update main suspension library parts and MEDM screens, one (1) person day to install. Time cost can be lumped in with other front-model changes, depending on what is approved.

Schedule Impact Estimate: All suspension front-end models would need to be recompiled, reinstalled, restarted, alignment values, and calibration gains restored into new fields, and a new safe.snap captured. This could be piggy-backed on other suspension front end changes during a maintenance period.

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Nature of Change (check all that apply):
- ☐ **Safety**
- ☐ **Correct Hardware**
- ☐ **Correct Documentation**
- ☐ **Improve Hardware**
- ☐ **Improve/Clarify Documentation**
- ☒ **Change Interface**
- ☐ **Change Requirement**
- ☒ **Change Software**

Importance:
- ☒ **Desirable for ease of use, maintenance, safety**
- ☒ **Desirable for improved performance, reliability**
- ☐ **Essential for performance, reliability**
- ☐ **Essential for function**
- ☐ **Essential for safety**

Urgency:
- ☐ **No urgency**
- ☒ **Desirable by date/event: _____**
- ☐ **Essential by date/event: _____**
- ☐ **Immediately (ASAP)**

Impacted Hardware (select all that apply):

☒ **Repair/Modify. List part & SNs: _____**

Simulink Library Parts that are common to the top mass of each suspension type:
${userapps}/release/sus/common/models/
SIXOSEM_F_STAGE_MASTER.mdl (QUAD, BSFM, TMTS)
SIXOSEM_T_STAGE_MASTER.mdl (HLTS, HSTS, OMCS)
HSSS_MASTER.mdl (HAUX, HTTS)

☐ **Scrap & Replace. List part & SNs:_____**

☐ **Installed units? List IFO, part & SNs: _____**

☐ **Future units to be built**

Impacted Documentation (list all dwgs, design reports, test reports, specifications, etc.):

Disposition of the proposed change(s):

The disposition of this proposed engineering change request is to be completed by Systems Engineering and indicated in the "Notes and Changes" metadata field in the DCC entry for this ECR. The typical dispositions are as follows:

- **Additional Information Required**: in which case the additional information requested is defined. The ECR requester then re-submits the ECR with the new information using the same DCC number for the ECR but with the next version number.
- **Rejected**: in which case the reason(s) for the rejection are to be given
- **Approved**
- **Approved with Caveat(s)**: in which case the caveat(s) are listed
- **TRB**: the ECR is referred to an ad-hoc Technical Review Board for further evaluation and recommendation. It is the System Engineer's (or designee's) responsibility to organize the TRB. The System Engineer (or designee) then makes a technical decision based on the TRB's recommendation. Links to the TRB's documentation (charge, memos, final report, etc.) are to be added to the "Related Documents" field for this ECR.
- **CCB**: a change request for approval of additional funds or schedule impact is to be submitted to the Configuration Control Board. Links to the CCB's documentation (CR, etc.) are to be added to the "Related Documents" field for this ECR.

Concurrence by Project Management:

Acknowledgement/acceptance/approval of the disposition is to be indicated by the electronic "signature" feature

in the DCC entry for this ECR, by one the following personnel:

- Systems Scientist
- Systems Engineer
- Deputy Systems Engineer