

Advanced LIGO Engineering Change Request (ECR)

ECR Title: SRC alignment with a new 118.3 MHz modulation scheme

DCC No: E1700327-v1

Date: 9/15/2017

**Requester: Daniel Sigg
Hang Yu**

Impacted Subsystem(s): ISC ASC

Description of Proposed Change(s): We are proposing a new scheme for aligning the signal-recycling cavity. Details are in [T1700215](#), and a successful test is reported in alog [38594](#) and T1700000. The implement requires: (i) a new modulator at 118.3 MHz with a modulation index of at least 0.1, (ii) two RF harmonics generators to produce 8th and 13th order harmonics of the main modulation signal, (iii) a 72.8 MHz demodulation chain for the two AS port wavefront sensors, and (iv) increasing the intrinsic SRC gouy phase to 22-25 deg.

Reason for Change(s): The existing scheme relies on weak 9MHz sidebands at the AS port. This makes it susceptible to wavefront distortions introduced by differential heating and curvature mismatch. Furthermore, the 36 MHz demodulated signal is not a true wavefront sensor. It acts as an RF optical lever and is plagued by offset errors. The new scheme is less influenced by wavefront distortions due to a higher transmissivity to the AS port. It is less susceptible to offset errors, since the alignment signals are derived from the quadrature phase, and the in-phase signals are used for auto-centering.

Estimated Cost: Electronics: \$10k/ifo, Modulator: TBD, Retune AS WFS for 72 MHz: TBD

Schedule Impact Estimate: 1 week of installation, 2 weeks of commissioning time, assembly & testing of new hardware.

Nature of Change (check all that apply):

- Hardware Safety
- Correct Hardware
- Correct Documentation

- Improve Hardware
- Improve/Clarify Documentation
- Change Interface
- Change Requirement

Importance:

- Desirable for ease of use, maintenance, safety
- Desirable for improved performance, reliability
- Essential for performance, reliability
- Essential for function
- Essential for hardware safety

Urgency:

- No urgency
- Desirable by date/event: _____
- Essential by date/event: Feb 2018 (H1)
- Immediately (ASAP)

Impacted Hardware (select all that apply):

- Repair/Modify. List part & SNs: _____
- 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.):

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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