Review Report
Design Requirements and Concept for the A+ ISC Filter Cavity and Relay Optics

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Findings

- The committee finds the requirements for the inclusion of a filter cavity in Advanced LIGO well-motivated, complete and accurate.
- Concerns about available time
  - Preliminary design by end of September
  - Final design by end of year
  - Can approve designs on individual basis, if needed and appropriate (e.g., optics substrates)
- Concerns about locking scheme
  - Requires high CLF power: Need for a test
  - May not work → high risk
  - Need alternatives

Findings (2)

- Concerns about squeezer performance
  - Current L1 and H1 squeezer indicate high loss and high phase noise
  - If true, would limit squeezer potential for A+
  - Should do more investigations during current observation run
- Back scatter is a major issue
  - for light exiting the interferometer towards the squeezed light source
  - Reflection from filter cavity is ~100%
  - Requires 2 Faraday isolators on the squeezer side
  - Drives requirements for residual mirror motion and frequency stability of RLF

Actions

- Develop a requirement for initial alignment and positioning
- Derive a requirement for the green pump and CLF intensity noise
- Test of the higher power CLF
- Test of the high speed digital data acquisition
- Near term items
  - The filter cavity optics substrates and coatings
  - Optics tables for HAM7 and HAM8 (size & location)
  - What about HAM6?
  - Integrated floor plan with optics tables, racks, and cable trays

Approved items

- Design for 200.105 MHz VCXO source, 200 MHz demodulator and 200MHz RF combiner
- Power stabilization of green pump and CLF → Implement with ECR
- Development of IR QPD chain in transmission of FC (depending on a decision whether to include a far field sensor)
- Development of a low power QPD chain for FC sensing (assuming that sampling the reflected FC beam is adopted as the baseline)
- All electronics associated with the green diagnostics beam
- Production of 2/ifo picomotor controllers for ISC

Recommendations

- Consider sensing the filter cavity by sampling the reflected beam
- Add quadrant IR sensor in transmission of the filter cavity
- Length sensing with detuned RLF (so that the idler is N x FSR away)
- Consider sensing the filter cavity sensing with a null servo (use symmetric AM sidebands around RLF, ie., 2 CLFs)
- Modify OMC DCPD response for higher bandwidth at 3.125 MHz
- Skeptical about using the OMC QPDs to replace the 42.4 MHz wavefront sensors