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Acquisition strategy for an inter-satellite laser interferometer

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One way of improving the ranging accuracy of a GRACE like mission is to exchange the microwave instrument by a laser interferometer. A fast GRACE follow-on could also include a laser ranging demonstrator in addition to the proven microwave system. The currently proposed setup for such an laser interferometer contains on each satellite an optical bench and a laser. One laser on one of the satellites will be stabilised to a reference cavity and acts as the master laser which the laser on the second spacecraft will be offset-phase locked to. On each spacecraft there will be a phasemeter measuring the beatnote frequency of the interfering local reference and the incoming measurement beam. The amplitude of the interferometer signal strongly depends on the power of the received light and the relative attitude between the local reference and the incoming measurement beam. Once the interferometer signal is strong enough a steering mirror controlled by the interferometer's differential wavefront sensing signal (DWS) maintains simultaneously good wavefront overlap and transmitted beam alignment. However, after launch the initial alignment is unknown and must be determined by an autonomous procedure that scans 5 degrees of freedom (2 angles on each spacecraft plus the laser frequency). A complication is that there is no direct communication between the spacecraft. The current status of an algorithm for initial acquisition will be presented.