PROCEDURES FOR
CITF LOCKING ON SB

Locking Group
Cascina, February 2006

Locking Scheme

Trigger signal: B5_2f_ACq
Normalization: B5_2f_ACq (Exponent = 1)
Photodiode: B2_ACp (for PRCL – to PR), B2_ACq (for MICH – to BS)
Mirror Action: PR and BS
Possible Alternatives: Use B2_3f in place of B2.

Use the algo ***Gc/Locking/Locking_Ganesh*** selecting it in ***Gc/Locking/Algorithms_Name*** (tag ***Locking_Ganesh*** → Commit). This is done by selecting the tag ***Loaded by Locking*** in *Gc/Locking/* and Commit.

STEP 0 - PRELIMINARY CHECKS: Check not involved mirrors are misaligned, Local Controls and Injection quality markers are green.

STEP 1 – NORTH CAVITY ALIGNMENT (usual procedure – operators)
Misalign not involved mirrors.

STEP 2 - CHECK PHOTODIODE SIGNALS
Check photodiode centering by the quality markers
Check no saturation occurs: use DataDisplay *Locking* → *Photodiode Tuning*.
Typical expected signals (before restart): See Fig.1.
Check mirror swing: Check the number of fringes per second.

STEP 3 - TUNING OF THE DEMODULATION PHASE
Maximize p/q of the error signal you want to use DataDisplay *Locking* → *Photodiode Tuning*

STEP 0 - PRELIMINARY CHECKS: Check not involved mirrors are misaligned, Local Controls and Injection quality markers are green.

STEP 1 – CITF ALIGNMENT
Start from the ITF and misalign end mirrors or perform the rough alignment as explained as step 3.

STEP 2 - CHECK PHOTODIODE SIGNALS
Check photodiode centering by the quality markers
Check no saturation occurs: use DataDisplay *Locking* → *Photodiode Tuning*.
Typical expected signals (before restart): See Fig.1
Check mirror swing: Check the number of fringes per second

STEP 3 - TUNING OF THE DEMODULATION PHASE
Maximize q/p for *B5_2f* (used as trigger for SB locking) and the p/q of the error signal you want to use. (Indeed, the PRCL swing is the dominant one. You have to tune the phase so to minimize p/q).

IMPORTANT: The B5_2f_ACq has to be positive onc**e the CITF crosses the sidebands.** If this is not possible one has to change the Pr29 configuration file as described in the logbook entry of 23/02/2005. The important point is that, looking at the plots of B5 and B5_2f_ACq in parallel, one has to see the crossing of the Carrier (higher peak in B5) in correspondence of a negative deep in B5_2f_ACq and positive otherwise.

STEP 4 - SELECT RIGHT SENSING
Gc/Locking/Sensing/Locking_Ganesh (version ***1.240*** before the restart).

STEP 5 - SELECT RIGHT FILTERING - DRIVING
You can select from the database (*Gc/Locking/Filtering/Locking_Ganesh*) the version ***1.338.*** As for cavities, the driving part of the database is not used since it is embedded in the algo.

STEP 6 - SET DSP GAINS FOR MIRROR CONTROL
1 or –1 to PR and BS DSP and 0 on other towers.

STEP 7 - MEASUREMENT OF THE OPTICAL GAINS
Indeed the Ganesh algo is written in the form Length = G_optical $^{-1}$ * Photodiode_ACq / (Normalization/Normalization_Max_Value). As a consequence around the resonance the (Normalization/Normalization_Max_Value) is equal to one. G_optical = Photodiode_ACq / (Length). Written in our language.

$$G\_optical = \frac{photodiode\_pkpk}{\lambda / 2F}$$

In this case we have two optical gains to be measured. It is not possible to measure the MICH one and thus we are forced to trust in simulation (the gain on MICH is 20 times smaller than the gain measured on PRCL). To measure PRCL gain we need to give a kick to PR mirror by an abrupt change of dampSw gain in the DSP card and looking at the maximum value achieved during the many resonance crossing by the pkpk value of the PRCL error signal.

STEP 8 - MEASUREMENT OF THE NORMALIZATION POWER
The right value of the normalization power is given by the peak value at the resonance of the signal used as a trigger. It has to be compared with the value before the restart. The same increase affecting the power (after/before) is expected on these values.

STEP 9 - PUT IN ACTION THE NEW ALGO
Check that in the sensing you selected the error signal and the trigger signal are the ones you want to use. Insert in the sensing the two values measured in the previous steps (optical gain and normalization power). Database commit of algoname, sensing, driving and filtering. Then from Gc made the usual transition: ***End → Idle → Configured → Await.***

STEP 10 - OPEN DATA DISPLAY FOR LOCKING
Open dataDisplay from *LaunchPad* → *Locking* → *CITF Locking*.

STEP 11 - TRY TO LOCK
Click ***Steady*** on the Supervisor client interface and looks correction spikes on the mirror are opened. This means that the locking algo is triggering.

STEP 12 - ADDITIONAL STEP - TF MEASUREMENT

Once the locking is achieved one can launch a macro already performing the measurement of the open loop transfer function. From the *virgorun* account type *lock* in order to go in the right folder. From this folder type *cal_on PR 0.1* to start the measurement. The *0.1* value (concerning the noise amplitude) could be not enough. A pre-defined dataDisplay is automatically launched by this macro. If no coherence between excitation and response (right plot) appears try to increase slightly the level of excitation (for instance by typing *noise PR 0.5*, with the obvious meaning). Same can be done for BS (MICH) loop.

Locking Data Archive before restart**:** *GPS Time 808071603.*