

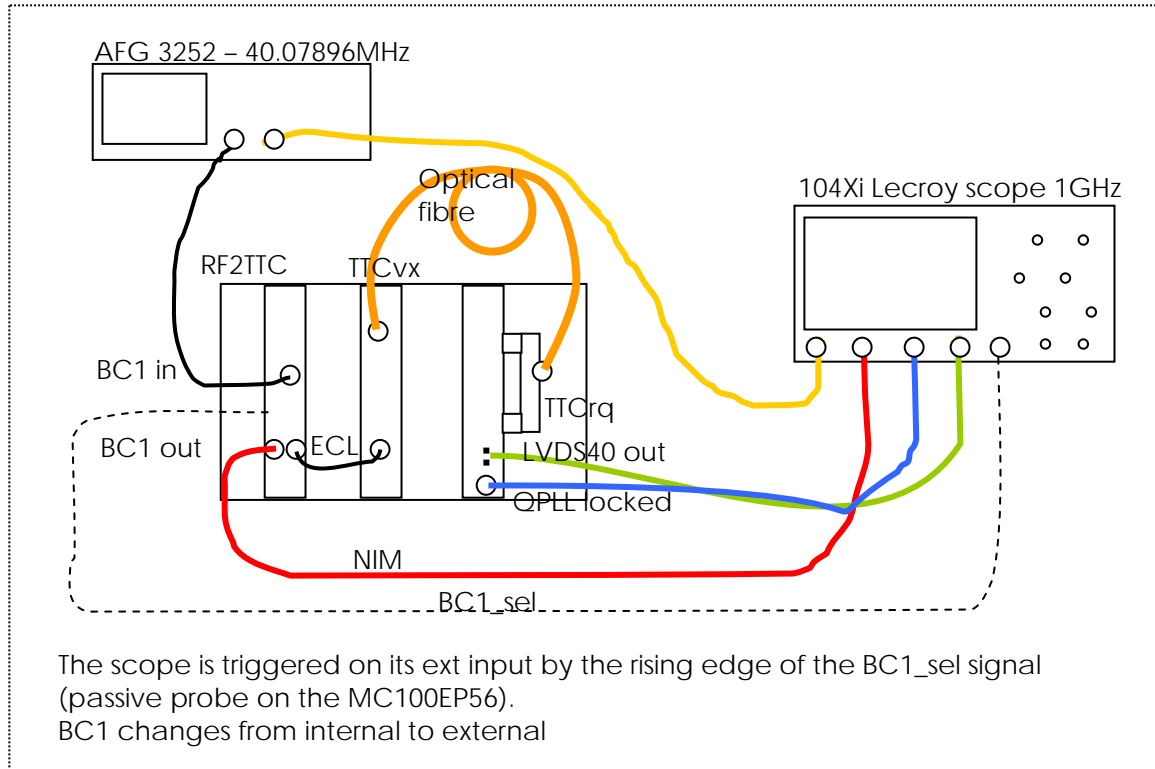
TTC NOTE - DRAFT:

Transient states of RF2TTC output clocks

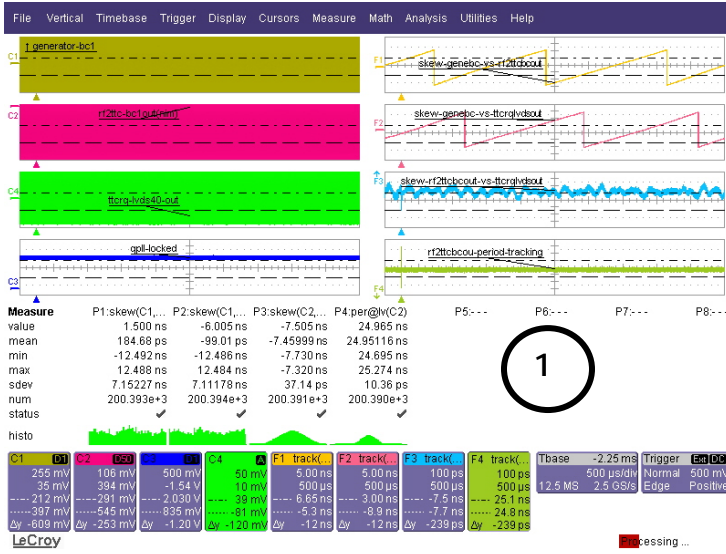
Study made on the behavioral of Bunch Clock outputs of the RF2TTC and of a connected TTCrq when the clock source changes from internal to the RF Bunch Clock at 14TeV

15 July 2008

Setup1:



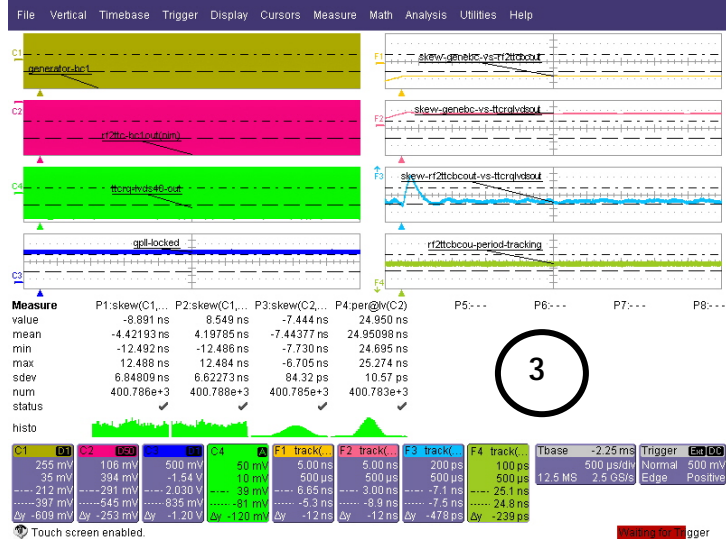
Signal analysis after a BC1 source change (internal=40.0784MHz, external=40.07897MHz). (BC1\_sel register value changes from 0 to 1)



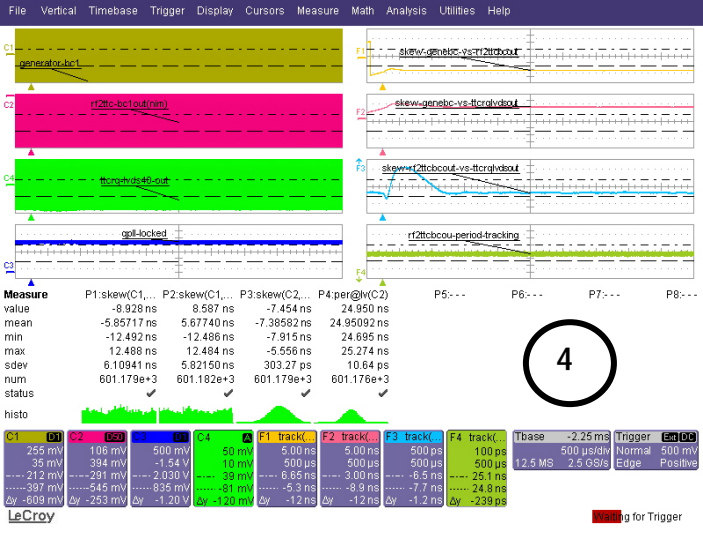
1



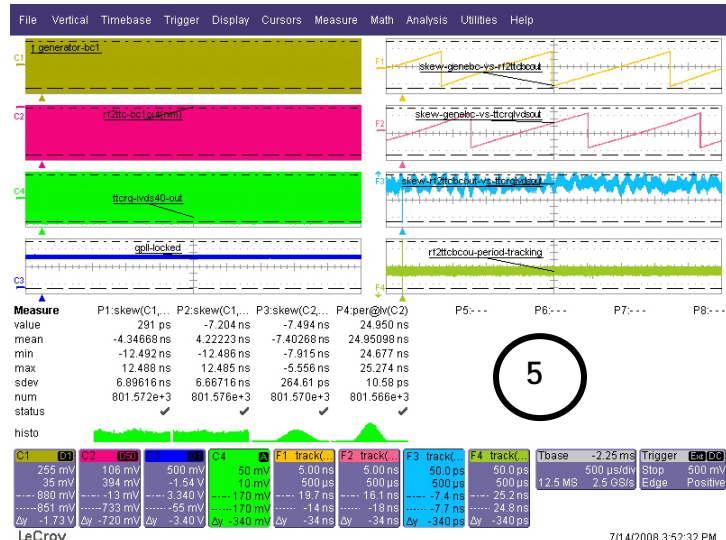
2



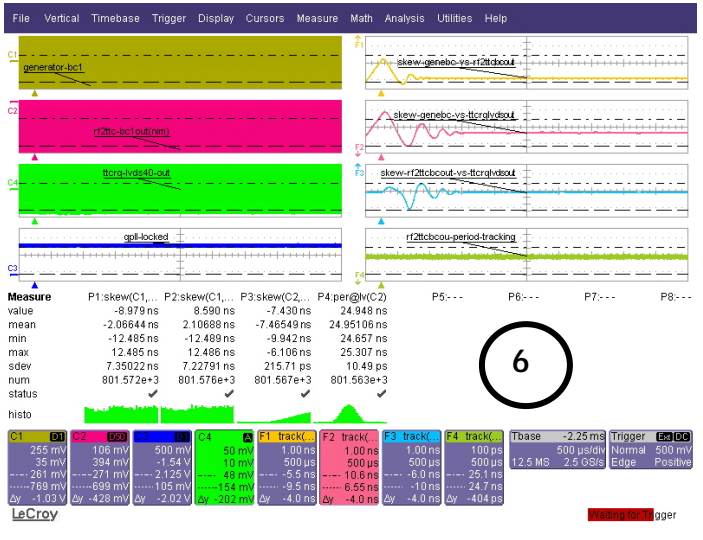
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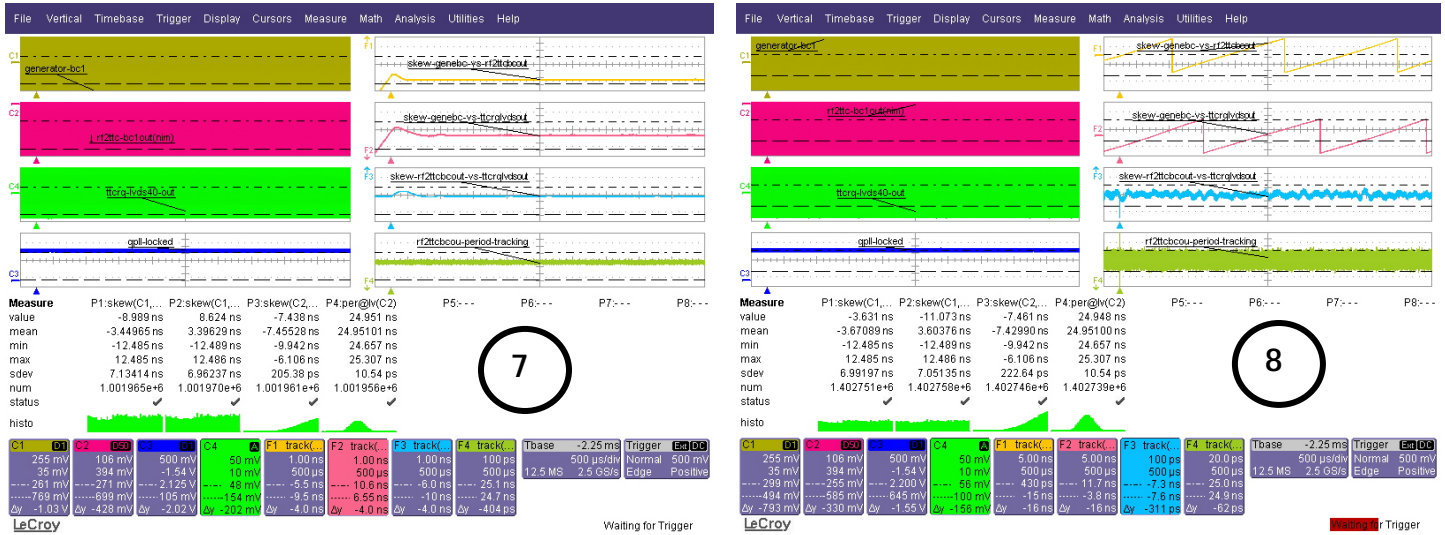
4



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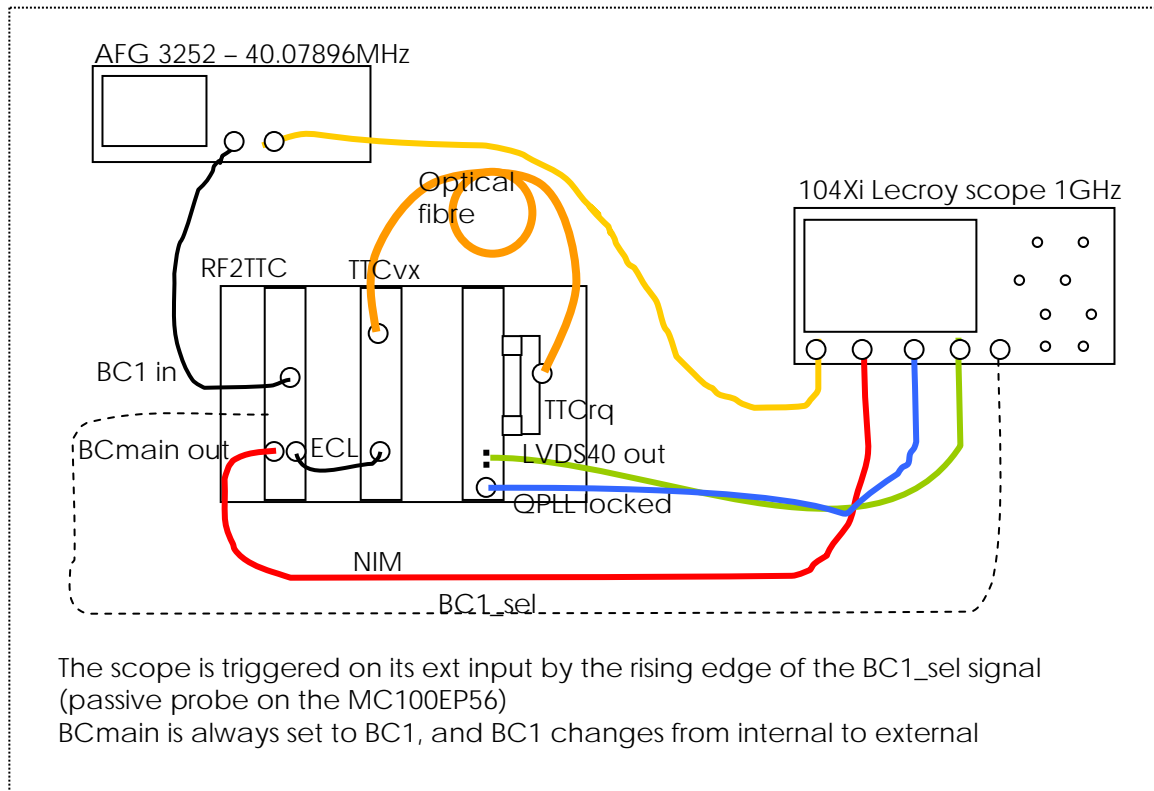


6

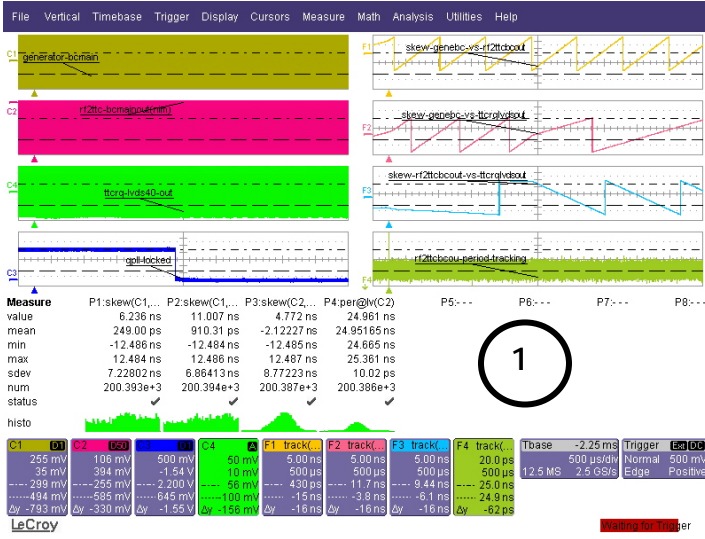


Typical behavioral for setup1:

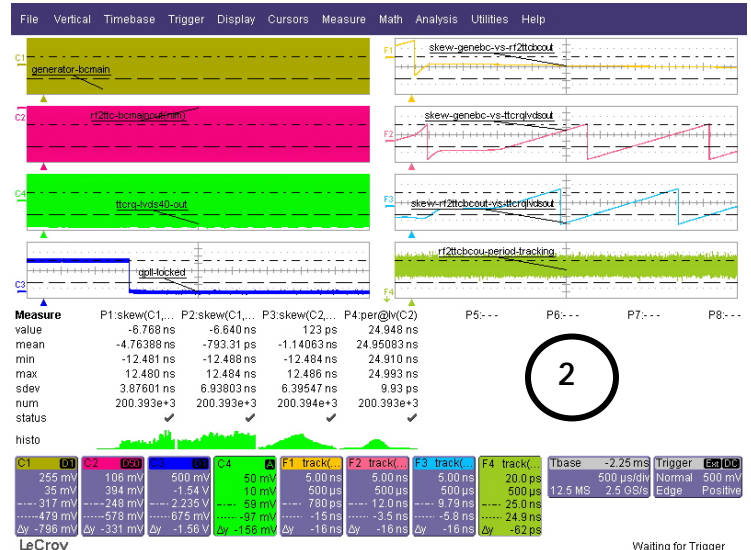
- the BC1-QPLL on the RF2TTC loses the lock, but the QPLL on the TTCrq manages to track the phase without losing the lock. (cases 1, 5, 8)
- the 2 QPLLs keep tracking the signal without losing the lock
- when there is an unlock, the locking time can be more than 200ms
- Even when the first QPLL is losing the lock, the peak to peak period jitter of the signal delivered by the second QPLL is not more than 60ps, except a very narrow peak of about +-300ps when the source of the clock is changing from internal to external.
- When no lock is lost, the skew between QPLL input and output clocks can oscillate with an amplitude up to 5-6ns

Setup2:

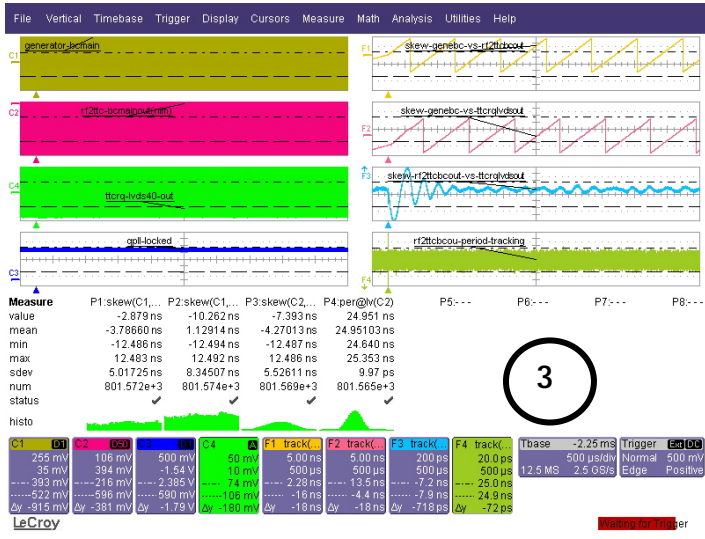
Differences with the setup1: although the source of the signal is connected to BC1, the QPLL of the RF2TTC involved in this test is the BCmain QPLL. The delays between the BC1 and its QPLL, and BC1 and BCmain QPLL are different. In this case, we can often see a loss of lock of the QPLL on the TTCrq (the TTCrq is the same for the 2 setups).



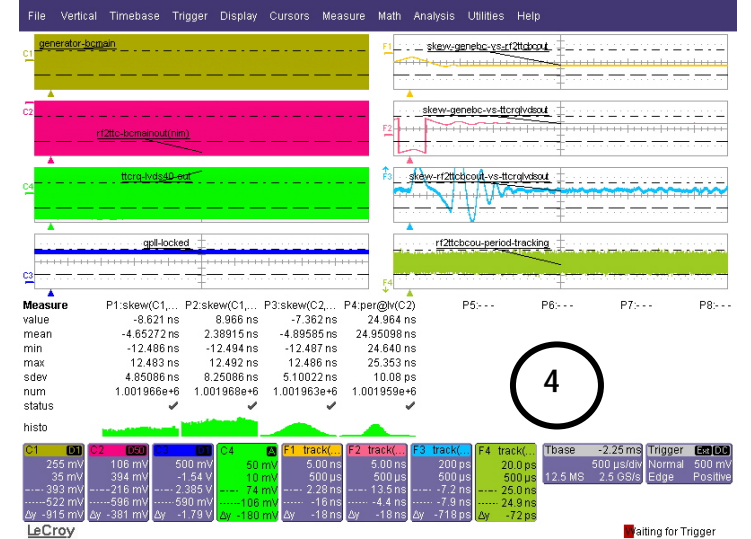
1



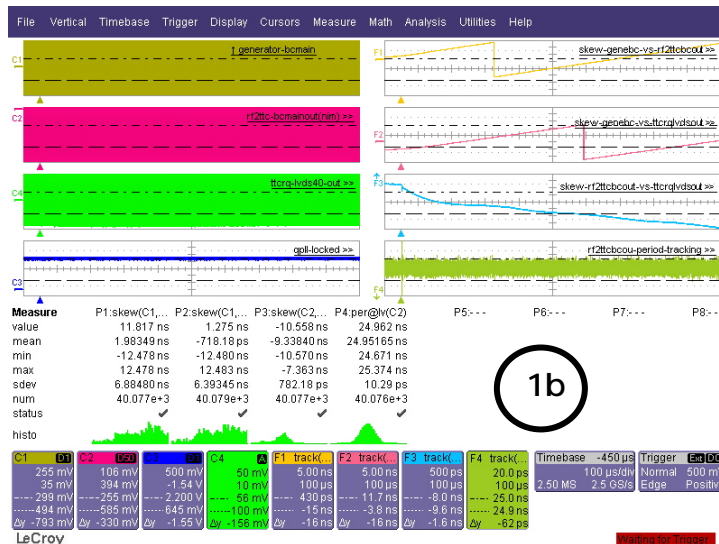
2



3



4



1b

Typical behavioral for setup2:

- the BCmain-QPLL on the RF2TTC loses the lock, but the QPLL on the TTCrq manages to track the phase without losing the lock. (case 3)
- the 2 QPLLs keep tracking the signal without losing the lock (case 4 – the big jump of F2 is a change of  $\pi/2$  in the phase and is not a sign of discontinuity)
- the 2 QPLLs lose the lock (case 1. 1b is a zoom of the first part of case1)
- the BCmain QPLL tracks the signal, but the QPLL of the TTCrq loses the lock after a while (case 2).
- when there is an unlock, the locking time can be more than 200ms
- Even when the first QPLL is losing the lock, the peak to peak period jitter of the signal delivered by the second QPLL is not more than 60ps, except a very narrow peak of about  $\pm 300$ ps sometimes when the source of the clock is changing from internal to external.
- When no lock is lost, the observed skew between QPLL input and output clocks can oscillate with an amplitude up to 5-6ns

Conclusion:

When there is a change of clock source, it is possible that some of the QPLLs at the second level lose the lock while some other ones manage to keep tracking the signal. If no reset is done, it may result to a mismatch of the BC counters between sub-systems. It is thus recommended at least to reset the counters 1 second after the change of clock source.