QPLL Status – December 2004

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People

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2) Micro Crystal
3) Nevis

Outline

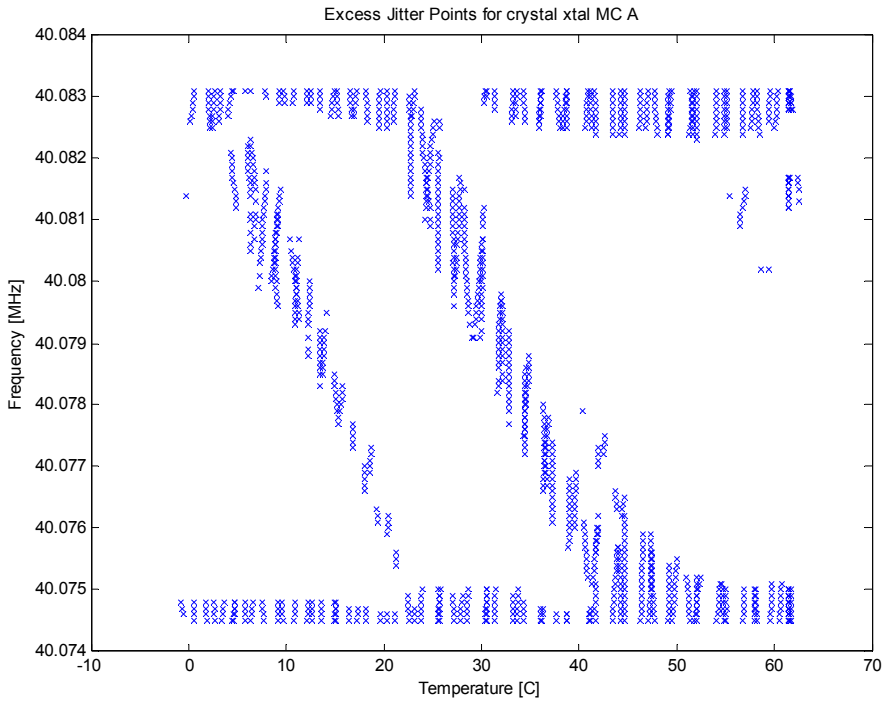
- QPLL jitter problem
  - Crystal activity dips
  - Power reduction network
    - Circuit
    - Layout
- Irradiation tests
- TTCrq

QPLL Jitter Problem

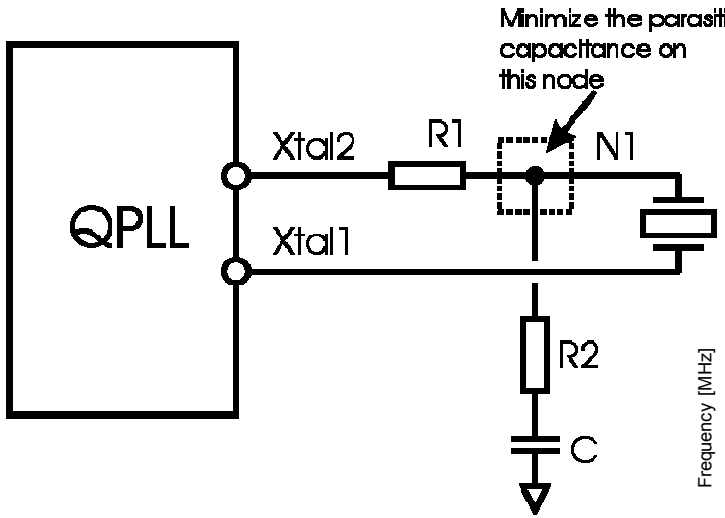
- August 2004:
  - Stefan Simion found that at some frequencies an temperatures the QPLL jitter was largely exceeding the typical values.
- September 2004
  - Both Nevis and CERN worked quite hard at the problem but all the hypotheses were either rejected or difficult to confirm.
- October 2004
  - With the help of Micro Crystal it was possible to confirm that the problem was due to activity dips in the crystal due to excessive power driving.
- October/November 2004
  - During this period work was done to find a simple and effective way of reducing the power delivered to the crystal.

Activity dips

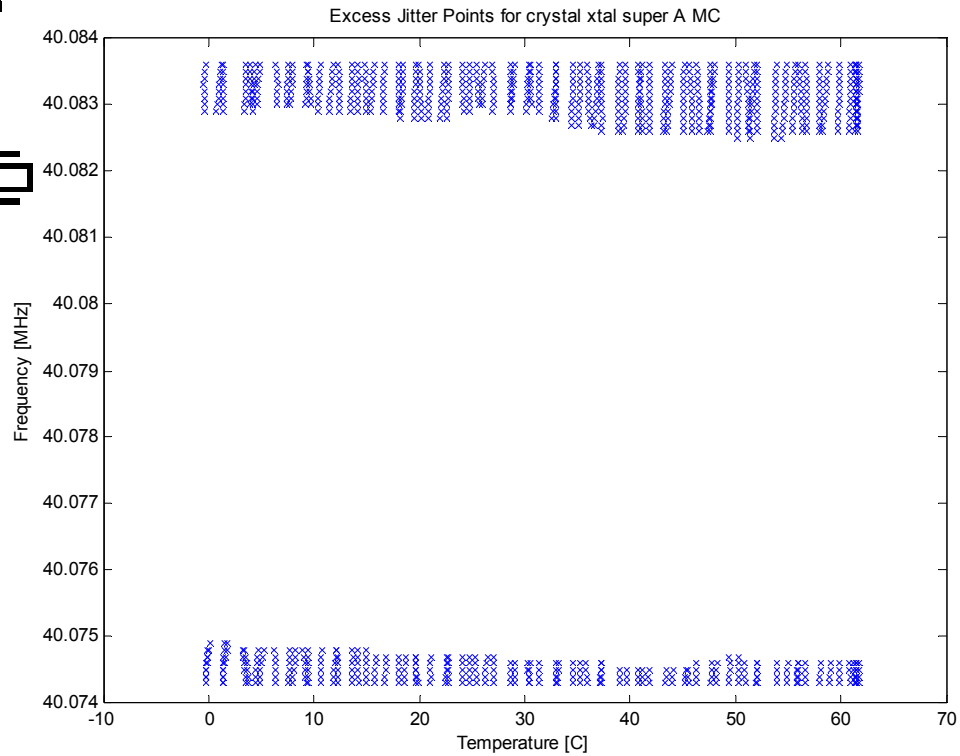
- Activity dips are due to vibration modes that are mechanically coupled to the fundamental resonant mode.
  - The fundamental mode is a thickness shear motion while modes causing activity dips are not.
  - These modes can have frequencies quite close to the fundamental mode and are very dependent on temperature.
  - They can thus interfere with the fundamental mode distorting the electrical characteristics of the crystal near the resonance.



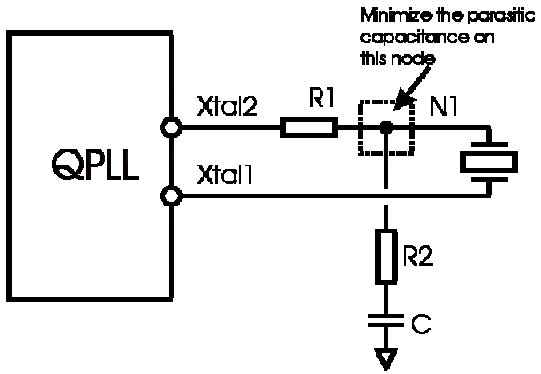
Power reduction network



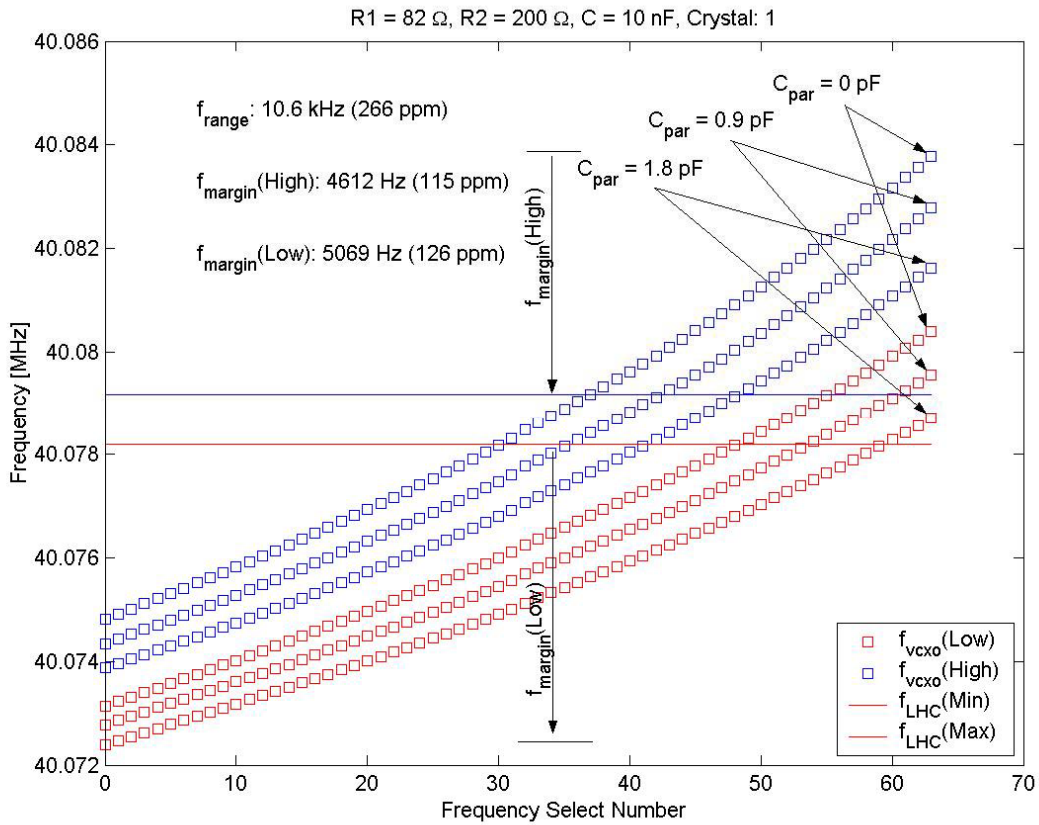
R1 = 62 Ω, R2 = 240 Ω, *C* = 10 nF



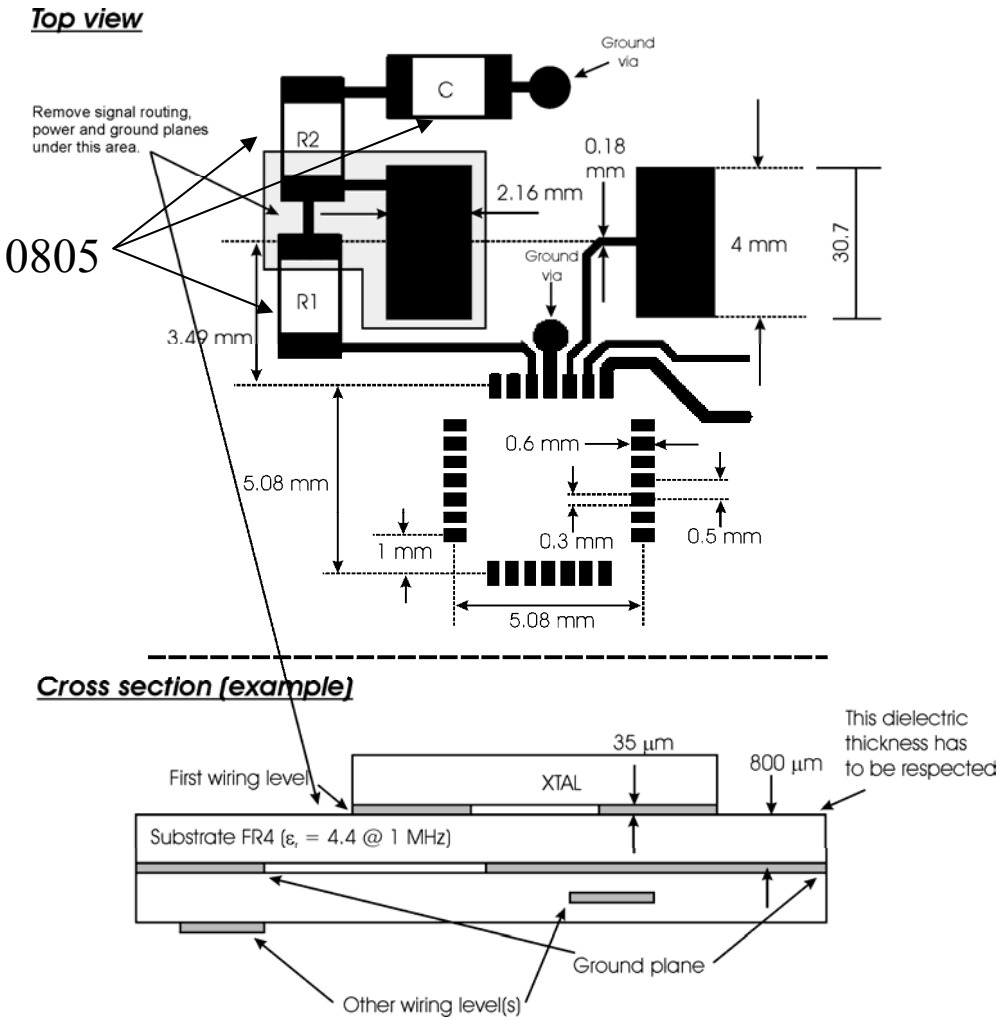
Power reduction network



- Parasitic capacitance on "N1":
  - Increases the power drive
  - Pulls the resonance frequency
  - Must be minimized
- As far as we can tell:
  - Activity dips are eliminated
  - QPLL jitter and centre frequency remain basically unchanged.



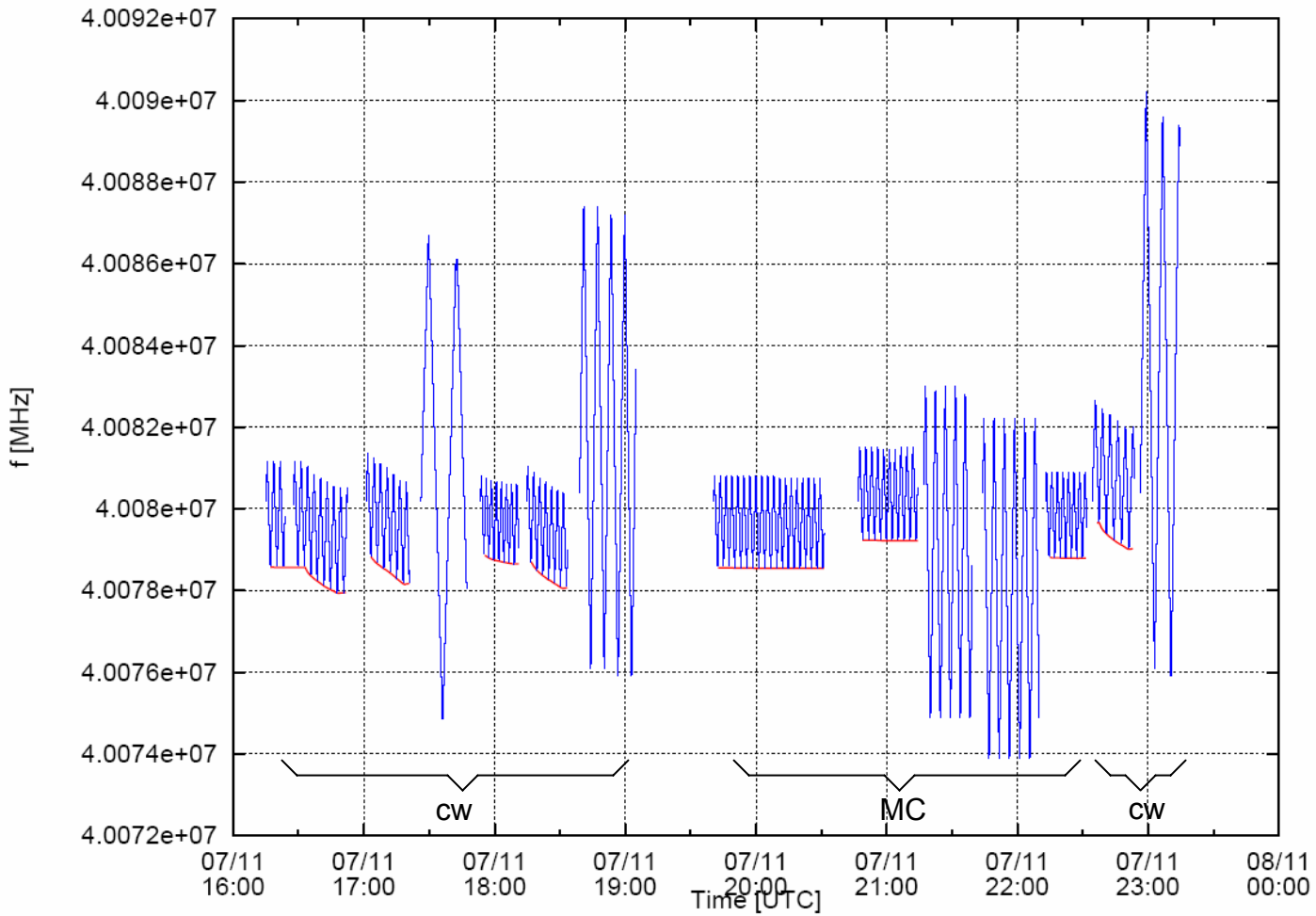
Power reduction network - Layout



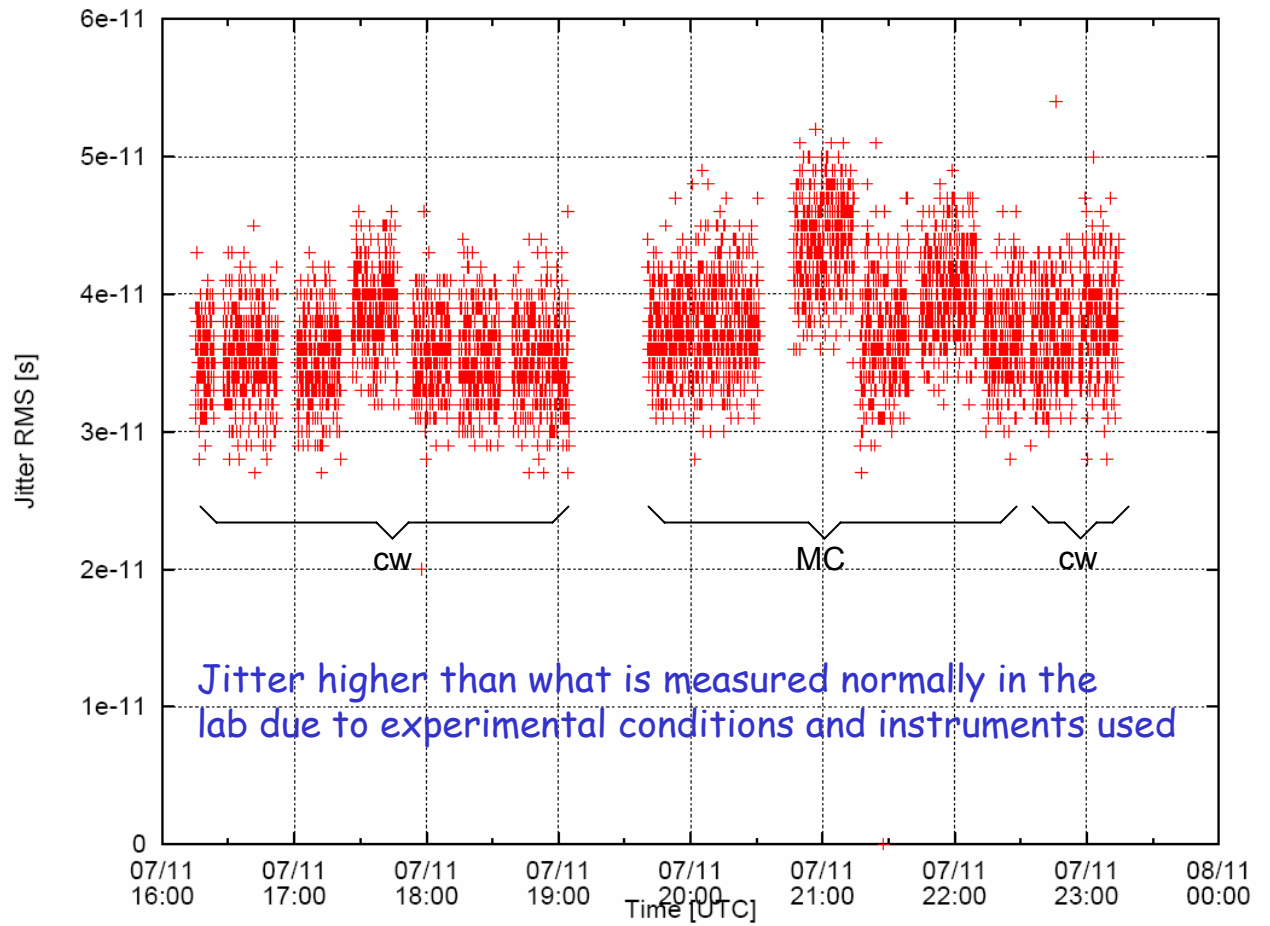
Irradiation Tests

- Irradiation tests made in Boston by:
  - Sefan Simion and John Parsons
- Proton beam:
  - Energy: 160 MeV
  - Fluence: 2.3 to 2.5 10^{13} p/cm^2
- QPLL3
- Quartz crystals:
  - Micro Crystal
  - Conner Winfield
- (Accelerated aging tests being done at CERN)

Irradiation



Irradiation



TTCrq

- New TTCrq on the drawing board
  - Introduction of the power network
  - Pin J2 - 39 will become a +2.5 V power input
    - For cards working in a radiation hard environment that can not use the internal 2.5 V regulator
    - Optional 0 Ω resistor for 100% compatibility with the previous version
  - Optional 100 Ω internal terminations for the LVDS signals
- Fabrication schedule:
  - Through CERN: mid January
  - Discussing with an external manufacturer to speedup things