

Postcards From The Rising Edge: NTP and Owamp within 100 μ Second RTT

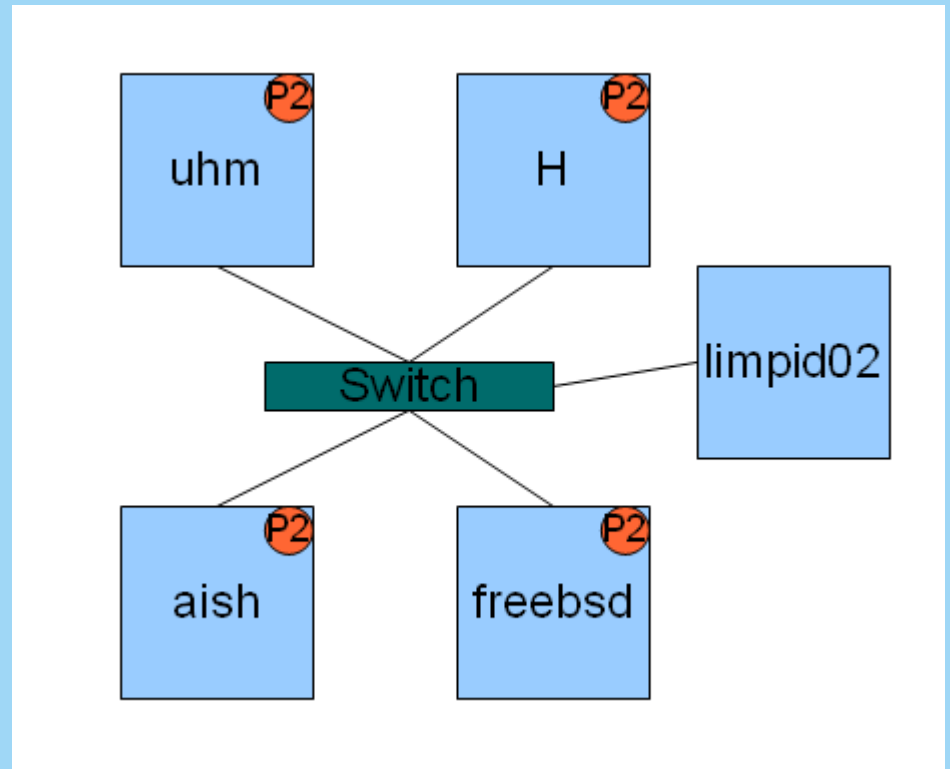
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[http://net.its.hawaii.edu
/network-performance/using-praecis/](http://net.its.hawaii.edu/network-performance/using-praecis/)

Disclaimers

- Your public NTP server is probably adequate for what you use it for.
- Still, it deserves some attention
- NTP may not be as set-and-forget as you may suppose
- See my previous Lightning Talk for some perspective
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- Had some time with pre-deployed hardware for TLPW PerfSONAR
- 5 servers, 4 CMDA modules
- Decided to see what was to be seen, before sending them to their sites
- Typical RTT between boxes $\sim 100 \mu\text{S}$

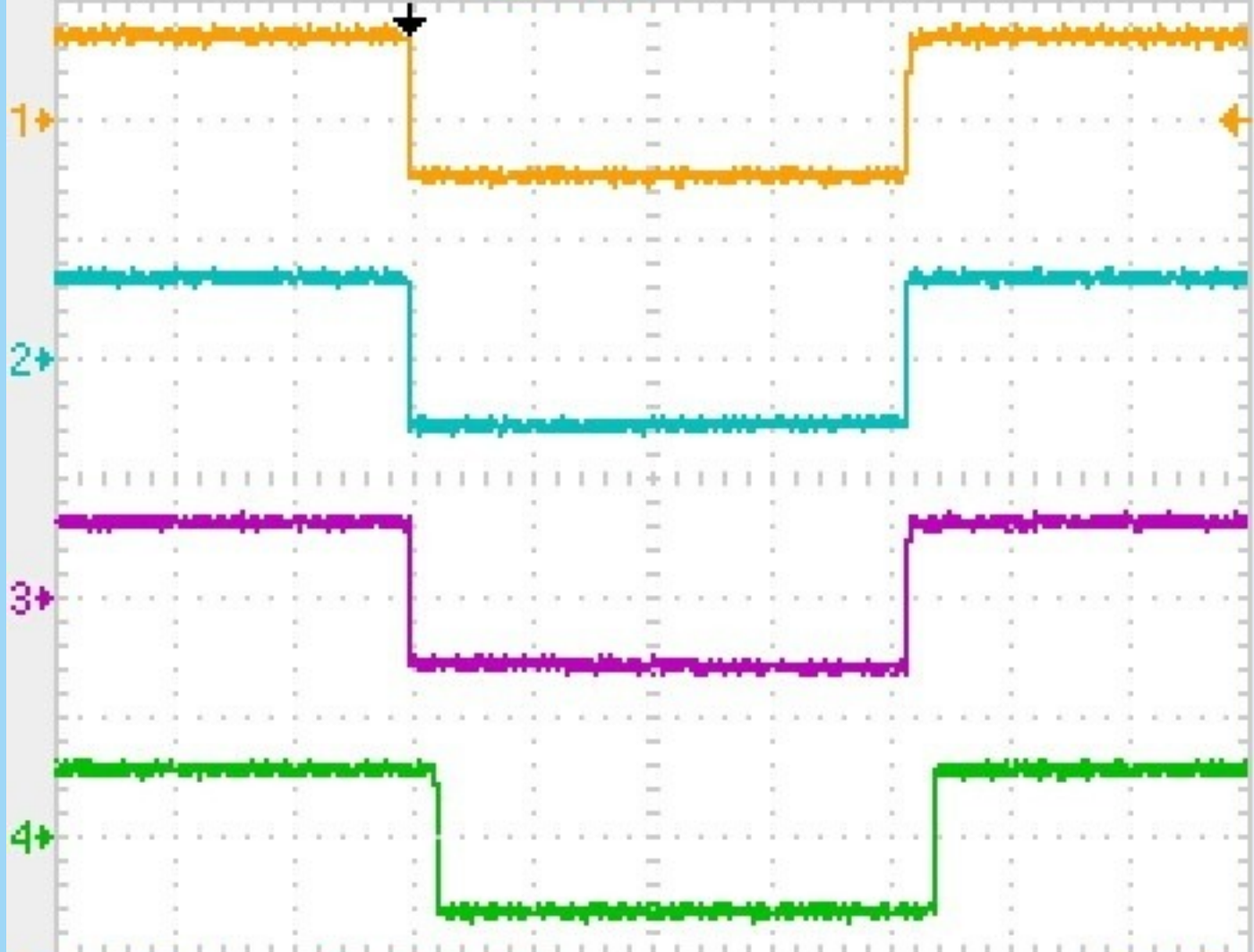


- With the ER Praecis CDMA Modules, there are several modes you can use with NTP
 - PPS with Truetime TOD
 - Trimble Palisade mode
 - Some others that are less accurate.
- Owamp benefits from clock accuracy within 100 μ S or less, clock errors are influential N in Owamp's SNR
- NTP using only network peers maintains time accurate to within milliseconds, orders of magnitude less accurate
-

PPS plus Truetime TOD

- Unix-like OS are not RTOS
- PPS-API is a usable solution
- Easy to do in FreeBSD
- Somewhat easy to do in Linux
 - IFF: you've got the right kernel with the right doo-dads in it
 - IFF: You've got linux-utils with `ldattach` (semi-common)
- IFF: your NTP works with PPS
- Even with all IFF – it requires fudge-numbers.
-

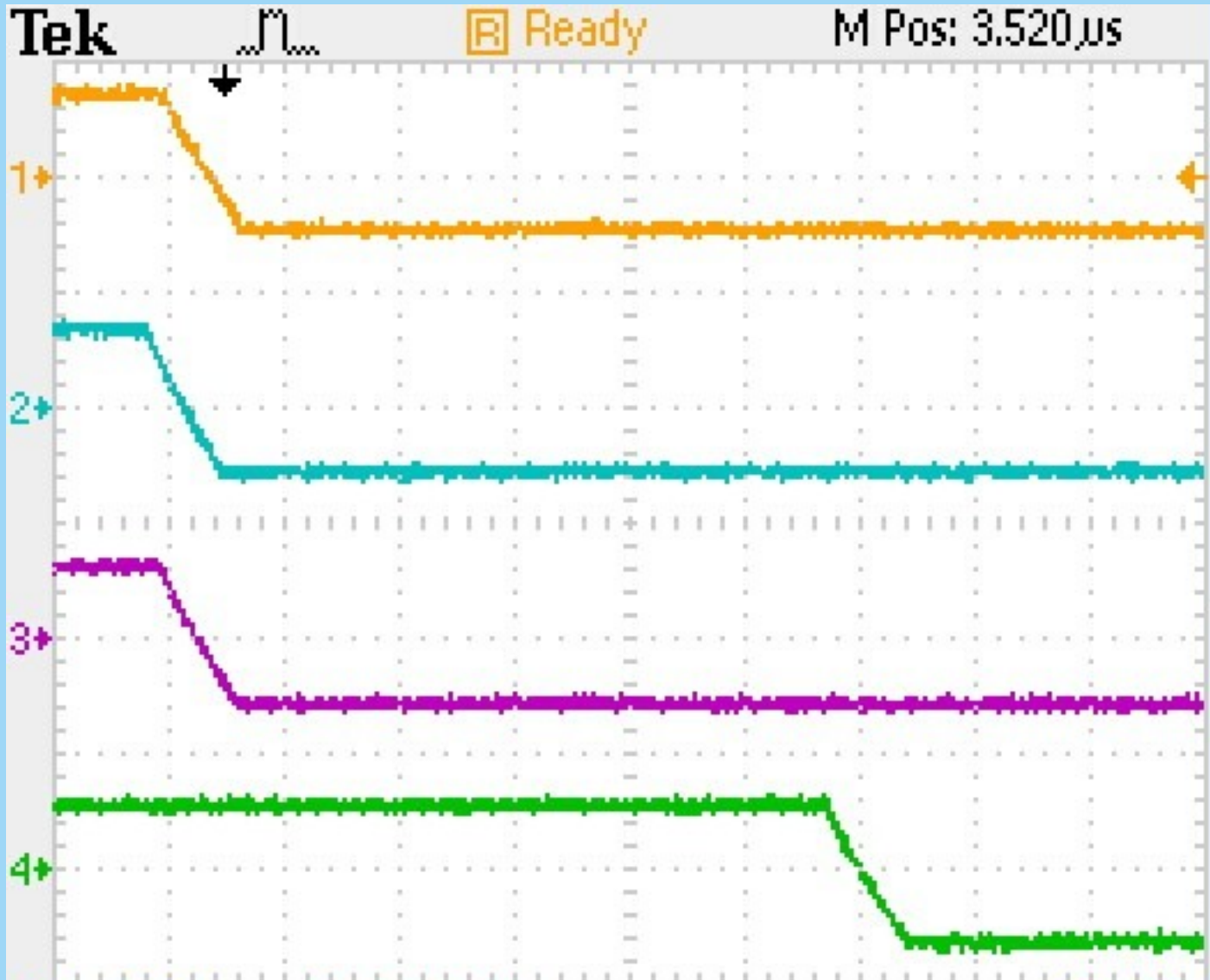
Tek  Trig'd M Pos: 51.00 μs



PPS outputs from 4 CDMA radios.

Channel 4, which is using a different CDMA base station, is about 6 microseconds later than the others.

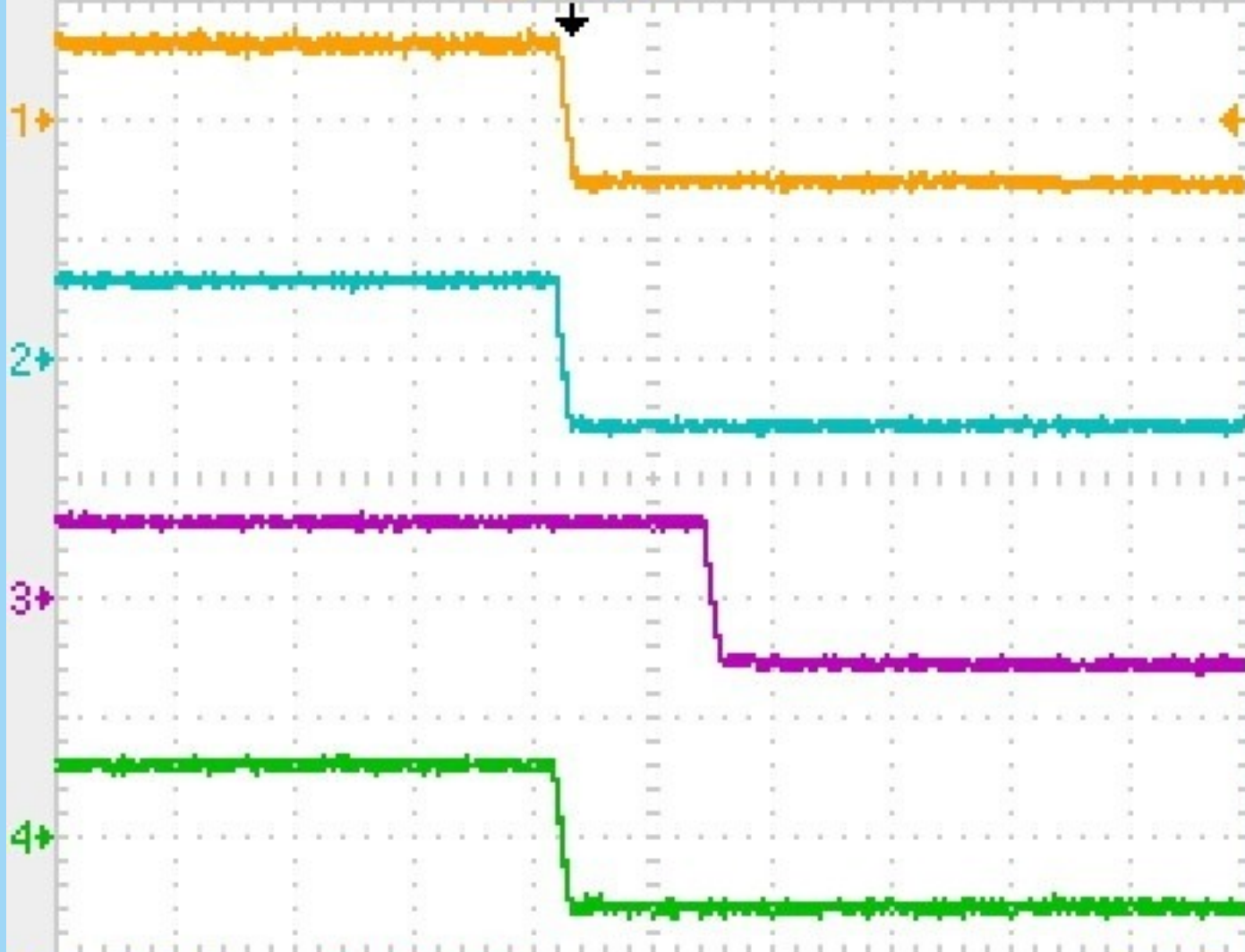
CH1 10.0V CH2 10.0V M 25.0 μs CH1 ~ 0.00V
CH3 10.0V CH4 10.0V



Same pulses as above, with higher horizontal resolution.

This "close-up" shows about 5.8 μs difference on #4,, and #: is about 0.1 μs earlier than 1 & 3.

Tek Ready M Pos: 3.480 μ s



PPS from same 4 radios as above, after the antenna feedlines on #3 and #4 were swapped. This shows that small differences in antenna placement can have significant effects on reception

CH1 10.0V CH2 10.0V M 5.00 μ s CH1 \sim 0.00V
CH3 10.0V CH4 10.0V 17-May-11 12:44 <10Hz

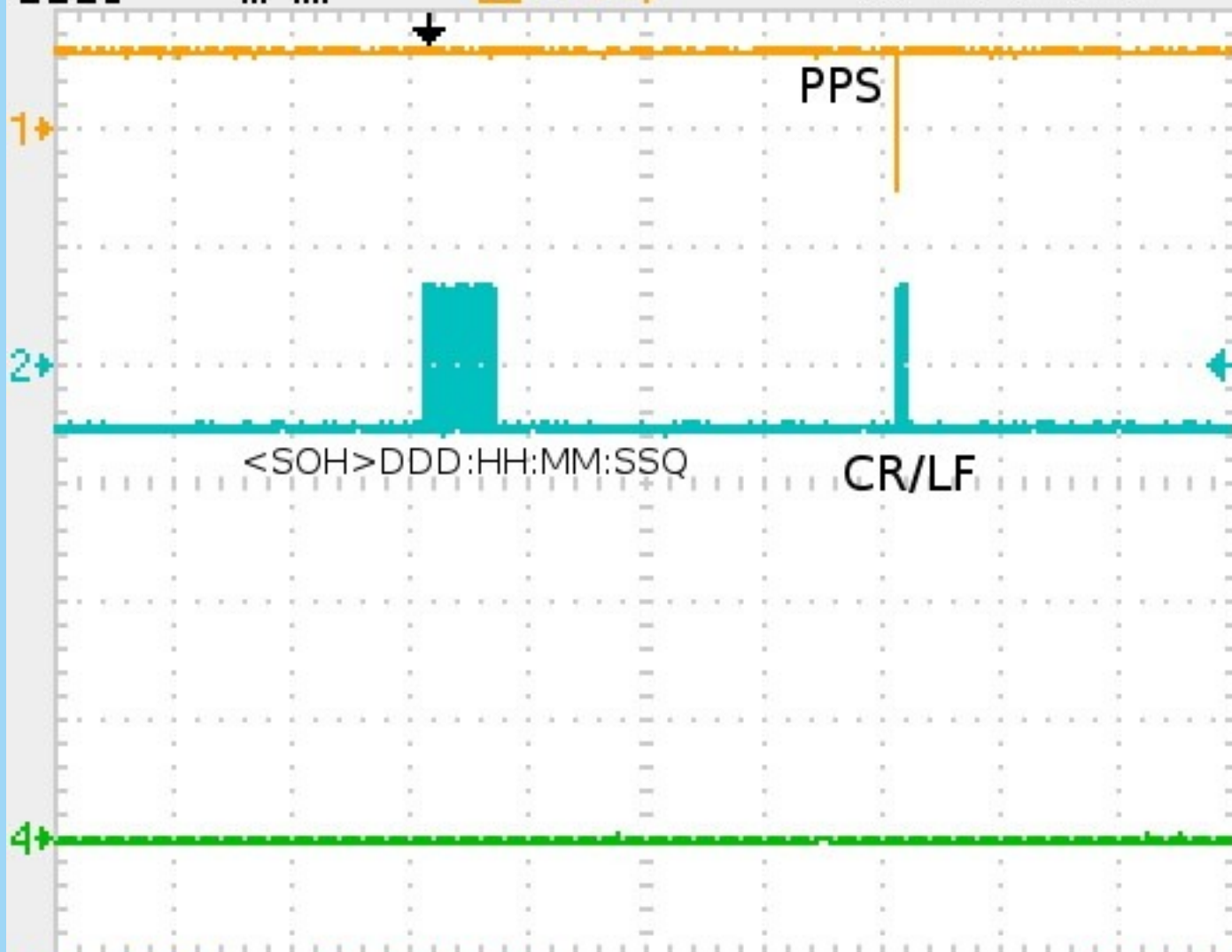
Tek



Ready

M Pos: 46.80ms

SAVE/REC



Action
Save Image

File
Format
JPEG

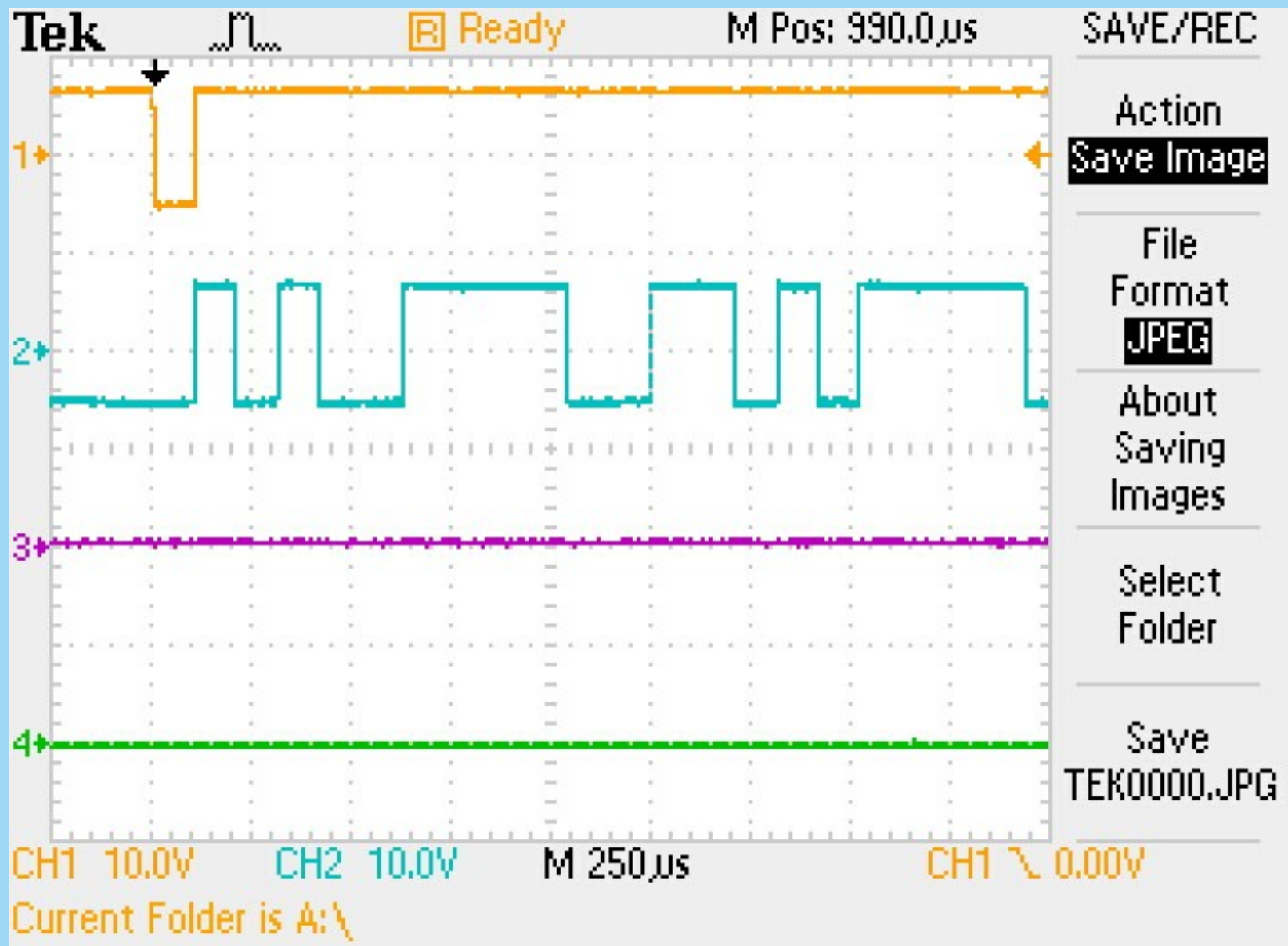
About
Saving
Images

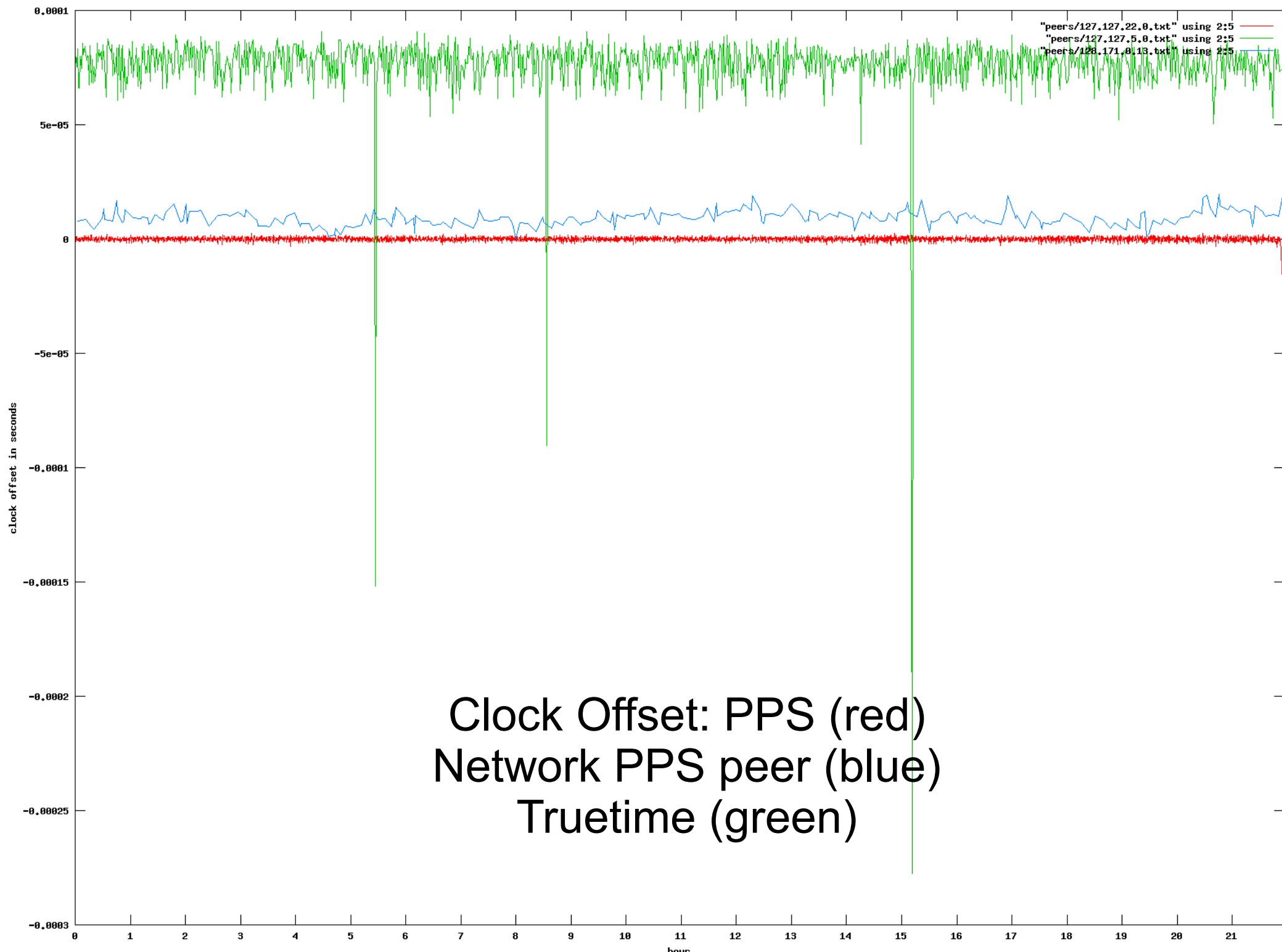
Select
Folder

Save
TEK0001.JPG

CH1 10.0V CH2 10.0V M 25.0ms CH2 / 0.00V

Current Folder is A:\





What PPS is supposed to look like

```
root@aishibano:~# ntpq -p
      remote           refid      st t when poll reach  delay  offset  jitter
=====
+kiko-manawa.uhn .CDMA.      1 u   -   64    1   0.535   7.572   0.036
+ntproundtop.haw .GPS.       1 u   1   64    1   4.178   7.464   0.094
+128.171.0.8     .CDMA.      1 u   -   64    1   0.104   7.538   0.068
+uhmanoa-dl.ps.u .CDMA.      1 u   1   64    1   0.112   7.598   0.021
 net.its.hawaii. 128.171.3.2 2 u   -   64    1   0.208   7.609   0.035
 wintermute.uhne 128.171.235.62 2 u   1   64    1   0.221   7.618   0.043
 irtfgps1.ifa.ha .GPS.       1 u   4   64    1  11.519   7.833   0.001
 k2tyml.keck.haw .GPS.       1 u   3   64    1  19.461   6.564   0.001
 tick.mhpc.hpc.  .GPS.       1 u   2   64    1   3.882   7.454   0.001
*TRUETIME(0)    .CDMA.      0 l   -   64    1   0.000   0.018   0.001
oPPS(0)         .PPS.       0 l   -   16    1   0.000   7.437   0.001
```

What PPS will look like

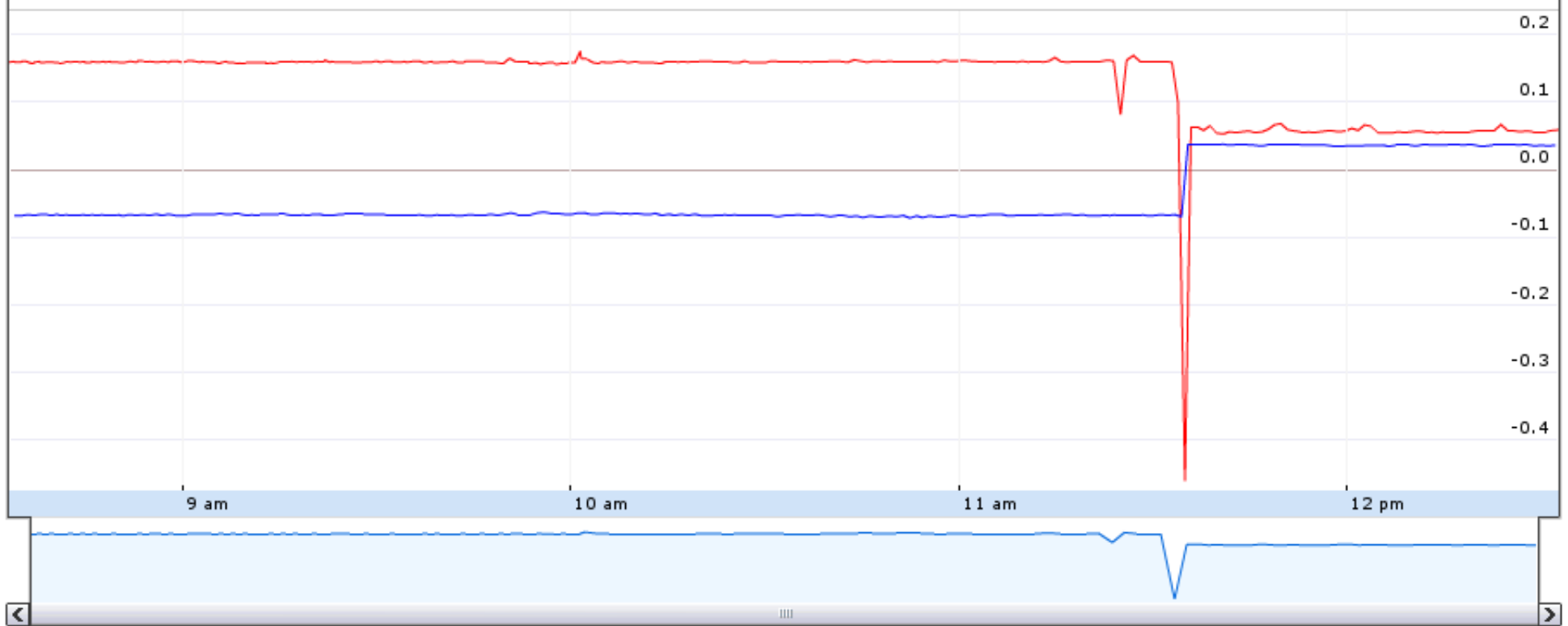
remote	refid	st	t	when	poll	reach	delay	offset	jitter
+kiko-manawa.uhn	.CDMA.	1	u	13	64	377	0.514	0.254	0.706
+ntproundtop.haw	.GPS.	1	u	18	64	377	4.114	0.223	0.743
+128.171.0.8	.CDMA.	1	u	18	64	377	0.111	0.305	0.760
+uhmanoa-dl.ps.u	.CDMA.	1	u	14	64	377	0.102	0.281	0.748
-net.its.hawaii.	128.171.3.2	2	u	20	64	377	0.166	-1.143	1.548
+wintermute.uhne	128.171.235.62	2	u	8	64	377	0.188	0.184	0.686
+irtfgps1.ifa.ha	.GPS.	1	u	46	64	377	11.377	0.627	1.010
+k2tyml.keck.haw	.GPS.	1	u	49	64	377	14.643	-0.282	1.267
+tick.mhpcc.hpc.	.GPS.	1	u	33	64	377	3.780	-0.232	0.816
xTRUETIME(0)	.CDMA.	0	l	1	64	377	0.000	-6.952	0.535
*PPS(0)	.PPS.	0	l	16	16	377	0.000	-0.096	0.185

Source: 128.171.0.13 (128.171.0.13) -- Destination: uhmanoa-dl.ps.uhnet.net (128.171.0.6)

Zoom: 1' 5' 1h 1d 5d 1m 3m 6m 1y Max

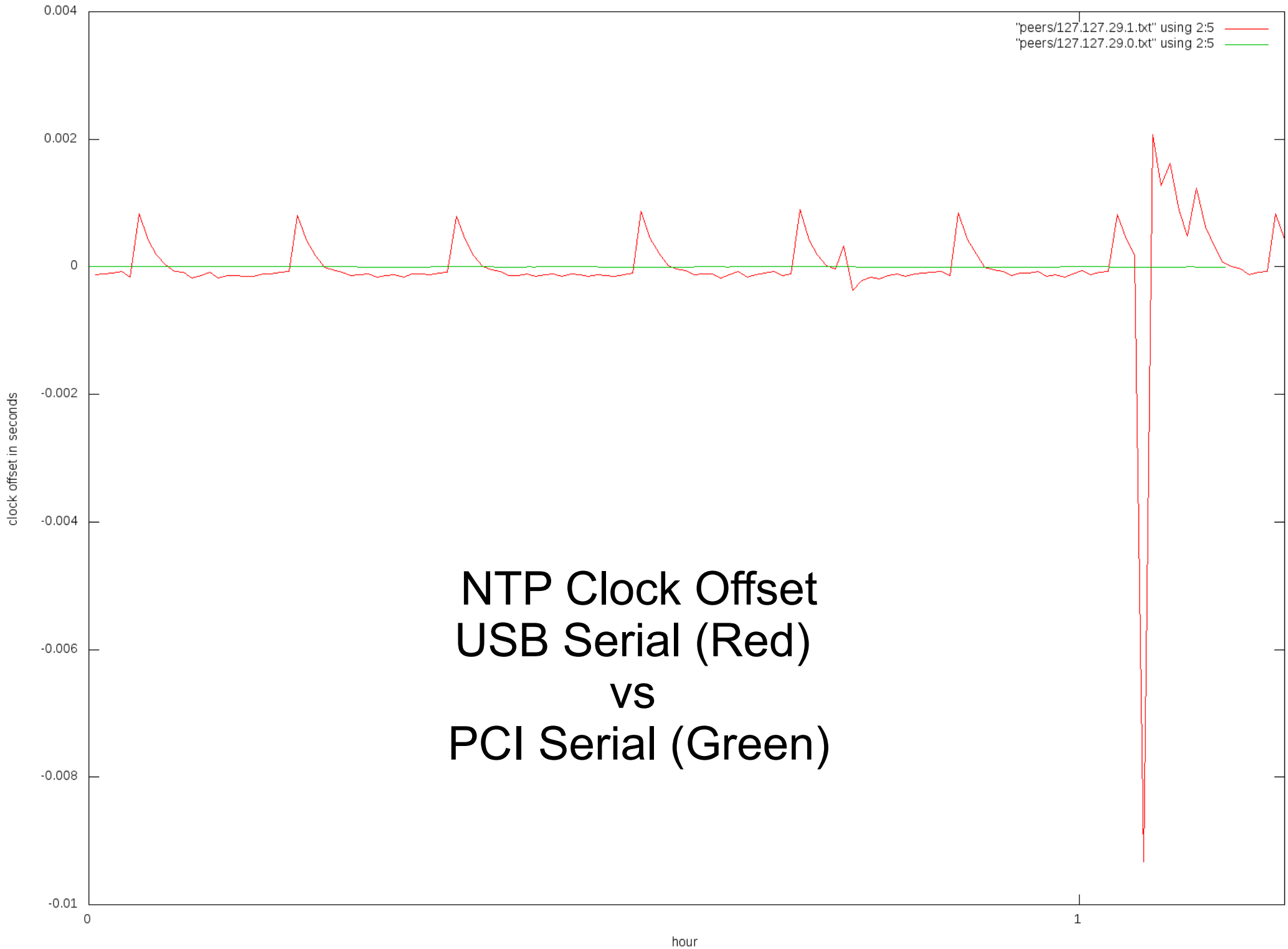
12:32 May 27, 2011

● [Dst to Src] Delay (MSec) 0.04 ● [Src to Dst] Delay (MSec) 0.06

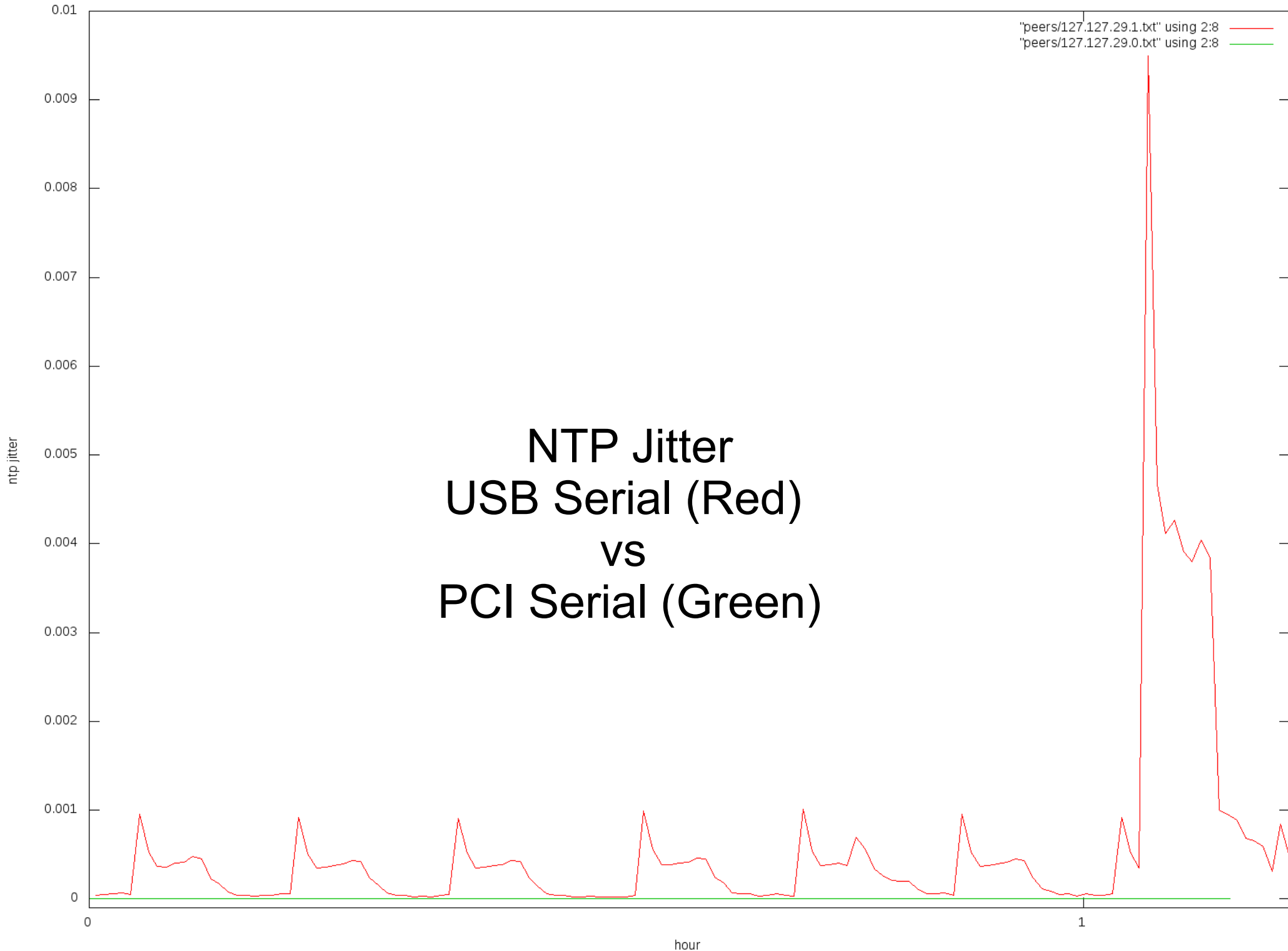


Trimble Palisade Mode

- ER Praecis II (or Ct) runs a real RTOS
- Trimble mode works by having the NTP server command the Praecis to “timestamp now” by raising CTS
- Kernel version and doo-dads irrelevant
- Almost all stock NTPd's work with this mode
- It produces the same NTP precision (10^{-20} sec.) as PPS
- Accuracy is indistinguishable, and much tighter than needed



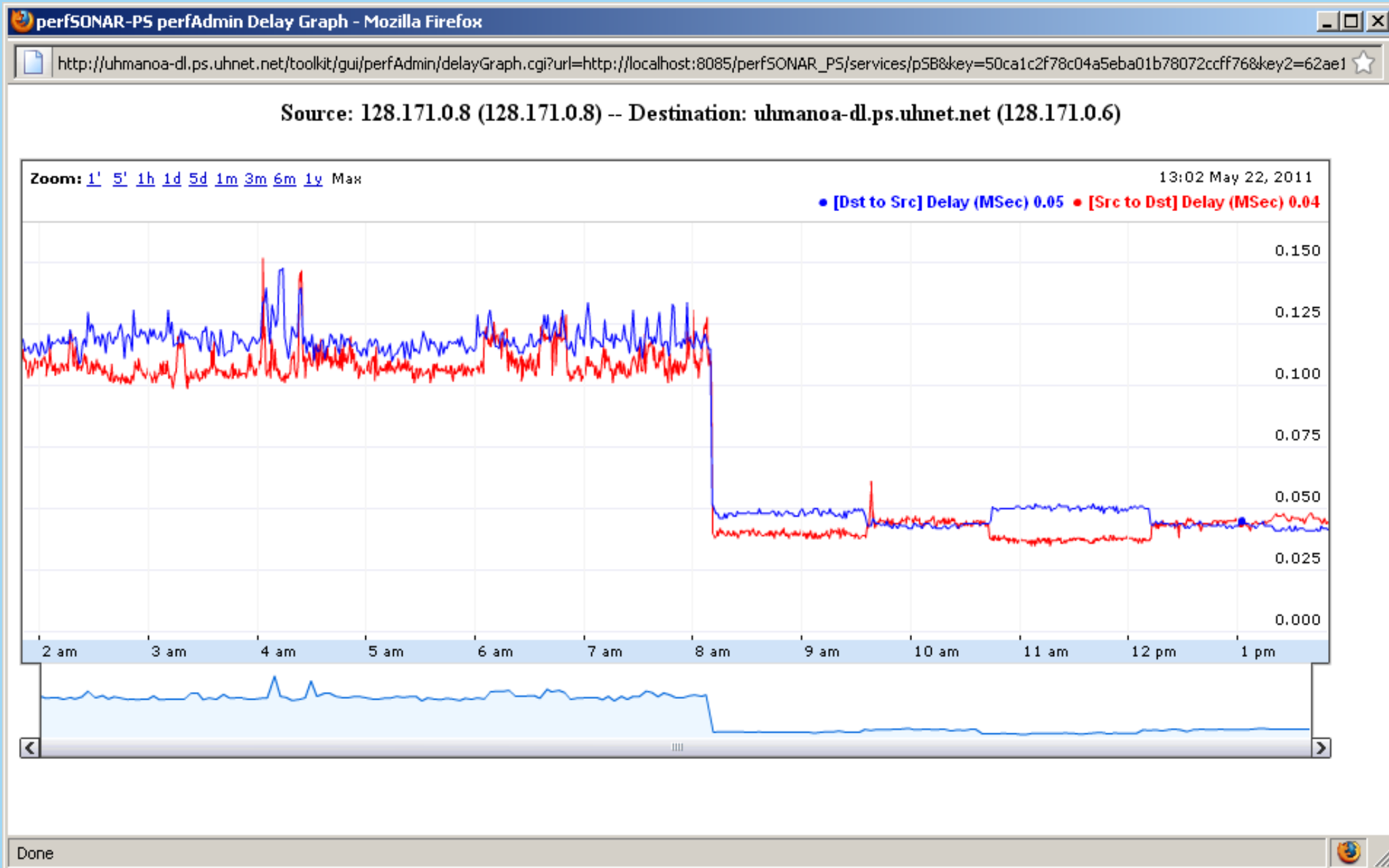
**NTP Clock Offset
USB Serial (Red)
VS
PCI Serial (Green)**



**NTP Jitter
USB Serial (Red)
VS
PCI Serial (Green)**

"peers/127.127.29.1.txt" using 2:8
"peers/127.127.29.0.txt" using 2:8

2000-line ACL; early accept; none;



220 Net Peers - Clock Offset

