Timing Receiver Failures

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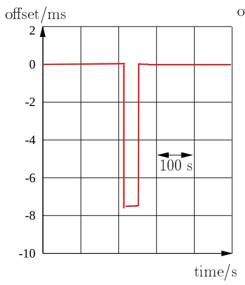
Receiver Failures

Stellar GPS 100A

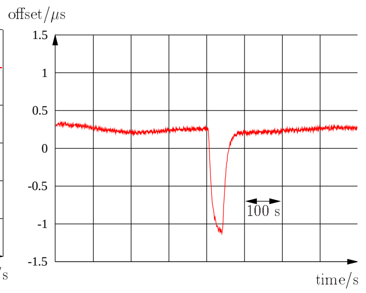
- **Spurious pulses.** Twelve "spurious" 1 pps pulses appeared, partly in bursts, arbitrarily in between regular ones. These are possibly due to interfacing problems.

NavSymm NTFR-S

- **250 μs bias.** The originally shipped NavSymm receiver's 1 pps exhibited a constant bias of 250 μs ahead of UTC. It turned out that this problem was the result of a known (!) firmware bug, which was fixed in a replacement unit that was finally used for the actual evaluation.



Pulse jumps



Pulse ramps

- **Pulse jumps.** The 1 pps data of the NavSymm revealed pulse jumps (eight totally) as shown in the figure above. A short time before the jump an accuracy indicator ACC-TIME (in the SFM-message) jumps to zero, which means *bad accuracy*. But shortly after the jump ACC-TIME returns to normal values, although the 1 pps pulses were still extremly offset from UTC. Eventually the 1 pps offset also returned back to normal values.
- **Pulse ramps.** A phenomenon similiar to the pulse jump one showed up (six times), where the offset gradually grew to values more than 1 μs that reduced to normal values after a while (see figure on the right).
- **Wrong timetag.** At the beginning of some days (for 2–3 seconds) the receiver transmitted a wrong timetag information. For example, it said 1995 Dec 14 00:00:00, while it should have said 1995 Dec 15 00:00:00.

Motorola VP-Oncore

- **Lost pulses.** No Failures, except ten ommited 1 pps pulses lost along with their time tags.

Magellan Brain

- **Coasting mode.** During 0.3% of the time the receiver was in the *coasting*-mode where it tracks too few satellites to obtain correct measurements. The linearily growing offset indicates that the receiver derives its 1 pps pulse from its local clock.
- **Sudden jumps.** The receiver exhibited sudden jumps of 10 μs and 1 ms, which was also indicated by the receivers' accuracy value TFOM (Time Figure of Merit). Nevertheless some jumps happened that were not indicated by TFOM.
- **Wrong timetag.** One out of thousand of the timetags were found to be incorrect (usually off by one second).

Trimble SVeeSix-CM2

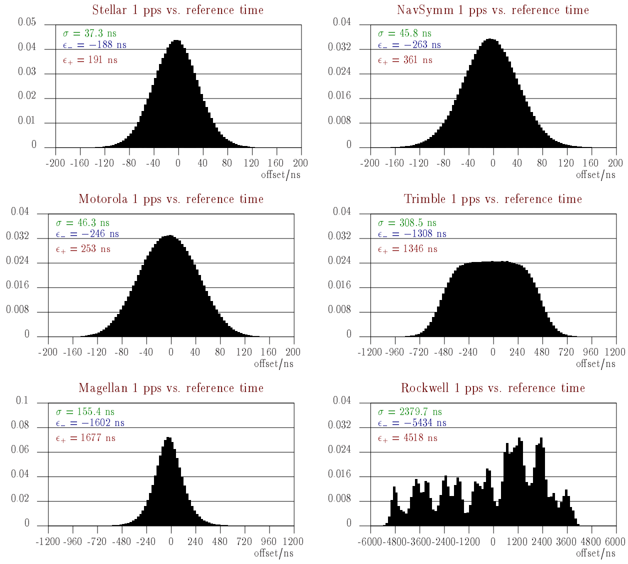
- **Wrong insertion of leap second.** The Trimble receiver outputs the time tag both in UTC and GPST. The leap second 1995/1996 was incorrectly inserted already on 1996 Jan 01 00:00:00 GPST (=1995 Dec 31 21:59:50 UTC) instead of 1996 Jan 01 00:00:00 UTC.

Rockwell Microtracker

- **Bad accuracy.** To bad accuracy (10 μs-range) of 1 pps pulses (actually timemark pulse) to seperate normal behaviour and failures.

Distributions

The following tables and graphs characterize the distribution functions of the 1 pps outputs of the receivers against the reference time for the full measurement period of 2 months. Note: In the graphs the means were subtracted to make direct comparison easier. Furthermore any faulty behaviour was elimaneted from data.



Signal	mean $\bar{x}$/ns	rms σ_x/ns	ϵ_-/ns	ϵ_+/ns
Stellar 1 pps	0	37	-188	191
NavSymm 1 pps	244	46	-263	361
Motorola 1 pps	108	46	-246	253
Trimble 1 pps	310	309	-1308	1346
Magellan 1 pps	60	155	-1602	1677
Rockwell 1 pps	7.933	2.380	-5434	4518