First results with TSC

A new clock for TTM

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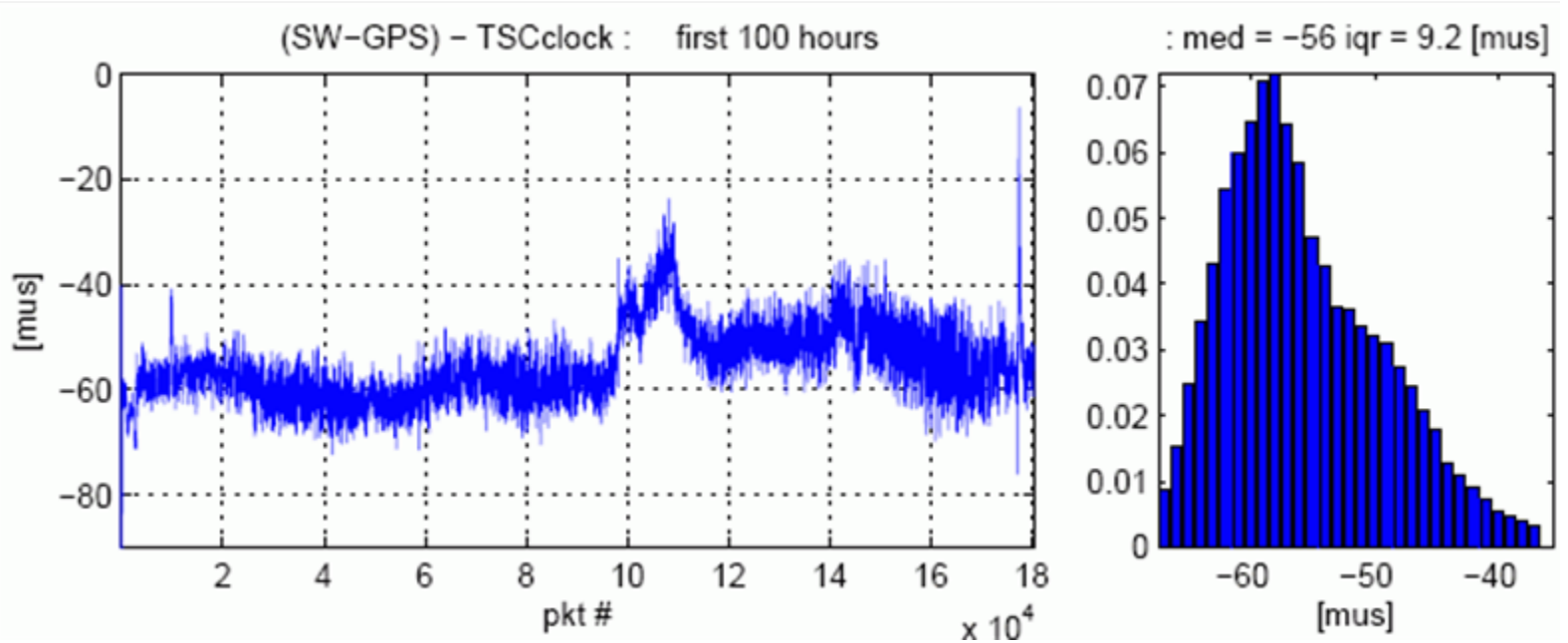
Why a new clock?

- TTM uses GPS receiver for accurate timekeeping
- Requires a good view of the sky
  - installation on rooftop
- Not always easy to install
  - Building logistics, landlord, …
- “we already have a GPS / stratum-1 time server”
  - But accuracy of NTP synchronization not good enough for delay measurements

TSC clock

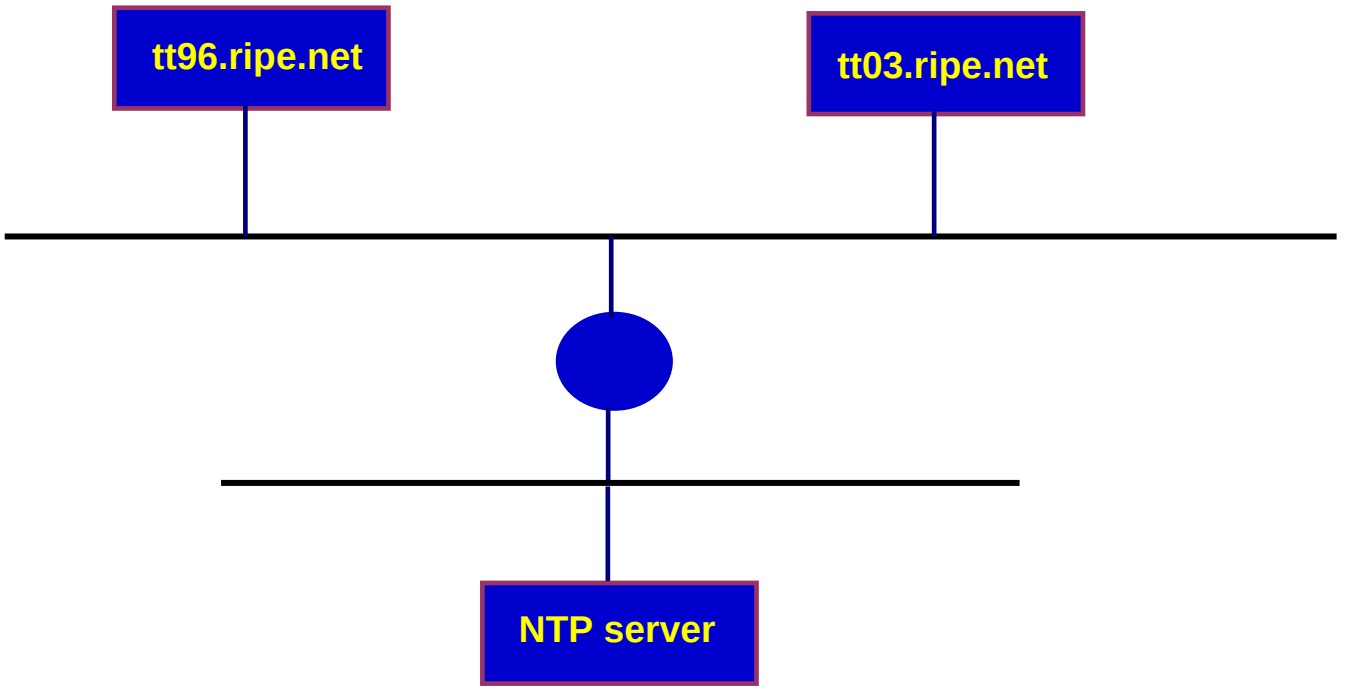
- Darryl Veitch et.al., University of Melbourne
  - TSC register good basis for precise differential time measurements (round trip times, jitter, …)
  - One-way delays require two *synchronised* clocks
    - Difference in offset from true time should be small and stable
  - NTP stratum-1 server provides info on absolute time
  - TSCclock: combine TSC register with NTP timestamps
    - Concept presented at IMC 2004 *http://www.imconf.net/imc-2004/papers/p219-veitch.pdf*
    - API finalised in recent months
  - Installed in TTM environment for benchmarking

TSC vs GPS: first 100 hours



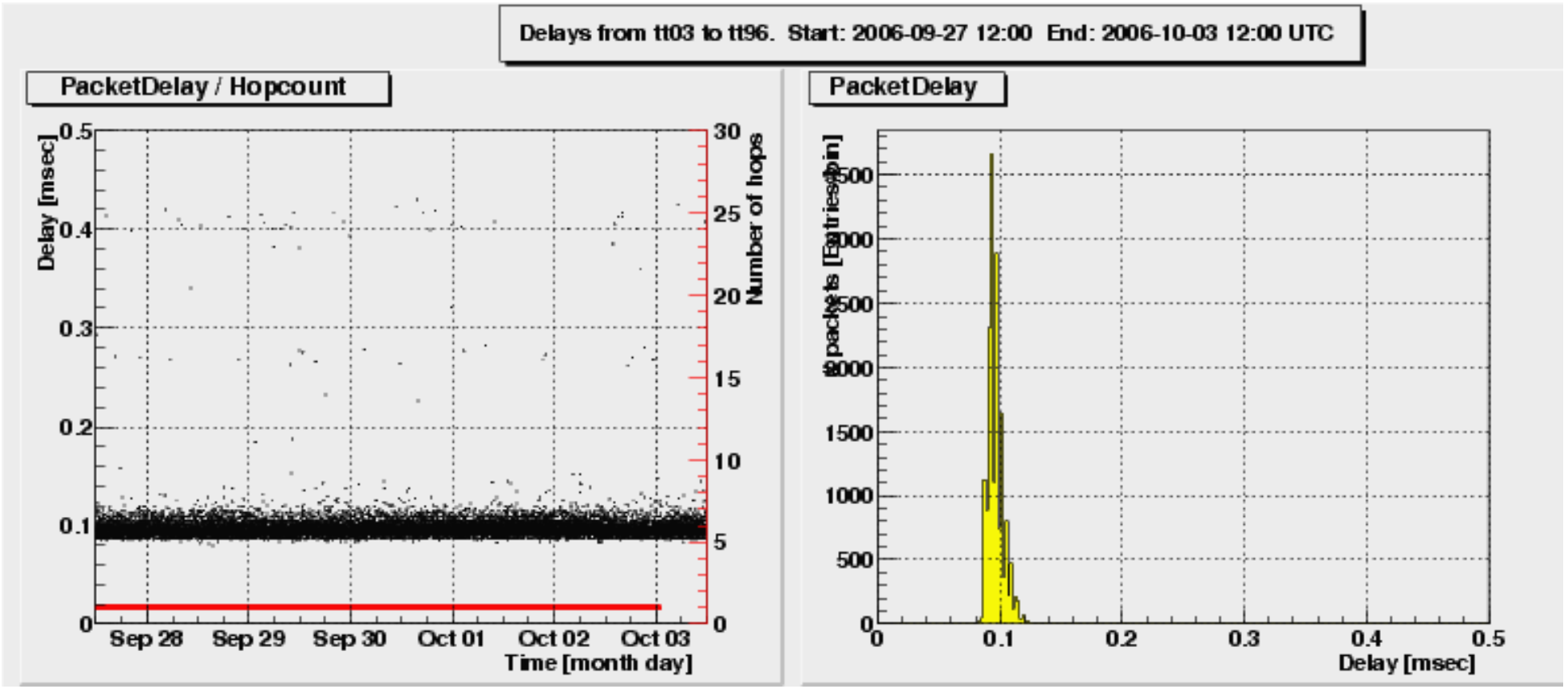
In-kernel comparison of GPS and TSC clocks

Test setup (simplified)



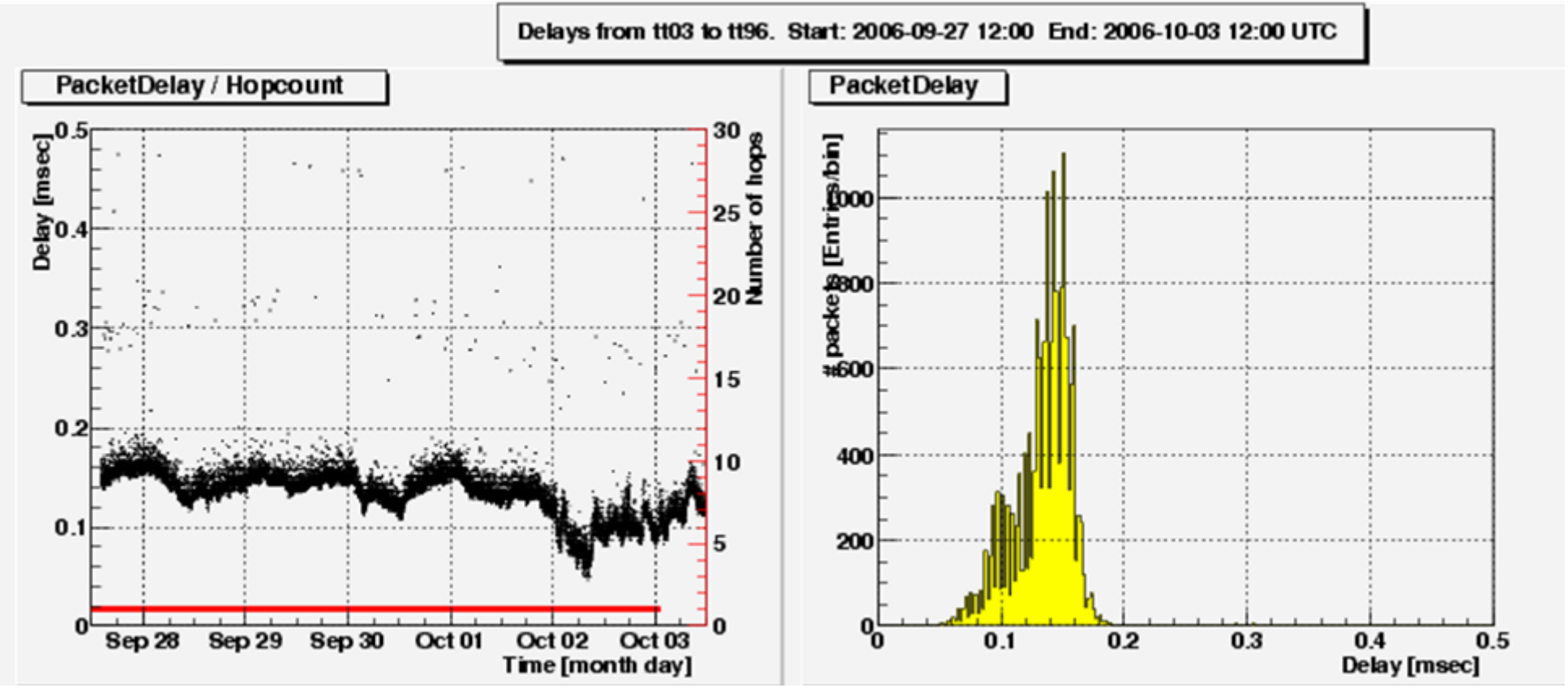
- tt96: prototype testbox, TSC & GPS clocks
- tt03: production testbox, GPS only

GPS performance



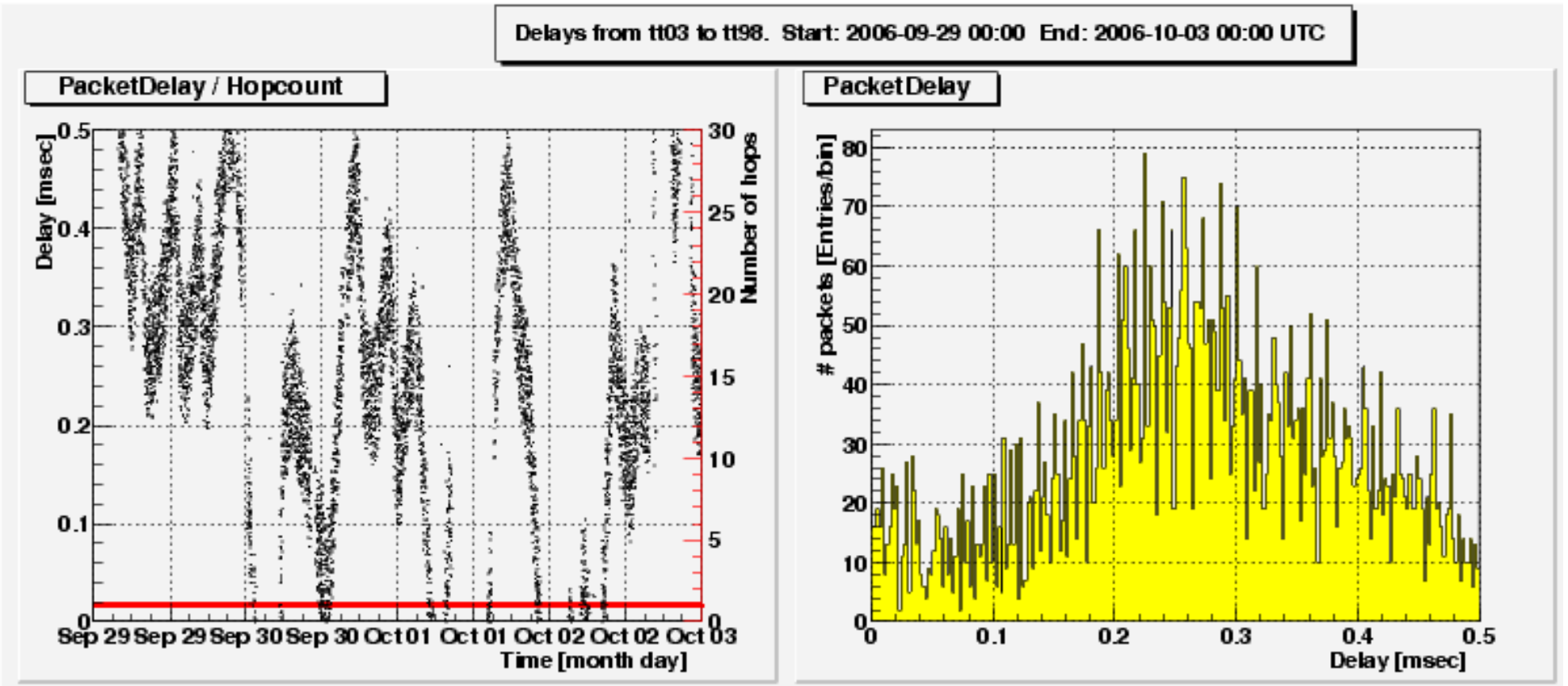
- Stable baseline and median delay value

TSC performance



- Less stable over longer time frame, +/- 50 microsec

TTM delays with NTP only



➡ Fluctuations of hundreds of microseconds!

Conclusion

- First TSC results are promising
  - Proven solution for TTM when NTP server is nearby
  - Accuracy good enough for “long distance” measurements (TTM delays of miliseconds and higher)
  - Much better than standard NTP synchronisation
- Next steps:
  - More testing needed with NTP server further away (longer distance, more network hops)
  - Fully integrate in TTM production software (kernel modifications, measurement software)

Questions?