

Questions

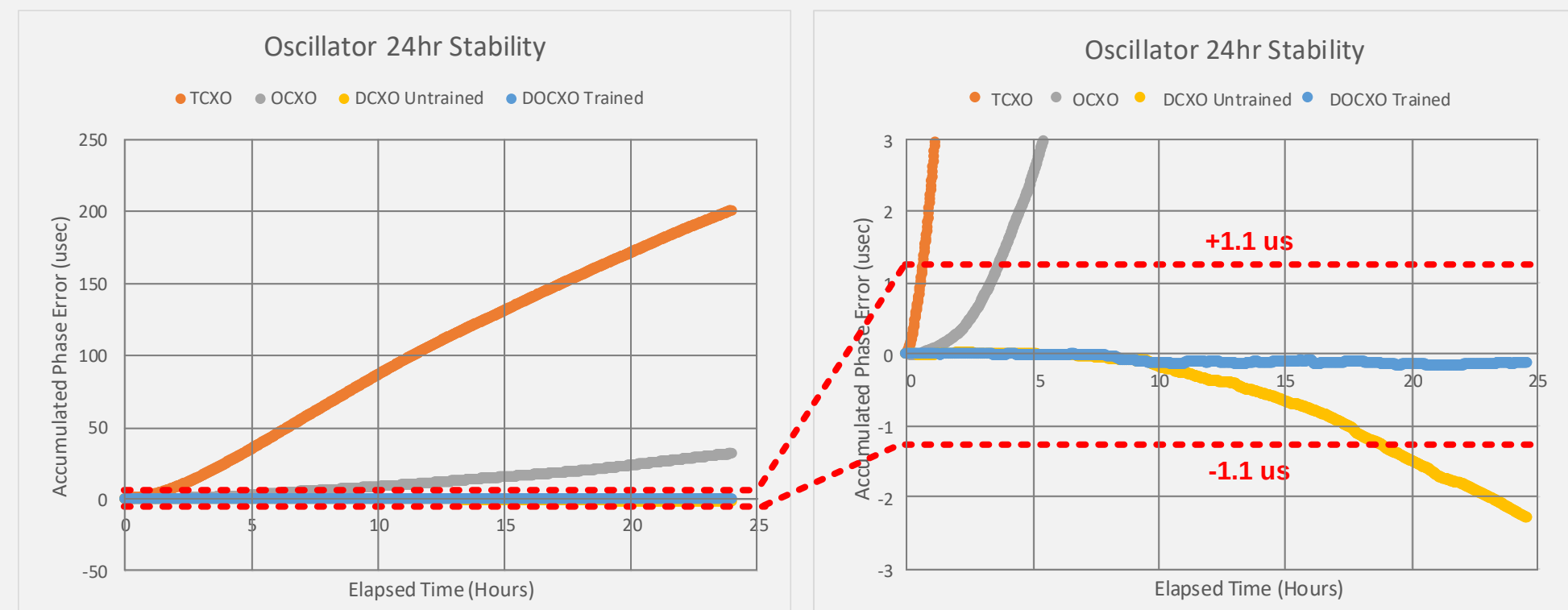
What are the key factors that affect holdover performance in a IEEE 1588 system?

- 1 Local Oscillator Frequency Stability
 - TCXO, OCXO or DOCXO. Which one will give better holdover performance?
- 2 Physical Layer Assist (with/without)
 - Does physical layer assist help with holdover performance?
- 3 Servo Loop Holdover Averaging (Initial Offset/Drift Rate)
 - Does the servo loop and DCO resolution affect holdover performance?

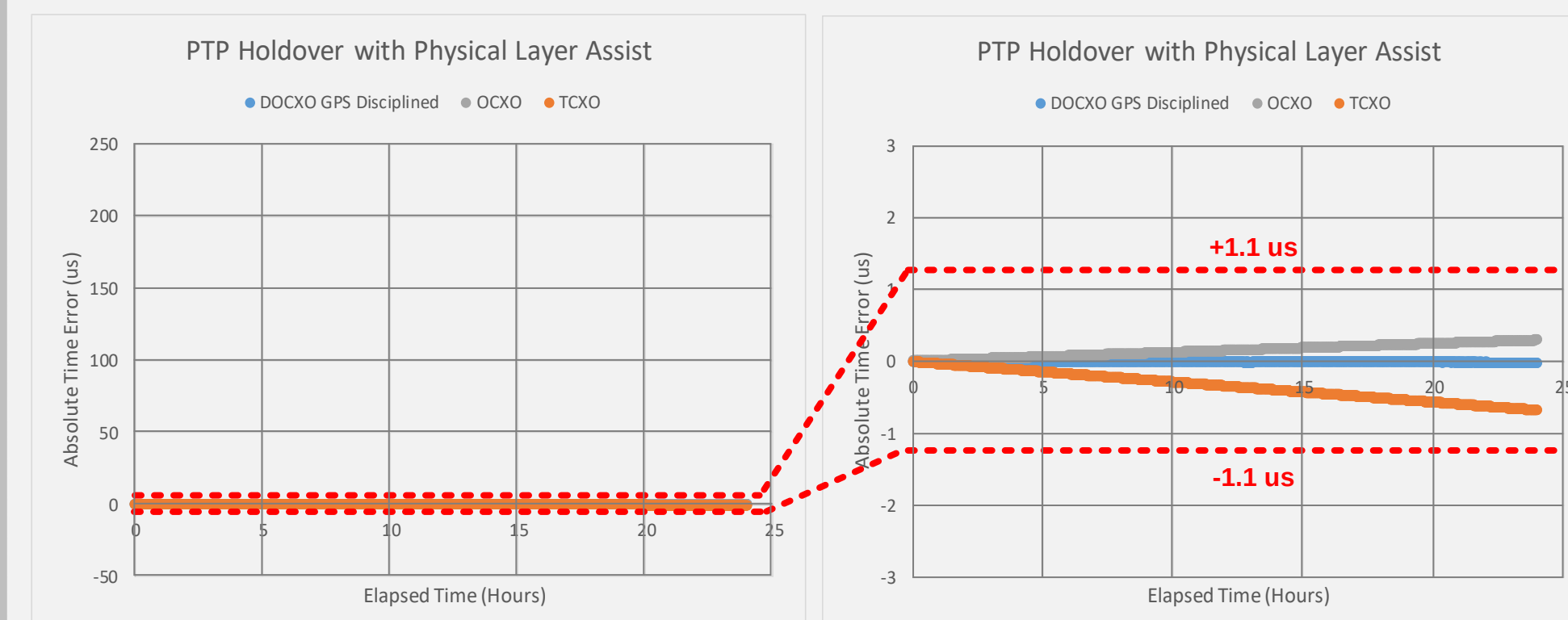
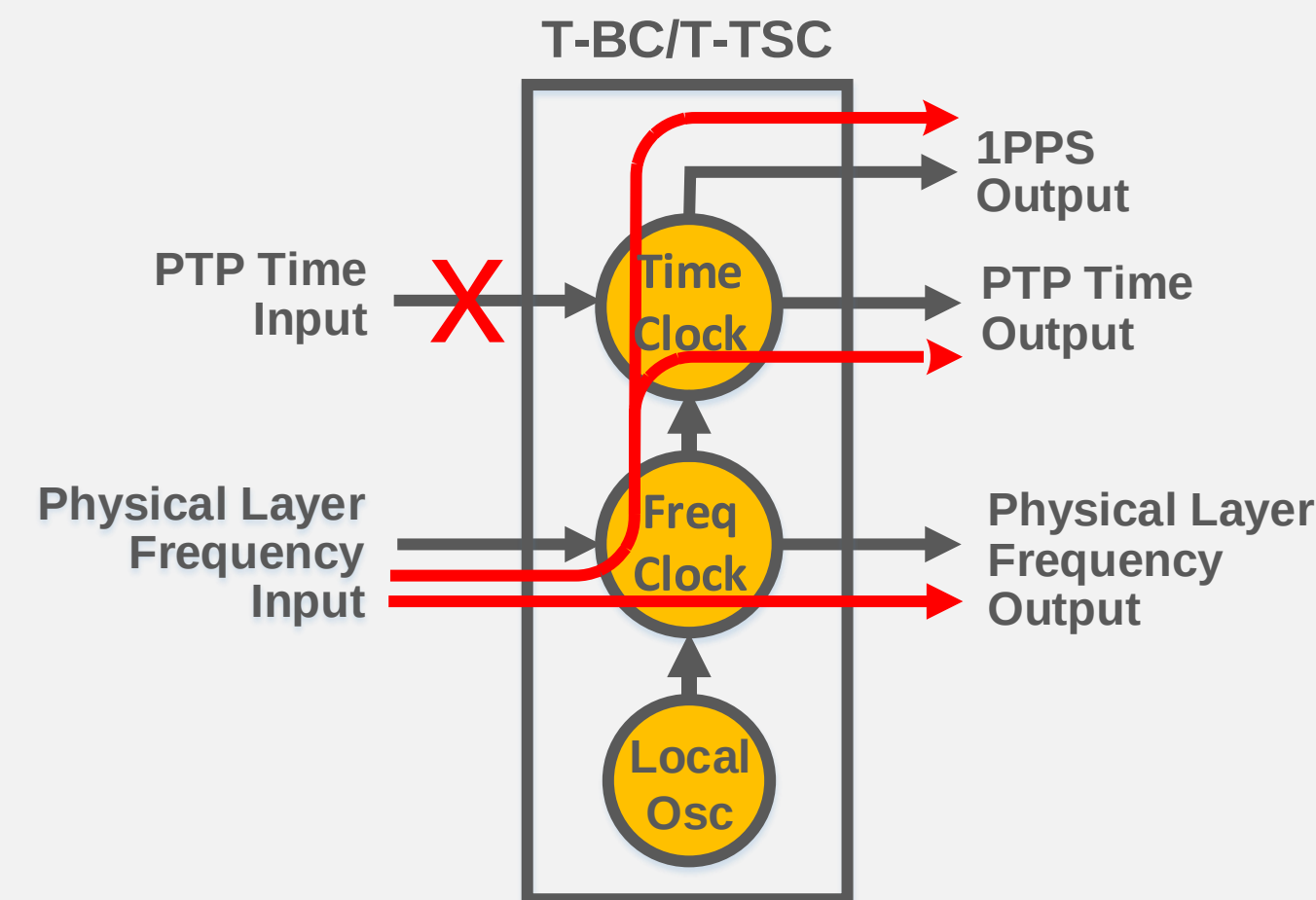
Local Oscillator Frequency Stability (Free-running)

Time Until Accumulated Phase Error Exceeds **1.1 μ sec**:

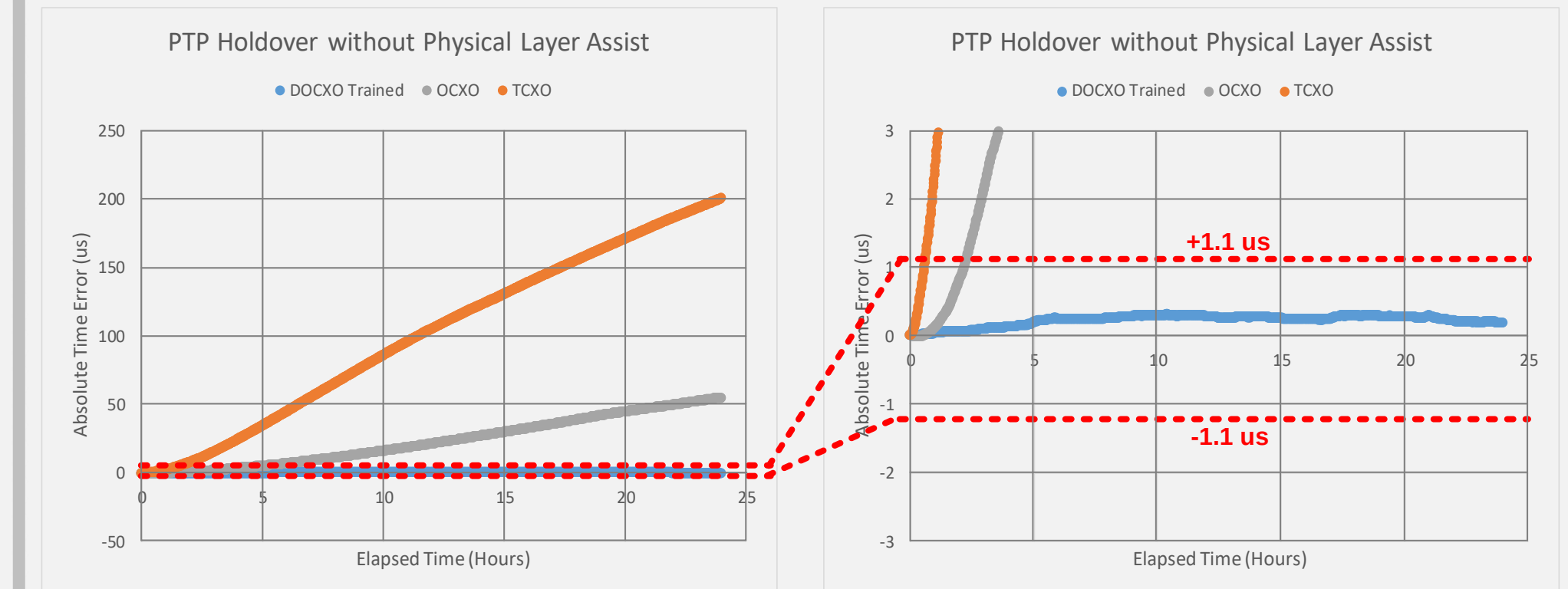
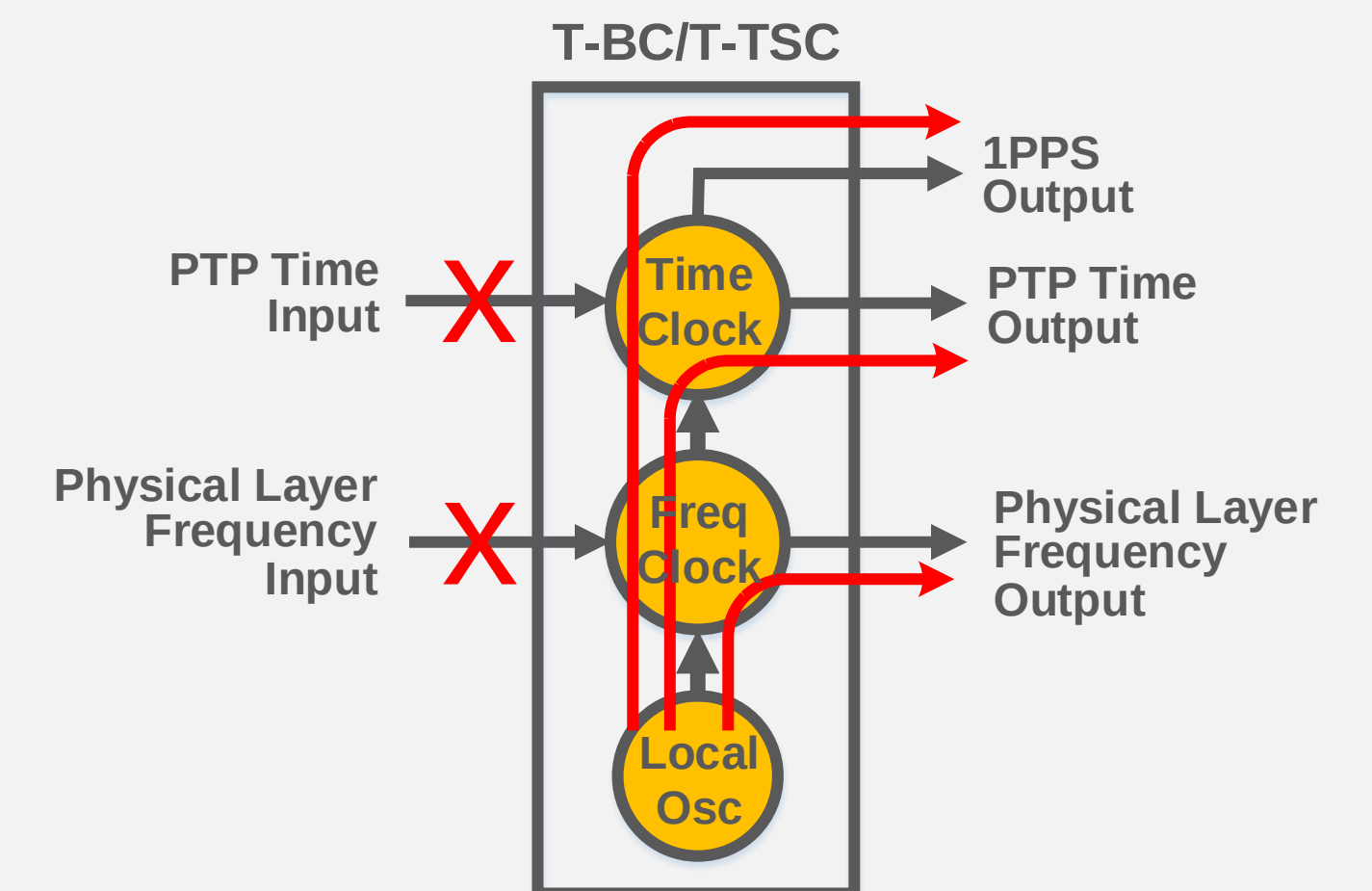
TCXO: 37 minutes
OCXO: 3 hours, 25 minutes
DOCXO (Freerun): 17 hours, 25 minutes
DOCXO (GPS Disciplined): > 24 hours



PTP Holdover - *With* Physical Layer Assist

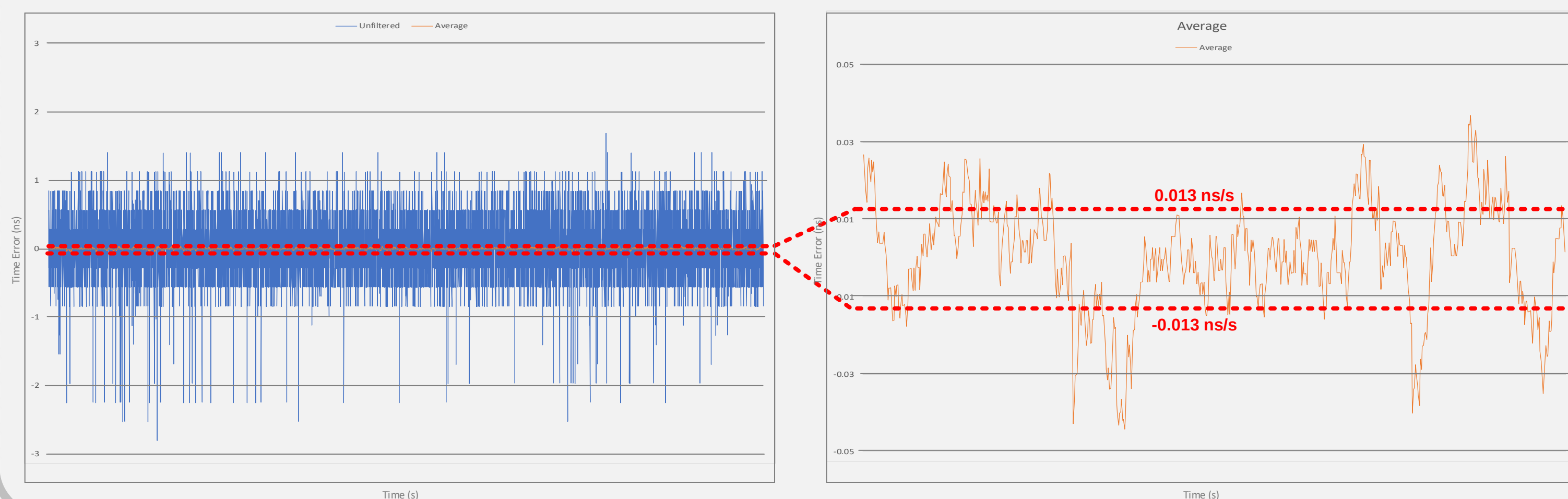


PTP Holdover - *Without* Physical Layer Assist



PTP Servo Loop Holdover Averaging

Frequency averaging while locked determines the frequency drift rate while in holdover. It must be better than ± 0.013 ns/s to meet $\pm 1.1 \mu$ s over 24 hours.



Conclusions

- ◆ The availability of physical layer assist had the greatest influence on meeting 24-hour holdover performance. Oscillator performance becomes less of a contribution when physical layer assist was available. TCXO, OCXO, and DOCXO all met $\pm 1.1 \mu$ s time error over 24 hours.
- ◆ PTP servo loop averaging is a critical factor in meeting 24-hour holdover when physical layer assist is available. The initial offset (or average drift rate) needs to be below ± 0.013 ns/s.
- ◆ Oscillator frequency stability (and ageing) become key contributing factors in holdover without physical layer assist. GPS disciplined oscillators are needed in meeting $\pm 1.1 \mu$ s time error holdover over 24 hours.

References and Acknowledgements

- ◆ The data for this poster is based on the research paper and presentation at ISPCS October, 2019 by Robert M. Kaminsky of Silicon Labs, "Test Results of IEEE 1588v2 Network Synchronization Holdover Performance using Various Types of Reference Oscillators"