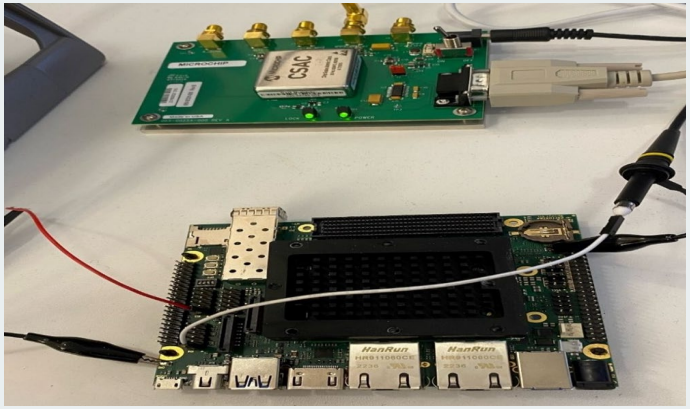


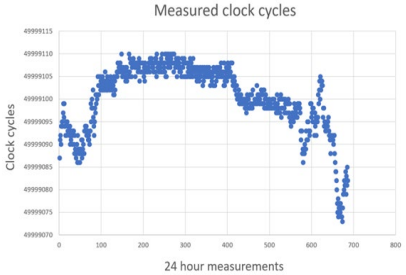
Comparison of time synchronization methods through FPGA for sensors in an AUV

Purpose and aim

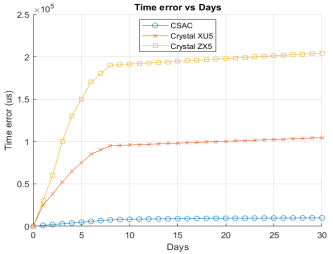
- Development of Field Programmable Gate Array (FPGA) based algorithm that measures clock cycles of the Control Processor's clock and stores them in a register so that its drift and the corresponding time and position error of the Autonomous Underwater Vehicle (AUV) HUGIN for Kongsberg Discovery can be calculated.
- Development of FPGA based algorithm that sends trigger pulses, synchronized to Pulse Per Second (PPS) from Global Navigation Satellite System (GNSS) disciplined oscillator, to the sensors.
- Comparison of two crystal oscillators and a Chip Scale Atomic Clock (CSAC) as timekeeping methods by comparing time error through the FPGA based algorithm and oscilloscope measurements.
- Comparison of PPS, Precision Time Protocol (PTP) and Network Time Protocol (NTP) as synchronization methods by comparing offset from GNNS disciplined oscillator.

Results, important findings

Measured clock cycles through FPGA

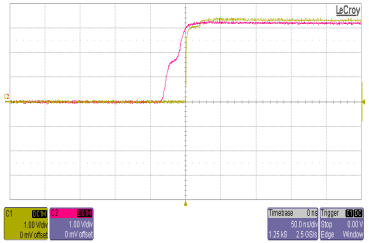


CSAC exhibits lowest drift



CSAC exhibits lowest offset when synchronized to incoming PPS

CSAC PPS OUT (yellow) to PPS IN (red) synchronization



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