Comments--

According to the author, this manuscript demonstrates bidirectional clock synchronization with time-correlated photon pairs. Between two different clocks, a precision of 51 ps in 100 s has been achieved with count rates of order 200 s^{-1}. The demonstrated protocol is claimed distance independent, secure against symmetric delay attacks and provides a natural complement to techniques based on Global Navigation Satellite Systems (GNSS). Furthermore, the protocol can be augmented to provide authentication of the timing signal via a Bell inequality check. The clock synchronization with time-correlated photon pairs can have many important applications and is of broad interest. Nonetheless, there are a few issues which must be addressed by the authors before the manuscript could be considered for publication.

In their manuscript, the authors presented that they used a simple point-to-point single mode optical connection based on bidirectional exchanging the SPDC photons, which seems that the quantum two-way time transfer is investigated for the first time in this paper. In fact, the two-way quantum clock synchronization protocol was proposed as early as 2017. A raw theoretical analysis was demonstrated on the conference of Quantum Information and Measurement 2017 (https://www.osapublishing.org/abstract.cfm?uri=QIM-2017-QF3A.4). A first experimental demonstration of the two-way quantum clock synchronization on a fiber coiling link of 20km with two clocks locked to a common frequency reference was presented on the conference of CLEO Pacific Rim 2018 (https://www.osapublishing.org/abstract.cfm?uri=CLEOPR-2018-Th4J.3). The most recent result based on the same setup can be found on arXiv (1812.10077), which achieves a time transfer time deviation of 922 fs at 5 s and 45 fs at 40960 s. I think these work should be cited and the authors may need limit their discussion to the condition of comparing two different clocks.

Based on the equation (8) in the manuscript and the value given afterwards, it's hard to say what the sigma refers to, the FWHM width or the natural width. If it's FWHM width, which seems coincident with the expression in Eq. (8), then the value should be 683 ps instead of 290 ps. Please check it carefully and make a correction. Using the characterized precision of δt and pair rate of 200 s^{-1}, the timing response parameter of 1.65 ns^{-1} cannot be extracted based on Eq. (9). Could the author please explain why it doesn't coincide?