Journal	Physical Sciences Forum (ISSN 2673-9984)
Manuscript ID	psf-2088638
Type	Proceeding Paper
Title	DEVELOPMENT OF A CLOCK GENERATION AND TIME DISTRIBUTION SYSTEM FOR HYPER-KAMIOKANDE
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Abstract   The construction of the next-generation water Cherenkov detector Hyper-Kamiokande (HK) has started. It will have an about ten times larger fiducial volume compared to the existing Super-Kamiokande detector and increased detection performances. The data taking is planned from 2027. Time stability is crucial, as detecting physics events relies on reconstructing Cherenkov rings based on the coincidence between the photomultipliers. The above requires a distributed clock jitter at each endpoint smaller than 100 ps. In addition, since this detector will be mainly used to detect neutrinos produced by the J-PARC accelerator in Tokai, each event needs to be timed-tagged with a precision better than 100 ns with respect to UTC in order to be associated with a proton spill from J-PARC, or events observed in other detectors for multi-messenger astronomy. The HK collaboration is in an R&D phase and several groups are working in parallel for the electronics system. This proceeding will present the studies performed at LPNHE (Paris) related to a novel design for the time synchronization system. We will discuss the clock generation, including the connection scheme between the GNSS receiver (Septentrio) and the atomic clock (free-running Rubidium), the precise calibration of atomic clock and algorithms to account for errors on satellites orbits, the redundancy of the system ; and a two-stage distribution system that sends the clock and various timing-sensitive information to each front-end electronics module, using a custom protocol.

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Comments and Suggestions for Authors

Minor suggestions:

-Subsection 1.2 title, would be better "Timing needs and requirements"

-Subsection 1.2 line 46, get rid of "to keep it simple"

-Subsection 2.1 line 69, rephrase "at more or less short term", maybe specify "short term"

-Subsection 2.3, line 95, "For this, it is needed to use the standard "Common view technique" of time transfer (software used is available here : [11])", it would be better "The use of.... is needed", get rid of the colon befor the ref [11]

- Subsection 3.1 line 109 Instead of "after many cross-checks" it would be better: "After the required cross-checks and calibrations"

-References: I think just the web links are ok without "Available online"

Submission Date	25 November 2022
Date of this review	16 Nov 2023 16:49:13