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A Design of Clock and Timing System Prototype for Hard X-ray FEL Facility

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Shanghai Hard X-ray Free Electron Laser Facility (SHINE) aims at producing the X-ray pulses in the photon energy range from 3 keV to 25 keV, which is under construction. To target the design purpose, SHINE requires high precise distribution of the clock and timing signals over distance of about 3.1 km. Based on the standard White Rabbit (WR) precision time protocol, this paper presents a prototype design of customized high precision clock and timing system. Meanwhile, special clock processing methods are proposed for the requirements of different devices in SHINE, including dividing frequency, adjusting phase delay and duty cycle, and adding MASK information. Test results indicate that the skew jitter of distributed clock over the frequency range from about 1Hz to 1MHz is less than 20 picoseconds RMS and the range of phase delay adjustment can be up to 1 second with a step size of about 400 picoseconds.

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