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Upgrade of the RF Reference System at J-PARC LINAC

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In J-PARC, the accelerator systems are controlled using the master clock of 12 MHz made in Computer/Network Equipment Room (CER) of the central control building. The low-level radio frequency (LLRF) system of LINAC is based on the reference signal of 312 MHz synchronized with the 12 MHz clock. The reference signal was made by a module, which is called "RF&CLK board", in the upstream part of Klystron Gallery and then the reference signal is distributed to each RF control station. However, this "RF&CLK board"became the significant source of the instability in phase. Therefore a new RF reference signal oscillator was installed at J-PARC LINAC for improvement of the phase stability. This module has the 80 MHz Oven Controlled Xtal Oscillator (OCEO) and the Phase Looked Loop (PLL) under temperature control by Peltier module. The phase noise of the output signal in this module was measured by the signal source analyzer. The jitter of the output signal, which was estimated from the integration of phase noise from 10 Hz to 1 MHz, becomes about 240 fsec and was one order smaller than that of the old system (about 1700 fsec). However, the original performance of this module is expected to be better. It's thought to be due to the 12 MHz input signal in this module. Therefore, the path of the 12 MHz master clock was optimized except for unnecessary modules. In addition, necessary modules, the O/E and E/O modules, were selected for the less phase noise in some kind of modules with the same features. Then, the jitter of the output signal in the RF reference signal oscillator improved to be about 41 fsec, which is less than one fifth that before the optimization. This value satisfies the required phase stability (+/-0.3 deg.) for the distribution system of the LLRF reference signals. For the installation of the new RF reference signal oscillator and the optimization of the distribution system, the accelerating RF power with more stable can be provided. It can be expected to improve the operating ratio in J-PARC LINAC and to suppress the activation in each device can be expected.
I will introduce the new RF reference oscillator and talk about the performance of this system.

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