Virtual Hard X-Ray Collaboration Seminar Series

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Title: High-powered and short-pulsed pulser newly developed by using wide-band RF amplifiers

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Abstract:

A method of frequency-segmented power amplification using multiband radio frequency (RF) amplifiers was proposed to generate stable high-voltage pulses for an electron beam chopper system of the SACLA injector. The concept behind this method is that an arbitrary pulse with a specified duration and sharp edges can be reconstructed using only several frequencies, and most of the power is concentrated on the fundamental frequency. The high-voltage pulse can, therefore, be obtained by amplifying each segmented frequency and then combining it with the RF power combiners. To correct the frequency-dependent group delays and gain of the amplifier circuit and to perform fine-tuning of the pulse structure, a seed pulse is divided into several lines that have bandpass filters, variable delay lines, variable power attenuators, and main RF amplifiers. A prototype pulser was designed and fabricated based on this method and then stable rectangular pulses with a 2 ns width of 0.2 kV height, peak-to-peak flat top of 0.8%, and route-mean-squared peak jitter of less than 0.2% were successively generated in both single- and multi-bunch structures. Now, the prototype is being power-upgraded and a new chopper chamber optimized for the pulser is in production to be applied to the SACLA injector. In the future, this type of pulser will play an important role in accelerators that require complicated and precise beam handling at high repetition rates of kHz or MHz.