

# PULSE RIDER

## Application Note

Pulse Rider PG-1000 Series

Pulse Generator for Big Physics Applications



## Laser Driver

In big physics experiments photomultipliers are fundamental since they allow to convert photons in electric charge that can be received by the acquisition system allowing the detecting photons. The emission of phonons can be correlated to a specific phenomenon studied by physicians like the Cherenkov effect.

During the photomultipliers design and production stages, it is necessary to characterize and calibrate them using a laser beam or a LED diode. The light source must be driven by an enable signal with a fixed width and repetition.

Using Active Technologies Pulse Rider PG-1000 Series pulse generators it is possible to generate a pulse with different width, period and amplitude.

It is very fast and easy setting a single pulse put the instrument waiting for external trigger-in or generate pulses in continuous way.

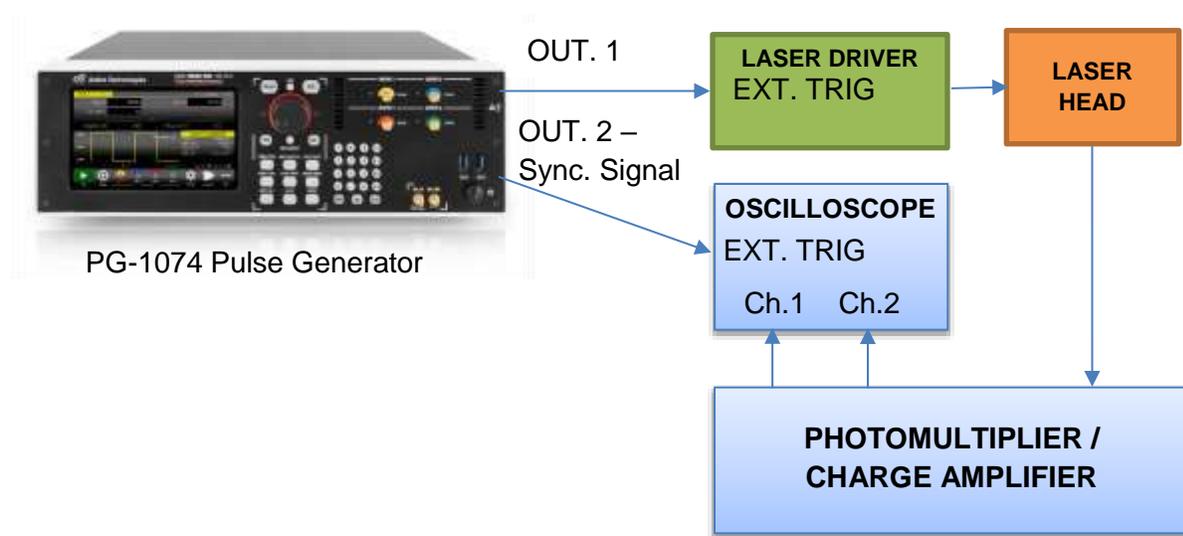
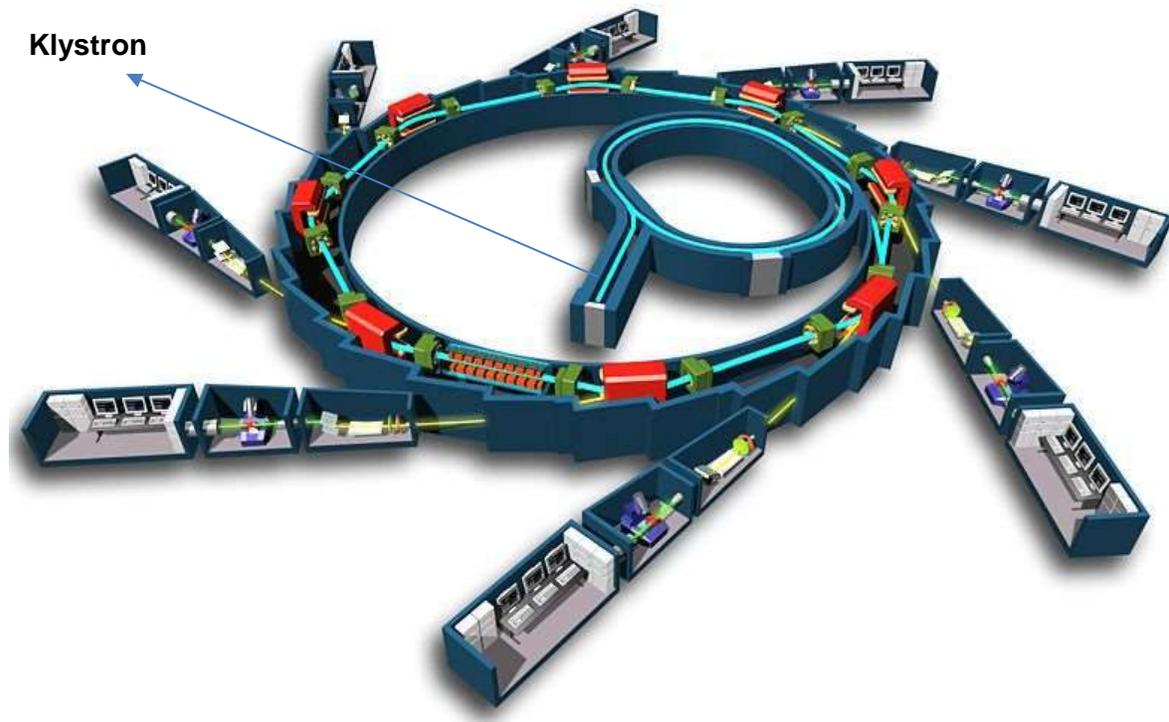


Figure 1: Principle scheme of set-up for the photomultiplier / charge amplifier test and characterization.

## ***Klystron Control and Synchronization***

A klystron is a specialized linear-beam vacuum tube that can be used in multiple applications, as example in the colliders used for big physics experiments, it has the purpose to generate the particles that will collide.



Like for the laser applications, it is necessary to generate an enable signal to drive the klystron.

That signal can be generated by a complex system based on logical port or on FPGA, but the design and developing of this system could take long time, moreover if it is necessary to change the timing, the user has to change the schematic or the FPGA code.

The Pulse Rider PG-1000 Series pulse generators offer an off-the-shelf solution to control and modify the klystron enable signal parameters in an easy way using the graphical interface and the touch screen display.



Figure 2:: Simple Rider UI, generation of two narrow pulses (5 ns) with 7.5 ns of Delay(s) one from the other.

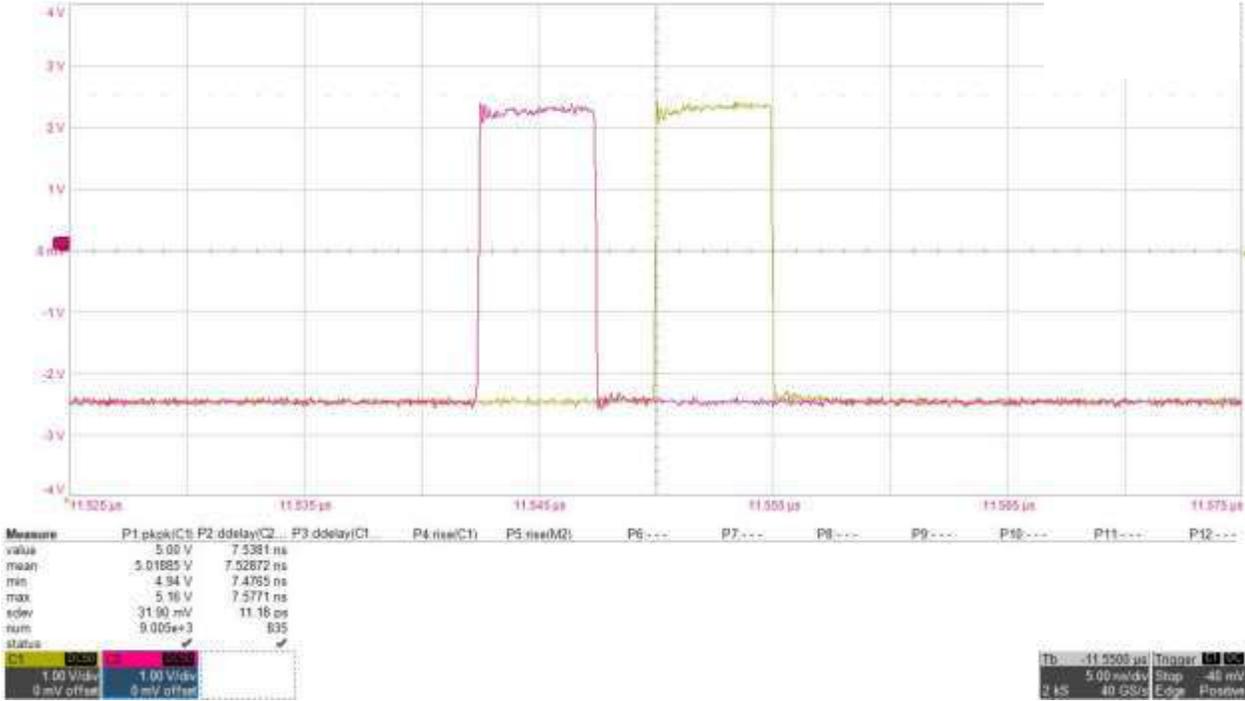


Figure 3: Oscilloscope screen capture, generation of two narrow pulses (5 ns) with 7.5 ns of Delay(s) one from the other.

Another interesting application in klystrons driving is the possibility of synchronize multiple units; the PG-1000 Series pulse generators have up to 4 independent synchronized channels that can be used to supply synchronization signals with a specific delay from the trigger signal.

This feature allows to synchronize multiple klystrons taking count and compensating the delay between the different driving chains.

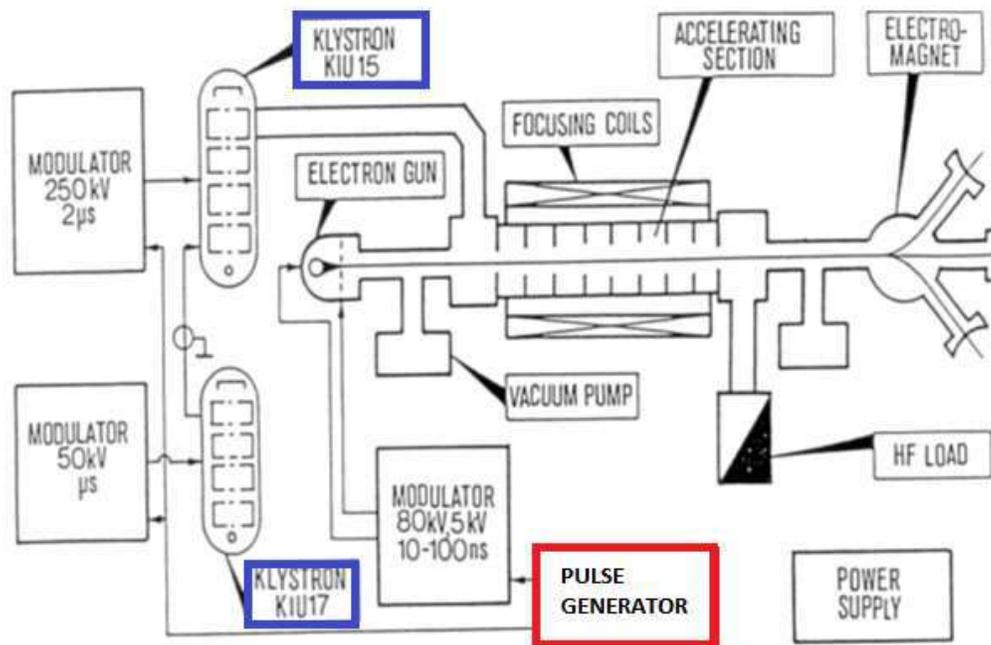


Figure 2 Example of complex system, where a Pulse Generator PG-1000 can synchronize two klystrons

### **Read Out System Testing**

In big physics experiment despite the main role is played by the detectors that allow observing physical phenomenal, a very efficient read out electronic acquisition chain is equally important because it permits to collect and store many real time data.

The read out chain is based on a hierarchic tree structure where the lowest level is near the detectors and it converts the digital pulses using a communication protocol to deliver information to the next level.

Usually the lowest level is composed by an FPGA system that collects the digital pulses of multiple detectors and creates a data packet to deliver to the next level using an optical link. During the development of this system, the engineers usually don't have detectors or the

entire colliders in their laboratory, so it is necessary to find a way to simulate pulses generated by the detectors.

Using the Active Technologies Pulse Rider PG-1000 Series pulse generators it is possible to test the response of the FPGA system making sure on the timings and synchronization; as example you can inspect what will happen if the channels would have some skew and test the receiving of multiple pulses or glitches.

The Active Technologies Pulse Rider PG-1000 Series pulse generators offer up to 4 channels, each channel deliver single, double, triple or quadruple pulses each pulse independent with its period, width and delay respect to the trigger-in signal.



4 Output Channels can be used simultaneously to simulate the Detector Pulses

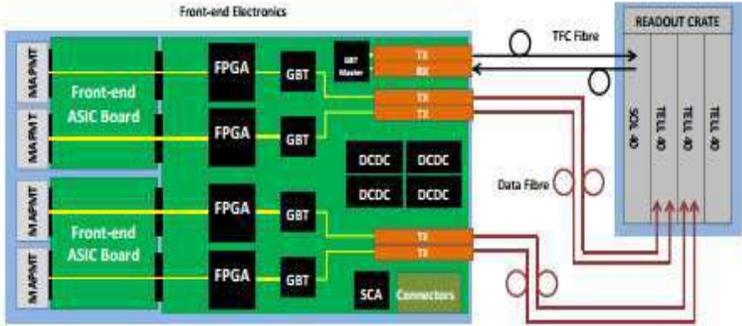


Figure 3: Principle scheme of read out chain: the Pulse Generator PG-1000 substitute the the photomultiplier and the charge amplifier during the preliminary test.

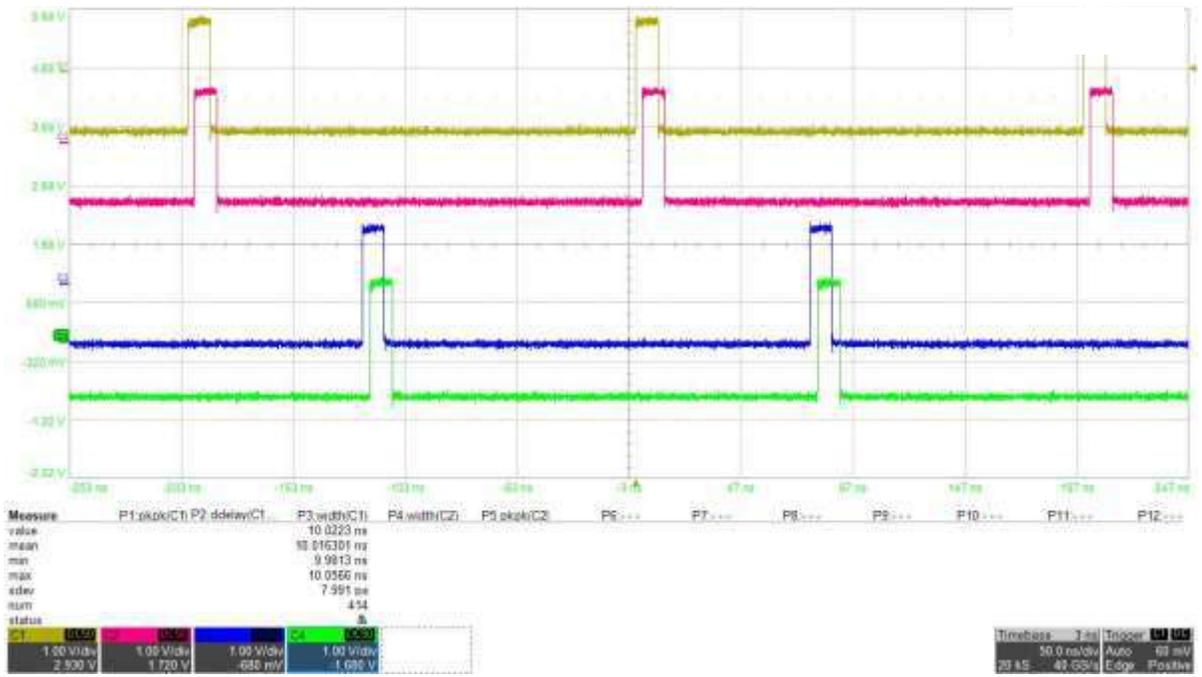


Figura 4: PG-1074 model: four channel synchronized with delay between 100ps and 1 ns

### **About Active Technologies**

Active Technologies is an Italian company expert in semiconductor test equipment and electronic instrumentation design.

# **PULSE RIDER**

The Pulse Rider Series offers premium signal integrity with the easiest to use touch screen display interface (SimpleRider™).

The Generation of pulses requires only a few screen touches.

Its innovative hardware architecture provides the possibility to generate multiple pulse sequences, such as double, triple or quad pulses, with fully independent timing parameters.



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