Wide-pulse LED pulser potentially for use in HRPPD evaluation

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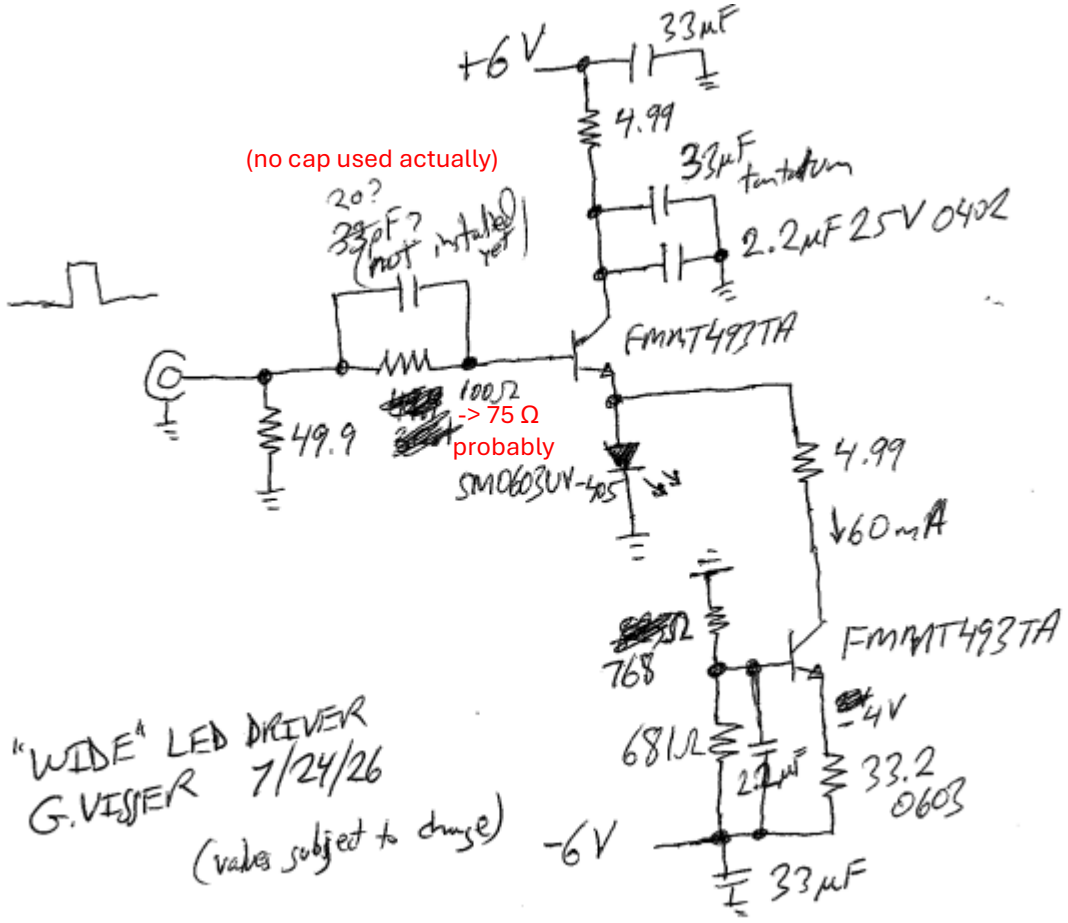
To study single photon time resolution of HRPPD (or other photodetectors) in the presence of a wide pulse of other photons, a suitable LED pulser is needed to mimic this “background” signal while fast laser pulse is used for the signal to measure.

This requires a different sort of driver circuit for the LED, compared to the usual problem of driving the LED to as narrow as possible a pulse width.

Simply driving an LED from a 50 Ω source is possible, but rise/fall times will probably be rather slow. We can speed that up with a voltage buffer of low output impedance. (~1 Ω expected relatively easy to achieve.)

Implementation

Input pulse w/ high & low level and potentially adaptive pulse shape, from waveform generator 50 Ω.



FMMT493 was a reasonable transistor for this that I had in my stash. Possibly there are some that will perform better. Good enough for now. SPICE says ~1 Ω output impedance (not measured yet).

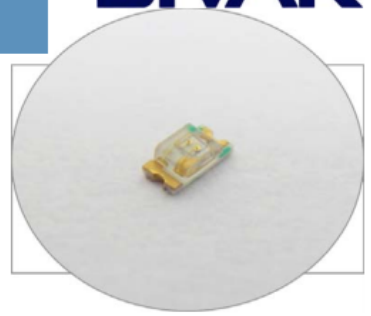
Same LED as used in FEMC monitoring pulser

SURFACE MOUNT LED
ULTRAVIOLET, 0603 PACKAGE

BIVAR

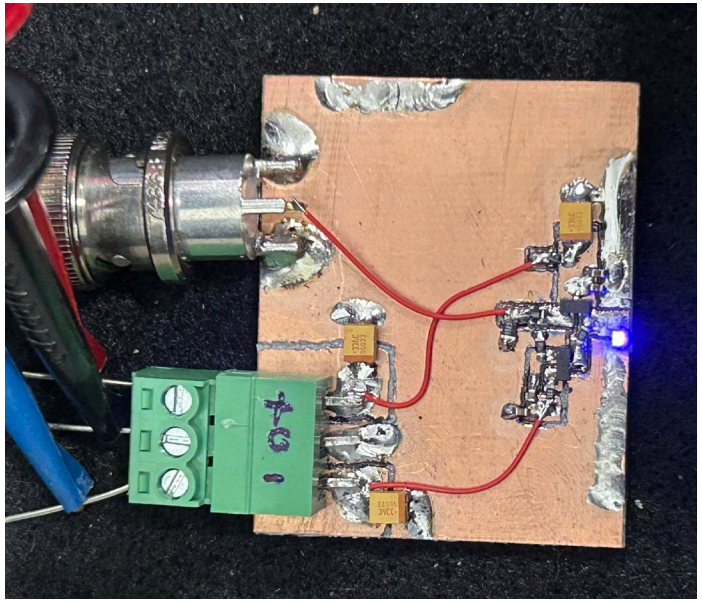
SM0603UV-405

- Industry Standard 0603 Package
- RoHS Compliant
- UV Emitting LED
- Water Clear Lens
- Wide Viewing Angle
- Ideal for Curing, Detection, and Medical Applications

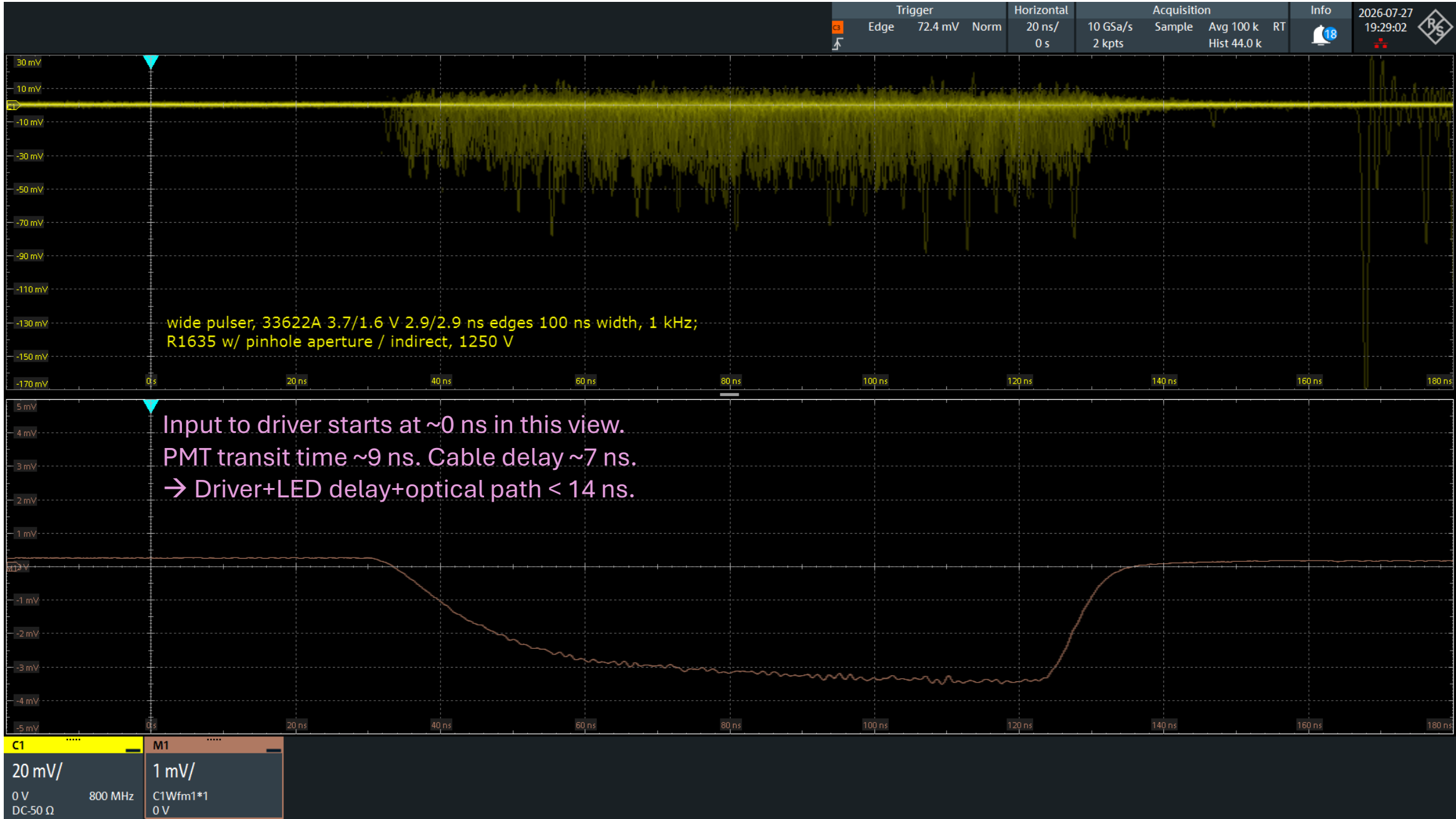


Bivar's Surface Mount 0603 UV package LED is offered in a standard 0603 foot print and is ideal for any UV applications. The miniature package provides long life and reliability making it ideal for industrial curing, hazard detection, medical applications such as instrument sterilization, fluorescent counterfeit watermark detection, and forensic applications. The water clear LED lens provides for maximum radiant power output and wide viewing angles. Bivar SM0603 UV LED is packaged in standard tape and reels for pick and place assemblies.

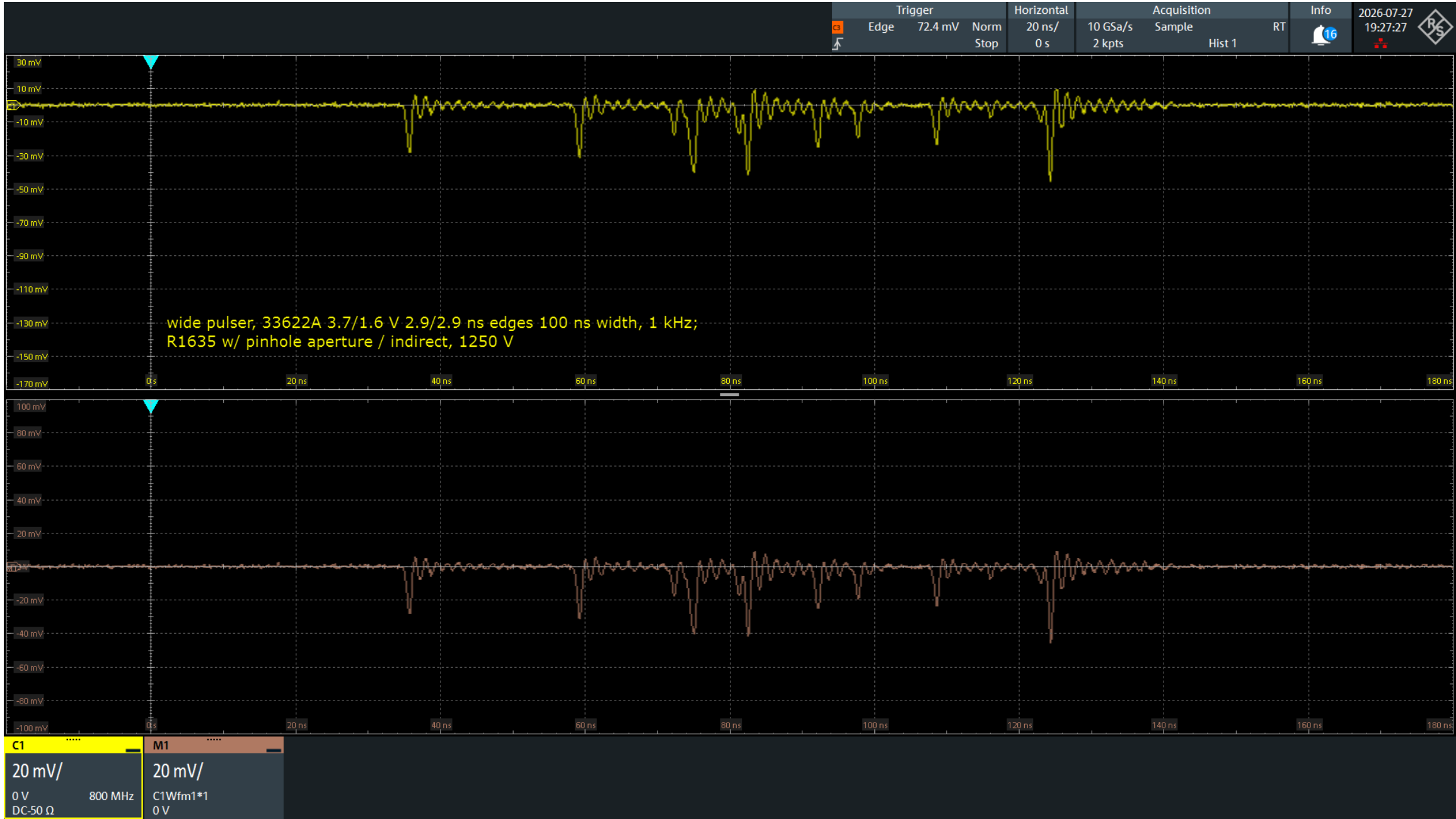
Part Number	Material	Emitted Color	Peak Wavelength λp(nm)	Lens Appearance	Radiant Power (mW)	Viewing Angle
SM0603UV-405	InGaN/SiC	ULTRA VIOLET	405 ~ 410	Water Clear	5 ~ 10	130°



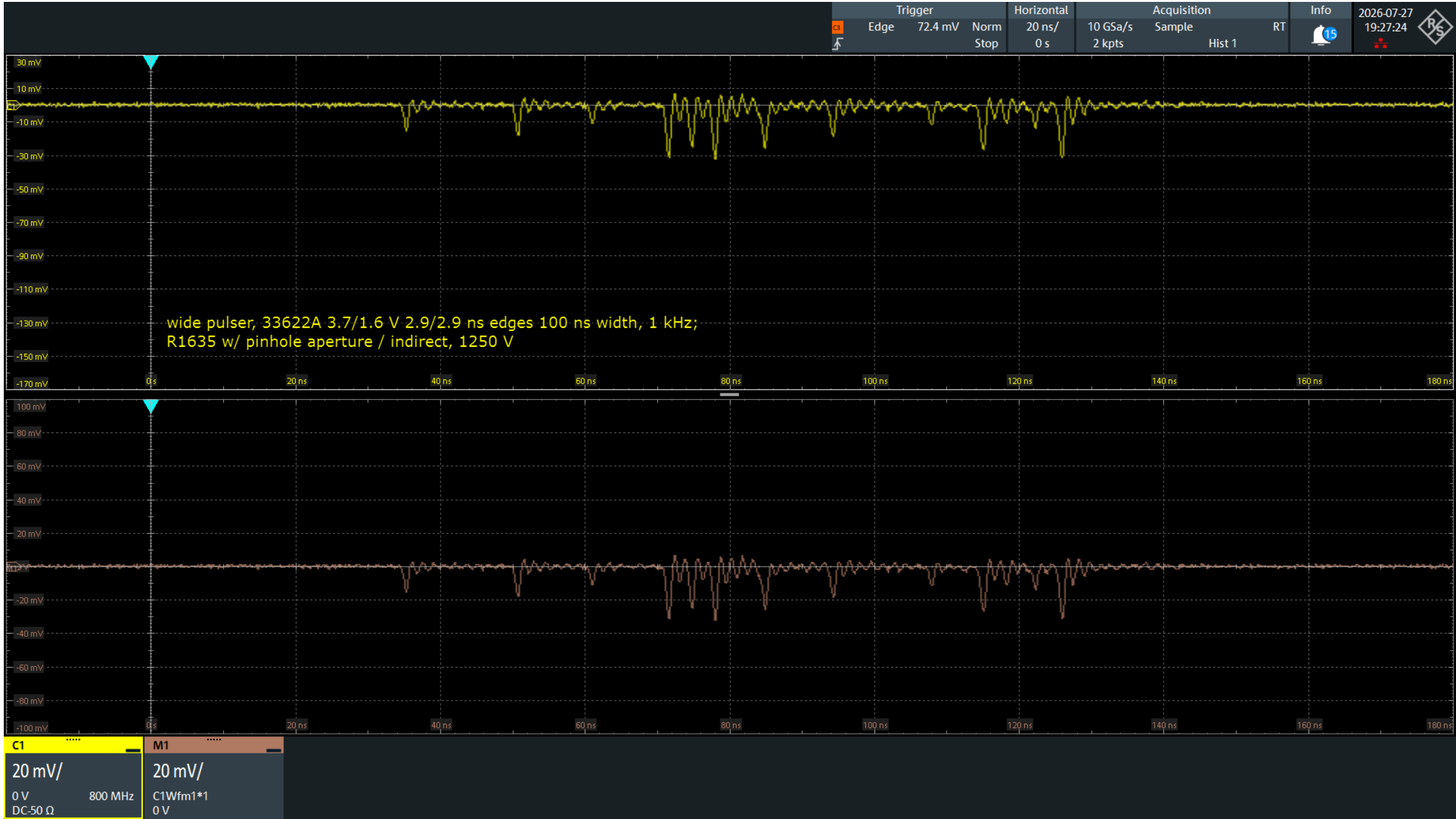
Average of many events, viewed by fast PMT with small aperture / indirect path (i.e. lots of optical attenuation).
M1 trace is average response (100000 events). See a few single events in following slides.



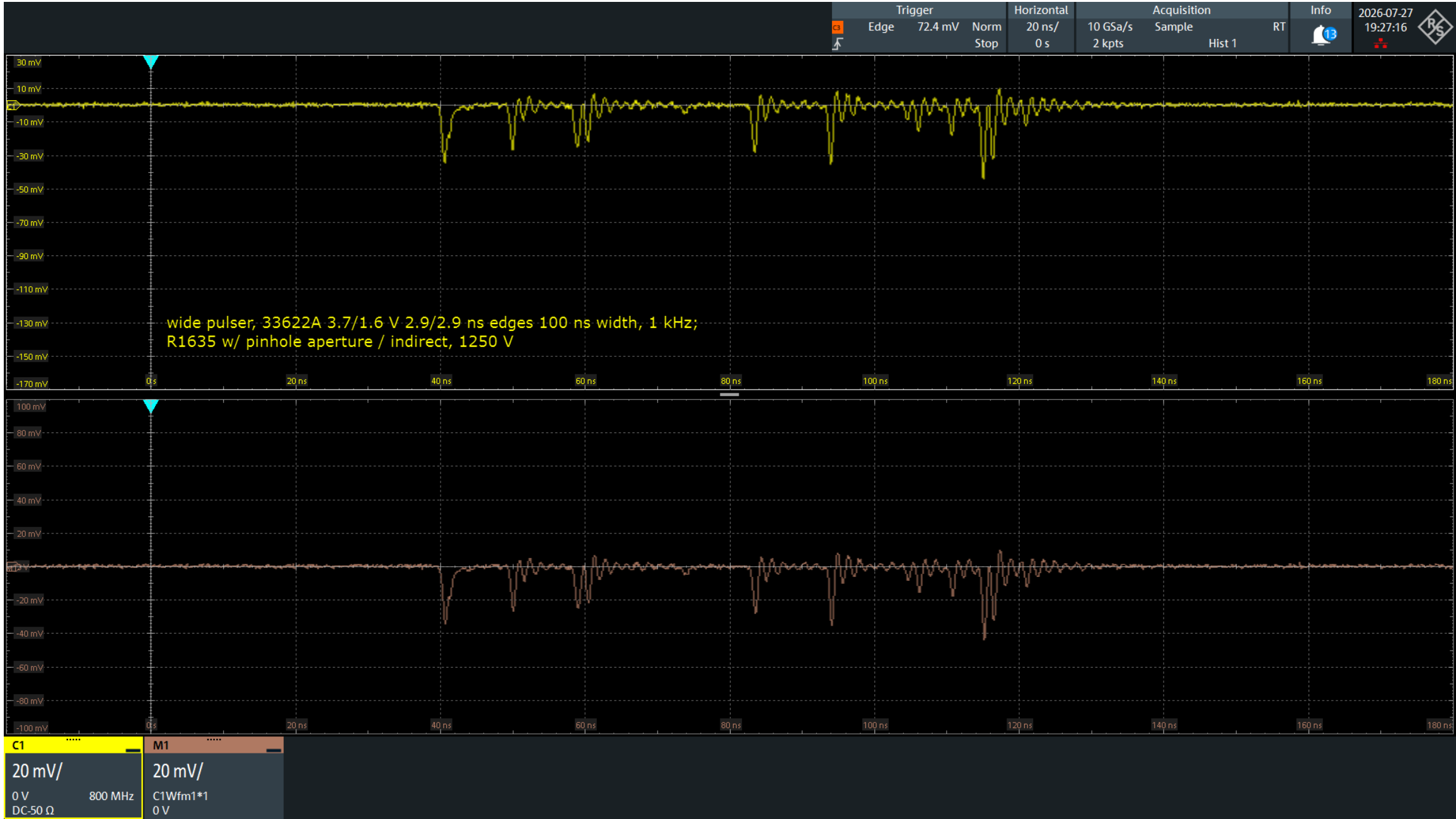
One event


Trigger
Edge 72.4 mV Norm
Stop
Horizontal
20 ns/
0 s
Acquisition
10 GSa/s Sample RT
2 kpts Hist 1
Info
16
2026-07-27
19:27:27
wide pulser, 33622A 3.7/1.6 V 2.9/2.9 ns edges 100 ns width, 1 kHz;
R1635 w/ pinhole aperture / indirect, 1250 V
C1
20 mV/
0 V 800 MHz
DC-50 Ω
M1
20 mV/
C1Wfm1*1
0 V

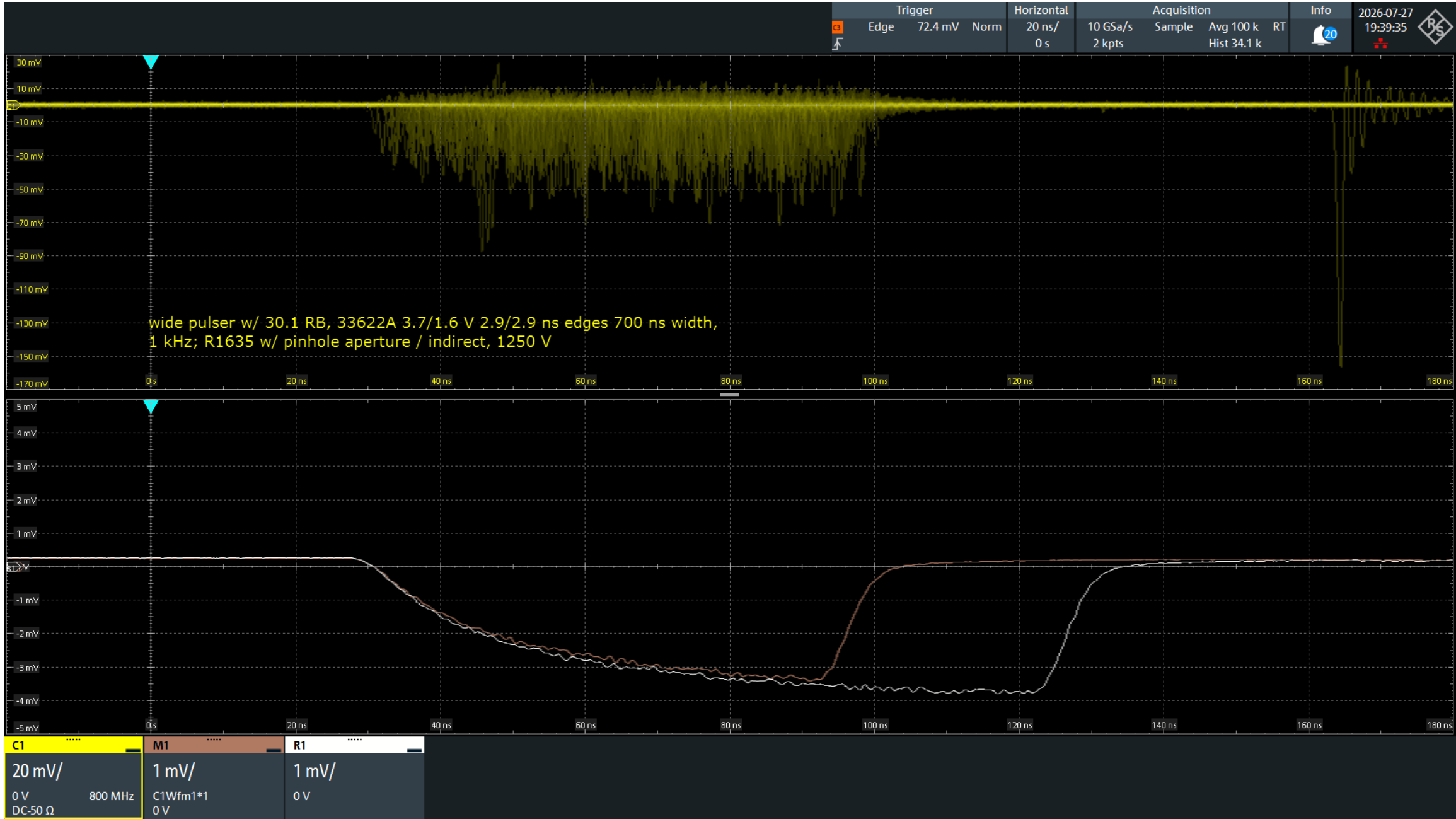
One event


Trigger
Edge 72.4 mV Norm
Stop
Horizontal
20 ns/
0 s
Acquisition
10 GSa/s Sample RT
2 kpts Hist 1
Info
2026-07-27
19:27:24
wide pulser, 33622A 3.7/1.6 V 2.9/2.9 ns edges 100 ns width, 1 kHz;
R1635 w/ pinhole aperture / indirect, 1250 V
C1
20 mV/
0 V 800 MHz
DC-50 Ω
M1
20 mV/
C1Wfm1*1
0 V

One event


Trigger
Edge 72.4 mV Norm
Stop
Horizontal
20 ns/
0 s
Acquisition
10 GSa/s Sample RT
2 kpts Hist 1
Info
2026-07-27
19:27:16
wide pulser, 33622A 3.7/1.6 V 2.9/2.9 ns edges 100 ns width, 1 kHz;
R1635 w/ pinhole aperture / indirect, 1250 V
C1
20 mV/
0 V 800 MHz
DC-50 Ω
M1
20 mV/
C1Wfm1*1
0 V

70 ns vs. 100 ns pulse width – as you'd expect



50 ns pulse width – wider view showing also rare but typically large signal PMT afterpulsing, looks as expected I think. The afterpulsing evidently does not contaminate our view of real signal.