Tektronix

2601B-PULSE Example TSP Script

DigitizeCompletePulse.tsp

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Script Description

- This example script creates (and subsequently calls) a function that can be used with the Model 2601B-PULSE current pulser to output and digitize a single current pulse.
- With a few modifications, the basic approach shown in this example can be applied to the 2601B-PULSE SMU.
  - The integrating analog-to-digital converters must be used because the SMU does not have high-speed digitizers.
  - The pulser Pulse Width and Measure Delay attributes do not apply to the SMU. Instead Trigger Timers or SMU Source and Measure Delays must be used.

Note: Refer to the 2601B-PULSE Reference Manual for additional information about instrument operation and programming, including the Trigger Model.

Function Description

digitize_pulse(current_level, pulse_width, meas_aperture, rangev, rangei, source_protectv, sense_protectv, bias_current)

Pass Parameters:

- current_level : Peak current level of pulse in amps
- pulse_width : Width of current pulses in seconds
- meas_aperture : Effective integration time in seconds
- rangev : Voltage measure range in volts
- rangei : Current source and measure range in amps
- source_protectv : Voltage protection level at source terminals
- sense_protect : Voltage protection level at sense terminals
- bias_current : Idle current level in amps (base level for pulses)

Function Description - continued

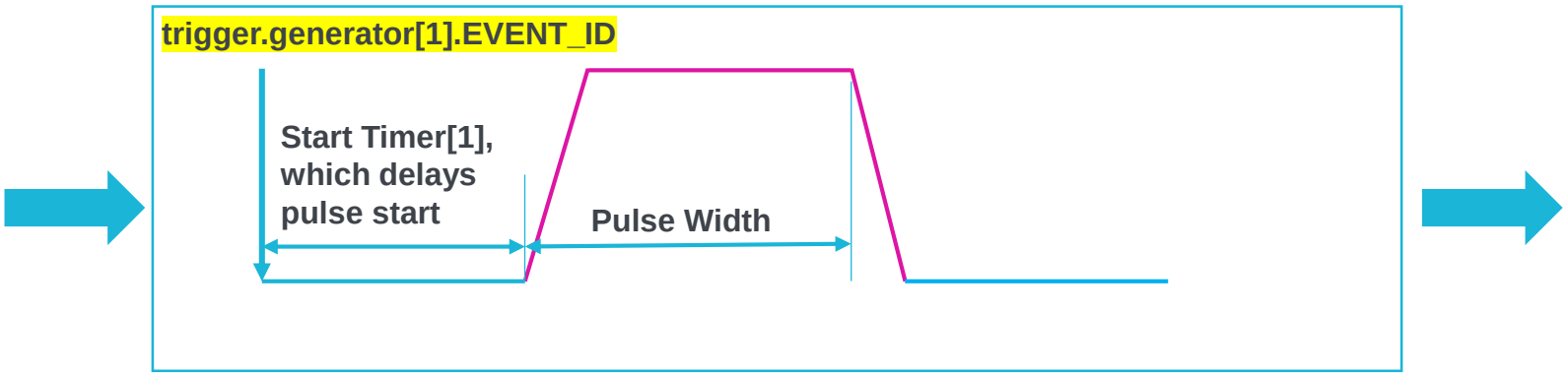
- The pulse is generated using the instrument's Asynchronous Trigger Model.
- The Pulse Width is determined by a new pulser command, which provide more precise timing than a Trigger Timer. Needed to support pulses as short as 10µs.
  - smua.trigger.source.pulsewidth
- Using the dual 1MS/s digitizers built into the current pulser, the voltage and current are sampled simultaneously across the entire pulse.
  - Digitizers run at 1MS/s. Sample taken every 1µs.
  - Setting measure aperture (smua.pulser.measure.aperture) greater than 1µs causes multiple samples to be averaged and returned as a single reading.
  - Thus, the aperture setting defines an effective sample interval. If the aperture is set to 5µs, then a reading is taken every 5µs.
  - Therefore the effective sample rate (i.e. reading rate) is 1/measure aperture.

Function Description - continued

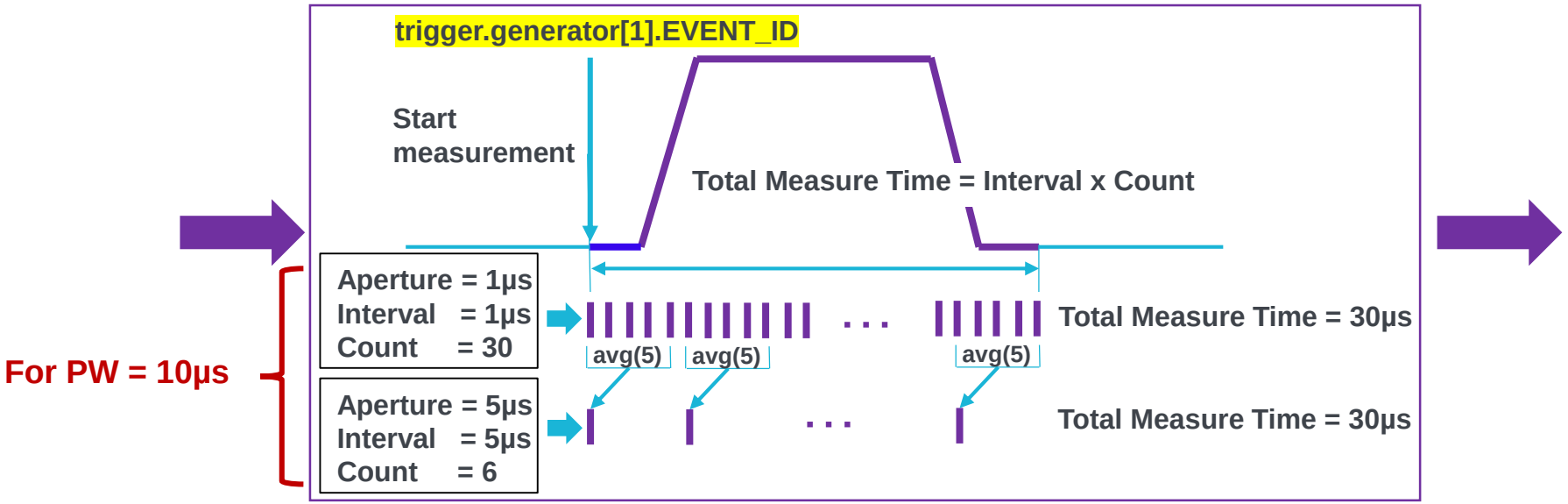
- The sampling nominally starts 10us before the start of the pulse and stops 10us after the end of the pulse.
- The pre-pulse acquisition interval is controlled using a standard Trigger Timer.
- The total acquisition time is the product of the measure count and the effective sample interval.
- See the next slide for a timing diagram.

Trigger Timing Scheme Used With Async Trig Model

Source Flow

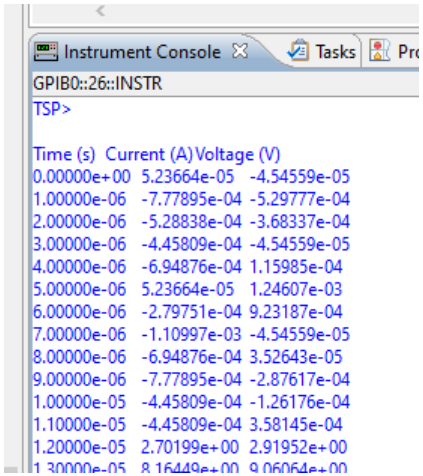


Measure Flow



Function Description - continued

- Upon completion of the sweep, the data is printed to the Test Script Builder Instrument Console in a format that is suitable for copying and pasting into Microsoft Excel for graphing and analysis.
- Results are for: digitize_pulse(10, 50e-6, 1e-6, 10, 10, 40, 20, 0)



Time (s)	Current (A)	Voltage (V)
0.00000E+00	5.23664E-05	-4.54559E-05
1.00000E-06	-7.77895E-04	-5.29777E-04
2.00000E-06	-5.28838E-04	-3.68337E-04
3.00000E-06	-4.45809E-04	-4.54559E-05
4.00000E-06	-6.94876E-04	1.15985E-04
5.00000E-06	5.23664E-05	1.24607E-03
6.00000E-06	-2.79751E-04	9.23187E-04
7.00000E-06	-1.10997E-03	-4.54559E-05
8.00000E-06	-6.94876E-04	3.52643E-05
9.00000E-06	-7.77895E-04	-2.87617E-04
1.00000E-05	-4.45809E-04	-1.26176E-04
1.10000E-05	-4.45809E-04	3.58145E-04
1.20000E-05	2.70199E+00	2.91952E+00
1.30000E-05	8.16449E+00	9.06064E+00