FastAmp with APD carrier Measurements
Oct 2018 at Penn
Laser and Fe55 sources
Output to Input pickup & resonance eliminated

10/11/2018

Manny Morales & Mitch

Pickup Mitigation

Output Cabling - (primary mitigation)

- Differential output cables high speed coax soldered to fastamp board.
- Both routed together inside of a braided wire shield connected to the box but not the fastamp board.

APD hookup - (potential improvement in robustness of noise rejection)

- Examined sensitivity to input protection diodes - none observed
- Examined balanced inputs with a capacitor on input B to carrier board reference plane (gnd) 5pF cap to input B likely helpful in GHZ level rejecting pickup. Not proven.

→ Result can operate FAST AMP and carrier board with APD connected with or without shield cover on box. Previously not possible with cover on box.

Tests with APD biased

Manny has operated FastAmp several times over the past two weeks with the bias as high as 1750V.

Trials on Tuesday evening. Bias turned on to ~ 1Kv before pulses related to HV were observed on scope at FastAmp output. ~ 200mV

Bias increased slowly (several minutes) to 1.4KV when higher rate… several Hz pulses were observed then output settled.

Manny increased from there ~ 50V per 15-20min from 1450 to 1750V when measurements began.

Pulser (biased quiescent at .5V and then “on” at 1.4V for 380ps)

…probably too low “on” voltage for reliable shot to shot uniformity.

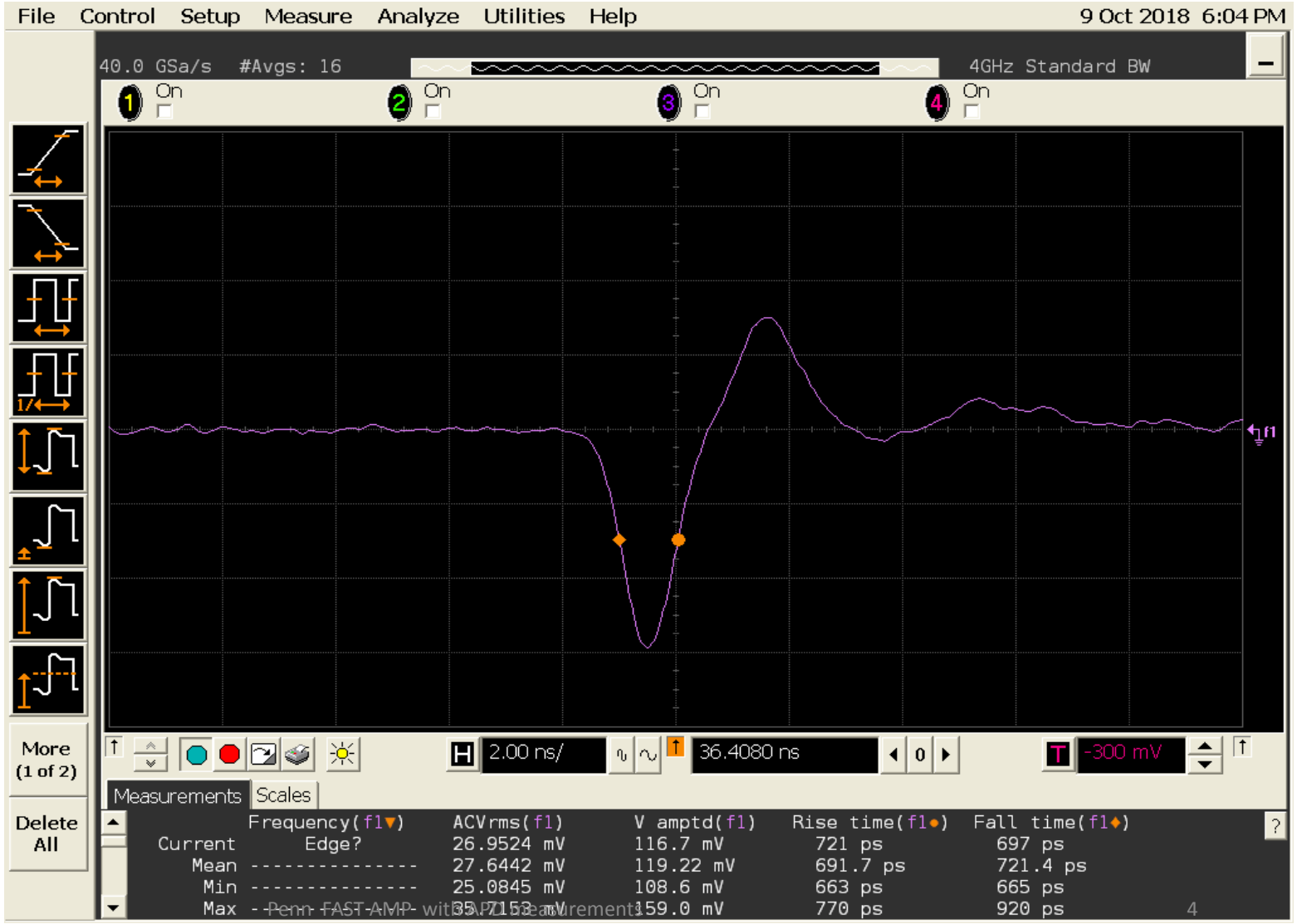
Tests at 1750 with Laser & Fe55

Tests at 1780 to increase gain for Fe55 observations

Laser pulses
16 Average
APD @ 1750V

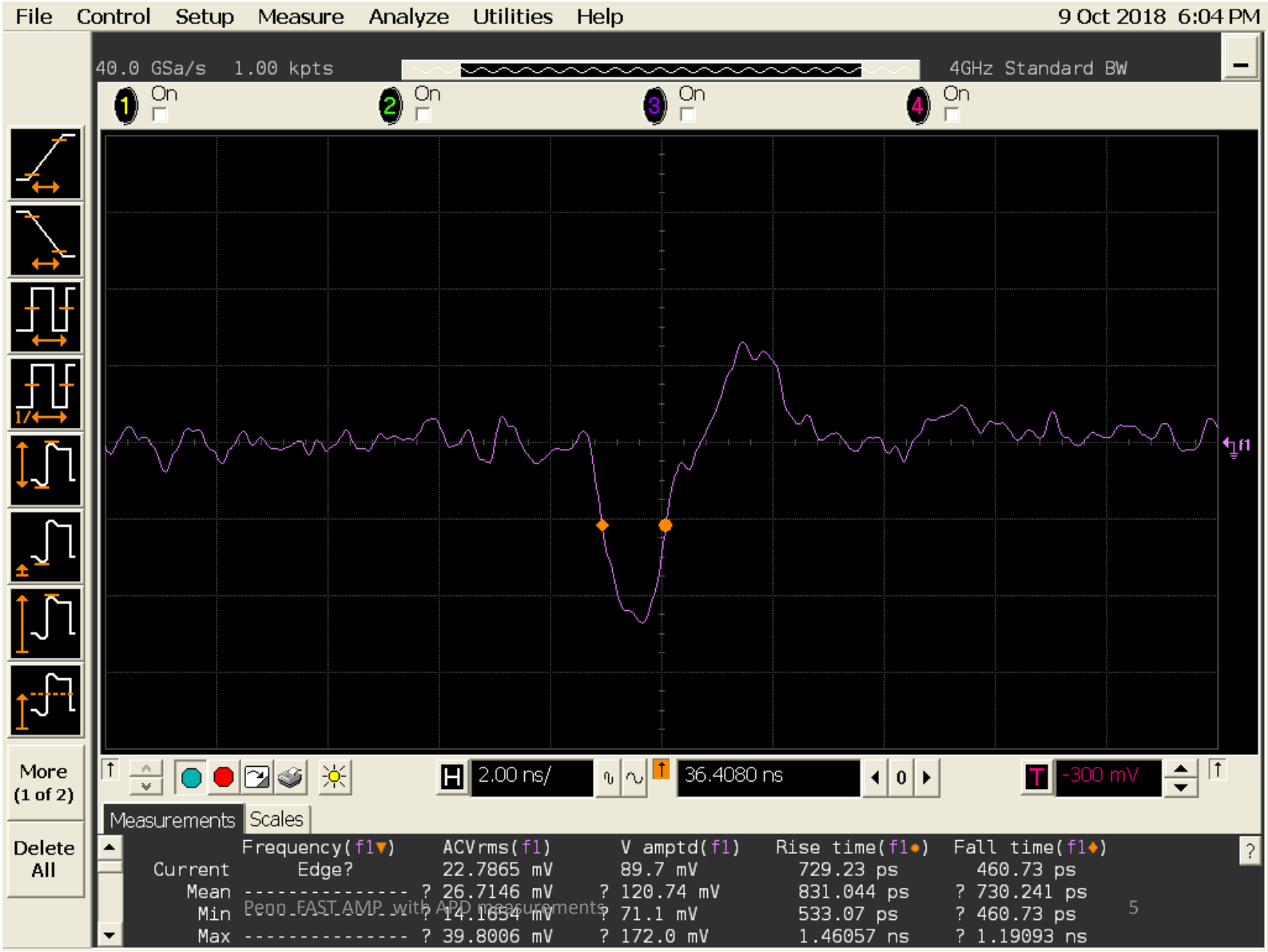
700ps leading Edge

27mV Amplitude



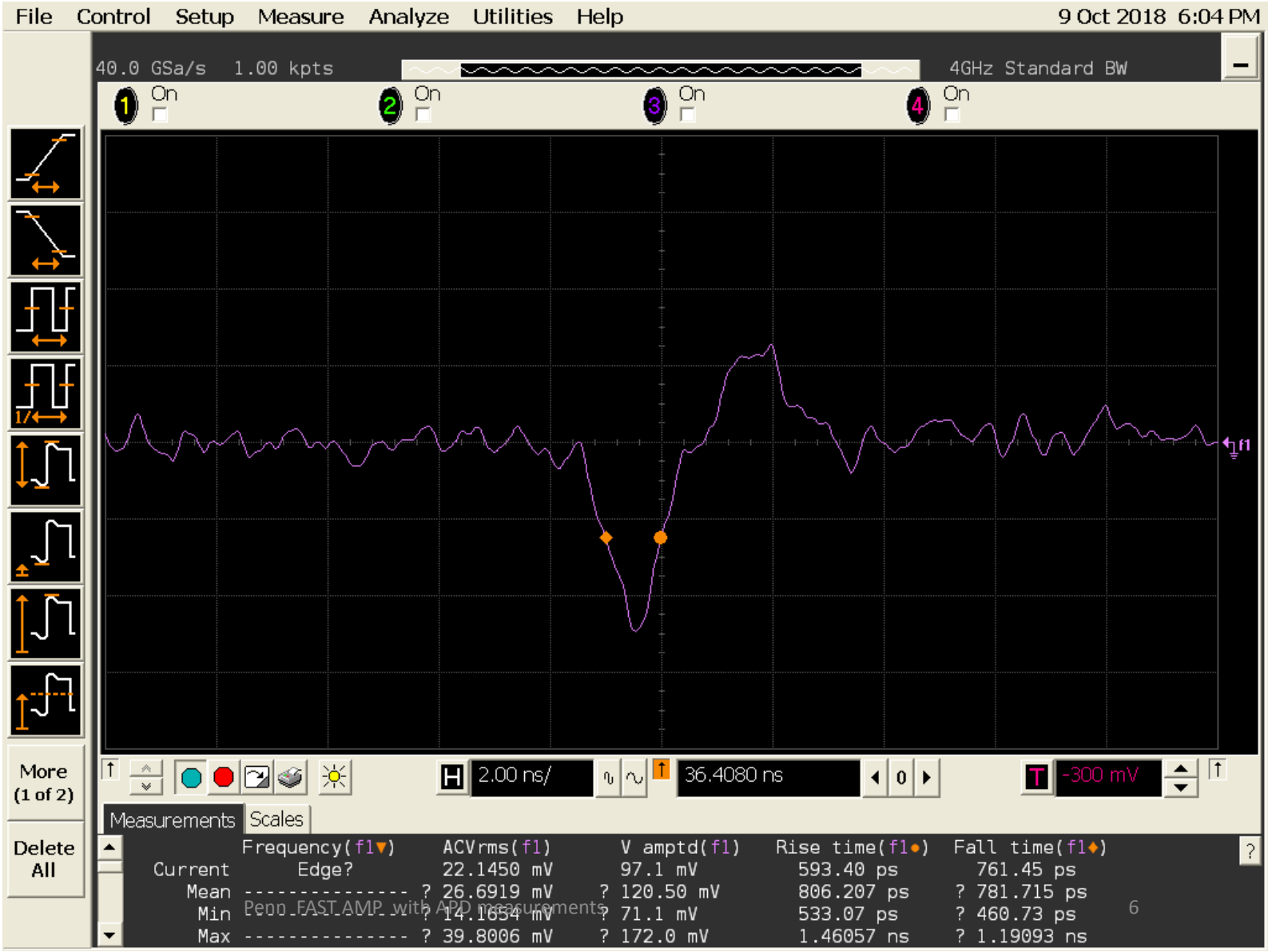
Laser pulses
Single Shot
APD @ 1750V

460ps leading Edge



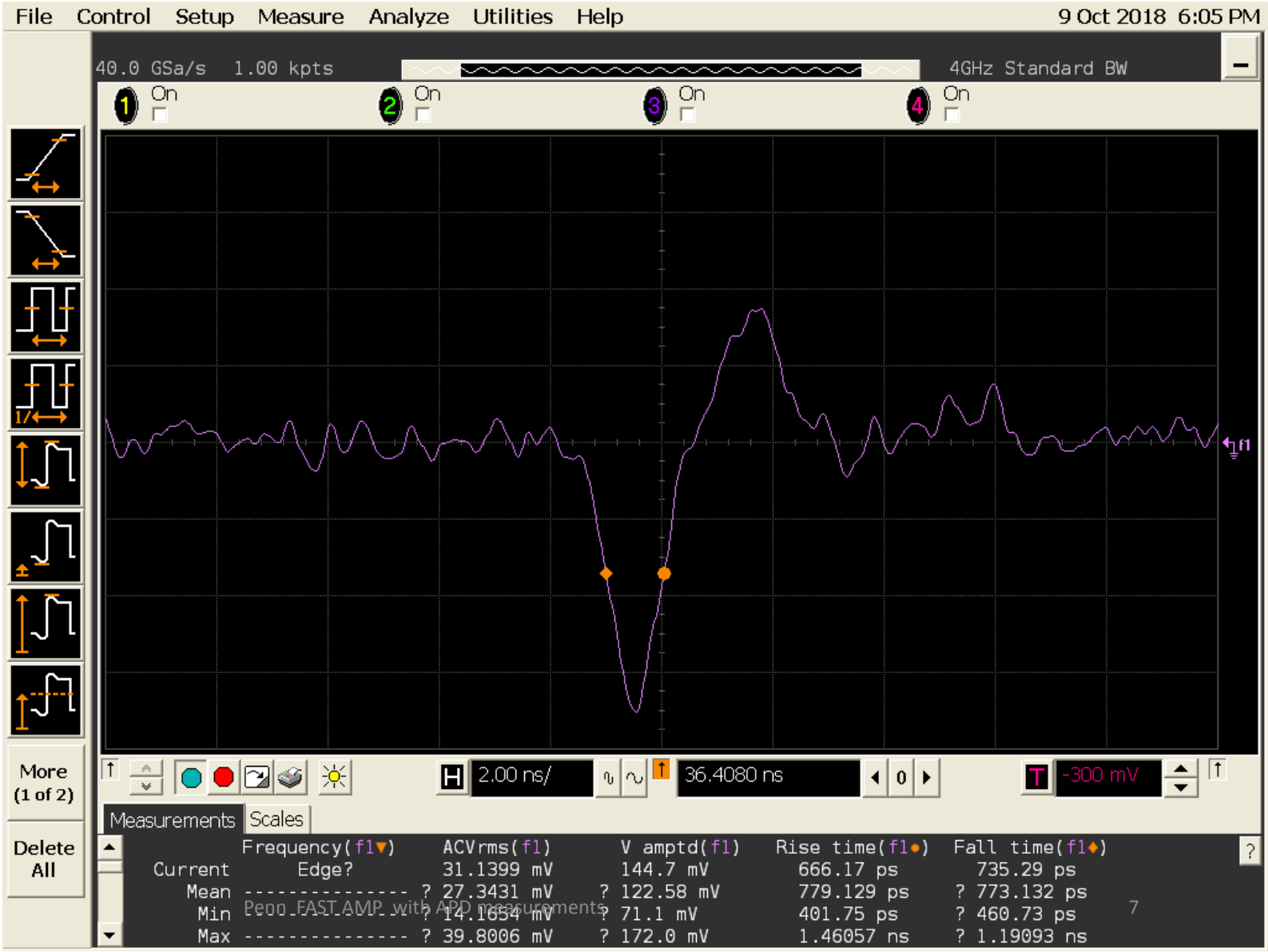
Laser pulses Single Shot APD @ 1750V

760ps leading Edge



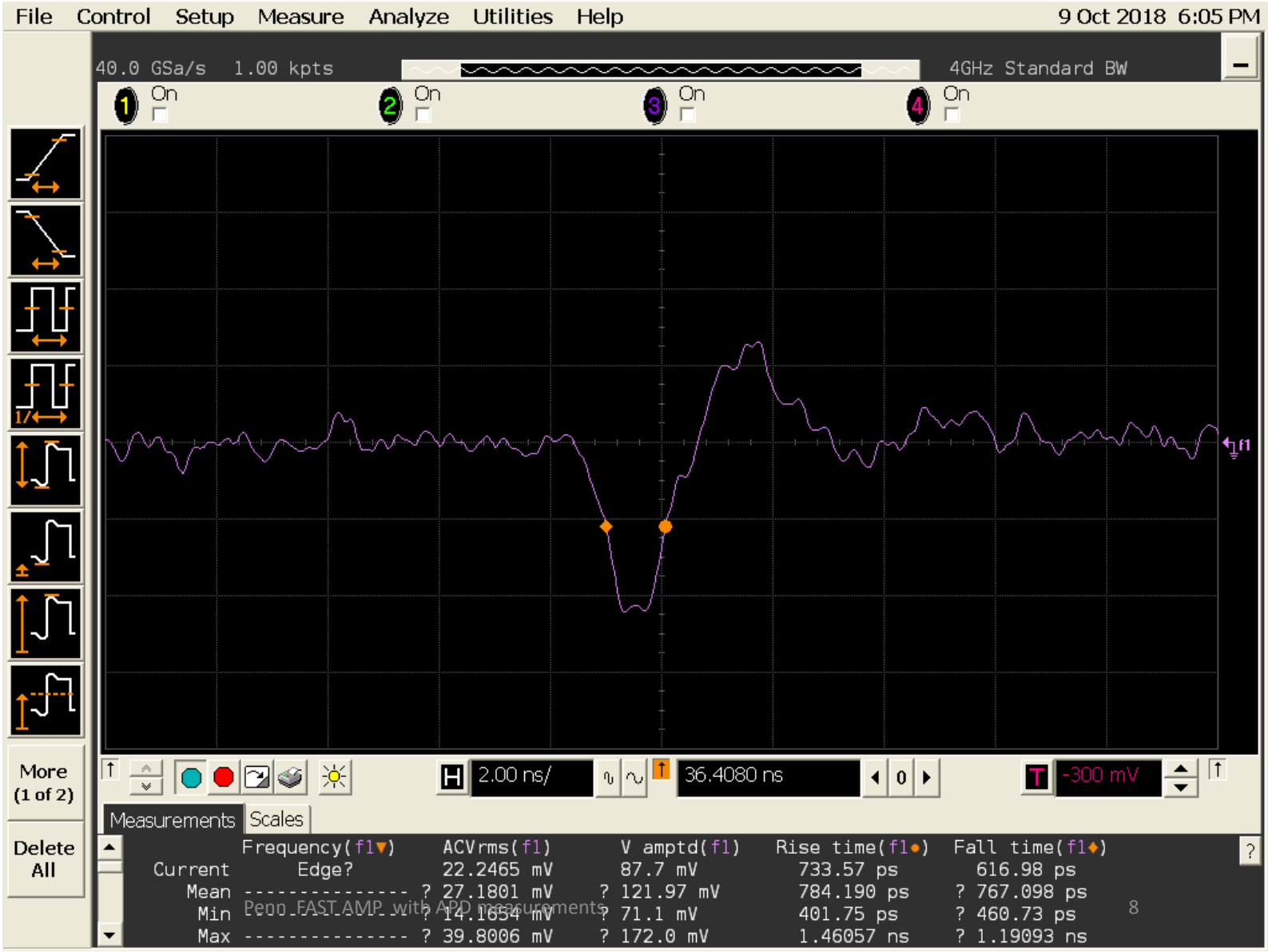
Laser pulses
Single Shot
APD @ 1750V

735ps leading Edge



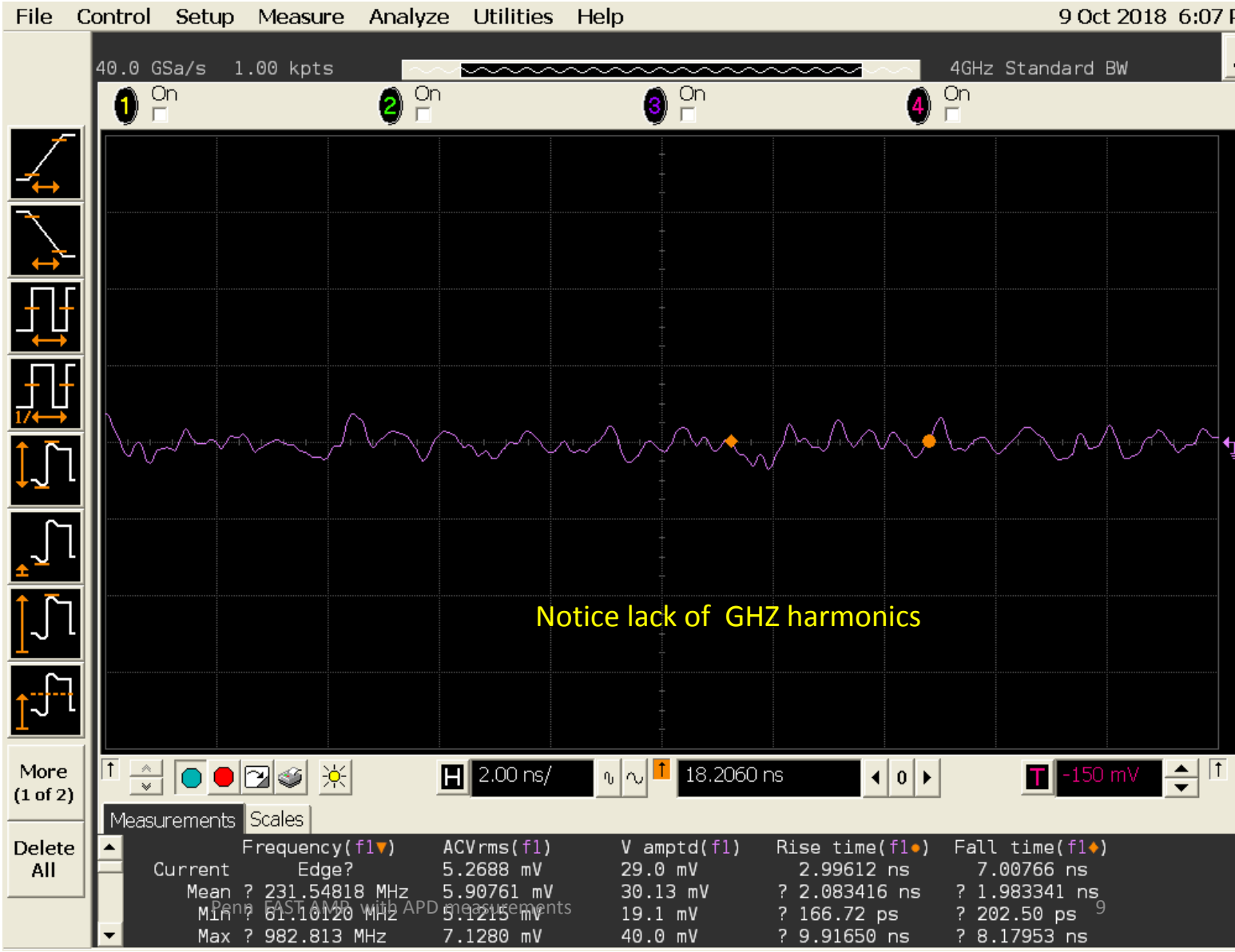
Laser pulses
Single Shot
APD @ 1750V

616ps leading Edge

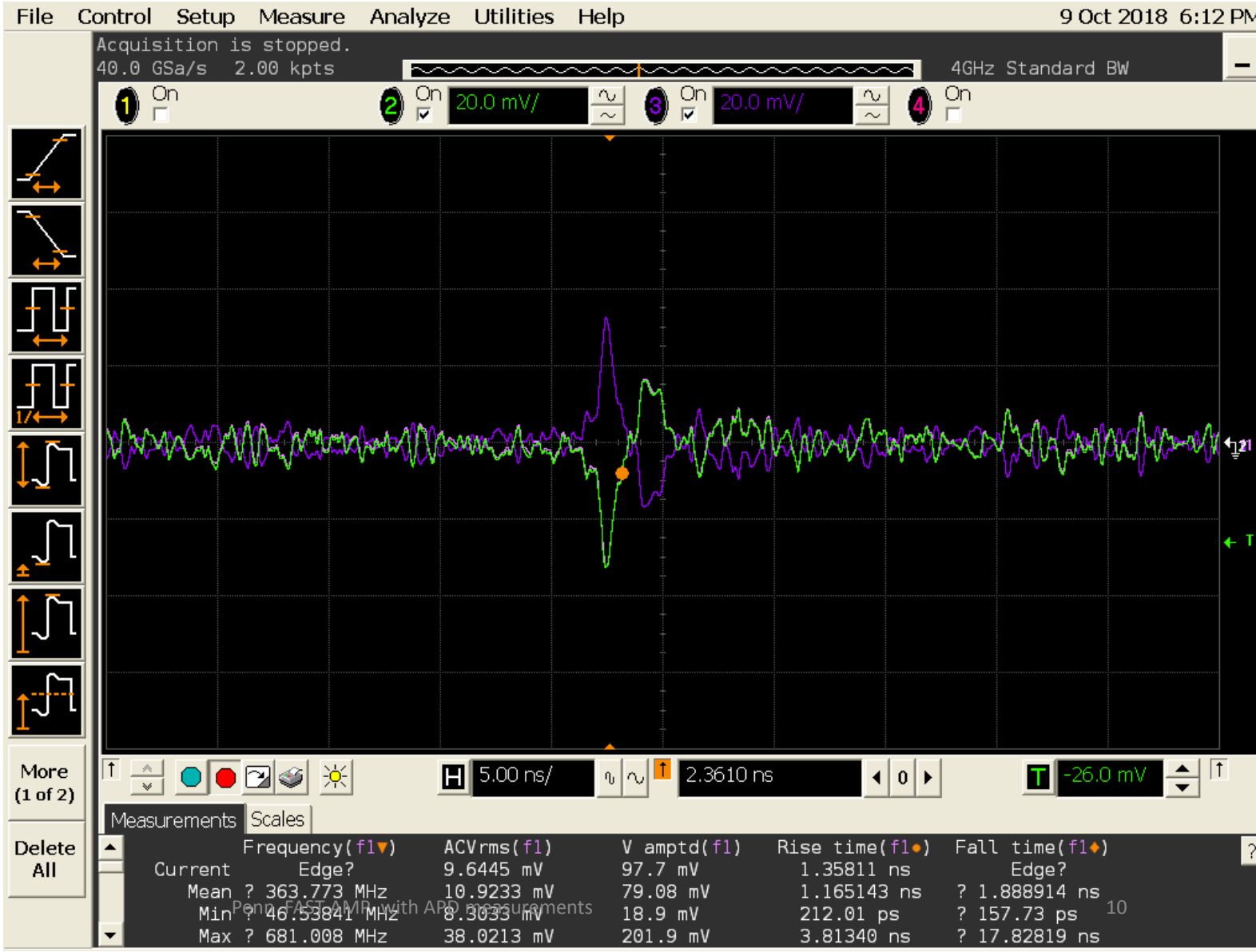


Laser pulsed Single Shot Noise APD @ 1750V

5.3mV

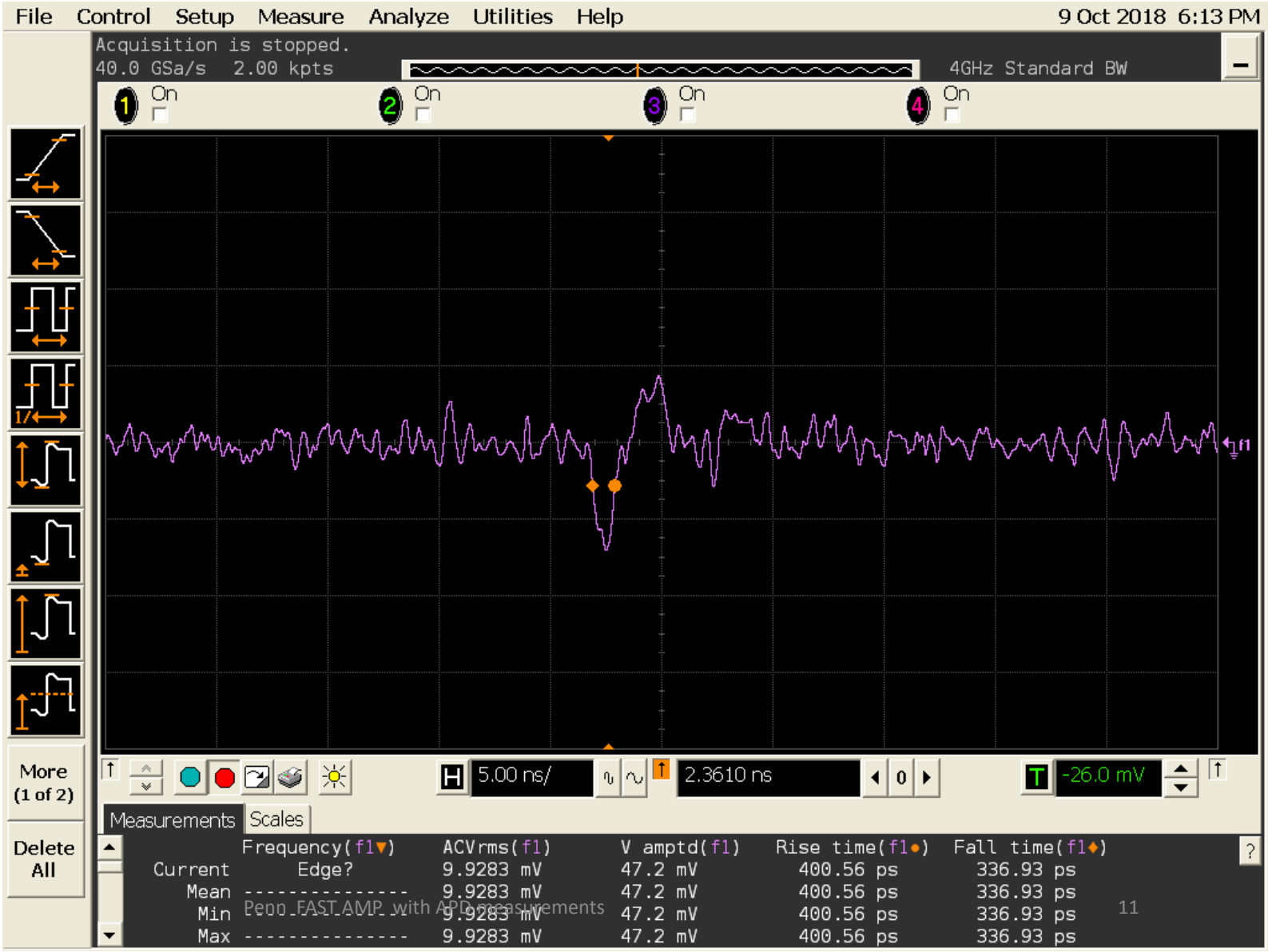


Fe55 pulses
Single Shot
APD @ 1750V



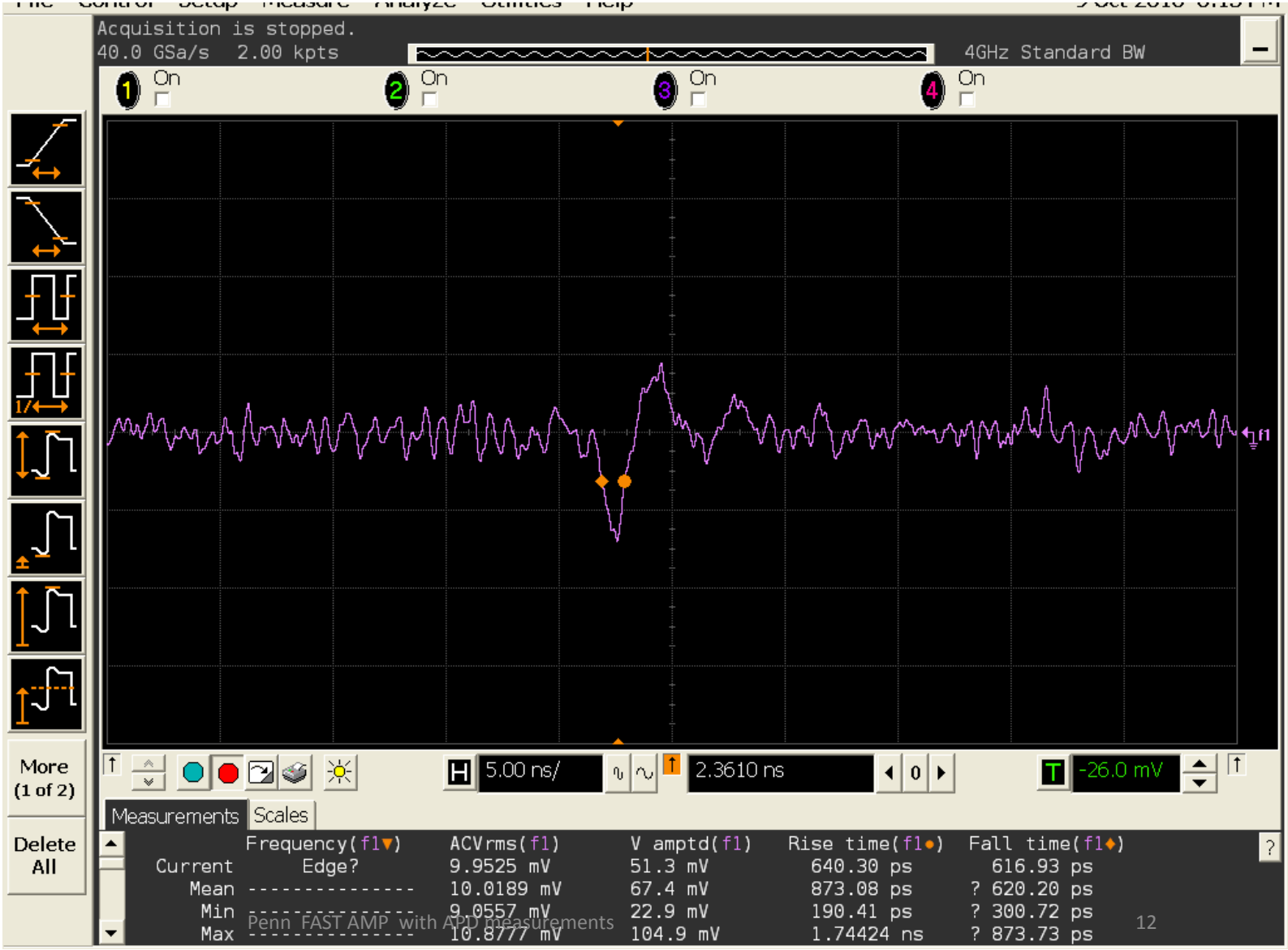
Fe55 pulses Single Shot APD @ 1750V

340ps leading Edge



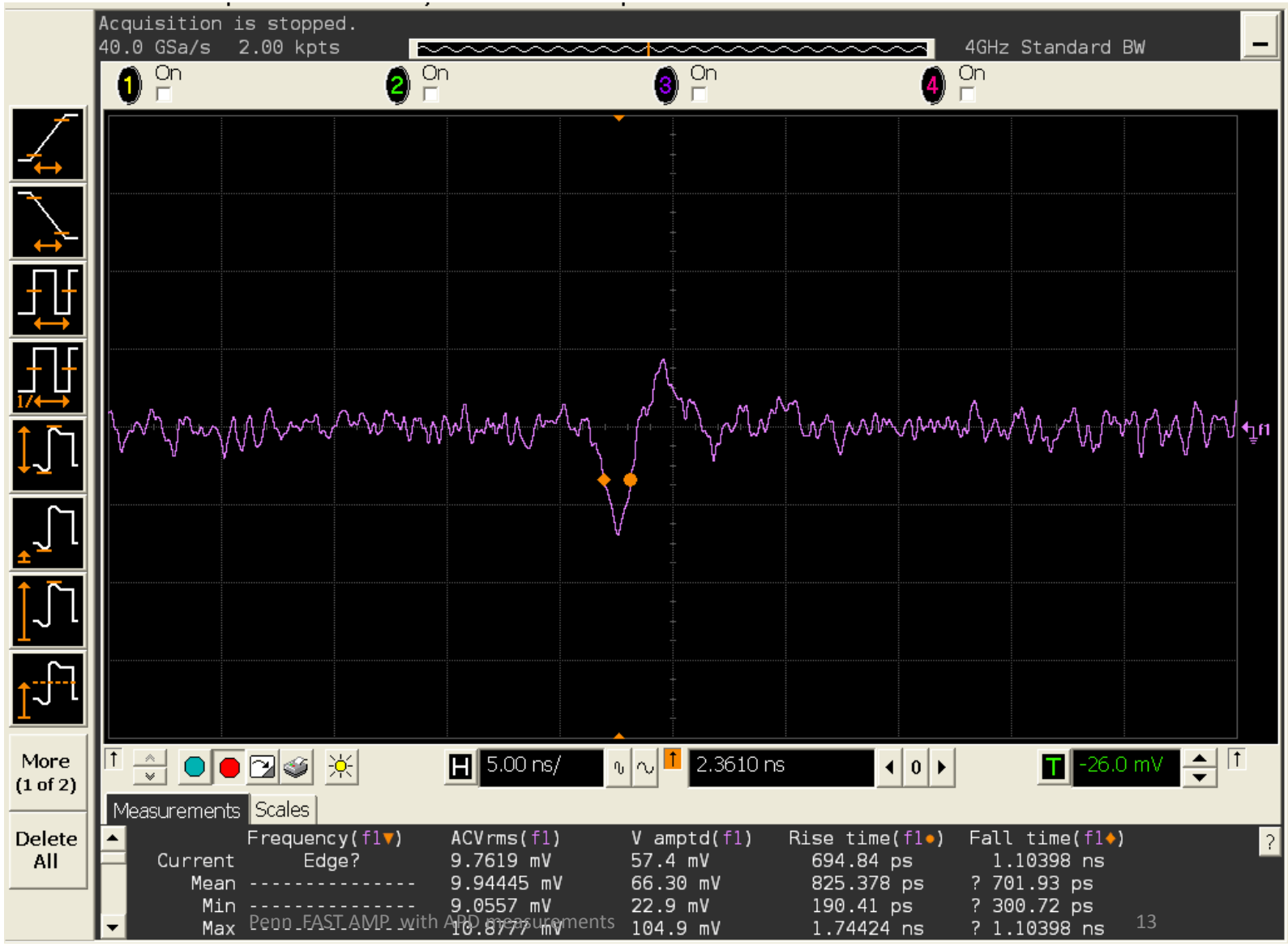
Fe55 pulses Single Shot APD @ 1750V

616ps leading Edge



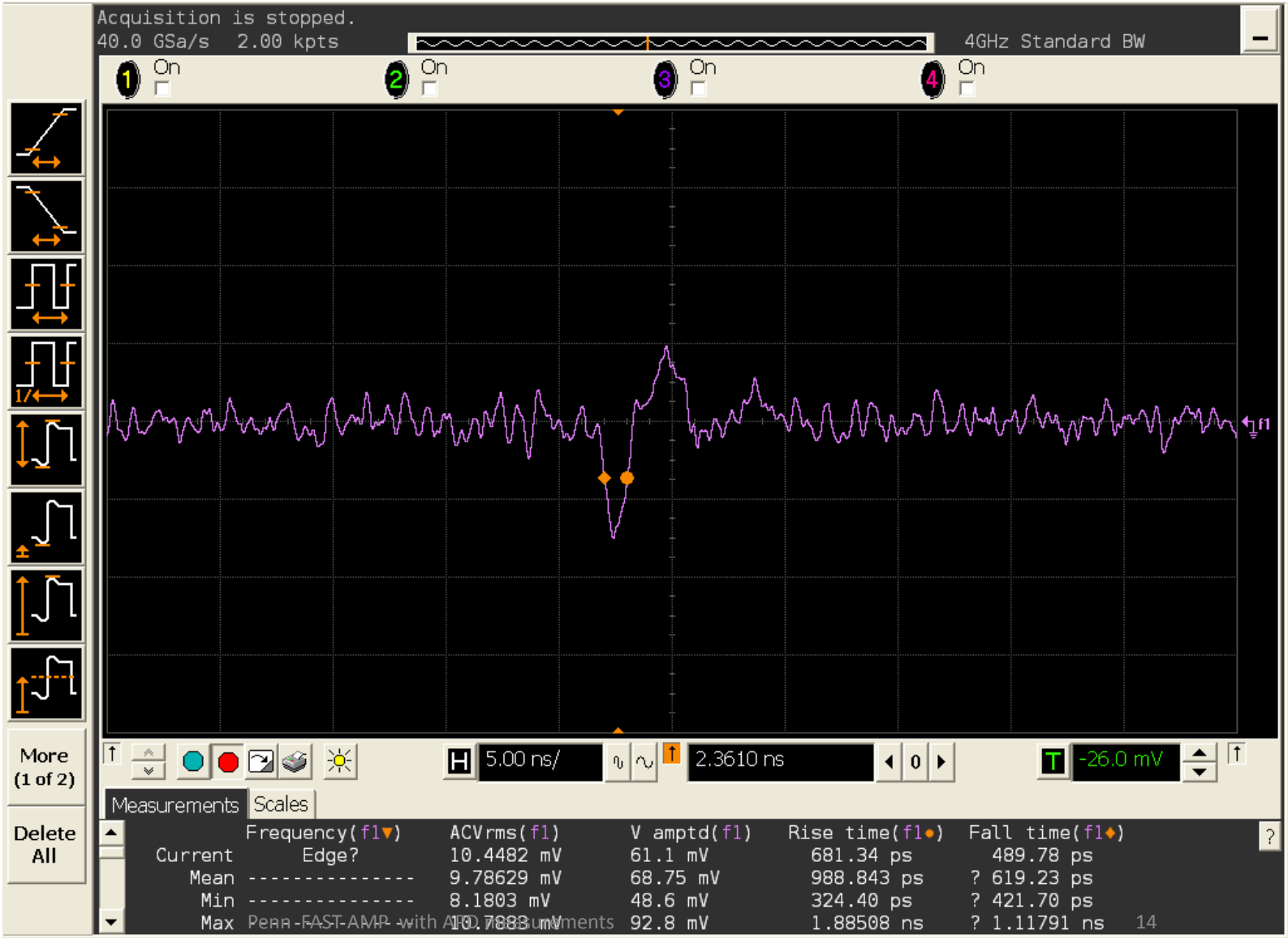
Fe55 pulses Single Shot APD @ 1750V

1100ps leading Edge



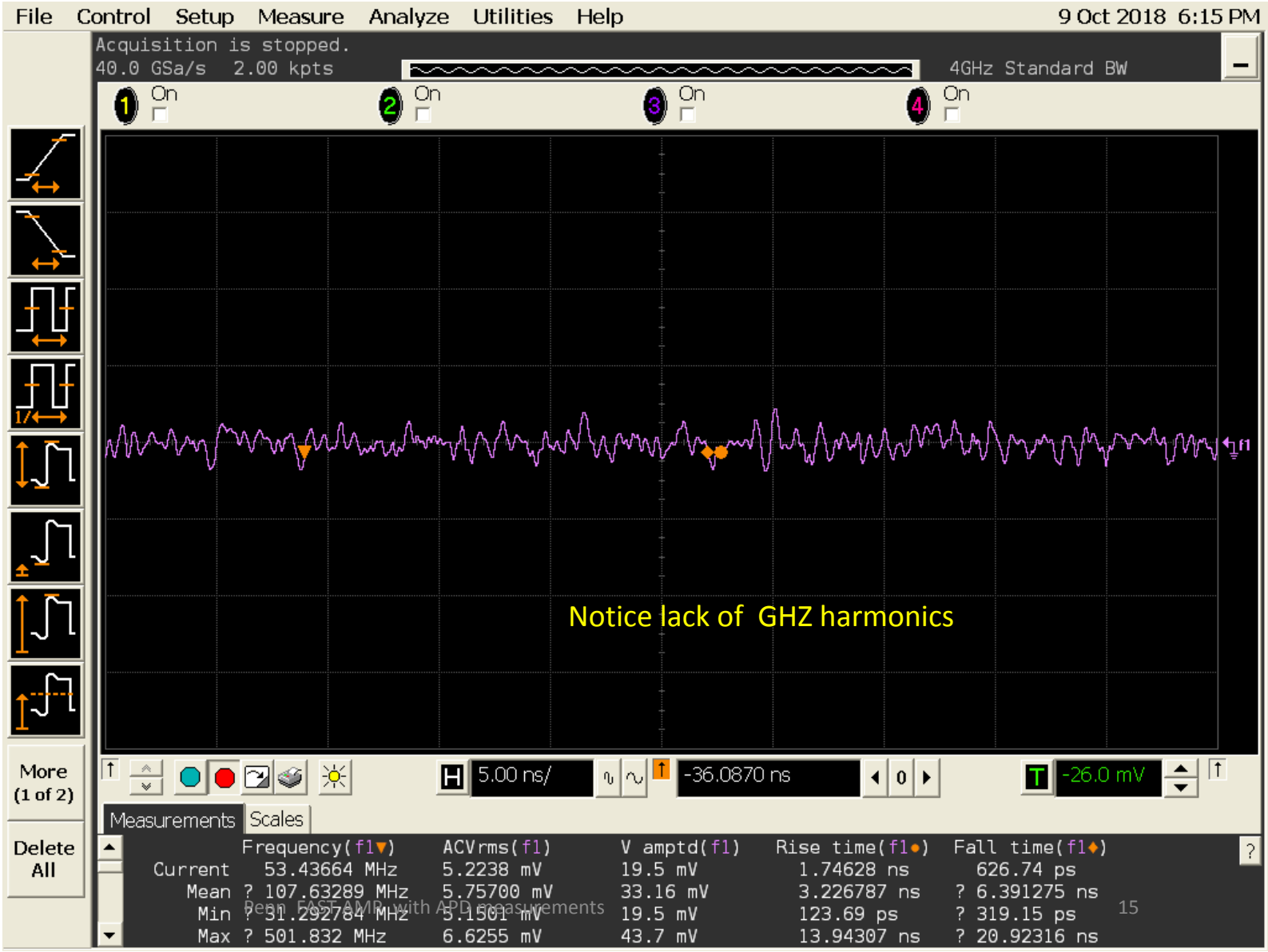
Fe55 pulses
Single Shot
APD @ 1750V

490ps leading Edge



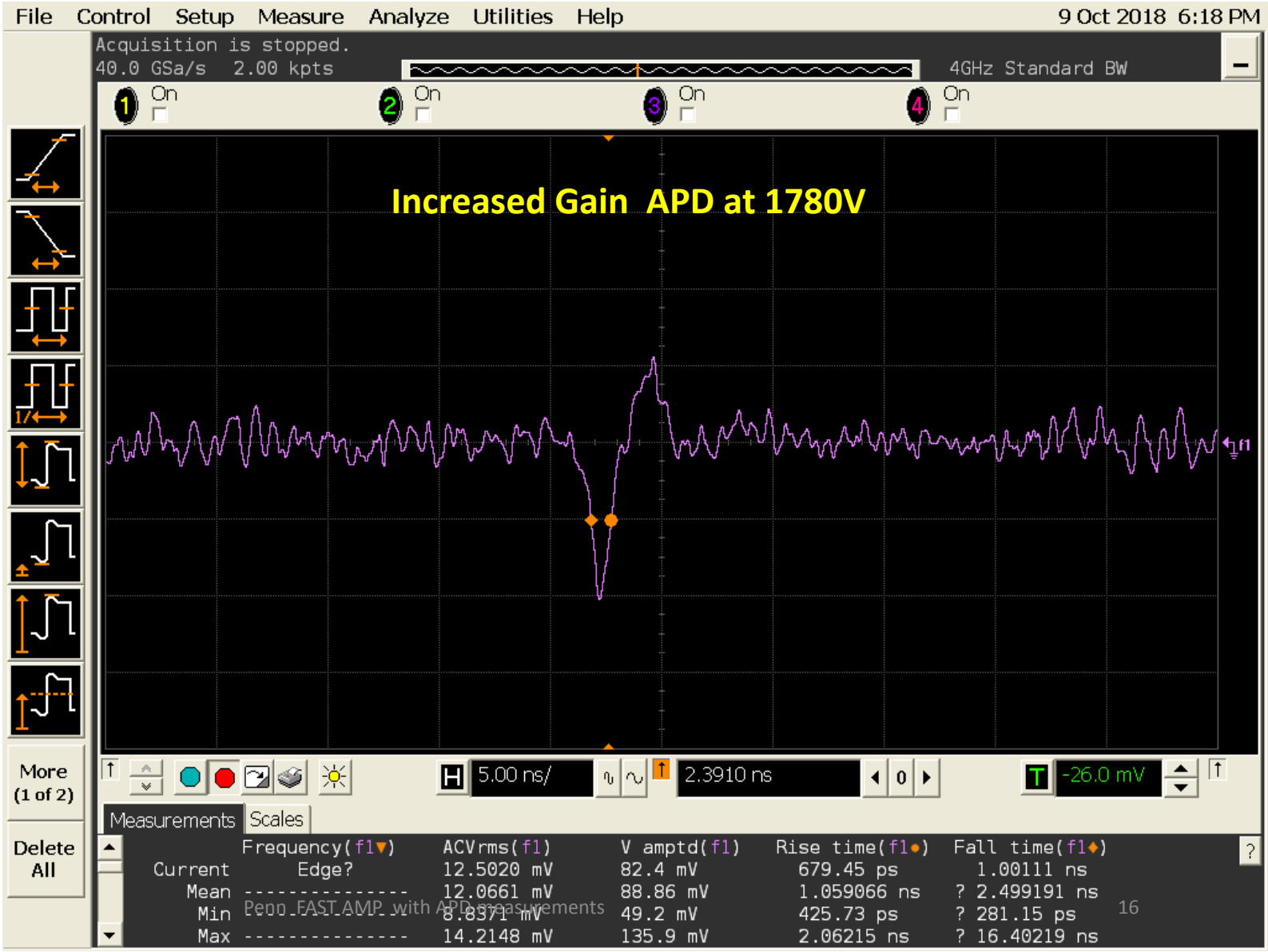
Auto Triggered APD @ 1750V

5.2mV



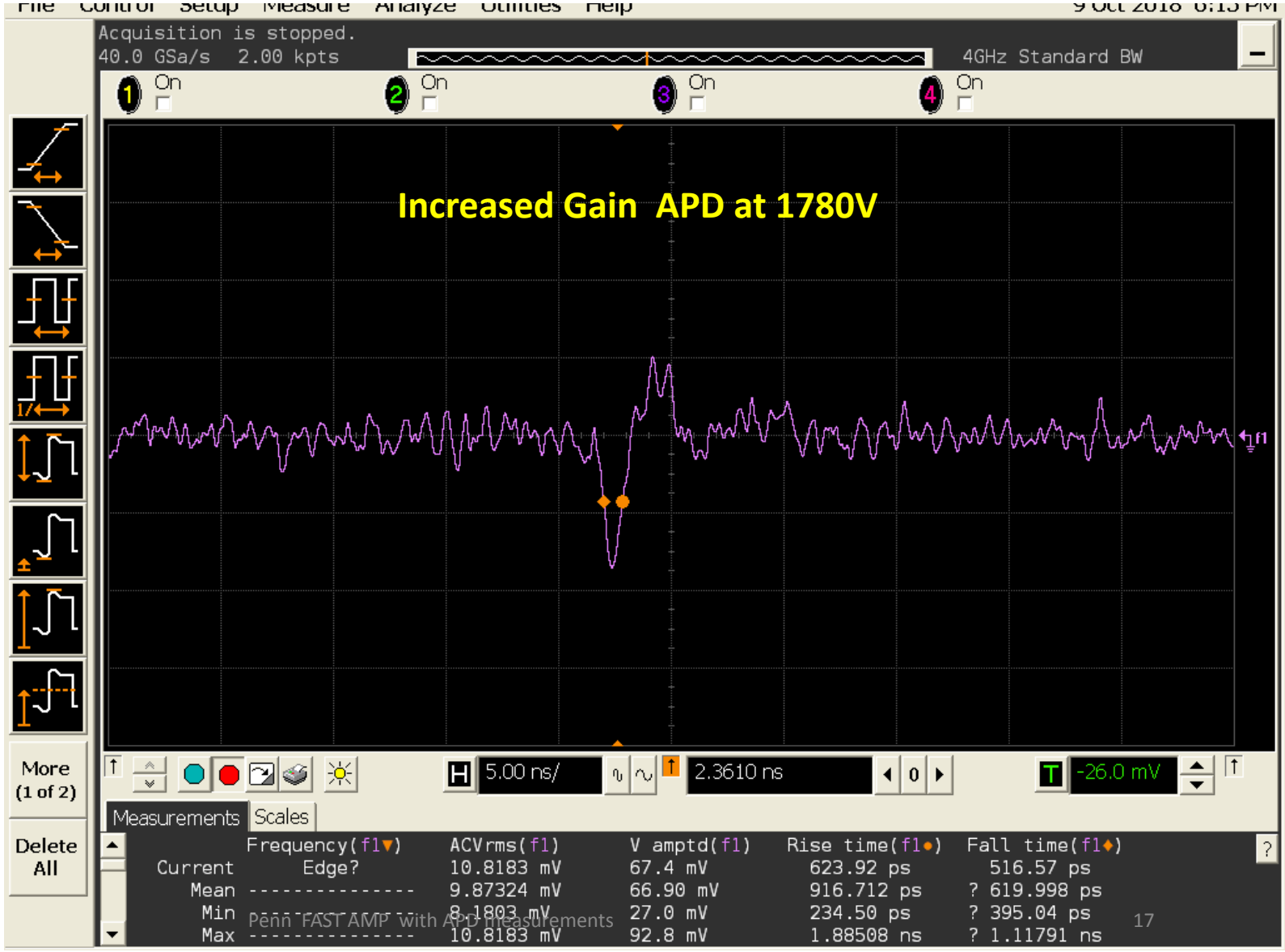
Fe55 pulses Single Shot APD @ 1780V

1000ps leading Edge
Amplitude 12.5mV



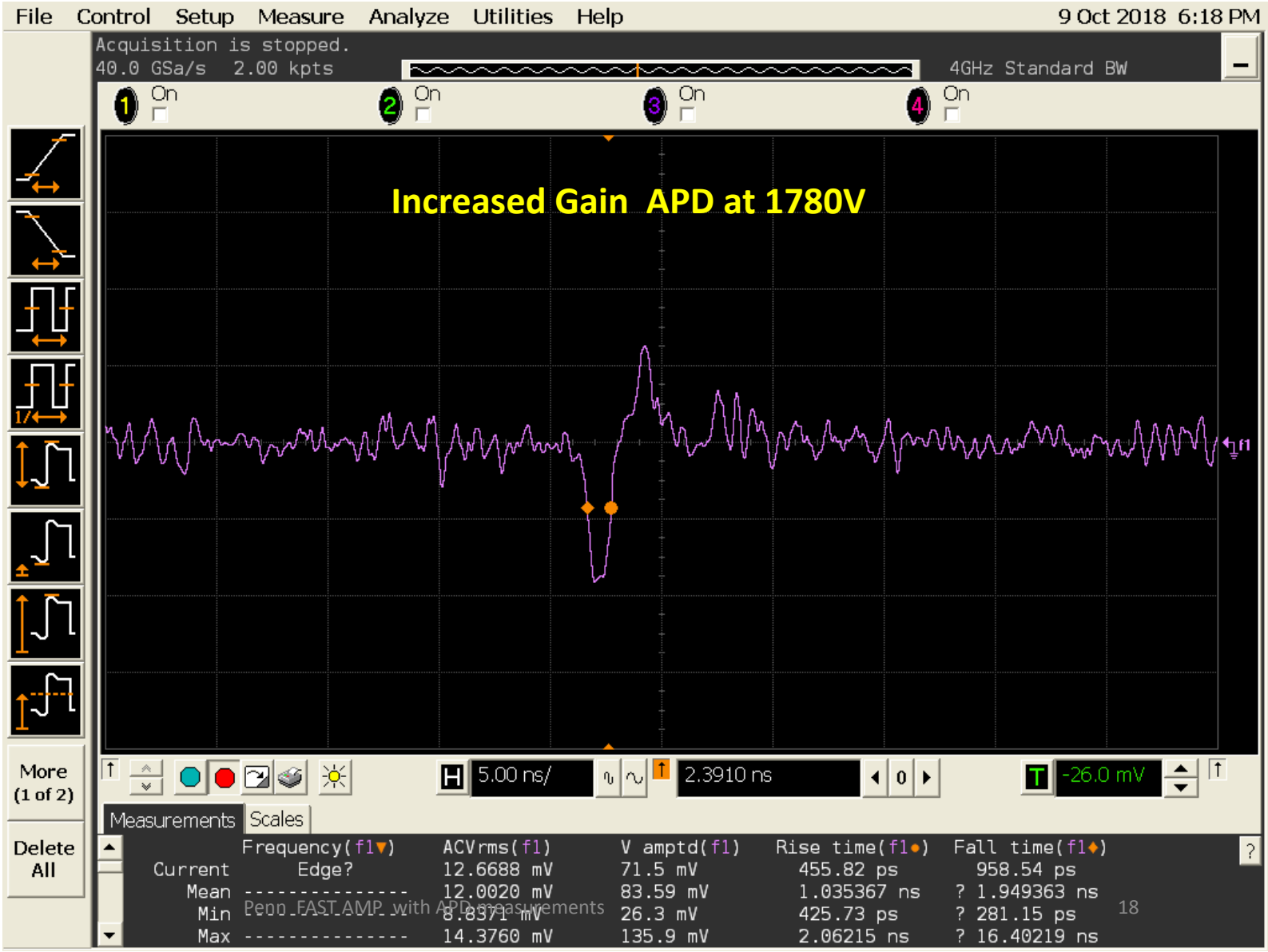
Fe55 pulses Single Shot APD @ 1780V

520ps leading Edge
Amplitude 9.8mV



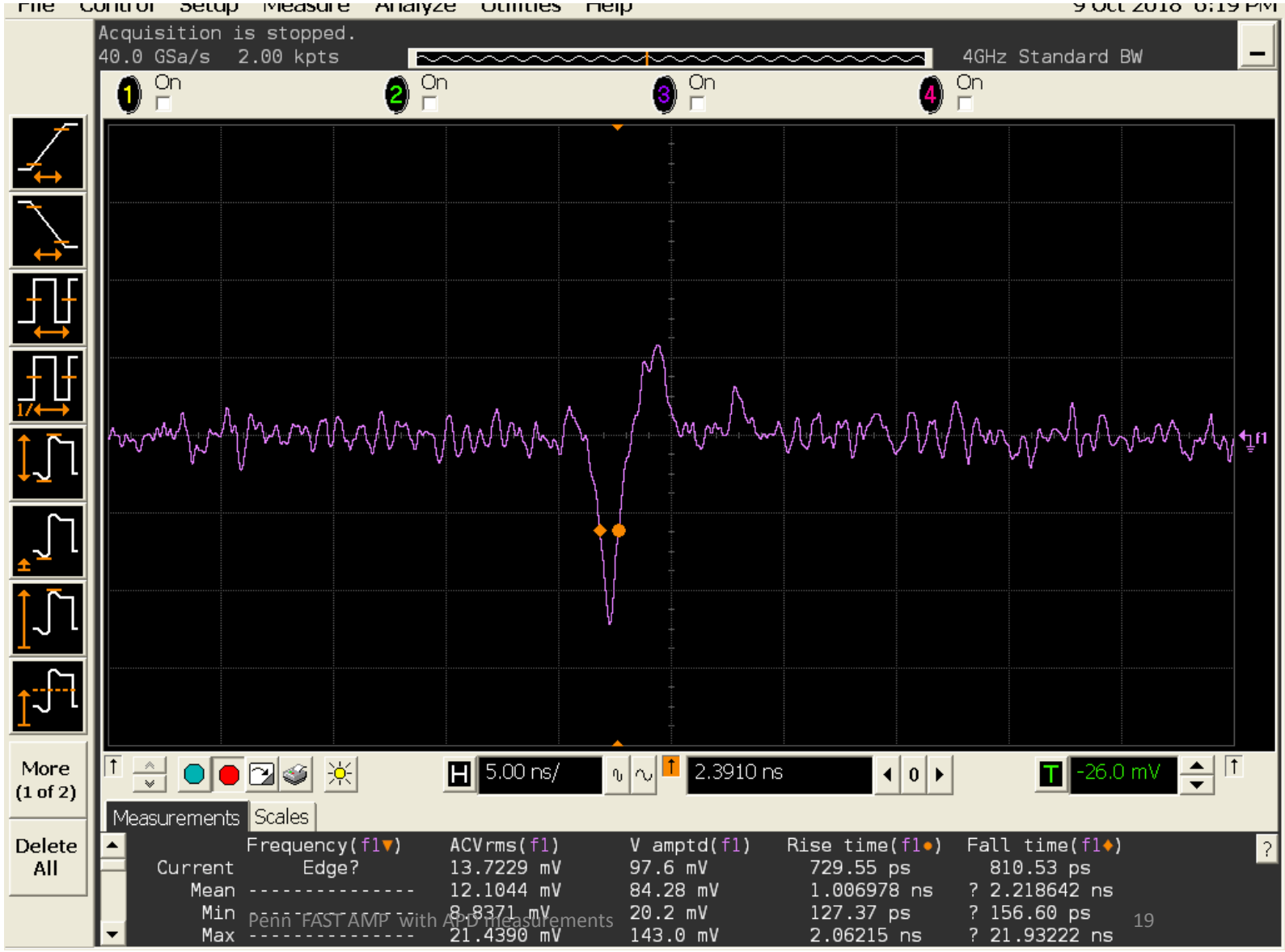
Fe55 pulses Single Shot APD @ 1780V

958ps leading Edge
Amplitude12.6mV



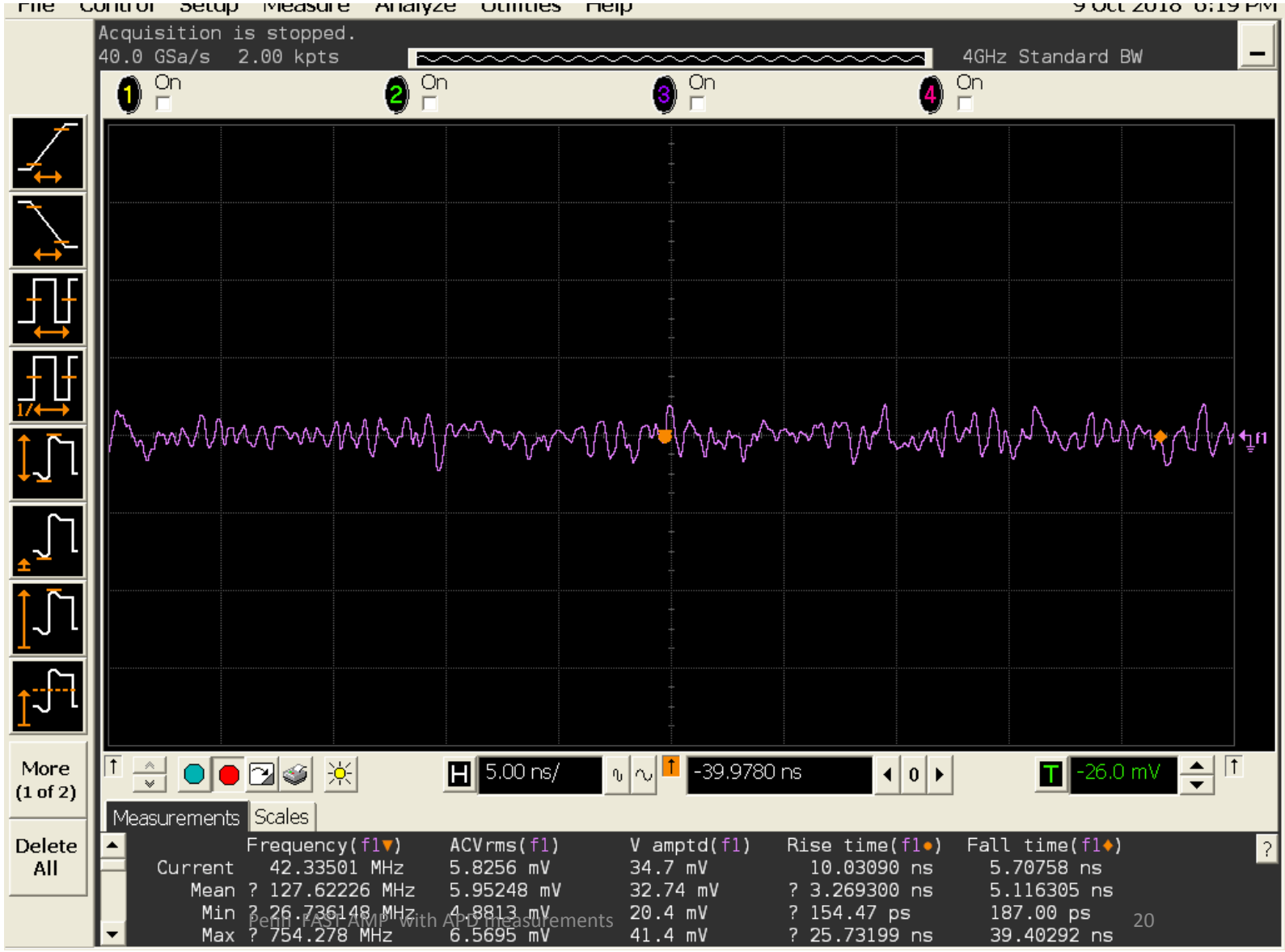
Fe55 pulses Single Shot APD @ 1780V

818ps leading Edge
Amplitude13.7mV



Auto Trigger Single Shot APD @ 1780V

RMS 5.8mV



Conclusions / next steps

- Stable Robust operation after multiple manipulations, no magic positions to eliminate noise.
- Noise seems random
- APD still working

  → **Return to Charged Particle Test Beam.**

- Experiment with/Optimize digital filtering starting with the highest BW available.

Next Step at Penn –

- Experiment with trenched substrate 8X8mm Carrier board to achieve a more balanced differential input. Milled out ground plane by Stan will have one installed APD by Bert.
- Improve Laser biasing as per Kirk / Sebastian
- Study shot to shot Fe 55 amplitude/ shape variation.