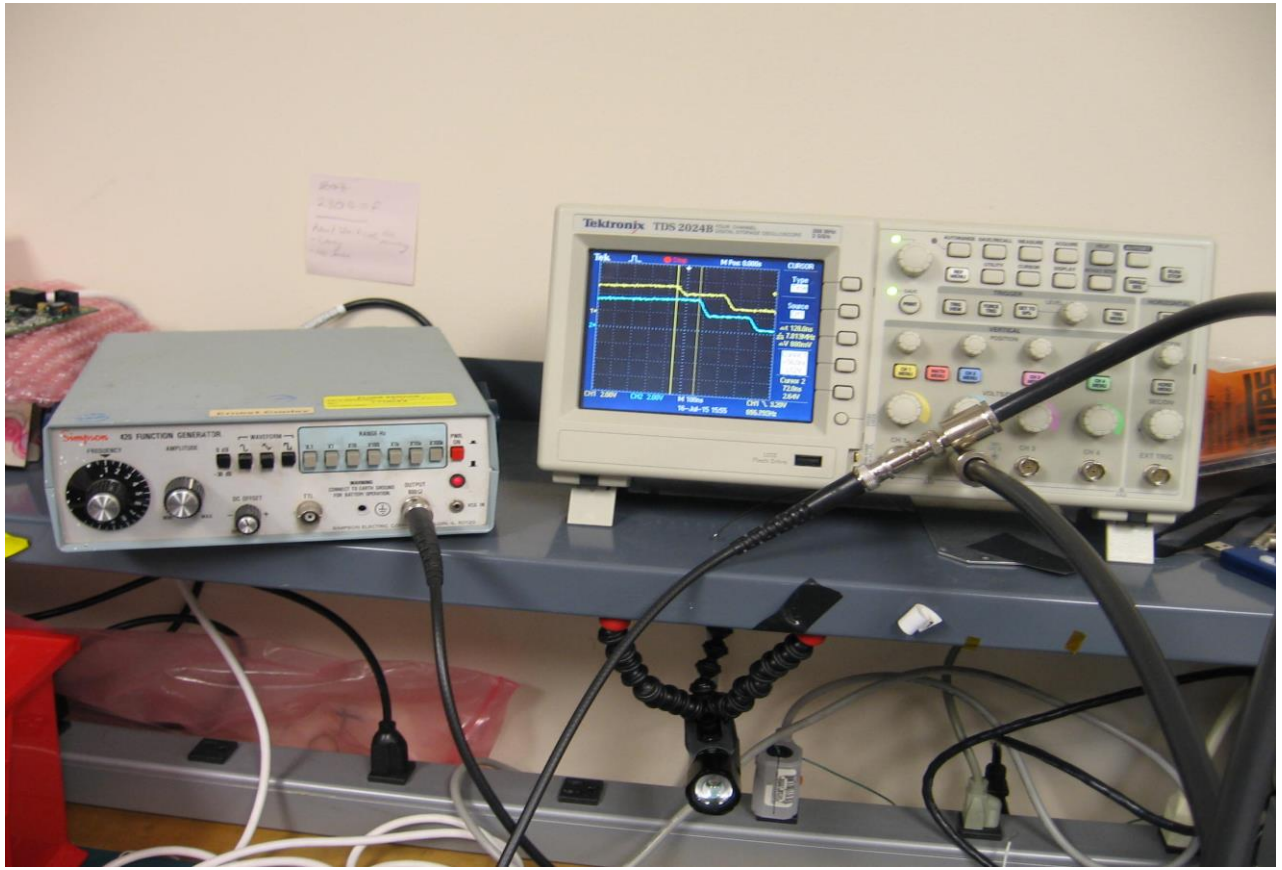
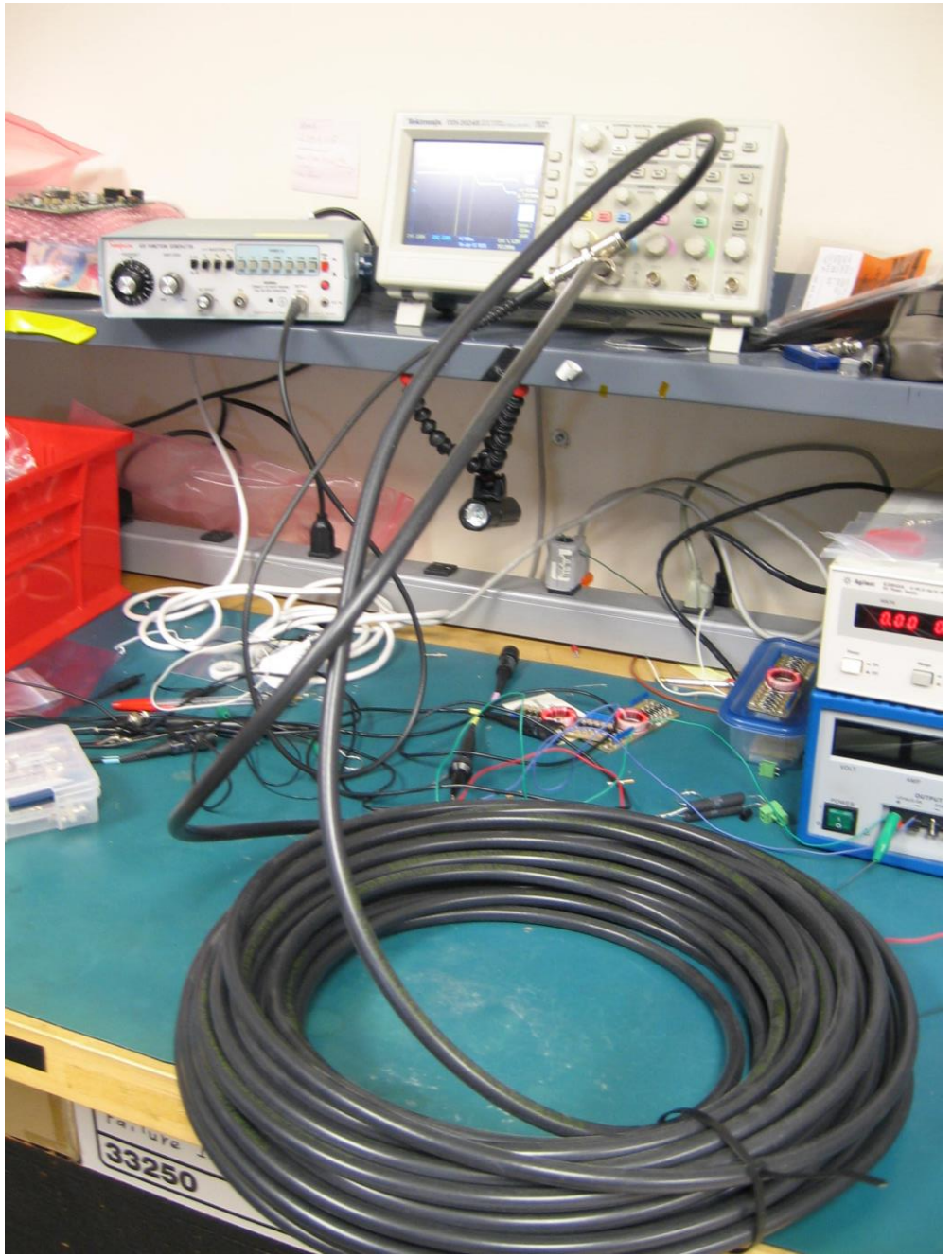
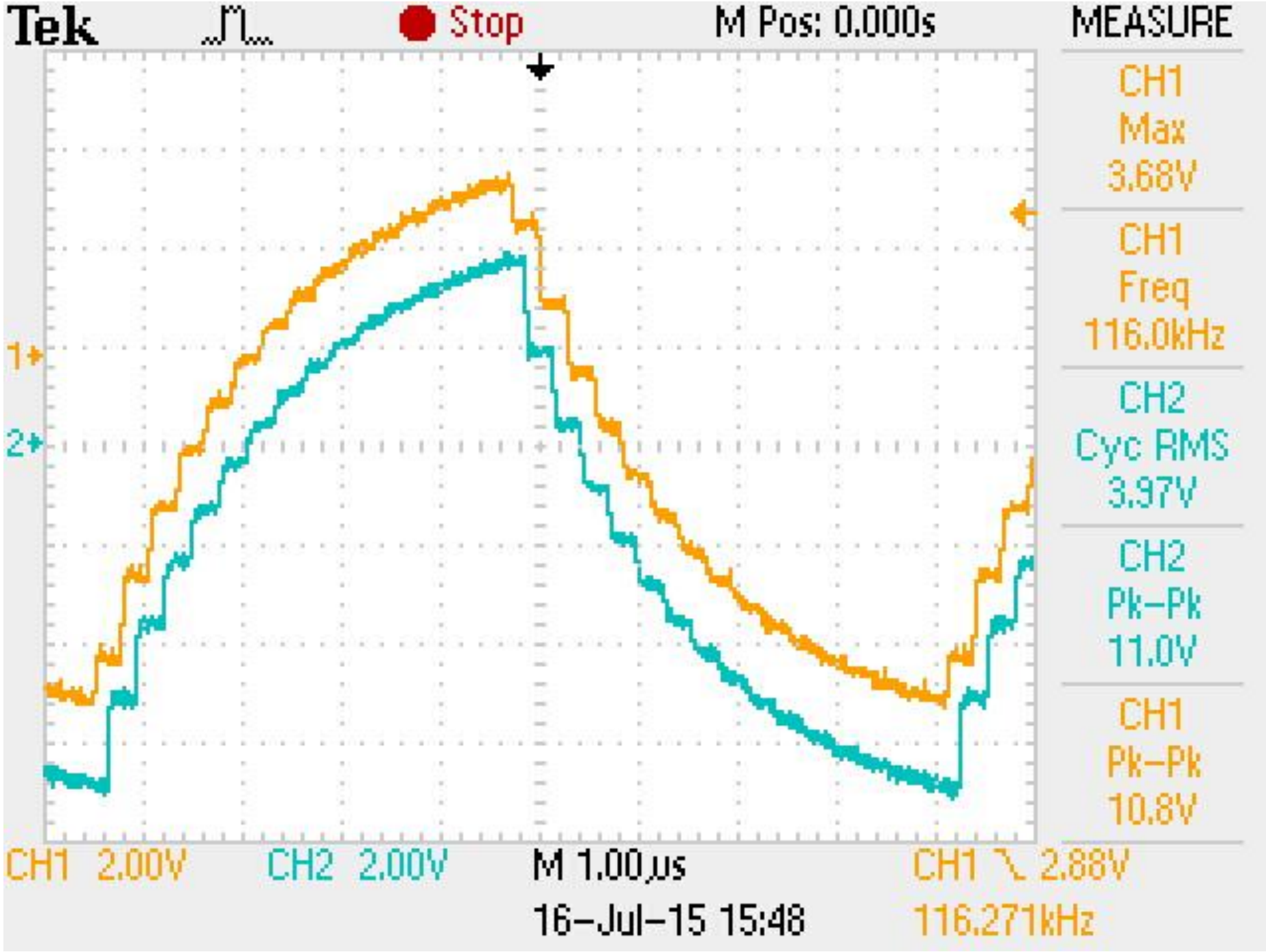
Capacitor Charging in Steps

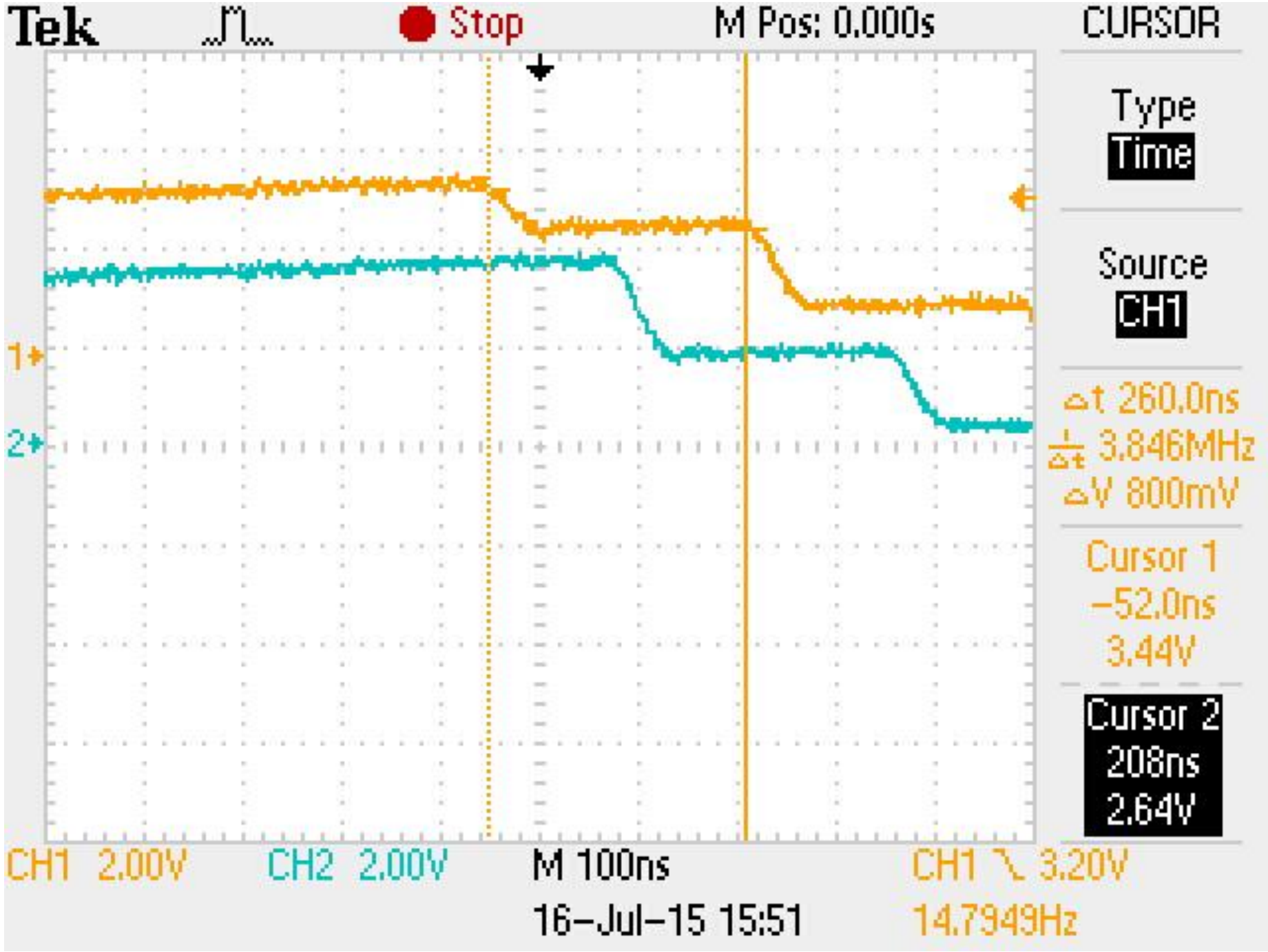
Demonstrating Theory C with bear skins and stone knives

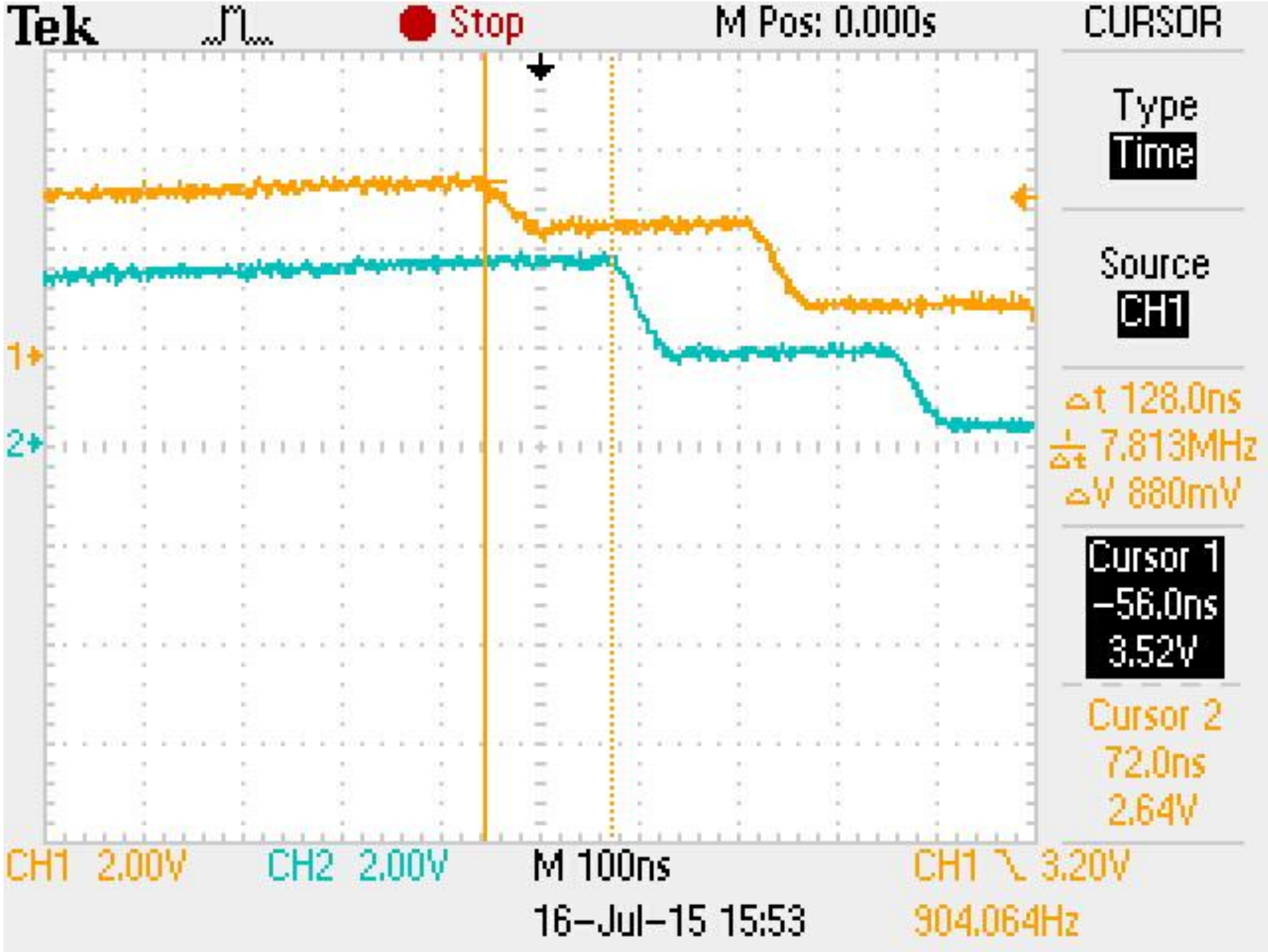
Equipment: Simpson 420 Function Generator producing about ~100KHz square wave via 600 ohm output, Tektronix TDS 2024B: Channel 1 (yellow) connected to signal generator output, Channel 2 (blue) connected to far end of RG8 coax. 100 feet of RG-8, 50 ohm coax (Belden 8214) ~2600pF calculated capacitance, 2682pF measured capacitance






Tek
Stop
M Pos: 0.000s
MEASURE
CH1
Max
3.68V
CH1
Freq
116.0kHz
CH2
Cyc RMS
3.97V
CH2
Pk-Pk
11.0V
CH1
Pk-Pk
10.8V
1
2
CH1 2.00V
CH2 2.00V
M 1.00µs
CH1 2.88V
16-Jul-15 15:48
116.271kHz


Tek
Stop
M Pos: 0.000s
CURSOR
Type
Time
Source
CH1
Δt 260.0ns
1/Δt 3.846MHz
ΔV 800mV
Cursor 1
−52.0ns
3.44V
Cursor 2
208ns
2.64V
1→
2→
CH1 2.00V
CH2 2.00V
M 100ns
CH1 ∖ 3.20V
16−Jul−15 15:51
14.7949Hz


Tek
Stop
M Pos: 0.000s
CURSOR
Type
Time
Source
CH1
Δt 128.0ns
1/Δt 7.813MHz
ΔV 880mV
Cursor 1
-56.0ns
3.52V
Cursor 2
72.0ns
2.64V
1→
2→
CH1 2.00V
CH2 2.00V
M 100ns
CH1 ∖ 3.20V
16-Jul-15 15:53
904.064Hz

Background

My goal was to develop a demonstration that wouldn't need expensive test equipment. I first used my 200MHz Tektronix with short length of RG-58. I could see the steps but it was difficult to measure them. Longer "RG-58" didn't work. Testing revealed it wasn't even 50 ohms. I decided to invest in 100 feet of RG-8. I initially tried to terminate it with BNC connectors. I eventually switched to PL-259 "UHF" connectors and used "UHF" to BNC adaptors. This worked as shown. To my surprise, the steps were also clearly evident with the slowest analog scope available, which I think was a 6.5MHz Tenma 72-300. Conclusion: 100 feet of RG-8 was overkill. Subsequently I realized that Ham Radio people around the world have lots of RG-8.