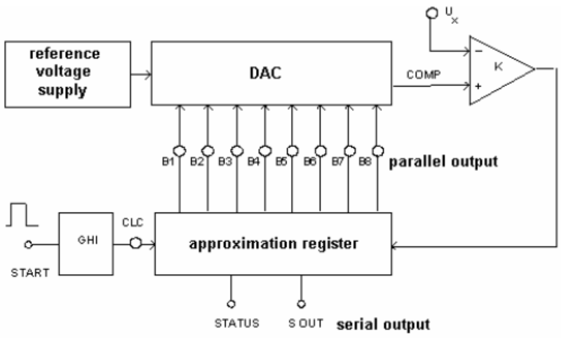
SAR ADC

Familiarize yourself with a basic principle of the SAR and dual-slope ADCs. What is the ADC integral nonlinearity characteristics and how do you obtain it?

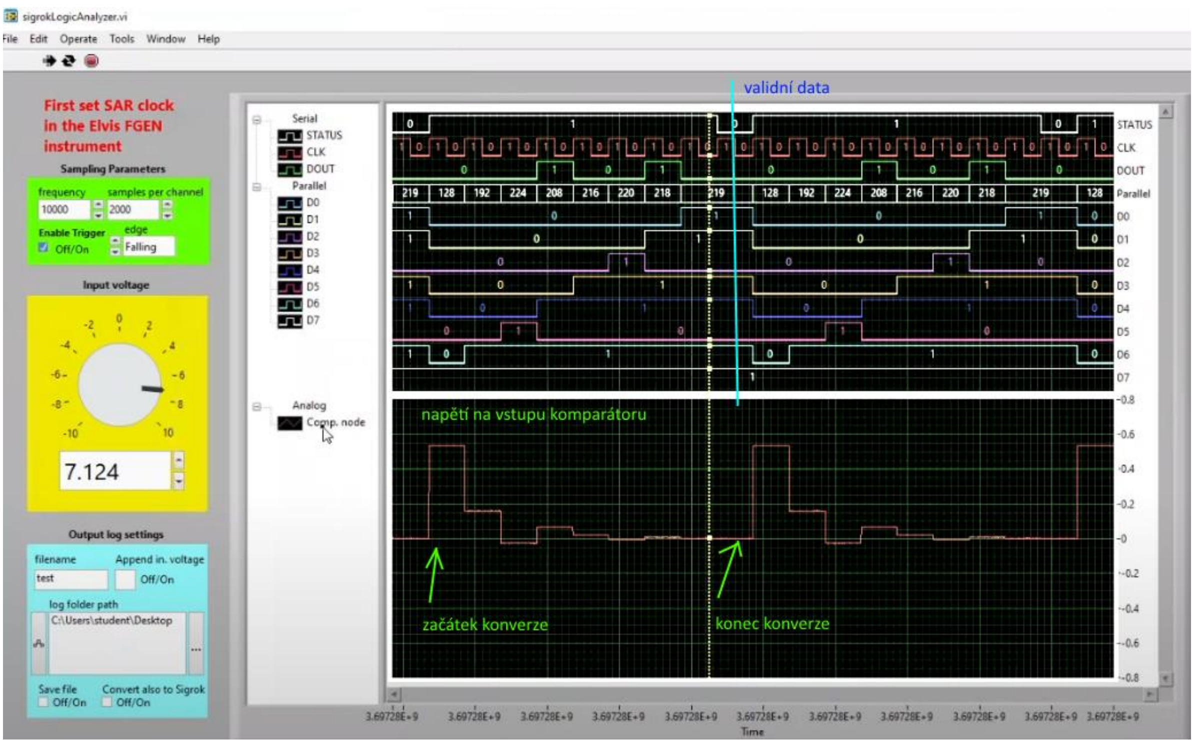


Preparation:
Study the WSH570 block diagram and familiarize yourself with its serial and parallel output bus. Which output bit is valid first during the process of approximation?

WSH570 ADC parameters: 8-bit, +- 10V range (20V span, center 0V - 127 LSB).

Minimal variant:
Measure and plot the ADC transfer function using variable input voltage (i.e. in 1V steps). Establish the LSB value and observe changing the LSB when slowly increasing the voltage. Compare the parameters obtained from with a simple calculation from the ADC binary output. Plot the INL graph.

Advanced variant:
Use the Sigrok software to decode also the serial output from the WSH570 SAR ADC. Pay attention to the correct settings of the SPI decoder (clock polarity, data phase etc...).



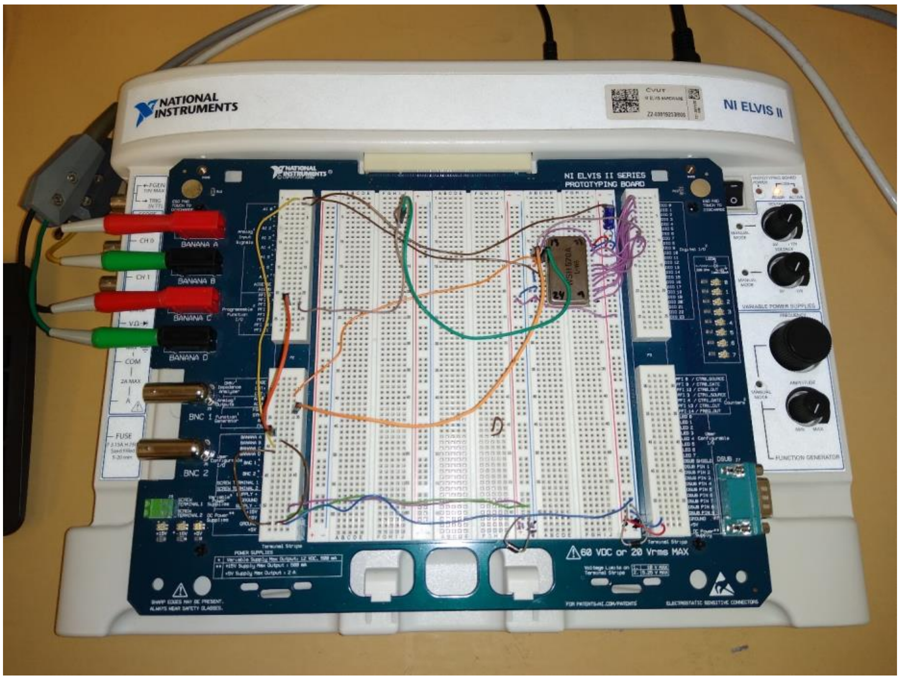


Figure 1 NI Engineering Laboratory Virtual Instrumentation Suite and the WSH570

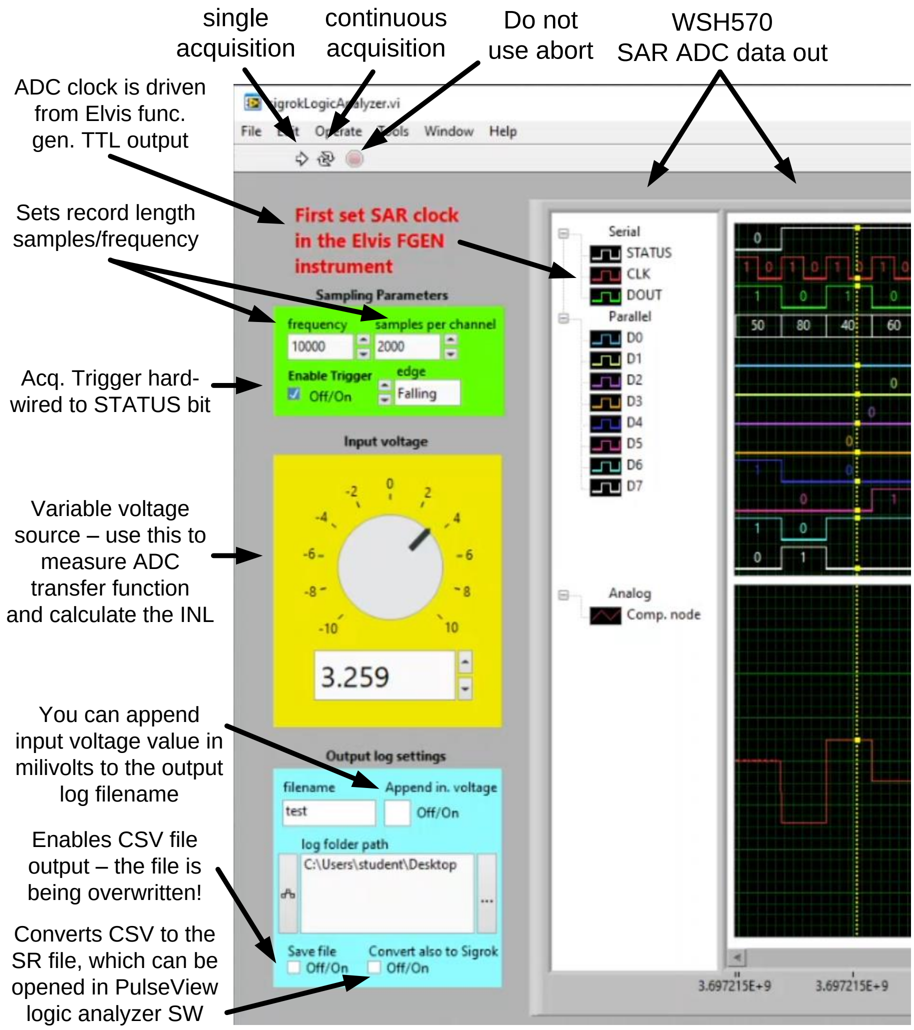


Figure 2 SAR task virtual instrument

Dual slope

Preparation:
What is the main advantage of dual slope over single slope integrating ADC? Which frequencies of the input signal are attenuated by the fixed integration time (let's say 50 ms)?

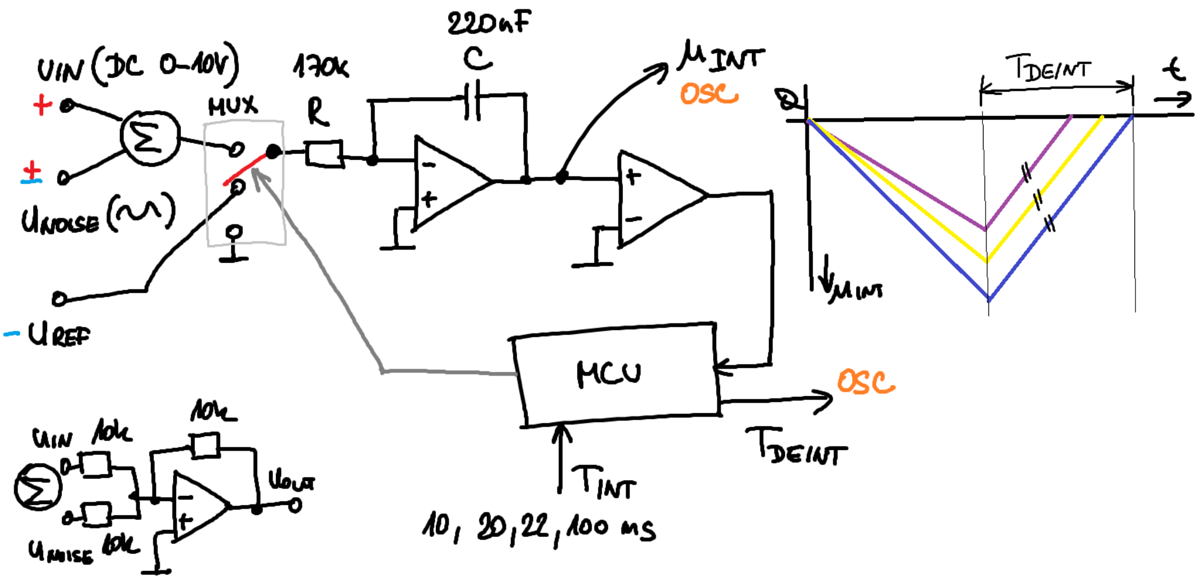
Integrating ADC parameters: Unipolar, 0-10V, tint = variable, 10-20-22-100 ms, discrete (built from OP482, analog MUX and STM32 microncontroller).

Minimal variant:
Measure the ADC transfer function using variable input voltage. Plot the INL.
Determine the value of the reference voltage (voltage used during fixed time integration) and use it to recalculate the measured time of "deintegration" to voltage.

Use the oscilloscope to observe the process of dual slope conversion and perhaps save a few images of the process for different voltages (you might use some oscilloscope function to overlay multiple waveforms on a single screen).

Use the function generator instrument to add noise signal to the ADC input and observe how does it affect the conversion process. Demonstrate the noise attenuation at specific frequencies to the lecturer.

Advanced variant:
Measure the frequency characteristics of the dual slope ADC using the frequency sweep function of the FGEN. The characteristics will be similar to the frequency response of a well known filter – which one? Determine the sample rate of the dual slope ADC circuit.



Block diagram of the descrete dual-slope AD converter

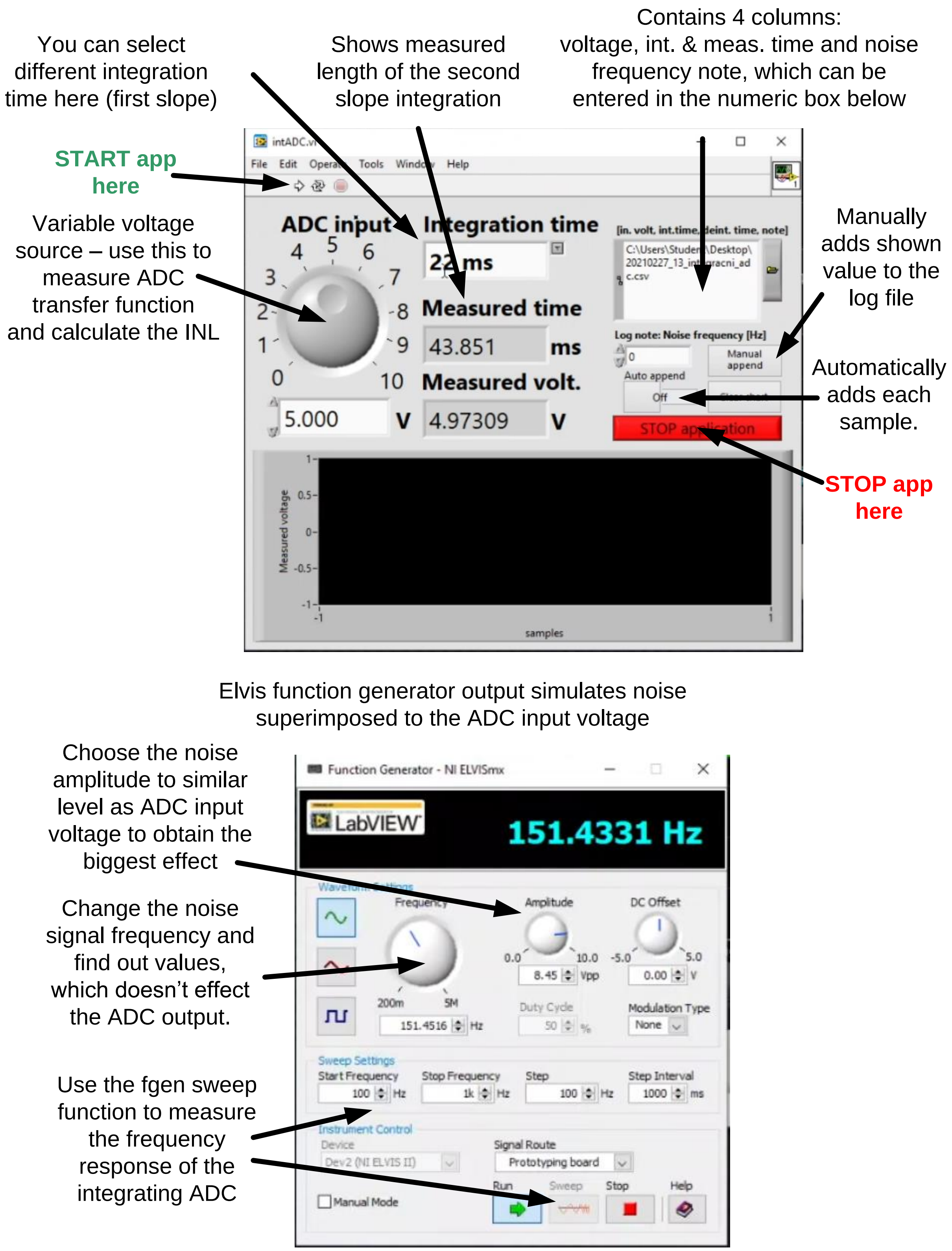


Figure 3 Dual Slope ADC virtual instrument