Time Interleaved Sampling

Time Interleaved Sampling (TIS) is a technique to increase the real-time sample rate of a digitizer. TIS uses multiple analog-to-digital converters (ADCs) to sample the same input waveform, but at different relative phases. The hardware then interleaves these samples to create the waveform as if only one ADC were sampling the waveform at a higher sample rate.

**NI High-Speed Digitize
SCOPE)**

Edition Date: January 2

Part Number: 370592A

**View Product Info
(http://sine.ni.com/nips**

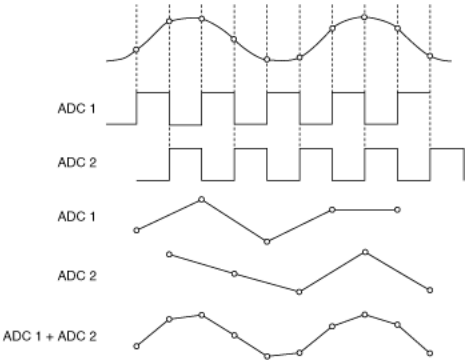
DOWNLOAD (Windows Only

**NI-SCOPE (Englis
(http://www.ni.co
Japanese
(http://www.ni.co**

Note To use time interleaved sampling for the NI 5152, 5153, and 5154, set the Enable TIS (/reference/en-XX/help/370592AB-01/scopepropref/pniscope_enabletis/) property or the `NISCOPE_ATTR_ENABLE_TIME_INTERLEAVED_SAMPLING` (/reference/en-XX/help/370592AB-01/scopefunc/cviniscope_attr_enable_time_interleaved_sampling/) attribute to TRUE. For all other devices, TIS is enabled automatically by setting the sample rate. The Enable TIS property is ignored.

How TIS Works

When you enable TIS on a channel, the digitizer samples the input signal of that channel using more than one ADC. The clocks of these ADCs are shifted to a phase that reflects the time when an ADC of a higher sample rate would acquire a point. An example is shown in the following figure.



To obtain a 2 G/s TIS rate using two ADCs, each operated at 1 G/s, the 1 GHz clock of one ADC is shifted 180 degrees with respect to the 1 GHz clock of the other ADC.

The data returned is in order and is acquired in real time. Therefore, the input signal is not required to be repetitive.

How TIS Affects Measurements

Because multiple ADCs are used in TIS, it is possible for mismatch between ADCs and phase offset between clocks to cause small changes in the spectral performance of the digitizer. NI digitizers calibrate most of these changes out, but some small residual changes may persist. It may be important, particularly in frequency domain applications, to understand the following effects.

- **Offset Mismatch**—If the ADCs are not perfectly matched in DC offset, a small spur can appear at DC and at the Nyquist frequency (Sample Rate/2).
- **Gain Mismatch**—If the ADCs are not perfectly matched in DC gain, spurs occur at image frequencies of input signal frequencies. The size of the image spurs are proportional to the amount of gain mismatch.
- **Phase Offset**—If the ADCs are not sampling at exactly the correct phase for the interleaving factor, images of the frequency content similar to those found with gain mismatch will occur.