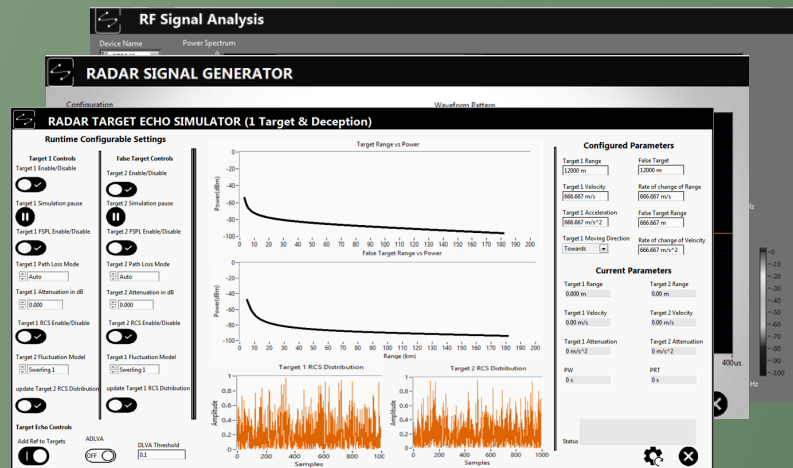


# Constelli Radar Toolkit

A development Library for  
Radar Engineers on NI LabVIEW  
& LabVIEW FPGA



## Overview

The Constelli Radar Toolkit (CRTK) extends built-in capabilities of NI LabVIEW and NI LabVIEW FPGA with functions and tools for Radar Waveform generation, Target/Emitter Simulation, and Measurements and Analysis. With this toolkit, you can rapidly develop applications for Radar Test & Measurements, Echo & Threat Simulators, Research, Design & Prototyping, and Radar Training & Teaching.

The Constelli RTK contains Examples that can be used for Simulation or with National Instruments hardware. The toolkit supports majority of the NI RF & FPGA Platforms including NI VST, RFSG & RFSA. Example library helps building applications faster with FPGA focused frameworks for Radar Target/Emitter Simulations, Waveform Generation and Analysis.

## CRTK Packages

CRTK Sig Gen

CRTK Sig Gen & Analysis

CRTK Sig Analysis

CRTK Suite

## Application Areas

Radar ATEs	Radar Target Echo Simulator	RCS Measurements
Threat Emulator	UWB Radar Signal Generator	Training simulator
Signal Analyzer	Pulse & Chirp Measurements	Radar Prototyping

## Key Features

LabVIEW Host & FPGA based Toolkit for  
Radar Test & Prototype Applications

Wide range of Radar Signal Generation  
Waveforms

Radar Signal Analysis & Measurements

Pulse & FMCW Chirp Measurements

Real-time Simulation of Target Echoes

Simulation of Doppler, RCS - Swerling 0,1,2,  
3 & 4 models, ECM - RGPO/I & VGPO/I

Floating & Fixed-point Algorithms

Handy Radar & Microwave calculators

Full-fledged application Examples right out  
of the box for Signal Generation, Analysis &  
Measurements, Radar Target Simulation and  
Emitter Simulation

Examples run on NI RFSG, RFSA, VST & USRP

## Package Feature Matrix

RTK Package vs Feature Matrix	Generation		Analysis & Measurement		Target Sim	Emitter Sim
	HOST	FPGA	HOST	FPGA		
CRTK Sig Gen	●					
CRTK Sig Analysis			●			
CRTK Sig Gen & Analysis	●		●			
CRTK Suite	●	●	●	●	●	●

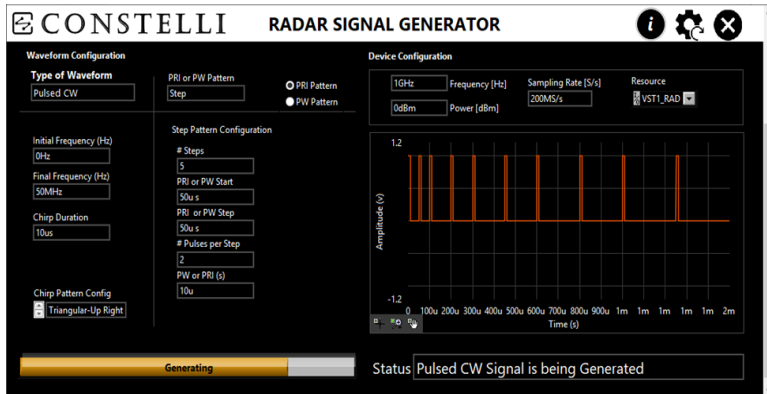
NOTE: CRTK Sig Gen, CRTK Sig Analysis, CRTK Sig Gen & Analysis are available only on HOST. Target and Emitter Simulation Packages are available on request.

● Included in Package    ● Available on Request

<b>CRTK Sig Gen</b> Wide range of Radar Waveforms on HOST and FPGA	<ul style="list-style-type: none"> <li>Frequency Modulated CW Signals: LFM CW, NLFMCW, SFMCW, FSKCW*</li> <li>Frequency Modulated Pulsed Signals: LFM, NLFM, SFM, FSK*</li> <li>Phase Modulated Signals: Pq, P2, P3, P4, Zadoff-Chu, Frank, Barker</li> <li>PW &amp; PRI Patterns: Ramp, Burst, Step, Staggered*</li> </ul>
<b>CRTK Sig Analysis</b> Radar Signal Analysis & Measurements on HOST and FPGA	<ul style="list-style-type: none"> <li>Envelope Detector</li> <li>PRI &amp; PW Calculator</li> <li>Pulse Measurements*</li> <li>Peak Side Lobe Level Analysis*</li> <li>Range &amp; Doppler Estimator*</li> <li>Matched Filter*</li> <li>FMCW Chirp Measurements*: Chirp Rate, Chirp Type, Duration</li> </ul>
<b>Target Simulation</b> Radar Target Echo Simulation in Real-time on FPGA	<ul style="list-style-type: none"> <li>Range Simulation: Blind &amp; Pulse Reference Methods</li> <li>Doppler Simulation</li> <li>RCS Models: Swerling 0,1,2,3,4</li> <li>ECM Features: RGPO(I), VGPO(I)</li> </ul>
<b>Emitter Simulation</b> Real-time Multi-Emitter Waveform generation on FPGA	<ul style="list-style-type: none"> <li>Real-time Waveform Generation on FPGA</li> <li>Multi-emitter Generation Capability</li> <li>Attenuation, Doppler and Timing Configuration</li> <li>Supports all the Radar Waveforms</li> </ul>
<b>Utilities</b> Handy Radar and Microwave calculators and converters on HOST	<ul style="list-style-type: none"> <li>Maximum Unambiguous Range</li> <li>Maximum Unambiguous Velocity</li> <li>Power Calculators</li> <li>RCS Converter</li> <li>Radar Range Equation, FSPL</li> <li>Receiver Sensitivity Calculator</li> <li>Doppler &amp; Velocity Converter</li> <li>Range &amp; Delay Converter</li> </ul>

\* Not available on FPGA

## CRTK Sig Gen



**CRTK Sig Gen** is a LabVIEW Host Library comprising VIs and Examples for Radar Signal Generation.

The library includes Signal Generation VIs such as CW and Pulsed, LFM Pulsed/CW, NLFM Pulsed/CW, SFM Pulsed/CW, P1, P2, P3, P4, Zadoff-Chu, Frank, and Barker. Library also includes PW and PRI Pattern Configuration VIs.

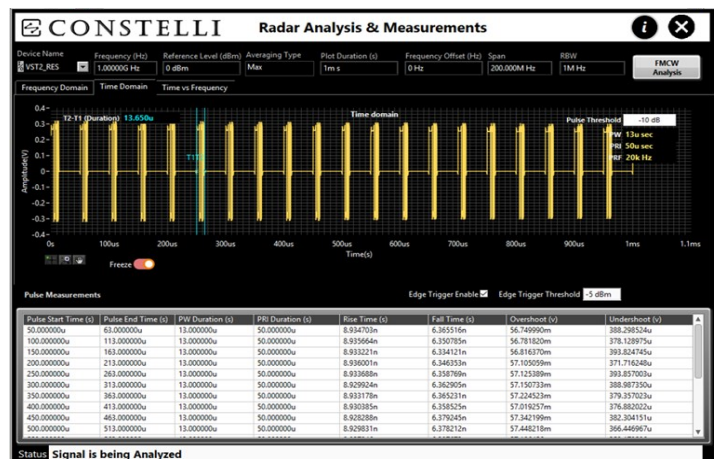
The example runs on NI VSG and illustrates signal generation using the VI library.

## CRTK Sig Analysis

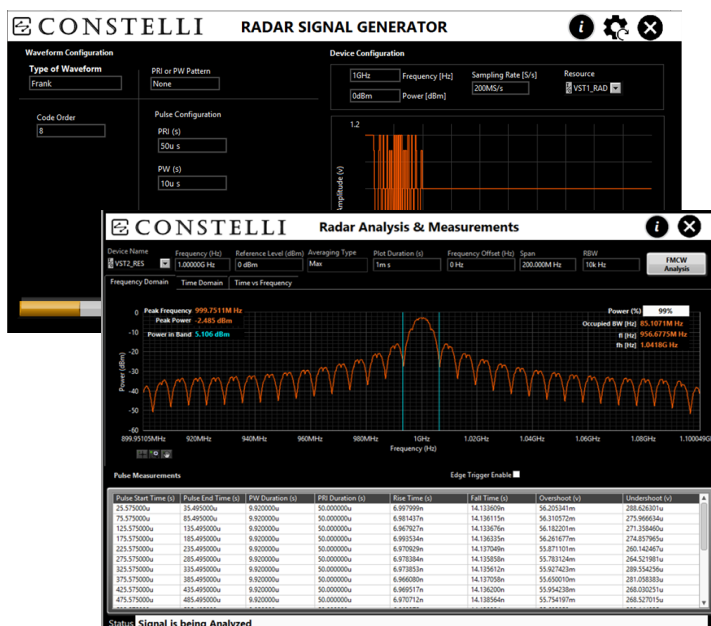
**CRTK Sig Analysis** is a LabVIEW Host Library comprising VIs and Examples for Radar Signal Analysis & Measurements features.

The library includes analysis and measurement VIs such as PW & PRI Calculator, Chirp Bandwidth, Chirp Rate, Range and Doppler Estimators.

The example runs on NI VSA and illustrates Radar Signal Analysis & Measurements such as time and frequency domain and time-frequency domain analyses, Pulsed & Chirp Signal Measurements such as PW, PRI, Rise Time, Fall Time, Overshoot and Undershoot, Chirp Duration, Rate and Bandwidth.



## CRTK Sig Gen & Analysis



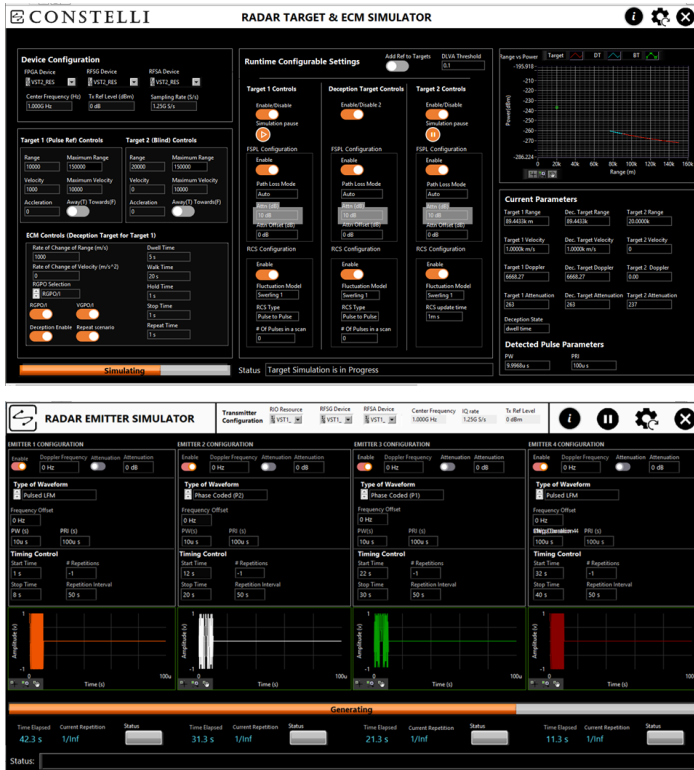
**CRTK Sig Gen & Analysis** is a LabVIEW Host Library comprising VIs and Examples for Radar Signal Generation, Analysis and Measurements.

It is the combination of above two packages: CRTK Sig Gen and CRTK Sig Analysis.

## CRTK Suite

**CRTK Suite** extends Radar Signal Generation, Analysis & Measurement features of above packages to FPGA. The library includes the FPGA VIs for Signal Generation and Analysis as well as the VIs of CRTK Sign Gen & Analysis Host library. The shipped examples support signal generation on NI RF & FPGA Platforms and contain pre-compiled bitfiles for NI VST (PXIe 5840, 5644/45/46) and NI USRP RIO.

## CRTK Suite (Target Sim & Emitter Sim Options)



Target & Emitter Simulation libraries are offered as optional add-ons to **CRTK Suite**.

The **Target Sim** library includes target simulation VIs such as Range, Doppler Shift, Free Space Path Loss ( $R^4$  Attenuation), Radar Cross Section (RCS), RGPO (I), and VGPO(I) simulation.

The example is shipped with pre-compiled bitfile for NI VST (PXIe 5840, 5644/45/46) illustrating generation of two targets and one ECM target.

The **Emitter Sim** library includes emitter simulation VIs such as timing configuration, attenuation and Doppler simulation.

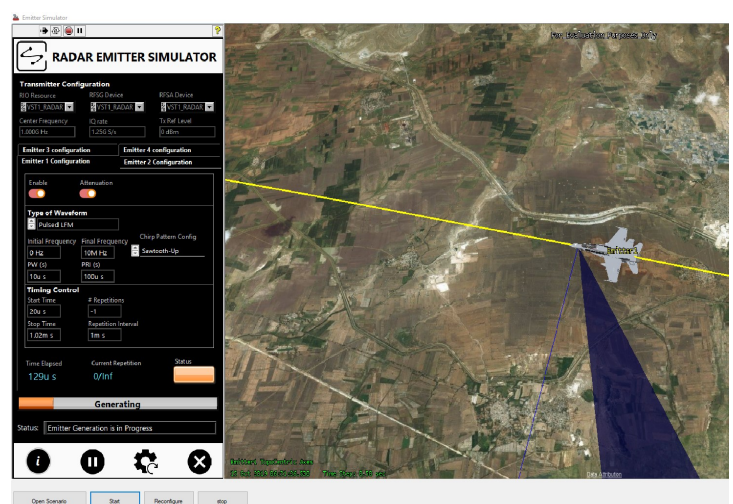
The example is shipped with pre-compiled bitfile for NI VST (PXIe 5840, 5644/45/46) illustrating real-time generation of up to four emitters with variety of radar waveforms.

## Customized Solutions

With expertise in System Architecting and Signal Processing, Constelli offers custom solutions to challenging requirements in Radar Design, Radar and EW Test Applications.

We developed variety of IP which includes Trajectory Definitions, Maneuvers, Antenna Beam & Scan Patterns, complex Jamming and ECM scenarios. **STK AGI** integration can also be done for more realistic and sophisticated Radar & EW test applications.

Apart from IP, we also offer up to 40 GHz multi-channel coherent frequency extension hardware for NI VST.



For more information, visit

**constelli.com**

For sales and support, write to us on [info@constelli.com](mailto:info@constelli.com)

*The information in this document gives only a general indication of the product capacity, performance and suitability, none of which shall form part of any contract. We reserve the right to make design changes without notice.*  
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