FMCW Snow Level Radar

# Hardware:

## Measurement Computing USB-2523 Data Acquisition board

$1,045

USB, 16bit resolution, 1MS/s sample rate, 24 digital I/O

Win10 64 bit – Visual Studio – C++/C# library

<https://www.mccdaq.com/usb-data-acquisition/USB-2500-Series.aspx>

DaqBoard3005USB

## SpinCore PulseBlaser PB24-100-4k-PCI Timing Generator

$1,525

PCI, 24 channels, 100MHz clock, 4K memory words, 50 shortest pulse, 10ns pulse resolution

Win 2000, C, SpinAPI.Net C#, Visual Studio 2008

<http://www.spincore.com/products/PulseBlaster/>

SpinCore Technologies, Inc: PulseBlaster-12(SP17)

## EVAL-AD9959 DDS

$412

USB, 4-Channel, 500 MSPS, 10-Bit DACs

Windows 64bit driver

Currently having issues controlling it. May need an Arduino to control it.

https://www.analog.com/media/en/technical-documentation/evaluation-documentation/57418637811849AD9959\_pcb\_0.pdf

## Mini-Circuits USB/Ethernet Smart Power Sensor

$

USB, Ethernet, ???

OS

https://www.minicircuits.com/WebStore/RF-Smart-Power-Sensors.html

<https://www.minicircuits.com/softwaredownload/PM_Programming_Manual.pdf>

## RedPitaya StemLab Data Acquisition and Signal Generator

Possible replacement for ISA Analog Hardware

https://www.redpitaya.com/

# Libraries

LibUSBK:

For AD9959 DDS

Version in use is LibUsbDotNet.dll 2.2.5.61

Latest version (3.0.7.0) is from 2014 and does not support higher than Win2000

https://sourceforge.net/projects/libusbk/

http://libusbk.sourceforge.net/UsbK3/index.html

MathNet.Iridium

Replaced with Math.Net Numerics - current version (4.15.0) is from 2020

MathNet.iridium version in use is 2008.8.16.470

https://iridium.mathdotnet.com/

https://numerics.mathdotnet.com/

Numerical Methods Library

Don't now where Dave got this dll

DAQCOM:

For DaqBoard3005USB board

32 and 64 bit dlls

# Differences with Lapxm:

## Control Panel:

\* Calculates some parameters similar to the Lapxm Easy Editor

\* Parameters stay the same once the radar is set up and running

## Data Acquisition:

\* Some differences in how the time series is handled before it can be passed into Lapxm’s normal chain of algorithms.

## Snow Level Algorithm

\* Discrimination on width

\* Peak picking is limited to 0-6m/s instead of full Nyquist

\* Signal to noise ???

## S-Band FM-CW Snow Level Radar

### Snow Level Radar

### S-Band Radar

The **S band** is a designation by the [Institute of Electrical and Electronics Engineers](https://en.wikipedia.org/wiki/Institute_of_Electrical_and_Electronics_Engineers) (IEEE) for a part of the [microwave](https://en.wikipedia.org/wiki/Microwave) [band](https://en.wikipedia.org/wiki/Radio_band) of the [electromagnetic spectrum](https://en.wikipedia.org/wiki/Electromagnetic_spectrum) covering [frequencies](https://en.wikipedia.org/wiki/Frequency) from 2 to 4 [gigahertz](https://en.wikipedia.org/wiki/Gigahertz) (GHz).

### FM-CW

*Frequency-modulated continuous-wave radar* (FM-CW) – also called continuous-wave frequency-modulated (CWFM) radar[[5]](https://en.wikipedia.org/wiki/Continuous-wave_radar#cite_note-5) – is a short-range measuring radar set capable of determining distance

### Brightband Height

220 mW

Installation Notes:

MC USB2523 DAQ

- run mccdaq.exe (2.6)

- allow the device manager to detect the board – it will be under DAS Component -> USB 2523

- update driver and select DaqBoard3005 driver

- Could run InstaCal and run a performance test and a DIO test

- Could run DAQami and see test sin and square waves

SpinCore PulseBlaster-12(SP17)

- run SpincCore\_API\_20150129.exe (32 bit) (or \_x86\_64 for 64 bit)

- latest version is SpinCore\_API\_20171214\_Universal