ACCEL LLRF
Frequency Tuning Proof of Concept

Project: DARPA ACCEL

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Full Script of RF Frequency Tuning in Jupyter Notebook -1

- Step 1: Set NCOs on both ADC and DAC data paths to 5712 MHz’s image in 1st Nyquist zone

```
In [48]: root.XilinxRFSoC.RfDataConverter.dacTile[0].dacBlock[0].ncoFrequency.set(186.24)
print(root.XilinxRFSoC.RfDataConverter.dacTile[0].dacBlock[0].ncoFrequency.get())
root.XilinxRFSoC.RfDataConverter.adcTile[0].adcBlock[0].ncoFrequency.set(796.8)
print(root.XilinxRFSoC.RfDataConverter.adcTile[0].adcBlock[0].ncoFrequency.get())
```

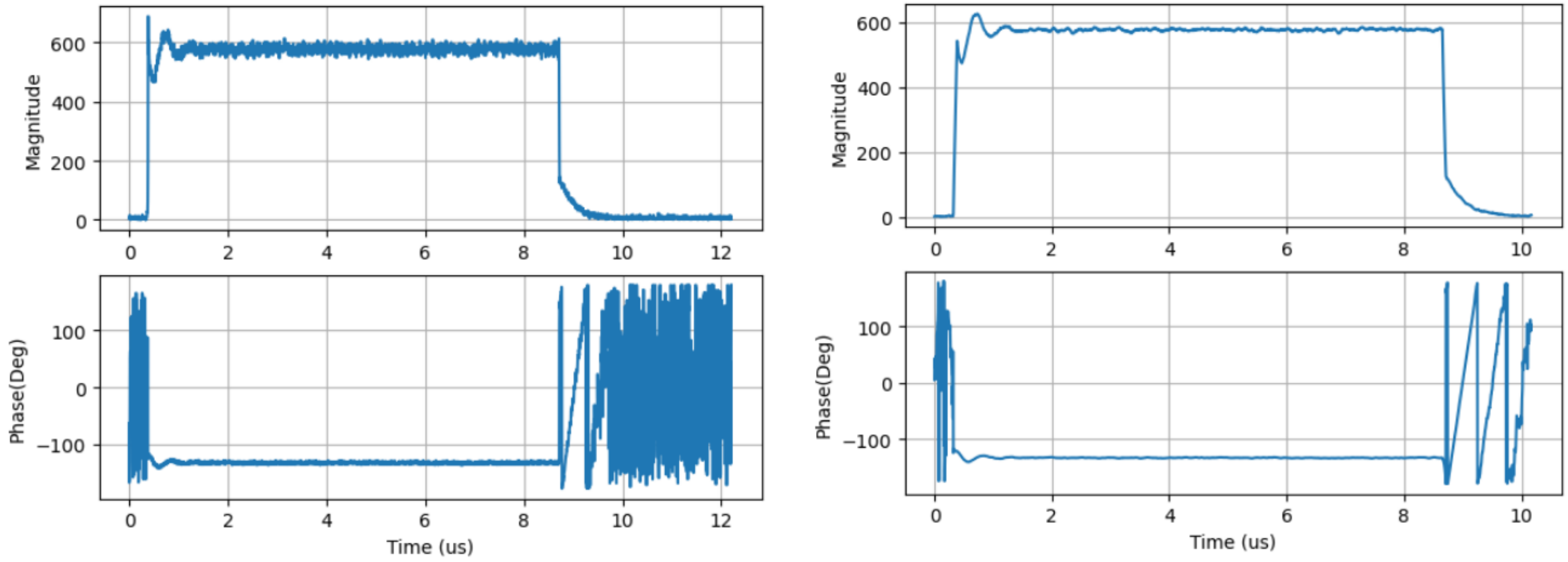
```
186.23999999999302
796.8
```

- Step 2: Set pulse amplitude and duration of the pulse

```
In [74]: root.XilinxRFSoC.Application.DacSigGenLoader.Amplitude.set(16383)
root.XilinxRFSoC.Application.DacSigGenLoader.Amplitude.get()
root.XilinxRFSoC.Application.DacSigGenLoader.Duration.set(2048)
root.XilinxRFSoC.Application.DacSigGenLoader.Duration.get()
root.XilinxRFSoC.Application.DacSigGenLoader.LoadWaveform()
```

Full Script of RF Frequency Tuning in Jupyter Notebook -2

- Step 3: Capture 2 frames for ADC sample and perform decode, IQ to phase and amplitude conversion and filtering



Full Script of RF Frequency Tuning in Jupyter Notebook -3

- Step 4: Calculate the frequency error from the phase values on pulse tail

In [80]:
```
p0=2160
p1=2200
time_gap=(p1-p0)*timeBin
print (time_gap)
phase_deg=mva_cplx_p0[p1]-mva_cplx_p0[p0]
print (phase_deg)
freq_c=1/(time_gap/phase_deg*360)
print (freq_c)
```

- Step 5: Set new NCO values on both ADC and DAC data paths

In [81]:
```
root.XilinxRFSoC.RfDataConverter.dacTile[0].dacBlock[0].ncoFrequency.set(186.24+freq_c)
print(root.XilinxRFSoC.RfDataConverter.dacTile[0].dacBlock[0].ncoFrequency.get())
root.XilinxRFSoC.RfDataConverter.adcTile[0].adcBlock[0].ncoFrequency.set(796.8-freq_c)
print(root.XilinxRFSoC.RfDataConverter.adcTile[0].adcBlock[0].ncoFrequency.get())
```

Full Script of RF Frequency Tuning in Jupyter Notebook -4

- Step 6: Capture 2 frames for ADC sample and perform decode, IQ to phase and amplitude conversion and filtering – reflection very low and flat phase on pulse tail, which mark the success of RF frequency tunning.