* Background
  + DAC models and Images.
  + Nyquist zones.
  + Supersampling: highly parallelized DDS.
  + Fpga ip cores
    - Signal generators
    - Time processors
    - Readout
    - Avg\_buf
* ~~Miscellaneous tests~~
  + ~~DAC & ADC Calibration table for constant output~~
* zcu111 transmon measurement.
  + Related-tests
  + Experiment setup
  + Results
    - Qubit characterization.
    - RB
* Zcu216 fluxonium measurement.
  + Related-tests
    - Control Labber from zcu.
    - Software development: Generic sequence
    - use RF to up-/down-convert instead of direct output.
    - Use amplifiers.
  + Experiment setup
  + Results
    - Qubit characterization.
* Zcu216 5-transmon chip measurement.
  + Related-tests
    - Pfb muxed readout
    - Differential pair p-side signal integrity test
  + Experiment setup
  + Results
    - Single-shot measurement
* Zcu216 5-fluxonium chip measurement.
  + Related-tests
    - Software development: Integrate generic sequence with qiskit
    - Muxed heterodyne readout
    - Two boards synchronization with pmod trigger
  + Experiment setup
  + results
* Focus on the following aspect
  + How we improve signal quality to make it usable in qubit measurement.
  + Comparison with traditional instruments (AWG).
  + Introduce what are the important factors a qubit control and measurement system need to have.

**Introduction**

High speed readout and control system are essential to qubit operations. Traditionally, time domain qubit measurement and control involve many separate components. The basic instrument needed are arbitrary waveform generator (AWG), RF source, IQ mixer, and digitizer. Such time-domain systems are not only space consuming, but also complex in wirings and software control. Worst of all, the high cost of instrument sets result in difficulty of scaling up for multi qubit systems. Here we adapt the qubit instrumentation and control kit (QICK) [1] based on Xilinx Field-programmable gate array (FPGA) RFSoC evaluation board and perform several qubit experiments such as 1Q qubit characterization (Rabi, T1, T2, etc.), 1Q randomized benchmarking, 5Q experiment. We achieved similar measurement results, but using only the two instrument QICK and RF source. The AWG and digitizer are completely replaced by QICK. Furthermore, as the time resolution of FPGA product keep improving, the RF source may not even be needed – a single QICK alone can perform all the tasks in the future. Such space and cost efficient RFSoC boards are ideal building blocks for developing quantum computers.