64 Element Microphone Array

- Electret Microphone

- NIST Mark II, version 2 uses the WM-52BM, electret microphone (impedance <= 3k, 1.5V, 300uA, -44dB sensitivity, >60 dB SNR) (Frequency Response above) and 2cm spacing. \( F_{\text{max}} = \frac{340 \text{ ms}}{2 \times 0.02} = 8.5 \text{KHz} \)

- None of the Digikey high volume electret microphones has the flat frequency response

- Panasonic shows on their website a WM-64PC that would work. Unfortunately, Digikey (Panasonic Distributer) says this is an obsolete part number (Frequency Response above).

- After a lot of digging, the Soberton EM-6050P (Digikey 433-1093-ND, $1.96) looks like our best electret microphone (Frequency Response above)

- Pin diameter is 0.02” – not shown on datasheet

- Op-Amp

- NIST Mark II, version 2 uses the TI op-amp OPA2228
  - VNoise=3nV/sqrt(Hz), INoise = 0.4 pA/sqrt(Hz), GBW=33MHz, Slew = 10V/us, +/- 2.5V but not spec’d at +/- 2.5
  - Not sure why they used a dual instead of a quad
  - Still available
- **OPA1604** is a more current option from TI
- **SOIC to PDip adapter** from Digikey

- Potentiometer for gain setting and reference voltage

  ![Potentiometer Diagram]

- **490-2661-6-ND**
  - 1.3mm = 0.051”
  - 1.2mm = 0.047”
  - 1.6mm = 0.063”
  - 2.0mm = 0.079”
  - Pin1,3 Pad is 0.051 x 0.063
  - Pin2 Pad = 0.079 x 0.063

- **Microphone spacing**
  - \( f \times \lambda = c \)
  - Max frequency is 20kHz, so \( \frac{\lambda}{2} = \frac{1.7\text{ cm}}{2} = 8.5 \text{ mm} \)
  - Diameter of the EM-6050-P is 6mm so this spacing is no problem.
  - 16 element array will be 25.5 cm long

- **USB Based ADC**
  - **User Guide**
  - Requires external power
    - Adapter: 780046-01 - $48
    - Power Cord:
  - Part numbers for Headers on board:
    - 34 pin (J1): 3M: **N2534-6002RB**
      - Mating connector: Digikey **MSVP34-ND**
    - 50 pin (P1): 3M: N2550-6002UB
      - Mating connector: Digikey **MSPV50-ND**
  - AO0,1 output to BNC
  - Clock in and out on PFI 12 and 13
  - Mounting Hardware (from Nutfield7 for LDV project)
- BNC, Right Angle, PCB Mount ([ARF1065NW-ND])
- Clock Fanout Buffer
  - NB3N551DR2G ($1.75 each)
  - 1 to 4 CMOS clock buffer up to 180 MHz
  - SOIC 8 package
- MultipleDaq.vi: Prototype microphone array with 4 Elvis Units and common clock
- Clock out on PFI13, Clock in on PFI12
- Configure PFI13 outside while loop with 1 second delay to make sure all 4 Analog Inputs are configured.
- No phase delay since the FGen output is connected to AI0+ on all 4 DAQ board
- These are multiplexed ADC so you expect to see 15/16/Fs delay between Channel 0 and Channel 15. At 50 KHz, that is almost 20us which is almost ½ a period of a 20KHz signal. So, this needs to be compensated for by upsampling by 16 and lining the samples up like they really occurred in time and then decimating by 16.
- I tried to add an 74hc04 for clock buffering but it caused more clock glitching
  - Test Points Digikey 5011K-ND
- Microphone Array Arrangements