1. White noise of resistors in LPF

\[
V_{j53k} = \sqrt{4 \times 1.67 \times 10^{-23} \times 300 \times 53000 \times 150} \\
= 0.399 \text{ } \mu\text{V}
\]

\[
V_{j106k} = \sqrt{4 \times 1.67 \times 10^{-23} \times 300 \times 106000 \times 150} \\
= 0.564 \text{ } \mu\text{V}
\]

Total noise = \(V_{j53k} \times \text{Gain} + V_{j106k}\) \\
= 0.399 + 2 + 0.564 \mu\text{V} \\
= 1.362 \mu\text{V}

2. NPF

At gain = 10, BW of 741 is \sim 100kHz (datasheet

\[
C \quad \frac{159k}{11} \quad \frac{159k}{11} \quad \text{mV}
\]
\[ V_{159k} = \sqrt{4 \times 1.67 \times 10^{-23} \times 300 \times 159000 \times 100000} = 17.85 \mu V \]

\[ V_{1.57m} = \sqrt{4 \times 1.67 \times 10^{-23} \times 300 \times 159000 \times 100000} = 56.45 \mu V \]

**Total Noise** = 17.85 \times 10 + 56.45 \mu V = 234.9 \mu V

3. **Noise Reduction Techniques**

- Twist leads from volunteer electrodes
- Shield leads
- Short wires on protoboard
- Twist/shield wires to terminal block
- Make BW as small as possible
- Better (lower noise) op amps
- Low noise resistors & caps
- Smaller realista values

We just use inexpensive components.

Higher noise