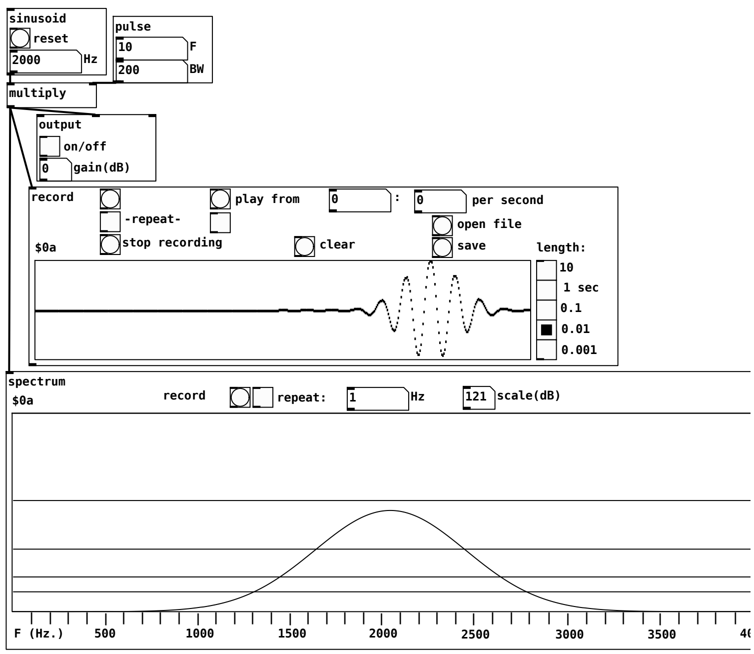
Lab: *The Heisenberg uncertainty principle.*

A rough statement of the Heisenberg principle is that the product of the standard deviations of a time-domain signal and of its frequency content is never less than $1/(4\pi)$, with equality achieved if both are Gaussian. Here is a patch to test this:



Without finding the exact constant, you can check the proportionality relationship as follows. As shown, set the sinusoid frequency to 2000 and the pulse frequency to 10. Test three different values of the pulse bandwidth: 50, 100, and 200. For each one, measure the duration in time of the pulse using the "record" object and the bandwidth of the peak in the spectrum. (For our purposes, the bandwidth of a peak is its width at half its height, that is, the x distance between the points on the side of the peak where the height is half as high as the highest point)

For each of the three bandwidths, report the two peak widths (in seconds for the recorded peak and in Hertz for the spectral peak) and multiply them to get a dimensionless quantity. Theory predicts that the product should be the same in all three cases.

(To test the constant of proportionality, you would need to find the half peak widths at the points where their linear amplitudes are $\exp(-1/2) \approx 0.6$ times the peak value; the peak height in dB (for the spectrum) should be -4.5 dB lower. This is tricky to measure given the tools available but I tried and got about 1/8 where I should have found 1/12. Hmm... close enough for Jazz I guess.)