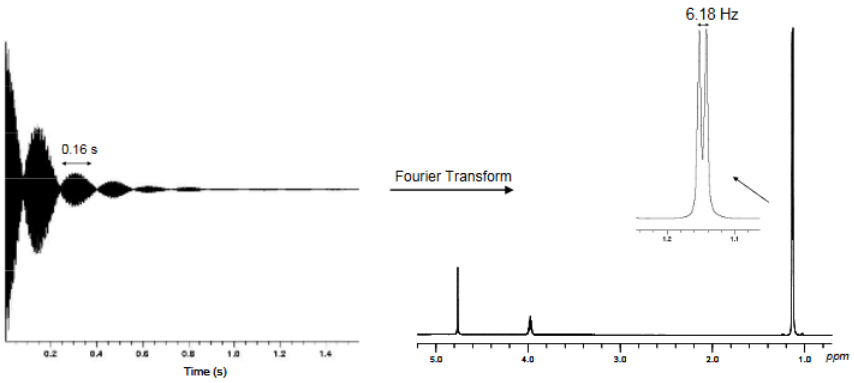
1.9: What is the Free Induction Decay?

The signal we detect is called a **Free Induction Decay** (FID). The FID is produced by the macroscopic magnetization after the pulse. The magnetization will undergo several processes as it returns to equilibrium. First immediately after the pulse, the transverse component of the macroscopic magnetization, M_{xy}, will begin to precess at its Larmor frequency. This precessing magnetization will induce an alternating current in a coil (the same one used to generate the rf pulse) wound round the sample. This induced AC current is our FID, such as the one shown below.



The FID contains all of the information in the NMR spectrum, but it is difficult for us to discern the information in this format. Fourier transformation of the FID, a time domain signal, produces the frequency domain NMR spectrum. The resonance frequencies of the signals in the transformed spectrum correspond to the frequency of oscillations in the FID. In this FID measured for isopropanol, the 0.16 modulation of the FID is due to the 6.18 Hz difference in frequency of the resonances of the intense methyl doublet. The intensity information of each component is contained in the intensity of the first point of the FID. The signals that comprise the FID decay exponentially with time due to relaxation processes discussed in the next section. The rate of decay for each component of the FID is inversely proportional to the width of each NMR resonance.