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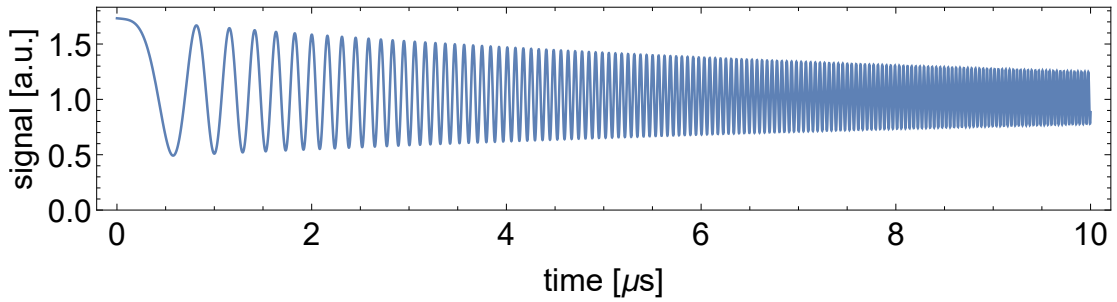
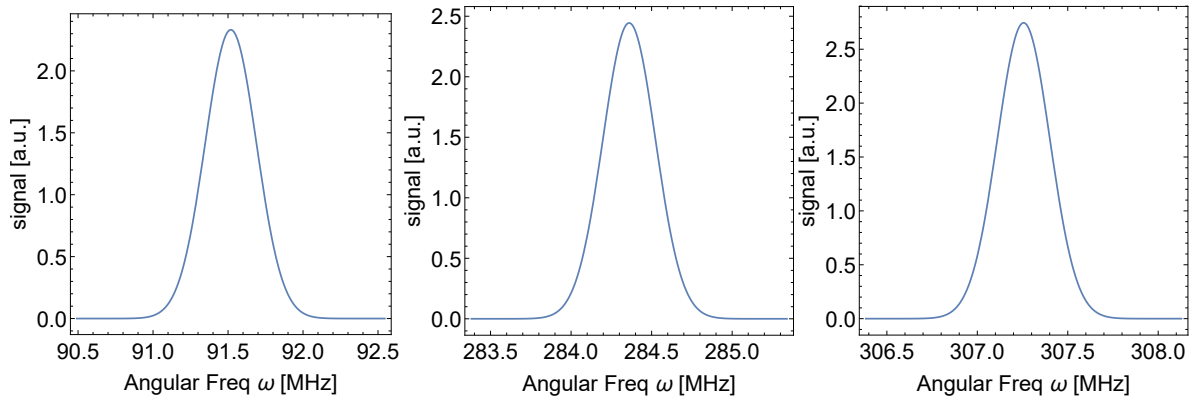
Wind of change

A Doppler LIDAR (light detection and ranging) is a powerful technique which is used for instance at LMD (one of the labs at l'X) to estimate the velocity of the wind as a function of altitude.
A laser pulse (wavelength 2 μm) is shot towards the sky. Upon propagation, part of this light is back scattered towards the source by atmospheric particles. The back scaterred field is coherently superposed with the source laser, and the resulting beam is sent onto a time resolved photodiode, which produces a voltage proportional to the beam intensity. Taking the time origin at the pulse emission, the corresponding signal looks like this :



Data treatment consists in performing a spectral analysis of the signal on short time windows. Below are shown the spectrum obtained around 10, 50 and 75 μs after the pulse emission



Estimate the wind speed (along the line of sight) at an altitude of 7.5 km.