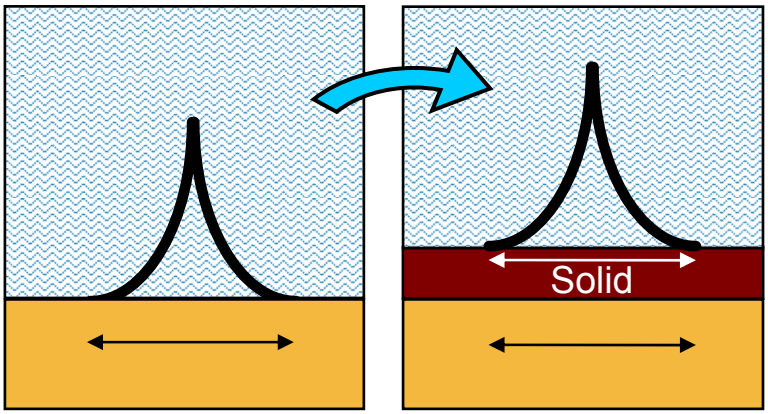
Q-Sense Detection Range

The detection range out from the sensor surface depends on the penetration depth of the oscillatory motion of the medium/applied layer on the sensor, which in turn depends on the viscoelasticity of this applied film or medium. The range varies from **nanometers** to **micrometers**, and is approximately 250 nm in pure water.

Applying a very rigid film such as a metal (or, a polystyrene film) still gives the same detection range as without, since no dampening will occur within the applied layer (see figure). A metal film thicker than a few µm may however induce strains that influences the stability of the measurement.



The exact penetration depth, *d*, in a homogeneous medium consisting of a bulk Newtonian fluid is:

$$d = \sqrt{\frac{visc}{\pi \times freq \times dens}}$$

where viscosity is given in [kg/ms] and density in [kg/m3]. For a Q-Sense standard 5 MHz crystal, these values in water at 20°C are:

Harmonic:	(nm)
Fundamental	252
3rd	146
5th	113
7th	95
9th	84
11th	76
13th	70

(Kanazawa, K. K. and Gordon, J. G., *Anal. Chem.* **1985**, *57*, p1770)