(1)

$$\#\,\text{cycles} = \frac{\Delta\phi}{2\pi} = \frac{K d \Delta n}{2\pi} = \frac{d\Delta n}{\lambda}$$

for air → vacuum, $\Delta n = 3\times10^{-4}$

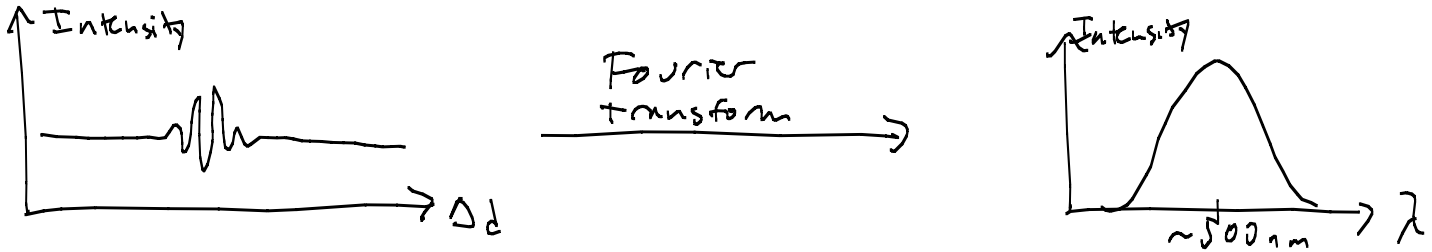
If $d = 20$ cm $(2\times10\,\text{cm})$, and $\lambda = 6.33\times10^{-5}$ cm,

There are $\dfrac{20\times3\times10^{-4}}{6.33\times10^{-5}} \sim 94$ cycles

(2) (i) White light is composed of a wide spectrum of colors (wavelengths). Each component picks up different phase differences when passing through the interferometer paths, especially when rays are at angles to the normal, so constructive and destructive interference occurs at different points for each wavelength.

(ii) You would see the Fourier Transform of the white light spectrum,

e.g.



(3) modified Michelson; light takes 2 round trips through each arm before combining due to corner cubes.

(4) See lecture #8, p.4:

$$X_0 = \frac{\lambda L}{d} = \frac{10^{-4}\,cm\;\; 10^{2}\,cm}{d} = 10^{-1}\,cm$$

$$d = \frac{10^{-4}\;\; 10^{2}}{10^{-1}} = 10^{-1}\,cm \quad (1mm)$$