

Beam Steered AO Deflectors: Phase Calculation between adjacent RF Channels

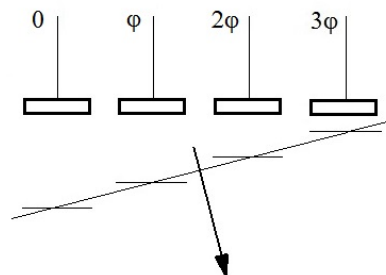
The formula for determining exact phase matching in a longitudinal mode beam steered AOM is (in radians):

$$\phi(f) = \pi \cdot \left[\frac{D \cdot \lambda_o \cdot 10^{-6}}{v a^2 \cdot n_o} \cdot f^2 \cdot \left(1 - \frac{f_1}{f} \right) \right]$$

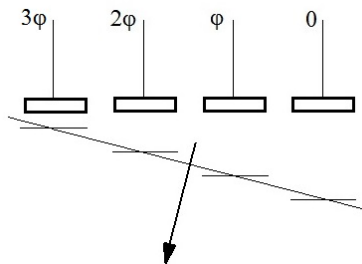
D	distance between electrodes (mm)
n _o	refractive index
f	frequency (MHz)
f ₁	frequency at desired center*
λ _o	free space wavelength (nm)
v _a	acoustic velocity (m/s)

This the same regardless of the number of electrodes.

When $\phi(f)$ is positive, the arrangement is



and when negative,



* f₁ is typically the device centre frequency, F_c.

Alternatively for near balanced + and – phase values over the bandwidth, set the desired centre $f_1 = f_c \cdot f_c^2 / (f_{\min} \cdot f_{\max})$, where $f_{\max} - f_{\min} = \text{scan bandwidth}$.

Examples:

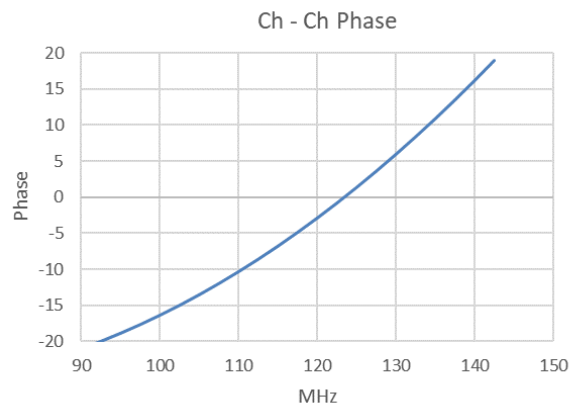
1: D1384-aQ120- (Quartz AOD, $F_c=120\text{MHz}$, $BW=40\text{MHz}$),

$D = 5.5\text{ mm}$, $n_o = 1.55$, $v_a = 5.72\text{ mm}/\mu\text{second}$

$f_1 = 123\text{ MHz}$ (for balanced phase)

$\lambda_o = 355\text{ nm}$

A plot of phase in degrees versus frequency is shown below



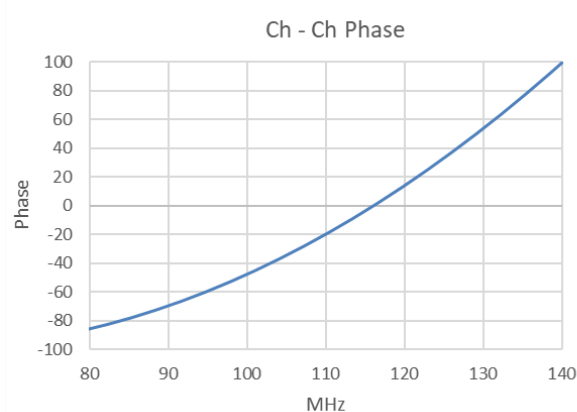
2: D1086-T110- or D1135-T110- (TeO₂ AOD, $F_c=110\text{MHz}$, $BW=50\text{MHz}$),

$D = 6\text{ mm}$, $n_o = 2.2$, $v_a = 4.2\text{ mm}/\mu\text{second}$

$f_1 = 116\text{ MHz}$ (for balanced phase)

$\lambda_o = 1064\text{ nm}$

A plot of phase in degrees versus frequency is shown below



2: D1319-T220- or D1445-T220- (TeO₂ AOD, Fc=220MHz, BW=100MHz max),

D = 4.4 mm, no = 2.3, va = 4.2 mm/μsecond

f1 = 229 MHz (for balanced phase)

λ_o = 399 or 405 nm

A plot of phase in degrees versus frequency is shown below

