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Beam Steered AO Deflectors: Phase Calculation between adjacent RF Channels

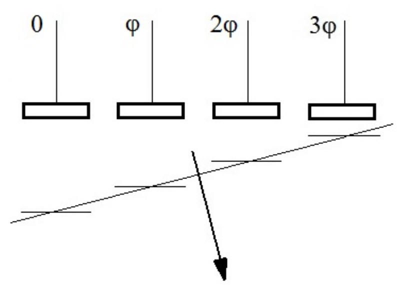
The formula for determining exact phase matching in a longitudinal mode beam steered AOM is (in radians):

$$\varphi(f) = \pi \cdot \left[\frac{D \cdot \lambda o \cdot 10^{-3}}{va^2 \cdot no} \cdot f^2 \cdot \left(1 - \frac{f1}{f}\right)\right]$$

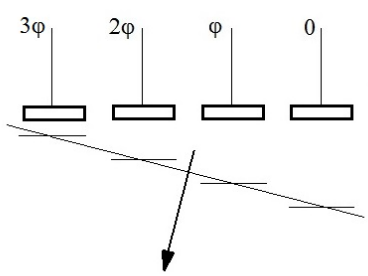
D	distance between electrodes (mm)
no	refractive index
f	frequency (MHz)
f1	frequency at desired center*
λo	free space wavelength (nm)
va	acoustic velocity (m/s)

This the same regardless of the number of electrodes.

When ϕ(f) is positive, the arrangement is



and when negative,



* f1 is typically the device centre frequency, Fc.

Alternatively for near balanced + and – phase values over the bandwidth, set the desired centre f1 = fc*fc^2/(fmin*fmax) , where fmax-fmin = scan bandwidth .

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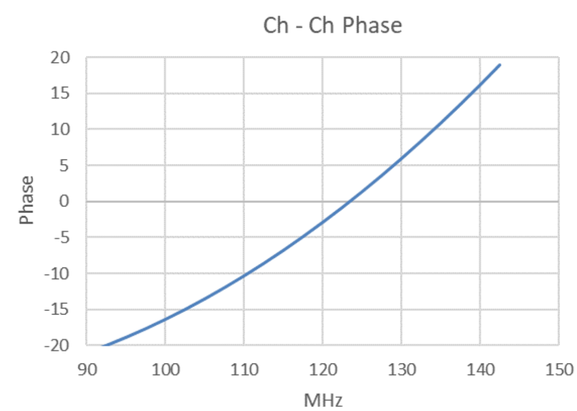
Examples:

1: D1384-aQ120- (Quartz AOD, Fc=120MHz, BW=40MHz),

D = 5.5 mm, no = 1.55, va = 5.72 mm/µsecond
f1 = 123 MHz (for balanced phase)
λo = 355 nm

A plot of phase in degrees versus frequency is shown below



2: D1086-T110- or D1135-T110- (TeO2 AOD, Fc=110MHz, BW=50MHz),

D = 6 mm, no = 2.2, va = 4.2 mm/µsecond
f1 = 116 MHz (for balanced phase)
λo = 1064 nm

A plot of phase in degrees versus frequency is shown below