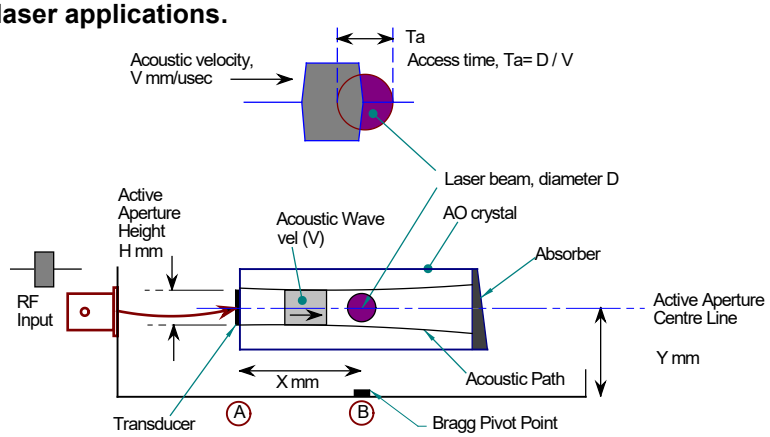
1: Timing considerations for pulsed laser applications.

Synchronizing pulsed laser output with the RF frequency points in iMS4 Image mode.

Considerations:

<u>AO device</u>
Pedestal delay (T_p) is the time taken for the acoustic packet, (RF frequency) to transit from the AO transducer to the centre of the laser beam.

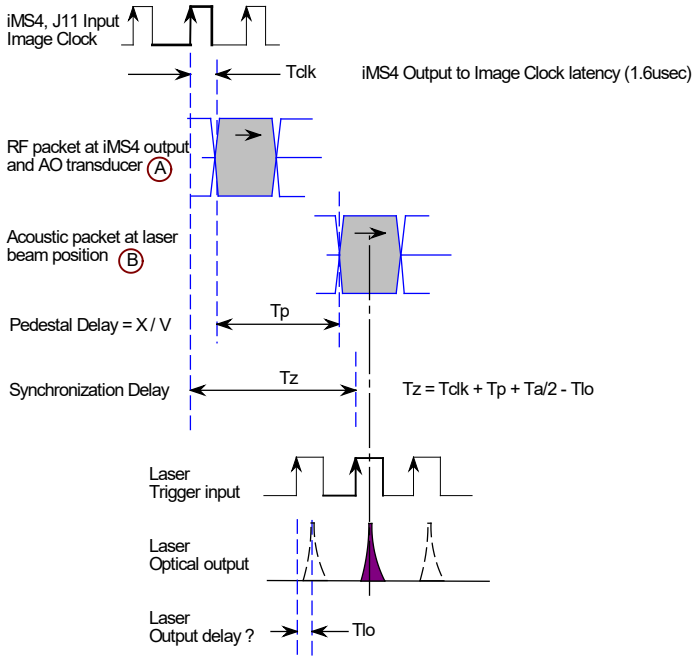
Access time (T_a) is the time taken for an acoustic packet to transit across the laser beam diameter.



<u>RF driver</u>
iMS4 output delay (T_{clk}) is the delay between the RF output and the external Image Mode clock edge on J11

Delay through RF power amplifier is minimal (<0.1usec)

<u>Laser</u>
Laser output delay (T_{lo}) is the delay between the laser output and laser trigger input.



Example: D1384-aQ110-7 (v = 5700m/s)

iMS4 Image clock to RF output latency, T_{clk} = 1.6usec

Bragg Pivot point is located ~12mm from transducer.
For a laser beam is aligned over this point, then T_p= 2.1usec

For a 5mm beam diameter, the transit delay T_a = 0.88usec

Assume 0.1usec delay between laser trigger input and the laser output pulse. T_{lo} = 0.1usec

Then $T_z = T_{clk} + T_p + T_a/2 + T_{lo}$ = 4.24 usec

This is the synchronization delay required between the Image clock and laser trigger.
For a continuously running pulsed laser the synchronization delay may be shortened by integer periods of the laser rep rate.

In this example $T_{z1} = T_z$ – (period x n) , where n = quotient of (T_z / period).

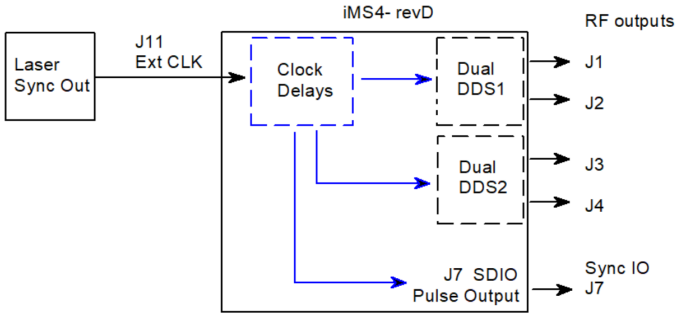
Using an 800KHz laser, pulse period = 1.25usec, n =3 and T_z becomes 0.49usec

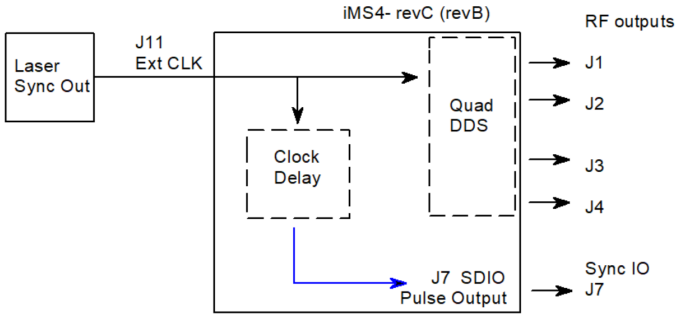
2: iMS4 Image Clock and Timing Control

The Image clock updates the RF signals on the iMS4 output channels J1..4 and the synchronous data presented on connector J7. The image clock is generated internally or applied externally via connector J11.

iMS4-revD allows a user programmable delay to be introduced between this Image clock signal and the output update for both the RF output timing and the synchronous output signal timing.

Earlier revisions iMS4-revB and iMS4-revC only allow a user programmable delay to be introduced on to the Synchronous output signal timing.





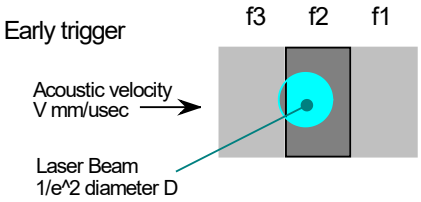
Timing control is essential when:

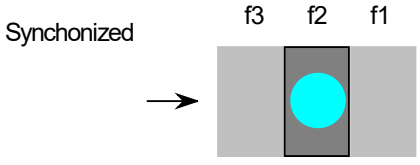
The laser rep-rate period approaches the acoustic access time* in the AO device.

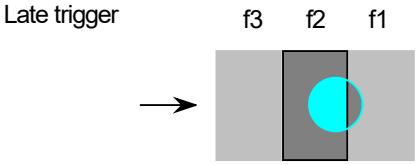
…or…

When the beam diameter is increased, the access time* approaches the Image clock period.

Rev-D offers more options for optimizing synchronization.



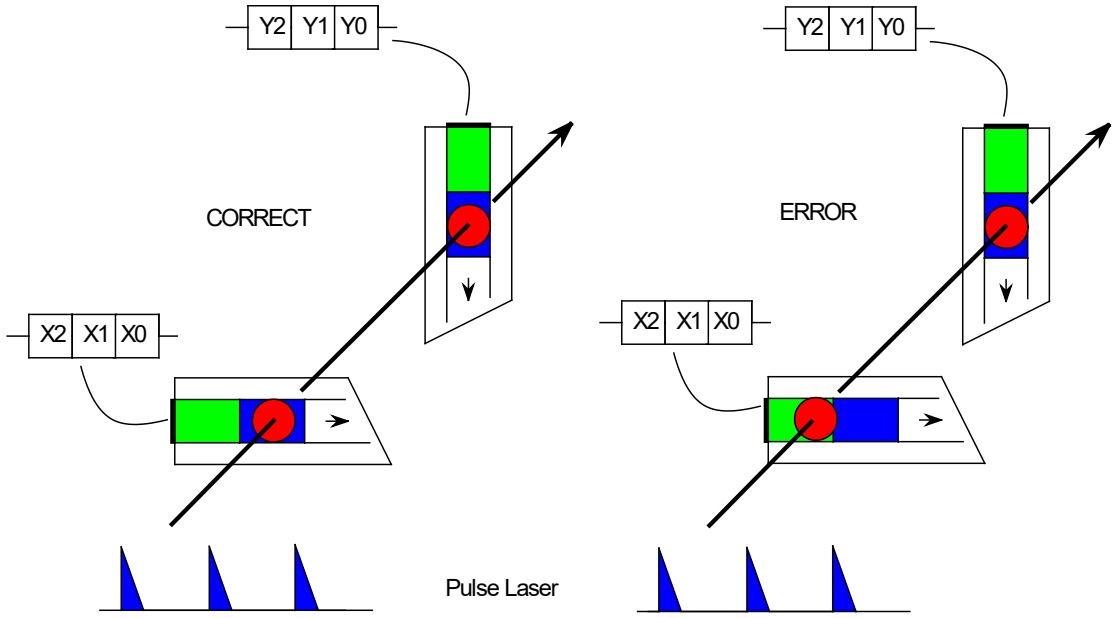




* Access time
T_a = beam diameter / acoustic velocity

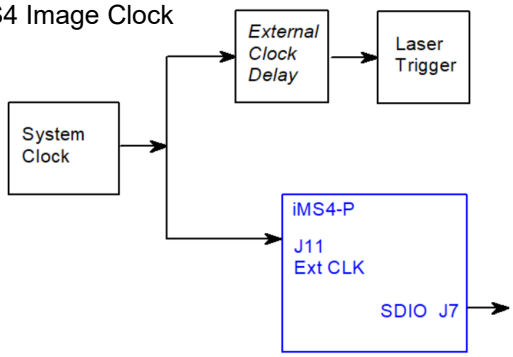
Also see AN221108

For a dual Axis XY AO deflector, correct synchronization is required in both axes.
Careful alignment of the laser beam above the Bragg pivot point on both AODs will aid this process.

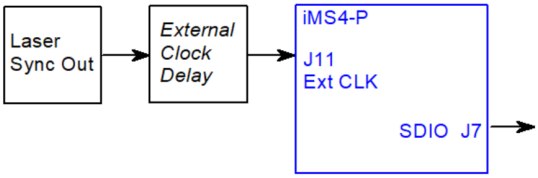


3: Possible Laser Trigger /iMS4 Image Clock Configurations

A: System drives both the Laser Trigger and iMS4 Image Clock

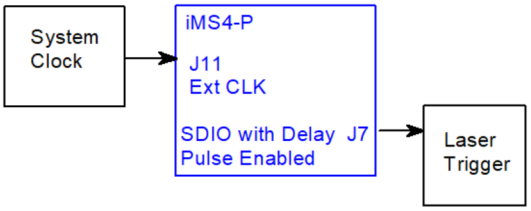


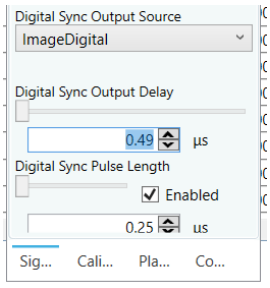
B: Laser sync output clock drives the iMS4 Image clock



The '***External Clock Delay'*** function in the above schematics is not an internal feature of the iMS4

C: iMS4 sync output (J7) triggers laser output.

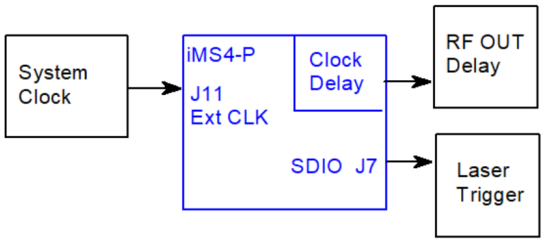


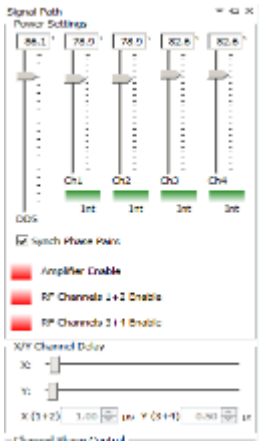


(Sync Control, Isomet Studio GUI)

D: iMS4 sync output (J7) triggers laser with RF outputs delayed.

Rev-D ONLY





(RF Delay Control, Isomet Studio GUI)