Application Note

Optical Delay Line Mirror Mount
- 9848-KT

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Technical background

An optical delay line is the common choice for all applications where the delay in the time domain between 2 or more light-pulses needs to be varied by increments in the femtosecond to nanosecond regime. The difference in path length between 2 beams divided by the speed of light gives the actual time delay. E.g. a difference in path length of 1um equals a time delay of 3.3 fs. (1 um) / (3x10^8 m/s). Note that a movement of the delay stage results in twice the total path length, e.g. 1µm movement of the stage corresponds to 6.6 fs.

Our motivation

This application-note is meant to quickly walk you through the process of "how to" align New Focus' latest delay-line mount in 7 steps. You will see that the delay-line mount has advantages over using two independent mirror mounts. The delay line mount will help to reduce alignment time and to get your experimental results more quickly.

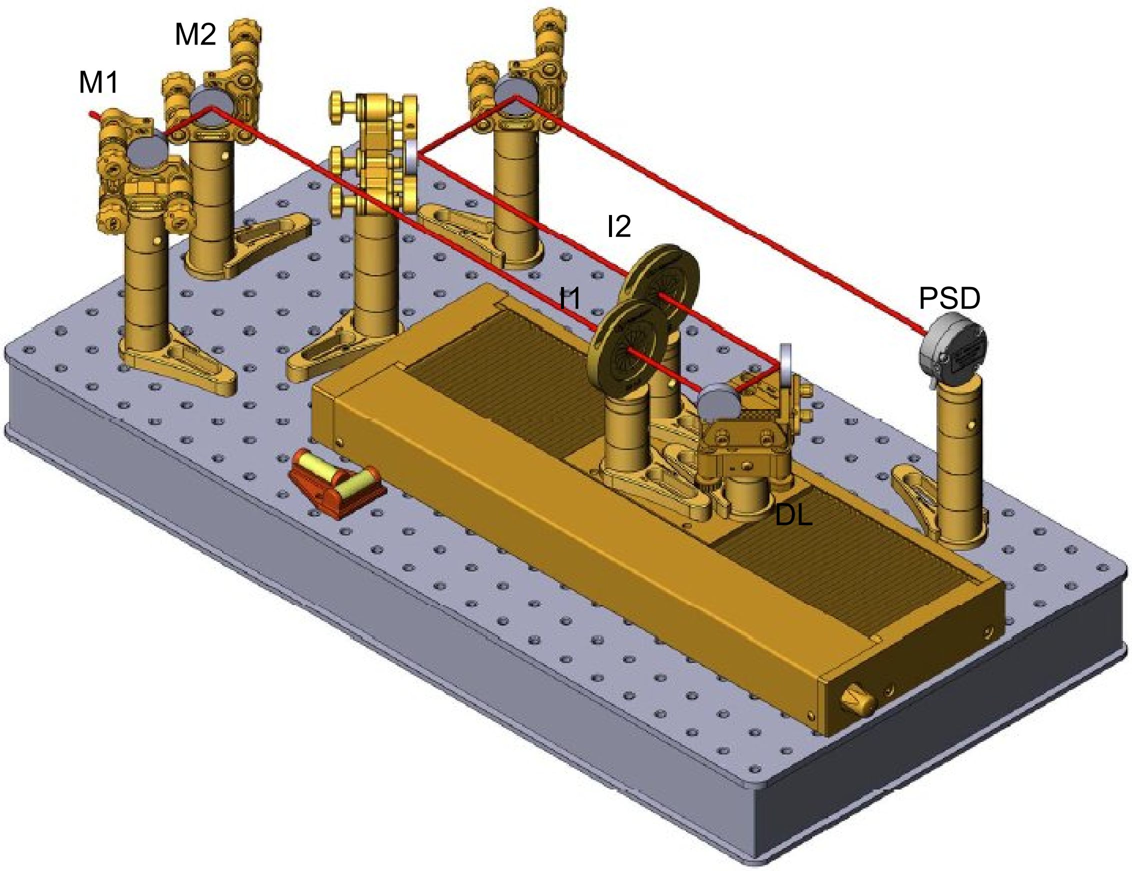


Fig1. *Schematic layout of the setup. All relevant parts are labeled individually and referenced in the text*

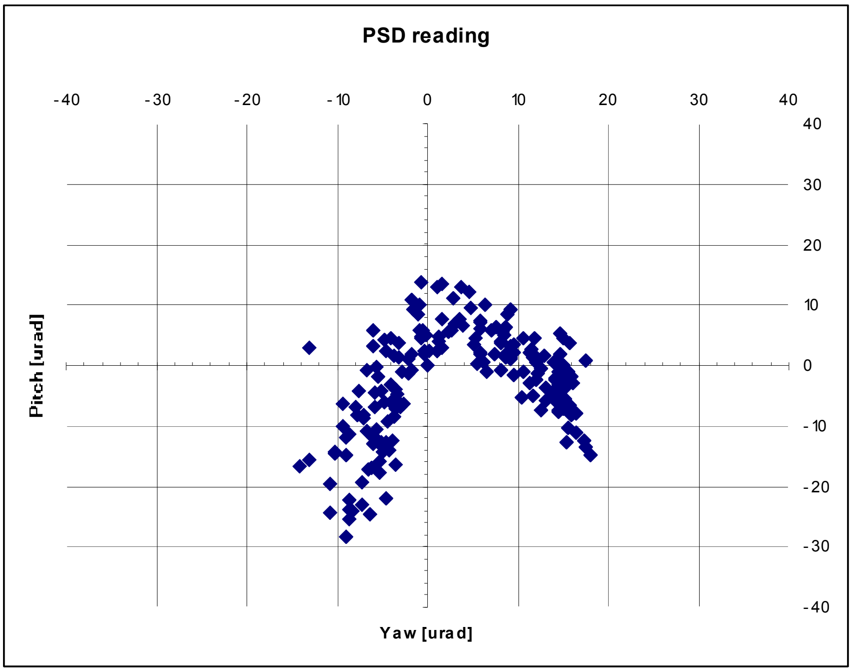
Course of action

1. Position the linear stage on your optical table and mount it to the table.
2. Place a set of 2 mirror mounts such that you can control the position of the beam and the angle of incidence (Mirrors M1 and M2).
3. Fix the delay line mount (DLM) onto the linear stage, use a spirit level to make sure it is in your working plane. Install the mirrors.
4. Position a set of two irises (I1 and I2) as shown in the picture, both on the exact same height on the stage. Pedestal posts with a defined height are your best choice for this job.
5. Close the first iris and move the delay line into the minimum delay position; now use mirror M1 to adjust the near-field on iris I1. Move the stage to its maximum delay position and align the far-field on iris I1 using mirror M2. Do a couple of iterative steps until the incident beam is parallel to the direction of travel and in the working plane above the table, i.e. the beam passes the centre of the iris in both near-field and far-field position.
6. Close the iris on position 2 and use the (centre) adjustment screw on the DLM to vertically align the beam through the iris I2. Make sure you are still in the XY plane with the help of the spirit level. If not, do a few iterative steps of correction alignment.
7. Place the position sensitive device (PSD) at approx. 1m from the DLM as shown above and use M2 for fine adjustment based on the PSD readings with a few iterative back and forth moves of the linear stage. In this example, a set of 2 additional mirrors is used to direct the beam onto a PSD which is used to measure the level of alignment of the delay stage.

Note: Usage of the PSD improved the alignment by more than 30% compared to an alignment checked only with the unaided eye.

Results

The results of an experiment performed at Newport application lab are shown below.



Results: *Deviation from the centre in both X (Pitch) and Y (Yaw) axis are shown in urad. The data points were collected over a delay of 1ns. I.e. 150mm travel of the linear stage.*

It can easily be seen from the graph that the beam deviation is less than 30 urad in both, pitch and yaw. The value for pitch exclusively arises from the stage's flatness and equals half the value shown above.

Part List

	metric	**imperial**
1x PSD	Conex-PSD9	Conex-PSD9
1x Delay line mount	9848-KT	9848-KT
1x Stage	FMS200PP	FMS200PP
2x Iris	M-ID-1.0	ID-1.0
5x Optical pedestals 4 inch height	M-PS-4	PS-4
2x Optical pedestals 2 inch height	M-PS-2	PS-2
1x Post extension	M-PS-0.5E	PS-0.5E
8x Clamping fork	PS-F	PS-F
4x Mirror holder	M-SN100-F2K	SN100-F2K
6x Mirror	10D20ER.1	10D20ER.1
1x Controller, e.g.	SMC100PP	SMC100PP
1x Optical pedestals 1 inch height	M-PS-1	PS-1
3x Optical pedestals 0.25 inch height	M-PS-0.25	PS-0.25
2x Optical pedestals 0.125 inch height	M-PS-0.125	PS-0.125

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