BeamLock

BeamLock® 2D / 4D

Two- or four- dimensional beam stabilisation

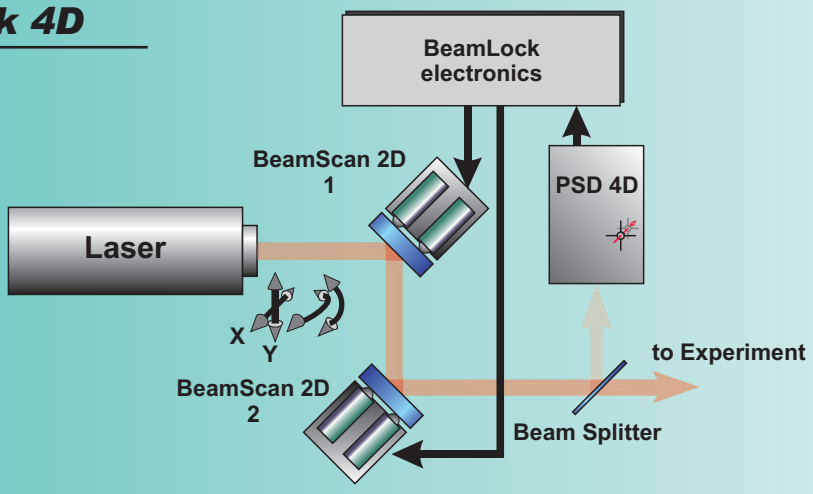
In two (translational or rotational) or four (translational and rotational) degrees of freedom

Compensation of mechanical drifts

Automatic alignment of laser beams

Stabilized scanning

Principle *BeamLock 4D*



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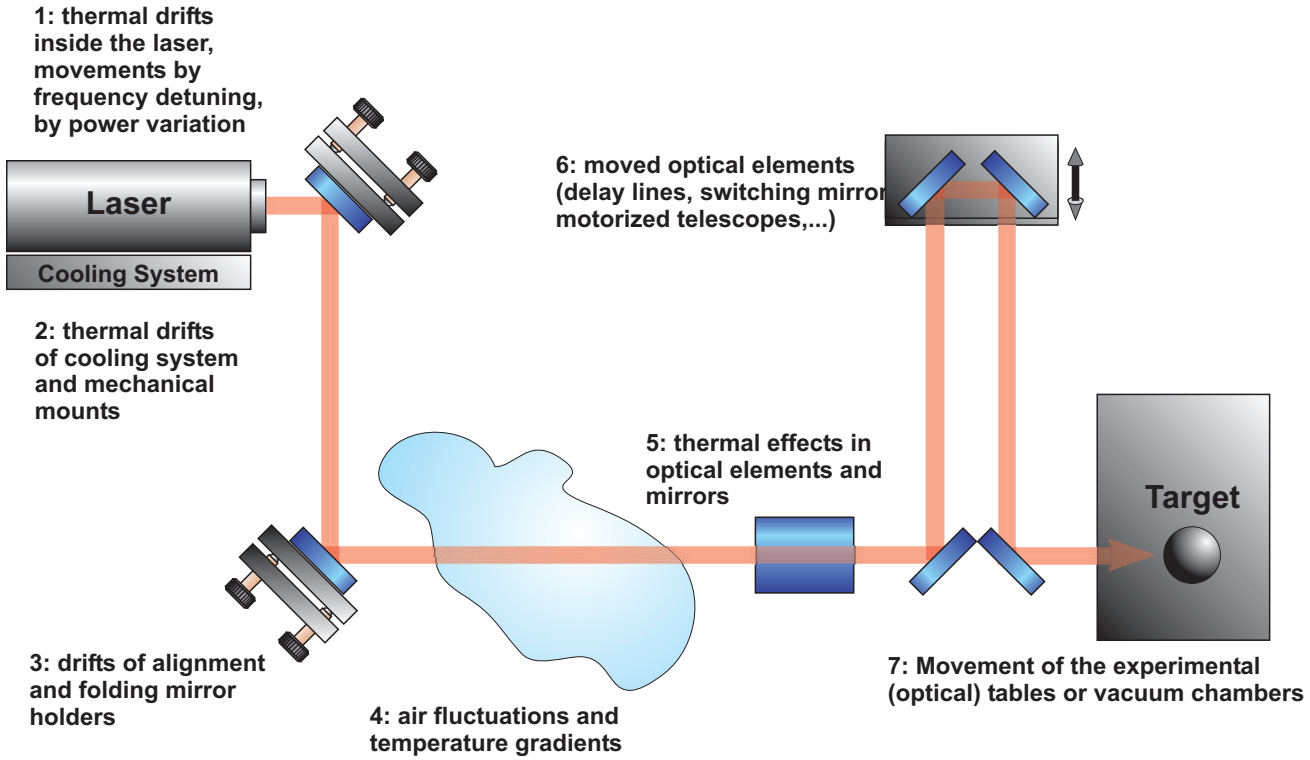
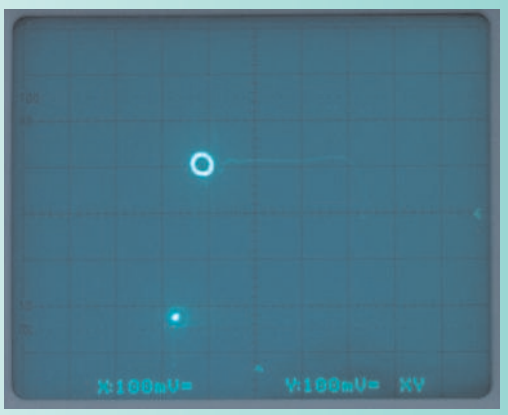
Principle of Operation

Laser beams, used in an experiment or in industrial applications, can move in space for many reasons:

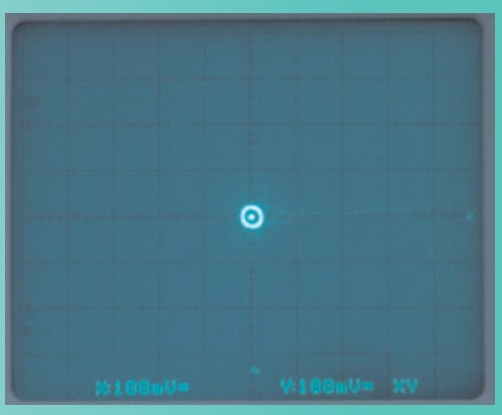


The laser beam pointing stabilization system *BeamLock*® compensates for all of these disturbances. The laser beam position and its angle are measured by the 4D position sensitive detector PSD 4D in four degrees of freedom (two beam positions "X" and "Y", and two angles " " and " "). The position of a (collimated) laser beam is characterized by these four values. The measured deviation signals of the laser axis with respect to the reference axis are processed continuously by the *BeamLock*® electronics. Herein control signals for four piezo actuators of the BeamScan mirrors are generated. *BeamScan* contains two 2D movable mirrors, which control these four degrees of freedom in four fast closed lock loops to keep the laser beam exactly at the reference axis.

The beam position is displayed on an oscilloscope screen as a dot (PSD 1, representing the beam position X, Y) and a small circle (PSD 2, representing the beam angle).



Laser out of lock



Laser beam locked

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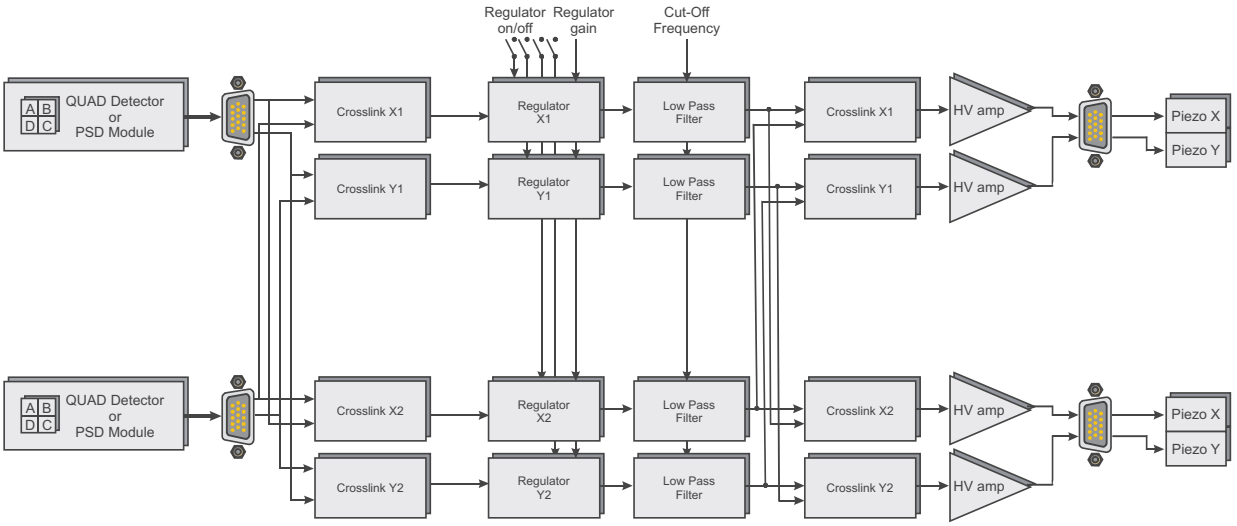
Block Diagram *BeamLock 4D*

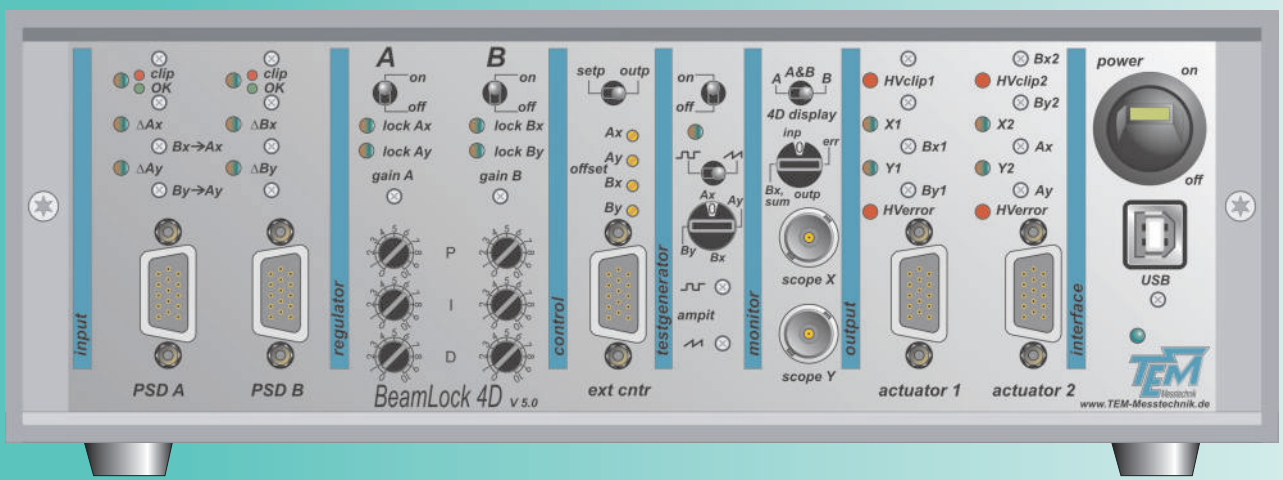
BeamLock® is a modular system, consisting of different elements, which can be adapted to the individual application: Different types of scanners (with various values of displacement, beam diameters, mirror types, movement speeds) and different types of PSDs (Position Sensitive Detectors) with various types of sensors (wavelength, beam diameter, resolution, dimensions, QUAD or duo/tetra lateral PSDs) are available.



*Cross-link section: for diminuation of crosstalk between rotation and translation signals

Control Elements

PSD input with signal range and clip check for each channel X1, Y1, X2, Y2
Set point definition (X1, Y1, X2, Y2), fixed, external, or by test generator
Modulation connectors which allow for modulation of either the set values or the output signal
Error calculation (4D actual position - set position)
Test ramp generator for alignment purposes and system check
Gain and regulator control logic
Four PIDT2 regulators
Cross-link circuitry
Four (or six, resp.) output piezo amplifiers, including output display
Monitor multiplexer, including 4D chopping display
USB port for digital settings and read-out



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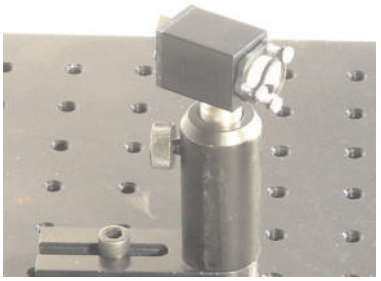
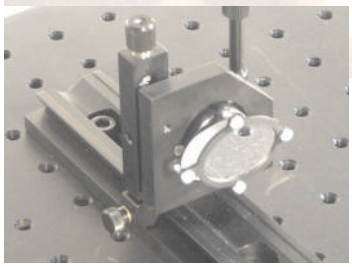
BeamScan OneInch actuators

We recommend to use *BeamScan OneInch* as piezo-driven mirror mounts to rapidly redirect your laser beam. *BeamScan OneInch* is available for 1/2", 1" and 2" mirrors. It fits into standard 1" adjustable mirror mounts. The cuboid corpus with its M4 thread also mounts easily on posts.





Specifications:

Angular stroke:	5 mrad
Driving voltage	0…150V
Capacitance	800nF
Resonance freq	up to 3kHz
Connector	Binder 4-pin

Mirrors available on request.

BeamScan 2D or *BeamScan 4D* are compact modules to rapidly redirect your laser beam in two rotational (or in two rotational and two translational, respectively) degrees of freedom. The angular stroke is much higher than with *BeamScan OneInch.*

Specifications:

Angular stroke:	10..100 mrad
Driving voltage	0…200V
Capacitance	160..1200nF
Resonance freq	depends on mirror, approx 100Hz
Connector	HD15 (VGA-like)

Mirrors available on request.

The *PSD* (position-sensitive detector) is delivered either as open PCB or inside a small aluminium housing, which easily mounts to an optical rail system or posts.
The separate PSD electronics includes the normalization, i.e. the division by the sum signals which makes the output signal independent of the laser intensity.
A sample-and-hold stage for pulsed lasers is available.

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Mechanically moved optical elements

Sometimes optical elements have to be moved within the application:

Motorized or Manual Telescopes or Zoom Expanders

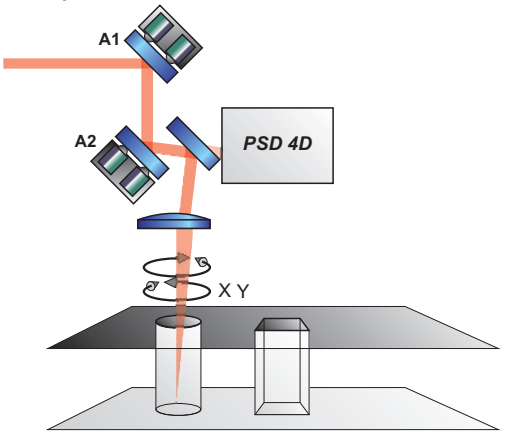
In some applications setups of optical lenses have to be moved (telescopes, zoom tele-scopes, expanders,…) It is impossible to position and move these elements exactly at the optical axis. Thus a beam pointing movement will be watched during the movement of the optical element.

Switching Mirrors

In some applications the laser beam is switched between two paths of the experiment by a manually or by a motorized switching mirror. The reproducibility of the mirror position may be very high, but will not be perfect. Residual

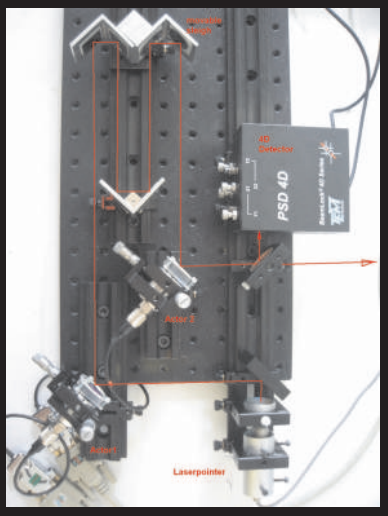
Fast 4D stabilized scanning

- Micro machining
- Micro drilling
- Arbitrary hole shapes



Delay Lines

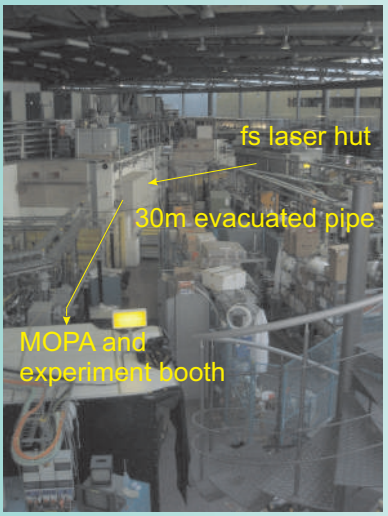
In short pulse laser systems (ps or fs durations) so-called delay lines are often used to match or shift two laser pulses in time with respect to each other. A set of several mirrors is moved by a motorized sleigh witch has to be aligned to be exactly parallel to the optical path. This can only be done to a certain state; it is difficult to align better than some ten microns. In addition the motorized rail is not perfectly straight; there will be curvatures in the order of typically some ten up to some 100 microns, depending on the length and the price of the rail.



Movement of the experimental (optical) tables or vacuum chambers

Often the laser and the experimental target are mounted at different optical tables. Many experiments are located in small or large vacuum chambers. Those components will be at different and changing temperature values. This leads to relative pointing drifts, even if each element is very stable.

Photograph on the right: *BeamLock*® installed between fs-laser and experiment at BESSY Berlin (distance 30m).



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Technical Data

Control and PD inputs:	max. ± 5 Volt
Regulation bandwidth:	DC ... 10 kHz
Filter:	2nd order low pass 150 Hz...8 kHz
HV-output:	0 … 150V (maximum value adjustable), max. 150 mA per channel
Housing dimensions:	88 mm x 260 mm x 209 mm (H x W x D)
Supply voltage:	100...120 V / 200...240 V, 50 ... 60 Hz

Subject to change without notice. Customer specific solutions on request.

Development, Manufacturing and Distribution

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