„Compact“ Laser Beam Stabilization
PSD detectors and *Adjust-In* function

1. Introduction

The Laser Beam Stabilization *Compact* can be operated with different detectors. In most cases we recommend to use 4-quadrant detectors. However, in some applications it can be advantageous to use our optional *PSD* detectors. This is especially the case if the stabilized target position shall be adjusted electronically. For this application, our system can be equipped with the *Adjust-In* function, which we present in this paper.

With the 4-quadrant detectors, the target position is always defined by the center of the sensor. With *PSD* detectors, in contrast, the target position can be any point on the sensor surface. Its position can be freely selected and varied by the *Adjust-In* function. The sensor of the *PSDs* has a very fine grid structure. The resolution of the detectors depend on the beam diameter and reach the sub-micrometer range.

The sensors of both detectors are shown in figures 1 and 2. At the 4-quadrant detector, the thin lines between the sectors are clearly visible. Their intersection point specifies the target position for the laser.

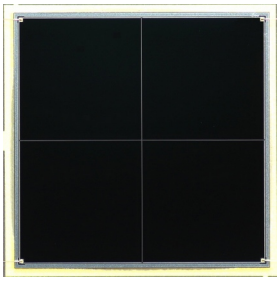

Figure 1: Sensor of a 4-quadrant detector

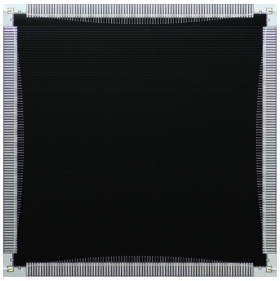

Figure 2: Sensor of a PSD detector

2. Applications

The possibility to shift the target point on one or both detectors of the beam stabilization can be used for different applications. The three most common are:

1) The detectors are already placed in the setup before the final adjustment of the laser. After the laser adjustment, the target positions are read out on the *PSDs* and the laser beam is stabilized onto these. For convenience, the current laser position can be set as the new target position by one click via the *Set&Hold* function in our software.

2) Conversely, it is also possible to perform the final laser adjustment by electronically shifting the target positions on the *PSDs*. Fine adjustment is thus made solely electronically via the piezo-driven mirrors, so that there is no need to re-adjust the mirrors manually.

3) The laser beam is moved to different points during operation. With a continuous variation of the target points, the laser beam can be moved along a defined path. In doing so, the laser follows the external input but remains stabilized with the highest resolution during the movement.

3. Description

In the default state, the system stabilizes the beam onto the electronic center of the *PSD* detector. This center is defined by a voltage of 0 V for the x and y position. Via the *Adjust-In* function it is possible to add offset voltages to these values. They shift the target position on the sensor accordingly. The laser is stabilized onto this new position.

By using a 4-axes system with two *PSD* detectors, the target positions on both detectors can be changed independently. This allows both, the beam position and the beam angle to be varied electronically.

The offset voltages can be set via the optional serial interface or software. Figure 3 shows the parameters window of our software. Using the *Set&Hold* function, the current laser position can be set as the new target position by clicking "*Set*". This enables the above application 1. For application 2, you can use the input mask labelled with *Adjust-In* and enter the desired values for x and y manually.

For application 3 you can for example send commands via the serial interface to move the laser to the desired position.

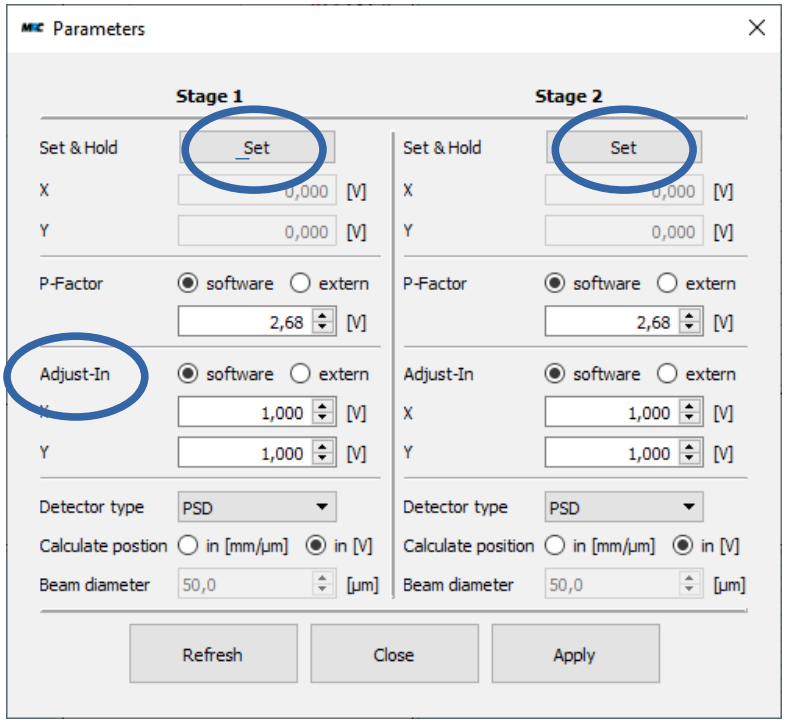

Figure 3: Parameters window of the software to set the target position.

We can equip the controller with optional analog voltage inputs. This makes it possible to apply the offset voltages to the system via an external voltage source. This can be especially advantageous for application 3, if you want to move the target points with a signal generator.

Figure 4 shows the analog inputs *"Adj1"* and *"Adj2"* on the controller. Voltages in the range of -5V ... +5V can be applied.

Figure 4: Side panel of the Compact controller with additional "Adjust-In" inputs for electronic adjustment of the x and y positions on the PSD detectors.

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