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Technical Bulletin

3D Drop Imaging for a special recognition of the deposited drop

Introduction:

Non-contact piezo dispensing has displaced pin spotting in most applications. There are many benefits to contact free spotting including stable drop performance, full control of the drop volume and the ability to maintain the integrity of target surfaces. These benefits have turned piezo dispensing into the method of choice when it comes to spotting microarrays, biosensor loading and many more applications. The standard method for positioning a nozzle in non-contact spotters is to align the nozzle to a special mark within the controlling monitor of the spotter (Fig. 1).
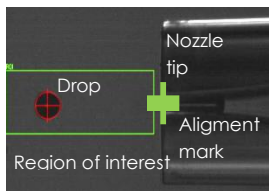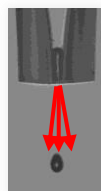

Figure 1. Alignment mark

Figure 2. Deviated path of flight of a drop

It is clear, that the positioning can only be performed precisely in two dimensions: Left-right and up-down. Depth, as the third dimension, is missing. To overcome this, the drop is used as determinant for the depth. This method is sufficiently accurate for most applications.
Sometimes however, a drop can be deflected and take a deviated path of flight (Fig. 2). SCIENION have developed a new and highly precise drop positioning method.

Setup:

The 3D-DropCam system is set up using two independent horizontal CCD cameras (Drop Cam 1 and 2) mounted at a 90° angle (Fig.3). They are illuminated by two strobe lights.
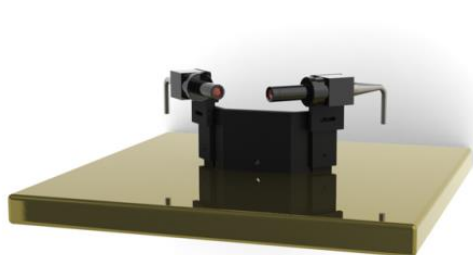

Figure 3. Schematic setup

Mode of action:

Upon drop dispense, each camera captures and image of the dispensed drop from an angle of 90° thus creating a 3D image of the drop. This allows for precise determination of the drop position within the range of a couple of pixels (Fig.4; 1 pixel = 2µm). The alignment of the cameras is generated by an alignment tool which consists of a reflective surface with a black mark on it. The black mark represents the target surface and is the reference point, to where the drop is forced.

There are several capabilities of this technology:
- Active shifting of the drop towards the process level.
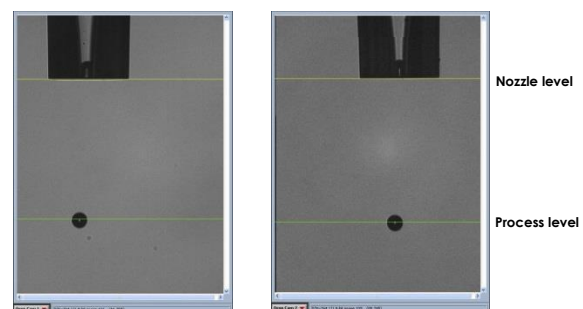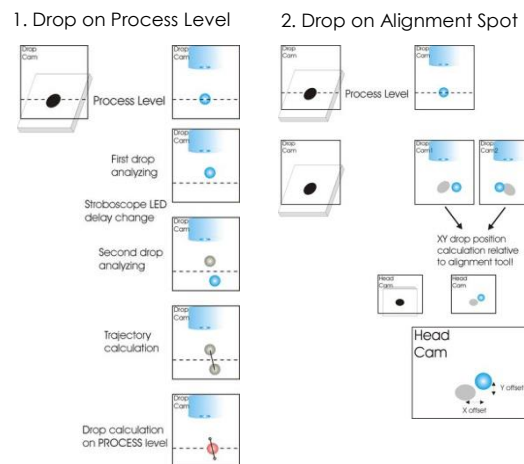- Active correction of the drop-target alignment due to determination of the drop position.

Figure 4. Process level where the drop is supposed to hit the target, left: camera 1, right: camera 2

Conclusion:

Precision is crucial for the production of biosensors and microarrays used in Lab-on-a-Chip. The presented 3D Camera enables enhanced recognition of the deposited drop.