Liquid Dosing Innovation

A major pharmaceutical manufacturer wanted to commercialize a new technology to integrate a liquid Active Pharmaceutical Ingredient (API) into a solid tablet with the application of Process Analytical Technology (PAT).

Challenge

Our client was looking for an automation partner to commercialize a new manufacturing process to integrate a liquid active pharmaceutical ingredient (API) into a solid tablet. This process required dispensing droplets of a dosing solution of a highly potent API onto the surface of placebo tablets in a 24 x 24 array moving at high speed.

The key performance indicators for this project were:

• Dispense rate: 20,000 tablets per hour
• Dispense volume range of 4-10 uL
• Dispense volume accuracy of ≤ ± 2% relative standard deviation
• Process Analytical Technologies
• 100% verification of droplet volume
• 100% verification of the drop placement of API on the tablet

Solution

We successfully demonstrated to our client our ability to scale a prototype lab setup to a fully automated production equipment with better dispense volume accuracy. This was based on our thorough process understanding and our vast experience in high speed, high accuracy, dispense, and in-house vision capabilities.

We took the following approach to address our client's challenges:

Proof of Principle
To better understand the existing prototype lab setup at the customer's facility, we embedded an engineer in the customer's development team. We gained process knowledge as well as performed proof of principle (PoP) studies that established process capability and the process window for the dispense process.

High Precision Multi-Axis Coodination
We accurately synchronized the motion of the dispense head with the moving tablets, while synchronizing the motion of the dispense pump for accurate dispense timing using high precision multi-axis coordination.

Custom Dispense Pump Head Design
We modified off-the-shelf positive displacement pump system by replacing the original motor with a high accuracy servo motor, added stepper linear motor and encoder for volume control, and added quick pump head disconnect for pump head removal via glove ports.
We also used a high speed vision system to measure droplet volume in mid air for volume verification.

High Speed Near-IR Vision System
We measured the API location on the tablet to ensure the entire droplet is contained within the tablet.

Multiple Vision Systems
We used multiple vision systems to verify print legibility, as well as automatic calibration and verification of the vision systems using NIST traceable fiducial targets.

Results

We successfully completed commissioning of the line at the customer's facility. As a result of our involvement in the process development effort, we were able to achieve a highly stable dispense process with accuracy of < 0.4%. The success of this project provides a revolutionary approach to manufacturing high potency medicine for our client.