# Real-time monitoring of industrial printing processes

## Enables calibration, optimization & control of high-end printing applications

### Emerging industrial printing applications

Although inkjet printing technology was developed a long time ago, its potential for commercial and industrial printing applications is greater than initially conceived. Today, state-of-the-art industrial printers can deposit, at high-speed, microscale droplets of a wide variety of fluids without contacting the material being printed. These capabilities make inkjet printing suited to be deployed across a range of industrial applications, far beyond the scope of graphics production.

### Examples of emerging industrial printing applications

- Printed electronics
- OLED display printing
- Inkjet print head manufacturing
- Bio-printing (e.g. heart valves)
- Medical inhalers
- Fuel & solar cell printing
- Printed MEMS & batteries
- Pharmaceuticals
- Printed sensors & actuators
- Agricultural spray applications

### Lack of real-time droplet monitoring

Without any real-time droplet monitoring solution, a conventional ejection process however often leads to considerable amount of waste material, unknown quality due to droplet volume variation, varying ejection speed and trajectories of droplets, and higher costs incurred due to readjustment downtime.

Print quality and production costs are the criteria that will determine to what extent printing processes will be adopted in industrial applications. Dantec Dynamics can contribute considerably to eliminate these concerns inherent to any printing process.

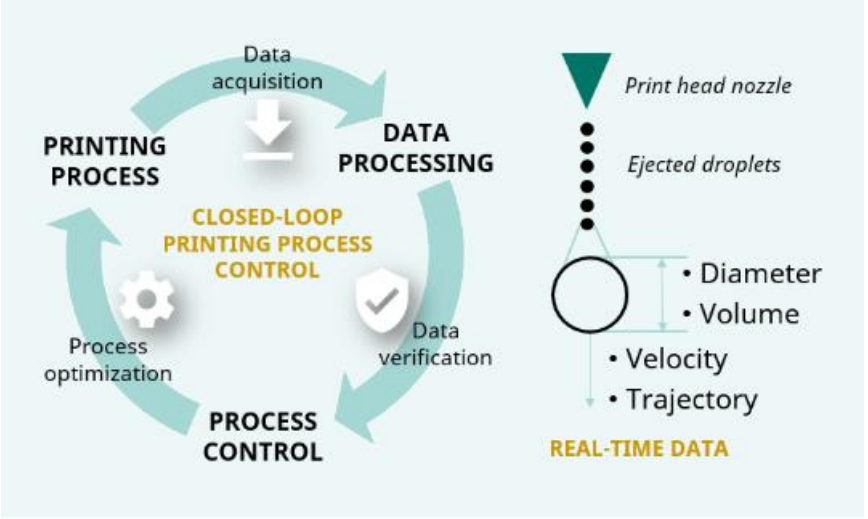
### Quantitative droplet characteristics measurement – a base for a better process control

Dantec Dynamics' Integrated PDA System (IPS) is designed to measure droplet characteristics (size, velocity and direction) in industrial printing and ejection applications such as mass-production of printed electronics, OLED displays, photovoltaics, fuel cells, MEMS, batteries, and many more.

IPS is a laser-optic measurement solution which provides online, real-time characteristic information as droplets are ejected from the nozzles. This on-the-fly information is crucial for continuous quality control monitoring, and creates a feedback loop which can guide optimization of the ejection process parameters.

As an integral component of an industrial printing solution, IPS' overall purpose is to create and maintain a stable, high-quality printing process.

*Droplet to be measured by Laser based IPS system*



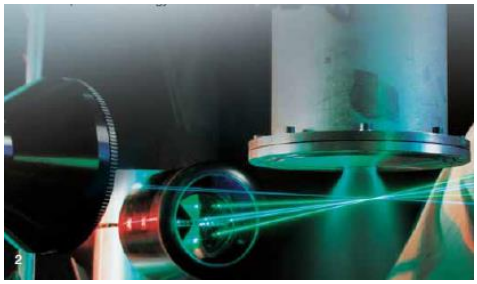

*Real-time measurement of droplet characteristics allows closed loop process control of industrial printing applications*

## Process control

The acquired real-time information on droplet characteristics can be used in a feedback loop to control nozzle settings (closed loop). Therefore, manufacturing parameters can not only be monitored but also, if necessary, adjusted. Corrective actions can be implemented at an early stage to optimize the production performance and output quality, removing the need for costly shut-downs of printing lines for calibration purposes.
Also, continuous monitoring helps identify and rectify droplet characteristics which are out of tolerance early on that otherwise would have led to a poor quality production batch – reducing waste and process costs.

## The measurement system

The IPS is an integrated system based on Particle Dynamics Analysis (PDA) which is a well-known and established technology used for spray characterization diagnostics – one of Dantec Dynamics' core competencies.



*Laser based PDA method measurement of laboratory droplet characterization*

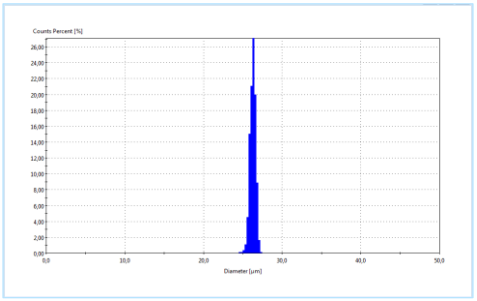
**Key features**

- **Real-time information on droplet size, velocity and trajectory**
- **Closed loop process control**
- **Enables calibration & optimization of industrial printing applications**

**Key benefits**

- **Feedback for instantaneous nozzle adjustments**
- **High measurement accuracy**
- **Higher printing quality**
- **Reduced downtime and process costs**
- **Maximizes production output**

By integrating an IPS into a printing process, industrial producers can benefit from better manufacturing performance as well as higher and more stable product quality output - All key factors for improving the profitability of a complex and costly high-end printing application.



*Histogram: Result image of droplet diameter*

| Technical specifications | |
|---|---|
| **Droplet characteristics** | Volume (size), velocity and trajectory |
| **Typical diameter/ volume range** | 1 µm to 90 µm (0.0005 pL to 381 pL) |
| **Resolution** | 0.1 µm |
| **Accuracy** | 3 % of size range |
| **Cont. data rate** | 150,000 droplets/s |
| **Velocity** | Up to 60 m/s |
| **Vel. components** | 2 |
| **Data processing** | Real-time |
| **Droplet capturing rate** | 100 % |
| **Embedded software driver** | Yes |

DANTEC DYNAMICS Turn Measurements into Knowledge





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