

# What is Inside Your Chocolate ?

ChocoScope

MADE IN GERMANY



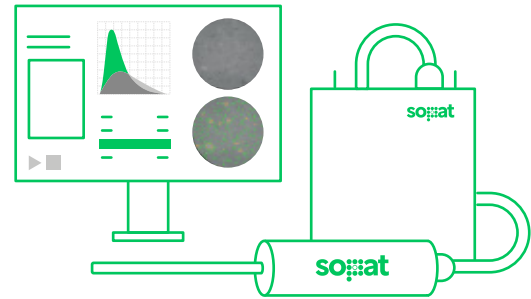
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# Principal challenges

The challenges in industry are numerous and can be divided into various categories. The ChocoScope offers a way to address these issues.



## Cocoa



Cocoa is a natural product which differs in hardness, exact composition, and quality. This can have implications further downstream the production process. The ChocoScope can help to detect these effects as early as possible.

## Production cost control



Energy consumption and price of cocoa butter are significant cost drivers in the production process. The ChocoScope helps to reduce overmilling and off-specification batches and hence increase the throughput.

## Quality control



Besides fineness, particle size and shape, the ChocoScope can also be trained to detect agglomerates, bubbles, and foreign matter and thus may play a significant role in quality control.

## The automated measurement



Conventional methods to determine the fineness are based on sample taking, dilution and offline measurements. The ChocoScope measures 24/7 completely self-sufficient within the process stream-no sample taking, no dilution, no manual handling needed.

## The optimal milling time



The optimal milling time is changing from batch to batch and country of origin. But the consumer expects to get the same high quality product every time. The ChocoScope shows the decrease in size and increase in particle roundness and hence indicates the progress of milling in real-time.

### Detect and measure size and shape inline, right within the production process:

- Cocoa particles
- Cocoa powder
- Cocoa butter crystals
- Sugar, milk powder
- Nuts and waffle pieces
- Impurities

# The solution: ChocoScope

SOPAT developed and optimized a powerful tool to characterize solid particles in cocoa liquors and chocolate: The ChocoScope.

In confectionary products, a broad range of different particles is present, such as cocoa, sugar, nuts, wafer pieces, bubbles and many more.

The automatic image analysis software provides information in real-time on number and volume weighted particle size distributions (PSDs) and calculates various useful and commonly used values like the  $x_{v50}$  or  $x_{v90}$ .



Product Model	ChocoScope
Measurement Range [ $\mu\text{m}$ ]	1.5 - 350
Field of View (image diagonal) [mm]	0.75
Tube Length [mm]	220
Tube Diameter [mm]	12
Pressure Range [bar]	0.1 - 40
Probe Temperature Range [ $^{\circ}\text{C}$ ]	-10 - 130
Periphery Temperature Range [ $^{\circ}\text{C}$ ]	0 - 40
Probe Window Material	Sapphire
Probe Tube Material	1.4404 (316L)
Probe Housing Material	
Weight (without Cable) [kg]	4.5
Focus	Electronic
Picture Rate [Hz]	15
Picture Resolution [MP]	5
Power Input [VA]	141
Certifications	CE, IP65, CIP/SIP, RoHS

# Improving Chocolate Production

SOPAT offers an allround solution for different usages in cocoa, chocolate, confectionary and bakery industry.

Integrate SOPAT's ChocoScope directly into your production line:



## Phase 1

### Measure particles inline

- Inline particle analysis requires neither sample extraction nor preparation like diluting, filtering, or even dispersing.

## Phase 2

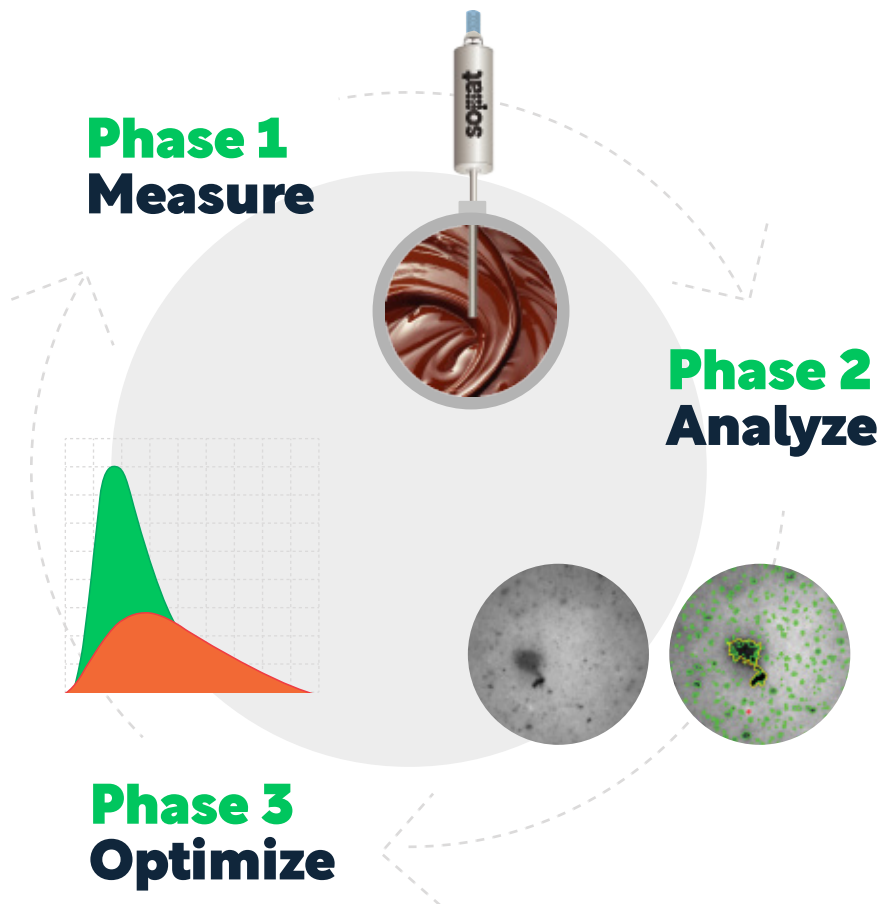
### Analyze in real-time

- Analyze bright and dark particles individually and get quantitative results
- Track variations in particle size distribution and shape to obtain characteristic percentiles like  $x_{v,10}$ ,  $x_{v,50}$ ,  $x_{v,90}$  and  $x_{n,10}$ ,  $x_{n,50}$ ,  $x_{n,90}$ .

## Phase 3

### Optimize your production

- Avoid overmilling to limit the amount of cocoa butter to be added.
- Detect product particles, foreign particles or aggregates.
- Save energy, natural resources and reduce production costs.
- Ensure to get persistent quality of the product, despite the fluctuations of raw product properties.



# What is Inside Your Chocolate?

## IMAGING

### Imaging:

Photo-optical techniques are able to identify different kinds of particles according to their optical properties.

### Visualization:

Images reveal what is inside your chocolate. Cocoa, sugar, milk powder, nut pieces or other particles differ in size, shape and color and can be differentiated.

### Quantification:

The ChocoScope combines the visual information with quantitative results from automated image analysis.

## DATA ACQUISITION

### Data Treatment:

Starting from the original image, different steps of pre-filtering and background subtraction bring out the individual particles.

### Analysis:

The underlying algorithms can be used to differentiate particles according to their grey value, size and shape (see image below).

### An Example:

In the image below, three particle fractions were analyzed individually: small dark (marked in green), large dark (marked in orange) and bright particles (marked in red).

## PROCESS CONTROL

### Interpretation:

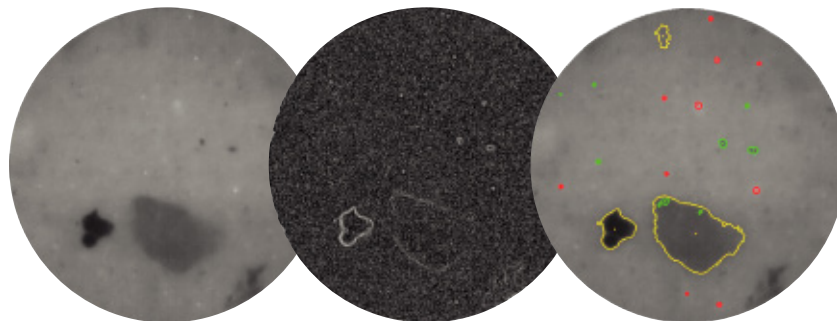
Particle size distributions can be obtained inline by analyzing the images.

### Process Control:

SOPAT's combination of stroboscopic image acquisition and simultaneous analysis enables a continuous process control using the ChocoScope.

### Standardized:

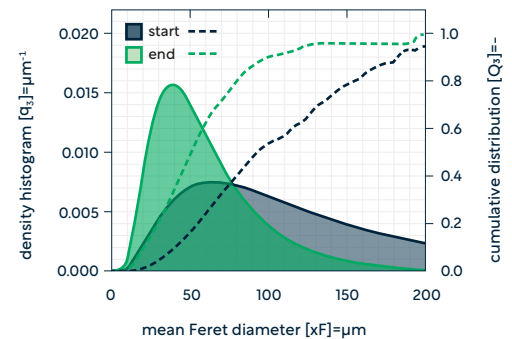
SOPAT's automated image analysis detects particles and quantifies size and shape according to ISO standards: ISO 13322-1-2014, ISO 12322-2-2006



1 Original picture

2 Prefilter, normalize

3 Object classification



4 Particle size distribution

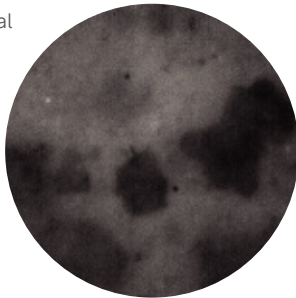
# Use of the ChocoScope

**Cocoa particles in cocoa liquor are broadly distributed in size and need to be milled for subsequent use.**

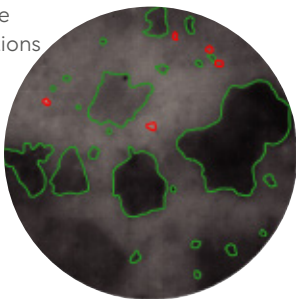
Follow the particle size distribution in cocoa liquor to optimize the milling process and save energy and resources.



Original image



Particle detections

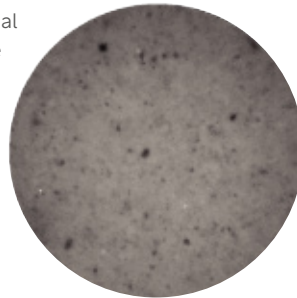


**In chocolate products, particles (cocoa, sugar, milk powder) should not exceed 30 μm in size to achieve a pleasant mouthfeel.**

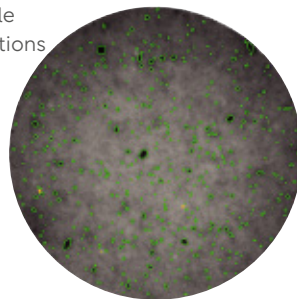
Characterize the chocolate before conching to obtain the required flow properties and the best product quality.



Original image



Particle detections

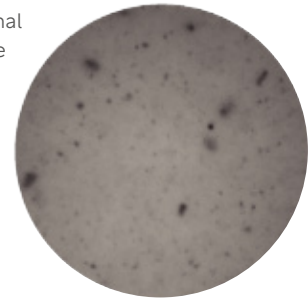


**In fillings, the particle size of nuts, waffles or other ingredients strongly determines the mouthfeel of the final product.**

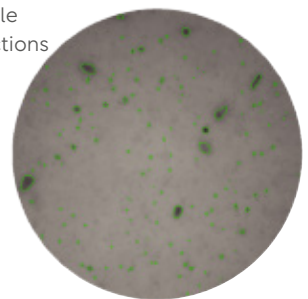
Particle analysis can also be applied to nougat fillings, or to other confectionary products, and helps to improve product development and quality control.



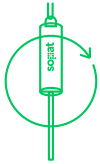
Original image



Particle detections



# Integration into Production Line



The ChocoScope can be inserted at several positions in the production line according to the individual production conditions and the need to avoid contaminations.



The design of the probe with a tip diameter of 12 mm and a tube length of 220 mm enables a comfortable integration into your existing process.



The system is FDA compliant according to EC 1935/2004.



The ChocoScope fulfills CIP/SIP requirements.



Easy connection to your process control system (PCS) via Modbus TCP/IP, OPC UA or others is given.



The modular design of the individual components (probe, Centralbox, computer) allows an easy handling.

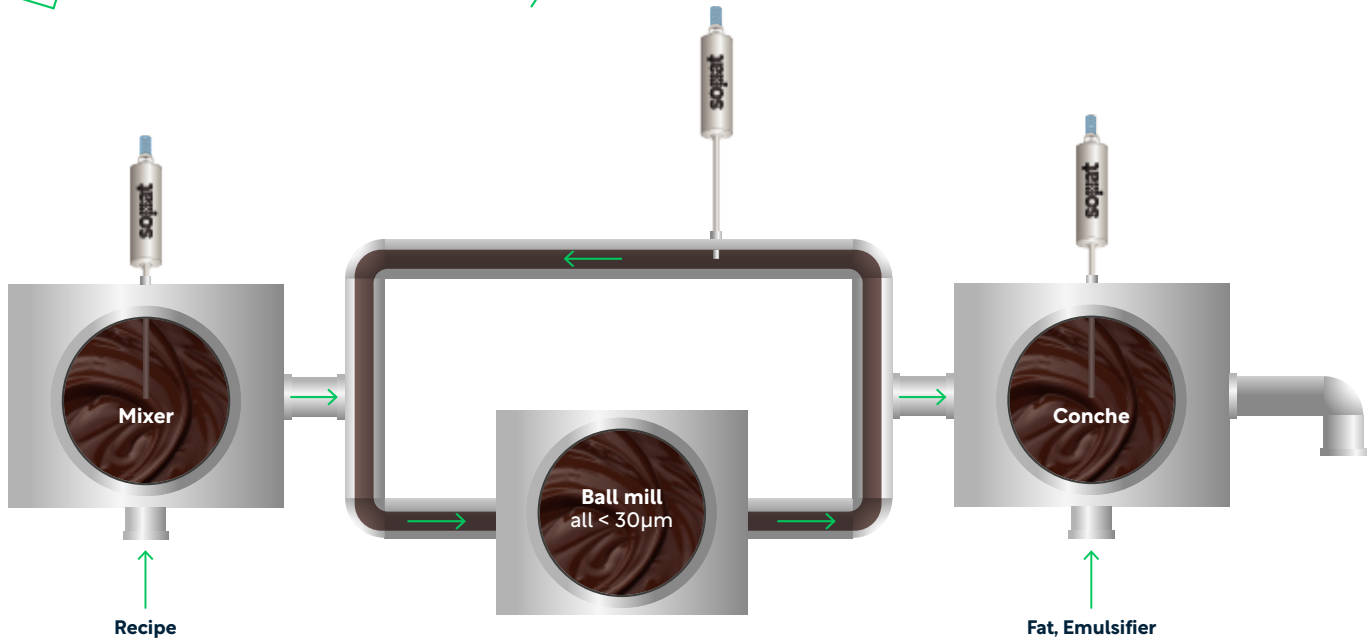


The ChocoScope is easy to clean.

## AS AN EXAMPLE

**The ChocoScope can be inserted at the exit of a ball mill refiner.**

This enables real-time monitoring of the product's particle size and shape evolution and thus easier and faster process control.





# Globally Active Thanks to a Strong Sales Network



SOPAT GmbH

Bergholzstraße 8 | 12099 Berlin | Germany

T- +49-30-398-2020-00

F- +49-30-398-2020-49

[info@sopat.de](mailto:info@sopat.de)

[sopat.de](http://sopat.de)



C/ Caléndula 95 | Miniparc II | 28109 Alcobendas | Madrid - España

[info@iesmat.com](mailto:info@iesmat.com) | +34 91 650 8005 | CIF: A-84330133

[www.iesmat.com](http://www.iesmat.com)



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