



Contribution of Blending on Dough Rheology

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Rheology

The word rheology was invented in 1929 to name the discipline of a society engaged in the study of how materials deform in response to forces.

Although the word “rheology” is derived from the Greek “ρῆω”, which means “flow”, it is used in the wider sense to mean that branch of physics which is concerned with the deformation of materials.



Food Rheology

When we talk about **rheology** in food, we are specifically looking at the flow or deformation substances. Despite the word “flow,” rheology is equally applied to solids, gases, and liquids including such things as solutions, emulsions, suspensions, foams, gels, and melts, as well as semisolids like creams and pastes.

Rheology is important in the making of cereal, bread, pasta, chocolate, and salad dressings, among many others.



Flour and Dough Rheology

Flour is a naturally occurring polymer, and concentrated mixtures of flour and water are non-Newtonian. Dough rheology is the study of stress and strain in dough as the dough is mixed and transforms into a visco-elastic mass.

The big complication is that most materials, and especially all biological materials, have both liquid and solid aspects.

Rheological characteristics such as elasticity, viscosity, tenacity and extensibility are important rheological parameters of flour for the milling and bakery industries in prediction of the processing parameters of dough and quality of end the products.



Why do we measure rheology of flour, dough?

Rheological measurements on bread dough have long been used as a method to define its physical properties, the main aims of which are:

- ✓ To obtain a quantitative description of its mechanical properties,
- ✓ To characterize and predict its performance during processing and end-use,
- ✓ To obtain information related to its molecular structure and composition.

(Dobraszczyk, 2016; 2020)

What are the rheological properties of flour?

Rheology can tell us how a dough will behave under a given set of conditions and can be used to characterize and predict its performance during deformation, for example during mixing, sheeting, proving and baking of dough.

Rheological parameters indicate how the dough processes in production equipment into end-product.



How do we measure flour/dough rheology by Mixolab?

How to assess the quality of the flours?

- Physicochemical compositions!
- Rheological properties!
- Direct performance in the final product!

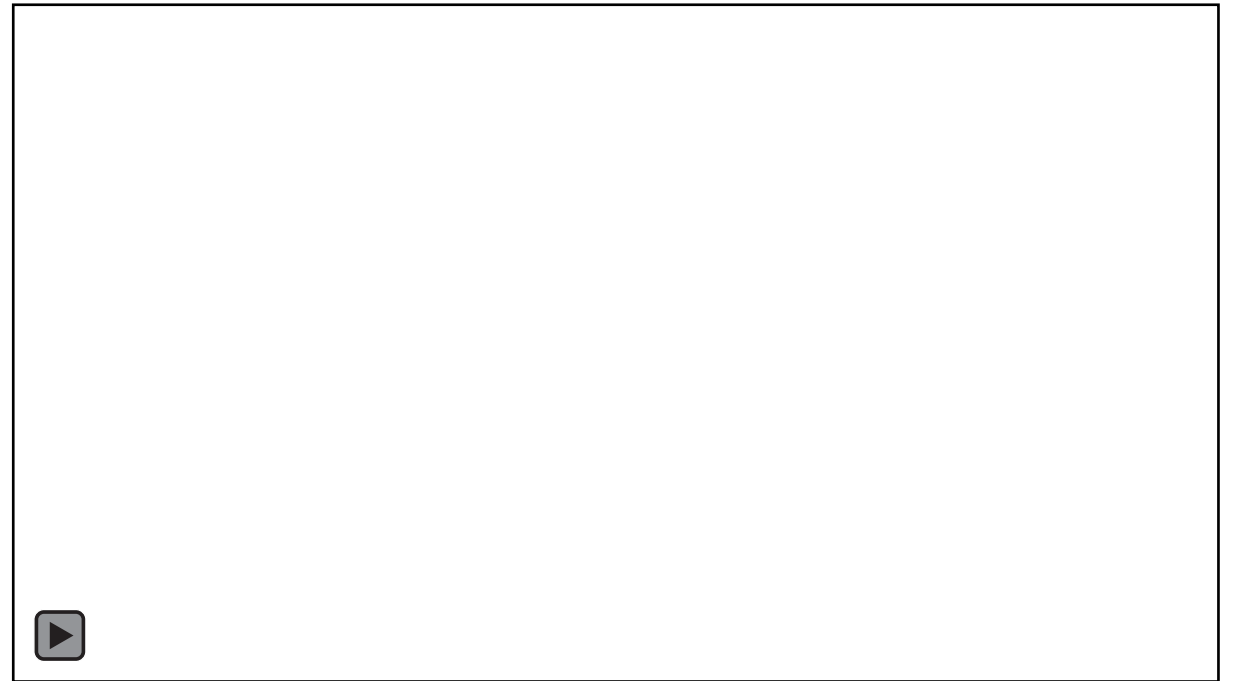


How do we measure flour/dough rheology by Mixolab?

Functional & Rheological Mixolab 2 - Dough Analysis

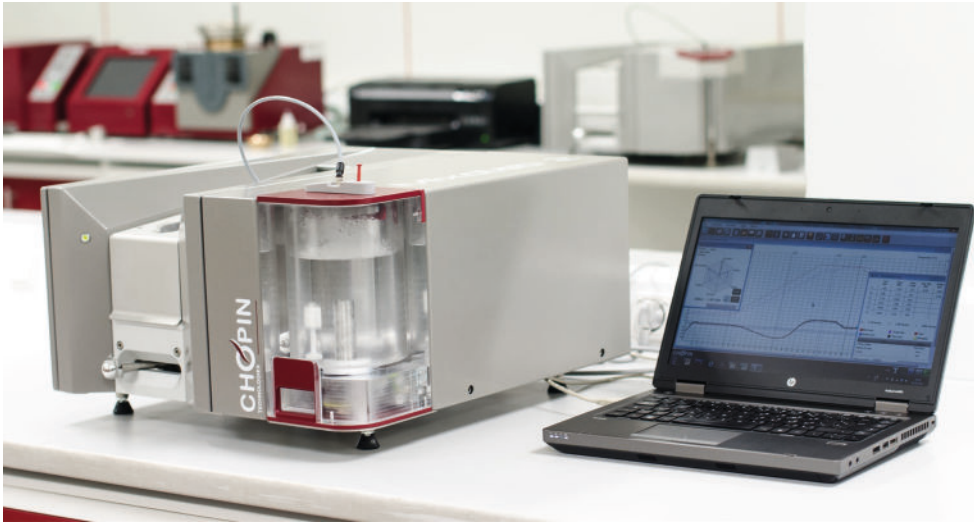
- We measure **the torque** produced by a dough between two blades at **constant mixing speed** during successive phases at **distinct temperatures**.
- This can be related to the **evolution of the dough consistency** during mixing, baking and cooling !

The Mixolab is a recording mixer specifically developed to measure rheological dough properties during mixing and heating.



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Functional & Rheological Mixolab 2 - Dough Analysis



Compliant with

ICC 173/1 ; AACC 54-60-01 ; NF V03-765 ; ISO 17718:2013 ; GOST R 54498-2011

- To get access to a **maximum of data** :
 - Protein behavior
 - Starch behavior
 - Enzyme impact
 - Combinations...
 - Works on dough but not on a batter
- In one fully **automated** test,
- With only 50g sample,
- Using a **standardized**, internationally recognized method !

How do we measure flour/dough rheology by Mixolab?

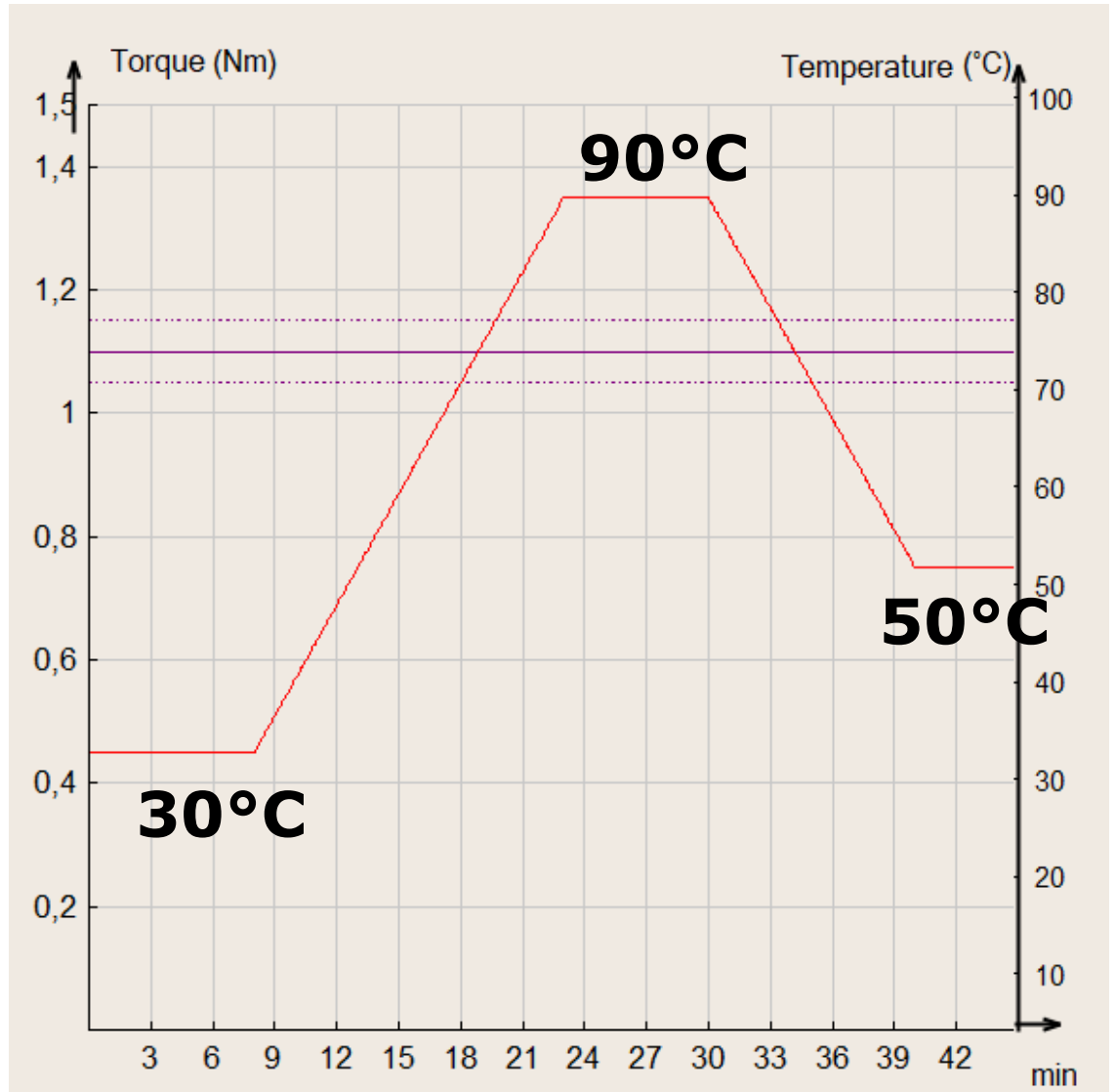
Functional & Rheological Mixolab 2 - Dough Analysis

Standard Protocol Chopin +

Protocol at variable temperature defined in the standards.

Mixing speed, 80rpm.

Possibility to create customized testing protocols for various cereals or different applications.



How do we measure flour/dough rheology by Mixolab?



Configure the test



Weight the indicated amount of flour



Incorporate the flour in the mixer bowl



Place the nozzle

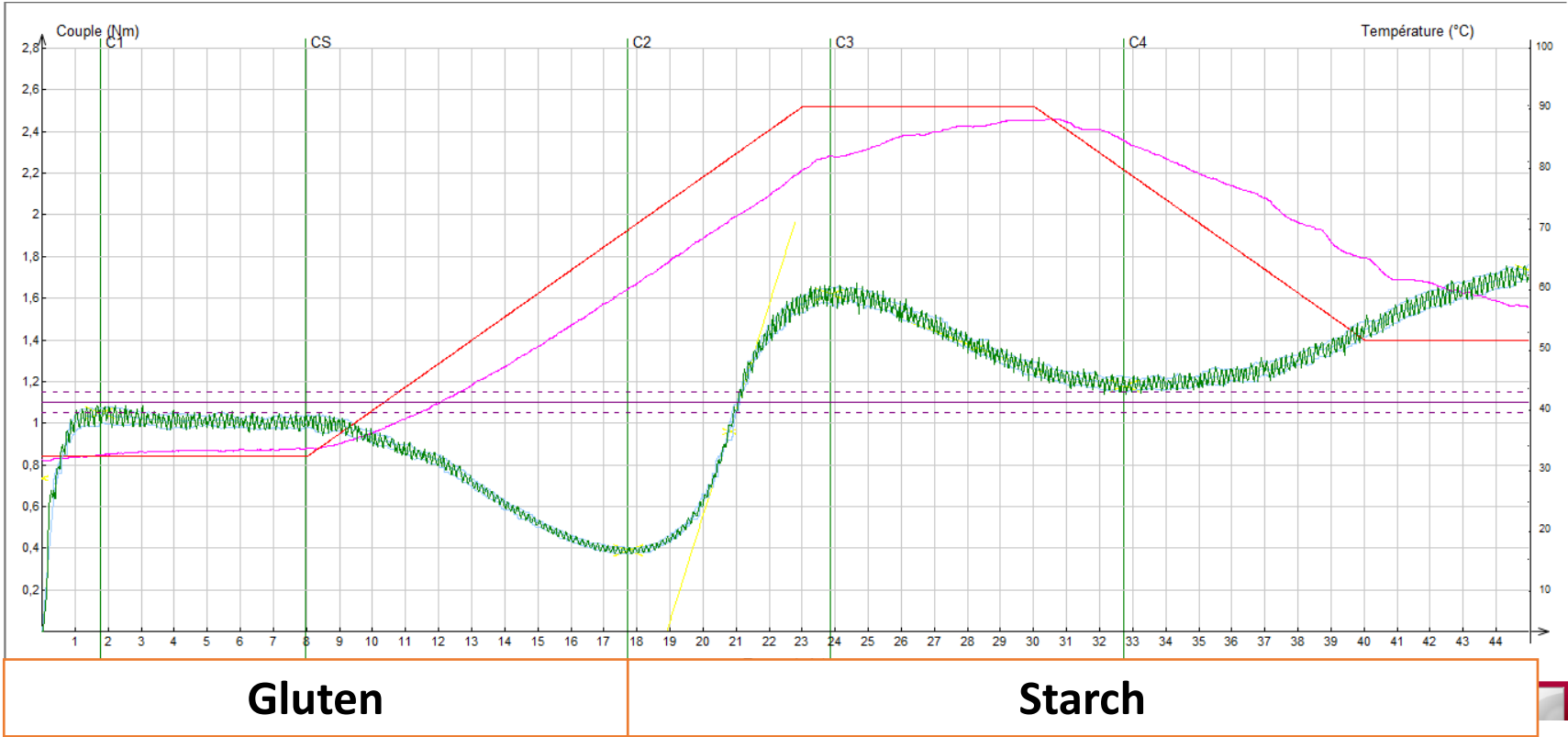


Test time: 45 min / Operator time: 5 min

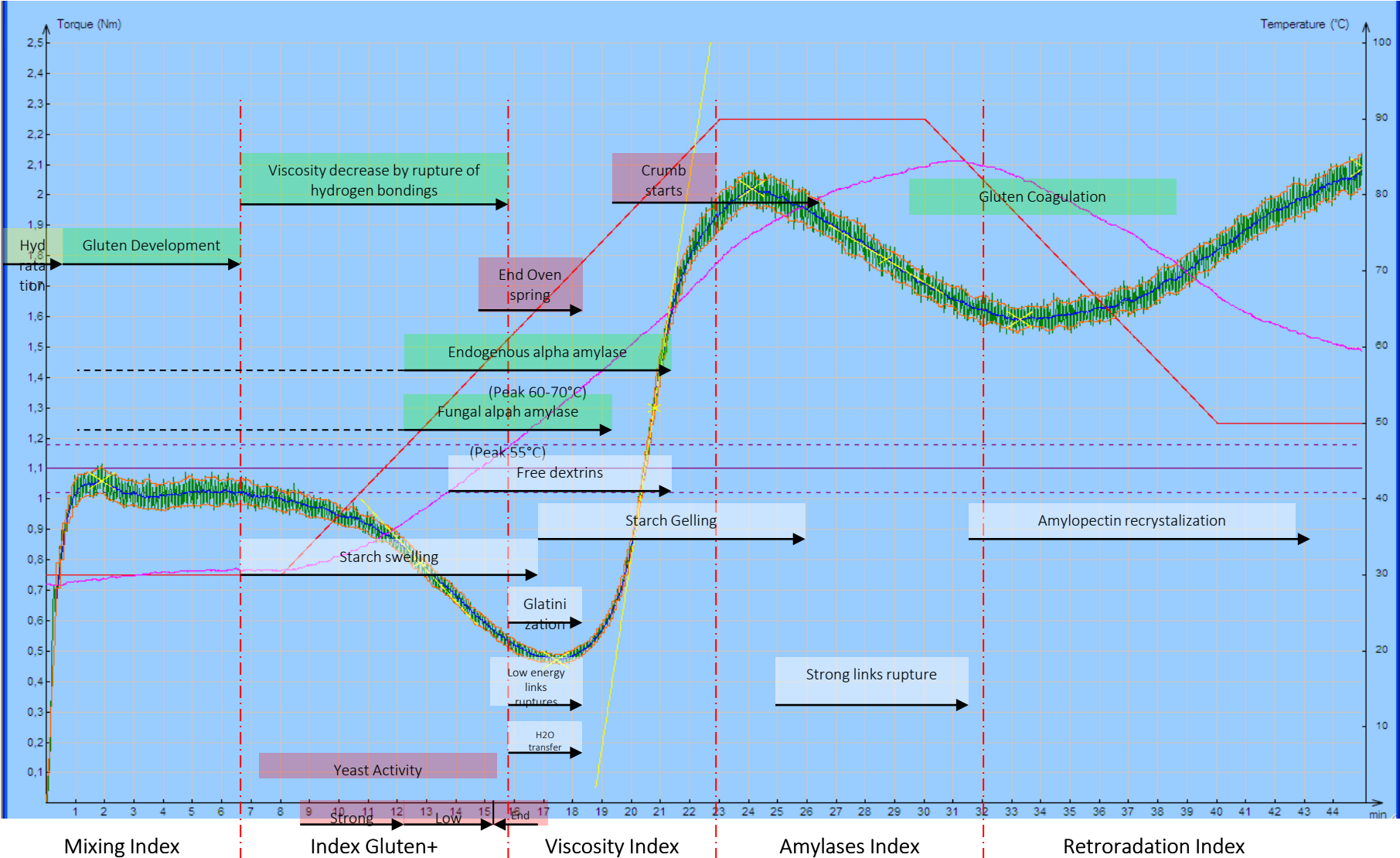
How do we measure flour/dough rheology by Mixolab?



Standard Mixolab Curve



How do we measure flour/dough rheology by Mixolab?



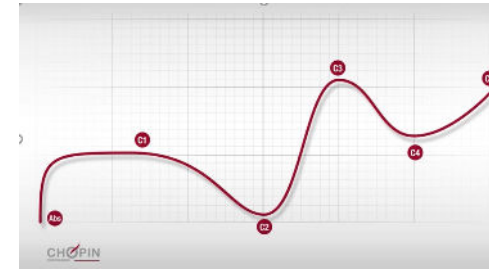
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Functional & Rheological Mixolab 2 - Dough Analysis

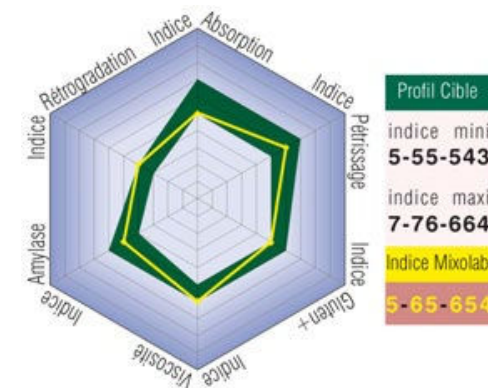
The “Profiler” system allows products to be simply classified based on six quality criteria: water absorption, mixing, gluten, viscosity, amylase, and retrogradation.

It is a perfect tool and a new approach for the quality control of raw materials. It offers the possibility to create specific target profiles based on finished products quality to help better screen flours and detect under-performing flours.

Mixolab Standard



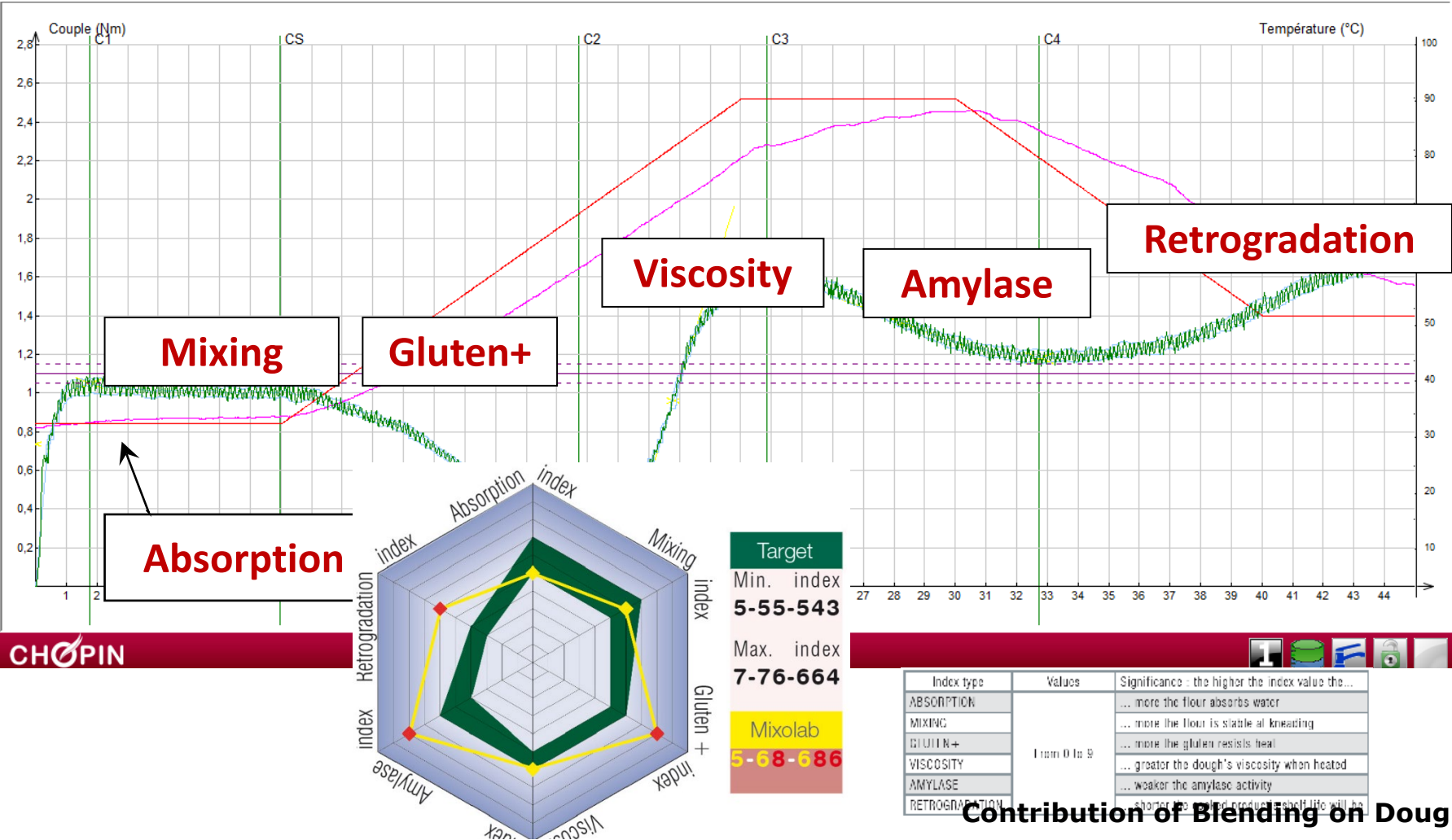
Mixolab Profiler



How do we measure flour/dough rheology by Mixolab?

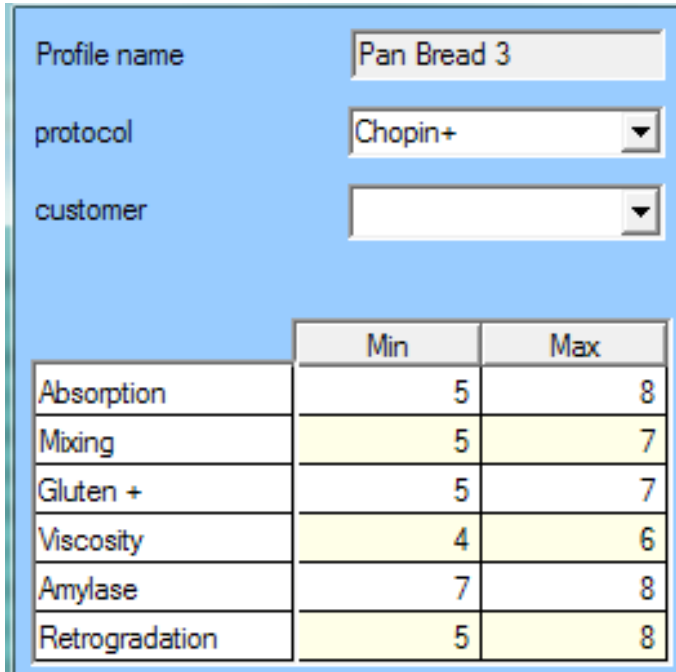
Mixolab Profiler

The profile is a "curve translator"



How do we measure flour/dough rheology by Mixolab?

3 EASY steps to create a profile



The screenshot shows the Mixolab software interface for creating a target profile. It includes input fields for 'Profile name' (Pan Bread 3), 'protocol' (Chopin+), and 'customer'. Below these is a table with rheological parameters and their target minimum and maximum values.

	Min	Max
Absorption	5	8
Mixing	5	7
Gluten +	5	7
Viscosity	4	6
Amylase	7	8
Retrogradation	5	8

- It all starts with observing the BEHAVIOR of the dough on the manufacturing line of YOUR customers.

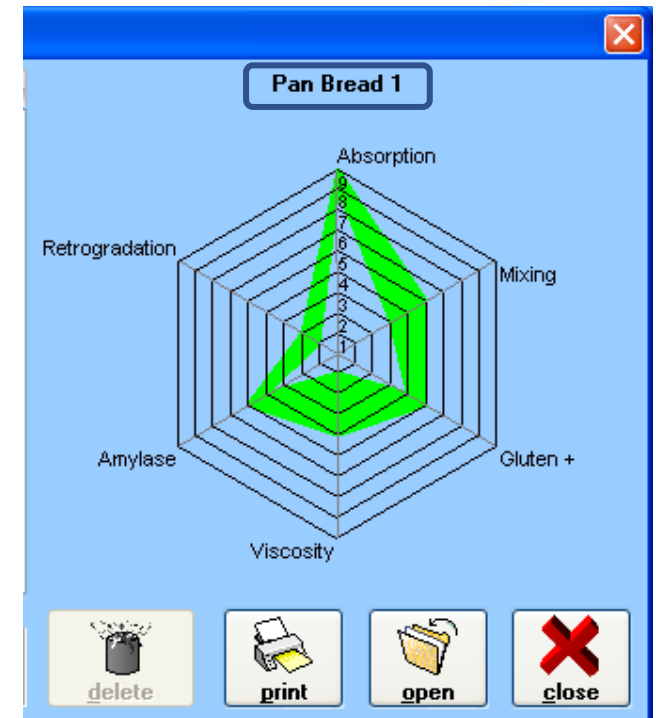
- 1) Select all the flours that are giving perfect results
- 2) Analyze the flour in the Mixolab (minimum of 20 samples)
- 3) Use the integrated software to determine the minimum/maximum values (target profile)

You can create as many target profiles as you need (per product, per line...).

Easy and objective flour/baker communication is key!

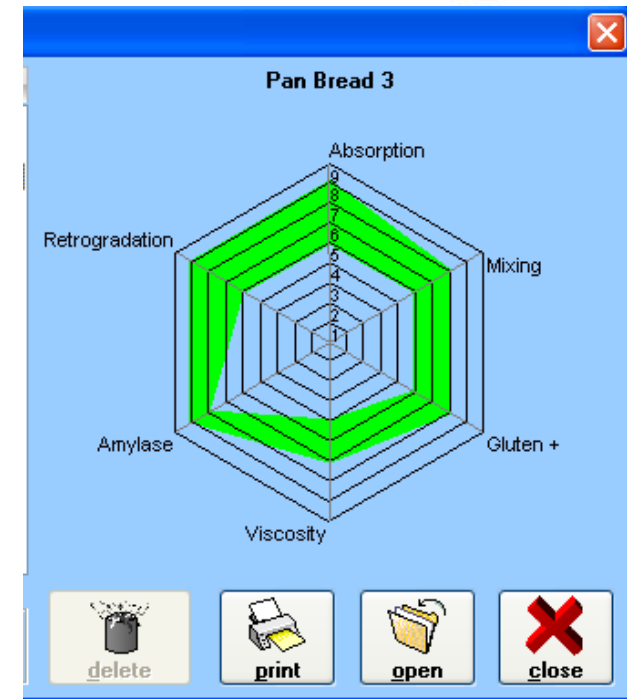
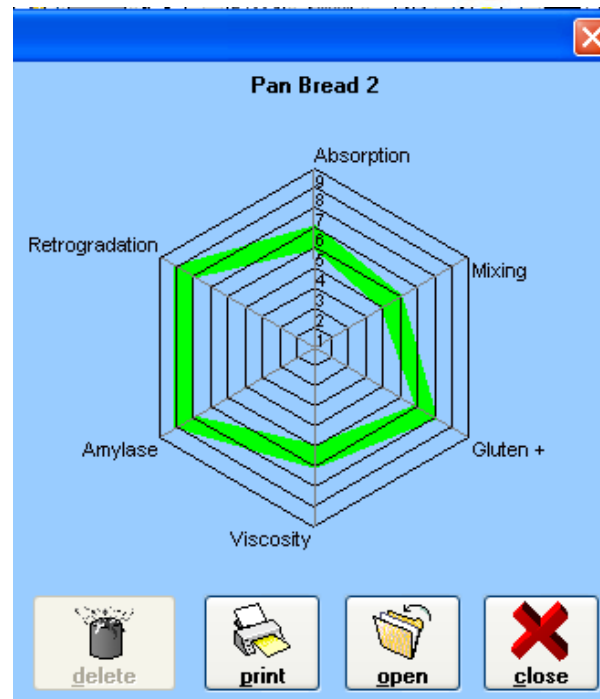
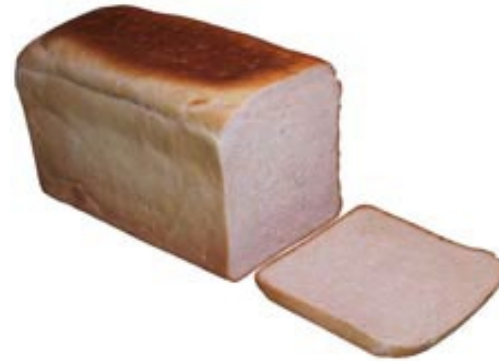
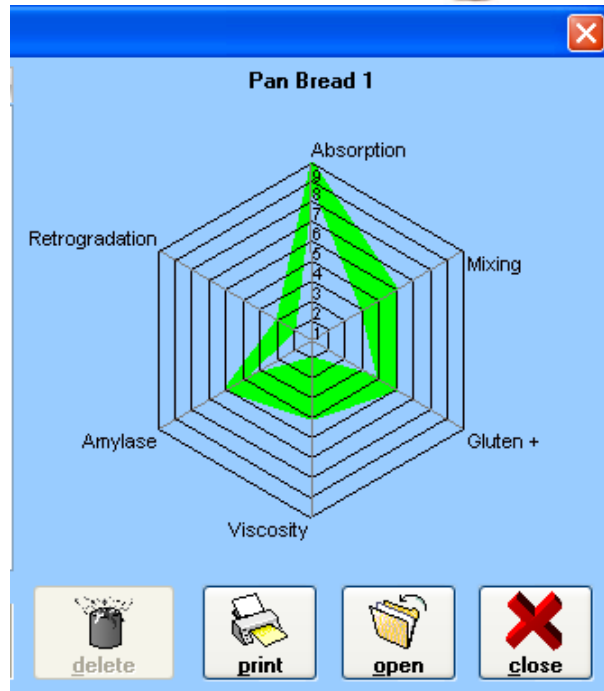
How do we measure flour/dough rheology by Mixolab?

Different baked products need different types of flours for best quality!



How do we measure flour/dough rheology by Mixolab?

Flour can be optimized for different baking process even for the same product!



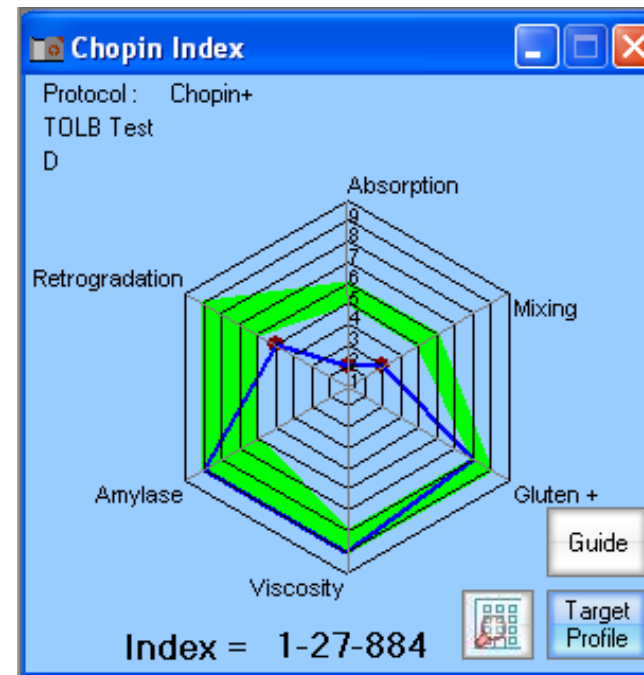
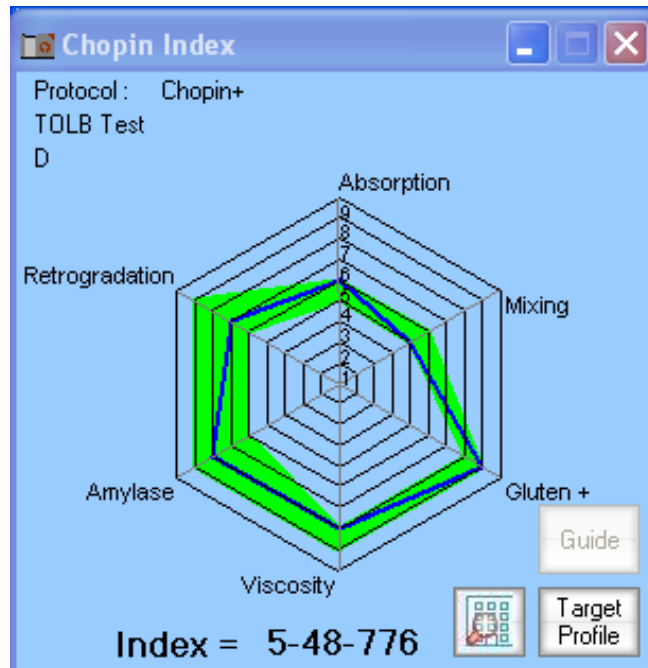
How do we measure flour/dough rheology by Mixolab?

Functional & Rheological Mixolab 2 - Dough Analysis

Mixolab Profiler: The Target Profile
Finally : You're IN or You're OUT

You are **IN** :
Your flour has the
requested qualities for
your final product

You can receive or
deliver the flour

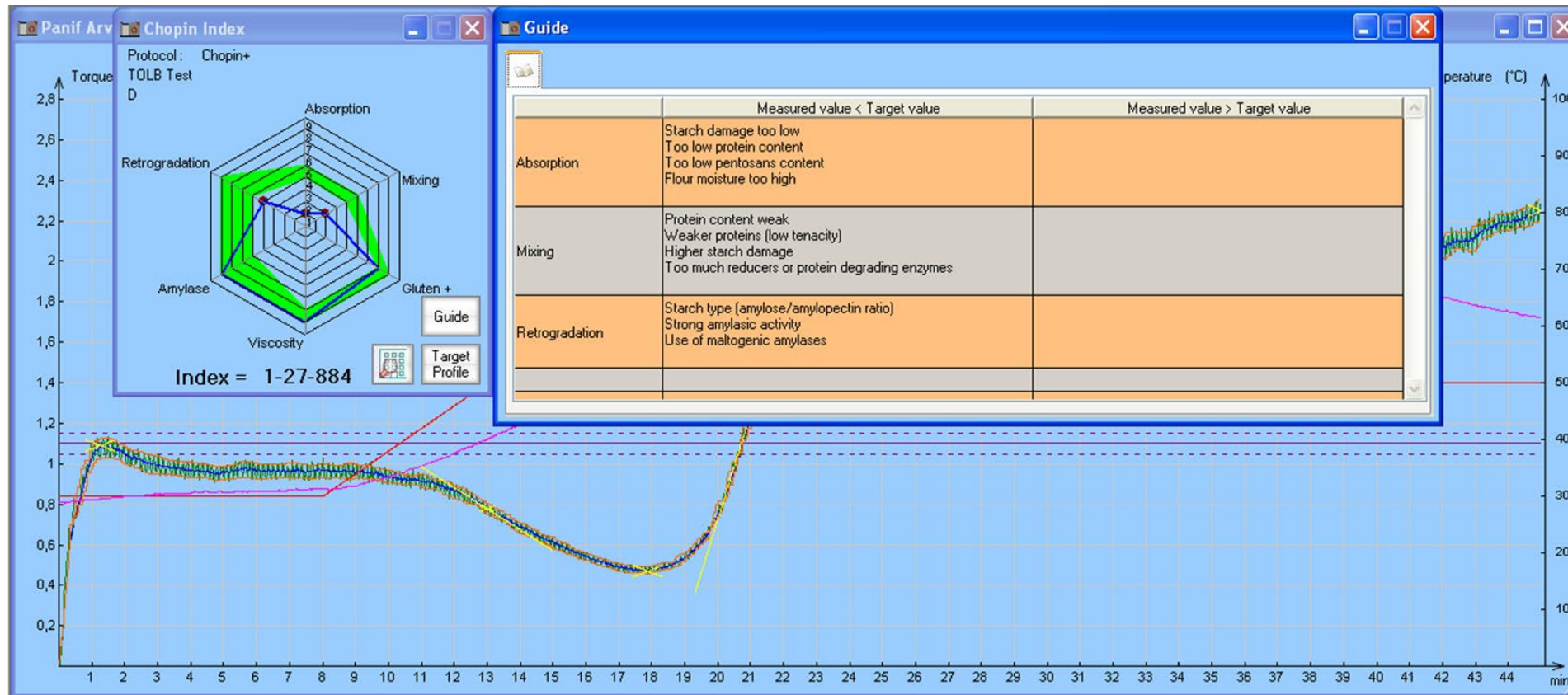


You are **OUT** :
The **Mixolab Guide** will help
you how to improve the
profile

How do we measure flour/dough rheology by Mixolab?

Profiler Guide

Profiler guide help identify potential root cause of out of spec issues
Great tool for QC managers to improve flour selection practice

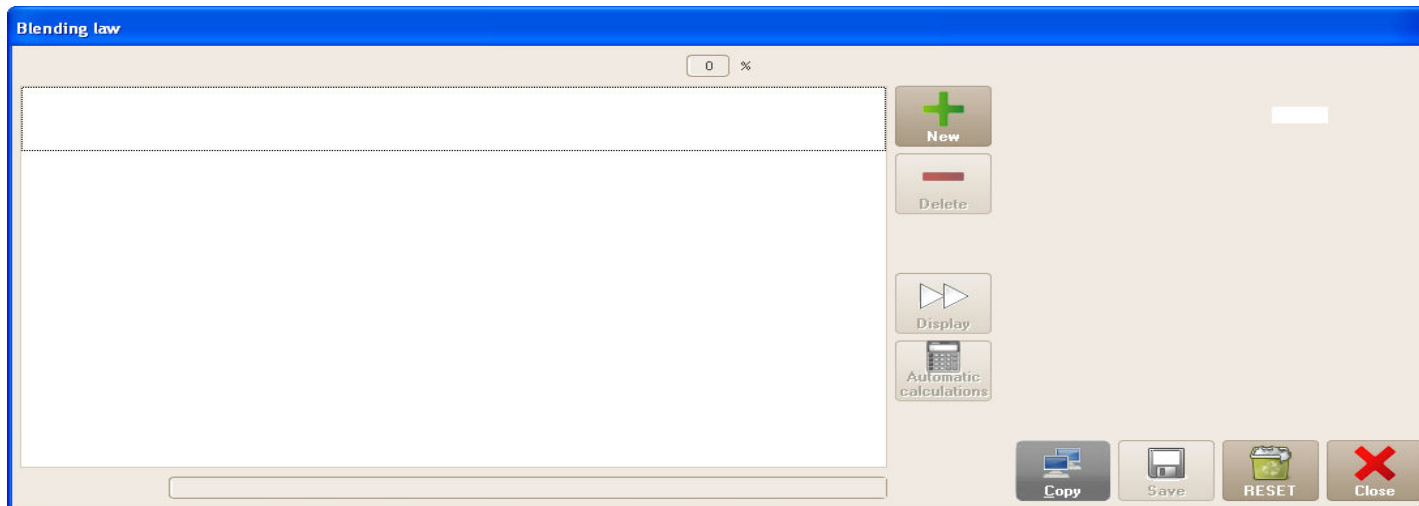


How do we measure flour/dough rheology by Mixolab?

Blending Law

“Blending law” function to create and save theoretical curves corresponding to blends of prior results. This function allows mixing different tests and obtaining the result curve of this blend.

From the "MIXOLAB CHOPIN Technologies" general window, click on icon:

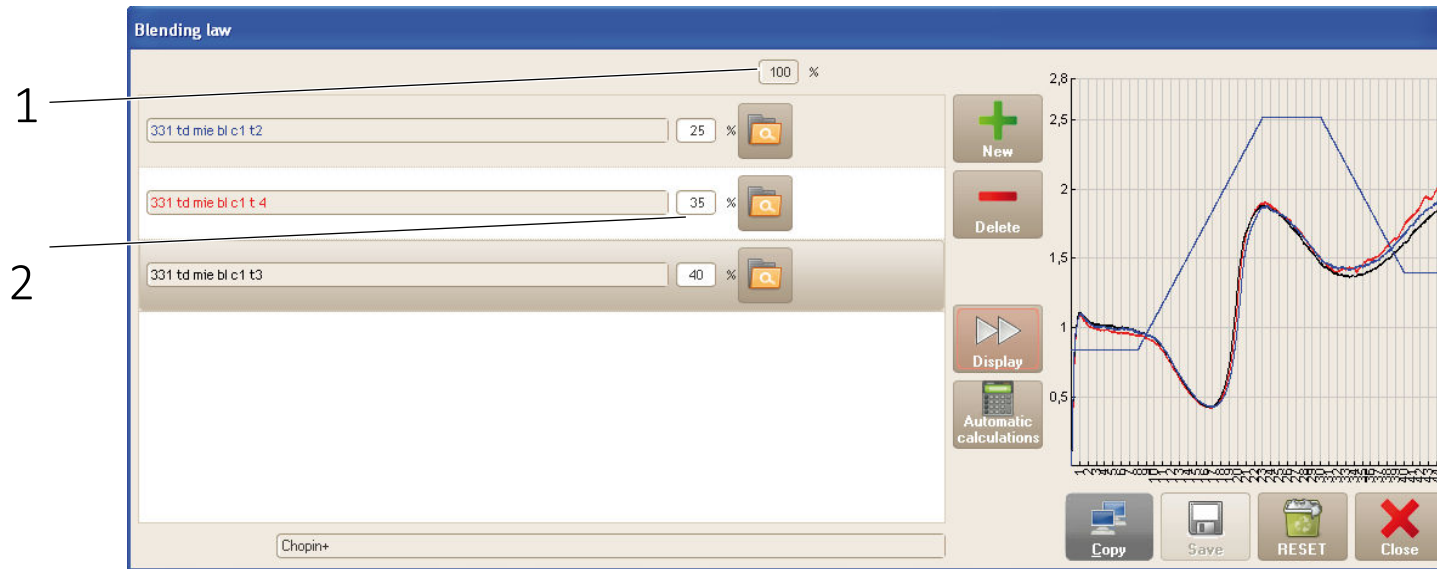


[Blending law]

How do we measure flour/dough rheology by Mixolab?

Blending Law

- To create a blend, choose the different test by pressing button [New].
- Choose the different tests to be blended in the list and click on [Open]. Several tests can be selected at the same time.



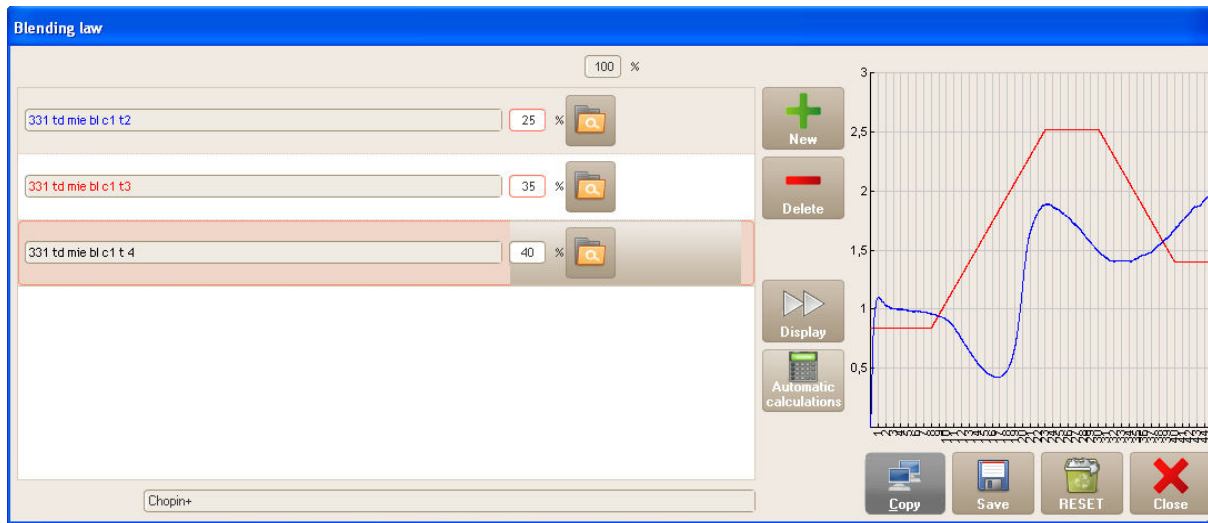
Enter the percentage for the different tests (2).

The total percentage (1) must be equal to 100%.

How do we measure flour/dough rheology by Mixolab?

Blending Law

- To see the different individual test curves, press button [Display].
- To run the blend calculation, press button [Automatic calculations].
- A loading bar shows the calculation progress. The resulting curve is then displayed.



Save the blend results!

It can now be used like any other test results via the menu of [Managing tests](#).

It is identified by the symbol:



How do we measure flour/dough rheology by Mixolab?

Functional & Rheological Mixolab 2 - Dough Analysis

Benefits

- Provides a clear overview of the entire flour quality and the dough properties
- Design specifications according to your specific process
- Analyze doughs with various ingredients as well as complete formulas
- Understand the dough behavior at the lab and at line
- Improves operators' productivity, repeatability and control thanks to the automated test and the comprehensive, and intuitive software
- Use proven, industry-standard analysis for your testing procedures



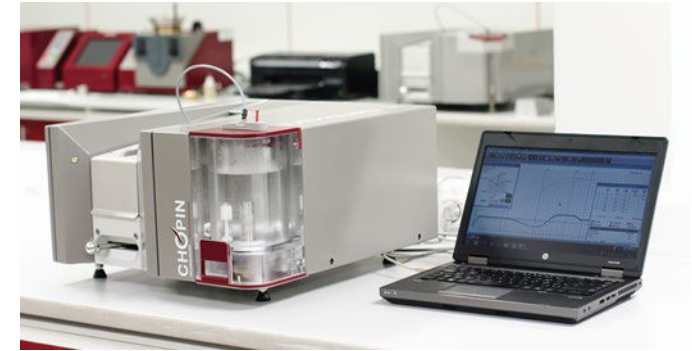
Why do we measure flour/dough rheology by Mixolab?



- Bakers
- Millers
- Breeders
- Additive manufacturers
- Gluten manufacturers
- Storage facilities
- Research institutes/
Universities/schools



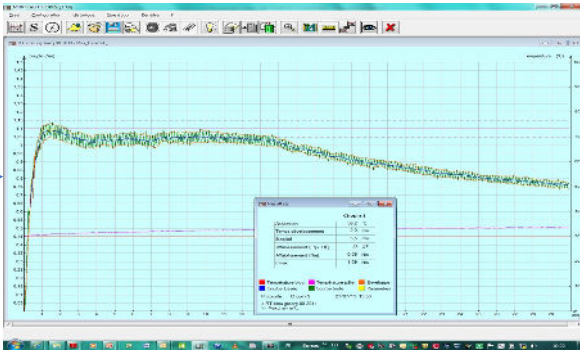
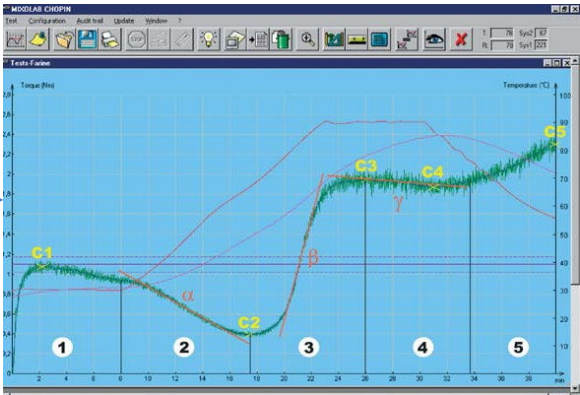
- Seeds or **grain selection**
- Establishing specification sheets
- **Inspect grain or flour**
- **Blending wheat and flour**
- **Adapting flour quality**
- **Dosing additives**
- Developing new recipes
- Process control & optimization



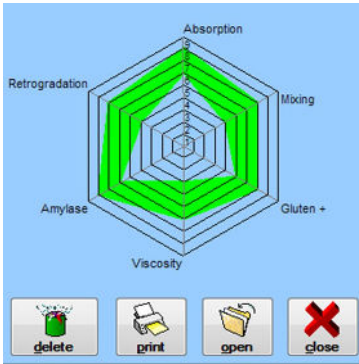
CONCLUSION

CONCLUSION

3 Main Potential Uses:



UNIQUE
Flour
characterization
system
(Specifications)



KEEP TRACK
With your
historical data
(Providers)

MEASURE
What happens at
line
(Objective control)



CONCLUSION

- ❖ The Mixolab analyses flour performance throughout the entire breadmaking process, including the mixing, heating and cooling phases.
- ❖ These extra stages thus have the potential to tie research into industry, because the instrument can generate curves to compare differences both between flours and among industrial baking conditions.

(Rosentrater and Evers, 2018)

CONCLUSION

- ❖ Rheology is important for many aspects of food production and consumer consumption: it involves the physical characteristics of fluids and semisolid foods, the engineering and process design, the development of new products, and their testing including their sensory properties!
- ❖ As flour quality fluctuates in dough plants, monitoring rheology and making corrections to dough to maintain consistent product quality takes on added importance!

CONCLUSION

- ❖ Dough rheology measurements are key for adjusting and smoothening processing of dough in plants!
- ❖ Specifications should include key physical and rheological parameters in addition to the chemical parameters!
- ❖ Besides process control, the sourcing of raw material, and especially wheat flour, could be improved by specifying dough processing criteria including its rheology.



KPM Analytics Company Overview



KPM Analytics Introduction



We craft assurance. For our partners. For their customers.

PURPOSE

We provide premium quality assurance equipment to food producers through expert craftsmanship and intimate knowledge of their business needs.

VISION

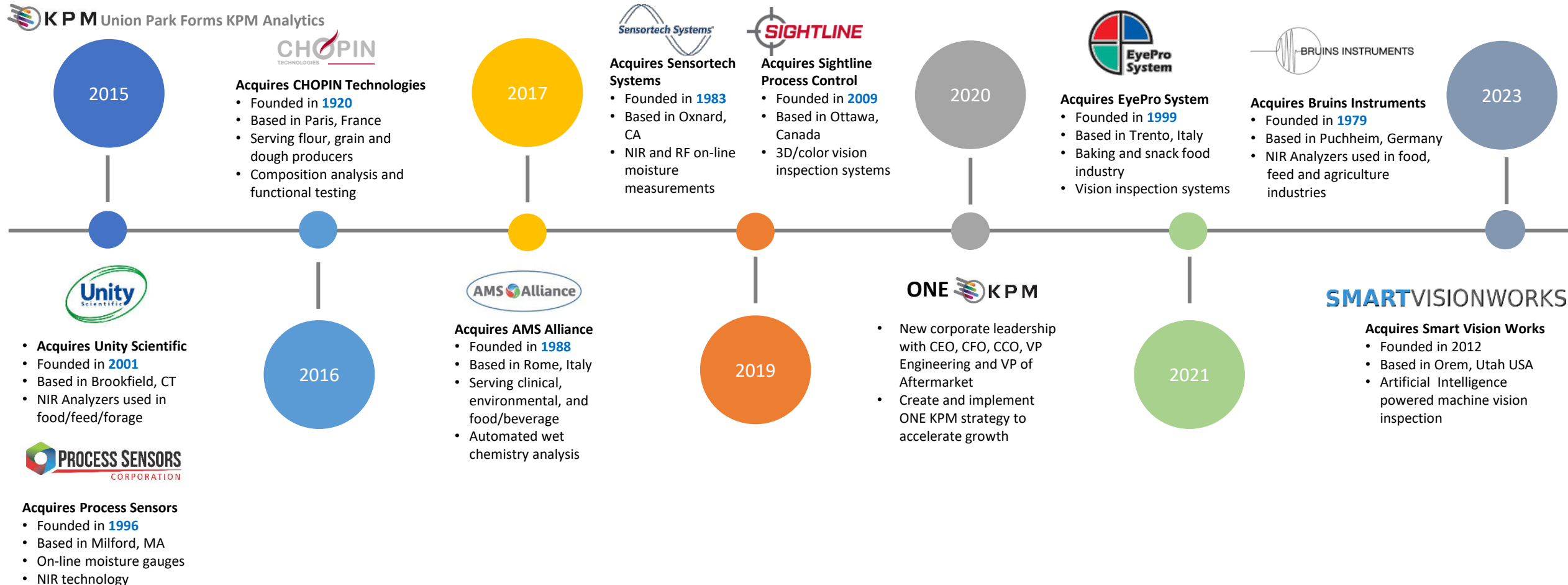
Food and agricultural brands the world over will grow stronger from our driven, dedicated, and caring approach to solving their challenges, enabling KPM to become the global industry leader.

MISSION

To provide the best solutions for helping our partners control their product quality, scale capacity, and protect their brands.

Timeline and Progression of KPM Analytics

KPM Analytics brands have long and successful histories servicing customers worldwide



Industries We Serve

KPM's main focus is serving food producers, helping them ensure quality and protect their brand.

KPM is leading the industry for quality solutions at all stages of production.

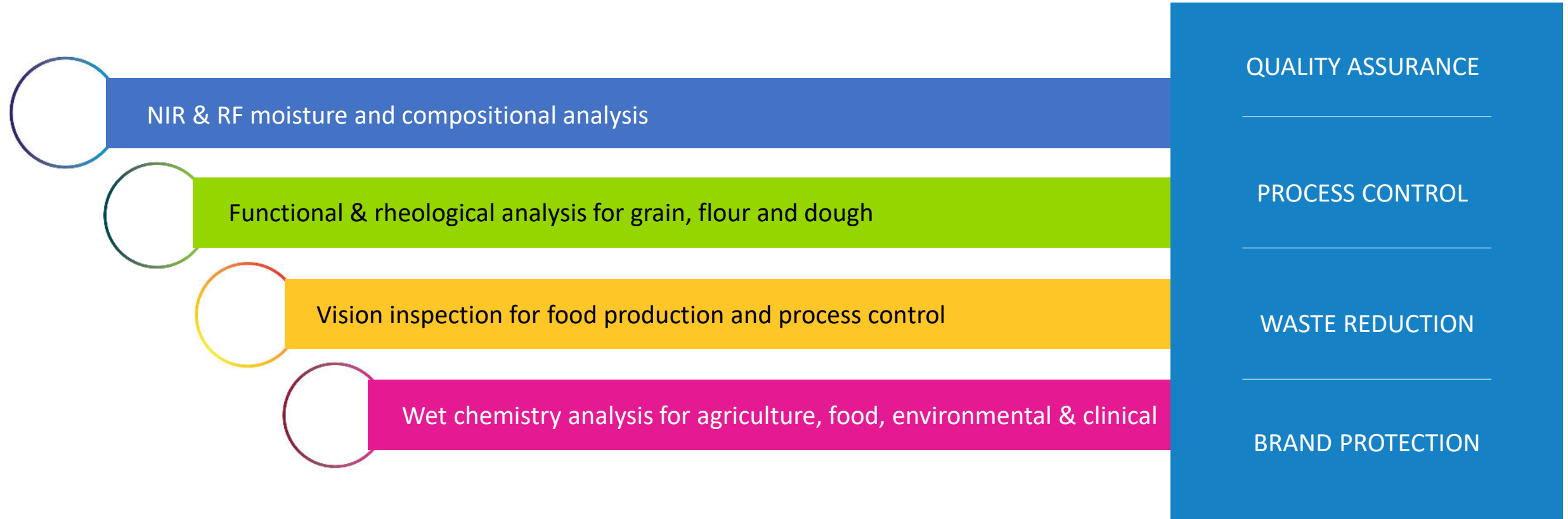


Our product lines are also widely used in agriculture and feed and forage to measure critical quality parameters.

Environmental, chemistry and industrial industries benefit from our accurate lab and sensing technologies.

- Food Production
- Agriculture
- Feed & Forage
- Environmental
- Industrial

Solutions for Every Stage of Production



A Global Team

KPM customers are supported by our global sales, service and authorized distribution network.

9

9 product brands
based in 5 countries
and growing.

200 +

Over 200 distributors
worldwide.

15,000 +

Over 15,000
installations around
the world.



U.S.A. (Boston)
+1 (774) 462-6700

Canada (Ottawa)
+1 (800) 768-6821

U.K. (London)
+44 1536 408066

France (Paris)
+33 01 41 47 71 38

Poland (Warsaw)
+48 22 6739526

Germany (Frankfurt)
+49 (6721) 988 6720

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Thank you!

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