NIRMaster Solution for Milling&Bakery Industry

Summary – NIRSolutions in the Food Industry

1. BUCHI Labortechnik AG presentation

2. NIR Technology principles

3. NIRMaster FT-NIR Spectromether

4. NIRMaster solutions for Milling&Bakery

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BUCHI Labortechink AG Headquarter, Switzerland

1. BUCHI Labortechnik AG

BUCHI Labortechnik AG in Flawil, Switzerland

➢BUCHI is a leading world-wide supplier in key technologies such as evaporation and separation for research laboratories as well as near infrared spectroscopy and distillation and extraction for quality control purposes.

➢Since 1939 Our goal is to sustain a high level of competence in product development, manufacturing and application around these technologies.

➢We believe that providing high quality products and responsive service will support the innovation and effectiveness of our customers.

Quality in your hands

1. BUCHI Milling&Bakery Quality Control Analytical Solutions

A brand which want to keep or increase its market position must work on **productions characterized by high quality**
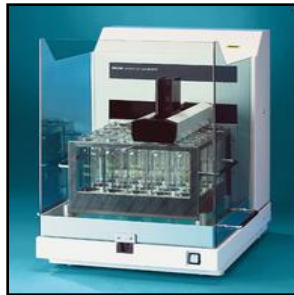
QUALITY CONTROL
- Raw materials
- Intermediates
- End products

Reference techniques **to be compliant with Worldwide regulations** and fast non-destructive analytical techniques able to analyze a **huge number of different samples in fast and cost saving mode**
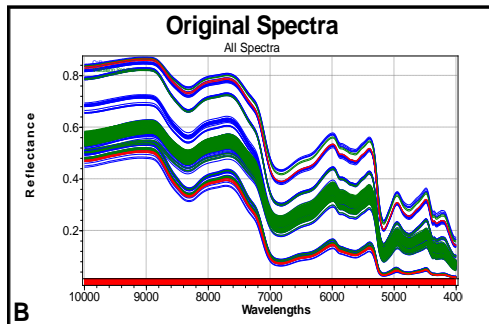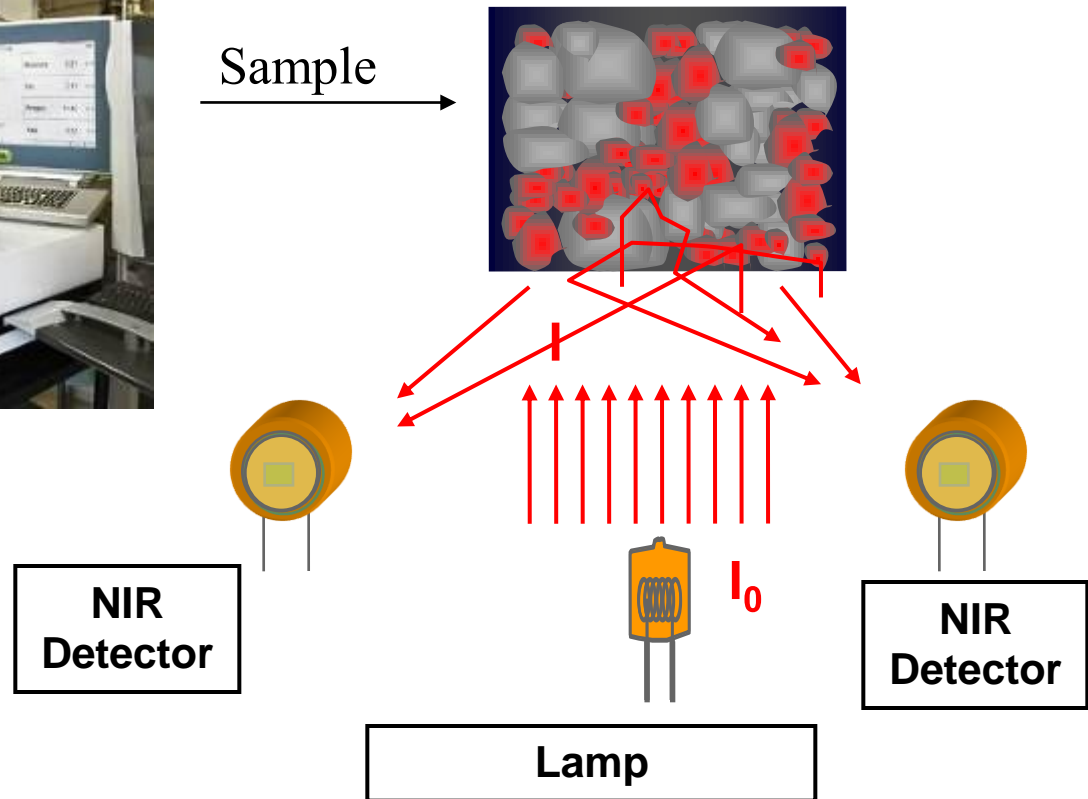
Kjeldhal (Nitrogen)

Near Infrared

2. Near InfraRed (NIR) Technology – samples measured as they are

Sample →

Original Spectra
All Spectra

NIR Detector

I_0

NIR Detector

Lamp

- Only sample preparation eventually required is grinding
- No solvents required
- **measuremnt time: less 20 second**
- **Multiple parameters measured at same time (moisture, protein, ash..)**

2. Example: Protein content analysis

Number of real sample analyzed on daily basis

Additional possible measures

| 0-5 | 5-10 | 10-20 | >20 |

+10

Kjeldhal Solutions

+20

NIR Solutions

+30

From lab to process

2. NIR Working principle

"Spectroscopy" is defined as "part of Chemical Physics which studies interaction between Matter and Radiation. The word "INTERACTION" identify the intimate nature of this discipline

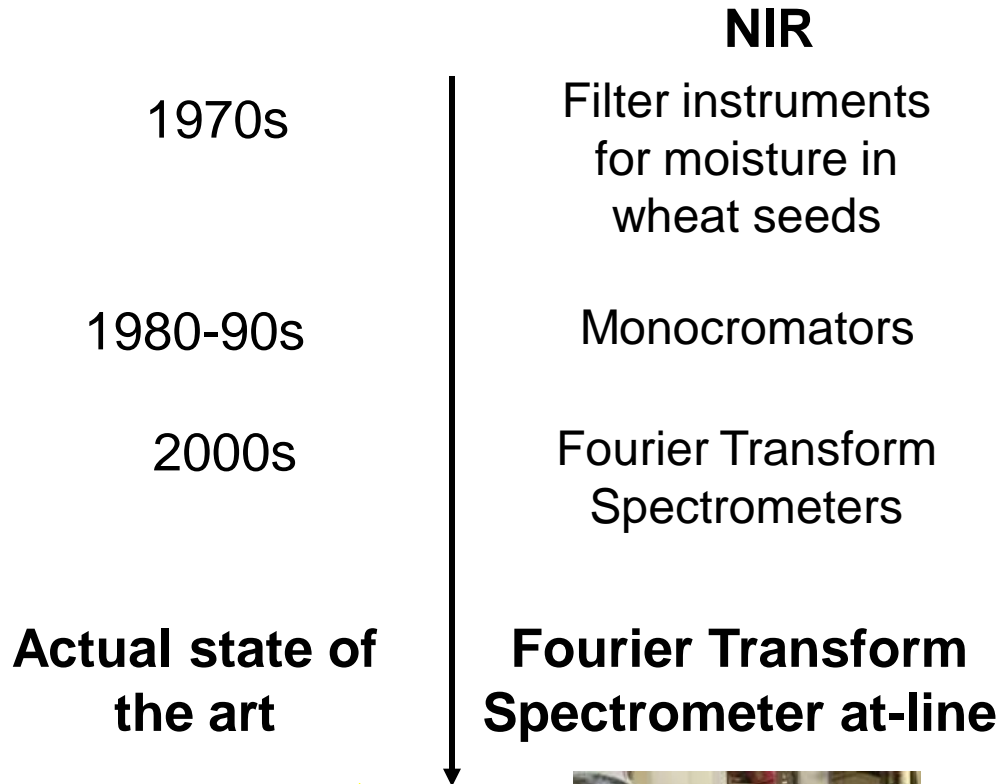**"interaction between two subjects is possible only if they exchange their energy content"**

Every subject hit by a radiation, it refelcts or transmits only a part of such radiation. The part which has not been reflected or transmitted is absorbed by the subject's specific molecules, like for example **protein or moisture into wheat seeds**, according to Lambert-Beer Law:

$$A = -log_{10}T = \varepsilon Cx$$

Near IR
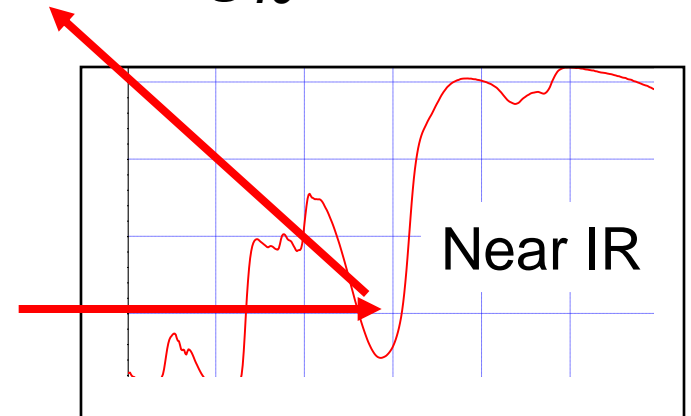
2. NIR Technology hystorical development from NIR to FT-NIR

NIR

FT-NIR Advantages:

1970s — Filter instruments for moisture in wheat seeds

➢ Better signal-to-noise ratio (higher measurement accuracy)

1980-90s — Monocromators

2000s — Fourier Transform Spectrometers

➢ No standardization required for calibration transfer

Actual state of the art

Fourier Transform Spectrometer at-line

➢ Very low service manteinance required

3. NIRMaster – First FT-NIR Standalone to bring light in production processes at-line

BUCHI

Production Environment at-line solution

- **Hygienic easy-clean design**
  increases food safety day by day

- **Polarization Fourier Transform-NIR**
  reduces costs

- **Faster results**
  speed up your decisions

- **Reliable hardware**
  for reliable business – built in real PC

- **Easy-operation**
  for a lean workflow

3. NIRMaster: IP Quality Control into Mills and Bakery Plants

High ingress protection (IP) 54

First number:
Protection against solid objects

5 = Protection against dust limited ingress (no harmful deposit).

Second number:
Protection against liquids

4 = Protection against water sprayed from all directions

3. NIRMaster: unique features

- ➢ Supporting touch screen operation
- ➢ Get more analysis information
- ➢ Higher productivity
- ➢ Higher quality
- ➢ Better understanding in production

# 3. NIRMaster as Quality Control Solution for Milling&Bakery Industry

1. **Quality control of raw materials and ingredients**

   At uploading bulk flour or at bakery silos:
   - Prevent unsatisfactory loads of raw materials
   - Check flour shipment for conformity to specification
   - Determine quality of whole and ground grains (e.g. wheat, corn, rice, tapioca)
   - Quantify important factors of raw materials for better quality of finished products (amylose and amylopectin content)

2. **Quality control of bakery mixtures and dough**

   At production site:
   - Predict flour yield, water absorption, and dough development time
   - Quality verification of bread baking mixtures
   - Determine ash content affecting baking performance and the crumb color of baked bread
   - Determine starch damage and water absorption during the milling process

3. **Quality control of finished products**

   At production site or packing area:
   - Control quality of finished products (e.g. bread, biscuits, flour, confectionery, pasta, and breakfast cereal)
   - Ensure compliance with any statutory compositional requirements (e.g. moisture content of bread)
   - Provide data for nutrition labelling

4. NIRMaster Solutions Milling&Bakery

Product	Wheat Flour N555-515	Whole Rice N555-519	Semolina N555-5120	Wheat flour-Bakery Special	Sunflower Flour	Corn/ Maize grinded
Property						
Moisture	8.9 – 16.1	9.0-15.8	8.5-16	8.9 -16.1	7- 13	3.3 – 15.4
Protein	7.3 – 18.8	5.0- 11.0	8-28	7.3 -18.8	26.5 - 39	5.9 – 22.2
Fat		0.1- 3.0			0.5 – 5.5	
Ash	0.3 -1.3	0.3- 1.6	0.6 – 11.6	0.3- 1.3	6 – 8.3	0.8 – 7.8

4. NIRMaster Wheat seeds application
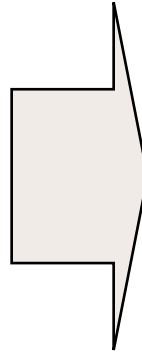
Property	Correlation coefficient R	Standard Error of Prediction	Range
Moisture	0.87	0.6	8.7 – 15.6
Protein	0.98	0.3	10.2 – 18.9
Ash	0.95	0.01	0.46 – 0.64
Gluten	0.99	0.7	22.3 – 47.4

4. NIR Wheat Flour

CHEMICAL PARAMETERS

Moisture
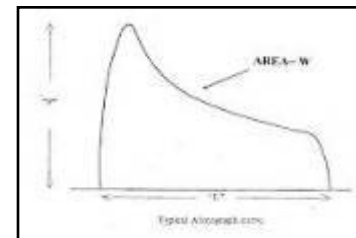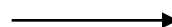Protein Content
Falling Number

RHEOLOGICAL PARAMETERS
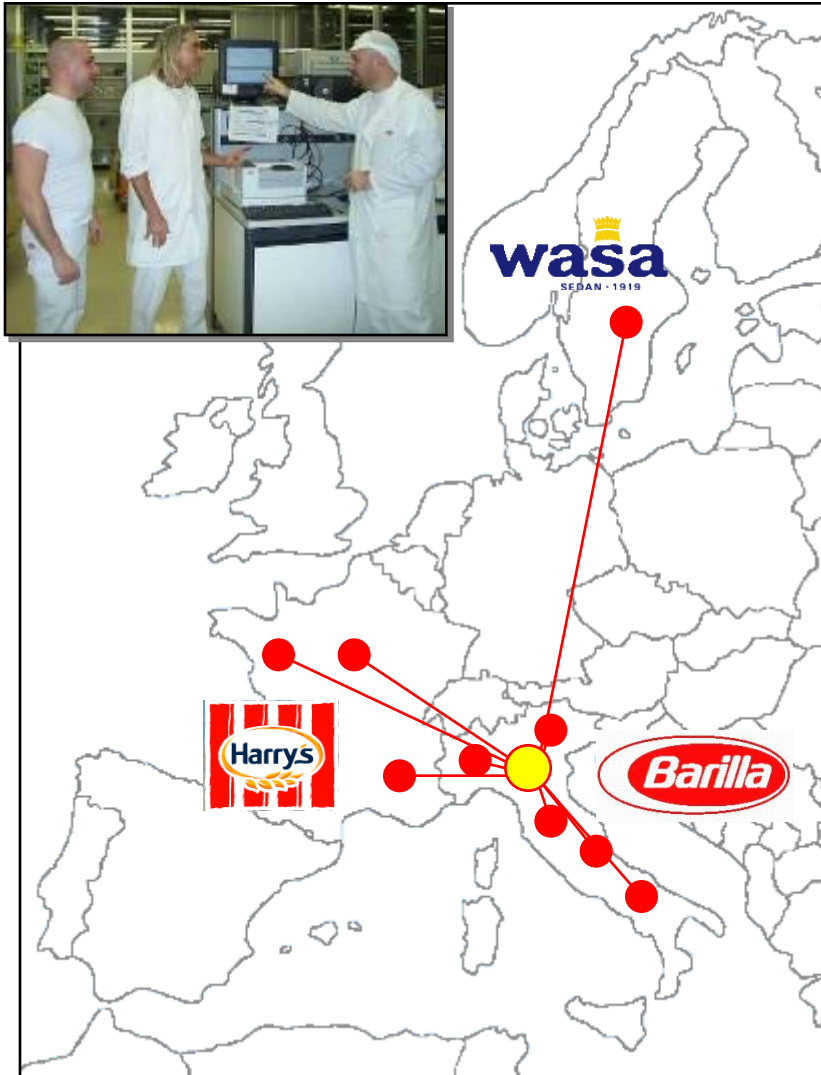
Farinographic
Baking Absorption

→
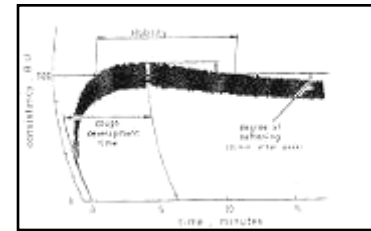
**Brabender
Farinograph**

Alveographic
W
P/L

→

**Chopin
Alveograph**

4. Barilla Bakery FT-NIR Network

"Barilla Food Company has always been characterized by clear focus to quality, as demonstrated by significant investment in research and innovation. ***Since 2005 the company has put into action a network of Fourier Transform NIR Spectrometers for Quality Control Laboratories of its bakery plants****. This Barilla's Network of FT-NIR instruments, originally used only for the analysis of chemical and rheological parameters of wheat flour, has been recently extended to the control of other raw materials and some finished products by developing quantitative as well as qualitative screening methods."*

Barilla

4. NIRMaster Cous-Cous and Pasta Noodles

	Samples	Method	Range
Moisture	210	PLS	10.00 - 16.09
Protein	144	PLS	11.02 - 14.03
Ash	210	PLS	0.69 - 1.35

4. BUCHI NIRMaster Solutions for Milling&Bakery

Hardware

Services

-Support on-site and by remote

- Service engineers

- Application expert support

Applications&Software

- Wheat, Corn, Rice, Canola, Sunflower

- Flour, Pasta, Cous-cous

- Auto-calibrationg wizard

Thanks for your attention!

Visit us at BUCHI booth A-10 to see NIRMaster Solution

or

www.buchi.com

or

campolongo.g@buchi.com

Quality in your hands