MPA – Simply ONE FT-NIR™ for Dairy

- ONE Instrument. ONE Software Package. ONE Partner.

Innovation with Integrity

FT-NIR

Simply ONE FT-NIR™ Technology for Dairy Manufacturers by Bruker

ONE Instrument. ONE Software Package. ONE Partner.

Before the introduction of Bruker's Simply ONE FT-NIR™ Technology, multiple instruments were required; FT-IR for fluids such as milk and whey, NIR for powders and grated samples, and NIT for samples such as yogurt, cottage cheese and puddings.

The Bruker MPA Dairy system is configured to test the full range of dairy products.

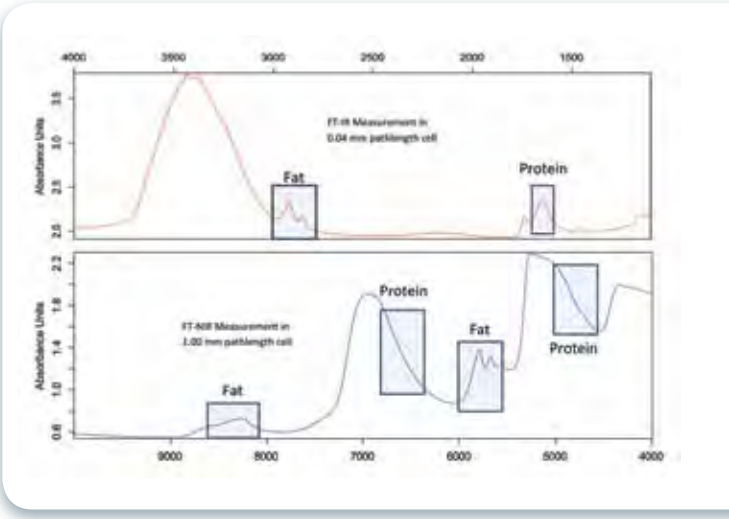
- Simplify routine testing – Shorter learning curve.
- Realize faster ROI – ALL Products. ALL Parameters.
- Eliminate need to cross train on multiple instruments.
- Minimize risk – Streamline FSMA compliance.
- Obtain data from start to finish to support lean manufacturing and six sigma initiatives.

Make the Switch to FT- NIR

Fourier Transform (FT) technology applied to the Near Infrared (NIR) spectral region delivers the same performance advantages that revolutionized measurements in the Infrared (IR) region more than 30 years ago.

FT-NIR instruments offer distinct advantages over FT-IR:

- Measure larger volume to average out sample inhomogeneity
- Quartz flow cells for liquid measurements are wear-free. No calibration drift or cell replacement required
- Routine measurement of high viscosity samples thanks to larger tube and flow cell diameter
- Every instrument is a master. Seamlessly transfer calibrations between different instruments



Exceptional precision and accuracy, coupled with significantly improved sensitivity and speed of Bruker's FT-NIR instruments allows measurement of overtones and combination bands of the very same signals used to measure dairy products with FT-IR instruments.

RockSolid™ Interferometer

The heart of Bruker's Simply ONE FT-NIR™ is the RockSolid Interferometer, based on Corner-Cube technology. This design ensures that the alignment in the optics never changes, eliminating the need for continual adjustments.

A Corner-Cube array was placed on the moon in 1969 by Apollo 11 astronauts. Without any adjustments, it is still going strong today measuring the distance between the earth and the moon within 2 cm accuracy.

For more information on the Corner-Cube on the moon, visit http://www.jpl.nasa.gov/m/news/news.php?feature=605#.UzxDl16j5yF.

Simply ONE FT-NIR™ Technology for Incoming Raw Materials by Bruker

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A key FT-NIR advantage: larger diameter tubing with large volume transmission sample cell easily handles high viscosity samples like condensed milk or ice cream mix without producing excessive back pressure in the system.

Virtually No Sample Preparation. Cheese, grated samples, powders and thick samples such as yogurts and cultured products are simply placed in a sample dish. The dish is rotated during the measurement, insuring that the result is representative of the entire sample.

- Test and standardize incoming ingredients
- Sequester out-of-spec materials
- Keep scorecards for vendor performance
- Initiate mass balance calculations
- Streamline compliance with FSMA
- Screen for economically motivated adulteration (EMA)

Liquid Sampling Module (LSM). Routine maintenance for the LSM is easy. All serviceable components are located on the front of the LSM for easy access and exchange.

For in-homogenous samples, rotating cups are used to average large sample areas for improved sampling of representative material.

A wide variety of sample dishes is available to suit any requirements – from disposable polystyrene dishes for fast sampling with no cleanup, to cups with water-free quartz windows when ultimate sensitivity is required.

More Than Milk

Often, the first manufacturing steps are skimming off the cream and then ultra filtration of the skim milk. Cream and UF skim milk are then added to the skim milk to standardize the fat and protein level, ensuring a consistent starting point in the production process.

The MPA Dairy system simultaneously routinely measures Fat, Protein, Lactose and Total Solids in milk, cream, and whey with accuracy and precision comparable to the standard reference methods. An added advantage of Simply ONE FT-NIR™ technology is improved calibration transfer between units; long term stability and less downtime.

Food Safety and Modernization Act (FSMA) critical aspects:

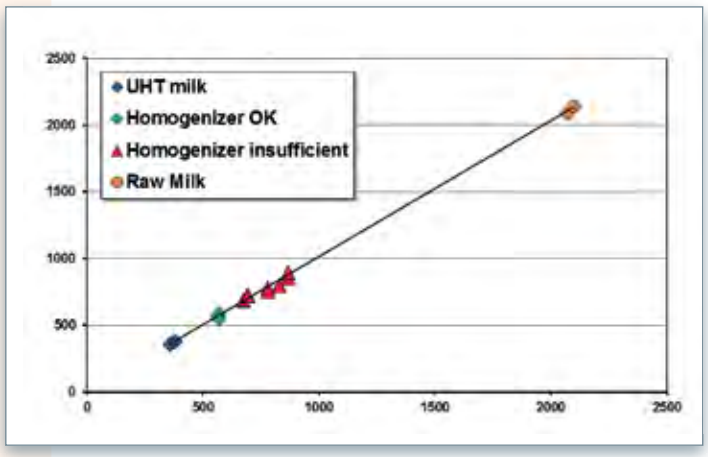
- Supplier qualification, especially foreign suppliers
- Screening for economically motivated adulteration (EMA)
- Trends in Freeze Point Depression and Milk Urea Nitrogen may indicate adulteration of fluid milk samples.
- Qualitative pass/fail methods for EMA screening and; to monitoring lot-to-lot consistency of ingredients such as:
  - Honey
  - Cocoa/Chocolate
  - Fruits
  - Flavors
  - Sweeteners
  - Starches
  - Emulsifiers
  - Stabilizers
  - Packaging and Containers
  - Oils
  - Sugars

Easy and Reliable Operation with Bruker's LSM

- Software-controlled set-up of methods
- Customizable to the optimum parameters for each sample
- Set pumping volumes and speed to adjust for viscosity
- Temperature-control assures measurement accuracy
- Automated, timed cleaning cycle prevents cross contamination
- Homogenize only those samples that require it, avoiding unnecessary operation of homogenizer.

Raw materials that can be analyzed using the MPA Simply ONE:

- Raw Milk
- Skim Milk
- Cream
- UF Milk
- WPC
- Milk Powder



FT-NIR spectral changes correlate well to butterfat droplet size, providing a simple and efficient diagnostic tool for homogenizer efficiency, taking the guesswork out of scheduling maintenance intervals.

Simply ONE FT-NIR™ Technology for In-Line Applications by Bruker

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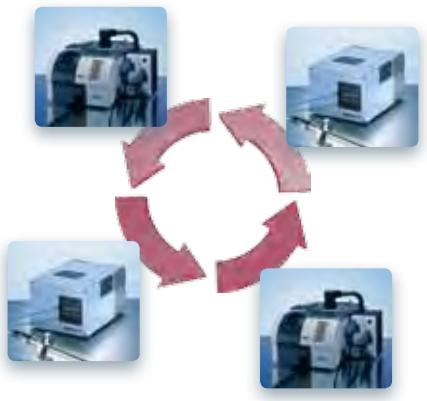
Configure a dedicated FT-NIR for use with a single Unit Operation, or a multi-channel instrument to support multiple Unit Operations in a dairy processing plant.

The exceptional precision and accuracy of Bruker's Simply ONE FT-NIR™ facilitates the easy transfer of product calibrations from one analyzer to another to scale up sample throughput as your production increases, or as new products are added to your portfolio.



- Optimize individual Unit Operations
- Control charting of key process parameters
  - Easy identification of out-of-spec conditions
  - Identify trends and apply corrections to keep Unit Operations within specifications
- Update data for Mass Balance calculations for each Unit Operation

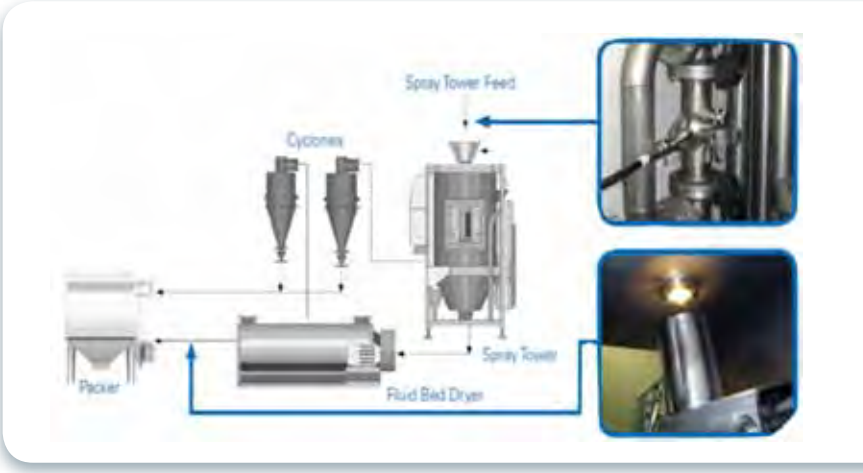
Rapid At-Line Testing

At-Line testing provides a cost-effective way to continually optimize unit operations. Simply ONE FT-NIR™ systems allow fast, easy determination of control parameters at key points in production for either solids, liquids, or both types of samples on a single instrument. A single instrument placed near a separator can be used to determine percent solids in the product feed, residual protein in the whey stream, and percent solids in the product stream.

Simply ONE FT-NIR™ for In-Line Applications

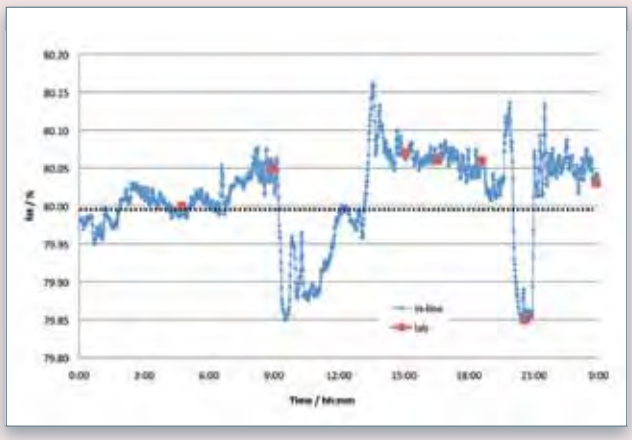
Bruker's Rocksolid Interferometer, based on corner cube mirrors, ensures that the instrument is not affected by vibration. Now it is possible to enjoy the same high performance of Bruker's laboratory systems with multiplexed in-line process measurements.

- The full NIR spectral range is measured, including the combination band region where small changes in protein can be readily discerned
- Multiplexing for up to six measurement points on a single instrument significantly reduces the cost per sampling point
- Minimal maintenance and long-term stability of the instrument and the calibrations



In a typical spray drying unit, the Matrix F continuously monitors several parameters (e.g. fat, protein, lactose, total solids) of the liquid spray tower feed, while providing feedback to the unit based on testing the powder at the sifter of the fluid bed dryer for moisture and several key parameters.

Typical FT-NIR installation for measurement of fat content in butter production. Similar systems are employed in extrusion processes and in separation processes for cultured dairy products.



In-line measurement at key control points reveals short term process variation and drift. Operating closer to the set point with reduced variation improves yield and consistency, often delivering ROI in months rather than years.

Simply ONE FT-NIR™ Technology for Final Products by Bruker

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- Quickly Test Compliance with Label Claims
- Insure Products Meet USDA Grade Requirements
- Analyze Products and Co-Products to Finalize Mass Balance and Yield Calculations

Computing Mass Balance is a key indicator of conversion efficiency in a dairy plant. Simply ONE FT-NIR™ lets you determine that your costly ingredients are in your products and not in a waste stream.

Dairy processors place high demands on instruments for precision and accuracy as well as durability and ease-of-use. Simply ONE FT-NIR™ delivers.

Fluid Milk with Simply ONE FT-NIR™

Accuracy:
Better than **0.8% CV** (Fat, Protein, Lactose and Total Solids) on raw milk

Repeatability:
Better than **0.2% CV** (Fat, Protein, Lactose and Total Solids) on raw milk

Bruker Dairy calibrations

Bruker Dairy calibrations are the product of more than two years focusing on measurement of Standardized Milk samples as well as other fluid dairy products obtained from recognized laboratories employing AOAC approved reference methods.

Milk calibrations standards from DQCI laboratories, preheated on 40 C
All MPA are pre-calibrated based on DQCI samples

Product	Sour Cream 0.5% over formulated	with Simply ONE FT-NIR™ Sour Cream 0.1% over formulated
Plant Production Capacity (lbs/day)	20000	20000
Days in Production/yr	340	340
Allowable Safety Window (%Fat)	0.5	0.1
Butterfat Give-Away/yr (lb)	34000	6800
Butterfat Market Price/lb	$1.75	$1.75
Annual Butterfat Give-Away Cost	$59,500.00	$11,900.00
Annual Savings with Simply ONE FT-NIR™		**$47,600.00**

Simply ONE FT-NIR™ provides fast and accurate reporting for nutritional labeling, and determination of butterfat content to meet product grading standards. Over-formulation to insure that grade standards are met has a significant negative impact on manufacturing efficiency and production costs. A dairy plant producing 20,000 lbs of sour cream each day, over-formulating by 0.5% for butterfat content, has nearly $59,500 more in annual raw material costs, and lost annual production of 200,000 lbs -with a retail value of more than $330,000.[1]

[1] Based on Butterfat price of $1.75/lb. and an average retail price of $1.63/lb. for Sour Cream as of February 2014

Simply ONE FT-NIR™ Technology for Software and Quality Systems by Bruker

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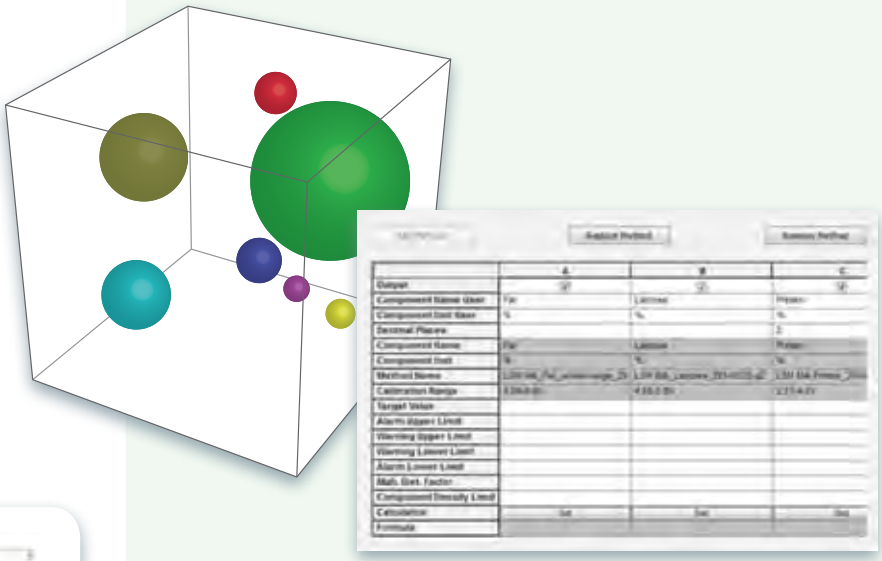
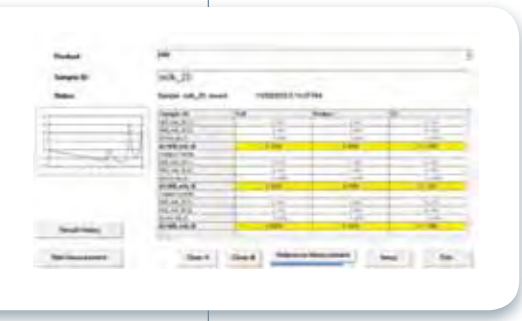
- Intuitive operator interface backed by sophisticated data evaluation methodology
- Full instrument validation for regulatory compliance with IQ, OQ and PQ protocols
- Performance Validation Tools for ISO 17025 Calibration Validation
- Complete digital data retention and 21 CFR Part 11 compliance

One Software Package.

Whether your instrument is for in-line process, a bench top unit dedicated to controlling a single unit operation, or in a lab to analyze everything, there is one software package that does it all. Opus is designed to deliver traceability to document that a sample was measured using the correct instrument set-up, that results were obtained using the correct evaluation methods, and then archive the spectra and results in a single file for each sample. You can easily recall any sample data for internal audits, or for external auditors examining your data and methods.



Using Simply ONE FT-NIR™ couldn't be easier. Just select the product and you are ready to go! Everything else is fully automated – even cleaning the sample path for liquid samples.

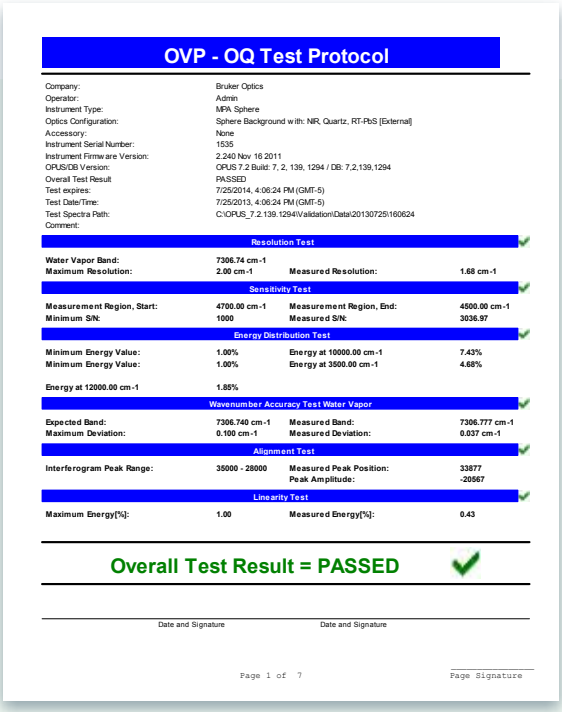


Powerful evaluation tools extract information from your samples– cluster analysis for raw material qualification, and PLS methods for quantitative analysis.

- Hierarchical Identification for raw material qualification
- PLS Quantitative Analysis for compositional analysis
- Conformity Test
- Multi-evaluation to sequence cluster and PLS analysis for each sample, with the ability to perform calculations using the measured values from the sample

PerformanceGuard Monitoring

PerformanceGuard continually monitors critical system functions, and immediately informs the operator if there is an out-of–spec condition. OQ and PQ test status is also indicated with separate results for liquid, solid and in-line measurement points.



OVP - OQ Test Protocol

Company:	Bruker Optics
Operator:	Admin
Instrument Type:	MPA Sphere
Optics Configuration:	Sphere Background with: NIR, Quartz, RT-PbS [External]
Accessory:	None
Instrument Serial Number:	1535
Instrument Firmware Version:	2.240 Nov 16 2011
OPUS/DB Version:	OPUS 7.2 Build: 7, 2, 139, 1294 / DB: 7,2,139,1294
Overall Test Result	PASSED
Test expires:	7/25/2014, 4:06:24 PM (GMT-5)
Test Date/Time:	7/25/2013, 4:06:24 PM (GMT-5)
Test Spectra Path:	C:\OPUS_7.2.139.1294\Validation\Data\20130725\160624
Comment:	

Resolution Test

Water Vapor Band:	7306.74 cm-1		
Maximum Resolution:	2.00 cm-1	Measured Resolution:	1.68 cm-1

Sensitivity Test

Measurement Region, Start:	4700.00 cm-1	Measurement Region, End:	4500.00 cm-1
Minimum S/N:	1000	Measured S/N:	3036.97

Energy Distribution Test

Minimum Energy Value:	1.00%	Energy at 10000.00 cm-1	7.43%
Minimum Energy Value:	1.00%	Energy at 3500.00 cm-1	4.68%
Energy at 12000.00 cm-1	1.85%		

Wavenumber Accuracy Test Water Vapor

Expected Band:	7306.740 cm-1	Measured Band:	7306.777 cm-1
Maximum Deviation:	0.100 cm-1	Measured Deviation:	0.037 cm-1

Alignment Test

Interferogram Peak Range:	35000 - 28000	Measured Peak Position:	33877
		Peak Amplitude:	-20567

Linearity Test

Maximum Energy[%]:	1.00	Measured Energy[%]:	0.43

Overall Test Result = PASSED

Date and Signature Date and Signature

Page 1 of 7 Page Signature

Performance Validation for Regulatory Compliance

Bruker spectrometers and software are fully validated to meet the requirements of Pharma, FSMA and ISO 17025. Our internal quality systems have been scrutinized by major Pharmaceutical and Food Manufacturing companies, and found to be the best in the industry. Simply ONE instrument performance qualification includes full OQ and PQ test protocols that are integrated into daily instrument operation. Each measurement channel has a specific set of tests and pass/fail criteria. Tests use built-in standards and can be scheduled to run in off-hours so your instrument is fully qualified and ready to go when you are ready to begin the day's measurements.

Service and Support North America

Bruker Optics is staffed by expert scientists and engineers with an in-depth knowledge of instrumentation and applications in the dairy industry. Our product specialists are available to assist you with method development either remotely or in your lab.

Bruker Corporation Boston, MA
Phone +1 (978) 439-9899

Bruker Optics in Houston, TX
● **FT-NIR Headquarters**
Phone +1 (281) 292-2447

Bruker Optics in Madison, WI
Phone +1 (608) 276-3800

Bruker Optics in Fremont, CA
Phone +1 (510) 683-4335

Bruker Optics in Milton, Canada
Phone +1 (905)-876-4641

Bruker Mexicana in Mexico City, Mexico
Phone +52 55 5601-2599

About Bruker Corporation

For more than 50 years, Bruker Corporation is driven to always provide the best technological solution for each analytical task.

Today, worldwide more than 6,000 employees are working on this permanent challenge at over 90 locations on all continents. Bruker systems cover a broad spectrum of applications in all fields of research and development and are used in all industrial production processes for the purpose of ensuring quality and process reliability.

www.bruker.com/dairy

Bruker FT-NIR Systems

Tango FT-NIR for QA/QC Applications

MPA Multi-Purpose Analyzer

Matrix-I for at-line analysis

Matrix-F for in-line process applications