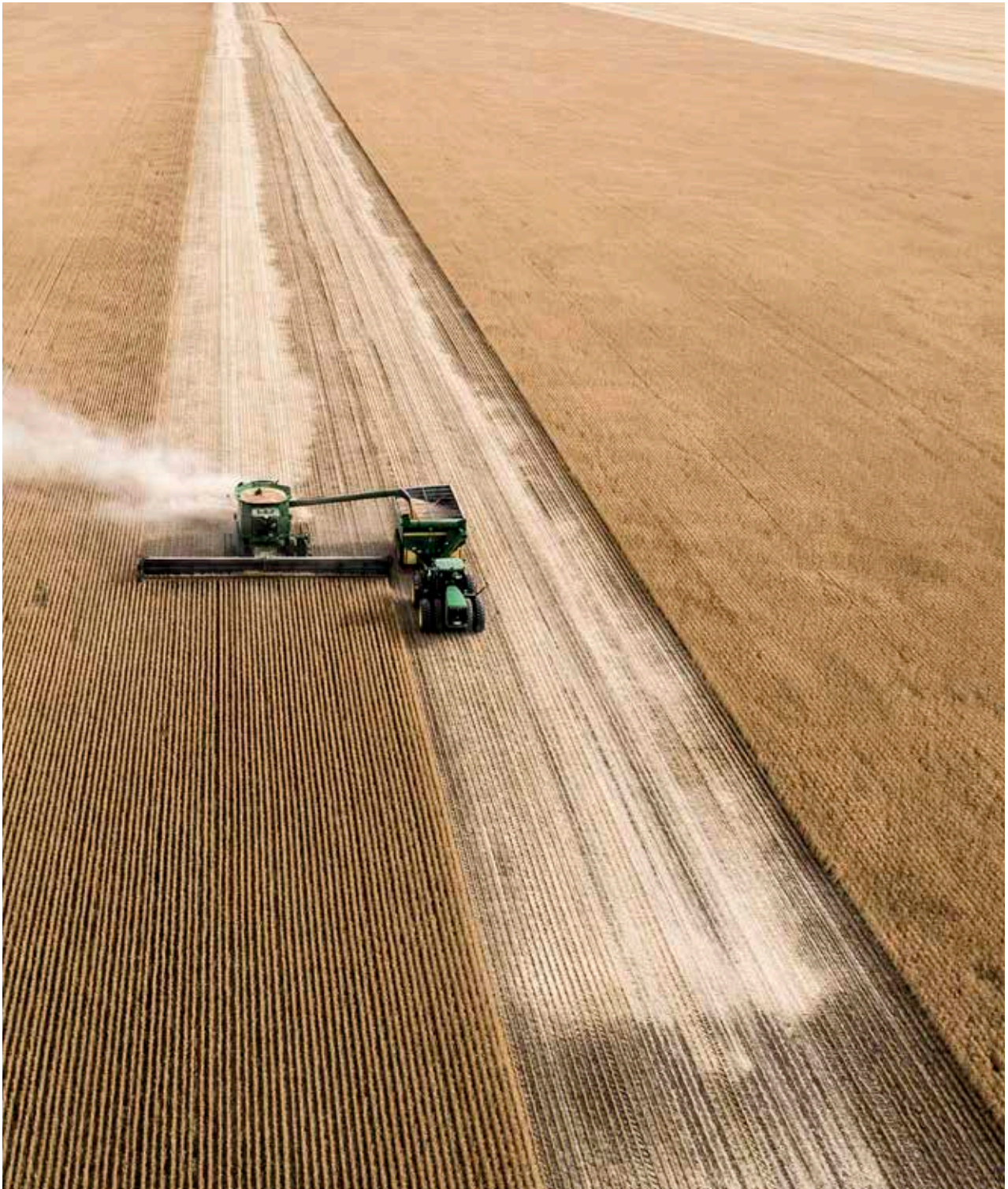


**FOSS**

# FOSS IN GRAIN, FLOUR MILLING & OILSEED PROCESSING



ANALYTICS BEYOND MEASURE



# ANALYTICS BEYOND MEASURE

Grain production has provided us with challenges ever since man began to harvest. Today, weather patterns, effective handling and varying yield are just some of the critical factors we need to consider in our quest to feed the growing global population. Advanced grain analysis supported by the latest in digital connectivity can show the way.

By driving digitalisation forward, you can add a new level of automation to your business and secure quality and consistency. You will be able to limit the number of human errors that slow you down. Scale your business faster. And reduce manual labour and labour costs.

A lot can be lost and a lot can be won on the journey from raw

material to finished product. That is why we have spent the last 60 years developing and refining instruments that measure every little step of the way. We translate measurements into mathematical algorithms that power automated systems, optimise your manufacturing process and make you grow. Securing and improving food quality is what we do.

Neither natural resources nor knowledge go to waste. Intelligent information management can turn existing production into efficient processes that generate less waste, bigger yields and higher quality.

We call it:  
Analytics Beyond Measure









# WE HELP YOU TO SECURE THE BEST RAW MATERIAL ...



## Plant breeding

The super grain that will save the world's food problems – unlikely to be found, but ongoing research in plant breeding is leading to higher yields and improved resistance to drought, disease and pests.

FOSS analytical solutions provide convenient routine analysis options with either near infrared (NIR) or automated chemical analysis for reference analysis.



## On Farm

What is the crop really worth? Should I segregate and blend before delivery? Where should we start harvesting and when? If it can't be measured it can't be managed.

On farm testing with FOSS equipment gives accurate measurements in line with those at the receival site used for grower payments.



## Receival

Grains, oilseeds and pulses – they can all be tested quickly, easily and accurately for payment and segregation. Most grains, oilseeds and pulses can be analysed directly without any sample preparation and, thanks to technology developed by FOSS, you get correct results whatever the weather or location.





## AND PUT IT TO THE BEST POSSIBLE USE



### Intake

At intake to crushing or milling, virtually instant measurements of key parameters such as moisture, protein and oil content allow you to decide how to store and use raw material.



### In production

In the process, continuous measurements keep you in the picture avoiding nasty surprises and helping to streamline your production for optimal results.

Accurate and timely information about key parameters such as protein, moisture and ash allow you to fine-tune processes for profit and consistent quality.



### Final products

At product release, rapid, reliable tests allow you to release shipments with confidence.



# PLANT BREEDING WITH NEAR INFRARED (NIR) OR AUTOMATED CHEMICAL ANALYSIS FOR REFERENCE ANALYSIS

FOSS solutions include the ability to present small and delicate samples without destroying the sample. In addition to protein, moisture and oil in grain, other ready-to-use application models are available such as extract for beer production and moisture in green malt.

For the many additional applications, users can develop their own calibrations using FOSS calibration development software. An example is the analysis of nitrogen in rice leaves as the taste of rice is deeply related to its protein content.

The high transferability of calibrations and the ability to link instruments in a network allow instruments and result data to be coordinated from a central location, to guarantee identical results in all locations.

## **Reference analysis**

Despite the obvious advantage of indirect NIR methods; robust, reliable reference methods are

required to develop the calibrations or equations upon which such analysers depend. For today's busy laboratory automated testing systems that generate rapid and well-documented results are essential for quality environmental management. Automated Chemical Analysis (CA) systems address the needs of these laboratories with a wide range of tried and tested solutions covering the so-called compositional or proximates testing.

In addition, a significant volume of analyses remain within the laboratory environment for QC/QA, labelling and product development purposes. To support your compliance with governmental bodies and Quality Assurance programme, FOSS offers documentation for equipment qualification covering installation and operational qualification (IQ/OQ) as well as performance qualification (PQ).



**For over 30 years  
FOSS has led the  
way in calibration  
development around  
the globe**









# ON FARM ANALYSIS WITH ALIGNED NEAR INFRARED

The idea of giving farmers a portable instrument to measure grain in the field is nothing new, but until recently, getting the measurements in line with the measurements at the receival site has been problematic.

On farm measurements with FOSS equipment (Infratec™ Sofia) are fully aligned with the results given by payment analysis at the receiving station (Infratec™ NOVA or Infratec™ 1241). The Infratec NOVA and Infratec 1241 have a number of approvals for trade purposes and are the official system used for payment by bulk grain handlers around the world.

Deliveries can be made safe in the knowledge that they won't be rejected for excess moisture. And grain can be segregated and blended on farm for optimal price according to market demands, for instance, in some years and markets, a difference of just 0.1% in protein can mean the difference between high and low premium payment.



FOSS Digital Services can help you reduce your production costs and secure the quality of your products regardless of where they are produced. Our digital services will ensure you have peace of mind knowing that your data is backed up and protected for whenever you need it.

## **Keeping it all up to date**

FOSS solutions can be connected to the internet, so even though a farmer testing grain in a field miles from the nearest town may appear to be a long way from the bustle of international grain markets, he is still, in fact, an integrated part of the supply chain.

With a web-based update system keeping his grain analyser up to date for example, with adjustments and improvements to calibrations according to seasonal changes, the measurements are as reliable as any made on the journey from the field to the table.



# RELIABLE AND RAPID GRAIN ANALYSIS FOR RECEIVALS AND TRADE

Rapid analysis at the weighbridge has become indispensable for modern grain receipt. Today, over 10,000 Infratec™ grain analysers are in use for testing grain at receipt sites. The Infratec is the official system used for payment by bulk grain handlers around the world and has a number of approvals for trade purposes.

Grains, oilseeds and pulses can all be tested quickly, easily and accurately for payment and segregation. Most can be analysed directly without any sample preparation and, thanks to the Infratec stabilising technique patented by FOSS, you get correct results whatever the weather.

The huge Infratec database comprises over 50,000 cross checked samples, PLS and robust ANN-based calibrations building on a wide sample range from many years of harvests. This gives a level of accuracy and stability that enables Infratec to test even the most unusual samples.

A Test Weight Module allows rapid and accurate volume weight determination of the grain for milling potential and efficient silo management.

## Networked instruments

Payment analysis must deliver unquestionable reliability and uniformity, regardless of location and operating conditions – a requirement that networked Infratec instruments have effectively addressed by giving identical measurements, wherever they are located. All major grain producing countries now use FOSS ANN calibrations and the Infratec system.

Infratec networks have been recognised by both commercial and governmental authorities from the introduction of the first network in 1991 and, today, more than 7000 Infratec instruments are linked in global networks.

## Visual grain testing

The current process of grading by visually inspecting grain is subjective. Furthermore, getting highly skilled staff in place often at remote locations can be problematic and costly during the busy harvest season. The EyeFoss™ encapsulates valuable experience, empowering any operator to make assessments. EyeFoss instruments are monitored and managed via the internet for consistent measurements across multiple sites.

## Smaller grain receipt sites

Knowing the quality of your grain is just as important for smaller, low infrastructure sites for segregation and marketing of grain. The Infratec™ Sofia is a robust, portable analyser offering reliable measurements aligned with the Infratec grain analyser.

Infratec Sofia measurements are based on the same comprehensive data used to calibrate Infratec instruments.

## Some of the main commodities that can be measured quickly and accurately at receipt

**Grains:** Wheat, durum wheat, barley, corn, oats, rye, triticale, sorghum/milo, rough rice

**Oilseeds:** Soybean, rapeseed/canola, sunflower, cotton, peanuts

**Pulses:** Lentils, faba beans, chick peas, green peas, lupins



## Global calibrations

Grain processing is truly a global industry with raw materials being traded in international markets.

FOSS global calibrations are developed using data obtained from all over the world with data from over 50,000 samples from more than 20 harvests. Calibrations have been developed in collaboration with regulatory authorities and customers around the world.

The unique development of Artificial Neural Networks (ANN) has created large calibration models that cover multiple products. Calibrations are continuously being expanded with new raw materials and updated with new data to ensure the latest crops and varieties are covered.





# FLOUR MILLING INTAKE AND PROCESSING



## Ash is cash:

New levels of accuracy provided by NIR technology is helping millers to save thousands of euros through better yield.



FOSS solutions add significant value when acquiring grain for milling wheat flour, semolina, soy meal, ground wheat, middles, rice meal, corn meal, etc.

Moisture and protein in batches of whole grain are measured as they arrive at the flour mill. This allows the perfect blend of grain for consistent quality products downstream in the milling process. It also helps to improve the tempering process by allowing the right timing, use of energy and water according to the exact nature of the grain.

### **Bench top analysis at intake with volume/weight determination**

Robust, easy to use, bench top solutions can be positioned at the weighbridge for a virtually instant test. In addition to testing moisture and protein, a bench top solution can measure Test Weight for an accurate volume weight determination of the grain. Test Weight is a widely recognised specification in grain grading because it is related to the degree of quality and is often used as an index of milling potential. Moisture content, climate conditions, kernel size, density and packing factors affect test weight. The volume weight can also be used as a silo management tool to optimise the storage space in the silo.

### **Flour milling intake**

Recently, the concept of using near infrared analysis for periodic testing of grain deliveries has been taken a step further by FOSS with the ProFoss™ whole grain in-line analyser. This system can measure entire batches of grain using a specially designed sample interface that analyses the grain as it is conveyed in a standard pipe or transport system without the need for sample diverters. It then feeds a continuous stream of analysis data back to a computer in your control room.





# TAKE CONTROL OF THE MILLING PROCESS

**Rapid, routine analysis with FOSS instruments gives a higher level of knowledge in milling and is setting new standards for quality control in the ancient art of producing flour.**

With reliable information about moisture, protein, ash, gluten, water absorption and other key parameters, you can improve the consistency of end products and the entire milling process. For instance, new levels of accuracy in measuring critical parameters such as ash offers improved yield. The instruments are also highly robust complying with ISO 12099 standards. NIR instruments are tailor made for routine analysis in a laboratory or close to the production line.

#### **In the laboratory or control room**

Bench top analysis can be performed quickly and easily by anyone working in the plant, for example, with the latest NIR technology, the sample is just poured into a cup and placed in the instrument.

Results are displayed on a screen within a minute. Likewise, falling number tests are made fast, convenient and reliable with a modern approach to the traditional test method.

#### **An eye in the process**

In addition to bench top analysers, NIR analysis can be applied directly in the process stream. Taking measurements every few seconds, solutions such as ProFoss™ provide critical information about your process 24/7 for optimal quality products and improved profitability in flour analysis.

Monitoring process variations using a trend chart and a moving average function enables the detection of process variations that are significantly smaller than the standard error of prediction (SEP) of a laboratory analyser. Even if one result is wrong for some reason, this has no influence on the overall result because a new result will be generated a few seconds later.





# OIL SEED INTAKE AND CRUSHING

## Take control

Whether you work in oil-seed trading, crushing and refining, meal production or with traditional production of olive oil, reliable measurement results delivered in a simple, timely way give you more power to control production for optimal quality and profit. Analysis results for key control parameters are delivered in a fast, convenient way to help you simplify lab operations, avoid rework in production, ensure end-product quality and get the very best out of valuable raw material.

## Tools for end product control

FOSS supplies both indirect (infrared) and chemical analysis solutions for end product control. For chemical analysis we can provide a complete range of solutions aimed at automating steps for speed and safety while minimising use of chemicals.

The key to oil crushing starts by controlling the quality of the raw material at the intake. Throughout the subsequent production cycle, FOSS dedicated analytical solutions deliver rapid reliable information in a simple and convenient way to help you to improve your profitability.

Just one example is in oil crushing where FOSS solutions help to control the quality of the oil seeds at the intake so that you pay for what's really important - the oil content. Another example can be taken from vegetable oil refinery. As much as 25 tonnes or so of edible oil can flow through a typical vegetable oil plant every hour. The removal of Free Fatty Acids (FFA) relies on the correct amount of inputs, too little and you don't remove all the FFAs, too much and you waste good materials. Reliable and frequent information from FOSS solutions provides more power to control production, reduce the risk of re-work and ultimately, improve profit.



# TYPICAL APPLICATIONS FOR FOSS SOLUTIONS



## **All in one, soy bean analysis**

The Infracac™ NOVA can be used to control soy beans for oils and moisture at intake. And with the sample transport module option you can use the same unit to test soy meal for moisture, fat, protein and fibre at the end of the process.



## **Improving yield in olive oil production**

Rapid analysis of fat and moisture in olive paste and pomace with the smart, easy to use Olivia™ analyser is an obvious way to improve yield, for example, by ensuring the milling process is as efficient as possible.



## **Optimal process control with inline NIR**

Continuous measurements of moisture, protein and oil content in soya meal directly from the production process helps you to improve efficiency while also improving quality and profit.

## Nine good reasons to consider FOSS solutions for the oil crushing industry

- 1. Raw material at the right price -** Pay the right price for oil seeds on an objective measurement of oil content and moisture.
- 2. Quality in, quality out -** Make fast and accurate spot checks on crude oil before it enters your refining process or check the oil content of seeds before they enter the crushing process.
- 3. Avoid re-work -** Continuous information about key parameters of the oil flowing through your production lets you get production right first time.
- 4. Segregate for profit -** A fast and accurate indication of how your olive oil matches up to IOOC standards allows you to segregate batches for maximum profit.
- 5. Effective lab work -** Take advantage of fast and safe methods of conducting standard wet chemistry analysis.
- 6. Act now -** Key information delivered just when you need it gives you the power to spot problems and act promptly.
- 7. Improve operations with automatic control -** Integrate a FOSS process control solution into your production and enjoy hands-free monitoring/control 24 hours a day.
- 8. Your own on-site laboratory -** Practical and simple to use FOSS solutions, avoid waiting for results from an external laboratory.
- 9. Enhance your reputation with consistent products -** Check finished batches and prove to customers that products match required specifications.



# TECHNOLOGY OVERVIEW



## Near infrared reflectance and transmittance

FOSS NIR solutions use either near infrared transmittance or near infrared reflectance technology all according to the job to be done. When measuring whole grain for instance, near infrared transmittance used in the Infratec™ NOVA grain analyser offers superior performance. Measurements are made in a lower wavelength range, 850-1050 nm. The higher energy level of the light in the lower range allows for deeper penetration into the grain kernels, so not only the surface, but also the inner part of the kernel is measured, giving a superior representation of the sample analysed.

In contrast, for measuring samples such as flour, near infrared reflectance across a broad wavelength from 1100 nm up to 2500 nm is ideal for testing parameters such as ash and other key parameters such as moisture, protein and colour. FOSS solutions such as the NIR™ DS2500 have a unique signal-to-noise ratio giving an ultimate measure of ash and other low level parameters in need of accuracy. In addition, a combination of cup rotation and sub-scans measures different points in the sample for accurate results.



## Near infrared in the process

Near Infrared can also be applied directly in the process flow with the ProFoss™ analyser. For instance, in flour milling, the ProFoss can be mounted directly in the milling process where it measures the flour as it flows through the pipes for moisture, protein and ash every few seconds. The results are fed back to a computer in the mill control room and displayed on an intuitive graphical interface.

Measurements are made using a high-intensity dual-lamp light source that illuminates the sample directly or through an optical fibre. The light interacts with the sample and the reflected or transmitted light is measured by the diode array sensor. The complete wavelength range is measured instantaneously enabling measurements to be accurately carried out even on fast moving samples. Calibrations are transferable between units and integration to process regulation systems through Kepware. Ethernet network is preferred, but Profibus, Profinet or analogue signals can also be used.

## Image analysis

The EyeFoss™ instrument uses image analysis technology to provide an objective supplement to existing visual checks performed by the human eye. It captures data and then processes it using a series of calibrations to determine grain quality.

It has been designed specifically to perform objective visual quality assessments of wheat, barley and durum such as identification of sprouted grain, weed seeds and un-millable material as well as grain defects such as broken, mould, stained or frost damage.

Networking software called FossManager™ is used to ensure that all instruments perform the same. An instrument can be connected into a network allowing calibration and software updates to be made by an expert user via the internet. The expert can also monitor the instrument to ensure optimal performance at all times.





## Digital connectivity

FossManager™ networking solutions remotely manage, configure and calibrate all your analytical instruments.

A network comprises a group of standardised instruments controlled from a Network Administration Centre ensuring that all units will give the same performance independent of operator or location. The master instrument is also used to monitor the accuracy of the calibrations.

The entire network can quickly be updated or upgraded with new calibrations from the centre. Administration costs are reduced, administrative routines are simplified, and duplication of effort is eliminated.

## Calibrations and transferability

A key principle behind FOSS analytical solutions is that it should be simple for any business to take advantage of. In relation to near infrared instruments, ready-to-use Artificial Neural Network (ANN) calibrations are a key part of the FOSS solution. Robust, stable and based on 25 years of data collection reflecting seasonal and geographic variations, the calibration has achieved a unique position as a platform for advanced grain analysis operations. The Infratec™ NIR calibration is now a European standard for measuring protein and moisture in whole grain of wheat and barley.

New instruments are backwards-compatible with the older calibration databases. In this way, databases have continuously been expanded and today the largest ones contain more than 50,000 samples. Continuous design improvements over successive generations of instruments have also improved the stability and uniformity of individual instruments, leading to excellent calibration transferability across populations of instruments with very little calibration adjustment required.



## Unified Grain Moisture Algorithm

High-frequency (149 MHz) UGMA compliant test. This penetrates deep into the kernel to give accurate results for moisture in all types of grains, beans and pulses



## Automated laboratory methods

Standard methods such as Dumas and Kjeldahl are not always the most convenient tests to perform, but are nonetheless essential for reference and labelling purposes, while the standard falling number test remains the only effective way to test for weather damage at grain receipt.

FOSS automated laboratory solutions include many innovative features designed to make these universal tests as fast, cost-effective and safe as possible. The cooling lid on the Alphatec™ FN<sup>Q</sup> analyser, for example, helps avoid a rush of hot steam when loading samples, while batch handling automation offered by the Kjelttec™ and Dumatec™ improves throughput of samples during Kjeldahl analysis.



