



**Malvern  
Panalytical**  
a spectris company

# CNA Pentos cross belt analyzer

Real Time Cement Process Control





**Key features:**

- Rapid and accurate elemental analyses
- Suitable for a wide range of particle sizes (fines to rocks)
- Robust Factory Calibration
- Can be customized for unusual material types
- Wide elemental measurement range
- Integrated Moisture measurement
- Simple installation and easy maintenance
- Measures nearly all material on the belt
- Stable analytical performance

## Take your cement operations to the future

The cement industry has ambitious goals to reduce carbon footprint, control other emissions, improve quality, and boost profitability. Several novel process adaptations are under consideration to help achieve these goals. All of these have one thing in common – tight process control is required for them to be effective. Accurate real time elemental analyses provide the information critical for this control.

The CNA provides information to generate a stable and chemically correct kiln feed. This is the most critical parameter in stabilizing and optimizing pyro processing. In addition, information from the CNA provides guidance to:

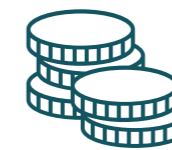
- Extend quarry life by utilizing as much marginal material as possible.
- Generate chemically correct stockpiles for further processing.
- Perform real time control of additives to minimize cost and maximize raw mix quality
- Validate the quality of additive deliveries



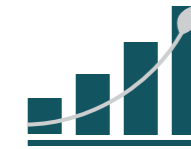
### With our range of on-line analyzers, you benefit from:



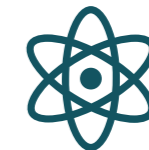
Unmatched safety



Low cost of ownership



Reduced Environmental Impact



High Accuracy and Reproducibility



Measure a wide range of rock sizes with high representativity

### Plus, enjoy increased stability with:

- Optimal use of alternative raw materials
- Efficient and consistent raw material processing
- Reduced costs with lower burning zone temperature and improved clinker grindability
- Process stability leads to reduced downtime and improved refractory life



# How information from PFTNA can make your process more efficient

PFTNA uses an electrical tube to provide a pulsed flux of neutrons. These neutrons interact with the nuclei of each element on a passing conveyor belt. Each element emits characteristic gamma radiation which is measured and

quantified to obtain an elemental analysis of the material. The PFTNA Sodern technology uses deuterium-tritium (D-T) fusion to generate high energy neutrons



## Ultimate operator safety

Unlike hazardous radioactive isotope-based units that continuously emit neutrons, the CNA neutron emitting module (NEM) can be switched off during downtime, maintenance, or emergencies. This provides the basis for a unique automated radiation protection system (ARPS) using a series of electrical interlocks that ensure unmatched radiation safety.



## Highly representative data

The pulsed D-T neutron generator provides 14 MeV neutrons, enabling constant neutron flow for unmatched performance stability and close monitoring of key cement parameters like LFS, C<sub>3</sub>S, C<sub>2</sub>S, C<sub>3</sub>A, iron modulus, and silica modulus. The fast-moving and high-energy 14 MeV neutrons allow improved results even with significant particle size variations and significantly reduce sensitivity for varying belt loads and blend ratios.



## No hazardous waste

The electric neutron source does not generate hazardous waste that is unavoidable with radioactive isotopes. Once neutron tubes reach the end of life, they are simply returned to Sodern for disposal.



## Minimal administration

Compared to radioactive sources, the use of a PFTNA neutron tube drastically reduces handling and transportation hassle, eases administrative burdens, and lowers licensing requirements to comply with local norms and regulations.



## World-class technology

Our partner Sodern is the world's leading supplier of neutron tubes handling industrial, defense, and security applications.





## From Quarry to Raw Mill

Aging quarries pose challenges in maintaining optimal limestone composition. A CNA Pentos helps to:

- Extend the quarry life by maximizing the use of low-grade rock
- Avoid unwanted contaminants such as Mg, Na, or S
- Minimize the use of high-cost corrective additives!



### Limestone pile management

The CNA analyzer tracks the cumulative chemistry of the pile. This allows the operator to direct the trucks to different areas of the quarry so the final elemental composition of the pile is closer to the target.



### Raw mix proportioning

The CNA analyzer monitors the chemistry of the raw mix and automatically triggers an adjustment of the reclaimed stockpile and additive proportions. This results in:

- Decreased variability in the raw mix and kiln feed
- Lower fuel consumption per ton of clinker produced

## Energy savings: Fuel and electricity

With chemically correct and stable kiln feed, the kiln runs smoother with lower fuel consumption, reduced temperatures, and easier grinding clinker.

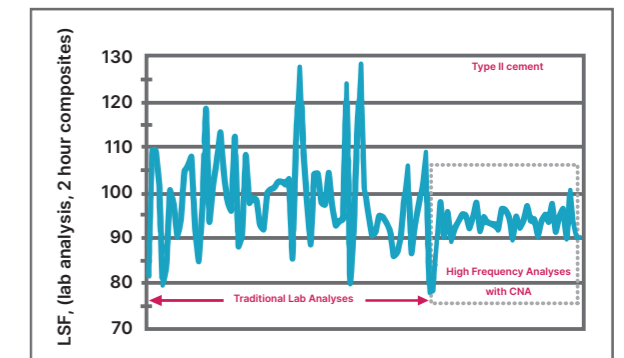
### Three key savings:

1. Kiln Heat Consumption – The stability of the raw mix chemical composition is a key parameter contributing to the heat consumption. Stable chemistry allows operators to reduce fuel and operate closer to practical limits. Conversely, unstable chemistry requires operators to burn additional fuel to accommodate swings in the burnability of the mix. The CNA can achieve a lower standard deviation for monitoring key parameters such as LFS,  $C_3S$ ,  $C_2S$ ,  $C_3A$ , and related moduli. This decreases heat consumption and related emissions.
2. Grinding energy – Unstable raw mix chemistry forces operators to over-fire the kiln. This creates a hotter burning zone temperature and more sintered (dense) clinker. This clinker can be significantly more difficult to grind, unnecessarily increasing the energy required to grind it.

3. Additional production – If a kiln operates with reduced heat consumption, it enables additional clinker production. This additional production can be a significant benefit if the plant enjoys a high buying demand for the additional cement.

Talk to our experts about estimated savings for your plant.

### Stabilize then optimize





# CNA Pentos

## The fifth-generation on-line analyzer

### CNA Pentos

CNA Pentos is especially suitable for confined spaces and low belt loads. With the neutron source and gamma detector located on both sides of the belt, it is recommended for layered or non-homogeneous material.

### Key benefits

#### Calibration flexibility

The CNA Pentos can support a wide range of materials, with secondary calibrations for new or non-standard material measurements.

#### Tailored belt loading

The CNA Pentos has been enhanced to cover a wider range of belt loads, particularly the lower loads found in smaller plants.

#### Optimized detector design

The detector design has been enhanced to increase long-term stability and eliminates the effects of stray neutrons.

#### Easy maintenance

The expert service tool enables simplified instrument performance testing by advanced clients and service engineers.

#### 1 Neutron emitting module (NEM)

Using the PFTNA Sodern technology, the module can generate high-energy pulsed neutrons for enhanced depth of interrogation. Thanks to its unique ability to be turned off, the CNA is safe and easy to license for transportation.

#### 2 Sliding plate

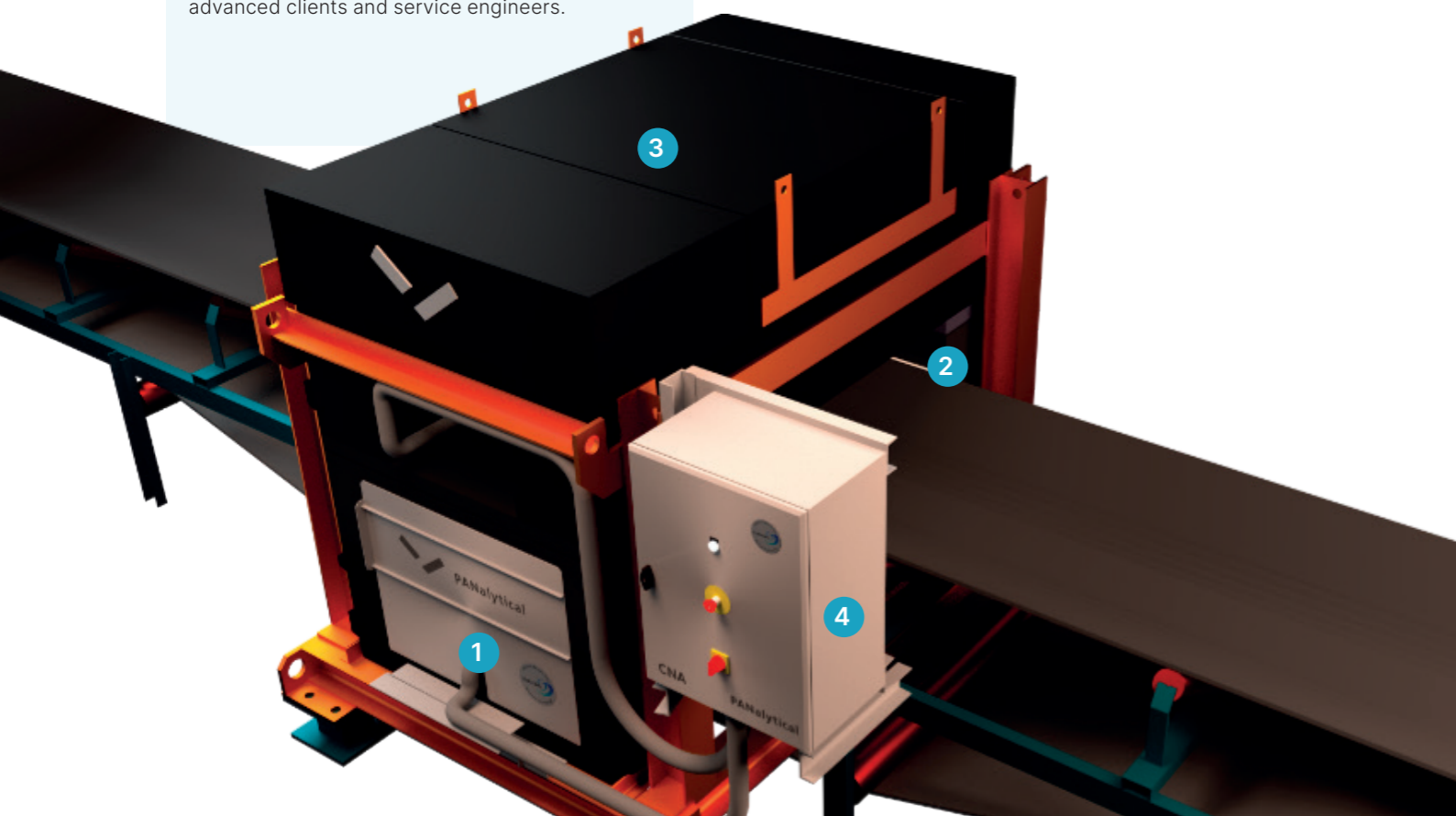
This white polyethylene plate is used to protect the CNA in contact with the belt.

#### 3 Gamma detectors

The interaction between neutron and nucleus generates spectra that are the elemental signature of the matter. The signal is collected by Bismuth-Germanium-Oxide (BGO) photo-scintillators. This is a reliable and well-proven technology developed for applications in fields such as particle physics, aerospace physics, and nuclear medicine.

#### 4 Electronic cabinets

The compact electronic cabinet is installed next to the system for easy access during maintenance. It contains a programmable logic controller (PLC) for information exchange with plant, as well as the high voltage power supply required for the neutron generator.



# Technical specifications

Analysis	
Methods	Pulsed fast & thermal neutron activation analysis
Generator	Electrical neutron generator (On/Off)
Quantified elements:	Si, Al, Fe, Ca, Mg, S, Na, K, Ti, Mn, Cl
Cement parameters	LSF, C3S, C2S, C3A, iron modulus, silica modulus
Moisture	Yes
Features	<ul style="list-style-type: none"> <li>Non-material specific</li> <li>Unaffected by varying belt loading</li> <li>Stable analytical performance (SAP) system</li> </ul>
Environment	
Temperature	From -35°C (-31 °F) to 45°C (105°F)
Humidity	Non-flowing
Operational	
Conveyor width	600 to 2000 mm
Material top size	Up to 450 mm
Belt speed	Up to 4 m/s, faster speed upon request
Belt inclination	0 - 20°C
Installation	
Standard version	W = 2 m, L = 1.1 m, and H = 1.8 m. Weight = about 2.9 t
Extended shielding	W = 2.2 m, L = 1.3 m, and H = 2.1 m. Weight = about 5.3 t
Electronics	
Electrical cabinet	H = 800 mm, W = 600 mm, D = 400 mm
Power requirement	Single phase 230 V, 47 to 63 Hz, less than 2 kW
Dry contact inputs	Up to 4 m/s, faster speed upon request
4 - 20 mA inputs	Weight feeder, speed feeder
User interface	
CNA control software	CNA data collector, trending application, and basic pile building function
System interface	OPC (industry standard for communication). Other interfaces upon request
Communication	
Connection	<ul style="list-style-type: none"> <li>Ethernet or fiber optic</li> <li>Interface suitable for many plant control networks</li> </ul>
Off-site communication	Network link over high speed broadband or a satellite phone
Safety	
Safety loop	Automatic radiation protection system
Radiation levels	<ul style="list-style-type: none"> <li>Compliant with European Council Directive 96/29/EURATOM</li> <li>No radiation when not in operation</li> </ul>
Maintenance	
Customer support	Malvern Panalytical customer support service with PANassist. Wide range of maintenance contracts upon request



# CNA Pentos - five generations of improvements

## CNA Manager user interface

A user interface for the CNA Pentos features 'status at a glance' information and flexible display of concentrations, trends, and pile compositions.

## Belt load flexibility

The amount of material on the belt (belt load) is a key parameter for analyzer performance. The CNA units are factory calibrated to support a wide range of belt loading. The CNA Pentos has been enhanced to cover a wider range of belt loads, particularly the lower loads found in smaller plants.

## Calibration flexibility

The CNA Pentos can support a wider range of materials, with secondary calibrations for new or non-standard material measurements.

## Reliability

The CNA Pentos features enhanced electronics to improve reliability and minimize component failures.

## Improved detector design

The detector design has been improved to increase the long-term stability and eliminate the effects of stray neutrons.

## Improved neutron flux regulation

A significant benefit of the electrical neutron source is its ability to regulate the neutron flux and therefore the instrument stability. An improved neutron control algorithm is included with the fifth-generation instrument, providing better long-term instrument stability.

## Improved maintenance tools

The Pentos maintenance software toolbox has been enhanced. The new expert service tool is provided to simplify instrument performance testing by advanced clients and service engineers. In addition, the service engineer configuration tool has been enhanced to simplify and expedite setting and checking of key operational parameters.



CNA manager interface - 'status at a glance' view



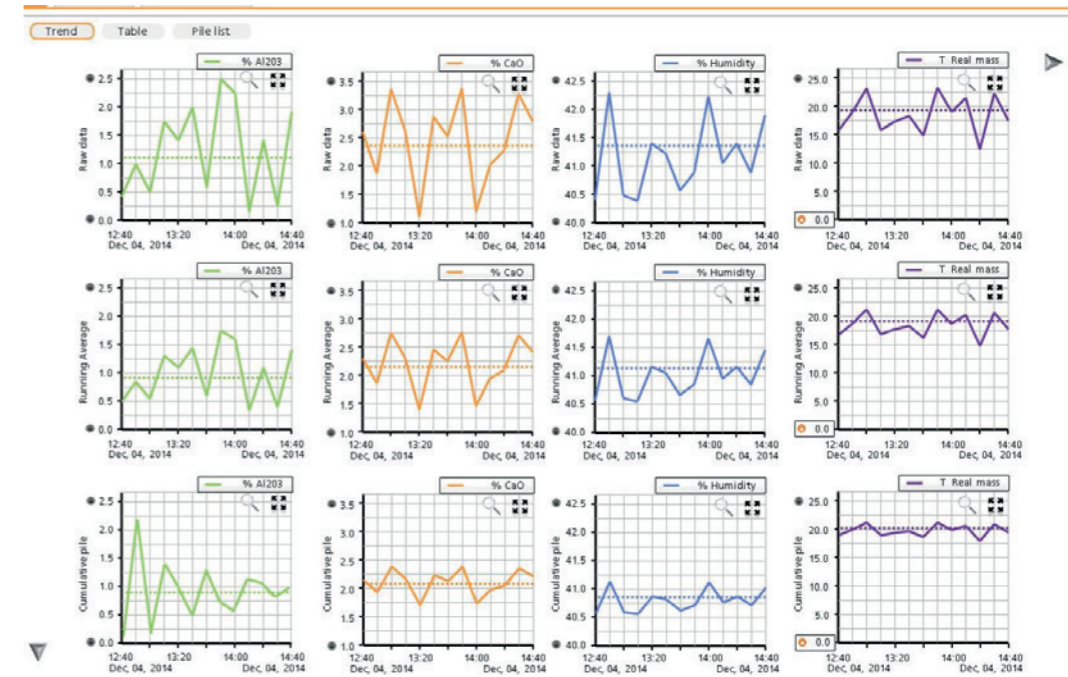


# Intuitive control interface

## CNA Manager

A simple and intuitive user interface for the CNA has been created to provide 'status at a glance' information and more flexible display of concentrations, trends, and pile compositions. It facilitates:

- Set-up of user accounts
- Database management
- Display of data in an easy and user-friendly way
- Remote access for multiple clients
- Stockpile management
- Use of OPC servers



## Designed for tough environments

Industrial environments can be dirty, dusty, muddy, noisy, vibrating, cold, warm, humid, etc.

The CNA is specifically manufactured for challenging situations and is highly effective in locations where sampling is expensive or difficult.

The electronic cabinets are rated IP65 with a sun-proof, water-resistant, and dust-resistant cover.







## Upgrade your CNA with a service agreement



### Key benefits

- Preventive and corrective maintenance
- Performance verification
- Certification
- Support during incidents
- Easier financial planning
- Extended instrument lifetime

### Plus: enjoy several additional services



#### Analysis solutions

To help ensure that your analytical methods are set up correctly, we offer a range of complete analysis solutions.

Our specialists will set up and integrate our analytical modules in your workflow and train your process personnel to use them. The set-up of optimized method validation and maintenance procedures is also included.



#### Compliance services

Want to take the stress out of your audit process? Our experts can advise you on all your compliance needs, from basic data verification to calibration or even full instrument qualification.

We offer support with:

- Results verification
- Full qualification
- Radiation safety compliance



#### Training

For users looking to deepen their knowledge, we offer a comprehensive range of classroom training courses on analytical techniques, methods, and the operation of our instruments and software. We can also deliver customized on-site training.





## About Malvern Panalytical

We draw on the power of our analytical instruments and services to make the invisible visible and the impossible possible.

Through the chemical, physical and structural analysis of materials, our high precision analytical systems and top-notch services support our customers in creating a better world. We help them improve everything from the energies that power us and the materials we build with, to the medicines that cure us and the foods we enjoy.

We partner with many of the world's biggest companies, universities and research organizations. They value us not only for the power of our solutions, but also for the depth of our expertise, collaboration and integrity.

We are committed to Net Zero in our own operations by 2030 and in our total value chain by 2040. This is woven into the fabric of our business, and we help our employees and customers think about their part in creating a healthier, cleaner, and more productive world.

With over 2300 employees, we serve the world, and we are part of Spectris plc, the world-leading precision measurement group.

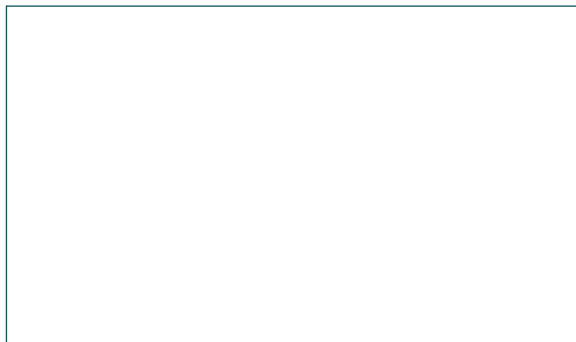
**Malvern Panalytical. We're BIG on small™**

## Service & Support

Malvern Panalytical provides the global training, service and support you need to continuously drive your analytical processes at the highest level. We help you increase the return on your investment with us, and ensure that as your laboratory and analytical needs grow, we are there to support you.

Our worldwide team of specialists adds value to your business processes by ensuring applications expertise, rapid response and maximum instrument uptime.

- Local and remote support
- Full and flexible range of support agreements
- Compliance and validation support
- Onsite or classroom-based training courses
- e-Learning training courses and web seminars
- Sample and application consultancy



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