

**Thermo Electron
Materials and Minerals**

Tianjin Design Institute, Tianjin

Analyze • Detect • Measure • Control™

Thermo
ELECTRON CORPORATION

Thermo Electron

Our line of business

- Industry leader in high tech instruments, systems and software

What our products/ services do

- Analyze... detect... measure... control...

Our core strengths

- Technology innovation
- Good business people

The markets we serve

- A variety of markets...including life sciences, **process control**, optical, and photonics

Our customer value proposition

- Helping our customers to succeed...lasting partnerships and services

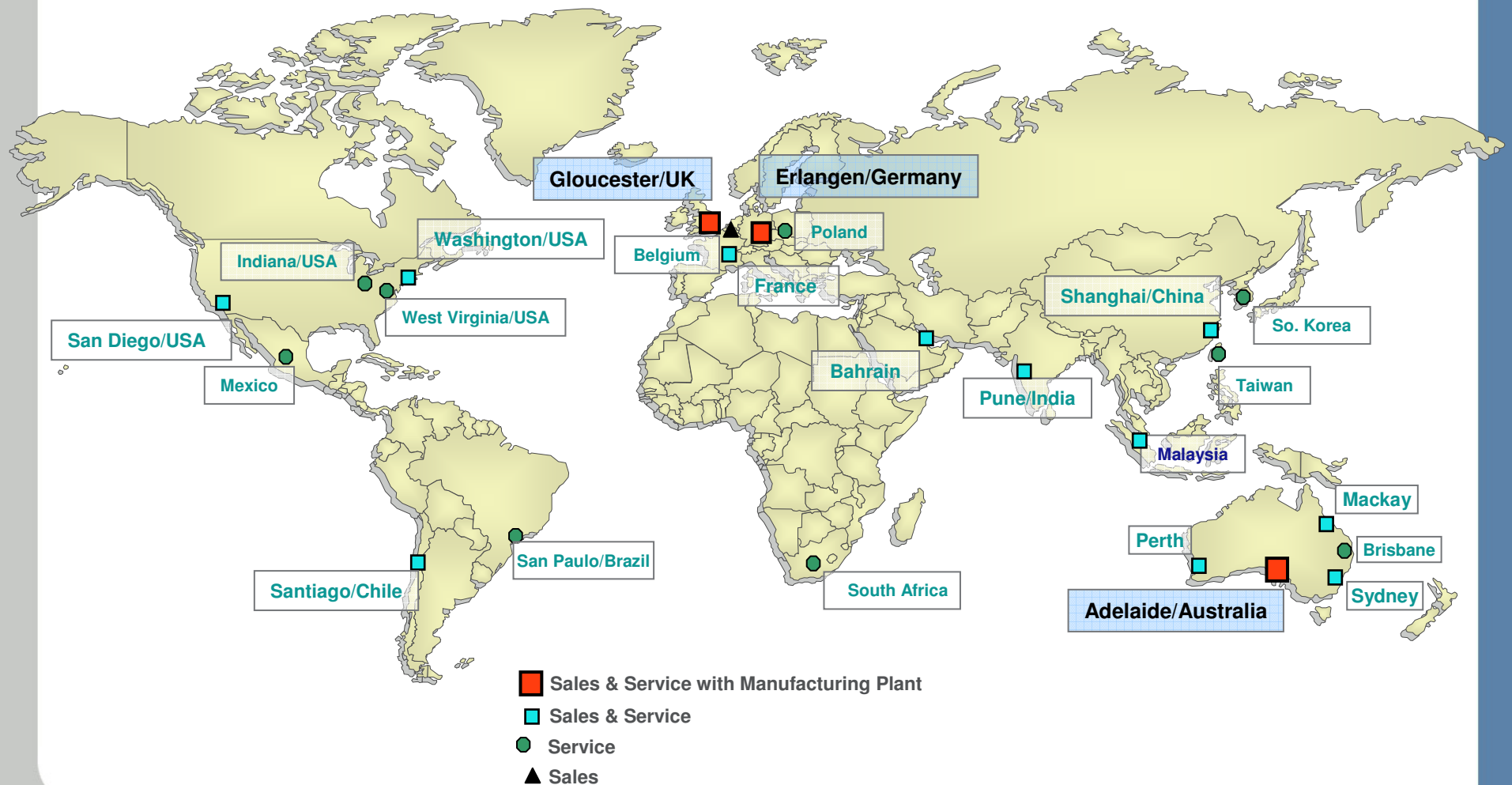
Website: www.thermo.com

Thermo Electron Global Presence

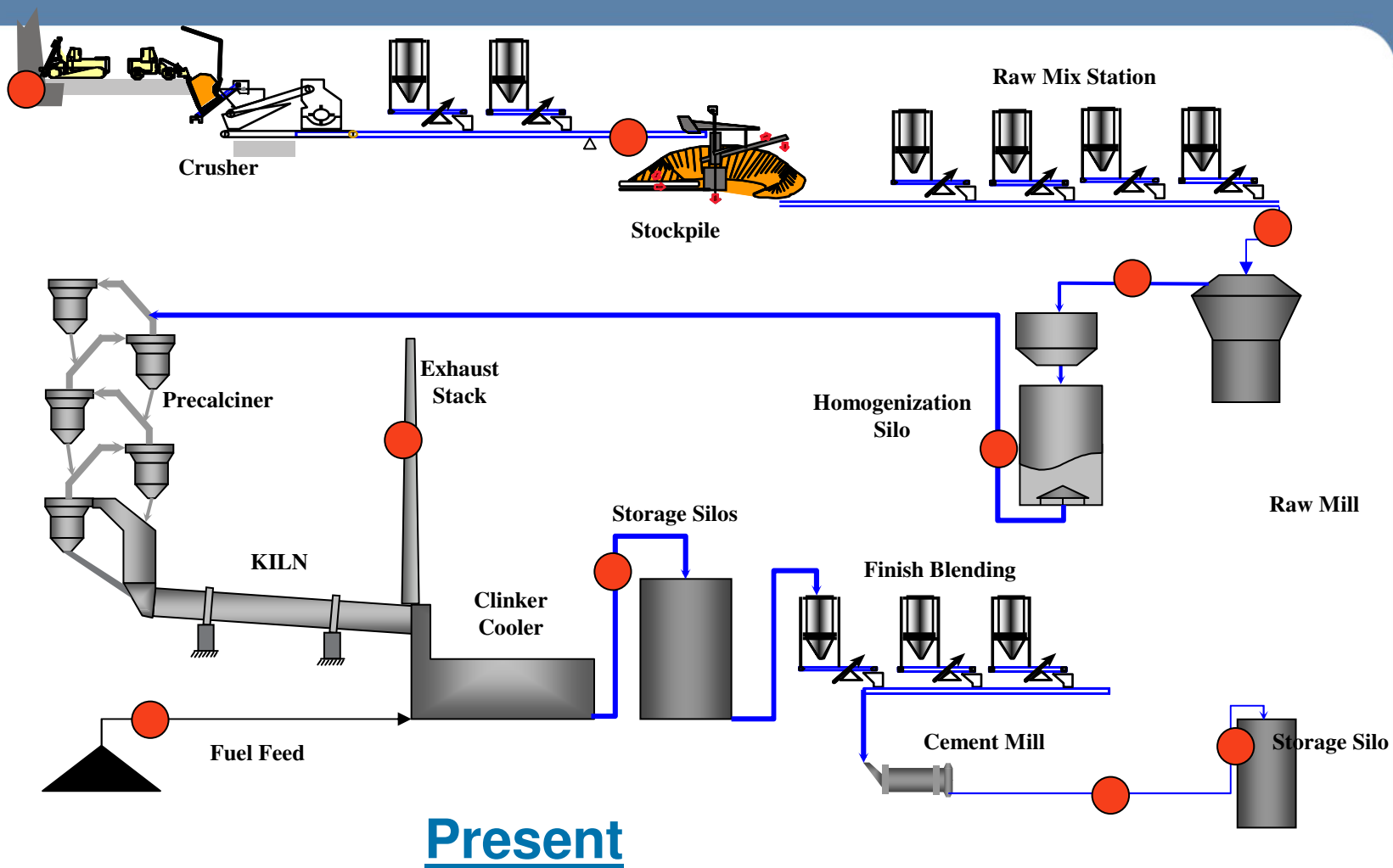


***Our Products and Services Make the World a Healthier,
Cleaner and Safer Place***

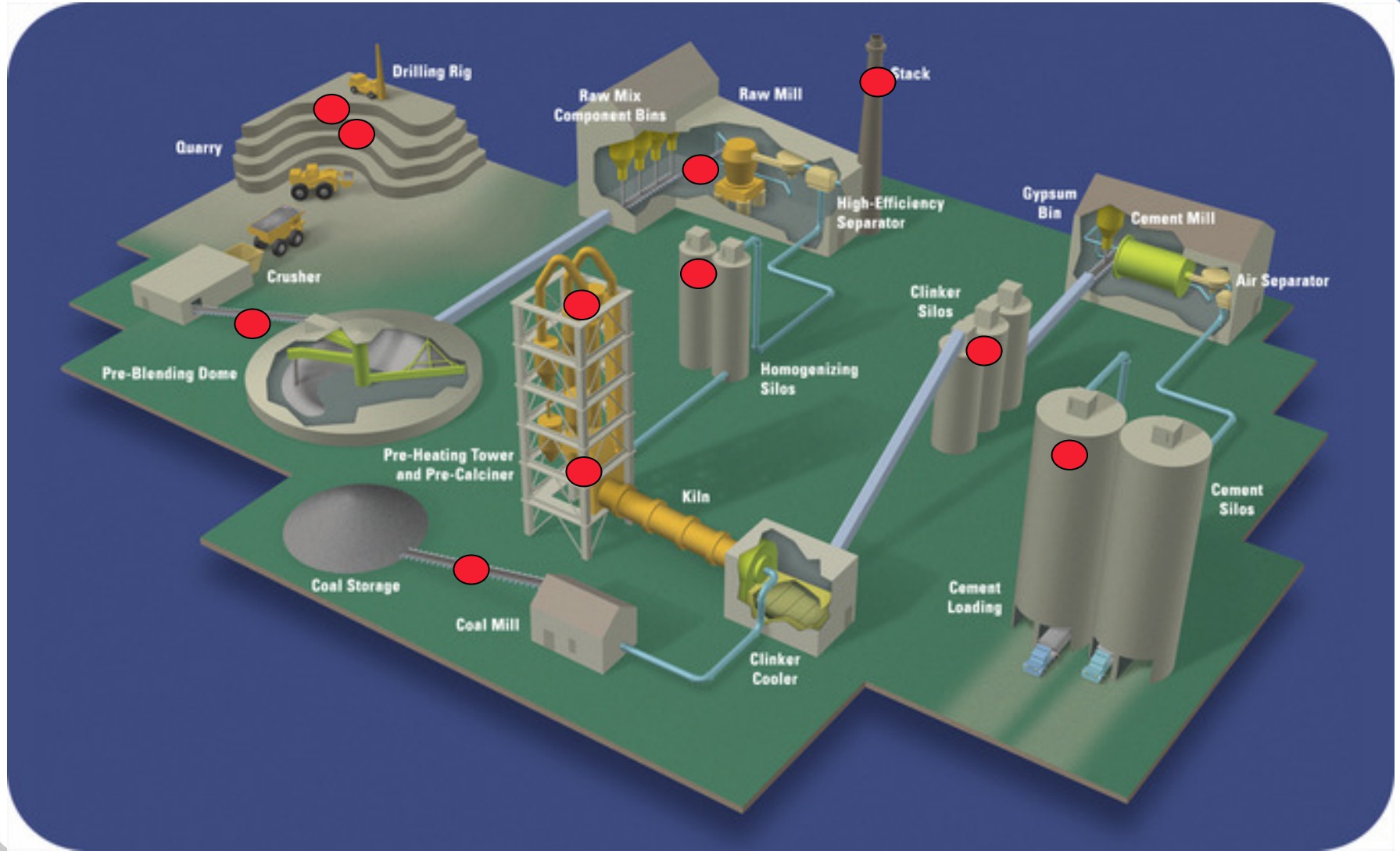
M&M Commercial Organization



Thermo Cement Discrete Instruments



Thermo Electron presence in Cement Industry



Emerging Trends...in Global Cement Industry

EMERGING TRENDS IN CEMENT INDUSTRY

- Cost pressures driving
 - *Efficient plant equipment designs*
 - *Focus on alternative raw material and fuel usage*
 - *Process optimization*



Online raw material control
Immense process optimization opportunities for new as well as existing plants

FACTORS DRIVING HIGHER CEMENT PRODUCTION COSTS

- 60-65% variables attributable to raw materials
 - *Restrict quarry utilization*
 - *Poor flexibility to vary raw material feed*
 - *Additional costs towards additives*
 - *Un-stable kiln operation*

Real time Analysis can help in addressing these issues Effectively and Efficiently



Prompt Gamma Neutron Activation Analysis - PGNAA -

What is it?
Why do we use it?

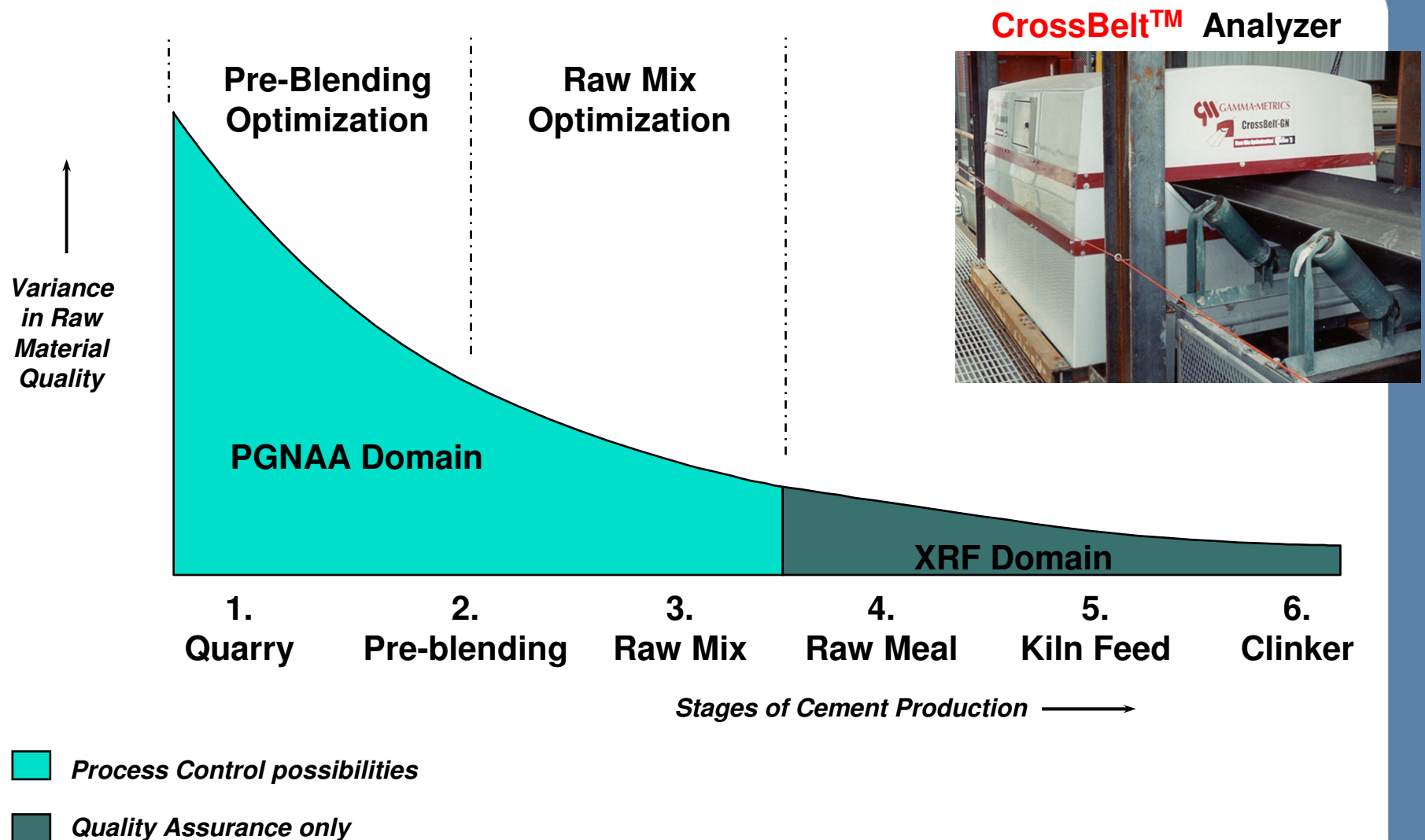
PGNAA, What is it?

- Elemental Analysis Technique
- Bulk Analysis Method
– *Penetrating Technology*
- Non-Destructive Analysis Tool

PGNAA, Why Do We Use it?

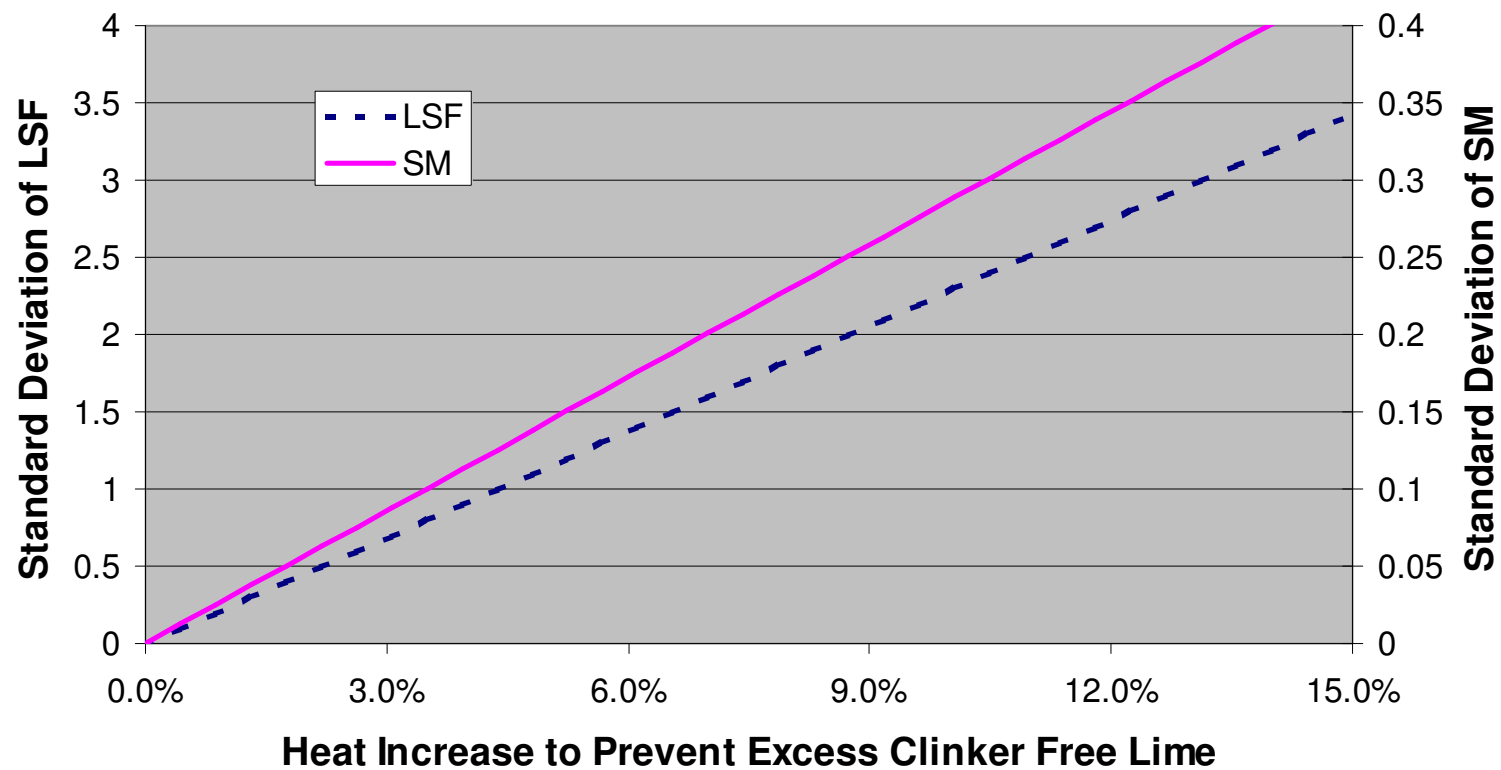
- PGNAA Enables Accurate, High Frequency Process Control
- Highly Automated & Mechanically Simple
- Sampling Systems add Time Delay and Error
- Surface Analysis is often not Representative
- Measures the entire bulk of material as it travels on the belt
- Analysis independent of size and type of material as well as conveyor speed (up to 300mm)
- Can measure moisture

XRF vs. PGNAA comparison – complementing technologies for efficient process control

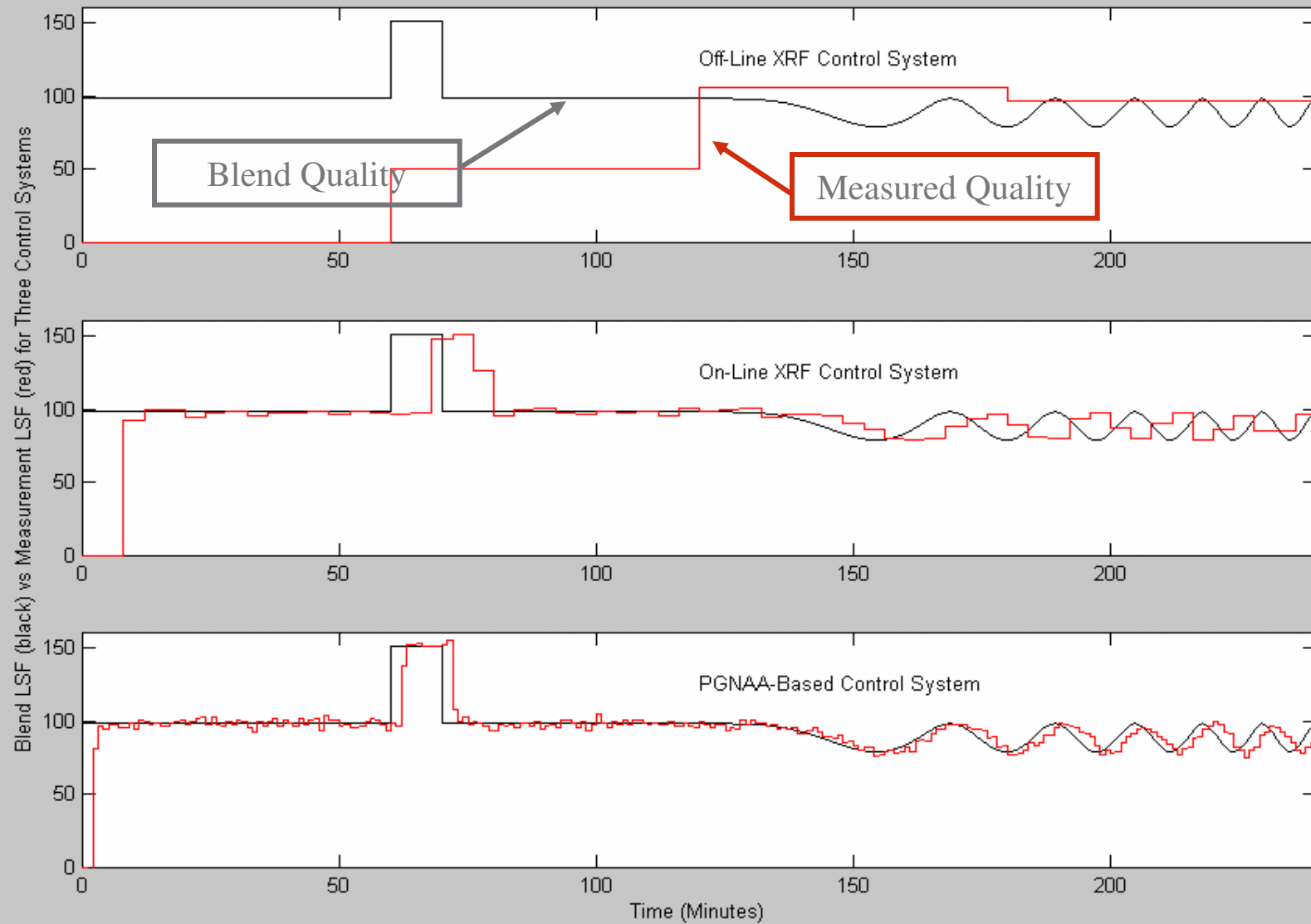


RAMOS Reduces the Standard Deviation

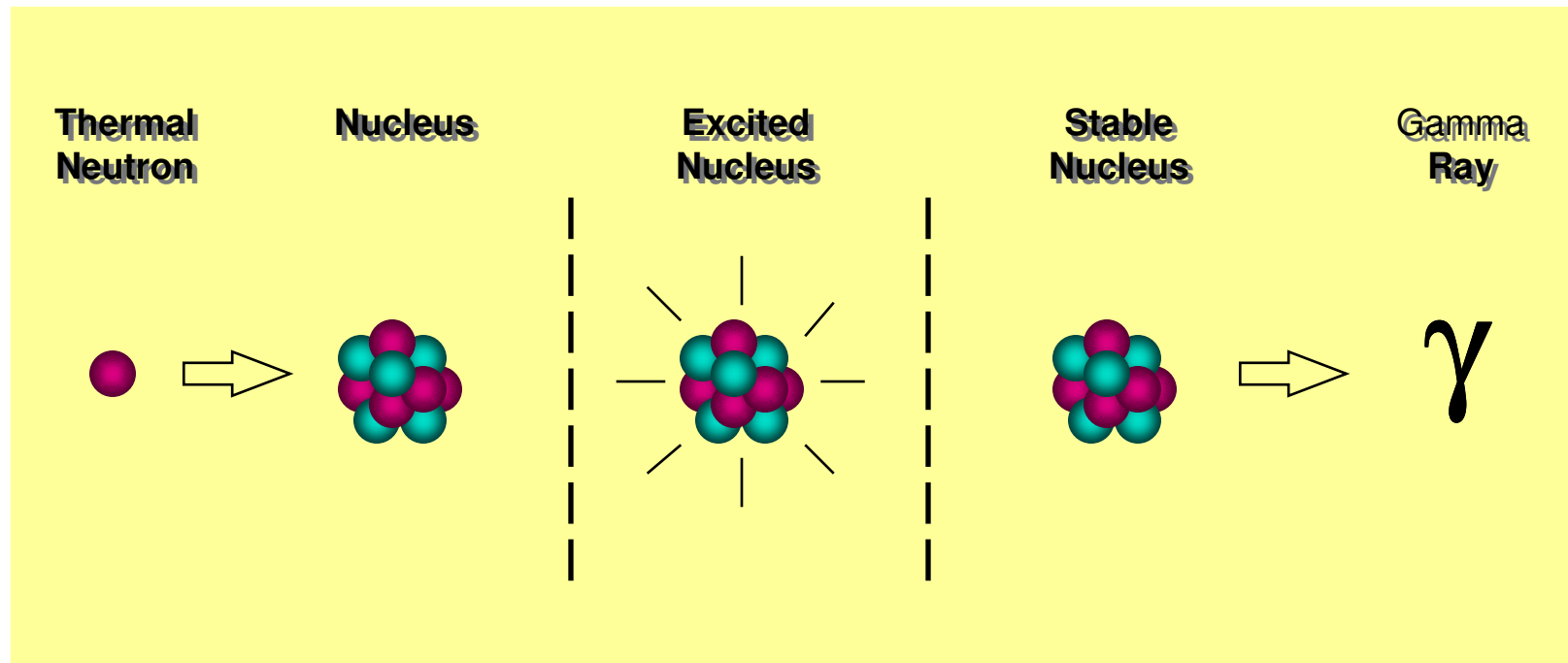
LSF & SM as Independent Variables



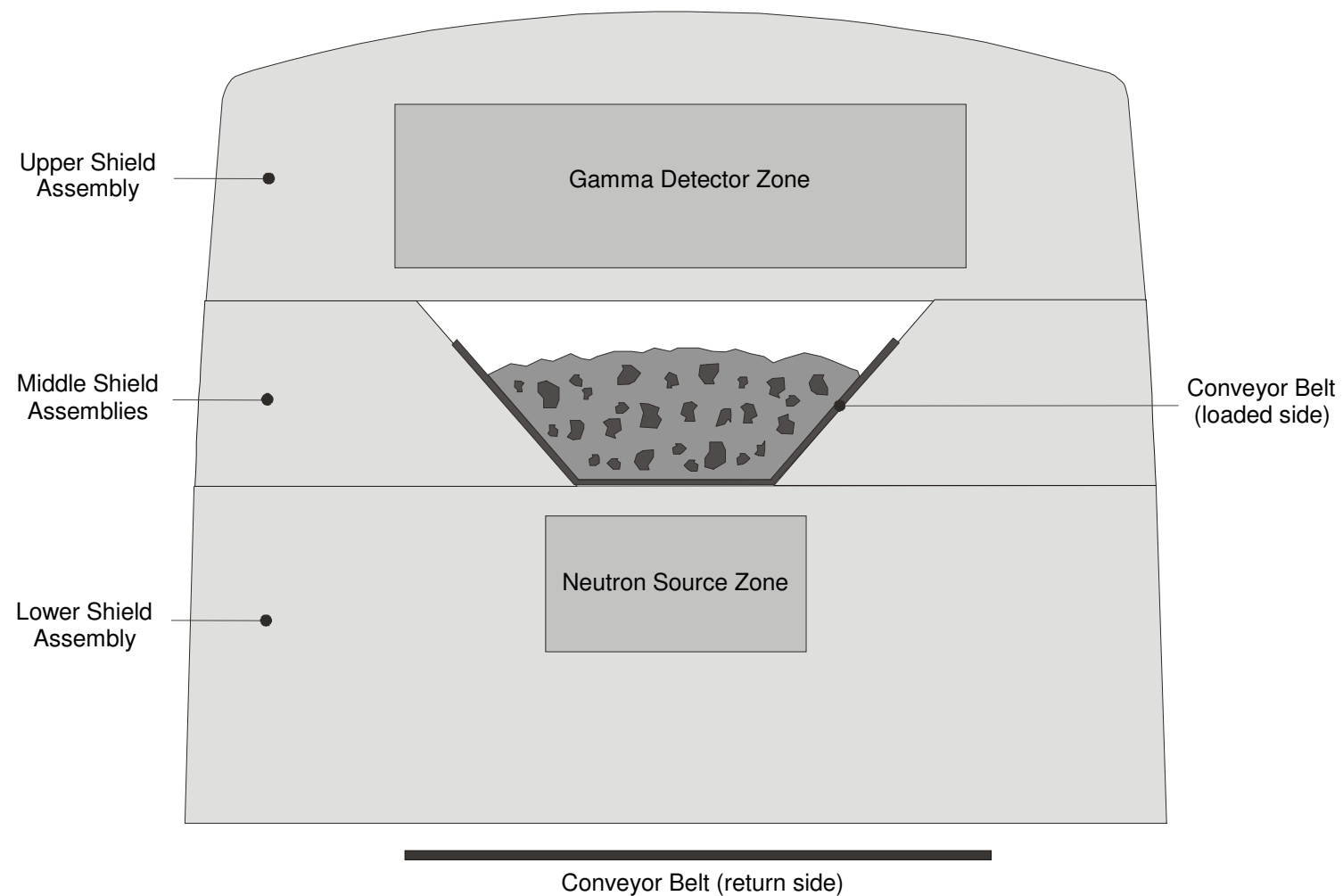
The Ability for Different Blending Processes to Track Chemistry Variations



Prompt Gamma Neutron Activation Analysis (PGNAA) – operating principle



The advanced CBX Analyzer



PARAMETERS ANALYZED IN ONE MINUTE

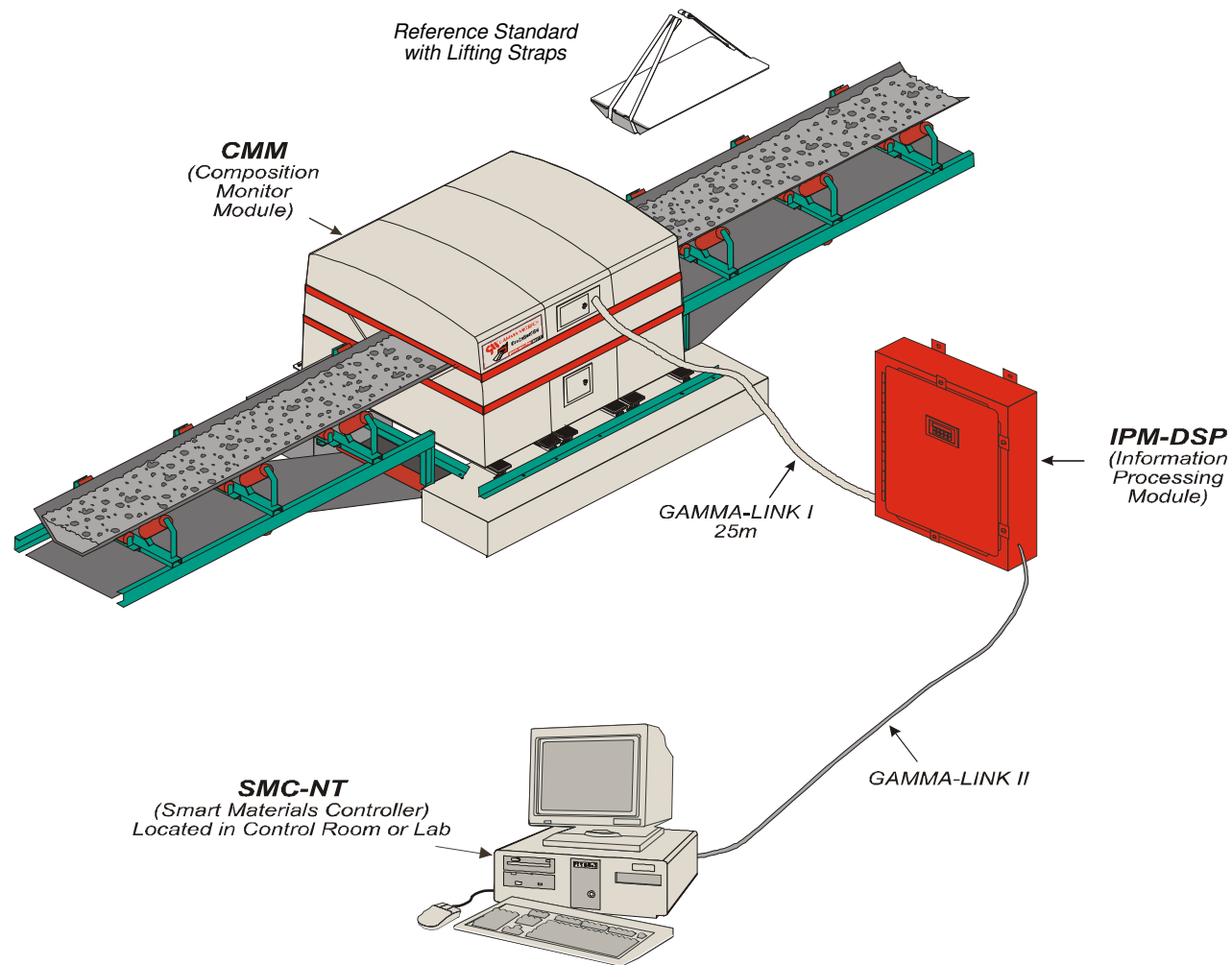
- **Direct Measurement**

- **CaO**
- **SiO₂**
- **Fe₂O₃**
- **Al₂O₃**
- **MgO**
- **K₂O**
- **Na₂O**
- **S**
- **Cl**
- **Moisture**

- **Computed**

- **Silica Ratio**
- **C₃S**
- **C₃A**
- **LSF**
- **A/F Ratio**
- **Liquidity**
- **Burnability**

Scope of Supply



On-line Bulk Material Analysis Evolution

1985 Chute Type Analyzer



1993 CrossBelt Analyzer



1997 CrossBelt GN Analyzer



2003 CBXpert Analyzer



Thermo Cement

Installed Base



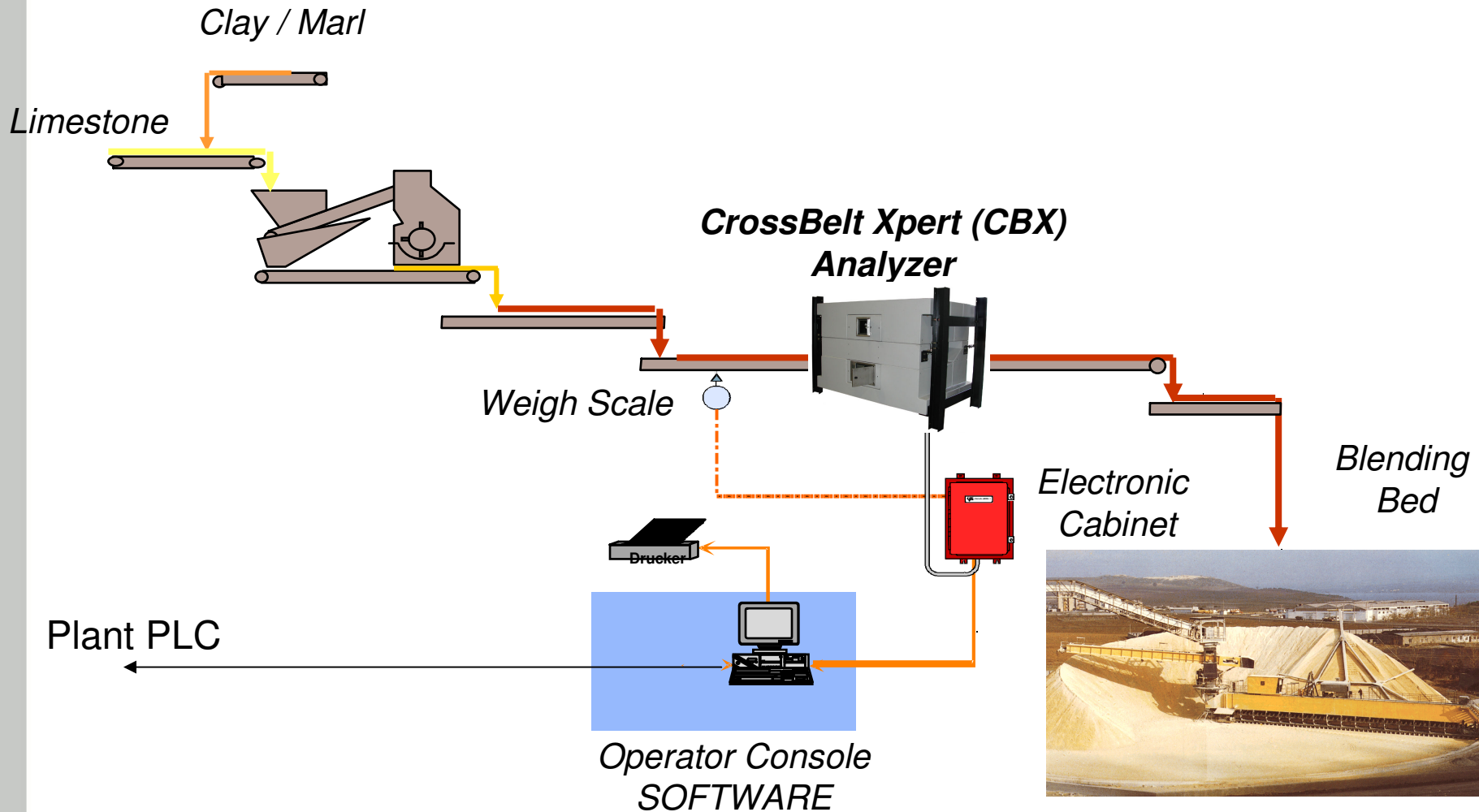
**Over
Over 250 Installations spanning 40 countries and
6 continents**

CBX Applications

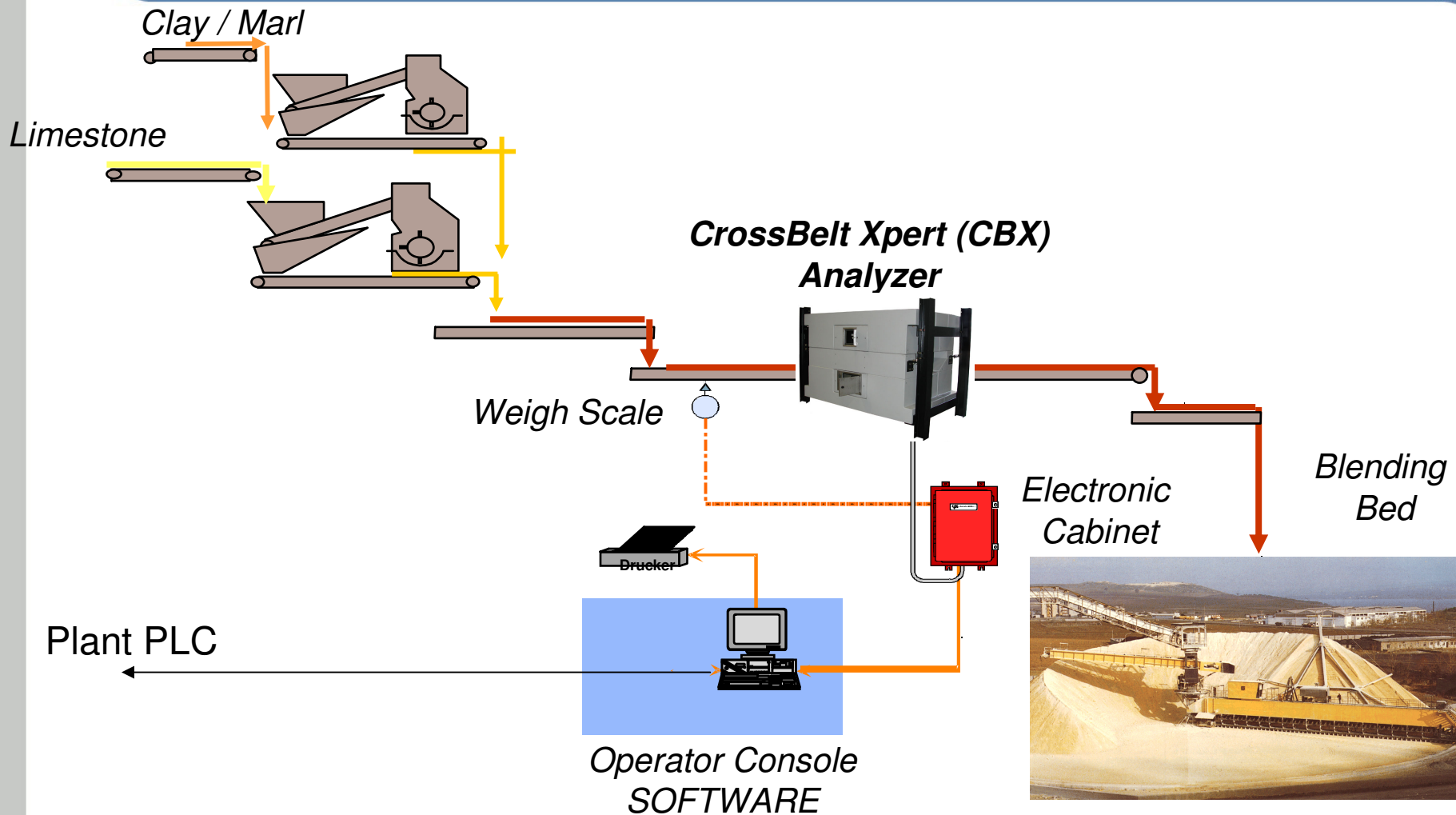
Analyze • Detect • Measure • Control™

Thermo
ELECTRON CORPORATION

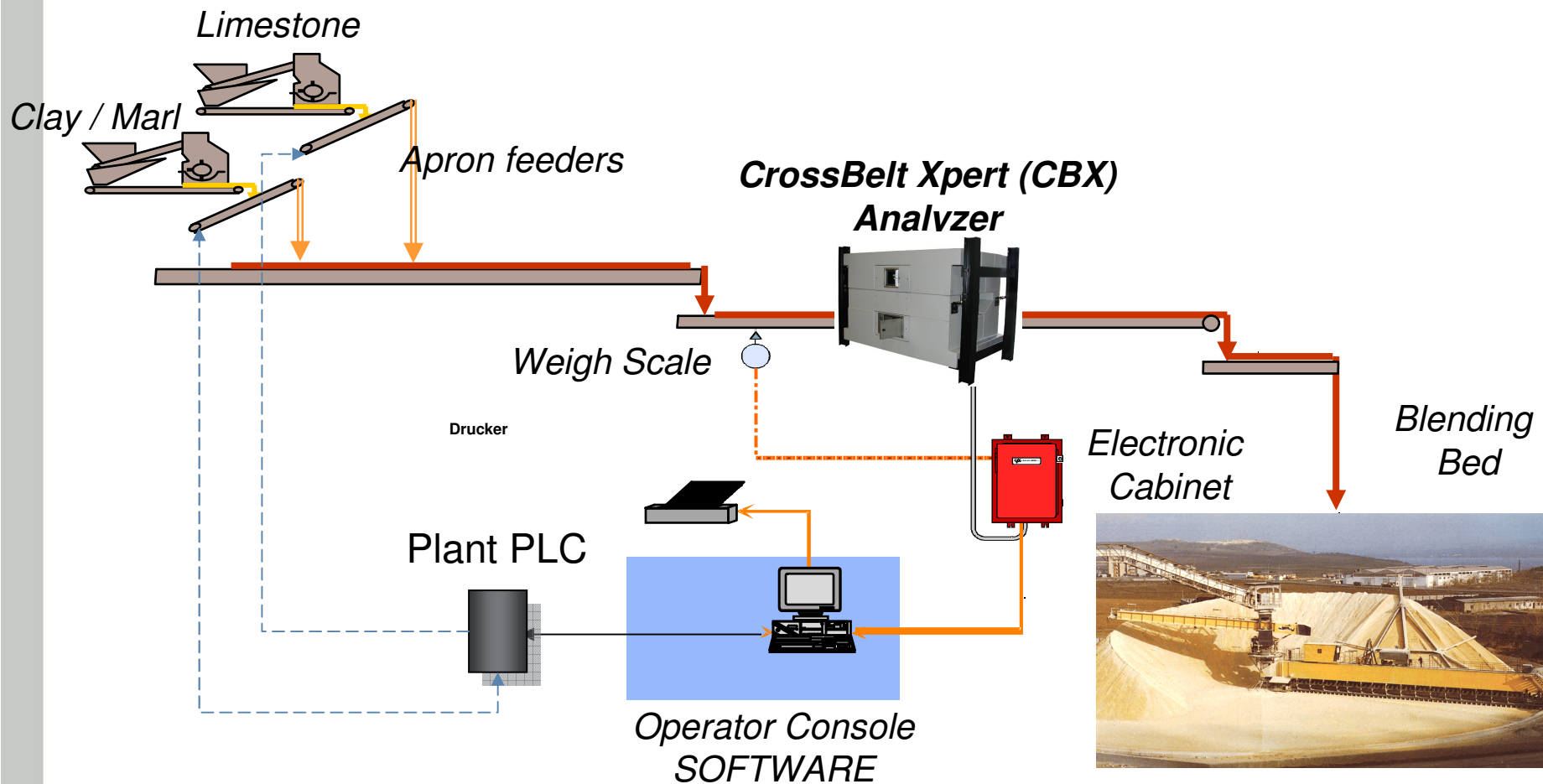
CBX- Manual Stockpile Control using one or two type of raw material source



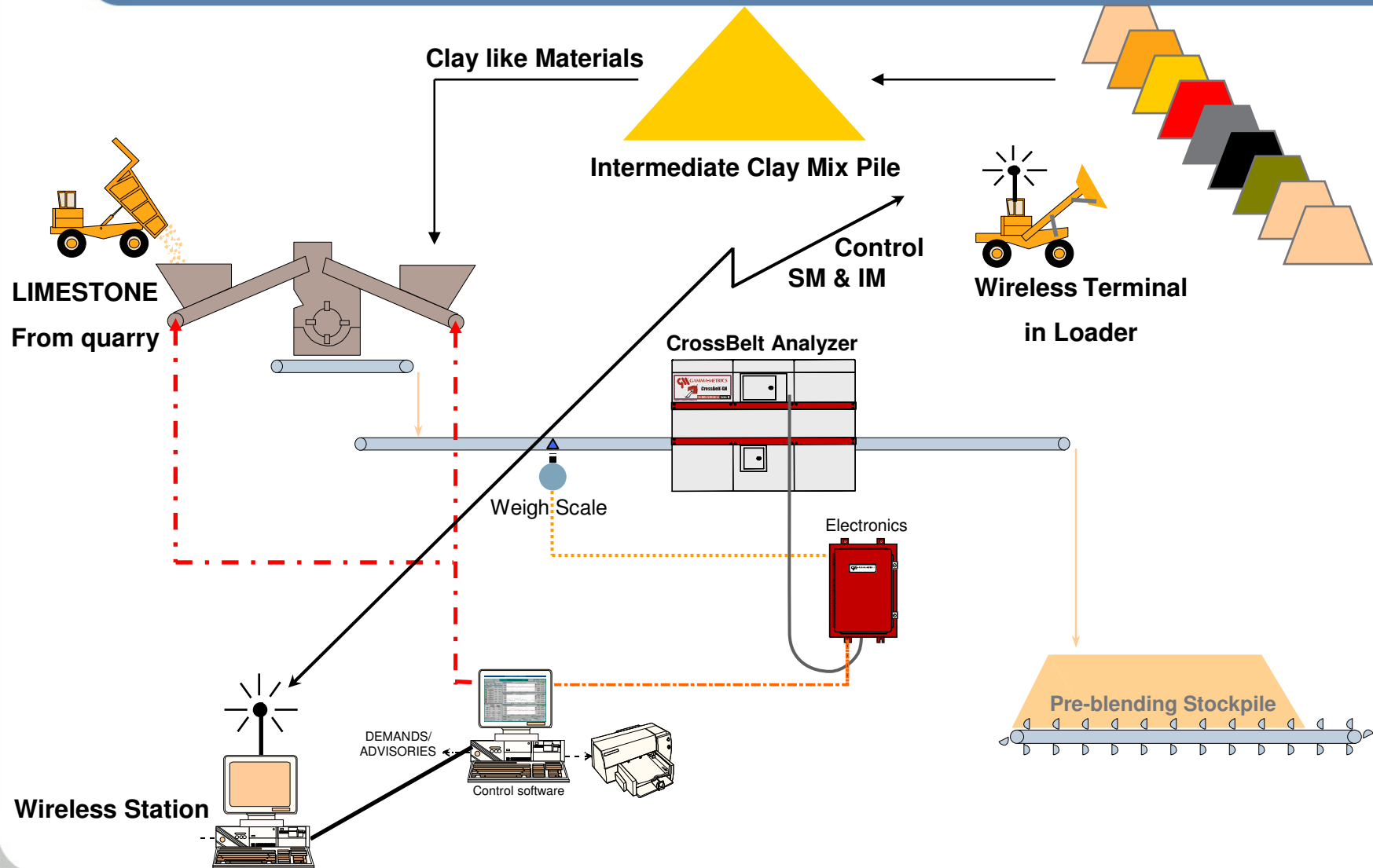
CBX- Manual stockpile control using multiple raw material sources.



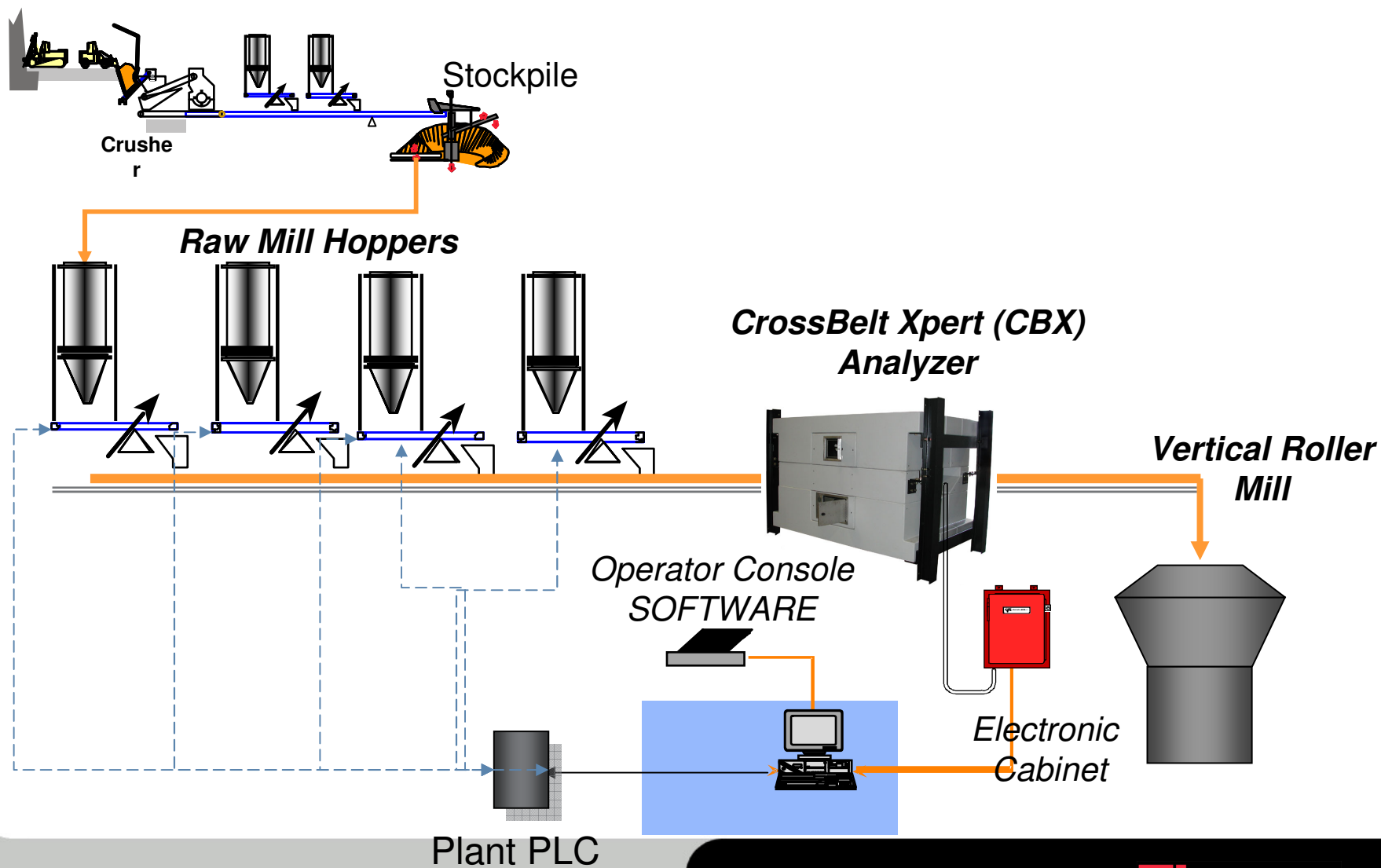
CBX- Auto Stockpile Control for multiple raw material sources.



Combination of Manual and Auto Stockpile Control to optimize stockpile building using variety of raw materials

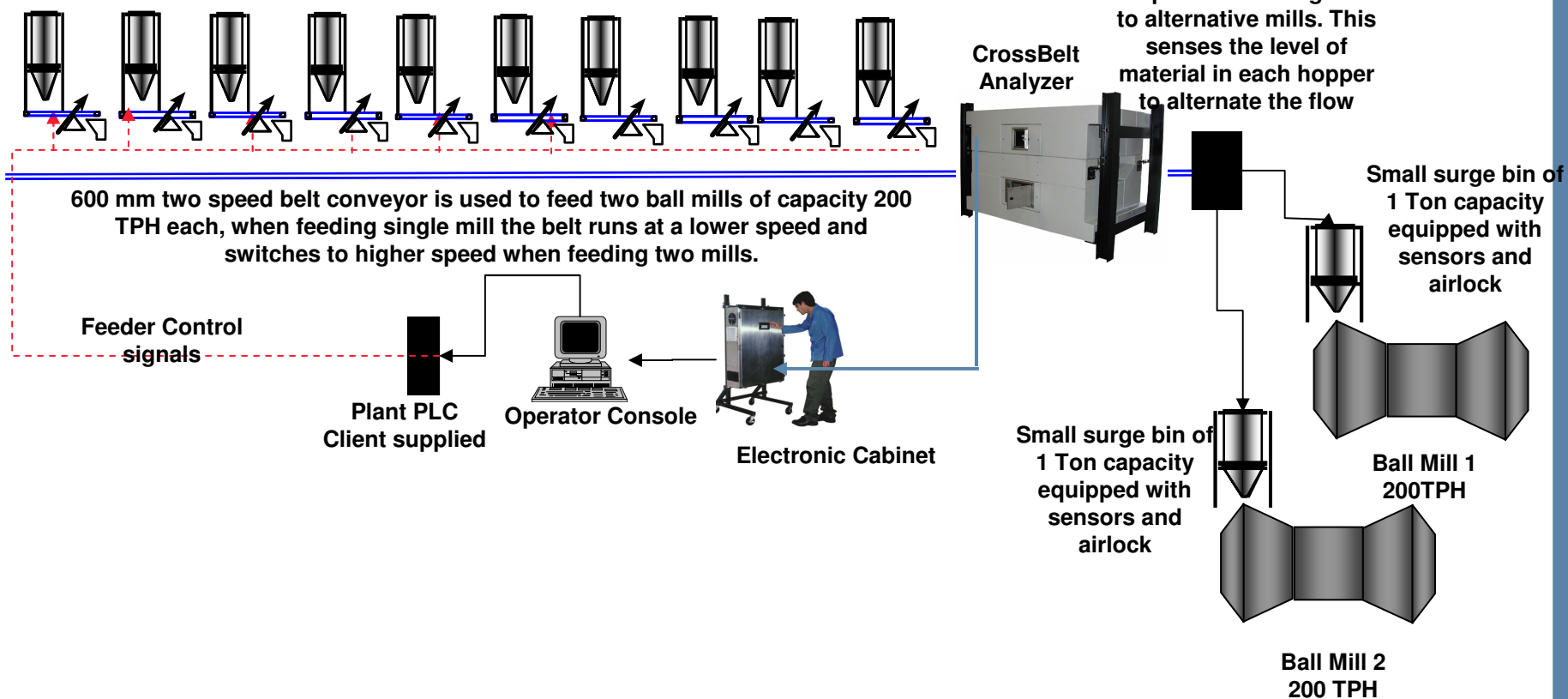


CBX- Raw Mix – Typical



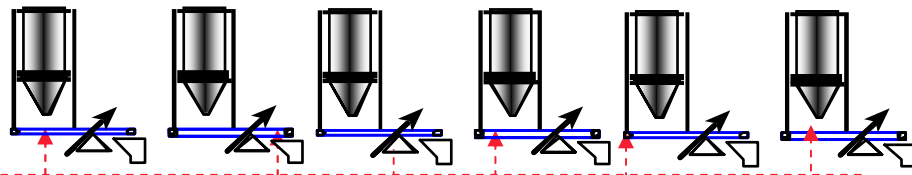
CBX – Multiple Hoppers and Raw Mills

10 Raw Mill hoppers – 3 of the hoppers are used to feed limestone, additional 3 hoppers are used to feed Catalyst fine a chemical waste, 1 for iron ore, 1 for shale, 1 for silica and the last hopper to feed slag



CBX – Multiple hoppers and variety of mills

6 Raw Mill hoppers – 2 of the hoppers are used to feed limestone, 2 more are used for clay feed, 1 hopper is used for iron ore and the last one feeds mineralizer



1000 mm two speed belt conveyor is used to feed one VRM of 240 TPH and one ball mill of capacity 90 TPH each, when feeding one mill the belt runs at a lower speed. The ball mill is used only when you need to increase the capacity

Feeder Control signals

Plant PLC
Client supplied

Operator Console

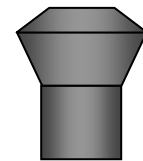
Electronic Cabinet



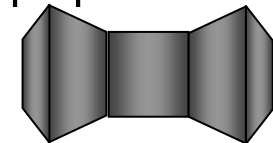
CrossBelt Analyzer



A surge hopper equipped with reversible belt to enable feeding the two mills. This reversible belt operates in rapid succession dispensing more material in the VRM and less in Ball Mill



Vertical Roller
Mill 2
240 TPH

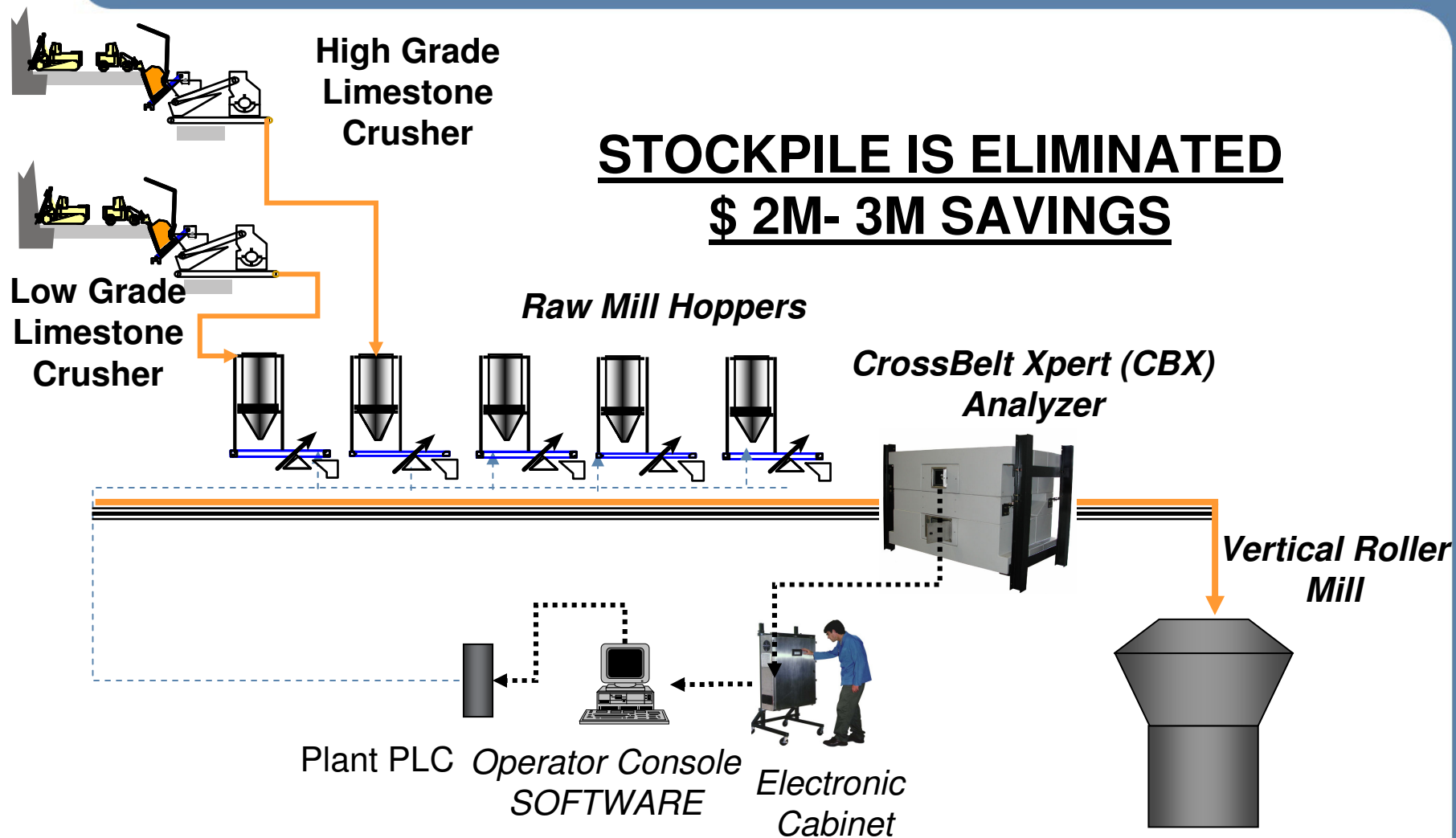


Ball Mill 1
90TPH

Each mill is equipped with very small capacity bins to enable material flow into the mills

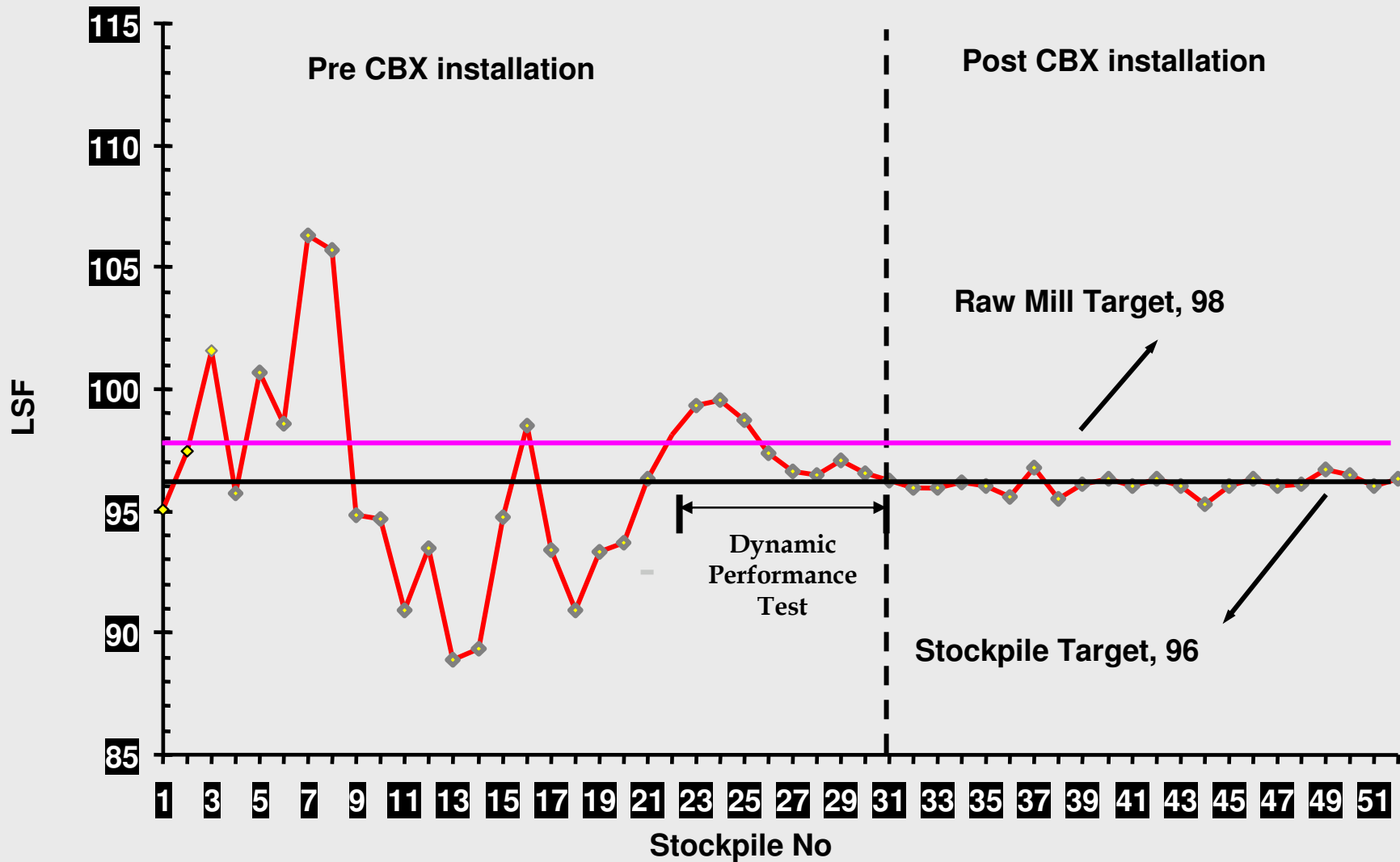
Please note Holcim Cerro Blanco runs Vertical Roller Mill most of the times, and the ball mill is only used when there is a need to increase capacity

CBX – Unique Application Designed to Reduce and Optimize Capital Expenditure – Tianshan Yunfu Cement

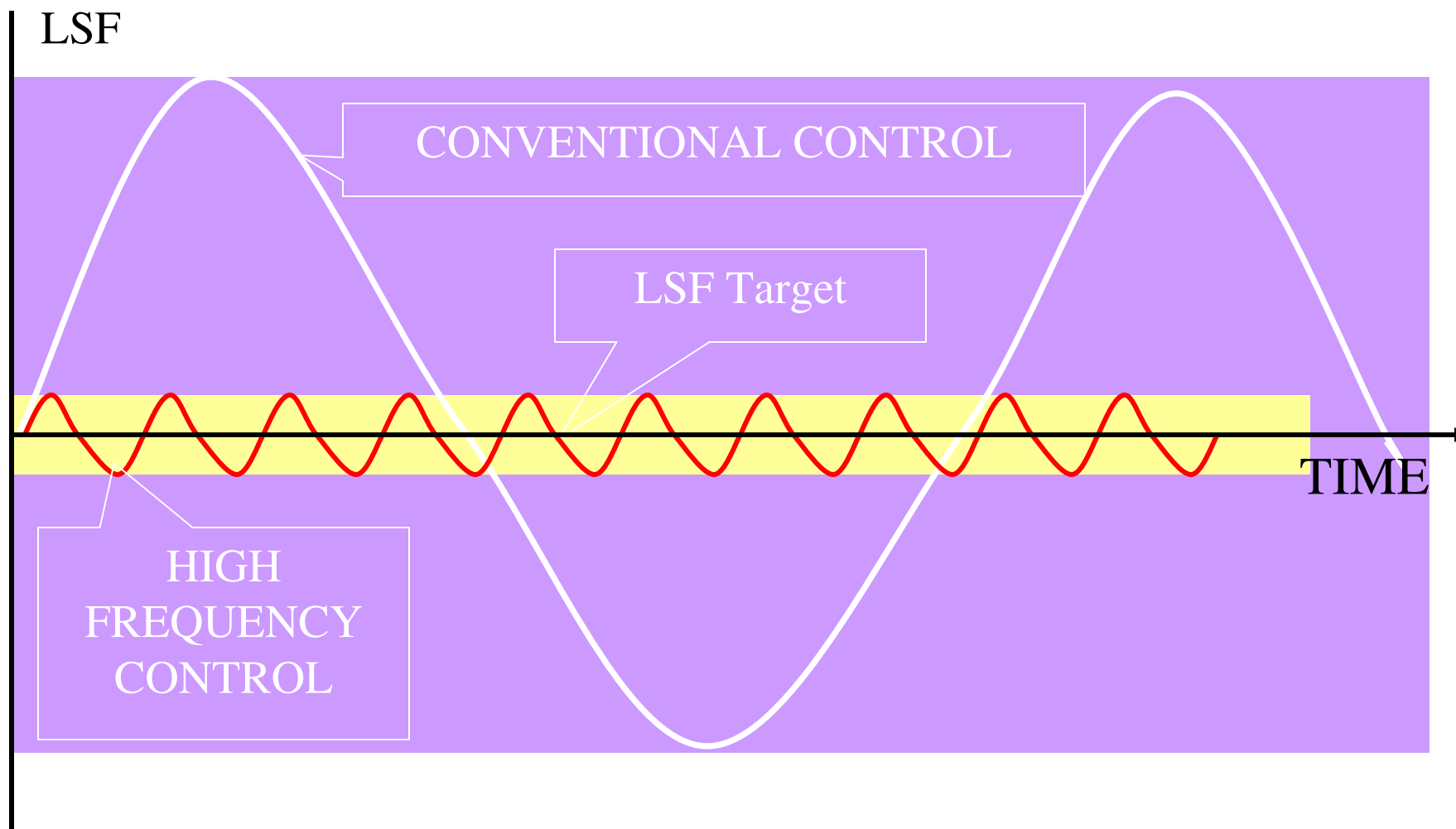


STOCKPILE IS ELIMINATED
\$ 2M- 3M SAVINGS

Stockpile LSF before and after installation of CBX

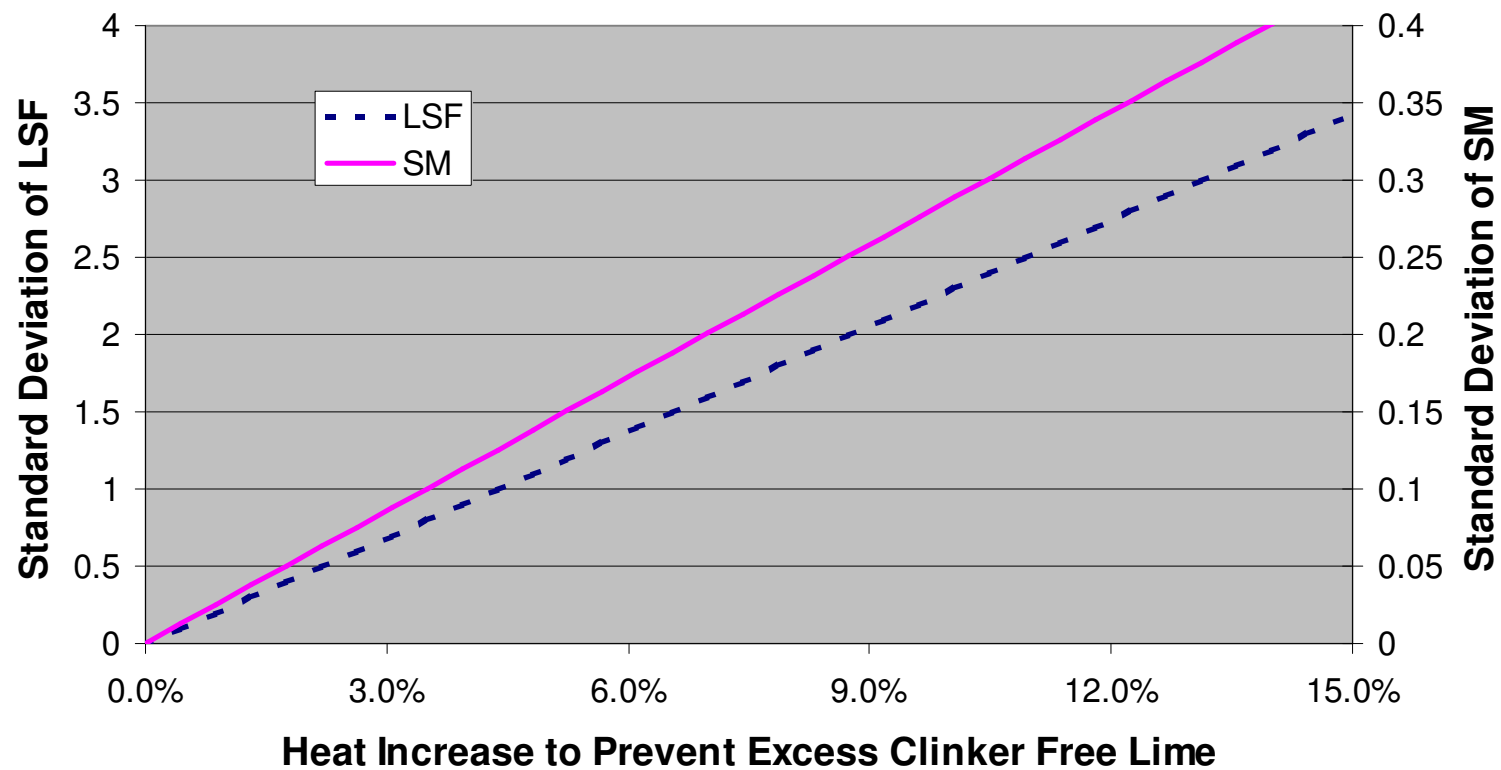


WHY High Frequency Control ??



RAMOS Reduces the Standard Deviation

LSF & SM as Independent Variables



Benefits of High Frequency Raw Mix Proportioning

- Assured raw meal homogeneity consistently
- Stable kiln operation
- Reduction in fuel cost
- Reduction in clinker grinding cost
- Extended brick life
- Higher production
- Improved end product quality

Raw mix control : User feed back

Cement Plant	Country	Improvements Realized
Apasco Norte	Mexico	Refractory life exceeded two years.
Cementi Rossi	Italy	Fuel costs reduced 5.6%.
Colacem	Italy	Able to run entire plant with one person on night shift. Discontinued active homogenization in homo silos.
Compagnie des Ciments Belges	Belgium	Reduced kiln feed variability by a factor of 3. Discontinued active homogenization in homo silos.
Lafarge Corneilles	France	Reduced kiln feed variability by 60%.
Sococim	Senegal	Reduced fuel costs by 4%.
Blue Circle Southern	Australia	Kiln feed LSF S.D. reduced from 3 to <1
Lafarge Mannersdorf	Austria	Kiln feed homogeneity achieved without blending in silos
Luilihe	China	Improved productivity by 10%, 70% quality improvement

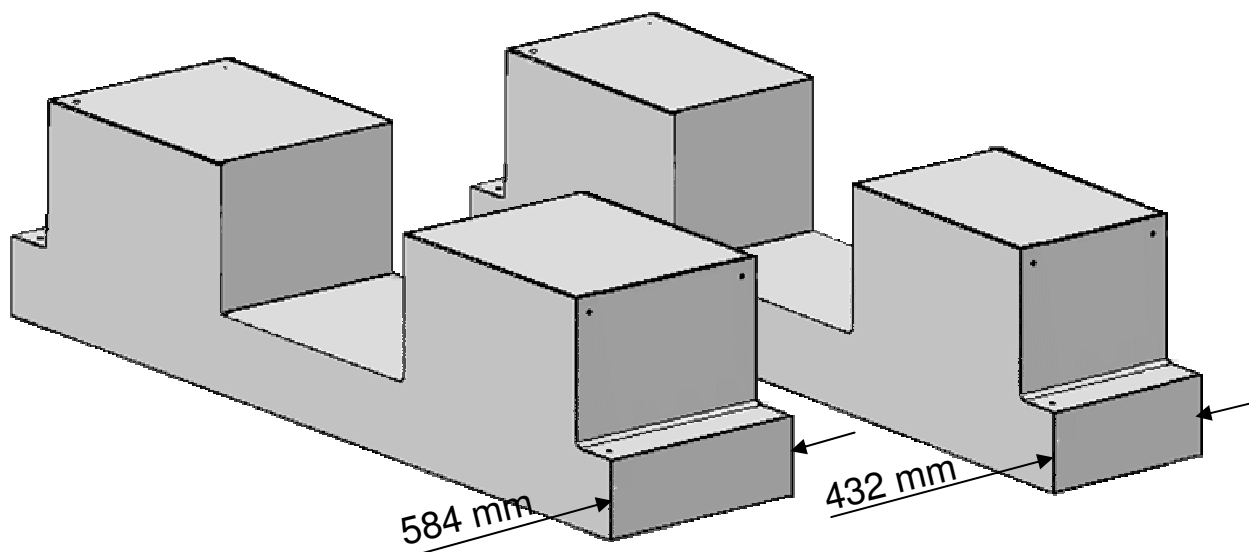
CBX



CBXpert Design Features - Shielding

Flexible analyzer width

To have the maximum variability in analyser width a modular shielding block design with two sizes has been developed

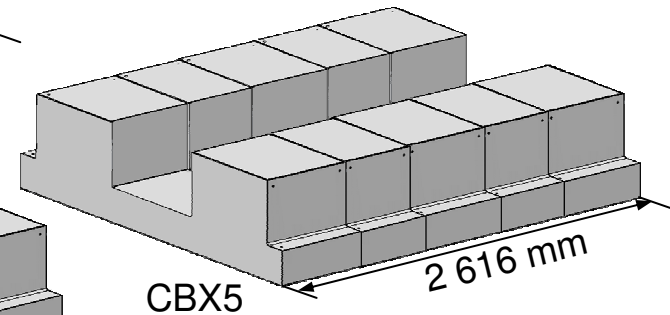
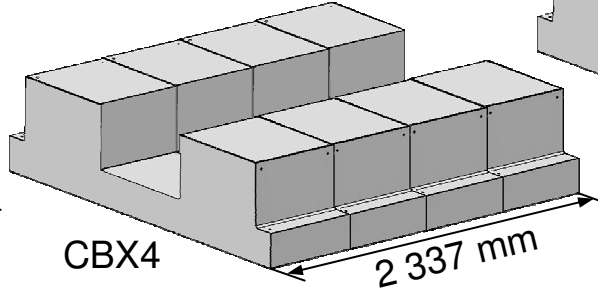
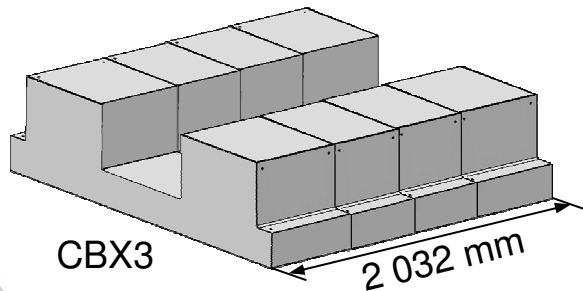
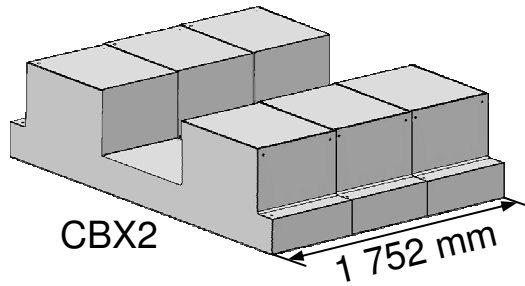
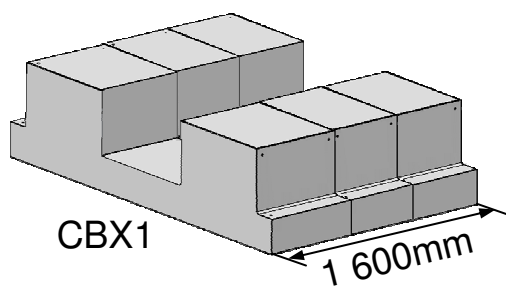


CBXpert Design Features - Shielding

Flexible analyzer width

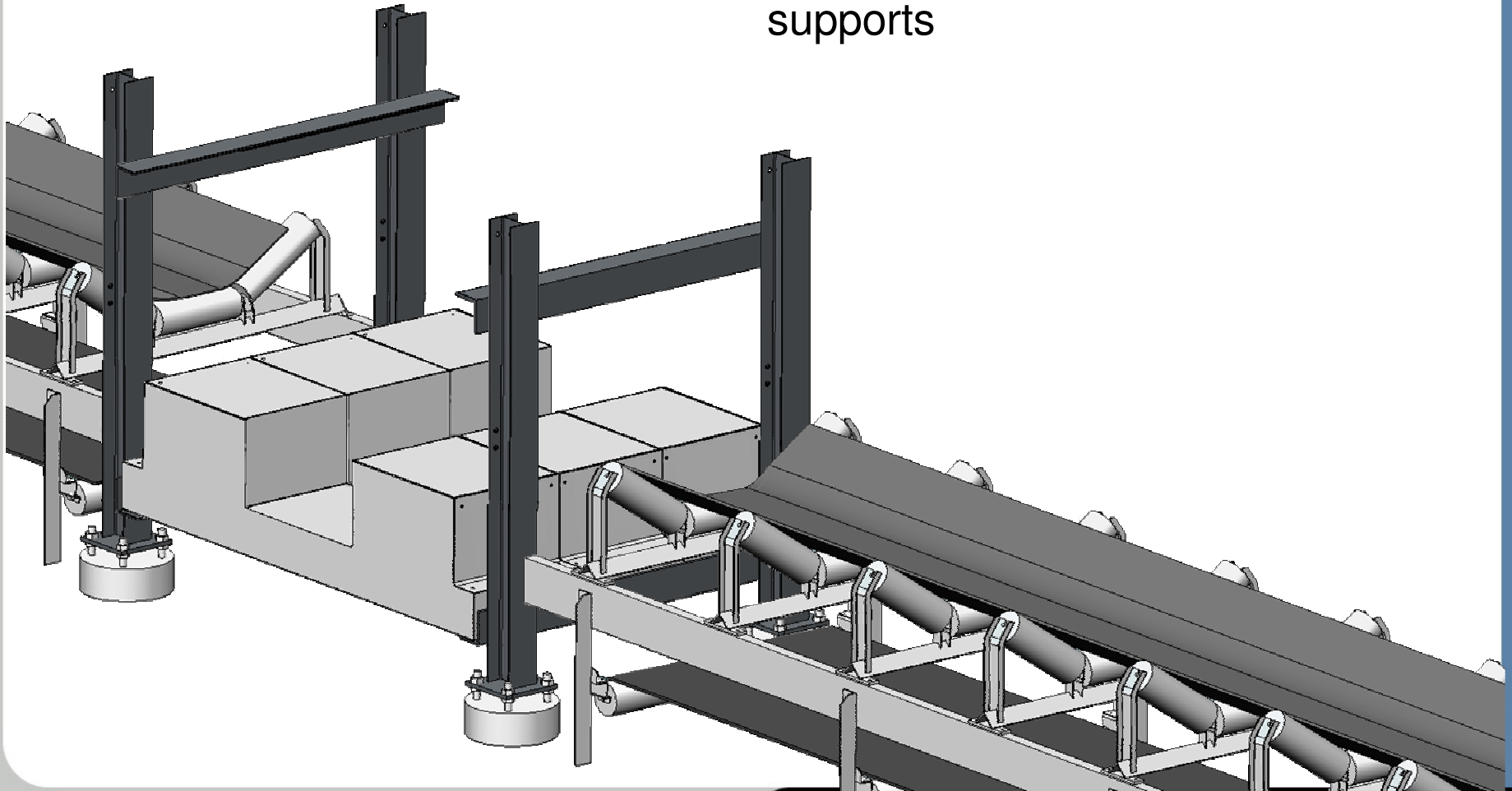
CBX1	Belt width 600-1000 mm
CBX2	Belt width 1200 mm
CBX3	Belt width 1400 – 1600 mm
CBX4	Belt width 1800 – 2000 mm
CBX5	Belt width 2100 – 2200 mm

The two block sizes allow the configuration of different analyser width



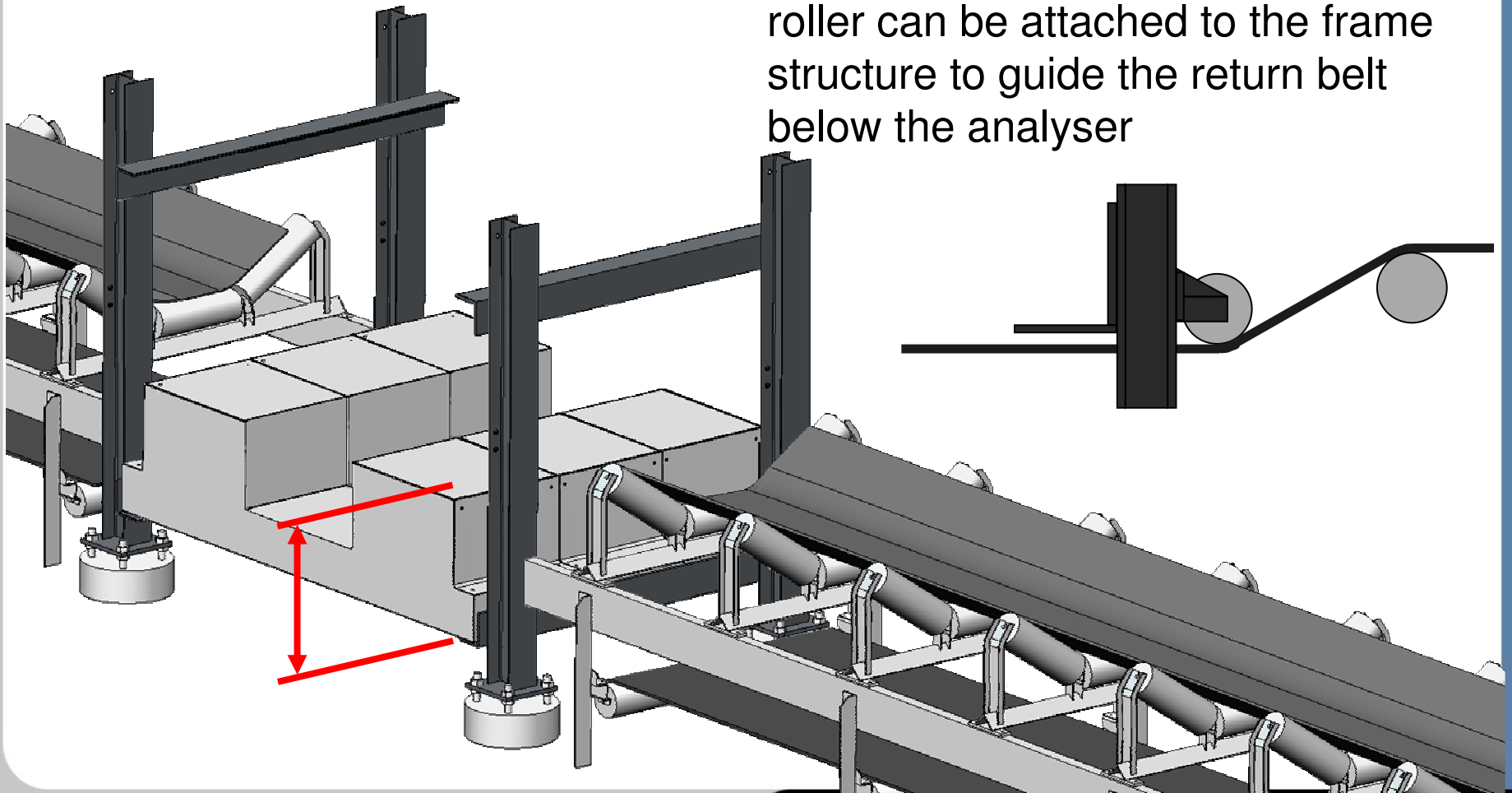
CBXpert Shielding Integration

Then the bottom shielding blocks are placed on the bottom frame supports



CBXpert Belt Integration

Distance between belt and return belt is 710 mm. If distance is less a roller can be attached to the frame structure to guide the return belt below the analyser

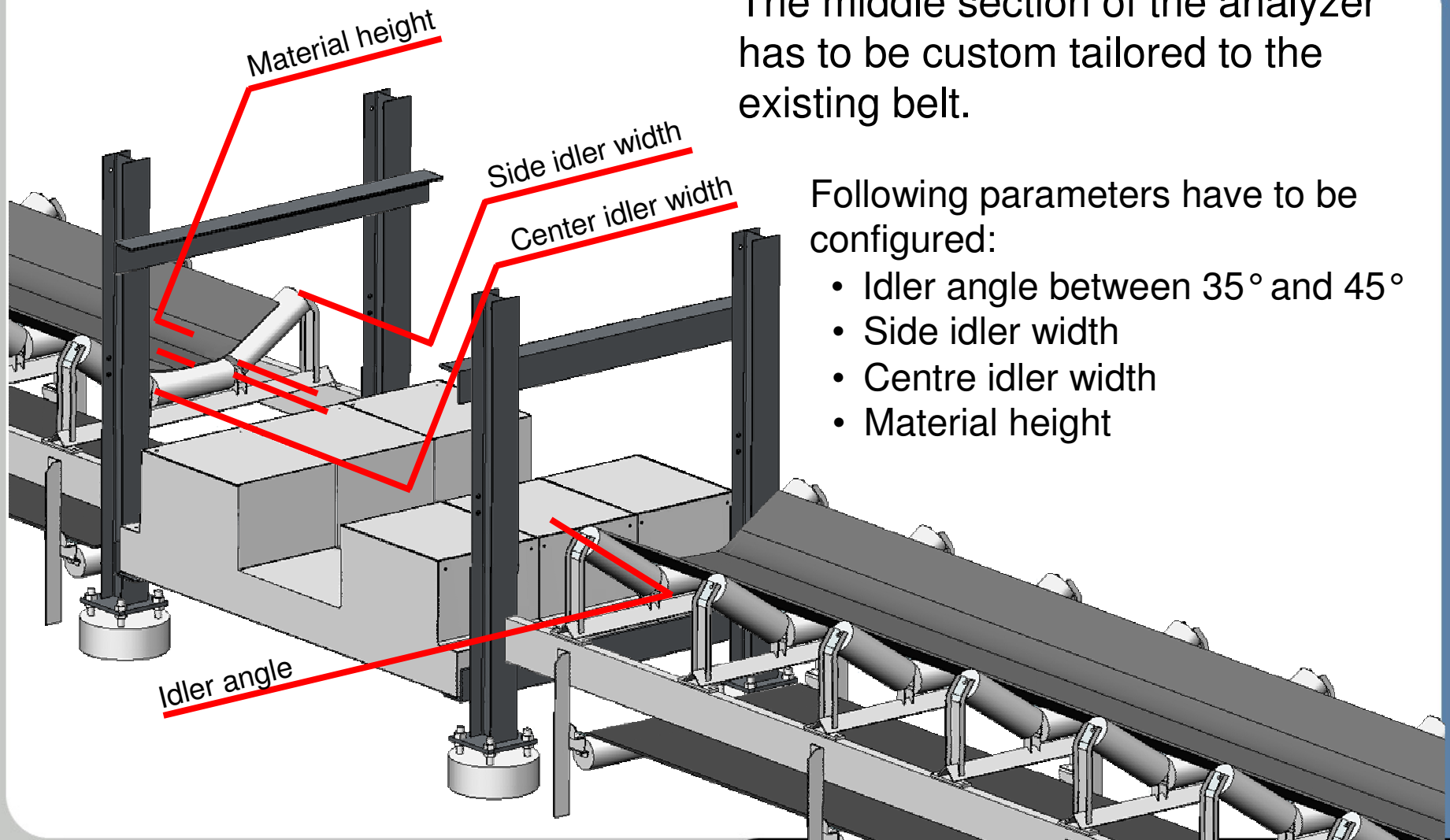


CBXpert Shielding Integration

The middle section of the analyzer has to be custom tailored to the existing belt.

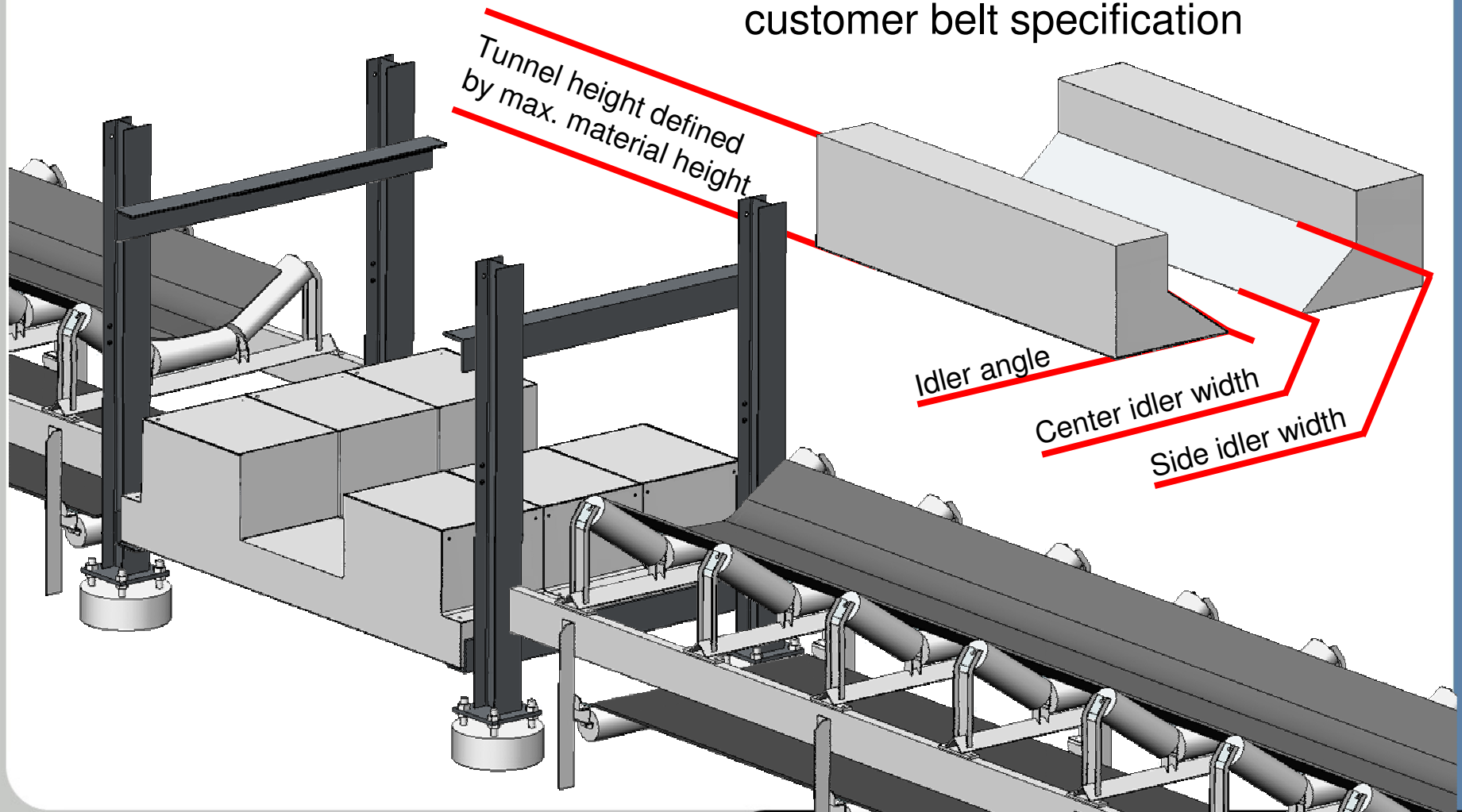
Following parameters have to be configured:

- Idler angle between 35° and 45°
- Side idler width
- Centre idler width
- Material height



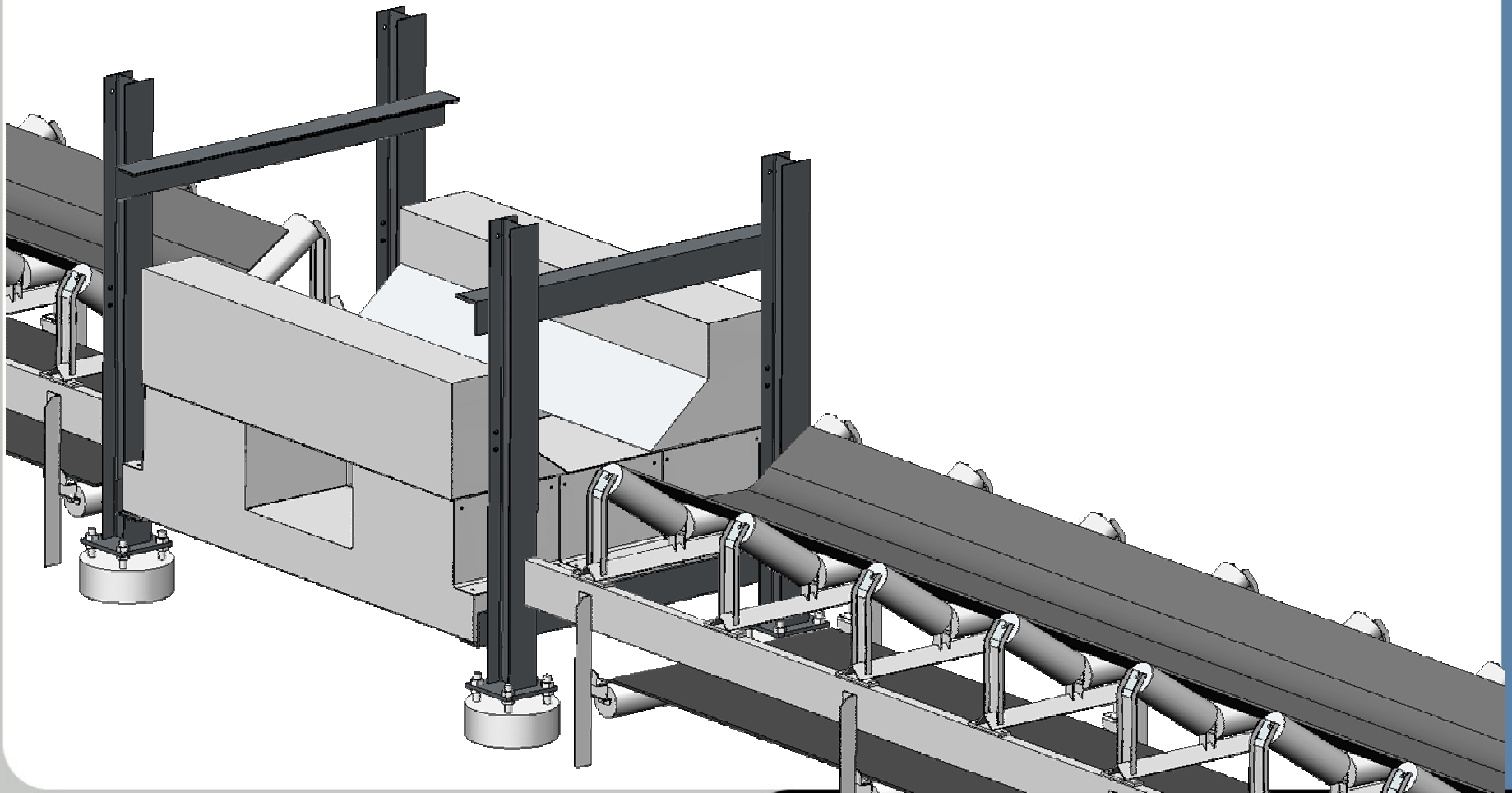
CBXpert Shielding Integration

Side blocks get configured to customer belt specification



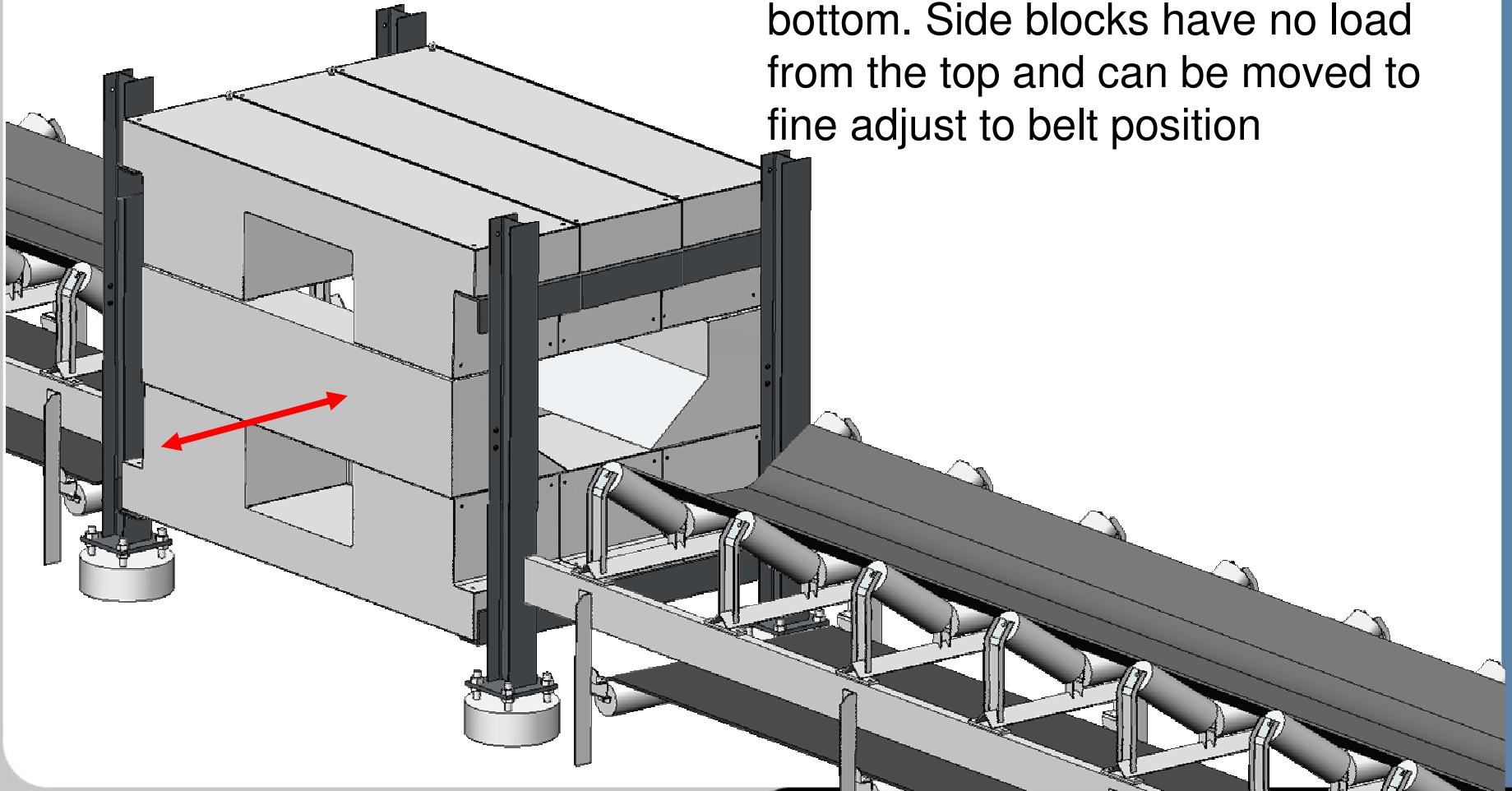
CBXpert Shielding Integration

Side blocks are installed on the bottom shielding blocks



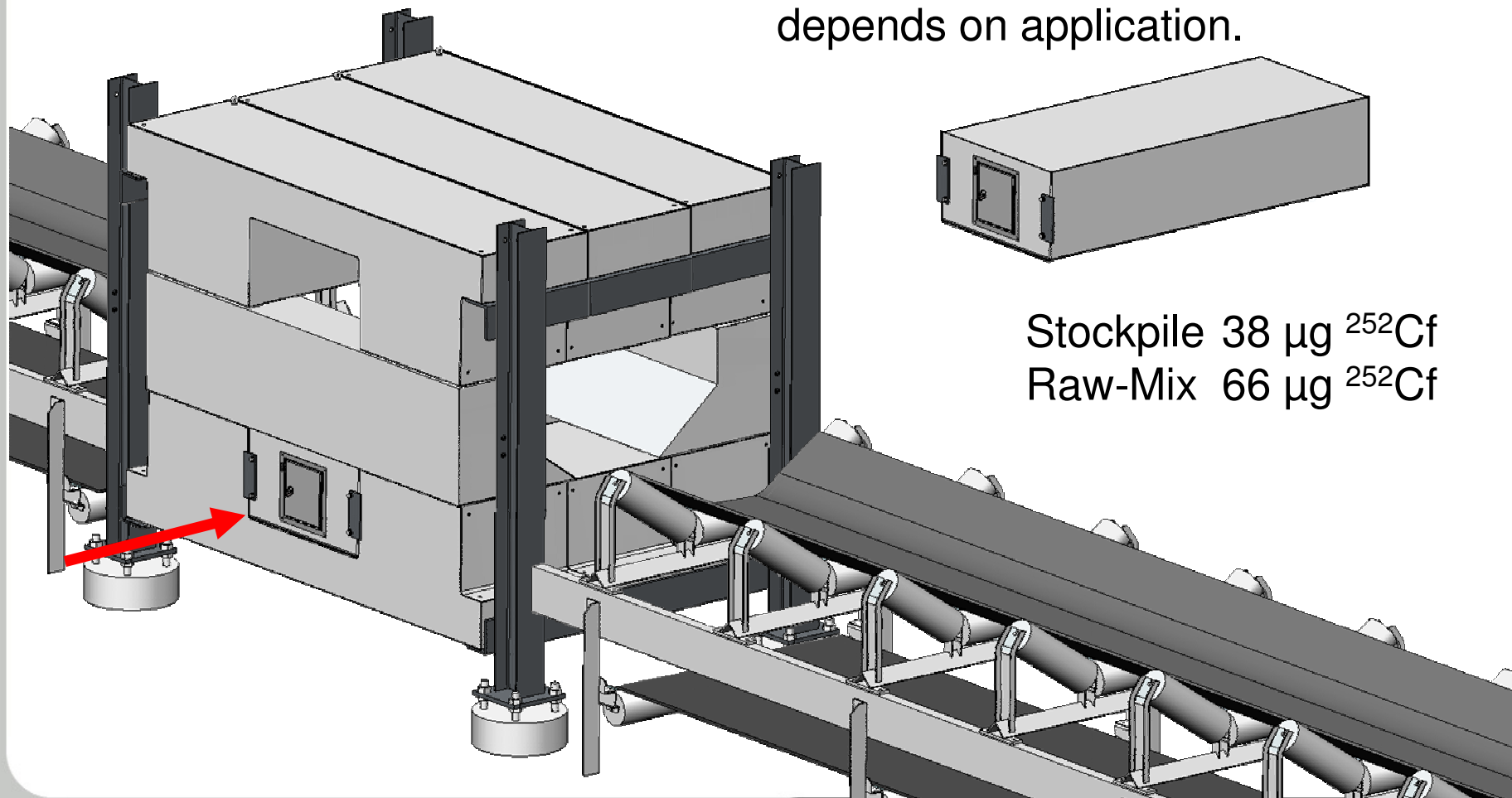
CBXpert Shielding Integration

For the top shielding the same shielding blocks are used as at the bottom. Side blocks have no load from the top and can be moved to fine adjust to belt position



CBXpert Shielding Integration

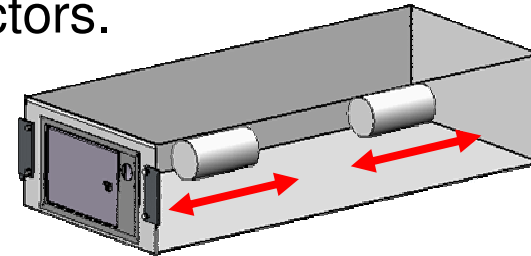
Source block has 4 sources positions. Initial source loading depends on application.



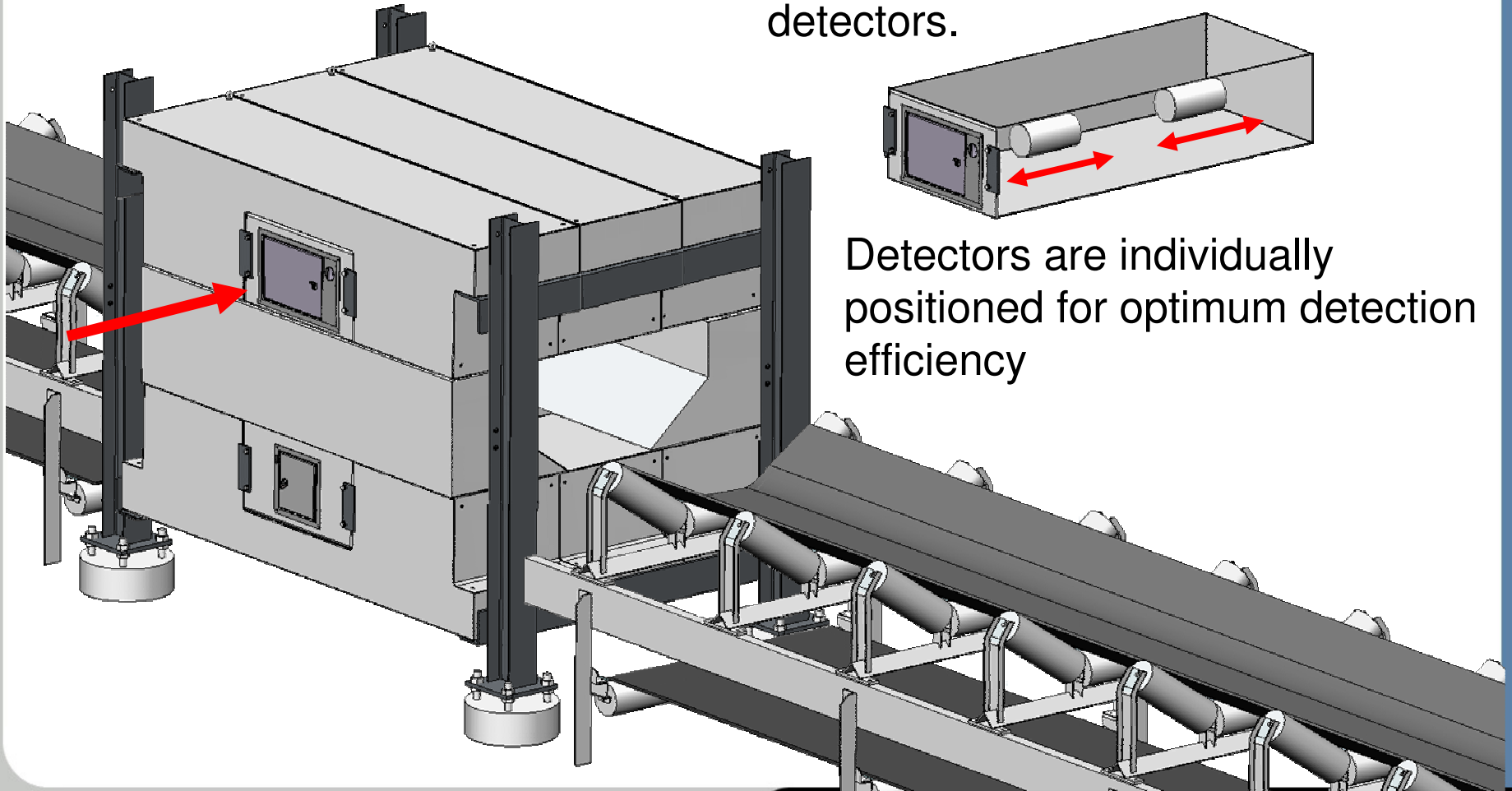
Stockpile 38 μg ^{252}Cf
Raw-Mix 66 μg ^{252}Cf

CBXpert Shielding Integration

Detector block contains the new horizontally positioned heated detectors.

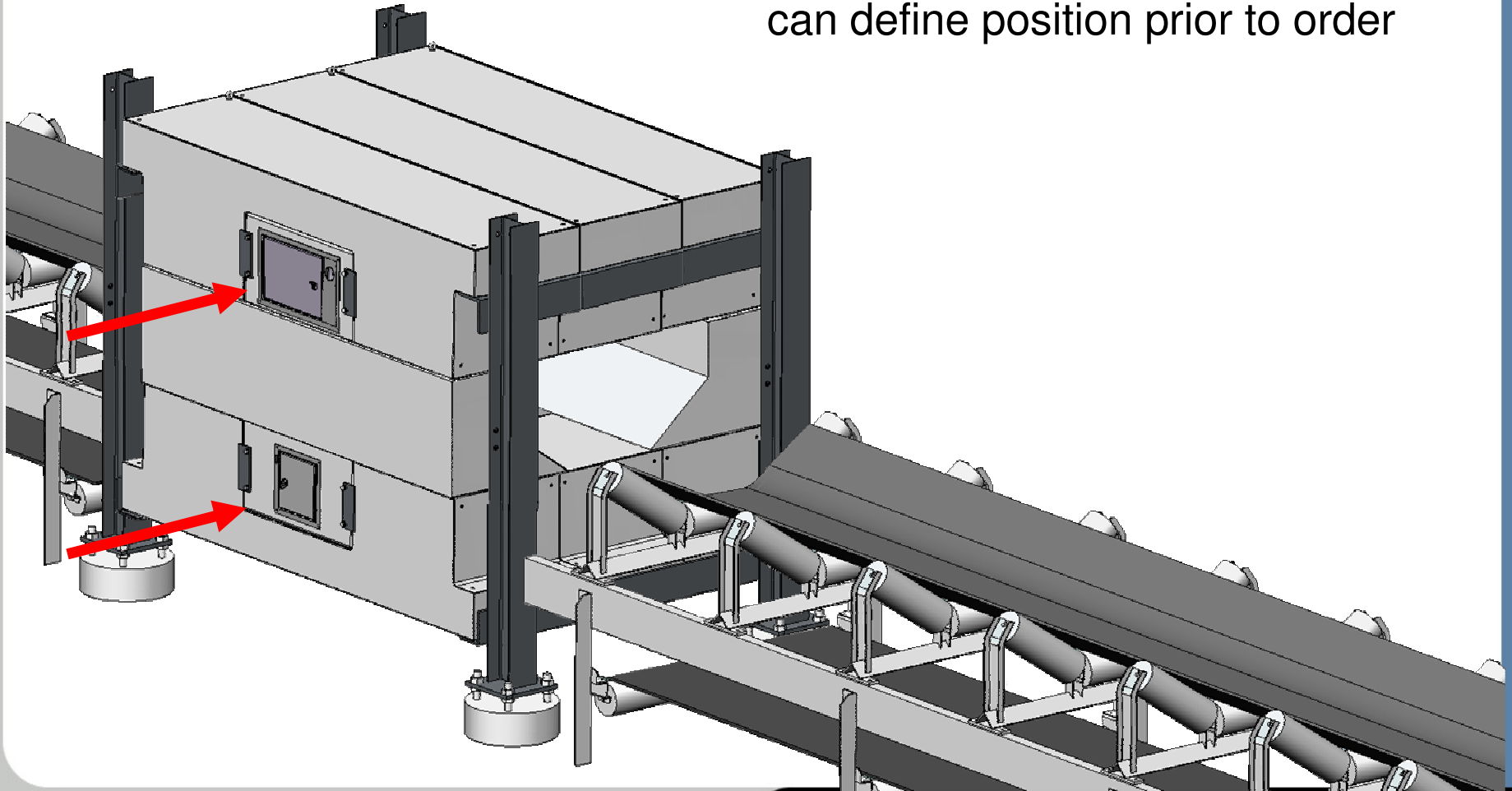


Detectors are individually positioned for optimum detection efficiency



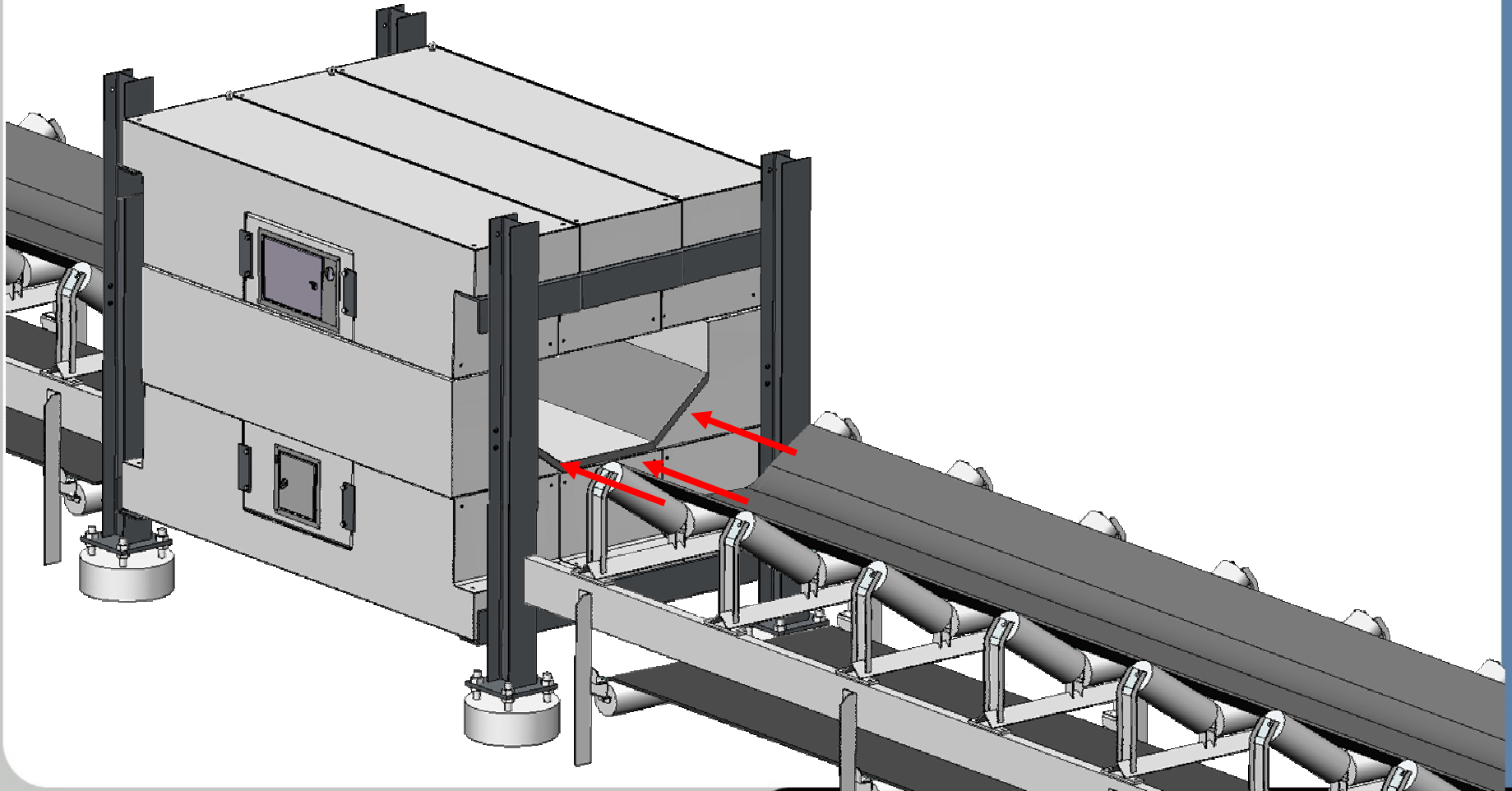
CBXpert Shielding Integration

Access to source and detector is always from one side. Customer can define position prior to order



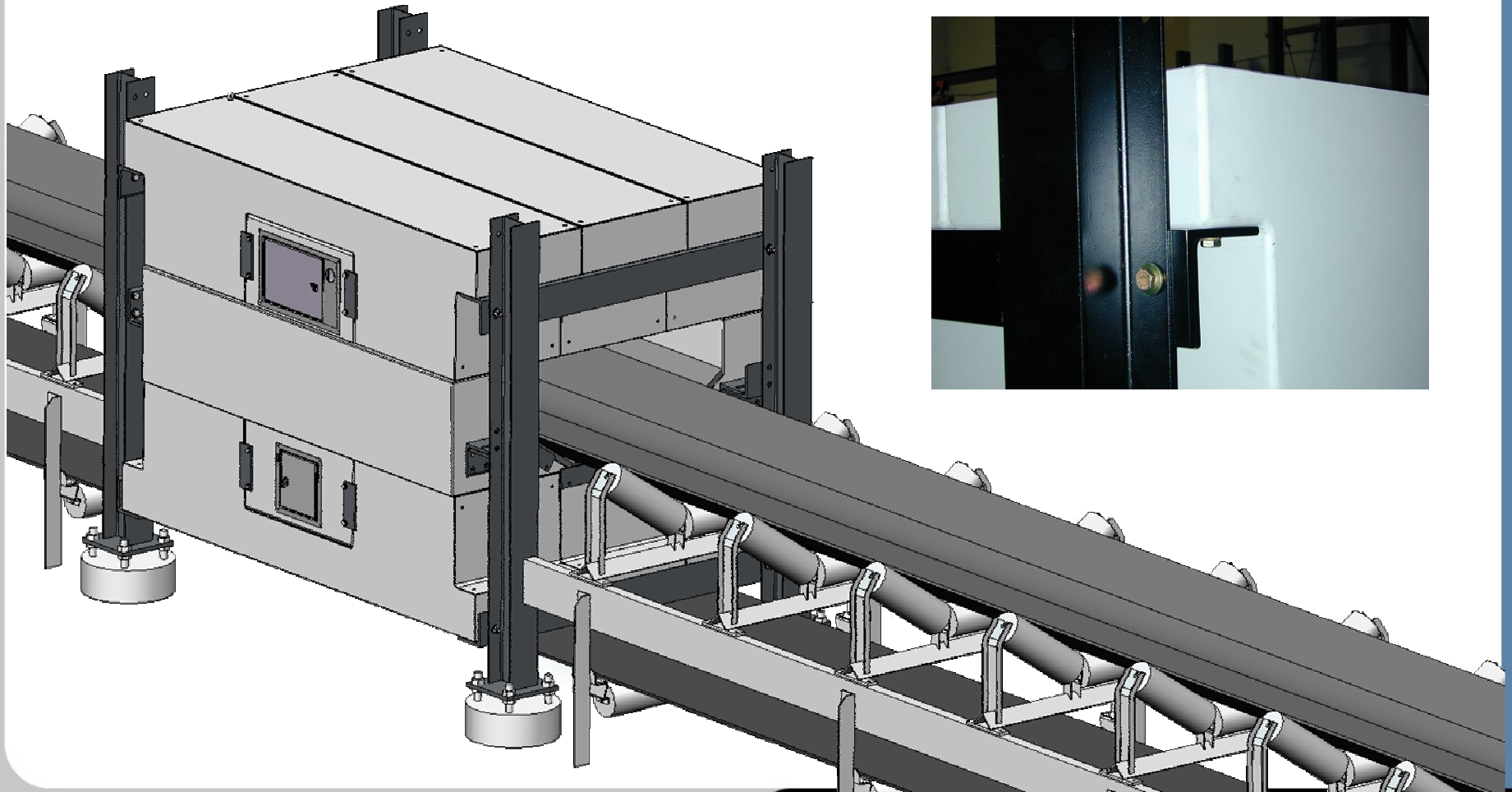
CBXpert Shielding Integration

Custom tailored liners are installed to protect the tunnel area



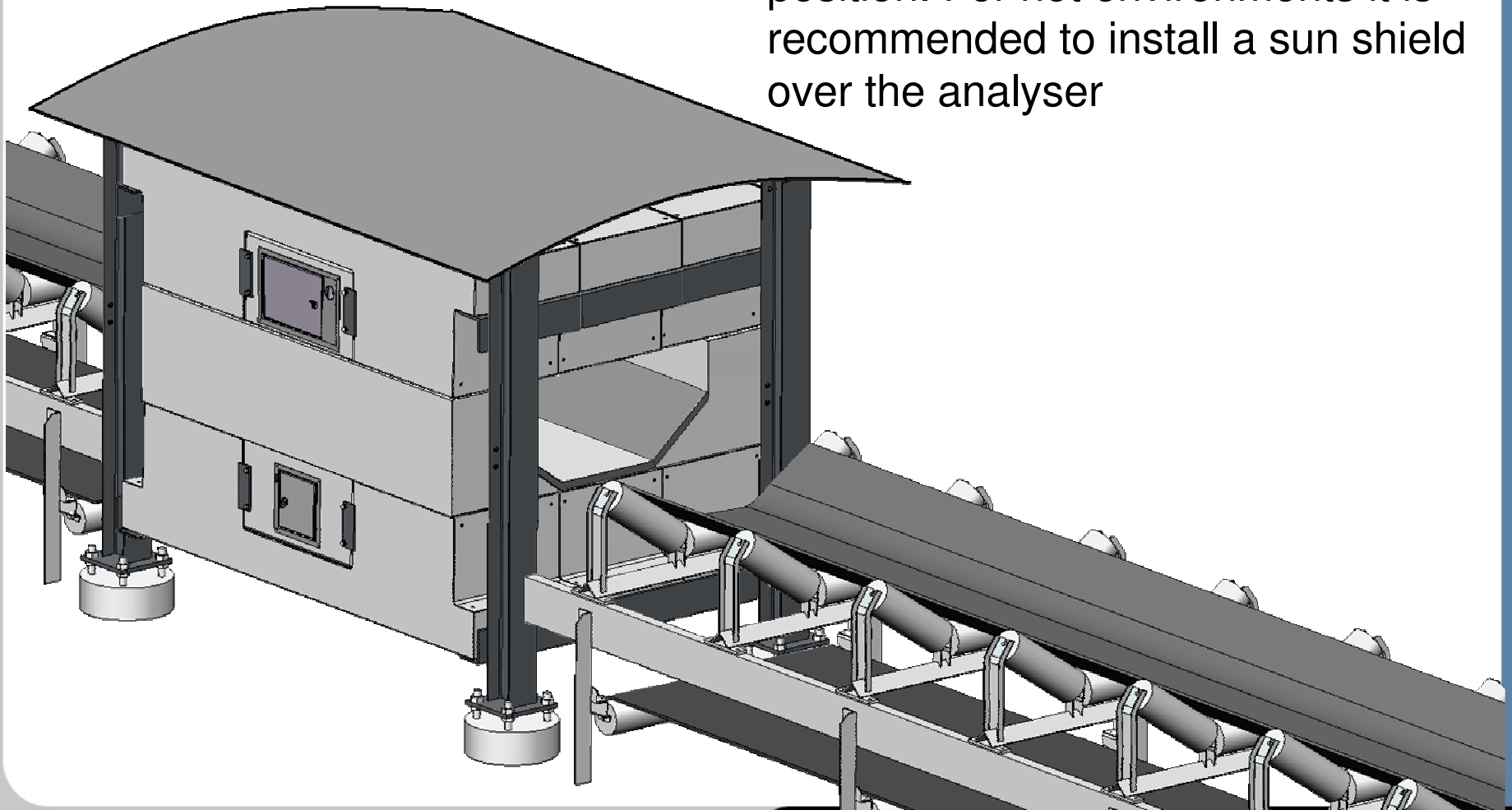
CBXpert Shielding Integration

All shielding parts get bolted to the frame and fixed in position



CBXpert Shielding Integration

The analyser shielding is in position. For hot environments it is recommended to install a sun shield over the analyser



Example CBX Installation: Dragon Products

- ✓ **No Building or Sun-Shade**
- ✓ **10-Block Modular Design**
- ✓ **No Platform**
- ✓ **No Bend Pulleys for Belt Return**
- ✓ **Single Sided Maintenance Access**
- ✓ **No A/C Requirement**
- ✓ **35° Trough Angle**
- ✓ **Proprietary Modular Reference Standards**

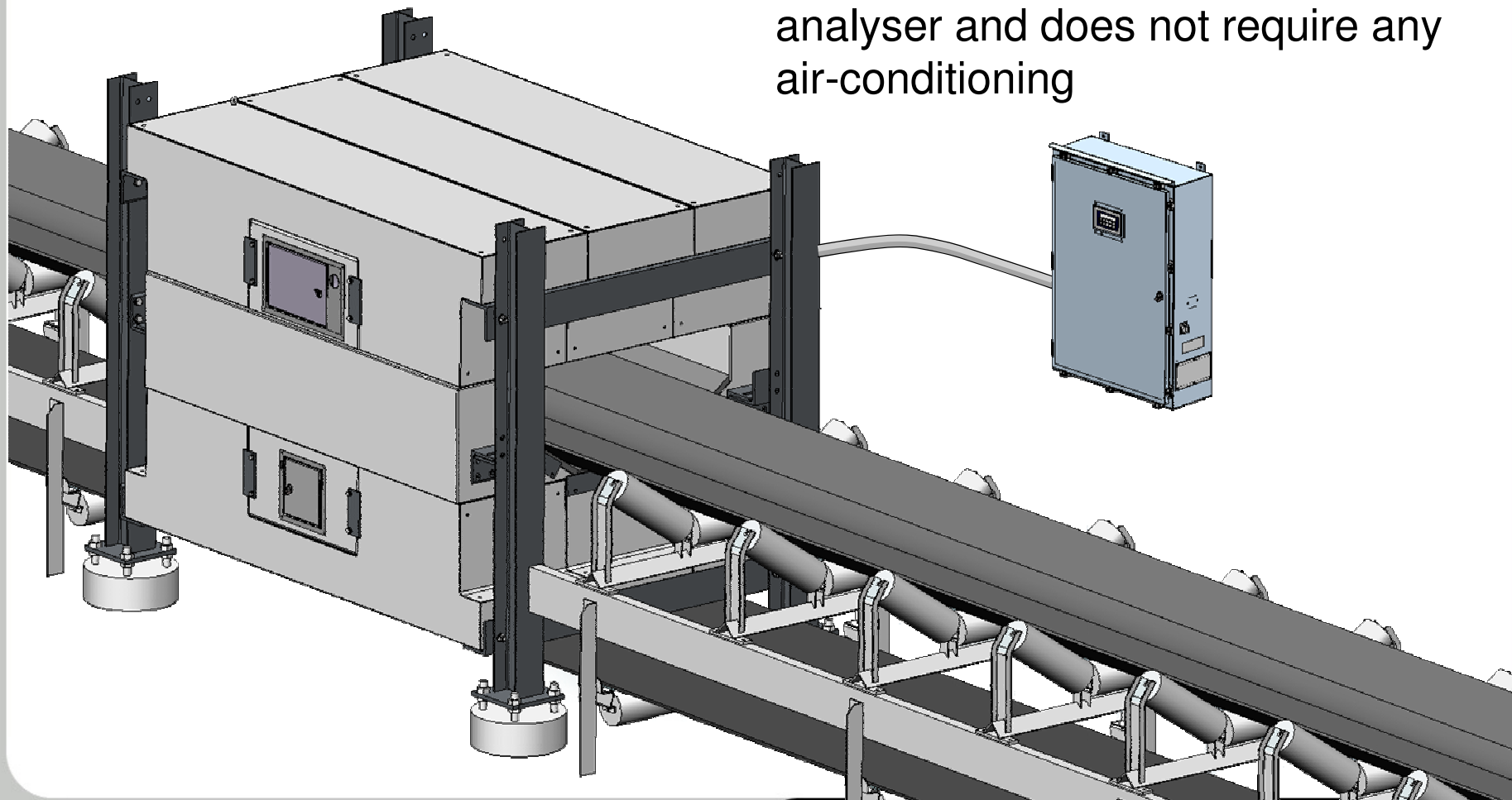


Installation Photo



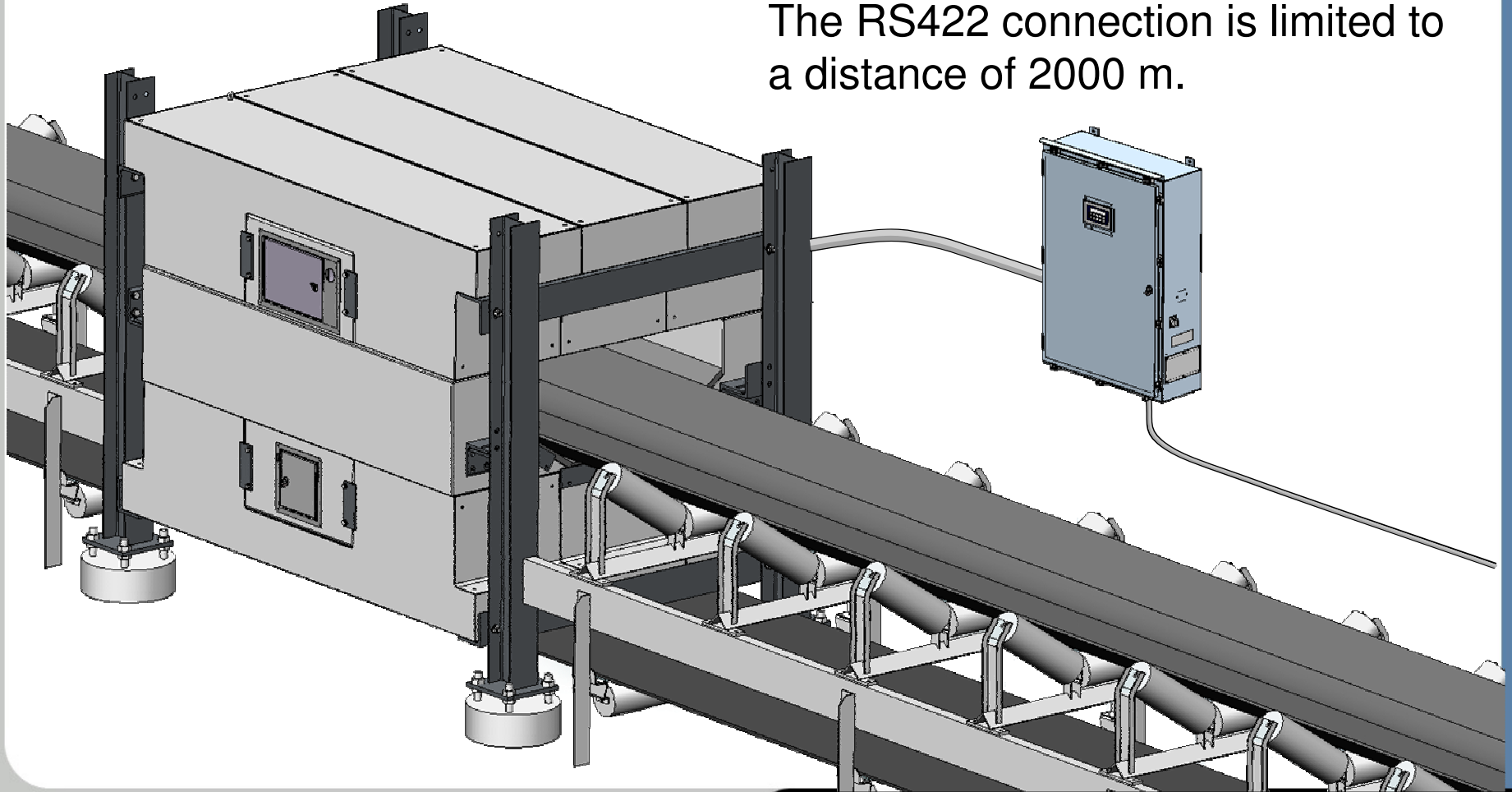
CBXpert Electrical connection

The electronics enclosure can be positioned up to 100 m from the analyser and does not require any air-conditioning



CBXpert Electrical connection

Connection to the control room can be done by RS422 or optical cable. The RS422 connection is limited to a distance of 2000 m.



Plant Interface

- OPC – Ole for Process Control
- ODBC – Open Data Base Connectivity
- Serial Protocol

Best of both the worlds (Baggies and Modular Reference standards)



Non-symmetrical Loading is Duplicated
in Factory Testing

- No Overhead hoist required
- Easily handled by one person
Maximum 22Kg
- Easily stored



CBX



Static guarantees – typical for stockpile

STATIC REPEATABILITY

The system is guaranteed to perform equal to or better than the following static repeatability specifications. Values are stated on a dry basis (LOI included).

Oxide	<i>Guarantee</i> One Standard Deviation (1)	<i>Expected Repeatability</i> One Standard Deviation (1)
SiO ₂	0.15%	0.10 %
Al ₂ O ₃	0.17%	0.11%
Fe ₂ O ₃	0.04%	0.02%
CaO	0.27%	0.20%
MgO	0.30%	0.20%
K ₂ O	0.04%	0.02%
Na ₂ O	0.13%	0.08%
SO ₃	0.07%	0.04%

Static guarantees –typical for stockpile

•STATIC ACCURACY

- The system is guaranteed to perform equal to or better than the following static accuracy specifications in stockpile monitoring applications.
- The values are stated on a dry basis (LOI included).
- Standard Range**

•Oxide	•Range (1)	•Guaranteed Maximum RMSD (2)	•Expected Maximum RMSD (2)
•SiO ₂	•20% (4%-24%)	•0.40 %	•0.35 %
•Al ₂ O ₃	•10% (0%-10%)	•0.35 %	•0.26 %
•Fe ₂ O ₃	•10% (0%-10%)	•0.10 %	•0.06 %
•CaO	•35% (18%-53%)	•0.40 %	•0.35 %
•MgO	•6% (0%-6%)	•0.50 %	•0.38%
•K ₂ O	•3% (0%-3%)	•0.15 %	•0.10 %
•Na ₂ O	•3% (0%-3%)	•0.30 %	•0.20 %
•SO ₃	•3% (0%-3%)	•0.17 %	•0.09 %

- ⁽¹⁾ Range of material composition in reference standards.
- Guarantees are a function of the range, a larger range will dictate a larger guarantee. Conversely, a smaller range will dictate a smaller guarantee
- ⁽²⁾ Root Mean Squared Deviation, one-hour period

Typical repeatability guarantees – raw mix

Belt Loading	Guaranteed Ten-minute Repeatability by Oxide ⁽¹⁾							
Kg/m	SiO ₂	Fe ₂ O ₃	Al ₂ O ₃	CaO	MgO	K ₂ O	Na ₂ O	SO ₃
55	0.28	0.08	0.32	0.50	0.67	0.08	0.24	0.13
60	0.27	0.07	0.30	0.48	0.64	0.07	0.23	0.13
65	0.26	0.07	0.29	0.46	0.61	0.07	0.22	0.12
70	0.25	0.07	0.28	0.44	0.59	0.07	0.21	0.12
75	0.24	0.06	0.27	0.43	0.57	0.06	0.21	0.11
80	0.23	0.06	0.26	0.41	0.55	0.06	0.20	0.11
85	0.22	0.06	0.25	0.40	0.54	0.06	0.19	0.11
90	0.22	0.06	0.25	0.39	0.52	0.06	0.19	0.10
95	0.21	0.06	0.24	0.38	0.51	0.06	0.18	0.10
100	0.21	0.06	0.23	0.37	0.49	0.06	0.18	0.10
105	0.20	0.06	0.23	0.36	0.48	0.06	0.18	0.10
110	0.20	0.05	0.22	0.35	0.47	0.05	0.17	0.09
115	0.19	0.05	0.22	0.35	0.46	0.05	0.17	0.09

Typical Accuracy guarantees – raw mix

Guaranteed Maximum RMSD ⁽²⁾		
Oxide	Range ⁽¹⁾	RMSD
SiO ₂	12% - 15%	0.30%
Al ₂ O ₃	2% - 4%	0.28%
Fe ₂ O ₃	0.5% - 3.5%	0.07%
CaO	39.5% - 45.5%	0.30%
MgO	0% - 2%	0.25%
K ₂ O	0% - 1%	0.10%
Na ₂ O	0% - 1%	0.20%
SO ₃	0% - 1%	0.20%

Dynamic performance -typical

Guarantee

Based on the test procedure and conditions specified below, Thermo Electron guarantees that the one-hour standard deviation of the difference between will not exceed the values in the following table.

Quality Parameter	Guarantee One standard deviation ⁽¹⁾	Expected One standard deviation ⁽¹⁾
LSF	2.5	1.5 – 2.0
SM	0.15	0.1
IM	0.18 ⁽²⁾	0.1 ⁽²⁾

(1)Values are stated on a dry basis (Loss On Ignition included)

(2)IM must be below 2.5

QUESTIONS

Thank you for your time

Base Cement and PREBOS Plus Software for CBX Analyser

Analyze • Detect • Measure • Control™

Thermo
ELECTRON CORPORATION

Control Software

- Controls the CBX analyser
- Handles Oxide Calibration
- Calculates Oxides and user defined control parameters

PREBOS Plus Software

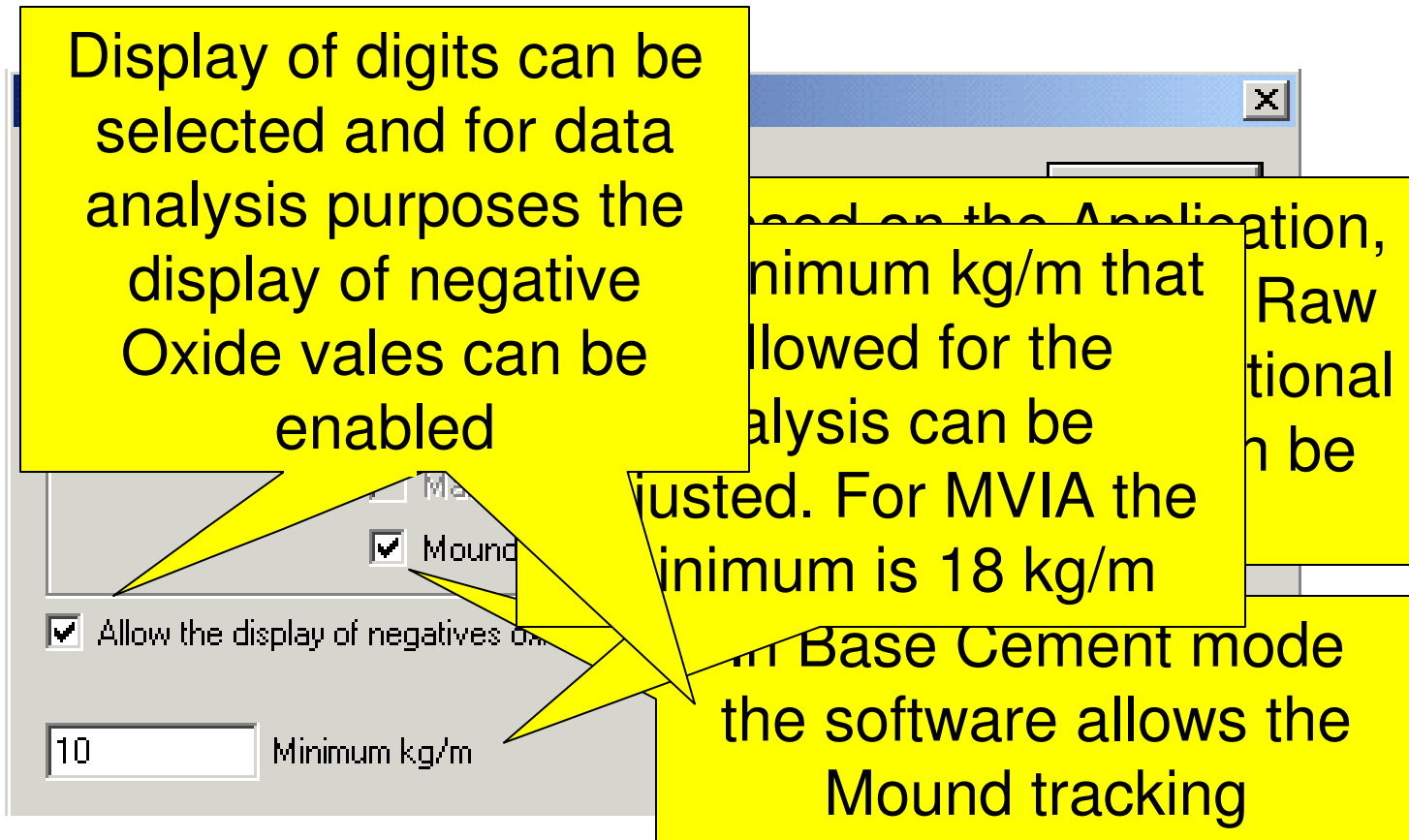
- Keeps track of the mound (stockpile) by monitoring the cumulative chemistry of the stockpile and maintaining the history data for control purposes
- Monitors the composition of the mound and based on several parameters mentioned below provides advisories to the plant operator to change the proportions of raw material sources to achieve the target and desired chemistry:
 - *The target and desired chemistry*
 - *The cost of various raw material*
 - *The priority of usage*
 - *The actual chemistry of the stockpile*

System Configuration

Display of digits can be selected and for data analysis purposes the display of negative Oxide vales can be enabled

Based on the Application, minimum kg/m that allowed for the analysis can be trusted. For MVIA the minimum is 18 kg/m

In Base Cement mode the software allows the Mound tracking



The screenshot shows a software configuration window with the following elements:

- A checkbox labeled "Mound" which is checked.
- A checkbox labeled "Allow the display of negatives on" which is checked.
- A text input field labeled "Minimum kg/m" containing the value "10".

Standard Configuration

Predefined QC equations

LSF | SM | IM | C3S | C2S | C3A | C2F | C4AF | Percent Liquid | Burnability Index | Burnability Factor | Delta BC | Custom

LSF = 100 x $\frac{1 \times \text{CaO}}{2.8 \times \text{Al}_2\text{O}_3 + 1.65 \times \text{Al}_2\text{O}_3 + 0.35 \times \text{Fe}_2\text{O}_3} + 0$

OK Cancel Apply

All for control parameters are pre-defined

Equations can be customised to comply with local requirements

Customised Configuration

Predefined QC equations

LSF | SM | IM | C3S | C2S | C3A | C2F | C4AF | Percent Liquid | Burnability Index | Burnability Factor | Delta BC | Custom

+ x SiO₂ + x Al₂O₃ + x Fe₂O₃
+ x CaO + x K₂O + x SO₃
+ x MgO + x Na₂O + x Trace

= x $\frac{\text{[Equation]}}{\text{[Equation]}}$ +

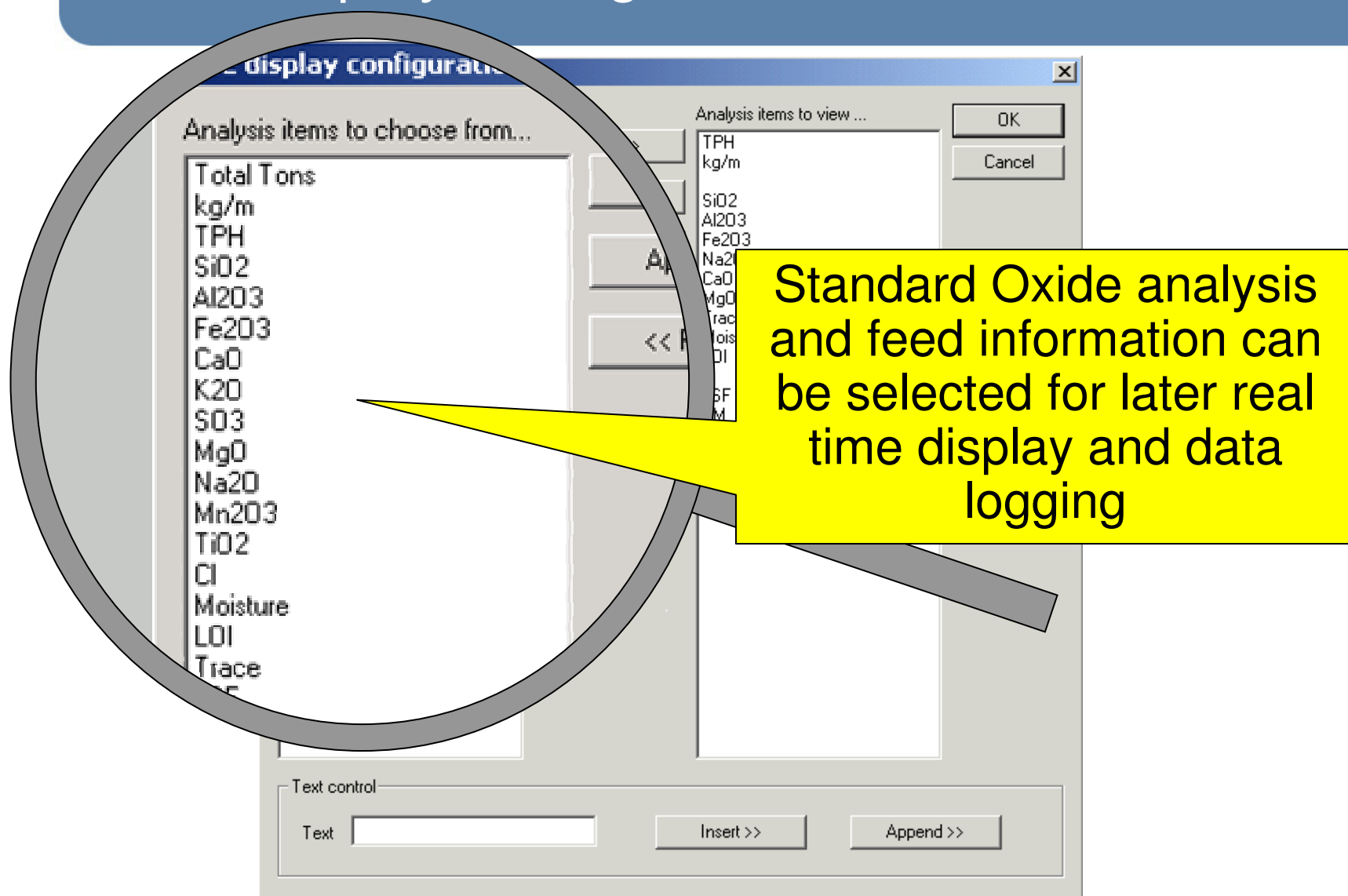
+ x SiO₂ + x Al₂O₃ + x Fe₂O₃
+ x CaO + x K₂O + x SO₃
+ x Na₂O + x Trace

☒ Use dry basis

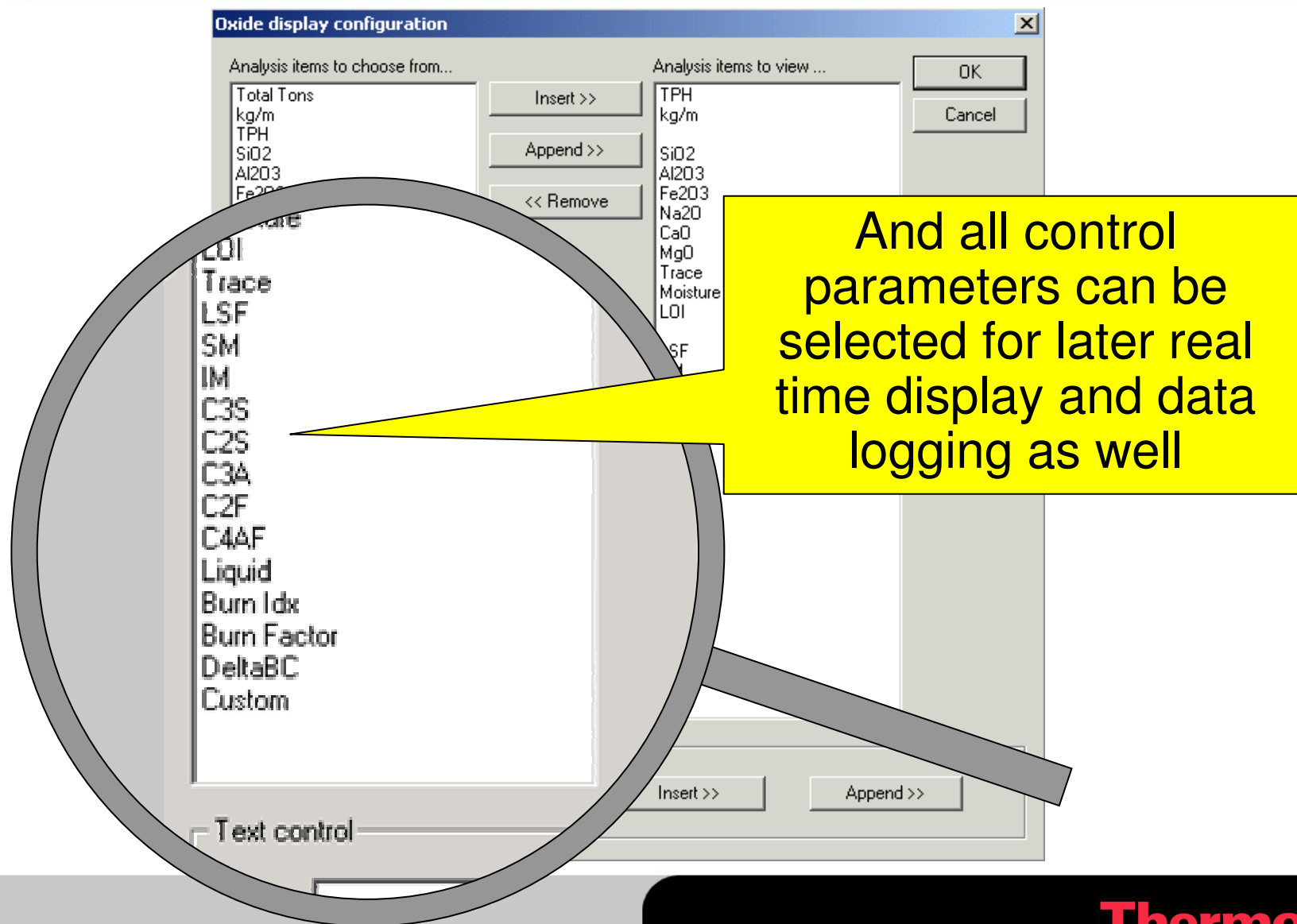
OK Cancel Apply

Customised equation can be defined to comply with specific customer control parameters

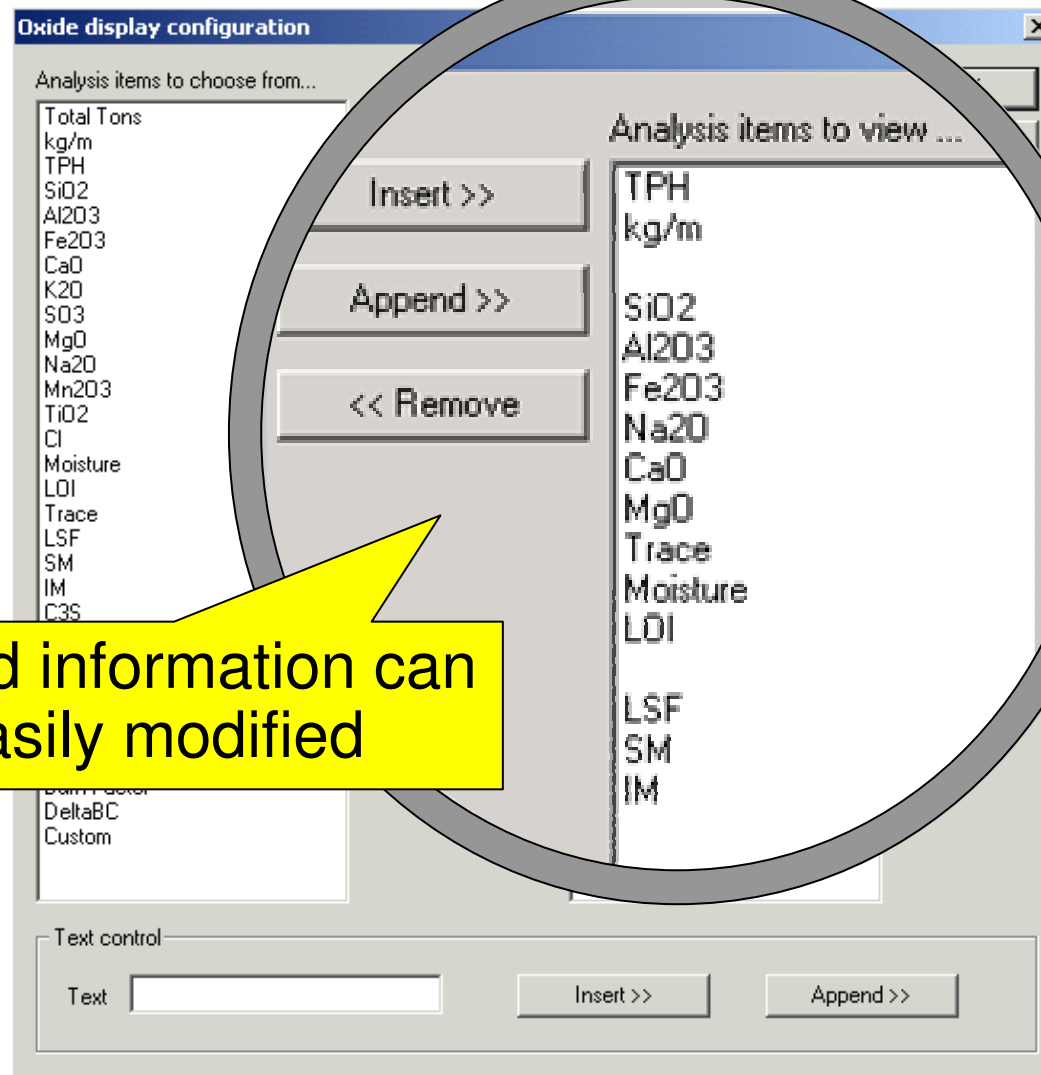
Oxide Display Configuration



Oxide Display Configuration



Oxide Display Configuration



Displayed information can
be easily modified

Alarm Configuration

The screenshot shows a software window titled "Configure Alarm Thresholds". It contains a table of alarms and a configuration panel on the right. Three yellow callout boxes highlight specific features:

- Low and high limits can be defined**: Points to the "Limits" section where "High value" is set to 100 and "Low value" is set to 76.
- as well as the type of message or the output to the DCS system**: Points to the "Indicator" section with checkboxes for "Pop Up Message", "Audible", and "External Signal".
- For each control parameter alarm levels can be defined separately**: Points to the table of alarms.

Alarm to configure...		
IPM - SMC com	[Rolling] Burn Factor	[Cumulative]
Det #1 temp	[Rolling] DeltaBC	[Cumulative]
[Rolling] LSF	[Cumulative] SM	
[Rolling] SM	[Cumulative] IM	
[Rolling] IM	[Cumulative] C3	
[Rolling] C3	[Cumulative] C2	
[Rolling] C2	[Cumulative] C1	
[Rolling] C1		
[Rolling] C0		
[Rolling] C-1		
[Rolling] C-2		
[Rolling] C-3		
[Rolling] C-4		
[Rolling] C-5		
[Rolling] C-6		
[Rolling] C-7		
[Rolling] C-8		
[Rolling] C-9		
[Rolling] C-10		
[Rolling] C-11		
[Rolling] C-12		
[Rolling] C-13		
[Rolling] C-14		
[Rolling] C-15		
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[Rolling] C-93		
[Rolling] C-94		
[Rolling] C-95		
[Rolling] C-96		
[Rolling] C-97		
[Rolling] C-98		
[Rolling] C-99		
[Rolling] C-100		

Limits

High value: 100
Low value: 76

Indicator

☐ Pop Up Message
☐ Audible
☐ External Signal

Alarm level

☒ Information
☐ Caution

☒ Alarm is enabled

OK Cancel

Alarm Configuration

Configure Alarm Thresholds

Alarm to configure...

IPM - SMC com	[Rolling] Burn Factor	[Cumulative] DeltaBC
Det #1 temp	[Rolling] DeltaBC	[Cumulative] Custom
Det #2 temp		
Belt		

Limits

100 High value

76 Low value

☐ Audible

☐ External Signal

Alarm level

☒ Information

☐ Caution

☐ Warning

☐ Error

☐ Fatal

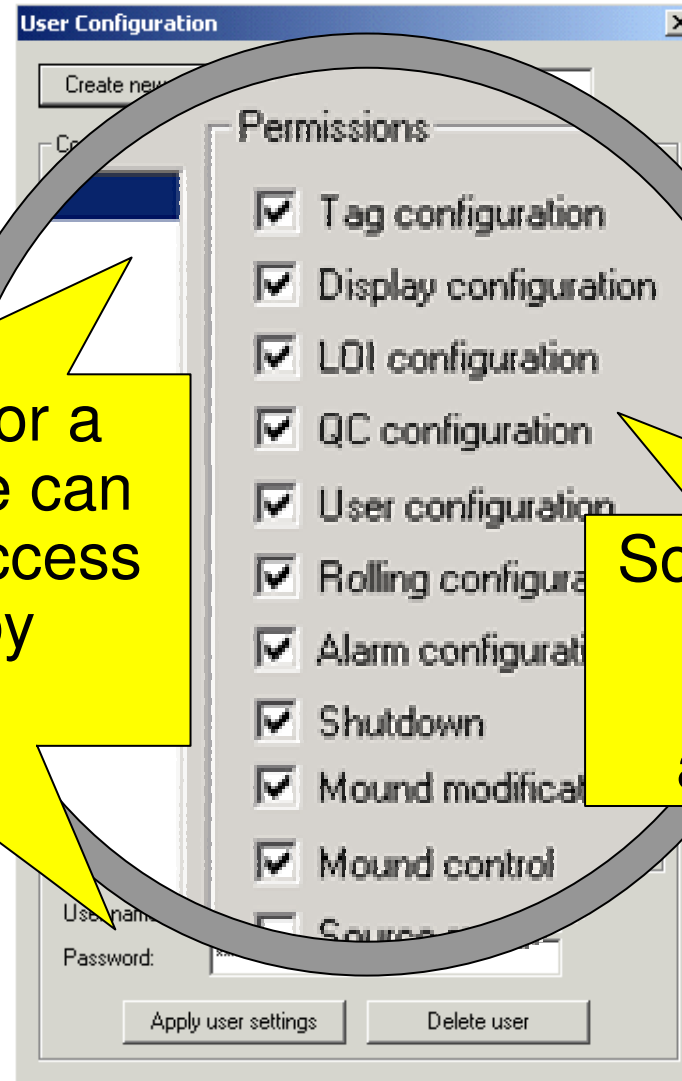
-1 Alarm index

☒ Alarm is enabled

Callout 1: For each alarm the alarm level can be configured to enable the operator to judge the alarm correctly

Callout 2: For each control parameter alarm levels can be defined separately

User Configuration



For each operator a permission profile can be defined and access is controlled by password

Software configuration and control level access are easily added or removed

Analysis Page

Thermo Gamma-Metrics - Base Cement

File Log on/off Config Edit View Help

Analysis Oxide Statistics Alarms System status Graph Real time trends

Analysis	Current	Rolling	Cumulative	Interval	< Export Interval
Tons	5.00	245.00	317.92	297.92	
TPH	2937.09	2937.09	230.96	0.00	
kg/m	27.78	27.78	27.64	27.63	
SiO2	13.55	13.55	13.55	13.55	
Al2O3	3.63	3.63	3.63	3.63	
Fe2O3	3.92	3.92	3.89	3.89	
Na2O	0.27	0.28	0.27	0.27	
CaO	40.23	40.39	40.23	40.23	
MgO	2.6	2.6	2.6	2.6	
Trace			0.1	0.1	

the cumulative and a pre-defined analysis interval

The current analysis

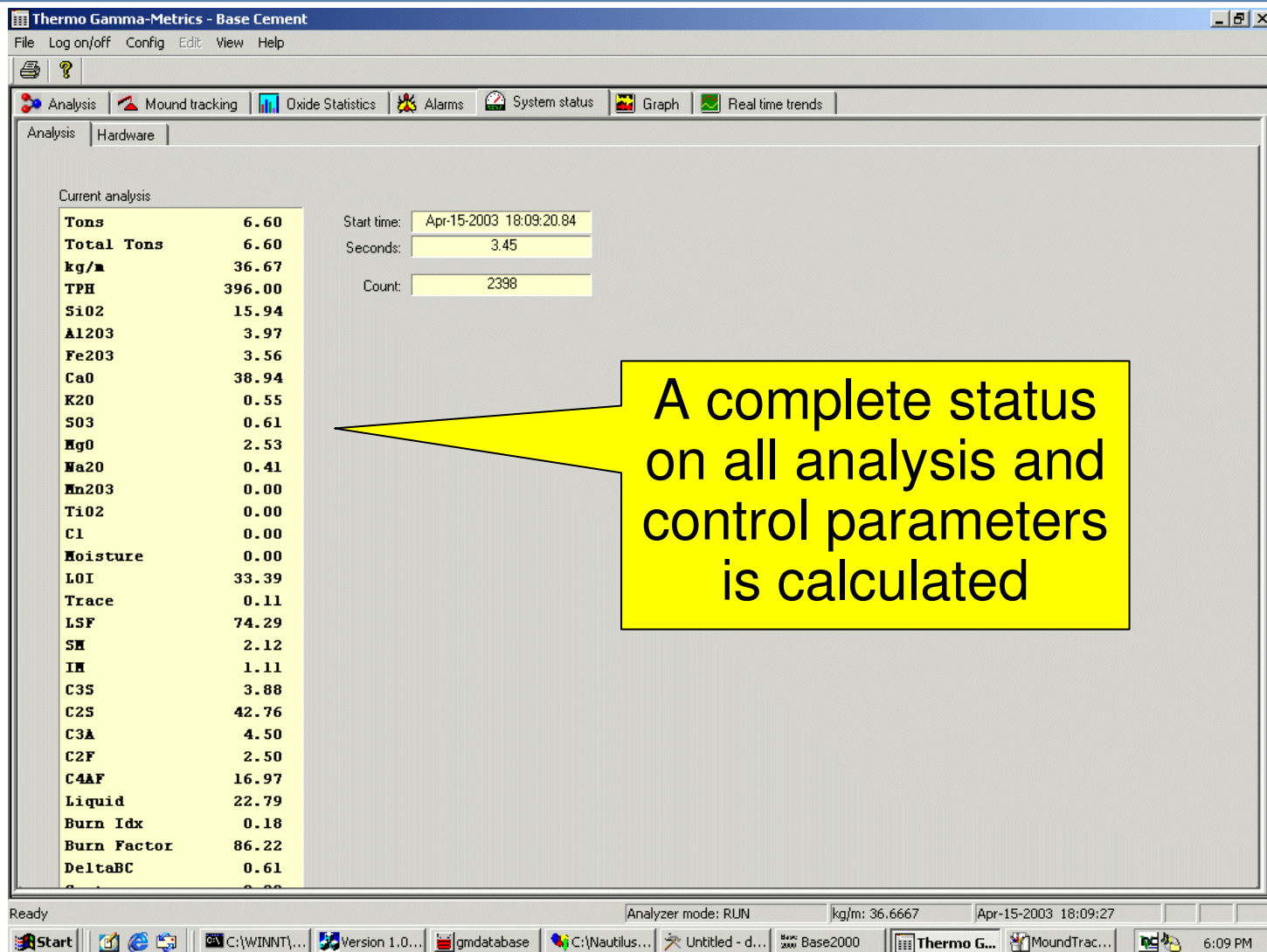
Date and time information for each summary are given at the bottom of the page

Analysis count	1	49	64	60	Number of records
	04/15/03 11:52:01	04/15/03 11:42:24	04/15/03 11:39:22	04/15/03 11:39:22	Actual start time
	04/15/03 11:52:13	04/15/03 11:52:13	04/15/03 11:52:13	04/15/03 11:51:24	Actual stop time
			04/15/03 11:00:00	04/15/03 11:00:00	Requested start time
				04/15/03 12:00:00	Requested stop time
					Destination
		10			Requested period (minutes)

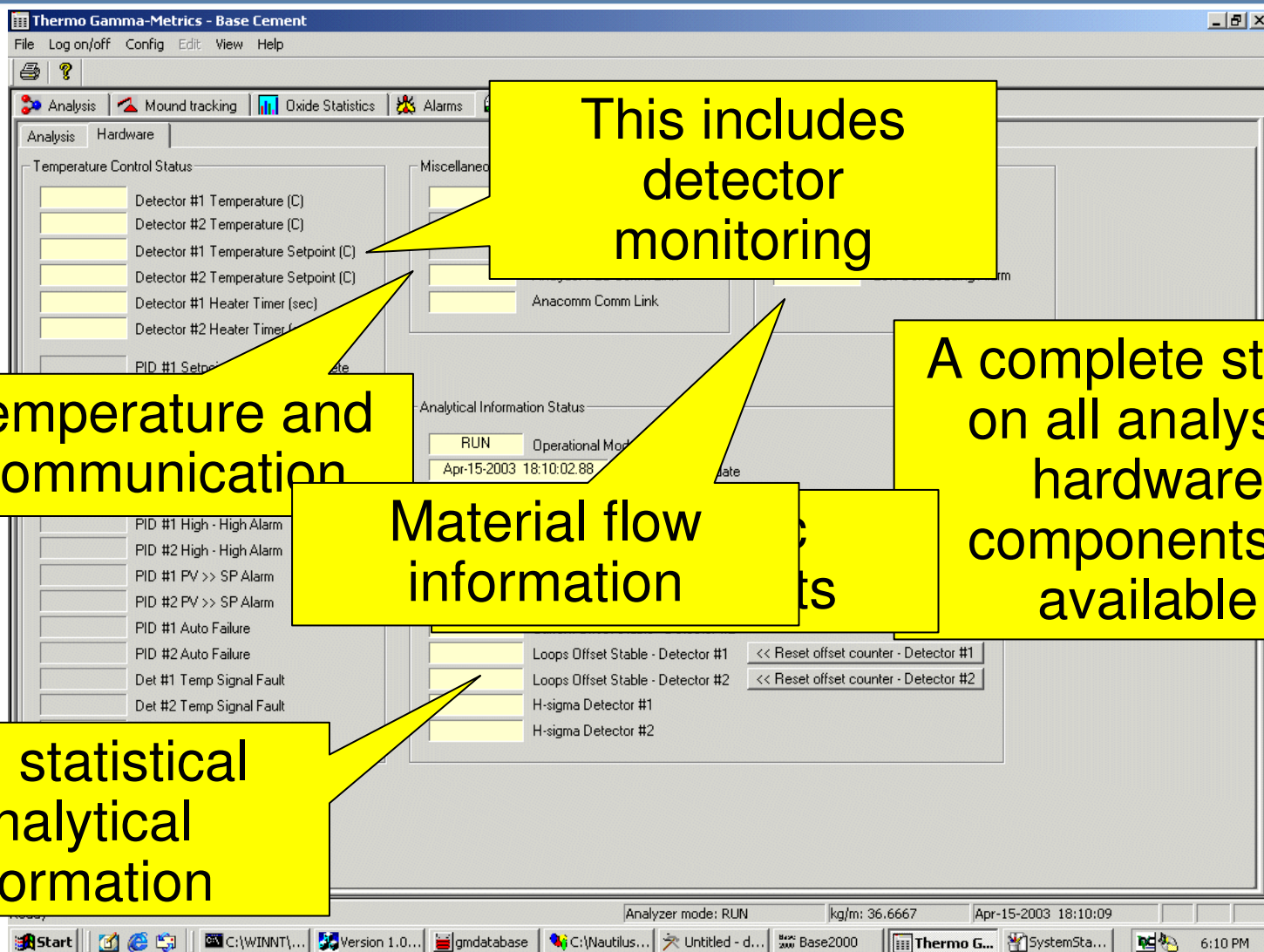
Ready Analyzer mode: RUN kg/m: 27.7778 Apr-15-2003 11:52:15

Start C:\WININT\... Version 1.0... gmdatabase Untitled - d... Base2000 Thermo G... Config C:\Nautilus... 11:52 AM

Analysis Status

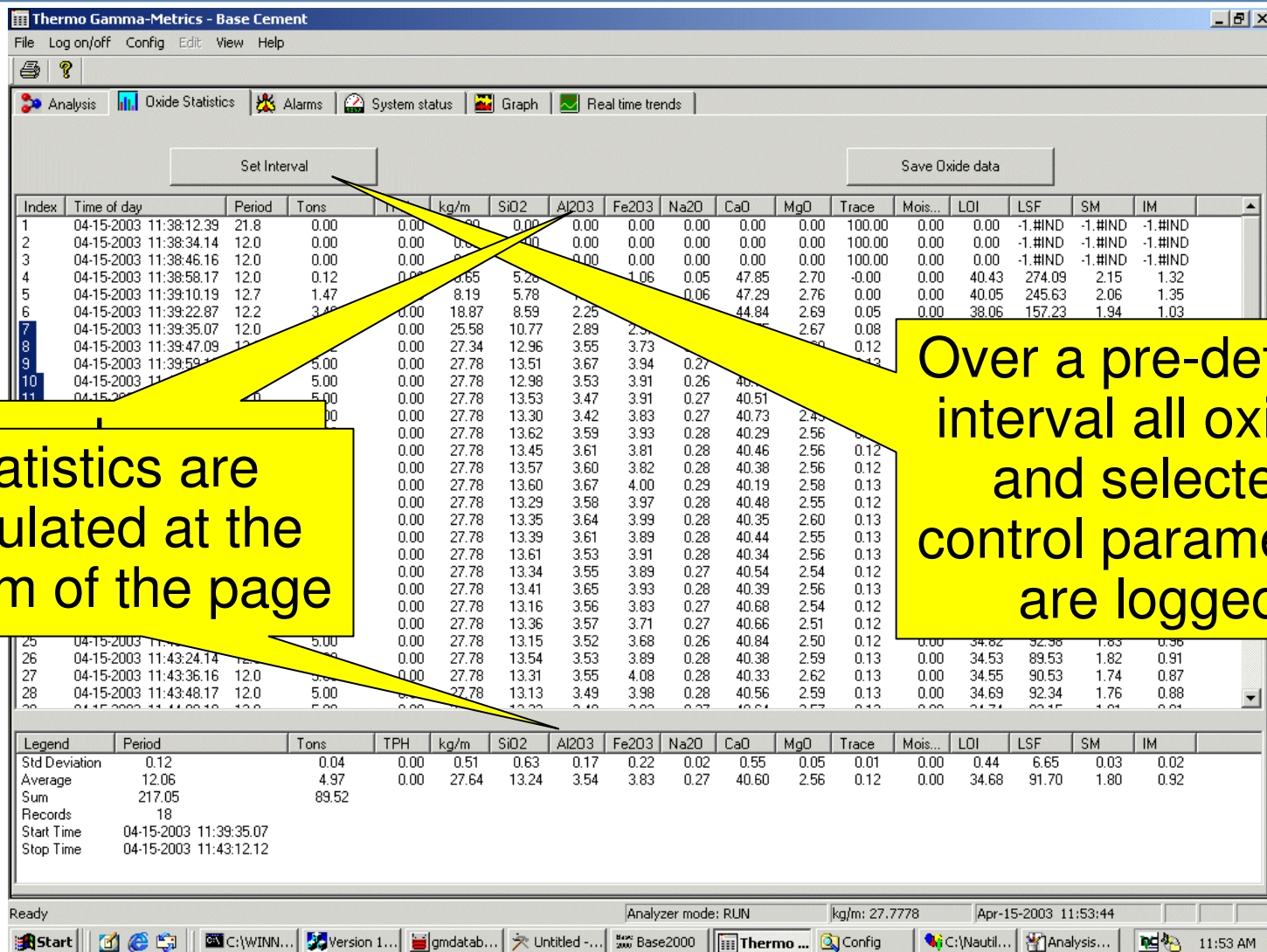


Hardware Status

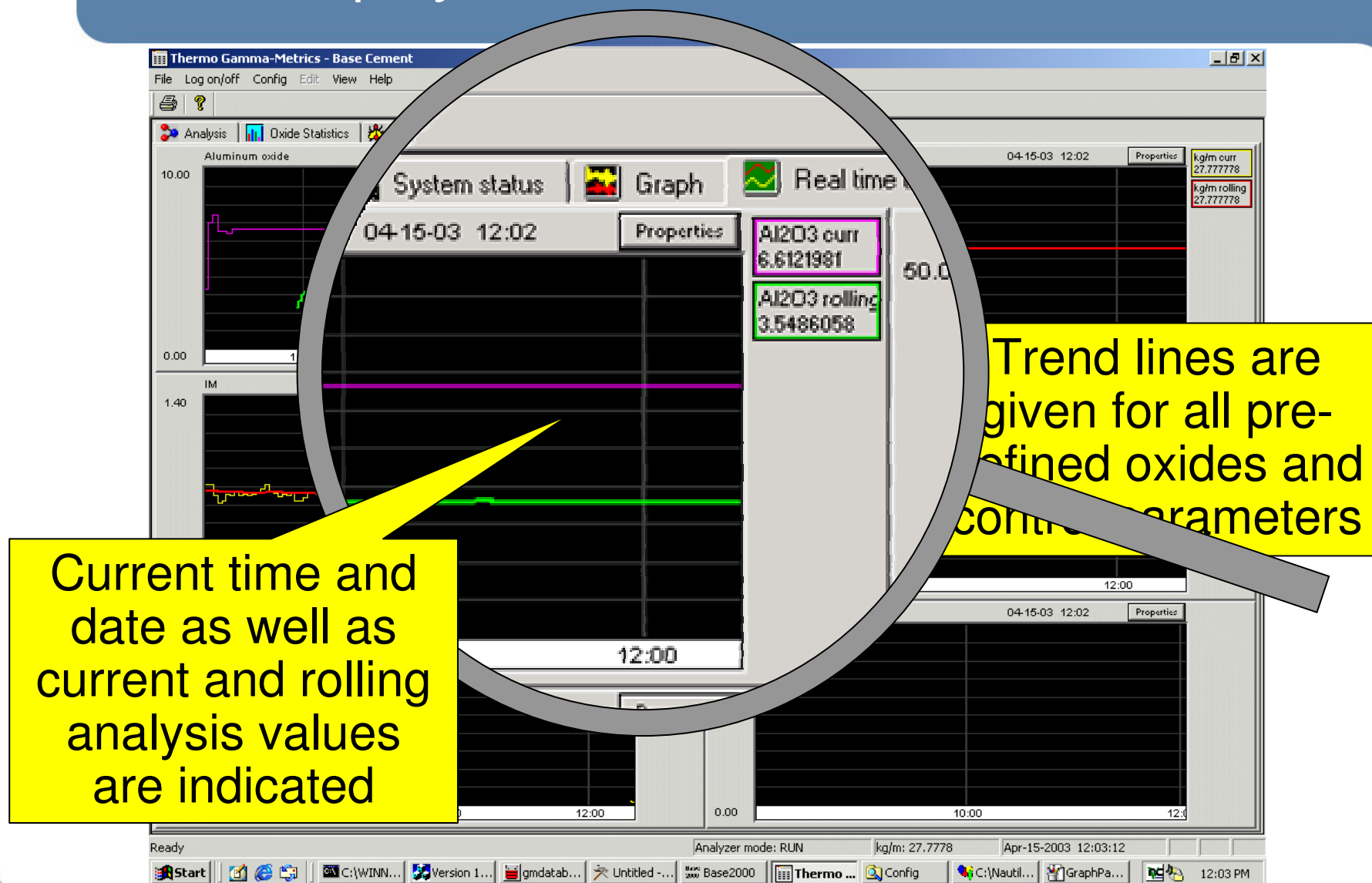


And statistical
analytical
information

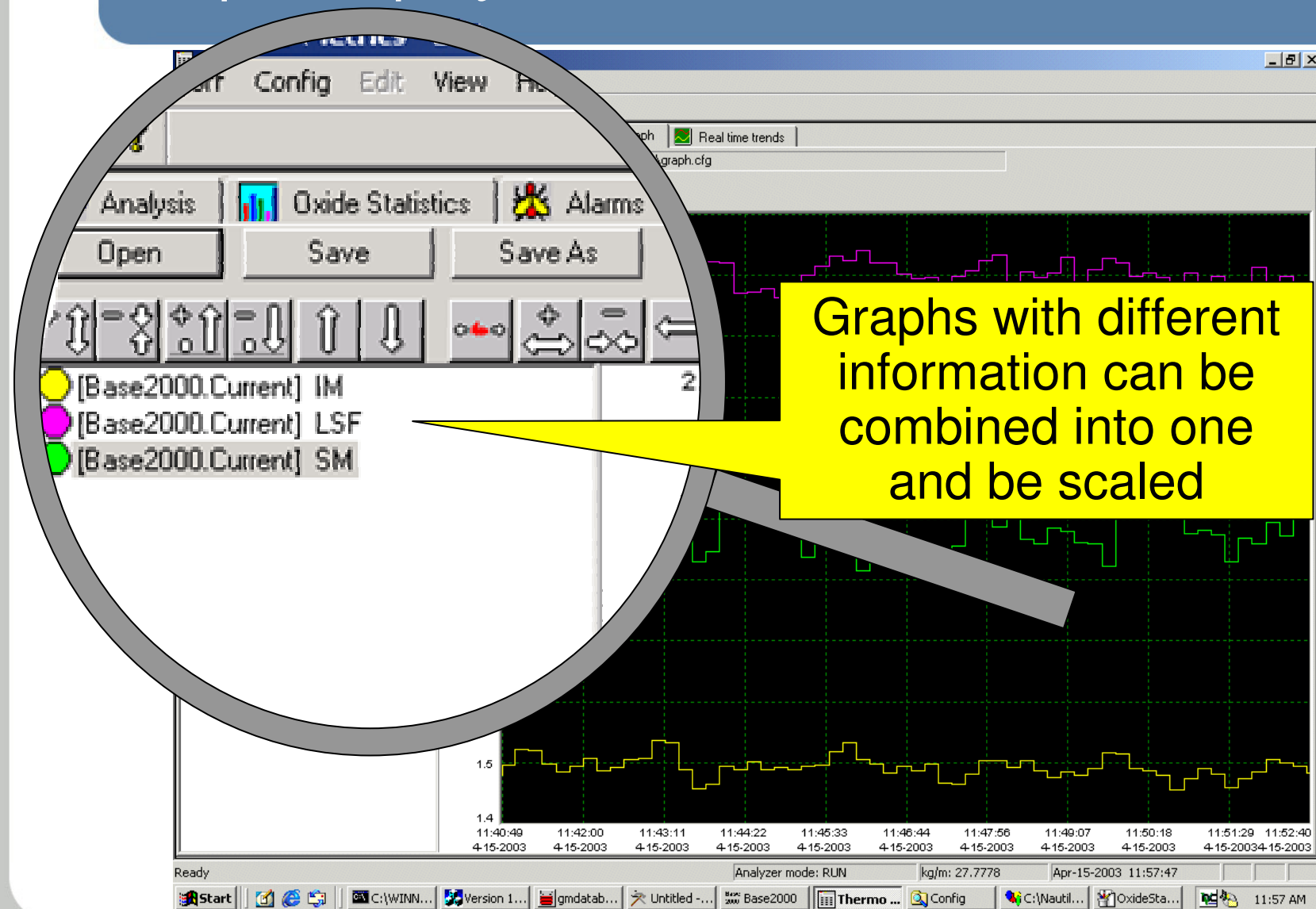
Statistical Oxide Data-Base



Trend Display



Graph Display



Alarm Summary Page

And alarm condition and description is given

Time	Source	Level	Message
04-15-2003 18:13:47.76	Base	INFO	Rolling IM too high!
04-15-2003 18:13:47.75	Base	INFO	Rolling LSF too low!
04-15-2003 18:13:47.75	Base	INFO	Rolling SM too high!
04-15-2003 18:13:40.94	Base	INFO	Rolling Trace too low!
04-15-2003 18:13:47.75	Base	INFO	Rolling Moisture too low!
04-15-2003 18:13:47.75	Base	INFO	Rolling MgO too high!

Tag Data Pool- Base Cement

Datapool Tag Mapping

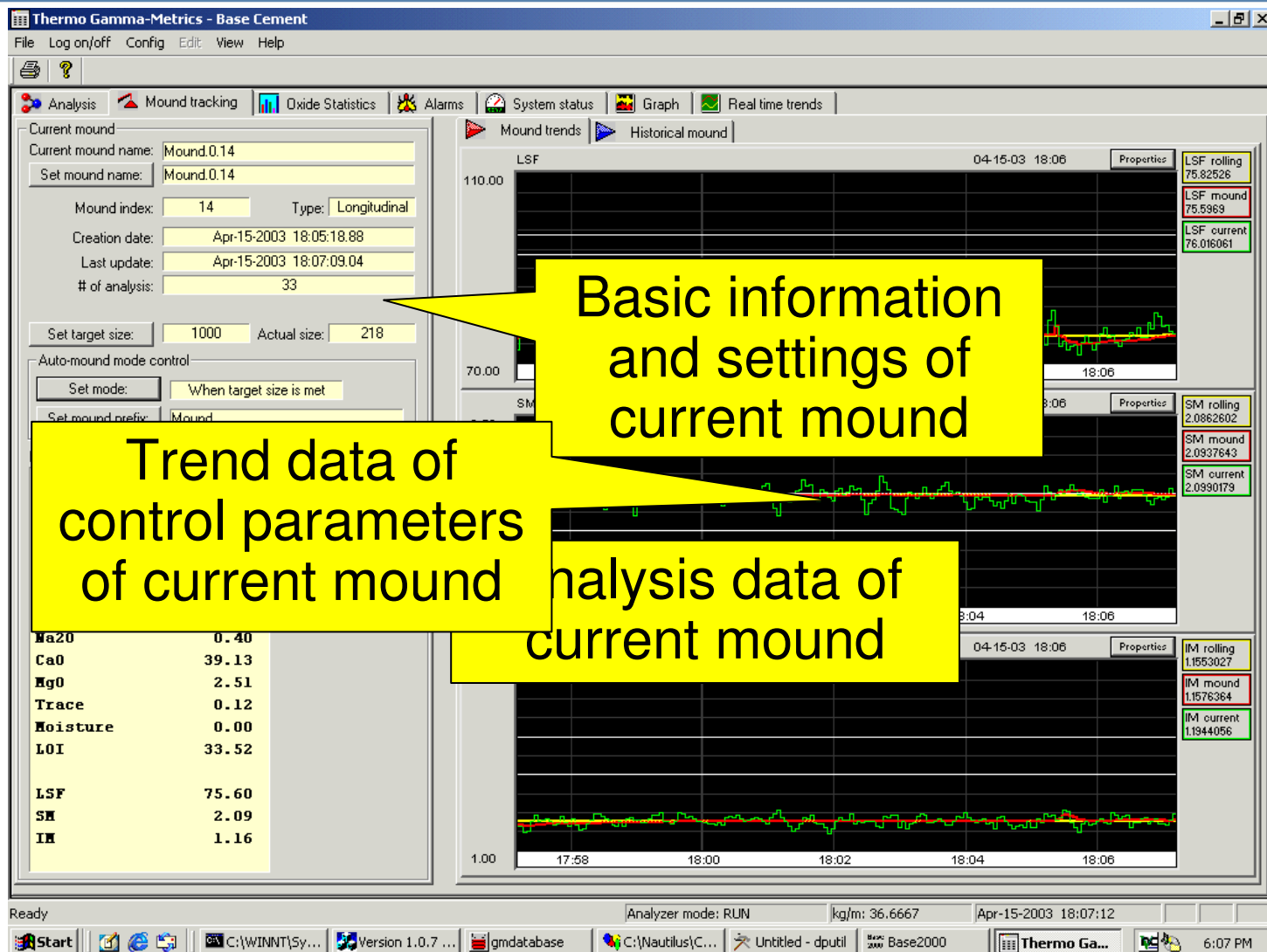
Material basis:
☐ Loss free
☒ DRY

Delete mapping

OK
Cancel

Description	Group	Tag
Set mound name	anacomm.Write	Set Material source/target
Get mound name	anacomm.Read	Material source/target
Auto-mound create signal		
Auto-mound switch signal		
Analysis update	car	Update
Tons	car	Analysis tons
Total Tons	SpecAnalysis.de...	accumulated tons
kg/m	car	kg/m
TPH	SpecAnalysis.de...	TPH
SiO2	car.db	SiO2
Al2O3	car.db	Al2O3
Fe2O3	car.db	Fe2O3
CaO	car.db	CaO
K2O	car.db	K2O
SO3	car.db	SO3
MgO	car.db	MgO
Na2O	car.db	Na2O
Mn2O3	car.db	Mn2O3
TiO2	car.db	TiO2
Cl	car.db	Cl
Moisture	car.lf	moisture
LOI	car.db	L.O.I
Analyzer mode	anacomm.Read	cal mode
Alarm message index		
House temperature	anacomm.Read	House_Temp
Detector #1 temperature	anacomm.Read	Det#1_Temp
Detector #2 temperature	anacomm.Read	Det#2_Temp
Current Heater Timer - Det#1	anacomm.Read	Heater #1 Timer
Current Heater Timer - Det#2	anacomm.Read	Heater #2 Timer
Current Temp Setpoint - Det#1	anacomm.Read	PID #1 Current SP
Current Temp Setpoint - Det#2	anacomm.Read	PID #2 Current SP
PID Status - Det#1	anacomm.Read	PID #1 Status

Mound Trend Display- PREBOS Plus



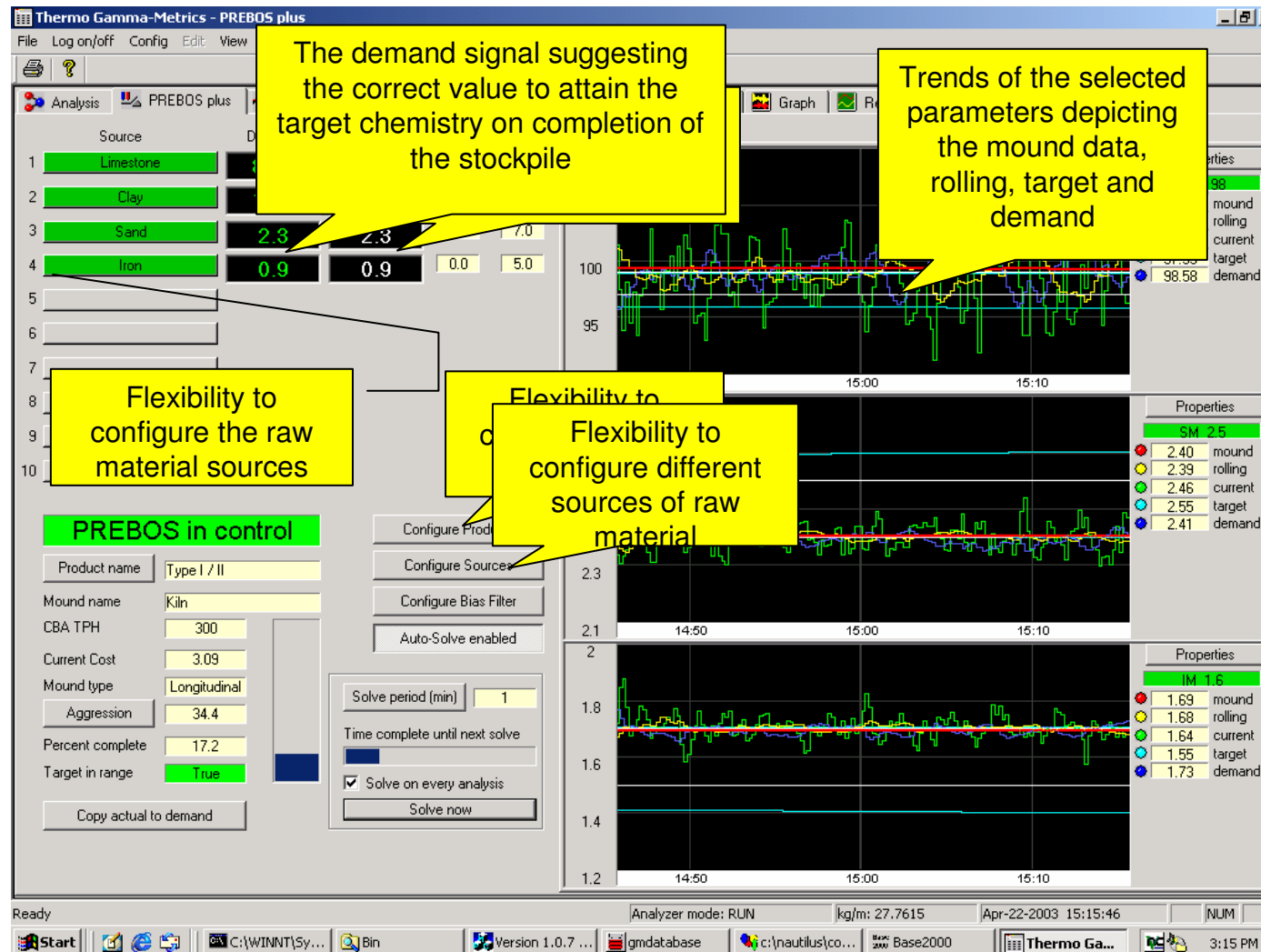
Mound History- PREBOS Plus

The screenshot shows the Thermo Gamma-Metrics - Base Cement software interface. The main window displays a list of mounds and their analysis data. Yellow callout boxes highlight specific features:

- Basic information of finished mound:** Points to the 'Mound.0.0' entry in the list.
- Result of plan modification displayed in last column:** Points to the '2003.20' value in the 'Moisture' column.
- Analysis data of finished mound:** Points to the '2003.20' value in the 'Moisture' column.
- Basic information, settings and analysis data of current mound:** Points to the '2003.20' value in the 'Moisture' column.
- List of mounds that can be recalled:** Points to the '2003.20' value in the 'Moisture' column.
- Different mound analysis can be added to calculate further modifications:** Points to the '2003.20' value in the 'Moisture' column.

The software interface includes a menu bar (File, Log on/off, Config, Edit, View, Help), a toolbar, and a main window with a list of mounds and their analysis data. The list includes columns for Mound index, Type, and various analysis parameters (SiO2, Al2O3, Fe2O3, Na2O, CaO, MgO, Trace, Moisture, LOI, LSF, SM, IM). The 'Moisture' column shows values ranging from 0.00 to 33.56. The 'LOI' column shows values ranging from 0.00 to 33.56. The 'LSF' column shows values ranging from 0.00 to 33.56. The 'SM' column shows values ranging from 0.00 to 33.56. The 'IM' column shows values ranging from 0.00 to 33.56. The '2003.20' value is highlighted in the 'Moisture' column.

Main Control Screen - PREBOS Plus



Other Features

- Software can control several stock-piles sequentially
- All logged data can be exported in ASCII format
- All oxide vales and calculated control parameters can be linked into the DCS system from the control PC
- DCS link can be via Ethernet or PLC communication card

What is Important for Process Control?

Raw Mix

1. **Repeatability / Precision**
2. Uniformity of Analysis
3. Robustness of Analysis
4. Accuracy

Stockpile

1. Robustness of Analysis
2. Uniformity of Analysis
3. Repeatability / Precision
4. Accuracy

Level 1 PSA “Self Service”

Inclusions

ACCESS & RESPONSE

RADIATION SERVICES (excluding RSO Training)

PREDICTIVE & PREVENTATIVE MAINTENANCE

RECOVERY & ASSISTANCE (Remote Support Only)

- Remote Technical Support

- Remote Software Support (Assistance)

SURVEILLANCE & OPTIMIZATION

- System Repeatability and Linearity

- Dynamic Calibration and Accuracy (Verification / Adjustment)

OPERATIONS TRAINING

Exclusions

RECOVERY & ASSISTANCE

- On-Site Labor

- Travel & Living Expenses

SURVEILLANCE & OPTIMIZATION

- Plant Performance Verification

PARTS

SYSTEM LIFE EXTENSION

Level 2a PSA

Inclusions

ACCESS & RESPONSE

RADIATION SERVICES (excluding RSO Training)

PREDICTIVE & PREVENTATIVE MAINTENANCE

RECOVERY & ASSISTANCE

SURVEILLANCE & OPTIMIZATION

System Repeatability and Linearity

Dynamic Calibration and Accuracy (Verification / Adjustment)

PARTS

Replacement of Failed Parts

Preemptive Replacement Parts

OPERATIONS TRAINING

On-Site Operator Training

Exclusions

SURVEILLANCE & OPTIMIZATION

Plant Performance Verification

PARTS

Consumable Parts

On-Site Spare Parts

OPERATIONS TRAINING

Operations & Maintenance Training

SYSTEM LIFE EXTENSION

Level 2 PSA “3 Year”

Inclusions

ACCESS & RESPONSE

RADIATION SERVICES (excluding RSO Training)

PREDICTIVE & PREVENTATIVE MAINTENANCE

RECOVERY & ASSISTANCE

SURVEILLANCE & OPTIMIZATION

System Repeatability and Linearity

Dynamic Calibration and Accuracy (Verification / Adjustment)

PARTS

Replacement of Failed Parts

Preemptive Replacement Parts

Consumable Parts

OPERATIONS TRAINING

On-Site Operator Training

Operations & Maintenance Training

Exclusions

SURVEILLANCE & OPTIMIZATION

Plant Performance Verification

SYSTEM LIFE EXTENSION

PARTS

On-Site Spare Parts

Thermo Cement

Installed Base

- Holcim
- Lafarge
- Cemex
- Heidelberg
- Italcementi
- Cimpor
- Grasim Industries
- Onoda Chichibu
- Buzzi Unicem
- SECIL

68 Installations with TOP 10 Cement Producers