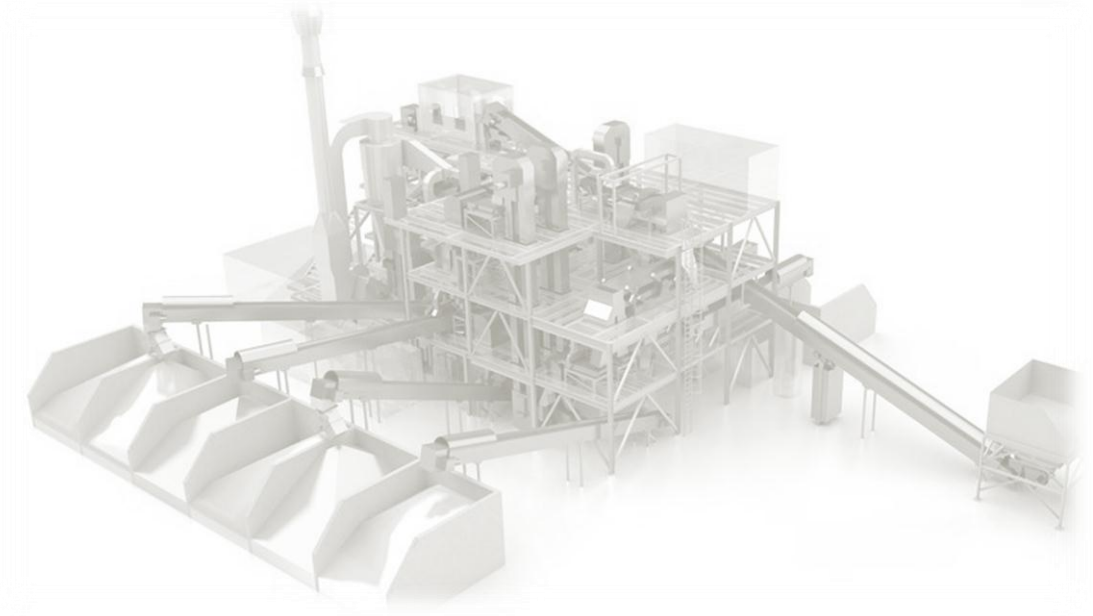


Glassman Conference 2013
11.09. – 12.09. Las Vegas, NV

QUALITY CONTROL

in GLASS RECYCLING

CONTENT

A1 INTRODUCTION - BT-WOLFGANG BINDER and REDWAVE

Based in Gleisdorf, Austria – founded in 1997

3 business segments;
- Minerals processing technology (dry mortar mixing plants)
- Conveying and material handling technology
- Environmental technology

Systems supplier

75 employees

Member of BT-Group with 300 employees

Over 700 projects in more than 40 countries world-wide

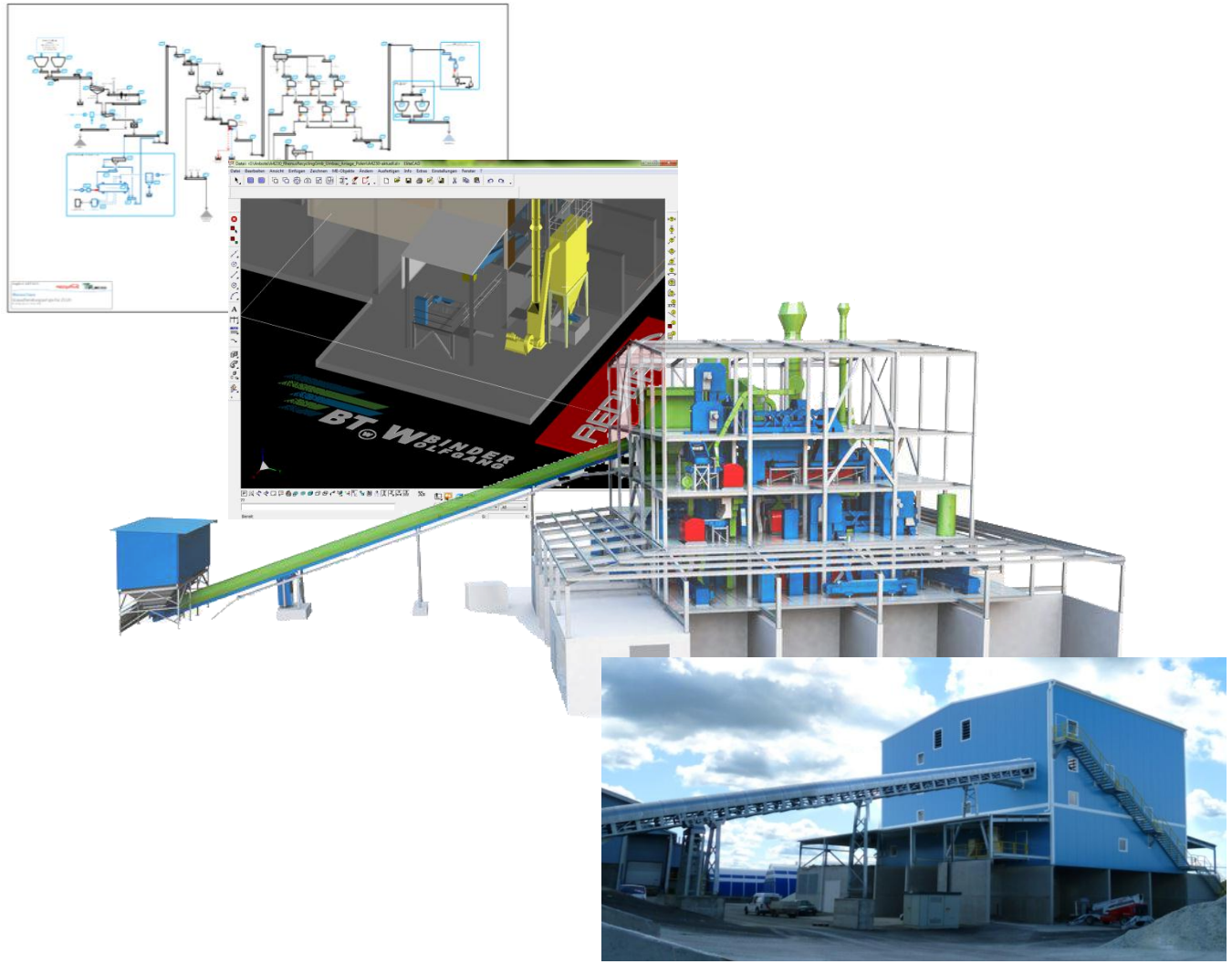
REDWAVE is the trade mark of BT-Wolfgang Binder GmbH

REDWAVE stands for the entire sensor-based and optical sorting portfolio and system solutions in all company segments

Portfolio ranges from mineral sorting to glass sorting to paper and plastics sorting

A2 REDWAVE GLASS RECYCLING SERVICE

- Process charts
- Material flow diagrams
- Mass balance calculations
- Plant layout design



B1 REQUIREMENTS on WASTE GLASS SORTING

To obtain cullet that can be used as raw material for re-melting in glass furnace

Input Materials

Material from kerbside collection

Bottle bank material

MRF glass material

REMOVAL OF CONTAMINANTS

COLOUR SORTING

Glass Treatment and Sorting Process

Final product

Re-use in container glass industry

Other use (construction industry, aggregates, etc.)

PRODUCT QUALITY

…defined by content of

- Ceramics, Stones, Porcelain (max. 25 ppm - 5 ppm)
- Ferrous Metals (max. 5 ppm - 1 ppm)
- Non Ferrous Metals (max. 5 ppm - 1 ppm
- Glass ceramics (not accepted)
- Lead glass (max. 200 ppm in batch)
- Lose organics (max. 300 g/to)
- Other colours

…other coloured glass in

Flint:	max. 0,2% other colours
Amber:	max. 2,5%
Green:	max. 5,0%

B2 THE WASTE GLASS SORTING PROCESS

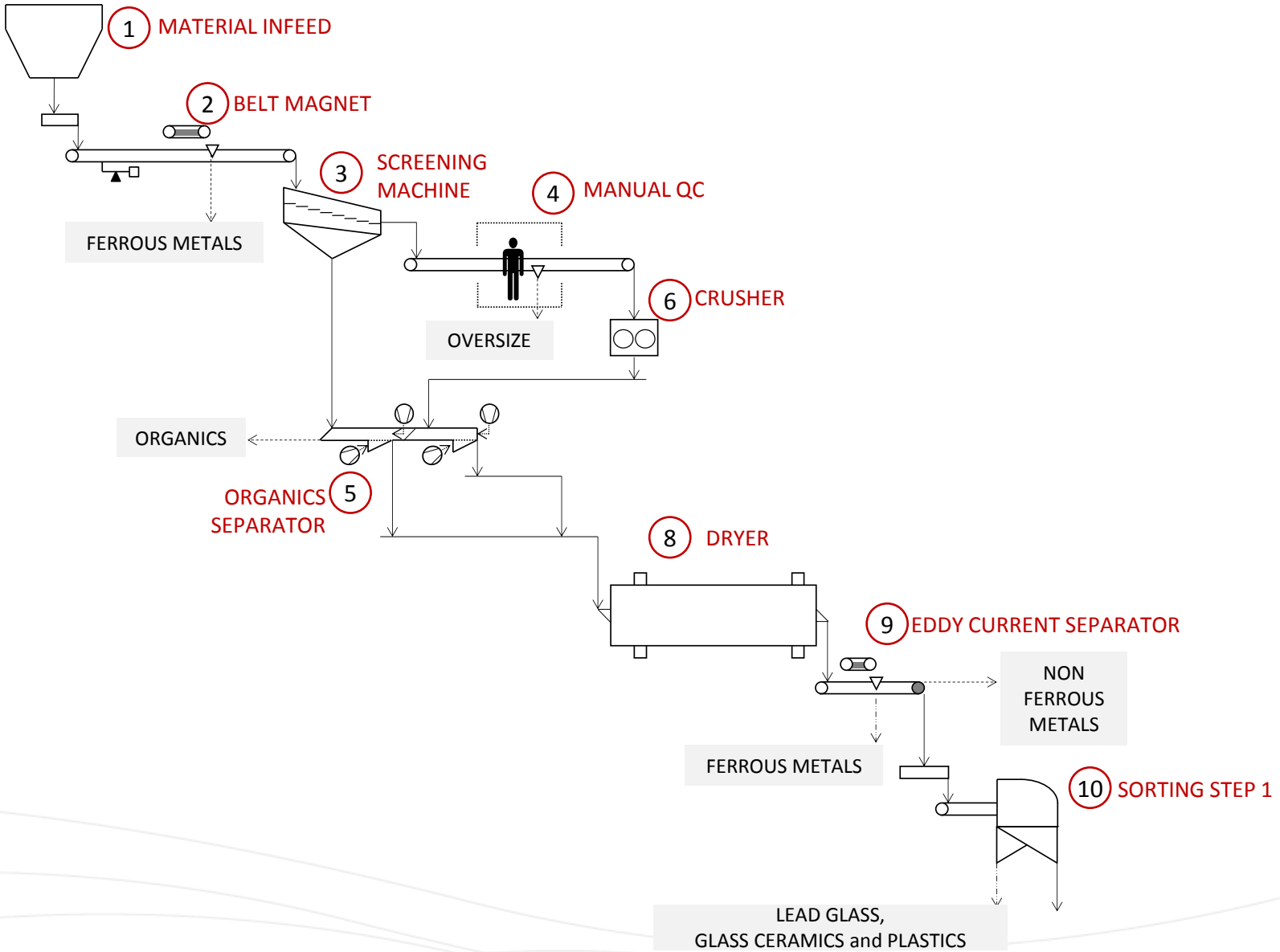
INPUT MATERIAL - glass from collection system

Removal / separation of

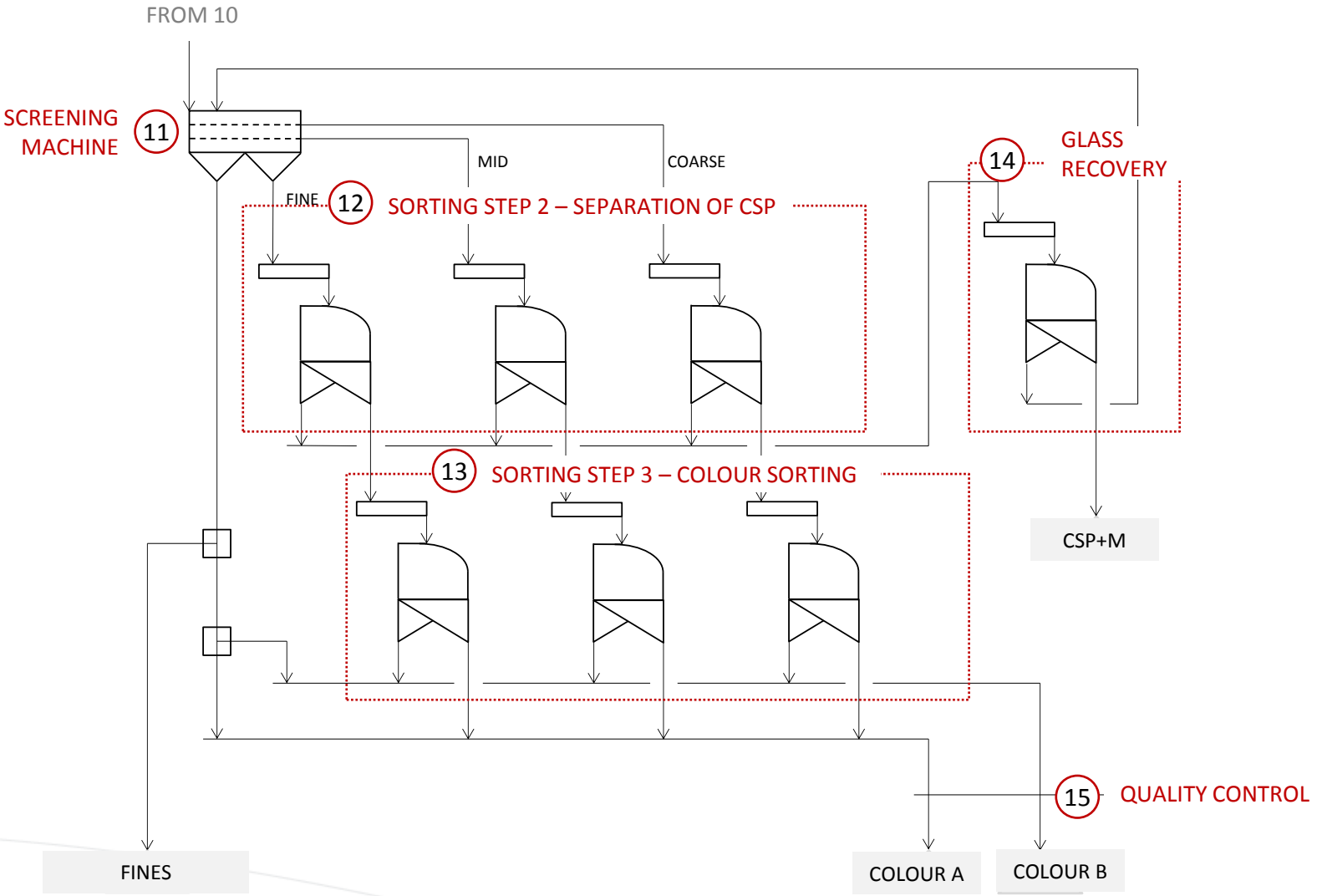
PRE-PROCESSING	Crushing, screening, metal separation, manual QC check, organics separation, drying	FINES, METALS, ORGANICS, MOISTURE
SORTING STEP 1	Removal of lead glass, glass ceramics and plastics	LEAD GLASS, GLASS CERAMICS, PLASTICS
SORTING STEP 2	Removal of ceramics, porcelain and stones	CERAMICS, STONES, PORCELAIN, METALS
SORTING STEP 3	Cullet colour sorting	Glass → GLASS RECOVERY
	FLINT / GREEN / AMBER	
SORTING STEP 4	Cullet colour clean-up	OTHER COLOURS, CONTAMINATS
QUALITY CONTROL		

FINAL FLINT | FINAL GREEN | FINAL AMBER

B3 PRE-PROCESSING LINE



B4 GLASS SORTING LINE



C1 QUALITY CONTROL of FINAL PRODUCTS

Current situation

Manual quality check

- Non-representative sample quantities
- Human factor and subjectivity likelihood of misinterpretations
- Random sample selection
- Non preventive quality control

REDWAVE Systems

AUTOMATED QUALITY CONTROL TOOL

Targets / Considerations

- To reduce or eliminate above mentioned issues by the combination of automated sorting technology and human assets
- To standardise sampling process and reliability
- To increase the sample quantity

C2 REDWAVE QUALITY MANAGEMENT SYSTEM - QMS

The QMS system is the combination of

REDWAVE Sample Analysing System - SAS

Hardware tool

For the continuous sample taking and sample quality check of final products

REDWAVE Process Monitoring and Control System - PMCS

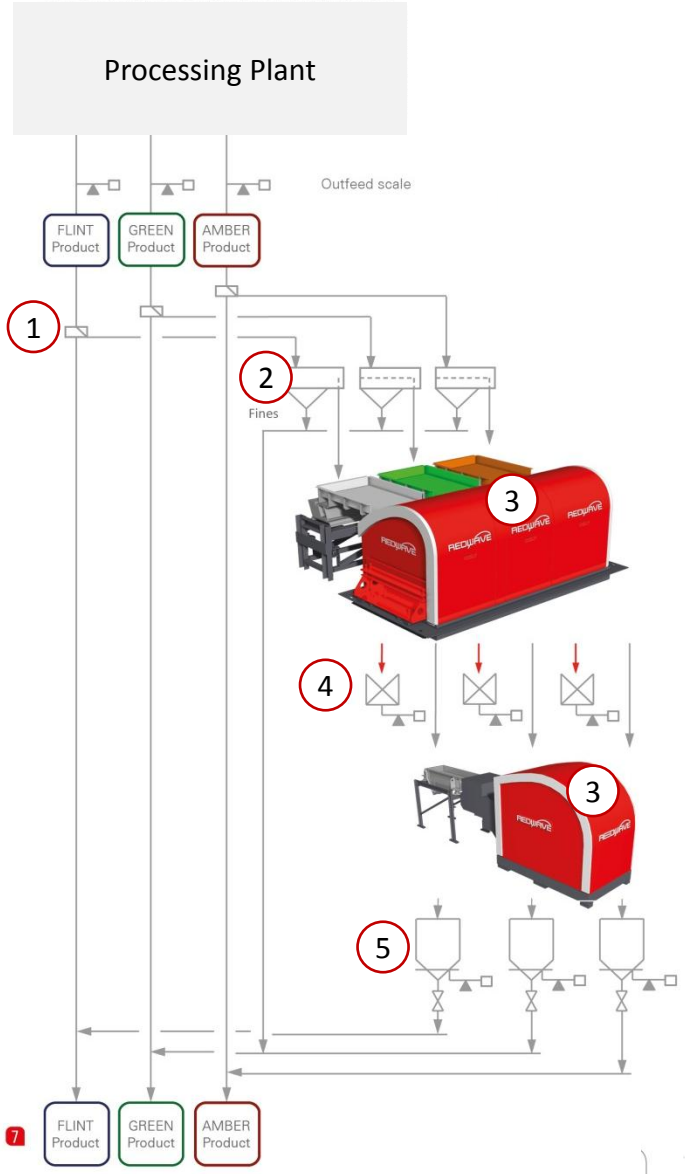
Software tool

For the continuous monitoring and optimisation of the sorting process by analysing the individual processing steps within the plant

Benefits from installing the QMS

- Automated quality control of higher and representative samples quantities
- Continuous product analysis (grain size, weight, colour distribution)
- Quality assurance and quality control already during sorting process
- Warning message if threshold values are exceeded or fallen short of
- Fault finding assistance (sorting machines, screen mats, etc.)
- Increase of plant efficiency due to targeted data evaluation
- Archiving of previous analyses and monitoring over a long period

C3.1 REDWAVE SAMPLE ANALYSER – SAS – THE SAMPLING PROCESS



1	Automated sample taking
	Sample quantity can be adjusted by activation time and frequency of sampler flaps – sampling quantity is up to 10% of outfeed capacity
2	Optional: Fine Screen
3	Sample unit(s) analyses the samples
	If pre-set threshold values (e.g. contamination level) is exceeded, the sample unit generates a warning alert to the operator
4	Option – contaminants are ejected for manual inspection
	Sample Analyser sorts out contamination material for manual inspection – approx. 5 % of incoming sample quantity for detailed manual inspection
5	Scale system
	The weight of the ejected material and passing material is recorded and stored in a data base and the contamination level in g/t or ppm is determined

Manual inspection

C3.2 REDWAVE CAMERA SAMPLE ANALYSER

for recognition of

CSP + METAL

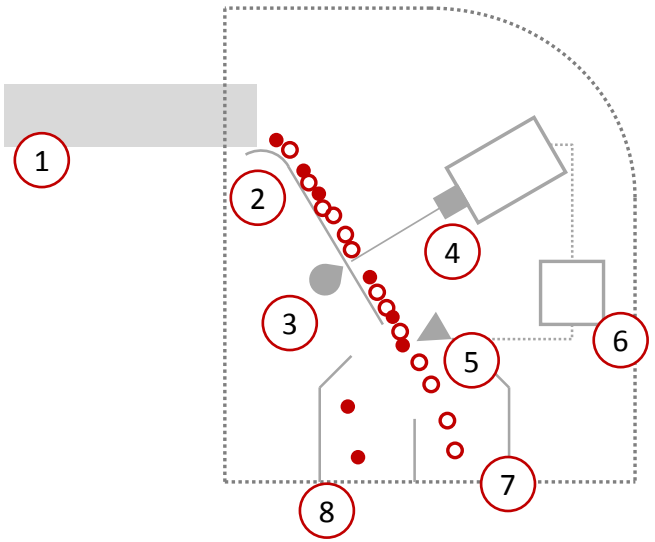
COLOUR

Sensor system

- High-resolution line camera with image processing technology
- Transmission LED light source

Mechanical features

- Modular design from 500mm up to 2000mm working width
- Ejection unit with high-speed solenoids



1 VIBRATORY FEEDER

2 GLASS SLIDE

3 LIGHT SOURCE

4 CAMERA

5 VALVES / NOZZLES

6 PROCESSOR UNIT

7 PASSING FRACTION

8 EJECT FRACTION

C3.3 REDWAVE XRF SAMPLE ANALYSER

for recognition of

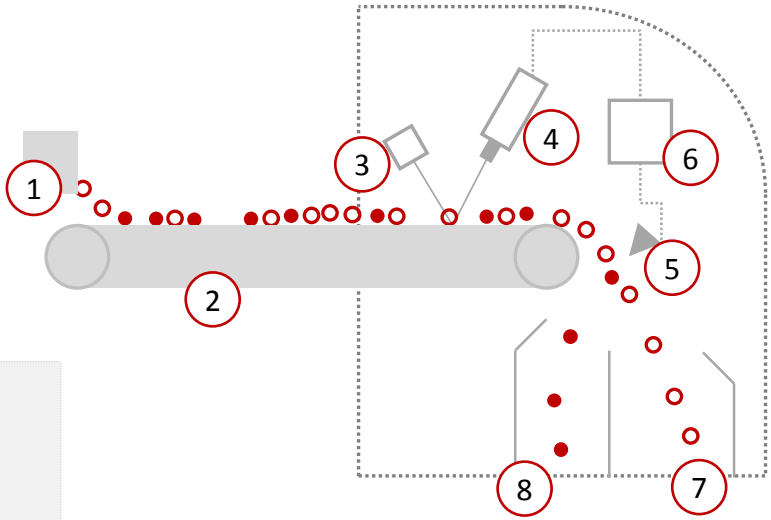
LEAD GLASS, CRT GLASS,
GLASS CERAMICS, HEAT TREATED GLASS,
STRONTIUM GLASS, ARSENIC GLASS, etc.

Sensor system

- X-ray fluorescence (XRF) spectral analysis sensor consisting of x-ray tubes and detectors

Mechanical features

- Ejection unit with high-speed solenoids



1 VIBRATORY FEEDER

2 BELT CONVEYOR

3 DETECTOR

4 X-RAY TUBE

5 VALVES / NOZZLES

6 PROCESSOR UNIT

7 PASSING FRACTION

8 EJECT FRACTION

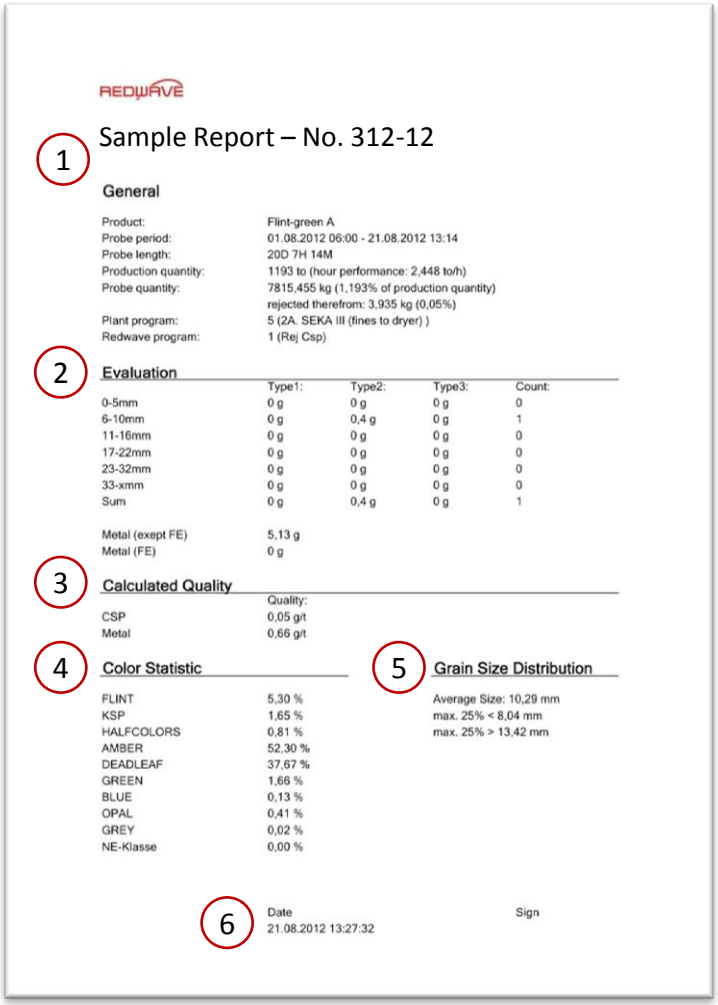
ADVANTAGES OF XRF COMPARED TO OTHER TECHNOLOGIES

- Determination of material by elemental composition
- Capable of detecting all cullet colours
- Detection accuracy regardless of input moisture and contamination

C3.4 REDWAVE – OVERVIEW DETECTION TECHNOLOGIES

Contaminant(s) to be recognised	Sensor technology
GLASS COLOUR SORTING	LINE CAMERA
CERAMICS, STONES, PORCELAIN (CSP)	LINE CAMERA
METALS (ferrous and non-ferrous)	INDUCTIVE METAL SENSOR
LEAD GLASS	X-RAY FLUORESCENCE
GLASS CERAMICS	X-RAY FLUORESCENCE
CRT GLASS	X-RAY FLUORESCENCE
PLASTICS, ACRYLIC GLASS, LAMINATED GLASS	NEAR INFRARED SPECTROSCOPY

C3.5 REDWAVE SAMPLE ANALYSER – SAS – REPORT SYSTEM



REDWAVE

1 Sample Report – No. 312-12

General

Product:	Flint-green A
Probe period:	01.08.2012 06:00 - 21.08.2012 13:14
Probe length:	20D 7H 14M
Production quantity:	1193 to (hour performance: 2,448 to/h)
Probe quantity:	7815,455 kg (1,193% of production quantity) rejected therefrom: 3,935 kg (0,05%)
Plant program:	5 (2A. SEKA III (fines to dryer))
Redwave program:	1 (Rej Csp)

2 **Evaluation**

	Type1:	Type2:	Type3:	Count:
0-5mm	0 g	0 g	0 g	0
6-10mm	0 g	0,4 g	0 g	1
11-16mm	0 g	0 g	0 g	0
17-22mm	0 g	0 g	0 g	0
23-32mm	0 g	0 g	0 g	0
33-xmm	0 g	0 g	0 g	0
Sum	0 g	0,4 g	0 g	1

Metal (exept FE)	5,13 g
Metal (FE)	0 g

3 **Calculated Quality**

	Quality:
CSP	0,05 g/t
Metal	0,66 g/t

4 **Color Statistic**

FLINT	5,30 %
KSP	1,65 %
HALFCOLORS	0,81 %
AMBER	52,30 %
DEADLEAF	37,67 %
GREEN	1,66 %
BLUE	0,13 %
OPAL	0,41 %
GREY	0,02 %
NE-Klasse	0,00 %

5 **Grain Size Distribution**

Average Size: 10,29 mm
max. 25% < 8,04 mm
max. 25% > 13,42 mm

6 Date: 21.08.2012 13:27:32 Sign

Automated reporting system and history tracking

A sample report is automatically generated by the system – frequency can be set from hourly to daily or monthly

Data base system ensure a good and reliable documentation system over a long time period

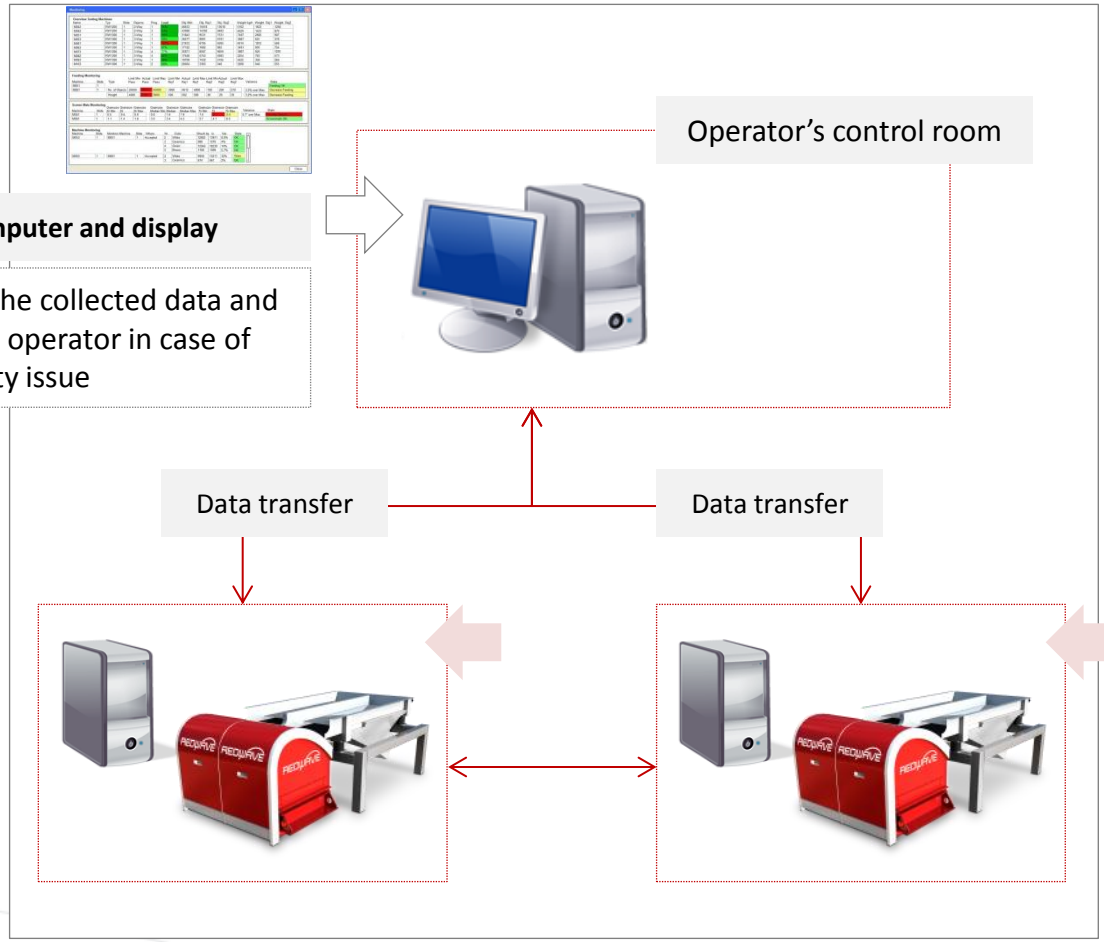
1	Sample number and general information
2	Contaminants in sample
3	Final product quality
4	Colour statistics
5	Material size distribution
6	Sample information

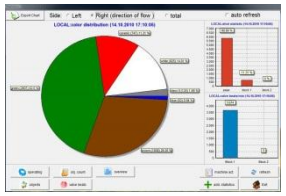
C4.1 REDWAVE PROCESS MONITORING AND CONTROL SYSTEM - PMCS

Software tool for existing or new glass sorting plants using REDWAVE sorters

The system utilises and processes data and information collected by optical sorters in a sorting plant

System layout





Data collectors

Each optical sorter in the plant collects data of its infeed material (colour statistics, object statistics, grain size statistics, etc.)

C4.1 REDWAVE PROCESS MONITORING AND CONTROL SYSTEM - PMCS

VALUE	CRITERIA	WARNINGS
Colour statistics	Too high	Infeed material composition Sorting performance of upstream sorter to be checked
Contamination level	Too high	Infeed material to be checked Sorting performance of upstream sorter to be checked
Material size	Too high	Screen mats in upstream screening machine to be checked

THANK YOU FOR YOUR ATTENTION!

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