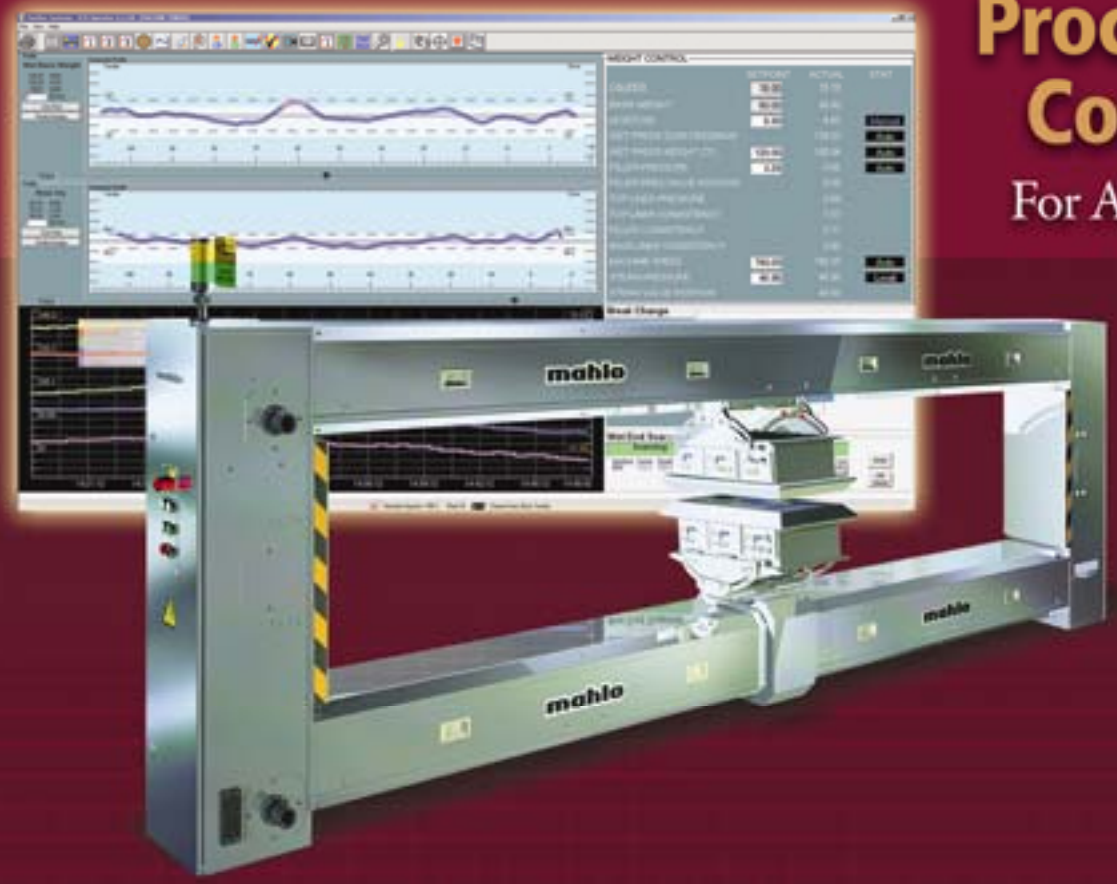
mahlo
trendsetting technology. worldwide.

PANTHER

ADVANCED
SERVICE PROVIDERS



Process Measurement, Control and Service

For All Your Paper Production Needs

- Process Monitoring
- Machine Control
- Production Analysis
- Quality Management
- Cost-Effective Service

Welcome!

New On-Line Sensor Technologies for the Paper Industry:

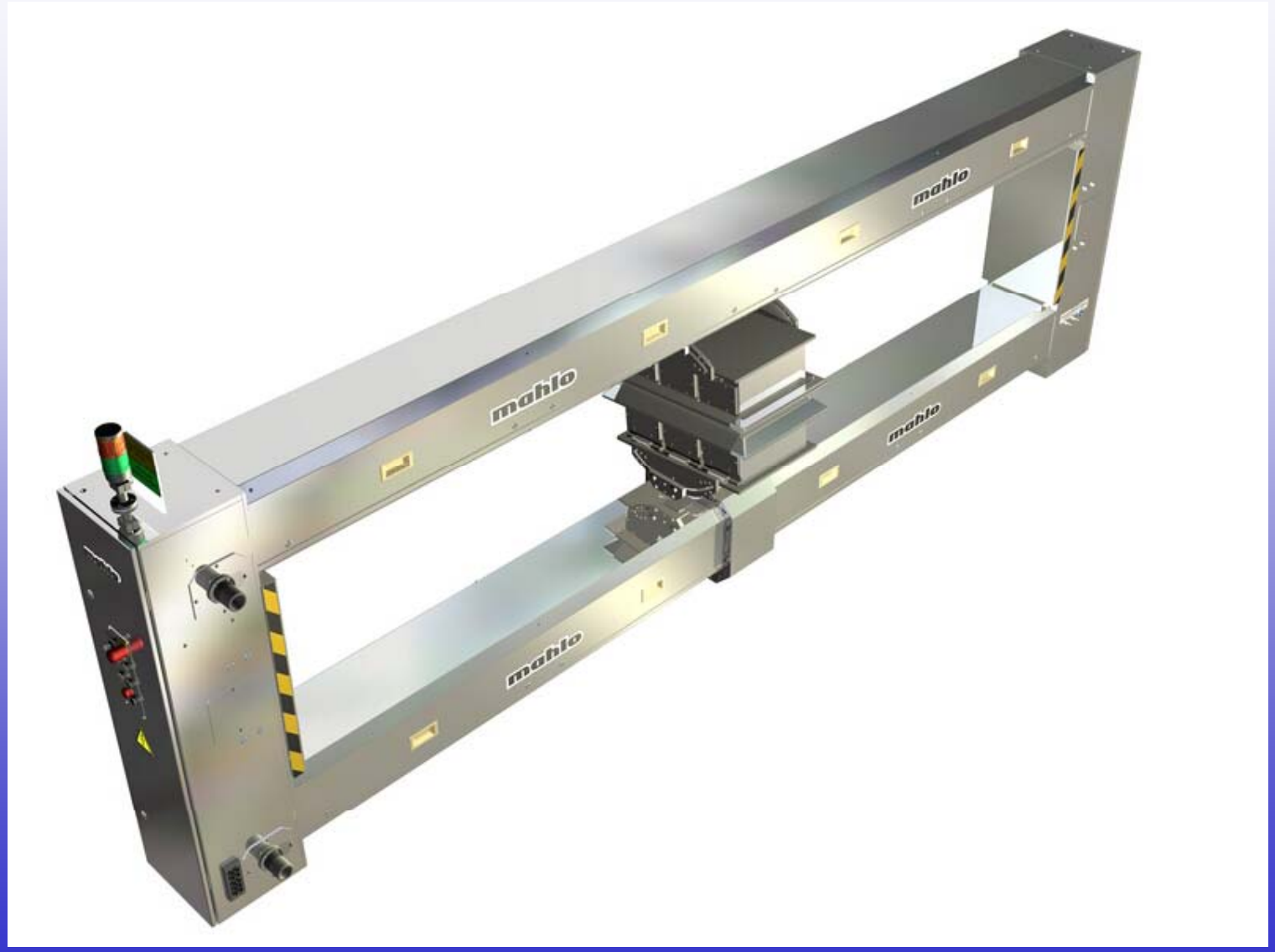
- The DML Laser Caliper Sensor
- The DFI Beta Transmission Sensor

Presented by Eric Reber, Mahlo America Inc.

PaperCon 2011

The MAHLO PaperPro II

mahlo
trendsetting technology. worldwide.

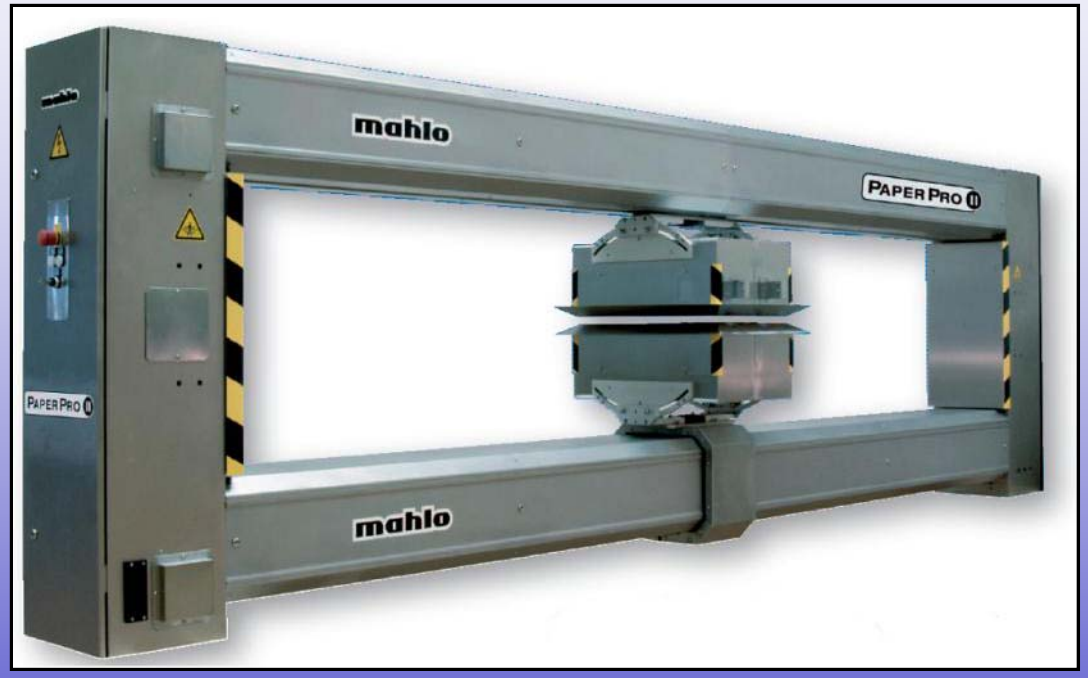


The MAHLO PaperPro II

trendsetting technology. worldwide.

A professional scanning platform for pulp & paper

- Stainless steel covers with quick service access capability
- Fully anodized or chemical Nickel coated German Steel
- Rigid, acid proof long life THK ® Linear Bearings
- Factory prepared for air purging and liquid cooling (closed loop)
- Dual Energy Chain System
- Weight 800 – 1850 kg
- Up to 7200 mm Web Width
- Space Efficient, Sealed Design
- Low Maintenance requirements



products

Mahlo

PaperPro II

Scanner Drive-Side End Bell

Reliable brushless 550W AC gearmotor

4“ steel reinforced drive belts

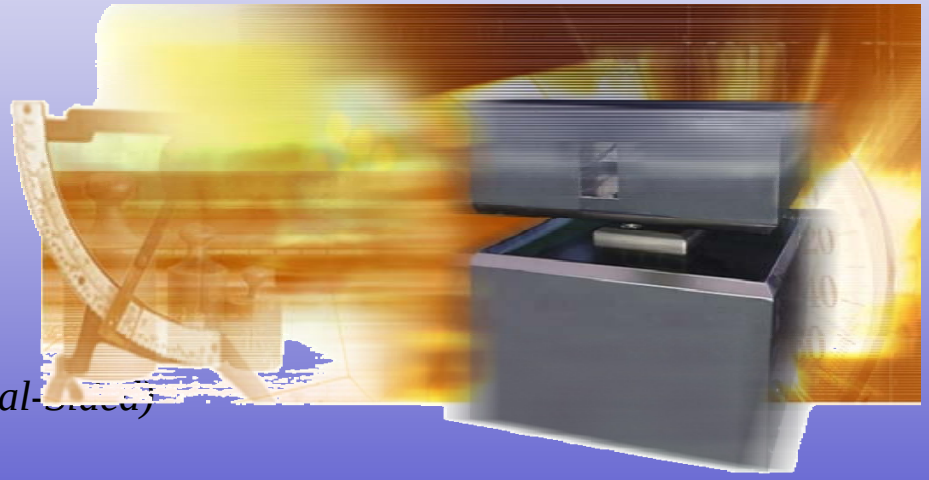
Kevlar/Steel reinforced timing belt

Off-the-shelf gearmotor, drive, belts, relays, etc.

All components laid out for easy access, testing and maintenance

Mahlo On-line Measurement Sensors

- **BASIS WEIGHT SENSORS**
  - ***Beta Transmission Sensors***
  - *X-Ray Backscatter Sensor*
  - *X-Ray Transmission Sensor*
  - *Infrared Absorption*
- **MOISTURE SENSORS**
  - *Infrared Absorption*
  - *Microwave Resonance*
  - *Microwave Absorption*
- **CALIPER THICKNESS SENSORS**
  - ***Laser Triangulation*** *(Single- and Dual-Sided)*
  - *Air Bearing*
  - *Light Touch*
- **ASH SENSOR**
  - *Fe^{55} Transmission Sensor*
- **GLOSS SENSOR**
  - *GMR-12 Reflectance Sensor*



The *NEW* Mahlo D•F•I Beta Sensor

mahlo
trendsetting technology. worldwide.

Introduction

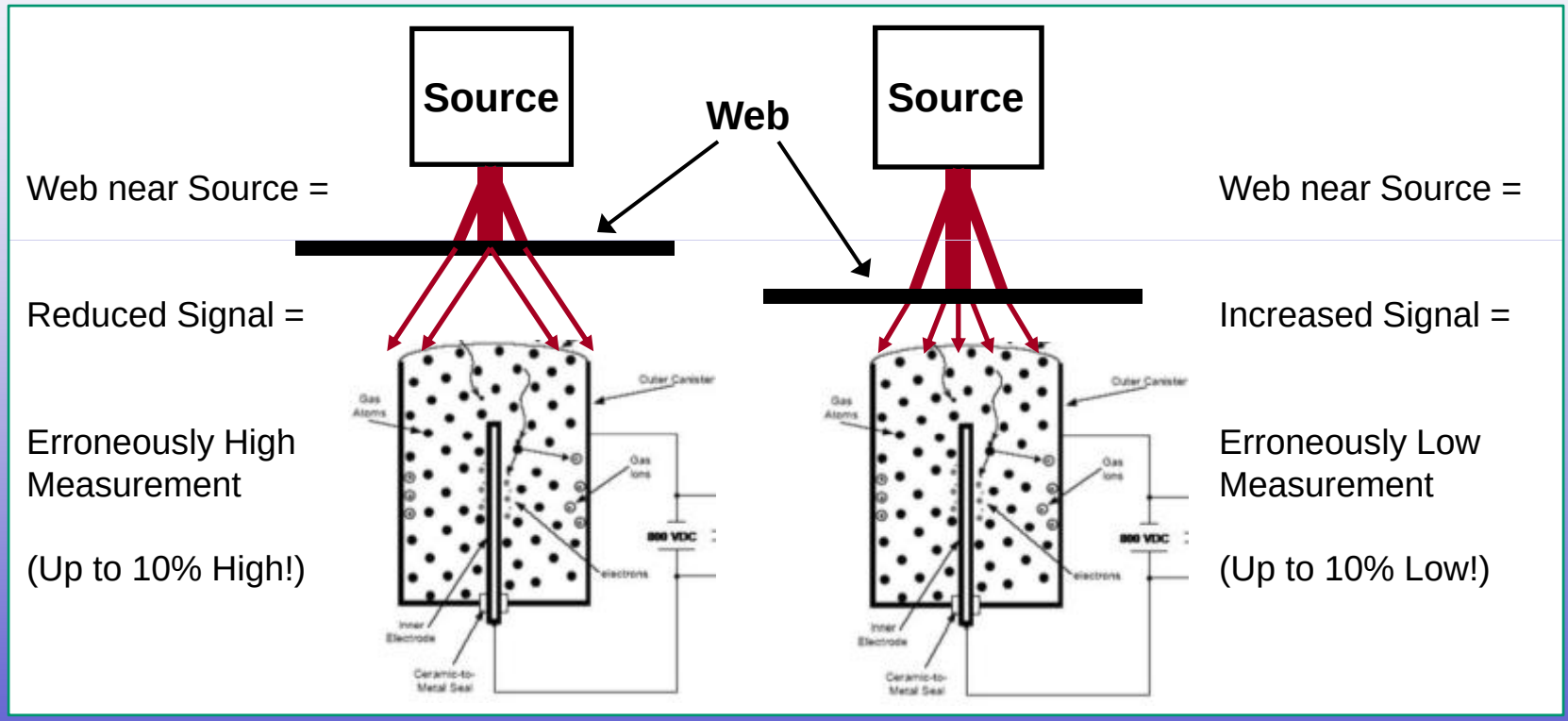
The Mahlo DFI is a Family of Beta Transmission Sensors:

- **Incorporates Dynamic Flutter Independence**
- **The DFI is Completely Unaffected by sheet passline / flutter up to 1.75“!**
- **Stable low activity isotopes**
- **Digital Measurement Signal**
- **High resolution and low measurement noise**
- **Low maintenance and high personnel safety**

Introduction

Older Style Beta Gauge

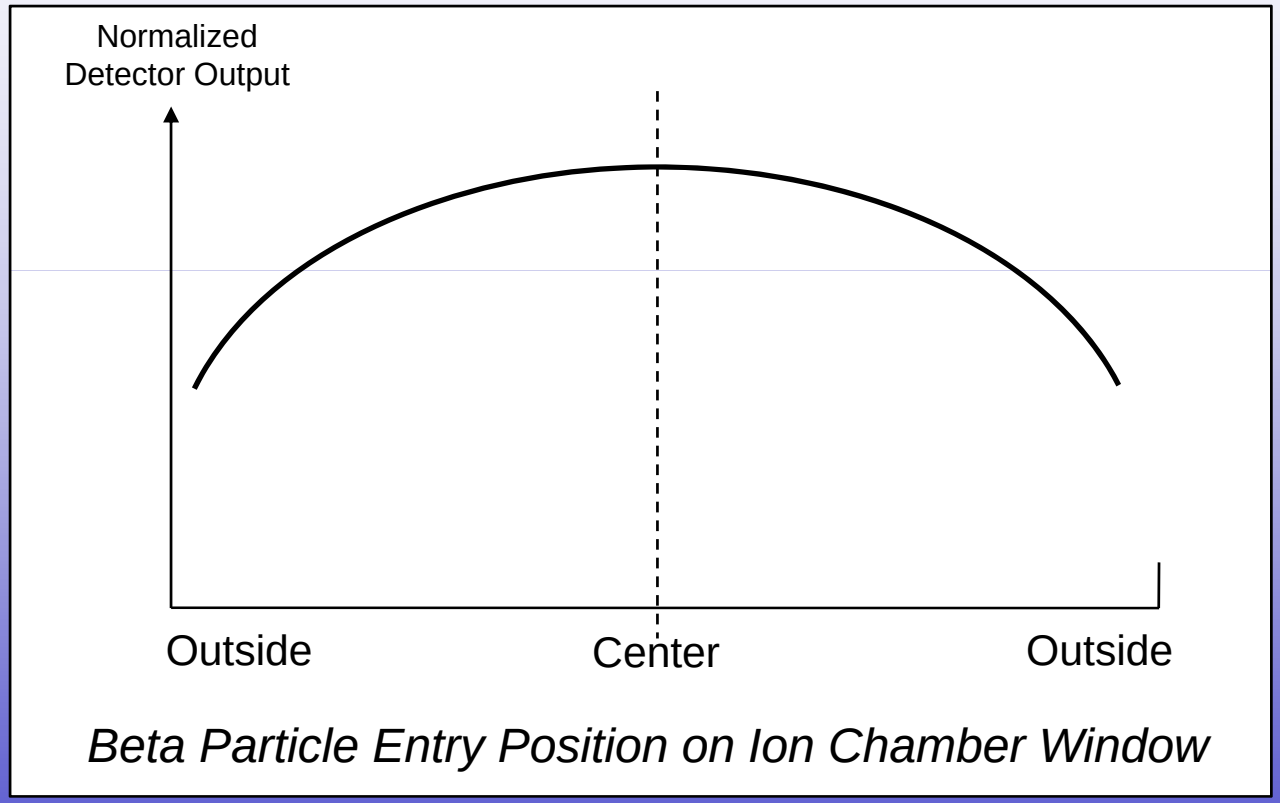
Why it is Passline / Flutter Sensitive



- Typical traversing beta transmission sensor
  - Ionization chamber response to detector signal as web is moved through measurement gap from source to detector

Older Style Beta Gauge

Why it is Passline / Flutter Sensitive

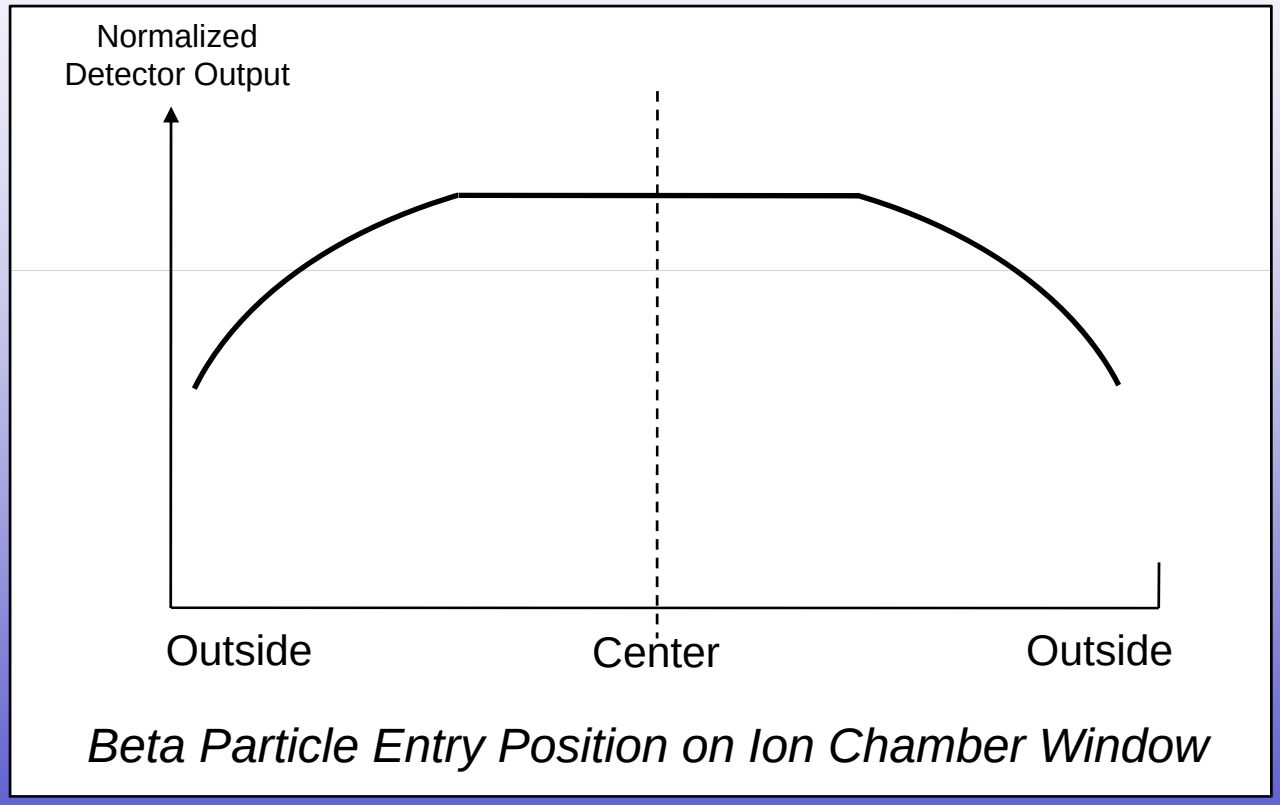


Beta Particle Entry Position on Ion Chamber Window

- Typical traversing beta transmission sensor
  - Ionization chamber response to beta particle entry location across window
  - More sensitive in center than at edges

Older Style Beta Gauge

Why it is Passline / Flutter Sensitive

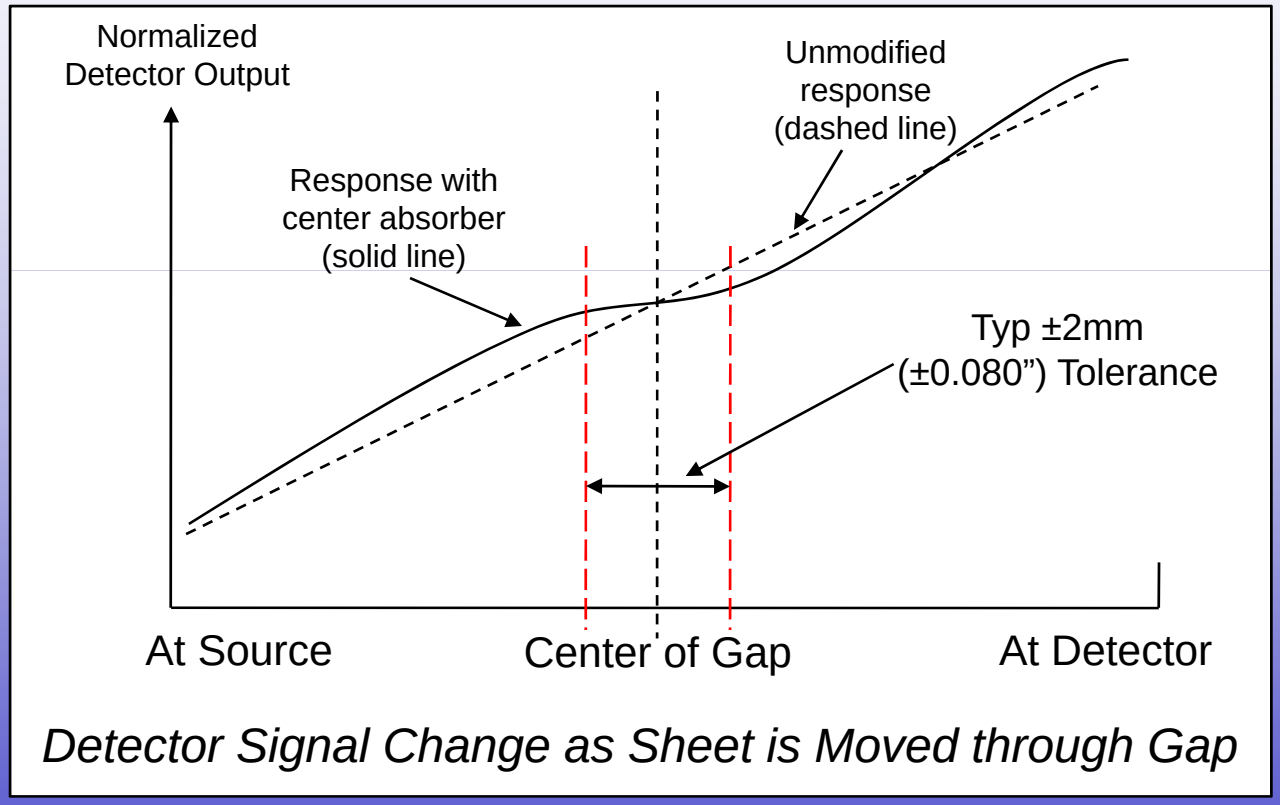


Beta Particle Entry Position on Ion Chamber Window

- Typical traversing beta transmission sensor
  - Heavy Absorber placed on detector window to *dumb down* higher response at center

Older Style Beta Gauge

Why it is Passline / Flutter Sensitive



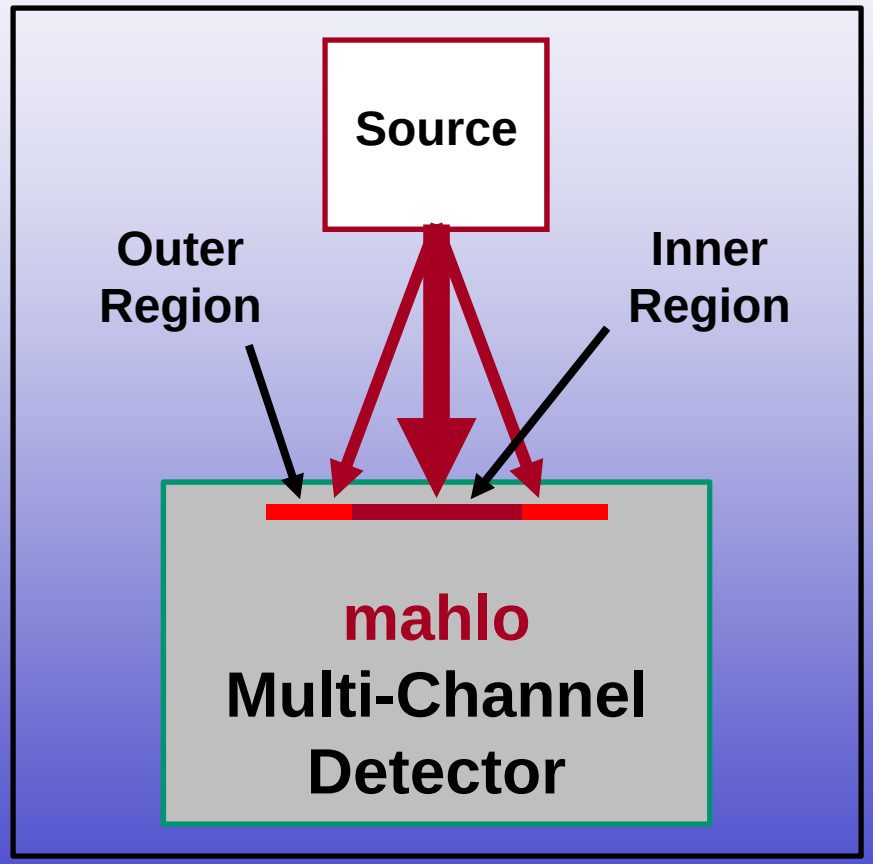
Detector Signal Change as Sheet is Moved through Gap

- Typical traversing beta transmission sensor
  - Ionization chamber response to detector signal as sheet is moved through measurement gap from source to detector

Mahlo Dynamic Flutter Independence

How it works

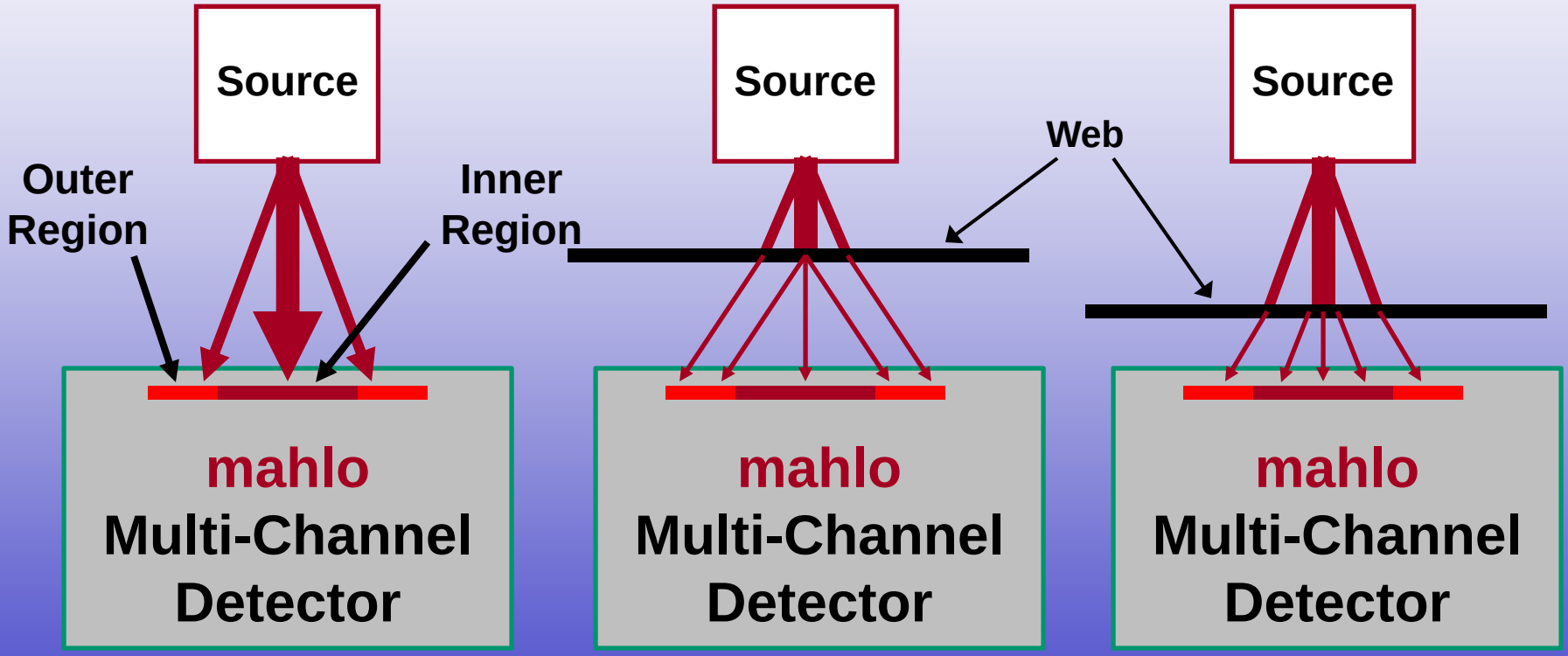
- Innovative New Multi-Channel Beta Detector
- Differentiates between Beta Particles entering the center and those entering the perimeter of the Detector
- Completely Self-Corrects for Sheet Movement in the Measurement Gap
- Over two times (2.8x) the Detection Efficiency of traditional ion chamber
- Patented



Technology

Mahlo Dynamic Flutter Independence

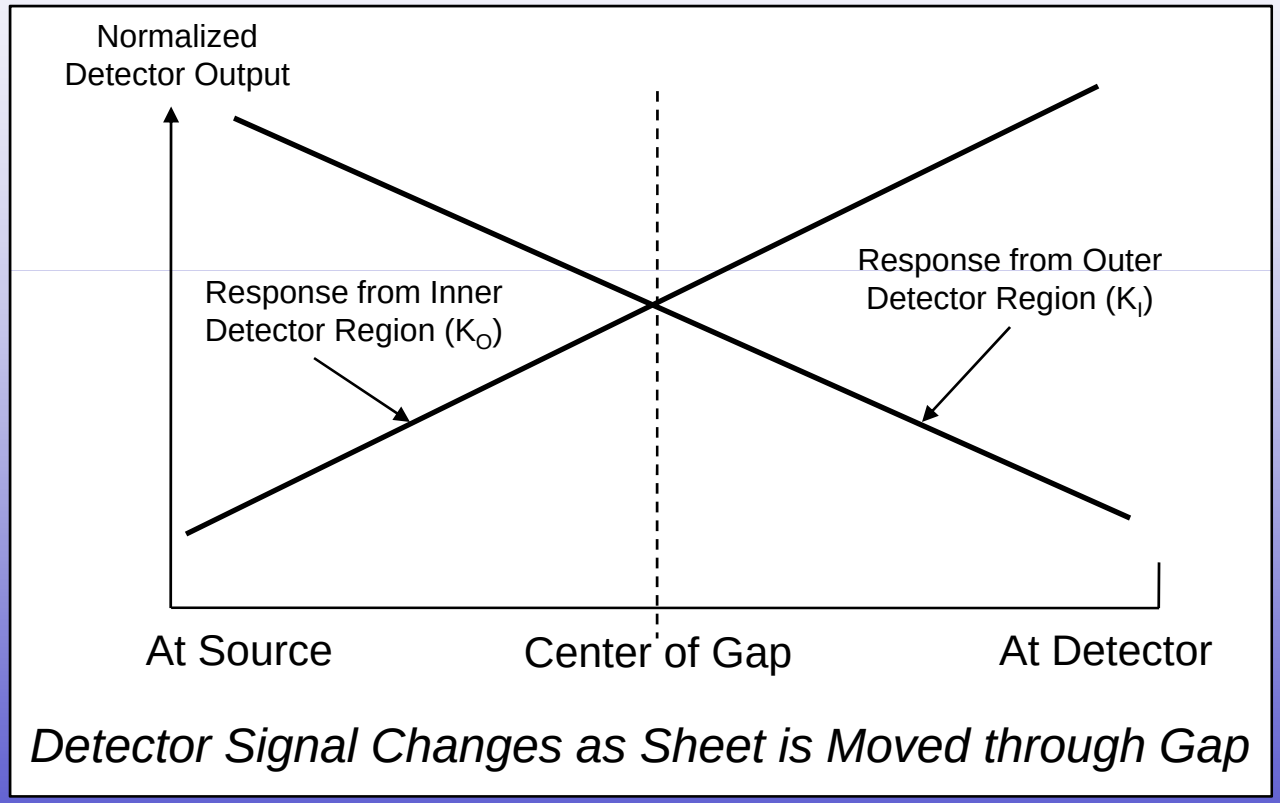
How it works



- Mahlo Multi-Channel Detector Captures Beta Particles in Each Channel
- No Heavy Absorbers to Reduce the Signal
- Over 2x the Detection Efficiency of Older Beta Gauges

Technology

Mahlo Dynamic Flutter Independence
How it works



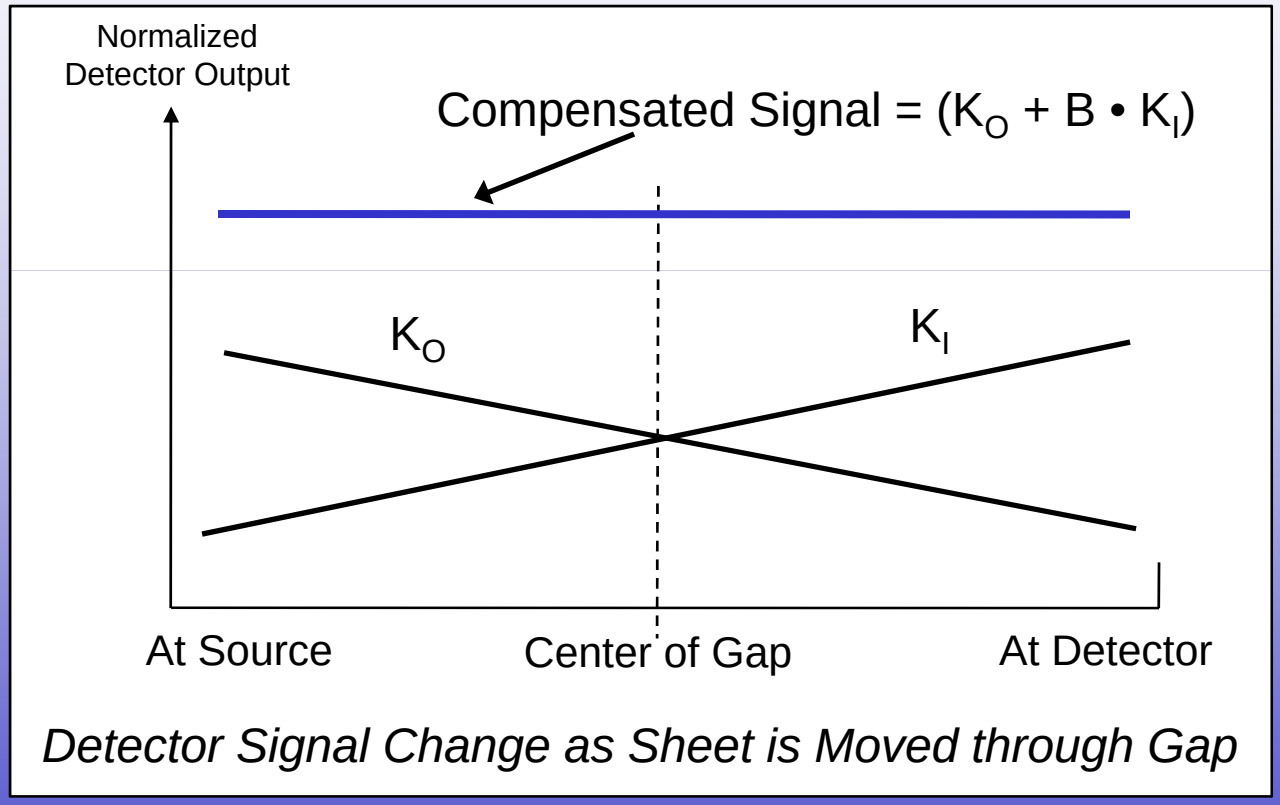
Detector Signal Changes as Sheet is Moved through Gap

- Mahlo DFI Raw Response
  - Inner Channel measures a linear increase in signal as the sheet moves from Source to Detector
  - Outer Channel measures a linear decrease in signal as the sheet moves from Source to Detector

Technology

Mahlo Dynamic Flutter Independence

How it works



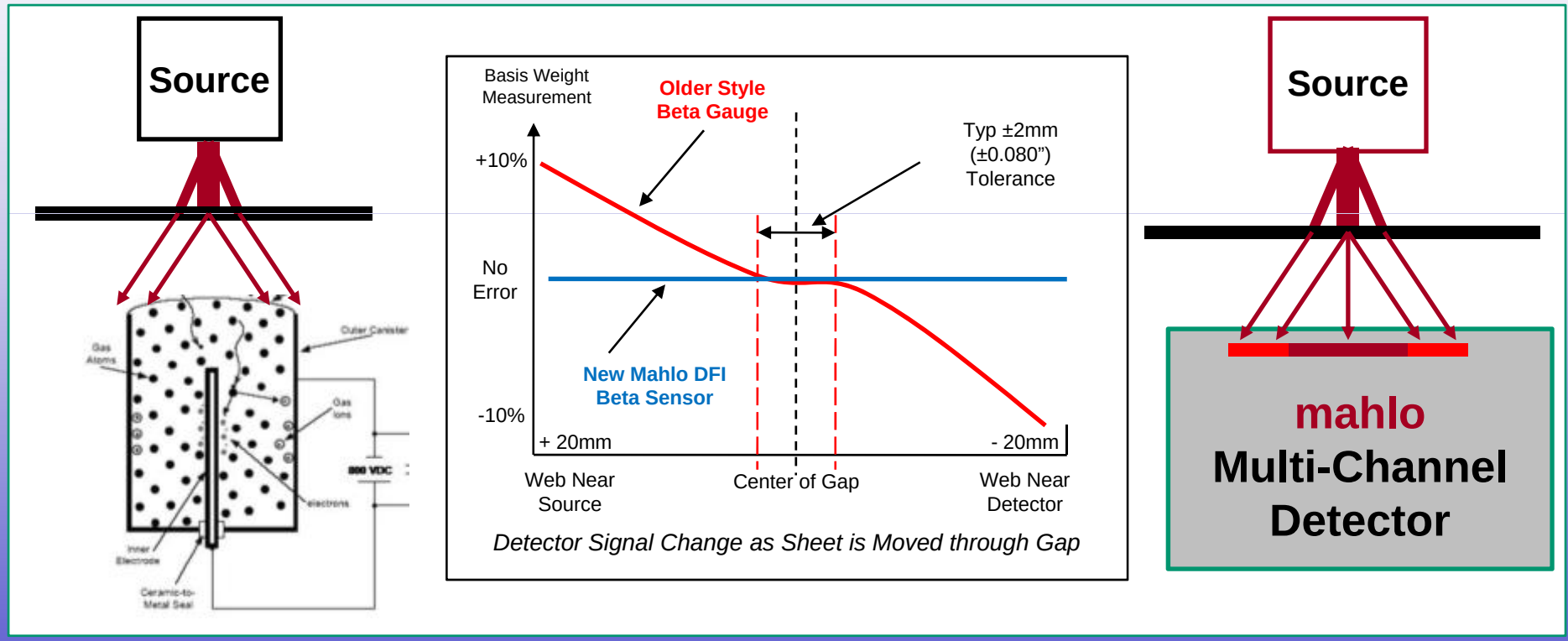
Detector Signal Change as Sheet is Moved through Gap

- Mahlo DFI Measurement Signal
  - Individual Signals are compared and summed
  - Compensated Signal is completely unaffected by sheet flutter or position

Technology

Mahlo DFI versus Older Style Beta Gauge

Actual Passline / Flutter Sensitivity



- Comparison of Passline / Flutter Sensitivity
  - Older Beta Gauge ±2mm tolerance, up to ±10% Error throughout measurement gap
  - **Mahlo DFI Beta Sensor** - ±40mm tolerance; ***No Measurement Change Throughout Entire Measurement Gap***

Technology

Mahlo DFI Beta Sensor

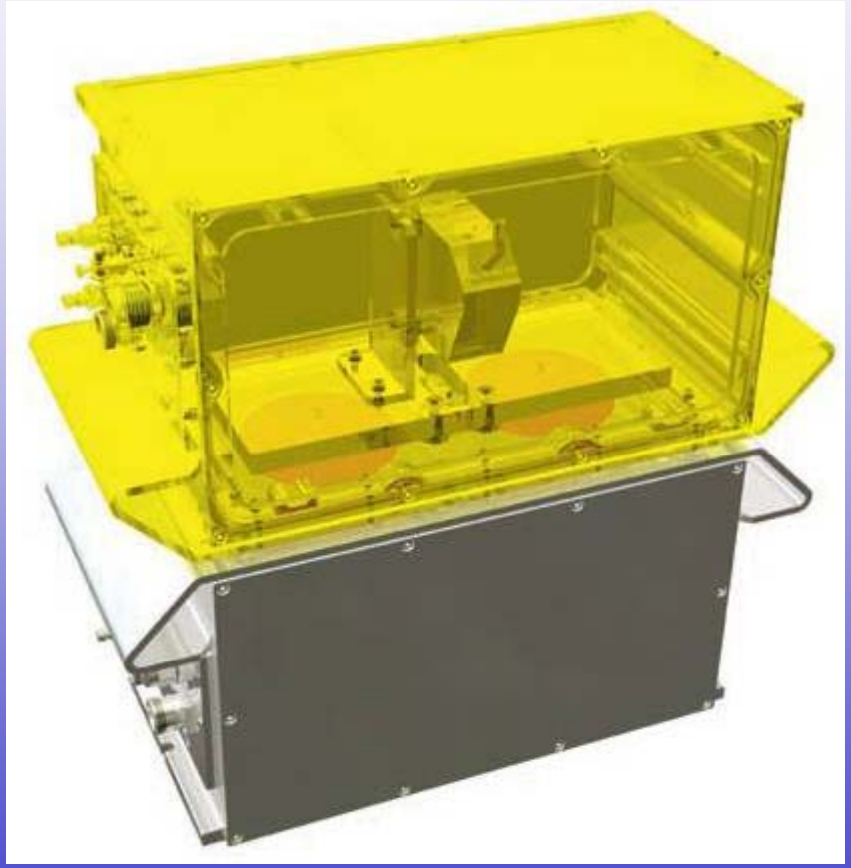
Specifications

Type of Measurement	Beta Transmission, Dual-Sided
Isotope	Promethium-147 1000mCi 2.6yr half-life Krypton-85 260mCi 10.7yr half-life Strontium-90 18mCi 29yr half-life
Measurement Range (SG = 1)	Pm-147 0 – 9mils (0 – 235gsm) Kr-85 0.4 - 50mils (10 – 1200gsm) Sr-90 8 – 235mils (200 – 6000gsm)
Repeatability (2σ, 1s)	Pm-147 ±0.05% or ±0.05gsm (the greater) Kr-85 ±0.1% or ±0.1gsm (the greater) Sr-90 ±0.3% or ±0. 5gsm (the greater)
Measuring Gap	Pm-147 0.4 – 0.8in (10 - 20mm) Kr-85 0.8 – 4in (20 – 100mm) Sr-90 1.6 – 6in (40 – 100mm)
Passline / Flutter Tolerance (New DFI)	100% of Measurement Gap from 10 – 40mm Minimum of 1.75“ within Larger Gaps
Ambient Limits	140°F, 0 – 95 % relative humidity (non-condensing)

CALIPRO DML Type 2
Introduction

The Mahlo Calipro DML Type 2 is a Laser Caliper Sensor that measures

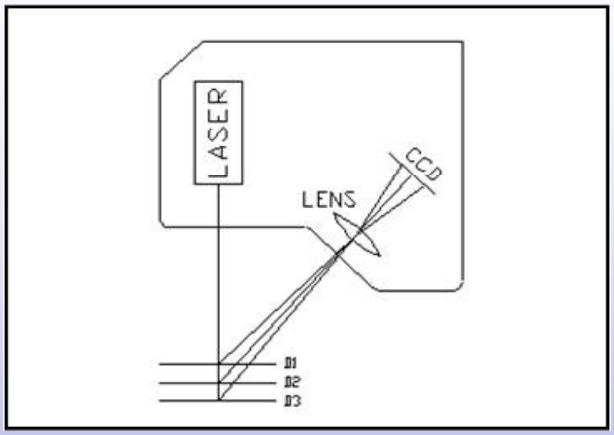
- **Using Laser Triangulation Sensor s and two high precision RF Sensors**
- **Measures the measurement gap dynamically and continuously to better than one micron resolution**
- **Using low CTE materials and high thermal isolation**
- **With Peltier cooling for internal temperature control of ±1°C**
- **With a dynamic repeatability of 5 microns**



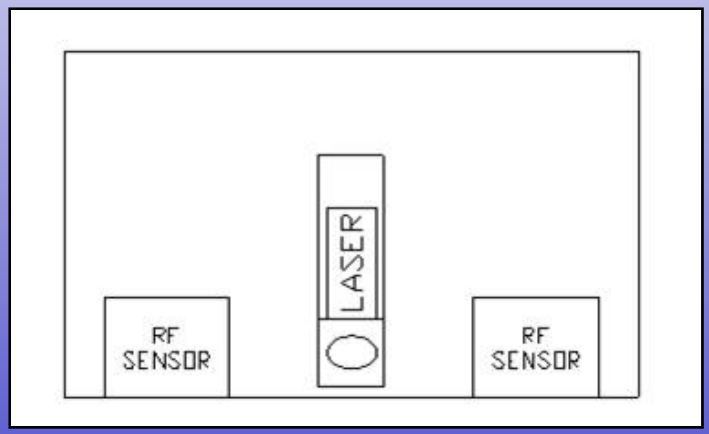
CALIPRO DML

How it works

- **Laser Distance Sensor**
  Extremely high resolution Laser Distance Sensor measures to better than 1 µ (0.00004“)



- **RF Distance Sensor**
  Two Radio Frequency (Eddy Current) Sensors measure the distance to the backing roller or lower Calipro head to the same resolution as the Laser Sensor



Technology

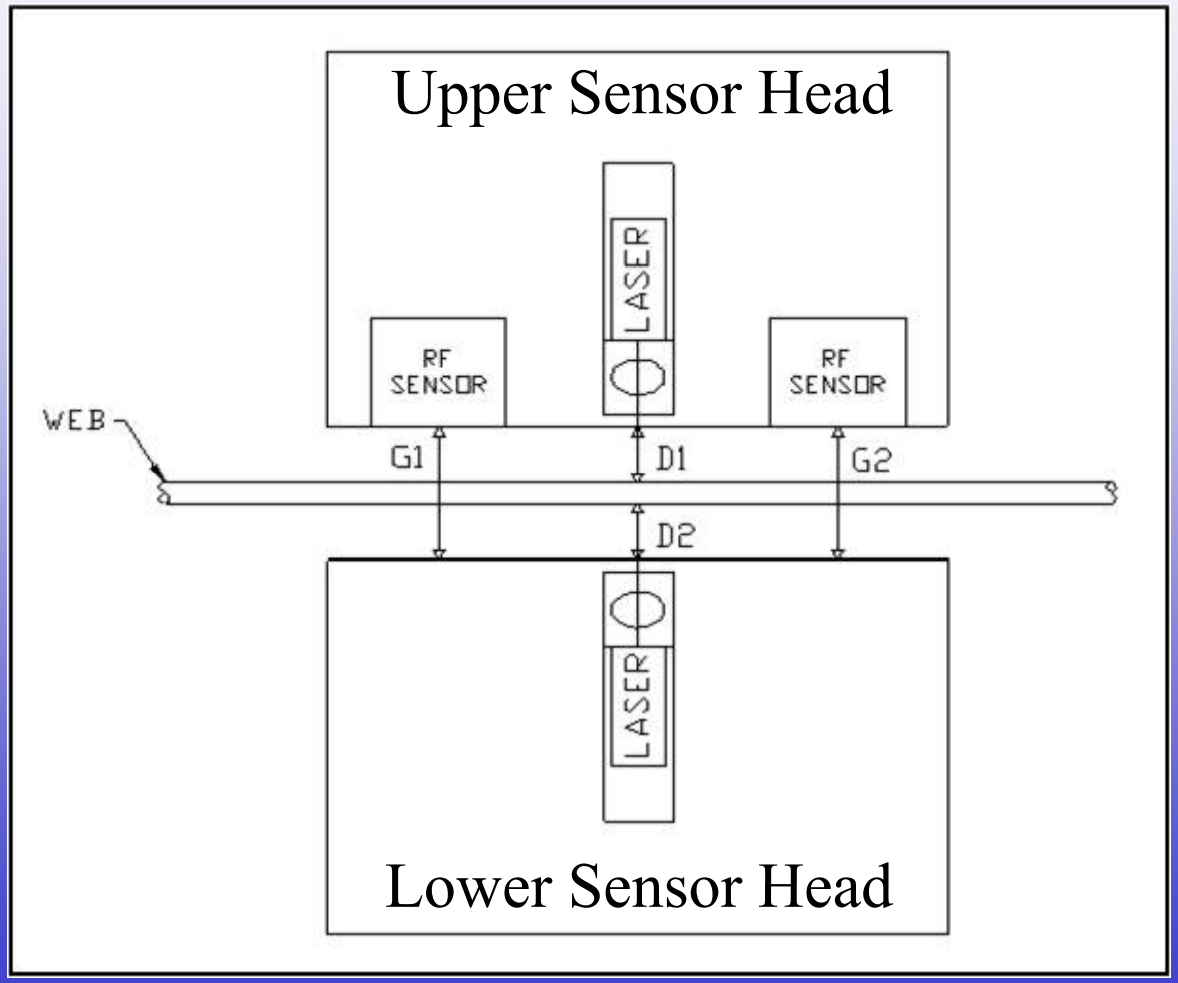
CALIPRO DML Type 2

How it works

Dual-Sided Thickness Measurement

- **The Upper Laser measures the distance to the top surface of the web**
- **The Lower Laser measures the distance to the bottom surface of the web**
- **The RF Sensors measure the distance to the lower sensor head**
- **Thickness =**

{(G1 + G2) ÷ 2} – D1 – D2



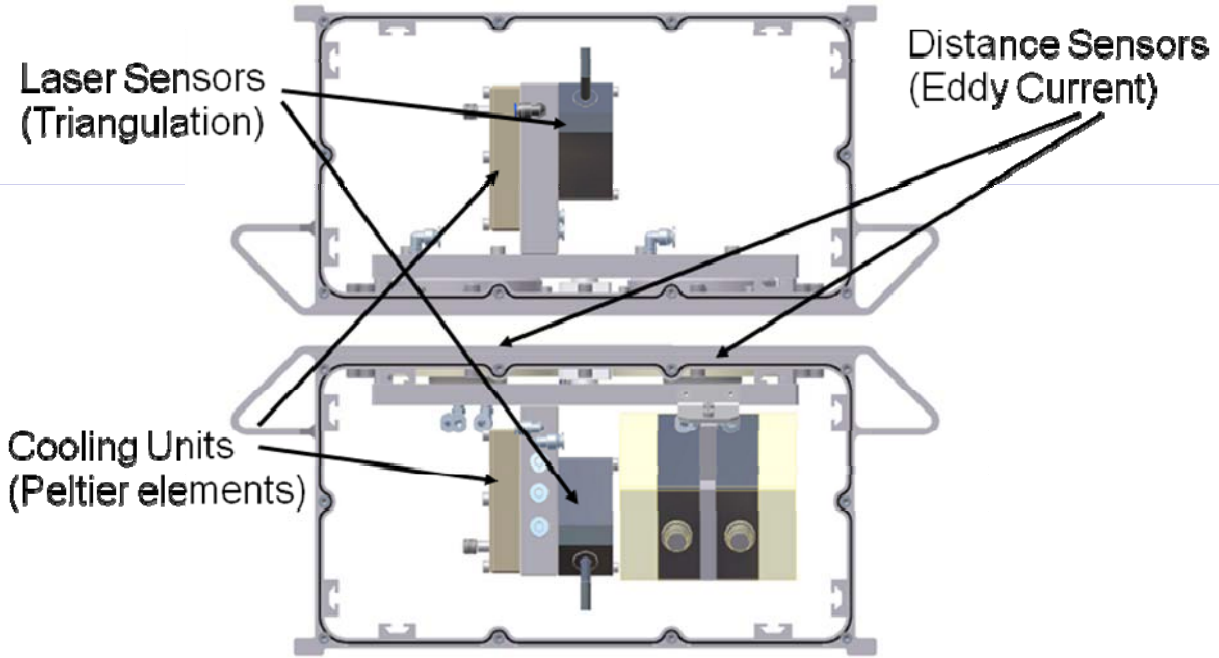
Technology

CALIPRO DML Type 2

How it works

Dual-Sided Thickness Measurement

- **Sensor Housings are Temperature Controlled to ±1°C**
- **Sensor Internal Volume is thermally Insulated**
- **Very Low Coeficient of Thermal Expansion Ceramic Sensor Mounting Plates**
- **Detailed Multi-Order Temperature Modeling and Compensation**



Technology

CALIPRO DML

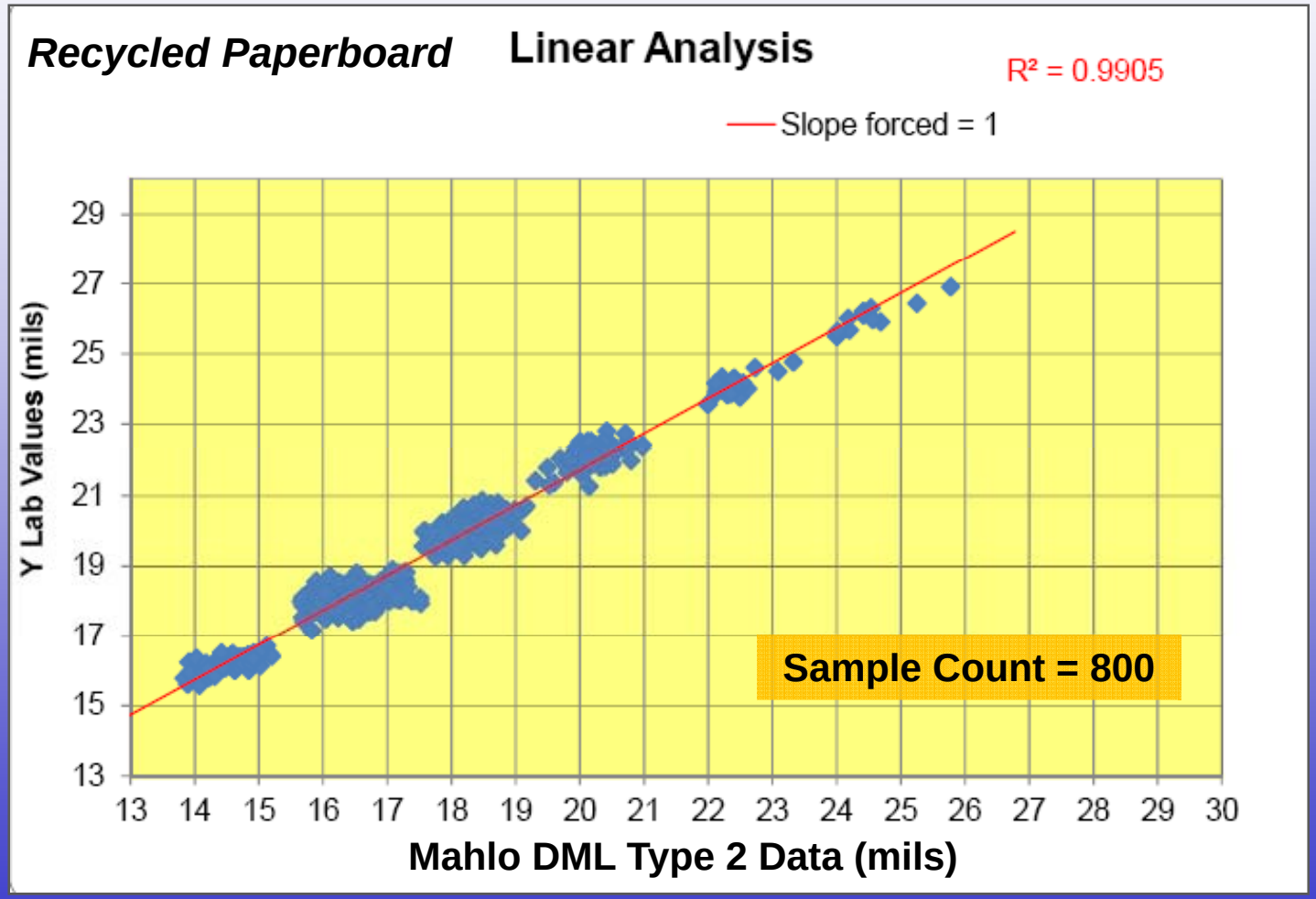
Specifications

Configuration	***Type 1*** ***Single Sided***	***Type 2*** ***Dual-Sided***	***Type 3*** ***Single-Sided***	***Type 4*** ***Dual-Sided***
	Continuous Active Gap Compensation		**Precision Stored Gap Profile**	
Measurement Principle	Laser Triangulation *plus* RF Sensors, against precision reference roller	Laser Triangulation *plus* RF Sensors, sensors above and below web	Laser Triangulation, against precision reference roller	Laser Triangulation, sensors above and below web
Measuring Range	0.05 – 10 mm (0.002 – 0.400 inches)		Dependent on material	0.25 – 45 mm (0.01–1.8") (Larger range available on request)
Measurement Gap	15 mm (0.6 inches)		50 mm (2 inches) (Larger gap available on request)	
Repeatability *(Dependent on material)*	Typically ***±5 µ (±0.0002 inches)***		Typically ±25 µ (±0.001 inches)*	Typically ±25 µ (±0.001 inches)
Laser Wavelength	650 nm			
Ambient limits	60°C (140°F), 0 – 95% relative humidity (non-condensing)			
Options	Air purging, Air or Water cooling			

Technology

CALIPRO DML

Typical Mill Results

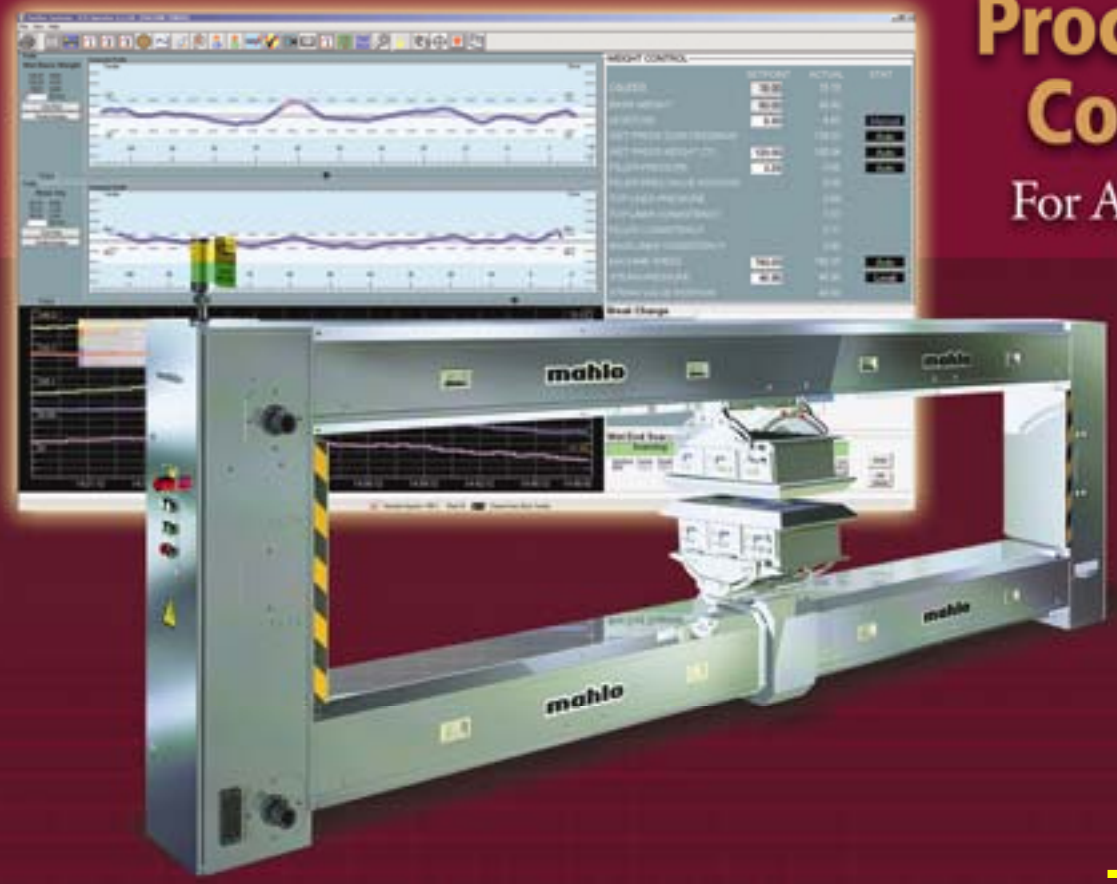


Technology

mahlo
trendsetting technology. worldwide.

PANTHER

ADVANCED
SERVICE PROVIDERS



Process Measurement, Control and Service

For All Your Paper Production Needs

- Process Monitoring
- Machine Control
- Production Analysis
- Quality Management
- Cost-Effective Service

Thank You!