

Vacuum Metallization

The Nordmeccanica way

By

Fabiano Rimediotti

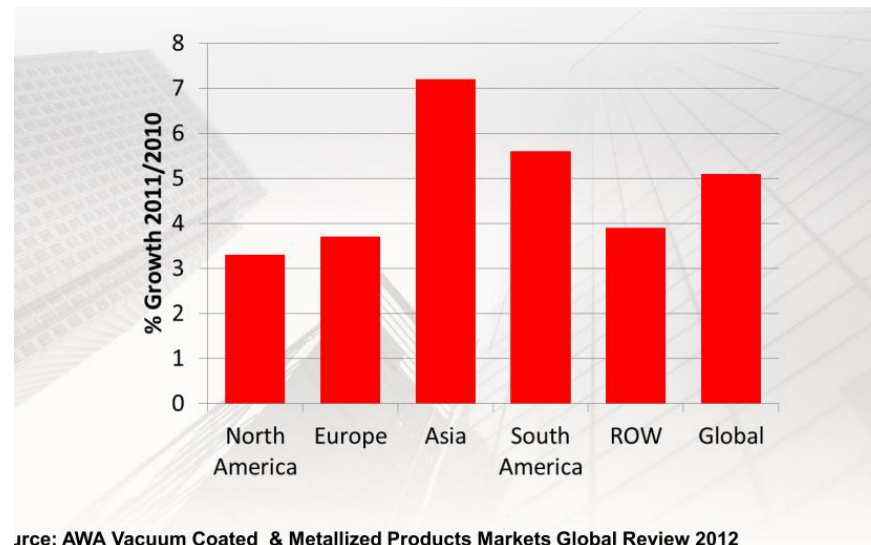
Nordmeccanica Group



NORDMECCANICA AND VACUUM METALLIZERS : The Motivation

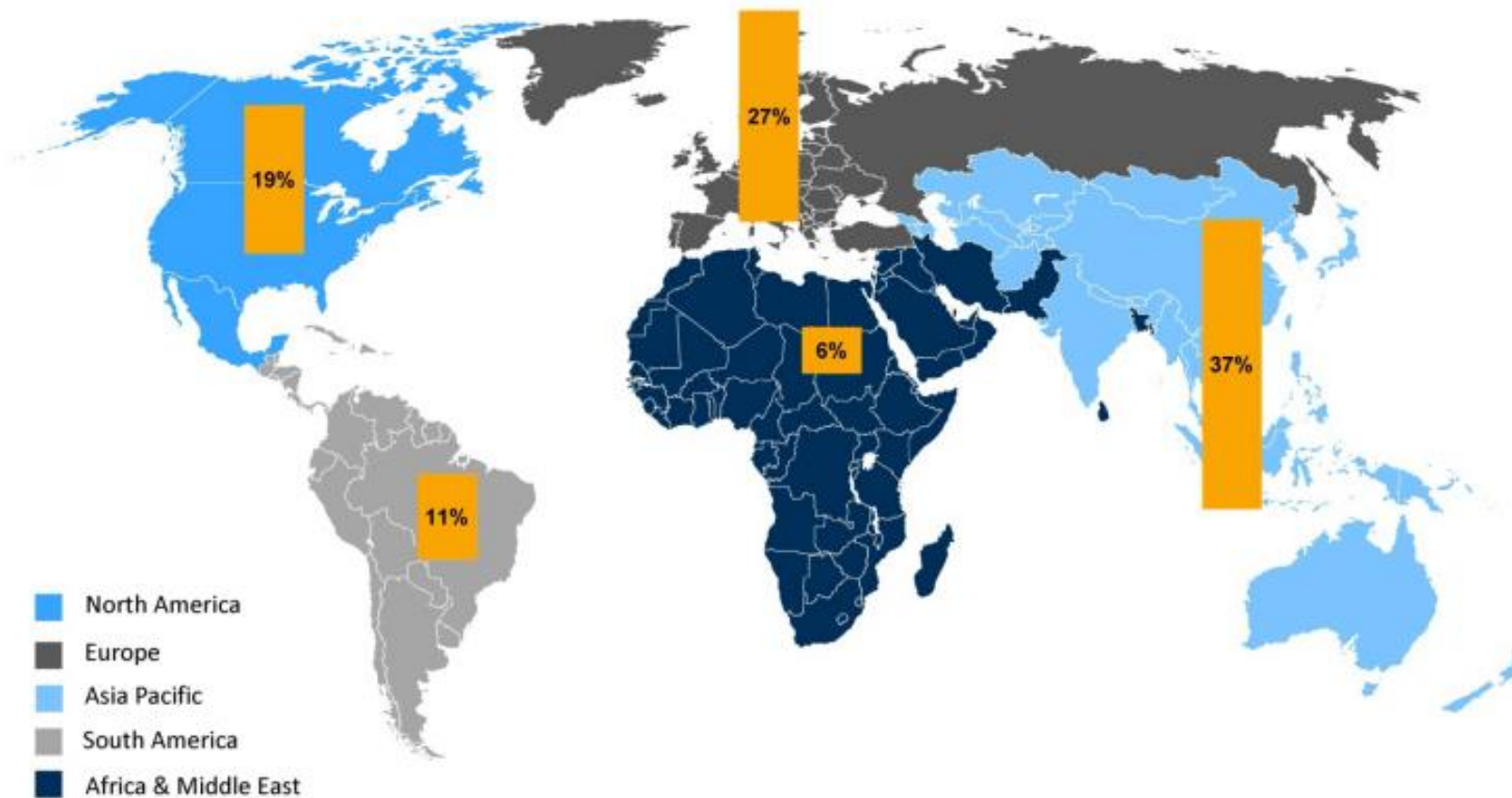
- ✓ The metallized materials are ubiquitous and key components of flexible packages
- ✓ The forecast of metallized materials demand predict a continuing growth on global basis :

Global growth for all vacuum coated materials estimated **at 5% in 2011** to a volume of **1,019 kilotons** (Source AWA, 2012)



NORDMECCANICA AND VACUUM METALLIZERS : The Motivation

- Metallized Material demand and production spread over all continents

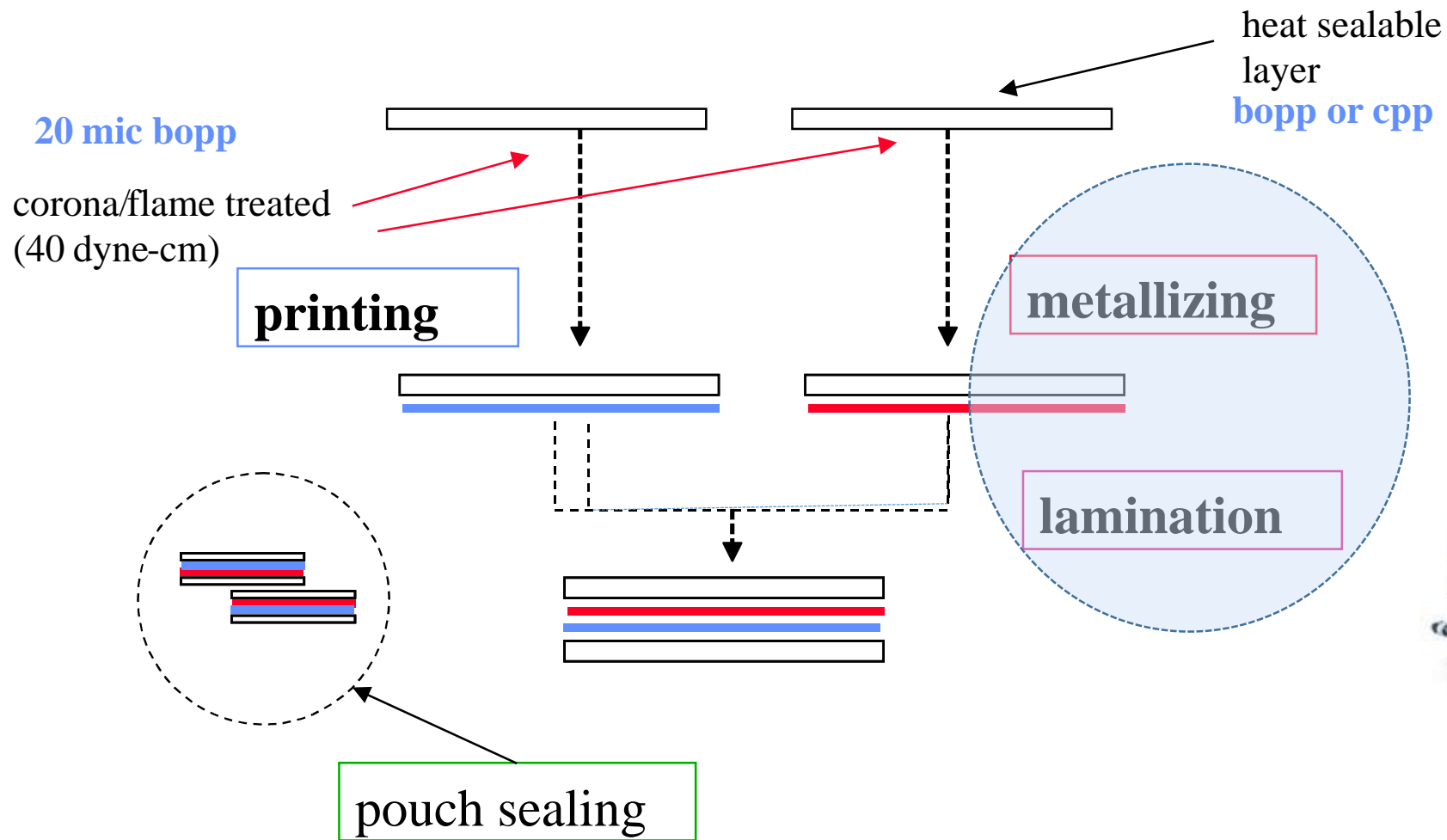


Source AWA 2012

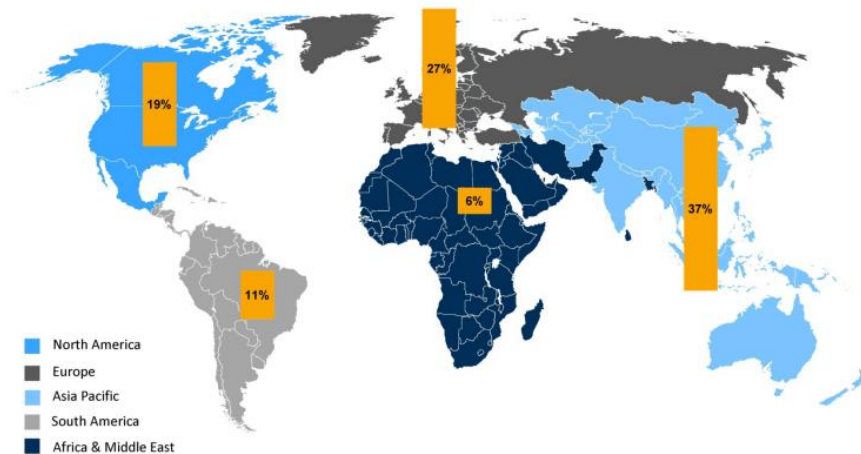
NORDMECCANICA AND VACUUM METALLIZERS : The Motivation

- ✓ NM-Vacuum can offer integrated solutions for the Converting Industry

Applications snack pouches



NORDMECCANICA AND VACUUM METALLIZERS : The Motivation



The NM established global presence will offer a close support to the widespread metallizing industry

NORDMECCANICA AND VACUUM METALLIZERS : Technology Background

- the legacy of a renowned vacuum technology

NM Vacuum continues the Vacuum coaters manufacturing tradition of Galileo Vacuum Systems



- More than one century in vacuum Technology
 - More than 50 years of metallizers manufacturing experience
- 300 metallizers (Vacuum Roll coaters) installed in 40 countries

- the NM excellence of design and manufacturing competence for the converting and flexible packaging industry

- More than 2000 installations worldwide (Coaters Laminators); 4 plants & 12 direct service centers in three continents

NORDMECCANICA AND VACUUM METALLIZERS : Projects in progress

1-Design and production harmonization

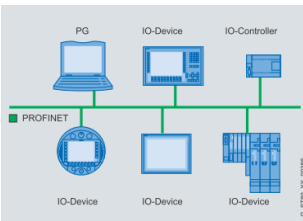
Galileo product range



NM - standard



Latest Components performance



NM –Vacuum metallizer range



State-of-the-art machine performance for an integrated converting line

NORDMECCANICA AND VACUUM METALLIZERS : Projects in progress

2 - a new metallizers generation

Galileo and Nordmeccanica joined machine manufacturing expertise

New Metallizing markets demands

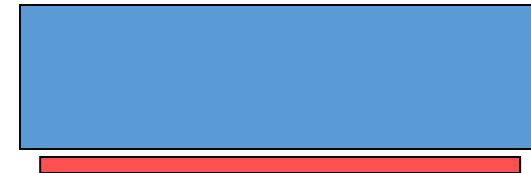
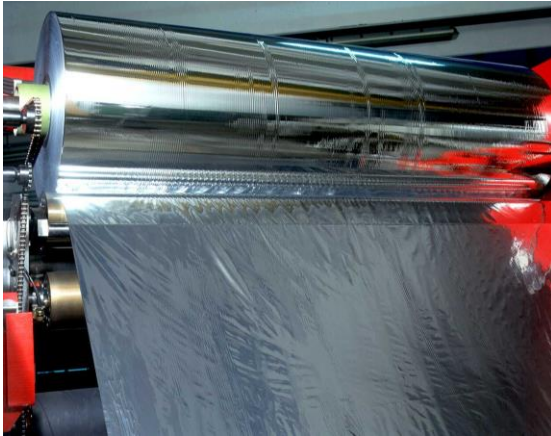
High
Output/Pro
duction
Efficiency

Automation
and quality
control

Diversificatio
n and
speciality



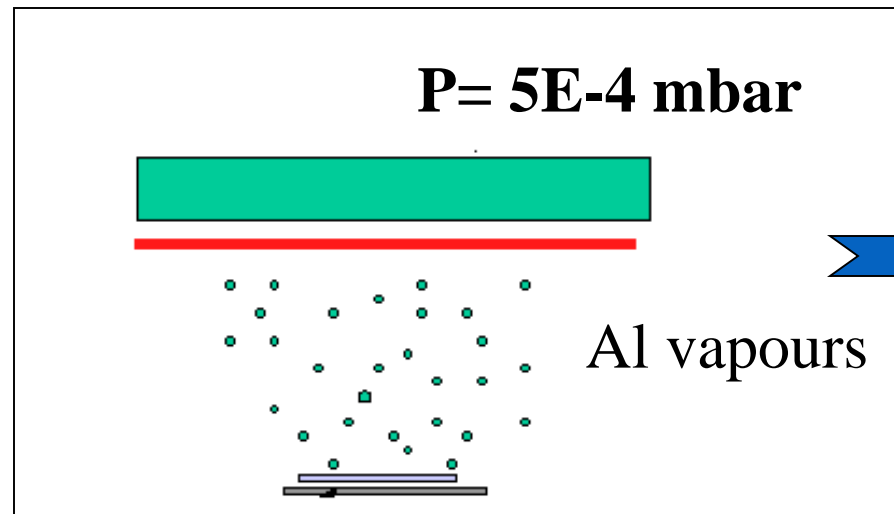
Metallized Materials



Plastic
film/paper

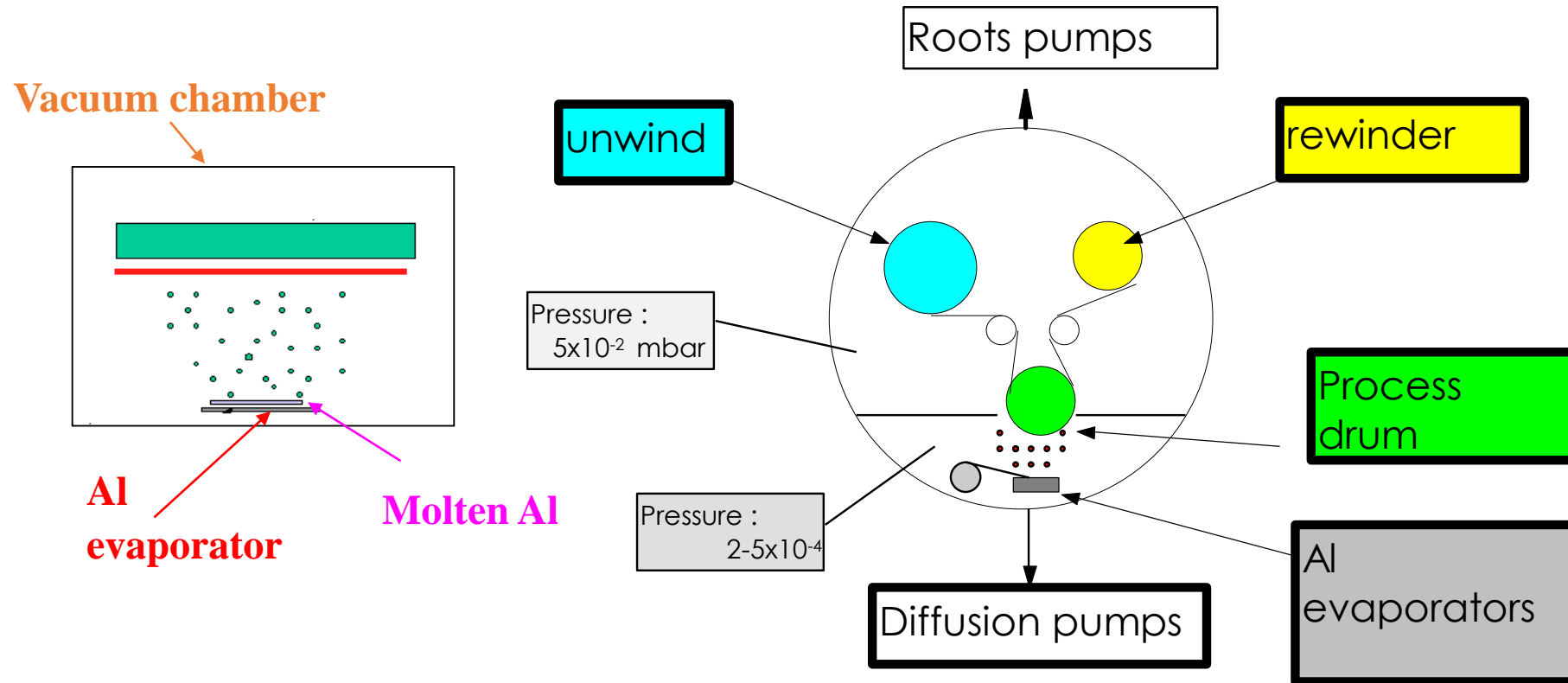
Al : 0.005 - 0.07 μ OD : 0.2 - 4

Ohm/sq : 0.5 - 10



Aluminium Layer
deposited from
metal vapours in
vacuum

The basic metallizer



NORDMECCANICA AND VACUUM METALLIZERS : Terminology and basics

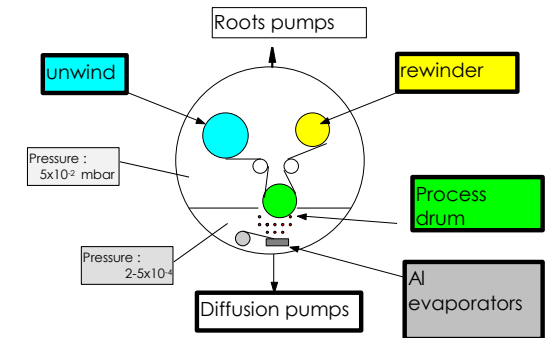
Pumping Group

A typical metallizer

Vacuum Chamber



Al evaporation system



Winding system

NORDMECCANICA AND VACUUM METALLIZERS : The market scenario

The metallizing Machines
destination markets

Film Manufacturers



Converters



Contract Metallizers



**Specialty/Paper
metallizers**



NORDMECCANICA AND VACUUM METALLIZERS : The market demand

The Industry focus

	output	Product diversification & Specialty	Process automation	Quality Control (SQC)
Film Manufact.	****	*	****	****
Converters	**	***	***	***
Contract Metallizers	***	****	***	***
Others	**	****	**	**

NORDMECCANICA AND VACUUM METALLIZERS : The offer range at a glance

<i>Model</i>	<i>Web width (mm)</i>	<i>Max roll diam (mm)</i>	<i>Max. working speed (m/min)</i>	<i>Industry</i>
<i>V8met (V8met-HS)</i>	<i>1000-1650</i>	<i>1000</i>	<i>840 (960)</i>	<i>Converter</i>
<i>MEGA met</i>	<i>2000-2500</i>	<i>1000</i>	<i>840</i>	<i>Converter/Fil m Mfr.</i>
<i>POWERmet₁</i>	<i>1000-1650</i>	<i>1000</i>	<i>1080</i>	<i>Converter</i>
<i>POWERmet₂</i>	<i>1650-2850</i>	<i>1270 (50")</i>	<i>1080</i>	<i>Converter/Fil m Mfr.</i>
<i>POWERmet3</i>	<i>3000-3550</i>	<i>1300</i>	<i>1080</i>	<i>Film Mfr.</i>
<i>GAMMAmet</i>	<i>1650-2200</i>	<i>1500-2000</i>	<i>1000-1200</i>	<i>Speciality/ Paper</i>



NORDMECCANICA AND VACUUM METALLIZERS : The latest technology trends

✓ High Output/Production Efficiency

❖ Working size

- Broad choice of web width to suit any industry category
- Large diam (&lenght) rolls

❖ Production Speed

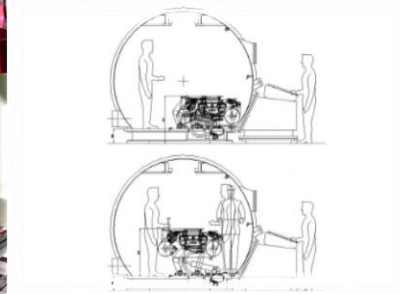
- High actual web Speed

Combined with:...

- Higher capacity evaporation
- Film winding and temperature control

❖ Production cycle optimization (idle time minimization)

❖ Production cost reduction/Energy saving



NORDMECCANICA AND VACUUM METALLIZERS : The main features

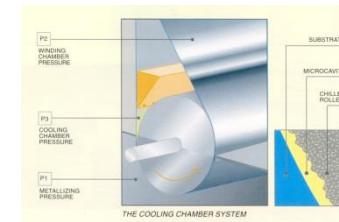
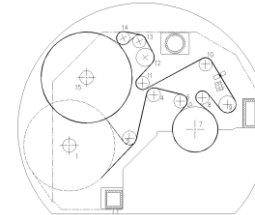
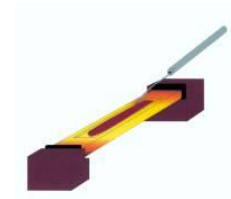
- High Production Speed

Industry best performance

•1000 m/min @ 2 OD +/- 5% (Pet/BOPP)

KEY POINTS:

- ✓ Evaporation system
- ✓ Winding mechanism & tension control
- ✓ Film cooling efficiency



NORDMECCANICA AND VACUUM METALLIZERS : The main features

- ***The renowned evaporation design***

- **Extractable Evaporation Bank**

Fast and accurate cleaning

- **Offset boats lay-out**

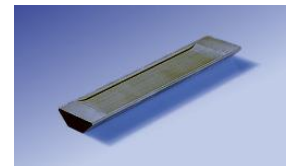
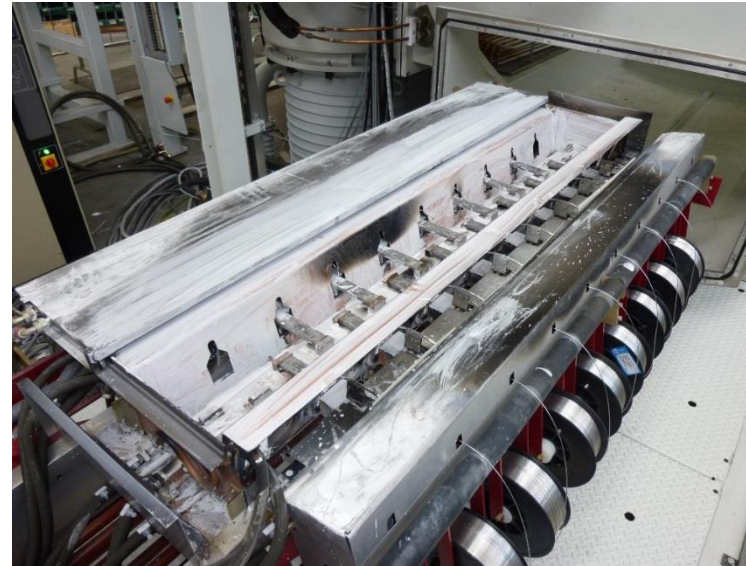
Al thickness uniformity

- **Al wire feed from stepper motors**

Accurate feed control and solution for no-splashing metallization

- **Al wire feed from 2 sides**

The solution for no wire stop



NORDMECCANICA AND VACUUM METALLIZERS : The main features

- ***The renowned evaporation design***

Boats firm contacts

**Al wire uniform feeding by
stepper motors**

**Cooled shields to protect against
radiation heat and to keep clean
the Al mechanism**



NORDMECCANICA AND VACUUM METALLIZERS : The main features

- ***The renowned evaporation design***

CMS: Coating thickness control

CMS_OD

by Optical Method

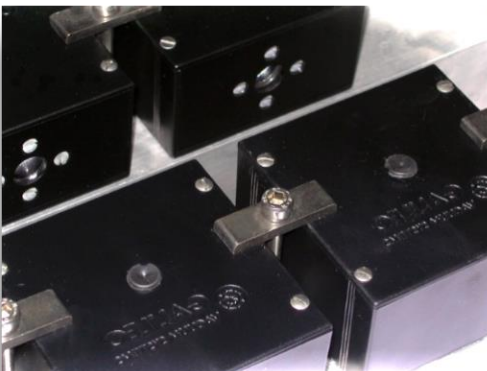
0 – 5 OD +- 0,5%

CMS_Ω/□

by RF method

0,5 – 10 Ω/\square +- 5%

CMS_OD& Ω /□ both methods



NORDMECCANICA AND VACUUM METALLIZERS : The main features

- ***Winding system designed for all substrates***

1 : Pay off

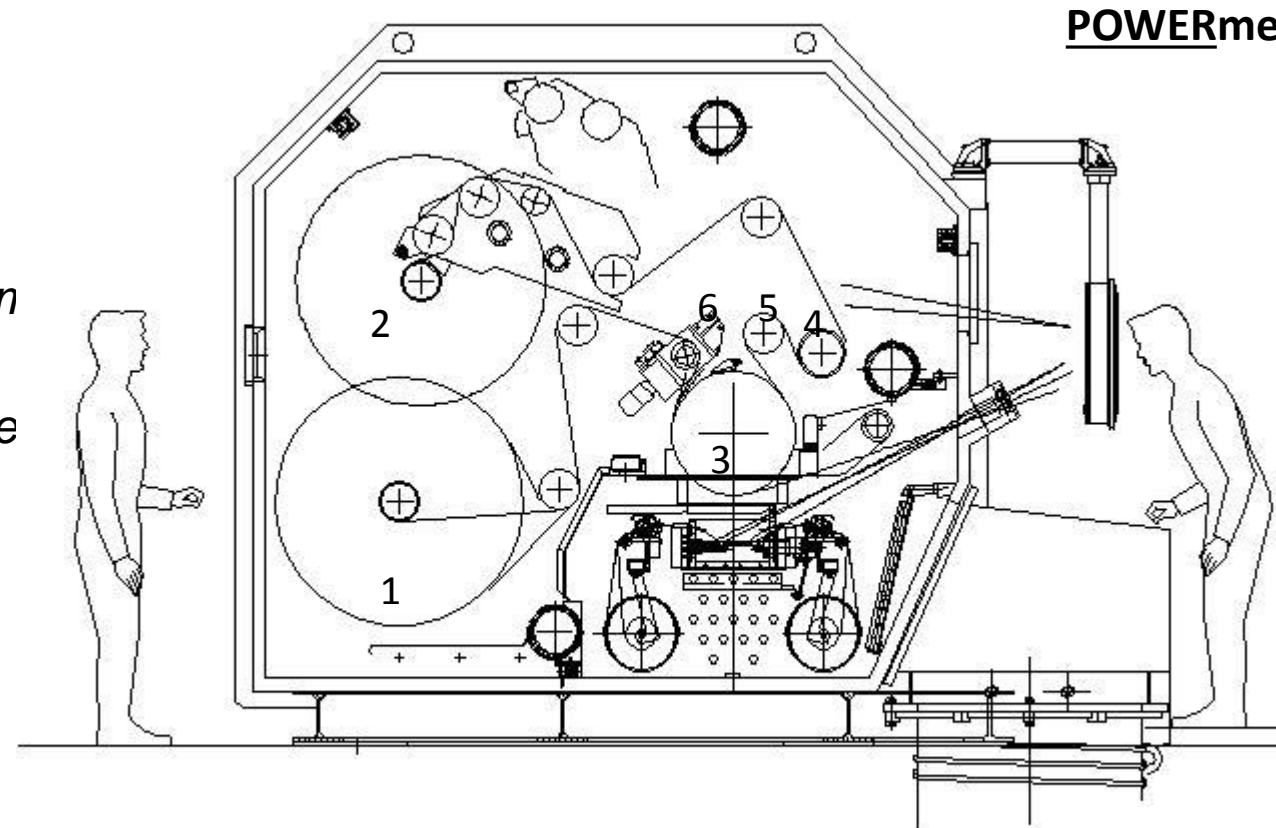
2 : Take-up

3 : Process drum

4 : Capstan roller

5 : Load Cell

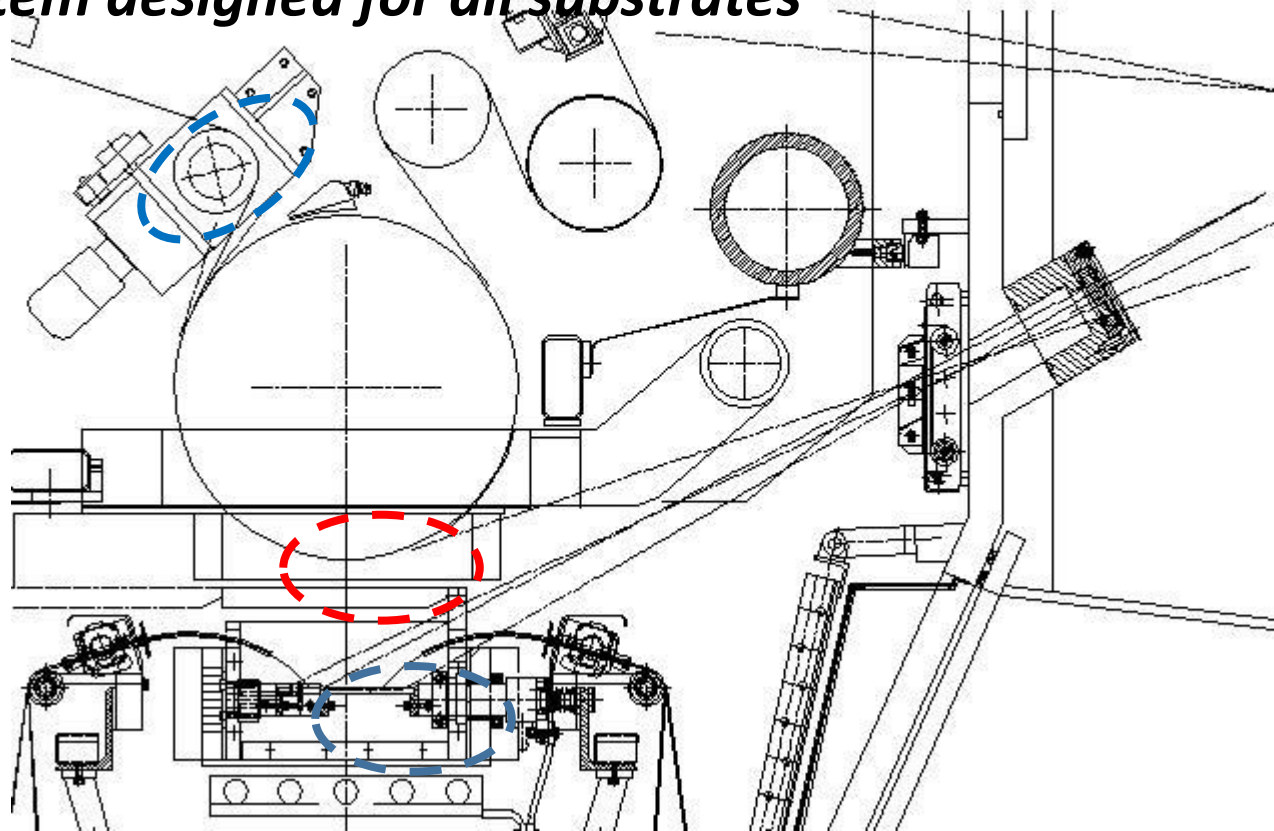
6 : Adjustable
spreader roller



POWERmet : 4 AC motor drive & Load cell

NORDMECCANICA AND VACUUM METALLIZERS : The main features

- ***Winding system designed for all substrates***



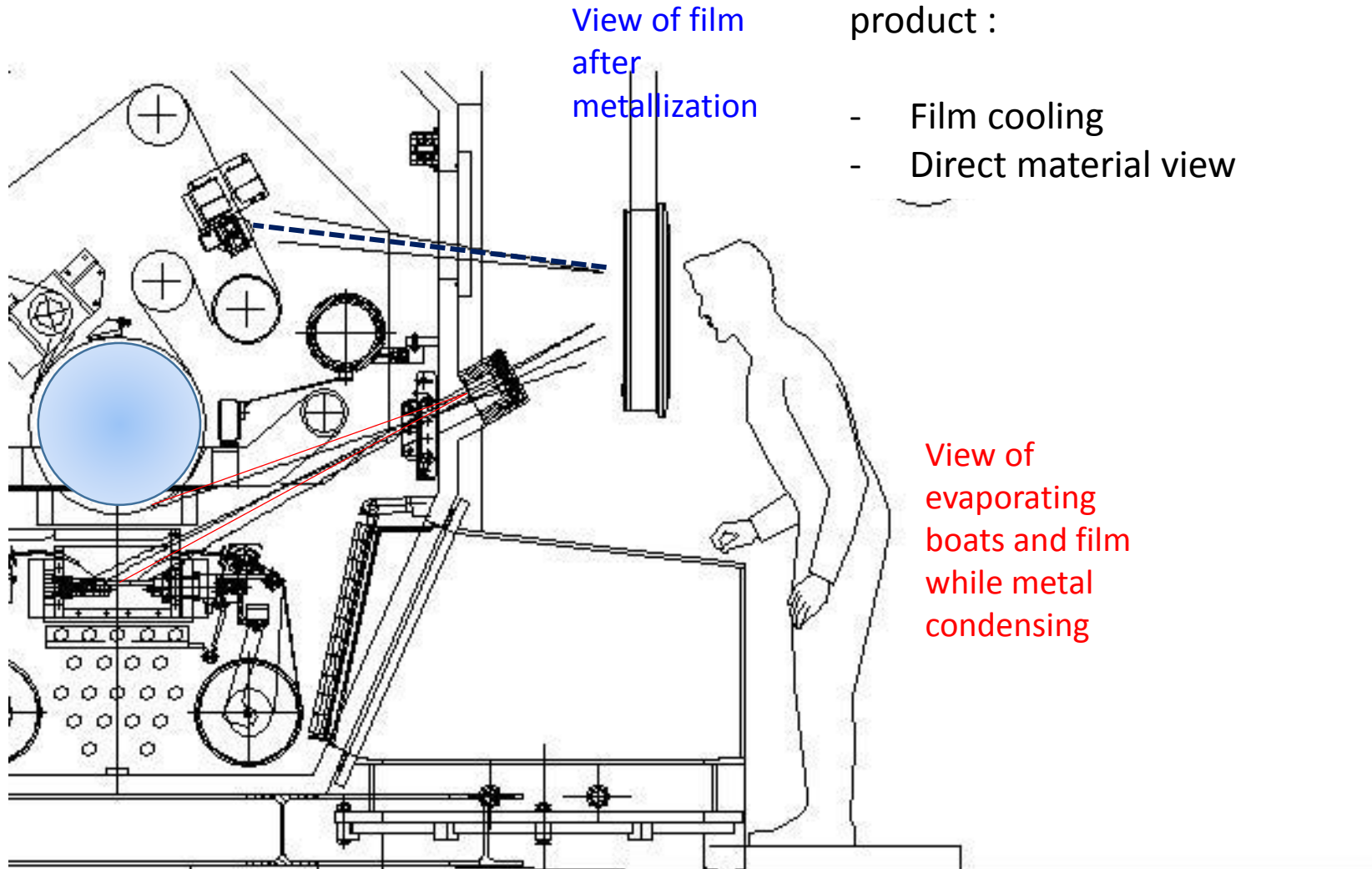
POWERmet : adjustable bow spreader roller and
process path view

NORDMECCANICA AND VACUUM METALLIZERS : The main features

- ***A special film cooling and inspection system***

The key points of high quality product :

- Film cooling
- Direct material view

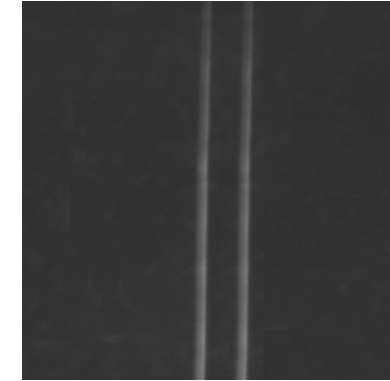


NORDMECCANICA AND VACUUM METALLIZERS : The main features

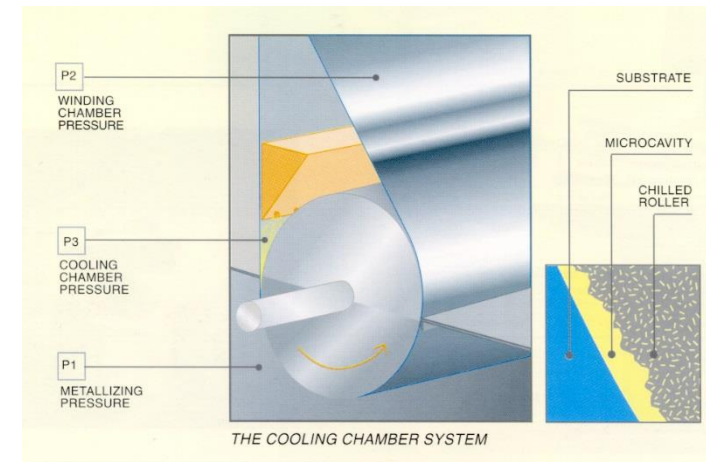
- *A special film cooling and inspection system*

Film Temperature control is required to avoid :

Heat generated wrinkles →
“tramlines”



**Galileo has developped the
EX.C.EL system to
guarantee a nearly
isothermal metallization**



NORDMECCANICA AND VACUUM METALLIZERS : The main features

○ Production cycle optimization

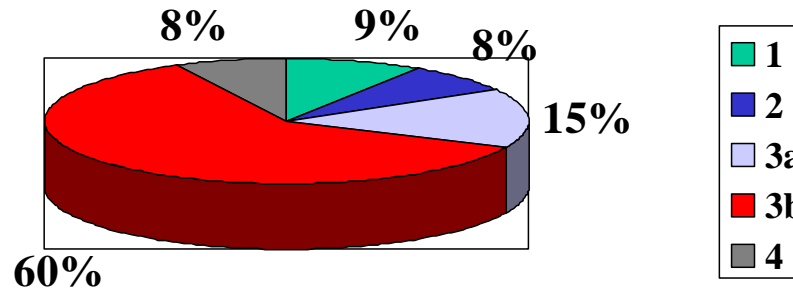
1 : Roll change

2 : Cleaning

3a : Chamber evacuation

3b : Metallizing

4 : Opening



(Typical for 25000 m roll length)

Idle time metallization strategies

✓ **Roll handling systems
integrated in the
metallizer control**

✓ **Optimised design
to minimise cleaning
procedures**

✓ **optimized
pump-down
cycle**

NORDMECCANICA AND VACUUM METALLIZERS : The main features

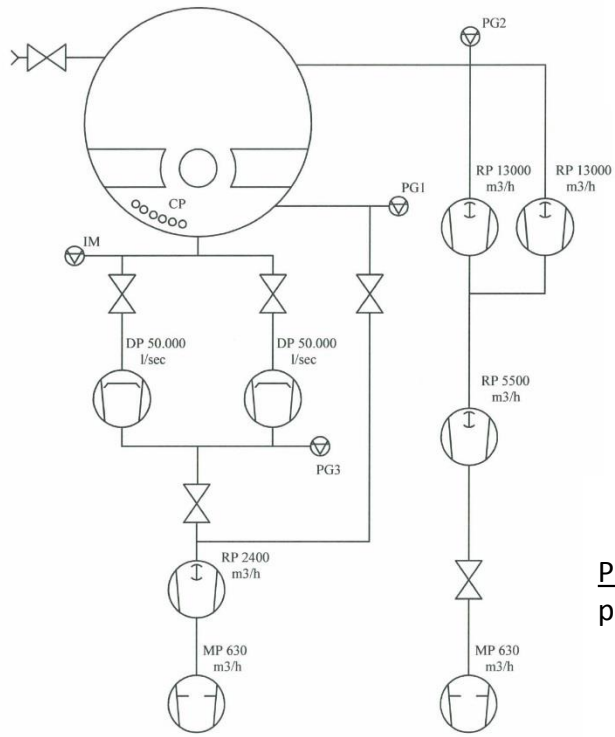
- Vacuum system designed to withstand every ambient condition

**The industry best
performance**

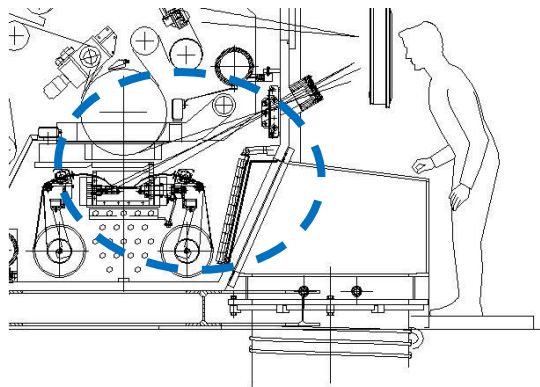
• *Pumpdown time (to $5 \cdot 10^{-4}$ mbar) < 6 min*
(clean, empty degassed chamber)

• *Chamber evacuation time in working condition : 10 min*

• *Ultimate Vacuum : $2 \cdot 10^{-5}$ mbar*



POWERmet-16
pumps diagram



Optimized pumps lay-out :

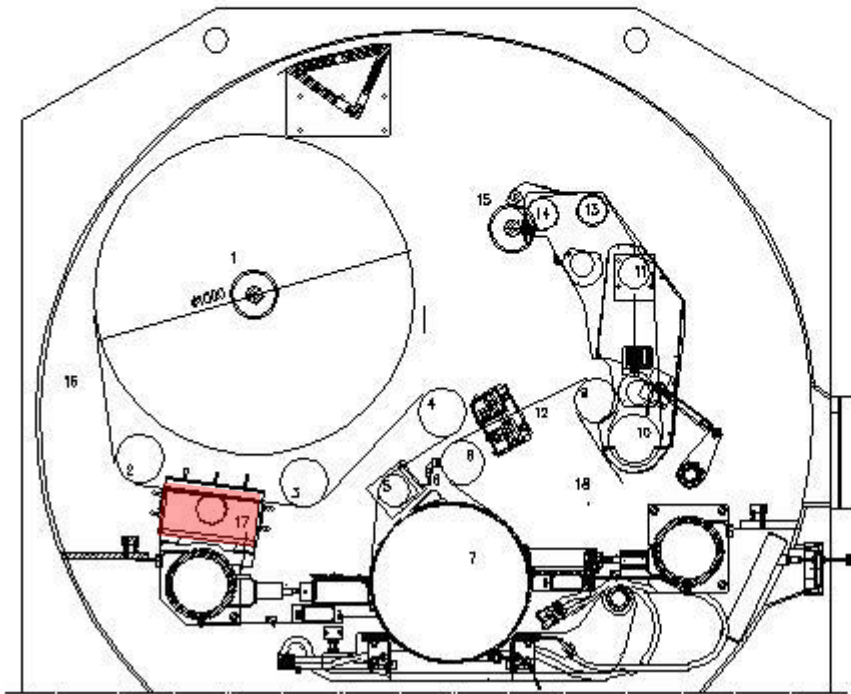
- Dp:symmetrical along the chamber
- Dp close to process and protected from debris
- Variable speed motors for soft starting and power saving

NORDMECCANICA AND VACUUM METALLIZERS : The latest technology trends

✓ DIVERSIFICATION & SPECIALITY

- *Open architecture for modular AddOns for extended functionality*

Plasma treatment



Film

Magnets

gas

Hollow
cathode

Ionized Gas
(Plasma)

Ions and electrons strike the film surface resulting in.....

- Surface cleaning
- Surface activation
- Chemical bonds generation

NORDMECCANICA AND VACUUM METALLIZERS : The main features

- ***Open architecture : modular AddOns for extended functionality***

Zinc Sulphide & Magnesium Floride coating

Zinc Sulphide ZnS

High Refractive Index

Holography



**Magnesium Floride
MgF2**

Anti-Reflection coatings



NORDMECCANICA AND VACUUM METALLIZERS : The main features

- ***Open architecture : modular AddOns for extended functionality***

Zinc Sulphide & Magnesium Floride coating

The process : Sublimation from crucible through nozzles, radiation heated

Example : sublimation modules for Aluminium metallizers

Interchangeable with standard boats

Special materials to last at high temperatures

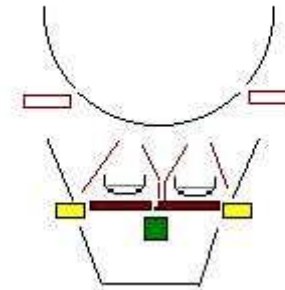
Low thermal inertia (minimizing heating and cooling cycles)

“Clean” environment

Range of process parameters :

Web Speed : 80 – 220 mpm

Deposited thickness : 60-120 nm



NORDMECCANICA AND VACUUM METALLIZERS : The main features

- ***Open architecture : modular AddOns for extended functionality***

In Line Pattern Metallizing (ILPM)

Selected Applications

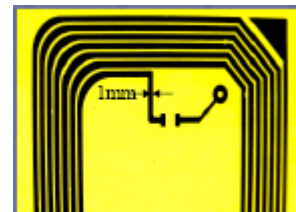
Packaging



Security



Others



NORDMECCANICA AND VACUUM METALLIZERS : The main features

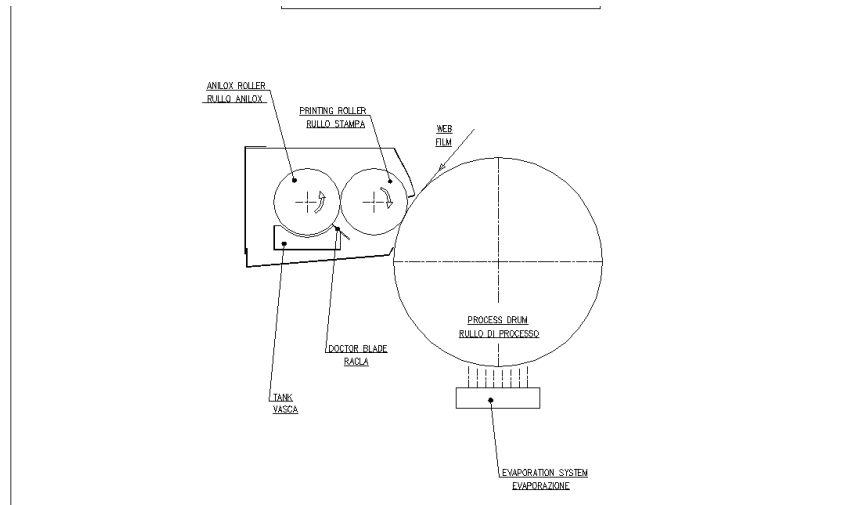
- ***Open architecture : modular AddOns for extended functionality***

In Line Pattern Metallizing (ILPM)

Flexo printing concept in vacuum chamber

Key points :

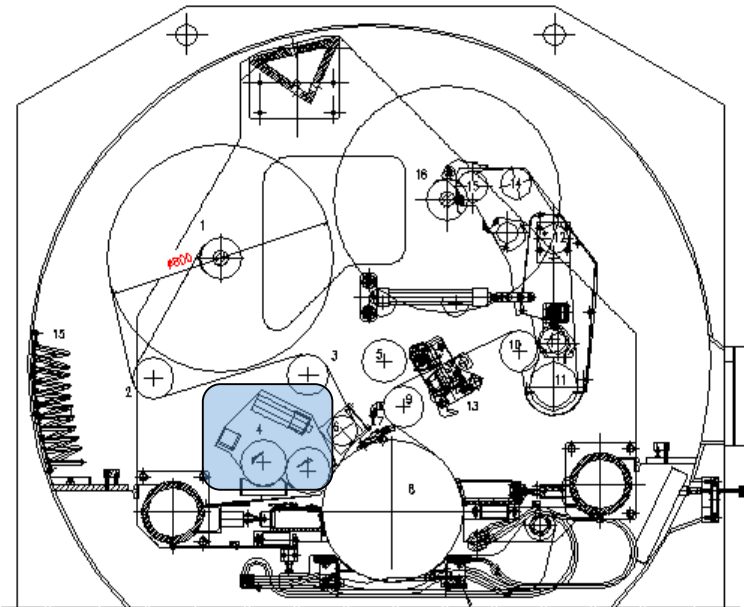
- **Clarity and definition**
- **Vacuum/heat compatible “ink”**
- **system containment to avoid contamination**



NORDMECCANICA AND VACUUM METALLIZERS : The main features

- **Open architecture : modular AddOns for extended functionality**

In Line Pattern Metallizing (ILPM)



- Width : up to 1650 mm
- Roll Diameter: max.800 mm
- Typical web speed (ILPM): 400-600 mpm

Photo-quality images



Micro-images definition



NORDMECCANICA AND VACUUM METALLIZERS : Metallized Paper

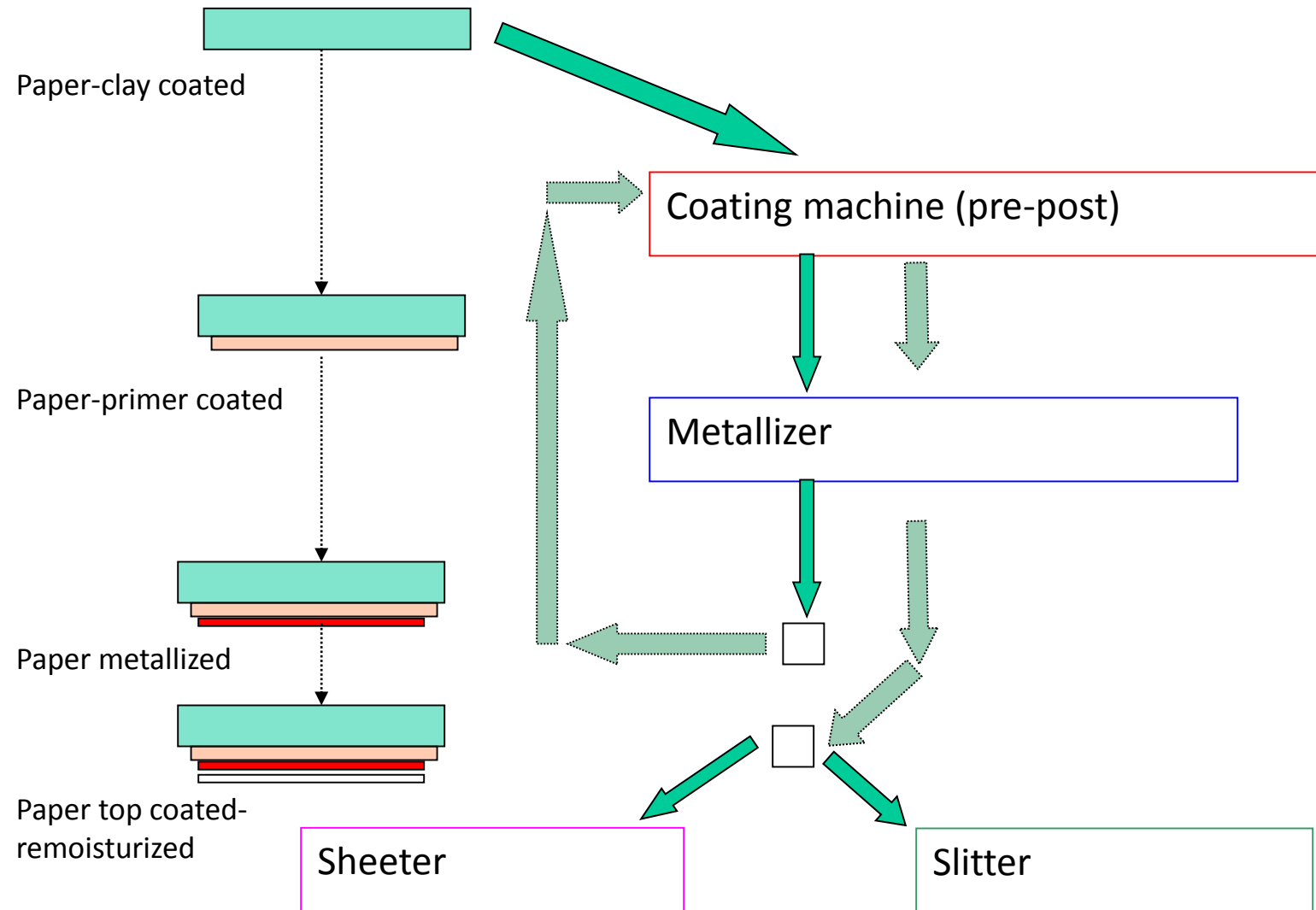
Selected – high volume applications

- Labels
for beer-liquor etc.
- Gift wrap
- Cigarette inner liner
- board



NORDMECCANICA AND VACUUM METALLIZERS : Metallized Paper

The basic production line



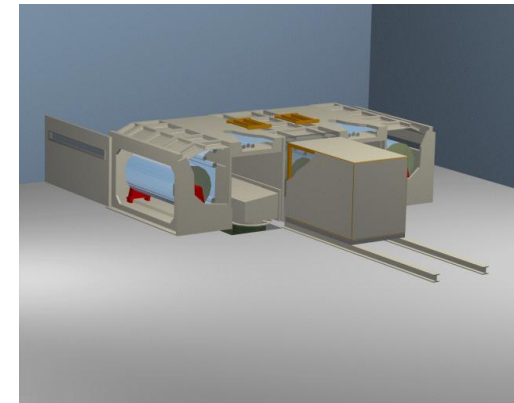
Paper Metallizing : the key process requirements

The Challenge

- Paper releases moisture in the vacuum chamber

The Solution

GAMMAmet designed for heavy vapour load



Main Features

- ❖ multizone
- ❖ extra pumping capacity
- ❖ cryogenics

NORDMECCANICA AND VACUUM METALLIZERS : Metallized Paper

GAMMAmet : designed for multi-zone metallizing

■ **Zoning** : separation of the coater in different sections to maintain difference of pressure and gas concentration

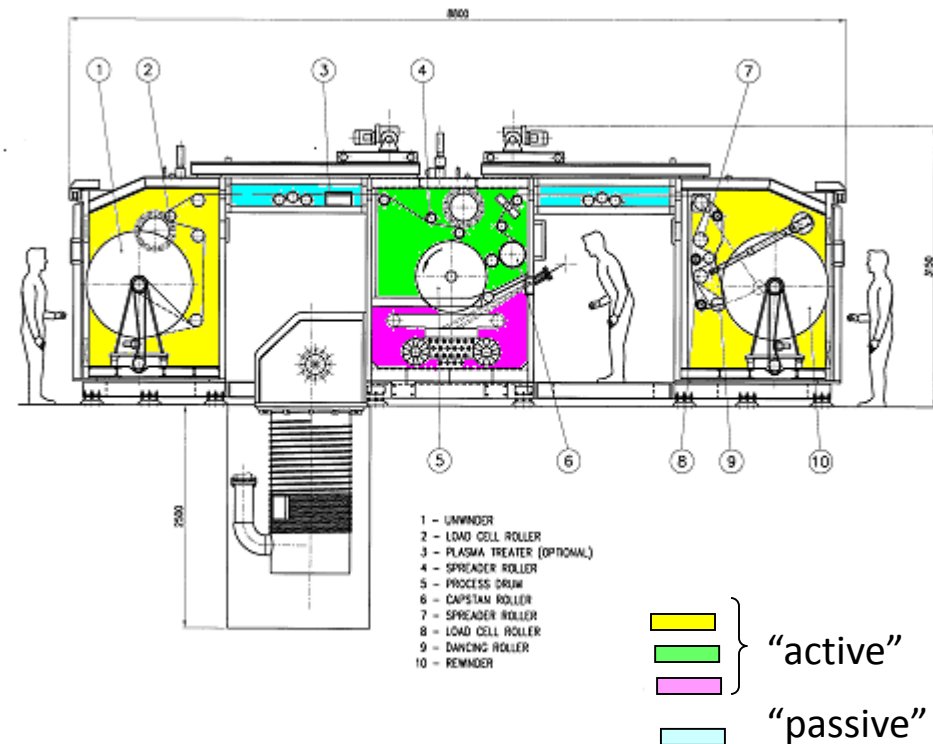
“Passive” zoning : mechanical separation by means of low “conductance” channels

“Active” zoning : mechanical separation + separate vacuum pumping

Different vacuum zones are key to

optimizing vacuum pumping efficiency :

- “high” vacuum only in process zones – 5×10^{-4} mbar
- “rough vacuum” (higher pressure) ($5 \times 10^{-2} \dots 10^{-1}$) in the non-process parts to minimize the gas volume to be removed



Pressure zones in a GAMMAmet – 3 chambers coater (basic configuration)

NORDMECCANICA AND VACUUM METALLIZERS : Metallized Paper

GAMMAmet- a multi-zoned metallizer



NORDMECCANICA AND VACUUM METALLIZERS : Metallized Paper

- ***Metallizing Process Efficiency and high volume production***

The Challenge

✓ ***Metallized paper is becoming a “commodity” product: large volume and production efficiency is mandatory for market success***

✓ ***Metallization is a “batch” process with a cycle efficiency depending on roll lenght and Speed***

✓ ***For thicker paper and especially for cardboard, the efficiency can be a problem (typical downtime >50%)***

The Solution

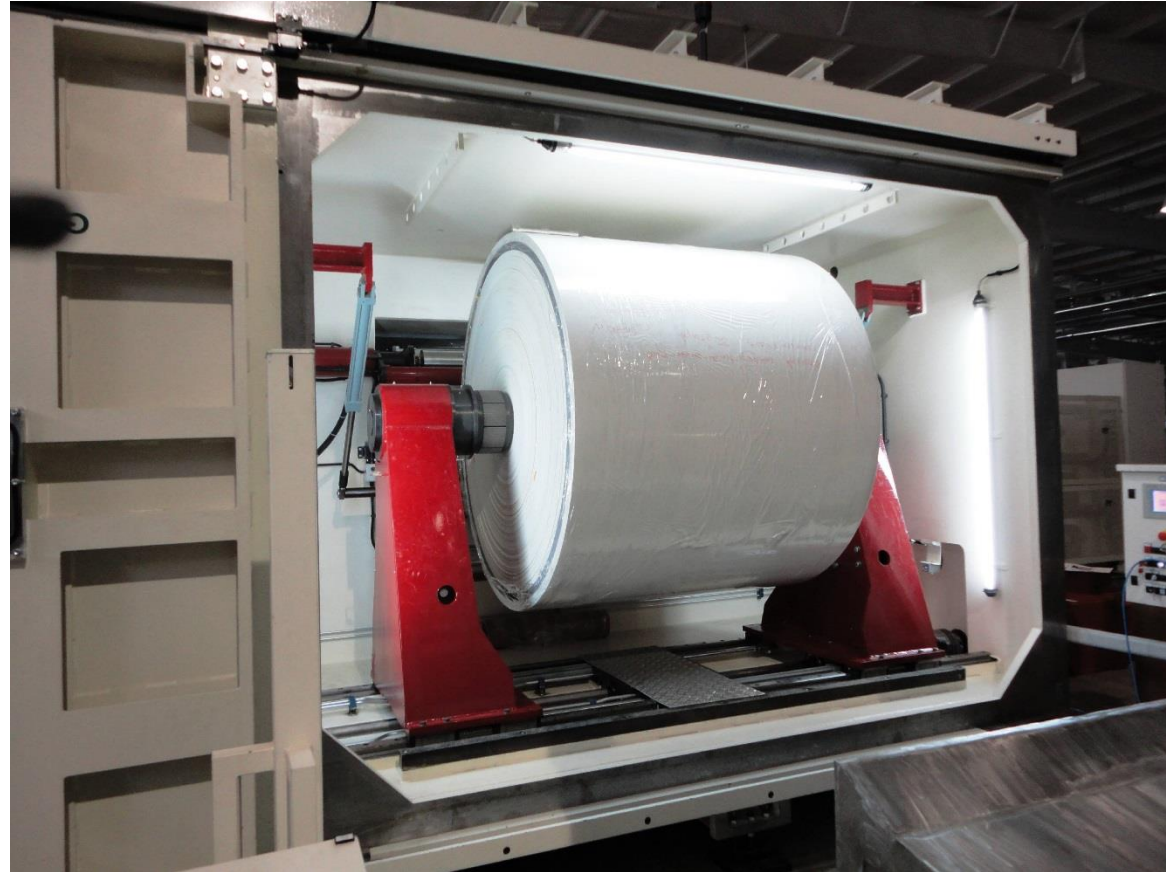
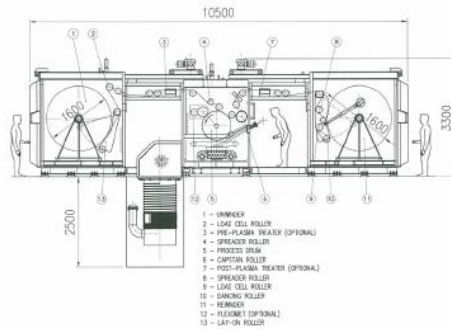
GAMMAmet offers the industry best solution

.....

- ***Extra large Roll diameter (up to 1.8 m)***
- ***High Web Speed over 1000 mpm***
- ***Convenient loading facilities***

NORDMECCANICA AND VACUUM METALLIZERS : Metallized Paper

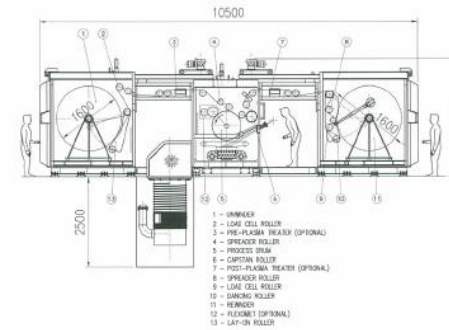
GAMMAmet : designed for extra-large roll capacity



- ✓ Shaftless support
- ✓ Sturdy and vibration free roll support
- ✓ Sliding doors for easy access

NORDMECCANICA AND VACUUM METALLIZERS : Metallized Paper

GAMMAmet : designed for roll loading efficiency



✓ Sliding doors for easy access

✓ Convenient roll loading



NORDMECCANICA AND VACUUM METALLIZERS : Metallized Paper

GAMMAmet : designed for high speed metallization



.Sturdy and balanced winding
structure
Large cooling drum

High evaporation capacity

NORDMECCANICA AND VACUUM METALLIZERS : Metallized Paper

GAMMAmet - P :the industry most efficient metallizer for paper



➤ *Web width : 1600-2100 mm*

➤ *Roll diam.: 1.5 – 1.8 m*

➤ *Web Speed : 1000 m/min*

➤ *Paper /board up to 250 gr/m²*

➤ *Moisture content : up to 5%*

Output : up to 15,000 Tons/yr