Replacement of Electroplating Produced in a Flexible Inline Production Platform

替代电镀工艺的灵活在线生产平台

Overview Presentation 介绍

- **Decorative PVD coating on plated substrate**
  装饰PVD涂层，作用在电镀工件上
  - **Layer built up** 涂层构成
  - **Color development** 颜色发展

- **PVD replacing plating: the challenge! PVD替代电镀：挑战！**
  - **Motivation** 目的
  - **Existing metallization technologies**现有的金属涂层技术
  - **Cromatipic® as an Alternative to Electroplating** 替代电镀工艺
  - **Layer built up** 涂层构成
  - **Functionality** 作用
  - **Plastic is first approach** 最早应用在塑料产品

- **The Metalliner:**在线生产平台
  - **Concept** 概念
  - **Modularity, Linear Motion System，Racks and spindles** 模块化，系统运转结构，工件和轴承
  - **Coating Properties**涂层性能
- **Conclusions** 结论

Decorative PVD on plated substrate 电镀工件上PVD

Typical Layer built up

PVD Finish
Chromium
Nickel
Copper
Metals, ABS plastics

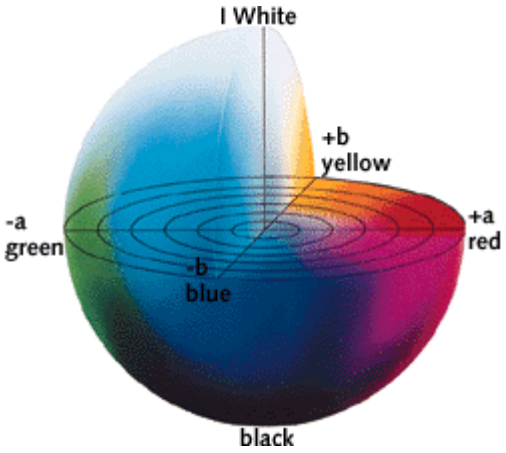
Wet process: electro plating
电镀工艺

Well known “metal colors”
With high scratch resistance
金属颜色，高耐磨性能

Decorative PVD on plated substrate电镀工件上PVD

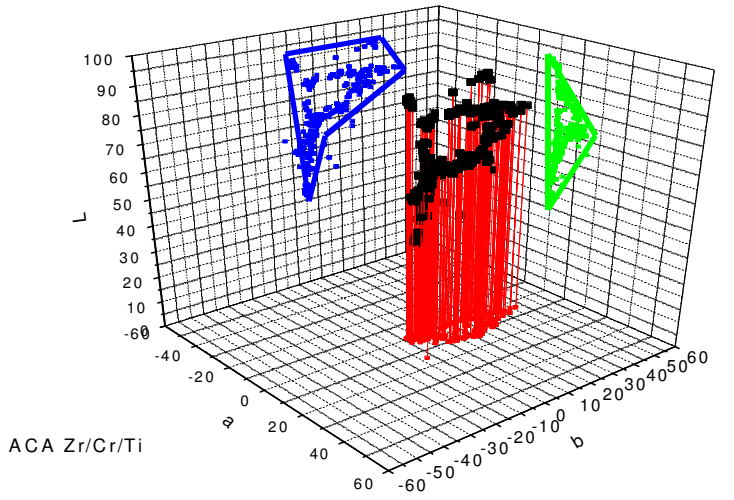
Quantify color
with photo spectro meter

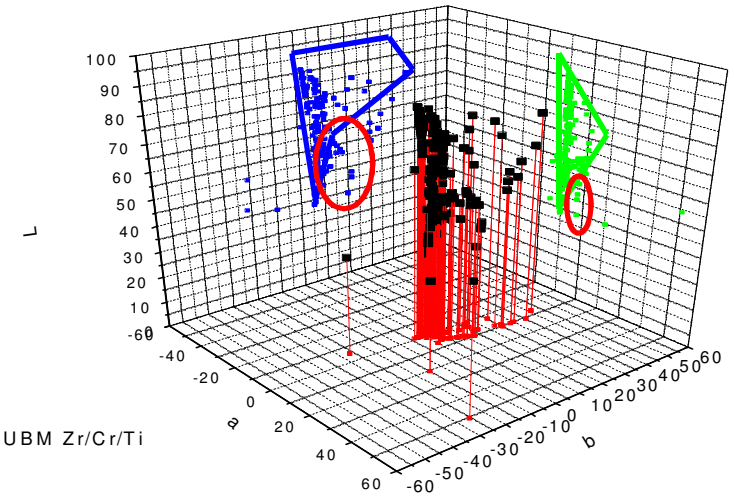
验收由色谱仪检测



In L* X a* X b* values

Decorative PVD on plated substrate电镀工件上PVD





SPUTTERING versus ARC:
磁控溅射对电弧

Sputtering is giving more Colors:
Lower L values are possible
磁控溅射涂层更多颜色
可以降低**L** 值

- **PVD replacing plating: the challenge!**
  PVD替代电镀：挑战！

Motivation - Plating on Plastics 在塑料上电镀

Plastics applications in the automotive industry塑料在汽车工业的应用

60% increase in the past decade在过去十年增加了60%

	2000 2.5 Million Tons ABS	2010 4 Million Tons ABS
Interior	48%	43%
Exterior	24%	22%
Engine compartment	19%	23%
Electrical compartment	9%	12%

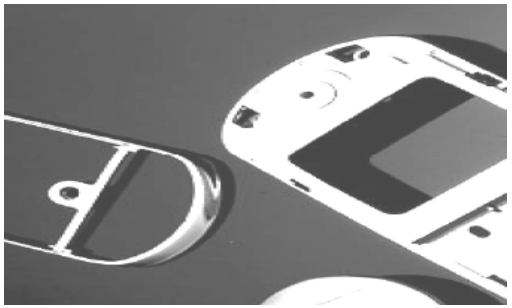
Motivation - Plating on Plastics在塑料上电镀

Plastics – Other Then Automotive Applications

塑料-在其他领域的应用

Decorative sets
装饰件
Cosmetics and Fashion
化装和时尚产品

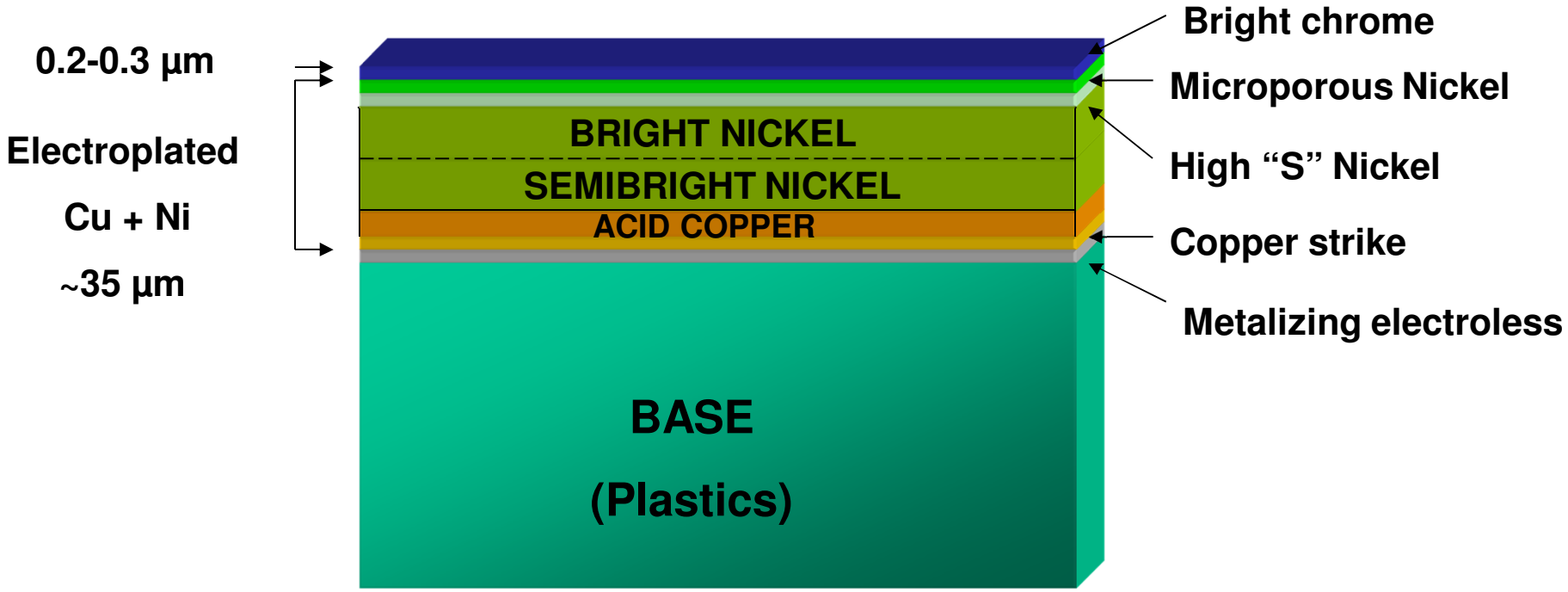
Sanitary
清洁产品



Mobiles, PDA MP3, cameras
手机，**PDA, MP3,**相机

Motivation 动力

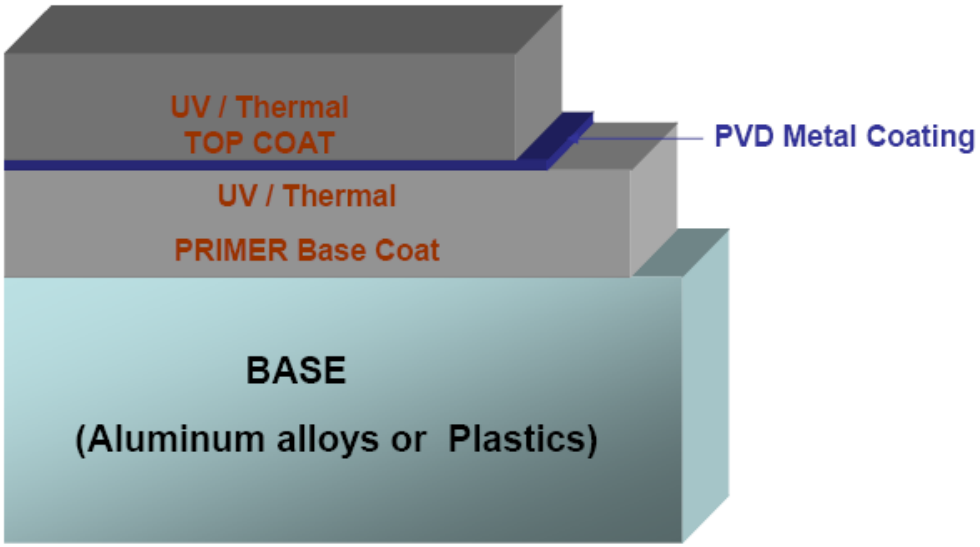
Existing Solutions – Cu-Ni-Cr Electroplating



Wet process, partially banned in the EU due to the use of Cr^{6+} (ROHS EU Directive 2002/95/EC)
Restricted mainly to ABS and ABS-PC

Motivation – Al Metallization (Cr-like look)

Existing solutions – Al Metallization (Cr-like look)
现有解决方案- 铝金属化（外观像-铬）



Possible disadvantages:
可能造成的缺点

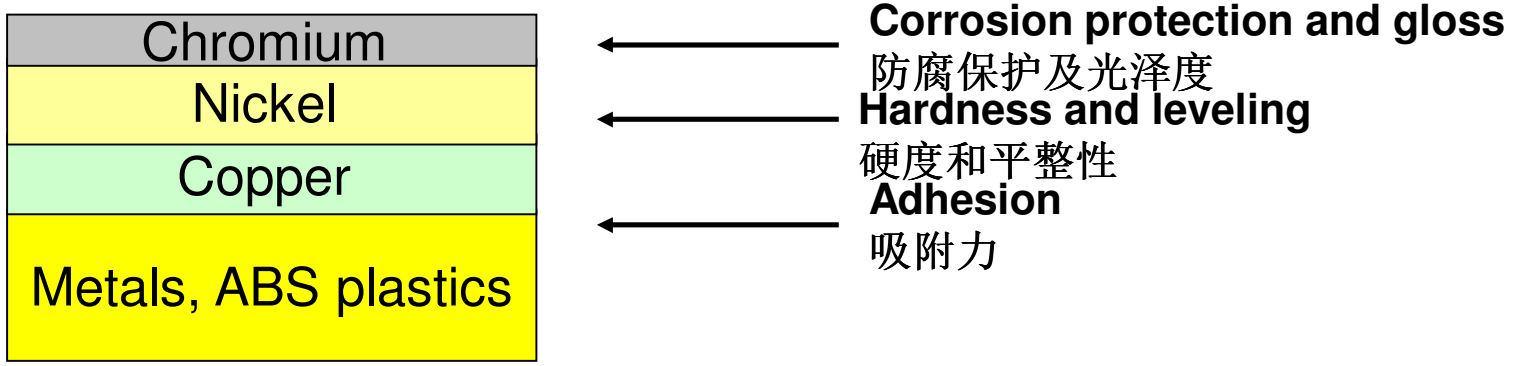
- **Multi-layer (base coat, PVD metal(s) and topcoat) with different thermal expansion properties**
- **多层化（基底涂层， PVD 金属以及顶部涂层）具有不同的膨胀性**
- **Tendency to failure on climate and thermal shock test**
- **气候和热冲击试验失败的倾向**
  Tendency of blistering of top coat layer on PVD layer
- **PVD顶部涂层起泡的倾向**
- **Top coat has tendency to surface defects (e.g. pitting, orange peel, roughness)**
- **涂层表面缺陷的倾向（如蚀 损，桔皮，粗糙度）**

- **High reject rate 高废品率**

PVD replacing plating: the challenge!PVD替代电镀

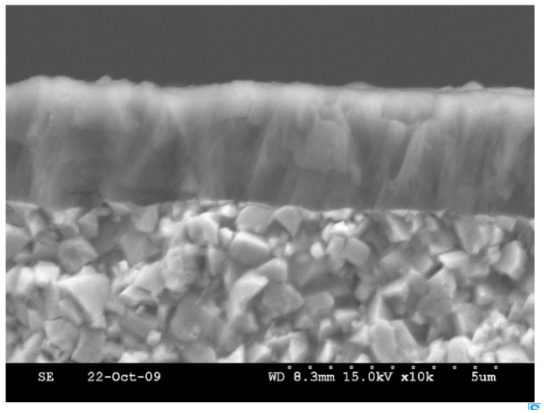
Layer built up and functionality from plating

涂层构成



PVD replacing plating: the challenge!PVD替代电镀

Leveling:平整性
PVD has no leveling functionality:
It will follow the surface:
PVD没有平整性功能：
它是完全根据表面而形成的：
So we need highly polished surface or other solution
因此我们需要对表面高度抛光或其他解决方案



Corrosion protection耐腐蚀:
PVD gives limited corrosion protection: due to columnar structure
PVD提供有限的防腐保护：由于其柱状结构
So we need NON-corroding substrate or other solution
因此我们需要防腐的基底或其他解决方案

PVD replacing plating: the challenge!PVD替代电镀

Leveling effect and corrosion protection functionality in spray coating: CROMATIPIC®
CROMATIPIC®的平整性和耐腐蚀性

PVD replacing plating: the challenge! PVD替代电镀

Advantage Cromatipic®: 优点

- Environmental friendly technology (no hexavalent chromium) 无污染
- Dry process 干式工艺
- NOT limited to ABS as a plastic 不限于ABS（电镀只使用ABS）
  (ABS is only plastic which is industrial used in plating)
- NO corrosion risc (no copper or nickel) 无腐蚀性（不含铜或镍）
- Simple 3 stage process (elimination of many process steps (10))
  3步工艺流程（减少工艺步骤）
- No top coat required 无顶部涂层需求
- Released for many ASTM/GM standards ASTM/GM标准多次使用

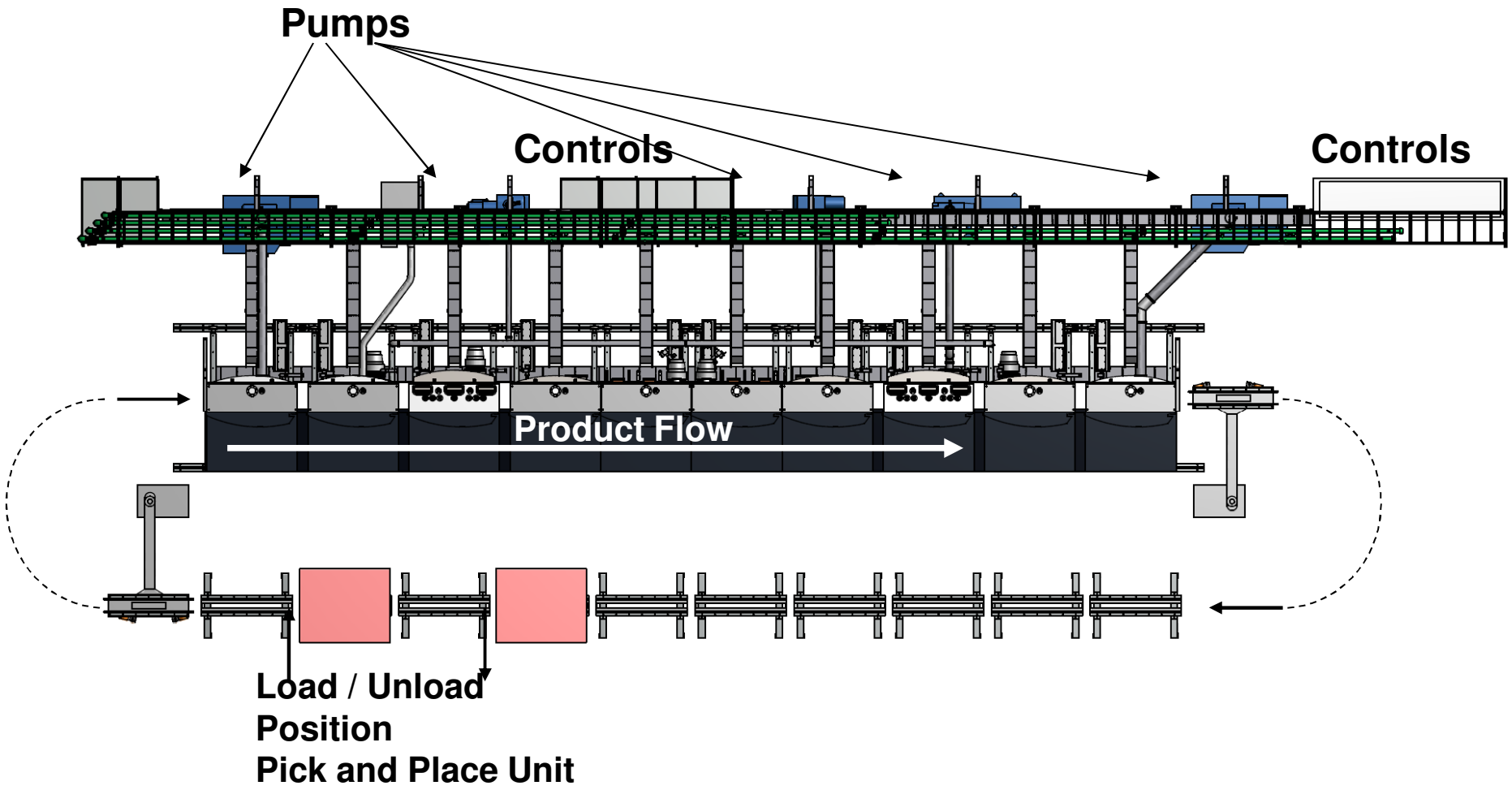
Metalliner 在线生产平台

metalliner
BY HAUZER

The Metalliner: Concept
在线生产平台：概念

Layout Metalliner 在线生产平台的布局

TOP VIEW



Industrial Design工业设计

metalliner
BY HAUZER

Modularity: Towards Technology
模块化设计：直面技术

Modularity: Towards Technology模块化设计：直面技术

Magnetron Sputtering,
Dual Magnetron Sputtering
磁控溅射，
双磁控溅射，

Arc Evaporation:
Circular or Rectangular
电弧蒸发：
圆形或矩形

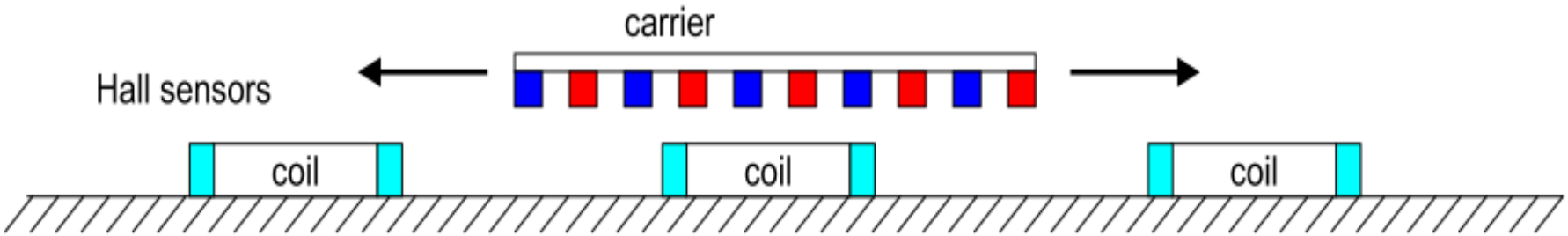
PACVD,
Or Any Other Technology
等离子体辅助化学气相沉积技术，
或其他技术

metalliner
BY HAUZER

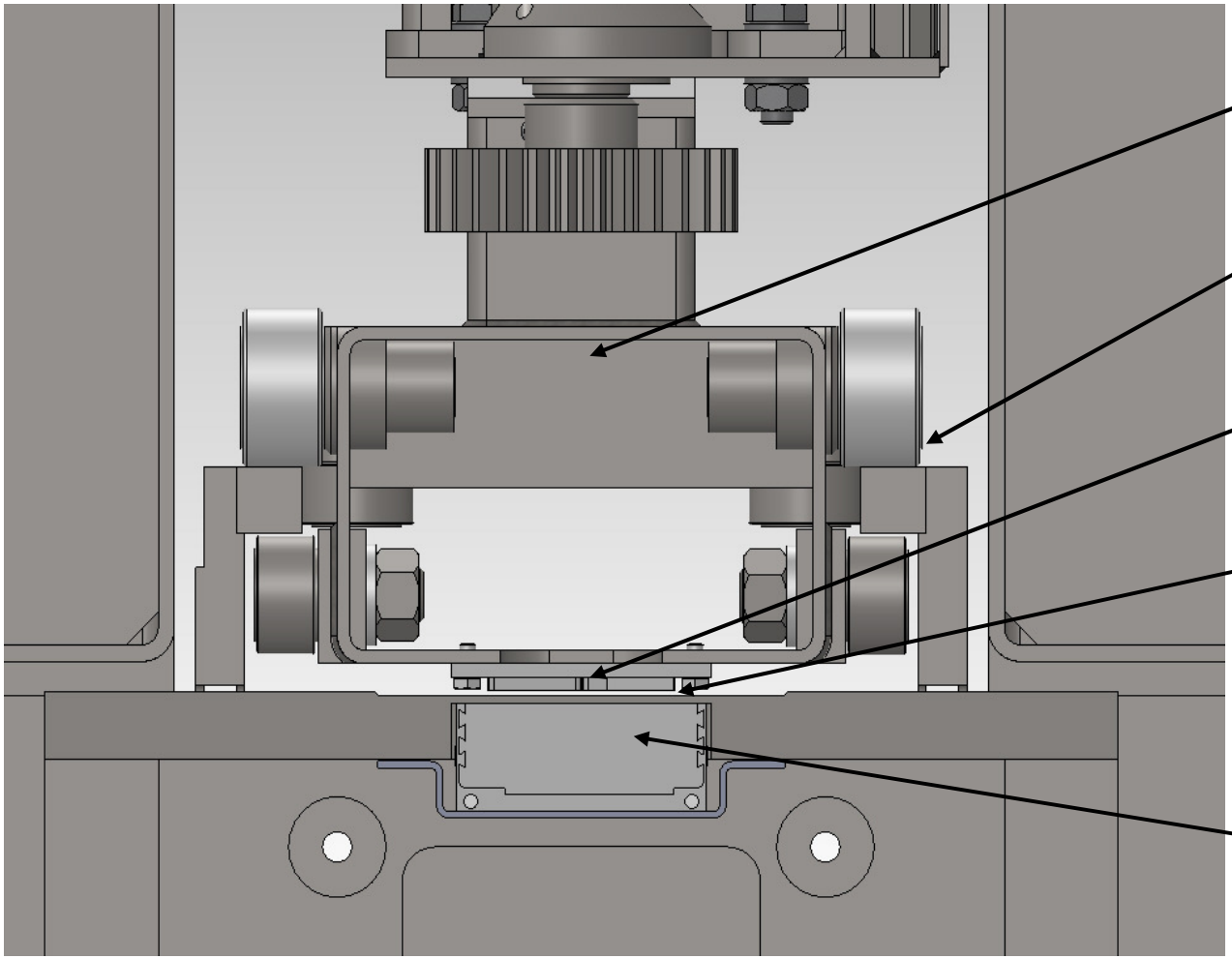
Transportation:
Linear Motion System
运输：
线性传动系统

Transportation: Linear Motion System (LMS)
运输： 线性传动系统

- **LMS: multiple position sensors**



Transportation: Linear Motion System (LMS)
运输： 线性传动系统



Carrier
运转小车

Rails
传感器

Magnet plate
磁场板

Cavity:
No Contact!
没有接触

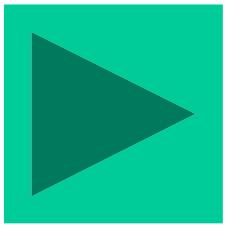
Motor coil
马达线圈

Transportation: Linear Motion System (LMS)
运输： 线性传动系统

By placing several coils in line, the carriers can move independently on the rails.
线圈的直线摆放，使小车能在轨道上独立运行

Hall sensors detect the position of each carrier.
高性能传感器能检测到每个小车的位置

Transport System 传动系统



metalliner
BY HAUZER

Racks and Spindles
导轨和装夹杆

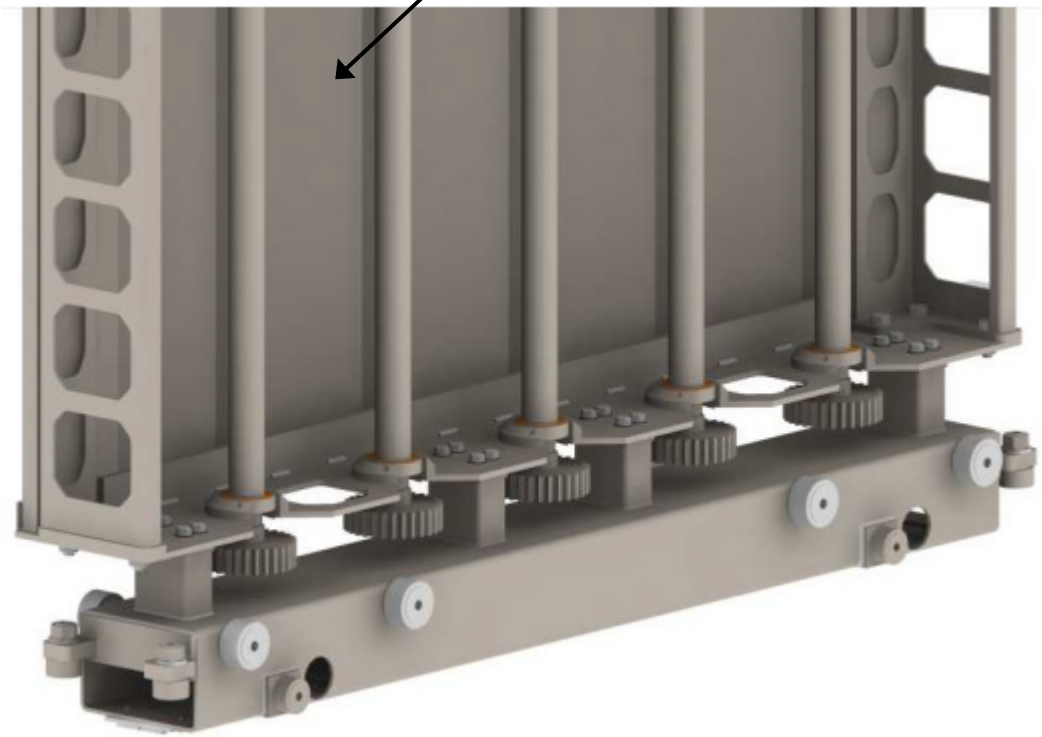
Metalliner: Racks and Spindles 导轨和装夹杆

Metalliner: Racks and Spindles 导轨和装夹杆

- **Loading Volume - 1.5m x 1.2m x 0.2m including rotation**
- **有效涂层装载空间- 1.5m x 1.2m x 0.2m 含旋转**

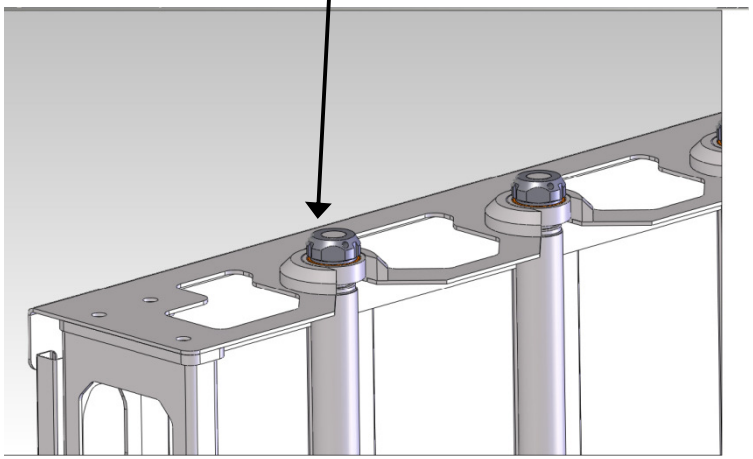
Metalliner: Racks and Spindles 导轨和装夹杆

Shields are part of the rack 屏蔽板是导轨的一部分

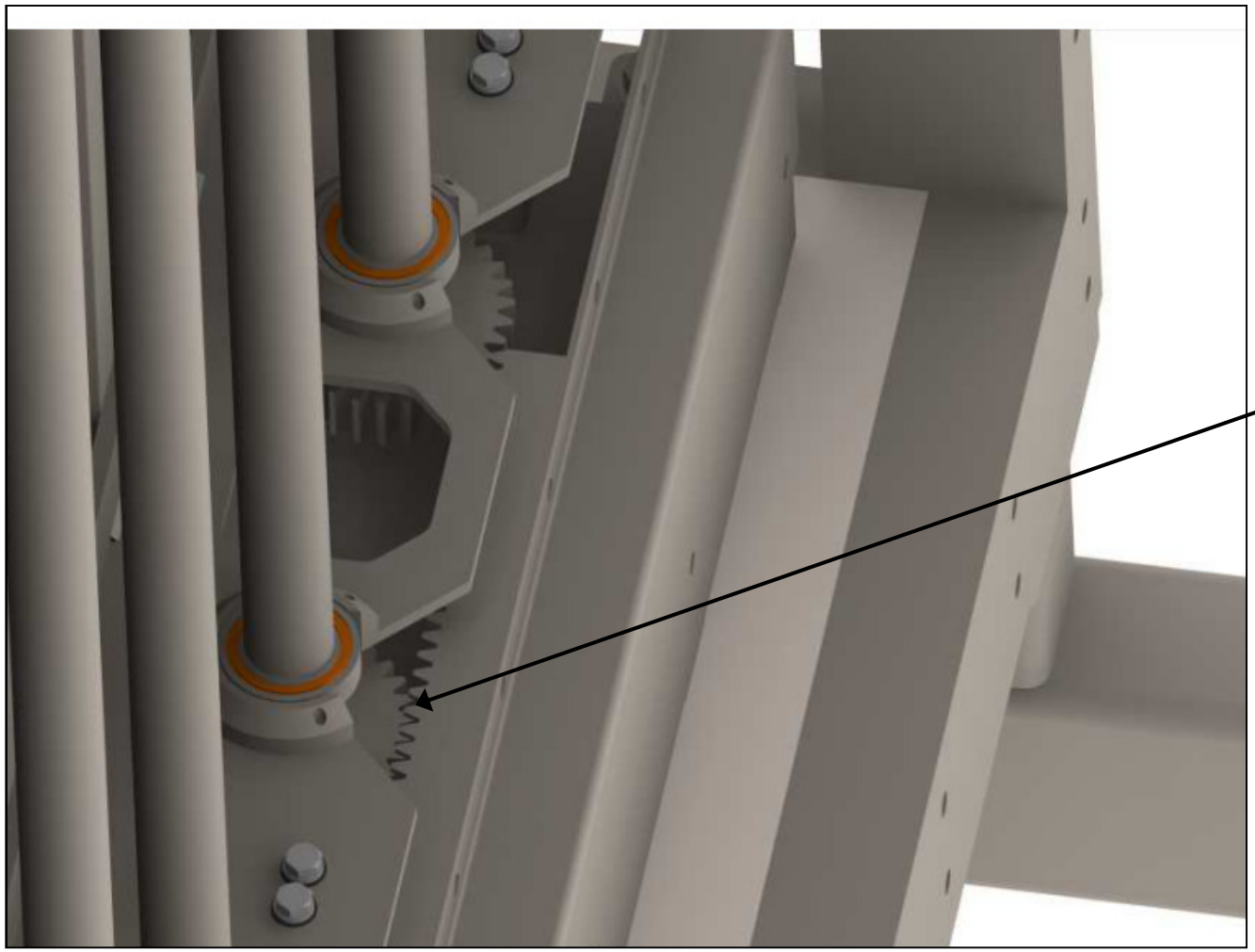


Interface for pick and place unit

界面用于拿取和安放部件单元



Metalliner: Racks and Spindles 导轨和装夹杆



Gear as a part of the Spindle and Cam shaft as part of the machine

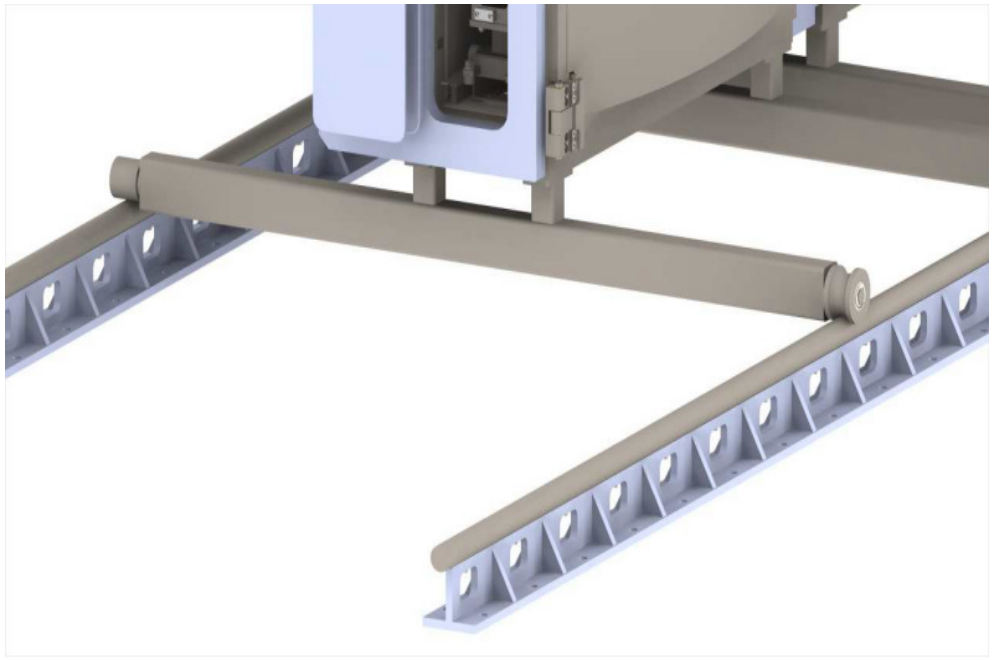
For spindle rotation

齿轮为装夹杆的一部分，凸轮轴为设备的一部分

用于装夹杆的旋转

Modularity:
Growing with your production needs
模块化设计：
随您的产量而增加

Modularity: Growing with Your Production Needs
模块化设计：随您的产量而增加

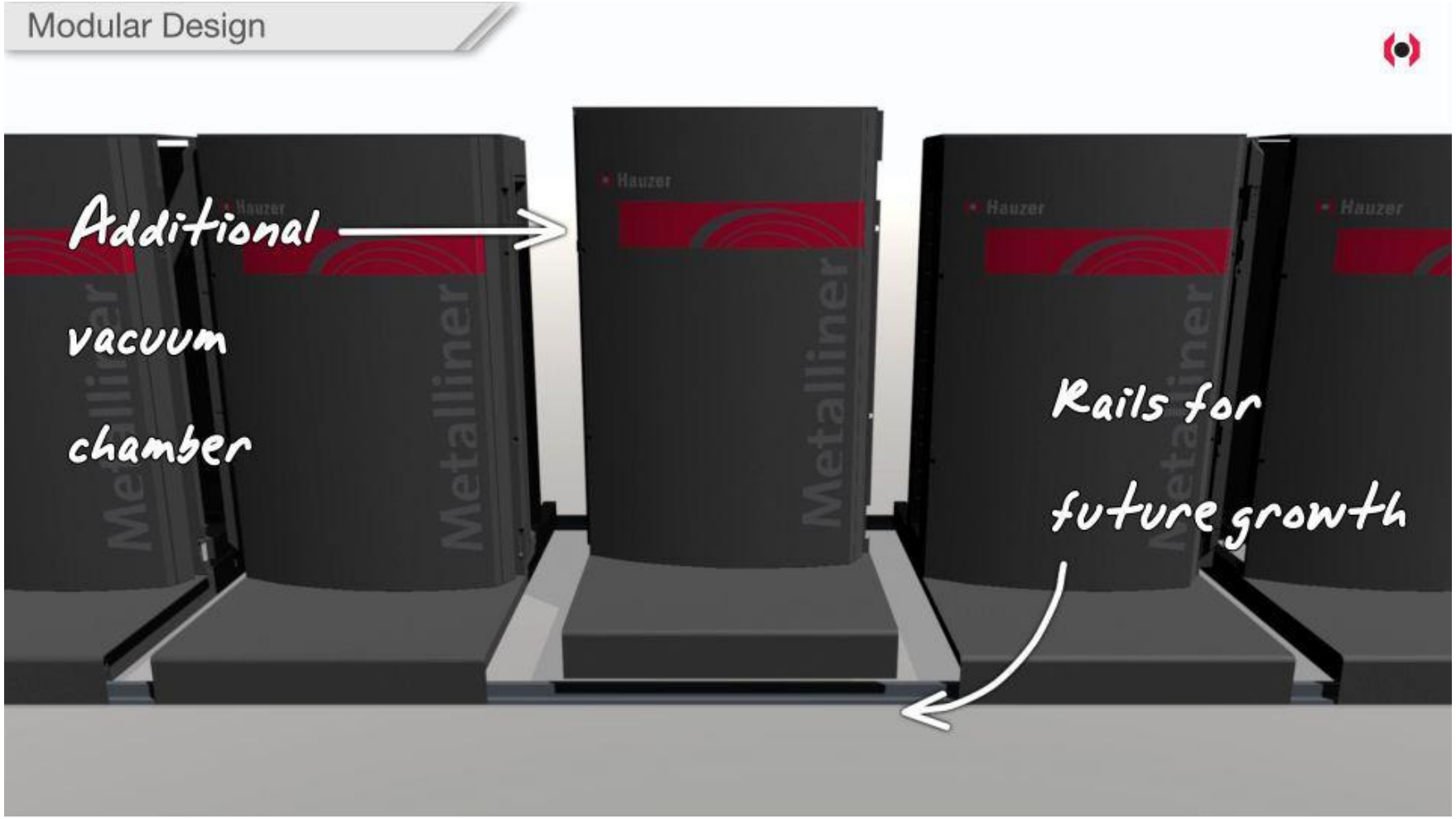


Each chamber has its own frame
每个腔体都有独立框架
Each frame is put on the rail
各个框架均安放在导轨上

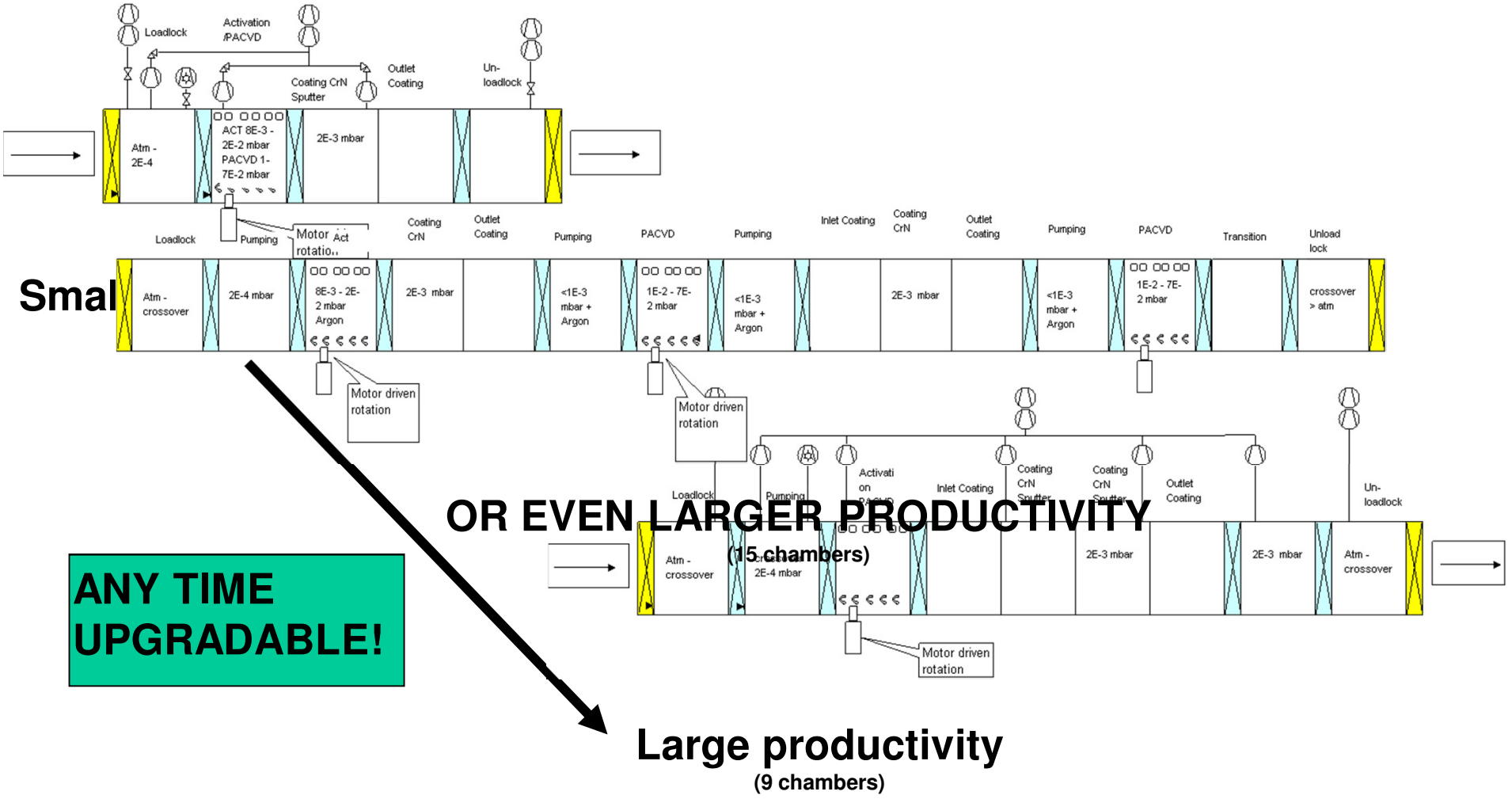
This allows:

- ✓ **Easy maintenance**
- ✓ **Serviceability**
- ✓ **Upgradability**
- ✓ 易于维护
- ✓ 提高使用性能
- ✓ 可随时升级

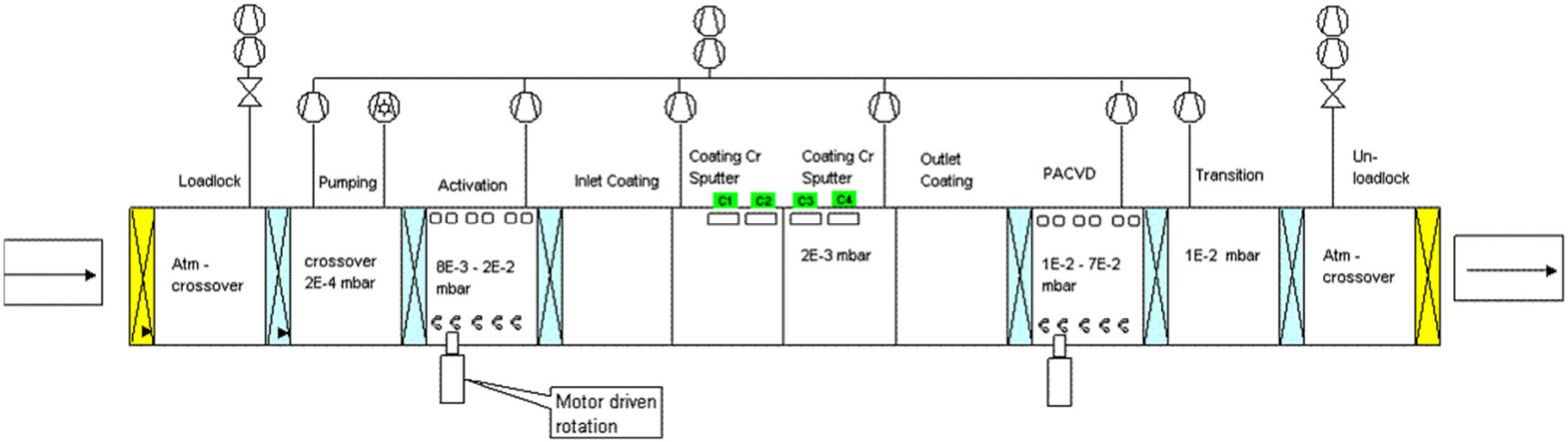
Modularity: Growing with Your Production Needs
模块化设计：随您的产量而增加



Modularity: Growing with Your Production Needs
模块化设计：随您的产量而增加

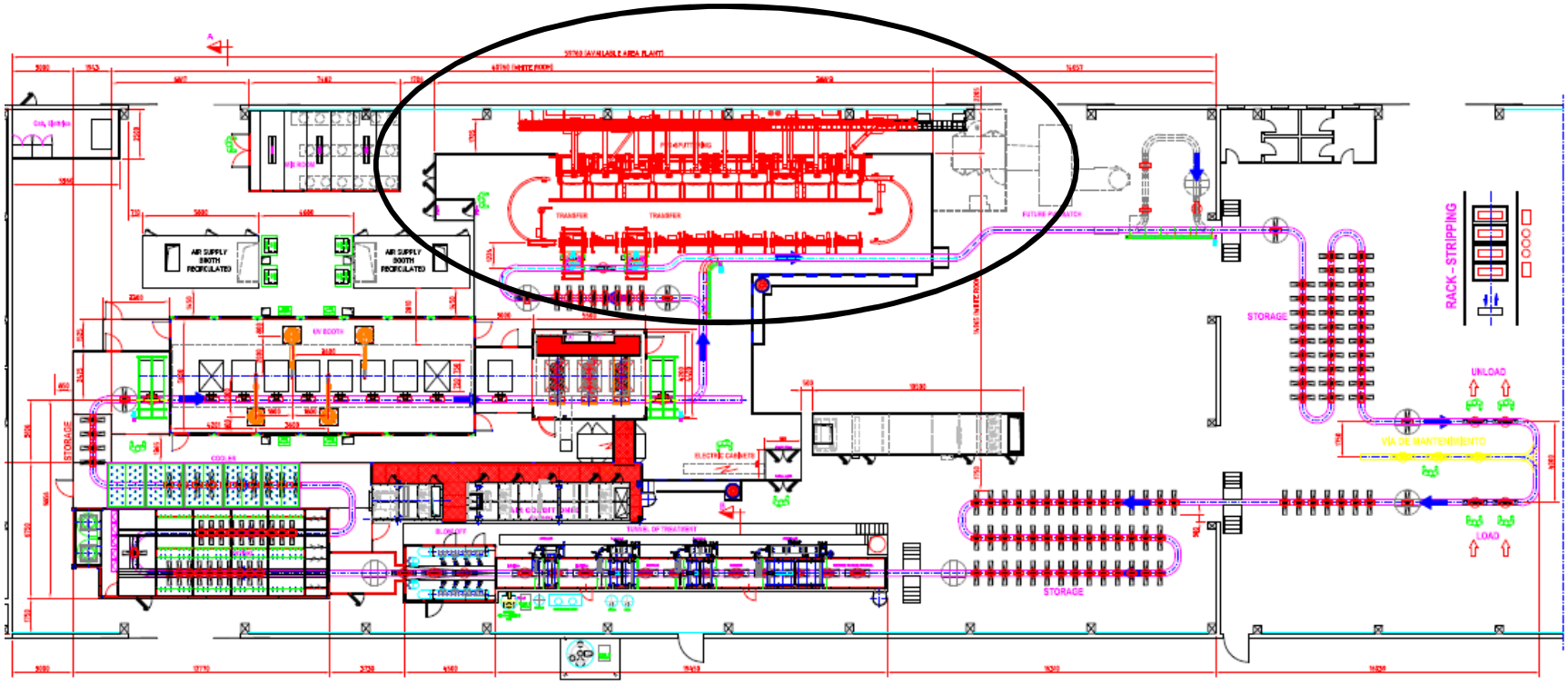


10-Chamber Version, Including SiO_2 Topcoat
10个腔体，包括SiO_2 顶部涂层



- **10 chambers** **10个腔体**
- **Technology is PACVD and UBM Sputtering** **PACVD和UBM技术**
- **Activation (= MF Ar Plasma) same as PACVD technology** **激活性与PACVD相同**
- **Takttime for 0,4 µm Cr sputtering - 60 seconds (1,8 M^2)**
- **Takttime for 0,4 µm Cr sputtering and rotation - 2,9 minutes (4,7 M^2)**
- **Takttime for Cr incl. PACVD Topcoat - 60 seconds (1,8 M^2)**
- **Takttime for Cr incl. PACVD Topcoat and rotation - 3,2 minutes (4,7 M^2)**

Layout Cromatipic® Project Cromatipic® 布局



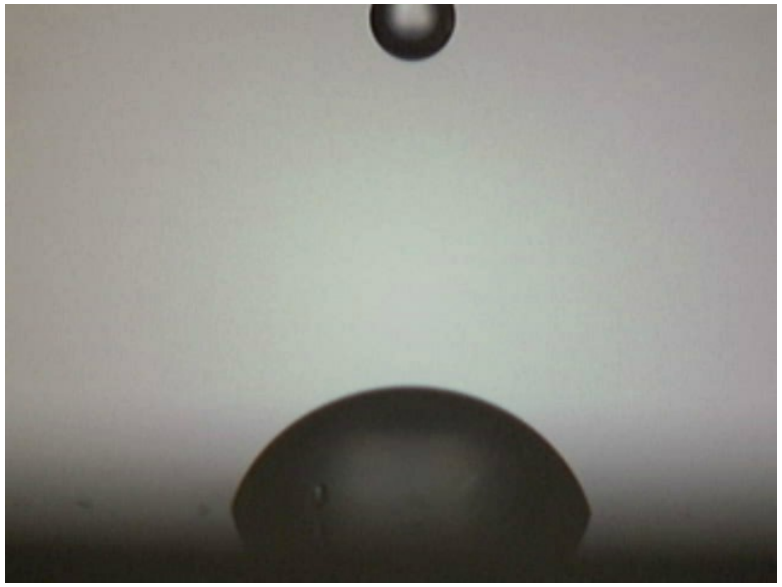
Metalliner fully integrated in the Cromatipic® production line
Full traceability of racks (components)
Metalliner与Cromatipic® 产品生产线完全融合
导轨的完整追踪性 （部件）

10-Chamber Version – Coating Properties
10个可视腔体 – 涂层性能

Activation of the Polymer Surface – 表面活化

Ar or Ar/N_2 Plasma by 40 kHz MF Plasma Generator

Contact Angle of H_2O Droplet

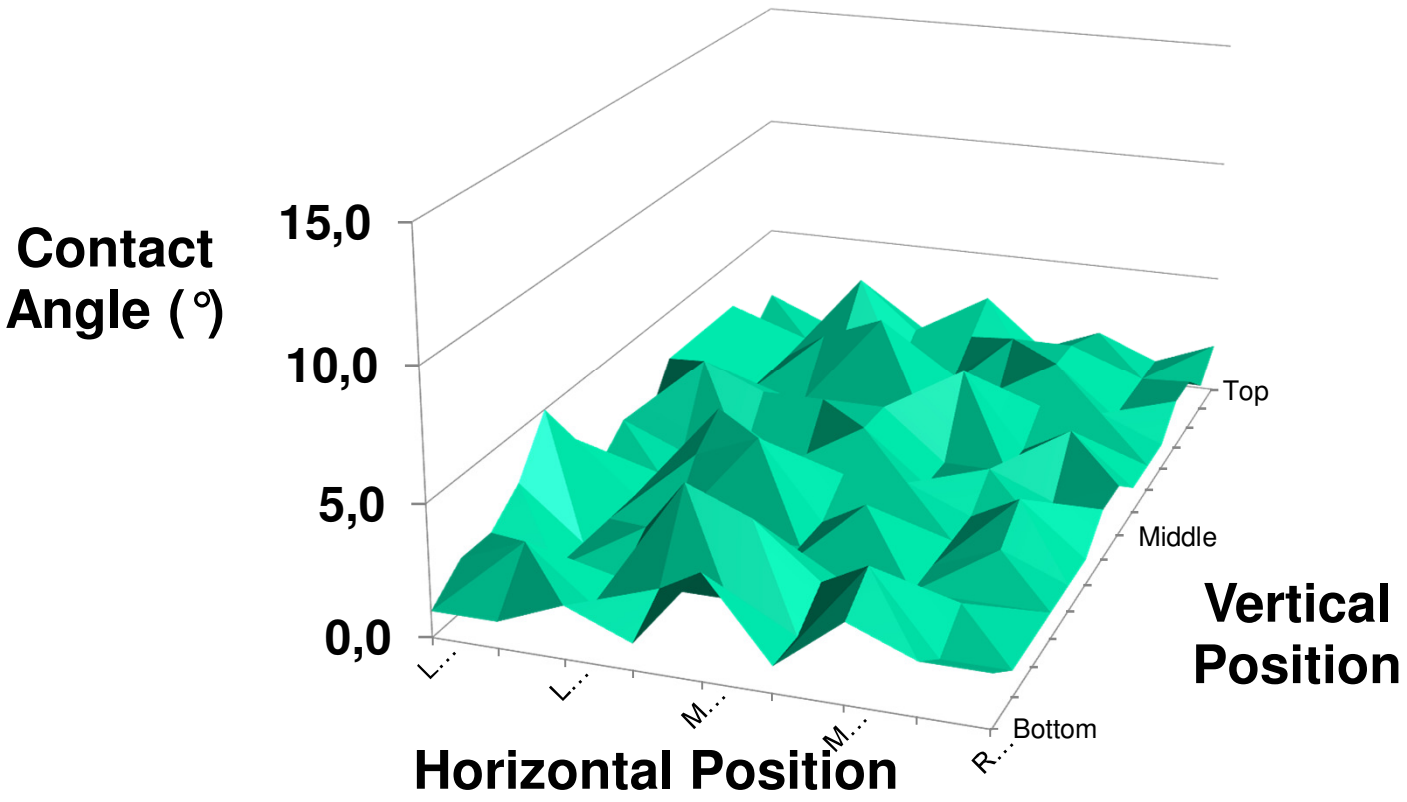


Before: $\theta \approx 75°$

After: $\theta < 5°$

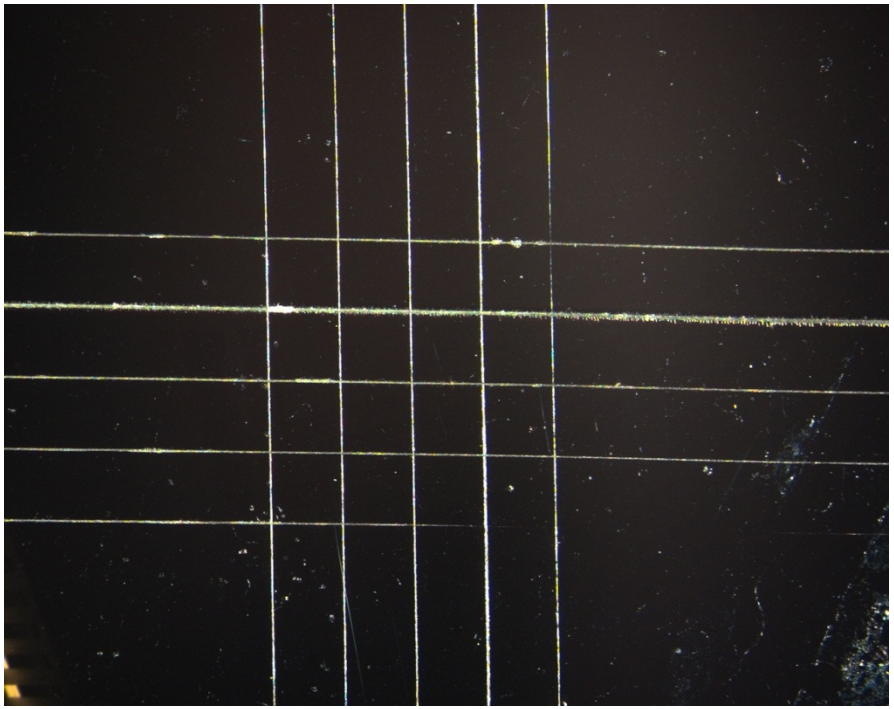
10-Chamber Version – Coating Properties
10个可视腔体 – 涂层性能

Activation Uniformity
激活均匀性



10-Chamber Version – Coating Properties
10个可视腔体 – 涂层性能

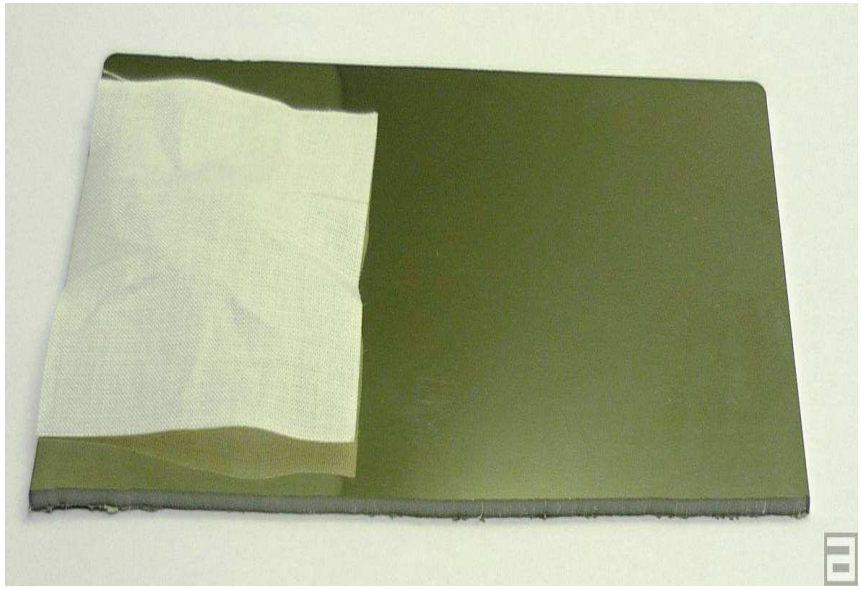
Adhesion by Crosshatch Tape Test (EN ISO 2409)



10-Chamber Version – Coating Properties
10个可视腔体 – 涂层性能

Contribution of the Top Coat (SiO_2)

Crockmeter Test, DIN EN 20105-A03 (100 cycles, load 900g)

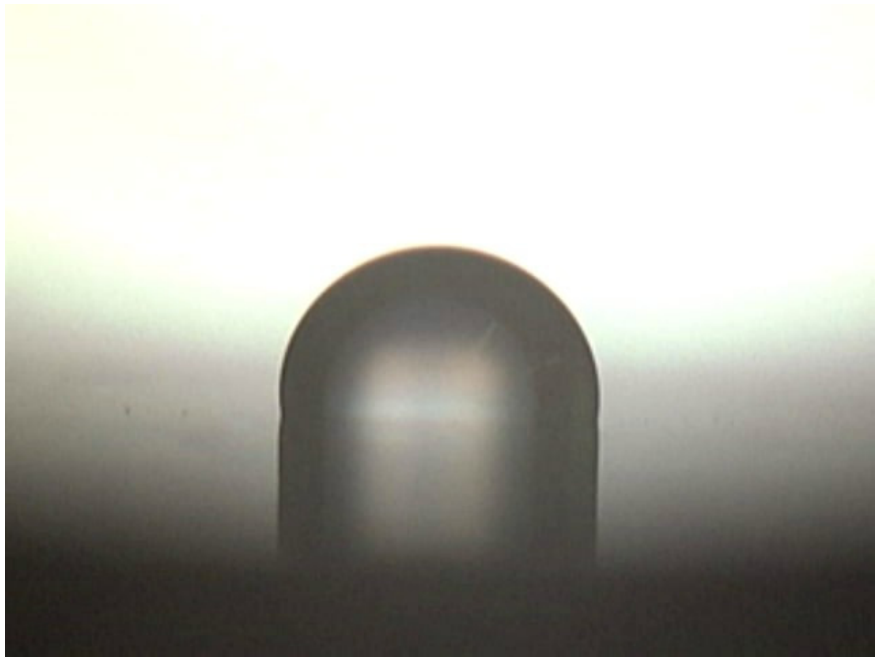


With Top Coat (SiO_2)

10-Chamber Version – Coating Properties
10个可视腔体 – 涂层性能

Contribution of the Top Coat (SiO_2)

Hydrophobicity – Fingerprint Resistivity

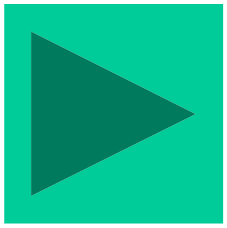


Cromatipic only $\theta \approx 27°$

Cromatipic© + Top Coat $\theta \approx 102°$

Conclusions 结论

metalliner
BY HAUZER



THANK YOU
FOR YOUR ATTENTION

非常感谢！