

MRAY OEM: Small form-factor quality control for anyone. The possibilities revealed

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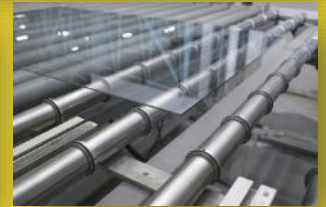
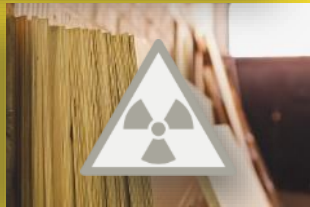
34 Hofer Vliesstofftage 6 November 2019

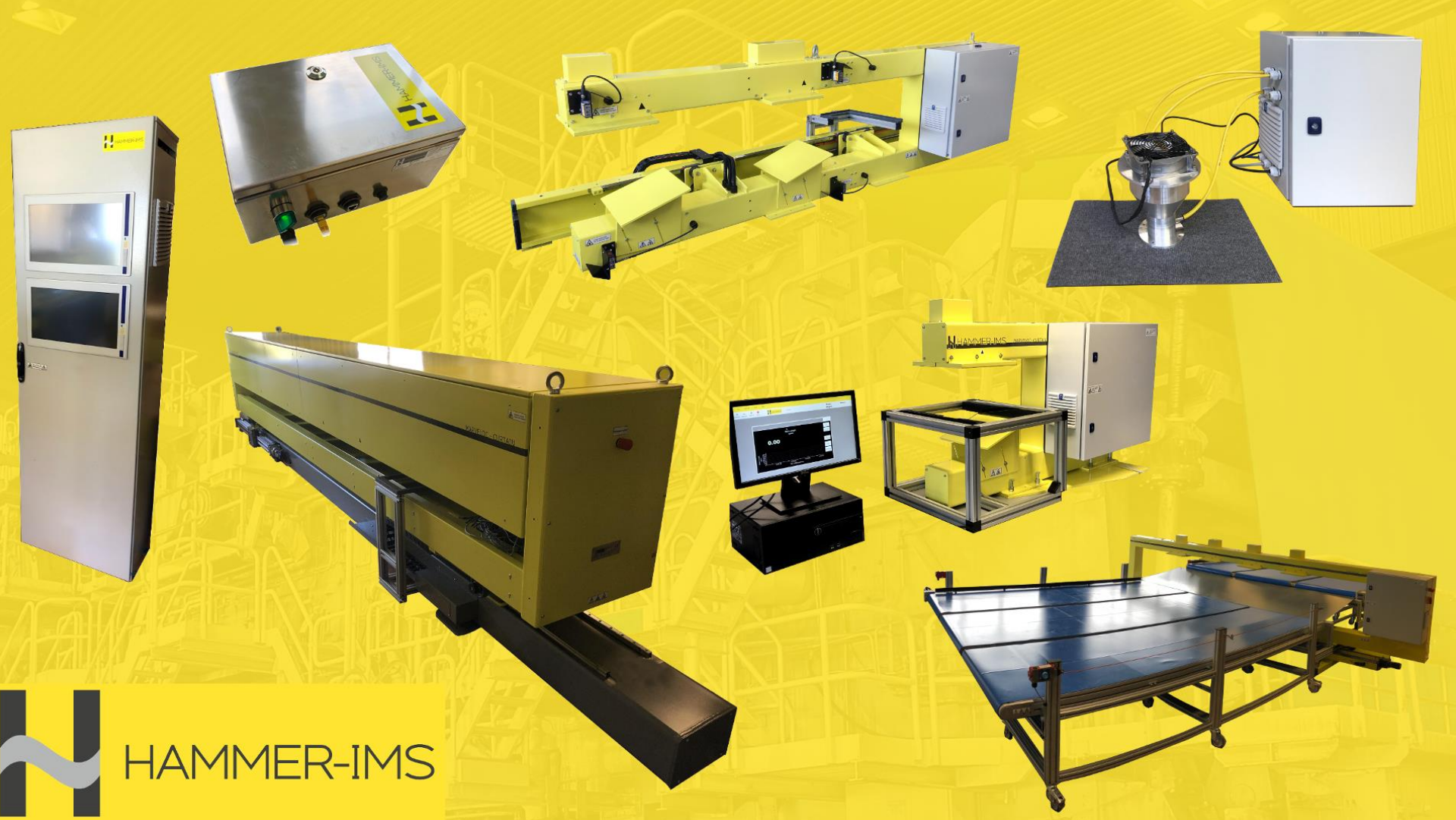


HAMMER-IMS

Who are we?

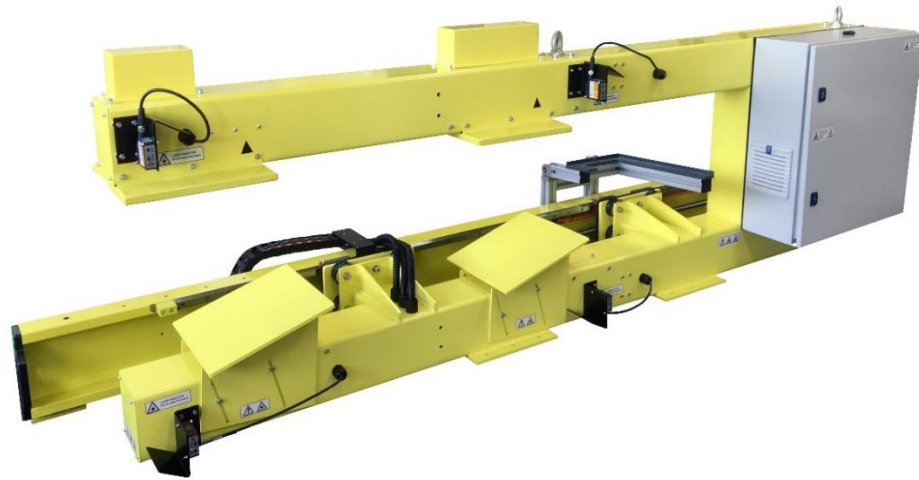






HAMMER-IMS

C-Frame solution





HAMMER-IMS

MARVELOC - CURTAIN

0-Frame solution

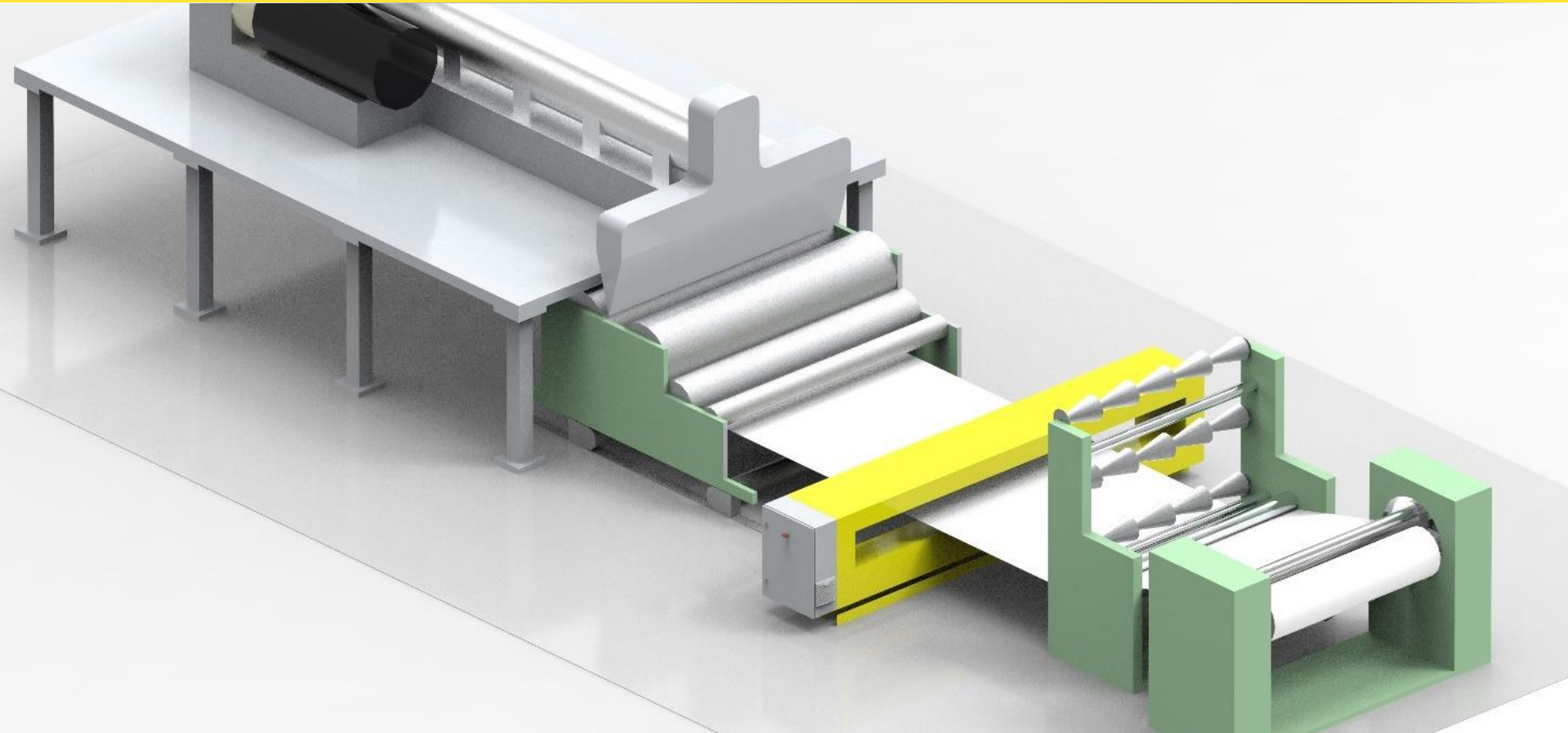




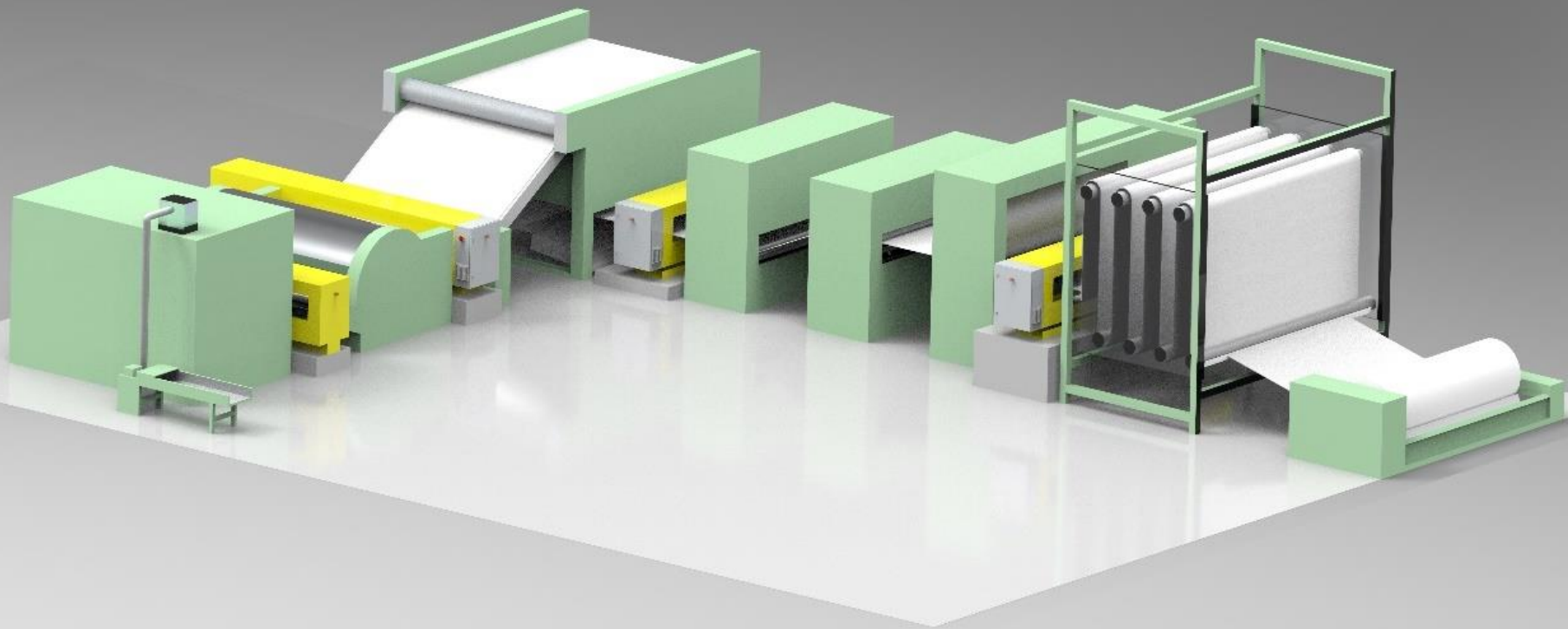
EQUIPEMENT
ANTI-BRUIT
OBLIGATOIRE

MARVELOC 602 CURTAIN

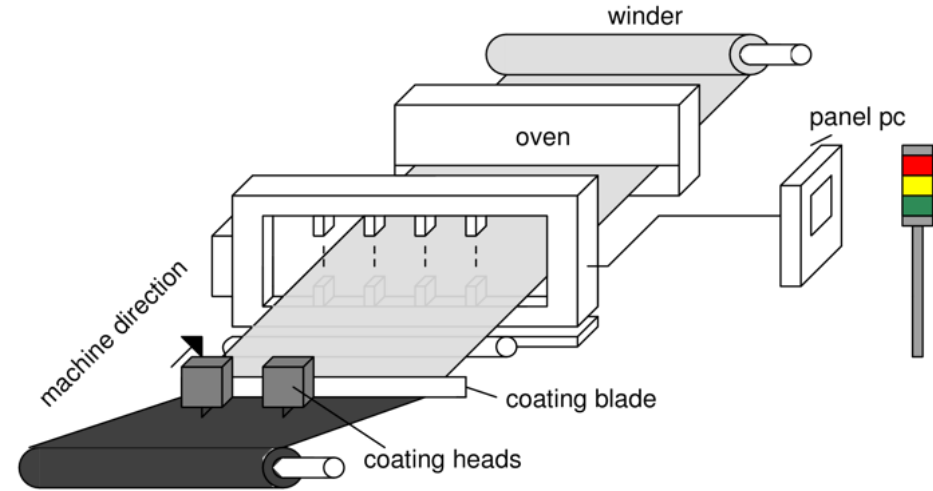
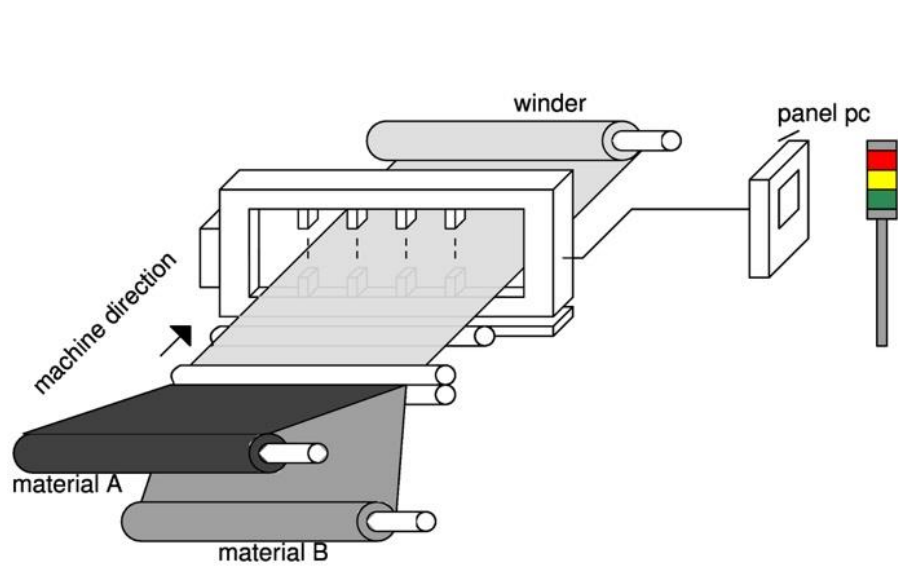
Extrusion



Drylaid



Lamination & Coating

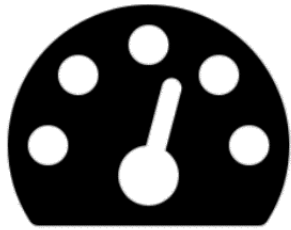


MRAY OEM MODULE

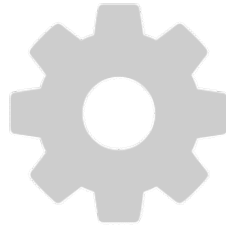
FOR BASIS-WEIGHT MEASUREMENTS



Hammer-IMS measuring systems



*M-Ray technology
and electronics*



*Frames and
mechanics*



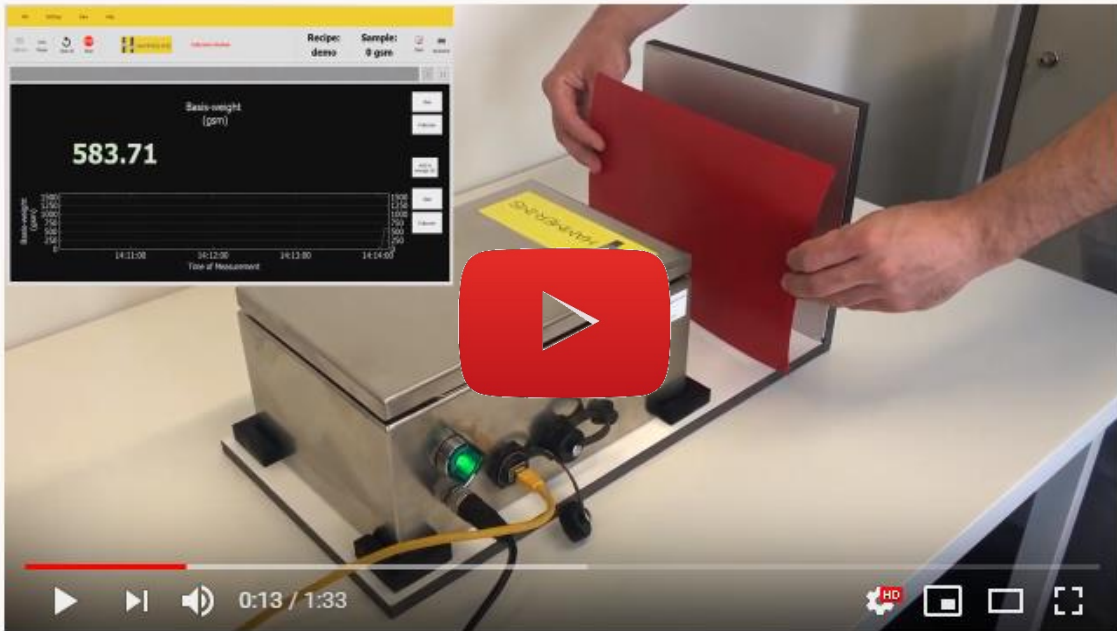
*Software and
support*





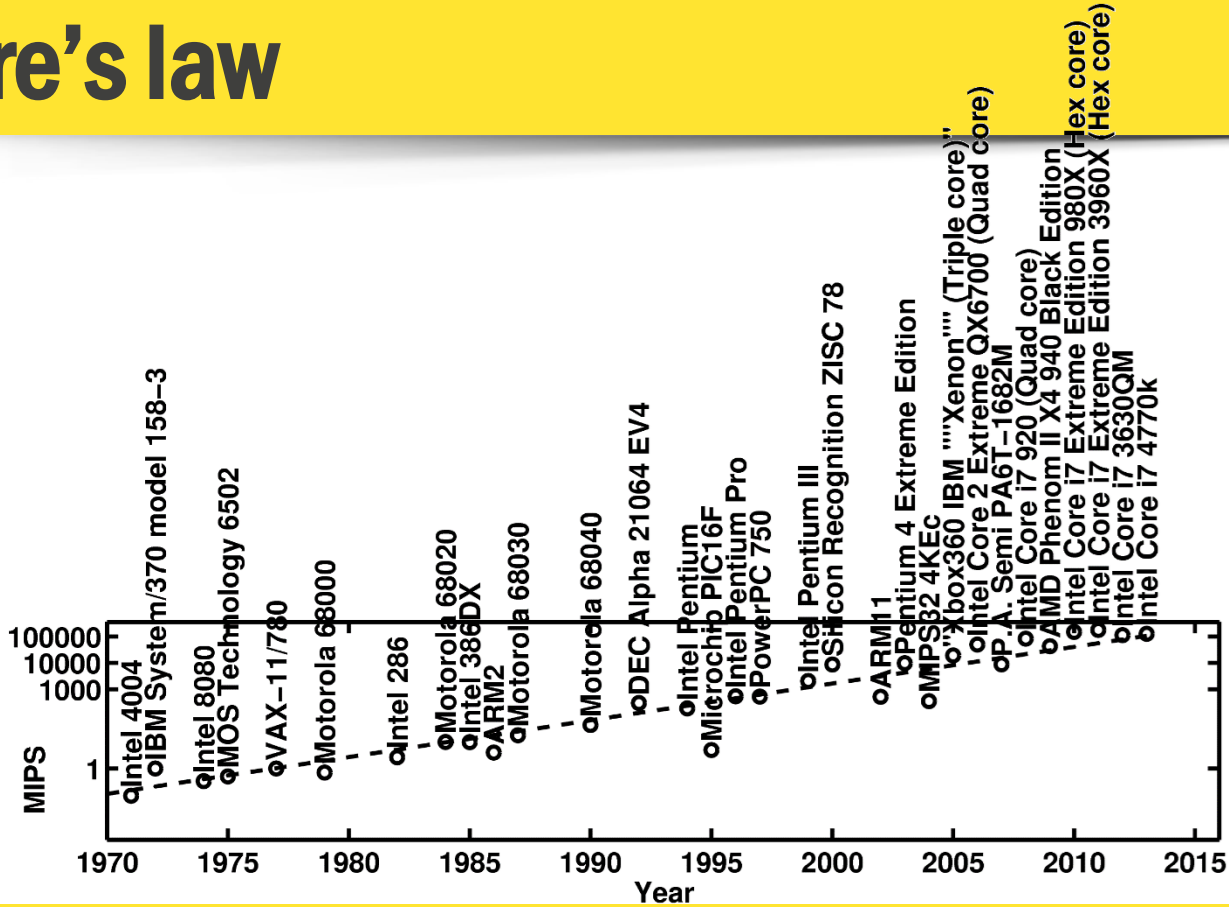
YouTube^{BE}

hammer-ims



M-Ray OEM Module by Hammer-IMS

Moore's law



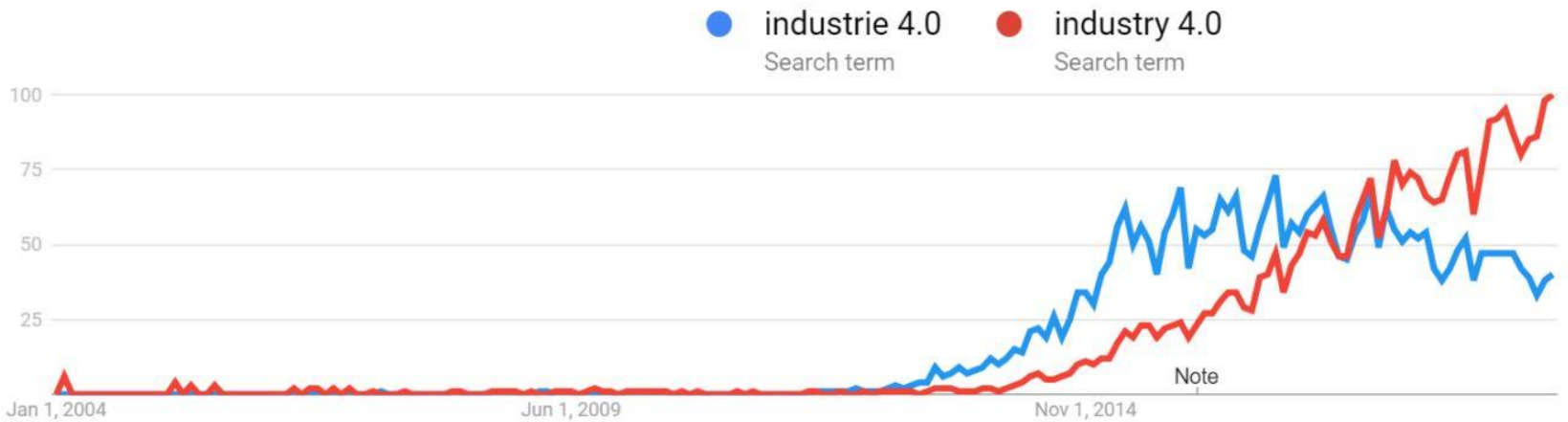
Moore's law at Hammer-IMS



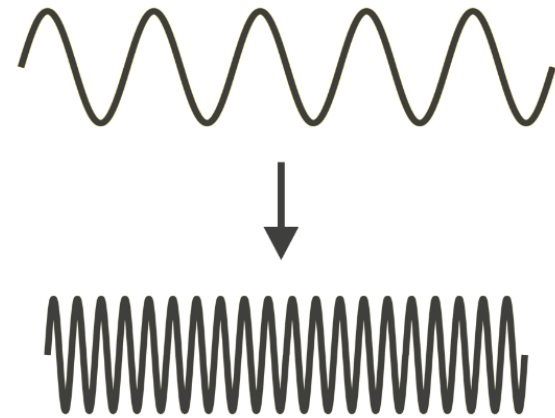
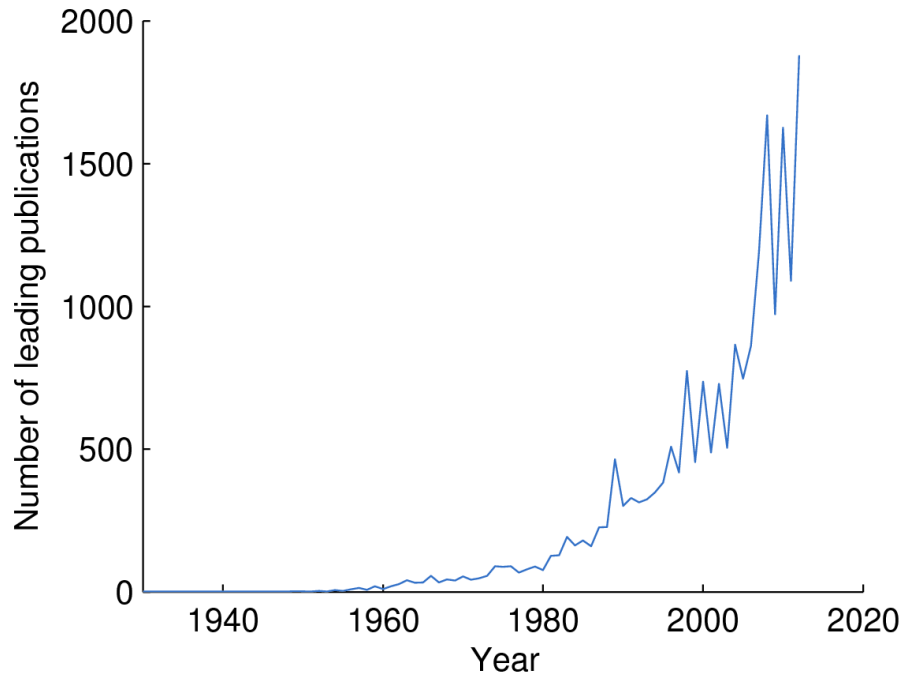
The future



Interest over time

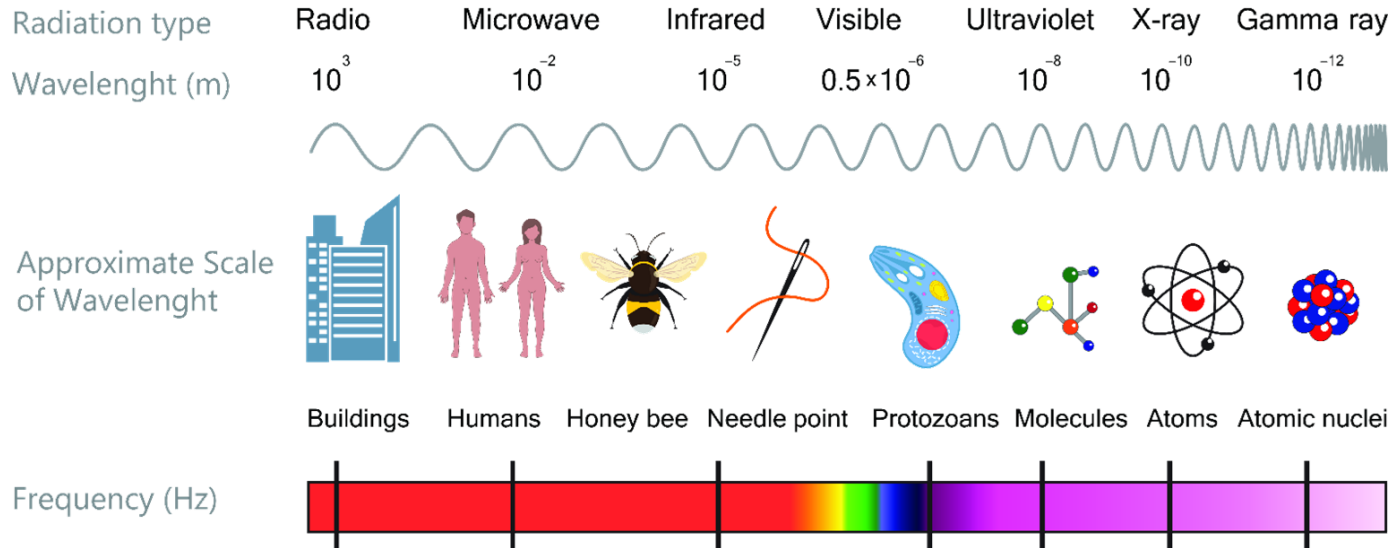


Multi-GHz -> Millimeter waves



Millimeter waves

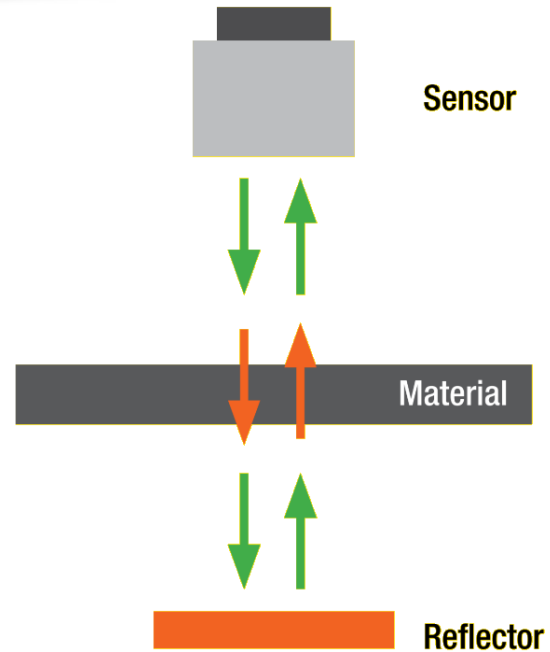
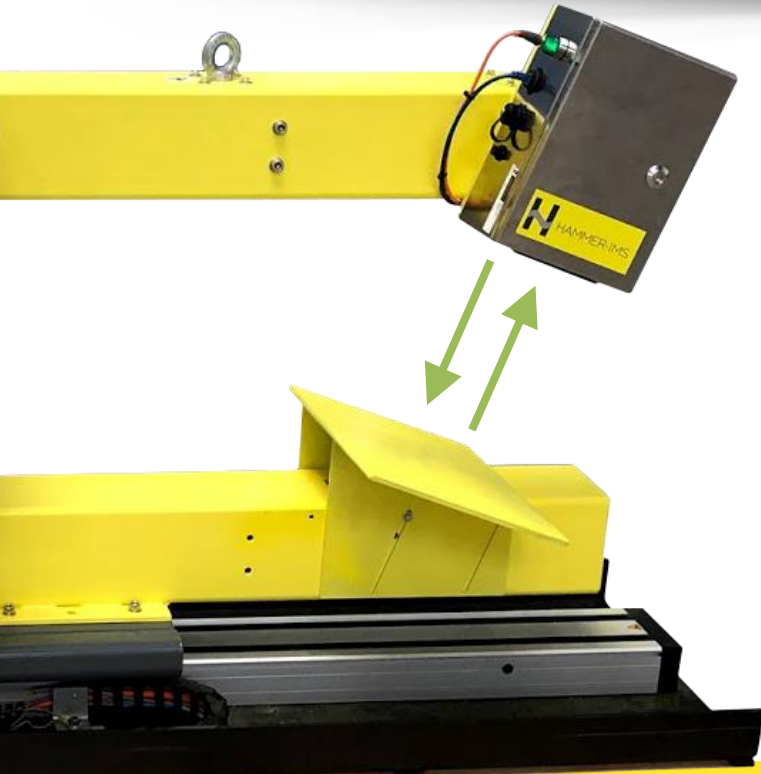
Electromagnetic Spectrum







Measuring time spans



Precision

$$\sigma^2 \geq \frac{c_{\text{air}}^2 \cdot 3}{4 \cdot \pi^2 \cdot T \cdot \text{SNR} \cdot \left[(f_c + \text{BW}/2)^3 - (f_c - \text{BW}/2)^3 \right]}$$

- GPS system: 20 meter altitude precision at 20200 km distance: relative precision of 1e-6
- Hammer-IMS system: 1 micrometer at 0.6 m distance: relative precision of 1.67e-6

Measured parameter vs. basis weight

- M-Ray

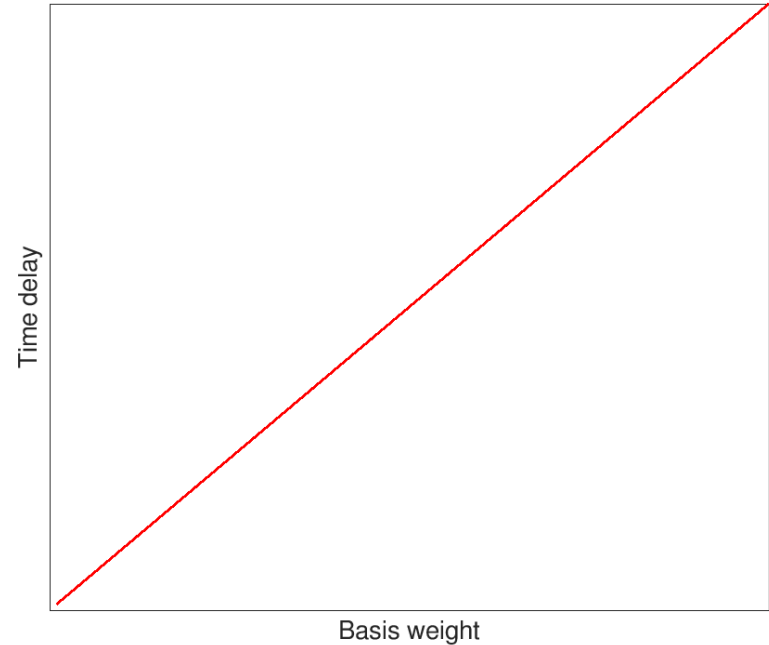
$$\Delta t = \frac{d}{c}$$

Where

Δt : wave time delay after traveling through the material

c : speed of electromagnetic waves in the material (material dependent)

d : amount of material per unit of area (e.g. gram per square meter)



Measured parameter vs. basis weight

■ Isotopes & X-Ray

$$\Delta I = \Delta I_0 e^{-\mu d}$$

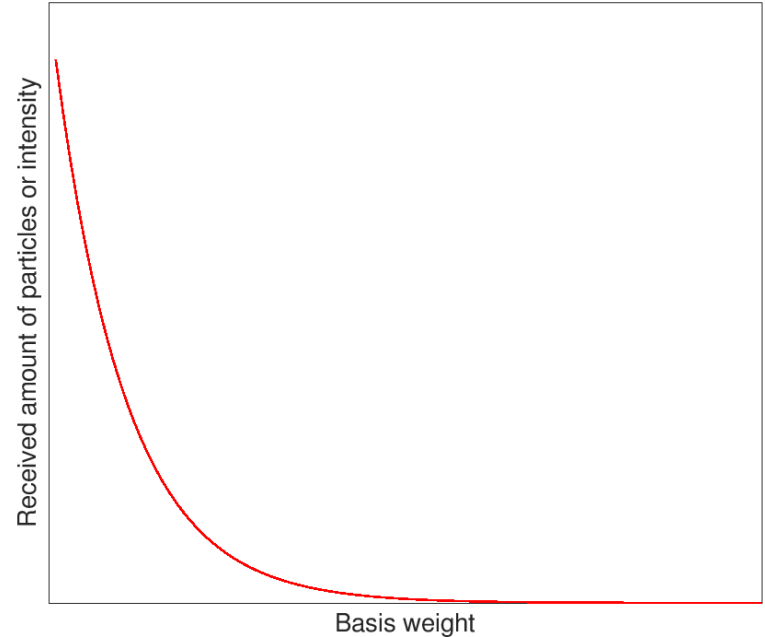
Where

ΔI : amount of detected particles (or intensity) after traveling through the material

ΔI_0 : amount of incident particles (or intensity) after traveling through air (same measuring path but without material)

μ : absorption coefficient of the material (material dependent)

d : amount of material per unit of area (e.g. gram per square meter)



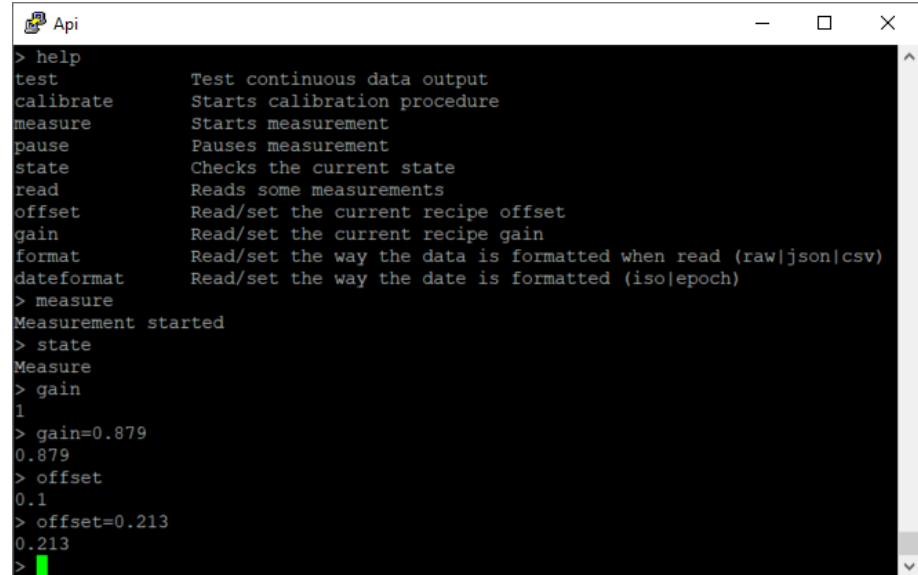
Product Description

- For machine builders and sensor integrators. For scientific researchers or enthusiasts who are passionate about non-nuclear measuring innovations.
- Is sold 'as is' and can be accessed through our OEM Programming interface.
- Next version's OEM Programming interface will also support multi-sensor use of the OEM module, so you can use several OEM-modules in a single application.
- Shipment: OEM module + cabling, embedded software, OEM Programming interface description, demo material, OEM programming source code.
- Support: Hammer-IMS can provide some assistance related to wireless regulatory and application development, where needed.
- In principle, this unit enables you to make your own flavor of a Marveloc-CURTAIN scanner system.



OEM Programming interface

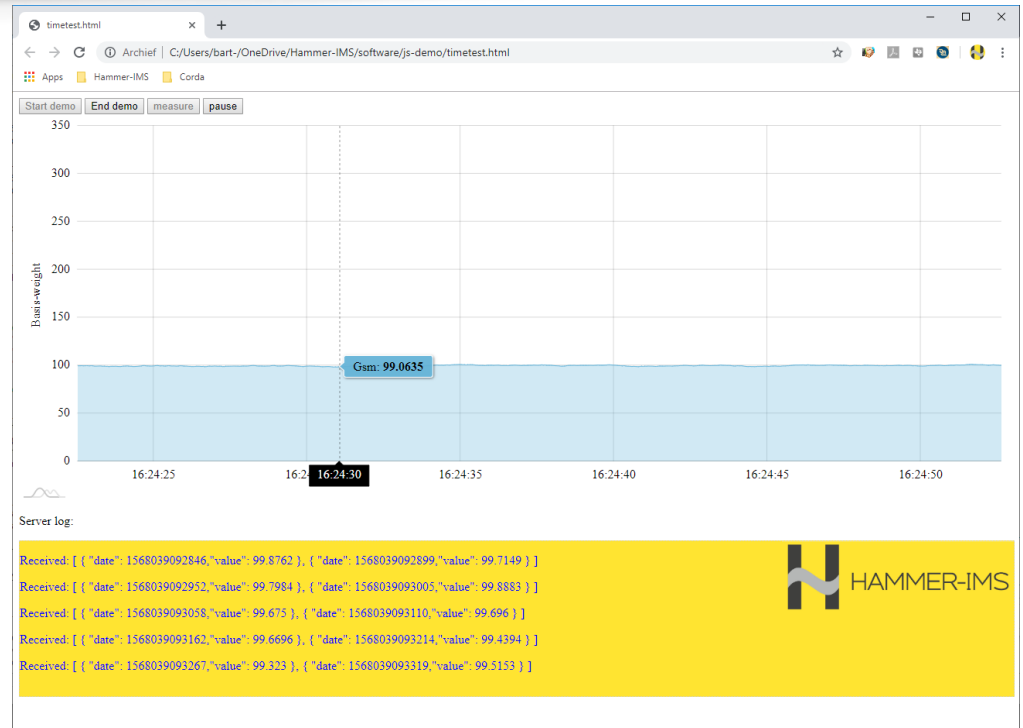
- TCP interface
 - Port 3201
 - Raw socket interface
 - For use with low level programming languages like C/C++
 - Accessible through Telnet or serial client



```
Api
> help
test          Test continuous data output
calibrate     Starts calibration procedure
measure       Starts measurement
pause         Pauses measurement
state         Checks the current state
read          Reads some measurements
offset        Read/set the current recipe offset
gain          Read/set the current recipe gain
format        Read/set the way the data is formatted when read (raw|json|csv)
dateformat    Read/set the way the date is formatted (iso|epoch)
> measure
Measurement started
> state
Measure
> gain
1
> gain=0.879
0.879
> offset
0.1
> offset=0.213
0.213
>
```


OEM Programming interface

- Websocket interface
 - Port 3202
 - Standard websocket (RFC 6455)
 - For use with high level programming languages like Javascript
 - Simple example provided



OEM Programming source code

- An open-source demo application working straight from your web browser

```
<script>
var interval;
var websocket;
var serverLog;
var startButton;
var endButton;
var statusline;
var chart;
var samples;
var loglines;
// amCharts parser has issue parsing csv/epoch combination
var dateFormat = "json"; // json | csv
var dateFormat = "epoch"; // iso | epoch
var parser;

var websocketEchoServerUri = "ws://localhost:3202";

am4core.ready(function() {

samples = 0;
loglines = 0;

serverLog = document.getElementById("server-log");
startButton = document.getElementById('start-demo');
endButton = document.getElementById('end-demo');
measureButton = document.getElementById('measure');
pauseButton = document.getElementById('pause');
statusline = document.getElementById('status');

// Themes begin
am4core.useTheme(am4themes_animated);
// Themes end

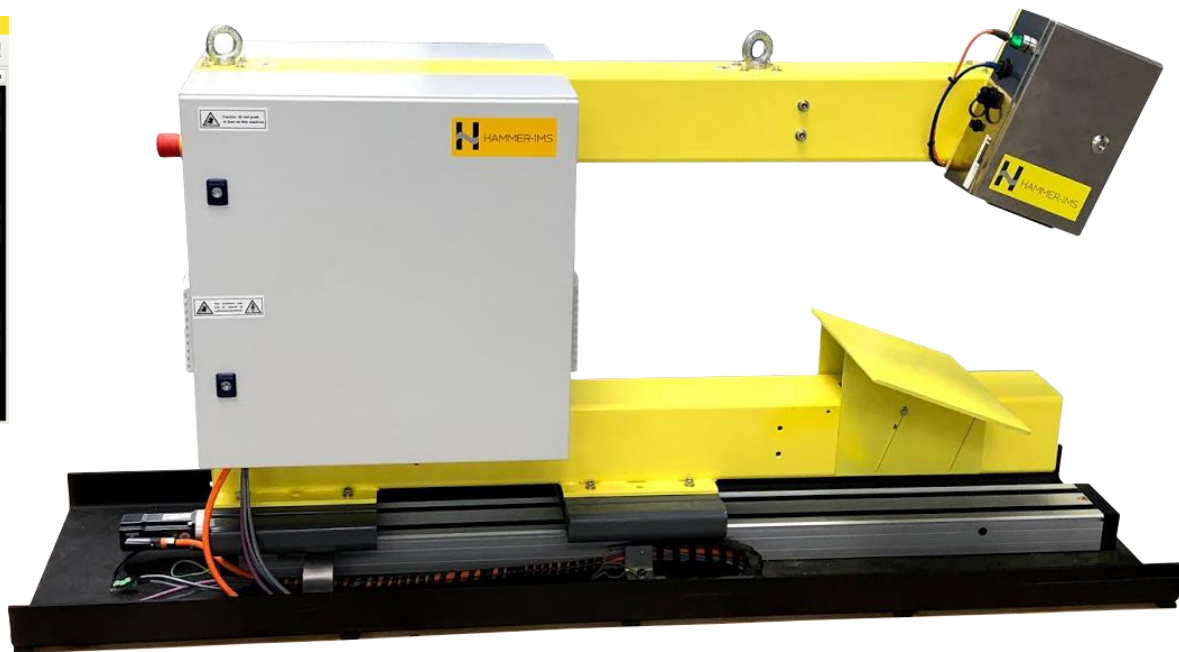
// Create chart
chart = am4core.create("chartdiv", am4charts.XYChart);

var dateAxis = chart.xAxes.push(new am4charts.DateAxis());
dateAxis.baseInterval = {
  "timeUnit": "millisecond",
  "count": 1
};
dateAxis.tooltipDateFormat = "HH:mm:ss";

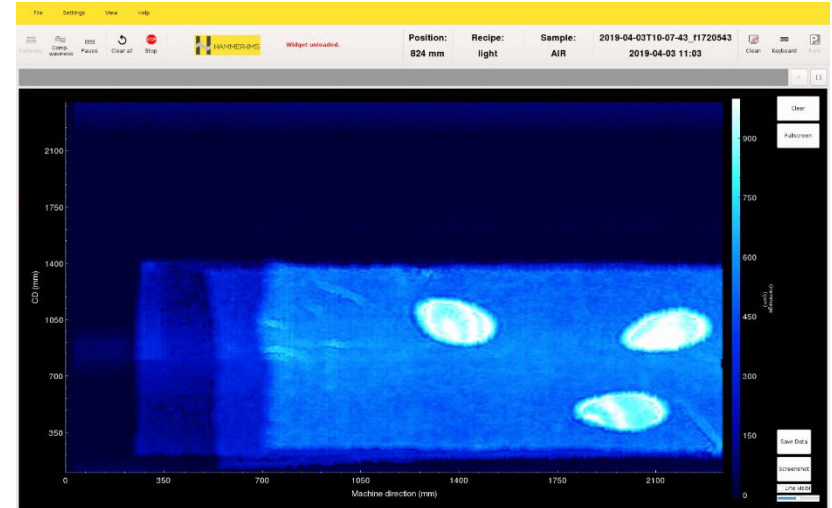
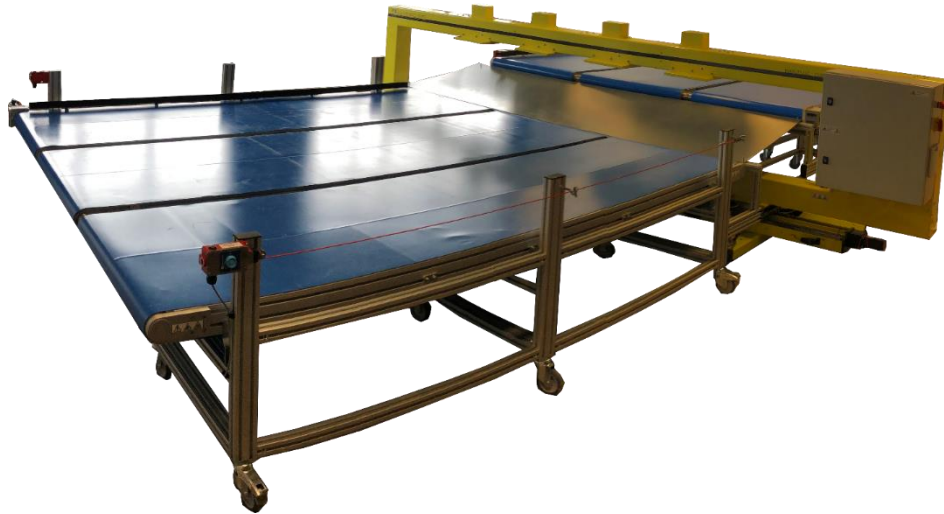
var valueAxis = chart.yAxes.push(new am4charts.ValueAxis());
valueAxis.tooltip.disabled = true;
valueAxis.title.text = "Basis-weight";
valueAxis.min = 0;
valueAxis.max = 350;


```

C-frame integration for inline applications



Lab solutions for 100 % quality control

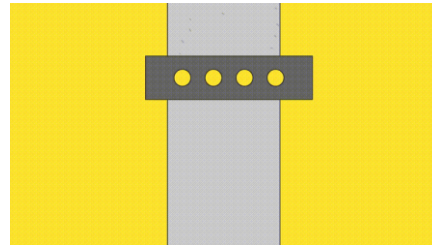
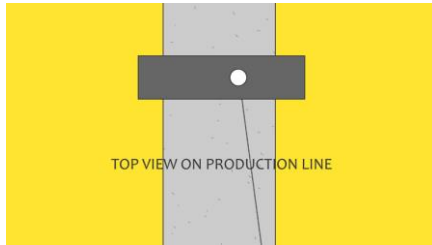


What do sensor integrators and machine builders get?

- No issues with radioactive licenses
 - Easy to transport and to handle
- Compatible with humans and environment
- Competitive pricing

What do end-users get?

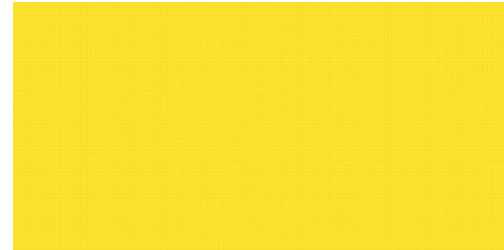
- Reduction of cost-of-ownership up to 150.000,00 Euro over the lifetime of a system (non-nuclear topology)



- No risk on material damage: Contactless system with measurement gap of 30 cm and more (30x higher than traditional systems) -> thick materials possible

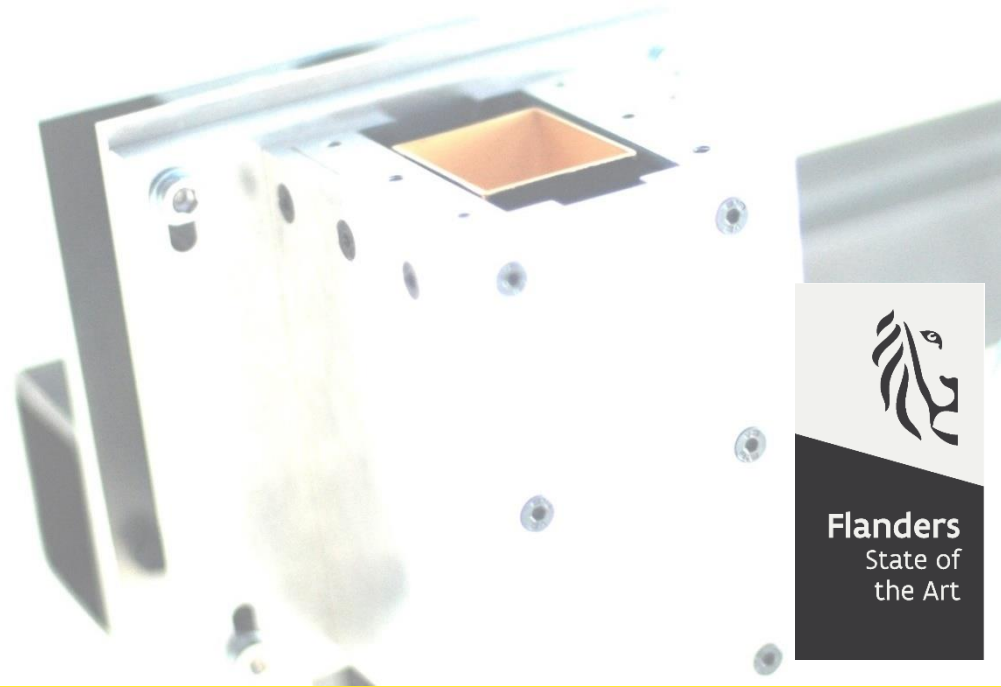


- 4x higher coverage (and even more) than traditional scanner thanks to 4 (or more) sensor head pairs



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State of
the Art