



BEYOND: A new generation of optimized E-beam & X-Ray irradiation solutions

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Life,
Science.

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INDUSTRIAL
SOLUTIONS



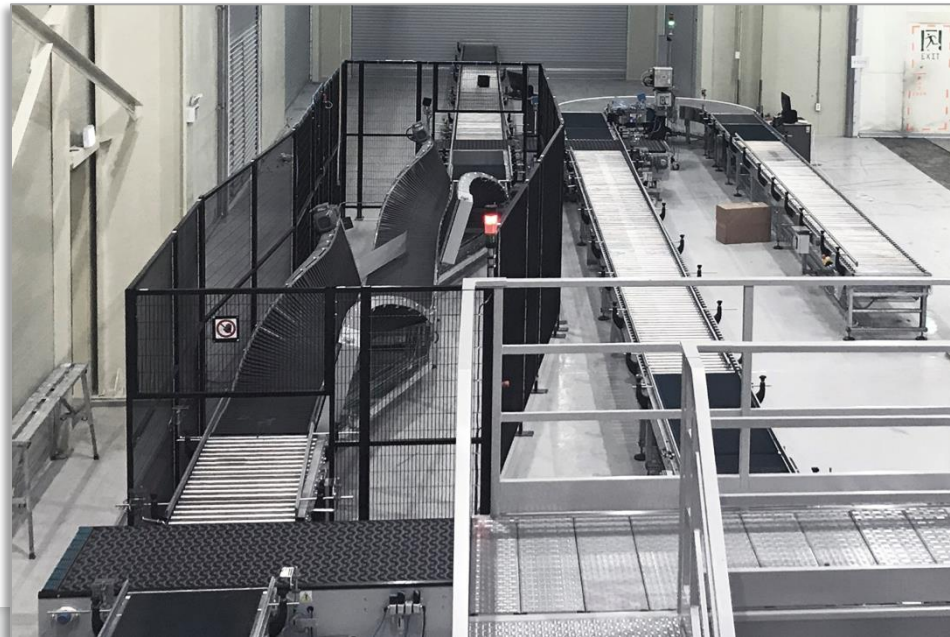
BEginning of the story.

- More than **50 Rhodotron** in use today all around the world contribute to making the technology more robust and mature.
- New in-house players are looking to build their own irradiation centers.
- X-ray is booming as a technology, but the whole irradiation process is not yet mastered by most irradiation facility users.



BEYOND, a new perspective.

- Even the best accelerator is useless if not combined within a proper **integrated solution**.
- Up to 30% of efficiency can be lost if the solution is not correctly optimized
 - ❓ Lower production capacity
 - ❓ Higher cost of operations
 - ❓ Bigger CO2 footprint



BEYOND, a compl

Shielding or Bunker
Energy & process dependent

Beam scanning & dose control
Linear, variable, parametric release

The Rhodotron
The electric engine for all solutions

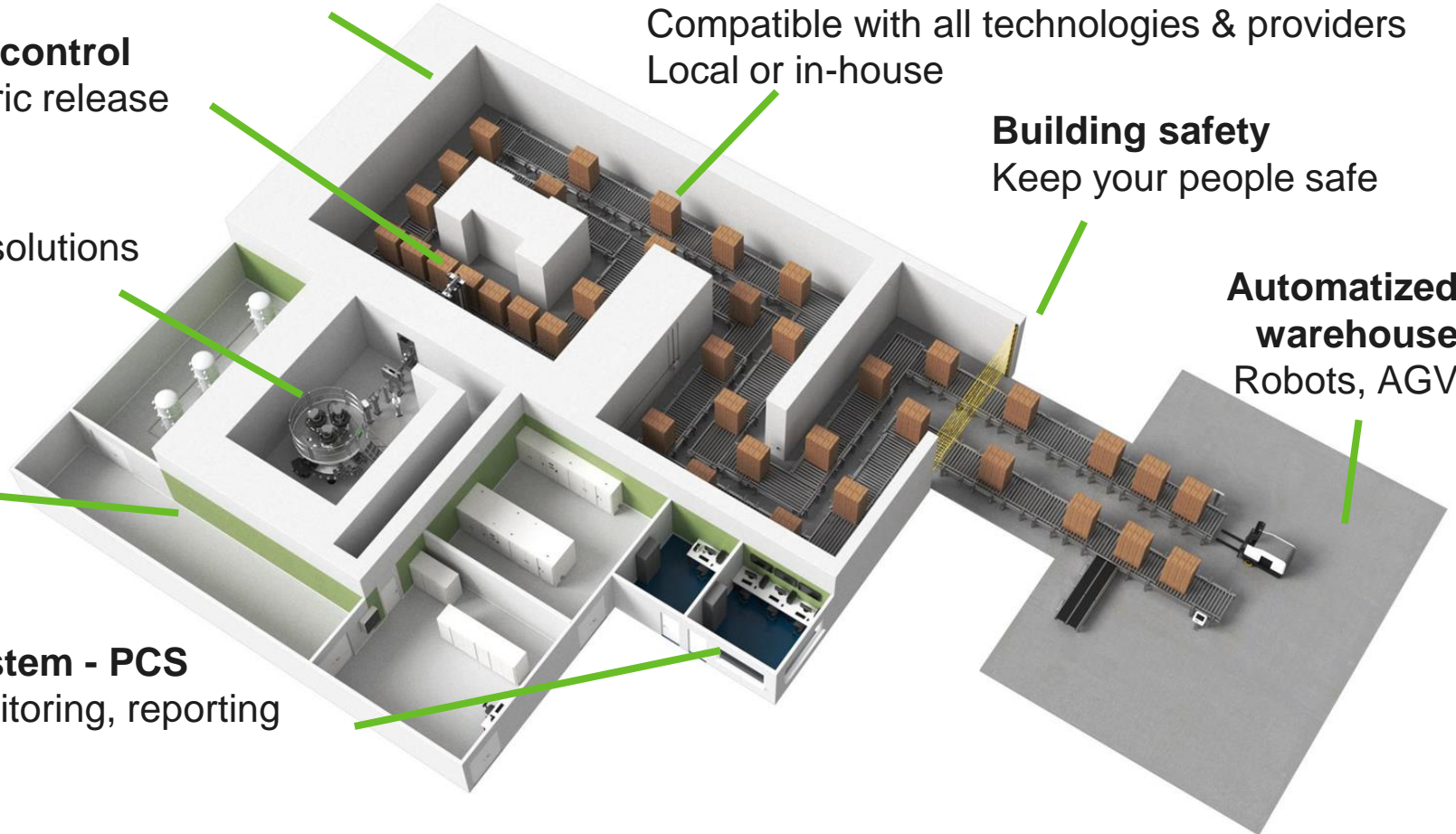
Ancillaries
Dosimetry, control, electrical
Ozone, maintenance
Energy supply

Process Control System - PCS
Recipes, control, monitoring, reporting
Interface with ERP

The conveyor: Box, tray, totes, pallet
Compatible with all technologies & providers
Local or in-house

Building safety
Keep your people safe

Automatized warehouse
Robots, AGV



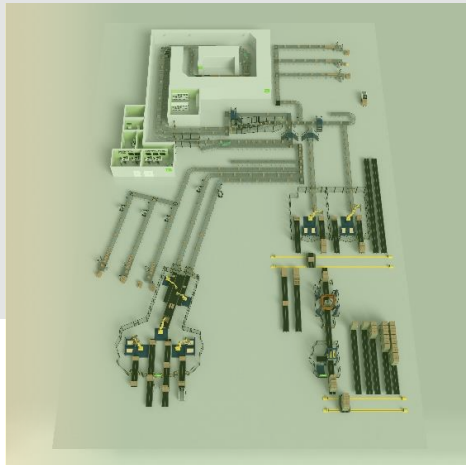
BEYOND, a complete solution.



BEYOND is a solution we build hand in hand to answer your needs & requirements

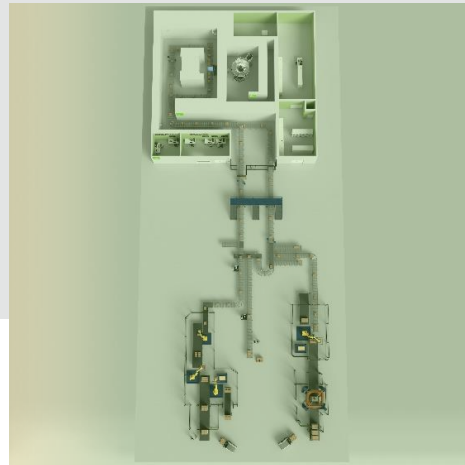
| BE EFFICIENT |

Volume.
Get the most out
of our technology .



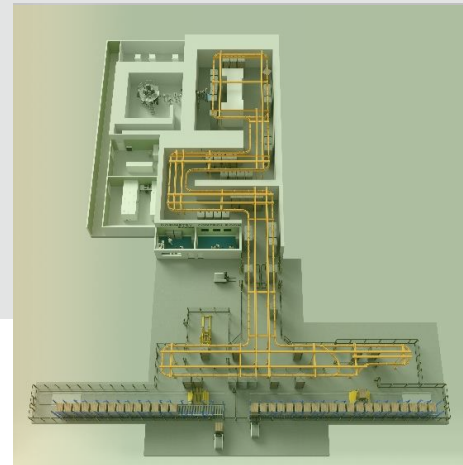
| BE SOFT |

Delicacy.
Your products
are in good hands.



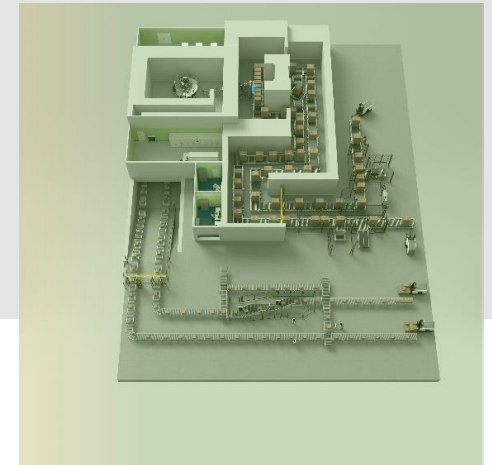
| BE WIDE |

Penetration.
Packaging is not
an issue.



| BE FLEX |

Versatility.
A solution to face
any situation.



BEYOND, a complete solution.



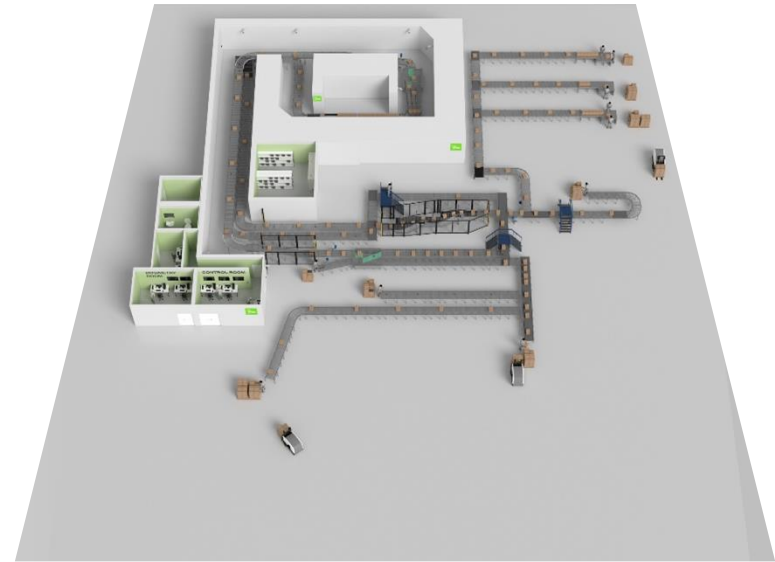
Powered by
the Rhodotron®



Be Efficient

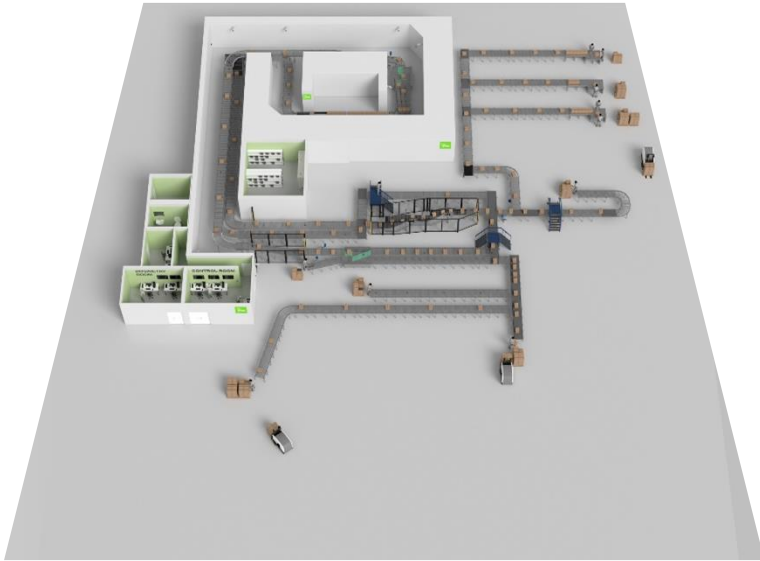
Finding the best solution for your business model

Conveyor flexibility

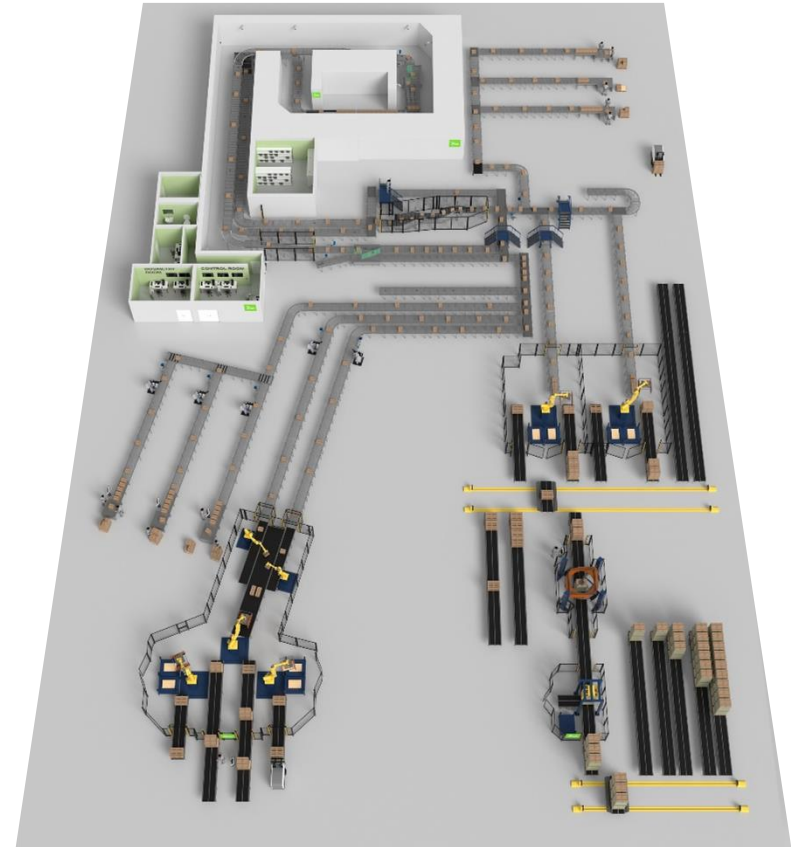


- More unloading lines bring flexibility in the product flow
 - Batches can be mixed under the beam
- Compatibility with trays allow small cartons and bags

How much automation is needed?



- Automation allows to increase the throughput further.
 - Can be added as needed.
- Hybrid mode with manual and automated operation

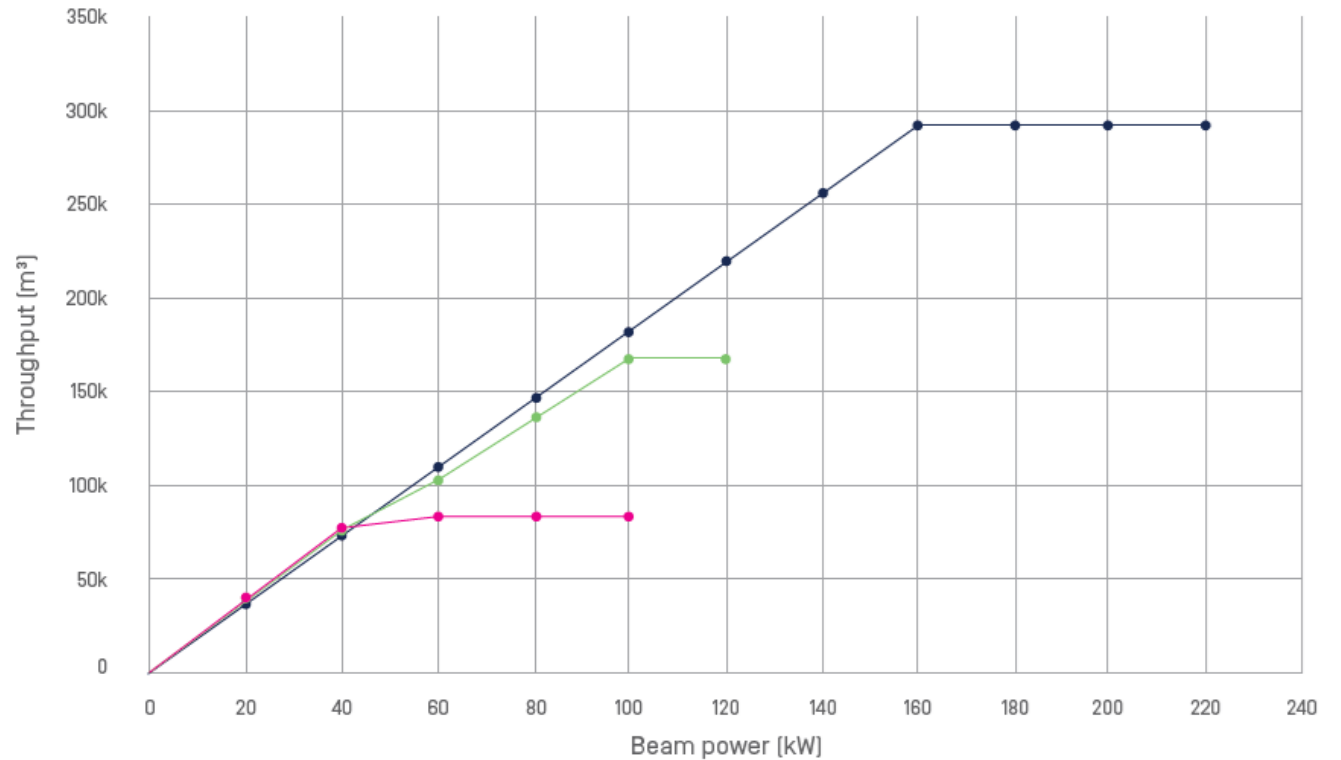


How much beam power?

- - - - - Medium throughput
- - - - - High throughput
- - - - - Very high throughput

ASSUMPTIONS

Box length [cm]	50
Box width [cm]	30
Box height [cm]	30
Density [g/cm ³]	0,15
Target dose [kGy]	25
Energy [MeV]	10
Shifts	Two 8-hour shifts /6 days/ 50 weeks
Hours	4800



Design optimization

How Monte Carlo and analytical tools can help us optimize your solution

Modality, beam power and conveyors.



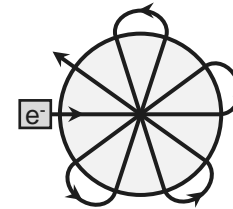
Process capacity

- Treatment times
- Maximum production volume



Product characteristics

- Dimensions
- Density



Rhodotron

- E-beam / X-ray
- Beam power
- Lateral / top-down irradiation

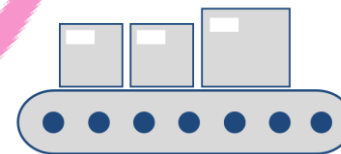


Product requirements

- Dose uniformity ratio
- Minimum dose

Optimization tools

- Monte Carlo simulations
- Analytical estimates
- Dose mappings



Conveyor & automation

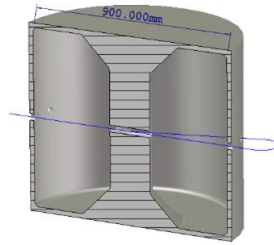
- Boxes / trays / totes / pallets
- Underbeam speed
- Palletizing / depalletizing robots
- Automated storage

New developments

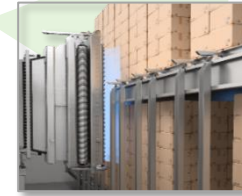
Pushing the limits of our solutions

Our path towards sustainability

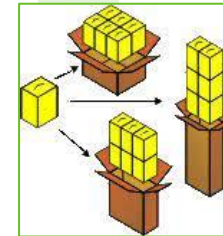
Solution Eco-Design & efficiency evolutions



Process efficiency from qualification



Product design & Packaging Optimization



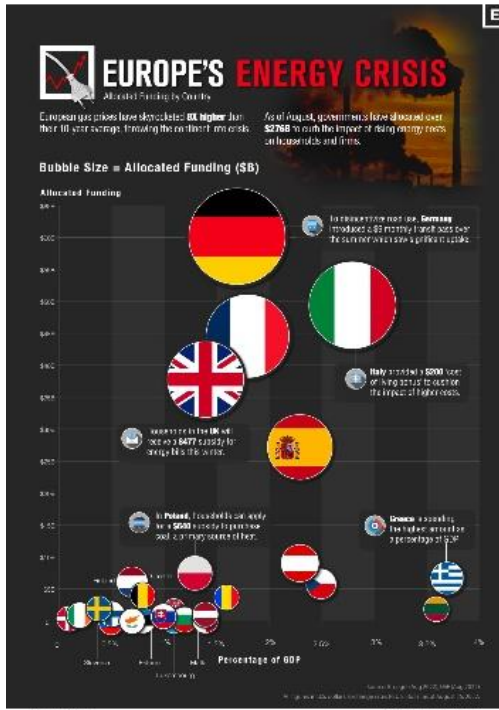
Beam delivery efficiency & Adaptive scans



Remote & predictive Services

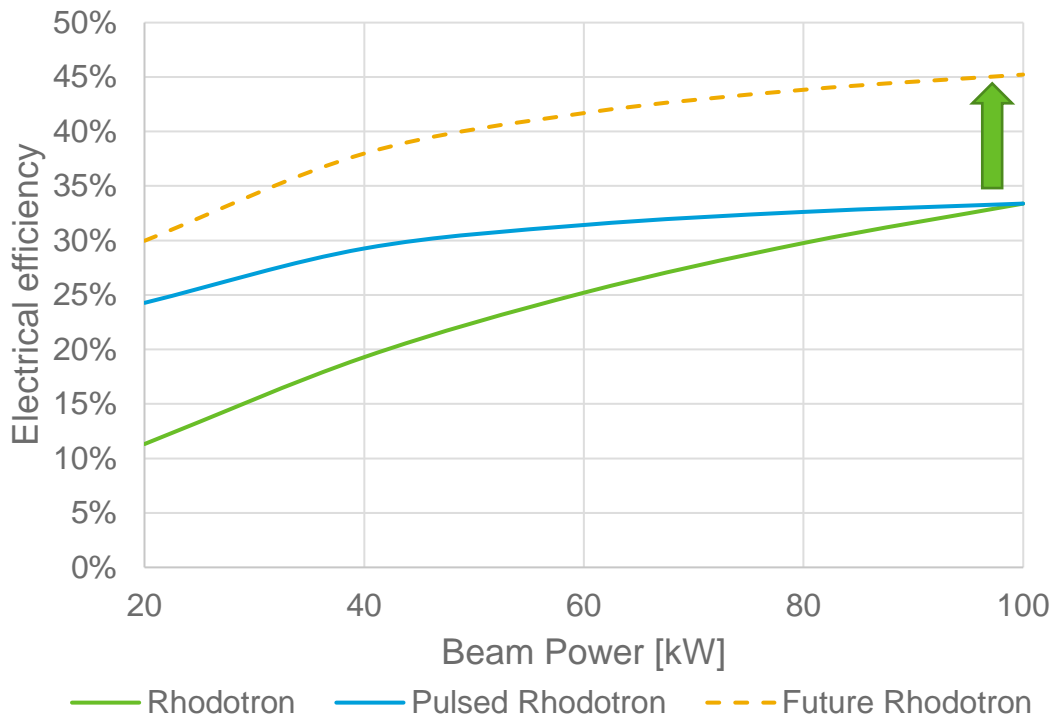


Building efficiency & heat recovery



Improving our accelerator technology

E-beam Rhodotron energy efficiency



- Our Rhodotron is 10 to 30% more efficient than other technologies
- 4 sites operating with pulsing mode, both in E-beam & X-Ray
- **Future versions will allow 45% efficiency at 100 kW**
- New technologies like **Solid State Power** are **ready**

Where E-beam Needs Help

Parametric release

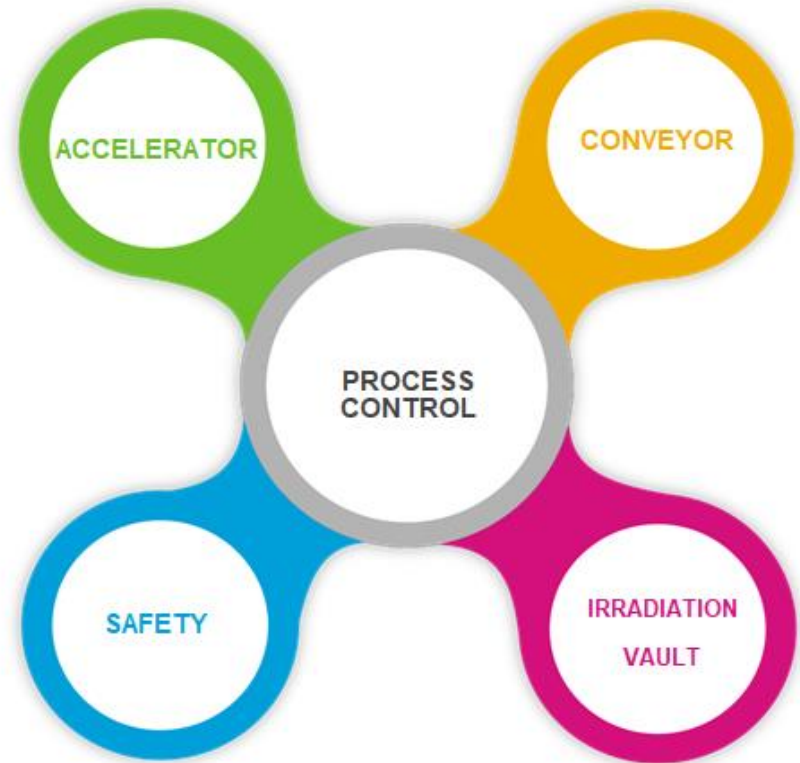
QA – Current Product Release Process



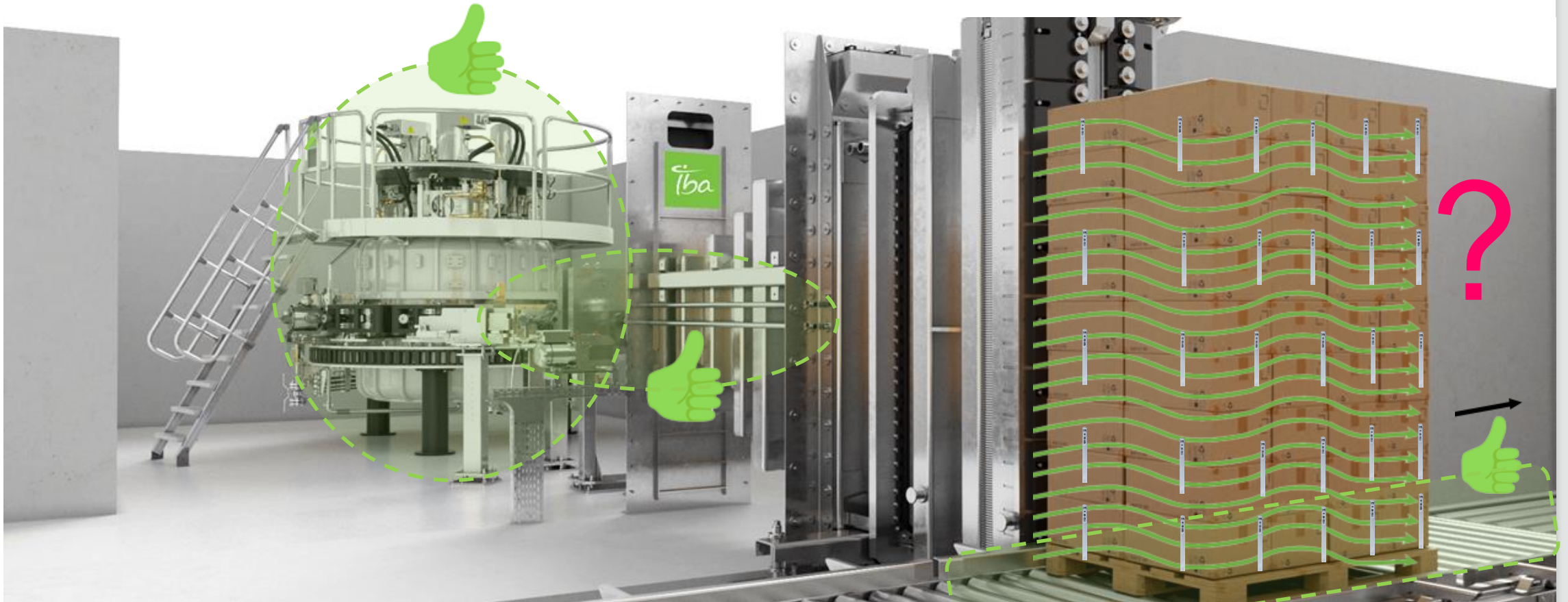
Routine Dosimetry



Parametric Release



QA – Current Product Release Process



RHODOTRON®

BEAM

CONVEYOR

BEAM FLUX

Call to the CIRMS community



- **Where do we need new standards?**
- How can we further enable parametric release for electron beam processing?



Thank you!