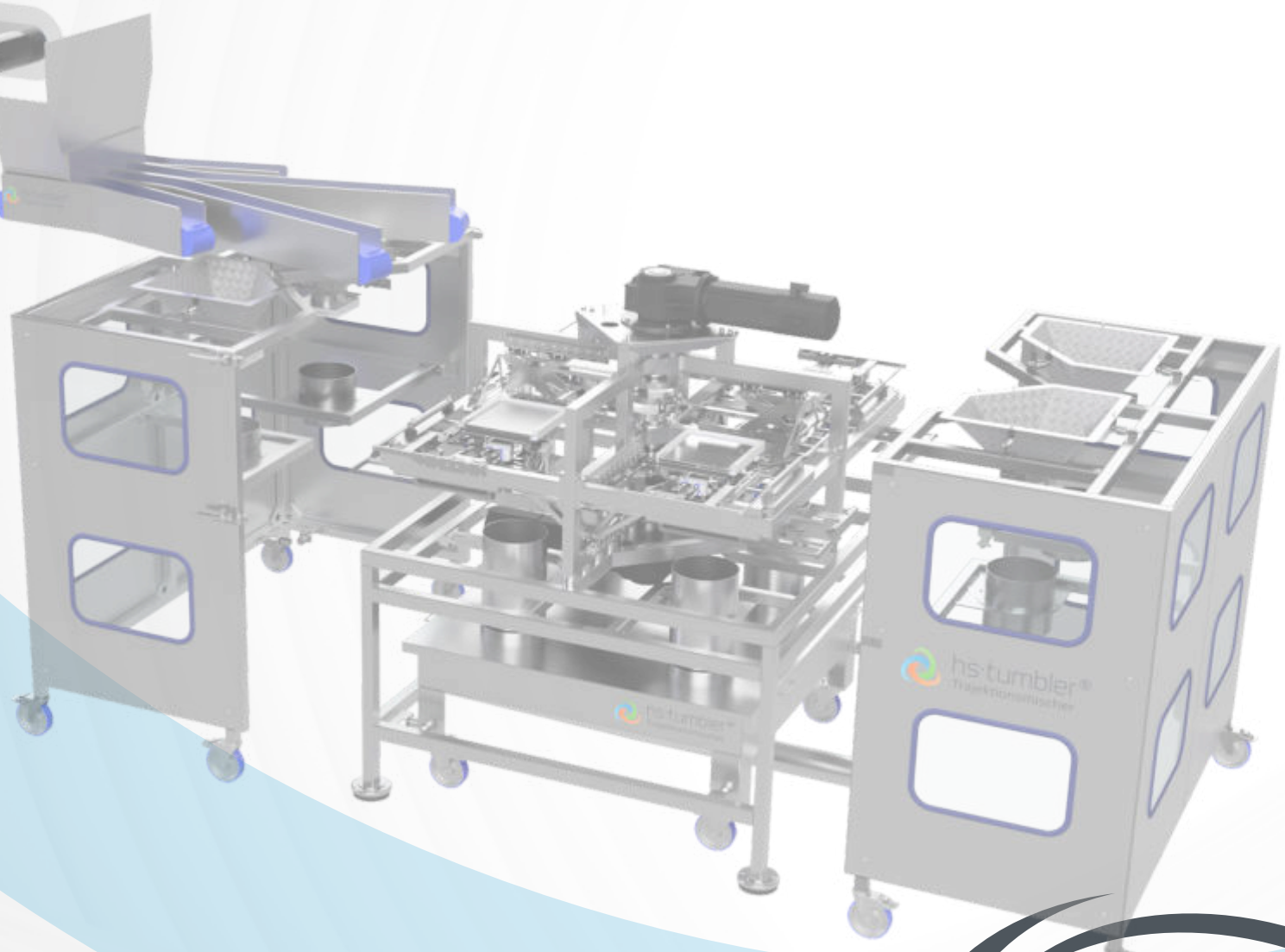
hs·tumbler®
Trajectory Mixer

Trajectory mixing

Innovation in Motion



About hs-tumbler

Originating from a pioneering concept at the German Institute of Food Technology (DIL), the initial spark evolved into the inaugural prototype of a near-series trajectory mixer within a research initiative. The inventor and patent holder Bernhard Hukelmann, continued the development, steering it towards market maturity and augmenting it with additional patents.

Buoyed by promising outcomes from trials with potential clients, two visionary investors, in collaboration with Mr. Hukelmann, established hs-tumbler GmbH in May 2021. Remarkably, the first series of machines were already realized by August 2022, swiftly finding application across diverse industries in Germany, Europe, and America. Looking ahead, the year 2024 marks a significant milestone with the introduction of the first full-scale production machine, enriching the portfolio of hs-tumbler GmbH.

From an idea to market maturity. With a dedicated team, the trajectory mixer quickly becomes the first large-scale production machine.

Abb. 1: hs-tumbler Headquarters in BIQ Business Innovation Park, Quakenbrück

Abb. 2: Bernhard Hukelmann and Andreas Leitze, Managing Partners

Revolutionizing Mixing: A Smarter Approach for Efficiency Across Industries

Our background comes from working in the food industry, dealing with process challenges like mixing and kneading different products. We've always been bothered by how long it takes to mix things, the efforts needed to clean equipment, and the limited flexibility when switching between products. This leads to using a lot of time, energy, and money on cleaning.
Imagine a solution that brings:

- Faster mixing times
- Saving energy, materials, and resources
- Improved product quality
- Contamination and dust free handling
- More flexibility in making and changing products
- Options for automating processes

This issue isn't just in food – it applies to mixing things in pharmaceuticals, metallurgy, cosmetics, and more.

The Dynamic Power of Trajectory Mixing with Lissajous Curves

The core concept of trajectory mixing involves guiding the process goods along a defined path at high speed, akin to a rollercoaster journey. This motion generates shear forces within the mix, promoting self-mixing. The trajectory is formed by combining two movements in the x and y directions, with the shape influenced by the speed ratio and starting points of these movements.

At the heart of this innovative mixing system are Lissajous curves, orchestrating the movement of the mix within the container along distinct curves in both the y and x-axes. The resultant shear forces ensure that individual components seamlessly blend with themselves during the mixing process.

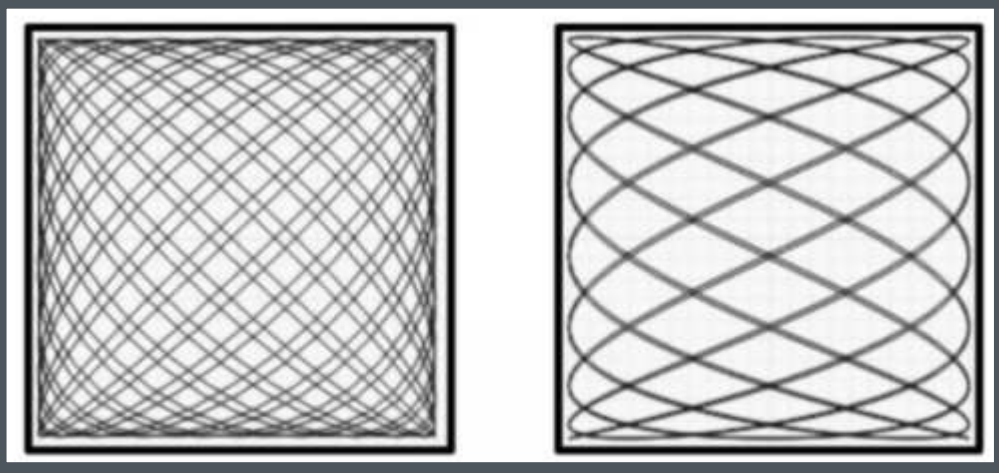


Fig. 3: Examples for different Lissajous curves. While the left one creates a beating movement (e.g. for meat), the second curve generates a kneading movement (e.g. for dough)

Benefits of trajectory mixing

Unleashed Efficiency

1. **Constant Motion for Speed:** Trajectory mixing is super fast because the whole mix is always moving. Unlike regular stirrers, it's 10 to 1000 times quicker, making blending a breeze. Process times are usually below 60 seconds per batch.
2. **Quick Process Times:** With short process times, trajectory mixing prevents heat generation in the mix and making the blending process speedy and efficient.
3. **Less Energy, More Savings:** Compared to other mixing methods, trajectory mixing uses way less energy, saving costs. It doesn't need external cooling or vacuum, keeping things simple.
4. **Easy Cleaning:** The stainless steel container is designed without corners or edges, making cleaning a breeze. It's quick and hassle-free, ensuring smooth operation.

Process Safety

1. **Hermetic Sealing Assurance:** Within the sealed stainless steel container, the mixing process unfolds in a fully enclosed space, ensuring impeccable hygiene and a dust-free environment.
2. **Critical Ingredient Compatibility:** The closed system makes the process suitable for even the most sensitive ingredients, eliminating the need for extensive containment areas.
3. **Diverse Production Capabilities:** The hermetic sealing not only ensures hygiene but also offers the versatility to produce products with specific dietary requirements. Whether kosher, halal, allergen-free, or gluten-free, all can be confidently manufactured on the same system.

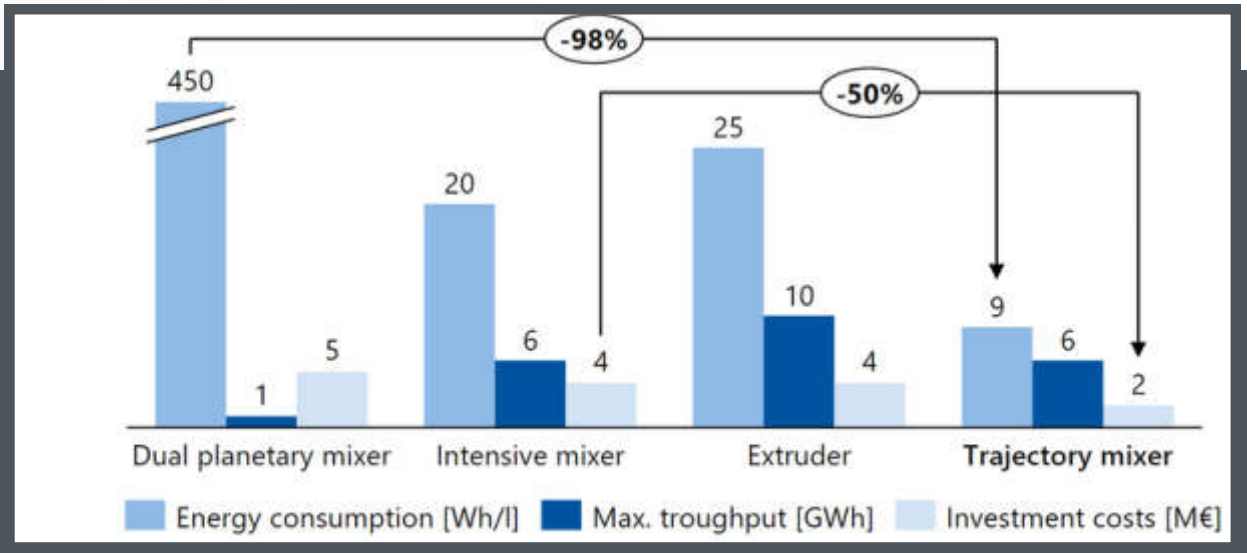


Fig. 4: Key performance indicators for mixing equipment; source: PEM Aachen

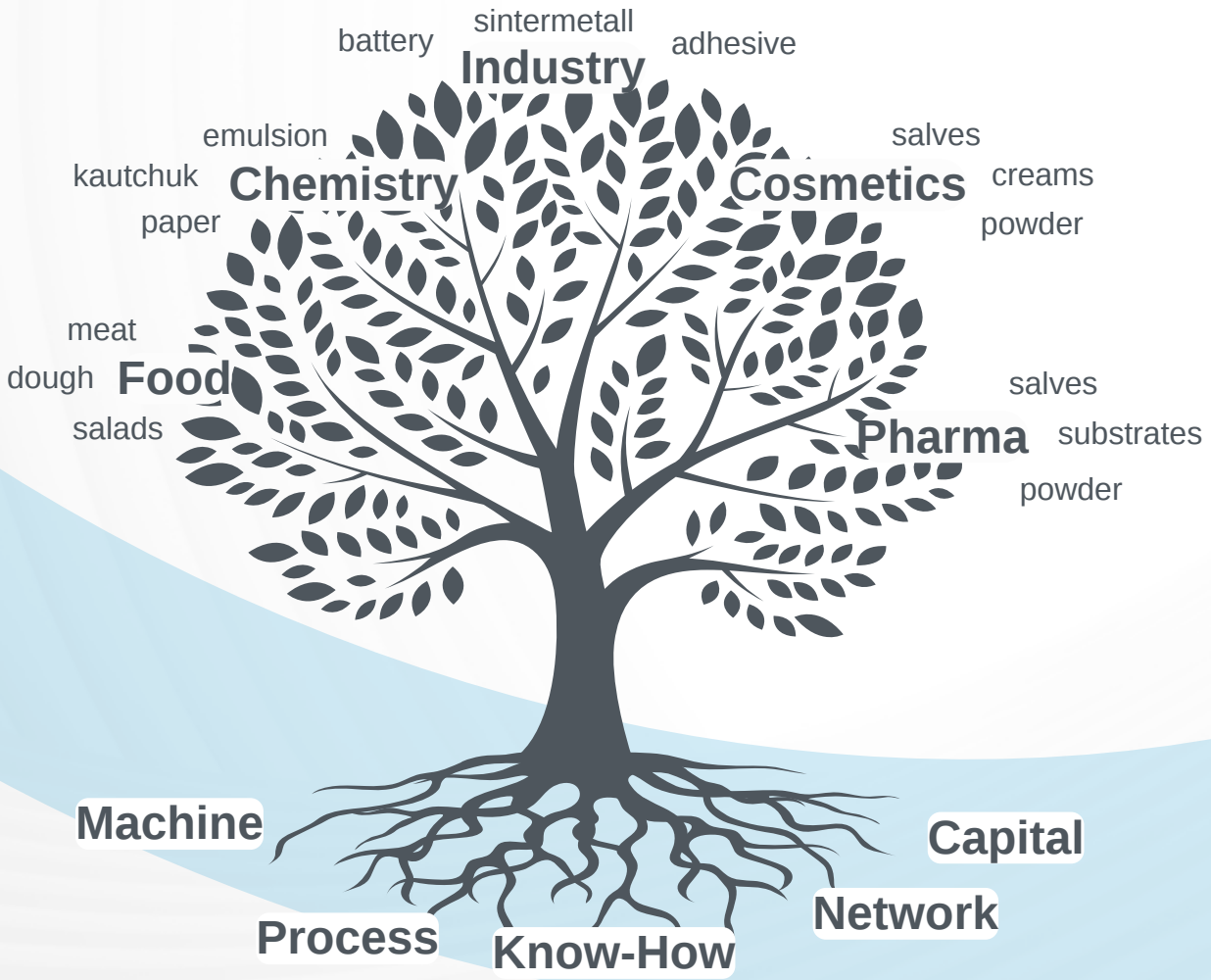
Unmatched Flexibility

In the ever-evolving landscape of industries like chemicals and food, where processes, raw materials, and end products constantly change, our trajectory mixers stand out as versatile solutions. Developed to cater to diverse user needs, whether dealing with dry-to-dry, dry-to-liquid, or liquid-to-liquid mixing, our mixers ensure efficient operations with guaranteed homogeneity.

As customer requirements and quality standards continue to rise, our trajectory mixers remain adaptable. The programmable curve shapes empower users with the flexibility to achieve high product variety, enabling seamless mixing across various applications.

From tumbling and marinating meat to handling pasta, confectionery, creams, vegan products, and even anode slurry for battery production, the applications are as diverse as the products themselves.

And there's more to come. We're exploring new ways our mixers can work, like mixing emulsions and mixtures in 3-phase systems. This includes things like catalyzer applications and the cool world of mechanochemistry. Our mixers aren't just machines—they're tools that keep up with what you need in today's changing industries.



Our trajectory mixers - K1 and J4

Trajectory mixer K1 - the entry class

Meet the K1, featuring a mono container with 4l volume - an excellent fit for large kitchens, laboratories, or compact production spaces crafting individual batches or custom-made products.

Empower your processes with the K1—where efficiency, adaptability, and hygiene converge to elevate your mixing experience.

Key Features:

1. **Hygienic Excellence:** The K1 boasts a hygienic design ensuring cleanliness in every mix, making it a reliable choice for various environments.
2. **Compact and Adaptable:** With its small footprint and minimal utility requirements, the K1 is a versatile solution suitable for nearly any workspace.
3. **Flexible Component Loading:** Whether manually fed or with the assistance of a robot arm, the K1 provides flexibility in how you introduce individual components.
4. **Versatile Mixing Capability:** Just like all trajectory mixers, the K1 is designed to mix a diverse range of materials, including foods, pastes, creams, powders, and slurries.
5. **Impressive Capacity:** Depending on loading speed and automation level, the K1 showcases a mixing capacity of 200 kg/h and beyond.

Fig. 6: Trajectory mixer K1

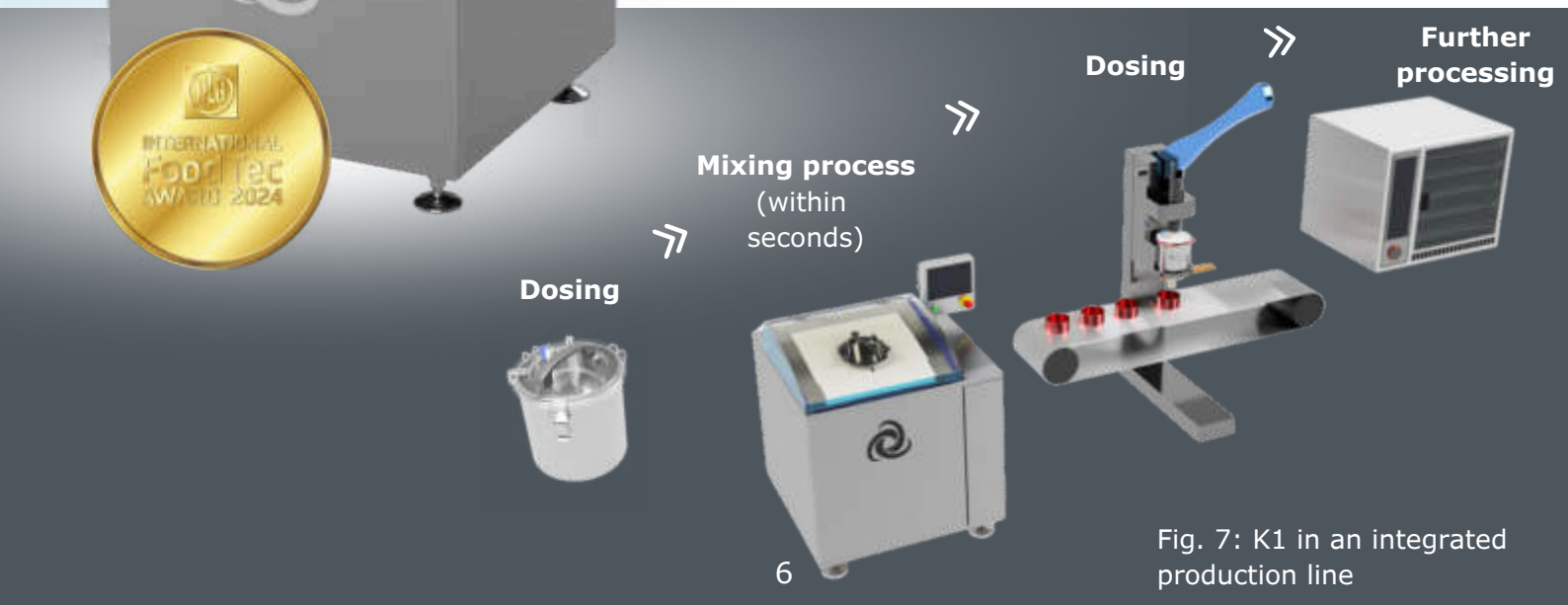


Fig. 7: K1 in an integrated production line

Trajectory mixer J4 - industrial class

Meet the J4, an industrial-class trajectory mixer meticulously crafted for outstanding performance. With the capability to simultaneously process four containers, each boasting a 15L volume, the J4 stands as a pinnacle of efficiency and productivity.

Elevate your industrial mixing capabilities with the J4 — a powerhouse designed for precision, efficiency, and unparalleled energy savings.

Fig. 8: Trajectory mixer J4 with feeding and weighting systems

Key Features:

1. **Automated Precision:** Unlocking the full potential of the J4 requires seamless integration into an automated production process. This ensures precision in coordination with corresponding feeding and discharging options, optimizing your workflow.
2. **Opposing Accelerations:** The innovative design of the J4 employs opposing accelerations within pairs of process containers. This not only enhances efficiency but also achieves remarkable energy savings by canceling out vibrations.
3. **Dual Feeding and Discharge Options:** The J4 provides versatile options for feeding and discharging:
   a. **Integrated Automation:** Each process container is equipped with an automatic opening and closing mechanism at both the top and bottom, enabling a continuous inflow and outflow of mixing goods.
   b. **Automated Loading/Unloading:** The loading and unloading of the process container is completely separated and decoupled from the mixing itself, ensuring efficiency and precision.

hs·tumbler®
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Food

Advanced Materials

Ca Zn Mg

Energy Solutions

Pharma & Cosmetics

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