



# Pulsed Electric Field Technology

unlocking the true potential of food





## Quick reference list for the benefits of Pulsed Electric Field treatment



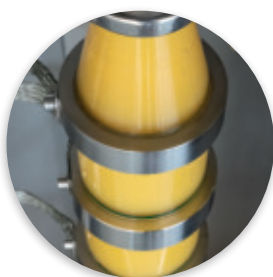
### snacks & chips

- new product opportunities
- higher capacity
- improved quality
- improved cutting
- improved crispiness
- improved texture
- better shapes
- less fracture
- even colour
- less oil uptake
- water savings
- energy savings



### juice & smoothies

- low temperature processing
- continuous 24 hr processing
- better production planning
- retained nutritional value
- extended market reach
- increased shelf life
- improved quality
- retained colour
- low energy use
- fresh taste



### extraction

- more valuable compounds
- low temperature processing
- improved colour extraction
- no enzymes needed
- faster extraction
- higher yield

### drying

- brighter retained colour
- better retained flavour
- better shape stability
- better rehydration
- improved quality
- higher capacity
- low energy use







Potatoes being conveyed from  
an Elea Advantage™ Belt system

“As PEF is applicable to all products  
where quality counts it will become  
the preferred industry technology.”

**Prof. Stefan Töpfl**

#### **Welcome.**

I first came across Pulsed Electric Field almost twenty years ago whilst studying food technology at TU Berlin.

I was immediately intrigued by PEF's dramatic impact on raw materials and the incredible range of possible applications.

Twenty years later I am still fascinated by the benefits and opportunities that we continue to discover about PEF.

Creating pores of a few nanometres diameter in a cell membrane causes substantial change to product characteristic on a macroscopic level and alters the way we think of processing.

PEF can restructure raw materials, improve cutting, increase yield, enhance product quality, extend shelf life and enable new

product development. One targeted treatment brings great value to your business.

I was very excited to be part of the team who built Elea. We have gathered the world's leading experts in Pulsed Electric Field under one roof at our custom built facility in Quakenbrück, Germany.

Today Elea supplies a range of PEF systems for the food and bioprocessing industry. We have now installed more than 125 Elea PEF systems worldwide.

Together we can take your concept through research to final installation and production, unlocking the true potential of food.



# Welcome to Elea

With a range of systems to suit any production line and over 125 Elea Advantage™ machines already installed globally, Elea is the world's leading supplier of PEF solutions.

**Elea PEF systems are transforming manufacturing processes - improving output, reducing labour costs, streamlining supply chain logistics and helping to minimise retail waste.**

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Through dedicated research spanning many years, we have refined our systems and brought astonishing change to the food and beverage sectors. Using only the principles of physics, our Elea Pulsed Electric Field (PEF) systems alter the physical structure of fresh produce and create benefits and applications to significantly increase yield, freshness, flavour and nutritional value, whilst also creating savings in time and energy.

At Elea our drive is the pursuit of unlocking potential in raw materials, including process optimisation and retaining quality. Our dedicated team is forged from some of the finest scientific minds in the sector, and

their research has already made extraordinary changes within the food industry.

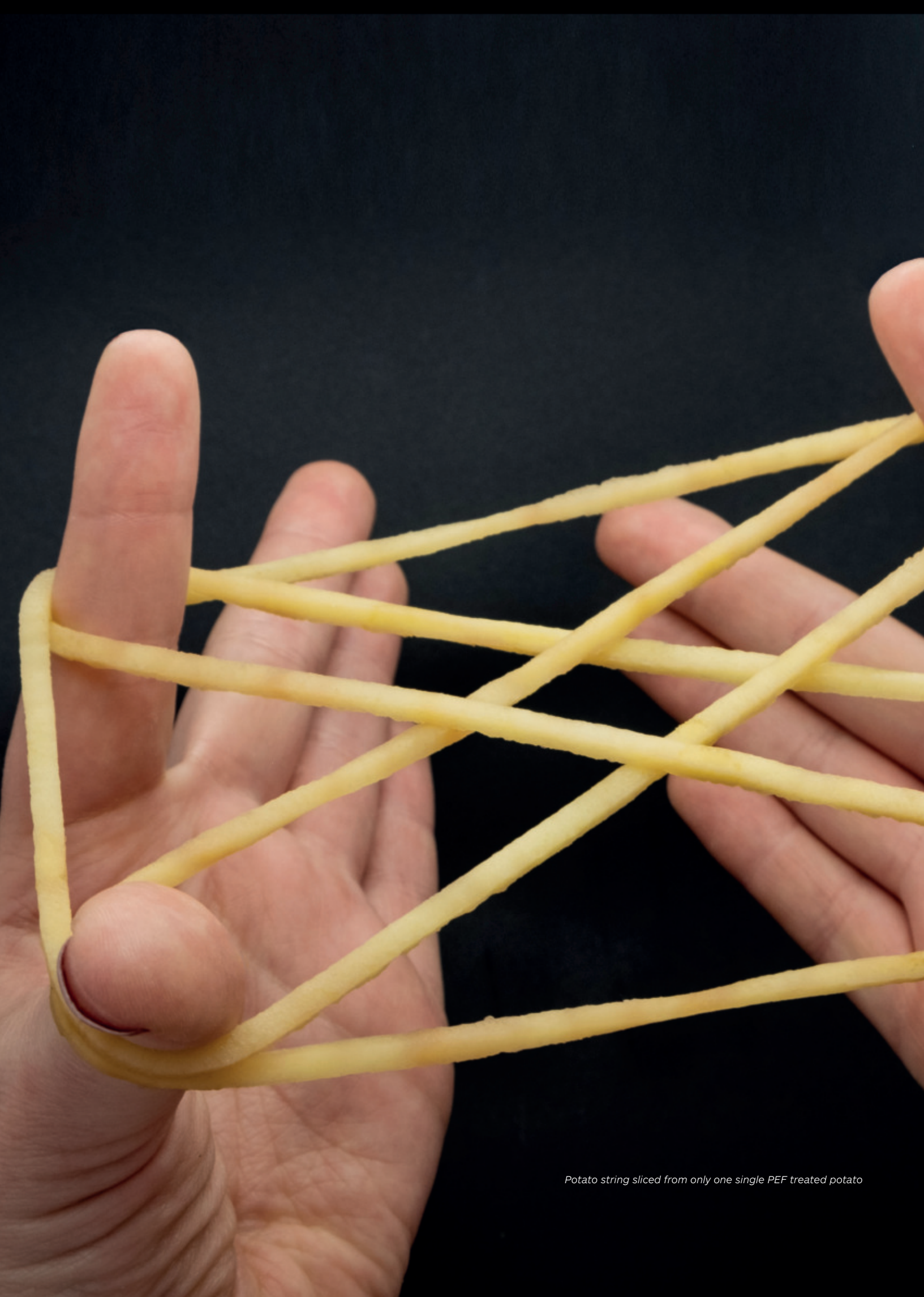
Our engineers build and construct Elea PEF systems with unparalleled precision to ensure the highest quality end product. We work in close collaboration with our clients and have designed and installed more than 125 Elea PEF systems worldwide.

We have been able to take leaps in our field and look forward to exploring exciting new opportunities, inventions and technical advances for Elea PEF in the future.

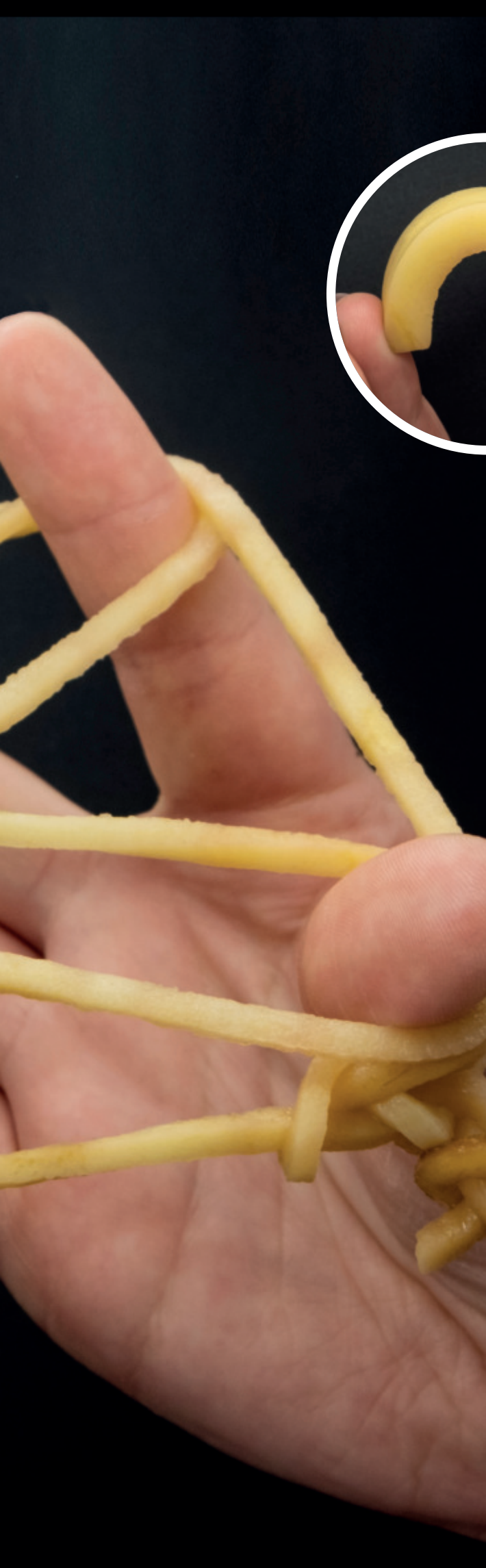


*Preparing an Elea Advantage™ system for trials in the pilot hall*





*Potato string sliced from only one single PEF treated potato*



*Elea PEF treated potato*

*Untreated potato*

## PEF alters the physical structure of fresh produce

Through the application of Elea PEF, the potential of raw materials can be unlocked.

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With their transformative abilities, our Elea PEF systems change the cell structure of fresh produce to allow for new applications and uses.

Our systems use precise and targeted electrical pulses to open the cell membrane with no adverse effects to the produce. It's a clean, gentle and targeted approach which can be used across a broad range of products to achieve high quality, as well as bringing a new level of efficiency to the process without the use of chemicals.

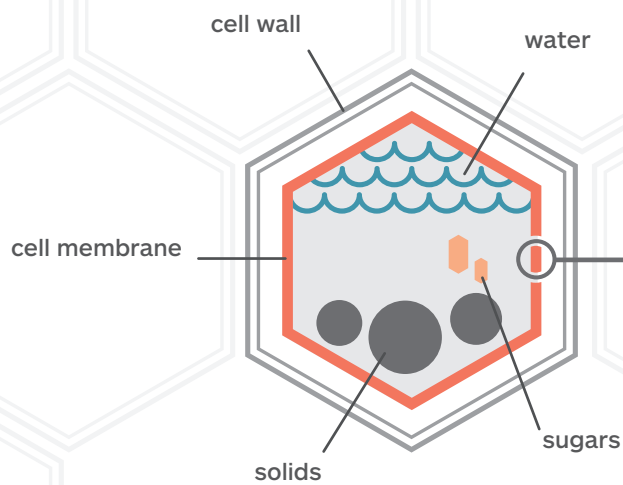
Through PEF, we can create radical new opportunities for food. Elea PEF alters the cell structure and raw materials have their full potential released. For example, here we can see a string made from single potato that has had its structure altered using PEF. The potato now has the strength and flexibility to maintain its structural integrity and provide new opportunity for product development.

We understand that Elea PEF has an untapped potential that goes beyond the industries that it's currently being applied to. As pioneers of this technology we are working to discover solutions that could be used in the non-food sectors, as well as exploring the value of new raw material such as algae.

# How does PEF work?

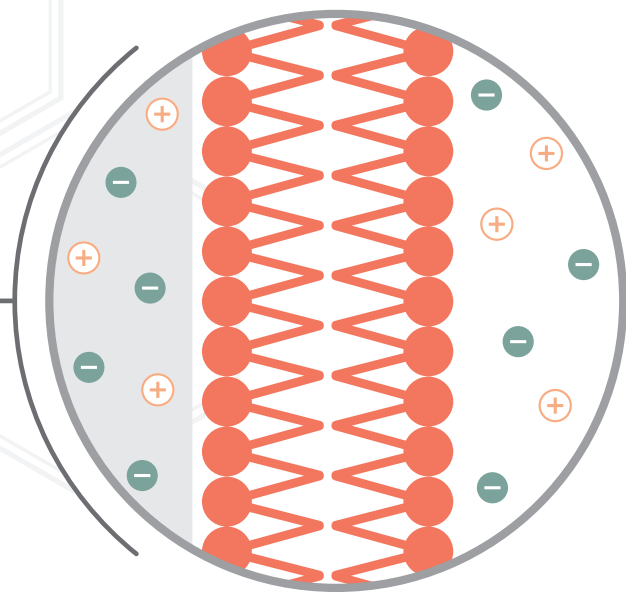
## Plant cell electroporabilisation

— opening cells using Elea PEF technology —



### plant cell

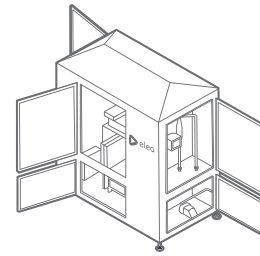
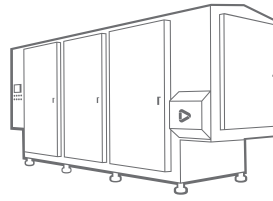
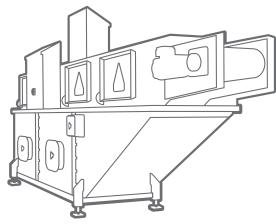
Average plant cell size is 50-100  $\mu\text{m}$   
with a cell membrane 5 nm thick.



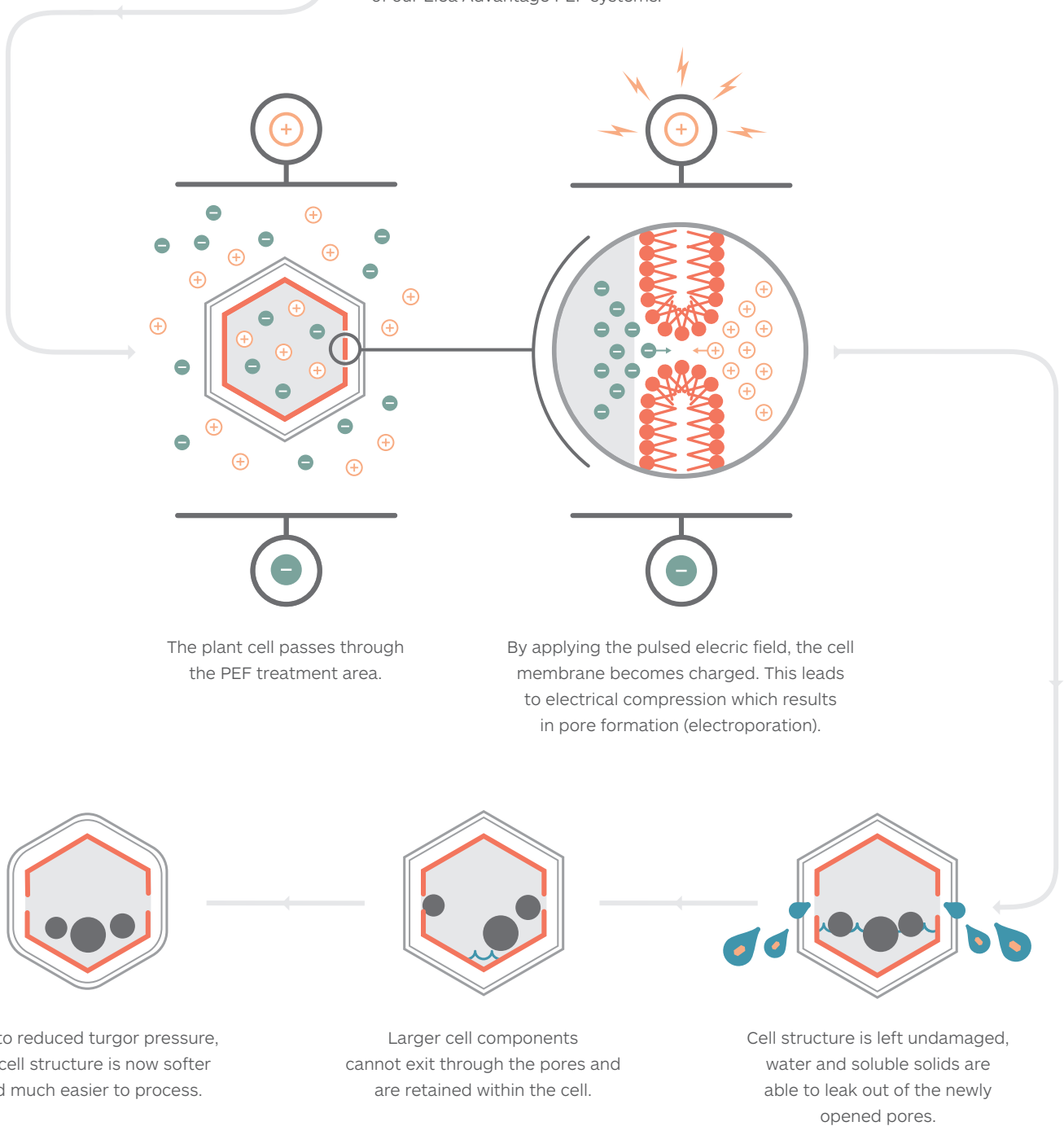
### magnified cell membrane

Magnified cell membrane with  
lipid bilayer separating cytoplasm  
and extracellular fluid. Both containing  
charged particles.





The chosen raw product enters one of our Elea Advantage PEF systems.





*Golden beetroot*



*Orange sweet potato v-cut*



*Purple sweet potato deep ridge-cut*



*PEF treated sweet potato twist*



## New shapes, exciting cuts and new snack opportunities

PEF treated raw materials are stronger, longer, much more flexible, easier and cheaper to process

**With the Elea Advantage™ Belt systems we can create radical new exciting opportunities for snacks. PEF positively alters the cell structure and raw materials have their full potential released.**

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Shown above is a piece of sweet potato being twisted. The sweet potato now has the strength and flexibility to maintain its structural integrity and provides new exciting opportunities for product development.

PEF has a remarkable effect on many different food items. Potatoes, sweet potato, carrots, tubers and other roots pass through the Elea PEF system to become better French fries, chips and other snacks.

Elea PEF increases colour vibrancy, radically improves development of dramatic shapes,

enhances cutting ability, produces a less feathered, smoother surface, improves texture and crispiness – anything is possible.

A smoother product surface reduces oil uptake which results in a healthier snack with a better mouthfeel. Less feathering enables better adhesion and distribution of seasoning and flavouring.

This can all be achieved with a simple, fast and targeted electro physical process.





Untreated (left) & PEF treated hot air-dried raisin

## Improved shapes, brighter colour and exceptional flavour for dried products

Elea Advantage™ systems help to produce better dried strawberries, bananas, mangos, carrots, bell peppers, mushrooms and many other fruits and vegetables.

**PEF treatment leads to a higher quality dried product with increased form stability and less shrinkage. Taste, aroma and colour are retained.**

### **Better shape stability**

PEF opens cell membranes, increasing the internal diffusion and providing greater control over the drying process, improving product stability and creating a more appetizing product.

### **Improved production**

Drying processes are enhanced by PEF resulting in energy savings and higher capacities.

### **Improved rehydration capacity**

Better shape preservation with PEF treatment produces a more open product structure, enhancing rehydration. For example PEF treated freeze-dried fruits rehydrate almost instantly with a 20% increase in rehydration capacity.

### **Higher quality freeze-drying**

Elea PEF treatment enhances the industrial

freeze-drying process, producing a new, healthier, premium product suitable for a wide range of various applications and types of markets.

### **Improved processes for hot air-drying**

PEF enables energy savings with reduced drying time and lower drying temperatures. For example, PEF assisted hot air onion drying enables a reduction of the drying time by approx. 20% together with a reduction in temperature of 10°C in the last drying section.

This results in a higher quality product with retained natural aroma, a more intense flavour and much better shape stability

*The improvements above are applicable to all types of drying, such as hot air, freeze, vacuum, microwave or infrared drying.*



*PEF treated freeze-dried fruit products*

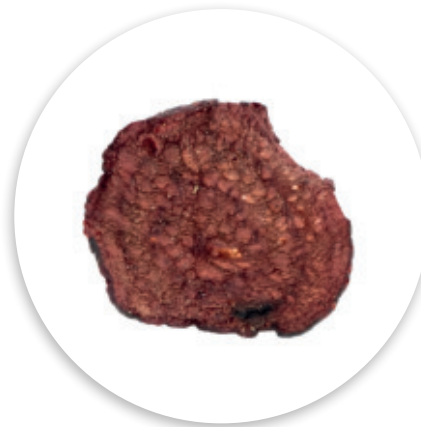
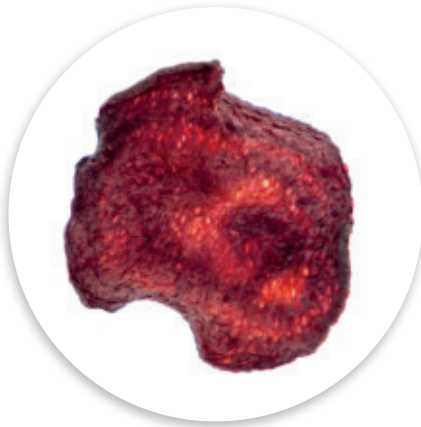


## PEF treated snack products

Sweet potato

Red beetroot

Carrot



untreated

## Compare the quality of PEF treated and untreated snacks and dried products

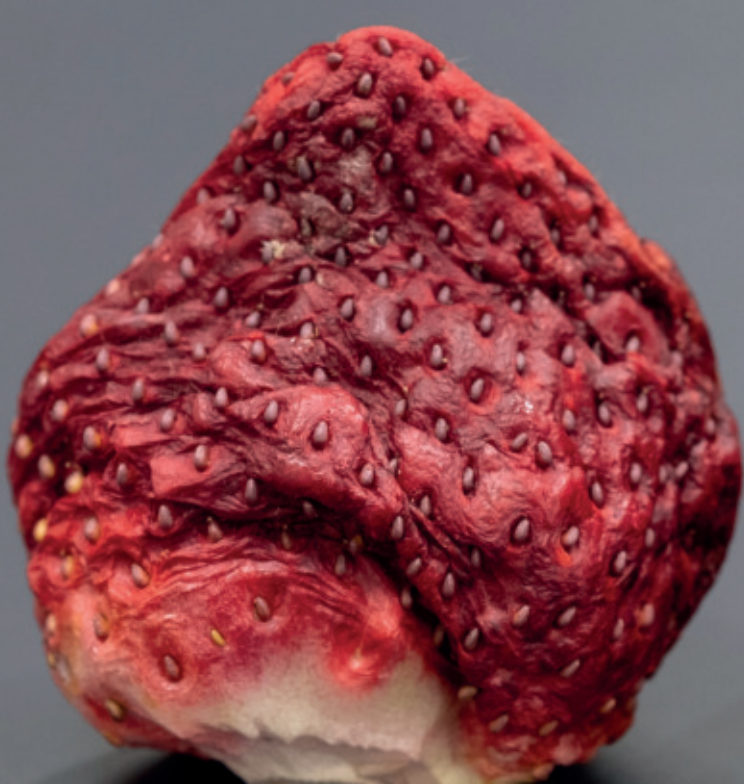
PEF dramatically enhances the quality of fried and dried products by enabling greater water release.

The untreated samples shown here have all been taken directly from products available on the supermarket shelves.

Comparing them directly to the PEF treated versions clearly demonstrate the dramatic increases in quality that PEF enables.

PEF results in greater shape stability, better preservation of sensitive colour pigments and greater colour vibrancy, reduced browning and a brighter, more appetising fried or dried product.





*untreated (left) & PEF treated freeze dried strawberry*



*untreated (left) & PEF treated freeze dried carrot*



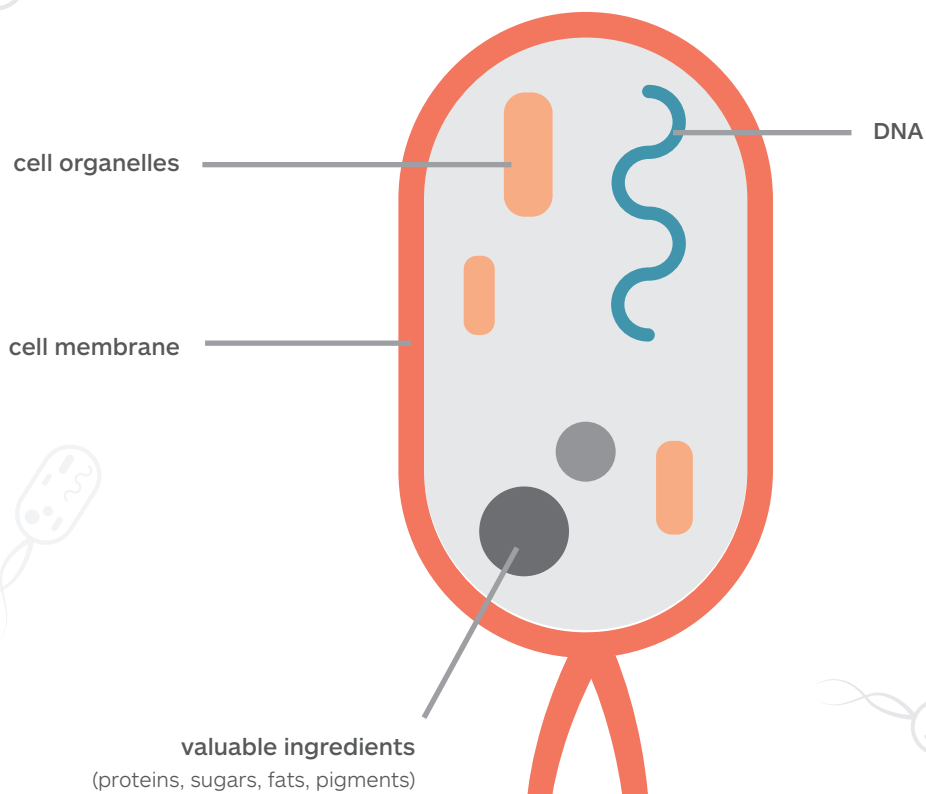
*untreated (left) & PEF treated hot aired dried tomato*



# How does PEF work?

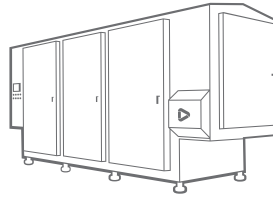
## Bacterial stimulation and inactivation

—— low temperature juice & smoothie processing ——



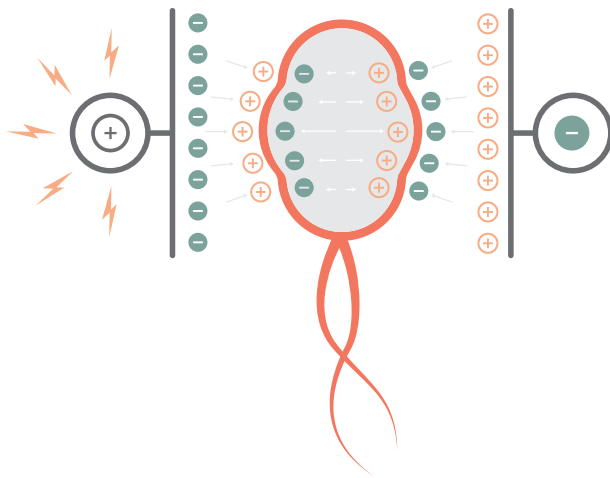
### Bacteria cell

average bacteria cell size is 0,5 - 10  $\mu\text{m}$   
with a cell membrane of 5 nm

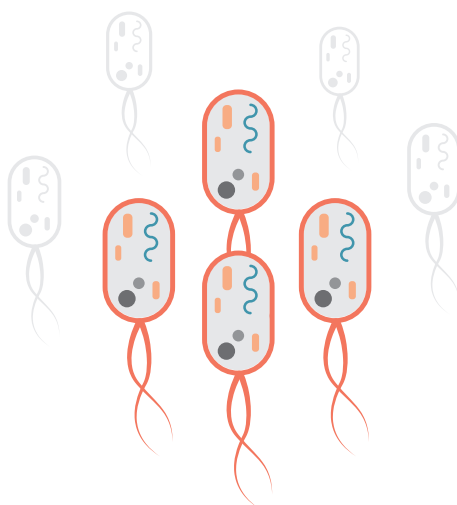


The chosen raw product enters one of our Elea PEF Advantage Pipe systems.

### PEF stimulation

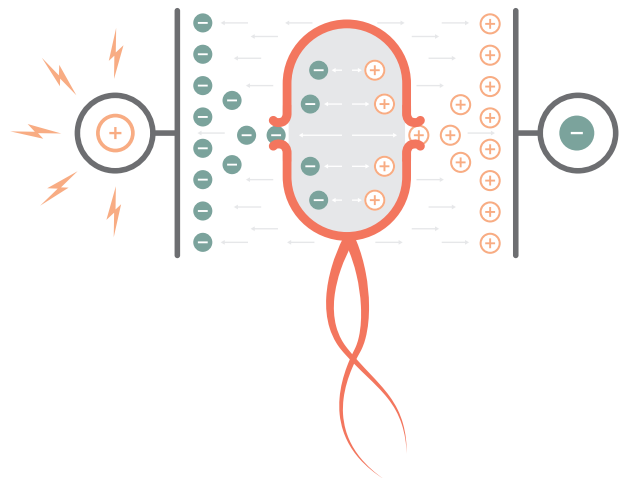


Positively and negatively charged particles are attracted to their respective electrodes. At reduced energy levels, the polarisation mechanism is inducing a stress response and stimulating cell activity.

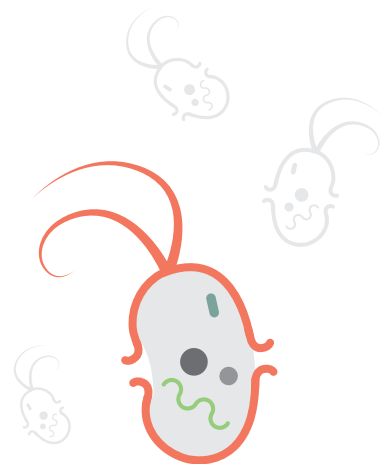


Increased growth, higher functionality and enhanced production rates of valuable ingredients.

### PEF inactivation



Positively and negatively charged particles are attracted to their respective electrodes. When the field strength exceeds the transmembrane potential, pore formation starts, forcing the cell membranes to open.



The bacteria is now inactivated (dead).





*Juice being tested in our PEF liquids pilot hall*



## Longer shelf life, fresher taste & better colour with Elea PEF Advantage™

Adding value, quality and opportunity to your juice  
24 hours a day, every day.

**PEF inactivates the bacteria in juice at low temperatures (see pages 18-19) providing the perfect alternative to other more expensive or more destructive processing solutions.**

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### **Improving juice quality with Elea PEF**

Taste, colour and nutritional value are better retained using the Elea Advantage™ Pipe range. Elea PEF is a low temperature process and this helps to preserve valuable compounds, whilst having a positive effect on the overall quality of the juices.

Using Elea PEF means that juices and smoothies retain their natural nutritional value, including vitamins, antioxidants and pigments, to produce a healthier, fresher and more appetising final product.

### **Microbial inactivation and extending shelf life**

The Elea PEF process has a positive effect at every stage of the production cycle. Despite lower energy costs there is an increased yield from raw materials and the shelf life of products is extended dramatically. This increase in shelf life has a favourable impact on supply chain logistics from factory to retailer, which in turn reduces wastage.

### **Increasing market reach**

The extended shelf life of Elea PEF treated liquids substantially increases the time that juices can be delivered to store. Having more time available means that there is the opportunity for an extended market reach, lower delivery costs and decreased product handling. This all ultimately results in reduced product return rates.

### **Better production planning**

Extended shelf life results in greater flexibility for production planning. It means that you have the ability to collate smaller lots into larger batches to reduce overheads and manufacturing costs.

### **Extraction benefits for juices**

PEF is a gentle and targeted process that opens pores in the plant cell as the fruit mash passes through the Advantage™ system. Colour and valuable compounds can then be extracted without the need for additional enzymes.



**Fresh green juice**  
Limited 3-4 days shelf life



**Thermal treated**  
Colour loss  
Reduced quality  
Lower nutritional value



**PEF treated by  
Elea Advantage™ Pipe**  
Low temperature processing  
Retained nutritional value  
Increased market reach  
Fresh taste  
Bright colour  
Longer shelf life  
Cost savings

## Comparing PEF with other processes

Low temperature, low maintenance and 24 hour continuous operation, make our PEF systems the best value juice processing solution.

**Compare the Elea PEF Advantage™ Pipe systems to the traditional thermal and HPP juice and smoothie processing.**

The biggest difference between PEF and conventional thermal pasteurization is the mechanism behind it.

While conventional treatment uses temperature to inactivate the bacteria, PEF is a low temperature process that gently inactivates microorganisms using electroporation.

A possible alternative to PEF is High Pressure Processing (HPP). It uses pressure to trigger protein denaturation and induce a low heat load microbial and enzyme inactivation in batch operation

As PEF is a continuous process it allows high volume processing and is easy to integrate into existing processing lines. PEF requires a very small footprint and electric energy supply. Due to short residence times PEF

systems are usually not required to be placed in chilled environments. Elea Advantage PEF systems make use of a solid state pulse modulator, hence very little maintenance is required.

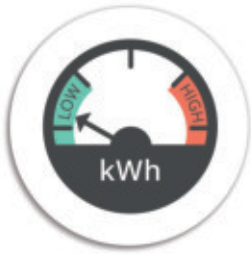
In total PEF results in processing costs of 0,01 – 0,02 € per liter of product, substantially lower than any other low heat technology suitable for juices or smoothies. As PEF is applied pre-bottling it is independent of the type of bottling material. PET or glass bottles, pouches or other consumer packaging can be used. But also B2B solutions such as sterile tanks are suitable.

In summary PEF is the superior solution for all premium products.









Less energy usage



Reduced water consumption



Faster process time



Enhanced process optimisation



Less fracture



Improved texture and crispiness



New cuts and shapes



Improved Cutting



Brighter colour



Reduced blade wear



Faster frying time



Accelerated drying



Faster blanching time



Less heat



Less oil



Higher capacity



Improved quality



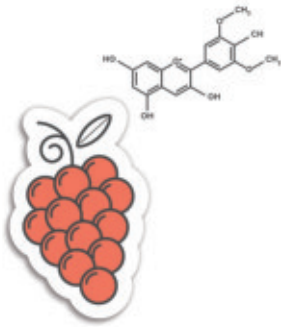
Significantly increased shelf life



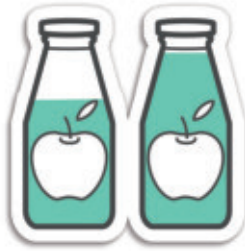
Better production planning



Extended market reach



Extraction of  
valuable compounds



Higher yield

# Product and process benefits of Elea Pulsed Electric Field

PEF reveals new applications to both  
process and raw produce.

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PEF brings positive and dramatic changes  
to the manufacturing process as well as to  
the actual raw materials themselves.

From saving energy and lowering water  
usage, to increasing yield and improving colour  
and quality.

As Elea PEF is applicable to all products  
where quality counts it will become the  
preferred industry technology.



Low temperature processing



Preservation of higher  
nutritional value



Retention of fresh taste



Colour extraction



Faster tumbling



Faster freeze  
drying



No enzymes needed



Retention of healthy  
ingredients



Faster extraction



Higher  
probiotic value




























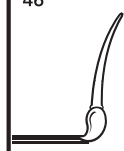

Bacterial  
spore control



Exceptional shape stability  
of freeze dried products

# The periodic table of products improved by Pulsed Electric Field

improved by Pulsed Electric Field

<div>1</div> <div>Apple juice</div> <div></div> <div>Shelf life increase</div>						
<div>3</div> <div>Beans</div> <div></div> <div>Soaking</div>	<div>4</div> <div>Osmotic drying</div> <div></div> <div>Diffusion enhancement</div>					
<div>7</div> <div>Fruit purée</div> <div></div> <div>Premium quality</div>	<div>8</div> <div>Dried vegetables</div> <div></div> <div>Moisture release</div>	<div>9</div> <div>Asparagus</div> <div></div> <div>Saponins release, texture modification</div>				
<div>13</div> <div>Strawberry</div> <div></div> <div>Freeze drying</div>	<div>14</div> <div>Melon juice</div> <div></div> <div>Premium quality</div>	<div>15</div> <div>Kiwi purée</div> <div></div> <div>High quality product</div>	<div>16</div> <div>Flowers</div> <div></div> <div>Perfume oils, colour extraction</div>	<div>17</div> <div>Yogurt</div> <div></div> <div>Low energy pasteurization</div>	<div>18</div> <div>Pesticide</div> <div></div> <div>Decontamination</div>	<div>19</div> <div>Waste water, Process water</div> <div></div> <div>Bacterial digestion or decontamination</div>
<div>27</div> <div>Acerola cherry</div> <div></div> <div>Antioxidant extraction</div>	<div>28</div> <div>Coconut water</div> <div></div> <div>Retains freshness</div>	<div>29</div> <div>Pomegranate juice</div> <div></div> <div>Extraction of healthy compounds &amp; colour</div>	<div>30</div> <div>Pineapple juice</div> <div></div> <div>Enzyme control</div>	<div>31</div> <div>Coolant</div> <div></div> <div>Reduce microbial load</div>	<div>32</div> <div>Power capsules</div> <div></div> <div>New raw ingredients</div>	<div>33</div> <div>Rapeseed</div> <div></div> <div>Oil &amp; protein extraction</div>
<div>41</div> <div>Tomato juice</div> <div></div> <div>Shelf life extension &amp; viscosity management</div>	<div>42</div> <div>Passion fruit juice</div> <div></div> <div>Low heat treatment</div>	<div>43</div> <div>Carrot juice</div> <div></div> <div>Low heat pasteurization</div>	<div>44</div> <div>Spinach</div> <div></div> <div>Microbial inactivation &amp; colour extraction</div>	<div>45</div> <div>Kale</div> <div></div> <div>Juice preservation &amp; cell disintegration</div>	<div>46</div> <div>Paint</div> <div></div> <div>Microbial inactivation</div>	<div>47</div> <div>Nutrient media</div> <div></div> <div>Low heat sterilization</div>

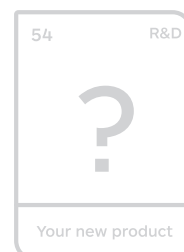
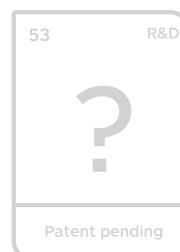
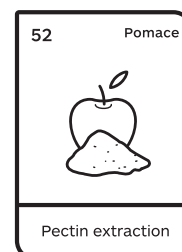
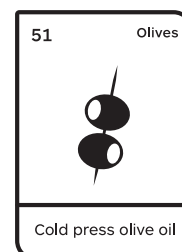
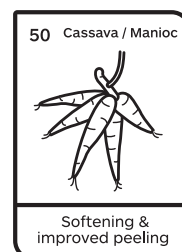
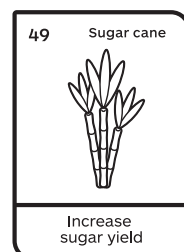
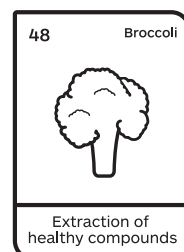
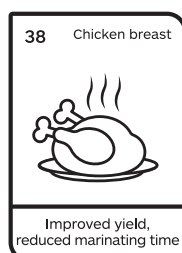
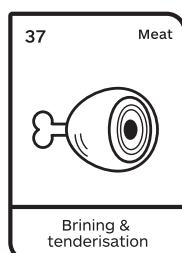
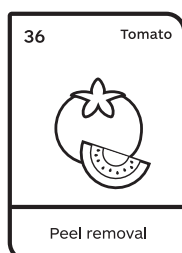
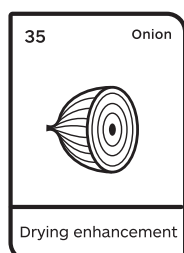
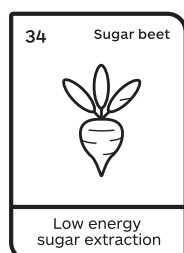
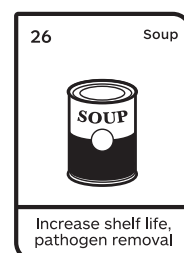
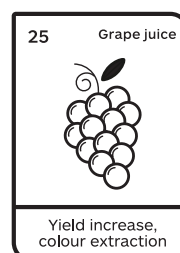
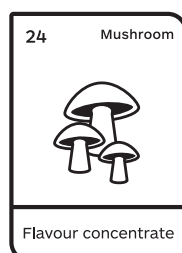
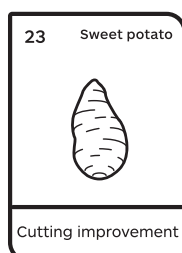
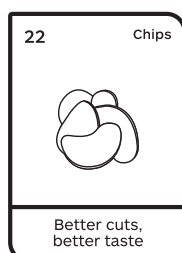
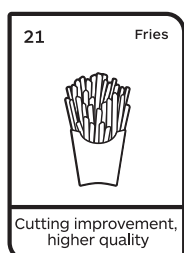
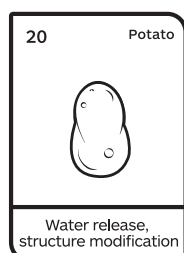
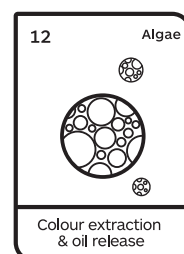
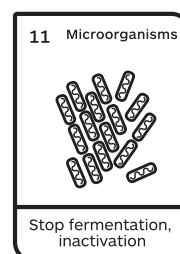
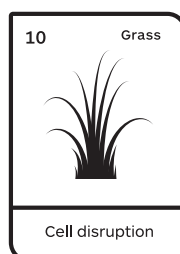
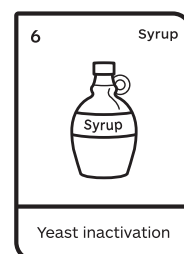
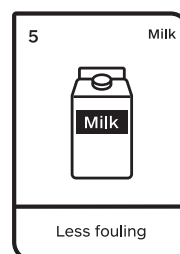
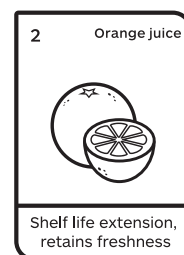


Elea PEF is applicable to a broad range of products, some can be seen here on our periodic table. More are yet to be discovered.

At Elea we've designed and developed systems that enable food, beverage and non-food products to be used in new and exciting ways. Releasing the potential of these raw materials has a vast number of benefits, including cutting improvement, higher nutritional value and increased shelf life.

Using our customisable systems designed and engineered in Germany, these benefits can be applied to a broad range of products such as juices, beer, puree, mashes, fruits and vegetables.

The full capability of these systems has yet to be realised and we are working to unravel even more benefits across other sectors in the future. We are continuously discovering new applications for Elea PEF.





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# Discover Elea PEF systems

Introducing our range of three systems

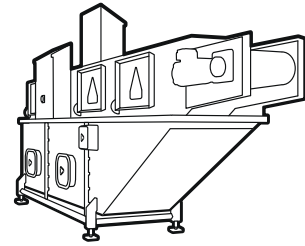
**Designed and engineered in  
Germany to the highest standard**

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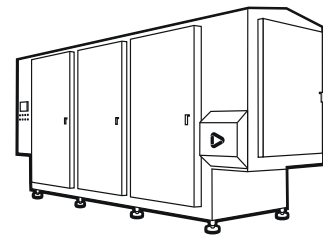
Elea PEF systems provide unparalleled value and energy efficiency to the manufacturing process. The Elea PEF Advantage™ Belt processes solid raw materials. The Elea PEF Advantage™ Pipe enables microbial inactivation in liquids and extracts valuable compounds from fruit mashes. PEF Pilot™ Dual is used for trials and research simulating Elea PEF systems at a small scale or for small production.

Customisable and available in a range of process capacities to ensure that they fit seamlessly into your existing production line, our systems are designed with the individual clients needs in mind.

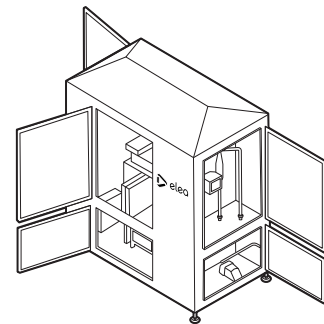
All Elea Advantage and PEF Pilot systems are engineered to the highest specifications and ensure continuous 24/7 operation.



PEF Advantage™ Belt  
One, 10, 100 & 1000



PEF Advantage™ Pipe  
1, 10, 100 & 1000



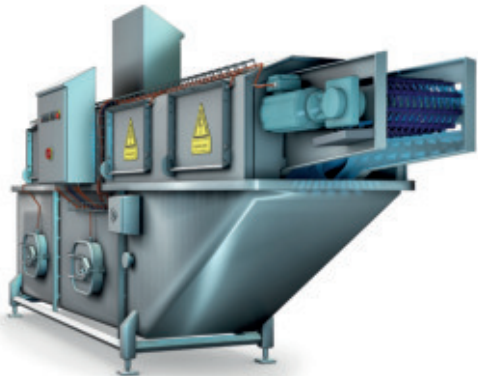
PEF Pilot™ Dual





# PEF Advantage™ Belt

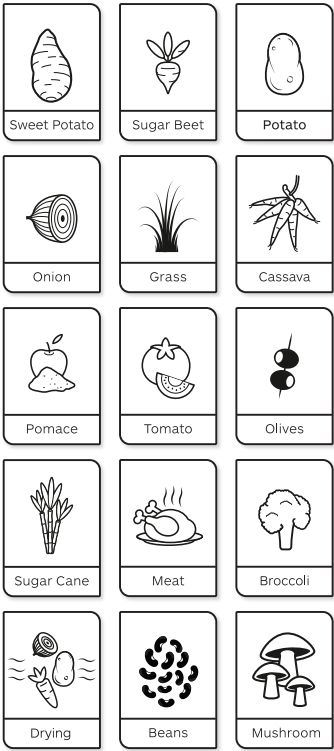
Tubers, roots, vegetables & fruits



The Elea Advantage™ Belt, is the ideal solution for the treatment of tubers, roots, vegetables and fruits. Available in four models, One, 10, 100 and 1000, each option can be customised to fit your needs.

The Advantage™ Belt systems range can process 1 – 60 t per hour, has quick start-up, small footprint and low energy and water usage.

The state-of-the-art control system with touch screen panel means that you can fully manage the process with maximum reliability and user safety.



## Pulse Generator

control system	Touch screen, measurement of peak voltage and current, connectors for oscilloscope, safety interlock, emergency off.
cooling	Air or water cooled depending on system.
dimensions	Dependent on system, stainless steel cabinet.

## Continuous Treatment Belt

capacity	Up to 60 t/h of potato in a potato water mixture.
water management	Automated level control, overflow channel, automated drain valve, water conductivity and temperature measurement.
electrodes	Stainless steel.
dimensions	Dependent on system, belt should be attached to generator.
power supply	Supplied from generator.

## Services Required

power supply	400/415 V, 50 Hz (3Phase/Ground), 100 A Other options available.
water	Water supply to treatment belt.
compressed air	6 bar.
drain valve	DN150 Flange.



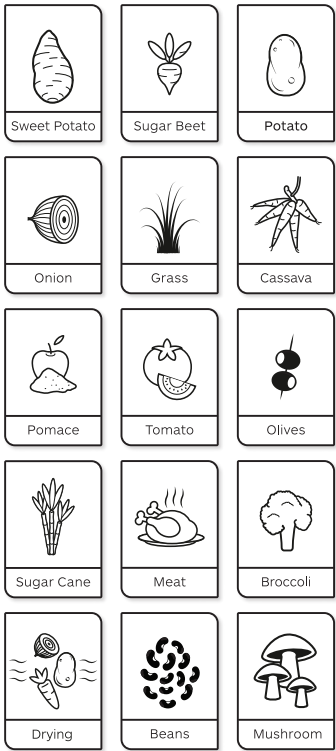


# PEF Advantage™ Belt One

All in one compact belt system

We've taken the technology and intelligence of the larger PEF Advantage™ Belt systems and reworked it to create a compact, all-in-one affordable and flexible solution for businesses looking for an output between 1 and 6 t/h.

A solid state system using the latest technology to obtain maximum reliability and user safety with an award winning design.



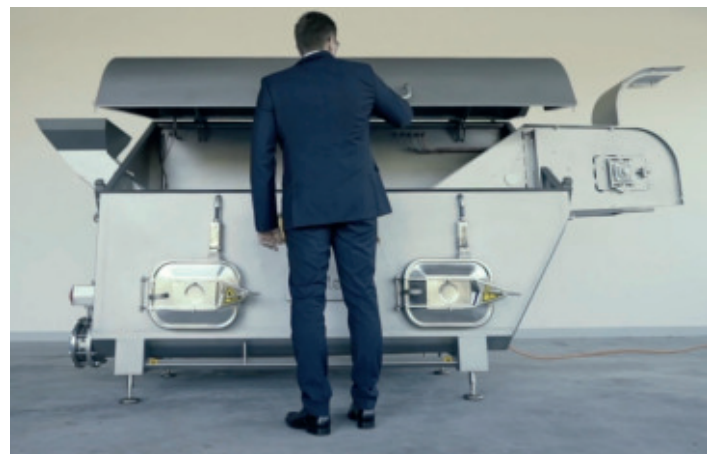
### Continuous Treatment Belt & Pulse Generator

capacity	Up to 6 t/h of potato in a potato water mixture.
safety standards	UL, ULc or CE.
electrodes	Titanium.
dimensions	4121 x 1347 x 1599 mm (LxWxH).
tank capacity	Approx. 1500 lt. +/- depending on working level.
system weight	1000 kgs. – Empty.
power supply	Supplied from generator.
pulse shape	Rectangular pulses with high energy efficiency.
control system	Siemens PLC: Option of remote operation, maintenance and fault diagnosis. Touch screen operation. Display of processing parameters.
optional	Various types of platforms to integrate system into existing installations.

### Services Required

power supply	400/415 V, 50 Hz (3Phase/Ground), 32 A Other options available.
water	Water supply to treatment belt.
compressed air	6 bar.
drain valve	DN150 Flange.







# PEF Advantage™ Pipe

Liquid & semi-liquid foods

Our PEF Advantage™ Pipe (1, 10, 100 and 1000) range can process both food and non-food liquid or semi-liquid products. The Elea PEF process inactivates bacteria to increase shelf-life and due to its gentle low temperature processing character retains freshness and quality. These systems also enable the extraction enhancement of several valuable compounds such as vitamins, colour and antioxidants from fruit mashes and achieve a higher level of juice yield.

The range can fulfill capacities between 50 L and 10,000 L per hour and each system has a hygienic integrated design that is CIP and SIP ready.

These systems put control in the hands of the operator and offer customisation of the process parameters. Close monitoring ensures compliance with all HACCP requirements and the modular design of the Advantage™ Pipe is simple to configure and easy to maintain.



## Pulse Generator

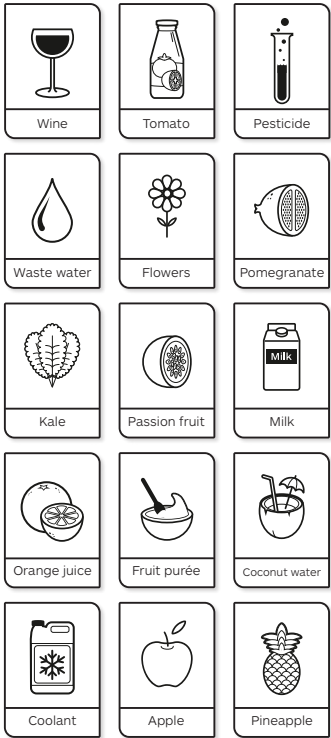
control system	Touch screen, measurement of peak voltage and current, connectors for oscilloscope, safety interlock, emergency off.
cooling	Air or water cooled depending on system.
dimensions	Dependent on system, stainless steel cabinet.

## Continuous Treatment Chambers

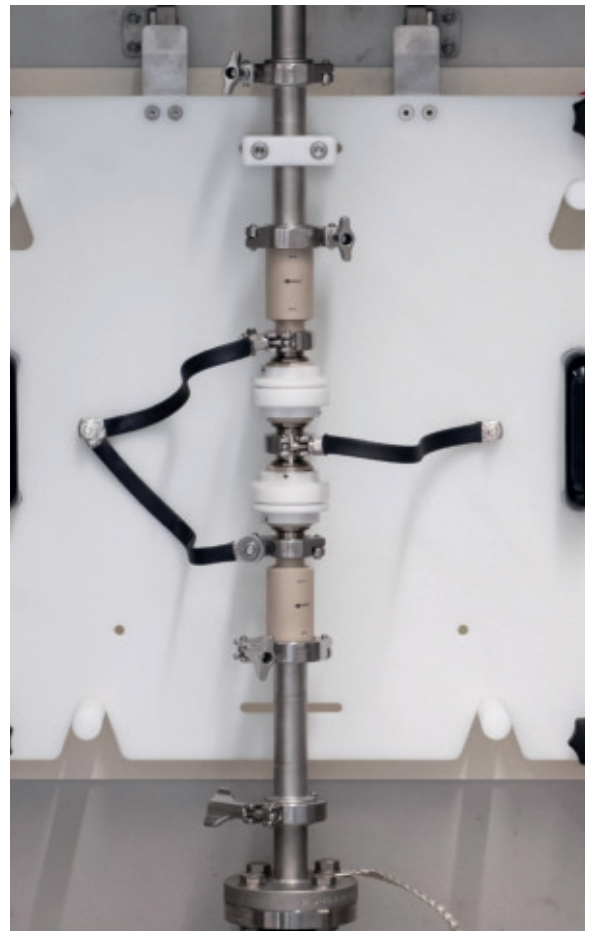
capacity	Up to 10 000 l/h of pumpable products, subject to load ratio and process requirements.
electrodes	Titanium.

## Services Required

power supply	400/415 V, 50 Hz (3Phase/Ground), 100 A. Other options available.
cooling	Air or water cooled depending on system.







# PEF Pilot™ Dual

Pulsed Electric Field trial  
& small production system



The PEF Pilot™ Dual is a versatile PEF system and can be delivered as a batch or liquid system. As changeovers are easy and quick it is suitable for research and development or small volume production. A PEF system using the latest technology to obtain maximum reliability and user safety.

## Pulse Generator

control system	Siemens PLC and touch screen, safety interlocks, for continuous liquid mode we also include flow meter, and temperature sensors.
cooling	Water and air cooled.
dimensions	2073 x 2327 x 1184 mm (W x H x D).

## Batch treatment chamber

capacity	Batch mode up to 10 kg per batch
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## Liquid treatment chamber

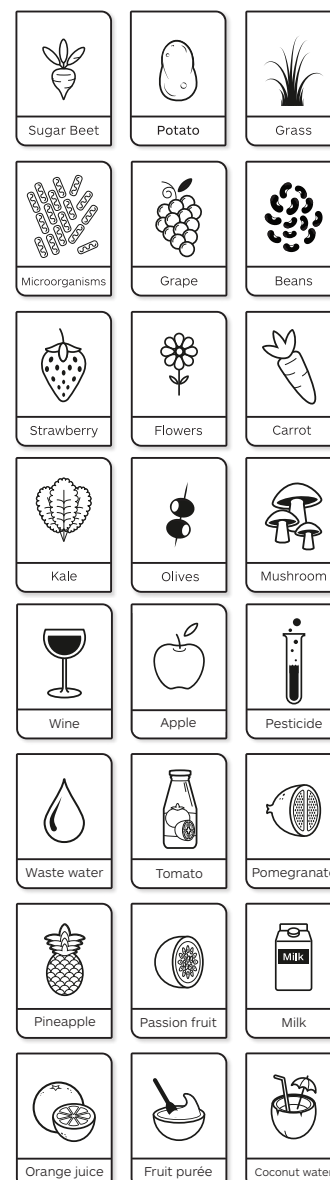
capacity	up to 250 l/h depending on process
electrodes	Titanium
sensors included	Flow meter and temperature sensors pre and post treatment

## System services required

power supply	400V, 50 Hz, 35 A (10 kW), other options available.
cooling water	1 bar minimum pressure max inlet temperature 25°C.

## Only for liquid system set-up

cooling water	6 bar – only required on liquid system for valve control.
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## PEF monitoring tools

Our range of monitoring systems have been designed and built by us to keep your PEF treatment parameters optimised.



## Cut Control™

Monitor quality control with precision and optimise treatment conditions for potato and vegetable cutting with Elea CutControl™.

Developed to measure the cutting force in roots, tubers and vegetables both before and after PEF treatments, Elea's Cut Control™ is an important tool when it comes to product quality control.

The Cut Control™ system is an industry-ready measurement unit that's ideal for use in a quality control lab, yet it's also portable to allow direct operation right at the heart of the production line. Delivered with a handy storage and transport case, the system also comes with two cutting grids and a sample preparation grid as standard.

The pneumatic pressure sensor helps to identify the optimum PEF treatment intensity and recommend the best parameters to achieve exceptional product yield, quality and flexibility. This can then be kept consistent throughout the production process.



## PEF Control™

Directly measure PEF impact on the cell disintegration level and optimise mass transport processes, such as sugar extraction, drying or infusion.



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Developed to measure the cell disintegration level in roots, tubers, vegetables and other food products, also small food like berries both before and after PEF treatments.

Monitor cell disintegration before and after various levels of Pulsed Electric Field treatment to optimise treatment conditions for fruit and vegetable processing with Elea PEF Control™.

The PEF Control™ system is an industry-ready measurement unit that's ideal for use in a research lab, yet it's also portable enough to allow direct operation right at the heart of the production line. Delivered with a handy storage and transport case, the system also comes with a measuring fork on a handle as standard.

Designed and built with the same care, quality and technical expertise as our other systems, it's the ideal addition to understand and enhance the benefits of PEF treatment.

## SafeJuice™ data logger

Easily monitor PEF treatment parameters for your juice and smoothie products.

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Elea has developed SafeJuice, a process monitoring tool to fulfill all operator and HACCP needs.

SafeJuice allows easy PEF implementation into industrial juice processing lines. The system includes modules for on-line acquisition and analysis of processing data such as energy delivery and treatment temperature as well as relevant product parameters such as conductivity, °Bx or pH.

As a result, the applied treatment intensity can be calculated in real time, allowing process monitoring as well as taking action in case of unexpected deviations,

for example adaptation of processing conditions or to initiate reprocessing.

With the new paperless SafeJuice data logger, processing data can be visualized and fully documented to ensure the production of safe juice and smoothie products of best retained natural quality and freshness.



*Designing PEF systems with our engineering team*



# Designed and built by Elea at our facility in Quakenbrück, Germany

We are the leading provider of PEF technology in the world

**Elea designs and manufactures PEF machines of outstanding quality  
for your production line.**

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The Elea manufacturing and assembly facility is located at Quakenbrück, Germany, adjacent to our R&D department and pilot hall facilities.

Elea focuses on the highest quality manufacturing, customer requirements and short lead times.

Each one of our systems is designed to be easily and fully integrated into your production line. PLC control and extensive monitoring options guarantee ease of operation.

Robust build and solid state typology makes our technology exceptionally reliable. Elea PEF machines are designed for 24/7 operation in any production environment.

We currently have over 40 personnel working in manufacturing, including design, electrical, mechanical, and software programming. All of them experts in their field.

Our dedicated installation and field service team works closely with the customer to ensure a smooth and successful commissioning of our systems.

Elea field technicians focus on installation and maintenance to ensure worldwide customer service and pro-active maintenance. With options for remote monitoring or service contracts we provide each customer with around the clock technical support.





*Running juice trials in our PEF liquids pilot hall*



## Application support & pioneering PEF research

No one is better placed to help trial your product with Pulsed Electric Field

**With more than 125 PEF systems in full production today we are recognised as sector leaders with a first-class reputation for our scientific and engineering expertise.**

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At Elea our experts can manage your PEF project from blueprint to production line, on-time and on-budget. Every PEF system we design is tailor-made to your specific needs.

Our scientists and engineers work with our clients every step of the way offering expert guidance and professional advice for their application. We take your product concept and apply our industry-leading knowledge and experience to designing a system that will deliver greatest value.

Through our R&D programmes we continuously strive for new Pulsed Electric Field opportunities and applications. New innovations and discoveries are often driven by our collaborative R&D projects. The knowledge gained from this research is directly funnelled into new PEF solutions and applications via the Elea Advantage systems.

Elea is currently involved in a wide range of PEF collaborative research projects including stimulation of algae for improved growth and extraction, PEF drying optimization for improved quality and form stability, new improvements for meat processing and exciting new opportunities for wine.

Elea has built a valuable network of research partners from both academic and industry backgrounds from all over the globe. These include research institutes such as DIL and FEI, and universities such as the University of Applied Science of Osnabrück, University Vienna BOKU, CPUT in South Africa and the Warsaw University Of Life Sciences in Poland.

Elea's research projects are adding constantly to our knowledge base and system expertise.

# Trialing your new application with Elea

Get the best results for your product with our help

**Elea offers trialing and expertise in our specially designed pilot halls.  
We can also place our PEF systems in your production line for onsite-trials.**

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Our custom-built pilot hall in Quakenbrück is fully equipped with state-of-the-art devices to emulate your production process.

Here we develop new applications and opportunities for PEF and are able to mirror industrial processes. Every PEF solution we develop is customizable and then up-scalable to a production line.

The core apparatus to many of our lab or pilot scale research projects are the Elea PEFPilot Dual systems. Enabling us to develop new products and services in conjunction with our research partners.

The results gained at smaller volumes with the PEFPilot is then up-scalable to our production systems.

## **Trial examples:**

- Shelf life study for liquids.
- Optimisation studies: trials regarding process optimisation and process savings.
- Long term trials on customer site.
- Frying trials with new cutting shapes or new raw materials.
- Drying and freeze-drying trials in pilot scale.

## **Pilot hall features**

- Trial batch PEF system with various chamber sizes.
- Continuous liquid PEF system + liquid handling system (tube in tube heat exchanger/cooling system).
- Industrial scale slicers with various cutting heads allowing to cut new and special shapes (e.g. Gothic arch cut).
- Professional fryers to mimic typical frying curves.
- Cutting force measurement devices.
- Good collaboration with local laboratories.
- Various juice extracting machinery for e.g. citrus fruits, fruits and vegetables and mashes.
- Special freezing and drying equipment.
- Packaging machine in tabletop size (e.g. vacuum or nitrogen packaging).
- Wide range of analysis equipment (e.g. in-time-analysis while test runs)
- Huge additional analytical capacity at our neighbouring laboratories of the German Institute of Food Technologies (DIL)
- Long term trials on customer site.
- Frying trials with new cutting shapes or new raw materials.
- Drying and freeze-drying trials in pilot scale.









*Untreated and PEF treated dried strawberries*



*PEF treated carrot chips*



*Running PEF trials on juice and smoothies at Elea*







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