

## SYSTEMS IN ACTION



### Permanent Barrier Facility Site

DTI has installed a pulsed electric field (PEF) modulator on the Chicago Sanitary and Shipping Canal (CSSC). Funded by the U.S. Army Corps of Engineers, this permanent barrier is designed to prevent Asian Carp migration into Lake Michigan where they would destroy existing fisheries.



### Permanent Generating System

Installation showing the array of pulse switches which deliver  $\pm 3$  kV pulses at up to 30 kA.

## PULSED ELECTRIC FIELD

DTI builds a range of Pulsed Electric Field (PEF) systems for R&D, small-scale, and large industrial applications. This technology utilizes DTI's advancements in high voltage pulsed power – allowing high voltage, high power systems to use solid state devices in place of large vacuum tubes or gas discharge switches. Since our initial developments nearly a decade ago, DTI has received numerous patents on this technology, and sold over 300 solid state, high voltage modulators, power supplies, and transmitters for a wide range of Government/Military and commercial applications, including radars, particle accelerators, and industrial processes such as semiconductor manufacturing.

PEF systems are part of DTI's proven line of solid state high voltage systems, some of which have been operated without failure for over 25 years. DTI has delivered a wide range of reliable, high voltage pulse generating systems for military, scientific, and commercial customers throughout its history.

### Applications

PEF has been used in a wide range of applications, including:

- **Electric Fish Barrier.** The permanently installed system employs PEF to repel Asian Carp without chemicals or nets that would interfere with shipping traffic.
- **Algal Oil Extraction.** The PEF system ruptures algae cells, easing access to intracellular oil, which is released into the surrounding solution.
- **Non-Thermal Pasteurization of Liquids and Semi-Solid Foods.** The PEF system kills microorganisms, preserving freshness without heating the product.
- **Sugar/Juice Extraction.** Similar in practice to algae oil extraction, the PEF system opens intracellular material (i.e., juice from vegetables, fruits or other plant materials) into the surrounding solution, increasing product yield.
- **Wastewater Treatment.** PEF can be used to kill pathogens or to open cells for enhanced digestion, reducing the volume of solids requiring disposal and increasing the amount of material available for conversion to energy.
- **Efficient Drying/Dehydration.** PEF can reduce energy usage in drying processes by up to 50% in comparison to traditional drying methods.
- **Tissue Modification.** PEF can be used to modify plant and meat texture by increasing tissue permeability. Texture modification is known to enhance food quality and promote efficient manufacturing processes, reducing the cost of downstream operations such as slicing or peeling, significantly.

# Pulse Electric Field Applications

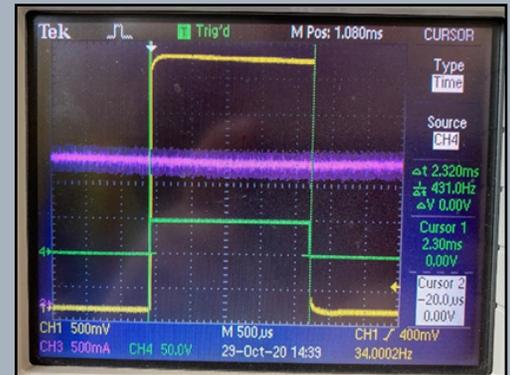
**DIVERSIFIED TECHNOLOGIES, INC.**

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DTI's PEF systems are electrically and physically customizable over a wide range of specifications, providing optimal solutions for specific applications. Users are able to vary the voltage, the duration, and frequency of the pulses independently. All DTI systems employ solid state electronics providing long system lifetime, high efficiency, and low operating costs.

A typical PEF system consists of:

- (1) A power supply to convert utility power to high voltage DC power.
- (2) A high voltage pulse modulator to transform the DC power into short pulses.
- (3) A treatment chamber where the high voltage pulses are applied to the product. Treatment chambers can be customized to treat a wide range of input materials, including liquids, slurries, and solids.
- (4) A touchscreen user interface for ease of operation.



**The pulse on DTI's Pulse Generating System during Fish Barrier operation .** Pulse conditions:  $\pm 1.7$  kV (3.4 kV total), 7.1 kA, 2.3 ms pulse width, 34 Hz pulse rate.



**IGBT used for Pulse Switches (9x9 pkg)** Each IGBT is rated at 5.2 kV, 3 kA peak. 16 of these IGBTs are used in the PGS.



**Industrial PEF Unit (150 kW)**  
built to NEMA 4 standards.

### Transmitters

### Pulsed Electric Field

### DC Power Supplies

### Power Converters

### Pulse Modulators

