

Impulse Microwave Food Sterilizer

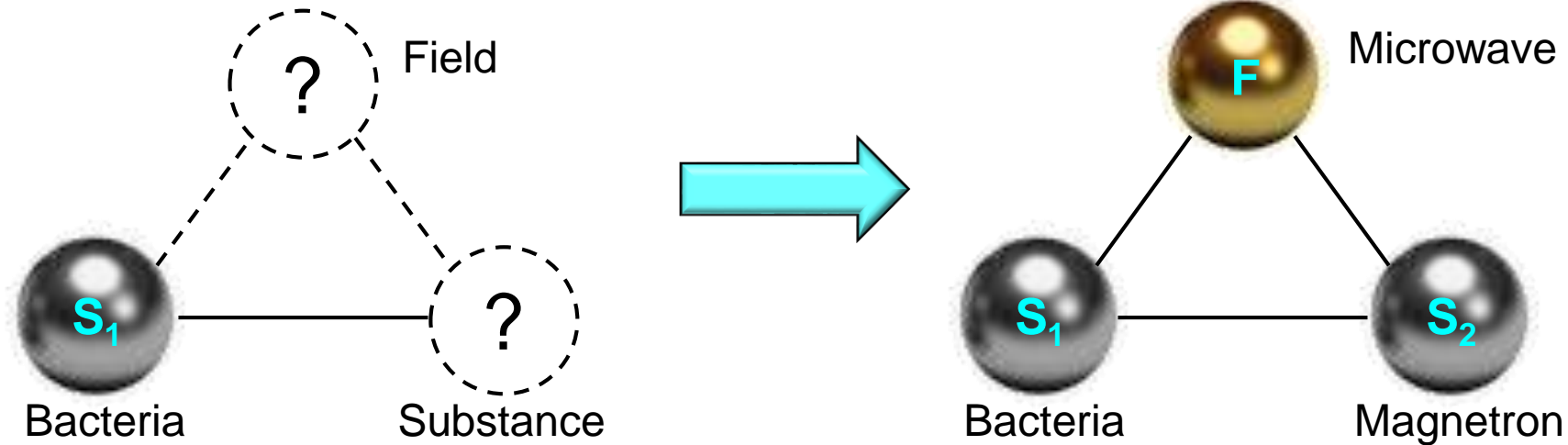
GEN TRIZ Case Study

Background

- Modern food processing (particularly dairy products) includes sterilization, prolonging shelf life and providing consumer safety
- There are two major methods of sterilization: heat treatment and application of chemical agents (preservatives and antibiotics)
- Both methods in many cases are poorly acceptable, because they affect taste of products or even health of consumers
- Thus, it is necessary to develop effective sterilization method, that:
 - Is suitable for mass production
 - Does not affect taste of products
 - Is not dangerous for consumers
 - Highly effective
 - Has low operation cost

GEN TRIZ Analysis

- Problem:
 - How to kill bacteria and spores
- GEN TRIZ tool - Application of Standard Inventive Solutions:



- Solution:
 - We proposed to use short microwave impulses of super-high power (tens of megawatts) as a tool to kill bacteria without significant heating. Treatment time is less than a minute, whereas temperature increase during processing is virtually insignificant (1° C)

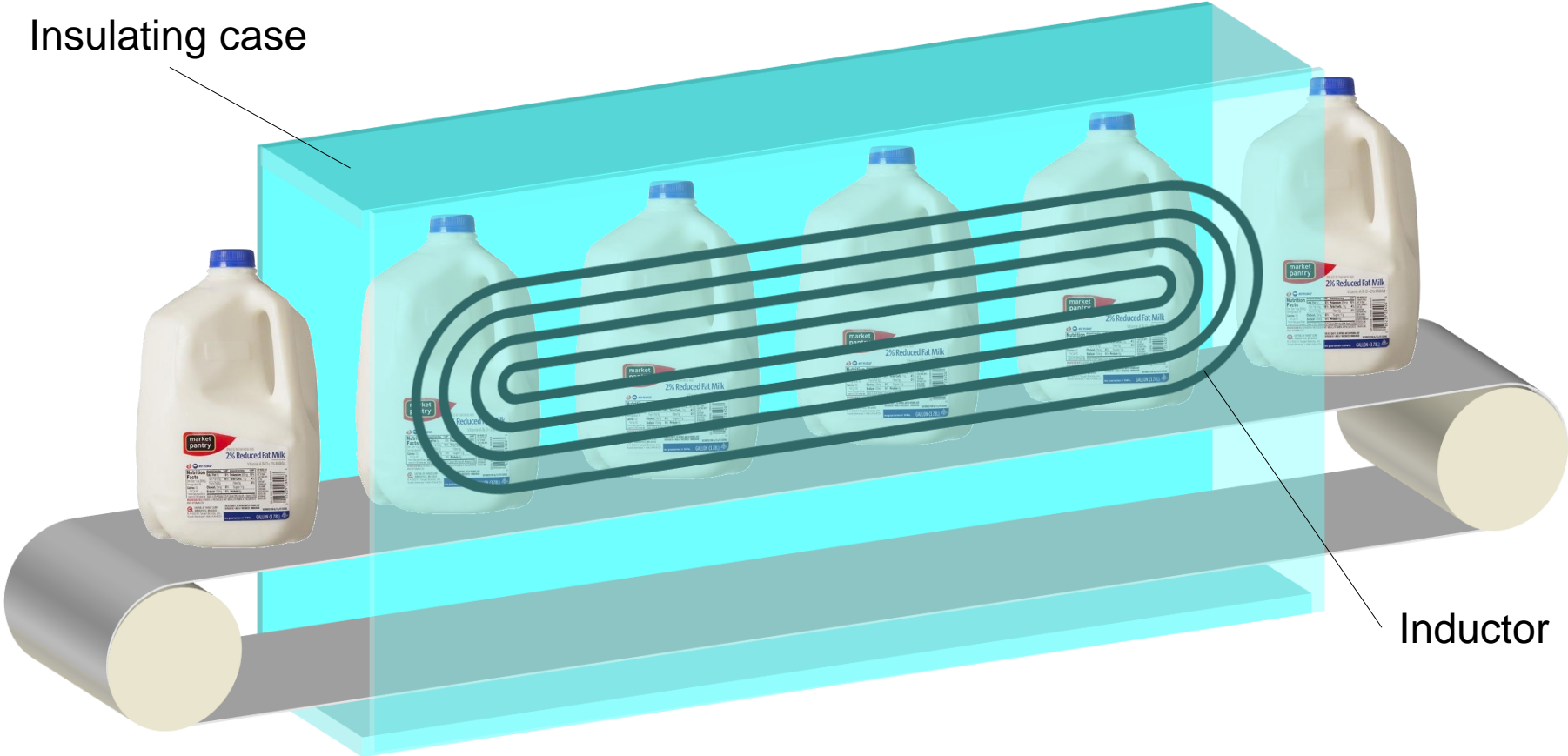
Solution: Impulse Microwave Sterilizer - Scientific Explanation

- Many pathogenic microorganisms are reported in literature to be sensitive to microwave treatment”
 - Escherichia coli
 - Streptococcus faecalis
 - Clostridium perfringens
 - Staphylococcus aureus
 - Salmonella
 - Listeria
 - Microscopic fungi
 - PL-1 bacteriophages
- Even spores can be inactivated with the microwave treatment, because they contain several percent of water
- Protein DNA destruction under microwave treatment is reported by a number of researchers as well, even if no significant heating occurs

Solution: Impulse Microwave Sterilizer - Process Description

- The device:
 - Is reliably protected from emission leakage,
 - Supports continuous (conveyor) process
 - Operates at 46° C initial product temperature
 - Produces 5-10 microsecond impulses of 40MW power each.
- The microwave generator is similar to the generators used in air-route surveillance radars and high energy accelerators
- Beer, wine, and an alcohol-free beverage were successfully sterilized at 46° C using the pulsed microwave sterilizer
- No microorganisms of several groups have been found in the treated products:
 - Bacteria: mesophilic aerobic, elective anaerobic, colon bacillus group, lactic acid group,
 - Microscopic fungi
 - Yeast

Solution: Impulse Microwave Sterilizer - Device Description



Solution: Impulse Microwave Sterilizer - Advantages

- The developed technology:
 - Is suitable for mass production
 - Does not affect taste of products
 - Is not dangerous for consumers
 - Highly effective
 - Has low operation cost