



WOLFRAM CONSULTING SERVICES

Optimizing Cold Chains for Sustainable Pharmaceutical Logistics

Industry: Engineering

Applications: Logistics, Cold Chains, Pharmaceuticals



THE CHALLENGE

The global transportation of medical products, such as vaccines, reagents and other temperature-sensitive pharmaceuticals, is a complex system that presents significant challenges. One key issue is ensuring thermal conditions are consistently maintained throughout the supply chain. An estimated 25% of medical shipments are spoiled on the way to their destinations because of improper thermal conditions.

The successful management of thermal conditions in supply chains is not a trivial problem: it requires integrating packaging material performance, transportation profiles, cooling agent behavior and real-world climate data.

SmartCAE's mission is to reduce product spoilage, improve supply chain reliability and promote sustainability in pharmaceutical logistics. To achieve this, they needed a software system capable of combining diverse data types and applying various algorithms for conducting simulations of real-world cold chain conditions.

HIGHLIGHTS

1:1

Ability to generate a complete **digital twin** of cold chain performance conditions.

90%

Reduction of spoilage by using Digital Cold Chain.

25

SmartCAE partners with customers from **25** countries.



THE APPROACH

To achieve their mission, SmartCAE developed Digital Cold Chain, a software platform powered by Wolfram technology that enables pharmaceutical companies and logistics providers to model and simulate cold chain performance. Digital Cold Chain incorporates inputs, including real sensor data, weather profiles and packaging system parameters, to build realistic models that SmartCAE's clients can rely on to make real decisions.

Digital Cold Chain's modules make the most out of Wolfram's powerful ODE-solving algorithms and symbolic-numeric computation, ensuring the platform delivers accurate, fast results—often within hours—helping clients make better, data-driven decisions across their cold chain operations.

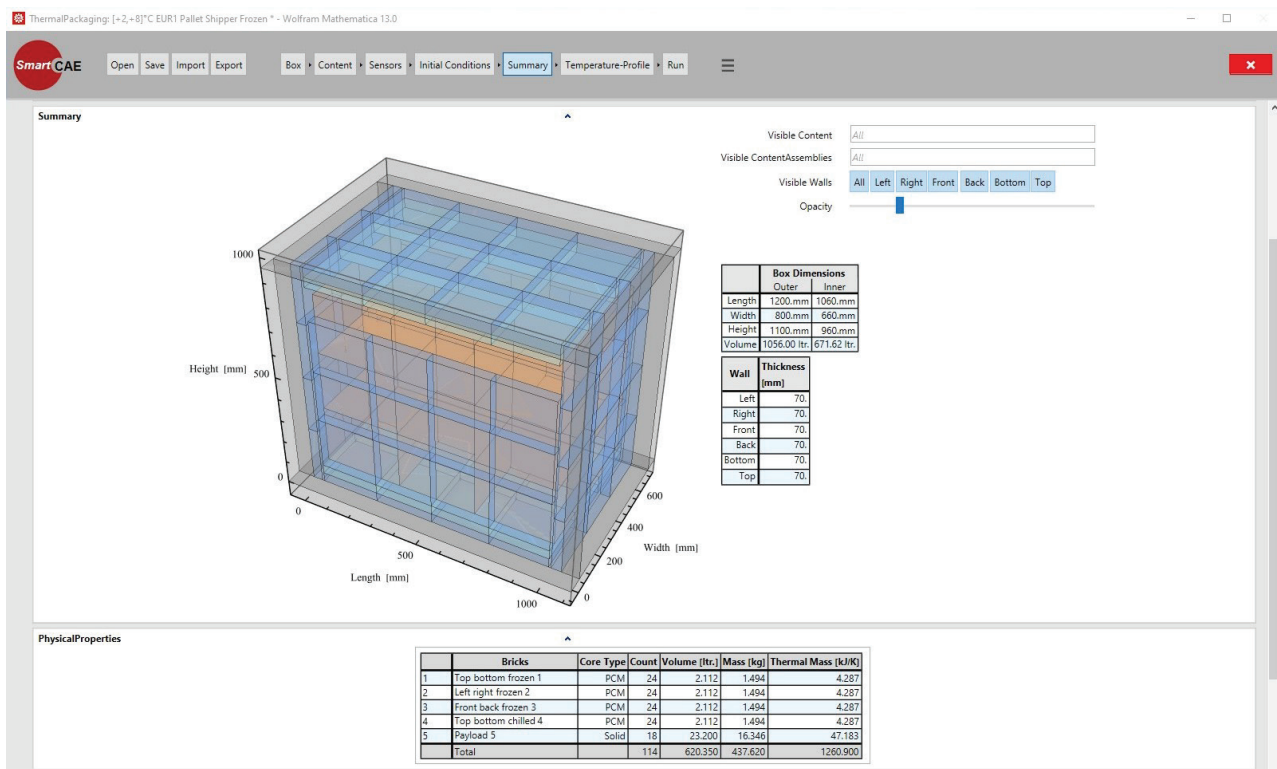
SmartCAE makes use of Wolfram Player Pro, which clients can install locally on their computers, making the deployment of Digital Cold Chain readily available to end users without needing the full Wolfram technology stack.

Combining Wolfram's computation and SmartCAE's domain expertise, Digital Cold Chain enables clients to:

- Create realistic models of products, packaging and shipping lanes. Expose the models to any ambient temperature profile, thermal radiation from hot tarmac and solar irradiance to observe the effects.
- Overlay measurement data with simulation results.
- Compare packaging solution profiles of different vendors.
- Access air humidity data for any global location on the land surface while taking into account diurnal and seasonal variation.

“Our goal is to minimize temperature excursions of drugs in the supply chain and reduce the carbon footprint impact on a global scale.”

—Stefan Braun
Managing Director
SmartCAE



Interactive analysis of thermal packaging in Digital Cold Chain.

ACHIEVEMENTS

- SmartCAE's technology was used effectively during the COVID-19 pandemic to ensure safe, efficient transport of vaccines and critical medical goods worldwide.
- Clients replaced costly trial-and-error shipping and simplistic models with predictive simulations, resulting in fewer temperature excursions and significantly reduced waste.
- By optimizing packaging and route design, companies achieved lower material usage, fewer failed deliveries and more efficient cold chain processes overall.

LET'S TAKE YOUR PROJECT TO THE NEXT LEVEL

Find out how the Wolfram Consulting Services team can jump-start your project with in-depth troubleshooting, code optimization, custom training or production deployment.