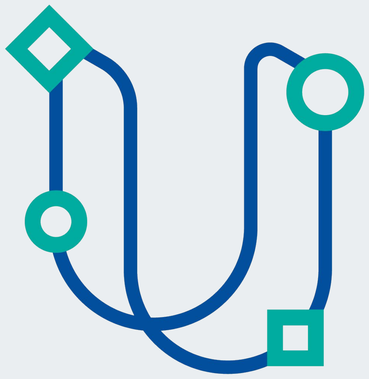

Uptim.ai

Empowering R&D with

Data analysis, Statistical modelling, Optimization and Uncertainty Quantification

Our story

How it all began

Uptim.ai

- Uptimai is a **state-of-the-art company for data** analysis, optimization, uncertainty quantification, smart design and data modelling.
- Our algorithm was **originally developed to estimate the impact area of space debris** and later adapted for use in general Computer-Aided Engineering
- Our approach combines advances in statistical modelling with elements of AI & Machine Learning

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Our tools

What we use to improve design and provide new know-how

- Our unique software for the propagation of uncertainty, statistics and data analysis
  - **New methods** for statistical insight
  - **Very efficient algorithms** for data analysis
- Our **vast amount of knowledge** in statistical methods, optimization, uncertainty quantification, surrogate modelling and **machine learning / AI**
- Our **experience** and background in aerospace & automotive engineering

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Projects we helped with

Using our knowledge and unique tool in other successful projects

Landing ground distance shortened by up to 18%

Glide Ratio improved from 113 to 166

Reduced the average displacement of the payload by 2x

Noise source identification for only 19 simulations

Optimizing Force and Specific Impulse of a turbofan

Accurate digital twin of Sunload heating

New software developments

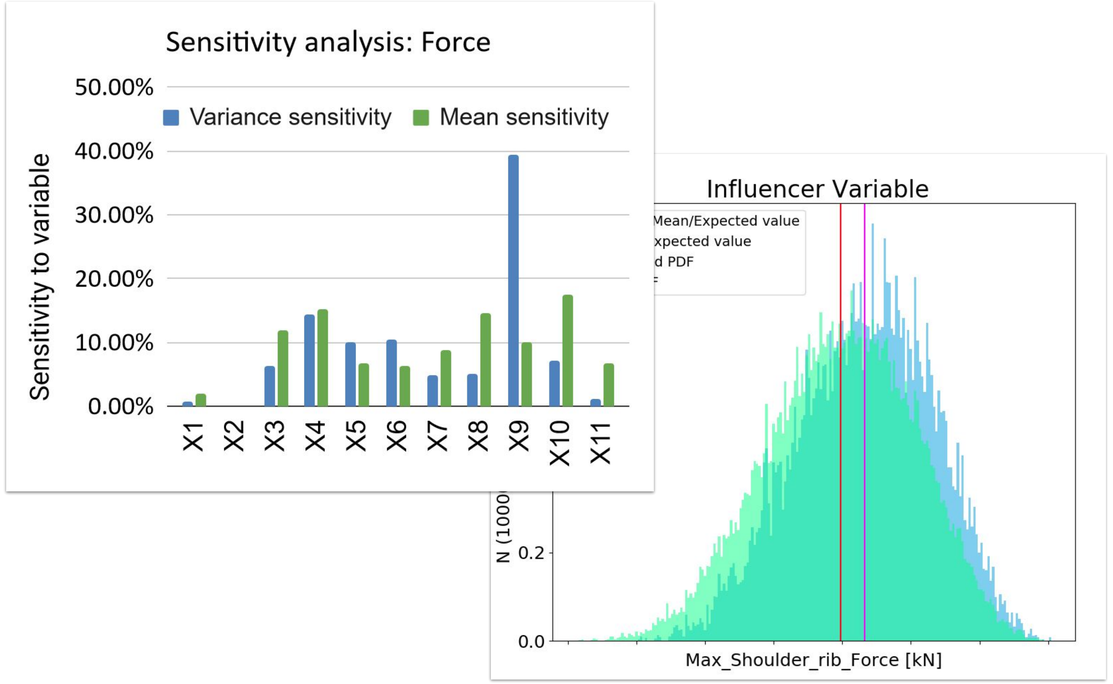
Uptim.ai

Our Unique Features

Uptimai Platform

Preliminary analysis

- Fast approach to **identify important parameters** (including correlations)
- Ideal for the initial stages of a project
- Visualizes **main statistical effects** from each input variable
- **Creates simple model for quick analysis**

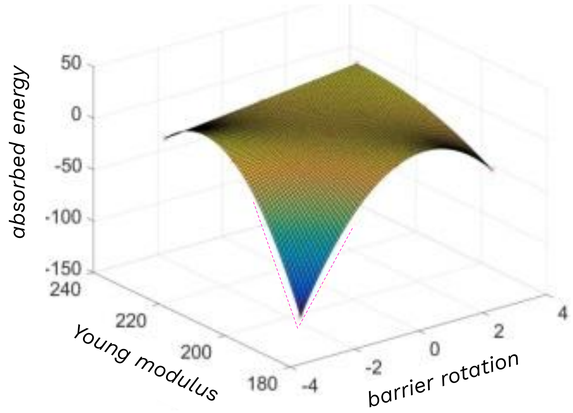


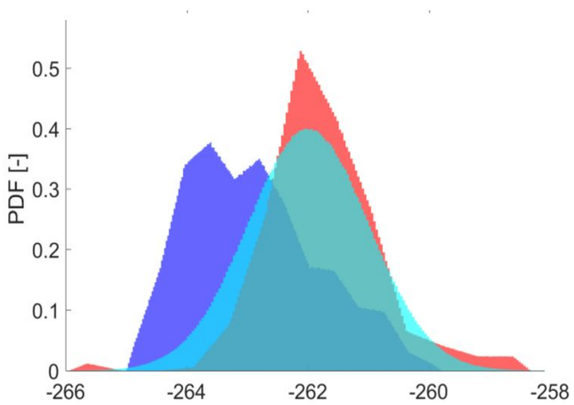
Based on the quick sensitivity analysis and the influencer, the user can decide how to reduce the design space

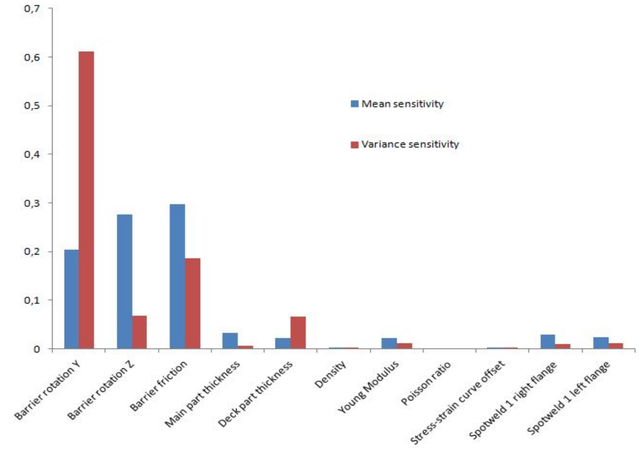
Uptimai Platform

Uncertainty Quantification - Surrogate Modelling

- Extended information than Preliminary Analysis
- Creation of accurate **Surrogate Model**, describing the physics behind the problem
- **Decoupling of the effects** for easier interpretation
- **Statistical tools** to help identify how uncertainties affect the solution



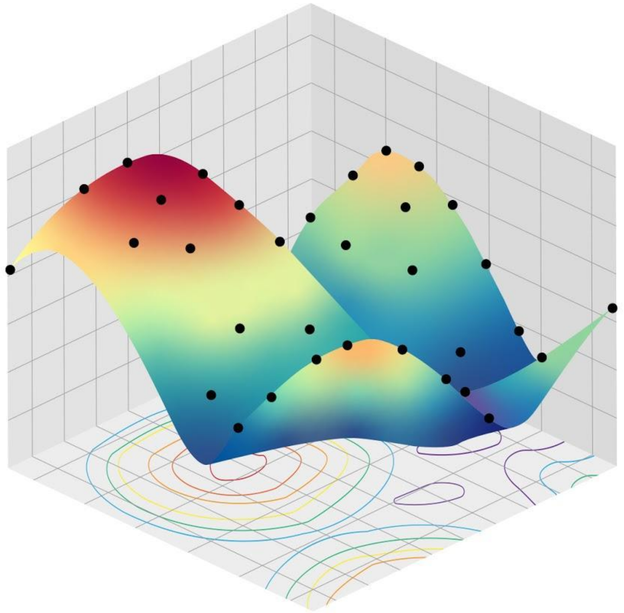




Uptimai Platform

Data analysis

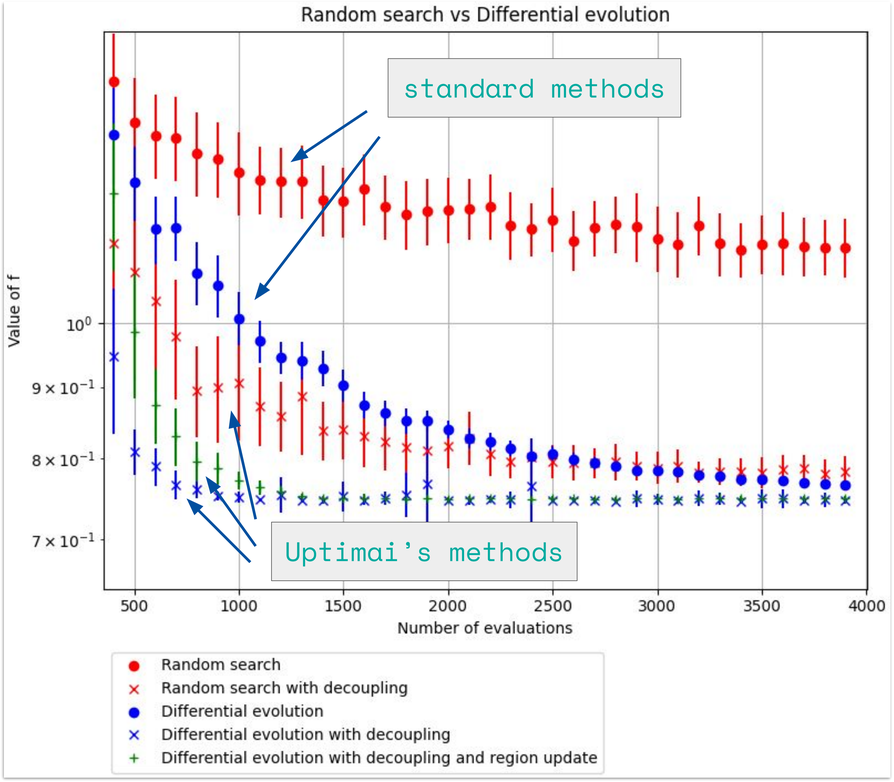
- Creation of **AI models from data** (measurements)
- Combined analysis of data and computer simulation, i.e. **rigorous model** and **data analysis**
- Focus on a **small dataset**
- The resulting AI model is studied in the same way as the model based on computations, e.g. optimization, uncertainty analysis etc…
- Can be used for **predictive MRO** (Maintenance Repair and Overhaul).



Uptimai Platform

Fast optimization approaches

- Benefits from a combination of **statistical** and **direct optimization approaches**
- Suitable for both **single-** and **multi-disciplinary** problems
- Optimizations with constraints applied to **input variables** and **unobserved outputs**
- Custom optimization techniques with **increased effectiveness** and stability of standard optimization algorithms

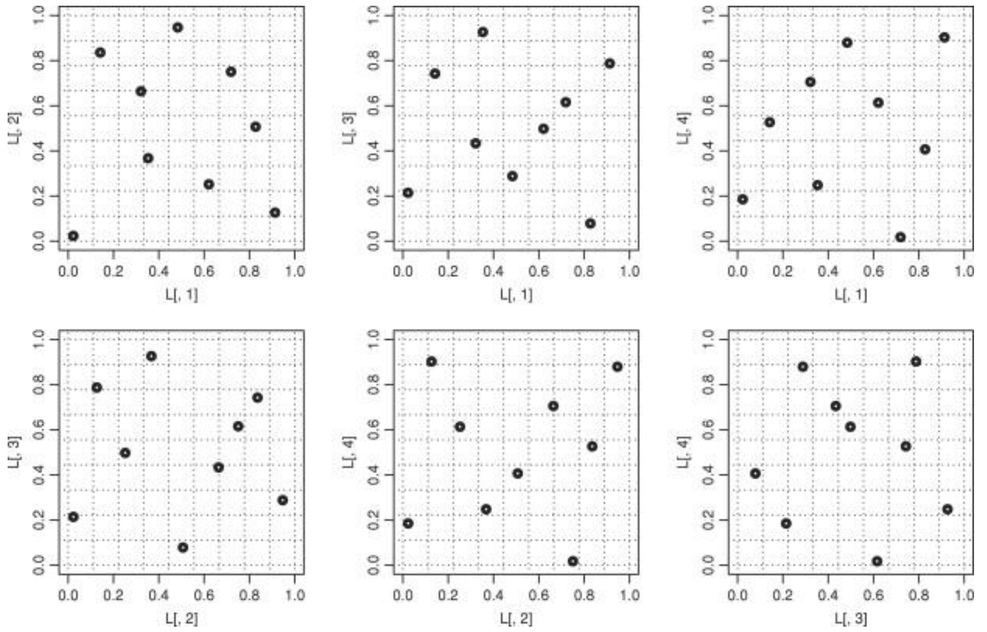


Comparison of optimization methods, testing function with 8 input variables

Uptimai Platform

Design Of Experiments - standard engineering approach

- Designed to **satisfy simple engineering approach** to simply help to improve the design
- Sample the domain of interest to cover the domain in the most efficient way
- Can be **coupled with data-analyser** to provide a rigorous approach
- Automatically **takes into account already existing samples/measurements**



Case Study

Uptim.ai

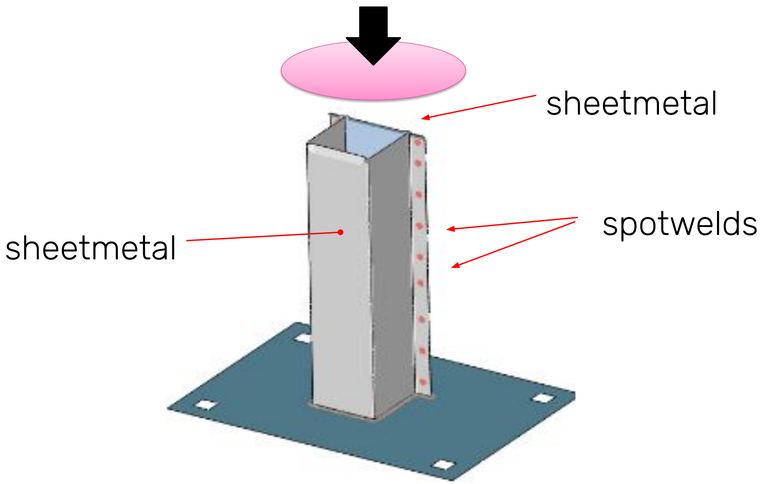
Example of our work

Impact Energy of a Welded Beam

Project done with Škoda Auto

Main Challenges

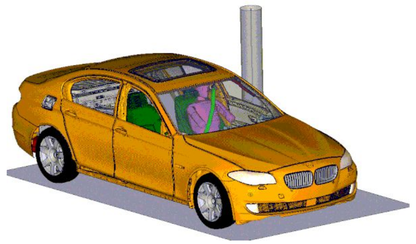
- Understand how simulation correlates with experiment
- How parameters influence the absorbed energy
- Optimize the absorbed energy
- Optimize the performance of the beam for different crash conditions



Our approach: On site approach

Connecting our solution directly to customer needs

1



We directly connected our software with in-side PAM-crash

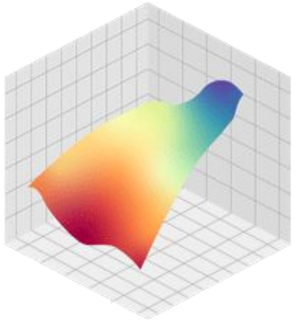
2

Skoda engineers provided ranges for each parameter

3

Uptimai ML Algorithm Effectively build an accurate model

4

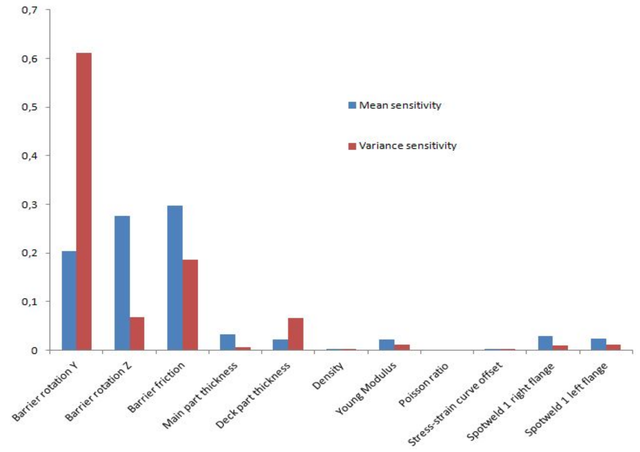


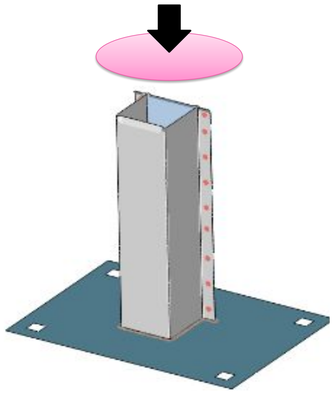
We provided a report with high-added value

Welded Beam: our tools

Understand the ability of inputs to affect the designed product

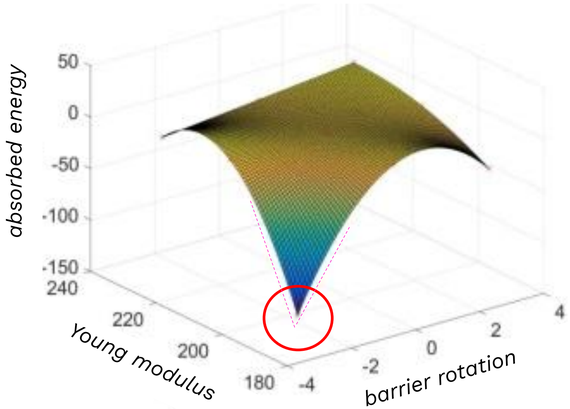
Barrier rotations have the major impact on overall result





Barrier rotation cannot be tackled alone but has to consider in combination with other interacting variables. Interaction with other variables play a significant role in the absorbed energy

Young modulus of material must be above 200 GPa

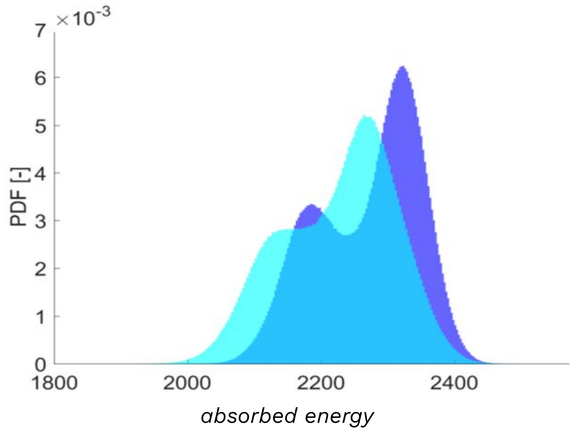


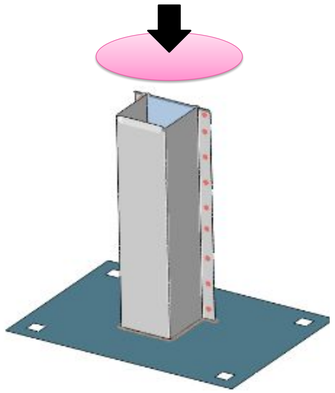
Combination of barrier rotation and material characteristics is a cause of unwanted extremities. Ensuring high young's modulus lead to high absorbed energy

Welded Beam: our tools

See how each input influences the product performance

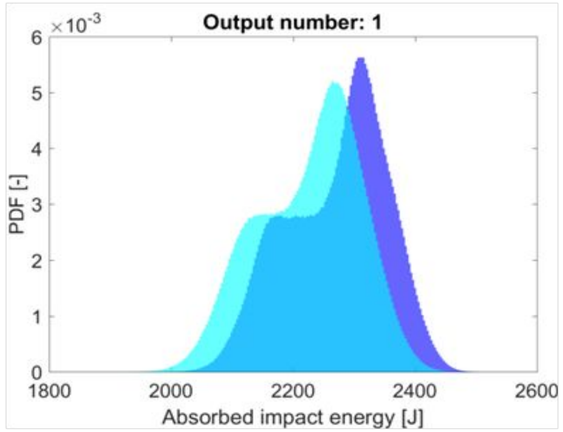
Barrier friction can improve the worst-case scenario





Barrier friction is influencing the mode of collapse. We suggested further investigate the friction between the beam and impactor

Adjusting spot weld positions leads to overall improvement

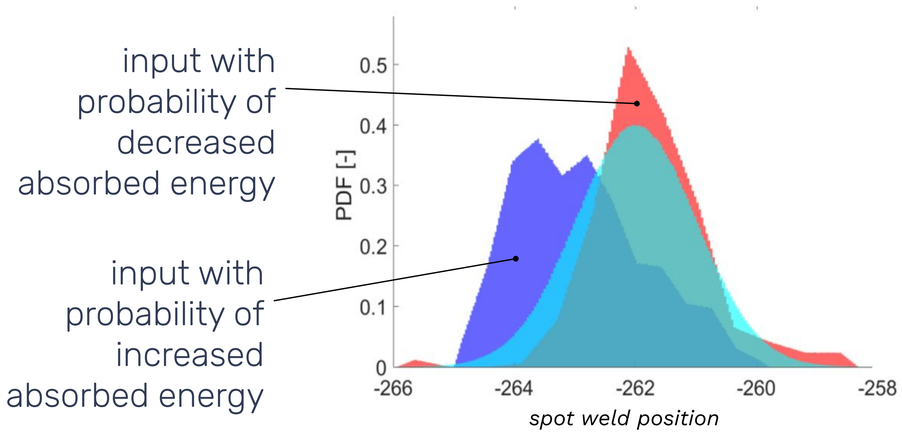


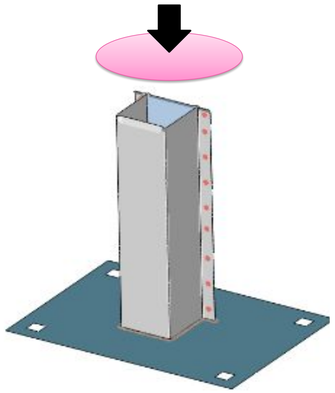
Spotwelds positions can improve the absorbed energy. The smart positioning of the spot welds can lead to significant improvement in the absorbed energy

Welded Beam: our tools

Find ranges of inputs leading to an increase in the performance

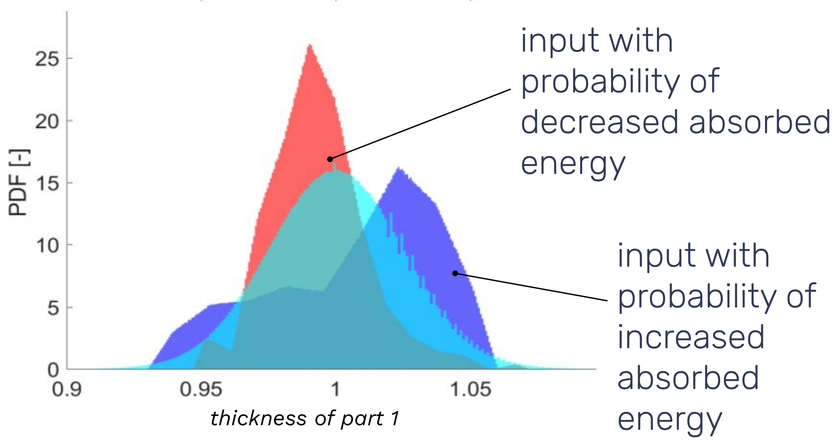
Spot weld positions must be non-equidistant





The probability of higher absorbed energy is driven by non-equidistant weld positions. This lead to a driven collapse of the beam and reduced variance in the absorbed energy

Parts must have different thickness



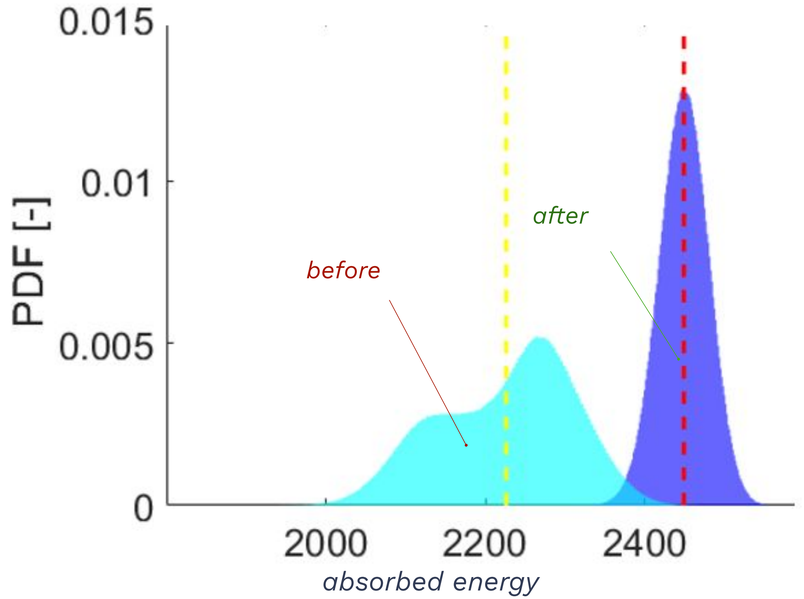
Different thickness for each part leads to higher absorbed energy due to driven collapse. Moreover, changing thickness leads to a reduction in overall weight -> non-measured characteristics

Welded Beam: Results

The absorbed impact energy of optimized geometries increased by 10% on average

- Absorbed impact energy increased by 10%
- The range of results decreased by 63%
- Fast development time
  (280 calculations instead of 4060)

Total absorbed energy after optimization



Case of a Welded Beam: Benefits

Provided several non-standard benefits and ideas

- Understanding which parameters and their interactions are the key players – Directed focus
- Understanding behavior of important parameters – a deeper insight
- Optimized behavior under various conditions - Statistically stable impact behavior
- Enhanced optimization – understanding how un-observed conditions can be improved

BONUS: They can play with our **AI model** to further understand how to improve the beam problem.

UptimAI

Your newest tool for robust design and smart optimization

Alex Guerrero

Position: Application Engineer

E-mail: alex.guerrero@uptim.ai

Mobile: +34 680 611 589