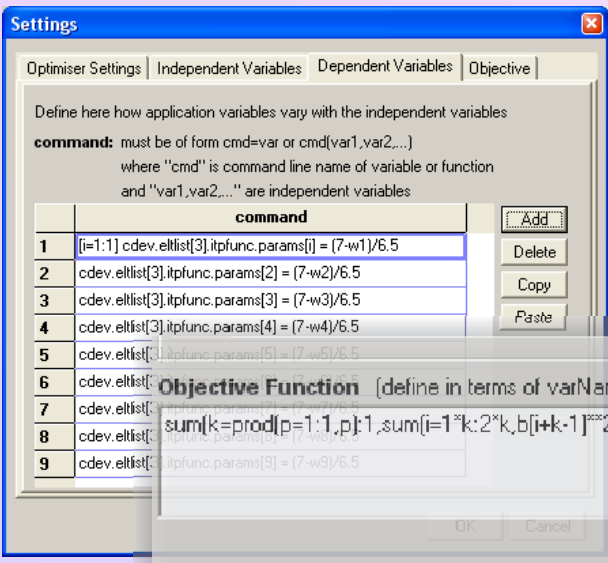
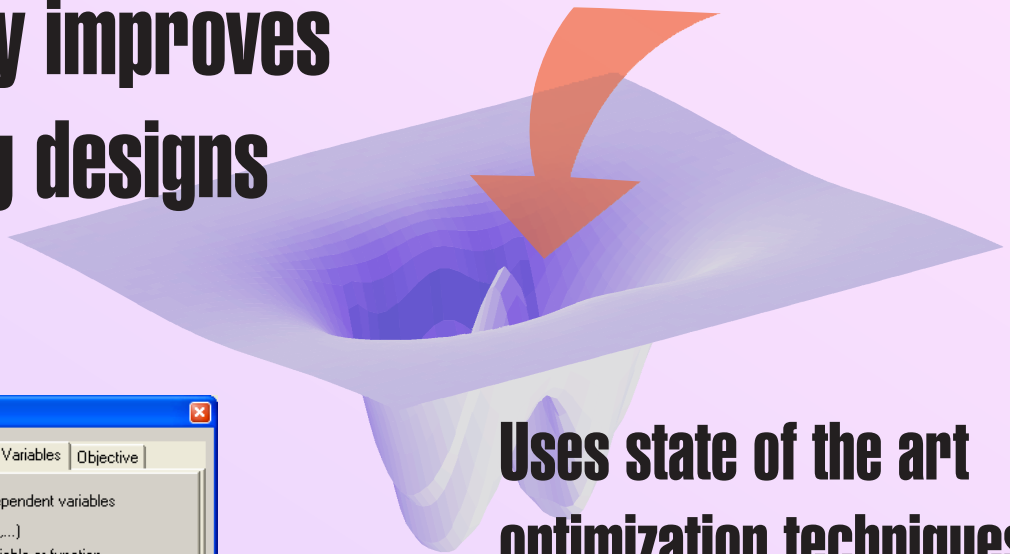


Automatically improves your existing designs

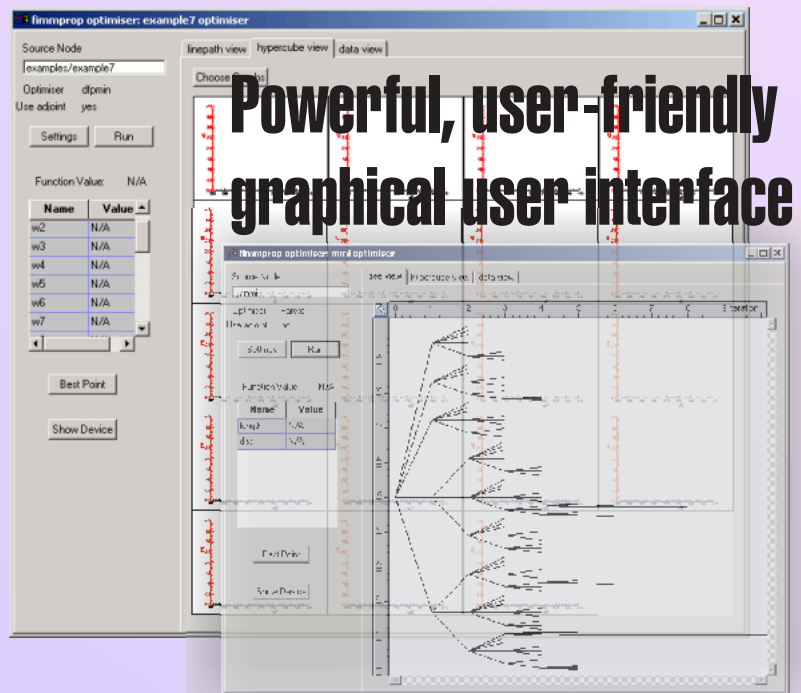
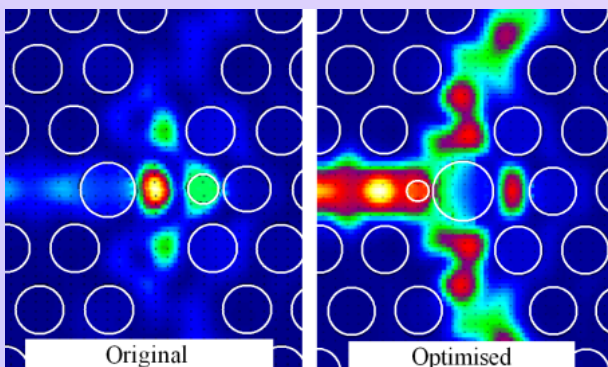


Uses state of the art optimization techniques

Complete flexibility with powerful built-in function parser

Tightly integrated with Photon Design products

Performance-tuned for photonic devices



Powerful, user-friendly graphical user interface

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What is Kallistos?

Kallistos is a novel optimisation tool capable of automatically improving existing designs of photonic devices with minimum intervention from the user. Using Kallistos, design cycle times of a new device can be dramatically reduced.

Considerable work has gone into all aspects of the product, resulting in a tool incorporating state-of-the-art optimisation algorithms, combined with a powerful graphical user interface making it easy for the user to set up, run and monitor design optimisation calculations.

How it works

In the first iteration of a product design, the user typically starts with an initial guess of a design, such as the linear taper in the illustrated example. Selected parameters and constraints defining the structure (e.g. governing the taper shape) are then declared in Kallistos, as well as the quantity that needs to be optimised (the objective function). Finally the calculation is launched with one of the optimisation algorithms available in Kallistos.

The function parser

Although Kallistos comes with a variety of predefined objective functions, it also comes with a powerful built-in function parser, making it possible to define arbitrarily complex parameter constraints and objective functions.

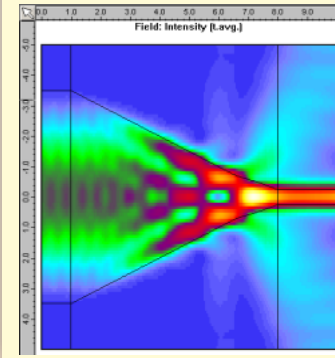
The optimisation algorithms

Finding solutions to complex optimisation problems can be a difficult task. In general there is no optimisation algorithm that works

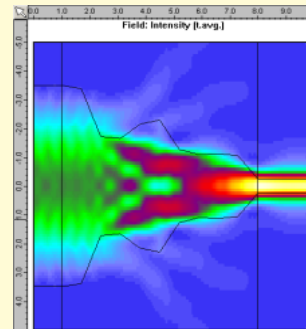
in all cases. Kallistos comes with several efficient algorithms based on recent advances in mathematical optimisation with complementing strengths:

- **Efficient local descent routines.** Ideal for large, computationally intensive structures, which can find an optimum within relatively few iterations.
- **Deterministic and stochastic global optimisation techniques.** These converge more slowly than the above, but are more likely, if not guaranteed, to find a global optimum.

We gave this to Kallistos...



...and got back this

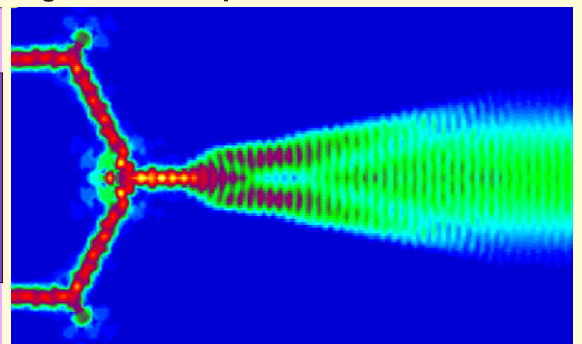
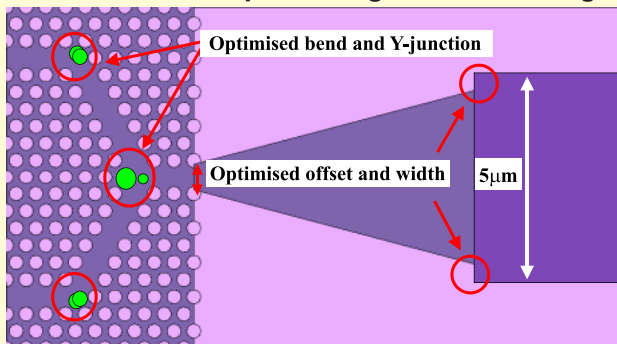


The device on the left is an ultra short ($7\mu\text{m}$) linear taper giving about 53% power transmission into the output fundamental mode. Kallistos was configured to seek a design with the same length, but with improved transmission. The result was the oddly shaped device shown here, giving over 90% transmission! This was a large problem involving dozens of parameters controlling the taper shape.

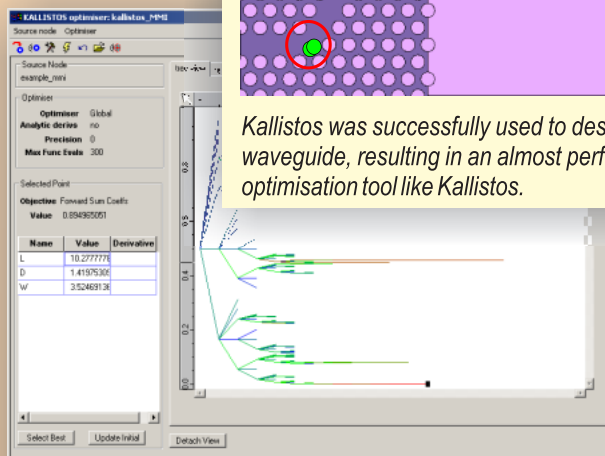
The monitoring interface

Far from adopting a black box approach, Kallistos comes with powerful graphical monitoring interfaces for following the progress of multidimensional optimisation calculations. These prove to be particularly useful for detecting potentially optimal designs when using a global optimiser. For example, the user can quickly locate a point of interest in the parameter space and "home in" on it with a local optimiser.

Use Kallistos to produce ground-breaking designs of entire photonic devices



Kallistos was successfully used to design an optimised photonic crystal Y-junction, as well as the taper injector from an input waveguide, resulting in an almost perfect transmission. This is an unprecedented result only achievable with a sophisticated optimisation tool like Kallistos.



The tree view is one of the monitoring interfaces in Kallistos for viewing the progress of a global optimization algorithm of any multidimensional problem. The longest branches correspond to potentially good designs. Just click on any of these to view the corresponding design.

Highly speed-optimised

Optimisation calculations can be very lengthy for complex 3D structures. We have exploited the mathematical structure of the wave equations to the full by incorporating an analytical procedure for calculation of the sensitivities, essential to the optimisation process. This and other improvements make Kallistos an extremely fast optimisation tool for the design of photonic devices.

Fault-tolerant

Kallistos was designed with the most complex, lengthy optimisation tasks in mind. As well as being able to save and resume multiple optimisation runs, Kallistos boasts an automatic recovery system from unexpected program shutdown, enabling a calculation to continue from where it left off.