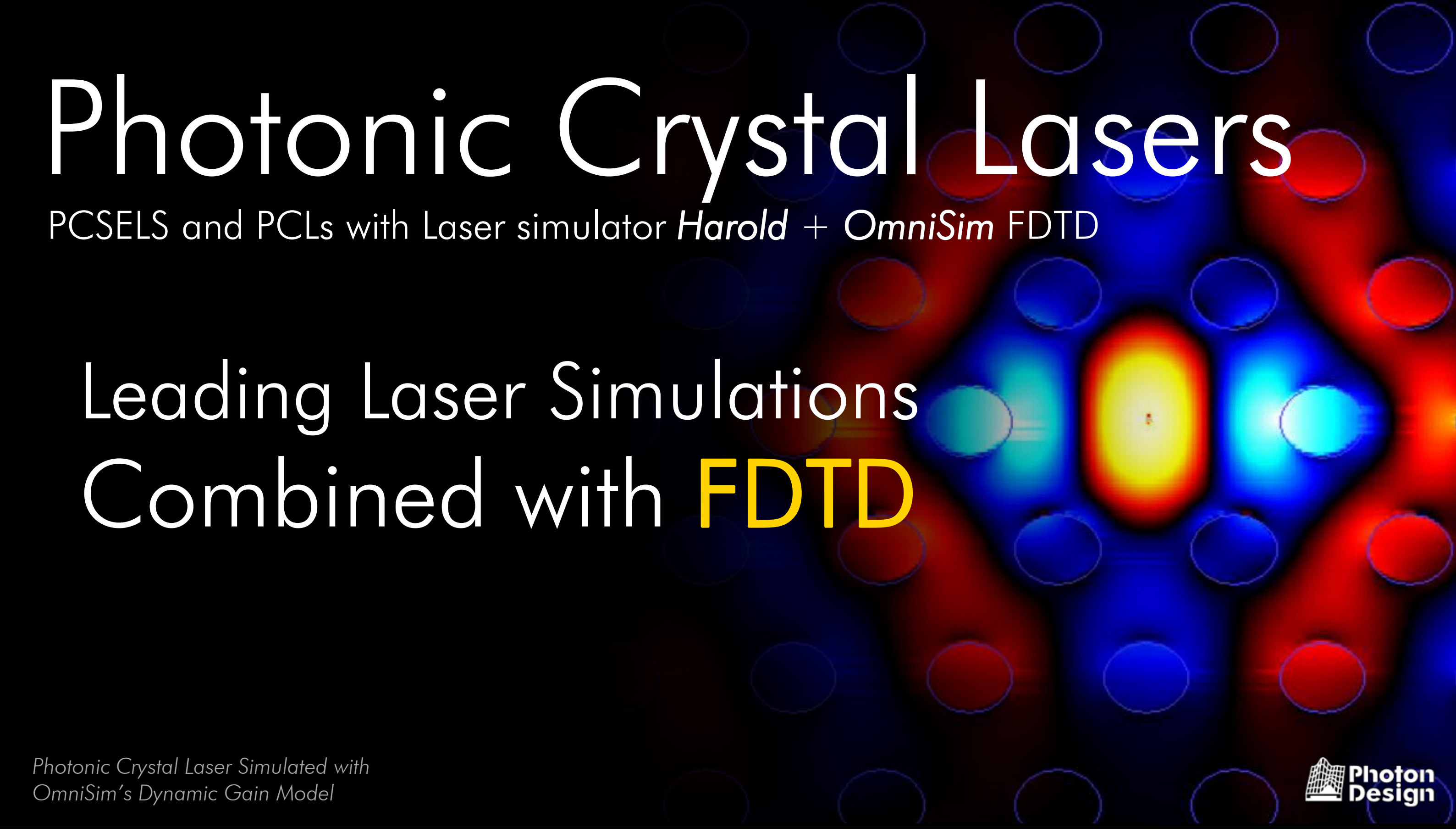
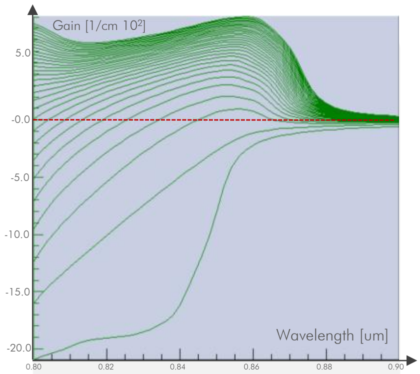
Photonic Crystal Lasers

PCSELS and PCLs with Laser simulator *Harold* + *OmniSim* FDTD

Leading Laser Simulations Combined with FDTD

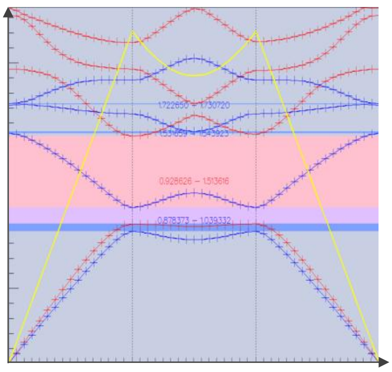


Photonic Crystal Laser Simulated with OmniSim's Dynamic Gain Model



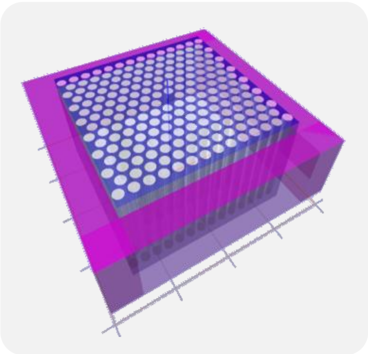
Simulate Gain Spectra

The industry's leading simulation tool for simulating MQW epitaxy structures.



Photonic Crystal Band Analyser

Automatically tune crystal + cavity for desired operational wavelengths *before* running FDTD. Fast.



FDTD + Gain Model

The market's most advanced FDTD for laser simulations including *carrier diffusion*.

The most advanced FDTD for laser simulations has been upgraded. The new ***Dynamic Gain Model*** for PCSEL simulations combines ***OmniSim***'s industry trusted FDTD with market leading laser simulator ***Harold***.

Combining bespoke tools for crystal design, a toolbox of supporting features, and FDTD cluster support, Photon Design is the *home* for leading photonic crystal laser designers.

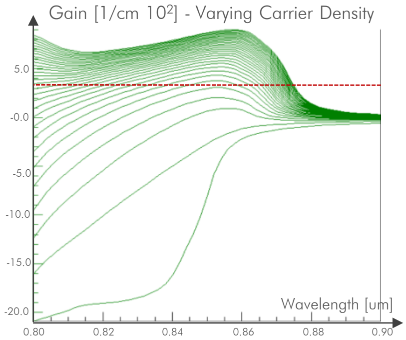
Start your 30 day trial today

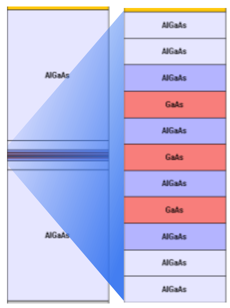
Photon Design have been serving the photonics community for over **30 Years** with market leading software for designing passive components, active components, and entire PICs. All of our tools are under continuous development driven by the feedback of our users and their cutting edge research.

info@photond.com
www.photond.com

What is Harold?

Harold is your advanced hetero-structure simulator for creating your *arbitrary multi-quantum well* epitaxy stack for photonic crystal lasers. Drawing on a vast amount of well established physical models, Harold provides a comprehensive set of simulation results including absorption and *gain spectra* that can be exported to OmniSim for active FDTD simulations in the *Dynamic Gain Model*.





MQW Epitaxy defined in Harold

Includes:

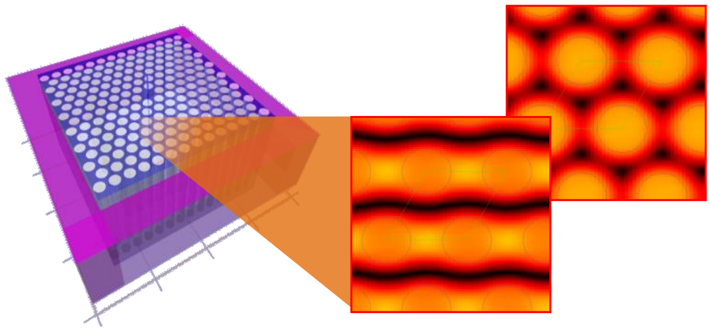
- 6 Band k.p model
- Fermi-Dirac statistics
- Drift diffusion model
- Thermionic emission
- Capture-escape model
- Biaxial strain model
- Auger, FCA, TPA effects
- Many more…

Other Applications:

• PICs • VCSLES • Quantum Dot Epitaxy • EAM + ERM

What is OmniSim?

OmniSim is your toolbox of simulation engines to support the photonic crystal designer. Starting as an FDTD specifically for crystals, OmniSim contains an intuitive user interface for creating crystal structures challenge free.



Multiple Bloch modes found for a crystal with OmniSim Band Analyser

Includes:

- Band Structure Analyser
- Automatic Optimisation Algorithms
- FDTD simulations including cluster support for large simulations.

Other Applications:

- *Surface Grating Couplers* and other PIC components
- Meta-lenses and Meta-materials with RCWA.

The Photonic Crystal Laser Design Flow

1. Harold – Gain spectra from thorough epitaxy simulation

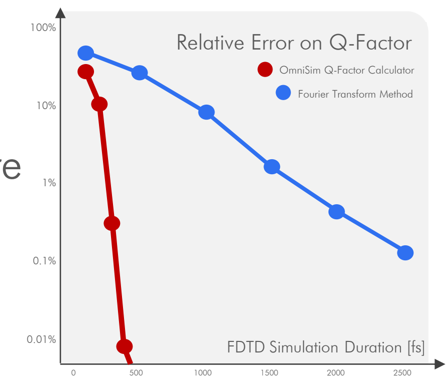
Describe your 1D epitaxy recipe using our extensive material database (+ add your own). A 6 band k.p model will solve Schrödinger equations to produce gain spectra to calibrate OmniSim's wide-band surrogate model.

2. OmniSim – Create and optimise photonic crystal structure

Quickly create full crystal layout with a bespoke photonic crystal editor. Create a full scale lattice + have freedom to alter individual 'atoms' with arbitrary shape.

- *3D Band Analyser* – Generate band diagrams of bulk crystal and crystal cavities + find Bloch modes including effective index, group velocity, dispersion, and loss.

- *Automatic Optimisation with Kallistos* – Have the software take lattice parameters and 'atom' sizes and automatically construct your crystal to operate at a desired wavelength. This includes optimizing crystal bulk + crystal cavities.



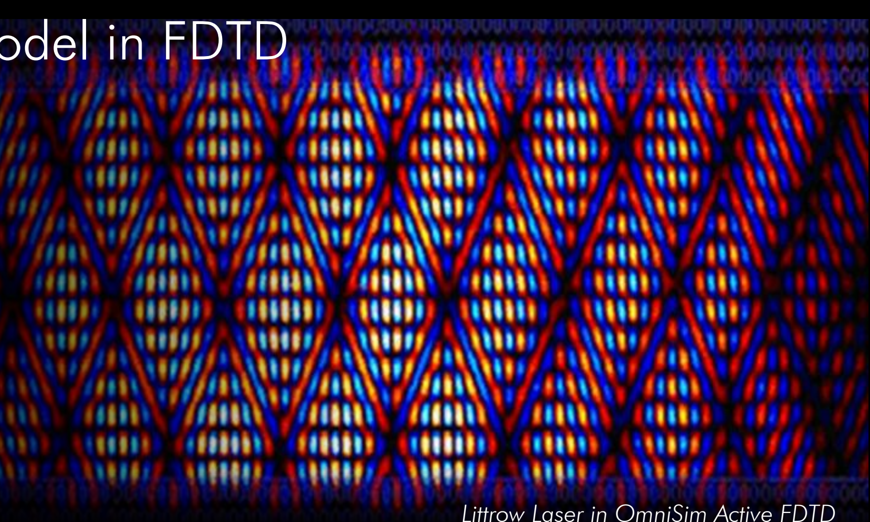
OmniSim Q-Factor Calculator finds results dramatically faster than conventional method

3. OmniSim Dynamic Gain Model in FDTD

The most advanced FDTD on the market for simulating photonic crystal lasers, the OmniSim Dynamic Gain Model updates gain as a function of the evolving carrier density modelled by the rate equations. This sophisticated model includes carrier diffusion, spontaneous and stimulated recombination, and current injection.

Use in-built *Q-Factor Calculator* to find results of FDTD simulations far in advance of traditional methods. Results include lasing wavelength and line-width (shown in graph above).

Performance is further optimised thanks to the simulation's carrier acceleration factor. A static gain model is available for faster simulations of a laser with carriers in steady state.



Littrow Laser in OmniSim Active FDTD