Convolution is one of several value-added software modules in the Leksell GammaPlan portfolio. It enables extremely accurate dose calculation for the treatment of heterogeneous tissue.

**Accurate Dose Distribution – Anywhere**
Convolution provides dose calculation accuracy that approaches the quality of a true Monte Carlo algorithm.* It is specifically designed to rapidly generate dose plans for heterogeneous tissue, such as tissue-air and tissue-bone interfaces.

**Flexibility for Speed and Efficiency**
Convolution gives you freedom-of-choice and superb flexibility, allowing you to decide which dose calculation algorithm to use for a specific target. You can choose TMR (Tissue-Maximum-Ratio) or Convolution, depending on target location.

**Total Confidence**
The accuracy that is possible with Convolution helps build confidence, while also giving you control. Choose your settings, change them at will and maintain full control over the final solution.

*Based on the results of benchmarking comparisons between Convolution and Monte Carlo calculations.
Convolution – Overview

Convolution requires a full-head CT scan as input. It models build-up effects as well as heterogeneity effects. The dose calculation is separated into two parts: primary dose and scatter dose algorithm.

Convolution is an accelerated multi-beam convolution algorithm that models build-up effects and takes heterogeneity of material into account. It uses Monte Carlo pre-calculated fluence planes for each beam calculated at the center of a water phantom. The fluence planes are scaled according to depth and heterogeneity. The algorithm separates the primary and the scattered secondary contribution for calculation of the dose.

The primary dose is calculated by convolving the TERMA (Total Energy Released per unit MAss) obtained from the fluence planes with an electron-density scaled primary kernel.

In order to gain simulation speed, the radiological lengths are pre-calculated for many equally distributed directions at every voxel and are used for each beam, thereby avoiding the need to repeatedly refer to the electron density-table.

The dose due to scattering is calculated by convolving a model-fitted depth kernel with the TERMA at the central axis of each beam. This scattered depth dose is then used to scale a lateral scattering dose profile.

Convolution relies on relative electron density defined from CT images covering the entire skull. Conversion between CT numbers and electron density values is performed via a user-defined CT calibration curve (per CT scanner console). Any electron density value outside the CT calibration curve is truncated. While planning, truncated values can be displayed during the definition of the electron density.

Convolution – for the Highest Calculation Accuracy in Heterogeneous Tissue

Elekta continues to add functionality to Leksell GammaPlan. Using the latest technology, Gamma Knife® software modules bring more power to your planning. This opens the platform for future upgrades and opportunities, while delivering on daily clinical needs for improved workflow, cost efficiency and treatment quality.