

# Application Note: Spatial Peak SAR Evaluation

## Spatial Peak SAR for 1 and 10 g

The spatial peak SAR - value for 1 and 10 g is evaluated after the Cube measurements have been done. The basis of the evaluation are the SAR values measured at the points of the fine cube grid consisting of 4 x 4 x 7 or 5 x 5 x 7 points. If you change any parameter afterwards with 'File Modify' (for example crest factor or medium factors) you will have to reevaluate the measurements. This evaluation can be repeated, if you press Job Evaluation on the selected scans. The algorithm that finds the maximal averaged volume is divided into three different stages.

(1) The data between the dipole center of the probe and the surface of the phantom is extrapolated. This data cannot be measured, since the center of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is ca 1 mm (see probe calibration sheet). You can visualize the extrapolated data from a cube measurement if you select Graph Evaluated.

(2) The maximal interpolated value is searched with a straight-forward algorithm. Around this maximum the SAR - values averaged over the spatial volumes (1g or 10 g) are computed using the 3d-spline interpolation algorithm. If the volume cannot be evaluated (i.e., if a part of the grid was cut off by the boundary of the measurement area) the evaluation will be started on the corners of the bottom plane of the cube.

(3) All neighboring volumes are evaluated until no neighboring volume with a higher average value is found.

### Extrapolation

The extrapolation is based on a least square algorithm [W. Gander, Computermathematik, p.168-180]. Through the points in the first 3 cm in all z-axis, polynomials of order four are calculated. This polynomial is then used to evaluate the points between the surface and the probe tip. The points, calculated from the surface, have a distance of 1 mm from one another.

### Interpolation

The interpolation of the points is done with a 3d-Spline. The 3d-Spline is composed of three one-dimensional splines with the "Not a knot"-condition [W. Gander, Computermathematik, p.141-150] (x, y and z -direction) [Numerical Recipes in C, Second Edition, p.123ff ].

### Volume Averaging

Firstly the size of the cube is calculated. The volume is integrated with the trapezoidal algorithm. 8000 points (20x20x20) are interpolated to calculate the average.

### Advanced Extrapolation

The BIOEMC group of the ETH Zurich is currently investigating the boundary effects on E-field probes. As soon as the research is finished DASY3 will allow to compensate for these boundary effects. But until then we do not encourage to use the 'Advanced Extrapolation' option.