

# Field II Simulation Program

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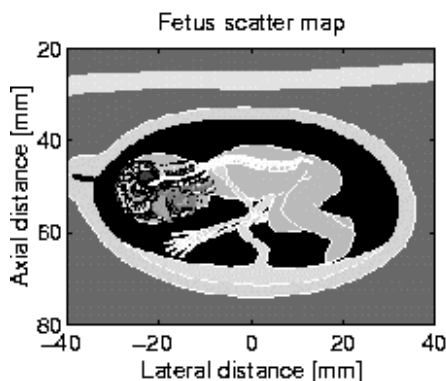
## Calculation of B-mode image of synthetic fetus

The anatomic phantoms are attempts to generate images as they will be seen from real human subjects. This is done by drawing a bitmap image of scattering strength of the region of interest. This map then determines the factor multiplied onto the scattering amplitude generated from the Gaussian distribution, and models the difference in the density and speed of sound perturbations in the tissue. Simulated boundaries were introduced by making lines in the scatterer map along which the strong scatterers were placed. This is marked by completely white lines shown in the scatterer maps. The model is currently two-dimensional, but can readily be expanded to three dimensions. Currently, the elevation direction is merely made by making a 15 mm thickness for the scatter positions, which are randomly distributed in the interval.

A phantom for a 3 month old fetus has been made. 200,000 scatterers were randomly distributed within the phantom, and with a Gaussian distributed scatter amplitude with a standard deviation determined by the scatter map. The phantom was scanned with a 5 MHz 64 element phased array transducer with  $\lambda/2$  spacing and Hanning apodization. A single transmit focus 70 mm from the transducer was used, and focusing during reception is at 40 to 140 mm in 10 mm increments. The images consists of 128 lines with 0.7 degrees between lines.

The fetus image is shown below. Note how the anatomy can be clearly seen at the level of detail of the scatterer map. The same boundary features as for the kidney image is also seen.

The images have many of the features from real scan images, but still lack details. This can be ascribed to the low level of details in the bitmap images, and that only a 2D model is used. But the images do show great potential for making powerful fully synthetic phantoms, that can be used for image quality evaluation.



Simulated fetus image



Artificial fetus in 12th week.

The m-files can be found at:

[examples/ftp\\_files/fetus](#)

The routine *field.m* initializes the field system, and should be modified to point to the directory holding the Field II code and m-files. The routine *mk\_pht.m* is then called to make the file for the scatterers in the phantom. The file *kidney6.bmp* holds the description of the kidney. The script *sim\_phas.m* is then called. Here the field simulation is performed and the data is stored in RF-files; one for each RF-line done. The data for the scatterers are read from the file *pht\_data.mat*, so that the procedure can be started again or run for a number of workstations. The data must then subsequently be processed to do the polar to rectangular mapping to yield the image.

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/examples/fetus\_example/fetus\_example.html  
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