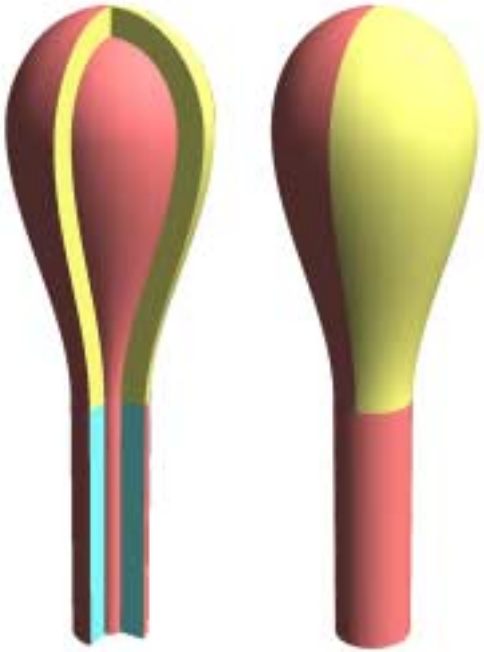
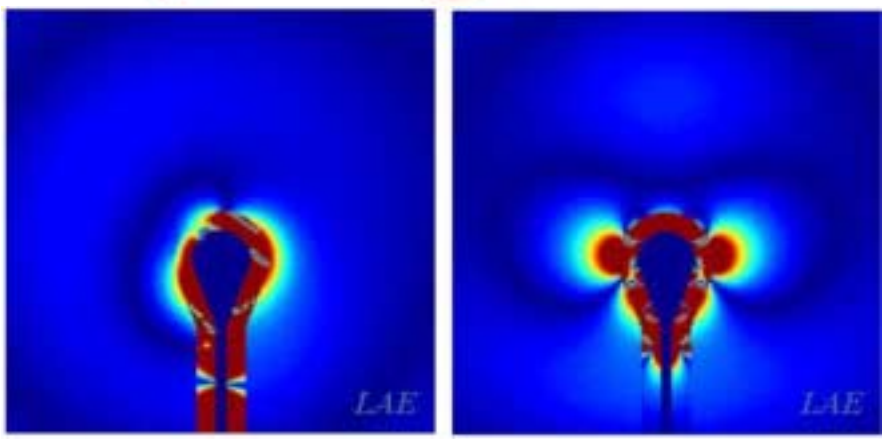
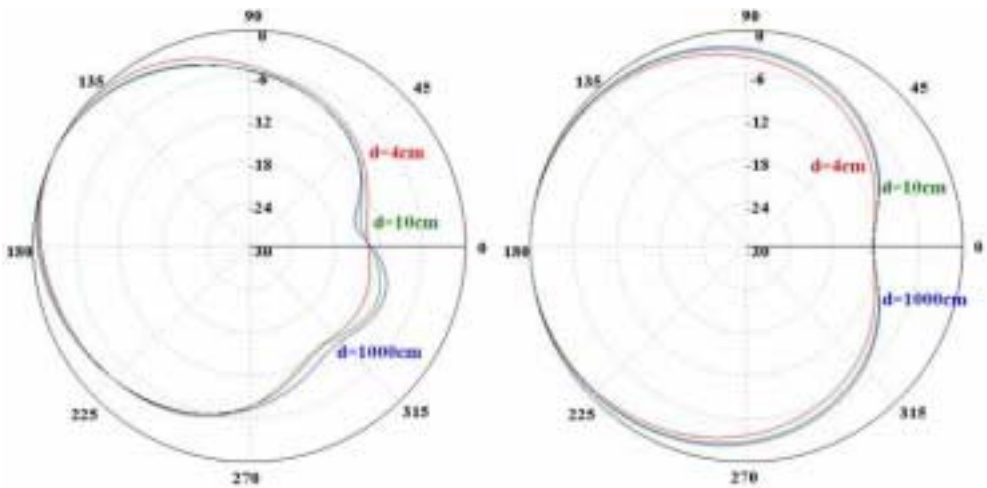
Antenna with a Directional Radiation



In order to minimize SAR for many communication systems besides the wide band radiation and the well matching between the cable and antenna, it is desirable for an antenna to have a directional radiation. For this purpose one side of the presented antenna structure was covered by a metallic shielding which makes possible achieving of a directed radiation. It is worthy to note that in Fig.10 the patterns have the same shape for different distances at which they were calculated. Namely, near field distribution at 4 cm distance and in the pattern of the far field of the antenna at a distance of 10 m. This indicates that the antennas under investigation have no reactive near field and the traveling wave fronts are formed already at short distances. This fact shows that no reactive fields exist near the antenna and in turn proves that it is still well matched with the free space.

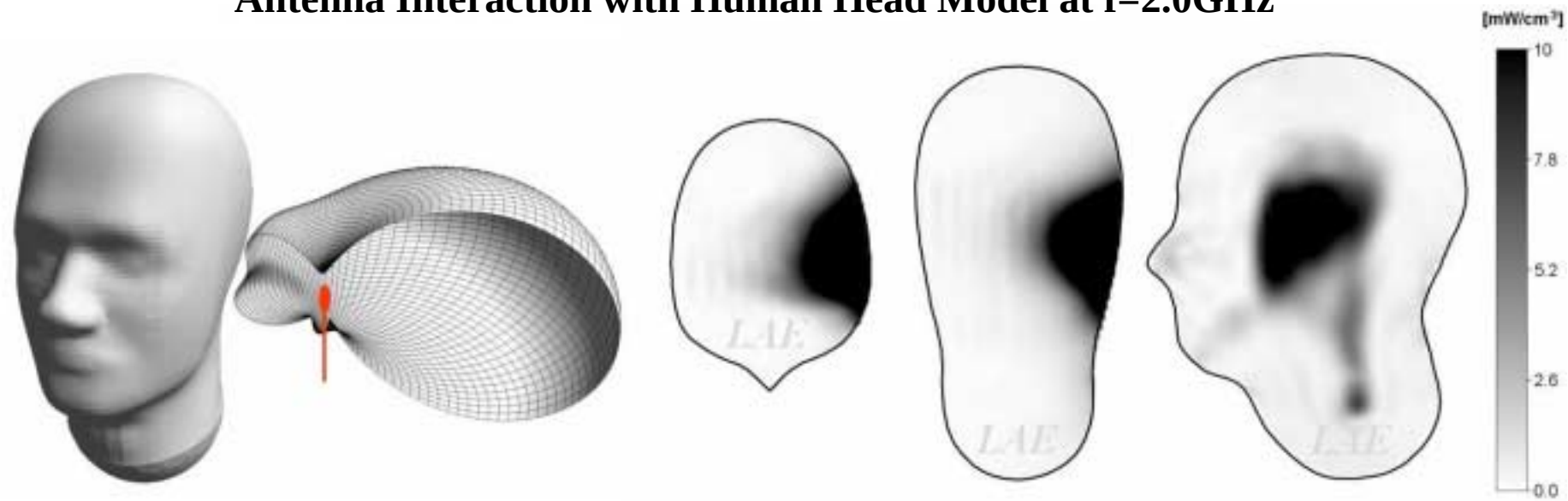


Distribution of near field H_ϕ *f=5GHz*



Radiated pattern in XOZ and XOY slices

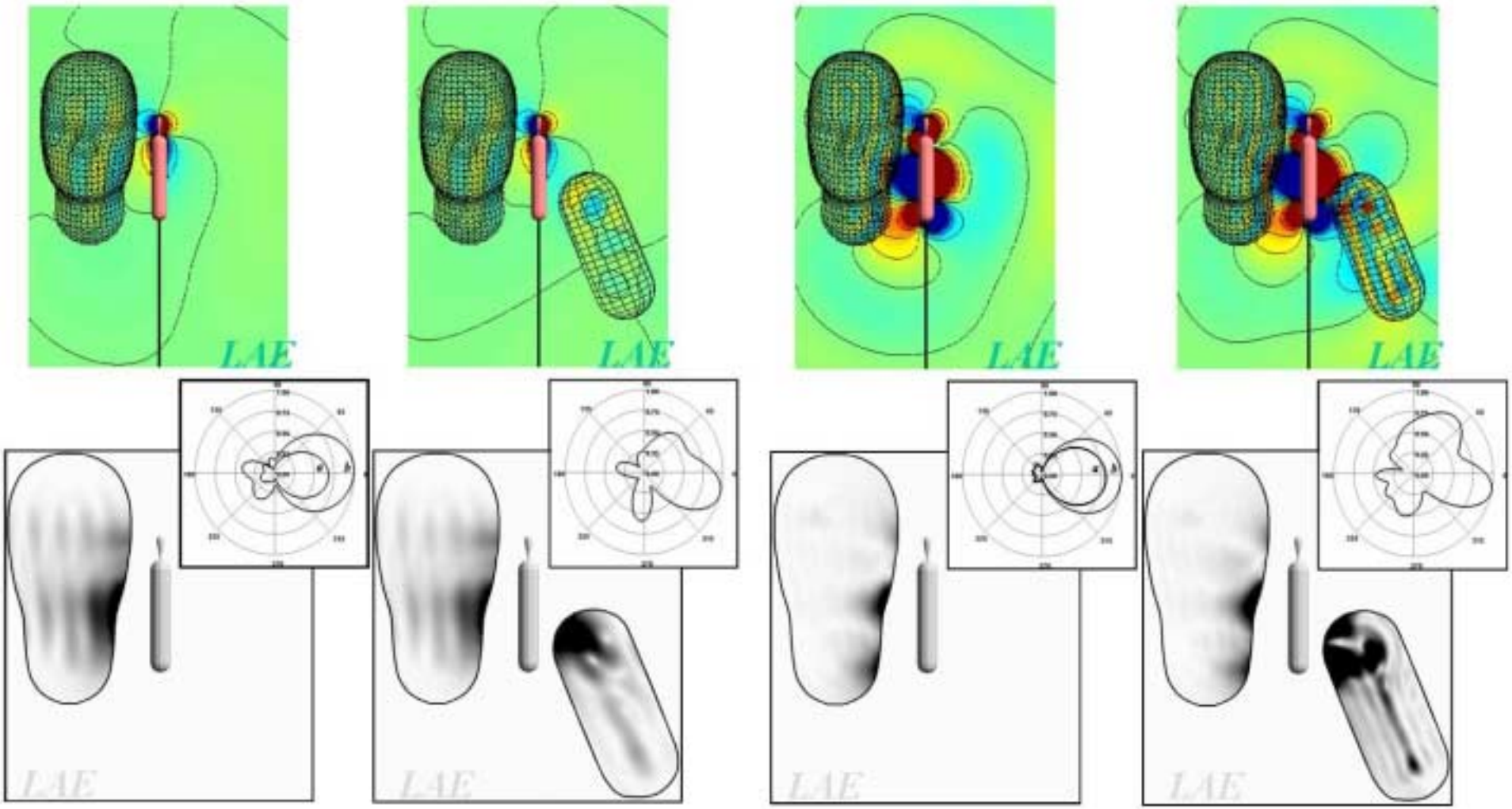
Antenna Interaction with Human Head Model at f=2.0GHz



To study the SAR problem, the next stage it was important to simulate the interaction of the antennas with the user's head. One of the main demands antenna must satisfy is the safety to the user – i.e. the SAR in the user's tissues must conform existing standards and have to be as low as it is possible. As a head model an IEEE standard head has been taken. Its averaged material parameters are $\varepsilon = 45$, $\sigma = 0.9$. To solve the corresponding electrodynamic problem using MAS a set of points is uniformly distributed along the body's surface. According to the geometry features the placement of the scattered field singularities has been determined. Placing the auxiliary sources in these locations allows one to decrease a number of unknowns and correspondingly significantly decrease demands to the computational resources. At the smooth surface domains the depth of singularities location is high enough – this allows carrying the sources far from the surface and even greater decrease their quantity. All these measures make the solution of the 3D diffraction problem on such complicated body as the head and it is possible perform just on regular PC and in the real time.

As examples, in figures show SAR distribution in the different sections using an antenna at 2.0GHz and the corresponding 3D radiation pattern.

Phone Interaction with Human Head and Hand



(f=0.9GHz) **(f=1.8GHz)**