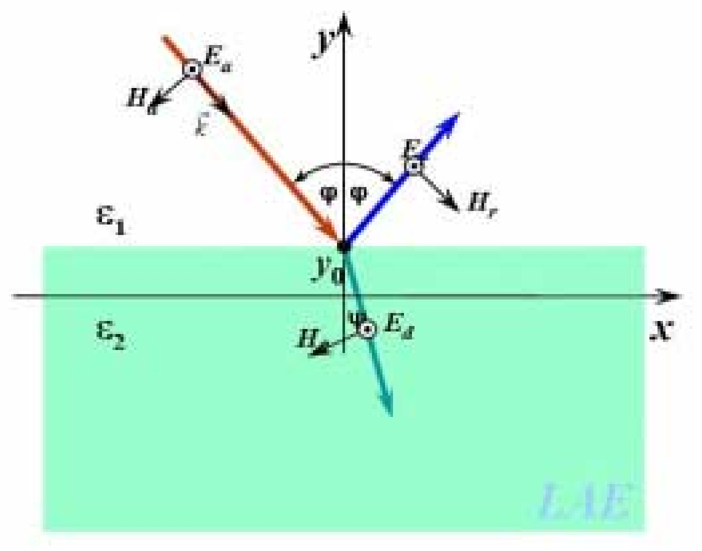
Approach of Visualization of the Latent Body's Shape and Position

In this topic we present the algorithm for the shape and position of a latent body reconstruction using the recovered electromagnetic or acoustic scattered fields. The holographic approach to the reconstruction of scattered field based on the MAS. The visualization of the body embedded within a dielectric media may be achieved whenever the dielectric media is transparent for particular frequency of the incident wave. The whole determination of the shape of a latent body requires this body to be illuminated from different sides with the different frequencies waves. The resolution of the recovered illuminated part is closely related to the number of incident frequencies.

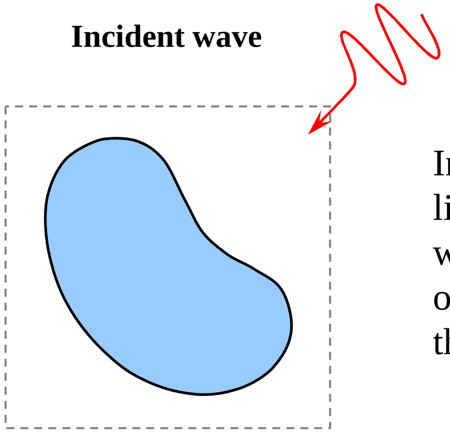


For the sake of clarity, by taking into account that the scatterer surface locally (in some neighborhood of a given surface point) may be approximated by the tangent plane, we explicate the proposed algorithm by using the Frenel's formulae. Because of the phase difference between the incident and the reflected waves after integration of the total field's intensity over some frequency range there appears in general an extremum along the scatterer surface. Thus after integration an absolute value of the total field has a global extremum at the scatterer surface. For the metallic body we have just a global minimum that equals zero, because in such a case the incident and the reflected waves have the same amplitudes and the opposite phases at the scatterer's surface.

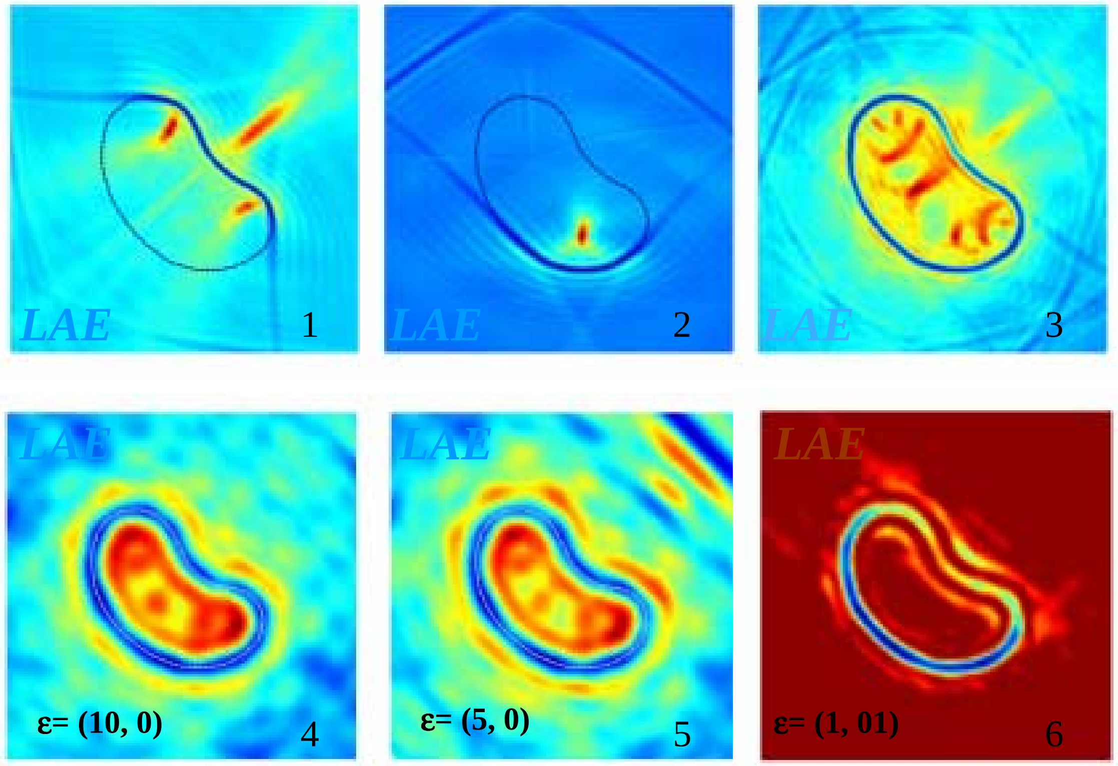
The numerical experiment has been performed according to the following steps: at first the direct diffraction problem is solved by means of MAS and then the reconstruction of the scattered field is made by using the information of near scattered field. After the reconstruction of the scattered field we make the summation over the absolute values of recovered fields corresponding to the different frequencies. This makes it possible to localize the extremum of that sum along the scatterer surface and allows one to use this method as the basis for a description of the determination of the shape and position problem.

Numerical Results for 2D Case

Incident wave



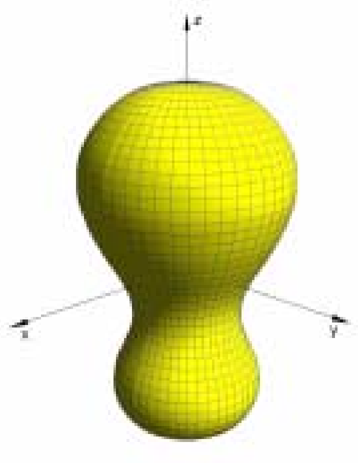
In this figure we present the geometry of a perfectly conducting body with a unit linear size to be recovered by the proposed algorithm. For this case the summation was done over the frequency range (ka=5÷25). Figures 1, 2 show the focused faces of body for the different angles of incident wave. The complete reconstruction of the scatterer surface is given in figure 3.

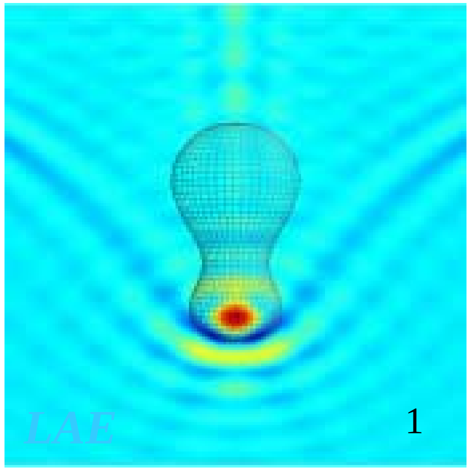


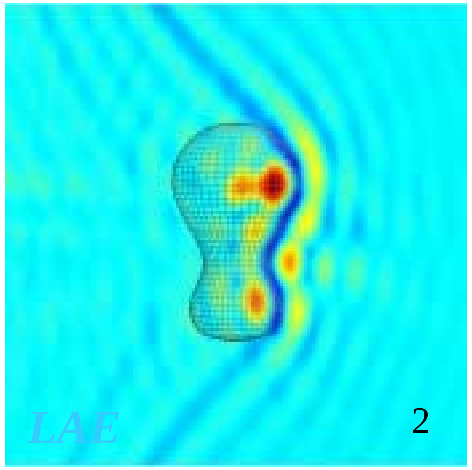
We have also considered the dielectric body with the same geometry. The corresponding results are shown in figures 4, 5, 6. The proposed algorithm gives a good reconstruction even in the case of a small difference of the bodies and outer medium permittivity. For instance in 6 the difference between the body's and media's permittivities equals 0.1%.

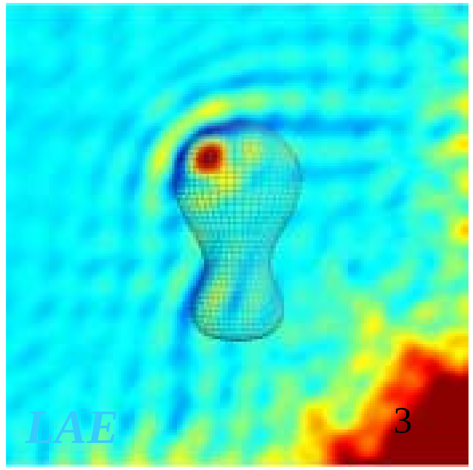
From the above-presented discussion one can conclude that the proposed algorithm makes it possible to recover the shape of metallic and dielectric bodies with a great accuracy.

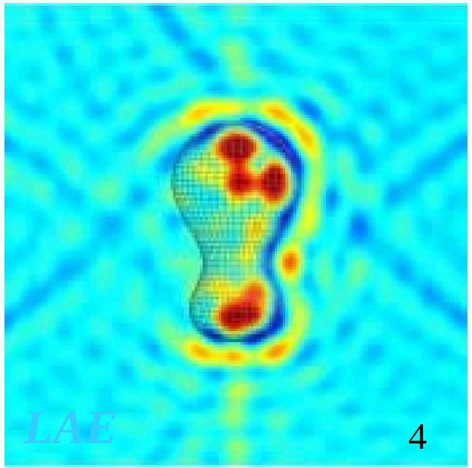
Numerical Results for 3D Case











In this topic we present the geometry of a 3D perfectly conducting body with a unit linear size to be recovered by the proposed algorithm. For this case the summation was done over the frequency range (ka=5÷25). Fig.1,2,3 show the focused faces of body for the different level of XOZ plane. The complete reconstruction of the scatterer surface in XOZ plane is given in fig.4. We can solve the reconstruction surface in different sections and then summarized these results to give complete surface of the s latent body. From the above-presented discussion one can conclude that the proposed algorithm makes it possible to recover the shape of metallic and dielectric bodies with a great accuracy.