

## Selected scientific results

### Stage 4

#### Set up of a device system for hyperthermia tests

Due to the different frequency response of nanoparticles depending on the materials and sizes, it was developed and built a hyperthermia device having the following features:

- power Output 1-200W
- frequency range 100KHz - 1MHz
- resonant circuit
- cooling of the resonant circuit
- indirect temperature measurement with laser beam, with +/- 0.3 °C precision

Temperature measurement setup:

- laser
- photodiode for measuring the signal from the liquid surface
- signal amplifiers; 16-bit analog to digital converter
- microcontroller ATmega 328 performs data collection and transmission to the computer
- computer interface
- acquisition and control software
- data acquisition step: minimum 0.2s

Electromagnetic field generation setup:

- 100KHz-1MHz frequency generator
- 1-200W power amplifier (broadband amplifier)
- Coil circuit

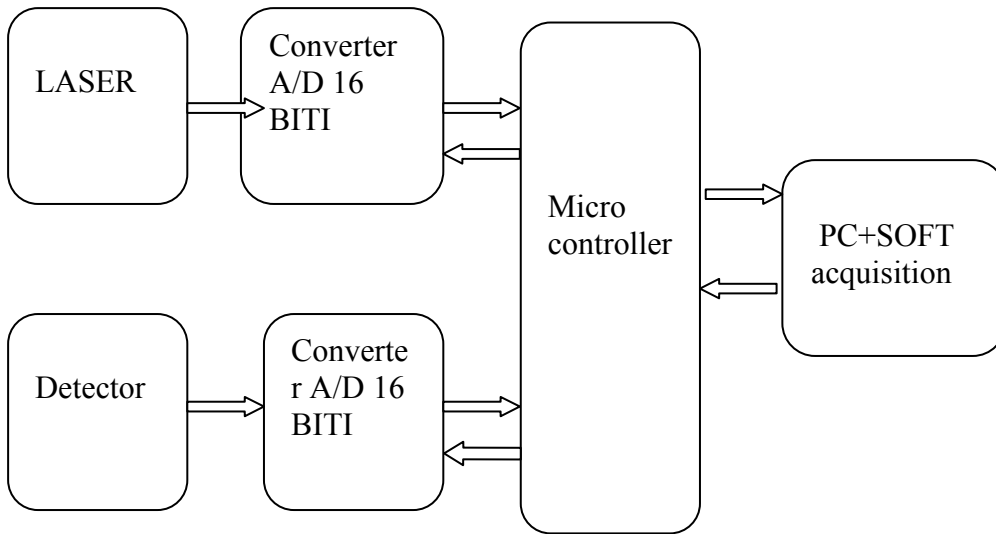


Fig. 1 Block diagram for temperature measurement with laser beam

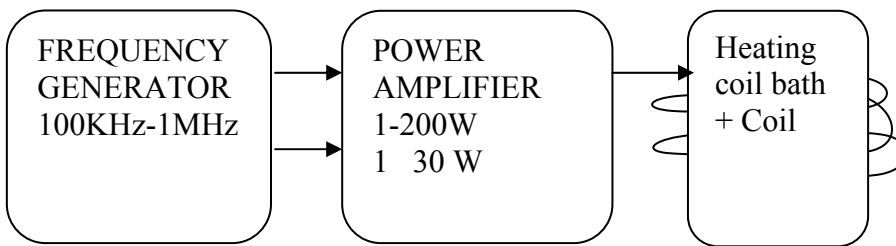


Fig.2 Block diagram of electromagnetic field



Fig.3 The experimental setup photograph.

Results:

$\text{Fe}_3\text{O}_4$  nanoparticles with 10nm mean diameter were dispersed in water with 10mg/ml. The heating characteristics were studied for various AC fields. The best results were obtained for an AC field with a frequency 228Hz and amplitude  $H_{AC}=162\text{Oe}$ .

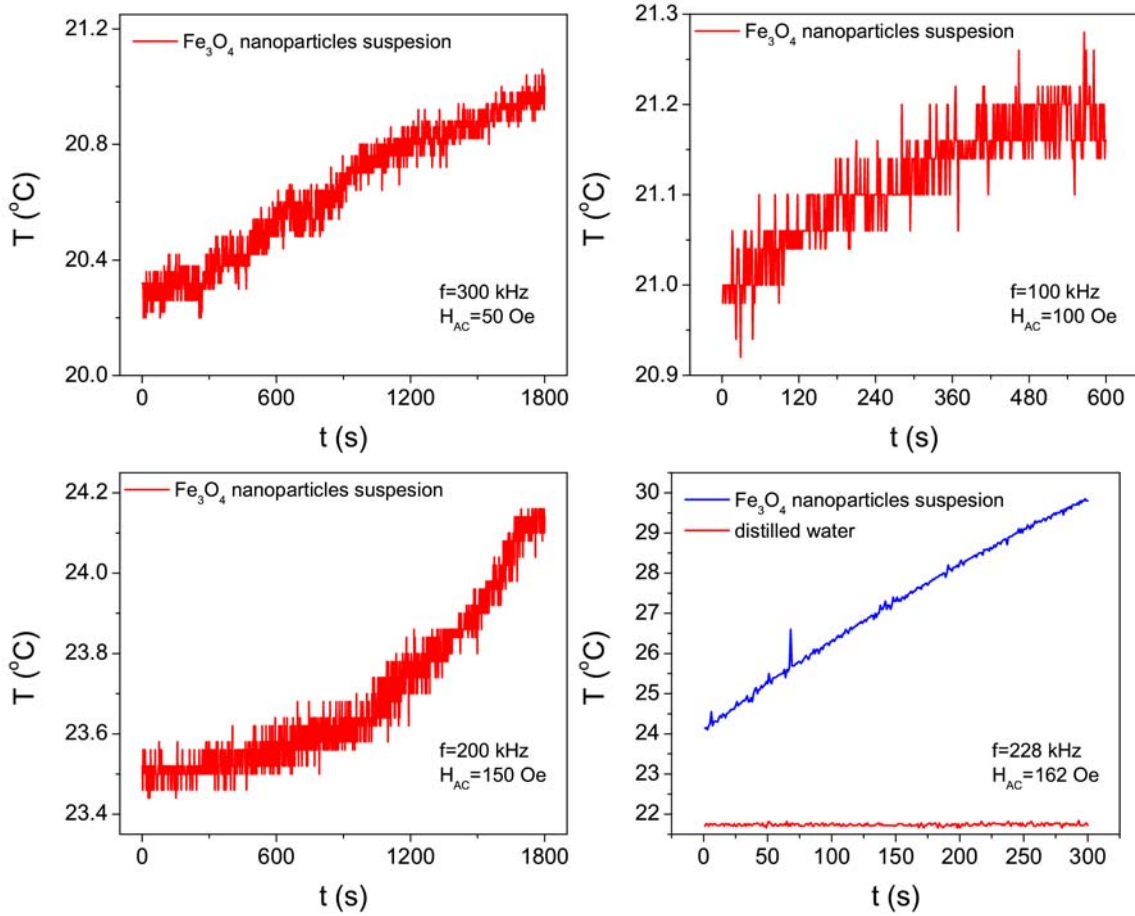


Fig. 4 Temperature increase over time for the nanoparticles in suspension. One can see that the best results are obtained for 228Hz  $H_{AC}=162\text{Oe}$ .