

## Equipment Development Center

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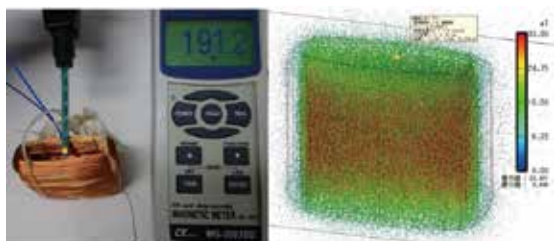


Researches and developments of novel instruments demanded in the forefront of molecular science, including their design and fabrication, are the missions of this center. Technical staffs in the two work sections, mechanics and electronics, are engaged in developing state-of-the-art experimental instruments in collaboration with scientists. We expanded our service to other universities and research institutes since 2005, to contribute to the molecular science community and to improve the technology level of the center staffs. A few selected examples of our recent developments are described below.

### Development of a Special Shape Coil

We are developing a special shape electromagnetic coil that can generate rotating magnetic field inside a cavity. This rotating field is important for aligning particles dispersed in a liquid. Since the shape and arrangement of coils affect the flow of magnetic flux with large complexity, it is not easy to estimate the direction and strength of magnetic flux generated by the coils. Therefore, computer-aided engineering is very important to help the designing. At the same time, we are fabricating the prototype model and evaluating the flow of magnetic flux by comparing the simulation and measurement result.

First, we have fabricated a winding machine to roll up wires in a customized way. Next, we have fabricated a simple shaped coil (wire diameter 0.6 mm, 725 turns), and measured generated magnetic flux density by a Gauss meter. As the



**Figure 1.** Measurement of magnetic flux density generated in a coil and result of CAE: 191.2 Gauss on experiment, 192 Gauss on CAE.

result of comparison between the results of simulation and experiments, a good matching was confirmed. (Figure 1)

Now, we are not only optimizing the shape and material of the coil, but also developing a novel fabrication method for a special shaped coil.

### Signal Fan-Out Buffer and Distributor

When we distribute a signal from photo diode/MCP/Photo-Multiplier Tube (PMT) to an oscilloscope or a data acquisition system, we normally use BNC T type adapter and coaxial cable. However, such connections cause huge attenuation and/or degradation of the signal.

Our Signal Fan-out buffer and Distributor (SFD) can output copied input signal (up to  $\pm 5V$ , 20 MHz) to multiple channels (up to 8), and can prevent degradation of signal using driving circuit by THS3001ID (Texas Instruments). In addition, SFD indicates, by two-color LED, the polarity of input/output signals, as well as connection/disconnection of cables using unique detection circuit by JFET operational amplifier ADA4610-2ARZ (Analog Devices). By the latter function, the users can grasp unexpected dropouts and disconnections of cables visually.



**Figure 2.** Inside view of Signal Fan-out Buffer and Distributor.