

**MCD (MAGNETIC CIRCULAR DICHROISM) WITH SUPERCON MAGNETS**

Supercon magnets are the choice for high field/low temperature MCD studies. Their use calls however for many additional cautions, not required by permanent or electromagnets.

Stray field:

As everybody knows from the typical set-up of supercon NMR rooms, stray magnetic field is a factor to care with, it may effect in our case:

- lamp arc positional stability
 - PEM modulator performance
 - photometer electronics (particularly when reed-relays are used)
 - photomultiplier tube
- 20 years ago a typical retrofit for a Jasco J-500 to be used with a supercon was including:
- iron made lamp housing
 - shielding for PEM
 - extension tube to position the photomultiplier 1 meter far away from the magnet

Today supercons have probably a better shielding; looking at data provided by Oxford Instruments (www.oxinst.com), which is currently the leader supplier, a 7T (70000 Gauss) magnet will output a stray field of 100 Gauss at 75 cm from the magnet center which goes down to less than 50 Gauss at 1 meter and 5 Gauss at 2 meter far away. So the following suggestions apply for a *do yourself* application:

- 150W Xe lamps have shorter, and probably less sensitive to magnetic field arc, so shielding may not be necessary.
- photomultiplier shielding is available from Hamamatsu (E989-03 for the 1-1/8" R376 or R316)
- place the supercon on the right of the sample compartment as close as possible depending from stray-field interference
- supercons are heavy toys, you'd need a support to lift it and a sealing around to avoid stray light. These should be made of mild-iron.
- arrange an extension to hold the PM tube (for your reference typically in Jasco set-up there is a spacer of about 30 cm between magnet end and the shielded PM tube)

Shielding can be home made (around the lamp housing and also around the PEM modulator) using simple adhesive shielding foils as available for example from VAC (www.vacuumschmelze.de)

Optical considerations:

Another critical aspect is the optical one: Jasco spectropolarimeters have a nominal parallel beam output, a decisive advantage over competitors approach in this respect. But the parallelism is nominal, not perfect.

Basically a spherical lens after the exit slit of the monochromator is used for the job. Unfortunately slit image is not a point, but it has some width (proportional to bandpass and related to wavelength) and a much larger height.

To confirm beam image in your instrument disconnect the PM tube and set wavelength at 540 nm with a mechanical slitwidth of 1 mm. Removing everything from standard sample compartment you can monitor with a piece of paper the beam shape in different positions ... It'll become wider and taller moving far away from sample compartment. You can somehow change conditions altering slightly the position of the lens after the slit (operation not allowed by the manufacturer, but you can remove fixing screws and play a bit around, pay attention not to damage the 45° quartz plates ...).

Adding a cylindrical lens may help to reduce the talling effect of the image, but the only real way would be to reduce the exit slit height A matter not easy also for a good service engineer.

This phenomena is more serious with more modern units. In order to get better sensitivity one of the tricks used has been to increase slits height. The benefits you get for normal operation don't pay in our case, since miracles are not possible and beam size increase substantially moving apart from sample compartment.

However, once a suitable compromise is found, refit the standard cell holder and place a mask with 8-10 mm Φ hole in the sample compartment PM tube hole, this will help in cutting off extra radiation.

Once the beam has a decent shape you may eventually focus it somehow using lenses, but any lens after the modulator may induce artifacts due to birefringence so apply a good care.

Too complex for you: ask support of your local Jasco service center, you'll get a qualified help.