

AVAILABLE PROBES

I. GENERAL CONSIDERATIONS

A. INNER COILS VS. OUTER COILS

1. The terms "inner coil" and "outer coil" refer to the fact that most probes have two different coils, one of which is wound on top of the other.
2. All other things being equal, an inner coil will yield better sensitivity for observation of a given nucleus because the inner coil is more tightly coupled to the sample. This sensitivity difference is of the order of a factor of 2 which would require a factor of 4 in time to regain the original sensitivity. Whenever sensitivity is an issue, you should always use a probe that has an inner coil tuned to the frequency of the nucleus to be observed. Examples:
 - a. To observe ^{13}C , use a probe with an inner coil tuned to ^{13}C and an outer coil tuned to ^1H for decoupling. If the sample is sufficiently concentrated to observe a ^{13}C spectrum, you will also be able to observe the ^1H spectrum on the outer coil. In this case, the sacrifice of ^1H sensitivity will be worth the convenience of not changing the probe to switch to ^1H observation.
 - b. If the amount of sample is small such that ^1H sensitivity is poor, always use a probe with an inner coil tuned to ^1H . If there is also an outer coil tuned to ^{13}C , you can obtain an HMQC spectrum which yields ^1H - ^{13}C connectivity information with a much better sensitivity compared to a heteronuclear shift correlation which utilizes ^{13}C observation.

B. PROBE COIL SIZES

1. Probe names include a diameter, e.g. 5 mm. This refers to the maximum diameter sample tube that will fit into the probe coil. A smaller tube will work. However, there is generally no particular advantage to using a smaller sample tube.
2. Whenever a limited amount of sample is available, but the material is reasonably soluble, use of a smaller diameter probe coil (and sample tube) will improve sensitivity for a given amount of sample. This comparison refers to probes of roughly equivalent technology. Probe technology has improved a great deal over the years, so the generalization may not hold when comparing probes of different ages.
3. Whenever solubility is limited, but an adequate quantity of sample is available, use of a larger diameter probe coil (and sample tube) will improve sensitivity for a given concentration of sample. The 10 mm probes we have are quite old and don't actually show this improvement vs. our more recent 5 mm probes.
4. Coil lengths vary somewhat depending on the probe and must be taken into consideration. The length of the column of liquid in the sample tube must be somewhat longer than the coil used for observation. The shorter the column of liquid, the more difficult it will be to shim the magnetic field homogeneity.

C. SAMPLE VOLUMES

1. Whenever adequate sample is available, always use a relatively long column of liquid compared to the length of the coil used for observation. When the quantity of sample is limited, make sure that the length of sample is somewhat longer than the observation coil. Estimates of column lengths as a function of sample volume are given below for 2.5 mm, 5 mm, and 10 mm sample tubes. (Sample lengths are measured from the outside bottom of the tube to the bottom of the meniscus.)
2. 2.5 mm sample tubes: - 1st 50 μl \simeq 11.5 mm; additional 50 μl \simeq 13.5 mm
(e.g. 100 μl \simeq 25 mm)
3. 5 mm sample tubes: - 50 μl \simeq 3.6 mm
(e.g. 555 μl \simeq 40 mm)
4. 10 mm sample tubes: - 1 ml \simeq 16 mm
(e.g. 2.5 ml \simeq 40 mm)

II. PROBES AVAILABLE FOR USE

A. Avance 600

a. 5 mm broadband probe

z-gradient- Inner coil: - tunable over the range of ^{31}P to ^{109}Ag
Outer coil: - double-tuned to ^1H & ^2H
shimfile name = **shimbb5**
VT range = -150°C to $+180^\circ\text{C}$

b. 5 mm triple broadband inverse probe

x,y,z-gradients- Inner coil: - double-tuned to ^1H & ^2H
Outer coil: - tunable over the range of ^{31}P to ^{109}Ag
& double-tuned to ^{13}C (separate BNC)
shim file name = **shimtb5**
VT range = -50°C to $+80^\circ$ (Much smaller range than all other probes)

B. Avance500

a. 5 mm broadband

probe with z-gradient- Inner coil: - tunable over the range of ^{31}P to ^{109}Ag - 16.5 mm long
Outer coil: - double-tuned to ^1H & ^2H - 18.5 mm long
(shimfile name = shimbb5)

b. 5 mm inverse broadband probe with z-gradient-

Inner coil: - double-tuned to ^1H & ^2H - 21 mm long

Outer coil: - tunable over the range of ^{31}P to ^{109}Ag
- 23 mm long

(shimfile name = shiminvbb5)

C. ARX500

1. The ARX500 console was purchased to replace an AM500 console, keeping the magnet. Several new probes were purchased and several of the older probes from the AM500 console are still usable.

2. New probes purchased with the ARX500 console:

a. 5 mm broadband
probe-

Inner coil: - tunable over the range of ^{31}P to ^{109}Ag - 15 mm long
Outer coil: - double-tuned to ^1H & ^2H - 17 mm long

(shimfile name = shimbb5)

b. 5 mm inverse
broadband probe-

Inner coil: - double-tuned to ^1H & ^2H - 16.5 mm long
Outer coil: - tunable over the range of ^{31}P to ^{109}Ag
- 20 mm long

(shimfile name = shiminvbb5)

c. 5 mm ^1H probe-

Inner coil: - tuned to ^1H - 16.5 mm long
Outer coil: - tuned to ^2H - 20 mm long

d. 2.5 mm $^1\text{H}/^{13}\text{C}/^{15}\text{N}$
probe with z-gradient-

Inner coil: - double-tuned to ^1H & ^2H - 12 mm long
Outer coil: - double tuned to ^{13}C & ^{15}N - 17.5 mm long

3. Probes from the AM500 console:

a. 5 mm $^{19}\text{F}/^1\text{H}$ probe-

Inner coil: - tunable to ^1H or ^{19}F - 15 mm long
Outer coil: - tuned to ^2H & tunable to ^1H or ^{19}F - 17 mm long

b. 10 mm broadband
probe-

Inner coil: - tunable over the range of ^{31}P to ^{103}Rh - 24 mm long
Outer coil: - double-tuned to ^1H & ^2H - 48 mm long

c. 10 mm ^{11}B probe-

Inner coil: - tuned to ^{11}B - 17 mm long
Outer coil: - double-tuned to ^1H & ^2H - 30 mm long
(Similar performance as 10 mm broadband probe for ^{11}B except that the probe is made of materials that don't contain boron and thus has no background signal.)

d. 10 mm ^{31}P probe-

Inner coil: - tuned to ^{31}P - 18 mm long
Outer coil: - double-tuned to ^1H & ^2H - 30 mm long
(Better sensitivity for ^{31}P than the 10 mm broadband probe)

e. 10 mm $^{13}\text{C}/^{31}\text{P}$ probe- Inner coil: - double tuned to ^{13}C & ^2H - 24 mm long
Outer coil: - double-tuned to ^1H and ^{31}P - 48 mm long
(Similar sensitivity for ^{13}C as 10 mm broadband probe)

D. ARX400

a. 5 mm QNP probe- Inner coil: - switched between ^{13}C , ^{31}P , and ^{19}F tuning - 17.5 mm long
Outer coil: - double-tuned to ^1H & ^2H - 17.5 mm long
(Standard probe that is left mounted)

b. 5 mm inverse
broadband probe - Inner coil: - double-tuned to ^1H & ^2H - 13.5 mm long
Outer coil: - tunable over the range of ^{31}P to ^{109}Ag
- 18 mm long

F. AC200

a. 5 mm Dual probe- Inner coil: - tuned to ^{13}C - 16 mm long
Outer coil: - double-tuned to ^1H & ^2H - 16 mm long
(Standard probe that is left mounted)

b. 10 mm broadband
probe- Inner coil: - tunable over the range of ^{31}P to ^{109}Ag - 24 mm long
Outer coil: - double-tuned to ^1H & ^2H - 34 mm long