SINGLE COIL TRIPLE RESONANCE HFX-PROBES FOR SOLID-STATE NMR SPECTROSCOPY

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Homogenous RF field distribution across the sample is a prerequisite for the biological $^{1}H/^{19}F/^{15}N$ solid state NMR probes used for ^{19}F-observation with ^{1}H-decoupling and for ^{15}N PISEMA experiments. The short ^{1}H and ^{19}F wavelengths that are comparable to the electrical length of the sample solenoid lead to an uneven current distribution in the coil and poor RF field homogeneity. To address this problem we designed double-input, triple-tuned $^{1}H/^{19}F/^{15}N$ probes for static and MAS applications, where sample coil is electrically balanced at both ^{1}H and ^{19}F frequencies. RF circuit diagrams are shown below for ^{1}H-optimized circuit (Fig. 1) and for ^{19}F-optimized circuit (Fig. 2). 90° pulse lengths achieved by the 6x6x3 mm^3 static probe are ^{1}H/3.0 μs, ^{19}F/3.5 μs, and ^{15}N/4.6 μs at 125 Watt of input power. In the 4 mm MAS probe, pulse lengths are ^{1}H/3.0 μs, ^{19}F/2.6 μs and ^{15}N/4.0 μs at the same input power.

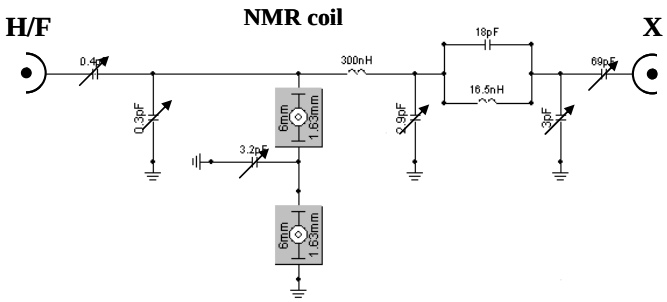
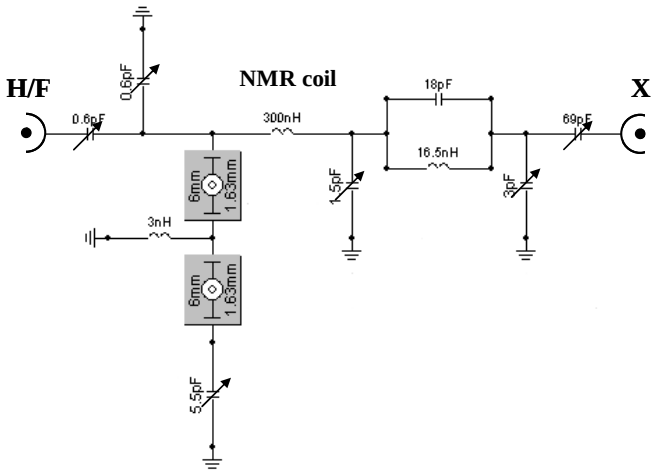


Figure 1: ^{1}H-optimized 300 MHz, static HFX probe design. Separation between ^{19}F and ^{1}H resonances is achieved with a ¼λ transmission line.



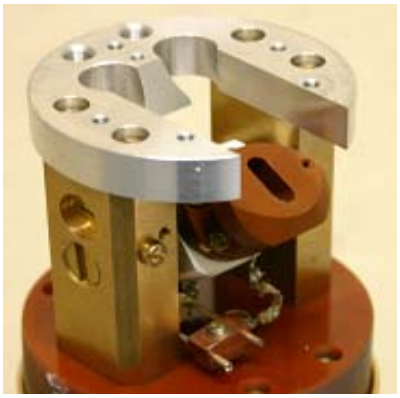


Figure 2: ^{19}F-optimized 300 MHz, 4 mm MAS HFX probe design. Separation between ^{1}H and ^{19}F resonances is achieved with a ¼λ transmission line.

References

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