

Using Gradients to Improve the HSQC

- Must Reject the ^1H - ^{12}C Proton Signal
 - (This is 100 Times Larger than ^1H - ^{13}C Signal)
- Gradients “Twist” the Magnetization into a Helix
 - ^1H Magnetization is Twisted 4X as Fast as ^{13}C
 - “Coherence Order”: Sensitivity to Twisting by Gradient
 - $p=1$ (^{13}C) $p=4$ (^1H)
- Desired Pathway: ^1H to ^{13}C to ^1H
 - Use Gradient of Magnitude 4 During the Time We Have ^{13}C Magnetization: Twist = 1×4
 - Use Gradient of Magnitude -1 During the Time We Have ^1H Magnetization: Twist = $4 \times (-1)$
 - Total Twist = 0, Magnetization is Observed
- Undesired Pathway: ^1H to ^1H (Bound to ^{12}C)
 - Total Twist = $4 \times 4 + 4 \times (-1) = 12$
 - No Signal Will Be Observed in FID
- In General: Sum of $p_i \times G_i$ Must Be Zero