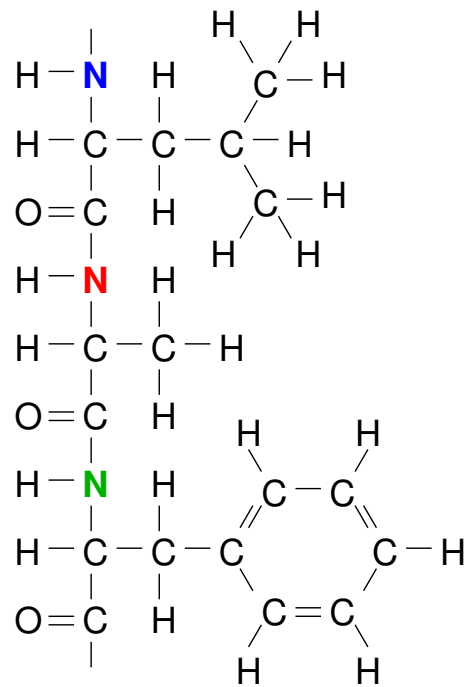


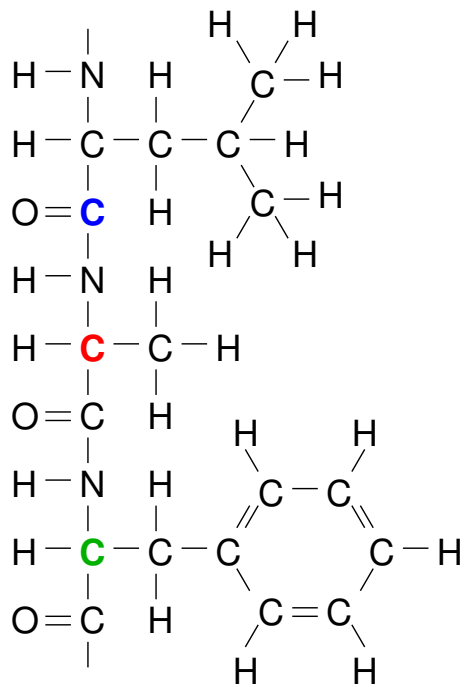
# LECTURE 5

# Spin systems in proteins

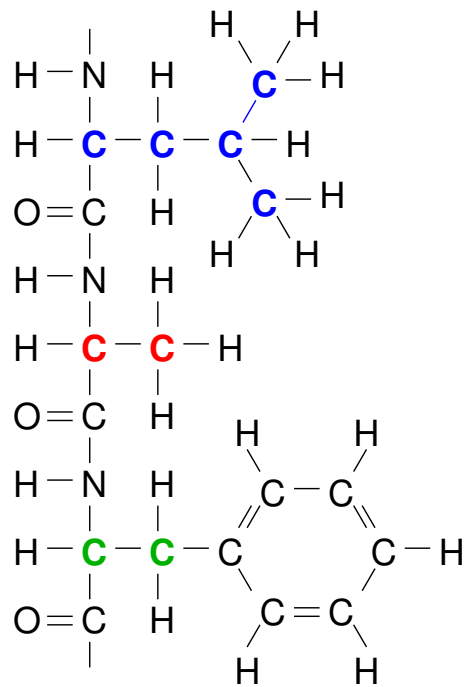
**A**



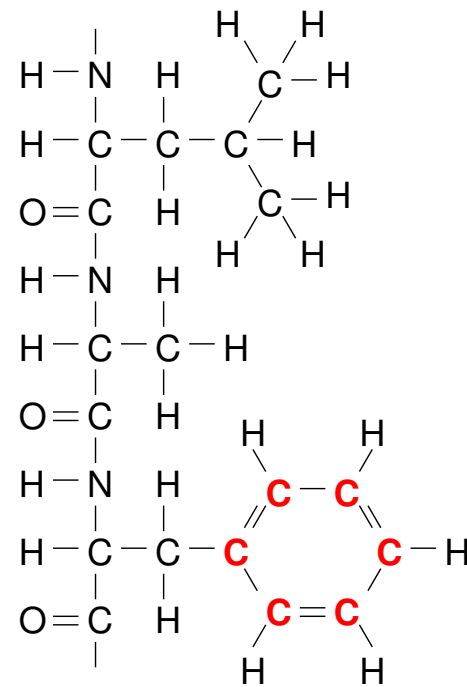
**B**



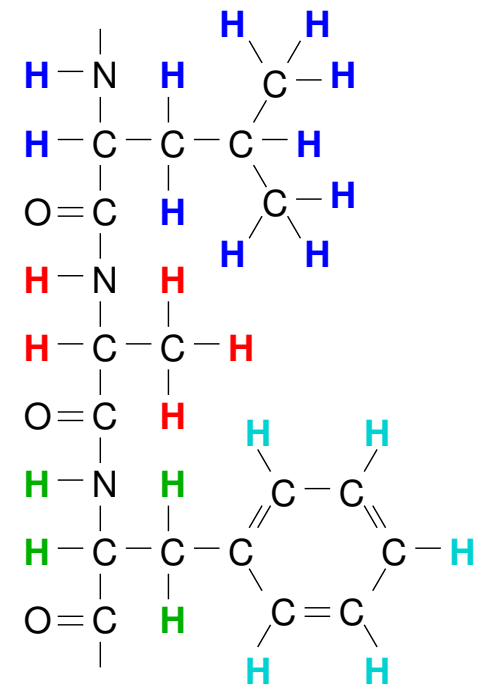
**C**



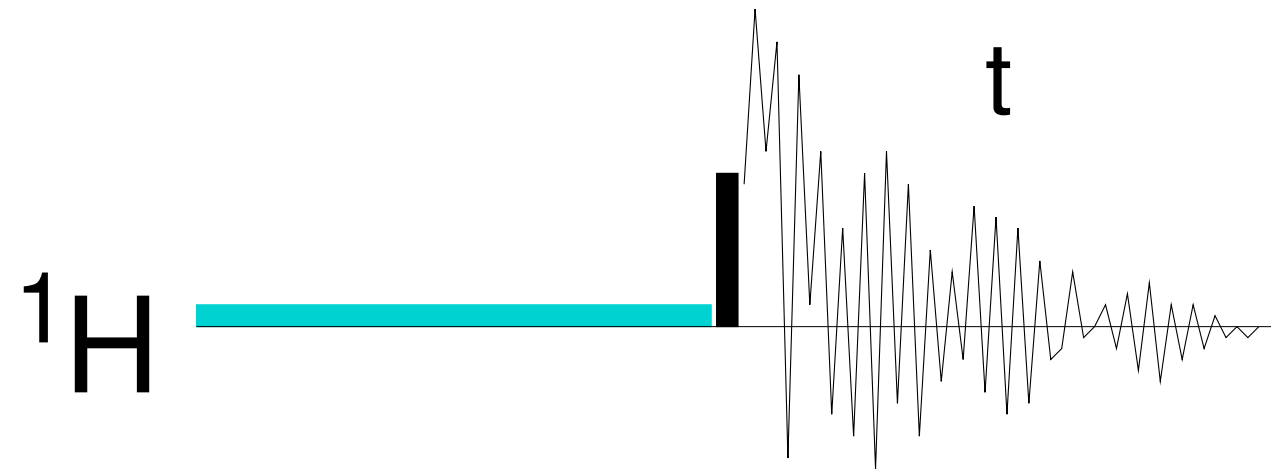
**D**



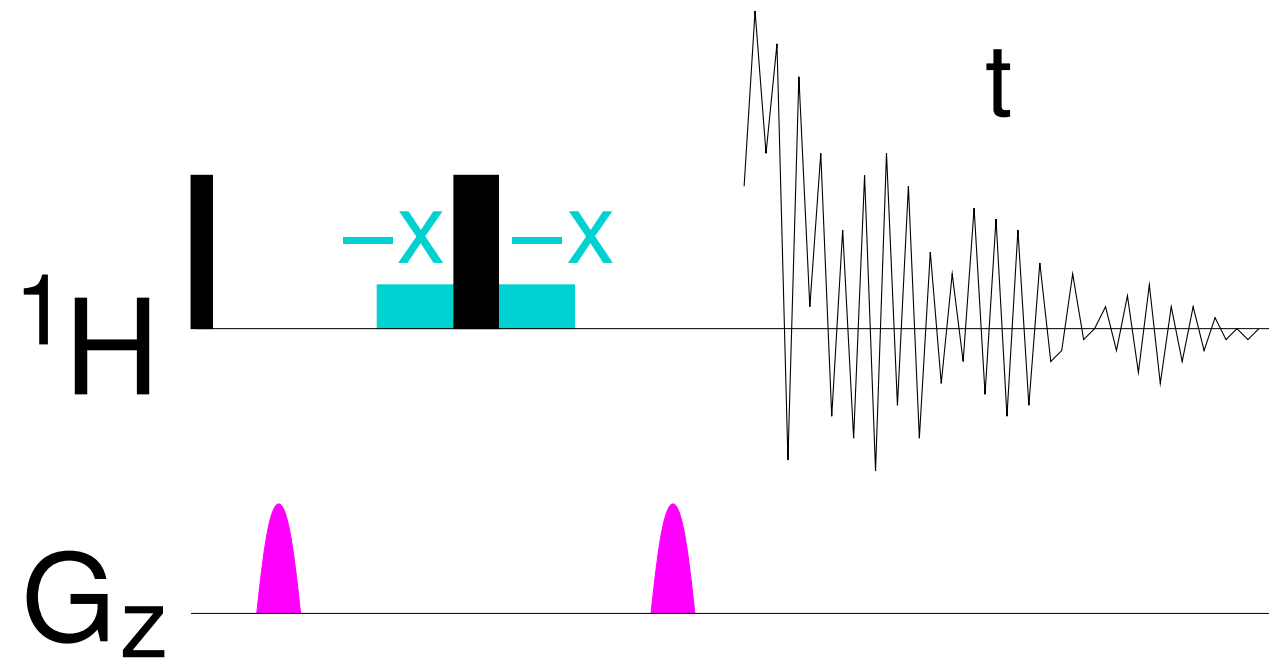
**E**

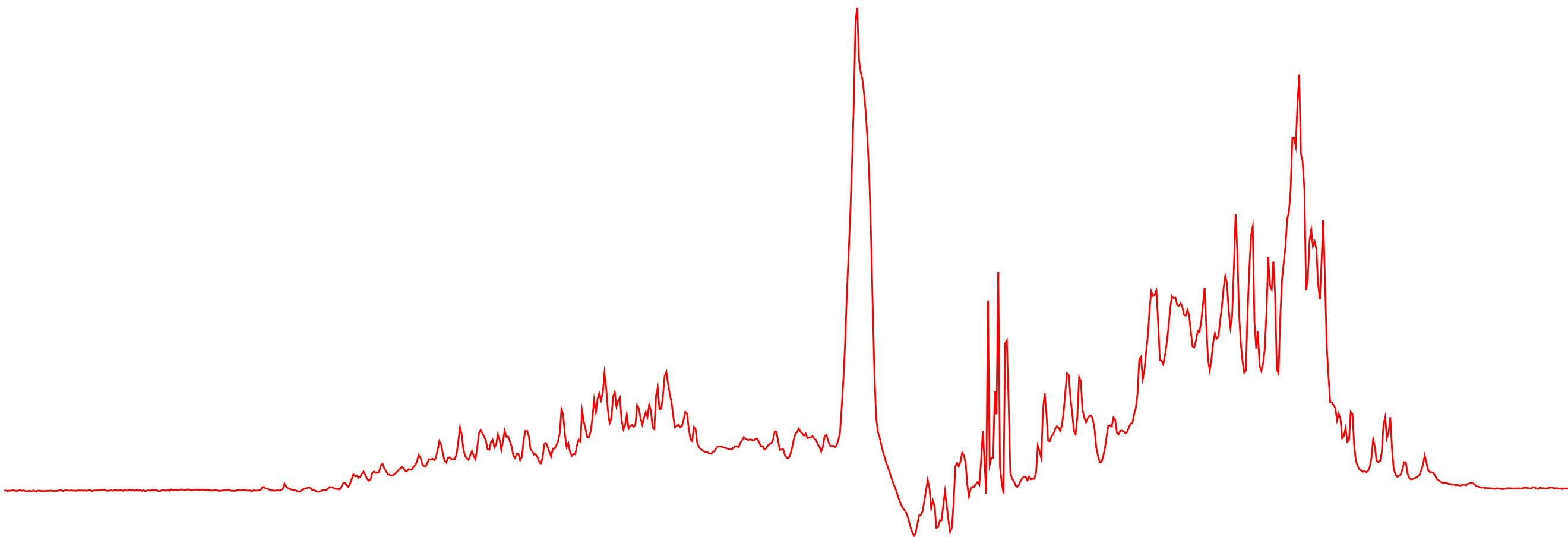


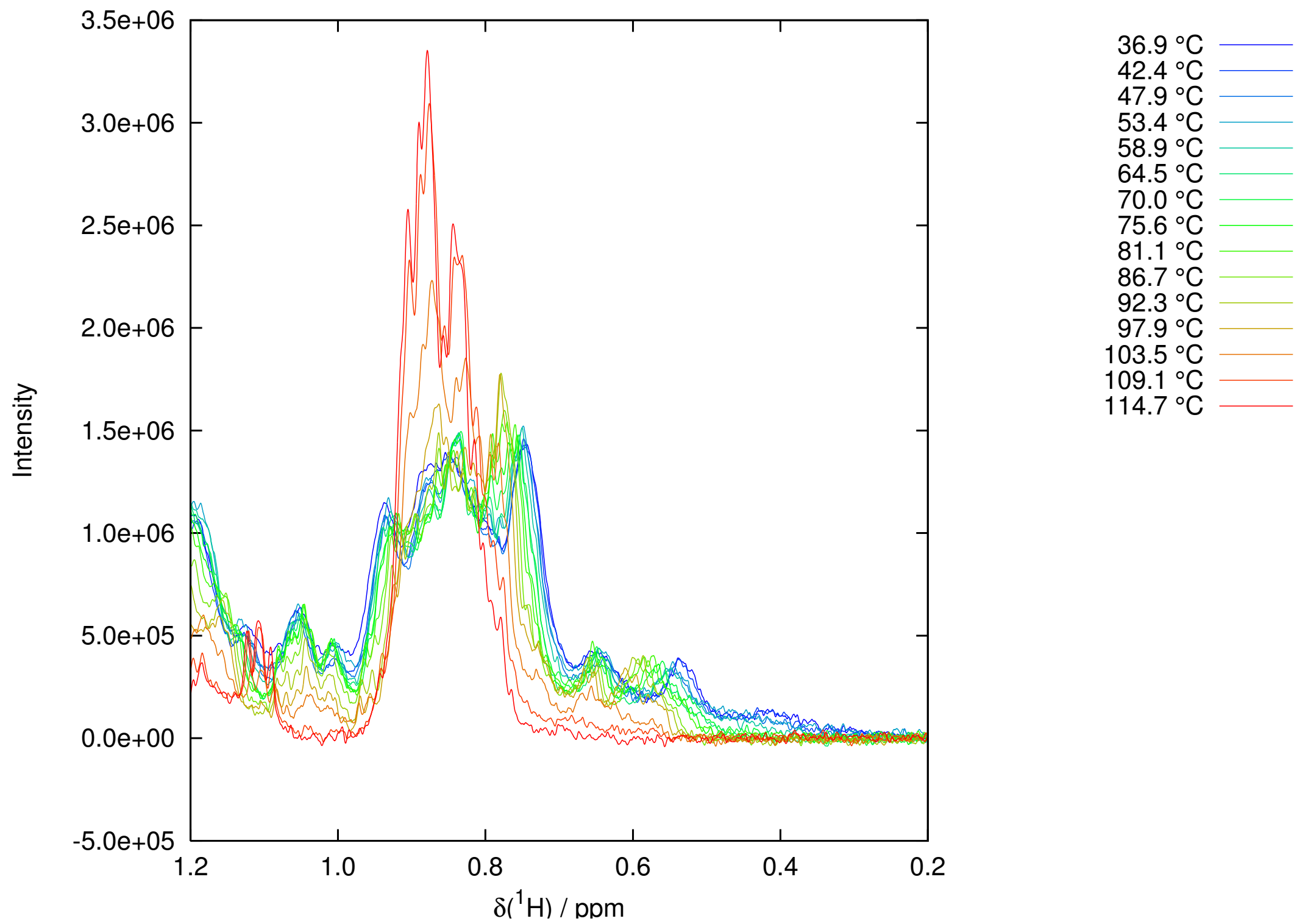
# Presaturation

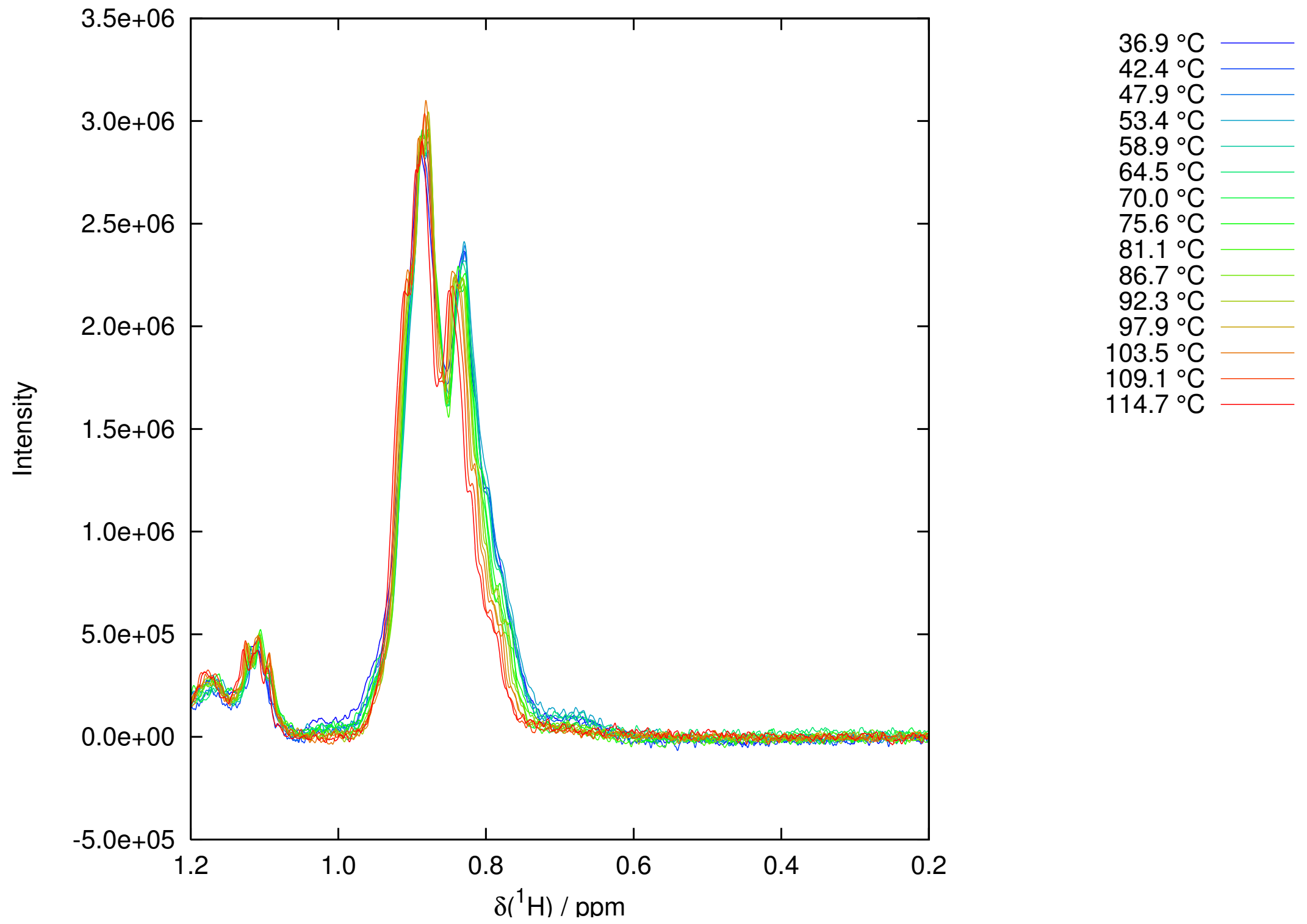


# WATERGATE

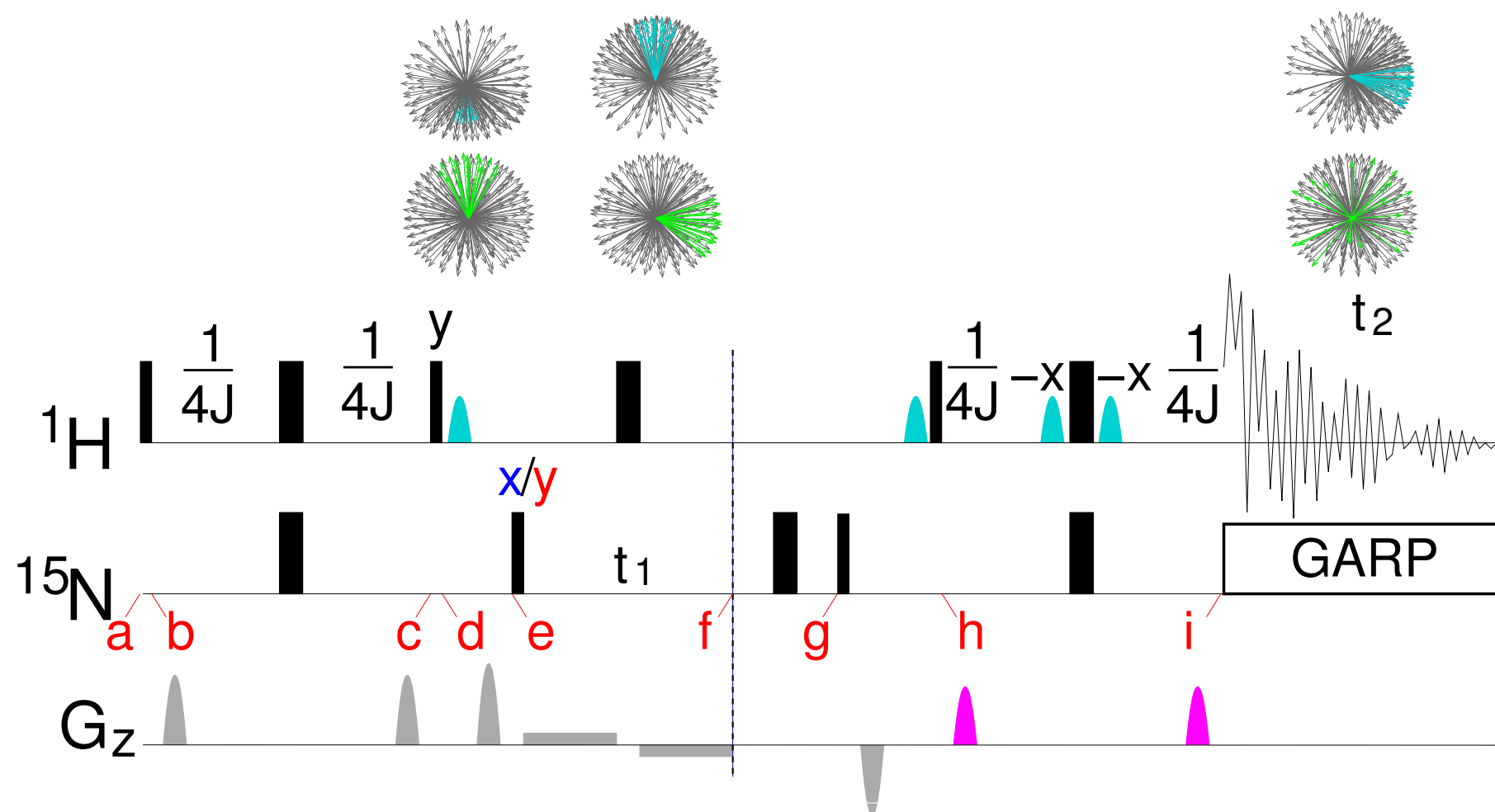




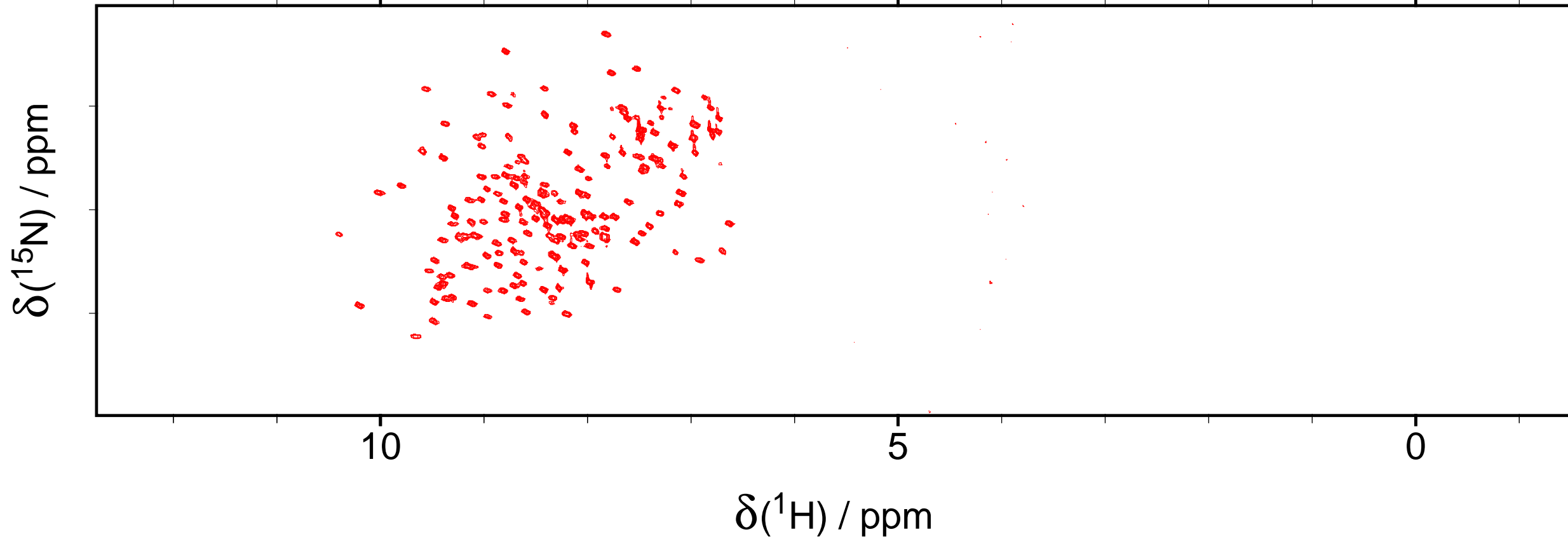
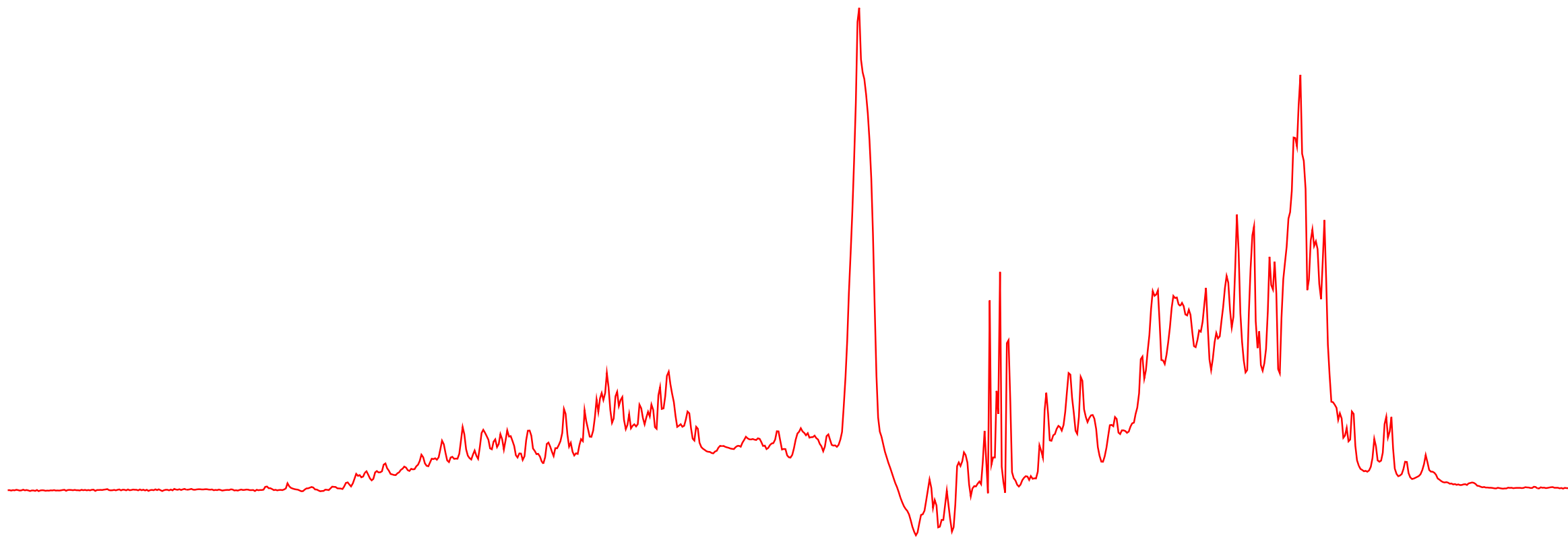




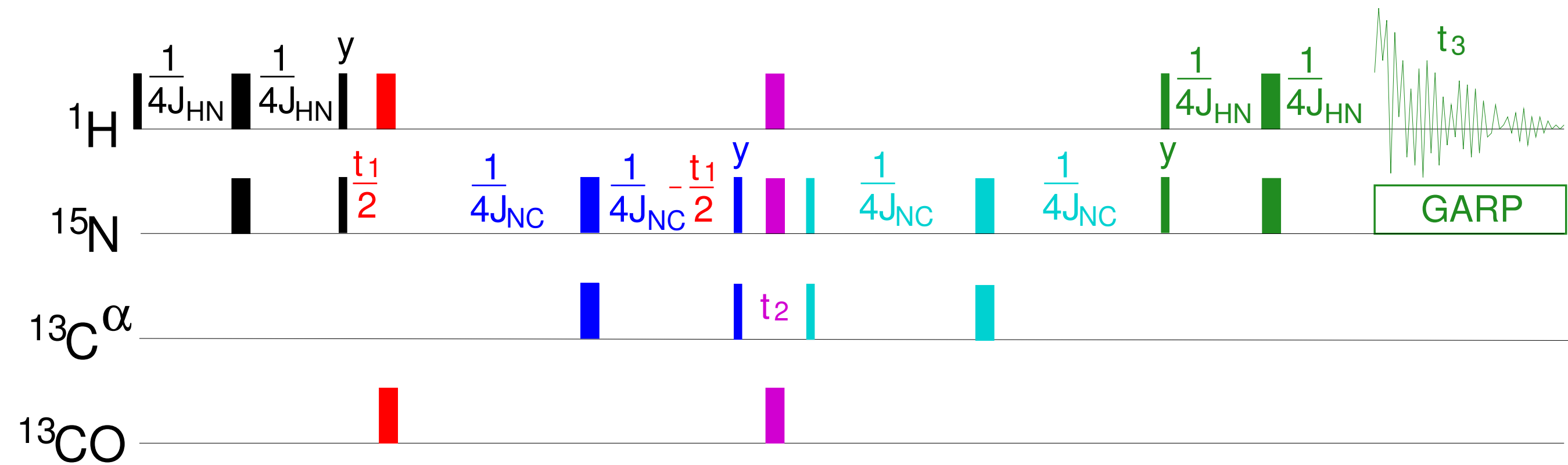
# $^1\text{H}-^{15}\text{N}$ HSQC

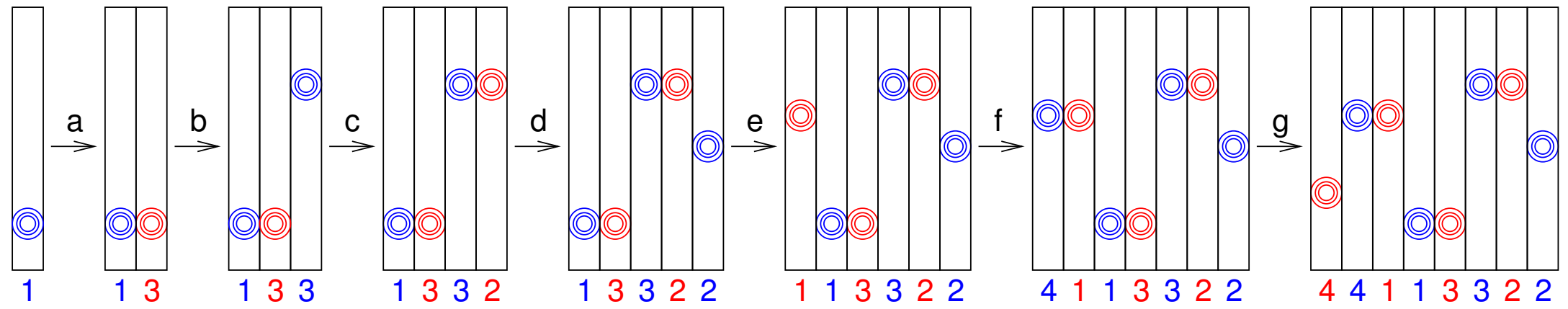
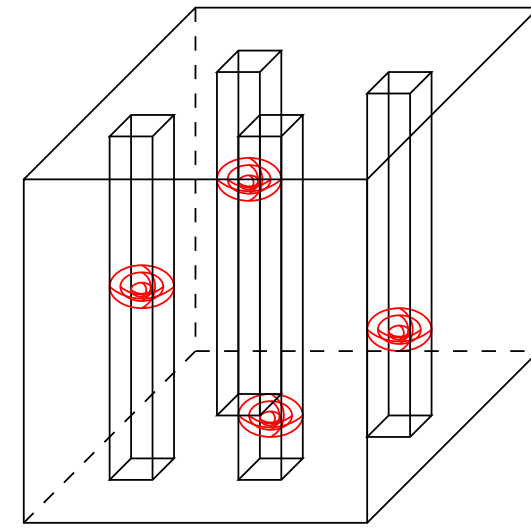
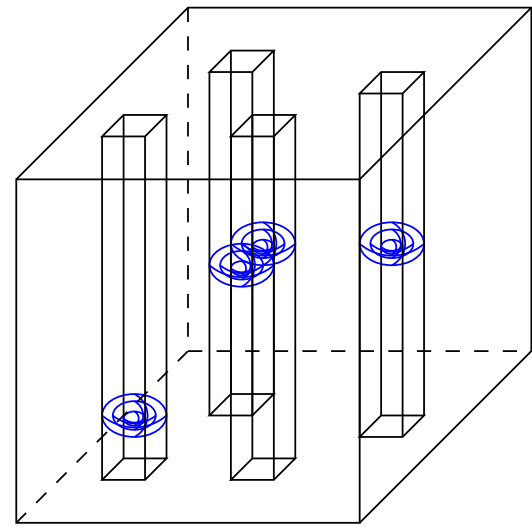
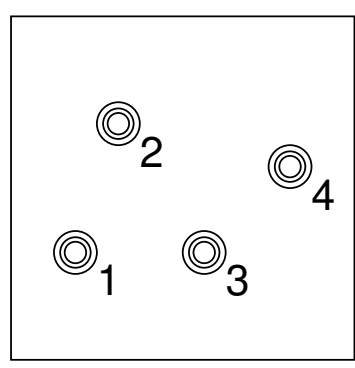
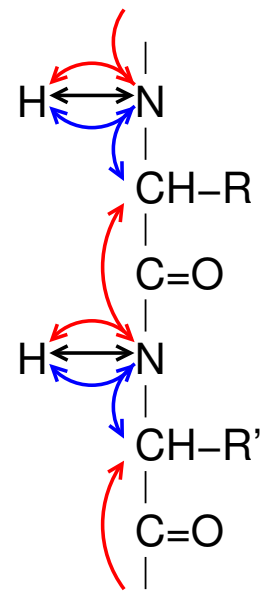






# HNCA, a triple resonance experiment





amino acid	NMR $C^\beta$	chemical shift
G	G	no $C^\beta$
A	A	< 25 ppm
C, E, H, K, M, P, Q, R, V, W	O	25 to 36 ppm
D, F, I, L, N, Y, C (S-S)	X	36 to 45 ppm
S, T	U	55 to 70 ppm

P A C D E F G H I K L M N Q R S T V W Y

O A O X O X G O X O X O X O O U U O O X

a = HNCACB  
b = CBCA(CO)NH

a b a b a b a b a b a b a b a b a b

