

# Solvent suppression in NMR

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# Problem

Normal we use solvent which is invisible in the NMR spectrum

-But what if We can not?

Water as solvent (10%D<sub>2</sub>O/90%H<sub>2</sub>O):

~100 M of proton signal – Compound X 0.001 M  
100 000:1

# Problem

Water

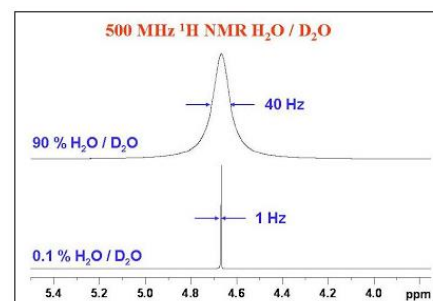


## Two major problems:

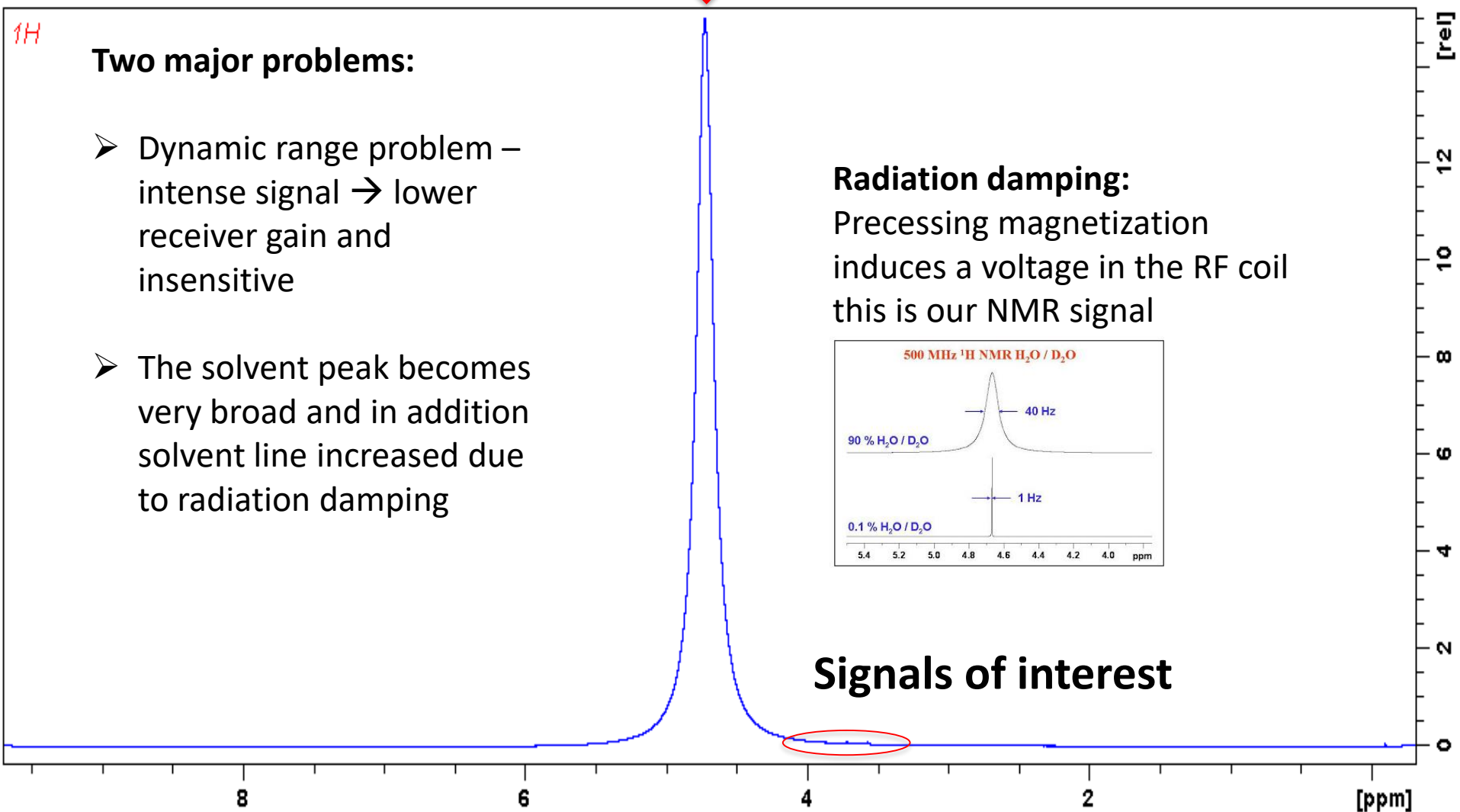
- Dynamic range problem – intense signal  $\rightarrow$  lower receiver gain and insensitive
- The solvent peak becomes very broad and in addition solvent line increased due to radiation damping

## Radiation damping:

Precessing magnetization induces a voltage in the RF coil this is our NMR signal



Signals of interest





# Ideal solvent signal Suppression

## - Wishlist to

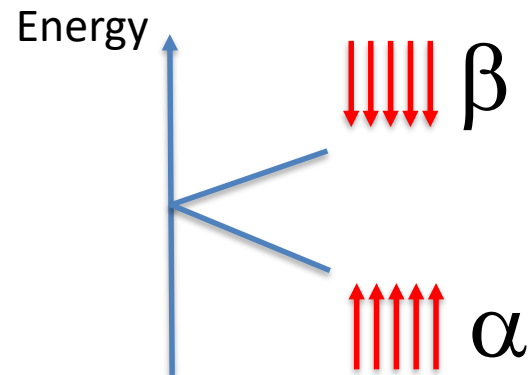
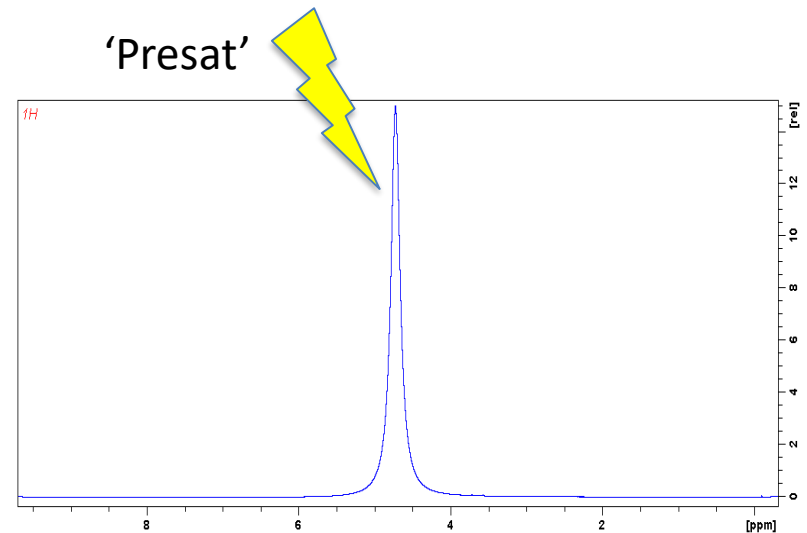
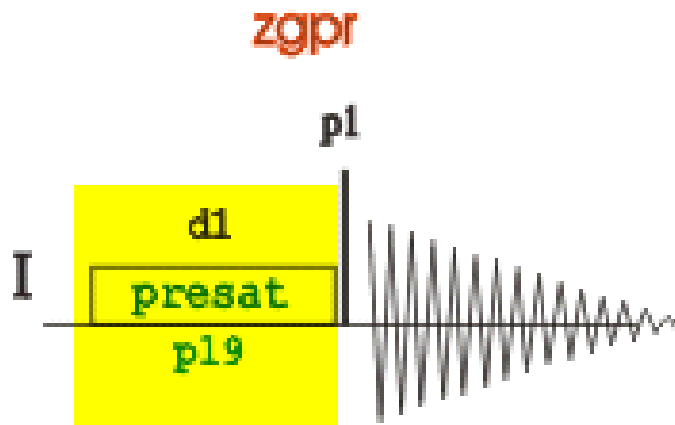


- Takes no time
- Affects only the solvent resonance and not the solute resonances
- Does not interfere with the pluse sequence
- Simple to setup

# Solvent suppression – methods overview

1. Saturation based methods
  - a) Discrimination by Frequency 
  - b) Discrimination by relaxation times
2. Methods Avoiding Solvent Saturation
3. Magnetization Destruction based methods 
4. Coherence Selection
5. Post acquisitional methods

# Solution 1 : Presaturation



# Solution 1 : Presaturation

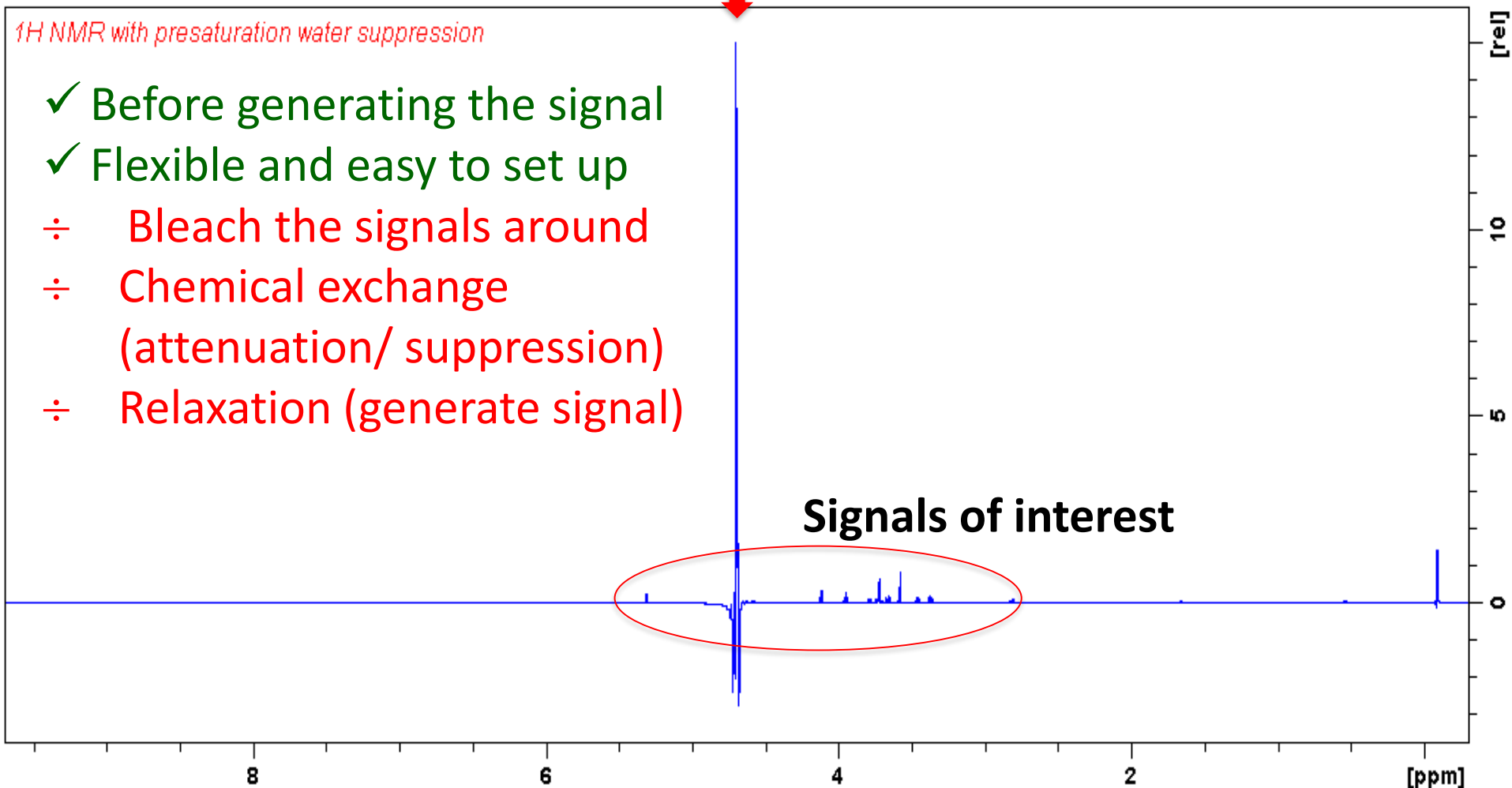
Water



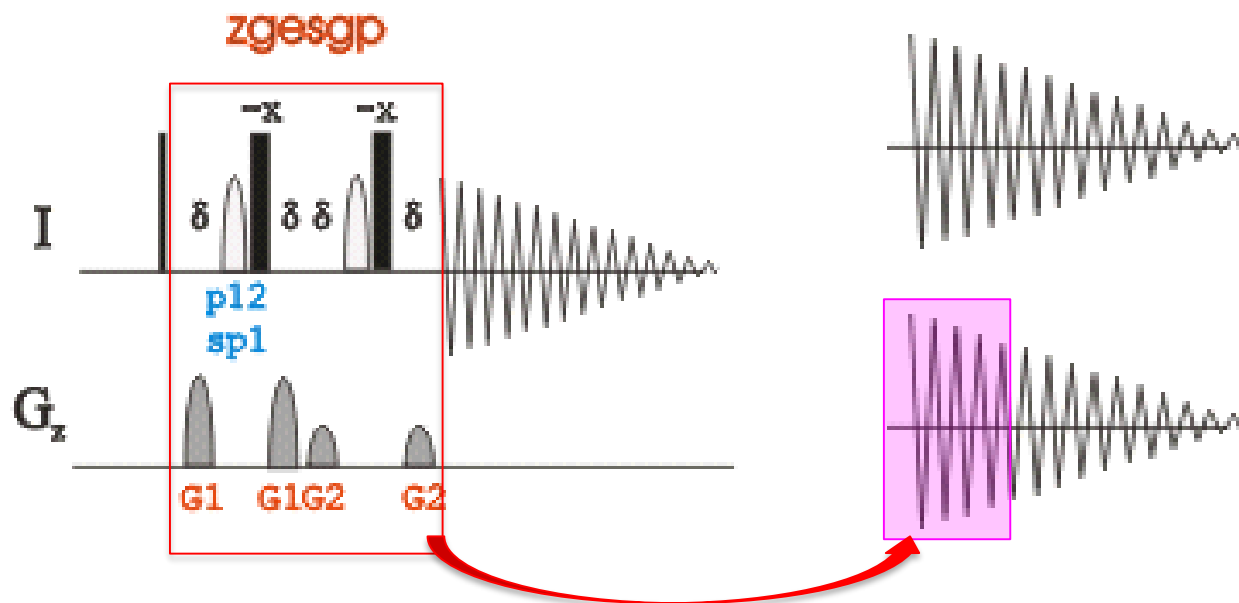
*<sup>1</sup>H NMR with presaturation water suppression*

- ✓ Before generating the signal
- ✓ Flexible and easy to set up
- ÷ Bleach the signals around
- ÷ Chemical exchange (attenuation/ suppression)
- ÷ Relaxation (generate signal)

Signals of interest

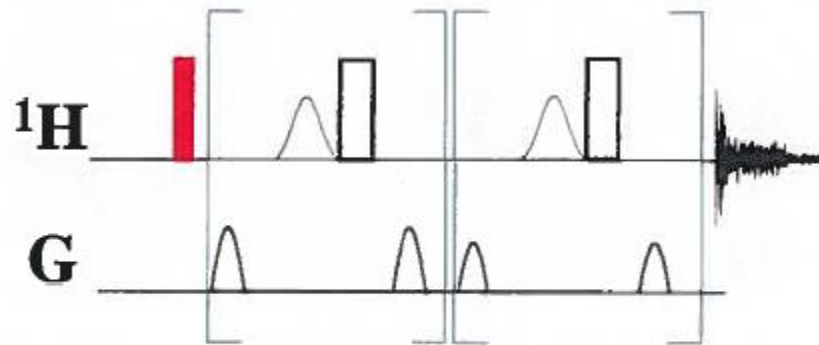


# Solution 2 : Excitation Sculpting

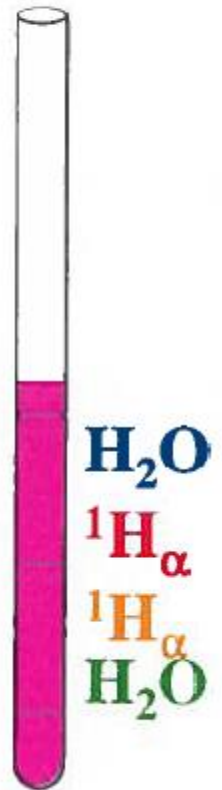
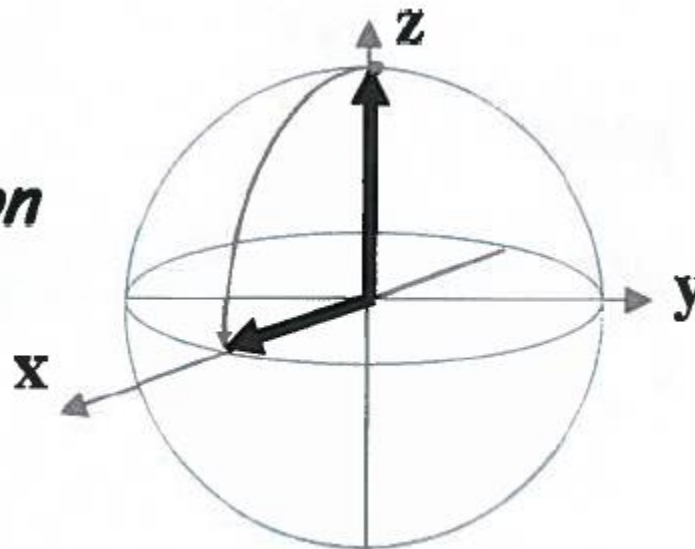




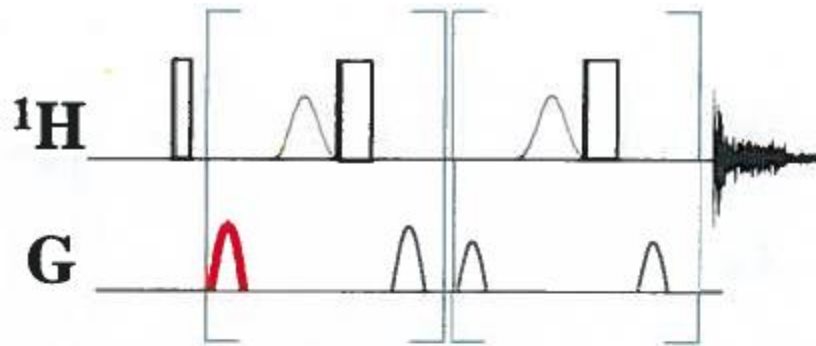
# Solution 2 : Excitation Sculpting



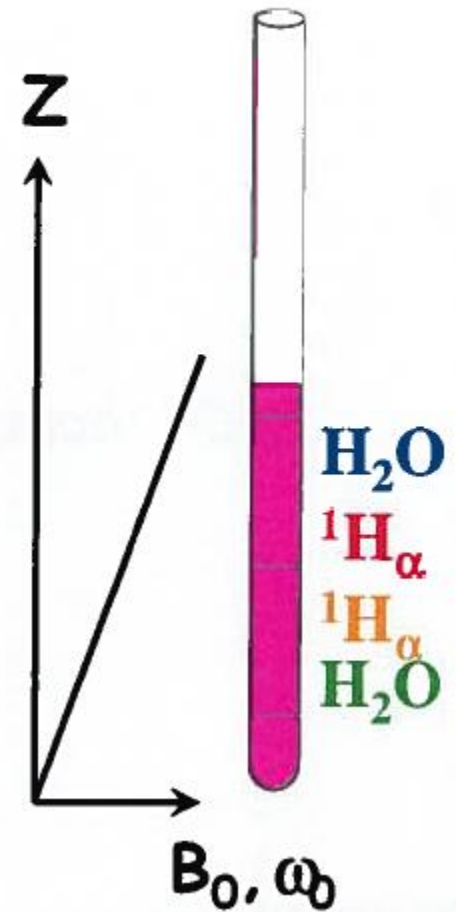
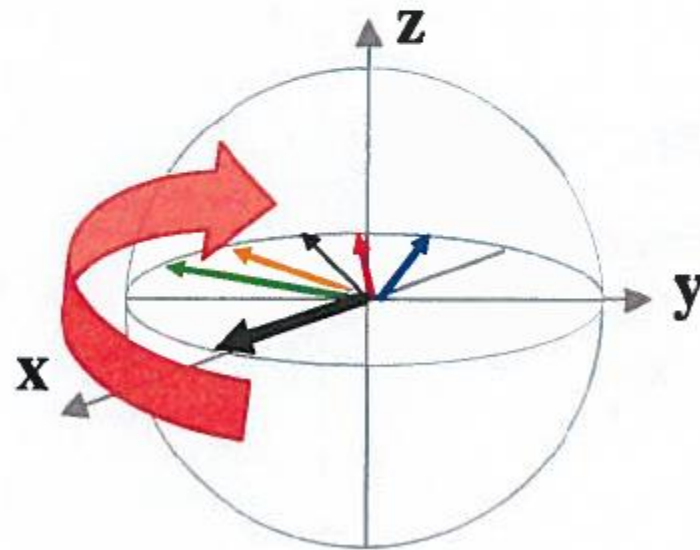
*90° excitation*



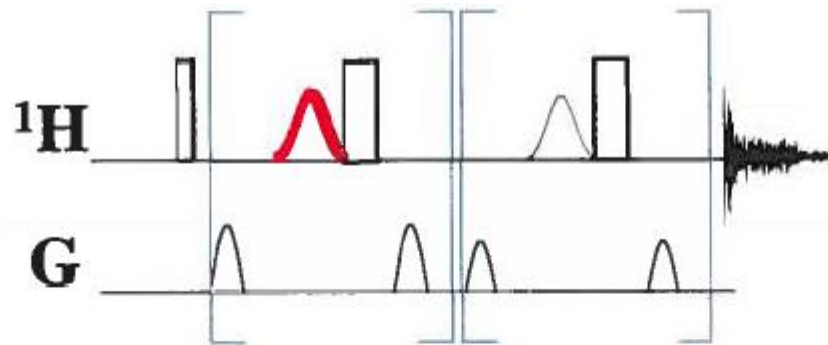
# Solution 2 : Excitation Sculpting



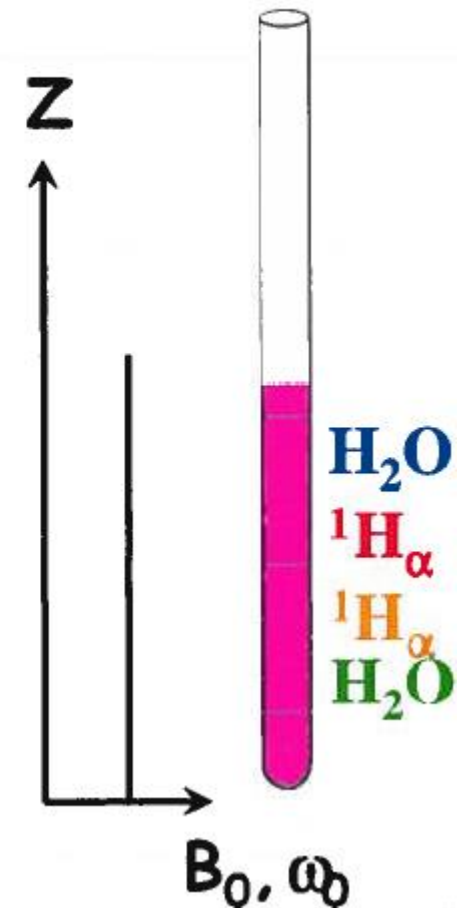
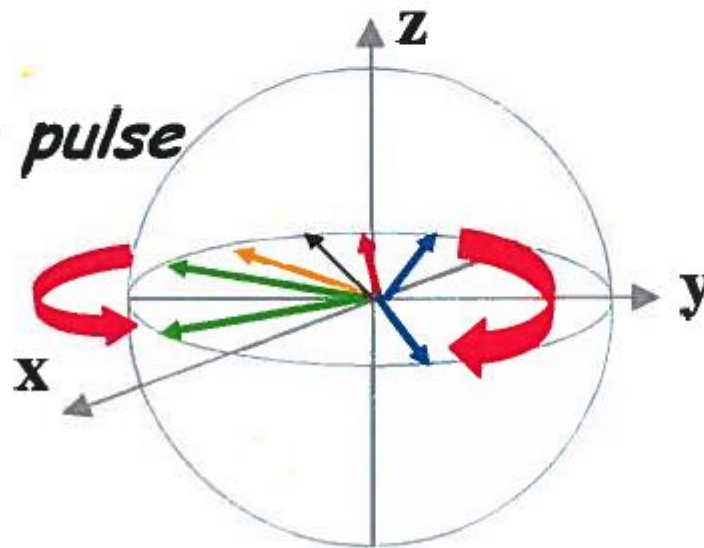
*defocussing  
gradient*



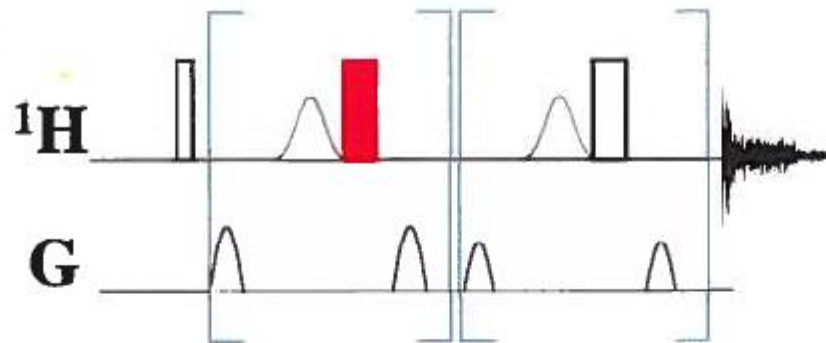
# Solution 2 : Excitation Sculpting



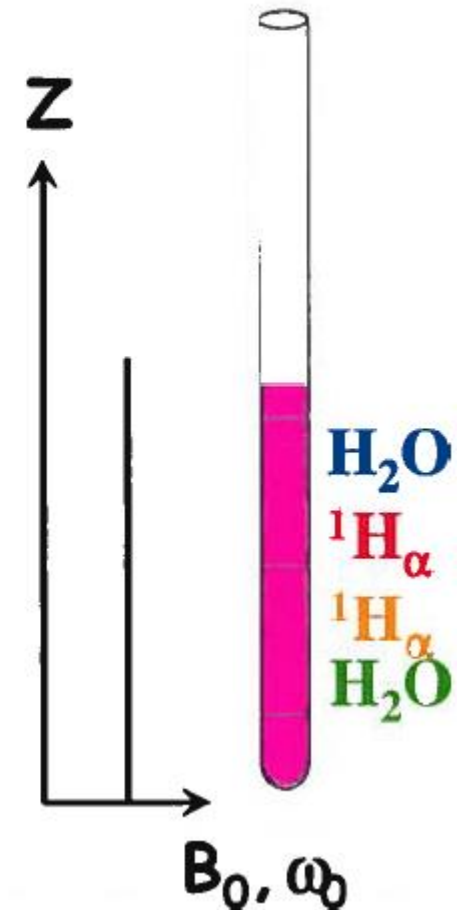
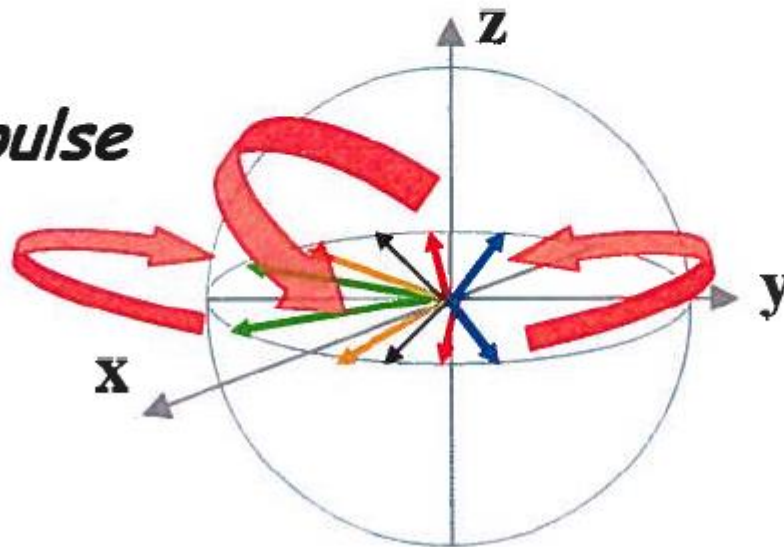
*180° selective pulse*



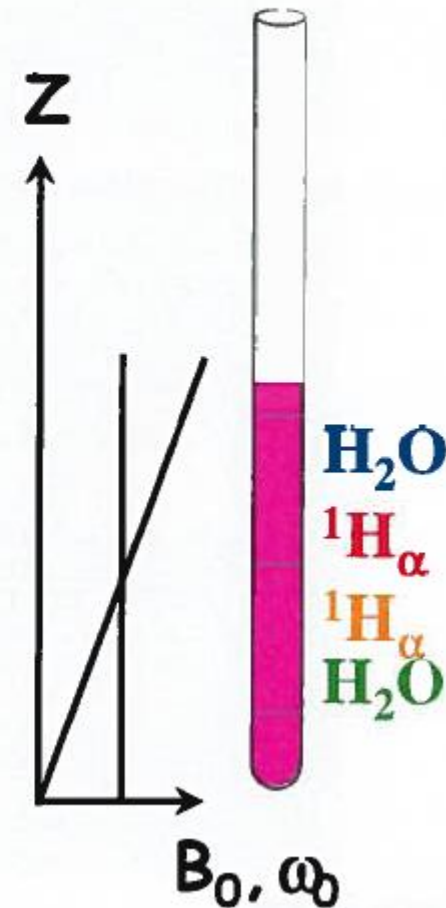
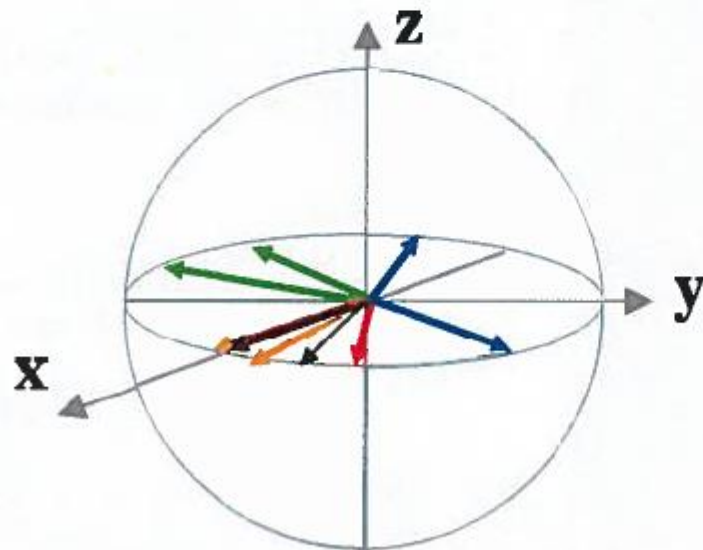
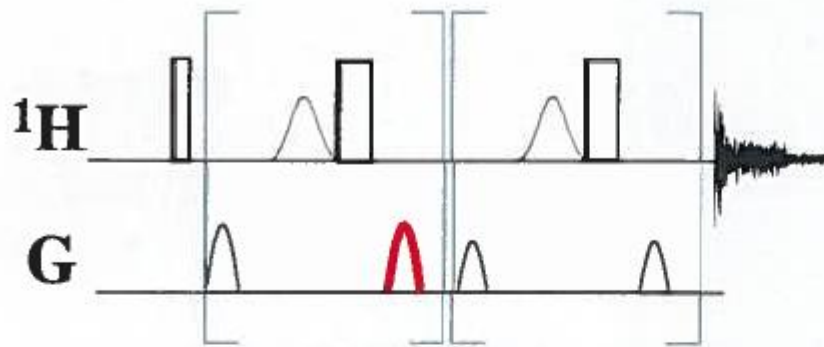
# Solution 2 : Excitation Sculpting



*180° hard pulse*



# Solution 2 : Excitation Sculpting

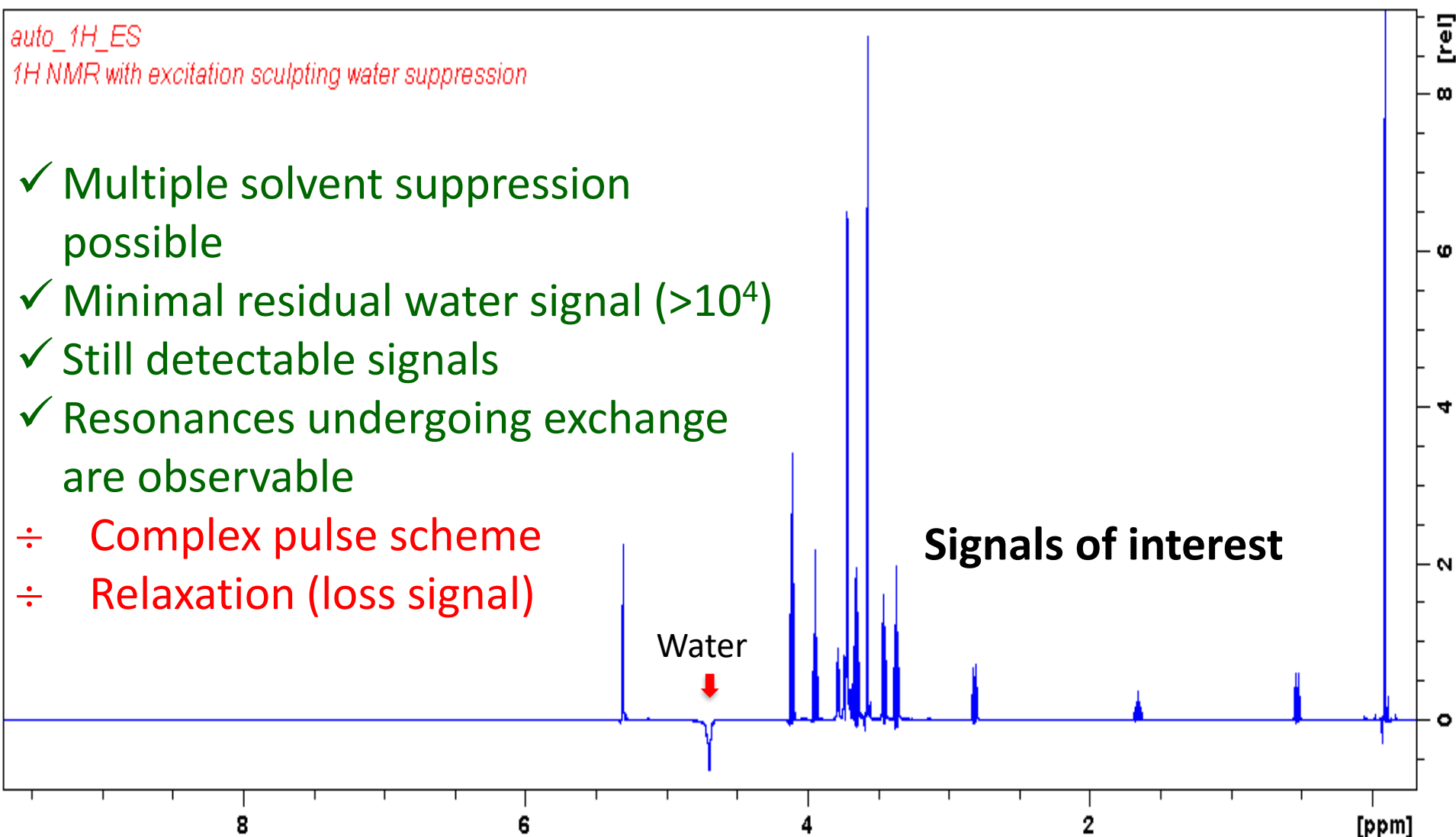


# Solution 2 : Excitation Sculpting

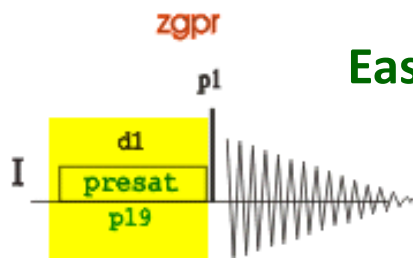
*auto\_1H\_ES*  
*1H NMR with excitation sculpting water suppression*

- ✓ Multiple solvent suppression possible
- ✓ Minimal residual water signal ( $>10^4$ )
- ✓ Still detectable signals
- ✓ Resonances undergoing exchange are observable

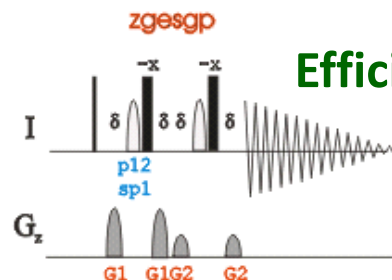
- ÷ Complex pulse scheme
- ÷ Relaxation (loss signal)



# Summary



Easy and simple!



Efficient but complex!

