# Experiments using the inverse probe set up for $^{31}$P on the Varian 500

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## What is an inverse probe?

An inverse probe is one which is very sensitive for $^{1}$H or $^{19}$F, but less sensitive for other nuclei, such as $^{31}$P or $^{13}$C. $^{1}$H and $^{19}$F are high-frequency nuclei; their Larmor frequency is much higher than those of almost all other nuclei.

## What experiments can be done with an inverse probe?

All experiments that are $^{1}$H-detected or $^{19}$F-detected are good. These include 1D $^{1}$H, HSQC, HMBC, COSY, etc. Experiments which detect $^{13}$C or $^{31}$P are much less sensitive when run on an inverse probe than when run on an "observe" probe, which is a probe optimized for detecting $^{13}$C or $^{31}$P, but not $^{1}$H.

## But can I run $^{31}$P on the inverse probe when it is tuned to $^{31}$P?

Yes. $^{31}$P is intrinsically very sensitive, because it is 100% abundant, so it is a reasonable experiment to run, even on an inverse probe. Still, it's not fantastic: the Bruker 400, the Bruker 500, and the Varian 500 with its usual probe (when tuned to $^{31}$P!) all give signal to noise ratios of about 250:1, while the Varian inverse probe gives 60:1. The Mercury 300 gives 64:1. These are tests on standard samples.

## Do I have to tune the p20180803_ID_autoshimrobe?

***Don't tune $^{31}$P: it's a bit tricky on this probe and it hardly changes from sample to sample.***

If you are just running a 1D $^{1}$H: no (although if you have very small amounts of sample, you should)

If you are running a 2D experiment: tune $^{1}$H only (don't tune $^{31}$P: it's a bit tricky on this probe and it hardly changes from sample to sample)

## What experiments are set up?

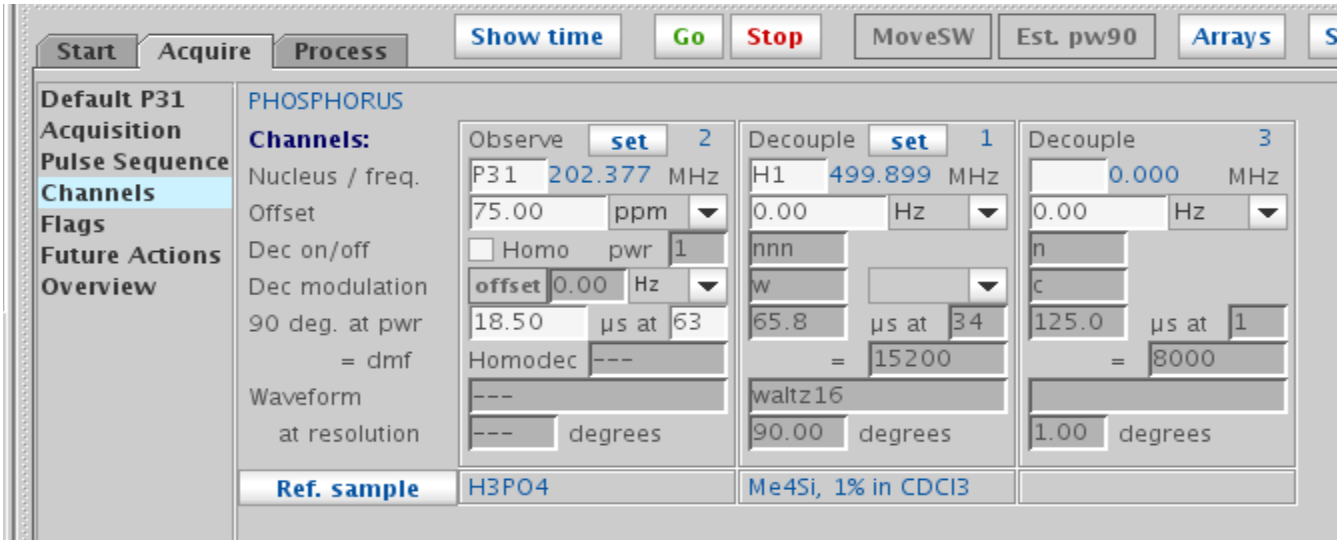
On the **McGill** tab:

- Proton: usual experiment, 8 scans; this should be excellent
- COSY: $^{1}$H-$^{1}$H through-bond correlation
- NOESY: $^{1}$H-$^{1}$H through-space correlation
- ROESY: $^{1}$H-$^{1}$H through-space correlation for large molecules (ca. 2000 MW)

- TOCSY: $^{1}$H total correlation spectroscopy showing coupled spin systems

On the **P31_Expts** tab:

- Phosphorus: basic phosphorus experiment, with $^{1}$H decoupling. Only 16 scans: you might want to double-click on the experiment in the queue list and go to the Acquisition panel to change the number of scans to 64. Centred on +75 ppm. If your signal is likely to be far from there (less than -25 ppm), go to the Channels panel (under Acquire) and set the Offset to where you think the signal will be (note that there is a drop down menu to change from Hz to ppm):




- P31_noH1dec: phosphorus, showing $^{1}$H splitting. Only 16 scans: you might want to double-click on the experiment in the queue list and go to the Acquisition panel to change the number of scans to 64. Centred on +75 ppm. If your signal is likely to be far from there (less than -25 ppm), go to the Channels panel (under Acquire) and set the Offset to where you think the signal will be (note that there is a drop down menu to change from Hz to ppm) (see above)