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; pp for proton detected MAS(H)NH 2D correlation
; employing water flip back
;constant time
;below : pl  - power level
;        p90 - 90° pulse

#include <Avance.incl>
#include <Delay.incl>

define delay twait
"twait=d20"

"pl8=pl2"                    ; 15N CP power
"p17=p16-p19"  ;

1 ze
  d18
2 40u do:f2  ;decouplers off
   d1 do:f1

  20u reset:f1  reset:f2 reset:f3
  20u fq=cnst10:f1    ; 1H carrier freq.
  5u pl6:f3    ; 13C pl for 15N J decoupling
  15u pl2:f2   ; 15N CP pl
  5u  pl3:f1   ; 1H p90 pl
  p4:f1 ph1    ;proton 90 pulse
  0.6u pl5:f1  ; 1H CP pl

  (p15:spf3 ph2):f2 (p15 ph10):f1  ; HN CP

 .5u pl4:f2 pl3:f1  ; 1H p90 power ; 15N p90 power
  (p5 ph15):f2     (p9 ph1):f1     ;1H p90 (opposite Boltzman) and 15N
p90

  d2
  2u
  2u
  2u cpd3:f3 ; 13C XY16+delays pulse train for J decoupling
  2u
  p5:f2 ph16      ; 15N to XY for evolution

  if "d0 > p6"
{
  (center (d0):f2  (p6 ph15):f1   )
  p5:f2 ph17     ; 15N to Z
}

else
{
   p5:f2 ph17     ; 15N to Z
   (p6 ph15):f1
}


  2u
```

```
  2u do:f3

  d2        ; d2+d0==CONST
  twait     ; H2O presaturation

 5u fq=cnst10:f1    ; pulsing freq.
 5u pl5:f1           ; back CP 1H pl

 (p17 ph14):f1  ; 1H pulse to compensate 1H pulse in back CP
 p7:f2 ph18    ;15N p90 for back CP
 0.7u pl8:f2                    ; back CP 15N pl
 (p16:spf4 ph12):f2  (p16 ph11):f1  ; NH CP
  .4u pl29:f2         ; WALTZ power on 15N
  .5u  cpd2:f2    ; 15N WALTZ16
  go=2 ph31 ;      ;Acquisition

  40u do:f1  ;decouplers off
  40u do:f2  ;decouplers off
  10m wr #0  if #0 zd
  1m ip17      ;tppi
  10u id0      ;increment evolution time
  10u dd2     ;decrement delay
  lo to 2 times td1
HaltAcqu, 1m
exit

ph1=  0 2                       ; 1H excitation
ph13=  2 0   ; 1H back to Z
ph2=  0 0 0 0  0 0 0 0  0 0 0 0  0 0 0 0                        ; 15N 1st
CP power
      0 0 0 0  0 0 0 0  0 0 0 0  0 0 0 0
      2 2 2 2  2 2 2 2  2 2 2 2  2 2 2 2
      2 2 2 2  2 2 2 2  2 2 2 2  2 2 2 2
ph3=  2 0                    ; ph1 mirror

ph15= 1 1 1 1  1 1 1 1  1 1 1 1  1 1 1 1      ; 15N along Z axis after
1st CP
      1 1 1 1  1 1 1 1  1 1 1 1  1 1 1 1
      3 3 3 3  3 3 3 3  3 3 3 3  3 3 3 3
      3 3 3 3  3 3 3 3  3 3 3 3  3 3 3 3

ph16= 2 2 2 2  2 2 2 2  2 2 2 2  2 2 2 2           ; 15N back to XY plane
for evolution
      0 0 0 0  0 0 0 0  0 0 0 0  0 0 0 0
      2 2 2 2  2 2 2 2  2 2 2 2  2 2 2 2
      0 0 0 0  0 0 0 0  0 0 0 0  0 0 0 0    ; 15N 1st CP power

ph17= 0                               ;15N along Z after evolution
ph18= 0 0 0 0  2 2 2 2             ;15N after H2O dephase for 2nd CP
ph19= 0 2 0 2  0 2 0 2  1 3 1 3  1 3 1 3

ph10= 3 3 3 3  3 3 3 3  3 3 3 3  3 3 3 3                       ; 1H in
1st CP
      3 3 3 3  3 3 3 3  3 3 3 3  3 3 3 3
      1 1 1 1  1 1 1 1  1 1 1 1  1 1 1 1
```

```
      1 1 1 1  1 1 1 1  1 1 1 1  1 1 1 1

ph11= 0 0 2 2  0 0 2 2  2 2 0 0  2 2 0 0            ; 1H in 2nd CP
ph14= 2 2 0 0  2 2 0 0  0 0 2 2  0 0 2 2            ; 1H back
ph12= 1                              ; 15N in 2nd CP

ph20= 1
ph21= 2       ;1H p180 for J decoupl.

ph22= 0 0 0 0  2 2 2 2
ph23= 1 1 1 1  1 1 1 1  3 3 3 3  3 3 3 3

ph29= 0 0 2 2  0 0 2 2  2 2 0 0  2 2 0 0

ph31= 0 2 2 0  2 0 0 2  2 0 0 2  0 2 2 0
      2 0 0 2  0 2 2 0  0 2 2 0  2 0 0 2
      2 0 0 2  0 2 2 0  0 2 2 0  2 0 0 2
      0 2 2 0  2 0 0 2  2 0 0 2  0 2 2 0

;pl2 15N 1st ramp-CP power
;pl4  15N p90 power
;p5 15N p90 duration
;pl3 1H p90 power
;pl5 1H CP power
;p15 1st CP, ramp
;p16 2nd CP
;p17 compensation for p16
;p19 possible difference p16 and p17
;d2 delay for refocusing
;d20 =twait
;d0 t1 increment
;pl29 WALTZ power on 15N
;pl6 13C pl on f3
;p1 p90 13C
;p2 p180 13C
;p4 1H p90 excite
;p6 1H p180 at J decoupling
;p7 15N p90 for calibration  ==normaly p5
;pl7 15N calibration power, ==normaly pl4
;cnst19 - H2O freq.
;cnst1 ==0
;d9 delay
;pl8 15N back cp power
;p29 1H p180
;cnst31 rotational freq.
;d8 T1 delay
;cnst10 1H carrier for 1st CP
;d18 prescan delay
```