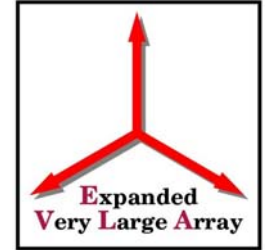


Water Vapor Radiometer

- Development project
- Not in EVLA baseline plans
- If successful, has implications for EVLA



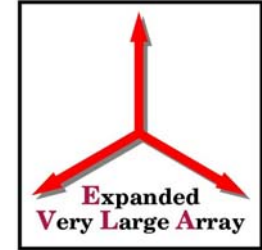
WVR....why?



-
- Water vapor emission in the atmosphere increases electrical path length resulting in phase fluctuations in the astronomical data
 - The effect of these fluctuations is greater at shorter wavelengths
 - Measuring fluctuation of the amplitude of water vapor emission at 22 GHz enables a phase correction to be generated and applied to astronomical data

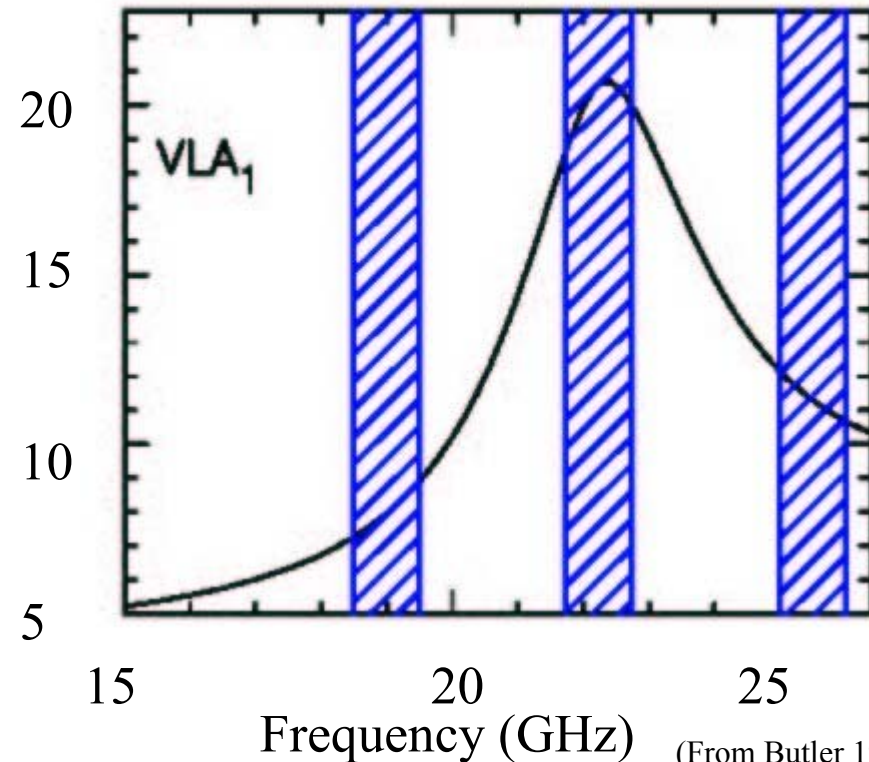


A three channel system for EVLA



- An optimized EVLA WVR design would include channel spacing as near the K band edge as possible

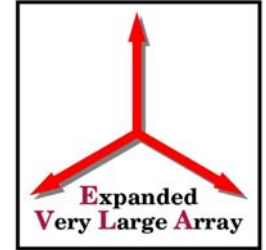
Deg (K)



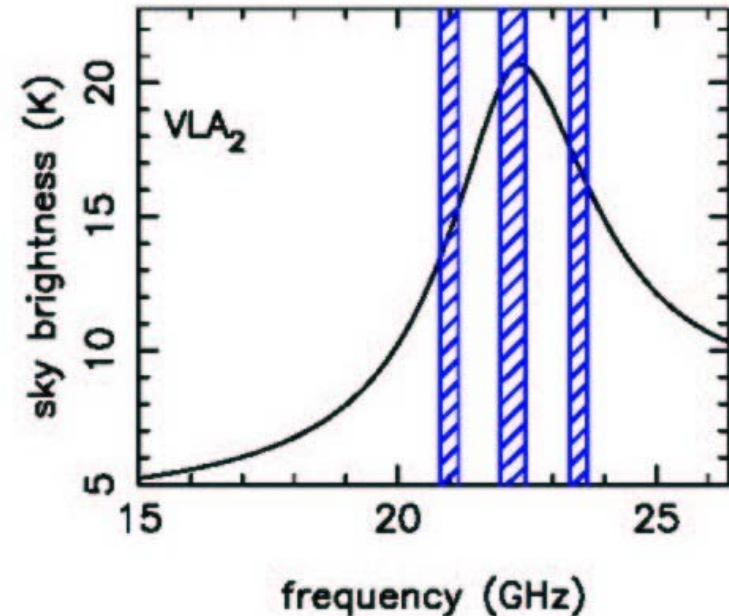
(From Butler 1999)



Current WVR system



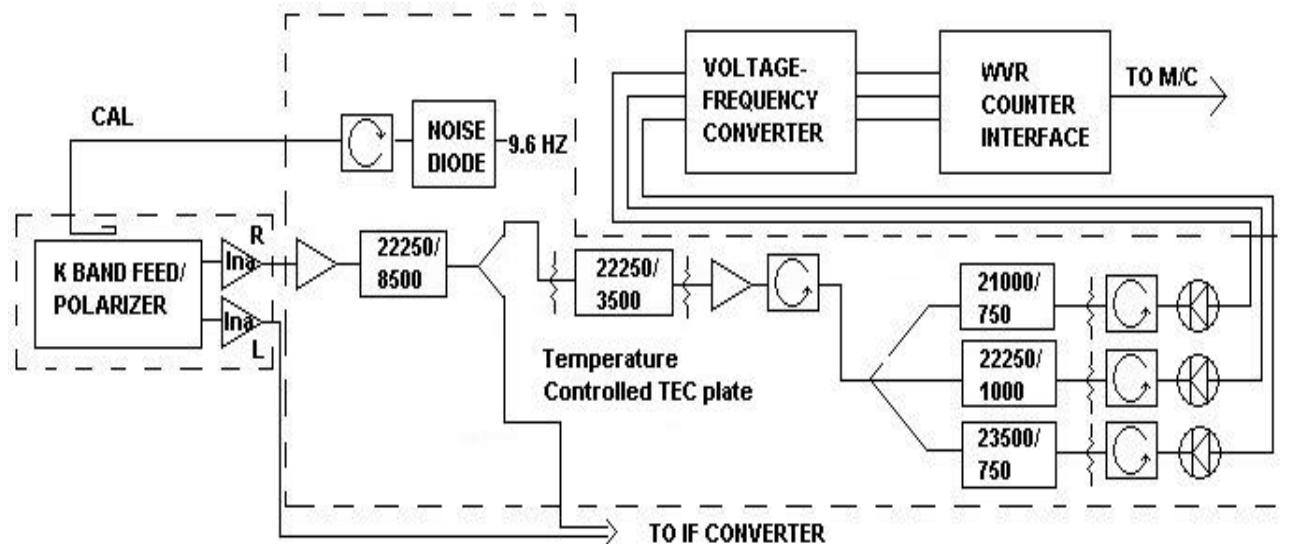
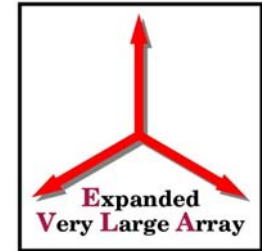
- The current WVR detection scheme uses three channels centered on the water line
- The bandwidth and frequency of the channels are limited by RFI generated in the present LO scheme



(From Butler 1999)

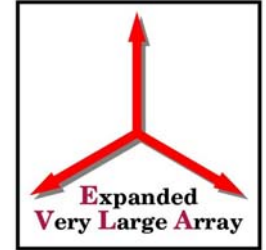


WVR block diagram





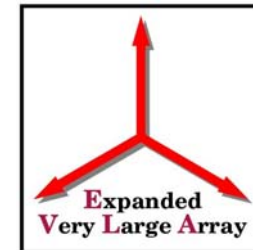
Requirements



-
- Defined by need to measure Q band phase fluctuations to 10 deg rms
 - Fractional amplitude stability of 10^{-4}
 - Timescales 2 sec to 30 min



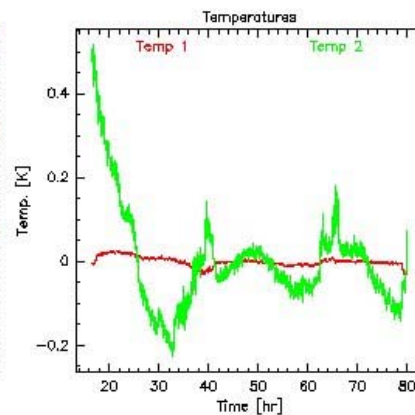
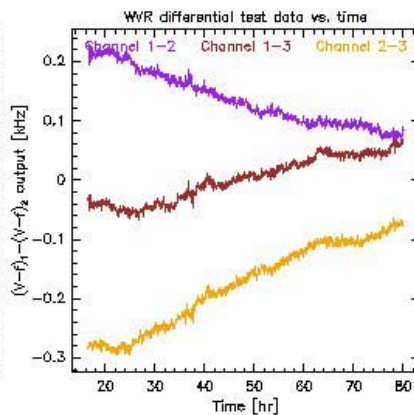
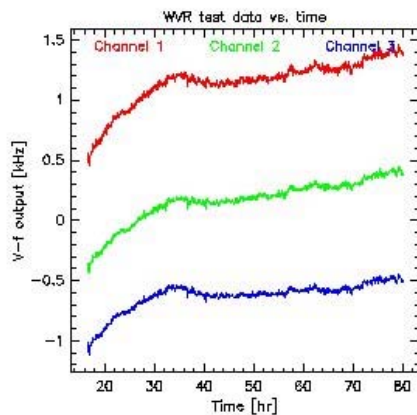
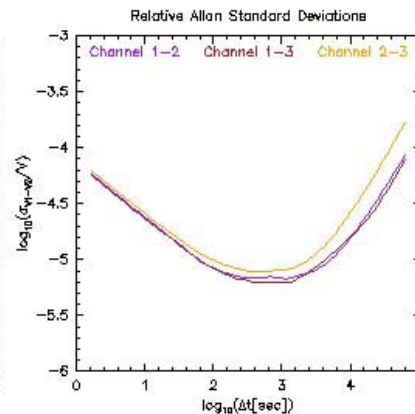
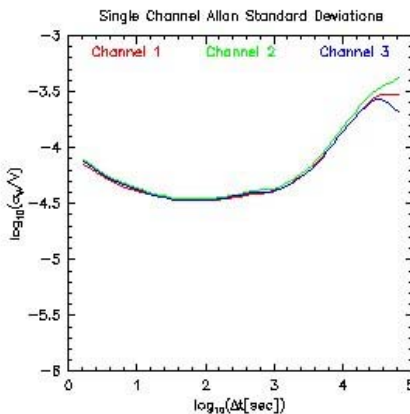
Recent WVR 'LAB' prototype stability measurements, using a Noisecom ND as the source



File = 0119ND
Averaging time = 113.88 sec
Channel 1 mean = 292.639 kHz
Channel 2 mean = 220.284 kHz
Channel 3 mean = 218.547 kHz
Temp. 1 mean = 294.964 K
Temp. 2 mean = 269.025 K
Time range: 16.6 to 80.0 hours
Mode : Ave(Off Data, On Data)

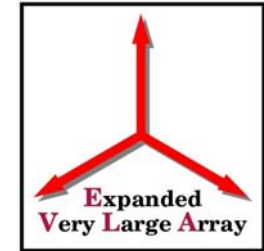
Notes:

Noise Diode as source
Changed temp setpoint
V-F #2
Temp #1 is RF plate
Temp #2 AOC lab ambient



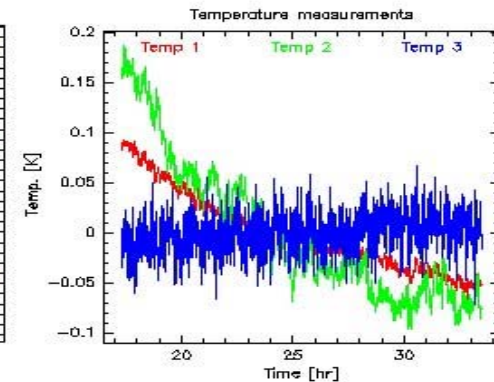
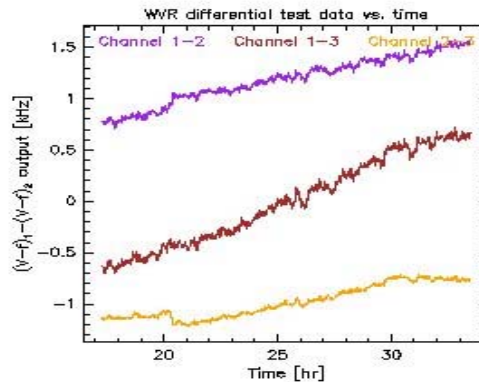
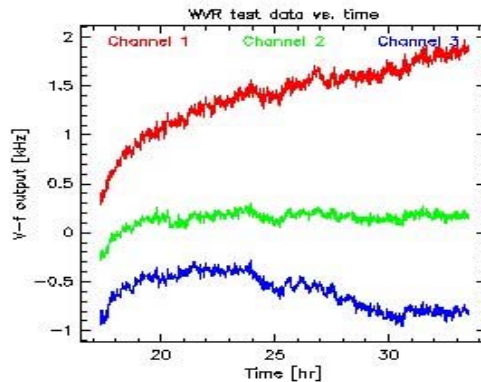
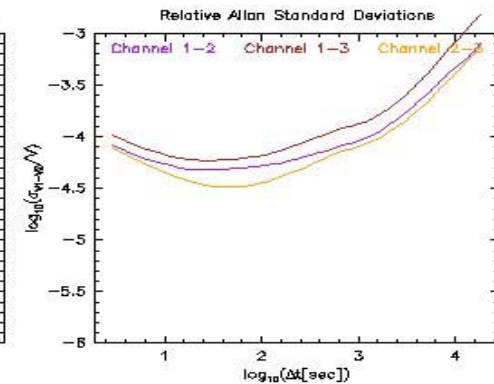
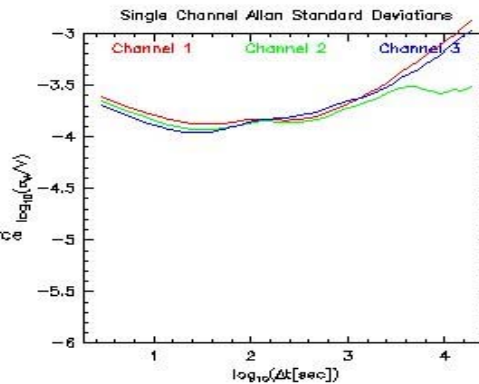


WVR stability measurements using K band #17 and a 'hot' load as source



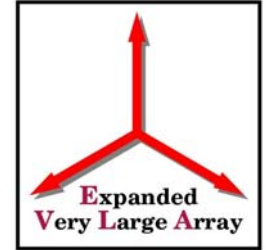
File = 1209KR
Averaging time = 29.10 sec
Channel 1 mean = 170.040 kHz
Channel 2 mean = 121.378 kHz
Channel 3 mean = 144.989 kHz
Temp. 1 mean = 294.519 K
Temp. 2 mean = 292.929 K
Temp. 3 mean = 306.244 K
Time range: 17.3 to 33.5 hours
Mode : Ave(Off Data, On Data)

Notes:
K band Receiver #17 with hot load as source
Temp #1 Hot load temp
Temp #2 Ambient
Temp #3 RF plate





WVR plans



- Install 2 prototypes Spring 2002
- Evaluate existing design Spring/summer 2002
- If successful, need 1 system/antenna.
- EVLA implications are:
 - Ku, K, Ka, Q band Rx adjacent on feed ring
 - LOs must not coincide with WVR channels
 - Space for WVR electronics in feed circle
 - Interface to monitor and control