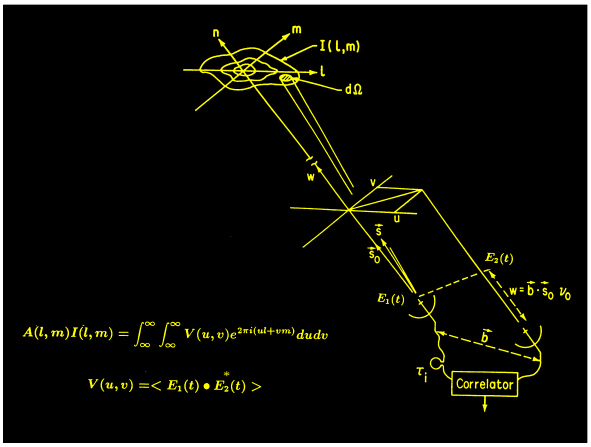
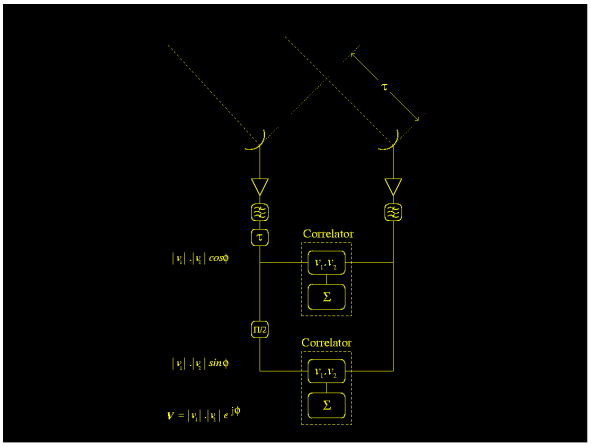
ATNF Synthesis Imaging Workshop

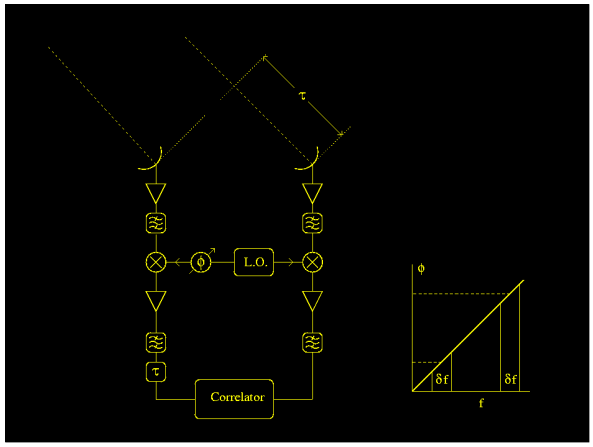
Correlators

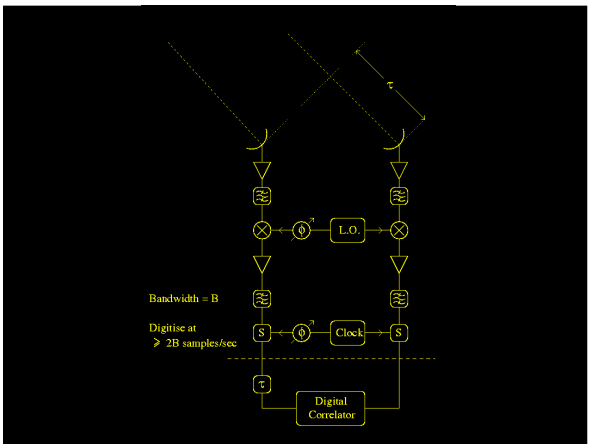
(Backend System)

Warwick Wilson, ATNF.



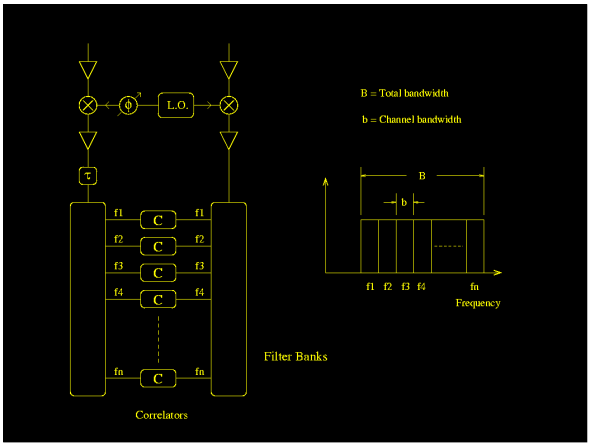






Advantages of measuring the Cross Power Spectrum

- Allows measurement of any frequency dependence in the source, e.g. spectral lines.
- Reduces the effects of frequency smearing and provides more independent measurements on the U,V plane. (MFS)
- Provides an easy method of delay calibration.
- Interference excision.



Visibility / Cross Power

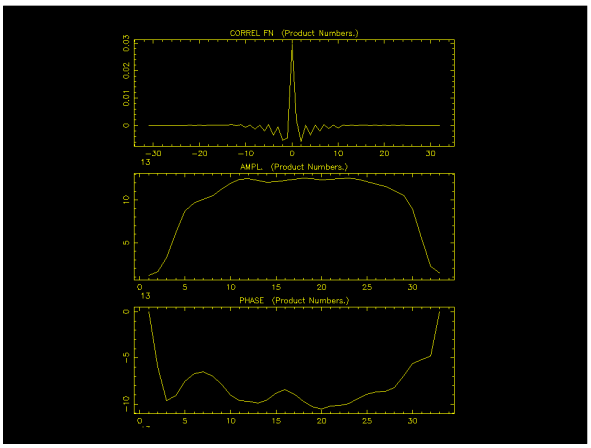
$$V = \langle E_1(t) \bullet E_2(t) \rangle$$

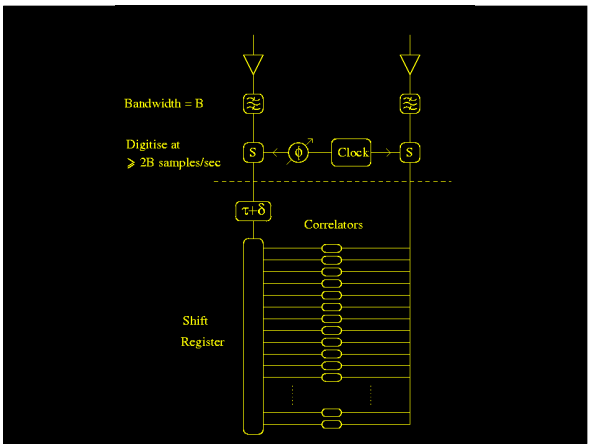
$$C(\tau) = \langle E_1(t) \bullet E_2(t+\tau) \rangle$$

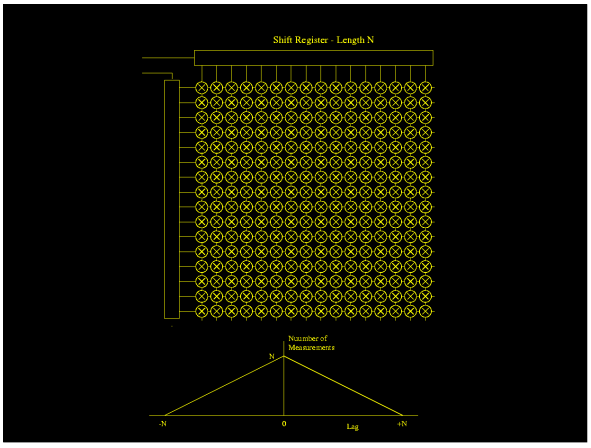
$$C(\tau) = \int V(f) e^{2\pi i f \tau} df$$

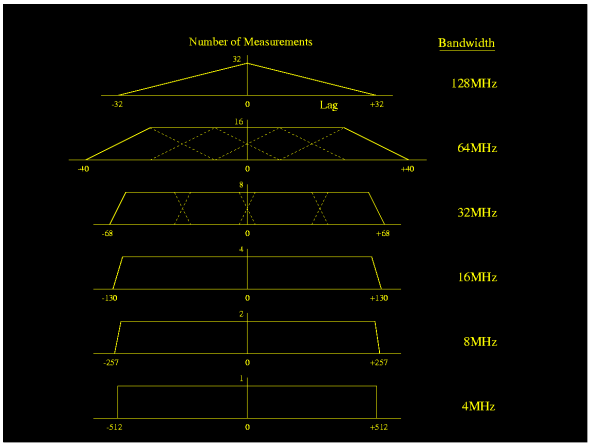
$$V(f) \Leftrightarrow C(\tau)$$

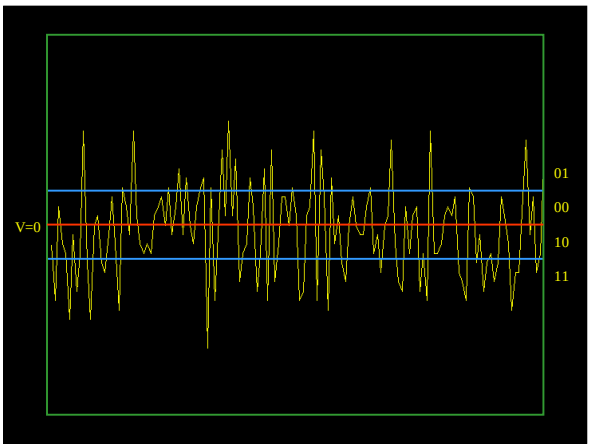
Cross Power Spectrum -- Cross Correlation Function


CORREL FN (Product Numbers.)
AMPL. (Product Numbers.)
PHASE (Product Numbers.)


Bandwidth = B
Digitise at
⩾ 2B samples/sec
S
ϕ
Clock
S
τ+δ
Correlators
Shift
Register


Shift Register - Length N
Number of
Measurements
N
-N
0
Lag
+N


Number of Measurements
Bandwidth
32
-32
0
Lag
+32
128MHz
16
-40
0
+40
64MHz
8
-68
0
+68
32MHz
4
-130
0
+130
16MHz
2
-257
0
+257
8MHz
1
-512
0
+512
4MHz



Bits	Levels	Efficiency
1	2	0.64
2	4	0.88