Summary of the b-factor for the VLBA FX correlator

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This memo gives the relations between mean values of digitized r_{dig} and analog r_{an} spectrum in the CROSS and AUTO correlation case.

$$r_{an} = r_{dig} \cdot BFACTA, \qquad AUTO$$

$$r_{an} = r_{dig} \cdot BFACTC, \qquad CROSS$$

$$BFACTA = \gamma^2 \cdot SAT/(A \cdot R_m \cdot H)$$

$$BFACTC = \gamma^2/(A \cdot R_m \cdot \alpha \cdot H)$$

where R_m - the maximum possible value on the output of a given digitizer
corresponding to unit correlation of the input analog signals.
α - the slope in the normalized conversion function between analog and
digitized signals (for the 1 bit case it is the well known Van Vleck correction $2/\pi$)
H - is the maximum of the auto convolution of the weighting function applied before the FFT
γ is a known factor applied in the NRAO correlator
A is an empirically found coefficient providing $r_{an} = 1$ in the AUTO case
SAT is a coefficient of saturation; SAT=1.125 for polarization off; SAT=1.25 for polarization on.
Saturation is a decrease of accumulated amplitude due to limit number of bits in the digital
representation of the amplitude. Saturation effect is negligible in cross correlation.

In the case of low cross correlation (the most typical case in radio astronomy), the formulas are valid for individual points in the cross correlation spectrum as well.
The values of the parameters as well as the values of the calculated BFACTA and BFACTC are given in the table for two type of digitizers and weighting functions.

Weight	#levels	A	R_m	H	α	γ	BFACTC	BFACTA	
								pol off	pol on
Hanning	TWO	5.36	1	0.335	0.6366	1.0159	0.9028	0.6466	0.7182
	FOUR	5.36	4.3048	0.335	0.8825	3.3888	1.6834	1.6714	1.8571
	TWO-FOUR	5.36	5.8784	0.335	0.8825	3.3888	1.2327		
BOX	TWO	5.36	1	0.8789	0.6366	1.0159	0.3442	0.2465	0.2739
	FOUR	5.36	4.3048	0.8789	0.8825	3.3888	0.6416	0.6371	0.7073
	TWO-FOUR	5.36	5.8784	0.8789	0.8825	3.3888	0.4699		

The values of BFACTC and BFACTA are valid for data which have been correlated after August 1994. These factors have to be divided by 1.5708 if a correlation had been done before August 1994.