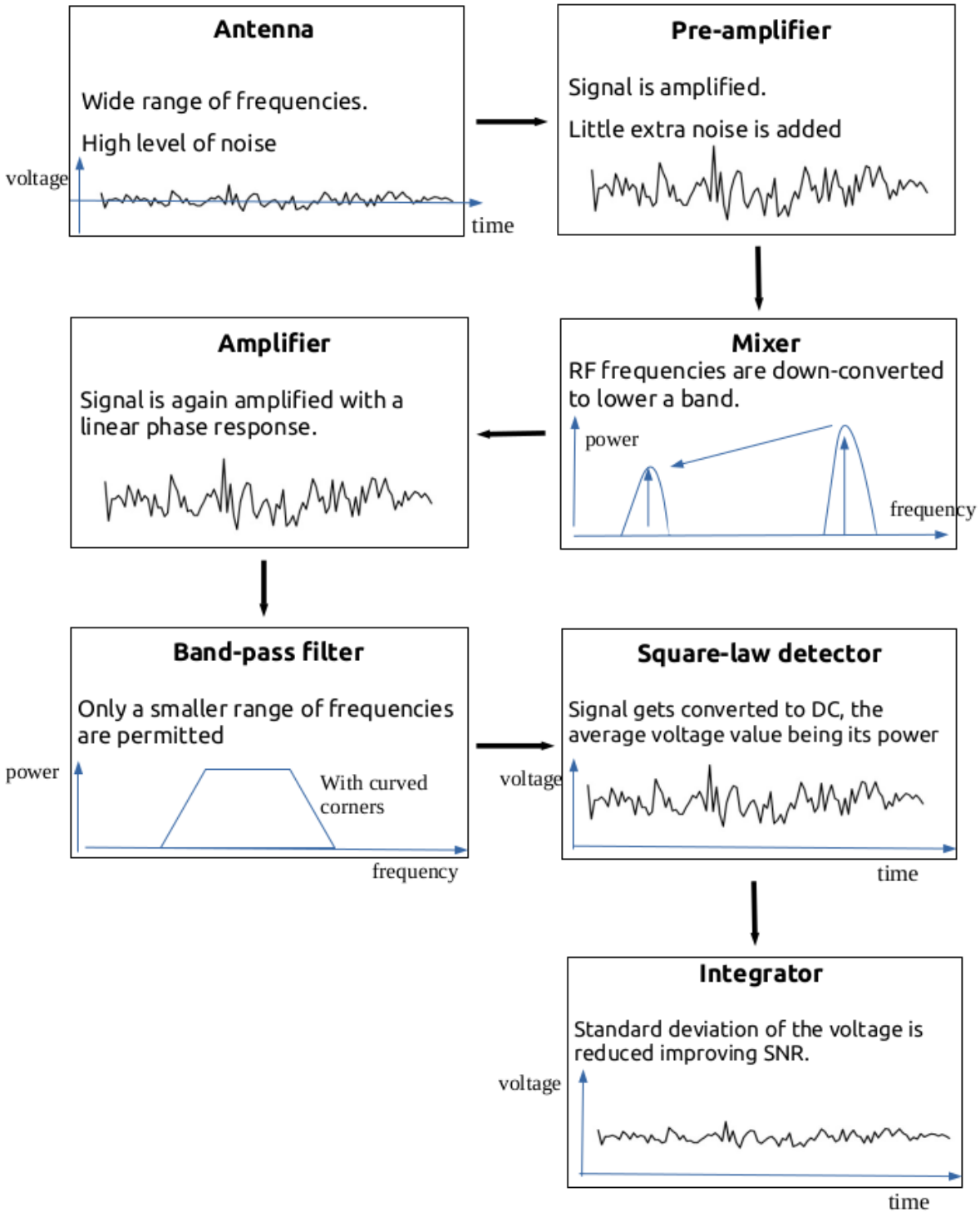
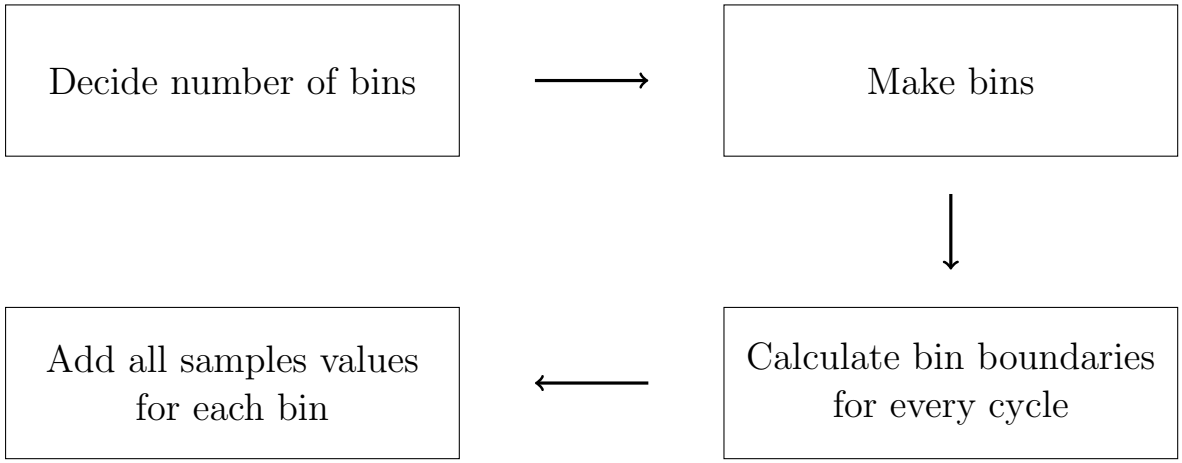
Make a block diagram of the signal processing line, characterizing the signal at various stages in the time and frequency domains.



Consider a 1 Jy source being observed by a dish of diameter 45m and let the observation bandwidth be 100 MHz. What is the power (expressed in dBm) of the electrical signal that the antenna generates?

The effective surface area collecting the radiation is the area of the circular aperture of the parabolic dish ie $A = \pi(D/2)^2 = 1590\,m^2$ approximately. Then assuming that the source is 1 Jy in the full bandwidth of frequencies of 100 Mhz, the power of the electrical signal that the antenna generates will be $P = S \cdot A \cdot \Delta\nu = 1 \cdot 10^{-26} \cdot 1590 \cdot 100 \cdot 10^6 = 1.59 \cdot 10^{-15}\,W$. In dBm this power would be $10 \cdot log_{10}(\frac{P}{10^{-3}}) = -117.98$ dBm approximately.

Given a intensity time series of N points, with sampling interval of τ, containing a pulsar signal with period P, write down the algorithm or flowchart for the folding (or stacking) for this time series to obtain the folded profile for the pulsar signal.



1. Decide the number of bins, let it be B. Lower B shows finer structure of the pulsar profile, while higher B provides better SNR.
2. Divide the time period of the pulsar in B parts; the ith part corresponding to $(\frac{i-1}{B}, \frac{i}{B})$ range of fraction of period P.
3. Let the points/samples be numbered as 1,2,3...N. We have to find out the samples which lie at the boundaries of the bins. Let $t = P/B$. So for the

first cycle, the first bin goes from sample 1 to sample t/τ, but this need not be an integer. The last sample for the first bin is chosen to be the integer closest to t/τ, say n_1. By similar process the range of samples in the second bin will be from $n_1 + 1$ to the integer closest to $\frac{2 \cdot t}{\tau}$, say n_2. In this way we use the rounded values of $\frac{i \cdot t}{\tau}, n_i$ to get the range of sample values for each bin. n_B will be the last sample marking a complete cycle. The next cycle/profile begins with $n_B + 1$.

For the jth cycle we do a similar process as above, except we will be rounding-off $\frac{i \cdot t + j \cdot P}{\tau}$ (i goes from 1 to B) to the closest integer to get the boundaries of the bins. In this way we continue until we reach the last sample N.

4. We calculated the range $(n_i + 1, n_{i+1})$ of sample values for all bins and for all cycles which were included in the N points. For a particular i, adding all the values in the range $(n_i + 1, n_{i+1})$ for all cycles will be *the* single value for the i bin. This is how we will get a single 'folded' profile with B number of points.