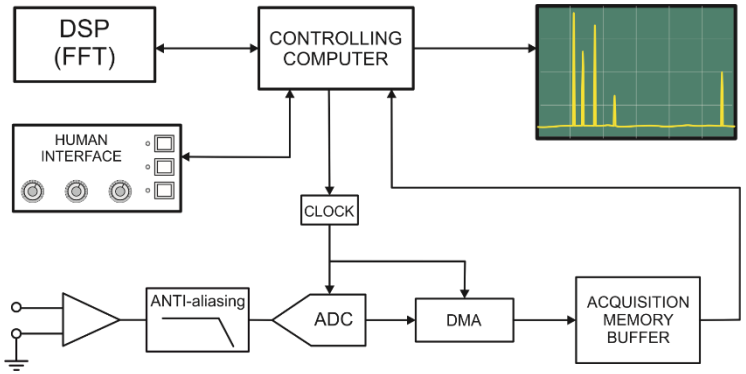
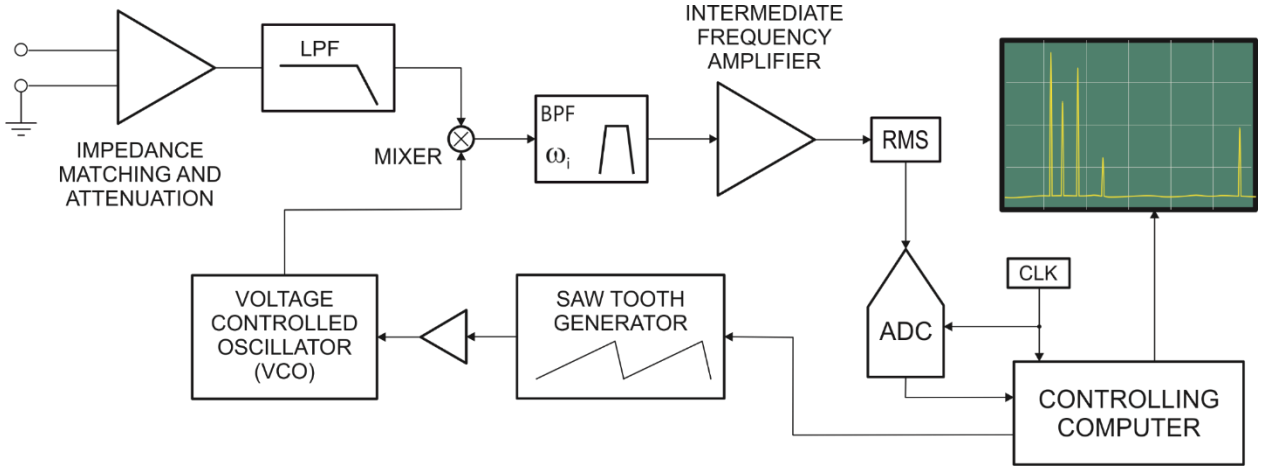
Spectrum analyzers



FFT-based



heterodyning-based

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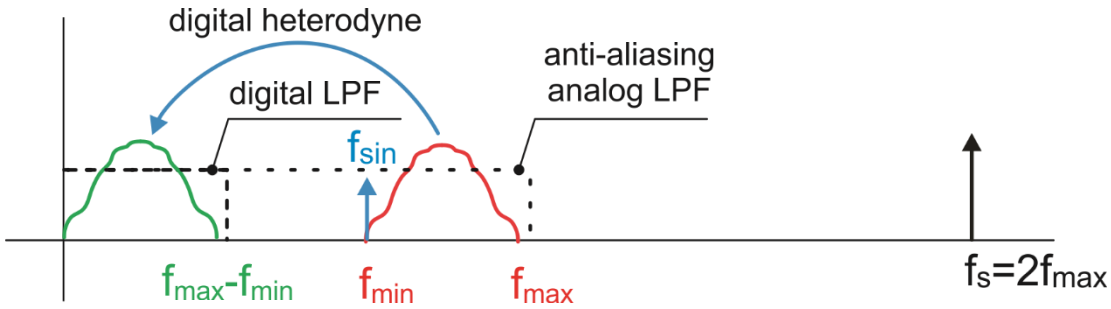
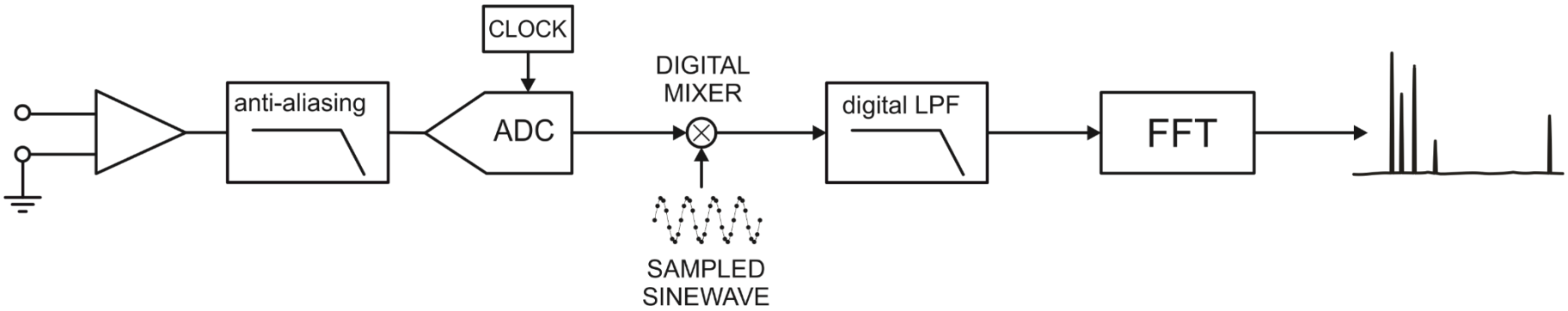
Band selectable analysis with FFT instruments

❑ digital heterodyning:



❑ processing chain



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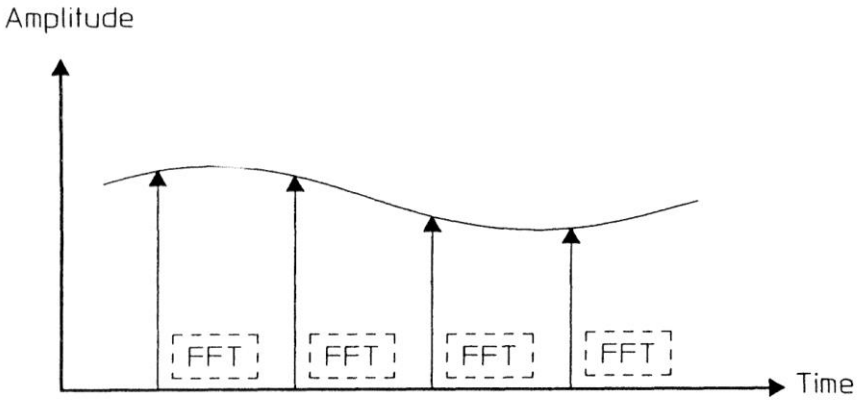
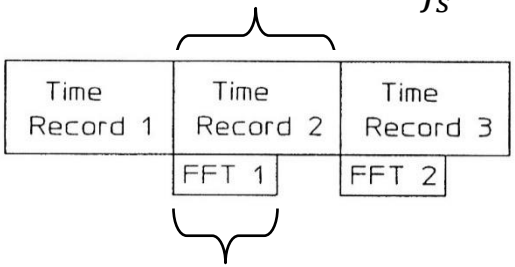
Real-time bandwidth of digital spectrum analyzers

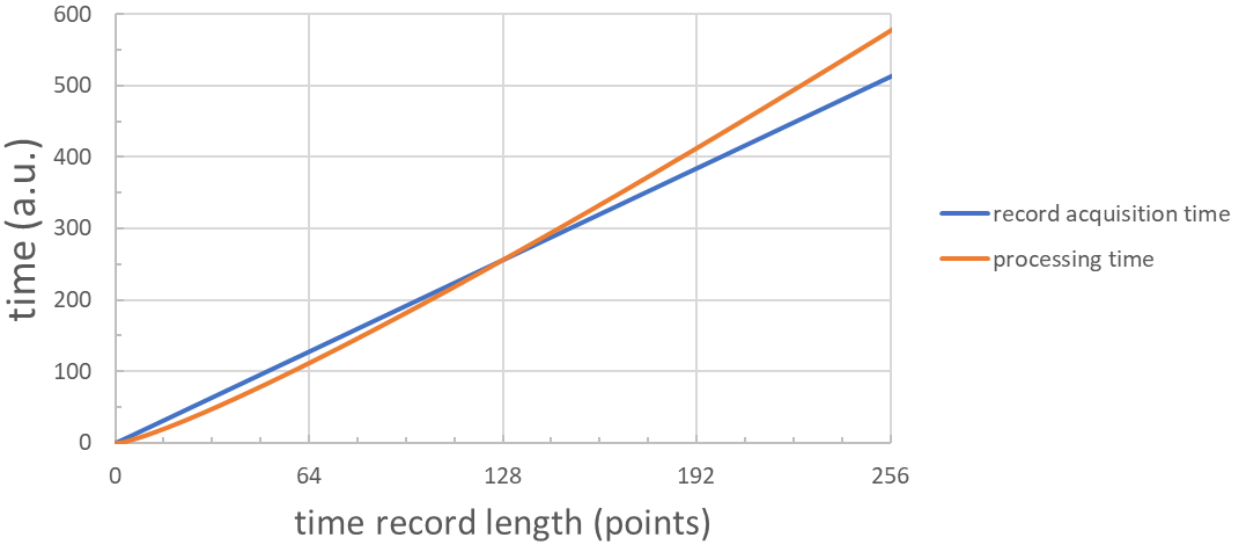


❑ real time

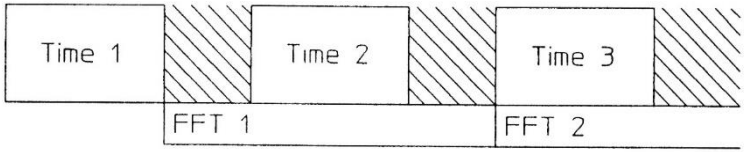
$$t_R = 2N \cdot \frac{1}{f_s}$$



$$t_P \propto N \cdot log_2(2N)$$



❑ not real time



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cont.

- due to the real-time condition $t_P < t_R = 2N \cdot \frac{1}{f_s}$, for a given N, the processing time t_P fixes a lower limit to the time interval Δt_R between two subsequent records:

$$\Delta t_R = 2N \cdot \frac{1}{f_s} > t_P$$

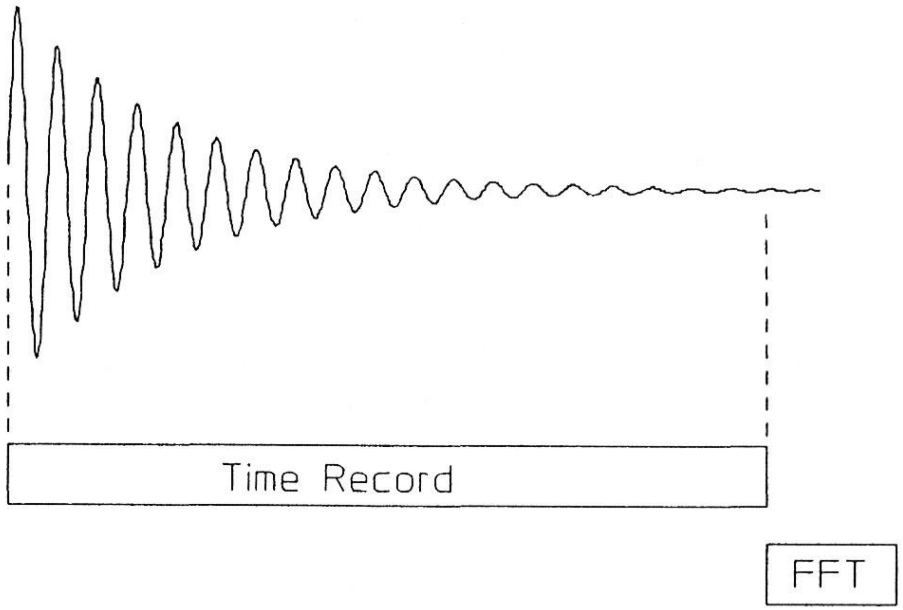
therefore $\frac{N}{t_P} > \frac{f_s}{2}$

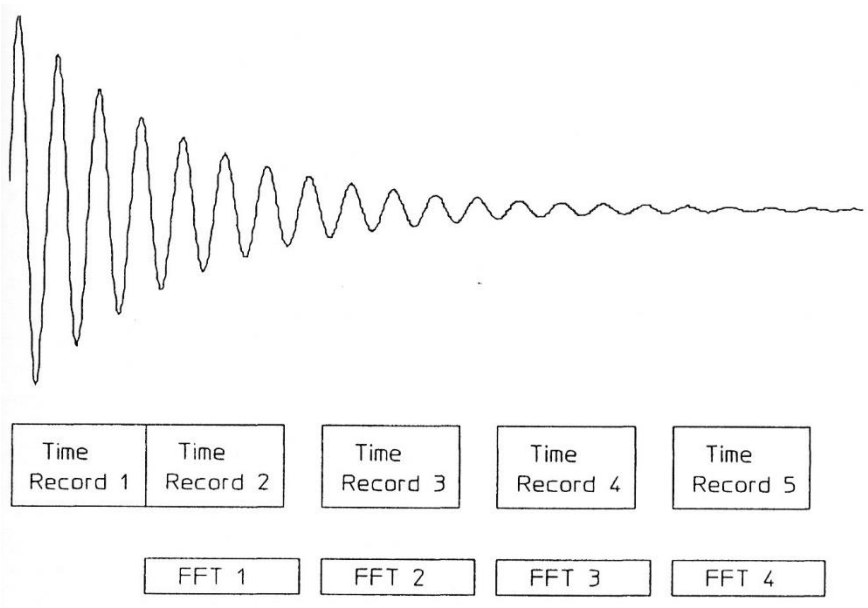
- we know that $f_s/2$ is the bandwidth of the FFT analysis, thus the upper limit of the bandwidth that can be processed in real-time, that is the real-time-bandwidth, is

$$RTBW = \frac{f_s}{2} = \frac{N}{t_P}$$

- to increase the RTBW we need more processing power resulting in higher costs

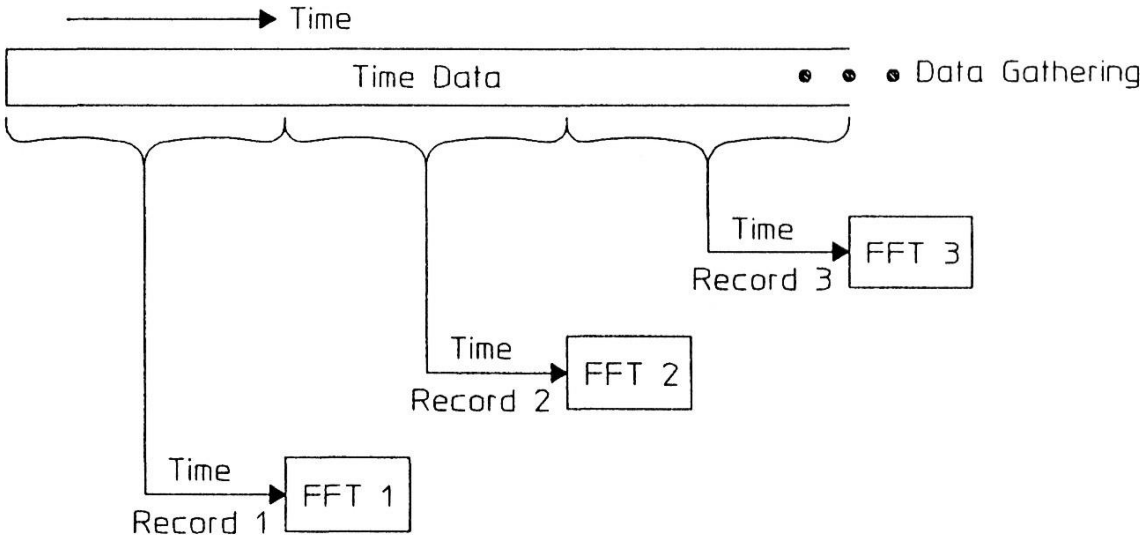
Transient analysis



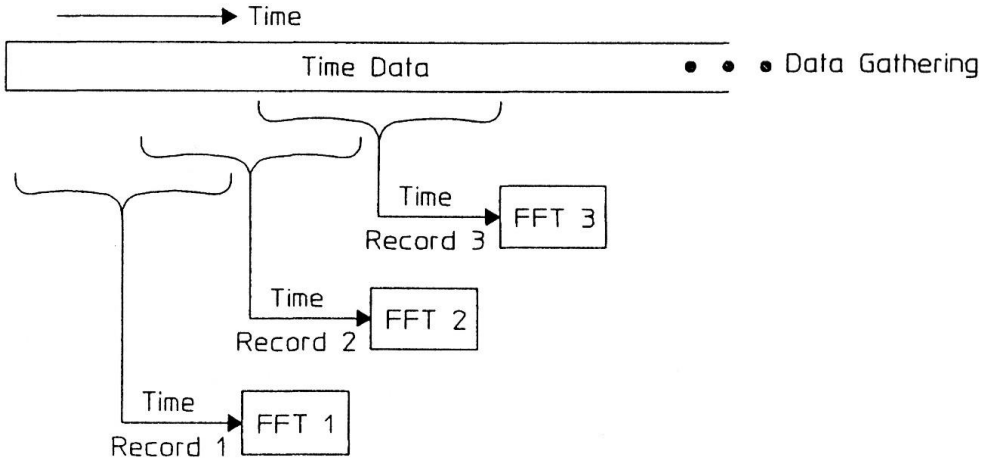


- a transient must be acquired entirely without interruptions
- a long transient having high frequency components requires a wide RTBW because, in this case we need a long-time record coupled with a high sample rate

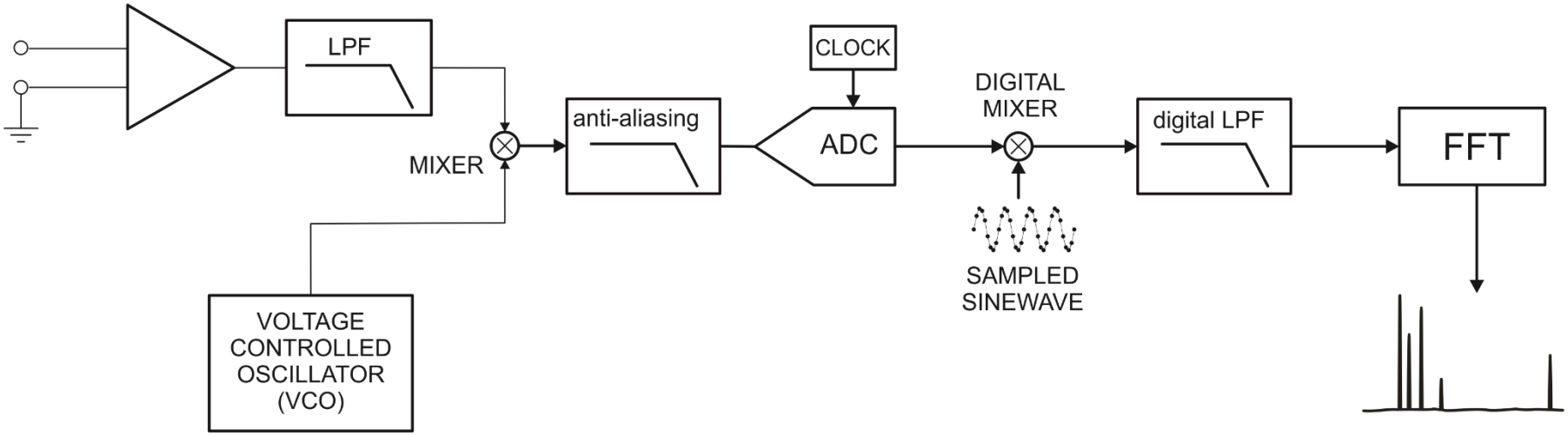
Overlapping

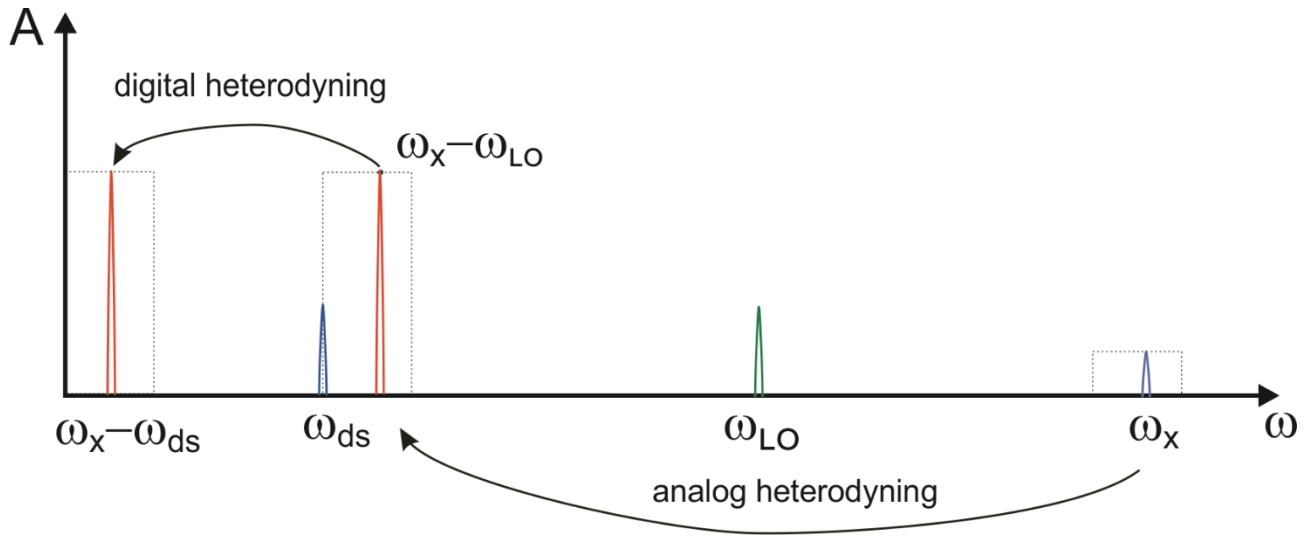


- a high RTBW makes it possible to anticipate the spectrum analysis by overlapping the time-records on the time axis



Real-time spectrum analyzer





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Spectrum maps