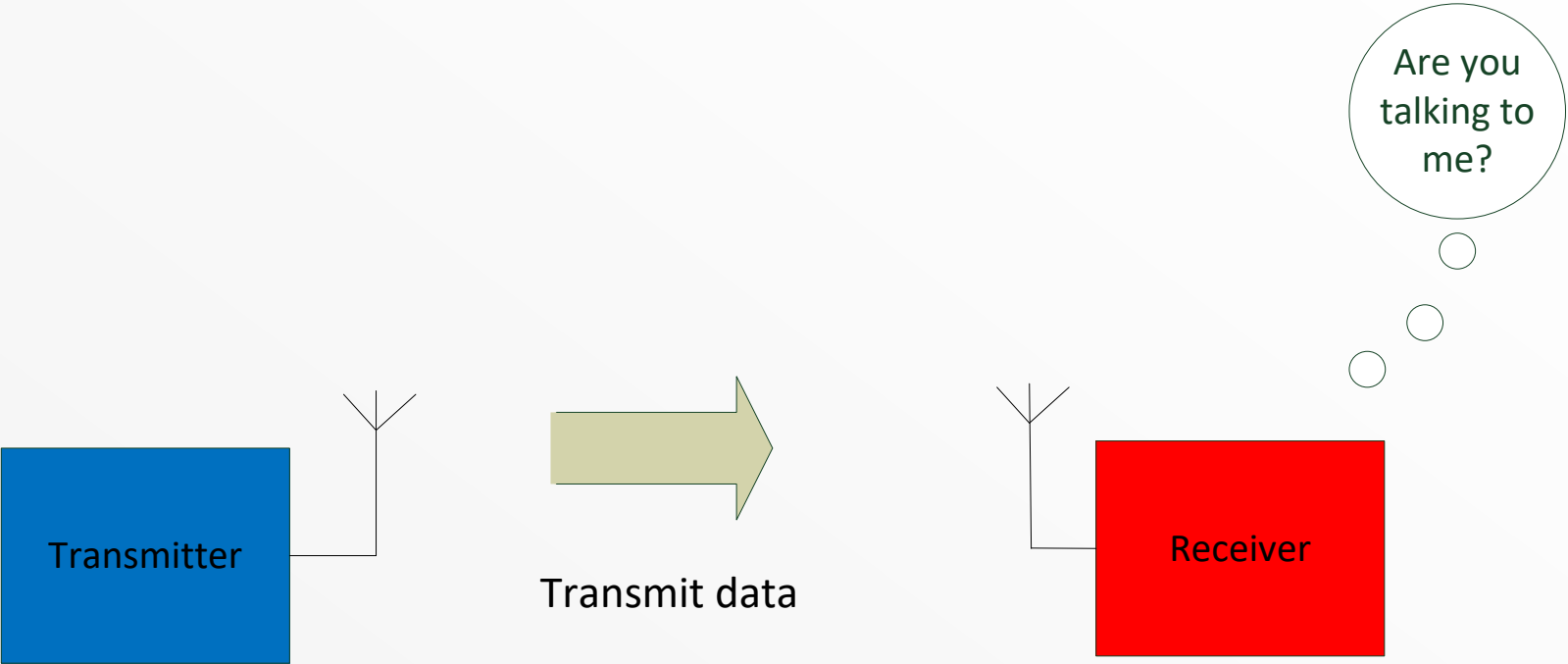
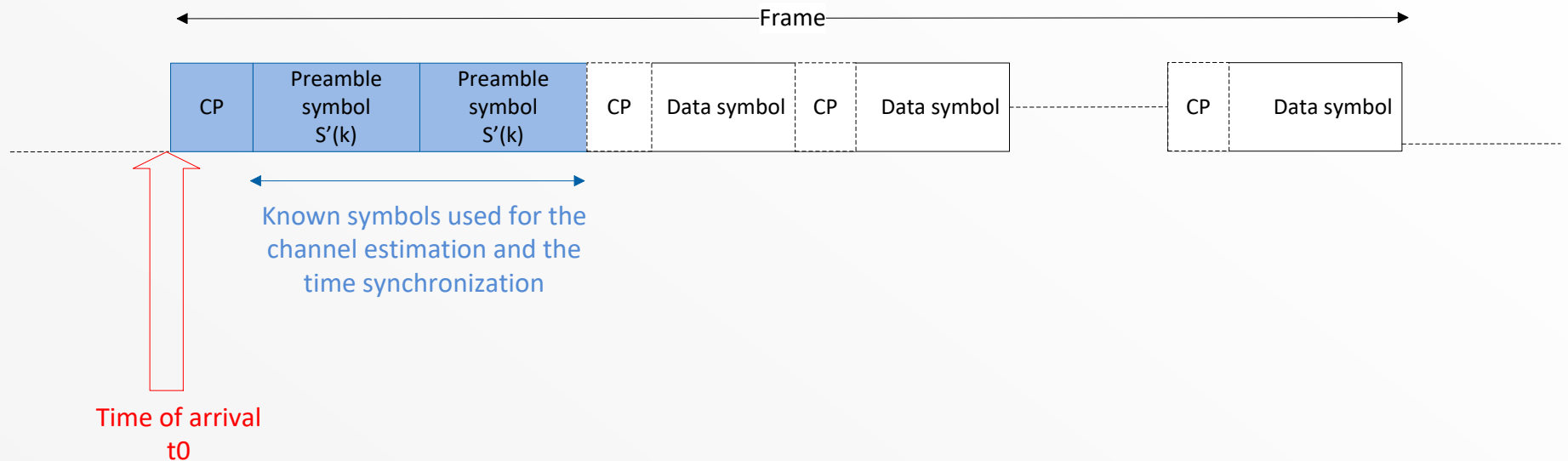
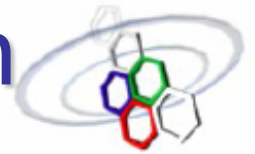


Conception of an OFDM communication channel

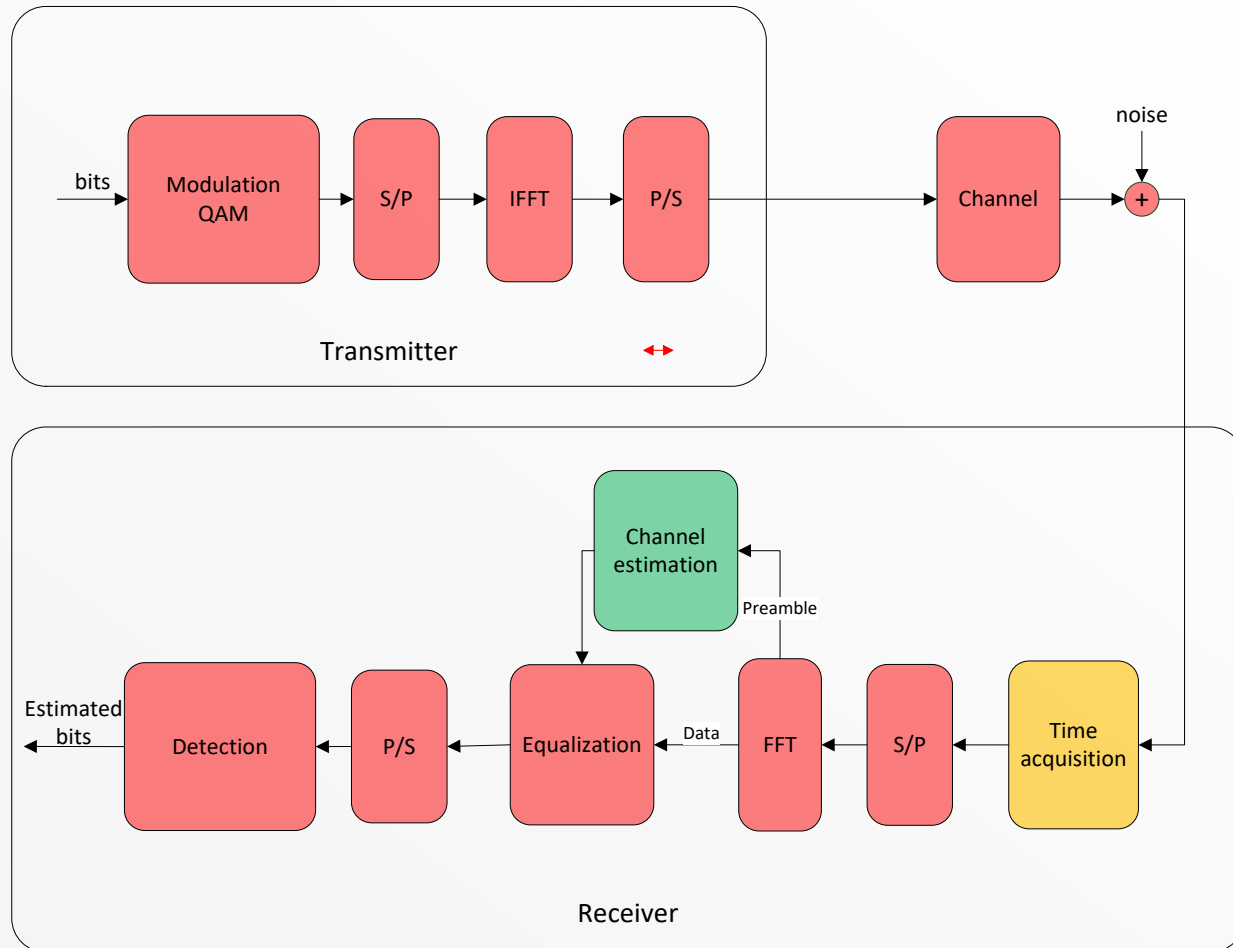
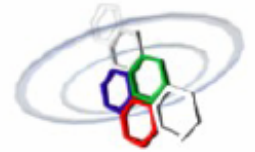
How the receiver knows that a data is coming?

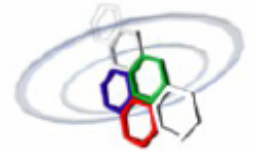


Where does the communication start?



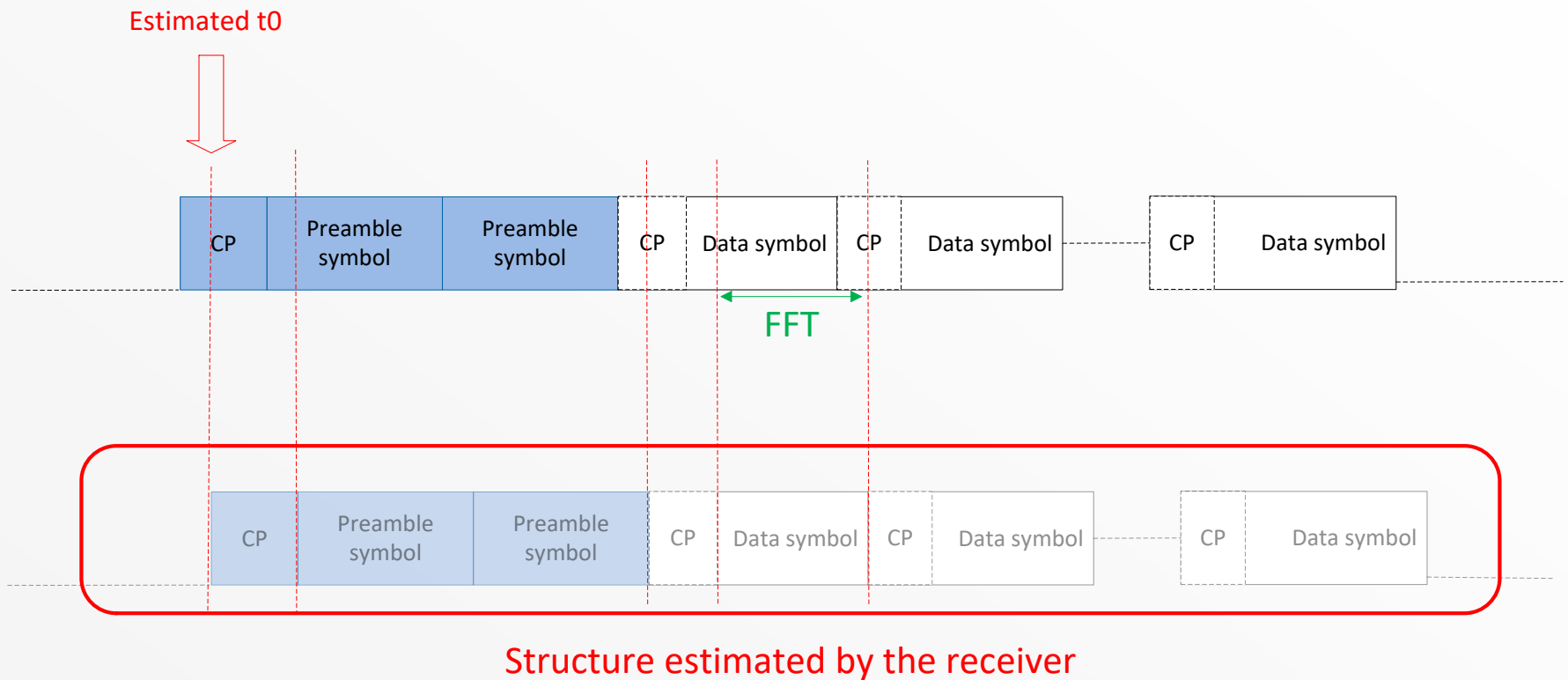
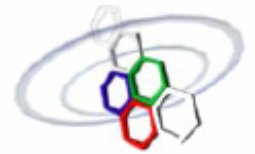
Objective



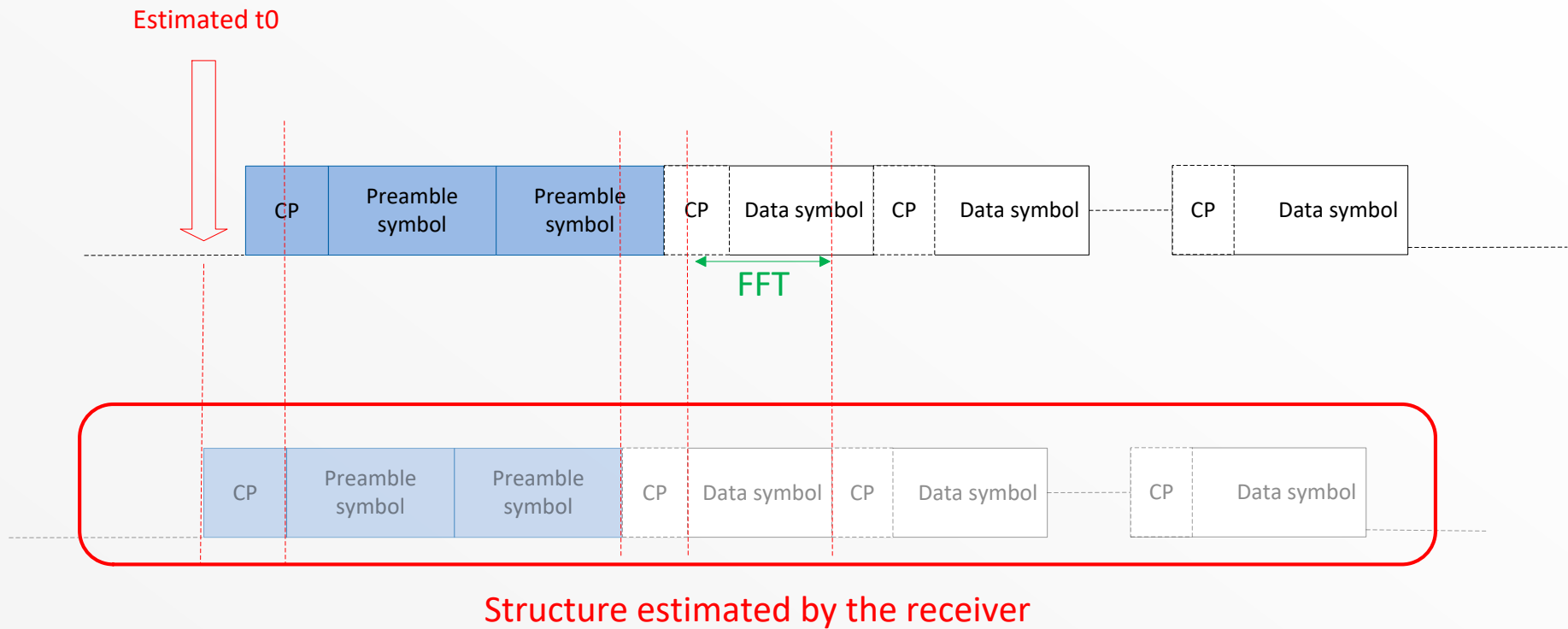
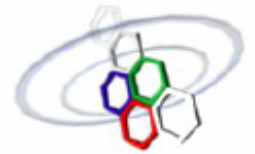


Impact of an error on the estimation of the time of arrival

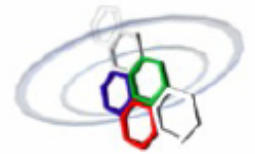
Time of arrival estimated too late



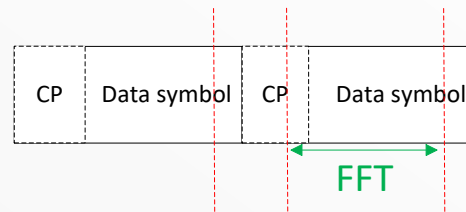
Time of arrival estimated too early



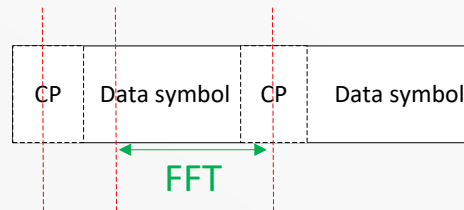
Which error creates the most important interferences?



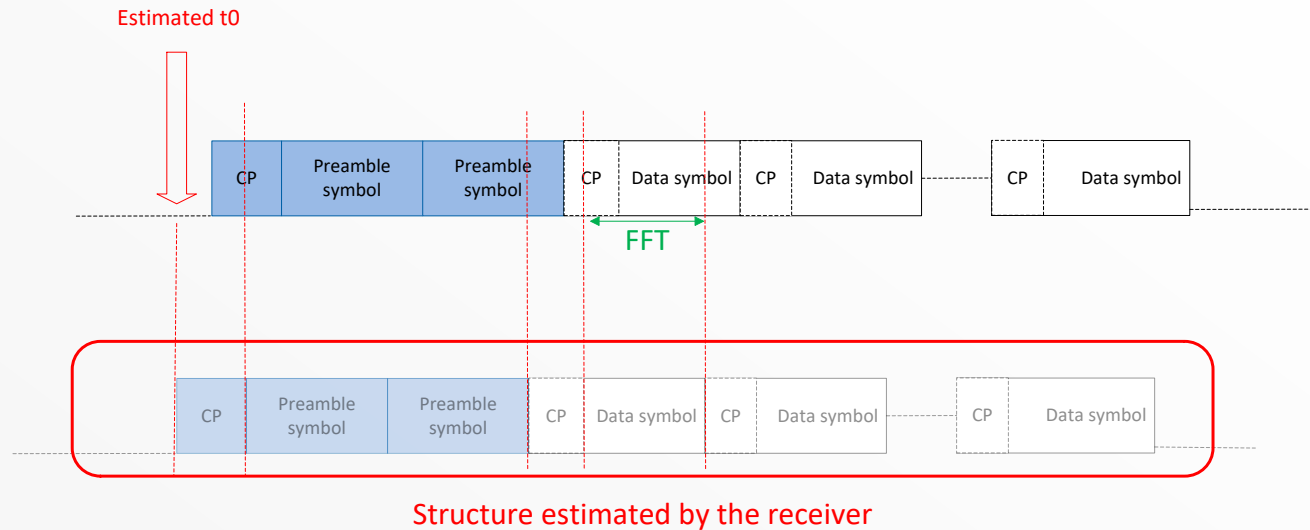
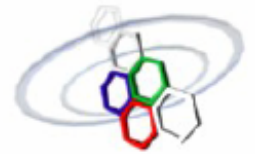
- TOA estimated too early?



- TOA estimated too late?



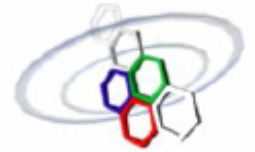
An error on the ToA creates a phase rotation



- All the symbols are affected: $H(k)S(k)e^{j\varphi(k)} + W(k)$
- The same error is done on the preamble:

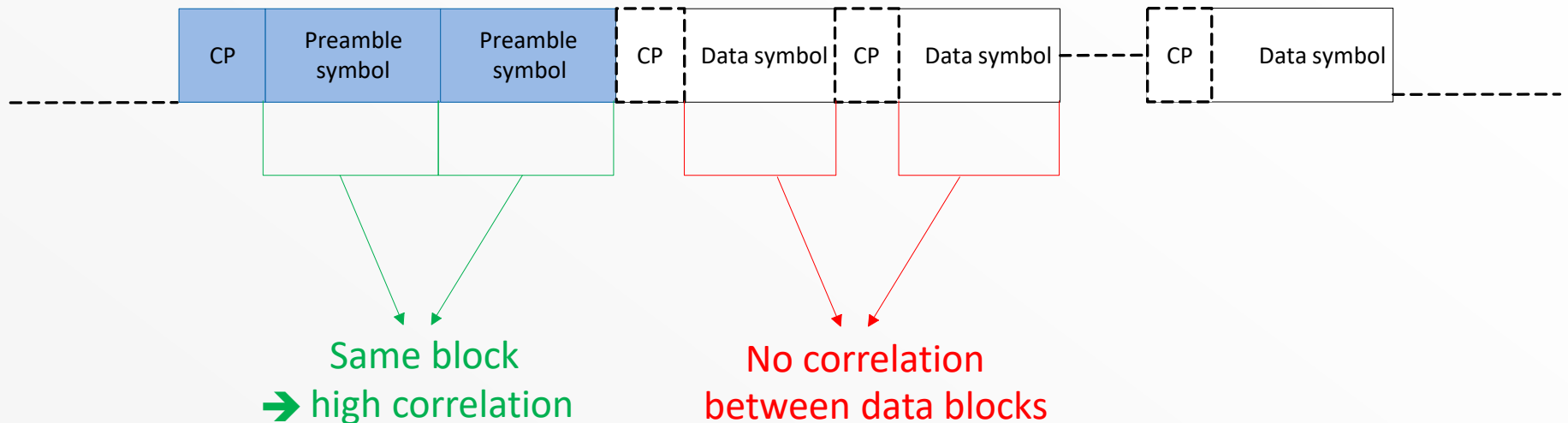
$$\hat{H}(k) = \frac{H(k)S'(k)e^{j\varphi(k)} + W(k)}{S'(k)} = H(k)e^{j\varphi(k)} + \frac{W(k)}{S'(k)}$$

- Compensated during the equalization



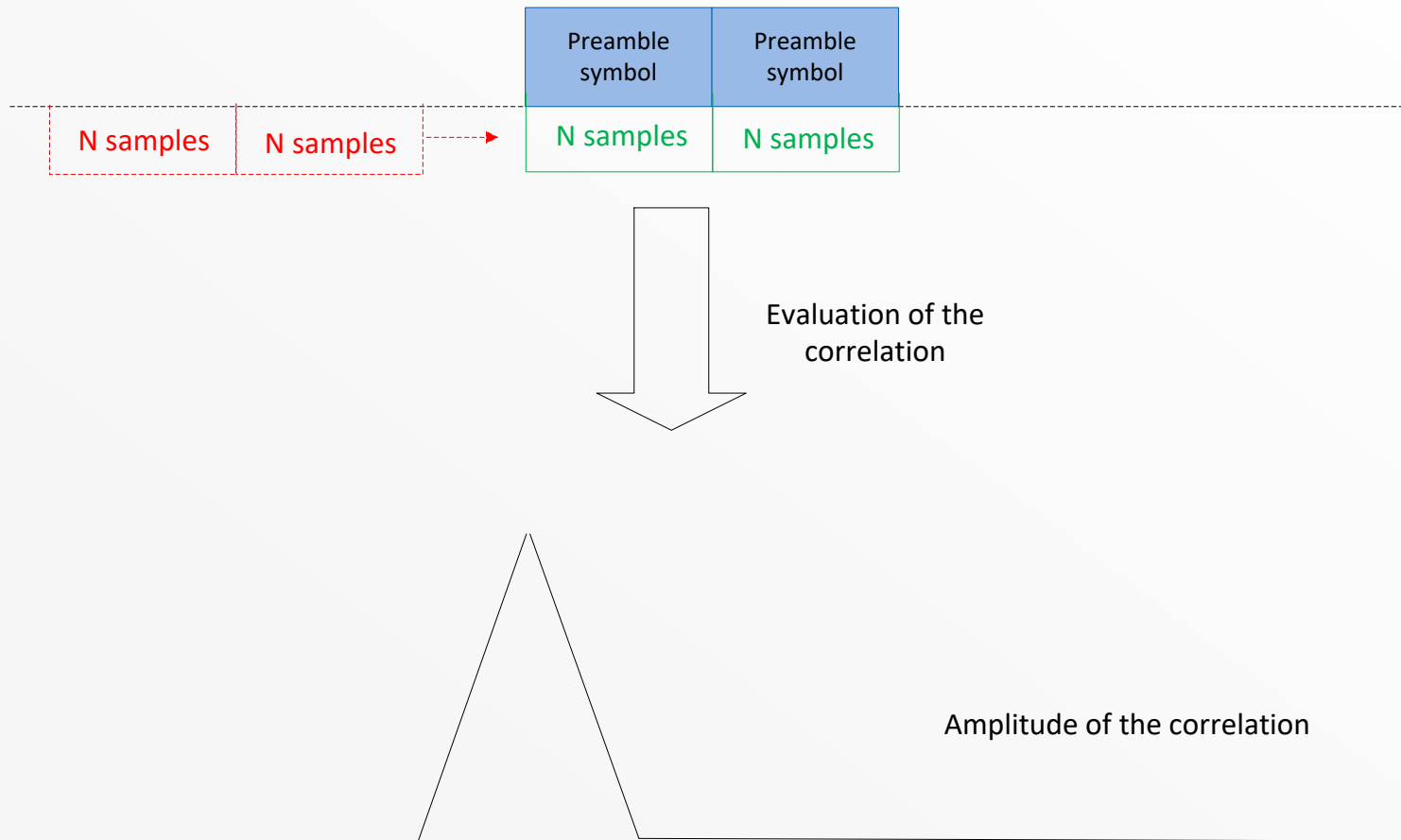
How can we estimate the time of arrival?

With the help of the preamble

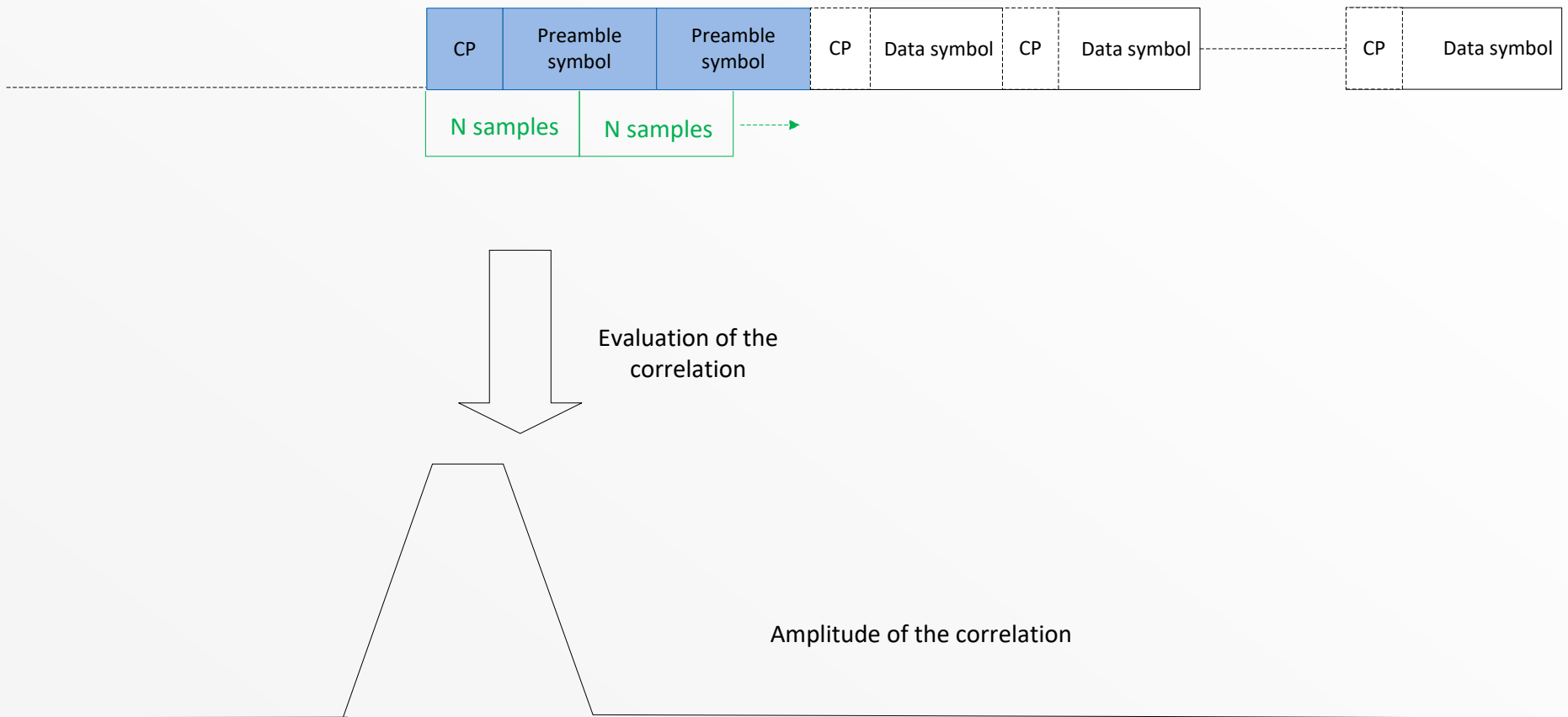
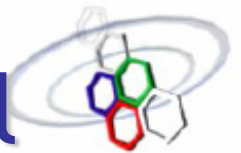


➔ We are in the preamble of our frame when the correlation is maximal

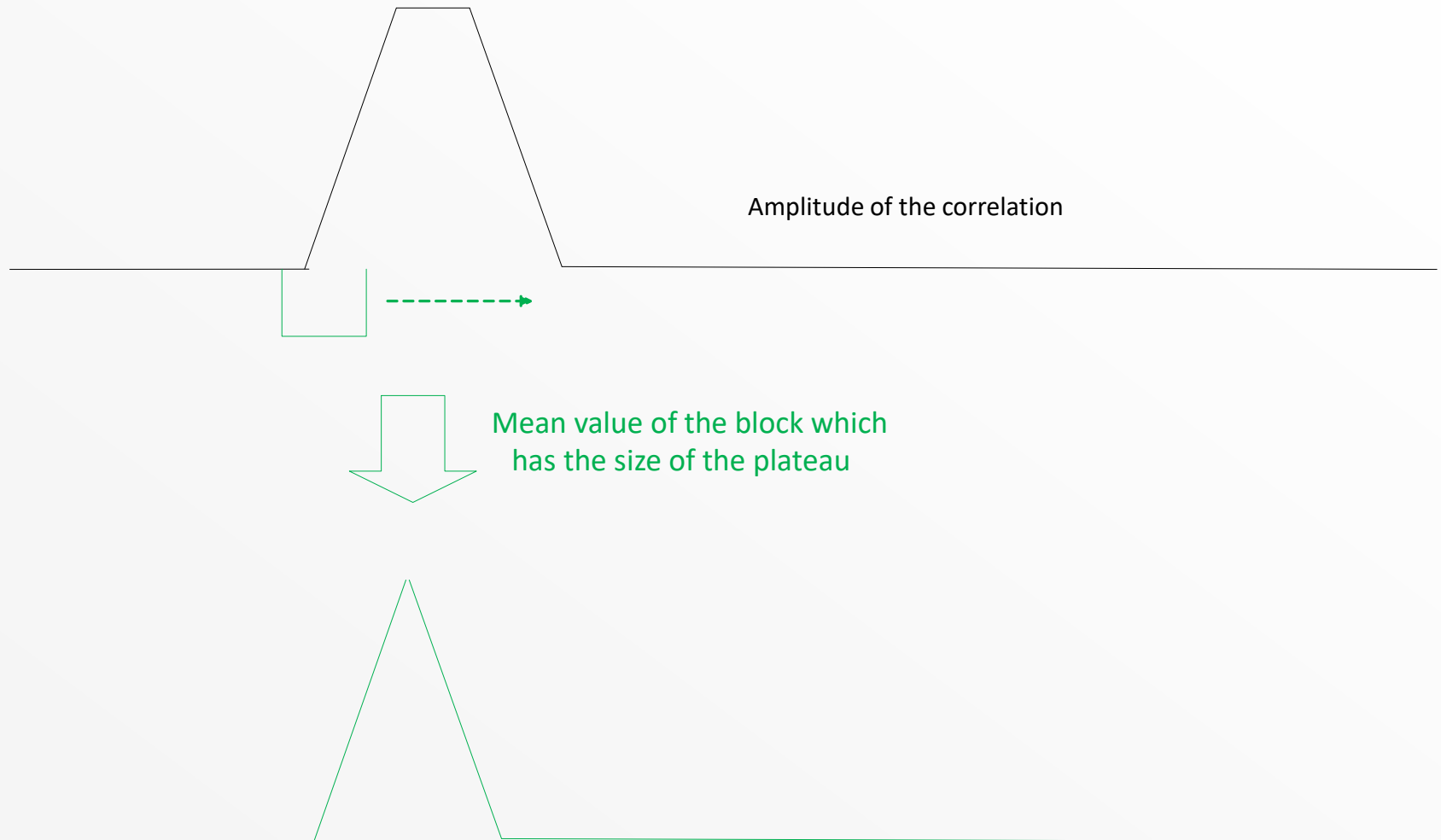
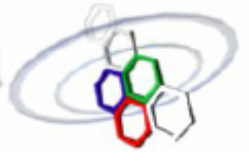
Estimation of the time of arrival



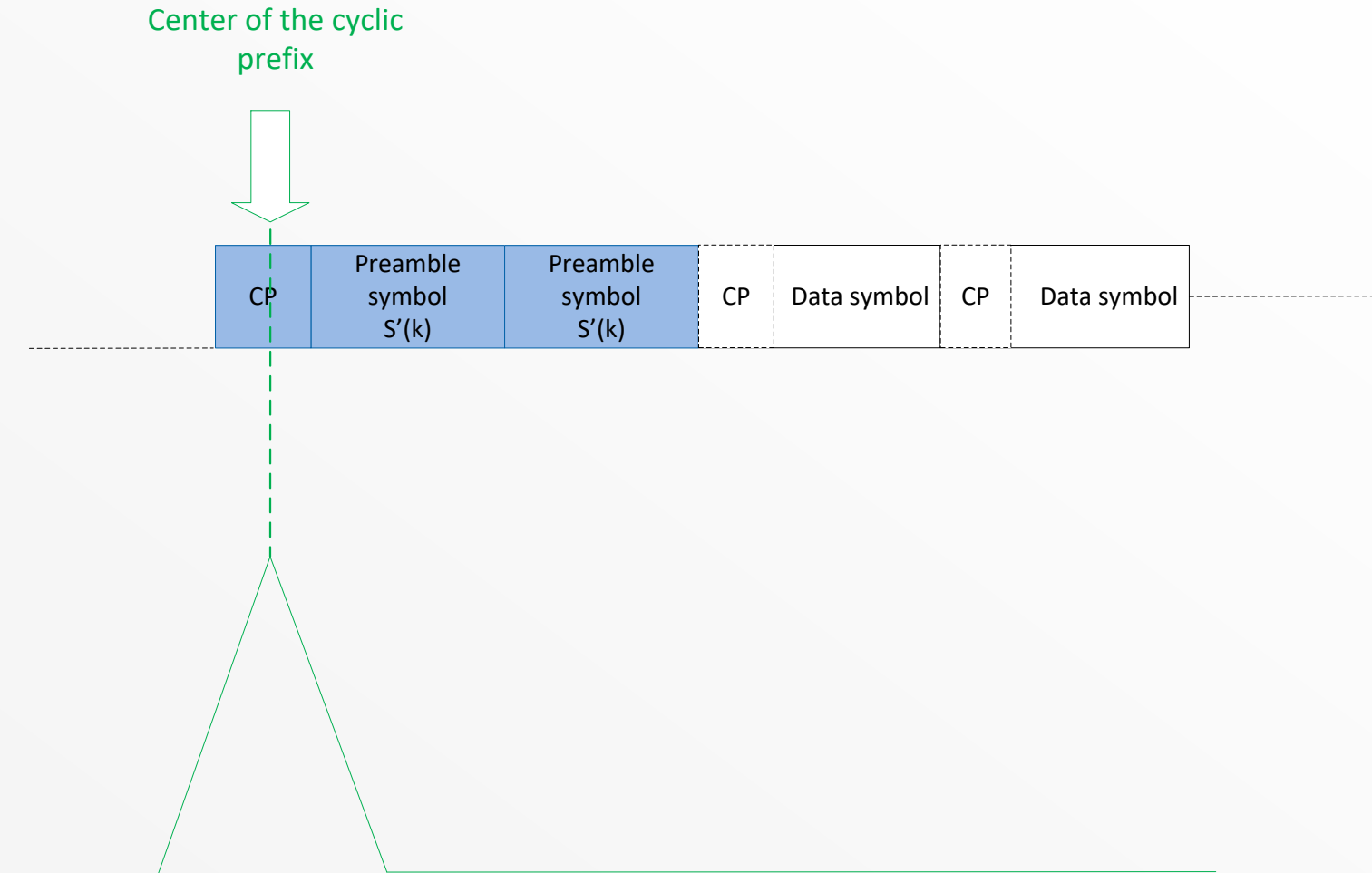
Estimation of the time of arrival

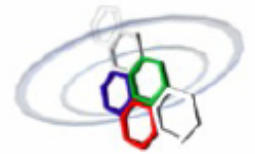


Evaluation of the center with a moving average function



Evaluation of the center with a moving average function





- Add an uncertainty on the time of arrival. What is its impact?
- Why an error on the ToA estimation creates a phase rotation which depends on the sub-carrier index?
- Implement the time acquisition. Explain the effect introduced by the cyclic prefix, and deal with it.
- Evaluate the accuracy on the ToA estimate. Does the ToA estimation impact the BER performance?