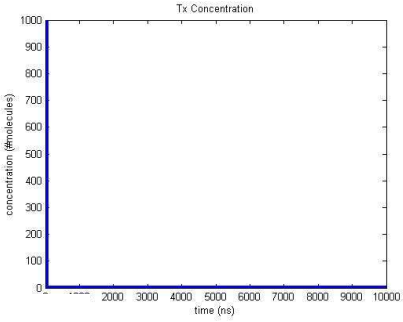
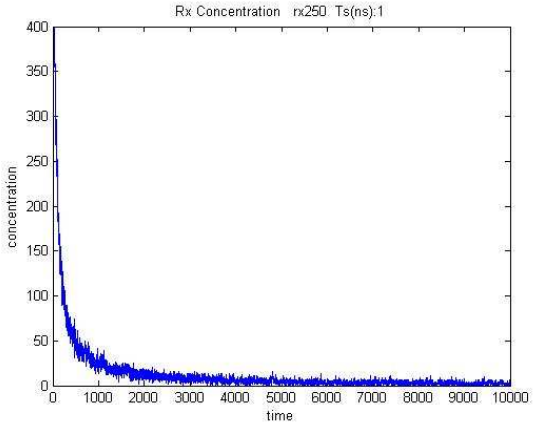
Simulations

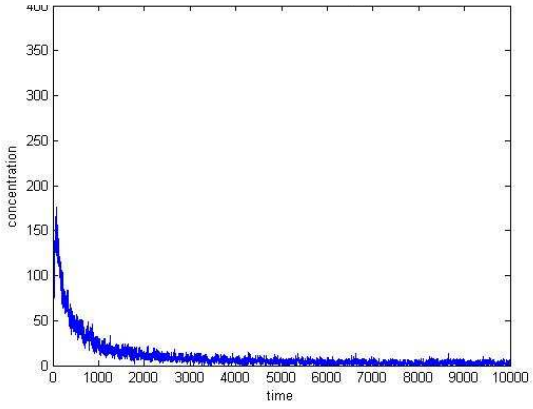
These simulations are made with the first version of the diffusive molecular channel simulator, which implements an infinite space; we are simulating the channel without walls. The transmitter emits a specific number of molecules during a time and these molecules propagate due to Brownian motion until the receiver. This one measures the number of molecules within a specific volume. As there is no space limits we are not taking into account a possible initial concentration of molecules.

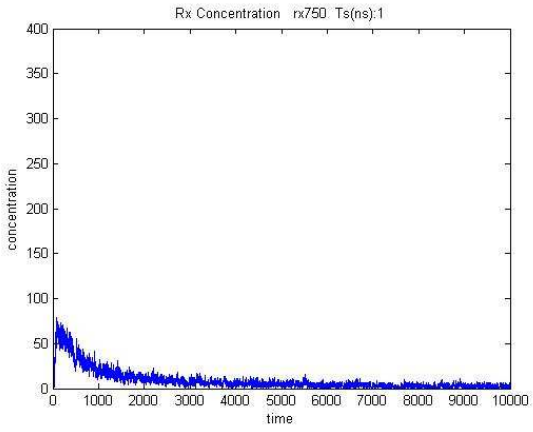
1. **How transmitted power decreases**

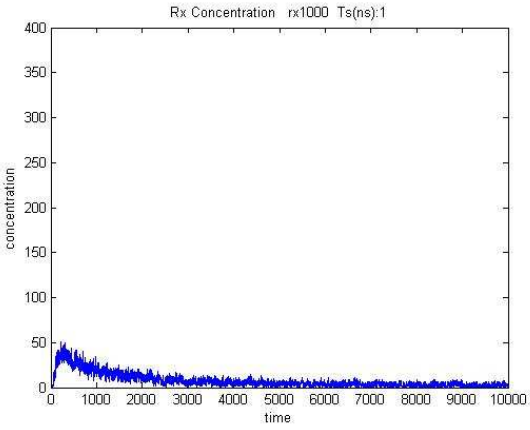


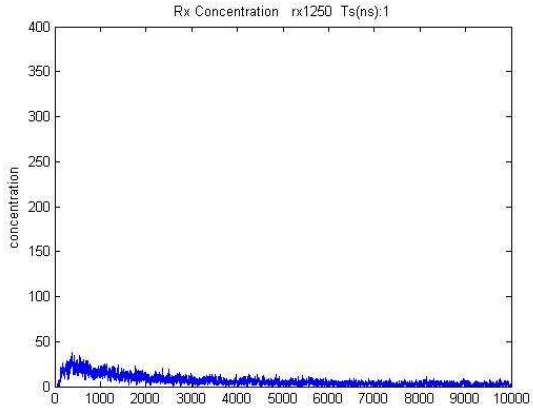
- Amplitude delta emission 10000 molecules
- Simulation time 10µs
- Sampling period 1ns
- Diffusion constant (nm2/ns): 1000
- 10 different receivers (sphere R=100nm)
- Distance between tx-rx (nm) :250, 500, 750, 1000, 1250, 1500, 1750, 2000, 2250, 2500

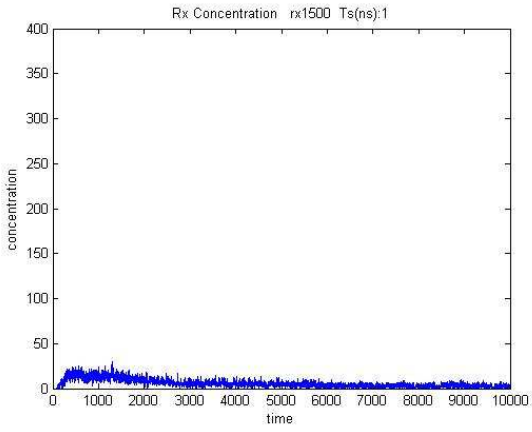


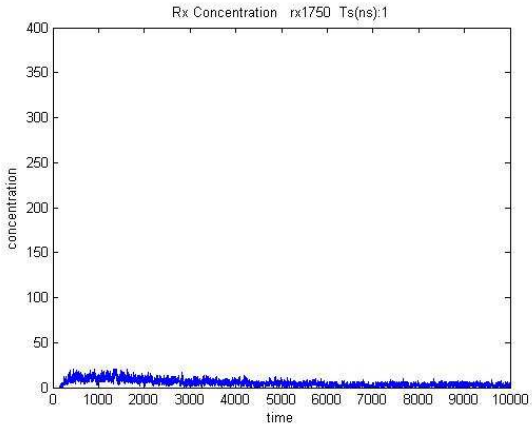


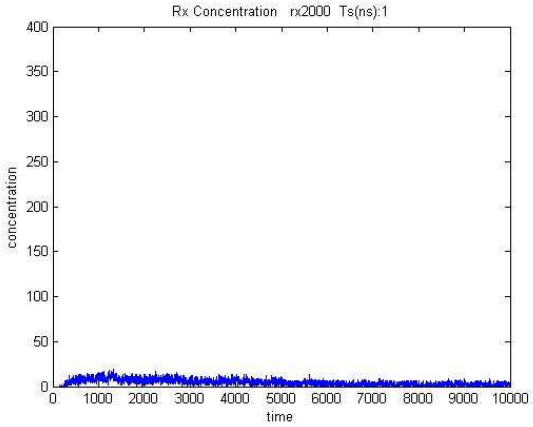


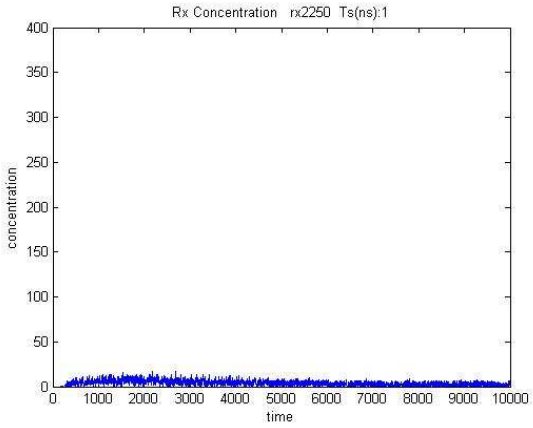

Rx Concentration rx1000 Ts(ns):1
concentration
time
0
50
100
150
200
250
300
350
400
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000

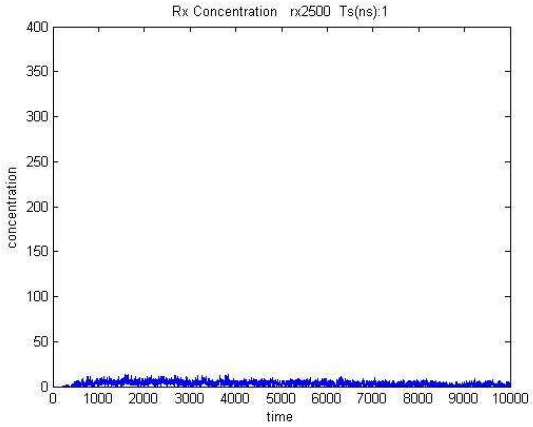

Rx Concentration rx1250 Ts(ns):1
concentration
0
50
100
150
200
250
300
350
400
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000

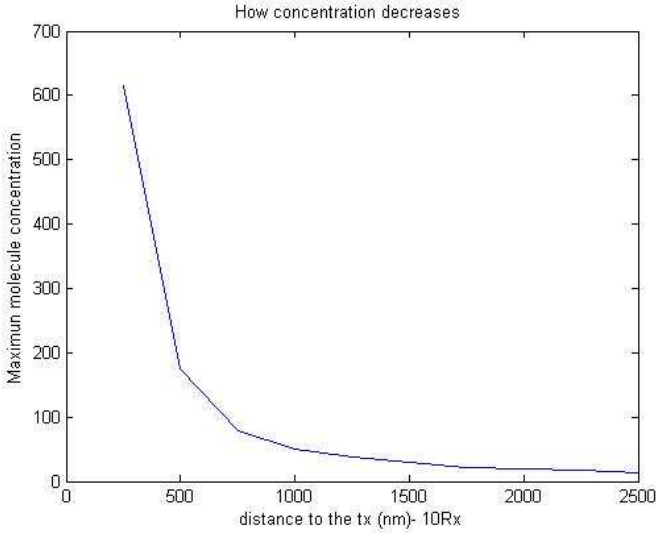

Rx Concentration rx1500 Ts(ns):1
concentration
time
0
50
100
150
200
250
300
350
400
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000


Rx Concentration rx1750 Ts(ns):1
concentration
time
0
50
100
150
200
250
300
350
400
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000


Rx Concentration rx2000 Ts(ns):1
concentration
time
0
50
100
150
200
250
300
350
400
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000


Rx Concentration rx2250 Ts(ns):1
concentration
time
0
50
100
150
200
250
300
350
400
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000


Rx Concentration rx2500 Ts(ns):1
concentration
time
0
50
100
150
200
250
300
350
400
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000

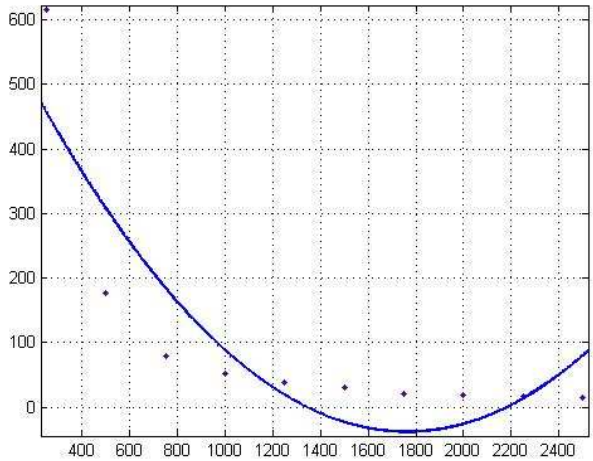

How concentration decreases
Maximun molecule concentration
distance to the tx (nm)- 10Rx
0
100
200
300
400
500
600
700
0
500
1000
1500
2000
2500

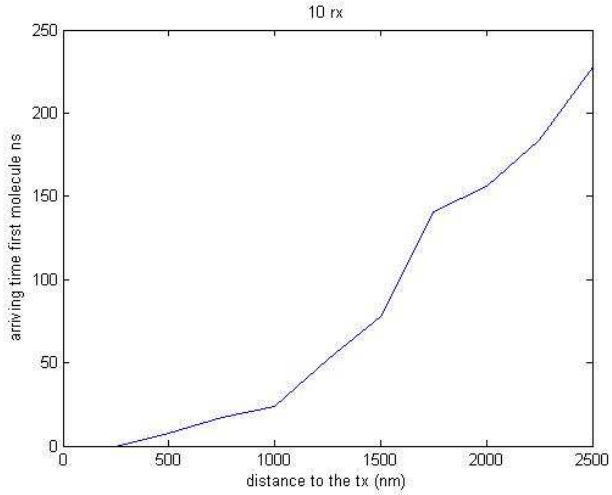
The concentration decrease fits with the following quadratic polynomial with a 95% confidence bounds: f(x) = 0.000217 *x^2 -0.7646 *x + 635.4

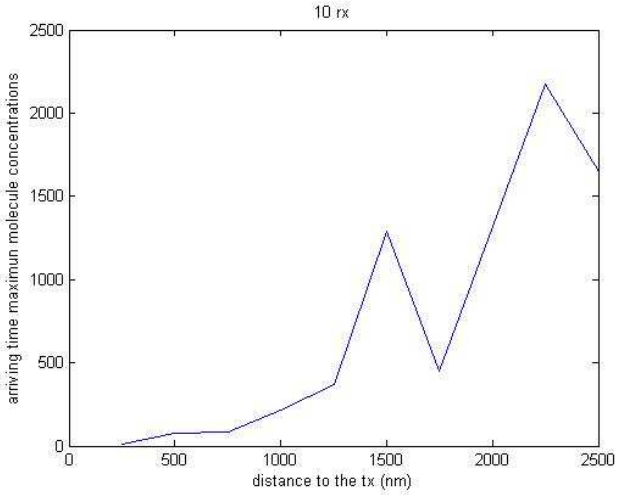
p1 = (5.499e-005, 0.000379)

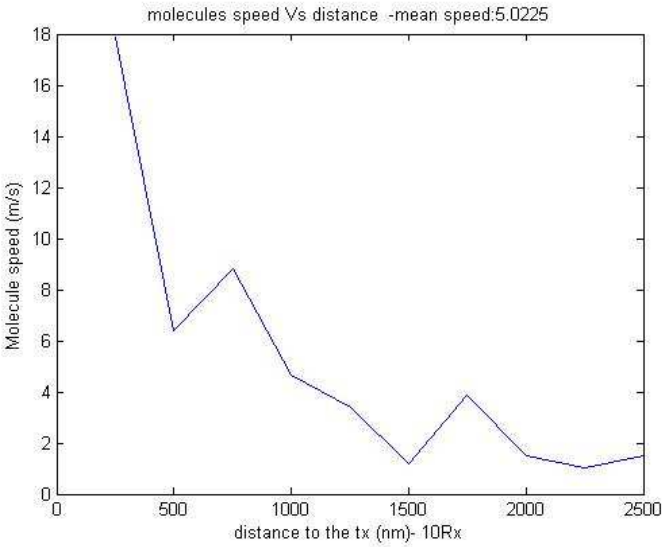
p2 = (-1.222, -0.3076)

p3 = (361.8, 909)



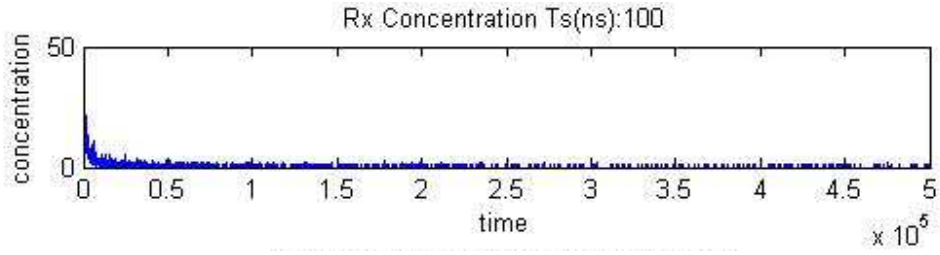


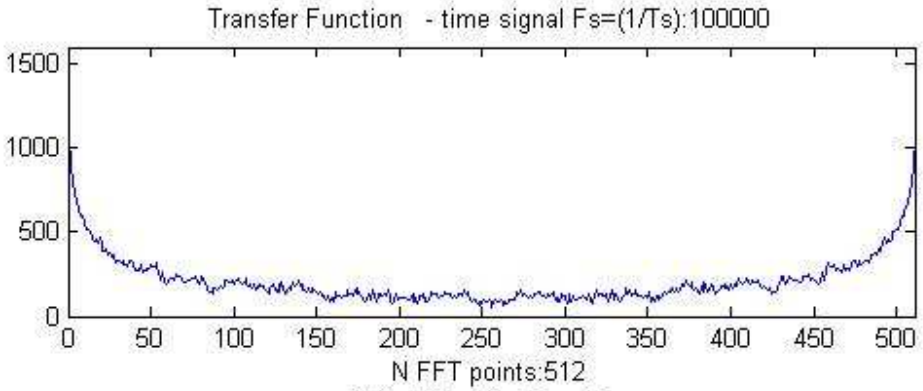


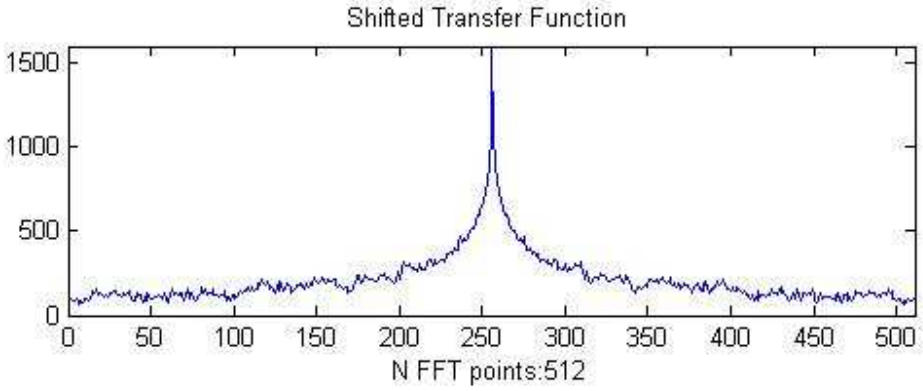


2. Channel Transfer Function

- Simulation time 500 µs
- **Sampling Period 100 ns**
- diffusion constant (nm2/ns): 1000.0
- emission of a delta amplitude 1000 molecules, time 0ns
- distance tx-rx 1µm







B)

- simulation time 5000 µs
- **Sampling Period 1000 ns**
- diffusion constant (nm2/ns): 1000.0
- emission of a delta amplitude 1000 molecules, time 0ns
- distance tx-rx 1µm