Technische Universiteit
Eindhoven
University of Technology

Advance CMOS Design *(5SFC0)*

2017
Semester A
Quartile 2

Spectral Analysis

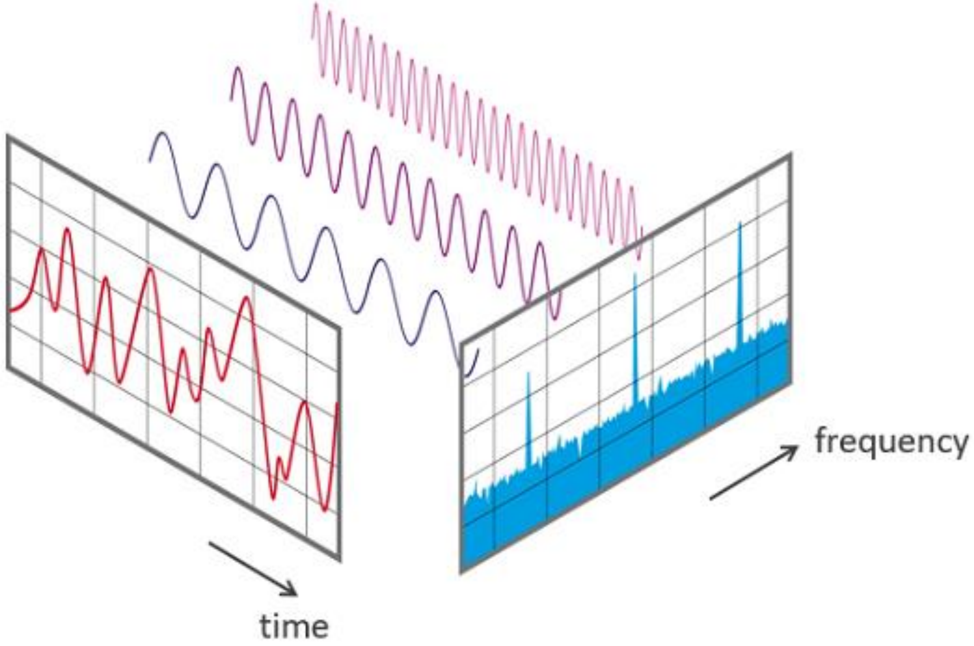
A Guide for FFT Simulations

- We need, for our project, a tool to monitor the performance of the circuit

- Best way to achieve that for a T/H is the Spectral Analysis

- Spectral Analysis will provide a graph with the:
  - Power
  - Frequency

  of the signal at the output of the T/H



- In that way we know that we have tracked correctly the input signal

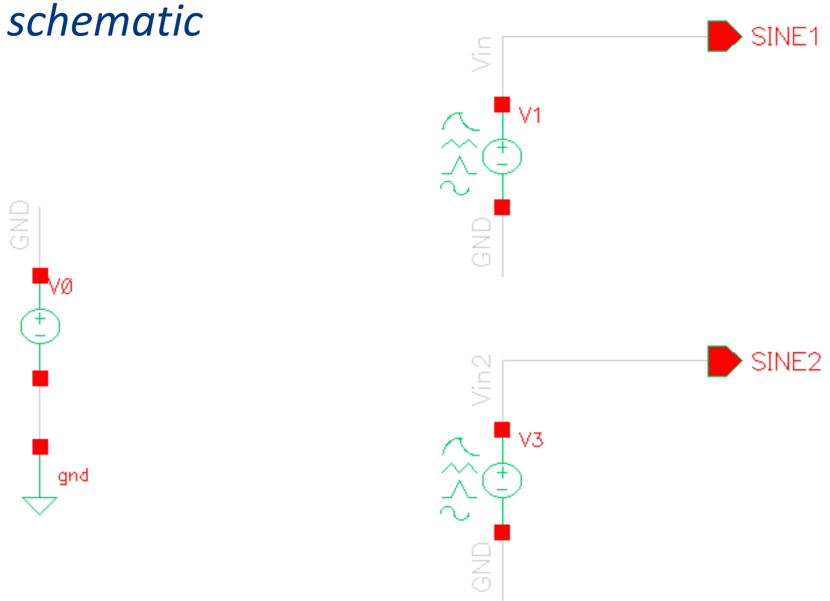
Key words :

- Nfft → Number of FFT points
- Fs → Sampling Frequency
- Fin → Signal’s Frequency
- Tsim → Simulation time

We can perform the FFT using Virtuoso/ADE L   Cadence

- Simulation Set-Up
  - As a first step we can perform FFT at a simple sinewave source.
  - We expect the fundamental tone (input frequency) at 0 dB
  - Noise floor (due to simulators limitations)

schematic



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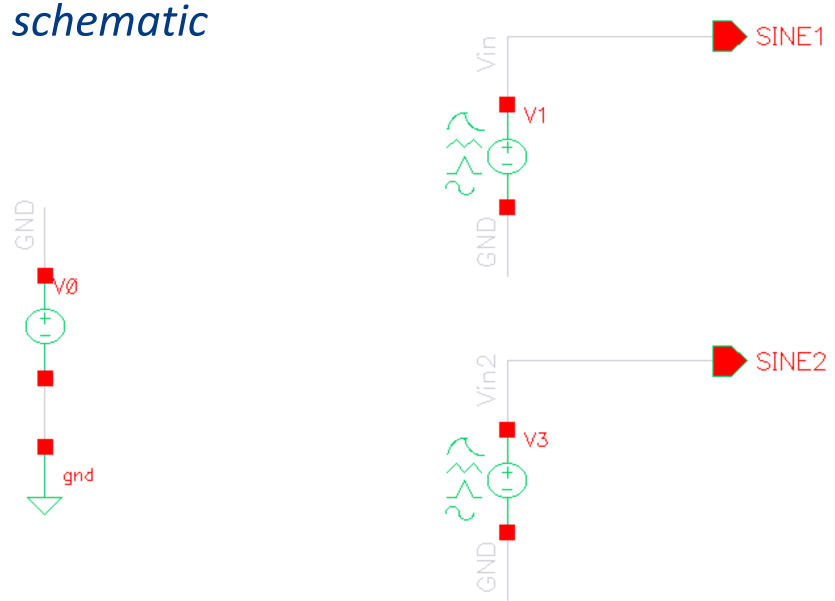
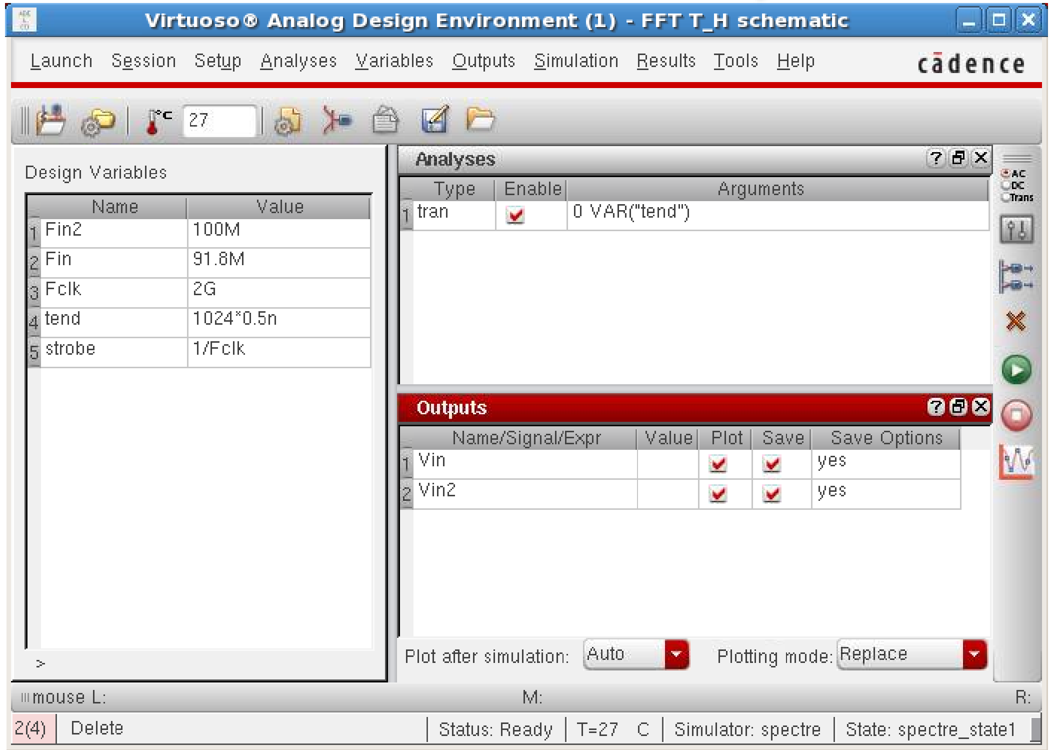
ADE L set-up

schematic

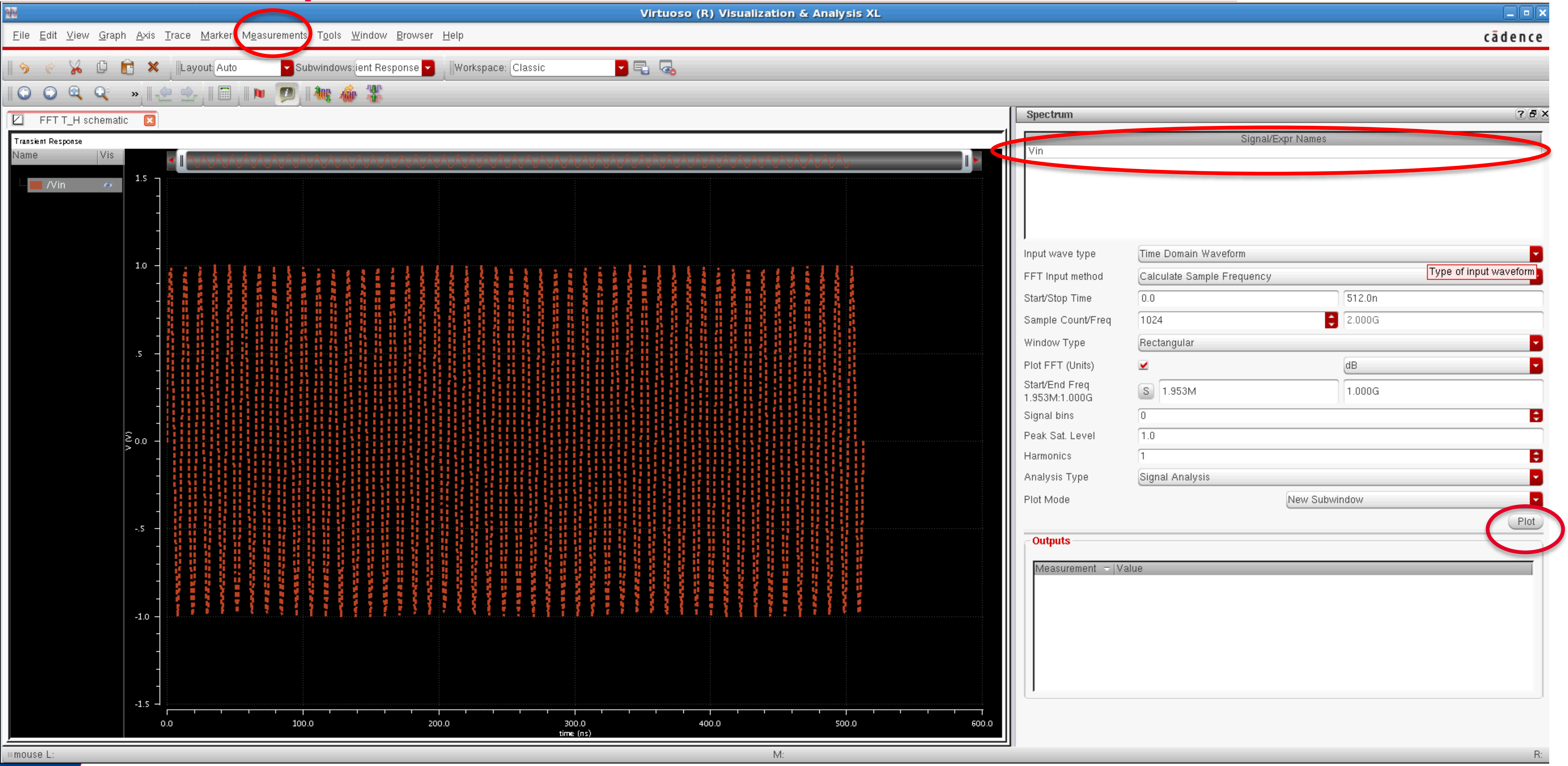




Add 'strobeperiod= 1/Fs'
Double-click on transient analysis → Choose 'Options' → Choose 'Output'

After the end of the simulation :

- Go to the transient plot window
- Select the *'measurements' option at the toolbar*
- Select *'Spectrum'*
- A new sub-window opens
- Click on the transient waveform
- You should see then the name of the waveform at the sub-window
- Press *'plot'*
- A new sub-window with the spectrum will be added


Virtuoso (R) Visualization & Analysis XL
File Edit View Graph Axis Trace Marker Measurements Tools Window Browser Help
cadence
Layout: Auto
Subwindows: ient Response
Workspace: Classic
FFT T_H schematic
Transient Response
Name
Vis
/Vin
1.5
1.0
.5
0.0
-.5
-1.0
-1.5
V (V)
0.0
100.0
200.0
300.0
400.0
500.0
600.0
time (ns)
Spectrum
Signal/Expr Names
Vin
Input wave type
Time Domain Waveform
FFT Input method
Calculate Sample Frequency
Type of input waveform
Start/Stop Time
0.0
512.0n
Sample Count/Freq
1024
2.000G
Window Type
Rectangular
Plot FFT (Units)
dB
Start/End Freq
1.953M:1.000G
S
1.953M
1.000G
Signal bins
0
Peak Sat. Level
1.0
Harmonics
1
Analysis Type
Signal Analysis
Plot Mode
New Subwindow
Plot
Outputs
Measurement
Value
mouse L:
M:
R:

Examples

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- *Example 1*
  - Fs= 2 GHz
  - Fin= 100 MHz
  - Nfft = 1024
  - Tsim= Nfft*(1/Fs)

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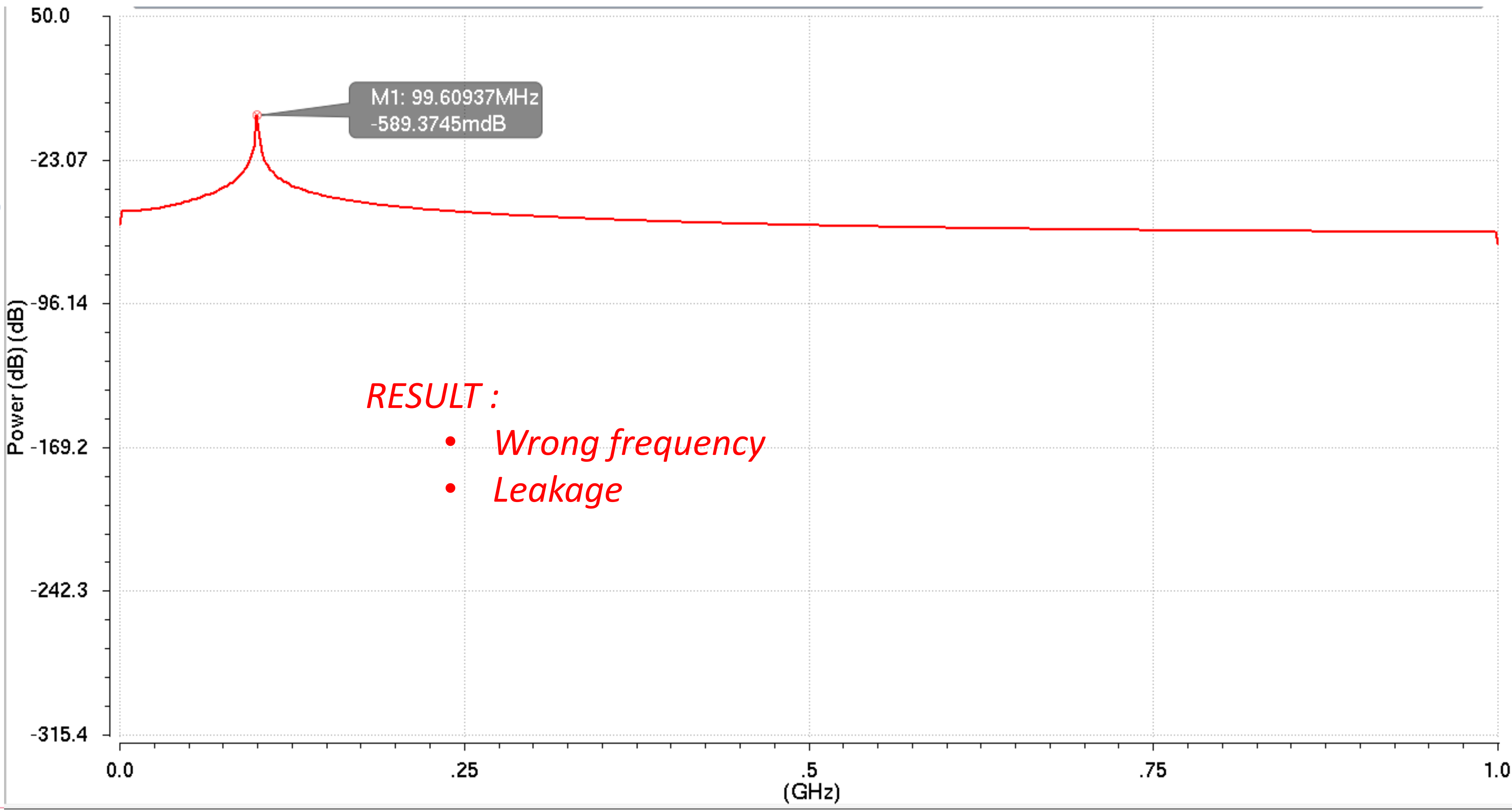
Performing FFT according to the above configuration



- *Example 2*
  - Fs= 2 GHz
  - Fin= 91.796875 MHz
  - Nfft = 1024
  - Tsim= 1024*(1/Fs)

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  - Fin= 91.796875 MHz
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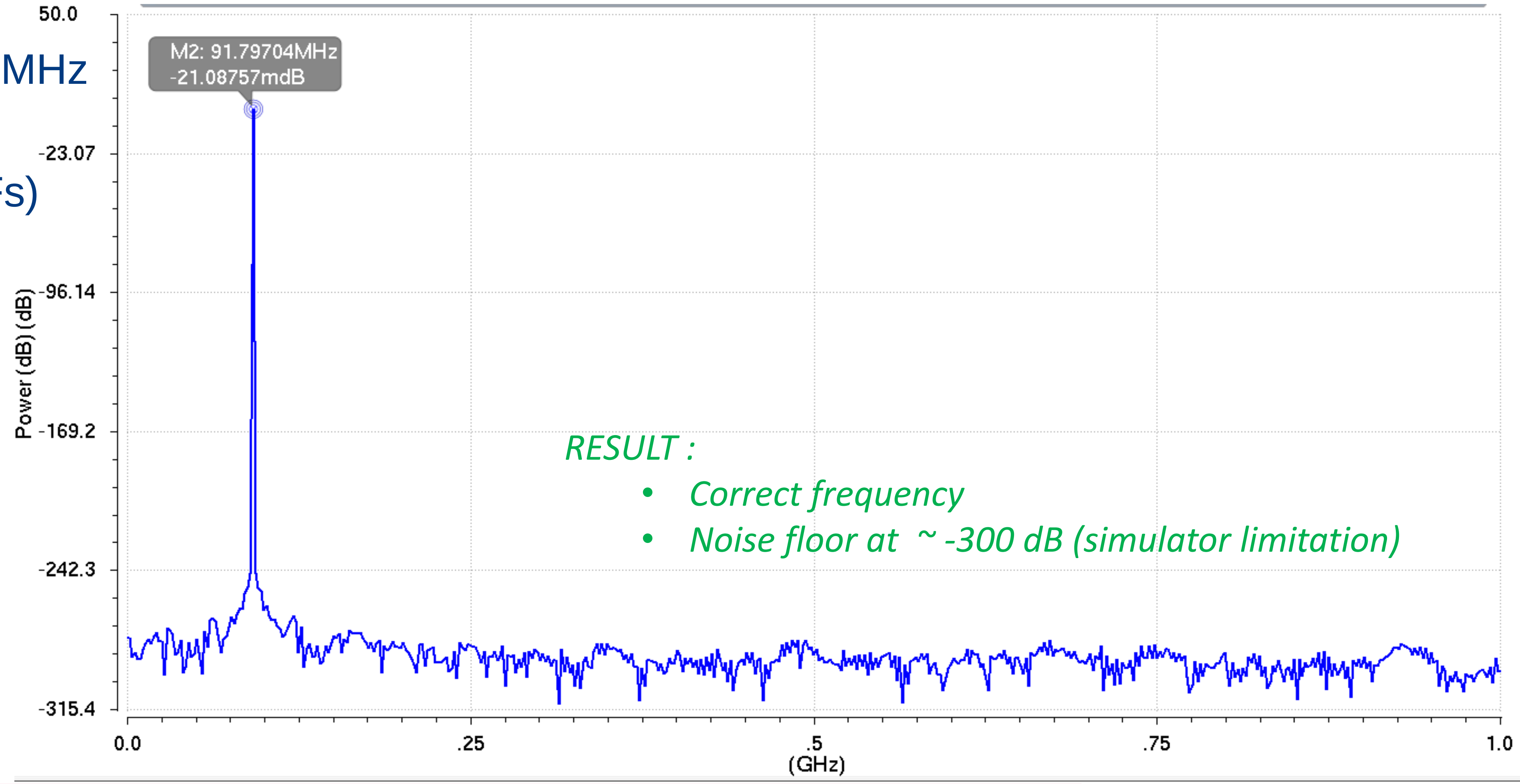
Performing FFT according to the above configuration



- *Process for FFT Simulation Set-Up*

a) Assume we want to have F_s= 2 GHz
b) Assume we want to have F_{in}= 100 MHz
c) Assume Nfft=1024
d) What is the Fin value in order to have an accurate FFT ?
e) Calculations

$$\frac{F_{in}}{F_s} \cdot Nfft = x$$

Then we pick the closest Prime Number to (x) → x_{new}

$$\frac{x_{new}}{Nfft} \cdot F_s = F_{in,new}$$

(After that calculation we use the new F_{in} at our simulations)

Note : There are plenty manuals/tutorials about FFT in the web. You can have a look for further details

TU/e