



Nano Scale Disruptive Silicon-Plasmonic Platform for Chip-to-Chip Interconnection

Development of a System and Device Simulation Platform

Deliverable no.: MS3
Due date: 04/30/2013
Actual Submission date: 05/20/2013
Authors: AIT
Work package(s): WP2
Distribution level: RE¹ (NAVOLCHI Consortium)
Nature: document, available online in the restricted area of the NAVOLCHI webpage

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¹
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Executive Summary

This milestone document presents a simulation platform that has been prepared for evaluating system and subsystem scenarios within the project. The platform has been realized with the VPI Photonics software.

Change Records

Version	Date	Changes	Author
0.1 (draft)	2013-03-14	Start	Emmanouil P. Fitrakis
0.8 (1st subm.)	2013-05-20	submission	Emmanouil P. Fitrakis Eleni Tsalera Ioannis Tomkos

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1. Introduction

This milestone presents a simulation platform for the chip-to-chip interconnect system that is being developed in NAVOLCHI. This platform will be used for evaluation of the targeted interconnect system on the basis of subsystem (plasmonic device) properties. In the case where simulations may show a divergence between target system specs and simulation results, a feedback loop will be utilized so that simulation results converge to the desired specs. The aim of this process is to produce feedback to the device leaders, feeding the targets for the subsystems. The outcomes will provide useful inputs to the device fabricators so that the “top down” and “bottom up” optimisation of target device specifications could be achieved.

2. Simulation platform

The chip-to-chip interconnect comprises a plasmonic transmitter and a plasmonic receiver. The plasmonic transmitter consists of a metallo-dielectric laser and a plasmonic modulator. The plasmonic receiver consists of a plasmonic pre-amplifier and a plasmonic photodetector. See the intermediate report, WP2 section, for more details on the system.

Note that while the system will consist of 4 similar (ideally: same) channels in parallel, we are only simulating one of the channels in the platform scenarios that follow.

The simulation tool VPI Photonics is used as the basis for the platform. Examples of the platform for different system scenarios that are being considered are given in the figures below, where the subsystems are visible. Within VPI, there are two different ways to program each subsystem module. The first possibility is to use VPI’s available internal generic modules to simulate each subsystem. In this case, the VPI user can enter the subsystem properties (as given by the device leaders) into the available input interfaces of VPI. A second possibility is to bypass VPI’s generic modules and replace them with Matlab files (that cooperate with VPI) in order to simulate the finer details of each subsystem. The plan is to start with the first possibility (using the VPI’s available generic modules) and eventually only replace the modules that prove to need additional details from a system perspective. Such replacements are going to be decided in view of the device testing results that are under progress.

In Figure 1 you can see a 1st simulation scenario. Nanolasers directly modulated are followed by gratings. The waveguide between the gratings will be simulated as free space. Next is the plasmonic amplifier and at the end is the plasmonic photodetector.

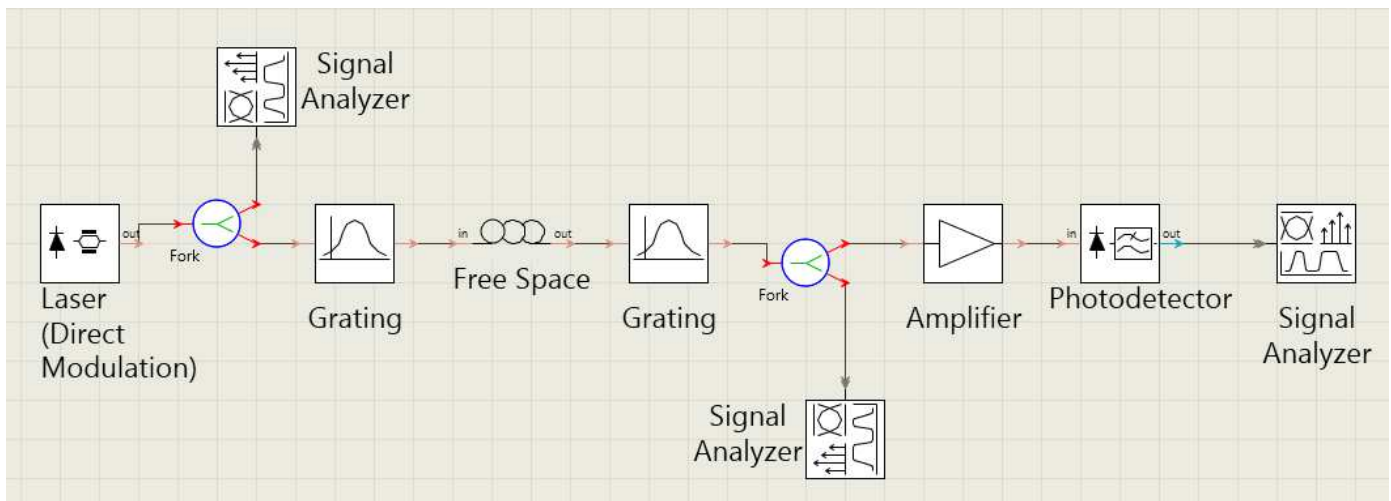


Figure 1: 1st simulation scenario (VPI).

In Figure 2, there is a 2nd simulation scenario. The only difference from 1st scenario is the waveguide (fiber) between the transmitter and the receiver, instead of the gratings and free space.

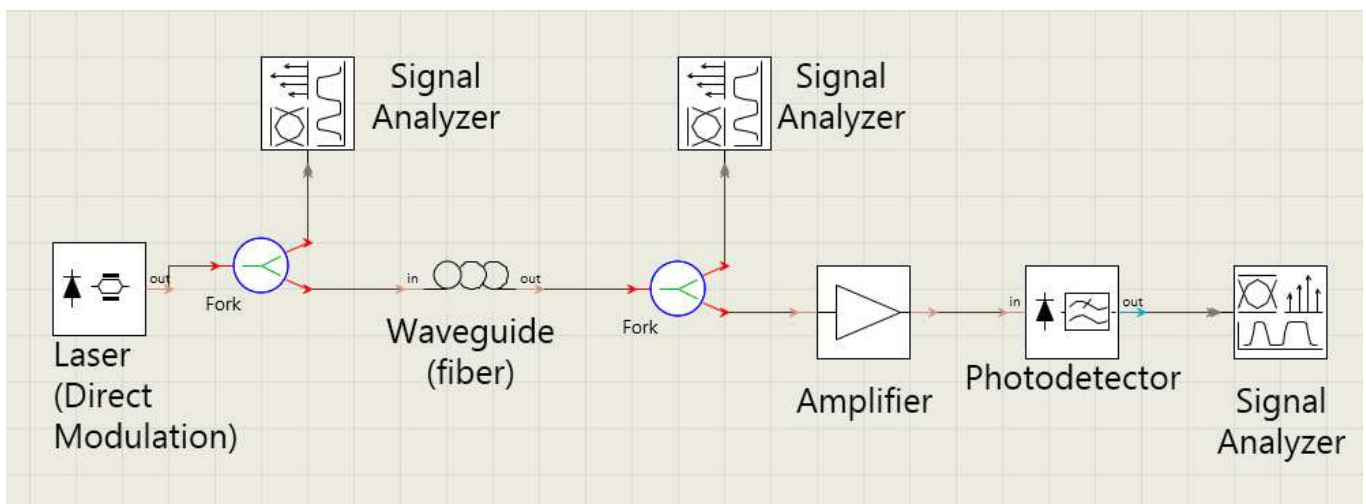


Figure 2: 2nd simulation scenario

In Figure 3, you can see a 3rd and last simulation scenario. Here, the basic difference from the other two scenarios is that the laser is indirectly modulated. The rest are the same with the 1st case scenario.

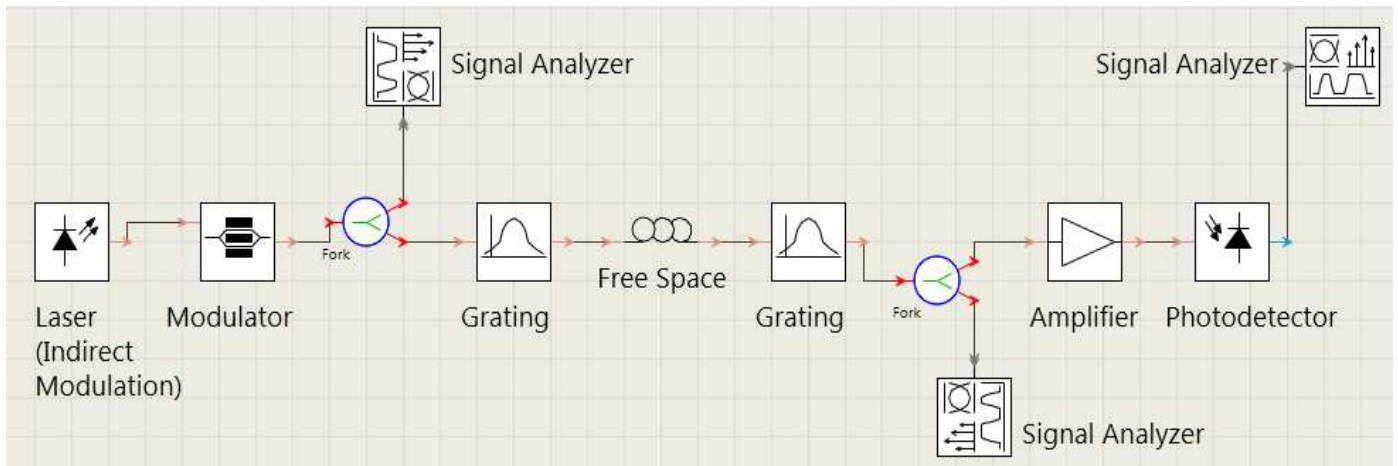


Figure 3: 3rd simulation scenario

For all approaches, each device can be modeled either by changing the parameters which VPI provides or by Matlab (through the Cosimulation VPI package). Cosimulation enables us to implement new simulation modules, additional to those provided by VPIphotonics.

The procedure to make this simulation platform can be described by the following steps:

1. Each partner must provide AIT the specifications of the device he is responsible for.
2. AIT will enter the parameters to the platform by editing VPI's parameters or through a MATLAB code.
3. Compare the results of this simulation platform with the objectives the project has set.
4. If the results are not the desired, AIT will decide which parameters of device or devices must be changed. So, it is necessary to establish an interaction between AIT and device leaders until the desired results will be achieved.

3. Conclusions

This simulation platform will be used within Task 2.2 of NAVOLCHI. The initial simulation results will be presented in Deliverable 2.3 (month 24).