

***Phalafel INFN Project***

***Kick Off Meeting***

WP 2 Silicon Photonics

Stefano Faralli, Philippe Velha, Simone Cammarata, Fabrizio Di Pasquale

15/01/2021

INSTITUTE  
OF COMMUNICATION,  
INFORMATION  
AND PERCEPTION  
TECHNOLOGIES



Scuola Superiore  
Sant'Anna



## WP 2 Silicon Photonics

WP2 (Silicon Photonics) It will develop the SiPh building blocks including RM, MZM, bus waveguides, optical couplers and splitter, integrated thermal heaters. It will submit the MPW of a mini-block chip (2.5x~5 mm<sup>2</sup>). The fabricated mini-block will be characterised, providing information for the design and fabrication of the second full block chip (5x~5 mm<sup>2</sup>) that will be tested allowing the final integration with EIC.

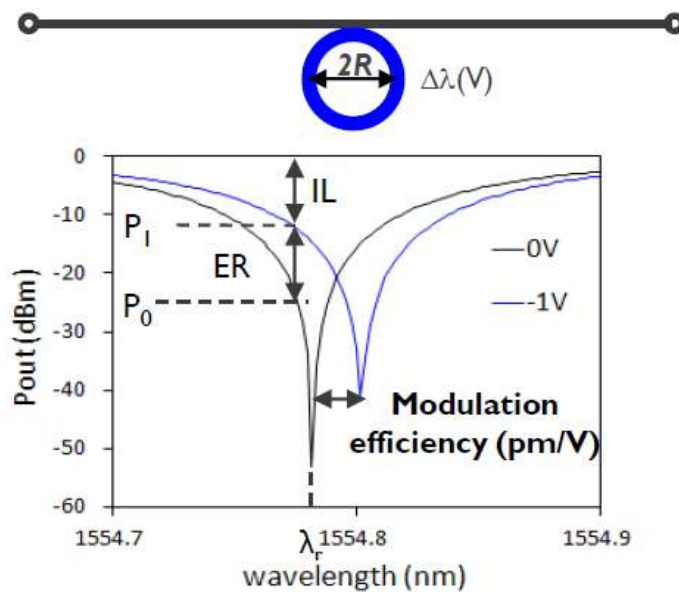
D2.1 SiPh submissions for the MPW run of the first miniblock including the building blocks (SSSA, INFN PI, UNIFI, UNIMI) (T0+7)

D2.2 SiPh submission for the MPW run full final block (SSSA, INFN PI, UNIFI, UNIMI) (T0+19)

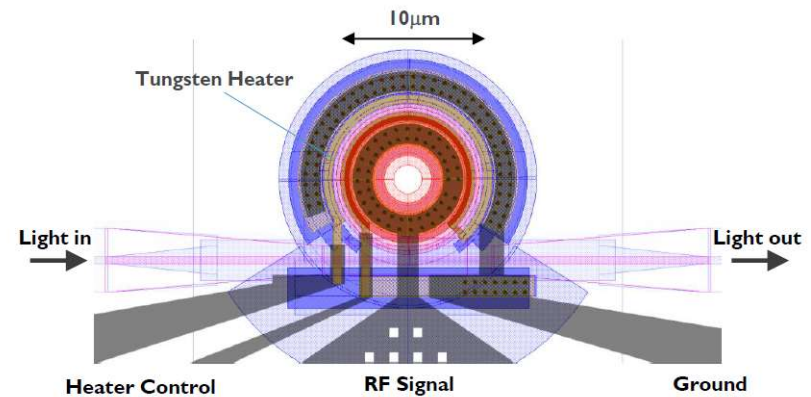
D2.3 SiPh final PIC characterization (SSSA) (T0+31)

# IMEC Ring Modulator

## Si Ring Modulator

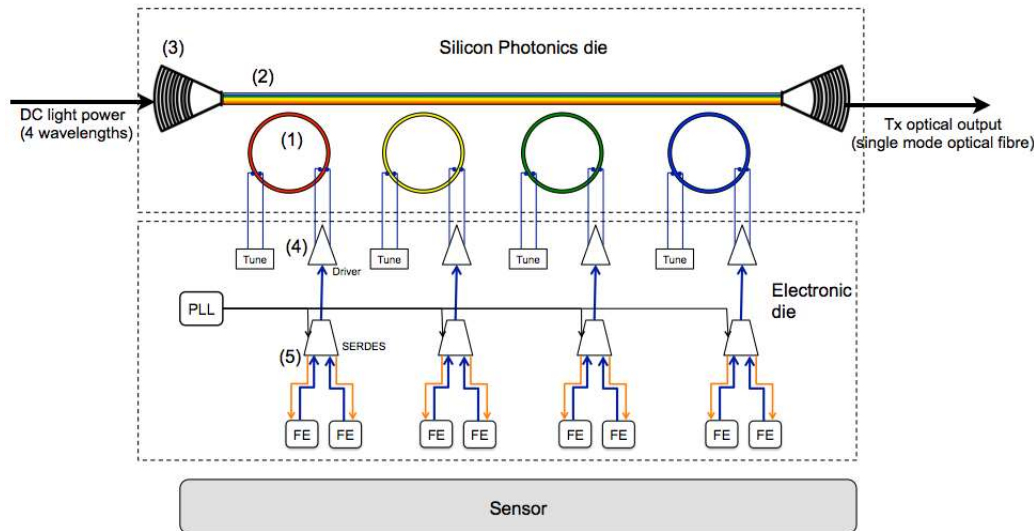


- Developed for high speed transmission (up to 50 GB/s)
- **Implant condition N2/P2** (Imec provides four different levels of ion implantation)
- Ring Radius 5  $\mu\text{m}$
- Metal Heater for thermal tuning of the resonance condition



# Falaphel Proposed Scheme

	FALAPHEL
<b>Data rate</b>	≥100 Gb/s
<b>Radiation TID</b>	≥1 Grad (10 MGy)
<b>Total Fluence</b>	>5 x 10 <sup>16</sup> n/cm <sup>2</sup>



WDM configuration

4 Ring Modulator at 25 Gb/s

4 channels at the Telecom C Band (1530-1565 nm)

IMEC Specifications

Ring Radius = 5 μm - FSR (@1550 nm)=19-20 nm

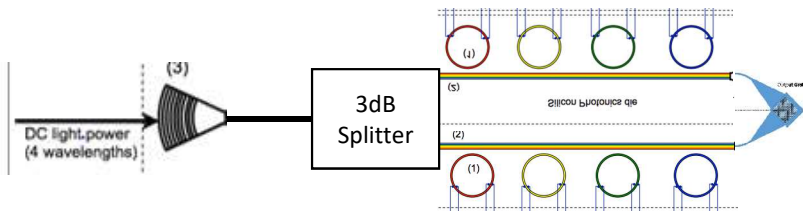
Heater efficiency 0.18 nm/mW

Modulation Efficiency 40pm/V

Insertion Loss =5 dB

# Back Up Scheme based on WDM+PDM

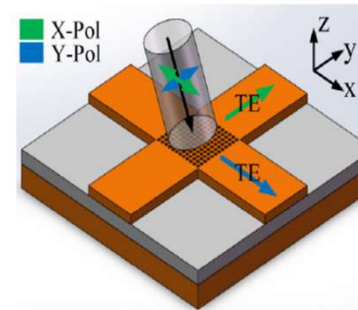
WDM configuration + Polarization Division Multiplexing  
8 Ring Modulator at 12.5 Gb/s  
4 channels at the Telecom C Band (1530-1565 nm)



The 2D Grating coupler at the output coupled 8 different channels (4 wavelengths x 2 orthogonal polarizations)

## 2D Grating Coupler

The two orthogonal polarization are coupled in two orthogonal WG with the same polarization TE



## Other Solutions

- PAM 4
- Ge EAM

# Specifications to be defined (T0+2)

- Operating Temperature
- Operating WL
- FSR /ring Radius (Footprint and packaging issue)
- Data Rate
- Insertion Loss + Power Budget
- ....

# MPW run deadline for the first year

SiPh submissions for the MPW run of the first miniblock

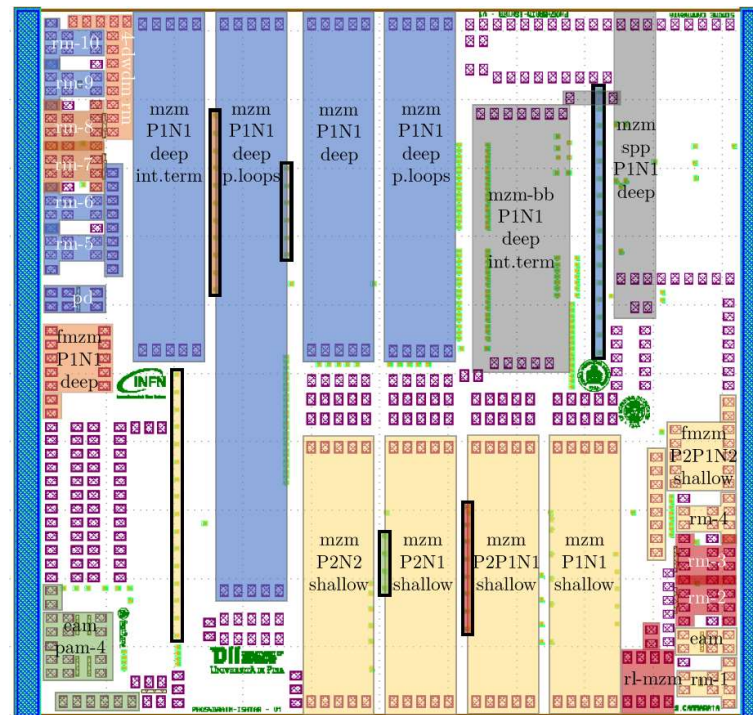
2021 IMEC MPW run schedule

imec

imec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
imec Si-Photonics Passives+					12					13		
imec Si-Photonics iSiPP50G			10					25				
imec SiN-Photonics BioPIX 300					4							
imec GaN-IC on SOI 200V				21								
imec GaN-IC on SOI 650V	20									20		

# Phos4Brain Chip

April-May 2021 (??) chip of the IMEC MPW run; the characterization of the chip will give us feedback for the new design



Tape Layout of the submitted design (June 2020)





Thank you for the attention

[stefano.faralli@santannapisa.it](mailto:stefano.faralli@santannapisa.it)