



**HAL**  
open science

## EU H2020 NEURONN: 2D Oscillatory Neural Networks For Energy Efficient Neuromorphic Computing

Stefania Carapezzi, Gabriele Boschetto, Corentin Delacour, Madeleine  
Abernot, Thierry Gil, Aida Todri-Sanial

### ► To cite this version:

Stefania Carapezzi, Gabriele Boschetto, Corentin Delacour, Madeleine Abernot, Thierry Gil, et al.. EU H2020 NEURONN: 2D Oscillatory Neural Networks For Energy Efficient Neuromorphic Computing. 15ème Colloque National du GDR SoC<sup>2</sup>, Jun 2021, Rennes, France. , 2021. lirmm-03270397

**HAL Id: lirmm-03270397**

**<https://hal-lirmm.ccsd.cnrs.fr/lirmm-03270397v1>**

Submitted on 22 Sep 2021

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

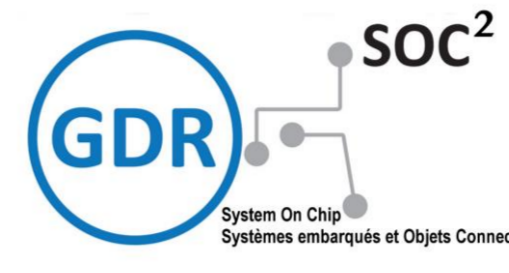


# EU H2020 NEURONN: Two-Dimensional Oscillatory Neural Networks For Energy Efficient Neuromorphic Computing



Stefania Carapezzi, Gabriele Boschetto, Corentin Delacour, Madeleine Abernot, Thierry Gil, Aida Todri-Saniai

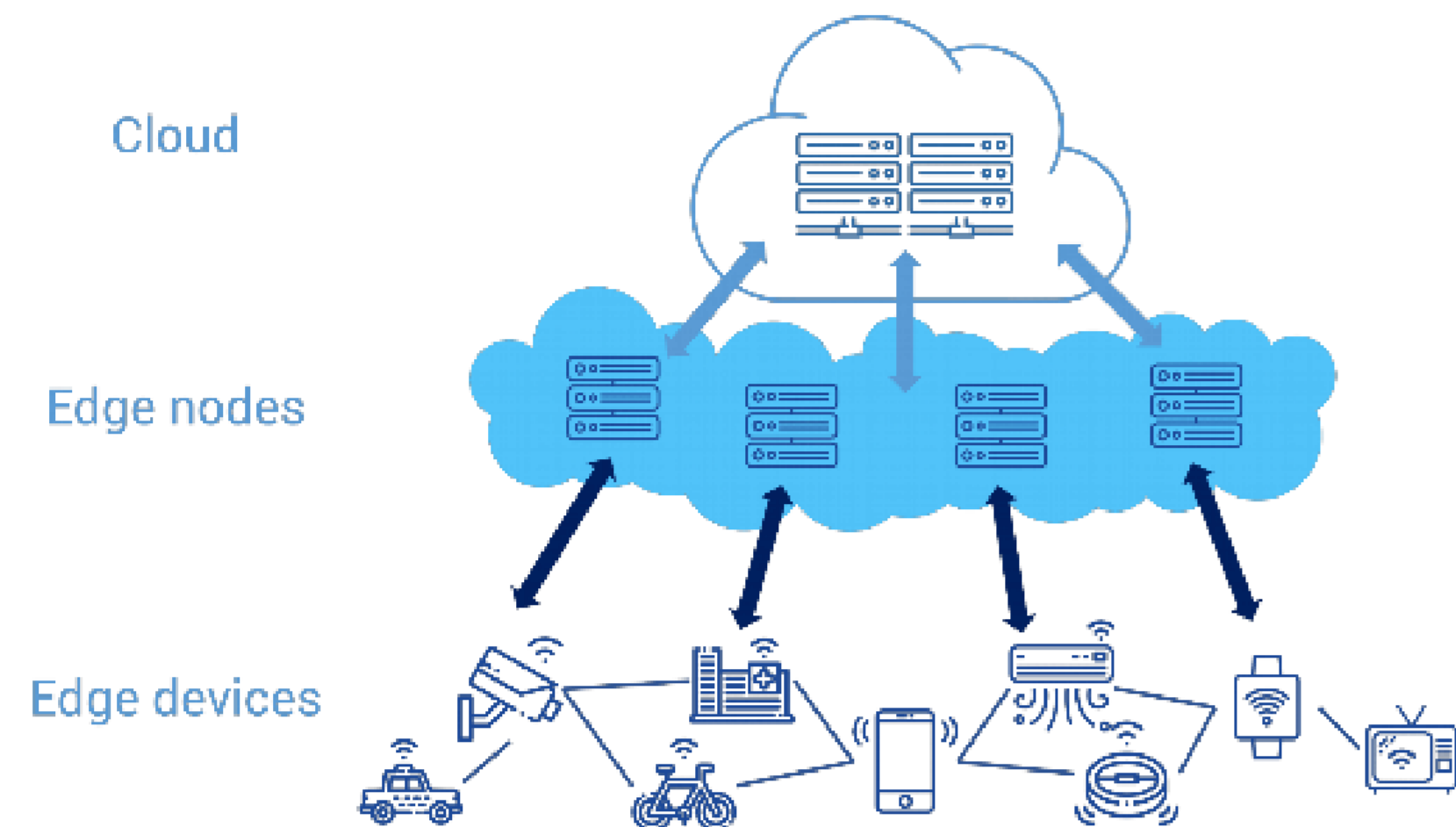
Microelectronics Department, LIRMM, University of Montpellier, CNRS, Montpellier, France



## MOTIVATION AND GOALS

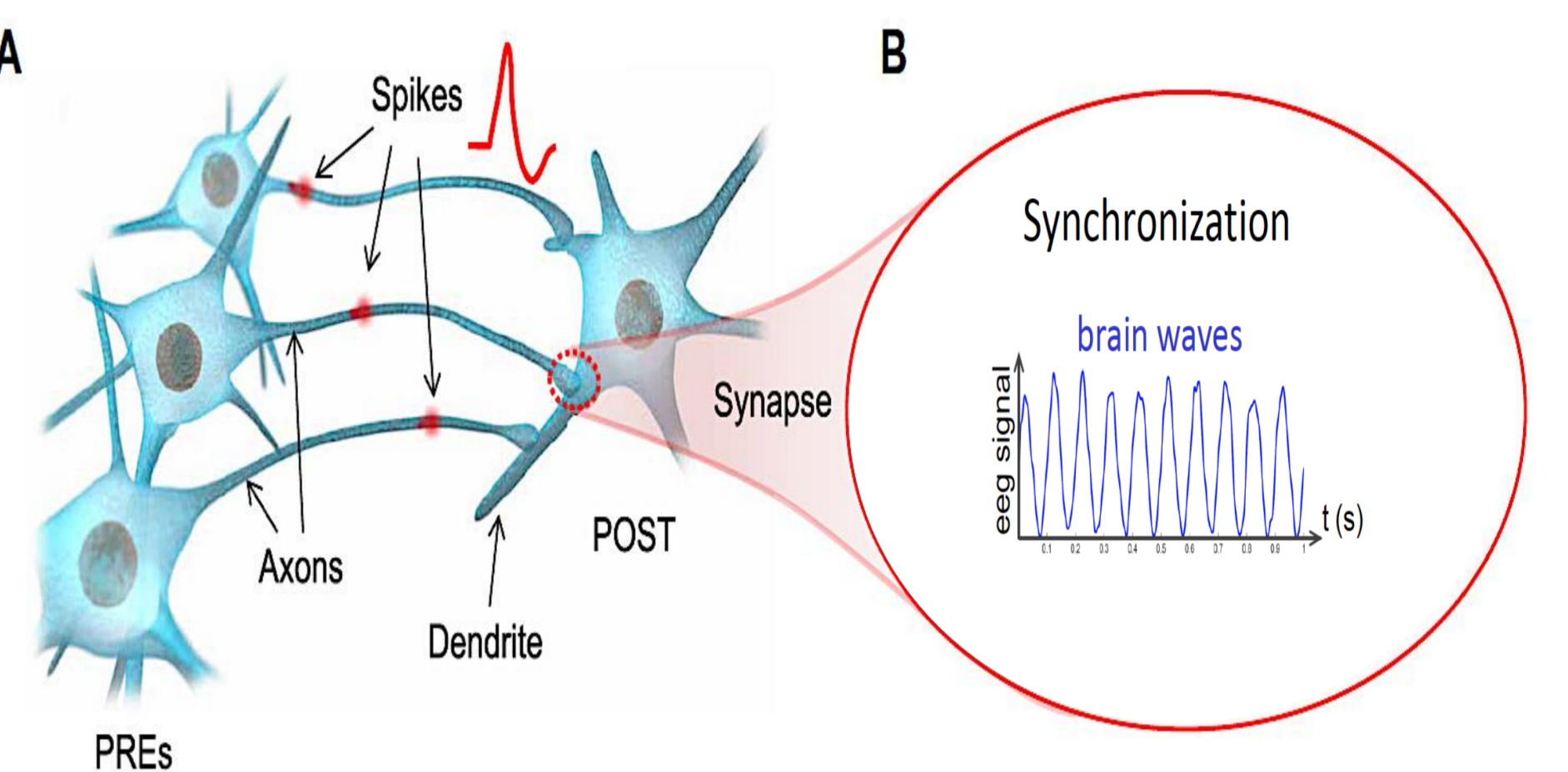
### ARTIFICIAL INTELLIGENCE AT THE EDGE

- Bandwidth (inference/second)
- Latency (frames/second)
- Privacy concerns
- Power consumption



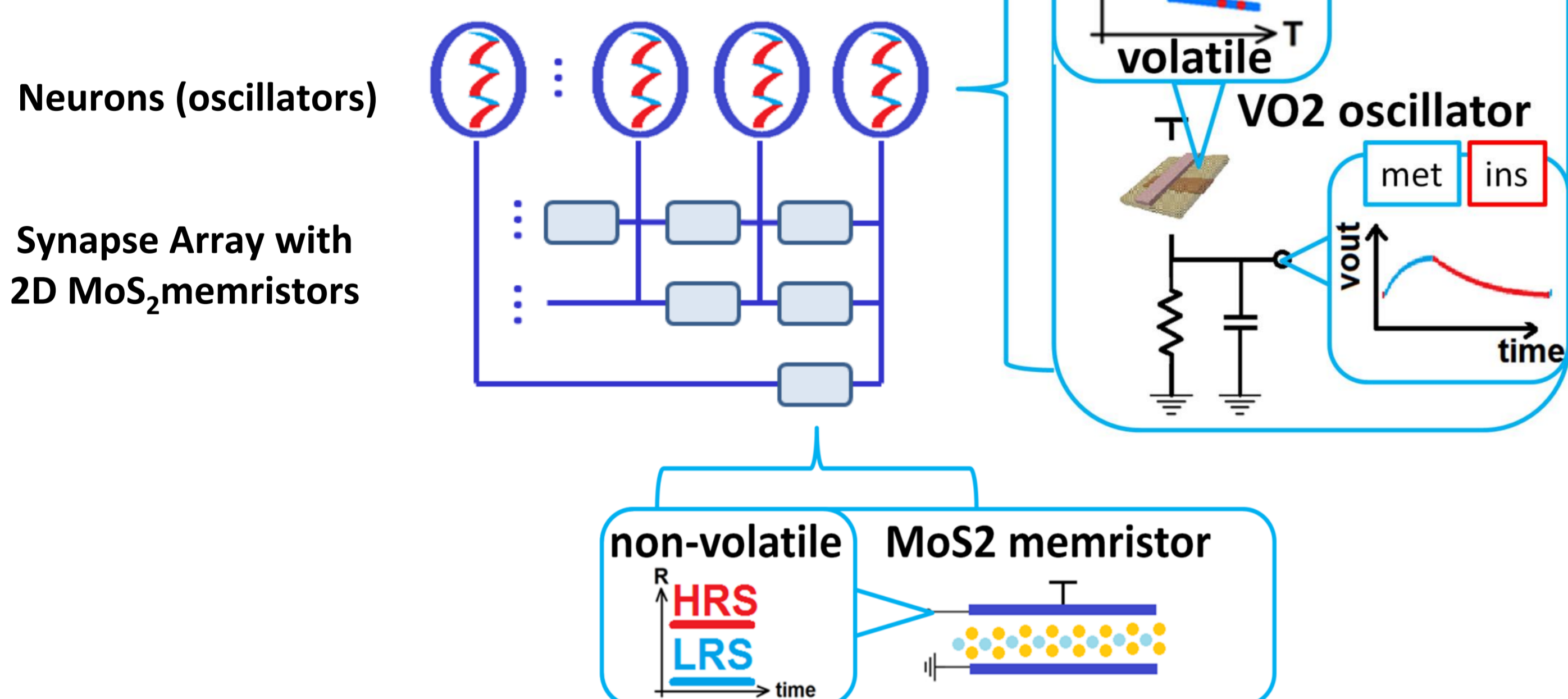
### NEUROMORPHIC COMPUTING

- Support online learning
- Excellent inference engine
- Low power consumption
- Scalable/low cost



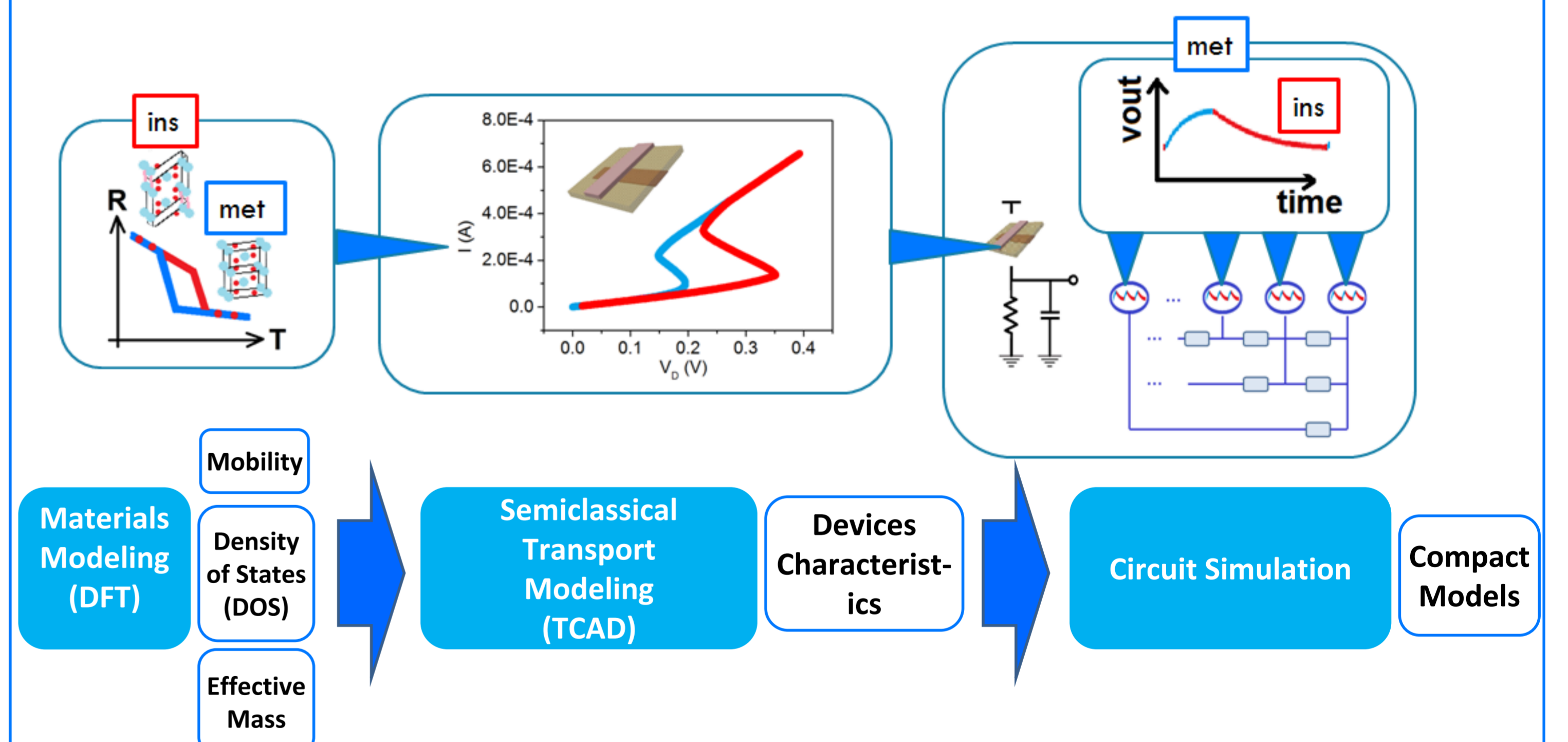
## WP1: NOVEL COMPUTING DEVICES AND CIRCUITS

- VO<sub>2</sub> oscillator devices emulating neurons
- MoS<sub>2</sub> memristor devices emulating synapses
- Co-integration of VO<sub>2</sub> and MoS<sub>2</sub> devices
- ONN VO<sub>2</sub> MoS<sub>2</sub> architecture



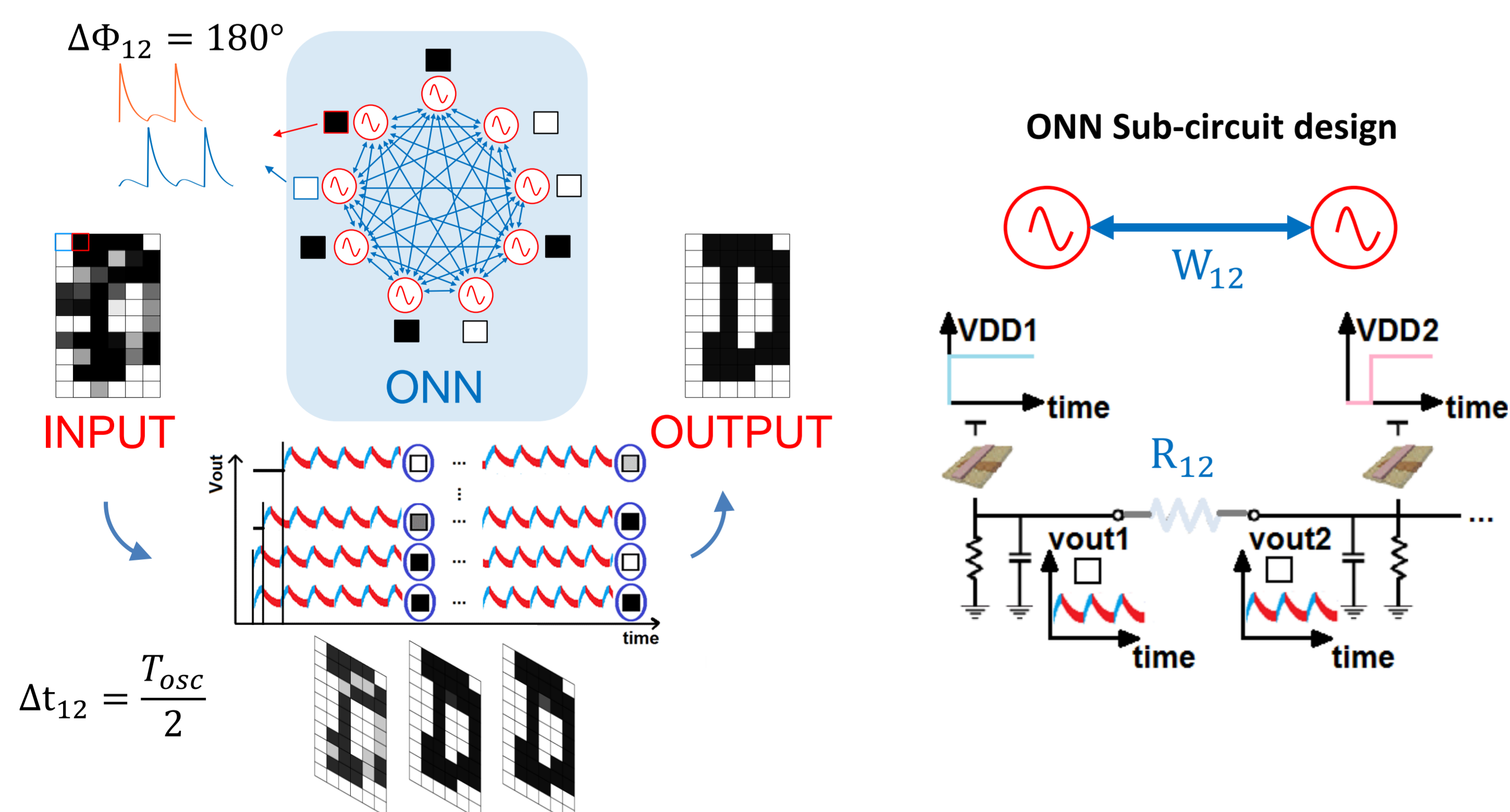
## WP2: ADVANCED DESIGN METHODS

- Atomistic simulation
- TCAD device-level simulation
- Compact-models for circuit-level simulation



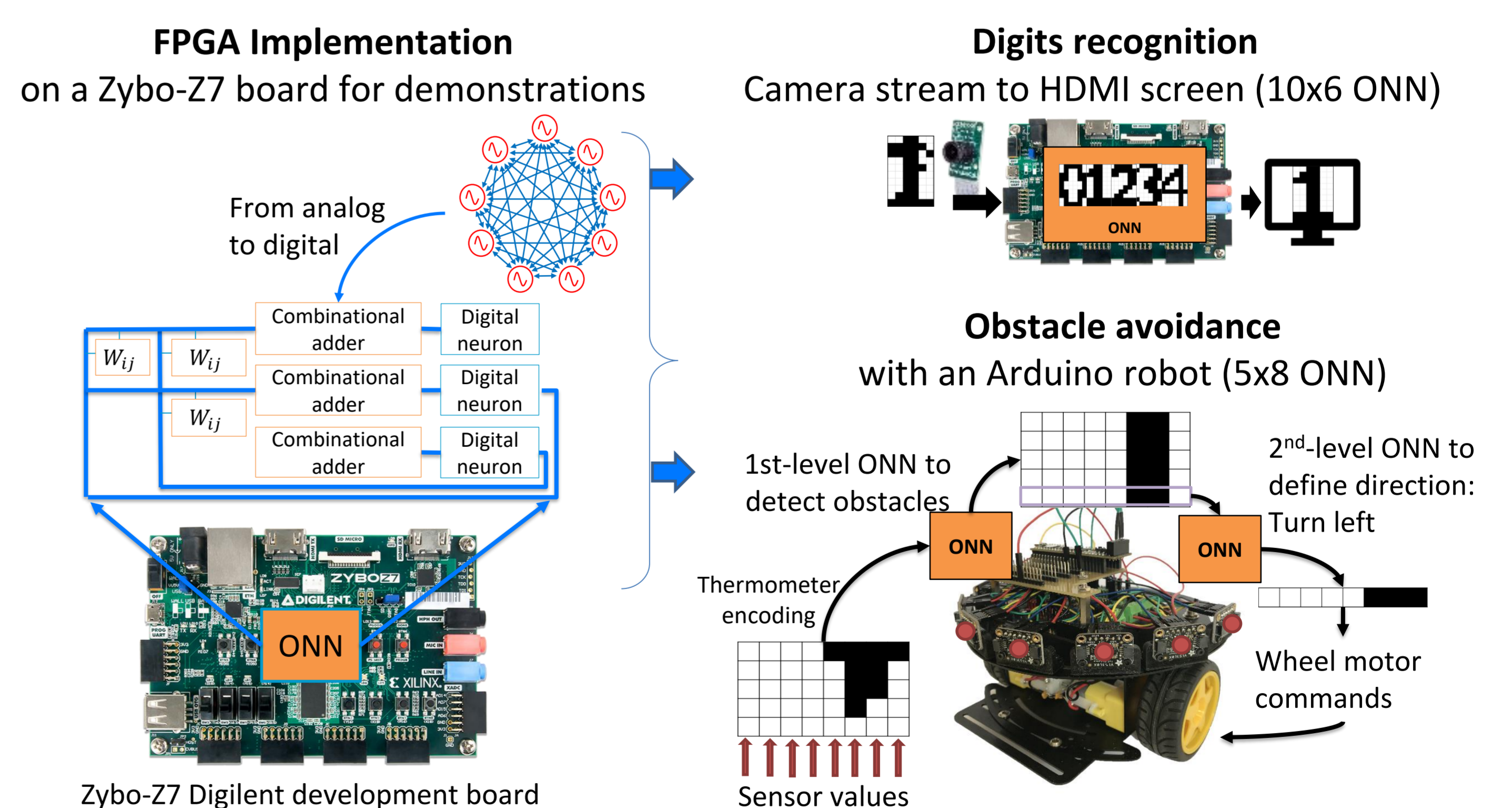
## WP3: ARCHITECTURE AND DESIGN SPACE EXPLORATION

- Energy-efficient Analog ONN Architecture Design



## WP4: DEMONSTRATORS AND USE CASES

- Digital ONN Implementation on FPGA



## ACKNOWLEDGEMENTS AND FUNDING



[Project page](#)



[Project Channel](#)



[Project Channel](#)



[www.neuronn.eu](http://www.neuronn.eu)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 871501.