

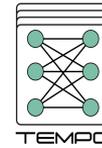
TEMPO

## TEMPO: Technology & hardware for neuromorphic computing

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“The fundamental goal of the TEMPO project is to develop technology platforms for emerging semiconductor devices and demonstrate them for the energy efficient hardware implementation of neuromorphic workloads.”

EMERGING TECH	DESIGN / ARCH	ALGO / APP
<ul style="list-style-type: none"> <li>- Define emerging tech platforms</li> <li>- Sync with foundry to enable development</li> <li>- Systematize logistics to support emerging tech development</li> </ul>	<ul style="list-style-type: none"> <li>- Design enablement of emerging technologies</li> <li>- Quantify PPA of hardware designs and compare against traditional logic</li> </ul>	<ul style="list-style-type: none"> <li>- Identify critical sections of core neuromorphic workloads</li> <li>- Adapt algos (DNN, SNN) to solve target applications</li> <li>- Map applications to emerging tech demonstrators</li> <li>- Quantify timing/energy budget at full system level</li> </ul>

*(\*) The TEMPO project has received funding from the Electronic Components and Systems for European Leadership Joint Undertaking under grant agreement No 826655. This Joint Undertaking receives support from the European Union's Horizon 2020 research and innovation programme and Belgium, France, Germany, Switzerland, The Netherlands.*

# BIRD'S EYE VIEW OF THE PROJECT

## ECSEL 2018 (\*)

(19 partners, 33 ME budget)

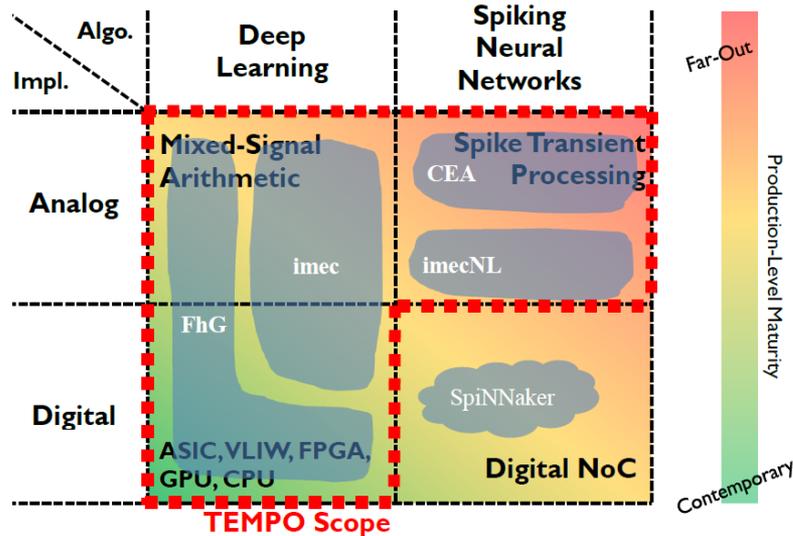
Innovative Design : CNN and SNN

## Different Memories

- MRAM
- FeRAM
- PCRAM
- OxRAM

## Silicon Technology

- 300mm Silicon wafers
- 22 and 28nm FDSOI technology



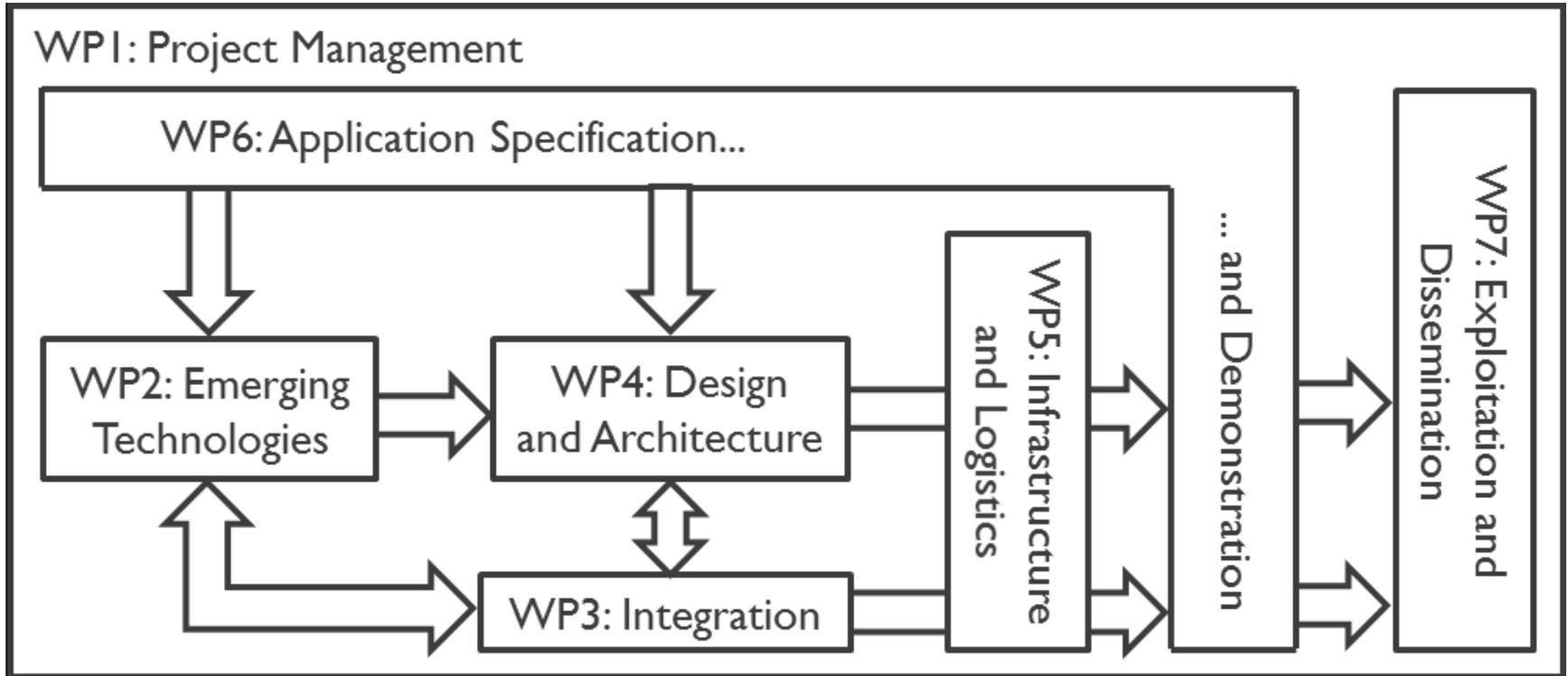
Next EU proposal: "ANDANTE" (ECSEL 2019)



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# WORK PACKAGES



# USE CASES

Application domain : « Edge AI »

*MRAM (imec), FeRAM (FhG/FMD), RRAM (CEA-Leti)*

	Use Case 1	Use Case 2	Use Case 3	Use Case 4	Use Case 5	Use Case 6	Use Case 7	Use Case 8
	Food classification	Traffic (object class.)	Pattern recognition	Predictive maintenance (signal class.)	Medical image denoising	Driving assistance (Lane)	(AI) Coaching Biomechanics assistance	Assessment of new memory concepts for automotive use
	(Philips R.)	(Valeo)	(Infineon)	(ST Micro)	(Philips H.)	(Innosent)	(Ato-gear)	(Bosch)
Domain	Food	Automotive	Digital industry	Digital industry	Medical Health	Automotive	Consumer	Automotive
Neural Network approach	DNN/SNN	SNN	SNN	DNN/SNN	SNN	DNN/SNN	DNN/SNN	DNN
FDSOI		Yes		Yes				
Bulk CMOS	Yes		Yes		Yes	Yes	Yes	Yes
Memories		RRAM		RRAM		FeRAM	MRAM	FeRAM, MRAM
3D SL and/or stacking	Yes		Yes		Yes	Yes	Yes	Yes
Comment	Less than 1sec to classify food from images out of 100 labels	30 msec to classify all objects (from a LiDAR)	10 msec to classify all objects (from a RADAR)	Predict time before failure (signal class.)	X-Ray images denoising with high SNR (vs SoA GPU)	Driving lane assignment @ 200m (from a RADAR)	New generation of running wearables (ARION)	Integration into next generation of BCD technologies. Assess safety / errors.



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