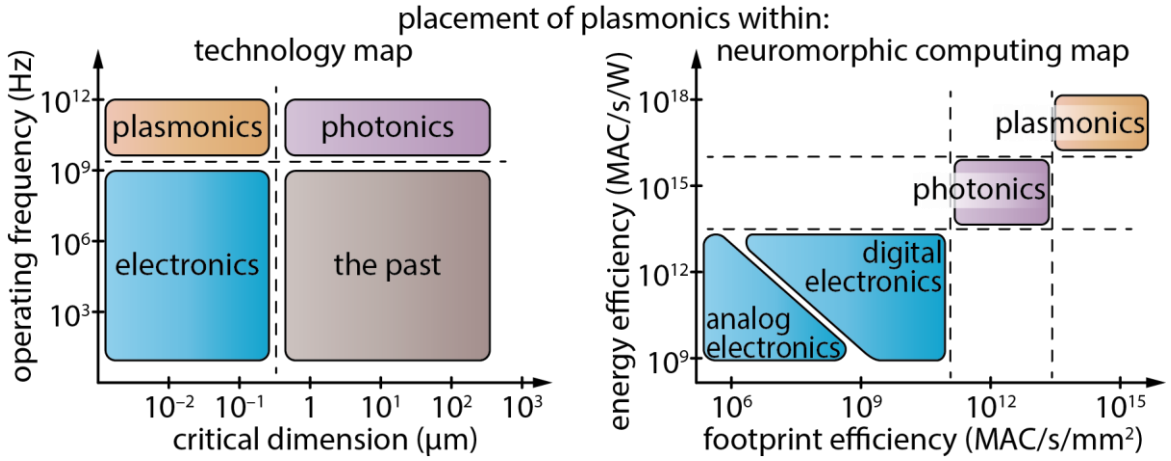
PlasmoniAC 1st press release

Turning plasmons into neurons to revolutionize the landscape of brain-inspired computing through EU-funded PlasmoniAC research project



Computing industry is rapidly moving from a programming to a learning era, where the 10 GMAC/s/W (MAC – multiply-accumulate operation) digital energy efficiency wall of current CMOS electronics and von-Neumann architectures cannot keep the pace with the new computational power metrics required. A new computing paradigm based on **non-von-Neumann layouts**, collocating memory and processing units and relying on the working principles of the human brain, has already begun to unfold, leading to the development of large neuromorphic machines that already exceed the overall efficiency of classical platforms. However, the current technology of both electronics and photonics is encountering difficulties in simultaneously improving the computational power and the energy- and footprint-efficiency of neuromorphic circuitry.

Being at the dawn of neuromorphic computing, a future-proof solution that could dominate this landscape for many years to come should obviously rely on the best-performing and top-efficient technology mixture. This is exactly where **plasmonics** comes to offer what electronics and photonics lack, a natural platform for synergizing photonic-level bandwidths with electronic-level sizes within an ultra-high energy efficiency envelope.

Gathered around this idea, 10 partners from 7 countries have united in launching **PlasmoniAC** project, aiming to take advantage of these fundamental benefits towards deploying and demonstrating a **neuromorphic plasmonic platform** that can optimize speed, energy and size-efficiency across all its constituent circuitry by utilizing and advancing the best-in-class technology and material platforms.

PlasmoniAC – "Energy- and Size-Efficient Ultra-Fast Plasmonic Circuits for Neuromorphic Computing Architectures" – is a new 3-year long EU-funded project, under the H2020-ICT-06-2019: Unconventional Nanoelectronics Call, launched on January 1st, 2020, aiming to release a whole new class of energy- and size-efficient feed-forward and recurrent artificial plasmonic neurons with **up to 100 GHz** clock frequencies and **1 and 6 orders of magnitude** better energy- and footprint-efficiencies, comparing to the current state-of-the art.

Following a holistic hardware/software co-design approach, PlasmoniAC targets the following **objectives**:

i) to elevate plasmonics into a computationally-credible platform with Nx100 Gb/s bandwidth, μm^2-scale size and $>10^{14}$ MAC/s/W computational energy efficiency, using CMOS compatible electro- and thermo-optic computational functions,

ii) to blend them via a powerful 3D co-integration platform employing photonic for interconnection, plasmonics for computations and non-volatile memristor-based control of the neuron weights,
iii) to fabricate and demonstrate a whole new class of plasmonic neurons for feed-forward and recurrent neural networks, applying them towards IT security-oriented applications, and
iv) to embrace them into a properly adapted Deep Learning training model suite, ultimately delivering a neuromorphic plasmonic software design library.

PlasmoniAC's **consortium** is strategically compiled from strong industrial and academic organizations which will work synergistically and complementary along the PlasmoniAC's value chain. Starting from material engineering and core fabrication technology providers through device and circuit manufacturers up to system testing suppliers and computing industry vendors PlasmoniAC's team includes: four distinguished universities, Aristotle University of Thessaloniki (GR), University of Southampton (UK), Swiss Federal Institute of Technology in Zurich (CH) and University of Burgundy - Franche-Comté (FR), two renowned international R&D centers, French National Center for Scientific Research (FR) and Interuniversity Microelectronics Centre IMEC (BE), the European research branch of one of the world's largest computing technology developer and supplier, IBM Research GmbH (CH), a dynamic SME with an excellent industrial and R&D track-record, AMO GmbH (DE), one of the world's largest capital equipment supplier and vendor in the area of DataCom components and systems, Mellanox Technologies Ltd (IL), and one of the leading photonic software design houses, VPIphotonics GmbH (DE).

As a coordinator, Aristotle University of Thessaloniki hosted the **kick-off meeting** on January 21st-22nd, 2020 in Thessaloniki, Greece, gathering representatives of all partners in a highly inspiring atmosphere and announcing intensive collaboration within the network. With all members highly motivated, PlasmoniAC is now looking forward to the first results.

The outcome of the PlasmoniAC project – a radically new neuromorphic plasmonic circuit technology - perfectly responds to the **pressing industrial needs** for high-speed, energy- and size-efficient low-cost neuromorphic chips, offering a unique chance for strengthening the competitiveness of European photonics industry and putting European companies at world-leading position in the global neuromorphic and Deep Learning market.

PlasmoniAC at a glance

Grant Agreement	871391
Programme	Horizon 2020 – Information and Communication Technologies: Unconventional Nanoelectronics
Duration	01/01/2020 – 31/12/2022 (36 Months)
Budget	Overall Cost: € 4,114,926.25 EU Contribution: € 3,999,458.75
Coordinator	Aristotle University of Thessaloniki, GR
Contact	**Prof. Nikolaos Pleros,** email: npleros@csd.auth.gr **Dr. George Dabos,** email: ntamposg@csd.auth.gr **Dr. Angelina Totovic,** email: angelina@auth.gr
Website	http://www.plasmoniac.eu