Project Acronym: **Fun-COMP**

Project Title: **Functionally scaled computing technology:** From novel devices to non-von Neumann architectures and algorithms for a connected intelligent world

WP5

Dissemination and Exploitation

(WP Leader UOXF)

Deliverable D5.11: Final Event

Deliverable ID: D5.11

Deliverable title: Final Event

Revision level: FINAL

Partner(s) responsible: UOXF

Contributors: UOXF (H Bhaskaran, N Farmakidis), UNEXE (C D Wright), WWU (Wolfram Pernice, A Ovvyan, D Raskhodchikov)

Dissemination level: PU[1]

[1] CO: Confidential, only for members of the Fun-COMP consortium (including the Commission Services); PU: Public.

Final Event

As part of the originally planned dissemination activities, a 'final event' was included as part of Task 5.1 with a view to showcasing major Fun-COMP achievements towards the end of the project's lifetime. The originally planned date for this was in Mo-45, or 3-months before the end of the project. As a result of interruptions and delays due to the covid pandemic, and the resulting project 6-month extension, the delivery of this final event was also delayed. Moreover, due to the fact that many people are still restricting and reducing, due to covid, their travel commitments, it was thought (by the Fun-COMP GA) that hosting a specialised in-person meeting to showcase Fun-COMP activities and achievements might be problematic (in terms of likely attendance numbers). It was therefore decided (again by the Fun-COMP GA) to instead hold a Fun-COMP exhibition as part of an already planned (and large-scale) international conference. The conference chosen was META 2022 held in Spain in July 2022 (see https://metaconferences.org/META/index.php/META2022). This conference provided a good vehicle for our needs for a number of reasons including:

- Over 200 in-person delegates were registered to attend
- The EU H2020 project PHEMTRONICS (http://www.phemtronics.eu/) had organised a mini summer school on phase-change photonics to run immediately prior to the main conference, attracting over 60 early-career researchers (PhDs and post-docs)
- Several Fun-COMP WP leaders were invited speakers at both the summer school and the main conference (e.g. David Wright, Harish Bhaskaran, Wolfram Pernice)
- The META conference had its own associated exhibition programme

We (UNEXE, UOXF and WWU) therefore hired an exhibition booth at the META 2022 conference at which we showcased Fun-COMP activities by various means including

- Specially-made Fun-COMP banners and posters
- Fun-COMP brochures
- Key Fun-COMP publications (on the Fun-COMP TPU, SNN and Correlation processors)
- Informative videos (running on loops on laptops)
- Examples of Fun-COMP chips including various generations of our photonic crossbar array (TPU) processor (with digital microscopes to allow visitors to the booth to see the chips for themselves)

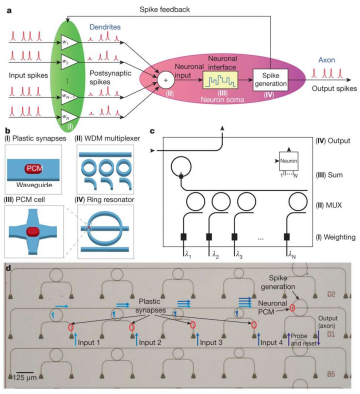
The META 2022 exhibition stand was 'manned' by David Wright (UNEXE), Nik Farmakidis (UOXF), Anna Ovvyan and Dimitri Raskhodchikov (both from WWU).

The stand attracted strong interest from academic and industrial attendees at the conference, with over 150 Fun-COMP brochures and other items of literature (e.g. copies of key papers) taken away by delegates.

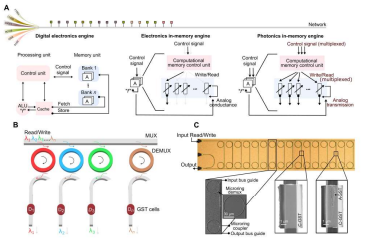
The designs used for the brochures and banners are included in the following pages.

The Fun-COMP brochure (printed on high-quality card to form a 3-way folded brochure)

Fun-COMP SNN



Fun-COMP correlation engine



Partners

- ❑ University of Exeter (UK)
- ❑ Thales (France)
- ❑ University of Muenster (Germany)
- ❑ University of Oxford (UK)
- ❑ IBM Research (Switzerland)
- ❑ IMEC (Belgium)
- ❑ CNRS-C2N (France)

Coordinator/contact

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Fun-Comp

Functionally-scaled computing technology

From novel devices to non-von Neumann architectures and algorithms for an intelligent world

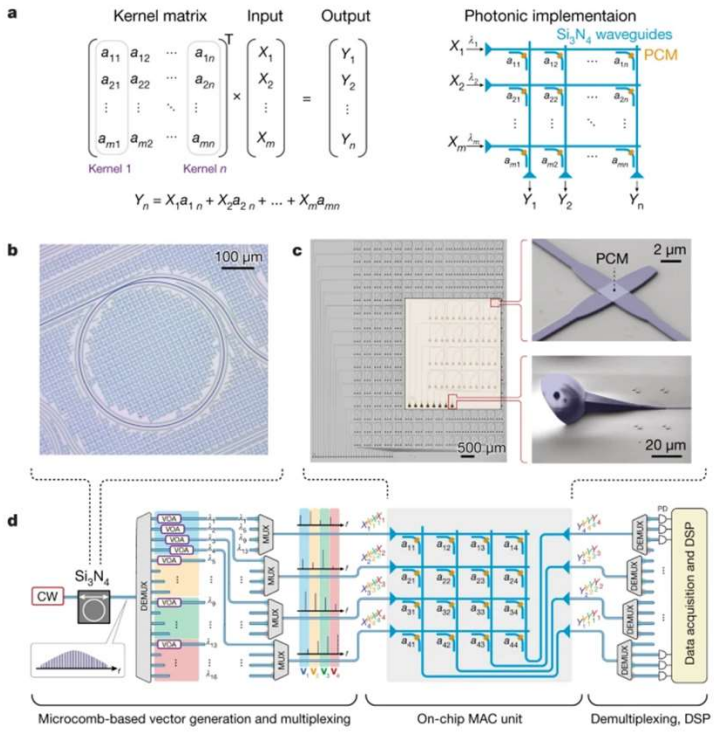
www.fun-comp.org

Fun-COMP is developing ground-breaking hardware technologies in the field of photonic computing.

Target applications range from ultra-fast, ultra-low-latency convolutional processing, to correlation detection and in-memory, reservoir and neuromorphic computing.

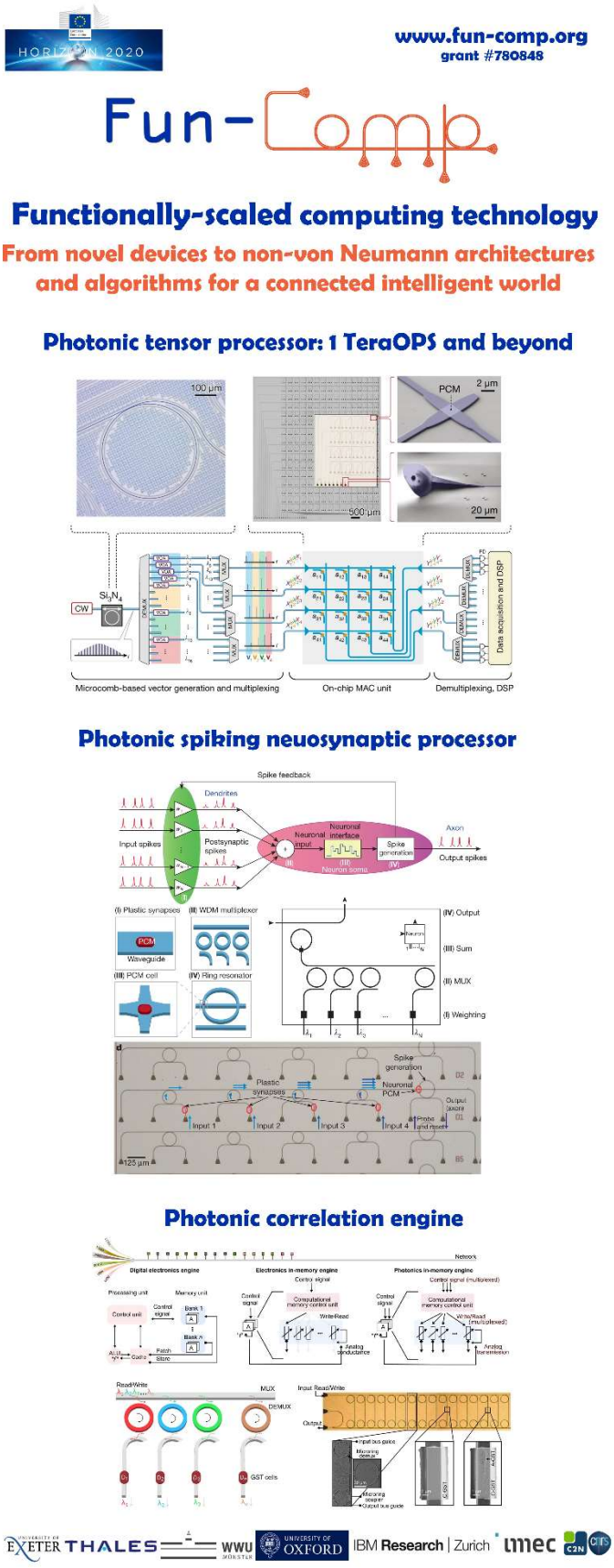
Fun-COMP devices and technologies offer a new way of 'doing' computing, ideally suited to modern-day needs of artificial intelligence and machine learning.

The Fun-COMP tensor processing unit: Computing at 1 TMAC/s and beyond

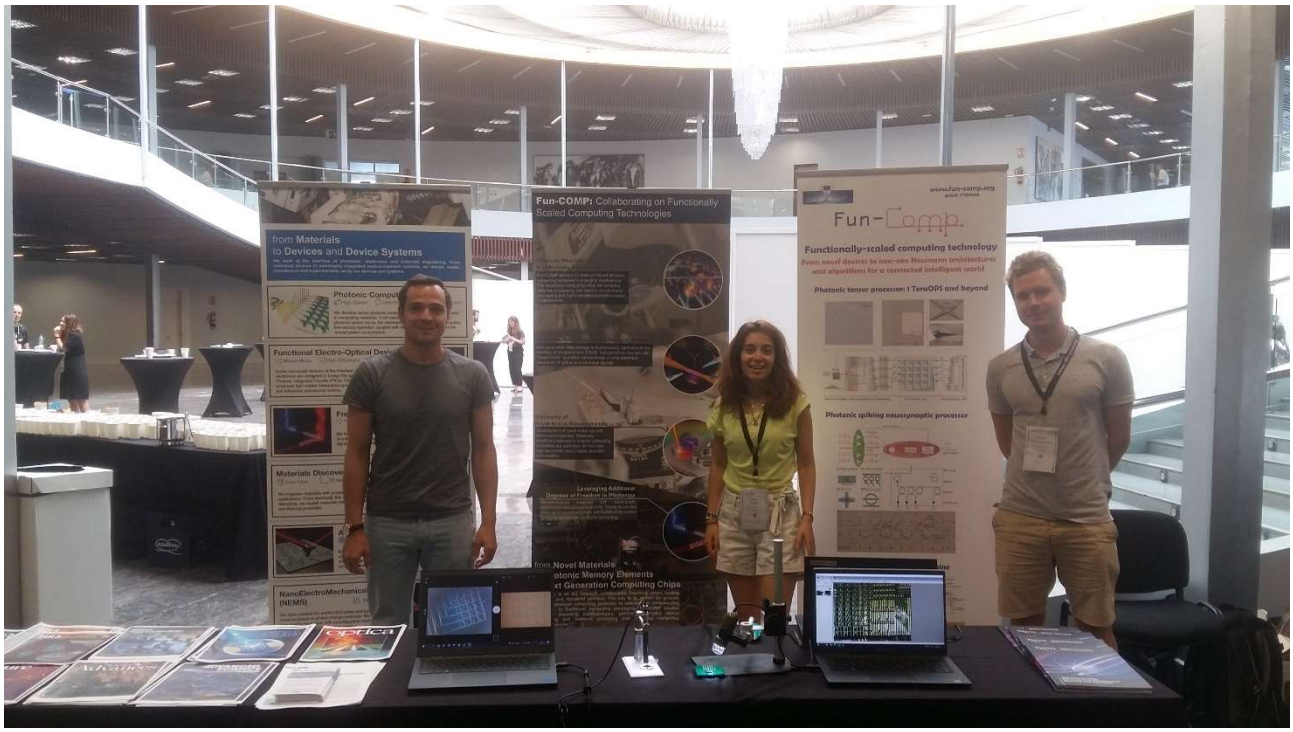


a, Basic matrix-vector multiplication (MVM): a vector is encoded in the amplitude of individual comb teeth of a photonic frequency microcomb, exhibiting wavelengths ($\mathbf{X}_1$ to $\mathbf{X}_m$) and sent to the corresponding matrix input waveguides. The matrix elements are inscribed in the state of phase-change material (PCM) cells on the waveguides. The splitting ratios of the directional couplers are chosen such that the same fraction of the light for each input reaches the output. **b**, Micrograph the Si_3N_4 microresonator used for frequency comb generation. **c**, Micrograph of a fabricated 16 × 16 photonic crossbar array. Inset shows a 4 × 4 matrix with 3D-printed input and output couplers. SEM images show the 3D-printed couplers and the waveguide crossings with the PCM. **d**, Sketch of the multiplexed all-optical MVM system. The input vectors are generated from lines the photonic frequency comb driven by a continuous-wave (CW) laser using wavelength division multiplexers (MUXs) and variable optical attenuators (VOAs). The entries of different input vectors are grouped together again employing wavelength multiplexing and sent to the on-chip MAC unit that performs the calculations. After combining the correct wavelengths with optical wavelength division demultiplexers (DEMUXs), the multiplication results are obtained from the photodetectors (PD). In the example shown here four kernels and four input vectors are operated at once, resulting in 64 MAC operations per time step.

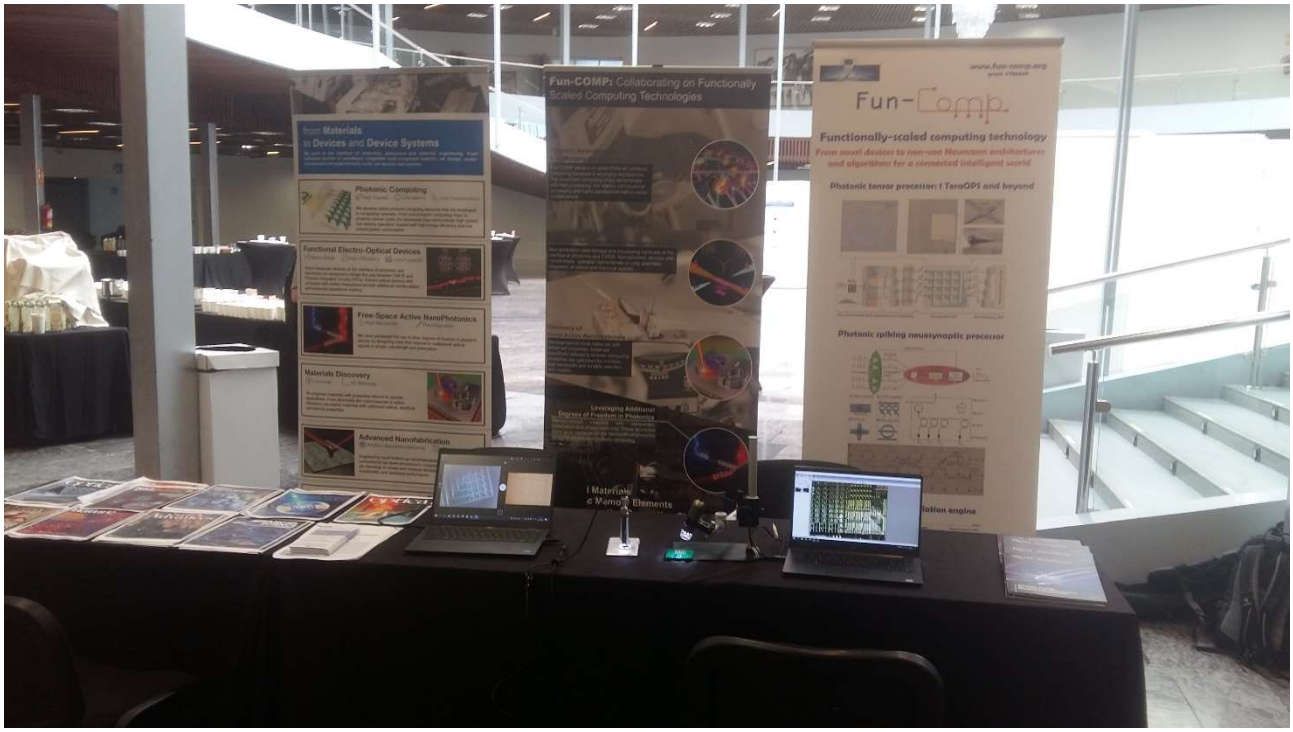
The Fun-COMP pull-up banner (measuring 2 m high x 0.8 m wide)



Photographs of the Fun-COMP exhibition stand are given below:



Stand showing pull-up posters/banners, chip demonstrations and various take-away publicity materials (and with Nik, Anna and Dimitri in picture)



Another photograph of the stand

A copy of the Phemtronics mini summer school, with contributions (on Fun-COMP related science and technology) from Fun-COMP partners UNEXE (David Wright), UOXF (Harish Bhaskaran) and WWU (Wolfram Pernice)

PHEMTRONICS SCHOOL PROGRAM

july 17, SUNDAY: FUNDAMENTAL CONCEPTS

08:00-8:15 **Opening: PHEMTRONICS SCHOOL**

08:15-10:00 **O. Muskens** *-Fundamentals of Plasmonics*

10:00-10:30 Coffee break

10:30-12:15 **T. Taubner** *-Introduction and Optical Properties of PCMs: from THz to VIS*
12:15-14:00 **D. Wright** *-Coupling with PCM*

Lunch

15:30-17:15 **J. Pesic** *-Density Functional Theory*

17:15-17:45 Coffee break

17:45-19:30 **K. Hingerl** *-Phase Transition in PCMs: Basic thermodynamic concepts*

july 18, MONDAY: APPLICATIONS/INDUSTRIAL&COMPANY VIEWS

08:30-10:15 **M. Wuttig** *-Chemistry of PCMs: Bonds and design of PCM*

10:15-10:45 Coffee break

10:45-12:30 **W. Pernice** *- PCM Engineering: Computing and Neuromorphic networks*
12:30-14:15 **H. Bhaskaran** *-Perspective of PCM applications: A company vision*

Concluding remarks

Lunch

PLACE: *Palacio de Congresos de Torremolinos* (https://palacio-congresos.es/en/home-2/), *Sala Manantiales* (*Manantiales room*, https://palacio-congresos.es/en/manantiales-room/).