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X-PIC – Deliverable

1st report about the communication impact, the exploitation and the dissemination activities.

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Work Package:	WP4
Lead Beneficiary:	POLIMI
Contributing beneficiaries:	CNR, INCDTIM, C5

[1] R = Report, P = Prototype, D = Demonstrator, ORDP = Open Research Data Pilot, O = Other, W = Websites, patents filling, etc.

[2] CO = Confidential, only for members of the consortium (including the Commission Services)

PP = Restricted to other programme participants (including the Commission Services)

PU = Public

RE = Restricted to a group specified by the consortium (including the Commission Services)

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Version	Date	Description
Version 1	30.03	First version

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Summary

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1. Introduction

The X-PIC project is part of Horizon 2020 Future and Emerging Technologies FET Open (call H2020-FETOPEN-2018-2020). The project aims at the realization of a new technological platform for the development of a EUV – soft X-ray integrated photonics.

The development of a novel technology able to manipulate high-energy photons in integrated devices may open integrated photonics to novel frontiers; in particular, the spectral range going form the extreme ultraviolet to the soft X-rays is very attractive for applications in Micro- and Nanoelectronics, Biology, Pharmacology, Material and Surface Sciences, Chemistry, Physics, Metrology and in many other fields.

The ambitious goals of the project will be reached through the synergetic interaction among different disciplines as Ultrafast Laser Technology, Extreme Nonlinear Optics, Femtosecond Laser Micromachining, Fluid Dynamics, Nanotechnology, EUV to soft X-rays technology. The partners involved in this proposal are leaders in those research fields, thus making the ambitious project goals feasible.

The innovative technology demonstrated in this project will be the base for a large variety of future devices offered to industrial and scientific customers, with functionalities tailored to specific applications.

The goal is to make X-PIC known to the widest possible group of potential users and pave the way to exploitation of the project results towards European leadership in the EUV-SXR integrated Photonics market.

2. Dissemination and Exploitation Strategy

2.1 In what area do you expect to make an impact?

2.1.1 Semiconductor market

The project goal is the development of a new technological platform for the realization of a EUV – soft X-ray integrated photonics. The current trend in EUV photolithography for large-scale microchip production is moving towards 5 nm spatial resolution enabling 5G networking to high-performance computing and artificial intelligence. The massively complex and expensive lithography machines operate at 13.5 nm, imaging a reflective photomask with a de-magnification factor onto photoresist-carrying semiconductor wafers. Further packaging of nanostructures requires lithography processes at wavelengths beyond EUV, most likely around 6 nm. Any defect in the phase mask will impact the performance of each exposed structure. Thus, few-nanometer resolution, high-speed mask inspection and metrology tools are of tremendous importance and still not sufficiently developed for large-scale commercial use.

The most promising solution is coherent diffractive imaging (CDI) using EUV-SXR laser pulses. Enabled by the coherence of laser-driven HHG, this nanoimaging method provides sub-wavelength (nanometer) resolution full-field imaging of surfaces or buried layers and allows even sensitive element-specific imaging of surfaces and sub-surface features. X-PIC will enable compact and powerful integrated solutions for CDI microscopes with industry-grade reliability (>85% up-time in the 13.5 nm business).

Since between 2018 and 2020, 75 lithography systems have been sold. ASML plans 40 units in 2021, 55 units in 2022 and 60 units in 2023, accumulating 240 systems in total[3]. Each 2 – 4 machines will require an own inspection tool, opening a market for already 58 tools with an annual market potential of well above 1 billion EUR. Targeted customers are companies providing EUV inspection tools, such as ASML, Rigaku, Nanospec, Lasertec, KLA. In addition, compact EUV-SXR lithography workstations will enable small-scale production and rapid prototyping for beyond-EUV chipmaking in R+D departments of large chipmaking companies or SME foundries.

2.1.2 Pharmacy and biology

Integrated lab-on-chip solutions working with EUV-SXR radiation may be developed by biomedical SMEs as analytical workstations oriented to the scientific and pharmaceutical markets. Pharmaceutical companies working on drug discovery are very interested in the potential for ultrafast EUV-SXR sources to determine the structure of molecular materials that can only be crystallized as nanocrystals. Further, in-vivo microscopy of biological species, such as viruses, becomes possible via CDI. In the scientific market it becomes possible to study mechanisms of photoprotection, damage and mutation-induced in proteins and DNA by energetic radiation; the microscopy of cells and tissues with chemical sensitivity; the study of radiation effects on elementary living species by reproducing hostile environments, with relevance to the investigation of ecosystems impacted by nuclear pollution but also to farming in irradiated environments (e.g. relevant for self-sustainability of long-term space missions).

2.1.3 Chemistry and advanced materials

High-tech SMEs working in the field of chemical-physical analysis may develop X-PIC devices for chemistry labs and industrial process control. In chemical industries, there is great interest in probing the structure of molecules and solid-state materials on femtosecond timescales, for example, to study basic aspects of catalytic mechanisms. Further, advanced EUV-SXR techniques such as nanometrology, hyperspectral imaging and spectroscopy allow for future material engineering for energy, such as improving batteries and thus electron mobility, or photovoltaic materials and fuel.

2.2 What might be the application of the results of your project?

X-PIC is per se aiming at the development of a radically new technological platform enabling, that will be the seed on the long term for several impressive applications. Here we mention a few examples:

- ***Novel metrology standards and innovative SXR comb spectroscopy in X-PIC devices****:* the generation of SXR frequency combs has relevance in several fields, like spectroscopy, searching for the variability of fundamental constants and realizing ultraprecise atomic clocks. Nowadays EUV frequency comb sources are based on HHG

[3] See *https://www.stockduediligence.com/p/the-asml-report?s=r* and *https://www.asml.com/en/investors/financial-results*

inside a bulky femtosecond enhancement cavity, with several limitations. We foresee that our technology will boost the exploitation of SXR combs by miniaturization of the comb source through direct HHG generation at high repetition rate inside a X-PIC device.

- ***Attosecond science in the water window inside X-PIC workstations***: attosecond-labs-on-chip integrated with microfluidic systems may pave the way to a novel Attosecond Science of Liquids. **An important application in this field is the study of ultrafast processes initiated in water by high-energy radiation**; among several topics, we just cite the investigation of DNA damage mediated by water photoionization. Nowadays these studies require bulky instrumentation available in a restricted number of advanced laboratories only; the X-PIC approach will condense in a small workstation the potential of present technology making it available also to not skilled users.
- ***PHz-rate photonics with X-PICs***: the density and speed of electronic integrated devices is approaching physical limits that may be overcome by photonic circuits; in this respect, an ultrafast natural carrier of information is offered by HHG, which provides at the same time a comb of attosecond pulses in temporal domain (eligible for a time-division multiplexing) and a comb of harmonics in the spectral domain (eligible for a wavelength-division multiplexing). By replacing the gaseous nonlinear medium with a thin solid-state layer emitting high harmonics driven by a suitable miniature high-repetition rate ultrafast laser, we may extend the X-PIC technology to the realization of optical processors at unprecedented processing speeds.

2.3 What outputs will be created?

Different types of data and formats, depending on their specific origin, will be generated and collected, as summarized by the following categories:

(i) images representing magnified photos of the X-PIC micromachined devices; fluorescence pictures of laser-induced plasmas produced inside the devices; results of photolithographic processes on semiconductor samples.

(ii) 1-D arrays representing spectra of the laser source; temporal fluctuation of the laser parameters; temporal evolution of lab environmental disturbances.

(iii) 2-D maps representing spectra of the XUV-soft X radiation generated inside the devices and resolved in wavelength/photon energy and divergence; slices of the computed speed, pressure, temperature, or density of the gas flowing inside the devices; slices of the simulated generation efficiency of the radiation inside the devices.

(iv) 3-D maps representing hyperspectral images of semiconductor samples probed by the X-PIC devices.

(v) Text files representing software developed for remote control of the experimental setup, for data analysis and numerical simulations.

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2.4 Where will the outputs be made available during and after the project?

The data produced within X-PIC will be made available in a public repository which provides a Digital Object Identifier (DOI) for each dataset, making the data identifiable and locatable via a persistent and unique identification mechanism. Thus, we assure datasets to be identifiable and citable in accordance with the FAIR principles. Such DOI will be used to cite data related to the scientific publication outcomes, enhancing reproducibility and dissemination of our results.

2.5 Who are the potential stakeholders of your results?

The potential target groups are reported in the table below:

TARGET GROUPS	**DESCRIPTIONS**
Scientific Community (Higher Education, Research)	Micro- and Nanoelectronics Biology Pharmacology Material and Surface Sciences Chemistry Physics Metrology Photonics (Spectroscopy, Lasers) Femtosecond laser micromachining
Higher Education	All Technical Universities in the cities of the Partners. Technical high schools in the countries of the Partners.
Industry	Companies in the ultrafast laser market, (e.g. Coherent Inc., Amplitude, Trumpf, LightConversion, Fastlite, Ultrafast Innovations, Hübner, NKT) Companies in the femtosecond laser micromachining market, (e.g. Femtoprint, Lightfab, Oxford Lasers) Companies in the semiconductor market (e.g. ASML, Rigaku, Nanospec, Lasertec, KLA) Pharmaceutical companies High-tech SMEs working in the field of chemical-physical analysis
General Public	Broad audience of photonics and physics enthusiasts

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2.6 How will you contact them?

The following are the main dissemination project activities:

- ***Project website and social media*.** The main source of information about the X-PIC technology platform will be provided by a modern project website (https://www.x-pic.eu) to ensure timely access of information to a large community. The project website will include an elevator-pitch (e.g. as video sequence) to disseminate the vision. To advertise the project website the well-connected consortium members will further spread the blog entries on social media platforms (e.g. **Twitter, LinkedIn, Researchgate**, etc.) and on their respective institute or company websites. This information about the XPIC technology will further spread through the world-wide-web and address a large community. A code of conduct has been defined regarding the use of social media (see Attachment n.1) The Governance Structure of the Consortium is composed also by a Project Management Team with an internal Outreach Office that is in charge of the communication and dissemination activities.
- ***Promotion of an "ecosystem" of scientists, enterprises, and users around EUV-SXR integrated photonics***. We will pursue this by organizing two International workshops on soft X Integrated Photonics (IXIP) to be held in the 2nd and 4th year of the project. IXIP will host multi-disciplinary speakers from both the academic and industrial worlds; we will condense in this way a large community around the technology, open novel collaboration and exploitation routes and pave the way to future large conferences in this novel field.
- ***Presentation of results at international scientific and industrial conferences, workshops, and PhD schools*** focused on laser technology and soft-X spectroscopy, imaging, and metrology. Especially, networking capabilities at these international conferences are ideal to further leverage the dissemination effect. In such cases, the scientific dissemination can be paired by presentations of working prototypes given by C5 during exhibitions, workshops, or webinars. This activity will also target high-tech SMEs and large multinational companies interested in this field. At PhD schools, young scientists can be reached, and future partnerships can build up to further enhance research and applications. A Massive Open Online Course on soft X integrated photonics and its applications will be promoted through the POLIMI Open Knowledge platform, also targeting a non-scientific audience.
- ***Publications of the project results in peer-reviewed scientific journals***. Journals with high impact factor and a broad scientific audience will be privileged to achieve the largest dissemination within the scientific community. The project will choose preferentially the open access "gold model" for publications. All consortium members will actively advertise scientific publications via social media by mentioning the acknowledgment "Funded by the European Union" or "Co-funded by the European Union" and the tag @EU_H2020. Break-through scientific publications will additionally be published in online journals and scientific news magazines (Europhysics News, Optics & Photonics News, Spectroscopy Europe) to reach the long-range audience towards the end of the project.
- ***Partnership with industries*.** Class 5 Photonics combines advanced optical technologies with industrial Lasers to deliver game-changing solutions while proving immense agility in a highly innovative high-tech market. The company is closely connected with internationally excellent research facilities and builds a solid network into

the EUV/SXR industry. The team believes in the success of X-PIC and is committed to the commercialization of EUVSXR sources and functional solutions. **The strategic goal is to deliver the full value chain of complete solutions to end customers, either from their resources or in close partnership with industry partners**. As a technology driver Class 5 Photonics already commercializes advanced bio-imaging solutions together with industry partners in the microscopy market. Besides, **we are motivated to transfer our advanced industry knowledge back to researchers** to create not only excellent training for individuals and teams, but also a highly synergetic feedback between industry needs and scientific excellence.

Here below a table recaps the identified stakeholders and the channels to reach them:

STAKEHOLDERS	**CHANNELS**
Scientific Community	• Conferences • Workshops • PhD schools • Scientific publications • Website
Higher Education	• Press releases • Events • Social Media • Visits to the laboratories
Industry	• Direct networking Conferences • Pitch events • Exhibitions • Events • Press release • Social media • Web site
General Public	• Press release • Social Media • Events • Website • Communication Campaign (e.g. Radio, TV)

Moreover, besides the project website, the Consortium will benefit from the channels provided by the European Union

- for project results : Horizon Results Platform (europa.eu) and Horizon Results Booster

o for publications: Open Research Europe | Open Access Publishing Platform (europa.eu)

For the exploitation of project results, new contacts and new possibilities of funding will be explored also by means of the European EOSC platform : https://eosc-portal.eu/

Potential Dissemination activities in public events

Future particular international and national events for outreach activities targeted by the project will be chosen among the following:

- The national yearly event **Italian Quantum Weeks** in April events promoted by Italian engineers, disseminators and educators on the occasion of the first World Quantum Day (in 2022 14th April) with the aim of raising awareness of the quantum world and the opportunities that the quantum revolution is about to offer. At POLIMI Dissemination activities will take place between 5th -12th April;

- The International yearly event of the **Day of Light** in May - a global initiative that provides an annual focal point for the continued appreciation of light and the role it plays in science, culture and art, education, and sustainable development, and in fields as diverse as medicine, communications, and energy;

- The international yearly events of the **European Researchers' Night** in September;

- **Festival della Scienza di Genova** in October 2022. The Genoa Science festival is a point of reference for science dissemination in Italy. It constitutes a great opportunity to meet for researchers, science enthusiasts, schools and families, in the framework of an international scientific event. It will be a perfect opportunity to introduce X-PIC project to general audience and also to reach scientist from other fields that might be interested in our technology. Moreover 2022 is the Year of Glass, which is the material where the X-PIC platform is fabricated thus it will be a good example of an innovative application.

2.7 Potential obstacles and solutions

The Coordinator established a Project Management Team with an Outreach office comprising an ICT specialist and a Communication specialist. This Unit will tackle any possible critical issue concerning Communication, Dissemination and Exploitation by coordinating with all the project partners.

Project Partners will discuss together possible risks and will identify possible solutions during periodic meetings. In particular, we can envisage the following possible risks and related mitigation strategies:

- **Intellectual property right issues** can potentially impact on the Communication and Dissemination activities, by posing a limit to the spreading and sharing of original research results before publication or in advance with respect to patenting. To address this issue, the Parties have signed the Consortium Agreement that regulates the intellectual property rights issues. In particular the Consortium Agreement covers the commercial

exploitation of the X-PIC results during the duration of the project, in the terms of what has been specified at the beginning of the project among partners, that goes under the name of jointly owned IPR. Results shall be owned by the party who carried out the work generating them, or on whose behalf such work was carried out. In order to avoid or resolve conflicts between project partners about the origin of the results, all the project partners shall maintain evidence showing the development of the generation of its own results in order to be able to prove its ownership and the date of its generation. When results have been developed jointly by several project partners, and it is not possible to distinguish their individual contributions, the results generated will be jointly owned, unless the project partners concerned agree on a different solution. To better manage joint ownership, project partners shall agree on its terms and conditions, either by incorporating the necessary provisions in the Consortium Agreement or by signing a joint ownership agreement. All the outcomes of the project that are jointly owned by multiple partners are therefore covered by the Consortium Agreement.

3. Project Internal Communication

The internal communication will be carried on according to following activities:

(i) Short and timely ***internal meetings within each research Unit*** involving all the members of the local research team at work on the project, or part of it, depending on the specific activity to be discussed.

(ii) ***Online meetings*** scheduled by the Coordinator with the local PIs ***involving two or more Partners***, depending on the specific task to be planned.

(iii) ***Project meetings involving all the Partners***, where the main results of the project will be presented and discussed with all the researchers involved in the project and where the Executive Board will define major strategies for the activities scheduled in the research plan.

(iv) In order to make sure that the project runs smoothly, meets its targets in time and that all work is properly documented, the project members will ***share information on a cloud service*** (CS), such as dropbox for internal restricted data. Later on other platforms could be considered. ZENODO will be used for open data.

(v) ***Biennial meetings with the Advisory Board*** will be essential for determining the project impact and the post-project exploitation path.

4. Confidentiality and intellectual property rights

Provisions for IP protection are detailed in the consortium agreement (CA). Most importantly:

(i) knowledge shall be the property of the contractor generating it

(ii) each participant enjoys royalty-free access to the results of the other participants if needed for the research within this project

(iii) pre-existing knowledge will be specified in the CA

(iv) the partners will disseminate the results according to the CA

(v) the results could be also shared with the members of the Scientific Advisory Board who are obliged to a non-disclosure agreement

Information about any exploitable results will only be disseminated once they have been adequately protected following the procedure of Article 29.1 of the Grant Agreement and Article 8.4.2 of the Consortium Agreement.

5. Exploitation

At project closure, part of the technology could be potentially market-ready for scientific customers. C5, that is the Exploitation Manager, in collaboration with the other Beneficiaries will provide a **Market Research Report document** as a deliverable at the end of the project. We will pursue a targeting of potential end-users by exploiting C5 privileged channels established with both industrial and academic customers. The market research will be an iterative cycle during the whole project duration and beyond: starting with an early communication plan to address potential target market audiences, we will find out market requirements for specific problems. Based on an evaluation of the market opportunities and we will further specify prototype capabilities.

The radical general concept will require increased TRL (specially for industrial markets). Three major routes will be considered:

(i) Consortium partners may **create start-up companies** to produce X-PIC integrated photonics elements and solutions under license. In this case, since C5 already provides ultrafast laser sources to several customers, the Consortium might take advantage of their existing commercial network for the distribution and commercialization of new systems, encompassing the laser source and the customer-tailored X-PIC platform. Both academic and industrial customers may thus have access to this new photonics technology as a fully supported product.

(ii) **Licensing of the IPR** to existing or newly founded external companies. C5 is a committed exploitation partner and will actively seek for pilot customers of the EUV-SXR source, consisting of the driver Laser system and the gas target. Based on the early-stage prototype results and part of the market research cycle, this communication may be possible in the second half of the project timeline.

(iii) Further **increasing of TRL** for application/market-specific requirements **in new projects** created by existing partners of the X-PIC consortium and new academic or industrial partners with European, national, or private funding with the clear goal of pushing the commercialization strategy.

6. External communication, dissemination and exploitation activities already implemented

a. External communication activities

The external communication activities of the first reporting period are reported in the tables below:

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Media	
WEBSITE	Link: https://www.fisi.polimi.it/it/home/news/57322 Type of website: DEPARTMENT OF PHYSICS POLIMI Number of views:121
LINKEDIN	Link: https://www.linkedin.com/posts/polimi_il-futuro-della-fotonica-integrata-activity-6802987233524621315-8nqD *(See Figure n.1)* Type of account: DEPARTMENT OF PHYSICS POLIMI Number of interactions: 23.431 views / 152 reactions
TWITTER	Link: https://twitter.com/polimi/status/1397484179986817026?s=20 Type of account: POLIMI Number of interactions: 4.649 views/ 20 likes / 2 retweets Link: https://twitter.com/fisipolimi/status/1399378234224087045 Type of account: DEPARTMENT OF PHYSICS POLIMI Number of interactions: 791 views/ 11 like / 2 retweet Link:https://twitter.com/fastgroup_ifn/status/1493608358145933316?s=20&t=haZt0ZnVujRYRGYC8ydw8w *(See Figure n.2)* Type of account: fastgroup IFN CNR Number of interaction: /6like/0 retweet Link:https://twitter.com/fastgroup_ifn/status/1329850799397199874?s=20&t=haZt0ZnVujRYRGYC8ydw8w *(See Figure n.3)* Type of account: fastgroup IFN CNR Number of interaction: /28like/10 retweet Link:https://twitter.com/CNR_IFN/status/1399274141568712711?s=20&t=haZt0ZnVujRYRGYC8ydw8w *(See Figure n.4)* Type of account: IFN CNR Number of interaction: 2 like/ 0 retweet Link:https://twitter.com/CNR_IFN/status/1399274050279645184?s=20&t=haZt0ZnVujRYRGYC8ydw8w *(See Figure n.5)* Type of account: IFN CNR Number of interaction: 7 like/ 1 retweet
MARKETWATCH	Article in a business journal: Katalin Kovacs, *Pulsuri laser ultrascurte. Ce stim despre ele? Cum le folosim? Pentru ce sunt utile? (Ultrashort laser pulses. What do we know about them? How do we use them? What are they usefull for?)* Marketwatch **236**, 22-23 (2021) *(See Figure n.6)*

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b. Dissemination activities

Publications and proceedings	
Micromachines **13**, 150, (2022)	Title of the publication: "Editorial for the Special Issue on New Trends and Applications in Femtosecond Laser Micromachining" by F. Bragheri et al. DOI: https://doi.org/10.3390/mi13020150 Open access repository link: https://re.public.polimi.it/handle/11311/1204279
Int J Appl Glass Sci. **13** 162–170 (2022)	Title of the publication: "Femtosecond laser micromachining of integrated glass devices for high-order harmonic generation" by R. Martínez Vázquez et al. DOI: https://doi.org/10.1111/ijag.16546 Open access repository link: https://re.public.polimi.it/handle/11311/1205468 *pre-print version available -open access process ongoing
Applied Sciences **12**, no. 4: 1978 (2022)	Title of publication: "Time-Resolved Imaging of Femtosecond Laser-Induced Plasma Expansion in a Nitrogen Microjet" by A. G. Ciriolo et al. . DOI: https://doi.org/10.3390/app12041978 Open access repository: https://re.public.polimi.it/handle/11311/1201410
Proceedings of the EPJ Web of Conferences **255**, 11005 (2021)	Title of publication: "Modeling femtosecond pulse propagation and high harmonics generation in hollow core fibers" by Valer Tosa et al. DOI: https://doi.org/10.1051/epjconf/202125511005 Open access repository: https://re.public.polimi.it/handle/11311/1190816

Conferences	
European Optical Society Annual Meeting, Rome (IT), 13-17 sept 2021 **Poster presentation**	Valer Tosa, *Modeling femtosecond pulse propagation and high harmonics generation in hollow core fibers*
13th International Conference Processes in Isotopes and Molecules, Cluj Napoca, (RU), 22-24 sept 2021 **Poster presentation**	Valer Tosa, *Numerical model for femtosecond pulse propagation in hollow core fibers,* Poster presentation
13th Int. Conf. Processes in Isotopes and Molecules, Cluj Napoca, 22-24 sept 2021 **Invited talk**	Salvatore Stagira , *Extreme Ultraviolet to soft-X-ray Photonic Integrated Circuits*

c. Exploitation activities

The X-PIC project is advised by a Scientific Advisory Board (SAB) that will analyse the project outcomes and will provide indications towards the most promising exploitation directions in scientific and technological areas. The SAB is composed by six members, three from the Academia and three from the Industry; all members have been appointed by the beginning of 2022, thus fulfilling the project milestone MS3 on time. The SAB members are briefly presented in the following:

Member	Affiliation	Role and Expertise
Carlo Altucci	Naples University (Academia)	**Full professor in Biomedical Physics** – Research in Bio-Nano-Photonics

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Nicola Bellini	Bright Solutions (Industry)	**Laser Applications and Systems Engineer** – Solid-state lasers and micromachining applications
Laura Cattaneo	Max Planck Institute – Heidelberg (Academia)	**Research Group Leader** – Ultrafast Spectroscopy of complex systems
Kutlu Kutluer	ASML (Industry)	**EUV Source Design Engineer** – High-volume EUV photolithography for the Semiconductor Industry
Matteo Negro	Cambridge Raman Imaging (Industry)	**Chief Technology Officer and Director** – Raman imaging instruments, ultrafast lasers
Annamaria Petrozza	Italian Institute of Technology (Academia)	**Senior Scientist in Material Science** – Development of Advanced Materials for Optoelectronics

The SAB will start advising the project by the end of the second year.

While a detailed plan for exploitation activities will be defined during the second year of the project, we foresee new opportunities emerging for X-PIC from recent events that may lead to interesting developments in a more distant future. The pandemic emergency led to a serious shortage in microchips produced in Eastern Asia, with subsequent issues in many industrial sectors. To counteract future shortages, the European Commission adopted on 8 February 2022 the European Chips Act[4] that aims to the "reinforcement of the semiconductor ecosystem in the European Union in order to ensure the resilience of supply chains and reduce external dependencies".

In this framework, the X-PIC project can contribute to the European needs by developing novel technologies for both high-resolution photolithography and surface nanometrology for the semiconductor industry. Hence this initiative will be monitored to capitalize the results and go further with the research in the field of semiconductor technologies and applications by taking advantage of new funds and partnerships.

[4] https://digital-strategy.ec.europa.eu/en/policies/european-chips-act

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Attachment n.1

Social Media Code of Conduct

Source: The Communications Council "Best Practice Guide Social Media Code of Conduct"

Introduction:

This Social Media Code of Conduct aims to provide specific guidance on best practice behaviour when working and operating within social media.

Social media guidelines for Beneficiaries:

1. Always exercise good judgement when posting and be aware that inappropriate conduct can negatively affect your organisation, clients and yourself. Always apply the following test: "Would my manager, client or customers be happy to see this content published?"

2. If you are commenting in a personal capacity about brands or campaigns you work on, you should be open and transparent about who you work for, who you represent or who you may be speaking on behalf of.
Not revealing your identity could attract negative accusations that you are engaging in covert advertising, marketing or PR activity.
Be upfront that the views being expressed are personal. For example, if you have a website or your own page on a social media platform a disclaimer is recommended such as: "The views expressed on this website/blog are my own and do not necessarily reflect those of my employer or its clients".

3. Posts should be accurate and fact-checked and capable of substantiation. If you do make a mistake, ensure you correct it promptly. It is important to reference the earlier comment because even if the erroneous comment has been deleted, someone may have saved it as an image or other format to use as evidence. Always ensure that any criticism is backed up with solid evidence.

4. Always act in a professional and constructive manner and use sound judgement before posting. Always be polite and respectful of individuals' opinions, especially when discussions become heated.
Show proper consideration for other people's privacy.
Never post malicious, misleading or unfair content about your organisation, colleagues, competitors or other stakeholders.
Do not post content that is obscene, defamatory, threatening or discriminatory to an individual, brand or entity.
Do not post comments that you would not say directly to another person and consider how other people might react before you post.
If you respond to published comments that you may consider unfair always be accurate and professional.
Remember to be authentic, constructive and respectful

5. Respect other people's intellectual property including trade marked names and slogans and copyrighted material. It's best practice to assume that all content online is protected by copyright.
Make sure you have permission to post copyright items, properly attribute the work to the copyright owner where required, and never use someone else's work as if it were your own. If you are unsure as to who might own an item of content, it's better to err on the side of caution and not post the content.

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6. Only reference information that is publicly available. Do not disclose any information that is confidential or proprietary to your organisation, its clients or any third party that has confidentially disclosed information to you. Examples of confidential information would include brand performance, business forecasts, strategic plans, trade secrets or any legal information.
Do not cite, post or reference clients, partners or suppliers without approval from the relevant manager in your organisation.

7. Do not use your organisation's, client's or a third party's logos, trade marks or materials on your website/blog or in a post unless it has been cleared for public use or been otherwise approved by the relevant manager in your organisation.

Assistance
If you require any advice or assistance in relation to these social media guidelines send your query to *" the Digital Committee at The Communications Council on hello@communicationscouncil.org.au "*

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Attachment n.2

Communication activities

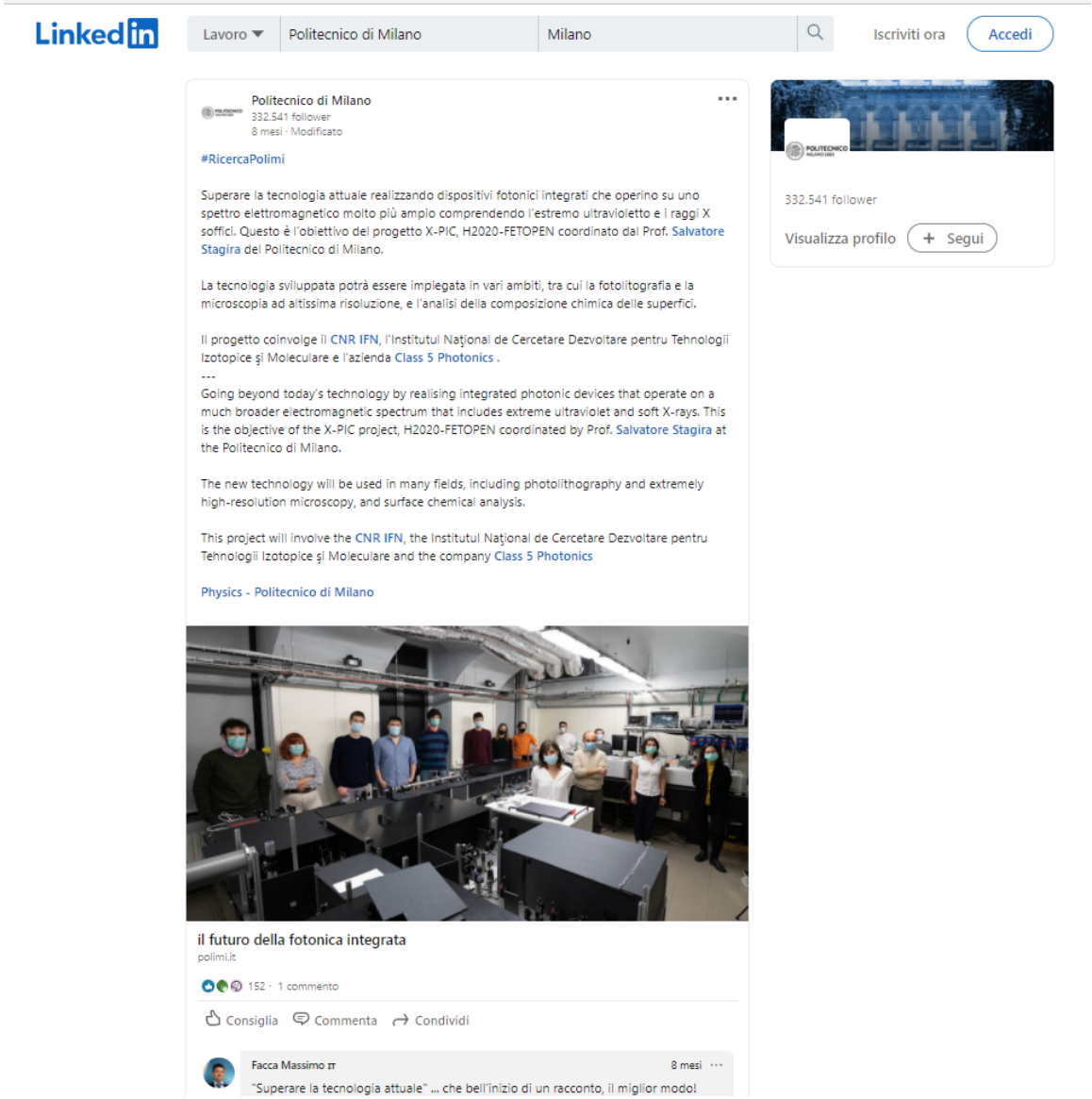


FIGURE 1 LINKEDIN POST ON POLIMI ACCOUNT

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 964588.

FIGURE 2 TWITTER POST ON FAST_GROUP IFN CNR ACCOUNT

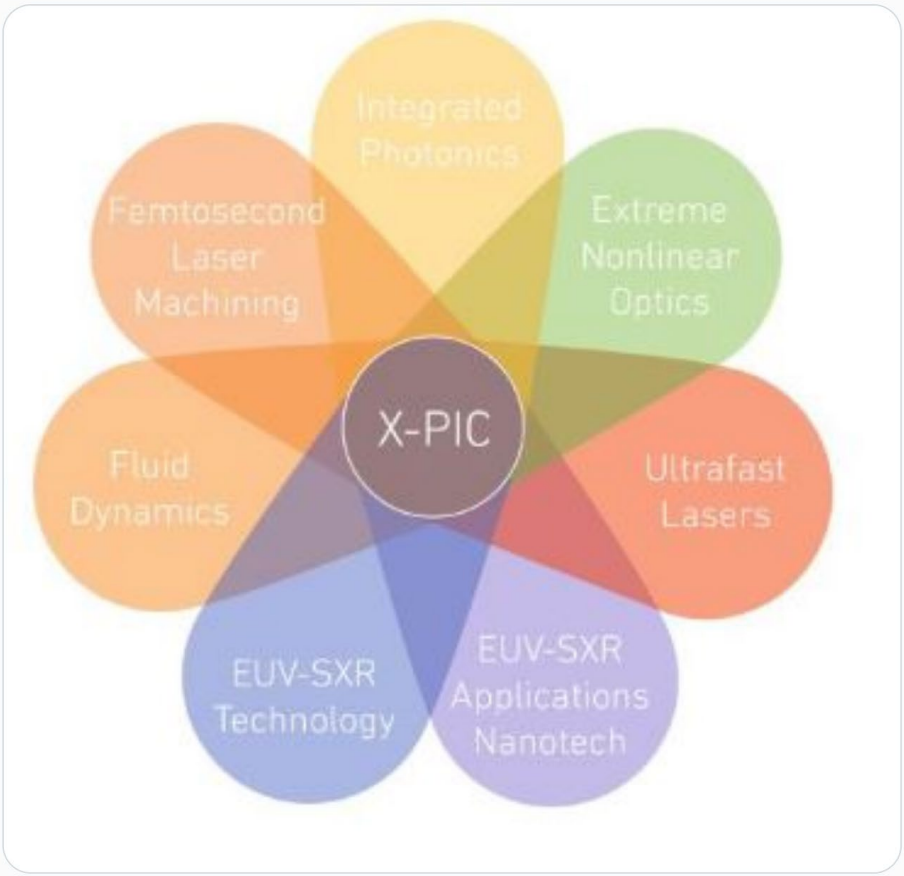
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 964588.

FAST Group
170 Tweets

Following

FAST Group @fastgroup_ifn · Nov 20, 2020

Great news!! The @FET_EU X-PIC project has been funded and our colleague Dr. Rebeca Martinez will lead the @CNR_IFN unit! The ultimate goal of X-PIC is is to marry #IntegratedPhotonics and EUV-softXray generation.. Congratulations Rebeca and all partners! 👏 @EU_H2020 @CNRsocial_



Fisica - PoliMi and 3 others

10 28

FIGURE 3 FIG. TWITTER POST ON FAST_GROUP IFN CNR ACCOUNT

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 964588.

FIGURE 4 TWITTER POST ON IFN_CNR ACCOUNT

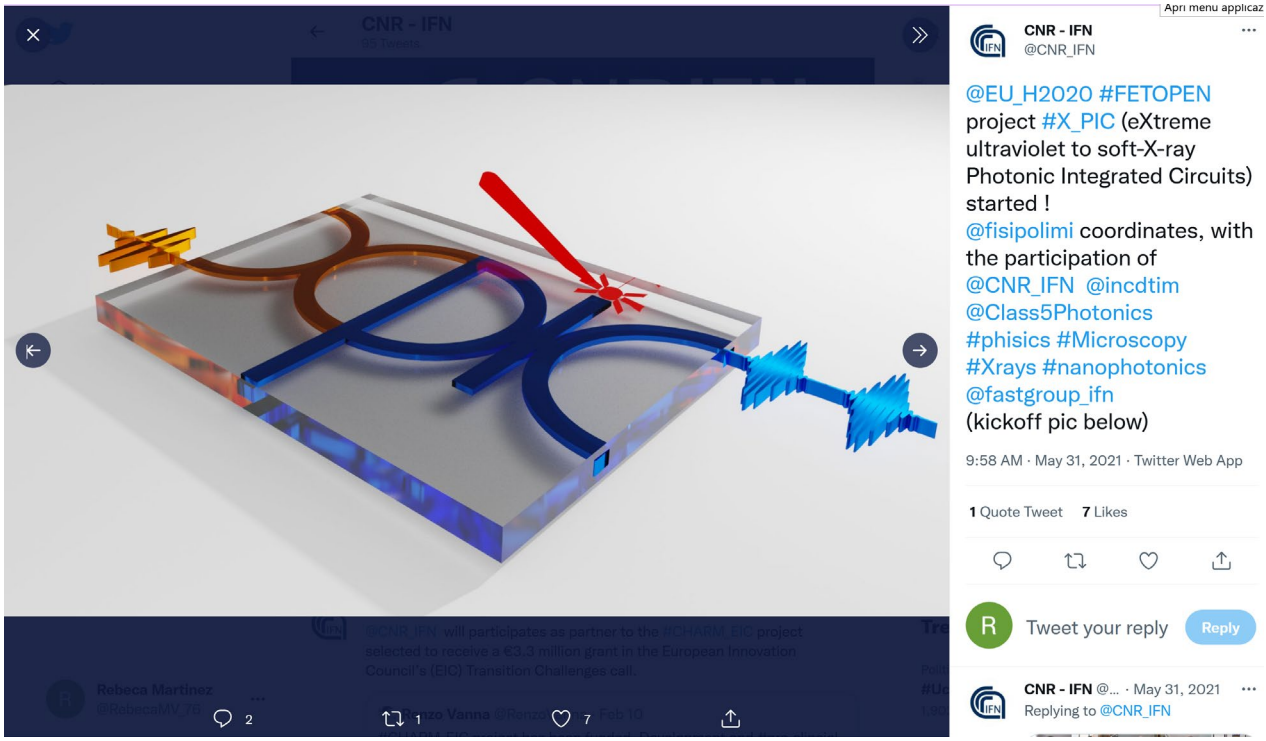


FIGURE 5 TWITTER POST ON IFN CNR ACCOUNT

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 964588.

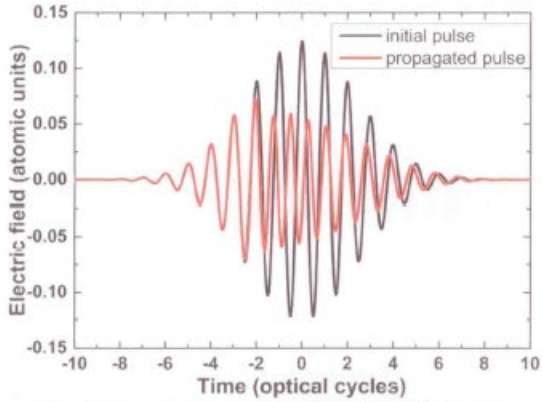


Figura 1. *Forma temporală a unui puls laser de 20 fs și 1.5 micrometri lungime de undă. Negru: puls cu învelitoare gausiană. Roșu: forma pulsului după ce s-a propagat 1 mm în 120 torr de argon.*

instantanee ale pulsului. Mai tehnic vorbind, intensitatea și faza câmpului laser în momentul interacțiunii cu atomul determină crucial rezultatul interacțiunii. Ar fi un eșec total dacă am presupune că interacțiunea laser-atom are loc cu un puls precum cel negru din *Figura 1*. Rezultatele măsurătorilor experimentale nici nu s-ar asemăna cu cele așteptate. Așadar, cunoașterea exactă a formei de puls, atât în domeniul temporal cât și în domeniul spațial, are o importanță crucială în orice experiment și orice aplicație.

În proiectul Pulse-MeReAd ne propunem să dezvoltăm un instrument numeric rapid cu care se poate reconstrui forma completă temporală și spectrală (conținând amplitudine și fază) a pulsurilor laser ultrascurte obținute la ELI-NP. Există metode experimentale de caracterizare a pulsurilor, cum ar fi „frequency resolved optical gating" (FROG), iar ca rezultat se obțin imagini 2D complicate, denumite spectrograme, care sunt practic amprenta pulsului necunoscut. Noi dezvoltăm un software bazat pe *deep neural networks* (DNN) pentru reconstruirea completă a pulsurilor generate la ELI-NP. Construim un DNN care procesează ca *input* amprentele 2D, iar ca *output* de predicție furnizează amplitudinea și faza spectrală a pulsului necunoscut. În *Figura 2* ilustrăm schematic principiul metodei propuse. Scopul nostru este să demonstrăm fezabilitatea științifică și să validăm proprietățile critice prin experimente de tip *proof-of-concept*, adică să antrenăm DNN-ul pentru reconstruirea pulsurilor din spectrogramele obținute în măsurătorile experimentale la ELI-NP.

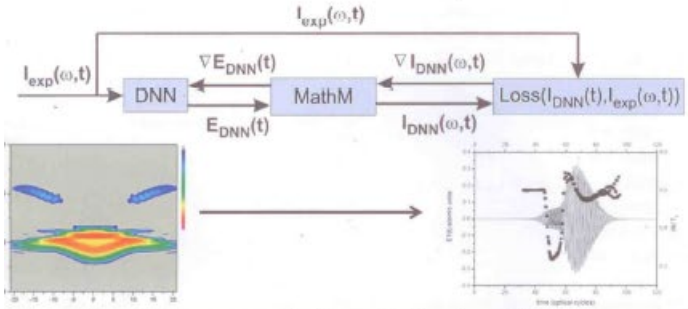


Figura 2. *Schema conceptuală a metodei bazate pe DNN pentru reconstruirea temporală (amplitudine + fază) a unui puls laser necunoscut (dreapta jos) din amprenta FROG măsurată (stânga jos).*

Proiectul H2020: X-PIC

Un proiect H2020 foarte interesant în care suntem implicați ca parteneri se intitulează „eXtreme ultraviolet to soft-X-ray Photonic Integrated Circuits", pe scurt X-PIC. Acesta este un proiect de tip FET (Future and Emerging Technologies) și este dedicat cercetării fundamentale. Partenerii în acest proiect ambițios sunt Politecnico de Milano (coordonator), CNR Italia, INCDTIM România, C5 Photonics GmbH Germania, perioada de desfășurare este 2021-2025. Scopul principal al proiectului este realizarea unui instrument miniaturizat pentru obținerea de radiație coerentă în XUV și raze X prin explorarea procesului de HHG în mediu de gaz rar într-o geometrie aparte. Conceptul de bază este acela de „lab-on-chip": se vor fabrica micro-chipuri cu micro-canale săpate în material dielectric, umplute cu gaz, prin care vor propaga pulsuri laser în infraroșu. În aceste ghiduri de undă miniaturizate se vor genera armonice de ordin foarte înalt, astfel încât se va atinge domeniul spectral „water window" (~300 eV). Eficiența procesului de generare de armonice este mai ridicată în fibră decât în spațiu liber, iar prin modularea controlată a diametrului fibrei, precum și a presiunii gazului de interacțiune, se poate obține o creștere suplimentară a fluxului de radiații XUV. Mărimea unui astfel de dispozitiv X-PIC va fi de ordinul milimetrilor! În *Figura 3* arătăm o ilustrație stilizată a schemei de principiu a echipamentului propus X-PIC.

Proiectul X-PIC va furniza un echipament compact și ieftin ca sursă de radiații XUV și raze X-moi. Echipamentul va putea fi folosit în orice laborator farmaceutic, de biotehnologie, în industria semiconductorilor, sau de companii care produc chimicale. O utilizare foarte promițătoare va fi în medicină, chiar în protocoale clinice.

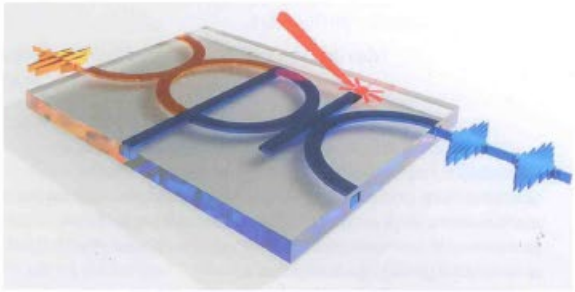


Figura 3. *Schemă stilizată a structurii de principiu a canalelor umplute cu gaz, săpate într-un mediu dielectric, care formează baza echipamentului X-PIC.*

Rolul INCDTIM în procesul de dezvoltare a acestui „lab-on-chip" este de a construi modelul matematic și de a efectua calculele numerice care descriu propagarea pulsurilor în ghiduri de undă si apoi de a rezolva problema generării de armonice în acest mediu. O parte semnificativă și cu impact direct va fi găsirea configurațiilor optime de grosimea canalelor, modularea diametrului și modularea densității gazului prin canale pentru a maximiza fluxul de fotoni XUV care se poate obține. ■

FIGURE 6 MARKET WATCH ARTICLE

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 964588.

Circuit fotonic integrat în domeniul XUV și raze X

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Acasă

Programul: PNCDI III, Programul 3 – Cooperarea Europeană și Internațională

Subprogram 3.6 – SUPORT

Tipul proiectului: PN-III-P3-3.6-H2020

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 964588

FIGURE 7 WEBPAGE OF THE PROJECT ON INCDTIM PAGE