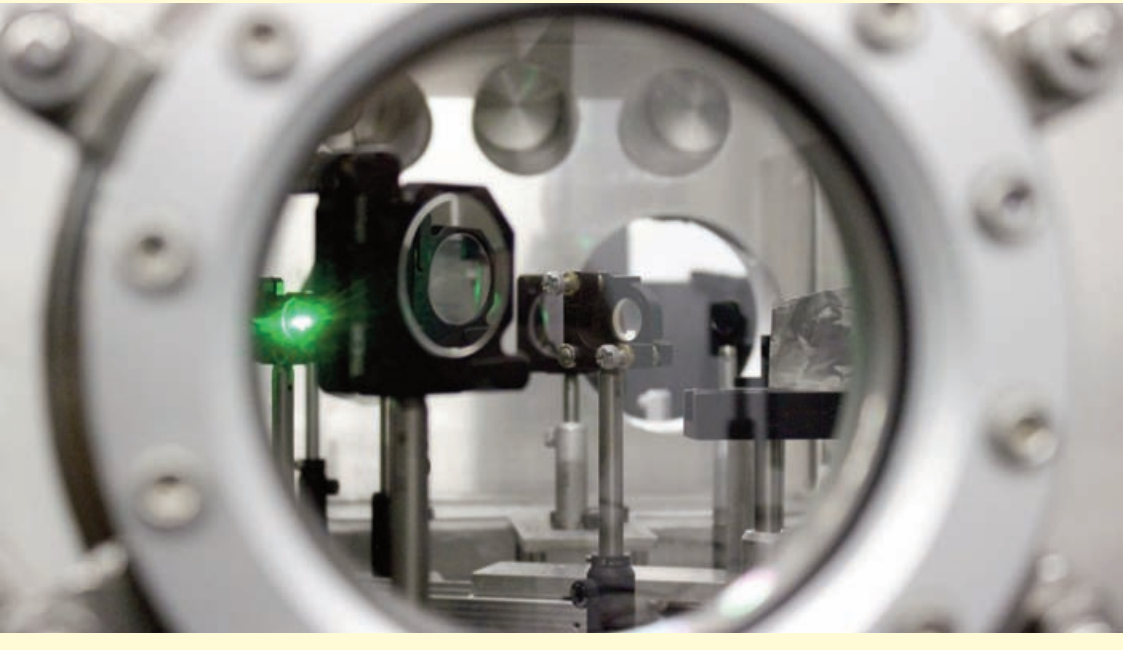
CLPU

CENTRO DE LÁSERES PULSADOS

Activities Report

2020



GOBIERNO DE ESPAÑA · MINISTERIO DE CIENCIA E INNOVACIÓN

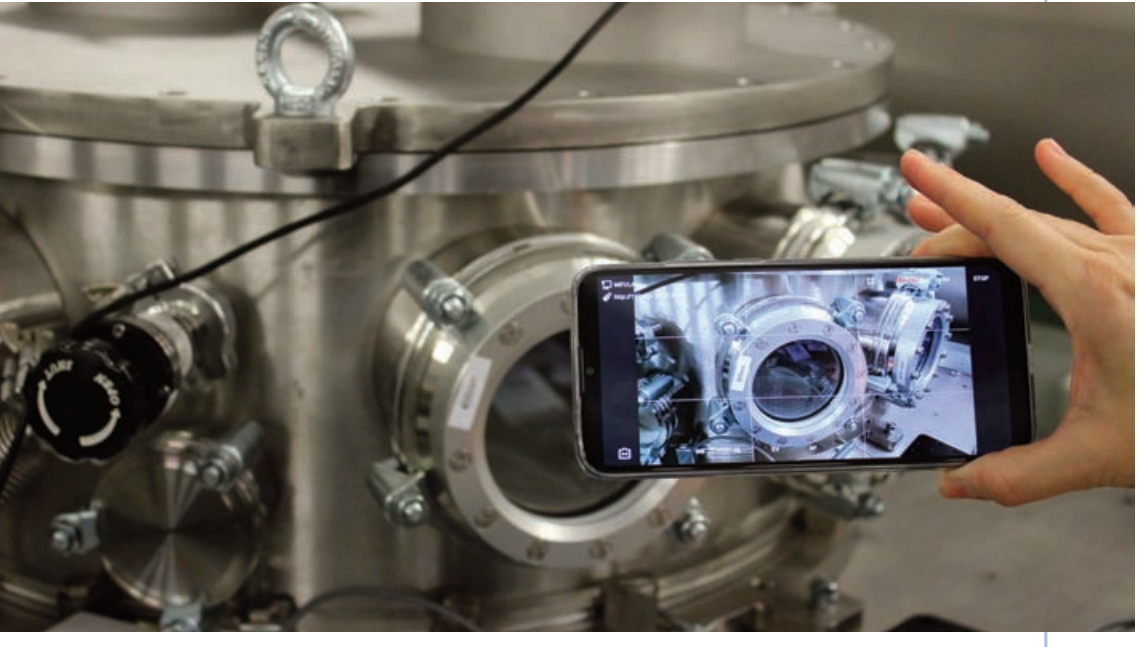
Junta de Castilla y León

VNIVERSIDAD D SALAMANCA
CAMPUS DE EXCELENCIA INTERNACIONAL

UNIÓN EUROPEA

Una manera de hacer Europa

"FONDO EUROPEO DE DESARROLLO REGIONAL"



Design: Javier Sastre
Cover image: Yaiza Cortés and Javier Sastre
Salamanca, 2021

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MESSAGE FROM THE DIRECTOR

2020. A difficult, strange and complicated year that might have been taken from a science fiction film but was, nevertheless real and devastating in many aspects. The sorrow of the thousands of families that have suffered losses, or of the freelance workers who have been forced to close down their businesses is impossible to express, as impossible as it is to gauge the impact of the closure of borders in a globalized world. And, on the other side of the coin, the pandemic has brought to light the courage and determination of thousands of professionals from different fields: police, urban-waste management workers, physicians, the army, nurses… and science and innovation, the latter recovering a role that the pre-SARS-CoV-2 socioeconomic progress at the global level had overshadowed.

Most certainly, at the Center for Pulsed Lasers we have also felt the shock waves of the earthquake that Covid-19 has caused, but as a public institution we have managed to adapt to meet its challenges. Let this report be an instance of the efforts made by all the infrastructure's workers to ensure the continuity of science and progress linked to VEGA, even during the first months of the 'new normal'. Thus, you will be able to see how after postponing some of the scheduled experiments of the second call, an effort was made in collaboration with the University of Osaka to be able to carry out what has been the CLPU's first remote experiment. Likewise, this impasse of almost complete isolation of countries has been used to implement improvements in the system, weaving a new future for VEGA's singularity at the international level. We also launched the third open access call for competition to VEGA and committed to continue scientific collaboration and training online, holding events like our Summer School in September.

In dark times there is a need for light, and at the Center for Pulsed Lasers we believe that the greatest light is that shed by society, science and innovation, because there is no future without them. This is the view of the three institutions that drive this infrastructure and, already with their support in 2020, they entered into dialogue to ensure the continuity of the consortium that forms the CLPU. I would like to use these lines to publicly thank the effort that is being made for the consolidation of this laser center for which we have worked so hard.

Finally, I would once again like to draw attention to our users, who are the ones to give meaning to our existence, since we are not only a research center but, above all, a user center. To them we owe our relentless efforts to ensure technological and scientific progress.

Thank you.

Luis Roso

CLPU director

EXPERIMENTAL CAMPAIGNS

The experimental schedule for 2020 at the facility included six campaigns corresponding to the second experimental annuity of the second open access call for competition to use VEGA. The first two, scheduled to take place between January and March, were developed as planned; however, after the world health crisis triggered by SARS-CoV-2, the remaining campaigns had to be postponed. Only after the healthcare lockdown measure ended in Spain was the remote implementation of one of the pending campaigns agreed, thus beginning the digital transformation of VEGA's experimental service at the CLPU.

Months with scheduled campaigns (Pre-Covid situation)

Final scheduling of the competitive campaigns (Post-Covid situation)

Ultimately only 205 of the 640 planned hours could be completed, which means that 62.5% of the sessions had to be postponed.

Therefore, the situation forced a replanning of the year that led to an effective use of resources to develop three key lines of action: the beginning of a digital change that could contribute to a continuum in the research carried out by the infrastructure's users and that made the start of the first remote experiment possible; innovations in VEGA to improve its positioning at the technological cutting edge as a unique instrument worldwide; and the streamlining of optimization in the experimental area, whose versatility was tested after the end of lockdown and summer as the first stage of a strategic campaign.

Let us begin with an analysis of the experimental campaigns that as

a user center could be carried out at the beginning and end of the year.

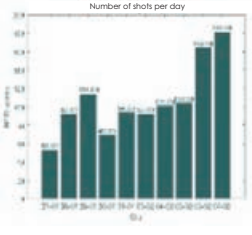
Competitive Campaign 01 :	*Stopping power measurements of energy-selected ions in a moderately coupled and degenerate plasma*
Timeline:	27 January to 7 February
Area:	Particle acceleration Medical applications

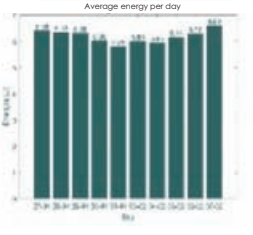
Aims

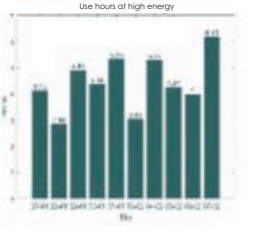
The aim of this experimental campaign is to measure the stopping power of a proton beam in extreme plasma, near the Bragg peak, where the speed of protons is comparable to electron thermal velocity in plasma. This experimental study in kilojoule facilities is very complex and has many limitations, which is why an approach using a pulsed ultra-intense laser was designed, its advantages being as follows: it offers pump/probe experimental conditions synchronized in the femtosecond range; high versatility, which allows the use of the same configuration to measure plasma conditions and proton stopping power; and, above all, VEGA's high repetition rate enhances statistical data collection. This experiment is the continuation of one that was started in the first call. In this case, the specific aims were:

- To characterize the proton beam using a magnet selector and select a 500 KeV beam with a scattering energy lower than 50 KeV,
- To study the stopping power using a 1 μm dry ice target and, subsequently, analyze the resulting plasma under specific temperature and density conditions.

VEGA operational data

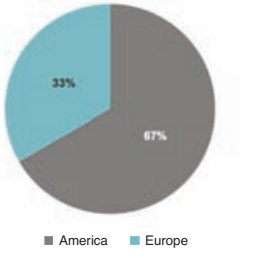






Principal investigator

USAL - CLPU



Partner institutions

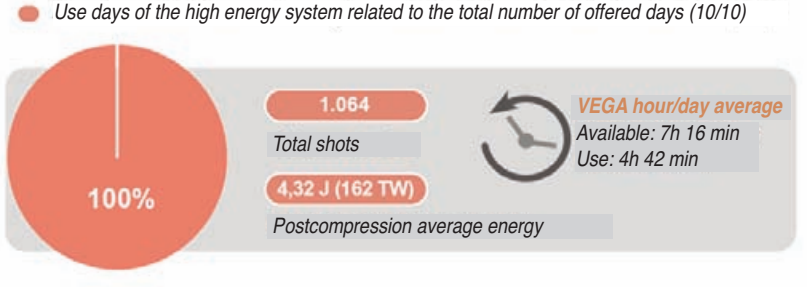
> University of San Diego (USA)
> University of Alberta (Canada)
> CELIA (France)

Outcomes and conclusions

This experimental campaign has led to three major achievements:

o Design and characterization of a new adjustable platform for proton-energy selection from laser-plasma sources.

o Confirmation of the feasibility and usefulness of the proton-energy selector by measuring the energy loss of the proton projectile on cold solid targets of different thicknesses. The first proton stopping power measurement is performed in Warm Dense Matter (WDM). The proton energy loss obtained through the measurements suggests that classical models overestimated the lost energy. However, the findings are consistent with the latest theories.

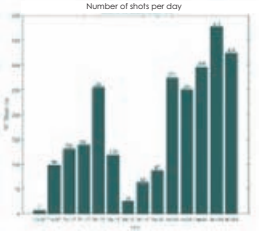


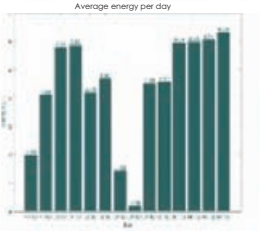
Competitive Campaign 02	*Proton/Electron beams' Space/Time characterization*
Timeline:	17 February to 6 March
Area:	Particle Acceleration (electrons)
	X-Ray Source Generation

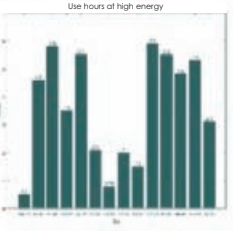
Aims

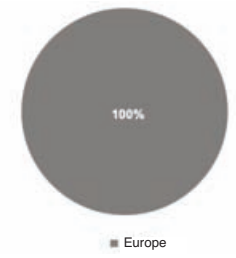
One of the phenomena that take place in laser-plasma interaction under certain conditions is Laser Wakefield Acceleration (LWFA). This phenomenon involves a charge separation in the plasma that generates intense electric fields that can persist in time long enough to accelerate electrons up to relativistic speeds. The latter, in turn, being accelerated charges, generate radiation. The spatiotemporal characteristics of these accelerated electron beams intrinsically depend on the laser's parameters, as well as on the properties of the plasma and on a variety of mechanisms that are involved, such as electron injection. Thus, the aim of this experimental campaign was to accelerate electrons by aiming the VEGA 2 laser (200 TW, 30 fs) at a gas target, mainly helium and/or hydrogen, using the LWFA mechanism and attempting to induce the injection process using a secondary beam (probe). Likewise, given that it is an experiment using secondary sources, the purpose is to define the properties of the electron beam and the terahertz radiation (THz) generated under these conditions, using different diagnostic methods.

VEGA operational data









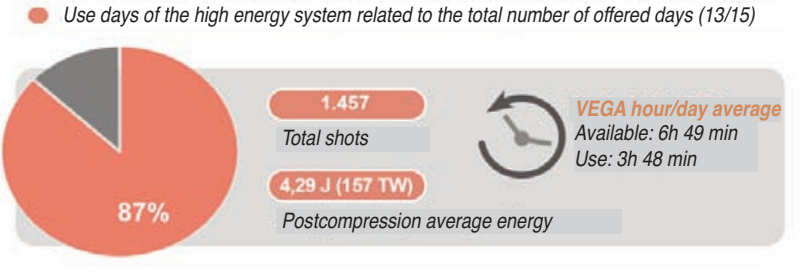
Principal Investigator: CLPU

Partner institutions:

> Chalmers University of Technology (Sweden)
> University of Strathclyde (UK)

Outcomes and conclusions

The data obtained in this experimental campaign are still being analyzed, but, in a very preliminary way, it may be affirmed that an effective electron acceleration of up to 100 MeV was achieved through some of the tested injection processes: self-injection, ionization injection…



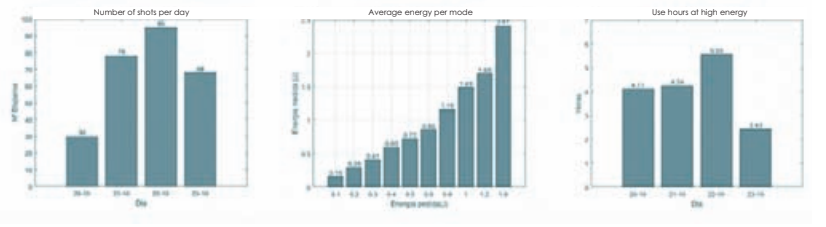
Strategic Campaign 01	*Focal Cone for High Order Harmonics – Phase I*
Timeline:	9 to 24 October
Area:	VUV / XUV experiments

Aims

The main purpose of this strategic campaign is harmonic generation with argon using a large volume (as compared to usual experiments) at 40 mb/mm of total gas volume. For this purpose, an ad hoc system was designed in VEGA-2 to use it at greater power, and the gas ionization (at a large volume) and recombination experiments were ca-

rried out. After passing VEGA's beam, the harmonic signals were sought in around tens of eV. However, because an IR filter was prepared in order to appropriately preserve the University of Alberta's UV detection camera, the UV detection threshold could not be reached. The experiment will continue in the coming year. Its optimization will open up a new field of application for VEGA that will not require radioactive-mode work and that may provide a unique VUV or XUV source.

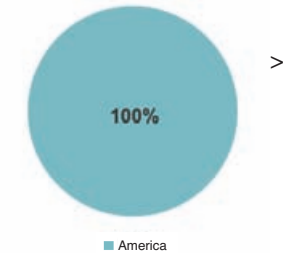
VEGA operational data



ince it is the first stage of an experimental campaign, no conclusions can yet be drawn from the first outcomes. Therefore, such conclusions will be addressed when the experiment is completed next year.

Principal Investigator: CLPU

Partner institutions:



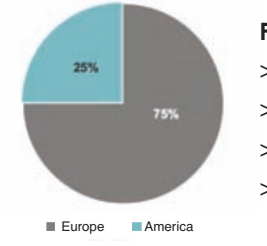
> University of Alberta (Canada)

Competitive Campaign 03	*VEGA-3 Commissioning: characterization of ion acceleration (1st phase)*
Timeline:	30 November to 4 December
Area:	Particle acceleration

Aims:

This experimental campaign sets two main landmarks. On the one hand, it is the first commissioning (execution and testing) experiment where the VEGA-3 system will be repetitively fired at various energies and time lapses, including its 30-Jule peak power and maximum 30-femtosecond laser pulse compression. At the same time, another goal is to conduct a study on how solid target thickness influences particle acceleration, together with the laser's pulsed energy and duration. Such analysis will allow the characterization of both the laser's parameters (power and focus stability, and time-lapse conditions), and the particle acceleration mechanism. All the data obtained will be used to analyze the laws of motion for particle acceleration using machine learning. This is the first experiment that the Center has conducted remotely with the principal investigator connected online and with the possibility of following the campaign using a system of cameras and viewfinders. The experiment is carried out in collaboration with ELI-ALPS, ENEA and the Lawrence Livermore National Laboratory, who loaned several detectors for the experiment.

Principal Investigator: Institute of Laser Engineering — University of Osaka, Japan



Partner institutions:

> Centre for Pulsed Lasers, Spain
> ENEA, Italy
> ELI-ALPS, Hungary
> LLNL, USA

Outcomes and conclusions

Pending data from the conclusion of the experimental campaign in January 2021 (2nd phase)

INNOVATION IN THE PW LASER SYSTEM

In 2020, the CLPU's specialized staff focused on the advanced implementation of technological developments that could boost VEGA's positioning as a unique and highly versatile tool with high added value for the user community. Bearing in mind that, as already mentioned, many experimental campaigns had to be postponed, the CLPU devoted its resources to improving the worldwide uniqueness of its petawatt system through the following actions:

- **Increase in the versatility of experimental stations and supplementary services:** This instance of technological progress has been achieved through a project associated with the Spanish ERDF Pluriregional Operative Program (POPE 2014 – 2020) call. In its context, the Centre for Pulsed Lasers presents the design of a *Pump&Probe* that involves the synchronization of VEGA's unique equipment with the CEP laser system, a system with lower-intensity but short-pulse-duration beams (6 femtoseconds) that allows an extraordinarily accurate temporal discrimination. One of the main activities of 2020 has been the drafting and publication of the tender-FEDER technical specifications to obtain the necessary material for this enhancement in operational modes. Likewise, work with the *Amplitude Technologies* company for the synchronization over fiber of VEGA's oscillators and the CEP laser is started.
- **Improvement of the stability of the amplifier of VEGA-2 at high-repetition rate:** Assessment of the cooling of the amplifying crystal of VEGA-2 by the Amplitude Technologies company, involving the dismantling of the amplifier's crystal and the replacement of the conductive material's coverage by a new one that improved the coolers functioning and eliminated a large part of the degradation in the beam that was caused by a lack of thermal dissipation at high-repetition rates. This process revealed that, at high-repeti-

tion rates, the thermal stress generated in the cryogenic entrance windows also affected the beam, which led to the decision of replacing it.

- **Improvement in the stability of VEGA 3 during single shot/repetition:** Because this amplifier is water-cooled, the difference in the thermal stress of VEGA-3 is very different when it operates in single-shot mode and in high repetition mode, which means that VEGA-3's output quality requires different settings for each of these situations. To ensure that the amplifier's crystals maintained the same conditions in both shot modes, a large-sized shutter was designed. This shutter is based on a motor with enough speed and precision to allow the precise movement of a large mirror inside and outside the line in the time-lapse between two 1 Hz pulses, that is, one second. A motor supplier that can customize it to include VEGA's synchronization electronics is being sought.
- **Improvement in the cleaning of the cooling circuit of laser power sources:** To prevent future failures, the composition of the dirt of the cooling system is analyzed after observing a significant accumulation of ferrous material that was damaging the valves. Thus, an action plan including the checking and cleaning of the heat exchanger between the primary and the secondary circuits was designed, and the buffer tank was replaced with a stainless steel one to prevent dirt from lingering on the line.
- **Implementation of single shot in the Experimental Area:** The hardware and software required to fire VEGA from the experimental area is developed and implemented, allowing remote firing from the user area.
- **Implementation of an application for the maintenance and inclusion of components associated with VEGA and its attached installations:** The programming of the specific maintenance application for laser laboratories, where all the components associated with VEGA and its attached installations is completed. The application makes the use and maintenance of the facility in coordination with the group of associated technicians easier.
- **Solving of VEGA's diode string shutters connected to PSS:** The closing time of the compressed-air shutters that are used to block VE-

GA's seed beam when it is in diode alignment mode had deteriorated. Such time gradually increased leading to safety errors in the PSS system that eventually affected the entire string due to the system's safety closure each time it detected such delays. A test target was assembled in Summer 2020 and the times the system crashed were analyzed according to the pressures used. Every piston on the string that was damaged due to this constant pressure was replaced, the circuit was adequately pressurized for its operation, and plans are being discussed to purchase new pistons that are tested in this operation mode.

- **Proposal for Q-switch closure prototype:** Following its design, the set up of an electronic prototype that can prevent the emission of a certain number of pumped laser beams depending on the installation's operative mode and in relation to the PSS system has begun. This module will become operative to prevent errors that might lead to the entrance of a dangerous number of pumped laser beams.
- **Implementation of a short pulse generation in saturable absorber simulation program:** A version of the FDTD algorithm for short pulse propagation in media such as saturable absorbers has been developed. The algorithm has been verified using data obtained from classical references and is currently being used to find the best absorber in terms of size and features to achieve an efficient temporal contrast filter for VEGA's front-end.
- **Collaboration with the Lund Laser Centre** to optimize the cleaning of the diffraction networks of VEGA's compressors.

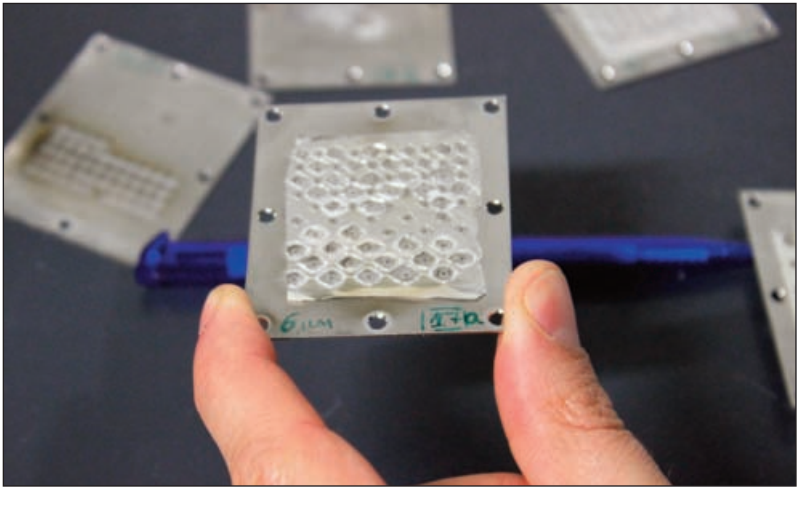
In view of the implementations mentioned above, the summary of VEGA's operational modes, including those planned and those already in process, stands as follows:

- VEGA-1 (20 TW)
- VEGA-2 (200 TW)
- VEGA-3 (1 PW)
- VEGA + CEP
- VEGA + Quanta Ray
- VEGA-2 + VEGA-3
- VEGA-1 + VEGA-2
- VEGA-1 + VEGA-3
- Uncompressed VEGA-2 + VEGA-3
- Uncompressed VEGA-1 + VEGA-3

Operational

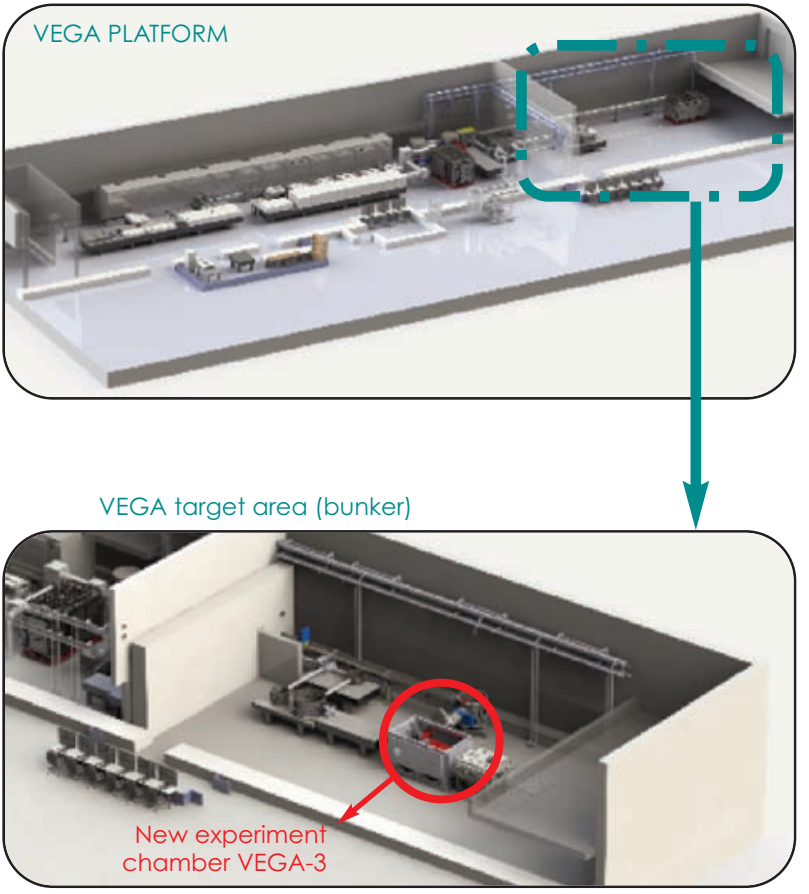
Commissioning phase

Research and planning phase



OPTIMIZATION OF THE TARGET AREA

Although VEGA is the major focus of the infrastructure, it must be noted that such a cutting-edge tool would be useless without an experimental area in keeping with it that enables the extraction of the full potential of the system's beam. Hence, in 2020, the Center's specialist scientists have devoted their efforts to optimizing an experimental area that can measure up to VEGA.



It is therefore also important to draw attention to the technological progress achieved in the testing bunker in 2020:

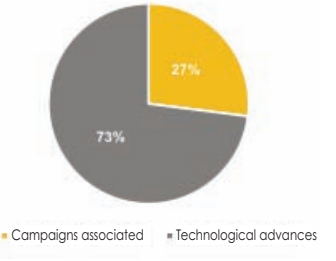
- **Optimization of the target area for VEGA-3:** After the first commissioning experiment using VEGA's most powerful output in 2019, and upon obtaining the approval of the Nuclear Safety Council for using its full operating capacity, the Center for Pulsed Lasers focused on completing the development of VEGA-3's experimental area to make full use of the laser system. In this regard, a new experimental chamber was acquired and set up adjacently to the already existing beam transport chamber to optimize the use of VEGA-3 in experiments that mainly involve particle acceleration.

- **Optimization of the target area for remote experiments:** The Center for Pulsed Lasers supports constant scientific progress and its impact on innovation and knowledge transfer. Accordingly, the strategic line followed after the end of the state of alarm has been one of transformation towards the 'new normal' of science and experiments in facilities such as ours. After a series of meetings with the principal investigators of the campaigns that were pending, the remote design of one of the experiments was agreed. Thus, alongside the fine-tuning of VEGA-3's experimental interaction chamber, efforts have been made to plan the remote campaign, including the purchase of the necessary material to capture high-definition images, control the scientific tools required and communicate in streaming. This is the first step towards a modality intended to prevent research from

being stopped. The product of this joint effort was the creation of LYRA, an interdisciplinary team made up of systems technicians, engineers and physicists. It is a platform that encompasses a wide array of applications to manage the controls, system acquisition and exploitation of the data corresponding to the architecture VEGA's associated devices.

COMPLEMENTARY SERVICES

Mechatronics



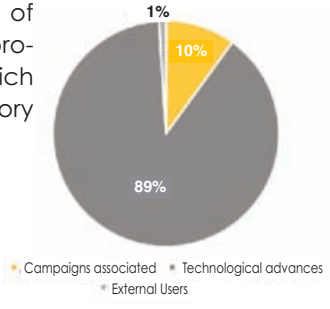
The mechatronics workstation is one of the complementary services that the Center for Pulsed Lasers offers. It is also unquestionably the one that provides the greatest added value to each campaign, since it allows the research team to perfectly adapt the experimental settings to their needs in a fully customized way. The workstation's key piece is its continuous 5-axis milling machine, which can produce highly complex pieces, ranging from optomechanical frames to customized prototypes. In 2020, it accumulated 248 hours of machining corresponding to 15 applications.

ULAMP

Ultrashort Laser Applications and Micromaterial Processing

This laboratory offers a high-quality laser material processing specialist service, available for both scientific research and development, and for industrial innovation. On several occasions, this laboratory has also been used for experimental campaigns, both of strategic and competitive access. Most of the time it has been associated with the customized implementation of experimental targets. As with the machining workstation, in 2020 it has been used several times for the technological implementation of new independent development ad-

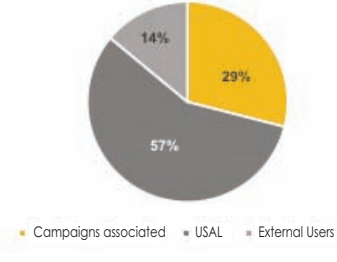
vances. Hence, the service distribution of the five applications that have been processed through the FARO platform, which amount to almost 90 hours of laboratory work, is as follows.



Microscopy

The main equipment of this complementary service consists of a SEM EVO HD25 scanning electron microscope capable of producing high-resolution images of samples of less than 10 microns. It also includes three different detectors that enhance its value: a secondary Everhart-Thorney electron detector; a secondary variable pressure electron detector; and a 5-segment retro-dispersed electron detector.

This is the first service that the Center of Pulsed Lasers made officially available. Most of its users are from the University of Salamanca and have received support in different research areas such as geology, chemistry or pharmacy. This year, however, the equipment has also been used by researchers from experimental campaigns, once again supplementing with its high versatility the unique service provided by the Center.



RESEARCH

Results

- Publications *(blue for experimental campaigns)*:

o Claps. G.; Cordella, F.; Pacella, D.; Romano, A.; Murtas, F.; Batani, D.; Turianska, O.; Raffestin, D.; Volpe, L.; Zeraouli, G.; Pérez-Hernández, J.A. and Malko, S. Soft X-ray measurements with a gas detector coupled to microchips in laser-plasma experiments at VEGA-2, Journal of Instrumentation, vol. 15, 2020.

o Rueda, P.; Videla, F.; Neyra, W.; Pérez-Hernández, J.A., and Ciappina, M.F., Above-threshold ionization driven by few cycle spatially bounded inhomogeneous laser fields, Journal of Physics B: Atomic, Molecular & Optical Physics, vol. 53, nº 6, 2020.

o Joundourakis, G.; Kucharik, M.; Limpouch, J.; Liska, R.; Salgado, C. et al, Innovative education and training in high power laser plasmas (PowerLaPs) for plasma physics, high power laser-matter interactions and high-energy density physics: experimental diagnostics and simulations, High Power Laser Science and Engineering, 8, 2020.

o Nelissen, K.; Liszi, M.; de Marco, M.; Ospina, V.; Drotár, I.; Gatti, G.; Kamperidis, C. and Volpe, L., Characterisation and modelling of ultrashort laser-driven electromagnetic pulses sources, Scientific Reports, 10, 1, 2020.

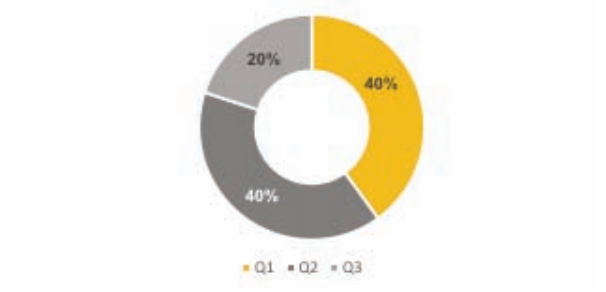
o Longman, A.; Salgado, C.; Zeraouli, G.; Apiñaniz, J.I.; Pérez-Hernández, J.A.; Khairy Eltahlawy, M.; Volpe, L. and Fedosejevs, R., Off-axis spiral phase mirrors for generating high-intensity optical vortices, Optics Letters 45, 8, 2187-2190, 2020.

o Pastor, I.; Álvarez-Estrada, R.F.; Roso, L.; Castejón, F. and Guasp, J., Nonlinear relativistic electron Thomson Scattering for laser radiation with orbital angular momentum, Journal of Physics Communication, vol. 4, nº 6, 2020

o Doctoral thesis defended online on 20 May by Sophia Malko, CLPU researcher, under the title "Laser-driven charged particle transport in warm dense matter and plasma".

o Doctoral thesis defended online on 13 October by Ghassan Zeraouli, CLPU researcher, under the title "Experimental studies for generation, transport and applications of ultra-short laser driven x-ray sources".

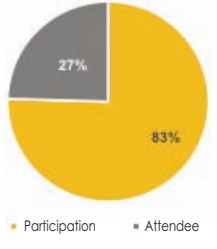
- Roso, L; Pérez-Hernández, J.A.; Lera, R., and Fedosejevs, R., 'The role of the ponderomotive force in high field experiments' chapter of the upcoming book of the PUILS series, Progress in Ultrafast Laser Science XVI (Springer Series in Chemical Physics), Yamanocuhi, K.; Midorikawa, K., and Roso, L. editores. Pending printing.



Quartiles (JCR 2019)

- Specialized events with shared results:

In 2020, the specialized staff of the Center have attended a total of 13 specialist events. Among them, and just before the lockdown period, a collaboration at the Czech facility PALS to conduct the experiment Study for temporal correlation between hot electron generation and the growth of plasma instabilities in different targets. It is important to note that more than 80% of these events involved direct participation of our researchers and technicians, as shown in the following results table:



Roso, L., VEGA, the Spanish High Repetition Rate Petawatt System, First Meeting of the European XFEL Spanish User Community, 12 to 15 January 2020, Leiden (Netherlands) [Presentation]

Roso, L., Science at the Center Pulsed Lasers with HRR lasers, Extreme Physics, Extreme Data at Lorentz Center, from 13 to 17 January 2020. [Guest presentation]

Colomer, B.; Ortiz, R.; Roso, L. and Rico, M., LASERONUAV – Development of a laser microdiode in 2.1 um as countermeasure system from RPAS, 9th International Symposium on Optronics in Defense and Security —OPTRO2020—, from 20 to 30 January 2020, Paris (France) [Presentation]

Apiñániz, J.I., Science at the Spanish Petawatt Laser, XII Jornadas de Jóvenes Investigadores en Física Molecular y Atómica —J2IFAM—, from 3 to 6 March 2020. [Guest presentation]

De Marco, M., Generation of EMP during high intense pulse-target interaction experiments, Fourth Workshop on Beam Line and Instrumentation —BLIN4—, 29 June 2020, Munich (Germany) [Online presentation]

Huault, M., RCF vs scintillator stack-based diagnostics for TNSA proton spectrum, Fourth Workshop on Beam Line and Instrumentation —BLIN4—, 29 June 2020, Munich (Germany) [Online presentation]

Roso, L., Salamanca experience on the high repetition rate experiments challenges, Fourth Workshop on Beam Line and Instrumentation —BLIN4—, 29 June 2020, Munich (Germany) [Online presentation]

Roso, L. Pulsed-light laser system, at the summer school organized by the Technical University of Cartagena 'Innovation and technology: New operating scenarios for security and defense', 30 June to 3 July [Online]

Pisonero J.D., FDTD Modeling of double ultrashort pulse propagation in nonlinear absorbing media, European Optical Society Annual Meeting —EOSAM—, 7 to 11 September 2020. [Online poster]

Roso, L., Introduction to CLPU, LaPlaSS2020 Experimental methods in high-intensity laser-plasma processes, 14 to 18 September, Salamanca (Spain) [Online presentation]

Volpe, L., Introduction to laser-plasma processes (VEGA), LaPlaSS2020 Experimental methods in high-intensity laser-plasma processes, 14 to 18 September, Salamanca (Spain) [Online presentation]

García, E., Laser Diagnostics, LaPlaSS2020 Experimental methods in high-intensity laser-plasma processes, 14 to 18 September, Salamanca (Spain) [Online presentation]

Zeraouli, G., X-Ray diagnostics for HRR experiments, LaPlaSS2020 Experimental methods in high-intensity laser-plasma processes, 14 to 18 September, Salamanca (Spain) [Online presentation]

Huault, M., Ion Diagnostics for HRR experiments, LaPlaSS2020 Experimental methods in high-intensity laser-plasma processes, 14 to 18 September, Salamanca (Spain) [Online presentation]

Malko, S., Selection and measurement of ion beam for applications, LaPlaSS2020 Experimental methods in high-intensity laser-plasma processes, 14 to 18 September, Salamanca (Spain) [Online presentation]

Apiñániz, J.I., Introduction to particle spectrometry and detection, LaPlaSS2020 Experimental methods in high-intensity laser-plasma processes, 14 to 18 September, Salamanca (Spain) [Online presentation]

de Marco, M., Laser-Plasma experiments with liquid targets, LaPlaSS2020 Experimental methods in high-intensity laser-plasma processes, 14 to 18 September, Salamanca (Spain) [Online presentation]

Henares, J.L., Design of near-critical gaseous targets, LaPlaSS2020 Experimental methods in high-intensity laser-plasma processes, 14 to 18 September, Salamanca (Spain) [Online presentation]

Salgado, C., Diagnostics of gaseous targets, LaPlaSS2020 Experimental methods in high-intensity laser-plasma processes, 14 to 18 September, Salamanca (Spain) [Online presentation]

Pérez-Hernández, J.A., Experimental activity on VEGA, LaPlaSS2020 Experimental methods in high-intensity laser-plasma processes, 14 to 18 September, Salamanca (Spain) [Online presentation]

Roso, L., The CLPU and the users access, VI CLPU Users Meeting, 01 to 02 October 2020, Salamanca (Spain) [Online presentation]

Volpe, L., Introduction to the VI CLPU Users Meeting, VI CLPU Users Meeting, 01 to 02 October 2020, Salamanca (Spain) [Online presentation]

Volpe, L., The CLPU Plasma-Chair: past, present and future, VI CLPU Users Meeting, 01 to 02 October 2020, Salamanca (Spain) [Online presentation]

Méndez, C., VEGA laser facility 2020, VI CLPU Users Meeting, 01 to 02 October 2020, Salamanca (Spain) [Online presentation]

Roso, L., Laser-driven neutron sources, VI CLPU Users Meeting, 01 to 02 October 2020, Salamanca (Spain) [Online presentation]

Volpe, L., Stopping power measurements of energy-selected ions in a moderately coupled and degenerate plasmas, VI CLPU Users Meeting, 01 to 02 October 2020, Salamanca (Spain) [Online presentation]

Malko, S., Low velocity ion stopping measurement in warm dense matter —WDM—, Plasmaphysik-Seminar Übernächste Woche, 20 October 2020 [Online presentation]

Malko, S., Low-velocity ion stopping power measurement in WDM, 62nd Annual Meeting of the American Physical Society Division of Plasma Physics, 09 to 13 November 2020. [Online presentation]

Malko, S., Experimental study of the dynamics of expanding magnetized HED plasmas, 62nd Annual Meeting of the American Physical Society Divion of Plasma Physics, 09 to 13 November 2020 [Online presentation]

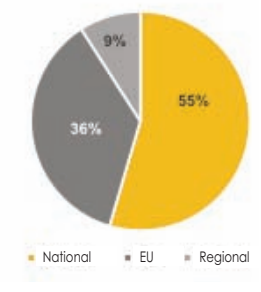
Lera, R. Generation of short x-rays from liquid metal jet source, research stay at ELI-Beamlines for the development of said experiment, January 2020.

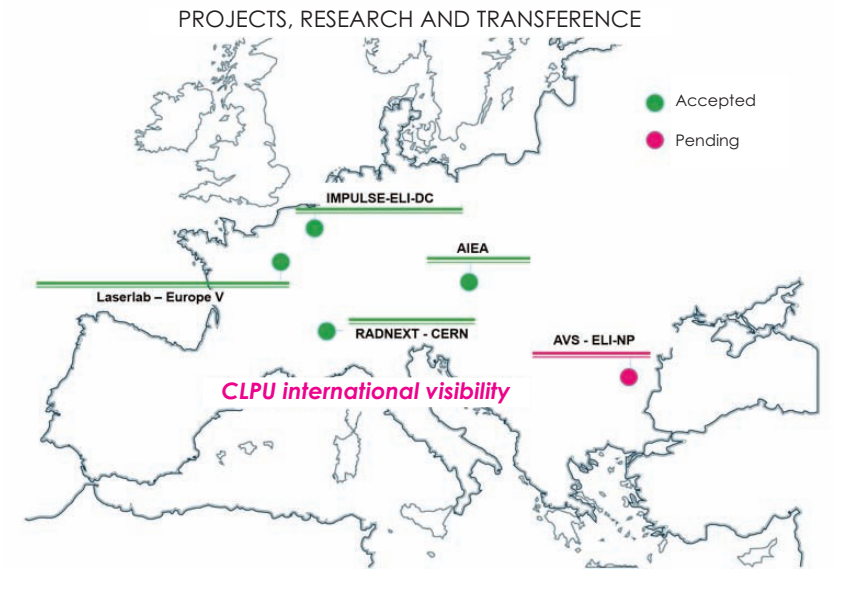
Zeraouli, G., Study for temporal correlation between hot electron generation and the growth of plasma instabilities in different targets (with an intensity of the order of $10^{16}Wcm^{-2}$), research stay at PALS, Prague, for the development of said experiment, March 2020.

Development

- Research Projects

By the end of 2020, the Center for Pulsed Lasers had 13 projects in progress in different areas of application, fields of research and categories, being the leader of over 60% of them, more than 85% belonging to the area of R&D. Without counting an ELI project in the area of nuclear physics, still pending resolution, the CLPU has moved from participating in one single European project to being involved in 5, potentially increasing its visibility as a Unique Scientific and Technical Infrastructure (ICTS) at the international level.





Laser-accelerated particles for medical applications

2016 Research Challenges for the funding of R&D&I projects

Generation of scientific knowledge for the search for solutions to the problems of the challenges of society.

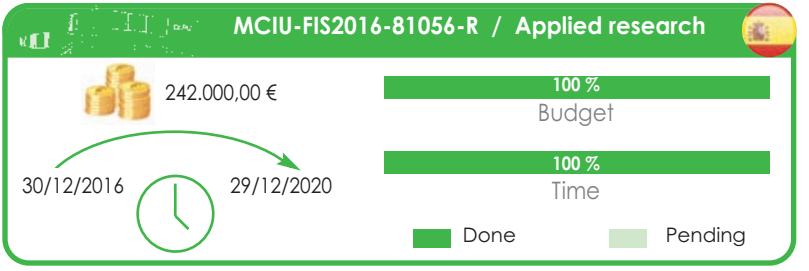
Aim:

The aim of this project is to generate radiation sources to measure and characterize the influence of ultrafast radiotherapy as compared to traditional radiotherapy. Specifically, the purpose is to develop an X-ray betatron source, a TNSA proton source and a preliminary phase neutron source. Such sources will be extremely valuable for biomedical scientists and will also be useful in the area of materials science.

Main actions:

Particle acceleration using intense lasers (such as VEGA) is already a reality, achieving short electron pulses with energies of several hundreds of MeV and proton pulses with energies of several tens of MeV. This team's research work has focused on progress in the creation of such sources, in making them repetitive and systematic and improving their dosimetry. Besides, high-energy X-ray and neutron sources have been achieved.

Specifically, this project represents a significant advance in laser accelerators.



Transport and handling of particles in laser accelerators: new scenarios for FLASH radiotherapy (TYMPAL)

Support Program for Research Projects co-financed by the European Regional Development Fund

Support research projects that include job creation for postdoctoral researchers.

Junta de Castilla y León

Europa impulsa nuestro crecimiento

FONDO EUROPEO DE DESARROLLO REGIONAL

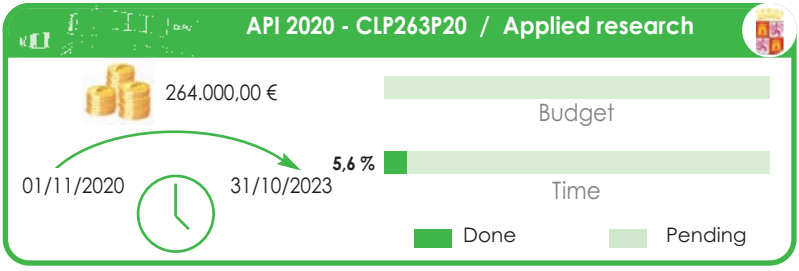
UNIÓN EUROPEA

Aim:

Since it is not possible to use the charged particle transport systems that are common in conventional accelerators, the CLPU has designed this project with the purpose of developing appropriate tools for laser-generated secondary radiation sources. Its main specific application is FLASH radiotherapy. Concentrating the dosage of radiotherapy in a short period of time has a positive impact on biochemical response processes, minimizing size effects. This is known as FLASH because the dose is delivered in a flash, and this is where lasers can take this FLASH to its extreme. Generating FLASH proton and electron sources will be one of the Center's priorities in the coming years in its pursuit to provide the medical community of the area of Salamanca with novel tools to study the biological effects on cancerous and healthy cells of radiotherapy delivered in ultra-short pulses.

Main actions:

The implementation of this project began in November 2020, and it was granted at the end of said year. Hence, the time corresponding to the year addressed in this report is hardly two months, which were devoted to starting the recruitment processes by defining the profiles of the doctorate-holders who were to become involved with the research project.



High-power pulsed laser guided system in the military field (SIGILAR)

2019 Cooperation in Scientific Research and Development in Strategic Technologies (COINCIDENTE) program

To capitalize on civil technologies developed under the R&D National Plan to incorporate innovative technological solutions that are relevant to the Ministry of Defense

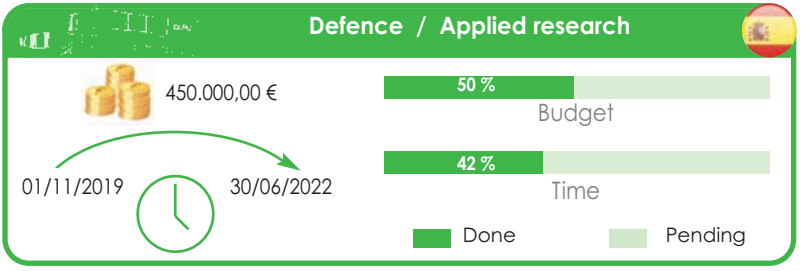
GOBIERNO DE ESPAÑA MINISTERIO DE DEFENSA

Aim:

The purpose of this action is to develop a laser demonstrator with a peak power of more than 15 kW that can emit stable shots and be installed on a platform with a laser beam control and directing system to be able to conduct functionality tests in field trials.

Main actions:

Kick-off meeting with all its participating partners and drafting of the various technical deliverables required (state-of-the-art of laser components and of the architecture of laser systems for the project's applications). After completing the precautionary health measure, the Quanta Ray system was installed and tests and experiments with different laser sources were carried out, drafting the corresponding reports. The design of the laser demonstrator began and so did the purchase of material for it. The specific software for the calculation of the different laser parameters was developed and the opto-mechanical designs for the beam's targeting and direction system were initiated.



Research on pathways to inertial fusión energy at the Center for Pulsed Lasers

This action is framed in the collaboration agreement signed with the International Atomic Energy Agency in the context of its own research project Pathways to Energy from inertial Fusion: Materials Research and Technology Development.

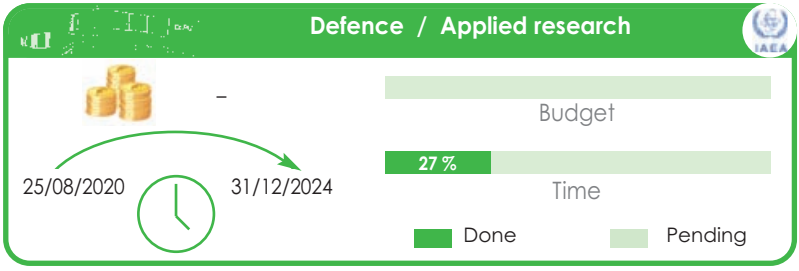
IAEA

Aim:

The project follows three major lines of research: to advance in the development of the science underlying fusion energy; to develop appropriate technology for such purpose using high-repetition-rate systems; and to develop next generation diagnostics.

Main actions:

In 2020, four meetings were held to define the participants' main line of research: orientation, tasks, etc.



Done Pending

Laserlab Europe V

Horizon 2020 > INFRAIA 2018

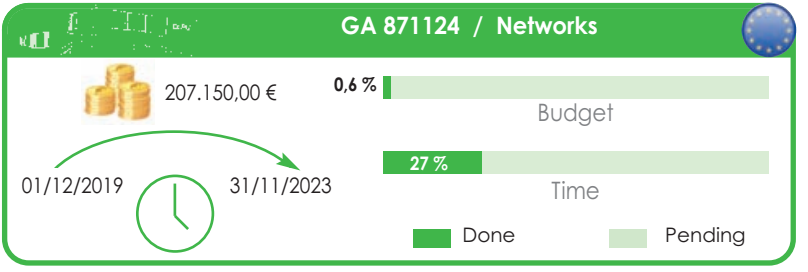
This European project is framed in the H2020 program, under the category of Integrated Activities for advanced communities, whose main purpose is to foster transnational access to R&D&I facilities among European researchers and to promote cooperation among research centers, scientific communities and industry, among others.

Aim:

Its main three objectives are to maintain a sustainable interdisciplinary network of European national laser laboratories, to strengthen the European leading role in laser research through joint research activities, and to offer access to state-of-the-art laser research facilities to researchers from all fields of science to perform world-class cutting-edge research.

Main actions:

2020 has marked the beginning of a period of reflection among the participating institutions to adapt the mechanisms of this network to the new reality generated by the pandemic. An attempt at finding solutions for the significant delays in essential scientific exchange activities that it has brought about has been made. Likewise, and in the framework of this project, the scientific collaboration activity for the analysis of the experimental results jointly obtained by the Center for Pulsed Lasers and the Helmholtz-Zentrum Dresden-Rossendorf in a campaign where a proton detector for high-repetition-rate experiments was tested was carried out.



Integrated Management & reliable operations of user-based laser scientific (IMPULSE)

IMPULSE

Horizon 2020 > INFRADEV 2018

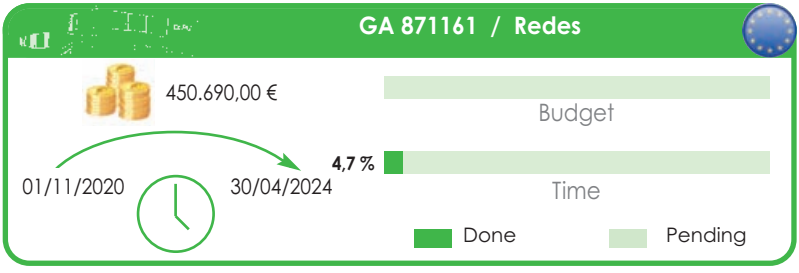
This is a European call, INFRADEV of the Horizon 2020 program, whose main objective is to support the conceptual and technical design of new research facilities. The European research community requires new research facilities in every area of science and technology to stay at the forefront of scientific progress and be able to help the industry to strengthen its knowledgebase to implement advances in technological development.

Aim:

ELI is a pan-European infrastructure devoted to ultra-intense lasers that is in the process of completing the development phase of three key facilities. Therefore, it has been considered relevant to create a project aimed at approaching the scientific, technical, organizational and management requirements that will be necessary for the transition to the full operation phase of the facilities, establishing user communities and broadening the network of members of the ELI consortium.

Main actions:

The CLPU collaborates in two main tasks: to standardize secondary source and laser metrology procedures; and to disseminate and support user communities. It officially started on 1 November, so that its development has been very little. Thus, the last two months of the year have been devoted to establishing contact with the project managers and preparing the kick-off meeting to be held in early January 2021.



Radiation facility network for the exploration of effects industry & research (RADNEXT)

Horizon 2020 > INFRAIA2020

This is an H2020 INFRAIA-02-2020 facility proposal aimed at integrating European infrastructures of great scientific value to boost technological knowledge and development.

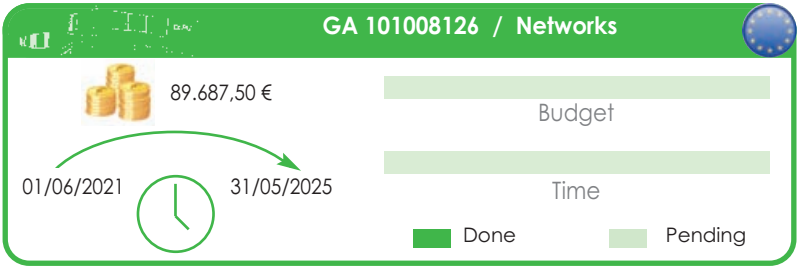
RADNEXT

Aim:

To create a network of irradiation methodology facilities to address the emerging needs for the irradiation of electronic components and systems. RADNEXT offers its users transnational access to a diverse network of facilities related to testing for the study of space radiation effects on electronic products. The beams available range from X-rays and energetic electrons to protons and heavy ions.

Main actions:

The role of the CLPU in this European project is to provide access to its ultra-intense pulsed laser for SEE (Single Event Effects) electronics testing using the secondary electron beam. In 2020, the projects logo, webpage and social media profile, especially LinkedIn, were designed, selected and launched, alongside the proposal for the review of the agreements established among the parties in the framework of the Grant Agreement that will be signed towards the middle of the coming year, which is when it will begin to be implemented.



European Network for Innovative Training Program

Plan Nacional de I+D+i > Europa Investigación

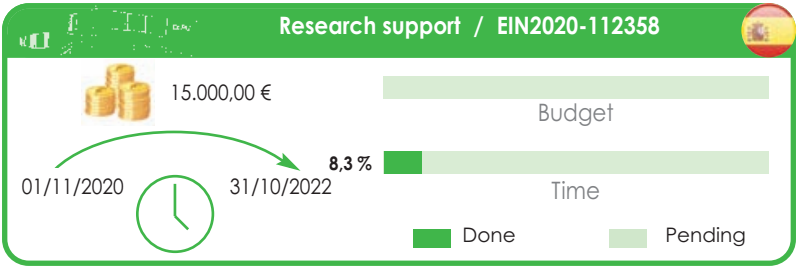
This is a call sponsored by the Ministry of Science, Innovation and Universities. Its purpose is to support the scientific community in the design and drafting of European projects.

Aim:

To present a European project based on the creation of a specialized training network for predoctoral students with sufficient stance to ensure a grant which has been almost achieved on two previous occasions. In this regard, and in compliance with the call, the CLPU is to hire an expert to provide it with support for the improvement of such project.

Main actions:

In 2020, the partners have held two meetings to specify and redefine the improvements required by the European project (objectives, deliverables, tasks…), as well as to establish the terms of the contract that will be signed towards the middle of 2021.



Technical Support Staff 2017

P.N. I+D+i > P.E. Promoción del Talento y Empleabilidad en I+D+i

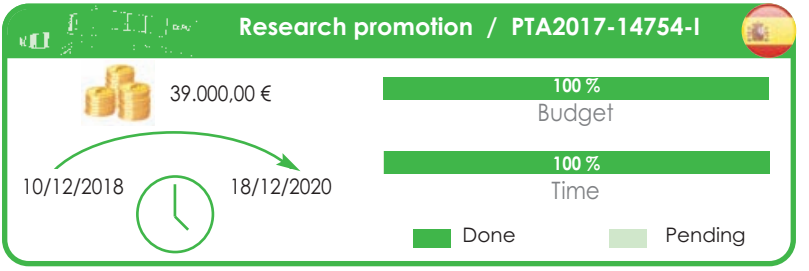
Promotion of talent and its employability sponsored by the Ministry of Science, Innovation and Universities. Its purpose is to develop actions that promote the hiring of young researchers and technicians to boost their research.

Aim:

As regards the Center for Pulsed Lasers, this aid focused on finding a researcher who could join the facility's Radioprotection Unit and take part in the implementation of the radioprotection protocol and processes for experimental campaigns.

Main actions:

In 2020, the development of a neutron detector whose basic physical principles are the neutron activation of gold foils was initiated. Gold foil activation measurements shall be performed using the CLPU's high-purity germanium detector, which provides information regarding laser-generated neutron fields. Likewise, measurements of VEGA-3 laser accelerator during the experimental campaigns have been scheduled. This will be performed using a high-sensitivity research dosimetry, comparing the responses to pulsed radiation of active and passive detectors. This request involves the development of a Radiation Protection Manual and the presentation of a list of technical procedures for radiation protection. Finally, the study of the Center's shielding for the purchase of new radiological shielding material for risk prevention and radiation protection.



Implementation of Youth Guarantee 2018

P.N. I+D+i > P.E. Promoción del Talento y Empleabilidad en I+D+i

Promotion of talent and its employability sponsored by the Ministry of Science, Innovation and Universities. The purpose of this call is to develop actions to foster the hiring of young researchers and technicians to boost their research.

The Center for Pulsed Lasers was granted THREE projects in the framework of this aid focused on incorporating young scientists into different areas of the facility:

Aim:

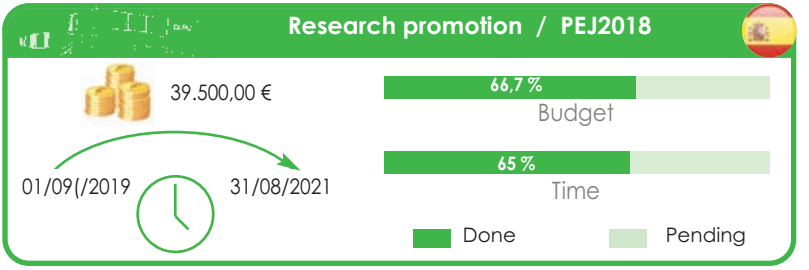
- In the Technical Area, one person was recruited for the implementation of technological developments aimed at optimizing and expanding the VEGA singular system.
- In the Radioprotection Unit, one person was also recruited for the development of the Radiation Protection Plan of the CLPU as a second category radioactive facility.
- In the Scientific Area, one person was recruited to develop the synchronization of the beams of the petawatt laser system.

Main actions:

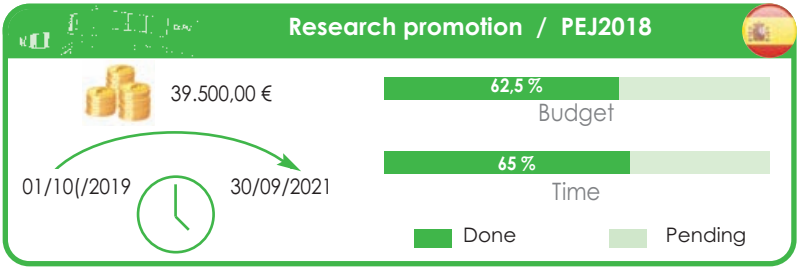
Below is an analysis of the main actions conducted under this call according to each recruitment:

- The young researcher attached to the CLPU's Technical Area focused on completing his training, especially in the area of programmable controllers, PLCS...; completed the technical corridor flood detection project; launched a system to automatically detect the operating condition of the different parts of VEGA; continued the inventory of the technical area, mainly of its computer elements; and progressed in the analysis of additional elements of the system to optimize its use and maintenance.
- The most noteworthy of the tasks performed by the young researcher attached to the Radioprotection Unit were as follows: supervision of the IRA/3254, which includes the preparation of the annual report for the Nuclear Safety Council; functions corresponding to the post of radioprotection official during the experimental campaigns, inclu-

ding the classification and declassification of radiological areas and zones; official dosimetry of the CND (National Dosimetry Center) and startup of the thermoluminescent dosimeters; study of the shielding of the CLPU's bunker; resolution and management of incidents in the PSS system; management of equipment calibration and functional verification of the Center's radiation monitoring network according to its protocol.



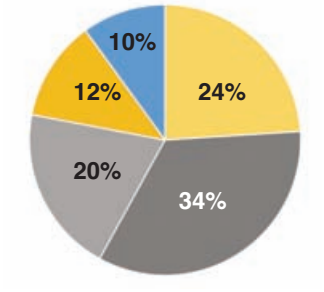
- The young researcher attached to the Scientific Area in 2020 effected the startup of the IRB 120 robot of ABB, including its calibration and the purchase of the different replacement parts. Likewise, she engaged in the study optical systems and their synchronization and collaborated in the experimental campaign, both in the development of pieces and prototypes for the Experimentation Area, and in the characterization of solid targets using electronic devices.



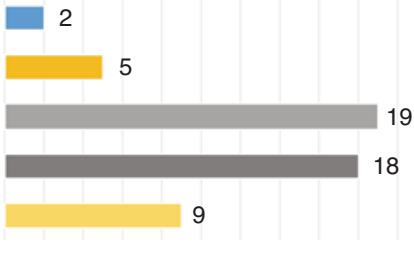
- Training

he CLPU staff has participated in a total of 87 courses, ten of which have been received by staff from different areas, counting them for the total as a different one in each area and including them as training, conferences, stays, etc. These courses amount to 2,632.50 training hours, with an average of 53.22 hours per worker. On an overall basis, as could be expected from an infrastructure of this nature, the main areas where training has been received are the technical and the scientific areas. Nevertheless, if only the specific courses are counted (those where there were no workers from different areas), the largest number of courses corresponds to the area of management, the reason being its crosscutting nature which encompasses workers from different areas of expertise.

Distribution by areas (Global)



Distribution by areas (Specific courses)



Scientific A. Technical A. Managm. A. Engineering U. Radioprotection U.

In addition to the specialization, improvement and upgrade of knowledge training received by all the Center's staff, mention should be made of the training delivered by scientists and technicians at different events:

- Collaboration with the University of Experience of the University of Salamanca through the delivery of master classes and the arrangement of visits to the Center. It was possible to deliver these practical classes at the CLPU because they took place just at the

beginning of the year. However, it has not been possible to continue with the entire collaboration scheduled because of the suspension of courses that began in March 2020 and lasted the entire year.

- Collaboration with the University of Salamanca by providing training in the master's degree in Laser Technology, and, as a novelty this year, participation of the CLPU in the only master's degree in Castile and León devoted to mathematical modelling, delivering the opening speech and undertaking the direction of an end of master's degree project.
- Training of 11 University of Salamanca students for curricular and extracurricular practices, supervision of four students' end-of-degree projects and internships for three young researchers as part of their doctoral and master's degree programs.
- Training of three vocational training students in the Management Area, with specialization in Systems, and for the Engineering Unit.
- Hosting of two specialized courses organized by the Laser-Plasma CLPU Chair of the University of Salamanca through its Lifelong Training Service:
  - Laser-Plasma Physics and Experimental Methods
  - Numerical Methods for Laser-Plasma Physics
- Launching of 5 specialist courses of the Laser-Plasma CLPU Chair of the University of Salamanca for academic year 2020-21, scheduled to begin in 2021:
  - Targetry and Diagnostics methods for laser-plasma experiments
  - Charged particle beams interaction & laser-driven plasmas
  - Laser-Plasma Physics and Experimental Methods
  - Numerical Methods for Laser-Plasma Physics
  - Free Electron Laser & High Brilliant Electron Beams
- Organization of the Laser-Plasma Summer School, which first took place online with great success as regards participation (over 100 students from 21 different European, Asian, American and African countries). This edition was the third offered by the school under the title 'Experimental methods in high-intensity laser-plasma processes'. It was held from 14 to 18 September and involved the participation of international experts for the morning sessions and that of the scientists of the CLPU for the theoretical-practical afternoon sessions. Likewise, students were given voice through a PechaKucha competition where young researchers shared their work in talks of no more than 20 slides and 7 minutes of presentation.

INNOVATION

The global pandemic has drawn more awareness than ever to the need of not only investing in science but also of connecting research and industry for the building of a knowledge-based resilient and robust economy. Accordingly, innovation stands as one of the strategic foundations of Unique Singular Scientific and Technical Infrastructures. This has led to the launching of several lines of research that include public-private collaboration proposals, technological development projects, consulting services and the promotion of innovation platforms. The most outstanding activities of 2020 are the following:

Projects

Multi-shot experimental campaigns with high repetition rate (CEMAR)

Subprograma Estatal de Infraestructuras Científicas y Técnicas y Equipamiento

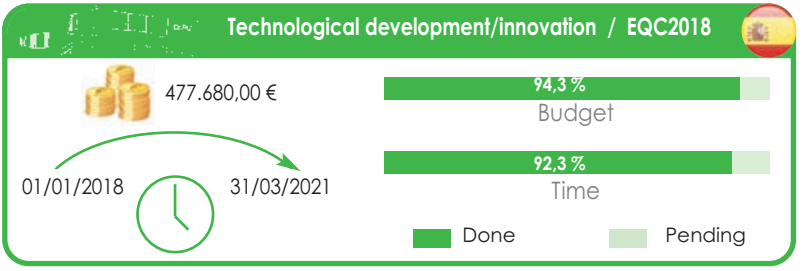
Its aim is to contribute towards the purchase, setup and upgrading of scientific-technical equipment for top quality research, improvement of results and scientific, economic and social impact and optimization of the functioning of the research infrastructures themselves.

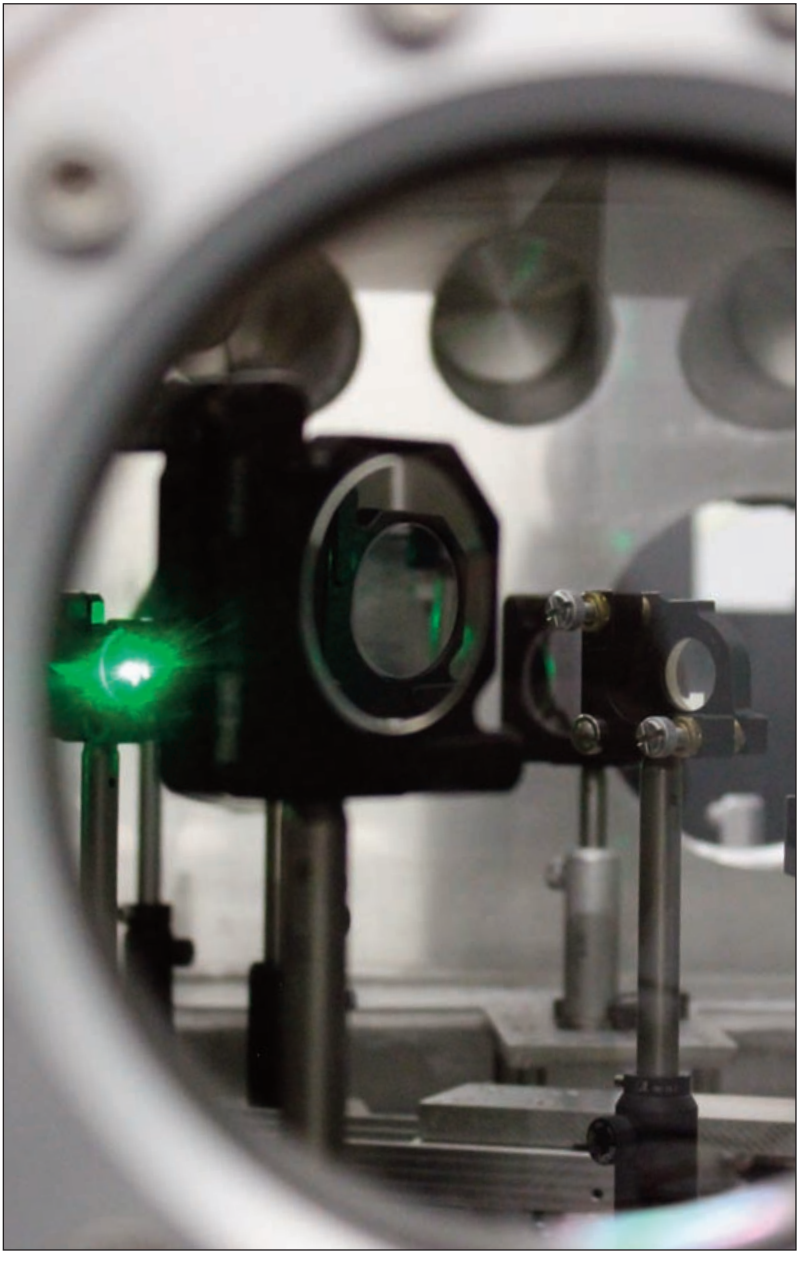
Aim:

The aim of this project is to achieve complete appropriateness of the Center's experimental area to meet the versatility and adequate parameters to make the fullest use of the singularity of VEGA's beam, both in terms of intensity and as regards its high repetition rate. It is useless to offer users a cutting-edge tool as our laser system if there is no fit experimental work area to extract the results obtained with a laser of such nature.

Main actions:

In 2020, equipment for the characterization and optimization of VEGA's laser pulses was purchased (adaptive optics, experimental area SPIDER and D-Scan), as well as shot-to-shot detection elements for the experiments (streak camera, intensified and X-ray camera, and gated camera), and, finally, a gate valve and a vacuum chamber for the vacuum system.





Rearrangement of VEGA laser facility beamlines for pump-probe experiments

Programa Operativo FEDER Plurirregional de España (POPE) 2014 - 2020

Call framed in the Spanish ERDF Pluri-regional Operative Program (POPE) 2014-2020. The Ministry of Science and Innovation is responsible for the management of the funds allocated to the POPE for research promotion, technological development and innovation. This CLPU project is part of the line of action of Singular Scientific and Technical Infrastructures whose priority is the improvement of R&I infrastructures to boost excellence in R&I.

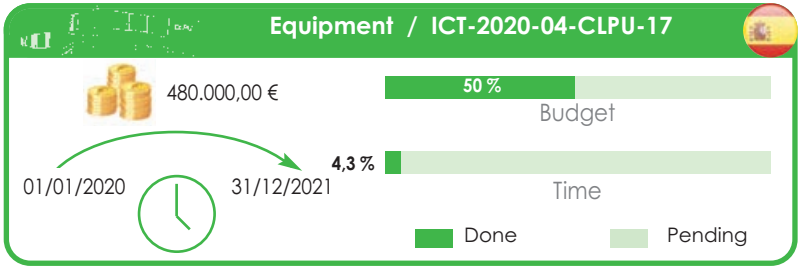
Aim:

The project is based on the design of a pump-probe system that analyses the extreme pressure and temperature conditions of small volumes of matter that VEGA-3 leads to. The purpose is to analyze the events that take place in very small timespans, sub-nanoseconds, after which they disappear in violent explosions. Added to the high repetition rate, this can explain the need to create a tool that allows the analysis of these conditions of great interest in the area of plasma physics and for the analysis of new states of matter. The proposal to achieve this is the use of a new laser tool that can be synchronized with the main beam, the CEP femtosecond system that will provide a test that is far less intense but ultra-short (6 femtoseconds) to achieve an extraordinarily accurate time discrimination.

Main actions:

The project was granted in 2020 and significant actions have been developed throughout such year. Two tenders for the purchase of the following equipment packages have been published: deformable mirror and wave-front sensor; optics and opto-mechanics for beam steering; monitoring for the stabilization of beam pointing and CCD cameras for tracking; opto-mechanics and spectrometer for the synchronization of beams at the femtosecond level; elements for the characterization and improvement of VEGA's laser pulses aimed at

optimizing the system's beams; pumped laser to stabilize the preamplification of VEGA's system; and short-pulse time-space characterization system. Alongside these tenders is a sub-contract involving the purchase of a replacement head for the VERDI pumped laser of the CEP.



Consulting Service

One of the means to foster knowledge transfer is the Consulting Service that the Center for Pulsed Lasers has been offering for years. Its main bastion is direct dialogue with businesses and the resolution process that is conducted through continued contact between the company and the CLPU's specialist scientists. In 2020, this service has considerably improved thanks to the technological innovation laboratory — LITeL— managers.

Platforms

The participation of the CLPU in different innovation and research platforms promotes Singular Scientific and Technical Infrastructures (ICTS) in different areas that are collateral to their area of expertise, promoting knowledge flow between industry and institution and generating new synergies. In 2020, the CLPU consolidated its presence and participation in the following platforms:

- **INEUSTAR/ INDUCIENCIA:** Private non-profit association whose purpose is to contribute to the progress of science and technology and to the strengthening of innovation. Its philosophy is based on building an efficient collaboration network involving companies, research centers, universities and support organizations and institutions. One of its activities in 2020 was the launching of 'Desayunos de Induciencia' where a group of experts gather to address some of the major scientific-technological challenges of today's world. In this regard, the director of the CLPU was invited to take part in the round table discussion of the session addressing "The future of Accelerators in Spain", held online on 11 December 2020.
- **CASTILE AND LEON DIGITAL INNOVATION HUB:** The purpose of this regional platform is to become a 'single window' where support, demonstration, training, consulting and fund channeling services for the introduction of IoT (Internet of things) and other disruptive technologies are offered to improve industries' capacities to integrate technology into their production processes and achieve a successful implementation of industry 4.0

policies. The CLPU joined this transfer platform at the beginning of 2020.

- **FOTÓNICA 21:** Spanish technology platform whose main purpose is to efficiently boost photonic technology in the process of industrial innovation and its applications in key sectors such as information and communication technology, industrial manufacturing processes, life sciences, and lighting and display.
- **PEPRI:** Promoted by the Spanish Society for Radiological Protection (SEPR) and by the Nuclear Safety Council (CSN) in 2014, this national platform is a forum created to foster idea-sharing, the search for synergies and the management of effective plans in the scope of radiological protection. In this regard, the CLPU has collaborated with the Nuclear Forum to design an information leaflet based on the CLPU and laser-induced particle acceleration.

In the year addressed in this report, it is also necessary to remark the CLPU's participation in the innovation platform launched by Startup Olé in collaboration with the Regional Government of Castile and León #*innovacionfrentealvirus*, aimed at providing solutions to the challenges brought about by SARS-CoV-2. It is an open and global initiative created by a technological, social and innovative community to help to mitigate, as far as possible, the effects of the COVID-19 pandemic. The platform launched a competition for the presentation of innovative projects in different areas, relying on the participation of CLPU staff among the experts and mentors who contributed to assessing some of the 176 projects that were presented from 20 different countries.

DISSEMINATION

Dissemination is one of the strategic scopes that has been most severely affected by the pandemic and the ensuing health measures. A dissemination agenda including different activities that had to be indefinitely postponed had been drawn up at the beginning of the year. Noteworthy among the suspended actions is a collaboration with the Centro Comercial el Tormes that was being carried out on occasion of the 60th anniversary of the first laser and which included an interactive presentation for school children and families. Likewise, the second edition of the Extreme Meetings, launched in 2019 with the presence of Nobel laureate Gérard Mourou, and the launching of the Light Cycles also had to be cancelled.

The first months of the year went by as usual, allowing students of the Experience Program of the University of Salamanca to visit the Center, and also carrying out the second open day for first cycle of Physics, Sciences, Mathematics and Engineering students from the University of Salamanca. Besides this, the San Agustín School invited us to take part in its IV Training Week "Teaching by educating", where our director Luis Roso directed the 'Laser, light for innovation' workshop delivered to students of the science branch of pre-university courses.

Restricted to the virtual environment from March onwards, 10 new information graphics related to basic concepts of light and optics were published on the Center's webpage on 16 May, on occasion of the International Day of Light (https://www.clpu.es/DIL2020_Infografias). Their purpose is to explain in a visual and easy to understand manner concepts such as waves, reflection and refraction, laser, the electromagnetic spectrum, fluorescence and phosphorescence, the anatomy of the eye, the discovery of colors, three-dimensional vision, or vision defects caused by refraction and diffraction. They can be either consulted on the website or downloaded free of charge.

The CLPU also collaborated with FORO NUCLEAR in the creation of an interactive infographic image of the Center and laser-induced particle acceleration that was published on its dissemination webpage, Rincón Educativo (https://www.rinconeducativo.org/es/recursos-educativos/lamina-interactiva-sobre-laseres-pulsados), and pro-

moted via its Twitter account, where it was viewed more than 8,500 times.

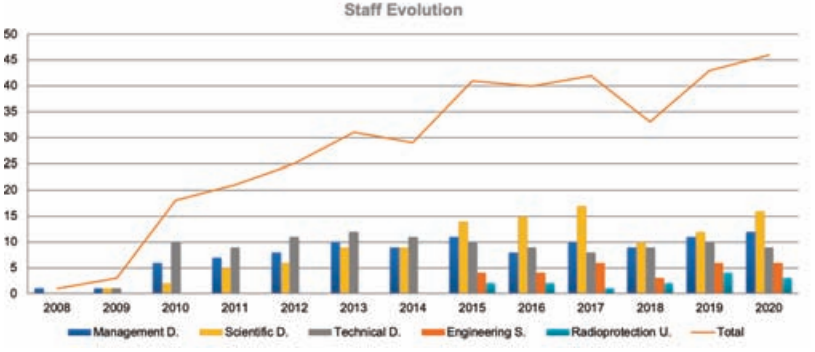
In this context, it should be noted that, coinciding with the International Day of Light, the CLPU launched its official Twitter profile under username @clpu_icts. From then on, it has gathered more than 150 followers and posted almost 50 tweets. This new presence of the CLPU on social media adds to its already open Youtube channels and LinkedIn CLPU Human Resources official profile.

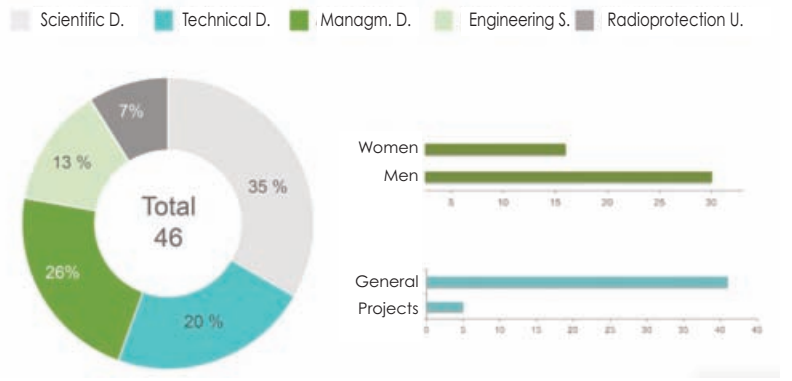
Finally, it is necessary to mention that, in the light of the compulsory health restrictions resulting from the pandemic, the design and drafting of two dissemination projects adapted to the 'new normal' was undertaken in the framework of the call for aids for the fostering of scientific, technological and innovation culture of the Spanish Foundation for Science and Technology (FECYT). This marked the beginning of a major change of perspective to increase the CLPU's dissemination repository and adapt it to the new context. In this regard, the project to virtualize visits to VEGA's platform was started and work on the design and recording of a new promotional video was continued.

INSTITUTIONAL INFORMATION

Human Resources

2020 ended with a total of 46 workers and an increase in the staff's evolutionary line given that, although 6 staff members left, 8 new recruitments were made. The staff distribution according to areas, funding and gender is shown in the following graphs.





External funding

Applied Research

Entity	Title	PI on CLPU	Amount	Role
Junta de CyL	Transport and handling of particles in laser accelerators: new scenarios for FLASH radiotherapy (TYMPAL)	Giancarlo Gatti	264.000,00 €	Leader
Min. Defensa	High-power pulsed laser guided system in the military field (SIGILAR)	Luis Roso	450.000,00 €	Leader
AIEA	Research on Pathways to Inertial Fusion Energy at the Centro de Láseres Pulsados	Luca Volpe	–	Partner

R+D+I networks

Entity	Title	PI on CLPU	Amount	Role
European Union	Laserlab Europe V	Luca Volpe	207.150,00 €	Partner
European Union	Integrated Management and reliable operations for user-based laser scientific excellence (IMPULSE)	Giancarlo Gatti	450.690,00 €	Partner
European Union	Research facility network for the exploration of effects for industry and research (RADNEXT)	José M. Álvarez	89.687,50 €	Partner

Technological Development

Entity	Title	PI on CLPU	Amount	Role
MINCIU	Multi-shot experimental campaigns with high repetition rate	José A. Pérez	477.680,00 €	Leader
MINCIU	Rearrangement of VEGA laser facility beamlines for pump-probe experiments (FEDER-POPE 2014-2020)	Luis Roso	480.000,00 €	Leader

HHRR - Research promotion

Entity	Title	PI on CLPU	Amount	Role
MINCIU	Promoción del talento y su empleabilidad / Technical Support Staff 2017	José M. Álvarez	39.000,00 €	Leader
MINCIU	Promoción del talento y su empleabilidad / Sistema Nacional de Garantía Juvenil 2018	José M. Álvarez	39.200,00 €	Leader
MINCIU	Promoción del talento y su empleabilidad / Sistema Nacional de Garantía Juvenil 2018	Cruz Méndez	39.200,00 €	Leader
MINCIU	Promoción del talento y su empleabilidad / Sistema Nacional de Garantía Juvenil 2018	Giancarlo Gatti	39.200,00 €	Leader

Research support

Entity	Title	PI on CLPU	Amount	Role
MINCIU	Research Europe / European Network for Innovative Training Programme	Luca Volpe	15.000,00 €	Leader

General data

Center structure

Transparency website