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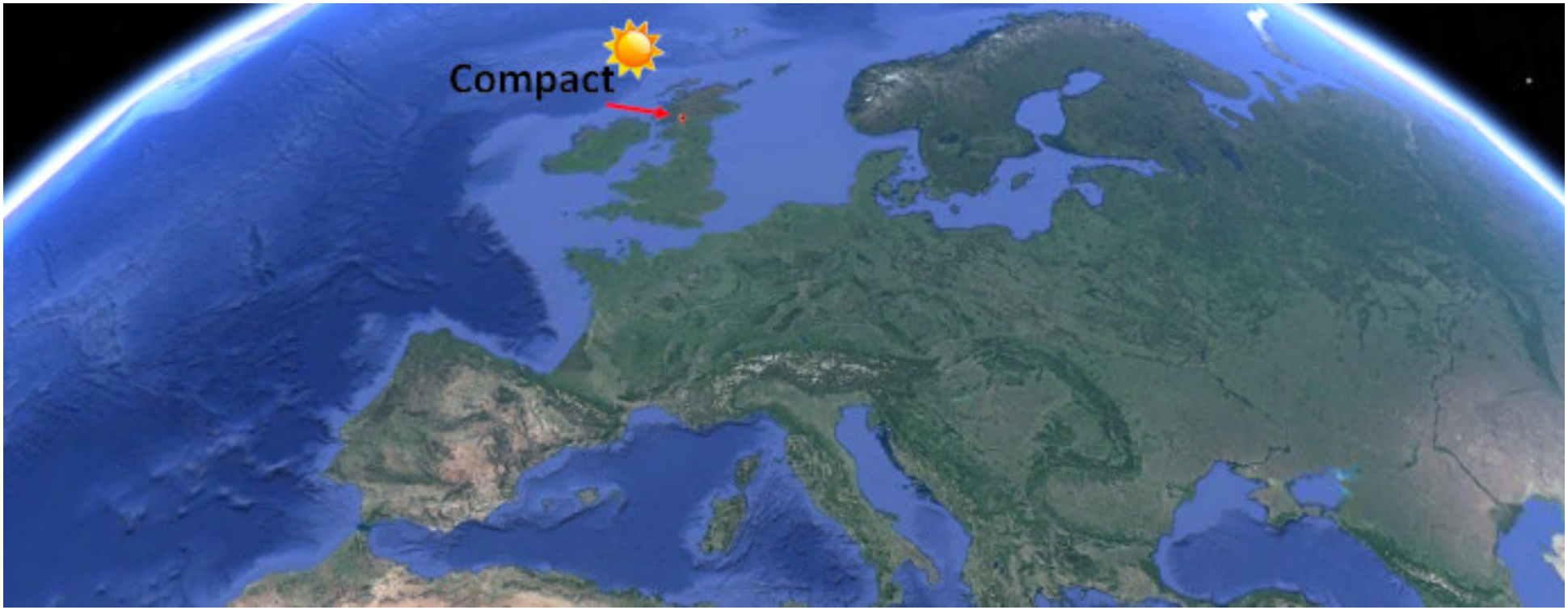
European Union

Compact

CompactLight – 2nd Periodic Report

3rd Annual Meeting | Virtual Glasgow again, 20-25 November 2020



Regina Rochow

2nd Periodic report: Timing

Reporting period: July 2019 – December 2020

"Under Article 19 and Article 20 of the grant agreement (GA), the coordinator must submit to the Commission technical and financial reports, including requests for payment - specifically:

26 February 2021

- deliverables identified in Annex 1
- periodic report (both technical and financial) within 60 days of the end of each reporting period (including the final one), including requests for payment ...

[H2020 online manual]

text & data parts ready on:

12 February 2021

financial parts ready on:

19 February 2021

2nd Periodic report: Structure

Contents of the report:

- part a1: 4 structured tables (PMO)
- part a2: forms and lists (all partners)
- part b: free text (all partners)
- part c: financial report structured forms (all partners)

Summary for publication: mostly ok!

Synchrotron light is electromagnetic radiation generated by charged particles that move at a speed near to the velocity of light on a curved path in accelerating machines called synchrotrons. The produced light, which is billion times more brilliant than light generated by conventional light sources, permits a large spectrum of applications in industry as well as basic and applied research in the fields of physics, chemistry, life sciences and medicine, environmental sciences etc. Currently, more than sixty synchrotron light sources are operational worldwide as giant microscopes for the study of matter.

In view of the huge utility and enormous utilisation of these machines, quantum jumps have been made in the last years in studying and implementing sources of even more intense electromagnetic radiation, called 'Free Electron Lasers' (FELs). These novel machines are based on linear accelerators (Linacs) for electrons followed by chains of undulators that force the high-speed electrons on wiggly trajectories, making them to emit light. The photon flux emitted by a FEL is several orders of magnitude higher than that produced by today's synchrotron radiation sources and consists of light pulses that can be extremely short, with a duration of femtoseconds (fs, 10-15 sec) and wavelengths below an Ångström (Å, 10-10 m). This radiation, called hard X-rays, belongs to the high energy range of the X-ray spectrum. At the current state, these characteristics make the FEL the most powerful instrument for basic research on matter.

Given the continuously growing demand in terms of 'beamtime' from the users, FEL sources are however not likewise distributed as synchrotrons, for technical reasons as well as for the huge investment and operation costs required.

CompactLight (XLS) is a H2020 Design Study funded by the European Union that started in January 2018 with a duration of three years. Launched by a group of 22 International Laboratories and two companies it aims at promoting the diffusion of FEL light sources at a global scale. The collaboration, coordinated by Elettra-Sincrotrone Trieste, brings together experts from the fields of electron sources, Linacs, and the structures required for the production of photons, to work on the 'Conceptual Design' of extremely compact FEL sources, with advanced performances and contained costs, in order to permit their diffusion also in contexts, where the financial resources for research are rather limited.

Work performed and main results: to be updated (PMO)

The key concept of the project, which started in January 2018 with a duration of three years, is to use cutting-edge technologies for realizing each of the different components of a FEL facility, combining them into a single, highly innovative machine: (a) the most advanced electron sources and photo injectors, (b) very high-gradient normal conductive radio-frequency (RF) structures, operating at 12 GHz, developed at CERN in the context of the Compact Linear Collider (CLIC) study group, to increase the global efficiency of the machine and reduce the required length of the linac at a fixed energy of the electron beam, and (c) short period undulators of the last generation to obtain high energy photons with lower electron energies as compared to present-day machines.

Large progress in defining the machine parameters and designing each single subsystem has been made by the partners in the first reporting period of the project. Options for a very compact beam injector in the S-, C- and X-band of frequencies have been investigated and discussed. The definition of a standardised rf unit for the X-band linac is progressing, a component that could even be used as a stand-alone element for smaller projects, i. e. a university-scale Compton source, or smaller FELs for special applications that can be constructed and operated with smaller budgets. New concept undulators like superconductive undulators and cryogenic permanent-magnet undulators, as well as exotic schemes, like microwave undulators have also been, and are still, under investigation.

The collaboration is considering the design of two FEL sources, Soft X-ray (SXR, at lower energies) and Hard X-ray (HXR, at higher energies) that cover the wavelength range from 5.0 nm to 0.08 nm (from 0.25 keV to 16.0 keV), with the possibility to use the two sources contemporarily at 100 Hz, and individually with HXR at 100 Hz and SRX up to a repetition frequency of 1 KHz.

Besides technical feasibility, the choices of the machine parameters are essentially driven by the expectations of the FEL user community concerning photon beam characteristics of future FEL sources and the vision of the consortium to providing a real cutting-edge facility with unique performance and opportunities. In order to explore the scientific users' requests, the partners have established a dialogue with them through presentations and discussions at relevant conferences and workshops, the conduction of an XLS User Survey, and a User Meeting with participation of representatives of the community held in the end of November 2018.

Progress, expected results, impact: to be updated (PMO)

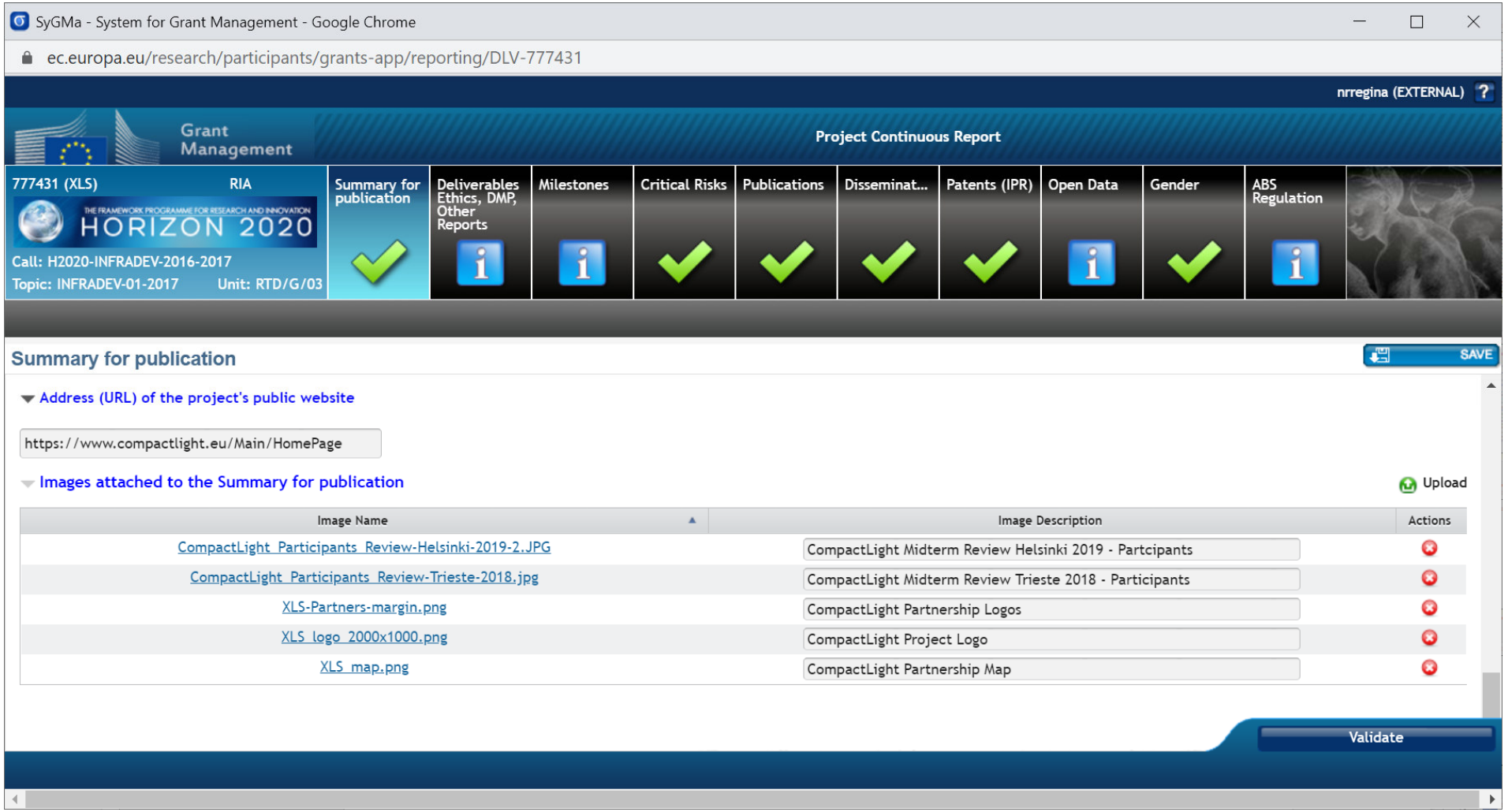
The overall concept underlying the project is to bring together recent advances in the main technical FEL sub-systems, i.e. electron photo-injector, linac accelerating structures and undulators, to produce the design of a next-generation facility with significantly lower cost and size than existing facilities. This brings to the use of very low emittance and higher repetition-rate sources, high-gradient linacs, high-efficiency klystrons, improved diagnostics, advanced undulators, the whole facility is being simulated using the most advanced beam dynamics and optimization tools, allowing to design such a cutting-edge facility.

The project will deliver to the scientific community a conceptual design of a machine with unique performance parameters and beam characteristics. The report will also include cost analyses and other strategic documents that support the decision-making process for constructing new facilities, or upgrading existing ones, using CompactLight technologies. The project will also consider the complementary use of the technology for small infrastructures, that can be installed and operated at universities. Project data not affecting the potential exploitation of results by the partners will be made accessible as Open Data to facilitate the use of the technologies.

The major goal of CompactLight is to make the construction and operation of X-ray FELs feasible for smaller countries, regions and universities. This will support their wide-spread availability, reducing oversubscription of existing machines, and creating more and unique research opportunities for the scientific users. Given the large importance of FELs their wide dissemination will have an enormous impact on many different research fields, create access opportunities in more countries, and contribute significantly to European scientific and industrial competitiveness. An important aspect is also the coordinated flow of expertise from Europe's larger research institutions to the smaller ones with ambitions to engage in cutting-edge photon science.

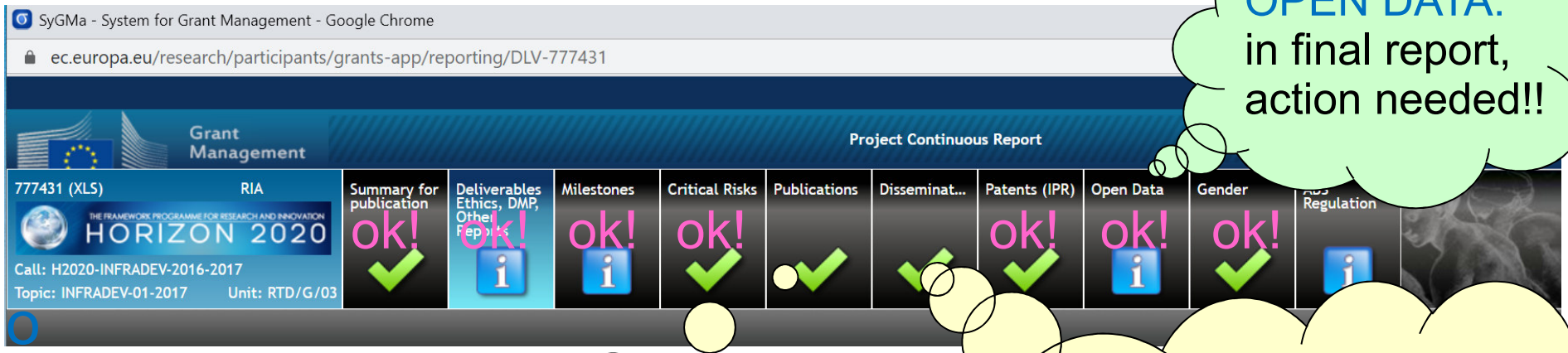
Major technology areas benefitting from the project are (a) high brightness e-sources (b) rf production and beam acceleration, (c) high-precision diagnostics, (d) undulators and photon production, etc., each of them with large application potential that goes beyond CompactLight and with clear opportunities for industries.

Images attached to the summary: to be updated (PMO)



Part 1b: forms and lists

Need to update the 'continuous reporting' data:



OPEN DATA:
in final report,
action needed!!

send us all your
PUBLICATIONS

see website, must be
'OPEN ACCESS',
with acknowledgement

all partners:
please send lists by
09 Dec 2020

Integrate the list in our Collab. Workspace (WP1) with your

- CONFERENCES attended
- PRESENTATIONS
- POSTERS
- PUBLIC EVENTS

https://espace.cern.ch/compactlight/WP1/_layouts/15/start.aspx#/SitePages/Home.aspx

Required text contributions

From WP and task leaders

Insert in Overleaf WP text document:

- Short description of WP activities and expected results, partners, deliverables, timing... (from last report)
- Description of the work performed in the WP and the tasks during the reporting period
- Overview of the progress made in the WP towards the project‘s objectives

Insert in Overleaf deviations section:

- Description and justification of all deviations from the original planning (description of work) in the WP

From each partner

Send to WP Leaders:

- Detailed description of the partner’s contribution to the work carried out in each WP and task in the WPs

Insert in Overleaf deviations section or send to Gerardo, Regina & Andrea:

- Descriptions and justifications of all deviations from the original planning of the single partner, divided in:
  - Use of resources (planned financial or human resources etc.)
  - Unforeseen subcontracting (if any)
  - Unforeseen use of in kind contribution from third party against payment or free of charges

Part b: free text

Work carried out:

- Coordinated by WP Leaders for their WP
- Review by WP partners and PCO

Deviations in WPs:

- Coordinated by WP Leaders for their WP
- Review by WP partners and PCO

Other deviations:

- Each partner with deviations
- Review by PCO

Contents

all texts to be ready for review by **12 February 2021**

Objectives & Impact:

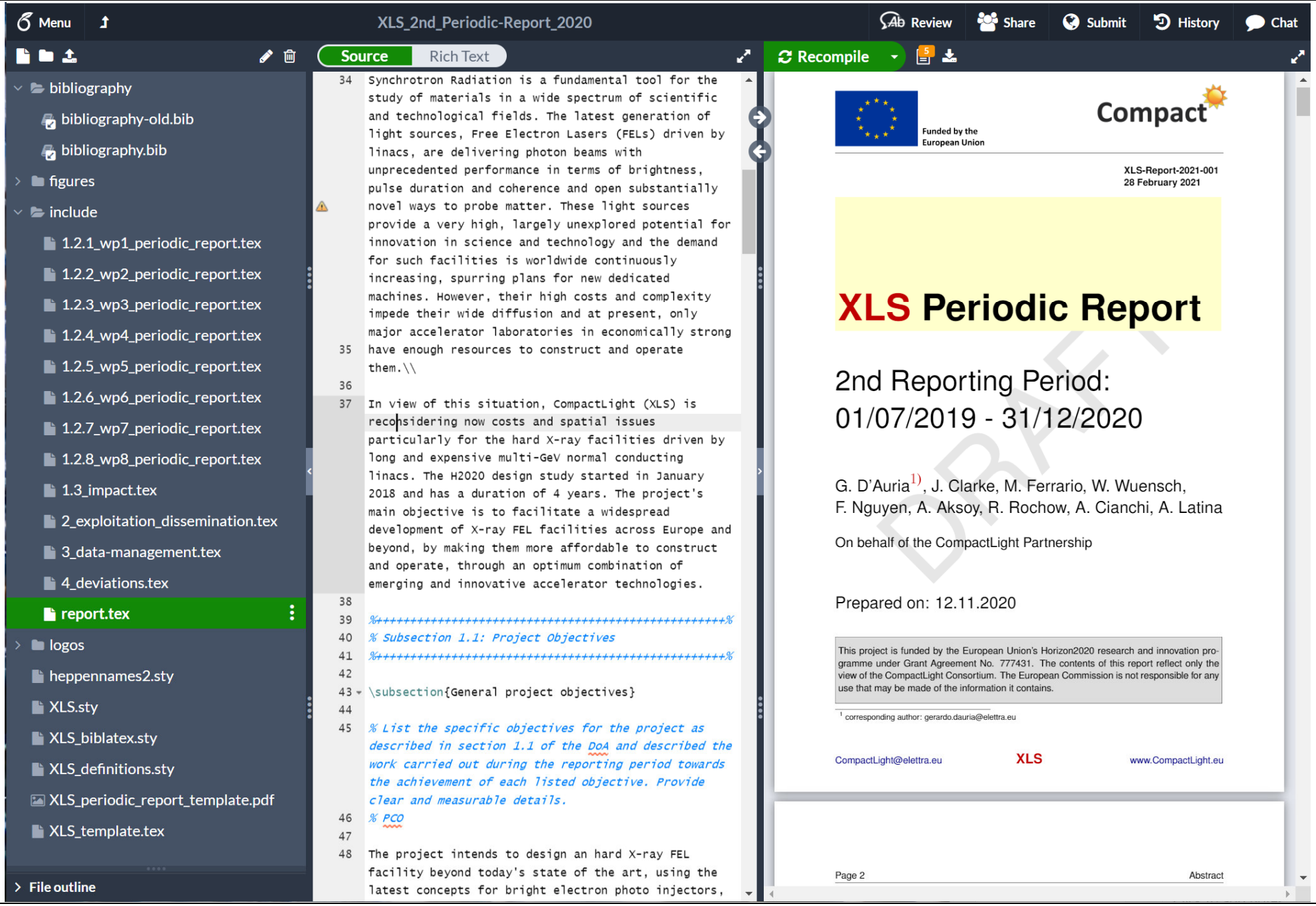
- PCO will review text from last time

Exploitation Plan:

- Update: Evangelos, Dimos, Regina
- Review by 'Assets' Working Group

Data Management:

- Update: Andrea, Regina, Gerardo
- Review by PCO, Communication Team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report.tex
logos
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XLS_biblatex.sty
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XLS_periodic_report_template.pdf
XLS_template.tex
File outline
34 Synchrotron Radiation is a fundamental tool for the study of materials in a wide spectrum of scientific and technological fields. The latest generation of light sources, Free Electron Lasers (FELs) driven by linacs, are delivering photon beams with unprecedented performance in terms of brightness, pulse duration and coherence and open substantially
35 novel ways to probe matter. These light sources provide a very high, largely unexplored potential for innovation in science and technology and the demand for such facilities is worldwide continuously increasing, spurring plans for new dedicated machines. However, their high costs and complexity impede their wide diffusion and at present, only major accelerator laboratories in economically strong have enough resources to construct and operate them.\\
36
37 In view of this situation, CompactLight (XLS) is reconsidering now costs and spatial issues particularly for the hard X-ray facilities driven by long and expensive multi-GeV normal conducting linacs. The H2020 design study started in January 2018 and has a duration of 4 years. The project's main objective is to facilitate a widespread development of X-ray FEL facilities across Europe and beyond, by making them more affordable to construct and operate, through an optimum combination of emerging and innovative accelerator technologies.
38
39 %++%
40 % Subsection 1.1: Project Objectives
41 %++%
42
43 \subsection{General project objectives}
44
45 % List the specific objectives for the project as described in section 1.1 of the DoA and described the work carried out during the reporting period towards the achievement of each listed objective. Provide clear and measurable details.
46 % PCO
47
48 The project intends to design an hard X-ray FEL facility beyond today's state of the art, using the latest concepts for bright electron photo injectors,
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XLS-Report-2021-001
28 February 2021
XLS Periodic Report
2nd Reporting Period:
01/07/2019 - 31/12/2020
G. D'Auria[1)], J. Clarke, M. Ferrario, W. Wuensch, F. Nguyen, A. Aksoy, R. Rochow, A. Cianchi, A. Latina
On behalf of the CompactLight Partnership
Prepared on: 12.11.2020
This project is funded by the European Union's Horizon2020 research and innovation programme under Grant Agreement No. 777431. The contents of this report reflect only the view of the CompactLight Consortium. The European Commission is not responsible for any use that may be made of the information it contains.
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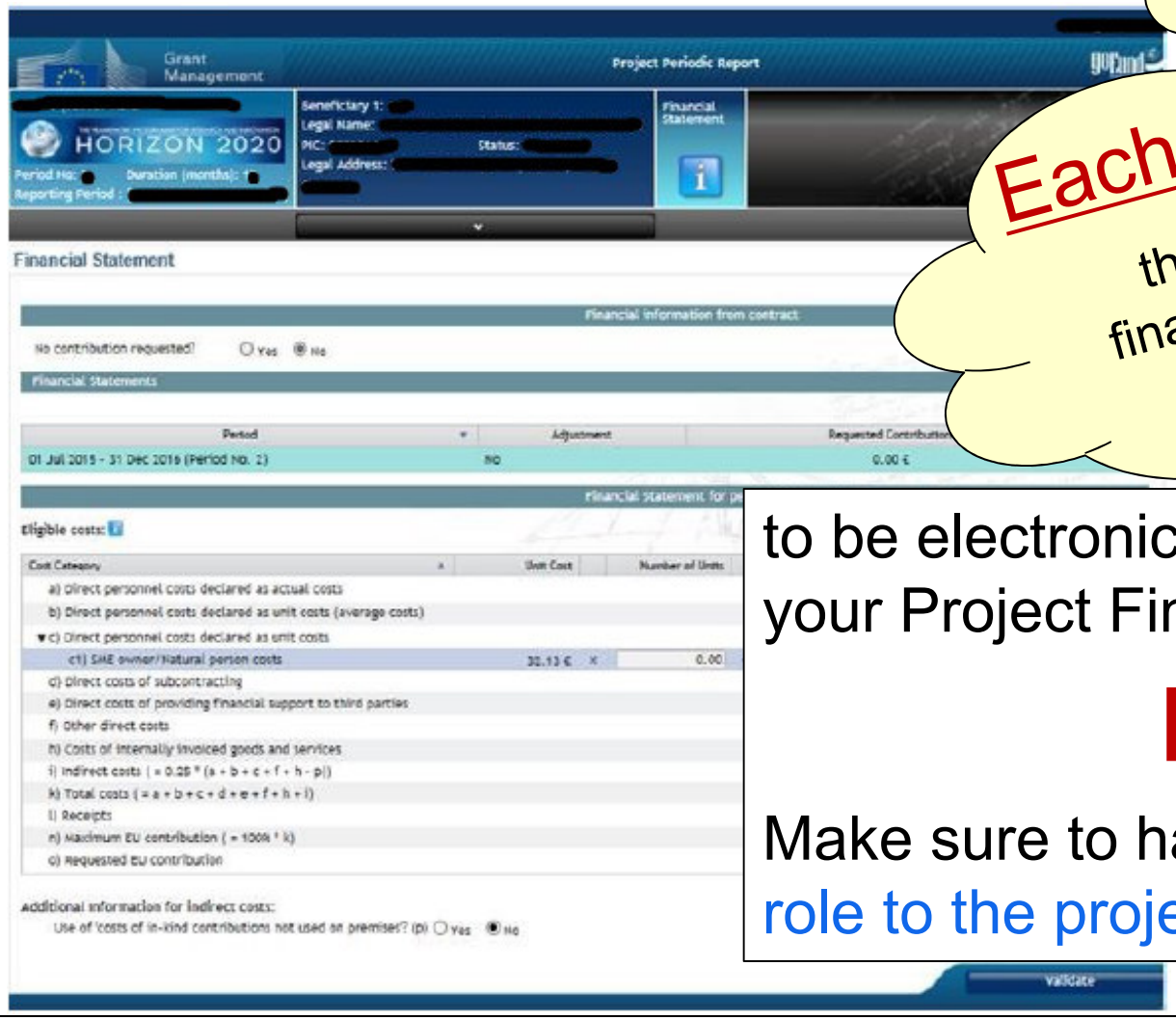
XLS
www.CompactLight.eu
DRAFT
Page 2
Abstract

Part c: financial statements



Each partner + KyTe:

the forms for individual financial statements will be available here

to be electronically signed & submitted by your Project Financial Signatory:

PFSIGN

Make sure to have one!!! Assign an FSIGN role to the project in your organisation

Part c: financial statement

#	Acronym	Total Costs approved	% Total Costs Approved	Total Budget
		state: November 2019		Grant Agreement
1	ST		49%	
2	CERN		59%	
3	STFC		32%	
5	IASA		9%	
6	UU		42%	
9	UA-IAT		26%	
10	ULANC		21%	
11	VDL ETG		13%	
12	TU/e		11%	
13	INFN		3%	
14	Kyma total		20%	
	Kyma srl		35%	
	KyTe		13%	
15	SAPIENZA		56%	
16	ENEA		59%	
17	ALBA-CELLS		59%	
18	CNRS		26%	
19	KIT		77%	
20	PSI		56%	
21	CSIC		66%	
22	UH/HIP		14%	
23	VU		53%	
24	USTR		72%	
	Total		**41%**	

85% received!!

Financial statement submission deadline:

19 February 2021

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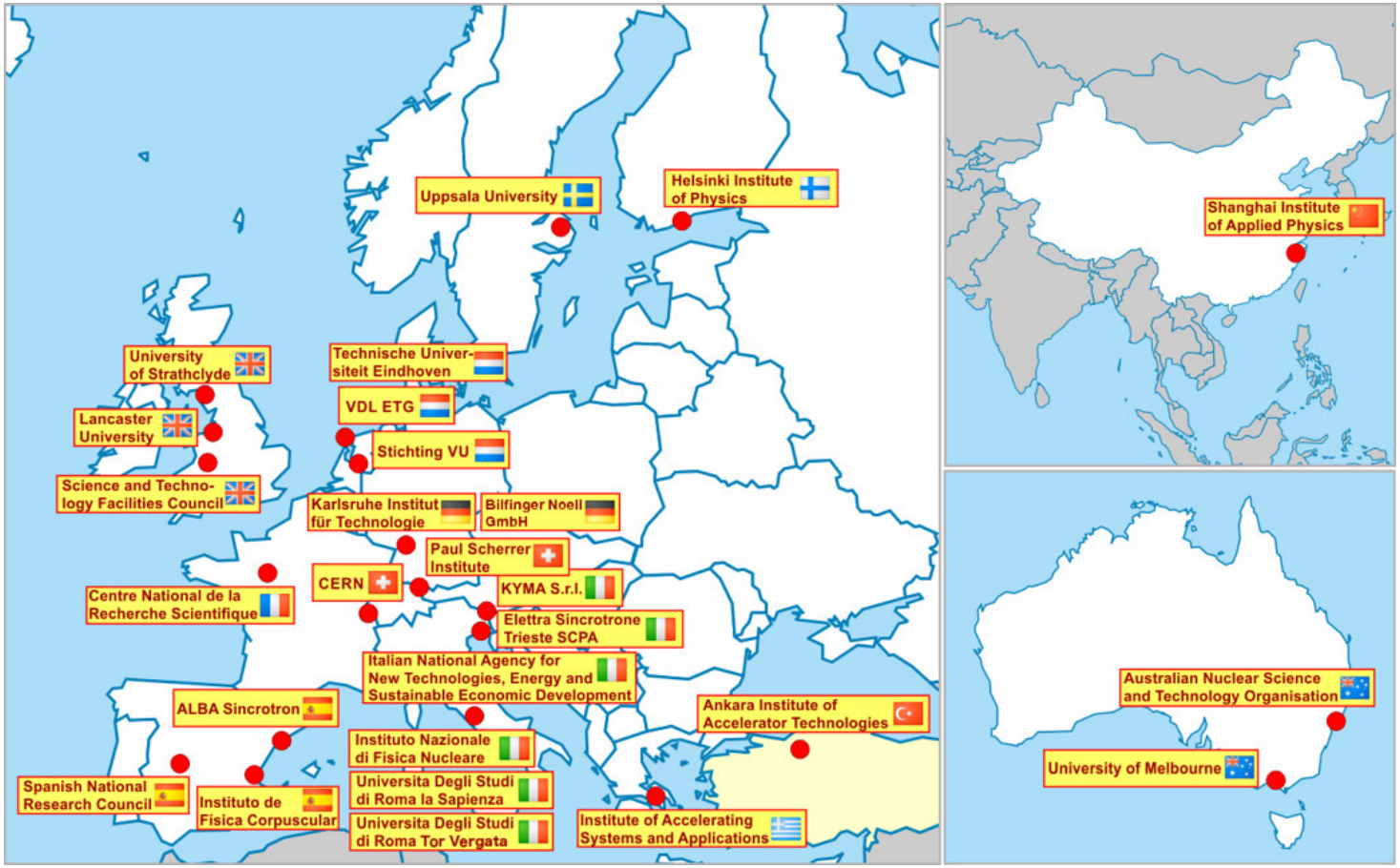
Thank you!

CompactLight@elettra.eu

www.CompactLight.eu



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