



Horizon 2020  
Programme

**CORTEX**

*Research and Innovation Action (RIA)*

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Start date : 2017-09-01 Duration : 48 Months  
<http://cortex-h2020.eu>



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**Website**

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CORTEX - Contract Number: 754316

Core monitoring techniques and experimental validation and demonstration Foivos MARIAS

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### Summary

The CORTEX public website (<http://cortex-h2020.eu>) was designed and developed to serve as a dynamic information and communication tool, as well as a platform for the project team. It acts as the main channel for news and updates with the aim to address the key questions that external visitors are expected to have, these include: ? What the project is about ? What the project is delivering, and why ? Who the partners of the project are ? How is the project is advancing research in core monitoring techniques Google Analytics is used as the tool to monitor the statistics of the website and will help to adapt the content architecture if necessary. The CORTEX website was officially launched in November 2017. It will be continuously updated and will evolve with the lifecycle of the project, according to the dissemination and communication policy of the project.

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### Approval

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## Abbreviations

EC DG RTD	European Commission – Directorate General for Research and Innovation
PQP	Project Quality Plan
DoA	Description of Action
WP	Work package
WPL	Work package leader
GB	Governing Board
CMB	CORTEX Management Board
PAR	Periodic activity report
PMR	Periodic management report
PR	Periodic report
QA	Quality assurance
PMO	Project Management Office
AEUG	Advisory End User Group
ECCP	Electronic Collaborative Content Platform

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- What the project is about
- What the project is delivering, and why
- Who the partners of the project are
- How the project is advancing research in core monitoring techniques

Google Analytics is used as the tool to monitor the statistics of the website and will help to adapt the content architecture if necessary.

The CORTEX website was officially launched in November 2017. It will be continuously updated and will evolve with the lifecycle of the project, according to the dissemination and communication policy of the project.

# 1 Introduction

The key objectives of CORTEX in terms of public communication are:

- To promote the project's activities, objectives and to disseminate its results to the scientific community as widely as possible;
- To engage and interact with stakeholders and target audiences (end-users, regulators, students, TSOs, researchers...);
- To contribute to the public acceptance of nuclear energy through improved reactor safety.

The CORTEX public website will contribute to achieving these objectives as the main channel for news and updates, as well as a repository for all of the project's public deliverables such as reports and communication and promotional material (flyer, poster, etc.).

It also provides access to the private area for CORTEX partners. This platform allows partners to share documents and work in a collaborative way.

This document outlines the main sections and technical characteristics of the website.

## 2 Content

The public CORTEX website (<http://cortex-h2020.eu>) will promote the European and international visibility of the project, communicate on the progress achieved and disseminate the results stemming from the project.

To make useful and relevant information available to the public, it was decided that the website should address the needs and the questions that would most likely interest external stakeholders or visitors, such as:

- What the project is about
- What the project is delivering, and why, including its vision
- Who the partners of the project are
- How the project is advancing research in core monitoring techniques

### 2.1 Homepage

All of the important information about the project can be accessed directly from the homepage and highlights of each section or topic are displayed. It represents the central point of information and aims to provide general information about the project and the expected results and impacts.

Therefore, visitors have direct access to information on:

- The project in numbers
- The project objectives
- The latest news and events
- The partners of the consortium
- The link to the partner area



The screenshot shows the homepage of the CORTEX project website. At the top, there is a navigation bar with links for 'ABOUT CORTEX', 'OBJECTIVES', 'NEWS & EVENTS', 'WORKSHOPS & COURSES', and 'RESOURCES'. The main header features the project title 'Core monitoring techniques & experimental validation and demonstration FOR IMPROVED REACTOR SAFETY' and a subtitle 'A European collaborative Horizon 2020 project funded by the European Commission'. Below this, a 'WELCOME TO THE CORTEX PROJECT' section displays four statistics: 48 Months, 20 Partners, 11 Countries, and 8 Training courses. The central area is divided into four columns: 'ABOUT THE PROJECT' (launched in September 2017), 'WORKSHOPS & COURSES' (a series of workshops and courses), 'PROJECT RESOURCES' (newsletters, promotional materials, publications), and 'ABOUT THE PROJECT' (repeated). A 'FOUR STRATEGIC OBJECTIVES' section follows, detailing four key goals: developing simulation tools, validating simulation tools, advanced digital analysis and machine learning, and modeling capabilities for reactor function and diagnostics. Below this are sections for 'LATEST NEWS' and 'EVENTS', including 'CORTEX KICKS OFF ON 5-6 SEPTEMBER' and 'PHYSOR 2018: REACTOR PHYSICS PAVING THE WAY TOWARDS MORE EFFICIENT SYSTEMS'. A 'CONSORTIUM PARTNERS' section lists various institutions like CHALMERS, CEA, EPFL, GRS, and TUM. The footer contains a 'LATEST NEWS' section, a 'NEWSLETTER' sign-up form, and a 'PARTNER AREA' link.

Figure 1: Screenshot of homepage

## 2.2 About CORTEX

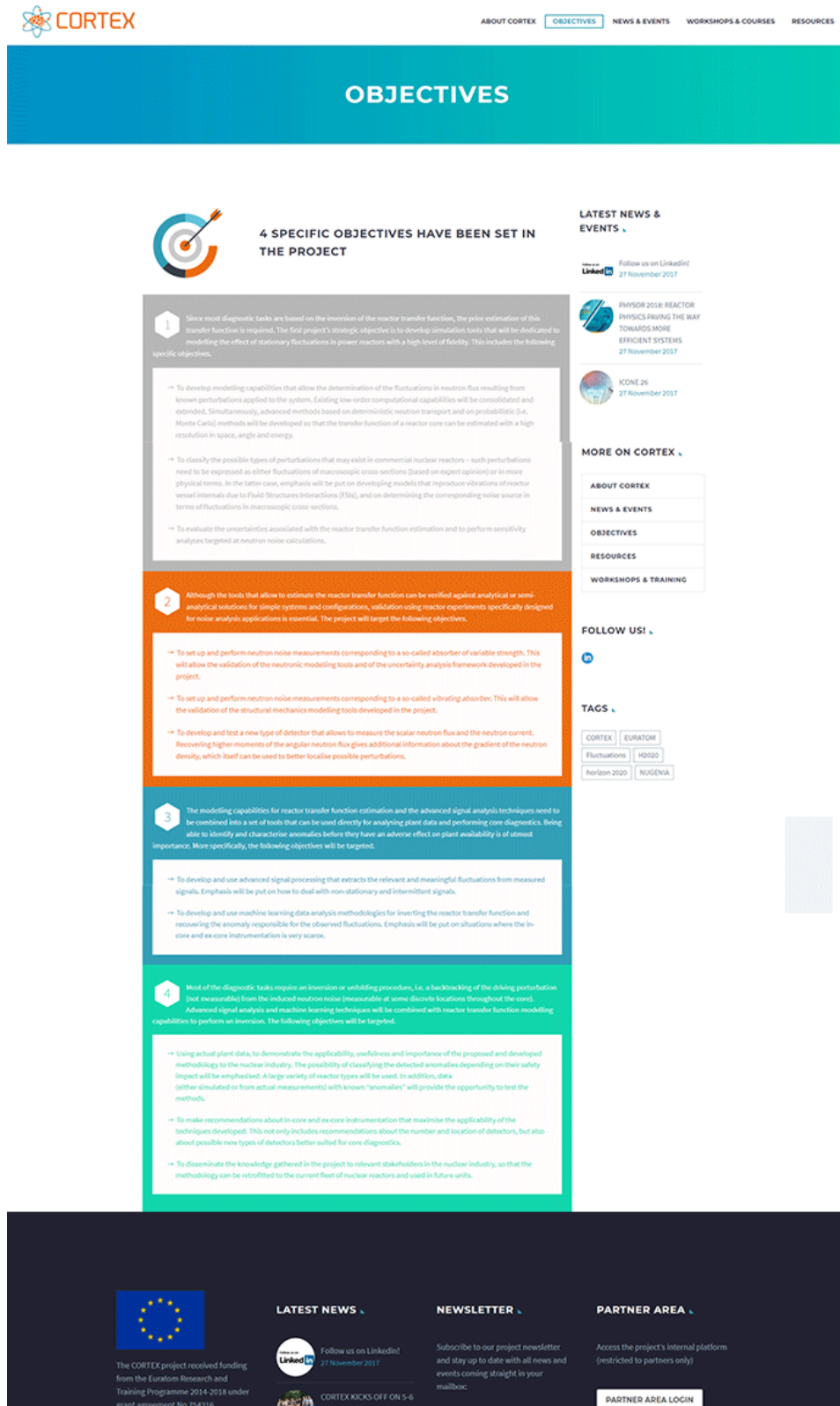
The “About CORTEX” page describes the project in general, its concept, what it aims to achieve and how it will contribute to improved reactor safety.



Figure 2: Screenshot of About CORTEX page

## 2.3 Objectives

The “Objectives” page describes and details the project’s top strategic objectives.



**OBJECTIVES**

**4 SPECIFIC OBJECTIVES HAVE BEEN SET IN THE PROJECT**

- Since most diagnostic tasks are based on the inversion of the reactor transfer function, the prior estimation of this transfer function is required. The first project's strategic objective is to develop simulation tools that will be dedicated to modeling the effect of stationary fluctuations in power reactors with a high level of fidelity. This includes the following specific objectives.

  - To develop modeling capabilities that allow the determination of the fluctuations in neutron flux resulting from known perturbations applied to the system. Existing low-order computational capabilities will be consolidated and extended. Simultaneously, advanced methods based on deterministic neutron transport and on probabilistic (i.e. Monte Carlo) methods will be developed so that the transfer function of a reactor core can be estimated with a high resolution in space, angle and energy.
  - To classify the possible types of perturbations that may exist in commercial nuclear reactors - such perturbations need to be expressed as either fluctuations of macroscopic cross-sections (based on expert opinion) or in more physical terms. In the latter case, emphasis will be put on developing models that reproduce vibrations of reactor vessel internals due to Fluid Structures Interactions (FSI), and on determining the corresponding noise source in terms of fluctuations in macroscopic cross-sections.
  - To evaluate the uncertainties associated with the reactor transfer function estimation and to perform sensitivity analyses targeted at neutron noise calculations.
- Although the tools that allow to estimate the reactor transfer function can be verified against analytical or semi-analytical solutions for simple systems and configurations, validation using reactor experiments specifically designed for noise analysis applications is essential. The project will target the following objectives.

  - To set up and perform neutron noise measurements corresponding to a so-called absorber of variable strength. This will allow the validation of the neutronic modeling tools and of the uncertainty analysis framework developed in the project.
  - To set up and perform neutron noise measurements corresponding to a so-called vibrating absorber. This will allow the validation of the structural mechanics modelling tools developed in the project.
  - To develop and test a new type of detector that allows to measure the scalar neutron flux and the neutron current. Recovering higher moments of the angular neutron flux gives additional information about the gradient of the neutron density, which itself can be used to better localise possible perturbations.
- The modeling capabilities for reactor transfer function estimation and the advanced signal analysis techniques need to be combined into a set of tools that can be used directly for analysing plant data and performing core diagnostics. Being able to identify and characterise anomalies before they have an adverse effect on plant availability is of utmost importance. More specifically, the following objectives will be targeted.

  - To develop and use advanced signal processing that extracts the relevant and meaningful fluctuations from measured signals. Emphasis will be put on how to deal with non-stationary and intermittent signals.
  - To develop and use machine learning data analysis methodologies for inverting the reactor transfer function and recovering the anomaly responsible for the observed fluctuations. Emphasis will be put on situations where the in-core and ex-core instrumentation is very scarce.
- Most of the diagnostic tasks require an inversion or unfolding procedure, i.e. a backtracking of the driving perturbation (not measurable) from the induced neutron noise (measurable at some discrete locations throughout the core). Advanced signal analysis and machine learning techniques will be combined with reactor transfer function modelling capabilities to perform an inversion. The following objectives will be targeted.

  - Using actual plant data, to demonstrate the applicability, usefulness and importance of the proposed and developed methodology to the nuclear industry. The possibility of classifying the detected anomalies depending on their safety impact will be emphasised. A large variety of reactor types will be used. In addition, data (either simulated or from actual measurements) with known “anomalies” will provide the opportunity to test the methods.
  - To make recommendations about in-core and ex-core instrumentation that maximise the applicability of the techniques developed. This not only includes recommendations about the number and location of detectors, but also about possible new types of detectors better suited for core diagnostics.
  - To disseminate the knowledge gathered in the project to relevant stakeholders in the nuclear industry, so that the methodology can be retrofitted to the current fleet of nuclear reactors and used in future units.

**LATEST NEWS & EVENTS**

Follow us on LinkedIn  
27 November 2017

PHYSOR 2018: REACTOR PHYSICS PAVING THE WAY TOWARDS MORE EFFICIENT SYSTEMS  
27 November 2017

ICONE 26  
27 November 2017

**MORE ON CORTEX**

- ABOUT CORTEX
- NEWS & EVENTS
- OBJECTIVES
- RESOURCES
- WORKSHOPS & TRAINING

**FOLLOW US!**

**TAGS**

- CORTEX
- EURATOM
- Fluctuations
- H2020
- horizon 2020
- NUGENIA

**LATEST NEWS**

The CORTEX project received funding from the Euratom Research and Training Programme 2014-2018 under grant agreement No 754316.

Follow us on LinkedIn  
27 November 2017

**NEWSLETTER**

Subscribe to our project newsletter and stay up to date with all news and events coming straight in your mailbox.

**PARTNER AREA**

Access the project's internal platform (restricted to partners only)

**PARTNER AREA LOGIN**

CORTEX KICKS OFF ON 5-6 SEPTEMBER

Figure 3: Screenshot of Objectives page



## 2.4 News and events

The “News and events” section reports on the news and events relating to CORTEX, as well as related projects, or news and events of interest to the project’s key stakeholders.

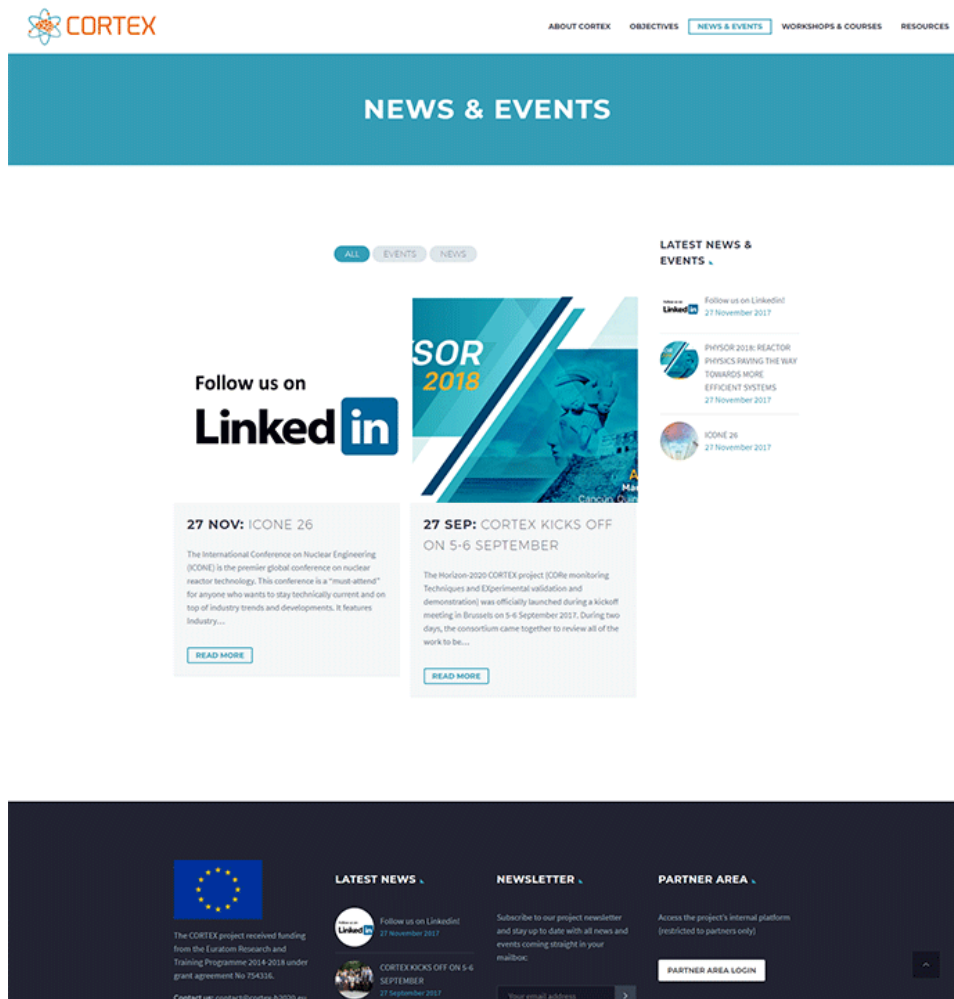
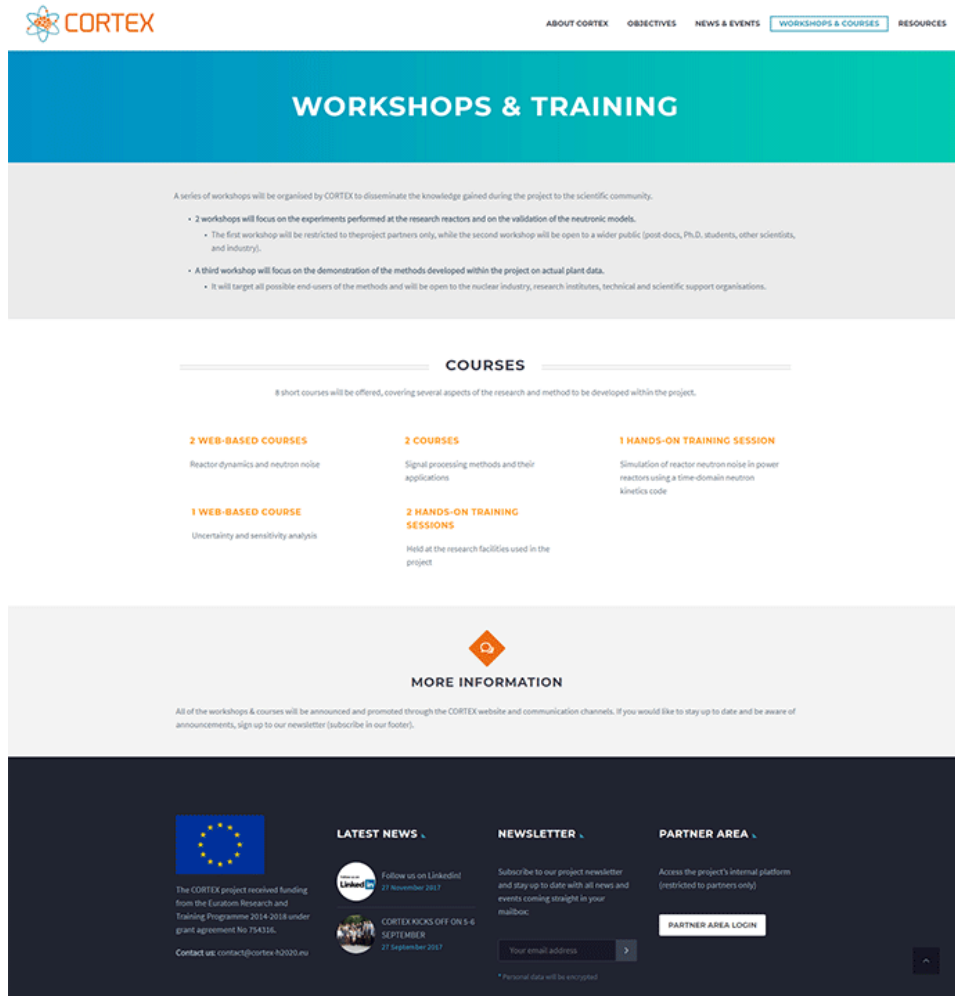


Figure 4: Screenshot of News and Events page

## 2.5 Workshops and courses

The “Workshops and courses” page presents all of the activities that will be organised by the project. This includes: web-based courses, workshops and hands-on courses. All events will be announced and promoted via this page and homepage of the website.



**WORKSHOPS & TRAINING**

A series of workshops will be organised by CORTEX to disseminate the knowledge gained during the project to the scientific community.

- 2 workshops will focus on the experiments performed at the research reactors and on the validation of the neutronic models.
  - The first workshop will be restricted to the project partners only, while the second workshop will be open to a wider public (post docs, Ph.D. students, other scientists, and industry).
- A third workshop will focus on the demonstration of the methods developed within the project on actual plant data.
  - It will target all possible end-users of the methods and will be open to the nuclear industry, research institutes, technical and scientific support organisations.

**COURSES**

8 short courses will be offered, covering several aspects of the research and method to be developed within the project.

<p><b>2 WEB-BASED COURSES</b></p> <p>Reactor dynamics and neutron noise</p>	<p><b>2 COURSES</b></p> <p>Signal processing methods and their applications</p>	<p><b>1 HANDS-ON TRAINING SESSION</b></p> <p>Simulation of reactor neutron noise in power reactors using a time-domain neutron kinetics code</p>
<p><b>1 WEB-BASED COURSE</b></p> <p>Uncertainty and sensitivity analysis</p>	<p><b>2 HANDS-ON TRAINING SESSIONS</b></p> <p>Held at the research facilities used in the project</p>	

**MORE INFORMATION**

All of the workshops & courses will be announced and promoted through the CORTEX website and communication channels. If you would like to stay up to date and be aware of announcements, sign up to our newsletter (subscribe in our footer).

**LATEST NEWS**

The CORTEX project received funding from the Euratom Research and Training Programme 2014-2018 under grant agreement No 754316. Contact us: [contact@corlex-h2020.eu](mailto:contact@corlex-h2020.eu)

Follow us on LinkedIn! 21 November 2017

CORTEX KICKS OFF ON 5-6 SEPTEMBER 27 September 2017

**NEWSLETTER**

Subscribe to our project newsletter and stay up to date with all news and events coming straight in your mailbox.

Your email address

\* Personal data will be encrypted

**PARTNER AREA**

Access the project's internal platform (restricted to partners only)

[PARTNER AREA LOGIN](#)

Figure 5: Screenshot of Workshops and Courses page

## 2.6 Resources

The “Resources” section gives access to the project’s resources, such as the public deliverables, press releases, photos galleries and promotional materials (brochures and flyers).

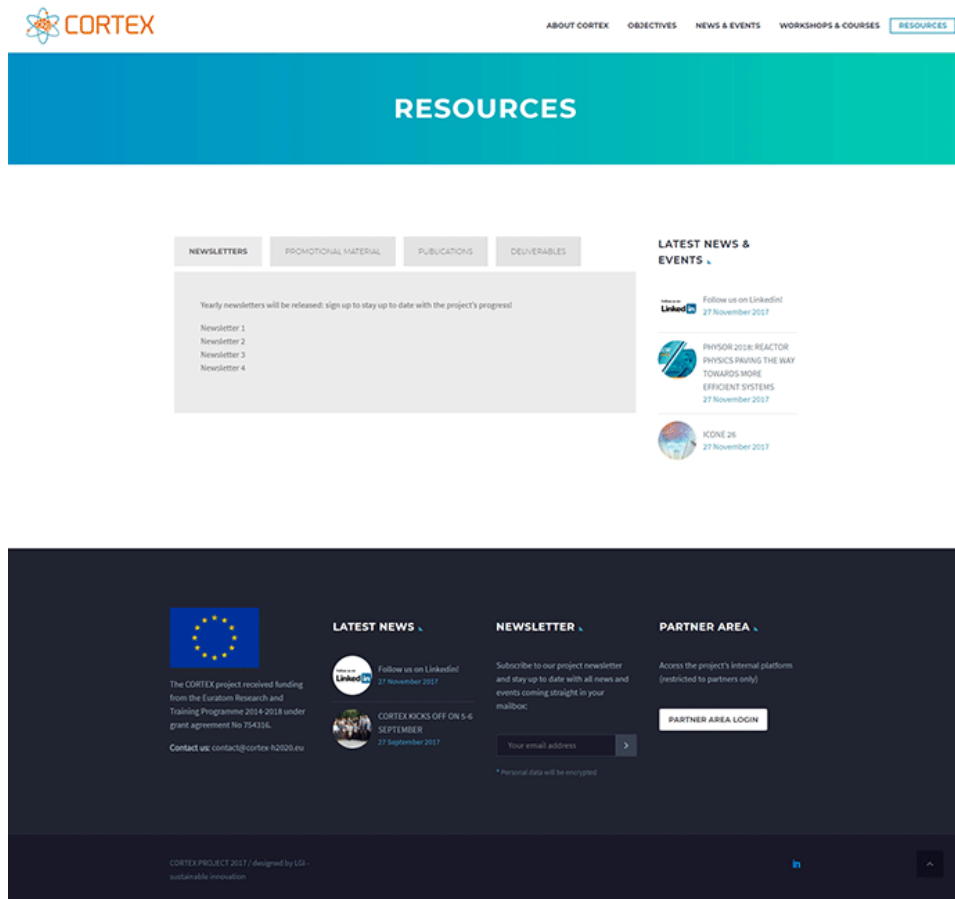


Figure 6: Screenshot of Resources page

## 2.7 Partner area

The “Partner area” section is dedicated to the project’s partners. This platform allows them to share documents and work in a collaborative way. It provides an online repository for information about the management of the project, contacts, results from the meetings, as well as internal working documents related to the different WPs that are required to be shared. All documents and files are saved and organised in one place and can be shared at any time, from any location or device.

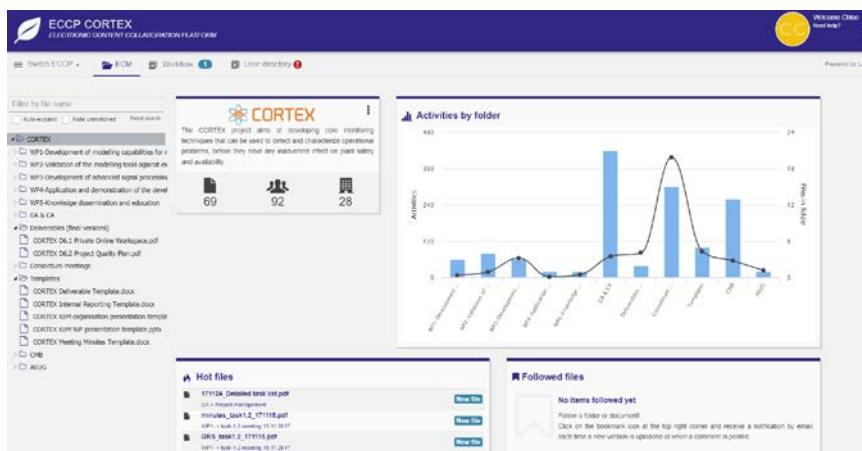


Figure 7: Screenshot of Partner area dashboard



## **2.8 Other considerations**

### **Browser compatibility**

The website is compatible with the common web browsers on all common operating systems. These include various versions of Internet Explorer, Firefox, Safari, Opera and Chrome.

The layout of the website is also responsive: it adjusts the design display based on the screen size of the device it's viewed on, regardless of whether it is viewed on a desktop, tablet or mobile.

### **Google analytics**

To understand how the website is used by visitors, a Google Analytics account will be registered for CORTEX. The reports will give a clear idea on:

- How many users are visiting the site
- Which pages are the most viewed
- The geographic location of visitors

### **Update of the webpage**

Updates will be made every 4 – 6 months so that it continues to adapt to the important milestones. This is to ensure that the website remains a dynamic and useful tool to spread the knowledge acquired during the project.

## **3 Conclusions**

The CORTEX website was designed during the first months of the project, and was launched in November 2017 according to specific needs, and aims to maximise the impact of the project. It also aims to boost the awareness of the results and milestones to be accomplished during the project. The CORTEX website will be updated regularly and will remain a flexible tool. The content and structure may evolve if necessary.