EUROPEAN RESEARCH EXECUTIVE AGENCY (REA)

REA.C – Future Society
C.04 – Reforming European R&I and Research Infrastructures

ANNEX 1 (part A)

Research and Innovation action

NUMBER — 951754 — FCCIS

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1.1. The project summary

Project Number [1]	951754	Project Acronym [2]	FCCIS

One form per project

General information	
Project title [3]	Future Circular Collider Innovation Study
Starting date [4]	02/11/2020
Duration in months [5]	48
Call (part) identifier [6]	H2020-INFRADEV-2019-3
Topic	INFRADEV-01-2019-2020 Design Studies
Fixed EC Keywords	
Free keywords	Research infrastructure, particle physics, particle accelerators, international collaboration, socio-economic impacts, EU smart specialisation, research and innovation missions, open innovation

Abstract [7]

What is the Origin of Everything? The Standard Model of Particle Physics explains everything except for the parts that it does not cover. This limitation calls for a science mission to gain a deeper understanding of matter, energy and the fundamental laws of nature. The first step is to elucidate the mysteries that revolve around the Higgs boson. Is it point like? Does it interact with itself? The best way to answer these such questions is to create a clean experimental environment with a highest luminosity particle collider. The Future Circular Collider Innovation Study (FCCIS) will deliver a conceptual design and an implementation plan for a new research infrastructure, consisting of a 100 km long, circular tunnel and a dozen surface sites. It will initially host an electron-positron particle collider. With an energy frontier hadron collider as a second step, it can serve a world-wide community through the end of the 21st century. This project will validate the key performance enablers at particle accelerators. Extreme luminosities, a factory producing a million Higgs bosons, luminosities up to 100 times the present world record with parts-per-million energy precision will strengthen Europe's leadership in excellent science for many decades. This project will attract academic and industrial leaders to develop a feasible and affordable project that incorporates ecodesign and resource efficiency from an early stage onwards. The project includes work with the host states France and Switzerland to ensure that the infrastructure blends in with the territorial boundary conditions. A socio-economic impact analysis will reveal the added value that this infrastructure will generate during its first phase and serve as the basis for developing a funding and implementation plan. This project emphasizes the user capacity building process with theoretical and experimental physicists at an international scale to ensure an exploitation of the facility from the start.

1.2. List of Beneficiaries

Project Number [1]	951754	Project Acronym [2]	FCCIS

List of Beneficiaries

No	Name	Short name	Country	Project entry date[8]	Project exit date
1	EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH	CERN	Switzerland		
2	COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	CEA	France		
3	CENTRE D ETUDES ET D EXPERTISE SUR LES RISQUES L ENVIRONNEMENT LA MOBILITE ET L AMENAGEMENT	Cerema	France		
4	CENTRE D'ETUDES DES TUNNELS	CETU	France		
5	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	CNRS	France		
6	CSIL - CENTRO STUDI INDUSTRIA LEGGERA SOCIETA' COOPERATIVA	CSIL	Italy		
7	STIFTUNG DEUTSCHES ELEKTRONEN-SYNCHROTRON DESY	DESY	Germany		
8	THE HENRYK NIEWODNICZANSKI INSTITUTE OF NUCLEAR PHYSICS, POLISH ACADEMY OF SCIENCES	IFJ PAN	Poland		
9	ISTITUTO NAZIONALE DI FISICA NUCLEARE	INFN	Italy		
10	KARLSRUHER INSTITUT FUER TECHNOLOGIE	KIT	Germany		
11	LATITUDE DURABLE SARL	LD	Switzerland		
12	MONTANUNIVERSITAET LEOBEN	MUL	Austria		
13	SPRINGER NATURE BV	SN	Netherlands		
14	TERRA MATER FACTUAL STUDIOS GMBH	TMFS	Austria		
15	THE UNIVERSITY OF LIVERPOOL	ULIV	United Kingdom		
16	UNIVERSIDAD DE SANTIAGO DE COMPOSTELA	USC	Spain		

1.3. Workplan Tables - Detailed implementation

1.3.1. WT1 List of work packages

WP Number[9]	WP Title	Lead beneficiary[10]	Person-months[11]	Start month[12]	End month[13]
WP1	Management	1 - CERN	83.00	1	48
WP2	Collider design	7 - DESY	383.00	1	46
WP3	Integrate Europe	1 - CERN	180.00	1	45
WP4	Impact & sustainability	6 - CSIL	149.00	1	44
WP5	Leverage & engage	8 - IFJ PAN	87.00	1	48
		Total	882.00		

1.3.2. WT2 list of deliverables

Deliverable Number[14]	Deliverable Title	WP number[9]	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D1.1	Project handbook	WP1	1 - CERN	Report	Public	4
D1.2	Data and dissemination management plan	WP1	1 - CERN	ORDP: Open Research Data Pilot	Public	6
D1.3	Advisory committee strategic recommendations	WP1	1 - CERN	Report	Public	46
D2.1	Collider performance, beam optics and design considerations baseline	WP2	1 - CERN	Report	Public	12
D2.2	Interaction region and machine detector interface design	WP2	9 - INFN	Report	Public	32
D2.3	Full-energy booster design	WP2	2 - CEA	Report	Public	40
D2.4	Experimental characterisations of particle collider key performance enablers	WP2	7 - DESY	Report	Public	42
D3.1	Transnational environmental evaluation requirements and framework	WP3	11 - LD	Report	Public	16
D3.2	Mining the Future® innovation challenge results	WP3	12 - MUL	Report	Public	24
D3.3	Particle collider layout and placement assessment	WP3	3 - Cerema	Report	Public	34
D3.4	Preliminary excavation materials management plan	WP3	4 - CETU	Report	Public	45
D4.1	Plan for research infrastructure socio-economic impact analysis	WP4	6 - CSIL	Report	Public	10
D4.2	Regional benefits and territorial development opportunities in a global	WP4	5 - CNRS	Report	Public	36
D4.3	Socio-economic impacts of the lepton collider-based research infrastructure	WP4	6 - CSIL	Report	Public	38

Deliverable Number[14]	Deliverable Title	WP number[9]	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D4.4	Implementation, financing and in-kind contribution strategy	WP4	1 - CERN	Report	Public	44
D5.1	Communication strategy	WP5	14 - TMFS	Report	Public	13
D5.2	Project scenario information package for institutional stakeholders	WP5	1 - CERN	Report	Public	20
D5.3	Preliminary collaboration governance framework	WP5	1 - CERN	Report	Public	32
D5.4	Engagement plan for stakeholders and non-scientific experts	WP5	14 - TMFS	Report	Public	36
D5.5	FCC-ee physics research programme	WP5	8 - IFJ PAN	Report	Public	43
D5.6	FCC-ee design report	WP5	1 - CERN	Report	Public	48

1.3.3. WT3 Work package descriptions

Work package number [9]	WP1	Lead beneficiary [10]	1 - CERN
Work package title	Management		
Start month	1	End month	48

Objectives

1) Manage the H2020 project and integrate it coherently with the international FCC study hosted by CERN
2) Coordinate the work at technical and scientific level of all work packages and maintain the project scope to successfully achieve the set project goals
3) Ensure the quality of the deliverables
4) Manage project-related risks
5) Ensure a coordinated flow of information between project, industry, academic institutions, govern-ment and funding agencies, including the European Commission
6) Plan dissemination and exploitation activities
7) Plan and perform gender and diversity relevant activities
8) Explore innovation potentials and their transfer to society and economy in cooperation with WPs 2, 3, 4, 5
9) Strategically place the new infrastructure and its development in a global landscape of related facili-ties, plan for geographically distributed and topically complementary co-construction

Description of work and role of partners

WP1 - Management [Months: 1-48]
CERN, CEA, Cerema, CETU, CNRS, CSIL, DESY, IFJ PAN, INFN, KIT, LD, MUL, SN, TMFS, ULIV, USC
Task 1.1: Project management and coordination (lead: CERN, participants: all beneficiaries)
This task will coordinate all project activities as described in section 3.2 “Management structure and pro-cedures”. The consortium agreement will be drawn up and signed by all beneficiaries before the project start date. The consortium will use a well-established DESCA model that has been tailored by CERN’s legal service for research infrastructure design studies. The model has been successfully used in several CERN coordinated H2020 projects. This task focuses on ensuring effective communication and exchange of information among the consortium partners, steering and monitoring the scientific and technical work, overseeing the project progress and ensuring that all work package leaders are working towards target milestone dates. The task also includes the organisation of consortium meetings notably the kick-off meeting, subsequent regular project management meetings and annual collaboration meetings that are combined with an international scientific/technical conference. Day-to-day project management includes the establishment, staffing and organisation of a project office at CERN with adequate infrastructures, of-fice resources and tool support. The collaborative Web platform facilitates keeping track of the project, milestones and deliverables, project members, working documents, meetings, reference materials, tem-plates and it also serves as a central entry point for project administration processes. This activity also in-cludes the development of a Data and Publications Management Plan (D1.2) to ensure that the research activities of the project are compliant with the H2020 FAIR and Open Access policies and the rec-ommendations of the Open Research Data pilot. The plan will outline how data will be collected, pro-cessed or generated within the project, particularly data originating from particle accelerator design work, from cost-benefit analysis and from the implementation studies.
Task 1.2: Financial and administrative management and reporting
(lead: CERN, participants: all beneficiaries)
This task includes the day-to-day management of financial, legal, ethical and administrative matters, as well as periodic reporting. The coordinator will ensure an effective interface between the consortium and the EC and will be responsible for financial and scientific reporting. The project coordinator will provide guidelines to the partners for monitoring the use of resources including timesheets and producing progress reports. The project coordinator will collate and review administrative and financial report contributions from partners to allow a timely submission of required periodic reports.
Task 1.3: Quality and risk management (lead: CERN, participants: all beneficiaries)
The participants will adhere to the highest professional standards and pay strict attention in applying qual-ity principles, standards and procedures to all tasks, ensuring adequate availability of resources (person-nel and support infrastructures) to be able to perform the tasks according to assured quality levels. This task will adopt a quality and risk management plan (QRMP) which is part of the project handbook (D1.1) to control and ensure high quality and effective monitoring of the activities and progress towards the ex-pected results. The QRMP will include quality objectives, measurement

criteria and associated indicators, the corresponding quality roles and responsibilities, as well as specific procedures for quality control and assurance of stakeholder satisfaction. Finally, it will define the coordination and personnel policy, includ-ing handling ethical and legal issues.
Task 1.4: Innovation management (lead: CERN, participants: all beneficiaries)
Innovation management is a key task in this "Innovation Study", following the "Open Innovation" best-practice, with at two goals: first, to develop a plan that creates an innovation by offering a sustainable long-term service for a world-wide physics community. Second, to foster innovations along the entire value chain, including the experiment detector projects and all necessary technical and non-technical ad-vances. An advisory committee consisting of multiple, domain-specific sub-groups which cuts across all domains will be set up. For implementation and operation aspects, a group consisting of experienced ex-ecutive managers from research infrastructures, the private sector and the third sector together with mem-bers of potential funding agencies and institutional stakeholders will be formed. Candidates for the com-mittee will be called from the ERA and beyond. The goal is to keep this body active beyond the project duration. Sub groups will meet regularly and a multi-disciplinary committee will meet at least once per year with representatives of the project management. The recommendations (D1.3) of the committee to create innovation for the core mission and for alternate target domains will be communicated all mem-bers of the project management.

Participation per Partner

Partner number and short name	WP1 effort
1 - CERN	60.00
2 - CEA	2.00
3 - Cerema	2.00
4 - CETU	2.00
5 - CNRS	2.00
6 - CSIL	2.00
7 - DESY	2.00
8 - IFJ PAN	1.00
9 - INFN	2.00
10 - KIT	1.00
11 - LD	1.00
12 - MUL	2.00
13 - SN	1.00
14 - TMFS	1.00
15 - ULIV	1.00
16 - USC	1.00
Total	83.00

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D1.1	Project handbook	1 - CERN	Report	Public	4

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D1.2	Data and dissemination management plan	1 - CERN	ORDP: Open Research Data Pilot	Public	6
D1.3	Advisory committee strategic recommendations	1 - CERN	Report	Public	46

Description of deliverables

D1.1: Project handbook (CERN)
Set of structures, procedures and tools to be used by the consortium members to implement the project. It includes guidelines and best practices for document management, project quality and risk management, internal and external communication, key dates, reference documents, plans and schedules, templates, a project team database and a copy of the members rights and duties.
D1.2: Data and dissemination management plan (CERN)
Documentation of the process, structures and tools to make data and publications openly accessible in this project applying the FAIR principles, “green” and “gold” open access publications.
D1.3: Advisory committee strategic recommendations (CERN, Cerema, CSIL, LD)
Summary of the project achievements up to the advisory committee review, the detailed international expert review of scientific, economic, communication and implementation related project domains and a comprehensive set of strategic recommendations in order to develop a plan for an innovative long-term service to be delivered by a sustainable research infrastructure and to develop tangible plans for innovations that target other domains with value for society and economy.

D1.1 : Project handbook [4]

Set of structures, procedures and tools to be used by the consortium members to implement the project. It includes guidelines and best practices for document management, project quality and risk management, internal and external communication, key dates, reference documents, plans and schedules, templates, a project team database and a copy of the members rights and duties.

D1.2 : Data and dissemination management plan [6]

Documentation of the process, structures and tools to make data and publications openly acces-sible in this project applying the FAIR principles, “green” and “gold” open access publications.

D1.3 : Advisory committee strategic recommendations [46]

Summary of the project achievements up to the advisory committee review, the detailed interna-tional expert review of scientific, economic, communication and implementation related project domains and a comprehensive set of strategic recommendations in order to develop a plan for an innovative long-term service to be delivered by a sustainable research infrastructure and to develop tangible plans for innovations that target other domains with value for society and economy.

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS1	Management structures established and technical / scientific work started	1 - CERN	1	M1.1: Board member lists established and accessible for consorti-um members through the collaborative Web tool. Agenda and draft minutes

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
				of board meetings available in document management system. Consortium agreement signed. Work schedule documented. Press release on project launch issued by CERN.
MS3	Progress reviewed 1	1 - CERN	7	M1.2: Agenda and draft minutes of board meetings available in document management system. Work progress reviewed and aligned in the form of a workshop with presentations on Indico site (Green). Contributions for Open Access pro-ceedings publication with SN (Gold) approved.
MS5	Research opportunities captured	15 - ULIV	14	M5.1: Physics research opportunities documented as presentations (Green, Indico). Contributions for Open Access proceedings with SN (Gold) approved. User community survey on research priorities launched.
MS6	Structure for cost estimates and funding needs	1 - CERN	18	M4.1: Structured document in tabular form with initial cost esti-mates and investment profile available via collaborative Web tool.
MS7	Progress reviewed 2	1 - CERN	21	M1.3: Agenda and draft minutes of board meetings available in document management system. Work progress reviewed and aligned in the form of a workshop with presentations publicly available on Indico (Green). Contributions for Open Access proceedings publication with SN (Gold) ap-proved.
MS8	Design report structure established	1 - CERN	24	M5.2: Design report structure set up in the collaborative writing environment. Section descriptions and production schedule available in

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
				document and chapter editor e-group set up.
MS9	Experimental physics goals captured	5 - CNRS	26	M5.3: Experimental physics goals documented in form of presen-tations on Indico (Green). Contributions for Open Access proceedings publication with SN (Gold) approved. User community survey on R&D topics, priorities and collabora-tion potentials considering geographical distribution and topical complementarity launched.
MS10	Progress reviewed 3	1 - CERN	33	M1.4: Agenda and draft minutes of board meetings available in document management system. Design report progress re-view and consolidation of contents in the form of a work-shop with presentations on Indico (Green). Contributions for Open Access proceedings publication with SN (Gold) approved.
MS11	Tool support for collaborative publishing workflow available	13 - SN	35	M5.4: Agreed and tested publishing process with SN, available for use with a collaborative writing tool.
MS12	Research programme consolidated	8 - IFJ PAN	38	M5.5: Draft of the physics research programme as collaborative effort of the engaged user community available in the form of presentations on Indico (Green). Contributions for Open Access proceedings publication with SN (Gold) approved.

Work package number [9]	WP2	Lead beneficiary [10]	7 - DESY
Work package title	Collider design		
Start month	1	End month	46

Objectives

This work package will deliver a performance optimised machine design, integrated with the territorial requirements and constraints identified by WP 3, considering cost, long-term sustainability, operational efficiency and design-for-impact developed by WP 4. The work builds on two pedestals: (1) the conceptual baseline established in the FCC-ee report and (2) a documentation of the FCC-ee physics programme goals. Involving beneficiaries and partners, the work package has the following objectives:
1) Optimise the collider parameters and layout (CERN, CEA, DESY, IFJPAN, INFN, BINP, KEK, UOXF)
2) Develop and openly document the collider beam optics and lattice design, including the interaction regions (CERN, CEA, DESY, BINP, KEK)
3) Establish procedures for optics corrections. Determine the beam diagnostics requirements and develop the beam instrumentation. Design the optics corrections and emittance tuning (DESY, CERN, KIT, KEK, UOXF)
4) Establish the impedance budget for the collider and the booster and evaluate single-beam collective effects for different modes of operation (INFN, DESY, CERN)
5) Design the collimation system, develop the aperture model and develop the machine protection concept (CERN, DESY, INFN)
6) Develop the top-up injection scheme (CEA, CERN, KEK)
7) Develop and document the machine detector interface, final focus, stabilisation measures, back-ground control and luminosity measurements (INFN, CERN, CNRS, KEK, UOXF)
8) Design and document the full energy booster (CEA, CERN)
9) Develop techniques for precision energy calibration, especially requirements and procedures for energy calibration using resonant depolarisation in the Z and W running modes, and benchmarking of techniques, like Compton scattering, to extend the energy calibration to higher energy (KIT, BINP, CERN)

Description of work and role of partners

WP2 - Collider design [Months: 1-46]
DESY, CERN, CEA, CNRS, IFJ PAN, INFN, KIT
Task 2.1: Work package coordination (lead: DESY, participants: CEA, CERN, CNRS, KIT, IFJPAN, INFN)
DESY, with the assistance from CERN, coordinates the tasks in this WP to ensure consistency of the work according to the project scope and plan. DESY organises the regular coordination meetings, workshops, manages the scope, reviews the progress, distributes information within the WP and manages the interfaces and collaborative with other WPs. IFJPAN coordinates the interfaces with theoretical and experimental physics communities. A specific person at CERN plans and follows up the documentation and open-access data publications concerning the experimentally tested beam optics at particle accelerators which are made available free of charge by the beneficiaries (Section 4.1). DESY, CEA, CERN and KIT focus on the accelerator design coordination. INFN coordinates the work around the interaction region. CERN coordinates the interfaces with partners BINP, KEK and UOXF and for the territorial layout and placement requirements (DRRT, EdG). CERN allocates a person for the configuration management of the beam optics, lattice and the element database. CERN produces an open Product Breakdown Structure (PBS, M2.1) and disseminates data on Zenodo. The editing of the collider-related chapters of the design report (D5.6, WP5) is with CERN.
Task 2.2: Collider design (lead: DESY, participants: CEA, CERN, KIT, IFJPAN, INFN, partners BINP, KEK)
Develop the parameters and machine layout, starting from the physics programme requirements (D2.1) and iteratively ensure that the design matches the physics research requirements with tasks 2.1 and 2.3 (IFJPAN). Study different numbers of interaction points (IPs) and compare their respective performance (CERN). Analyse and mitigate impedance and single-beam collective effects in the collider rings (INFN). Develop the positioning concept (CNRS). Conceive an effective beam diagnostics architecture, specify the device functions and performance (KIT). Understand the measurement needs and the level of precision required for a layout of the longitudinal beam diagnostics system. Develop a diagnostics concept based on an electro-optical setup for bunch-by-bunch measurements of the longitudinal profile and centre of gravity of the bunches. Time-resolved measurements of the horizontal beam size in a dispersive section are proposed as an approach to measure the energy spread. Test (D2.4) prototype diagnostics at the KARA accelerator (KIT). Develop the concept for the global orbit control system. Verify optics correction and vertical emittance tuning

procedures in beam tests (D2.4) at the PETRA III (DESY) storage-ring or, at VEPP-4M at BINP and at SuperKEKB (KEK) (D2.2). Integrate the findings in the main deliverable of the project (D5.6).
Task 2.3: Interaction region and machine detector interface design
(lead: INFN, participants: CERN, CNRS, DESY, partners BINP, KEK and UOXF)
Ensure that the interaction region design meets the collider performance goals and develop an accelerator-detector interface coherently with task 2.2. Develop a 3D model of the interaction region, including final quadrupole and solenoid magnets, support structures, cooling schemes, and vacuum system. Develop heat-load budget and determine cooling requirements. Analyse vibration and stability. Develop and refine concepts for the luminosity measurement. Analyse and propose effective design measures to control the background and to protect the machine. Design the collimation system, develop a collider aperture model and develop an accelerator-detector protection concept. Review the SuperKEK IP feedback (KEK) architecture, performance, merits and limitations. Experimental beam studies (D2.4) exploring the sensitivity of the beam-beam performance to IP optics aberrations are planned at DAΦNE (INFN) and at SuperKEKB (KEK) with the crab-waist collision scheme. Document the interaction region design (D2.2) and integrate the findings in the main deliverable (D5.6).
Task 2.4: Full energy booster and top-up injection design (lead: CEA, participants: CERN, INFN, BINP)
Design a full-energy booster and integrate it with the collider using a top up injection scheme (D2.3). This work comprises optics design, including injection and extraction region and beam transfer to the collider rings, field quality and dynamic aperture at injection and during the ramp and collective effects. Determine the minimum acceptable injection energy. Integrate the findings in the project's main deliverable (D5.6).
Task 2.5: Polarisation and energy calibration (lead: KIT, participants: CERN, partner BINP)
Develop and validate the optics correction and spin-matching procedures for establishing the transverse polarisation to achieve high-precision centre-of-mass energy calibration in cooperation with task 2.2 and 2.3. Refined energy calibration through resonant depolarisation with pilot bunches, polarisation wigglers and error assessment is an enabler for the extreme statistical precision and experimental accuracy at the Z pole and at the WW threshold. Plan tests (D2.4) with resonant depolarisation at KARA (KIT) and energy measurement at VEPP-4M (BINP). Possibly study an alternative energy calibration using Compton backscattering, benchmark the two methods in low energy running modes, and extrapolate to higher energy. Document (D5.6) the design, including the elements and expected performance with a level of detail that permits starting the detailed technical design.

Participation per Partner

Partner number and short name	WP2 effort
1 - CERN	84.00
2 - CEA	48.00
5 - CNRS	20.00
7 - DESY	108.00
8 - IFJ PAN	4.00
9 - INFN	86.00
10 - KIT	33.00
Total	383.00

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D2.1	Collider performance, beam optics and design considerations baseline	1 - CERN	Report	Public	12

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D2.2	Interaction region and machine detector interface design	9 - INFN	Report	Public	32
D2.3	Full-energy booster design	2 - CEA	Report	Public	40
D2.4	Experimental characterisations of particle collider key performance enablers	7 - DESY	Report	Public	42

Description of deliverables

D2.1: Collider performance, beam optics and design considerations baseline (CERN)
A technical report describing the baseline layout and the lattice together with a workable beam optics. The report includes the achievable performance and what remains to be addressed.
D2.2: Interaction region and machine detector interface design (INFN)
3D CAD proof-of-principle engineered mechanical design of the interface between the accelerator and detector components in the interaction region.
D2.3: Full-energy booster design (CEA)
A report describing the minimum acceptable injection energy into the booster, the lattice concept together with a workable beam optics, the ramp strategy and the top-up injection into the collider.
D2.4: Experimental characterisations of particle collider key performance enablers (DESY)
A report summarising the results from the experimental verifications of performance enabling techniques at various accelerators. Analysis of the beam-beam behaviour for the crab waist collision scheme and possibly, its sensitivity to various optics aberrations at the collision point.

D2.1 : Collider performance, beam optics and design considerations baseline [12]

A technical report describing the baseline layout and the lattice together with a workable beam optics. The report includes the achievable performance and what remains to be addressed.

D2.2 : Interaction region and machine detector interface design [32]

3D CAD proof-of-principle engineered mechanical design of the interface between the accelerator and detector components in the interaction region.

D2.3 : Full-energy booster design [40]

A report describing the minimum acceptable injection energy into the booster, the lattice con-cept together with a workable beam optics, the ramp strategy and the top-up injection into the collider.

D2.4 : Experimental characterisations of particle collider key performance enablers [42]

A report summarising the results from the experimental verifications of performance enabling techniques at various accelerators. Analysis of the beam-beam behaviour for the crab waist collision scheme and possibly, its sensitivity to various optics aberrations at the collision point.

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS1	Management structures established and technical / scientific work started	1 - CERN	1	M1.1: Board member lists established and accessible for consorti-um members through

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
				the collaborative Web tool. Agenda and draft minutes of board meetings available in document management system. Consortium agreement signed. Work schedule documented. Press release on project launch issued by CERN.
MS3	Progress reviewed 1	1 - CERN	7	M1.2: Agenda and draft minutes of board meetings available in document management system. Work progress reviewed and aligned in the form of a workshop with presentations on Indico site (Green). Contributions for Open Access pro-ceedings publication with SN (Gold) approved.
MS4	Product Breadown Structure	1 - CERN	8	M2.1: Structured document of collider elements in tabular form publicly released on Zenodo (Green, open data).
MS6	Structure for cost estimates and funding needs	1 - CERN	18	M4.1: Structured document in tabular form with initial cost esti-mates and investment profile available via collaborative Web tool.
MS7	Progress reviewed 2	1 - CERN	21	M1.3: Agenda and draft minutes of board meetings available in document management system. Work progress reviewed and aligned in the form of a workshop with presentations publicly available on Indico (Green). Contributions for Open Access proceedings publication with SN (Gold) ap-proved.
MS8	Design report structure established	1 - CERN	24	M5.2: Design report structure set up in the collaborative writing environment. Section descriptions and production schedule available in document and chapter editor e-group set up.

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS10	Progress reviewed 3	1 - CERN	33	M1.4: Agenda and draft minutes of board meetings available in document management system. Design report progress re-view and consolidation of contents in the form of a work-shop with presentations on Indico (Green). Contributions for Open Access proceedings publication with SN (Gold) approved.
MS11	Tool support for collaborative publishing workflow available	13 - SN	35	M5.4: Agreed and tested publishing process with SN, available for use with a collaborative writing tool.

Work package number [9]	WP3	Lead beneficiary [10]	1 - CERN
Work package title	Integrate Europe		
Start month	1	End month	45

Objectives

This work package will develop a territorially implementable project scenario. It includes a project de-scription, layout and placement variants, mission-critical invariants and territorial constraints, resource needs, risks, socio-economic synergy potentials and a project preparatory phase schedule including legal and administrative processes. Adopting an integrating approach from a very early stage ensures that the preparation phase is entered with a project scenario that has been validated by all stakeholders (popula-tion, host states, scientists, funding agencies). The project can only be implemented if both a territorial implementation scenario is societally acceptable and if the required performance for scientific research can be delivered. This work package links WP 2, which technically optimises the particle collider, with WP 4 integrating socio-economic aspects. Innovation potentials are explored along the activities in this project, which feed into WP 2, 4 and 5. One example is the international Mining the Future® challenge competition to identify ways for using the excavated materials.

Description of work and role of partners

WP3 - Integrate Europe [Months: 1-45]
CERN, Cerema, CETU, LD, MUL
Task 3.1: Work package coordination (lead: CERN, participants: CETU, LD, MUL)
CERN coordinates the tasks to ensure consistency of the work according to the project scope and plan. This includes the organisation of coordination meetings, scope management, progress reviewing, reporting and distribution of information within the WP as well as the management of the interfaces and collaborative work with the other WPs. LD assists in the coordination of the activities focusing on the framework for the environmental evaluation (D3.1). CETU and MUL assist in the coordination activities concerning the development of a strategy and preliminary plan for managing the excavation materials (D3.4). CERN coordinates the iterative optimisation of layout and placement (D3.3) with administration, tool support and open data publishing (Zenodo and geographical information system portals). CERN will interface to the partners in France (DRRT) and Switzerland (EdG) for public access to scenario information for citizens through existing portals (e.g. ge.ch/sitg, cdata.cerema.fr and data.gouv.fr). This approach will lead to a documented evolution of the infrastructure.
Task 3.2: Infrastructure placement optimization with respect to territorial requirements
(lead: CERN, participants: Cerema, CETU, MUL, LD, partners EdG, DRRT-AuRA)
The participants of this task cooperate closely with WP 2 to develop the layout and placement (D3.3) of the underground infrastructure and surface sites that host access shafts and technical infrastructures. The work progresses iteratively from an initial baseline (delivered by the EuroCirCol H2020 project) to a version that can be used in the administrative preparatory processes with host states (e.g. débat public in France), funding agencies (e.g. European Strategy for Particle Physics, national ministries and state departments), science policy bodies (e.g. ECFA, ESFRI, ERIC, GSO, GSF, STOA) and the public in the region (État et Canton de Genève in Switzerland, région Auvergne-Rhône-Alpes in France). The optimisation progresses iteratively,
taking into account the collider design (WP 2) and the territorial constraints and socio-economic synergies (WP 4). The underground infrastructure's depth adjustment is also considered a variable.
Task 3.3: Transnational environmental evaluation framework
(lead: CERN, participants: Cerema, CETU, LD)
Cerema, CETU and LD will document the requirements (D3.1) for the environmental evaluation process spanning the individual project phases (preparation, construction, commissioning, operation, upgrade to next phase). CERN provides input about the constraints and opportunities from its successful large-scale endeavours (LEP, LHC, HL-LHC) and its status as international organisation. CETU focuses on the lifecycle analysis of the materials management of the excavated materials. CETU will study the possibilities of applying this methodology to other areas of the project (e.g. construction of underground structures and surface sites). This work will lead to a survey to identify suitable tools, gaps and efforts needed to establish a workable infrastructure for the assessment and management of environmental impacts in a transnational context.
Task 3.4: Management of excavated materials
(lead: MUL, participants: CERN, Cerema, CETU, LD, partners EdG and DRRT-AuRA)

About 800 million tons of inert materials per year coming from tunneling and public engineering projects are today disposed of in landfills. This is a waste of valuable resources and taxpayer's money. FCC would generate 9 million m3 of excavated materials. Its particular location across EU boundaries (France and Switzerland) and CERN's status as an international organisation is an opportunity to pilot methods and to conceive regulatory frameworks to increase the use of excavated materials. A technical risk management (CETU, MUL) process will help planning the reduction of the quantity of materials destined for landfill. This task aims to reduce the funds required to dispose of the materials in traditional ways. It strives to find novel technologies to address the challenge and aims for regulatory innovation, for instance thorough guidelines beyond established practices. The prevalent material in the region, sedimentary rock called "molasse" will be analysed by MUL and CERN with the help of regional laboratories and academic institutes outside the consortium. The data will be made openly accessible on Zenodo (M3.1) to catalyse the innovation process. Cerema identifies opportunities for regional opportunities (industrial sector identification) and CETU focuses on the risk management framework (EN/ISO 31000), regulatory aspects (diagnosis, constraints, opportunities), life-cycle related topics and on defining a territorial approach (use-cases with credible economic impact, transport, disposal and landfill). This project engages a wide audience in the Mining the Future® challenge, an open world-wide competition to submit demonstrated solutions. CSIL participates in the economic impact analysis of all materials use cases and in assessing the innovation potentials of the proposals. An international expert committee to be established by the WP will select a proposal. The winner will be awarded with assistance to document the intellectual property (e.g. license or patent) and to develop a business plan (D3.2). The award will be funded from a specific budget in this project. If no viable proposal can be identified, the funds will be used to document in detail a classical use case, which has been identified for a sub-set of the materials (D3.4).

Participation per Partner

Partner number and short name	WP3 effort
1 - CERN	96.00
3 - Cerema	21.00
4 - CETU	24.00
11 - LD	18.00
12 - MUL	21.00
Total	180.00

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D3.1	Transnational environmental evaluation requirements and framework	11 - LD	Report	Public	16
D3.2	Mining the Future® innovation challenge results	12 - MUL	Report	Public	24
D3.3	Particle collider layout and placement assessment	3 - Cerema	Report	Public	34
D3.4	Preliminary excavation materials management plan	4 - CETU	Report	Public	45

Description of deliverables

D3.1: Transnational environmental evaluation requirements and framework (LD)
A technical report summarising the contents and reporting requirements for Environmental Evaluation (EE) as required by French and Swiss regulatory frameworks, aligned with CERN's status as international organisation which permits defining and setting up a unified process for the entire project that spans the two host countries. The report will include guidance on tool selection and will lay out the applicability of life-cycle analysis for selected areas.
D3.2: Mining the Future® innovation challenge results (MUL)
A report that gives the outcome and results of the innovation challenge. The deliverable comprises a communication action (event, press release, media report), a technical summary and evaluation of the eligible submissions and a description of the results.
D3.3: Particle collider layout and placement assessment (Cerema)
A technical report that summarises the feasibility of the project across French and Swiss territory including underground and surface structures and annexes (access, technical infrastructures, resource supplies) from the urbanistic, environmental and societal points of view.
D3.4: Preliminary excavation materials management plan (CETU)
A technical/managerial report that summarises the approach for managing the approximately 9 million cubic meters of excavation materials in a resource- and cost-effective way, pointing to innovation potentials with economic benefits for companies and environmental advantages for the European society. The plan is considered to be preliminary, since specific management processes, the economic viability and the environmental benefits of the envisaged excavation materials use cases depend strongly on the precise sub-surface investigations, the evolution of legal frameworks in the EU and Switzerland and the response of companies to market surveys, all of which are expected to evolve after this H2020 project ends.

D3.1 : Transnational environmental evaluation requirements and framework [16]

A technical report summarising the contents and reporting requirements for Environmental Evaluation (EE) as required by French and Swiss regulatory frameworks, aligned with CERN's status as international organisation which permits defining and setting up a unified process for the entire project that spans the two host countries. The report will include guidance on tool se-lection and will lay out the applicability of life-cycle analysis for selected areas.

D3.2 : Mining the Future® innovation challenge results [24]

A report that gives the outcome and results of the innovation challenge. The deliverable com-prises a communication action (event, press release, media report), a technical summary and evaluation of the eligible submissions and a description of the results.

D3.3 : Particle collider layout and placement assessment [34]

A technical report that summarises the feasibility of the project across French and Swiss territory including underground and surface structures and annexes (access, technical infrastructures, re-source supplies) from the urbanistic, environmental and societal points of view.

D3.4 : Preliminary excavation materials management plan [45]

A technical/managerial report that summarises the approach for managing the approximately 9 million cubic meters of excavation materials in a resource- and cost-effective way, pointing to innovation potentials with economic benefits for companies and environmental advantages for the European society. The plan is considered to be preliminary, since specific management pro-cesses, the economic viability and the environmental benefits of the envisaged excavation mate-rials use cases depend strongly on the precise sub-surface investigations, the evolution of legal frameworks in the EU and Switzerland and the response of companies to market surveys, all of which are expected to evolve after this H2020 project ends.

Schedule of relevant Milestones

Milestone number[18]	**Milestone title**	**Lead beneficiary**	**Due Date (in months)**	**Means of verification**
MS1	Management structures established and technical / scientific work started	1 - CERN	1	M1.1: Board member lists established and accessible for consorti-um members through the collaborative Web tool.

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
				Agenda and draft minutes of board meetings available in document management system. Consortium agreement signed. Work schedule documented. Press release on project launch issued by CERN.
MS2	Mining the Future® challenge call open	12 - MUL	5	M3.1: Application open for submission on Web. Geology data downloadable from Zenodo (Green, open data). Evaluation board of international experts established. GDPR and IP rules available at the call website. Press release issued by CERN and MUL.
MS3	Progress reviewed 1	1 - CERN	7	M1.2: Agenda and draft minutes of board meetings available in document management system. Work progress reviewed and aligned in the form of a workshop with presentations on Indico site (Green). Contributions for Open Access pro-ceedings publication with SN (Gold) approved.
MS4	Product Breadown Structure	1 - CERN	8	M2.1: Structured document of collider elements in tabular form publicly released on Zenodo (Green, open data).
MS6	Structure for cost estimates and funding needs	1 - CERN	18	M4.1: Structured document in tabular form with initial cost esti-mates and investment profile available via collaborative Web tool.
MS7	Progress reviewed 2	1 - CERN	21	M1.3: Agenda and draft minutes of board meetings available in document management system. Work progress reviewed and aligned in the form of a workshop with presentations publicly available on Indico (Green). Contributions for Open Access proceedings

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
				publication with SN (Gold) ap-proved.
MS8	Design report structure established	1 - CERN	24	M5.2: Design report structure set up in the collaborative writing environment. Section descriptions and production schedule available in document and chapter editor e-group set up.
MS10	Progress reviewed 3	1 - CERN	33	M1.4: Agenda and draft minutes of board meetings available in document management system. Design report progress re-view and consolidation of contents in the form of a work-shop with presentations on Indico (Green). Contributions for Open Access proceedings publication with SN (Gold) approved.
MS11	Tool support for collaborative publishing workflow available	13 - SN	35	M5.4: Agreed and tested publishing process with SN, available for use with a collaborative writing tool.

Work package number [9]	WP4	Lead beneficiary [10]	6 - CSIL
Work package title	Impact & sustainability		
Start month	1	End month	44

Objectives

This work package will develop the financial roadmap of the infrastructure project, comprising cost esti-mates, financing plan, and analysis of socio-economic impacts. The work progresses iteratively in coop-eration with WP 2 and WP 3. The financial feasibility of the research infrastructure builds on the concept of a long-term science mission, which permits re-using civil and technical infrastructures for an energy-frontier hadron collider; on the development of a well-balanced investment profile for the lepton collider that interleaves energy upgrades with operation phases; a topically complementary and geographically distributed in-kind participation scheme; a committed user community for experimental facilities at mul-tiple interaction points (work with WP 5) and a design that drives the generation of socio-economic wealth from the very early concept stage. The work package pursues the following goals:

- Estimate construction and operation costs
- Develop a spending profile
- Analyse the socio-economic impacts using a probabilistic, quantitative method
- Analyse the possibilities for international in-kind contributions
- Identify impact pathways for co-construction of high-tech systems with industrial partners
- Identify territorial and regional benefits in a global project

The work will lead to ranges and likelihoods for different impacts and to the formulation of recommen-dations for the infrastructure with cost-effectiveness sustainability in mind. Sustainability relies on the creation of a committed user community to support and actively participate in a long-term research pro-gramme. The findings will be integrated in the design of the particle collider (WP 2) and the territorial scenario (WP 3) such that energy and resource efficiency are also well reflected in a sustainable operation plan.

Description of work and role of partners

WP4 - Impact & sustainability [Months: 1-44]
CSIL, CERN, Cerema, CETU, CNRS, SN, USC
Task 4.1: Work package coordination (lead: CSIL, participants: CERN)
CSIL, with the assistance of CERN, coordinates the tasks to ensure consistency with the project plan scope and schedule. This includes the organisation of coordination meetings, setting up of a high-level advisory committee, organisation of reviews with external participation, follow-up of the work and pro-duction of scheduled deliverables and reports, coordination of the creation of products for dissemination, collection of information from the other work packages for this WP and dissemination of findings to the other WPs. The task includes the participation in project-wide workshops and conferences and engaging external participants. This highly intersectoral WP requires the coordination with the other WPs on the following subjects:
WP 1: Scoping analysis, project objectives, time horizon, learning from similar projects, stakeholder mapping, mutual understanding of expected contribution to society, taxonomy of impacts, fundamental approach to forecast and evaluate impacts and counterfactual scenarios. Selected consortium members will be invited to participate in this coordination activity.
WP 2: Research infrastructure baseline parameters and information concerning technologies, product and work breakdown for cost estimates, input parameters for the setup of the socio-economic impact analysis. Recommendations from this WP for adaptations of the machine design to increase the sustainability of the project.
WP 3: Information about the territorial constraints and cost impacts of risks (e.g. management of excava-tion materials), use of resources (e.g. water, electricity), information about territorial synergy potentials (waste-heat consumers, creation of new technical infrastructures, regional development needs), feedback from this WP on territorial development opportunities that would lead to increased socio-economic im-pacts.
WP 5: Information about envisaged engagement and communication products, information about exper-iment user community sizes, feedback from this WP in view of increased sustainability through citizen engagement and an increased attractiveness for a global science community to invest in the ERA.
Task 4.2: Cost estimates (lead: CERN, participants: CSIL)
Building on the best-practice recommendations developed with the involvement of CSIL , , CERN, with the help of CSIL, prepares the cost estimates for the construction and operation phases (M4.1, D4.3). This task includes the development of a spending profile for the preparation, construction and operation phases that is used for the socio-

economic impact analysis in task 4.3. The cost estimates draw upon the machine design carried out in WP 2 and the territorial integration activities in WP 3. The esti-mates will be based on CERN contracted studies, for infrastructure elements which are not part of this project and on more than 20 years' experience of building and operating the Large-Hadron Collider (LHC) and its high luminosity upgrade.
Task 4.3: Socio-economic impact analysis (lead: CSIL, participants: CERN, SN, USC)
Based on the social cost-benefit analysis work carried out for the LHC/HL-LHC programme and RI-Paths project findings , the participants develop the plan for performing the socio-economic impact study (D4.1). It includes the description of the project scenario, the documentation of the model input parameters, the analysis assumptions that will be gathered in a cooperative effort with the consortium members and the probabilistic mathematical models for all individual impact categories. The core model comprises the effects of training, technological spillovers including ICT, cultural effects, the value of the infrastructure for the public and the impacts of scientific products (e.g. model built with the involvement of SN for publications and openly accessible data). Carry out an ex-ante baseline probabilistic estimation of the socio-economic impacts using a Monte Carlo simulation-based approach (D4.3). Based on the findings, the consortium partners work on sustainability improvement levers and potential opportunities for increased impact. Formulate recommendations for the implementation strategy (D4.4) and document guidelines for the project preparatory phase in the design report (D5.6) taking into account, for instance, EU territorial cooperation programmes .
Task 4.4: Regional and territorial benefit potential identification
(lead: CNRS, participants: Cerema, CETU, CERN, CSIL, partners BINP, DOE, EdG and DRRT-AuRA)
Building on the intermediate findings of task 4.3, CNRS assisted by Cerema and CERN, develops a model for the territorial benefit potentials and works with beneficiaries and partners on potential local effects of the construction project and the long-term operation of the infrastructure in the region. This requires es-tablishing interfaces with regional industrial partners (partners EdG and DRRT-AuRA), stakeholders of different interest groups and host-state notified bodies, to develop regional development scenarios togeth-er. Using the impact pathways approach and value chain analysis, Cerema, CERN, CNRS and CSIL will perform studies of potential regional impacts (D4.2). One topic will be the study of creating a second technology pole for the research infrastructure, leveraging the existing CNRS "Laboratoire d'Annecy de Physique des Particules" (LAPP).
Task 4.5: Implementation, financing and in-kind contribution strategy (lead: CERN, participants: CSIL)
This task aims to integrate the new infrastructure in a global landscape of research facilities and develop a concept for a geographically distributed and topically complementary co-development with academic and industrial partners. It develops the financing and in-kind contribution strategy for the construction phase and drafts a concept for sustainable operation of the facility (D4.4). This plan takes into account the ongoing EU smart specialisation strategies to strengthen the research and innovation potentials of re-gions in Europe, as well as their complementarity and cohesion. The project participants will collaborate to propose ways to create visibility of the economic wealth growth through governments' investments during the construction period, e.g. through societal re-investment incentives for participating companies, conditions for re-investment, long-term symbiotic public-private partnerships, new financial structures, indirect innovation and spillover accounting, co-operative company structures and equity-holding of in-dividuals, private and public organisations.

Participation per Partner

Partner number and short name	WP4 effort
1 - CERN	60.00
3 - Cerema	3.00
4 - CETU	2.00
5 - CNRS	22.00
6 - CSIL	26.00
13 - SN	6.00
16 - USC	30.00
Total	149.00

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D4.1	Plan for research infrastructure socio-economic impact analysis	6 - CSIL	Report	Public	10
D4.2	Regional benefits and territorial development opportunities in a global	5 - CNRS	Report	Public	36
D4.3	Socio-economic impacts of the lepton collider-based research infrastructure	6 - CSIL	Report	Public	38
D4.4	Implementation, financing and in-kind contribution strategy	1 - CERN	Report	Public	44

Description of deliverables

D4.1: Plan for research infrastructure socio-economic impact analysis
A publicly available overview and guideline for the analysis of the socio-economic impacts of this research infrastructure. The plan compiles impact pathways and associated key performance indicators, a description of the quantitative analysis method for each impact pathway and the preliminary set of input parameters for this project.
D4.2 Regional benefits and territorial development opportunities in a global project
A report that summarises proposals for territorial (France, Switzerland) infrastructure service developments and for regional development potentials in nations that can contribute to the particle collider and physics programme. The descriptions listed are based on project relevance, foreseeable skills and capacity evolution, financial and technical feasibility and are rated by their potential to result in long term societal and economic wealth creation.
D4.3: Socio-economic impacts of the lepton collider-based research infrastructure
A technical summary of the quantitative socio-economic impact potentials for the individual impact pathways and a presentation of the overall impact analysis starting with the early construction phase.
D4.4: Implementation, financing and in-kind contribution strategy
A summary of the construction and operation cost estimates, outlining a financing plan allowing for a levelled investment profile and in-kind contributions from CERN member states and beyond.

D4.1 : Plan for research infrastructure socio-economic impact analysis [10]

A publicly available overview and guideline for the analysis of the socio-economic impacts of this research infrastructure. The plan compiles impact pathways and associated key performance indicators, a description of the quantitative analysis method for each impact pathway and the preliminary set of input parameters for this project.

D4.2 : Regional benefits and territorial development opportunities in a global [36]

A report that summarises proposals for territorial (France, Switzerland) infrastructure service developments and for regional development potentials in nations that can contribute to the par-ticle collider and physics programme. The descriptions listed are based on project relevance, foreseeable skills and capacity evolution, financial and technical feasibility and are rated by their potential to result in long term societal and economic wealth creation.

D4.3 : Socio-economic impacts of the lepton collider-based research infrastructure [38]

A technical summary of the quantitative socio-economic impact potentials for the individual impact pathways and a presentation of the overall impact analysis starting with the early con-struction phase.

D4.4 : Implementation, financing and in-kind contribution strategy [44]

A summary of the construction and operation cost estimates, outlining a financing plan allowing for a levelled investment profile and in-kind contributions from CERN member states and beyond.

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS1	Management structures established and technical / scientific work started	1 - CERN	1	M1.1: Board member lists established and accessible for consorti-um members through the collaborative Web tool. Agenda and draft minutes of board meetings available in document management system. Consortium agreement signed. Work schedule documented. Press release on project launch issued by CERN.
MS2	Mining the Future® challenge call open	12 - MUL	5	M3.1: Application open for submission on Web. Geology data downloadable from Zenodo (Green, open data). Evaluation board of international experts established. GDPR and IP rules available at the call website. Press release issued by CERN and MUL.
MS3	Progress reviewed 1	1 - CERN	7	M1.2: Agenda and draft minutes of board meetings available in document management system. Work progress reviewed and aligned in the form of a workshop with presentations on Indico site (Green). Contributions for Open Access pro-ceedings publication with SN (Gold) approved.
MS4	Product Breadown Structure	1 - CERN	8	M2.1: Structured document of collider elements in tabular form publicly released on Zenodo (Green, open data).
MS6	Structure for cost estimates and funding needs	1 - CERN	18	M4.1: Structured document in tabular form with initial cost esti-mates and investment profile available via collaborative Web tool.
MS7	Progress reviewed 2	1 - CERN	21	M1.3: Agenda and draft minutes of board meetings available in document management system. Work progress reviewed and aligned in the form of a workshop with presentations

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
				publicly available on Indico (Green). Contributions for Open Access proceedings publication with SN (Gold) ap-proved.
MS8	Design report structure established	1 - CERN	24	M5.2: Design report structure set up in the collaborative writing environment. Section descriptions and production schedule available in document and chapter editor e-group set up.
MS10	Progress reviewed 3	1 - CERN	33	M1.4: Agenda and draft minutes of board meetings available in document management system. Design report progress re-view and consolidation of contents in the form of a work-shop with presentations on Indico (Green). Contributions for Open Access proceedings publication with SN (Gold) approved.
MS11	Tool support for collaborative publishing workflow available	13 - SN	35	M5.4: Agreed and tested publishing process with SN, available for use with a collaborative writing tool.

Work package number [9]	WP5	Lead beneficiary [10]	8 - IFJ PAN
Work package title	Leverage & engage		
Start month	1	End month	48

Objectives

Use the results of the other work packages to engage stakeholders in the preparation of a new research infrastructure. Communicate the project rationale, objectives and progress. The objectives are:
1) Develop a strategy based on best practices and successful communication strategies of similar projects.
2) Develop a corporate brand identity.
3) Plan and implement the Web and social media presence of the project.
4) Develop a concept to disseminate the need and ambition for the continued exploration of nature at its smallest scales with particle physics collaborations (D5.3) to as wide as possible an audience.
5) Develop concepts to engage science interested and lay people in the scientific activities (D5.4).
6) Set up an open access science and engineering dissemination process (M5.4), leveraging modern col-laborative tools that permit setting up an integrated write-to-publish workflow for articles, proceedings and books.
7) Produce and disseminate scientific and technical materials (proceedings, articles, presentations, post-ers).
8) Coordinate with international partners to organise and contribute to outreach events for different au-diences.
9) Interest a young generation which will be the builders of the RI to pursue an education in a relevant field.
10) Work towards a gender balanced community and interest females.
11) Strive that this project creates a lasting impact beyond the project period in view of a) building theoretical and experimental physics communities who advocate the need for a new research infrastruc-ture, b) creating awareness of the technical feasibility and financial sustainability among the funding agencies and potential contributors, c) forging a project preparation plan with the host states (France, Switzerland).

Description of work and role of partners

WP5 - Leverage & engage [Months: 1-48]
IFJ PAN, CERN, CNRS, MUL, SN, TMFS, ULIV
Task 5.1: Work package coordination (lead: IFJPAN, participants: CERN)
IFJPAN coordinates this WP with the assistance of CERN to ensure consistency of the work according to the project scope and plan. This includes the organisation of coordination meetings, scope management, progress reviewing, reporting and distribution of information within the WP as well as the management of the interfaces and collaborative work with the other WPs.
Task 5.2: Project communication (lead: CERN, participants: all beneficiaries)
CERN will interface with each WP to regularly collect results and communicate them through the project communication channels. To integrate communication in the beneficiaries' media channels, implement-ing the subsidiarity principle, CERN requests the nomination of a communication officer (M1.1) from each beneficiary. This person must have (1) the authority, (2) the expertise and the (3) time and re-sources to insert contents into owned channels. It is in the interest of each beneficiary to engage as many people as possible. Therefore, the communication costs are expected to be carried by the beneficiaries.
The task includes creating a public-facing website that presents the science motivation, a description of the technical design work and the infrastructure project and which regularly features updated contents. CERN contracts the design and implementation of the public facing site at its own cost. All beneficiaries contribute regularly to the production of contents. CERN regularly informs the consortium members via an e-mail newsletter (reach-in). Work towards sustained presence in journals with high audience reach. Create information (D5.3: for host state authorities, EC bodies and CERN council) and marketing materi-als for selected needs such as the Mining the Future® competition (e.g. social media campaigns targeting particular engineering and science domains, industry branches and call advertisements in domain-specific publication channels). Develop material for a press release for the design report publication and organise a public event for this occasion (CERN, SN, TMFS). Communicate the findings of the socio-economic impact assessments (CSIL).
Task 5.3: Dissemination support (lead: SN, participants: CERN, partner Overleaf)
Define and implement an integrated scientific dissemination workflow (M5.4) that spans the entire lifecy-cle from authoring to publishing for scientific articles, collections of articles and books. The main use-cases are the conceptual design report (D5.6) and the physics research programme (D5.5). The working environment will be based on using a collaborative, scientific writing tool. Partner Overleaf, beneficiary SN and CERN will closely cooperate to motivate

publishers, scientists and tool suppliers to work together towards a long-term innovation in the area of scientific and technical publishing.
Task 5.4: Design report editing and publishing (lead: CERN, participants: SN, partner Overleaf)
This task concerns the production of the main deliverable of this project, the design report (D5.6) and the physics programme report (D5.5). SN accompanies the project team in producing the design report in view of achieving the highest attainable quality, leading to the widest possible dissemination. Partner Overleaf consults SN and CERN to promote the most efficient ways of using their collaborative authoring environment. Efforts to produce the deliverables are not covered by EC co-funding, but by CERN.
Task 5.5: Engagement and communication strategy
(lead: TMFS, participants: CERN, CNRS, IFJPAN, SN, ULIV, partners EdG, DRRT-AuRA)
Together with representatives from the physics community, host-state notified bodies, engineering and communications partners, conceive a means to engage members of society in the active preparation of the scientific work of the research infrastructure (D5.1). The business plan to implement this concept (D5.4) will comprise a catalogue of potential innovation products in the area of communications. Eventually, such developments can create a lasting link between the scientific community and the public, through the developments of new software, new visualisation concepts, new infotainment concepts integrating inter-active Internet contents, TV, print products and live events. The development of cultural goods in the form of touristic attractions is another pillar with socio-economic impact potentials that this activity will consider.

Task 5.6: Exploitation (lead: CERN, participants: CNRS, IFJPAN, ULIV, partners EdG, DRRT-AuRA, UOXF)
Engage stakeholders and build a user community. This work integrates the recommendations of the advisory committee (D1.3) and policy making bodies (ESFRI, ECFA, ESPP, EU STOA, ICFA) to define the steps for the project preparatory and implementation phases. This encompasses the creation of a framework that permits the creation of international experiment collaborations to use the infrastructure from the beginning (D5.3). IFJPAN organises regular working meetings with key representatives of the theoretical and experimental physics communities, implementing a cross-fertilisation between these two complementary areas, which drive the performance requirements. CNRS and ULIV with the cooperation of CERN and IFJPAN organise four physics workshops with proceedings to achieve consensus about the physics research programme (D5.5). The participants in this task commonly define the R&D needs in all relevant domains (theoretical physics, experimental physics detectors, particle accelerator and infrastruc-ture technologies), prioritise them and prepare the input for the European Strategy for Particle Physics process. They develop a financing strategy and a map of territorially balanced and topically complemen-tary contributions for implementing the research infrastructure (D4.4, in cooperation with WP 4), a struc-ture and database of project risks for the preparatory phase implementation (included in D3.3, in cooper-ation with WP 3). They also produce the foundation of a high-level project advocacy group, the defini-tion of a project governance and management structure (D1.3) and lay out in the implementation strategy (D4.4) and finally, develop a plan for impact generation (D4.2) based on the documented socio-economic impact potentials in cooperation with WP4. CERN together with the physics community repre-sentatives (CNRS, IFJPAN, ULIV, UOXF) drafts a suitable experiment collaboration governance frame-work (D5.3). This activity engages as many organisations as possible in the international Future Circular Collider study hosted by CERN (more than 130 institutes so far), reaching out far beyond the scope of this consortium.

Participation per Partner

Partner number and short name	WP5 effort
1 - CERN	12.00
5 - CNRS	4.00
8 - IFJ PAN	29.00
12 - MUL	1.00
13 - SN	12.00
14 - TMFS	18.00
15 - ULIV	11.00
Total	87.00

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D5.1	Communication strategy	14 - TMFS	Report	Public	13
D5.2	Project scenario information package for institutional stakeholders	1 - CERN	Report	Public	20
D5.3	Preliminary collaboration governance framework	1 - CERN	Report	Public	32
D5.4	Engagement plan for stakeholders and non-scientific experts	14 - TMFS	Report	Public	36
D5.5	FCC-ee physics research programme	8 - IFJ PAN	Report	Public	43
D5.6	FCC-ee design report	1 - CERN	Report	Public	48

Description of deliverables

D5.1: Communication strategy (TMFS)
A document that establishes a strategy for a coherent, impact-oriented communication. The strategy focuses on the design and early construction phase (duration 10 years). The purpose of this document is to define a communication approach and method and the scope, the objectives, to identify the stakeholders, to establish the foundations of the contents (project value, key messages). It should also define the target groups, the preferred communication channels, describe communication elements and a management process for defining, implementing and monitoring the effectiveness of communication in a resource- and cost- constrained environment, comparable to a business start-up phase.
D5.2: Project scenario information package for institutional stakeholders (CERN)
A set of documents in English, French and German targeting host state representatives that explains the project intent, the scope, schedule, preliminary costs, implementation concepts and indicators for socio-economic impacts. The documentation is complemented with maps showing the placement evolution, following the “avoid-reduce-compensate” and territorial synergy seeking approaches.
D5.3: Preliminary collaboration governance framework (CERN)
A document, outlining the structure and processes of an international collaboration hosted by CERN for the purpose of preparing collider and experimental physics projects. The document, in line with CERN’s international status and legal service requirements, aims at being used by the consortium to engage academic institutes world-wide to constitute proto-collaborations for the collider and experiment organisations that are represented by CERN as legal entities.
D5.4: Engagement plan for stakeholders and non-scientific experts (TMFS)
A plan describing individual engagement actions together impact potential, priority, risks, a gap analysis including potential R&D, information and knowledge required, estimated personnel and material resources, schedule and budget. Actions are considered up to a maximum time frame of 10 years, i.e. including the early construction phase.
D5.5: FCC-ee physics research programme (IFJPAN)
A scientific, book-style document that describes the experimental physics research programme based on theoretical physics motivations and the response to those scientific drivers.
D5.6: FCC-ee design report (CERN)
This book-style document is the main deliverable of the project. Motivated by D5.5, it details the design, infrastructure concepts and implementation plan.

D5.1 : Communication strategy [13]

A document that establishes a strategy for a coherent, impact-oriented communication. The strategy focuses on the design and early construction phase (duration 10 years). The purpose of this document is to define a communication approach and method and the scope, the objectives, to identify the stakeholders, to establish the foundations of the contents (project value, key mes-sages). It should also define the target groups, the preferred communication

channels, describe communication elements and a management process for defining, implementing and monitoring the effectiveness of communication in a resource- and cost- constrained environment, compara-ble to a business start-up phase.

D5.2 : Project scenario information package for institutional stakeholders [20]

A set of documents in English, French and German targeting host state representatives that explains the project intent, the scope, schedule, preliminary costs, implementation concepts and indicators for socio-economic impacts. The documentation is complemented with maps showing the placement evolution, following the “avoid-reduce-compensate” and territorial synergy seek-ing approaches.

D5.3 : Preliminary collaboration governance framework [32]

A document, outlining the structure and processes of an international collaboration hosted by CERN for the purpose of preparing collider and experimental physics projects. The document, in line with CERN’s international status and legal service requirements, aims at being used by the consortium to engage academic institutes world-wide to constitute proto-collaborations for the collider and experiment organisations that are represented by CERN as legal entities.

D5.4 : Engagement plan for stakeholders and non-scientific experts [36]

A plan describing individual engagement actions together impact potential, priority, risks, a gap analysis including potential R&D, information and knowledge required, estimated personnel and material resources, schedule and budget. Actions are considered up to a maximum time frame of 10 years, i.e. including the early construction phase.

D5.5 : FCC-ee physics research programme [43]

A scientific, book-style document published with SN that describes the experimental physics research programme based on theoretical physics motivations and the response to those scien-tific drivers.

D5.6 : FCC-ee design report [48]

This book-style document published with SN is the main deliverable of the project. Motivated by D5.5, it details the design, infrastructure concepts and implementation plan.

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS1	Management structures established and technical / scientific work started	1 - CERN	1	M1.1: Board member lists established and accessible for consorti-um members through the collaborative Web tool. Agenda and draft minutes of board meetings available in document management system. Consortium agreement signed. Work schedule documented. Press release on project launch issued by CERN.
MS2	Mining the Future® challenge call open	12 - MUL	5	M3.1: Application open for submission on Web. Geology data downloadable from Zenodo (Green, open data). Evaluation board of international experts established. GDPR and IP rules available at the call website. Press release issued by CERN and MUL.

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS3	Progress reviewed 1	1 - CERN	7	M1.2: Agenda and draft minutes of board meetings available in document management system. Work progress reviewed and aligned in the form of a workshop with presentations on Indico site (Green). Contributions for Open Access pro-ceedings publication with SN (Gold) approved.
MS5	Research opportunities captured	15 - ULIV	14	M5.1: Physics research opportunities documented as presentations (Green, Indico). Contributions for Open Access proceedings with SN (Gold) approved. User community survey on research priorities launched.
MS6	Structure for cost estimates and funding needs	1 - CERN	18	M4.1: Structured document in tabular form with initial cost esti-mates and investment profile available via collaborative Web tool.
MS7	Progress reviewed 2	1 - CERN	21	M1.3: Agenda and draft minutes of board meetings available in document management system. Work progress reviewed and aligned in the form of a workshop with presentations publicly available on Indico (Green). Contributions for Open Access proceedings publication with SN (Gold) ap-proved.
MS8	Design report structure established	1 - CERN	24	M5.2: Design report structure set up in the collaborative writing environment. Section descriptions and production schedule available in document and chapter editor e-group set up.
MS9	Experimental physics goals captured	5 - CNRS	26	M5.3: Experimental physics goals documented in form of presen-tations on Indico (Green). Contributions for Open Access proceedings publication with SN (Gold)

Schedule of relevant Milestones

Milestone number[18]	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
				approved. User community survey on R&D topics, priorities and collaboration potentials considering geographical distribution and topical complementarity launched.
MS10	Progress reviewed 3	1 - CERN	33	M1.4: Agenda and draft minutes of board meetings available in document management system. Design report progress re-view and consolidation of contents in the form of a work-shop with presentations on Indico (Green). Contributions for Open Access proceedings publication with SN (Gold) approved.
MS11	Tool support for collaborative publishing workflow available	13 - SN	35	M5.4: Agreed and tested publishing process with SN, available for use with a collaborative writing tool.
MS12	Research programme consolidated	8 - IFJ PAN	38	M5.5: Draft of the physics research programme as collaborative effort of the engaged user community available in the form of presentations on Indico (Green). Contributions for Open Access proceedings publication with SN (Gold) approved.

1.3.4. WT4 List of milestones

Milestone number[18]	Milestone title	WP number[9]	Lead beneficiary	Due Date (in months)[17]	Means of verification
MS1	Management structures established and technical / scientific work started	WP1, WP2, WP3, WP4, WP5	1 - CERN	1	M1.1: Board member lists established and accessible for consorti-um members through the collaborative Web tool. Agenda and draft minutes of board meetings available in document management system. Consortium agreement signed. Work schedule documented. Press release on project launch issued by CERN.
MS2	Mining the Future® challenge call open	WP3, WP4, WP5	12 - MUL	5	M3.1: Application open for submission on Web. Geology data downloadable from Zenodo (Green, open data). Evaluation board of international experts established. GDPR and IP rules available at the call website. Press release issued by CERN and MUL.
MS3	Progress reviewed 1	WP1, WP2, WP3, WP4, WP5	1 - CERN	7	M1.2: Agenda and draft minutes of board meetings available in document management system. Work progress reviewed and aligned in the form of a workshop with presentations on Indico site (Green). Contributions for Open Access pro-ceedings publication with SN (Gold) approved.
MS4	Product Breadown Structure	WP2, WP3, WP4	1 - CERN	8	M2.1: Structured document of collider elements in tabular form publicly released on Zenodo (Green, open data).
MS5	Research opportunities captured	WP1, WP5	15 - ULIV	14	M5.1: Physics research opportunities documented as presentations (Green, Indico). Contributions for Open Access proceedings with SN (Gold) approved. User community survey on research priorities launched.
MS6	Structure for cost estimates and funding needs	WP1, WP2, WP3,	1 - CERN	18	M4.1: Structured document in tabular form with initial cost esti-mates and

Milestone number[18]	Milestone title	WP number[9]	Lead beneficiary	Due Date (in months)[17]	Means of verification
		WP4, WP5			investment profile available via collaborative Web tool.
MS7	Progress reviewed 2	WP1, WP2, WP3, WP4, WP5	1 - CERN	21	M1.3: Agenda and draft minutes of board meetings available in document management system. Work progress reviewed and aligned in the form of a workshop with presentations publicly available on Indico (Green). Contributions for Open Access proceedings publication with SN (Gold) ap-proved.
MS8	Design report structure established	WP1, WP2, WP3, WP4, WP5	1 - CERN	24	M5.2: Design report structure set up in the collaborative writing environment. Section descriptions and production schedule available in document and chapter editor e-group set up.
MS9	Experimental physics goals captured	WP1, WP5	5 - CNRS	26	M5.3: Experimental physics goals documented in form of presen-tations on Indico (Green). Contributions for Open Access proceedings publication with SN (Gold) approved. User community survey on R&D topics, priorities and collabora-tion potentials considering geographical distribution and topical complementarity launched.
MS10	Progress reviewed 3	WP1, WP2, WP3, WP4, WP5	1 - CERN	33	M1.4: Agenda and draft minutes of board meetings available in document management system. Design report progress re-view and consolidation of contents in the form of a work-shop with presentations on Indico (Green). Contributions for Open Access proceedings publication with SN (Gold) approved.
MS11	Tool support for collaborative publishing workflow available	WP1, WP2, WP3, WP4, WP5	13 - SN	35	M5.4: Agreed and tested publishing process with SN, available for use with a collaborative writing tool.

Milestone number[18]	Milestone title	WP number[9]	Lead beneficiary	Due Date (in months)[17]	Means of verification
MS12	Research programme consolidated	WP1, WP5	8 - IFJ PAN	38	M5.5: Draft of the physics research programme as collaborative effort of the engaged user community available in the form of presentations on Indico (Green). Contributions for Open Access proceedings publication with SN (Gold) approved.

1.3.5. WT5 Critical Implementation risks and mitigation actions

Risk number	Description of risk	WP Number	Proposed risk-mitigation measures
1	Deliverables and milestones are delayed due to coordination inefficiencies and increased administration (O1-O5).	WP1, WP2, WP3, WP4, WP5	Separation of scientific/technical work and socio-economic/territorial feasibility is built into the project organisation through separate coordinators. A full-time administrator with ex-tensive EU project experience performs all monitoring and report-ing with the finance and legal services coordinators, beneficiaries and with the WP and task leaders. An experienced project assistant with configuration management and technical documentation skills manages all technical documentation for the consortium. Regular meetings with video-conferencing support at task, work package and consortium level with a Kanban organisation at project level, monitored by the coordinator ensure adequate communication throughout the project. An early bottom-up warning scheme time-ly escalates potential delays and gives the possibility to act with the highest relevant expertise as quickly as possible.
2	The project deviates from the original goals (O1-O5).	WP1, WP2, WP3, WP4, WP5	Separation of scientific/technical work and socio-economic/territorial feasibility is built into the project organisation through separate coordinators. A full-time administrator with ex-tensive EU project experience performs all monitoring and report-ing with the finance and legal services coordinators, beneficiaries and with the WP and task leaders. An experienced project assistant with configuration management and technical documentation skills manages all technical documentation for the consortium. Regular meetings with video-conferencing support at task, work package and consortium level with a Kanban organisation at project level, monitored by the coordinator ensure adequate communication throughout the project. An early bottom-up warning scheme time-ly escalates potential delays and gives the possibility to act with the highest relevant expertise as quickly as possible.
3	UK beneficiary experiences funding difficulties due to the Brexit process (O1, O4, O5).	WP1, WP2, WP5	The UK government has guaranteed funding for all successful competitive UK bids to Horizon 2020 that are submitted before UK leaves the EU, if there is a no-deal Brexit (www.gov.uk/guidance/horizon-2020-what-it-is-and-how-to-apply-for-funding#what-happens-after-eu-exit-on-31-january-2020).
4	Estimated amount of personnel or skills not adequate for tasks (O1-O5).	WP1, WP2, WP3, WP4, WP5	The beneficiary contributions are complementary, but in case of skills or personnel shortage or withdrawal of a key participant, the composition of the consortium permits re-allocation of funds to mitigate this risk. Should the issue persist, CERN

Risk number	Description of risk	WP Number	Proposed risk-mitigation measures
			will engage additional resources or contract a suitable supplier to complete the works.
5	Unilateral withdrawal of a key participant (O1-O5).	WP1, WP2, WP3, WP4, WP5	The beneficiary contributions are complementary, but in case of skills or personnel shortage or withdrawal of a key participant, the composition of the consortium permits re-allocation of funds to mitigate this risk. Should the issue persist, CERN will engage addi-tional resources or contract a suitable supplier to complete the works.
6	Unforeseen change of man-agement team during the pro-ject period (O1-O5).	WP1, WP2, WP3, WP4, WP5	Managerial positions have a deputy. Work package leaders are in-structed to coach and build up skills within their teams from the beginning that permit rapidly adapting to different situations by assigning managerial tasks to other team members.
7	Socio-urbanistic or environ-mental constraints impede developing a workable particle collider design (O1, O2).	WP2, WP3	The performance goals of the collider are lowered and compensa-tion actions for socio-urbanistic and environmental topics are de-veloped together with French and Swiss partner authorities through a collaborative risk-management process. In case no feasible placement can be identified, the openly available assessment re-sults include the rationale and consequently strategy and policy decision takers at international level are informed. The project continues with the development and publication of the scientific and technical results that are openly and freely available for the world-wide science and engineering community as valuable mate-rials for project alternatives.
8	Experimental verification of beam optics not possible due to particle accelerator unavailability (O1).	WP2	Facilities are made accessible to this study free-of-charge on a best effort basis by CERN, DESY, INFN and KIT. In case of unavaila-bility, a subset of investigations can be carried out at the KARA light source. Further organisations such as BINP (Russia), ESRF (France), KEK (Japan) and SLAC (DOE lab in the US) may be contacted by the consortium to plan alternative measurement cam-paigns.
9	Creation of an experimental physics user community for construction and operation periods progresses slowly or stalls (O2, O4).	WP5	Project management asks the expert and relationship promoters and members of the international advisory committee to work with the participants in charge of engaging a user community to analyse the reasons and to formulate requirements according to which the functions, performance and organisation of the RI have to be ad-justed. The findings will be documented as input to the next Euro-pean Strategy for Particle Physics Update process.
10	Insufficient socio-economic impacts identified or impacts cannot be adequately	WP4, WP5	A Technological Competence Leveraging, project will be added in deliverable D4.3 to continue working for an RI design that is sustainable after the project period. This method was successfully

Risk number	Description of risk	WP Number	Proposed risk-mitigation measures
	quantified with sufficient level of confidence (O3, O5).		used in the CERN coordinated EASITrain H2020 project to address a similar issue. The technical/ scientific parts of the project are not affected.
11	Stakeholder engagement ineffective (O2, O4).	WP4, WP5	Identify, which of the three congruence elements (task, responsibility, expertise) are insufficient to effectively engage stakeholders. Engage power and process promoters to focus on those stakeholders for which the available resources fit. Document what is missing to engage the stakeholders who have not been reached.
12	Mining the Future® challenge does not result in excavation materials use-case with inno-vation potentials (O5).	WP3	The reasons are published as part of the challenge results (D3.2). The award budget is re-invested in developing the excavation materials management plan (D3.4) to develop the conventional use cases in greater detail with a view to increasing efficiency.
13	Publication workflow not available in time for the development of the main deliverable (O1).	WP1, WP2, WP3, WP4, WP5	Fall back to a manual workflow. Strengthen the office and editori-al team to process changes and the publishing of a print-ready de-sign report using additional matching funds from CERN.
14	Strategy and policy groups do not encourage the continuation of exploring a circular particle collider project (O3).	WP1, WP2, WP3, WP4, WP5	The study continues with the development and publication of the scientific and technical results that are openly and freely available for the world-wide science and engineering community as background for project alternatives and endeavours with similar requirements.
15	Procurement constraints at a beneficiary site lead to delays or missing project resources such as software licences and materials (O1, O2, O3, O4, O5).	WP1, WP2, WP3, WP4, WP5	Funds are transferred among beneficiaries to acquire the needed resources that will be made available for the consortium to achieve their project goals. If needed, the coordinator establishes dedicated agreements, potentially including financial engagements with bene-ficiaries and partners in order to ensure proper project advancement.

1.3.6. WT6 Summary of project effort in person-months

	WP1	WP2	WP3	WP4	WP5	Total Person/Months per Participant
1 - CERN	60	84	96	60	12	312
2 - CEA	2	48	0	0	0	50
3 - Cerema	2	0	21	3	0	26
4 - CETU	2	0	24	2	0	28
5 - CNRS	2	20	0	22	4	48
6 - CSIL	2	0	0	26	0	28
7 - DESY	2	108	0	0	0	110
8 - IFJ PAN	1	4	0	0	29	34
9 - INFN	2	86	0	0	0	88
10 - KIT	1	33	0	0	0	34
11 - LD	1	0	18	0	0	19
12 - MUL	2	0	21	0	1	24
13 - SN	1	0	0	6	12	19
14 - TMFS	1	0	0	0	18	19
15 - ULIV	1	0	0	0	11	12
16 - USC	1	0	0	30	0	31
Total Person/Months	83	383	180	149	87	882

1.3.7. WT7 Tentative schedule of project reviews

No project reviews indicated

1. Project number

The project number has been assigned by the Commission as the unique identifier for your project. It cannot be changed. The project number **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

2. Project acronym

Use the project acronym as given in the submitted proposal. It can generally not be changed. The same acronym **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

3. Project title

Use the title (preferably no longer than 200 characters) as indicated in the submitted proposal. Minor corrections are possible if agreed during the preparation of the grant agreement.

4. Starting date

Unless a specific (fixed) starting date is duly justified and agreed upon during the preparation of the Grant Agreement, the project will start on the first day of the month following the entry into force of the Grant Agreement (NB : entry into force = signature by the Agency). Please note that if a fixed starting date is used, you will be required to provide a written justification.

5. Duration

Insert the duration of the project in full months.

6. Call (part) identifier

The Call (part) identifier is the reference number given in the call or part of the call you were addressing, as indicated in the publication of the call in the Official Journal of the European Union. You have to use the identifier given by the Commission in the letter inviting to prepare the grant agreement.

7. Abstract

8. Project Entry Month

The month at which the participant joined the consortium, month 1 marking the start date of the project, and all other start dates being relative to this start date.

9. Work Package number

Work package number: WP1, WP2, WP3, ..., WPn

10. Lead beneficiary

This must be one of the beneficiaries in the grant (not a third party) - Number of the beneficiary leading the work in this work package

11. Person-months per work package

The total number of person-months allocated to each work package.

12. Start month

Relative start date for the work in the specific work packages, month 1 marking the start date of the project, and all other start dates being relative to this start date.

13. End month

Relative end date, month 1 marking the start date of the project, and all end dates being relative to this start date.

14. Deliverable number

Deliverable numbers: D1 - Dn

15. Type

Please indicate the type of the deliverable using one of the following codes:

R	Document, report
DEM	Demonstrator, pilot, prototype
DEC	Websites, patent fillings, videos, etc.
OTHER	
ETHICS	Ethics requirement
ORDP	Open Research Data Pilot
DATA	data sets, microdata, etc.

16. Dissemination level

Please indicate the dissemination level using one of the following codes:

PU	Public
CO	Confidential, only for members of the consortium (including the Commission Services)
EU-RES	Classified Information: RESTREINT UE (Commission Decision 2005/444/EC)
EU-CON	Classified Information: CONFIDENTIEL UE (Commission Decision 2005/444/EC)
EU-SEC	Classified Information: SECRET UE (Commission Decision 2005/444/EC)

17. Delivery date for Deliverable

Month in which the deliverables will be available, month 1 marking the start date of the project, and all delivery dates being relative to this start date.

18. Milestone number

Milestone number:MS1, MS2, ..., MSn

19. Review number

Review number: RV1, RV2, ..., RVn

20. Installation Number

Number progressively the installations of a same infrastructure. An installation is a part of an infrastructure that could be used independently from the rest.

21. Installation country

Code of the country where the installation is located or IO if the access provider (the beneficiary or linked third party) is an international organization, an ERIC or a similar legal entity.

22. Type of access

TA-uc	if trans-national access with access costs declared on the basis of unit cost,
TA-ac	if trans-national access with access costs declared as actual costs, and
TA-cb	if trans-national access with access costs declared as a combination of actual costs and costs on the basis of unit cost,
VA-uc	if virtual access with access costs declared on the basis of unit cost,
VA-ac	if virtual access with access costs declared as actual costs, and
VA-cb	if virtual access with access costs declared as a combination of actual costs and costs on the basis of unit cost.

23. Access costs

Cost of the access provided under the project. For virtual access fill only the second column. For trans-national access fill one of the two columns or both according to the way access costs are declared. Trans-national access costs on the basis of unit cost will result from the unit cost by the quantity of access to be provided.