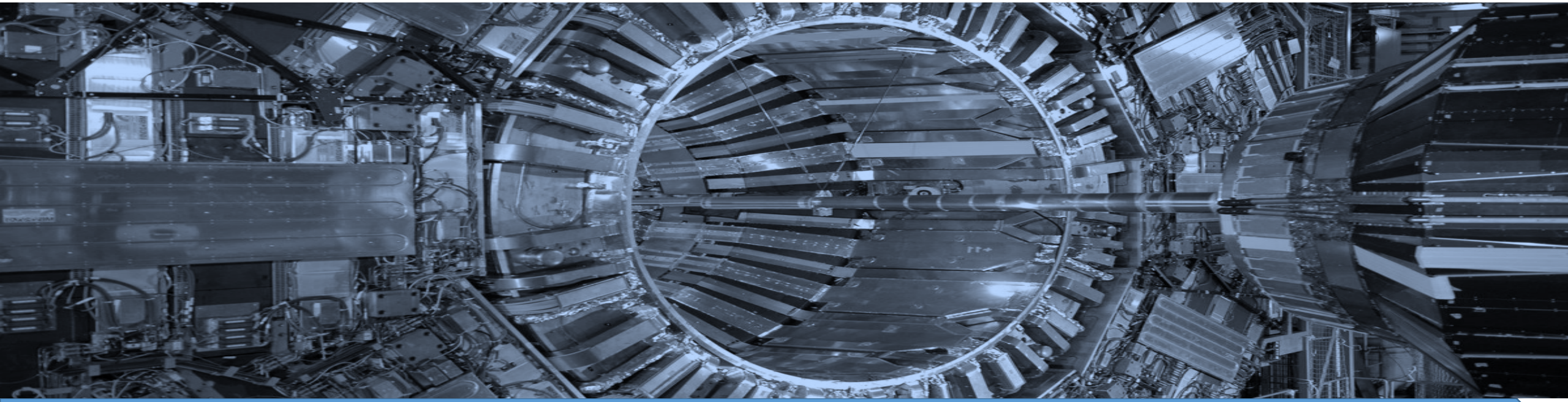
Kick-off meeting of the **Inter-American Network of Networks of QCD Challenges**

— CFNS, Stony Brook University —



STRONG-2020:

The strong interaction at the frontier of knowledge: fundamental research and applications

Boris Hippolyte (Université de Strasbourg - IPHC/IN2P3)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824093

Context: **Horizon 2020**

Horizon 2020 or **H2020** is the European programme for research and development during **2014-2020**

- ★ It had a budget of 79 billion euros
- ★ Several calls H2020-INFRAIA-01-2018-2019

Focus: Infrastructure Research Access and Innovation Action

Call	Budget (Million EUR)		Deadlines
	2018	2019	
Opening: 5 December 2017			
INFRAIA-01-2018-2019 (RIA)	101,5		22 March 2018
Opening: 14 November 2018			
INFRAIA-01-2019-2020 (RIA)		125	20 March 2019
Indicative total budget	136,5		

Context: **Horizon 2020**

Work Programme 2018-2020

- **Several topics:** biology, maths, physics…

Hadron physics:

- *Provide and facilitate access to key research infrastructures in Europe for the study of the properties of nuclear material in extreme conditions, transforming the advances of experimentation in hadron physics and new applications*

It should provide a long-term, sustainable perspective on the integration of relevant facilities and related resources

Project: **STRONG-2020**

Inception of the STRONG-2020

- **Call for letters of intent sent to 2000 people**
- Workshop in Nantes organised by **B. Erazmus** from 31/10 to 01/11 2017 to <u>evaluate and select the letters of intent</u>:

  ➡ 52 received

  ➡ 27 approved

  ➡ 12 projects merged into 5

Steering Committee

- Barbara Erazmus (Coordinator): IN2P3/SUBATECH (France)
- Nora Brambilla: TUM (Germany)
- David d'Enterria: CERN (Switzerland)
- Carlo Guaraldo: INFN:Frascati (Italy)
- Boris Hippolyte: IN2P3/IPHC (France)
- Tord Johansson: University of Uppsala (Sweden)
- Chiara La Tessa: INFN-Tifpa (Italy)
- Frank Maas: JGU Mainz (Germany)
- Franck Sabatié: CEA/Saclay (France)
- Carlos Salgado López: Universidade de Santiago de Compostela (Spain)

- Víctor de Benito Rubio (Project Manager) : CNRS/IN2P3 (France)
- Tanja Pierret, Farah Alibay (SUBATECH)

Project: **Grant Agreement**

Project duration: from 1 June 2019 to 31 May 2023 (initially) **Total Budget:** 10 M €

to 30 November 2023 (now)

32 Work Packages (WPs):

- **MAN:** Management and Coordination
- **DISCO:** Dissemination and Communication
- **7** Transnational Access Research Infrastructures (**TA**)
- **2** Virtual Infrastructures (**VA**)

  Experimental /Theoretical /Instrumentation Activities:
- **7** Networking Activities (**NA**)
- **14** Joint Research Activities (**JRA**)

STRONG-2020 kick-off meeting in Nantes,
on October 23-25, 2019
https://indico.in2p3.fr/event/19715/

Scientific Frontiers: **Research Infrastructures**

Transnational Access

- **TA1-COSY** (Julich), Dieter Grzonka
- **TA2-MAMI** (Mainz), Achim Denig
- **TA3-LNF** (INFN, Frascati), Catalina Curceano / Carlo Guaraldo
- **TA4-FTD/ELSA** (Bonn), Harmut Schmieden
- **TA5-GSI** (GSI, Darmstadt), Yvonne Leifels
- **TA6-ECT*** (Trento), Gert Aarts
- **TA7-CERN** (CERN, Geneva), David d'Enterria
- The selection of infrastructure complement each other and allow for the exploration of specific strong interaction physics questions with different probes, such as electromagnetic probes at the electron machines or hadronic probes at the hadron machines, covering a broad range of energies.

Virtual Access

- **VA1-NLOAccess**

  Jean-Philippe Landsberg, CNRS, Orsay

- **VA2-3DPartons**

  Hervé Moutarde CEA, Saclay

- Provide open-access to state-of-the-art computer codes necessary for the high-precision phenomenology of heavy ion reactions and studies of the quark gluon plasma as well as for nucleon and nuclei parton structure research.

WP Thematic Division: **Hadron Physics**

★ **JRA7-HaSP** **Marco Battaglieri (INFN, Genova), Juan Nieves (UVEG, Valencia)**

Development of a common data-theory analysis framework to determine exotic hadrons properties by fitting new experimental data (MAMI, TJNAF, BESIII, COMPASS, LHCb and ALICE at CERN) to lattice QCD and effective-field-theory predictions.

★ **NA1-FAIRnet** **Fritz-Herbert Heinsius (RUB, Bochum)**

Improved data selection (trigger-detector-less data acquisition, deadtime-free frontend electronics, Field Programmable Array (FPGA) based online selection) plus distributed physics analysis for rare signal events under high background conditions (multi-PByte/month) in anti-p-p, anti-p-A, and A-A collisions for the PANDA and CBM experiments at the future FAIR facility.

★ **NA5-THEIA** **Josef Pochodzalla (UMainz)**

Address the “neutron stars hyperon puzzle” (contradiction between the observation of 2-solar masses neutron stars and microscopical predictions of a softening of the nuclear equation-of-state due to the presence of strange-quark hadrons) through combined theoretical and experimental studies of (anti)hypernuclei and bound strange-meson systems produced in hadronic collisions at various c.m. energies.

★ **NA6-LatticeHadrons** **Michael Peardon (TCD, Dublin)**

Development of combined software, data sharing, and methodologies in lattice QCD theory across Europe along 4 axes: (i) hadron spectroscopy and structure, (ii) hadrons under extreme conditions, (iii) hadrons in the SM and beyond, (iv) novel numerical algorithms and computing for lattice hadron physics.

WP Thematic Division: **Precision Physics**

★ **JRA3-PrecisionSM** **Mikhail Gorshteyn (UMainz), Andrzej Kupsc (University of Uppsala)**

Precise determination of the muon anomalous magnetic moment (g-2)μ; the CKM matrix element Vud from beta decay, and the weak mixing angle from parity-violating electron scattering. Associated novel constraints (or discovery) of physics beyond the SM.

★ **NA4-PREN** **Dominique Marchand (CNRS, Orsay), Randolf Pohl (UMainz)**

Address the “proton-radius puzzle” via combined data-theory analyses of new results in atomic spectroscopy (laser spectroscopy of Hydrogen molecules and molecular ions, muonic atoms, He+ ions, positronium, and muonium) and very-low momentum transfer (Q2) lepton-proton elastic scattering at various energies.

WP Thematic Division: **Heavy Ions**

★ **JRA2-FTE@LHC** **Cynthia Hadjidakis (CNRS, Orsay), Pasquale Di Nezza (INFN, Frascati)**

Development of novel gas-target techniques to be able to carry out the most energetic fixed-target collisions ever performed in the lab, using the LHC beams at ALICE and LHCb. Evaluation of the novel expected constraints on PDFs at high-x in the proton and nucleus, parton spin dynamics, as well as QGP properties via unique quarkonia measurements.

★ **NA3-Jet-QGP** **Marco van Leeuwen (Nikhef, Amsterdam), Guilherme Milano (LIP, Lisbon)**

Development of novel experimental and theoretical techniques for jet physics in A-A collisions, providing a reference implementation of jet interactions in a QGP via a full heavy-ion Monte Carlo (MC) event generator. Definition of new observables and development of new tools with increased sensitivity to the physical mechanisms involved in jet- QGP interactions.

★ **NA7-Hf-QGP** **Joerg Aichelin (CNRS, Nantes), Giuseppe Bruno (INFN, Bari)**

Extraction of QGP transport coefficients from new high-precision theoretical calculations and experimental measurements of the production of open and closed heavy flavour (HF) quarks (charm and beauty) in A-A collisions at the LHC. Accurate measurements of total c-cbar, b-bbar cross sections in p-p, p-A and A-Acollisions.

★ **JRA1-LHC-Combine** **Raphaël Granier de Cassagnac (CNRS, Palaiseau)**

Combination of key LHC (ALICE, ATLAS, CMS, LHCb) measurements in p-p, p-A, and/or A-A collisions to achieve high-precision constraints on nuclear PDFs, QGP properties, SM parameters, and/or searches of physics beyond the SM.

WP Thematic Division: **GPD/TMD/PDFs**

★ **JRA5-GPD-ACT** **Silvia Niccolai (CNRS, Orsay), Kresimir Kumericki (UNIZG, Zagreb)**

Extraction of GPDs from new high-precision QCD analyses of novel high-statistics e-p and p-p measurements at fixed-target and collider energies.

★ **JRA4-TMD-neXt** **Alessandro Bacchetta (INFN, Pavia)**

Extraction of unpolarized and polarized TMDs and parton fragmentation functions (FFs) from new high-precision QCD analyses of novel high-statistics measurements at e+e-, e-p and p-p at fixed-target and collider energies.

★ **JRA6-Next-DIS** **Daria Sokhan (UGlasgow), Francesco Bossu (CEA, Orsay)**

Development of new Monte Carlo tools and studies of benchmark channels, for e-A collisions at future deep-inelastic experiments (Electron-Ion Collider, EIC). Optimisation of associated detector designs for high-resolution tracking, vertexing, photon, and PID.

★ **NA2-Small-x** **Néstor Armesto (USC, Santiago de Compostela), Tuomas Lappi (JYU, Jyväskylä)**

Extraction of high-precision nuclear parton distribution functions (nPDF) through global fits including the latest LHC p-A and A-A data. Extension of current gluon-saturation calculations (CGC, BFKL, TMD...) to NLO accuracy with resummation corrections, for observables with three jets and with heavy-quarks.

WP Thematic Division: **Instrumentation**

★ **JRA14-MPGD_HP** **Bernhard Ketzer (UBO, Bonn), Fulvio Tessarotto (INFN, Frascati)**

Development (up to the prototype stage) of new gas detectors with improved capabilities in tracking, charged particle identification, photon detection, and timing in the picosecond region, capable of operating under very high beam intensity conditions.

★ **JRA9-TIIMM** **Eleuterio Spiriti (INFN, Frascati)**

Development of new silicon detectors based on Monolithic Active Pixel Sensors (MAPS) for high-precision tracking, and energy loss measurement for advanced particle identification.

★ **JRA8-ASTRA** **Johann Zmeskal (OeAW, Vienna)**

Development of beyond state-of-art radiation detectors based on semiconductors (Cadmium Telluride, Cadmium Zinc Telluride) able to perform high-precision measurements of X-ray and gamma-ray photons in different environments/conditions.

WP Thematic Division: **Instrumentation**

★ **JRA10-CryPTA** **Hartmut Dutz (UBO, Bonn)**

Production of polarized nucleon targets (at the prototype level) using solid state materials combined with superconducting high-field magnets and the Dynamic Nuclear Polarization method.

★ **JRA11-CRYOJET** **Alfons Khoukaz (WWU, Münster)**

Development of cryogenically-cooled cluster/pellet/microjet sources to be used as targets in a variety of collision setups.

★ **JRA12-SpinForFAIR** **Paolo Lenisa (INFN, Frascati)**

Optimization of the polarization of protons and antiprotons beams and targets for the GSI/FAIR storage ring.

★ **JRA13-P3E** **Eric Voutier (CNRS, Orsay)**

Optimization of high-intensity polarized electron and positron beam sources, and full design of the Hydro-Møller polarimeter detector using high-voltage monolithic active pixel sensors (HV-MAPS).

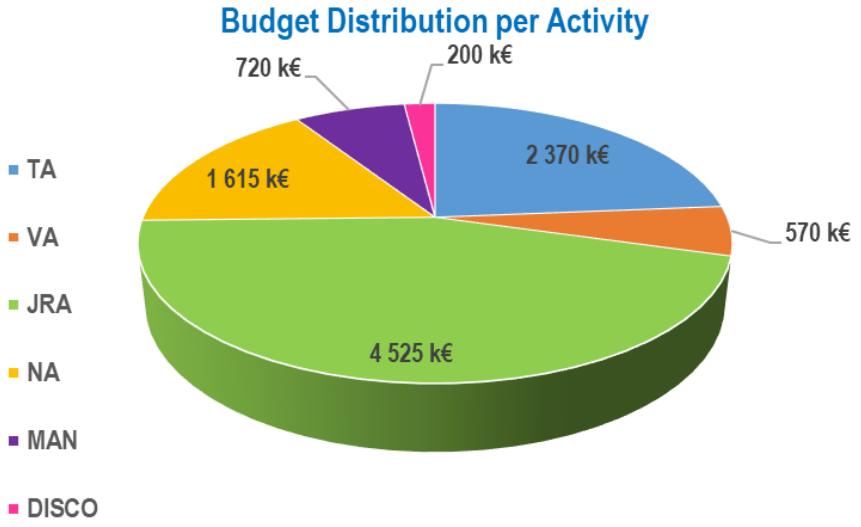
STRONG-2020: **Training and Leverage**

★ Postdoctoral positions and PhD fellowships:

Large fraction of the budget (Joint Research Activities) dedicated to the participation and the training of postdoctoral fellows and PhD students.

★ Significant leverage:

Positions (e.g. postdoctoral) initiated with STRONG-H2020 for which additional years (post-doctoral positions) are obtained combining with other requests and from additional financial sources.



STRONG-H2020: **Consortium Agreement**

- **44 participating institutions** (beneficiaries) in
- **16 countries:**
- Austria, Belgium, Switzerland, Germany, Spain, Finland, France, Croatia, Ireland, Italy, Montenegro, Netherlands, Poland, Portugal, Sweden, United Kingdom

- **Location details can be found on online Google map**

- **134 other Involved Institutions** (not receiving EU funding)

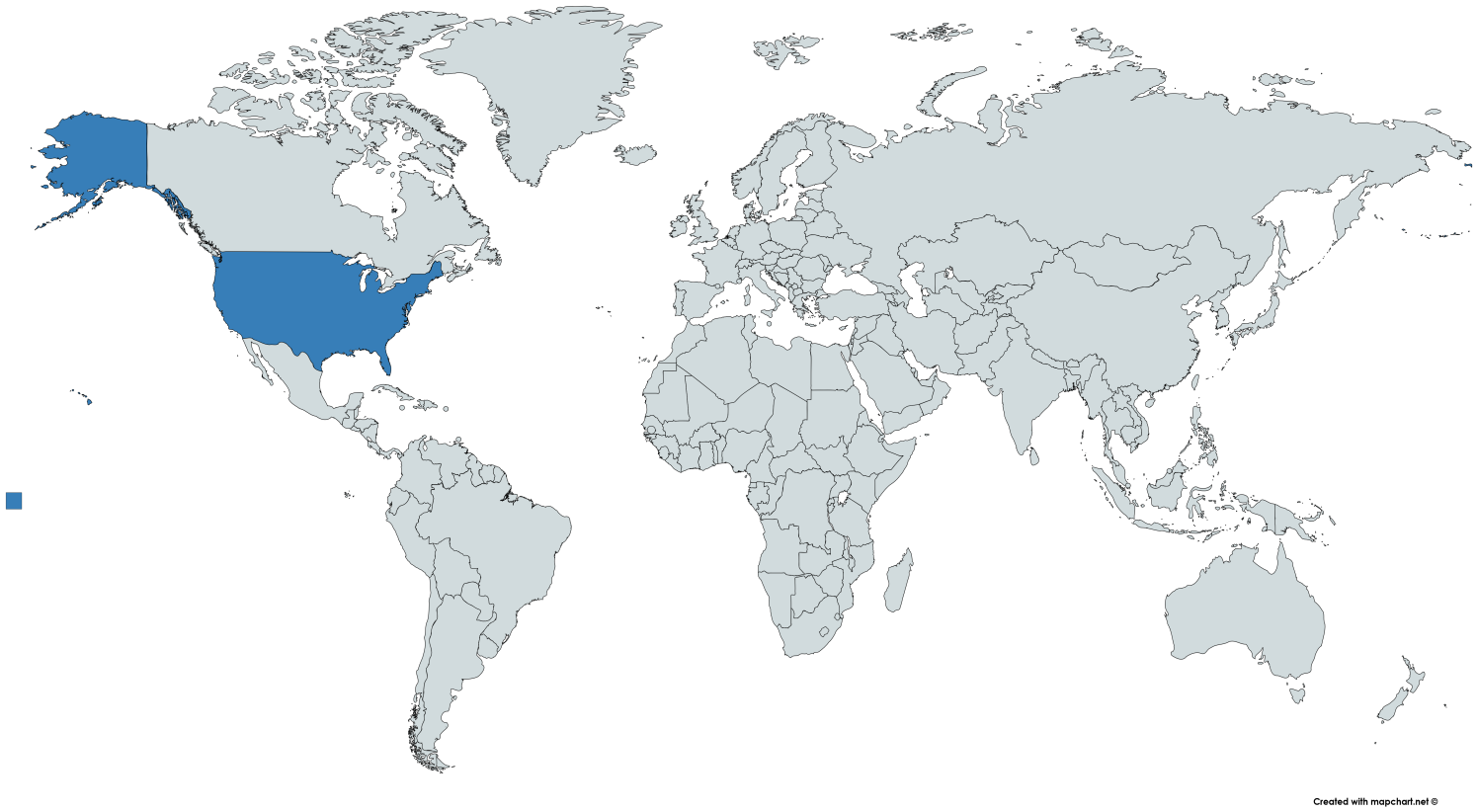
Czech Republic

Academy of Sciences of the Czech Republic	NA1
Czech Technical University	NA1, NA2, NA7
Charles University Prague	NA1, NA3, NA7, JRA1, JRA3
Nuclear Physics Institute of the Czech Academy of Sciences	NA3
Nuclear Physics Institute Rez	NA5

Russia

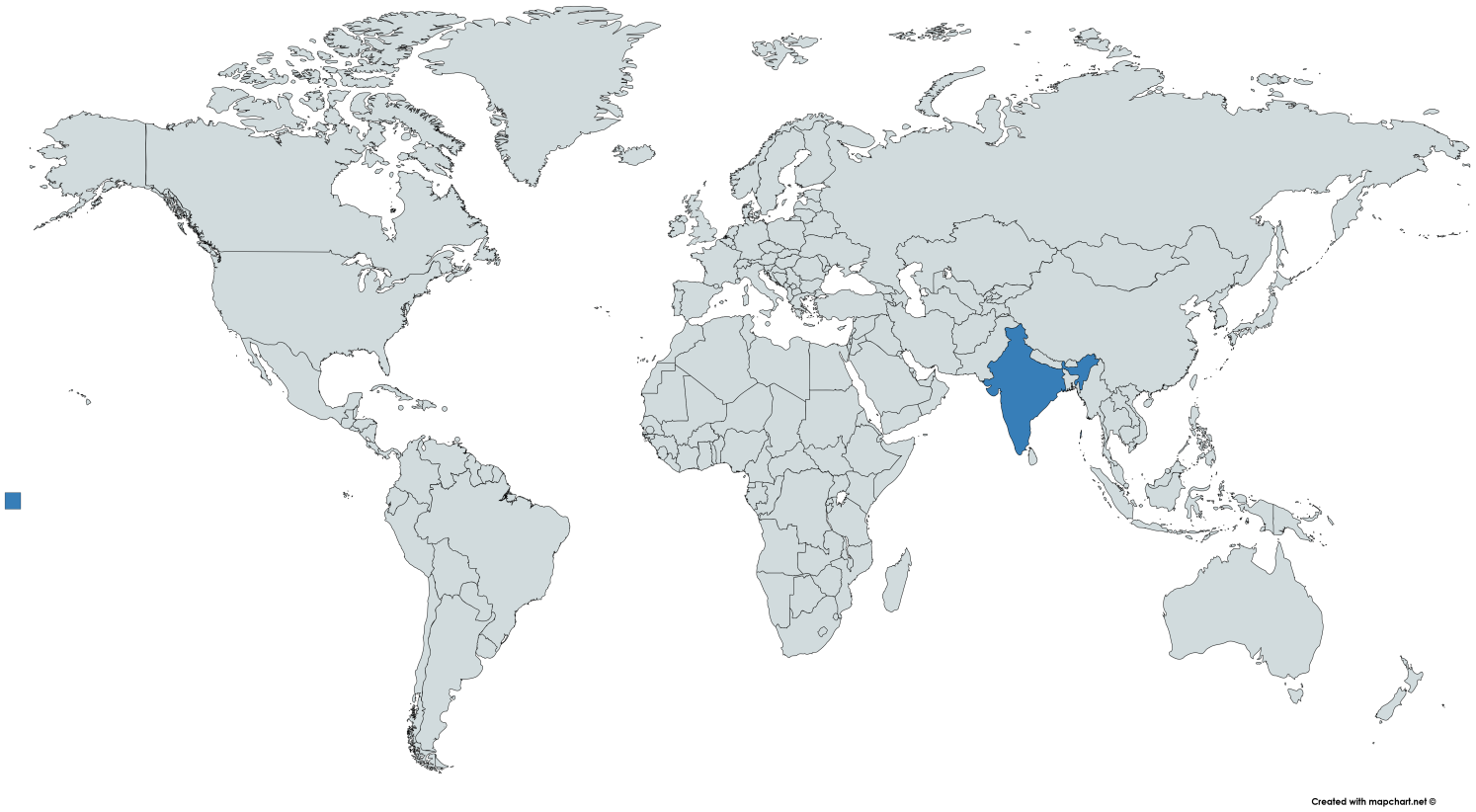
Joint Institute for Nuclear Research (JINR)	NA1
Joint Institute for Nuclear Research, Veksler and Baldin Laboratory, High Energy Physics (JINR-VBLHEP)	NA1
Joint Institute for Nuclear Research, Laboratory of Information Techologies (JINR-LIT)	NA1
Petersburg Nuclear Physics Institute	NA1 NA4
Institute for Nuclear Research (INR), Russian Academy of Sciences	NA1
Institute for Theoretical and Experimental Physics	NA1
Moscow Engineering Physics Institute (MEPhI)	NA1
Kurchatov Institute	NA1
Moscow State University	NA1
Budker Institute of Nuclear Physics (BINP)	NA1, JRA3
Institute for High Energy Physics (IHEP)	NA1
St. Petersburg Ioffe Physico-Technical Institute	NA1
St. Petersburg State Polytechnic University (SPb-SPU)	NA1

United States



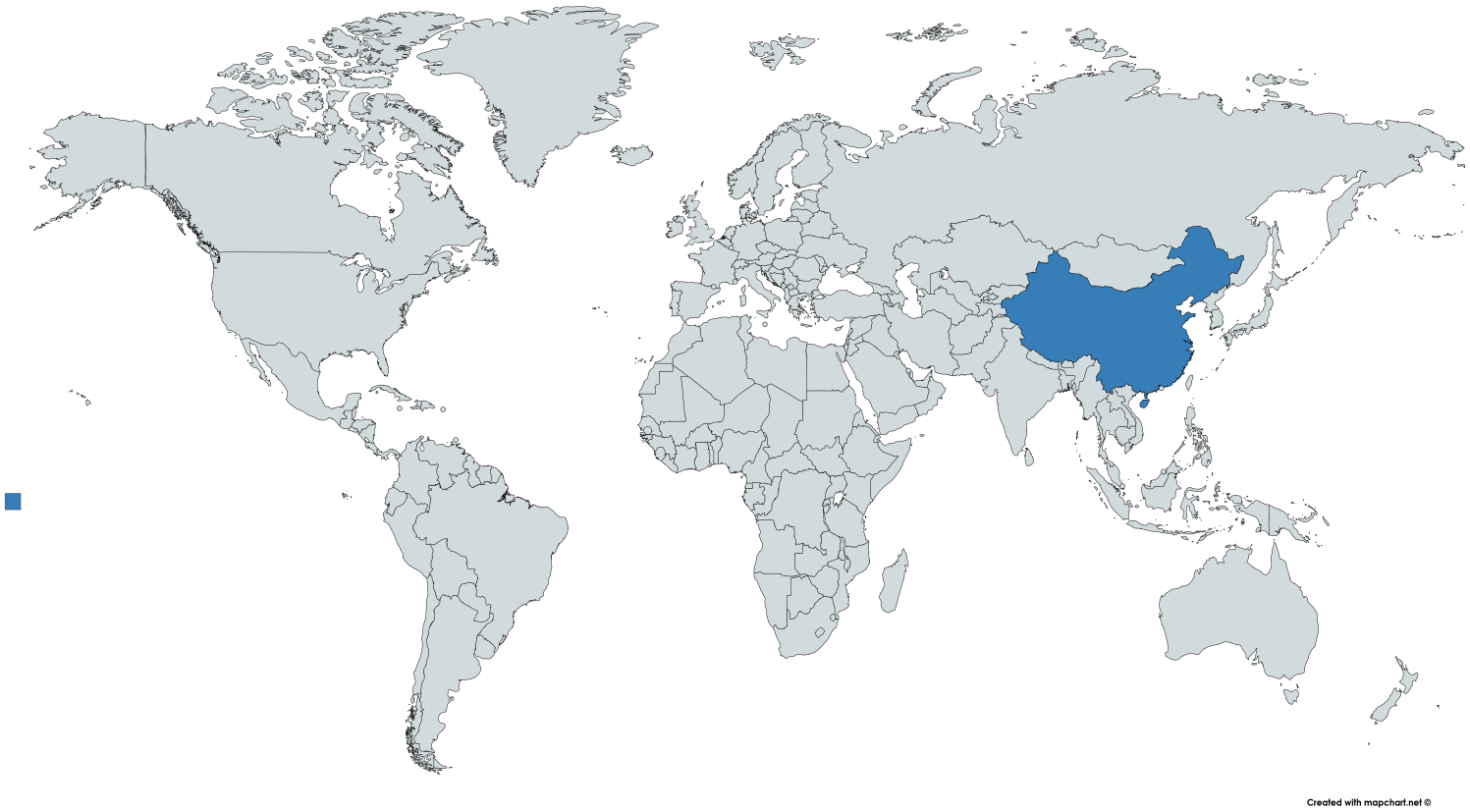
Thomas Jefferson National Accelerator Facility	JRA3, JRA4, JRA6
Northwestern University	NA1
George Washington University	NA4
Massachusetts Institute of Technology	NA4, NA7
University of Massachusetts	JRA3
North Carolina A&T State University	NA4
University of Illinois	JRA3
Rutgers, The State University of New Jersey	NA4
Brookhaven National Laboratory	JRA6
Fermilab	JRA3
University Hampton	NA5

India



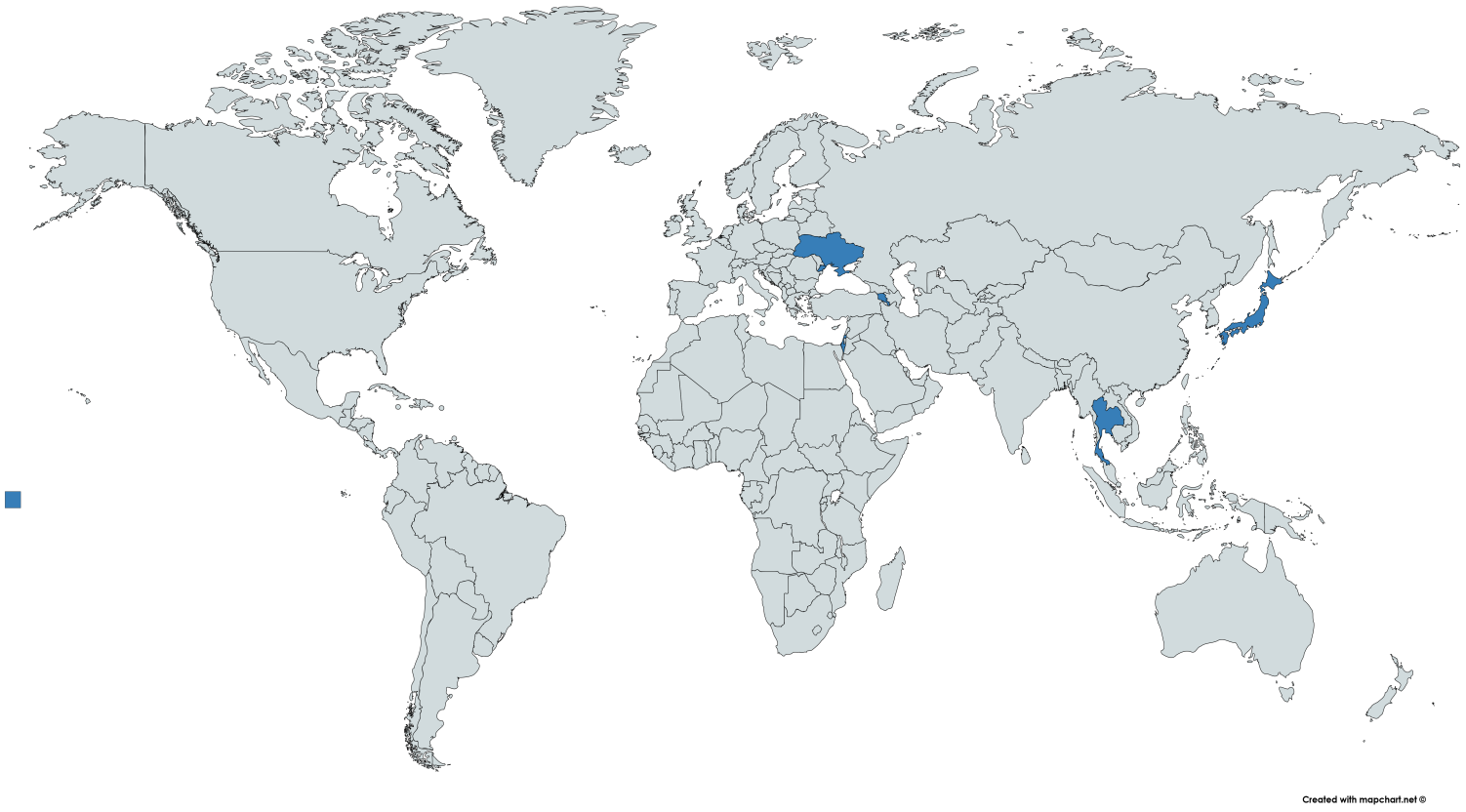
Aligarh Muslim University	NA1
Institute of Physics	NA1
Panjab University	NA1
Gauhati University	NA1
University of Rajasthan	NA1
University of Jammu	NA1
Indian Institute of Technology, Kharagpur	NA1
University of Calcutta	NA1
Kolkata Bose Institute	NA1
Kolkata Variable Energy Cyclotron Centre	NA1
Nuclear Physics Division, Bhabha Atomic Research Centre	NA1
Indian Institute of Technology	NA1
University of Kashmir	NA1
Banaras Hindu University	NA1

China



Chongqing University	NA1
Tsinghua University	NA1
Institute of High Energy Physics	NA1, JRA3
Institute of Modern Physics	NA1
University of Science and Technology of China	NA1
Institute of Particle Physics, HuaZhong Normal University	NA1
College of Physical Sciences and Technology, Central China Normal University	NA1

And many others…



Armenia	
Yerevan Physics Institute	NA5
Thailand	
Suranaree University of Technology	NA1
Ukraine	
Kiev Institute for Nuclear Research (KINR), National Academy of Science of Ukraine (NASU)	NA1
Taras Shevchenko Kyiv University	NA1
Israel	
Hebrew University of Jerusalem	NA4, NA 7
Ben Gurion University of the Negev	NA2
Japan	
Japan Atomic Energy Agency	NA5
Institute for Physical and Chemical Research RIKEN	NA5
Tohoku University	NA5
The University of Tokyo	NA5
High Energy Accelerator Research Organization (KEK)	NA5, JRA3, JRA7, JRA8

STRONG-H2020: **Management Structure**

MANAGEMENT TEAM

Scientific coordinator:

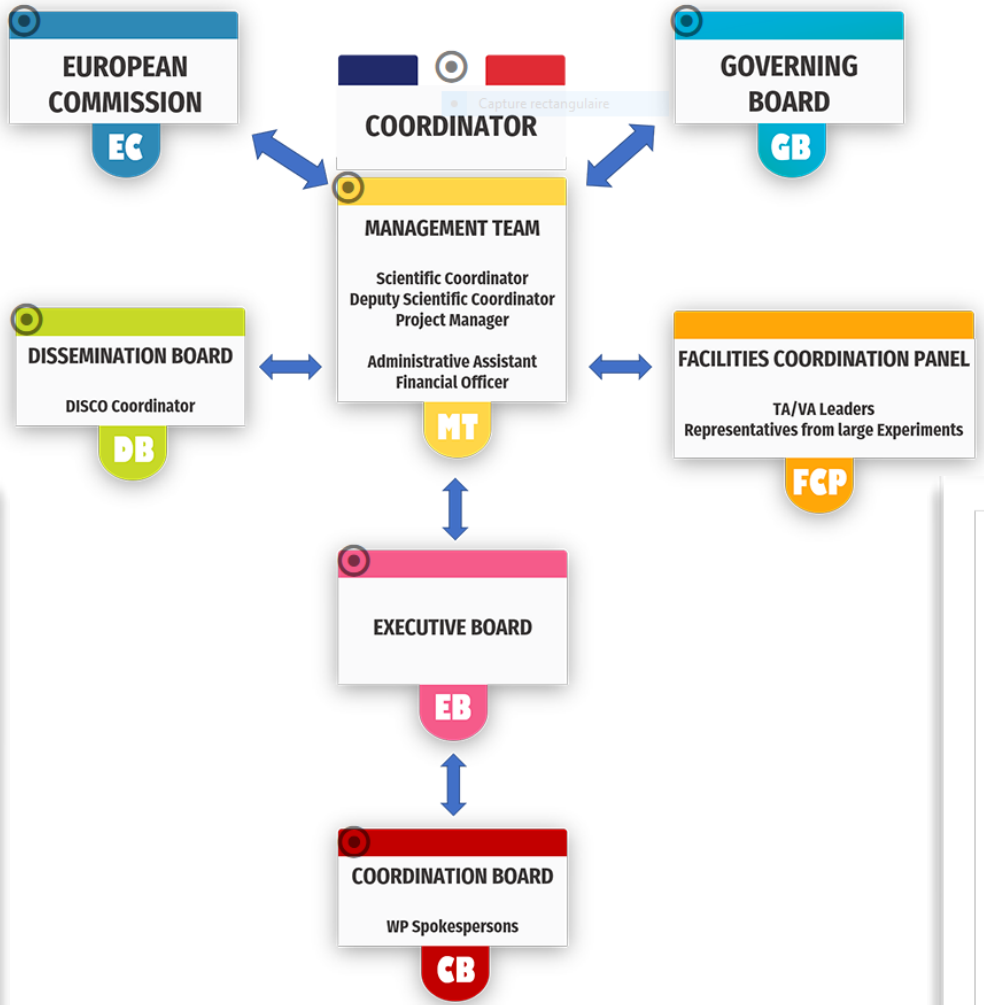
Barbara ERAZMUS

Deputy Scientific coordinator:

Carlo GUARALDO

Project Manager:

Emine AMETSHAEVA



GOVERNING BOARD

Chairperson:

Elena GONZALES FERREIRO

Download the complete lists of members

DISSEMINATION BOARD

DISCO Coordinator:

Catalina CURCEANU

Yvonne LEIFELS

Hervé MOUTARDE

Raphael GRANIER DE CASSAGNAC

Marco BATTAGLIERI

Fulvio TESSAROTTO

Maria Paola LOMBARDO

Piet MULDERS

EXECUTIVE BOARD

Scientific Coordinator:

Barbara ERAZMUS

Carlo GUARALDO

Boris HIPPOLYTE

Chiara LA TESSA

Frank MAAS

Franck SABATIÉ

Carlos SALGADO

Laura TOLOS

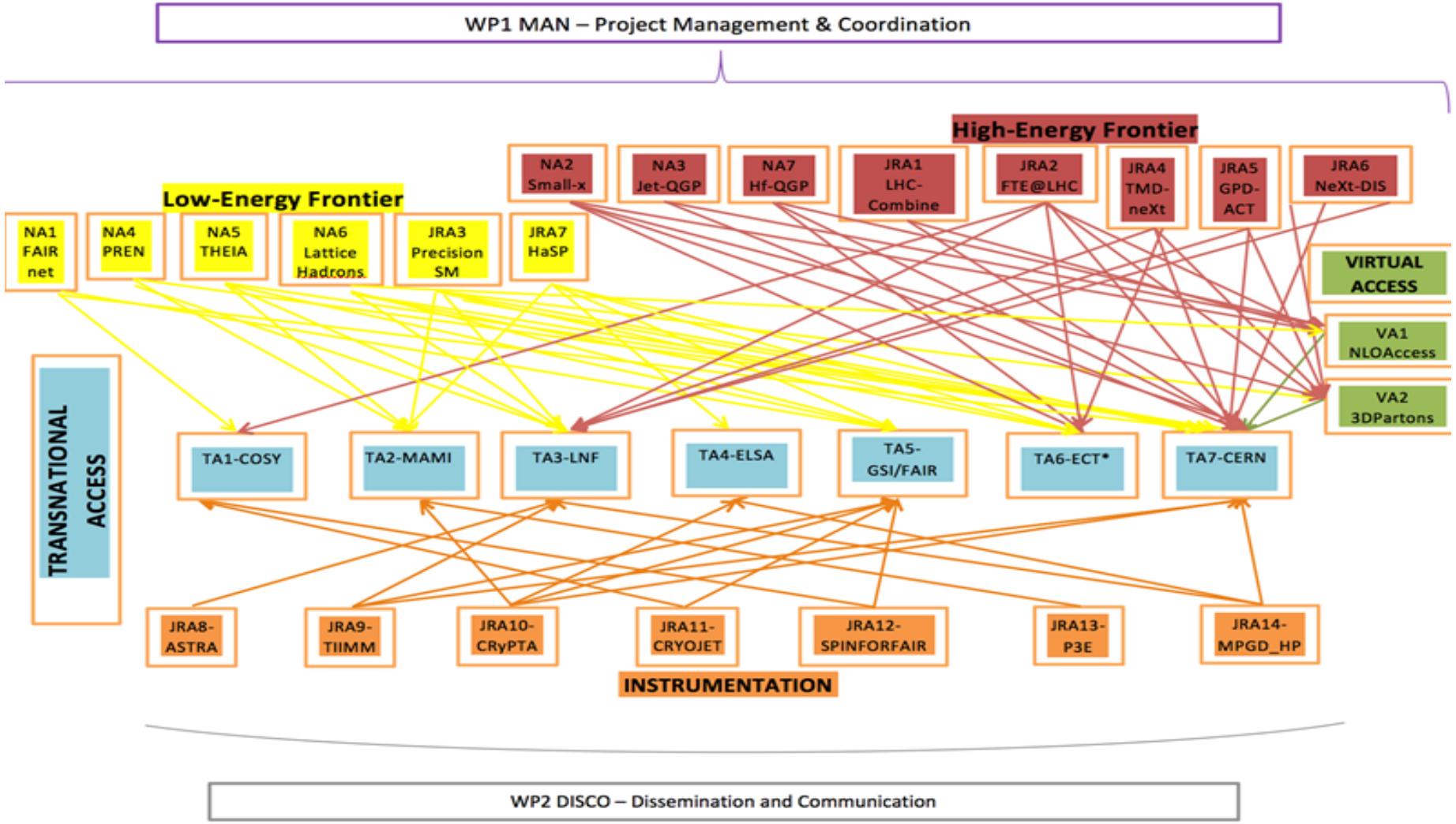
STRONG-2020: **Official Website**

- On the STRONG-2020 site, you can find:

  - Project objectives
  - Work packages description
  - Management structure
  - Participants detailed description
  - Meetings agenda
  - Documents
  - Outreach activities

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824093

Inter-relations between WPs



STRONG-H2020: **Significant Events**

First Amendment

The Amendment was accepted on November 18, 2020

Change of managing agency

Starting April 1, 2021, the management of the project is transferred to REA

New Project Officer (PO)

Following the change of managing agency, a new PO was assigned

First Periodic Report

The report was approved and all costs were accepted on June 25, 2021

Request of the Second Amendment

Amendment request was launched on August 13, 2021,
it is currently under study

List of beneficiaries

Participant name	Short name
Centre National de la Recherche Scientifique	CNRS
Oesterreichische Akademie der Wissenschaften	OeAW
Universite Catholique de Louvain	UCL
European Organization for Nuclear Research	CERN
Deutsches Krebsforschungszentrum Heidelberg	DKFZ
Facility for Antiproton and Ion Research in Europe GmBH	FAIR
Forschungszentrum Juelich GmBH	FZJ
GSI Helmholtzzentrum fuer Schwerionenforschung GmBH	GSI
Johannes Gutenberg-Universitat Mainz	JGU MAINZ
Rheinische Friedrich-Wilhelms-Universitat Bonn	UBO
Ruhr-Universitaet Bochum	RUB
Ruprecht-Karls-Universitaet Heidelberg	UHEI
Technische Universitaet Muenchen	TUM
Universitaet Hamburg	UHAM
Universitaet Regensburg	UREG
Westfaelische Wilhelms-Universitaet Muenster	WWU
Universidad Autonoma de Madrid	UAM
Universidad Complutense de Madrid	UCM
Universidad de Salamanca	USAL
Universidade de Santiago de Compostela	USC
Universidad del Pais Vasco/Euskal Herriko Unibertsitatea	UPV/EHU
Universitat de Valencia	UVEG

List of beneficiaries

Participant name	Short name
Jyvaskylan Yliopisto	YJU
Commissariat a l'Energie Atomique et aux Energies Alternatives	CEA
Ruder Boskovic Institute	RBI
Sveuciliste u Zagrebu	UNIZG
The Trinity College of Dublin	TCD
Consiglio Nazionale delle Ricerche	CNR
Fondazione Bruno Kessler	FBK
Istituto Nazionale di Fisica Nucleare	INFN
Politecnico di Milano	POLIMI
Javna Ustanova Univerzitet Crne Gore Podgorica	UOM
Rijksuniversiteit Groningen	RUG
Stichting Nederlandse Wetenschappelijk Onderzoek Instituten	Nikhef
Narodowe Centrum Badan Jadrowych	NCBJ
Politechnika Warszawska	WUT
The Henryk Niewodniczanski Institute of Nuclear Physics	IFJ PAN
Uniwersytet Jagiellonski	UJ
Laboratorio de Instrumentacao e Fisica Experimental de Particulas	LIP
Universidade de Aveiro	UAVR
Uppsala Universitet	UU
The University of Birmingham	UOB
The University of Edinburgh	UEDIN
University of Glasgow	UGLASGOW

Industrial partners

- 1. The Work Package FAIRnet explicitly states a cooperation of FZJ (partner) with companies like NVIDIA and Intel
- 2. Concerning the Work Package CryPTA, the relevant target group of Bonn University has a collaborative research project with CryoVac GmbH & Co KG, Troisdorf, a leading German manufacturer of cryogenic equipment and custom cryostats for low temperature STM-systems. The project is founded by the German Federal Ministry for Economic Affairs and Energy (BMWI) as a so called "ZIM-Project" (Central Innovation Program to foster market-driven technology-based R&D work within German SMEs) (for more information https://www.bmwi.de/Redaktion/EN/Artikel/SME-Sector/technology-neutral-project-support-01.htm)
- 3. There are two industrial companies involved in the Work Package TIIMM:
  - Tower Jazz (www.towerjazz.com), a global silicon foundry specialized in manufacturing analog integrated circuits. They will have the main role of producing the sensors prototypes implemented in the project
  - G&A Engineering (www.gaengineering.com), an enterprise which operates in the military and professional electronics that is also structured as a Research Center qualified by the Italian ministry of University and research. Their main role will be the assembly of the different prototypes which will be built thanks to their long standing expertise in silicon sensors, as evidenced in their overall assembly of the silicon tracker used in the AMS (Alpha Magnetic Spectrometer) experiment on the ISS (International Space Station)

Industrial partners

- 4. The Work Package SPINFORFAIR concerns a measurement in the field of hadron physics. In the preparation of the experimental test, industry has been involved as partner in the production of dedicated equipment:

  - superconducting solenoid (so called “siberian snake”) from a dedicated development by "Cryogenic Ltd" (UK) (http://www.cryogenic.co.uk)
  - semiconductor sensors from a dedicated development by "Micron Semiconductor Ltd" (UK) (http://www.micronsemiconductor.co.uk)
  - readout chips from a dedicated development of “Integrated Detector Electronics AS” (N). (http://ideas.no)

- 5. While the Work Package P3E doesn’t have industrial partners at this stage, the development concerning HV-MAPS and Polarized Positrons have a true potential of applications once successfully achieved

- 6. Regarding the Work Package CRYOJET, there are two companies involved:

  - The German company "Micreon GmbH" in Hannover will perform the last step in the cluster nozzle production line by laser drilling. This laser drilling for micrometer nozzles is a new topic for this company, so any experience gained here will be of high interest for further similar industrial products, i.e. injector nozzles for various fields.
  - The German company PROTIQ GmbH in Blomberg will produce in close cooperation with the JRA complex cryo-cooling devices using 3d-printing with, e.g., copper or stainless steel. The results performed for the planned state-of-the-art cryogenic targets are expected to open new fields for complex cryogenic cooler in many fields of technology.

Industrial partners

- 7. Three high-technology industrial partners will be involved in the project MPGD_HP:
  - ELTOS S.p.a., Arezzo, Italy
  - ELVIA PCB, Coutances, France
  - Technology Transfer Agency Techtra Sp. z o.o. TECHTRA, Wroclaw, Poland

- They will provide standard as well as special custom-designed components for the detector prototypes, work in close collaboration with our Institutes to adapt the innovative elements developed in the framework of this JRA to an industrial environment, define and optimize together with us new quality assessment methods and protocols for the innovative MPGD components and participate in the technology transfer of novel ideas, procedures and applications emerging from the proposed JRA, in view of a potential increase of their competitiveness in the international market.

CERN in STRONG-2020

The access to CERN facilities (PS/GIF++/IRRAD beam-test & irradiations, fixed-target exp. runs, meetgs, workshops,...) is provided to following WPs:

High-Energy Frontier	High-Energy Frontier	Low-Energy Frontier	Instrumentation
• VA-NLOAccess • VA-3DPartons • JRA-GPD-ACT • JRA-TMD-neXt • JRA-next-DIS	• NA-Small-x • JRA-FTE@LHC • NA-Jet-QGP • NA-Hf-QGP • JRA-LHC-Combine	• JRA-HaSP	• JRA-MPGD_HP • JRA-TIIMM • JRA-ASTRA • JRA-CryPTA • JRA-CRYOJET • JRA-P3E