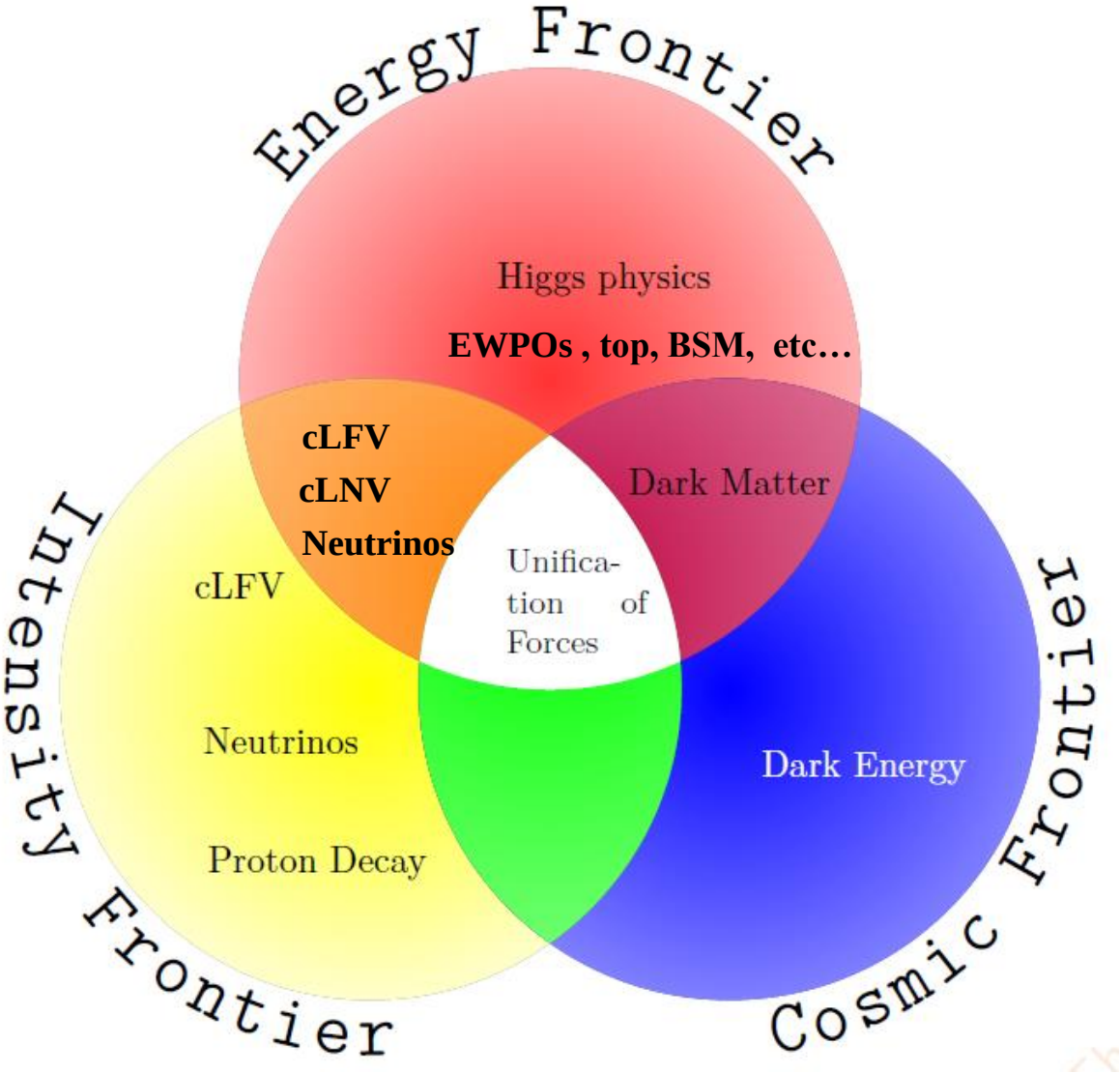

# 3d FCC Physics and Experiments Workshop
# Next steps

# IIId FCC Physics and Experiments Workshop*):

# Next steps

*) **Work**: **250** (registered) participants for **115 presentations**
**+ FCC software tutorial** https://hep-fcc.github.io/fcc-tutorials/

Organization: **congratulations and many thanks** to
-- M. Mangano, J. Gluza et al (theory)
-- M. Dam, F. Bedeschi, P. Collins, M. Aleksa and G Wilkinson (detectors)
-- G. Ganis, C. Helsens (software tutorial)
-- G. Emery and FCC secretariat
and all contributors!


Energy Frontier
Higgs physics
EWPOs , top, BSM, etc…
cLFV
cLNV
Neutrinos
Dark Matter
Unifica-
tion of
Forces
cLFV
Neutrinos
Proton Decay
Dark Energy
Intensity Frontier
Cosmic Frontier

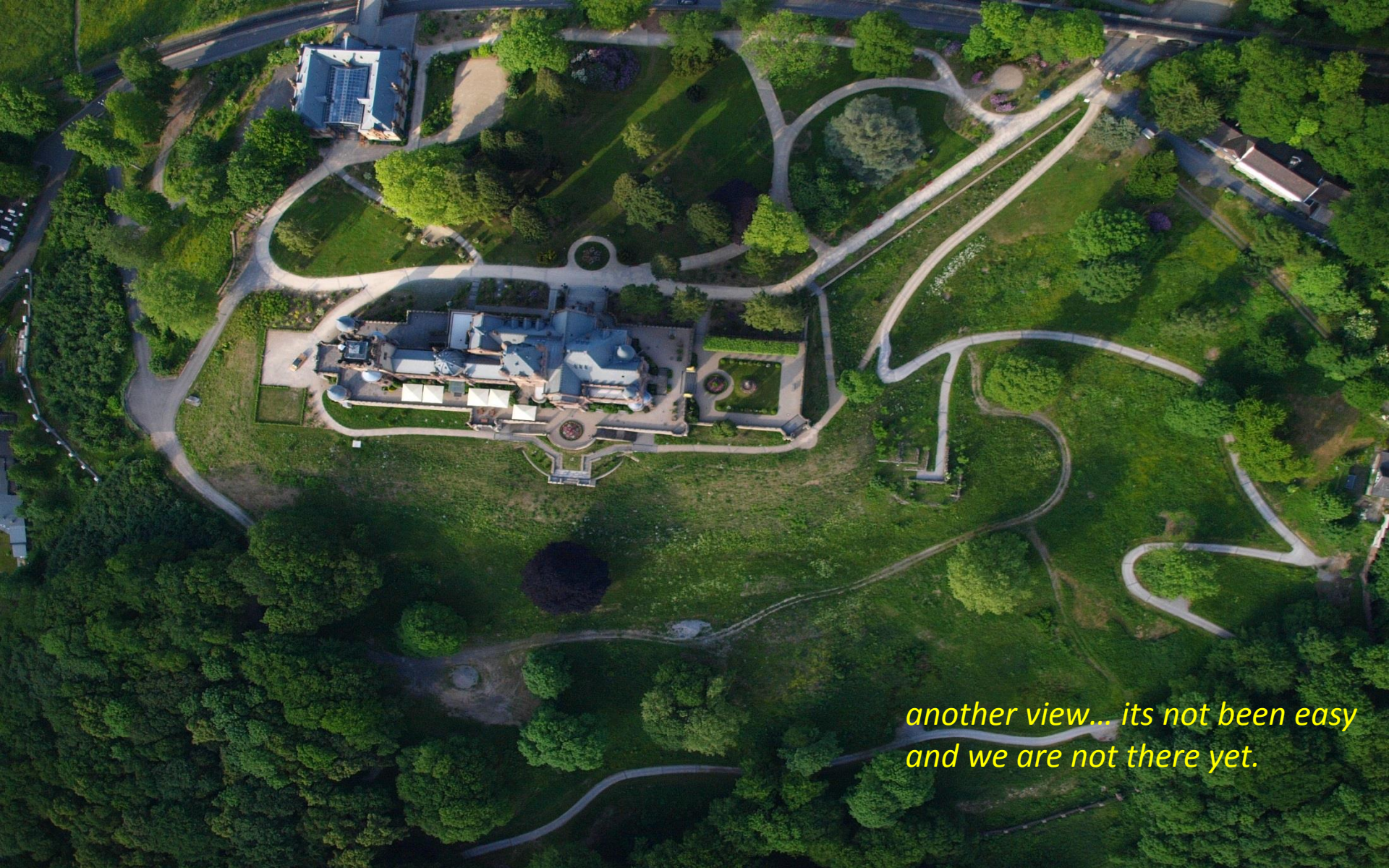
**Next Week:**

**European Strategy Update – Strategy Drafting Session**

**20—24 January 2020 | Bad Honnef, Germany**

***DrachenBurg***

the most famous sightseeing in Bad Honnef:
«the Fortress of the Dragons»


*another view... its not been easy*
*and we are not there yet.*

This is the real place I think.

What can we hope for? (For what concerns FCC)

➔ do not expect that the project will be approved, yet!

**A clear recommandation that CERN focuses on a new Circular Collider infrastructure (100km) leading to a TDR in ~5-6 years**

-- TDR on infrastructure and accelerator(s), backed up with much more solid physics case and detector studies

-- not detector TDRs yet.

**A recommandation to place R&D for High Field accelerator Magnets as top priority**

Hopefully also (important for funding our efforts!)

– explicit recommandation of FCC-ee (or FCC-INT or FCC-ee-hh-ep) as part of TDR

-- recommandation for strong theory effort in particular to back-up precision measurements

**Draft will not be public before March 2020**

# FCC main goals for 2020 - 2026

**Overall goal:**

- **Perform all necessary steps and studies to enable a definitive project decision by 2025/26, at the anticipated date for the next ESU, and a subsequent start of civil engineering construction by 2028/29.**

**This requires successful completion of the following four main activities:**

- **Develop and establish a governance model for project construction and operation**
- **Develop and establish a financing strategy, including in-kind contributions**
- **Prepare and successfully complete all required project preparatory and administrative processes with the host states (debat public, EIA, etc.)**
- **Perform site investigations to enable CE planning and to prepare CE tendering..**

**In parallel development preparation of TDRs and physics/experiment studies:**

- **Machine designs and main technology R&D lines**
- **Establish user communities, work towards proto experiment collaboration by 2025/26.**

# Towards the tunnel

**Role of Physics and Experiments working groups:**

-- Physics case for FCC-ee and hh and eh should be complete, rich, and solid
**-- engage community of users (experimenters and theorists)**

-- first step (ee) should be well thought out including detectors concepts
that can do the all aspects of the physics (maybe not every detector can)
EOI's for >4 detectors

-- w.r.t. 'Higgs factories', this means PID and great capability for systematic errors in EWPOs.

-- need TDR-level designs for lumi monitors, polarimeter, beam instrumentation etc…

-- do we need 2 or 4 IR geometry?

-- FCC-ee-hh-eh studies should absolutely continue together
(100 TeV is the ultimate goal and essential to motivate the tunnel)
to benefit from ***synergy and complementarity***

## Physics and Experiments studies

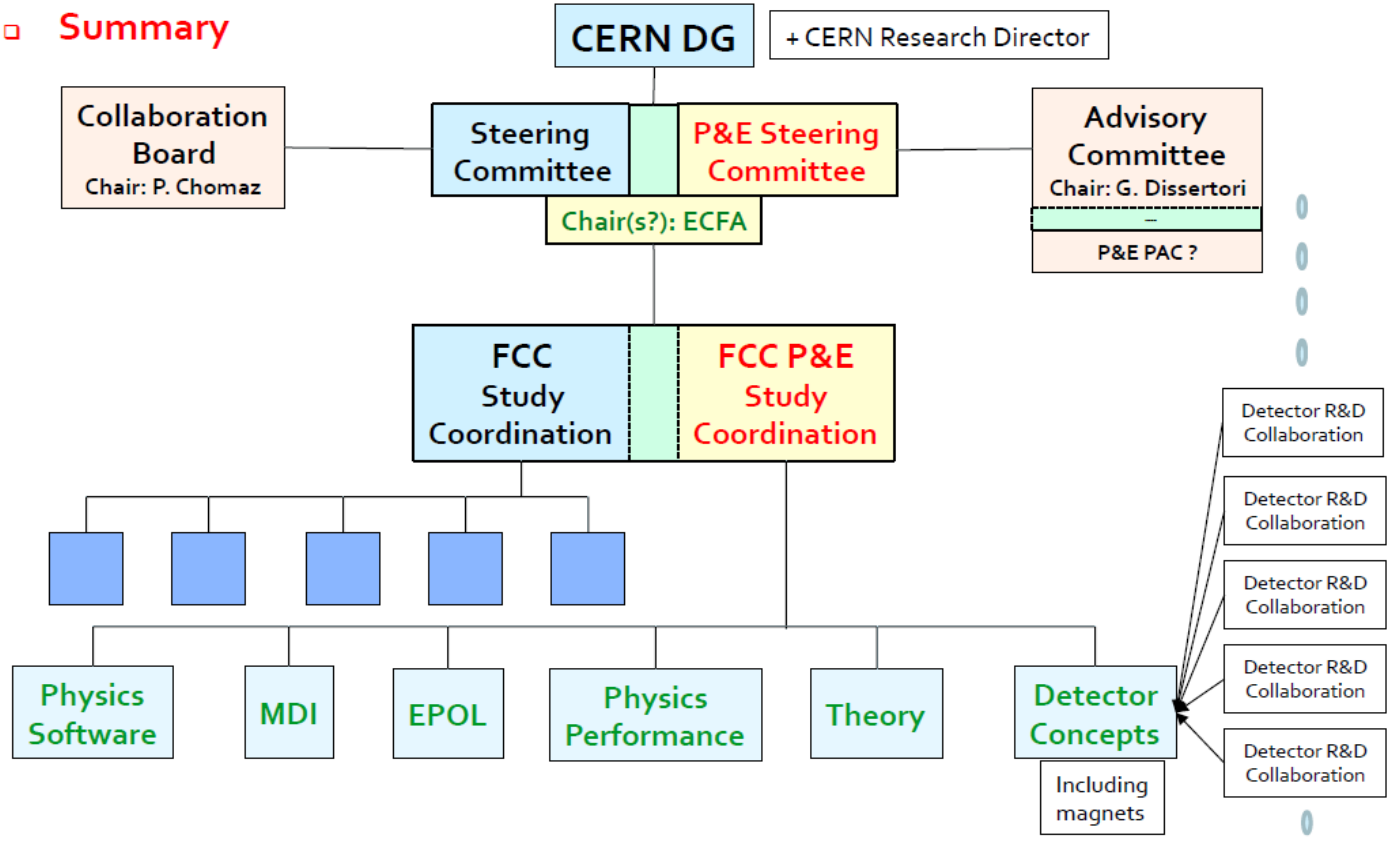
We started organizing ourselves in the last months towards the next steps

In particular physics and experiments studies should become more intense
-- towards detector conceptual designs and LOIs
**-- engage community of users (experimenters and theorists)**

Steps have been made towards broader reach, both by increasing the scope of our International advisory committee **FCC-IAC** and working within the framework of **ECFA**

# Possible FCC P&E Organization in 2020-2026

- Summary



## Comments

A. Blondel and P. Janot have presented a plan towards a modification of the current FCC org. chart, with particular goal of enlarging the steering committee (SC) with members that will oversee and advise on the Physics & Experiments (P&E) activities of the FCC study group.

- Such a modification is supposed to ease the adiabatic transition, in the years 2020 to 2026, from the current scheme towards a structure that, by the next European Strategy Update, will be optimized for a concrete project implementation.
- P&E SC membership should include 1-2 influential and supportive representatives per major institutes / labs / universities; the IAC has been invited to give advice on this body's composition.
- The IAC supports the proposal of enlarging the SC with additional focus on P&E and considers the corresponding changes to the FCC org. chart as appropriate.
- The IAC welcomes the idea of a kick-off meeting in the second half of 2020, under the assumption of a positive recommendation by the European Strategy Update for FCC-ee. Such a kick-off meeting may be organized under the umbrella of ECFA.

## Recommendations

The FCC study group is invited to pursue its plans towards strengthening/enlargement of both the steering committee and the coordination group with members focused on physics and experiments (P&E). However, the IAC recommends to pay attention to maintaining the essential interactions between machine and P&E sectors of the FCC coordination. In particular, the committee considers it premature to move towards a separation of machine and P&E experts for the IAC itself.

yes, of course we agree

-----Original Message-----
From: Jorgen D'HONDT <Jorgen.DHondt@vub.be>
Sent: Monday, November 18, 2019 2:38 PM
To: Michael Benedikt <Michael.Benedikt@cern.ch>
Subject: ECFA and towards new experiments at future colliders

Dear Michael,

Following the Restricted ECFA meeting on Friday, I was given the mandate to explore with the communities how ECFA can help, post strategy publication, with a view to establish in a community driven way new detector designs at future colliders and to support the physics studies involved. I am looking forward to discuss these matter with you in the near future in the context of FCC.

An item that was mentioned is to think in the direction of exploring synergies among the "detectors at future e+e- Higgs factories".

Kind regards,

Jorgen

➔ **Expect some kick-off gathering in spring/summer 2020**

**Some upcoming tasks for P&E stemming from this workshop**

1. establish a list of benchmark processes on which to compare detector solutions
   ex: $\sigma$ ee$\rightarrow$HZ, H$\rightarrow$ bb,cc,gg, $R_\ell$, $R_b$, $m_W$, tau lifetime, mass, polarization etc.
   need a little task force -- ILC&B-factory experts would be useful

2. discuss proposal
   to measure ee(ECM=30-90)-> hadrons (cross-section and evt shapes)
   and compare with possibilities offered by e+e-(91 GeV)$\rightarrow$ $\gamma$ + hadrons($\sqrt{s}$=30-90)
   need also a little QCD task for these studies

People who would be honored to be asked, please manifest yourselves

# FCC France (14-15 Nov.): 87 participants!

- Convergence is taking place: « France must take a leading role »

## Conclusions

Yves Sirois
Summary talk

- There is absolutely GREAT physics prospects at FCC
- We vitally and urgently need to built a consensus in favour of FCC-ee/hh
- France should take a leading role in bringing Europe together behind this sequence of projects at CERN

- The physics prospects are the best possible given current knowledge
  - Best coverage of « Higgs » physics and EWK symmetry physics
  - Ideal complementarity between FCC-ee and FCC-hh
  - Considerable precision improvement on SM parameters at FCC-ee
  - Discovery reach (> 5σ) beyond HL-LHC – There is life beyond HL-LHC !

nb forgot flavours ....

- France have leading contenders for SC magnets, ERLs, main detector concepts (high granularity calorimetry, tracking, etc), Polarisation, ...

We (France) better get organized around the FCC activities

***AB: Let us make sure similar meetings are organized in all EU countries, all must feel that they have a leading role!***
***contact us for help.***

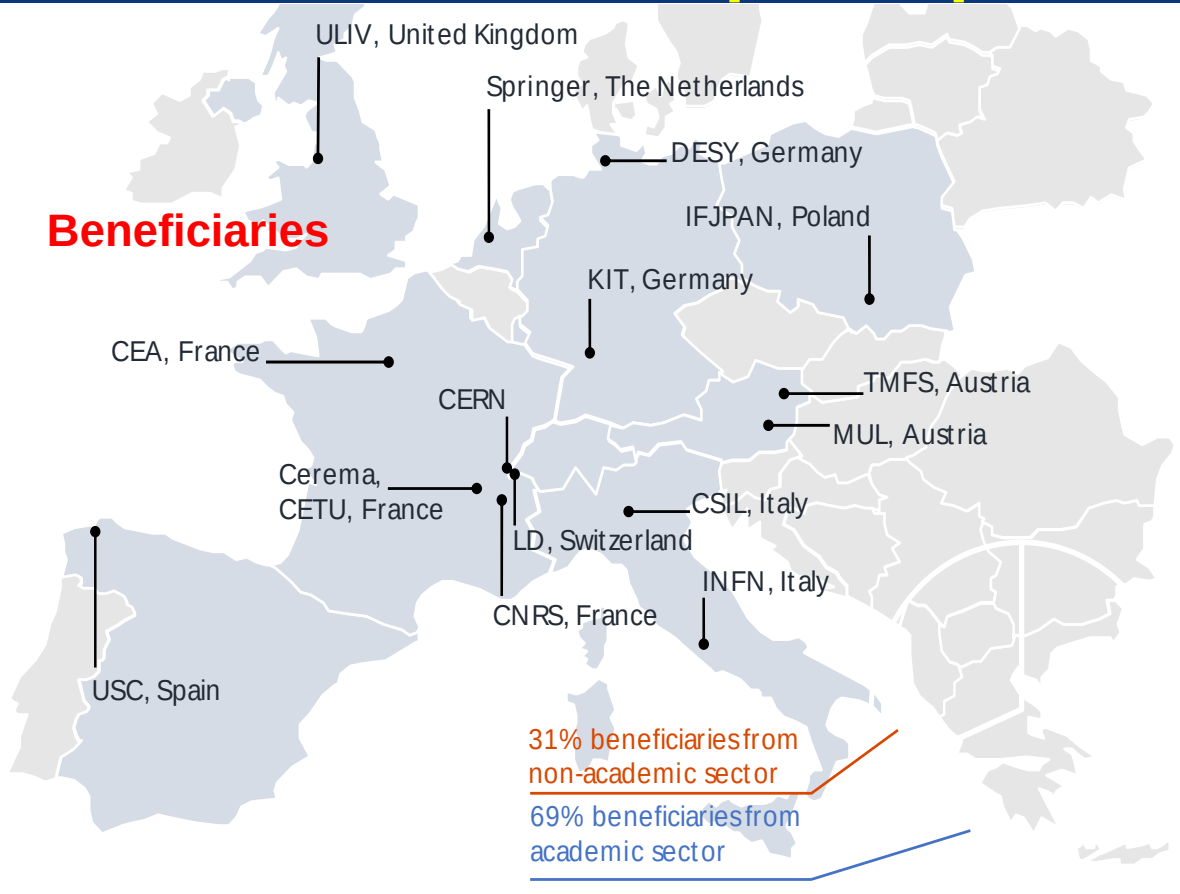
# H2020 DS FCC Innovation Study (FCC-IS)

**Goal: Carry out the technical design study for a 100 km long luminosity frontier circular collider infrastructure at CERN that will extend Europe's leadership in the domain of fundamental physics research until the end of the 21st century.**

The study focuses on the high priority topics to prepare the ground for a construction project by 2026:

1. **optimisation of the particle collider design**, which leads to the invariants of the infrastructure project,
2. planning and necessary investigations for a **sustainable civil engineering construction project** including the requirements of a circular economy,
3. **implementation and public participation processes in France and Switzerland** (CERN host states) including transnational topics such as environmental impact assessment, management of excavation materials and access to shared resources (electricity, water, communication, transport),
4. **definition and implementation of a project exploitation** plan considering the need to **create a committed user community** that exploits the RI from the beginning onwards and to **engage every member of the society**,
5. **Socio-economic** impact assessment with a plan to **design the facility for impact creation**, including the regional impacts and potential synergies for all participating stakeholders in Europe.

# H2020 DS FCC Innovation Study - participants




**Beneficiaries**

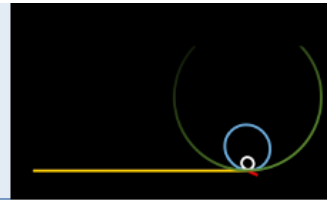
**Partners**

- D.R.R.T. (F)
- Etat de Geneve (CH)
- DOE (US)
- BINP (Ru)
- U Oxford (UK)

# *TLCnet* – Theory for Lepton Colliders

## ITN MSCA-2020 Action, **14 ESR projects**

submitted



**WP1** - **Theoretical precision predictions for future lepton colliders**

**WP2** - **Investigation of methods and tools for multiloop, multiscale SM calculations**

**WP3** - **Monte Carlo, high-performance computational numerical studies**

**Germany:** MPG – Gudrun Heinrich, TUM – Andreas Weiler, JGU – Stefan Weinzierl

**Greece:** NCSR – Costas Papadopoulos

**Hungary:** ELTE – Zoltan Trocsanyi, U. Debrecen – Adam Kardos

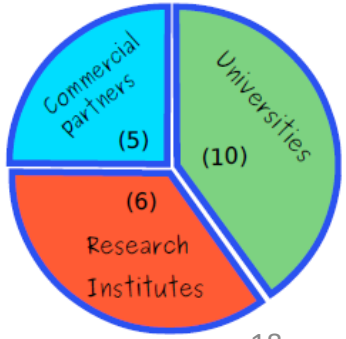
**Italy:** INFN – Barbara Mele, U.Roma Tre – Giuseppe Degrasi, U. Pavia – Guido Montagna

**Poland:** US – Janusz Gluza(*), IFJ – Stanislaw Jadach

**Spain:** U.Granada – Roberto Pittau(**), CSIC/IFIC – German Rodrigo

**Switzerland:** CERN – Claude Duhr, ETHZ – Aude Gehrmann- De Ridder

**UK:** U. Durham – Nigel Glover




(*) Network coordinator

(**) Deputy-Chair

# MSCA ACTION: SPIRAL-NET

STUDY OF PERFORMANCE OF INNOVATIVE RECONSTRUCTION ALGORITHMS AT LEPTON COLLIDERS

Optimal Global Event Reconstruction for lepton colliders across detector concepts and machines

Patrizia Azzi – INFN PD
Network Manager

Freya Blekman – VUB

Rebeca Gonzalez Suarez – UU

Marcel Vos – CSIC/IFIC

Frank Simon – MPG

Gregorio Bernardi – CNSR/LPNHE

Mogens Dam – UCPH

Mario Kadastik – KBFI

Daniela Bortoletto – U.Oxford

NON – ACADEMIC PARTNERS

Agilent Technologies SAES
Elytt Energy INEUSTAR
CACHET HumansSince1982

ACADEMIC PARTNERS

Gerardo Ganis – CERN

Frank Gaede – DESY

Daniel Jeans – KEK

# Conference presentations

1. ee, hh, eh have independent organization

2. for ee: If you would like to make presentation at a conference please get in touch with speakers board: Azzi/Blondel/Giacomelli/Klute

3. for the large conferences we will submit abstracts and look for speakers.
It is your chance to learn about the project and defend it!


FCC Week 2020 in Paris
preliminary date: 9 – 13 November 2020