

# FCC-contacts – July 21st

- News from FCC coordination meeting
- Demandes Dialog
- Meeting FCC-contacts de la rentrée
- Agenda FCC-France



# FCC PED coordination, 15 July 2021

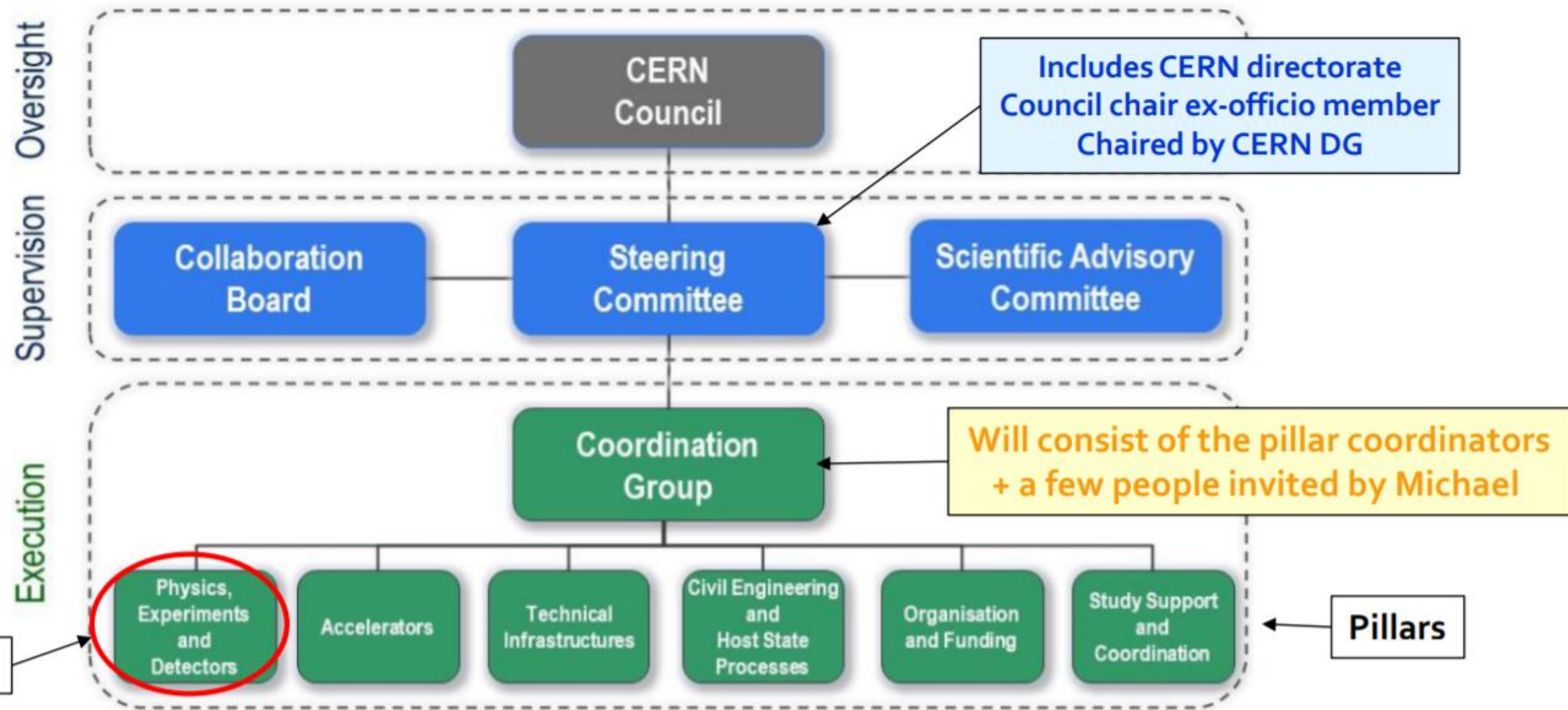


- **First coordination meeting after CERN Council approval of the FCC Feasibility Study!**
  - ◆ With focus on the first FCC stage: tunnel and FCC-ee

**This long-awaited clarification is essential for the project attractivity/communication**

- Affordability, “human” timescales, scientific focus, etc
  - A lot of positive feedback, including from physicists historically committed to linear colliders
- ◆ Official documents stress the importance of communication towards scientific community
  - Organisational structure: <http://cds.cern.ch/record/2774006/files/English.pdf>
  - Deliverables and milestones: <http://cds.cern.ch/record/2774007/files/English.pdf>
- ◆ Review of resources fall 2021
- ◆ Intermediate review mid-2023
- ◆ Delivery of Feasibility Study Report (FSR) end 2025

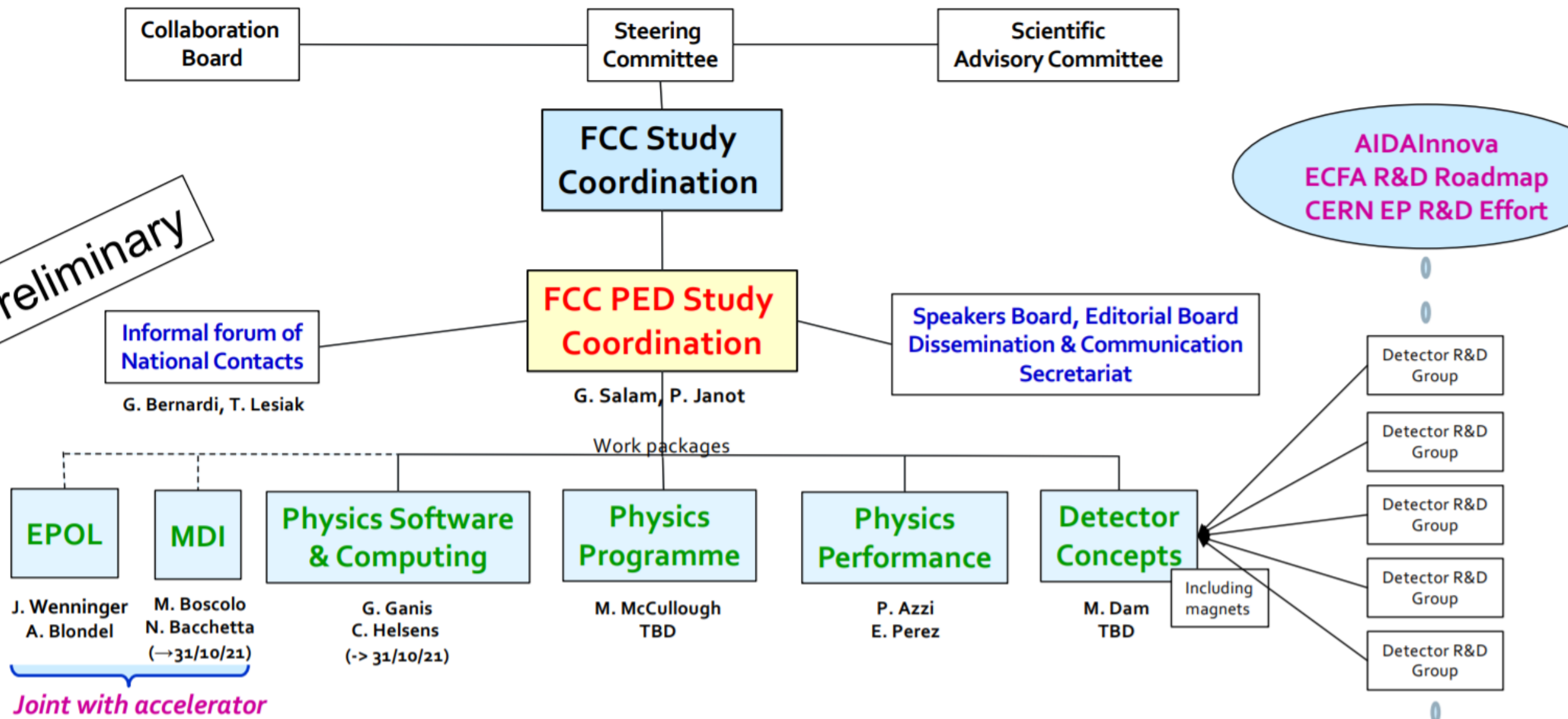
**An important milestone has been passed thanks to the work of many people in this group and beyond. The next phase begins now.**



- Smooth transition to the new structure expected to occur in September 2021



Preliminary



- **Transition period until Fall 2021 (following the FCC Feasibility Study coordination)**
  - ◆ **The PED Study Coordination will consist of**
    - The pillar coordinators and the work-package conveners
    - The chairs of the IFNC, Speaker's Büro, Editorial Board, ...
    - The organisers of the PED General monthly meeting
    - Plus a few add'l members chosen by the pillar coordinators (to be contacted)
  - ◆ **The actual work will be performed inside the work packages**
    - Each WP will have its own coordination body and updated mandate
      - To be proposed by the WP conveners to the pillar coordinators (and back)

e.g., Physics Programme has six working groups (+conveners): EW, Higgs, top, flavour, QCD, BSM
  - ◆ **Meanwhile, we keep the monthly "Steering group and coordination" meetings**
    - The new PED structure /names still demands an official approval from the project leader
      - In consultation with CERN DG and DRC
    - Still a number of TBD's to be sorted out
      - WP co-coordinators of Physics Programme, Detector Concepts, Software & Computing, MDI
      - Editorial Board, Communication and Dissemination, ...



<i>Action to be taken</i>		<i>Voting Procedure</i>
For information	<b>RESTRICTED COUNCIL</b> 203 <sup>rd</sup> Session <b>17 June 2021</b>	-

**FUTURE CIRCULAR COLLIDER FEASIBILITY STUDY:  
MAIN DELIVERABLES AND MILESTONES**

In the area of physics, experiments, and detectors, covered by the **Physics, Experiments and Detectors work package**, activities will continue on consolidating the physics case for the integrated FCC programme and the corresponding requirements on theoretical calculations and Monte Carlo generators. The FCC-hh detector concepts will be revisited in light of the evolution of the physics landscape and the experience gained with the High-Luminosity LHC detector upgrades, whilst for FCC-ee several detector concepts are being considered and benchmarked to meet the requirements of ultra-precise Higgs boson and electroweak measurements. The cost drivers for construction and operation will be evaluated and requirements on accelerator performance, technical infrastructure, integration and civil engineering will be formulated. Detector design and R&D will proceed in collaboration with the R&D for future detectors initiative at CERN, and with the activities that will emerge from the Detector Roadmap being developed under the auspices of ECFA.



# Towards the new FCC PED structure



- Web page, indico site, and mailing lists will be reshuffled to match the new structure
  - Physics & Experiments (2014-2020) → Physics, Experiments & Detectors (2021-2025)

Hadron Collider Physics and Experiments	14195
Lepton Collider Physics and Experiments	
Common activities	
Lepton Hadron Collider Physics and Experiment	

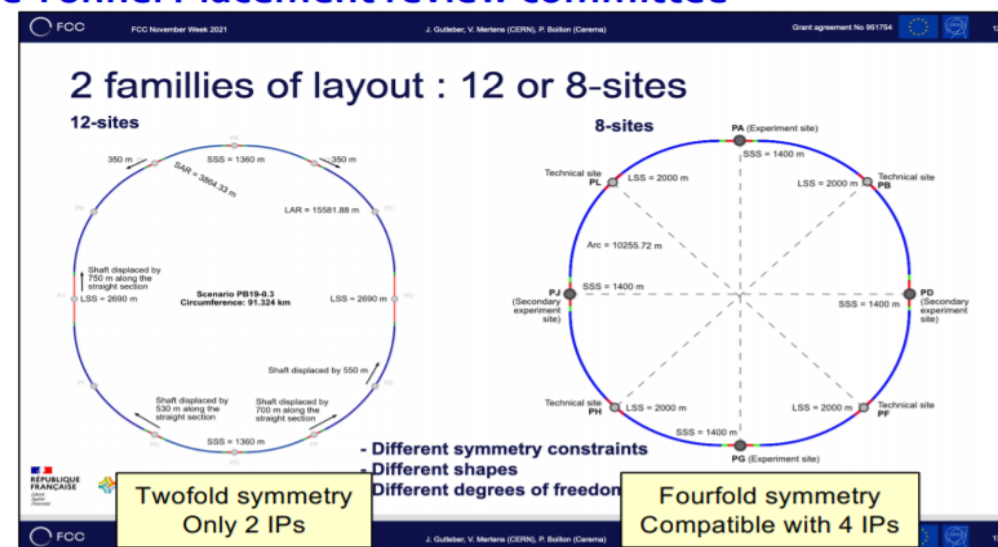
FCC-ee Physics Coordination	5259
FCC-ee Physics Workshops	
FCC-ee Related Events	
FCC-ee talks at conferences/workshops	
WG1: Electroweak physics at the Z pole	
WG2: Diboson physics and measurement of the W mass	
WG3: Higgs Boson Properties	
WG4: Top quark physics	
WG5: QCD and $\gamma\gamma$ physics	
WG6: Flavour physics	
WG7: Experimental signatures for new physics	
WG9: Online software and computing	
WG11: Detector designs	

PED Coordination meetings	5251
PED monthly general meetings	
Physics Performance	
Physics Programme	
Detector Concepts	
Software and Computing	
Machine-Detector Interface	
Beam Energy Calibration, Polarisation, Monochromatisation	
Informal Forum of National Contacts	
National Institute Meetings	
Conceptual Design Study (Archive)	

- ❑ **Mandate delivered on 1 June**
  - ◆ After six meetings of a dedicated task force
- ❑ **Long list of 29 coordinator candidates was received on 1 June**
  - ◆ Shortened to seven candidates on 16 June
  - ◆ All seven candidates were interviewed (AB, PJ)
    - Mogens Dam accepted to be one of the two co-coordinators
    - Some of the others would be happy to participate to an advisory/review board
    - One showed interest for the co-ordination – to be followed up.
- ❑ **Our arguments in favour of 4 IPs have been taken seriously and endorsed**
  - ◆ By the FCC Coordination Group and the Tunnel Placement review committee
- ❑ **Recommendation**
  - ◆ Define lowest-risk 8-Point option as new placement baseline
    - Leave open later choice between 2 and 4 IPs
    - Reduced number of surface sites
- ❑ **Deliverables from DC work package**
  - ◆ Four FCC-ee detector concepts
    - Compatible with requirements set by physics

## Task force

- Martin Aleksa
- Nicola Bacchetta
- Alain Blondel
- Paula Collins
- Mogens Dam (chair)
- Gerardo Ganis
- Paolo Giacomelli
- Patrick Janot
- Emmanuel Perez
- Frank Simon
- Guy Wilkinson





- **The FCC Software group is at work since 2014**
  - ◆ The mandate was last updated in 2019, and two coordinators were appointed
    - Gerardo Ganis (CERN); Clément Helsens (CERN, until end October 2021)
      - A new co-coordinator will probably be needed soon to take over from Clément
  - ◆ The mandate should now be revised (objectives, deliverables, milestones)
    - Accounting for what has (not) been done, and the new developments (key4hep, computing, ...)
  - ◆ A “work breakdown structure” (WBS, a.k.a. a list of tasks) should be produced
    - To welcome more easily possible newcomers and participating institutes
  - ◆ An organisational chart (working groups, etc.) could be needed
- **A dedicated “task force” could help in this perspective, with**
  - ◆ Experts (former Computing/SW coord.) from CMS, ATLAS, LHCb, ALICE, Linear Collider (\*)
  - ◆ A few direct stakeholders (users and developers) from FCC study
    - The specific composition is being discussed, and will be presented next time

**Please send proposals for participants to the task force !**



# Physics Programme coordination



- **The mandate and the organisational structure (WG's) are known**
  - ◆ Six working groups (EW, Higgs, Top, Flavour, QCD, BSM)
  - ◆ Matthew McCullough accepted to be one of the two co-coordinators, on the theory side
    - We also have an excellent candidate on the experiment side
      - Fully prepared and ready to jump in
    - Waiting for official confirmation from CERN management and Michael Benedikt
      - We are in contact with Joachim, Fabiola, and Michael to tentatively speed up the process
  - ◆ Meanwhile, Matthew/Gavin (and others) will be thinking of
    - Names for working-group conveners on the theory side
    - How to best address the FCC physics programme (ee+hh)
      - And establish the corresponding requirements on theoretical calculations and MC generators.

First report expected at the next meeting for discussion



Physics Performance meeting next Monday :

- Several Higgs reports, work done recently with master students or interns, at LLR, IJCLab, APC, Liverpool
- New contributors: very good !!
- In some cases: we learnt only recently that there was some advanced work already. We could have provided useful guidance (significant common ground across the various ZH analyses !)

To the national representatives: please encourage people to get in touch with us when they start a case study analysis, rather than at a later stage.

Work has also been done (hopefully reports soon) at :

- VUB (s-tagging, bachelor thesis)
- Udine ( AFB of b quarks)
- Clermont (  $K^*$  tau tau )

and recently started at LAPP (WW, W polarisation) and Geneva (LLPs)

First contact with Warwick (B. Murray) : interest in physics cases for particle ID and jet flavour tagging.





# Detector Concepts

**work-package mandate exists, structure is being prepared**

**Key deliverable: FCC-ee Detector Concept proposals, evaluation, and documentation**

- Compatible <sup>with</sup> the Detector Performance Requirements from “Physics Performance”
- Compatible with MDI layout and with timing and background conditions
  - A “Detector Concept” includes the assembly of sub-detectors (geometrical description, simulation, local reconstruction); the magnet system; an overview of services, power consumption, ecological impact; an evaluation of construction and operation costs
- For up to four interaction points
  - Allow for a range of complementary detector solutions to cover all FCC-ee physics opportunities

**Selection of other key tasks**

- Establish links with a broad range of R&D groups
  - Includes ECFA R&D Roadmap; AIDAInnova; CERN EP R&D effort
- Follow technological developments that could lead to new physics opportunities
- Identify and encourage R&D work in the direction of the FCC-ee requirements
- Promote the use of the common FCCSW platform and tools for performance simulation
- Maintain and update FCC-hh detector concept + study FCC-hh dedicated experiments

**Organisation**

- First step: Set up a “advisory board” / “review committee”
  - ❖ First task: help in setting up structure of working group
- Definition of sub-groups
  - ❖ Many possible ways to slice the cake |
    - Subdetectors, technologies, requirements, ...



- **A number of essays have been written and are under review (to be published in EPJ+)**
  - ◆ **Pave the way for the Physics Programme Work Package**

A future Higgs and Electroweak Factory (FCC): Challenges towards discovery

Scope:

- Physics Landscape after the Higgs discovery (M. Reece)

Theoretical challenges at the precision frontier:

- Overall perspective and introduction (C. Grojean)
- Theory challenges for EW and Higgs calculations (S. Heinemeyer, S. Jadach, J.Reuter)
- Theory challenges for QCD calculations (P. Monni, G. Zanderighi)
- Indirect discovery of physics beyond the Standard Model (J. de Blas)
- Direct discovery of new light states (S. Knapen, A. Thamm)
- Theoretical challenges for flavour physics (Y. Grossman, Z. Ligeti)
- Theoretical challenges for tau physics (T. Pich)

Physics opportunities and challenges

- FCC-ee overview: New opportunities create new challenges (A. Blondel, P. Janot)





# Physics Performance: Literature



## ❑ **A preliminary list of concrete physics studies**

See presentation from P. Azzi

<https://www.overleaf.com/read/dyjpdszrqxhz> and <https://indico.cern.ch/event/951830/>

## ❑ **EPJ+ essays (under review) paving the way for the Physics Performance Work Package**

### Higgs and Electroweak Factory (FCC): Challenges towards discovery

Links will be added in this slide when available

#### Physics opportunities and challenges

- [FCC-ee overview: New opportunities create new challenges](#) (A. Blondel, P. Janot)
- [From physics benchmark to detector requirements](#) (P. Azzi, E Perez)
- [Higgs and top challenges](#) (P. Azzi, L. Gouskos, M. Selvaggi, F. Simon)
- [Z line shape challenges: ppm and keV](#) (J. Alcaraz, A. Blondel, M. Dam, P. Janot)
- [Heavy-quark opportunities and challenges](#) (S. Monteil, G. Wilkinson)
- The tau challenges (M. Dam)
- [Hunt for rare processes and long-lived particles](#) (R. Gonzales-Suarez, M. Chrzaszcz, S. Monteil)
- [The W mass challenge](#) (P. Azzurri)
- [A special Higgs challenge: Measuring the electron Yukawa coupling](#) (D. d'Enterria)
- [A special Higgs challenge: The mass and cross-section measurements with ultimate precision](#)  
(P. Azzurri, G. Bernardi, S. Braibant, D. d'Enterria, P. Janot, A. Li, E. Perez)



## □ EPJ+ essays (under review) paving the way for the Detector Concepts Work Package

### Higgs and Electroweak Factory (FCC): Challenges towards discovery

#### Physics opportunities and challenges

- [From physics benchmark to detector requirements](#) (P. Azzi, E. Perez)
- Tracking and vertex detectors at FCC-ee (N. Bacchetta, P. Collins, P. Riedler)
- Calorimetry at FCC-ee (M. Aleksa, F. Bedeschi, R. Ferrari, F. Sefkow, C. Tully)
- Muon detection at FCC-ee (S. Braibant, P. Giacomelli)
- [Particle Identification at FCC-ee](#) (G. Wilkinson)
- Luminosity measurement at FCC-ee (M. Dam)

### Higgs and Electroweak Factory (FCC): Challenges towards discovery

#### Software Developments and Computational Challenges

- Key4hep, a framework for future HEP experiments and its use in FCC (G. Ganis, C. Helsens, V. Volkl)
- Accelerator-related codes and interplay with FCCSW (M. Boscolo, H. Burkhardt, G. Ganis, C. Helsens)
- Online computing challenges: detector and readout requirements (R. Brenner, C. Leonidopoulos)
- Offline computing resources and approaches for sustainable computing (G. Ganis, C. Helsens)

## □ ECFA Detector R&D Roadmap

- ◆ First draft of the report is available for comments
  - (deadline tomorrow 6pm!)
  - Contact your RECFA representative to have a copy

## □ FCC PED Workshop in Liverpool

- ◆ 7-11 February 2022, hopefully in person
  - Thank you CMS for moving their CMS week to end of January!
- ◆ Scientific Programme Committee chaired by Alain and Gavin
  - See Alain's presentation today

## □ Snowmass is about to restart

- ◆ Energy Frontier Workshop on 30 August-3 September: <https://indico.fnal.gov/event/49756/>
  - Meeting of the FCC Snowmass contacts just after this coordination meeting



# **Status of the FCC Physics, Experiments & Detectors Informal Forum of National Contacts**

Gregorio Bernardi, APC-Paris, CNRS/IN2P3

on behalf of the FCC-PED-National contacts



# Evolution of the scope of IFNC

The IFNC has been focusing so far only on FCC Physics Experiments and Detectors (PED),

we envision an extended parallelism with the FCG working group chaired by Emmanuel Tsesmelis. The project leader Michael Benedikt suggested recently that

- the current national contacts could also be a reference point for the whole feasibility study rather than only for physics, experiments and detectors. While most of us are not directly involved in Accelerator developments, such an approach would ensure more exchanges between the PED and accelerator community and to have harmonious developments in both areas.
- Getting ready for more focused meetings (one or a few countries at a time)

Regarding point 1, questions sent to NC:

1. Is there an accelerator physics or technology activity in your country that already participates in the FCC, or could potentially participate?
2. Do you have contacts with (or know how to contact) these existing or potential groups?



## Demandes Dialog

	initial 2020	FINAL 2020		demandes 2021
CPPM	5	3		
IJC Lab	3	3		
IPHC	5	4		5
IP2I	8,8	5		
LAPP	2			5
LLR	3,3	3		
LPNHE	9	4		
LPC	5	4		
LPSC	2,2			
FCC-FR / APC	12	10		12
TOTAL	55,3	36		22



## Next FCC-contacts meeting

Should we move the meeting to another day ? Thursday afternoon ?

Should we have it shorter (max 1.5h) and more frequently (every 2-3 weeks) ?

→ More specialized

First meeting 9th or 16th of September ?

Topic: Microvertex R&D ?

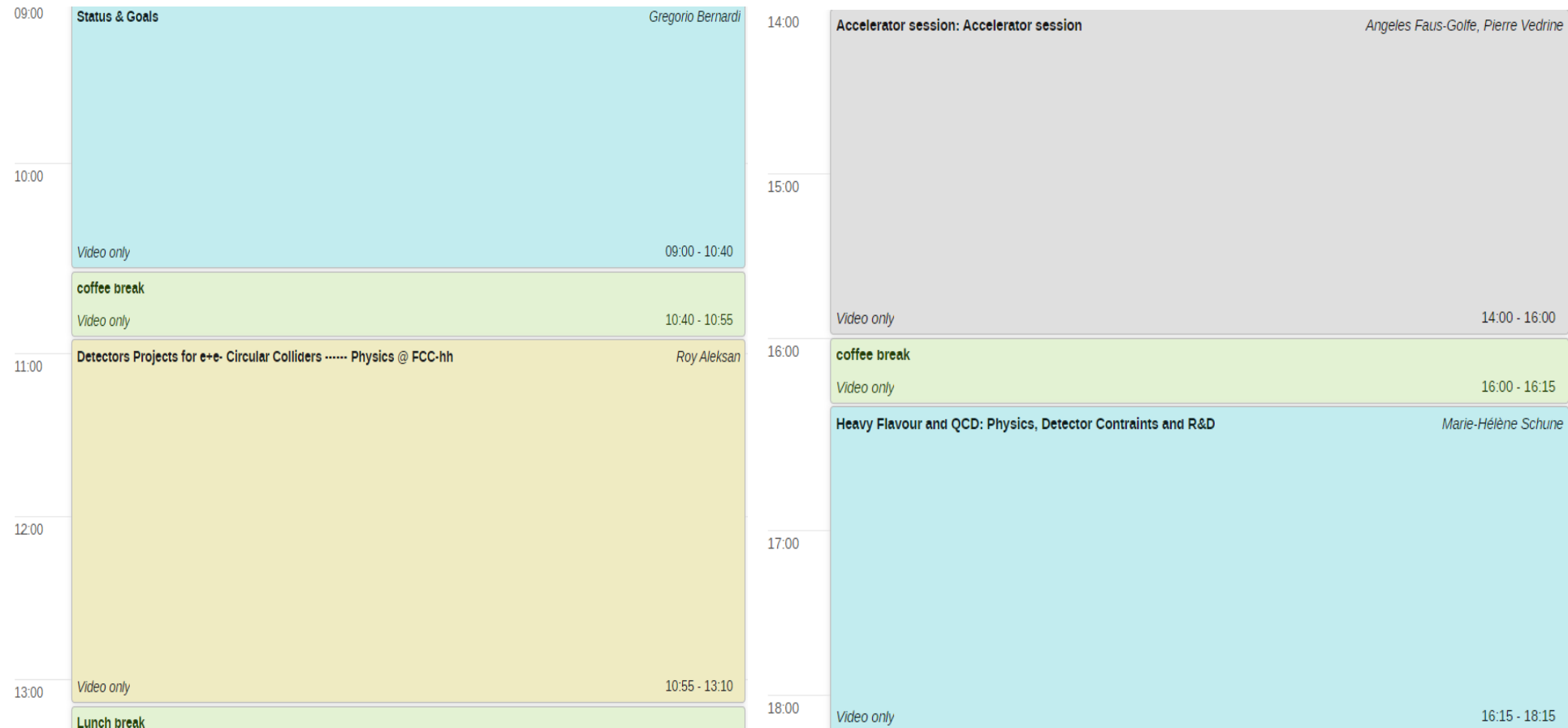
# Activités FCC-France présentées à la visite du rECFA par Dirk Zerwas

Partant du programme du jamboree, et des présentations à FCC France (physique et R&D)

- études d'impacts de choix de géométrie du tracker et de budget de matière sur la résolution du tracking (IPHC)
- exigences en performance pour un trajectometre (IP2I)
  - "Etudes des performances de reconstruction de traces (résolution en impulsion , paramètres d'impact...) en fonction du design des détecteurs internes de traces. " Aymeric FRANCIA (encadrante Gaelle BOUDOUL)
- construction d'un modèle effectif, avec un singlet scalaire, pour modéliser des scalaires composites légers (IP2I)
  - "Physique de précision sur les modèles de Higgs composite au FCC-ee: Construction d'un modèle effectif, avec un singlet scalaire, pour modéliser des scalaires composites légers" Andres PINTO (encadrant Giacomo CACCIAPAGLIA)
- ~~Top quark physics @ FCC-ee (IPHC)~~
- Higgs boson coupling measurements to charm quarks at FCC-ee (APC)
- The total  $e^+e^- \rightarrow ZH$  cross section  $\sigma_{HZ}$  (APC,IJCLab,LLR)
- The Higgs boson total decay width  $\Gamma_H$  (LLR)
- Perspectives for high-precision  $\alpha_S(m_Z^2)$  determinations FCC-ee (LPNHE)
- High-precision  $\alpha_S(m_Z^2)$  from  $e^+e^- \rightarrow \text{hadrons}$  data below the Z peak (LPNHE)

# 3rd FCC-France : November 30 Mardi→Jeudi à Annecy

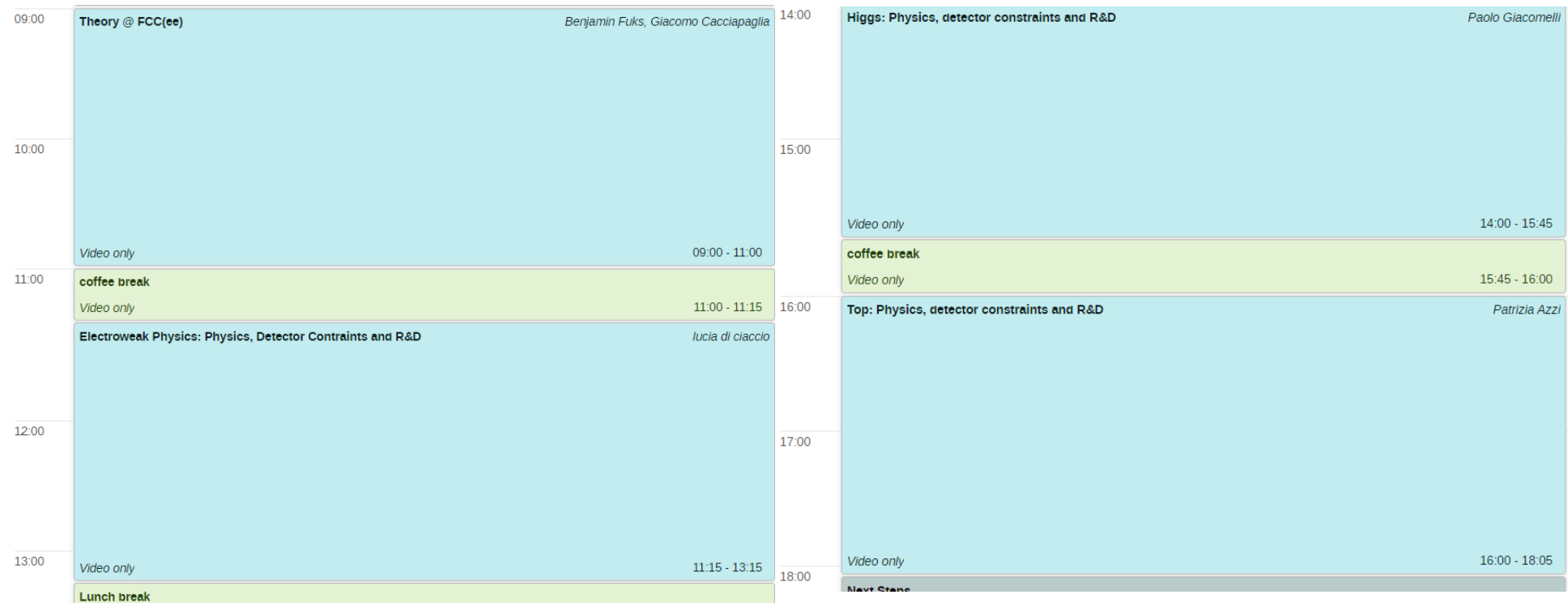
## Rappel agenda Mai (1<sup>er</sup> jour)





# 3rd FCC-France : November 30 Mardi→Jeudi à Annecy

## Rappel agenda Mai (2eme Jour)



- Pour Novembre, nous aurons du Mardi au Jeudi, 3 jours max.
- ILC ?
- Sessions supplémentaires ?

# Tour de Table / Case studies / R&D / Stages

IRFU	Saclay
APC	Paris
CPPM	Marseille
IJCLab	Orsay
IPHC	Strasbourg
IP2I	Lyon
LAPP	Annecy
LPC	Clermont
LLR	Palaiseau
LPNHE	Paris
LPSC	Grenoble
L2IT	Toulouse

Next meeting: