FCC-contacts – September 21

- News des futurs colliders

- Survey des activités possibles théo/pheno pour FCC (G. Cacciapaglia, B. Fuks)

- Workshop d'Annecy

- Tour de Table
  - point sur les case studies, slides pour les EAP

- AOB

European Strategy and new from Japan

Main points:

-- Higgs Factory is highest priority, loaction not specified, only FCC-ee and ILC mentioned
-- way towards high energies with FCC-hh is the long term plan, and it will be at CERN.
This is materialized by recommandation of strong R&D on High Field magnets
-- clear recommendation for the Technical and Financial Feasibility Study of FCCs
→ **go ahead towards TDR's for FCC-ee and hh**

Europe, together with its international partners, should investigate the technical and financial feasibility of a future hadron collider at CERN with a centre-of-mass energy of at least 100 TeV and with an electron-positron Higgs and electroweak factory as a possible first stage.

Such a feasibility study of the colliders and related infrastructure should be established as a global endeavour and be completed on the timescale of the next Strategy update.

The timely realisation of the electron-positron ILC in Japan would be compatible with this strategy and, in that case, the European particle physics community would wish to collaborate.

FCC-ee et ILC peuvent travailler de manière plus rapprochée. Compatibilité.

https://www.kek.jp/en/topics-en/topic20200911-2/

In February 2020, KEK submitted an application to the Ministry of Education, Culture, Sports, Science and Technology (MEXT) for adoption of the ILC project as part of the "Fundamental Concept for Promoting Large Scientific Research Projects Roadmap"; however, in March, KEK withdrew the application in light of the subsequent international development of the project. On the occasion of the release of the "Roadmap 2020" draft, we sent the following notice to the press on September 8. As announced below, the ILC International Development Team was recently established with KEK as the host, and KEK will be vigorously promoting the ILC project under the new international project promotion framework.

Back to FCC : main goals

Overall goal

- Perform all necessary steps and studies to enable a definitive project decision by 2026, at the anticipated date for the next ESU, and a subsequent start of civil engineering construction by 2029.

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
- 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 collaborations by 2025.

FCC program, and next steps

- **FCC-ee offers a huge physics program** with
  - ➡ Higgs and top measurements with > 10^6 events each in short (3-5y) runs
  - ➡ Unique possibilities
    - Electron Yukawa coupling
    - TeraZ + beam energy calibration
    - keV and ppm precision on EWPOs at Z resonance and WW threshold
    - $\alpha_{QED}(m_Z)$, $\alpha_S(m_Z)$, $\sin^2\theta_W^{eff}$ and $G\tau$
    - Searches for LLPs and rare phenomena (LFV, LNF, light scalars, ...)
    - Flavor physics program with 10^{12} Bs and 10^{11} τ's
    - Offering sensitivity to new physics at scales of 10 to 70 TeV

- Main challenge is to imagine/optimize detector to match statistical power and to sharpen the theory calculations

FCC-ee : Next steps

The detector R&D roadmap will be studied under the supervision of ECFA so that CERN-EP detector R&D will be re-assessed

- intensify our efforts to enlarge and support the experimental community
  ➔ French FCC contacts

- development of detector concepts matching the requirements
  ➔ involve our technical teams, once constraints better known

- intensify theoretical developments esp. precision calculations
  ➔ French FCC contacts : G. Cacciapaglia, B. Fuks

- physics studies (benchmark case studies towards detector requirements)
  ➔ all of us, cf new structure, Physics Performance

Building the software – common effort with other projects

Common Effort: Key4HEP / EDM4hep

Inter-project activity to develop a common software framework

- Meeting every Tuesday morning at 9h00
  - See https://indico.cern.ch/category/11461/
  - Good attendance and good coverage of different communities
  - Still too few contributors to make significant quick progress, but better than nothing
- Two fellows assigned 100% to the project
  - Valentin Volkl, Placido Fernandez
- Dedicated GitHub project: https://github.com/key4hep

+ FCCSW group meetings -- Many achievements!
integration of algorithms (primary, secondary tertiary vertices, tracking)
FCC-ee backgrounds from MDI group and much more….
Coming up: extrapolation algorithm, geometry, tutorial (also in the Snowmass context)

C. Helsens, G. Ganis

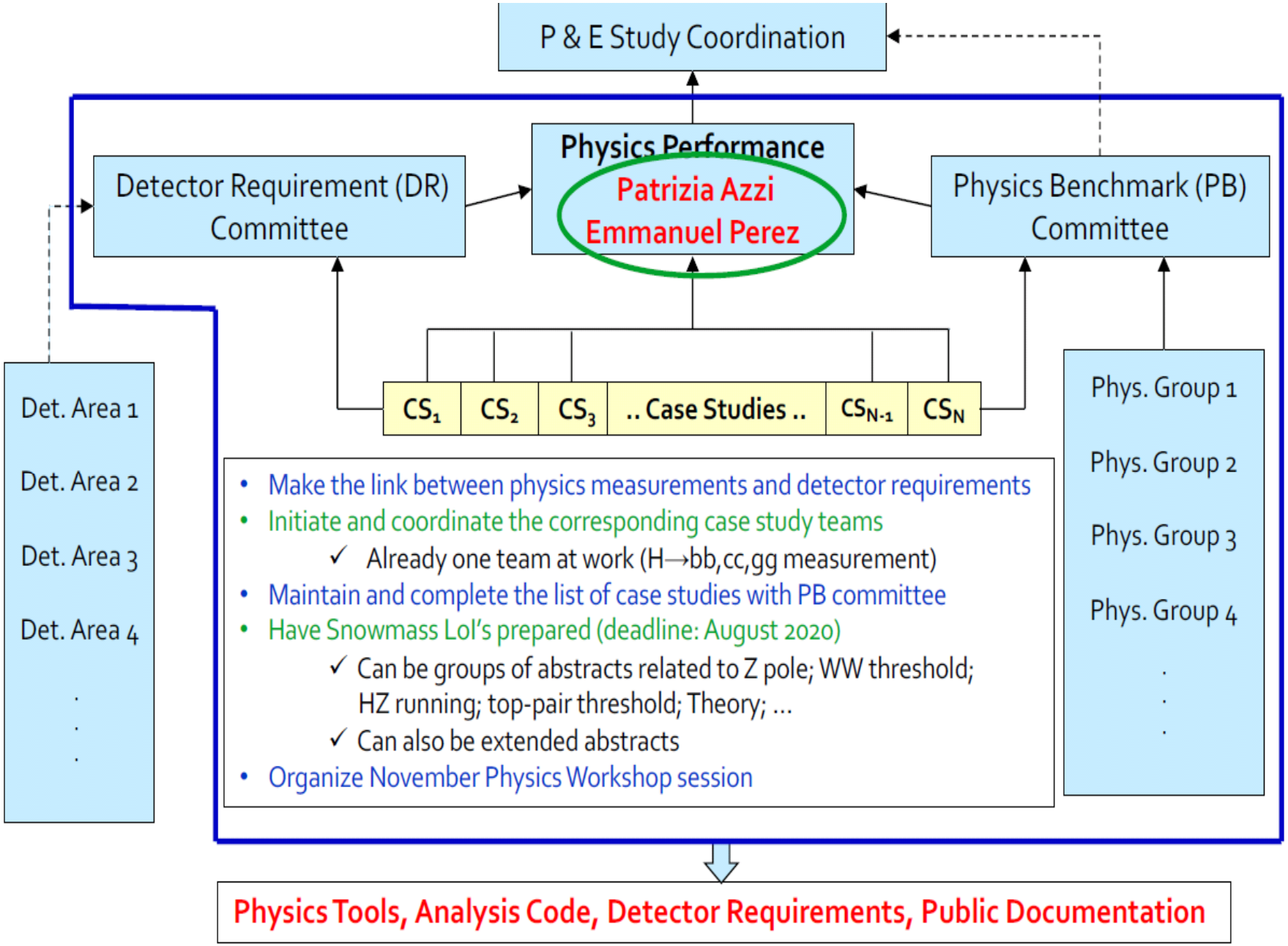
FCC-software : Next steps

- MC generators
  - Interfacing, testing
- MDI
  - Shared formats
  - GuineaPig++ integration
  - Overlay of MDI/signal events
- Detector concepts
  - IDEA DR Calo full simulation
  - IDEA Muon system full sim
  - Validation of LAr Ecal for FCC-ee
  - Enabling of CLD in FCCSW/k4h
- Validation/testing of Delphes cards
- Reconstruction
  - Tracking algorithms
  - Vertex reconstruction
  - ACTS integration
  - ML for calo reconstruction
- Identification
  - e, mu, tau, c, b tagging / ID
- Analysis tools
  - RDataFrame based analysis
- AoB
  - Distributed Computing
  - Porting to other OSs
  - ...

C. Helsens, G. Ganis

Physics Performance group

- For a year, the highest priority of the FCC Physics & Experiments activity
  - Will be to start and coordinate the work on the process and tools ("Case Studies")
    - By which detector requirements can be established from a set of benchmark measurements
- We need a re-organization of the physics group coordination
  - To generate a sustained creative atmosphere and ensure a more efficient focus
  - To channel the efforts in a common working environment
    - Towards the proposal and development of benchmark measurements
      - ➔ Physics groups will be actively involved
    - Towards the development of simulation and analysis tools
      - ➔ Software proponents should be associated
    - For the delivery of documentation and a consistent set of inputs to the next CDR
      - ➔ Detector proponents should be associated
- We propose to create a "Physics Performance (PP) Group" to this aim
  - With two motivated coordinators based at CERN, available for ~0.8 FTE at least
  - With an ad-interim mandate (to be reviewed in a year)


P & E Study Coordination
Physics Performance
Patrizia Azzi
Emmanuel Perez
Detector Requirement (DR) Committee
Physics Benchmark (PB) Committee
Det. Area 1
Det. Area 2
Det. Area 3
Det. Area 4
CS1
CS2
CS3
.. Case Studies ..
CSN-1
CSN
Phys. Group 1
Phys. Group 2
Phys. Group 3
Phys. Group 4
• Make the link between physics measurements and detector requirements
• Initiate and coordinate the corresponding case study teams
✓ Already one team at work (H→bb,cc,gg measurement)
• Maintain and complete the list of case studies with PB committee
• Have Snowmass LoI's prepared (deadline: August 2020)
✓ Can be groups of abstracts related to Z pole; WW threshold; HZ running; top-pair threshold; Theory; ...
✓ Can also be extended abstracts
• Organize November Physics Workshop session
Physics Tools, Analysis Code, Detector Requirements, Public Documentation

Case studies and Physics groups

CS_i = i^{th} case study team

- Development
  - Establishes milestones and analysis strategy
  - Develops analysis code
  - Develops necessary physics tools
    - ➔ If they exist, start from already existing tools / code
  - Propose and implement new ideas

- In an iterative process, brings case study to conclusions
  - Documents and maintains code
  - Delivers detector requirements
  - Produces public documentation (prep
  - Delivers input for the Physics CDR

- Reports strategy and results in Physi

Physics groups and physics groups conveners

- Physics groups (See previous mandates in https://fcc-ee.web.cern.ch/content/wg[#X]-exp, with [#X] = 1 to
  - They are part and parcel of the Physics Performance group organization
  - They participate actively in the case study activities
    - ➔ Physics group members can be CS team contact or member (and vice-v
  - They help establishing and improving the case study strategy
  - They propose new case studies and check their potential and feasibility

- Physics group conveners
  - They are the backbone of the Physics Benchmark Committee
  - They deepen the existing physics case (did we forget anything?)
  - They discuss and evaluate new ideas with the Phenomenology group
  - We start with the existing conveners (when they have not disappeared)
    - ➔ We need to foresee more/new conveners & think of additional physics
  - Conveners need to be hired in the international community (ECFA role?)
    - ➔ In order to increase participation to the study across the board

Physics groups

- Current/Previous organization (not all conveners are active)

Physics and Experiment Studies coordination
A. Blondel, P. Janot (EXP), C. Grojean, M. McCullough, M. Mangano, J. Ellis (TH)

EW Physics with Z's and W's J. Alcaraz, P. Azzurri, E. Locci A. Freitas	Higgs properties M. Klute, K. Peters C. Grojean	Top quark physics P. Azzi, F. Blekman	ee → H D. d'Enterria

QCD and γγ physics D. d'Enterria P. Skands	Flavours physics S. Monteil J. Kamenik	New physics M. Pierini, C. Rogan M. McCullough	Global Analysis Synergies J. De Blas	Precision Calculations A. Freitas, J. Gluza S. Heinemeyer

- By 15 September, we would like to receive
  - Your proposals of new physics groups *ex: tau physics, Long Lived Particles, (+FCC-hh)*
  - Your nominations for physics group conveners
    - ➔ Current conveners who want to continue should of course let us know
      Some have already said they could not continue as conveners
    - ➔ Most urgent part of the mandate will be to enlarge international participation

FCC-ee : Case studies Electroweak, QCD, HF, Taus

LOI repository
https://indico.cern.ch/event/951830/

1. Towards an ultimate measurement of $R_\ell = \frac{\sigma(\mathrm{Z}\to\mathrm{hadrons})}{\sigma(\mathrm{Z}\to\mathrm{leptons})}$
2. Towards an ultimate measurement of the Z total width Γ_Z
3. Towards an ultimate measurement of the Z peak cross section
4. Direct determination of $\sin^2\theta^\ell_\mathrm{eff}$ and of $\alpha_\mathrm{QED}(m^2_\mathrm{Z})$ from muon pair asymmetries
5. Determination of the QCD coupling constant $\alpha_\mathrm{S}(m^2_\mathrm{Z})$
6. Tau Physics, Lepton Universality, and Lepton Flavour Violation
7. Tau exclusive branching ratios and polarization observables
8. Z-pole Electroweak observables with heavy quarks
9. Long lived particle searches
10. Measurement of the W mass

FCC-ee : Case studies, Higgs, Top, Theory, misc

11. Measurement of the Higgs boson coupling to the c quark
12. Measurement of the ZH production cross section
13. Measurement of the Higgs boson mass - Part I
14. Measurement of the Higgs boson mass - Part II
15. Inferring the total Higgs boson decay width - Part I
16. Inferring the total Higgs boson decay width - Part II
17. Determination of the $HZ\gamma$ effective coupling
18. Electron Yukawa via s-channel $e^+e^- \to H$ production at the Higgs pole
19. Measurement of top properties at threshold and above
20. Search for FCNC in the top sector
21. Theory Needs for FCC-ee
22. Beyond MFV: constraints on RH charged currents and on dipole operators
23. Construction of CP-odd observables to probe CP-violating Higgs couplings
24. Combined fit of Higgs and top data

FCC-ee : Evolution dans les différents pays

Progress continuing:

- FRANCE and ITALY: are well established already. Contact (G. Bernardi, R.Aleksan) (F. Bedeschi)

- UK: lots of progress. Contacts in all HEP groups and at the two STFC lab sites (RAL and DL).
  First meeting in September. (Christos Leonidopoulos Guy Wilkinson)

- Poland: (T. Lesiak) planning FCC information day at Epiphany conference in January.

- Spain: starting within a national 'future colliders' structure (Juan Alcaraz)

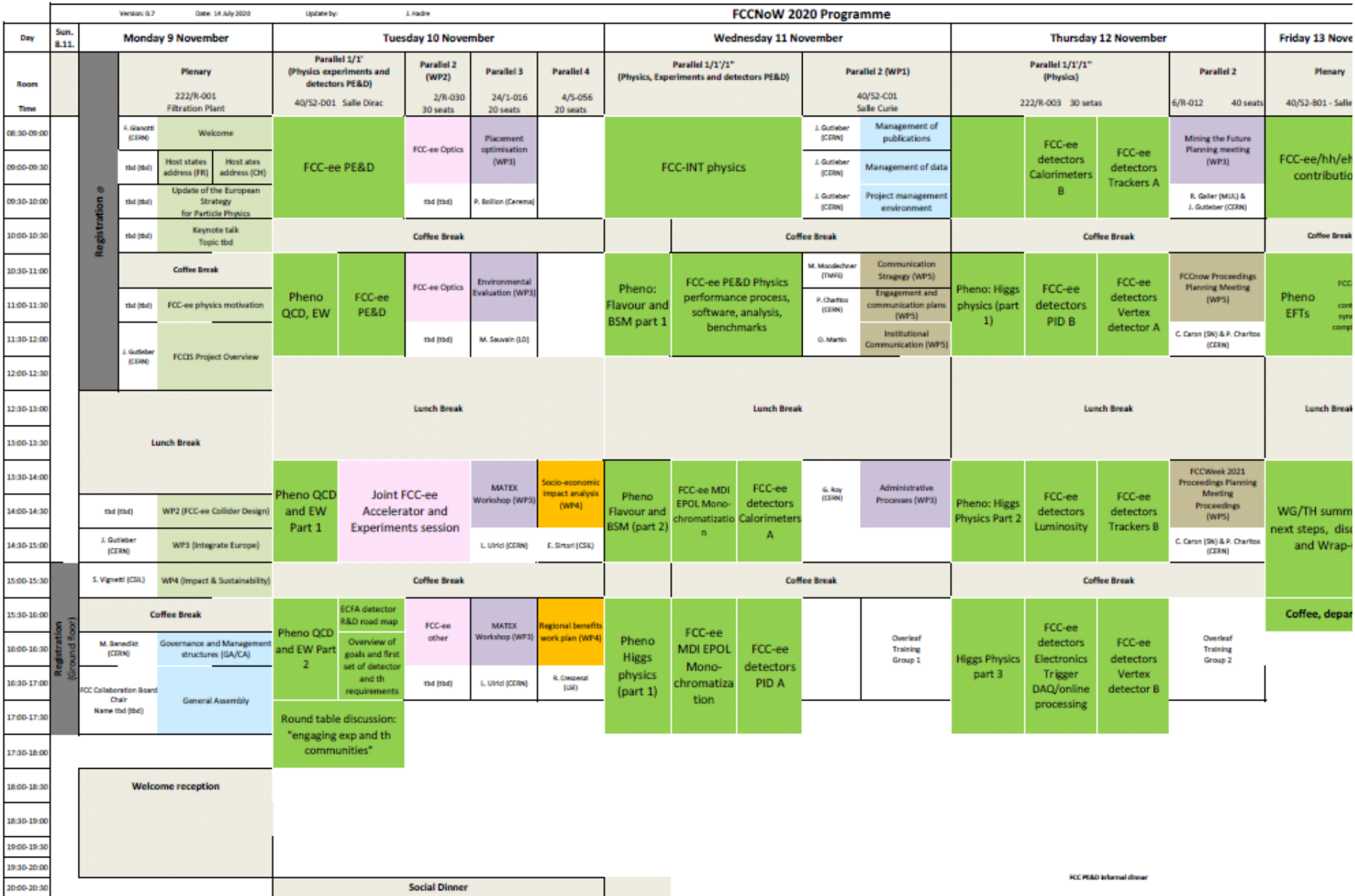
- CH well in the road map, CHARD for accelerator (e+ source)
  discussions on towards effort FCC funding. CH unambiguously supported FCC-INT project.

- Belgium and Netherlands (just starting, contact Freya Blekman)

- Contacts with Germany, USA, Austria, Estonia etc.. have been initiated – to be followed.

FCC-IS kick-off meeting and 4th Physics workshop

9-13 November https://indico.cern.ch/event/932973/



Workshop Annecy

Avec le retour progressif en présentiel nous pourrions confirmer la date de Décembre pour le prochain workshop FCC-France, avec une partie accélérateur comme on l'avait mentionné il y a un certain temps.

Le LAPP a confirmé sa disponibilité

Objectif : déplacement sur 3 jours

il y aurait aussi une connection on-line.

NSIP / Dialog (old slide, où en es t-on ?)

- Possibilité de demander des missions pour les collègues engagés ou s'engageant à au moins 10% de FTE d'ici Septembre 2020.
- Mieux vas ne pas demander pour ceux qui promettent pour 2021 (ils iront aux meetings FCC sur le budget de leur équipe principale).
- Possibilité de demander une gratification de stage (3 ou 4 mois = 1800 ou 2400 E) pour stagiaire M1 ou M2
- Pas de demande de poste cette année
- Pas de demande d'argent R&D cette année
- Possibilité de proposer des thèses conjointes LHC-FCC

Tour de Table + Case studies

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

Next meeting: Vendredi 16 Octobre 15h ?