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Panorama of Future Colliders efforts

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Who are the other players?

- FCC Physics Detector and Experiment: progress into reorganization of the work. New conveners being appointed
- ECFA Workshop for future Higgs/EWK/Top factories: new effort common to all future lepton colliders. what is it and how to make it useful for us?
- **Snowmass:** FCC is organizing "white papers". Effort to involve US colleagues.
 - General white paper on FCC-ee S. Eno
 - DRCalo S. Eno
 - LLP white paper containing FCC-ee studies (theory and exp) A. De Roeck

Structuring the FCC Physics effort

- Physics Programme (Simon/McCullogh) is proposing a sub-group structure: Higgs / Flavours / Precision EW / Top / BSM / QCD
 - Appointed conveners with "theory" profile
 - Experimental conveners will be shared with Physics Performance
 - <u>They are the liason between the two groups</u> (a mandate is being written)
- Physics Performance (Azzi, Perez) will have then a mirror sub-group structure:
 - Higgs / Flavours / Precision EW / Top / BSM / QCD
 - Appointing 2 or more "Experimental" conveners for each topic
 - this can be mirrored by "contacts" in the different national efforts

More details about the new structure

- Choice of conveners ongoing, hopefully will have them in place beginning of 2022. Can have a role in the Liverpool workshop.
 - For Top group, were there is little activity, will wait beginning of next year.
- Changes to meetings:
 - Phys Performance meeting will contain more mature presentation (can be joined/non overlapping with Phys Prog).
 - Subgroups will call working meetings for their own discussions
- Once Detector Concepts group start we'll have to consider cross activities: such as impact of local simulation and reconstruction into "Case Studies"

ECFA statement July 2020

 ECFA recognizes the need for the experimental and theoretical communities involved in physics studies, experiment designs and detector technologies at future Higgs factories to gather. ECFA supports a series of workshops with the aim to share challenges and expertise, to explore synergies in their efforts and to respond coherently to this priority in the European Strategy for Particle Physics (ESPP).

Goal: bring the entire e⁺e⁻ Higgs factory effort together, foster cooperation across various projects; collaborative research programmes are to emerge



Recommendations from the IAC

- Extension to include electroweak and top factory
- Extend the physics studies (w.r.t studies of European Strategy update (EPPSU)), where relevant (not all completed at time of EPPSU), however, focus on e⁺e⁻ potential
 → no discussion of pros and cons of various machines or alternatives to e⁺e⁻ Higgs factories
- Understand better the interplay between (HL)-LHC and an e⁺e⁻ Higgs/EW/Top factory
- Development of common tools important (software, simulation, fast simulation, ...)
- Development of common analysis methods of high interest
- Exploit synergies, discuss challenges, do not restrict to common items
- Need for theoretical accuracy and MC generator improvements ...
- ..

WG1 Physics Potential

WG2 Physics Analysis Methods

WG1 ("Physics Potential") mandate

- Set up a forum on physics potential of future Higgs and top/EW factories to collect, compare and harmonise the work of the different project-specific coordinated efforts, as well as independent theoretical and experimental research on the subject. The perspectives of the (HL-)LHC on physics targets, that are in common or in synergy with those of the future Higgs and top/EW factory, are part of the mandate.
- Identify thematic areas or specific topics where concrete work should be organised in the context of the ECFA Working Group, in coordination with the existing project-specific Working Groups. The main focus should be on problems that are common to several Higgs and top/EW factories, and/or relevant to identify synergies. Small thematic groups/task forces could be appointed to carry out concrete work and deliver notes and/or original publications.
- Propose ideas for new observables, new experimental tests, new ancillary measurements

WG1 activities

J. List, J. Alcaraz, F. Maltoni, J. De Blas

- WG1-PREC: Precision calculations and theoretical, parametric and experimental systematic uncertainties
- WG1-EFT: Global interpretation in (SM)EFT and UV complete models
- WG1-HTE: Higgs, top and electroweak physics
- WG1-HF: Flavour Physics
- WG1-SRCH: Direct discovery potential

P. Azzi, D. Zerwas, F. Piccinini

What is WG2?

GENERATORS

SIMULATION

RECONSTRUCTION

ALGORITHMS & TOOLS

SOFTWARE ECOSYSTEM

SW: G.Ganis, F. Gaede, A. Sailer

- Monte Carlo generators for e+e- precision EW, Flavour, Higgs, and top physics,
- Luminosity measurements
- Fast simulation and the limitations of such techniques
- Full Simulation
- Track and vertex reconstruction algorithms
- Jet algorithms / jet reconstruction
- Particle-flow reconstruction and global event description
- Requirements on particle identification
- Flavour tagging algorithms
- Importance of timing information
- Constrained fit

Why a WG2?

- Take stock of the current status of development of the various items:
 - From the different lepton collider communities
 - From the LHC experience
- **Recognise** the overall needs for the precision/sensitivity of the future measurements from ee colliders (common and specific) through discussion and exchange
- Help satisfy those needs triggering and/or following up work in the specific communities
- Efficiently **apply** the latest tools and information for the benefit of all in a common software ecosystem for the future (key4hep)

Optimize Meetings & Workshop

- Need to profit of the synergies with the rest of project structures and avoid duplications
- **ECFA "Focus" Workshop on specific topics:**
 - Generators", November 2021
 - "Simulation", 1-2 Feb 2022 Padova
 - "Reconstruction", Spring 2022, Desy
 - Generator follow-up", Spring 2022 Siegen
- Example: Our activities on IDEA Simulation can be discussed with other experts at the "Simulation" workshop. Since the software is common to all.
 - Developments will continue in the specific projects

Conclusion: what's in it for RD-FCC?

- □ Situation still quite in flux until the next European strategy
- Clear common goal of a unique software framework so that all the developments will be usable by the project that is approved
- Facilitate the exchange of expertise across different projects in a concrete manner
- National efforts can find a way to have visibility not only because of their good work but also as conveners/contact on specific topics. Lots of space also for younger contributors, also coming from the LHC and new to the lepton colliders. This can help expand our group in Italy as well.