ECFA

European Committee for Future Accelerators

Report of the ECFA Chairperson

Jorgen D'Hondt (Jorgen.DHondt@cern.ch)

PECFA meeting, November 15-16th, 2018, CERN

RECFA/PECFA meetings 2018 & 2019

- The following visits and meetings are foreseen in 2018
  - *Romania (Bucharest), March 23-24, 2018*
  - *Austria (Vienna), April 6-7, 2018*
  - *Slovakia (Bratislava), May 18-19, 2018*
  - *ALBA (Barcelona), July 19-20, 2018 (including PECFA and RECFA meetings)*
  - *The Netherlands (Amsterdam), October 19-20, 2018*
  - **CERN, November 15-16, 2018 (including PECFA and RECFA meetings)**

- The following country visits in 2019:
  - Spring RECFA visits: Spain (1-2 March), Slovenia (5-6 April), Poland (24-25 May)
  - Summer RECFA and PECFA: at the EPS-HEPP meeting in Ghent, Belgium
  - Fall RECFA visit: Cyprus *(date to be decided)*
  - Fall RECFA and PECFA: CERN (14-15 November)

PECFA meeting in 2020

Plenary ECFA meeting at a major laboratory in the European region, typically in June-July 2020

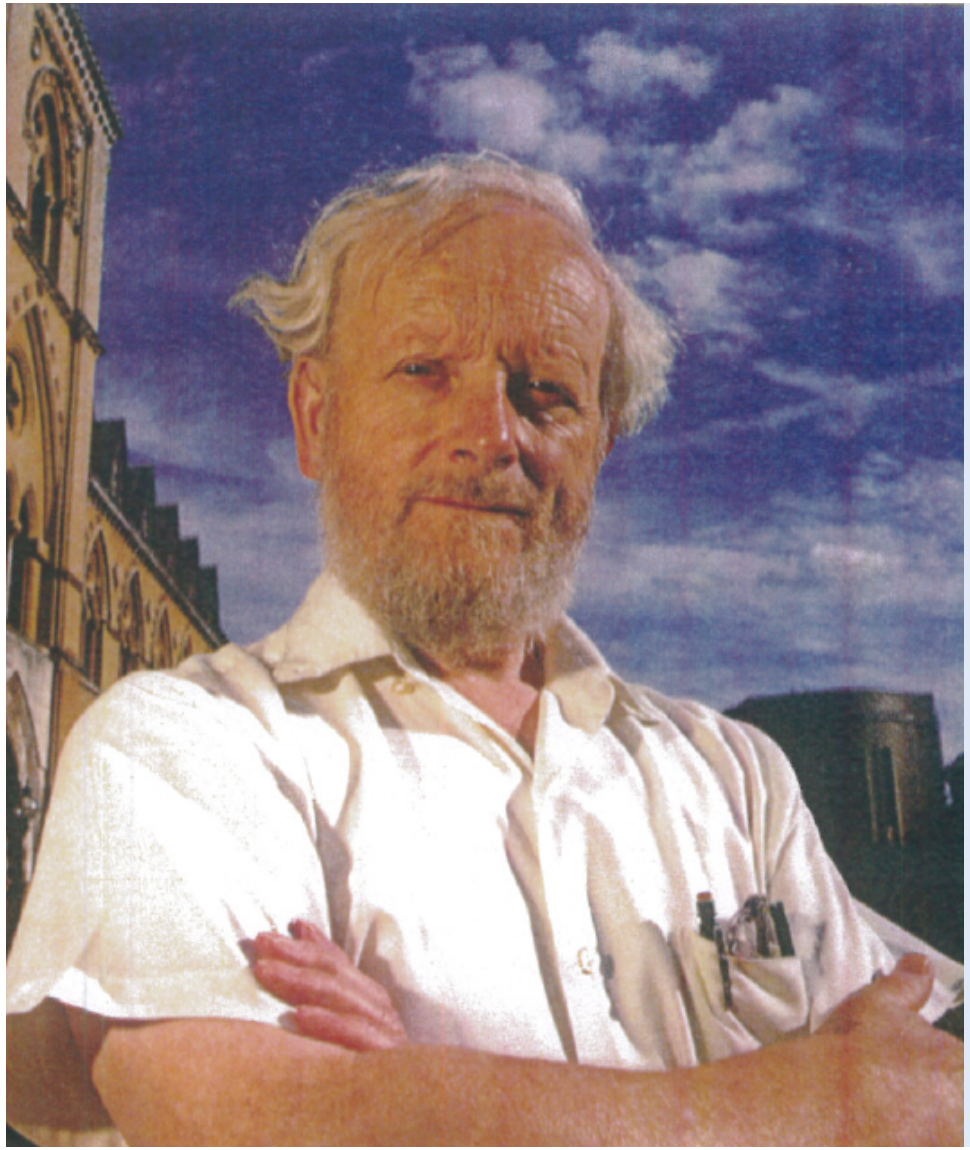
1. I would launch, via email, a call for venues to all ECFA members
   - The proposals can be composed by ECFA and non-ECFA members, but need to be supported by at least one RECFA member
   - A proposal would contain at least: proposed date(s), location, description of the meeting room(s), accommodation, potential transport, potential visits to the scientific facilities, local organising team, …
   - Deadline to receive proposals: 15 February 2019

2. First discussion of the proposals within RECFA at our meeting on 1-2 March 2019 (Spain), decide within RECFA either at our meeting on 4-5 April 2019 (Slovenia) or on 24-25 May 2019 (Poland)

3. Announce the venue at the PECFA meeting at Ghent/Belgium, i.e. during the joint EPS-HEP and ECFA session

New members

COUNTRY	INCOMING		REPLACING	
Spain				
	Teresa	Rodrigo	Juan Alcaraz	PECFA
	Concepción	Gonzalez-García	Luis Benitez	PECFA
	Luis	Garcia Tabares	Caterina Biscari	PECFA
Switzerland				
	Mike	Seidel	Leonid Rivkin	RECFA & PECFA
	Frédéric	Blanc	Olaf Steinkamp	PECFA
	Andreas	Knecht	re-newed	PECFA
Czech Republic				
	Jana	Bielčíková	Marek Taševský	PECFA
	Marek	Taševský	Michal Sumbera	RECFA & PECFA
Netherlands				
	Marco	van Leeuwen	Thomas Peitzmann	PECFA
Poland				
	Anna	Kaczmarska	Barbara Wosiek	PECFA
	Wojciech	Wiślicki	Jan Kalinowski	PECFA
Romania				
	Alexandru-Mario	Bragadireanu	Calin Alexa	RECFA & PECFA
on hold	*Nicolae*	*Hurduc*	*Florin-Dorian Buzatu*	*PECFA*
	Florin	Constantin	Ionel Lazanu	PECFA
Hungary				
	Gabor	Veres	Gabriella Pasztor	PECFA



John H. Mulvey
(1929 – 2018)

ECFA chair 1981-1983

Passed away on 10th of September 2018

Update of the European Strategy for Particle Physics
(https://europeanstrategy.cern)

Key objectives set by Council

- Deliver by May 2020 an update of the European Strategy for Particle Physics in a global context (decision of Council, December 2016)
- This strategy or vision will thereafter be a roadmap for funding agencies and laboratories to define concrete research programmes

Strategy Secretariat

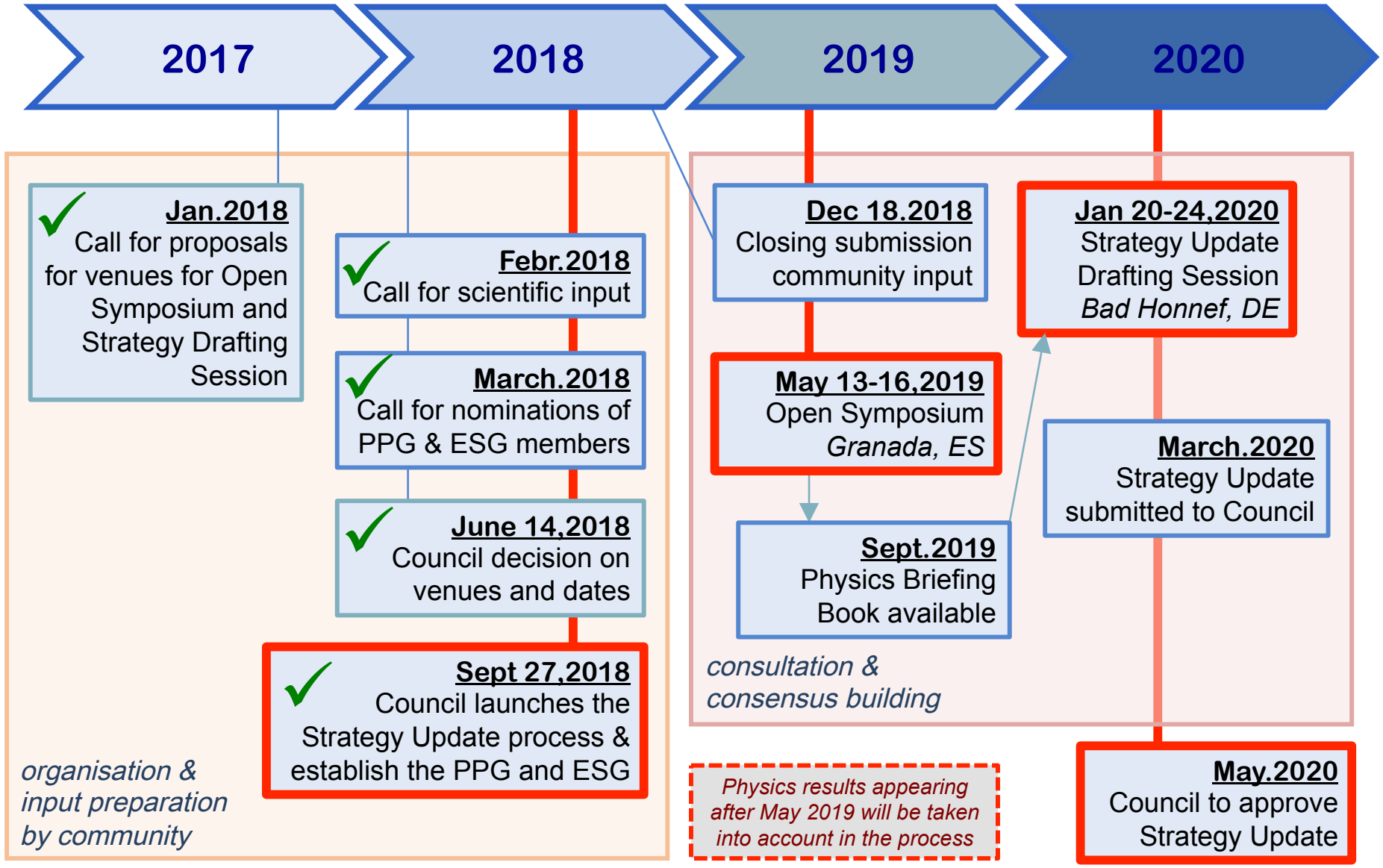
Council appointment, September 2017:

- H. Abramowicz (Chairperson)
- J. D'Hondt (ECFA Chairperson, *ECFA: European Committee for Future Accelerators*)
- K. Ellis (SPC Chairperson, *SPC: Science Policy Committee @ CERN*)
- L. Rivkin (European LDG Chairperson, *LDG: Lab Directors Group*)

- Contact: EPPSU-Strategy-Secretariat@cern.ch

Responsible for the organisation of the process.

European Particle Physics Strategy *Update*



PPG
Physics Preparatory Group

ESG
European Strategy Group

Submit input
https://indico.cern.ch/event/765096/

Open Symposium
https://cafpe.ugr.es/eppsu2019/

Composition of the PPG

Physics Preparatory Group (PPG), Council appointment, September 2018:

- H. Abramowicz, J. D'Hondt, K. Ellis, L. Rivkin (*Strategy Secretary*)
- C. Biscari (ES), Belen Gavela (ES), Beate Heinemann (DE), Krzysztof Redlich (PL)
- Stan Bentvelsen (NL), Paris Sphicas (GR), Marco Zito (FR), Antonio Zoccoli (IT)
- Gian Giudice (*CERN*)
- Shoji Asai and Xinchou Lou (*delegates from Asia*)
- Marcela Carena and Brigitte Vachon (*delegates from the Americas*)

Responsible to organise the Open Symposium and to deliver to the European Strategy Group (ESG) a Briefing Book.

Composition of the ESG

European Strategy Group (ESG) composition, adopted by Council, December 2013:

- the Strategy Secretary (acting as Chairperson),
- one representative appointed by each CERN Member State,
- one representative for each of the Laboratories participating in the major European Laboratory Directors' meeting, including its Chairperson,
- the CERN Director-General,
- the SPC Chairperson,
- the ECFA Chairperson.

Responsible to deliver a draft Strategy Update to Council.

Invited:

- the President of the CERN Council,
- one representative from each of the Associate Member States,
- one representative from each Observer State,
- one representative from the European Commission and JINR,
- the Chairpersons of ApPEC, FALC, ESFRI, and NuPECC,
- the members of the Physics Preparatory Group.

New ECFA Working Group
"Working Group on Higgs physics potential at future colliders"

Towards new discoveries via the Higgs sector

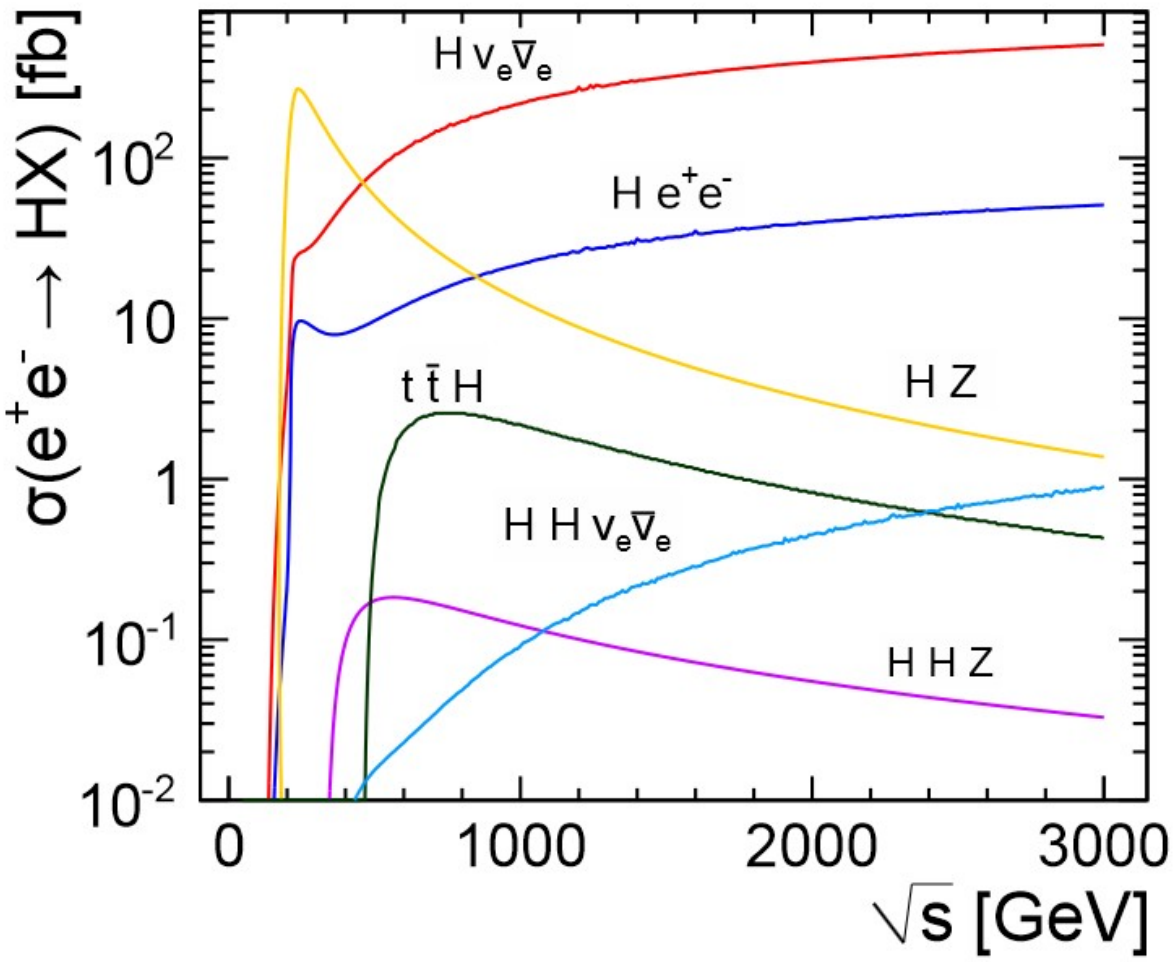
- No clear indication where new physics is hiding, hence experimental observations will have to guide us in our exploration.
- One of the avenues is to explore as fast as possible, and as wide as possible, the Higgs sector.
  - Yukawa couplings
  - Self-couplings (HHH and HHHH)
  - Couplings to Z/W/γ/g
  - Rare SM and BSM decays (H→Meson+γ, Zγ, FCNC, μe/τμ/τe, …)
  - CP violation in Higgs decays
  - Invisible decay
  - Mass and width
  - …
- Important progress will be made on Higgs physics with the LHC and the HL-LHC.
- To discover new physics inaccessible to the (HL-)LHC, future colliders will be complementary.

Towards new discoveries via the Higgs sector

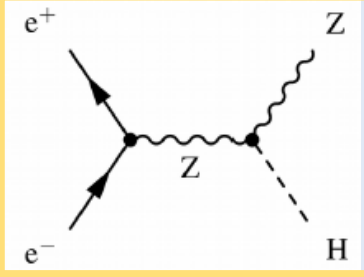
- A science-driven question: *What is the fastest track with the future colliders that will be proposed to the European Strategy update, in parallel or following the HL-LHC programme, to explore the mentioned variety of features of the Higgs sector?*

e^+e^- colliders

- The properties of the Higgs boson in the Standard Model can be measured with several analyses methods at several e^+e^- centre-of-mass energies (e.g. 250, 365, 500, >500 GeV).
- This can be done at several machines (e.g. ILC, CLIC, FCC-ee, CEPC).
- *<u>The obvious thought:</u> produce as many Higgs bosons as possible and open as many couplings as possible*
- *Single and double Higgs production*

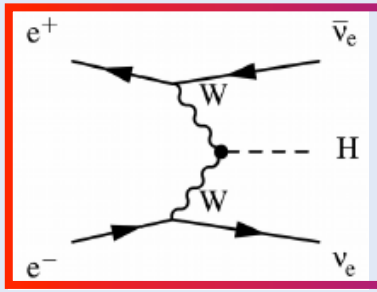


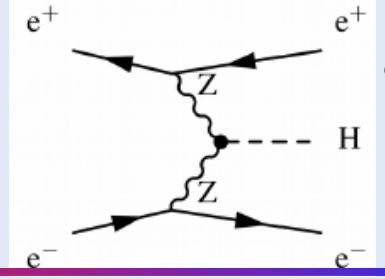
Single Higgs production



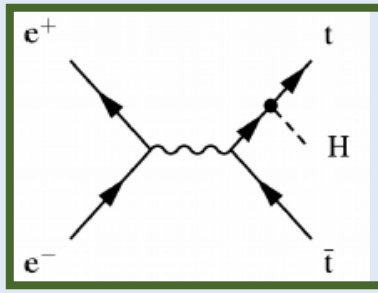
the dominant production
up to ~500 GeV

peaks at ~240-250 GeV



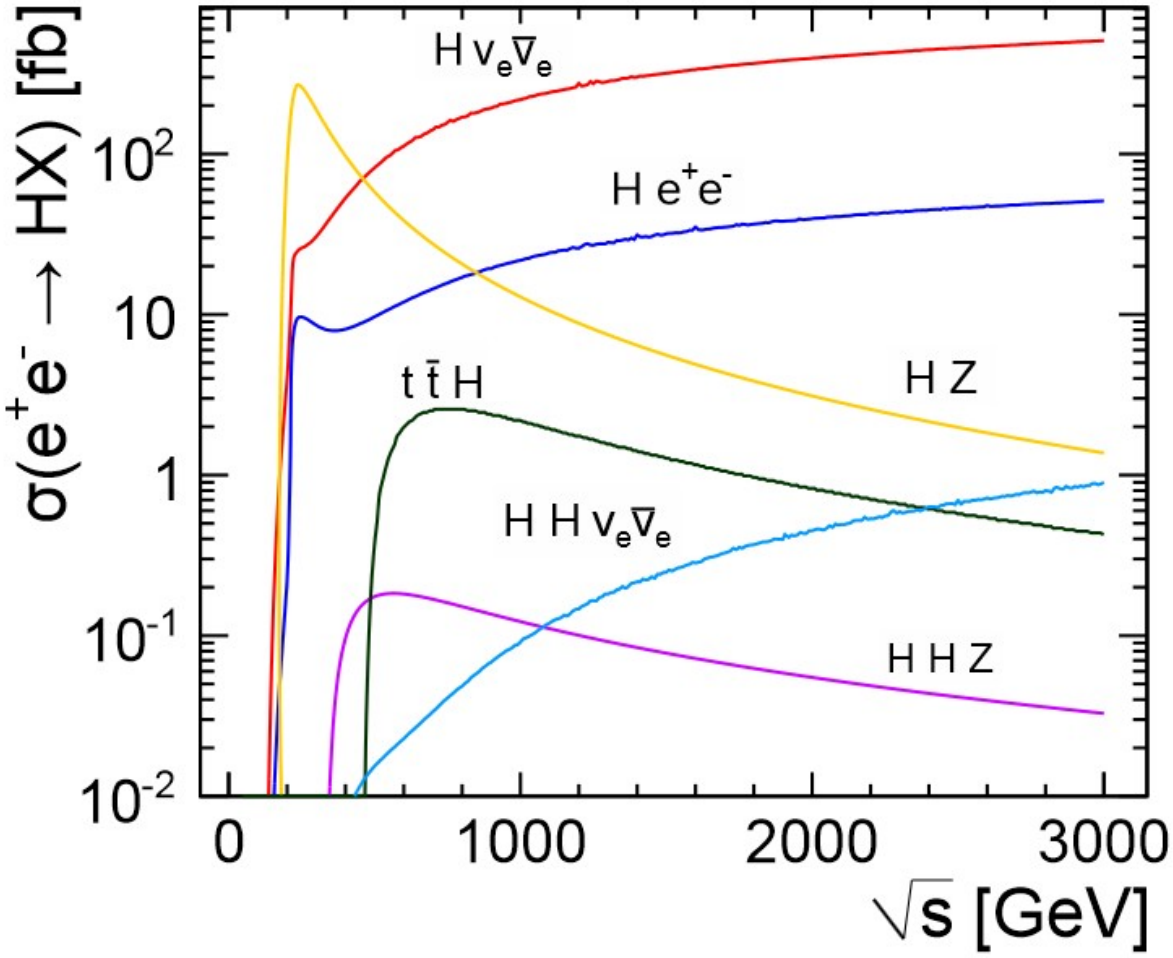


$\sigma \sim \log(s)$

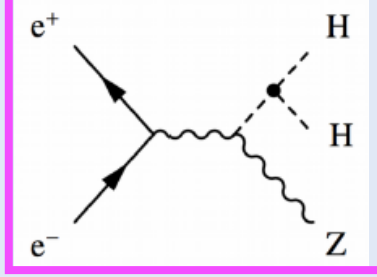


top-Yukawa coupling

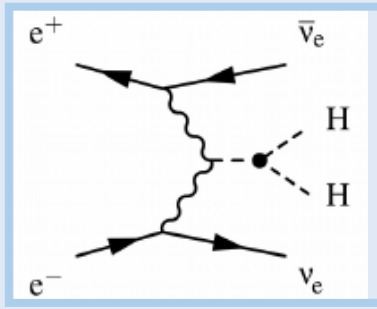
threshold ~500 GeV
reaches maximum ~800 GeV

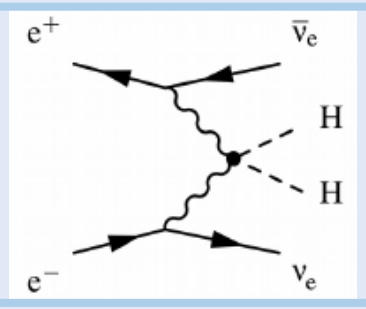


Double Higgs production



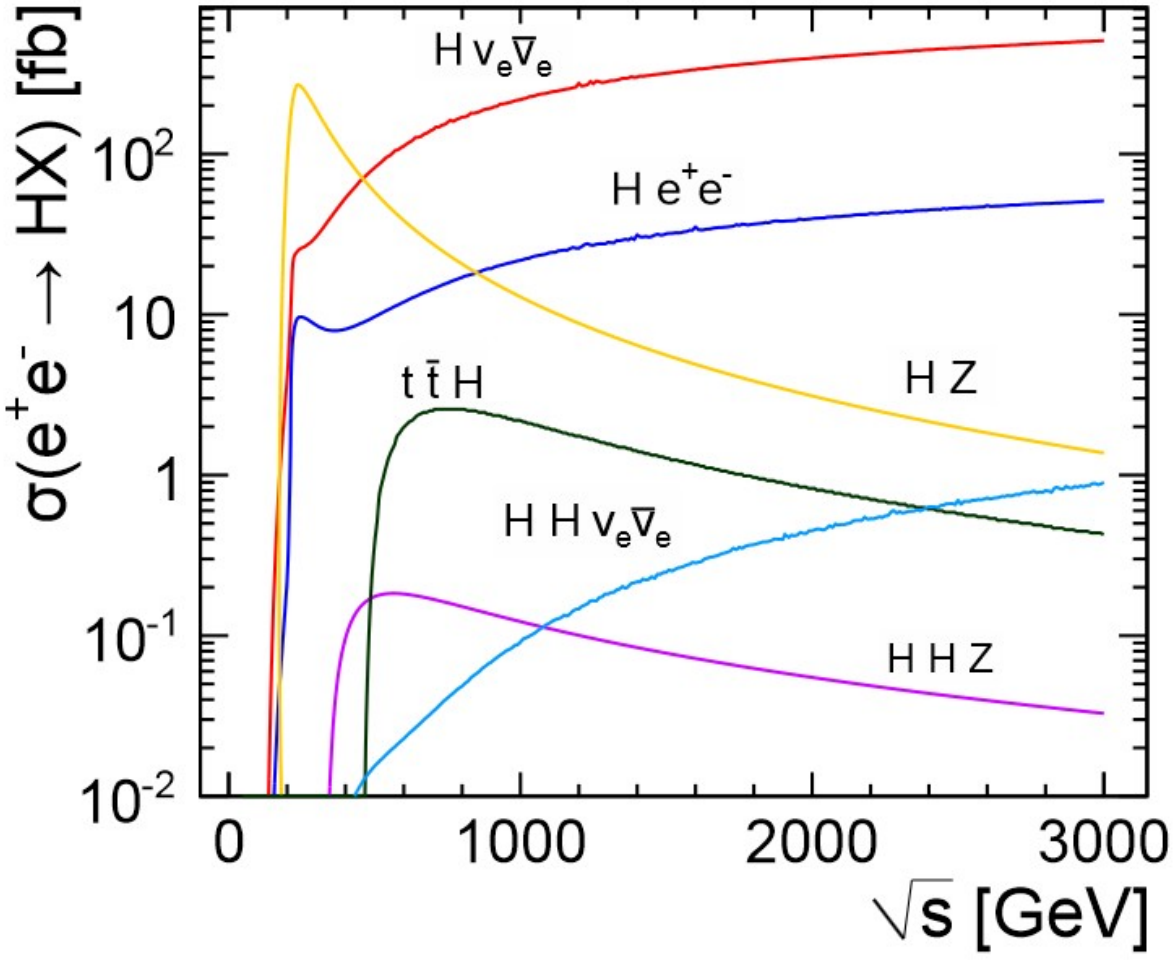
maximum ~600 GeV





$\sigma \sim \log(s)$

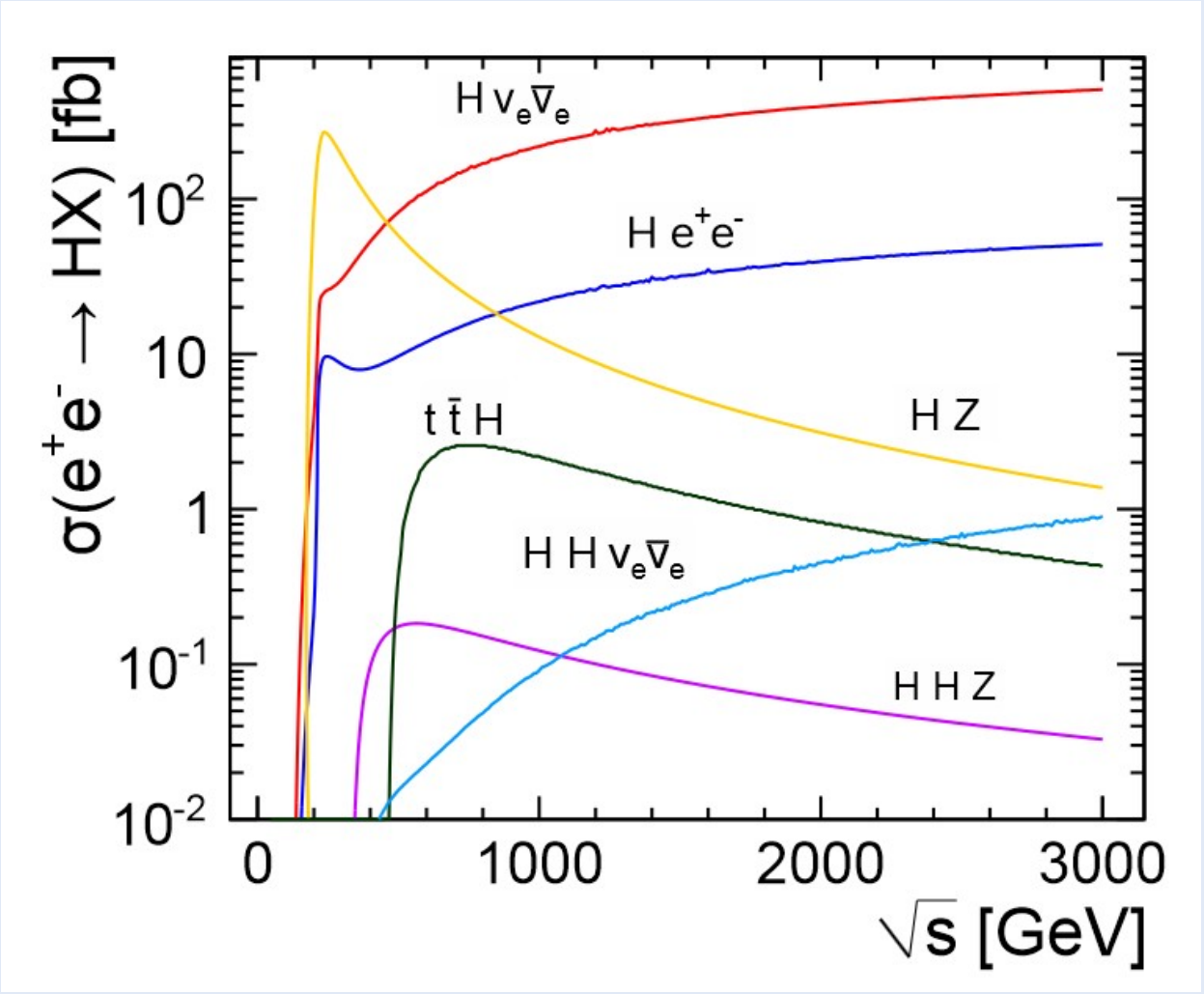
With all these single and double Higgs processes available, at all collision energies 240-1000 GeV, all couplings are “directly” observable.



e^+e^- colliders

- *<u>The obvious:</u> produce as many Higgs bosons and open as many couplings*

Fold this information with the luminosity versus collision energy profiles of future colliders, and other machine settings (e.g. polarization) and detector settings.



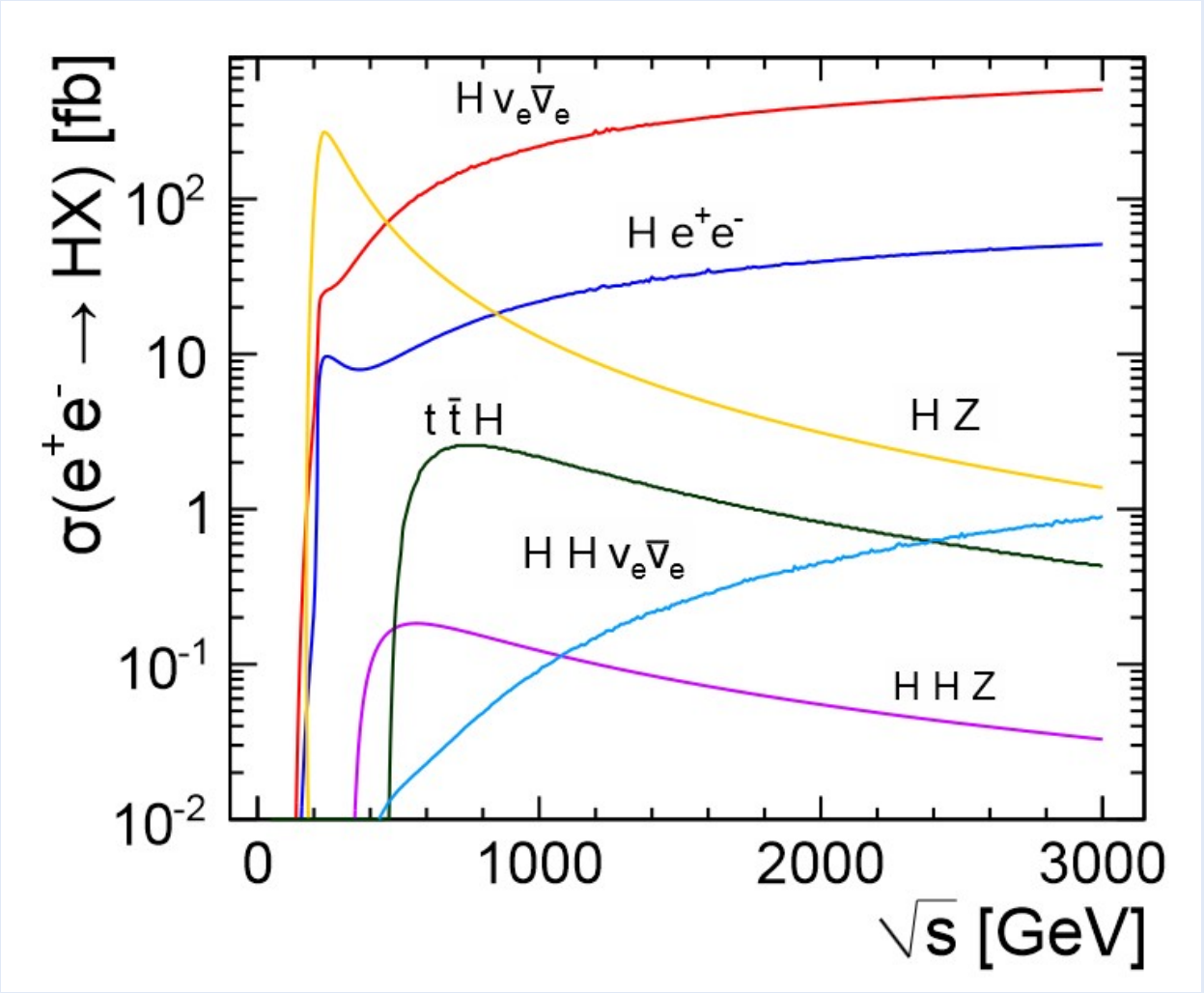
e^+e^- colliders

- *<u>The obvious:</u> produce as many Higgs bosons and open as many couplings*

Fold this information with the luminosity versus collision energy profiles of future colliders, and other machine settings (e.g. polarization) and detector settings.

- *<u>The less obvious (1):</u> the cross sections of these production diagrams are influenced by higher order effects*

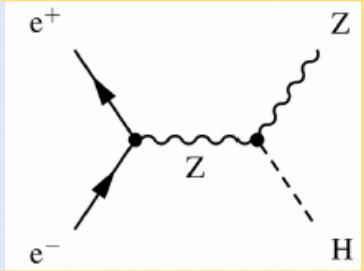
Hence become "indirectly" sensitive at lower collision energies to couplings that are only "directly" opened at higher collision energies.



e^+e^- colliders

One example

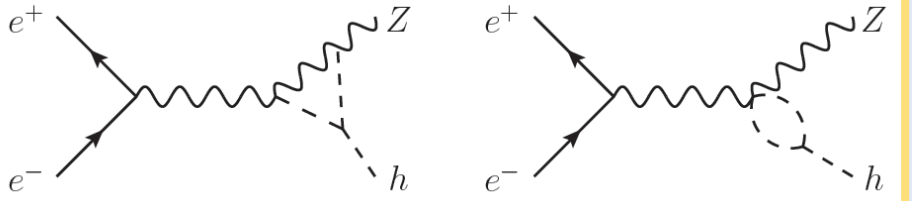
maximum
~240-250 GeV

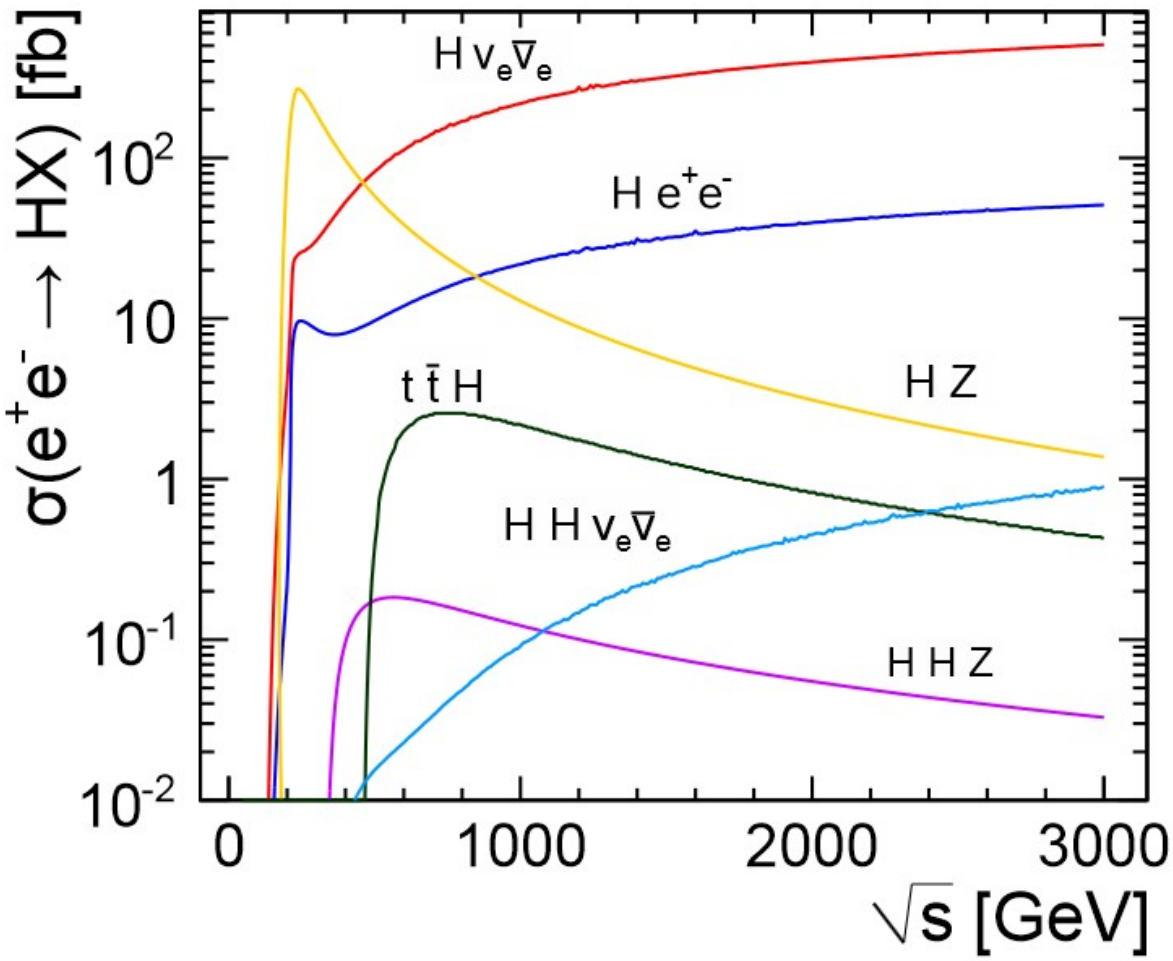


+

~2% effect on σ_{HZ} at 240 GeV

Di Vita et al., JHEP 1802 (2018) 178, arXiv:1711.03978

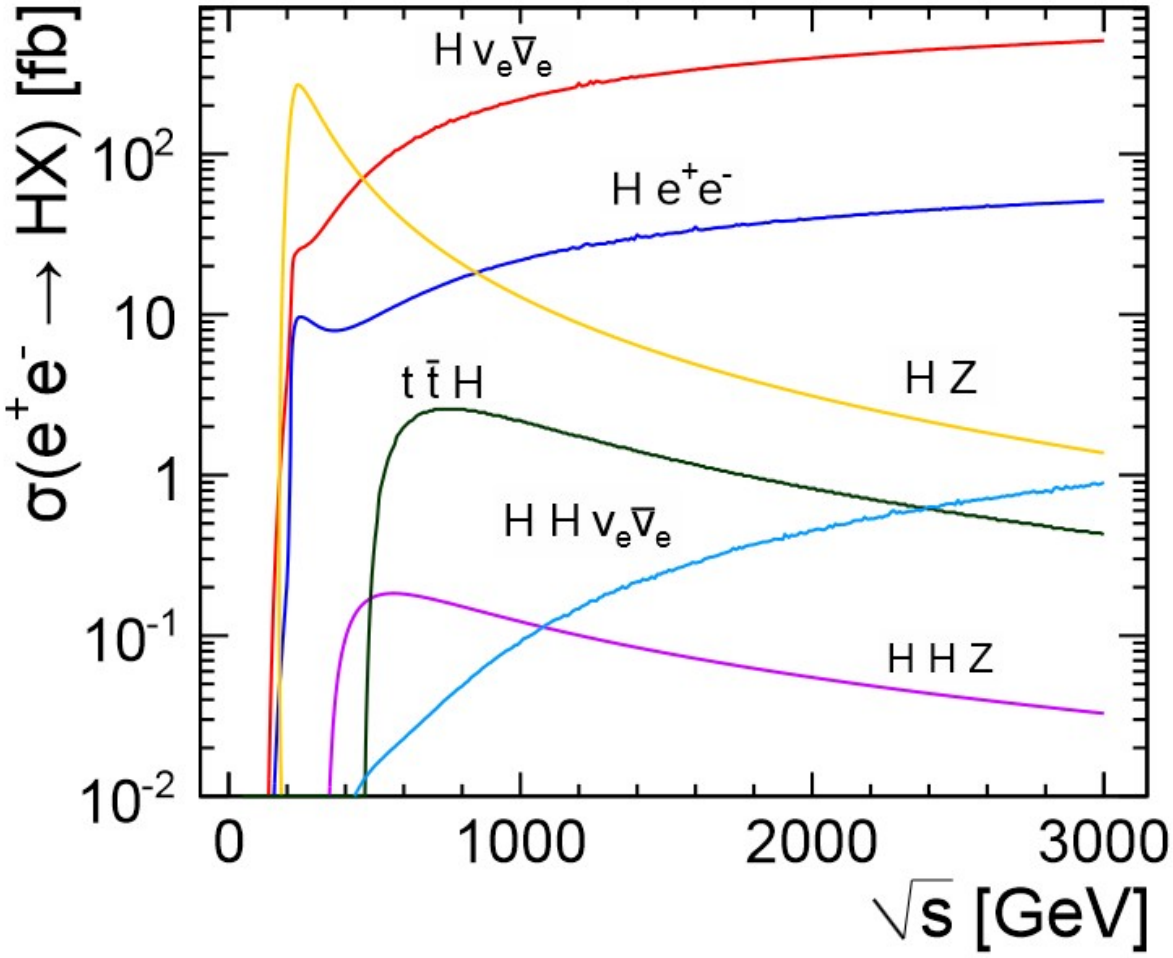




e^+e^- colliders

- *<u>The less obvious (2):</u> the potential complementarity of colliders, especially if they might be operational in parallel*

Coherently folding luminosity profiles, energy profiles and "indirect"-versus-"direct" measurements potentials of several future colliders is challenging but essential to answer the first question.



Other colliders

Apart from the proposed e^+e^- colliders, all other future colliders with a potential to explore the Higgs sector and proposed to the European Strategy update are to be considered.

Some examples are muon colliders, e-p colliders, and p-p colliders.

Also for these future colliders the proposed luminosity profiles, energy profiles and running schemes are to be included.

Towards a working group on "Higgs physics with future colliders in parallel and beyond the HL-LHC"

- Within its role, and in concert with the PPG, RECFA agrees to organize a working group of experts (typically non-ECFA members) with the objective to compare in detail the complementarity of the options, and this across the different colliders.
- The collider (and detector) settings of all future colliders will be input to the European Strategy process, to bring together the Higgs physics potential across colliders in a coherent and comparable manner is challenging
- The working group would inform the community towards the discussions organized in the context of the European Strategy

Mandate agreed by RECFA in consultation with the PPG "Higgs physics with future colliders in parallel and beyond the HL-LHC"

- In the context of exploring the Higgs sector, provide a coherent comparison of the reach with all future collider programmes proposed for the European Strategy update, and to project the information on a timeline.
- For the benefit of the comparison, motivate the choice for an adequate interpretation framework (e.g. EFT, κ, …) and apply it, and map the potential prerequisites related to the validity and use of such framework(s).
- For at least the following aspects, where achievable, comparisons should be aim for:
  - Precision on couplings and self-couplings (through direct and indirect methods)
  - Sensitivities to anomalous and rare Higgs decays (SM and BSM), and precision on total width
  - Sensitivity to new high-scale physics through loop corrections
  - Sensitivities to flavor violation and CP violating effects
- In all cases the future collider information is to be combined with the expected HL-LHC reach, and the combined extended reach is to be compared with the baseline reach of the HL-LHC.
- In April 2019, provide a comprehensive and public report to inform the community.

Members of the working group of 5-6 members
"Higgs physics with future colliders in parallel and beyond the HL-LHC"

- Following a call for nominations by the ECFA chair to RECFA members, RECFA members would be asked to propose suitable candidate members, and check their availability
- A similar call would go to the PPG members
- The ECFA chair would collect all the nominations by 7 December 2018
- The ECFA chair would consult with the PPG members assigned to prepare the "EW physics" topics for the Open Symposium, and select the members of the working group
- In a dedicated RECFA meeting, RECFA members will be asked to endorse the selection.
- The working group would be formed by the end of 2018, and receive the relevant information submitted to the European Strategy update

ECFA Communication

Since the PECFA meeting at ALBA, the ECFA chair reported to

SPC (24-25 September 2018)

Council (27-28 September 2018)

NuPECC (12-13 October 2018, Bucharest)

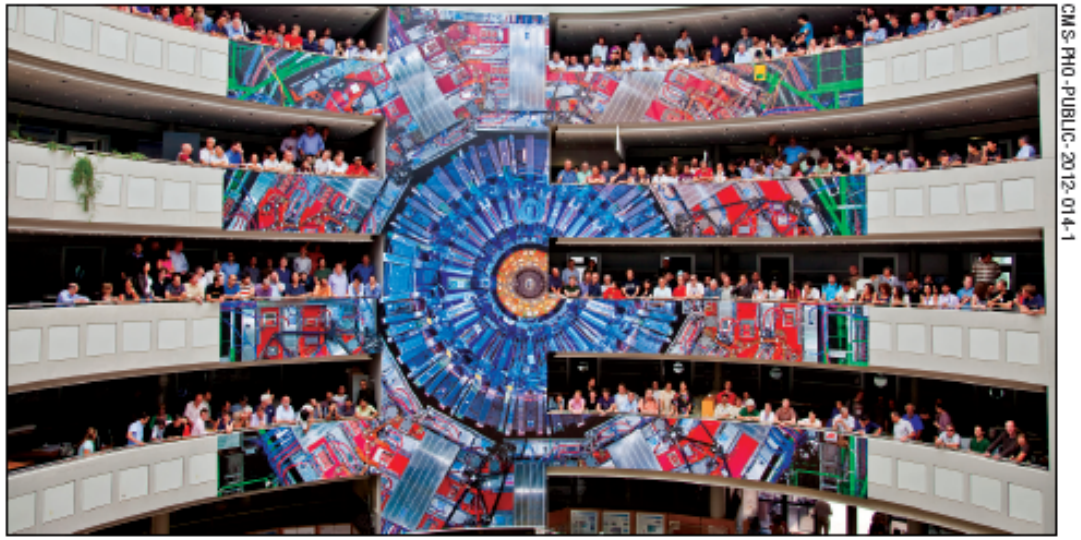
POLICY

Survey addresses recognition in large collaborations

The European Committee for Future Accelerators (ECFA) has created a working group to examine the recognition of individual achievements in large scientific collaborations. Based on feedback from an initial survey of the leaders of 29 CERN-based or CERN-recognised experiments in particle, nuclear, astroparticle and astrophysics, ECFA found that the community is ready to engage in dialogue on this topic and receptive to potential recommendations.

In response, ECFA has launched a community-wide survey to verify how individual researchers perceive the systems put in place to recognise their achievements. The survey will be distributed widely, and can be found on the ECFA website (https://ecfa.web.cern.ch) with a deadline for responses by 26 October.

The results of the survey will be disseminated and discussed at the upcoming plenary ECFA meeting at CERN on 15–16 November. An open session during the morning of 15 November, also to be webcast, will be devoted to the discussion of the outcomes of the survey, and aims to gather input to be submitted to the update of the European Strategy for Particle Physics (*CERN Courier* April 2018 p7). During the remaining open sessions, comprehensive overviews of all major future collider projects in and beyond Europe, and related accelerator technologies, will be given.



Physicists in CERN's Building 40. The ATLAS and CMS collaborations at the LHC each number more than 3000 members from over 200 institutes.

"Visibility and promotion of young scientists is of utmost importance in science and in particular also for the large collaborations in high-energy physics," says ECFA chairperson Jorgen D'Hondt. "On the eve of the update process of the European Strategy update, it is an outstanding opportunity for ECFA to take on its responsibility for informing the community about the opportunities and challenges ahead of us. Everybody is welcome."

CERN Courier
October 2018
https://cerncourier.com/survey-addresses-recognition-in-large-collaborations/

Also in CERN Bulletin
https://home.cern/cern-people/updates/2018/10/addressing-recognition-large-collaborations?utm_source=Bulletin&utm_medium=Email&utm_content=2018-10-04E&utm_campaign=BulletinEmail

ECFA Newsletter #1

available on the ECFA website:

https://ecfa.web.cern.ch

- Facilitate ECFA members to inform their communities with a brief and comprehensive ECFA newsletter
- It summarizes the Plenary ECFA meeting and includes relevant announcements
- Is available only digitally as a PDF document
- Aim to have this available shortly after each PECFA meeting, hence twice per year (i.e. a Summer and a Winter edition)

ECFA Newsletter #1
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- Sincere thanks to everybody who contributed to the creation of this first Newsletter
- Such a newsletter can only be achieved with the input and the help of many colleagues
- Thank you!

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THANK YOU FOR YOUR ATTENTION

ECFA dinner this evening

Restaurant 1 at CERN
Starting at 19:30

Only for ***registered*** ECFA members, speakers and panel members
(we reached the maximum capacity of the restaurant)