News

1. CDR Publication status
2. FCC-ee workshop in January
3. Fallout of FCC CDR press-release
4. FCC CDR presentation Symposium, 4-5 March 2019
3. Granada ESPP 13-16 May 2019
4. FCC week in Brussels 24-29 June 2019
5. FCC-ee CDR 5 → papers
6. Upcoming conferences
7. FCC-ee Physics and experiments, next steps
8. collaboration items … and collaboration with CEPC
9. CDR figure repository

Monthly Physics (vidyo-)meetings

Patrizia Azzi and Matthew McCullough have agreed to convene the monthly meetings
many thanks!

Do not hesitate to contact them to volunteer topics!

Announcement will be sent to mailing list fcc-ee-DesignStudy@cern.ch
as for all general announcements
do subscribe and invite colleagues to subscribe too.

Agenda will be posted on http://cern.ch/FCC-ee

HEP **1** records found Search took 0.13 seconds.

1. **First Look at the Physics Case of TLEP**
   TLEP Design Study Working Group (M. Bicer (Ankara U.) *et al.*). Aug 28, 2013. 49 pp.
   Published in **JHEP 1401 (2014) 164**
   DOI: 10.1007/JHEP01(2014)164
   Conference: C13-07-29.2 Proceedings
   e-Print: arXiv:1308.6176 **[hep-ex]** | PDF
   References | BibTeX | LaTeX(US) | LaTeX(EU) | Harvmac | EndNote
   CERN Document Server; ADS Abstract Service; Link to PDF on ECONF; Link to Proceedings write-up on ECONF; Link to Article from SCOAP3
   Detailed record - Cited by 499 records

oldy but goody!

HEP **499** records found 1 - 25 ▶ ▶▶ jump to record: 1 Search took 0.13 seconds.

1. **Higgs Parity, Strong CP, and Dark Matter**
   David Dunsky, Lawrence J. Hall, Keisuke Harigaya. Feb 20, 2019. 28 pp.
   e-Print: arXiv:1902.07726 **[hep-ph]** | PDF
   References | BibTeX | LaTeX(US) | LaTeX(EU) | Harvmac | EndNote
   ADS Abstract Service
   Detailed record

2. **Numerical evaluation of Mellin-Barnes integrals in Minowskian regions and their application to two-loop bosonic electroweak contributions to the weak mixing angle of the Zbb - vertex.**
   Johann Usovitsch. 2018. 125 pp.
   DOI: 10.3204/PUBDB-2017-12744
   References | BibTeX | LaTeX(US) | LaTeX(EU) | Harvmac | EndNote
   Link to Fulltext
   Detailed record

3. **Detecting the light gauge boson Z μτ via Higgstrahlung process in the U(1)Lμ−Lτ model at e + e − colliders**
   Jin-Xin Hou, Chong-Xing Yue, Zhen-hua Zhao (Liaoning Normal U.). 2019. 16 pp.
   Published in **Nucl.Phys. B940 (2019) 377-392**
   DOI: 10.1016/j.nuclphysb.2019.01.017
   References | BibTeX | LaTeX(US) | LaTeX(EU) | Harvmac | EndNote
   Link to Article from SCOAP3
   Detailed record

4. **Electroweak Precision Tests of the Standard Model after the Discovery of the Higgs Boson**
   Jens Erler, Matthias Schott. Feb 13, 2019. 65 pp.
   MITP/19-006
   e-Print: arXiv:1902.05142 **[hep-ph]** | PDF
   References | BibTeX | LaTeX(US) | LaTeX(EU) | Harvmac | EndNote
   ADS Abstract Service
   Detailed record

5. **Lepton flavor violation induced by neutral and doubly-charged scalars at future lepton colliders**
   P.S. Bhupal Dev, Rabindra N. Mohapatra, Yongchao Zhang. Feb 13, 2019. 13 pp.
   Conference: C18-10-22
   e-Print: arXiv:1902.04773 **[hep-ph]** | PDF
   References | BibTeX | LaTeX(US) | LaTeX(EU) | Harvmac | EndNote

XIth FCC-ee **Work**shop: **THEORY AND EXPERIMENTS**

https://indico.cern.ch/event/766859/
117 participants and ~ as many talks of great quality.

1. FCC CDR https://fcc-cdr.web.cern.ch/

volume 1 Physics at FCC
volume 2 FCC-ee
volume 3 FCC-hh
volume 4 HE-LHC

four 10-page papers for the strategy

1. FCC implementation plan →
2. FCC-ee
3. FCC-hh
4. HE-LHC

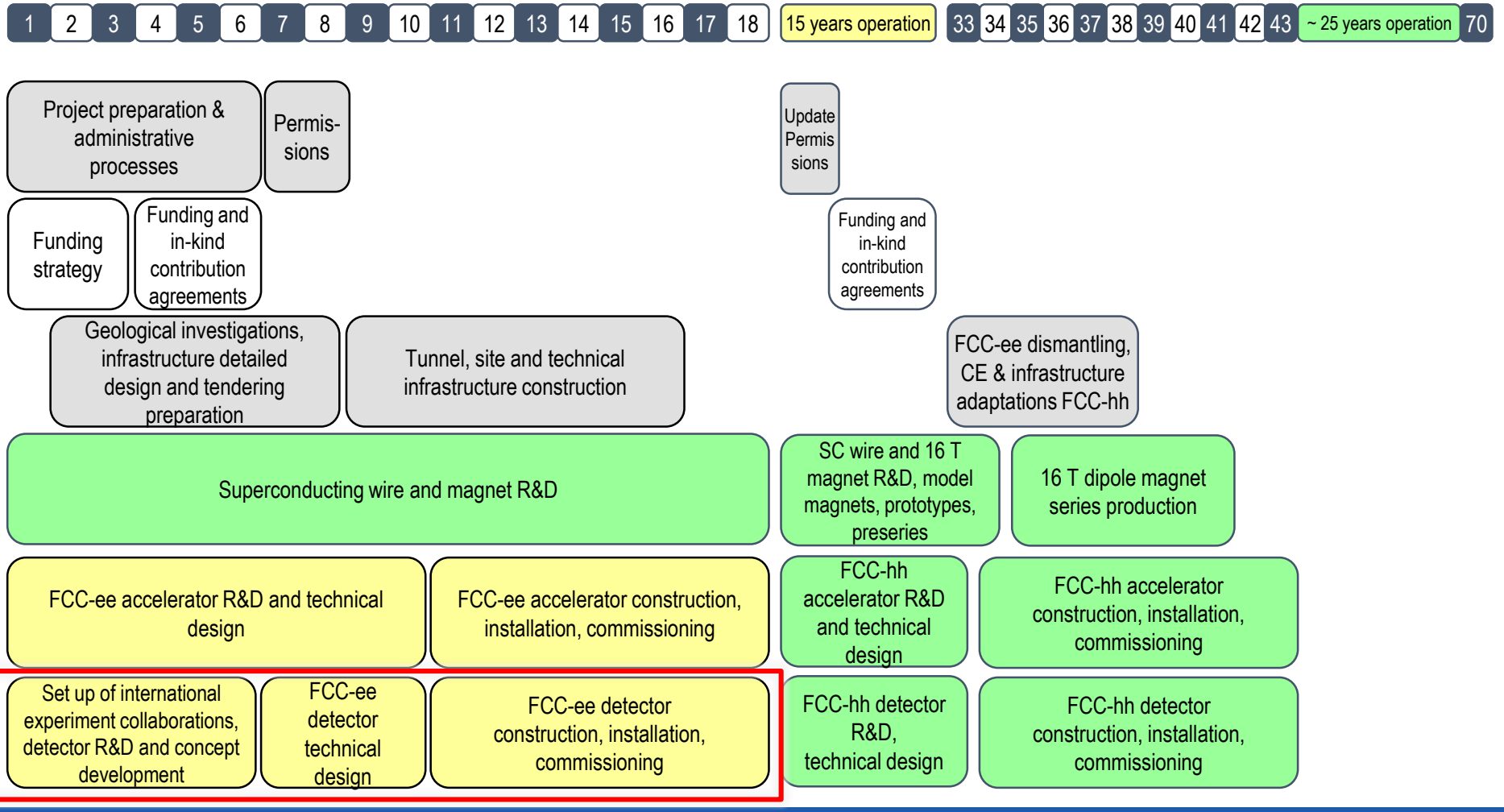
The FCC collaboration proposal is the integrated project spanning CERN's future until 2090. (70 years project): FCC-ee followed by FCC-hh (AA, eh) (not including muon collider)

Synergy and Complementarity

Sensitivity ++ Precision ++ Energy

NB: its been ~43 years since the first LEP yellow report and 30 years since the first beams and physics discovery (3 neutrinos!) in the LEP/LHC tunnel (and 19 more years to go, total = 62 years.

FCC integrated project technical timeline



We have gone a long way!

2010-11-12 : ideas, wishes, basic concepts, (VHE-LHC, LEP3, TLEP), Higgs discovery

2013 ESPP2013 wants «ambitious post-LHC accelerator projet »

2014 Kick-off meeting

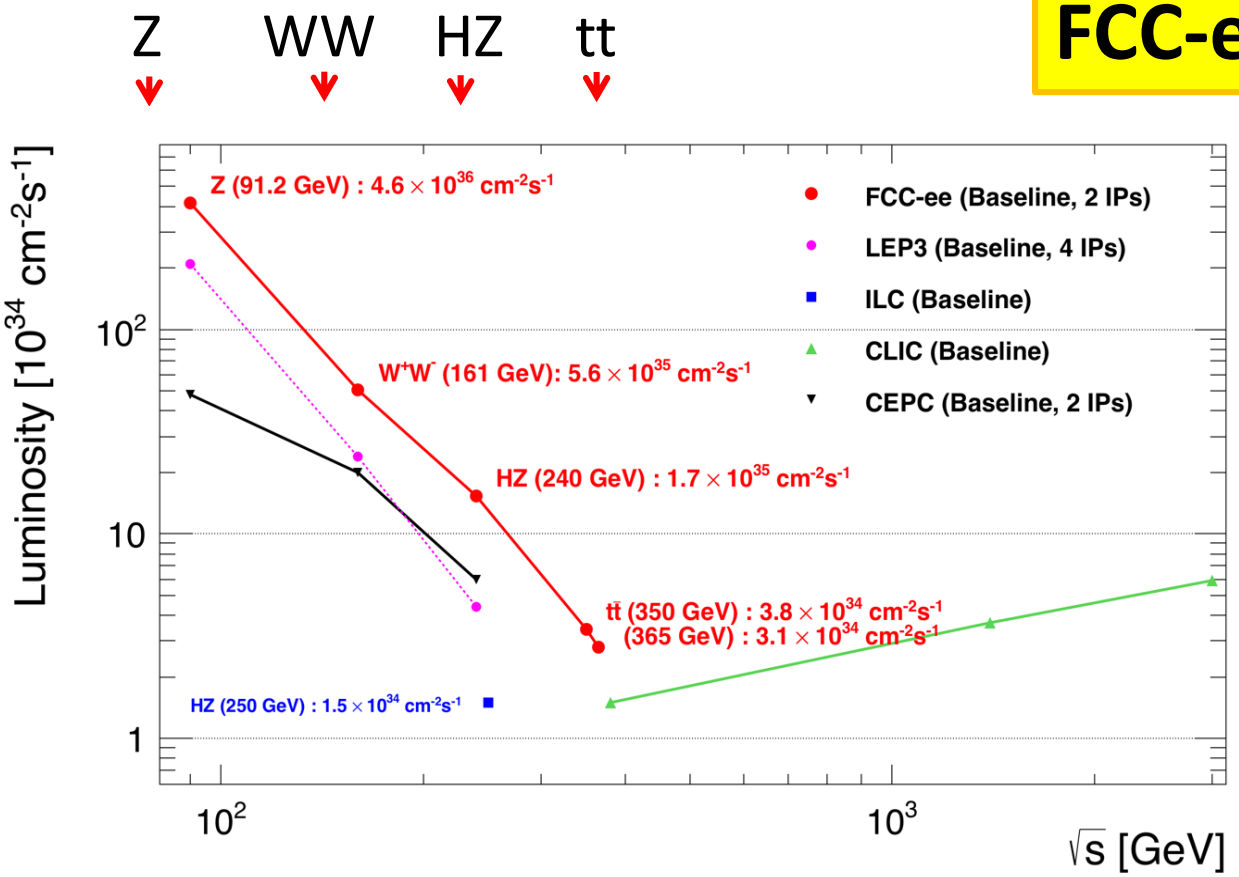
2018 ESPP contributions and CDR submitted

➔ **FCC can be done! Starting with the e+ e- collider.**

2019➔ Start of a new time towards realization

2019 (15 January) CERN directorate New Year Presentation
https://indico.cern.ch/event/779524/
Press release on FCC CDR release
FCC CDR physics presentation 4-5 March at CERN;
Plenary Meeting (ESPP) Granada 13-17 May
FCC General meeting in 24-28 June in Brussels https://indico.cern.ch/event/727555

FCC-ee



Event statistics :

					E_{CM} errors:
Z peak	**E_{cm} : 91 GeV**	**5 10^{12}**	**e+e- → Z**	**LEP x 10^5**	100 keV
WW threshold	**E_{cm} : 161 GeV**	**10^8**	**e+e- → WW**	**LEP x 2.10^3**	300 keV
ZH threshold	**E_{cm} : 240 GeV**	**10^6**	**e+e- → ZH**	**Never done**	2 MeV
$t\bar{t}$ threshold	**E_{cm} : 350 GeV**	**10^6**	**e+e- → $t\bar{t}$**	**Never done**	5 MeV

Great energy range for the heavy particles of the Standard Model.

1. Fallout of FCC CDR press-release

https://www.interactions.org/press-release/international-collaboration-publishes-concept-design-post

-- LOTS OF BUZZ Generally, goodreports on many media
for a selected list see: https://twitter.com/FCC_study

However a clear tendency to identify ***FCC = next bigger LHC***
little about the FCC-ee in itself, as first step if at all.
(getting better after comments to press office)

Excellent interview of Michel Spiro in Le Monde:
http://huet.blog.lemonde.fr/2019/01/21/physique-le-cern-propose-un-accelerateur-de-100-km/
even explains that linear colliders are «less adapted to today's physics questions»

-- Two notable negative articles

-- NYT by Sabine Hossenfelder (*so* bad)

https://www.nytimes.com/2019/01/23/opinion/particle-physics-large-hadron-collider.html
Ten years in, the Large Hadron Collider has failed to deliver the exciting discoveries that scientists promised.
This triggered much kickback including, e.g. Lisa Randall
https://www.nytimes.com/2019/02/01/opinion/letters/physics-research-collider-cern.html

"Colliders are expensive, but so was the government shutdown.
Only one of these will yield lasting insights into the nature of matter."

-- Physics today more recently
https://physicstoday.scitation.org/do/10.1063/PT.6.2.20190205a/full/

MLM interviewed (mostly asked and talks about 100 TeV machine and elaborates about magnet technology…) ☹ little on FCC-ee let alone its physics.

Then this citation by Halina Abramowicz (our ESPP chair)

China's CEPC and the FCC design bear similarities. As envisioned they would both be 100 km in circumference and start as electron–positron colliders. The electron–positron FCC would go to higher luminosities and energies. At 365 GeV it could create top-quark pairs; the CEPC at 240 GeV could not. Still, says Abramowicz, for electron–positron collisions, a linear collider is the better investment. "A circular machine only makes sense if you [then move on] to a high-energy proton–proton collider." She doesn't expect both the FCC and the CEPC to be built. "I am assuming a global approach, sharing resources," she says. Of course, the FCC would be funded by European and partner countries, whereas so far the CEPC is a solely Chinese project.

Protests etc…
'several people' escalated to Benedikt , Gianotti, Ursula Baessler (Chair of council) who was charged to ask ESPP chair to exert 'neutrality'.

Our take: linear and circular collider cover different energies with different luminosities and are not interchangeable. They are more complementary than duplicating eachother.

and our DG!

https://physicsworld.com/a/preparing-for-a-post-lhc-future/

General introduction is nearly carbon copy of the FCC-ee CDR:

*We are at a very exciting time in particle physics. On the one hand the Standard Model — the theory that describes the elementary particles we know and their interactions – works very well. All the particles predicted by the Standard Model have been found with the Higgs boson, which was discovered at the Large Hadron Collider (LHC) in 2012, being the last missing piece. In addition, over the past decades the predictions of the Standard Model have been verified experimentally with exquisite precision at CERN and other laboratories around the world. On the other hand, we know that the Standard Model is not the ultimate theory of particle physics because it cannot explain observations such as dark matter and the dominance of matter over antimatter in the universe and many other open questions *), so there must be physics beyond the Standard Model. Precise measurements of known particles and interactions are just as important as finding new particles.*

*) except that we spell out the neutrino masses – it's a sterile discussion whether massive neutrinos are in or out of the Standard Model.

This has worried some of you:

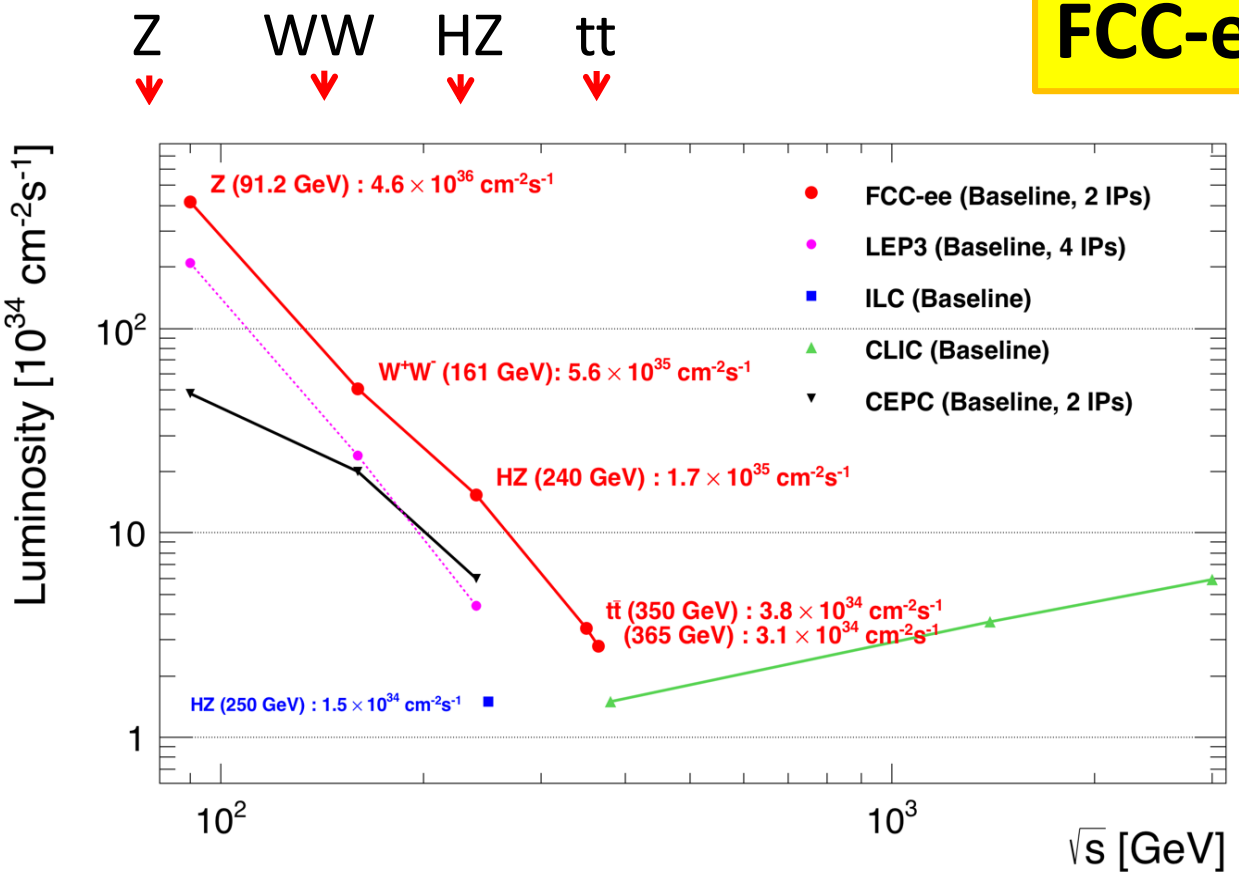
Japan is expected to give some indication about plans to build the International Linear Collider (ILC) in March. If Japan goes ahead, would CERN get behind the ILC as the next big machine in particle physics?

The fact that Japan is considering building a linear electron-positron collider demonstrates that there is great interest in the study of the Higgs boson as an essential tool for advancing our knowledge of fundamental physics. If Japan decides to go ahead with the ILC, they will undertake negotiations with the international community – Canada, Europe and CERN, the US and other possible partners — to build a strong collaboration. In this case, the most likely option for CERN would be to build a proton-proton circular collider that is complementary to the ILC.

notes 1) that this does not answer the question whether CERN would actually get behind ILC…
2) that the (unspecified) pp collider in question is more likely to be HE-LHC in that case…
3) and if you make the sums, there is more to lose than to gain in this operation!

4) in that case I would be ready to make the case that the linear and circular e+e- colliders might be, in fact more complementary, and that the discovery potential of FCC-ee is so much broader that the construction of ILC250 would'nt lessen FCC- ee physics case.
→ so that we can really go to FCC-ee and eventually to 100 TeV!

FCC-ee



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Linear vs circular: complementarity is evident, cross-over at about 350-400 GeV

More feedback?

FCC CDR Symposium, 4-5 March 2019

https://indico.cern.ch/event/789349/

REGISTER – COME– ADVERTISE – BRING YOUR FRIENDS

many speakers from FCC-ee team:
-- Mogens
-- Alain
-- Roberto
-- Patrick
-- Jorge
-- Patrizia
-- Stéphane
-- Oliver
-- Matthew

Strategy symposium, Granada, 13-16 May 2019

It is important to go and speak up ! (encouraged by CERN DG)

Register! https://cafpe.ugr.es/eppsu2019/

157 contributions submitted and now disclosed

FCC Week, Brussels, 24-28 June 2019

Web site in preparation (not to be used just as yet)
http://fccweek2019.web.cern.ch/
Aim is to promote the FCC integral programme to the EU and to produce lively continuation of activity. We should all go.

see draft agenda enclosed

Higher-level representation in opening meeting
Strategy sessions are foreseen

High priority topics, not fully worked out for the CDR, to be scheduled:
- **Machine optimization (4 IP vs 2 IP)**
- **Integrated simulation tools for accelerator polarization**
- **Final focus system , IR magnetics etc… (sextupoles)**
- **MDI / IR optimization, mechanical design, smaller/lighter beam pipe**
- **More detector concepts and technologies**
- **Beam backgrounds with full simulation of IDEA**
- **+ New and exciting physics topics and ideas**
- **+ Ongoing work updates**

your ideas/contributions welcome

Reserve the date!

	Monday 24 June		Tuesday 25 June				Wednesday 26 June				Thursday 27 June				Friday 28 June	
	Plenary Ground floor Ballrooom I+II		Parallel 1 Ground floor Ballroom I	Parallel 2 Ground floor Ballroom II	Parallel 3 1st floor Creativity/Explo	Parallel 4 8th floor Clarity Vision	Parallel 1 Ground floor Ballroom I	Parallel 2 Ground floor Ballroom II	Parallel 3 1st floor Creativity/Explo	Parallel 4 1st floor Evasion/Inno	Parallel 1 Ground floor Ballroom I	Parallel 2 Ground floor Ballroom II	Parallel 3 1st floor Creativity/Explo	Parallel 4 1st floor Evasion/Inno	Plenary Ground floor Ballrooom I+II	
Registration @ Palace Lobby (Ground floor)	**Opening, study status and physics perspectives**	Welcome (Speaker, ORG)	EuroCirCol machine design WP2	SC RF cavities and technologies	FCC physics & experiments	Economics of Science Workshop	FCC-ee machine design	EuroCirCol cryo-beam vacuum design WP4	FCC physics & experiments	Host state implementation concepts Tunneling technologies	FCC-ee MDI design	Conductor R&D Nb3Sn	FCC physics & experiments	Beam transfer systems and beam dumps R&D status	**Summaries Machines and Technologies**	FCC-hh machine design
		keynote														FCC-ee machine design
			Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)		I&D / Technologies
	Chairperson (ORG)	keynote	**Coffee Break** (Lobby Ground floor and 1st floor Atrium)				**Coffee Break** (Lobby Ground floor and 1st floor Atrium)				**Coffee Break** (Lobby Ground floor and 1st floor Atrium)				Chairperson (ORG)	Magnets / RF
	Coffee Break (Lobby Ground floor)		EuroCirCol machine design WP2	SC RF cavities and technologies	FCC physics & experiments	Economics of Science Workshop	FCC-ee machine design	EuroCirCol 16 Tesla magnet WP5	FCC physics & experiments	Technical infrastructure optimisation	FCC-ee MDI design	Conductor R&D HTS	FCC physics & experiments	RESERVE SESSION	**Coffee Break** (Lobby Ground floor)	
	EuroCirCol final results	EuroCirCol WP2+3 FCC-hh design													**Summaries Physics and Experiments**	
		EuroCirCol WP4 - Vacuum system	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)		FCC-hh physics & experiments
	Chairperson (ORG)	EuroCirCol WP5 - 16 T Magnets														FCC-ee physics & experiments
	Lunch (Restaurant & Brasserie, Ground floor)		**Steering Committee** (closed session) room	**Lunch** (Restaurant & Brasserie, Ground floor)			**Lunch** (Restaurant & Brasserie, Ground floor)				**International Advisory Committee** (closed session) room	**Lunch** (Restaurant & Brasserie, Ground floor)			Chairperson (ORG)	Closing remarks
			EuroCirCol EIR design WP3	RF power sources	FCC physics & experiments	Economics of Science Workshop	FCC-ee injector design	EuroCirCol 16 Tesla magnet WP5	FCC physics & experiments	Cryogenics	HE-LHC overview	Hi-field magnet R&D	FCC physics & experiments	FCC-ee magnet and vacuum systems		
	Status FCC-ee, technologies and infrastructure	FCC-ee design overview														
		SRF and power sources R&D overview	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)		
	Chairperson (ORG)	Civil engineering, I&D overview	**Coffee Break** (Lobby Ground floor and 1st floor Atrium)				**Coffee Break** (Lobby Ground floor and 1st floor Atrium)				**Coffee Break** (Lobby Ground floor and 1st floor Atrium)					
	Coffee Break (Lobby Ground floor)		**Poster session** Klimt, Ground floor			CBA panel discussion	**Regional projects** Ballrooom I+II (Ground floor)				FCC-eh option	Long-term HFM strategy	FCC physics & experiments	FCC-ee beam diagnostics and feedback		
	Strategy, funding instruments	keynote														
		keynote	EuroCirCol EIR design WP3	3 GHz e- linacs FCC-ee injector	FCC physics & experiments	Chairperson (ORG)	Chairperson (ORG)				Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)		
		keynote				**CBA Reception** (closed session)	**Cold refreshments** (Lobby Ground floor)									
	Chairperson (ORG)	keynote	Chairperson (ORG)	Chairperson (ORG)	Chairperson (ORG)						FCC, EuroCirCol					

First step: collect topics for FCC Physics and experiments please volunteer yourself (talk or poster)

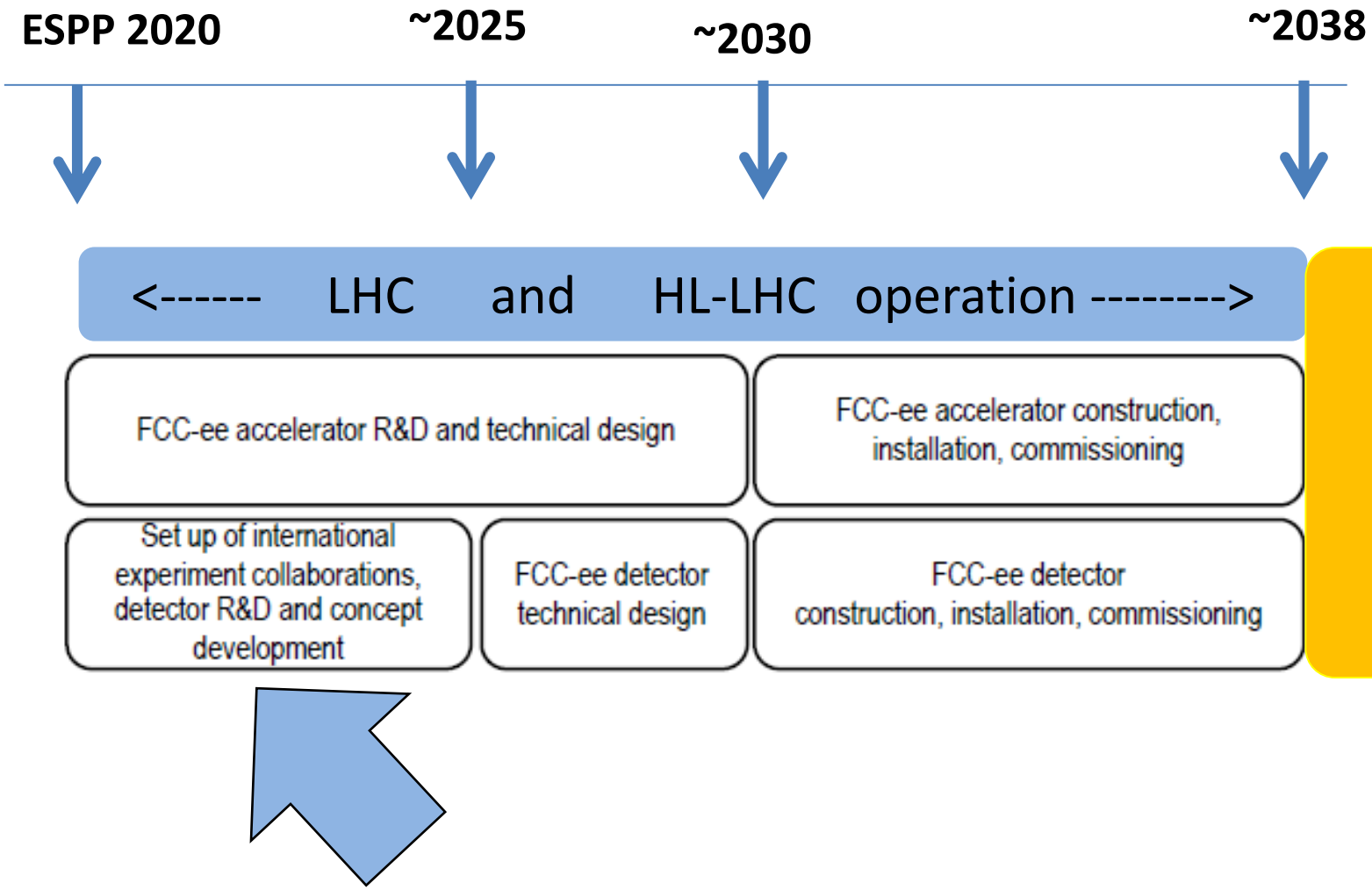
OUR «CDR 5»

It has been decided by the FCC CG that the 'full CDR' will not be published.

WE ARE IN THE PROCESS OF PUBLISHING ORIGINAL CONTENT THAT DID NOT MAKE IT TO THE 'CONCISE CDRs'.

see list below.

Collaboration



Start exploring this

Next steps:

0. please contibute to spread the word in resp. communities (countries, exp. collab)
1. please attend the Granada meeting ! (Fabiola dixit)
2. resume monthly physics VCs (feel free to volunteer)
   also may be able to intensify detector and simulation meetings

3. Target is high quality and richly attended Brussels meeting

4. Concerning detector discussions

0. much more detailed studies of detector requirements and R&D
   mapped on FCC-ee physics landscape is needed
1. need efficient software tools to ease start-up of newcomers (CERN support)
2. funding schemes (beyond CERN) will be investigated for R&D and simulations
2. remain at the level of requirements and concept discussions + R&D
   for the next few years.
   Build up of experimental collaborations will follow with instructions from top level
   Should happen only when solid schedule is known.

IF YOU ARE NOT REGISTERED ON THE FCC-ee MAILING LIST PLEASE DO

http://cern.ch/fcc-ee → contact/join us → join us (fill form)

TOPICS FOR WORK (PRELIMINARY LIST = WORK IN PROGRESS) -- 1 --

Work topics towards the FCC weeks in Brussels (Jun. 2019) and Paris (Oct. 2020)

Detector concepts

- IDEA
  - Drift chamber geometry optimization
  - Drift chamber tracking efficiency (single tracks, taus, simple jets, jets)
  - Combined test-beam data analysis
  - Simulation of calorimeter response
  - Simulation of magnet / preshower effect on calorimeter response
  - Optimisation of the calorimeter geometry in full simulation
- CLD
  - Detector optimization
  - Performance validation
  - Cost estimate update
- New detector concepts
  - Liquid argon / Tile calorimeter
  - Study the impact of magnet system before/after calorimeters
  - particle ID practical possibilities -- what physics?
- Luminosity measurement
  - Issues to solve: electronics, cooling, alignment
  - Correcting for the biasses from focussing effect, pinch effect, px kick, …

TOPICS FOR WORK (LIST = WORK IN PROGRESS) – 2 --

Machine-Detector Interface and Energy calibration

- Mechanical design for beam-pipe + luminosity calorimeter + vertex detector
- Beam background studies in the IDEA drift chamber
- Possibility of a smaller beam pipe up to 240 GeV - impact on flavour tagging
- Progress with MDI-Sim
- Final focus system (sextupoles)
- Z gamma at 160 GeV (calibration) and 240 GeV with detector simulation
- Use of muon momentum measurement for the point-to-point energy error

Contributions to the "turn-key" software, FCCSW

- Develop the IDEA simulation and reconstruction in FCCSW
  - Vertex detector + vertexing
  - Drift Chamber + tracking
  - Dual readout calorimeter + clustering
  - b- and c-tagging
  - Particle Flow reconstruction
- Port some of the LCSoft software tools to FCCSW
- Port CLD simulation to FCCSW (could this be done by CLIC people?)
- Start simulation of new detector concepts
  - Liquid Argon calorimeter from FCC-hh
  - Start developing or use algorithm developed for IDEA

TOPICS FOR WORK (LIST = WORK IN PROGRESS) – 3 --

Theoretical calculations (see long list in https://arxiv.org/abs/1809.01830)

Physics studies (exp. + th.)

- Electroweak physics at the Z pole
  - Influence of IFI on forward backward asymmetry and alphaQED
  - Space like measurement of alphaQED with low angle Bhabha
  - Effective mixing angle from tau polarization measurement
    - Starting with the tau -> rho nu channel
  - Rb with realistic b tagging
  - b asymmetry with the simpler lepton channel
  - Phenomenology: WWgamma TGC in the e+e- nue nue gamma channel
- Diboson physics
  - Systematic uncertainties on TGC measurements
  - EFT fit beyond TGC dominance assumption
- Higgs studies
  - Measurement of Higgs boson to b, c, g with detector simulation
  - CP studies in tau lepton decays
- Global EFT fit (EWPO, diboson, Higgs) to emphasize the correlations and the importance of Z pole run in Higgs coupling extraction.
- Top quark studies
- QCD

TOPICS FOR WORK (LIST = WORK IN PROGRESS) – 4 --

Flavours

- CKM Physics - NP in DF = 2
- Bs to tau tau
- Bc to tau nu
- CPV in B mixing
- …
- tau physics branching ratios and tests of universality

BSM physics

- neutrinos
- Axion-Like-ParticleS
- …

Communication

- Maintenance and development of the FCC-ee web site

???

-- Collaboration guidelines are being drafted

main points:

-- world wide effort to study and design the circular e+e- electroweak factory

-- transition : {Information & good-will} → {MOU + committment}

- **-- important to levy resources and real work**
- **-- ensure real support and committment from institutes**
- **-- also this will allow use of latest, supported software, algorithms etc..**

some boundary conditions

-- do not give numbers or results in public if they are not documented!
-- may need to protect indico pages for meetings etc…
-- need volunteers for web site, repositories etc…

-- Program Advisory Committee for FCC-ee physics and experiments studies
as body of the International Advisory committee chaired by **G. Dissertori**

10.01.2019 | News | Press release | CHIPP

The FCC provides science for almost a century

Swiss particle physicists support the project to construct a 100 km circular accelerator infrastructure at CERN.

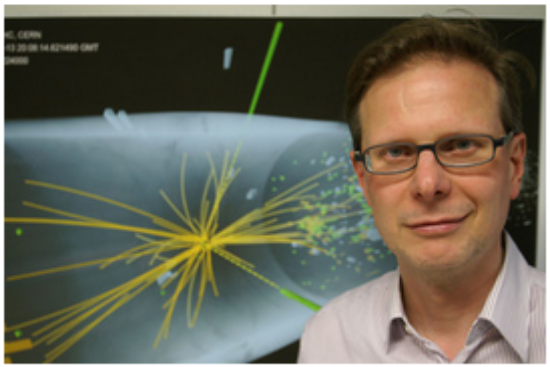


Image: B. Vogel, Switzerland

In spring 2020 the European particle physics community will decide on a new European Strategy highlighting the strategic long-term goals in this important field of fundamental research. In December 2018 Swiss scientists – organized by the Swiss Institute of Particle Physics / CHIPP – have formulated their input to the new European Strategy. Günther Dissertori – professor at ETH Zurich, member of the CHIPP Executive Board and incoming Scientific Delegate of Switzerland in the CERN Council – explains the main points of the Swiss strategic input.

Prof. Dissertori, Swiss particle physicists recently have established a new research roadmap. The new strategy will replace the roadmap of 2004 focussing on the CERN particle accelerator LHC which finally started operation in 2009...

CDR figure repository

After the message announcing the CDR publication we were asked if there was a ***repository for the figures.***

-- it is in our interest to publicize as much as possible.

-- of course the figures can be screenshot (advantage: include the caption)

~OK for talks, not enough for papers, proceedings, etc….

-- we plan to upload at least the CDRs 1 and 2 on ARXIV (using the full latex output) (request made)

-- also we need to revive our FCC-ee web site

→ need a volunteer