General Physics meeting 26 April 2021
NEWS

FCC

ECFA
European Committee for Future Accelerators

Agreed at the last PECFA meeting

Physics, Experiment & Detector studies towards a Higgs Factory

Support for and Acknowledgement of a series of PED@HF workshops

PED@HF – Physics, Experiments and Detector studies at Higgs Factories

ECFA acknowledges 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.

Setting up an International Advisory Committee (IAC) was agreed to be the next step.
This will involve some RECFA members and European leaders of Future Colliders with a mandate to setup a Program Committee (PC) that would develop a program to respond coherently to the Higgs Factory priority in the ESPP.

AB: The initial ideas were developed with Jorgen in discussions in March 2020
will make it possible to organize general meeting with all the 'Higgs Factory' community (CLIC, FCC-ee, ILC, CEPC)

FCC

ECFA Detectors Experiments and Physics Workshops

Three working groups defined and conveners agreed for WG 1 and 2.

Group 1, Physics Potential: Juan Alcaraz, Jenny List, Fabio Maltoni and James Wells

Group 2, Physics Analysis Methods : Patrizia Azzi, Dirk Zerwas, Fulvio Piccinini

Group 3 Detectors (pending ECFA road map completion)

This was agreed by r-ECFA on12 March.

Meeting WG1 and WG2 conveners with K. Jakobs, C. Grojean, P. Janot, A. Robson, A. Wulzer on 9 April
All have now officially accepted their convenership roles. They also support to have a
short "(informational) kick-off meeting" where the status quo and a first workplan will be discussed.
They will discuss among themselves details and how to structure this.
Possible date: meeting before end of June is favoured, the most likely date is Friday, 18th June, afternoon.

Official announcement soon.

ECFA detector R&D road map

https://indico.cern.ch/event/957057/

All relevant information is located on this indico site
input meetings:

Session I (in general collider oriented), afternoon 19 February 2021:
Input Session I

Talk I: HL-LHC (incl. flavour physics)
Talk II: strong interactions at future colliders
Talk III: strong interactions at future fixed target facilities
Talk IV: future linear high energy e+e- machines
Talk V: future circular high energy e+e- machines *(Mogens Dam)*
Talk VI: FCC-hh *(Martin Aleksa)*
Talk VII: muon collider

Session II (in general non-collider oriented) afternoon 22 February 2021: Input Session II

Talk I : neutrino short and long baseline
Talk II: astro-particle neutrinos
Talk III: DM-like facilities
Talk IV: decay facilities
Talk V: low energy facilities

ECFA detector R&D road map

https://indico.cern.ch/event/957057/

Symposia

Nine one-day symposia are foreseen as listed below.

Task Force 7: Electronics and On-detector Processing

Symposium date: Thursday 25.3.2021 Indico link to agenda

Task Force 8: Integration

Symposium date: Wednesday 31.3.2021 Indico link to agenda

Task Force 2: Liquid Detectors

Symposium date: Friday 9.4.2021 Indico link to agenda

Task Force 5: Quantum and Emerging Techologies

Symposium date: Monday 12.4.2021 Indico link to agenda

Task Force 3: Solid State Detectors

Symposium date: Friday 23.4.2021 Indico link to agenda

Task Force 1: Gaseous Detectors

Symposium date: Thursday 29.4.2021 Indico link to agenda

Task Force 9: Training

Symposium date: Friday 30.4.2021 Indico link to agenda

Task Force 4: Photon Detectors and Particle Identificaion Detectors

Symposium date: Thursday 6.5.2021 Indico link to agenda

Task Force 6: Calorimetry

Symposium date: Friday 7.5.2021 Indico link to agenda

Attendance by FCC members is important: these are often **excellent presentations** and ***it's worth checking that FCC detector requirements have been heard (and repeated if needed) *→***

ECFA det R&D Will start drafting report early May.
→ first draft before summer conferences
→ → final document by fall 2021.
Hopefully will be a live document,
follow up and updates still to be defined.

← This week

Time

Feedback on ECFA detector R&D road map
this page to be filled with feed back from you

AB : excellent talk by Mogens at the input session

-- however in the 'integration' session two points of important were missed

-- the improved requirements on the precision on detector dimensions (not an alignment issue) for LumiCAL and R_ℓ measurement

-- requirement on magnetic field monitoring in particular for point to point errors on scan but also for e.g. tau mass measurement (again not an alignment issue)

Action→ I wrote a note to Werner Riegler (CC: PPCs, PJ) to explain the why and how of these.

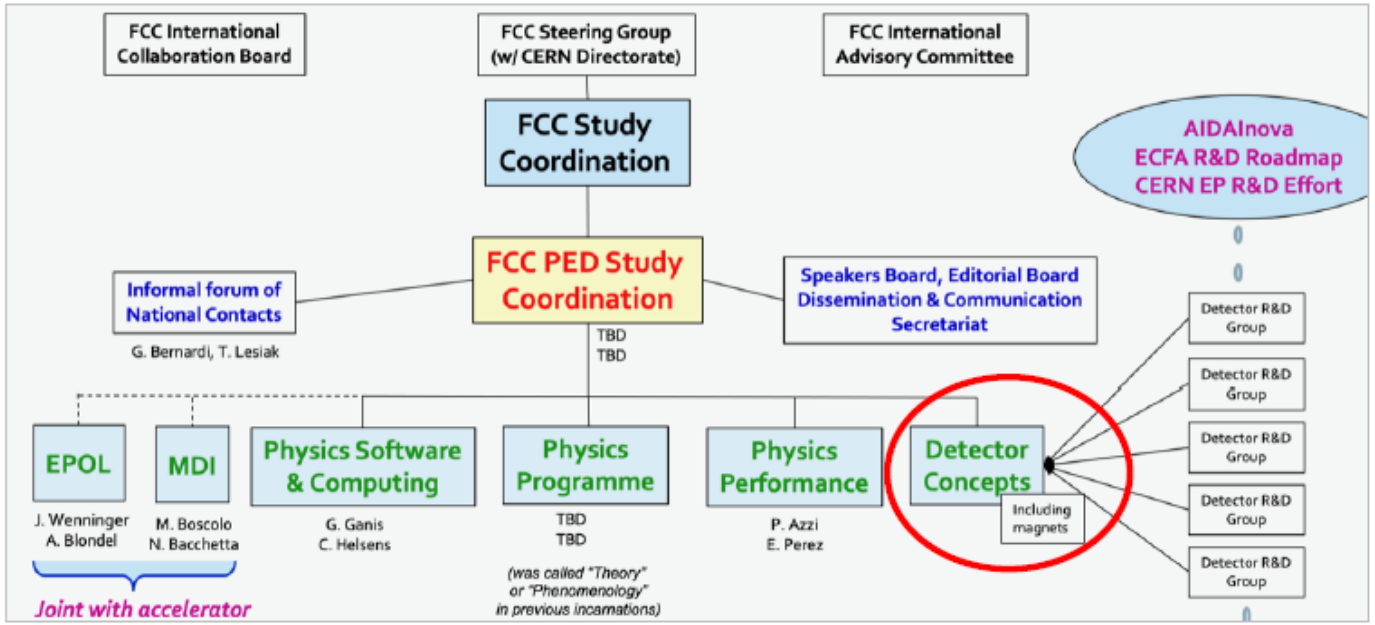
+ follow-up email with more detailed explanations.

A CALL ON YOU ALL: IF YOU SEE SIMILAR OVERSIGHT PLEASE REACT AND LET US KNOW!

Towards a detector concept working group

Towards an FCC effort on detector concepts

- ***Ad-hoc task force to prepare a proposal for the organization and the mandate of an FCC-ee "detector concept" effort, within the FCC PED***
- Members:
  - Martin Aleksa
  - Nicola Bacchetta
  - Alain Blondel
  - Paula Collins
  - Mogens Dam (chair)
  - Gerado Ganis
  - Paolo Giacomelli
  - Patrick Janot
  - Emmanuel Perez
  - Werner Riegler (?)
  - Frank Simon
  - Guy Wilkinson



- From invitation letter (A.Blondel, P.Janot):
  - The task force is encouraged to consult outside our group
  - A first report will be expected after about a month

Towards a detector concept working group

1. Goals - what we want to achieve ?
   - Present community with opportunity to develop and optimize detectors
     - Need for both geographical (via national contacts / initiatives) and topical growth
   - Make sure detector concepts are capable of delivering the detector requirements
   - Steer/inform Detector R&D in the direction of the requirements of FCC-ee

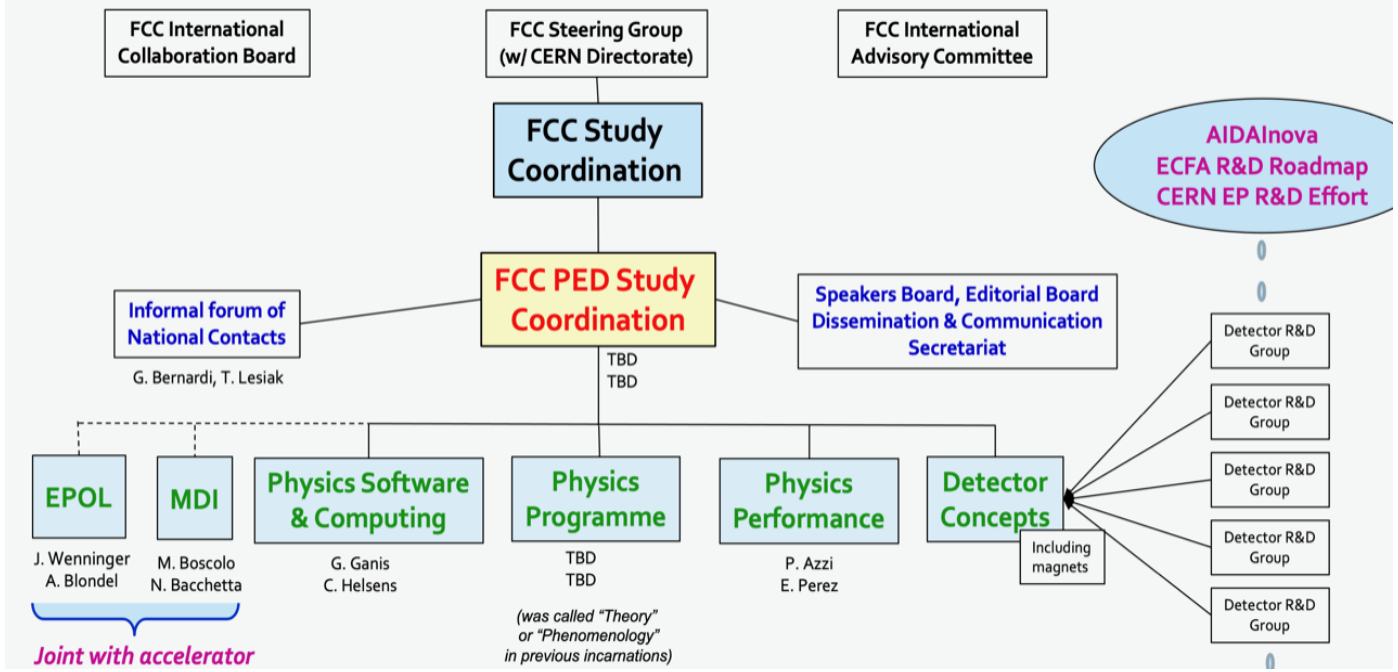
2. Deliverables ?
   - Define what should appear in the CDR+ at end 2024 – early 2025
   - Define ”what tools and by whom” should be provided as community support

3. Gathering the community around challenges
   - Invite community and potential leaders to participate in the challenge of implementing detector solutions that satisfy detector requirements using technology that either exists, or can be realistically developed over the next 10-15 years

Some points raised:
- Stress double opportunity: i) for detector ”inventors” to put into application their technologies ii) for experiments to benefit from it
- Eventhough main focus should be on ee, hh should not be forgotten / left out
- Importance of key4HEP software (FCCSW)
- detailed study and optimization of subdetectors
- ”plug-n-play” assembly of detector concepts from detector components
- Proposal for lab-to-lab software initiative (CERN, DESY, Fermilab, …) covering ”Higgs and EW/top factories” and FCC-hh.
- Dedicated detector workshop for e+e- possibly arranged via ECFA PED activities ”Higgs and EW/top factories”

Study organization (needs to be approved by CERN council nd did not pass in March)
still in the process of streamlining in view of June 2021 council

we presented our plans .... but some comments by delegates remain to be addressed ...



DG insisted that:
Physics performance and detector concepts for FCC-hh must be included.

Main conclusions:

Concerning the FCC-hh 'presence' DG's concern is mostly related to 'message' to council. However...

1. FCC-hh is already included in the « Physics program » and can be easily integrated in detector concepts
2. FCCSW is already functional for FCC-hh
3. The FCC-hh detector concept exists and has been documented, but should continue updates to detector technology
4. Additional studies concerning *beyond the multi-purpose detector* (FCC-hh_b, Heavy ion, other fixed target activities (FASER and Mathusla-like) should be kept alive.
5. some performance studies will probably be necessary to e.g. compare to high energy lepton colliders (μμ, ee) which are under study as "plan B"

Concerning the roles in the study.

➔ DG happy with the proposed structure it is now up to *PED* to complete the list of conveners, starting with the Physics etc and to propose/discuss them to/with the management

« 50/50 CERN/non-CERN » principle to be respected across-the board (suggestions from PED SG/CG are still welcome)
NB we are already way above this for all physics groups steering committee etc...

Personnal comment (AB): importance to keep 'FCC-INT' (ee and hh) together is absolutely paramount.
It is essential for community of particle physics and funding agencies etc.. to realize that they come together
FCC-ee is the only possible first step ! (it is not « optional »)

FCC Software matters

Clement Helsens and Gerardo Ganis

Recent activities

- Distributed Computing with DIRAC
  - Activation of FCC VO completed
    - People can register their certificate following standard procedures
  - Connection with iLCDIRAC and CERN EOS area established
    - Results will be stored under /eos/experiment/fcc/prod
    - Hierarchical structure being defined
  - Full example MC+Delphes being worked out (A Stano + A Sailer)
- Augment Computing resources at CERN
  - Current quotas at CERN: 400 TB (~300 TB used), 4000 HEPSpec06 (CPU)
    - Limit of what can be obtained for free
  - Requested formal offer for 1 PB, 9000 HS06 and tape archival support for selected files
    - Not for free, previous quote was about 20 kCHF/year
- MDI and Detector
  - Activities restarted, bimonthly meetings
    - Regaining control of GuineaPig for IPC bkg well advanced
    - Ongoing discussions for unified geometry description (DD4hep to/from CAD)

https://voms2.cern.ch:8443/voms/fcc/aup/sign.action

LEP data in EDM4hep

- Interest raised in the context of DPHEP
  - FCC letter to support ALEPH request to CERN management for preservation support, underlying EDM4hep format and interest for all LEP data
- Study group being setup in DPHEP context to prepare a document with technical feasibility
  - One representative per *surviving* LEP experiment (no L3), DPHEP chair (D Düllmann, IT), G Ganis (EP, EDM4hep)
- Current (proto)plan
  - Convert data + existing MC
  - If needed, new MC will be generated in old format, then converted
    - No plan to describe LEP detectors in DD4hep and implement digitisation
    - Delphes detector description ?

Preliminary non-official

Status and near-term plan of SuperKEKB

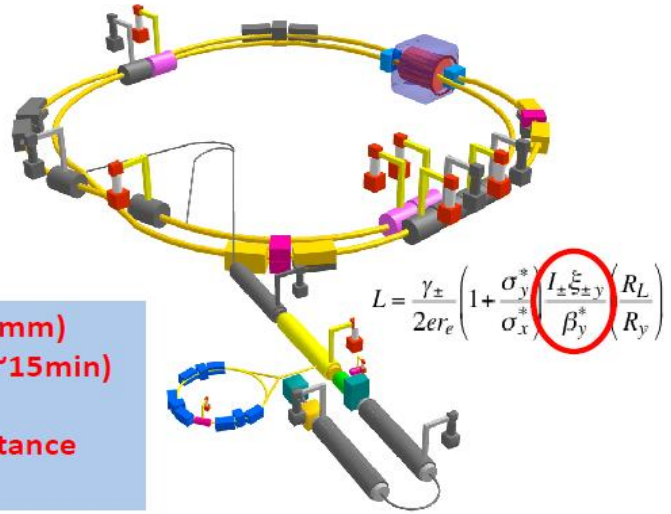
R. Yang (KEK)

Acknowledgements: Y. Ohnishi, Y. Funakoshi, M. Tobiyama, K. Oide and SuperKEKB commissioning group

from optics meeting 23/4/2021
https://indico.cern.ch/event/1030046/

SuperKEKB – TLEP demonstrator!

from 2015 FCC presentation remember ?



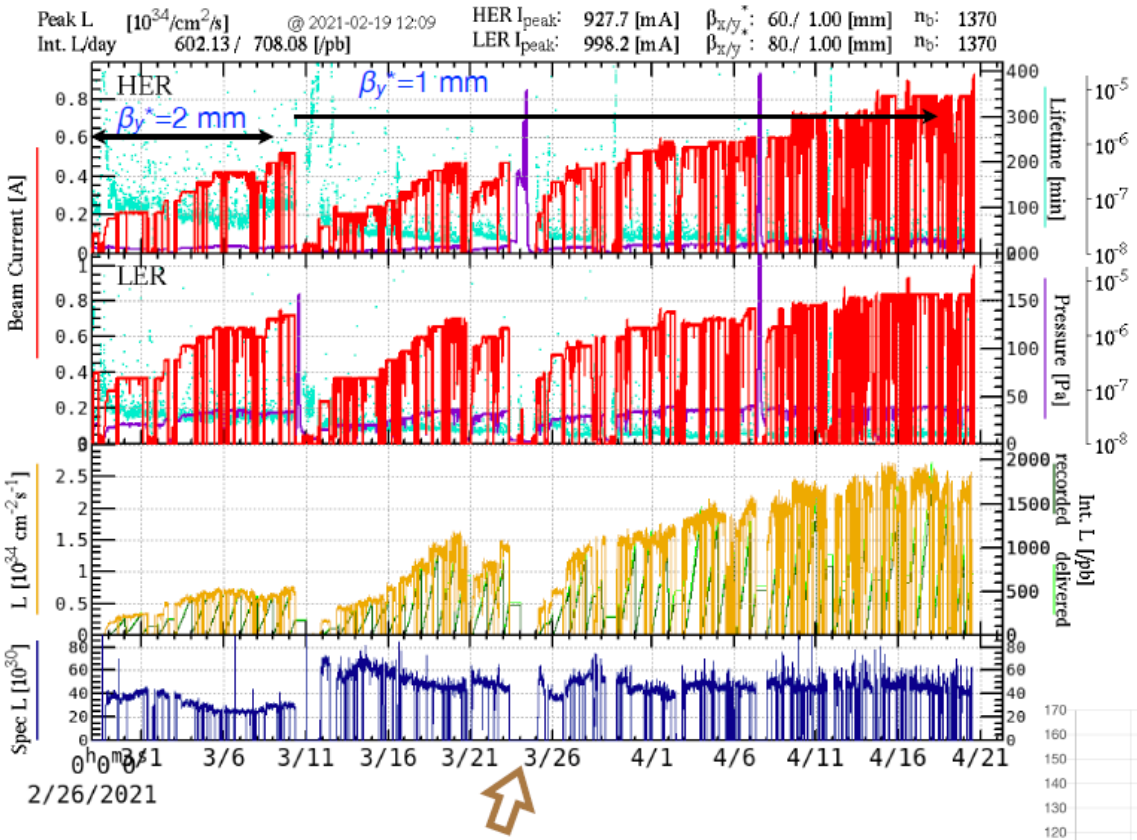
$$L = \frac{\gamma_\pm}{2er_e}\left(1+\frac{\sigma_y^*}{\sigma_x^*}\right)\left(\frac{I_\pm \xi_{\pm y}}{\beta_y^*}\right)\left(\frac{R_L}{R_y}\right)$$

- β_y*=300 μm (TLEP: 1 mm)
- lifetime 5 min (TLEP: ~15min)
- $\varepsilon_y/\varepsilon_x$=0.25% (~TLEP)
- off momentum acceptance
- e^+ production rate

History of 2021ab operation

This is a record!

- Peak *L*: 2.83x10^{34} cm^{-2}s^{-1} for 840/820 mA (LER/HER) on Apr. 15, 2020
- Int. *L*:1628.86 pb^{-1} /day for 840/820 mA (LER/HER) on Apr. 17, 2020



Downs due to technical troubles (machine & detector) and beam aborts

- LER/HER started on Feb. 16/ Feb. 24; beam collision since Feb. 26—> Jul. 05
- MR optics (after Mar. 11, 2020)
  LER: β_x^*/β_y^*= 60/1 mm
  w/ 40% CW
  HER: β_x^*/β_y^*= 80/1 mm
  w/ 80% CW
- Achieved max. current (up to Apr. 20) : 1/0.93 A of LER/HER
- Delivered lumi. is lower than expectations (170 fb^{-1} up to present)

Machine parameters

	KEKB : June 17, 2009		SuperKEKB : April 14, 2021		SuperKEKB : July 1, 2020		SuperKEKB : final design		Unit
Ring	LER	HER	LER	HER	LER	HER	LER	HER	
Emittance	18	24	4.0	4.6	4.0	4.6	3.2	4.6	nm
Beam Current	1637	1188	837	819	536	530	3600	2600	mA
Number of bunches	1585		1272		978		2500		
Bunch current	1.03	0.750	0.658	0.644	0.548	0.542	1.44	1.04	mA
Horizontal size σ_x^*	147	170	17.9	16.6	15.5	16.6	10.1	10.7	μm
Vertical cap sigma Σ_y^*	1.33		0.417		0.317		0.079		μm
Vertical size σ_y^*	0.940		0.295		0.224		0.048	0.062	μm
Betatron tunes ν_x / ν_y	45.506 / 43.561	44.511 / 41.585	44.524 / 46.596	45.531 / 43.577	44.525 / 46.581	45.531 / 43.574	44.53 / 46.57	45.53 / 43.57	
β_x^* / β_y^*	1200 / 5.9	1200 / 5.9	80 / 1.0	60 / 1.0	60 / 0.8	60 / 0.8	32 / 0.27	25 / 0.30	mm
Piwinski angle	0	0	10.7	12.7	12.3	12.7	19.3	19.0	
Beam-Beam parameter ξ_y	0.129	0.090	0.0390	0.0228	0.0345	0.0199	0.0881	0.0807	
Specific luminosity	1.71×10^{31}		5.25×10^{31}		6.90×10^{31}		2.14×10^{32}		$cm^{-2}s^{-1}/mA^2$
Luminosity	2.11×10^{34}		2.83×10^{34}		2.00×10^{34}		8×10^{35}		$cm^{-2}s^{-1}$
Remarks	Crab crossing		Crab waist		Crab waist		-		

* previous peak lumi. of 2.4×10^{34} $cm^{-2}s^{-1}$ achieved with β_y^*=1 mm (0.73/0.62 A) in Jun. 2020

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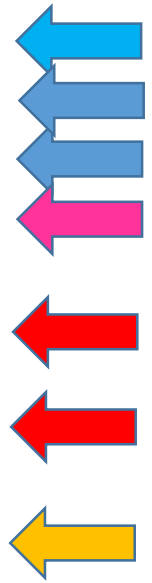
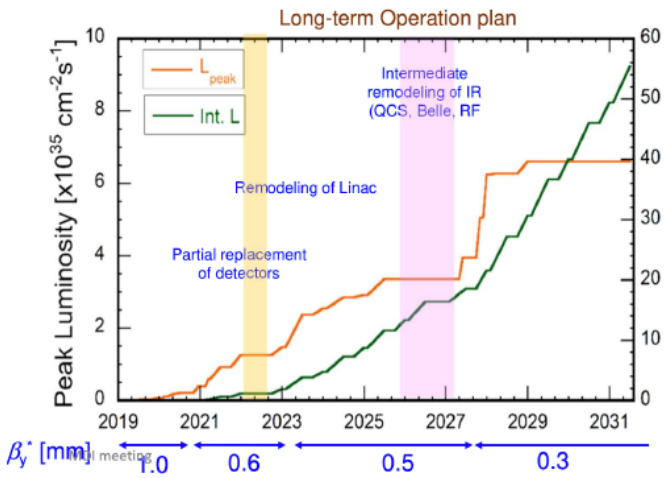
Table by Y. Ohnishi http://afsad1.kek.jp/redmine/documents/216

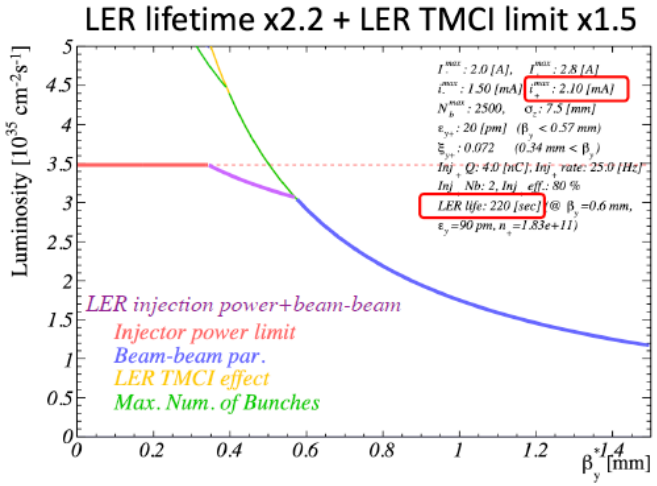


several x factor 3= factor ~30 to gain

Long-term scenarios (tentative)

- Upgrade of LINAC and IR have been proposed by the accelerator group
- Max. L=3.0-3.5x10^{35} cm^{-2}s^{-1} is expected after the IR upgrade (LER lifetime x2.2, TMCI x1.5) with β_y^*=0.6-0.3 mm (K. Nakamura). The peak L is then limited by injection power!





Y. Suetsugu, SuperKEKB MDI meeting (2020)
K. Nakamura, talk at SuperKEKB MDI meeting (https://kds.kek.jp/event/37285/)

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Summary

- New world-record luminosity of 2.83x10^{34} cm^{-2}s^{-1} has been achieved after increasing beam current to 840/820 mA (LER/HER). The record integrated luminosity is ~1.6 fb^{-1}/day.
- By increasing beam current to 1.1~1.2 A, a peak luminosity of 3.8x10^{34} cm^{-2}s^{-1} is expected for 2021ab operation. However, many challenges, e.g., injection efficiency & BG, collimator & TMCI, beam-size blowup, instability and hardware troubles, are to be tackled.
- Further improvement of luminosity is mainly limited by beam-beam effects and injection power (lifetime), and upgrade of LINAC & IR in next 5 years will of immense importance.

SuperKEKB commissioning is still in early-stage and enormous efforts are needed towards the design luminosity!!

Thank you!

Also from the optics meeting

-- report from the SRF review

-- main discussion is whether to keep the present 400MHz 1cell/4 cells + 800 MHz (5 cells)

-- or to move to Swell cavities (see news of last month) at 650 MHz

-- synergy of CLIC +FCC-ee concepts + RF frequency is ½ ILC (maximize synergies)

-- report from injector review

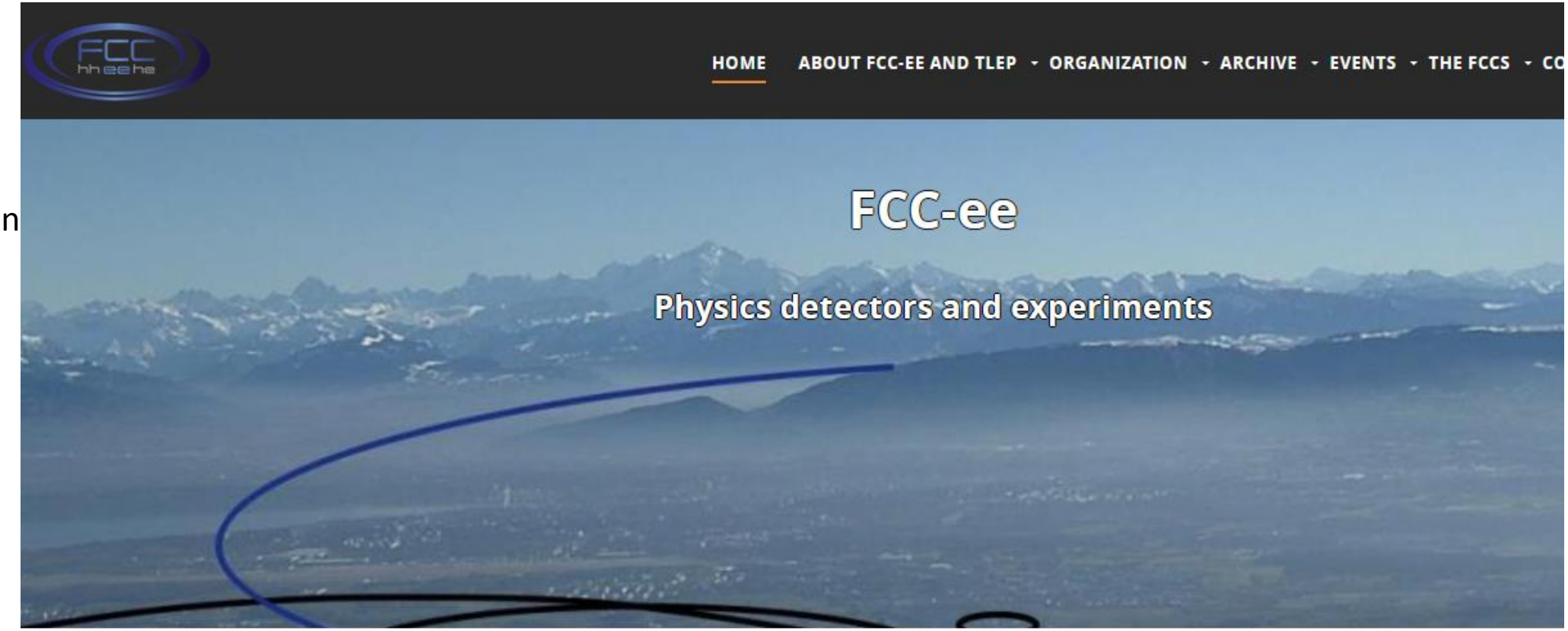
-- new idea to separate the e+ and e- low energy (up to 4-6 GeV) linacs

-- e+ target is quite a 'hot' topic – probably needs rotating devis and water cooling.

-- discussion on the optics for WW run (as Z (45/45) or as ZH(90/90) or special (60/60)? (gains 10-20%))

Web page

functionality has been much improved
and you can actually find here useful info



the indico thread of all the FCC-lepton meetings

Stay aware

- **The general FCC physics, experiments, detectors** past and upcoming meetings
- **FCC-ee physics performance** past and upcoming meetings
- **FCC-ee monthly physics meetings** past and upcoming meetings
- **FCC conferences and workshops:** Past and upcoming Events

The FCC-ee in a few words

The idea of a large circular e+e- collider as Higgs Factory came from a conjunction of circumstances: i) the need of a large tunnel for the continuation of the high energy exploration after the LHC; ii) the new 'nano-beam' designs proposed for the 'super' B factories; iii) and of course the discovery of the Higgs boson with a mass that could have been reached (with efforts) at LEPII. The idea of such a machine as a first step toward a 100TeV pp collider was submitted to the ESPP2013/13 and led to the FCC study, launched in 2014. The study concluded in its FCC-int submission to the ESPP2020 that the *"The most effective and comprehensive approach to thoroughly explore the open questions in modern particle physics is a staged research programme, integrating in sequence lepton (FCC-ee) and hadron (FCC-hh) collisions"*.

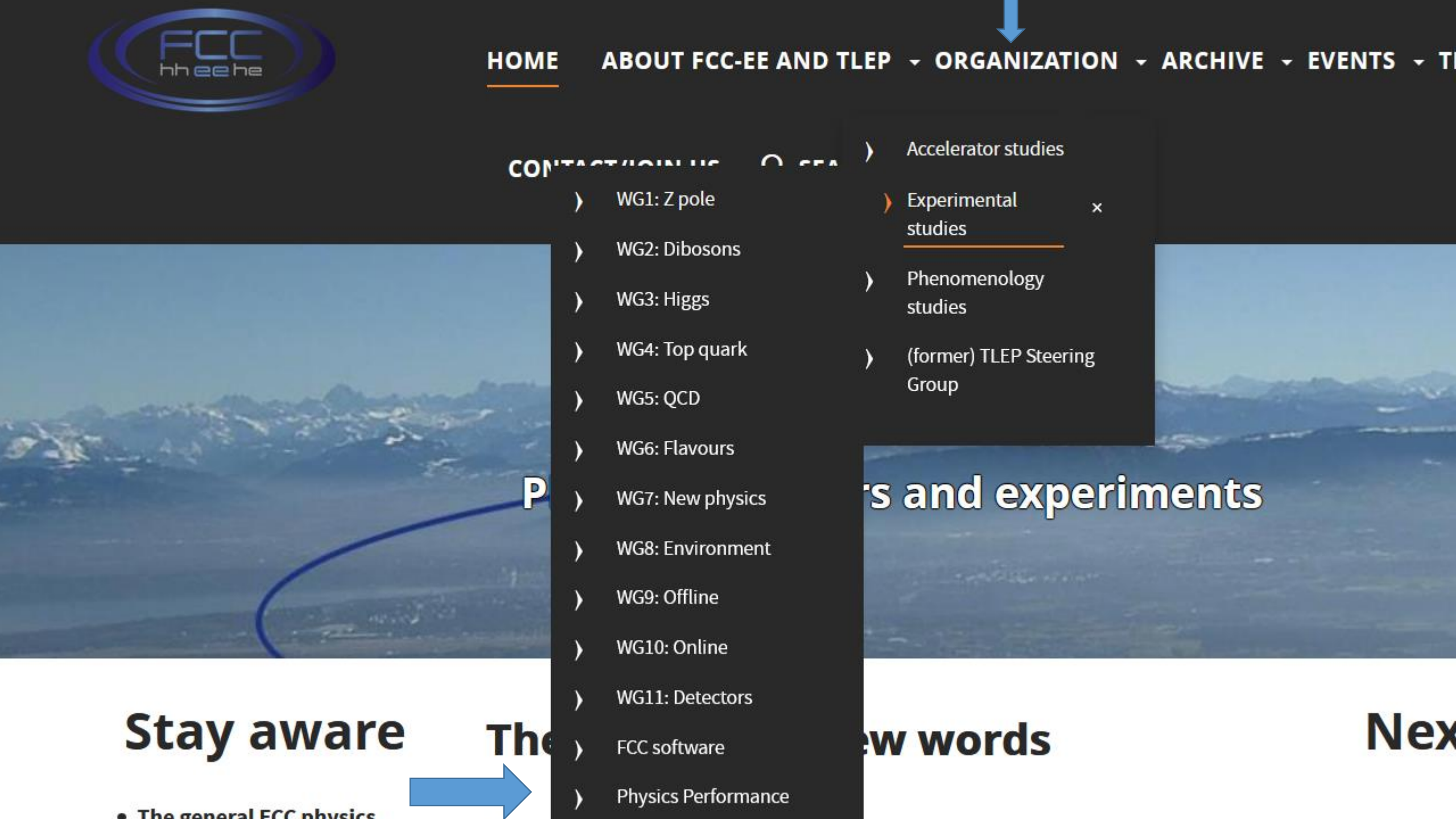
The ESPP concluded: ***"Europe, together with its international partners, should investigate the technical and financial feasibility of a future hadron collider at CERN with a centre-of-mass energy of at least 100 TeV and with an electron-positron Higgs and electroweak factory as a possible first stage.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

Next events

FCC-ee Physics, Experiments, and Detectors General Meetings
FCC-ee physics zoom meeting -
Mon, 04/26/2021 - 15:00

WG8: Machine-Detector Interface
FCC-ee MDI meeting #32 and FCCIS WP2.3 meeting #3
Tue, 04/27/2021 - 09:30

General Software Meetings
FCC Software Meeting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ABOUT FCC-EE AND TLEP
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Accelerator studies
Experimental studies
Phenomenology studies
(former) TLEP Steering Group
WG1: Z pole
WG2: Dibosons
WG3: Higgs
WG4: Top quark
WG5: QCD
WG6: Flavours
WG7: New physics
WG8: Environment
WG9: Offline
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View on GitHub

FCCeePhysicsPerformance

Welcome to the FCC-ee Physics Performance Documentation

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FCC Speaker Büro

Markus Klute
Alain Blondel
Daniela Bortoletto
Susanne Gascon
Paolo Giacomelli

Upcoming Conferences

➡ **Conferences and workshops in 2021. Currently working on**

- WIN 2021
  - focus on physics; deadline for abstracts today; still adding topics
- LISHEP 2021
  - invited plenary talk; looking for speaker
- EPS 2021
  - broad list of topics; physics talks similar to WIN; looking for detector and accelerator contributions; deadline for abstracts May 8th
- NUFACT 2021
  - interest for accelerator talk; deadline for abstrac 31st May 2021.

WIN 2021

Weak Interactions and Neutrinos 2021

Minnesota, USA

Category	Presentations
International Conference	*3*

June 7, 2021 to June 12, 2021

Information
The deadline for abstract submissions is April 15th.

Status
Collecting proposals for abstracts and speakers.

Coordinator

Search presentations in this conference... Search

Searches of axion-like particles via photon fusion at the FCC-ee
By: *June 7, 2021*

Abstract: Prospects for measurements of axion-like particles (ALPs) produced via photon-photon fusion in e+e- collisions at the FCC-ee will be presented. Competitive exclusion limits, better by up to a factor of 10 compared to the best achievable bounds expected at any other facility before FCC-ee, can be re... read more.

Electron Yukawa from s-channel resonant Higgs production at FCC-ee
By: *June 7, 2021*

Abstract: Measuring the electron Yukawa is impossible in Higgs boson decays, H -> e+e- , given the smallness of the electron mass that leads to a vanishingly small decay branching fraction. The only direct method to extract the Higgs-electron coupling is through resonant s-channel production in e+e- collisio... read more.

Heavy neutrino searches at the FCC *June 7, 2021*
By:

Abstract: The Future Circular Collider (FCC) is proposed as a post-LHC particle collider at CERN. It consists of an sequential implementation of a Higgs and Electroweak factory lepton (FCC-ee) collider and of a 100

➡ **Adding abstracts on EW, flavor, and Higgs (including FCC-hh) physics**

EPS 2021

European Physical Society Conference on High Energy Physics

Hamburg, Germany

Category	Presentations
International Conference	*6*

July 26, 2021 to July 30, 2021

Information
The deadline for abstract submission is May 7th, 2021

Status
Collecting proposals for abstracts and speakers.

Coordinator

Search presentations in this conference... Search

Tile Multiple Readout and Beyond for FCC *July 26, 2021*
By:

Abstract: Dual-Readout Compensated Calorimetry with Tile Sensors Friday, March 19, 2021 2:40 PM (20 minutes) We discuss techniques and materials to develop optimize the energy resolution in the long-term performance of calorimeters as required by the challenging environment of future colliders and high inten... read more.

Very Forward Calorimetry at the FCC *July 26, 2021*
By:

Abstract: The success of any particle detector at a collider experiment depends on its ability to measure both the trajectories and energies of particles exiting the interaction point. Especially important and difficult is measuring the trajectories and energies of particles in the very forward region - par... read more.

New radiation-hard scintillators for FCC Detectors *July 26, 2021*
By:

Abstract: Future circular and linear colliders, as well as the Large Hadron Collider in the High-Luminosity era, have been imposing unprecedented challenges on the radiation hardness of particle

The dual-readout calorimeter module R&D using innovative 3D metal printing for future e+e- colliders *July 26, 2021*
By:

Abstract: Innovative 3D metal printing technology has been recently improved and used widely in various fields for both basic science and high technology. The next generation methodology of the novel calorimeter, dual-readout calorimeter, is one of the candidates to achieve very high energy resolutions for b... read more.

The tracking system of the IDEA detector concept for a future e+e- collider *July 26, 2021*
By:

Abstract: The IDEA detector concept for future e+e- colliders proposes a tracking system composed by a Si based inner system, an ultra-low mass Drift Chamber central system with Particle Identification capabilities and a Si based outer layer surrounding the drift chamber. The designed tracking system allo... read more.

Search for additional scalar bosons at the FCC-ee *July 26, 2021*
By:

Abstract: As a proposed Higgs factory, the cornerstone of the FCC-ee physics program is the exploration of the Higgs boson at center-of-mass energies of 240 to 365 GeV. Direct and model-independent measurement of its coupling to the Z boson through the study of the Z boson recoil mass spectrum. The recoil ma... read more.

- **Looking for software, detector, machine, and theory contributions**
- **Adding WIN abstracts**

Conference DB

- **Conference database**
  - https://fcc-ee-conference.web.cern.ch/
  - Login with CERN SSO to create account
  - Feedback is welcome
- **Currently populating database with 2021 conferences and improving appearance**
- **Next, adding information from 2020 and before**
- **Link from FCC webpages and publicizing.**

0. FCC-nordic took place March 22 https://indico.uu.se/e/fccnordic

Some UPCOMING EVENTS

1. next FCC week 28 June – 2 July
   Only plenary sessions with PED sessions in the afternoon

2. next FCC-France workshop Annecy du Tuesday 30 Novembre to Thursday 2 Decembre
   hopefully in flesh!

3. next FCC-PED workshop (all FCC flavours) Liverpool February 2022