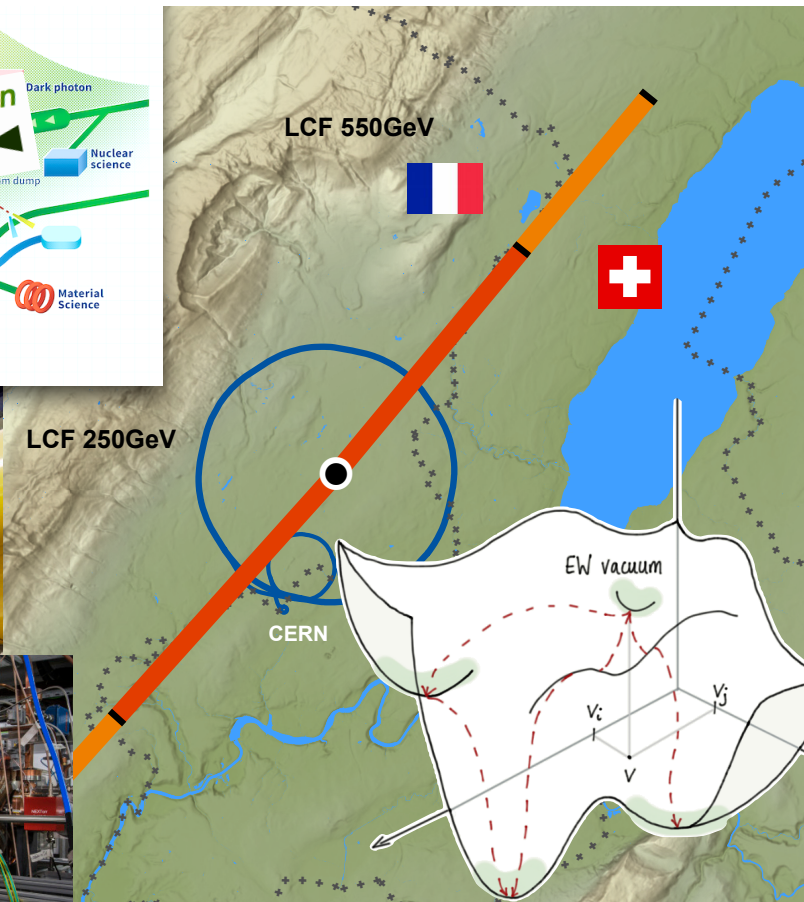
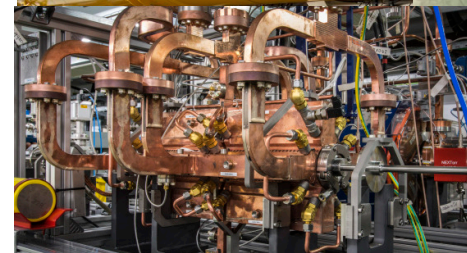
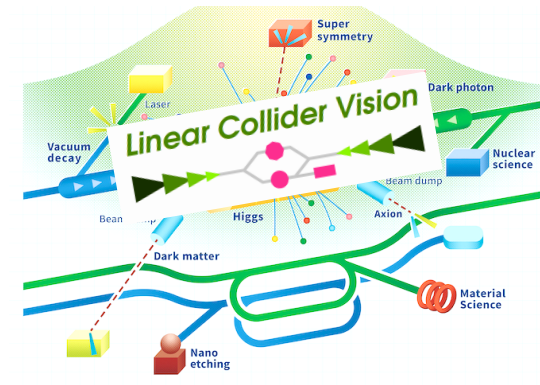


LC Vision Update

Jenny List
ILD Workshop
Sep 16 2026

- What's going on in
 - LCVision
 - IDT
 - LCF380
- LCWS
- Opportunities for ILD
[in full understanding that ILD's main focus has to be on FCC-ee now]



LCVision Update (1)

The bottom-up LC community organisation

- 7-9 January 2026: 2nd LC@CERN Workshop

- <https://indico.cern.ch/e/lcf2026>

- 221 registered participants, about 80 in person

- Relevant for detectors:

- Dual BDS design => at some point might ask ILD for feed-back
- Upgrade options e.g. à la HALHF, ERL-based, photon-photon etc will have detector implications
- Still many interesting physics potential studies open, e.g. high(er) ECM, ERL-like lumi, photon-photon, ...

- Workshop Statement recognising that FCC-ee has been chosen as the strongly preferred flagship project for CERN, but also pointing out that the ESG recommendations acknowledge that LC are technically mature and competitive if high enough energy:

“In December 2025, the European Strategy Group (ESG) published recommendations expressing a strong preference for FCC-ee as the next flagship project. The ESG recognized that linear colliders are technologically mature and offer programmes in Higgs and top-quark physics that are competitive to FCC-ee when operated at two energy stages and up to 550 GeV centre-of-mass energy.”

[full text: https://indico.cern.ch/event/1602105/attachments/3198205/5693101/LCatCERN_statement_final.pdf]

**Fully understood that ILD
needs to focus on FCC-ee**



Physics & Detectors

Machine-Detector-Interface

- **Two IRs**

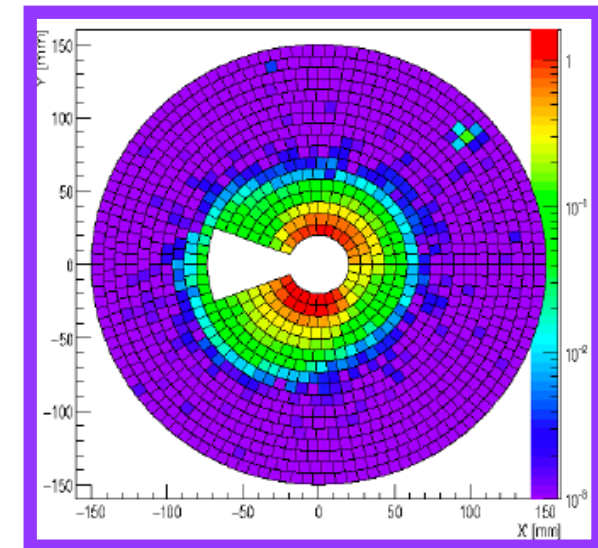
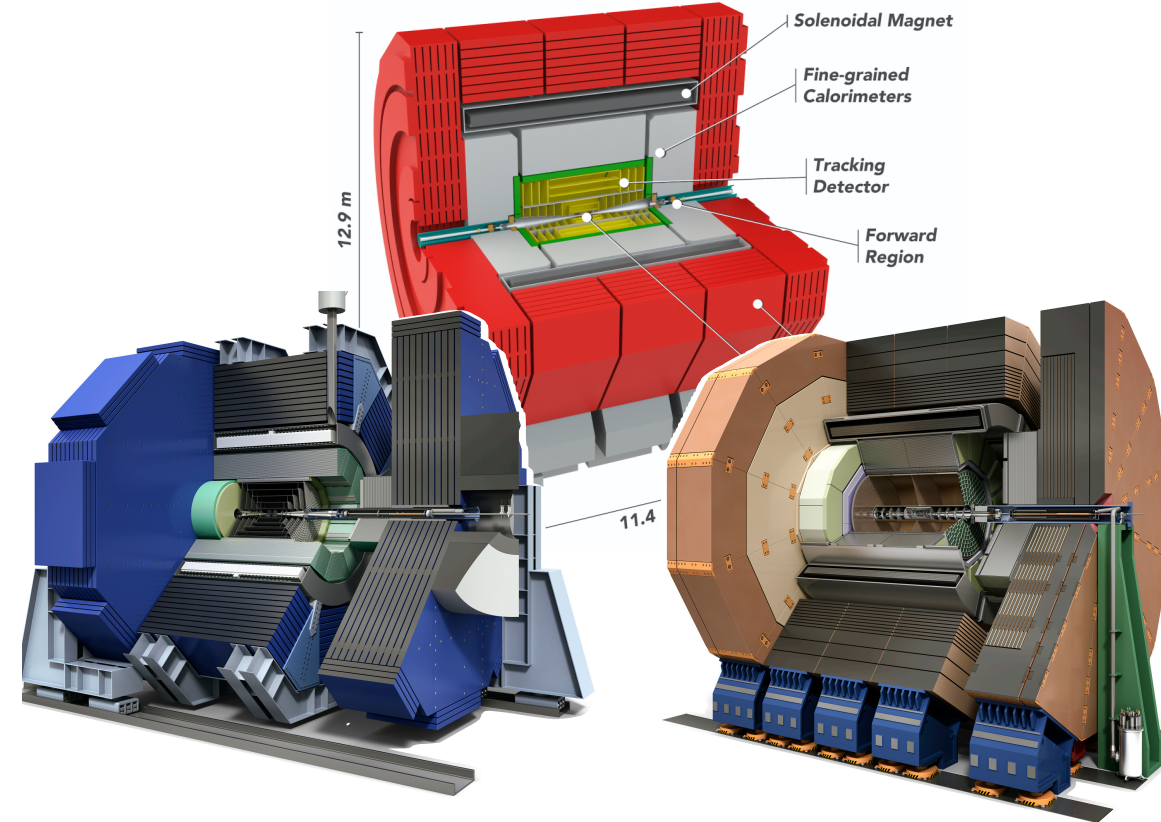
- no push-pull
- 2-BDS optics needs to be re-designed
- detector hall & infrastructure re-design

- **Intimate connection with detector design**

- choice of crossing angle(s)
- choice of L^* (focal length of final quadrupole)
- re-design of beam pipe / forward / inner detectors
- (anti-)DID, anti-solenoid, ...
- backgrounds / occupancies (pairs, neutrons from dump, halo muons, ...)

- **... and with measurement of high-level beam parameters**

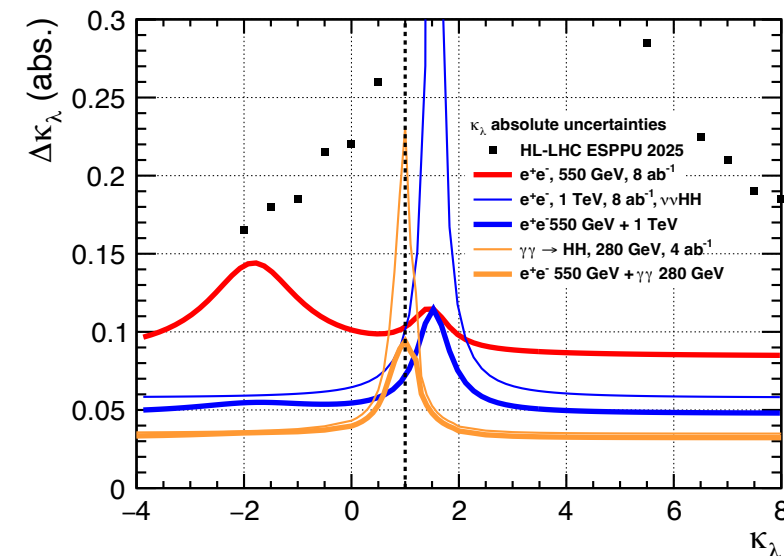
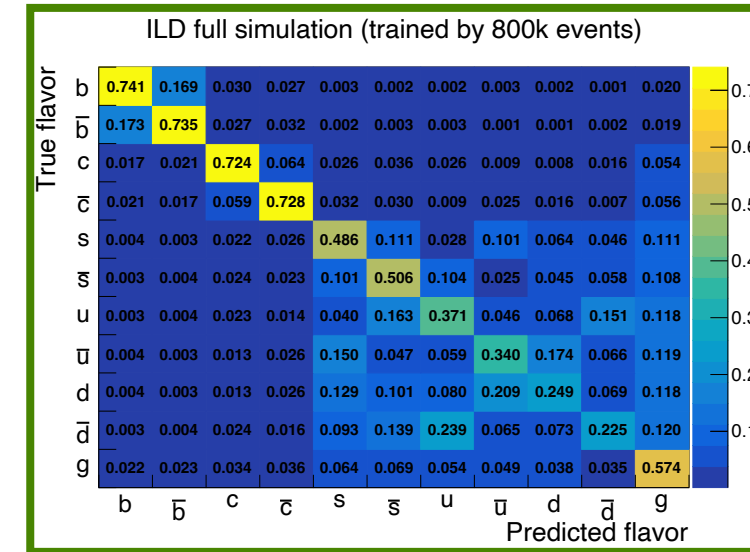
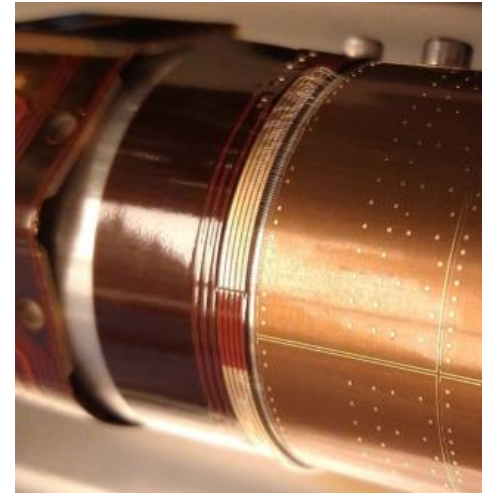
- Luminosity / beam energy / polarisation



Physics & Detectors

beyond MDI

- Should also use the next two years to
 - modernize the classic LC detector concepts
 - or even come up with completely new ones?
 - re-visit physics performance with modern analysis tools
 - do a comprehensive set of physics studies at **550 GeV** and **higher energies**
 - understand better the physics potential and detector implications of
 - **gamma-gamma**
 - or any of the other upgrade ideas
 - develop more concrete design for beyond collider experiments



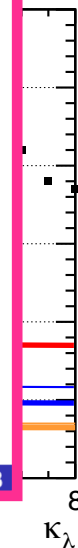
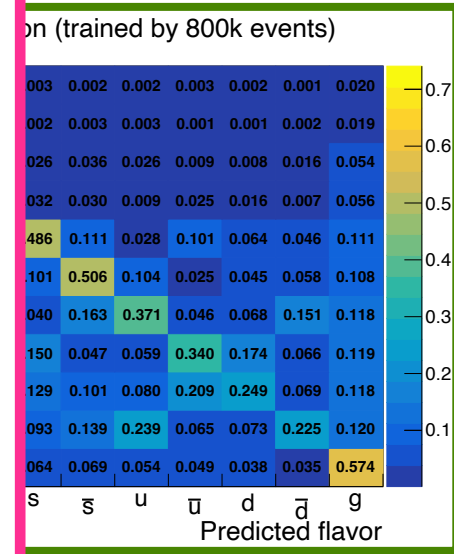
Physics & Detectors

beyond MDI

- **Should also use t**
 - modernize the c
 - or even come u
 - **re-visit physics**
 - do a comprehen
 - **higher energie**
 - understand bet
 - implications of
 - **gamma-gar**
 - or any of the
 - develop more c
 - experiments

Organizing Themes in the LC Vision Context

- 1 **Expanding capabilities and physics-performance/cost of a LC facility.** Higher/lower energy, higher lumi, better/worse collision conditions (ECM spread, backgrounds, overlay). Higher polarization. Positron polarization. Alternative beams. Beyond collider modes. *Need to understand the realistic capabilities of the more novel accelerator approaches (ERL, plasma), detector consequences, and physics studies to highlight.*
- 2 **Advancing the understanding and mitigation of experimental effects that limit the physics capabilities.** Better detector designs & algorithms, strategies for controlling systematic uncertainties. *Also understanding impact of various accelerator approaches on detector designs (eg. backgrounds).*
- 3 **Highlighting specific physics case scenarios.** Priority on those that demonstrate the LC advantage over current and future competitors including FCC-ee, FCC-hh, and muon collider. This includes both broadening, but also better identifying relevant physics case scenarios.
- 4 **Advancing further with current flagship studies.** Examples: ZHH, $\nu\nu$ HH, $\gamma\gamma \rightarrow$ HH.
- 5 **Are EFTs really helpful in comprehending the physics potential?.** They basically concretize the assumption that there are no new particles to be directly produced. *Needs to be explained much better so that we all understand what has value/deserves more scrutiny/improvement.*



LCVision Update (2)

The bottom-up LC community organisation

- The LCVision ``long document'' report (i.e. back-up document for ESPPU) has been published in EPJ-ST:
 - *Eur.Phys.J.ST* 235 (2026) 6, 1641-1796 • e-Print: [2503.19983](#) [hep-ex]
 - **Many thanks for all the important contributions from ILD members!**
- Continuing
 - Weekly meetings of the LCVision Editorial Board
(E.Adli, M.Ishino, P.Koppenburg, B.List, JL, T.Nakada, R.Poeschl, A.Robson, S.Stapnes, C.Vernieri)
 - Bi-weekly meeting of the LCVision Coordination Group & IDT-WG3
 - With all the LCVision author teams & the LC@CERN workshop conveners as guests
 - Central point of exchange in the LC community, incl. all technologies / collider ideas
- HALHF is finalising its ``pre-CDR'', input to next CERN-DESY directorates meeting Oct 1/2
- Better understanding some key ESG plots....

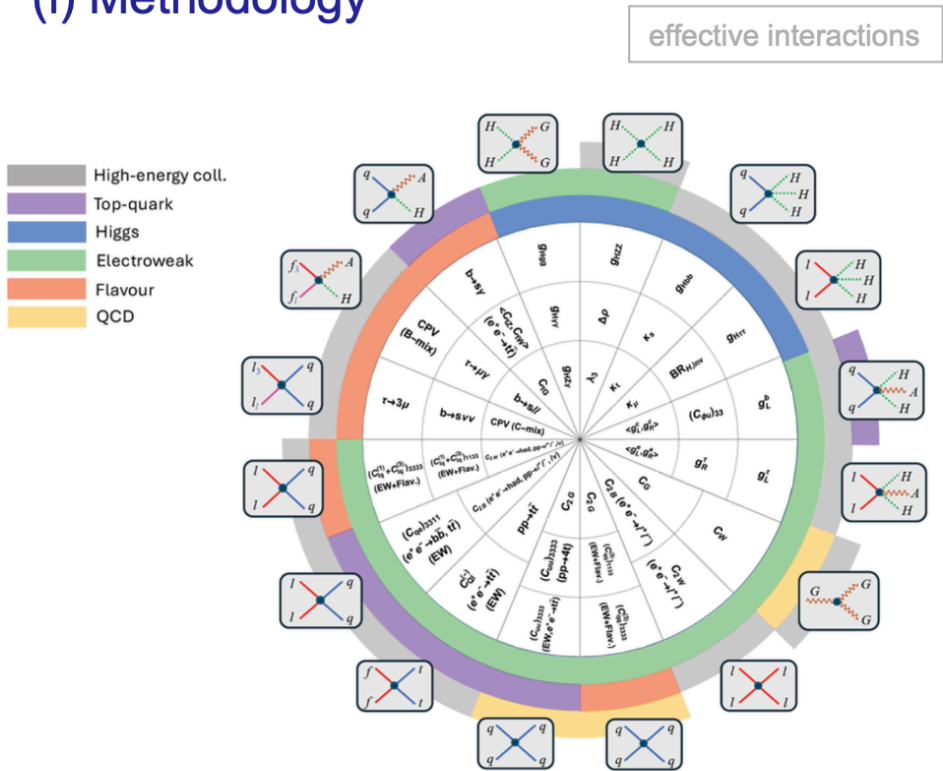
**Scientific discussion / understanding
≠ disputing ESG decision**

Interlude: an optical deception experiment

Don't trust your eyes without asking your brain :)

Coverage of the Physics Landscape

(i) Methodology*



*Thanks to Jorge de Blas, Monica Dunford and Gino Isidori (ESG WG 2b)

- Slice physics landscape in 16 different sectors (adequate representation of the effective interactions among SM fields where new physics can show up)
- Sensitive to: Higgs, el.weak, top, flavour, QCD, high-energy observables
- Each sector is subdivided in 2 or 3 rings with increasing measurement challenges
- Examples:
 - Higgs-only operators ($HZZ, \Delta\rho, \lambda_3$)
 - Quark Yukawa (Y_b, Y_s, Y_t)
 - Tri-linear gauge operators (el.weak, GGG)
 - 4-lepton ops. (W parameter, Y parameter)
- Compare potential of each collider for all sectors/rings
- HL-LHC performance is used as reference
- **Improvement factors** in precision w.r.t. HL-LHC are evaluated and mapped on a log-scale covering the range 1 to 5

HL-LHC: 1 (gray scale 1 = black)
Best collider: 5 (gray scale 5 = white)

K.Jakobs, ESPP update at pECFA July

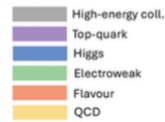
White = good, black = bad

Interlude: an optical deception experiment

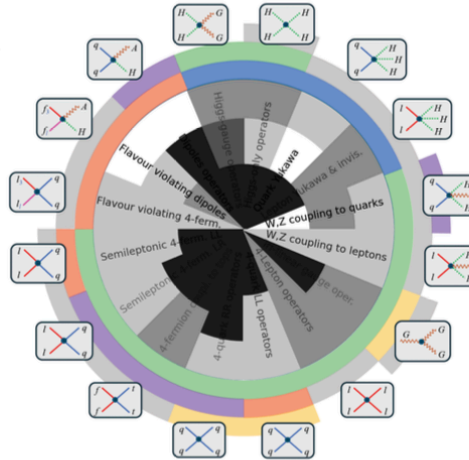
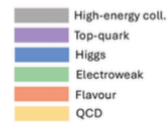
Don't trust your eyes without asking your brain :)

Coverage of first-stage e^+e^- colliders

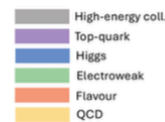
FCCee



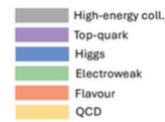
LEP3



LCF250



LCF550



K.Jakobs, ESPP update at pECFA July

White = good,
black = bad

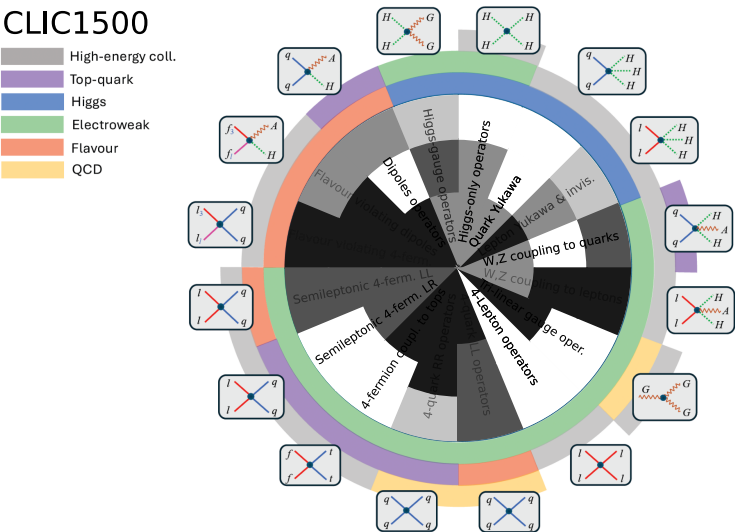
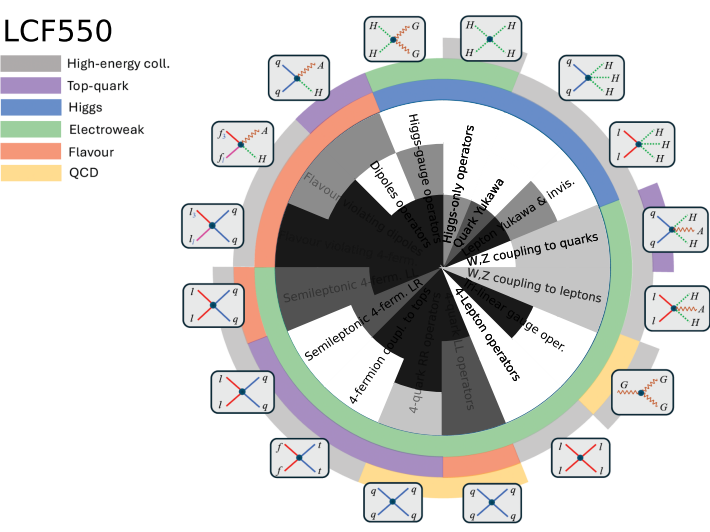
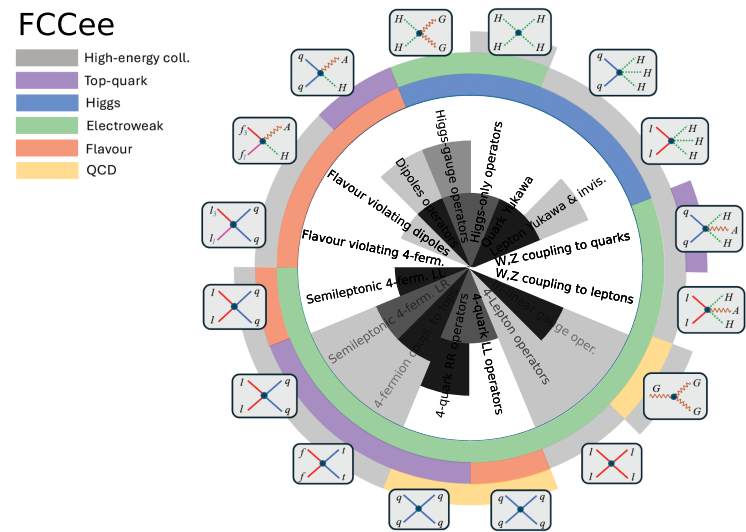
=> FCC-ee has much more white than anybody else, in all physics sectors, right?

=> didn't we always say they give comparable performance for Higgs, top, EW, And only the b-physics at the Z pole is unique to FC-ee?

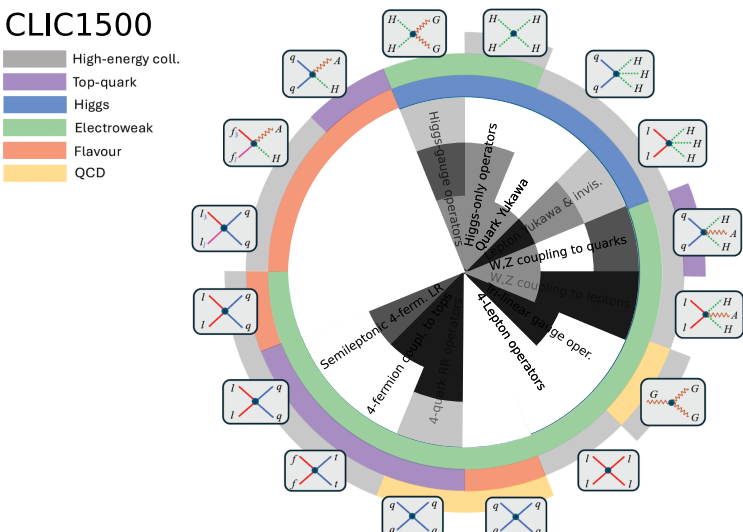
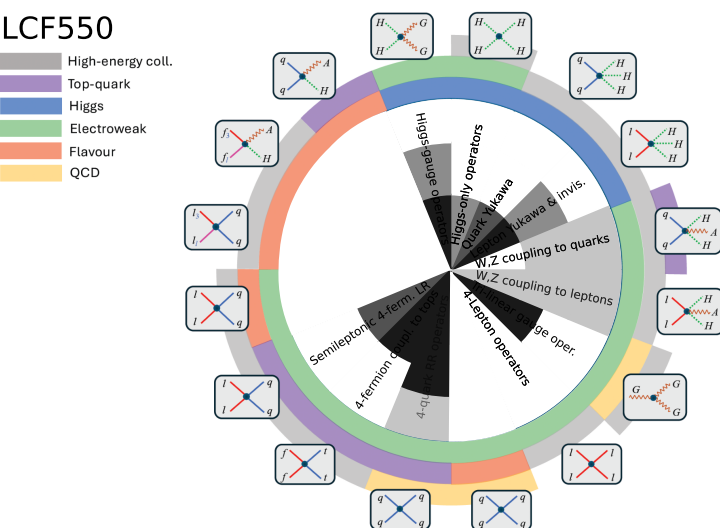
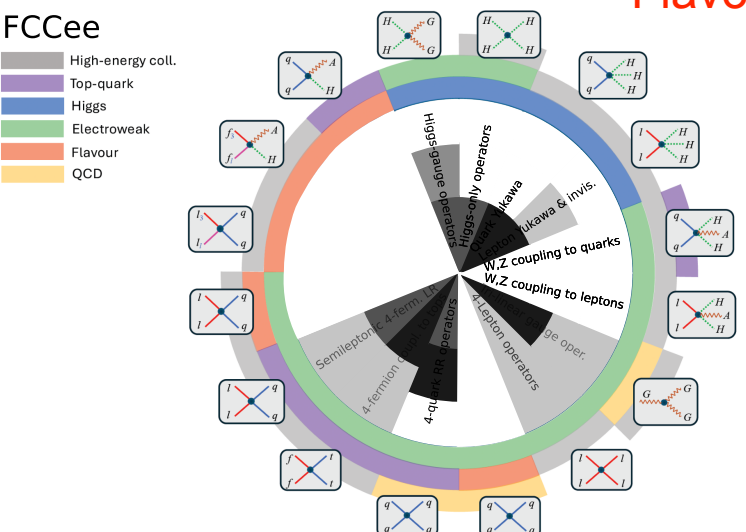
Interlude: an optical deception experiment

Don't trust your eyes without asking your brain :)

Originals:



Flavour observables blanked out:

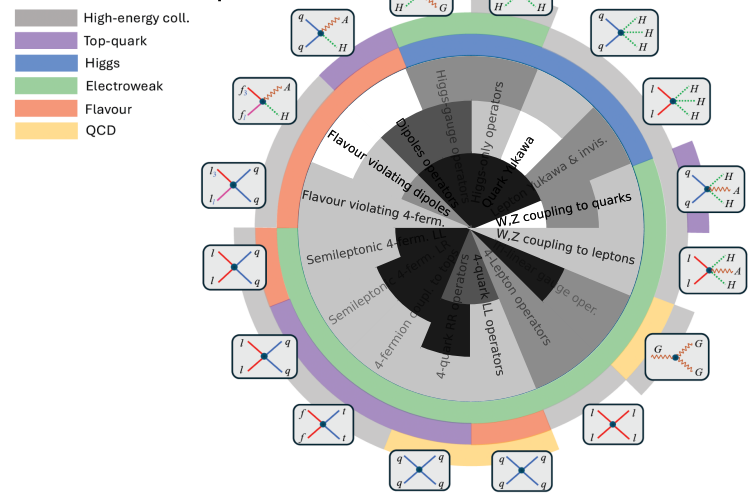


Interlude: an optical deception experiment

Don't trust your eyes without asking your brain :)

Originals:

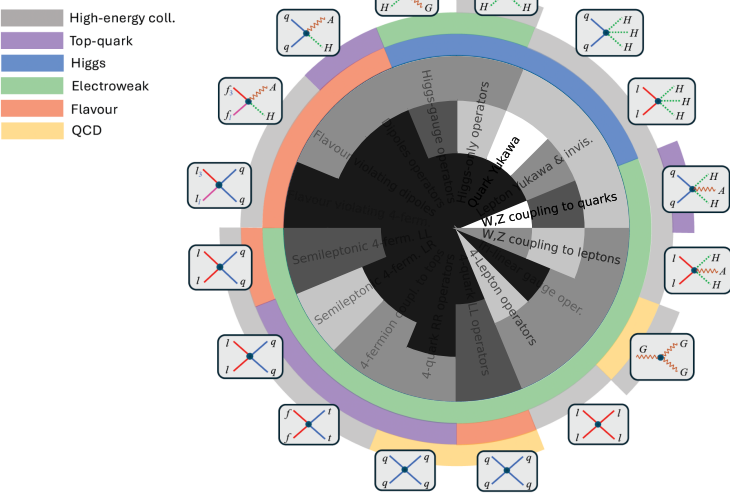
FCCee-descope



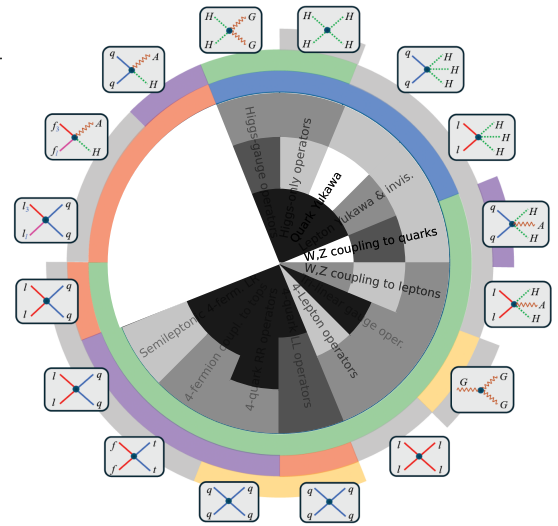
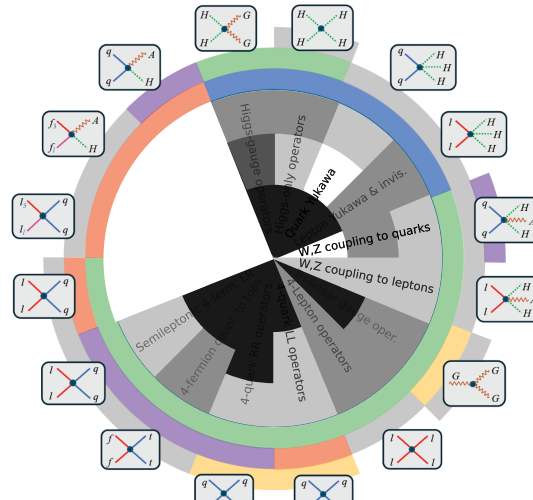
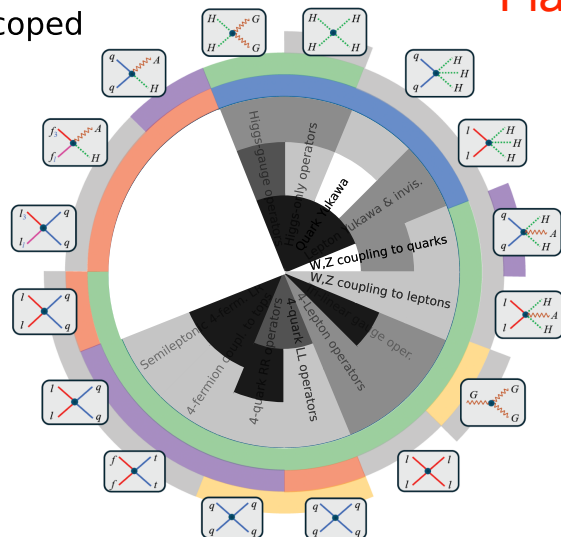
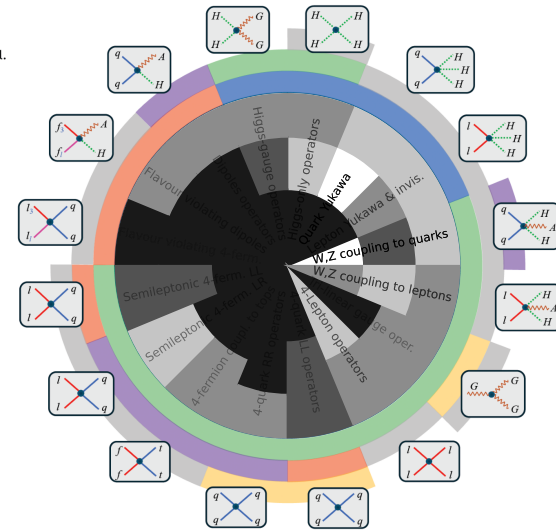
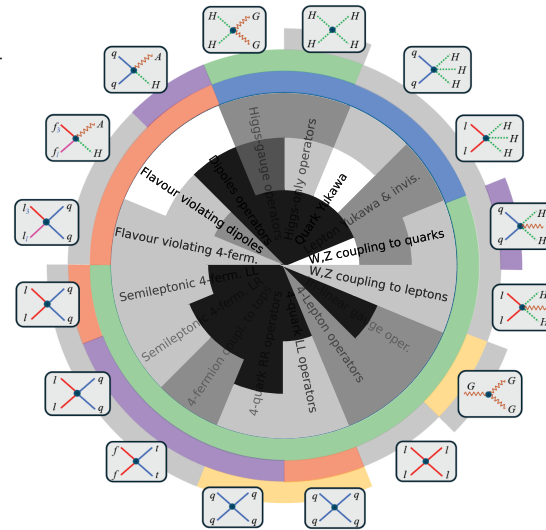
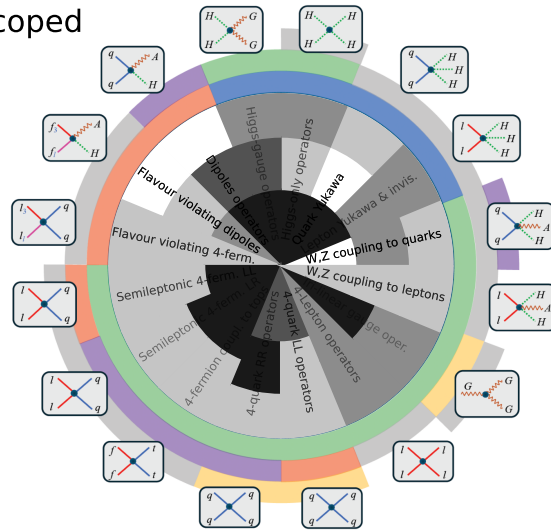
LEP3



LCF250



Originals:



Flavour observables blanked out:

ILC International Development Team

The ICFA-mandated organisation

- IDT mandated by ICFA to work towards realising the ILC in Japan, reports regularly to ICFA
- ILC Technology Network installed as “pre-lab ligh” (= high-priority work packages of ILC pre-lab proposal) => ITN currently agreed & funded until spring 2028
- In August: ICFA mandated the IDT-EB to workout a proposal for a successor organisation for the IDT, with a wider scope, not restricted to ILC in Japan
- Aim to present this to ICFA in early November
- Establish new organisation next year?

ILC International Development Team

The ICFA-mandated organisation

- IDT mandated by ICFA to work towards realising the ILC in Japan, reports regularly to ICFA
- ILC Technology Network installed as “pre-lab ligh” (= high-priority work packages of ILC pre-lab proposal) => ITN currently agreed & funded until spring 2028
- In August: ICFA mandated the IDT-EB to workout a proposal for a successor organisation for the IDT, with a wider scope, not restricted to ILC in Japan
- Aim to present this to ICFA in early November
- Establish new organisation next year?

Why at all in times of FCC-ee?

Advanced accelerator R&D is continuing, other fields are making use of new technologies (ESRF: C3, DESY: LWA, ...)

=> Need think-tank on how collider-based particle physics could profit from advanced accelerators, and make sure the relevant R&D is covered



Invitation to LCWS2026

November 9-13 at KEK

- <https://agenda.linearcollider.org/event/11000/>
- > 120 abstracts submitted
- > 100 registrants
- Early registration deadline Oct 4



FCC-ee Option Analysis: LCF380 & LEP3

Towards a new CERN Flagship Collider

- M.Thomson, FCC week Helsinki:

What about other ideas?

Following the European Strategy for Particle Physics Update, FCC-ee is CERN's sole vision for the next flagship collider project – **the case is clear**

- In the coming few years we will focus on this goal – **our aim is the successful realization of FCC-ee**

In making the case for FCC-ee, we will need to present an “options analysis”

- This is *required* by some CERN Member States – and is a normal part of an investment decision process
- In the update of the ESPP, the scientific assessment of options has been done already – **the answer is clear: FCC-ee then descope FCC-ee**
- To support the decision-making process on FCC-ee, CERN will coordinate the preparation of documentation (for LEP3 and one LC concept) on technical readiness, cost, risks, future R&D needs **and the scientific and strategic reasons why these are not identified as CERN's future flagship project**



Mark Thomson | FCC Week 2026 | Welcome and Introduction

8 June 2026

22

**Hot-off-the-press, post-presentation news
change of mandate: 380 GeV => 250 GeV**

- => CERN mandated a study each on LEP3 and LCF380
- required by some CERN member states as part of FCC-ee decision process
- LCF380 chaired by A. Lombardi
- Budget in MTP (sum for 2026-2028): 1.5MCHF material and staff 5.1 FTEy

Focus on

- dual-BDS
- CFS
- Cost
- Risk

Continuous review schedule
& report by end of 2027



Summary

and outlook

- The LC community acknowledges that FCC-ee is the strongly preferred choice for the future of CERN, and that ILD needs to focus on FCC-ee
- LCs however remain a technologically mature and financially stageable option
 - To study Higgs, top and EW if FCC-ee would turn out to not be financially feasible
 - To bring advanced accelerator R&D to use in colliders
 - To react on surprises from HL-LHC - and/or direct / indirect detection experiments
- ICFA is discussing a successor organisation for the ILC IDT
- LCWS2026 Nov 9-13 at KEK, right after ICFA seminar
- CERN has set up an LCF study (as part of an FCC-ee option analysis)
- LCVision remains the bottom-up, community driven forum

