

Status of the European Strategy for Particle Physics: Higgs Factories

Anadi Canepa

HFCC monthly meeting

Nov 6 2025

European Strategy

The European Strategy for Particle Physics is the cornerstone of Europe's strategy-setting process for the long-term future of the field.

Mandated by the CERN Council, the Strategy takes into account results from the LHC and other facilities in the world, the international physics landscape and developments in related fields with the aim to maximize scientific returns.

"The aim of the Strategy update should be to develop a **visionary and concrete plan** that greatly advances human knowledge in fundamental physics through the realization of the **next flagship project at CERN**. This plan should attract and value **international collaboration** and should allow Europe to continue to play a leading role in the field."

[Link to the portal](#)

Organization: Secretariat

Secretariat's role is to

- Establish a detailed plan, to be approved by the CERN Council
- Prepare the work of the ESG and the Physics Preparatory Group (PPG) (see following slides)

STRATEGY SECRETARIAT	
Strategy Secretary (Chair)	Prof. Karl Jakobs
SPC Chair	Dr Hugh Montgomery
LDG Chair	Prof. Mike Seidel
ECFA Chair	Prof. Paris Sphicas

[Link to CERN Scientific Committees](#)

Organization: Particle Physics Preparatory Group

The remit is to prepare the scientific contribution to the work of the ESG (the "Briefing Book"), based on the input it gathers from the community

- The definition of sub-topics and benchmarks
- Review of the submitted white papers
- Organization of community meetings where appropriate
- Consultation with proponents of experiments and projects
- Convenership of the Symposium
- Editing the Physics Briefing Book

PPG MEMBERS	
Strategy Secretariat	
Scientific Secretary (Chair)	Prof. Karl Jakobs (DE)
SPC Chair	Dr Hugh Montgomery (USA)
ECFA Chair	Prof. Pareskevas Sphicas(GR)
LDG Chair	Prof. Mike Seidel (CH)
SPC	
Prof. Pilar Hernandez (ES)	
Prof. Gino Isidori (CH)	
Prof. Fabio Maltoni (BE/IT)	
Prof. Jocelyn Monroe (UK)	
ECFA	
Dr Tommaso Boccali (IT)	
Dr Thomas Bergauer (AT)	
Dr Cristinel Diaconu (FR)	
Prof. Monica Dunford (DE)	
CERN	
Dr Gianluigi Arduini (CERN)	
ASIA/AMERICAS	
Dr Anadi Canepa (USA)	
Prof. Xinchou Lou (China)	
Prof. Rogerio Rosenfeld (Brazil)	
Prof. Yuji Yamazaki (Japan)	



Organization: PPG Working Groups

The Strategy Secretariat proposed 9 PPG working groups to cover the full range of physics topics as well as the technology areas of accelerators, detector technologies and computing.

Each group has two co-conveners and an early-career researcher acts as scientific secretary.

Working Group	Co-convener (PPG member)	Co-convener	Scientific Secretary
Electroweak physics	Monica Dunford (DE, exp)	Jorge de Blas (ES, theory)	Emanuele Bagnaschi (IT)
Strong interactions	Cristinel Diaconu (FR, exp)	Andrea Dainese (IT, exp, HI)	Chiara Signorile-Signorile (DE)
Flavour physics	Gino Isidori (CH, theory)	Marie-Hélène Schune (FR, exp)	Maria Piscopo (NL)
BSM physics	Fabio Maltoni (BE/IT, theory)	Rebeca Gonzalez Suarez (SE, exp)	Benedikt Maier (UK)
Neutrino physics and cosmic messengers	Pilar Hernandez (ES, theory)	Sara Bolognesi (FR, exp)	Ivan Esteban (ES)
Dark matter and dark sector	Jocelyn Monroe (UK, exp)	Matthew McCullough (CERN, theory)	Yohei Ema (CERN)
Accelerator science and technology	Gianluigi Arduini (CERN, acc)	Phil Burrows (UK, exp, acc)	Jacqueline Keintzel (CERN)
Detector instrumentation	Thomas Bergauer (AT, exp)	Ulrich Husemann (DE, exp)	Dorothea vom Bruch (FR)
Computing	Tommaso Boccali (IT, exp, comp)	Borut Kersevan (SL, exp, comp)	Daniel Thomas Murnane (DK)

Full composition of the PPG can be found [here](#)

Organization: European Strategy Group (ESG)

Member States	
Austria	Prof. Jochen Schieck
Belgium	Prof. Pierre Van Mechelen
Bulgaria	Prof. Venelin Kozuharov
Czech Republic	Prof. Rupert Leitner
Denmark	Prof. Jens-Jørgen Gaardhøje
Estonia	Prof. Martti Raidal
Finland	Prof. Katri Huitu
France	Dr Christelle Roy
Germany	Prof. Klaus Desch
Greece	Prof. Panagiotis Kokkas
Hungary	Prof. Dezső Varga
Israel	Prof. Marek Karliner
Italy	Prof. Antonio Zoccoli
Netherlands	Prof. Eric Laenen
Norway	Prof. Heidi Sandaker
Poland	Prof. Tadeusz Lesiak
Portugal	Prof. Mário Pimenta
Romania	Dr Calin Alexa
Serbia	Dr Lidija Zivkovic
Slovakia	Dr Marek Bombara
Spain	Dr Maria Jose Costa
Sweden	Prof. Richard Brenner
Switzerland	Prof. Ben Kilminster
United Kingdom	Prof. Mark Lancaster

CERN Director-General	Dr Fabiola Gianotti
CERN Director-General Designate	Prof. Mark Thomson

Major European National Labs	
CIEMAT	Dr Nicanor Colino
DESY	Prof. Beate Heinemann
IJCLab	Prof. Achille Stocchi
IRFU	Prof. Franck Sabatié
LNF	Dr Sandra Malvezzi
LNGS	Prof. Ezio Previtali
NIKHEF	Prof. Jorgen D'Hondt
PSI	Prof. Klaus Kirch
STFC-RAL	Prof. Sinead Farrington
STFC-Daresbury Lab.	Prof. Jim Clarke

Strategy Secretariat Members	
Strategy Secretary (ESG Chair)	Prof. Karl Jakobs
SPC Chair	Dr Hugh Montgomery
LDG Chair	Prof. Mike Seidel
ECFA Chair	Prof. Paris Sphicas

ESG INVITEES

President of the CERN Council	Prof. Costas Fountas
Associate Member States in the pre-stage to Membership	
Cyprus	Prof. Panos Razis
Slovenia	Prof. Borut Paul Kerševan
Associate Member States	
Brazil	Prof. Leandro Salazar de Paula
Croatia	Dr Budimir Kliček
India	tbc
Latvia	Ms Antra Gaile
Lithuania	Dr Andrius Juodagalvis
Pakistan	Dr Masood Iqbal/Dr Zafar Yasin
Türkiye	tbc
Ukraine	Prof. Borys Grynyov
Observer States	
Japan	Dr Kazunori Hanagaki
United States of America	Prof. Michael Tuts 
Organisations with Observer status	
European Commission	Ms Patricia Postigo McLaughlin
Other invitees	
Chair APPEC	Dr Carlos Peña Garay
Chair NuPECC	Prof. Eberhard Widmann
Chair ESFRI	Prof. José Luis Martínez
Other members of the PPG (in addition to the Strategy Secretariat)	

Full ESG composition can be found [here](#)

Remit for ESG

Input to ESG deliberations

- The input of the particle physics community, 2020 Strategy update, results from the LHC, progress in the construction of the HL-LHC, Future Circular Collider Feasibility Study

Deliverables

- **preferred option for the next collider at CERN and prioritised alternative options** to be pursued if the chosen preferred plan turns out not to be feasible or competitive.
- **areas of priority** for exploration **complementary to colliders** and for other experiments to be considered **at CERN and at other laboratories in Europe, as well as for participation in projects outside Europe**
- review of accelerator, detector and computing R&D, theory sustainability of accelerator-based particle physics, strategy and initiatives to attract, train and retain the young generations, public engagement and outreach

Input from the community

Four sets of questions developed by the ECFA chair to be addressed in the national inputs.

Themes of the questions:

1. Preferred next major/flagship collider at CERN
2. Should CERN/Europe proceed with the preferred option if Japan proceeds with ILC, China with CEPC, US with the Muon Collider
3. What is the prioritized list of alternative options if the preferred option is not feasible

Link to the guidance is [here](#)

National inputs to the ESPP update could be sent at different points in time:
By 31 March 2025, By 26 May 2025 so it could be analyzed by the ESG in time for the Open Symposium, **by 14 November 2025 for input to be considered by the ESG at its Drafting Session**

23-27
JUNE
2025

European Strategy
for Particle Physics

OPEN SYMPOSIUM
European Strategy
for Particle Physics

2026 UPDATE

A community-wide event
inviting participants to debate
the future orientation
of European particle physics.

PHYSICS PREPARATORY GROUP		LOCAL ORGANIZING COMMITTEE	
Karl Jakobs (chair)	Xinchou Lou	Sandra Malvezzi (chair)	Mauro Morandin
Gianluigi Arduini	Fabio Maltoni	Manuela Allegrì	Aleandro Nisati
Thomas Bergauer	Jocelyn Monroe	Cecilia Borca	Stefania Pasquato
Tommaso Boccali	Hugh Montgomery	Roberto Carlin	Giuseppina Salente
Anadi Canepa	Rogério Rosenfeld	Alessia Capitani	Roberto Tenchini
Cristinel Diaconu	Mike Seidel	Francesca Ciuchchio	Antonella Varaschin
Monica Dunford	Pareskevas Sphicas	Marco Ciuchini	Roberto Giacomelli
Pilar Hernandez	Yuji Yamazaki	Roberto Giacometti	Michele Michelotto
Gino Isidori		Michele Michelotto	Mauro Mezzetto

Lido di Venezia
Lungomare G. Marconi, 1861

ESG Working Groups

ESG is structured in 7 WGs

- WG1 - National inputs (*from US, Anadi Canepa*)
- WG2a - Project assessment (*from US, Mike Tuts*)
- WG2b - Physics Potential (*from US, Anadi Canepa*)
- WG3 - Strategy Implementation
- WG4 - Relations with other fields of physics
- WG5 - Sustainability
- WG6 - Public Engagement, education, communication + social and career aspects
- WG7 - Knowledge and technology transfer

Links to:
benchmark measurements and processes
standardised set of technical data

Review of large projects

A number of proposals for **large-scale research projects (capital investment of at least 250 MCHF)** – including, but not limited to, particle colliders and collider detectors – have been submitted. These proposals vary in scale, anticipated timeline, and technical maturity.

Analysis of physics potential by PPG:

- Defined benchmark measurements and processes

Analysis of projects' feasibility by ESG:

- Studies of delivery steps and challenges associated with delivery
- Assessment of how each project could fit into the wider roadmap for European particle physics.
- Defined standardized set of technical data

Timeline for the update of the European Strategy for Particle Physics

Council appointment of the members of the PPG and decision on the venue for the **Open Symposium**

Deadline for the submission of main input from the community

Open - Symposium

Deadline for the submission of final national input in advance of the **ESG Strategy Drafting Session**

Submission of the draft strategy document to the Council

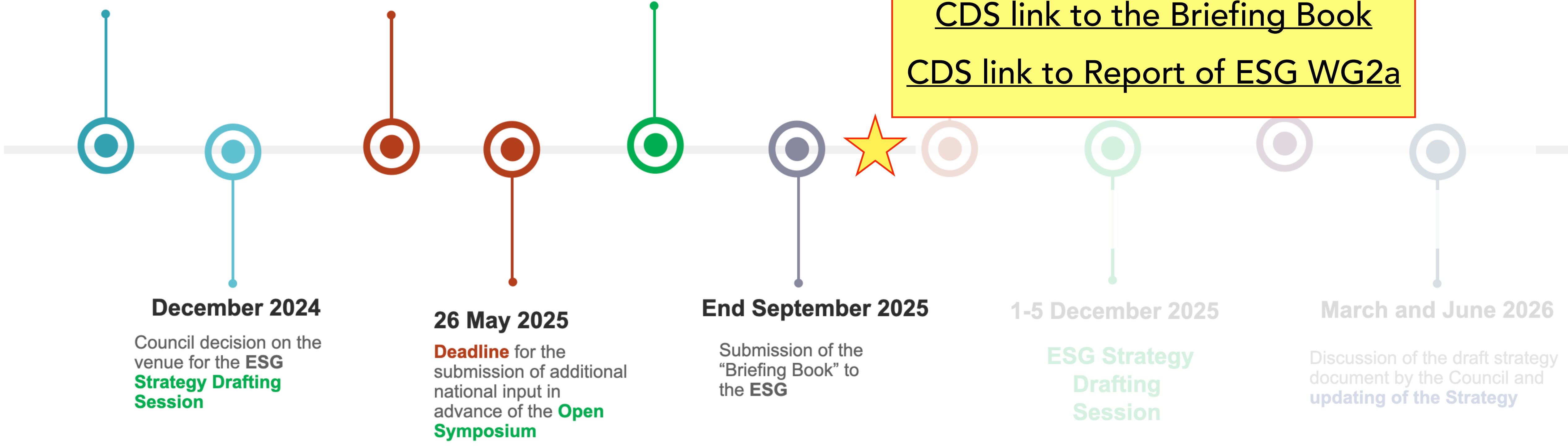
End September 2024

31 March 2025

23-27 June 2025

14 November 2025

End January 2026



CDS link to the Briefing Book
CDS link to Report of ESG WG2a

December 2024
 Council decision on the venue for the **ESG Strategy Drafting Session**

26 May 2025
Deadline for the submission of additional national input in advance of the **Open Symposium**

End September 2025
 Submission of the "Briefing Book" to the ESG

1-5 December 2025
ESG Strategy Drafting Session

March and June 2026
 Discussion of the draft strategy document by the Council and updating of the **Strategy**

Proposed Higgs Factories at CERN - 2045 timescale

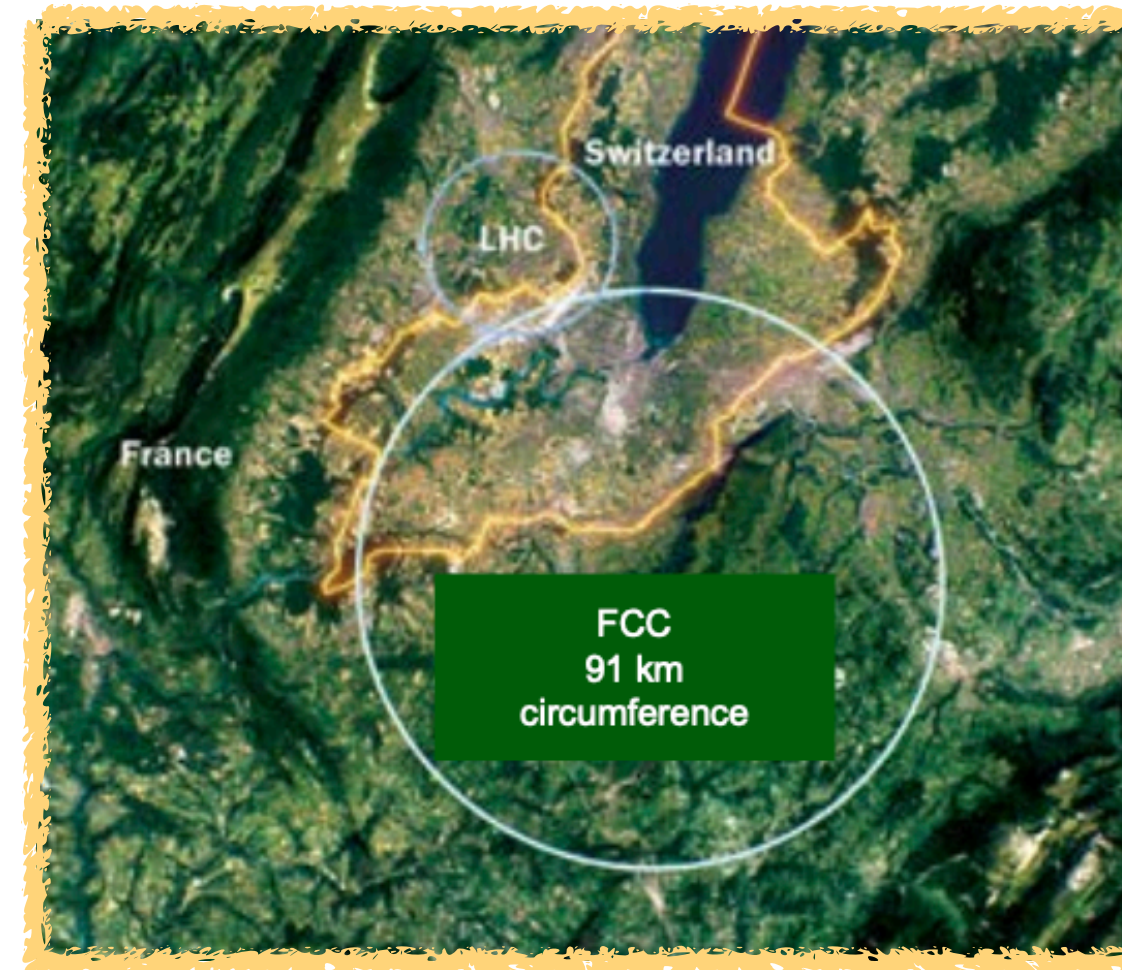
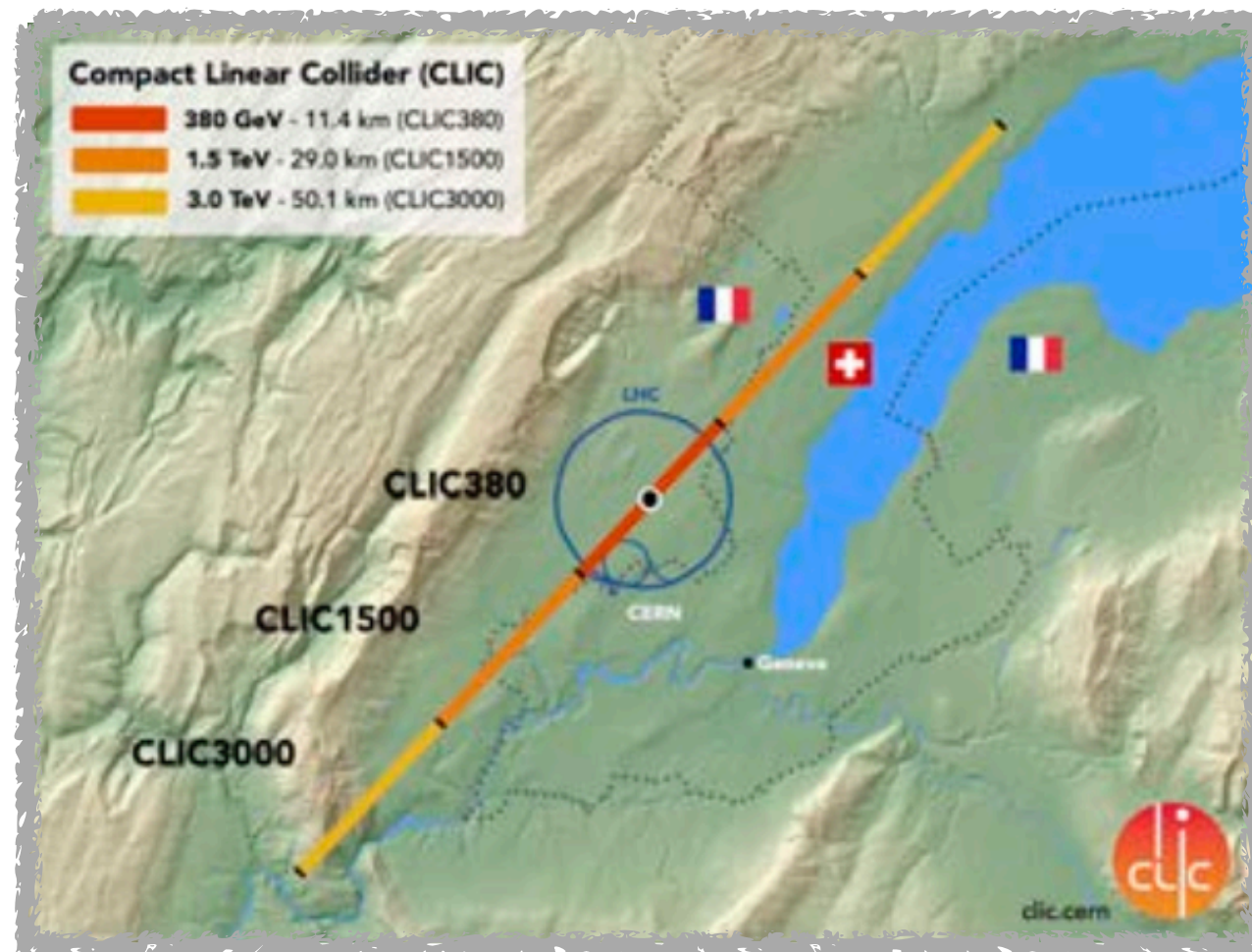
	CLIC			FCC-ee				FCC-hh	LCF				LEP3		
	e ⁺ /e ⁻			e ⁺ /e ⁻				p/p	LP	FP			e ⁺ /e ⁻		
Particles colliding [-]	e ⁺ /e ⁻			e ⁺ /e ⁻				p/p	e ⁺ /e ⁻				e ⁺ /e ⁻		
C.o.m. energy [GeV]	380	550	1500	91.2	160	240	365	84600	250	91.2	250	550	91.2	160	230
Length [km]	12.1	15	29.6	90.7				90.7	33.5				27.6		
#IPs [-]	2	2	1	4				4	2				2		
Peak inst. lumi/IP [10³⁴cm⁻²s⁻¹]	2.2	3.2	3.7	140	20	7.5	1.4	30	1.35	0.28	2.7	3.85	40	6.2	1.6
Peak power consumption [MW]	166	210	287	251	276	297	381	355	143	123	182	322	200	226	250
Cost [BCHF]^a	7.2	+30% ^b	+7.1	15				+19 ^c	8.3	+0.8		+5.5	3.9		

standalone FCC-hh 28.4 BCHF

Overview of the Proposed Higgs Factories at CERN (in BB)

- CLIC
 - Two Beam Acceleration scheme
 - Drive beam loss control and machine protection critical
 - Multiple test facilities to support elements of the design
 - A few CLIC modules with active alignment constructed
 - 1 GeV X-band RF linac available from 2031 (EuPRAXIA)

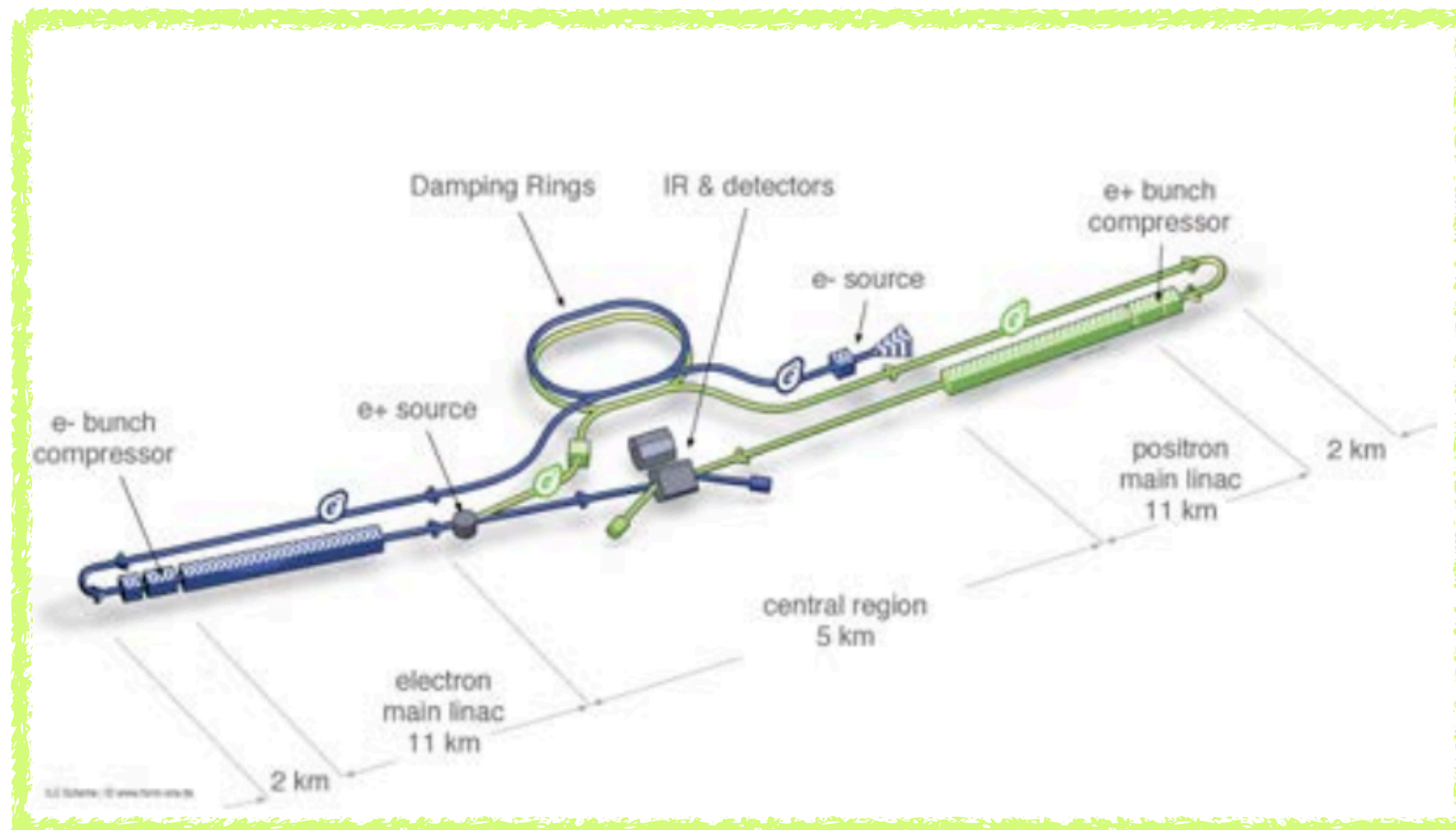
- FCC-ee
 - Collider and booster equipped with SRF systems
 - Flexibility to change between the 3 modes (Z, WW, ZH)
 - Machine protection and collimation systems critical
 - Single-cell bare 400 MHz cavity and 5-cell 800 MHz prototype cavity tested so far
 - Construction of dedicated SRF facility at CERN aiming for demonstration by 2031
 - Proof of principle of critical technologies demonstrated at LEP, SLC, KEKB, PEP-II, SuperKEKB, ++



Overview of the Proposed Higgs Factories at CERN (in BB)

- LCF
 - 2 x ILC repetition rate
 - 2x ILC for gradient and Q_0 (31.5 MVm^{-1} , 2×10^{10})
 - Remaining R&D for positron source
 - Target gradient demonstrated in small production
 - EU-XFEL operates 640 cavities at 70% of LCF gradient

- LEP3
 - Max SR power 50 MW, > RF system than FCC-ee
 - Cannot switch between modes at nominal luminosities
 - No detailed lattice or beam dynamics studies, parameters mainly obtained by scaling from FCC-ee



Assessment of large-scale accelerator projects (ESG WG2a)

1. **Scope** detailed description of goals, objectives, tasks necessary for successful project completion
2. **Technical Readiness Level of major sub-systems** standardized 9-level scale to measure how mature and deployment-ready a technology is, from concept (TRL 1) to fully operational (TRL 9)
3. **R&D** R&D, R&D plan level-of-definition, funding status
4. **Test Facilities** Need of new major test facilities and their scope level-of-definition
5. **Performance uncertainties** 3 ranges of luminosity uncertainty factors
6. **Site preparation**
7. **Schedule**
8. **Cost** 3 ranges of luminosity AACE® (Association for the Advancement of Cost Engineering) International cost estimate classification matrix
9. **Risks**

Cost class	Level of definition	Typical estimating technique	Typical purpose of estimate	Expected accuracy ranges, low (L) and high (H)
Class 5	0/2%	Capacity factored, stochastic, most parametric models, judgement or analogy	Concept screening	L: -20/-50%; H: +30/+100%
Class 4	1/15%	Equipment factored, more parametric models	Study or feasibility	L: -15/-30%; H: +20/+50%
Class 3	10/40%	Semi-detailed unit costs with assembly level line items. Combination of various techniques (detailed, unit-cost, or activity-based; parametric; specific analogy; expert opinion; trend analysis).	Preliminary, budget authorization	L: -10/-20%; H: +10/+30%
Class 2	30/70%	Detailed unit costs. Combination of various techniques (detailed, unit-cost, or activity-based; expert opinion; learning curve).	Control or bid/tender	L: -5/-15%; H: +5/+20%
Class 1	50/100%	Deterministic, most definitive cost estimation.	Check estimate or bid/tender	L: -3/-10%; H: +3/+15%

For each criterion: a set of questions have been addressed by the project's proponents → "traffic light" color code associated to the answers

Summary of the assessment of large-scale accelerator projects at CERN

- FCC-ee

Project	Scope	TRL	R&D	Test facilities	Performance	Site preparation	Schedule	Cost	Risk
FCC-ee 91-365 GeV		4 - 7 / 6.0							

Sub-system	TRL	Comments
Collider and booster	4 - 5	The collider in general has a high TRL score because of the mature technologies generally used. Lower level systems (SRF, photon beam dumps, etc.) show lower TRL scores but are generally lower cost elements as well.
Injectors and transfer lines	7	The injector designs were recently updated and are mature.
Civil engineering	7	Tunnel construction is based on recent experience and risks are well understood and partially carried in the project as actual cost.
Technical infrastructure	6	Apart from conventional infrastructure only the cryoplants are advanced technology. Maybe the liquid metal cooling systems if they are to be used for the dumps are critical. Cryogenics is a core expertise at CERN.
Summary	4 - 7	Cost-weighted average TRL = 6.0.

- LCF

Project	Scope	TRL	R&D	Test facilities	Performance	Site preparation	Schedule	Cost	Risk
LCF 250-550GeV		5 - 7 / 5.5							

Sub-system	TRL	Comments
Collider	5 - 7	The successful construction and several years of operation of EU-XFEL provide a high level of maturity to the SRF technology used in the LCF project. Some aspects of the design have not been proven at EU-XFEL or elsewhere, neither an operating gradient of 31.5MV/m nor a $Q_0=2 \times 10^{10}$ and in particular not a combination of the two. A lower TRL score applies for sub-systems like the modulator suitable for tunnel installation, the main beam dumps and the positron source.
Injectors and transfer lines	5	
Civil engineering	5	The design of the tunnel (smaller width with respect to ILC) will have to be validated with integration, shielding and safety studies.
Technical infrastructure	5	Same as above.
Summary	5 - 7	Cost-weighted average TRL = 5.5 (250 GeV - LP).

Summary of the assessment of large-scale accelerator projects at CERN

- CLIC

Project	Scope	TRL	R&D	Test facilities	Performance	Site preparation	Schedule	Cost	Risk
CLIC 380GeV 1.5TeV		4 - 6 / 5.2							

- LEP3

Project	Scope	TRL	R&D	Test facilities	Performance	Site preparation	Schedule	Cost	Risk
LEP3 91-230GeV		3 - 6 / 4.0							

LEP3

Scope pre-conceptual study

Technical readiness Level of major sub-systems HTS magnets

R&D HST magnets, 800 MHz SRF, vacuum chamber; lattice, full scale simulation; funding is unclear

Performance uncertainties due to lack of detailed lattice design and full scale simulation

Site preparation main uncertainty related to the location of the injectors and transfer lines

Schedule WBS is missing

Cost HTS magnets, civil engineering, disposal and storage of LHC, cryogenics

Risk formal plan not in place

High Energy Colliders

- Deepest questions remain unanswered
- Answering these demands tools beyond today's accelerators
- A future path with a Higgs factory, followed by a collider at the energy frontier will allow us to stress-test the Standard Model to a breaking point, and to explore entirely new territory
- By committing to this path, we can ensure that the coming decades of particle physics are as revolutionary as the last

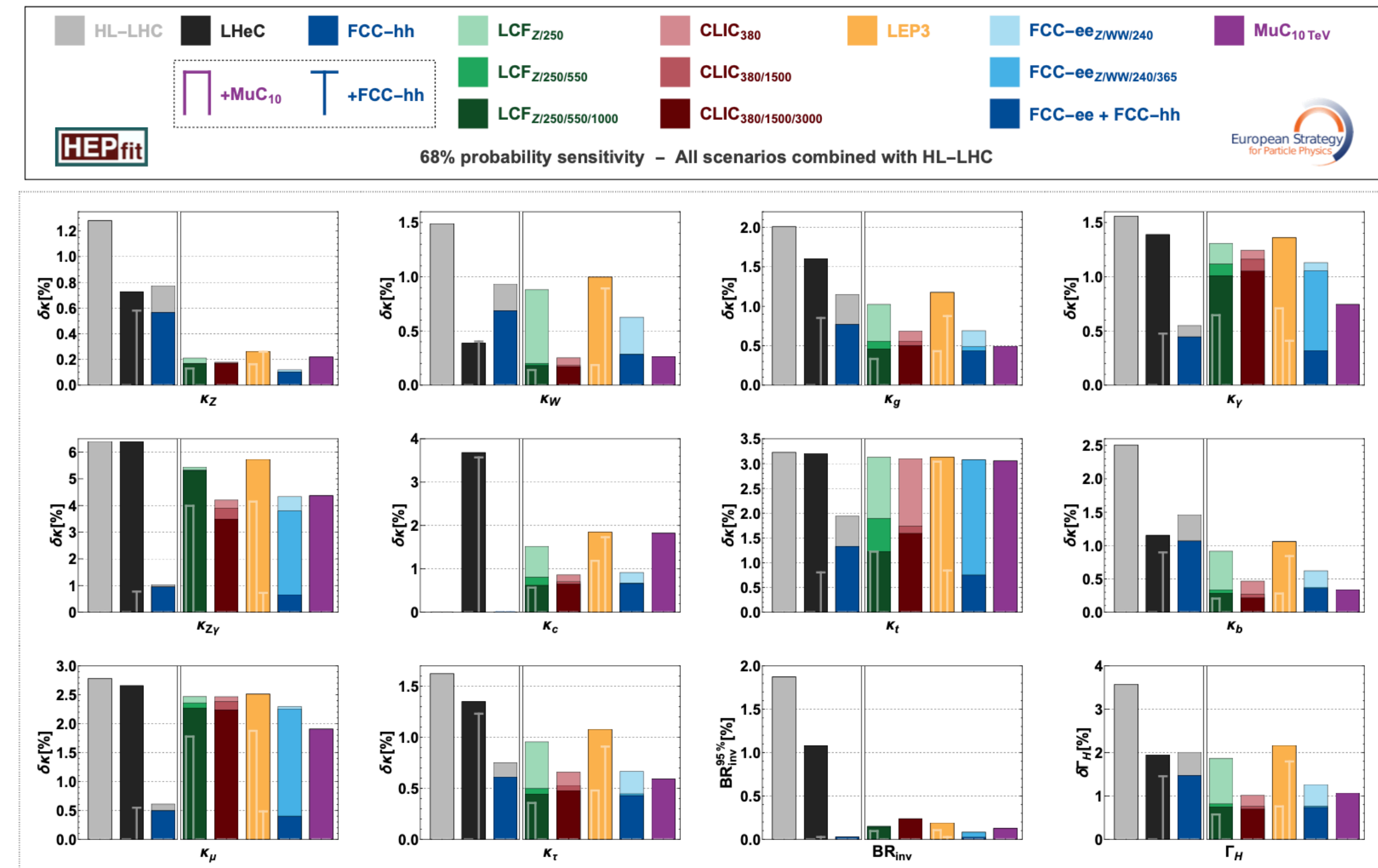
e^+e^- projects	Energies (GeV)								FCC-hh 85 TeV	CLIC Muon Collider 3 TeV	Muon Collider Plasma Collider 10 TeV	
	91	160	240	365	380	550	1000	1500				
FCC-ee	X	X	X	X								
LCF-250	X		X									
LCF-250+550	X		X	X		X						
CLIC-380					X							
CLIC-380+1500					X			X				
LEP 3	X	X	X (230)									
ep collider												
LHeC			50 GeV (e-) on 7 TeV (p)									
High-energy options												
FCC-ee + FCC-hh (85 TeV)	X	X	X	X					X			
FCC-hh (85 TeV)									X			
LCF + 1 TeV option	X		X			X	X					
LCF + High-energy lepton collider	X		X			X					X	
CLIC + 3 TeV					X			X		X		
Muon Collider									X		X	
LEP3 + FCC-hh (85 TeV)	X	X	X(230)						X			
LEP3 + High-energy lepton collider	X	X	X(230)								X	
LHeC + FCC-hh (85 TeV)			50 GeV (e-) on 7 TeV (p)						X			

Table 1.1 of BB

Physics Potential: Studies of the Higgs Boson

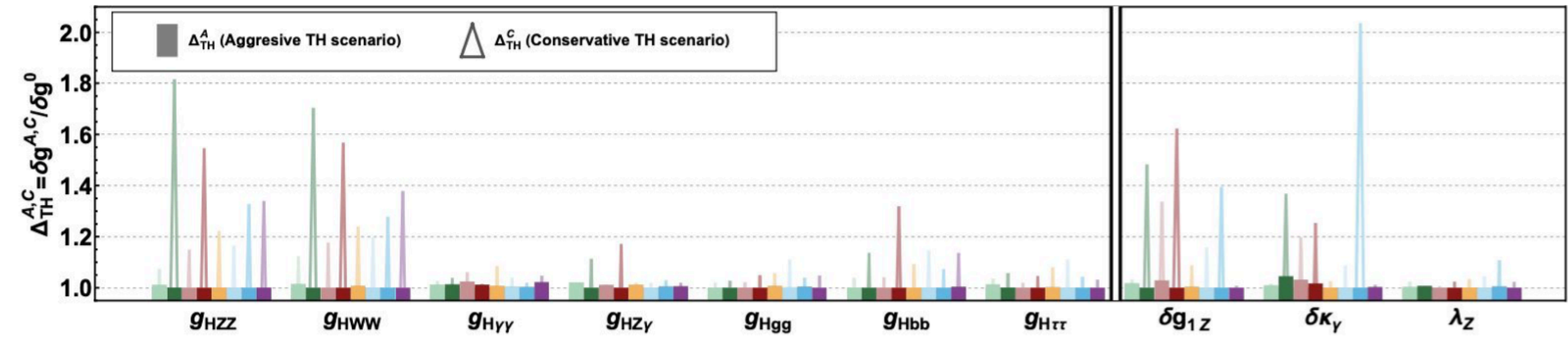
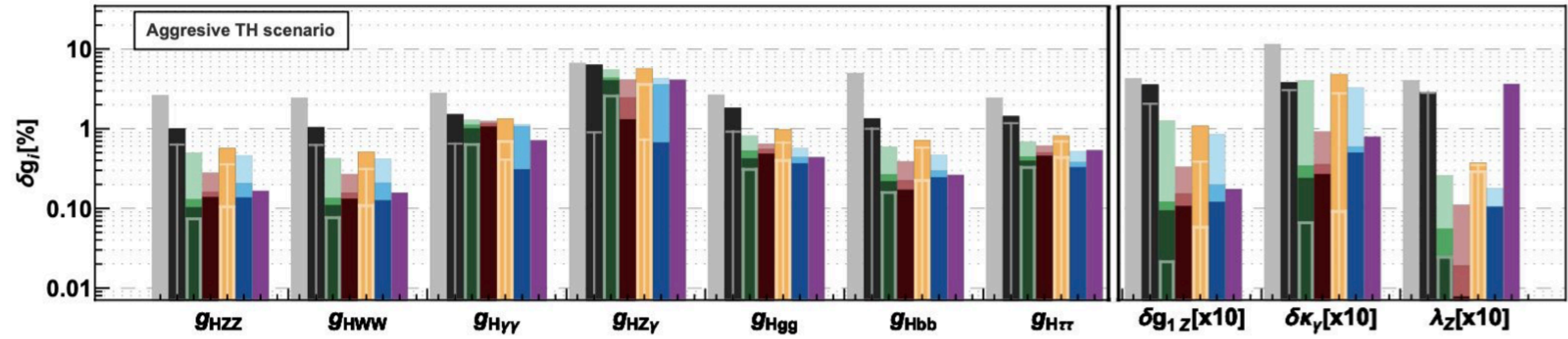
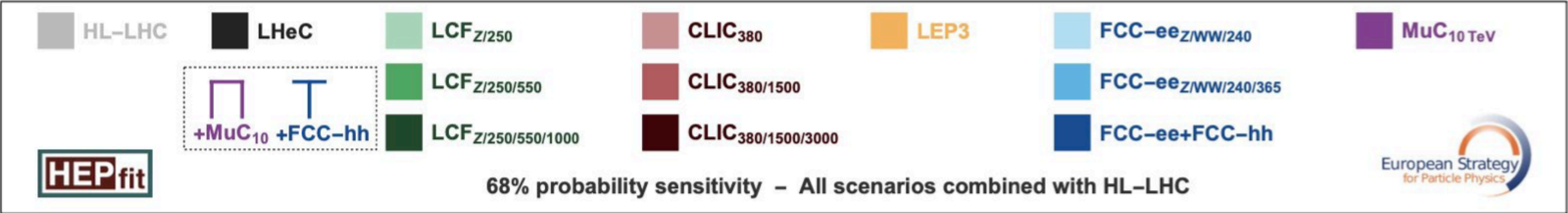
- Precisely known initial state and clean environment
- Model-independent measurements of the couplings
- Several production modes accessible
 - ZH at $\sqrt{s} \sim 240$ GeV, VBF $\sqrt{s} > 450$ GeV
 - ttH, ZHH and $\nu\nu$ HH $\sqrt{s} > 500$ GeV + benefit from the increase in luminosity
- At LCs vs CC, increase of effective cross-section depending on the beam polarization scheme
 - By 1.0 to 1.4 for ZH production, by 0.2 to 2.4 for WW fusion
- At CCs, larger instantaneous luminosity and option to operate several interaction points simultaneously (*FCC-ee only*)
- FCC-ee (LEP3) $\sim 9x$ ($2x$) number of Higgs bosons for all interaction points together per unit time compared to the LC250

Precision	FCC-ee	LEP3	LCF-CLIC
ZH σ	0.31%	0.56%	0.66% (LCF, CLIC380)
ttH σ	NA	NA	5.6-8.7% and 3.9-5.7% (LCF550 GeV)
Mass	4 MeV	10 MeV	12 MeV (LCF250)



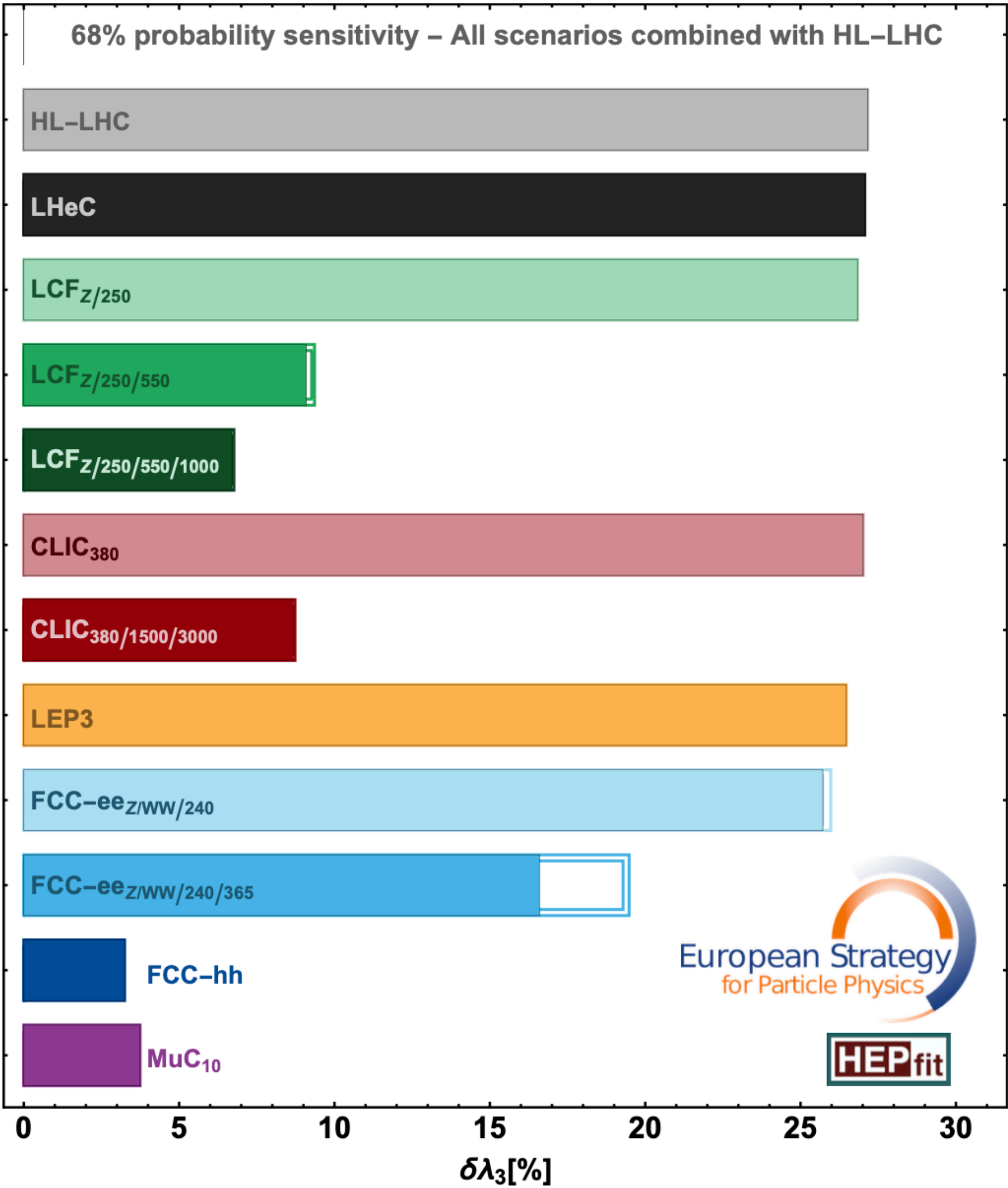
Complete set of studies within SMEFT available in the BB

Physics Potential: EFT framework



- Constraints from EWPOs further improving precision on Higgs couplings
- Per mille precision when including multiple energy stages

Physics Potential: Sensitivity to Higgs self-coupling



- No significant improvement achieved in colliders at $\sqrt{s} \sim 230$ GeV
- HL-LHC combined with FCC-ee - precision 17-20%.
- LC 550 GeV (3 TeV) - precision 7-11%

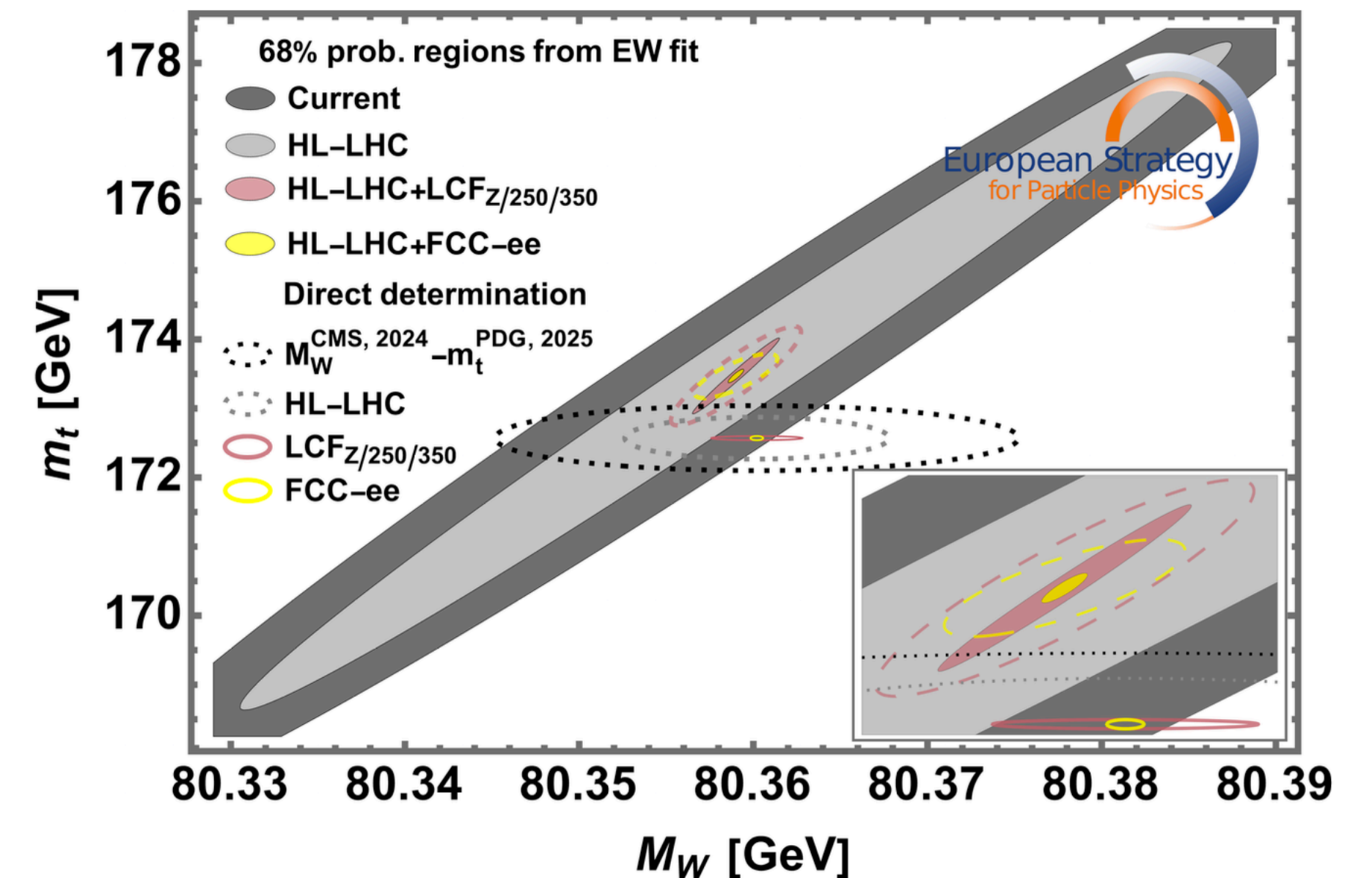
Physics Potential: EW and Top Physics

- Very high luminosities at CC
 - 6×10^{12} (FCC-ee) and 2×10^{12} (LEP3) Z bosons for all interaction points
 - Improvements of roughly a factor 30 in observables that depend primarily on the total rate, compared to the LCF
- Polarized beams at LCs offering sensitivity to chiral observables
 - Partially compensating for lower luminosity than CC
 - Enhanced sensitivity to some of the interactions that affect EWPOs via vector-boson scattering at high energy LCs
- Precise determination of the top-electroweak couplings
 - Access to chiral structure via longitudinal beam polarization at LCs (direct) with $\sqrt{s} > m_{tt}$
 - Exploitation of polarization of top's decay products at FCC-ee
- At LC with $\sqrt{s} > 550$ GeV, sensitivity to energy-dependent operators

Precision	FCC-ee	LC $\sqrt{s} > m_{tt}$
Mass	7 MeV	20 MeV

Theory uncertainties ~ 35 MeV

Observable	Current	FCC-ee	LCF	LEP3
Δm_Z (keV)	2000	4 (100)	200	7.5 (100)
$\Delta \Gamma_Z$ (keV)	2300	4 (12)	125	7.5 (23)
δR_μ ($\times 10^{-6}$) $R_\mu \equiv \frac{\Gamma_{had}}{\Gamma_\mu}$	1600	2.4 (2.3)	90 (90)	4.5 (2.3)
δR_b ($\times 10^{-6}$) $R_b \equiv \frac{\Gamma_b}{\Gamma_{had}}$	3300	1.2 (1.6)	70 (60)	2.2 (3.0)
$\Delta \sin^2 \theta_W$ ($\times 10^6$)	130	0.4 (0.5)	2.7 (2.3)	0.75 (0.95)
$\Delta \alpha(m_Z)^{-1}$ ($\times 10^3$)	14	0.8, 3.8	–	1.4, 7.3
Δm_W (keV)	9900	180 (160)	500 (1600)	430 (700)
$\Delta \Gamma_W$ (keV)	42000	270 (200)	2000	650 (500)

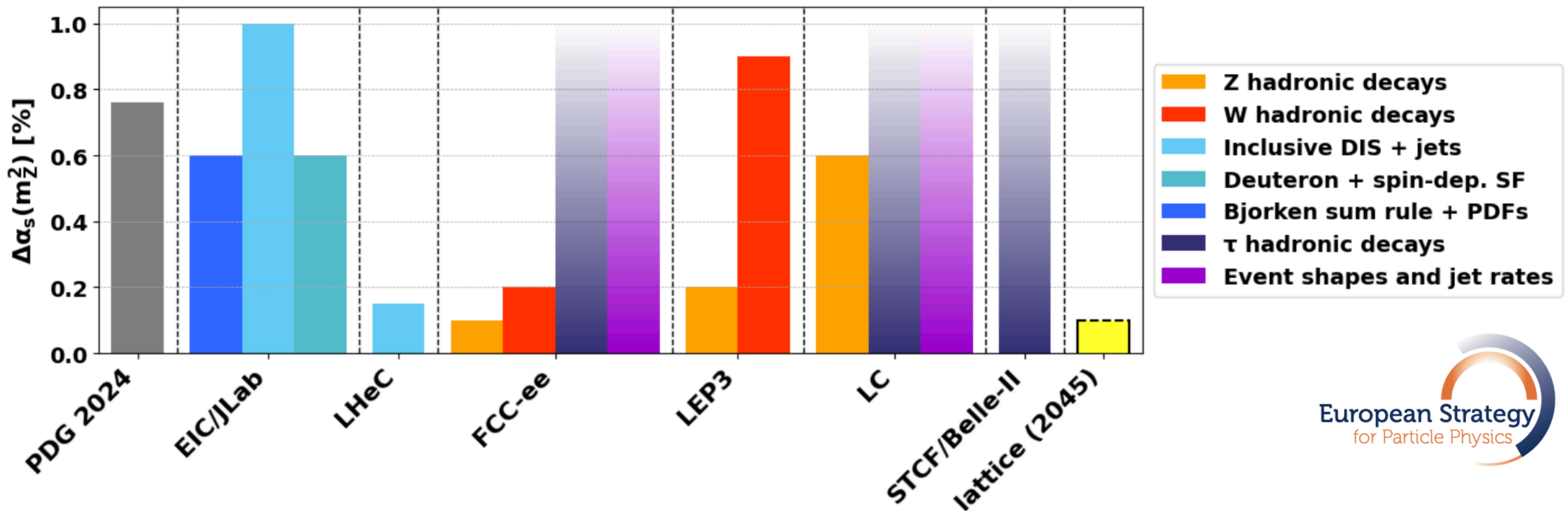


Complete set of studies within SMEFT available in the BB

Physics Potential: Strong Interactions

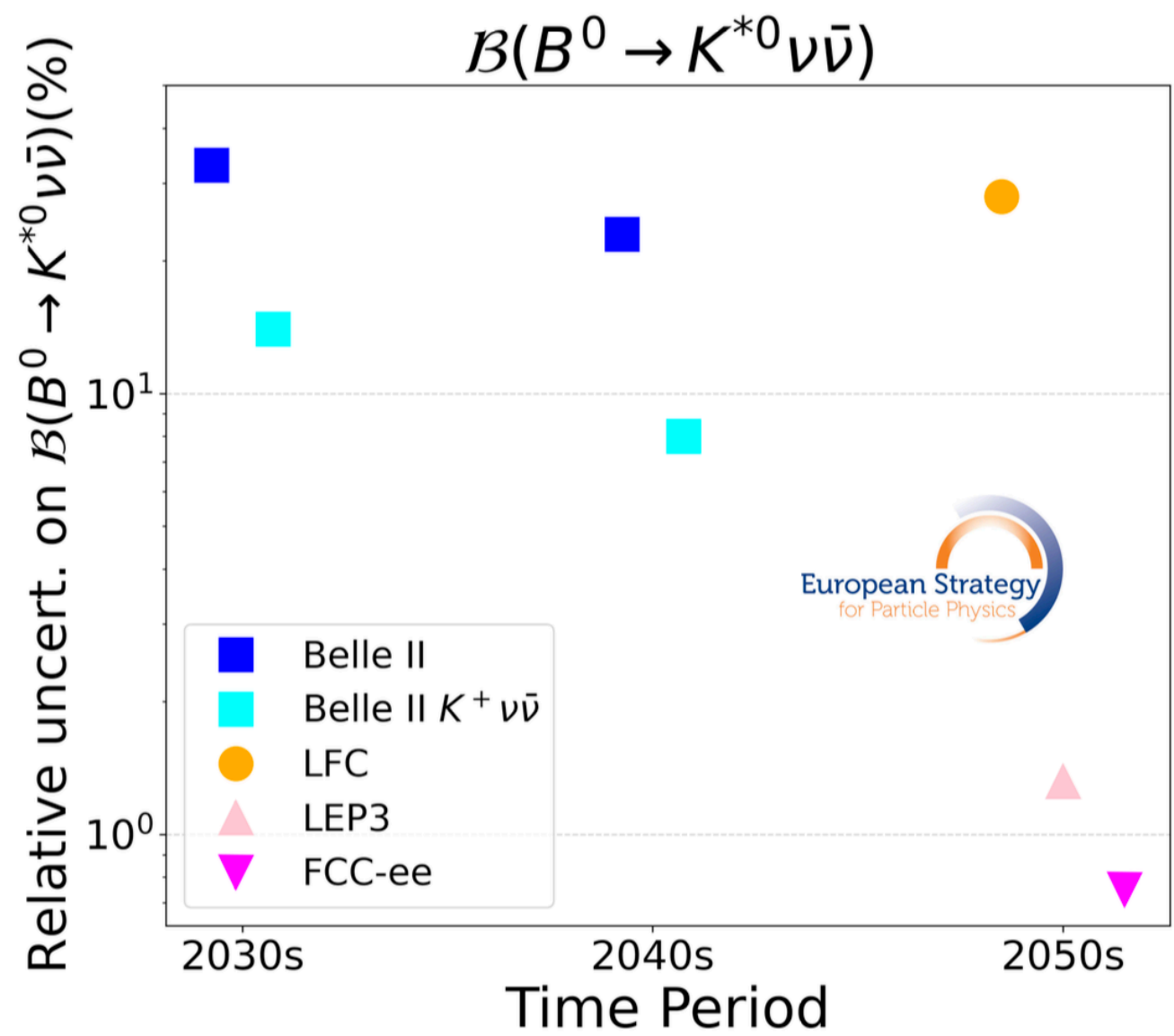
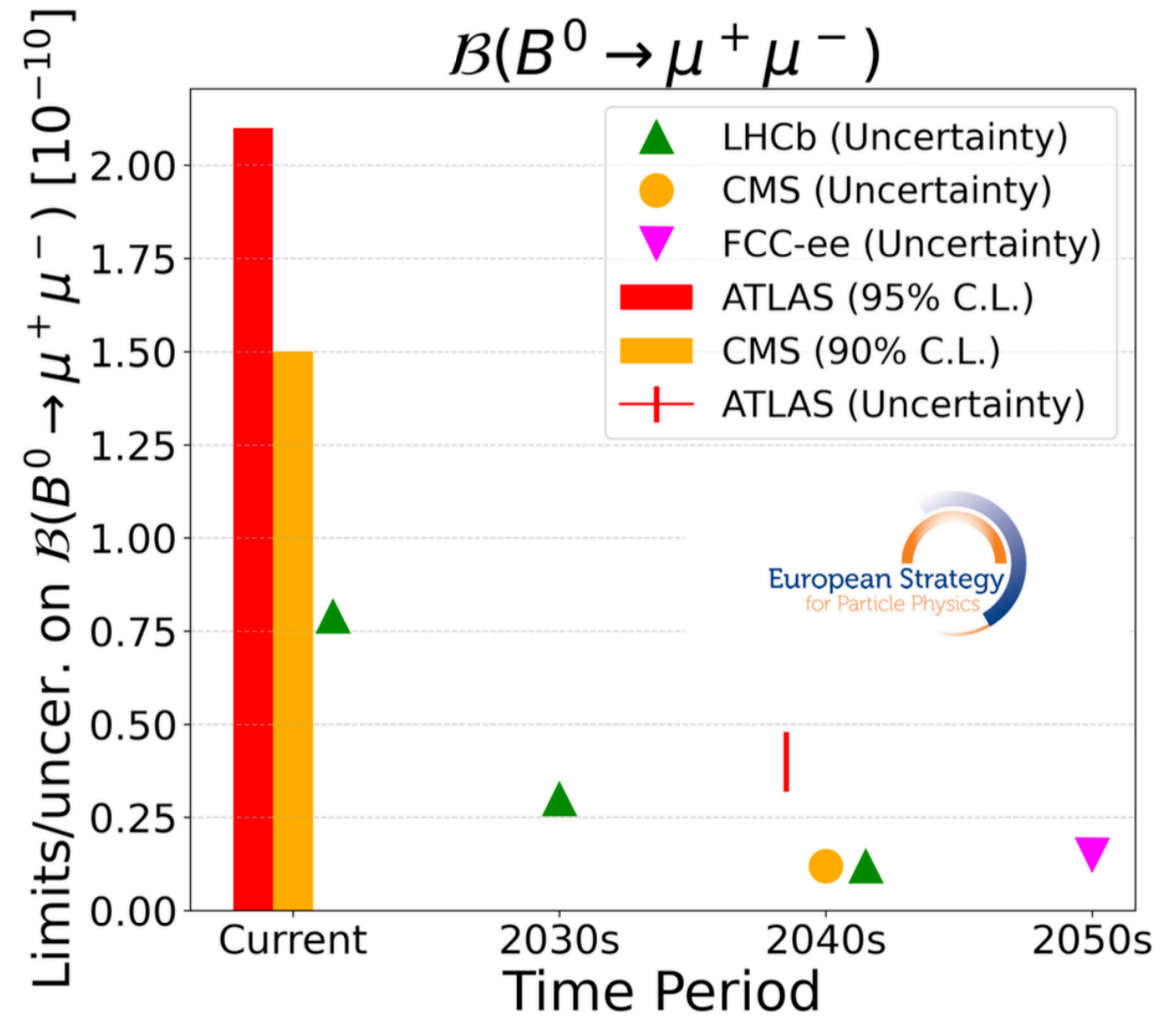
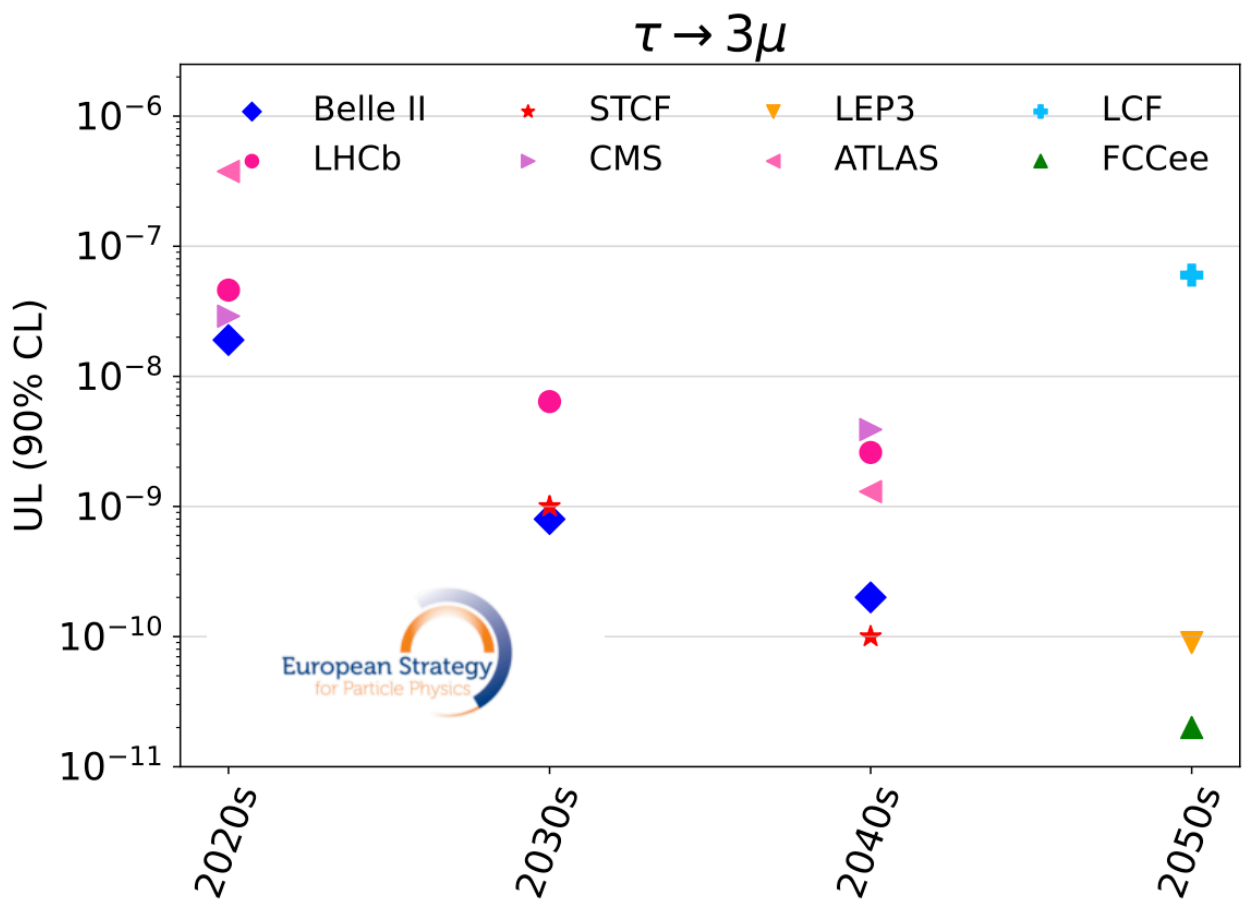
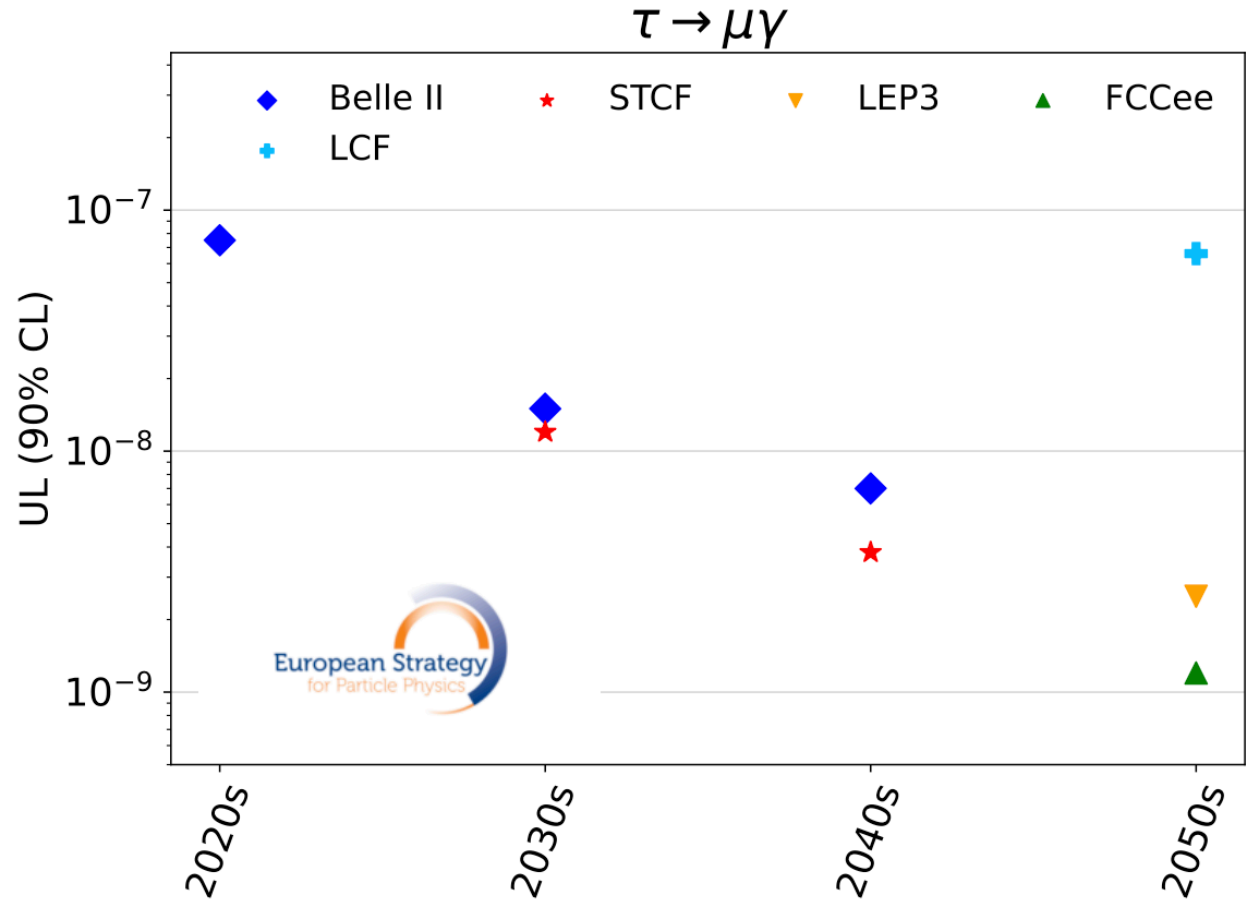
- Determination of the strong coupling constant, impact of strong interaction effects on top and W mass

Facility, Experiments	Colliding systems, \sqrt{s}	Timeline	Precision QCD	Partonic structure	Hot and dense QCD	QCD connections
FCC	<i>ee</i> 90-365 GeV <i>pp</i> 84 TeV <i>AA</i> 33 TeV <i>pA</i> 52.8 TeV	> 2047 > 2074	$\alpha_s(m_Z^2), \alpha_s(Q^2),$ m_t, Γ_t, m_W	(n)PDF, TMD, small to large x	New probes of time evolution, early times	Cosmic rays (ν , modeling pri- mary interaction)
LCF CLIC	<i>ee</i> 0.25-1 TeV <i>ee</i> 0.38-1.5 TeV	> 2050	$\alpha_s(m_Z^2), \alpha_s(Q^2),$ m_t, Γ_t, m_W			
LEP3	<i>ee</i> 91-230 GeV	> 2047	$\alpha_s(m_Z^2)$			



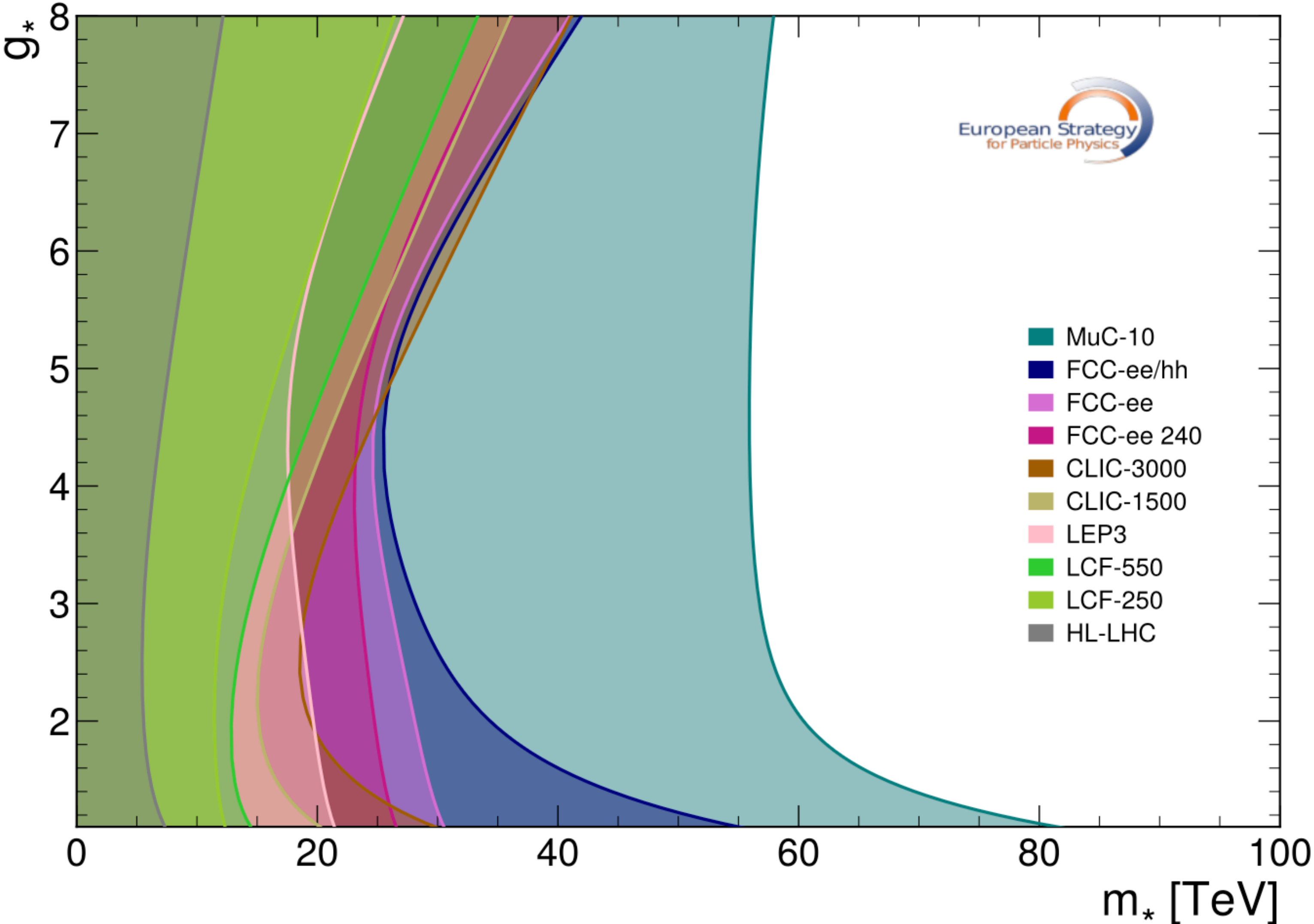
Physics Potential: Flavor Sector

- Significant sensitivity thanks to large Z sample at the FCC-ee
 - Stringent detector requirements
 - High-resolution vertex detectors, ultra-light detector materials, excellent tracking and high hermeticity
 - Effective charged-hadron identification, reliable electron and muon separation
 - Excellent energy resolution and good transverse and longitudinal segmentation



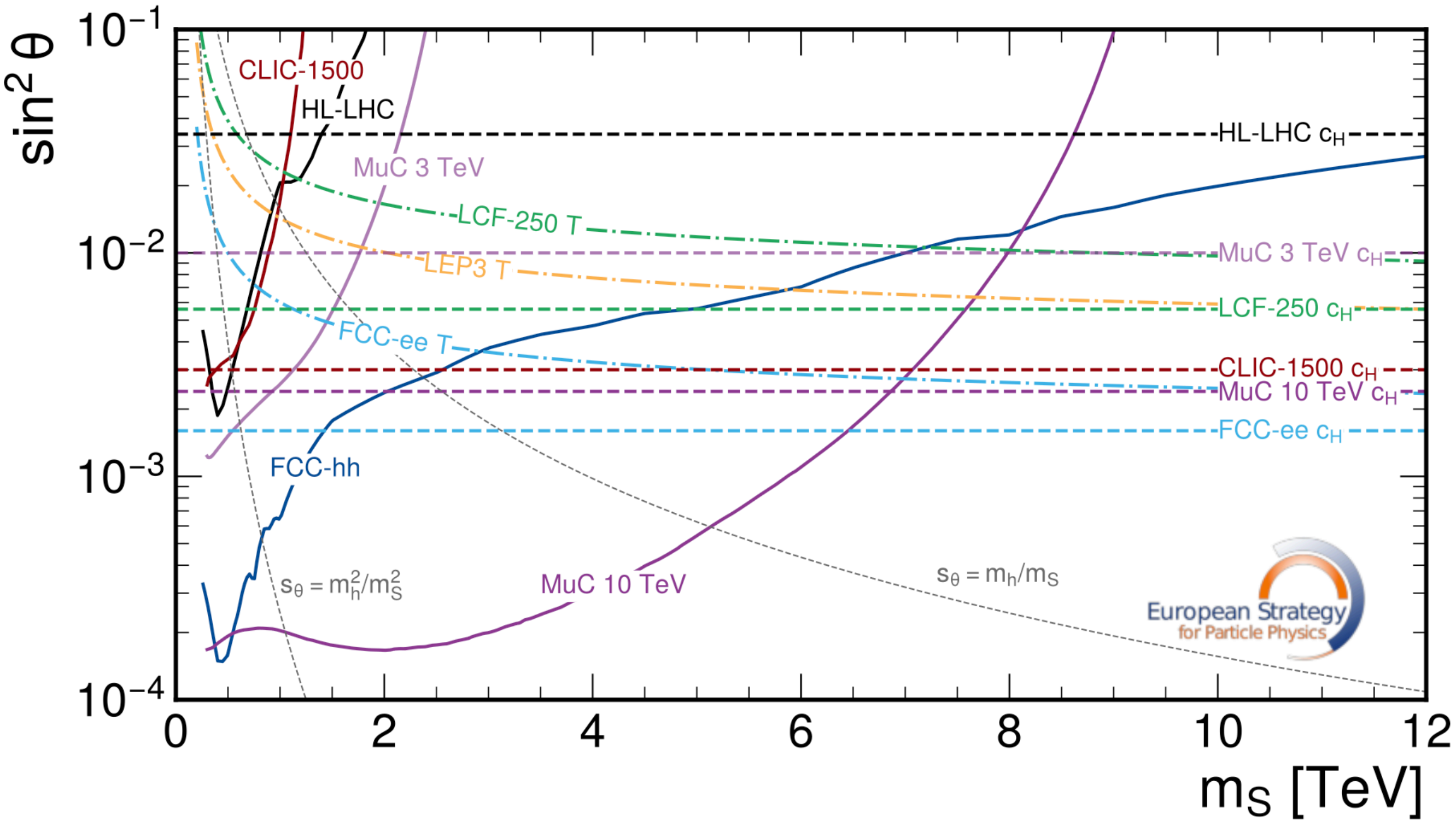
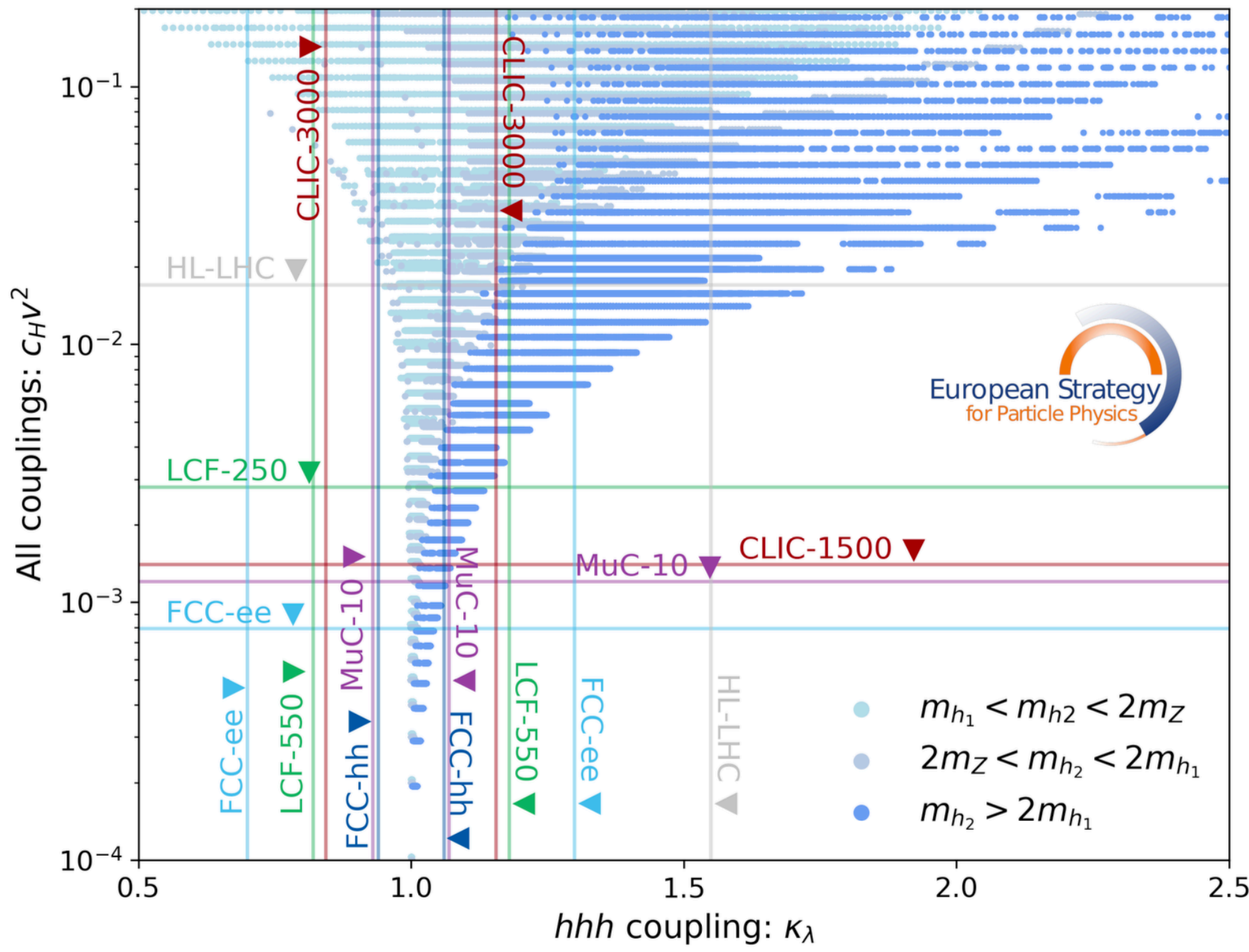
Physics Potential: BSM

- Low energy Higgs factories offering insights into BSM models tied to the weak scale
 - Compositeness, SUSY
 - Scalar sector
 - New forces
 - Portals
- And to Dark Matter
- Excellent complementary between precision program and direct searches (for low mass states)



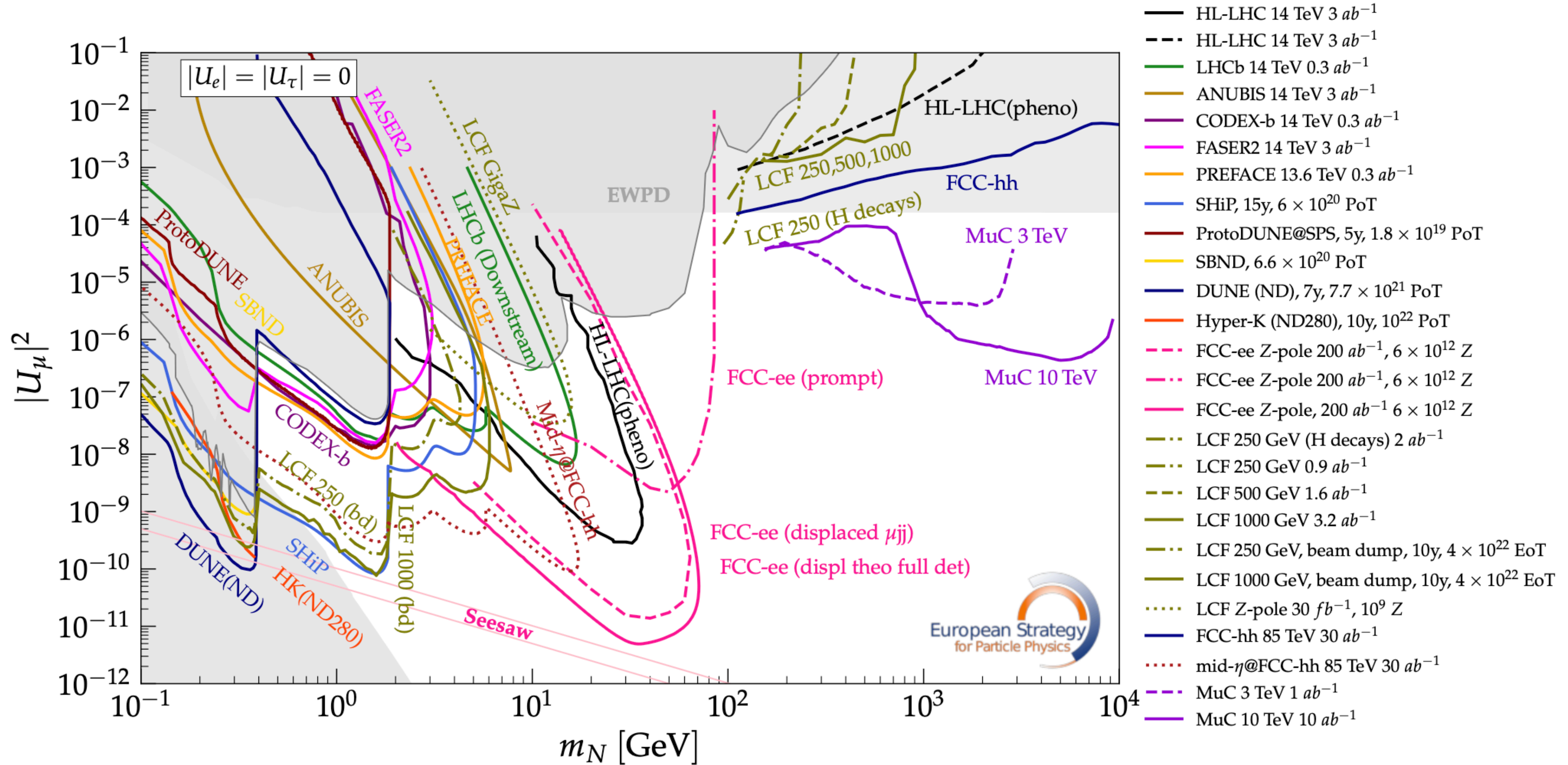
Physics Potential: BSM - Extended Scalar Sector

- Extended scalar sector leading to strong 1st order EW phase transition
- Additional scalars closely tied to the Higgs boson (additional Higgs bosons or communicating with the SM through the Higgs portal)
- Probed via precision measurements and direct search for new scalars



Physics Potential: BSM - Portals

Exceptional sensitivity through direct searches for low mass states at Tera-Z



Timeline for the update of the European Strategy for Particle Physics



In preparation for the Drafting Session

- Updates to the national inputs by Nov 14th
 - Three questions sent by email on Sep 25
 - What is the preferred large scale post LHC accelerator for CERN?
 - What is the preferred alternative, if the preferred option would not be feasible?
 - What is the preferred alternative, if the preferred option would not be competitive?
 - Working group reports
 - Draft recommendations by the ESG working groups and the Secretariat
-
- After the drafting session: deliberation document to be finalized by Jan 9th 2026, final document at the end of Jan 2026

Conclusions

- The Physics Briefing Book is now available
- Among the ee machines with $\sqrt{s} \sim 250$ GeV, FCC-ee provides the highest precision thanks to its large luminosity
- LC with $\sqrt{s} \sim 550$ GeV bring additional and significant improvements
- Tera Z also achieves exceptional sensitivity in direct and indirect searches for new phenomena
- Out of all HFs, the FCC-ee has been assessed to be the most mature proposal
- FCC-ee has received strong endorsement by MS, AMS, NMS

Project	Scope	TRL	R&D	Test facilities	Performance	Site preparation	Schedule	Cost	Risk
CLIC 380 GeV, 1.5 TeV	Green	4 - 6 / 5.2	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
FCC-ee 91-365 GeV	Green	4 - 7 / 6.0	Green	Green	Green	Green	Green	Green	Green
LCF 250 - 550 GeV	Green	5 - 7 / 5.5	Green	Green	Green	Yellow	Yellow	Yellow	Yellow
LEP3 91 - 230 GeV	Red	3 - 6 / 4.0	Red	Green	Yellow	Green	Red	Red	Yellow

