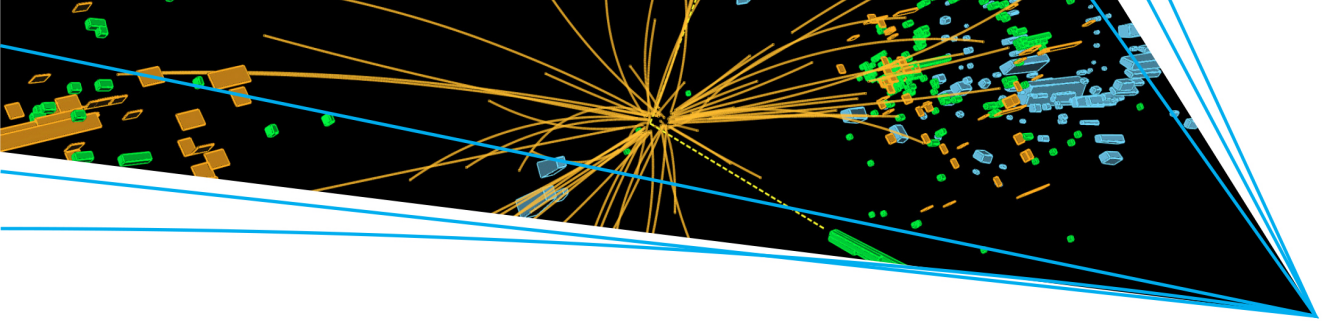


KET
Komitee für
Elementarteilchenphysik

Bericht vom European Strategy Process in der Teilchenphysik

Frank Ellinghaus

Bergische Universität Wuppertal

für das KET

KHuK-Jahresversammlung 2019

Komitee für Elementarteilchenphysik

Gewählte Mitglieder (seit Ende 2018):
M. Beneke, V. Büscher, F. Ellinghaus, , M. Elsing, E. Garutti,
M. Kobel, J. List, U. Uwer, G. Weiglein

Ex-Officio Mitglieder
S. Bethke (Council), K. Desch (Gutachterausschuss),
T. Hebbeker (DPG), A. Caldwell (MPG), J. Mnich (DESY),
P. Schleper (RECFA)

Vorsitz: U.Uwer, Stellvertr. V. Büscher.

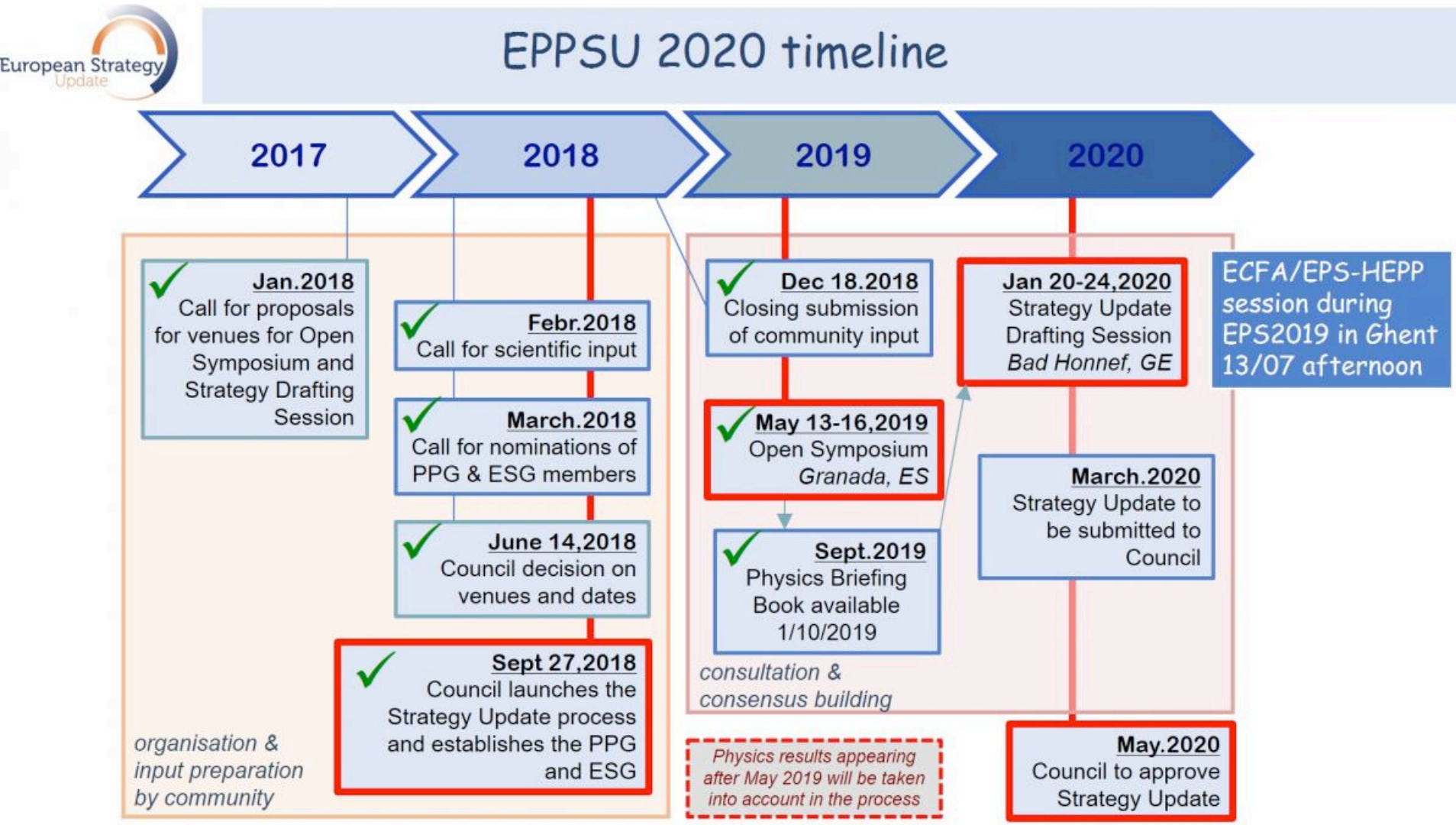
Ständiger Gast: yHEP-Vertreter*in – Ch. Grefe

KET-Kontakt für KAT=T. Hebbeker, KfB=M. Elsing, KHuK=F. Ellinghaus

Protokolle der KET Sitzungen:

http://www.ketweb.de/meetings__veranstaltungen/sitzungen/

European Particle Physics Strategy Update (EPPSU)



Ein langer Prozess in Deutschland

- 4 Workshops (2016/2017) organisiert von KAT, KHuK und KET zur Zukunft der:
  - e+e- Collider
  - Neutrinophysik
  - Non-Collider Physik
  - Hadron Collider

- Abschlussworkshop (Bonn, Mai 2018) mit Abschlusserklärung

- Abschlusserklärung war die Grundlage des deutschen Inputs der Teilchenphysik zum EPPSU, submittiert Dezember 2018

- Insgesamt 160 Beiträge zum EPPSU

Key statements bzgl. Collider

Dezember 2018

The physics potential of the experiments at the LHC and its upgrade, the HL-LHC, as well as at SuperKEKB must be fully exploited.

An electron-positron collider, upgradeable to a centre-of-mass energy of at least 500 GeV, should be realised, with the highest priority, as the next international high- energy project.

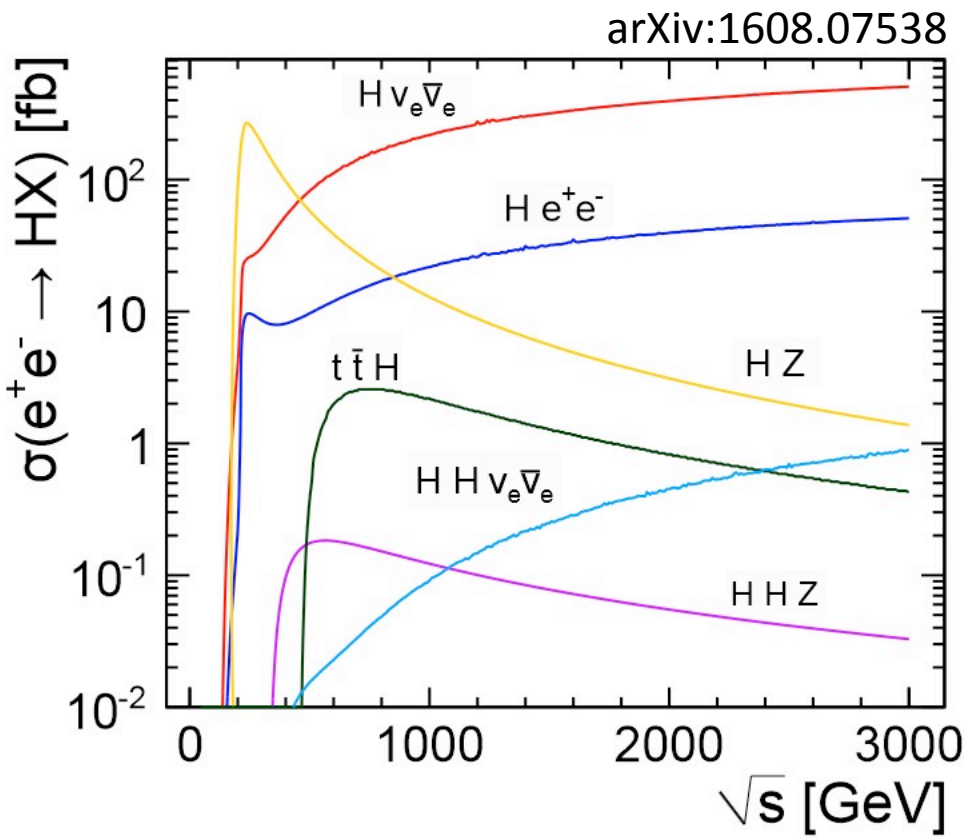
We strongly support the Japanese initiative to realise, as an international project in Japan, the ILC as a "Higgs-Factory" with an initial centre-of-mass energy of about 250 GeV.

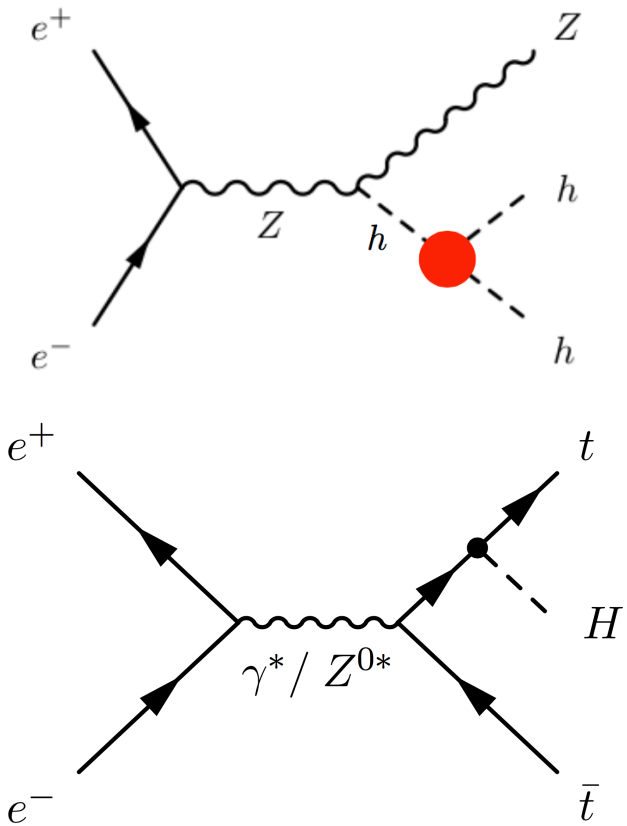
Continuation of the development of accelerator and detector technologies and studies for a next-generation hadron collider, at the highest possible centre-of-mass energies beyond the LHC, should be pursued with high priority.

(Dokument behandelt auch non-Collider, Accelerator based Neutrino Physics, Theory,…)

Warum 500 GeV ?

Schwerpunktenergie von mindestens 500 GeV erlaubt Messung der Higgs-Selbstkopplung (direkt in HH Produktion) und der ttH Produktion (Higgs-Selbstkopplung auch indirekt über single H Produktion → Loops)





Review of Inputs in Granda, Mai 2019

Siggi Bethke: Overview of submitted national inputs, Granada, Mai 2019

summary of national priorities and interests for large future HEP projects :

country	item #	e+e- e-w,H,.. (ILC, ...)	e+e- incl. ttbar (FCC-ee)	e+e- incl. HH (ILC+,CLIC)	hh beyond LHC	hh he-LHC	hh FCC	eh	accel. R&D	R&D magnets FCC,he-LHC	R&D novel PWA,μ+μ-	non-accelerator (DM,ndbd)	neutrino physics	intensity frontier	nuclear (FAIR,EIC...)	astro-particle
A	108	1			3				2			√			√	√
B	122	1														
CH	142	1	1		3		3		2	2	3		√	√	√	√
CZ	88	3		3	2	2	2		1	1	1		√		4	
D	33	1		1	3	3	3		2	2	2	4	√	√	√	√
DK	61	3	3		3		3		2	2	2	1	√	√	√	√
E	31	1	3	1	3	3	3		2	2	4		√		√	√
F	15,116,155	1	√	√	3		3	√	2	2	√	√	√	√	√	√
FIN	55	1		1									√		√	√
I	26,138	1	1		3		3		2	2	2	√	√	√		√
IL	34	√			√							√	√	√		
N	43	1		1					3		3	√			√	√
NL	166	1	3	2	3		3		2	2	3	√	√	√		√
PL	125	1	√	√					2							
RO	73												√	√		
S	127	1		1					2	2	√	√	√	3		√
SLO	78															
UK	134,144	1		1	2		2	2	3	3	√	√	√		√	
total score:		13,67	3	6,83	3,67	1,17	3,33	0,5	6,67	5,33	3,75					

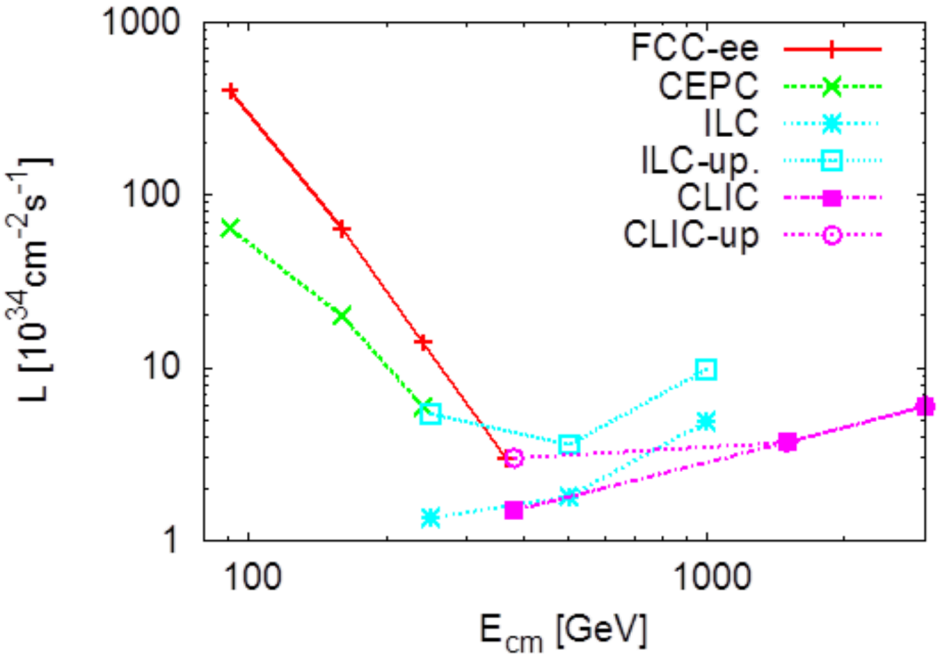
1...4: priority 1 to priority 4;
√: mentioned without (clear) assignment of priority
total score: =Σ(1/priority) where given; √ not counted

Notes:
– table reflects status of inputs submitted by Dec. 2018
– intended for overview of physics or projects priorities
– see disclaimers on previous and following pages!

→ Prioritäten waren nicht immer eindeutig, aber Präferenz für e+e- Collider

Was weiter geschah…

- Keine (positiven) Neuigkeiten aus Japan bzgl. ILC
- Physics Briefing Book (arXiv:1910.11775)
  → Zusammenfassung der Diskussionen in Granada bzgl. der 160 Beiträge
- FCC (and CEPC) CDR (Conceptual Design Report)
  → Circular e+e- Collider haben hohe Luminosität aber sind unterhalb der HH Schwelle

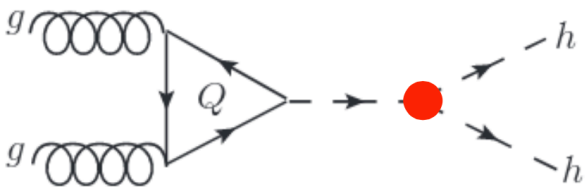


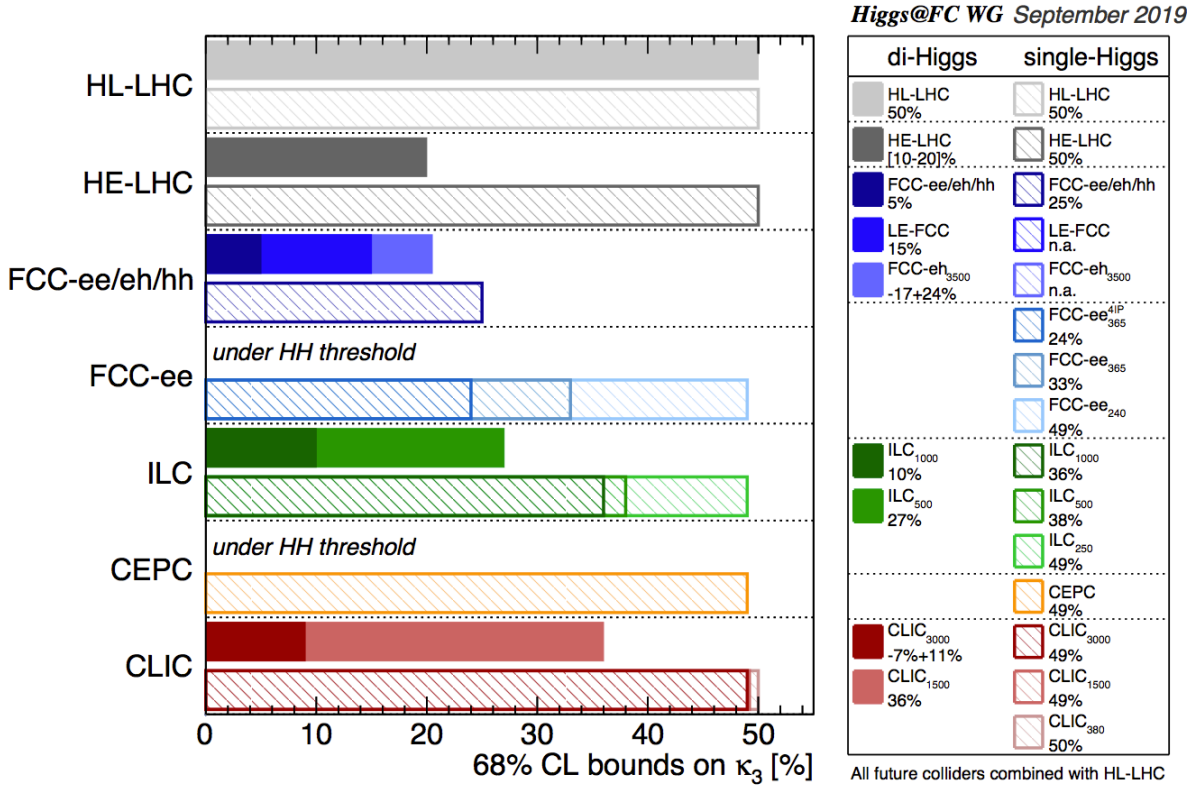
Physics Briefing Book

- Realistischere Projektionen für den HL-LHC basierend auf Run-2 Analysen →

Neue Projektionen

Was werden wir schon vom HL-LHC lernen ?
(HH Produktion ca. 1000 mal kleiner als H Produktion)





Physics Briefing Book

Nur aus direkten di-Higgs Messungen:
Higgs-Selbstkopplung kann am LHC auf 50% bestimmt werden
Higgs-Selbstkopplung kann am ILC-500 auf 27% bestimmt werden

→ 500 GeV weniger wichtig ?

Request for additional Input

- Neuer “Request for Input”, idealerweise bis zur nächsten ESG Sitzung (6.11.2019, recht kurzfristig und vor der KET Jahresversammlung)

Revolving around future major colliders in Europe, at this stage, five scenarios are defined to initiate the discussions within the European Strategy Group (ESG).

	2020-2040	2040-2060	2060-2080
		1st gen technology	2nd gen technology
CLIC-all	HL-LHC	**CLIC380-1500**	CLIC3000 / other tech
CLIC-FCC	HL-LHC	**CLIC380**	FCC-h/e/A (Adv HF magnets) / other tech
FCC-all	HL-LHC	**FCC-ee (90-365)**	FCC-h/e/A (Adv HF magnets) / other tech
LE-to-HE-FCC-h/e/A	HL-LHC	**LE-FCC-h/e/A (low-field magnets)**	FCC-h/e/A (Adv HF magnets) / other tech
LHeC-FCC-h/e/A	HL-LHC **+ LHeC**	**LHeC**	FCC-h/e/A (Adv HF magnets) / other tech

Considering the information summarized in the Physics Briefing Book, we seek input for each of the five scenarios on the following aspects:

- Basierend auf dem nationalen Input Dokument hat KET einen ersten Antwortentwurf formuliert und in der Community zirkuliert.
- Nach Auswertung des Rücklaufs erschien es KET notwendig einen iterierten Entwurf, der die neueren Entwicklungen berücksichtigt, auf der KET Jahrestagung (14.+15. Nov) zu diskutieren.

ESG Meeting 6.11.2019

ESG meeting Nov 6 2019:

- all member states except D, GB, Israel and Serbia gave update statements to their national inputs
- some stress that an overall agreement within their community is not really possible
- significant drift towards FCC (ee and especially hh)
- e+e- collider as next international machine still of utmost priority…
- … with less explicit but still existing support for ILC@Japan
- some smaller countries point out not to be able to contribute to a project in Japan
- non-scientific arguments for ILC@Japan: additional funds for HEP; frees road to FCC-hh in Europe
- almost no explicit priority for CLIC
- only few priority statements for innovative technology developments (plasma; μ-collider, …)
- USA, Russia, Japan: general strong encouragement for FCC in Europe (no news from Japan on ILC)
- in general: overall importance of CERN and a future high energy frontier program at CERN
- in general: broad support of viable Physics Beyond Collider program (PBC)

Folie von S. Bethke auf der KET Jahresversammlung

Wesentlichste Änderungen

As next international high-energy project, we consider an electron-positron collider as highest priority of our field. Maximum complementarity with measurements at hadron colliders would require the collider to be upgradable to center-of-mass energies of at least 500 GeV to allow direct measurements of the Higgs self-couplings and to provide a high sensitivity to BSM physics.

Currently, different design options for the next electron-positron collider are being discussed; one of these machines should be built. The decision for one of these projects and its realisation should happen in a globally coordinated context and as an international effort. Europe, with CERN as the European laboratory for particle physics, should play a leading role in both the decision making process and the realisation of the next electron-positron collider project.

We emphasise the vital role of CERN for Particle Physics in Europe and world-wide and believe that CERN should prepare to host the next hadron collider at the high-energy frontier.
Europe through CERN and the national laboratories and institutes should pursue the development of advanced accelerator and detector technologies with high priority.

"Fast finales" Statement, kleinste Änderungen noch möglich…

Die letzten Schritte

Das Dokument mit dem zusätzlichen Input bzgl. der verschiedenen Collider Szenarien geht rechtzeitig zum nächsten ESG meeting ein:

- 13. Dez. 2019: nächstes ESG meeting (CERN)
- 19.-24. Jan. 2020: ESG drafting session (Bad Honnef)
- 19./20. Mär. 2020: CERN Council Sitzung (CERN)
- Mai 2020: Approval of Strategy by Council (Budapest)

BACKUP

BACKUP

Antwort an ESG

We reaffirm CERNs leading role in particle physics. A long-term perspective for the laboratory is vital for the development of our field.

The successful realization of the HL-LHC and the full exploitation of its physics potential should be the highest priority for the mid-term future.

As next international high-energy project, we consider an electron-positron collider as highest priority of our field. Maximum complementarity with measurements at hadron colliders would require the collider to be upgradable to center-of-mass energies of at least 500 GeV to allow direct measurements of the Higgs self-couplings and to provide a high sensitivity to BSM physics.

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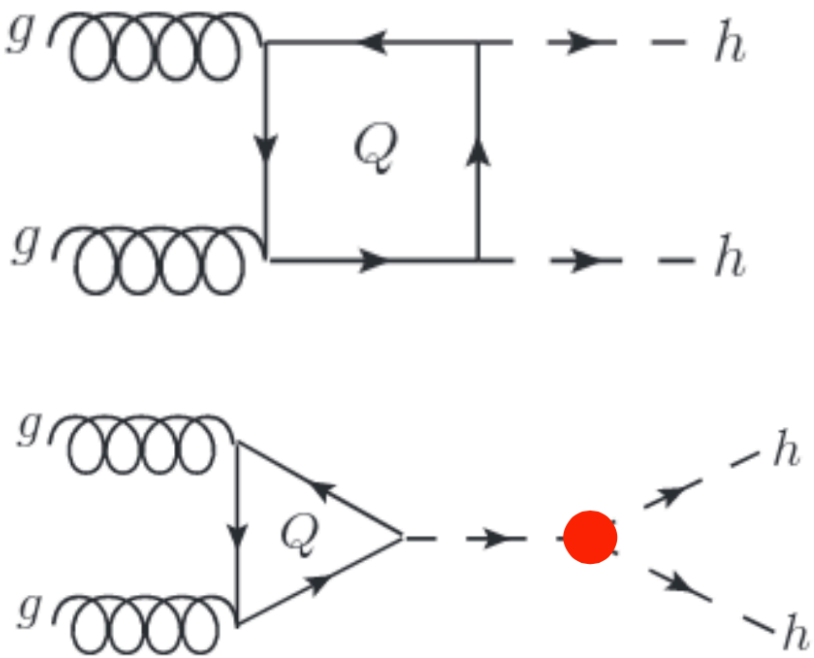
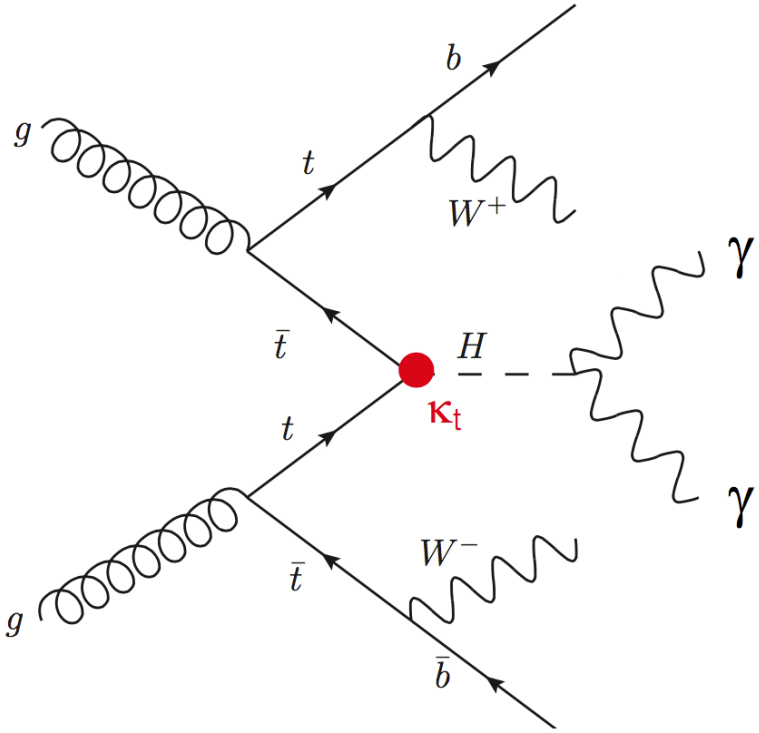
Considering the information summarized in the Physics Briefing Book, we seek input for each of the five scenarios on the following aspects:

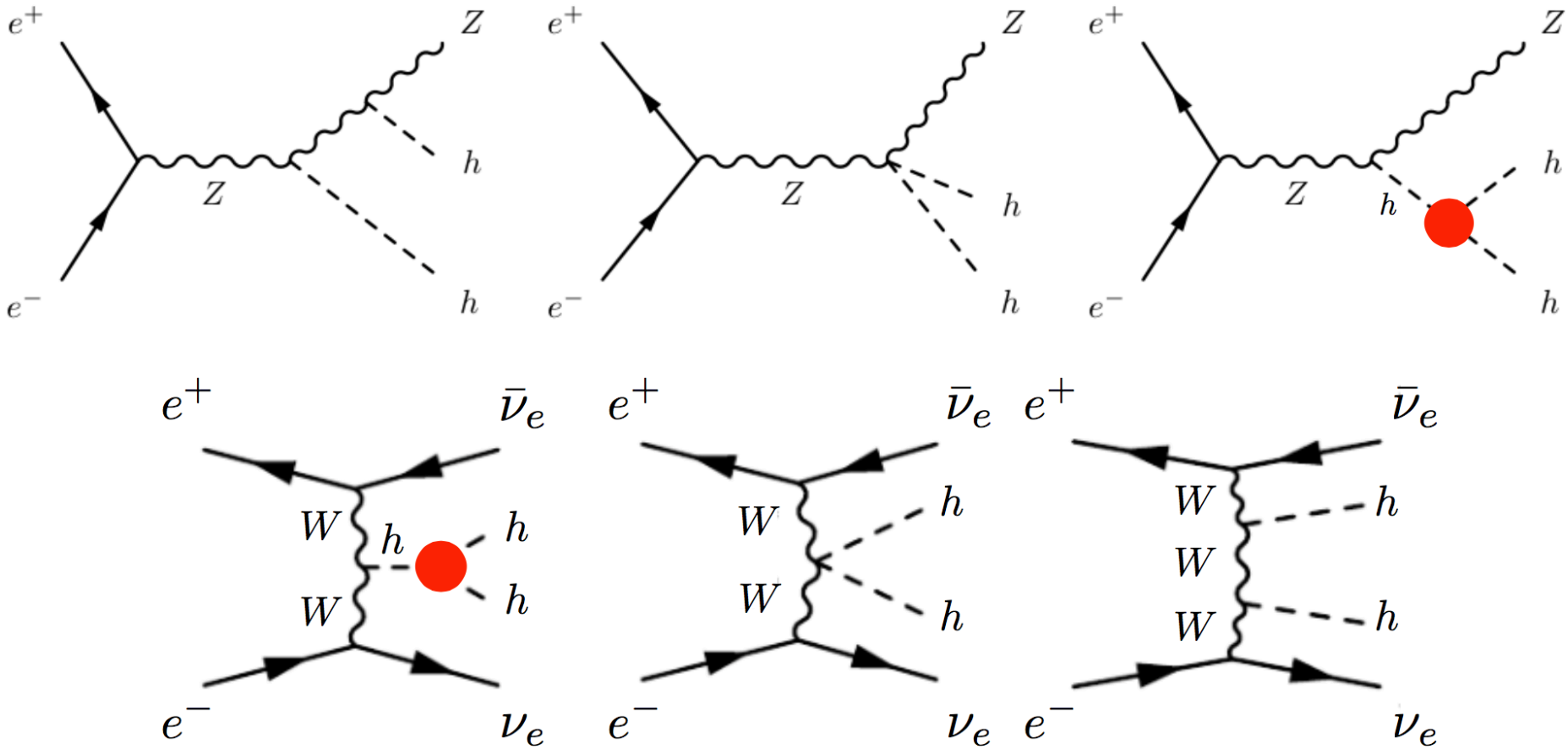
- Arguments pro & con on the physics program
- Arguments on the technical, financial and organization feasibility
- Arguments on the community support
- Verification if we collect with the above list, adequate and sufficient elements to be considered for this and the next strategy updat

pp-Collider





e+e- Collider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