overview of

"national inputs"

submitted to the 2020 ESPP

- disclaimer
- future collider projects and timelines
- summary of national priorities
- top priorities and further future projects
- selection of general policy statements
- summary

disclaimer (1)

- "national" inputs from 18 CERN MS and from 4 NMS (CDN, J, RUS, USA) (some nations submitted >1 ...)
- here: concentrate on analysing
 - inputs from particle physics commun.
 - priority future HEP (collider) projects
 - selection of general policy statements

• not include statements on running and on approved projects (LHC, hl-LHC, KEKb,...)

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disclaimer (2)

- sometimes difficult to separate priorities from possibly unsorted lists of topics (assign priority levels or check marks?)
- interpretation of statements sometimes difficult
- multiple inputs not always consistent
- margin between priority levels sometimes feeble
- -> there is a certain "degree of freedom" for interpretation, classification and assignment of priority levels
- some "national inputs" not really based on community input; representation of number of scientists different by up to 1-2 orders of magnitude...

Proton collider Possible scenarios of future colliders Electron collider Electron-Proton collider Construction/Transformation 4 years Preparation Japan 9 years ILC: 250 GeV 500 GeV 1 TeV $\approx 4-5.4 \text{ ab}^{-1}$ 2 ab⁻¹ 4 ab-1 20km tunnel 31km tunnel 40 km tunnel 8 years CepC: 90/160/240 GeV SppC aim similar to FCC-hh 16/2.6/5.6 ab⁻¹ 100km tunnel 11 years FCC hh: 150 TeV ≈20-30 ab⁻¹ 350-365 GeV FCC-ee: 1.7 ab⁻¹ 8 years 10 years 90/160/250 GeV 150/10/5 ab⁻¹ 100km tunnel 11 years FCC hh: 100 TeV 20-30 ab⁻¹ 8 years 15 years FCC hh: 100 TeV 20-30 ab⁻¹ 100km tunnel CERN 8 years HE-LHC: 27 TeV 10 ab-1 HL-LHC: 13 TeV 3-4 ab⁻¹ 2 years 6 years LHeC: 1.2TeV FCC-eh: 3.5 TeV 2 ab⁻¹ 0.25-1 ab^{-1©} 5 years 7 years 1.5 TeV CLIC: 380 GeV 3 TeV 2.5 ab⁻¹ 5 ab⁻¹ 1.5 ab⁻¹ 11 km tunnel 50 km tunnel 29 km tunnel 2020 2030 2040 2090 2080 2050 2070 2060

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
Α	108	1			3				2			V			V	V
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CH	142	1	1		3		3		2	2	3		V	V	V	V
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D	33	1		1	3	3	3		2	2	2	4	٧	٧	V	V
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E	31	1	3	1	3	3	3		2	2	4		٧		V	V
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tota	Iscore:	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;

V: mentioned without (clear) assignment of priority total score: =Σ(1/priority) where given; V 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!

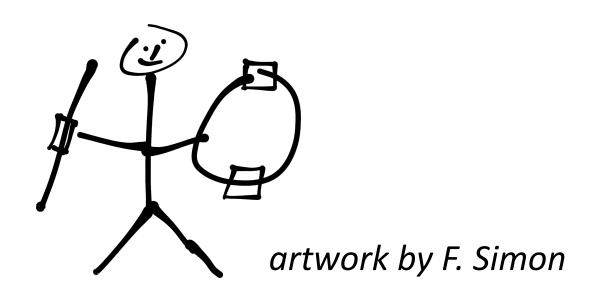
summary of NMS inputs:

country			e+e- incl. ttbar (FCC-ee)		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
CDN	157	V	V	V	V	V	٧					V	٧			
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tota	I score:															

- 18 MS and 4 NMS submitted national inputs on HEP
- 3 MS and 3 NMS provided no explicit priorisation
- -> "total scoring" based on 15 MS
- total score defined as $\Sigma(1/\text{priority})$

future HEP project priorities:

- highest priority for a (general) e+e- collider as next big project : total score of 13,67 out of 15 max.
 - score of 3,00 for upgradeability to include ttbar and/or explicitly for FCC-ee
 - score of 6,83 for upgradeability to include HH or ttH and/or explicitly for linear colliders (i.e. ILC+ or CLIC)



future HEP project priorities:

- second priority for (general) accelerator R&D: score of 6,67
 - score of 5,33 for R&D of high-field s.c. magnets (he-LHC, FCC)
 - score of 3,75 for R&D of novel accel. techniques (PWA, μ-coll.)
- third priority for a hadron collider beyond the LHC: score of 3,67
 - score of 1,17 for the he-LHC
 - score of 3,33 for the FCC-hh
 - score of 0,50 for e-h collider (LHeC or FCC-eh)
- notable observation: similar priorities for FCC-hh and for R&D of novel accelerator techniques!

further future projects

- neutrino physics (long baseline; ndbd; cosmic)
- physics beyond colliders
- dark matter searches
- intensity frontier
- nuclear physics
- gravitational waves
- astro-particle projects

selection of general policy statements

- maintain leading role of CERN (in Europe and the world)
- "a" future international collider at CERN!
- participation in outside-of-Europe collider project through CERN
- diversity and complementarity: CERN and national Labs
- (support for) astro-particle physics projects at CERN
- improvements for the CERN organization and laboratory (see e.g. input doc #166)
- importance of: theory; instrumentation; computing

summary:

- clear <u>preference</u> for an e+e- collider as the next h.e. collider:
 - as H-factory and for precision e.w. measurements (ILC, CEPC, FCC-ee, CLIC)
 - significant demands for upgradeability to access tt (ILC, CEPC, FCC-ee, CLIC) and also HH and ttH final states (ILC+; CLIC)
- second priority: R&D for future h.e. collider: h.f. s.c. magnets for hadron colliders, and also novel accelerator techniques (PWA, μ-collider)
- third priority: future hadron collider beyond LHC (FCC-hh; fewer demands for he-LHC and eh-collider)
- large diversity of other, "smaller" projects (PBC, neutrino, DM searches, precision/intensity frontier, astro-particle, ...