

# European Particle Physics Strategy Update

Brigitte Vachon (McGill)

> IPP AGM 7 June 2019



- Every few years, the European particle physics community reviews the roadmap and priorities of the field, updating the European Particle Physics Strategy (EPPS). More information is available here:
  - <u>http://council.web.cern.ch/en/content/european-strategy-particle-physics</u>.
- The next update process was launched by the CERN Council in September 2018 and is scheduled to be completed in May 2020.

### EPPSU organization

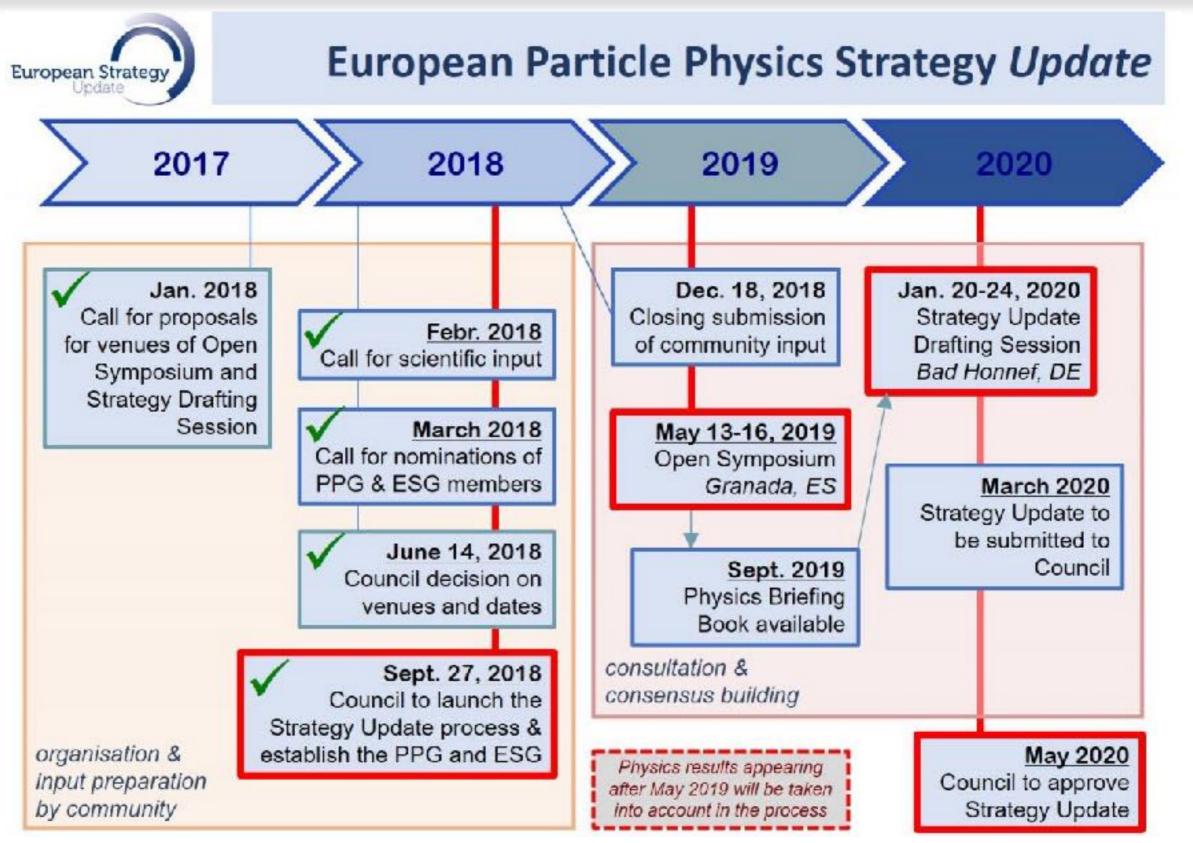


Composition of each group can be found in the backup slides.

- Strategy Secretariat:
  - Organize/coordinate EPPSU process.
  - 4 members.
- Physics Preparatory Group (PPG):
  - Prepares the scientific input to the strategy update based on community input, and submits the "Briefing Book" to the ESG.
  - 17 members.
    - > Delegates from the Americas: Marcela Carena (US), **BV (Canada)**
    - Delegates from Asia: Shoji Asai (Japan), Xinchou Lou (China)
- European Strategy Group (ESG):
  - Drafts strategy update to be submitted to CERN council for approval.
  - ESG is assisted by the Physics Preparatory Group.
  - ~ 36 members (+ 29 invitees).

### EPPSU 2020 Process





Brigitte Vachon, McGill

IPP AGM, 7 June 2019

### Scientific Input to EPPSU



- Call for community inputs issued in March 2018 with deadline for submission set for December 18, 2018.
- 160 written submissions received.

Track	Granada					
ID	sessions	# inputs	Description	Conveners		
1		40	Large experiments and projects	PPG		
2		42	National road maps	ESG		
11		22	Other (communication, outreach, strategy process, technology transfer, individual contributions,)	ESG		
7	B1	21	Electroweak physics (physics of the W, Z, H bosons, of the top quark, and QED)	Keith Ellis	Beate Heinemann	
8	B2	27	Flavour Physics and CP violation (quarks, charged leptons and rare processes)	Belen Gavela	Antonio Zoccoli	
5	B3	25	Dark matter and dark sector (accelerator and non-accelerator dark matter, dark photons, hidden sector, axions)	Marcela Carena	Shoji Asai	
3	B4	51	Accelerator Science and Technology	Caterina Biscari	Lenny Rivkin	
4	B5	20	Beyond the Standard Model at colliders (present and future)	Gian Giudice	Paris Sphicas	
10	B6	31	Strong interactions (perturbative and non-perturbative QCD, DIS, heavy ions)	Krzysztof Redlich	Jorgen D'Hondt	
9	B7	27	Neutrino physics (accelerator and non-accelerator)	Stan Bentvelsen	Marco Zito	
6	B8	35	Instrumentation and computing	Xinchou Lou	Brigitte Vachon	

• Open Symposium organized based on written inputs.

### Canadian input to EPPSU



- Canadian submission prepared by IPP, CINP, TRIUMF and SNOLAB.
  - McDonald and Perimeter Institutes also reviewed and provided input.
- Submission based on 2017-21 Canadian Subatomic Physics Long Range Plan (LRP), including updates since the last LRP broad community consultations.
- Canadian submission attached to agenda.

Canadian Submission to the European Particle Physics Strategy Update

Submission Theme: National Road Maps

Prepared by: Institute of Particle Physics Canadian Institute of Nuclear Physics TRIUMF SNOLAB

Contact: J.M. Roney, Director, Institute of Particle Physics director@ipp.ca

December 18, 2018

## Open Symposium

- Symposium consisted in both parallel and plenary sessions, organized and convened by members of the Physics Preparatory Group (PPG).
- Parallel sessions were organized around 8 different themes:
  - Accelerator science and technology
  - Instrumentation and computing
  - Electroweak physics
  - Strong interactions
  - Neutrino physics
  - Beyond Standard Model at colliders
  - Dark matter and dark sector
  - Flavour physics and CP violation
- Symposium schedule designed to provide sufficient time for detailed discussion.
- 603 participants

CERN Council Open Symposium on the Update of

#### European Strategy for Particle Physics



European Strategy

13-16 May 2019 - Granada, Spain



#### Physics Preparatory Group

#### Halina Abramowicz (Chair) Shoji Asai Beate Heinemann Stan Bentvelsen Xinchou Lou Caterina Biscari Krzysztof Redlich Marcela Carena Leonid Rivkin Jorgen D'Hondt Paris Sphicas Keith Ellis Brigitte Vachon Belen Gavela Marco Zito Gian Gludice Antonio Zoccoli

#### Local Organizing Committee

Francisco del Águila Ju Antonio Bueno (Chair) M Alberto Casas Co Nicanor Colino Bi Javier Cuevas Jo Elvira Gámiz Maria José García Borge Igor García Irastorza

Eugeni Graugés

Juan José Hernández Mario Martínez Carlos Salgado Benjamin Sánchez Gimeno José Santiago

#### https://cafpe.ugr.es/eppsu2019/

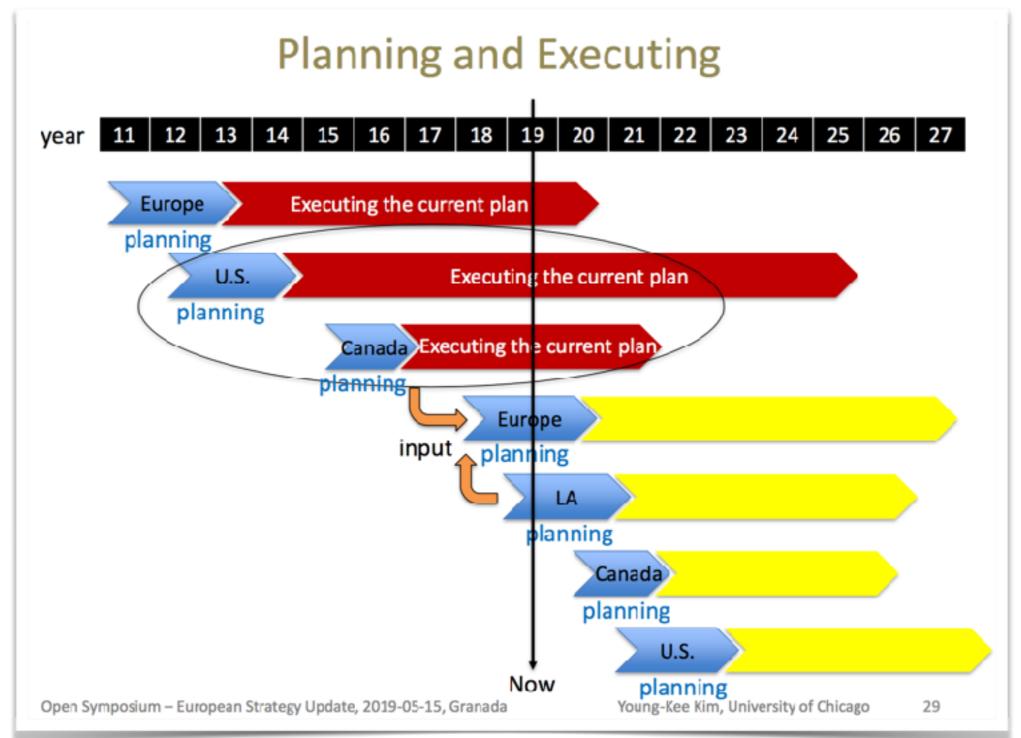


#### Perspectives from the Americas



"Perspective on the European Strategy from the Americas"

Presented by Young-Kee Kim (U.Chicago), APS-DPF Chair-Elect (2019) & Chair (2020).



IPP AGM, 7 June 2019

## Next collider(s)?



- What is the best implementation for a Higgs factory?
- Path towards the highest energies: how to achieve the ultimate performance?
- How to achieve proper complementarity for the high intensity frontier vs. the high-energy frontier?

### Future Colliders



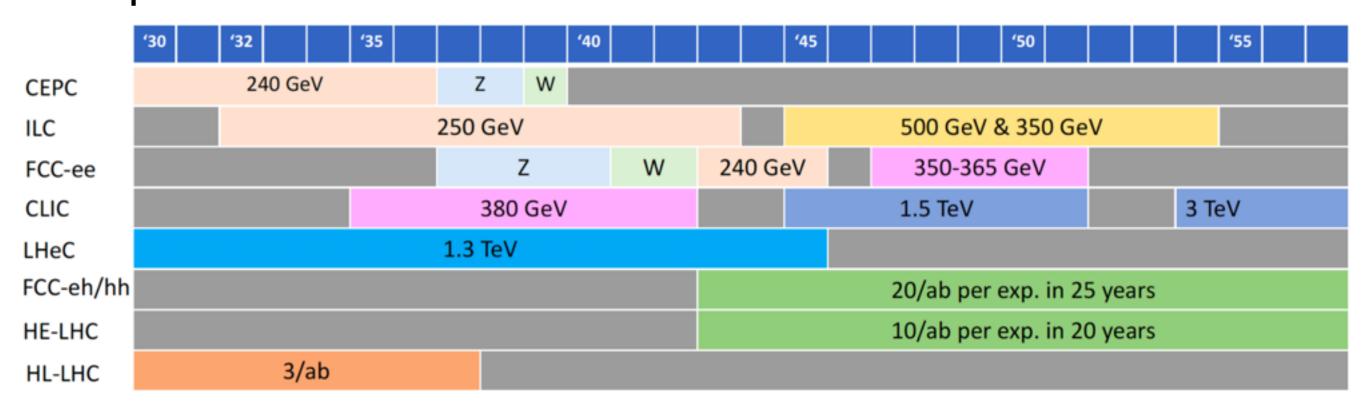
Collider	Туре	$\sqrt{s}$	𝖗 [%] [e <sup>−</sup> /e <sup>+</sup> ]	N(Det.)	$\mathscr{L}_{inst}$ [10 <sup>34</sup> ] cm <sup>-2</sup> s <sup>-1</sup>	$\mathscr{L}$ $[ab^{-1}]$	Time [years]	Refs.	Abbreviation
HL-LHC	рр	14 TeV	-	2	5	6.0	12	[10]	HL-LHC
HE-LHC	pp	27 TeV	16T dipole	2	16	15.0	20	[10]	HE-LHC
FCC-hh	pp	100 TeV	magnets	2	30	30.0	25	[1]	FCC-hh
FCC-ee	ee	$M_Z$	0/0	2	100/200	150	4	[1]	
100 km ring		$2M_W$	0/0	2	25	10	1-2		ee
		240 GeV	0/0	2	7	5	3		FCC-ee <sub>240</sub>
		$2m_{top}$	0/0	2	0.8/1.4	1.5	5		FCC-ee <sub>365</sub>
							(+1)	(1y SD	before 2m <sub>top</sub> run)
ILC	ee	250 GeV	$\pm 80/\pm 30$	1	1.35/2.7	2.0	11.5	[3,11]	ILC250
20-40 km		350 GeV	$\pm 80/\pm 30$	1	1.6	0.2	1		ILC350
20-40 KM		500 GeV	$\pm 80/\pm 30$	1	1.8/3.6	4.0	8.5		ILC500
							(+1)	(1y SD after 250 GeV run)	
CEPC	ee	$M_Z$	0/0	2	17/32	16	2	[2]	CEPC
100 km ring		$2M_W$	0/0	2	10	2.6	1		
		240 GeV	0/0	2	3	5.6	7		
CLIC	ee	380 GeV	$\pm 80/0$	1	1.5	1.0	8	[12]	CLIC <sub>380</sub>
		1.5 TeV	$\pm 80/0$	1	3.7	2.5	7		CLIC <sub>1500</sub>
I I-50 km		3.0 TeV	$\pm 80/0$	1	6.0	5.0	8		CLIC <sub>3000</sub>
							(+4)	) (2y SDs between energy stages)	
LHeC	ep	1.3 TeV	-	1	0.8	1.0	15	[9]	LHeC
HE-LHeC	ep	1.8 TeV	-	1	1.5	2.0	20	[1]	HE-LHeC C
FCC-eh	ep	3.5 TeV	-	1	1.5	2.0	25	[1]	FCC-eh

"Capability of future machines for precision Higgs physics", M. Cepeda

### Future Colliders



#### Proposed schedule



"Overview and technical challenges of proposed Higgs factories", D. Schulte

#### Higgs @ Future Colliders Report: arXiv:1905.03764

Brigitte Vachon, McGill

## Summary



- EPPSU process ongoing and to conclude with approval of strategy, by the CERN Council, in May 2020.
- CND written input to EPPSU was prepared by IPP, CINP, TRIUMF and SNOLab, with input from the McDonald and Perimeter Institutes, and submitted in December 2018.
- Open Symposium recently took place in Granada, Spain, 13-16 May 2019.
- Physics Preparatory Group (PPG) currently drafting the "Briefing Book" to be submitted to the European Strategy Group (ESG).
- Stay tune!



# Additional Material

### Strategy Secretariat



#### STRATEGY SECRETARIAT

Scientific Secretary (Chair)	Prof. Halina Abramowicz (IL)
SPC Chair	Prof. Keith Ellis (UK)
ECFA Chair	Prof. Jorgen D'Hondt (BE)
Chair EU Lab. Directors' Mtg	Prof. Lenny Rivkin (CH)

#### Physics Preparatory Group (PPG)

- Strategy Secretary
  - Halina Abramowicz (IL)
- SPC chair
  - Keith Ellis (UK)
- Delegates nominated by SPC
  - Caterina Biscari (ES), Belen Gavela (ES), Beate Heinemann (DE), Krzysztof Redlich (PL)
- ECFA chair
  - Jorgen D'Hondt
- Delegates nominated by ECFA
  - Stan Bentvelsen (NL), Paris Sphicas (GR), Marco Zito (FR), Antonio Zoccoli (IT)
- Chair of European Lab Director meeting
  - Lenny Rivkin (CH)
- Delegate nominated by CERN
  - Gian Giudice (CERN)
- Delegate nominated by ICFA
  - Americas: Marcela Carena (US) and Brigitte Vachon (Canada)
  - Asia: Shoji Asai (Japan) and Xinchou Lou (China)



[17 members]

#### European Strategy Group (ESG)

#### Members:

- the Strategy Secretary (acting as Chair),
- one representative appointed by each CERN Member State,
- one representative appointed by each of the Laboratories participating in the major European Laboratory Directors' meetings, including its Chair (CERN, CIEMAT (Madrid-Spain), DESY (Hamburg-Germany), Irfu (Saclay-France), LAL (Orsay-France), N (Amsterdam-Netherlands), LNF (Frascati-Italy), LNGS (Gran Sasso-Italy), PSI (Villigen-Switzerland), STF (Didcot-UK)),
- the CERN Director-General,
- the SPC Chair,
- the ECFA Chair.

```
Invitees: [~ 29 people]
```

- the President of the CERN Council,
- one representative from each of the Associate Member States,
- one representative from each Observer State,
- one representative from the European Commission,
- the Chairs of ApPEC and NuPECC,
- the Chairs of FALC and ESFRI,
- the members of the Physics Preparatory Group.

European Strategy