HEP overview in Belgium

RECFA visit – September 12th 2025
Hotel Le Plaza

B. Clerbaux, D. Dobur, N. van Remortel
(Belgian representatives at the ECFA)
on behalf of the Belgian HEP community

CONTENT

1- Kingdom of Belgium, some indicators

2- Higher education system

3- HEP groups and research projects

4- Resources for research

5- BE at CERN

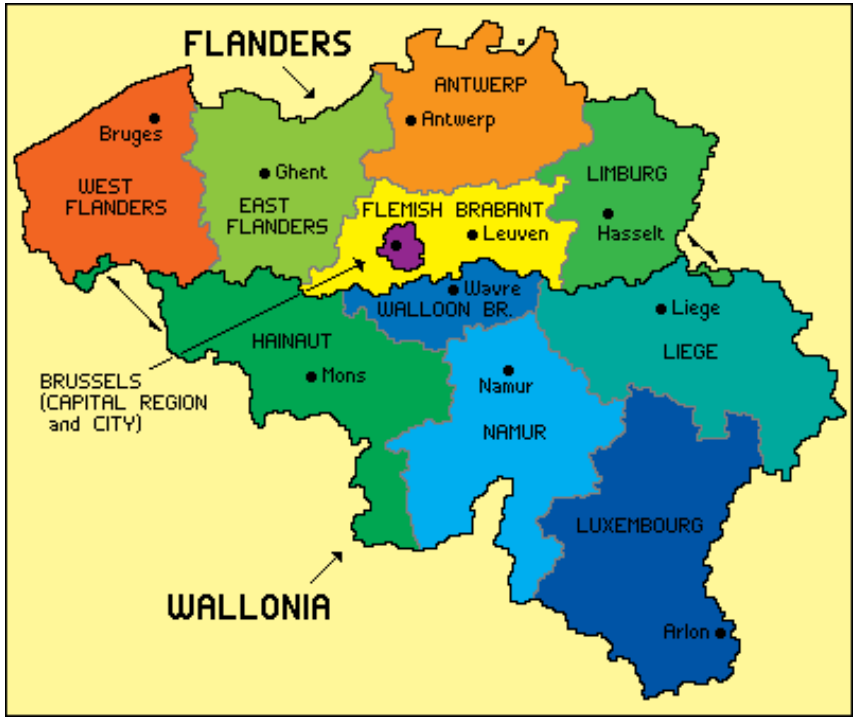
6- HEP coordination

7- Conclusions

1- Kingdom of Belgium, some indicators

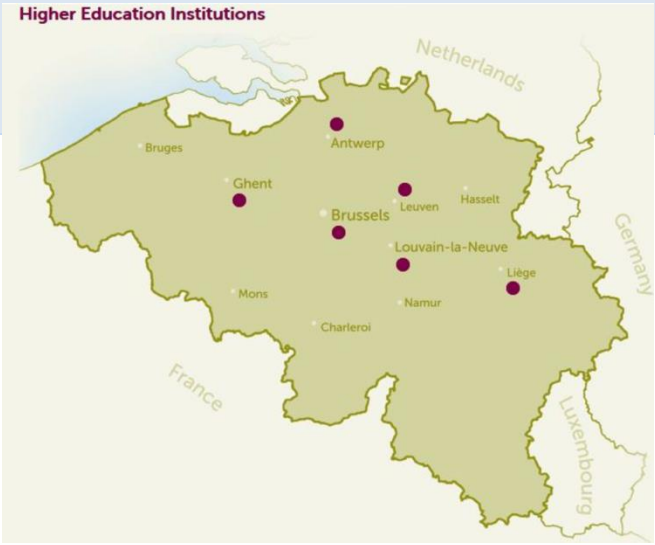
- **1 Federal state:** National matter: justice, defense, finance, and social security
- **3 Communities : Flemish (FL), French (FR), German**
  Matters concerning "people" : education, culture, part of the health policy
- **3 Regions: Flanders, Wallonia, Brussels-capital (bi-lingual)**
  Matters concerning "territory" : economy, transport, employment, environment

Population: 11.8 million residents
0.5% population growth/year
58% In Flemish Region,
31.4% in Walloon Region
10.6% in Brussels-Capital Region



University teaching and public research :
is run independently by the two communities in the regions in which they have authorities :
Flemish Community :
Flanders, Brussels-capital → FL
French Community:
Wallonia, Brussels-capital → FR

2- Higher education system



- **Universities** :BA (3y)-MA (2y) system (Bologna, since 2004) + PhD (4y) for research

- **University college** ("higher-school") : practical and profession-oriented programs, associated to universities, deliver BA and MA degrees

Flemish Community	French Community
UGent	**ULiège**
VUB (Vrije U. Brussels)	**UCLouvain (U. Catholique de Louvain)**
UAntwerpen	**ULB (U. Libre de Bruxelles)**
KULeuven (Katholieke U. Leuven)	**UMons**
UHasselt	UNamur

9 universities deliver MA diploma in physics (not UHasselt)
8 universities train PhD in particle physics (EXP and/or TH) (not UHasselt and UNamur)
Almost all fundamental research is performed at Universities

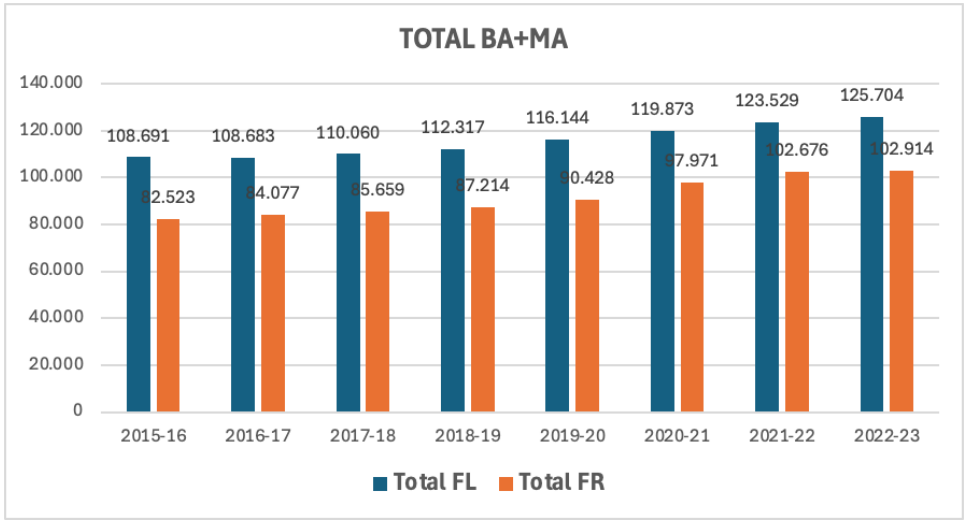
2- Higher education system

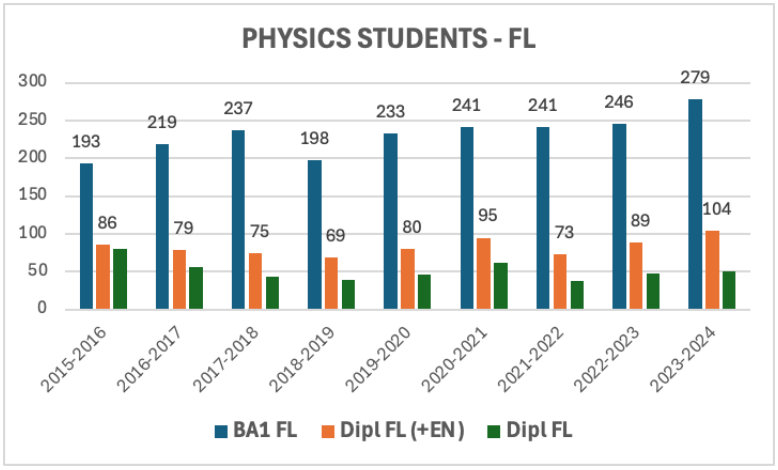
Sources: CREF and VLIR

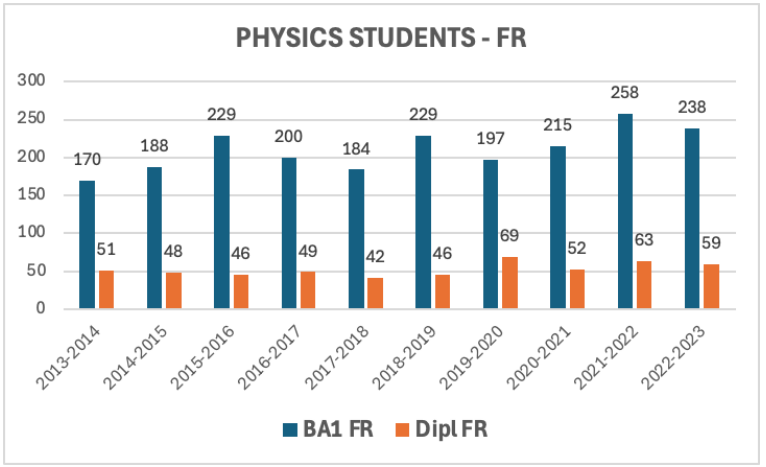
- **Total number of BA+MA students at university**
  ~2-3% increase per year

- **Number of BA1 (first generation) students in PHYSICS at university**
  ~ 3.5-4% increase per year

- **Numbers of students being diplomated (MA2) in PHYSICS at University:**
  stable at ~160 per year





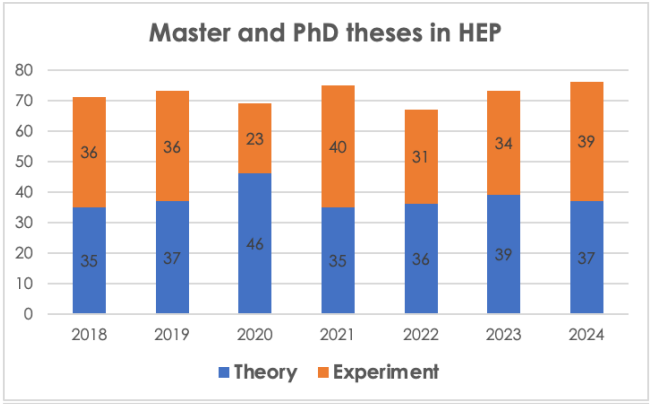


2- Higher education system

Source: data@HEP

EXPERIMENTAL		THEORY
HEP		
ULB	IIHE	ULB
VUB		VUB
UCLouvain	CP3	UCLouvain
UGent		UGent
UAntwerpen		UAntwerpen
		UMons
Nuclear		ULiège
KULeuven		KULeuven

IIHE : Interuniversity Institute for High Energies
CP3 : center for Cosmology, Particle Physics and Phenomenology

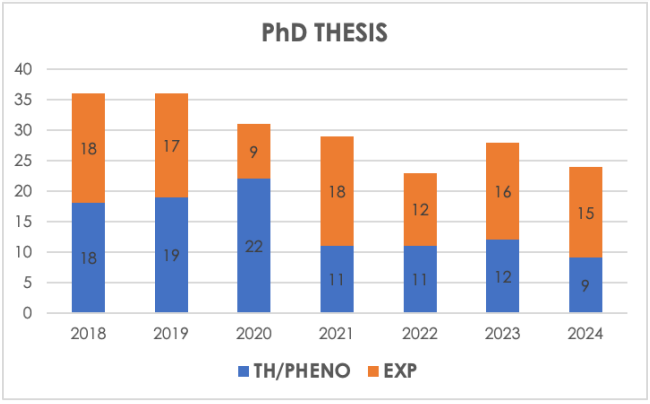


→ stable ~70/year

½ EXP- ½ TH

HEP: ~45-50/year

EXP: ~20-25/year
TH: ~25-30/year



3- HEP groups and research projects

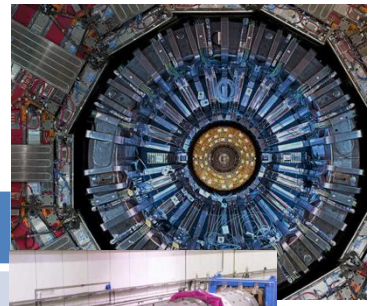
Sources data@HEP

- Accelerator based experiments

→ See talks by D. Dobur, P. Vanlaer, E. Cortina and G. Neyens

In 2010 : CMS, NA62, ISOLDE, + HERMES & H1 (DESY)

EXPERIMENT	GROUPS	2017- FTE	2024 - SR
CMS	ULB, VUB, UCL, UA, UG	70,5	88 (73 FTE)
NA62	UCL	4,75	5
SHIP	UG		1
ISOLDE/MEDICIS	KUL	32	30



Soon : EIC (Brookhaven National Lab) new hiring at the VUB

- R&D in detector, DAQ and accelerators

→ See talk by M. Tytgat

EXPERIMENT	GROUPS	2017 - FTE	2024 -SR
Future Collider	ULB, VUB	0.5	2,1
R&D	ULB, VUB, UCL, UA, UG, KUL	26,75	9,6
Spin-off	KUL, VUB, UCL	7	1,3

Large overlap between R&D and CMS In 2017

2017 → FTE = perm. + PD + PhD

2024 → SR = perm. + PD + PhD + eng./comp.

3- HEP groups and research projects

Sources data@HEP

- **Neutrino and astroparticle experiments** → See talks by J.A. Aguilar Sanchez and K. de Vries

In 2010 : OPERA, IceCube, TA

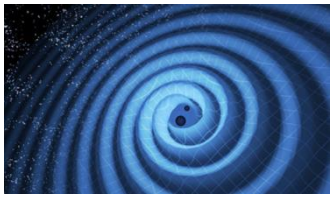
EXPERIMENTS	GROUPS	2017 - FTE	2024 - SR
SoLiD	VUB, UA, UG	9,5	-
IceCube	ULB, VUB, UG, UCL	19	17
LOFAR	VUB	4	3
TA	ULB	2	1,5
JUNO	ULB	1	3,7
AUGER	ULB	-	5
RNO-G	ULB, VUB, UG	-	11,4
KM3NET	UCL, (ULB)	-	7

3- HEP groups and research projects

Sources data@HEP

- **Gravitational Wave experiments**

→ See the talk by H. van Haevermaet



In 2010 : None

EXPERIMENT	GROUPS	2017- FTE	2024- SR
VIRGO	KUL,ULB, VUB, UCL, UA, UG, ULg	-	25
ET, ETpathfinder	KUL, UA, UCL, UG, Ulg, ULB, VUB, UM	4	29
LIGO	ULB, ULg	2,5	2
LISA	ULB, KUL	2	2

- **BE Theory/Pheno community**

→ See the talks from M. Tytgat

In 2010 : TH/PH (108)

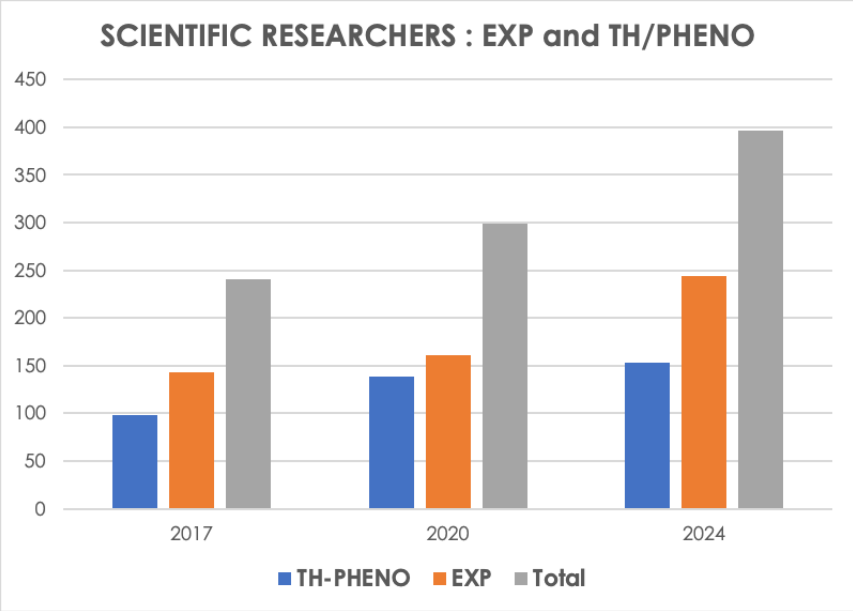
	GROUPS	2017- FTE	2024 - FTE
Theory/Pheno	ALL	98	153

3- HEP groups and research projects

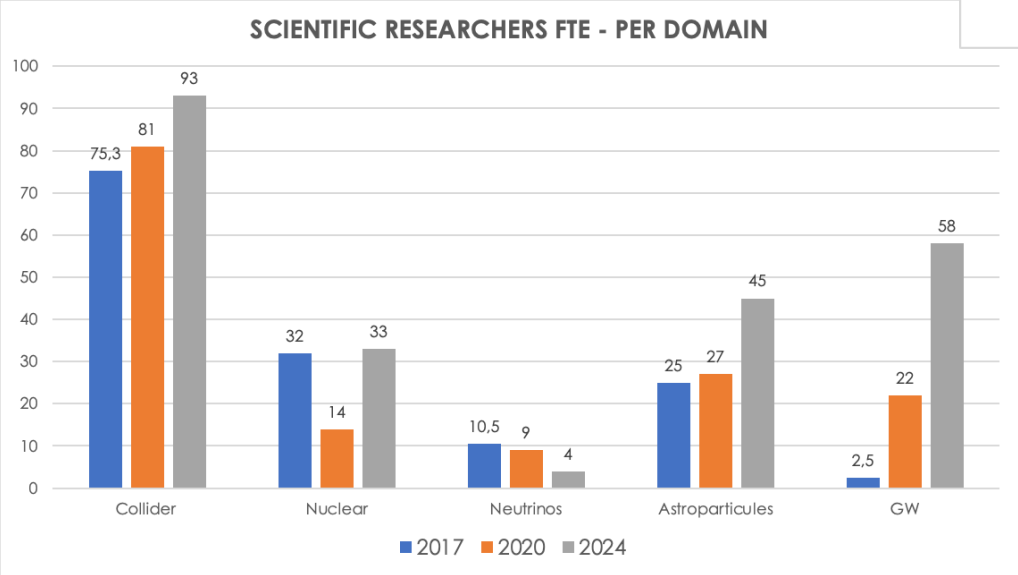
Sources data@HEP

Evolution : 2017 Previous RECFA
2020 Mid-term report
2024

→ Positive evolution in scientific researchers in EXP and TH/PH



Scientific researchers (FTE) per domain :

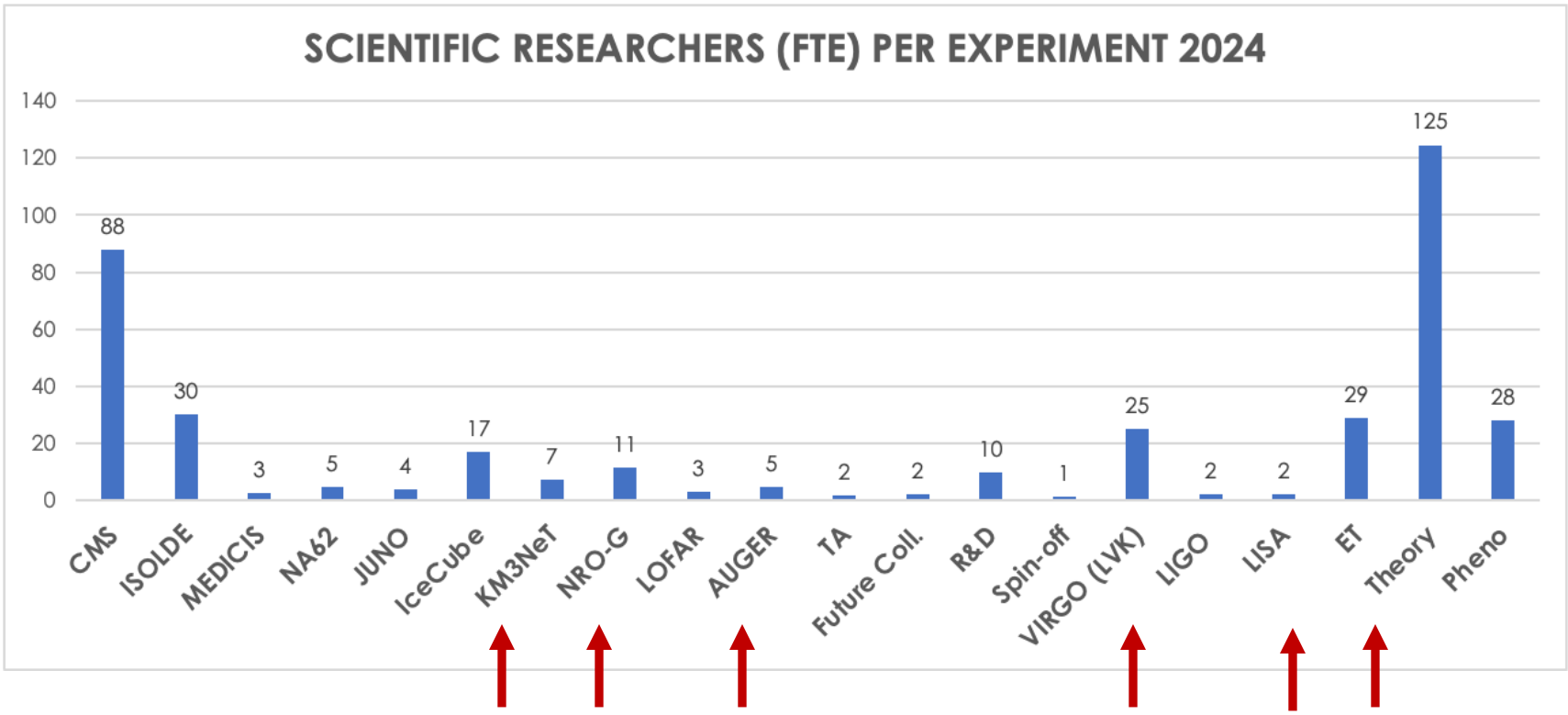


Caution
in 2017 :
SR = Perm+PD+PhD
in 2024 :
SR = Perm+PD+PhD+eng./comp.

3- HEP groups and research projects

Source: data@HEP

- TODAY, FTE of scientific researchers across experiment and projects :

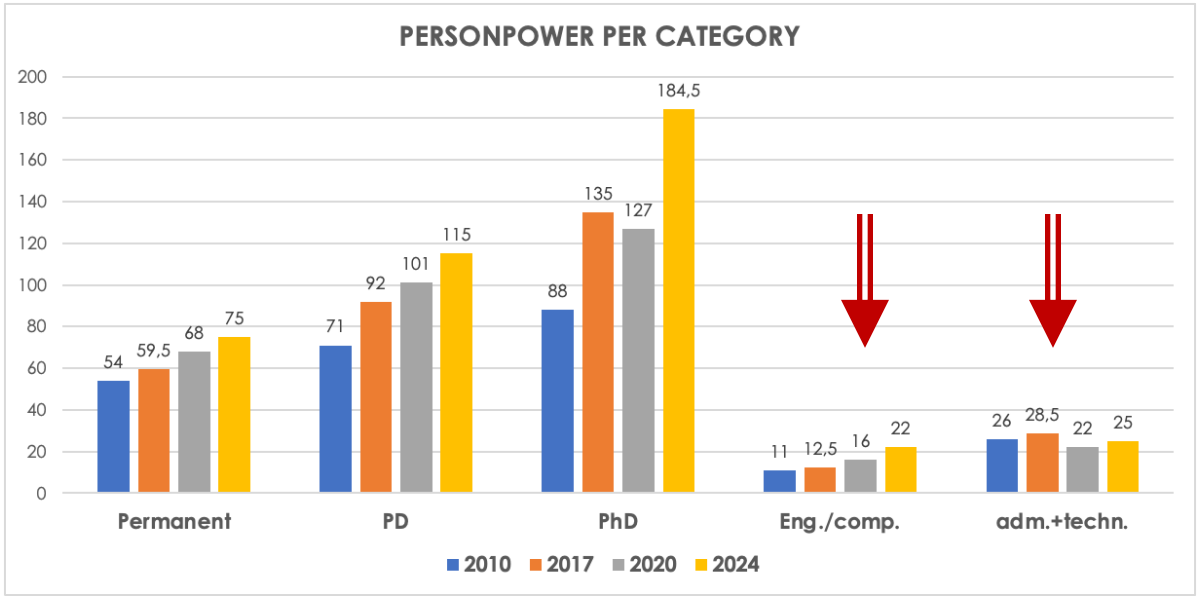


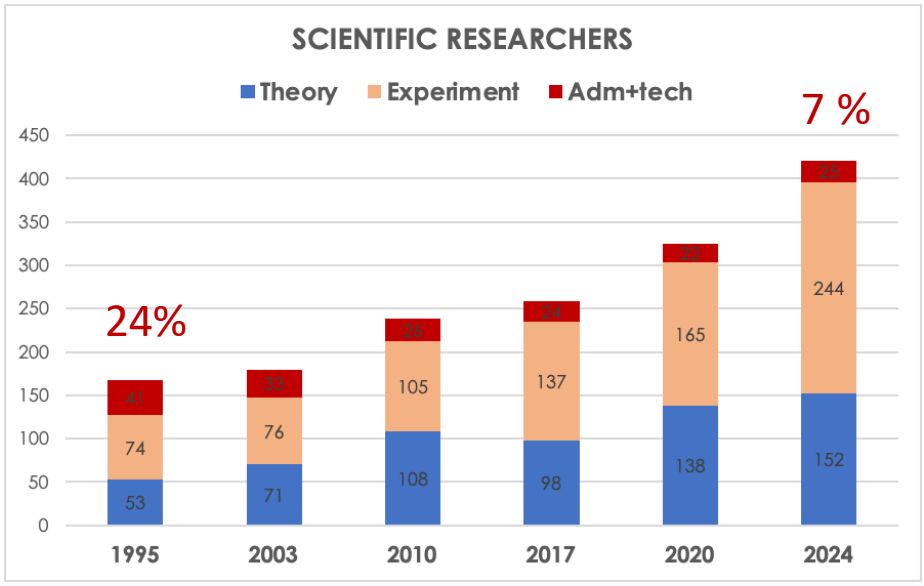
New since 2017

Nice diversity across 4 main domains : collider, nuclear, neutrinos&astroparticle, GW + Theory&pheno

3- HEP groups and research projects

Source: data@HEP





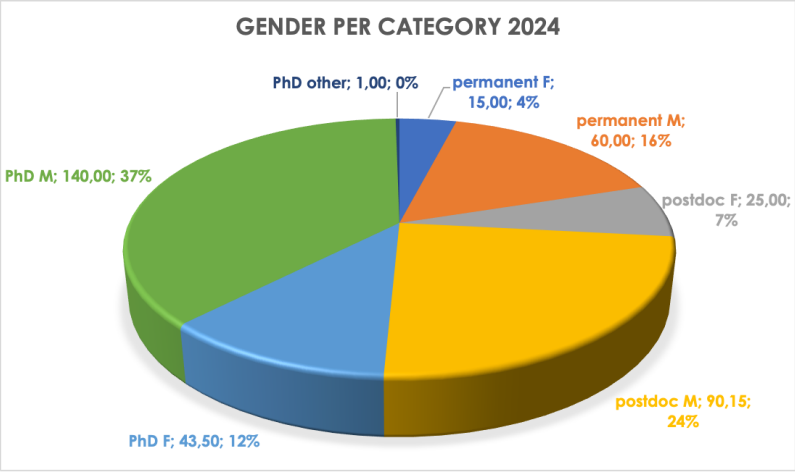
- Positive evolution in personpower (PP) for Permanent, PD and PhD
- Very low fraction of PP in Eng./comp (6% in 2024)

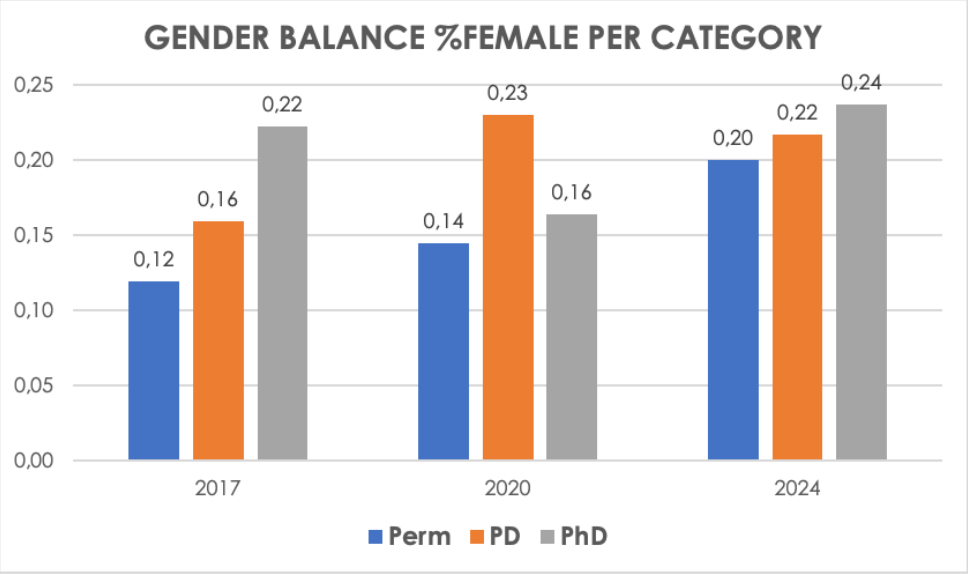
- Very low and decreasing fraction of adm+techn PP
  24% in 1995
  7% in 2024

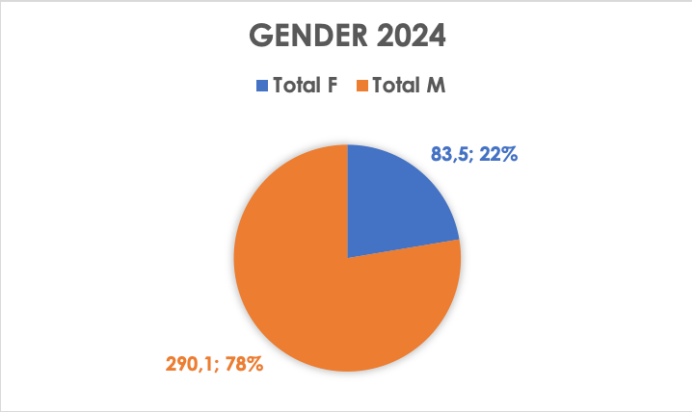
3- HEP groups and research projects

Source: data@HEP

- Gender distribution :





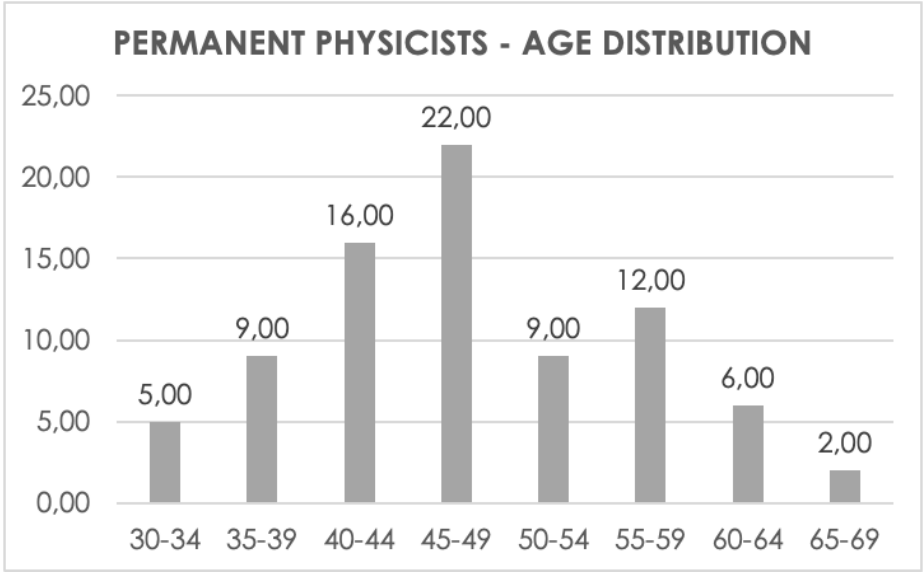


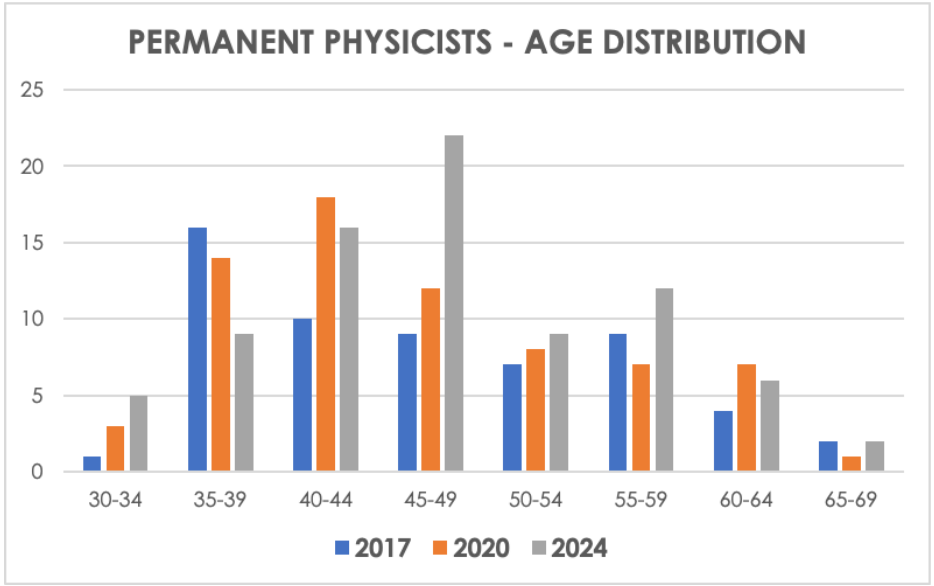
- Gender unbalanced : 22% F and 78% M
- Gender unbalanced in all career stages despite large effort in university hiring policies
- Improvement in the permanent category

3- HEP groups and research projects

Source: data@HEP

- **Age distribution :**





- 2 new recent F hirings of young permanent staff in CMS in 2025

4- Resources for research

Main funding sources

Flemish community :

- **FWO** : fund. research, equip, personnel for EXP and TH
  - International research Infra (IRI) (4y)
    main source for large exp.: equip, (tech) PP, M&O
  - Junior and senior Research Projects (4y, projects)
  - WEAVE projects (bottom-up cross-EU initiative)
  - Mandates PD, PhD
  - Odysseus (tenure track (5y)+ 0.5 to 3.5 Meuros)

  No permanent reserach position since 2000
- **Universities** : personnel + base funding
- **iBOF**: 4y – (2.4-3.4ME) Interuniversity (FL) fund

French community :

- **FNRS** : fund. research, equip, PP for EXP and TH
  - IISN (1-4y, projects)
    main source for large exp.: equip, M&O,personnel)
  - IISN : CMS-II core cost
  - Mandates PD, PhD
  - Permanent research position (no research eng.)
  - FRIA grants for PhD
  - WEAVE projects
- **Universities** : personnel, ARC

Federal government :

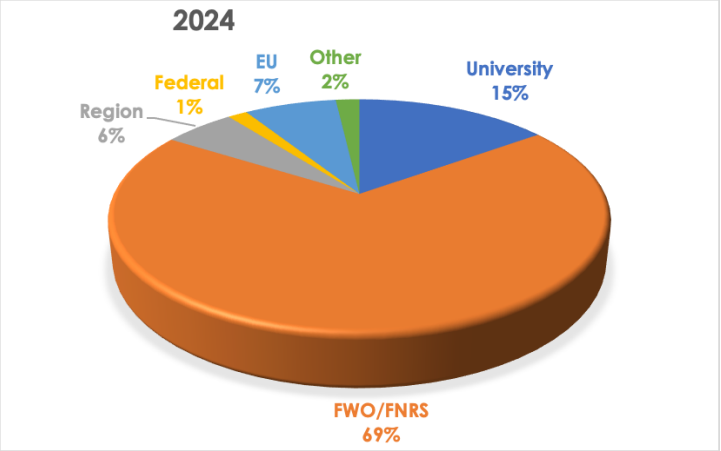
- Economic affairs : CERN fee
- BELSPO

Regions : R&D and innovation

Europe :

Horizon2020, ERC, M.Curie, COST, …

HEP Community in 2024 :

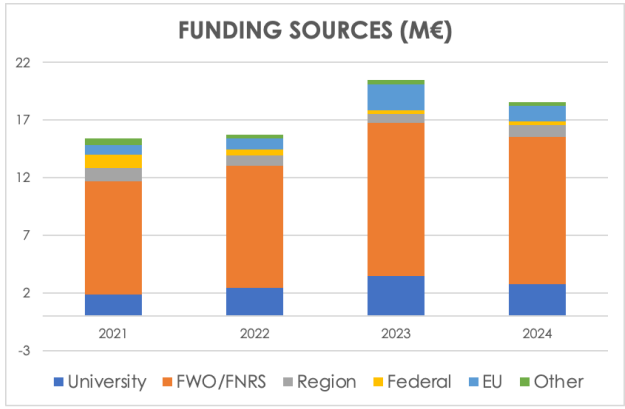


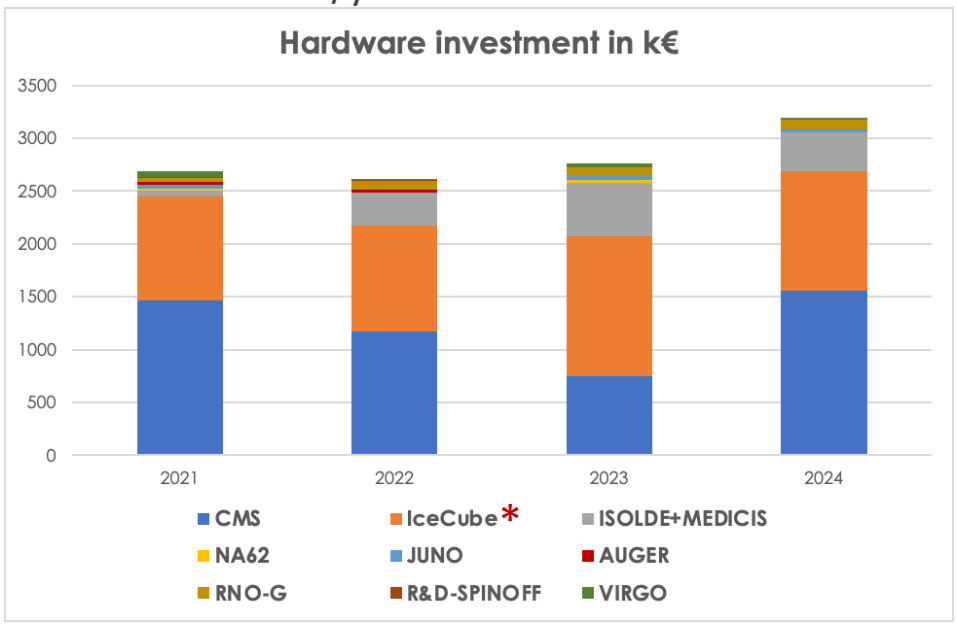
4- Resources for research

Source: data@HEP

- **Repartition is ~stable with time →**
  about 15-20 M€/year
  Rely at ~69% on FWO/FNRS

- **Hardware investment :**
  about 2-3 M€/year





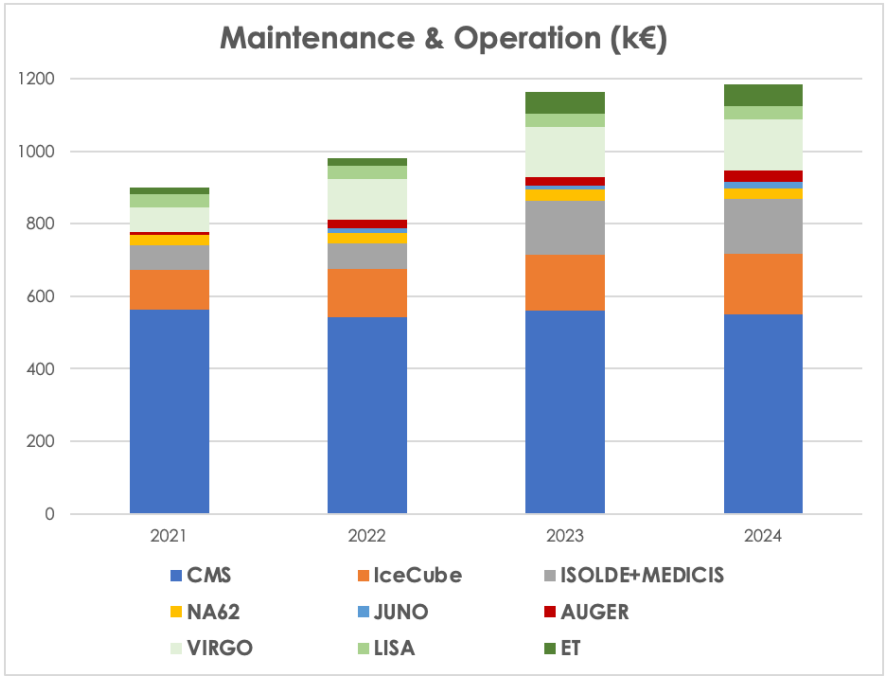
*IceCube + its radio extension (RNO-G)

For ET :
-Federal ET-PP&ETO: 4 M€
-Flanders : (EU-EFRO,FWO IRI,FL region)
2021 : 4.2 M€ (ETpathfinder)
2022-2025: ~34 M€ (ET-PP,EMR site,R&D)
2026-2029: ~17 M€ expected
-Wallonia & FNRS:
2020: ETEST: 16.2 M€ (4y) (CRYSTAL,site)
2020: ERC SILENT 2M€ (5y)
2019-25 : 2M € (IISN)
2023: ULiege 0.7 M€
2024: 4 ET Projects: 10 M€ (4y)
-Reserved for construction :
200 M€ in Flanders and 200 M€ in Wallonia

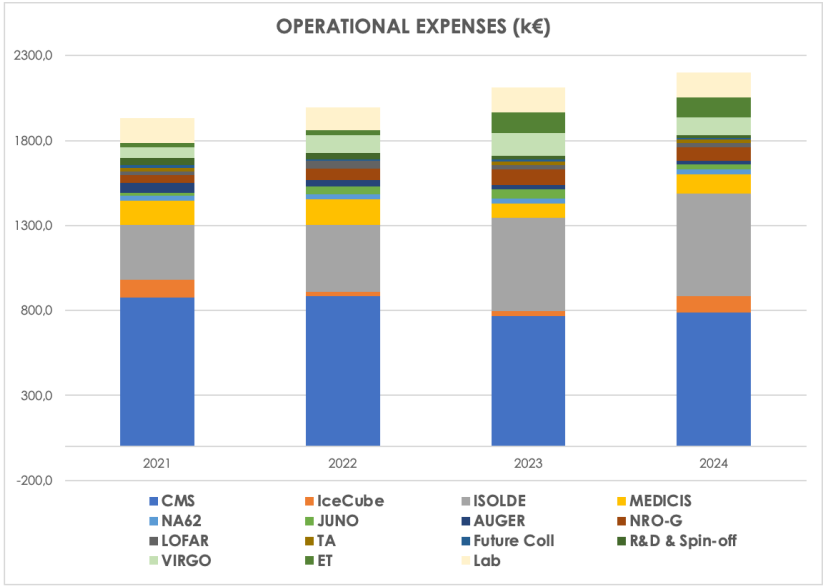
4- Resources for research

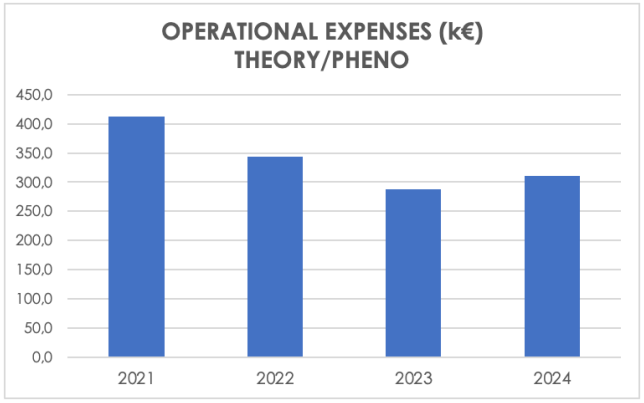
Source: data@HEP

Maintenance and Operation (M&O):
In total about 1,1M€/year in 2024



Operational expenses : (travels, small materials)
In total about 2M€/year in 2024





- M&O budget for large experiment provided
- Sufficient budgets in EXP and TH for travels and small expenses

5- BE at CERN : Users/Institutes

Sources: CERN Greybook

University	Experiments	Users	External Participants	Others
KULeuven	ISOLDE	49	23	3
ULB	CMS	30	10	1
UCLouvain	CMS, NA62	24	6	2
VUB	CMS, RD-18	22	5	0
UGent	CMS, SHiP	14	4	0
UAntwerpen	CMS	8	8	0

+ JRC (Geel) + BNRC(Mol)

Number of Authors:	127
Total number of participants:	218
Users:	153
External Participants:	59
Other Participants:	6

Sources: CERN Personnel Stat 2024

Table 33a: Users by Country of Institute over the last 5 Years (2020 – 2024)

Country of Institute	Year				
	2020	2021	2022	2023	2024
AT	82	74	85	86	88
BE	122	122	129	129	142
BG	37	39	43	46	49

5- BE at CERN : Staff/Fellows

Sources: CERN Personnel Stat 2024

Table 25: Staff Members by Nationality, Professional Category and Female representation – 31.12.2024

Nationality	Professional Category												Grand Total	
	1		2		3		4		5a		5b/5c			
	Research Physicists		Scientific & Eng. work		Technical work		Manual work		Prof. Admin. work		Office & Admin. work			
	F	Total	F	Total	F	Total	F	Total	F	Total	F	Total	F	Total
AT		2	7	47	1	3			2	5	1	1	**11**	**58**
BE	1	3	3	45	2	23		2	6	13	9	10	**21**	**96**
BG			2	11		1			1	2			**3**	**14**

3,4%

3,6%

Table 29a: Members of the Personnel other than Staff by Nationality and Status – 31.12.2024

Nationality	Graduates and Fellows		MPA (excl. Users and MPA training)		MPA training		Users		Grand Total	
	HC	*%*	*HC*	*%*	*HC*	*%*	*HC*	*%*	*HC*	*%*
AT	13	1.1	9	1.0	22	4.3	94	0.8	**138**	**0.9**
BE	20	1.7	10	1.1	6	1.2	101	0.8	**137**	**0.9**
BG	2	0.2	8	0.9	3	0.6	83	0.7	**96**	**0.6**

5- BE at CERN : Contribution and Industrial Return

Sources: CERN procurement

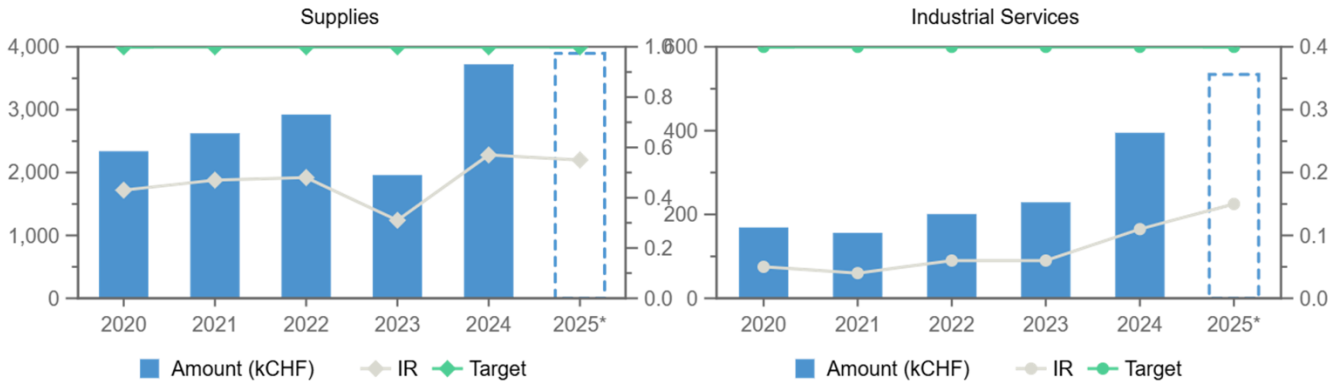
- **Belgian annual contribution to CERN** (kCHF)

Year	Country Contribution	All Countries	%
2020	31 269	1 196 893	2.61
2021	32 398	1 199 321	2.7
2022	32 668	1 206 284	2.71
2023	33 204	1 230 382	2.7
2024	34 053	1 266 086	2.69
2025	34 355	1 267 954	2.71

- **Belgian Industrial Return (IR)**

	Supplies		Services	
Year	Ratio	Target	Ratio	Target
2020	0.54	1	0.05	0.4
2021	0.54	1	0.05	0.4
2022	0.51	1	0.05	0.4
2023	0.42	1	0.05	0.4
2024	0.45	1	0.07	0.4
2025*	–	1	–	0.4

Since many years IR stays too low
Poorly unbalanced countries

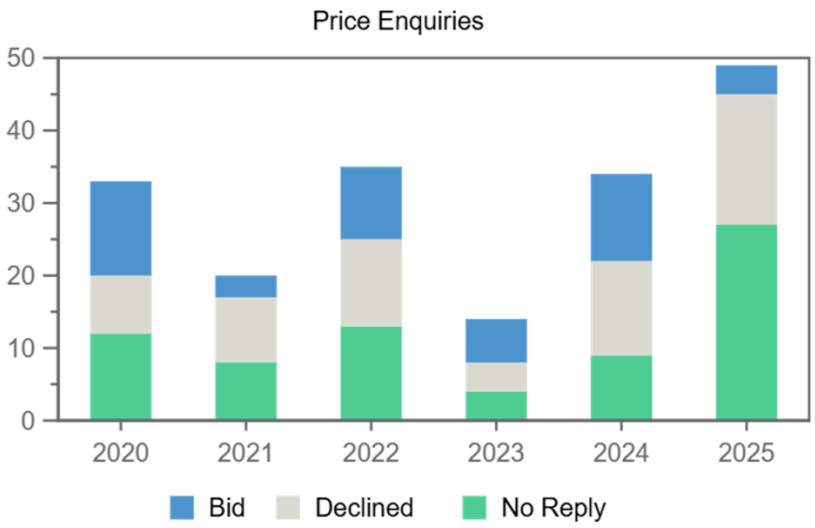


BE expenditures in 1) Transport, Handling and Vehicle, 2) Mechanical engineering, 3) Information technology

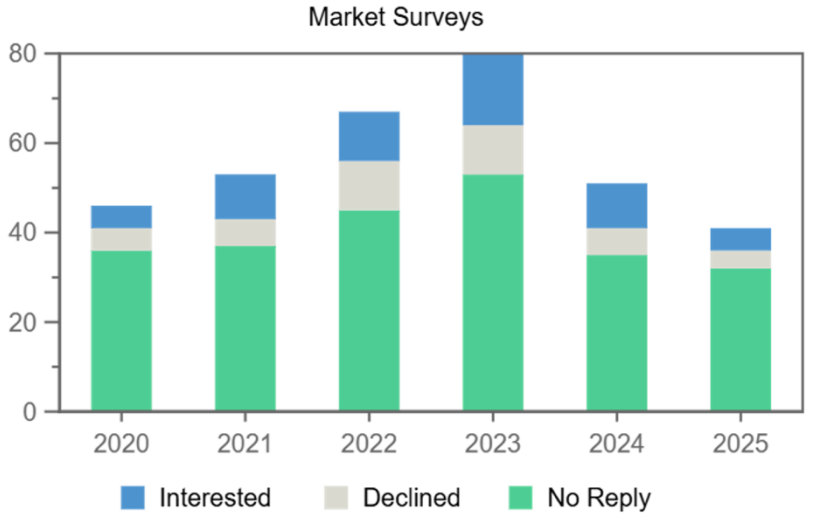
5- BE at CERN : Contribution and Industrial Return

Sources: CERN procurement

- **Price Enquiries** above 50k CHF
  Number of firms contacted



- **Market survey** for BE
  Number of firms contacted



Large fraction of “declined” or “no reply”

6- Coordination of the HEP community

FL/FR and EXP/TH in HEP at large

- IAP (InterUniversity Attraction Pole, BELSPO) - terminated
Initiative of “Solstice meetings” – 3 phases 2002->2017
- Transfer to FWO/FNRS - **EOS (excellence of Science)** - terminated
FL/FR and EXP/TH but more focussed project 2017-2021
- Transfer to WEAVE (bottom-up cross-EU initiative)

- COSPA meeting : BE networking
- Consortium EGO (EU Grav. Observatory)
- Collider community : ECFA
Also NUPPEC/APPEC

- Discussion about the next flagship experiment at CERN
Organised by BE delegate at the CERN council + ECFA members
Several workshop/meetings/Discussions
HEP community at large

HEP at large
TH/EXP

Conclusions

Overall HEP situation in BE is positive:

- Keep strong commitment at CERN
  in particular LHC program (CMS and CMS tracker endcap upgrade), in NA62/SHiP
  Large group in nuclear physics - ISOLDE
- Diversification in various fields
  - Strong increase of participation in GW (VIRGO/ET)
  - New initiative in neutrino/astroparticules – development of radio detection
- Strong EXP and TH groups
- Growth in person power and funding
- Age profile and new young hirings

Points of attention :

- Diversity and future flagship experiment
- * Funding and R&D : lack of research engineers and technicians in EXP groups,
  Salary not attractive compared to private market
- * Umbrella/Strategic body (financial/organisational) to promote/coordinate the EXP/TH – FL/FR HEP community
- Gender balance
- Industrial Return

*Already In 2017 RECFA report

Conclusions

We are grateful to our two main funding agencies for the strong support provided to the HEP community, as well as the other sources (universities, regions, federal, …)

We would like to thank the HEP colleagues who worked hard to provide us with all numbers

KUL-NUCL	Gerda Neyens	UGent	Didar Dobur
KUL-TH/GW	Thomas Hertog	Ulg-FSA	Christophe Collette
UA-EX	Nick van Remortel	Ulg-AST	Jean-René Cudell
UCL-PH	Cécile Degrande	UM-TH	Nicolas Boulanger
UCL-EX	Christophe Delaere	VUB-ST	Ben Crabs
ULB-ST	Geoffrey Compere	VUB-PH	Alberto Mariotti
ULB-PH	Michel Tytgat	VUB-EX	Michael Tytgat
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