Belgium HEP Overview

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IIHE-Université Libre de Bruxelles
on behalf of the Belgian HEP community

RECFA Visit
Brussels 21st April 2017

Selected indicators for Belgium

lun. 15 ° 4 °

mar. 11 ° 2 °

Population

11.2 million

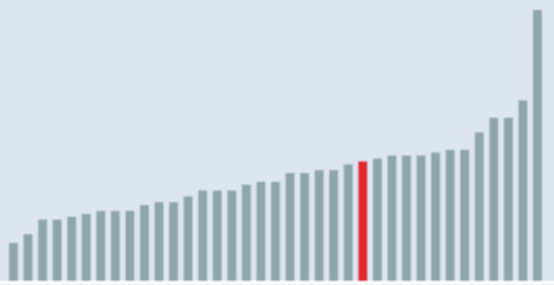
Growth rate: **0.4%** ↓

Education

Science

GDP

45 873 US$ per capita



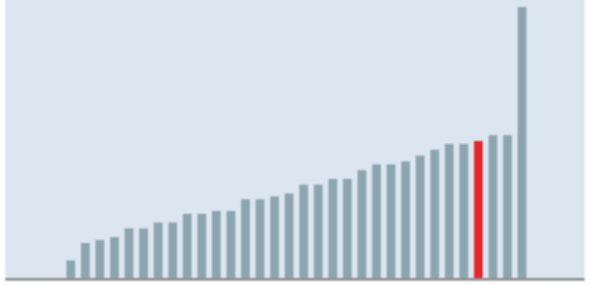
Projected growth rate:

1.5% ↑

Tax

Tax on personal income:

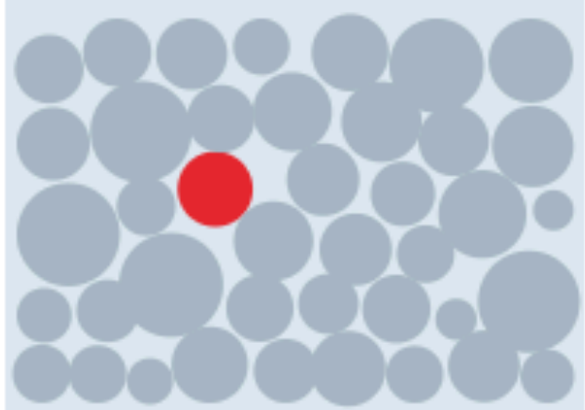
12.6 % of GDP



Income inequality

CO_2 emissions

7.8 tonnes per capita



Debt

Household debt:

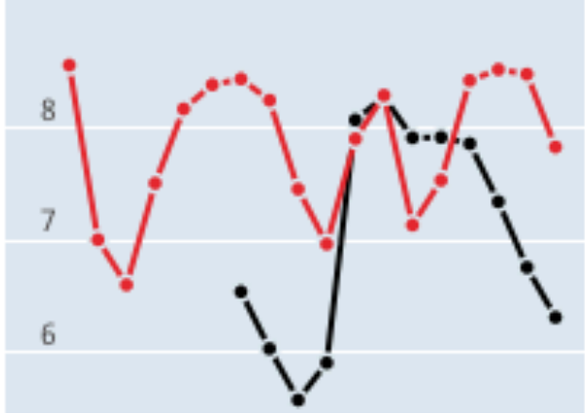
114.3 % of disposable income

Government debt:

126.5 % of GDP

Unemployment

7.8 % of labour force



data.oecd.org/belgium (April 2017)

As member state, Belgium contributes to 2.76% of CERN total budget (value of 2015)

Kingdom of Belgium

- 1 Federal State
- 3 communities
  - Dutch/Flemish (59%)
  - French (41%)
  - German (<1%)
- 3 regions
  - Flanders (Dutch)
  - Wallonia (French)
  - Brussels-Capital (Bilingual)

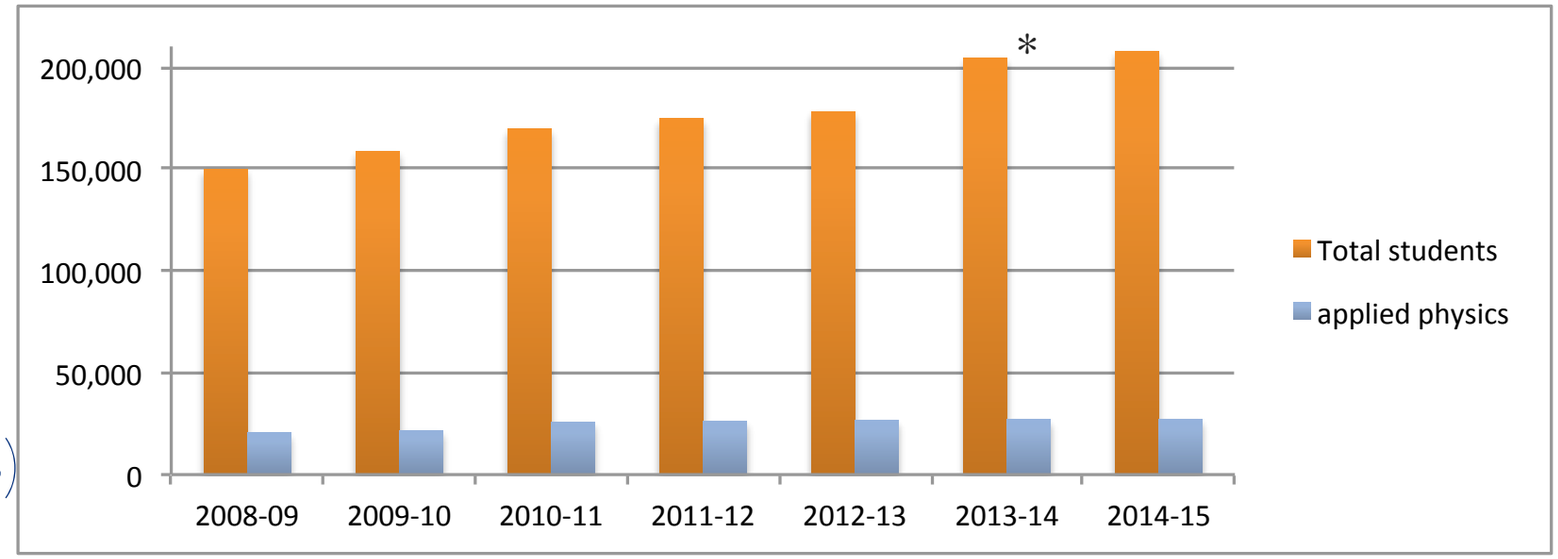
Political evolution: more and more transfer of competences from the federal to the communities/regions.
University teaching and public research are run totally independently by the 2 communities… with some noticeable exceptions

Higher Education

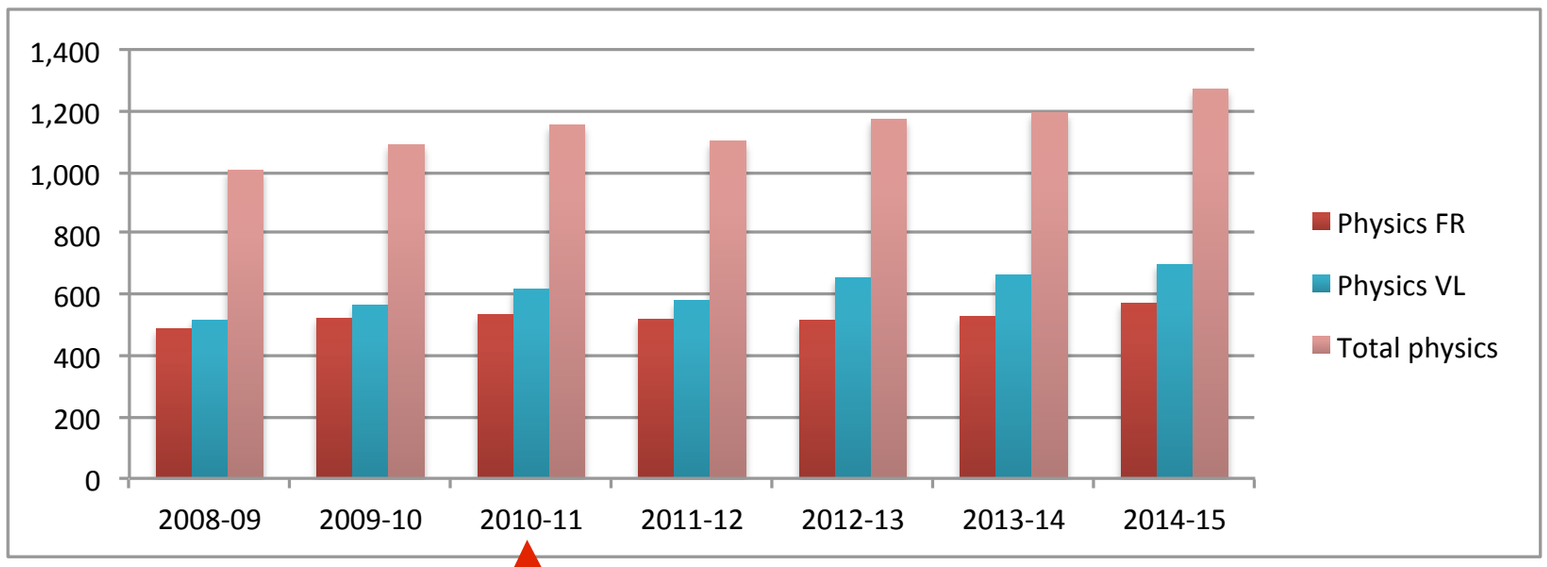
Higher Education System

- Bologna system:
  - BA: Bachelor degree (3 years)
    - College (short + long term)
    - University
  - MA: Master degree (1 or 2 years)
    - College (long term)
    - University
  - PhD (4 years)
    - University

registration in 1st year for BA+MA prog.



* College long term included in 2013-24 (Flanders)



RECFA 2010

→ + 10%

Almost all reasearch is performed in Universities

Universities

Flemish Community

with Part. Phys.

- **VUB**: Vrije Universiteit Brussel
- **KUL**: Katholieke Universiteit Leuven
- **UGent**: Universiteit Gent
- **UA**: Universiteit Antwerpen

no Part. Phys.

- Universiteit Hasselt

French Community

with Part. Phys.

- **ULB**: Université Libre de Bruxelles
- **UCL**: Université catholique de Louvain
- **ULg**: Université de Liège
- **UMons**: Université de Mons

no Part. Phys

- Université de Namur
- Université Saint-Louis Bruxelles

all large Universities train Phd in Particle Physics

exp. and/or theory

HEP research

University Groups

Experimental

HEP

- **ULB**: Université Libre de Bruxelles
- **VUB**: Vrije Universiteit Brussel
- **UCL**: Université catholique de Louvain
- **UGent**: Universiteit Gent
- **UA**: Universiteit Antwerpen
- **UMons**: Université de Mons *

Nuclear

- **KUL**: Katholieke Universiteit Leuven

Theory

- **ULB**: Université Libre de Bruxelles
- **VUB**: Vrije Universiteit Brussel
- **UCL**: Université catholique de Louvain
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* UMons now closing experimental Part. Phys. dept.

University Groups

Experimental

HEP

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} IIHE

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CP3

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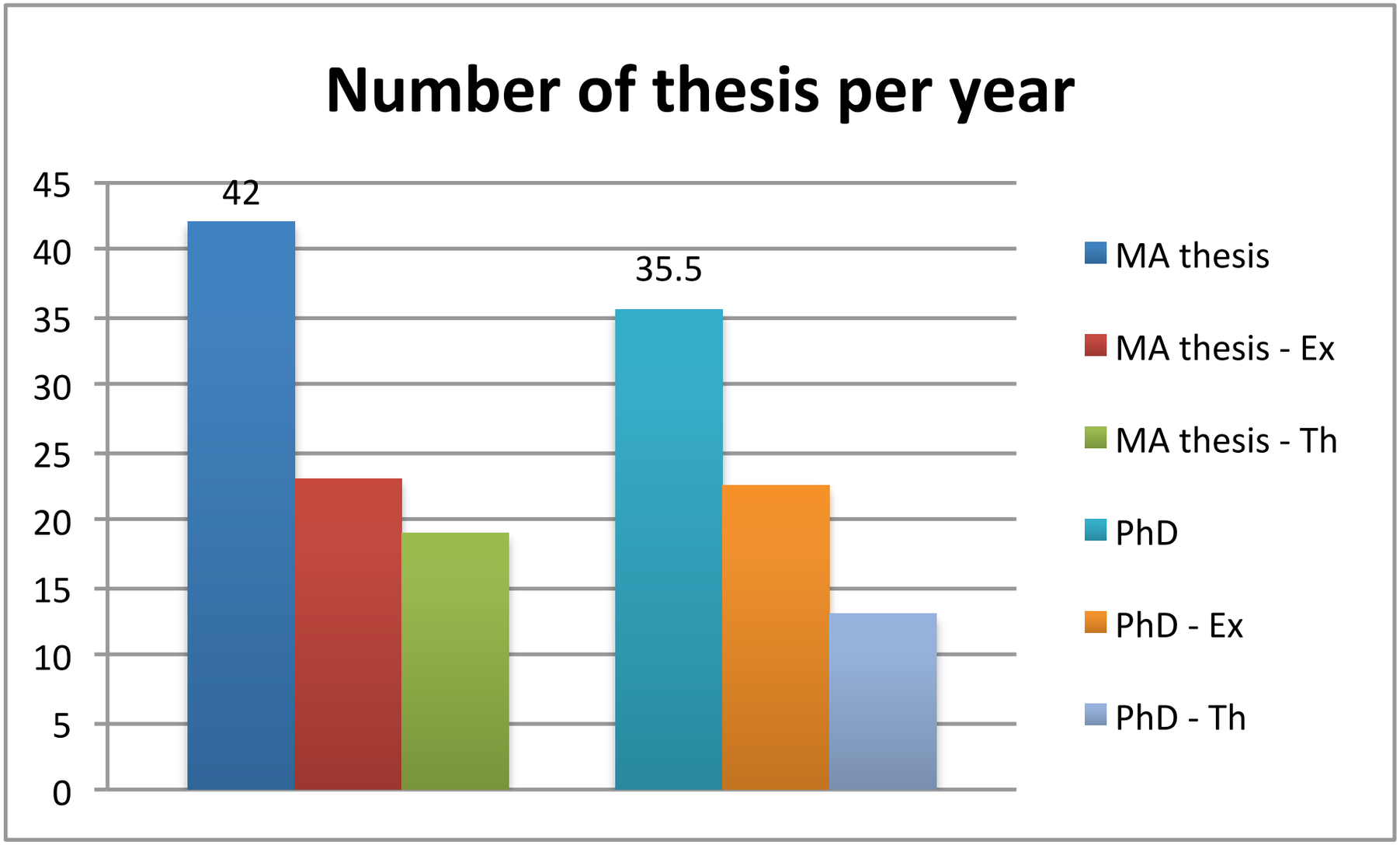
University Groups

Experimental Theory



→ 3.2 PhD/y/Mhab

Accelerator Based Experiments

Experiment	Groups 2010	FTE 2010	Groups 2017	FTE 2017
HERMES (DESY)	UGent	3.5		
H1 (DESY)	ULB, VUB UA	4.4		
CMS	ULB, VUB, UCL, UA, UGent, UMons	66.3	ULB, VUB, UCL, UA, UGent	70.5
NA62	UCL	2.8	UCL	4.75
ISOLDE	KUL	35	KUL	32

also: S3-SPIRAL (GANIL, 5 FTE KUL), n-EDM (PSI, 4 FTE KUL)

FTE= permanents + postdocs + PhD

Neutrino and Astroparticle Experiments

	Experiment	Groups 2010	FTE 2010	Groups 2017	FTE 2017
Neutrino	OPERA	ULB	2		
	SoLiD (SCK-CEN-reactor-B)			VUB, UA UGent	9.5
	JUNO (reactor - China)			ULB	1 (approved in 2017)
Astroparticle	IceCube	ULB, VUB UGent, UMons	16.4	ULB, VUB, UGent	19
	LoFar (CR - radio telesc)			VUB	4
	TA (HE-CR)	ULB	1 (theory)	ULB	2 (theory)

also: LIGO (2.5 FTE, ULB), ARA (1→ 0 FTE, ULB)

R&D: Detectors, DAQ and Accelerators

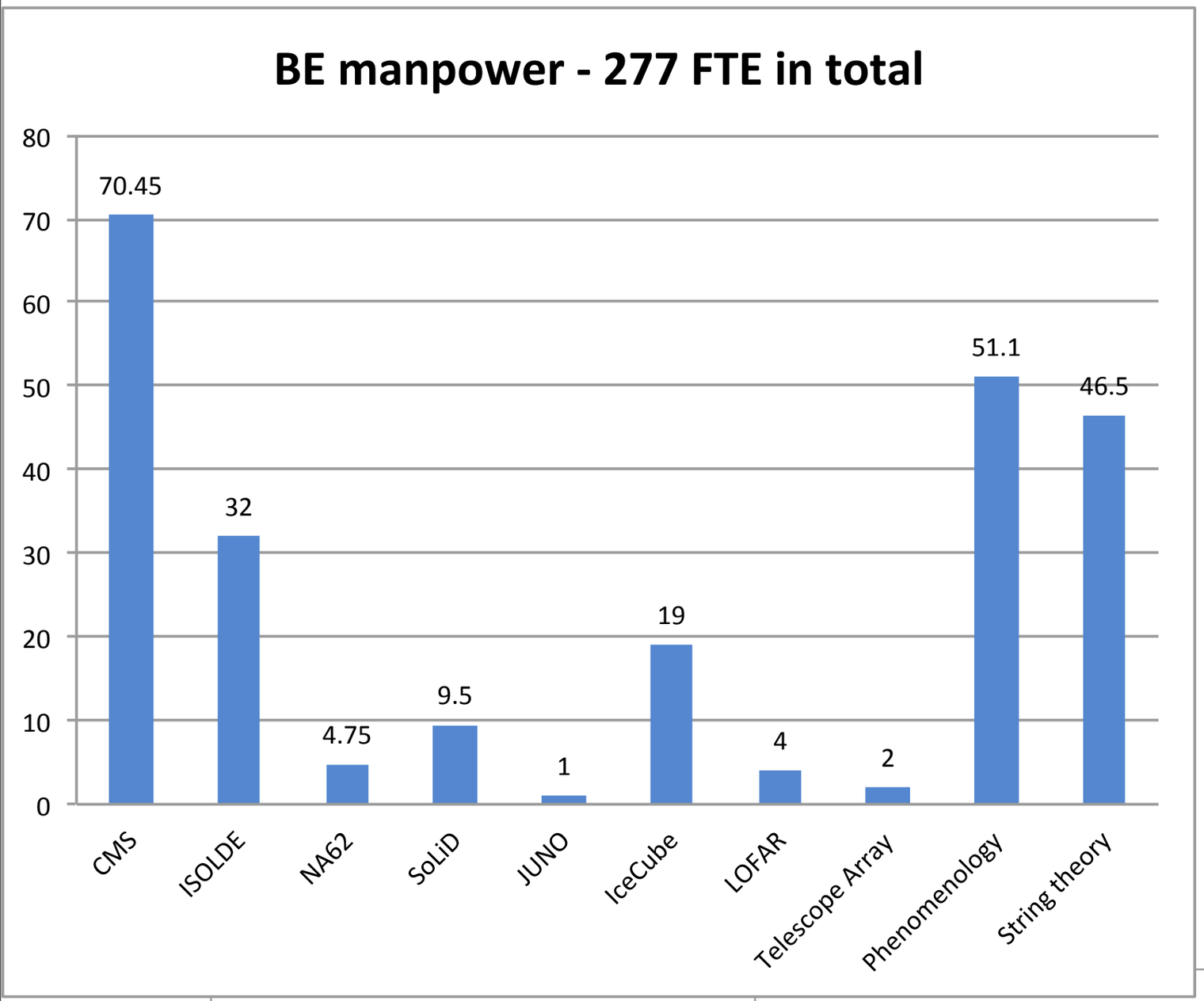
Experiment	Group	FTE*	Topic
CMS-II	ULB VUB UCL UA UGent	3.5 1.5 3.3 1 4.5	Tracker Up, DAQ-GEM Tracker Up Tracker Up Tracker Up muon Up
MEDICIS	KUL	4	offline mass separator
CALICE/ TRAPPISTe (UCL cyclotron)	UCL	2.25	ILC calo/Silicon on insulator tracking
HIE-ISOLDE	KUL	1	SC cavities Laser ion source

* partical double counting

also: CLIC (0.5 FTE, ULB), IceCube (ULB, VUB, UGent)

Manpower : physicists

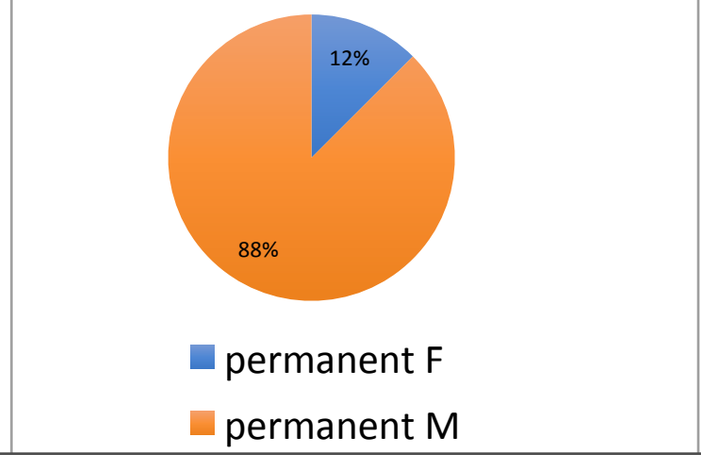
permanents + postdocs + PhD

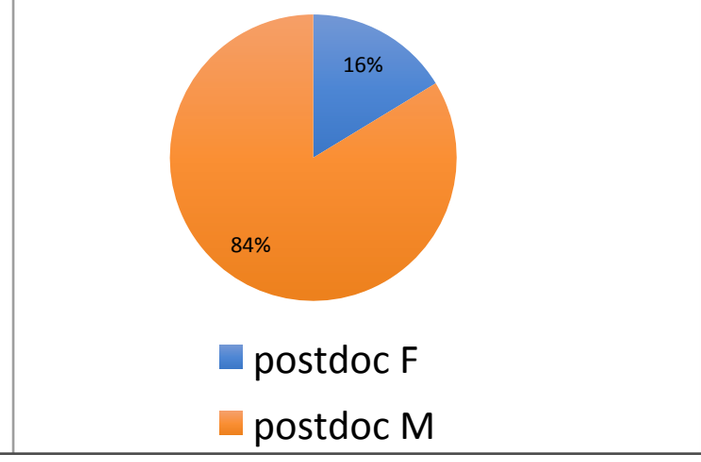


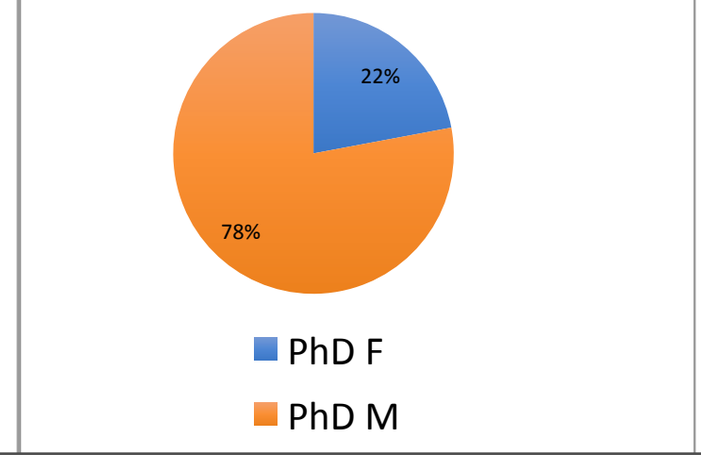
1/3 theory

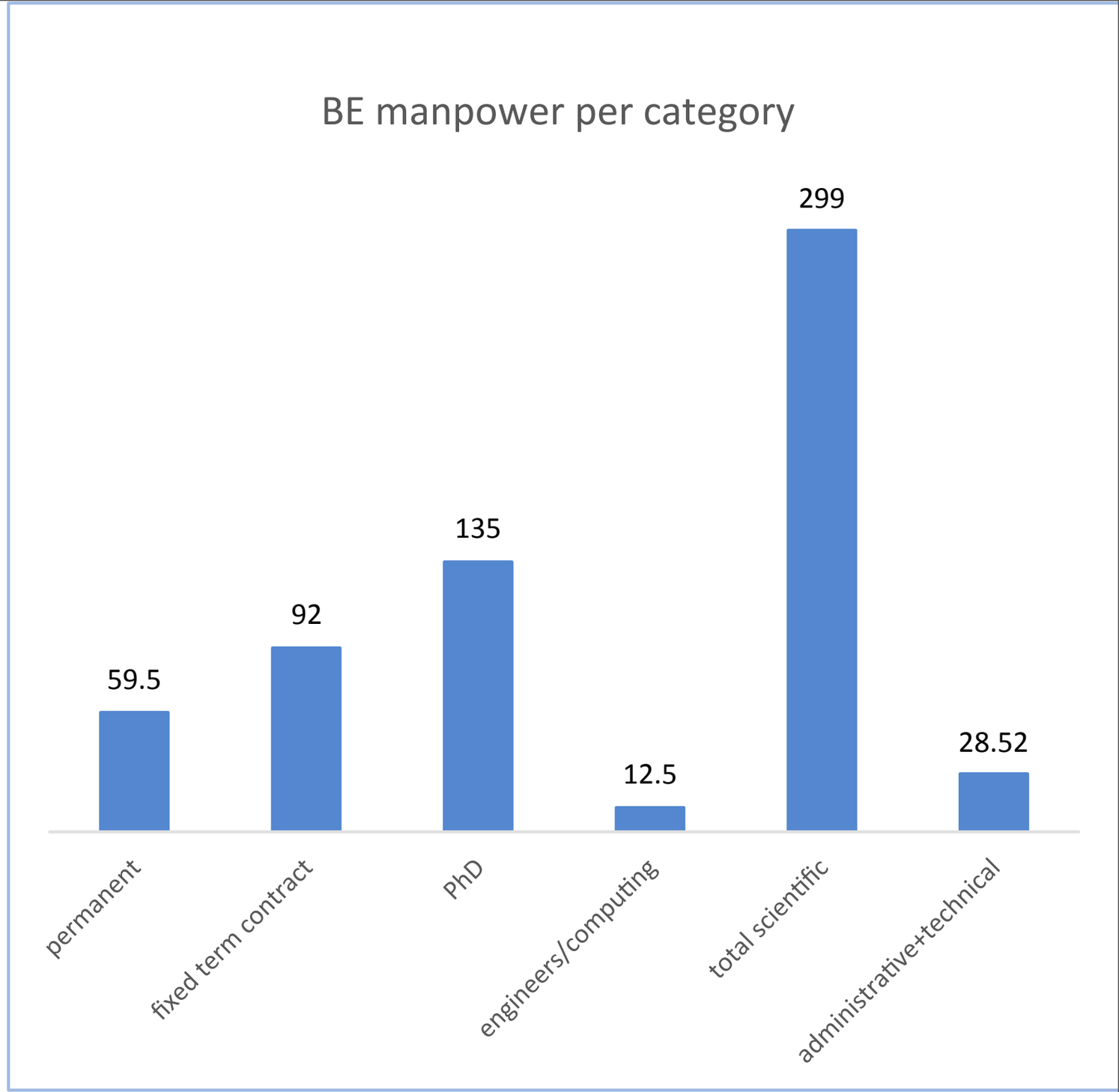
2/3 experim.

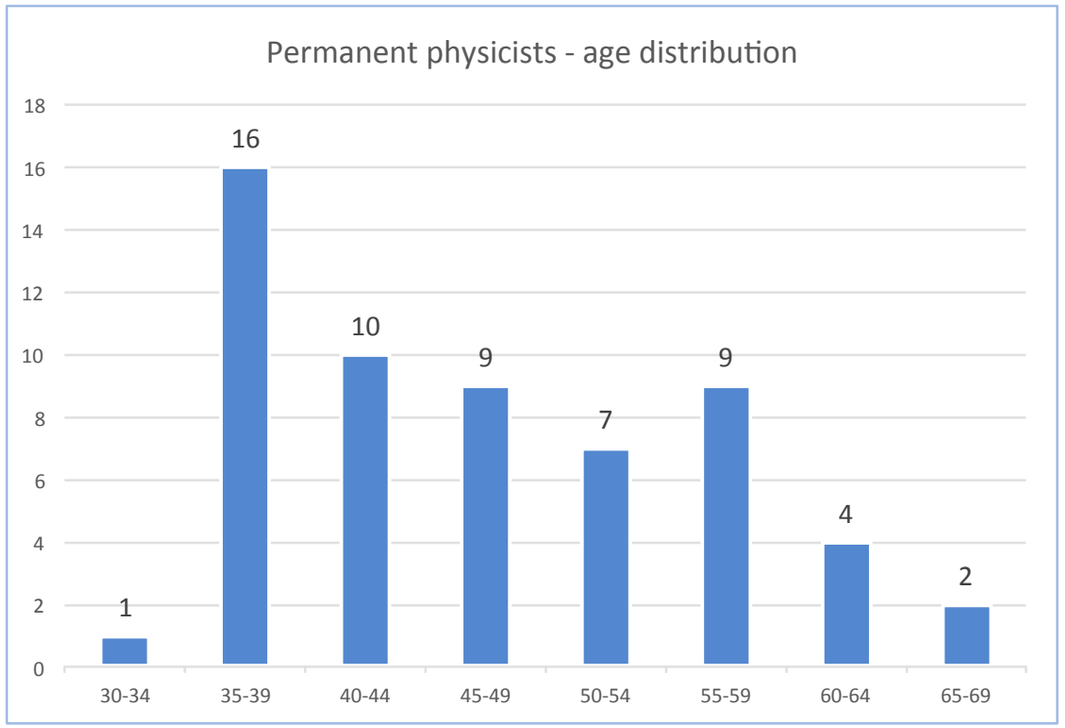
pheno: DM, Higgs, SUSY, neutrinos, QCD, cosmo, astropart,...



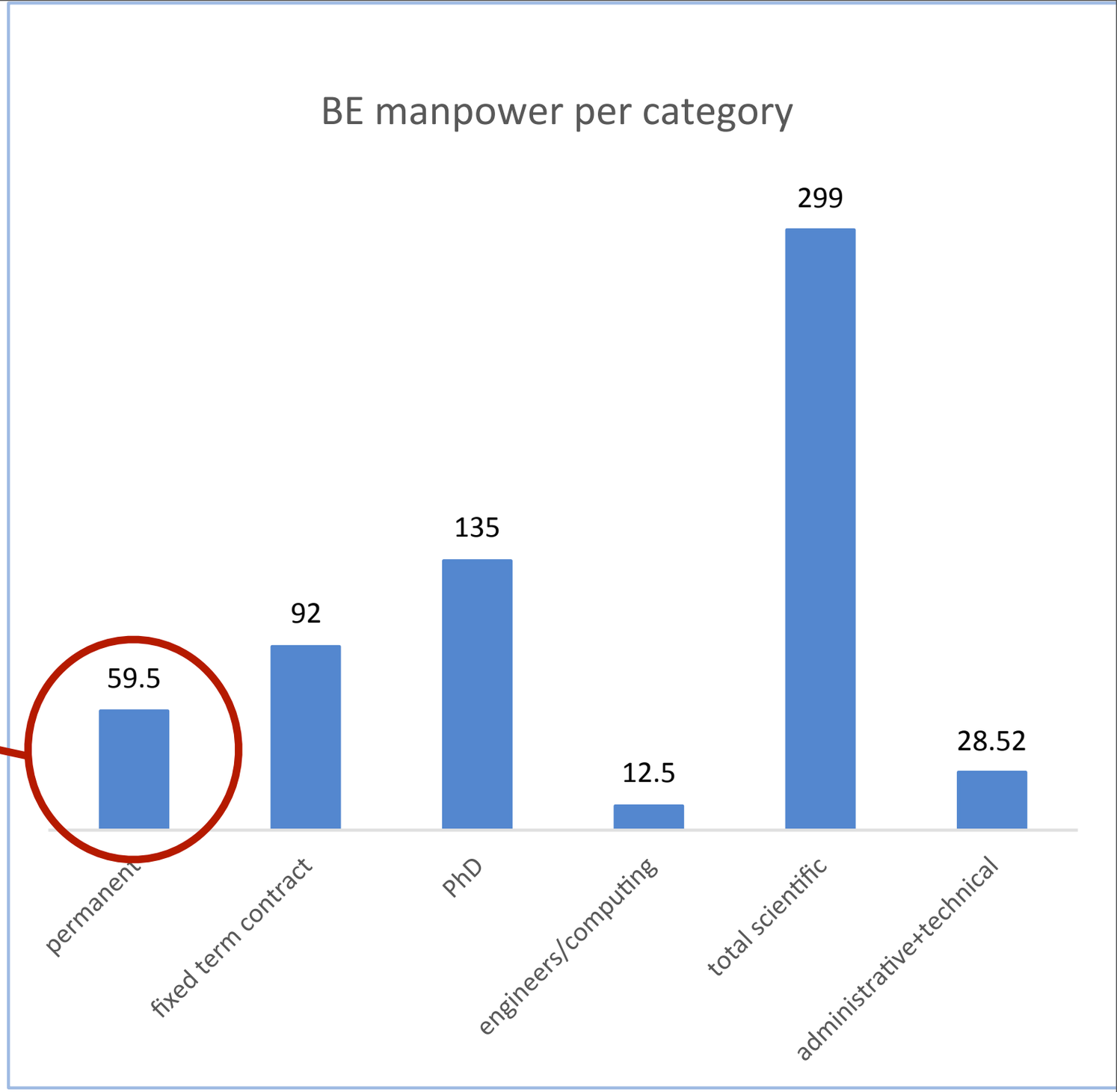





BE manpower per category
59.5
92
135
12.5
299
28.52
permanent
fixed term contract
PhD
engineers/computing
total scientific
administrative+technical



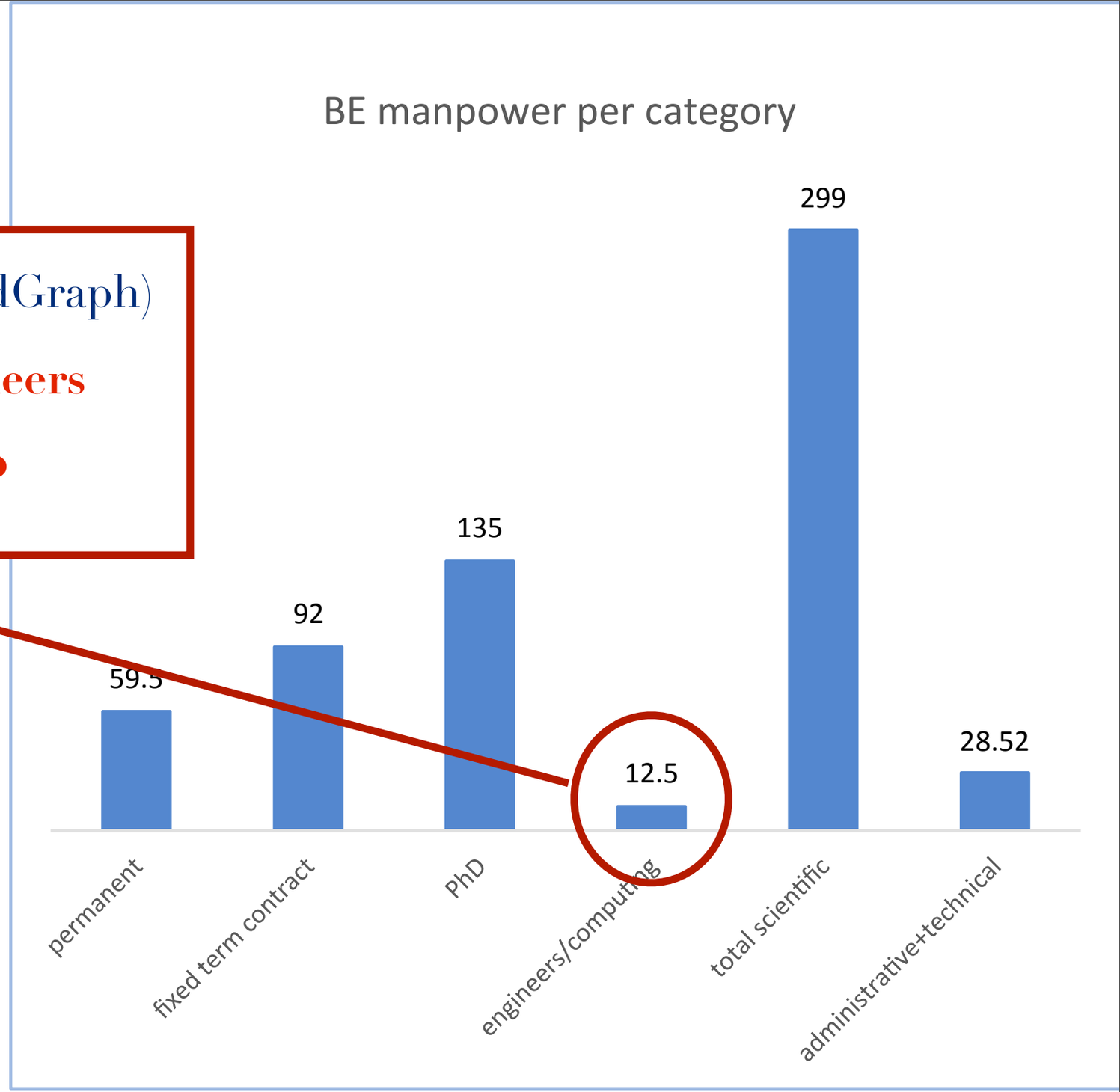
good age profile for permanent physicists



- 8 high level IT (Tier II,IceCube,MadGraph)
- 2 (nucl) + 2.5 (HEP) research engineers

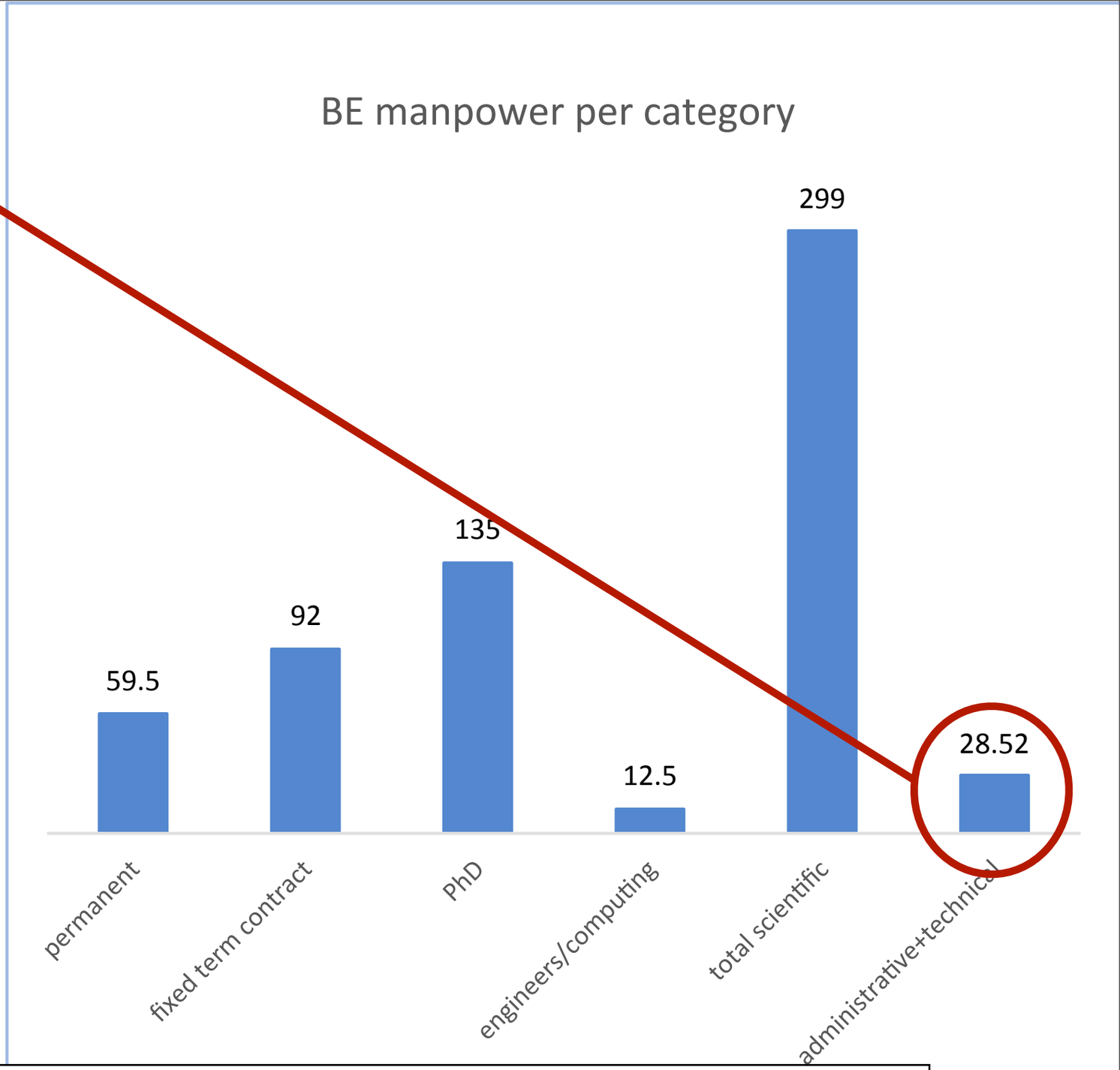
→ critical in HEP

Research engineers are crutial for experimental group in high technology experiments



HEP

	theory	exp	adm +tech
1995	53	74	41
2003	71	76	33
2010	108	105	26
2017	98	137	24



- continuous decrease of admin+tech.
- most of them on fixed term contract
- limit situation
- has to evolve positively to suceed the CMS Upgrade

Funding

Main agencies

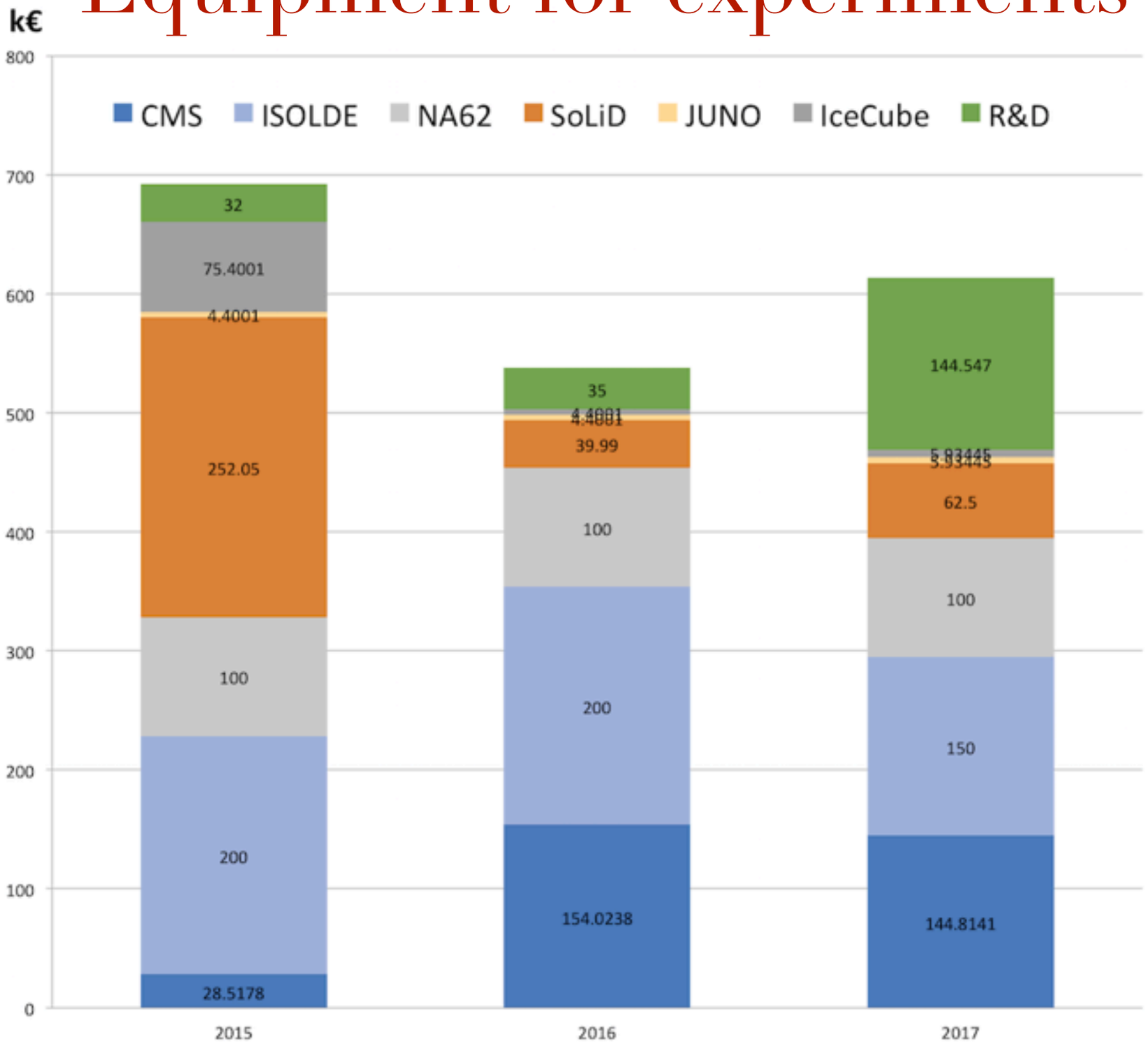
- Federal government
  - Economic affairs: CERN fee 2.76% in 2015
  - Science policy: IAP network (until Sept. 2017)
    - very positive for HEP community (postdocs, PhD)
    - now changed: from network to project oriented funding (FWO/FNRS)
- Flemish community
  - FWO: fundamental reasearch, equip, personnel for exp + theory
    - Big Science (5 y, main source for large exp.)
    - Research programs (projets - 4y)
    - Mandates (postdocs, PhD)
    - Odysseus (tenure track + 0.7→2M€)
    - no permanent position
  - Flanders: HERCULES (CMS-II: core cost + equip)
  - Universities: personnel+ center of excellence

Main agencies - con't

- French community
  - FNRS: fundamental reasearch, equip, personnel for exp + theory
    - IISN : (projects 1y, main source :equip, M&O, personnel
    - IISN : CMS-II: core cost
    - Mandates (postdocs, PhD)
    - permanent academic positions (no research engineers)
  - FRIA : grants for PhD
  - Universities: personnel + center of excellence

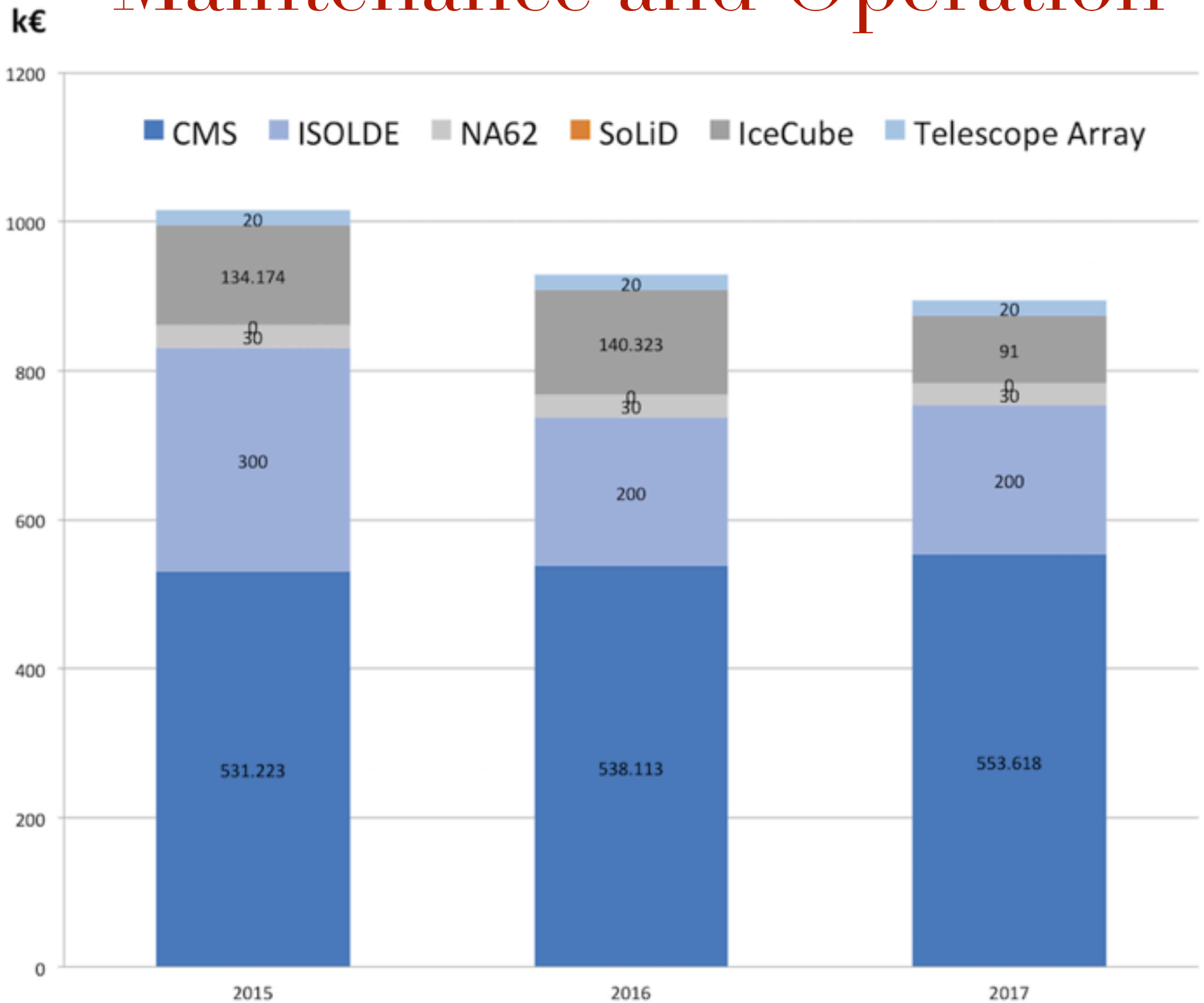
- Other: EU (5 ERC,...), CSC-China, RW,...

Equipment for experiments



- Solid construction
- start of CMS-II local equipment (CMS&R&D)
- computing: see talk of O. Devroede

Maintenance and Operation



- reflecting size of the groups

Regarding RECFA 2010 Report

impressive activities in the two large linguistic communities. These communities are well united and focused on a few large projects, such as CMS and ICECUBE, at the cost of diversity.

→ Despite the political context the HEP community continues to be united and focused. The IAP network funding helped to push further our collaborations between Belgian groups, in particular between exp. and theorist.

The R&D activities seem too scattered. They could benefit from a clear strategy that would include the important opportunities for industrial spin-off.

→ Better organisation of R&D with the preparation of CMS upgrade: common effort of 6 exp. groups.

→ Lack of spin-off is still a weak point

Summary and Worries

- Good health of our community in general
- Extended since last RECFA visit (people and research topics)
- Corresponds to transition of two generations - good age profile
- We are grateful to our funding agencies that they are strongly supportive for the upgrade of the CMS experiment and we are looking forward to see this consolidated in concrete contracts.

Summary and Worries

with some worries...

- French+Flemish Communities:
  - Critical lack of research engineers in exp. groups

    experts in leading-edge technology is crutial to contribute significantly in modern HEP experiments

- French Community:
  - no specific instrument to support long term projects
  - no new technician can be hired at the FNRS/IISN

- Flemish Community:
  - the lack of technicians

Backup slides

Industry Supply Return Coefficient