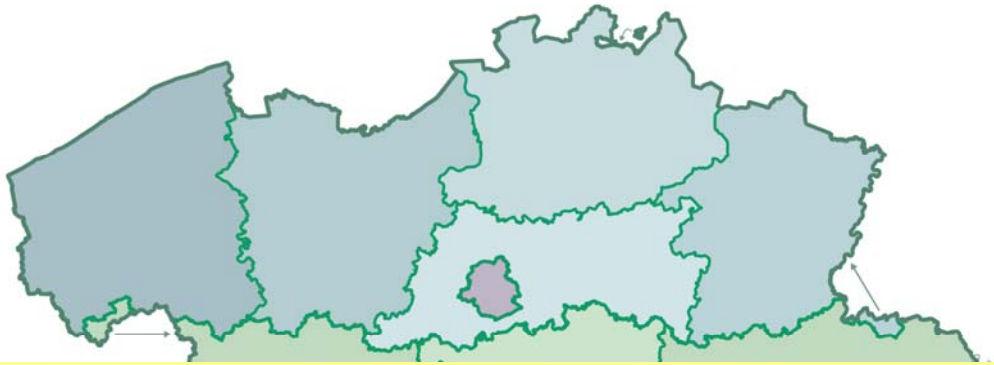

MIDTERM REPORT FROM BELGIUM

EVOLUTION SINCE THE RECFA VISIT TO BELGIUM IN MAY 2003

Catherine De Clercq
IIHE, Vrije Universiteit Brussel
For the Belgian HEP comunity
CERN, 30 November 2007

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BELGIUM

BELGIUM : FEDERAL STATE WITH (UNIQUE?) DOUBLE STRUCTURE

- **Federal government**

- **3 regions** : Flanders, Wallony, Brussels-Capital
  matters bound to "soil" , irrelevant for this talk

- **3 communities** : Flemish, French, German speaking
  10,4 = 6,0 4,3 0.07 million people
  matters bound to "people and culture"

⇓

University teaching and public research is run totally independently by the 2 main communities in the regions in which they have authority:

Flemish : Flanders, Brussels-Capital VL[aams]
French : Wallony, Brussels-Capital FR[ançais]

FUNDING OF RESEARCH

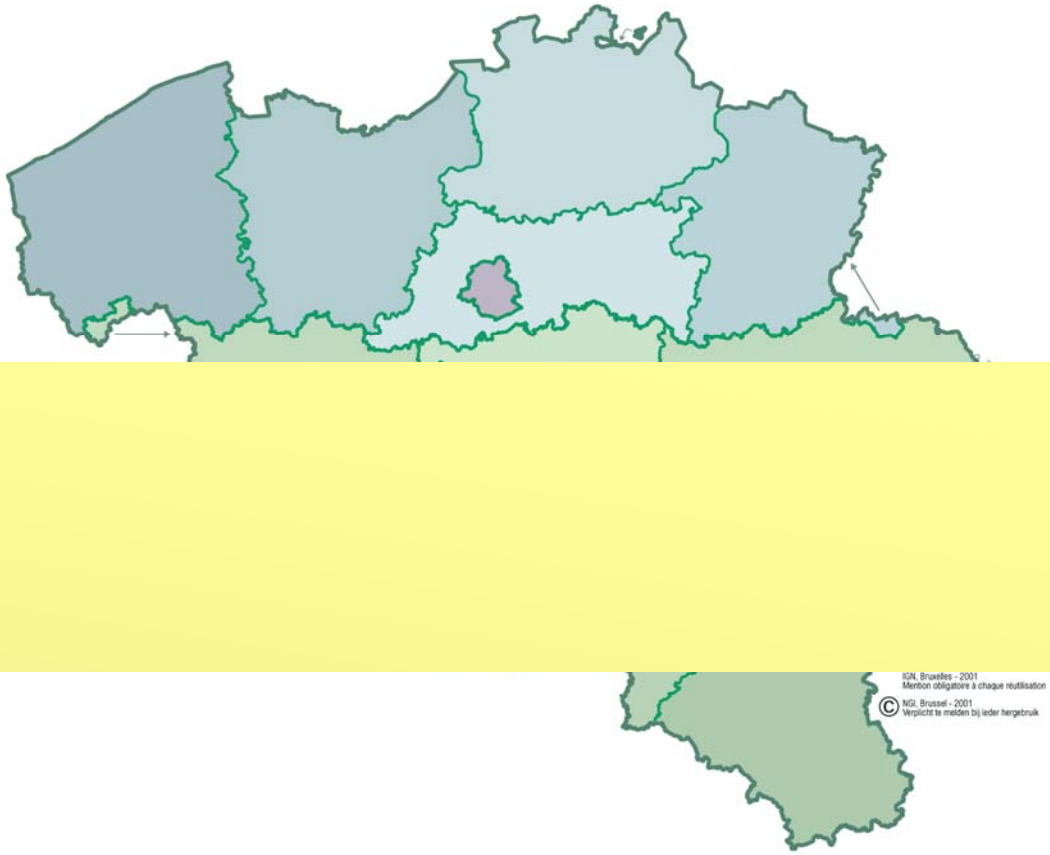
Main Agencies relevant to HEP

Federal government
Economic affairs: CERN fee – 2,62% - 16,5M€ in 2004
Science policy: IAP networks – see later

Flemish community
FWO : fundamental research
equipment, running, personnel for experiments & theory
IWT : applied research – grants for PhD theses
Universities : mainly personel

French community
FNRS : fundamental research and IISN (nuclear sciences only)
equipment, running, personnel for experiments & theory
FRIA : applied research - grants for PhD theses
Universities : mainly personel

Other : EU, private …



TEACHING

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BELGIUM

HIGHER EDUCATION SINCE 2003

- 1 October 2004 (academic year 04-05) start of Bachelor-Master system (Bologna agreements)
- Physics transformed from 2+2 (candidate, licentiate) system to 3+2 (bachelor, master) structure
- Most science and technology domains now 3+2 structure

- Schools for higher education are now associated to universities and deliver bachelor and master degrees

⇳ Academic and professional bachelors and masters

THE BELGIAN UNIVERSITIES

Flemish community(7)

- **Universiteit Gent - UGent**
- **Vrije Universiteit Brussel – VUB**
- **Universiteit Antwerpen - UA**
- **Katholieke Universiteit Leuven - KUL**
- Katholieke Universiteit Leuven, campus Kortrijk – KULAK (only Ba)
- Universiteit Hasselt – UHasselt (only Ba)
- *Katholieke Universiteit Brussel - KUB*

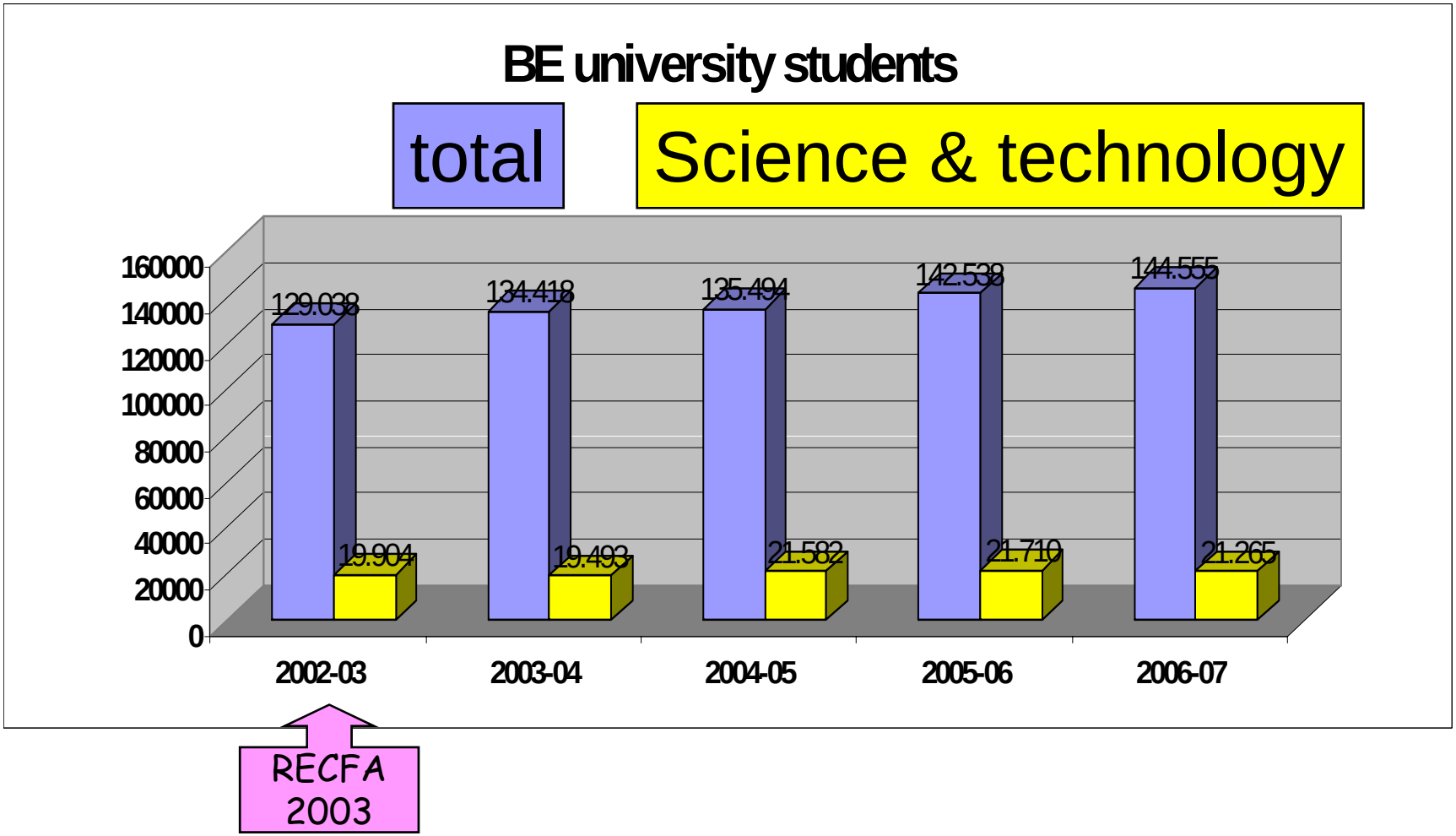
Italic = no physics
Bold = HE physics

French Community(9)

- **Université de Liège – ULg**
- **Université Catholique de Louvain – UCL**
- **Université Libre de Bruxelles – ULB**
- **Université de Mons-Hainaut – UMH**
- Facultés Universitaires Notre-Dame de la Paix à Namur – FUNDP
- *Faculté Polytechnique de Mons – FPMs*
- *Facultés Universitaires Saint-Louis – FUSL*
- *Facultés Universitaires Catholiques de Mons – FUCaM*
- *Faculté universitaire des sciences agronomiques de Gembloux – FUSAGx*

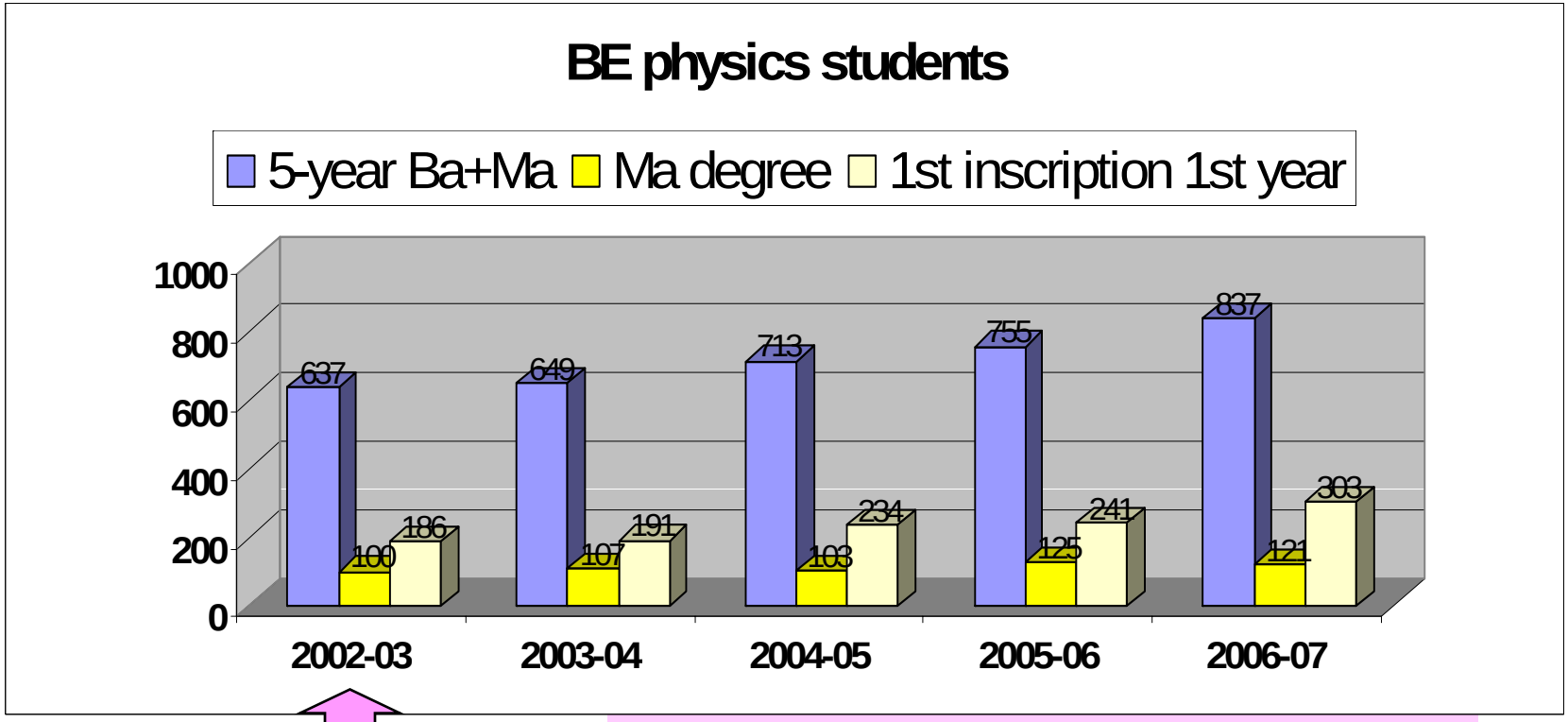
9 universities deliver Master in physics diploma
8 universities train HE physicists

UNIVERSITY STUDENTS



(Science+Tech)/total : 15,4%(02-03) to 14,7%(06-07)

PHYSICS STUDENTS



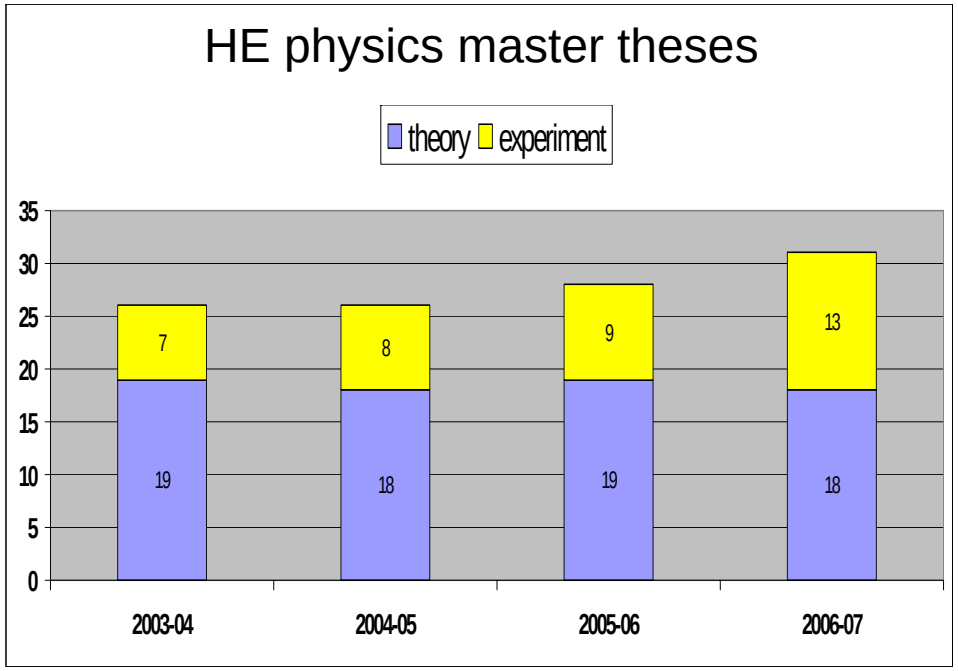
New inscriptions :

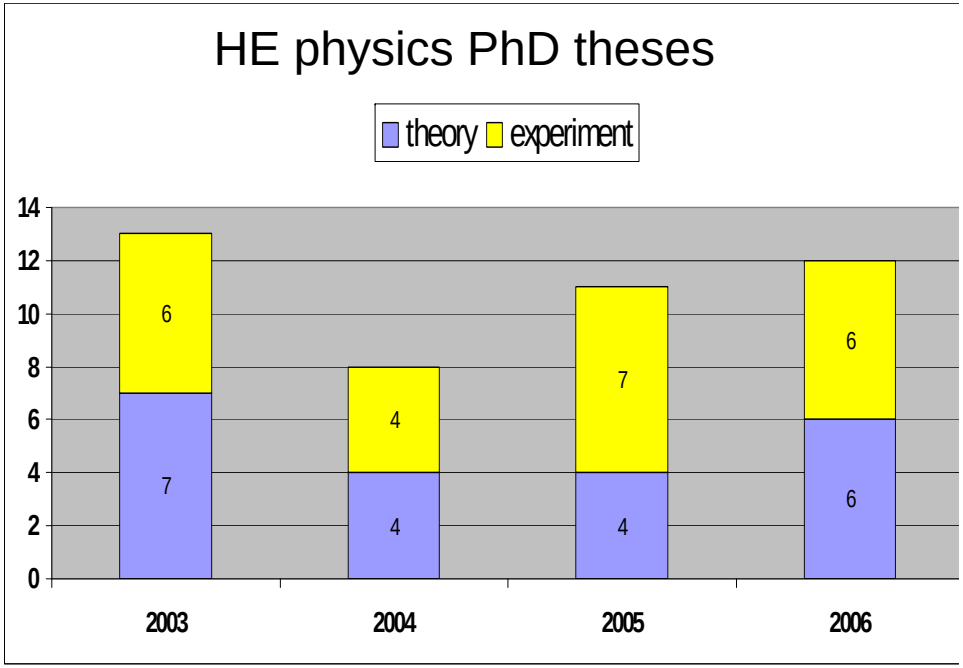
186 in 02-03 to **303** in 06-07

Masters/licentiate degrees :

100 in 02-03 to **123** in 06-07

STUDENTS IN HE PHYSICS





24% 25% 22% 26%

HE Ma thesis/Ma degrees

average time for PhD thesis
4,5 years
(4,3 TH and 4,7 EXP)

UNIVERSITIES WITH HEP THESES

HEP theory (7)

- Vrije Universiteit Brussel
- Katholieke Universiteit Leuven
- Université de Liège
- Université Catholique de Louvain
- Université Libre de Bruxelles
- Université de Mons-Hainaut
- Universiteit Gent – UGent
-

HEP experiment (6)

- Vrije Universiteit Brussel
-
-
- Université Catholique de Louvain
- Université Libre de Bruxelles
- Université de Mons-Hainaut
- Universiteit Gent
- Universiteit Antwerpen
- *Katholieke Universiteit Leuven: ISOLDE*

All large universities in Belgium have experimental and/or theoretical HE physics activities and/or LE experiments at large accelerators

THE HEP GROUPS AND PROJECTS

Fundamental .be Interactions

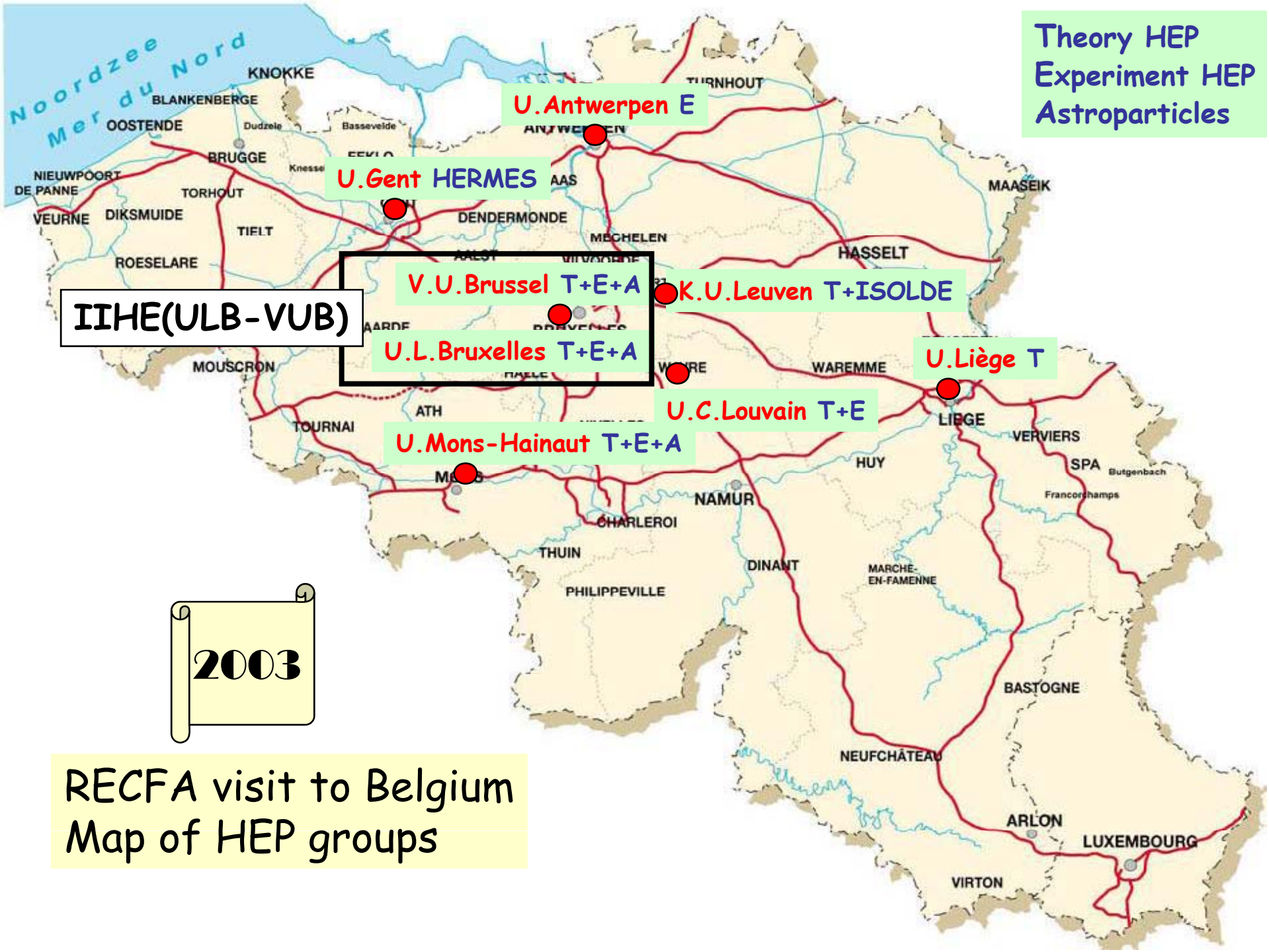
THE GROUPS

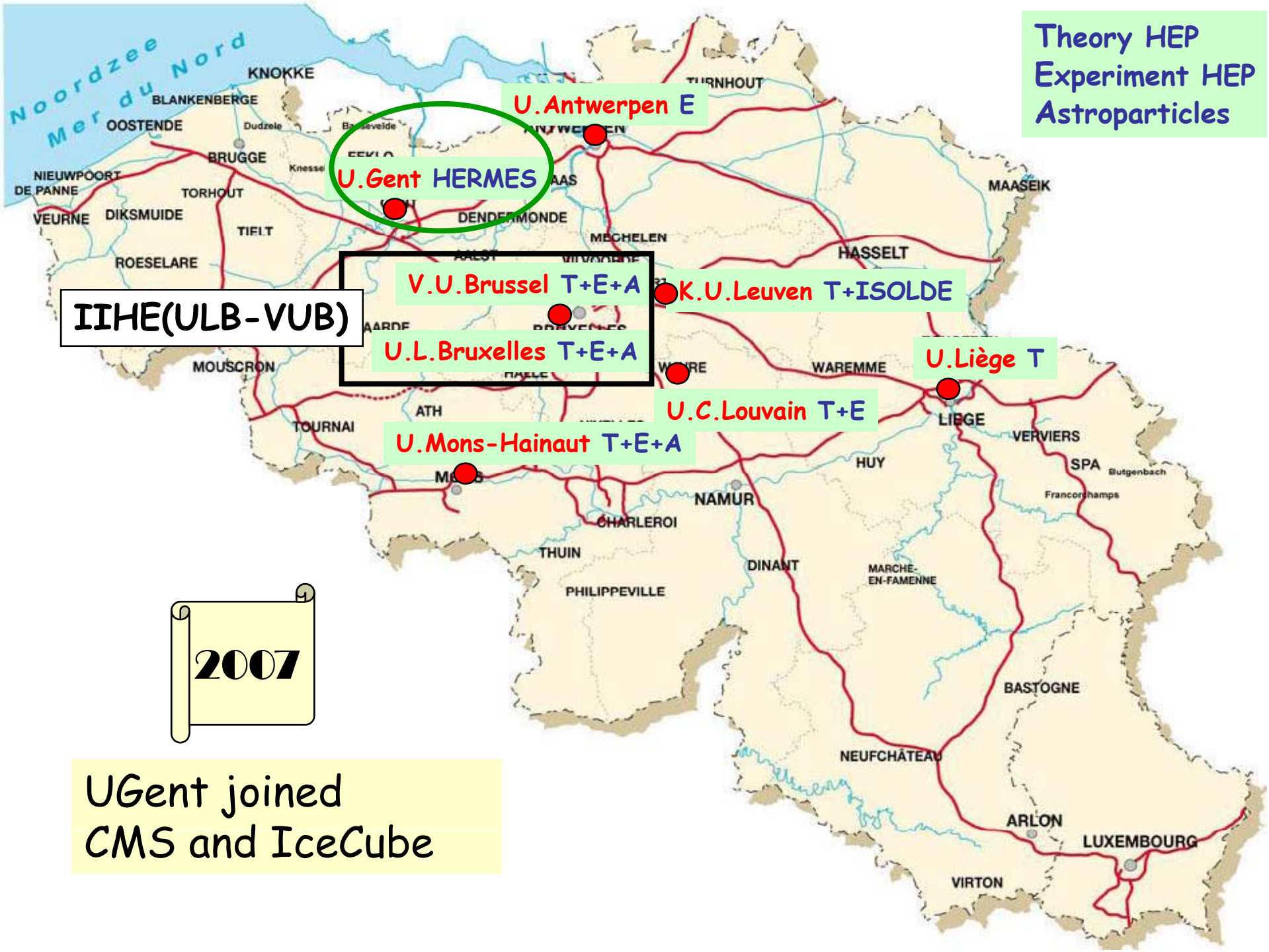
HEP theory (8)

- Vrije Universiteit Brussel
- Katholieke Universiteit Leuven
- Université de Liège
- Université Catholique de Louvain
- Université Libre de Bruxelles (2 groups)
- Université de Mons-Hainaut
- Universiteit Gent – UGent
-

HEP experiment (6)

- Vrije Universiteit Brussel
-
-
- Université Catholique de Louvain
- Université Libre de Bruxelles
- Université de Mons-Hainaut
- Universiteit Gent
- Universiteit Antwerpen
- *Katholieke Universiteit Leuven @ ISOLDE*


Theory HEP
Experiment HEP
Astroparticles
U.Antwerpen E
U.Gent HERMES
IIHE(ULB-VUB)
V.U.Brussel T+E+A
K.U.Leuven T+ISOLDE
U.L.Bruxelles T+E+A
U.Liège T
U.C.Louvain T+E
U.Mons-Hainaut T+E+A
2003
RECFA visit to Belgium
Map of HEP groups
Noordzee
Mer du Nord
KNOKKE
BLANKENBERGE
OOSTENDE
BRUGGE
NIEUWPOORT
DE PANNE
VEURNE
DIKSMUIDE
TORHOUT
TIELT
ROESELARE
DENDERMONDE
MECHELEN
HASSELT
MAASEIK
TURNHOUT
MOUSCRON
TOURNAI
ATH
WAREMME
LIEGE
VERVIERS
SPA
Francorchamps
HUY
NAMUR
CHARLEROI
THUIN
DINANT
MARCHE-EN-FAMENNE
PHILIPPEVILLE
BASTOGNE
NEUFCHÂTEAU
ARLON
LUXEMBOURG
VIRTON


Theory HEP
Experiment HEP
Astroparticles
U.Antwerpen E
U.Gent HERMES
IIHE(ULB-VUB)
V.U.Brussel T+E+A
K.U.Leuven T+ISOLDE
U.L.Bruxelles T+E+A
U.Liège T
U.C.Louvain T+E
U.Mons-Hainaut T+E+A
2007
UGent joined
CMS and IceCube
Noordzee
Mer du Nord
KNOKKE
BLANKENBERGE
OOSTENDE
BRUGGE
NIEUWPOORT
DE PANNE
VEURNE
DIKSMUIDE
TORHOUT
TIELT
ROESELARE
MOUSCRON
TOURNAI
ATH
DENDERMONDE
MECHELEN
HASSELT
MAASEIK
WAREMME
LIEGE
VERVIERS
SPA
Francorchamps
HUY
NAMUR
CHARLEROI
THUIN
DINANT
MARCHE-EN-FAMENNE
PHILIPPEVILLE
BASTOGNE
NEUFCHÂTEAU
ARLON
LUXEMBOURG
VIRTON

WWW.F-I.BE

A collaboration across several borders

- *Fundamental Interactions: at the boundary between **theory, phenomenology and experiment***
- **Structured network** of all (14) **Belgian groups involved in HEP**
- Coordinator Jean-Marie Frère (Université Libre de Bruxelles)
- 4 **European partners**: NIKHEF, Pisa, Durham, Paris Sud
- Board & management structure: common advertising and hiring of postdocs, meetings, seminars
- Funded by the federal government (IAP, Interuniversity Attraction Poles program phase 6)
- 5,8M€ for 2007-11 - used mainly for PhD + postdoc hirings
- Previous phase (02-06) : 3,9M€ - mainly for postdocs hirings

ACCELERATOR BASED EXPERIMENTS

Experiment	Groups	Physicist FTE	Main hardware contribution	Recent-current involvement
HERMES	U. Gent	4.5	Trigger hodoscope RICH	Analysis
H1	U.L.Bruxelles V.U. Brussel U.Antwerpen	9	Barrel wire chambers Very forward spectrometer	Analysis VFPS
ZEUS	U.C.Louvain	1		Analysis
CMS	U.L.Bruxelles V.U. Brussel U.Mons-Hainaut U.Antwerpen U.C.Louvain U.Gent	46.8	Silicon tracker Trigger RPC muon chambers FP420 CASTOR	Commissioning Preparation analyses MC production

HERA 14,5 FTE – LHC 46,8 FTE

NEUTRINOS & ASTROPARTICLES

Experiment	Groups	Physicist FTE 2007	Main hardware contribution	Recent-current involvement
CHORUS	U.C.Louvain	0.5	Optical fibre tracker	Analysis
HARP	U.C.Louvain	0.3	Cherenkov detector	Analysis
OPERA	U.L.Bruxelles	2	Scintillator strips target tracker	Commissioning analysis
IceCube	U.L.Bruxelles V.U. Brussel U.Mons-Hainaut U.Gent	17.2	Optical module optimisation Slow controls	Analysis MC production

- beams 2,8 FTE – astroparticles 17,2 FTE

R&D DETECTORS AND ACCELERATORS

project	Groups	Physicist FTE 2007	topic
RD39/50	U.C.Louvain	2.7	Radiation hard semiconductors
ILC	U.L.Bruxelles V.U. Brussel	2	DAQ TPC Participate in EUDET
MICE	U.C.Louvain	0.2	Magnetic shielding TOF
Beta beams	U.C.Louvain	0.5	Radioactive ion source

4,7 FTE in detector R&D
Other activities will start in 2008

0,7 FTE in accelerator R&D

THEORY

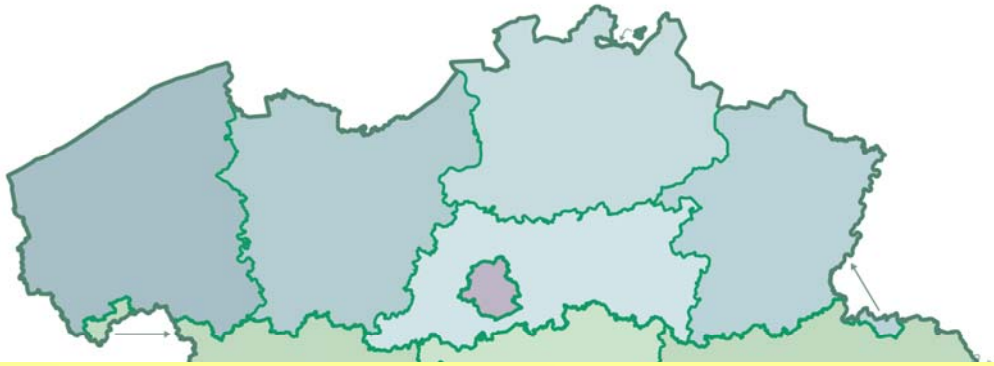
topic	Groups	Physicist FTE 2007
String theory	U.L. Bruxelles V.U. Brussel K.U. Leuven	42
phenomenology	U.C.Louvain U.L. Bruxelles U. Liège	47

89 FTE in theory

87,1 FTE in experiment

SPINOFF

- Crystal Clear Collaboration - Spokesperson Stefaan Tavernier (V.U.Brussel)
- Development of instrumentation for medical imaging
- Manpower: 6.9 FTE physicists, all in V.U.Brussel
  - Permanent: 0,5 FTE
  - Postdoc: 2,4 FTE
  - PhD Students: 4 FTE
  - Technical support: 0,5 FTE
- €392.900 total equipment investment in 2004-2007
- €217.800 total running cost in 2004-2007, or €54.400 per year
- Funding sources: VUB university, Flemish community (FWO,IWT)



RESOURCES FOR RESEARCH

Manpower and budget

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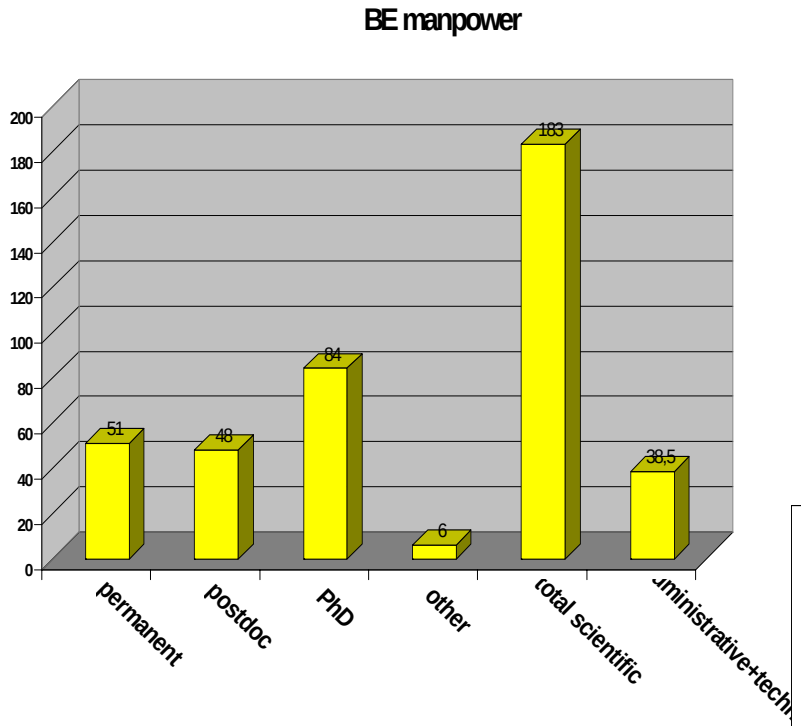
MANPOWER

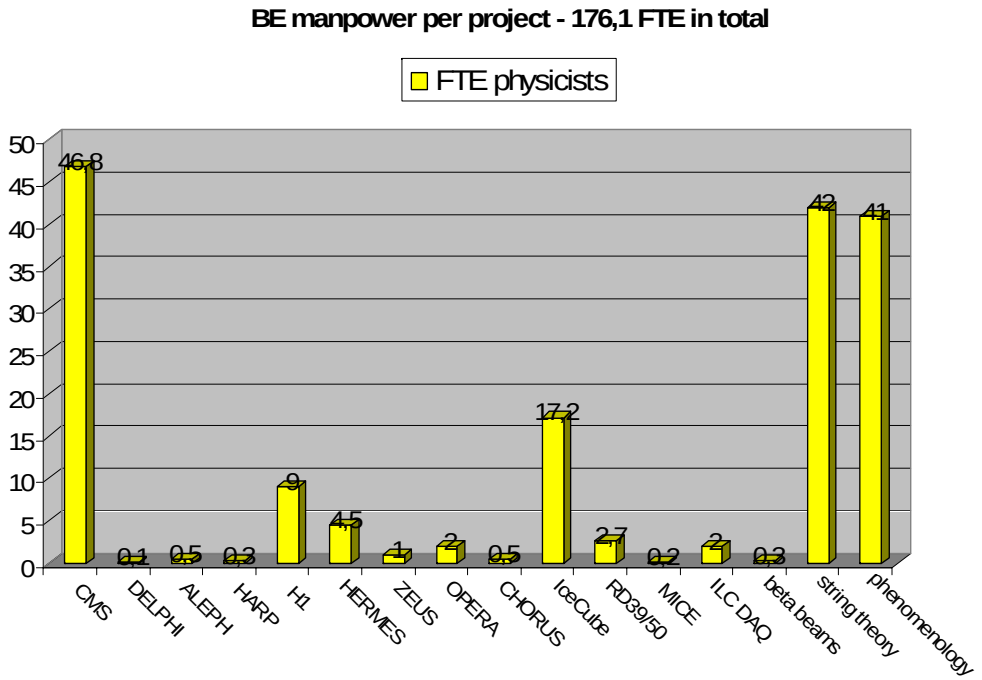


On 1 October 2007:

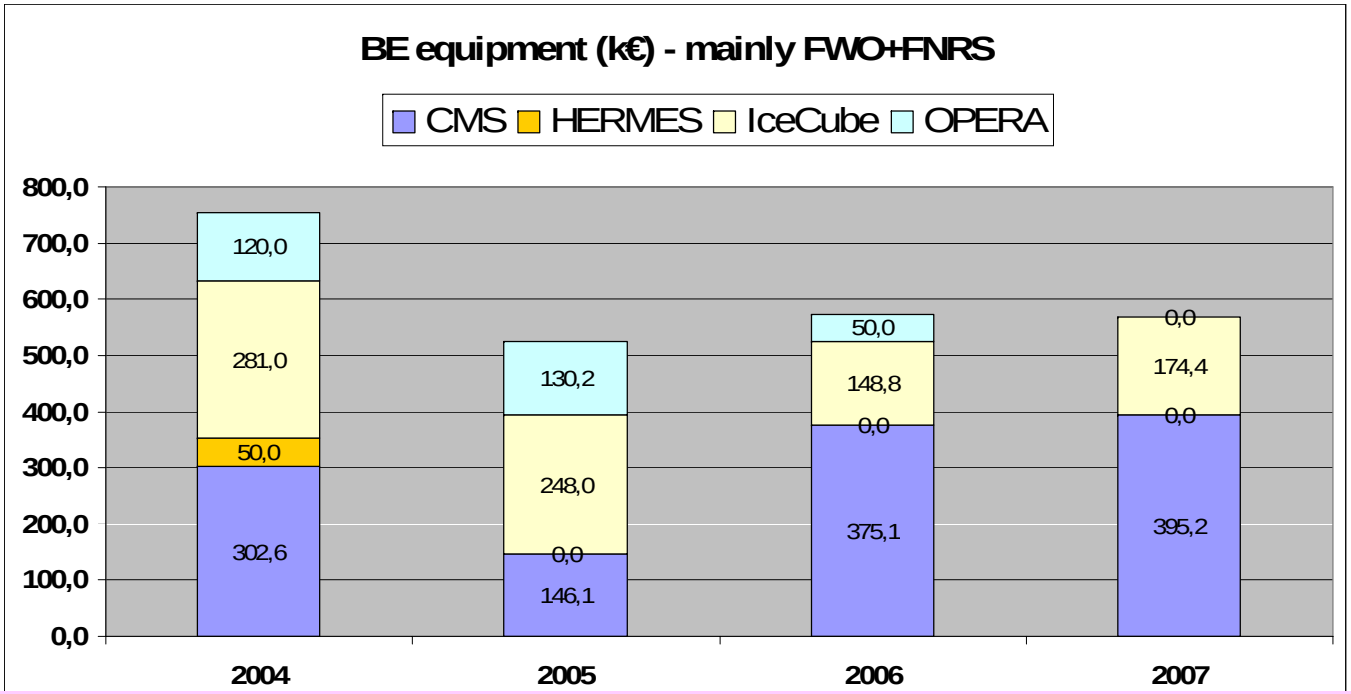
- 176,1 FTE physicists
- 89 FTE theory
- 87,1 FTE experiment

- 38,5 FTE technical and administrative

	theory	exp	adm+tech
1995	53	74	41
2003	71	76	33
2007	89	87	38



EQUIPMENT FOR EXPERIMENTS



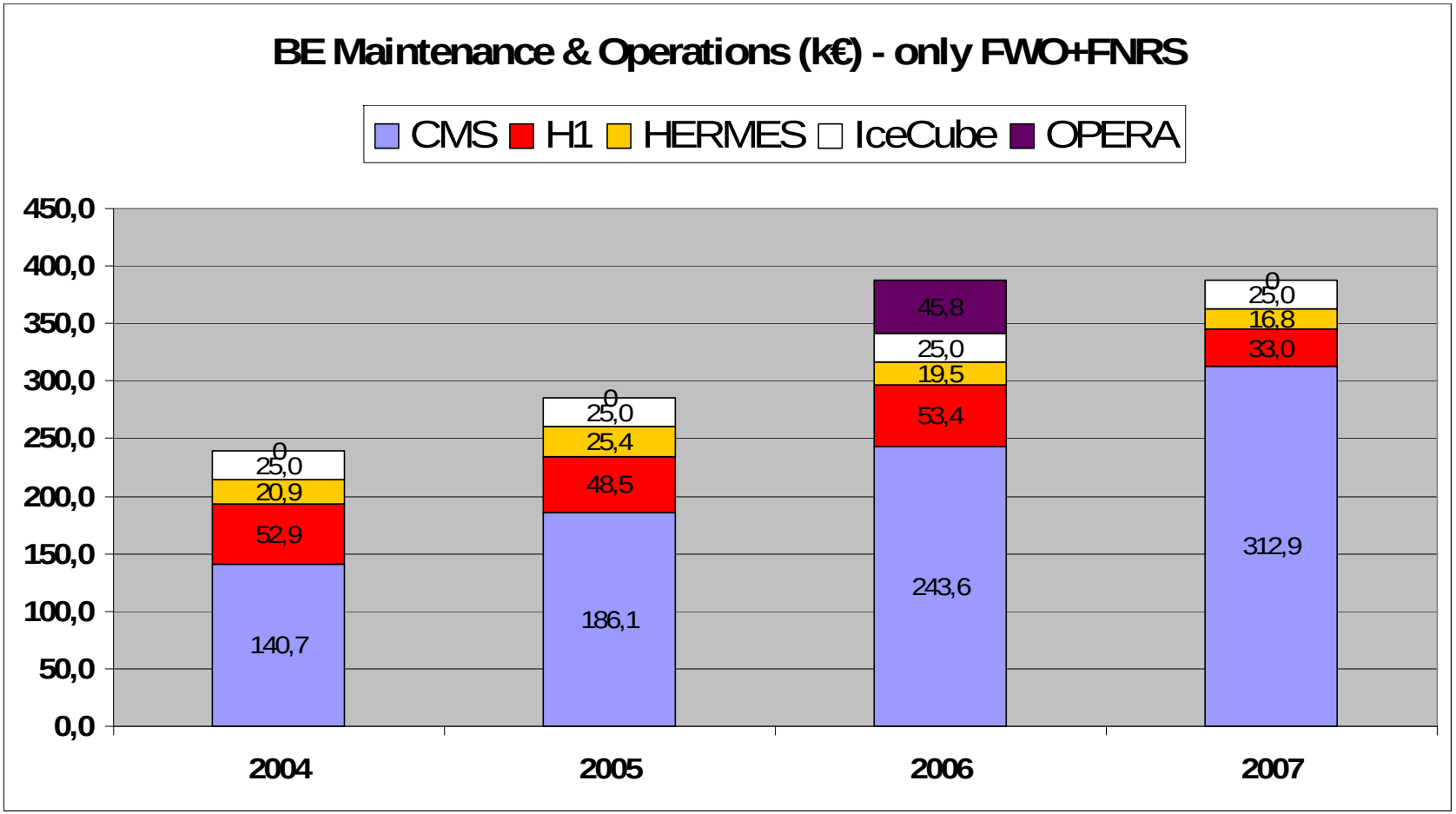
Totals:	753,5	524,3	573,9	569,6

RECFA 2003

CMS	total(04-07) :	1.219,0k€
HERMES	total(04-07) :	50,0k€
IceCube	total(04-07) :	852,1k€
OPERA	total(04-07) :	300,2k€

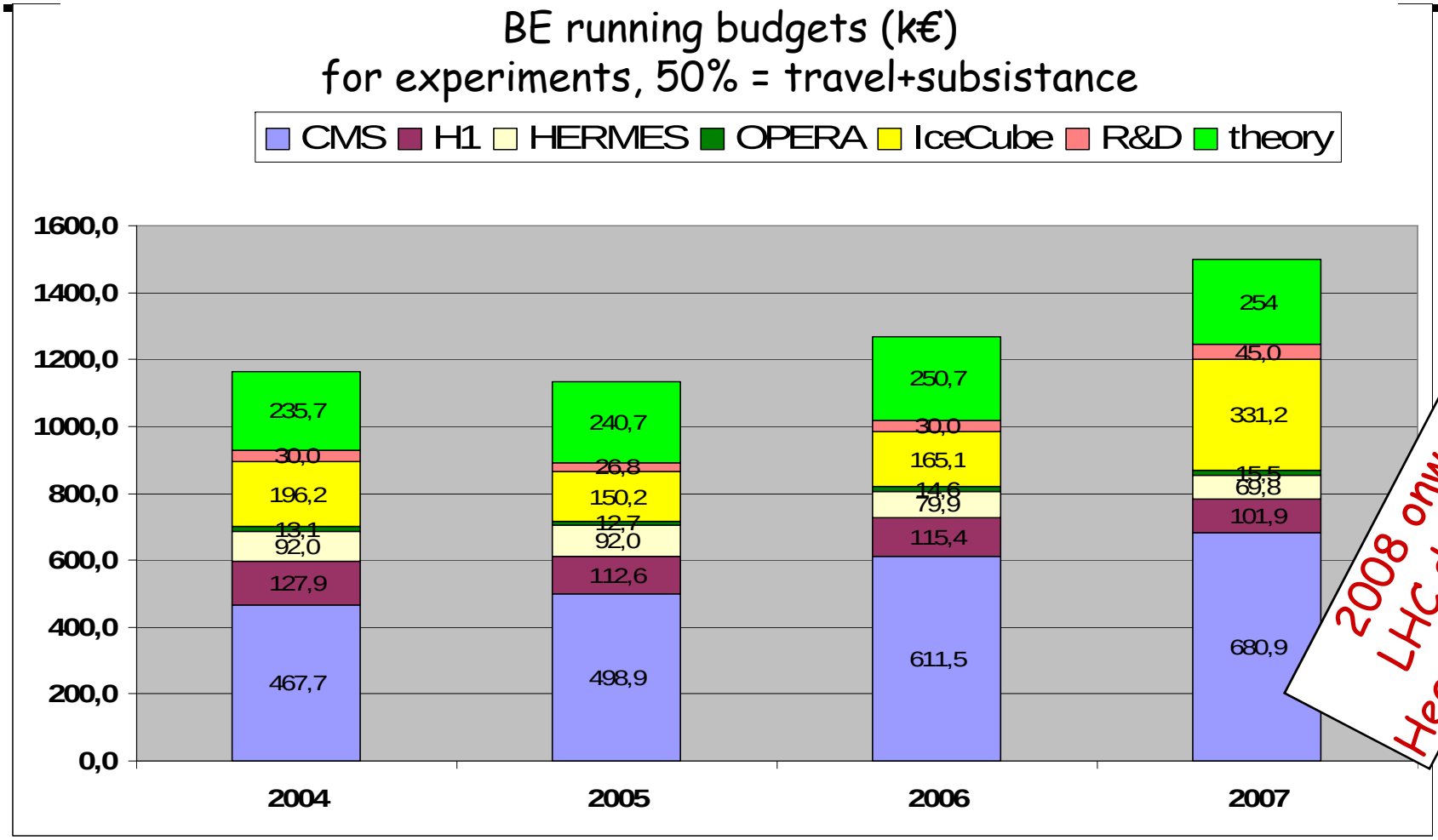
CMS	total(96-03) :	1.239,6k€
HERMES	total(96-03) :	575,0k€
IceCube	total(96-03) :	471,3k€
OPERA	total(96-03) :	372,0k€

MAINTENANCE AND OPERATION



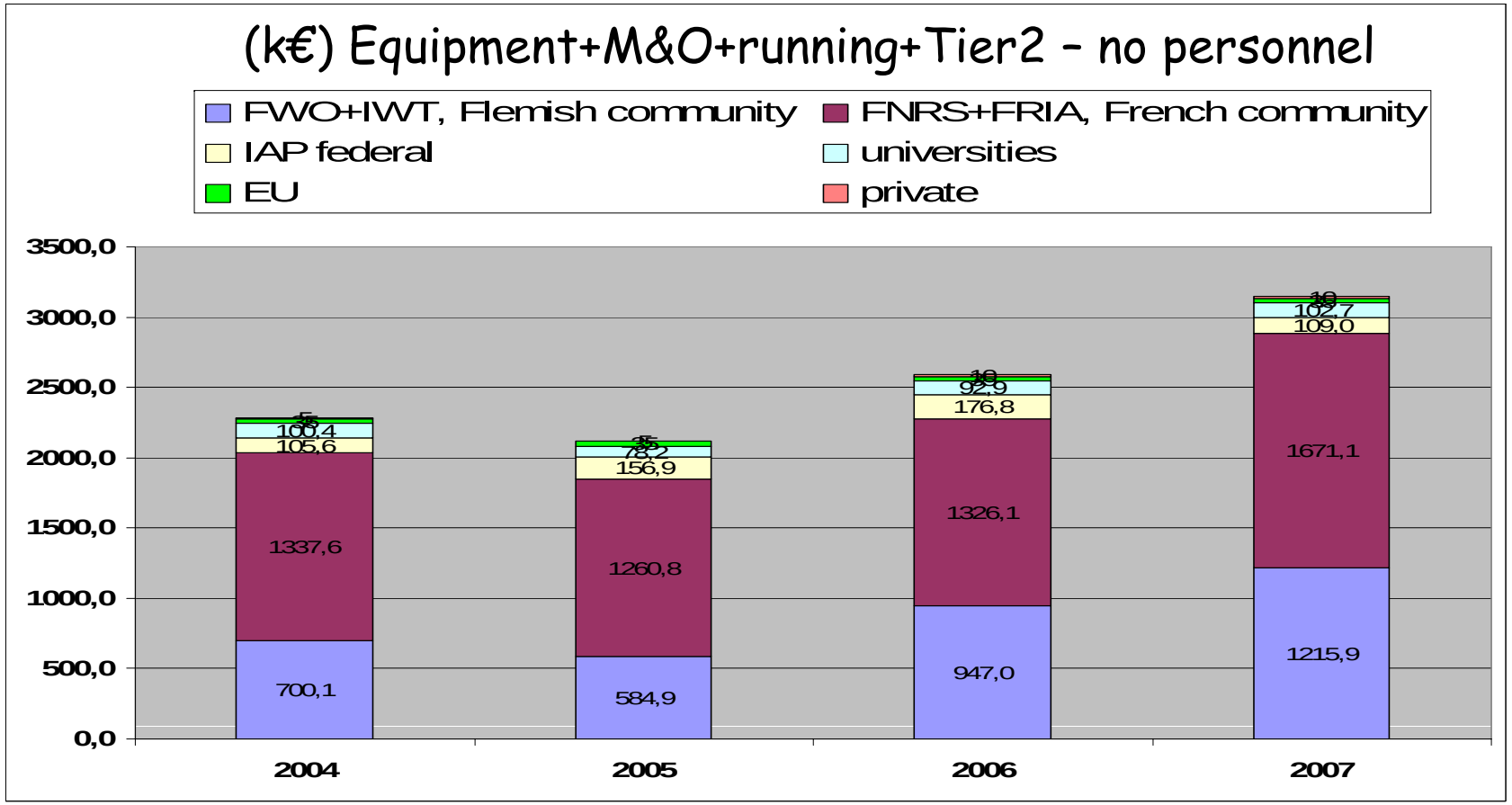
Totals:	239,6	285,0	387,3	387,6

RUNNING BUDGET

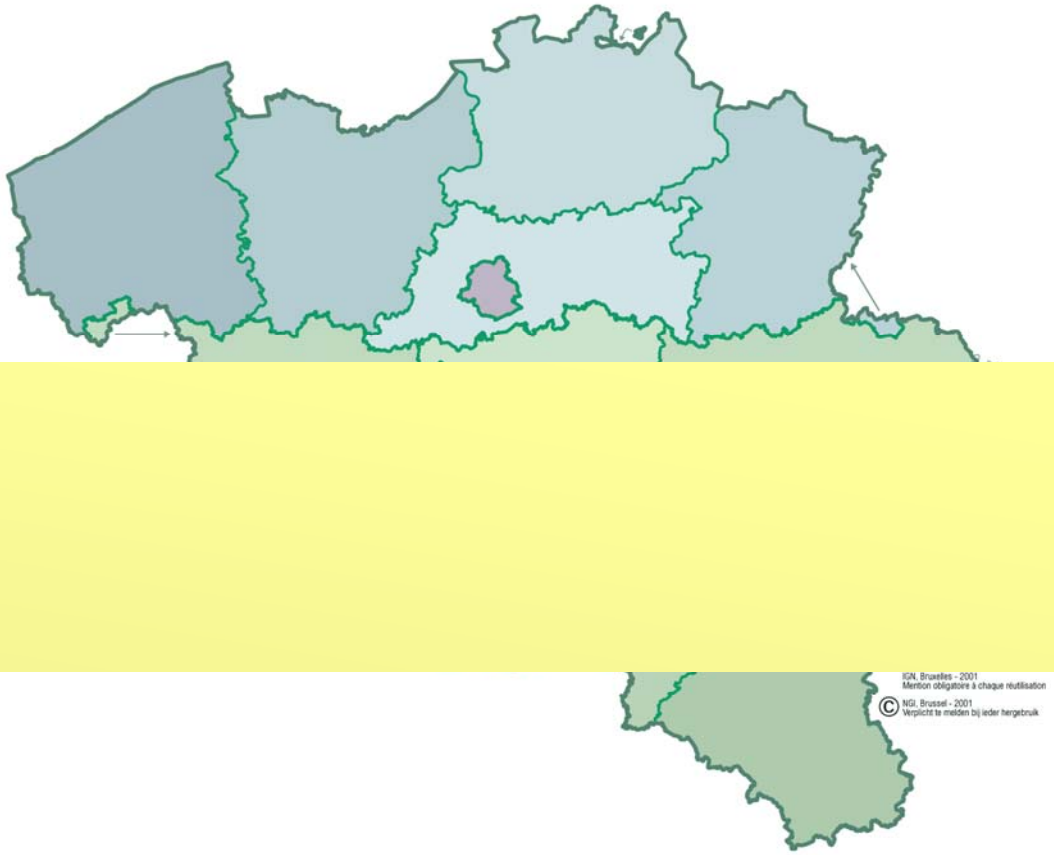


	2004	2005	2006	2007
Total	1.162,6	1.133,9	1.267,2	1.498,4

BUDGET – FUNDING SOURCE



Total	2284	2121	2588	3144
+IAP(personnel)	780	780	780	1116



COMPUTING

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COMPUTING FOR EXPERIMENTS

- federated Belgian Tier2 for CMS spread over 2 locations: UCL@Louvain-la-Neuve and IIHE(ULB-VUB)@Brussels
- MOU with Tier1 in CC-IN2P3(Lyon)
- BEgrid : multidisciplinary, operated by Belgian academic network Belnet - coordination and support by IIHE(ULB-VUB)
- BELGRID : multidisciplinary, Wallonia region – coordination by UCL

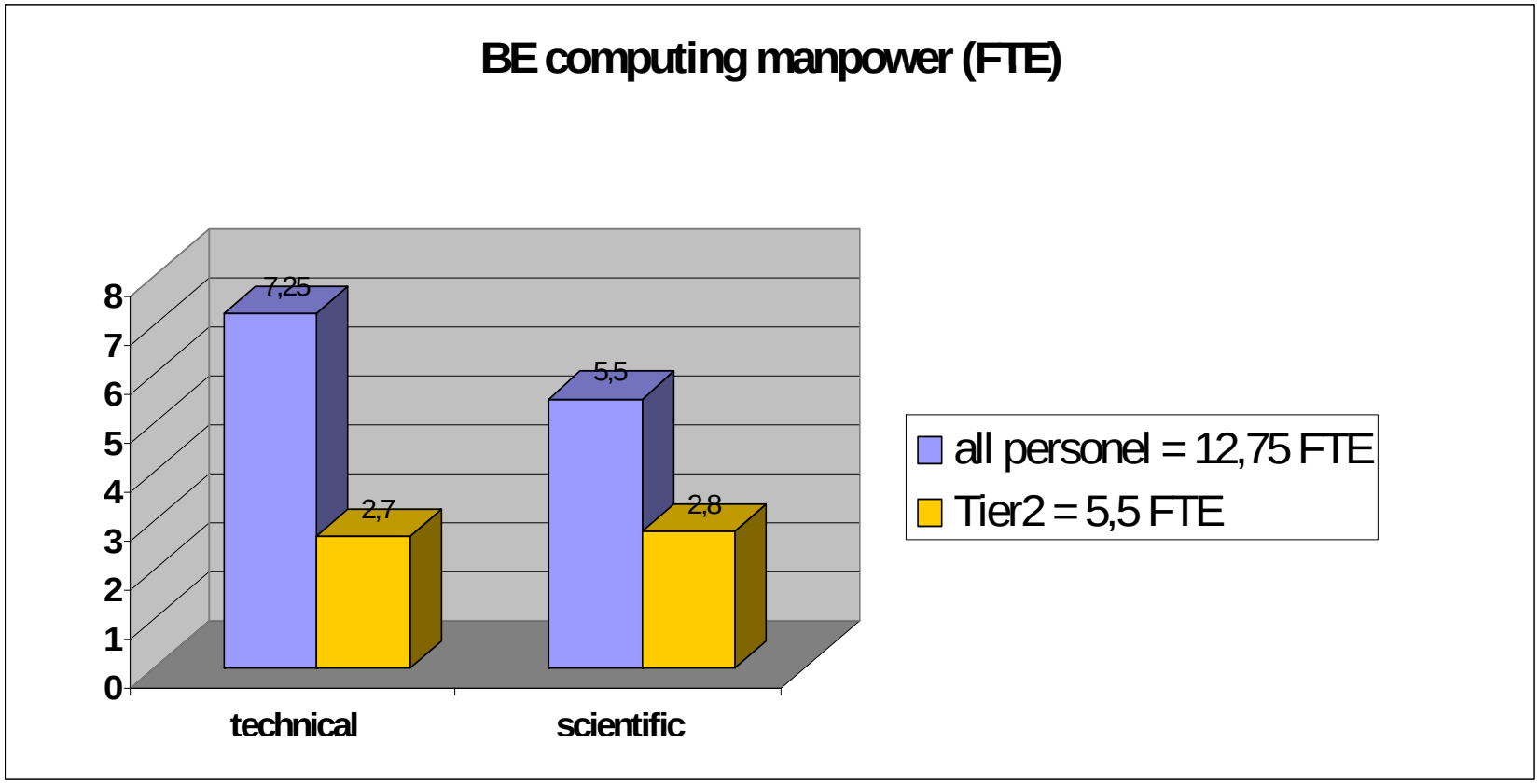
- Several local clusters for intensive computing for HERA experiments(H1,HERMES,ZEUS), IceCube and OPERA

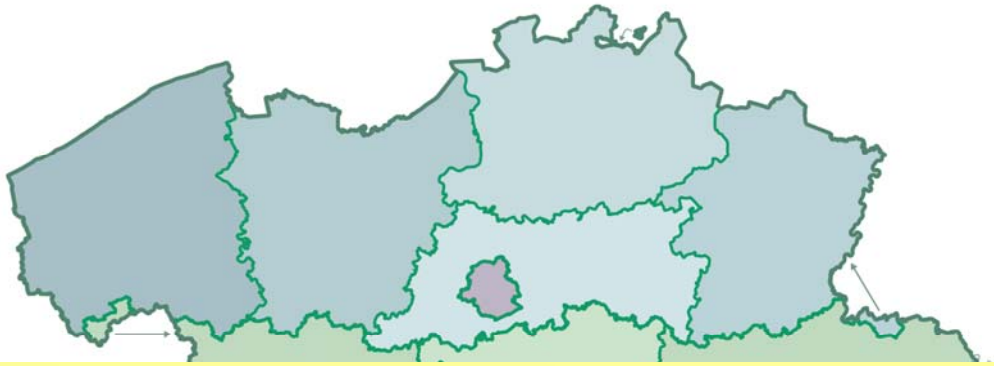
- Designed for 40-50 physicists – actual nb now is 46

	deployment profile		deployed now		cost	available	network	
	CPU(MSI2K)	disk(Tb)	CPU(MSI2K)	disk(Tb)	k€	k€	UCL	IIHE
2007	0,4	100	0,47	100	600	695	1 Gb	0,4Gb
2008	0,9	200			350			1Gb
2009	1,4	400			300			
2010	2,3	700			300			

- Total cost 1.550k€ :
  - 2/3 FNRS(FR) : secured up to 2008 - pledged up to 2010 – to be confirmed each year
  - 1/3 FWO(VL) : secured up to 2007 – future requests to be introduced each year

MANPOWER FOR COMPUTING





THE 2003 RECFA REPORT

Some problems found a solution!

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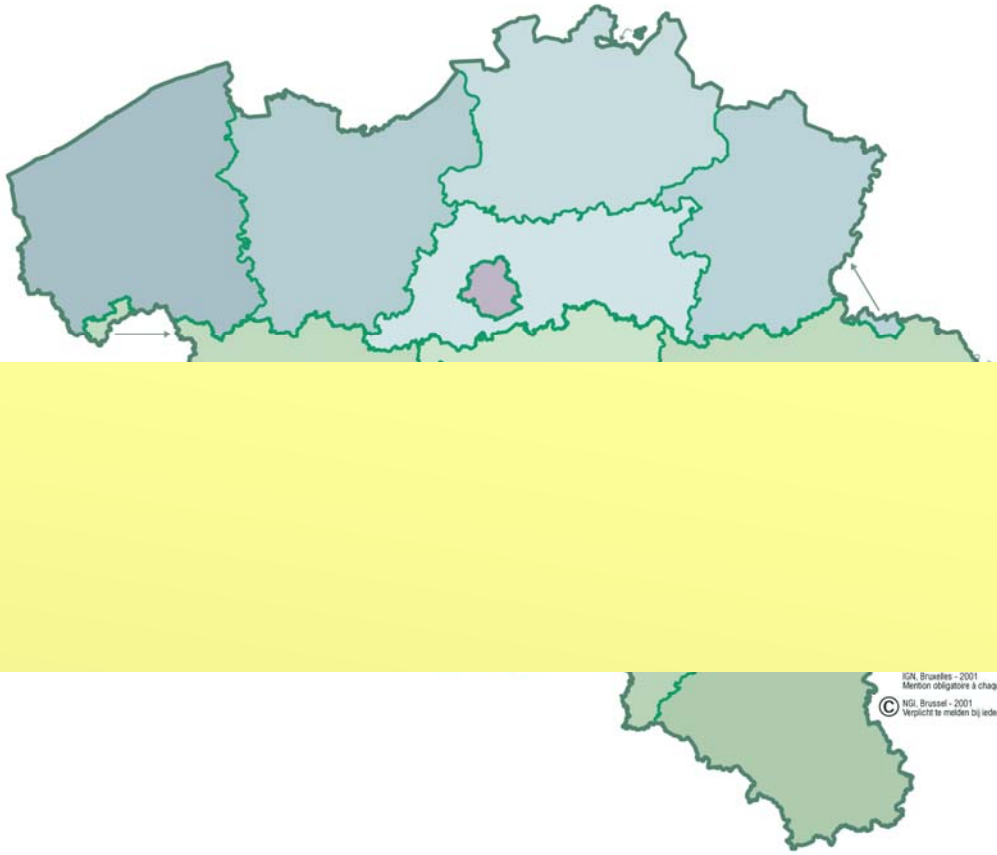
THE WORRIES OF RECFA

- « *Recruitment of young academic staff to replace substantial fraction of community that is close to retirement* »

  ➧ about 15 young academics recruited, both TH and EXP

- « *Difficulties in obtaining HEP funding at FWO(Flemish gov) : 4-year funding cycle not appropriate for long-term nature of experiments* »

  ➧ new funding program « Big Science » launched in 2006 – for participation to CERN, ESRF, ESO and EMBL research – main part went to CMS and ISOLDE



BACKUP SLIDES

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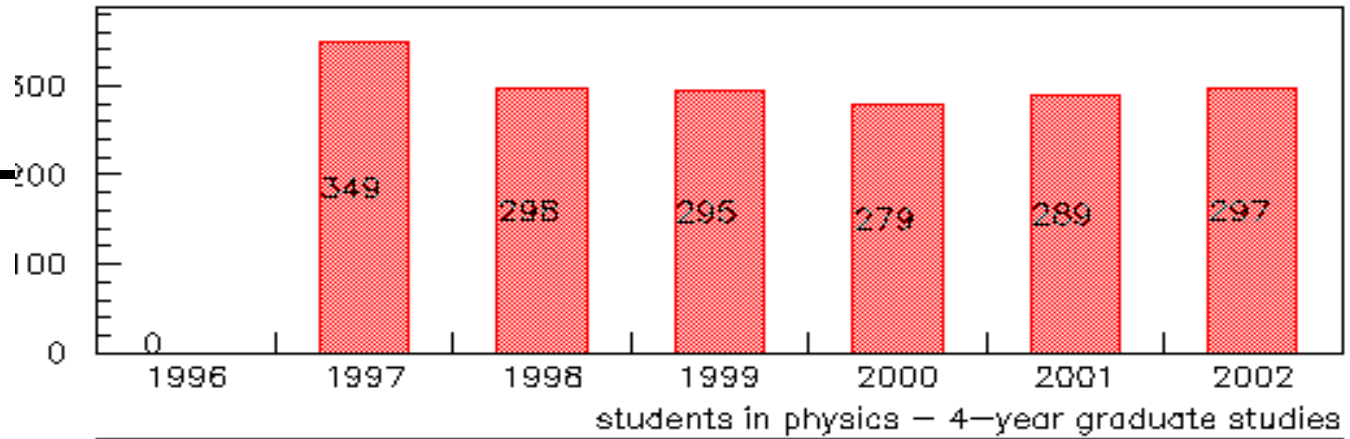
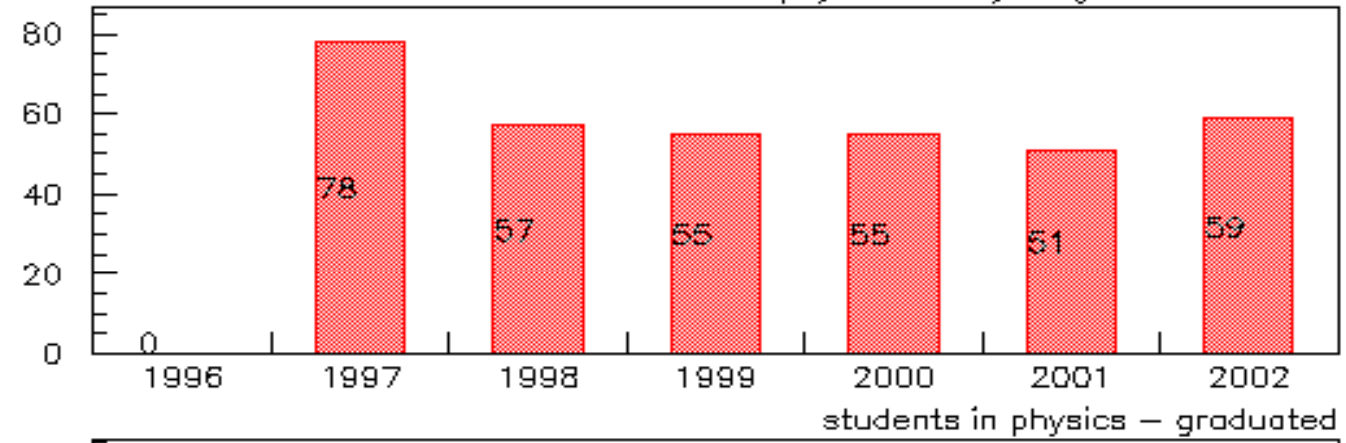
Students in physics Main French-speaking universities

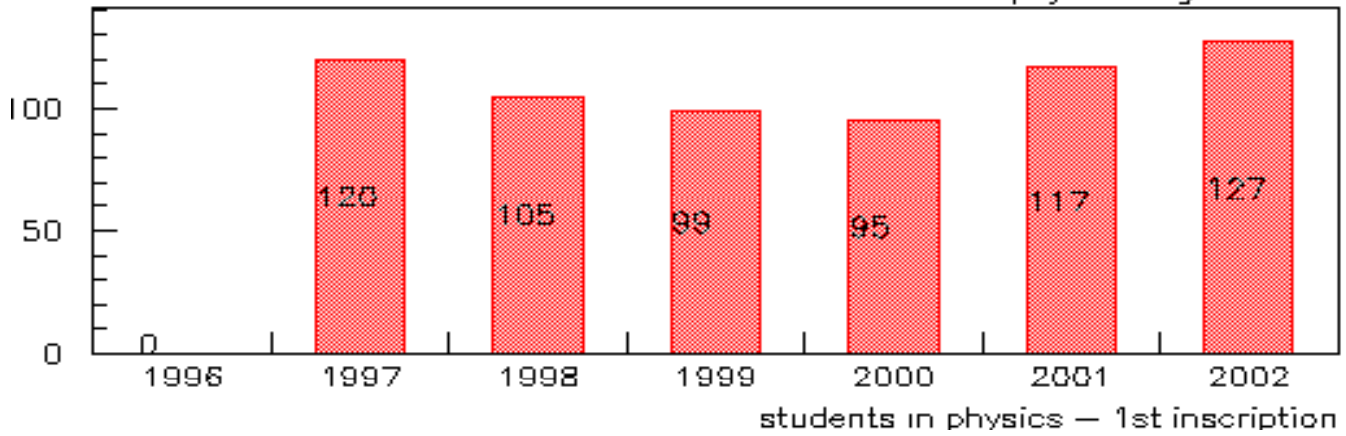
4-year graduate studies



graduated



1st inscription in 1st year

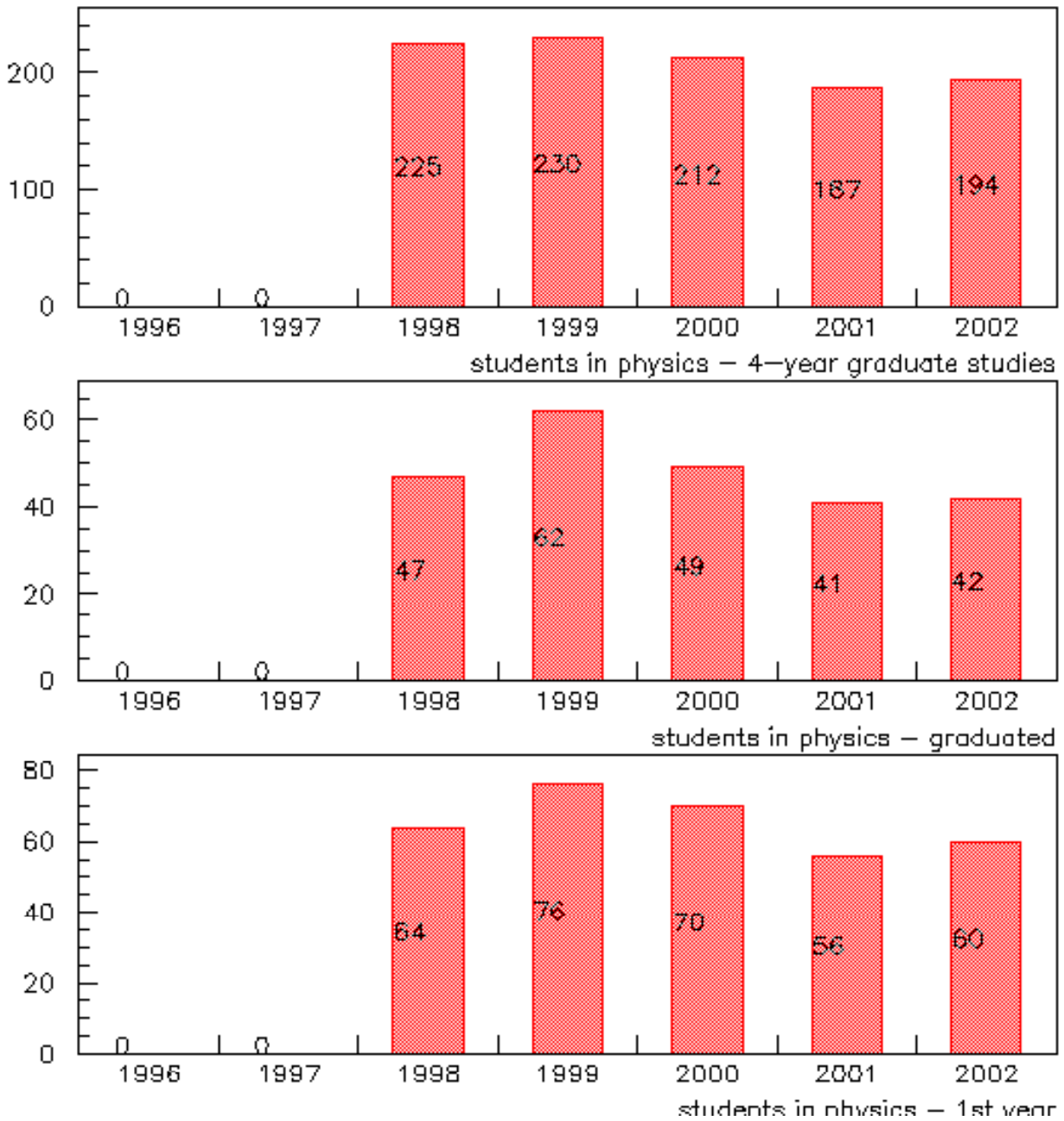


Students in physics
Main Flemish universities
Except U.Antwerpen

4-year graduate studies

graduated

1st year

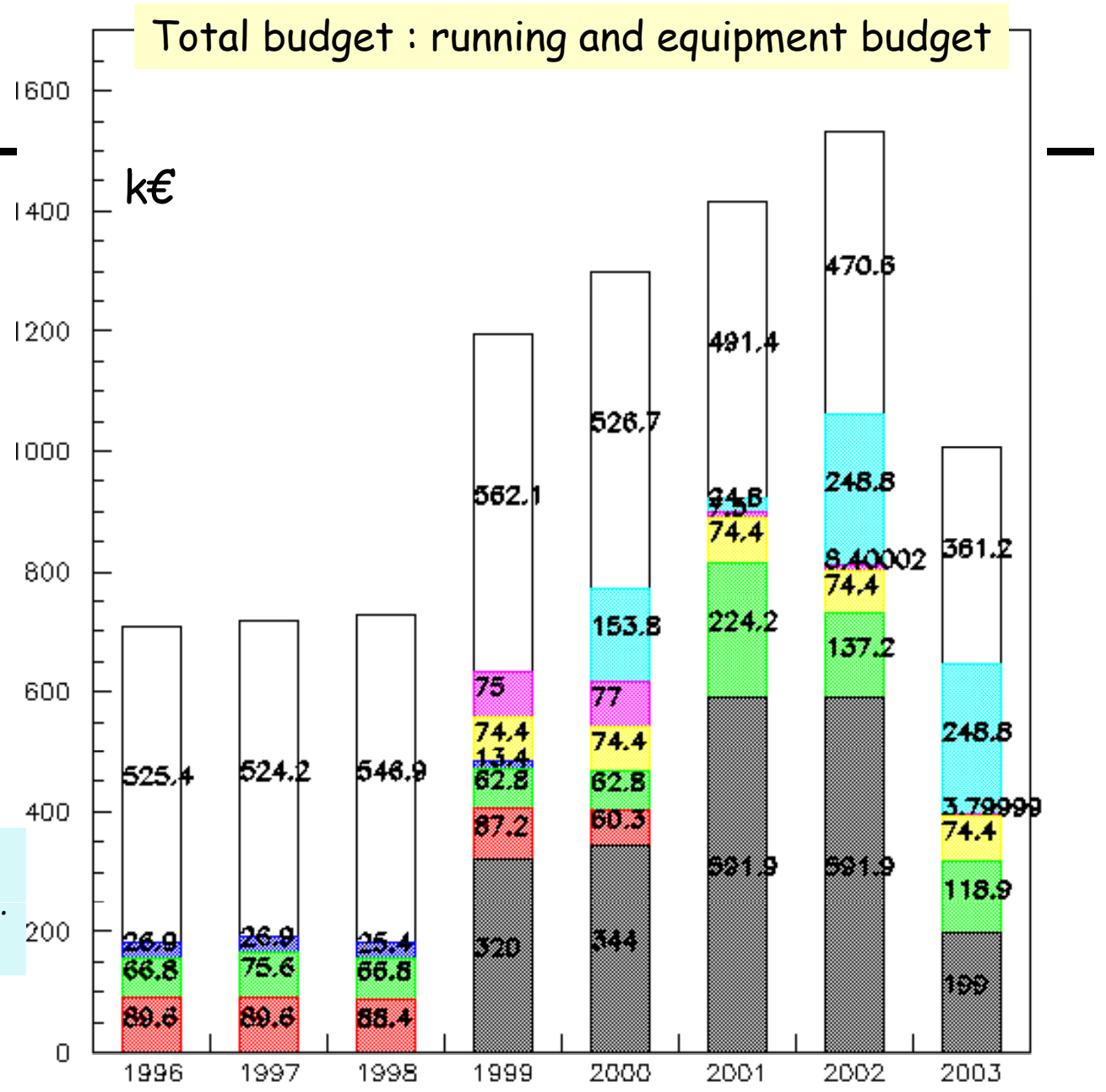


- Deliverable detectors + M&O, common funds, …

	Total 1996-2003
AMANDA/ICE^3	471.3 k€
HARP	171.7 k€
OPERA	372.0 k€
CHORUS	92.6 k€
H1	417.6 k€
DELPHI	165.1 k€
CMS	658.8 k€

- Groups budget : running, equipment, R/D, prototypes, … steadily decreasing

4534.8k€

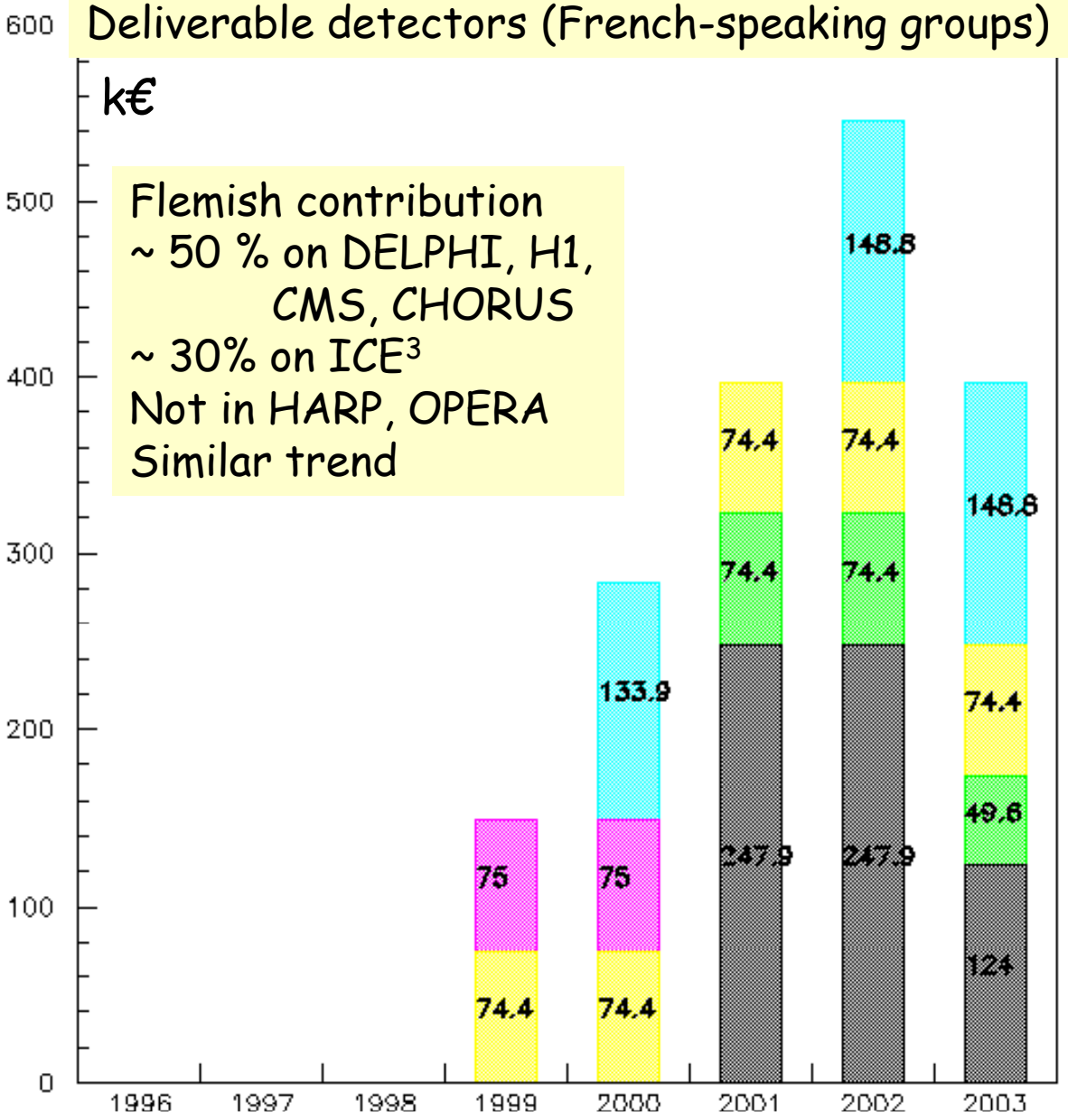


Total 1996-2003

AMANDA/ICE^3	431.5 k€
HARP	150.0 k€
OPERA	372.0 k€
CHORUS	0.0 k€
H1	198.4 k€
DELPHI	0.0 k€
CMS	619.8 k€

1996-1998 – quiet years
1999 – start of OPERA
1999/2000 HARP
2000 - start of AMANDA
2001/03 – H1 upgrade
2001 – start of CMS

Deliverable detectors (French-speaking groups)



Flemish contribution
~ 50 % on DELPHI, H1, CMS, CHORUS
~ 30% on ICE^3
Not in HARP, OPERA
Similar trend

HEP Budget (k€) : FNRS-IISN v.s. FWO HEP v.s. LEP

	Running + Equipment FWO	HEP /HEP+LEP FWO	Normalized to 1993-95 FWO	Running + Equipment IISN	HEP /HEP+LEP IISN	Normalized to 1993-95 IISN
1996				729	0.47	0.82
1997				739	0.48	0.83
1998				768	0.48	0.86
1999	579	0.53	0.85	832	0.49	0.93
2000	584	0.57	0.86	1215	0.66	1.36
2001	581	0.51	0.83	1096	0.55	1.23
2002	601	0.56	0.86	1369	0.61	1.53
2003	359	0.48	0.53	1170	0.59	1.31

CMS

CMS

- Significant budget decrease since 1999 even during CMS funding in 1999-2002
- No reduction of LEP programme
- Research around large accelerators: HERMES, ISOLDE

- Large budget increase since 1999 HARP, OPERA, H1 upgrade, AMANDA … and CMS in 2000-2003
- Policy of reduction of LEP programme around the U.C.Louvain cyclotrons cluster

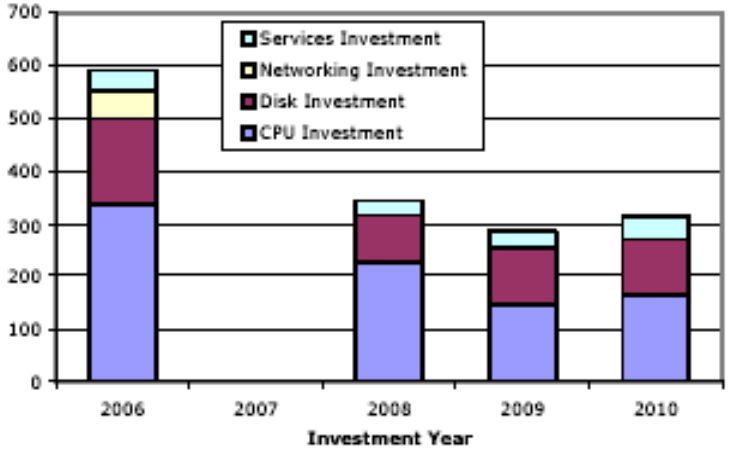


Figure 5: Yearly investment profile.

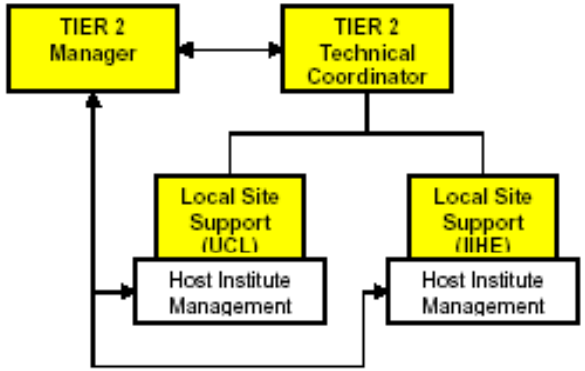


Figure 1: TIER-2 Management organization