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IN2P3

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Programmes Physique des Particules

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Outline

- LHC experiments :
 - ATLAS & CMS
 - LHCb
- nEDM
- LC detectors R&D
- Other particle physics projects
- Computing
- Conclusion



Laboratories involved in LHC experiments

ATLAS : CPPM, LAL, LAPP, LPC-CI, LPNHE, LPSC

CMS : IPHC, IPNL, LLR

LHCb : CPPM, LAL, LAPP, LPC-CI, LPNHE

- All labs involved in LHCb are involved in ATLAS
- Only LLR involved in one LHC experiment
- Other (IPHC, LPSC, IPNL, LPC-cl) involved in ALICE

Human Resource in LHC projects (Dec 2012) @ IN2P3

	Physicists *	PhD Students **	Technical staff (FTE) ***	% Const/M&O
ATLAS	101 (88 +13)	51	51	8.3 / 6.2
CMS	48	~20	-	4.5 /3.5
LHCb	42 (36+6)	13	~15	11/10.1

* CNRS + university staff members + postdocs

** integrated over 3 years thesis

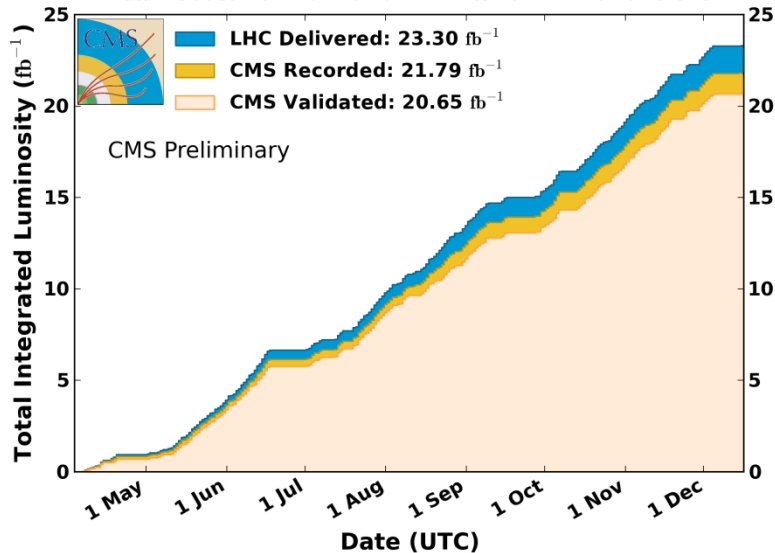
*** IBL implication in ATLAS

~3 new fixed positions /year on LHC experiments since 2009

ATLAS & CMS running

CMS Integrated Luminosity, pp, 2012, $\sqrt{s} = 8$ TeV

Data included from 2012-04-04 22:37 to 2012-12-16 20:49 UTC



High efficiency data taking
Both ATLAS & CMS detectors
working well

Contribution to data taking and
detectors performance studies

ATLAS : e, γ (EM Calo), jets (Tile calo)
 b tagging (pixel detector)

CMS : e, γ (EM Calo)
 b tagging (Si tracking detector)
+ Particle Flow algorithms

• Many IN2P3 group activity
conveners and visible impact

ATLAS & CMS : Higgs physics

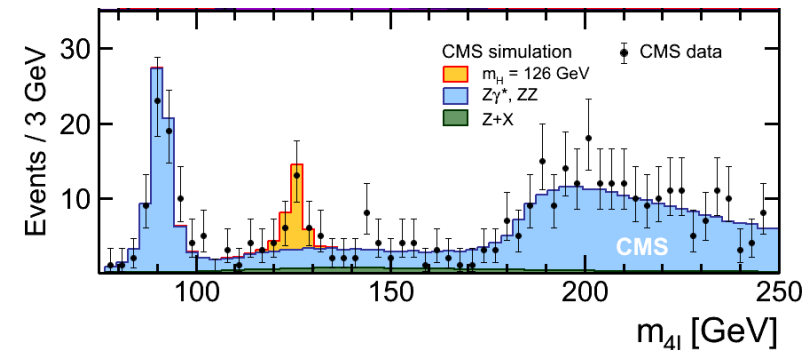
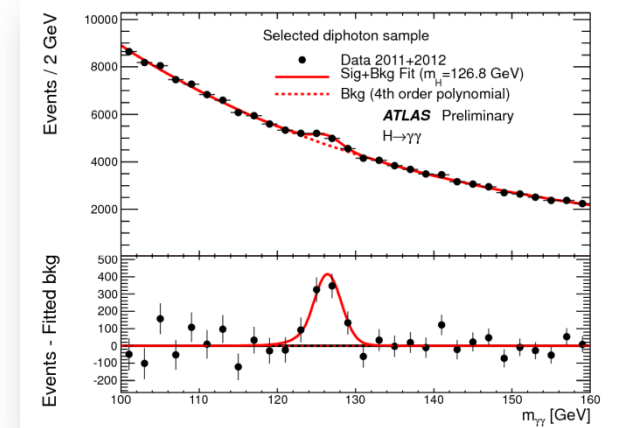
ATLAS* : (~50%)

- Leading role in $H \rightarrow \gamma\gamma$ discovery + spin/mass
- Strong involvement in $H \rightarrow 4l, b\bar{b}$
- Growing activity in $H \rightarrow \tau\tau$

CMS : (40%)

- Leading role in $H \rightarrow 4l$ discovery + spin/mass
- Strong involvement in $H \rightarrow \gamma\gamma$ and $\tau\tau$

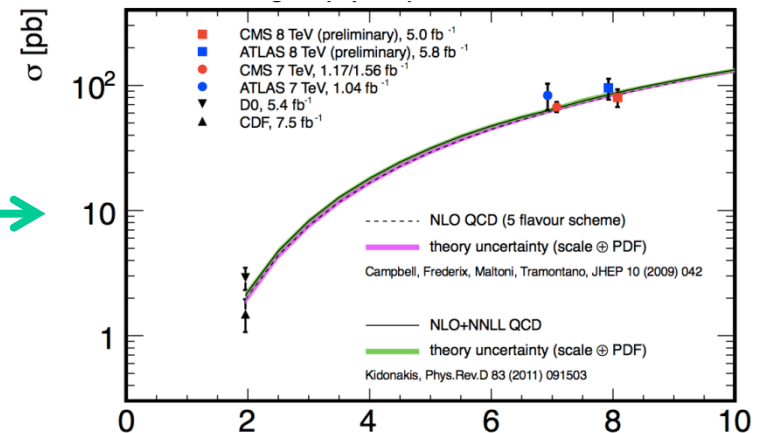
* Higgs co-convener from IN2P3



ATLAS & CMS : Other physics topics @ IN2P3

ATLAS and CMS top physics : (~25 %)

- Cross section and mass measurement
- Single top
- Boosted top in ATLAS
- New physics in top events in CMS



SUSY searches in ATLAS/CMS

Exotic in ATLAS (Z', extradim)

ATLAS upgrades @ IN2P3

- Contribution to IBL :

Construction and commissioning in LS1 (2013-2014) : sensors studies, electronics and cooling/cabling

- Phase 1 upgrade (LS2 in 2018) :

- Calorimeter trigger upgrade to maintain ~ 20 GeV single lepton threshold by using more granularities at LV1. Sharing/contribution still to be defined (baseplane, mother/ daughter boards, ADC...)

Requested funds should be available and MoU end 2013

- Phase 2 upgrade (LS3 ,?) :

-(Too) Many approaches followed for pixel upgrades

- Calorimeter upgrades not yet fully defined

And very limited budget for R&D

CMS upgrades @ IN2P3

- Phase 1 upgrade (LS2 in 2018 but (too) aggressive options for 2016 winter shutdown) :

- Calorimeter trigger upgrade
- Tracker cooling
- Pixel DAQ

Funds available should match requests/ MoU end 2013

- Phase 2 upgrade (LS3 ,?) : (less advanced in CMS/ATLAS)

- Pixel DAQ
- Endcap Tracker
- Track trigger (* *common ATLAS/CMS interest at IN2P3*)
- calorimeter upgrade ?????

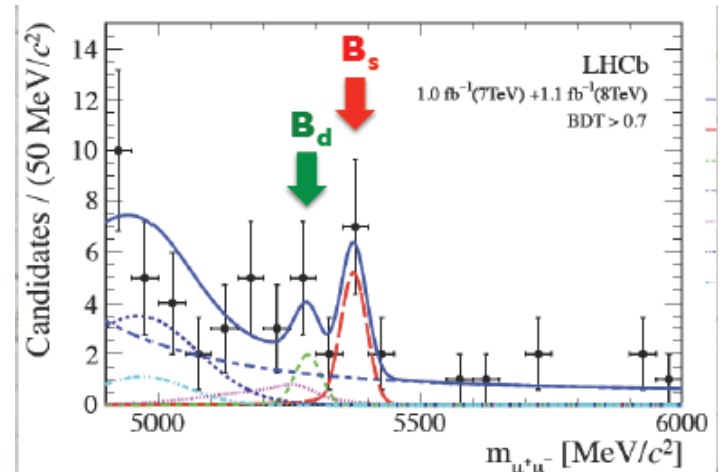
As in ATLAS very limited budget for P2 R&D

LHCb : running + analysis

Strong implication in data taking and expert presence at CERN
 (calorimeter, trigger...) + performances

Main physics topics @ IN2P3 :

- **New physics** : $B_s \rightarrow \mu\mu$ ($\tau\tau$),
 $B_d \rightarrow K^* l^+ l^-$
- **Precision measurements** :
- $B_s \rightarrow J/\Psi \phi \rightarrow \Gamma_s, \phi_s$
- γ measurement
- Charm physics
- Radiative decays





LHCb : Upgrades

Major modifications @ LS2 (10 MHz → 40 MHz, velo/tracker...):
Funding of LHCb upgrades at collaboration level still not fully clarified.

IN2P3 interests :

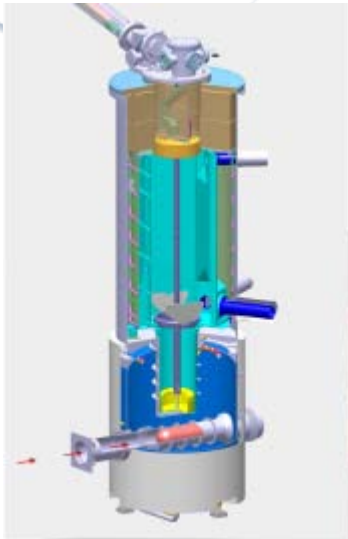
- New Front End electronics for calorimeters
- 40 MHz readout and related DAQ (ATCA)*
- Level I trigger upgrade
- Central tracker with fibers

Anticipated budget will not cover all requests. Will have to decide strategy end 2013/early 2014 before signing MoU

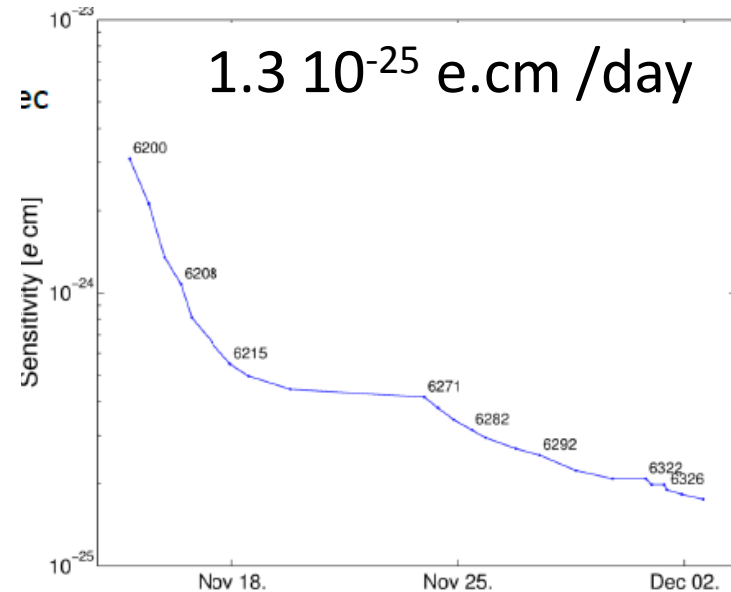
* Common interest ATLAS/LHCb @ IN2P3

nEDM @ PSI (Phase II)

3 laboratories (LPC-Caen, LPSC, CSNSM) : 8 fixed positions + 3 PhD



2012 : 3 weeks of data, mainly commissioning
 -PSI UCN intensity still not at nominal.
 - large improvement on apparatus/environment



Statistical sensitivity

$$\sigma = \frac{\hbar}{2E\alpha T\sqrt{N}}$$

α Visibility of resonance
 E Electric field strength
 T Time of free precession
 N Number of neutrons

Conseil S

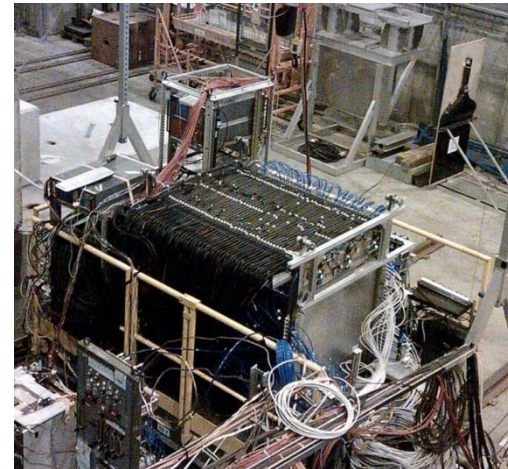
2013-2014 : nEDM data taking (100 days /year) → 1.5 10⁻²⁶ reach (best word limit)

Status report + proposal Phase III (x10)
 → next IN2P3 CS

LC detectors R&D

Calorimeters R&D (CALICE) : 8 laboratories (IPNL, LAL, LAPP, LPC-Cl, LPNHE, LPSC, LLR, Omega) : Phys : 19 FTE, Engineers : 13

- **SHDCAL** (with RPC or μ Megas) : 1m³ prototype, tested at CERN SPS in 2012 → analysis and publications expected in 2013. Combined TB end 2014/early 2015 (AIDA)
- **ECAL** : Technological prototype (embedded Electronics, cooling...) Test Beam @ DESY in 2013
- **Micro-electronics** : third generation of readout chips (AIDA)
→ 2014 : limited support to finalize R&D, 2015 and beyond will strongly depend on ILC progress/schedule





LC detectors R&D

Vertex R&D PICSEL (IPHC) : Phys ~ 5 FTE, Engineers : 15, 5 PhD

Activity is not only ILC driven (STAR, ALICE.....)

Plume project + AIDA : minimize material budget with CMOS

ILC status :

- IN2P3 : LC committee to identify/coordinate IN2P3 community if ILC project emerges

- Japan : Site choice in July 2013, proto-collaboration (ILD ?)

 - High level government discussions (→2015,2016)

 - Limited resource to finalize R&D and be involved in Engineering studies.

 - If ILC, will have to discuss level on investment in P2/SLHC and ILC around 2015/2016



Other particle physics projects

Babar : < 3 FTE, considered terminated in 2013

D0 : Still quite involved in W mass measurement ,expect activity tails on 2014 (~5 FTE)

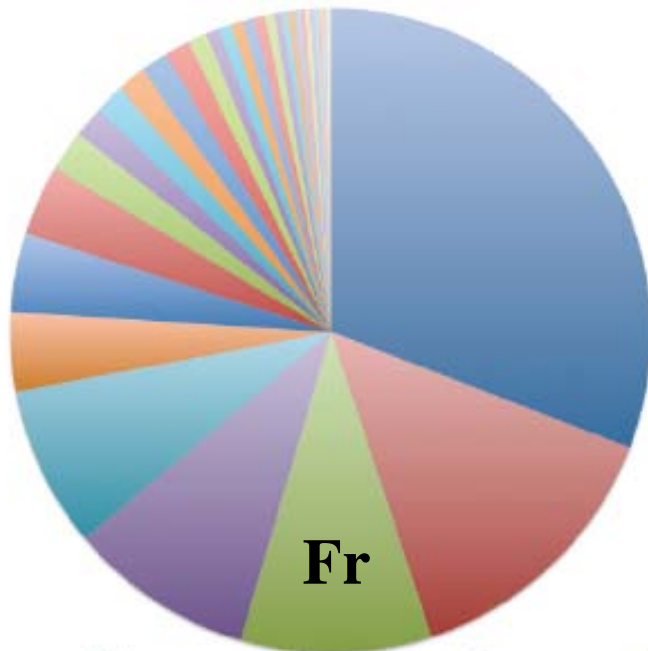
AEGIS : 3 FTE. Proton source installation and commissioning this summer. Positronium measurements; Goal for a g (anti-H) measurement in 2016 ?

On going discussion about possible participation to **Super KEKB** :

- Should be physics driven (no hardware contribution)
- Not a single laboratory
- between 5-10 physicists and a strong national coordination

Decision to be taken end 2013/early 2014 (budget limitation)

French contribution to LHC computing



T1 (CC-IN2P3) in 2013 :
 9% (CPU)
 9% (disk storage)
 8% (tape storage)

2015 : factor 2 on LHC requests / 2013
 Budget mainly constant or decreasing. Over 2013-2016
 Expect 10-20 % budget increase at T1
 Cover only 70 % of needed budget to maintain T2

Figure 9: Tier 2 cumulative CPU time delivered by Country (Jan 2012 - Mar 2013)



Computing @ IN2P3

CC-IN2P3 budget constant since 2011 (after strong reduction in 2010)

But (large) increasing requests :

(End of IRFU convention to CC-IN2P3, under discussion)

- Still LHC, with high luminosity

- LSST

- Euclid

- CTA ?

+ many other users

→ Computing budgets and related manpower issues.

Review of LSST/Euclid needs after summer

External resource (EU ?)..



Conclusion

Particle physics priority :

- LHC exploitation and Phase I construction. Still discussion for P1 budget with CNRS/ministry . Computing contribution decreasing
- Try to maintain “small scale” projects to allow diversity
- Limited R&D both for Phase 2 LHC and ILC R&D