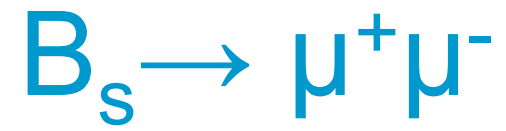
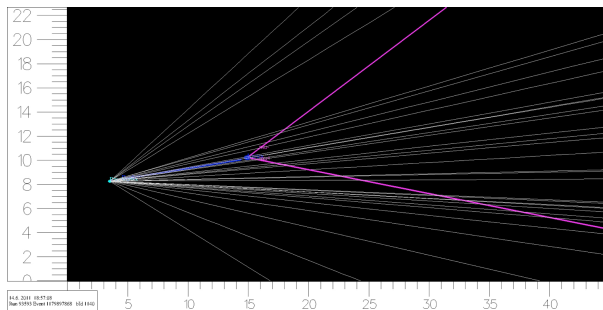
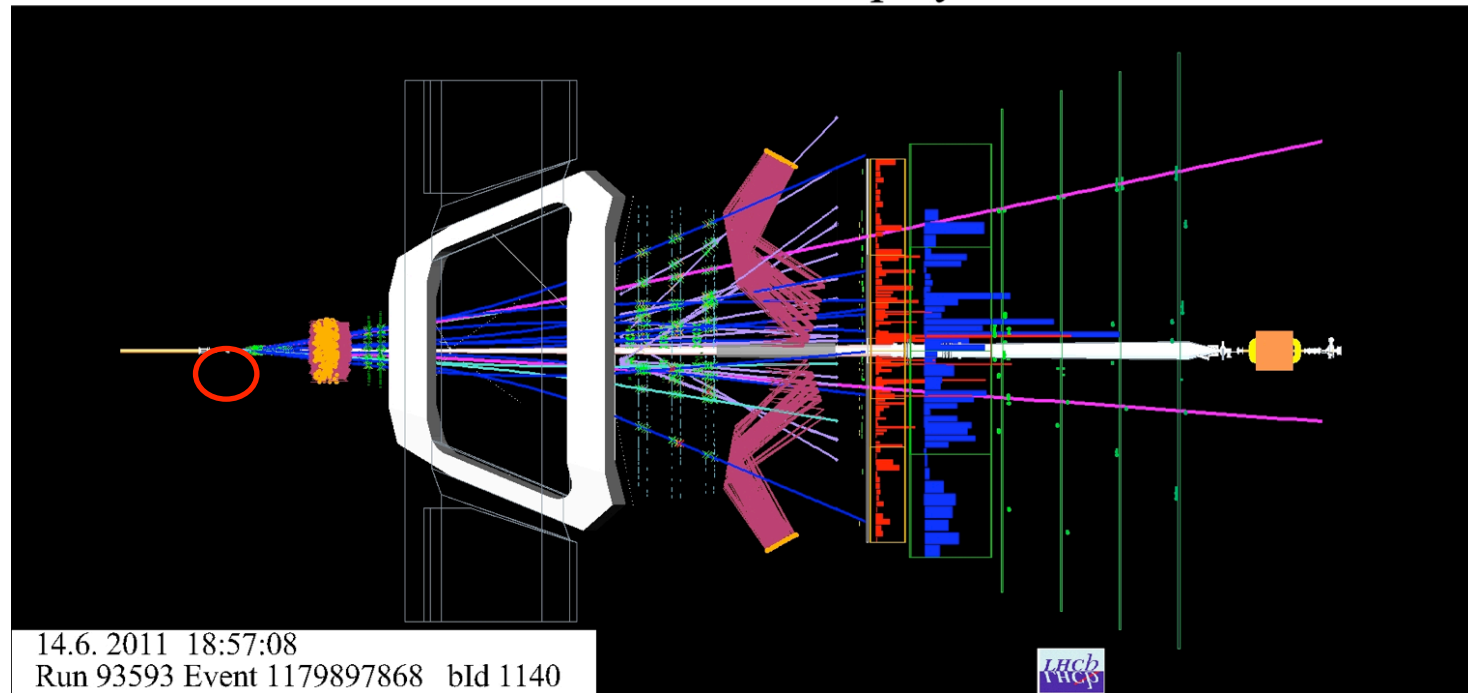


# LHCb

U. Marconi, INFN Bologna

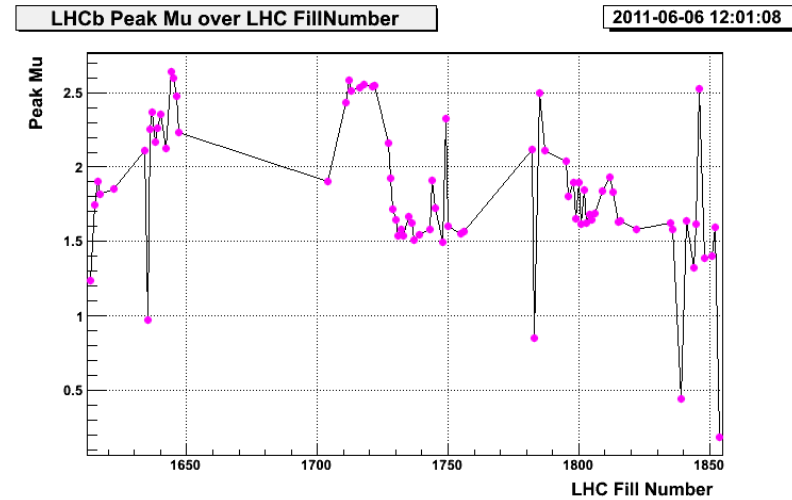
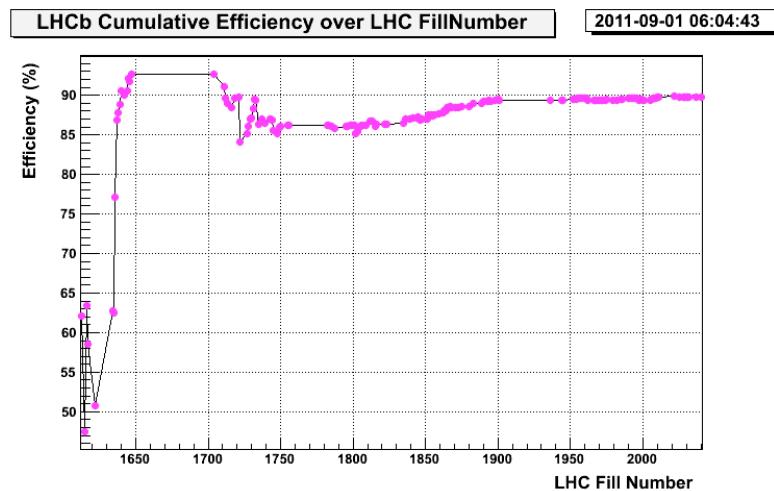
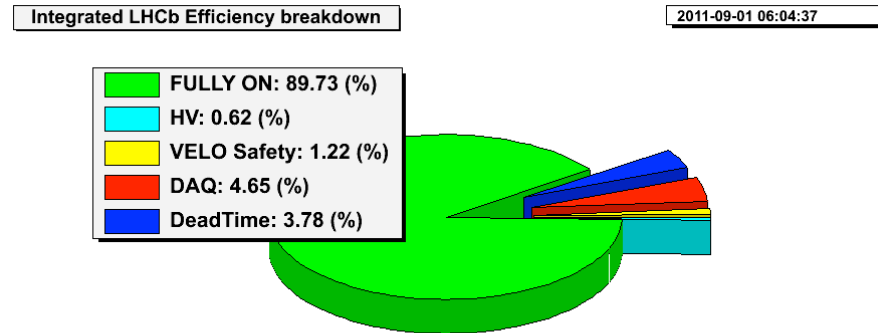
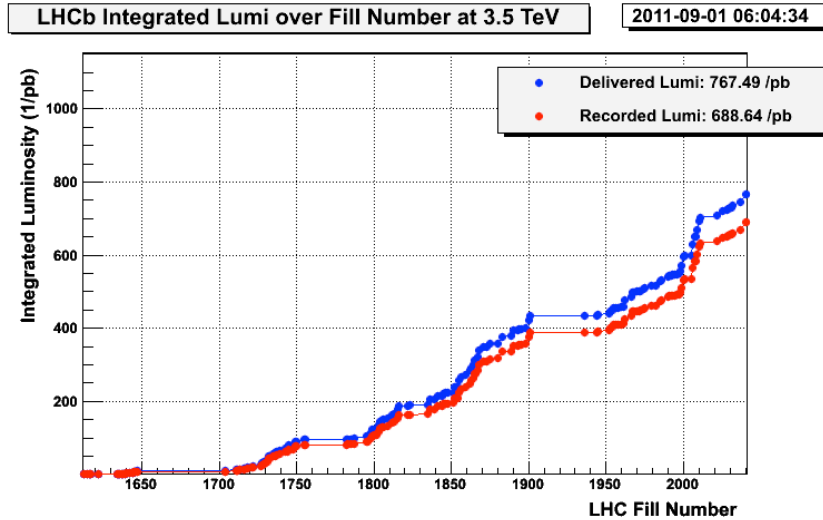


## LHCb Event Display

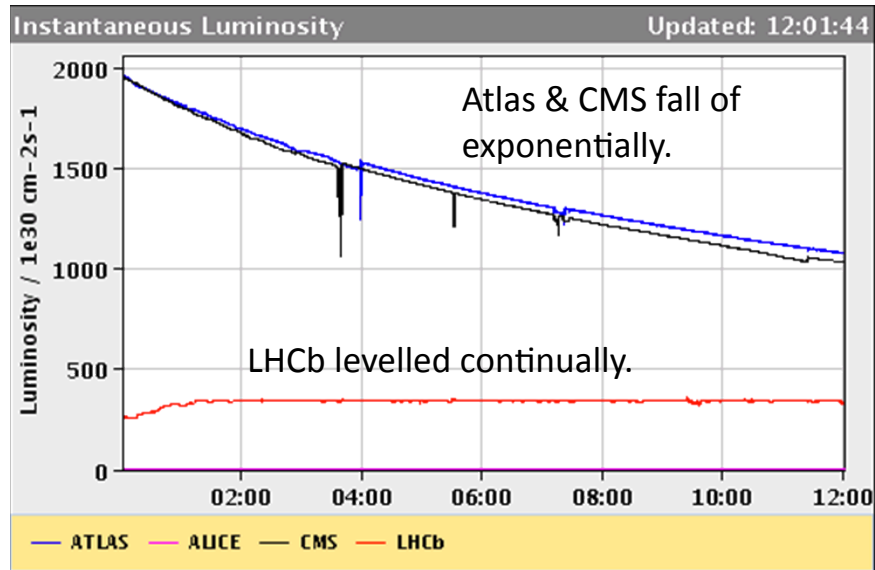


Decay length = 11.5 mm  
Track shown for  $p_T > 0.5$  GeV/c  
 $m_{\mu\mu} = 5.376$  GeV/c<sup>2</sup>

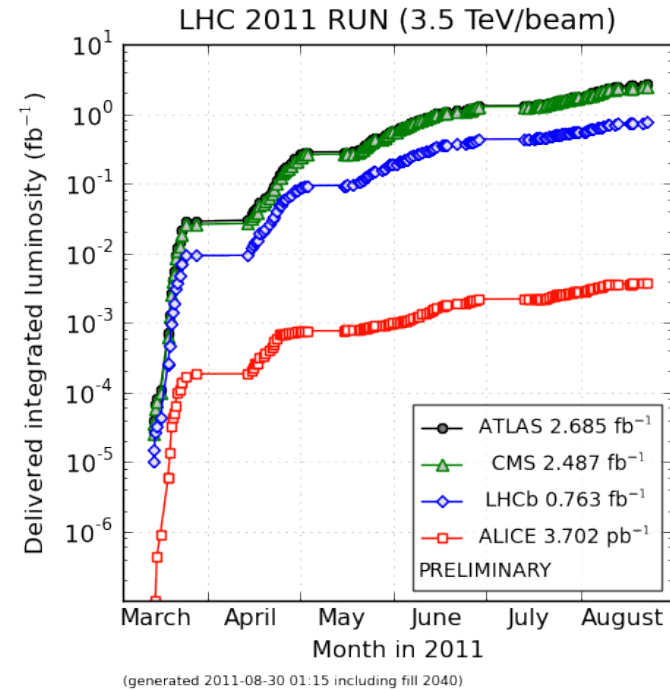
# Operational Plots



# Luminosity



90 ÷ 95 % was recorded as quality data.



# Afferenze

Sezione	2011	2012
Bari	3 / 2.5	2 / 1.7
Bologna	8 / 7.4	6 / 5.4
Cagliari	8 / 7.1	8 / 7.2
Ferrara	6 / 5.1	6 / 5.1
Firenze	7 / 5.7	6 / 5.4
Genova	6 / 4.8	6 / 5.1
LNf	12 / 8.1	10 / 7.8
MI-B	8 / 6.1	9 / 6.3
Roma-I	7 / 6.1	7 / 4.6
Roma-II	4 / 3.7	5 / 4.8
Totale	69 / 56.6	65 / 53.4

# Collaborazione LHCb

## M&O Category A share for 2012

effective date of 30. August 2011

	2009		2010		2011		30.Aug. (V1Aug) for 2012	
	People	fraction	People	fraction	People	fraction	People	fraction
Brazil	12	3.7	11	3.1	12	3.4	17	4.7
France	40	12.3	42	12.0	44	12.3	43	12.0
Germany, BMBF	11	3.4	16	4.6	16	4.5	14	3.9
Germany, MPI	5	1.5	6	1.7	6	1.7	8	2.2
Ireland	3	0.9	2	0.6	2	0.6	2	0.6
Italy	44	13.6	47	13.4	53	14.8	54	15.1
Netherlands	19	5.9	16	4.6	14	3.9	13	3.6
China	3	0.9	3	0.9	3	0.8	3	0.8
Poland	10	3.1	10	2.8	7	2.0	8	2.2
Romania	4	1.2	5	1.4	5	1.4	3	0.8
Russia	32	9.9	32	9.1	32	9.0	28	7.8
Spain	17	5.2	16	4.6	18	5.0	17	4.7
Switzerland	17	5.2	21	6.0	24	6.7	23	6.4
Ukraine	4	1.2	3	0.9	3	0.8	3	0.8
United Kingdom	57.5	17.7	65	18.5	64	17.9	65	18.2
United States of America	6	1.8	9	2.6	9	2.5	9	2.5
Cern	40	12.3	47	13.4	45	12.6	48	13.4
sum	<b>324.5</b>	100.0	<b>351</b>	100.0	<b>357</b>	100.0	<b>358</b>	100.0

# LHCb per MOF Cat. A

Institute	Tot.Persons	Persons_on_contract	Seniors	PostDocs	PhDstudents	PhDengineers	Engineers	Master-stud.	other	valid Authors	should_pay	MOCatA
Bari	3	3	1	2	0	0	0	0	0	2	2	2
Bologna	11	9	4	2	1	1	0	1	0	8	6	6
Cagliari	9	9	5	2	1	1	0	0	0	9	8	7
Ferrara	9	6	4	0	2	0	0	0	0	7	4	4
Firenze	7	7	4	2	1	0	0	0	0	6	5	5
LNF	20	14	10	2	0	2	0	0	0	8	8	8
Genoa	6	5	4	0	1	0	0	0	0	5	4	4
Milano B	11	10	4	5	1	0	0	0	0	7	7	7
Roma 2	6	5	3	2	0	0	0	0	0	6	5	5
Roma 1	12	9	7	1	0	0	1	0	0	8	8	6

Rilevante per MOF Cat. A

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## M&O A old and new forecast (without VELO and Power) in kCHF:

	Year					
	2009	2010	2011	2012	2013	2014
Detector related costs	914	920	920	940	940	920
Secretariat	192	192	185	185	185	185
Communications	12	50	30	12	12	12
Core Computing	100	150	150	150	150	150
Online Computing	850	750	810	880	880	880
Test beams, calibration facilities	20	30	30	30	40	40
Laboratory operations	60	60	60	60	60	60
General services	360	360	360	360	360	360
	<b>2508</b>	<b>2512</b>	<b>2545</b>	<b>2617</b>	<b>2627</b>	<b>2607</b>

Year	2012	2013	2014
Detector related costs	880	920	920
Secretariat	185	185	185
Communications	50	50	50
Core Computing	150	150	150
Online Computing	900	900	900
Test beams	30	40	40
Laboratory operations	50	50	50
General services	330	330	330
Total	2565	2625	2625



## Approved 2011 M&O Category A Budget:

As Romania has become a CERN member state in 2011, we propose and will ask to consider 2011 NMS power contribution as an advance payment for 2012, if you agree.

In coming years,  
Romania will  
appear as a MS.

2011	PhD eq. total/ funding auth.		M&O A	VELO	Power	
			kCHF	kCHF	kCHF	Total
			2,545	100	970	
	%	CHF	CHF	CHF	CHF	CHF
BRAZIL	12	3.4	85,546	3,361	32,605	121,513
FRANCE	44	12.3	313,669	12,325		325,994
BMBF GERMANY	16	4.5	114,062	4,482		118,543
MPI, MPG, GERMANY	6	1.7	42,773	1,681		44,454
IRELAND	2	0.6	14,258	560	5,434	20,252
INFN ITALY	53	14.8	377,829	14,846		392,675
NETHERLANDS	14	3.9	99,804	3,922		103,725
P. R. CHINA	3	0.8	21,387	840	8,151	30,378
POLAND	7	2.0	49,902	1,961		51,863
<b>HHNIPNE ROMANIA</b>	5	1.4	35,644	1,401	<b>13,585</b>	50,630
RUSSIA	32	9.0	228,123	8,964	36,839	273,926
SPAIN	18	5.0	128,319	5,042		133,361
SWITZERLAND	24	6.7	171,092	6,723		177,815
UKRAINE	3	0.8	21,387	840	8,151	30,378
UK	64	17.9	456,246	17,927		474,174
USA	9	2.5	64,160	2,521	23,158	89,838
CERN	45	12.6	320,798	12,605		333,403
<b>TOTAL</b>	<b>357</b>	<b>100.0</b>	<b>2,545,000</b>	<b>100,000</b>	<b>127,924</b>	<b>2,772,924</b>

## CHF to Euro/Dollar exchange rates

Very unfortunate for us, as most of the contributions come from Euro/Dollar states. Strain visible in the incoming funds.

We have no mechanism to compensate for this, neither our budget would survive such an exercise.

Only tip, wherever we can, we should try to pay in Euros/Dollars...

# INFN-CERN Associate

- Diego Milanese, Bari, 01-01-2010, **30-12-2011**;
- Denis Derkach, Bologna, 01-08-2011, 30-07-2012;
- Marco Bettler, Firenze, 01-08-2010, **30-07-2011**;
- Maddalena Frosini, Firenze, 01-01-2011, **30-12-2011**;
- Flavio Achilli, LNF, 01-07-2011, 30-06-2012;
- Roberta Cardinale, Genova, 01-07-2011, 30-06-2012;
- Marcin Kurcharczyk, Milano-B, 01-07-2011, 30-06-2012;
  
- Tre contratti si chiudono entro il 2011.
- I contratti con inizio a Luglio o Agosto del 2011, che proseguono nel 2012 sono quattro, per **24** mesi di finanziamento.

# Preventivi

- Metabolismo Missioni Estere: 12 kE/FTE.
  - Il costo per settimana sia 1.5 kE:  
 $7. * 150. \text{ (soggiorno)} + 500. \text{ (viaggio)}$ .
  - I turni in LHCb sono ~ 20/giorno.  
Il totale dei turni a nostro carico:  
 $20. \text{ (turni al giorno)} * 364. \text{ (giorni)} * 10./12. \text{ (mesi utili/anno)} * 15./100. \text{ ( frazione italiani)}$  da distribuire fra ~50 FTE italiani: 18 turni a testa.
  - 8 settimane complessive per FTE: 4 LHCb week e 4 di turno.
  - $8. \text{ week/FTE} * 1.5 \text{ kE /week} = 12 \text{ kE/FTE}$
- Contributo alle ME per responsabilità: 10 kE.
- Metabolismo Missioni Interne: 2 kE/FTE
- Metabolismo Consumi: 2 kE/FTE

# Riepilogo richieste

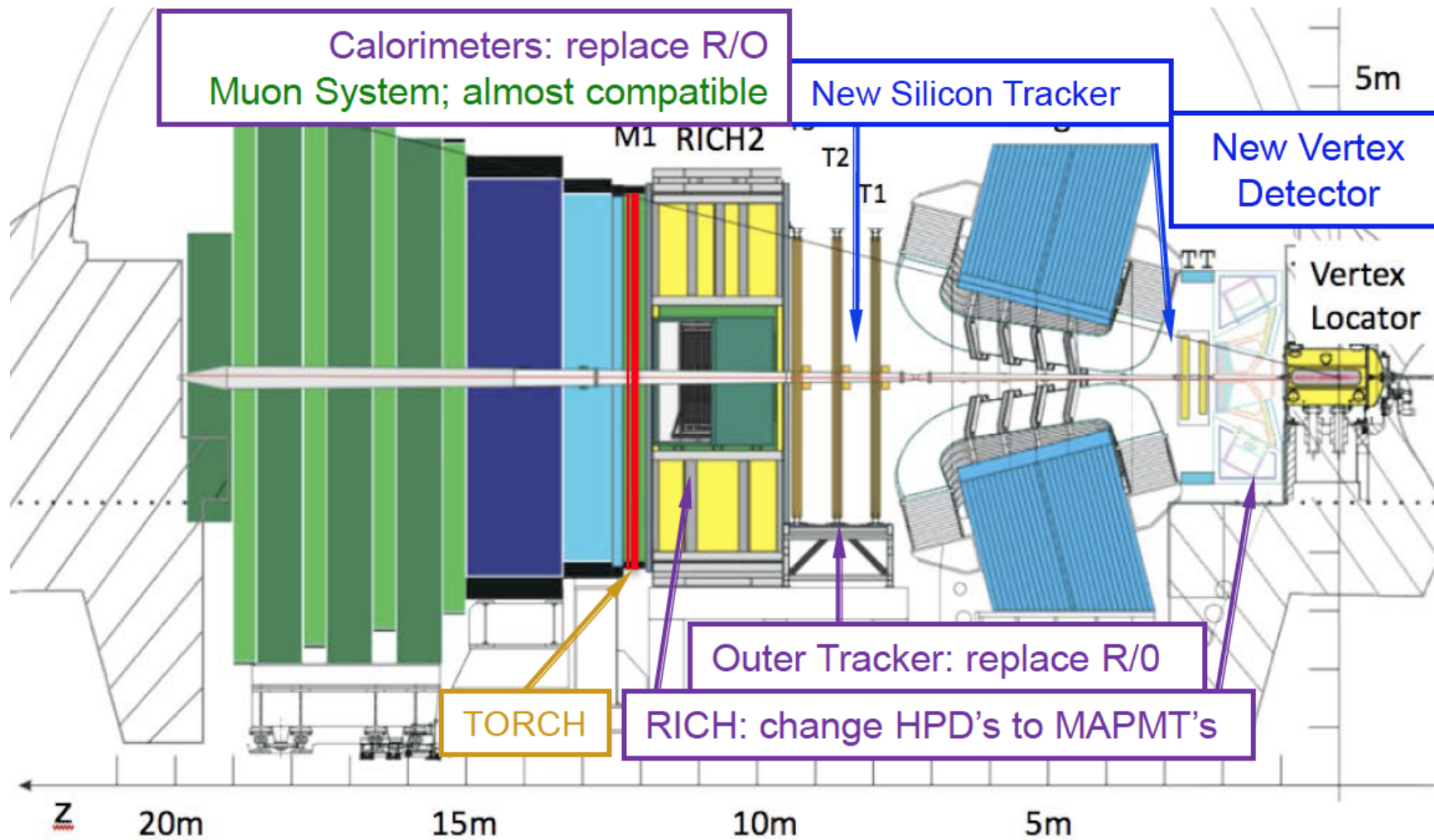
Struttura	A carico dell'I.N.F.N.									
	interno	estero	consumo	trasporti	licenze-SW	manutenzione	inventario	apparati	speservizi	TOTALI
BA	3.50	20.50	3.50							27.50
BO	9.50	148.00	18.50					340.00		516.00
CA	14.00	104.00	15.00							133.00
CNAF.DTZ	1.50	3.00								4.50
FE	8.00	49.50	8.00							65.50
FI	8.00	66.00	11.00							85.00
GE	7.00	57.00	6.50						5.00	75.50
LNF	16.00	100.00	35.00				5.00	85.00		241.00
MIB	13.00	91.00	62.00							166.00
RM1	11.00	66.00	11.00							88.00
RM2	9.50	68.00	9.50							87.00
<b>Totalli</b>	<b>101.00</b>	<b>773.00</b>	<b>180.00</b>				<b>5.00</b>	<b>425.00</b>	<b>5.00</b>	<b>1,489.00</b>

- apparati BO: MOF Cat A:  $(2617.*0.151 + 15.)$  kSF
- consumi BO: MOF Cat B Trigger: 10 kSF
- apparati LNF: MOF Cat B MUON System: 106 kSF
- consumo MIB: MOF Cat B RICH: 20 kSF

# Computing

- Deficit di FTE INFN nel core computing.
  - Documento presentato alla CSN1.
- Abbiamo una persona (A. Falabella) disposta a lavorare nel team del core computing al CERN per 12 mesi.
  - Servono per questo 6 mesi di ME dedicate.
  - Il CERN pagherebbe gli altri 6 mesi.

# Upgraded LHCb



# Upgrade

## Present LHCb detector

collect  $\sim 5 \text{ fb}^{-1}$  with  $L \sim 3 \times 10^{32} \text{ cm}^{-2} \text{ s}^{-1}$

Exploration example :

- search for  $B_s \rightarrow \mu\mu$  down to SM value

Precision studies:

- Measure CKM angle  $\gamma$  to 3-4° to permit meaningful CKM tests



## Upgraded LHCb Detector

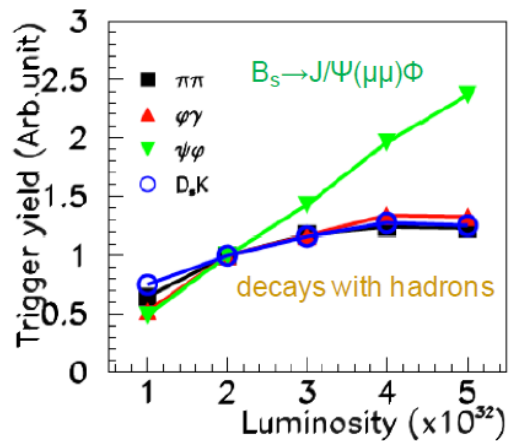
collect  $> 50 \text{ fb}^{-1}$  with  $L \sim 1 \times 10^{33} \text{ cm}^{-2} \text{ s}^{-1}$

Precision studies:

- Measure  $\text{BR}(B_s \rightarrow \mu\mu)$  to precision of  $\sim 10\%$  (assuming SM value)

Exploration example:

- Search for  $B^0 \rightarrow \mu\mu$



## LHCb Upgrade :

- $\mathcal{L} \sim 1 \times 10^{33} \text{ cm}^{-2} \text{ s}^{-1}$  with 25ns bunch spacing
- Average pile-up  $\sim 2.1$



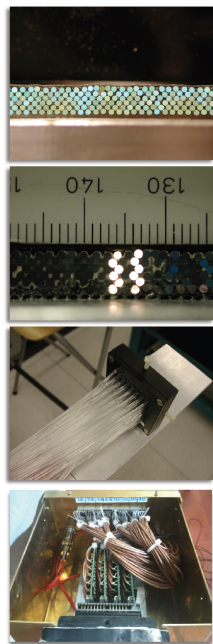
# Upgrade

- A (very tentative) schedule for LHC/LHCb
  - 2011-2012 LHCb data taking
  - 2013-2014 LHC repair / LHCb maintenance, first infrastructures for upgrade
  - 2015-2017 LHCb data taking
  - 2018 LHC shutdown / LHCb upgrade installation
- LHCb Upgrade preparation
  - 2011-2013 R&D, technological choices, TDR preparation and its approval
  - 2013-2014 Funding requests for approval
  - 2014-2017 Construction



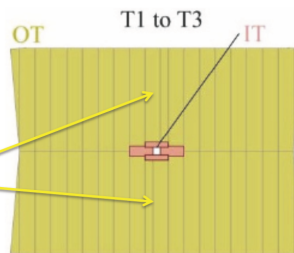
# Upgrade

- Richiesta dei LNF per 5 kE upgrade IT.



## R&D on thick scintillating fibers (LNF)

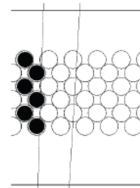
A possible replacement of central OT modules exposed to radiation and high hits densities



Test setup:  
2.3 m long module made of 6 layers of scintillating fibers (1mm thick) sent to a channel of MAPMT H8500

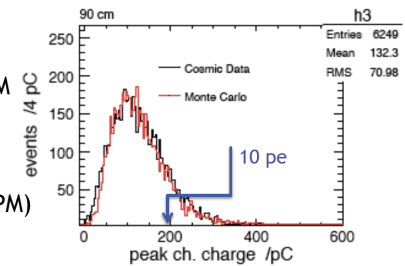
Signal amplifier + analog readout (64 channels ~ 64 mm)

External MDT tracker ( $\sigma_x \sim 150 \mu\text{m}$ )



## Preliminary results

- Fiber spatial resolution ~290  $\mu\text{m}$  ( $\rightarrow$  200  $\mu\text{m}$  with 0.7 mm fibers)
- P.E. number ~ 7 p.e. @1 m from the PM
- Threshold ~  $\frac{1}{4}$  p.e. (noise 5%)
- Track efficiency ~ 93% (@ 2.3 m from PM)  
~ 98% (@ 0.6 m)



### Next steps:

- Test MAPMT R7600 (better QE, less cross-talk)
- Fibre with double cladding (to reduce X0)
- Squared fibres (for an efficient use of charge sharing)