



## Outline

- LHCb detector
- First days of data taking
- Beauty cross section
- Summary and Outlook

## LHCb @ LHC

liadi

LHCb

b



b

[rad]

ATLAS

CERN

b



CMS



A Large Hadron Collider Beauty Experiment for Precision Measurements of CP-Violation and Rare Decays

### The LHCb Detector



#### The LHCb Detector



IH

#### The LHCb Detector



27 June 2008 Installation of major structures is complete



#### A walk through the LHCb spectrometer...



#### **B-Vertex Measurement**





- $^{\sim}$  5  $\mu m$  hit resolution
- $^{2}$   $\rightarrow$  30  $\mu$ m IP resolution

Wiedner at PIC2008 Perugia

#### **B-Vertex Measurement**





#### Momentum and Mass measurement



#### Momentum and Mass measurement





#### Momentum and Mass measurement



## Particle Identification



#### RICH: K/ $\pi$ identification using Cherenkov light emission angle



## Particle Identification



RICH: K/ $\pi$  identification using Cherenkov light emission angle





### RICH: K/ $\pi$ identification; eg. distinguish D<sub>s</sub> $\pi$ and D<sub>s</sub>K events.





# LHCb calorimeters





## LHCb calorimeters





## LHCb muon detection



Muon system:

Level 0 trigger: High Pt muons

•Muon ID

27 June 2008



## LHCb muon detection



#### Muon system:

- Level 0 trigger: High Pt muons
- •Muon ID

27 June 2008

## LHCb trigger







## Cosmic muon event





# Initial minimum bias run

- only 4 filled bunches at L =  $1.1 \times 10^{29}$  cm<sup>-2</sup>s<sup>-1</sup>
- 2 kHz minimum bias to disk
- 300 Hz non-empty minimum bias events to disk
- 10<sup>8</sup> events in approx. 100 hours of running

Filling scheme	for nex	xt step	(2008)
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F	Parameters		Rates in 8	
k <sub>b</sub> N		beta*	Luminosity	Events/
	(m)	(cm <sup>-2</sup> s <sup>-1</sup> )	crossing	
68	<b>4 10<sup>10</sup></b>	10	2.0E+30	0.15
68	<b>4 10<sup>10</sup></b>	5	4.9E+30	0.3
68	<b>9 10<sup>10</sup></b>	10	9.6E+30	0.76
68	<b>9 10</b> <sup>10</sup>	5	2.4E+31	1.6





# **Beauty x-section**

- Requirement: working MUON-system, Main Tracker and VeLo
- measure J/Ψ -production cross sections
- disentangle fractions of prompt and detached J/Ψs
- relate non promt J/Ψ yield to bb cross sections







# Summary

- The LHCb detector is ready to take data in 2008:
  - Good decay time resolution to resolve  ${\sf B}_{\rm s}$  oscillations
  - Good mass resolution to efficiently suppress background
  - Excellent particle identification for K- $\pi$  separation
  - Efficient trigger for many B-decay topologies
- Inclusive "low  $p_{T}$ " physics from day one
- Determination of the b-cross section in first months



# Outlook

- Physics program in 2009:
  - Very interesting results with first 0.5 fb<sup>-1</sup> of data:
    - $B_s \rightarrow J/\psi \phi$  2 $\beta_s$  measurement with ~0.05 precision (S.M. exp. 0.0368 0.0017)
    - $B_s \rightarrow \mu\mu$  BR limit down to SM value (3.35 0.32) x10<sup>-9</sup>

 $B_d \rightarrow K^{0^*}\mu\mu$  ~1800 events, overtaking B-Factories statistics

Core physics program @ 2fb<sup>-1</sup> per year

#### <u>CP Violation - 1 year (2 fb<sup>-1</sup>)</u>

- $\gamma$  from trees: 5° 10°
- $\gamma$  from penguins:  $\approx 10^{\circ}$
- B<sub>s</sub> mixing phase: 0.023
- $\beta_{s}^{eff}$  from penguins: 0.11

Rare Decays - 1 year (2 fb<sup>-1</sup>)

• 
$$B_d \rightarrow K^{0*} \mu \mu s_0 : 0.5 \text{ GeV}^2$$

• 
$$B_s \rightarrow \phi \gamma \quad A_{dir} , A_{mix} : 0.11$$
  
 $A_{\Lambda} : 0.22$ 

 $A_{\Lambda}$ 

P B<sub>s</sub>→µµ BR.: 6 x 10<sup>-9</sup> at 5
$$\sigma$$



## The End