



Exclusive B-Decays in ATLAS

Alessandro Cerri for the ATLAS collaboration

ATLAS

- General purpose pp detector
- Few peculiarities:
 - Huge massive detector!
 - Solenoidal field tracker complemented by separate muon spectrometer
- Will not go into details, feel free to ask questions



B physics with ATLAS

- Large b production cross-section [few 100 μ b]
- Excellent muon detection and tracking performance
 - B physics in ATLAS is mostly driven by muon-based triggers!

ATLAS data taking

- I.23 fb⁻¹ integrated in 2011
- I.26E33 cm⁻² s⁻¹ peak luminosity
- Overall data taking efficiency >95%
 - All subsystems >90%
- Expect >10 fb⁻¹ by the end of 2012
- <# interactions/crossing>: 6
- Results discussed based on
 - ▶ 2010 (~40 pb⁻¹)

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- ▶ 2011 (~1.2 fb⁻¹ so far)
- data, depending on specific result discussed





We also reconstruct Λ , Σ , Ω , $\Lambda_{\rm b}$, etc.

Open charm cross section



Open charm cross section



Mass resolution: J/ ψ studies

- ► J/ ψ → µµ, fit 2-track vertex
- Mass value and dependency on η (J/ ψ) consistent with PDG/MC:



Proper time: tracking & PV determination

Hits on tracks / 4 µm

- PV determined with 13-16 μ m precision
- Tracker residuals within expected performance, not fully consistent with simulation





ATLAS-CONF-2010-098

One additional track: J/ ψ K⁺

- Select additional track with K mass hypothesis
- Fit 3-track vertex, with mass-constraint on J/ ψ
- Unbinned maximum-L fit with Gaussian+linear background



Measured mass consistent with PDG within statistical uncertainty

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Two additional tracks...

- Add two tracks, assume $K^* \rightarrow K\pi$, $K^0 \rightarrow \pi\pi$, or $\phi \rightarrow KK$ and J/ $\psi \rightarrow \mu \mu$
- Fit 4-track vertex or two 2-track vertices





Mass values compatible with PDG within stat. uncert.

Alessandro Cerri, EPS2011 July 21, 2011

B_→I/ ψ K

Data •



		BL		signai	<u> </u>
Bd (K*)	No	5278.6±1.3	36.8±2.0	2680±150	10280±110
	Yes	5279.6±0.9	38.8±1.2	2340±80	1330±60
Bd (K _s)	No	5278.5±1.2	24.3±1.4	781±45	4436±75
	Yes	5279.7±1.0	24.3±1.1	616±30	910±34
Bs	No	5363.6±1.6	21.9±1.9	413±36	764±17
	Yes	5364.0±1.4	26.6±1.6	358±22	90±7
BS	Yes	5363.6±1.6 5364.0±1.4	21.9±1.9 26.6±1.6	413±36 358±22	90±7

Consistent masses with PDG, good mass resolution

Measuring lifetimes

- Perform simultaneous unbinned max-L fit to mass and decay time distributions
 - Signal:
 - M: Gaussian with predicted per-candidate mass resolution plus corrective scale-factor
 - T: Gaussian-smeared truncated exponential
 - Background:
 - M: Linear function
 - ► **て**:
 - L. One Gaussian
 - 2. Two Gaussian-smeared truncated exponentials
 - 3. One Gaussian-smeared symmetric exponential [exp(-| τ _{Bck3}|)]
- I2 free parameters!

 $\mathbf{f}_{sig}, \mathbf{m}_{B}, \mathbf{S}_{m}, \mathbf{S}_{\tau}, \tau_{B}, \mathbf{b}, \tau_{Bck2a}, \tau_{Bck2b}, \tau_{Bck3}, \mathbf{f}_{Bck1}, \mathbf{f}_{Bck2}, \mathbf{f}_{Bck3}$

Lifetime fit results: B⁰ $\begin{array}{c} & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & &$ 10⁴ bs Data • — Total Fit Events / 0.2 Data ---- Background Total Fit Signal 10³ Non-prompt J/w Background 600 Prompt J/w Background 400 **ATLAS** Preliminary 10² $\sqrt{s} = 7 \text{ TeV}$ 200 $dt = 40 \text{ pb}^{-1}$ 5350 5200 5250 5300 B_d Mass [MeV] **10** $m_{B_d} = (5279.0 \pm 0.8) \text{MeV}$ $\sigma_m = (34.3 \pm 0.9) \,\mathrm{MeV}$ <u>-</u>2 $\tau_{B_{\perp}} = (1.51 \pm 0.04 \pm 0.04) \text{ ps}$ 2 8 0 6 4 10 B_d Proper Decay Time [ps] Good agreement with PDG



Summary and Outlook

- B physics in ATLAS is mostly based on muon triggers
- Heavy-flavor signals (D, D*, Ds etc.) encouraging
- We will be competitive in the long run:
 - 2 fb⁻¹ from LHCb will be integrated when ATLAS will have collected 10 fb⁻¹
 - ATLAS will make a valuable contribution to β_s
- On-track for CPV measurements, we have successfully assessed our performance in terms of mass and propertime reconstruction
- Looking forward to many more fb⁻¹ of integrated luminosity!