Ekaterina (Katya) Govorkova
(28.01.1993)

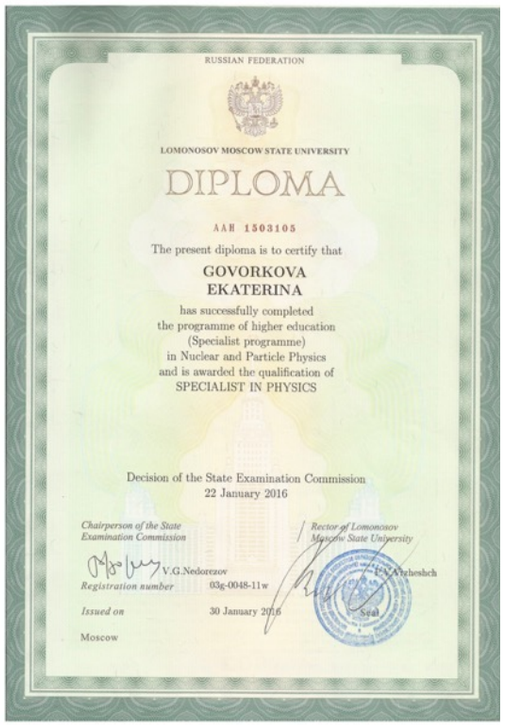
- Graduated from Moscow State University (MSU)

(January 2016)

- Physics Faculty: Specialist in Physics
- Main field of study: Nuclear and Particle Physics
- Specialization: High Energy Physics
- Diploma Thesis: Study of photons and neutral

pions reconstruction efficiency in the LHCb experiment [CERN-THESIS-2015-272]

- Supervisor: Dr. Daria Savrina
- Member of ITEP LHCb group since 2013
- Advisors: Dr. Vanya Belyaev, Dr. Victor Egorychev

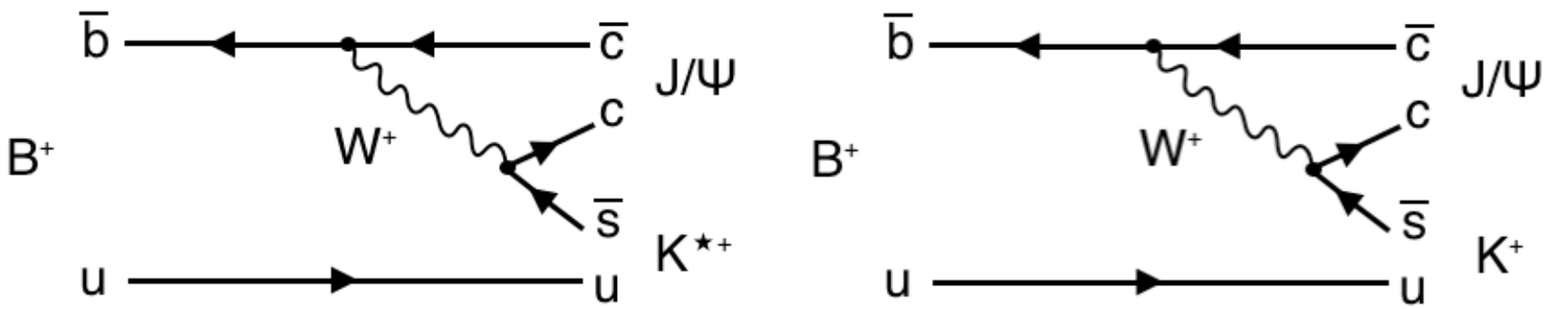


Study of π^0/γ reconstruction efficiency

MC doesn't perfectly describe photon reconstruction and selection

Choose two convenient B-meson decay modes to study photon reconstruction and selection efficiency $B^+ \to J/\Psi\, K^+$ and $B^+ \to J/\Psi\, K^{*+}(K^+\pi^0)$:

- large signal yields
- similar topology (final states differ only by presence of $\pi^0(\gamma\gamma)$)



- known ratio of branching fractions

$$\frac{\mathcal{B}\left(B^+ \to J/\psi\, K^+\right)}{\mathcal{B}\left(B^+ \to J/\psi\ (K^{*+} \to K^+\pi^0)\right)} = \left(\frac{1}{3} \times (1.39 \pm 0.09)\right)^{-1}$$

- obtain correction factor to π^0 and γ reconstruction and selection efficiency

$$\eta^{\text{corr}}_{\pi^0} = \frac{N^{B^+ \to J/\psi\left(K^{*+} \to K^+\pi^0\right)}}{N^{B^+ \to J/\psi\, K^+}} \times \frac{\varepsilon^{\text{MC}}_{B^+ \to J/\psi\, K^+}}{\varepsilon^{\text{MC}}_{B^+ \to J/\psi\,(K^{*+} \to K^+\pi^0)}} \times \frac{\mathcal{B}\left(B^+ \to J/\psi\, K^+\right)}{\mathcal{B}\left(B^+ \to J/\psi\ (K^{*+} \to K^+\pi^0)\right)}$$

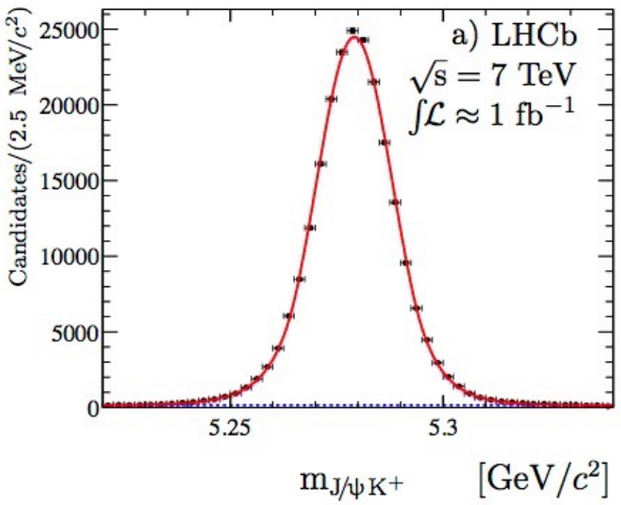
Study of π^0/γ reconstruction efficiency

Correction factors are obtained separately
for 2011 and 2012 data
due to different conditions of the data-taking

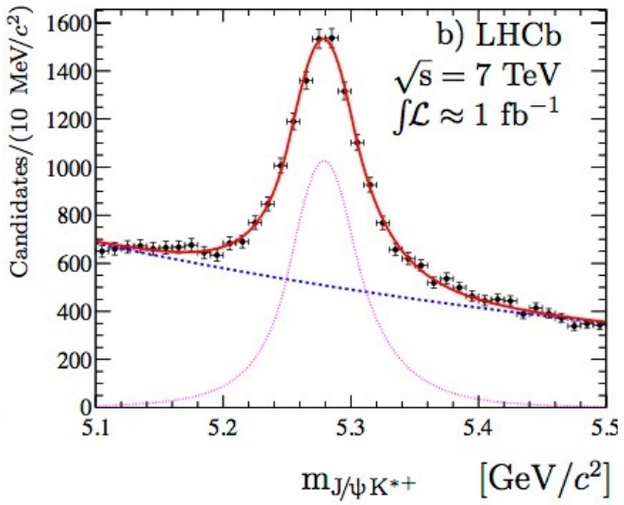
Efficiency are obtained from simulation

$$\frac{\varepsilon^{\mathrm{MC}}_{B^+\to J/\psi K^+}}{\varepsilon^{\mathrm{MC}}_{B^+\to J/\psi (K^{*+}\to K^+\pi^0)}} = \frac{\varepsilon^{\mathrm{gen\&acc}}_{B^+\to J/\psi K^+}}{\varepsilon^{\mathrm{gen\&acc}}_{B^+\to J/\psi (K^{*+}\to K^+\pi^0)}} \times \frac{\varepsilon^{\mathrm{rec\&sel}}_{B^+\to J/\psi K^+}}{\varepsilon^{\mathrm{rec\&sel}}_{B^+\to J/\psi (K^{*+}\to K^+\pi^0)}} \times \frac{\varepsilon^{\mathrm{trig}}_{B^+\to J/\psi K^+}}{\varepsilon^{\mathrm{trig}}_{B^+\to J/\psi (K^{*+}\to K^+\pi^0)}}$$

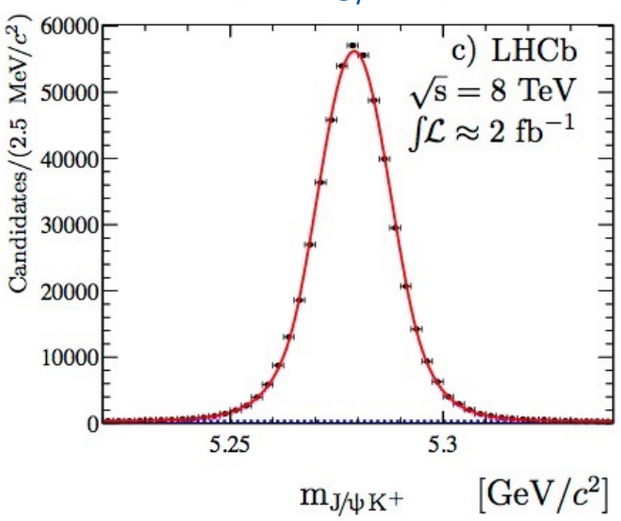
$B^+\to J/\Psi\, K^+$



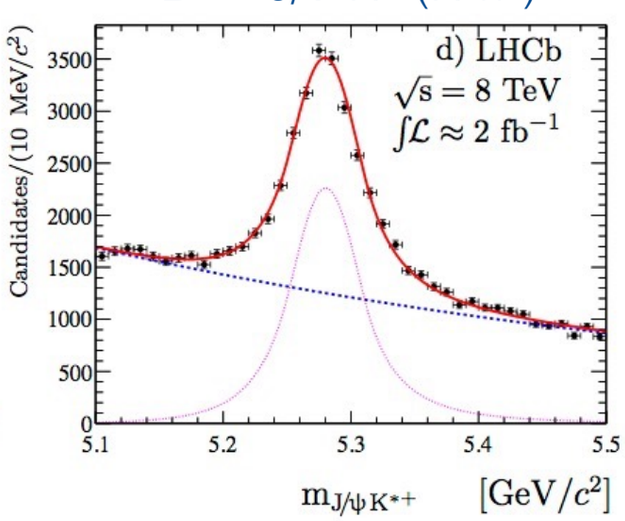
$B^+\to J/\Psi\, K^{*+}(K^+\pi^0)$



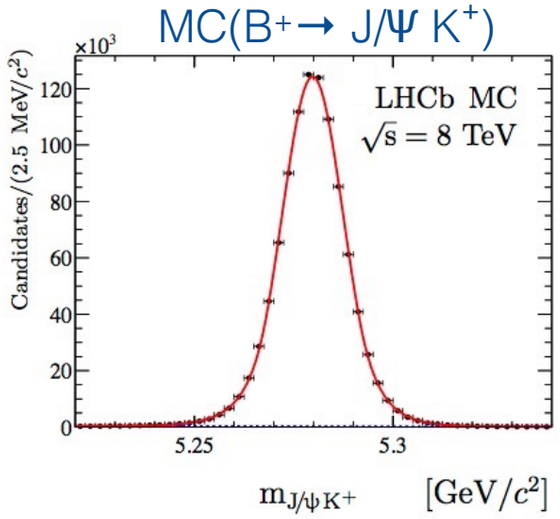
$B^+\to J/\Psi\, K^+$



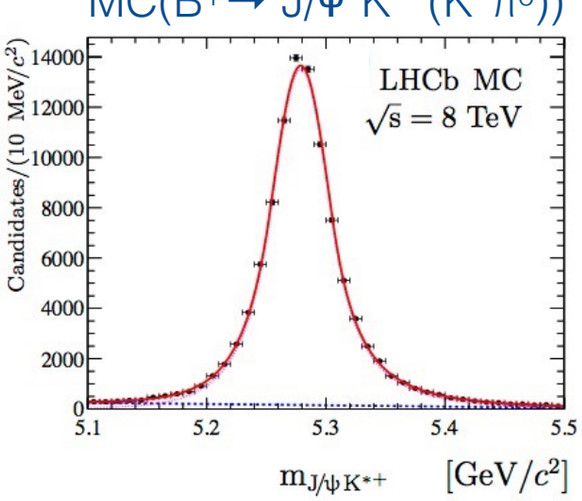
$B^+\to J/\Psi\, K^{*+}(K^+\pi^0)$



MC($B^+\to J/\Psi\, K^+$)



MC($B^+\to J/\Psi\, K^{*+}(K^+\pi^0)$)



List of contributions to systematic uncertainty

Source	Uncertainty [%] 2011 $\sqrt{s} = 7$ TeV	2012 $\sqrt{s} = 8$ TeV
Fit model	0.2	
Trigger	1.1	
Acceptance	1.4	0.2
Total	1.8	1.1

Study of π^0/γ reconstruction efficiency

Correction factor for 2011 and 2012 data

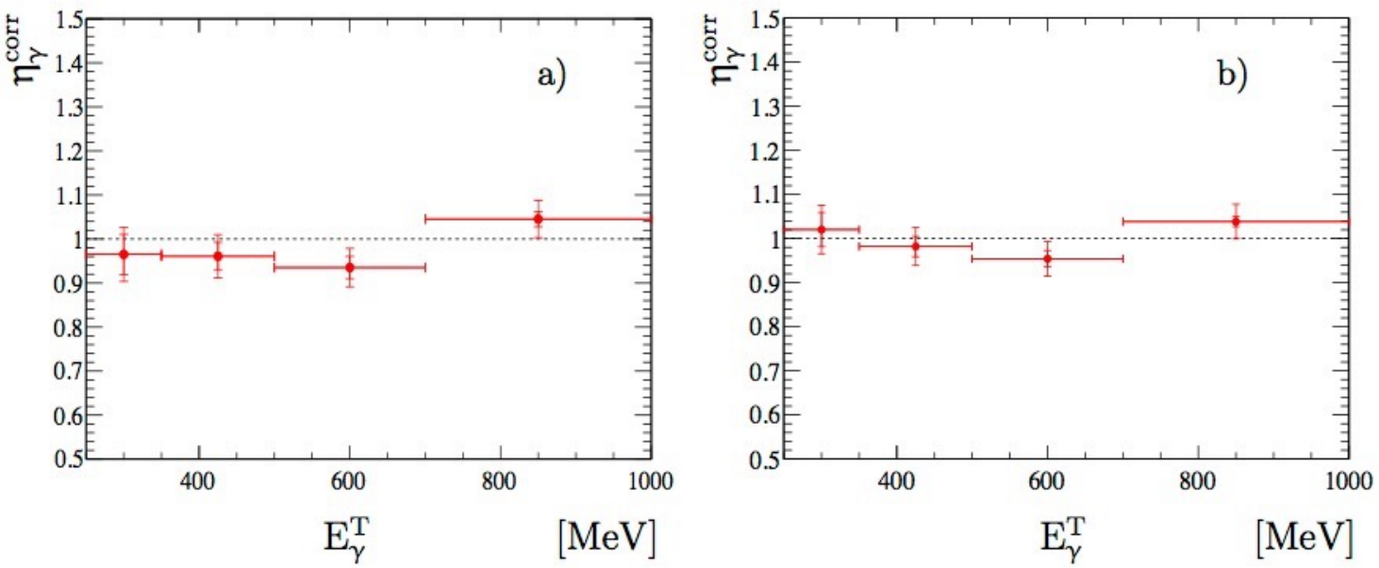
$$\eta_{\pi^0}^{\rm corr} = (103.2 \pm 2.6\,(stat) \pm 2.3\,(syst) \pm 6.7\,(\mathcal{BR}))\ \%,$$

$$\eta_{\pi^0}^{\rm corr} = (105.9 \pm 1.8\,(stat) \pm 1.6\,(syst) \pm 6.9\,(\mathcal{BR}))\ \%,$$

$\eta_{\pi^\circ} = (\eta_\gamma)^2$ leads to:

$$\eta_{\gamma}^{\rm corr} = (101.6 \pm 1.3\,(stat) \pm 1.1\,(syst) \pm 3.3\,(\mathcal{BR}))\ \%,$$

$$\eta_{\gamma}^{\rm corr} = (102.9 \pm 0.9\,(stat) \pm 0.8\,(syst) \pm 3.4\,(\mathcal{BR}))\ \%,$$

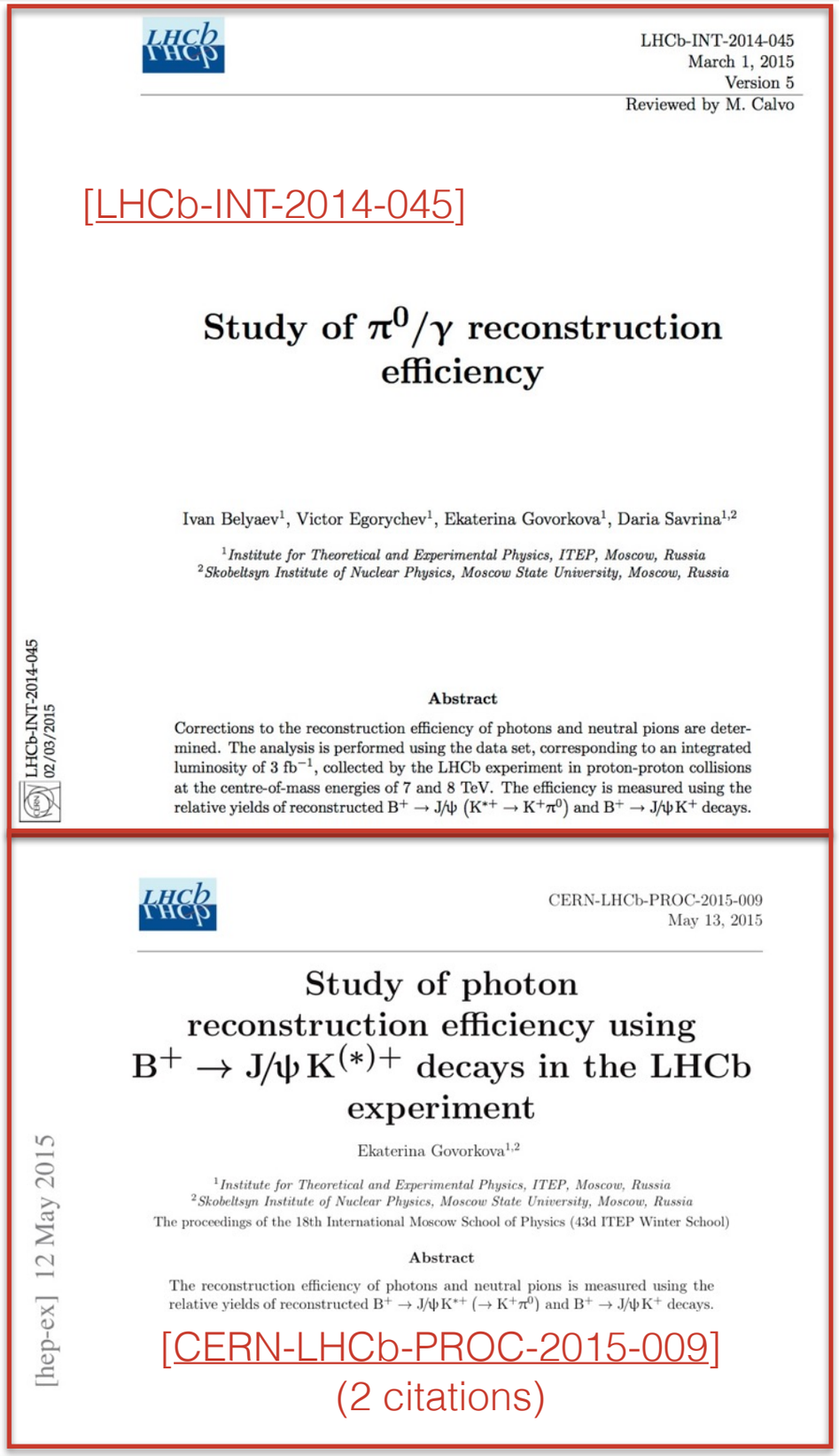


Factors $\eta_\gamma^{\rm corr}$ for (a) 2011 and (b) 2012 data in bins of photon transverse energy.

[Calo Objects meeting 9 July 2k14]

[LHCb Calorimeter meeting 10 September 2k14]

[Calo Objects meeting 7 November 2k14]



LHCb-INT-2014-045
March 1, 2015
Version 5
Reviewed by M. Calvo

[LHCb-INT-2014-045]

Study of π^0/γ reconstruction efficiency

Ivan Belyaev[1], Victor Egorychev[1], Ekaterina Govorkova[1], Daria Savrina[1,2]

[1] *Institute for Theoretical and Experimental Physics, ITEP, Moscow, Russia*
[2] *Skobeltsyn Institute of Nuclear Physics, Moscow State University, Moscow, Russia*

Abstract

Corrections to the reconstruction efficiency of photons and neutral pions are determined. The analysis is performed using the data set, corresponding to an integrated luminosity of 3 fb^{-1}, collected by the LHCb experiment in proton-proton collisions at the centre-of-mass energies of 7 and 8 TeV. The efficiency is measured using the relative yields of reconstructed $B^+ \to J/\psi\,(K^{*+} \to K^+\pi^0)$ and $B^+ \to J/\psi K^+$ decays.

CERN-LHCb-PROC-2015-009
May 13, 2015

Study of photon reconstruction efficiency using $B^+ \to J/\psi\,K^{(*)+}$ decays in the LHCb experiment

Ekaterina Govorkova[1,2]

[1] *Institute for Theoretical and Experimental Physics, ITEP, Moscow, Russia*
[2] *Skobeltsyn Institute of Nuclear Physics, Moscow State University, Moscow, Russia*

The proceedings of the 18th International Moscow School of Physics (43d ITEP Winter School)

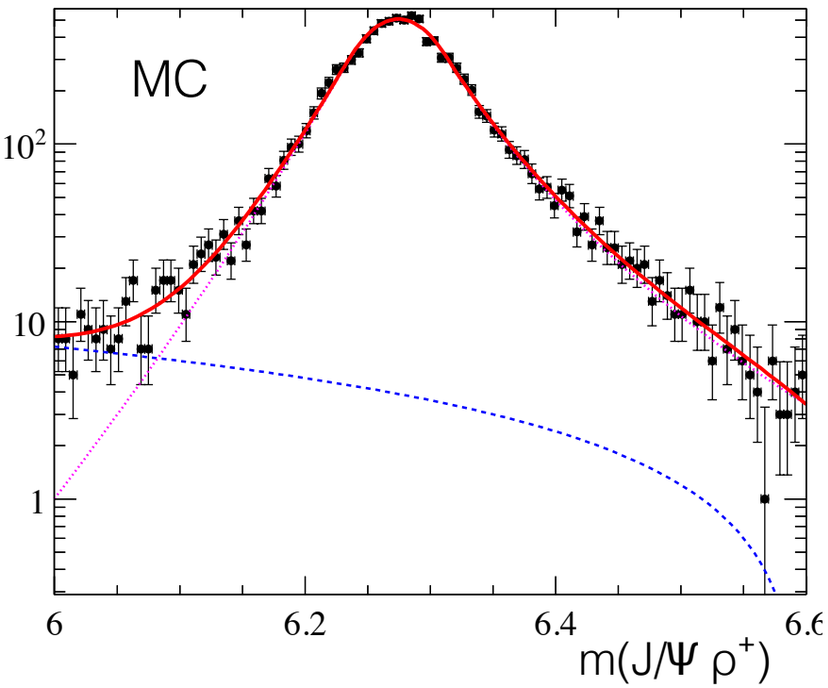
Abstract

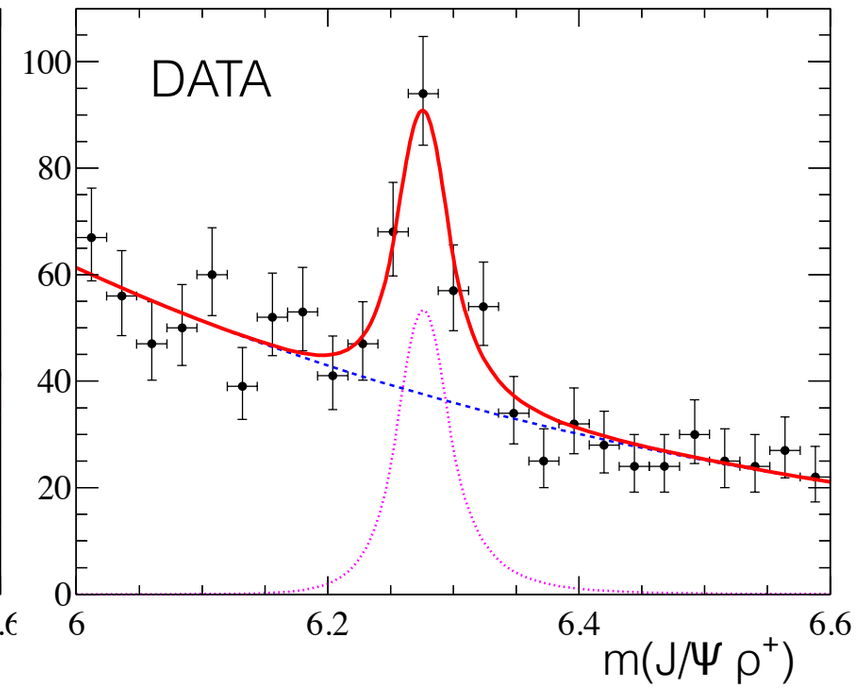
The reconstruction efficiency of photons and neutral pions is measured using the relative yields of reconstructed $B^+ \to J/\psi K^{*+}\,(\to K^+\pi^0)$ and $B^+ \to J/\psi K^+$ decays.

[CERN-LHCb-PROC-2015-009]
(2 citations)

Observation of the $B_c^+ \rightarrow J/\Psi\ \rho^+$

Only ≈ 20 B_c-meson decays are currently known
Branching fractions are predicted with factorisation approach [A. Likhoded A. Luchinsky]





BDTG selection

J/Ψ, π° and PV constraints applied for B_c-candidates

Double-sided Crystal Ball for signal fit (tail parameters fixed on MC)

	MC	DATA
N	9862 ± 119	138 ± 24
m [MeV/c^2]	6274 ±1	6276 ± 4
σ [MeV/c^2]	39 ± 2	20 ± 4

Sigma in MC is twice as large as in data

What have been cross-checked:

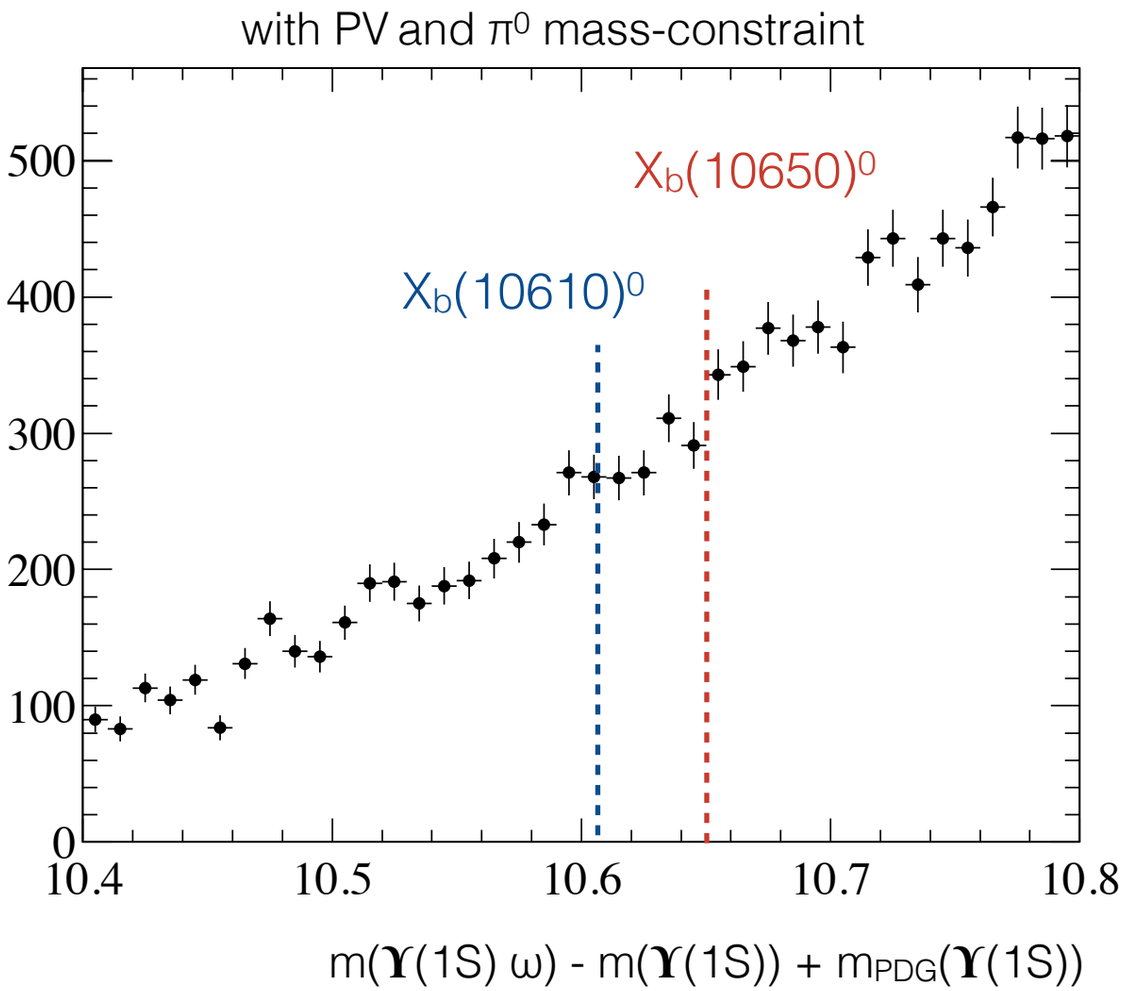
- BDTG selection applied to another decay channel
- check if background can affect sigma in data
- potential contributions to $B_c^+ \rightarrow J/\Psi\ \rho^+$ signal
- dependence of MC resolution on $P^T(\pi^\circ)$
- check sigmas without Decay Tree Fitter

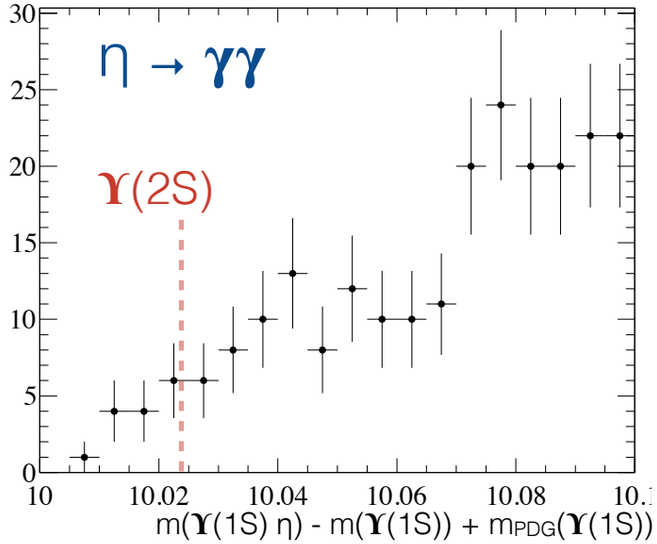
[Report at B and Bc meeting 5 August 2015]

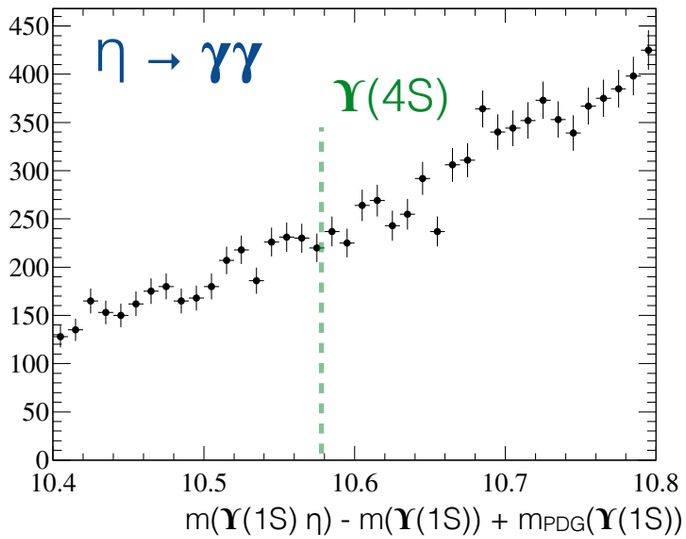
Search for $X_b^0 \rightarrow \Upsilon(1S)\,\omega$ and $\Upsilon(nS) \rightarrow \Upsilon(1S)\,\eta\,(\eta')$

- Search for exotic states $X_b^0(10610)$ and $X_b^0(10650)$ in $\Upsilon(1S)\,\omega$ final state [M.Karliner]
- Search for $\Upsilon(nS) \rightarrow \Upsilon(1S)\eta$, since it is known and convenient normalisation channel for exotic states

[B and Bc meeting 23 September 2015]







[Update at tomorrows Exotic Onia meeting]

Search for:

$X_b^0 \rightarrow \Upsilon(1S)\,\omega$

$\Upsilon(nS) \rightarrow \Upsilon(1S)\,\eta$

extended to ⟶

Search for:

$X_b^0 \rightarrow \Upsilon(nS)\,\omega$

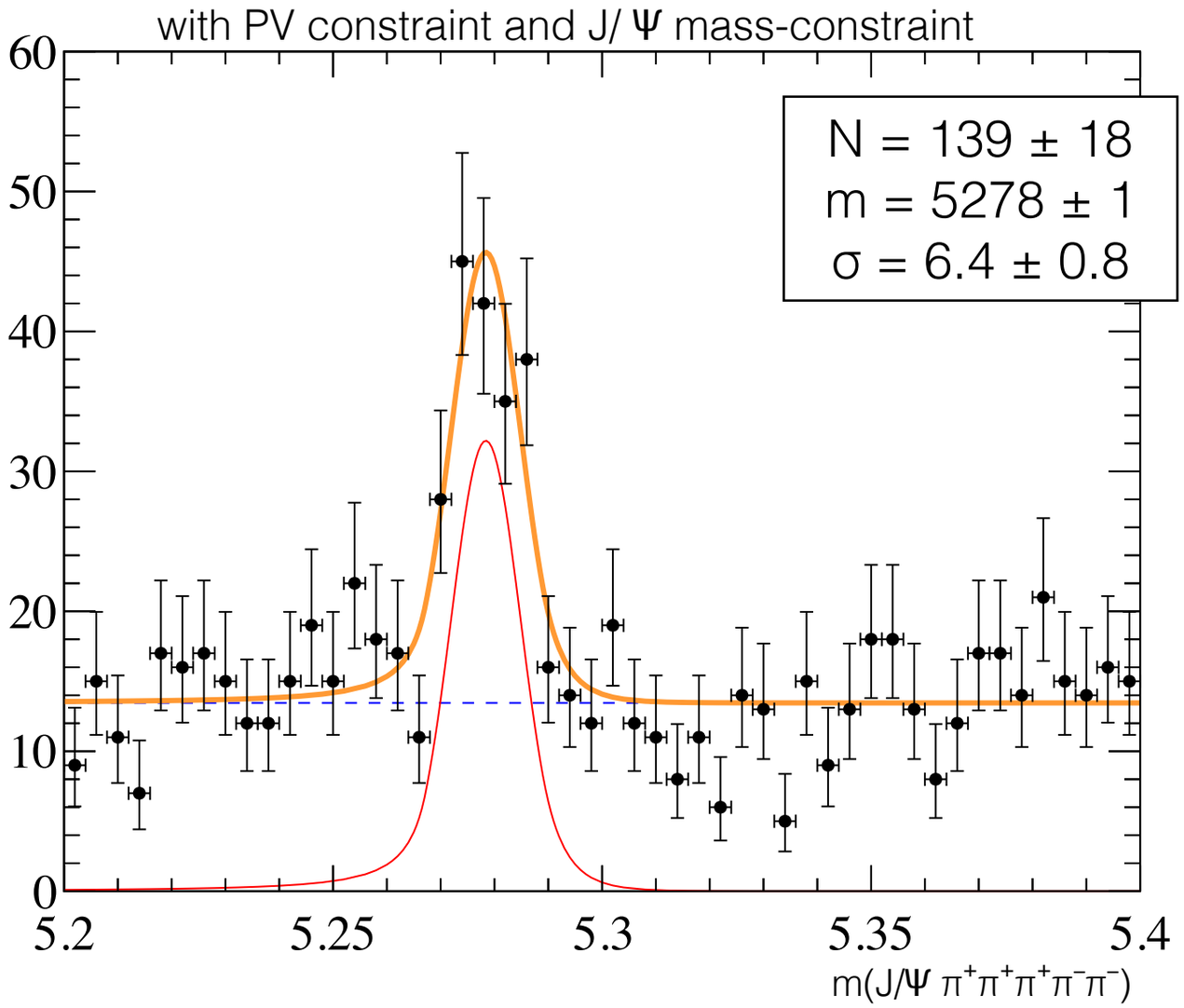
$\Upsilon(nS) \rightarrow \Upsilon(nS)\,\eta$

$\Upsilon(nS) \rightarrow \Upsilon(nS)\,\eta'$

Observation of the $B^+ \to J/\Psi\, \pi^+\pi^+\pi^+\pi^-\pi^-$ decay

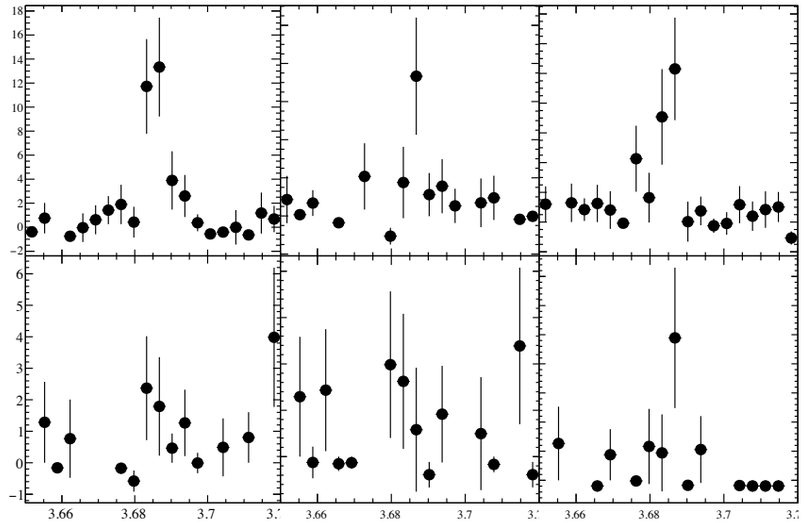
Signal from $B^+ \to J/\Psi\, \pi^+\pi^+\pi^+\pi^-\pi^-$ is observed for the first time
Evidence of the $B_c^+ \to J/\Psi\, \pi^+\pi^+\pi^+\pi^-\pi^-$ [JHEP 05 (2014) 148]

Both resonant and non resonant mode are studied:
$B^+ \to J/\Psi\, \pi^+\pi^+\pi^+\pi^-\pi^-$ and $B^+ \to \Psi(2S)(\to J/\Psi\, \pi^+\pi^-)\pi^+\pi^+\pi^-$

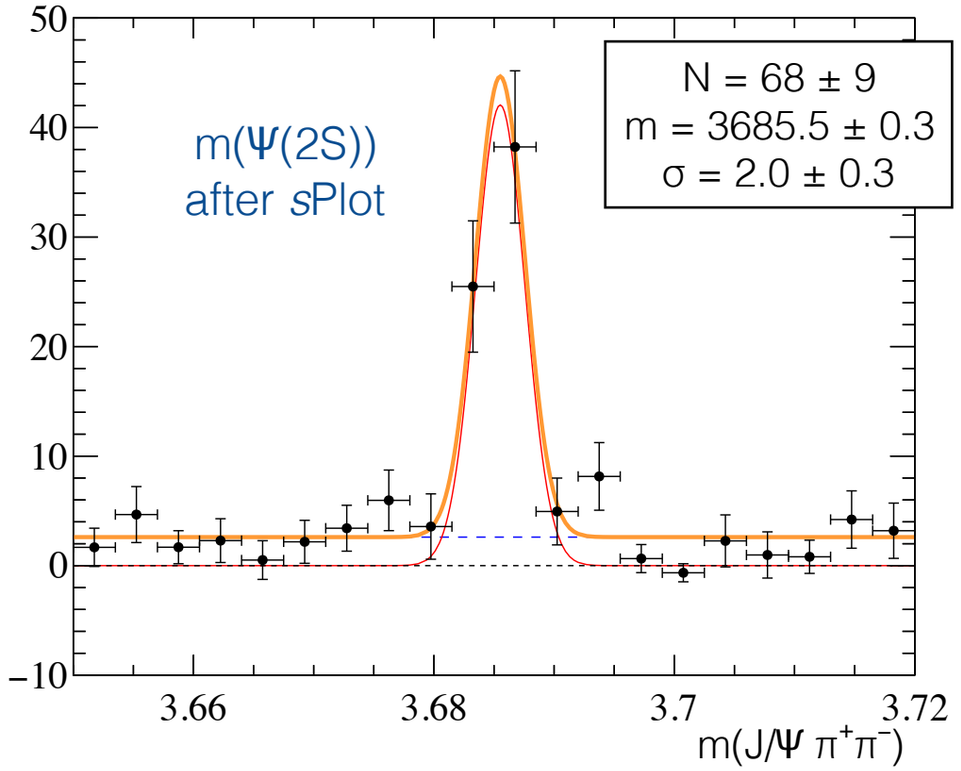


Fit function: Double-sided CB for signal (tails fixed from MC)+Constant

All possible $J/\Psi\, \pi^+\pi^-$ combinations after sPlot



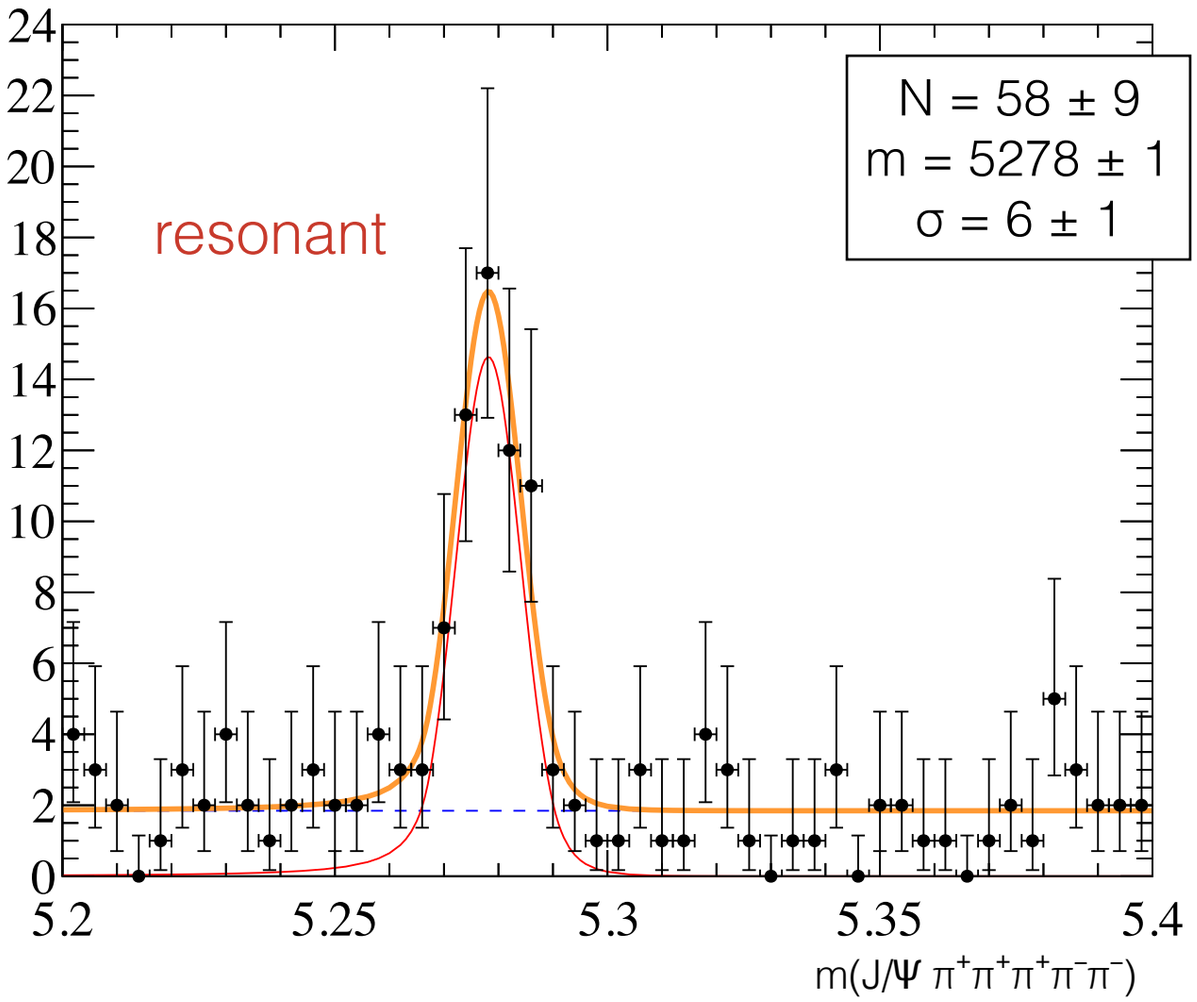
Sum of all possible $J/\Psi\, \pi^+\pi^-$ combinations after sPlot



Observation of the $B^+ \to J/\Psi\, \pi^+\pi^+\pi^+\pi^-\pi^-$ decay

At least one of six possible $J/\Psi\, \pi^+\pi^-$ combinations:
$m(J/\Psi\, \pi^+\pi^-)$ is in ±6 MeV/c^2 of $\Psi(2S)$ mass

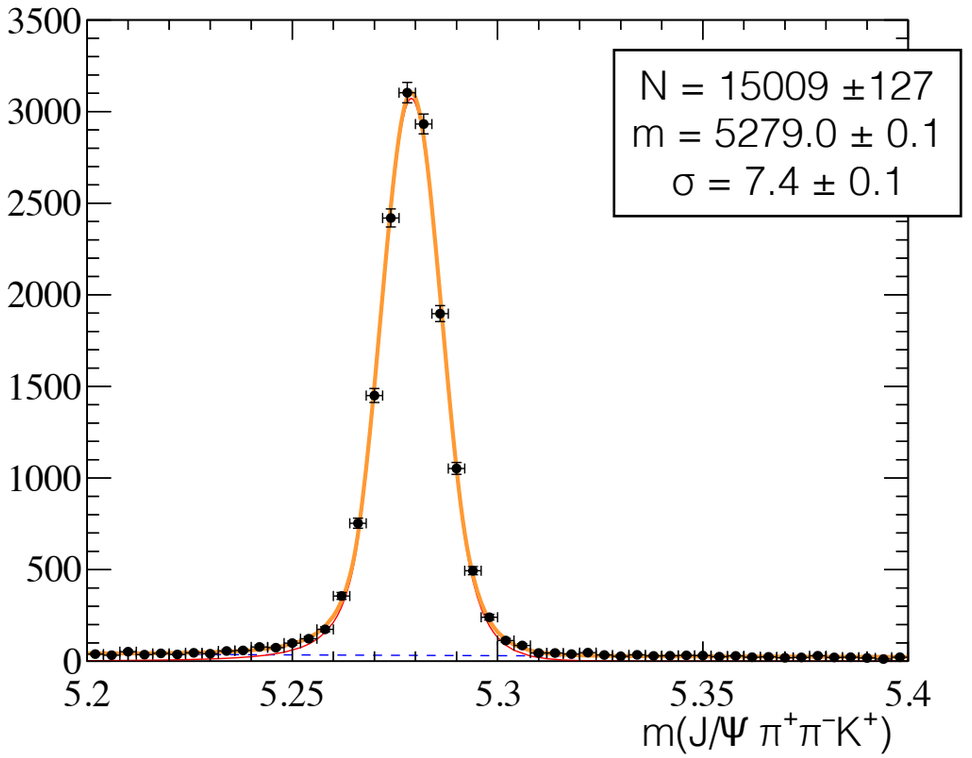
$N_{\Psi(2S) \text{ from sPlot}} = 68 \pm 9$
in agreement

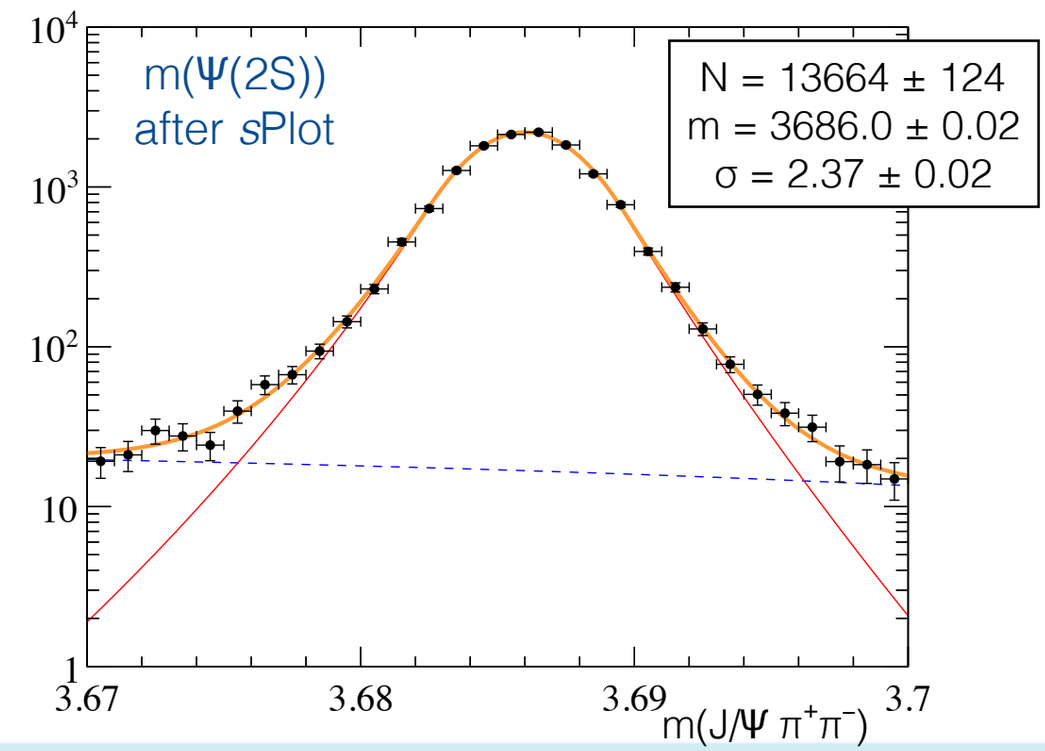


with PV constraint and J/ Ψ mass-constraint

Fit function: Double-sided CB for signal (tails fixed from MC)+Constant

Normalisation channel: $B^+ \to \Psi(2S)\, (J/\Psi\, \pi^+\pi^-)\, K^+$





Observation of the $B^+ \to J/\Psi\, \pi^+\pi^+\pi^+\pi^-\pi^-$ decay

$$\frac{\mathcal{B}(B^+ \to J/\psi\, 3\pi^+2\pi^-)}{\mathcal{B}(B^+ \to \psi(2S)\, K^+)} = \frac{N_{J/\psi\, 3\pi^+2\pi^-}}{N_{\psi(2S)K^+}} \times \frac{\varepsilon_{\psi(2S)K^+}}{\varepsilon_{J/\psi\, 3\pi^+2\pi^-}},$$

$$\frac{\mathcal{B}(B^+ \to \psi(2S)\, \pi^+\pi^+\pi^-)}{\mathcal{B}(B^+ \to \psi(2S)\, K^+)} = \frac{N_{\psi(2S)\pi^+\pi^+\pi^-}}{N_{\psi(2S)K^+}} \times \frac{\varepsilon_{\psi(2S)K^+}}{\varepsilon_{\psi(2S)\pi^+\pi^+\pi^-}},$$

MC: BC_VHAD model for $B^+ \to J/\Psi\pi^+\pi^+\pi^+\pi^-\pi^-$
(cross-check simple Phase Space model)

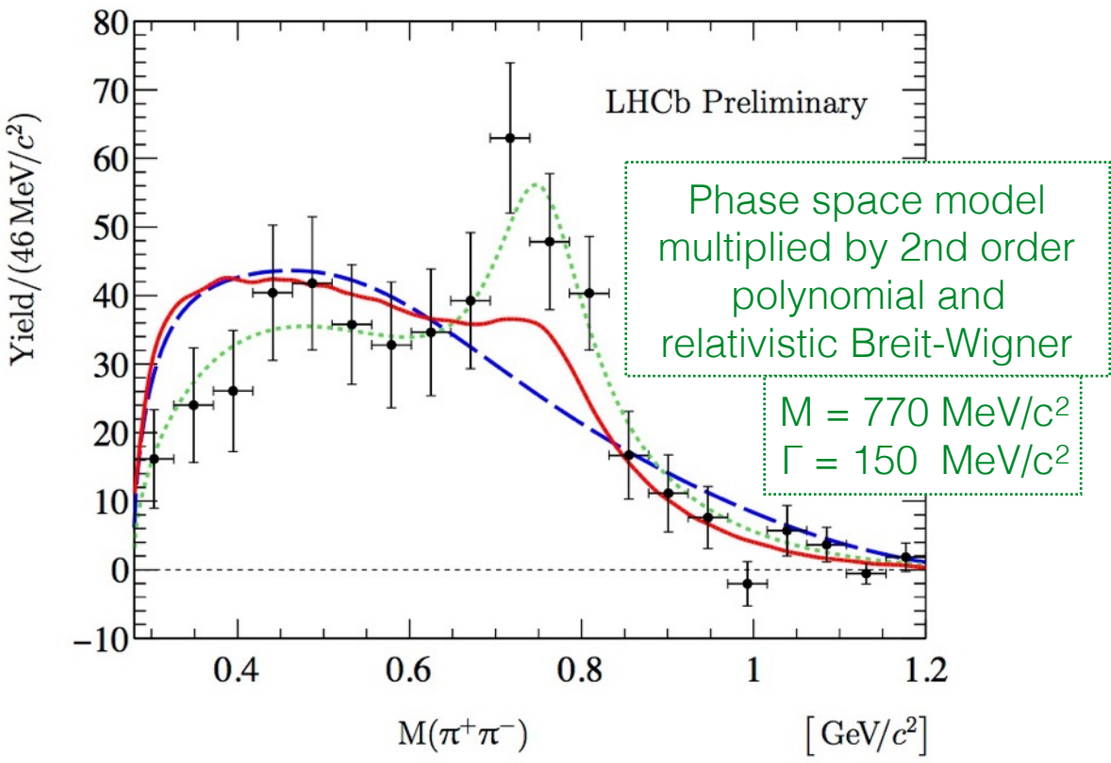
$$\frac{\varepsilon^{tot}_{\psi(2S)K^+}}{\varepsilon^{tot}_{J/\psi\, 3\pi^+2\pi^-}} = \frac{\varepsilon^{gen}_{\psi(2S)K^+}}{\varepsilon^{gen}_{J/\psi\, 3\pi^+2\pi^-}} \times \frac{\varepsilon^{rec\&sel}_{\psi(2S)K^+}}{\varepsilon^{rec\&sel}_{J/\psi\, 3\pi^+2\pi^-}} \times \frac{\varepsilon^{trig}_{\psi(2S)K^+}}{\varepsilon^{trig}_{J/\psi\, 3\pi^+2\pi^-}} \times \frac{\varepsilon^{hID}_{\psi(2S)K^+}}{\varepsilon^{hID}_{J/\psi\, 3\pi^+2\pi^-}}$$

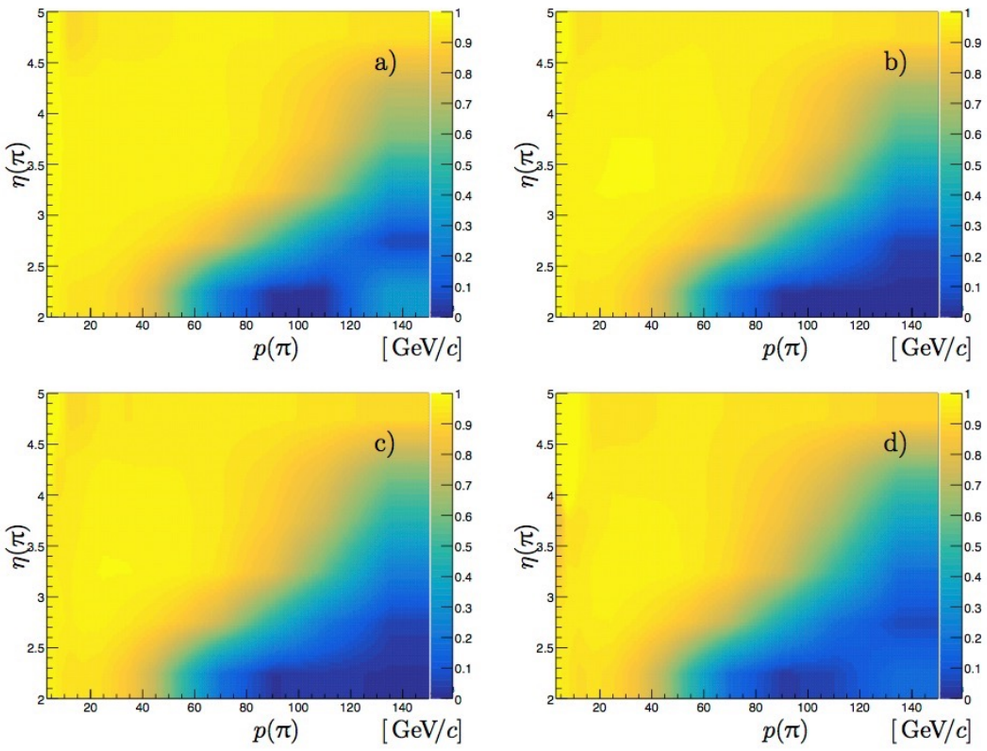
Take into account both efficiencies,
calculated for the pure non-resonant and resonant decays:

$$k = \frac{N_{\psi(2S)\pi^+\pi^+\pi^-}}{N_{\psi(2S)\pi^+\pi^+\pi^-} + N_{J/\psi\, 3\pi^+2\pi^-,nr}} = \frac{68 \pm 9}{139 \pm 18} = 0.49 \pm 0.09$$

$$\frac{\varepsilon_{\psi(2S)K^+}}{\varepsilon_{J/\psi\, 3\pi^+2\pi^-}} = k \times \frac{\varepsilon_{\psi(2S)K^+}}{\varepsilon_{\psi(2S)\pi^+\pi^+\pi^-}} + (1-k) \times \frac{\varepsilon_{\psi(2S)K^+}}{\varepsilon_{J/\psi\, 3\pi^+2\pi^-,\mathrm{nr}}} = 5.44 \pm 0.72$$

Data (sPlot) vs MC **BC_VHAD** vs MC **PHSP**





Observation of the $B^+ \to J/\Psi\, \pi^+\pi^+\pi^+\pi^-\pi^-$ decay

List of contributions to systematic uncertainty

Source	$J/\psi\,\pi^+\pi^-(all)$	$J/\psi\,\pi^+\pi^-(\psi(2S))$
Fit model	2.8	2.3
Track reconstruction	1.5	1.5
Hadron interaction	2×1.4	
Hadron identification	0.3	0.3
Trigger	1.1	
Sum in quadrature	4.4	4.1

Results:

$$\frac{\mathcal{B}(B^+ \to J/\psi\, 3\pi^+2\pi^-)}{\mathcal{B}(B^+ \to \psi(2S)\, K^+)} = (5.53 \pm 1.03\,(stat) \pm 0.24\,(syst)) \times 10^{-2},$$

$$\frac{\mathcal{B}(B^+ \to \psi(2S)\, \pi^+\pi^+\pi^-)}{\mathcal{B}(B^+ \to \psi(2S)\, K^+)} = (2.86 \pm 0.45\,(stat) \pm 0.12\,(syst)) \times 10^{-2}.$$

[B2CC meeting 21 January]

[B2CC meeting 17 March]

LHCb-ANA-2014-030
March 29, 2016
version 0

First evidence of the $B^+ \to J/\psi\, 3\pi^+2\pi^-$ and the $B^+ \to \psi(2S)\,\pi^+\pi^+\pi^-$ decays

Ivan Belyaev[1], Victor Egorychev[1], Ekaterina Govorkova[1], Daria Savrina[1,2]
[1] *ITEP, Moscow, Russia*
[2] *SINP MSU, Moscow, Russia*

Abstract

The decays $B^+ \to J/\psi\, 3\pi^+2\pi^-$ and $B^+ \to [\psi(2S) \to J/\psi\,\pi^+\pi^-]\,\pi^+\pi^+\pi^-$ are observed using data, corresponding to an integrated luminosity of 3.0 fb^{-1}, collected by the LHCb experiment in proton-proton collisions at the centre-of-mass energies of 7 and 8 TeV. The branching fractions of $B^+ \to J/\psi\, 3\pi^+2\pi^-$ and $B^+ \to \psi(2S)\,\pi^+\pi^+\pi^-$ decays related to that of the $B^+ \to [\psi(2S) \to J/\psi\,\pi^+\pi^-]\,K^+$ mode are measured to be

$$\frac{\mathcal{B}(B^+ \to J/\psi\, 3\pi^+2\pi^-)}{\mathcal{B}(B^+ \to \psi(2S)\, K^+)} = (5.53 \pm 1.03\,(stat) \pm 0.24\,(syst)) \times 10^{-2},$$

$$\frac{\mathcal{B}(B^+ \to \psi(2S)\, \pi^+\pi^+\pi^-)}{\mathcal{B}(B^+ \to \psi(2S)\, K^+)} = (2.86 \pm 0.45\,(stat) \pm 0.12\,(syst)) \times 10^{-2},$$

where the first uncertainties are statistical and the second are systematic.

Calo-liaison for BandQ WG

since February 2016

Duty: Small updates about CaloObjects news at BandQ meetings

[BandQ Calo-liaison report 10 February]

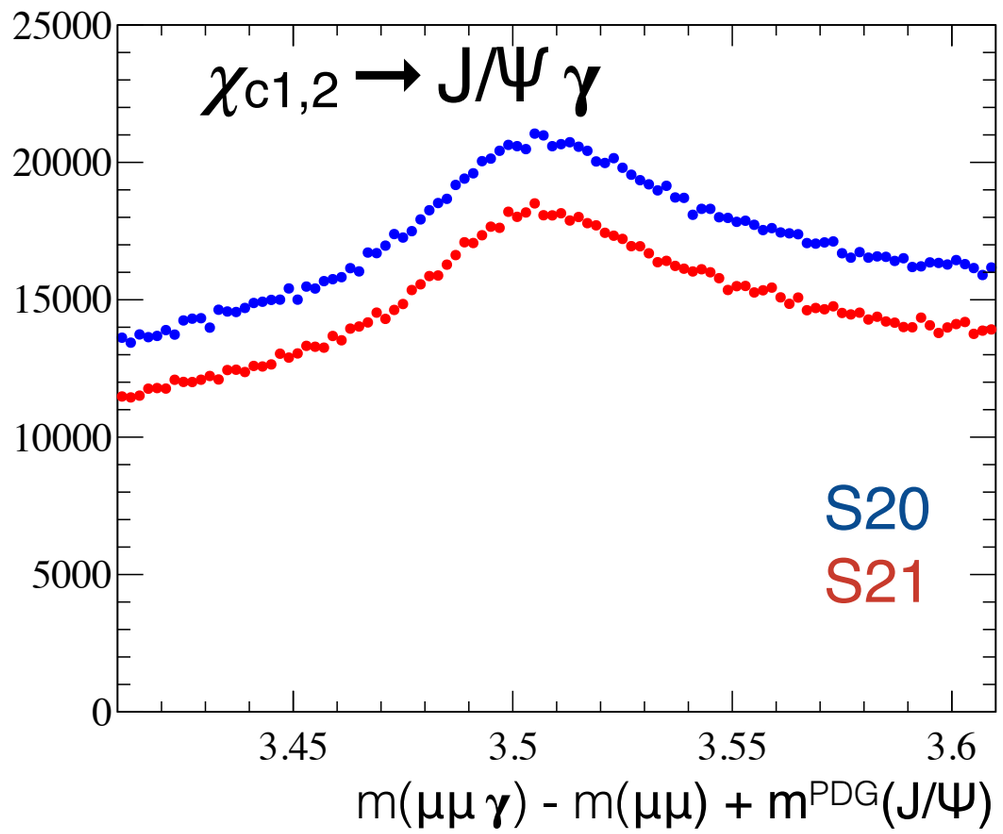
[BandQ Calo-liaison report 16 March]

Reports at CaloObjects meetings about BandQ analyses

[Calo Objects in the B&Q analyses 3 March]

Extra tasks
(for instance: compare $\chi_{c1,2} \rightarrow J/\Psi\,\gamma$ for S20 vs. S21)

[Exotic Onia Meeting 23 March]



Talks at conferences and schools

1. Study of π^0/γ reconstruction efficiency at the LHCb experiment, 13-th Kurchatov Young Scientist School, Moscow, Russia

(Diploma for the best talk)

2. Study of π^0/γ reconstruction efficiency at the LHCb experiment, Young Scientist Conference, ITEP, Moscow, Russia

3. Study of π^0/γ reconstruction efficiency at the LHCb experiment, 12-th International conference of students, postgraduates and young scientists ”Lomonosov”, Moscow, Russia

4. Study of π^0/γ reconstruction efficiency at the LHCb experiment, 18-th Moscow International School of Physics (ITEP Winter School), Ershovo, Russia [LHCb-TALK-2015-023]

Seminars

Study of π^0/γ reconstruction efficiency at the LHCb experiment, SINP MSU, Moscow, Russia

English

- TOEFL test (January 2016)
- Graduate Record Examinations (GRE February 2016)

Teaching

- Physics and Math for Schoolchildren (private tutor)
- “Co-supervising” bachelor students at SINP MSU