

Central Exclusive Production (CEP) of J/ψ at LHCb

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About me



- Amsterdam, the Netherlands
- Physics and Astronomy bachelor at University of Amsterdam
- UvA GRAPPA master in September
- LHCb this summer

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Goal of this research

Understand electron reconstruction
using J/ψ ee cross section
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measurement in CEP

$J = \psi$ has recently been
measured:

$\sigma_{J = \psi} = 399 \cdot 10^{-16} \text{ pb}$
(arXiv:1806.04079)

We expect this to be the same for
 $J = \psi$ ee

Motivation: Lepton flavour universality violation

Recent hints of lepton flavour universality violation found in the $B \rightarrow K^{0*}$ and $B^+ \rightarrow K^{*0}$ channels

arXiv:1705.05802
JHEP 08 (2017) 055

arXiv:1406.6482
PRL. 113, 151601 (2014)

$$R_{K^{(0)}} = \frac{\Gamma(B^+ \rightarrow K^{*0} \mu^+ \mu^-)}{\Gamma(B^+ \rightarrow K^{*0} e^+ e^-)}$$

My research: feed down from J_c

Sometimes feed down from J_c ! J_c

This can be mistaken for Bremsstrahlung,
throwing off the reconstructed mass of the J_c

Branching ratios	
c	(J_c)
c0	1.30 %
c1	33.9 %
c2	19.0 %

Short recap: Bremsstrahlung

Bremsstrahlung: deflection of electron trajectory by atoms, causing electron to radiate photons and lose energy
This complicates the electron reconstruction

Method

Use MC data of $c \rightarrow J/\psi + \gamma$ to study spatial distribution of the photon wrt the daughter particles ($\mu^+\mu^-$ or e^+e^-)

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Muon with the closest angle to the photon is chosen as the muon of interest

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Distance between muon and photon on the Ecal (where the Bremsstrahlung reconstruction happens) is calculated

Results: spatial transverse distance distribution

Ecal structure

Ecal is not isotropic: three different regions in Ecal with different cell and cluster sizes

Ecal cell sizes

region	cell size (cm ²)	cluster size (cm ²)
I	4.04 x 4.04	12.12 x 12.12
II	6.06 x 6.06	18.18 x 18.18
III	12.12 x 12.12	36.36 x 36.36

Results: Ecal structure

I

II

III

Ecal cluster sizes

region	cluster size (cm ²)
I	12.12 x 12.12
II	18.18 x 18.18
III	36.36 x 36.36

Summary

CEP $J=0$ production as **control channel** for lepton flavour universality
(clean channel and no new physics expected)

Feed down signal from c ! $J=0$ production, where c can be
mistaken for **Bremsstrahlung photon**

Small contribution of c in each of the Ecal regions $< 5\%$

Summary

CEP $J=0$ production as **control channel** for lepton flavour universality (clean channel and no new physics expected)

Feed down signal from c ! $J=0$ production, where c can be mistaken for **Bremsstrahlung photon**

Small contribution of c in each of the Ecal regions ($< 5\%$)

Next up:

Look at Bremsstrahlung reconstruction using ee MC data

Infer spatial distribution on Ecal and quantify contribution of c

Look at $J=0$! ee data, continue the work of Alvaro Loya Villalpando

BACK UP

Muon identification check

- Muon selection is based on angle between muon and photon
- This figure shows the calculated distance for the closest muon ('short distance') and the furthest out muon ('long distance')

