Update about the fitting

- Fix the height of the combinatorial backgrounds and non-prompt backgrounds
  - The height of the $J/\psi_1\mu^+\mu^-$ and $\mu^+\mu^-J/\psi_2$ should be the same
  - The height of the $J/\psi_1(NP)J/\psi_2(P)$ and $J/\psi_1(P)J/\psi_2(NP)$ should be the same

Components		N
$J/\psi_1 J/\psi_2$	P+P	2620 ± 60
	NP+P	940 ± 50
	P+NP	900 ± 50
	NP+NP	5020 ± 90
$J/\psi_1\mu^+\mu^-$		450 ± 40
$\mu^+\mu^-J/\psi_2$		550 ± 50
$\mu^+\mu^-\mu^+\mu^-$		4 ± 15

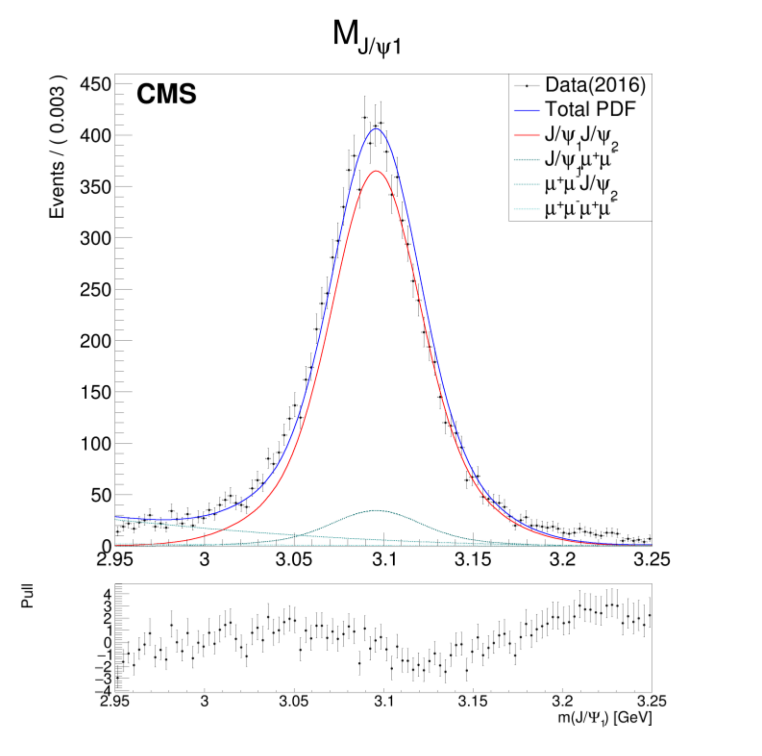
⇒

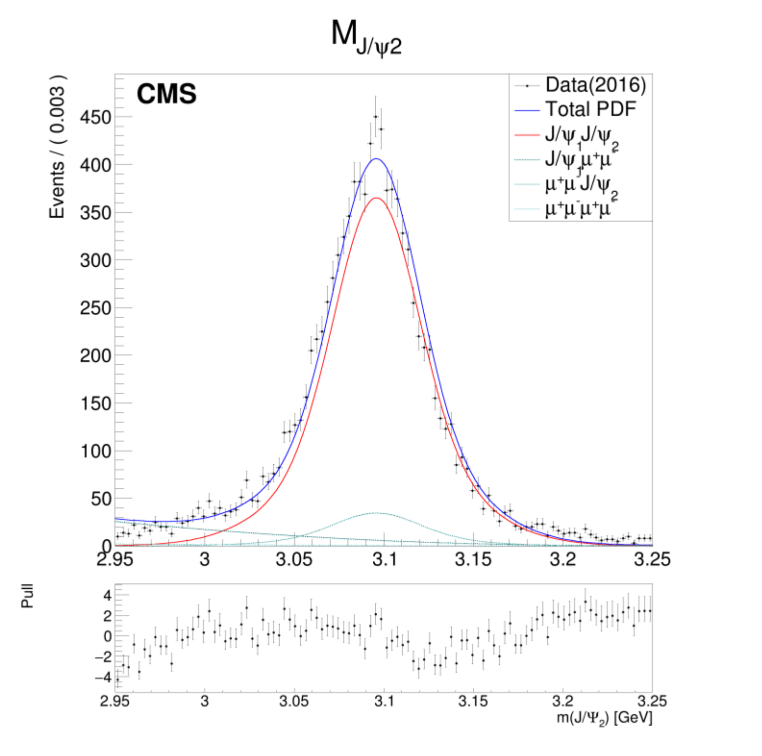
Components		N
$J/\psi_1 J/\psi_2$	P+P	2620 ± 60
	NP+P	920 ± 30
	P+NP	
	NP+NP	5020 ± 90
$J/\psi_1\mu^+\mu^-$		500 ± 30
$\mu^+\mu^-J/\psi_2$		
$\mu^+\mu^-\mu^+\mu^-$		2 ± 30

Update about the fitting

- A pre 2Dfit (mass dimension) to fix the height of the combinatorial backgrounds
  - Fix CB and Cheb

$J/\psi_1 J/\psi_2$	$8750 + 110$
$J/\psi\mu^+\mu^-$	830 ± 30
$\mu^+\mu^-\mu^+\mu^-$	70 ± 20





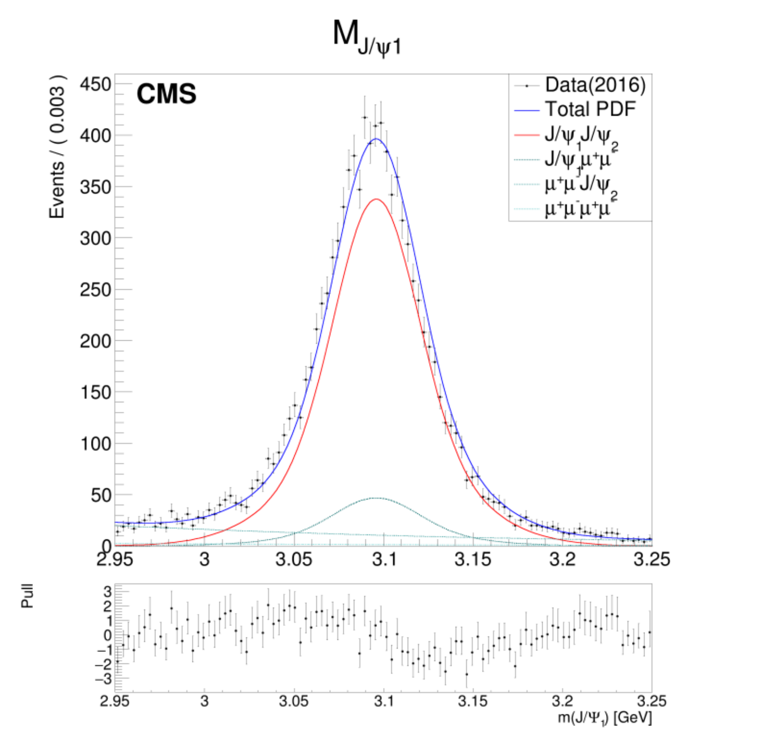
- The fitting quality is poor
- Overestimate the combinatorial backgrounds and underestimate the JJ

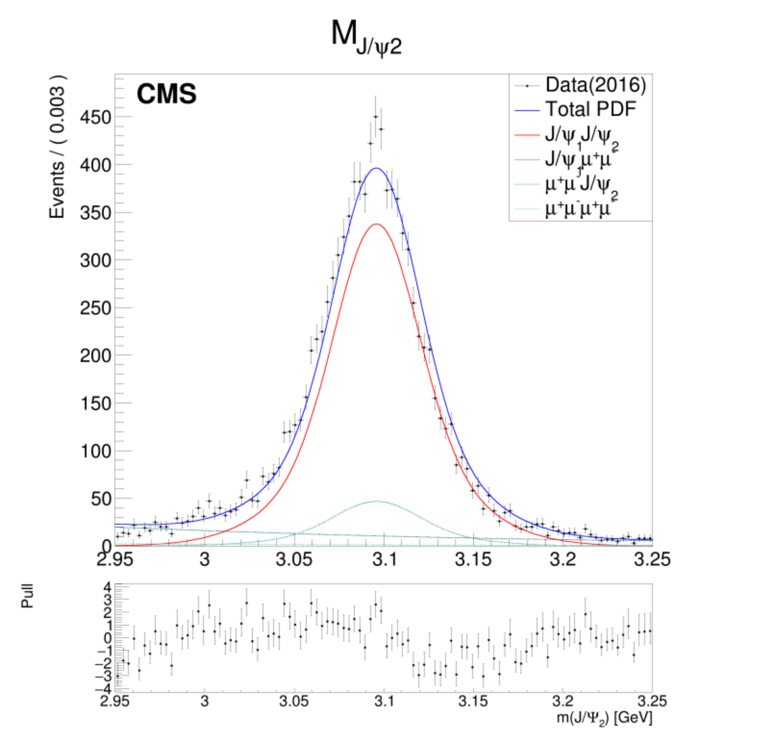
Update about the fitting

- A pre 2Dfit (mass dimension) to fix the height of the combinatorial backgrounds
  - Fix CB

$J/\psi_1 J/\psi_2$	$8090 + 120$
$J/\psi \mu^+\mu^-$	1120 ± 50
$\mu^+\mu^-\mu^+\mu^-$	140 ± 30

- Similar to the last case but the quality of the fitting is better

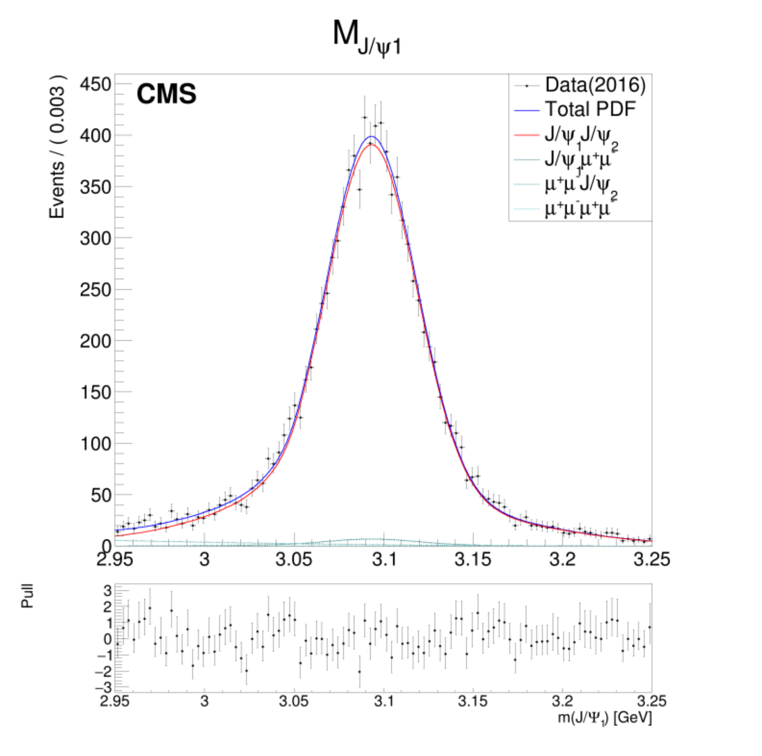


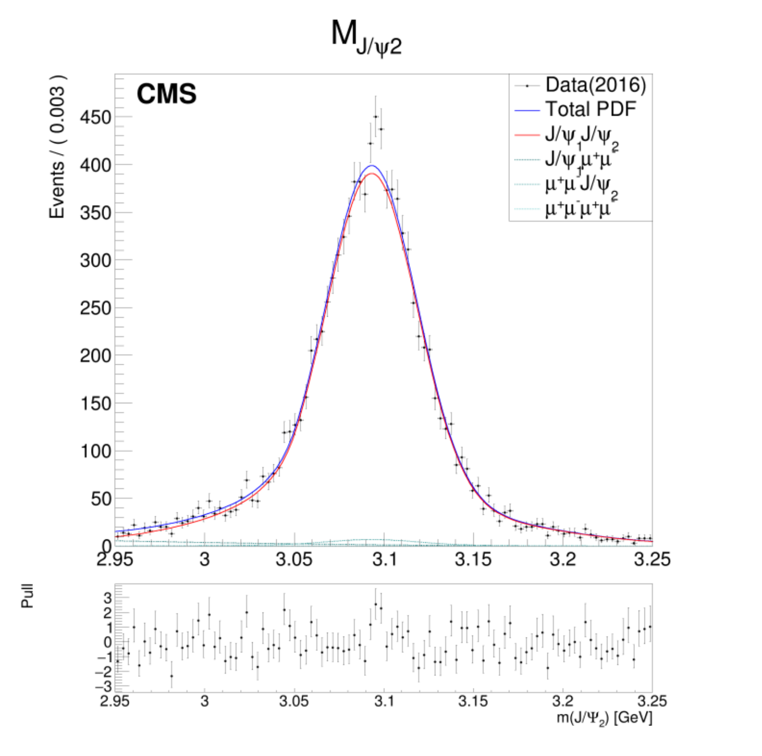


Update about the fitting

- A pre 2Dfit (mass dimension) to fix the height of the combinatorial backgrounds
  - Fix Cheb

$J/\psi_1 J/\psi_2$	$10120 + 160$
$J/\psi\mu^+\mu^-$	180 ± 60
$\mu^+\mu^-\mu^+\mu^-$	0 ± 3





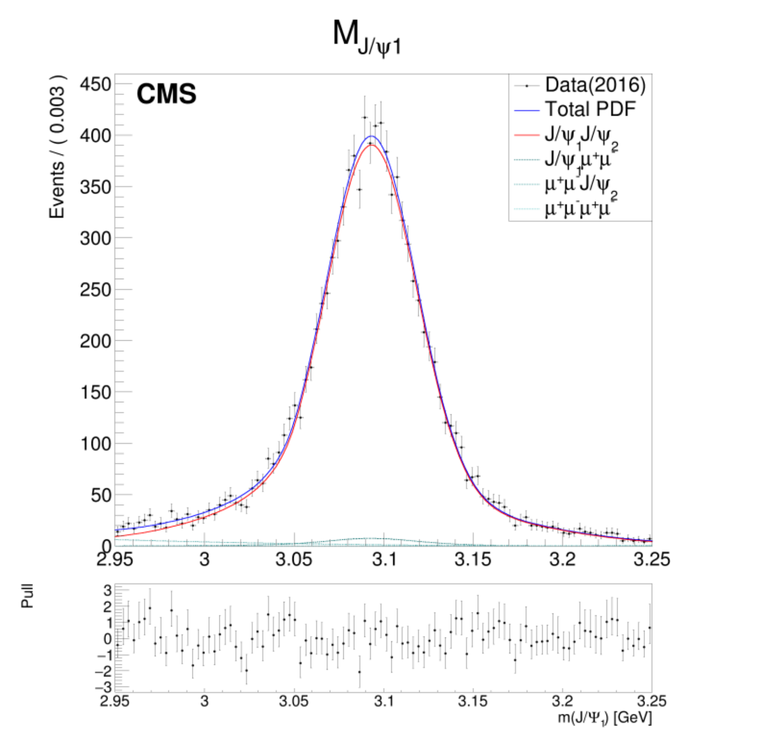
- The fitting is unreasonable
- Underestimate the combinatorial backgrounds and overestimate the JJ

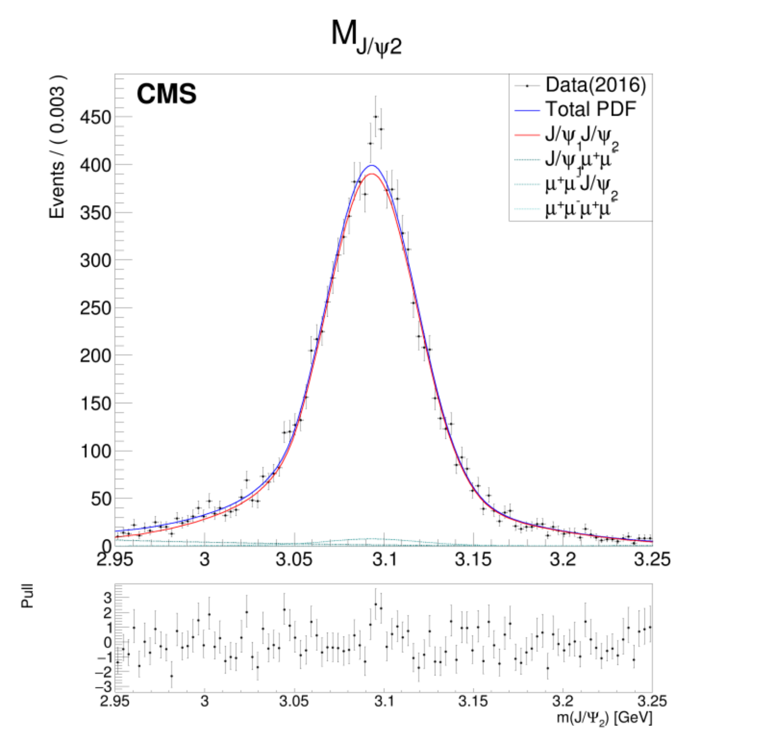
Update about the fitting

- A pre 2Dfit (mass dimension) to fix the height of the combinatorial backgrounds
  - Float

$J/\psi_1 J/\psi_2$	$10090 + 170$
$J/\psi\mu^+\mu^-$	190 ± 70
$\mu^+\mu^-\mu^+\mu^-$	0 ± 15

- Similar to the last case



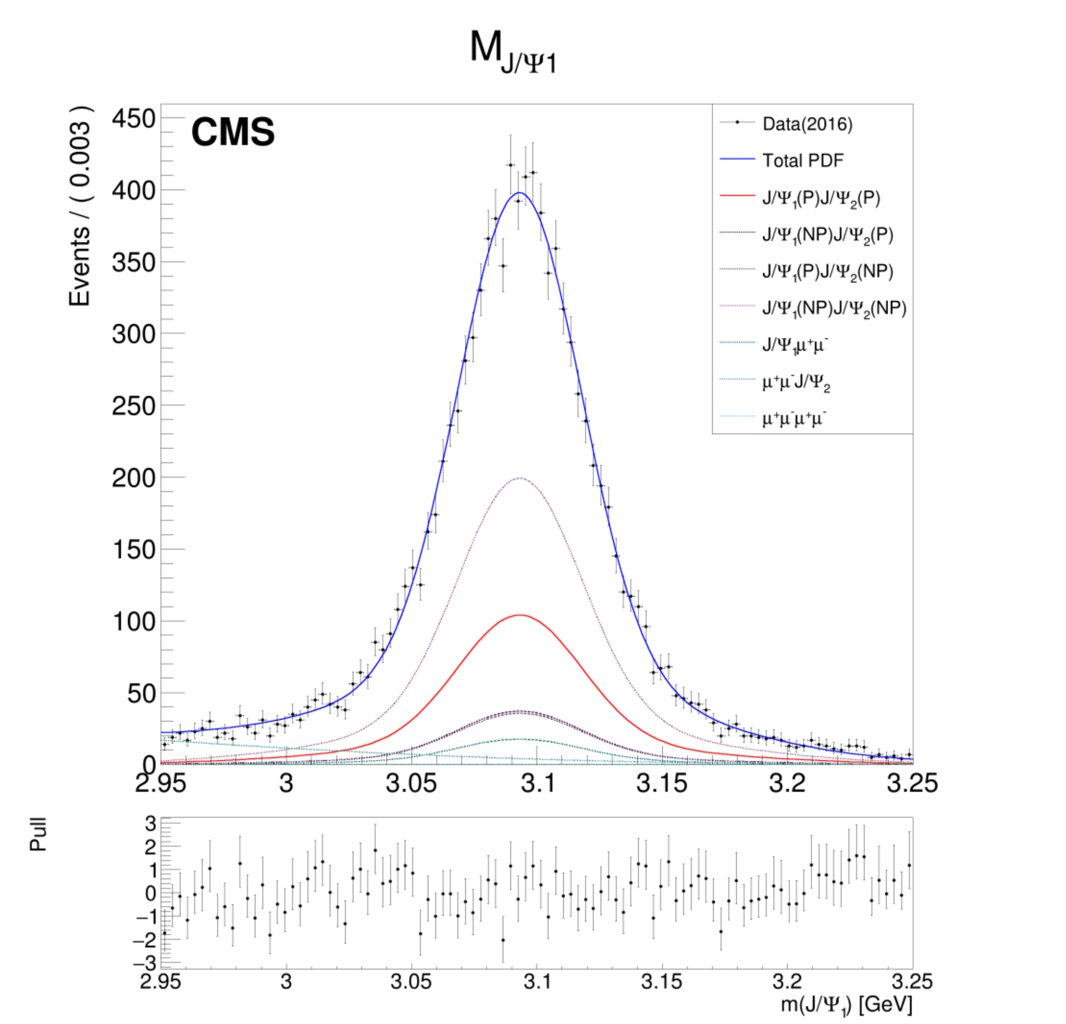


Summary

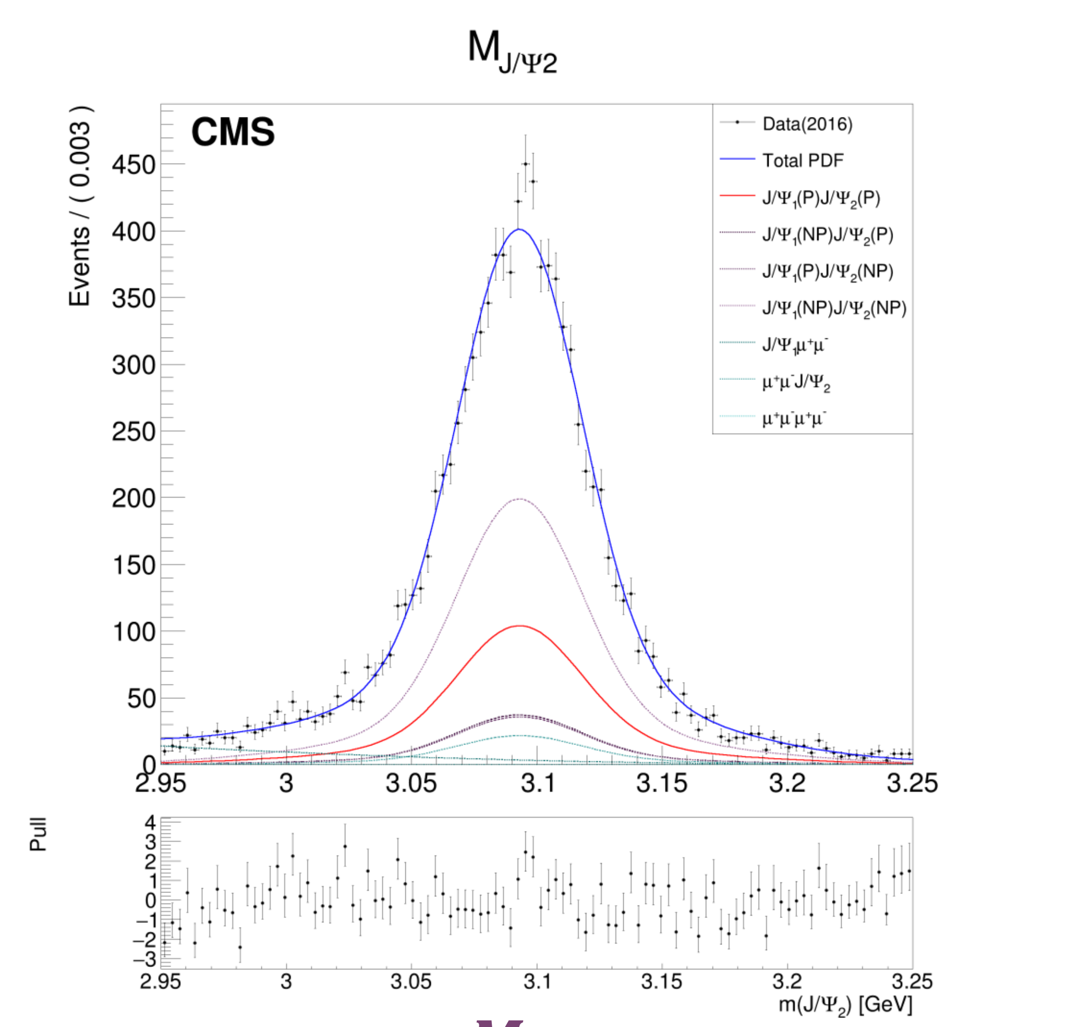
- Fix the height of two combinatorial backgrounds and two p-np combinations
  - No big discrepancy is observed compared to the origin method
  - The strategy is reasonable and propose to accept
- Pre 2D fit to fix the height of combinatorial backgrounds
  - A better result can be found if the CB shape is fixed
  - The result is unreasonable if the CB shape is float
  - The height acquired by this method shows a big difference with direct 4D fit
  - The direct 4D fit may be more reasonable since the time information can also help in differentiating the combinatorial background
  - Too complicated since the pre fit has to be applied for every bin in binning fit
  - Propose to abandon this method

Back Up

Origin fitting (4.6)

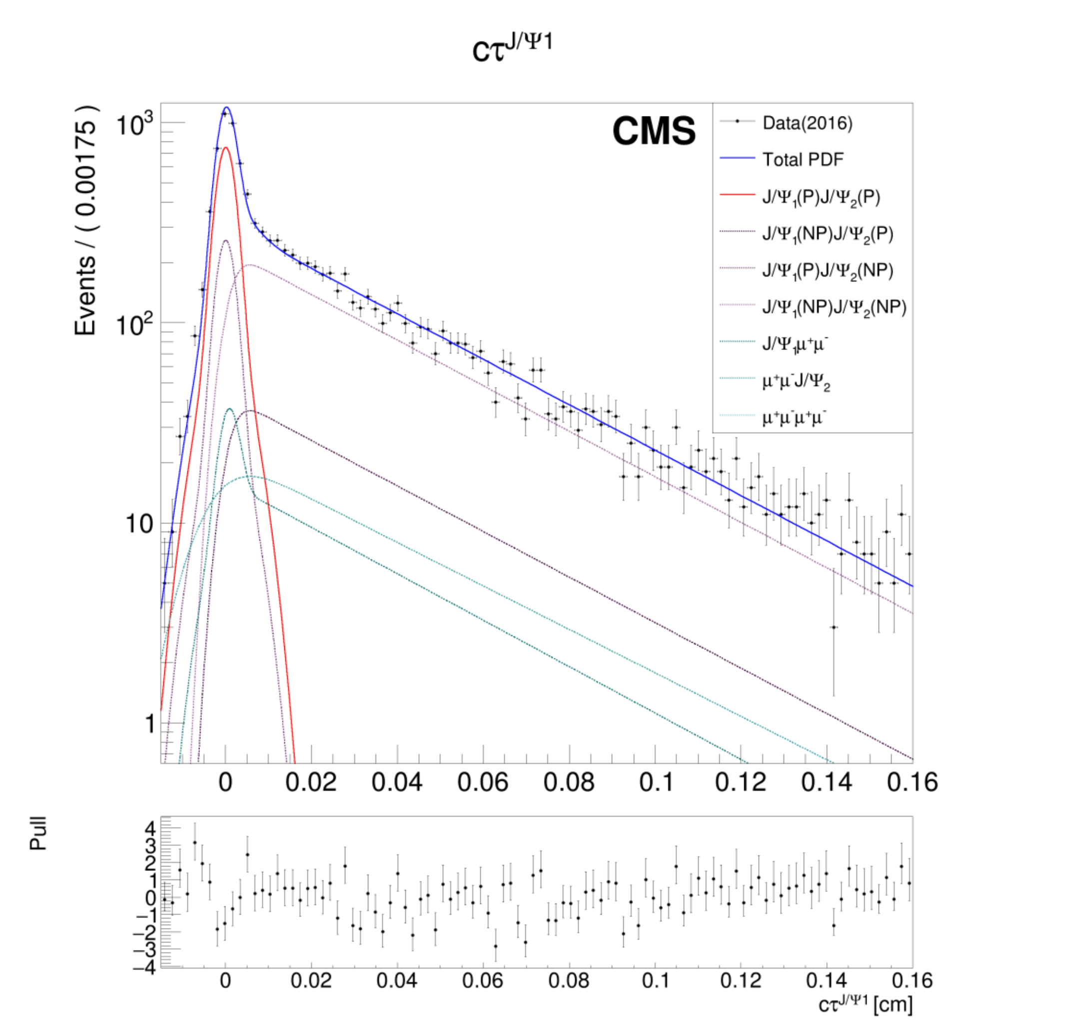


$M_{J/\psi1}$

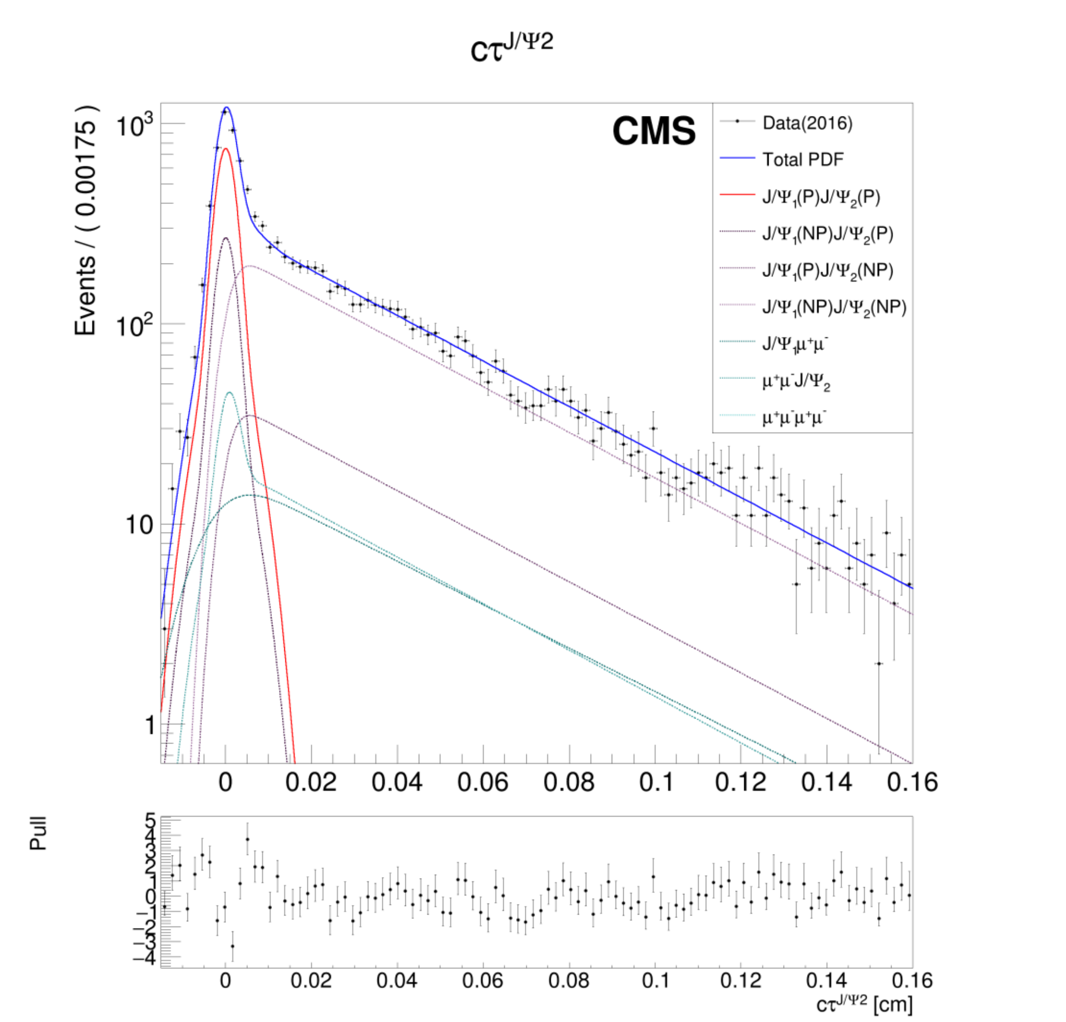


$M_{J/\psi2}$

Origin fitting (4.6)

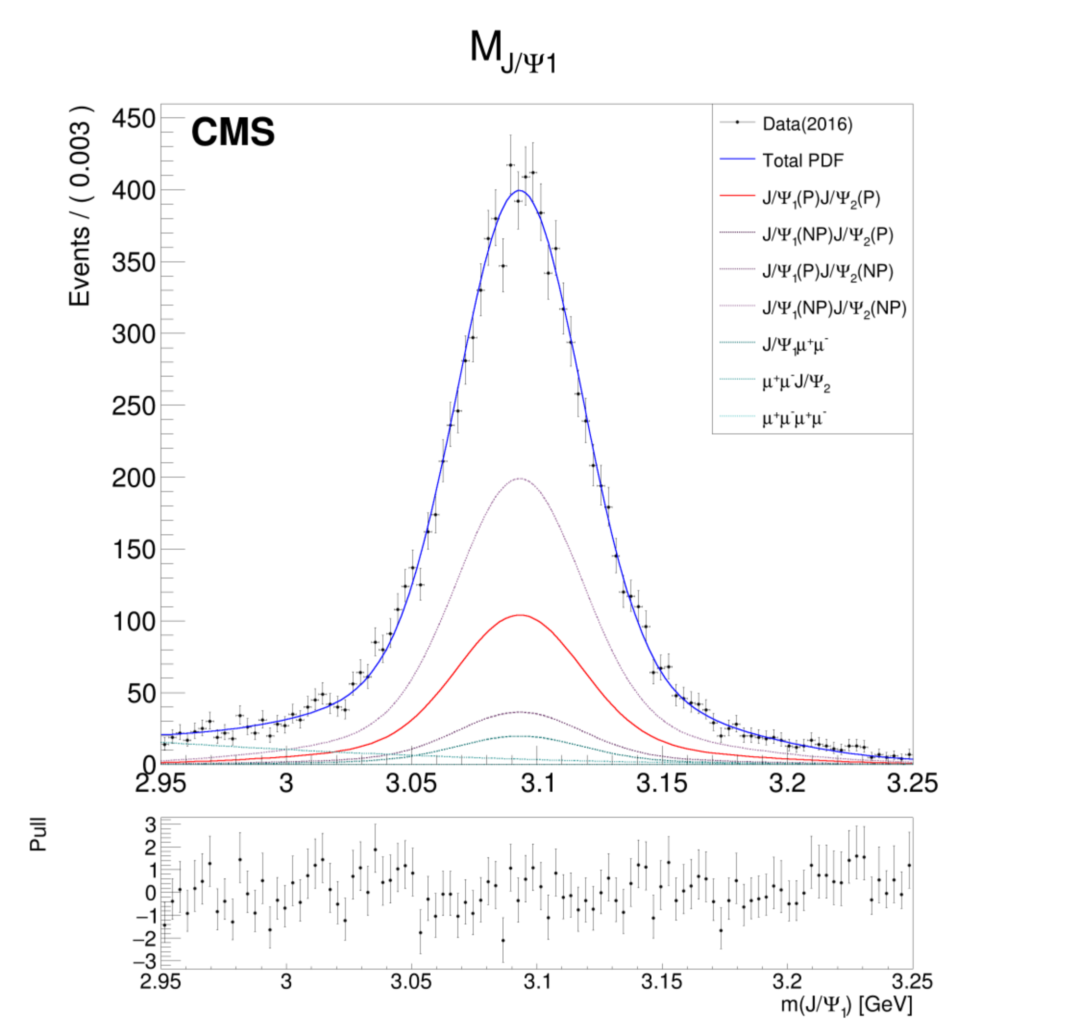


$c\tau_1$

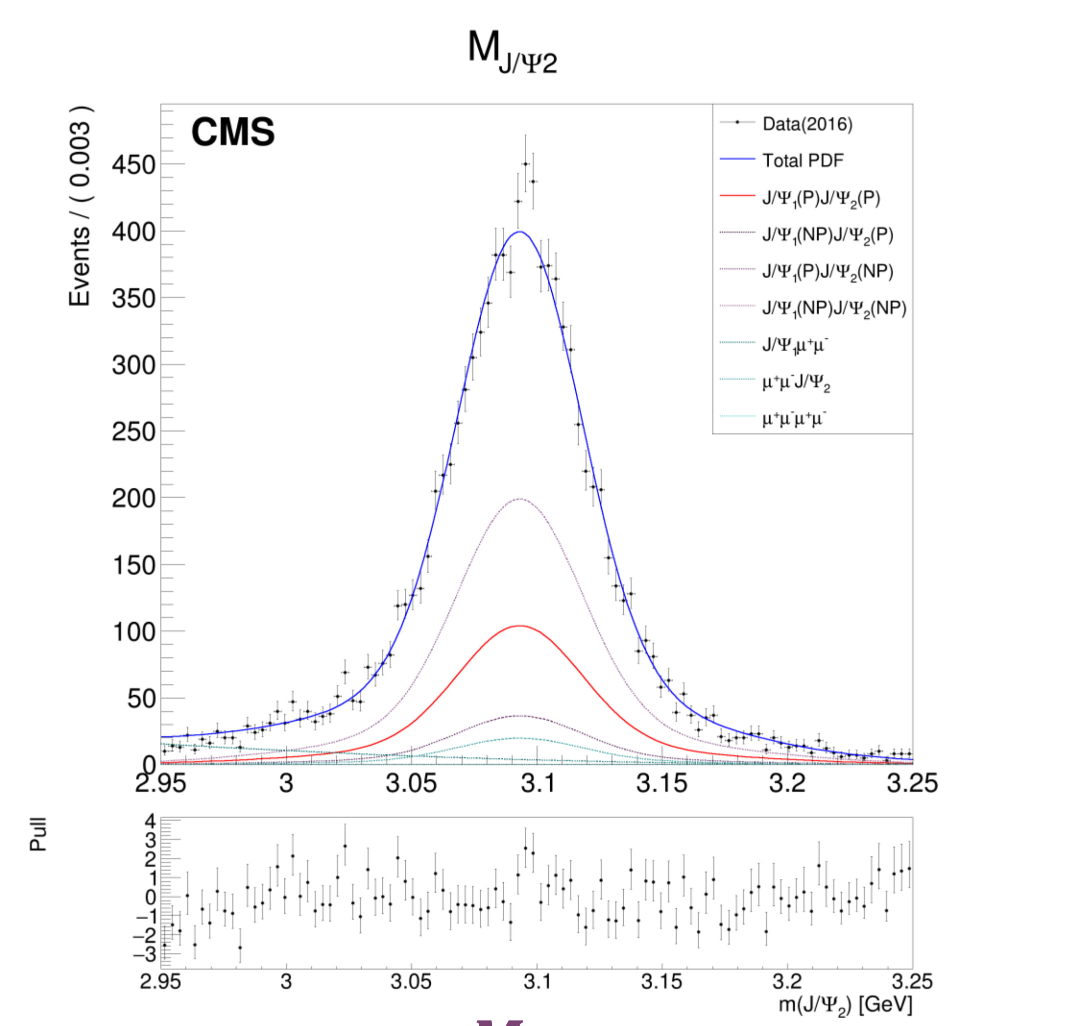


$c\tau_2$

Updated fitting

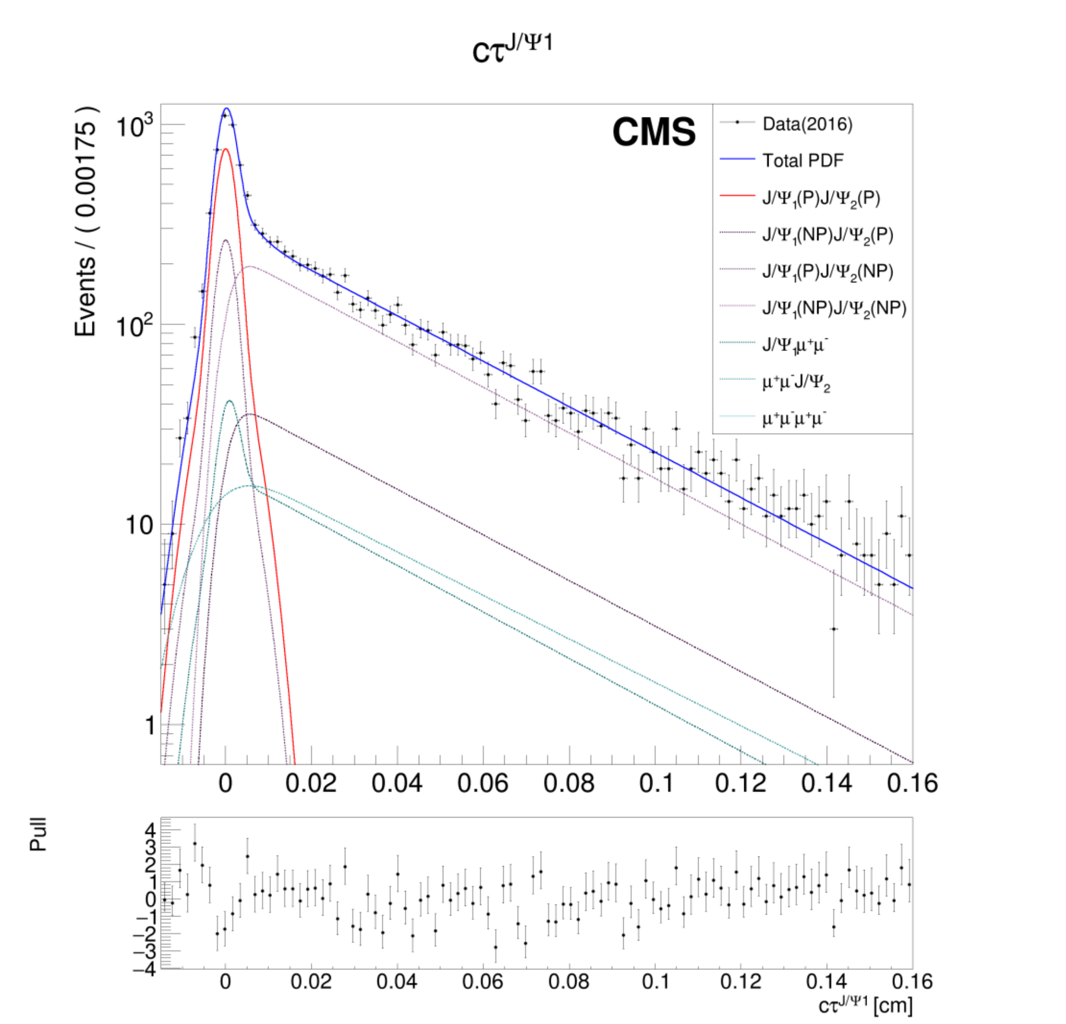


$M_{J/\psi 1}$

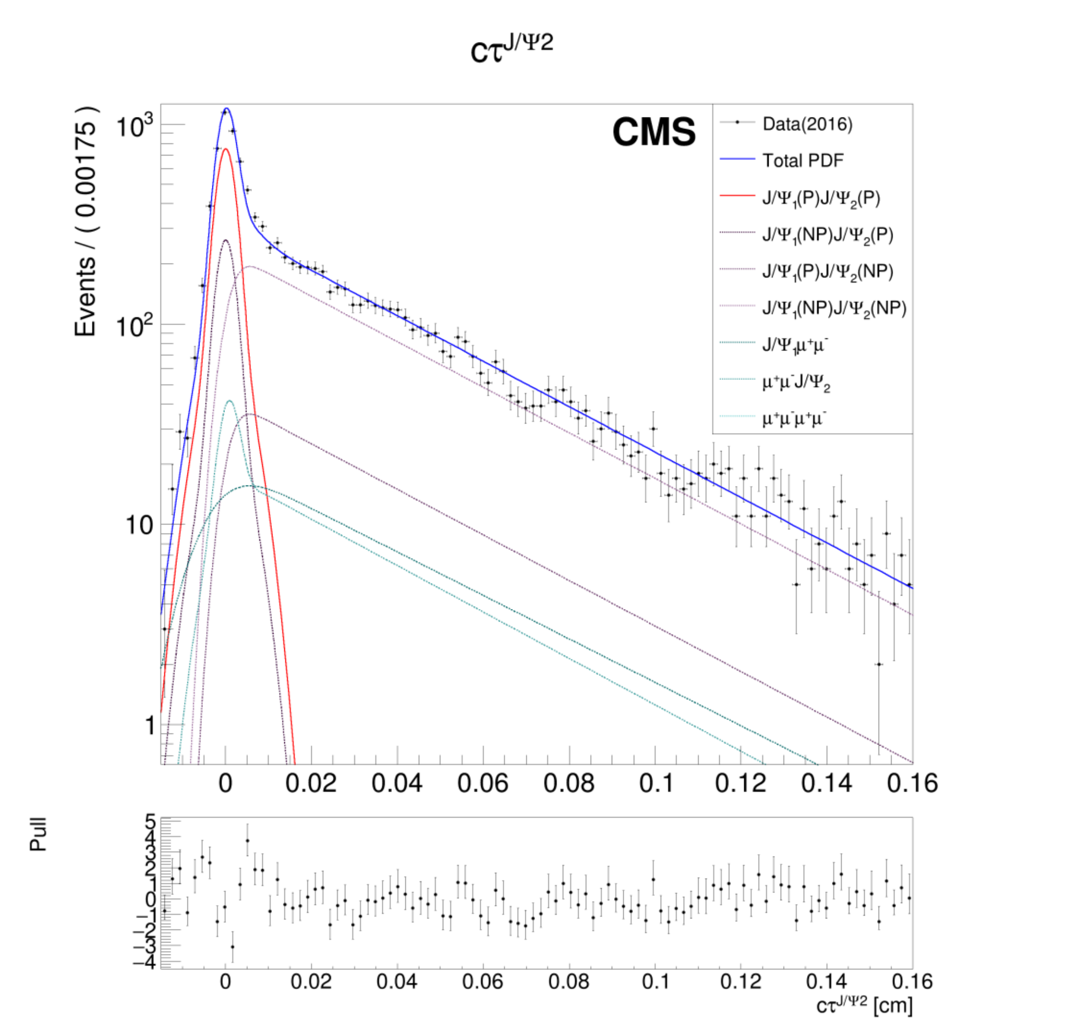


$M_{J/\psi 2}$

Updated fitting

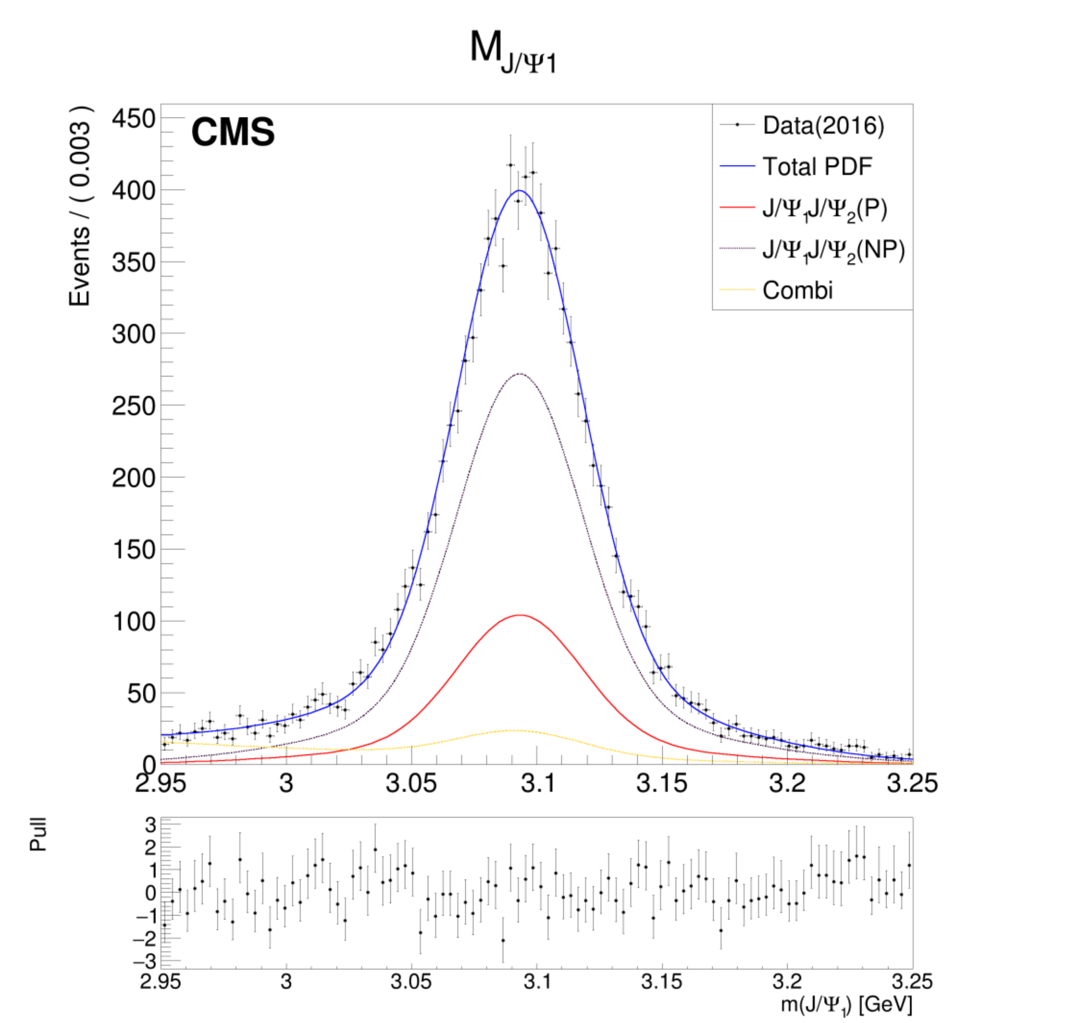


$c\tau_1$

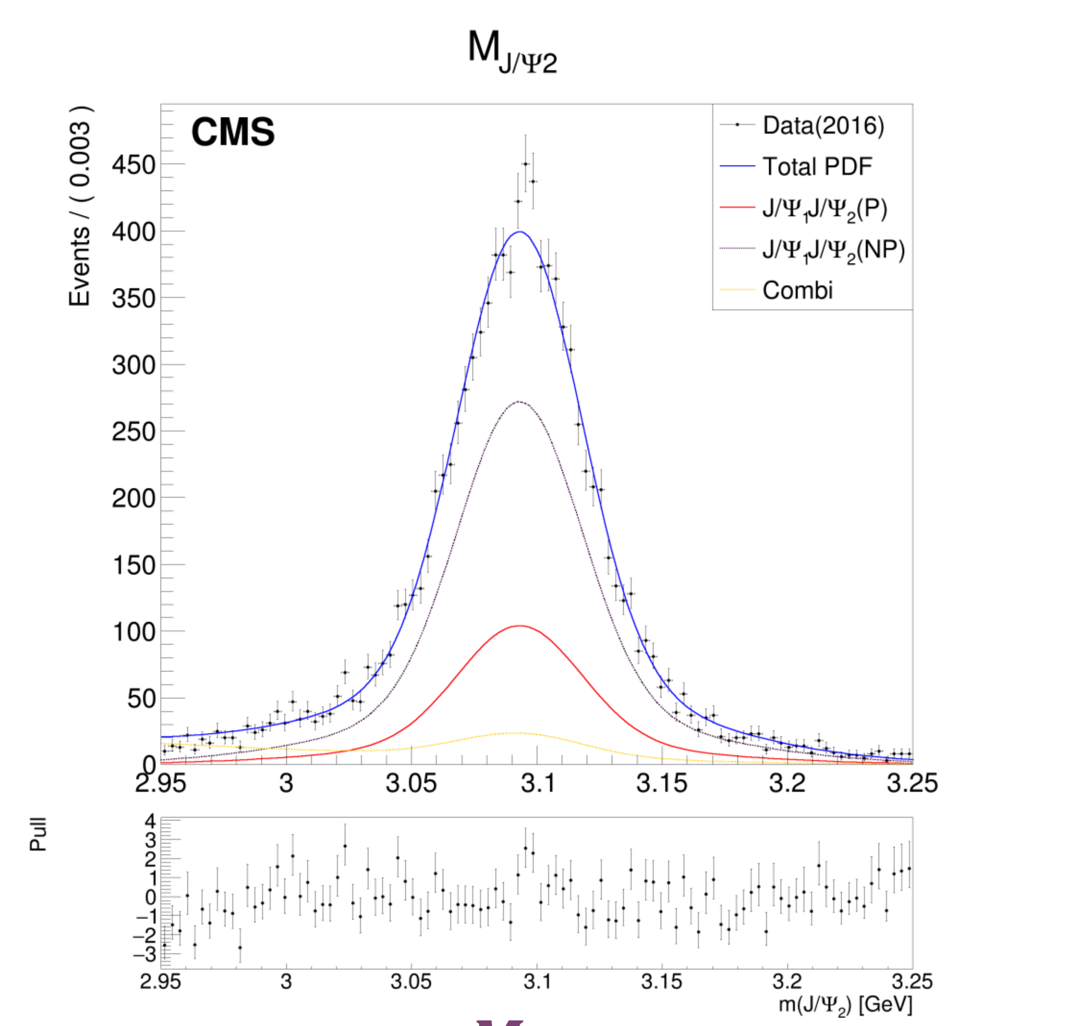


$c\tau_2$

Concise plotting

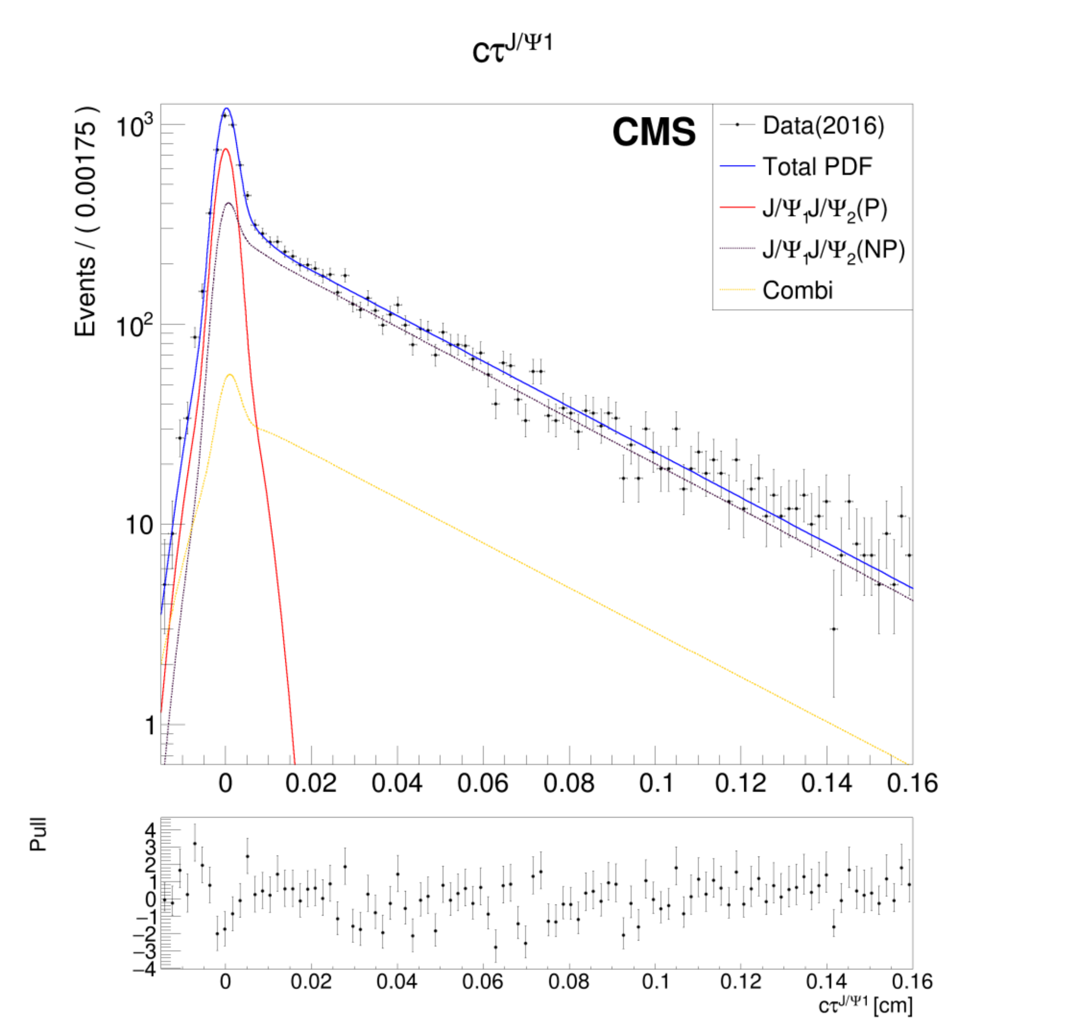


$M_{J/\psi 1}$

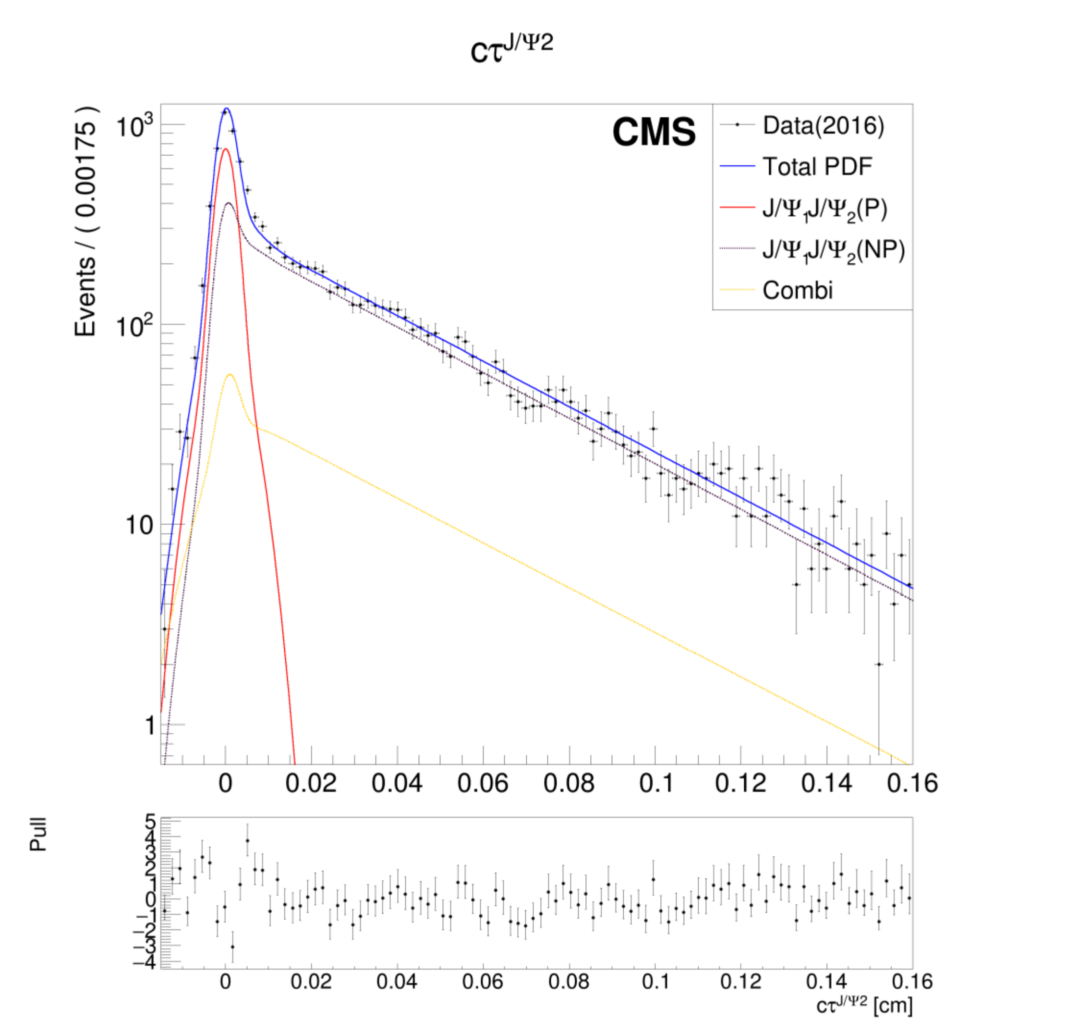


$M_{J/\psi 2}$

Concise plotting

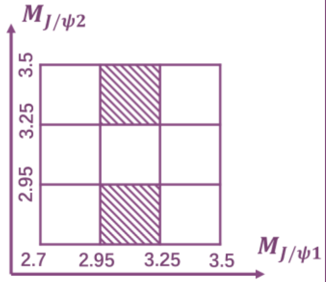


$c\tau_1$



$c\tau_2$

Fitting procedure



- Mix SPS and DPS samples into the prompt sample (8K:4K)
- 1D fit to the prompt sample on the $c\tau_1$ dimension to acquire the **shape1** (double gaussian)
- 1D fit to the non-prompt sample on the $c\tau_1$ dimension to acquire the **shape2** (convolution of an exponent and a gaussian)
- 1D fit to the prompt sample on the $M_{J/\psi 1}$ dimension to acquire the **shape3** (double CB)
- 1D fit to the data sample on the $M_{J/\psi 1}$ dimension to acquire the **shape4** (second order Cheb, the fitting is applied with a merging of the float Cheb and the **shape3**)
- Side band cut to the data sample to acquire the combinatorial background ($J/\psi_1\mu^+\mu^-$)
- 1D fit to the $J/\psi_1\mu^+\mu^-$ on the $c\tau_1$ dimension to acquire the **shape5** (merging of a gaussian and a convolution)
- 1D fit to the $J/\psi_1\mu^+\mu^-$ on the $c\tau_2$ dimension to acquire the **shape6** (convolution of an exponent and a gaussian)
- **Final fitting**

Final fitting

<table>
<tr><th colspan="2">Components</th><th>$M_{J/\psi 1}$</th><th>$M_{J/\psi 2}$</th><th>$c\tau_1$</th><th>$c\tau_2$</th><th>N</th></tr>
<tr><td rowspan="4">$J/\psi_1 J/\psi_2$</td><td>P+P</td><td rowspan="4">Double CB</td><td rowspan="4">Double CB</td><td>Shape1</td><td>Shape1</td><td>$N_{JJ(PP)}$</td></tr>
<tr><td>NP+P</td><td>Shape2</td><td>Shape1</td><td rowspan="2">$N_{JJ(PNP)}$</td></tr>
<tr><td>P+NP</td><td>Shape1</td><td>Shape2</td></tr>
<tr><td>NP+NP</td><td>Shape2</td><td>Shape2</td><td>$N_{JJ(NPNP)}$</td></tr>
<tr><td colspan="2">$J/\psi_1 \mu^+\mu^-$</td><td>Double CB</td><td>Shape4</td><td>Shape5</td><td>Shape6</td><td rowspan="2">$N_{J\mu\mu}$</td></tr>
<tr><td colspan="2">$\mu^+\mu^- J/\psi_2$</td><td>Shape4</td><td>Double CB</td><td>Shape6</td><td>Shape5</td></tr>
<tr><td colspan="2">$\mu^+\mu^-\mu^+\mu^-$</td><td>Shape4</td><td>Shape4</td><td>Shape6</td><td>Shape6</td><td>$N_{\mu\mu\mu\mu}$</td></tr>
</table>

- **The functions that share the same name listed in the table also share the same set of parameters** (because of the smearing between two J/ψs)
- **The parameters for the shape1/2/4/5/6 are fixed from the previous fitting**
- **The parameters for the double CB are float**
- **All the heights are float**