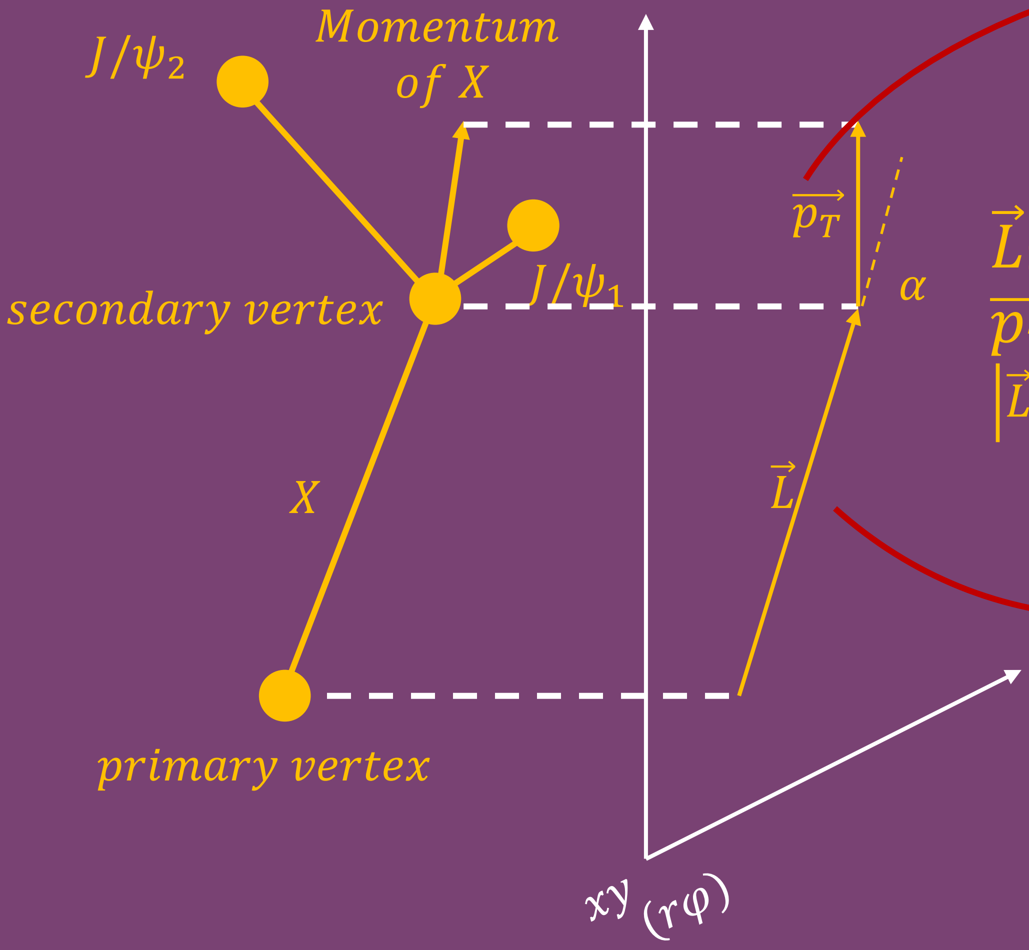
Ntuple fragment about distance

```
...
vtx.SetXYZ(Double_ups_DecayVertex->position().x(),Double_ups_DecayVertex->position().y(),0);
pvtx.SetXYZ(thePrimaryV.position().x(),thePrimaryV.position().y(),0);
TVector3 vdiff = vtx - pvtx;
TVector3 pperp(LV_P.Px(),LV_P.Py(),0);
VertexDistanceXY vdistXY;
double cosAlpha = vdiff.Dot(pperp)/(vdiff.Perp()*pperp.Perp());
Measurement1D distXY = vdistXY.distance(Vertex(*Double_ups_DecayVertex), thePrimaryV);
double lxy=distXY.value();
...
double ctauPV =lxy*cosAlpha* fitFourMu->currentState().mass()/pperp.Perp();
double lxyPV = vdiff.Dot(pperp)/pperp.Mag();
...
```


* Github: 3342-3372 for no mass constraint, 3395-3424 for mass constraint

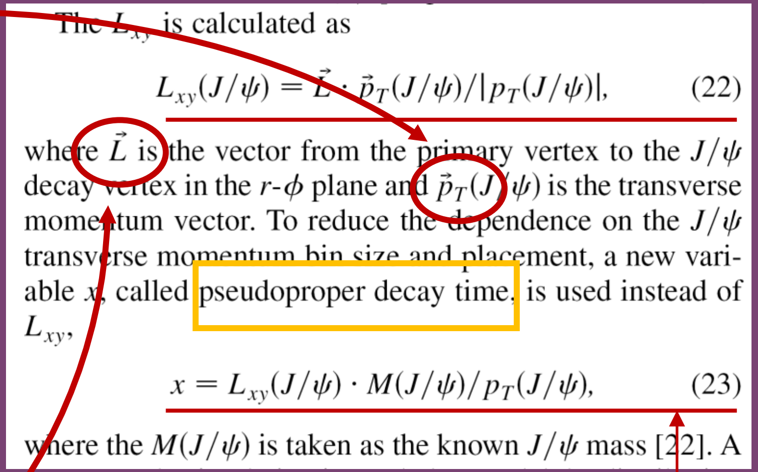
Ntuple fragment about distance



$\vec{L}$: vdiff

$\vec{p_T}$: pperp

$|\vec{L}|$: distXY.value()



The L_{xy} is calculated as

$$L_{xy}(J/\psi) = \vec{L}\cdot\vec{p}_T(J/\psi)/|p_T(J/\psi)|, \quad (22)$$

where $\vec{L}$ is the vector from the primary vertex to the J/ψ decay vertex in the r-ϕ plane and $\vec{p}_T(J/\psi)$ is the transverse momentum vector. To reduce the dependence on the J/ψ transverse momentum bin size and placement, a new variable x, called pseudoproper decay time, is used instead of L_{xy},

$$x = L_{xy}(J/\psi)\cdot M(J/\psi)/p_T(J/\psi), \quad (23)$$

where the $M(J/\psi)$ is taken as the known J/ψ mass [22]. A

cosAlpha: $\cos\alpha = \vec{L}\cdot\vec{p_T} / |\vec{L}|\cdot|\vec{p_T}|$

lxy: $|\vec{L}|$

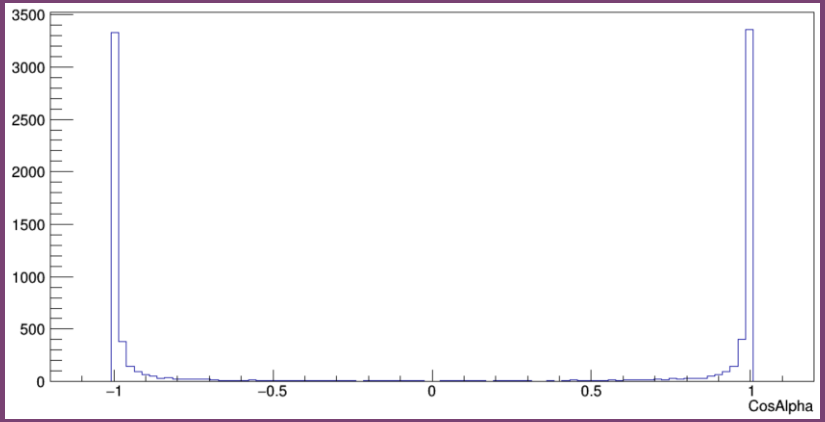
ctauPV: $x = |\vec{L}|\cdot\cos\alpha\cdot M(X)/|\vec{p_T}|$

$= \vec{L}\cdot\vec{p_T}/|\vec{p_T}| \cdot M(X)/|\vec{p_T}| = \boxed{L_{xy}\cdot M(X)/|\vec{p_T}|}$

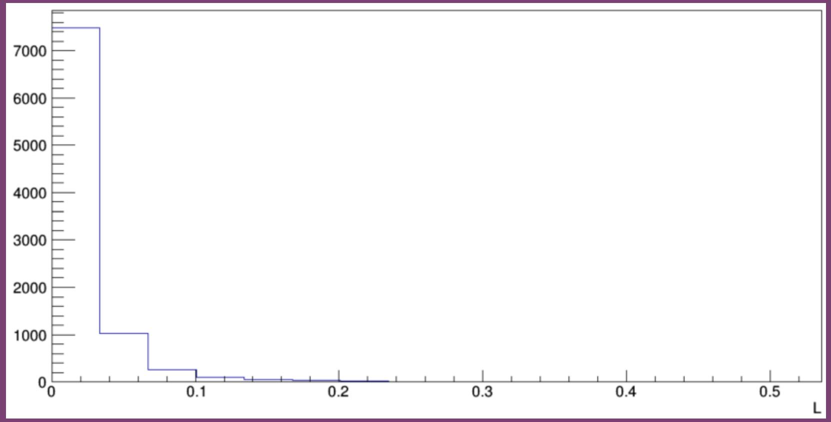
lxyPV: $L_{xy} = \boxed{\vec{L}\cdot\vec{p_T}/|\vec{p_T}|}$

* PRD 71, 032001 (2005): arXiv:hep-ex/0412071

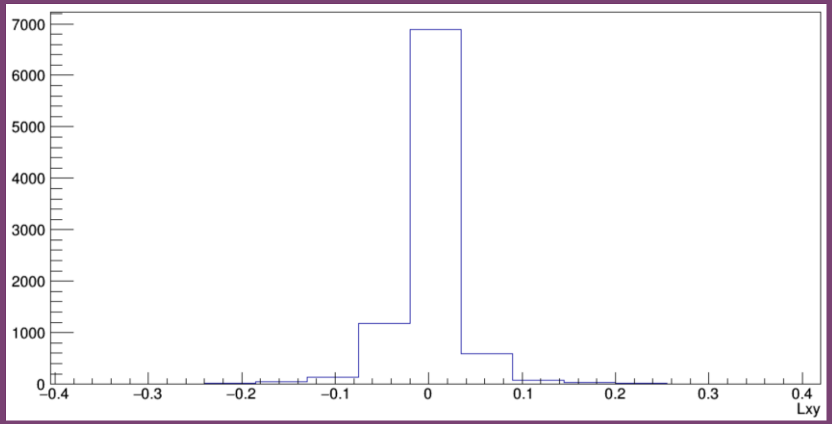
Ntuple fragment about distance



$cos\alpha$



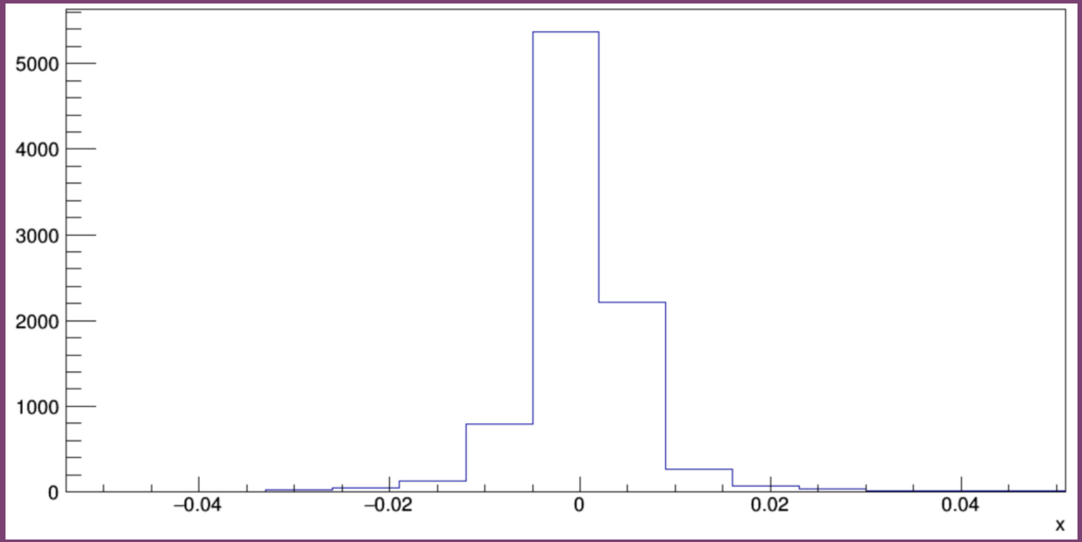
$\left|\vec{L}\right|$



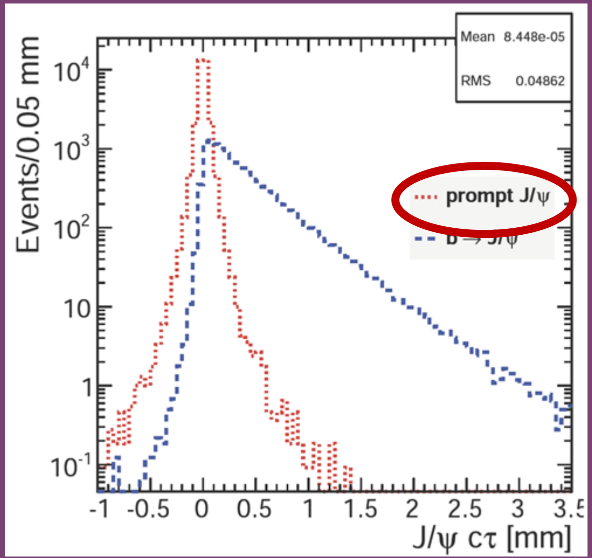
L_{xy}

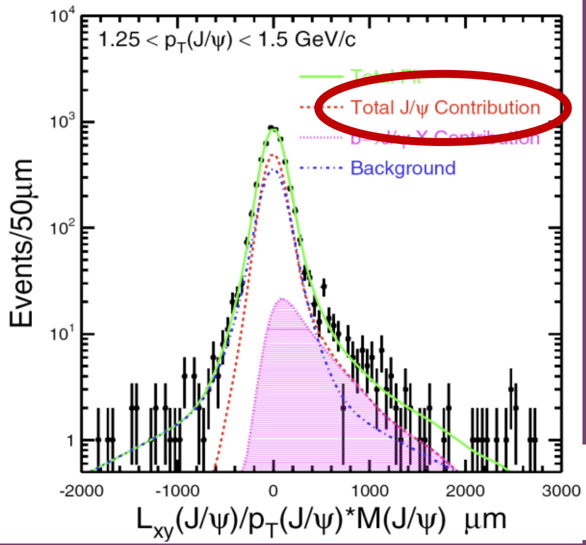
- Value is reasonable

Ntuple fragment about distance



x

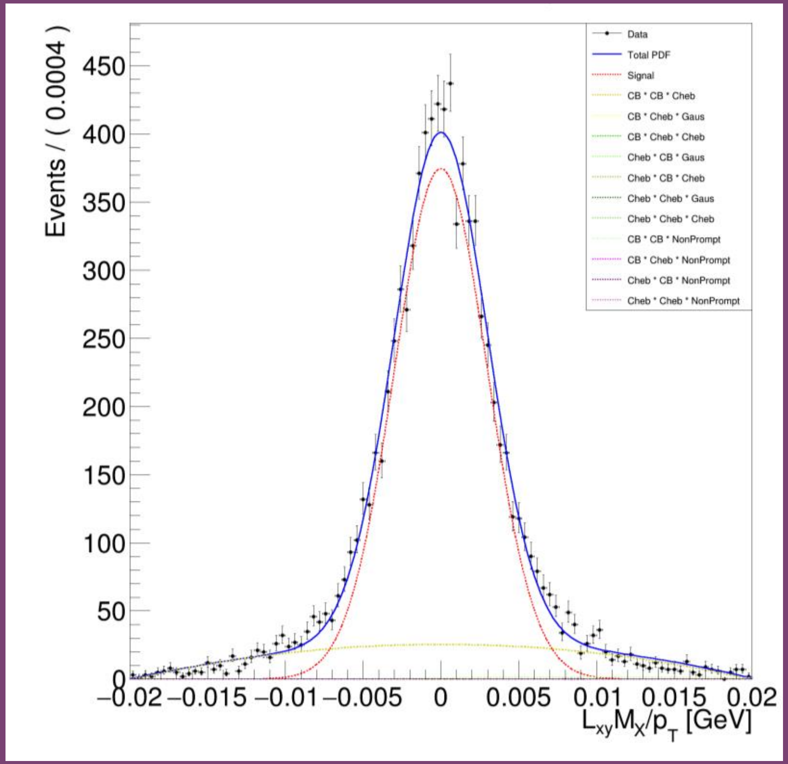




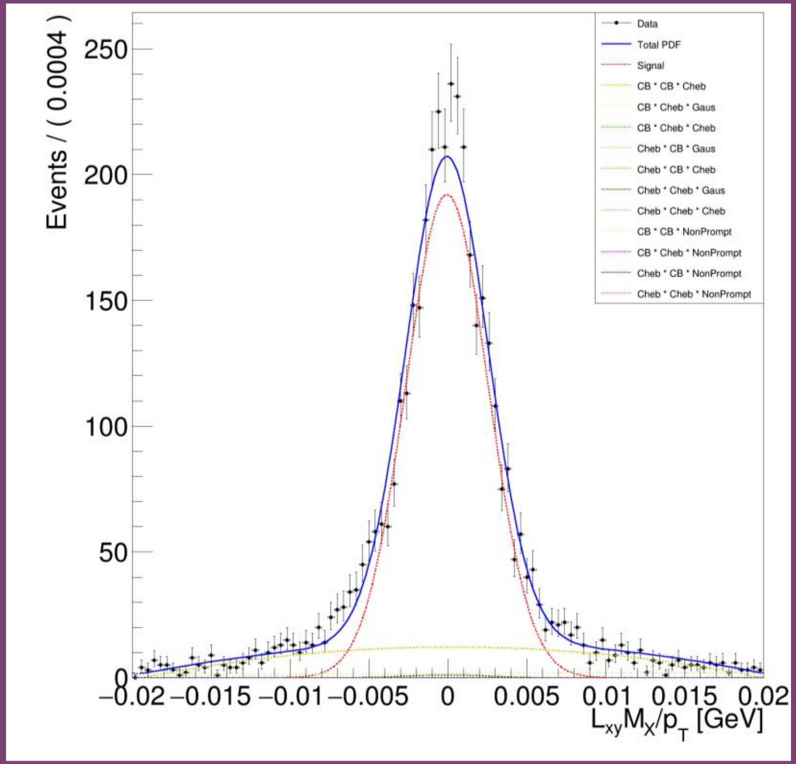
- Our sample has similar distribution

* AN2010-138

Ntuple fragment about distance



SPS



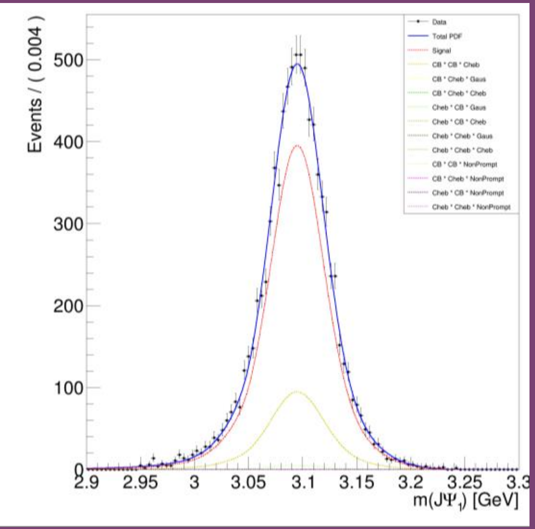
DPS

- Similar distribution between SPS and DPS

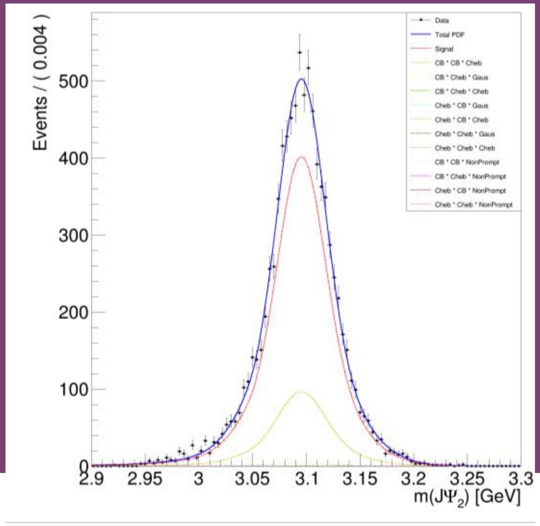
Code for 3D fit

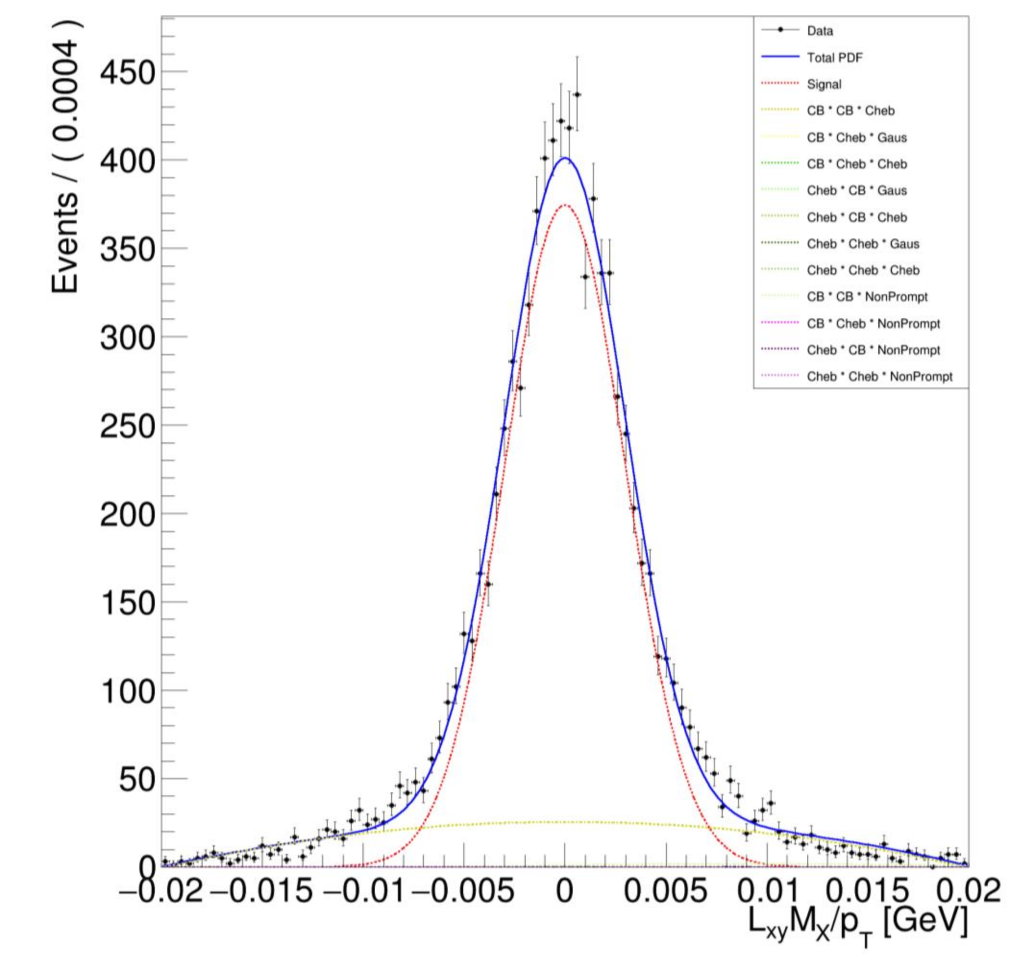
The merging of the combinatorial background is cancelled, different components are separated

M_{J/ψ_1}



M_{J/ψ_2}





x

With Non-prompt Pdf

- Gauss + Second order Cheb + Non-prompt pdf
- Testing non-prompt pdf: convolution of exponent and Gauss(resolution)
- The exponent function is cut by a step function at 0

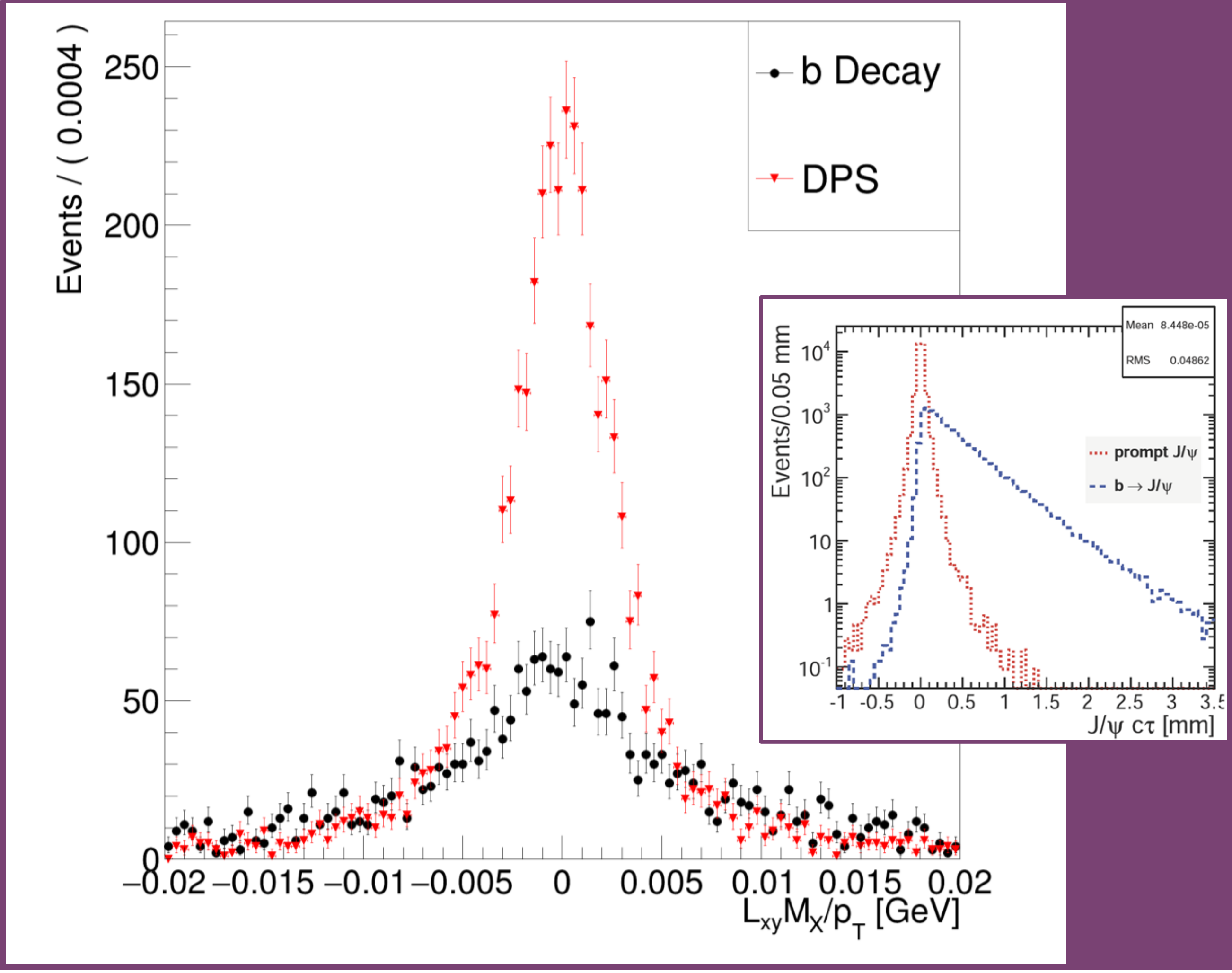
B decay sample

- $b\bar{b} \rightarrow J/\psi J/\psi$
- Sample for one year has been produced for test (2018)
- Tighter GEN filters were applied (p_T 3.3; $|\eta|$ 2.5)
- Statistic:

Total candidates:		Passing other cuts:		Passing four muon vertex cuts:
235238	$\longrightarrow$	156827	$\longrightarrow$	**2829**
	~67.8%		~1.8%	

* Vertex probability (four muons) > 0.01

B decay sample

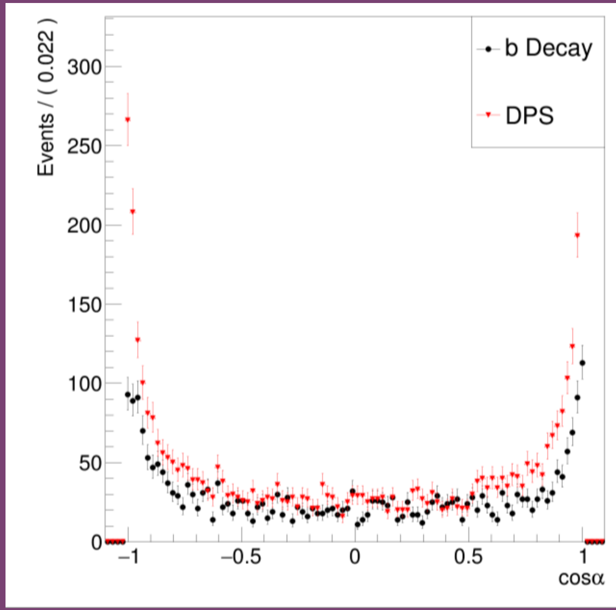


x

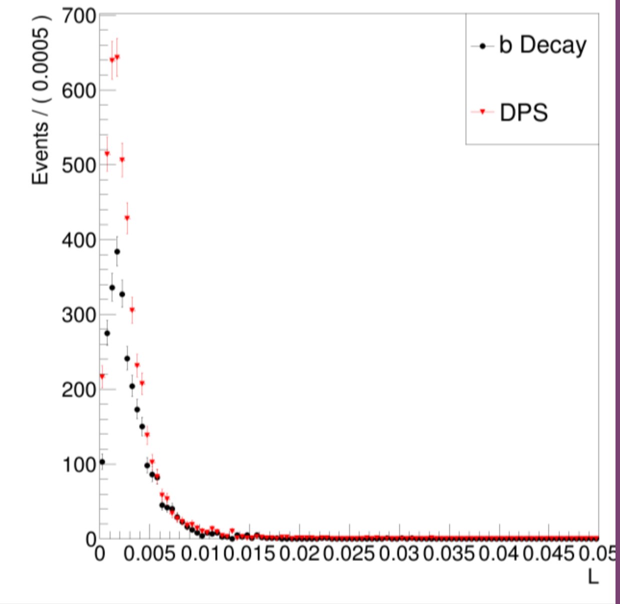
- **No obvious difference can be found except the statistic**
- Slight discrepancy in the width
- Does not meet the exponent shape in the previous study (symmetry distribution, no tail)

B decay sample

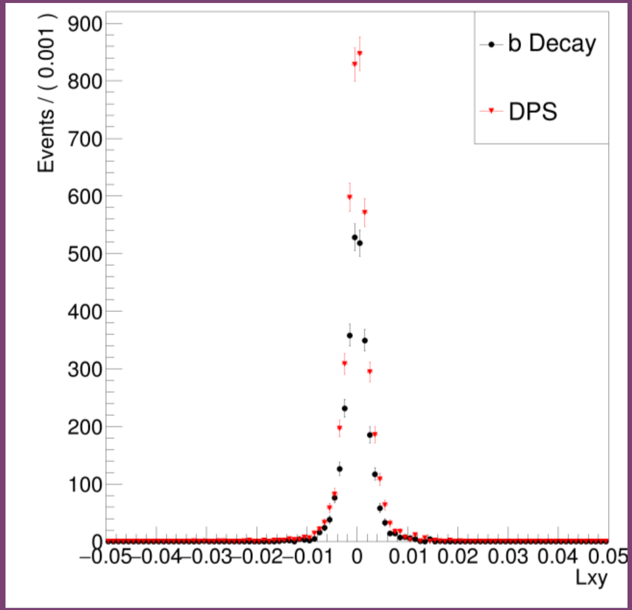
Other variables about distance?



$\cos\alpha$



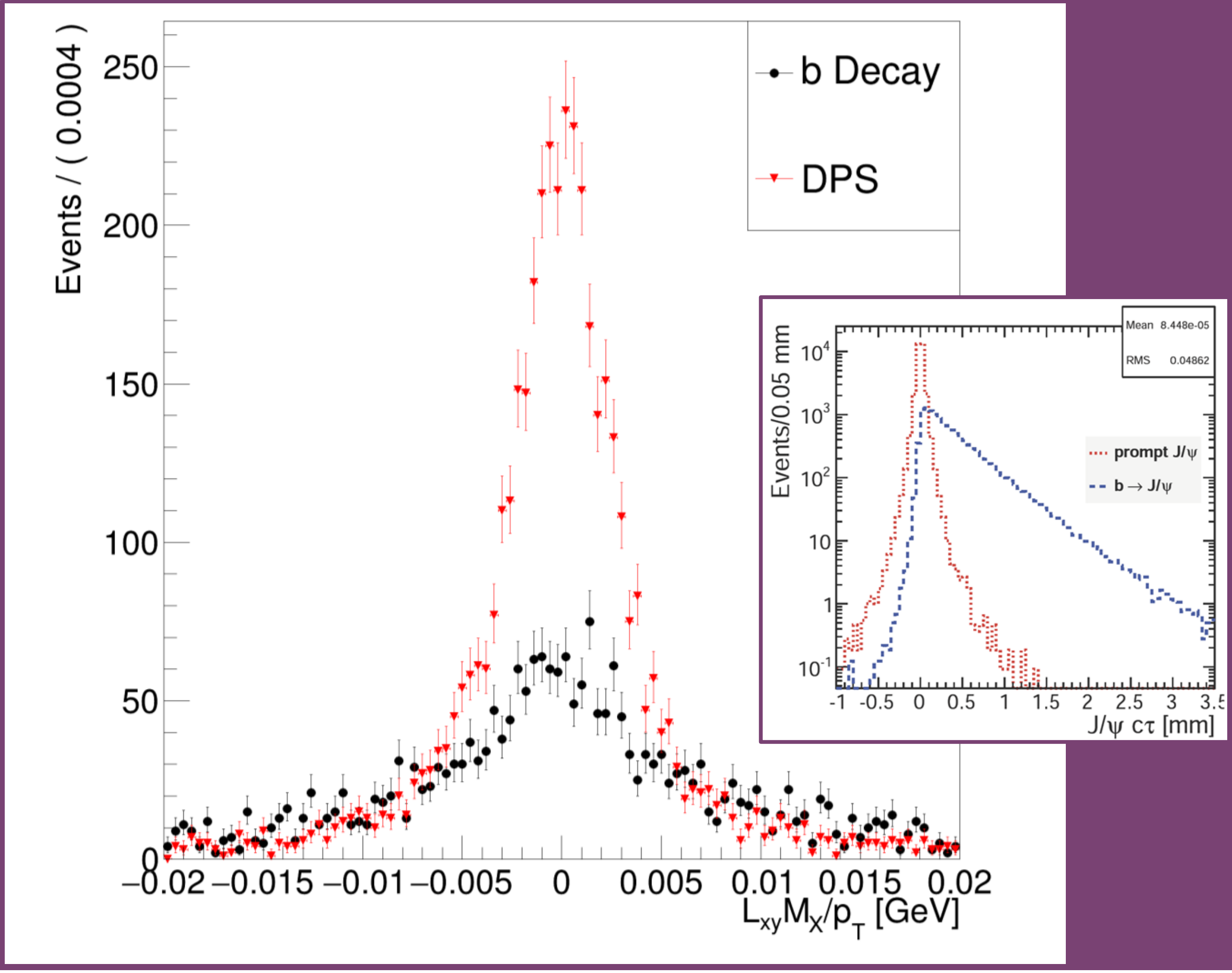
$|\vec{L}|$



L_{xy}

- **Basically no obvious difference can be noticed between two samples**
- $\cos\alpha$ for b decay sample has a slightly stronger trend to distribute around 0

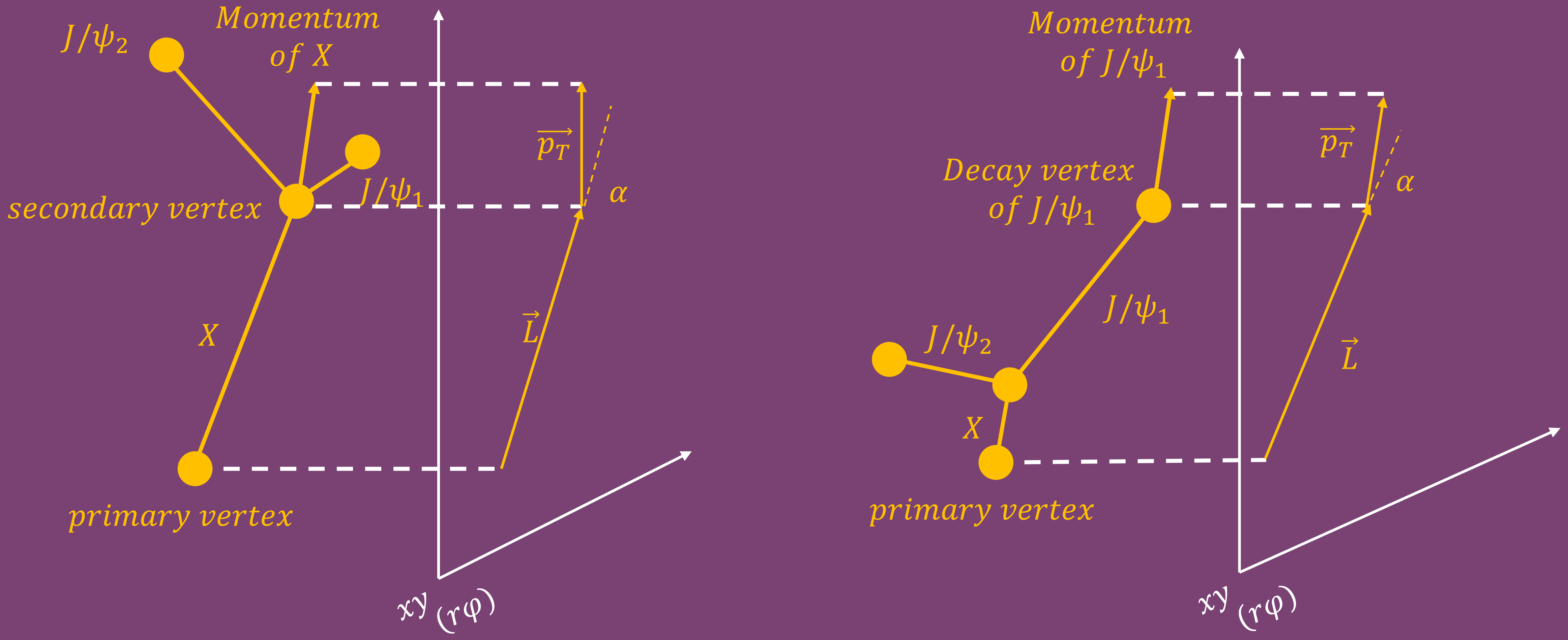
B decay sample



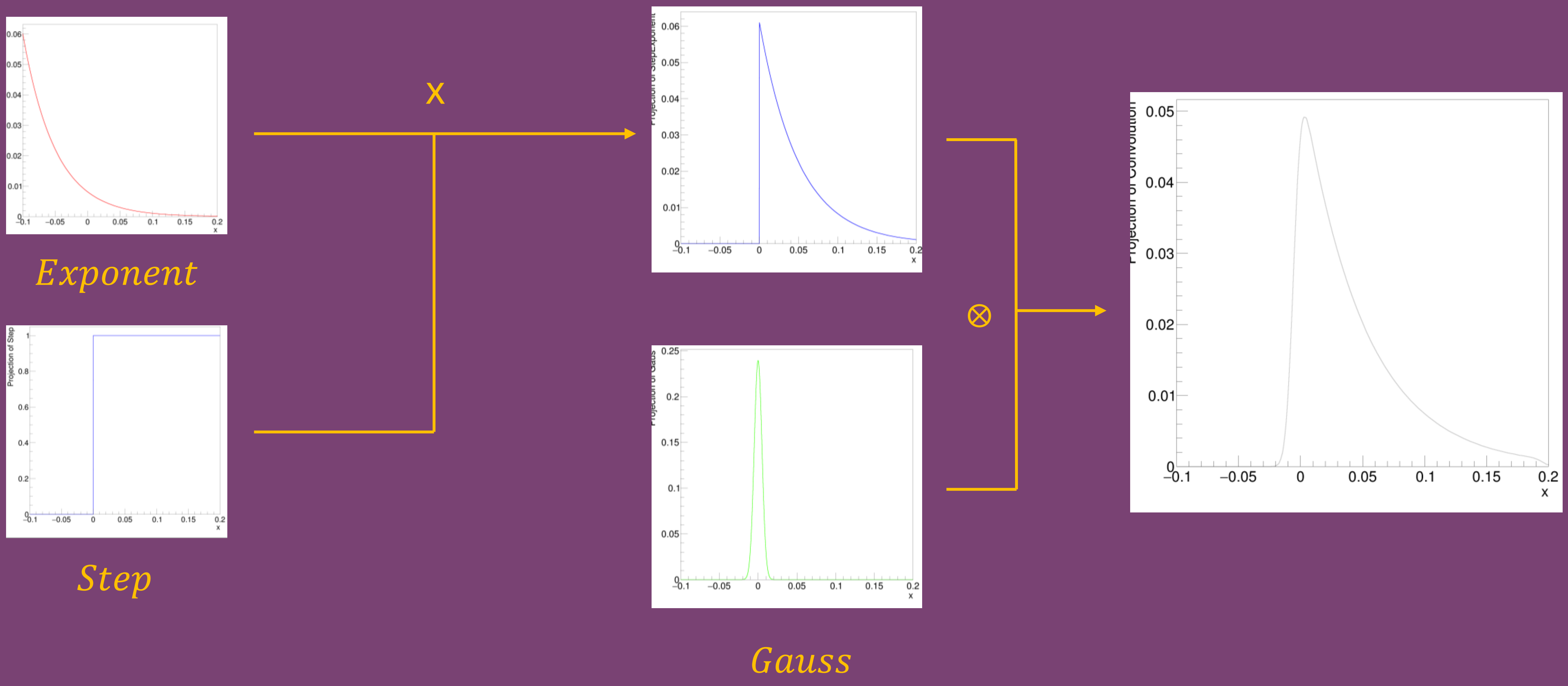
x

- **No obvious difference can be found except the statistic**
  - Slight discrepancy in the width
  - Does not meet the exponent shape in the previous study (symmetry distribution, no tail)

- Produce another sample by someone else to cross check?
- Enlarge the statistic?



Momentum of X
J/ψ_2
secondary vertex
J/ψ_1
$\overrightarrow{p_T}$
α
X
$\vec{L}$
primary vertex
xy ($r\varphi$)
Momentum of J/ψ_1
Decay vertex of J/ψ_1
$\overrightarrow{p_T}$
α
J/ψ_1
J/ψ_2
$\vec{L}$
X
primary vertex
xy ($r\varphi$)


Exponent
Step
x
Gauss
⊗