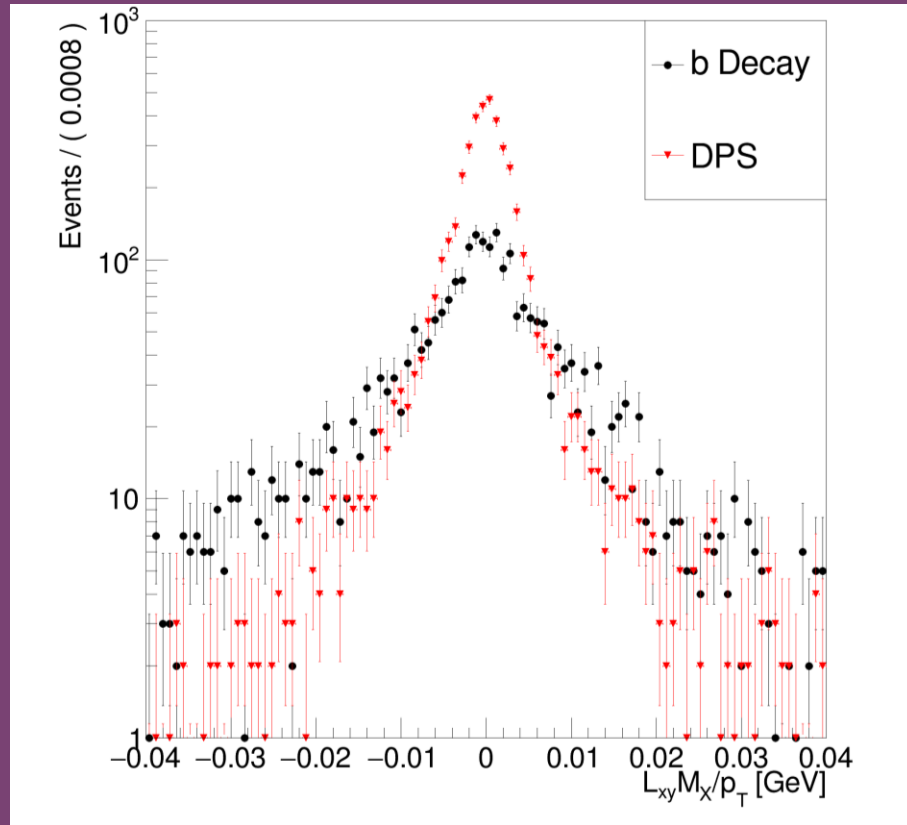# B decay sample

x

(pseudoproper decay time)

- **Distributions about distance are similar between prompt and non-prompt samples**

- **Three way to check:**
  - Check the code itself
  - Search for $b \to J/\psi$ sample to compare with the reference
  - Search for old sample (before UL) to check the sample

Old sample

- Several (RECO/SKIM) datasets were found

- The statistic for most of which is too small to be used **2016**

- Only two have larger statistic

  - /Pythia8_BBartoJJ/hwen-MC2016_skim_RECO_bbartoJJ_ihep_v1-bab3dc527d7ce6154976436b56c47cab/USER
  - /bbarTo4mu_13TeV_pythia8/zhenhu-BPHSkim-v2-RunIIAutumn18MiniAOD-b9db486c73b65ab0e045fe715b58c49c/USER
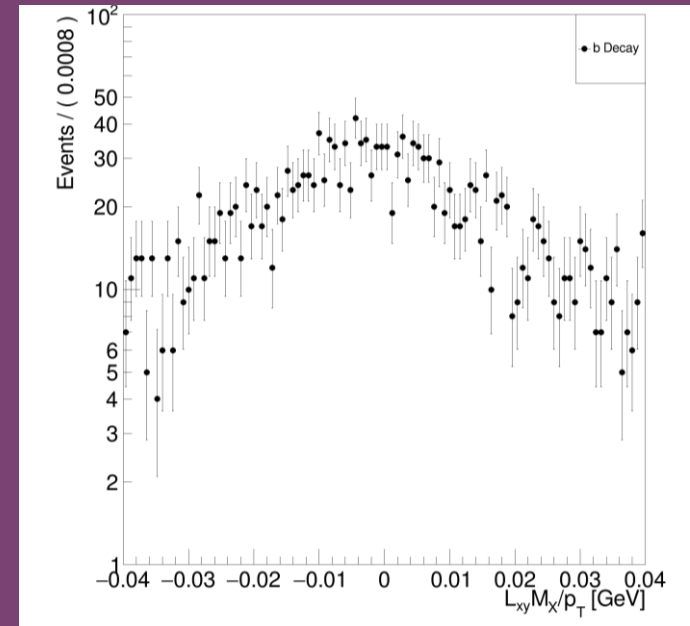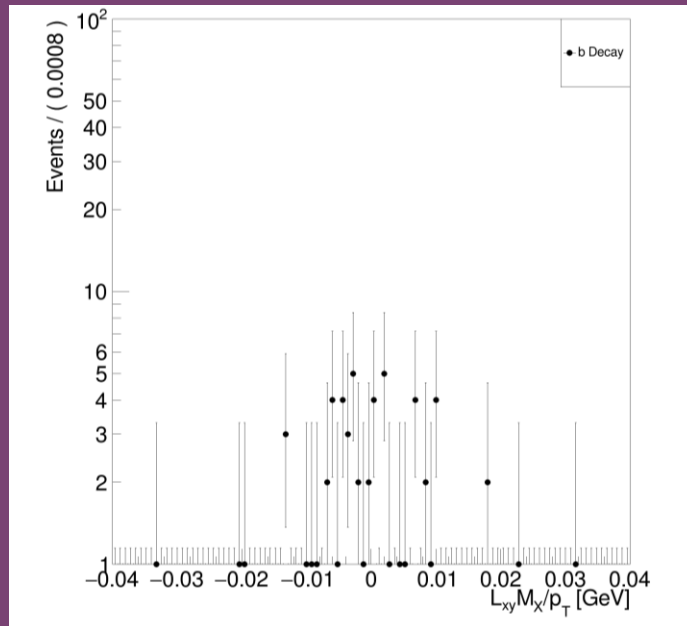
2018

Old sample

- 2016 is not available

  - All the variables with "ID_OS_VTX" suffix are void

  - The statistic of which is a little smaller than the 2018

- 2018 has insufficient statistic

  - Only 67 events left after all the cuts were applied

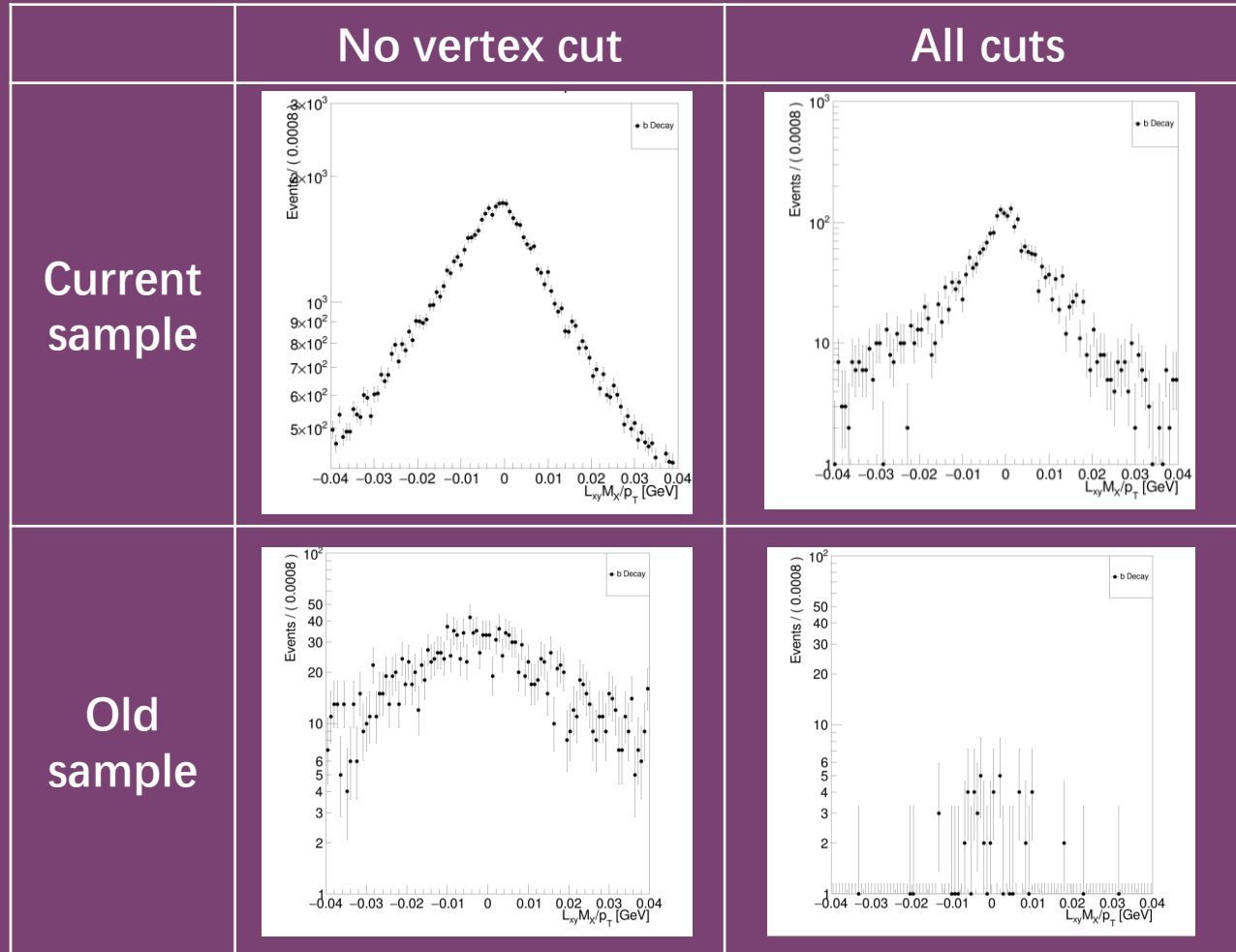 - Tried to check the shape without four muon vertex probability cut

Old sample

- 2018 has insufficient statistic
  - Only 67 events left after all the cuts were applied
  - Tried to check the shape without four muon vertex probability cut

Summary

	No vertex cut	All cuts
Current sample		
Old sample		

- Statistic for the old (before UL) sample is insufficient
- No shape can be observed with all cuts applied
- The shape is similar with our current sample if the vertex cut is removed
- **The problem of the symmetry may not come from the UL configuration**
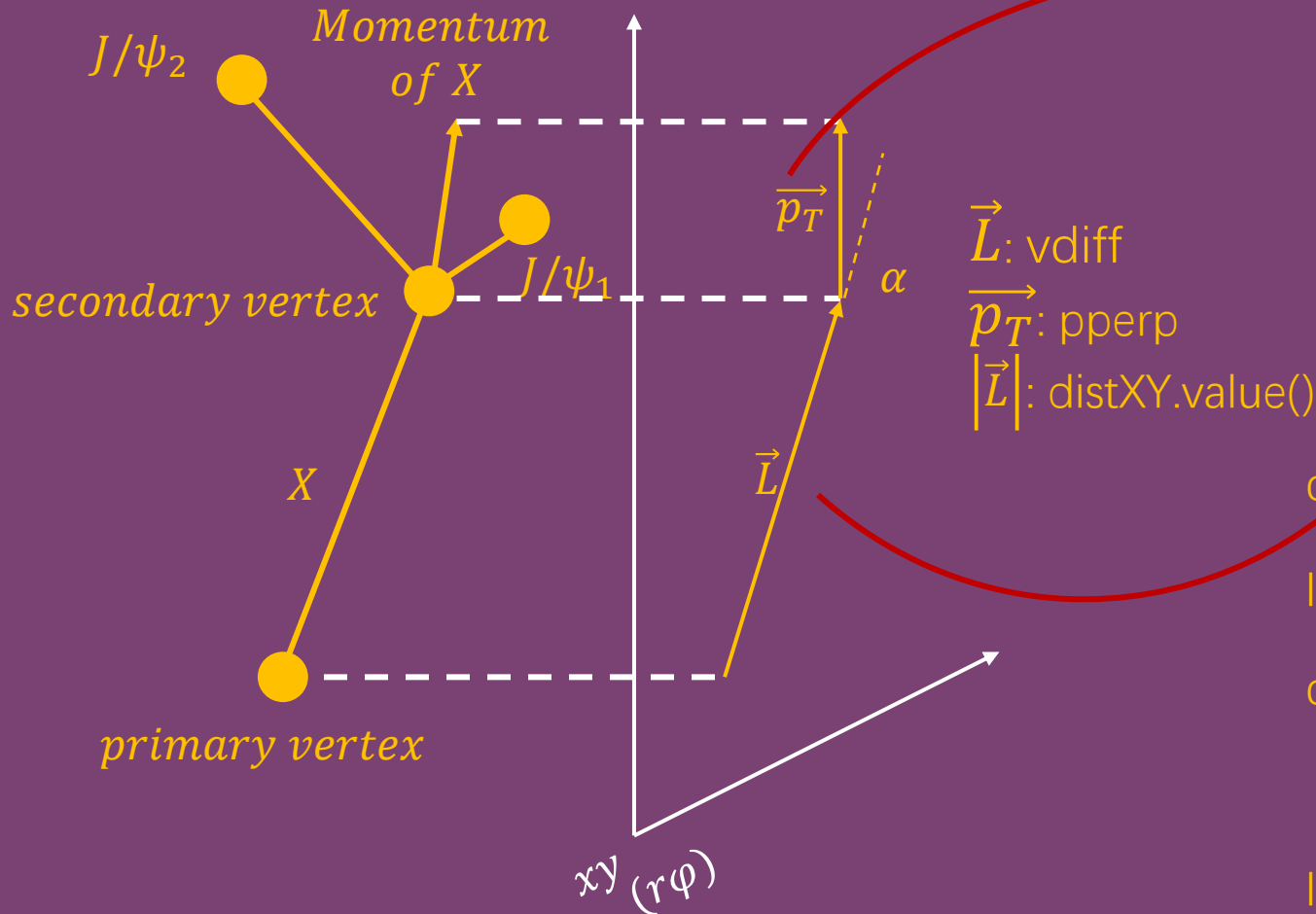
Old dataset

- RECO
  - 16: /Pythia8_BBartoJJ/xgao-MC2016_RECO_Pythia_BBartoJJ_v1-780f4e3aaa78204b6570efb2838aa51a/USER
  - 16: /Pythia8_BBartoJJ/yusui-MC2016_RECO_yusui_v1-780f4e3aaa78204b6570efb2838aa51a/USER
  - 17: /Pythia8_BBartoJJ/yangzh-Pythia8_BBartoJJMC2017_RECO_yzifixed_v1-a9060a3af4d8974a100eeeda34a973c3/USER
  - 17: /Pythia8_BBartoJJ/diwang-MC2017_RECO_diwang_v1-a9060a3af4d8974a100eeeda34a973c3/USER
  - 18: /bbarTo4mu_13TeV_pythia8/xgao-RunIIAutumn18MiniAOD-102X_upgrade2018_realistic_v15-v1-RECO-2f1667a4ab974bdf4cb2916f291c3603/USER
  - 18: /Pythia8_BBartoJJ/diwang-MC2018_RECO_diwang_v1-92d92f5109469f45356010fe9aa58810/USER
- SKIM
  - 16: /Pythia8_BBartoJJ/hwen-MC2016_skim_RECO_bbartoJJ_ihep_v1-bab3dc527d7ce6154976436b56c47cab/USER
  - 17: /Pythia8_BBartoJJ/hwen-MC2017_skim_RECO_bbartoJJ_ihep_v1-d2874dc3d42cb581edf013d7a2e8aa6b/USER
  - 18: /bbarTo4mu_13TeV_pythia8/zhenhu-BPHSkim-v2-RunIIAutumn18MiniAOD-b9db486c73b65ab0e045fe715b58c49c/USER

Ntuple fragment about distance

J/ψ_2

Momentum of X

secondary vertex

J/ψ_1

X

primary vertex

$\overrightarrow{p_T}$

α

$\vec{L}$

xy $(r\varphi)$

$\vec{L}$: vdiff

$\overrightarrow{p_T}$: pperp

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

The L_{xy} is calculated as

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

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},

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

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

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

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

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

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

lxyPV: $L_{xy} = \dfrac{\vec{L}\cdot\overrightarrow{p_T}}{|\overrightarrow{p_T}|}$