

# Trigger studies on tau1x1 LFUV search

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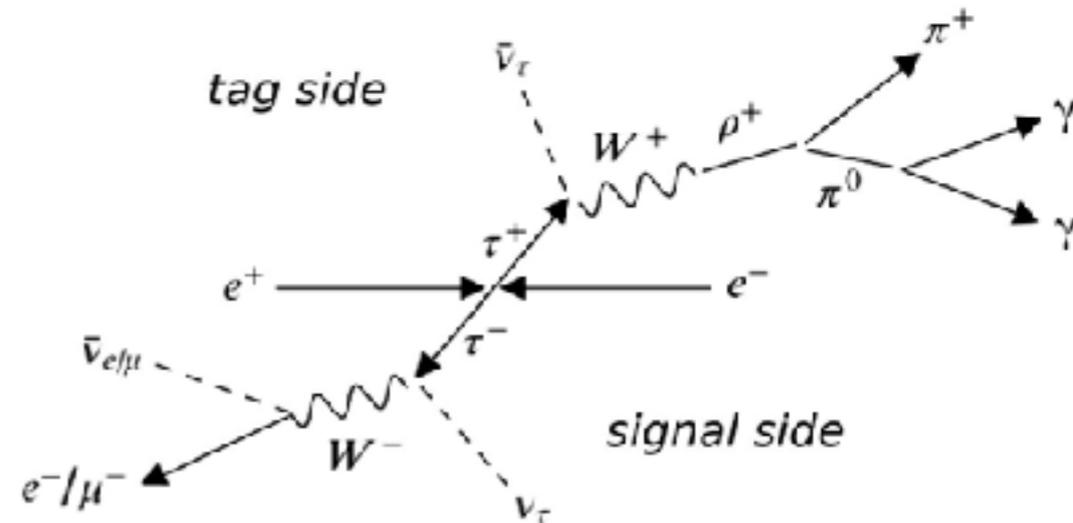
Trigger weekly meeting, 29 September 2022



# Preselection cuts

Preselection cuts → **85% taupair pure sample**

sig\_clusterE > 0  
tag\_clusterE > 0  
nPhotons\_sig < 2  
nPhotons\_tag < 4  
nPi0\_candidates\_sig == 0  
nPi0\_candidates\_tag > 0  
1.807 <= visibleEnergyOfEventCMS < 9.039  
-16.130 <= missingMass2OfEvent < 95.577  
0.211 <= missingMomentumOfEventCMS\_theta < 2.969  
0.633 <= thrust < 0.991  
0.943 <= trackOpeningAngleCMS < 3.123  
-0.919 <= tau\_tag\_cosTheta\_CMS < 0.997  
-5.087 <= mu2Max\_tag < 1.638  
0.054 <= tag\_angleToThrustPlane < 1.565  
0.287 <= tau\_tag\_p\_CMS < 5.353  
0.202 <= tau\_sig\_p\_CMS < 4.857

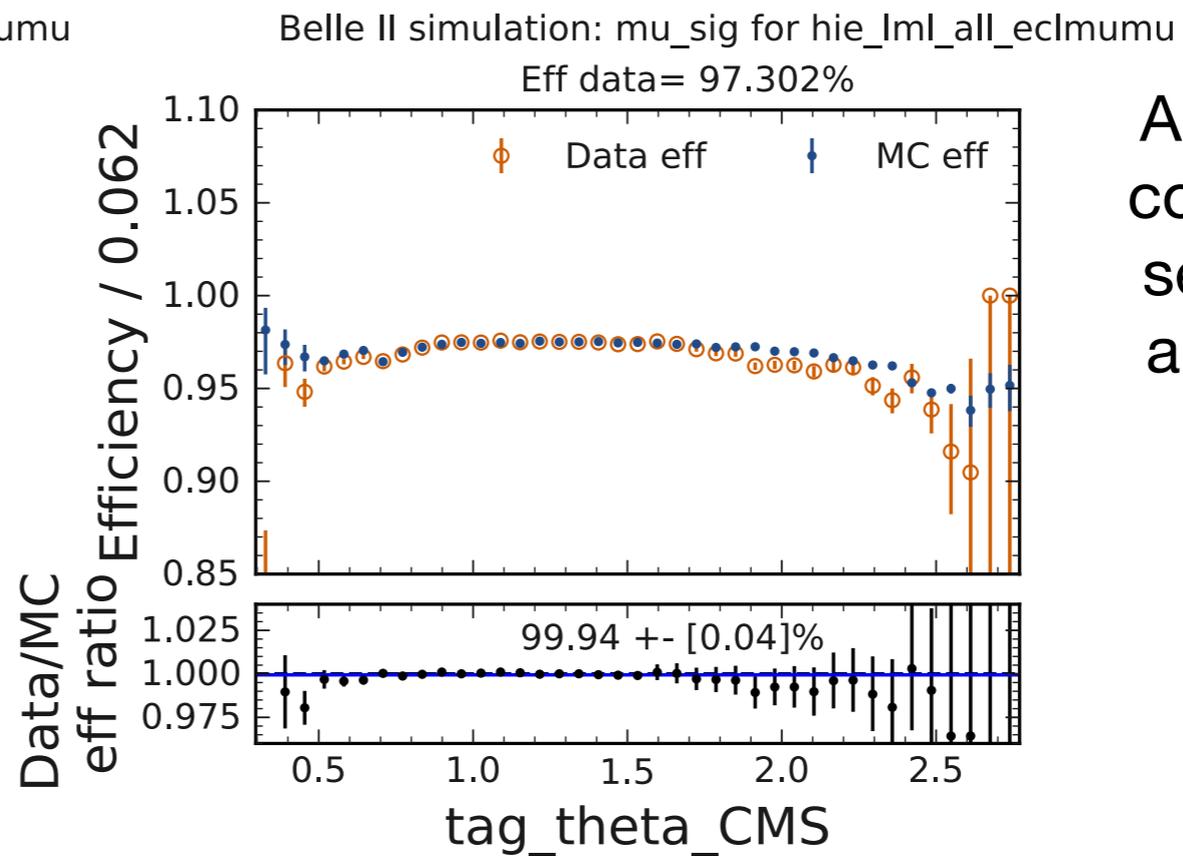
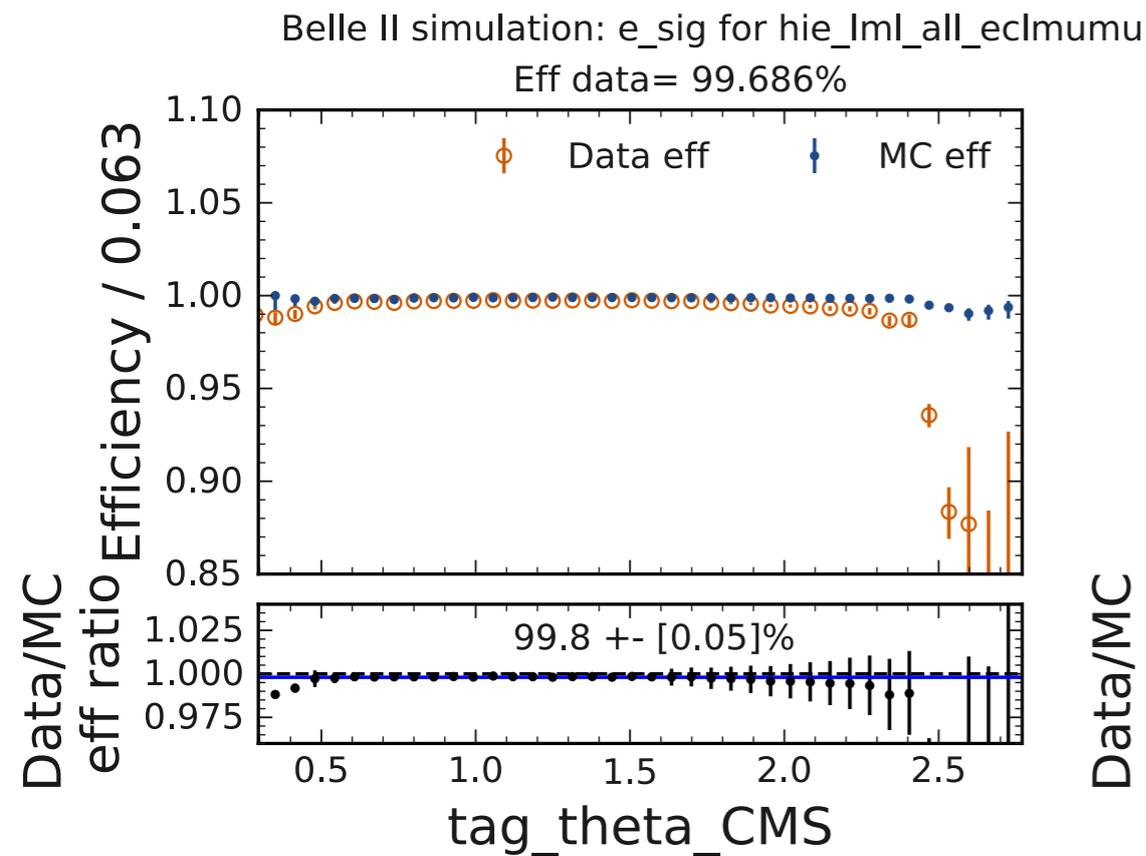


**I need to update it with the final selection to have ~100% purity!**

**electron and muon tag side distinguished via:**

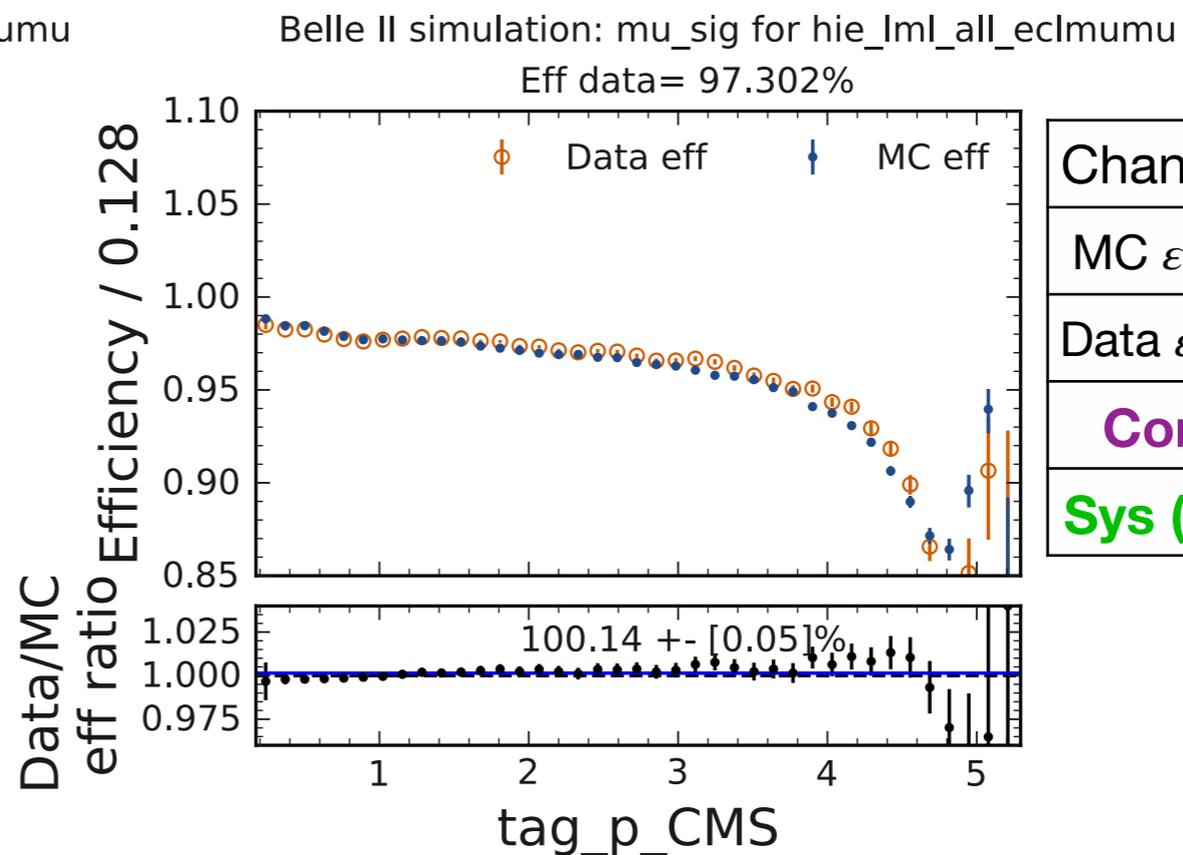
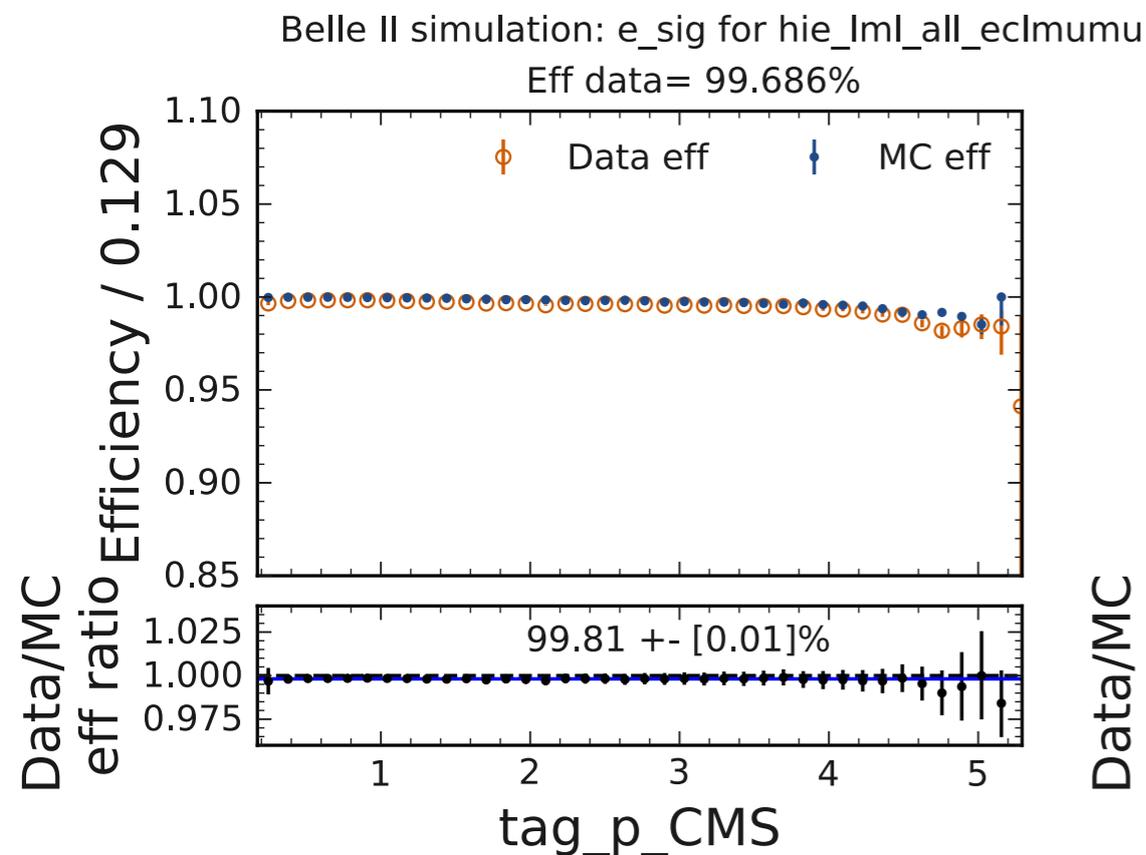
sig\_pidChargedBDTScore\_e > 0.85  
sig\_pidChargedBDTScore\_mu > 0.85

# Data-MC comparison



Application of a correction factor separately for e and  $\mu$  channels

↓  
Systematics come from correction factor error



Channel	e	$\mu$
MC $\epsilon$ %	99.874	97.148
Data $\epsilon$ %	99.686	97.302
<b>Corr</b>	<b>0.9981</b>	<b>1.0016</b>
<b>Sys (%)</b>	<b>0.05</b>	<b>0.05</b>

# Reference trigger: bias contribution

Belle II simulation: e\_sig for hie\_lml\_all\_eclmumu

Belle II simulation: mu\_sig for hie\_lml\_all\_eclmumu

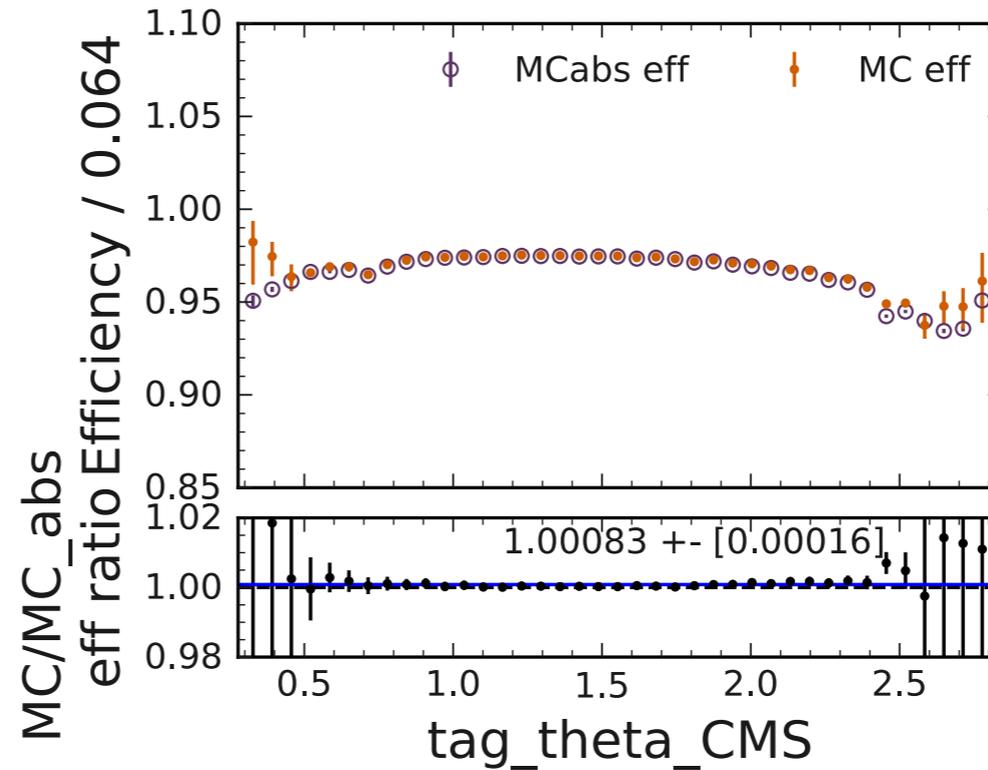
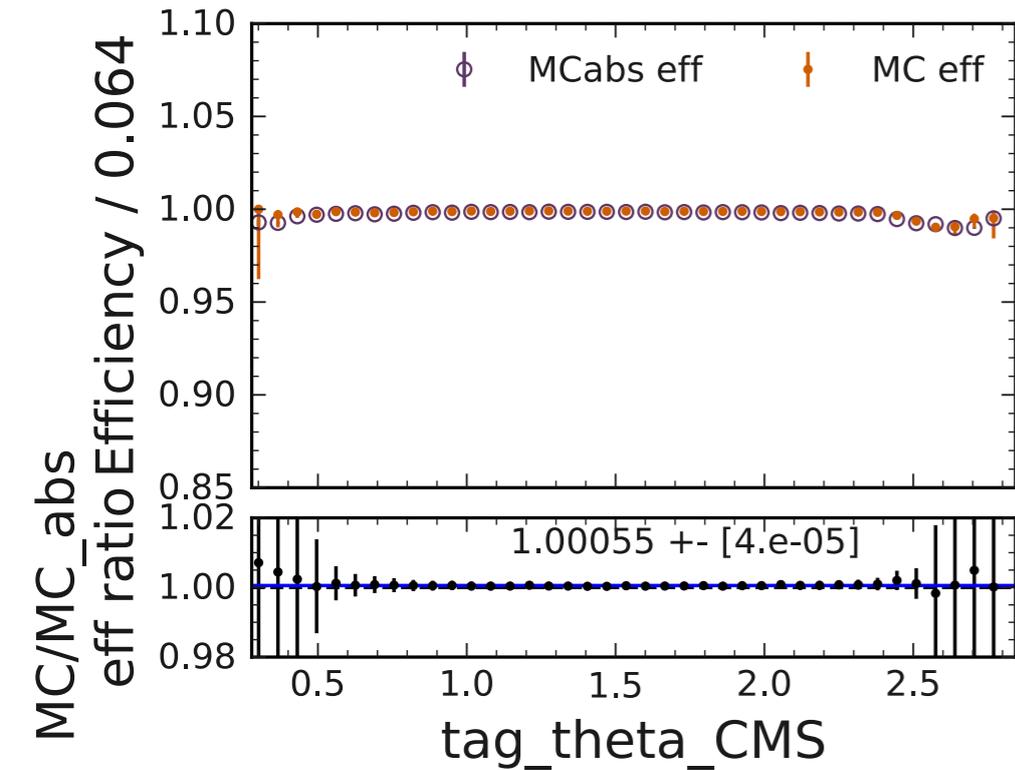
$$\epsilon_{\text{abs}} = \frac{\text{ECL trigger}}{\text{Selected events}}$$

**ffo+fso used  
as reference**



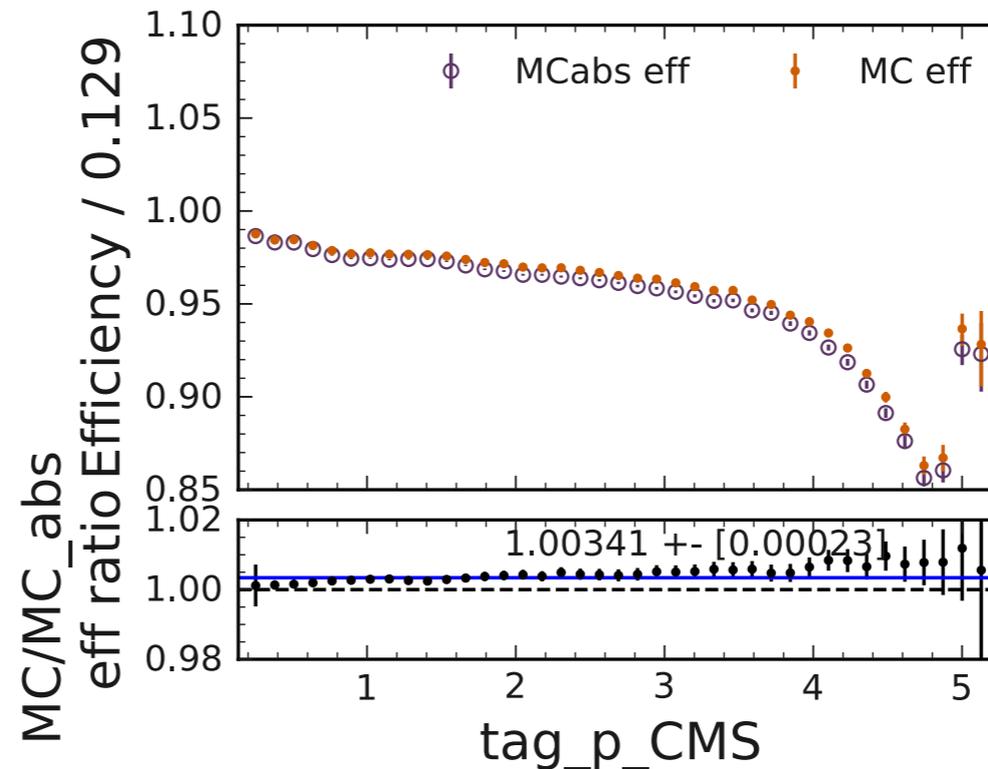
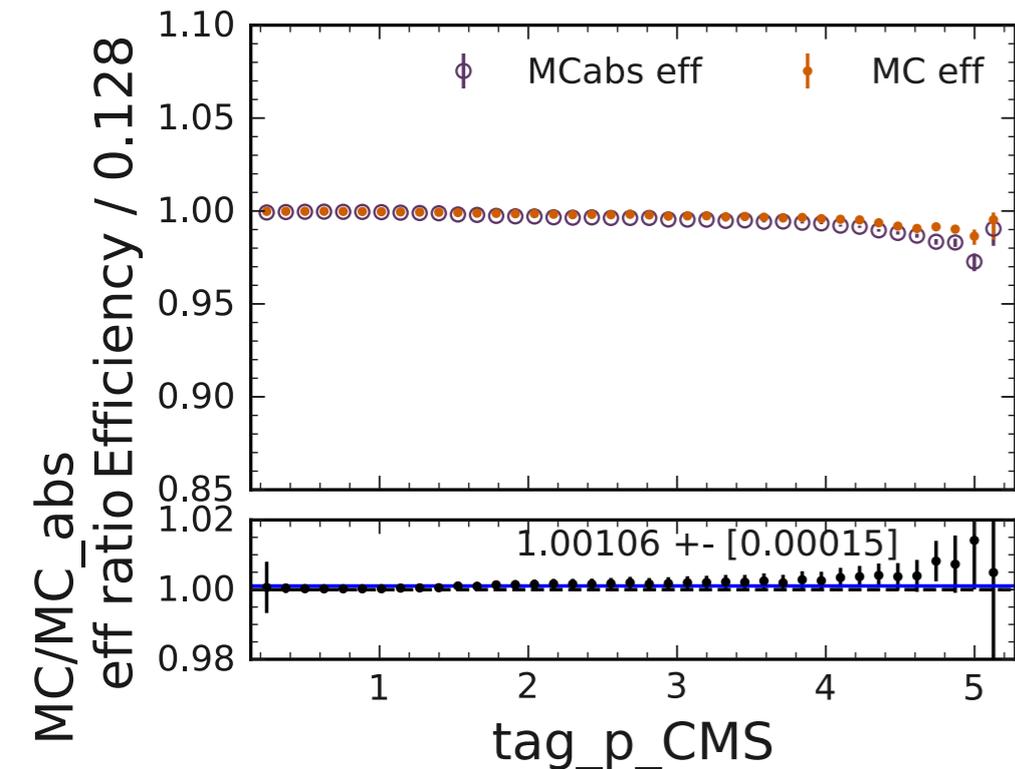
**Bias introduced by  
using a trigger  
reference is small**

**but not negligible  
for the  $\mu$  case**



Belle II simulation: e\_sig for hie\_lml\_all\_eclmumu

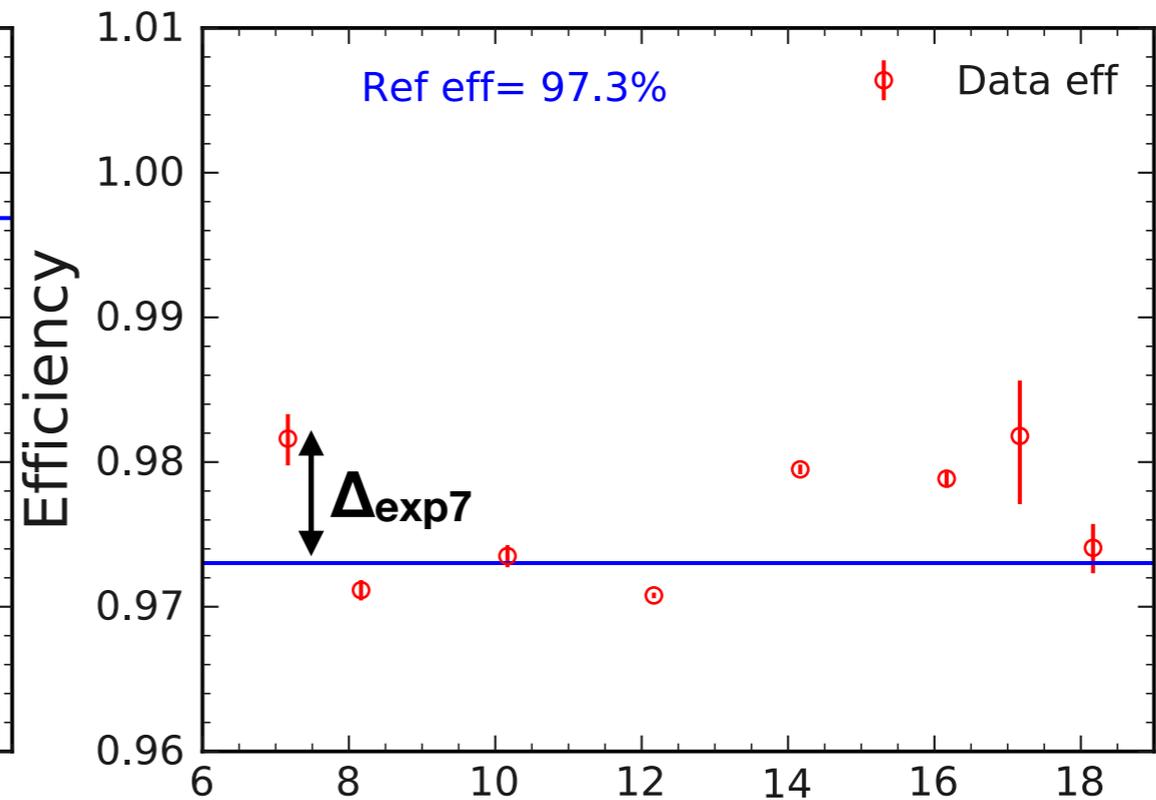
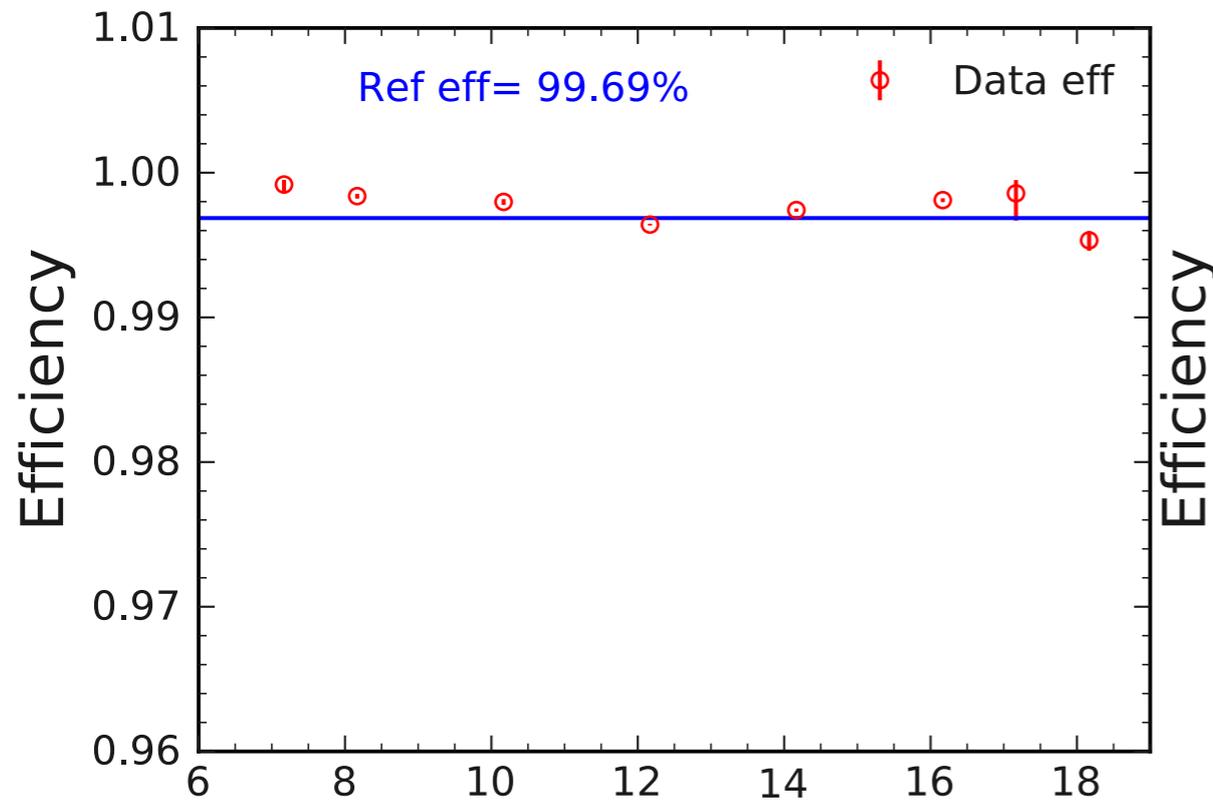
Belle II simulation: mu\_sig for hie\_lml\_all\_eclmumu



# Trigger efficiency dependence with time

Belle II simulation: e\_sig for hie\_lml\_all\_eclmumu

Belle II simulation: mu\_sig for hie\_lml\_all\_eclmumu



The systematic uncertainty is a weighted average of each  $\Delta$  corresponding different exp numbers

$$\text{Exp dep sys} = \frac{\Delta_{\text{exp7}} * L_{\text{exp7}} + \dots + \Delta_{\text{exp18}} * L_{\text{exp18}}}{L_{\text{tot}}}$$

Sys	e	$\mu$
Data-MC	0.05	0.05
Ref trig	0.11	0.34
Exp dep	0.13	0.26
<b>Total (%)</b>	<b>0.124</b>	<b>0.437</b>

# Emergency slides!!

