Group meeting

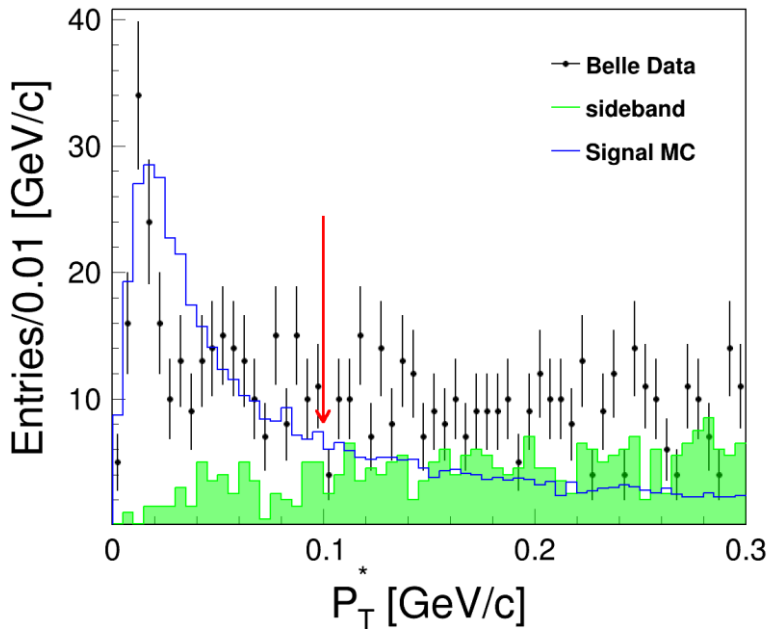
2024.12.20

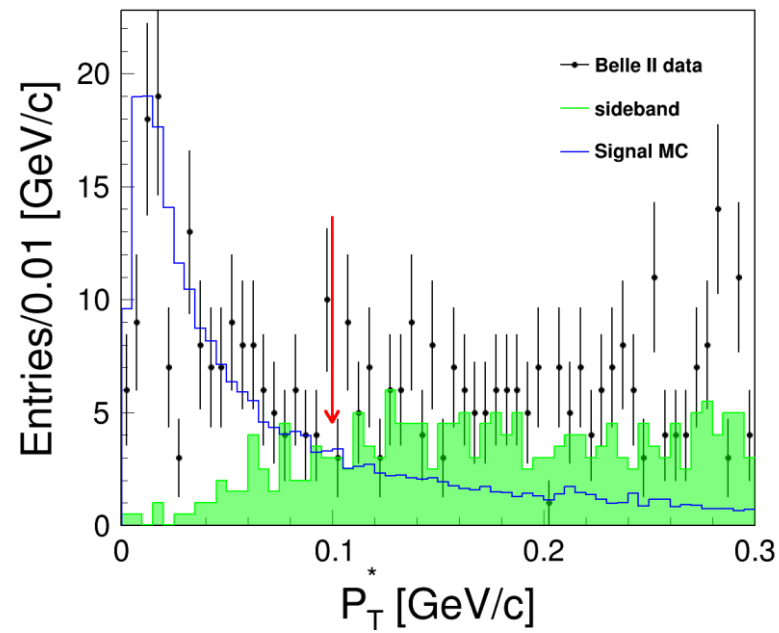
Event selection

- Good charged tracks
  - | dr | < 2 cm, | dz | < 4cm
  - $N_{goodtrack}$ = 4
- Particle Identificationl
  - muID > 0.7 for all
  - eID > 0.5 for all e
  - atcPIDBelle(2,3) > 0.6 for all π
- Bremsstrahlung photons
  - within 0.05 radians of the original electrons
  - $E_\gamma > 20\text{MeV}$
- π^0 selection
  - Photon divided into two categories based on cluserE: γ_{low} and γ_{high}.
  - cluserE > 40MeV if from barrel and cluserE > 50MeV for other regions for γ_{low}.
  - Mass constraint fit with $\chi^2 < 25$.
  - Best candidate selection using χ^2 for $P_t < 0.2\ GeV/c$ π^0s .
  - Using pi0:eff40_May2020Fit with only best candidate selection in Belle II

Event selection

- J/ψ, ω reconstruction
  - 3.04 GeV $/c^2 < M_{\ell^+\ell^-} <$ 3.14 GeV $/c^2$
  - 0.72 GeV $/c^2 < M_{\pi^+\pi^-\pi^0} <$ 0.84 GeV $/c^2$
  - 0.86 GeV $/c^2 < M_{\pi^+\pi^-\pi^0} <$ 0.98 GeV $/c^2$ and 0.60 GeV $/c^2 < M_{\pi^+\pi^-\pi^0} <$ 0.72 GeV $/c^2$ for sideband
- $M^2_{Rec} > 10\ (\mathrm{GeV}/c^2)^2$ for $\pi^+\pi^-\ell^+\ell^-$to suppress ISR $\psi(2S)$ backgrounds.
- $|M_{\ell^+\ell^-} - M_{\ell^+\ell^-\pi^+\pi^-} - 0.589| > 0.01\ \mathrm{GeV}/c^2$ suppress $\psi(2S)$ backgrounds.
- $P_t^* < 0.1\ \mathrm{GeV}/c$ for $\omega J/\psi$ system to identify $\gamma\gamma \to \omega J/\psi$ events.



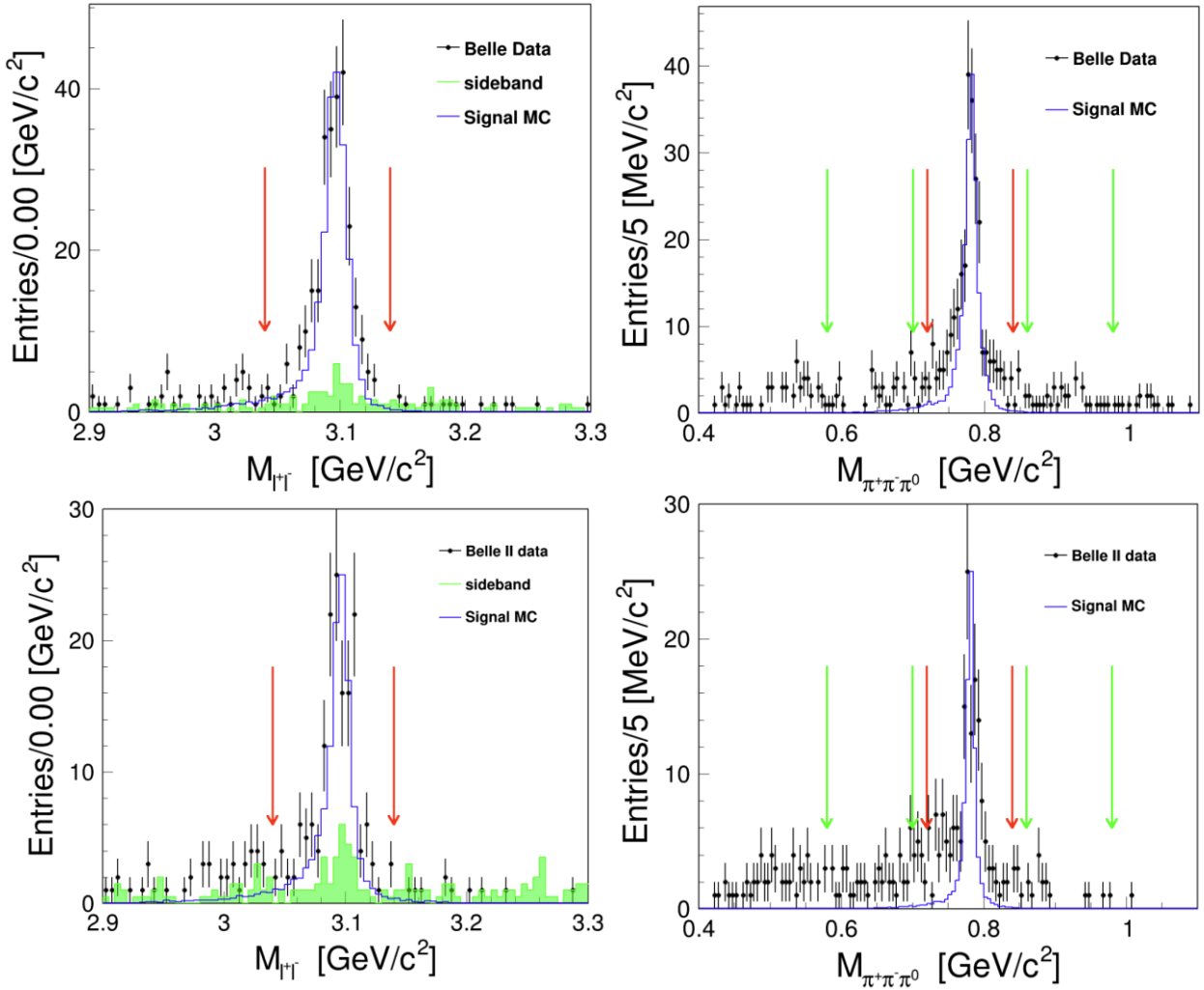


J/ψ, ω reconstruction

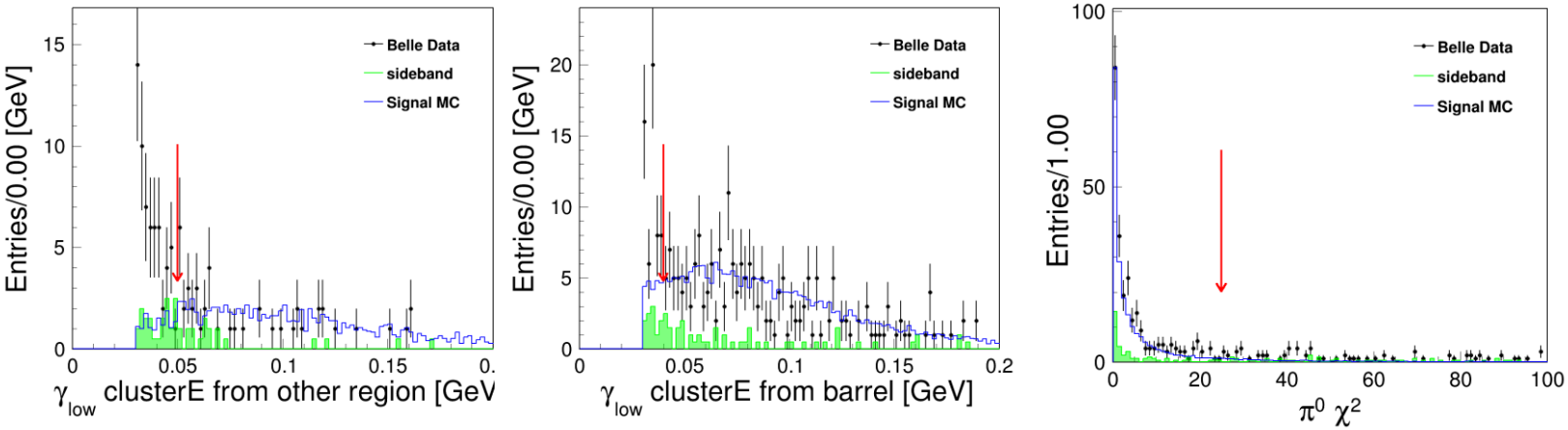
3.04 GeV $/c^2 < M_{\ell^+\ell^-} <$ 3.14 GeV $/c^2$

0.72 GeV $/c^2 < M_{\pi^+\pi^-\pi^0} <$ 0.84 GeV $/c^2$

0.86 GeV $/c^2 < M_{\pi^+\pi^-\pi^0} <$ 0.98 GeV $/c^2$ and 0.58 GeV $/c^2 < M_{\pi^+\pi^-\pi^0} <$ 0.7 GeV $/c^2$ for sideband



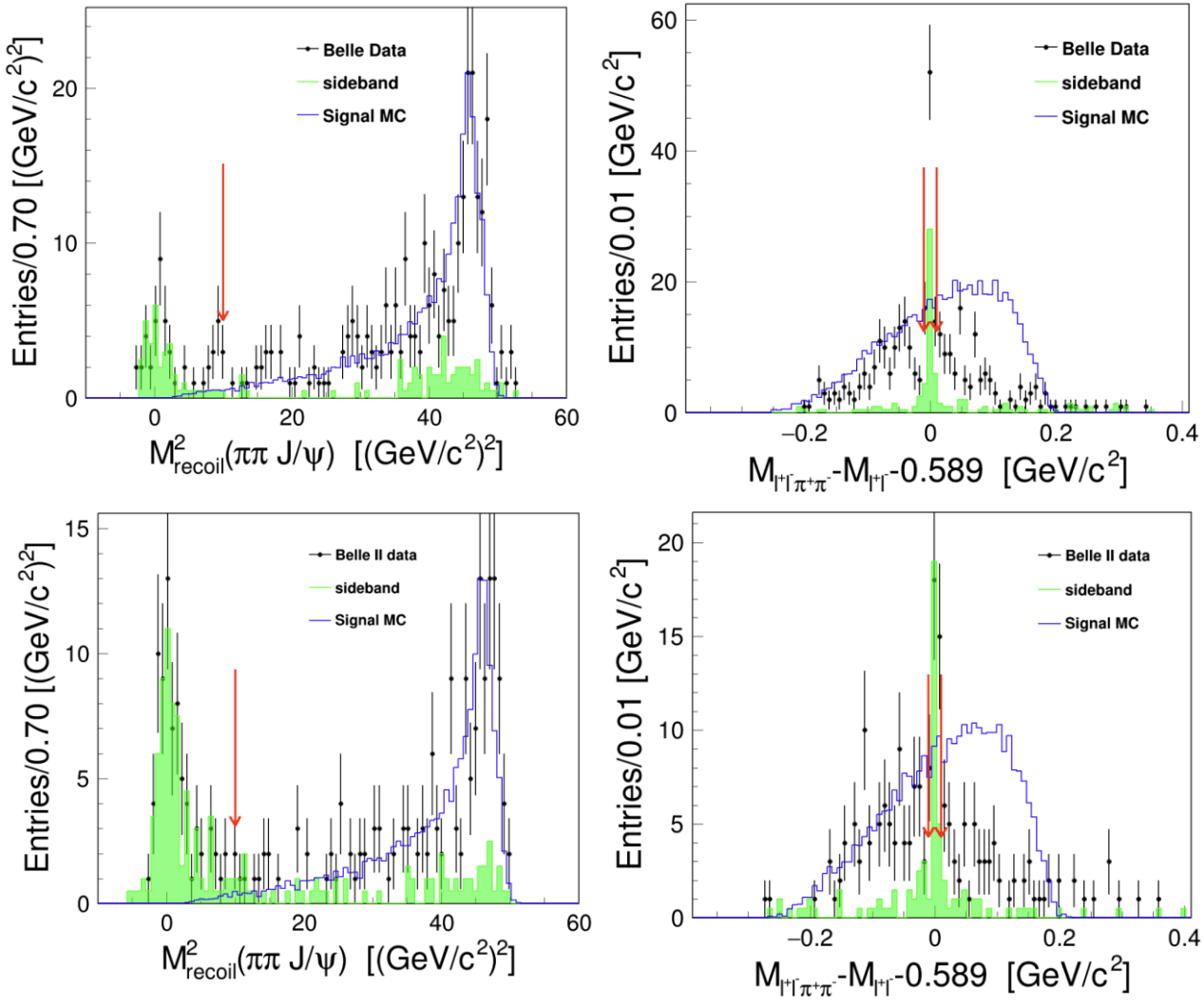
π^0 distributions Belle



- π^0 selection
  - Photon divided into two categories based on cluserE: γ_{low} and γ_{high}.
  - cluserE > 40MeV if from barrel and cluserE > 50MeV for other regions for γ_{low}.
  - Mass constraint fit with $\chi^2 < 25$.
  - Best candidate selection using χ^2 for $P_t < 0.2\ GeV/c$ π^0s .

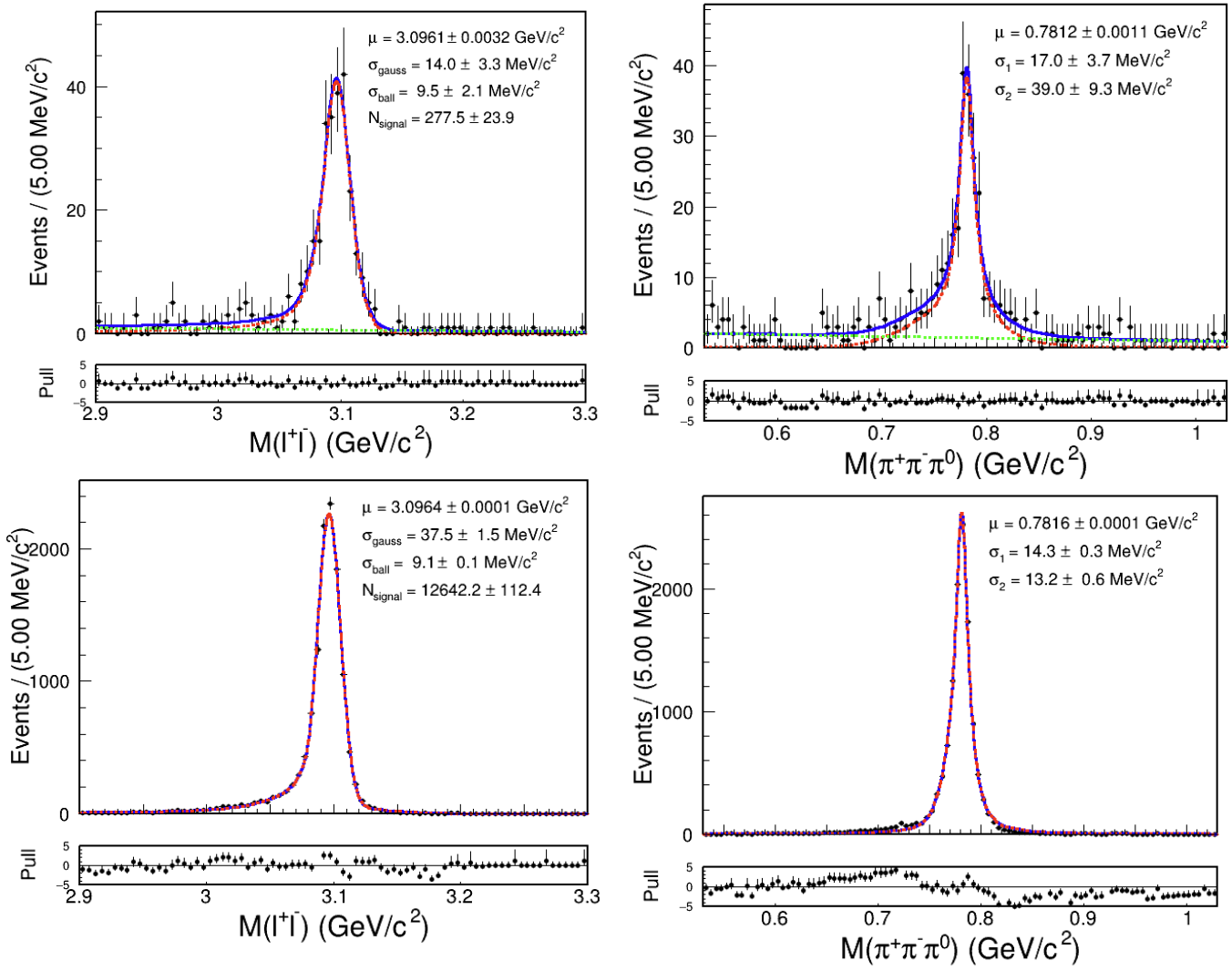
Background suppression

- $M^2_{Rec} > 10\ (\mathrm{GeV/c^2})^2$ for $\pi^+\pi^-\ell^+\ell^-$to suppress ISR $\psi(2S)$ backgrounds.
- $|M_{\ell^+\ell^-} - M_{\ell^+\ell^-\pi^+\pi^-} - 0.589|$ >0.01 $\mathrm{GeV/c^2}$ suppress $\psi(2S)$ backgrounds.



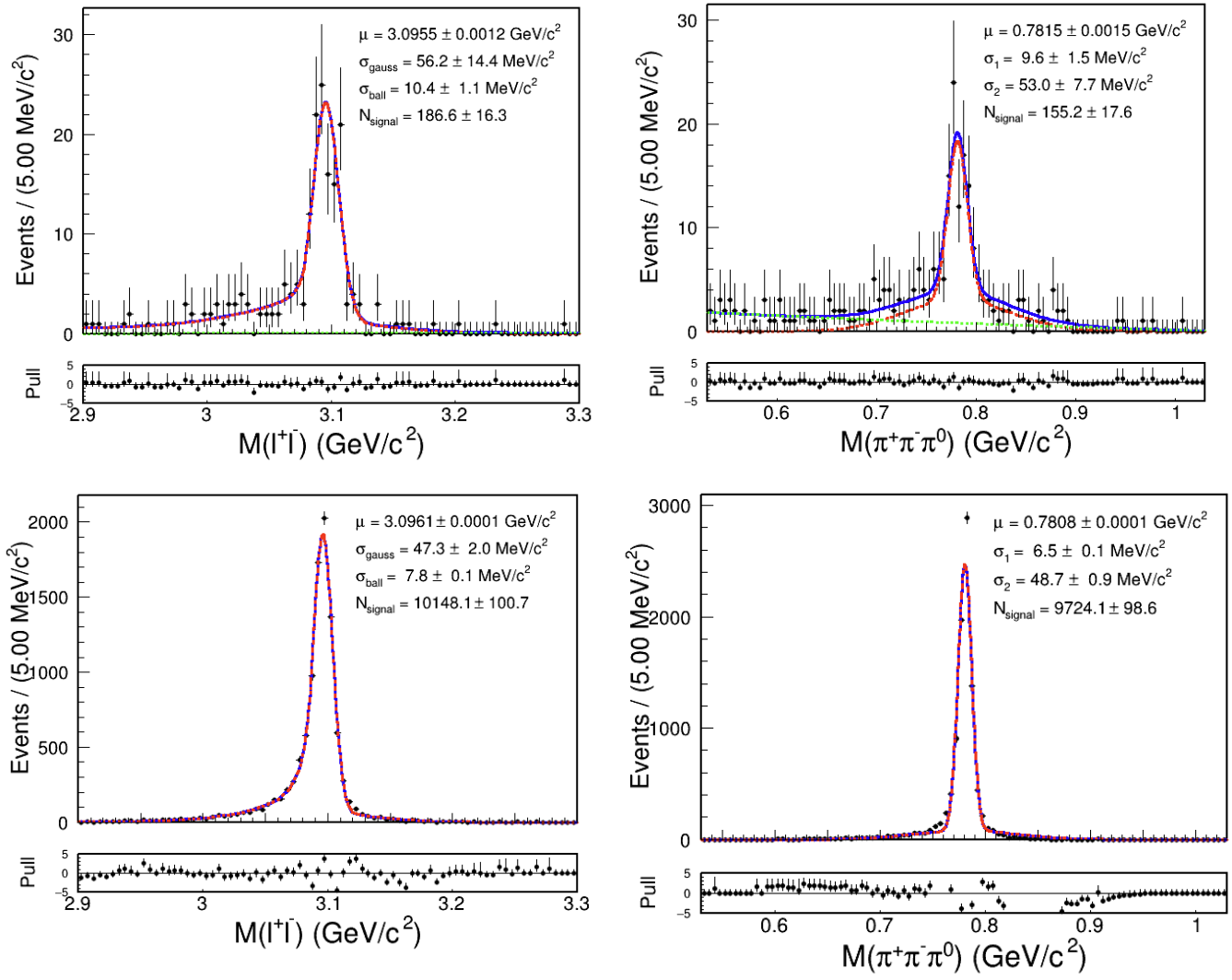
Belle fit

- Double gauss for M_ω, gauss + crystalBall for $M_{J/\psi}$, polynomial for bkgs.
- First row for data, Second row for MC.

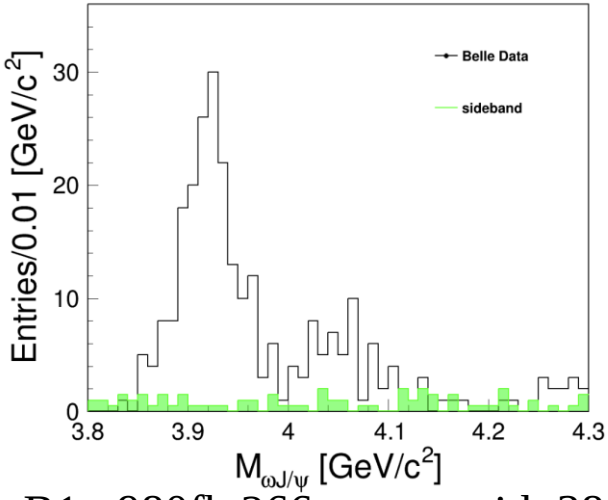


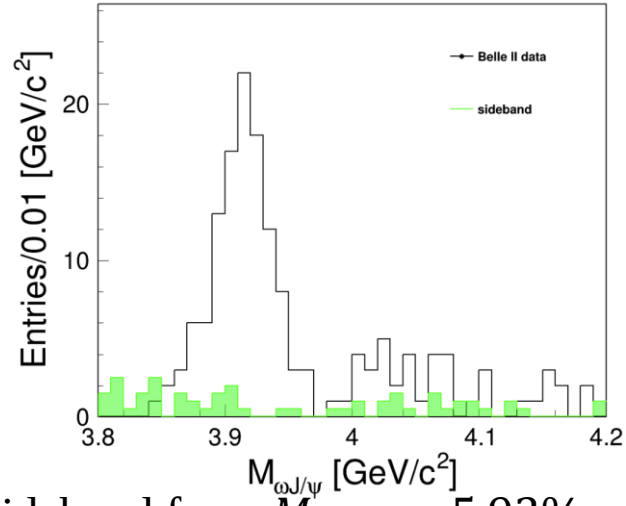
Belle II fit

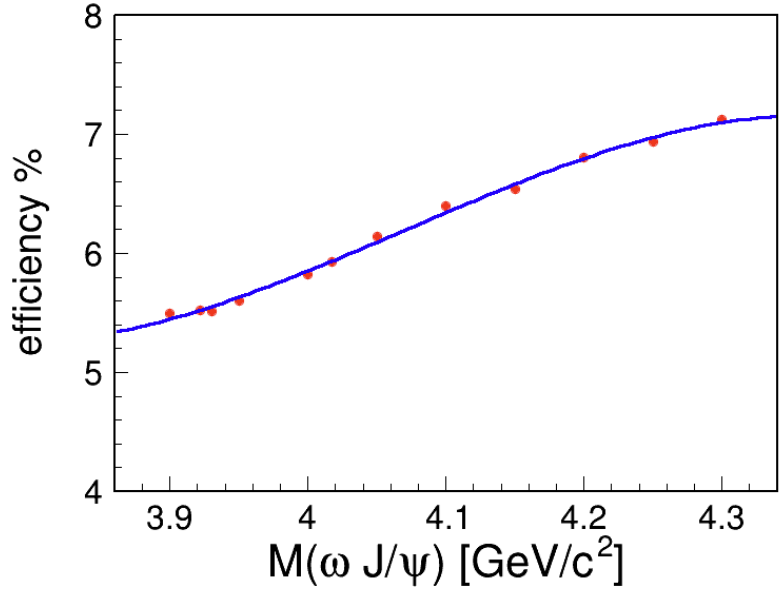
- Double gauss for M_ω, gauss + crystalBall for $M_{J/\psi}$, polynomial for bkgs.
- First row for data. Second row for MC.



Final distribution





B1 : 980fb 266 events with 38 sideband from M_ω, $\varepsilon = 5.93\%$.

B2 :365fb:149 events with 27.5 sideband from M_ω, $\varepsilon = 9.39\%$.